APPENDICES TO
MINNESOTA
NONPOINT SOURCE POLLUTION
ASSESSMENT REPORT

September 26, 1988

Prepared by the

Minnesota Pollution Control Agency

Division of Water Quality

Pursuant to 1987 Laws, Ch 392, Sec 5

Coded as MS 115.095 Appendices

APPENDIX A

Lakes Assessed for NPS Impacts with Threatened or Impaired Aesthetic and Swimming Uses

KEY TO THE LAKE ASSESSMENT TABLE

LAKE ID	-	Minnesota Department of Natural Resources lake identification number. MDNR. 1968. An Inventory of Minnesota Lakes. Bulletin 25. St. Paul, Minnesota.
HUC	-	U.S. Geological Survey hydrologic unit code. USGS. 1974. Hydrologic Unit Map, State of Minnesota. Denver, Colorado.
SEG	-	U.S. Environmental Protection Agency stream segment numbering system or the Minnesota Pollution Control Agency stream segment numbering system.
NAME	-	Lake Name.
ACRES	-	Lake size in acres.
ME	-	Type of assessment - M, monitored; E, evaluated.
Trophic	-	Lake trophic state - O, oligotrophic; M, mesotrophic; E, eutrophic; H, hypereutropohic.
SA	-	Use support relative to acid rain - FS, fully supporting; ST, supporting but threatened.
ALK	-	Alkalinity.
SOURCES	-	Source of impact - M, point source impact.

ECOREGION = NORTH CENTRAL HARDWOOD FOREST FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
73-0037	07010202	016	PEARL	733	E	M	FS	160.0	
73-0038	07010203		CARNELIAN	164	E	M	FS	140.0	
73-0051	07010202		PLEASANT	222	E	M	FS	150.0	
73-0055	07010202	016	GRAND	666	E	M	FS	170.0	
73-0076	07010202	016	GOODNERS	150	E	M	FS	160.0	
73-0092	07010201		SAGATAGAN	159	E	M	FS	90.0	
73-0102	07010201		BIG WATAB	227	M	O	FS	145.0	
73-0106	07010201		BIG FISH	558	M	M	FS	210.0	
73-0117	07010201		UPPER SPUNK	301	E	M	FS	180.0	
73-0118	07010201		PELICAN	344	M	O	FS	150.0	
73-0123	07010201	018	LOWER SPUNK	292	E	M	FS	180.0	
73-0128	07010201		MIDDLE SPUNK	231	E	M	FS	185.0	
73-0156	07010202	002	BECKER	176	E	M	FS	220.0	
77-0007	07010104		MOUND 3 MI SO OF	274	M	M	FS	115.4	
77-0022	07010104	030	MONS	86	E	O	FS	140.0	
77-0027	07010104		LONG 2 MI NW OF B	372	M	M	FS	195.0	
77-0034	07010104	030	LITTLE SWAN	149	E	M	FS	180.0	
77-0149	07010202		LONG 6 MI NE OF S	143	M	M	FS	140.0	
82-0046	07030005		SQUARE	210	M	O	FS	123.1	
82-0049	07030005		BIG CARNELIAN	444	M	M	FS	103.8	
82-0106	07010206		ELMO	304	M	M	FS	116.4	
82-0167	07010206		WHITE BEAR	2585	M	M	FS	101.9	
82-2001	07010206	001	UNNAMED	-	M	M		-	
86-0011	07010204		CHARLOTTE 3 MI W	235	M	M	FS	100.0	
86-0053	07010204		PULASKI 1 MI NE O	770	M	M	FS	130.0	
86-0146	07010203		IDA	231	M	O	FS	140.0	
86-0233	07010203		SUGAR	920	M	M	FS	160.0	
86-0234	07010203		BASS	213	M	O	FS	150.0	
86-0251	07010203		PLEASANT	639	M	M	FS	150.0	
86-0273	07010204		FRENCH	310	M	M	FS	195.0	
86-0279	07010203		TWIN	1012	M	O	FS	155.0	
86-0289	07010203		SYLVIA	747	M	O	FS	170.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST LAKES FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
27-0133-04	07010206	008	MINNETONKA(ST.ALBAN	168	M	M		-	
27-0137	07010206		CHRISTMAS	276	M	M	FS	135.4	
27-0179-02	07010206		LONG (NORTH BAY)	-	M	M	FS	94.3	
27-0200	07010205		RATTAIL	12	M	M		-	
34-0079	07010204		GREEN	5406	M	M	FS	175.6	M
34-0116	07020004		HENDERSON	73	M	M		-	
34-0142	07020004		GEORGE	248	M	M	FS	276.0	
34-0217	07020005		FLORIDA	662	M	M	FS	211.5	
47-0002	07010204		FRANCIS	991	M	M	FS	150.0	
47-0119	07010205		MINNE BELLE	545	M	M	FS	145.0	
49-0024	07010201		PIERZ	170	E	M	FS	110.0	
49-0081	07010104		PINE	197	M	O	FS	110.0	
49-0140	07010201		CEDAR 4 MI W OF U	253	M	M	FS	142.0	
56-0191-01	09020103		STUART (MAIN BASIN)	638	E	M		-	
56-0238	09020103		CLITHERALL	2522	M	O		-	
56-0239	09020103	019	WEST BATTLE	5663	E	M	FS	178.0	
56-0243	09020103		MARION	1610	M	M	FS	176.7	
56-0252	07020002		MIDDLE	194	E	O		-	
56-0253	07020002		EAGLE	838	E	M	FS	252.5	
56-0302-01	09020103		SILVER	-	M	M	FS	271.7	
56-0303	09020103		MOLLY STARK	153	E	M		-	
56-0304	09020103		NO NAME	34	E	M		-	
56-0306	09020103		ELBOW	189	M	M	FS	182.5	
56-0328	09020103		LITTLE MCDONALD	1174	M	O		-	
56-0358	09020103		SCALP (SEVEN) 1 M	244	M	O	FS	166.7	
56-0360	09020103		ROSE	1145	M	O		-	
56-0369	09020103		SIX	181	M	M		-	
56-0382	09020103		EAST TWIN	333	M	M	FS	225.0	
56-0386	09020103		BIG MCDONALD	3502	E	M		-	
56-0388	09020103		LONG	1273	M	M		-	
56-0428	07020002		LONG 6 MI NE OF D	198	M	M	FS	220.0	
56-0449	09020103		PLEASANT	370	M	M	FS	355.0	
56-0475	09020103		PICKEREL	829	M	O	FS	170.9	
56-0570	07020002		BASS	292	M	M		-	
56-0695	09020103		HEILBERGER 14 MI	224	M	M	FS	175.8	
56-0749	09020103		CRYSTAL	1317	E	M		-	
56-0760	09020103	017	LIZZIE	3904	E	M	FS	195.8	
56-0781	09020103		SWAN	689	M	M		-	
56-0784	09020103		LONG 11 MI N OF F	756	M	M	FS	215.7	
56-0786	09020103		PELICAN	3925	M	M	FS	193.3	
56-0877	09020103		JEWETT 10 MI N OF	737	M	M	FS	318.5	
60-0217	09020301		UNION	734	M	M		-	
61-0037	07020005	009	LINKA 2 MI N OF G	197	M	M	FS	179.2	
62-0038-01	07010206		VADNAIS (EAST VADNA	369	M	M	FS	139.3	
62-0061	07010206		TURTLE	444	M	M	FS	120.2	
62-0073	07010206		SNAIL	157	M	M	FS	95.3	
66-0014	07040002		DUDLEY	60	M	M		-	
66-0015	07040002		KELLY	60	M	M		-	
70-0010	07020012		MURPHY	35	M	M		-	
70-0011	07020012		MINNREG	46	M	M		-	
70-0026	07020012		LOWER PRIOR	827	M	M	FS	146.0	
71-0040	07010207		SANDY	70	M	O		-	
71-0081	07010203		MITCHELL	170	M	M	FS	150.0	
71-0082	07010203		BIG	251	M	M	FS	170.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
27-0133-11	07010206	008	MINNETONKA (MAXWELL	-	M	E	FS	110.0	
27-0133-13	07010206		MINNETONKA (NORTH A	-	M	E	FS	130.0	
27-0138	07010206	008	PEAVEY	10	E	E		-	
27-0176	07010205		INDEPENDENCE	851	M	E	FS	122.9	
27-0192	07010205		REBECCA	234	M	E	FS	142.4	
30-0107-01	07010207		BLUE (NORTH BAY) 3	-	E	E	FS	150.0	
33-0009	07030004	004	POMROY	260	E	E	ST	7.0	
33-0032	07010207	007	LEWIS	243	E	E	FS	100.0	
33-0033	07030004		DEVIL'S	121	E	E		-	
34-0044	07010204		DIAMOND	1927	M	E		-	
34-0171	07020004		EAGLE	845	E	E	FS	163.8	
34-0206	07020005		ANDREW	764	E	E		-	
40-0057	07040002		FRANCES	895	E	E	FS	135.0	
44-0038	09020305		ISLAND 7 MI S OF	611	M	E	FS	160.0	
47-0015	07010204		JENNIE	960	E	E	FS	150.0	
47-0026	07010204		LONG	162	E	E	FS	155.0	
47-0046	07010204	019	WASHINGTON	2639	M	E	FS	160.0	M
47-0050	07010204		MANUELLA	286	E	E	FS	190.0	
47-0064	07010205		ERIE	182	E	E	FS	150.0	
47-0068	07010204		STELLA	553	M	E	FS	170.0	
49-0035	07010104		GREEN PRAIRIE FISH	168	E	E	FS	80.0	
56-0130	09020103	007	BIG PINE 2 MI E O	5067	M	E	FS	190.0	
56-0141	09020103		RUSH 2 MI N OF OT	5338	M	E	FS	142.2	M
56-0142	09020103	014	LITTLE PINE AT PE	2036	M	E	FS	188.0	
56-0240	09020103		BLANCHE	1312	E	E	FS	208.3	
56-0242	09020103		OTTER TAIL	14753	E	E	FS	176.7	
56-0305	09020103	019	NO NAME	52	E	E		-	
56-0307	09020103		NO NAME	44	E	E		-	
56-0310	09020103	005	WALKER	694	E	E		-	
56-0656	07020002		FOSSAN	69	M	E		-	
56-0658	09020103		WALL	683	M	E	FS	208.9	
56-0915	09020103	016	PRAIRIE 2 MI N OF	1016	M	E	FS	185.0	
60-0032	09020305		TURTLE 4 MI NE OF	545	M	E	FS	170.0	
60-0069	09020301		SAND HILL	598	M	E		-	
61-0023	07010204	012	GROVE 2 MI NE OF	379	M	E	FS	179.2	
61-0041	07020005		SCANDINAVIAN AT G	396	M	E	FS	186.0	
61-0064	07020005	009	AMELIA	932	E	E	FS	142.5	
61-0130	07020005	016	MINNEWASKA	7110	M	E	FS	223.9	M
62-0001	07010206		SILVER	68	M	E	FS	68.3	
62-0007	07010206		GERVAIS	213	M	E	FS	116.3	
62-0013	07010206		PHALEN	218	M	E	FS	103.9	
62-0024	07010206		BIRCH	127	M	E	FS	68.8	
62-0028	07010206		SUCKER	60	M	E	FS	136.0	
62-0040	07010206		WILLOW	75	M	E	FS	147.2	
62-0054	07010206		MC CARRON	81	M	E	FS	101.8	
62-0057	07010206		JOSEPHINE	109	M	E	FS	107.4	
62-0070	07010206		ROUND	122	M	E		-	
62-0074	07010206		GRASS	146	M	E	FS	113.1	
62-0078	07010206		JOHANNA	230	M	E	FS	97.4	
62-0080	07010206		EMILY	12	M	E		-	
62-0082	07010206		WABASSO	46	M	E	FS	102.4	
66-0038	07040002		FRENCH	816	M	E		-	
71-0057	07010203		BIRCH	149	E	E		-	
71-0069	07010203		ANN	184	E	E	FS	80.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST   FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
02-0003	07010206		OTTER	338	M	E	FS	105.7	
02-0015	07010206		RANDEAU(RONDEAU)	546	M	E	FS	136.0	
02-0022	07030005		ISLAND	65	M	E	FS	118.0	
02-0042	07030005		COON	1466	M	E	FS	84.9	
02-0053	07010206	003	HAM	193	M	E	FS	112.0	
02-0133	07010207		EAST TWIN	116	M	E	FS	103.4	
03-0017	07010106		TWO INLETS	578	E	E		–	
03-0102	07010106	033	SHELL	3140	E	E	FS	160.0	
03-0163	09020103		LIZZIE	89	E	E	FS	140.0	
03-0180	09020103		NORTH TWIN	139	E	E		–	
03-0381-01	09020103	018	DETROIT (MAIN BAY)	–	M	E	FS	183.3	
03-0506	09020103		LITTLE CORMORANT	924	M	E		–	
03-0575	09020103		LEIF	519	E	E		–	
10-0002	07020012		RILEY	301	M	E	FS	93.5	
10-0018	07010206	008	SCHUTZ	105	M	E	FS	136.0	
10-0019	07020012		BAVARIA	188	M	E	FS	103.7	
10-0041	07010206	008	ZUMBRA	162	M	E	FS	103.0	
10-0044-01	07010206		AUBURN (WEST BAY)	–	M	E	FS	129.7	
10-0045	07010206		STIEGER	281	M	E	FS	145.3	
10-0059	07020012		WACONIA	2607	M	E	FS	158.8	
13-0028	07030005		SOUTH LINDSTROM	450	M	E	FS	59.0	
13-0068	07030005		FISH	306	E	E	FS	120.0	
13-0083-02	07030005	032	GOOSE (SOUTH)	470	M	E		–	
19-0027	07020012		CRYSTAL	292	M	E	FS	128.0	
19-0031	07020012		ORCHARD	243	M	E	FS	131.3	
19-0050	07010206		SUNFISH	44	M	E		–	
19-0075	07010206		SCHULTZ	16	M	E	FS	73.3	
21-0007	07010202		HERBERGER	172	E	E	FS	160.0	
21-0054	07010108		VICTORIA	420	E	E	FS	163.3	
21-0076	07010108		IRENE 1 MI NW OF	636	M	E	FS	176.7	
21-0092	07010108		MARY	2395	E	E	FS	193.3	
21-0144-02	07010108		LOBSTER (WEST BAY)	513	M	E	FS	180.0	
21-0216	07020005		WHISKEY	162	M	E	FS	211.7	M
21-0291	07020005		RED ROCK	708	M	E		–	
26-0097	07020002	004	POMME DE TERRE	1794	E	E	FS	190.0	
27-0026	07010206		WOOD	165	M	E		–	
27-0031	07010206		CALHOUN	421	M	E	FS	128.0	
27-0037	07010206		WIRTH	37	M	E	FS	130.0	
27-0038	07010206		BROWNIE	18	M	E		–	
27-0039	07010206		CEDAR	170	M	E	FS	119.0	
27-0042-02	07010206		TWIN (MIDDLE BAY) A	–	M	E	FS	109.8	
27-0048	07020012		HYLAND	104	M	E	FS	127.5	
27-0061	07010206	007	CHAMPLIN MILL POND	38	M	E		–	
27-0062-02	07020012		ANDERSON (SW BAY) I	140	E	E		–	
27-0062-03	07020012		ANDERSON (SE BAY) I	80	E	E		–	
27-0067	07020012		BRYANT	174	M	E	FS	149.8	
27-0085	07010206		LIBBS	17	E	E		–	
27-0089-01	07020012		SHADY OAK (NORTH BA	–	E	E	FS	140.0	
27-0107	07010206		PARKERS	92	E	E	FS	151.0	
27-0111-01	07010206		EAGLE (EAGLE BAY) I	–	M	E	FS	147.7	
27-0117	07010206		WEAVER	148	M	E	FS	93.3	
27-0118	07010206		FISH	228	M	E	FS	123.5	
27-0133-01	07010206	008	MINNETONKA (GRAYS B	–	M	E	FS	100.0	
27-0133-05	07010206	008	MINNETONKA(UPPER LA	–	M	E	FS	130.5	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST PARTIALLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
02-0026	07030005		LINWOOD	567	M	E	FS	96.4	
02-0045	07010206		GOLDEN	57	M	E	FS	141.4	
02-0075-02	07010206		MOORE (EAST BAY)	-	M	E	FS	63.2	
02-0084	07010206	003	CROOKED	130	M	E	FS	108.8	
02-0130	07010207		PICKEREL	274	E	E	FS	99.0	
05-0007	07010203	008	MAYHEW	131	E	E	FS	120.0	
10-0007	07020012		LUCY	90	M	E	FS	142.7	
13-0012-01	07030005		CHISAGO (NORTH BAY)	-	M	E	FS	59.0	
13-0041-01	07030005		GREEN(LITTLE GREEN)	-	M	E	FS	83.0	
13-0041-02	07030005		GREEN(MAIN BASIN)	-	M	E	FS	86.5	
13-0069-02	07030005	031	RUSH (WEST BAY) 6	-	M	E	FS	125.0	
19-0026-01	07040001		MARION (EAST BAY) I	-	M	E	FS	140.9	
19-0065	07010206		HOLLAND	35	M	E	FS	90.9	
21-0016	07010202		SMITH 3 MI W OF O	648	M	E	FS	168.8	
21-0090	07020005	019	TURTLE 6 MI NE OF	220	M	E	FS	210.0	
21-0144-01	07010108		LOBSTER (EAST BAY)	724	M	E	FS	180.0	
21-0180	07010108		MILL 7 MI S OF GA	600	M	E	FS	180.0	
21-0212	07020005	022	LITTLE CHIPPEWA 3	176	M	E	FS	200.0	
26-0002	07020002	008	PELICAN	3728	E	E	FS	291.0	
27-0014	07010206	002	POWDERHORN	11	M	E		-	
27-0035-01	07010206		SWEENEY-TWIN - SWEE	46	E	E		-	
27-0040	07010206		LAKE OF THE ISLES	103	M	E	FS	95.0	
27-0104	07010206		MEDICINE	948	M	E	FS	107.1	
27-0111-02	07010206		EAGLE (PIKE BAY) A	95	E	E		-	
27-0133-10	07010206	008	MINNETONKA (CRYSTAL	-	M	E	FS	137.5	
27-0133-12	07010206		MINNETONKA (STUBBS	198	M	E		-	
27-0139	07010206		FOREST	81	M	E		-	
27-0149	07010205		SPURZEM	65	M	E		-	
27-0165	07010206	007	JUBERT	64	M	E		-	
27-0184-02	07010205		WHALETAIL (SOUTH BA	-	M	E	FS	130.3	
27-0191	07010204		SARAH	586	M	E	FS	119.5	
30-0072	07010207		LONG	390	M	E		-	
30-0107-02	07010207		BLUE (SOUTH BAY) 3	-	E	E	FS	120.0	
34-0154	07010204		NEST	990	E	E	FS	185.0	M
34-0193	07020004		POINT	164	E	E		-	
34-0251	07020005		NORWAY	2496	M	E	FS	174.3	
40-0033	07040002		VOLNEY 4 MI SE OF	283	M	E	FS	134.4	
40-0063	07040002		GERMAN	988	E	E	FS	110.0	
40-0124	07020007		EMILY	235	E	E	FS	140.0	
43-0104	07010205		STAHL	142	E	E	FS	150.0	
47-0061	07010205		WILLIE	182	E	E	FS	190.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
71-0158	07010203		PICKEREL	121	E	E	FS	120.0	
71-0159	07010203		LONG	182	E	E	FS	115.0	
73-0023	07010203		BEAVER	152	E	E	FS	150.0	
73-0035	07010203		SCHOOL SECTION	188	E	E	FS	140.0	
73-0070	07010201	019	WATAB	95	E	E	FS	180.0	
73-0107	07010201		LONG	163	E	E	FS	130.0	
73-0147	07010202		BROWNS	324	E	E	FS	190.0	
73-0159	07010202		BIG	403	M	E	FS	170.0	
73-0196	07010204		RICE	1568	M	E	FS	180.0	M
73-0200	07010204	010	KORONIS	3109	E	E	FS	180.0	M
73-0233	07010202		KINGS	194	E	E	FS	180.0	
77-0010	07010202		BASS AT GREY EAGL	95	M	E	FS	155.0	
77-0019	07010201	016	MARY 4 MI W OF ST	111	M	E	FS	170.0	
77-0023	07010104	030	BIG SWAN	859	E	E	FS	176.7	
77-0032	07010104		LADY 3 MI N OF GR	207	M	E	FS	177.0	
77-0084	07010202		BIG BIRCH	1980	M	E	FS	161.7	
77-0089	07010202	005	LITTLE BIRCH	793	M	E	FS	165.7	
77-0215	07010202	013	OSAKIS AT OSAKIS	6758	M	E	FS	167.5	M
80-0030	07010106	028	SOUTH TWIN	267	E	E	FS	170.0	M
80-0037	07010106		STOCKING	356	E	E		–	
82-0023	07030005		LILY	52	M	E		–	
82-0045	07030005		CLEAR	31	E	E	FS	150.0	
82-0052	07030005		BIG MARINE	1577	M	E	FS	85.0	
82-0080	07030005		HALFBREED	74	M	E	FS	116.6	
82-0103	07010206		OLSON	79	M	E		–	
82-0104	07010206		JANE	159	M	E	FS	85.0	
82-0115	07010206		TANNERS	70	E	E	FS	76.0	
82-0140	07010206		ONEKA	381	M	E	FS	21.0	
86-0069	07010203		LONG	87	E	E	FS	240.0	
86-0120	07010204		RAMSEY AT MAPLE L	355	M	E	FS	155.0	
86-0134	07010204		MAPLE	777	M	E	FS	135.0	M
86-0156	07010203		MARY	209	E	E	FS	130.0	
86-0163	07010203		LIMESTONE	188	E	E	FS	160.0	
86-0182	07010204		ROCK	175	E	E	FS	140.0	
86-0193	07010204		MARY	180	E	E	FS	140.0	
86-0199	07010204		HOWARD	717	E	E	FS	160.0	
86-0263	07010204	004	COKATO	544	M	E	FS	223.3	M
86-0288	07010203		JOHN	411	E	E	FS	145.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
02-0004	07010206		PELTIER	465	M	H	FS	138.3	
02-0005	07010206		GEORGE WATCH	509	M	H	FS	171.0	
02-0006	07010206		CENTERVILLE	464	M	H	FS	145.7	
02-0007	07010206		FORSHAM	202	M	H		–	
02-0008	07010206		RICE	408	M	H		–	
02-0009	07010206		RESHANAU	304	M	H	FS	104.0	
02-0013	07010206		BALDWIN	204	M	H		–	
02-0016	07010206		HOWARD	448	M	H		–	
02-0019	07010206		TAMARAC	100	M	H	FS	150.0	
02-0034	07030005		MARTIN	218	M	H	FS	117.0	
02-0072	07010206	003	LADDIE	77	E	H	FS	58.0	
02-0075-01	07010206	002	MOORE (WEST BAY)	–	M	H	FS	79.0	
03-0359	09020103		SALLIE	1267	E	H	FS	185.0	
03-0382	09020103		ST. CLAIR	140	E	H		–	M
03-0647	09020106	009	STINKING	370	E	H	FS	130.0	M
05-0009	07010201		PULARSKIS	138	E	H	FS	44.0	
05-0013	07010201	003	LITTLE ROCK	1384	M	H		–	
10-0006	07020012		LOTUS	252	M	H	FS	137.3	
10-0042	07010206		PARLEY	281	M	H	FS	131.3	
10-0044-02	07010206		AUBURN (EAST BAY)	120	M	H		–	
10-0048	07010206		WASSERMANN	277	M	H	FS	127.7	
10-0052	07020012		REITZ	70	M	H	FS	176.7	
10-0069	07020012		BENTON	115	E	H		–	M
10-0070	07020012		MUEWISSON	58	E	H		–	M
10-0078	07020012	002	RICE	347	E	H	FS	105.0	
10-0088	07020012	002	HYDES	226	M	H	FS	151.0	
10-0089	07020012		GOOSE	394	E	H		–	
10-0095	07010205		SWEDE	423	E	H	FS	125.0	
10-0121	07010205		EAGLE	184	M	H	FS	169.4	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST PARTIALLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
47-0062	07010205		GREENLEAF	224	E	E	FS	160.0	
47-0095	07010203	015	CLEAR	497	E	E	FS	160.0	
47-0134	07010204	017	RIPLEY AT LITCHFI	1060	M	E	FS	150.0	
56-0138	09020103		EAST BATTLE	2040	E	E	FS	230.0	
56-0569-01	09020103		NORWAY (EAST BAY)	217	M	E	FS	183.3	
58-0119	07030004	001	CROSS	1013	E	E		-	
61-0067	07020005		VILLARD	536	E	E	FS	143.3	
62-0002	07010206		BALD EAGLE	1012	M	E	FS	122.3	
62-0046	07010206		PLEASANT	593	M	E	FS	134.7	
62-0056	07010206		OWASSO	357	M	E	FS	111.6	
62-0062	07010206		CHARLEY	32	M	E	FS	131.7	
62-0075-02	07010206		ISLAND (BASIN NORTH	-	M	E	FS	60.8	
66-0018	07040002		ROBERDS	608	M	E		-	
66-0027	07040002		CIRCLE	976	M	E		-	
66-0029	07040002		FOX	308	M	E	FS	125.0	
66-0039	07040002		MAZASKA	685	M	E	FS	120.0	
70-0069	07020012		FISH	175	M	E	FS	135.8	
71-0067	07010203	004	EAGLE	426	E	E	FS	110.0	
73-0072	07010201	019	ROSSIER	40	E	E	FS	191.0	M
73-0138	07010201	017	TWO RIVERS	756	E	E	FS	196.3	M
73-0150	07010202		EDEN	290	E	E	FS	210.0	M
73-0273	07010202		MCCORMIC	203	E	E	FS	170.0	
77-0014	07010104		STUMP	34	E	E	FS	120.0	
77-0026	07010104		MOOSE 2 MI N OF B	124	M	E	FS	145.0	
77-0150	07010202	008	SAUK	2111	M	E		-	
77-0150-01	07010202		SAUK(SW BAY)	500	M	E		-	
77-0150-02	07010202		SAUK(NORTH BAY)	1611	M	E		-	
77-0181	07010202		MAPLE	367	E	E	FS	146.7	
81-0055	07020011		REEDS	187	M	E	FS	124.4	
82-0031	07030005		NORTH TERRAPIN	85	E	E	FS	110.0	
82-0033	07030005		MAYS	25	E	E	FS	100.0	
82-0054	07030005		BONE	206	M	E	FS	125.0	
82-0101	07010206		DEMONTREVILLE	140	M	E	FS	77.5	
82-0153	07010206		SUNSET	124	M	E	FS	62.0	
82-0159	07030005		FOREST	1098	M	E	FS	135.6	
82-0163	07010206		CLEAR	400	M	E	FS	127.3	
86-0023	07010204		BEEBE	315	M	E	FS	140.0	
86-0051	07010204		CONSTANCE	161	E	E	FS	270.0	
86-0148	07010203		EAGLE	244	E	E	FS	110.0	
86-0217	07010204		GRANITE	339	E	E	FS	140.0	
86-0223	07010203		INDIAN	129	M	E	FS	135.0	
86-0227	07010203		CEDAR	726	M	E	FS	164.9	
86-0252	07010203	014	CLEARWATER	3182	M	E	FS	173.9	M
86-0284	07010203	015	AUGUSTA	161	M	E	FS	222.9	M
86-0293	07010204		COLLINWOOD	584	E	E	FS	180.0	
86-0298	07010203		UNION	91	E	E	FS	280.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
30-0044	07010207		LITTLE STANCHFIELD	138	E	H	FS	155.0	M
30-0080	07010207		FRANCIS	301	E	H		-	
30-0096	07010207		LORY	212	E	H	FS	68.0	
30-0138	07010207		SOUTH STANCHFIELD	398	E	H	FS	130.0	
33-0014	07030004		UNNAMED	30	E	H	FS	11.0	
33-0015	07030004	004	MUD	214	M	H	FS	86.0	
33-0016	07030004		SPENCE	55	E	H	FS	10.0	
33-0017	07030004		UNNAMED	35	E	H	FS	12.0	
33-0018	07030004		SELLS	64	E	H	FS	14.0	
33-0027	07030004		SPRING	16	E	H	FS	26.0	
33-0028	07030004		KNIFE	1039	E	H	FS	64.0	
33-0036	07030004	014	FISH	311	E	H		-	
33-0040	07030004	014	ANN	653	E	H	FS	68.0	
34-0192	07020004		LONG	1575	E	H		-	
40-0001	07040002		HORSESHOE	417	E	H	FS	130.0	
40-0002	07040002	017	UPPER SAKATAH	881	E	H	FS	190.0	M
40-0009	07040002		SUNFISH	118	E	H	FS	120.0	
40-0013	07040002		DIAMOND	120	E	H		-	
40-0020	07020012	025	GREENLEAF 2 MI SW	306	M	H	FS	94.0	
40-0031	07040002	017	TETONKA	1209	E	H	FS	185.0	
40-0079	07020012	021	CLEAR	313	E	H	FS	170.0	
40-0092-01	07040002		JEFFERSON (NORTHEAS	-	E	H	FS	140.0	
40-0092-03	07040002		JEFFERSON (MIDDLE B	705	M	H		-	
40-0117	07020007	028	WASHINGTON	1505	M	H	FS	149.6	
40-0119	07020007		SCOTCH	565	E	H	FS	170.0	
43-0012	07010205		WINSTED	407	E	H	FS	200.0	M
43-0014	07010205		SOUTH	216	E	H		-	M
43-0073	07010204		HOOK	327	E	H	FS	150.0	
43-0115	07010205		CEDAR	1924	E	H	FS	190.0	
47-0032	07010204		SPRING	218	E	H	FS	203.3	M
47-0038	07010204	004	BIG SWAN	628	E	H	FS	180.0	
47-0042	07010203	015	BETTY (BETSY)	182	M	H	FS	267.7	M
47-0049	07010205		BELLE	886	E	H	FS	200.0	
47-0060	07010205		SIOUX	381	E	H	FS	170.0	
47-0082	07010204		DUNNS	159	E	H	FS	140.0	
47-0102	07010204		ROUND	263	E	H	FS	130.0	
47-0177	07010204	016	LONG	711	E	H	FS	160.0	
49-0025	07010201	006	RICE	323	E	H	FS	110.0	
49-0030	07010201		PELKEY	113	E	H	FS	120.0	
56-0308	09020103		NO NAME	46	E	H		-	M
56-0309	09020103	019	SLAUGHTERHOUSE SLU	19	E	H		-	
56-0476	09020103		MAINE	83	E	H		-	
56-0945	09020103	001	ORWELL	396	E	H		-	M
58-0142	07030004		POKEGAMA	1474	M	H	FS	100.0	
61-0072	07020005	009	GILCHRIST	330	E	H	FS	178.8	
62-0004	07010206	001	PIGSEYE	511	E	H		-	
62-0006	07010206		KOHLMAN	72	M	H	FS	143.7	
62-0010	07010206		KELLER	68	M	H	FS	118.5	
62-0011	07010206		WAKEFIELD	23	M	H	FS	65.2	
62-0012	07010206		ROUND	30	M	H	FS	116.3	
62-0016	07010206		BEAVER	84	M	H	FS	132.5	
62-0018	07010206		DEEP	73	M	H	FS	161.7	
62-0048	07010206		BENNETT	41	M	H	FS	53.4	
62-0049-01	07010206		LANGTON(NORTH BAY)	20	M	H		-	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
13-0012-02	07030005		CHISAGO (SOUTH BAY)	-	M	H	FS	61.0	
13-0027	07030005		SOUTH CENTER	836	M	H	FS	54.5	
13-0032	07030005		NORTH CENTER	726	M	H	FS	52.0	M
13-0069-01	07030005	031	RUSH (EAST BAY) 5 M	-	M	H	FS	136.7	
19-0020	07040002		CHUB	261	E	H	FS	89.0	
19-0021	07020012		ALIMAGNET	109	M	H		-	
19-0023	07040001		FARQUHAR	74	E	H	FS	70.0	
19-0026-02	07040001		MARION (MIDDLE BAY	200	M	H		-	
19-0067	07020012		THOMAS	56	E	H	FS	70.0	
21-0003	07010202		SWIMS	151	E	H	FS	220.0	M
21-0011	07010202		KUNTZ	161	E	H	FS	170.0	
21-0051	07010108		HENRY	159	E	H	FS	210.0	M
21-0053	07010108		AGNES	141	E	H	FS	180.0	M
21-0081-01	07010108		WINONA (NORTH BAY)	-	E	H	FS	164.1	M
21-0081-02	07010108		WINONA (SOUTH BAY)	-	E	H	FS	140.0	M
21-0336	07020005		FANNY	43	E	H	FS	260.0	M
26-0076	07020002	007	LITTLE	69	E	H		-	M
27-0004	07020012		PENN	32	E	H	FS	176.7	
27-0019	07010206	002	NOKOMIS	204	M	H	FS	101.0	
27-0034	07010206		CRYSTAL	76	M	H	FS	71.0	
27-0042-01	07010206		TWIN (SOUTH BAY) AT	-	E	H	FS	76.0	
27-0058	07010206		RYAN	18	E	H		-	
27-0062-01	07020012		ANDERSON (NORTH BAY	210	E	H		-	
27-0078	07020012		STARING	161	M	H	FS	196.0	
27-0098	07010206		BASS	175	E	H	FS	81.0	
27-0103	07010206		LOST	20	E	H		-	
27-0110	07010206		UNNAMED	14	E	H		-	
27-0125	07010206		DIAMOND	408	M	H	ST	8.5	
27-0127	07010206		FRENCH	352	M	H		-	
27-0133-09	07010206	008	MINNETONKA (HALSTED	-	M	H	FS	128.0	M
27-0133-14	07010206		MINNETONKA (WEST AR	-	M	H	FS	134.1	M
27-0133-15	07010206		MINNETONKA (JENNING	-	M	H	FS	143.6	M
27-0141	07010206	008	TANAGER	50	M	H	FS	113.3	
27-0144	07010206	008	GALPIN	48	E	H		-	
27-0157	07010206		WOLSFELD	36	E	H	FS	152.0	
27-0160	07010206		LONG	272	M	H	FS	126.7	
27-0181	07010206		DUTCH	160	M	H	FS	151.0	
27-0182	07010206		LANGDON	141	M	H	FS	174.3	
27-0184-01	07010205		WHALETAIL (NORTH BA	420	M	H		-	
30-0022	07010207		SKOGMAN	215	E	H	FS	110.0	
30-0043	07010207		FANNIE	393	E	H	FS	110.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST				NOT SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
86-0190	07010204		ANN	386	E	H	FS	190.0	
86-0208	07010203		SWART WATTS	171	E	H	FS	150.0	
86-0229	07010203		MINK	301	E	H	FS	100.0	
86-0230	07010203		SOMERS	158	E	H	FS	100.0	
86-0281	07010203		CAROLINE	116	M	H	FS	230.2	M
86-0282	07010203	015	LOUISA	149	M	H	FS	248.7	M
86-0297	07010203	015	SCOTT	92	M	H	FS	262.6	M

ECOREGION = NORTHERN GREAT PLAINS				PARTIALLY SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
41-0034	07020004		EAST STAY	220	E	E	FS	155.0	
76-0146-02	07020002		OLIVER (SE BAY) 1	-	M	E	FS	356.3	

ECOREGION = NORTHERN GREAT PLAINS				NOT SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
06-0002	07020002		ARTICHOKE	2053	M	H	FS	280.0	
06-0029	07020001		LONG TOM	133	M	H	FS	213.3	
06-0152	07020001	022	BIG STONE	12610	M	E		-	M
37-0046-01	07020001		LAC QUI PARLE (SOUT	4700	E	H		-	
41-0021	07020006	007	DEAD COON	576	M	H	FS	186.7	
41-0043	07020006	008	BENTON AT LAKE BE	2857	M	H	FS	168.0	
41-0089	07020004		SHAOKOTON 7 MI SW	995	E	H	FS	165.0	
42-0002	07020006		SCHOOL GROVE 6 MI	318	E	H	FS	245.0	
42-0047	07100001		YANKTON	382	M	H	FS	146.7	
42-0052	07020008		ROCK	422	M	H	FS	158.3	
42-0093	07020006		EAST GOOSE	139	M	H	FS	166.7	
51-0063	07100001	006	SARAH	1093	M	H	FS	148.3	
51-0082	07100001		CURRANT	394	M	H	FS	198.0	
75-0075	07020002	002	PERKINS 10 MI N O	519	M	H	FS	262.9	
75-0200	07020002		HATTIE 5 MI S OF	488	M	H	FS	185.7	
75-0267	09020102	005	PETERSON SLOUGH	52	E	H	FS	240.0	
75-0268	09020102	005	LUNDBERG	91	E	H	FS	180.0	
76-0086	07020005		HASSEL	706	M	H	FS	240.0	
76-0146-01	07020002		OLIVER (NW BAY)	-	E	H	FS	300.0	

ECOREGION = NORTH CENTRAL HARDWOOD FOREST NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
62-0049-02	07010206		LANGTON(SOUTH BAY)	15	M	H		–	
62-0055	07010206		COMO	70	M	H	FS	48.8	
62-0067	07010206		LONG	184	M	H	FS	133.5	
62-0069	07010206		PIKE	36	M	H	FS	112.5	
62-0071	07010206		VALENTINE	60	M	H	FS	115.6	
62-0075-01	07010206		ISLAND (BASIN SOUTH	–	M	H	FS	59.4	
62-0081	07010206		MUD	16	M	H		–	
62-0083	07010206	002	SILVER	69	M	H	FS	53.3	
66-0008	07040002	015	CANNON	1591	M	H		–	
66-0032	07040002		UNION	437	E	H		–	
66-0047	07040002	017	HUNT	160	M	H		–	
66-0052	07040002		CEDAR	872	M	H	FS	117.1	
66-0055	07040002		SHIELDS	877	M	H		–	
70-0022	07020012		CLEARY	137	M	H	FS	135.0	
70-0050	07020012		MCMAHON	131	M	H	FS	73.3	
70-0052	07020012		CYNTHIA	195	E	H	FS	145.0	
70-0054	07020012		SPRING	631	M	H	FS	167.2	
70-0072	07020012		UPPER PRIOR	340	M	H	FS	143.1	
70-0091	07020012		CEDAR	749	M	H	FS	184.9	
70-0095	07020012		O DOWD	257	M	H	FS	110.0	
70-0120	07020012		THOLE	141	M	H	FS	108.0	
71-0013	07010203	009	ORONO	281	E	H	FS	110.0	
71-0055	07010203		ELK	353	M	H	FS	110.0	
71-0141	07010203	004	ELK BIG	360	E	H	FS	140.0	
71-0146	07010203		BRIGGS	406	E	H	FS	110.0	
71-0147	07010203		RUSH	161	E	H	FS	110.0	
73-0014	07010203	015	MARIE	114	M	H	FS	238.0	
73-0083	07010202	002	GREAT NORTHERN	113	M	H	FS	201.3	M
73-0086	07010202		KNAUS	107	M	H	FS	194.8	M
73-0087	07010202		KRAYS	90	M	H	FS	201.3	M
73-0088	07010202		BOLFING	103	M	H	FS	170.4	M
73-0089	07010202	002	ZUMWALLES	111	E	H	FS	202.3	M
73-0133-01	07010202		CEDAR ISLAND (MAIN	995	M	H	FS	169.8	M
73-0133-02	07010202		CEDAR ISLAND (MUD L	995	E	H	FS	137.6	M
73-0133-03	07010202	002	CEDAR ISLAND (KOETT	995	M	H	FS	197.0	M
73-0133-04	07010202	002	CEDAR ISLAND (EAST	–	M	H	FS	206.3	M
73-0139	07010202		LONG	460	M	H	FS	150.0	
73-0157	07010202		HORSESHOE	995	M	H	FS	181.4	M
73-0199	07010201		SAND	202	E	H	FS	150.0	
81-0095	07020011	016	ELYSIAN	2289	E	H	FS	162.0	
82-0122	07010206		PINE TREE	170	M	H	FS	57.3	
86-0009	07010204		MARTHA	97	M	H	FS	100.0	
86-0025	07010204		SCHOOL	76	E	H	FS	69.0	M
86-0026	07010204		MUD	128	E	H	FS	96.3	M
86-0041	07010204		DEAN	178	M	H	FS	130.0	
86-0089	07010204		TAMARACK	52	E	H	FS	140.0	
86-0090	07010204	020	BUFFALO AT BUFFAL	1510	E	H	FS	181.4	M
86-0097	07010204		CARRIGAN	162	E	H		–	M
86-0106	07010204		LITTLE WAVERLY	278	E	H	FS	180.0	
86-0114	07010204		BIG WAVERLY	179	E	H	FS	150.0	
86-0139-02	07010203		UNNAMED (N BAY)	80	E	H		–	
86-0178	07010204		DOG	94	E	H	FS	110.0	
86-0184	07010204		DUTCH	218	E	H	FS	210.0	M
86-0188	07010204		EMMA	180	E	H	FS	180.0	

ECOREGION = NORTHERN LAKES AND FORESTS

FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
04-0130	07010101	029	BEMIDJI	6420	M	M	FS	163.8	
04-0137	09020302		WHITEFISH	330	E	M		-	
04-0166	09020302		JULIA	450	M	M	FS	134.0	
04-0230	07010101		DEER	262	M	M	FS	152.5	
09-0003	04010301		GRAHAM	46	M	M		-	
09-0008	04010201		CHUB	274	M	M	FS	49.0	
09-0026	07030003	007	BOB	78	M	M		-	
09-0029	07030003		PARK	373	M	M		-	
09-0032	04010201		BIG	507	M	M	FS	16.0	
09-0034	07030003	006	BEAR	106	M	M		-	
09-0035	07030003	006	LITTL HANGING HORN	118	M	M		-	
09-0038	07030003	006	HANGING HORN	409	M	M		-	M
09-0057	07010103		EAGLE	410	E	M	FS	56.0	
09-0068	07010103		COLE	153	M	M	FS	20.0	
11-0009-01	07010103		L THUNDER (W BAY) 5	-	E	O	FS	140.0	
11-0009-02	07010103		L THUNDER (E BAY) 5	-	E	M	FS	140.0	
11-0045	07010105		MARGARET	15	E	M	ST	9.5	
11-0054	07010105		LITTLE ANDRUS	24	E	O	ST	8.5	
11-0059	07010105		WASHBURN	1768	M	M	FS	72.3	
11-0062	07010102		THUNDER	1331	M	M		-	
11-0069	07010102		BASS	224	M	O		-	
11-0073	07010103		BIG RICE	2530	E	M	FS	140.0	
11-0102	07010102		ISLAND 10 MI SW O	277	M	M	FS	42.1	
11-0105	07010102		UPPER TRELIPE 8 M	422	M	M	FS	131.7	
11-0121	07010102		MABEL	165	E	M	FS	38.0	
11-0142-02	07010102		LONG (MAIN BASIN)	650	M	O		-	
11-0171-01	07010102		WABEDO (NE BAY) 5	560	M	M		-	
11-0174	07010102		GIRL	383	M	O		-	
11-0201	07010102		WOMAN	4782	M	M		-	
11-0203-03	07010102	008	LEECH (AH-GWAH-CHIN	10	M	M		-	M
11-0203-04	07010102	008	LEECH (SHINGOBEE BA	40	M	M		-	M
11-0218	07010106		UPPER GULL	371	M	M		-	
11-0220	07010106		RAY (BASS LAKE)	136	M	M		-	
11-0221	07010106	007	SPIDER	21	M	M		-	
11-0234	07010102		PONTO	724	E	O	FS	60.0	
11-0237	07010105		DEEP PORTAGE	31	M	O		-	
11-0250	07010105		ADA	975	M	M	FS	95.0	
11-0263	07010102		CHILD	316	M	M		-	
11-0265	07010102		SQUAW	31	E	M	FS	150.0	
11-0273	07010102		WIDOW	180	M	M		-	
11-0296	07010102		MOCCASIN	242	E	M	FS	22.0	
11-0302	07010102		LITTLE PORTAGE	68	E	M	ST	5.4	
11-0304-01	07010106		SYLVAN (SW BAY) AT	-	E	M	FS	100.0	
11-0304-02	07010106		SYLVAN (NE BAY) AT	-	E	O	FS	110.0	
11-0305	07010106	004	GULL	9541	M	M	FS	108.2	
11-0308-01	07010105		BIG PORTAGE (WEST B	-	M	M	FS	120.0	
11-0308-02	07010105		BIG PORTAGE(E BAY/R	185	M	M		-	
11-0311	07010102		WEBB	724	E	O	FS	110.0	
11-0314	07010101		LYDICK	60	E	M		-	
11-0351	07010105		FIVE POINT	219	M	M	FS	140.0	
11-0355	07010105		OX YOKE	166	E	M	FS	110.0	
11-0358	07010105		HORSESHOE	225	E	M	FS	100.0	
11-0361	07010105		SANBURN	233	E	M	FS	90.0	
11-0383	07010102		PLEASANT	1038	M	O	FS	130.0	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
01-0015	07010103		GREEN	68	E	M	FS	13.0	
01-0023	07010103		ROUND	577	M	O	FS	24.0	
01-0024	07010103	011	TOWN LINE	32	E	M	ST	6.2	
01-0031	07010103		ANDERSON	86	E	M	FS	24.0	
01-0032	07010103		CAMP	14	E	M	FS	12.0	
01-0038	07010103		REMOTE	132	E	O	ST	2.0	
01-0059	07010103		HAY	106	E	M	FS	98.0	
01-0087	07010104		SUGAR	398	E	O	FS	44.0	
01-0089	07010104		LONG	415	E	M	FS	76.0	
01-0102	07010104		WILKINS	372	M	O		-	
01-0117	07010104		NORD	411	E	M	FS	19.0	
01-0125	07010104		LONE	448	M	O		-	
01-0137	07010104		ROUND	607	E	O	FS	84.0	
01-0150	07010104		LITTLE SPRUCE	40	E	O	FS	42.0	
01-0157	07010207		BIG PINE	614	M	O	FS	98.0	
01-0159	07010104		FARM ISLAND	2054	M	M		-	
01-0178	07010104		SPIRIT	530	M	M	FS	82.0	
01-0208	07010104		SUNSET	135	E	M	FS	20.0	
01-0209-01	07010104		CEDAR (MAIN BASIN)	-	E	M	FS	108.0	
01-0212	07010105		MOULTON	258	E	M	ST	8.0	
01-0217	07010104		LITTLE TURTLE	11	M	M		-	
03-0029	07010106		HUNGRY MEN 2 MI E	91	M	M	FS	101.0	
03-0030	07010106		BOOT 2 MI NW OF TW	401	M	O	FS	157.3	
03-0085	07010106		BAD MEDICINE 11 MI	782	M	M	FS	130.0	
03-0134	09020103		GREEN WATER	71	E	M		-	
03-0136	09020103		JUGGLER	365	M	O		-	
03-0153	09020103		ISLAND	1160	M	M	FS	160.0	
04-0011	07010101		MOOSE	568	M	M	FS	120.0	
04-0030	07010101		CASS	29775	M	M	FS	142.5	M
04-0076	07010101		LONG	395	M	O		-	
04-0122	09020302		MEDICINE	446	E	M	FS	140.0	

ECOREGION = NORTHERN LAKES AND FORESTS				FULLY SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
16-0365	04010101	033	CLARA	410	E	O	FS	15.0	
16-0366	04010101		HOLLY	69	E	M	FS	24.0	
16-0373	04010101	033	CHRISTINE	192	E	M	FS	20.0	
16-0375	04010101		PIPE	300	E	M	ST	8.0	
16-0381	04010101	028	JOCK MOCK	17	E	M	FS	14.0	
16-0388	04010101	038	BOUDER	136	E	M	FS	10.0	
16-0398	04010101	029	WENCH	24	M	M	ST	7.5	
16-0402	04010101	029	JUNO	248	E	O	ST	8.0	
16-0406	04010101		HOMER	516	E	M	ST	9.0	
16-0412	04010101	029	NORTH CONE	86	M	O	ST	7.4	
16-0435	04010101		DAVIS	465	E	O	ST	7.0	
16-0448	09030001		LOON	1197	E	M	FS	15.0	
16-0453	04010101	035	RICE	182	E	M	FS	12.0	
16-0456	04010101		NORTH TEMPERANCE	178	E	M	ST	8.0	
16-0460	09030001		LONG ISLAND	901	E	O	FS	10.0	
16-0477	04010101		BURNT	327	E	M	FS	10.0	
16-0486	04010101		BAKER	24	E	M	FS	10.0	
16-0496	04010101	041	SAWBILL	944	E	M	FS	10.0	
16-0608	09030001		HAM	100	E	O	FS	12.0	
16-0617	09030001		GNEISS	220	E	O	FS	20.0	
16-0622	04010101	042	ALTON	1034	E	M	FS	12.0	
16-0629	09030001	022	SEA GULL	3736	M	M	FS	16.0	
16-0632-01	09030001	045	GULL (MAIN BASIN) 2	172	M	M		-	
16-0654	04010101		TIMBER	236	E	M	FS	10.0	
16-0659	09030001	021	BETH	182	E	M	ST	3.8	
16-0677	09030001	021	DENT	112	E	M	ST	7.8	
16-0686	09030001	021	WINE	264	E	M	ST	5.6	
16-0701	09030001	021	BARTO	95	E	M	ST	5.0	
16-0720	09030001	043	RATTLE	50	M	M		-	
16-0753	09030001		GILLIS	595	E	O	FS	14.0	
16-0757	09030001		PETER	259	E	O	FS	14.0	
16-0759	09030001	045	ALPINE	834	M	O	FS	14.0	
16-0768	09030001	043	JASPER	239	M	O		-	
16-0793	09030001	045	RED ROCK	353	E	M	FS	24.0	
16-0808	09030001	021	PHOEBE	625	E	M	ST	5.3	
16-0809	09030001	043	LITTLE SAGANAGA	1575	M	M	FS	14.0	
16-0811	09030001	043	GABIMICHIGAMI	1236	M	O	FS	14.0	
16-0812	09030001	043	KINGFISHER	35	M	O		-	
18-0019	07010207		KENNEY	108	M	M		-	
18-0034	07010104		BAY	2392	M	M		-	
18-0038	07010104		CLEARWATER	917	M	O		-	
18-0041-01	07010104		CROOKED-SUGAR BAY	120	M	M		-	
18-0041-02	07010104		CROOKED-MAIN BASIN	320	M	O		-	
18-0044	07010104		HANKS	171	M	M		-	
18-0048	07010207		PARTRIDGE	185	M	M		-	
18-0050	07010104		PORTAGE	292	M	M		-	
18-0059	07010104		BLACK	105	M	M		-	
18-0069	07010104		PORTAGE	120	M	M		-	
18-0090	07010104		SERPENT	1057	E	M		-	M
18-0099	07010104		EAGLE	228	M	M		-	
18-0140	07010104	026	BLACK BEAR	217	E	M	FS	120.0	
18-0206	07010105		PAPOOSE	94	M	M	ST	7.3	
18-0212	07010105		RUTH	623	M	O		-	
18-0225	07010105		ADNEY	322	M	M		-	

ECOREGION = NORTHERN LAKES AND FORESTS				FULLY SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
11-0395	07010102		LONG	56	E	M	FS	10.0	
11-0411	07010105		PINE MTN	1567	E	M		–	M
11-0412	07010102		BIRCH	1283	M	M	FS	103.3	
11-0413	07010102		TEN MILE	4640	M	O		–	
11-0415	07010101		PIKE BAY	4760	E	M	FS	139.3	M
11-0450	07010106		SOUTH HAYNES	96	E	M	FS	68.0	
11-0472	07010102		HOWARD	398	M	M		–	
15-0005	07010101		SQUAW 3 MI SW OF	151	M	M	FS	76.0	
15-0010	07010101		ELK 5 MI S OF LAK	271	M	M	FS	160.0	
15-0057	07010101		LONG 5 MI NW OF L	145	M	O	FS	162.5	
15-0068	09020103		LONG LOST	390	M	O		–	
16-0019	04010101	015	TOM	576	M	M	ST	9.0	
16-0023	04010101		ESTHER	76	M	M	FS	10.0	
16-0027	04010101		MCFARLAND	384	E	O	FS	16.0	
16-0029	04010101		DEVILFISH	398	E	M	ST	8.0	
16-0030	04010101		HIGHLANDER	29	E	M	FS	10.0	
16-0033	04010101		CHESTER	49	M	M	FS	10.0	
16-0035	04010101		JOHN	169	E	M	FS	12.0	
16-0041	04010101	013	PINE	2257	E	O	FS	18.0	
16-0049	04010101		TROUT	257	M	O	FS	13.5	
16-0077	04010101	017	GREENWOOD	1783	M	O	ST	9.0	
16-0089	04010101	018	NORTHERN LIGHT	433	E	M	FS	10.0	
16-0090	04010101	013	CRYSTAL	211	E	O	FS	10.0	
16-0096	04010101		ELBOW	437	E	O	FS	11.0	
16-0104	04010101	026	MUSQUASH	141	E	M	FS	10.0	
16-0114	04010101		ALDER	534	E	O	FS	12.0	
16-0115	04010101		ROCKY	76	E	M	FS	16.0	
16-0139	04010101		CLEARWATER	1325	M	O	FS	15.0	
16-0143	04010101	024	DEVIL TRACK	1873	E	M	FS	14.5	
16-0146	04010101		E. BEARSKIN	643	E	M	FS	10.0	
16-0147	04010101		FLOUR	319	E	M	FS	22.0	
16-0156	04010101	026	TWO ISLAND	794	E	[illegible]	FS	10.0	
16-0164	04010101		BATH	30	E	M		–	
16-0182	04010101		BALL CLUB	188	M	M	ST	9.0	
16-0191	04010101		THRUSH	16	E	O		–	
16-0192	04010101		THRASHER	27	E	M		–	
16-0198	04010101		LEO	145	E	M	FS	10.0	
16-0202	04010101		SQUINT	18	M	M	FS	12.3	
16-0227	04010101		HUNGRY JACK	459	E	M	FS	20.0	
16-0228	04010101		WEST BEARSKIN	493	M	O	FS	18.0	
16-0232	04010101		DUNCAN	478	E	O	FS	20.0	
16-0235	04010101		MCDONALD	99	E	M	FS	10.0	
16-0239	04010101		POPLAR	755	E	M	FS	10.0	
16-0247	04010101		BIRCH	266	E	M	FS	19.0	
16-0252	04010101	032	PIKE	810	E	M	FS	20.0	
16-0267	04010101		VERNON	233	E	M	FS	11.0	
16-0299	09030001		RUSH	274	E	M	ST	9.0	
16-0328	09030001		IRON	105	E	M	FS	14.0	
16-0337	09030001		MAYHEW	202	E	O	FS	17.0	
16-0343	04010101		SURBER	10	E	M	FS	12.5	
16-0347	04010101		LITTLE CASCADE	262	E	O	FS	10.0	
16-0348	04010101	029	BRULE	4162	M	O	FS	10.0	
16-0356	09030001		GUNFLINT	4047	E	M	FS	24.0	
16-0357	09030001		CRAB	91	E	O	FS	16.0	

ECOREGION = DRIFTLESS AREA LAKES NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
25-0001	07040001	001	PEPIN	25000	E	H	FS	138.3	M

ECOREGION = NORTH CENTRAL HARDWOOD FOREST LAKES FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
02-0091	07010207		GEORGE	487	M	M	FS	70.7	
03-0304	09020106		BIG SUGAR BUSH	472	E	O		-	
03-0387	09020103		FLOYD	1234	M	M		-	
03-0475	09020103		MELISSA	1855	M	M		-	
03-0500	09020103		MAUD	540	M	M		-	
03-0576	09020103		BIG CORMORANT	3380	M	M	FS	250.0	
03-0602	09020103		MIDDLE CORMORANT	377	M	M	FS	186.7	
03-0657	09020103		TURTLE 4 MI NE OF	184	M	M	FS	212.5	
10-0009	07010206		MINNEWASHTA	747	M	M	FS	132.5	
10-0012	07020012		ANN	117	M	M	FS	145.7	
10-0053	07010206		PIERSON	340	M	M	FS	114.6	
13-0053	07030005		COMFORT	219	M	M		-	
14-0030	09020106		FIFTEEN	139	E	M		-	
19-0057	07020012		FISH	25	E	M	FS	93.3	
19-0076	07010206		MCDONOUGH	19	M	M	FS	71.3	
21-0056	07010108		LE HOMME DIEU	1892	E	M	FS	169.2	
21-0057	07010108	011	CARLOS	2520	M	M	FS	179.9	
21-0079	07020005		MAPLE AT FORADA	835	M	M	FS	207.5	
21-0080	07010108		DARLING	984	E	M	FS	187.1	
21-0083	07010108		MILTONA 1 MI W OF	6159	M	M	FS	184.0	
21-0085	07010108		ANDREWS 2 MI SW O	946	M	M	FS	211.3	
21-0106-01	07010108		LATOKA (NORTH BAY)	446	M	O		-	
21-0123	07010108		IDA	4506	M	M	FS	200.0	M
21-0145	07020005		CHIPPEWA 2 MI NE	1761	M	M	FS	198.9	
27-0016	07010206		HARRIET	353	M	M	FS	102.0	
27-0035-02	07010206		SWEENEY-TWIN (TWIN	20	E	M		-	
27-0047	07020012		BUSH	207	M	M	FS	95.4	
27-0071	07020012		ROUND	33	E	M		-	
27-0089-02	07020012		SHADY OAK (MIDDLE B	-	E	M	FS	140.0	
27-0133-02	07010206	008	MINNETONKA (LOWER L	-	M	M	FS	131.9	
27-0133-03	07010206	008	MINNETONKA (CARSONS	116	M	M		-	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
18-0239	07010106		SILVER	213	M	O		-	
18-0251-01	07010105		SANDBAR (HORSESHOE	560	M	M		-	
18-0251-02	07010105		SANDBAR (HORSESHOE	415	M	M		-	
18-0271	07010105		DAGGETT	225	M	M		-	
18-0284	07010105		VELVET	160	M	M		-	
18-0297	07010105		WEST FOX	472	M	O		-	
18-0298	07010105		EAST FOX	234	M	M		-	
18-0301	07010105		MEYER	53	E	M	FS	150.0	
18-0305	07010105		EDWARD	2032	E	M	FS	120.0	
18-0306	07010106		BASS	455	M	M		-	
18-0308	07010105		PELICAN	8253	M	O		-	M
18-0310	07010105	007	WHITEFISH	7370	M	O	FS	114.0	
18-0311	07010105	007	RUSH	891	M	O		-	
18-0312	07010105	008	CROSS	1751	M	O	FS	113.3	
18-0315	07010105		BIG TROUT	1418	M	O	FS	102.0	
18-0320-01	07010104		GILBERT (EAST BAY)	-	E	M	FS	92.0	
18-0320-02	07010104		GILBERT (WEST BAY)	-	E	M	FS	120.0	
18-0352	07010105		OSSAWINNAMAKEE	644	M	O		-	
18-0354	07010105	008	PIG	213	M	O		-	
18-0356	07010105	008	CLAMSHELL	189	E	O		-	
18-0359	07010105		STAR	153	M	O		-	
18-0360	07010105		LITTLE STAR	50	M	O		-	
18-0361	07010105		KIMBALL	186	M	M		-	
18-0362	07010105	008	GRASS	52	M	M		-	
18-0364	07010105		CLEAR	220	M	O		-	
18-0372	07010106		NORTH LONG	5998	M	M	FS	120.0	
18-0373	07010106		ROUND 3 MI S OF N	1644	M	M	FS	130.0	
18-0374	07010106		CLARK	309	E	M		-	
18-0376	07010106		UPPER CULLEN	435	M	M		-	
18-0377	07010106		MIDDLE CULLEN	382	M	M	FS	120.0	
18-0378	07010105	008	LOWER HAY	685	M	M	FS	110.0	
18-0398	07010106		ROY	271	M	M		-	
18-0399	07010106		NISSWA	207	M	M		-	
18-0403	07010106		LOWER CULLEN	512	M	M		-	
18-0409	07010106		WEST TWIN	117	M	O		-	
29-0001	07010106		KETTLE	41	E	O	FS	120.0	
29-0015	07010102		CRYSTAL	91	E	O	FS	80.0	
29-0020	07010106		LOON	112	E	M		-	
29-0022	07010102		STEEL	55	E	O	FS	170.0	
29-0023	07010106		ROBINSON	46	E	M	FS	110.0	
29-0048	07010102		BENEDICT	440	M	M		-	
29-0061	07010102	020	GARFIELD	980	M	M		-	
29-0074	07010106		INDIAN	49	E	O	FS	140.0	
29-0075	07010102	022	KABEKONA	2252	M	M		-	
29-0081	07010106		WOLF	261	E	M	FS	86.0	
29-0083	07010106		BLADDER	217	E	M	FS	100.0	
29-0117-02	07010106		SPIDER (EAST BAY) 2	120	M	O		-	
29-0148	07010106		UPPER BOTTLE	465	E	O		-	
29-0151-01	07010106		BIG MANTRAP (EAST B	750	E	M		-	
29-0151-02	07010106		BIG MANTRAP (MIDDLE	700	E	M		-	
29-0151-04	07010106		BIG MANTRAP (WEST A	200	E	O		-	
29-0151-05	07010106		BIG MANTRAP (HOME B	80	E	O		-	
29-0161	07010106	030	LONG	1974	M	M		-	
29-0180	07010106		LOWER BOTTLE	660	E	O		-	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
29-0185	07010106		BIG SAND	1640	M	O		-	
29-0188	07010106		GILMORE	91	E	M		-	
29-0239	07010101	033	SPEARHEAD	188	M	O		-	
29-0247	07010106		MORAN	95	E	M		-	
29-0312	07010106		CEDAR 3 MI E OF T	98	M	M	FS	120.0	
31-0001	04010201		LONG	124	E	M	FS	88.0	
31-0020	07010103		HART	325	M	M	FS	91.0	
31-0026-01	07010103		TWIN (EAST BAY) 5 M	-	E	M	FS	16.0	
31-0052	07010103		BOWER	88	M	M		-	
31-0058	09030005		BEATRICE	123	E	M	FS	10.0	
31-0093	07010103		LITTLE SAND	206	E	M	FS	70.0	
31-0141	07010103		SHOAL	285	E	M	FS	45.0	
31-0158	09030005		THISTLEDEW	318	M	M	FS	88.0	
31-0160	09030005		MIRROR	102	M	M		-	
31-0171	09030005		CRUM	21	M	M		-	
31-0175	09030006		LONG	86	M	M	ST	5.5	
31-0188	09030006	019	LORRAINE	31	E	M	FS	140.0	
31-0190	07010103		TWIN	250	E	M	FS	120.0	
31-0209	07010103	013	CLEAR	92	M	M	ST	9.0	
31-0218	07010103	028	SHAMROCK	52	E	M	FS	140.0	
31-0219	07010103	028	O'REILLY	198	E	M	FS	140.0	
31-0254	07010103		UNNAMED	20	E	M	FS	12.0	
31-0259	07010103		BALSAM	654	M	M		-	
31-0260	07010103		WHITE SWAN	148	M	M		-	
31-0289	09030005		LOST	85	M	M		-	
31-0311	09030006		ERSKINE	39	M	O		-	
31-0316	09030006		BASS	125	M	M	FS	11.8	
31-0317	09030006		LARSON	187	M	O	FS	160.0	
31-0339	09030006	019	PICKEREL	293	E	M	FS	110.0	
31-0349	07010103		ANTLER	232	M	M		-	
31-0373	07010103		HALE	142	E	M	FS	140.0	
31-0392	07010103		WABANA	2133	E	M		-	
31-0414	07010103		MOON	27	M	M		-	
31-0416	07010103		BLACK ISLAND	102	M	M	ST	8.0	
31-0417	07010103		NOSE	96	M	M	ST	7.0	
31-0422	09030006		RUBY	229	M	O		-	
31-0424	07010103		BURNT SHANTY 10 M	183	M	M	FS	42.3	
31-0434	07010103		SNOWSHOE	20	E	M	FS	14.0	
31-0438	07010103		SAND 12 MI N OF C	150	M	M	FS	79.3	
31-0454	07010103		EAGLE	252	M	M	FS	52.0	
31-0480	09030006		GUNN	342	E	M	FS	120.0	
31-0481	09030006		HIGHLAND	102	E	M		-	
31-0524-01	09030006	009	COON (NW BAY/COON L	-	E	M	FS	52.0	
31-0524-02	09030006		COON (SE BAY (SANDW	-	E	M	FS	52.0	
31-0532-01	07010101	003	POKEGAMA (MAIN)	3180	M	O		-	
31-0532-02	07010101	003	POKEGAMA (WENDIGO)	12720	E	M		-	
31-0536	07010103		DOAN	89	M	O		-	
31-0540	09030006		CLUBHOUSE	210	M	M	FS	110.0	
31-0554	07010101	003	SISEEBAKWET	1312	E	O	FS	110.0	
31-0603	07010101		LUCKY	13	E	O	ST	8.0	
31-0604	07010101		LAWRENCE	41	E	O	FS	12.0	
31-0616	09030006		EAST SMITH	145	E	M	FS	12.0	
31-0620	09030006		CARIBOU	251	E	O	FS	22.0	
31-0624	09030006		GRAVE	503	E	M	FS	130.0	

ECOREGION = NORTHERN LAKES AND FORESTS				FULLY SUPPORTING SWIMMABLE USE					
LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
31-0638	07010101		BEAVER	13	E	O	FS	10.0	
31-0643	07010101		DOCTOR	17	E	O	ST	8.0	
31-0644	07010101		ISLAND	19	M	O		-	
31-0645	07010101		KREMER	64	E	M	FS	10.0	
31-0649	09030006		DOCK	30	E	O	ST	8.0	
31-0653	09030006		NORTH STAR	1052	E	M	FS	110.0	
31-0656	09030006		BIG DICK	246	M	M		-	
31-0664	09030006		RANIER	72	M	O	FS	52.0	
31-0671	09030006		BIG ISLAND 5 MI E	193	M	M	FS	18.1	
31-0679	09030006		LITTLE SMITH	27	E	M	FS	44.0	
31-0687	09030006		JOHNSON	305	E	M		-	
31-0719	07010101	007	DEER	3926	M	O		-	
31-0722	07010101		MOOSE	1231	E	M	FS	120.0	
31-0725	09030006		(BIG) TURTLE	2018	M	M		-	
31-0775	07010103	035	NO-TA-SHE-BUN	238	E	M	FS	96.0	
31-0812	07010101	010	BALL CLUB	3936	E	M	FS	135.0	
31-0837	09030006	009	NOMA	59	M	M		-	
33-0003	07030003		FIVE	42	M	M	ST	5.6	
38-0011	09030001	043	AGAMOK	106	M	M		-	
38-0024-01	04010101		CROOKED (EAST BAY)	-	E	O	FS	17.0	
38-0026	04010101		HARE 4 MI NW OF TA	48	E	M	FS	18.0	
38-0028	04010101		ECHO 4.5 MI NW OF	46	E	M	FS	24.0	
38-0029	04010101		GOLDENEYE	10	E	M	FS	10.0	
38-0033	04010101		NINEMILE 4 MI NW	339	E	M	FS	21.0	
38-0047	04010101		WILSON	622	M	M	FS	16.7	
38-0057	04010101		HOGBACK 5 MI E OF	44	E	M	FS	19.0	
38-0058	04010101		SCARP 5.5 MI E OF	43	E	M	FS	10.0	
38-0064	09030001		COFFEE	126	E	M	FS	10.5	
38-0067	04010101		ORGAN	44	M	O		-	
38-0104	09030001	021	POLLY	513	E	O	FS	10.0	
38-0108	09030001	021	KIVANIVA	38	M	M		-	
38-0113	09030001	021	RAVEN	205	E	M	FS	10.0	
38-0126	09030001	021	ELTON	122	M	M		-	
38-0140	09030001	021	BOULDER	236	E	M	FS	11.0	
38-0147	09030001	021	MAKWA	143	M	O		-	
38-0151	09030001	021	PAN	100	M	M		-	
38-0153	09030001	021	ADAMS	448	M	O	ST	9.5	
38-0157	09030001	021	ANIT	11	M	M		-	
38-0166	09030001	043	CHERRY	147	E	M	FS	22.0	
38-0180	09030001	043	OGISHKEMUNCIE	701	M	O	FS	13.0	
38-0187	09030001	043	EDDY	197	M	O	FS	17.0	
38-0188-02	09030001	043	EKABIC PONDS(MIDDLE	24	M	O		-	
38-0193	09030001	043	MUELLER	24	M	O		-	
38-0194-01	09030001	043	JENNY (WEST BAY)	93	M	O		-	
38-0195	09030001	043	ANNIE	23	M	M		-	
38-0206	09030001	043	HANSON	284	E	M	FS	26.0	
38-0207	09030001	043	ESTER	389	E	M	FS	28.0	
38-0214	09030001	043	RABBIT	104	E	M	FS	22.0	
38-0218	04010101		ELIXER	18	E	M	FS	24.0	
38-0223	09030001	021	BEAVER	237	M	M	ST	7.3	
38-0225	09030001	021	SAGUS	172	E	M	FS	10.0	
38-0226	09030001	043	KEKEKABIC	1620	M	O	FS	16.0	
38-0227	09030001	043	AMOEBER	386	E	M	FS	24.0	
38-0269	04010101		HOMESTEAD 4.5 MI	57	E	M	FS	14.0	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
38-0330	09030001	021	ALICE	1566	M	M	FS	10.0	
38-0336	09030001	021	AMBER	135	M	M	ST	6.9	
38-0338	09030001	021	RIVER	126	M	M		–	
38-0351	09030001	021	THOMAS	1471	M	O	ST	9.3	
38-0369	09030001	021	HATCHET	126	E	M	ST	9.6	
38-0372	09030001	021	FRASER	1091	M	O	FS	10.0	
38-0388	09030001	043	SPOON	223	M	M	FS	30.0	
38-0390	09030001	043	BONNIE	71	M	M		–	
38-0397	09030001	021	INSULA	2700	E	M	ST	9.7	
38-0404	09030001	043	KNIFE	5536	M	O	FS	30.0	
38-0453	09030001	021	SOUTH WILDER	614	E	O	ST	6.0	
38-0488	09030001	021	DISAPPOINTMENT	976	E	M	FS	12.0	
38-0491	09030001	043	VERA	181	E	O	FS	35.0	
38-0498	09030001	021	ENSIGN	1408	E	M	FS	21.0	
38-0502	09030001	043	ASHIGAN	189	E	M	FS	36.0	
38-0526	09030001	021	PARENT	1571	E	O	FS	16.0	
38-0529	09030001	023	SNOWBANK	3303	M	O	FS	13.0	
38-0580	09030001	021	HORSESHOE	194	E	M	ST	6.2	
38-0584	09030001	021	PIETRO	339	E	M	FS	12.0	
38-0590	09030001	021	GULL	503	E	M	ST	8.0	
38-0600	09030001	021	THREE	854	E	M	ST	8.0	
38-0605	09030001	021	ONE	876	E	O	FS	10.0	
38-0608	09030001	021	LAKE TWO	481	E	M	ST	9.0	
38-0616	09030001	021	MANOMIN	455	E	M	ST	9.0	
38-0638	09030001	021	CLEARWATER	641	E	O	ST	9.0	
38-0640	09030001	021	OJIBWAY	438	E	M	FS	33.0	
38-0645	09030001		BASSWOOD-WHOLELAKE	29400	E	M	FS	17.0	
38-0651	04010202		KANE	110	M	M	ST	7.9	
38-0664	09030001	011	DUNNIGAN	83	M	M	ST	3.9	
38-0674	09030001	011	EAST CHUB	64	M	M	FS	23.8	
38-0691	09030001		AUGUST	218	E	M	FS	17.0	
38-0701	09030001	021	GABBRO	896	E	M	FS	31.3	
38-0715	09030001	021	TRIANGLE	318	E	O	FS	36.0	
38-0718	09030001	021	GREENSTONE	345	E	M	FS	22.0	
38-0724	09030001	021	TOFTE	134	E	M	FS	69.3	
38-0727	09030001	021	ELLA HALL	511	E	M	FS	28.0	
38-0729	09030001	021	WOOD	643	E	M	FS	49.0	
38-0741	09030001	021	PICKEREL	184	E	M	FS	29.4	
38-0744	04010102		STEWART	267	M	M	FS	52.0	
38-0779	09030001		FARM	1328	M	M	FS	14.0	
38-0780	09030001		BROWNS	206	E	M	FS	22.0	
38-0784	09030001		NEWTON	500	E	M	FS	16.0	
38-0786	09030001		SANDPIT	65	M	O	ST	9.7	
38-0792	09030001		HORSE	647	E	O	ST	6.0	
38-0810	09030001		CEDAR	489	E	O	FS	26.0	
38-0816	09030001		MOOSECAMP	190	E	O	ST	8.0	
38-0817	09030001	037	CROOKED	10904	E	M	FS	20.0	
48-0002	07010207		MILLE LACS	132516	M	M	FS	92.3	
49-0015	07010201		LONG	120	E	M	FS	110.0	
49-0016	07010201		SULLIVAN	1221	E	O	FS	72.0	
49-0019	07010201		ROUND	113	M	M		–	
49-0137	07010108	017	FISHTRAP	1303	M	M		–	
58-0007	07030001		ROCK	81	M	M		–	
58-0013	07030001		GRIEGS	53	M	M		–	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
58-0024	07030001		BIG TAMARACK	75	M	M	ST	6.1	
58-0028	07030001	042	LITTLE TAMARACK	60	M	M		-	
58-0044	07030001		OLIVE	12	M	M		-	
58-0048	07030003		OAK	442	E	M		-	
58-0062	07030003		ISLAND	546	M	M		-	
58-0074	07030003		JOHNSON	37	E	M	FS	16.0	
58-0078	07030003		RUSH	125	M	M		-	
58-0081	07030003		SAND	501	E	M		-	
58-0088	07030001		UNNAMED	10	M	M		-	
58-0107	07030003	003	LONG	75	E	M		-	
58-0123	07030003	022	GRINDSTONE	529	M	M		-	
58-0127	07030003		LITTLE BASS	16	M	M	ST	6.2	
58-0128	07030003		BASS	30	E	M	ST	4.0	
69-0001	04010201		PINE	430	E	M	FS	15.3	
69-0061	09030001	006	ONE PINE	363	E	M	FS	18.0	
69-0063	09030001		BASS	144	E	M	FS	28.0	
69-0066	09030001	025	LITTLE LONG	293	E	M	FS	42.0	
69-0071	09030001		HIGH	277	E	M	ST	8.0	
69-0084	09030001		SLETTEN	18	M	M	ST	7.3	
69-0085	09030001	025	FENSKE	105	M	M		-	
69-0093	09030001		GUN	336	E	M	FS	10.0	
69-0100	09030001		BOOT	308	E	M	ST	6.0	
69-0115	09030001		BEAR ISLAND	2667	E	M	FS	15.0	
69-0117	09030001	006	JOHNSON	465	E	M	FS	10.0	
69-0118	09030001	025	BURNTSIDE	10236	M	O	FS	12.0	
69-0128	04010202		BRIAR	70	M	M	FS	20.0	
69-0129	04010202		SPRING	97	E	M	FS	50.0	
69-0161	09030001	025	WOLF	299	E	M	FS	38.0	
69-0181	09030001		SLIM	296	E	M	ST	6.0	
69-0205	09030001		STUART	752	E	O	ST	6.0	
69-0213	09030001	028	TOE	484	E	O	FS	16.0	
69-0220	09030001		CRAB	219	E	O	ST	8.0	
69-0223	09030001	031	AGNES	973	E	O	FS	12.0	
69-0224	09030001		LAC LA CROIX	34070	E	M		-	
69-0254	04010201		BEAR HEAD	674	E	M	FS	19.7	
69-0278	09030002	024	ARMSTRONG	389	E	M	FS	38.0	
69-0285	09030002		EAGLENEST #4	1471	E	M	FS	44.0	
69-0316	09030001	033	BIG MOOSE	1032	E	M	ST	8.0	
69-0329	09030001		MEANDER	139	M	O		-	
69-0330	09030001		OYSTER	714	E	O	ST	8.0	
69-0342	09030001		ROCKY	114	E	O	ST	6.0	
69-0343	09030001		HUSTLER	272	M	M	ST	4.9	
69-0350	09030001	028	GE-BE-ON-EQUAT	607	E	O	ST	8.0	
69-0369	09030001	028	TAKUCMICH	320	E	O	FS	10.0	
69-0381	09030002		BUCK	194	E	O	ST	8.0	
69-0434	04010201	035	WYNNE	279	E	M	FS	52.7	
69-0448	09030002		PINE	912	E	M	ST	7.0	
69-0452	09030001		BOOTLEG	352	E	O	ST	6.0	
69-0464	09030001		UPPER PAUNESS	215	E	M	ST	6.0	
69-0470	09030001		LOON	2616	E	O	ST	8.0	
69-0481	09030001	028	FAT	102	M	O		-	
69-0484	09030001	028	LITTLE LOON	175	E	M	FS	10.0	
69-0487	09030001	028	GUN	158	E	M	ST	6.0	
69-0493	04010201		LONG	208	E	M		-	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
69-0498	09030002	028	TROUT	7641	E	M	FS	11.0	
69-0528	04010201		LITTLE LONG	19	E	M	FS	15.0	
69-0553	04010201		BASS	146	E	M		-	
69-0565	04010201	035	ESQUAGAMA	366	M	M	FS	64.0	
69-0587	09030002	028	ORINIACK	761	E	O	ST	7.0	
69-0591	09030002		PICKET	312	E	O	ST	8.0	
69-0604	09030001	026	DOVRE	120	E	O	ST	6.0	
69-0616	09030002	003	CRANE	3088	E	M	FS	16.0	
69-0684	09030003		MUKOODA	754	E	O	FS	27.0	
69-0690	09030002		WINCHESTER	360	E	O	ST	8.0	
69-0694	09030003		RAINY	220800	E	M		-	
69-0744	09030002	029	ELBOW	1852	E	O	ST	7.0	
69-0748	09030002		KJOSTAD	444	E	O	ST	8.0	
69-0755	09030002		MARION	163	E	O	FS	22.0	
69-0760	09030003		LITTLE JOHNSON	481	E	M	FS	16.0	
69-0763	04010201		DOHERTY (SPIRIT)	71	M	M		-	
69-0765	09030003		LONG	409	E	M	FS	40.0	
69-0802	09030002		HOODOO	252	E	O	ST	9.0	
69-0806	09030002	007	MOOSE	977	E	O	FS	16.0	
69-0819	09030003		GANNON	89	E	M	FS	20.0	
69-0842	09030003	024	BLACKDUCK	1264	E	O	FS	42.0	
69-0864	09030003		ASH	669	E	O	FS	50.0	
69-0916	09030005		DOLLAR	11	E	M	FS	18.2	
69-0923	07010103		HOBSON	66	M	M	ST	8.8	
69-0939	09030005		STURGEON	1664	M	O		-	
80-0011	07010106		SAND	128	E	O	FS	42.0	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
01-0062	07010103		BIG SANDY 10 MI N	6571	M	E	FS	54.5	
01-0077	07010103		RAT	405	M	E	FS	80.0	
01-0096	07010104		DAM	642	E	E	FS	80.0	
01-0099	07010104		GUN	760	M	E	FS	115.6	
01-0104	07010104		FRENCH	137	E	E	FS	120.0	
01-0126	07010104		SJODINE	50	E	E	FS	14.0	
01-0129	07010104		SISSABAGAMAH	365	E	E	FS	56.0	
01-0136	07010104		WAUKENABO	644	M	E	FS	110.0	
01-0142-01	07010103		HILL (SOUTH ARM) AT	-	E	E	FS	140.0	
01-0142-02	07010103		HILL (MAIN BASIN) A	-	E	E	FS	135.0	
01-0147	07010104	025	ESQUAGAMAH	835	M	E		-	
01-0148	07010103		WHITE ELK	780	E	E	FS	16.0	
01-0170	07010104		HANGING KETTLE	302	E	E		-	
01-0185	07010104		DOGFISH 2.	43	E	E	FS	26.0	
01-0188	07010104		BLIND	370	E	E	FS	80.0	
01-2001	07010104		UNNAMED	135	E	E		-	
03-0107	09020103		TOAD	1666	M	E	FS	165.0	
03-0127	07010106		BASS	135	E	E	FS	140.0	
03-0189	09020103		LITTLE TOAD	345	M	E	FS	167.5	
04-0038	07010101	027	ANDRUSIA	1510	E	E	FS	150.0	M
04-0079	07010101	027	WOLF	1051	E	E	FS	146.7	M
04-0124	09020302		SANDY	260	E	E	FS	60.0	
09-0006	04010301		BLACKHOOF	41	E	E	FS	17.0	
09-0016	04010301		SAND	123	M	E	ST	5.4	
09-0019	04010301		MUNSON	36	M	E		-	
09-0020	04010301		KATZEL	46	M	E		-	
09-0041	07030003	006	MOOSEHEAD	291	M	E		-	
09-0060-02	07010103		ISLAND (SOUTH BAY)	-	E	E	FS	60.0	
09-0062	07010103		CROSS	110	M	E		-	
11-0029	07010101	035	VERMILLION	417	E	E	FS	150.0	
11-0037	07010105		LEAVITT	130	M	E		-	
11-0046	07010105		MARION	8	E	E	FS	10.8	
11-0055	07010105		PAVELGRIT	20	M	E	ST	6.3	
11-0092	07010102		LITTLE SAND	428	M	E	FS	38.5	
11-0104	07010102		LAURA	1346	E	E	FS	76.0	
11-0116	07010102		STEVENS	88	M	E	ST	9.3	
11-0129	07010102		LOWER TRELIPE	425	E	E	FS	140.0	
11-0147	07010101		WINNIBIGOSHISH	53425	E	E		-	
11-0156	07010105		LOUISE	46	E	E	FS	56.0	
11-0162	07010102	031	RICE	248	E	E	FS	150.0	M
11-0222	07010106	008	MARGARET	222	M	E		-	
11-0253	07010105		WEST TWIN	36	E	E	ST	5.0	
11-0257	07010102		ISLAND	176	E	E	FS	94.0	
11-0297	07010102		STOCKING	34	E	E	FS	18.0	
11-0307	07010105		NORWAY	505	E	E	FS	130.0	
11-0367	07010105		LIND	377	E	E	FS	140.0	
11-0381	07010102		PAQUET	122	E	E	FS	120.0	M
16-0141	04010101		CARIBOU	452	E	E	FS	17.0	
16-0220	04010101		MORGAN	82	E	E	FS	11.0	
16-0233	04010101		PARTRIDGE	109	E	E	FS	22.0	
16-0250	04010101		MARK	183	E	E	FS	12.0	
16-0342	09030001		E. POPE	30	E	E	FS	11.0	
16-0346	04010101	006	CASCADE	435	E	E	FS	10.0	
16-0354	04010101		WINCHELL	820	E	E	ST	9.0	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
16-0360	04010101	006	CARIBOU	728	M	E	FS	29.8	
16-0380	04010101	028	GUST	135	E	E	FS	10.0	
16-0382	04010101		LICHEN	276	E	E	FS	10.0	
16-0454	04010101	038	CRESCENT	836	E	E	FS	12.0	
16-0571	09030001		FROST	236	E	E	FS	11.0	
16-0607	09030001		ROUND	14	E	E	FS	14.0	
16-0645	04010101		TOOHEY	406	E	E		-	
16-0657	09030001	021	GRACE	391	E	E	ST	6.0	
18-0009	07010201		ERSKINE	176	M	E	FS	120.0	
18-0060	07010104		AGATE	184	E	E	FS	67.0	
18-0076	07010104		LONG	196	M	E		-	
18-0088	07010201		PLATTE	1673	E	E	FS	92.0	
18-0093	07010104		RABBIT	531	E	E	FS	140.0	M
18-0096	07010104	011	UPPER (SOUTH) LONG	793	M	E		-	
18-0104	07010104	011	NOKAY	660	M	E	FS	110.0	
18-0117	07010104		BLACKHOOF	183	E	E	FS	103.8	M
18-0136	07010104	011	LONG (LOWER SOUTH)	1380	M	E		-	
18-0155	07010104		CROW WING	373	M	E		-	
18-0165	07010105		ROSS	495	M	E		-	
18-0183	07010105		ISLAND	240	M	E	FS	44.0	
18-0185	07010105	004	MARY	380	M	E		-	
18-0195	07010105		DOLNEY	264	M	E		-	
18-0207	07010105		SQUAW	82	M	E	ST	6.5	
18-0218	07010105		TROUT	121	M	E		-	
18-0220	07010105		SMOKY HOLLOW	123	E	E	FS	16.0	
18-0224	07010105		FOOL	246	E	E	FS	12.0	
18-0240	07010106		FAWN	132	M	E		-	
18-0242	07010104		UPPER MISSION	817	M	E	FS	100.0	
18-0243	07010104		LOWER MISSION	698	M	E	FS	120.0	
18-0266	07010105		LITTLE PINE	384	M	E		-	
18-0287	07010105		GREER	353	E	E	FS	70.0	
18-0294	07010105		MITCHELL	433	E	E	FS	110.0	
18-0296	07010105		EAGLE	356	M	E		-	
18-0379	07010104		WHITE SAND	441	M	E		-	
18-0404	07010106		SIBLEY	418	M	E		-	
18-0408	07010106		MAYO	155	M	E		-	
18-0412	07010105		UPPER HAY	581	E	E	FS	110.0	
18-0416	07010105		LIZZIE	170	E	E	FS	100.0	
29-0003	07010106		NAGEL	69	E	E	FS	110.0	
29-0066	07010102		MIDGE	588	M	E	FS	120.0	
29-0077	07010106		THIRD CROW WING	646	M	E		-	
29-0085	07010106		SECOND CROW WING	12	E	E		-	
29-0157	07010106	028	NORTH TWIN	225	E	E	FS	180.0	M
29-0250	07010106		PORTAGE 4.5 MI NW	412	M	E		-	
31-0003	09030005		SOUTH STURGEON	193	E	E	FS	24.0	
31-0026-02	07010103		TWIN (WEST BAY) 6	43	M	E		-	
31-0028	04010201		BEAUTY	217	E	E	FS	24.0	
31-0051	07010103		STINGY 13 MI N OF	377	M	E	FS	29.8	
31-0057	07010103		SHERRY	104	E	E	FS	28.0	
31-0067-01	07010103	013	SWAN (WEST BAY)	9	M	E		-	M
31-0067-02	07010103	017	SWAN (MAIN BASIN)	9	M	E	FS	108.6	M
31-0069	07010103		BUCK 10 MI N OF N	492	M	E	FS	42.5	
31-0070	07010103	029	O'LEARY	124	M	E		-	
31-0120	07010103		MCCARTHY	112	M	E		-	

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LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
31-0152	07010103	030	WOLF	188	E	E	FS	50.0	
31-0154	07010103		HARTLEY	281	E	E	FS	78.0	
31-0157	09030005	011	BEAR	339	M	E	FS	40.0	
31-0193	07010103		CROOKED	418	E	E	FS	68.0	
31-0216	07010103		TROUT	1890	M	E	FS	122.0	M
31-0231	07010103	028	LAWRENCE	395	E	E	FS	66.0	
31-0292	09030005		OWEN	328	E	E	FS	16.0	
31-0334	09030006	019	DEER	1748	M	E	FS	100.0	
31-0347	07010103		SPRUCE	56	E	E	FS	46.0	
31-0384	07010103	026	PRAIRIE	991	E	E	FS	78.0	
31-0413	07010103		BURROWS	291	E	E	FS	13.0	
31-0530	09030006		BUSTIES	252	M	E	FS	80.0	
31-0533	07010103	031	BLANDIN	449	E	E	FS	140.0	
31-0547	07010101		SMITH	39	M	E		-	
31-0576	07010101		BASS	2457	E	E	FS	120.0	
31-0586	07010101		JOHNSON	305	E	E	FS	20.0	
31-0600	07010101		HILL	38	E	E	FS	10.0	
31-0610	07010101		LITTLE MOOSE	271	E	E	FS	150.0	
31-0622	09030006		DEAD HORSE	97	E	E	FS	69.0	
31-0623	09030006		BOY	27	E	E	FS	130.0	
31-0646	07010101		SURPRISE	11	E	E	FS	10.0	
31-0654	09030006		BURNS	144	E	E	FS	100.0	
31-0663	09030006		FOREST	36	E	E	FS	100.0	
31-0704	09030006		BATSON	110	E	E	FS	150.0	
31-0718	07010101		STEVENS	228	E	E	FS	76.0	
31-0726	09030006		BELLO	493	E	E		-	
31-0733	07010101		LITTLE SISEEBAKWET	304	E	E	FS	96.0	
31-0786	09030006		JESSIE	1635	M	E	FS	140.0	
31-0826	09030006	015	SAND	4306	E	E	FS	115.0	
31-0848	09030006	009	BEAVER	32	M	E		-	
31-0850	07010101		LTL WINNIBIGOSHISH	896	E	E	FS	150.0	
31-0877	09030006	012	SQUAW	2158	E	E	FS	110.0	
31-0882	09030006	011	DORA	735	M	E	FS	120.0	
33-0001	07030003		ELEVEN	290	E	E	FS	40.0	
33-0006	07030003		FEATHERBED	38	E	E	ST	4.0	
33-0024	07030004	008	FULL OF FISH	51	E	E	ST	8.0	
38-0053	04010101	047	DAM FIVE	82	E	E	FS	36.0	
38-0068	09030001		WINDY	450	E	E	ST	8.0	
38-0079	09030001	021	WATONWAN	66	E	E	ST	8.0	
38-0080	09030001	021	KAWISHIWI	400	E	E	ST	8.0	
38-0090	09030001	021	MALBERG	404	E	E	ST	8.0	
38-0098	09030001	021	KOMA	260	E	E	ST	5.8	
38-0150	09030001	021	PANHANDLE	8	M	E		-	
38-0220	09030001	019	PERENT	1800	E	E	ST	7.5	
38-0255	04010101		TANNER	55	E	E	FS	10.0	
38-0256	04010101		DIVIDE	65	E	E	FS	10.0	
38-0393	04010101		DUMBELL	476	E	E	FS	26.0	
38-0396	09030001		ISABELLA	1516	E	E	ST	8.0	
38-0400	09030001	021	IMA	773	E	E	FS	14.0	
38-0406	04010102		LAX	274	E	E		-	
38-0415	09030001		DELAY	94	E	E	FS	22.0	
38-0483	09030001	021	FIRE	96	E	E	FS	14.0	
38-0503	09030001	021	BOOT	209	E	E	FS	15.0	
38-0642	09030001	021	WIND	1009	E	E	FS	24.0	

ECOREGION = NORTHERN LAKES AND FORESTS — FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME		ACRES	ME	TROPHIC	SA	ALK	SOURCES
38-0650	04010202		MARBLE		159	E	E	FS	34.0	
38-0656	09030001	011	GREENWOOD		1469	E	E	ST	6.3	
38-0666	09030001	011	SLATE		235	E	E	FS	20.0	
38-0673	09030001	011	HIGHLIFE		20	M	E		–	
38-0704	09030001	014	TURTLE		337	E	E	ST	8.3	
38-0722	09030001	021	CLEAR		236	E	E	FS	10.0	
38-0735	09030001	011	SAND		506	E	E	FS	19.3	
38-0738	09030001		GARDEN		670	E	E	FS	16.0	
38-0750	04010102		CHRISTIANSON		158	M	E	ST	2.3	
38-0751	04010202		THOMAS		157	E	E	FS	28.0	
38-0785	09030001		TIN CAN MIKE		147	E	E	FS	12.0	
49-0032	07010104		MICHAELS		68	E	E	ST	6.0	
49-0079	07010108		ALEXANDER		2990	E	E	FS	106.7	
49-0127	07010108		SHAMINEAU		1681	E	E	FS	95.3	
58-0010	07030001		RAZOR		100	M	E		–	
58-0012	07030001		MCGOWAN		21	M	E		–	
58-0015	07030001		KEENE		13	M	E		–	
58-0054	07030001	046	WALLACE		26	M	E		–	
58-0063	07030003		LORDS		36	E	E	FS	24.0	
58-0067	07030003		STURGEON		1700	E	E	FS	40.0	
58-0073	07030003		DAGO		107	M	E		–	
58-0083	07030003		SECOND		44	M	E		–	
58-0089	07030003		CEDAR		69	M	E		–	
58-0099	07030003	004	FIRST		80	M	E		–	
58-0103	07030003		MUD		29	M	E		–	
58-0132	07030003		INDIAN		73	E	E	ST	8.0	
58-0135	07030003		MILLER		77	E	E	ST	8.0	
58-0137	07030003		BASS		195	E	E	FS	16.0	
58-0138	07030003	020	BIG PINE		387	M	E	FS	88.0	
69-0002	04010201		SEVEN BEAVER		1410	E	E	FS	20.8	
69-0003	09030001	006	BIRCH	2 M	7628	E	E	FS	26.1	
69-0004	09030001		WHITE IRON		3429	E	E	FS	17.1	
69-0011	04010202		PEQUAYWAN		533	E	E	FS	44.0	
69-0016	04010202		SAND		32	E	E	FS	24.0	
69-0023	04010202		INDIAN		57	E	E	FS	30.0	
69-0027	04010202		STONE		186	E	E	FS	50.0	
69-0028	04010202		LITTLE STONE		181	E	E	FS	28.0	
69-0044	04010201	033	LONG		433	E	E		–	
69-0058	09030001	006	PERCH		91	E	E	FS	12.0	
69-0069	09030001	024	SHAGAWA		2370	M	E	FS	23.0	M
69-0080	09030001		NELS		143	E	E	ST	4.0	
69-0082	09030001		GRASSY		213	E	E	ST	6.0	
69-0086	09030001		LITTLE SLETTEN		14	E	E	ST	9.0	
69-0111	04010202		SMITH		220	E	E	FS	53.0	
69-0112	04010202	011	BEAR		61	E	E	FS	30.0	
69-0116	09030001		MITCHELL		241	E	E	FS	18.0	
69-0119	09030001		FIRST		17	E	E	FS	10.0	
69-0132	04010202		BARRS		117	E	E	FS	30.0	
69-0143	04010202		WOLF		467	E	E	FS	20.0	
69-0190	09030001		BIG		1740	E	E	ST	7.5	
69-0230	04010202		SCHULTZ		202	E	E	FS	74.0	
69-0232	04010202		HORSESHOE		90	E	E	FS	22.0	
69-0234	04010202		MIRROR		21	E	E	FS	68.0	
69-0235	04010202		SUNSHINE		78	E	E	FS	25.0	

ECOREGION = NORTHERN LAKES AND FORESTS FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
69-0237	04010202		CAMERON	70	E	E	FS	64.0	
69-0277	09030002		CLEAR	119	E	E	FS	14.0	
69-0339	09030001		RAMSHEAD	480	E	E	FS	17.0	
69-0376	04010201	034	WHITEWATER	1210	E	E		-	M
69-0378	09030002	011	VERMILION	40557	M	E	FS	53.5	M
69-0394	04010202	007	FLOWAGE	110	E	E	FS	73.0	
69-0399	04010202	007	DEEPWATER	20	E	E	FS	10.0	
69-0412	04010201		COMSTOCK	458	E	E	FS	54.0	
69-0456	09030001		JEANETTE	293	M	E	ST	9.0	
69-0461	09030001		SHELL	484	E	E	ST	9.0	
69-0489	04010202		CARIBOU	569	M	E	FS	45.0	
69-0491	04010202	004	FISH	3071	M	E		-	
69-0496	04010201	035	EMBARRASS	650	M	E	FS	62.0	M
69-0532	04010201	022	PIONEER	56	E	E	FS	28.0	
69-0542	04010201		WILSON	52	E	E	FS	14.0	
69-0544	04010201		DINHAM	210	E	E	FS	40.0	
69-0545	04010201		CAMERON	162	E	E	FS	28.0	
69-0546	04010201		SCHUBERT	218	E	E	FS	10.0	
69-0562	04010201		COE	51	M	E	ST	2.6	
69-0615	09030002		ECHO	1054	E	E	FS	14.0	
69-0642	04010201		ELLIOT	398	E	E	FS	94.0	
69-0644	04010201		FIG	92	E	E	FS	10.0	
69-0764	09030002		SUNSET	309	E	E	ST	8.0	
69-0920	09030005		STUART	35	E	E	FS	12.0	
69-0924	07010103		ELK	14	E	E	FS	44.0	
69-0933	09030005	012	SIDE	372	E	E		-	
80-0004	07010106	038	LOVEJOY	57	E	E	FS	130.0	

ECOREGION = NORTHERN LAKES AND FORESTS PARTIALLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
01-0019	04010201		WOLF	168	E	E	FS	18.0	
01-0033	07010103		MINNEWAWA	2513	M	E		-	
01-0072	07010103		ROCK	317	E	E	FS	48.0	
01-0123-01	07010104		ELM ISLAND (MAIN BA	-	E	E	FS	84.0	
04-0069	09020302	030	BLACKDUCK	2742	M	E	FS	130.0	M
09-0007	04010301		SPRING	41	E	E	FS	76.5	
09-0010	04010301		HAY	215	E	E	FS	10.0	
09-0018	04010301		HIZER	33	M	E		-	
11-0101	07010105		GEORGE	601	M	E	FS	37.8	
18-0049	07010207		WILSON	63	E	E	FS	10.0	
18-0127	07010104		COLE	114	E	E	FS	26.0	
18-0186	07010105		PERRY	144	E	E	FS	26.0	
18-0191	07010105		BASS	71	E	E	FS	12.0	
31-0258	07010103		KING	296	E	E	FS	96.0	
31-0329	09030006		LITTLE HORSESHOE	11	M	E		-	
31-0341	07010103	032	LITTLE SPLITHAND	223	M	E	FS	96.0	
31-0353	07010103	033	SPLITHAND	1420	M	E	FS	92.0	
31-0403	07010101		BOSLEY	31	E	E	FS	10.0	
31-0813	09030006	016	BOWSTRING	9220	E	E	FS	110.0	
31-0857-01	07010101	013	CUT FOOT SIOUX (MAI	-	E	E	FS	140.0	
31-0921	07010101	017	DIXON	680	E	E	FS	100.0	
33-0002	07030003		BEAUTY	64	E	E	ST	6.0	
58-0009	07030001		STEVENS	15	M	E		-	
58-0018	07030001		LENA	44	M	E		-	
58-0025	07030001		DOLLAR	20	E	E	ST	4.0	
58-0038	04010301	016	NET	136	M	E		-	
58-0040	07030001	046	CLAYTON	17	M	E		-	
58-0059	07030003		STEVENS	53	M	E		-	
58-0100	07030003	005	UNNAMED	19	M	E		-	
58-0104	07030003		CLEAR	25	E	E	ST	4.0	
58-0129	07030003		LITTLE PINE	75	M	E		-	
58-0131	07030003		FISH	82	M	E		-	
69-0065	09030001	025	MINISTER	50	E	E	FS	10.0	
69-0120	09030001	025	EVERETT	109	E	E	FS	10.0	
69-0139	04010202		SANTA CLAUS	8	E	E	FS	10.0	
69-0199	09030001		ED SHAVE	97	E	E	FS	12.0	
69-0217	09030002		WEST ROBINSON	135	E	E	FS	30.0	
69-0231	04010202	007	JACOBS	88	E	E	FS	38.0	
69-0249	04010201		COLBY	539	E	E	FS	27.8	
69-0457	09030002		NIGH	38	E	E	FS	10.0	
69-0490	04010201	012	PIKE	508	E	E	FS	62.0	
69-0538	04010201		BERG	128	E	E	FS	28.0	
69-0588	09030002		PAULINE	62	E	E	FS	12.0	
69-0598	09030002		ASTRID	109	E	E	FS	10.0	
69-0848	07010103	010	PRAIRIE	853	E	E		-	
69-0921	07010103	029	WAYMIER	36	E	E	FS	12.0	

ECOREGION = NORTHERN LAKES AND FORESTS — NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
01-0158	07010207		GREGG	31	E	H	ST	8.0	
03-0273	09020103	014	PERCH 8 MI E OF D	40	M	H	FS	110.0	
09-0067	07010103	009	TAMARACK	228	M	H		–	
18-0203	07010105	004	EMILY	675	M	H		–	
31-0198	07010103		LITTLE COWHORN	166	E	H	FS	110.0	
31-0896	09030006	014	ROUND	2964	E	H	FS	120.0	
36-0018	09020302		BARTLETT	292	E	H	FS	114.0	M
49-0005	07010201	010	PEAVEY	123	E	H	FS	24.0	
58-0029	07030001	040	GRACES	54	M	H		–	
58-0032	04010301		HEADQUARTERS	14	M	H		–	
58-0102	07030003		FOX	104	M	H		–	
69-0590	09030002		MAUDE	88	E	H	FS	12.0	
69-0717	04010201		ELBOW	165	M	H	FS	110.8	M
69-0725	04010201	037	MASHKENODE	101	E	H	FS	93.2	M
69-0775	04010201		MC QUADE	164	E	H	FS	64.4	M

ECOREGION = RED RIVER VALLEY — FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
60-0305	09020301		MAPLE	1445	E	E		–	

ECOREGION = RED RIVER VALLEY — NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
78-0025	09020101	010	TRAVERSE	11528	E	H		–	

ECOREGION = WESTERN CORN BELT PLAINS — FULLY SUPPORTING SWIMMABLE USE, BUT THREATENED

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
07-0053	07020011		DUCK	288	E	E	FS	170.0	
07-0060	07020011		EAGLE	914	E	E	FS	180.0	
65-0006	07010205		ALLIE	510	M	E		-	
74-0023	07040002	024	BEAVER	90	M	E	FS	132.5	
81-0003	07020011		ST OLAF	102	M	E	FS	123.3	

ECOREGION = WESTERN CORN BELT PLAINS — PARTIALLY SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
07-0101	07020007	026	LILY	142	E	E	FS	266.7	M
32-0018	07020010	013	FISH 3 MI SE OF W	287	M	E	FS	151.8	
43-0034	07010205		SILVER	500	E	E		-	M
46-0109	07020009	011	FOX	1041	M	E		-	
81-0014	07040002		CLEAR	652	E	E	FS	173.3	

ECOREGION = WESTERN CORN BELT PLAINS NOT SUPPORTING SWIMMABLE USE

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
07-0044	07020011		MADISON	1171	M	H	FS	148.9	
07-0047	07020007		GEORGE	141	M	H	FS	102.5	
07-0054	07020011		BALLANTYNE	353	M	H	FS	158.6	
07-0079	07020011		LURA	1224	E	H	FS	180.0	
08-0011	07020008		CLEAR	335	E	H	FS	130.0	
08-0026	07020010		HANSKA	1844	E	H	FS	135.9	
08-0045	07020008		SLEEPY EYE (WHOLE L	251	E	H	FS	220.0	
17-0003	07020010		MOUNTAIN	229	E	H	FS	140.0	
17-0007	07020010		BINGHAM	259	M	H	FS	145.0	
17-0022	07100001		COTTONWOOD	152	E	H	FS	140.0	
22-0074	07020011		BASS	201	M	H	FS	153.3	
24-0014	07080202	011	ALBERT LEA	2453	E	H	FS	223.3	M
24-0018-01	07080202	013	FOUNTAIN (EAST BAY)	-	M	H	FS	203.3	M
24-0030	07080203		STATE LINE	446	E	H		-	
24-0044	07020011		FREEBORN	2222	E	H	FS	140.0	
32-0020	10230003	053	LOON 8 MI SW OF J	725	M	H	FS	135.0	
32-0022	10230003	055	CLEAR 3 MI W OF J	415	M	H	FS	201.4	
32-0024	10230003		LITTLE SPIRIT	572	E	H	FS	200.0	
32-0069	10230003	067	ROUND	1024	E	H	FS	160.0	
34-0086	07010205		BIG KANDIYOHI	4294	M	H	FS	181.3	
34-0096	07010205		LITTLE KANDIYOHI	932	E	H	FS	207.5	
34-0105	07010205		KASOTA	469	E	H	FS	230.0	
34-0169-03	07010205		WAGONGA(MAIN BASIN)	1776	M	H	FS	232.5	M
43-0084	07010205		MARION	586	E	H	FS	140.0	
43-0085-01	07010205	006	OTTER (MAIN BASIN)	-	E	H	FS	240.0	
46-0020	07020009		SOUTH SILVER	245	E	H	FS	140.0	
46-0046	07020010		PERCH	175	E	H	FS	160.0	
46-0052	07100003	019	BRIGHT	648	E	H	FS	140.0	
46-0096	07100003		CLEAR	273	E	H	FS	170.0	
46-0133	07020009		BIG TWIN	457	M	H	FS	231.3	
51-0040	07100001	005	BLOODY 4 MI N OF	267	M	H	FS	172.5	
51-0043	07020008		FOX	174	E	H	FS	270.0	
51-0046	07100001	005	SHETEK 3 MI E OF	3351	M	H	FS	155.0	
52-0034	07020007		SWAN	6500	E	H	FS	165.0	
53-0007	10230003	068	INDIAN	204	E	H	FS	150.0	
53-0020	07100001		EAST GRAHAM	523	E	H	FS	155.0	
53-0021	07100001		WEST GRAHAM	526	M	H	FS	126.7	
53-0028	10230003	084	OKABENA AT WORTHI	974	E	H	FS	150.0	
55-0004	07040004	008	ZUMBRO	991	M	H	FS	214.7	M
72-0013	07020012		SILVER	694	E	H	FS	130.0	
72-0017	07020012	006	WASHINGTON	630	E	H	FS	210.0	M
72-0049	07010205		SCHILLING	779	E	H	FS	200.0	
72-0050-01	07020012		HIGH ISLAND (MAIN B	-	E	H	FS	135.0	
83-0036	07020010		KANSAS	388	M	H	FS	190.0	
83-0040	07020010		LONG 5 MI SO OF S	264	M	H	FS	136.7	
87-0016	07020004		CURTIS	440	M	H	FS	171.7	
87-0030	07020004	029	WOOD	484	M	H	FS	165.0	

LAKES THAT WERE NOT ASSESSED FOR SWIMMABLE USE SUPPORT, BUT WERE ASSESSED FOR ACID SENSITIVITY

LAKEID	HUC	SEG	NAME	ACRES	ME	TROPHIC	SA	ALK	SOURCES
11-0117	07010102		LAKE TWENTYSIX	102			FS	10.0	
18-0293	07010105		KEGO	272			FS	120.0	
21-0242	07020005		AARON	545			FS	200.0	
33-0005	07030003		THIRTEEN	51			ST	6.0	
38-0686	09030001	011	NORTH MCDOUGAL	240			FS	15.5	
40-0061	07040002		TUSTIN	153			FS	120.0	
62-0034	07010206		GOOSE	152			FS	57.0	
62-0058	07010206		LITTLE JOHANNA	18			FS	100.0	
69-0375	04010201	025	WHITEFACE RESVR.	5600			FS	25.0	
69-0841	09030002	008	PELICAN	10945			FS	38.0	

APPENDIX B

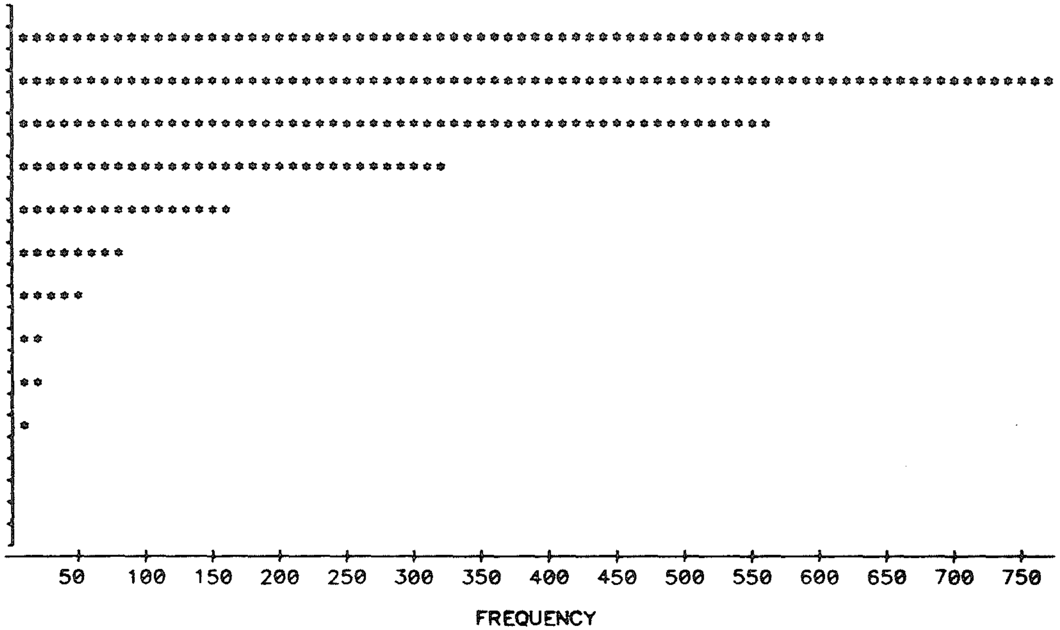
Stream Segments Assessed for NPS Impacts

SAS 21:59 THURSDAY, MAY 12, 1988 1

Minnesota Pollution Control Agency

Reach Mile Histogram for ma.reach

FREQUENCY BAR CHART



MIDPOINT MILES	FREQ	CUM. FREQ	PERCENT	CUM. PERCENT
0	599	599	23.16	23.16
6	769	1368	29.74	52.90
12	562	1930	21.73	74.63
18	319	2249	12.34	86.97
24	162	2411	6.26	93.23
30	75	2486	2.90	96.13
36	47	2533	1.82	97.95
42	18	2551	0.70	98.65
48	22	2573	0.85	99.50
54	9	2582	0.35	99.85
60	3	2585	0.12	99.96
66	1	2586	0.04	100.00

Note: file contains some lakes.

KEY TO THE STREAM ASSESSMENT TABLE

HUC	-	U.S. Geological Survey hydrologic unit code. USGS. 1974. Hydrologic Unit Map. State of Minnesota. Denver, Colorado.
SEG	-	U.S. Environmental Protection Agency stream segment numbering system or the Minnesota Pollution Control Agency stream segment numbering system.
NAME	-	Stream Name.
ECO	-	The ecoregion the stream segment occurs in - NLF, Northern Lakes & Forests; CHF, Central Hardwood Forests; WCBP, Western Corn Belt Plains; NGP, Northern Glaciated Plains; DA, Driftless Area; RRV, Red River Valley; NMW, Northern Minnesota Wetlands.
USESUP	-	Water quality support based on best attainable pollutant concentration - NS, not supporting; PS, partially supporting; FS, fully supporting.
TSS	-	Total Suspended Solids - F, full impact; P, partial impact; N, no impact.
N	-	Nitrate Nitrogen - F, full impact; P, partial impact; N, no impact.
TP	-	Total Phosphorus - F, full impact; P, partial impact; N, no impact.
BOD	-	Biological Oxygen Demand - F, full impact; P, partial impact; N, no impact.
MILES	-	Number of stream miles represented by the stream segment monitored.
SAMP	-	Number of water quality samples used for the assessment of the stream segment.

OBS	HUC	SEG	NAME	ECO	USESUP	TSS	N	TP	BOD	MILES	SAMP
1	04010101	007	LAKE SUPERIOR	NLF	NS	F	N	F	F	14.6	27
2	04010101	109	KADUNCE CK	NLF	NS		N	P		8.5	22
3	04010101	021	KIMBALL CK	NLF	NS		N	P		7.8	14
4	04010102	008	LAKE SUPERIOR	NLF	NS	F	N	F	F	8.6	27
5	04010201	211	ST. LOUIS R	NLF	NS	N	N	N		12.9	56
6	04010201	031	ST. LOUIS R	NLF	NS	N	N	N	P	15.7	86
7	04010201	540	PENOBSCOT CK	NLF	NS	N	N	N	P	3.4	15
8	04010201	013	ST. LOUIS R	NLF	NS	N	N	N	N	9.5	97
9	04010201	020	WHITEFACE R	NLF	NS	N	P	N	F	28.6	70
10	04010201	740	E SWAN CK	NLF	NS	N	N	N	N	7.8	19
11	04010201	209	ST. LOUIS R	NLF	NS	N	N	N	N	10.1	86
12	07010101	427	MISSISSIPPI R	NLF	NS	P	P	P	N	12.5	98
13	07010101	033	MISSISSIPPI R	NLF	NS	P	P	N	P	34.5	98
14	07010101	004	MISSISSIPPI R	NLF	PS	P	F	P	P	7.3	98
15	07010103	513	TROUT CK	NLF	NS	F	P	N	F	3.3	15
16	07010103	012	MISSISSIPPI R	NLF	NS	N	P	N	N	21.7	53
17	07010104	005	MISSISSIPPI R	NLF	NS	N	N	N	P	9.6	85
18	07010104	030	SWAN R	CHF	NS	F	N	F	F	28.4	37
19	07010107	107	UNION CK	CHF	NS	P	N	N	N	5.5	14
20	07010201	017	S TWO R	CHF	NS		F	N		10.9	14
21	07010202	012	SAUK R	CHF	PS	P		F		17.5	11
22	07010202	106	SAUK R	CHF	NS	N	N	N	F	2.6	29
23	07010202	802	STONY CK	CHF	NS	N	N	N	F	12.7	27
24	07010202	001	SAUK R	CHF	NS	N	N	N	N	13.3	109
25	07010202	B02	EDEN LK OUTLET	CHF	NS	N	N	N	N	7.3	26
26	07010202	004	SAUK R	CHF	NS	N	N	N	F	9.1	29
27	07010202	902	KOLLING CK	CHF	NS	F	N	F		3.1	15
28	07010202	102	SAUK R	CHF	NS	N	N	N	N	5.5	28
29	07010202	204	CD #44	CHF	NS	N	N	N		11.4	24
30	07010202	206	SAUK R	CHF	NS	N	N	N	N	16.0	63
31	07010202	306	UNNAMED CK	CHF	NS	F		N		2.5	14
32	07010202	105	ADLEY CK	CHF	NS	N	N	P	F	8.7	28
33	07010202	003	GETCHELL CK	CHF	NS	N	N	N	F	17.9	29
34	07010202	202	SAUK R	CHF	NS	N	N	N	F	36.2	27
35	07010203	009	MISSISSIPPI R	CHF	NS	P	N	F	F	29.8	98
36	07010203	210	MISSISSIPPI R	CHF	PS	P	P	F	F	3.5	86
37	07010204	001	CROW R	CHF	NS	N	N	N	N	23.0	24
38	07010205	007	BUFFALO CK	WCBP	NS	F	N	N	N	40.9	27
39	07010205	407	DITCH TRIB TO BUFFALO CK	WCBP	NS	F	N	N	N	1.9	12
40	07010205	106	S FK CROW	WCBP	NS	F	P	N	N	16.3	18
41	07010206	A02	GOLDEN LK INLET	CHF	NS	N	N	N		2.4	108
42	07010206	201	MISSISSIPPI R	WCBP	NS	N	F	P	F	14.8	36
43	07010206	302	MISSISSIPPI R	CHF	NS	N	N	P	P	11.8	98
44	07010207	005	RUM R	CHF	NS	N	N	F	F	28.8	98
45	07020010	001	WATONWAN R	WCBP	NS	N	N	P	P	12.9	18
46	07020001	002	MINNESOTA R	NGP	NS	F	P	P	N	16.1	100
47	07020002	001	POMME DE TERRE R	NGP	NS	N	P	N	P	35.9	87
48	07020003	115	CANBY CK	NGP	NS	F	N	N	F	9.3	13
49	07020004	008	MINNESOTA R	WCBP	NS	N	F	P	F	3.6	19
50	07020004	022	YELLOW MEDICINE R	NGP	NS	N	N	N	N	16.6	20
51	07020005	001	CHIPPEWA R	NGP	NS	P	N	P	P	11.2	20
52	07020007	002	MINNESOTA R	WCBP	NS	N	N	P	P	5.7	100
53	07020007	021	MINNESOTA R	WCBP	NS	N	F	P	F	5.1	98
54	07020007	010	MINNESOTA R	WCBP	NS	N	P	P	F	5.2	99
55	07020008	001	COTTONWOOD R	WCBP	NS	N	N	P	P	19.9	64

OBS	HUC	SEG	NAME	ECO	USESUP	TSS	N	TP	BOD	MILES	SAMP
56	07020009	019	BLUE EARTH R	WCBP	NS	P	N	P	F	4.2	51
57	07020009	001	BLUE EARTH R	WCBP	NS	N	N	P	P	3.4	124
58	07020009	405	CEDAR RUN	WCBP	NS	F	N	P	N	15.3	18
59	07020009	004	ELM CK	WCBP	NS	N	N	P	N	30.4	22
60	07020009	010	CENTER CK	WCBP	NS	F	F	N	N	19.4	22
61	07020010	109	ST JAMES CK	WCBP	NS	N	P	N	N	11.4	12
62	07020011	014	LESUEUR R	WCBP	NS	F	N	N	P	49.9	14
63	07020012	013	MINNESOTA R	WCBP	NS	N	N	N	P	9.0	98
64	07020012	024	RAVEN STREAM	CHF	NS	N	N	N	P	13.1	14
65	07020012	009	HIGH ISLAND CK	WCBP	NS	N	P	N	N	22.6	13
66	07020012	124	E BR RAVEN STR	CHF	NS	N	N	N	N	10.1	11
67	07030001	013	ST. CROIX R	NLF	NS	N	N	N	P	7.2	99
68	07030003	001	KETTLE R	NLF	NS	N	N	N	P	15.0	75
69	07030005	003	ST. CROIX R	CHF	NS	F	N	F	F	12.1	98
70	07030005	007	ST. CROIX R	CHF	PS	P	P	F	F	13.5	28
71	07040001	312	VERMILLION R	WCBP	NS	F	P	N	F	23.9	54
72	07040002	019	STRAIGHT R	WCBP	NS	F	F	N	F	5.6	22
73	07040002	021	STRAIGHT R	WCBP	NS	P	N	N	F	4.7	75
74	07040002	002	CANNON R	WCBP	PS	P	F	P	P	11.0	86
75	07040003	023	GARVIN BROOK	DA	NS	N	N	N	P	17.1	108
76	07040006	009	MISSISSIPPI R	DA	NS	N	N	P	F	8.2	54
77	07040006	001	MISSISSIPPI R	DA	NS	N	N	N	P	4.3	98
78	07040008	001	ROOT R	DA	NS	N	N	N	P	6.0	86
79	07040008	121	CURTIS(CARTERS) CK TRIB	WCBP	NS	N	N	N	N	2.5	12
80	07080201	016	CEDAR R	WCBP	NS	P	N	N	P	8.4	98
81	07080201	321	CEDAR R	WCBP	NS	P	N	P	P	4.9	63
82	07080201	323	CEDAR R, E FK	WCBP	NS	P	N	N	N	3.7	83
83	07080202	009	SHELL ROCK R	WCBP	NS	N	P	N	N	9.8	103
84	07100001	131	OKABENA CK	WCBP	NS	N	N	N	N	11.0	53
85	07100002	013	DES MOINES R, W FK	WCBP	NS	N	F	N	N	26.8	18
86	07100003	021	DES MOINES R, E FK	WCBP	NS	N	N	N	P	28.5	20
87	09020101	114	RABBIT R	RRV	NS	N	N	N	N	22.4	20
88	09020102	001	MUSTINKA R	RRV	NS	F	N	N	N	8.7	66
89	09020103	301	OTTER TAIL R	RRV	FS	F	F	F	F	7.5	18
90	09020103	016	PELICAN R	CHF	NS	F	P	N	P	32.2	15
91	09020103	101	OTTER TAIL R	RRV	NS	N	P	F	F	27.0	98
92	09020104	105	RED R	RRV	NS	N	P	F	F	24.6	97
93	09020104	202	RED R	RRV	NS	N	N	P	F	18.4	98
94	09020104	006	WHISKEY CK	RRV	NS	F	N	N	F	14.3	19
95	09020107	009	RED R	RRV	NS	N	N	N	P	18.0	98
96	09020301	004	RED R	RRV	NS	N	N	N	F	6.3	99
97	09020303	003	RED LAKE R	RRV	PS	P	F	F	F	17.0	18
98	09020303	001	RED LAKE R	RRV	NS	N	P	F	F	1.5	98
99	09020309	001	SNAKE R	RRV	FS	F	F	F	F	5.4	18
100	09020312	003	TWO R, M BR	RRV	PS	F	P	F	F	11.0	18
101	09020314	005	ROSEAU R	NMW	PS	F	P	F	P	38.4	18
102	09030001	013	KAWISHIWI R	NLF	NS	F	N	F	P	5.1	12
103	09030001	011	STONY R	NLF	NS	P	N	P	F	36.8	12
104	09030001	541	BEAR ISLAND R	NLF	NS	P	P	N	N	8.1	12
105	09030001	006	KAWISHIWI R (BIRCH L)	NLF	NS	F	N	F	F	21.6	86
106	09030002	002	CRANE LK OUTLET	NLF	NS	P	N	F	F	1.1	12
107	09030004	213	RAINY R	NLF	PS	P	P	P	F	2.9	124
108	09030005	001	LITTLE FORK R	NMW	NS	N	P	P	P	15.3	18
109	09030005	019	LITTLE FORK R	NLF	NS	N	N	N	N	17.6	11
110	09030006	001	BIG FORK R	NMW	NS	N	P	P	F	7.0	18

OBS	HUC	SEG	NAME	ECO	USESUP	TSS	N	TP	BOD	MILES	SAMP
111	09030007	001	RAPID R	NMW	PS	P	P	F	F	7.2	18
112	09030008	005	RAINY R	NMW	PS	P	P	P	P	4.7	97
113	09030008	006	BAUDETTE R	NMW	PS	P	P	P	P	3.1	17
114	09030008	002	WINTER ROAD R	NMW	PS	F	P	F	F	5.3	18
115	09030009	116	WILLIAMS CK(CD 1)	NMW	NS	P	N	N	P	12.7	13
116	10170203	033	PIPESTONE CK	NGP	NS	N	N	N	N	22.0	22
117	10170204	025	ROCK R	NGP	NS	N	N	N	P	12.9	23

APPENDIX C

Minnesota Ground Water Resources U.S. Geological Survey
Water - Supply Paper 2275.

MINNESOTA
Ground-Water Resources

Minnesota is a State renowned for its surface water. However, 94 percent of the public-supply water systems and 75 percent of all Minnesotans derive their domestic water supplies from ground water. In addition, about 88 percent of the water used for agricultural irrigation is supplied by ground water. Ground-water withdrawals for irrigation are competing for available supplies with nearby domestic wells, particularly in parts of western Minnesota where buried-drift aquifers are widely used. The quality of water in most aquifers statewide is suitable for most uses. However, ground water is unsuitable for some uses because of naturally occurring saline water along the western border of Minnesota and along the north shore of Lake Superior and because of nitrate contamination in the karst area of southeastern Minnesota. Ground-water withdrawals for various uses in 1980 and other related statistics are given in table 1.

GENERAL SETTING

Differing geologic features and land forms of Minnesota cause significant differences in ground-water conditions. Minnesota is situated on the southern margin of the Canadian Shield, which is a region of Precambrian crystalline and metamorphic rocks. In Paleozoic times, nearly 2,000 feet (ft) of clastic and carbonate sediment was deposited in a shallow depositional basin in southeastern Minnesota known as the Hollandale embayment. Minnesota's most productive aquifers consist of a sequence of sandstone, limestone, and dolomite beds in the Hollandale embayment (Delin and Woodward, 1984). During the Pleistocene Epoch, four continental glaciations advanced and retreated across Minnesota, blanketing the bedrock with drift as thick as 700 ft. Sand and gravel deposits in the drift constitute important aquifers, particularly in western Minnesota where the drift is thickest and where bedrock aquifers have small yields.

Precipitation, which ranges from about 19 inches (in.) in the northwestern corner of the State to about 32 in. in the southeastern corner, supplies water to four major drainage basins—Hudson Bay, St. Lawrence, Mississippi, and Missouri. As much as 30 percent of the precipitation infiltrates and becomes part of an extensive ground-water system.

PRINCIPAL AQUIFERS

The 14 principal aquifers (Adolphson and others, 1981) in Minnesota can be grouped according to general rock type into crystalline (igneous and metamorphic) rocks, volcanic rocks, sedimentary rocks (sandstone, sandstone and carbonate, and carbonate), and unconsolidated glacial drift and alluvium. The aquifers are described below and in table 2; their areal distribution is shown in figure 1.

Table 1. Ground-water facts for Minnesota

[Withdrawal data rounded to two significant figures and may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day. Source: Solley, Chase, and Mann, 1983]

Population served by ground water, 1980	
Number (thousands)	3,051
Percentage of total population	75
From public water-supply systems:	
Number (thousands)	1,910
Percentage of total population	47
From rural self-supplied systems:	
Number (thousands)	1,141
Percentage of total population	28
Freshwater withdrawals, 1980	
Surface water and ground water, total (Mgal/d)	3,100
Ground water only (Mgal/d)	670
Percentage of total	22
Percentage of total excluding withdrawals for thermoelectric power	48
Category of use	
Public-supply withdrawals:	
Ground water (Mgal/d)	230
Percentage of total ground water	34
Percentage of total public supply	52
Per capita (gal/d)	120
Rural-supply withdrawals:	
Domestic:	
Ground water (Mgal/d)	120
Percentage of total ground water	18
Percentage of total rural domestic	100
Per capita (gal/d)	105
Livestock:	
Ground water (Mgal/d)	58
Percentage of total ground water	9
Percentage of total livestock	85
Industrial self-supplied withdrawals:	
Ground water (Mgal/d)	120
Percentage of total ground water	18
Percentage of total industrial self-supplied:	
Including withdrawals for thermoelectric power	5
Excluding withdrawals for thermoelectric power	20
Irrigation withdrawals:	
Ground water (Mgal/d)	140
Percentage of total ground water	21
Percentage of total irrigation	88

UNCONSOLIDATED GLACIAL-DRIFT AQUIFERS

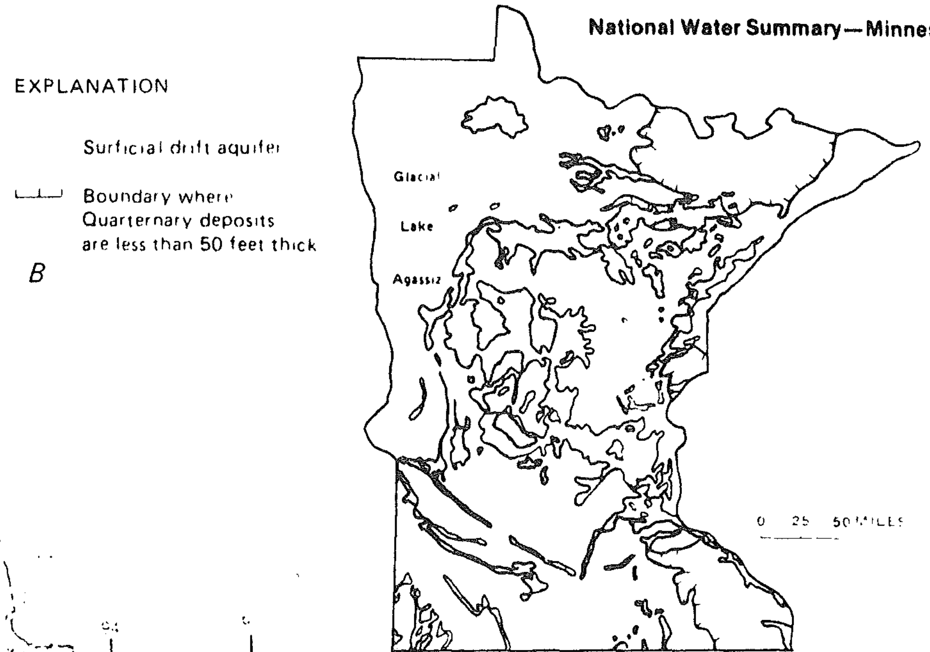
Surficial-Drift Aquifers

Surficial-drift aquifers are exposed at land surface and cover about one-third of the State. These aquifers consist of alluvial outwash, beach-ridge, valley-train, and ice-contact deposits (fig. 1). Extensive outwash deposits are a significant source of water for irrigation wells in central Minnesota. Generally, iron and manganese concentrations are greater than 1 milligram per liter (mg/L), and, locally, concentrations of nitrite plus nitrate as nitrogen exceed 30 mg/L.

Table 2. Aquifer and well characteristics in Minnesota

[Gal/min = gallons per minute; ft = feet; mg/L = milligrams per liter. Sources: Reports of the U. S. Geological Survey]

Aquifer name and description	Well characteristics			Remarks
	Depth (ft)	Yield (gal/min)		
	Common range	Common range	May exceed	
Unconsolidated glacial-drift aquifers:				
Surficial-drift aquifers: Sand and (or) gravel deposits located at or near land surface. Generally unconfined.	30 - 240	100 - 800	2,000	Generally good quality water. Large concentrations of iron and manganese in some areas. Nitrate contamination present in some areas.
Buried-drift aquifers: Sand and (or) gravel deposits located within thick drift. Generally confined.	80 - 380	100 - 600	1,500	Commonly hard water. Large iron, sulfate, and chloride concentrations in some areas, particularly where underlain by Cretaceous and Red River-Winnipeg aquifers.
Sedimentary bedrock aquifers:				
Cretaceous aquifer: Sandstone lenses near the base of a predominantly shale section. Generally confined.	280 - 620	10 - 250	1,000	Commonly hard water. Large sulfate, chloride, and dissolved-solids concentrations in many areas.
Upper Carbonate aquifer: Limestone, dolomite, and dolomitic limestone. Generally confined.	120 - 480	200 - 500	1,000	Includes Cedar Valley, Maquoketa, Dubuque, and Galena Formations. Locally, in karst area, water from a few wells contains large concentrations of nitrate and iron.
St. Peter aquifer: Fine- to medium-grained sandstone. Generally confined.	110 - 614	100 - 250	1,000	Generally good quality water. Large iron, sulfate, and manganese concentrations in some areas, particularly where overlain by Cretaceous aquifer.
Prairie du Chien-Jordan aquifer: Mainly dolomite and sandstone. Generally confined; unconfined near Minnesota and Mississippi Rivers.	170 - 910	500 - 1,000	2,700	Generally good quality water. Large iron and sulfate concentrations in some areas, particularly where overlain by Cretaceous aquifer. Locally, water has large concentrations of nitrate, iron, and manganese.
Red River-Winnipeg aquifer: Mainly sandstone and limestone with shale stringers. Generally confined.	260 - 480	100 - 250	500	Dissolved-solids concentrations range from 3,000 to 60,000 mg/L. Large iron, sodium, and chloride concentrations.
Ironton-Galesville aquifer: Mainly sandstone with interbedded shale and dolomitic sandstone. Generally confined.	170 - 640	40 - 400	1,500	Generally good quality water. Large concentrations of iron, sulfate, and hardness in some areas, particularly where overlain by Cretaceous aquifer.
Mount Simon-Hinckley aquifer: Sandstone siltstone, and shale. Generally confined.	90 - 1,130	400 - 700	2,000	Generally good quality water. Large iron, sulfate, boron, and chloride concentrations in some areas, particularly where overlain by Cretaceous aquifer.
Crystalline bedrock aquifers:				
North Shore Volcanics aquifer: A series of basaltic lava flows and interbedded sedimentary rocks. Generally confined.	20 - 930	5 - 25	100	Yields water from interflow sediments and from joints and fractures in basalt. Saltwater present in some areas north of Lake Superior.
Sioux Quartzite aquifer: Well-cemented quartzite. Commonly unconfined.	120 - 1,300	5 - 100	450	Commonly hard water. Large sulfate concentration, particularly where mixed with water from Cretaceous aquifer.
Proterozoic Metasedimentary aquifer: Thin-bedded gray to black argillite. Generally confined.	30 - 500	5 - 70	250	Small dissolved-solids concentration. Commonly used in conjunction with underlying Biwabik Iron Formation aquifer for public and industrial supplies.



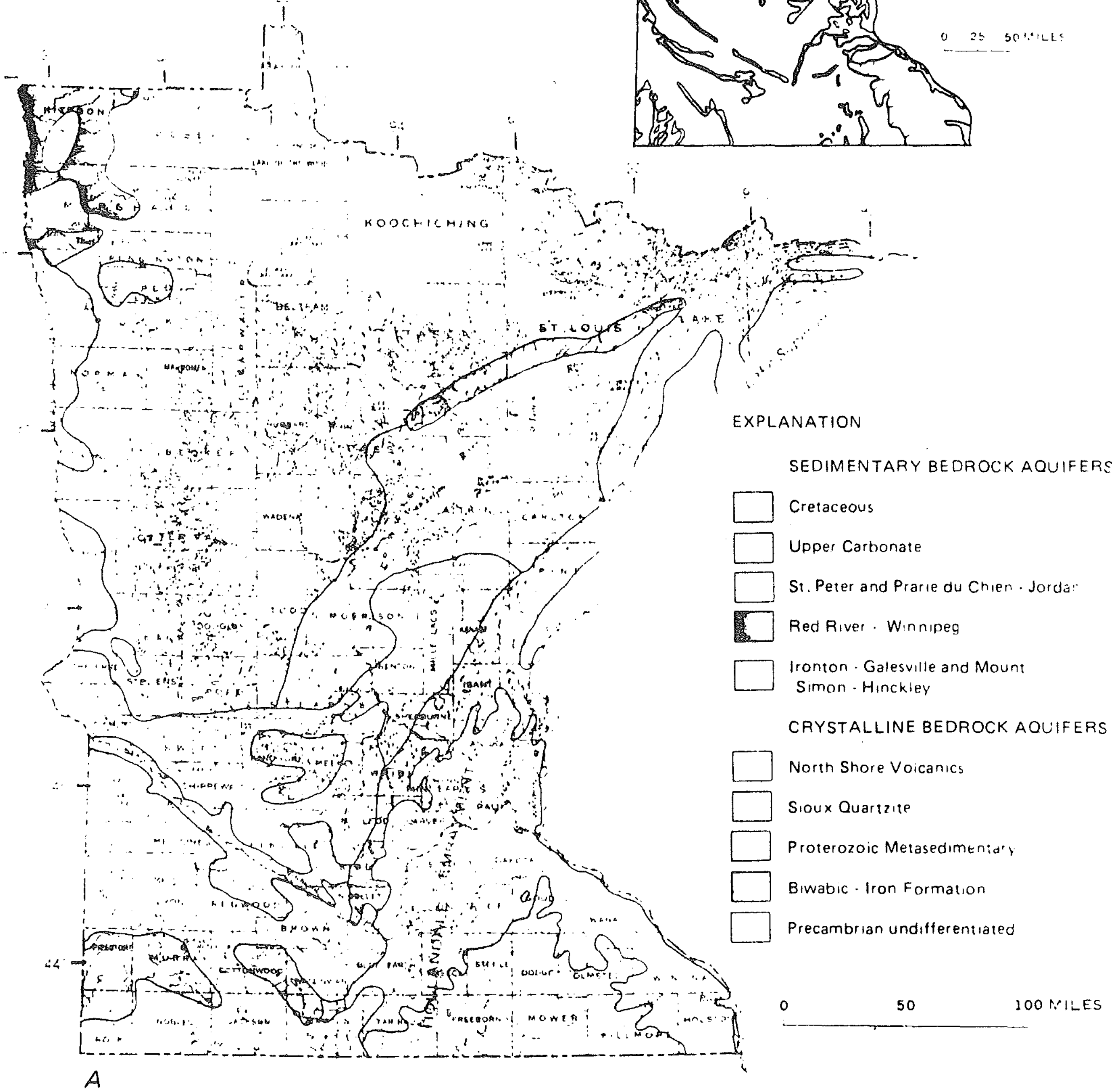


Figure 1. Principal aquifers in Minnesota. *A*, Geographic distribution of bedrock aquifers. *B*, Geographic distribution of surficial-drift aquifers and physiographic diagram. (See table 2 for more detailed description of the aquifers. Sources: *A*, Woodward, 1984. *B*, Compiled by D. G. Woodward from U.S. Geological Survey files; Raisz, 1954.)

Table 2. Aquifer and well characteristics in Minnesota—Continued

Aquifer name and description	Well characteristics			Remarks
	Depth (ft)	Yield (gal/min)		
	Common range	Common range	May exceed	
Biwabik-Iron Formation aquifer: Ferruginous chert. Generally confined; unconfined locally.	170 - 600	250 - 750	1,000	Hard water and large iron concentration in some areas. Most productive source of ground water in Mesabi Iron Range.
Precambrian undifferentiated aquifer: granite, greenstone, and slate. Generally confined.	30 - 450	5 - 25	100	Commonly hard water. Large sulfate chloride concentrations found in areas.

Buried-Drift Aquifers

Buried-drift aquifers are present in nearly all areas of the State except in the northeast and southeast where the drift is thin or absent (fig. 1). Aquifers consist of discontinuous lenses of fine to coarse sand and gravel that are isolated from one another by till. Buried-drift aquifers are used extensively for supplying water to public-supply, irrigation, and farm wells in central and southwestern Minnesota. Locally, water in the aquifers can contain large concentrations of iron (4.6 mg/L), sulfate (1,200 mg/L), and chloride (1,000 mg/L).

SEDIMENTARY BEDROCK AQUIFERS

Cretaceous Aquifer

The Cretaceous aquifer underlies drift in southwestern and western Minnesota. Water from the aquifer is used primarily for rural domestic and stock supplies. It contains locally large concentrations of dissolved solids (3,540 mg/L), chloride (1,500 mg/L), and sulfate (1,700 mg/L), particularly in areas southwest of the Minnesota River (Woodward and Anderson, 1985).

Upper Carbonate Aquifer

The Upper Carbonate aquifer is present in the southern part of the Hollandale embayment and is the source of water for many public-supply, industrial, and rural domestic wells. Karst conditions exist in the eastern part of the aquifer, and ground water in this area commonly is contaminated from agricultural wastes and other nonpoint sources of pollution (Adolphson and others, 1981).

St. Peter Aquifer

The St. Peter aquifer is separated from the underlying Prairie du Chien-Jordan aquifer by the basal St. Peter confining bed in the Minneapolis-St. Paul area and directly overlies the Prairie du Chien-Jordan aquifer in the rest of the Hollandale embayment (Woodward, 1985b). Dissolved-solids concentrations range from 100 to 600 mg/L and hardness ranges from 200 to 400 mg/L as calcium carbonate (Ruhl and others, 1984b).

Prairie du Chien-Jordan Aquifer

The Prairie du Chien-Jordan aquifer is present in the central and southern parts of the Hollandale embayment. Water supplies from the aquifer have been slightly to moderately developed in the southeast and well developed in the Minneapolis-St. Paul metropolitan area where it provides about 80 percent of the annual ground-water supply (Horn, 1983). Locally, water from the aquifer has large concentrations of nitrate (29 mg/L), iron (1.4 mg/L), and manganese (420 mg/L) (Ruhl and others, 1985b).

Red River-Winnipeg Aquifer

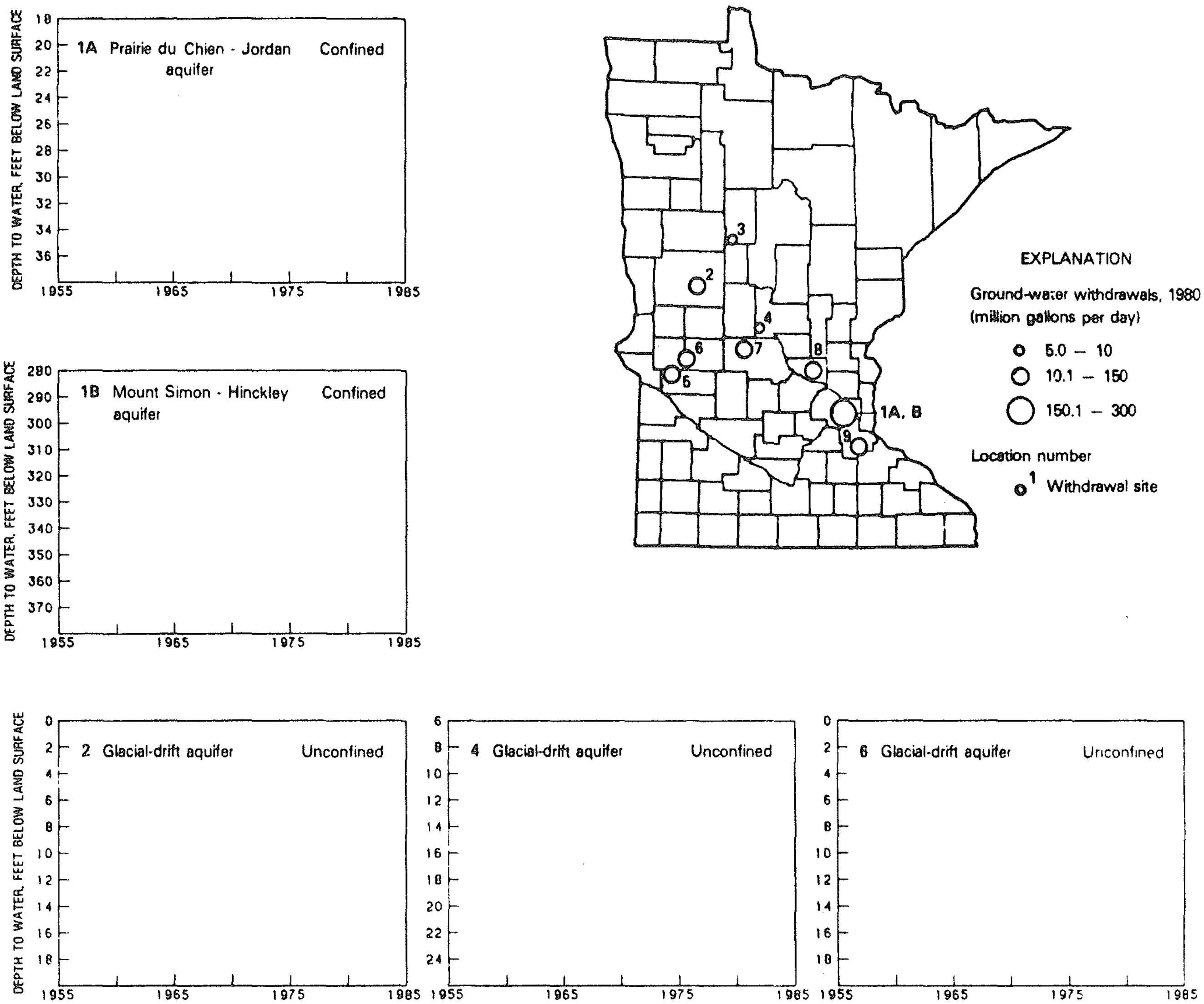
The Red River-Winnipeg aquifer underlies several hundred feet of till and lake sediments of Glacial Lake Agassiz in the northwest corner of the State. Water from the aquifer is very mineralized; dissolved-solids concentrations range from 3,000 to 60,000 mg/L. The water is a sodium chloride type (Ruhl and Adolphson, 1985).

Ironton-Galesville Aquifer

The Ironton-Galesville aquifer is present in most of the Hollandale embayment and is most commonly used in the northern and northwestern parts of the embayment. Dissolved-solids concentrations generally range from 200 to 650 mg/L (Ruhl and others, 1984).

Mount Simon-Hinckley Aquifer

The Mount Simon-Hinckley aquifer completely underlies the Hollandale embayment. About 10 percent of the ground water used in the Minneapolis-St. Paul metropolitan area comes from this aquifer. A long-term cone of depression has developed in the Minneapolis-St. Paul area as a result of extensive pumping over the past 80 years. The dominant water type is calcium-magnesium bicarbonate, but sodium-chloride-type water is present at depth in the southeastern part of the embayment (Wolf and others, 1984).



WITHDRAWAL SITES			
No. on map	Geographic area	Aquifer	Principal uses
1A, B	Minneapolis-St. Paul metropolitan area.	Prairie du Chien-Jordan, Ironton-Galesville, Mount Simon-Hinckley.	Public supply, industrial.
2	Otter Tail County . . .	Unconsolidated glacial-drift . .	Irrigation.
3	Hubbard and Wadena Counties.	. . . .do	Do.
4	Todd and Morrison Counties.	. . . .do	Do.
5	Swift and Stevens Counties.	. . . .do	Do.
6	Pope and Kandiyohi Counties.	. . . .do	Do.
7	Stearns County	. . . .do	Do.
8	Sherburne County . .	. . . .do	Do.
9	Dakota County	Prairie du Chien-Jordan, glacial-drift.	Do.

Figure 2. Areal distribution of major ground-water withdrawals and graphs of annual greatest depth to water in selected wells in Minnesota. (Sources: Withdrawal and water-level data from U.S. Geological Survey files.)

Crystalline Bedrock Aquifer

North Shore Volcanics Aquifer

The North Shore Volcanics aquifer is the major bedrock aquifer along the north shore of Lake Superior. Water generally is obtained from the upper 300 to 400 ft where fractures and weathering are extensive. The aquifer is moderately developed for rural and public supply. Dissolved-solids concentrations range from 100 to 50,000 mg/L but commonly are about 1,300 mg/L.

Sioux Quartzite Aquifer

The Sioux Quartzite aquifer underlies most of southwest Minnesota; locally, it is an important aquifer, furnishing water to seven municipal and to numerous rural domestic and stock wells. Dissolved-solids concentrations generally are less than 900 mg/L, and total hardness is less than 400 mg/L as calcium carbonate.

Proterozoic Metasedimentary Aquifer

The Proterozoic Metasedimentary aquifer underlies drift in the north-central part of the State. The water is of the calcium-magnesium bicarbonate type and is used for numerous rural domestic and some public supplies.

Biwabik-Iron Formation Aquifer

The Biwabik-Iron Formation aquifer crops out in north-central Minnesota, and yields water to many public-supply and industrial wells along the Mesabi Iron Range. Altered zones associated with joints, fractures, and solution channels provide the secondary porosity and permeability. The water meets U.S. Environmental Protection Agency drinking-water regulations for most chemical constituents, although dissolved solids range from 157 to 390 mg/L, and the water locally contains large concentrations of iron (4.9 mg/L) and manganese (1.8 mg/L).

Precambrian Undifferentiated Aquifer

Precambrian igneous and metamorphic rocks underlie the entire State. These rocks yield limited supplies of water to rural domestic and livestock wells in the southwestern, central, and northeastern parts of Minnesota where fractures, faults, and weathered zones provide porosity and permeability. Calcium-magnesium bicarbonate type water is the most common in the aquifer, and dissolved-solids concentrations generally are less than 300 mg/L.

GROUND-WATER WITHDRAWALS AND WATER-LEVEL TRENDS

The largest ground-water withdrawals in the State, exclusive of the Minneapolis–St. Paul metropolitan area (location 1, fig. 2), are in major irrigated agriculture regions (fig. 2). Surficial- and buried-drift aquifers supply the irrigation water for all pumping centers except for Dakota County (location 9, fig. 2), which uses the Prairie du Chien–Jordan aquifer as its primary source for irrigation water. The largest concentration of pumping is in the seven-county Twin Cities metropolitan area.

The well hydrographs shown in figure 2 reflect the response of water levels to pumping at selected withdrawal centers. The effects of the mid-1970's drought are shown in the three hydrographs of drift wells (hydrographs 2, 4, 6), where water levels began to decline in 1972–1974 and remained below normal through 1977 as a result of increased pumping for irrigation. Little long-term change in water levels is noted in the well hydrographs in unconfined drift aquifers in irrigated areas.

Two aquifers, the Prairie du Chien–Jordan and Mount Simon–Hinckley, supply about 80 and 10 percent, respectively, of the ground water pumped in the Minneapolis–St. Paul metropolitan area. The Mississippi, Minnesota, and St. Croix Rivers are in hydraulic connection with and affect the pattern of flow in the Prairie du Chien–Jordan aquifer. Water generally flows toward these rivers from northeast, northwest, and south of Minneapolis and St. Paul. Consequently, intensive pumping has caused only localized cones of depression in the potentiometric surface of this aquifer (Schoenberg, 1984). From 1971 to 1980, average water levels in the Prairie du Chien–Jordan aquifer changed less than 5 ft in most of the area but rose or declined as much as 25 ft locally in response to pumpage and recharge. One hydrograph (location 1A, fig. 2) shows a general water-level decline in the Prairie du Chien–Jordan aquifer below western Minneapolis because of increased pumping for public supply. In contrast, the water level in the Mount Simon–Hinkley aquifer (location 1B, fig. 2), which has only a slight hydraulic connection with the rivers, is greatly affected by pumping. During 1971, the measurable cone of depression, centered in east-central Hennepin County, was about 25 miles in diameter. Decreased annual pumpage from the Mount Simon–Hinkley aquifer from 1971 to 1980 caused water levels in that aquifer to rise.

GROUND-WATER MANAGEMENT

Minnesota has extensive ground-water management and planning legislation. Three State-level organizations implement most of the regulatory and planning programs mandated by this legislation (Bruemmer and Clark, 1984):

The Minnesota Department of Natural Resources (MDNR), through its Division of Waters, has a major role in ground-water resource planning and management. The MDNR provides technical assistance on water-supply, conservation, and well-interference issues and manages an appropriation-permit program. This program requires that a permit be obtained to appropriate ground or surface water (with the exception of domestic use for 25 persons or less) and that annual pumpage be reported. The Division of Waters is responsible for maintenance of a statewide observation-well monitoring network, a water-use program, and investigation of the State's water resources. The research, data collection, and analyses provided by this program, which is operated in cooperation with the U.S. Geological Survey, constitute part of the data base used by the MDNR to make ground-water management decisions.

The Minnesota Department of Health (MDH) is concerned with the health-related and domestic-supply issues involving ground water. The MDH approves plans for public-supply wells, establishes and enforces well-construction standards, and licenses well drillers(Minnesota Statutes, Chapter 156A); requires well-completion reports for new wells; regulates, through permits, the reinjection of ground water and ground-water thermal-exchange devices (Minnesota Statutes, Chapter 156A.10); and administers the public water-supply regulations in concurrence with the Safe Drinking Act (Minnesota Statutes, Chapter 114.381 and 7 MCAR 1.145-1.150).

The Minnesota Pollution Control Agency (MPCA) administers programs dealing with ground-water-quality issues and pollution-control requirements (Minnesota Statutes, Chapters 115 and 116). The MPCA administers its programs through a system of rules:

- Preservation and protection of underground water in the State by preventing any new pollution and by abating existing pollution [6 MCAR § 4.8022 (WPC-22)].
- Regulation of sewage-sludge land spreading (6 MCAR § 4.6101-4.6136).
- Regulation of hazardous-waste facilities (6 MCAR § 4.9001-4.9010).
- Regulation of sanitary landfills (Minnesota Rule SW-6 and SW-12).
- Regulation of septic tanks and drainfields (6 MCAR § 4.8040).
- Regulation of storage of liquid products (WPC-4).
- Regulation of intrastate (6 MCAR § 4.8014) and interstate (6 MCAR § 4.8015) standards for water quality and purity.

The Environmental Response and Liability Act (Minnesota Statutes, Chapter 115B), passed in 1984, is referred to as the "Minnesota Superfund Act" and authorizes the MPCA to provide funds to clean up contamination sites and gain reimbursement later.

Permits are required for disposal practices and to operate facilities that could affect the quality of ground water. The MPCA maintains a network of 400 wells and springs to monitor ground-water quality throughout Minnesota.

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APPENDIX D

A Comparison of Surficial Sand Aquifer Water Quality in Intense, Moderate and Limited Agricultural Regions of Minnesota.

A Comparison of Surficial Sand Aquifer Water Quality in Intense, Moderate and Limited Agricultural Regions of Minnesota

February 1988

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ABSTRACT

Water quality data collected primarily by the Minnesota Pollution Control Agency (MPCA) and U.S. Geological Survey (USGS) between 1978 and 1986 were analyzed to observe ground water quality trends throughout the State of Minnesota. Attempts were made to minimize hydrogeologic differences surrounding each well by limiting the wells to those developed in surficial sand aquifers that were greater than 10 feet deep. Counties with wells developed in surficial sand aquifers were classified as having intense, moderate, or limited agriculture based on the percentage of county acres in cultivation and row crop production (i.e. intense > 80 percent cultivated, moderate 30-60 percent cultivated; limited, < 5 percent cultivated).

Comparisons of nitrate, chloride, and phosphorus concentrations were made between counties in the three agricultural regions. Median nitrite+nitrate-N concentrations were 2.2, 2.9, and 0.05 mg/l in counties with intense, moderate, and limited agricultural practices, respectively. Drinking water standards for nitrate-N were exceeded in 25 percent and 19 percent of wells in the intense and moderate agricultural regions. The limited agricultural region had no wells with nitrate concentrations exceeding the drinking water standard. Chloride concentrations were below drinking water standards in all wells. However, increasing trends in chloride concentration were apparent from limited to more intense agricultural regions. Total phosphorus concentrations in several wells from all three regions were high enough to possibly contribute to lake eutrophication upon discharge.

INTRODUCTION

In many agricultural areas throughout the country there is a growing concern over the impact of agricultural practices on ground water quality. Studies in Minnesota have documented the existence of agricultural chemicals in many aquifers that supply drinking water. The two types of aquifers that seem most highly impacted are carbonate aquifers in southeastern Minnesota and surficial sand aquifers which are found throughout much of the state. While several Minnesota aquifers are contaminated by agricultural chemicals, the extent of this problem and spatial trends throughout the state have not been defined.

Minnesota has several regions of varying degrees of agricultural intensity. The presence of surficial sand aquifers in different agricultural intensity regions provides an opportunity to study water quality trends in hydrogeologically sensitive aquifers under various land-use practices. This study was conducted to: (1) gather and analyze existing Minnesota surficial sand aquifer water quality data and reports, and (2) observe spatial trends in surficial sand aquifer water quality in Minnesota counties classified as having intense, moderate and limited agricultural development.

BACKGROUND

Surficial Sand Aquifers (SSAs)

Most surficial sand aquifers (SSAs) in Minnesota that are large enough to supply water for domestic, agricultural, and industrial use are glacial outwash sand and gravel deposits. However, other surficial aquifers occur as alluvial, valley-fill, ice contact, and beach ridge deposits. Because SSAs have no confining layers between the water table and soil surface and usually have coarse textured soil above the zone of saturation, there is a high potential for water and chemicals at the soil surface to move at a relatively rapid rate into these aquifers. The hydrogeologic sensitivity and widespread use of SSA waters makes these aquifers of particular interest in water quality studies. SSAs are widespread throughout much of the state, but are most common in central Minnesota (Fig. 1).

Water Quality Parameters

There are many types of pollutants that potentially reach ground water. Three of the more common chemical parameters indicative of water quality degradation are described below.

Nitrate Nitrogen

The nitrate form of nitrogen in drinking water becomes a health risk when it exceeds the U.S. Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA) primary drinking water standard of 10 mg/l. It is common practice for labs analyzing ground water samples to test for nitrite plus nitrate nitrogen. Since nitrite-N concentrations in ground water are usually negligible compared to nitrate-N, the drinking water standard of 10 mg/l can, in most instances, be applied to the measured nitrite plus nitrate nitrogen concentration. Nitrate-N concentrations above 10 mg/l can cause a blood disorder in infants called methemoglobinemia. Methemoglobinemia from excessive nitrate concentrations has resulted in the death of infants (1).

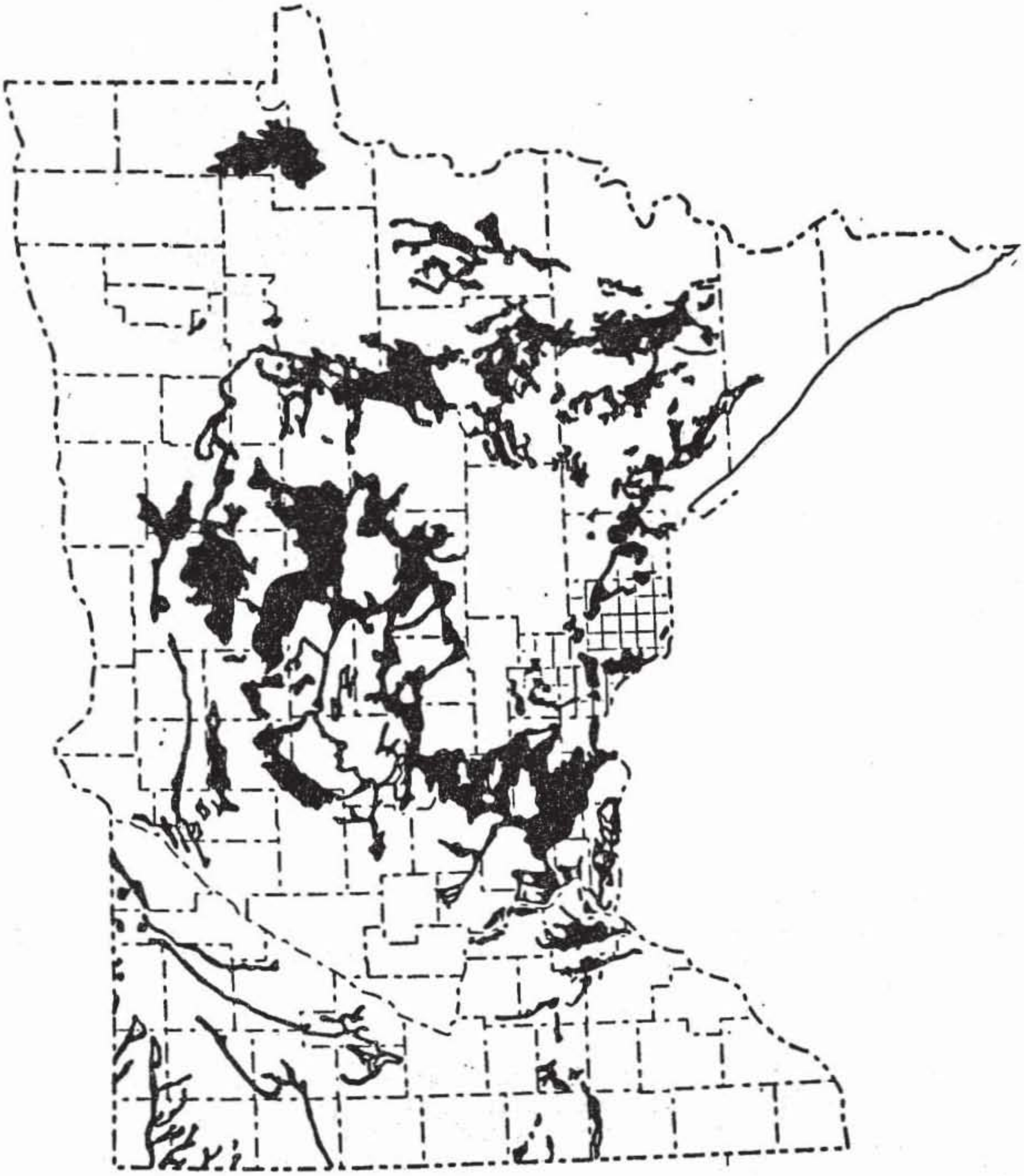

Fig. 1 Location of most major surficial sand aquifers throughout Minnesota (geologic interpretations by H.W. Anderson of the U.S. Geological Survey).

Typical human-induced sources of nitrate-N in the soil include commercial agricultural and sod fertilizers, manure, and septic-tank effluent. Other sources of soil nitrogen include legumes, plant residue, and rainfall. Nitrate ions are very mobile and thus have a high potential to leach through soils into ground water. Blackman (1985) noted that in some studies more than 50 percent of fertilizer nitrogen was lost from the rooting zone within a few weeks after application. Once nitrate reaches ground water, it may accumulate, be lost through denitrification, be diluted with lower nitrate water, or be transported until discharged into a lake, stream, or marsh.

Nitrate tends to move through the soil at the front of percolating water. Research has indicated that higher concentrations of nitrate often exist in ground water following recharge events (Hallberg, 1986; Myette, 1984; Wehrmann, 1983). Thus, short-term temporal changes in nitrate can be quite noticeable, varying with precipitation events, irrigation, and timing of nitrogen inputs. Nitrate entering ground water will tend to remain near the top of the water table and move with advective flow unless the flow field is altered. (Myette, 1984).

Besides having direct health implications, the presence of nitrate in ground water may also indicate the presence of other contaminants. The other contaminants will vary depending on the source of nitrate. For example, if high nitrate is derived from manure or septic system effluent, there is a possibility that bacteria may also be present. Where there are intensive agricultural practices, the potential for presence of pesticides in ground water may be associated with high nitrate concentrations (Buzicky, 1987; Klaseus, 1986; Myette, 1984).

Chloride

The U.S. EPA and MPCA secondary drinking water standard for chloride is 250 mg/l. In excessive concentrations, chloride can be toxic. Chloride in ground water is associated with sources such as septic-system effluent, road de-icing salts, fertilizers, and manure. Chloride is also found naturally in ground water due to dissolution of chloride-bearing rocks such as halite. Chloride, like nitrate, is soluble and negatively charged and thus highly mobile. Therefore, chloride can be used as an indicator of solute movement from potential pollution sources.

Phosphorus

Phosphorus (P) in ground water is not generally considered a health threat. However, when ground water with high P concentrations discharges into lakes directly or indirectly via streams, it can contribute to a lake's P load (Brown 1986; Knutson, 1984). Since P is the least available macronutrient in many lakes, additional P introduced can lead to increased algal or biomass populations and weed growth.

Phosphorus in soils and aquifers originates largely from the disintegration and decomposition of rocks containing the mineral apatite. Native P concentrations are extremely variable between different soils and geologic units (Wetzel, 1983). In addition to natural sources, P is commonly introduced to soils by agricultural fertilizers and septic system effluent. While phosphorus from fertilizer and septic effluent has generally been found to be attenuated in soil, exceptions to this have been noted. Fox and Kamprath (1971) found a certain soil consisting largely of quartz sand and a soil which was primarily muck and peat to be subject to leaching of P fertilizers. Soils lower in iron and aluminum compounds have less ability to retain mineral phosphates. Viraraghaven and Warnock (1976) found that phosphate from a septic drainfield system was reduced by only 25 to 50 percent through five feet of soil.

Minnesota Surficial Sand Aquifer Ground Water Quality Data

There are primarily four agencies, the Minnesota Pollution Control Agency (MPCA), United States Geological Survey (USGS), Minnesota Department of Health (MDH), and Minnesota Department of Agriculture (MDA), that have (1) collected ground water quality data in many counties throughout Minnesota, and (2) made their data relatively easy to access.

Minnesota Pollution Control Agency (MPCA)

As part of the "ambient" ground water monitoring program by the Minnesota Pollution Control Agency's Division of Solid and Hazardous Waste, 96 wells completed in surficial sand aquifers have been sampled at least once since 1978. Sabel and Porcher (1987) found the water in these SSAs to be calcium-magnesium-bicarbonate dominant. The primary drinking water standard for nitrate-N (10 mg/l) was exceeded in 15 percent of the 96 SSA wells sampled and the nitrate standard was exceeded in 4.6 percent of the other 314 wells that were not developed in surficial sand aquifers. Thus, on the whole, surficial sand aquifers were shown to be more highly impacted by nitrate than other aquifers in Minnesota. The secondary drinking water standard of 250 mg/l for chloride was exceeded in only 0.6 percent of the surficial sand aquifer well samples taken. While slight upward trends in nitrate concentrations were noticed between 1978 and 1983, not enough years of data have been collected to establish statistically significant temporal nitrate concentration trends in Minnesota's SSAs.

United States Geological Survey (USGS)

The United States Geological Survey (USGS) conducted several studies on surficial sand aquifers in Minnesota counties that included collections of water quality data and brief discussions of the data (Myette, 1986; Myette, 1984B; and Adolphson, 1983). Three additional USGS studies emphasized water quality and influences of land use on water quality in surficial sand aquifers (Myette, 1984A; Anderson, 1987A; Anderson, 1987B).

A report, "Ground Water Quality Appraisal of Sand-Plain Aquifers in Hubbard, Morrison, Ottertail, and Wadena Counties, Minnesota," is a comprehensive study on ground water quality within SSAs in four counties. This study by Myette (1984A) incorporated data from 124 wells that were completed in sand plain aquifers within Hubbard, Morrison, Ottertail, and Wadena counties during 1978 and 1979. A summary of the results from this study is presented below.

1. Median and mean NO_2+NO_3-N concentrations were 0.4 and 4.2 mg/l, respectively, and median and mean chloride concentrations were 4.2 and 14 mg/l. These values were thought to be slightly elevated due to intense irrigation practices in the regions studied.

2. Comparisons of 1978 and 1979 data with mid to late 1960s water quality data indicates that concentrations of NO_2+NO_3-N have increased in local agricultural areas.

3. Nitrate concentrations were found to vary seasonally and annually with fluctuations in ground water levels. High concentrations of agricultural chemicals were found following major recharge events.

4. NO_2+NO_3-N and Cl^- concentrations decreased quite dramatically with depth below the water table during site specific investigations at the Staples Irrigation Center. The stratification appeared to be greatest during periods of little recharge.

5. Statistical comparisons were made of NO_2+NO_3-N concentrations up and down gradient from major agricultural areas with 57 up-gradient and 46 down-gradient wells sampled in four counties. Within each of the counties median nitrate concentrations up-gradient from agricultural areas ranged from 0.1 to 0.7 mg/l. Downgradient wells had county median concentrations between 6.0 and 9.5 mg/l.

6. Spatial variability in water quality over large regions is complicated by relationships between hydraulic characteristics, precipitation, land-use practices, and proximity of the well to chemical sources.

In another USGS study, Anderson (1987A) sampled 56 wells at 45 sites during 1982, 1983, and 1984 in surficial sand-plain aquifers underlying 600 square miles of Douglas, Kandiyohi, Pope, and Stearns counties in west-central Minnesota. The following conclusions were drawn from this study:

1. Nitrate-N concentrations exceeded the Minnesota drinking water standard of 10 mg/l in 50 percent of the wells sampled. Mean dissolved NO_2+NO_3-N concentrations were 4.3 mg/l in uncultivated areas, 5.4 mg/l in non-irrigated cultivated areas, and 17 mg/l in irrigated cultivated areas.

2. At 8 of 11 two well nested sites, where one well was screened near the water table and another well was screened 10 or more feet below the water table, NO_2+NO_3-N concentrations were higher near the water table than deeper in the aquifer.

3. Nitrate-N concentrations fluctuated seasonally in response to the combined effects of precipitation, irrigation and fertilization. One well had NO_2+NO_3-N concentrations that fluctuated between 18 and 72 mg/l between August 1982 and May 1984. The large amount of short term or seasonal fluctuations in NO_2+NO_3-N concentration suggests a relatively short time frame for reduction of nitrate concentrations at certain locations.

4. Concentrations of sulfate, chloride, and nitrate-N were significantly higher in irrigated areas than uncultivated areas.

5. Nitrate-N concentrations were found to be directly related to specific conductance and chloride concentrations.

6. Four out of eight wells sampled for herbicides had detectable concentrations of atrazine (.2 to .6 μg/L).

Ninety-nine wells sampled by the USGS during 1984 and 1985 in the Anoka sand-plain aquifer provided water quality data and land-use/water quality trends in east-central Minnesota (Anderson, 1987B). Well locations were selected to represent maximum effect of land-use practices. Nearly 30 percent of these wells had NO_2+NO_3-N concentrations exceeding 10 mg/l. Median NO_2+NO_3-N concentrations were found to be lower in undeveloped and non-irrigated cultivated regions (0.13 and 1.6 mg/l) than irrigated and residental lands (5.6 and 3.0 mg/l). Sulfate, chloride, and specific conductance were also noticeably higher in the irrigated and residential areas vs. the undeveloped and non-irrigated areas. Median NO_2+NO_3-N concentrations were significantly higher in wells screened near the water table than wells screened more than 10 feet below the water table. Herbicides were detected in 11 of 18 wells, with a maximum concentration of 1.7 μg/L.

Minnesota Department of Health (MDH) and Minnesota Department of Agriculture (MDA)

The Minnesota Department of Health (MDH) and Minnesota Department of Agriculture (MDA) have collected baseline information on the presence and extent of agricultural pesticides in Minnesota's ground water. Samples from more than 700 wells have been tested for nitrate and 30 different pesticides. MDA monitoring efforts have been focused on agricultural areas especially susceptible to pesticide contamination. Many of these wells are thought to be in surficial sand aquifers; however, detailed soil and hydrogeologic information has not been obtained by the authors to confirm which wells are SSA wells.

Interim study results of over 500 wells showed pesticide detections in 38 percent of all wells sampled (Klaseus, 1986). Atrazine was, by far, the most commonly detected pesticide in each survey phase. Atrazine was found in 35 percent of the wells sampled and in over 90 percent of the wells that tested positive for pesticides. Alachlor was the next most commonly detected pesticide, found in about 5 percent of the wells sampled. While pesticides are being detected in numerous wells, the concentrations being detected are quite low, usually less than 1 μg/L. Surficial sand and gravel aquifers (central and western areas of Minnesota) and karst area aquifers (southeastern Minnesota) were found to be the aquifers most highly impacted.

The Minnesota Department of Health (MDH) has suggested that when pesticides are detected, nitrate-N is also likely to be detected, but nitrate-N concentrations are not always found to be a reliable indicator of pesticides (Klaseus, 1986). Interim data from the MDA (Buzicky, 1987) suggests a slightly stronger relationship between the presence of certain pesticides and nitrate concentrations than the MDH interim data (Table 1). Due to the location of sampled wells, it was believed that there was little chance that nitrate detected in sampled wells originated from septic systems or sources other than agricultural.

TABLE 1 - Interim data from the Minnesota Department of Agriculture Pesticide Survey (Buzicky, 1987). Pesticide detection limits were 0.05 ppb.

NO_2+NO_3-N Concentrations (ppm)	Number of Wells	No Pesticides Detected % of wells(#)	Atrazine Detected % of wells(#)	Other Pesticides Detected % of wells(#)
<1	32	84.4% (27)	12.5% (4)	3.1% (1)
1-10	36	52.8% (19)	44.4% (16)	2.8% (1)
>10	29	37.9% (15)	51.7% (15)	10.3% (3)

METHODS OF ANALYSIS

Water quality trends were observed in surficial sand aquifer wells located in one of three agricultural regions in Minnesota: intense, moderate, and limited agriculture.

Agricultural Intensity Regions

Counties having surficial sand aquifers with sampling stations were categorized based on their agricultural land use. All counties with more than 80 percent of their land area in cultivation and greater than 50 percent of their land area in row crop production were considered to be intensive agricultural counties. Counties with 30 to 60 percent of their land area in cultivation and 10 to 20 percent of county land area in row crop production were considered to have moderate agricultural practices. All counties with less than 12 percent of their land area in cultivation and less than 5 percent of their land in row crop production were considered limited agricultural counties. The criteria for each agricultural category were chosen somewhat arbitrarily based on where large breaks in the land-use data occurred.

Counties with SSA water quality data that fell into one of the three agricultural regions are shown in Figure 2. Unshaded counties in Figure 2 either did not have wells with surficial sand aquifer water quality data or did not fall into one of the three agricultural categories. Counties in the intense agricultural region are located in southwestern Minnesota and counties in the limited agricultural region are located in northeastern Minnesota. Counties with SSAs and moderate agricultural development are found in central Minnesota. The limited and moderate agricultural regions have large broad, surficial sand plains, whereas the intense agricultural areas have smaller, narrow, surficial-sand plains.

Sampling Stations

This study focused on water quality in surficial sand aquifers. To make inferences about spatial ground water quality trends and land use activities, it is important to analyze aquifers with similar characteristics. Surficial sand aquifers were chosen for study because of their widespread occurrence, hydrogeologic sensitivity (relatively rapid response to human-induced pollutants), and common human-usage for domestic, agricultural, and industrial water supplies in Minnesota.

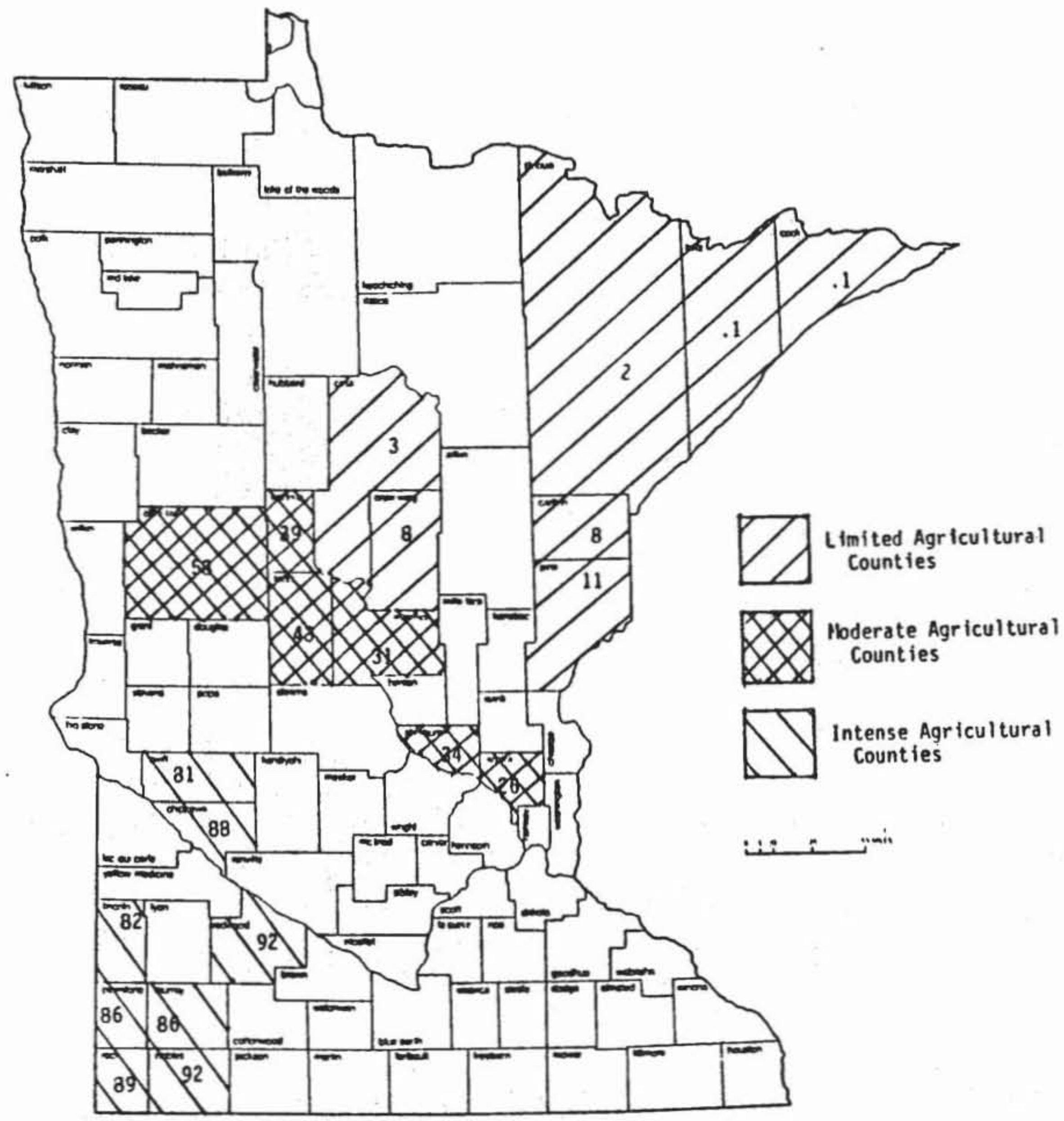

Fig. 2 Agricultural classification of counties where surficial sand aquifer water quality data were available. The numbers within each county represent the percent of land area in each county that is under cultivation.

Water quality data came primarily from two sources: (1) the MPCA ambient ground water monitoring program, and (2) USGS published reports on regional sand plain aquifers. Data from two public water supply wells in Pipestone County and two in Rock County were collected by the Department of Health.

Attempts were made to use data sources that represented ambient conditions. The MPCA data were considered to give ground water quality information most indicative of ambient conditions. In agricultural regions where there was an insufficient number of wells (less than 30) or counties (less than 6), USGS·data were added to the MPCA data.

MDH and MDA data were generally not used in this study because (1) their efforts were concentrated on sampling ground water in areas suspect to agricultural impacts on ground water, and therefore did not represent ambient conditions, (2) information about the aquifer type that the wells were developed in was not readily available, and (3) results from the MDA and MDH studies will soon be published by the respective agencies.

Water quality information from wells less than 10 feet deep were not included in this study. Well depths ranged from 14 to 114 feet, 12 to 116 feet, and 11 to 145 feet in the intense, moderate, and limited agricultural regions, respectively. Median well depths were 42.5, 42.0, and 24.0 ft. in the three respective regions.

All water quality data were from samples collected between 1978 and 1986. When wells were sampled more than once between 1978 and 1986, average water quality parameters were used to represent the water quality of those wells. Wells were generally sampled from April through October.

Figure 3 shows the number of study wells by county and sampling agency. Regional water quality trends were based on 28, 51, and 34 wells sampled in the intense, moderate, and limited agricultural regions, respectively.

Water Quality Parameters

Since nitrate in ground water is of concern because of health impacts and possible association with pesticides in agricultural regions, it was the primary water quality parameter examined. The MPCA samples were analyzed for total NO_2+NO_3-N while USGS samples were analyzed for dissolved NO_2+NO_3-N. The assumption was made in this study that total NO_2+NO_3 in ground water is similar in most cases to dissolved NO_2+NO_3 concentrations. Therefore, no distinction was made between MPCA (total NO_2+NO_3-N) and USGS (dissolved NO_2+NO_3-N) data.

Cloride (Cl^-) and total phosphorus (P) were also examined. Chloride data (total chloride from MPCA data and dissolved chloride from USGS data) were available from most sampled wells. Total phosphorus concentrations for the study were derived from the MPCA ambient data set. Comparisons of both chloride and phosphorus concentrations were made between each of the three agricultural regions. While other nutrients and metals in ground water may have originated from human-induced sources, the authors chose to focus on NO_2+NO_3-N, Cl^- and total P. NO_2-NO_3-N and Cl were believed to be the best indicators of agricultural land-use impacts on ground water quality, given the available data. Phosphorus was chosen because of its association with agricultural fertilizers and because relatively few studies have examined total phosphorus concentrations in Minnesota ground water. Pesticides were not incorporated into the spatial trends comparison because very little ambient pesticide data were available for analysis.

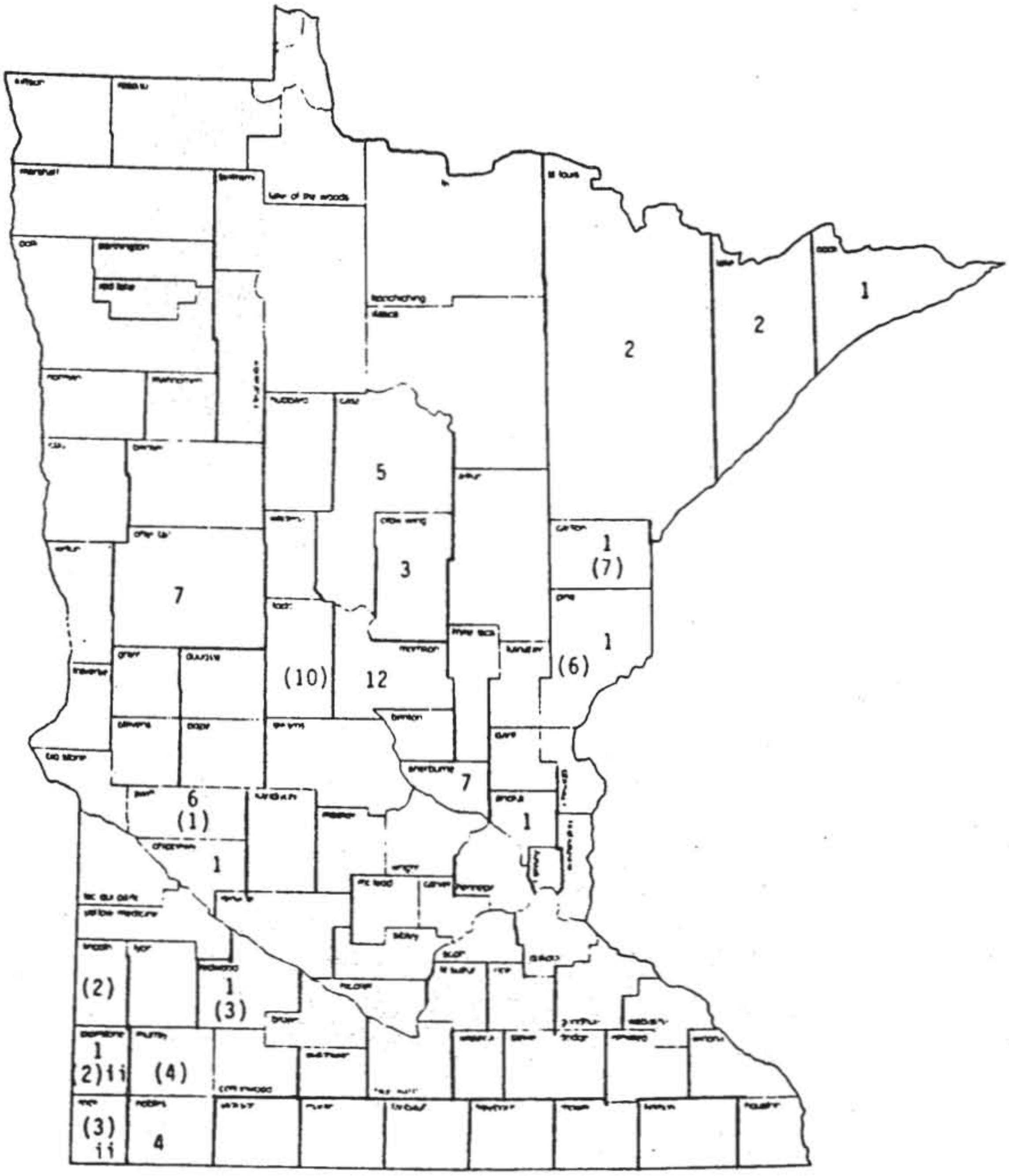

Fig. 3: Number of wells used in this study that were sampled by the MPCA (no parentheses), USGS (parentheses), and MDH (Roman numerals).

OBSERVED TRENDS

Nitrate-N

Mean, median, and maximum NO_2+NO_3-N concentrations within each land-use region were determined (Table 2). Within each of the three regions, the mean NO_2+NO_3-N value was much higher than the median NO_2+NO_3-N concentration. The median is a more useful statistic than the mean in characterizing water quality in the three regions because of the skewed distribution indicated by these differences. Box plots representing the 25th and 75th percentiles of NO_3-N data are shown in Figure 4. The percentage of wells sampled in each region that had NO_2+NO_3-N concentrations that were: (a) not detectable, (b) 0.01 to 10 mg/l and (c) >10 mg/l are represented in Figure 5. NO_2+NO_3-N concentrations are rarely detected and are significantly lower in the limited agricultural region than both the moderate and intense agricultural regions. Over 25 percent and 18 percent of the wells sampled in the intense and moderate agricultural regions, respectively, exceeded the NO_3-N drinking water standard of 10 mg/l. While there were higher NO_2+NO_3-N concentrations detected within the intensive agricultural region than in the moderate agricultural counties, the moderate agricultural region actually had a slightly greater median nitrite + nitrate concentration.

TABLE 2: Mean, median and maximum nitrite + nitrate as nitrogen concentrations from the three agricultural regions.

	Nitrite + Nitrate - N (mg/l)		
Ag. Region	mean	median	maximum
intensive	6.2	2.2	40.0
moderate	5.6	2.9	28.0
limited	0.7	0.05	7.8

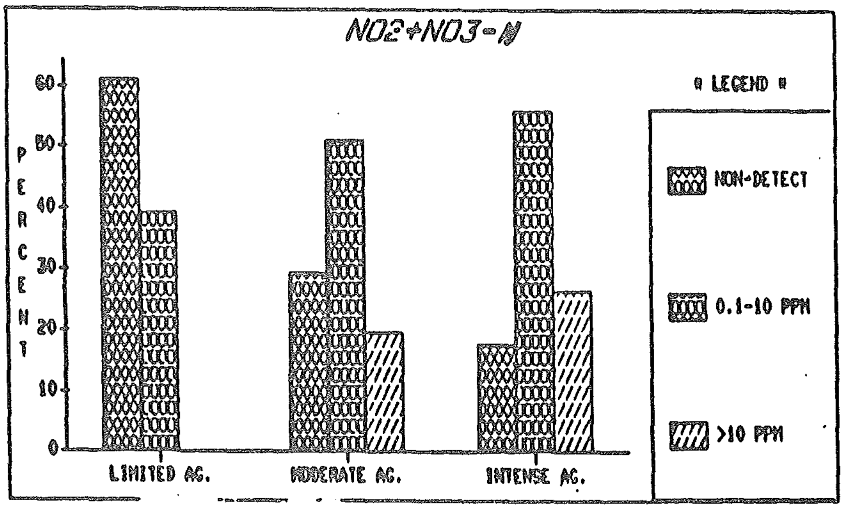

Fig. 5 Percent of wells in each agricultural region that had NO_2 and NO_3 levels that were Nondetectable, 0.1 to 10 ppm; and greater than 10 ppm.

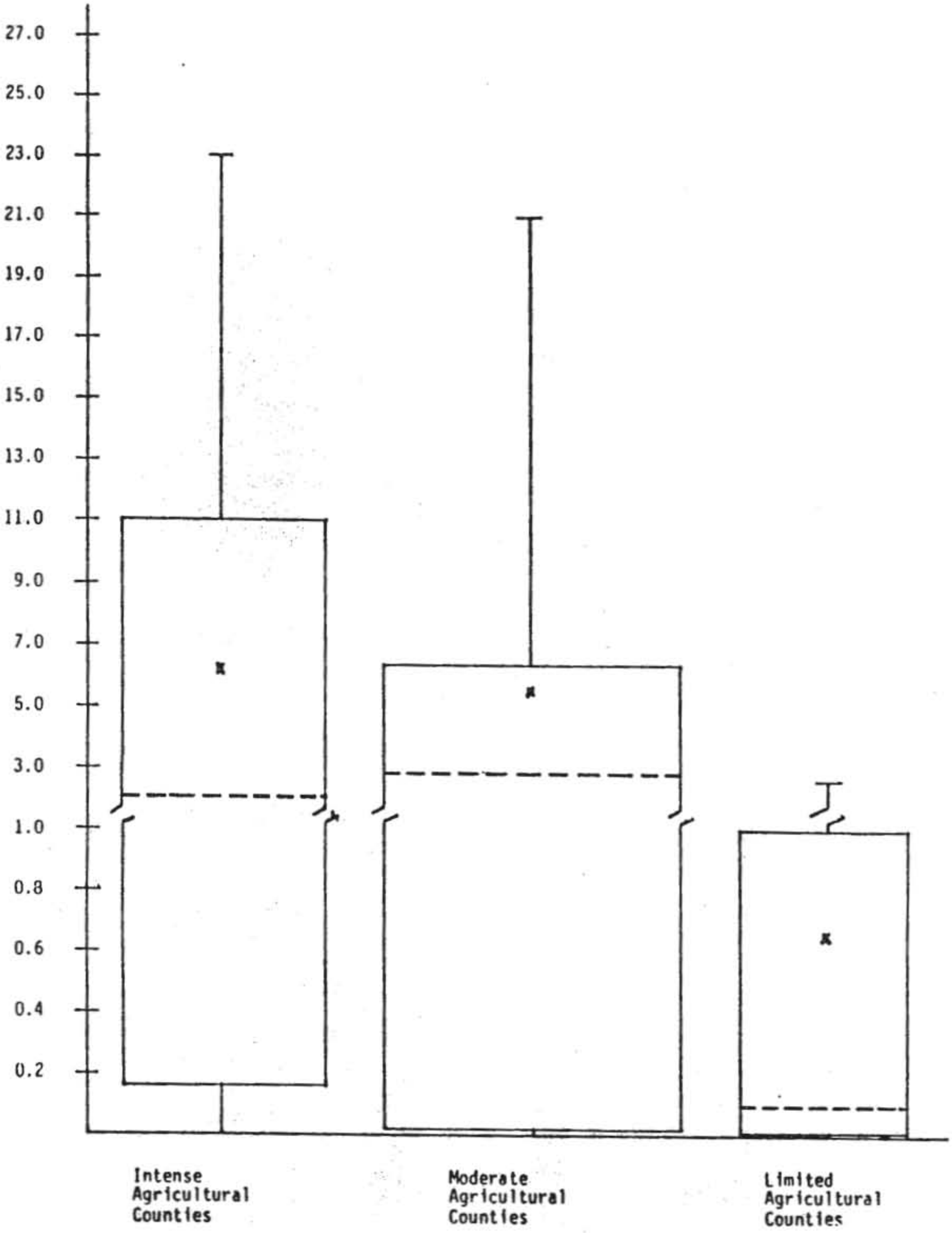

Fig. 4 Box plots indicating quantities of NO_2+NO_3-N concentration in the intense, moderate, and limited agricultural regions. Dashed lines represent median concentrations and Xs represent mean concentrations. The box width indicates the relative number of wells sampled for NO_2+NO_3 in each region.

Chloride

The maximum chloride concentration in all 113 wells in this study was 96 mg/l, far below the 250 mg/l standard. Mean and median chloride concentrations show an increasing trend from the limited agricultural region to the intensive agricultural region (Table 3). Median chloride concentrations in the moderate agricultural or transitional region are more than twice the limited agricultural region concentrations. Box plots showing the 25th, 50th, 75th, and 95th percentiles of chloride concentration within each region are shown in Figure 6.

TABLE 3: Mean, median and maximum chloride concentrations from the three agricultural regions.

	Chloride (mg/l)		
Ag. Region	mean	median	maximum
intensive	18.5	11.0	68
moderate	14.2	8.0	96
limited	7.4	3.9	35

Phosphorus (P)

Total phosphorus content ranged from 0.01 to 6.22 mg/l in the three regions. There were two extremely high phosphorus concentrations reported by the MPCA, 6.22 and 3.91 mg/l, both from Cass County wells. The next highest concentration was 0.40 mg/l, measured in a Sherburne County well. In eutrophic lakes total P concentrations usually range between 0.026 and 0.099 mg/l, and hypereutrophic lakes generally have total P concentrations greater than or equal to 0.1 mg/l (Wetzel, 1983). Fifty-eight percent of the wells sampled for total P had concentrations greater than 0.026 mg/l, and 18.8 percent of the wells had a total P concentrations greater than 0.1 mg/l. Measurement of total P does not always provide a good indication of the amounts of P readily available for aquatic plant growth. However, Mackenthun (1969) reported that total P concentrations greater than 0.05 mg/l could result in profuse algae growth. Phosphorus concentrations in several wells in all regions appear to be high enough to contribute to eutrophication of lakes upon discharge. Mean and median total P values are shown in Table 4. Based on the limited set of data, it appears that the highest concentrations of total P occur in the limited agricultural region. However, there is insufficient data in both the limited and intense agricultural regions to confirm this apparent trend.

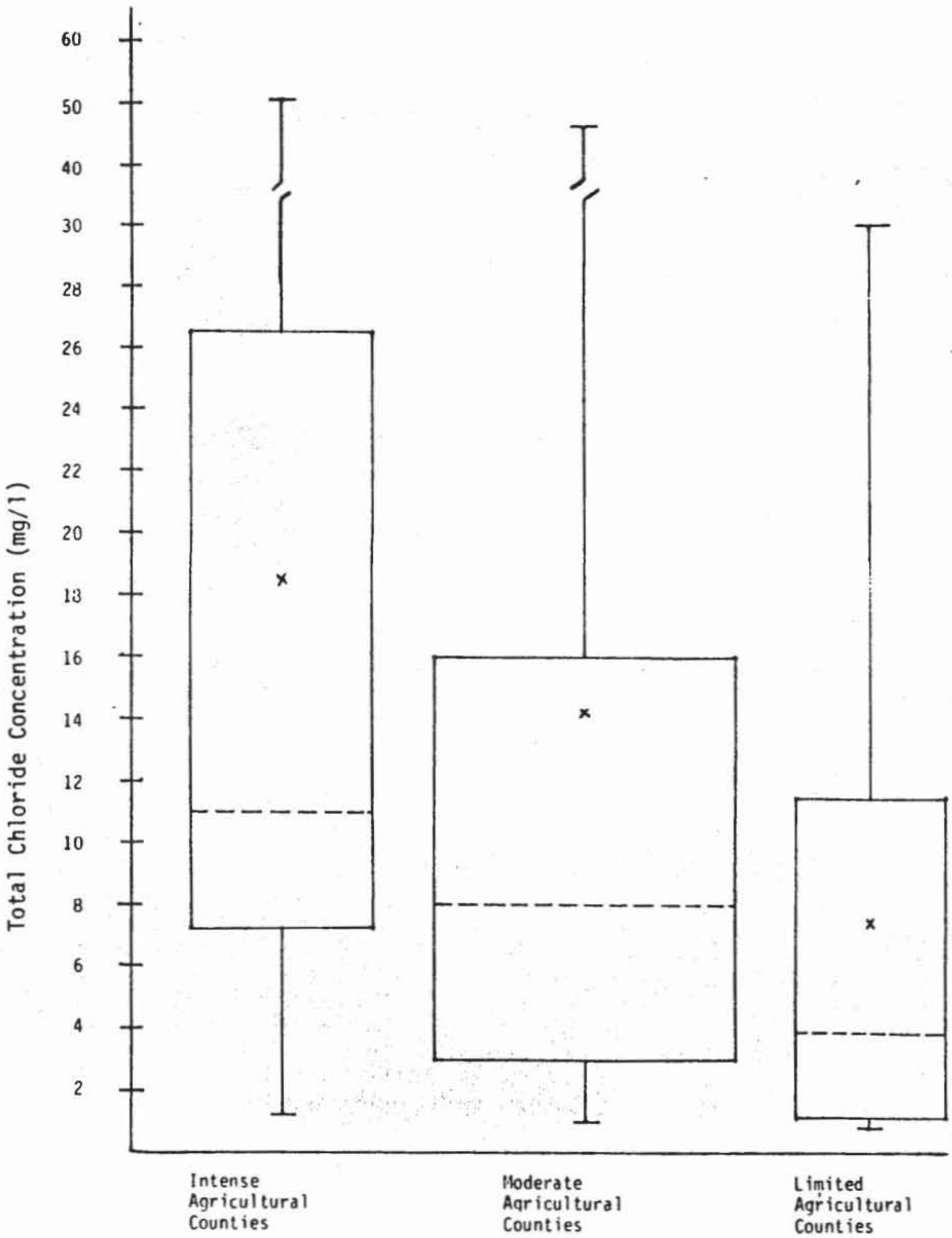

Fig. 6 Box plots indicating quantities of chloride concentration in the intense, moderate, and limited agricultural regions. Dashed lines represent median values and Xs represent mean chloride concentration The box width indicates the relative number of wells sampled for chloride in each region.

TABLE 4: Mean, median and maximum total phosphorus concentrations from the three agricultural regions.

Ag. Region	# Samples	Total Phosphorus (mg/l) Mean	Median	Maximum
intensive	11	0.050	0.038	0.147
moderate	36	0.064	0.046	0.40
limited	15	0.990	0.061	6.22

DISCUSSION

Factors Influencing Water Quality

There are many factors that influence water quality at any given surficial aquifer well including: depth to water table, well screen interval, vertical and lateral directions of ground water flow, flow velocity, aquifer transmissivity, age of water, topsoil and subsoil characteristics, recent precipitation events, irrigation, topography, proximity from contamination sources, and land-use activities. Examples of how a few of these factors may influence water quality are discussed in the following paragraph.

A well screened near the top of an unconfined aquifer will allow sampling of the most recent recharge or youngest ground water. Usually water near the water table will tend to have the highest concentrations of nitrate and chloride. An exception to this would be if a discharging well exists nearby. The cone of depression created by a discharging well can increase the mixing zone, resulting in deeper movement of contaminants into the aquifer. A high capacity well (e.g. irrigation well) can significantly alter the natural ground water flow field, changing the flow rate and direction. Depending on the hydrogeology, this may result in areas of concentrated contaminants. The well screen length may also affect the quality of water collected. A short screen near the water table will tend to capture more polluted water than a longer screen, which would allow for more dilution.

In this study, attempts were made to somewhat minimize hydrogeologic differences surrounding each well in the three agricultural regions by limiting the wells to those developed in surficial sand aquifers that were greater than 10 feet deep. Many of the other factors were not considered in this study. While not enough well site information was known in this study to draw conclusions about relationships between water quality and land use practices, the trends noted in the results section do provide some insight into the nature and scope of nitrate concentrations in Minnesota surficial sand aquifers.

Agriculture and Ground Water Quality Trends

The higher nitrate and chloride concentrations found in the intensive and moderate agricultural regions are especially significant, given that the limited agricultural region generally has coarse textured topsoils, receives greater precipitation, and had a shallower median well depth than the other two regions. The reason that the intense agricultural region did not have significantly higher nitrate concentrations than the moderate agricultural region may be due to differences in the hydrogeologic and/or land use surrounding the wells. For example, it is possible that there was more irrigation near wells in the moderate agricultural regions than the intensive regions. It would be necessary to make field checks at each well site in order to confirm whether the wells in each agricultural region are on land representative of its defining characteristics. The results shown in this study indicate that there is reason for concern regarding the quality of ground water in surficial sand aquifers located in counties considered to have intensive and moderate agricultural practices. Agricultural practices may also be impacting SSAs in the limited agricultural region in localized areas which are not being monitored. High nitrate and chloride concentrations in ground water, can be derived from non-agricultural sources in localized areas; however, the widespread occurrence of nitrate in ground water suggests that agriculture is the major contributor. Since relatively high phosphorus concentrations were found in all agricultural regions, with the highest two concentrations being found in the limited agricultural region, agriculture is not suspected to be the major contributing source of phosphorus in Minnesota surficial sand aquifers. While septic systems and fertilizers may be influencing phosphorus concentrations in localized areas, the dominating factor controlling phosphorus concentrations in most surficial sand aquifers is most likely native P levels in the soil and geologic units. The reader is referred to a report by Larson (1985) for an in depth discussion of phosphorus in soil and ground water. Larson found mean phosphorus concentrations of 0.09, 0.03, and 0.22 mg/l in three wells located in the Anoka Sand Plain in East Central Minnesota. He concluded that the volume and duration of baseflow and high levels of phosphorus in the surficial outwash makes the Anoka sand plain aquifer a potentially important phosphorus source affecting surface water quality. In other areas of the state with naturally high phosphorus concentrations in ground water, agricultural water quality management goals may need to be re-evaluated to account for phosphorus in ground water that is discharging to surface waters.

Future Research and Monitoring Direction

Further study is needed of phosphorus concentrations in ground water and the ground water contribution to lake water budgets. Continued ground water monitoring of inorganics is needed to better understand both temporal and spatial variability of ground water quality in Minnesota.

While the inorganic parameters discussed in this study are of concern, the presence of organic chemicals in the state's ground water is of even greater concern. Pesticides in drinking water have been implicated in acute and chronic diseases and in impaired functions of several organ systems; however, the specific health impacts of pesticides in drinking water are not yet understood. It may take a generation of exposure before the health implications of pesticides in drinking water are known. By this time, the concentrations of pesticides showing up in many wells throughout the state may be much higher. Another complication in understanding the health effects of pesticides in the environment is the breakdown of pesticides in the environment into other products that may not be identifiable and may have negative health effects. The existence and possible health implications of pesticides in Minnesota drinking water point to the need for further work in both long-term monitoring studies and health risk assessment research.

In addition to continued and new state-wide monitoring of both inorganic and organic chemicals, there is a need for more intensive localized monitoring efforts in areas suspected of being impacted by agricultural and other nonpoint sources of pollution. With smaller scale monitoring, it is possible to examine many of the factors contributing to nonpoint source ground water pollution. The results of such studies will aid in our understanding of water quality implications of various land-management practices.

CONCLUSIONS

This study observed that elevated NO_2+NO_3-N concentrations exist in surficial sand aquifers in Minnesota counties with moderate and intensive agricultural practices. Median nitrite+nitrate-N concentrations were 2.2 and 2.9 mg/l in the intensive and moderate agricultural regions, respectively. NO_2+NO_3-N concentrations exceeded the drinking water standard in 25 percent of wells located in the intensive agricultural counties, and the standard was exceeded in 18 percent of wells in moderate agricultural counties. NO_2+NO_3-N concentrations were significantly lower in counties with limited agricultural practices. An increasing trend in chloride concentrations was noticed from the limited agricultural region of Minnesota to the intense agricultural region. However, all chloride concentrations were below the drinking water standard. Phosphorus concentrations in several wells from all regions were high enough to indicate that ground water discharge to surface waters may (greatly) contribute to eutrophication of lakes.

Further monitoring and analysis is needed to better define and understand: (1) ground water quality impact trends from nonpoint source pollution, (2) land use and hydrogeologic factors influencing water quality, (3) the extent, nature, and health implications of pesticides in Minnesota's ground water, and (4) land-management practices needed to reduce the impacts of nonpoint source pollution of ground water.

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APPENDIX E

Pesticides and Ground Water: Surveys of Selected Minnesota Wells.

PESTICIDES AND GROUNDWATER:

SURVEYS OF SELECTED MINNESOTA WELLS

Minnesota Department of Health (MDH)
and
Minnesota Department of Agriculture (MDA)

February 1988

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Prepared for the
Legislative Commission on Minnesota Resources

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EXECUTIVE SUMMARY

Between July 1985 and June 1987, the Minnesota Departments of Health (MDH) and Agriculture (MDA) conducted cooperative surveys of water wells for selected pesticides. The surveys were funded by the Legislative Commission on Minnesota Resources and were intended to provide baseline information on the occurrence and extent of agricultural pesticide contamination in the State's groundwater and drinking water.

Pesticides were selected for survey consideration based on an evaluation of existing information related to use, toxicology and environmental transport and fate. Emphasis in the final selection was placed on those pesticides which were commonly used in the State and/or which appeared to be more likely to adversely impact groundwater and public health. Analytical methods were developed for the selected pesticides by the MDH and MDA laboratories. Only one of the selected pesticides, 2,4-D, had a Federal or State drinking water standard. In order to address the public health concerns presented by the detection of pesticides in drinking water, the MDH established recommended allowable limits (RALs) for the other pesticides considered in the survey.

In general, wells were selected for sampling in agricultural regions of the State and, within those regions, from areas where the local or regional soils and hydrogeologic conditions make the groundwater especially susceptible to pesticide contamination. Karst aquifers and shallow sand and gravel aquifers overlain by coarse-textured soils were viewed as particularly sensitive and most likely to show evidence of groundwater contamination by pesticides. Some wells were also selected outside of these sensitive areas to provide areal coverage of the State's agricultural regions and diverse cropping patterns.

The MDA sampled 100 observation, irrigation, and private drinking water wells and five drain tiles on a time-series or repetitive basis (typically, four samples per site). The MDH collected a single sample at each of 400 public drinking water wells. A second sample was collected from each well in which pesticides were detected in the initial sample.

The results of the surveys indicated that several pesticides were present in groundwater, especially in hydrogeologically sensitive areas of the State. One or more pesticides were detected in 165 (33 percent) of the 500 wells sampled. Pesticides were observed more frequently in observation and private drinking water wells than in public drinking water wells. This difference is most likely attributable to the shallower depths of many of the observation and private drinking water wells and to their closer proximity to fields receiving pesticide applications.

Fifteen pesticides, including thirteen herbicides, one insecticide and one wood preservative, were detected in the surveys. Atrazine, the most commonly detected pesticide in each survey, was found in 154 (31 percent) of the 500 wells sampled and in over 90 percent of the wells which tested positive for pesticides. Alachlor, the next most commonly occurring compound in each survey, was found in 17 wells. Each of the remaining thirteen pesticides was detected in seven or fewer wells.

Although the percentage of wells with detectable levels of pesticides was relatively high, the concentrations detected were usually low. Eighty-four percent of all pesticide occurrences were at concentrations less than 1.0 μg/l. Levels exceeding the RALs were observed in samples collected from ten wells, including four public drinking water wells and one private drinking water well.

At the low concentrations typically observed in these surveys, the public health concerns focus on potential chronic health effects. Chronic toxicity information for many pesticides is limited. Although this body of information has improved significantly in recent years, it is difficult to associate specific health effects with exposure to low levels of pesticides in drinking water.

Pesticides were detected in wells in 51 counties, but were most commonly found in wells completed in the karst formations in southeastern Minnesota, the shallow, outwash sand and gravel aquifers in central Minnesota and the shallow, alluvial sand and gravel aquifers in southwestern Minnesota. Few pesticide occurrences were observed in northwestern and south central Minnesota.

The widespread occurrence of pesticides, primarily atrazine, at low concentrations in certain areas indicates that groundwater contamination may result from normal pesticide use as well as from spills, leaks, back-siphonages and other point sources.

Significant vertical differences in pesticide and nitrate-nitrogen occurrence and concentration were observed in adjacent observation wells in certain central Minnesota sand and gravel aquifers. The nature of this vertical stratification varied from site to site.

While pesticides were observed more frequently in wells in certain areas of the State, the potential for contamination in a specific well is determined by a complex set of factors, including the contaminant source, chemical properties, local groundwater vulnerability, local agricultural practices and well construction. These factors vary considerably from area to area and from well to well.

Nitrates were analyzed to determine if there was a relationship between nitrate and pesticide occurrence and concentration in groundwater and to evaluate nitrate testing as a surrogate for pesticide testing. Nitrates were not found to be a reliable indicator of pesticide occurrence or a quantitative predictor of pesticide concentration.

The baseline information generated in these surveys has significantly expanded our knowledge of pesticide contamination in Minnesota groundwater and drinking water. Nevertheless, it is important to recognize the limitations of the surveys. A limited number of wells and pesticides were studied during a relatively short time frame under unusual precipitation conditions. As a result, these surveys do not provide a comprehensive statewide assessment of the extent of groundwater contamination by pesticides. Additional monitoring, research, regulatory and educational efforts will be needed to minimize the impact of pesticides on groundwater quality and public health.

INTRODUCTION

Agricultural lands in Minnesota account for over 30 million of the State's 53 million total acres. In 1986, Minnesota ranked fifth in the nation in crop acreage planted with 20.6 million acres under cultivation. A wide range of soil and climatic conditions result in diverse cropping patterns across the State. The most widely planted crops are corn, soybeans, wheat, barley, oats and alfalfa. Other crops of local or regional significance include sugar beets, sunflowers, potatoes, sweet corn, rye, peas, edible beans and flax.

Pesticides are used extensively in agricultural crop production. In a Minnesota Agricultural Statistics Service publication covering the 1984 crop year, Minnesota farmers were reported to have used pesticides on over 96 percent of their corn, soybean and sugar beet acreage, nearly 90 percent of their wheat and sunflower acreage and on 60 percent of their small grain acreage (Minnesota Agricultural Statistics Service, 1985). In total, an estimated 40-45 million pounds of active pesticidal ingredients were applied to approximately 16.5 million acres of Minnesota farmland during the 1984 crop year.

This extensive pesticide use has both benefits and risks. Pesticide use has allowed farmers to increase crop yields while decreasing the time and fuel spent on crop production. At the same time, there has been increasing evidence that certain pesticides are entering ground and surface waters, posing a potential threat to drinking water.

In response to concerns generated by the detection of pesticides in certain Iowa and Wisconsin groundwaters and by the limited pesticide monitoring data available for Minnesota groundwaters, the Minnesota Departments of Health (MDH) and Agriculture (MDA) initiated cooperative surveys of water wells for selected pesticides. The surveys were funded by the Legislative Commission on Minnesota Resources (LCMR) in July 1985 and were intended to provide baseline information on the occurrence and extent of agricultural pesticide contamination in the State's groundwater and drinking water.

All samples were collected between July 1985 and June 1987. The MDA sampled 100 observation, irrigation, and private drinking water wells and five drain tiles on a time-series or repetitive basis (typically, four samples per site). The MDH collected a single sample at each of 400 public drinking water wells. A second sample was collected from each well in which pesticides were detected in the initial sample. The surveys will be referred to in this report as the MDA survey and the MDH survey.

Additional funding was obtained from the United States Environmental Protection Agency (U.S. EPA) and used by MDH to conduct complementary monitoring of approximately 225 private drinking water wells. The methods and results of that survey are presented in a separate report (MDH, 1988).

COMMON METHODS AND BACKGROUND INFORMATION

Pesticide Selection

The pesticide selection process involved the evaluation of information and data related to use, toxicology and environmental transport and fate. Pesticide use information was obtained, primarily from the Minnesota Agricultural Statistics Service, for each of the major crops grown in the State. Information on toxicology and environmental transport and fate was obtained, in part, through consultation with the MDH's Section of Health Risk Assessment, the University of Minnesota and other State agencies. Work performed by the U.S. EPA (Cohen et al., 1984) and the states of Wisconsin (Goethel et al., 1983), California (Litwin et al., 1984; and Bowes, 1984) and Iowa (Hallberg et al., 1984) was also utilized. Limited information was available on the environmental transport, fate and toxicology of many of the compounds in current use.

After evaluation of existing information, the MDH and MDA jointly selected 45 pesticides for further consideration. Emphasis in the final selection was placed on those pesticides which were commonly used in the State and/or which appeared to be more likely to adversely impact groundwater and public health.

The MDH and MDA laboratories were requested to develop and verify analytical methods for the selected pesticides. The two laboratories coordinated efforts to ensure that similar analytical methods and reporting limits would be developed and used in the surveys. Some variation resulted from differences in laboratory equipment, procedures and personnel, but these variations did not significantly affect the findings of this report.

Due to time constraints and limitations in laboratory capability, analytical methods were developed and verified for only 30 of the 45 pesticides on the original list. Both laboratories developed analytical capabilities for chlorinated acid herbicide and base/neutral extractable compounds. In addition, the MDA laboratory developed analytical capabilities for aldicarb and performed these analyses for both departments. The pesticides, analytical methods and reporting limits are presented in Tables 1 and 2 for the MDA and MDH surveys, respectively. A brief description of each pesticide included in the surveys is presented in Appendix A. Narrative information on the analytical methods is provided in the methods section for each survey.

Recommended Drinking Water Limits

Federal and State drinking water standards have been established for six pesticides. Only one of these chemicals, 2,4-D, is commonly used in Minnesota and included in the surveys. In order to address the public health concerns presented by the detection of pesticides in drinking water, the MDH established recommended drinking water limits for the remaining pesticides in the survey (Table 2). These recommended allowable limits (RALs) were established utilizing health effects data available from the U.S. EPA and other sources. The MDH used standard methods, developed by the U.S. EPA, for: 1) determining whether a contaminant should be considered carcinogenic or noncarcinogenic; and 2) calculating an acceptable level for the contaminant in drinking water.

For noncarcinogens, an acceptable level was calculated based on a no-observed-adverse-effect-level (NOAEL) obtained from human and/or animal studies. Safety factors were applied to the NOAEL to account for various uncertainties, including extrapolation from animal studies to humans, gaps in the toxicologic profile, and the variable sensitivity of a heterogenous human population to a toxicant. This calculation yielded a reference dose level (RFD). Exposure levels that exceeded the RFD were considered unsafe.

The health risks associated with known or suspected carcinogens were evaluated based on the assumption that consuming drinking water containing any amount of a carcinogenic contaminant would increase the cancer risk of the consumer. Exposure levels (the concentration of the carcinogen in drinking water) were converted to risk levels using potency slopes obtained from the U.S. EPA or other reputable sources. This calculation was based on methods prescribed by U.S. EPA's Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1986). Risk levels were then evaluated in relation to the acceptable risk of one cancer per 100,000 population per lifetime. Risks which exceeded this level were judged to be unacceptable.

Drinking water containing multiple pesticides, all at concentrations below their respective RALs, was evaluated based on additive effects or risks. Additivity assumes that the toxic effects of two or more chemicals are similar and that the total toxic effect is the sum of their individual effects. The exposure level for multiple contaminants was judged to be unacceptable if the sum of each contaminant's concentration (C) divided by its RAL exceeded one:

$$\frac{C_1}{RAL_1} + \frac{C_2}{RAL_2} + \cdots\cdots + \frac{C_n}{RAL_n} > 1$$

The RALs were developed as health advisories, not as enforceable standards, and are subject to change as better health effects information becomes available. The RALs were modified in January 1988 to reflect the U.S. EPA draft health advisories which were prepared for certain pesticides as part of the National Pesticide Survey.

Well Selection

In general, wells were selected in agricultural regions of the State and, within those regions, from areas where the local or regional soils and hydrogeologic conditions make the groundwater especially susceptible to pesticide contamination. Karst aquifers and shallow sand and gravel aquifers overlain by coarse-textured soils were viewed as particularly sensitive and most likely to show evidence of pesticide-related groundwater contamination.

The karst region in southeastern Minnesota is generally characterized by shallow depths to porous and permeable carbonate bedrock and, in some areas, by features such as sinkholes, caves and disappearing streams. These conditions can result in rapid transport of surface water containing dissolved or soilbound pesticides into the groundwater.

Shallow sand and gravel aquifers overlain by coarse-textured, low organic matter soils occur throughout the State and are particularly widespread in central Minnesota (Figure 1). These aquifers are comprised primarily of glacial outwash and alluvial deposits, but also include beach ridge deposits in northwestern Minnesota. The potential for pesticide movement to groundwater is increased in these areas because the soils typically allow rapid water infiltration and have a low capacity for adsorption of organic compounds. Irrigation, which is commonly practiced in many of these areas, may also contribute to the downward migration of pesticides.

Some wells were also selected outside these sensitive areas to provide areal coverage of the State's agricultural regions and diverse cropping patterns. Additional information on well selection is provided in the methods section for each survey.

Soil Moisture and Precipitation, Fall 1985-Spring 1987

Soil moisture and precipitation are important factors in the downward movement or leaching of soluble pesticides into groundwater. Although these factors were not directly considered in the surveys, the soil moisture and precipitation conditions existing immediately before and during the surveys may have had an important influence on the occurrence of pesticides in ground-water.

In 1985, Minnesota experienced the fifth consecutive year of wet fall soil conditions. A mathematical model based on precipitation information gathered at measuring stations across the State indicated that soil moisture conditions in significant portions of Minnesota were wet or very wet heading into the spring of 1986 (Figure 2). Since the map prepared by the State Climatological Office and the University of Minnesota's Department of Soil Science is based on medium- to fine-textured soils, the soil moisture conditions in areas of coarse-textured soils are underestimated.

Following the wet fall of 1985, precipitation in the hydrologic year ending September 1986 greatly exceeded normal amounts in large portions of the State (Figure 3). Some areas recorded three times the normal precipitation in April. September was generally regarded as one of the wettest on record. Central Minnesota received the greatest amount of above normal precipitation, with some areas receiving 20 inches or more above normal.

In sharp contrast, precipitation was greatly below normal amounts in most areas of the State during the remaining months of the surveys (October 1986-June 1987). Precipitation typically ranged from 4 to 10 inches below normal during this period (Figure 4).

METHODS: MDA PESTICIDE SURVEY

Site Selection

The purpose of the MDA pesticide survey was to evaluate the possibility of pesticide movement to groundwater in Minnesota. Accordingly, agricultural regions thought to be susceptible to movement of pesticides to groundwater were emphasized in site selection. In addition, some wells were selected in regions or conditions that were thought to be less susceptible in order to evaluate results from several hydrogeologic and agronomic conditions.

Susceptible regions were defined by soil and hydrogeologic characteristics that permitted rapid recharge and minimal filtration. Two general regions fit these criteria: 1) the unconfined, surficial sand and gravel aquifer regions; and 2) the karst region of southeastern Minnesota.

Unconfined, Surficial Aquifers. Unconfined, surficial aquifers are concentrated in central Minnesota where extensive areas of glacial outwash and sand plains exist. While most soils in these areas are coarse textured, a mixture of soil types in local areas is common. Alluvial valleys in southwestern Minnesota, where there are soil associations similar to those seen in central Minnesota, also present conditions that were thought to be susceptible to pesticide movement to groundwater.

The general criteria for well selection in unconfined aquifers were: 1) agricultural fields in immediate proximity to the wells; 2) water table less than 30 feet deep and preferably with the well screen located within 10 feet of the water table; 3) well location in the estimated downgradient direction of groundwater flow from agricultural fields; 4) distribution of locations with regard to crops, soils, climate and pesticide usage; 5) history of pesticides or nitrates in the well.

Karst. The karst region is located in southeastern Minnesota and is characterized by disappearing streams, springs, sinkholes and fractured limestone or dolomitic bedrock. Karst aquifers feature cracks and crevices in the bedrock that allow rapid water movement. Fractured bedrock is overlain by variable depths of loess-derived, silt-textured soils. Silt soils are typically well drained.

Wells were sampled in four southeastern areas with varying karst features. The nature of the karst aquifers prevented monitoring of specific fields without extensive hydrogeologic studies that were beyond the scope of this project. Regions or wells were selected for sampling in the southeast based on information obtained from the Minnesota Geologic Survey (MGS), Minnesota Pollution Control Agency (MPCA), local health sanitarians, and previous nitrate or pesticide analysis.

In addition to the shallow wells in the unconfined, surficial aquifers in susceptible regions and the wells in the karst, a limited number of other sites were also selected. Two irrigation wells screened beneath a confining layer were selected because of intense pesticide use near these wells. Five tile lines were sampled in southern and western Minnesota. Tile lines provide subsurface drainage for excess soil moisture in poorly drained, fine-textured soils and are common throughout southern and western Minnesota.

Well Type

The majority of wells selected in the unconfined, surficial aquifers were water table observation wells which were originally installed and monitored by the Department of Natural Resources (DNR) or the United States Geologic Survey (USGS). A few of the wells were specifically installed for water quality monitoring. The typical observation well had a 1.25- to 2-inch diameter steel casing with a 2- to 3-foot sand point screen. Three of the observation wells were polyvinyl chloride (PVC). The majority of the wells were installed several years prior to the study; however, two wells were installed as recently as 1985. A total of 65 observation wells were sampled in the study.

Thirty-one drinking water wells were utilized in areas where established observation wells were not available. Twenty drinking water wells were sampled in the southeast, two in the southwest, three in the northwest, and six in central Minnesota.

Four high capacity (500-1000 gpm) irrigation wells were sampled. These wells were located in highly susceptible areas with coarse-textured soils; two were located in close proximity to intensive pesticide use.

Sample Collection

Timing. Samples were obtained from most of the 100 wells in the spring, summer and fall of 1986 and a fourth sample was collected in the winter or spring of 1987. Although four samples were typically collected from each well, eight wells were only sampled three times due to well closures, dropped water tables or inaccessibility. Individual sampling intervals varied due to collection scheduling or laboratory analytical capacity.

Tile lines were only sampled in the spring of 1986. Three tile lines were sampled once and two were sampled twice. Tile lines at these sites did not run in the fall of 1986.

Sampling Protocol. Observation and drinking water wells were pumped to evacuate three volumes of standing water prior to sample collection. The MDA laboratory provided washed and capped one-liter amber bottles with Teflon-lined caps. The bottles were rinsed with sample water immediately before filling. One bottle was filled for each analytical extraction procedure. Sulfuric or orthophosphoric acid was added as a stabilizer for the chlorinated acid herbicide and N-methylcarbamate procedures, respectively. The nitrate-nitrogen samples were collected in 125-milliliter (ml) polypropylene bottles. All samples were placed in an insulated cooler, refrigerated with prefrozen cold packs or ice and transported to the laboratory. Samples were delivered to the laboratory within 48 hours of sampling.

Observation wells were evacuated and sampled with a peristaltic pump or, in a few instances where water tables were deeper than the lift capacity of the pump, with a bailer. Prior to each sampling, the pump's silicone tubing or the bailer was rinsed with triple-deionized water and acetone. The polypropylene tubing, dedicated to each well, was stored in a plastic bag between sampling events. Drinking water wells were sampled from the tap.

A few variations of the above procedure were necessary. Irrigation wells were sampled at a nozzle or a tap during field irrigation or after pumping an estimated three volumes of water. Tile lines were sampled at the outlet during the spring flowage in 1986. A few observation wells that were pumped dry during evacuation were allowed to recharge before sample collection. Nine samples were collected from four sites by University, DNR or county personnel following MDA sampling instructions. These samples were shipped by one-day delivery service to the laboratory in a refrigerated cooler.

Laboratory Analysis

All samples were analyzed by the MDA Laboratory Services Division except for 21 samples analyzed by the MDH Public Health Laboratories Division. Prior to the initiation of the field phase of the project, a method reporting limit was determined for each analyte in the base/neutral extractable and chlorinated acid herbicide procedures. Method reporting limits were established for the N-methylcarbamate and nitrate-nitrogen procedures based on daily signal-to-noise assessment and prior analyst experience.

Upon delivery to the laboratory, samples were refrigerated at 4°C until extraction. The maximum holding time prior to extraction was 10 days, though the majority were extracted in less than seven days. Analysis was completed within 30 days of extraction.

Base/neutral pesticides. This procedure identified and quantified some of the most widely used pesticides in Minnesota. All samples collected in the survey were analyzed with this procedure.

Sample preparation for gas chromatography analysis entailed the extraction of one liter of sample water with methylene chloride followed by concentration to a volume of 3 ml. Retention times and peak areas were compared with known standards after single-port injection into dual DB-1 columns mounted on a Varian 3400 gas chromatograph equipped with a Ni-63 electron capture (EC) detector and a nitrogen/phosphorus (NP) detector. Positive values were confirmed on either a Perkin Elmer Sigma 2 gas chromatograph equipped with a DB-17 column and EC and NP detectors or a Perkin Elmer Sigma 300 gas chromatograph equipped with a Supelcowax 10 column and EC and NP detectors.

Chlorinated acid herbicides. This procedure was run at least once on samples from all but a few wells. Samples collected from certain wells, such as those in the southeast or those with a chlorinated acid herbicide history, were routinely analyzed with this procedure.

Sample preparation for this procedure included field stabilization of the sample by acidification. In the laboratory, the sample was extracted with methylene chloride. The derivatives of the chlorinated acids, acid esters and salts were hydrolyzed with potassium hydroxide, extracted with methylene chloride and concentrated. The acids were converted to methylesters with methyl iodide and tetrabutylammonium hydroxide. Benzene was added and the sample was then concentrated for injection.

Gas chromatography analysis was conducted on a Tracor Model 560 with a Hewlett-Packard Model 3388A integrator. A Hall electroconductivity detector with a DB-1 megabore column was used for initial analysis and a Ni-63 EC detector with a OV-17 column used for confirmation.

<u>N-methylcarbamate/pesticides.</u> This procedure was used primarily on samples collected near areas of probable aldicarb use. Field stabilized samples were extracted with dichloromethane, evaporated to dryness and dissolved in a methanol and water solution. The solution was analyzed by HPLC/post column fluorometric detection with confirmation by gas liquid chromatography with NP detectors.

<u>Nitrate-nitrogen.</u> Nitrate-nitrogen analyses were conducted on all samples. A Perkin Elmer 552 spectrophotometer was used to measure absorbency following color development with chromatropic acid. The method reporting limit was 1 mg/l.

<u>Quality Control.</u> Standard quality assurance practices were observed. Glassware, reagents, and other potential sources of interference were evaluated and monitored. Method blanks, field blanks and blind duplicate samples accounted for approximately 20% of the total analyses. Spiked samples, for procedure validation, accounted for another 10% of the samples.

Spiked laboratory procedure validation samples were routinely analyzed during the survey. Average percent recoveries (and standard deviations) for three commonly detected pesticides were: atrazine, 91 (17); alachlor, 90 (21); and cyanazine, 67 (26). Spiking levels were 1 μg/l or less for the three pesticides.

RESULTS AND DISCUSSION: MDA PESTICIDE SURVEY

One or more pesticides were detected at least once in 51 of the 100 wells and in three of the five tile lines sampled. The highest proportion of detections occurred in the southeastern and central Minnesota regions (Figure 5).

Eight pesticides, including six herbicides, one insecticide and one wood preservative, were detected and confirmed in the MDA survey (Table 3). Atrazine, the most commonly detected pesticide, was found in 47 of the 51 wells in which a pesticide was detected. Atrazine accounted for 78 percent (112 of 144) of all pesticide detections. Alachlor, the second most commonly detected pesticide, was found in eight wells and accounted for six percent (9 of 144) of all pesticide detections. Metribuzin was found in four wells, while cyanazine and pentachlorophenol were each found in three wells. Aldicarb was detected in samples collected from two wells. Simazine and dicamba were each found in only one well.

Samples collected from 41 of the 51 wells in which a pesticide was detected contained only one pesticide. Ten wells had samples collected from them in which more than one pesticide was detected. Two of these wells had multiple pesticides in all four samples.

Concentrations of most of the pesticide detections were less then 1.0 μg/l. Median concentrations for the most commonly detected pesticides, atrazine and alachlor, were 0.38 and 0.37 μg/l, respectively. Thirteen wells contained pesticide concentrations greater than 1.0 μg/l.

Pesticide use information collected for fields adjacent to wells indicated that a variety of pesticides were applied near wells sampled in this survey. Although the information collected on pesticide use was not sufficient to allow examination of the nature of the relationship of nearby pesticide applications to groundwater contamination, many pesticides applied near wells were not detected in groundwater samples.

Nitrate-nitrogen concentrations averaged greater than 1 mg/l for 61 percent of the wells. Nitrate-nitrogen concentrations averaged over 10 mg/l in 23 percent of the wells sampled. The high frequency of occurrence and the high concentration of nitrate-nitrogen was not unexpected due to the proximity of the wells to agricultural fields and the selection of wells in susceptible regions.

Pesticides and nitrate were frequently present together in the wells sampled, although no concentration relationship was evident. Figure 6 illustrates the pesticide and nitrate-nitrogen concentrations observed from all samples that contained detectable concentrations of pesticide and nitrate-nitrogen. The absence of a definitive relationship is further supported by the detection of pesticides in 24 samples where nitrate-nitrogen was not detected. Also, nitrate-nitrogen was commonly detected in the absence of pesticides. However, wells with concentrations of nitrate-nitrogen greater than 10 mg/l were more likely to contain a detectable pesticide.

Some results from the MDA survey are presented below by geographical regions. While the survey data are organized by region, and the regional conditions influence the potential impacts on groundwater in the vicinity of the monitoring wells, the results are not intended to be representative of all groundwater or drinking water in each region. Rather, the results may be largely dependent on the immediate soils, hydrogeology or other site-specific conditions.

Northwestern Minnesota

Northwestern Minnesota is dominated by the Glacial Lake Agassiz Lacustrine Plain, more commonly known as the Red River Valley. This area consists of a nearly level plain of uniform soil and subsoil material. The soils are high in organic matter and have clayey and silty texture. Soils are generally poorly drained. The eastern portion of the Red River Valley is comprised of a series of ancient beach ridges with coarse-textured soils.

Groundwater in the northwestern region is typically found in buried, confined lenses. Surficial aquifers are usually low yielding due to the fine aquifer materials. Some coarser-textured aquifers in the southern portion of the Red River Valley, along the beach ridges or in alluvial areas, can be used as sources of water supply.

Agriculture in the Red River Valley is intensive, with the principal crops being wheat, barley and soybeans. Other important crops, though grown on substantially less acreage, are potatoes, sugar beets and sunflowers. Wheat, barley and soybeans generally receive one herbicide application per growing season, while potatoes, sugar beets and sunflowers commonly receive multiple applications of insecticides, fungicides and herbicides. Post-emergence applications of 2,4-D and MCPA on small grains, as well as a diverse group of other compounds such as triallate, trifluralin and bronate, are commonly used.

Eight wells were sampled in five counties in the Red River Valley. Wells were generally completed deep beneath the water table, with a median water column in the monitoring wells of 18 feet and a range of 5 to 35 feet. A summary of the well-site information is presented in Table 4.

Pesticides and nitrate-nitrogen were not detected in any of the eight wells sampled. Soil, climatic and pesticide use characteristics do not provide a high potential for movement of pesticides or nitrate to groundwater. It was anticipated that the combination of low aquifer recharge potential and high organic matter, fine-textured soils and fine-textured subsoils would result in a limited impact of pesticides on the groundwater in this region. The few wells sampled were not necessarily located in the most susceptible regions of the northwest nor did the wells available for sampling have screens located near the water table. Both of these factors may have influenced pesticide and nitrate-nitrogen detections in this region; however, the results are consistent with the initial evaluation that the northwest region would be less susceptible.

Southwestern and South Central Minnesota

The undulating prairies of southwestern Minnesota are a result of multiple glacial advances which left outwash, till, moraines and narrow meltwater channels. These features have had a major influence on the formation of soils in this region. Typical of the region are fine- or loamy-textured soils overlying loamy calcareous subsoil with moderate to poor drainage. Alluvial valleys commonly feature coarse-textured soils with excessive drainage characteristics.

The surficial aquifers are principally alluvial, although some drift aquifers are present. Yields in most alluvial aquifers are adequate for irrigation. The alluvial aquifers are typically unconfined, hydraulically connected to streams, and responsive to spring and fall recharge.

Agriculture in the southwest is dominated by dryland corn and soybean production. These two crops account for approximately 85 percent of the planted acreage, with corn grown on an estimated 45 percent of the land. Other crops are alfalfa, wheat and oats. Irrigation occurs in the narrow alluvial valleys where coarse-textured soils predominate. Corn, soybeans and wheat typically receive a single herbicide application, though tank mixes of two or more products are not uncommon. Post-emergence application of a second herbicide is also a common practice. Herbicides which are commonly used include: cyanazine, alachlor, atrazine, metolachlor, EPTC, 2,4-D, dicamba and trifluralin. Insecticides are not used extensively in this region.

A diversity of geomorphic and soil conditions was represented at the 17 well sites sampled in the southwest. Seven wells were situated in alluvial areas, with the remaining wells in moraine or drift areas. Thirteen sites contained layers of silt- or clay-textured soil or subsoil, although the depths were not thick enough to be considered a confining layer. Soil textures near the wells ranged from sandy loam to clay loam, although the majority of the sites were associated with fine-textured soils. A summary of well-site descriptions is presented in Table 5.

Only four of the 17 sites contained detectable levels of pesticides. Atrazine was detected once in three wells. Pentachlorophenol and atrazine were detected in the deepest well sampled (45 feet). None of the pesticides appeared in repeat samples. Nitrate-nitrogen was detected in seven wells. Only one well exceeded 10 mg/l nitrate-nitrogen. This exception was a 30-foot, tile-cased drinking water well located on a farm with a livestock operation.

The few pesticide detections in the southwest may be a function of the diversity of geomorphic settings, the thickness and presence of silt- and clay-textured soils and subsoils or the depth of the well screens into the aquifer. Although some atrazine use was reported in past years near monitoring wells, growers reported that atrazine rate and frequency of use have been reduced due to carry-over problems associated with the calcareous soils.

There was a general absence of elevated nitrate-nitrogen concentrations in the wells sampled in the southwest. Silt- and clay-textured soil and subsoil may have influenced movement of nitrate to the groundwater. Vertical stratification of the nitrate may also have occurred. The sampling techniques utilized limited the opportunity to detect nitrate-nitrogen at more than a short distance above or below the well screen.

Southeastern Minnesota

The karst region of southeastern Minnesota is one of the regions in the State most susceptible to groundwater contamination. Variable depths of permeable, loess-derived silt that range from hundreds of feet to less than two feet thick, overlie carbonate bedrock with fractures, solution channels and sinkholes. The soils are silty- or loamy-textured, have medium organic matter content, and are typically well drained. In the northernmost portion of the region, the carbonate bedrock is overlain by coarse-textured soils and subsoils with low organic matter and clay content. Soils in this region are often moderately to excessively drained.

Several major aquifers are located in the southeast. The upper carbonate and St. Peter, if present, are separated by a confining layer. The St. Peter and Prairie du Chien-Jordan may be hydraulically connected. The Prairie du Chien-Jordan may be unconfined or confined depending upon location. Beneath the Prairie du Chien-Jordan lie the Franconia-Ironton-Galesville and the Mt. Simon-Hinckley aquifers, which are separated by confining layers.

Rapid vertical drainage through soils and subsoils in this region is compounded by rapid vertical movement through karst formations. Hallberg et al. (1984) suggested that infiltration through the soil in areas similar to southeastern Minnesota may deliver the greatest mass of pesticides to the groundwater. The upper carbonate, St. Peter and Prairie du Chien-Jordan aquifers can be impacted by direct movement of surface water runoff into sinkholes. Regionally, sinkholes may be important contributors to pesticide movement to groundwater. In Winona County alone, Dalgleish and Alexander

(1984) inventoried 535 sinkholes and estimated that a total of over 700 may exist in the county.

Corn, the dominant crop in the region, is grown on nearly half the crop acreage. Hay, soybeans and oats account for approximately 19, 18 and 10 percent of the remaining cropland, respectively. Corn and soybeans receive the majority of the pesticide applications. Alachlor, atrazine, cyanazine, dicamba and 2,4-D are the most widely used herbicides. Insecticides, such as terbufos, fonofos, phorate and chlorpyrifos, are commonly used for control of corn rootworm. Fungicides are seldomly used in the area. The majority of the pesticides are applied in the spring as pre-plant, pre-emergent or early post-emergent applications.

Twenty-one wells were sampled in southeastern Minnesota (Table 6). Since there are few established observation or monitoring wells in the area, private water supply wells were selected for sampling. Wells in Dakota, Mower and Olmsted Counties were selected based on recommendations from local officials and on previous nitrate-nitrogen analysis. Wells in Winona County were chosen from a list of wells that had been part of the Garvin Brook Watershed Study (Garvin Brook RCWP, 1985). In most cases, information on the wells was limited to an owner-reported total depth. Well casing depth was available for a few of the Winona County wells. Except for one shallow sand point well in Dakota County, well depths ranged from 50 to over 400 feet and terminated in either the upper carbonate or the Prairie du Chien-Jordan aquifers.

Analytical results from the well water sampling indicate that 13 of the 21 wells contained measurable concentrations of a pesticide in at least one of the four samples taken from each well (Table 7). Atrazine was detected in all 13 wells that contained a pesticide and in all the samples that contained pesticides. Four wells contained atrazine on all four sampling occasions. Cyanazine and alachlor were detected only once in the wells in which they were present. Dicamba was found in all four samples taken from one well.

Figure 7 presents the distribution of atrazine detections for southeastern Minnesota. The majority of the detections were less than 1 µg/l.

Although pesticide presence fluctuated, the concentrations of the pesticides detected in each well tended to be relatively constant. Wells having samples with atrazine concentrations greater than 0.2 µg/l usually had atrazine detected in subsequent samplings. In wells having samples containing atrazine at less than 0.2 µg/l, the reproducibilty of detection at the next sampling averaged 50 percent.

Most of the wells selected in the southeast were not associated with an obvious potential point source. However, because of the karst features and the location of most wells in farmyard settings, potential point sources could not be totally excluded. Two wells were located near possible point sources. These wells contained the highest atrazine concentrations and the only dicamba findings. Pesticide concentrations exceeded 1.0 µg/l in both wells in every sample collected. In contrast, wells without an obvious potential point source nearby exceeded 1.0 µg/l in only two of 75 samples.

Pesticides were detected in nine of the ten wells in Winona County. The large proportion of wells containing pesticides may be a result of the wells being located in the area where the Prairie du Chien-Jordan aquifer is likely to receive regional recharge water. In Winona County, wells were sampled that terminated in the Jordan sandstone. Although the number of wells sampled in the Prairie du Chien limestone was too small to show statistically significant relationships, there may be a slight difference in water quality between the limestone and sandstone, even though they are hydraulically connected. Wells cased into the limestone had slightly higher pesticide concentrations than wells cased into the sandstone.

In Olmsted County, soil conditions varied from one well site to another. The only well that contained pesticides in more than one sample was located in an area containing many nearby sinkholes and very shallow soil. This particular well was 83 feet deep and terminated in the Galena portion of the upper carbonate aquifer. The other well in which a pesticide was detected was located nearby and was only 50 feet deep, but contained atrazine in only one of the three samples collected. The two wells that did not contain pesticides were located in areas that typically have a layer of loamy glacial till between the soil and the limestone bedrock.

Dakota and Mower Counties each had one well in which atrazine was detected. The Mower County detection was unusual in that the well was 150 feet deep and located in a region of deep, loamy soils. In Dakota County, one shallow sand point well in a heavily irrigated area contained atrazine in two samples. Wells in Dakota County that were finished in the Prairie du Chien-Jordan aquifer did not contain detectable concentrations of pesticides.

All but two wells in the southeast contained measurable nitrate-nitrogen concentrations, with seven of the 21 wells exceeding the drinking water standard of 10 mg/l. Nitrate-nitrogen concentrations fluctuated in some wells and remained relatively constant in others.

Nitrate-nitrogen was detected in all but one well in which pesticides were found. Nitrate-nitrogen concentration and pesticide concentration were not directly correlated. However, at higher nitrate-nitrogen concentrations, the number of detections of atrazine and other pesticides increased (Figure 8). The average nitrate-nitrogen concentration of samples without pesticides was 6.2 mg/l compared to an average nitrate-nitrogen concentration of 12.9 mg/l for those samples with detectable concentrations of pesticides.

Central Minnesota

The central Minnesota region included a wide geographic area with diverse soil, agronomic and climatic conditions. The majority of wells sampled in central Minnesota were in unconfined, surficial sand and gravel aquifers associated with outwash plains. The outwash plains, formed as a result of debris deposition from the meltwater streams of stationary glaciers, are commonly associated with coarse-textured, well-drained soils with a low water holding capacity. These soils tend to be loamy sands or sandy loams with low organic matter content and low clay content. Soil series representative of outwash regions include Hubbard, Esterville, Menahga, and Sioux. The subsoil is usually composed of sand and gravel.

Shallow, unconfined aquifers typically exhibit a high hydraulic conductivity and are a readily available source of water. Water tables are commonly less than 30 feet beneath the soil surface.

Agriculture is the principal land use in central Minnesota. Corn and soybeans are grown on approximately 36 and 22 percent of the crop acreage, respectively. Small grain and hay account for the majority of the remaining acreage. Crops such as potatoes or sugar beets are grown on small, but locally concentrated, acreage. Irrigation is common in central Minnesota and accounts for the majority of the estimated 300,000 to 500,000 irrigated acres in the State.

Commonly used herbicides are atrazine, alachlor, metolachlor, 2,4-D, dicamba, metribuzin, and trifluralin. Insecticides such as terbufos, fonofos and carbofuran are used by some growers for corn rootworm control. Aldicarb is used to a limited extent on some potato acreage. Insecticides or fungicides are applied to sweet corn, potatoes, and sugar beets. Pesticides are commonly applied by ground sprayers at planting or by aerial application after the crop development.

A total of 54 wells were sampled at 45 sites in central Minnesota. At nine of the sites, two wells were located immediately adjacent to each other but at different depths in the aquifer. These adjacent sites are discussed in detail in the following section, though data presented in this section includes information and results from both wells at these nine sites. Table 8 summarizes information from central Minnesota wells.

The 54 wells included 45 water table observation wells, six drinking water wells, and three irrigation wells. The median depth of observation wells and potable wells was 23 feet with a range of 7 to 60 feet. The majority of wells were 11 to 30 feet deep. (Figure 9). The median water table depth of the observation wells (water table measurements were not available for drinking water or irrigation wells) was 12 feet with a range of 2 to 42 feet. The majority of the water table levels, taken as a mean over the duration of the study, were between 6 and 15 feet beneath the surface (Figure 9).

Five herbicides, one insecticide and one wood preservative were detected in central Minnesota wells (Table 9). Pesticides were present in 34 of the 54 wells sampled and at 31 of the 45 sites. Most pesticide detections were less than 1 μg/l (Table 9) and most samples contained only one pesticide.

The most frequently detected pesticide was atrazine, which accounted for 78 percent of the total pesticide detections. Atrazine was detected at 29 of the 45 sampling sites and in 30 of the 54 wells sampled in central Minnesota. The median atrazine concentration was 0.32 μg/l and most detections were less than 1 μg/l (Figure 10.). Atrazine concentrations greater than 3 μg/l were measured in all samples collected from three wells. The highest concentrations measured in the survey for atrazine and alachlor, 42.4 and

2.81 µg/l, respectively, were detected in a single sample from a central Minnesota well. A sample collected from the same well four months later contained atrazine and alachlor at 9.1 and 0.15 µg/l, respectively.

Generally, atrazine demonstrated persistence once it was found. Of the 29 wells in which atrazine was detected, 15 wells contained atrazine in three or more of the four samples taken from each well. Once atrazine was detected in the central Minnesota wells, 78 percent of the time the detection would be confirmed in the next sample. Only 5 percent of the initial detections were not confirmed in the subsequent sample but were detected in a later sample.

Alachlor was the second most frequently detected pesticide in the central Minnesota region. It was detected in seven samples collected from six wells. Only one well had alachlor present in consecutive samples. In six of the seven samples in which alachlor was detected, atrazine was also detected. In the six wells in which both alachlor and atrazine were found, four of the wells demonstrated a continued atrazine presence without a continued alachlor presence.

Aldicarb was detected in two observation wells adjacent to irrigated potato fields. One well was twelve feet deep with the water table at 6 feet. The first three samples from this well had levels of 9.0, 30.6 and 19.0 µg/l, followed by a fourth sample in which no aldicarb was detected. Four different pesticides were detected in this well during the course of the survey. The other well in which aldicarb was detected was 43 feet deep and screened at 20 feet. Aldicarb was detected twice at concentrations of 0.5 and 0.7 µg/l.

Pesticides other than atrazine repeated in only 57 percent of the subsequent samples. Metribuzin, cyanazine and pentachlorophenol did not repeat in any well. Alachlor repeated once in one of the seven wells in which it was detected. Simazine and aldicarb repeated in the wells in which they were found. The well with simazine and the well with three aldicarb detections (the fourth sample contained pentachlorophenol) were the only two wells in which a non-atrazine pesticide was detected on all four sampling occasions.

Wells in which pesticides were detected were examined with regard to well depth, water table depth and depth of the well beneath the water table. Well depth was related to pesticide detections in that the majority of detections occurred in wells less than 30 feet deep (Figure 11). Also, eight of the ten wells that contained a pesticide on all four sampling occasions were less than the median depth of 22 feet. A correlation was not observed between pesticide occurrence and water table depth or well depth beneath the water table. In areas with coarse-textured subsoil, relatively minor differences in the depth to the water table should have little impact on the capability of a pesticide to move to the groundwater. While the depth of the well beneath the water table would be expected to have significant effects on the detection and concentration of pesticides in groundwater, those differences were not noted in this portion of the study.

Analysis of the nitrate-nitrogen concentrations with respect to well depth, water table depth and depth of the screen beneath the water table did not indicate any relationships. Sixteen wells contained no detectable levels of nitrate-nitrogen. An approximately equal distribution of wells with concentrations of nitrate-nitrogen at less than 1 mg/l, 1 to 10 mg/l and greater than 10 mg/l was observed. The lack of a direct relationship between nitrate and well characteristics indicates the site-specific nature of nitrate contamination in shallow, unconfined aquifers. Evidently a number of factors are involved in the distribution of nitrate within shallow unconfined aquifers.

Atrazine concentrations were not related to nitrate-nitrogen concentrations in central Minnesota wells. Figure 6 illustrates the lack of a linear relationship between detectable concentrations of nitrate-nitrogen and atrazine.

Pesticide presence was related to nitrate-nitrogen concentration. Pesticides were more likely to be found at higher nitrate-nitrogen concentrations (Figure 12). However, nitrate-nitrogen was not always a good indicator of pesticides, since pesticides were present in some wells where nitrate-nitrogen was not present. Conversely, pesticides were not present in some wells where nitrate-nitrogen concentrations were high.

The presence of an elevated or high nitrate-nitrogen concentration at a point in an aquifer indicates that the point is impacted by a nitrogen source. This nitrogen source may or may not be related to a pesticide source. Therefore, the presence of nitrate only indicates the potential for a pesticide to be present providing the pesticide is also capable of utilizing the same pathway as the nitrate.

The methodology employed in this survey was not sufficient to determine the interactions of the complex sets of factors that affect nitrate and pesticide movement to groundwater.

Adjacent Observation Wells

Two adjacent observation wells located within two feet of each other were sampled at nine sites in central Minnesota. These wells were screened at different depths in unconfined sand and gravel aquifers. Simultaneous sampling of adjacent wells permitted the examination of vertical differences in the aquifer with regard to pesticide and nitrate-nitrogen occurrence and concentration.

Vertical differences in nitrate-nitrogen concentrations were observed by Myette (1984) in unconfined surficial aquifers. Myette concluded that nitrate-nitrogen concentrations were highest near the water table and that little mixing occurred near the source of nitrate unless the groundwater was disturbed by pumping.

Well logs indicated that subsoil materials ranged from fine sand to gravel at all sites; however, two sites contained 5-foot layers of silty or clayey material. Six of the nine adjacent well sites were located in proximity to irrigated cropland. The mean depths for the shallow and deep wells were 17 and 28 feet, respectively. Well screen depth beneath the water table averaged 6 feet for the shallow wells and 17 feet for deep wells. Summary information about the sites is contained in Table 10.

The data from these sites indicate that significant vertical differences in pesticide and nitrate-nitrogen presence and concentration occur in unconfined, surficial aquifers. The degree of the differences varied from site to site and emphasized the site-specific nature of aquifer contamination by pesticides and nitrate. Three general types of situations were observed at the adjacent observation wells.

The first situation was observed at two of the nine sites where no pesticides were detected in any samples. However, the shallow wells had higher nitrate-nitrogen concentrations than did the deeper wells. Average nitrate-nitrogen concentrations were 7.4 and 1.9 mg/l for the shallow and deep wells, respectively.

The second situation occurred at four sites. The shallow wells at these sites contained more pesticides and had greater pesticide concentrations, more pesticide detections, and higher nitrate-nitrogen concentrations. The shallow wells averaged 14.5 mg/l nitrate-nitrogen while the deep wells averaged 1.1 mg/l nitrate-nitrogen. The shallow wells contained pesticides in eleven of sixteen samples. Atrazine was detected in all four shallow wells at average concentrations of 15.0, 0.67, 0.41 and 0.19 μg/l. Alachlor was detected three times in two shallow wells and cyanazine was detected once in a shallow well. Two deep wells contained atrazine in only two of sixteen samples at an average concentration of 0.14 μg/l. No other pesticides were detected.

The remaining three sites had more prevalent pesticide contamination in the deep well. At one site, nitrate-nitrogen was detected only once in the deep well, while atrazine was detected in three of four samples at an average of 0.15 μg/l. A second site contained nearly equal nitrate-nitrogen concentrations of 12.9 and 16.4 mg/l for the shallow and deep wells, respectively, but metribuzin was detected only in the deep well in one of the four samples. At the third site, the deep well contained atrazine in all four samples. The shallow well at this site had atrazine in two of three samples. Concentrations averaged 0.76 μg/l atrazine and no nitrate-nitrogen in the shallow well compared to 0.18 μg/l atrazine and 24.1 mg/l nitrate-nitrogen in the deep well.

This data indicates that pesticide and nitrate-nitrogen occurrence and concentration in unconfined, surfical aquifers vary with depth. These vertical differences vary by site and by time of sampling.

Tile Line Analysis

Many soils in southern and western Minnesota have poor natural drainage characteristics. These soils typically have high organic matter and clay content which contribute to reduced permeability. To farm these soils productively, artifical drainage systems, or tile lines, are often installed. Tile line effluent under controlled conditions can reflect fertilizer and crop management practices and has been used to evaluate nitrate-nitrogen leaching losses (Randall et al., 1988).

Five tile lines were sampled from research plot areas at three University of Minnesota Experiment Stations. The tile line systems were installed at an average depth of 4 feet to facilitate effluent collection from individual small plots for research purposes. These plots were "wrapped" in plastic to a depth of 6 feet to prevent lateral movement of water from outside the plots. No surface inlets were located in the plot areas. Tile lines were installed in 1976 at Waseca and Lamberton and in 1983 at Morris. Samples were collected twice from Waseca and once from both Lamberton and Morris in the spring of 1986. There was no discharge from the tile lines in the fall of 1986 and in the spring of 1987.

Pesticide use information was obtained for the Waseca and Lamberton sites for the previous thirteen years (Table 11). The Morris sites had pesticide use information for the previous three years; however, atrazine use information was available that indicated the herbicide had been used in 1966, 1969, 1972 and 1983.

Atrazine was detected in three of the five tile lines sampled. No other pesticides were detected. Detection of atrazine in the tile lines was associated with atrazine use. Atrazine was present in the Waseca tile lines at concentrations of 0.59 and 0.80 μg/l in samples obtained on April 8 and at concentrations of 0.94 and 0.98 μg/l in samples collected on June 8. Atrazine was used in 10 of the last 13 years at Waseca and in each of the last eight years. At the Morris sites, atrazine was detected in one tile line at a concentration of 0.23 μg/l. It should be noted, however, that atrazine was used in 1983 which also was the year of tile line installation. Subsurface contamination by surface soil containing atrazine residue may be the source of atrazine in the tile line effluent.

Several other pesticides were used at each site, though none were detected in the tile lines. Alachlor, cyanazine, carbofuran and terbufos were used at all sites to varying degrees. Overall, alachlor was the most frequently used herbicide (twelve of thirteen years at Waseca); however, it was not detected in the tile line effluent.

Soil characteristics related to poor natural drainage, such as high clay and organic matter content, also are important factors in pesticide adsorption and degradation. These factors interact with the chemical characteristics of various pesticides differentially and may provide a partial explanation for the nondetection of pesticides, other than atrazine, in the tile lines.

METHODS: MDH PESTICIDE SURVEY

Well Selection

Wells serving public water supplies (PWS) were selected for sampling by the MDH in order to address public exposure to pesticides in drinking waters. Public water supplies are defined as systems which provide piped water for human consumption to at least 25 persons or 15 service connections for 60 days or more of the year. Public water supplies serving year-round residents include municipal systems, mobile home park systems, and apartment complexes. Other PWS, which serve transient populations, include office buildings, factories, schools, churches, restaurants, service stations, resorts and campgrounds. A total of 400 PWS wells, including 224 municipal wells, were selected for sampling in 77 counties.

Wells were generally selected for sampling based on their apparent susceptibility to pesticide contamination. A well was assumed to be susceptible if pesticides were used in the area and the well/well site was characterized by one or more of the following: 1) karst topography; 2) surficial sand and gravel aquifers overlain by coarse-textured soils; 3) shallow depth to bedrock (less than 50 feet); 4) known water quality problems, particularly high or fluctuating nitrates; 5) proximity to facilities which handle bulk quantities of pesticides; and 6) proximity to irrigated cropland. Wells regarded as most susceptible to pesticide contamination were located in the karst region in southeastern Minnesota and in the surficial sand and gravel aquifer areas in central and southwestern Minnesota. Most sampled wells were located in these sensitive areas.

Some wells were selected outside of the most sensitive areas in order to provide areal coverage of the State's agricultural regions and diverse cropping practices. Many of these wells were regarded as less susceptible to pesticide contamination. Few wells were sampled in northeastern Minnesota due to the limited agricultural activity in the area.

More than half of the wells were selected prior to initiation of sampling. These wells were selected based on recommendations provided by MDH district offices, city and county health departments, the Minnesota Pollution Control Agency, Minnesota Geological Survey, Agricultural Extension Service and others. Soils and geological maps, well records and historical water quality data were also used in the site selection process.

The remainder of the wells included in the survey were selected in the field as the survey progressed. These sites were chosen to include geographic areas not adequately covered in the initial well selection and to provide additional data on aquifers of particular interest, i.e., the karst formations and surficial sand and gravel aquifers.

Sample Collection

Timing. Four hundred initial and 125 follow-up samples for pesticide and nitrate analyses were collected from the selected wells between May 1986 and June 1987 (Figure 13). Most initial and follow-up samples were collected during the 1986 growing season (May through October) and during the spring of 1987 (April through June). A few samples were collected during each of the intervening months (November 1986 through March 1987). Sampling was scheduled such that all areas under study were visited several times during the survey. Timely collection of these samples was achieved with the assistance of MDH field staff.

Due to funding limitations, a follow-up sample was collected from only those wells in which pesticides were detected in the initial sample. Follow-up samples were also collected from several wells where initial sample results were inconclusive. The time elapsed between collection of initial and follow-up samples ranged from two weeks to several months, depending on the time required for laboratory analyses, travel distances, availability of the well for sampling, and other factors.

Site descriptions and well data were compiled for each sampled well and recorded on specially prepared survey forms (Figure 14). Maps indicating well location, land use, and observed pesticide sources were prepared in the field. Information on well construction and hydrogeology was obtained for most wells from well owners, well logs, MDH records or other resources. Pesticide use practices in the vicinity of the wells were determined through interviews with local farmers, pesticide dealers, and/or commercial applicators at 153 of the 400 well sites.

Sampling Protocol. Samples were collected from a point on the water supply system as near as possible to the well and prior to any treatment, if possible. Water samples were obtained after evacuation of two to three casing volumes of water or after operation of the well pump for 10-15 minutes. The sample tap was flushed and samples were collected in 1-liter, amber glass bottles with Teflon-lined caps. Separate bottles were used to collect samples for chlorinated acid herbicides and for base/neutral extractable pesticides. Samples for aldicarb analysis were collected from 13 wells in identical bottles and sent to the MDA laboratory for analysis. A sample for nitrate-nitrogen analysis was collected from each well in a 125-ml polypropylene bottle. All samples were immediately packed in ice and returned to the laboratory as soon as possible, usually within 72 hours.

Laboratory Analysis

All samples, except those for aldicarb analysis, were analyzed at the MDH laboratory in Minneapolis. Samples were stored at 4°C prior to extraction. Samples were usually extracted within seven days of collection, and analyzed within 21 and 40 days of collection for base/neutral and acid extracted pesticides, respectively.

Base/Neutral Pesticides. Base/neutral pesticide samples were extracted at a neutral pH with 15 percent (by volume) methylene chloride in hexane and analyzed by gas chromatography. Analysis for five base/neutral pesticides was performed using a Varian Vista 6000 gas chromatograph. Extracts for these analytes were run simultaneously through DB-5 and SPB-35 capillary columns connected to a Varian Thermionic Specific Detector, which was specific for nitrogen and phosphorous. Analysis for the remaining 17 base/neutral pesticides was performed using a Tracor Model 570 gas chromatograph. Extracts for these analytes were run simultaneously through DB-5 and DB-WAX capillary columns connected to Ni-63 electron capture detectors. In both procedures, the second column was used to confirm the presence of compounds detected with the first column.

Chlorinated Acid Herbicides. Samples to be analyzed for chlorinated acid herbicides were acidified in the laboratory and then extracted with methylene chloride. The resulting extract of chlorinated acids, acid esters and salt was hydrolyzed with potassium hydroxide, extracted with methylene chloride and concentrated. The acids were converted to pentafluorobenzyl esters by derivatization with pentafluorobenzyl bromide and calcium carbonate. Isooctane was added and the sample was concentrated for injection. Identification of the esters was made by gas chromatographic separation using a Hewlett-Packard Model 5880A gas chromatograph. Each sample was run simultaneously through DB-1701 and DB-5 capillary columns connected to Ni-63 electron capture detectors. The second column was used to confirm the presence of compounds detected with the first column.

Nitrate-Nitrogen. Nitrate-nitrite nitrogen was determined using a Technicon Auto Analyzer II, with a copper-cadmium reductor column, to measure absorbency following color development with sulfanilamide and N-1-napthylethylenediamine dihydrochloride. The method reporting limit was 0.4 µg/l. Nitrite concentrations are usually negligible in groundwater samples and the results are therefore presented as nitrate-nitrogen for purposes of this report.

Quality Control. The following standard quality assurance/quality control practices were used. Method blanks were analyzed daily to safeguard against contamination of glassware and/or reagents. Laboratory spiked samples were analyzed with each sample batch to monitor method performance for all compounds. Each sample analyzed for base/neutral pesticides was also spiked with methoxychlor to monitor extraction efficiency.

Field blanks accompanied most samples and were extracted and analyzed with the samples. Spikes and duplicates were each collected and analyzed with approximately ten percent of the samples to monitor analytical accuracy and precision, respectively. The following average percent spike recoveries (and standard deviations) were obtained for the compounds most frequently detected in the survey field samples: atrazine, 92.7 (8.5); alachlor, 102.9 (32.0); and 2,4-D, 84.7 (19.8). The spike concentrations were 0.26 µg/l for atrazine; 0.10 and 0.20 µg/l for alachlor; and 0.19, 0.78 and 3.18 µg/l for 2,4-D.

Reporting Results. Well owners were notified in writing of analytical results. Four wells in which pesticide concentrations exceeded RALs established in January 1988 are scheduled for resampling in spring 1988. Well owners are being notified that final recommendations on water use will be based on the outcome of the 1988 sampling. In wells with a nitrate-nitrogen concentration exceeding the drinking water standard (10 mg/l), the MDH advised that water not be consumed by infants under six months of age.

A brochure on pesticides in groundwater (Freshwater Foundation, 1986) was sent to all owners of wells in which pesticides were detected. A brochure providing information on water quality and proper well construction and location (MDH, 1983) was sent to all noncommunity PWS well owners where nitrate-nitrogen concentrations exceeded 1.0 mg/l.

RESULTS AND DISCUSSION: MDH PESTICIDE SURVEY

Pesticides were detected in 114 (28.5 percent) of 400 sampled wells. Pesticides were detected in wells in 48 counties spanning most of the study area, but were most commonly found in southwestern, southeastern, and central Minnesota (Figure 15). Few occurrences of pesticides in well water were observed in northwestern and south central Minnesota.

A total of 12 different pesticides, all of which were herbicides, were detected in the survey (Table 12). Atrazine was the most commonly detected compound and was found in 107 wells. Atrazine was detected in initial samples in every month except February 1987, when only three initial samples were collected. Alachlor and 2,4-D, the next most frequently occurring pesticides, were found in eight and seven of the sampled wells, respectively. Nine other herbicides were each detected in three or fewer wells. None of the insecticides or fungicides included in the survey were detected.

A single pesticide was observed in 100 of the 114 contaminated wells. Atrazine was the only pesticide observed in 94 of these wells. Six other wells had one of four pesticides (propachlor, 2,4-D, picloram, or alachlor) as the sole contaminant.

Multiple pesticides were detected in 14 wells. A total of 11 different pesticides was detected in the 14 wells, with atrazine being detected in 13 of these wells.

Observed pesticide concentrations were usually low. Atrazine concentrations were less than 0.10 μg/l in 69 of the 107 wells with atrazine results above the detection limits, and exceeded 1.0 μg/l in only seven wells. The highest concentrations of atrazine were found in the three areas where pesticides were most commonly detected: the southwest, the southeast, and central Minnesota.

At the time the field work and laboratory analyses were completed, no contaminants exceeded the RALs in use at that time. However, four wells had contaminants at levels exceeding the new RALs established in January 1988. In three wells, atrazine concentrations exceeded the RAL, 3.0 µg/l, in both the initial and follow-up samples. In a fourth well, a single sample contained four pesticides whose combined concentrations exceeded the recommended limit for drinking water containing multiple pesticides.

Measurable concentrations of the initially identified pesticide occurred in 65, 57, and 50 percent of the follow-up samples for atrazine, 2,4-D, and alachlor, respectively. Positive follow-ups were also observed for dicamba, picloram, MCPA, and metribuzin. Follow-up samples were below detection limits for the five other pesticides detected in initial sampling.

Pesticide occurrence in follow-up samples is dependent on several factors, including time elapsed between sampling events, pesticide mobility, pesticide persistence, rainfall, and the rates of groundwater movement in the vicinity of the well. Because each well was sampled only once or twice, an assessment of changes in pesticide occurrence and concentration over time could not be made in this survey.

Aquifer Analysis

Pesticide results were evaluated based on well construction and source aquifer. Well construction information was obtained from several sources including well owners/operators, MDH records, well logs and soils and geological maps. Based on this information, it was determined that 282 wells were completed in unconsolidated aquifers, 92 wells were completed in sedimentary bedrock, and eight wells were completed in igneous or metamorphic bedrock. The aquifer(s) supplying the remaining 18 wells could not be determined. Pesticides were not detected in any of these 18 wells.

Unconsolidated Aquifers. Two hundred eighty-two wells which terminated in unconsolidated glacial, alluvial, or lacustrine deposits were included in this classification. Twelve different pesticides were detected in a total of 79 of these wells. Atrazine was detected in 74 wells. Ten of the 14 wells with multiple contaminants were completed in unconsolidated formations.

Aquifers in unconsolidated formations can be grouped into two broad categories: 1) surficial, unconfined aquifers, which are generally viewed as more susceptible to contamination from the land surface; and 2) buried, confined aquifers, which are isolated from the land surface by an impervious layer, such as clay, and are generally regarded as less susceptible to contamination. However, information on well construction was usually not sufficient to permit a distinction between wells completed in surficial, unconfined aquifers and wells completed in buried, confined aquifers. Therefore, well casing depth was evaluated as a potential index of well vulnerability to pesticide contamination.

Casing depth was available for 179 wells finished in unconsolidated formations. Pesticides were found in 46 of these wells. The median casing depth for contaminated wells, 48 feet, was 24 feet shallower than the median casing depth for wells in which pesticide was not detected (Table 13). Pesticides were detected in wells cased as deep as 233 feet. Wells in which pesticide was detected in both the initial and follow-up samples tended to have shallower casings than wells with only a single pesticide occurrence.

The relationship between casing depth and pesticide occurrence is further illustrated in Figures 16 and 17. Pesticide occurrence was most common in wells with the shallowest casing depths and declined as depth increased. Forty-three percent of wells cased less than 50 feet deep were contaminated at least once, while only 18 percent of the wells deeper than 50 feet were contaminated.

Atrazine concentrations also declined as depth increased (Figure 18). The median concentration was 0.12 µg/l for wells cased less than 50 feet deep and 0.04 µg/l for wells cased to 50 feet deep or more.

The influence of casing depth on vulnerability of a well may be reduced under certain conditions. Wells with inadequate grout or damaged casing may allow water from very shallow depths to enter the well without percolating through the unconsolidated materials for the entire depth of the casing. In this survey, there was no means by which to evaluate the integrity of the well grout or casing.

Sedimentary Bedrock Aquifers. Ninety-two sampled wells obtained water from sedimentary bedrock formations. Fifty-six of these wells were located in nine southeastern counties which comprise most of the karst region in Minnesota (Dakota, Dodge, Fillmore, Goodhue, Houston, Mower, Olmsted, Wabasha, and Winona Counties). Pesticides were detected in 32 sedimentary bedrock wells, including 24 wells in the nine southeastern counties. Atrazine was detected in 30 wells at concentrations ranging from 0.02 to 5.5 µg/l. Alachlor was detected in three wells and picloram, propachlor, and dicamba were each detected in one well. Two wells had a single contaminant other than atrazine and four wells had multiple contaminants.

Casing depth was available for 73 of the 92 wells completed in sedimentary bedrock. Pesticide occurrence in sedimentary bedrock wells did not appear to be related to casing depth. Pesticides were detected throughout most of the range of sampled casing depths (Table 14). Casing depth may be a poor indicator of water quality for several reasons. Wells with damaged casing or inadequate grouting may be drawing water from depths much shallower than the casing depth. In addition, well records and other geologic information indicated that most sampled wells were cased into the first bedrock encountered in drilling or into formations which were hydraulically connected to overlying bedrock. Under these conditions, there may be little impediment to downward migration of pesticides other than the overlying unconsolidated materials. "Filtration" of percolating water will be determined, at least in part, by the thickness of this unconsolidated mantle, i.e., depth to bedrock.

Results did suggest a relationship between pesticide occurrence and depth to bedrock (Figure 19). Pesticides were detected in 41 percent of the wells encountering the first bedrock at depths less than 100 feet, but in only ten percent of the wells encountering the first bedrock at depths greater than or equal to 100 feet. Pesticide occurrence did not appear to be influenced by depth to bedrock when that depth was less than 100 feet.

Pesticide occurrence in specific bedrock formations is presented in Table 15. Formations are listed with the youngest formation at the top of the table and the oldest formations at the bottom. In the upper carbonate formations (Cedar Valley through Galena), pesticides were detected in 46 percent of the wells with depth to bedrock less than 100 feet, but were not detected in any of the ten wells with depth to bedrock equal to or greater than 100 feet. In the lower carbonate (Prairie du Chien) and adjoining sandstone formations (St. Peter and Jordan), pesticides were detected in 48 percent of the wells with depth to bedrock less than 100 feet. Pesticide was detected in one of four wells in these formations which had depths to bedrock greater than 100 feet. Pesticides were detected in only two of 17 wells completed in older cambrian and precambrian formations and were not detected in any of the four wells completed in Cretaceous formations.

<u>Igneous and Metamorphic Bedrock Aquifers.</u> Eight of the sampled wells were completed in igneous or metamorphic bedrock aquifers. Six wells were

in the Sioux quartzite in south central and southwestern Minnesota, one was a granite well in Morrison County, and one was a granite well in the Minnesota River Valley in Chippewa County. Atrazine, the only pesticide detected, was found in two Sioux quartzite wells in Pipestone County and the granite well in the Minnesota River Valley.

The three contaminated wells occurred where depth to bedrock was less than 35 feet. Depth to bedrock was greater than or equal to 35 feet for the five clean wells. While only a few wells were sampled, the occurrence of contamination where depth to bedrock is shallow is consistent with findings in sedimentary bedrock wells.

Pesticide Sources

Pesticides in groundwater were assumed to come from two possible sources: 1) diffuse, or non-point, sources, resulting from land application of pesticides; and 2) point sources, such as pesticide mixing, rinsing, disposal, or storage sites or backsiphonage incidents. All sampled wells were located in agricultural areas and most wells were within one quarter mile of crops which typically receive pesticide applications. Therefore, potential non-point pesticide sources existed in the vicinity of essentially all sampled wells. At most well sites, however, pesticide use information was not sufficient to allow examination of the nature of the relationship between normal pesticide use and well water contamination.

Many sampled wells were located in proximity to potential point sources of pesticide contamination, such as bulk pesticide storage and handling facilities. Fifty-seven wells were located within one quarter mile of identified potential point sources, including nine wells within 100 feet of potential point sources. Pesticides were detected in five of these nine wells and in 17 of 48 wells located between 100 feet and one quarter mile from a potential point source

Six of 14 wells with multiple contaminants and five of seven wells with atrazine concentrations greater than 1.0 μg/l were located within one quarter mile of potential pesticide point sources.

Several factors must be considered when interpreting these results. First, all the wells located near pesticide point sources were also close to nonpoint sources. It was not possible in this study to isolate a single pesticide source for any sample in which pesticides were detected. Second, many sampled wells may also have been located near unidentified point sources. These wells need to be included to provide a complete analysis of point source data. Finally, the implied link between pesticide point sources and well water contamination could not be substantiated without detailed investigations of the potential point sources, which were beyond the scope of this survey.

Nitrate-Nitrogen and Pesticides

Samples collected at 395 sites were analyzed for nitrate-nitrogen. Nitrate-nitrogen was detected above the reporting limit, 0.4 mg/l, in 187 wells (47.3 percent), and exceeded the drinking water standard, 10 mg/l, in 28 wells (7.1 percent) (Figure 20). The maximum nitrate-nitrogen concentration was 36 mg/l. Nitrate-nitrogen concentrations exceeded 10 mg/l in 11 wells in the central sand plains, 9 wells in the southwest, and 3 wells in the south-east.

Nitrate-nitrogen analyses were conducted primarily to determine if there was a relationship between nitrate-nitrogen and pesticide occurrence in ground-water. If such a relationship existed, the relatively inexpensive nitrate-nitrogen analysis could be used as a surrogate for the expensive pesticide analyses.

A clear relationship between pesticide and nitrate occurrence was not observed in this survey. Only 82 of 187 wells (43.3 percent) with detectable nitrate also contained detectable concentrations of pesticide (Table 16). Pesticides were detected in 32 wells in which nitrate was not detected, indicating that nitrate cannot be used as a reliable indicator of pesticide occurrence.

Survey results did indicate that pesticides occurred more frequently in wells with higher nitrate-nitrogen concentrations. Pesticides were found in 60.7 percent of wells with nitrate-nitrogen concentrations greater than 10 mg/l, compared to a 17.4 percent pesticide occurrence in wells with nitrate-nitrogen detected at less than 1.0 mg/l.

Nitrate data were also examined to see if there was a relationship between nitrate-nitrogen concentration and pesticide concentration. The scatter of the data in Figure 21 shows no apparent relationship between pesticide and nitrate-nitrogen concentration.

The lack of a clear relationship between pesticide and nitrate occurrence in well water may be due, in part, to the respective sources of these products. While pesticides and nitrates may both occur in groundwater as a result of land-applied treatments, nitrates may also come from many other sources unrelated to pesticides, such as septic systems, animal feedlots or barnyards.

COMMON DISCUSSION

These surveys were intended to provide baseline information on the occurrence and extent of agricultural pesticide contamination in groundwater and drinking water in Minnesota. Although the full extent of pesticide contamination is unknown, the results of these surveys indicate that several pesticides are present in groundwater, especially in hydrogeologically sensitive areas of the State.

Combined pesticide results taken from both surveys are presented in Table 17. One or more pesticides were detected in 165 (33 percent) of the 500 wells sampled. Pesticides were observed more frequently in observation and private drinking water wells than in public drinking water wells. This difference is most likely attributable to the shallower depths of many of the observation and private drinking water wells and to their closer proximity to fields receiving pesticide applications.

Fifteen pesticides, including thirteen herbicides, one insecticide and one wood preservative, were detected in the surveys. Atrazine, the most commonly detected pesticide in each survey, was found in 154 (31 percent) of the 500 wells sampled and in over 90 percent of the wells which tested positive for pesticides. Alachlor, the next most commonly occurring compound in each survey, was found in 17 wells. Each of the remaining thirteen pesticides was detected in seven or fewer wells.

Although the percentage of wells with detectable levels of pesticides was relatively high, the concentrations detected were usually low. Eighty-four percent of all pesticide occurrences were at concentrations less than 1.0 μg/l. Levels exceeding the RALs were observed in samples collected from ten wells, including four public drinking water wells and one private drinking water well.

At the low concentrations typically observed in these surveys, the public health concerns focus on potential chronic health effects. Chronic toxicity information for many pesticides is limited. Although this body of information has improved significantly in recent years, it is difficult to associate specific health effects with exposure to low levels of pesticides in drinking water.

Pesticides were detected in wells in 51 counties, but were most commonly found in wells completed in the karst formations in southeastern Minnesota, the shallow, outwash sand and gravel aquifers in central Minnesota and the shallow, alluvial sand and gravel aquifers in southwestern Minnesota. Few pesticide occurrences were observed in northwestern and south central Minnesota.

The widespread occurrence of pesticides, primarily atrazine, at low concentrations in certain areas indicates that groundwater contamination may result from normal pesticide use as well as from spills, leaks, back-siphonages and other point sources.

While pesticides were observed more frequently in wells in certain areas of the State, the potential for contamination in a specific well is determined by a complex set of factors, including the contaminant source, chemical properties, local groundwater vulnerability, local agricultural practices and well construction. These factors vary considerably from area to area and from well to well.

The baseline information generated in these surveys has significantly expanded our knowledge of pesticide contamination in Minnesota groundwater and drinking water. Nevertheless, it is important to recognize the limitations of the surveys. A limited number of wells and pesticides were studied during a relatively short time frame under unusual precipitation conditions. As a result, these surveys do not provide a comprehensive statewide assessment of the extent of groundwater contamination by pesticides.

RECOMMENDATIONS

The occurrence of certain pesticides in groundwater, the unknown human health implications resulting from exposure to low levels of pesticides in drinking water, and the many unresolved questions related to the movement and fate of pesticides in the environment raise issues which need to be addressed. These issues have been the subject of considerable agency and legislative attention. The MDA is in the process of implementing the 1987 Pesticide Control Law which significantly broadened the Department's duties and responsibilities regarding pesticides and included requirements to address pesticide impacts on water quality. The MDH Safe Drinking Water initiative before the 1988 legislative session includes a request to fund ongoing monitoring of public water supplies for pesticides, and a request for support of an expanded groundwater program will be included in the next biennial budget request. The Environmental Quality Board's Water Resources Committee is currently working on a pesticide and nutrient management strategy aimed at protecting the State's groundwater and surface water. Efforts such as these must be continued and additional information must be gathered in order to develop programs and policies which adequately protect water resources and public health.

On the basis of these surveys and a broader range of concerns about pesticides, we offer the following recommendations:

Monitoring

1. Pesticide monitoring programs or activities should be developed which include:

- statewide ambient groundwater and surface water sampling to establish baselines and trends;

- public water system sampling to assess public exposure to pesticides in drinking water;
- intensive area-specific and pesticide-specific studies to further define pesticide occurrence, extent and trends in hydrogeologically sensitive areas of the State;
- sampling near spill sites and bulk pesticide storage and handling facilities to assess the impacts of those activities on water quality;
- selected private well sampling near known or suspected contamination sites; and
- selected private well sampling based on representative conditions, such as source aquifer, soils, hydrogeologic characteristics, well construction and pesticide use.

2. Public and private laboratory analytical capabilities need to be developed for additional pesticides and pesticide breakdown products and more public and private laboratory capacity is needed to accommodate larger numbers of samples. A laboratory certification program should be developed to ensure accurate, reproducible pesticide results from public and private laboratories.

3. Interagency agreements and technical work groups should be established to ensure coordinated planning and implementation of pesticide monitoring programs. Standard data collection and management protocols should be established.

4. A statistically designed pesticide use survey, capable of determining use and trends at the county or subcounty level, should be conducted on an annual basis.

Research

1. Research is needed to determine pesticide and soil characteristics which affect leaching, adsorption and persistence in Minnesota.

2. Research is needed to determine pesticide degradation pathways and breakdown products in Minnesota's soils and waters.

3. Applied research should be conducted to develop management practices which reduce pesticide leaching.

4. Risk assessment efforts should be expanded so that new health effects and exposure information can be evaluated and appropriate health advisories issued.

Education and Information

1. Information should be made available to pesticide applicators and dealers which addresses pesticide handling, mixing and storage near wells.

2. Educational programs and information related to pesticide products and their use should be expanded to include health and environmental components.

3. Groundwater vulnerability mapping should be conducted at the State and local level. County geologic and hydrologic mapping needs to be accelerated.

Regulation

1. Pesticide regulatory and enforcement activities should be increased to address major point sources of pesticide contamination in groundwater and drinking water.

2. Private and commercial applicator training programs should be approved for applicator certification only if they include an acceptable groundwater component.

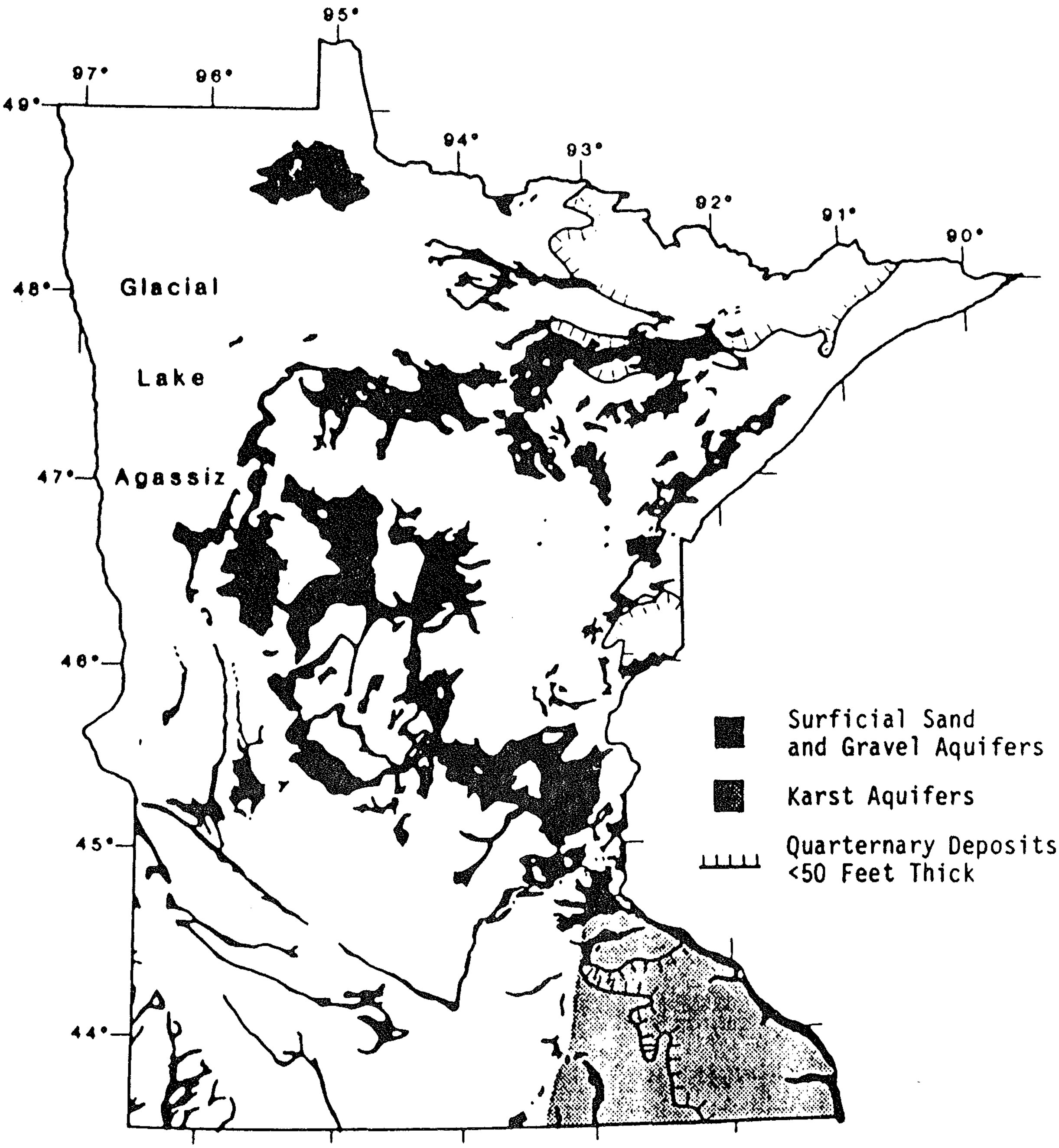
3. The water well program should be expanded to ensure that new wells are properly sited, constructed and maintained, thereby reducing the potential

for pesticide contamination. Abandoned wells should be properly sealed to eliminate potential routes of pesticide movement between and within aquifers.

4. A State pesticide regulatory management plan, including procedures for modifying pesticide use, should be developed. Provisions of the plan would be implemented when specific situations require controls to prevent further degradation of groundwater quality.

FIGURE 1

SURFICIAL SAND AND GRAVEL AQUIFERS
AND KARST AQUIFERS IN MINNESOTA



Modified from H. W. Anderson, *In* Adolphson, D. G., J. F. Ruhl, and R. J. Wolf, 1981. *Designation of Principal Water-Supply Aquifers in Minnesota*. U.S. Geological Survey Water-Resources Investigations 81-51, 24 p.

FIGURE 2

SOIL MOISTURE, NOVEMBER 1, 1985

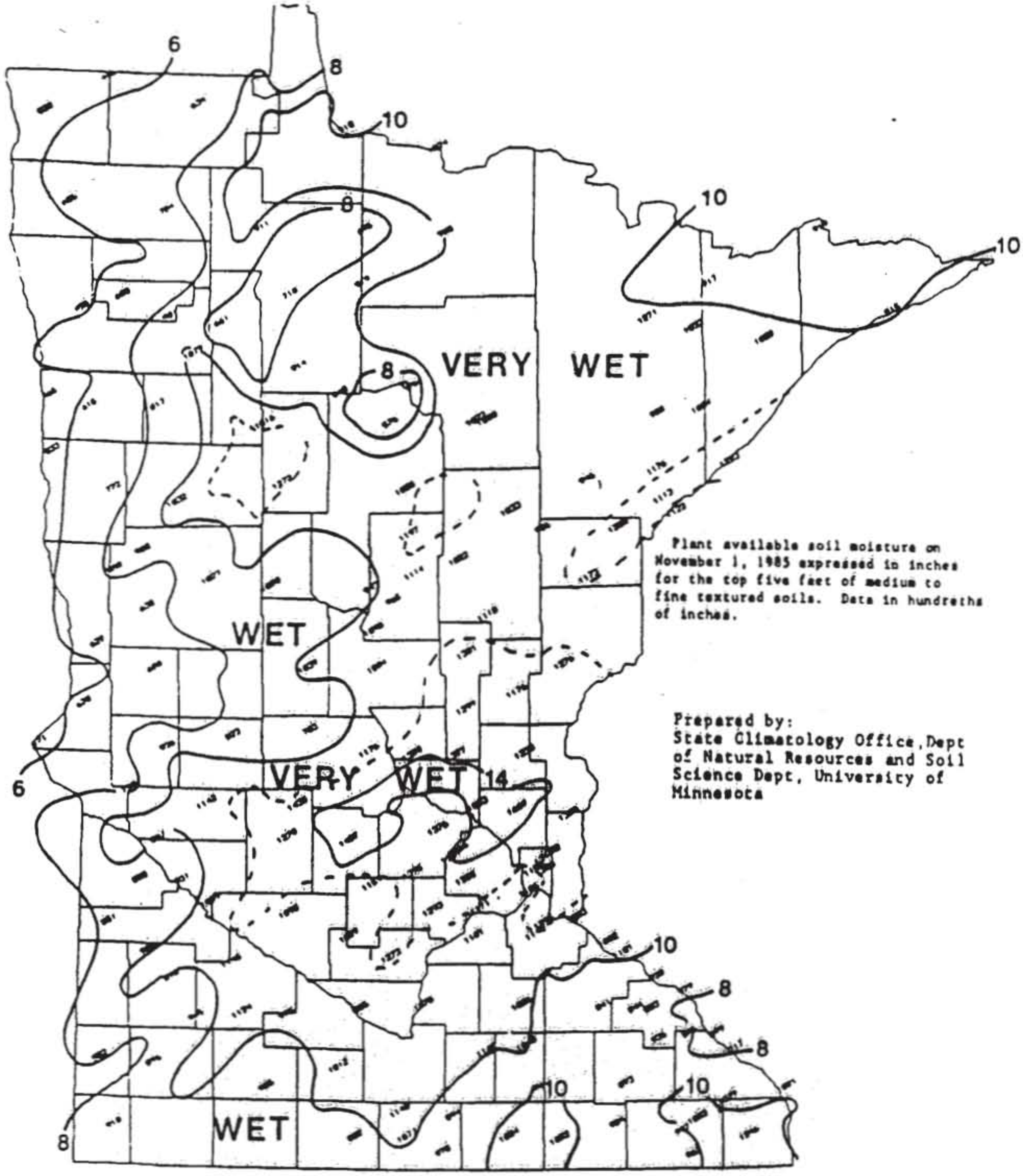
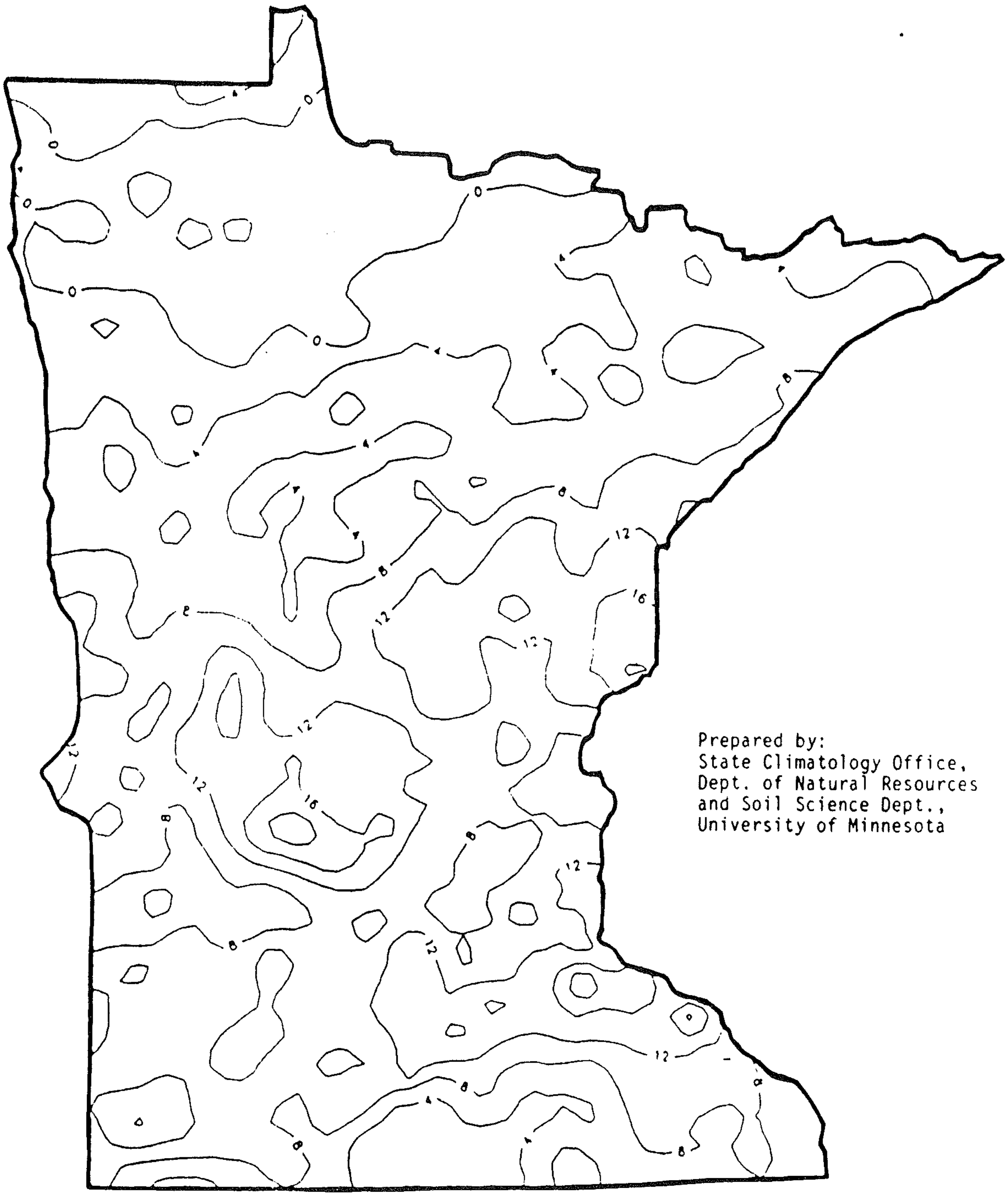


FIGURE 3

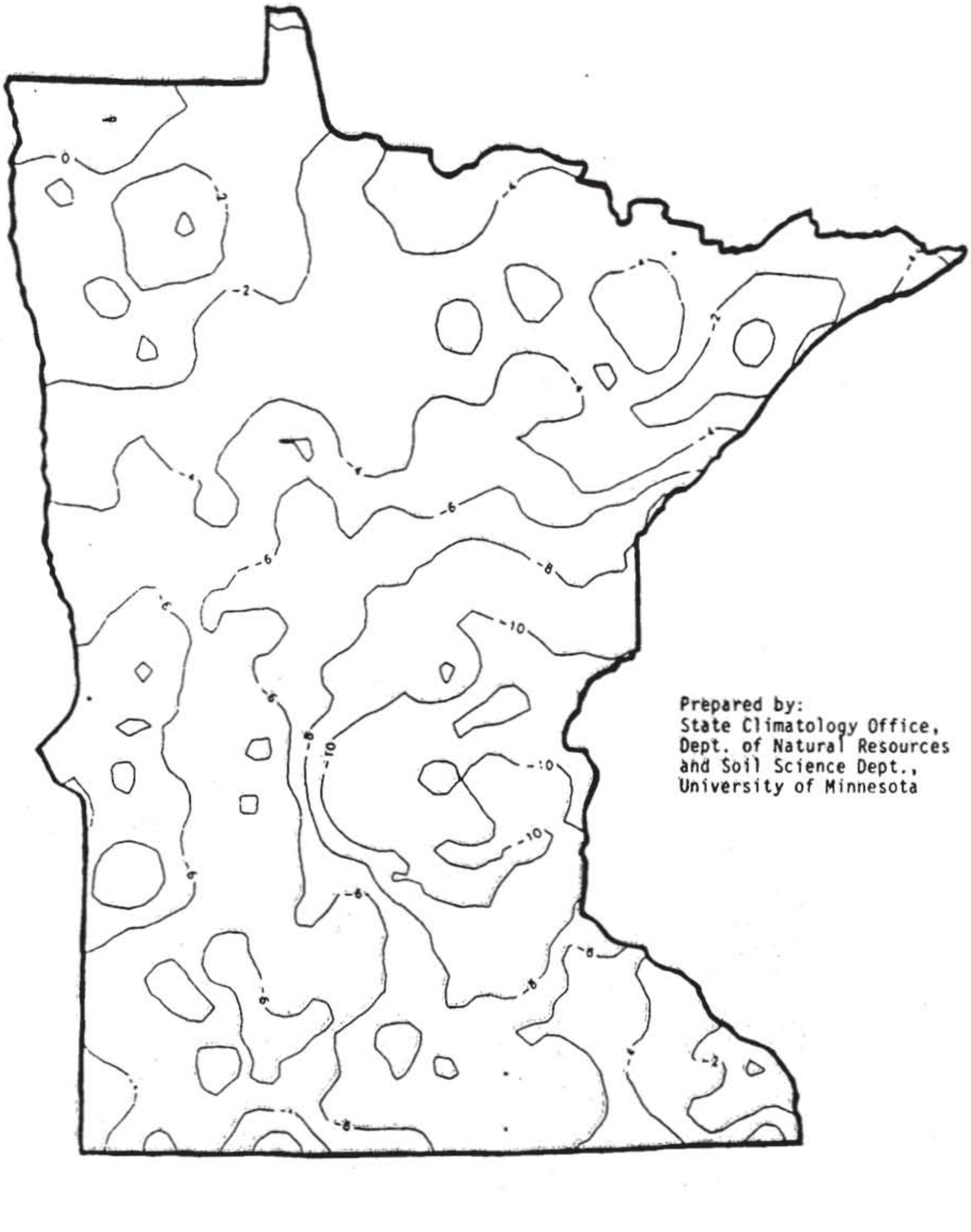
HYDROLOGIC YEAR PRECIPITATION
OCTOBER 1985-SEPTEMBER 1986
DEPARTURE FROM 1951-80 NORMALS, INCHES



Prepared by:
State Climatology Office,
Dept. of Natural Resources
and Soil Science Dept.,
University of Minnesota

FIGURE 4

HYDROLOGIC YEAR PRECIPITATION
OCTOBER 1986-JUNE 1987
DEPARTURE FROM 1951-80 NORMALS, INCHES



Prepared by:
State Climatology Office,
Dept. of Natural Resources
and Soil Science Dept.,
University of Minnesota

FIGURE 5
OCCURRENCE OF PESTICIDES
MDA SURVEY

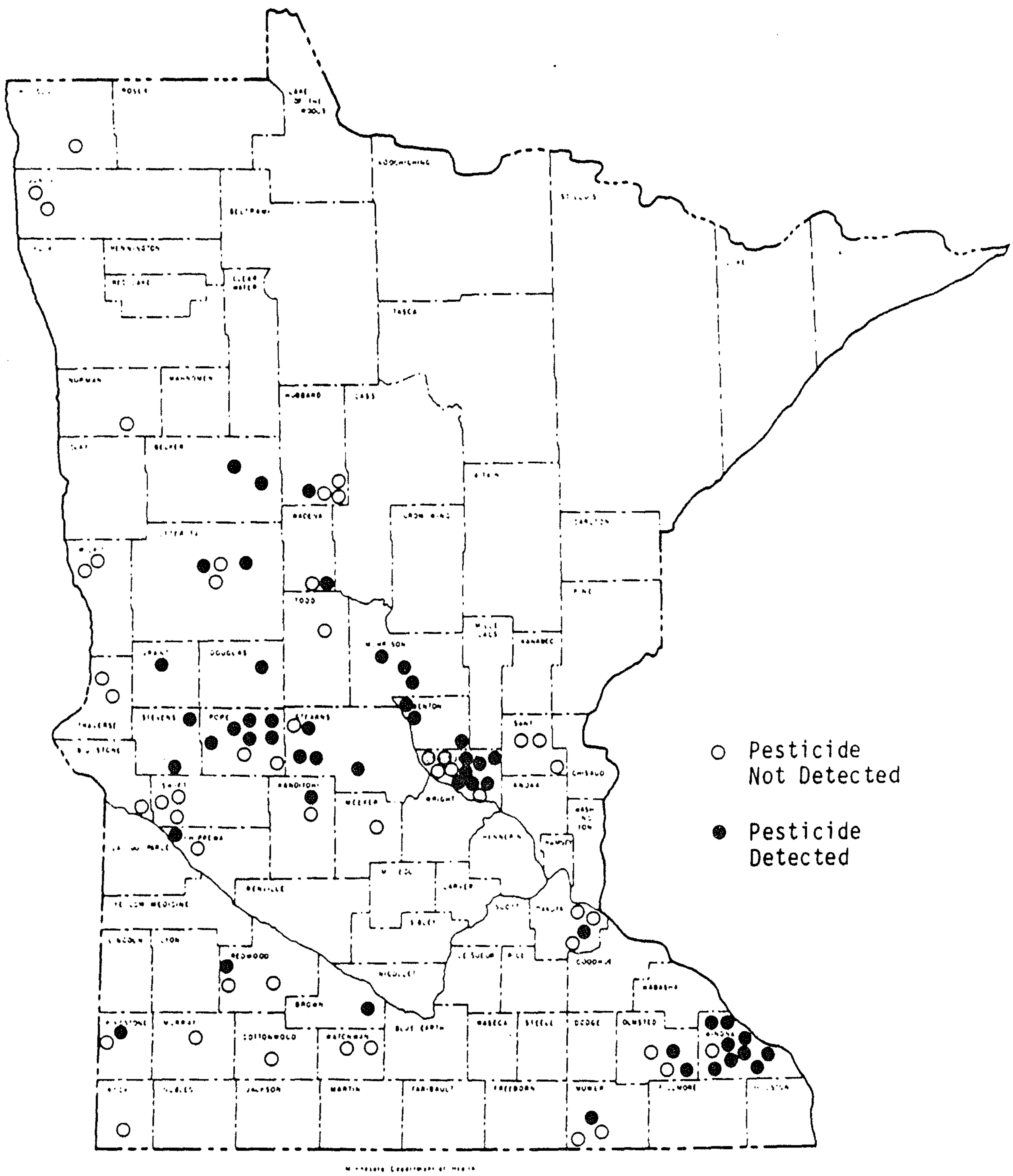


FIGURE 6

ATRAZINE CONCENTRATION VS. NITRATE CONCENTRATION OBSERVATION AND PRIVATE WELLS

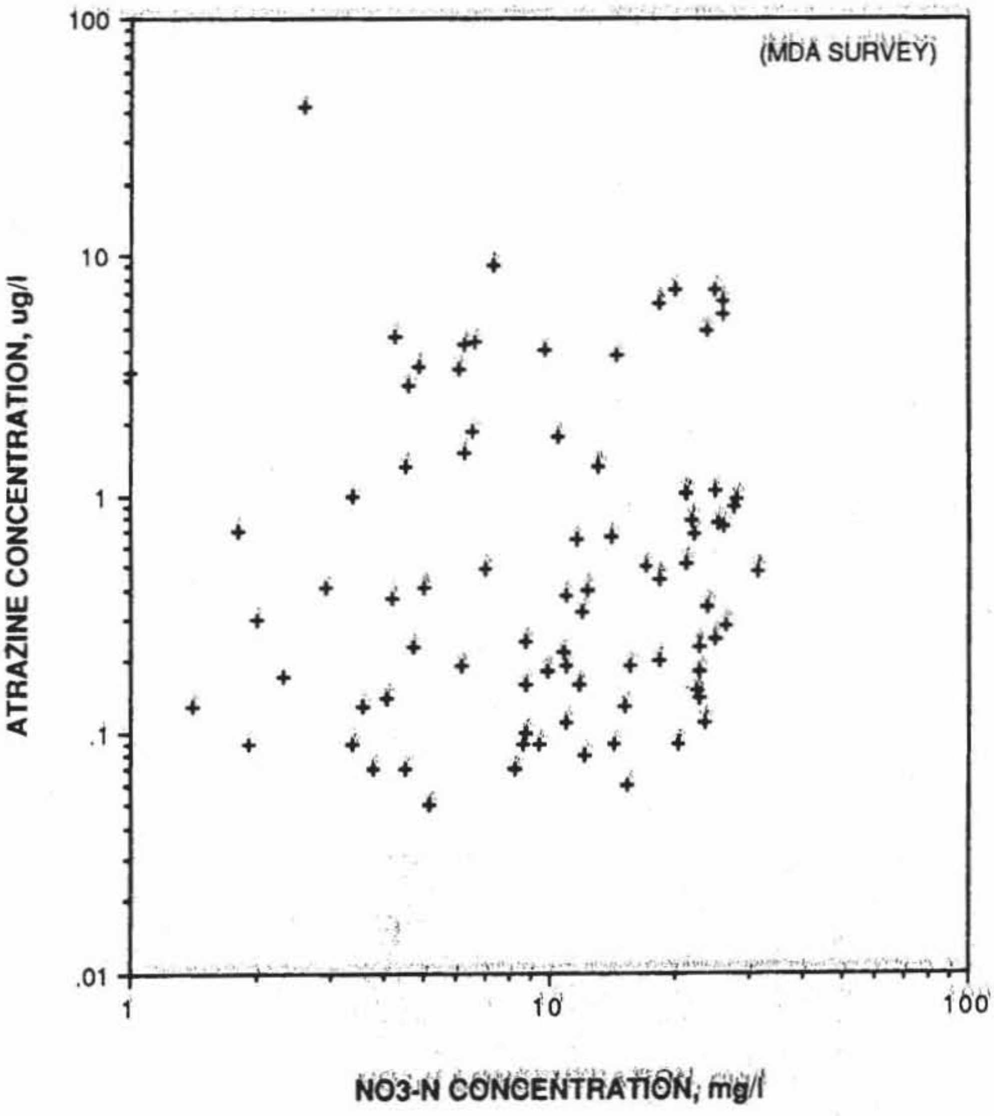


FIGURE 7

DISTRIBUTION OF ATRAZINE CONCENTRATIONS PRIVATE WELLS IN SOUTHEAST MINNESOTA

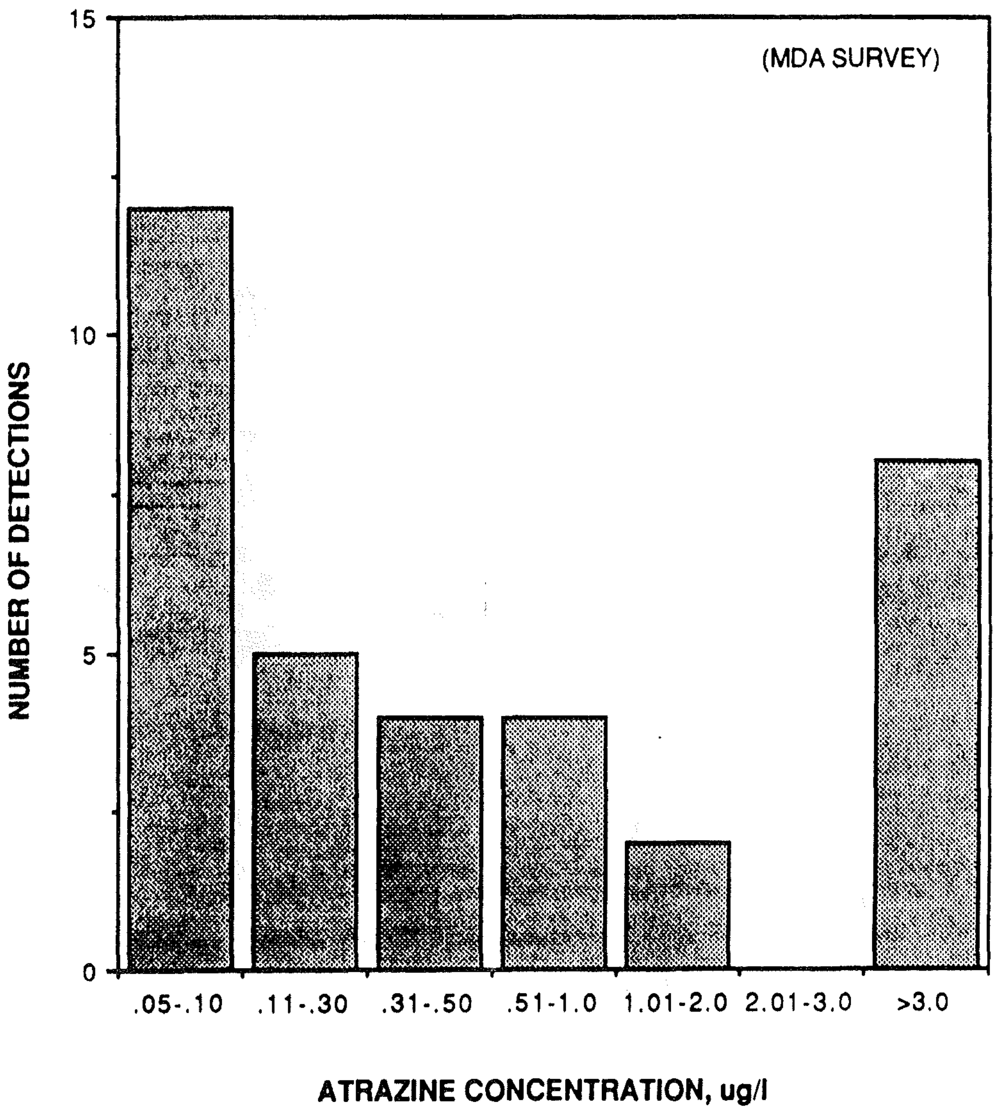


FIGURE 8

ATRAZINE OCCURRENCE VS. NO3-N CONCENTRATION PRIVATE WELLS IN SOUTHEAST MINNESOTA

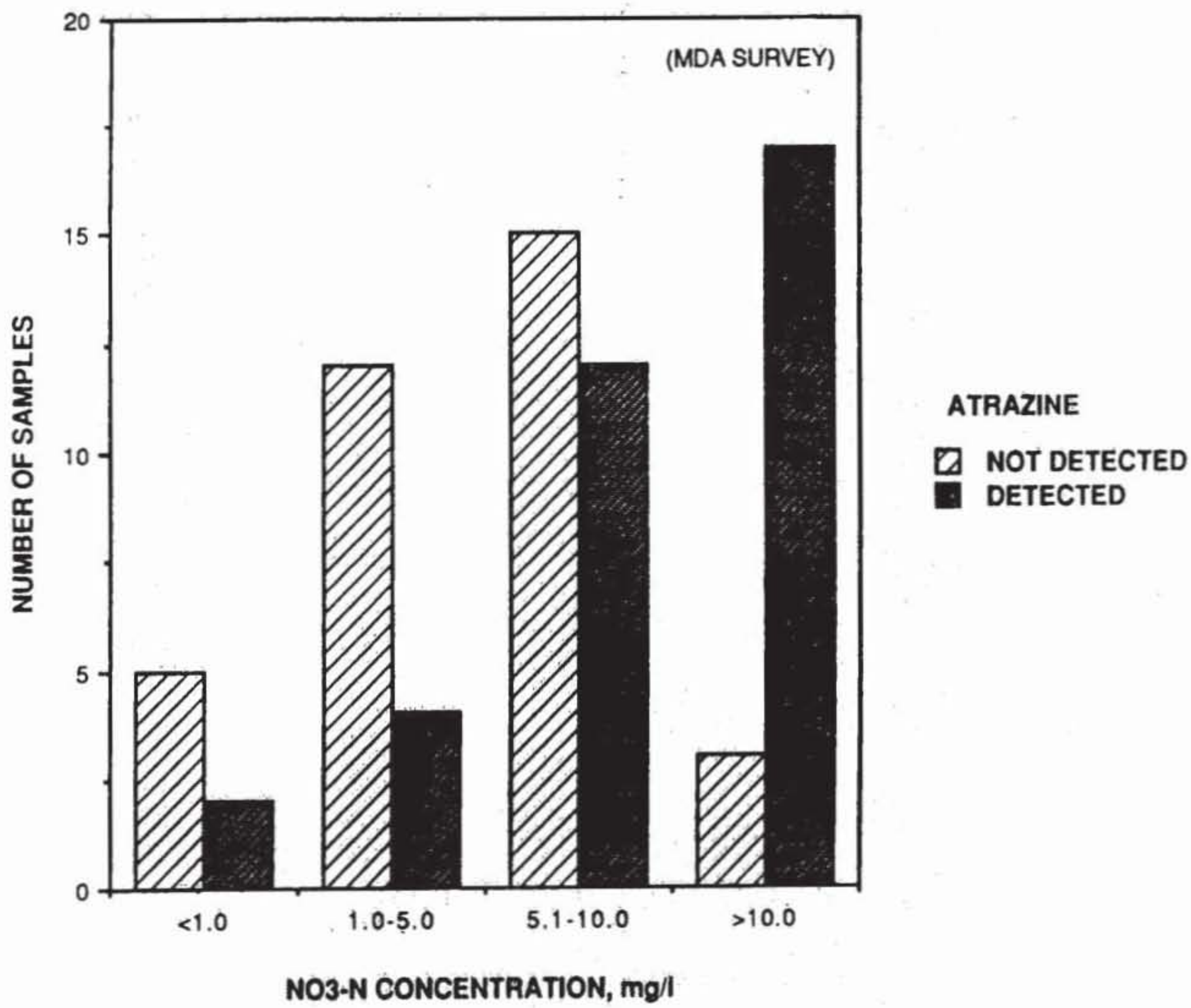


FIGURE 9

DISTRIBUTION OF WATER TABLE AND WELL DEPTHS CENTRAL MINNESOTA

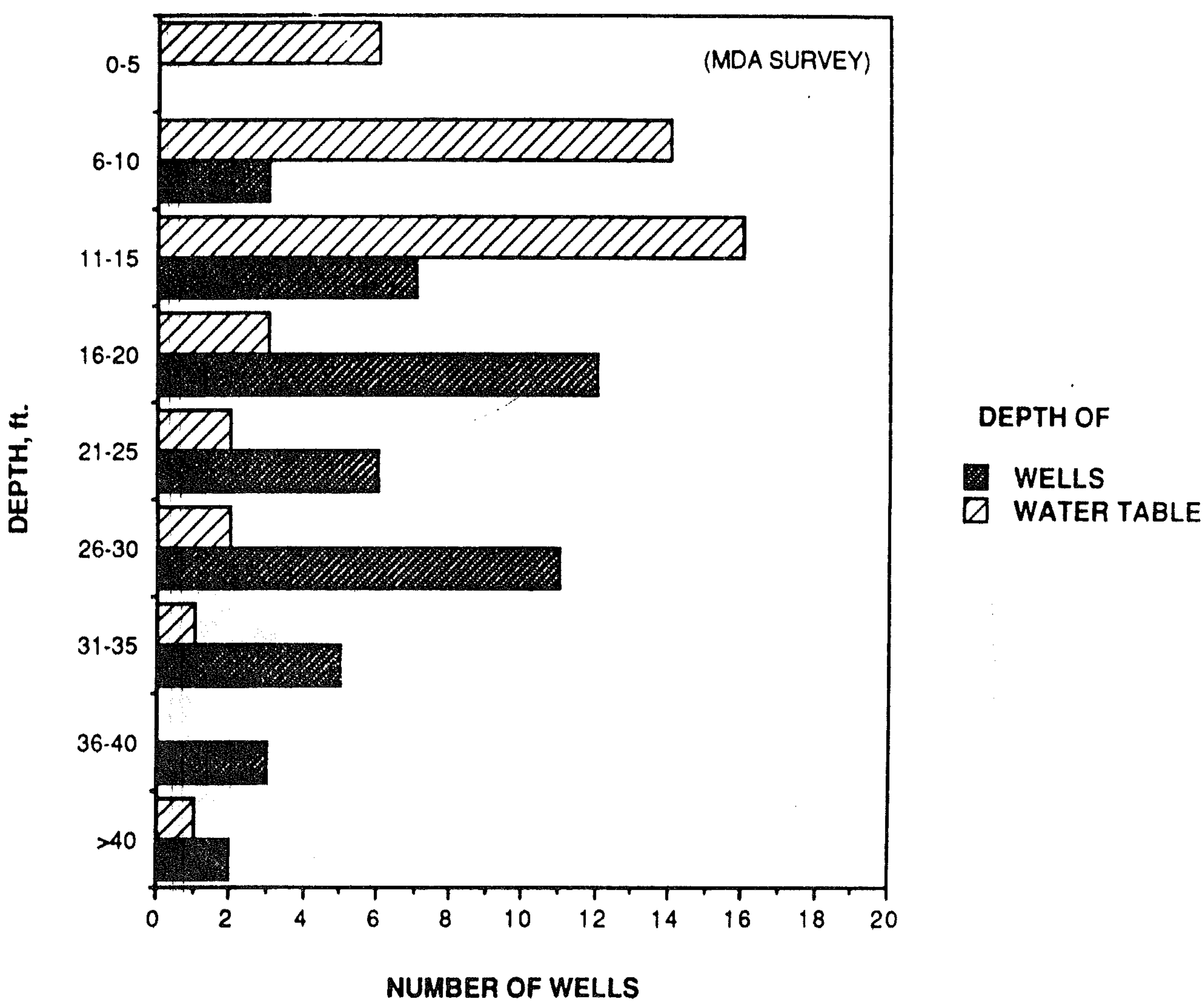


FIGURE 10

DISTRIBUTION OF ATRAZINE CONCENTRATIONS WELLS IN CENTRAL MINNESOTA

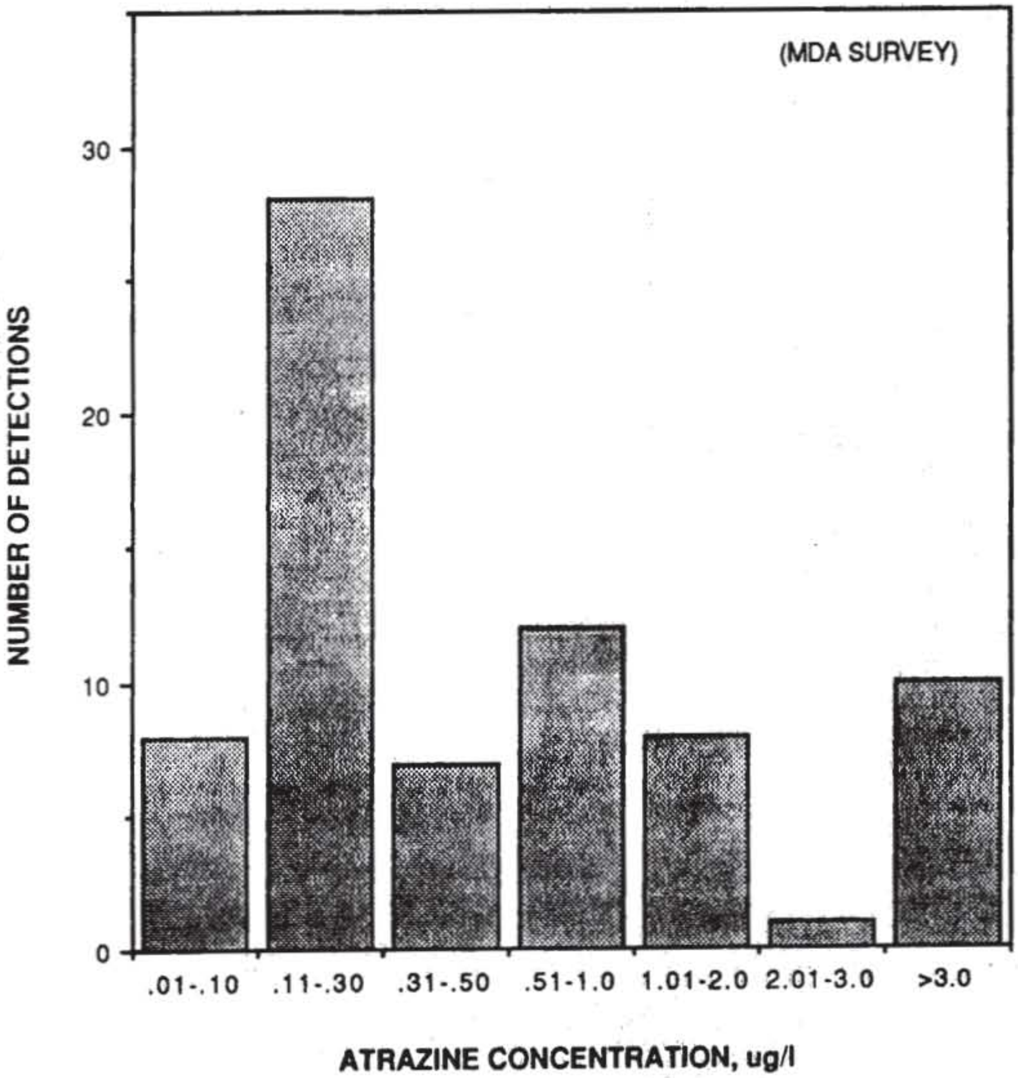


FIGURE 11

FREQUENCY OF PESTICIDE OCCURRENCE VS. WELL DEPTHS CENTRAL MINNESOTA

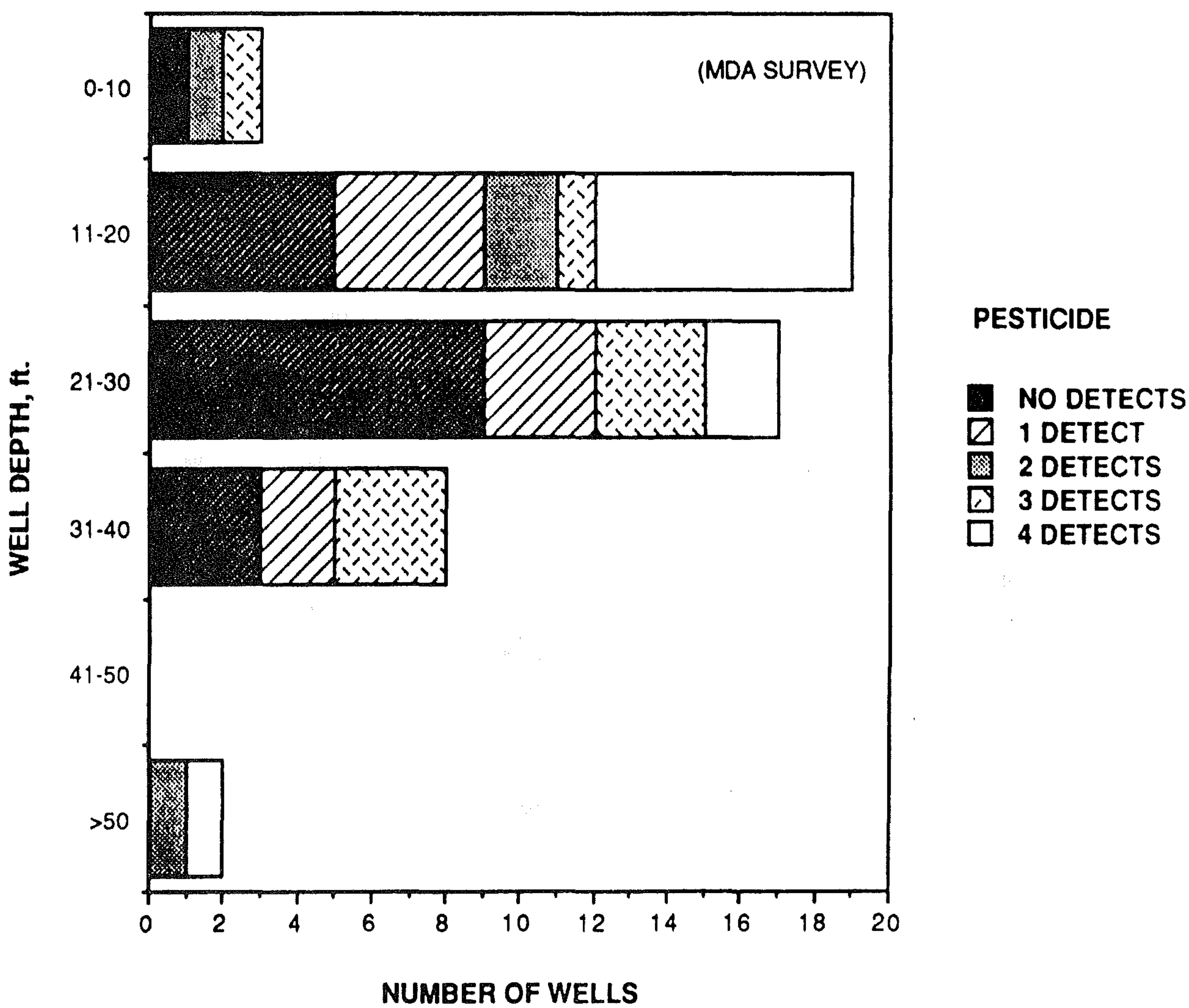


FIGURE 12

PESTICIDE OCCURRENCE VS. AVERAGE NO3-N CONCENTRATION WELLS IN CENTRAL MINNESOTA

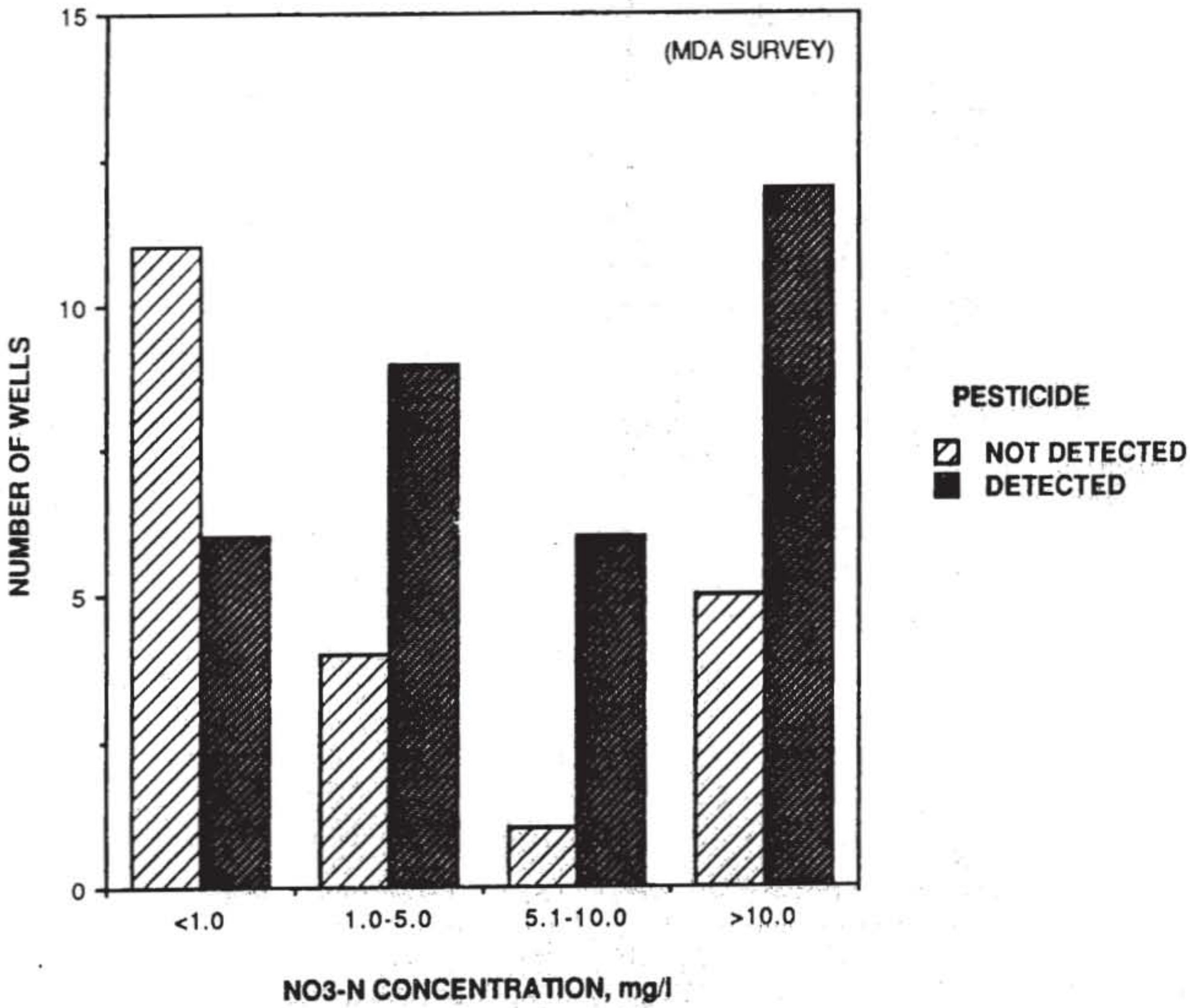


FIGURE 13

SAMPLING DISTRIBUTION BY MONTH PUBLIC WELLS

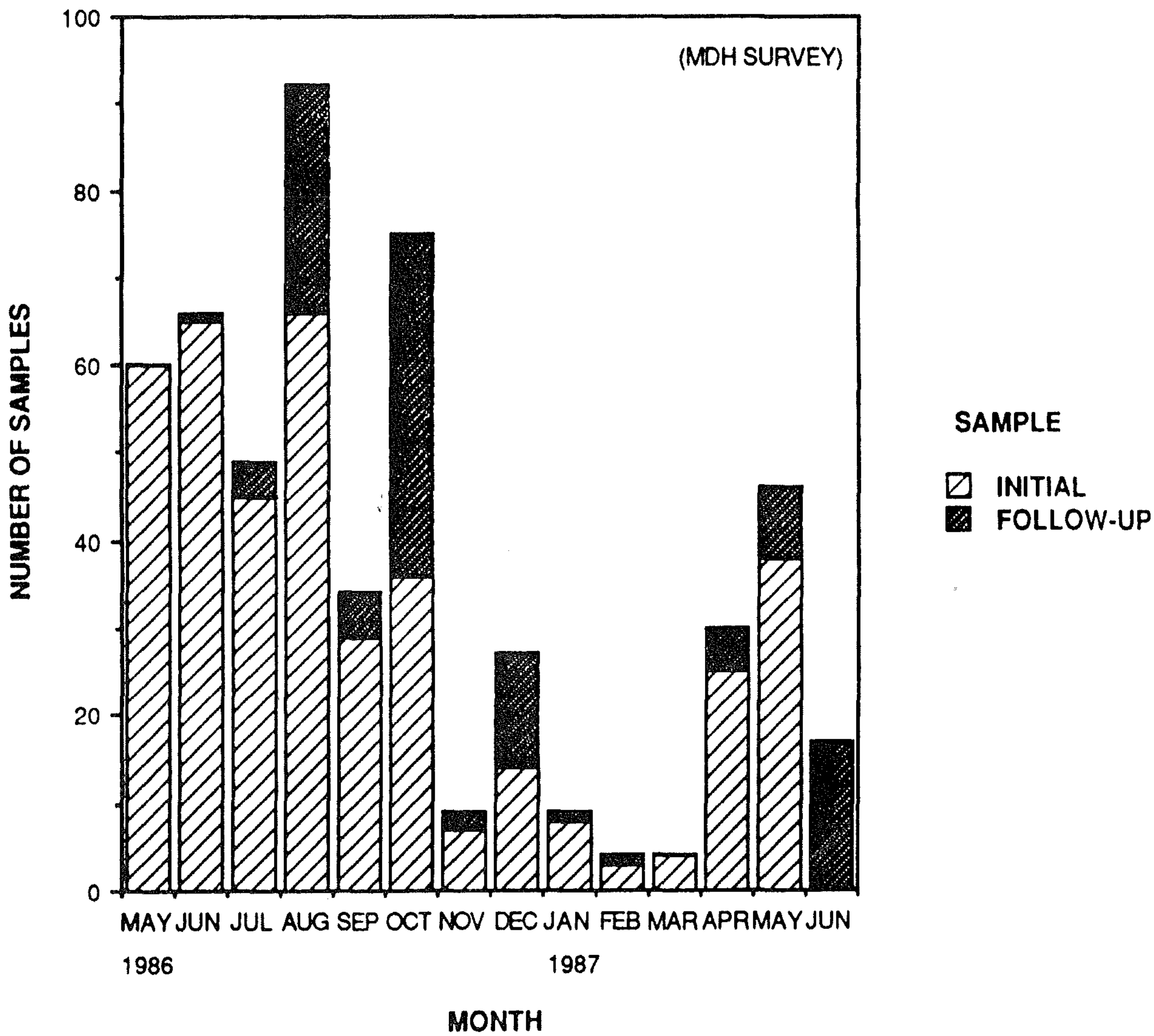


FIGURE 14
GROUNDWATER MONITORING GENERAL INVENTORY FORM
MDH SURVEY

MINNESOTA DEPARTMENT OF HEALTH

GROUND-WATER MONITORING - GENERAL INVENTORY FORM
Form SSU-1 Rev. 9-85

☐ FILE MAINTENANCE CODE
A - Add (New Facility)
B - Update (Existing Facility)
C - Delete from Inventory

Form Completed and Sample Collected by

☐ LV - LCMR VOLATILE ORGANIC CHEMICAL PROJECT
☐ LP - LCMR PESTICIDE PROJECT
☐ LM - LANDFILL MONITORING PROGRAM
☐ EP - EPA PESTICIDE MONITORING PROGRAM
☐ OT - OTHER ____________

DIRECTIONS ON REVERSE SIDE OF FORM

1. INVENTORY INFORMATION

A.

Name of Establishment or Facility (Public System) | Site I.D. | Landfill Site Code (if applicable)

Name of Owner (Last Name First) | Check here if new PWS facility ☐

Establishment or Facility Address (Street or Route) | PWS I.D. (if applicable)

City | Area Code | Fac. Telephone No.

County | Co. Code | State | Zip Code

B.

Name of Occupant (If Different from Owner) (Last Name First) | Area Code | Occ. Telephone No.

Occupant's Address (Street or Route)

City | State | Zip Code

2. WELL DATA

A. Water System Type (check ✓ one)

Potable Wells
☐ M Community Municipal
☐ O Community Non-Municipal
☐ N Non-Community Non-Licensed
☐ L Non-Community Licensed
☐ P Private

Non-Potable Wells
☐ T Monitoring
☐ I Irrigation
☐ X Other ____________

Unique Well Number | Field Well No.

B. Well Location

Township N | R Range W | Sec. | ¼ | ¼ | ¼ | ¼ | Base Map (Location): ____________

C. Date Well Constructed | Constructed by | Well Depth ft. | Casing Depth ft. | Depth to Water ft. | Depth to Bedrock ft.

D. Casing Diameter in. | Casing Above or Below Grade in. | Well Grouted ☐ Yes ☐ Unknown ☐ No | Waterbearing Formation (Name of Formation) ☐ S Sandstone ____ ☐ L Limestone ____ ☐ U Unconsolidated ____ ☐ X Other ____

3. ADDITIONAL COMMENTS (directions to site, possible contaminant sources, etc.)

4. SKETCH WELL SITE AND ADJACENT LAND ON REVERSE SIDE (see instructions)

FIGURE 15
OCCURRENCE OF PESTICIDES
PUBLIC WELLS, MDH SURVEY

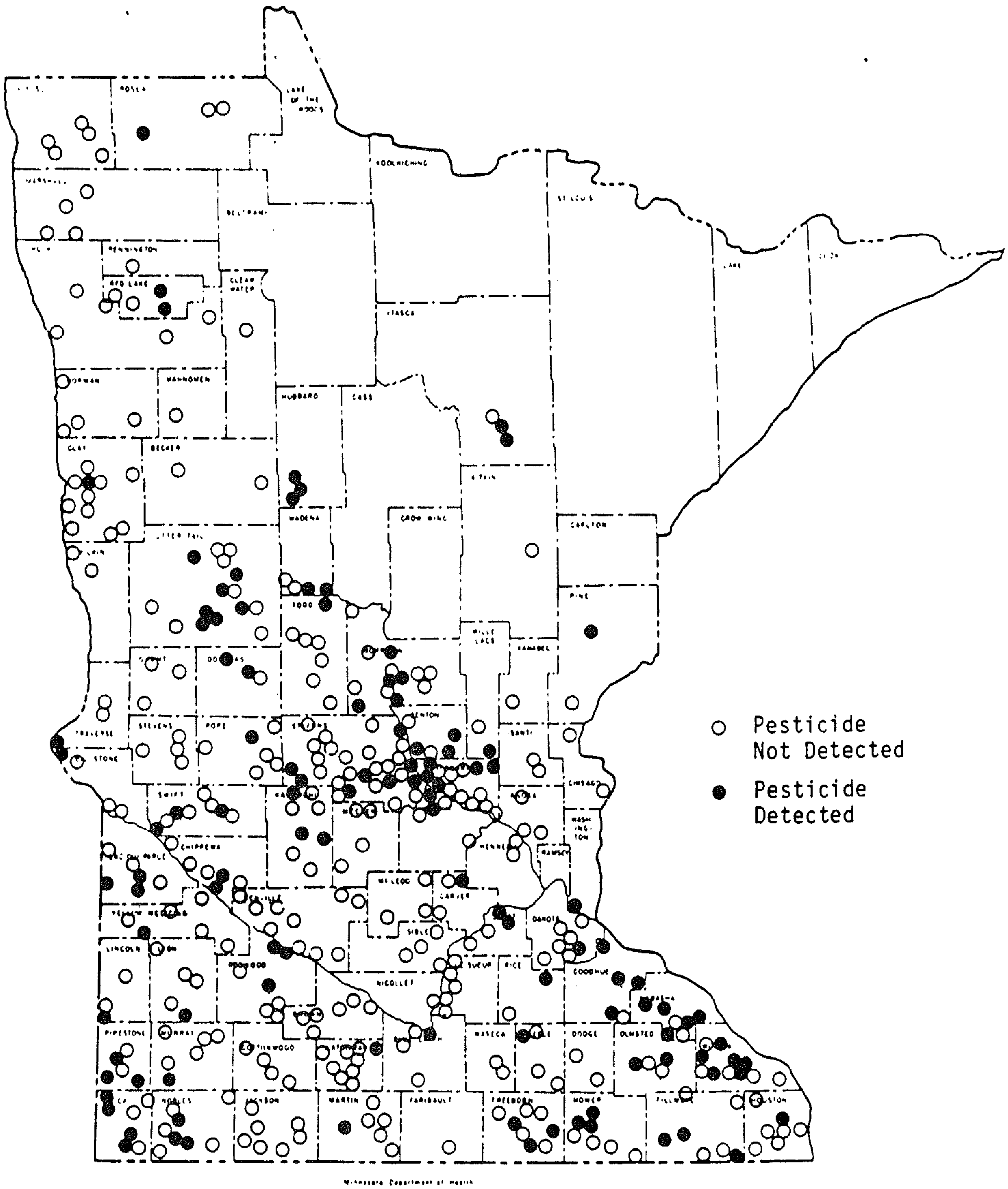


FIGURE 16

PESTICIDE OCCURRENCE VS. CASING DEPTH PUBLIC WELLS IN UNCONSOLIDATED AQUIFERS

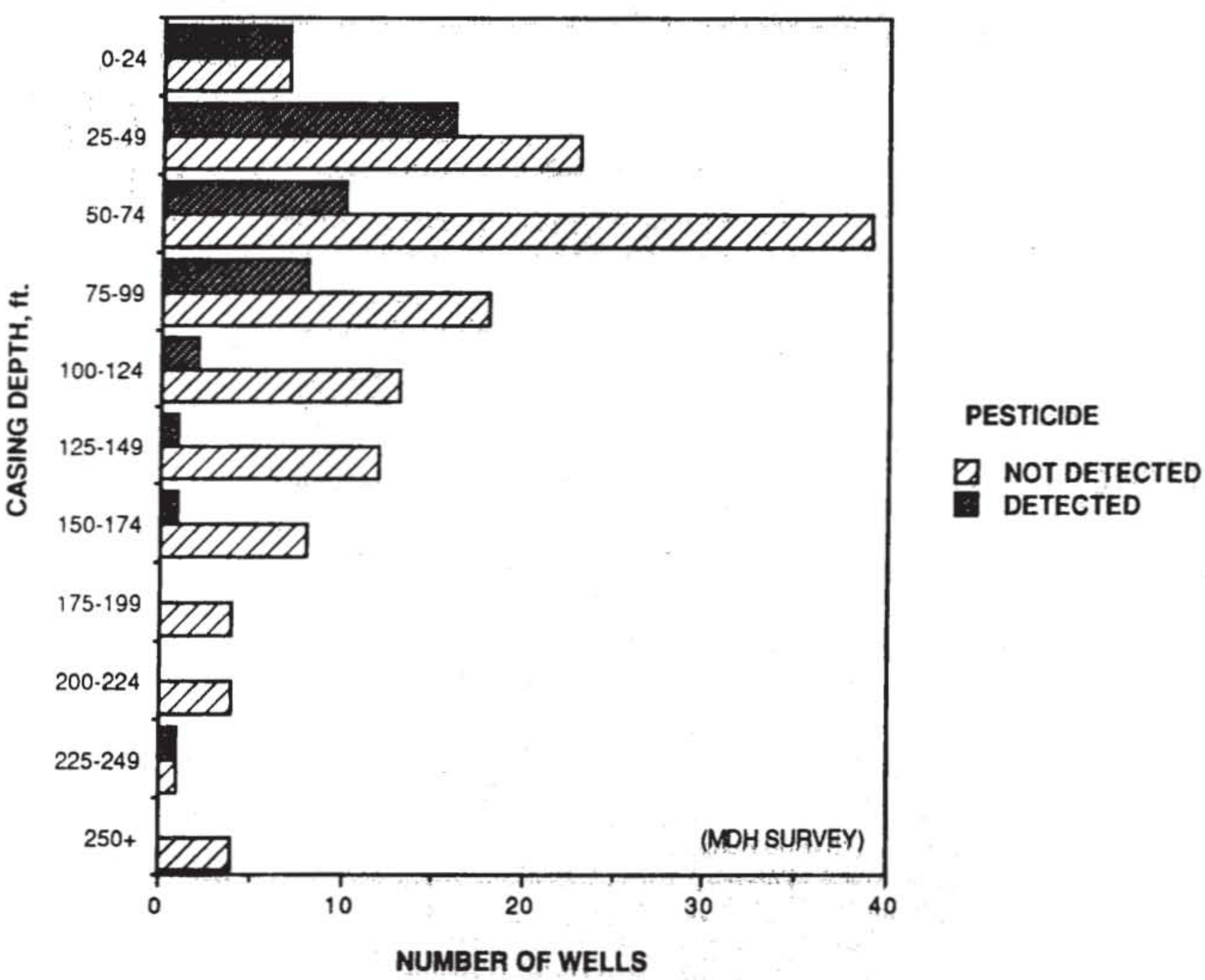
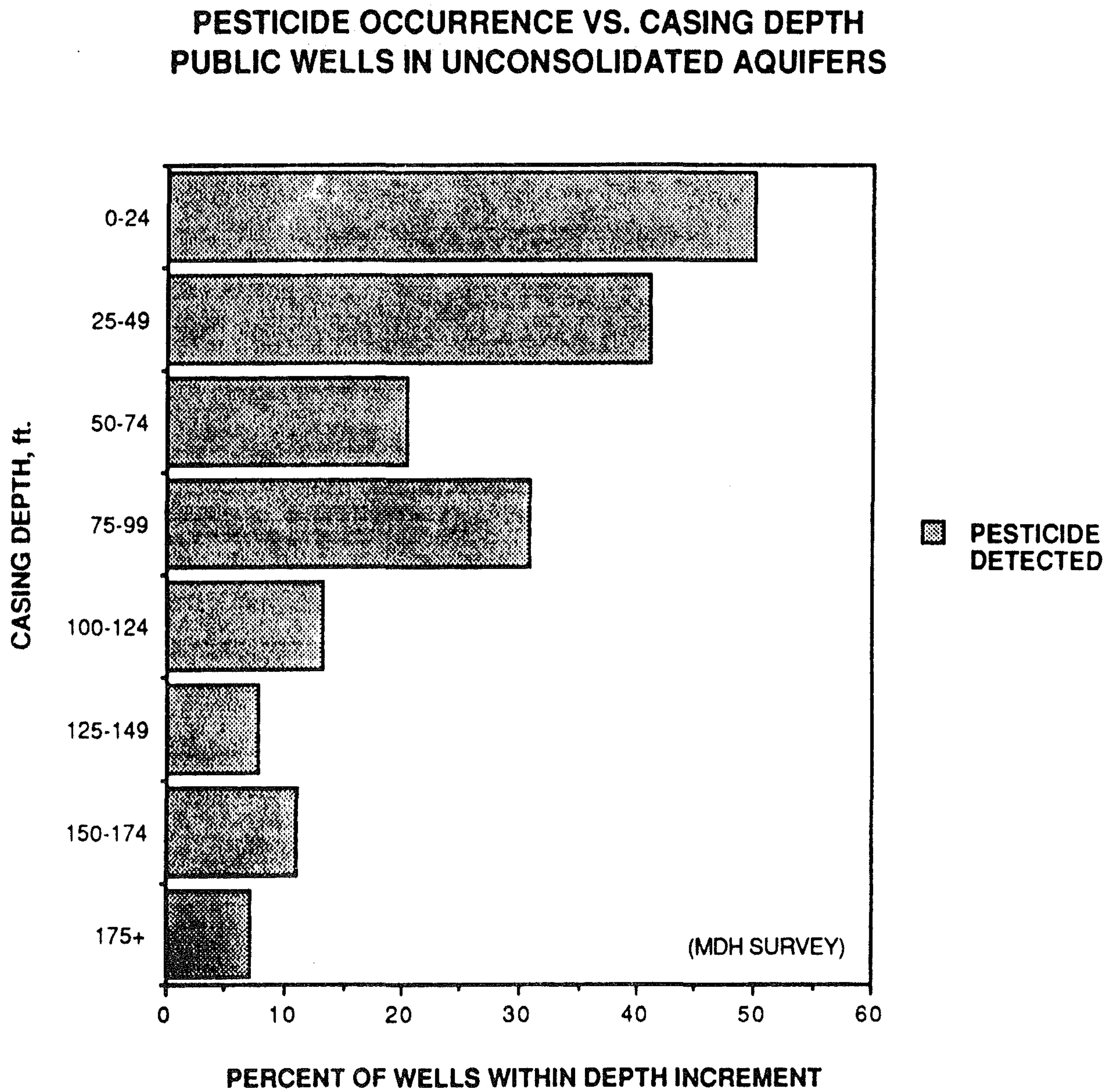


FIGURE 17



PESTICIDE OCCURRENCE VS. CASING DEPTH
PUBLIC WELLS IN UNCONSOLIDATED AQUIFERS
CASING DEPTH, ft.
0-24
25-49
50-74
75-99
100-124
125-149
150-174
175+
(MDH SURVEY)
0
10
20
30
40
50
60
PERCENT OF WELLS WITHIN DEPTH INCREMENT
PESTICIDE DETECTED

FIGURE 18

ATRAZINE CONCENTRATION VS. CASING DEPTH
PUBLIC WELLS IN UNCONSOLIDATED AQUIFERS

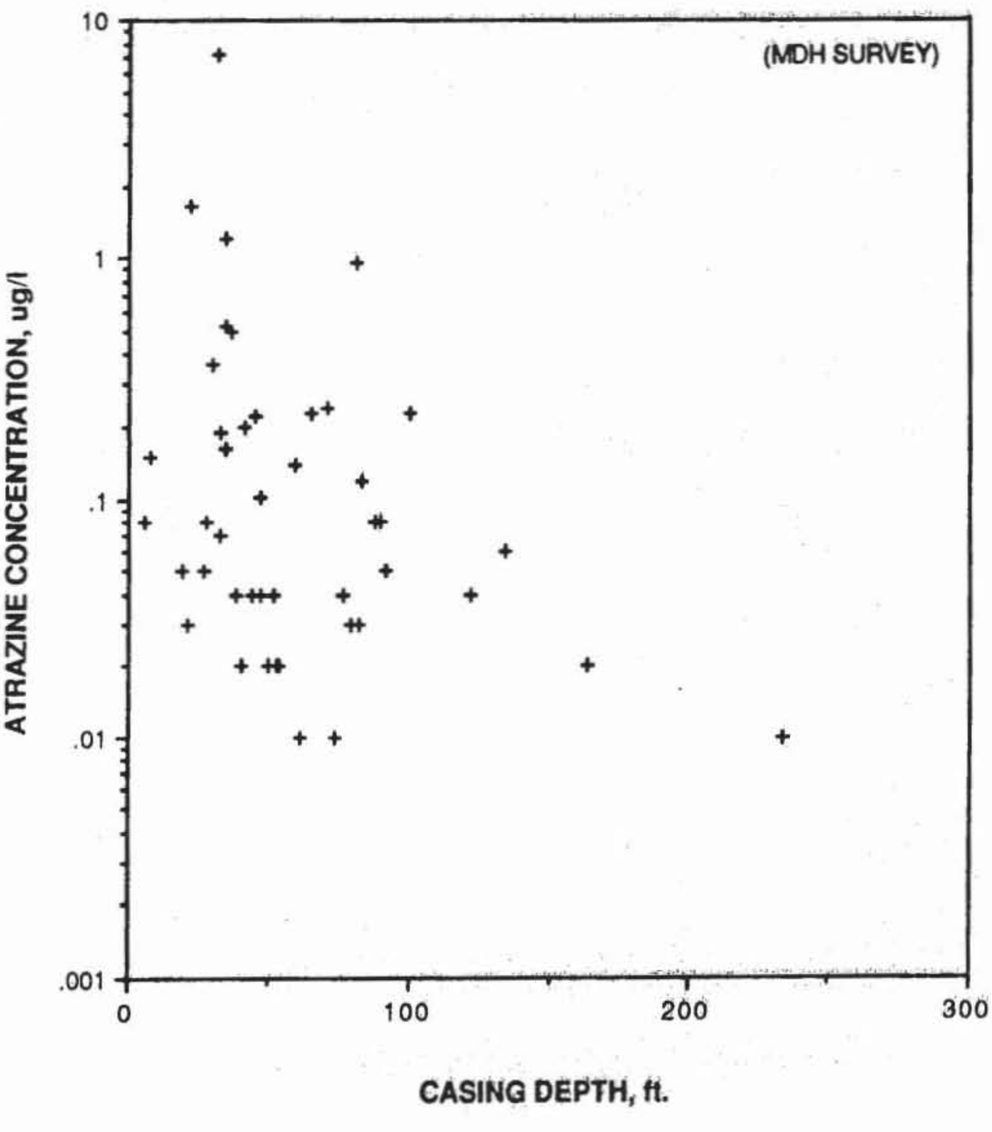


FIGURE 19

PESTICIDE OCCURRENCE VS. DEPTH TO BEDROCK PUBLIC WELLS IN SEDIMENTARY BEDROCK AQUIFERS

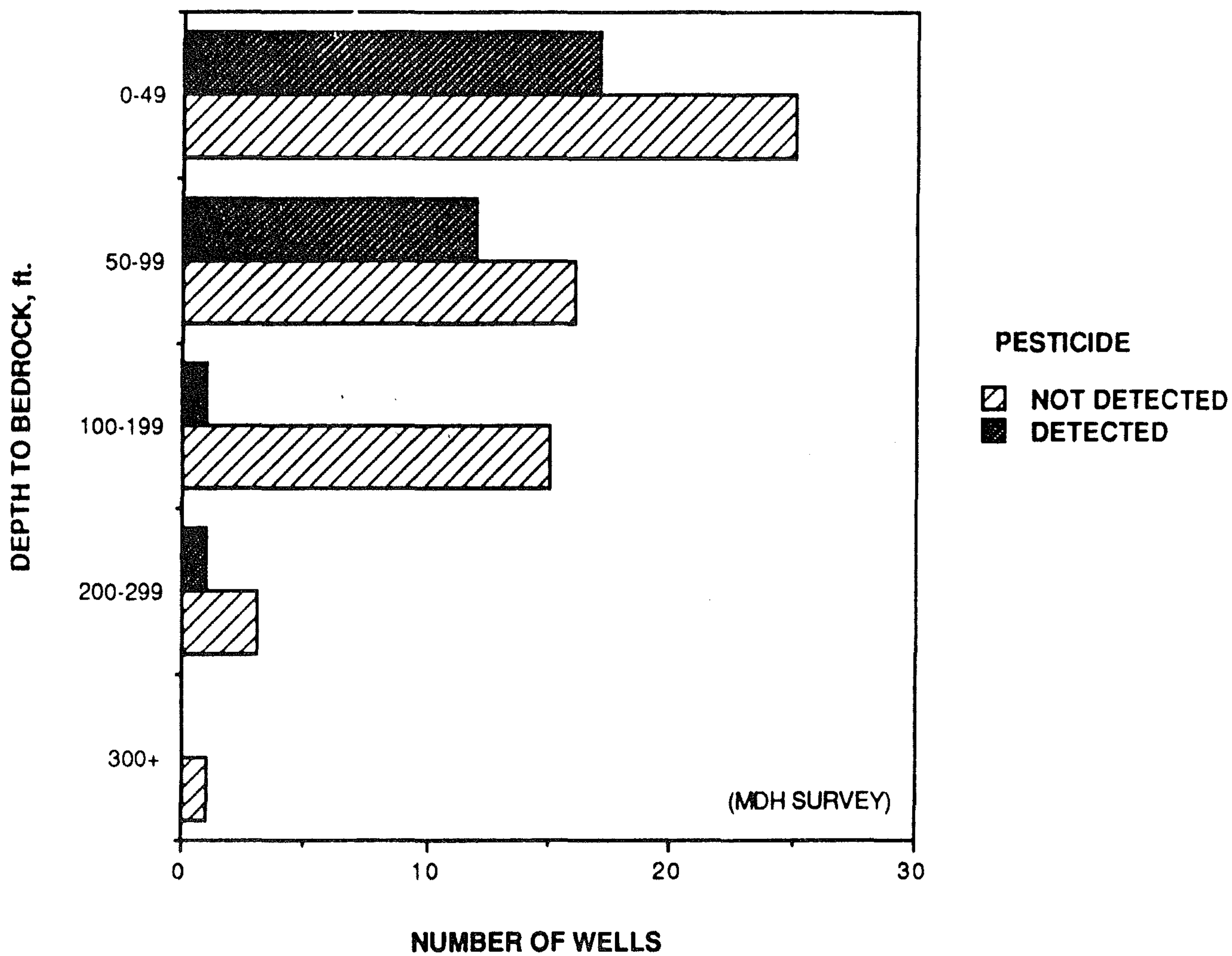


FIGURE 20
OCCURRENCE OF NITRATES
PUBLIC WELLS, MDH SURVEY

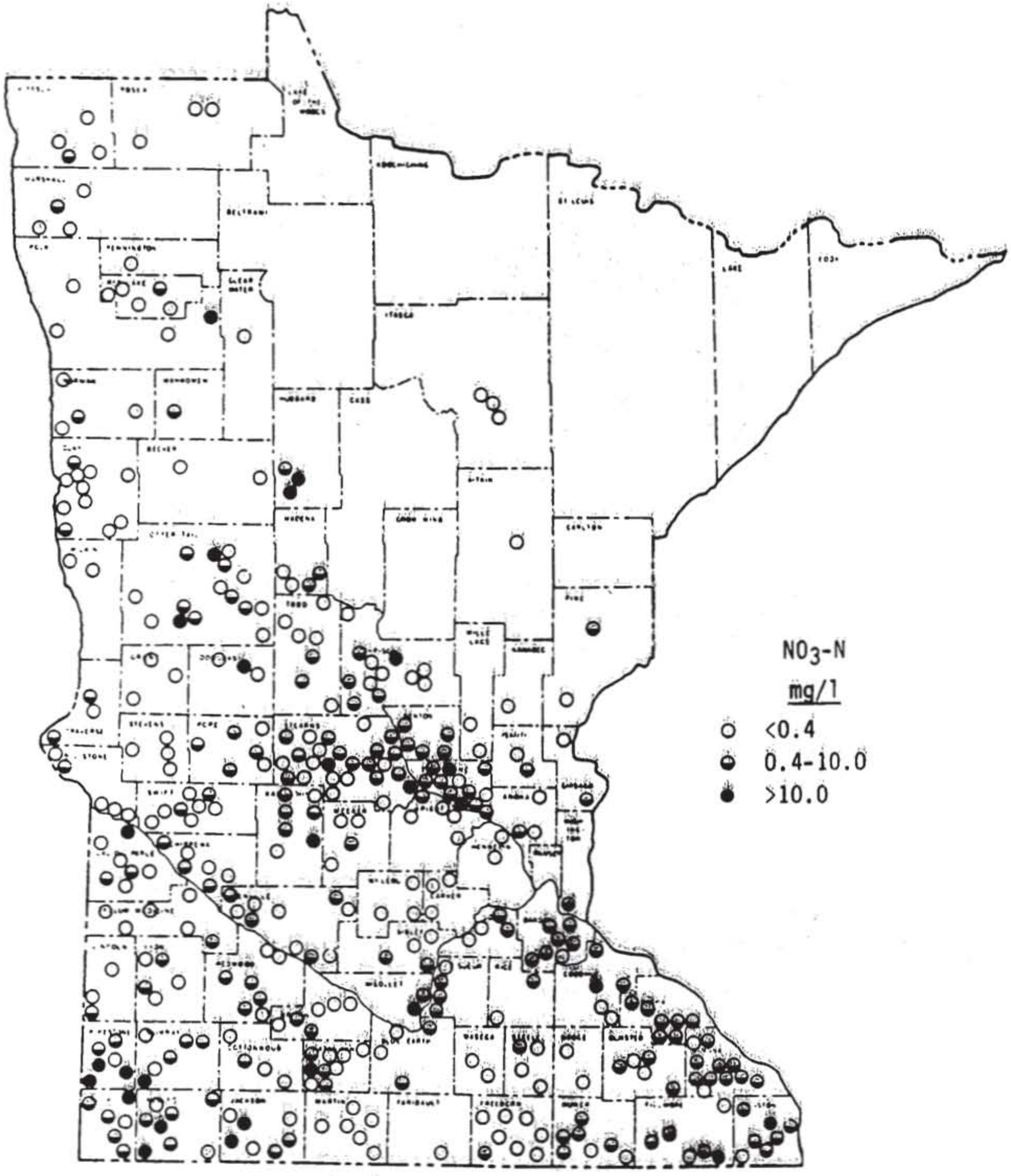


FIGURE 21

ATRAZINE CONCENTRATION VS. NITRATE CONCENTRATION PUBLIC WELLS

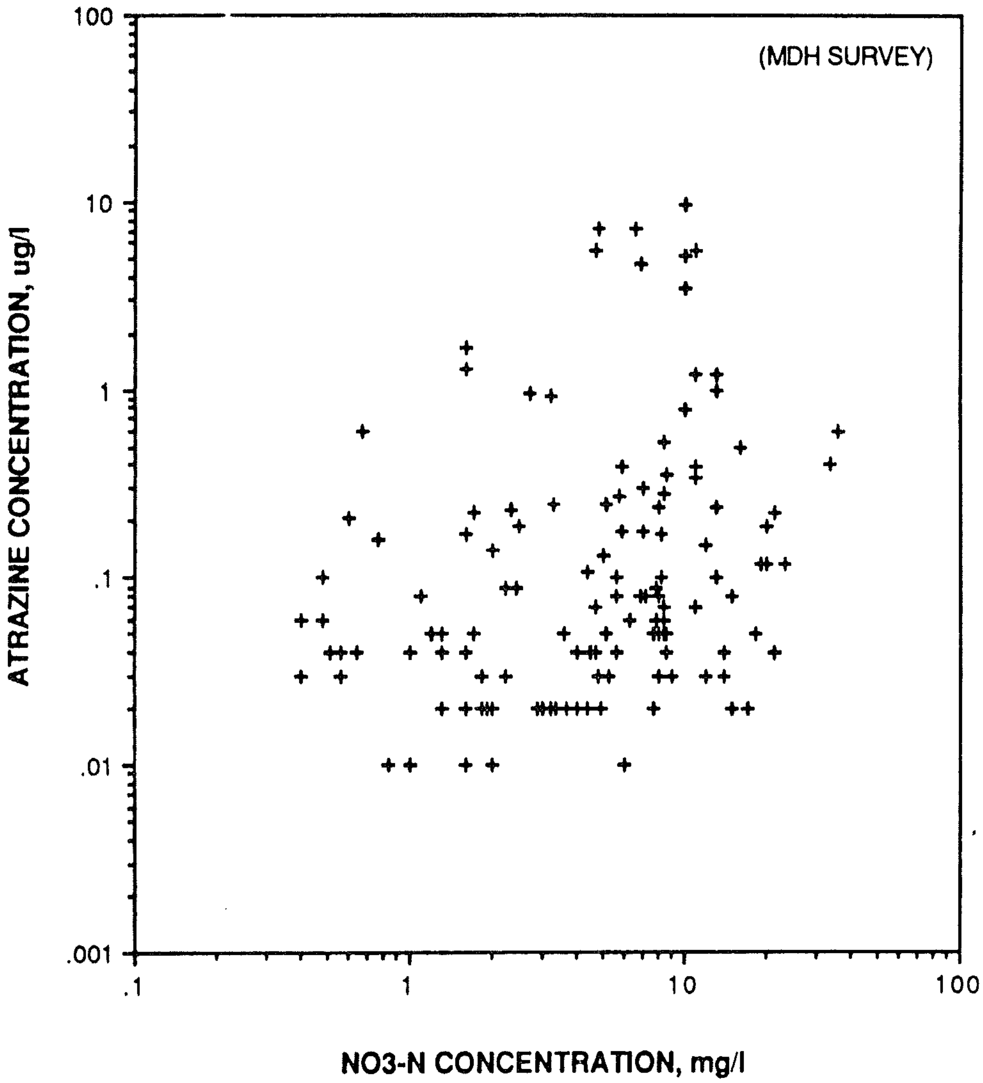


TABLE 1
PESTICIDE ANALYTES
MDA SURVEY

Pesticide	Analytical Method	Reporting Limit (µg/l)	Recommended Allowable Limit (µg/l)
Herbicides			
Alachlor	BN	0.16	6.
Atrazine	BN	0.05	3.
Butylate	BN*	0.79	50.
Chloramben	ACID	1.60	105.
Cyanazine	BN	0.12	9.
Dicamba	ACID	0.18	9.
EPTC	BN*	0.24	35.
Linuron	BN	0.17	44.
MCPA	ACID	0.27	3.6
Metolachlor	BN	0.56	10.
Metribuzin	BN	0.17	175.
Picloram	ACID	1.80	490.
Propachlor	BN	0.10	92.
Simazine	BN	0.08	35.
Trifluralin	BN	0.02	2.
2,4-D	ACID	0.21	70.
Insecticides			
Aldicarb	N-M	0.5	9.
Aldicarb Sulfone	N-M	0.5	
Aldicarb Sulfoxide	N-M	0.5	
Carbaryl	N-M	0.5	700.
Carbofuran	N-M	0.5	36.
3-OH Carbofuran	N-M	0.5	
Chlorpyrifos	BN	0.24	21.
Disulfoton	BN	0.82	0.3
Fonofos	BN	0.16	14.
Methyl Parathion	BN	0.10	2.
Phorate	BN	0.49	0.7
Phosphamidon	BN	0.70	-
Fungicide			
Pentachlorophenol	BN	0.28	220

BN: Base neutral extraction with electron capture and nitrogen-phosphorus detection
ACID: Chlorinated acid herbicide procedure
N-M: N-methylcarbamate pesticide procedure
*: No response with electron capture detection

TABLE 2

PESTICIDE ANALYTES
PUBLIC WELLS, MDH SURVEY

Pesticide	Analytical Method	Reporting Limit (μg/l)	Recommended Allowable Limit (μg/l)
Herbicides			
Alachlor	BN-ECD	0.05	6.
Atrazine	BN-NPD	0.01	3.
Butylate*	BN-NPD	0.01	50.
Chloramben	ACID	0.05	105.
Cyanazine	BN-ECD	0.5	9.
Diallate	BN-ECD	0.12	10.
Dicamba	ACID	0.04	9.
EPTC*	BN-NPD	0.01	35.
Linuron	BN-ECD	0.4	44.
MCPA	ACID	0.05	3.6
Metolachlor	BN-ECD	0.13	10.
Metribuzin	BN-ECD	0.02	175.
Picloram	ACID	0.04	490.
Propachlor	BN-ECD	0.2	92.
Simazine	BN-ECD	0.3	35.
Trifluralin	BN-ECD	0.03	2.
2,4-D	ACID	0.04	70.
2,4,5-T	ACID	0.04	21.
2,4,5-TP	ACID	0.05	10.
Insecticides			
Aldicarb	MDA	0.5	9.
Carbaryl*	BN-NPD	0.05	700.
Carbofuran*	BN-NPD	0.05	36.
Chlorpyrifos	BN-ECD	0.05	21.
Dimethoate	BN-ECD	0.2	140.
Disulfoton	BN-ECD	0.45	0.3
Fonofos	BN-ECD	0.03	14.
Methyl Parathion	BN-ECD	0.02	2.
Phorate	BN-ECD	0.10	0.7
Terbufos	BN-ECD	0.2	0.18
Fungicide			
PCNB	BN-ECD	0.02	49.

BN-ECD: Base neutral extraction with electron capture detection
BN-NPD: Base neutral extraction with nitrogen-phosphorus detection
ACID: Chlorinated acid herbicide procedure
MDA: Analysis performed for MDH by MDA
*: Confirmatory analytical method not available until September 12, 1986

TABLE 3

OCCURRENCE OF PESTICIDES
MDA SURVEY

Pesticide	Wells with Detections*	Samples with Detections	Median (µg/l)	Range (µg/l)
Atrazine	47	112	0.38	0.01-42.4
Alachlor	8	9	0.37	0.16- 2.81
Metribuzin	4	4	0.41	0.12- 0.78
Cyanazine	3	3	0.22	0.18- 2.90
Simazine	1	4	1.40	0.49- 2.58
Dicamba	1	4	0.66	0.53- 0.86
Aldicarb	2	5	9.0	0.50-30.6
Pentachlorophenol	3	3	0.58	0.42- 0.64

*One or more pesticides were detected in 51 (51%) of 100 sampled wells.

TABLE 4

SUMMARY OF WELL-SITE INFORMATION FROM NORTHWESTERN MINNESOTA MDA SURVEY

Counties (wells):	Kittson (1), Marshall (2), Norman (1), Traverse (2), and Wilkin (2)
Geomorphic Regions: (wells)	Agassiz Lacustrine Plain, Red River Valley (8)
Soils:	Fargo, Hegne, Rolliss, Valler, and Beardon
General Description:	Intense small grain agriculture on poorly drained, high clay and organic matter soils
Pesticides Used:	2,4-D, MCPA, triallate, bromoxynil and trifluralin
Crops:	Small grain, soybeans, and sugar beets
Well Depth:	Median 23 ft.; Range 10-43 ft.
Water Table:	Median 5 ft.; Range 3-8 ft.
Pesticides Detected:	None

TABLE 5

SUMMARY OF WELL-SITE INFORMATION FROM SOUTHWESTERN AND SOUTH CENTRAL MINNESOTA MDA SURVEY

Counties (wells):	Big Stone (1), Brown (1), Chippewa (2), Cottonwood (1), Murray (1), Pipestone (2), Redwood (3), Rock (1), Swift (3), and Watonwan (2)
Geomorphic Regions: (wells)	Appleton-Clontarf Outwash Plain (6), Blue Earth Till Plain (6), Minnesota Outwash Plain (1), Southwestern Coteau (4)
Soils:	Maddock, Esterville, Darfur, Estelline, and Barnes
General Description:	Intensive corn and soybean dryland farming on loamy-textured, high organic matter soils; some local regions of irrigated corn production
Pesticides Used:	Trifluralin, 2,4-D, cyanazine, alachlor and dicamba
Crops:	Corn and soybeans
Well Depth:	Median 19.0 ft.; Range 8-45 ft.
Water Table:	Median 10.0 ft.; Range 5-20 ft.
Pesticides Detected:	Atrazine, pentachlorophenol

TABLE 6

SUMMARY OF WELL-SITE INFORMATION
FROM SOUTHEASTERN MINNESOTA
MDA SURVEY

Counties (wells):	Dakota (4), Mower (3), Olmsted (4), Winona (10)
Geomorphic Regions:	Cannon Valley Outwash (2), Mississippi Valley Outwash (2), Harmony Plainview Uplands (10), Claremount-Lyle Plains (3), Rochester Drift Plain (1), Red Wing-LaCrescent Uplands (3)
Soils:	Mt. Carroll, Port Byron, Ostrander, Kasson, Hubbard
Pesticides Used:	Atrazine, alachlor, cyanazine, 2,4-D, dicamba
Crops:	Corn, soybeans, alfalfa
Pesticides Detected:	Atrazine, alachlor, dicamba, cyanazine

TABLE 7

OCCURRENCE OF PESTICIDES
SOUTHEASTERN MINNESOTA
MDA SURVEY

Pesticide Name	Wells with Detections	Samples with Detections	Median (µg/l)	Range (µg/l)
Atrazine	13	35	0.32	0.05-7.18
Alachlor	2	2	0.21	0.19-0.23
Cyanazine	1	1	0.18	N.A.
Dicamba	1	4	0.67	0.53-0.86

TABLE 8

SUMMARY OF WELL-SITE INFORMATION FROM CENTRAL MINNESOTA MDA SURVEY

Counties (wells):	Becker (2), Douglas (1), Hubbard (4), Wadena (2), Benton (3), Morrison (3), Grant (1), Isanti (3), Kandiyohi (2), Pope (8), Stearns (5), Meeker (1), Sherburne (12), Stevens (2), Todd (1), Otter Tail (4)
Geomorphic Regions: (wells)	Anoka Sand Plain (3), Alexandria Moraine Complex (1), Belgrade-Glenwood Outwash Plain (13), Big Stone Moraine (1), Crow Wing Outwash Plain (5), Detroit Lakes Outwash Plain (1), Mississippi Outwash Plain (13), Osakis Till Plain (2), Park Rapids-Staples Outwash Plain (12), St. Croix Moraine (1)
Soils:	Hubbard, Esterville, Dorset, Sioux
General Description:	Corn, soybean and potato production on coarse-textured low organic matter soils frequently associated with irrigation
Pesticides Used:	Atrazine, alachlor, trifluralin, metolachlor, 2,4-D, dicamba, aldicarb, terbufos, carbaryl, metribuzin, cyanazine
Crops:	Corn, soybeans, potatoes, small grains
Well Depth:	Median 22.9 ft.; Range 7-60 ft.
Water Table:	Median 11.9 ft.; Range 2-42 ft.

TABLE 9

OCCURRENCE OF PESTICIDES
CENTRAL MINNESOTA
MDA SURVEY

Pesticide	Wells with Detections	Samples with Detections	Median (µg/l)	Range (µg/l)
Atrazine	30	74	0.38	0.01-42.4
Alachlor	6	7	0.39	0.16- 2.81
Aldicarb	2	5	9.0	0.50-30.6
Metribuzin	4	4	0.41	0.12- 0.78
Simazine	1	4	1.40	0.49- 2.58
Pentachlorophenol	2	2	0.53	0.42- 0.64
Cyanazine	1	1	0.22	N.A.

TABLE 10

SUMMARY OF WELL-SITE INFORMATION FROM ADJACENT WELLS MDA SURVEY

Counties:	Sherburne (4), Stearns (2), Isanti (1), and Kandiyohi (1)
Soil:	Hubbard, Zimmerman, Sverdrup
General Description:	Coarse-textured soils and subsoils, often with irrigation nearby
Shallow Well Depth:	Mean 17.1 ft.; Range 10-23 ft.
Deep Well Depth:	Mean 28.0 ft., Range 22-37 ft.
Shallow Water Table Depth:	Mean 5.8 ft.; Range 2-9 ft.
Deep Water Table Depth:	Mean 16.7 ft.; Range 12-20 ft.

TABLE 11

SOIL TYPE AND FREQUENCY OF PESTICIDE USE
TILE LINE SAMPLING SITES
MDA PESTICIDE SURVEY

Site Location	Tile Line	Soil Type	Pesticide Use (years)**
Morris	1	Nutley clay	Alachlor (2) Cyanazine (2) EPTC (1) MCPA (1)* Terbufos (1) Carbofuran (1)*
Morris	2	Nutley clay Hammerly loam Barnes loam	Alachlor (3) Cyanazine (3) Glyphosate (1)* MCPA (1)* Terbufos (1) Carbofuran (1)
Lamberton	1	Webster loam	Alachlor (5) Cyanazine (9) EPTC (3) Propachlor (4) Carbofuran (8)* Terbufos (5)
Waseca	1	Webster clay loam	Alachlor (12) Atrazine (10) Cyanazine (2) Dicamba (1)* Propachlor (1) Carbofuran (8)* Isofenphos (1)* Terbufos (4)
Waseca	2	Webster clay loam	Same as Waseca No. 1 plus 2,4-D (1)*

*N-methylcarbamate and acid herbicide analysis not conducted.

**Pesticide use information for 3, 13, and 13 years for Morris, Lamberton and Waseca, respectively.

TABLE 12

OCCURRENCE OF PESTICIDES PUBLIC WELLS, MDH SURVEY

Pesticide	Wells with Detections*	Samples with Detections	Median (μg/l)	Range (μg/l)
Atrazine	107	177	0.06	0.01-9.70
Alachlor	8	14	0.44	0.07-4.03
2,4-D	7	12	0.22	0.07-5.70
Dicamba	3	6	0.10	0.05-0.21
Picloram	3	5	0.16	0.08-0.63
MCPA	2	4	0.26	0.13-2.20
Metribuzin	2	3	0.23	0.10-1.05
Metolachlor	2	2	0.42	0.30-0.55
Propachlor	2	2	0.35	0.20-0.50
Cyanazine	1	1	0.80	N.A.
EPTC	1	1	0.33	N.A.
2,4,5-T	1	1	0.21	N.A.

*One or more pesticides were detected in 114 (28.5%) of 400 sampled wells.

TABLE 13

EFFECT OF CASING DEPTH ON PESTICIDE OCCURRENCE PUBLIC WELLS IN UNCONSOLIDATED AQUIFERS MDH SURVEY

Result	Number of Wells	Casing Depth (ft.) Median	Casing Depth (ft.) Range
Pesticide Not Detected	133	72	16-380
Pesticide Detected	46	48	6-233

TABLE 14

EFFECT OF CASING DEPTH ON PESTICIDE OCCURRENCE PUBLIC WELLS IN SEDIMENTARY BEDROCK MDH SURVEY

Results	Number of Wells	Casing Depth (ft.) Median	Casing Depth (ft.) Range
Pesticide Not Detected	48	160	52-528
Pesticide Detected	25	185	40-455

TABLE 15

PESTICIDE OCCURRENCE IN SELECTED SEDIMENTARY BEDROCK FORMATIONS
PUBLIC WELLS, MDH SURVEY

Formation*	No. of Wells with Depth to First Bedrock:			
	<100 ft.		≥100 ft.	
	Pesticide Detected	Pesticide Not Detected	Pesticide Detected	Pesticide Not Detected
Cretaceous	0	1	0	3
Cedar Valley (DCVA)	5	3	0	0
DCVA or OMDG	0	2	0	0
Maquoketa-Dubuque-Galena (OMDG)	1	2	0	7
Decorah-Platteville-Glenwood	0	1	0	0
St. Peter (OSTP)	1	0	0	0
OSTP or OPDC	0	1	0	1
Prairie du Chien (OPDC)	6	6	0	0
OPDC or CJDN	5	4	0	0
Jordan (CJDN)	9	12	1	2
Older Cambrian and Precambrian	1	9	1	6

*Well casing terminates in the indicated bedrock formation. Some wells also extend into deeper formations.

TABLE 16

RELATIONSHIP BETWEEN PESTICIDE OCCURRENCE
AND NITRATE-NITROGEN CONCENTRATION
PUBLIC WELLS, MDH SURVEY

	No. of Wells with NO_3-N Concentration (mg/l):			
	<0.4	≥0.4, <1.0	≥1.0, ≤10.0	>10.0
Pesticide Not Detected	176	24	71	11
Pesticide Detected	32	10	54	17
Total	208	34	125	28
Percent with Pesticides Detected	15.4	29.4	43.2	60.7

TABLE 17

OCCURRENCE OF PESTICIDES
ALL WELLS
MDA AND MDH SURVEYS

Pesticide	Wells with Detections*	Median (µg/l)	Range (µg/l)
Atrazine	154	0.12	0.01-42.40
Alachlor	16	0.39	0.07- 4.03
2,4-D	7	0.22	0.07- 5.70
Metribuzin	6	0.32	0.10- 1.05
Dicamba	4	0.17	0.05- 0.86
Cyanazine	4	0.51	0.18- 2.90
Picloram	3	0.16	0.08- 0.63
Pentachlorophenol	3	0.58	0.42- 0.64
Metolachlor	2	0.42	0.30- 0.55
Propachlor	2	0.35	0.20- 0.50
MCPA	2	0.26	0.13- 2.20
Aldicarb	2	9.0	0.50-30.60
Simazine	1	1.40	0.49- 2.58
2,4,5-T	1	0.21	N.A.
EPTC	1	0.33	N.A.

*One or more pesticides were detected in 165 (33%) of 500 sample wells.

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APPENDIX

Herbicides

Alachlor (Lasso) - a widely used, pre-emergence herbicide used to control annual grasses and broadleaf weeds in soybeans and corn. Registered for use in 1969.

Atrazine (Aatrex) - a widely used, pre-emergence herbicide used to control weeds in corn. Registered for use in 1963.

Butylate (Sutan) - a widely used, pre-plant herbicide applied to control grassy weeds in corn. Registered for use in 1967.

Chloramben (Amiben) - a widely used, pre-emergence herbicide used to control weeds in soybeans. Registered for use in 1960.

Cyanazine (Bladex) - a widely used, pre- and post-emergence herbicide used for control of annual grasses and broadleaf weeds in corn. Registered for use in 1971. Restricted use classification.

Diallate (Avadex) - a pre-emergence herbicide used in corn, soybeans and sugar beets. Registered for use in 1963. Restricted use classification.

Dicamba (Banvel) - a widely used post-emergence herbicide used to control weeds in corn and small grains and to control brush and vines in non-crop areas. Registered for use in 1967.

2,4-D or (2,4-dichlorophenoxy)acetic acid - a widely used post-emergence herbicide used to control broadleaf weeds in corn, small grains, rangeland, pastures and lawns. Registered for use in 1948.

EPTC or S-ethyl dipropylthiocarbamate (Eptam or Eradicane) - a widely used, selective herbicide used to control annual and perennial grasses in corn and potatoes. Registered for use in 1969.

Linuron (Lorox) - a widely used herbicide used for weed control in corn and soybeans. Registered for use in 1966. Restricted use classification.

MCPA or (4-chloro-o-tolyoxy)acetic acid (Agroxone) - a widely used, post-emergence herbicide used to control annual and perennial broadleaf weeds in small grains, grassland and non-crop areas. Registered for use in 1952.

Metolachlor (Bicep or Dual) - a widely used, pre-plant and pre-emergence herbicide used in corn and soybeans. Registered for use in 1976.

Metribuzin (Lexone or Sencor) - a widely used, broad spectrum herbicide used to control grassy and broadleaf weeds in soybeans. Registered for use in 1973. Restricted use classification.

Picloram (Tordon) - a broad spectrum herbicide used to control broadleaf and woody plants in rangelands, pastures, and rights-of-way. Registered for use in 1963. Restricted use classification.

Propachlor (Bexton or Ramrod) - a widely used, pre-emergence herbicide used to control grasses and broadleaf weeds in corn. Registered for use in 1965.

Simazine (Princep) - a pre-emergence herbicide used to control grasses and broadleaf weeds in corn. Registered for use in 1957.

2,4,5-T or (2,4,5-trichlorophenoxy)acetic acid - a post-emergence herbicide used to control weeds and wood plants on industrial sites and rangeland. All uses have been cancelled.

2,4,5-TP or 2-(2,4,5-trichlorophenoxy)proprionic acid (Silvex) - an herbicide for weed and brush control. All uses have been cancelled.

Trifluralin (Treflan) - a widely used, pre-emergence herbicide used to control annual grasses and broadleaf weeds in soybeans. Registered for use in 1963.

Insecticides

Aldicarb (Temik) - a pesticide applied to soil or plants to control insects, mites or nematodes. Registered for use in 1970. Restricted use classification.

Aldicarb Sulfone - a breakdown product of aldicarb.

Aldicarb Sulfoxide - a breakdown product of aldicarb.

Carbaryl (Sevin) - a widely used, broad spectrum insecticide used on more than 1,000 different crops, trees, bushes and shrubs. Registered for use in 1958.

Carbofuran (Furadan) - a widely used, broad spectrum pesticide used to control insects, nematodes and mites in corn. Registered for use in 1969. Restricted use classification.

3-OH Carbofuran - a breakdown product of carbofuran.

Chlorpyrifos (Lorsban, Dursban or Killmaster II) - a widely used, soil insecticide used to control corn rootworms and cutworms in corn. Registered for use in 1965. Restricted use of Killmaster II.

Dimethoate (Cygon) - a systemic insecticide/acaricide used to control a wide variety of insects and mites in farm buildings, corn, soybeans and vegetables. Registered for use in 1963. All dust formulations cancelled.

Disulfoton (Disyston) - a systemic insecticide/acaricide used to control many species of insects and mites. Registered for use in 1958. Restricted use classification.

Fonofos (Dyfonate) - a widely used, pre-emergence insecticide used to control corn rootworm, wireworms, and cutworms. Registered for use in 1967. Restricted use classification.

Methyl Parathion (Metron) - a pesticide used for control of various insects. Registered for use in 1954. Restricted use classification.

Phorate (Thimet) - a widely used, soil and systemic insecticide used to control a wide range of insects in corn, soybeans and other crops. Registered for use in 1959. Restricted use classification.

Phosphamidon (Dimecron) - a systemic insecticide used against sucking insects and aphids in a variety of crops. Restricted use classification.

Terbufos (Counter) - a widely used, pre-emergence pesticide used to control rootworms, insects and nematodes in corn. Registered for use in 1974. Restricted use classification.

Fungicides

PCP or Pentachlorophenol - a wood preservative used to protect for fungus decay and termite attack. Cancelled for non-wood uses. All other uses restricted.

PCNB or Pentachloronitrobenzene - a soil fungicide and seed dressing agent used for a variety of specialty crops and lawns. Registered for use in 1954.

APPENDIX F

Ground Water Contamination Susceptibility in Minnesota.

GROUND WATER CONTAMINATION SUSCEPTIBILITY IN MINNESOTA

February 23, 1988

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EXECUTIVE SUMMARY

Introduction

The purpose of this project was to design and demonstrate a method of assessing relative susceptibility to ground water contamination in Minnesota using previously published physical resource data. The determination of ground water contamination susceptibility will be in map form and should be useful in targeting State regulatory, monitoring, planning, preventative, and public information efforts in those areas determined to be most critical.

Background Information

The parameters that control ground water susceptibility to contamination are quite varied and overlapping and include: soil media, topography, depth to water, aquifer media, vadose zone materials, net recharge, hydraulic conductivity of aquifer, hydraulic gradient, distance to nearest drinking water supply, depth to bedrock, unsaturated zone permeability and thickness, saturated zone permeability and thickness, and net precipitation. The systems that have been developed using some of the aforementioned factors are generally designed for site specific application to known contamination sites and are not useful for a statewide assessment.

The parameters chosen for this project (aquifer materials, recharge potential, soil materials, and vadose zone materials) are those which are readily derived using several published maps. The aquifer materials map was created by combining the Quaternary Hydrogeology Map with a modified version of the Bedrock Hydrogeology Map of Minnesota. The recharge potential map is a simplification of the Hydrologic Groups of Minnesota Soil Atlas data. The Minnesota Soil Atlas was also the source of information for the soil materials map. The soils data were created by combining two data sets, rooting zone and substratum, into a generalized soil materials map. Vadose zone materials are those which are unsaturated and located just below the soil horizon and above the aquifer materials. The vadose zone materials map was derived from three existing maps: Quaternary Geology Map, a modified version of the Bedrock Hydrogeology Map, and the Depth to Bedrock map, which indicates where the vadose zone is thin or absent.

Discussion

The preliminary map of susceptibility to ground water contamination delineates a variety of susceptible regions located across the State. The areas of highest ground water contamination susceptibility, as well as those designated as lowest, appear to be in general agreement with the experience of Minnesota ground water professionals.

In general, areas of highest ground water contamination susceptibility are those typically composed of:

-aquifer material: sand and gravel, sandstone, karstic limestone
-recharge potential: moderate to high
-soil materials: generally sandy soils
-vadose zone materials: sand and gravel, sandstone, and karstic limestone

The areas of lowest ground water contamination susceptibility are those which are composed of:

-aquifer materials: low yielding aquifer materials (nonaquifer on map)
-recharge potential: very low to low
-soil materials: clay to loam
-vadose zone materials: silt to clay loam or clay

The areas of the State which have received high ratings are those which are dominated by sand and gravel aquifers (predominantly in central, north-central, and east-central Minnesota) and those areas in the southeastern corner of the State which have karstic bedrock near the surface.

Future modifications, if funding is available, may include the refinement of the assessment methodology through the addition of data and new components. These components may include depth to water/thickness of the vadose zone, potential sources of contamination, and other cultural or demographic impacts.

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INTRODUCTION

Purpose and Scope

The purpose of this project was to design and implement a method of assessing relative ground water contamination susceptibility in Minnesota using published and previously compiled data. The input data, all of which is in map form, is limited to certain representative physical/hydrogeologic characteristics of the State. The product, which was to be completed in a one year period of time, is a preliminary map which may be useful in focusing State regulatory, monitoring, planning, preventative, and public information efforts on those areas which are found to be most susceptible. Also, local units of government may wish to use the methodology developed as a guideline for local studies of ground water contamination susceptibility. As a by-product, this project has identified data which is currently unavailable or uncompiled and would be needed to create a final version of the map; hence it will help focus future statewide data gathering/compilation efforts.

The assessment of ground water susceptibility to contamination is a main component of a broader, longer range effort to designate "Priority Ground Waters." This proposed effort, as staffing and funds are allocated, will include modifying and updating the physical/hydrogeologic susceptibility assessment, adding sources of impacts (potential pollution sources, land use, etc.), and severity of impacts (water use, population density, etc.).

Literature Review

DRASTIC

Many different hydrogeologic susceptibility rating systems have been developed over the past several years. With one notable exception, DRASTIC, all are designed to be used in very site specific settings. DRASTIC was developed by the National Water Well Association under contract to the United States Environmental Protection Agency (USEPA, 1985). It is one of the few systems designed to predict hydrogeologic sensitivity to surface derived contaminants in areas larger than 100 acres. This system is based on major geologic and hydrogeologic parameters including: depth to water (D), net recharge (R), aquifer media (A), soil media (S), topography (T), influence of the vadose zone (I), and hydraulic conductivity of the aquifer in question (C).

Each of the above DRASTIC parameters is weighted and each individual factor (within a given parameter) is assigned a rating on a scale of 1 to 10. A map of the area to be rated is developed, for each of the respective parameters, using available data. A numerical score is assigned to each different factor on a given parameter map. To obtain the final DRASTIC rating, all of the factors (within a specific area) are multiplied by their respective parameter weights. The parameters scores for these areas are then summed to obtain a relative DRASTIC score.

Wisconsin

The State of Wisconsin has developed a system which evaluates ground water contamination susceptibility, at a statewide scale, using geologic factors

(Schmidt, 1987). These factors include type of bedrock, depth to water table, surficial deposits, soil characteristics, and depth to bedrock. Depth to bedrock is the most critical factor and determines how much weight is given to each of the remaining factors. For example, if the depth to bedrock is less than 5 feet the type of bedrock is considered an important factor and receives a high weight. However, if the depth to bedrock is greater than 50 feet the water table is assumed to occur above the top of the bedrock. Consequently, the type of bedrock is not considered relevant and is given no weight in the scoring.

A final score is calculated by multiplying the factor weight with each respective factor score and adding the resulting values. High scores indicate areas of lower ground water contamination susceptibility.

Illinois

The Illinois State Geological Survey has developed a system for evaluating contamination potential which may result from land burial of municipal wastes and surface or near surface disposal of wastes (Berg et al., 1984). This system is based solely on geologic information which was compiled on stack unit (vertical geologic sequences) maps, representing unconsolidated and consolidated deposits, of the entire State. The limit of examination, in terms of depth, was 50 feet. The vertical sequences of materials were combined into sets of geological sequences. Unique sets were identified, then described by relating type, texture, and permeability of materials to depth, thickness, and position within the geologic sequence. Contamination potential ratings were created by comparing the ability of earth materials to accept, transmit, restrict, or remove contaminants from waste effluent.

LeGrand Method

The LeGrand method, developed by Harry LeGrand in 1964 and expanded in 1983, is used for evaluating ground water sensitivity to contamination at waste sites (LeGrand, 1964; 1983). The numerical rating of a particular site is developed from point values for distance to nearest water supply, depth to water table, water table gradient, and permeability/sorption characteristics of the materials through which water must pass. Letters representing a coded site description are used to describe the degree of confidence in the rating and two additional identifiers are used to describe miscellaneous site characteristics. For example, 18-3834ABWM describes a waste site:

-18 = total score

- -3 = distance of 150 to 299 meters to the nearest water supply
- -8 = depth of 0.5 to 1 meters to the water table
- -3 = water table gradient of less than 2 percent toward the water supply
- -4A = sand with 15 to 30 percent clay
- -B = a fair degree of confidence in the estimates of parameter values
- -W = water supply in question is a well
- -M = mounding of water table beneath a contamination site--common beneath waste sites where there is liquid input

Scores range from 0 to 32, with the highest scores indicating that the site is sensitive to ground water contamination.

New Jersey

The New Jersey Geological Survey has developed a very comprehensive ground water pollution priority system, which evaluates a pollution site's threat to ground water quality (Hutchinson and Hoffman, 1983). The first of two stages examines the physical setting and hydrogeologic characteristics. These include: distance and direction to the nearest water well, distance to nearest surface water, background water quality, recharge, unsaturated zone thickness and permeability, saturated aquifer thickness, saturated zone permeability, hydraulic gradient, depth to bedrock, and population served by endangered aquifer(s). The second stage evaluates waste characteristics: length of time the source has existed, diversity of highly toxic chemicals and known or suspected carcinogens, toxicity, radioactivity, persistence, compound mobility, hazardous waste quantity, and total waste quantity (Hutchinson and Hoffman, 1983). Each of these factors is assigned points based on a rating scale (0 to 3 points). These are summed and divided by the total possible score to give an overall site score. The relative score allows managers to allocate limited resources to those sites which are thought to have the highest potential danger.

Hazard Ranking System

The Hazard Ranking System (HRS) was developed by the USEPA to evaluate the relative potential of uncontrolled hazardous substance facilities to cause health or safety problems, or ecological and environmental damage using existing data (USEPA, 1985). One of the primary goals of this system is to apply uniform technical judgement to all potential hazards presented by a facility relative to other facilities. This system examines the potential harm caused by contaminants migrating through ground water, surface water, and air. Ground water migration of contaminants is of primary concern and includes factors such as: depth to aquifer, net precipitation, permeability of geologic materials, distance to nearest well, population served, and various waste characteristics. Scores for the ground water, surface water, and air portions of the ranking are added to give the overall site scores. The scores from sites nationwide are used to determine which sites should be the highest priorities for further investigation under the Superfund program.

USEPA Surface Impoundment Assessment

The USEPA Surface Impoundment Assessment was developed to locate surface impoundments across the country and to evaluate the ground water contamination potential these facilities present (USEPA, 1983). The ground water contamination potential is based on unsaturated zone permeability and thickness, saturated zone permeability and thickness, existing ground water quality, and contaminant hazard potential rating. The facilities are assigned numerical ratings based on hydrogeologic factors. These factors are summed to yield priority scores which are relative to other sites.

SELECTION OF COMPONENTS

The number of possible input components in a hydrogeologic susceptibility assessment is virtually infinite. The site specific and regional assessments cited previously have included both physical/hydrogeologic and cultural factors such as: depth to water, distance to known or potential contamination sites, soil type, land use, population density, topography, net recharge, hydraulic gradient, aquifer type, vadose zone material, aquifer material, presence of low permeability units, time of travel zones, depth to bedrock, average rate of water withdrawal from wells in a given area, saturated zone thickness, well density, and occurrence of low pH units.

For the Minnesota project, an interagency work group was formed to identify which of the many possible factors were the most feasible to use for statewide mapping. This work group was led by the author and was composed of representatives from the Minnesota Departments of Health, Agriculture, Natural Resources, Transportation; Minnesota Pollution Control Agency, Metropolitan Council, Minnesota State Planning Agency, Minnesota Geological Survey, and the United States Geological Survey. The physical/hydrogeologic and cultural factors used in composing the ground water contamination susceptibility map were selected using three criteria: (1) perceived importance of the factor in controlling ground water movement; (2) availability of data on a statewide basis; and (3) cost of entering data on a computerized database. The work group concluded, due to time and funding considerations, to limit the current project solely to physical/hydrogeologic characteristics. This system will be used as a foundation on which future data elements, including sources and severity of impacts, may be added.

Several additional interagency meetings were conducted to decide which characteristics were most desirable for a statewide assessment. After a series of exercises to rank the characteristics in order of importance, the work group determined that the most desired characteristics are: depth to water, aquifer materials, vadose zone materials, net recharge, and soil type. However, depth to water could not be included at this time as this information is contained in tens of thousands of individual well logs and has not been compiled or mapped.

This project is intended to deal with and apply to all potential contaminants in a generic sense. The differences and complexities in the physical/chemical characteristics of both the earth materials and contaminants are acknowledged; however, it is beyond the scope of a regional project such as this one to deal with these different contaminant behaviors. Susceptibility in this project deals solely with the ability or limitation of the physical resource to inhibit advective vertical/horizontal movement of contaminants due to its grain size or texture and structure (i.e., permeability). Chemical/biological controls on contaminant movement could be incorporated for various contaminant types in the future, if desired.

Digitization

Three existing geologic maps were digitized specifically for this project: Paleozoic Lithostratigraphy of Southeastern Minnesota (Mossler, 1983), Geologic Map of Minnesota - Depth to Bedrock (Olsen and Mossler, 1982), and Geologic Map of Minnesota - Quaternary Geology (Hobbs and Goebel, 1982). Digitization is the process whereby data represented on a given map is converted into a computerized data file. Before the digitization process begins the major latitude and longitude coordinates are "matched" to other maps in the computer file in order to minimize the distortion and maximize the consistency of the computerized product. Each map unit boundary is electronically scanned and the location of that boundary is continuously recorded in a computer file. Each portion of the map is then divided into "grid cells." In this case the grid cell size chosen was 40 acres in order to minimize the "blockiness" of the map. Grid cell files are organized into rows and columns and each cell is assigned a class value which represents a characteristic of a particular location. Each file contains data related to only one characteristic, such as soil or aquifer material.

Data Limitations

The data limitations for this project were dictated by those of the published source maps. The first limitation one must consider when using a map is the map scale. The Quaternary Geology and Hydrogeology Maps, Bedrock Hydrogeology Map, and Paleozoic Lithostratigraphy of Southeastern Minnesota were published at 1:500,000 (1 inch = 8 miles) and the Depth to Bedrock and the Minnesota Soils Atlas were published at 1:1,000,000 (1 inch = 16 miles) and 1:250,000 (1 inch = 4 miles), respectively. None of these maps displays a unit which is less than one square mile in area. Thus, one can conclude that the "resolution" or accuracy of data depicted on these maps is probably limited to the minimum size of any map unit shown. Secondly, all of the source maps depict relatively large map units which are characterized by the predominant material type. Clearly, a more detailed examination of these broad areas would show that in many cases they are in fact quite heterogeneous. These variations are not shown due to either the inability to depict these areas on a large map scale or the general lack of detailed data. Also, some interpretations shown on the source maps were either derived from other publications or from data which have not been field verified. The end result of all this is that interpretations of published data have been made based on the assumption that this data is reasonably accurate at the State scale. Since some of the original sources of information are not well documented there is a certain degree of uncertainty regarding the accuracy of the data maps. This uncertainty carries over to the component maps and consequently the compilation map.

The component and compilation maps created by this project appear to have a resolution which was determined by the grid cell size (40 acres). However, the actual resolution of a given map is in fact not determined by the grid cell size, but is controlled by the density at which data was collected and hence the scale of the map. For example, a map drawn at a scale of 1:64,000 (1 inch = 1 mile) can have a resolution eight times greater than a map at a scale of 1:500,000 (1 inch = 8 miles). The majority of the source maps used for this project were published at a scale of 1:500,000. Therefore maps completed as a part of this project will be useful only for regional appraisals. These maps are not usable for extrapolation to more localized levels (county or township).

COMPONENTS

Aquifer Materials

For purposes of this project aquifer materials refers to the aquifer nearest the land surface and is composed of consolidated or unconsolidated materials such as sand, gravel, and porous or fractured bedrock which yield sufficient quantities of water for use. Water in aquifers is contained within the pore spaces of granular and terrigenous sediments (e.g., sand and gravel, sandstone) and in fractures and solution openings of nonterrigenous sediments (e.g., limestone and dolomite). When a contaminant reaches the water table or aquifer, the aquifer materials control the rate, direction, and path length that a contaminant will travel. The direction a contaminant travels may be partially determined by fractures or solution openings and the location of low permeability zones. Generally speaking, larger grain sizes and a higher percentage of solution openings within an aquifer are indicative of greater permeabilities and an increase in the ground water contamination susceptibility.

Maps used to construct this component map were: Hydrogeologic Map of Minnesota - Quaternary Hydrogeology, Hydrogeologic Map of Minnesota - Bedrock Hydrogeology, and Paleozoic Lithostratigraphy of Southeastern Minnesota. The initial step was to modify the hydrogeology represented on the east central and southeastern portions of the Bedrock Hydrogeology Map using the more up-to-date information from the study of Paleozoic Lithostratigraphy of Southeastern Minnesota. The geologic formations interpreted to be bedrock aquifer confining units were reclassed to be the stratigraphically lower aquifer units. The surficial and buried drift aquifers delineated on the Quaternary Hydrogeology Map were given highest priority in terms of map unit representation, and those areas labeled as nonaquifer on the Quaternary Hydrogeology Map were classified as the units found on the modified Bedrock Hydrogeology Map. Areas labeled as nonaquifer are those which are Precambrian igneous and metamorphic rocks which yield sufficient quantities of water on a local basis only. The modified Bedrock Hydrogeology Map was subsequently combined with the Quaternary Hydrogeology Map and reclassed to be representative of the aquifers in Minnesota (Figure 1).

The factors shown on the aquifer materials map are composed of the following units:

a. Nonaquifer - are most of those rocks shown as Precambrian igneous and metamorphic on the Bedrock Hydrogeology Map of Minnesota. These rocks are given a low rating because they serve as an aquifer on a local basis only and the types of zones from which water is withdrawn are not well know in areal extent.

b. Shaly Sandstone - is the Cretaceous age aquifer unit. This aquifer is often thin and discontinuous in southwestern Minnesota and is often confined by either shale or glacial till and hence the ground water contamination susceptibility is interpreted as being low.

c. Metamorphic/Igneous - this factor includes geologic units found in southwestern and northeastern Minnesota: the Biwabik Iron Formation

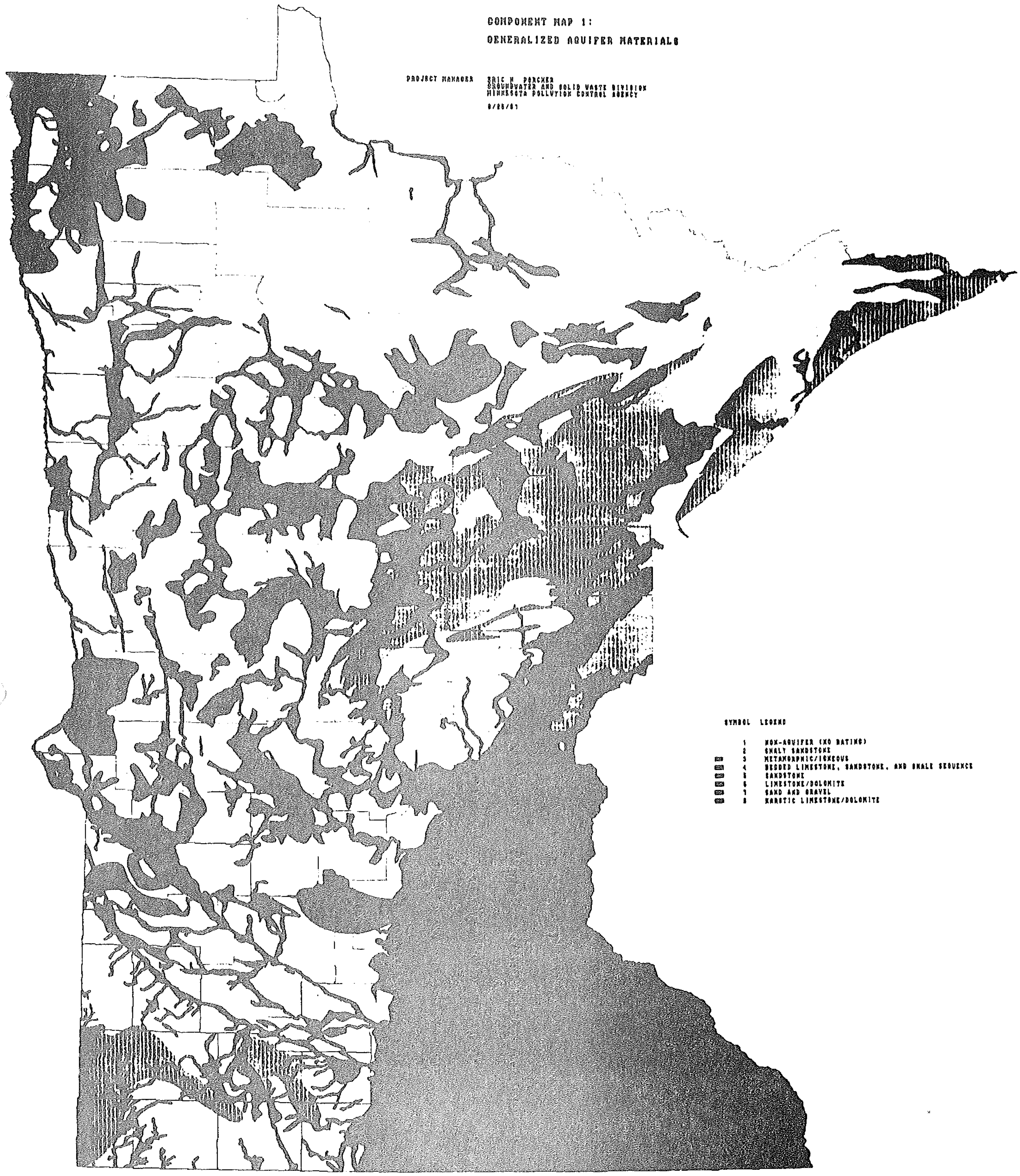

Figure 1. Aquifer Materials Component Map

(ironbearing chert), Keweenawan Volcanics (basaltic lava flows), Sioux Quartzite (orthoquartzite), and Proterozoic Metasedimentary rocks (thinly bedded argillite, slate, and metagraywacke). The water in these rocks is usually contained in fractures and therefore the ground water contamination potential is assumed to be low even though the extent of the fractures, joints, and solution (and also the degree of interconnection) features is not known.

d. Bedded Limestone, Sandstone, and Shale - typically thin bedded rocks comprise the Red River-Winnipeg Formation. Although ground water from this aquifer yields saline water the ground water contamination susceptibility is assumed to be low even though the extent of the fractures, joints, and solution features are not known.

e. Sandstone - generally thick sandstone deposits including the St. Peter Sandstone, Jordan Sandstone, Franconia-Ironton-Galesville Sandstones, and the Mt. Simon-Hinckley Sandstone. These sandstones usually contain both intergranular and fracture porosity and hence are placed in the moderate range.

f. Limestone/Dolomite - consists solely of the western nonkarstic portions of the Prairie du Chien Group carbonates which are usually thin to thick bedded limestone and dolomite. The ground water contamination susceptibility is highly dependent on the degree of fracturing found in this rock type.

g. Sand and Gravel - a textural description composed of sand and gravel sized particles which contain various amounts of fine particles. The ground water contamination potential is primarily dependent on the percentage of coarse grained particles.

h. Karstic Limestone/Dolomite - a lithified carbonate rock which has existed under conditions of dissolution so that caverns and fractures have formed and become interconnected. Included are those areas of Minnesota where the first aquifer unit is considered to be either the Cedar Valley Formation, Maquoketa-Dubuque-Galena Formations or the eastern portion of the Prairie du Chien Group carbonates.

The ratings for the factors found in the aquifer materials are based in part on DRASTIC and also on the generalized hydraulic conductivity values found in Kanivetsky and Walton (1979).

Ratings for "Aquifer Media"

FACTOR	RATING
Nonaquifer	1
Shaly Sandstone	3
Metamorphic/Igneous	4
Bedded Limestone, Sandstone, and Shale Sequences	5
Sandstone	6
Limestone/Dolomite	7
Sand and Gravel	9
Karstic Limestone/Dolomite	10

Recharge Potential

The source for virtually all ground water is precipitation which infiltrates the ground surface and presumably reaches an aquifer. Recharge potential is the amount of water which may penetrate the ground surface relative to other areas of the State. The implication here is that water recharging an aquifer may transport a contaminant vertically towards and horizontally within an aquifer. In areas where aquifers are confined by over and underlying low permeability units the ground water may in fact be partially protected from any infiltrating contaminants. For those aquifers which are confined the amount of recharge is a function of the degree of confinement and also the location of the principal recharge area. In any case, the recharge water may be the principal media by which contaminants are dissolved and consequently transported. In theory then, the amount of recharge is directly proportional to the ground water contamination potential.

Recharge potential (Figure 2) is the modification of hydrologic soil groups from the Minnesota Soil Atlas Series. A hydrologic soil group is defined as a group of soils having the same runoff potential under similar storm and cover conditions. Properties of bare soils which influence the minimum rate of infiltration after prolonged wetting are depth to seasonally high water table, intake rate, slope, permeability after prolonged wetting, and depth to a very low permeable layer (USDA, 1983). Any influence that ground cover may have is not taken into consideration.

The infiltration rates of the hydrologic soils group were interpreted to be directly proportional to recharge potential (areas with high infiltration rates are equal to high recharge potential, etc.). Where multiple hydrologic groups existed in a given area a conservative estimate was made regarding the classification.

The factor ratings for recharge potential are based on derived data and hence are nonquantitative:

Ratings for "Recharge Potential"

FACTOR	RATING
No Rating	0
Very Low	1
Low	3
Moderate	6
High	9

Soil Materials

Generalized soil materials, for purposes of this document, refers to the uppermost 6 feet of the earth's surface. Soils are thought to be an important consideration in the assessment of ground water contamination susceptibility because they may have a significant impact on the amount of water which may infiltrate the ground and consequently the ability of a contaminant to move vertically towards the saturated zone or ground water. Generally speaking the ability of a soil to restrict flow of water is controlled by its texture (i.e.,

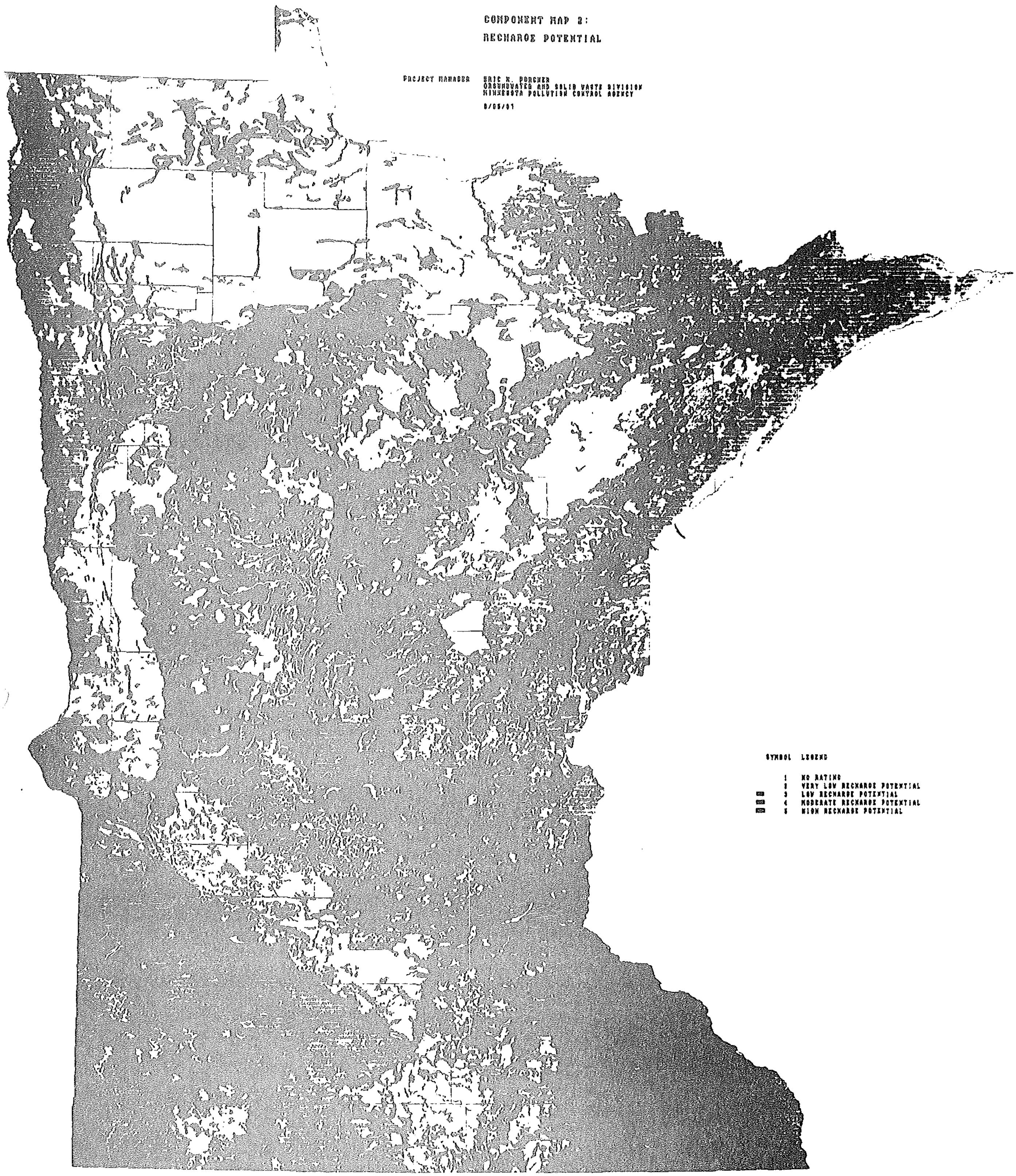

Figure 2. Recharge Potential Component Map

grain size) and the amount of clay present. The general philosophy here is that smaller grain sizes (and therefore smaller permeabilities) result in a decreased ground water contamination susceptibility.

The Minnesota Soil Atlas is organized into rooting zone and substratum data sets. Due to the complexity of these data sets a soil scientist combined these data into seven different soil types, thus simplifying the data somewhat (Figure 3).

The soil material descriptions are listed as follows:

a. Clay - a soil textural classification which is characterized by 0 to 40 percent silt, 0 to 45 percent sand, and 55 to 100 percent clay. The fact that a clay, depending on its mineralogy, may shrink or swell is acknowledged but is not taken into consideration. This type of soil texture has the lowest rating in terms of ground water contamination susceptibility.

b. Clay loam - a soil textural classification which is characterized by 15 to 55 percent silt, 27 to 40 percent clay, and 20 to 45 percent sand. Since this soil has the potential of having a fairly high percentage of clay, and therefore low permeability, it has a low contamination susceptibility.

c. Silt loam - a soil textural classification characterized by 50 to 85 percent silt, 12 to 27 percent clay, and 0 to 50 percent sand. The protection provided by this soil is relatively high. However, due to its typically lower clay content it is rated higher than clay loam.

d. Loam - the textural class having moderate amounts of sand (22 to 52 percent), silt (27 to 50) percent, and clay (5 to 25) percent). The ground water pollution potential is generally considered to be moderate because of the clay and silt content.

e. Sandy loam - a soil textural classification characterized by 15 to 20 percent clay, 0 to 50 percent silt, and 45 to 85 percent sand. The higher percentage of sand is perceived to increase the contamination susceptibility.

f. Peat - defined as an unconsolidated material consisting largely of undecomposed, or only slightly decomposed, organic matter accumulated under conditions of excessive moisture. Although the flow regimes in peatlands are not well known and its association with ground water may be somewhat questionable, peat nevertheless receives a high rating simply because of its proximity to saturated conditions.

g. Sand - a textural classification based partially on grain sizes of between 0.05 mm (millimeter) and 2 mm diameter mineral or rock fragments, clay content of less that 15 percent, and sand size particles greater than 85 percent.

h. Thin or Absent - for purposes of this study this implies the absence of soils or soils which are less that 2 feet thick and thus are ineffective in retarding the vertical flow of contaminants.

Again, the factor ratings were based heavily on DRASTIC which uses the percent clay content as the basis for the ratings:

Ratings for "Generalized Soil Materials"

FACTOR	RATING
No Rating	0
Clay	2
Clay Loam	3
Silt Loam	4
Loam	5
Sandy Loam	6
Peat	8
Sand	9
Thin or Absent	10

Vadose Zone Materials

Vadose zone materials refer to that zone above the water table which is unsaturated. This definition is suitable when applied to all water table aquifers. However, in cases where a confined aquifer is being evaluated the vadose zone may be represented by an aquitard even though saturated conditions may exist above this aquitard. The vadose zone materials control the potential downward migration of contaminants with respect to the path length, velocity, and direction. Fracture and solution features may exert a strong influence on the velocity and direction a contaminant may take, however, where these features are not present the texture (i.e., permeability) of the material in question is the important factor.

The component map was constructed by using: Geologic Map of Minnesota - Quaternary Geology, Geologic Map of Minnesota - Depth to Bedrock, Paleozoic Lithostratigraphy of Southeastern Minnesota, and Geologic Map of Minnesota -Bedrock Hydrogeology. As in the aquifer materials map, the Bedrock Hydrogeology Map was modified (including confining units) in east-central and southeast Minnesota using the Paleozoic Lithostratigraphy of Southeastern Minnesota map.

The respective units from each of the maps were then combined via a 3-way frequency count which compares the frequency of occurrence of the units in a specific area. The Quaternary Geologic materials were interpreted to be the representative vadose zone materials in the majority of the State except: where the surficial materials were termed thin or absent on the Quaternary Geologic Map, and areas on the Depth to Bedrock map where there are "more or less continuous exposures of bedrock." In these areas the vadose zone was assumed to be the bedrock unit as depicted on the modified Bedrock Hydrogeology Map (Figure 4).

The vadose zone materials are described by either their textural or rock unit names:

a. Clay - a textural classification which is characterized by 0 to 40 percent silt, 0 to 45 percent sand, and 55 to 100 percent clay. This

Figure 3. Soil Materials Component Map

Figure 4. Vadose Zone Materials Component Map

unit is given a low contamination susceptibility rating because of its high clay content.

b. Clay Loam - a textural classification which is representative of Wisconsinian age glacial tills. It commonly contains up to 50 percent clay (Hobbs, 1987) and is therefore given a low contamination susceptibility rating.

c. Precambrian Igneous and Metamorphic - a generic rock unit name used to describe Precambrian age rocks with dominantly fracture porosity. This unit receives a low rating because the areal extent and distribution of the fractures is unknown.

d. Bedrock Aquifer Confining Units - confining units typically composed of siltstone, shale, shaly dolomite and sandstone which include: Decorah-Platteville-Glenwood Formations, St. Lawrence/Franconia Formations, and the Eau Claire Siltstone. These are considered to be aquitards and therefore are given a relatively low rating.

e. Silt - a textural class that is composed of 80 percent or more of silt and less than 12 percent clay with a size range of 0.002 mm to 0.05 mm. Comtamination potential of this unit is moderate due to the low percentage of clay and overall grain size.

f. Loam - the textural class having moderate amounts of sand (less than 52 percent), silt (27 to 50 percent), and clay (5 to 25 percent). The ground water contamination susceptibility is higher because of lower percentages of silt and clay.

g. Shaly Sandstone - a consolidated shale rich sandstone with moderate amounts of intergranular porosity referred to generically as the Cretaceous Aquifer. The ground water contamination susceptibility is moderate, however, it may increase with the incidence of fracturing.

h. Other Metamorphic/Igneous - this factor includes a wide variety of rocks: iron bearing chert, orthoquartzite, basaltic lava flows, thinly bedded argillite, slate, and metagraywacke. All of these rock types (Biwabik Iron Formation, Sioux Quartzite, Keweenawan Volcanics, and Proterozoic Metasedimentary) have significant amounts of fractures, faults, joints and solution channels. The moderate rating is primarily due to the fractures and faults even though the extent of these features are not known.

i. Sandy Loam - a textural classification characterized by 15 to 20 percent clay, 0 to 50 percent silt, and 45 to 85 percent sand. The higher percentage of sand increases the contamination susceptibility.

j. Sandstone - consolidated rock units including the St. Peter Sandstone, Jordan Sandstone, Ironton-Galesville Sandstone, Mt. Simon-Hinckley Sandstone. These hydrogeologic units are characterized by fine to coarse grains of quartz with good intergranular porosity. The high percentage of clean well sorted sand indicates a high pollution potential.

k. Sand - an unconsolidated deposit with a textural classification based on grain size between 0.05 mm and 2 mm with clay content of less than 10 percent, silt less that 15 percent, and sand greater than 85 percent. The very low percentage of silt and clay and therefore very low retardation of vertical movement of fluids provide little protection from contaminants.

l. Limestone/Dolomite - consists solely of the western portions of the Prairie du Chien Group carbonates and typically are comprised of thin to thick bedded limestone and dolomite. The ground water contamination susceptibility is highly dependent on the degree of fracturing found in this rock type.

m. Sand and Gravel - a textural classification consisting of a mixture of 0.05 mm to 32 mm sized particles. This unconsolidated deposit consists of minor amounts of silt and clay which depending on the percentage present may have a profound impact on the ground water susceptibility rating given this unit.

n. Peat - defined as an unconsolidated material consisting largely of undecomposed or only slightly decomposed organic matter accumulated under conditions of excessive moisture. Although the flow regime in peatlands is not well understood and their association with ground water may be somewhat questionable, peat nevertheless receives a high rating simply because it indicates that there is no vadose zone present.

o. Karstic Limestone/Dolomite - a consolidated rock which has extensive solution enlarged cavities, channels, and sinkholes. In Minnesota, the karstic unit includes the eastern portion of the Prairie du Chien Group carbonates, Cedar Valley Formation, and Maquoketa-Dubuque-Galena Formations. The ground water contamination susceptibility is considered to be very high because the solution features are essentially a direct conduit to the ground water.

The ratings for each of the factors, based in part on DRASTIC, are:

Ratings for "Vadose Zone Materials"

FACTOR	RATING
No Rating	0
Clay	2
Clay Loam	3
Precambriam Igneous and Metamorphic	3
Bedrock Aquifer Confining Units	4
Silt	4
Loam	5
Shaly Sandstone	5
Other Metamorphic/Igneous	5
Sandy Loam	5
Sandstone	6
Sand	6
Limestone/Dolomite	7
Sand and Gravel	8
Peat (No Vadose Zone)	10
Karstic Limestone/Dolomite	10

COMBINATION OF FACTORS

The previously described parameters were combined into a single computer file in order that relative values could be assigned to each of the unique hydrogeologic areas of the State. This computer file is simply a list of 4 and 5 digit numbers which represent the various combinations of parameters (and their respective factors). Each of the numbers (ones, tens, hundreds, thousands, and ten thousands column) is representative of a specific physical characteristic and its appropriate numerical rating as listed in the previous sections (Note: the numerals shown in the respective columns are not necessarily their rank value). The rank values were summed via computer to give a relative total. The range of actual values (lowest = 6; highest = 37) is 31 which was divided by five to obtain five nearly equal classes (Figure 5). For example, the number 1289 represents:

- -ones column - high recharge potential = 9 points
- -tens column - sandy soil materials = 9 points
- -hundreds column - shaly sandstone aquifer material = 3 points
- -thousands column - sand and gravel vadose zone materials = 9 points

The total score for this unique set of characteristics is 30 out of 39 possible points. In Minnesota well over 1000 unique combinations of physical characteristics exist (Appendix).

Classes	Summation of Respective Ranks
Lowest Ground Water Contamination Susceptibility	6 - 11
------	12 - 17
------	18 - 23
------	24 - 29
Highest Ground Water Contamination Susceptibility	30 - 37

Figure 5. Ground Water Contamination Susceptibility Rating Scheme

DISCUSSION

The assessment of ground water contamination susceptibility at the State scale is complicated and limited by the lack of accessible and already mapped data and the highly variable hydrogeology of the State. However, it is possible to depict ground water contamination susceptibility, using an evaluation system at the State scale.

The preliminary map of ground water contamination susceptibility delineates a variety of susceptible regions across the State (Figure 6). Areas of highest ground water contamination susceptibility, as well as those designated as lowest, appear to be in agreement, in a general sense, with the experience of several professionals who are familiar with contamination problems in the State of Minnesota.

The DRASTIC derived system has defined areas of highest contamination susceptibility as those typically composed of:

- -aquifer materials: sand and gravel, sandstone, karstic limestone
- -recharge potential: moderate to high
- -soil materials: generally sandy soils
- -vadose zone materials: sand and gravel, sandstone, karstic limestone.

The areas of lowest ground water contamination susceptibility are those which are composed of:

- -aquifer materials: low yielding aquifer material (nonaquifer)
- -recharge potential: very low to low
- -soil materials: clay to loam
- -vadose zone materials: silt to clay loam or clay

In general, areas of the State which have received high ratings are those which are dominated by sand and gravel aquifers (central, north-central, and east-central Minnesota) and those areas in the southeastern corner of the State which have abundant karstic bedrock near the surface (Figure 6).

In most areas, the system appears to be a reasonable and useful portrayal of ground water susceptibility to contamination. However, in southeastern Minnesota, and possibly in other areas, the soil materials may have had too much influence in lowering the contamination susceptibility rating. Soils in this area of the State are generally quite thin over karstic or sandstone bedrock, silty in texture and would tend to produce a low rating. An article by William Mueller (1987), which focuses on pesticide and nitrate contamination of ground water in the Big Springs Basin of northeastern Iowa, suggests that pesticides and nitrates may migrate through the soil much more rapidly than was previously thought. Chemicals in solution are thought to move through the soil along pathways such as root holes, worm burrows, and minute crevices, thereby by-passing the micro-pores which may act more effectively as a filtering mechanism. One of the questions which needs to be asked is: if soil materials are less effective in inhibiting vertical flow of pesticides and nitrates are they equally ineffective for other types of contaminants?

Regional projects such as this are useful for general planning, regulation, education, and ground water contamination prevention efforts involving or affecting the entire State. Extreme care must be taken to inform potential users of the preliminary compilation map of its limitations. Regional maps are usually adequate for large scale appraisals and are not to be directly extrapolated to the county or local level for use in zoning, siting, regulation, other activities that require more detailed mapping (Kanivetsky and Olsen, 1986).

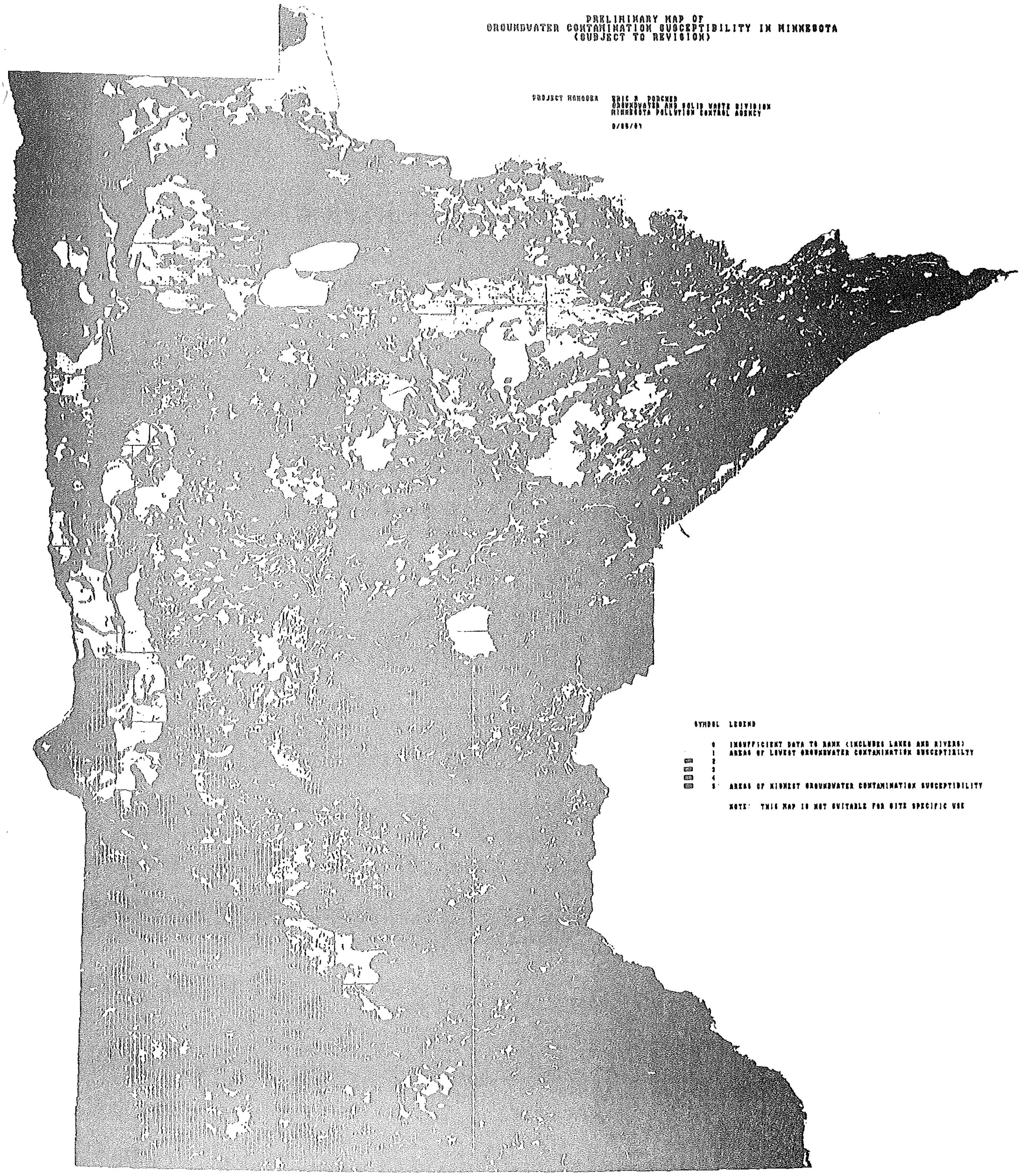

Figure 6. Ground Water Contamination Susceptibility Map

CONCLUSION

The ground water contamination susceptibility assessment method employed at the statewide scale is effective in delineating broad areas of varying sensitivity. Areas in Minnesota which are considered to have a relatively high susceptibility are those which are characterized by:

- -aquifer material: sand and gravel, sandstone, karstic limestone
- -recharge potential: moderate to high
- -soil materials: generally sandy soils
- -vadose zone materials: sand and gravel, sandstone, karstic limestone

The areas of lowest ground water contamination susceptibility are those which are composed of:

- -aquifer materials: low yielding aquifer material (non aquifer)
- -recharge potential: very low to low
- -soil materials: clay to loam
- -vadose zone materials: silt to clay loam or clay

The apparently high degree of resolution depicted on the component and compilation maps is misleading because of the type of graphic display data base used during the development process. Although the data is displayed in 40 acre "grid cells" the minimum size of a map unit should more likely be one square mile due to the accuracy or data density of the reference publications. Therefore, the usefulness of this project currently is limited to statewide planning, regulatory, monitoring, and public information/education efforts. Local units of government attempting to determine the hydrogeologic sensitivity of specific geographic areas, for purposes of local water planning, may find the methodology useful strictly as a guideline for the types of criteria needed for local assessments.

RECOMMENDATIONS

During the review process of the preliminary component and compilation maps several professionals from the various State and federal agencies, who were familiar with this project, were asked what measures could be taken to improve the quality of this ground water contamination susceptibility assessment. The questions asked, and answers received, are as follows:

1. What additional physical/hydrogeologic factors need to be included in future revisions of a statewide assessment such as this one?
   a. Depth to water and low permeability units, depth to bedrock, slope or topography.
   b. Depth to water, particularly in areas of the State dominated by surficial deposits.
   c. Quantitative values for recharge rate and depth to water, however this is very difficult to do.
   d. More detailed soils data.
   e. Depth to water.
   f. Thickness of vadose zone/depth to water.

2. Should any cultural factors (land use, population density, etc.) be included? If so, which ones?
   a. Land use.
   b. Ground water usage (domestic, industrial, or agricultural).
   c. Land use, population density.
   d. None - makes the assessment too complex.
   e. Potential sources of contamination (landfill sites, hazardous waste facilities, etc.), land use, inventory of contamination (permitted and unpermitted sources).
   f. No - leave it up to the individual or agency using the maps, since each application will have varying needs.
   g. Water use, land use (especially landfills and Superfund sites), health risk of specific contaminant types.

3. Are there any portions of the State which you feel should be treated separately (e.g., southeastern and northeastern Minnesota)? [This question was motivated by some work group members feeling that shallow karstic or fractured bedrock may be an overriding factor in a susceptibility assessment.]
   a. No.
   b. No, treat the State as a whole, leave separate parts for regional studies.
   c. Perhaps the southeastern portion of Minnesota.
   d. No, not in a statewide assessment.
   e. No.
   f. No, that would be a different type of project.
   g. No.

4. Should peat be treated as surface water or ground water? [Peat covers over 9000 square miles in Minnesota and varies in type, thickness, structure and permeability.]
   a. Don't know.
   b. Don't know how to rate it.

c. Not sure, probably should be treated as surface water.
d. Peat is a porous media that contains water so therefore it should be treated as ground water.
e. Not sure.
f. There is no good answer - there is too much variability in peat types.
g. Don't know.

5. Will this map(s) be useful to your agency in any way?
   a. Maybe for prioritizing data collection efforts.
   b. Possibly as an education tool and in regulatory efforts.
   c. Education tool and to compare with other vulnerability assessments.
   d. No, need more site specific data.
   e. Yes as a management tool and for large scale planning.
   f. Possibly use it for prioritizing which areas of the State need more water quantity controls.
   g. Yes, not exactly sure how it will be used yet.

6. Any other suggestions for improvement?
   a. Indicate what the mappable resolution is.
   b. Arbitrarily assign peat to a midpoint in the ranking scheme.
   c. Reassess the significance of soils or vadose zone materials over karstic bedrock. Soils have too much emphasis on the overall ranking system--need to weight them less. Limestone/dolomite, sand and gravel, sandstone, and karstic limestone should have equal ratings.
   d. Fill in data gaps, reassess ratings in northwestern Minnesota.
   e. Areas containing karstic limestone should automatically be given the highest rating possible. Reduce the rating assigned to peat.
   f. Nonaquifer portions of the aquifer materials map need to be reevaluated. Recharge potential needs to be combined with precipitation to come up with a better map. Need to address the varied degrees of protection offered by the different thicknesses of vadose zone materials.
   g. Nonaquifer portion of the aquifer materials map needs to be given a higher rating.

Numerous things could be done to improve the map of susceptibility to ground water contamination in Minnesota. Of primary importance is to fill in data gaps on the component maps. For example, the aquifer materials map has large areas of the State classified as nonaquifer. In many areas of this class it is thought that sand and gravel aquifers, both surficial and buried drift, exist. Unfortunately these aquifers have either not been mapped, have not been digitized, or there simply is no information documented in the literature (published or unpublished). The first step in correcting the lack of data problem is to conduct a literature search for any information regarding surficial and buried drift aquifers in the State of Minnesota. Secondly, if information is available, it should be used to modify the component map in order to reduce the area of the State which is unclassified. Finally, if no usable data is known to exist in specific areas or regions, it is recommended that additional inventories of the physical resources of the State of Minnesota be conducted at a scale useful to county or local units of government. This data would then be useful for both county and local management planning activities and for statewide data bases.

The recharge potential component may be improved through the addition of statewide precipitation-evapotranspiration data to the map. There may be areas of the State with equal recharge potential because of similar textures through the vertical profile; however, the average precipitation and evapotranspiration in these areas may be vastly different. In essence then, these areas may have been inadvertently rated the same even though the amount of recharge water available may be significantly different.

The validity of weighting soil materials equally with other factors in a ground water contamination susceptibility assessment needs to be examined in light of the article by Mueller (1987). Data from several different types of site specific contamination events need to be scrutinized in order to determine what effect, if any, soils have on surface or near surface derived contaminants. It may also be desirable to look further at the weighting of all input parameters.

In addition to refining the existing component maps, overall improvement of the methodology may be achieved by using a greater number of physical parameters. For example, it is thought that a component such as depth-to-water or thickness of the vadose zone is vital to the ground water contamination susceptibility assessment of a region. Depth-to-water is believed to be important because it determines the distance or amount of material a contaminant must travel through in order to reach the ground water. Greater distances presumably increase both the amount of time it takes for a contaminant to reach the saturated zone and the amount of soil or rock material the contaminant will migrate through. Hence greater distances increase the opportunity for attenuation. The development of this type of a component map would require the involvement of an agency with geologists/hydrogeologists who are experienced in the design of regional data maps. In Minnesota, a cooperative work agreement could be reached with either the Minnesota Geological Survey or the United States Geological Survey.

The assessment of ground water susceptibility to contamination is proposed to be the main component of a broader, longer-range effort to designate "Priority Ground Waters." When staffing and funds are allocated for this effort, it will be necessary to include nonphysical parameters in order to "prioritize" ground water. These parameters could include sources of impacts (potential pollution sources, land use, etc.) and severity of impacts (water use, population density, etc.).

Finally, the assessment of ground water contamination susceptibility at a statewide scale is a first order attempt at interpreting existing published data. This type of study is useful in broad-scale planning, education and management efforts. Ideally, susceptibility assessments should be conducted on a more local basis such as the township or county level. These types of studies will provide the detailed information needed for local planning, protection, management, and education projects. The major obstacle is the cost, time, and manpower required to complete such a study in all 87 Minnesota counties. However, through creative funding and cooperative efforts with the appropriate governmental units this objective could be achieved.

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APPENDIX

Key to four and five digit numbers (Note: the numerals shown in the respective columns are not necessarily their rank value):

Thousands and ten thousands column (vadose zone materials)

1000 = sand and gravel - 9 points
2000 = sand - 6 points
3000 = sandy loam - 5 points
4000 = silt - 4 points
5000 = loam - 5 points
6000 = clay loam - 3 points
7000 = clay - 2 points
8000 = shaly sandstone - 5 points
9000 = karstic limestone - 10 points
10000 = bedrock aquifer confining units - 4 points
11000 = sandstone - 6 points
12000 = limestone - 7 points
13000 = other metamorphic/igneous rocks - 5 points
14000 = Precambrian igneous and metamorphic rocks - 3 points
15000 = peat (no vadose zone) - 10 points
16000 = no rating - 0 points

Hundreds column (aquifer materials)

000 = nonaquifer (low yielding aquifer) - 1 point
200 = shaly sandstone - 3 points
300 = metamorphic/igneous - 4 points
400 = bedded limestone, sandstone, and shale sequences - 5 points
500 = sandstone - 6 points
600 = limestone/dolomite - 7 points
700 = sand and gravel - 9 points
900 = karstic limestone - 10 points

Tens column (soil materials)

00 = no rating - 0 points
10 = water - 0 points
20 = clay - 2 points
30 = clay loam - 3 points
40 = silt loam - 4 points
50 = loam - 5 points
60 = sandy loam - 6 points
70 = peat - 8 points
80 = sand - 9 points
90 = thin or absent - 10 points

Ones column (recharge potential)

0 = no rating - 0 points
2 = very low - 1 point
4 = low - 3 points
6 = moderate - 6 points
9 = high - 9 points

The various scores and their respective physical characteristic "codes" tabulated for the State of Minnesota are listed as follows:

Score	Code
6 =	7022
7 =	6022, 14022
8 =	4022, 6032, 7024
9 =	4032, 6024, 6042, 6222, 7034, 14024, 14042
10 =	2022, 4024, 4222, 6034, 6052, 6232, 6322, 7062, 14052
11 =	2032, 4034, 4232, 4322, 5024, 5042, 6044, 6062, 6224, 6242, 6332, 7026, 7054, 7324, 14062
12 =	2024, 2042, 2222, 4044, 4062, 4224, 4242, 4332, 5034, 6054, 6234, 6252, 6324, 6342, 6432, 6522, 7036, 7064, 7072, 13322, 14026, 14054
13 =	1022, 2034, 2052, 2232, 2322, 3062, 4234, 4252, 4432, 4522, 5044, 5332, 6036, 6064, 6072, 6244, 6262, 6334, 6352, 6532, 7046, 7082, 7524, 14036, 14064, 14072
14 =	1032, 2044, 2062, 2224, 2242, 2332, 3054, 3324, 4072, 4244, 4262, 4334, 4424, 4532, 4622, 5054, 6046, 6082, 6254, 6344, 6362, 6452, 6542, 6632, 7092, 7354, 7722, 8234, 14046, 14082, 15022
15 =	1024, 1042, 2054, 2234, 2252, 2324, 2342, 2432, 2522, 3064, 3072, 3262, 4082, 4254, 4434, 4632, 5036, 5072, 6056, 6092, 6236, 6264, 6272, 6354, 6462, 6534, 6552, 6642, 6722, 7066, 7084, 7364, 7372, 14056, 14074, 14092, 14722, 15032
16 =	1034, 1052, 1232, 2036, 2064, 2072, 2244, 2262, 2334, 2352, 2424, 2532, 2622, 3362, 4272, 4354, 4444, 4462, 4534, 4552, 4722, 5046, 5082, 5254, 5362, 5542, 6066, 6084, 6246, 6282, 6364, 6372, 6562, 6634, 6652, 6732, 7094, 7554, 7724, 7742, 8254, 13344, 14066, 14084, 15024, 15042
17 =	1044, 1062, 1224, 1242, 1332, 2046, 2082, 2254, 2362, 2434, 2542, 2632, 3029, 3056, 3264, 3354, 4066, 4246, 4634, 4652, 4732, 5056, 5074, 5264, 5354, 6094, 6256, 6346, 6382, 6472, 6554, 6662, 6724, 6742, 6932, 7564, 7572, 13354, 13722, 14094, 14724, 15034, 15052, 15232, 15322

18 = 1054, 1234, 1252, 1324, 1342, 1432, 2056, 2074, 2092, 2264, 2272, 2354, 2444, 2462, 2534, 2552, 2722, 3066, 3364, 3372, 4256, 4346, 4554, 4724, 4932, 5066, 5084, 5364, 6059, 6266, 6284, 6329, 6356, 6392, 6482, 6536, 6564, 6572, 6654, 6734, 6752, 6942, 7069, 7086, 7762, 8732, 13364, 13372, 13732, 14734, 14752, 15062, 15242, 15332

19 = 1036, 1064, 1072, 1244, 1262, 1334, 1424, 2066, 2084, 2246, 2282, 2364, 2372, 2562, 2634, 2652, 2732, 3094, 3256, 3346, 3554, 3724, 4266, 4284, 4356, 4564, 4572, 4654, 4734, 4752, 5256, 5742, 6069, 6086, 6366, 6384, 6546, 6636, 6672, 6744, 6762, 6934, 6952, 7096, 7754, 8256, 13346, 14069, 14762, 15054, 15234, 15252, 15324, 15342, 15432

20 = 1046, 1082, 1254, 1362, 1452, 2094, 2256, 2346, 2382, 2554, 2724, 2742, 2932, 3266, 3329, 3356, 3564, 3572, 4069, 4546, 4744, 4762, 4934, 4952, 5059, 5266, 5284, 5356, 5564, 5734, 5942, 6096, 6259, 6394, 6466, 6556, 6592, 6646, 6754, 7764, 7772, 8266, 8734, 8752, 10546, 11554, 13329, 13356, 13392, 13734, 14096, 14726, 14754, 15036, 15064, 15072, 15262, 15334

21 = 1029, 1056, 1074, 1272, 1354, 1462, 1722, 2059, 2266, 2284, 2329, 2356, 2482, 2564, 2572, 2654, 2734, 2752, 2942, 3069, 3086, 3366, 3384, 3546, 3672, 3744, 3762, 4466, 4556, 4646, 5069, 5086, 5366, 5384, 5546, 5672, 5762, 6079, 6269, 6286, 6359, 6566, 6584, 6656, 6736, 6764, 6772, 6954, 7089, 7369, 7386, 7746, 7782, 10556, 11564, 11572, 13366, 13384, 13744, 13762, 14736, 14764, 14772, 15046, 15082, 15254, 15344, 15452

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23 = 1094, 1256, 1346, 1382, 1472, 1554, 1724, 1742, 2096, 2259, 2466, 2556, 2592, 2646, 2754, 2962, 3079, 3269, 3566, 3656, 3764, 3772, 4369, 4386, 4666, 4746, 4782, 5269, 5566, 5656, 5764, 5772, 5954, 6396, 6469, 6756, 6946, 7569, 7766, 7784, 8269, 10746, 11556, 11754, 13736, 13764, 13772, 14099, 14756, 14774, 15066, 15084, 15246, 15282, 15364, 15372, 15732

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25 = 1069, 1086, 1366, 1546, 1672, 1744, 1762, 2089, 2369, 2386, 2666, 2746, 2782, 2964, 2972, 3279, 3729, 3756, 4569, 4766, 4784, 4956, 5099, 5396, 5756, 5774, 5946, 6389, 6596, 6669, 6686, 6794, 6966, 6984, 8756, 10569, 10586, 10766, 11746, 12656, 12764, 12772, 13396, 13729, 13756, 13792, 14794, 15059, 15266, 15356, 15482, 15564, 15572, 15734, 15752, 15942

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31 = 1389, 1596, 1669, 1686, 1794, 1966, 2689, 2796, 2969, 3779, 4789, 5996, 6799, 6989, 9766, 9956, 10789, 11796, 12769, 14799, 15289, 15569, 15586, 15766, 15784, 15956

32 = 1489, 1696, 1759, 2779, 2996, 3789, 4989, 5789, 8789, 9966, 12689, 12796, 13789, 15389, 15669, 15966

33 = 1589, 1769, 1786, 2789, 3799, 5989, 11789, 12996, 13799, 15489, 15759

34 = 1689, 1796, 1969, 2989, 12789, 15589, 15769, 15786

35 = 1779, 1996, 9796

36 = 1789, 9996

37 = 1799, 1989, 9789, 15789

APPENDIX G

Results of the Survey of Local Resource Managers
to Identify NPS Impacted Water Bodies.

NONPOINT SOURCE (____) WATERBODY SURVEY

Resource Management Organization________________________ Completed by____________________ Date______________

Waterbody Name*	Lake Identification Number or County Code for Other Waterbodies**	Based on your knowledge of NPS pollution problems, provide an estimate of the following						
		Status*** Check one		Area or Miles Affected	NPS Effects**** List Letter Code From Table A	Source Category**** List Number Code From Table B	Uses**** List Letter Code From Table C	
		Threatened	Impaired				Actual	Potential
1								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9								
10								
11.								
12.								
13								
14.								
15								

* List as many lakes, streams, aquifers or wetlands that you believed are impaired or could be impaired by nonpoint sources. Additional waterbodies may be included on the back of this form.

** If readily available, provide the lake identification number listed in Minnesota Department of Natural Resources Bulletin 25 "An Inventory of Minnesota Lakes". For the other waterbodies and if lake identification numbers are not available provide the county codes which are attached.

*** Impaired waterbodies show definite signs of degradation, threatened waterbodies may not show signs of degradation but watershed conditions are likely to cause problems that will impair the waterbody.

**** Select as many effects, source categories or uses that apply.

TABLE A

Types of Nonpoint Source Effects

If the Effect is:	Indicate:
Oxygen depletion	A
Eutrophication (heavy algal blooms, etc)	B
Bacteria contamination	C
Bottom sedimentation	D
Toxicity due to pesticides, dissolved metals, etc	E
Turbid waters	F
Physical habitat alteration	G
Unknown	H
Other	I

TABLE C

Actual or Potential Uses

If the actual or potential use is:	Indicate:
Fishing (poor)	S
Fishing (moderate)	T
Fishing (good)	U
Fishing (Unique)*	V
Swimming (poor)	W
Swimming (good)	X
Unknown	Y
Other	Z

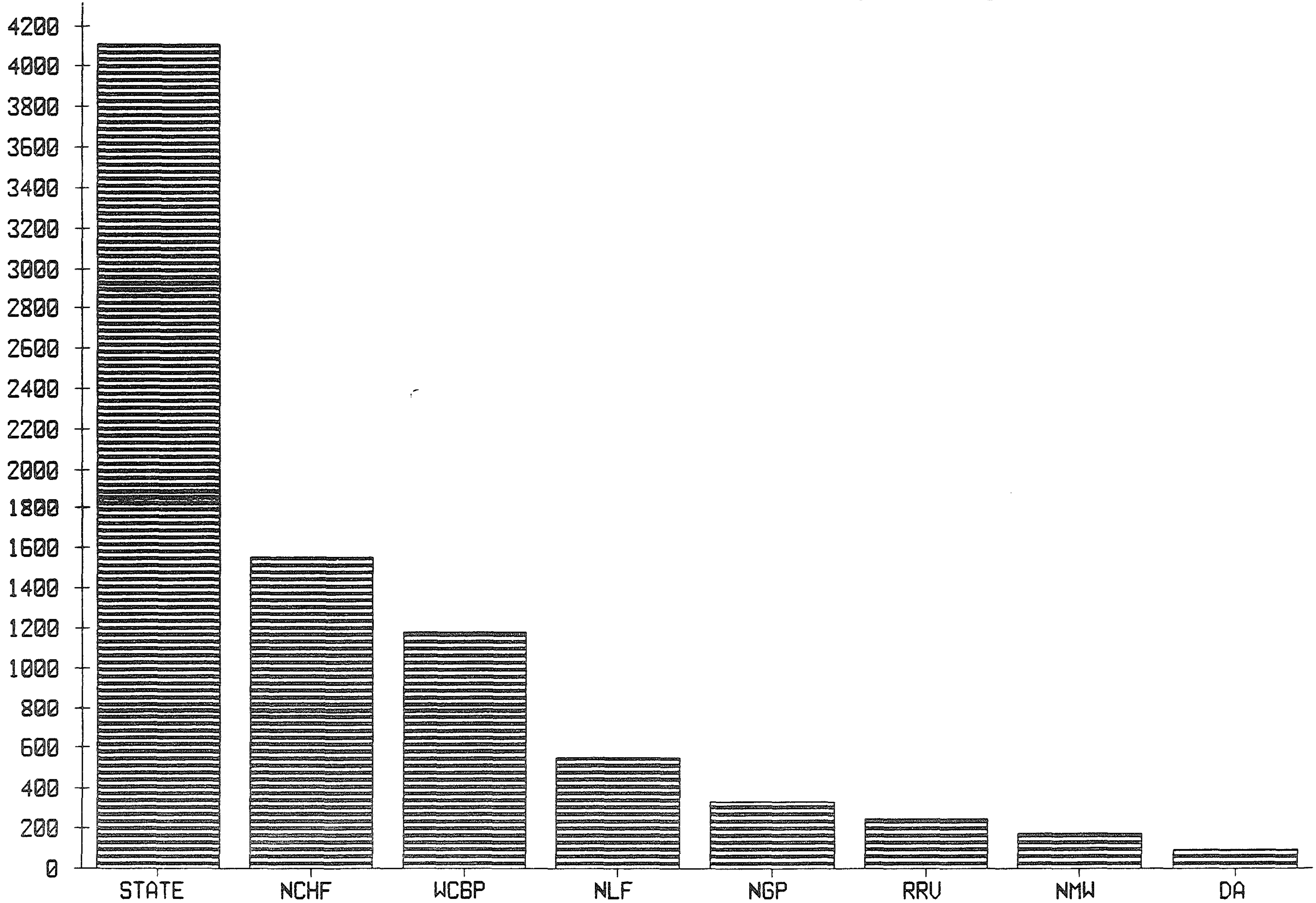
* Consider a fishery unique if it represents a species uncommon to the area such as a trout fishery where warmwater conditions normally prevail or the waterbody supports an endangered or rare species.

TABLE B

NPS Categories

If the NPC category is	Indicate:
Agriculture	
Non-irrigated crop production	11
Irrigated crop production	12
Specialty crop production (orchards etc.)	13
Pasture land	14
Feedlots (total confinement)	16
Animal holding/management areas	18
Agri-chemical application (pesticides & fertilizers)	19
Silviculture	
Harvesting, reforestration, residue mngt.	21
Forest mngt (herbicide application etc)	22
Road construction/maintenance	23
Contruction	
Highway/road/bridge	31
Land development	32
Urban Runoff	
Storm sewers	41
Surface runoff	43
Resource Extraction/Exploration/Development	
Surface mining	51
Subsurface mining	52
Mill tailings	56
Mine tailings	57
Land Disposal (Runoff/Leachate)	
Sludge	61
Wastewater	62
Landfills	63
Industrial land treatment	64
On-site wastewater systems (septic tanks)	65
Hazardous wastes	66
Hydrologic/Habitat Modification	
Channelization	71
Dredging	72
Dam construction	73
Flow regulation/modification	74
Bridge construction	75
Removal of riparian vegetation	76
Streambank modification/destabilization	77
Other	80
Source Unknown	90

FIGURE 1. RESULTS OF THE NPS SURVEY
The number of water bodies identified by ecoregion



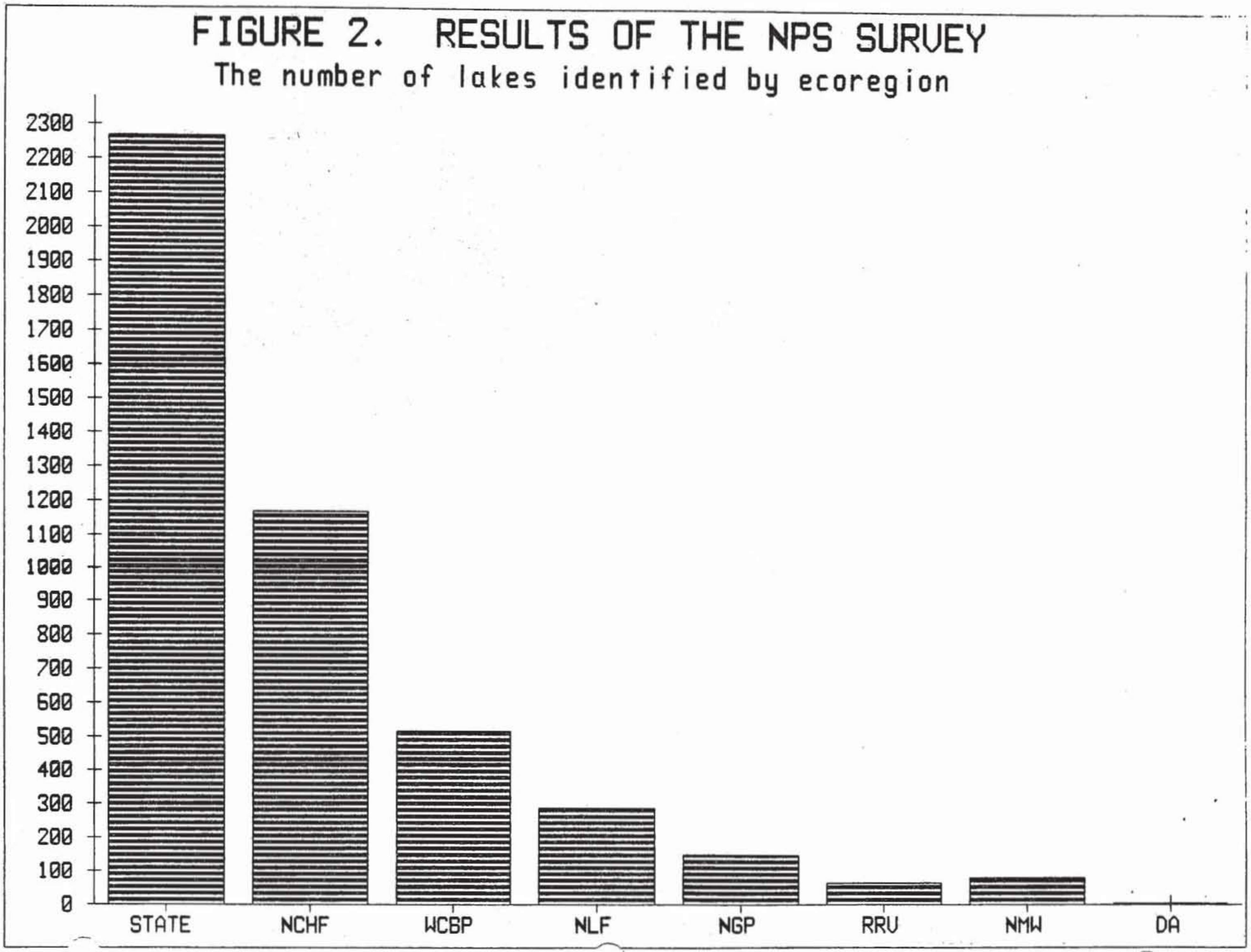


FIGURE 2. RESULTS OF THE NPS SURVEY
The number of lakes identified by ecoregion
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
STATE
NCHF
WCBP
NLF
NGP
RRV
NMW
DA

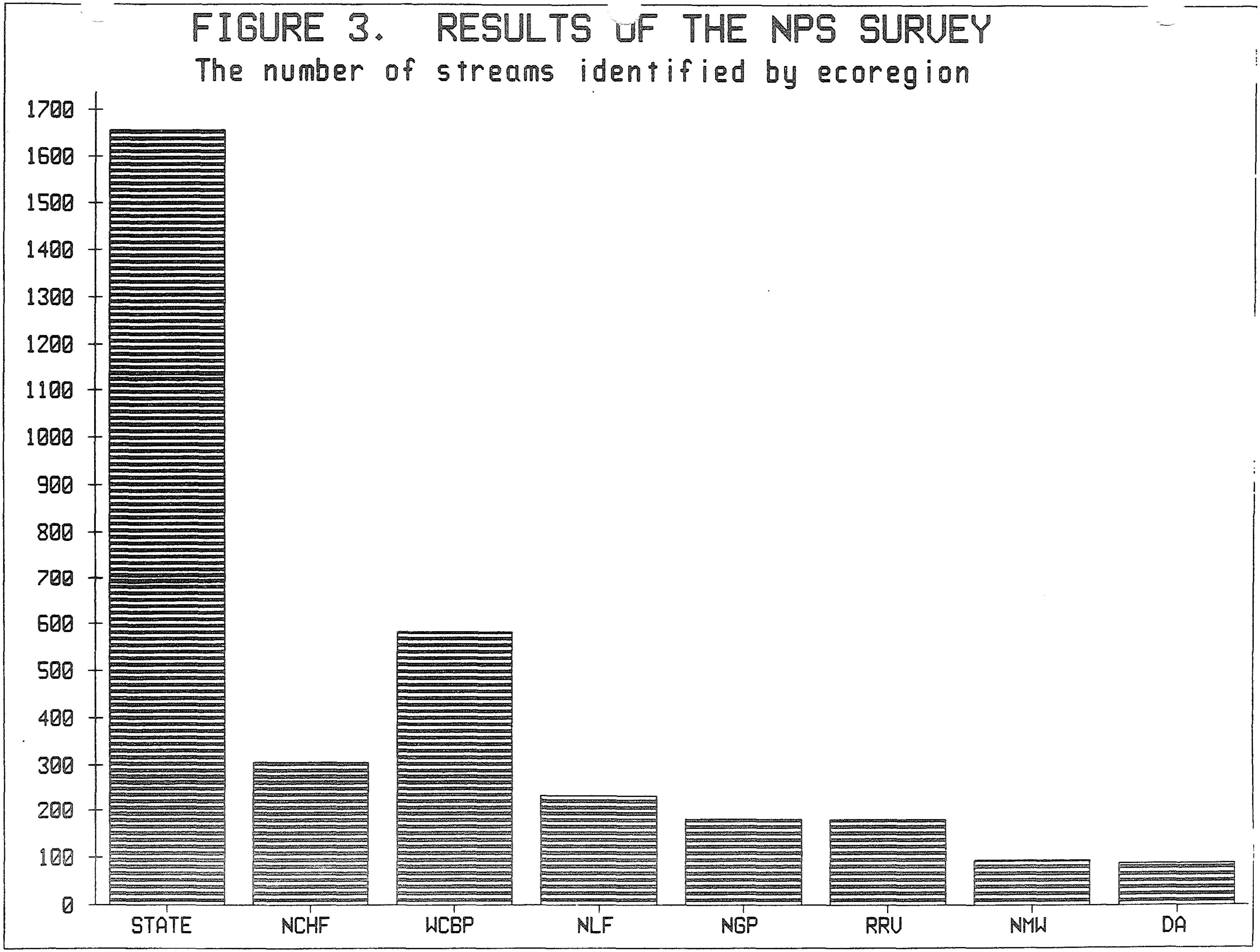


FIGURE 3. RESULTS OF THE NPS SURVEY
The number of streams identified by ecoregion
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
STATE
NCHF
WCBP
NLF
NGP
RRV
NMW
DA

FIGURE 4. RESULTS OF THE NPS SURVEY

The number of wetlands identified by ecoregion

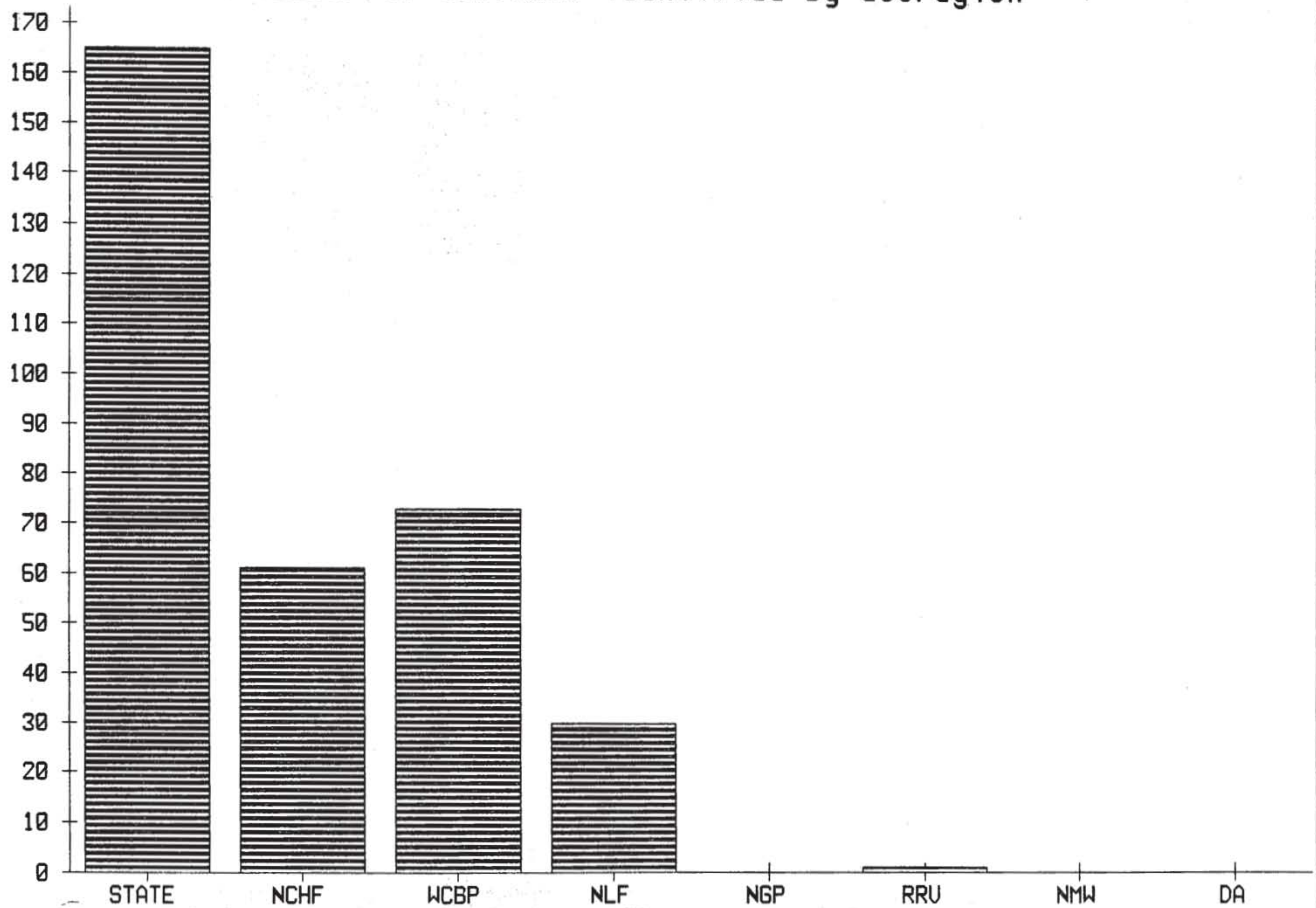


FIGURE 5. RESULTS OF THE NPS SURVEY

The number of aquifers identified by ecoregion

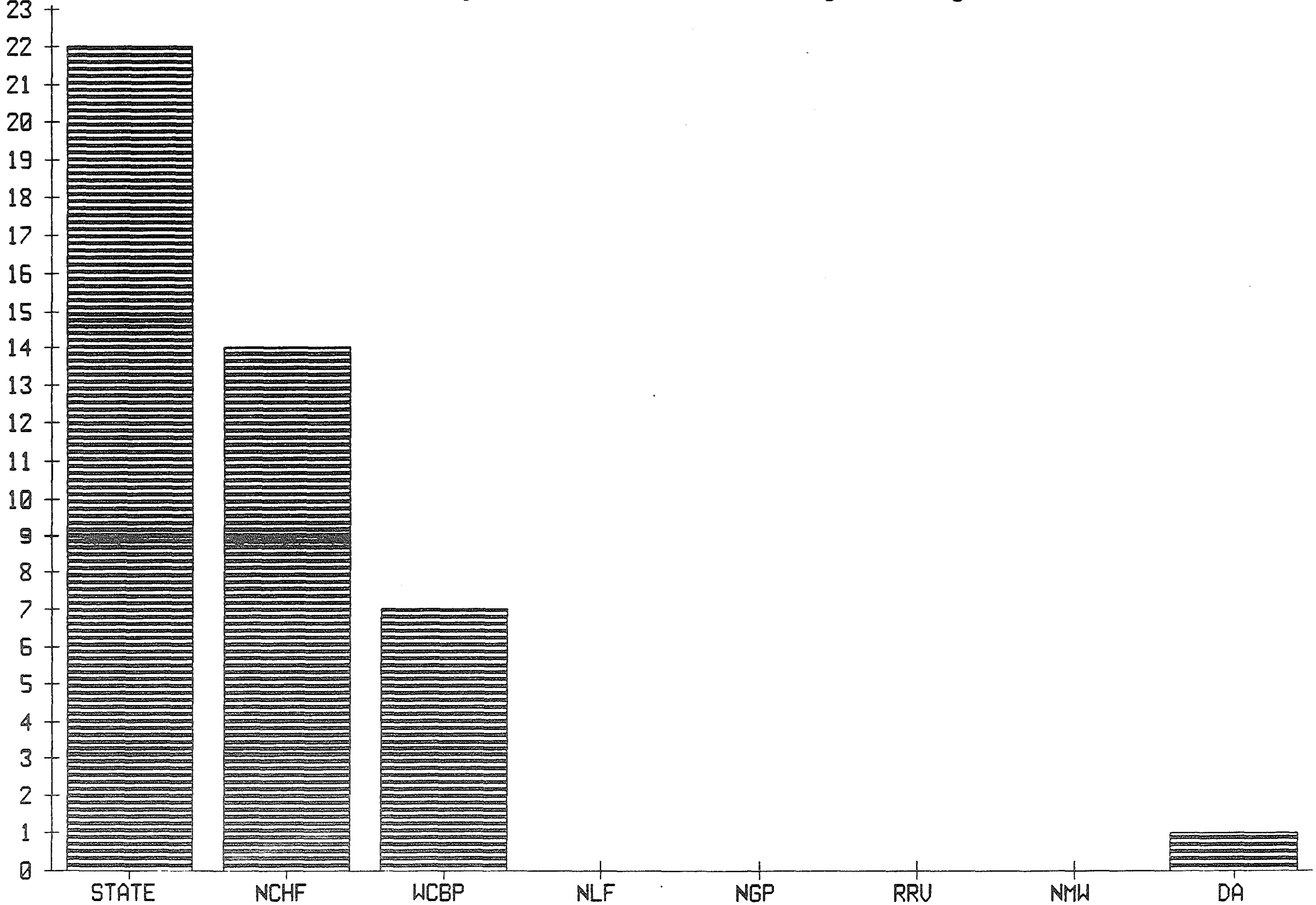
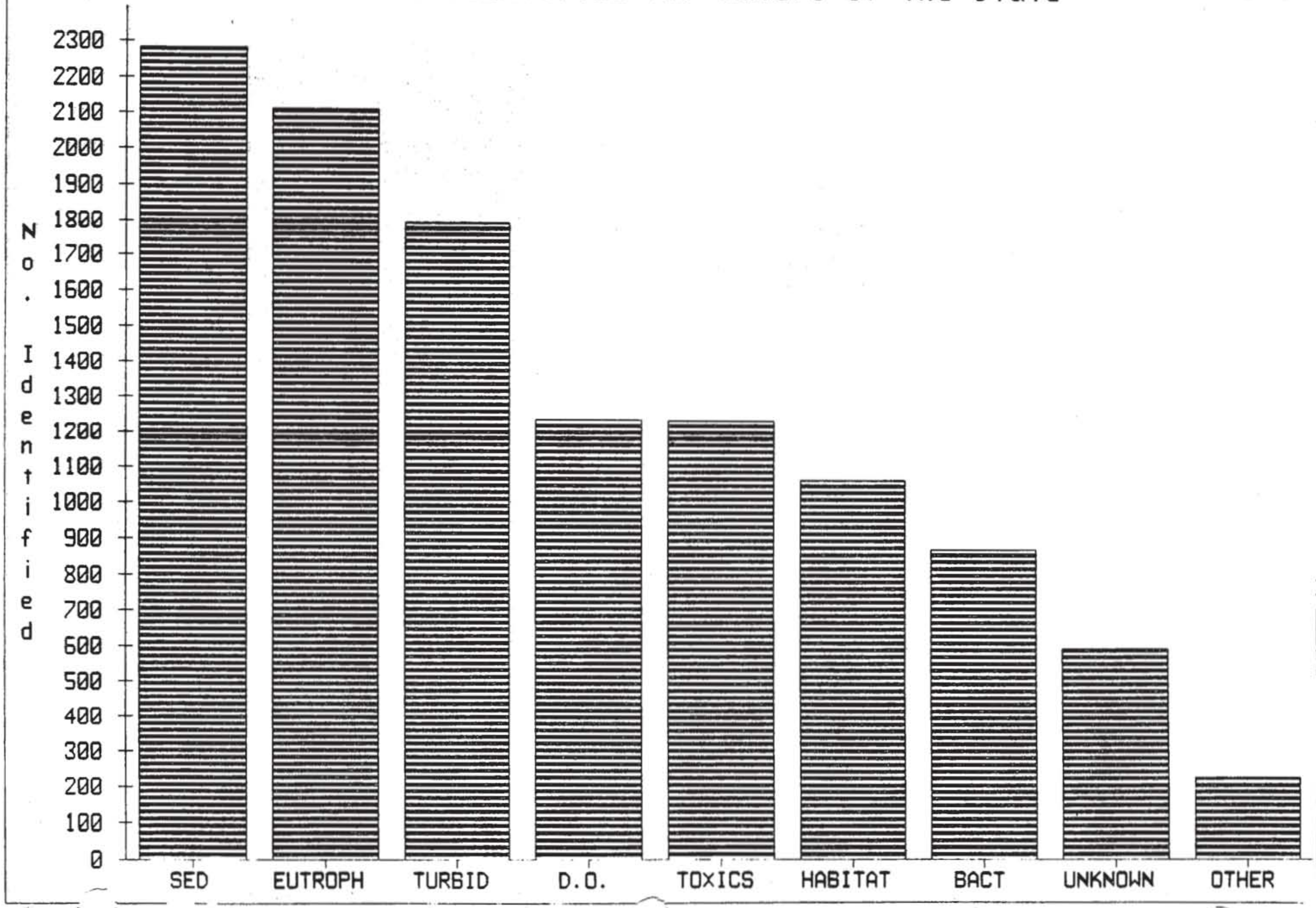


FIGURE 6. RESULTS OF THE NPS SURVEY

The NPS effects identified for waters of the state



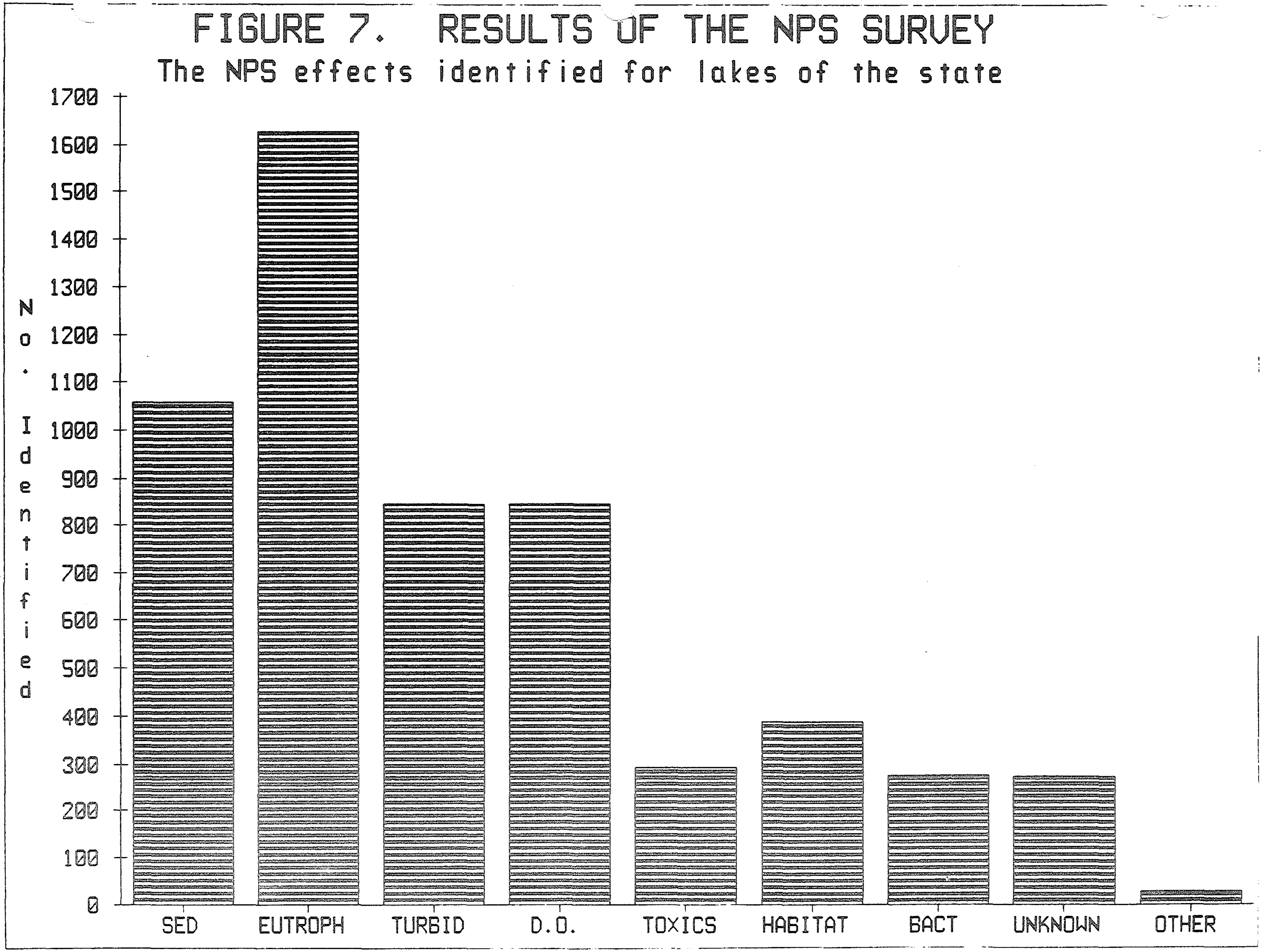


FIGURE 7. RESULTS OF THE NPS SURVEY
The NPS effects identified for lakes of the state
No. Identified
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

FIGURE 8. RESULTS OF THE NPS SURVEY

The NPS effects identified for streams of the state

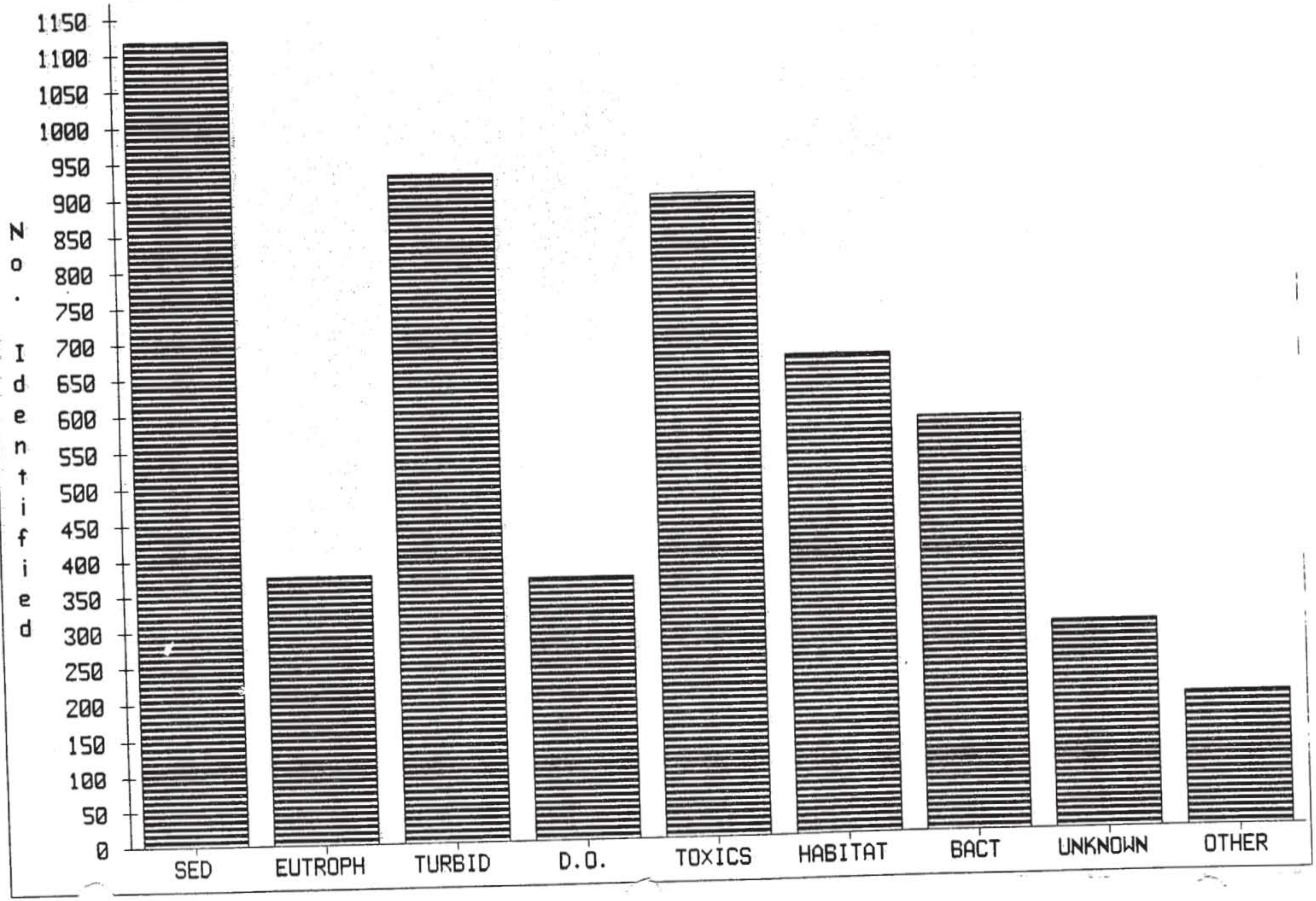
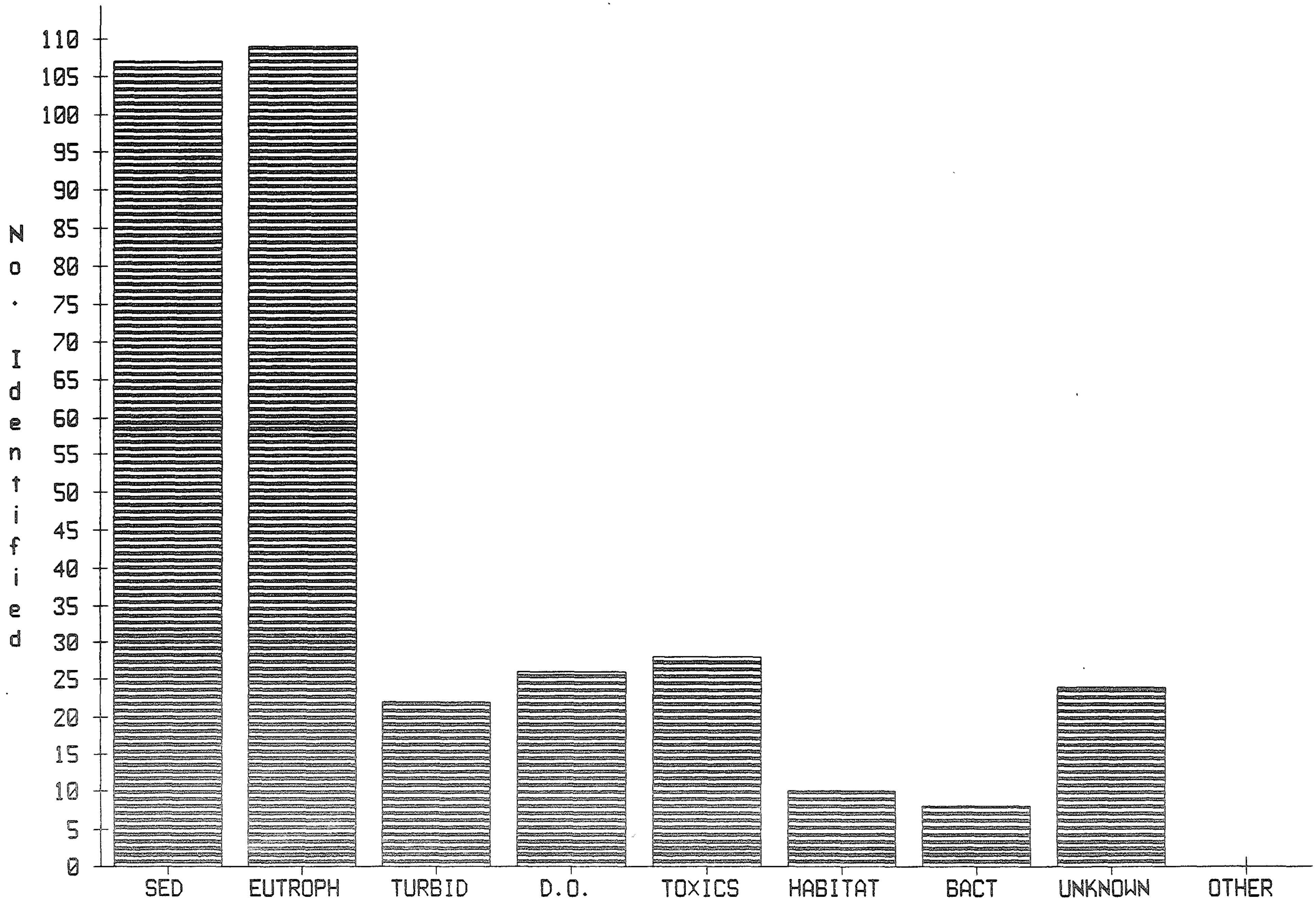


FIGURE 9. RESULTS OF THE NPS SURVEY

The NPS effects identified for wetlands of the state



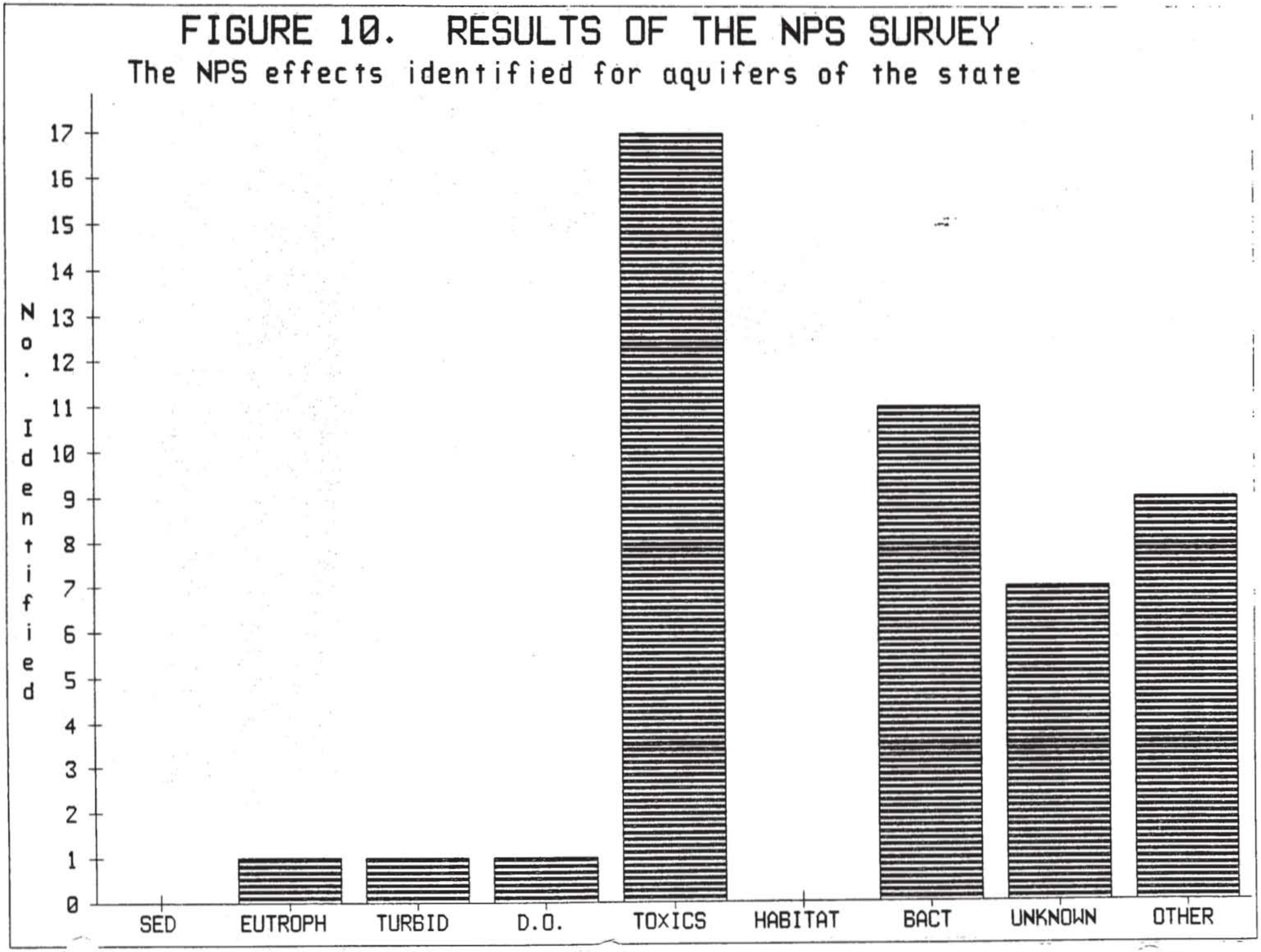


FIGURE 10. RESULTS OF THE NPS SURVEY
The NPS effects identified for aquifers of the state
No. Identified
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

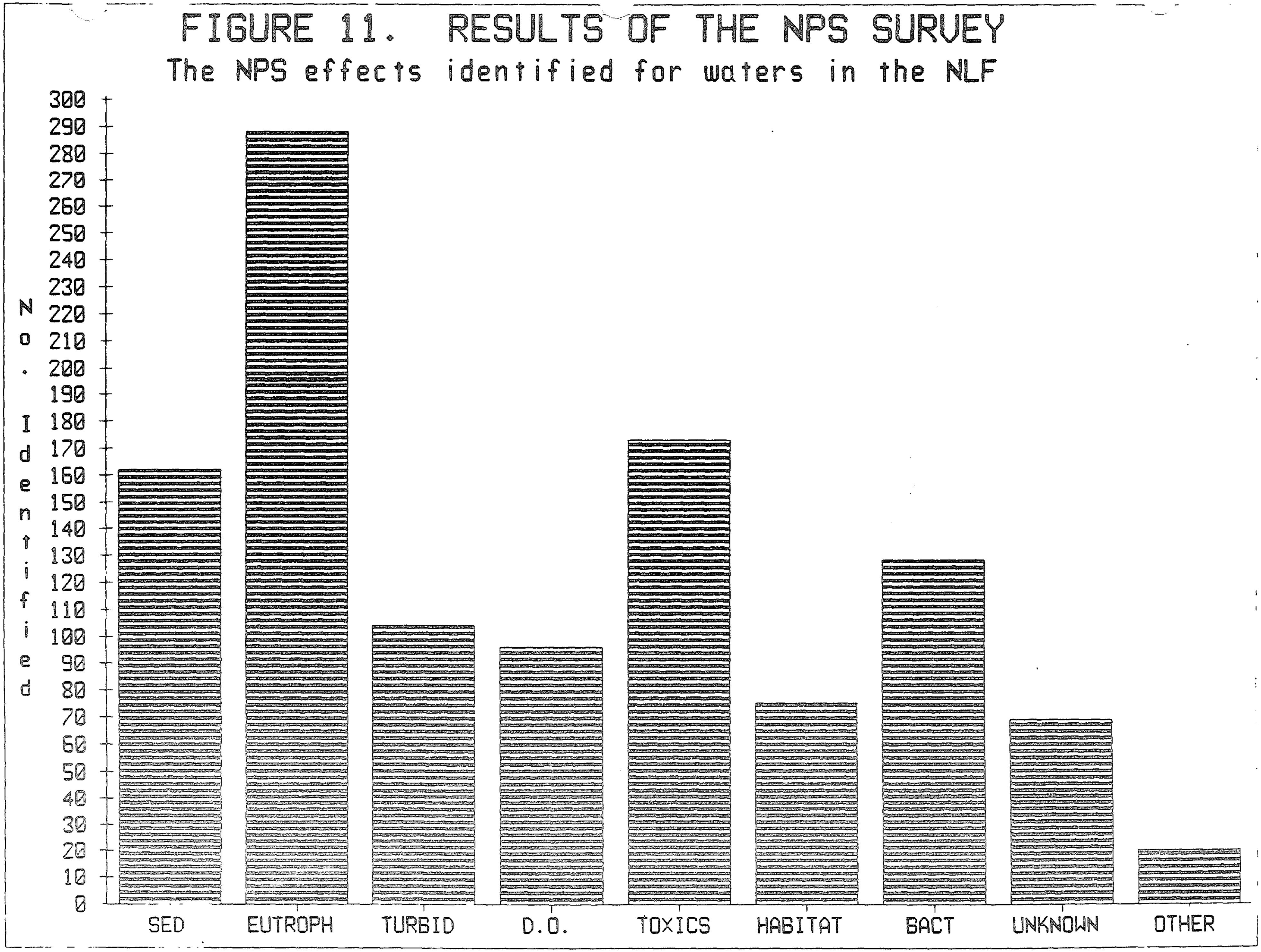


FIGURE 11. RESULTS OF THE NPS SURVEY
The NPS effects identified for waters in the NLF
No. Identified
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

FIGURE 12. RESULTS OF THE NPS SURVEY

The NPS effects identified for waters in the NMW

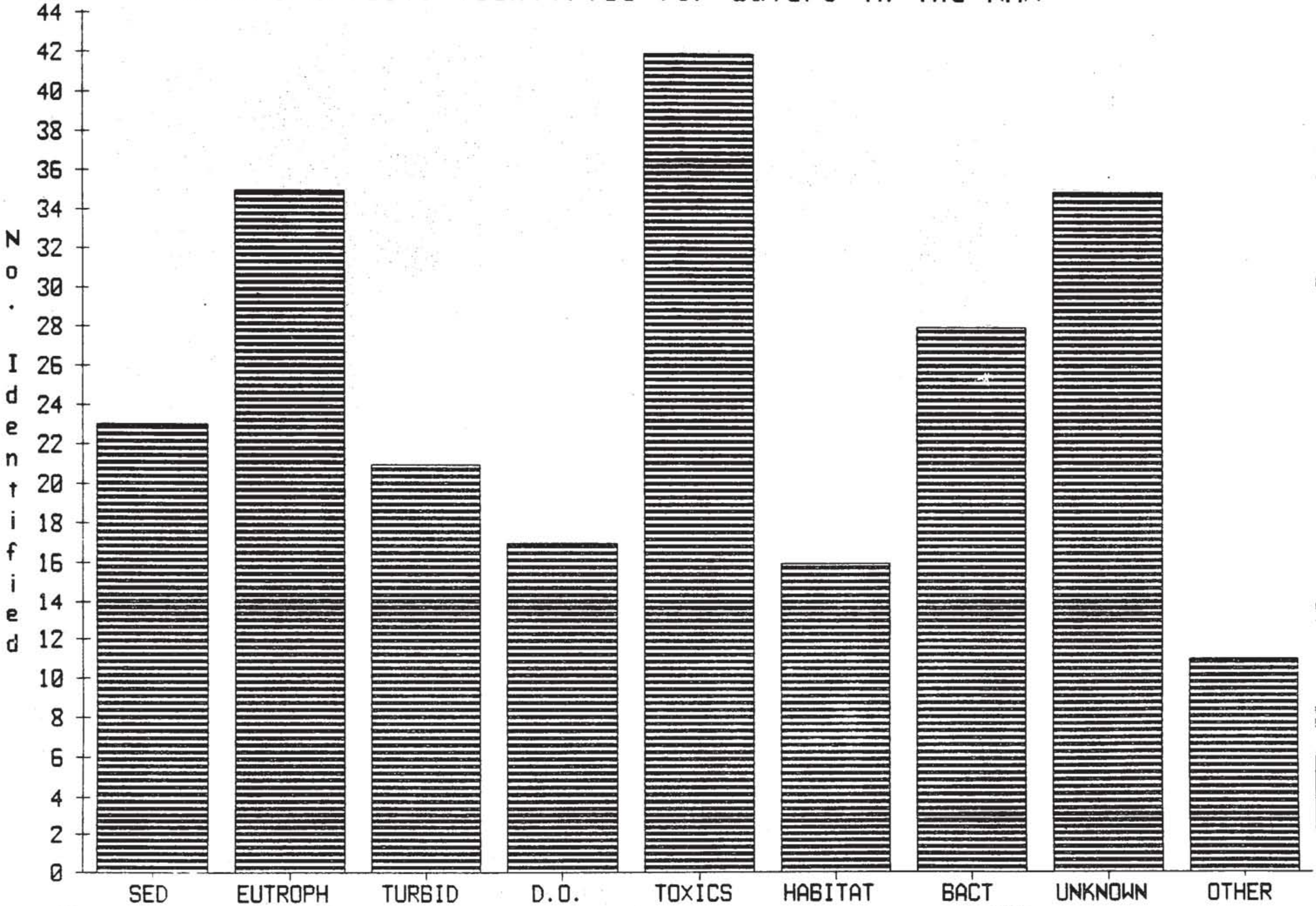
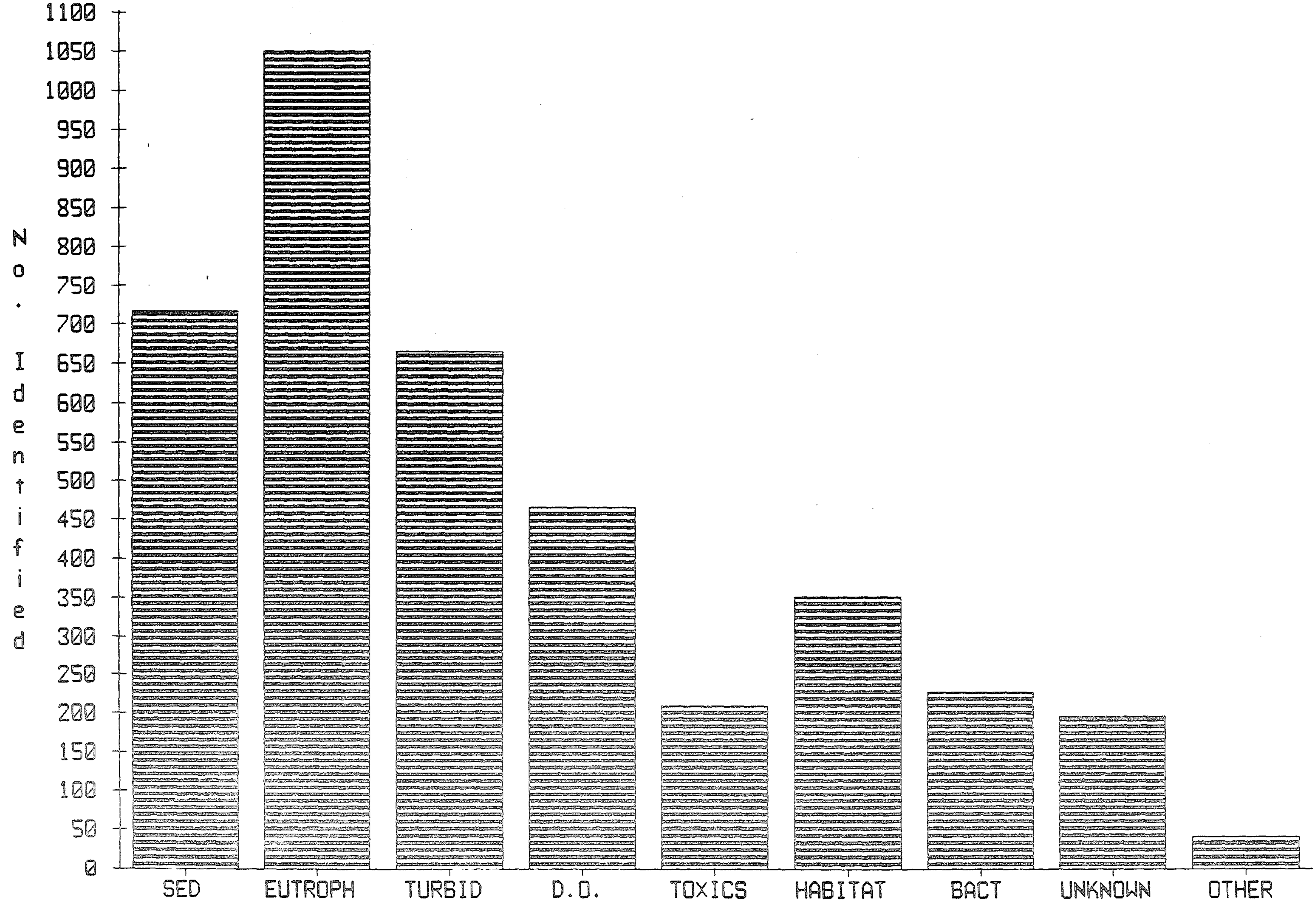


FIGURE 13. RESULTS OF THE NPS SURVEY

The NPS effects identified for waters in the NCHF



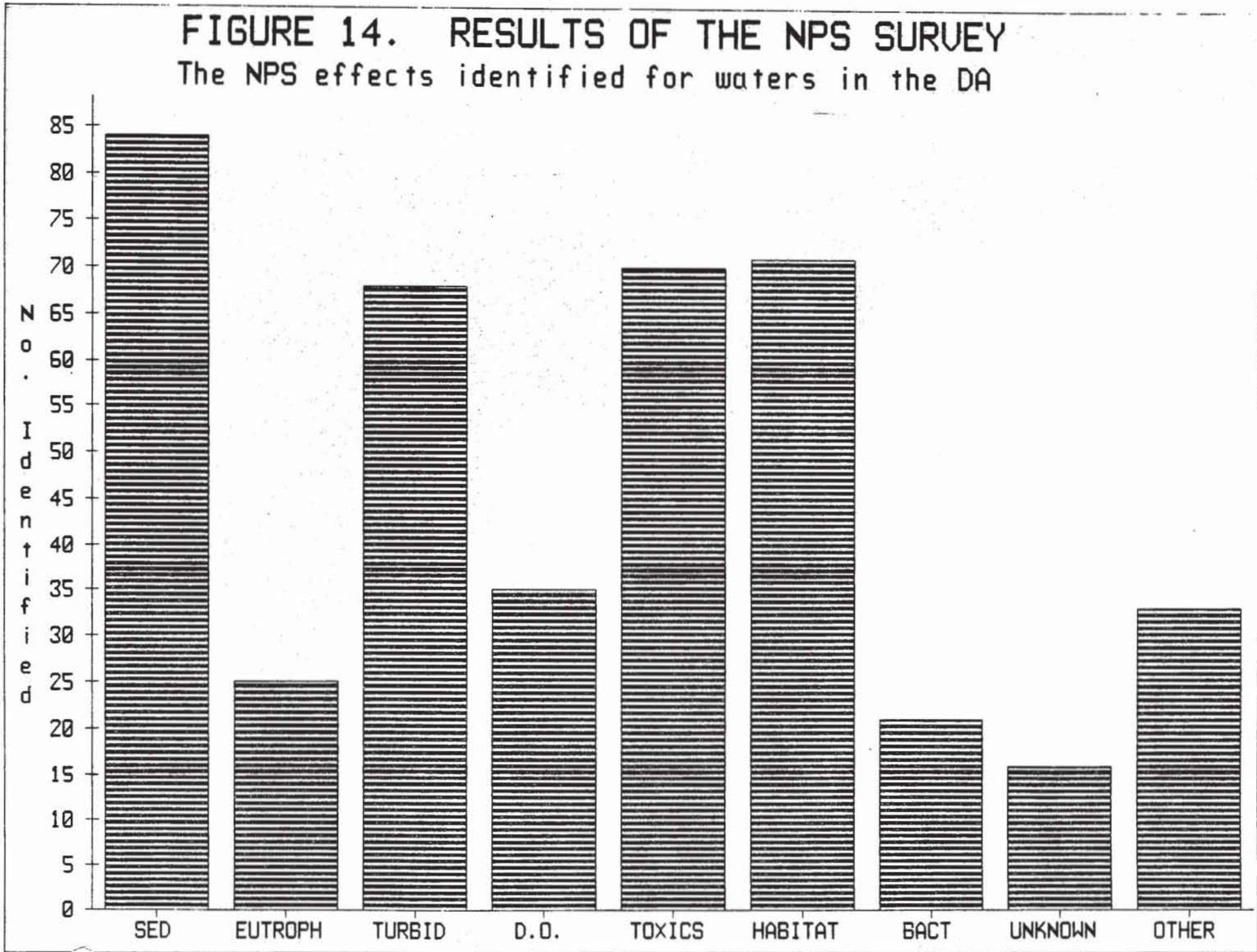
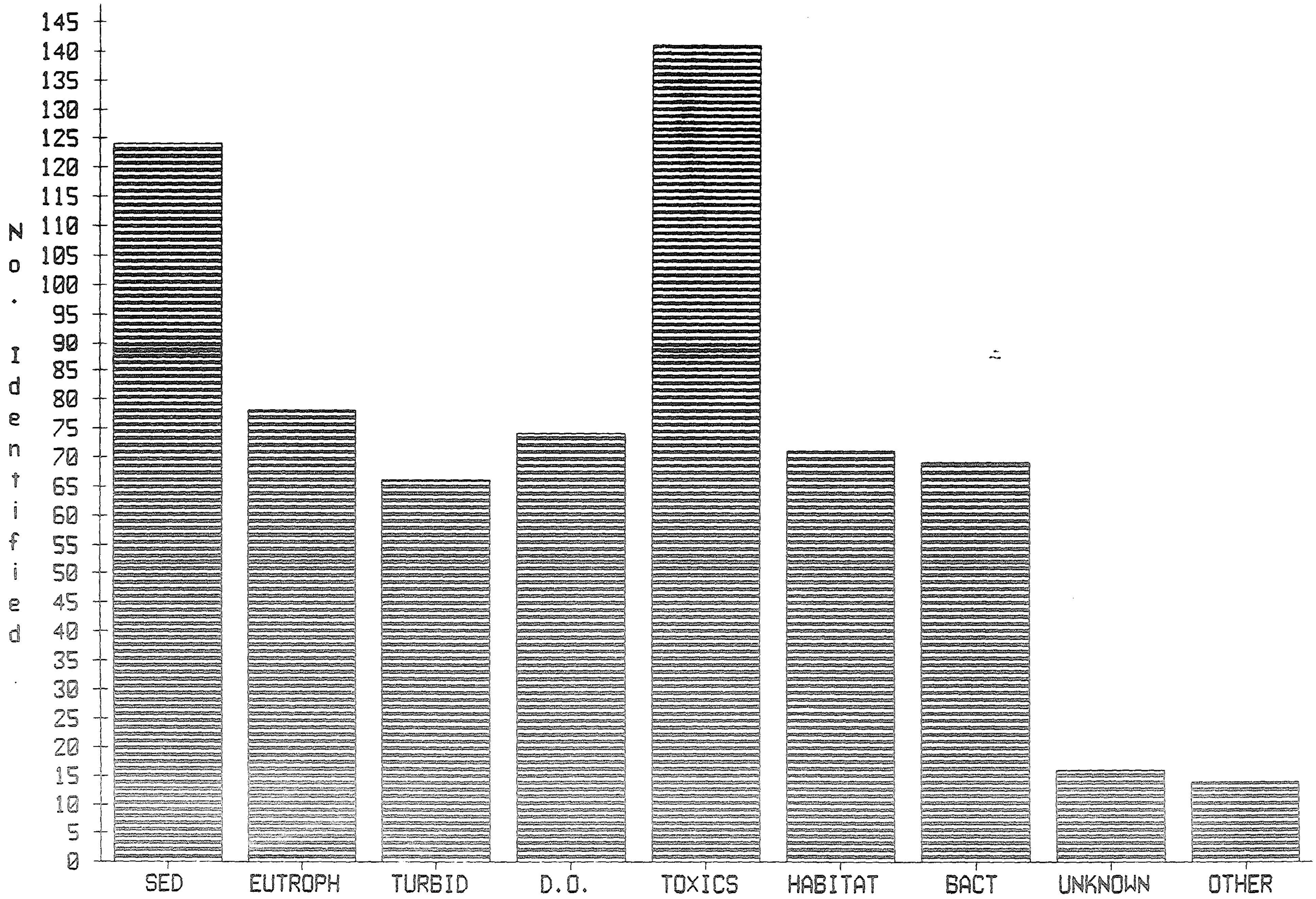


FIGURE 14. RESULTS OF THE NPS SURVEY
The NPS effects identified for waters in the DA
No. Identified
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

FIGURE 15. RESULTS OF THE NPS SURVEY

The NPS effects identified for waters in the RRV



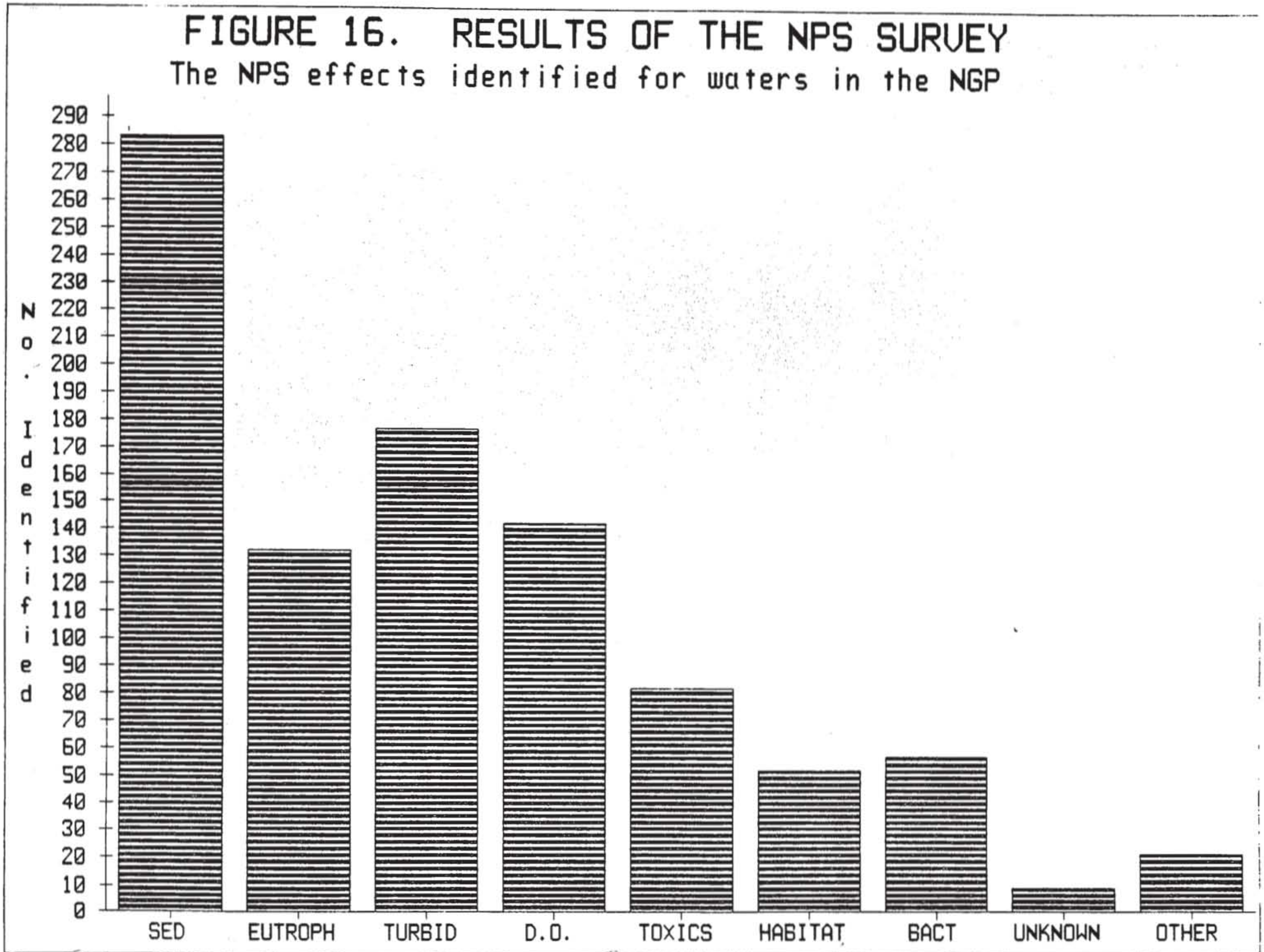


FIGURE 16. RESULTS OF THE NPS SURVEY
The NPS effects identified for waters in the NGP
No. Identified
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

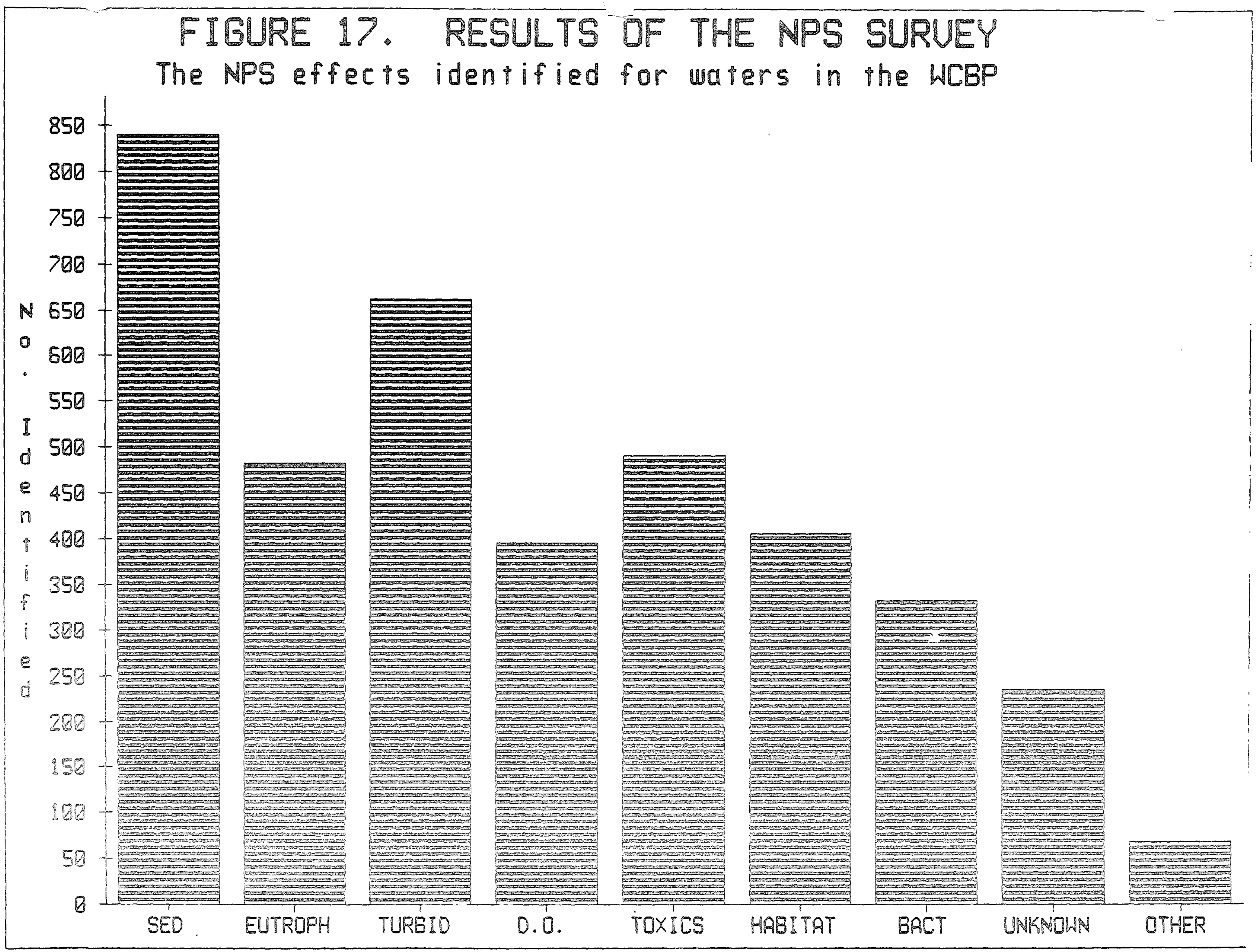


FIGURE 17. RESULTS OF THE NPS SURVEY
The NPS effects identified for waters in the WCBP
No. Identified
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
SED
EUTROPH
TURBID
D.O.
TOXICS
HABITAT
BACT
UNKNOWN
OTHER

FIGURE 18. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the state

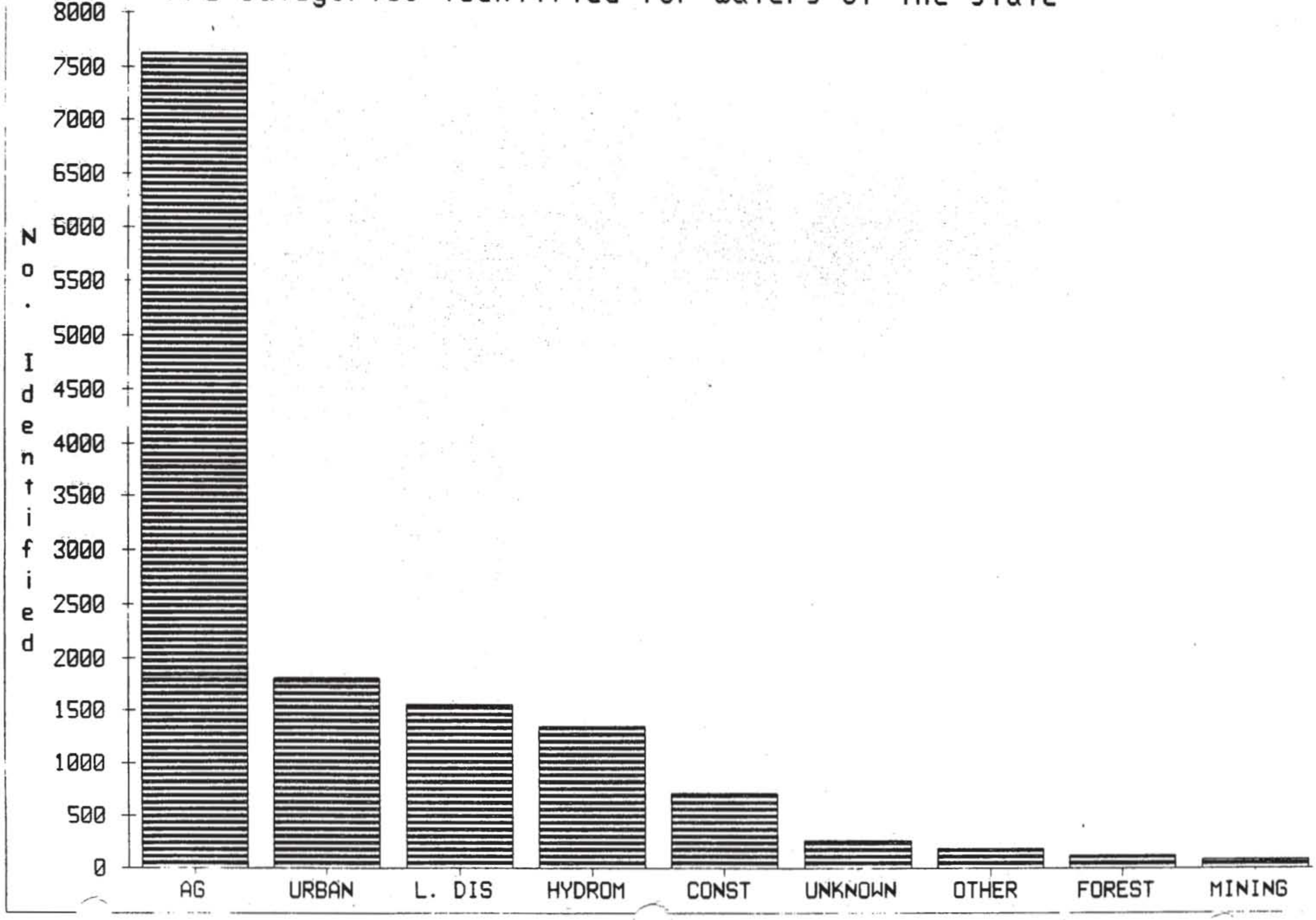
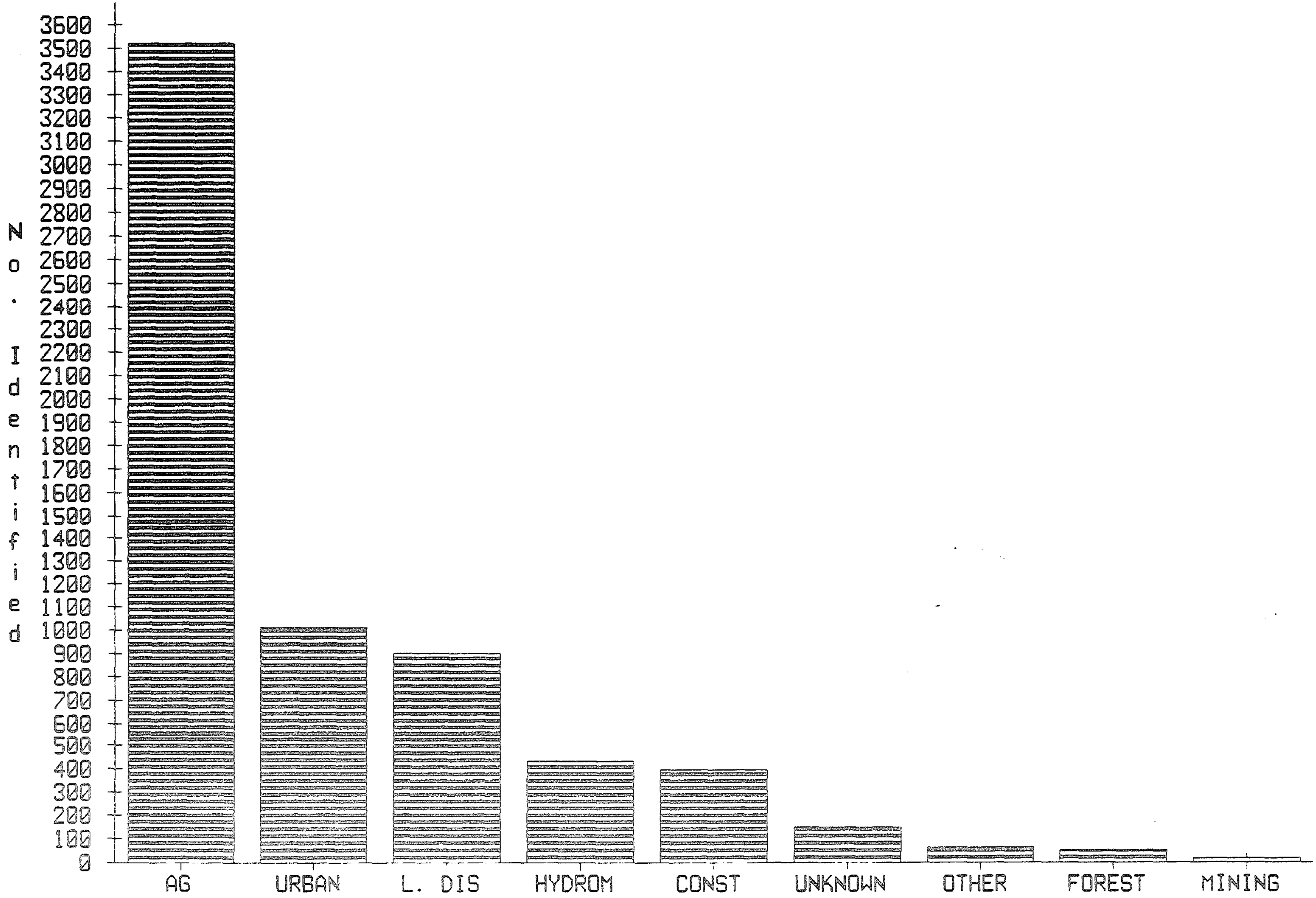


FIGURE 19. RESULTS OF THE NPS SURVEY

NPS categories identified for lakes of the state



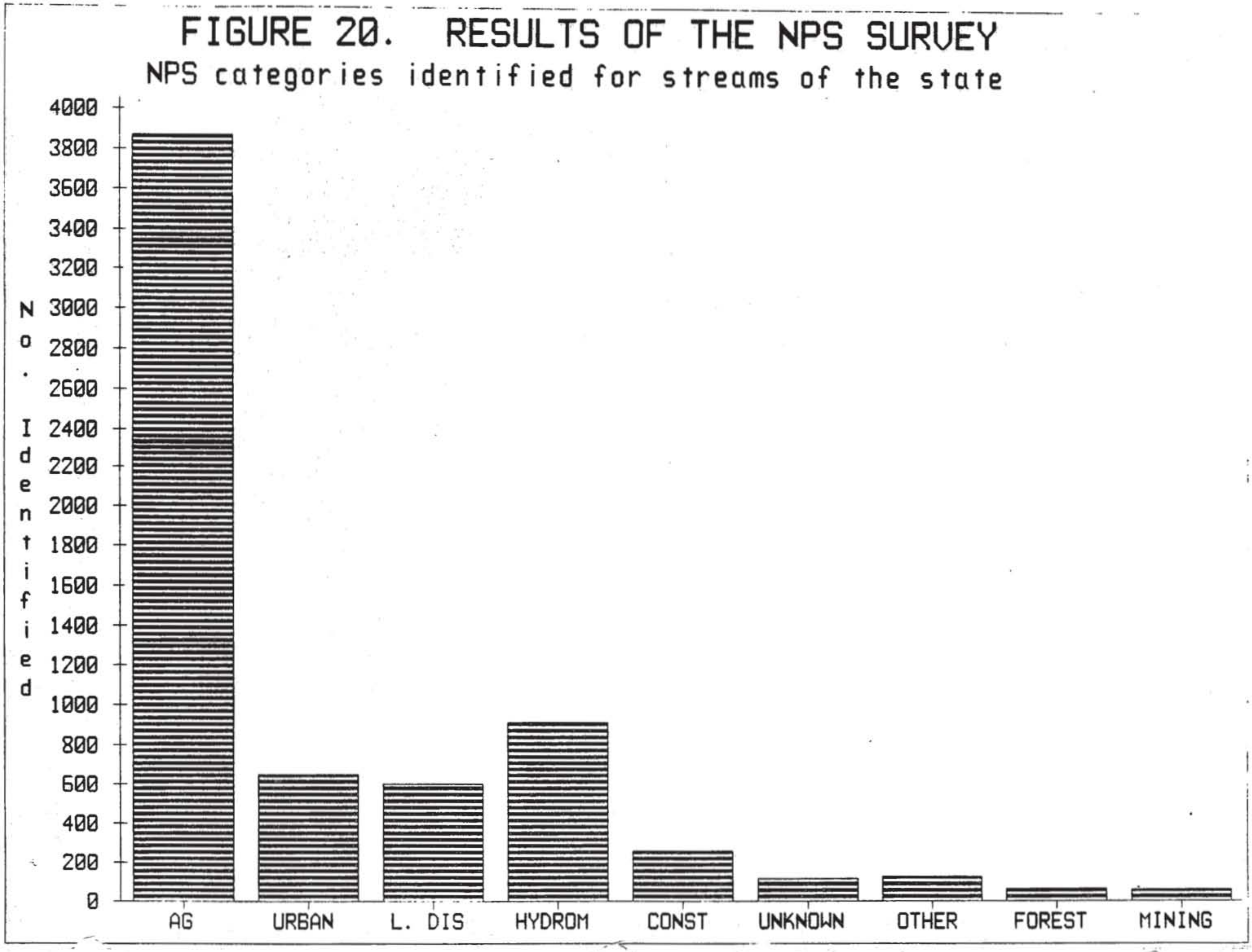


FIGURE 20. RESULTS OF THE NPS SURVEY
NPS categories identified for streams of the state
No. Identified
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
AG
URBAN
L. DIS
HYDROM
CONST
UNKNOWN
OTHER
FOREST
MINING

FIGURE 21. RESULTS OF THE NPS SURVEY

NPS categories identified for wetlands of the state

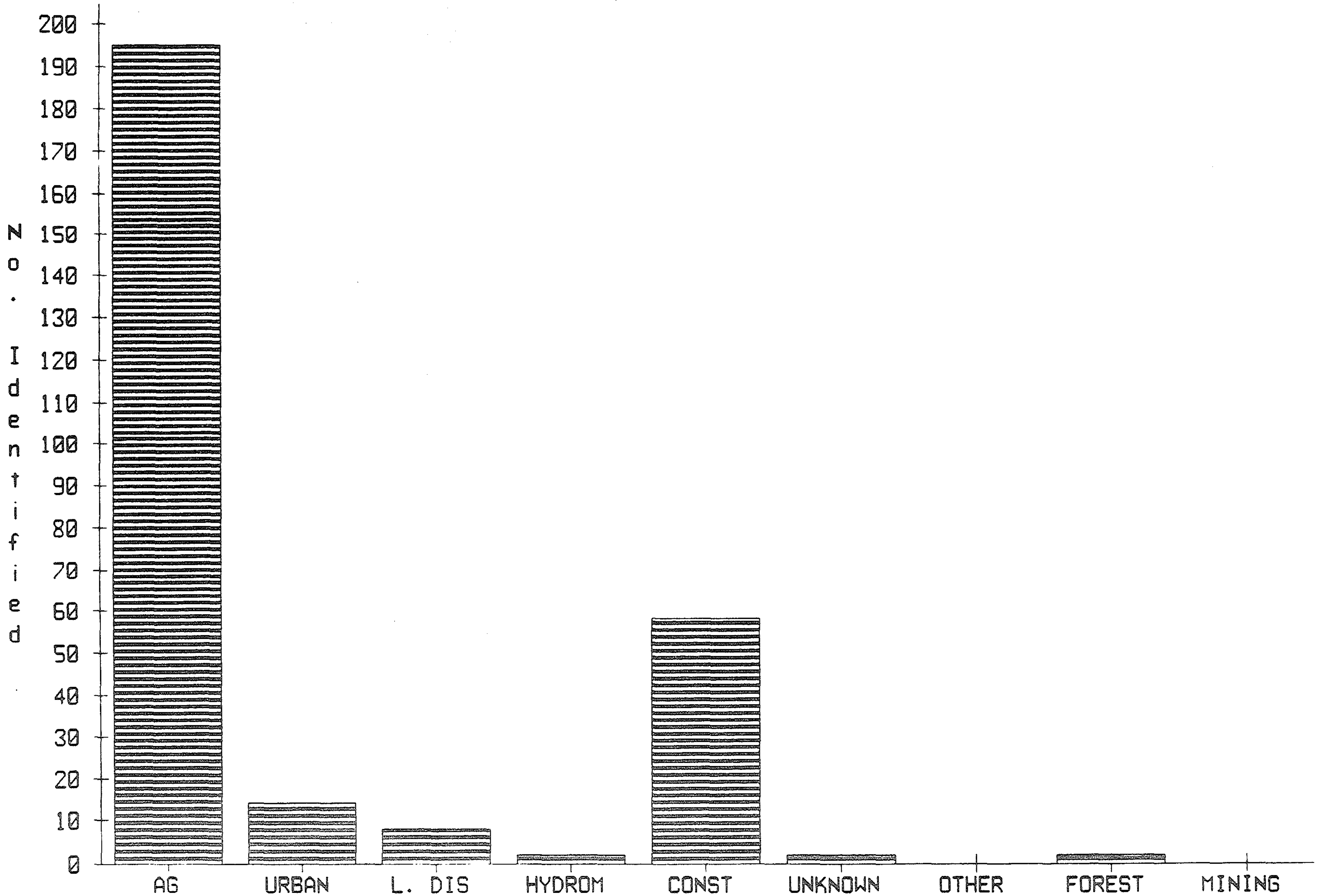


FIGURE 22. RESULTS OF THE NPS SURVEY

NPS categories identified for aquifers of the state

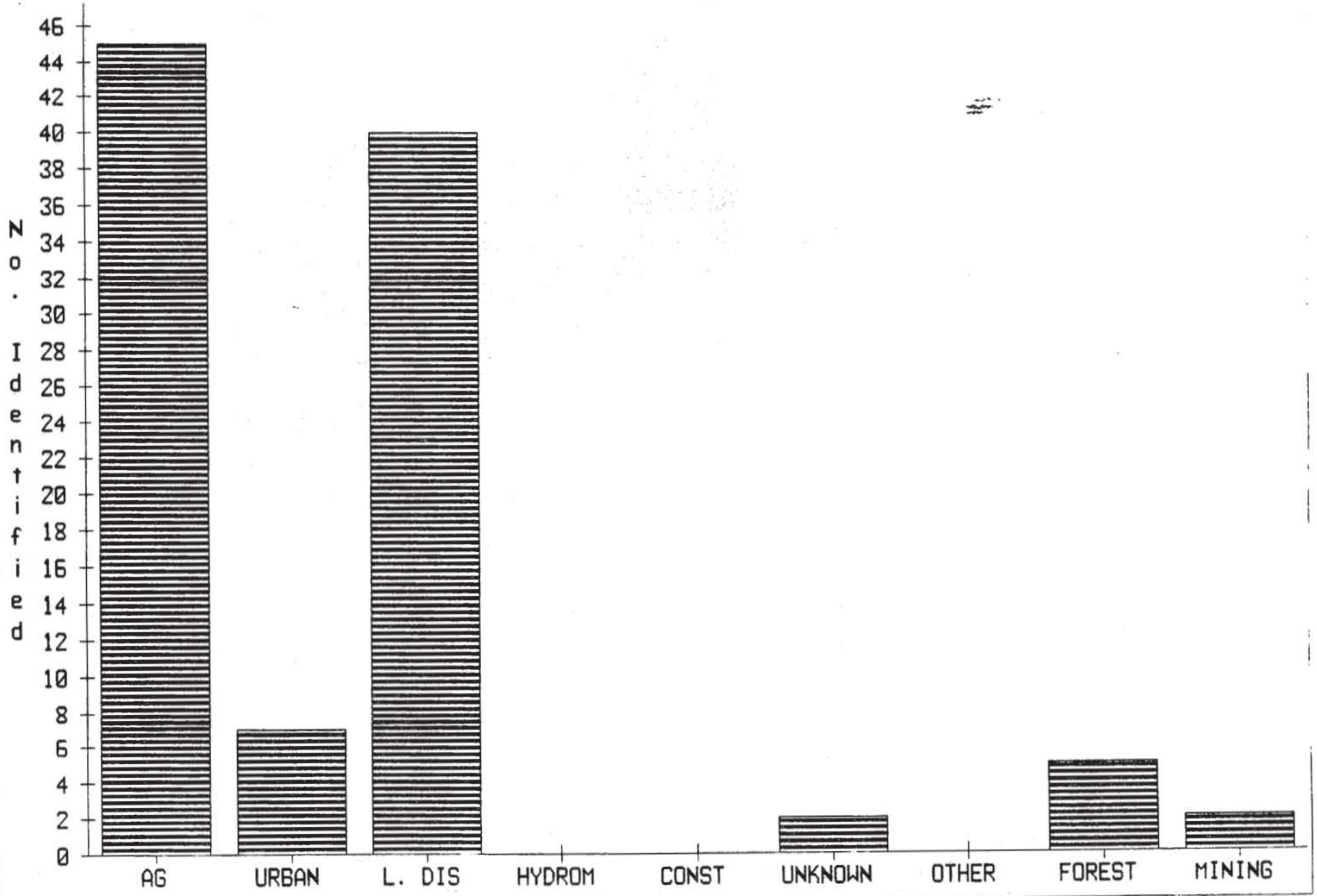


FIGURE 23. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the NLF

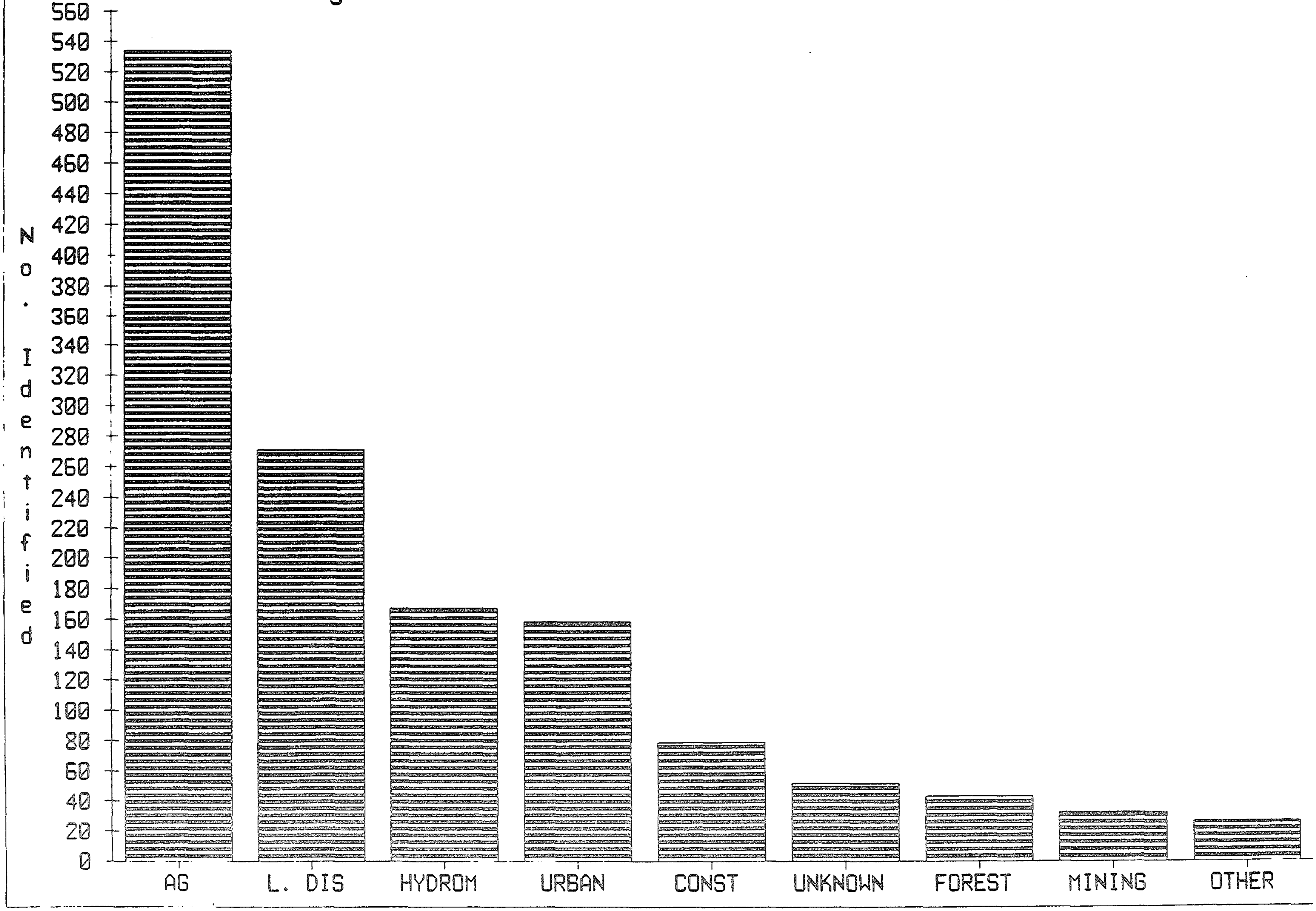


FIGURE 24. RESULTS OF THE NPS SURVEY

NPS subcategories identified for waters of the NLF

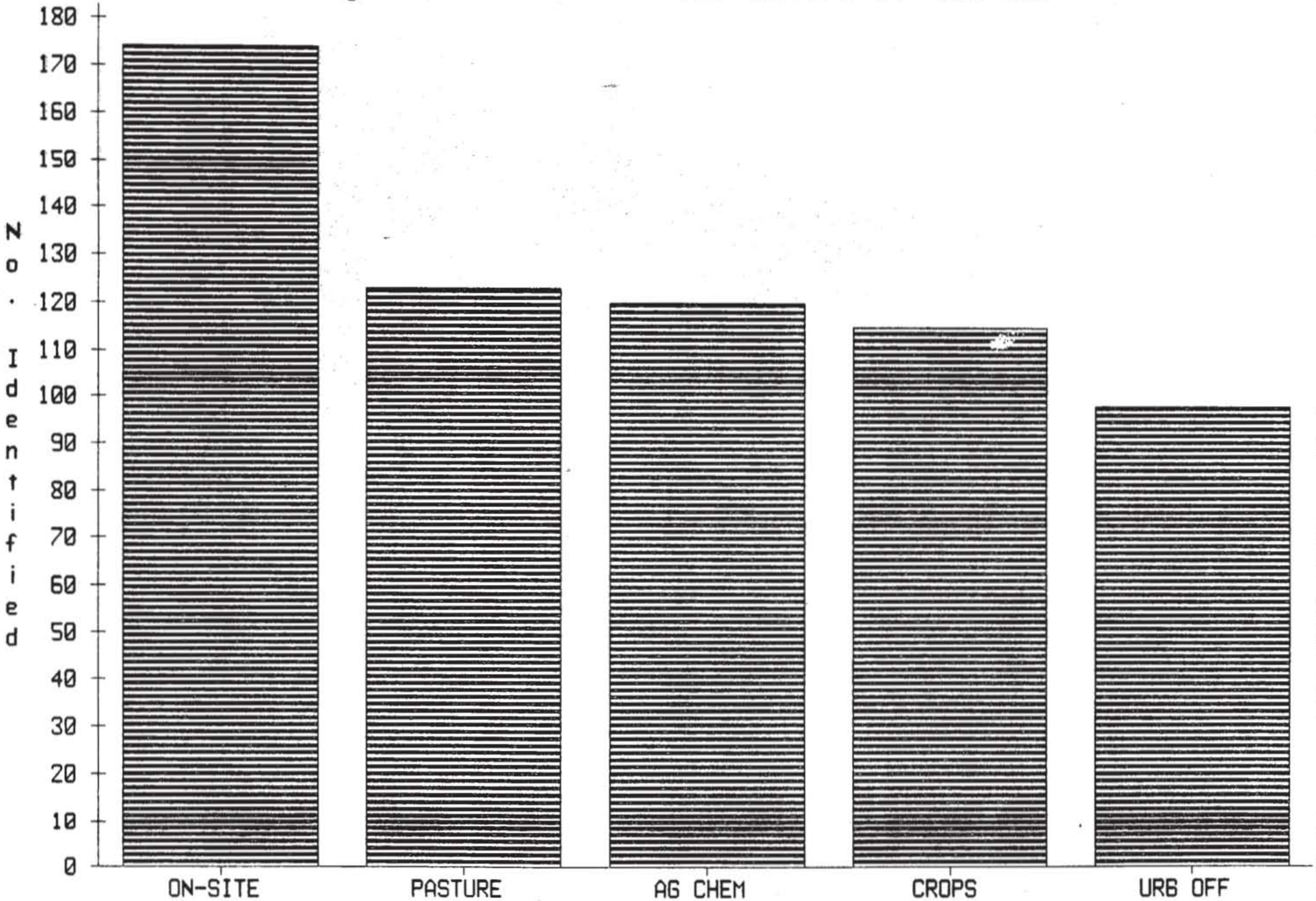


FIGURE 25. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the NMW

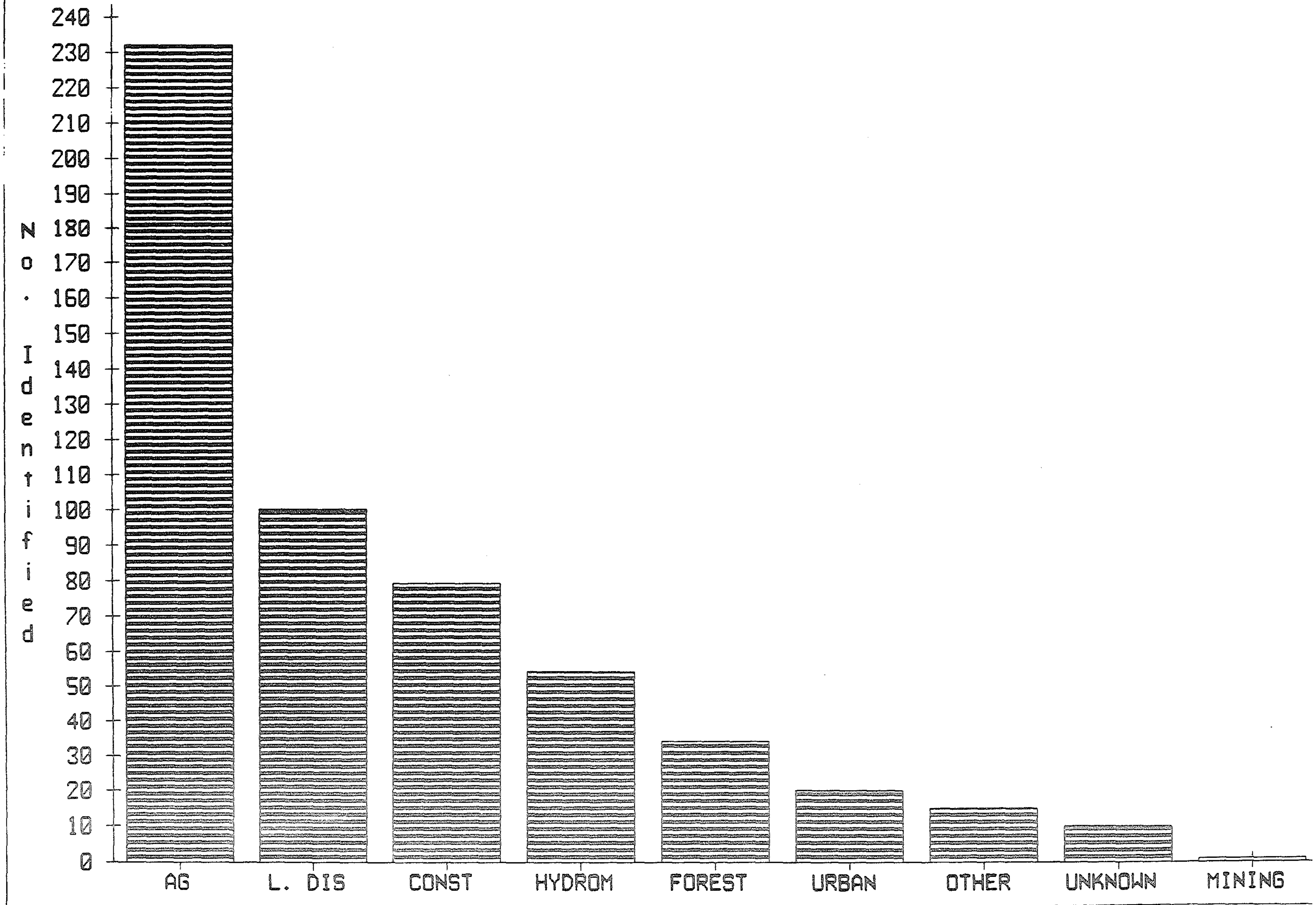


FIGURE 26. RESULTS OF THE NPS SURVEY

NPS subcategories identified for waters of the NMW

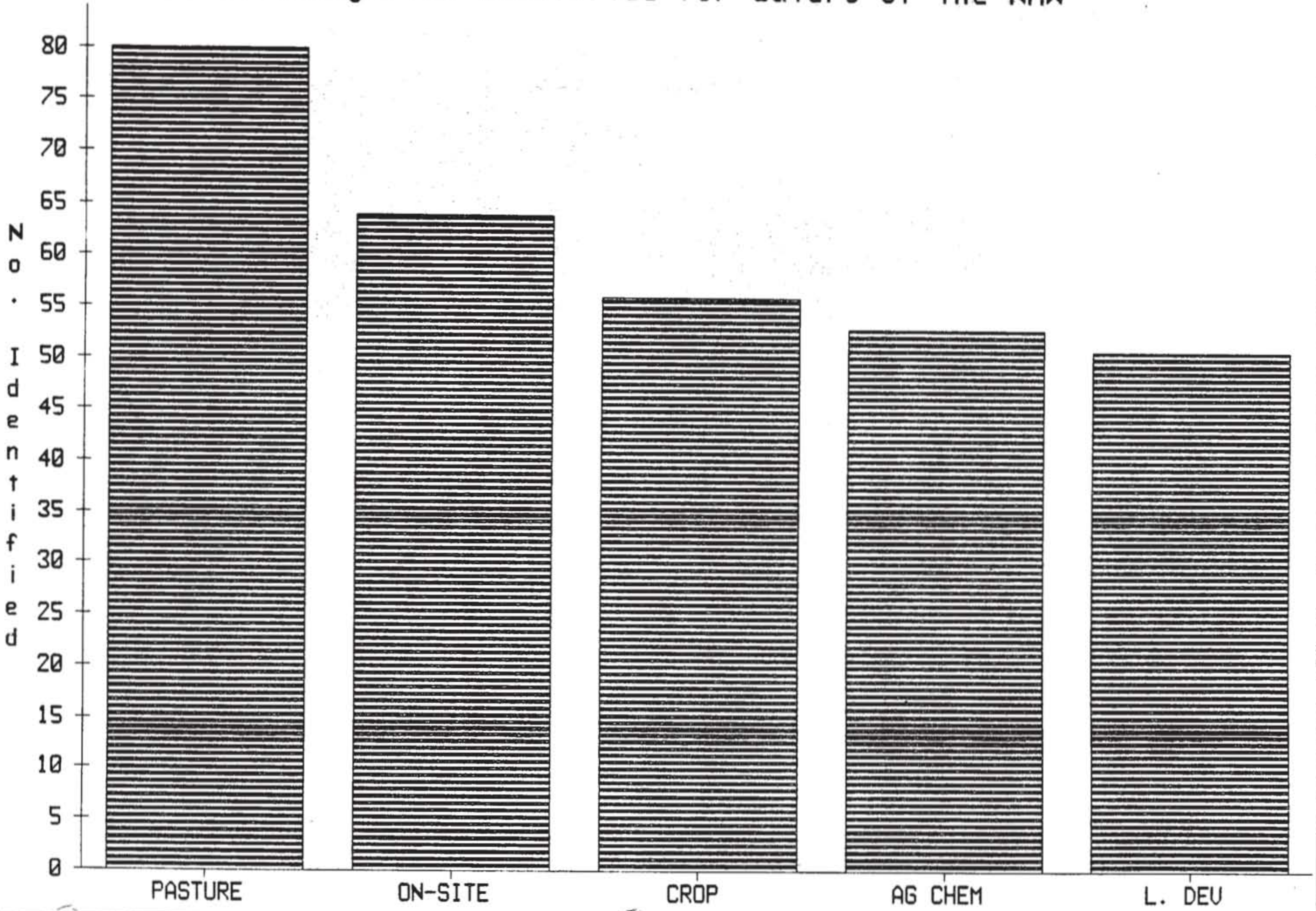


FIGURE 27. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the NCHF

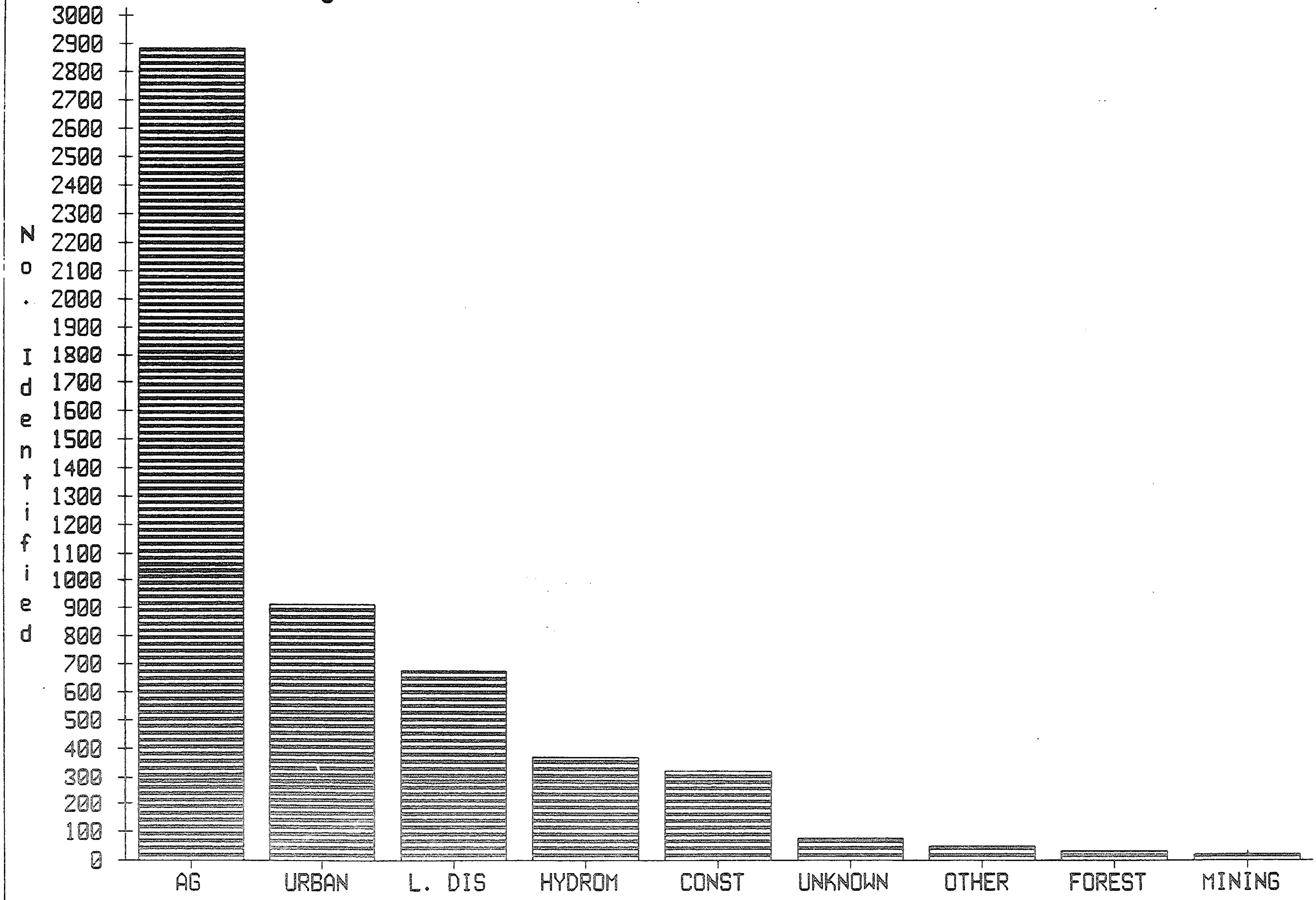


FIGURE 28. RESULTS OF THE NPS SURVEY

NPS subcategories identified for waters of the NCHF

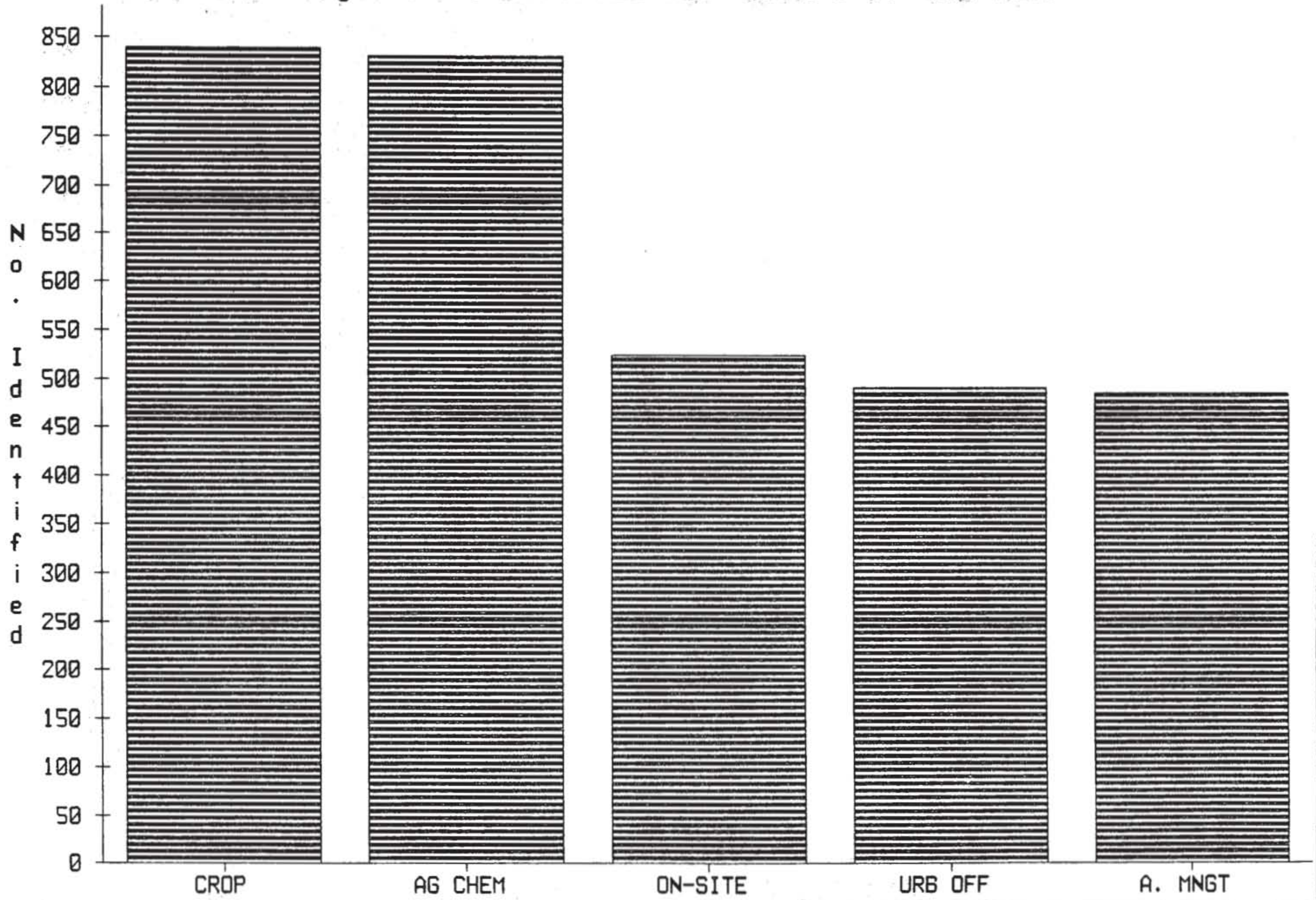


FIGURE 29. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the DA

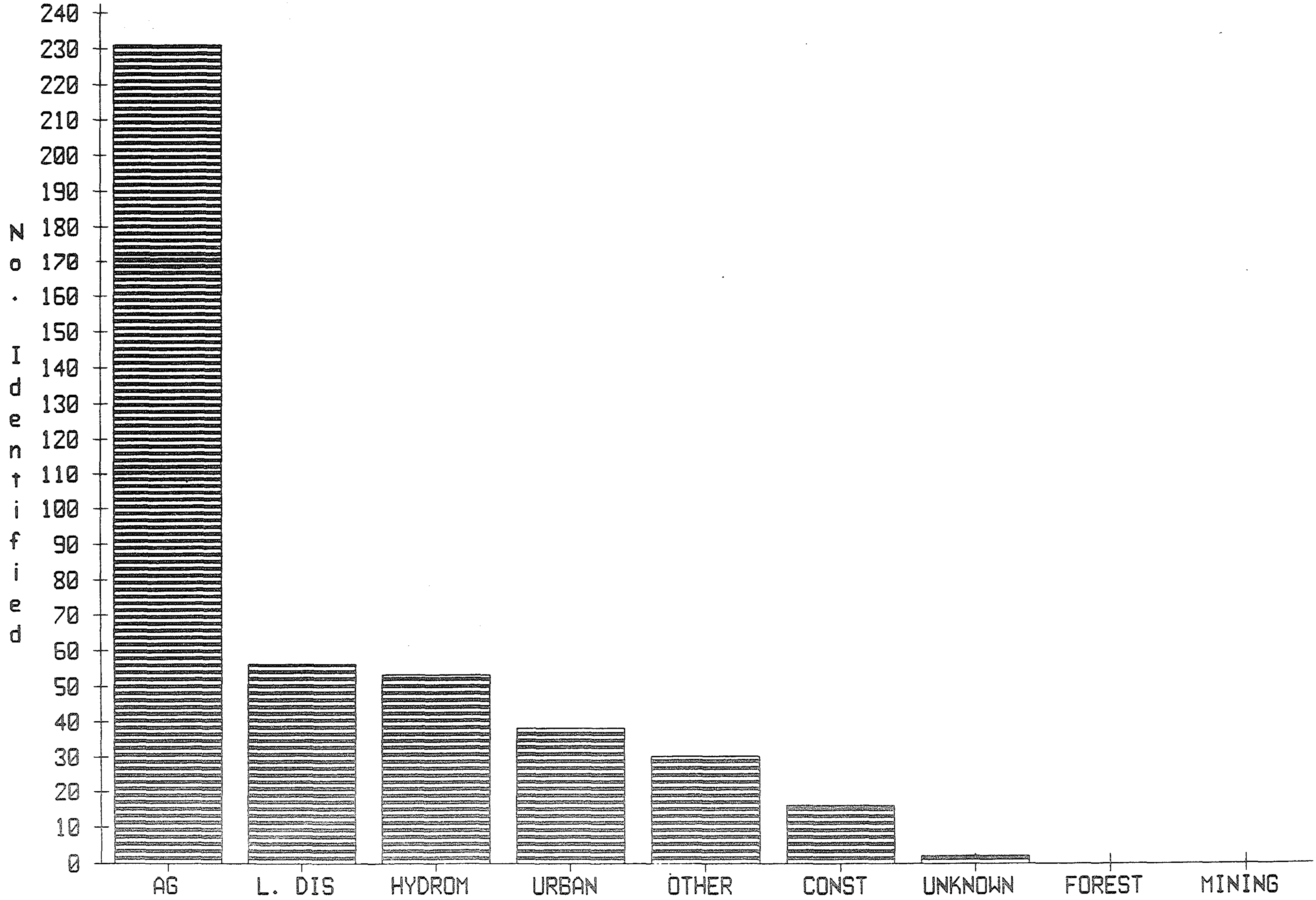


FIGURE 30. RESULTS OF THE NPS SURVEY

NPS subcategories identified for waters of the DA

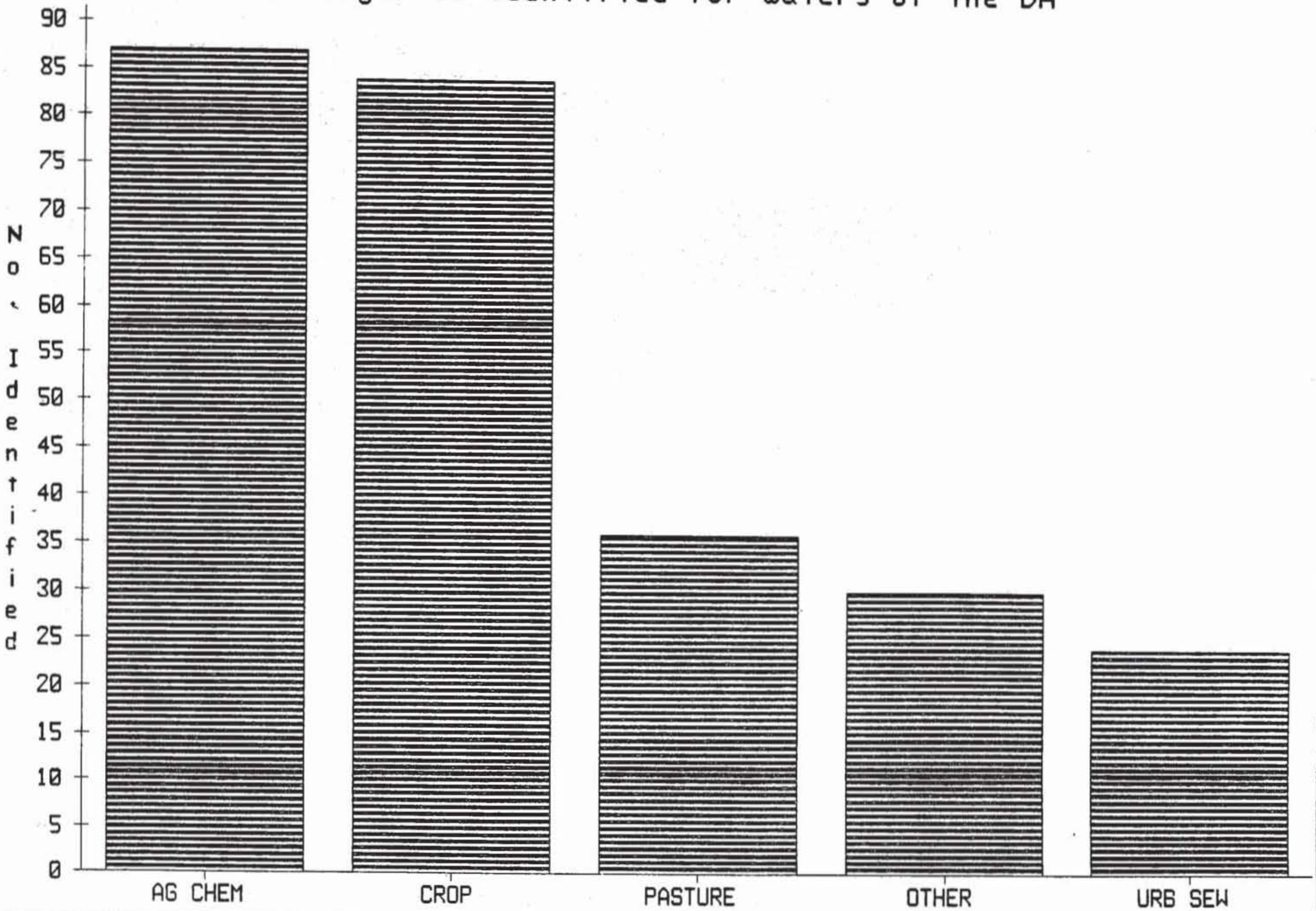


FIGURE 31. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the RRV

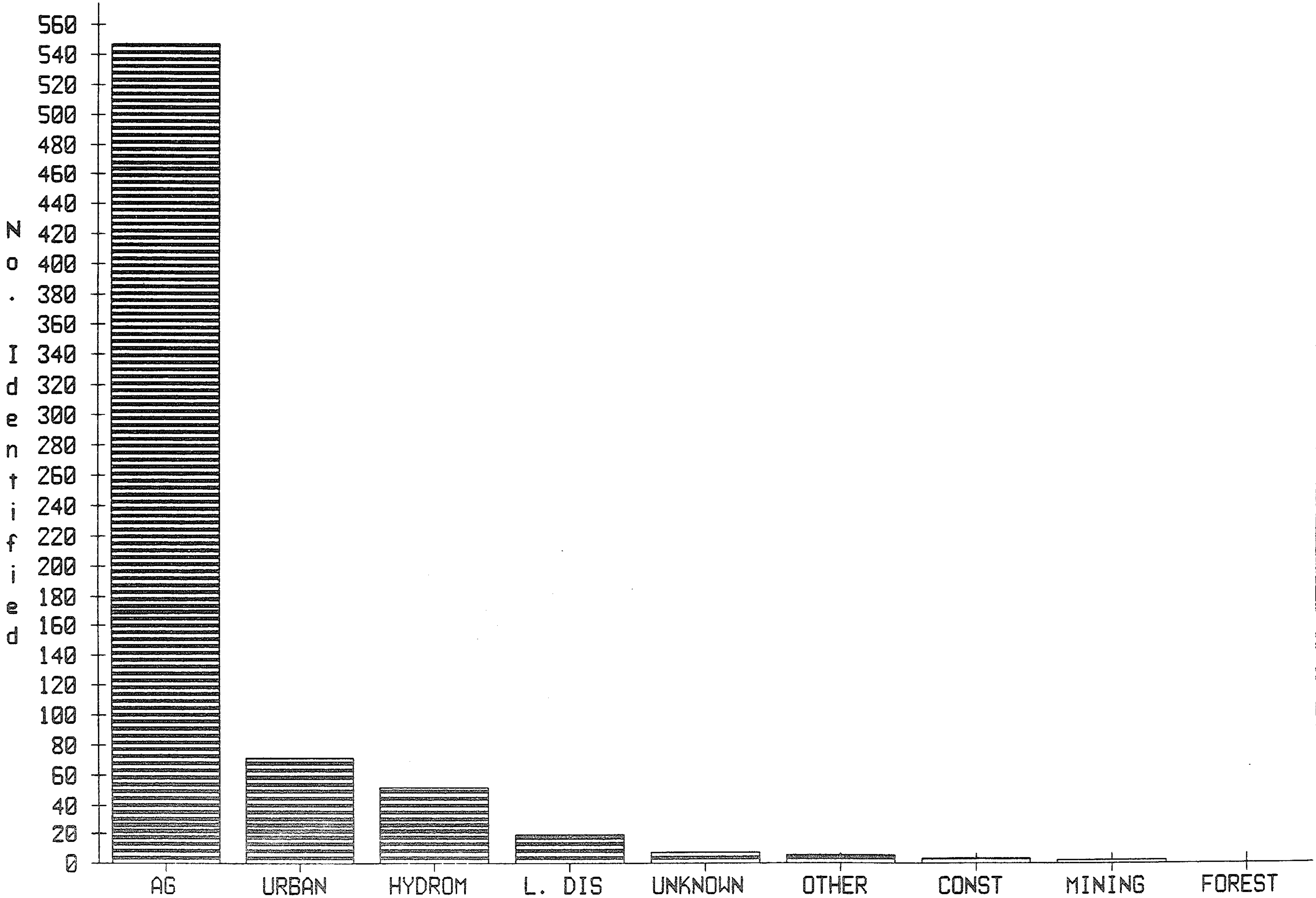


FIGURE 32. RESULTS OF THE NPS SURVEY

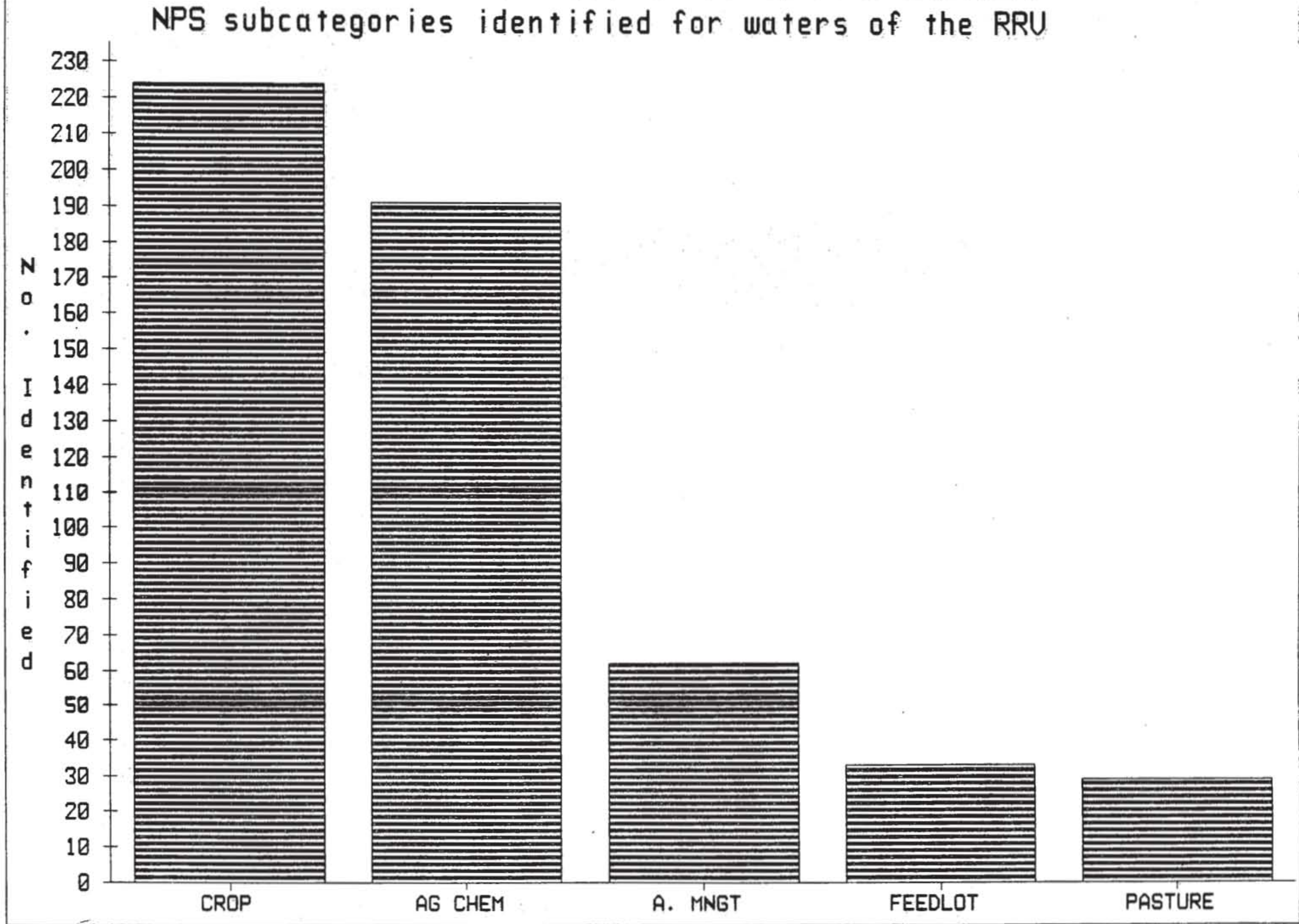
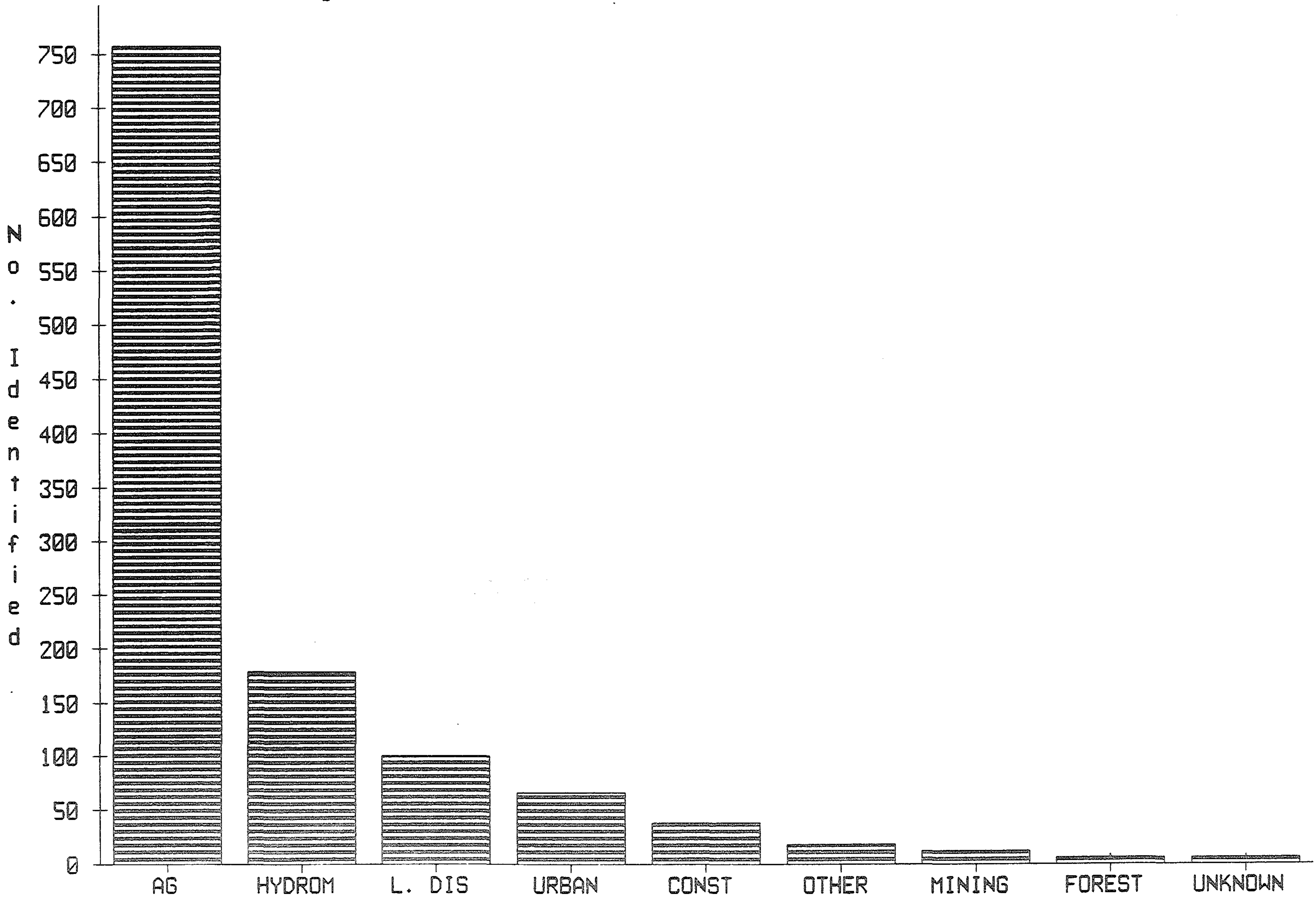


FIGURE 33. RESULTS OF THE NPS SURVEY

NPS categories identified for waters of the NGP



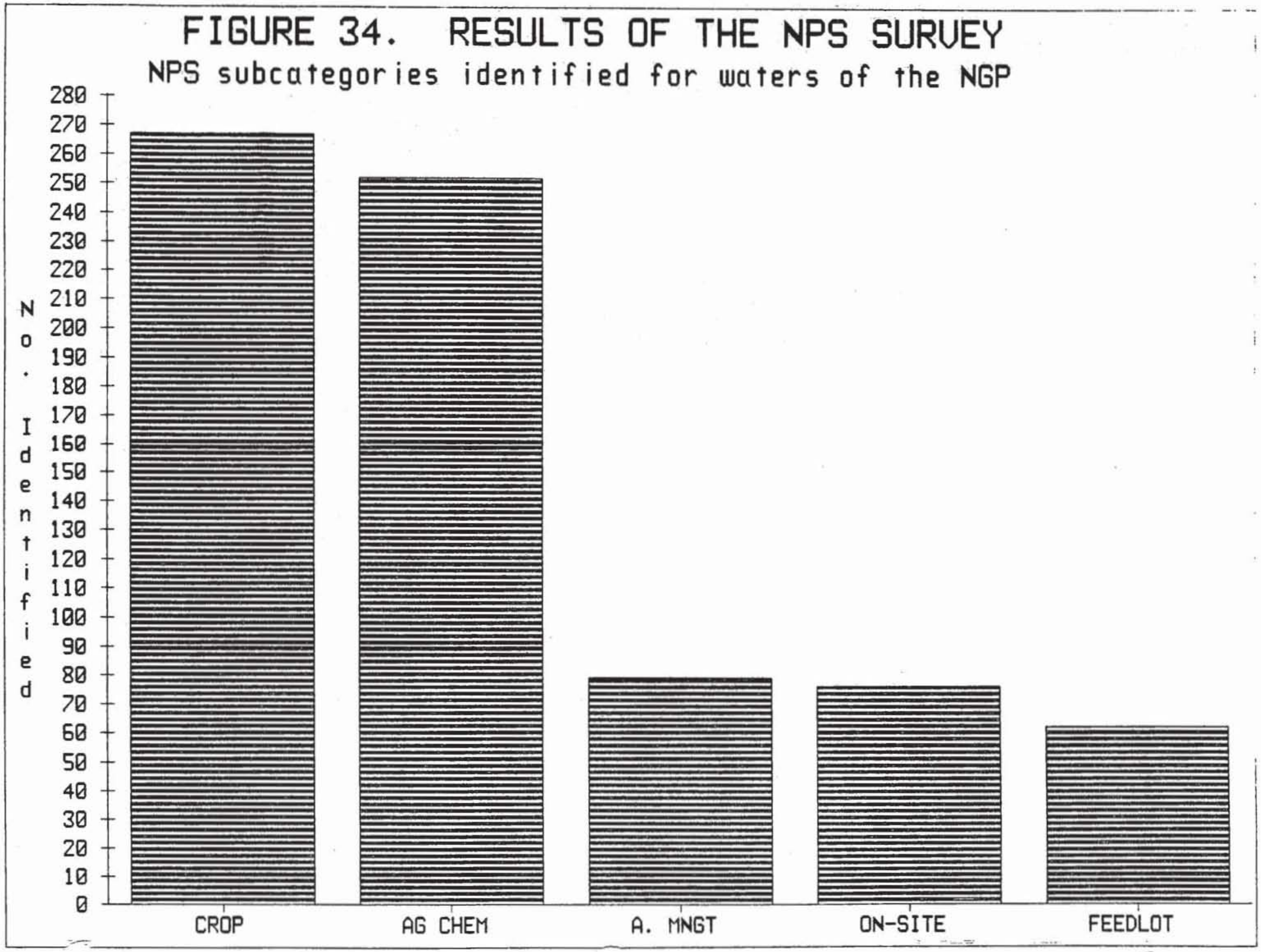


FIGURE 34. RESULTS OF THE NPS SURVEY
NPS subcategories identified for waters of the NGP
No. Identified
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
CROP
AG CHEM
A. MNGT
ON-SITE
FEEDLOT

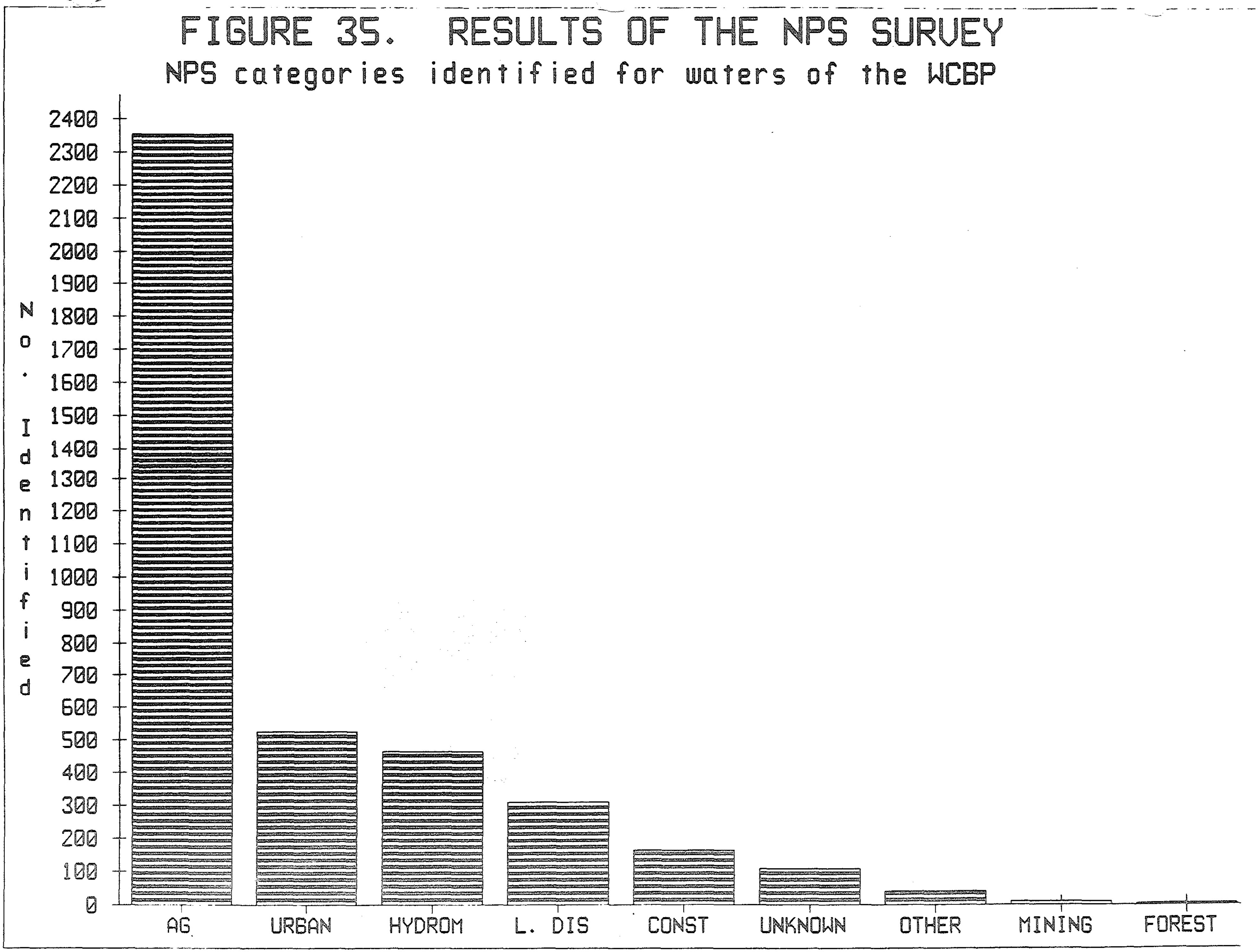
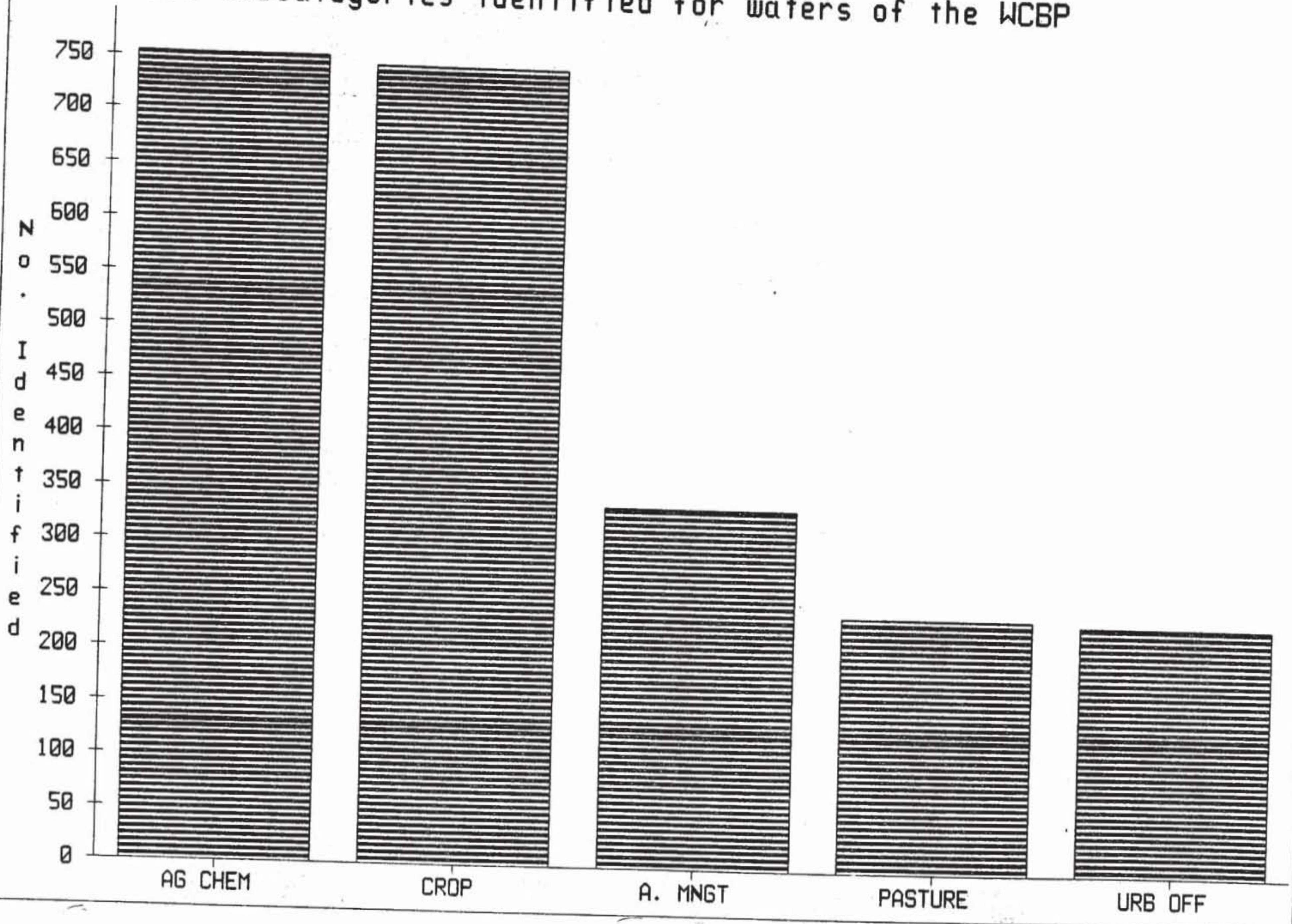


FIGURE 35. RESULTS OF THE NPS SURVEY
NPS categories identified for waters of the WCBP
No. Identified
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
AG
URBAN
HYDROM
L. DIS
CONST
UNKNOWN
OTHER
MINING
FOREST

FIGURE 36. RESULTS OF THE NPS SURVEY

NPS subcategories identified for waters of the WCBP



KEY TO THE NONPOINT-SOURCE SURVEY TABLE

HUC	-	U.S. Geological Survey hydrologic unit code. USGS. 1974. Hydrologic Unit Map, State of Minnesota. Denver, Colorado.
SEG	-	U.S. Environmental Protection Agency stream segment numbering system or the Minnesota Pollution Control Agency stream segment numbering system.
AUXID	-	Auxilary identification number.
RCHNAME	-	Water body name.
TI	-	T, Threatened; I, Impaired.
AMNT AFECT	-	Area affected.
EFFECT	-	NPS effect, see Table A of the survey to interpret the codes.
SOURCE	-	NPS source, see Table B of the survey to interpret the codes.
USE ACT	-	Existing uses of the water body, see Table C of the survey form to interpret the codes.
USE POT	-	Potential uses of the water body without NPS impacts, see Table C of the survey to interpret the codes.
RMO	-	Resource Management Organization identifying the water body.
DSN	-	Data Storage Number

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=? CNTYNAME= WBT=? ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
????????				-	-	-	-	-	-	mdof-211	87i
????????				-	-	-	-	-	-	mdof-533	87i
none				-	-	-	-	-	-	mdof-333	87h
all			all are NPS impacted in myarea	-	-	-	-	-	-	cza-61	87b
all			all are NPS impacted in myarea	-	-	-	-	-	-	msof-3-mont	87d
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	cza-46	87b
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	msow-4-madi	87c
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	msof-3-mont	87d
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	cza-61	87[illegible]
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	msof-i-glen	[illegible]
insufdef			all are NPS impacted in myarea	-	-	-	-	-	-	swcd-61	87g
insufdef			all lakes affected	-	-	-	-	-	-	msof-3-hink	87g
insufdef			all lakes nps impacted	-	-	-	19,11,70,10	-	-	msof-4-orto	87k
insufdef			all lks affected by septic sys	-	-	-	-	-	-	msof-1-dl	87d
all			all lks NPS impacted in myarea	-	-	-	-	-	-	cza-86	87b
all			all lks NPS impacted in myarea	-	-	-	-	-	-	msof-1-walk	87g
insufdef			all lks NPS impacted in myarea	-	-	-	-	-	-	cza-86	87b
insufdef			all lks NPS impacted in myarea	-	-	-	-	-	-	wd-sr	87e
insufdef			backwatrs of Miss NPS impacted	-	-	-	-	-	-	msow-5-wino	87d
insufdef			backwtrs of miss NPS impacted	-	-	-	-	-	-	msow-5-wino	87d
insufdef			bear lk in co 24 nps impacted	-	-	-	-	-	-	msow-5-owat	87c
possible			may be NPS problms in myarea	-	-	-	-	-	-	cza-15	86a
insufdef			no known nps problms in myarea	-	-	-	-	-	-	wmo-lrr	87
insufdef			no known nps problms in myarea	-	-	-	-	-	-	msow-2-gm	87k
insufdef			no known nps problms in myarea	-	-	-	-	-	-	msow-2-ely	87k
insufdef			no known nps problms in myarea	-	-	-	-	-	-	msow-3-brai	87k
insufdef			no known nps problms in myarea	-	-	-	-	-	-	cza-67	87k
insufdef			no known problms in myarea	-	-	-	-	-	-	cza-54	87k
none			no known NPS problms in myarea	-	-	-	-	-	-	mdof-131	87b
none			no known NPS problms in myarea	-	-	-	-	-	-	mdof-233	87b
none			no known NPS problms in myarea	-	-	-	-	-	-	mdof-254	87b
none			no known NPS problms in myarea	-	-	-	-	-	-	cza-42	86a
none			no known NPS problms in myarea	-	-	-	-	-	-	cza-54	86a
no new			no new NPS problms in myarea	-	-	-	-	-	-	mdof-31	87b
blnkform			no waterbodies in myarea	-	-	-	-	-	-	wmo-mmr	87j
blnkform			nothing entered	-	-	-	-	-	-	mdof-262	87i
blnkform			nothing entered	-	-	-	-	-	-	cza-43	87i
insufdef			other impaired lk in n co 69	-	-	-	-	-	-	mdow-2-gr	87c
insufdef			other threat lk in co 73,86,71	-	-	-	-	-	-	mdow-3-sc	87c
insufdef			prob ag nps affects every wate	-	-	-	-	-	-	msow-4-madi	87c
insufdef			red r watershed	I	-	EGI	11,71	S	U	mdow-1-dl	87h
insufdef			root r and tribs	-	-	-	-	-	-	cza-55	87i
comment			this page duplicates pg 1	-	-	-	-	-	-	cza-43	87b
insufdef			too numerous to list	-	-	-	-	-	-	cza-1	86a
insufdef			zumbro r and tribs	-	-	-	-	-	-	cza-55	87i
insufdef			I am sure there are others	-	-	-	-	-	-	msow-6-shak	87d
insufdef			I am sure there are others	-	-	-	-	-	-	msow-6-shak	87d
insufdef			I am sure there are others	-	-	-	-	-	-	swcd-47	87e
insufdef			I am sure there are others	-	-	-	-	-	-	mdof-344	87h
comment			NPS categories are unrealistic	-	-	-	-	-	-	mdow-3-brai	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=? CNTYNAME= WBT=? ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
insufdef			8 unnamed creeks	T	33	EC	71	Y	Y	swcd-67	87c

N= 51

CO=? CNTYNAME= WBT=AQUIFER ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-1120tsh	Unnamed Aqf	T	12000ac	H	19,22	-	-	swcd-44	87
		aqf-?	Unnamed Aqf(t143nr42ws25)	T	-	H	63	-	-	swcd-44	87
		aqf-?	Unnamed Aqf(t144nr42ws7)	T	-	H	63	-	-	swcd-44	87
		aqf-?	Unnamed Aqf(t145nr42ws34)	T	-	H	63	-	-	swcd-44	87
		aqf-?	Unnamed Aqf(t145nr42ws36)	T	-	H	63	-	-	swcd-44	87
		aqf-?	Unnamed Aqf(t146nr42ws15)	T	-	H	63	-	-	swcd-44	87

N= 6

CO=? CNTYNAME= WBT=LAKE ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		??-?	Blue Eagle Lk	I	-	DEI	11	T	T	mdow-1-dl	87h
		??-?	Campbell Lk	T	.26sqmi	CF	32,43,65	SW	TW	cza-43	87f
		??-?	Clearwater Lk	-	-	-	-	-	-	wd-rl	87h
		??-?	Forest Lk	-	-	B	-	-	-	wd-mc	87k
		??-?	French Lk	-	all	BF	40	-	-	msof-3-aitk	86b
		??-?	Grass Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
		??-?	Gun Lk	-	all	BF	40	TX	--	msof-3-aitk	86b
		31-?	Hay Lk	I	35ac	D	51	U	U	mdof-231	87i
		??-?	Horseshoe Lk	T	300ac	B	14	T	T	mdof-112	87h
		??-?	Lewis Lk	I	86ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
		??-?	Lily Lk	T	all	BCD	11,18,19,65	TW	UY	swcd-73	87f
		71-?	Little Elk Lk	I	-	ABDFH	19,65	TW	UX	msof-3-mont	87d
		??-?	Long Lk	-	-	B	-	-	-	wd-mc	87k
		??-?	Ludewig Lk	T	-	H	11	SW	-	swcd-8	87a
		??-?	Maria Lk	T	all	BCD	11,18,19,65	TX	UX	swcd-73	87f
		??-?	Sardy Lk	-	-	-	-	-	-	wd-rl	87h
		??-?	Sorby Lk	I	25ac	ABDE	11,14,16,19	S	U	swcd-60e	87g
		??-?	Ten Mile Cr	-	-	H	65	-	-	mpca-2	87i
		??-?	Twin Lk	-	-	B	-	-	-	wd-mc	87k

N= 19

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=? CNTYNAME= WBT=STREAM ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?		Burns Valley Cr,e	I	-	DEFGI	11,18,19,30	S	U	msof-5-lc	86b
?	?		Burns Valley Cr,main	I	-	DEFGI	11,18,19,30	S	U	msof-5-lc	86b
?	?		Burns Valley Cr,w	I	-	BDEFGI	11,18,19,30	T	U	msof-5-lc	86b
07020010	007		BUTTERFIELD CR	-		-	-	-	-	mdow-4-nu	87b
07020010	008		BUTTERFIELD CR	-	-	-	-	-	-	mdow-4-nu	87b
?	?		Carlton Lk	I	all	D	90	WT	UX	cza-12	86a
?	?		Cedar Valley Cr	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
?	?		Cold Spring Bk	T	-	DEFGI	11,18,19	U	U	msof-5-lc	86b
?	?		Cr By Lumas	-	-	-	-	-	-	swcd-58	87e
?	?		Cutface Ck	T	1.75mi	E	63	T	T	msof-2-gm	87g
09020305	001		CLEARWATER R	I	57.5	DAC	13,41	VTZ	-	cza-63	87b
09020305	005		CLEARWATER R	I		DAC	13,41	VTZ	-	cza-63	87b
09020305	007		CLEARWATER R	I		DAC	13,41	VTZ	-	cza-63	87b
09020305	013		CLEARWATER R	I		DAC	13,41	VTZ	-	cza-63	87b
?	?		Gilbert Cr	I	-	DEFGI	11,18,19	S	U	msof-5-lc	86b
?	?		Gilbert Cr	T	all	DEF	11,19	S	T	swcd-25	87k
?	?		Gilmore Cr	T	-	BDEFGI	11,18,19,30	U	U	msof-5-lc	86b
?	?		Gorman Cr	I	-	DEFGI	11,18,19,80	S	U	msof-5-lc	86b
?	?		Hazel Cr	T	2	C	16,19	Y	Y	cza-49	87f
?	?		Little Pickwick Cr	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
09020305	012		LOST R	I	24.5	DAC	13,41	T	Y	cza-63	87b
?	?		Mazappa Cr	I	-	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
?	?		Mill Cr	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
?	?		Mill Cr	I	-	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
?	?		Mill Pond	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
?	?		Miller Cr	I	-	DEFGI	11,18,19	S	U	msof-5-lc	86b
?	?		Moose R	I	20	ADEF	11,14,19	SW	SW	mdof-124	87h
07020001	007		MINNESOTA R	-	-	-	-	-	-	cza-37	86a
07020001	018		MINNESOTA R	-		-	-	-	-	cza-37	86a
07020001	019		MINNESOTA R	-		-	-	-	-	cza-37	86a
?	?		Pickwick Cr	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
?	?		Pleasant Valley Cr	I	-	DEFGI	11,18,19,30	T	U	msof-5-lc	86b
?	?		Rosebush Ck	T	1.5mi	E	63	T	T	msof-2-gm	87g
?	?		Rush Lk	I	all	BDFH	19,11,65	TW	UX	msof-3-mont	86b
09020303	009		RED LAKE R	T	32.5	D	13	VTZ	-	cza-63	87b
09020303	010		RED LAKE R	T		D	13	VTZ	-	cza-63	87b
09020303	012		RED LAKE R	T		D	13	VTZ	-	cza-63	87b
07020006	001		REDWOOD R	I		DH	11,18,90	TW	TW	cza-64	86a
07020006	003		REDWOOD R	I	all	DH	11,18,90	TW	TW	cza-64	86a
07020006	004		REDWOOD R	I		DH	11,18,90	TW	TW	cza-64	86a
?	?		Shingle Ck	T	4	DEFG	11,14,76,77	Z	Z	msof-5-lc	87h
?	?		Snake Cr	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
?	?		Speltz Cr	I	-	DEFGI	11,18,19	S	U	msof-5-lc	86b
?	?		Spring Bk	I	-	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
?	?		Spruce Cr	I	-	DFG	11,12,14,16,18,19,71,76,77	SW	VY	msof-i-glen	87f
?	?		Stockton Valley Cr	I	-	BDEFGI	11,18,19	T	U	msof-5-lc	86b
?	?		Sylvan Lk	-	-	H	18	-	-	mpca-2	87i
?	?		Trout Valley Cr	I	-	DEFGI	11,18,19	S	U	msof-5-lc	86b
?	?		Twelve Mile Cr	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
?	?		Twelve Mile Cr	I	-	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=? CNTYNAME= WBT=STREAM ECOREGN=?

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?		Whiskey Cr	I	–	DEI	11	T	T	mdow-1-dl	87h
07020010	001		WATONWAN R	–		–	–	–	–	mdow-4-nu	87b
07020010	002		WATONWAN R	–		–	–	–	–	mdow-4-nu	87b
07020010	003		WATONWAN R	–		–	–	–	–	mdow-4-nu	87b
07020010	004		WATONWAN R	–		–	–	–	–	mdow-4-nu	87b
07020010	006		WATONWAN R	–		–	–	–	–	mdow-4-nu	87b
07020010	005		WATONWAN R, N FK	–		–	–	–	–	mdow-4-nu	87b

N= 57

CO=01 CNTYNAME=AITKIN WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		01-?	Bible Lk	T	15ac	BF	14	T	T	mdof-331	87h
07010104		01-0104	French Lk	T	137ac	BG	13	UXZ	Z	msof-3-aitk	87i
07010104		01-0099	Gun Lk	I	735ac	B	12,71	WZ	X	mdow-2-gr	87c
07010104		01-0099	Gun Lk	T	735ac	B	13	UXZ	Z	msof-3-aitk	87i
07010103		01-0059	Hay Lk	T	140ac	B	73,74	TX	SW	mdof-332	87i
		01-?	Hill Lk	T	100ac	BF	14	TW	UX	mdof-331	87h
07030003		01-0001	Pine Lk	I	372	BFG	12,14,16,32,431	UW	–	msof-3-hink	87g
07010104		01-0178	Spirit Lk	T	530ac	B	18	UXZ	Z	msof-3-aitk	87i

N= 8

CO=01 CNTYNAME=AITKIN WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010104	025		LITTLE WILLOW R	T	2mi	GI	13	SZ	Z	msof-3-aitk	87i
07010103	x35		Morrison Bk	T	4	BFG	14	T	UV	mdof-331	87h
07010103	001		MISSISSIPPI R	T		E	19	–	–	msow-2-aitk	87c
07010103	001		MISSISSIPPI R	T	–	H	13	UZ	Z	msof-3-aitk	87i
07010103	002		MISSISSIPPI R	T		E	19	–	–	msow-2-aitk	87c
07010103	002		MISSISSIPPI R	T		H	13	UZ	Z	msof-3-aitk	87i
07010103	012		MISSISSIPPI R	T	–	E	19	–	–	msow-2-aitk	87c
07010103	012		MISSISSIPPI R	T		H	13	UZ	Z	msof-3-aitk	87i
07010104	014		MISSISSIPPI R	T		I	13	TZ	Z	msof-3-aitk	87i
07010104	015		MISSISSIPPI R	T		I	13	TZ	Z	msof-3-aitk	87i
07010104	024		MISSISSIPPI R	T	–	E	19	–	–	msow-2-aitk	87c
07010104	x15		Ripple R	T	.5mi	B	18	TZ	Z	msof-3-aitk	87i
07010104	016		RICE R	T	–	E	19	–	–	msow-2-aitk	87c
07010104	016		RICE R	T		I	13	TZ	Z	msof-3-aitk	87i
07010104	017		RICE R	T		E	19	–	–	msow-2-aitk	87c
07010104	017		RICE R	T	2mi	I	13	TZ	Z	msof-3-aitk	87i
07010104	020		RICE R	T		E	19	–	–	msow-2-aitk	87c

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By County, Waterbody Type, Name

CO=01 CNTYNAME=AITKIN WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010104	021		RICE R	T		E	19	–	–	msow-2-aitk	87c
07010103	105		SANDY RIVER	T	2mi	GI	13	UWZ	Z	msof-3-aitk	87i
07010103	205		SANDY RIVER	T		GI	13	UWZ	Z	msof-3-aitk	87i
07010103	305		SANDY RIVER	T		GI	13	UWZ	Z	msof-3-aitk	87i
07010103	013		SWAN R	T	20mi	DFE	14,32,43	WT	SW	mdof-332	87i
07010103	034		WILLOW R	T	5mi	I	13	TZ	Z	msof-3-aitk	87i

N= 23

CO=02 CNTYNAME=ANOKA WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		02-0013	Baldwin Lk	I	255ac	–	63	ZS	–	wd-rc	87e
07010206		02-0013	Baldwin Lk	I	255ac	–	63	ZS	–	wd-rc	87k
07010206	003	02-0090	Bunker Lk	T	1	B	90	SW	TX	wmo-cc	87d
07010206	003	02-0090	Bunker Lk	T	61ac	B	90	SW	TX	wd-co	87j
07010206	003	02-0090	Bunker Lk	I	–	H	90	S	S	wmo-Irr	87j
07010206		02-0006	Centerville Lk	I	455ac	–	63,32,43	XZT	–	wd-rc	87e
07010206		02-0006	Centerville Lk	I	455ac	–	63,32,43	XZT	–	wd-rc	87k
07010206		02-0018	Columbus Lk	I	37ac	–	63	–	–	wd-rc	87e
07010206		02-0018	Columbus Lk	I	37ac	–	63	–	–	wd-rc	87k
07030005		02-0042	Coon Lk	I	all	BF	41,43	T	U	msow-6-fl	87c
07010206	003	02-0084	Crooked Lk	I	3	B	41	SX	SX	wmo-cc	87d
07010206	003	02-0084	Crooked Lk	I	130ac	B	41	SX	SX	wd-co	87j
07010206	003	02-0084	Crooked Lk	T	0.3sqmi	AB	41,43	T	T	wmo-Irr	87j
07010206		02-0019	Crossways Lk	I	355ac	–	–	–	–	wd-rc	87e
07010206		02-0019	Crossways Lk	I	355ac	–	–	–	–	wd-rc	87k
		02-?	Farr Lk	I	2ac	ABDF	41,43	–	–	metc-frid	87j
07010206		02-0005	George Watch Lk	I	528ac	–	–	ZS	–	wd-rc	87e
07010206		02-0005	George Watch Lk	I	528ac	–	–	ZS	–	wd-rc	87k
07010206		02-0045	Golden Lk	I	57.2ac	B	12,13,19,63,32,14,43	XZT	–	wd-rc	87e
07010206		02-0045	Golden Lk	I	57.2ac	B	12,13,19,63,32,14,43	XZT	–	wd-rc	87k
07010206	003	02-0053	Ham Lk	T	4	B	41,11	TW	TW	wmo-cc	87d
07010206	003	02-0053	Ham Lk	T	193ac	B	41,11	TW	TW	wd-co	87j
		02-?	Harris Lk	I	3ac	ABDF	41,43	–	–	metc-frid	87j
07010206		02-0081	Hart Lk	T	8.6ac	BD	41,43	–	–	metc-ch	87k
07010206		02-0079	Highland Lk	I	17ac	ABD	41,43	–	T	metc-ch	87k
07010206		02-0016	Howard Lk	I	488ac	–	16,65,32	S	–	wd-rc	87e
07010206		02-0016	Howard Lk	I	488ac	–	16,65,32	S	–	wd-rc	87k
07010206		02-0118	Industry Ave. No. Pond	T	17ac	H	43	Y	Y	wmo-Irr	87j
07010206		02-0117	Industry Ave. So. Pond	T	40ac	H	43	Y	Y	wmo-Irr	87j
07010206		02-0110	Itasca	T	80ac	H	41,43,11	Y	Y	wmo-Irr	87j
07010206		02-0111	Jeglens Marsh	T	80AC	H	43	Y	Y	wmo-Irr	87j
		02-0687	LaBelle Pond	I	9ac	BD	41,43	–	–	metc-ch	87k
07030005		02-0023	Little Coon Lk	I	all	BF	41,43	S	Y	msow-6-fl	87c
		02-?	Locke Lk	I	5ac	ABD	41,43	S	–	metc-frid	87j
07010206		02-0116	Magnesium St. Pond	T	12ac	H	43	Y	Y	wmo-Irr	87j

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=02 CNTYNAME=ANOKA WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		02-0007	Marshan Lk	I	230ac	-	-	Z	-	wd-rc	87e
07010206		02-0007	Marshan Lk	I	230ac	-	-	Z	-	wd-rc	87k
07030005		02-0034	Martin Lk	T	-	F	80	SW	UX	mdow-6-sp	87b
07030005		02-0034	Martin Lk	I	all	BF	41,43	T	U	msow-6-fl	87c
07030005		02-0034	Martin Lk	T	-	F	80	SW	UX	mdow-6-sp	87f
07010206	002	02-0075-01	Moore Lk	I	108ac	-	63,43	X	T	wd-rc	87e
07010206	002	02-0075-02	Moore Lk	I		-	63,43	X	T	wd-rc	87e
07010206	002	02-0075-01	Moore Lk	I	75ac	ABDF	41,43	TX	-	metc-frid	87j
07010206	002	02-0075-02	Moore Lk	I		ABDF	41,43	TX	-	metc-frid	87j
07010206	002	02-0075	Moore Lk	I	108ac	-	63,43	X	T	wd-rc	87k
07010206	003	02-0052	Netta Lk	T	3	B	11,41	SW	SW	wmo-cc	87d
07010206	003	02-0052	Netta Lk	T	162ac	B	11,41	SW	SW	wd-co	87j
07010206		02-0003	Otter Lk	I	332ac	-	65,43	ZT	-	wd-rc	87e
07010206		02-0003	Otter Lk	I	332ac	-	65,43	ZT	-	wd-rc	87k
07010206		02-0004	Peltier Lk	I	465ac	-	32	ZT	-	wd-rc	87e
07010206		02-0004	Peltier Lk	I	465ac	-	32	ZT	-	wd-rc	87k
07010207		02-0112	Peltzer Pond	T	10ac	H	43	Y	Y	wmo-Irr	87j
07010207		02-0114	Ramsey Terrace Pond	T	45ac	H	43	Y	Y	wmo-Irr	87j
07010206		02-0009	Reshanay Lk	I	336ac	-	43	ZS	-	wd-rc	87e
07010206		02-0009	Reshanay Lk	I	336ac	-	43	ZS	-	wd-rc	87k
07010206		02-0008	Rice Lk	I	442ac	-	-	ZS	-	wd-rc	87e
07010206		02-0008	Rice Lk	I	442ac	-	-	ZS	-	wd-rc	87k
07010207		02-0104	Rogers	T	15ac	H	43	Y	Y	wmo-Irr	87j
07010206		02-0015	Rondeau Lk	T	275ac	-	-	S	-	wd-rc	87e
07010206		02-0015	Rondeau Lk	T	275ac	-	-	S	-	wd-rc	87k
07010207		02-0089	Round Lk	T	1.9sqmi	H	32,41,43	T	T	wmo-Irr	87j
		02-?	Secondary Pond	I	1.8ac	BD	41,43	-	-	metc-ch	87k
07010206		02-0109	Shack Eddy	T	12ac	H	43	Y	Y	wmo-Irr	87j
07010206		02-0011	Sherman Lk	I	33ac	-	-	ZS	-	wd-rc	87e
07010206		02-0011	Sherman Lk	I	33ac	-	-	ZS	-	wd-rc	87k
07010206		02-0083	Silver Lk	I	69.5ac	ABD	41,43	UX	-	metc-ch	87k
		02-0688	Spring Br Pond	I	180ac	D	41,43	-	-	metc-frid	87j
07010206	002	02-0071	Spring Lk	I	60.2ac	-	43	T	-	wd-rc	87e
07010206	002	02-0071	Spring Lk	I	60.2ac	-	43	T	-	wd-rc	87k
07010206		02-0080	Sullivan Lk	T	19ac	BD	41,43	-	-	metc-ch	87k
07010206		02-0113	Sunfish	T	30ac	H	43,11	Y	Y	wmo-Irr	87j
07010206		02-0010	Ward Lk	I	26ac	-	-	Z	-	wd-rc	87e
07010206		02-0010	Ward Lk	I	26ac	-	-	Z	-	wd-rc	87k
07010207		02-0085	Ward Lk	I	1.3sqmi	H	90	Y	S	wmo-Irr	87j

N= 74

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=02 CNTYNAME=ANOKA WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206	x02		Anoka/ramsey JD 1	-	-	-	31,32	-	-	wd-rc	87k
07010206	x02		Clearwater Cr	-	-	-	16,32	-	-	wd-rc	87k
07010206	x03		Coon Ck	T	13.1sqmi	DE	11,12,13,14,16,18,19,32,41,43	S	S	wmo-lrr	87j
07010206	003		COON R	I	10	DEF	19,32,43	SX	SX	wd-co	87j
07010207	026		ESTES BR	T	6mi	H	11,41,43	S	T	wmo-lrr	87j
07010207	x26		Ford Bk	T	1mi	H	11,43	Y	Y	wmo-lrr	87j
07010206	004		MISSISSIPPI R	T		H	41,43,23	Y	Y	wmo-lrr	87j
07010206	005		MISSISSIPPI R	T		H	41,43,23	Y	Y	wmo-lrr	87j
07010206	006		MISSISSIPPI R	T	4mi	H	41,43,23	Y	Y	wmo-lrr	87j
07010206	x02		Norton Cr	I	.5mi	-	41,43	-	-	metc-frid	87j
07040206	x02		Oak Glen Cr	I	1.2mi	-	41,43	-	-	metc-frid	87j
07010206	602		RICE CREEK	I	5mi	D	41,43	S	-	metc-frid	87j
07010206	602		RICE CREEK	T	-	B	63,66	-	-	wd-rc	87k
07010207	001		RUM R	T	5mi	H	41,43,23,74	U	Y	wmo-lrr	87j
07010207	002		RUM R	T	12.7sqmi	DEG	11,12,13,14,16,18,19,23,32,41,43,76	U	U	wmo-lrr	87j
07010207	004		RUM R	T		DEG	11,12,13,14,16,18,19,23,32,41,43,76	U	U	wmo-lrr	87j
07010206	x02		Spring Bk Cr	I	3mi	D	41,43	-	-	metc-frid	87j
07010206	x02		Stoneybrook Cr	I	2mi	-	41,43	-	-	metc-frid	87j

N= 18

CO=02 CNTYNAME=ANOKA WBT=WETLAND ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		02-0686w	Clover Pond	T	3ac	BD	41,43	-	-	metc-ch	87k
		02-0107w	Frank Lk	T	3.3ac	H	41,43	Y	Y	wmo-lrr	87j
		02-0088w	Leeman Lk	I	-	BH	90	S	S	wmo-lrr	87j
		02-0108w	Loch	T	5.2ac	H	41,43	Y	Y	wmo-lrr	87j
		02-0119w	Mineral Pond	T	12.1ac	H	41,43	Y	Y	wmo-lrr	87j
		02-630w	Sunny Acres Pond	T	53ac	H	41,43	Y	Y	wmo-lrr	87j
		02-0629w	Unnamed Wetland	T	1.3ac	H	41,43	Y	Y	wmo-lrr	87j
		02-0086w	Unnamed Wetland	I	100ac	H	41,43	S	S	wmo-lrr	87j
		02-0087w	Unnamed Wetland	I	-	H	43,90	S	S	wmo-lrr	87j

N= 9

CO=03 CNTYNAME=BECKER WBT=AQUIFER ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-?	Osage Aqf Part O Pineland Sand	T	-	EI	12	-	-	mdow-1-dl	87h
		aqf-112brd0	Straight R	T	10mi	E	12,1,19	-	-	mdow-co	87i

N= 2

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=03 CNTYNAME=BECKER WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020103		03-0286	Cotton Lk	I	all	ABDFG	40,65	TW	UX	msof-1-dl	86b
09020103		03-0286	Cotton Lk	I	-	ABDFG	65	TW	UX	msof-1-dl	87d
09020103	018	03-0381-01	Detroit Lk	T	all	GB	43,76,65	WXU	XU	mdow-1-dl	87h
09020103	018	03-0381-02	Detroit Lk	T		GB	43,76,65	WXU	XU	mdow-1-dl	87h
09020103		03-0387	Floyd Lk	I	all	ABDFG	19,40,65	TW	UX	msof-1-dl	86b
09020103		03-0387	Floyd Lk	I	-	ABDFG	19,65	TW	UX	msof-1-dl	87d
09020103		03-0387	Floyd Lk	T	all	B	11	U	U	mdow-1-dl	87h
09020103		03-0582	Ida Lk	I	all	ABG	11,19,40,65	TW	UX	msof-1-dl	86b
09020103		03-0582	Ida Lk	I	-	ABG	19,11,65	TW	UX	msof-1-dl	87d
09020103		03-0506	Little Cormorant Lk	I	all	ABG	11,18,19,40,65	TW	UX	msof-1-dl	86b
09020103		03-0506	Little Cormorant Lk	I	-	ABG	19,11,65,16	TW	UX	msof-1-dl	87d
		93-0189	Little Toad	I	all	ABDFG	11,18,19,40,65	TW	UX	msof-1-dl	86b
09020103		03-0189	Little Toad Lk	I	-	ABDFG	19,11,65,16	TW	UX	msof-1-dl	87d
09020103		03-0475	Melissa Lk	I	all	ABDFG	40,65	TW	UX	msof-1-dl	86b
09020103		03-0475	Melissa Lk	I	-	ABDFG	43,65	TW	UX	msof-1-dl	87d
09020103		03-0475	Melissa Lk	I	all	BD	62,65	UX	UW	mdow-1-dl	87h
09020103		03-0360	Muskrat Lk	I	all	B	62	SY	UX	mdow-1-dl	87h
09020103	014	03-0273	Perch Lk	I	all	FB	31	S	V	mdow-1-dl	87h
09020103		03-0359	Sallie Lk	I	all	ABDFG	40,65	TW	UX	msof-1-dl	86b
09020103		03-0359	Sallie Lk	I	-	ABDFG	43,65	TW	UX	msof-1-dl	87d
		93-0659	Sand Lk	I	all	ABGI	11,18,19,70	SW	UX	msof-1-dl	86b
09020106		03-0659	Sand Lk	I	-	ABGI	19,11,16,70	SW	UX	msof-1-dl	87d
09020103		03-0359	Sauie Lk	I	all	B	62,65	UX	UW	mdow-1-dl	87h
09020103		03-0382	St Clair Lk	I	all	B	43,62	-	-	mdow-1-dl	87h

N= 24

CO=03 CNTYNAME=BECKER WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020106	001		BUFFALO R	I	-	EGI	11	S	U	mdow-1-dl	87h
09020106	009		BUFFALO R	I		EGI	11	S	U	mdow-1-dl	87h
09020103	016		PELICAN R	I	-	G	71	Y	-	mdow-1-dl	87h
07010106	031		STRAIGHT R	T	14.7mi	BE	12,14,19,62,73	V	V	msof-1-pr	87h
07010106	031		STRAIGHT R	T	all	EI	12	V	V	mdow-1-dl	87h
07010106	031		STRAIGHT R	T	10mi	E	12,1,19	V	V	mdow-co	87i

N= 6

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=04 CNTYNAME=BELTRAMI WBT=LAKE ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010101	027	04-0038	Andrusia Lk	T	3sqmi	B	65	U	–	swcd-4	87g
07010101	027	04-0038	Andrusia Lk	I	1532	F	32,76,77,65	UX	–	msof-1-bemi	87h
09020302		04-0329	Balm Lk	T	508	F	32,65,76	UX	Y	msof-1-bemi	87h
09020302		04-0329	Balm Lk	–	–	–	–	–	–	wd-rl	87h
07010101		04-0135	Beltrami Lk	T	543	B	32,65,76	UX	–	msof-1-bemi	87h
07010101	029	04-0130	Bemidji Lk	T	6920ac	BDF	61,62,63,65,11,14,41,43,	UW	UX	mdow-1-bemi	87b
07010101	029	04-0130	Bemidji Lk	T	10sqmi	B	65	U	–	swcd-4	87g
07010101	029	04-0130	Bemidji Lk	I	6420	B	65,74,75,76,32,41,43,62,63	UX	–	msof-1-bemi	87h
07010101	029	04-0130	Bemidji Lk	I	6000ac	C	65	T	U	mdof-151	87h
07010101		04-0033	Benjamin Lk	T	33	H	21,31,32	VX	–	msof-1-bemi	87h
07010101		04-0132	Big Bass Lk	T	380	B	32,43,65,76	UX	Y	msof-1-bemi	87h
07010101		04-0049	Big Lk	T	3533	H	21,31,32,65	UX	–	msof-1-bemi	87h
07010101		04-0031	Big Rice Lk	I	600ac	B	90	Z	Z	mdof-112	87h
07010101	027	04-0079	Big Wolf Lk	T	1206ac	BDF	62,65	TW	TX	mdow-1-bemi	87b
07010101		04-0157	Black Lk	T	246	A	32,14,16	TW	–	msof-1-bemi	87h
09020302	030	04-0069	Blackduck Lk	I	2742ac	ABCDF	41,62,65	TW	UX	mdow-1-bemi	87b
09020302	030	04-0069	Blackduck Lk	T	5sqmi	B	65	T	–	swcd-4	87g
09020302	030	04-0069	Blackduck Lk	I	2596	B	14,31,32,43,62,65,76	UW	X	msof-1-bemi	87h
09020302	030	04-0069	Blackduck Lk	T	–	B	41,43,62,65	UX	–	wd-rl	87h
09020302	030	04-0069	Blackduck Lk	I	3000ac	B	65	T	U	mdof-151	87h
09020305		04-0297	Buzzle Lk	T	189	H	–	UX	–	msof-1-bemi	87h
09020305		04-0297	Buzzle Lk	–	–	–	–	–	–	wd-rl	87h
07010101	032	04-0141	Carr Lk	T	28.6	H	32,65,76	UX	–	msof-1-bemi	87h
07010101		04-0056	Carter Lk	T	30	H	21,32	TX	–	msof-1-bemi	87h
07010101		04-0030	Cass Lk	T	14sqmi	B	65	U	–	swcd-4	87g
07010101		04-0030	Cass Lk	I	15596	BE	21,32,62,65,66,74,76,77	TX	–	msof-1-bemi	87h
07010101		04-0030	Cass Lk Pike Bay	I	4500ac	E	66	UX	UX	mdof-112	87h
09020305		04-0343	Clearwater Lk	T	1008	H	11,14,16,18,32,65,76	TX	–	msof-1-bemi	87h
07010101		04-0230	Deer Lk	T	267	H	11,31,32,65	UX	–	msof-1-bemi	87h
09020302		04-0331	Delwater Lk	T	141	H	11,31,32,65	UX	–	msof-1-bemi	87h
07010101		04-0024	Gilstad Lk	T	237	H	21,31,32,65	UX	–	msof-1-bemi	87h
07010101		04-0089	Goose Lk	I	59	B	21,32,62,65,66,74,76,77	UX	–	msof-1-bemi	87h
07010101		04-0217	Grant Lk	T	210	H	14,32,65	UX	–	msof-1-bemi	87h
		04-?	Gull Lk	T	3sqmi	B	65	T	–	swcd-4	87g
07010101		04-0120	Gull Lk	T	2243	B	11,14,31,32,65	UX	–	msof-1-bemi	87h
07010101	032	04-0140	Irving Lk	T	644ac	BDF	61,62,65,11,14,41,43	UW	UX	mdow-1-bemi	87b
07010101	032	04-0140	Irving Lk	T	1sqmi	B	65	T	–	swcd-4	87g
07010101	032	04-0140	Irving Lk	I	613	B	31,32,41,43,62,65	UW	X	msof-1-bemi	87h
07010101	032	04-0140	Irving Lk	T	600ac	C	62	S	U	mdof-151	87h
		04-?	Island Lk	–	–	–	–	–	–	wd-rl	87h
09020302		04-0166	Julia Lk	–	–	–	–	–	–	wd-rl	87h
09020302		04-0166	Julia Lk	I	450	BD	14,18,21,22,32,65	UW	X	msof-1-bemi	87h
07010101		04-0007	Kitchi Lk	T	1785	F	14,21,32,65	UW	–	msof-1-bemi	87h
07010101		04-0110	Little Bass Lk	T	343	H	32,43,65,76	UX	–	msof-1-bemi	87h
09020305		04-0298	Little Buzzle Lk	T	70	H	–	TX	–	msof-1-bemi	87h
07010101		04-0016	Little Gilstad Lk	T	50	H	21,31,32,65	UX	–	msof-1-bemi	87h
		04-?	Little Moose Lk	I	240ac	B	90	Z	Z	mdof-112	87h
07010101		04-0155	Little Turtle Lk	T	464	H	14,31,32,65	UX	–	msof-1-bemi	87h
07010101	034	04-0142	Marquette Lk	T	1sqmi	B	65	T	–	swcd-4	87g
07010101	034	04-0142	Marquette Lk	T	504	H	32,65	UW	–	msof-1-bemi	87h

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By County, Waterbody Type, Name

CO=04 CNTYNAME=BELTRAMI WBT=LAKE ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		04-?	Meadow Lk	I	70ac	B	90	Z	Z	mdof-112	87h
09020302		04-0122	Medicine Lk	-	-	-	-	-	-	wd-rl	87h
09020302		04-0122	Medicine Lk	T	446	H	14,18,32,65	UW	-	msof-1-bemi	87h
07010101		04-0011	Moose Lk	T	500ac	B	90	T	T	mdof-112	87h
07010101		04-0342	Moose Lk	T	80ac	BFG	21,22,23,32,65	TX	-	swcd-15	87a
07010101		04-0152	Movil Lk	T	923	H	32,65	UW	-	msof-1-bemi	87h
09020302		04-0304	Myrtle Lk	-	-	-	-	-	-	wd-rl	87h
09020302		04-0344	Parks Lk	T	50ac	BE	65,14,11	UXZ	-	swcd-15	87f
07010101		04-0032	Pimushe Lk	T	1350ac	C	14,65	UW	UX	mdow-co	87c
07010101		04-0032	Pimushe Lk	T	1368	H	21,32,65	UX	-	msof-1-bemi	87h
07010101		04-0014	Popple Lk	I	100ac	B	90	Z	Z	mdof-112	87h
07010101		04-0034	Rabideau Lk	T	575	A	21,32,65	UX	-	msof-1-bemi	87h
09020302		04-0035	Red Lk	-	-	-	-	-	-	wd-rl	87h
07010101		04-0031	Rice Lk	T	618	H	32,65	UX	-	msof-1-bemi	87h
09020302		04-0124	Sandy Lk	T	242	H	32,65	UX	-	msof-1-bemi	87h
07010101		04-0086	Stocking Lk	I	75	A	14,32,65	SW	UX	msof-1-bemi	87h
07010101		04-0134	Three Island Lk	T	678	H	14,31,32,65	UX	-	msof-1-bemi	87h
07010101		04-0159	Turtle Lk	T	1436	H	14,31,32,65	UX	-	msof-1-bemi	87h
07010101		04-0111	Turtle River Lk	T	1737	H	14,31,32,65	UX	-	msof-1-bemi	87h
09020302		04-0035	Upper Red Lk	T	48000	H	12,13,16,31,32,65,71,72	UX	-	msof-1-bemi	87h
09020302		04-0035	Upper Red Lk	T	all	E	19	UX	-	mdof-152	87i
		04-?	Whitefish Lk	-	-	-	-	-	-	wd-rl	87h
07010101	027	04-0079	Wolf Lk	I	1051	B	14,31,32,65,77	UX	-	msof-1-bemi	87h

N= 73

CO=04 CNTYNAME=BELTRAMI WBT=STREAM ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010101	023			I		G	11,12,14,16,18,19,21,31,32,62	UW	-	msof-1-bemi	87h
07010101	029			I		C	62	S	U	mdof-151	87h
?	?		Balsam Bk	I	3mi	G	43,63,73	SW	Y	msof-1-bemi	87h
09020302	037		BATTLE R, S BR	I	-	F	14	Z	-	swcd-4	87g
09020302	037		BATTLE R, S BR	T	9mi	G	11,14,75,77	SV	V	msof-1-bemi	87h
09020302	037		BATTLE R, S BR	T	15	H	14,19,11	V	-	mdof-152	87i
09020302	038		BATTLE R, S BR	I		F	14	Z	-	swcd-4	87g
09020302	038		BATTLE R, S BR	T		G	11,14,75,77	SV	V	msof-1-bemi	87h
09020302	038		BATTLE R, S BR	T		H	14,19,11	V	-	mdof-152	87i
09020302	039		BATTLE R, W BR	I		F	14	Z	-	swcd-4	87g
09020302	039		BATTLE R, W BR	T	9mi	G	11,14,75,77	SV	V	msof-1-bemi	87h
09020302	039		BATTLE R, W BR	T	3	H	14,19,11	S	-	mdof-152	87i
09020302	026		BLACKDUCK R	I	-	F	14	Z	-	swcd-4	87g
09020302	026		BLACKDUCK R	I	17mi	H	14,16,19,31,71,75,76	SW	-	msof-1-bemi	87h
09020302	026		BLACKDUCK R	T	2	H	14,19,11	T	-	mdof-152	87
09020302	027		BLACKDUCK R	I		F	14	Z	-	swcd-4	87g
09020302	029		BLACKDUCK R	I		F	14	Z	-	swcd-4	87g
09020302	029		BLACKDUCK R	I		H	14,16,19,31,71,75,76	SW	-	msof-1-bemi	87h

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=04 CNTYNAME=BELTRAMI WBT=STREAM ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020302	029		BLACKDUCK R	I	20mi	F	14	T	U	mdof-151	87h
09020302	029		BLACKDUCK R	T		H	14,19,11	T	–	mdof-152	87i
09020305	013		CLEARWATER R	T	7mi	A	11,12,14,16,18,31,32,62,71,77	VX	V	msof-1-bemi	87h
09020305	013		CLEARWATER R	–	–	–	–	–	–	msof-1-bemi	87h
09020305	015		CLEARWATER R	I	–	G	12	Z	–	swcd-4	87g
09020302	130		COBURN CREEK	I	2mi	B	14	S	U	mdof-151	87h
09020302	034		CORMORANT R	T	9mi	G	12,14,21,31,32,77,18	SW	–	msof-1-bemi	87h
09020302	034		CORMORANT R	T	11	H	14,19,11	S	–	mdof-152	87i
09020302	031		CORMORANT R, S BR	T	9mi	G	12,14,21,31,32,77,18	SW	–	msof-1-bemi	87h
07010101	019		MISSISSIPPI R	I		G	11,12,14,16,18,19,21,31,32,62	UW	–	msof-1-bemi	87h
07010101	027		MISSISSIPPI R	I		F	14	Z	–	swcd-4	87g
07010101	027		MISSISSIPPI R	I		G	11,12,14,16,18,19,21,31,32,62	UW	–	msof-1-bemi	87h
07010101	027		MISSISSIPPI R	I		C	62	S	U	mdof-151	87h
07010101	032		MISSISSIPPI R	I		F	14	Z	–	swcd-4	87g
07010101	032		MISSISSIPPI R	I	70mi	G	11,12,14,16,18,19,21,31,32,62	UW	–	msof-1-bemi	87h
07010101	032		MISSISSIPPI R	I		C	62	S	U	mdof-151	87h
07010101	033		MISSISSIPPI R	I	–	F	14	Z	–	swcd-4	87g
07010101	033		MISSISSIPPI R	I	3000mi	C	62	S	U	mdof-151	87h
09020302	019		MUD R	I	16	ADEF	11,14,19	SW	SW	mdof-124	87h
09020302	x28		O'Brien Ck	I	5mi	BG	11,14,16,18,31,32,77	SW	V	msof-1-bemi	87h
?	?		Stump Lk	I	290	AB	31,32,62,65,77	UX	–	msof-1-bemi	87h
09020302	043		SHOTLEY BK	I	9mi	H	12,19,32,65,77	SW	UX	msof-1-bemi	87h
09020302	045		TAMARACK R	T	lower 5mi	E	12,13	TW	TW	mdow-1-bemi	87b
09020302	045		TAMARACK R	T	12mi	H	12,13,14,19,31,32,65,77	SW	UX	msof-1-bemi	87h
09020302	045		TAMARACK R	T	8	E	19	T	–	mdof-152	87i
07010101	025		TURTLE R	T	25mi	H	14,31,32,65,	UX	–	msof-1-bemi	87h

N= 44

CO=05 CNTYNAME=BENTON WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203		05-0004	Donovan Lk	T	–	CD	11,14,18,19,63,64,65	Z	Z	swcd-5	87e
07010203		05-0004	Donovan Lk	I	93ac	BEF	11,14,19	Y	–	mdof-2	87h
07010201	003	05-0013	Little Rock Lk	I	–	BCDF	19,43,65,11,12,14,18	TWZ	UXZ	swcd-5	87e
07010201	003	05-0013	Little Rock Lk	I	1259ac	BEF	11,12,14,19,32,43	T	–	mdof-2	87h
07010201	003	05-0013	Little Rock Lk	I	all	DH	11,65,90	TW	UX	cza-5	86a
07010203	008	05-0007	Mayhew Lk	I	127ac	BEF	11,14,19	T	–	mdof-2	87h
07010203	008	05-0007	Mayhow Lk	T	–	CEG	11,14,18,19,65	SWZ	UWZ	swcd-5	87e
07010201		05-0012	Unnamed Lk	–	95ac	BEF	11,14,19,12	T	–	mdof-2	87h

N= 8

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=05 CNTYNAME=BENTON WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?		Bailey Cr	T	-	EF	11,14,19	Y	-	mdof-2	87h
07010201	x03		Bunker Hill Cr	T	-	DEF	11,14,19	Y	-	mdof-2	87h
07010201	103		BUNKER HILL CREEK	T		CD	11,12,14,16,18,19,65	SWZV	TXZV	swcd-5	87e
07010201	203		BUNKER HILL CREEK	T	-	CD	11,12,14,16,18,19,65	SWZV	TXZV	swcd-5	87e
?	?		Collner Cr	T	-	EF	11,14,19	Y	-	mdof-2	87h
07010203	006		ELK R	T	-	CDF	11,14,16,18,19,63,65	TWZ	UWZ	swcd-5	87e
07010203	006		ELK R	T		DEF	11,14,19	T	-	mdof-2	87h
07010203	007		ELK R	T		CDF	11,14,16,18,19,63,65	TWZ	UWZ	swcd-5	87e
07010203	007		ELK R	T	-	DEF	11,14,19	T	-	mdof-2	87h
07010201	003		LITTLE ROCK CR	T	-	DEF	11,12,14,19	T	-	mdof-2	87h
07010203	008		MAYHEW CR	T	-	CD	11,14,16,18,19,65	SZ	XZ	swcd-5	87e
07010203	008		MAYHEW CR	I	-	DEF	11,12,14,19	T	-	mdof-2	87h
07010201	001		MISSISSIPPI R	T		CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	001		MISSISSIPPI R	I		DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010201	002		MISSISSIPPI R	T		CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	002		MISSISSIPPI R	I		DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010201	004		MISSISSIPPI R	T		CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	004		MISSISSIPPI R	I		DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010201	012		MISSISSIPPI R	T		CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	012		MISSISSIPPI R	I		DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010201	013		MISSISSIPPI R	T	-	CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	013		MISSISSIPPI R	I		DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010201	014		MISSISSIPPI R	I	-	DEF	11,12,14,19,32,41,43,62,66	U	-	mdof-2	87h
07010203	010		MISSISSIPPI R	T	-	CDF	18,19,32,41,43,62,77	TWZ	UXZ	swcd-5	87e
07010201	005		PLATTE R	I	-	CD	14,18,19,32,51	TXZ	UXZ	swcd-5	87e
07010201	005		PLATTE R	T	-	DEF	11,12,14,19	S	-	mdof-2	87h
07010203	x05		Stoney Bk	T	-	DEF	11,14,19	Y	-	mdof-2	87h
07010207	x25		Stoney Bk	T	-	CDF	11,12,14,18,19,65	SWZ	TWZ	swcd-5	87e
07010203	003		SAINT FRANCIS R	T	-	CDG	11,14,16,18,19,65	TWZ	UWZ	swcd-5	87e
07010203	003		SAINT FRANCIS R	T	-	DEF	11,14,19	T	-	mdof-2	87h
07010203	003		SAINT FRANCIS R	-	-	H	18	-	-	mpca-2	87i
07010201	x03		Zuleger Cr	T	-	CD	11,12,14,18,19,65	TWVZ	UXVZ	swcd-5	87e

N= 32

CO=06 CNTYNAME=BIG STONE WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002		06-0002	Artichoke Lk	T	2011ac	DFI	11,19,77	UX	-	swcd-6	87a
07020001	022	06-0152	Big Stone Lk	I	11185ac	BCDFI	11,16,18,19,41,43,65,77	TWZ	XZ	swcd-6	87a
07020001	022	06-0152	Big Stone Lk	I	729800ac	ABDF	11,12,16,18,19,41,43,62,63,65	TW	UX	wd-um	87e
09020102		06-0138	East Toqua Lk	I	440ac	BCI	11,19,41,43,77	SX	-	swcd-6	87a
07020001	010	06-0001	Marsh Lk	T	-	BDF	65,41,43,11,18,19	UWY	Y	cza-37	87b
07020001	010	06-0001	Marsh Lk	I	-	BDF	11,16,19	S	U	mpca-4	87i
07020001	010	06-0001	Marsh Lk	I	12sqmi	ABCDEGI	11,12,17,18,19,62,65,80	SW	SWY	swcd-37	87k
07020001	010	06-0001	Marsh Lk	I	all	DCF	19,11,65,18	U	X	cza-37	86a

N= 8

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=06 CNTYNAME=BIG STONE WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020001	007		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020001	018		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020001	019		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020001	020		MINNESOTA R	I	all	DEF	11,19,77	UWZ	-	mdow-4-mank	87h

N= 4

CO=07 CNTYNAME=BLUE EARTH WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020011		07-0054	Ballantyne Lk	I	-	ABF	19,11,65,40	T	U	msof-4-wate	86b
07020011		07-0054	Ballantyne Lk	-	-	ABF	19,11,65	T	U	msof-4-wate	87d
07020007		07-0098	Crystal Lk	T	-	ABF	40,19,11,65	U	U	msof-4-wate	86b
07020007		07-0098	Crystal Lk	-	-	ABF	43,19,11,65	U	U	msof-4-wate	87d
07020011		07-0053	Duck Lk	I	-	BF	19,11,65,40	T	U	msof-4-wate	86b
07020011		07-0053	Duck Lk	-	-	BF	19,11,65	T	U	msof-4-wate	87d
07020011		07-0053	Duck Lk	I	all	ABDF	11,16,18,19,65	UXZ	-	mdow-4-mank	87h
07020007		07-0047	George Lk	I	-	AB	11,65	T	U	msof-4-wate	86b
07020007		07-0047	George Lk	-	-	AB	19	T	U	msof-4-wate	87d
07020007		07-0096	Loon Lk	T	-	ABF	40,19,11,65	U	U	msof-4-wate	86b
07020007		07-0096	Loon Lk	-	-	ABF	43,19,11,65	U	U	msof-4-wate	87d
07020011		07-0079	Lura Lk	I	-	BF	19,11	T	U	msof-4-wate	86b
07020011		07-0079	Lura Lk	-	-	BF	19,11	T	U	msof-4-wate	87d
07020011		07-0044	Madison Lk	T	-	BF	19,11,65,40	U	U	msof-4-wate	86b
07020011		07-0044	Madison Lk	-	-	BF	19,11,65	U	U	msof-4-wate	87d
07020011		07-0044	Madison Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h

N= 16

CO=07 CNTYNAME=BLUE EARTH WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020009	001		BLUE EARTH R	I	-	DEFG	11,18,19	U	UV	msof-4-wate	86b
07020009	001		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	002		BLUE EARTH R	I		DEFG	11,18,19	U	UV	msof-4-wate	86b
07020009	002		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	002		BLUE EARTH R	-	-	DEFG	19,11	U	UV	msof-4-wate	87h
07020009	003		BLUE EARTH R	I		DEFG	11,18,19	U	UV	msof-4-wate	86b
07020009	003		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	003		BLUE EARTH R	-		DEFG	19,11	U	UV	msof-4-wate	87h
07020009	009		BLUE EARTH R	I		DEFG	11,18,19	U	UV	msof-4-wate	86b
07020009	009		BLUE EARTH R	I	all	DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	013		BLUE EARTH R	I		DEFG	11,18,19	U	UV	msof-4-wate	86b
07020009	015		BLUE EARTH R	I		DEFG	11,18,19	U	UV	msof-4-wate	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=07 CNTYNAME=BLUE EARTH WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	012		CANNON R	–		DEFG	19,11	U	U	msof-4-wate	87h
07040002	013		CANNON R	–	–	DEFG	19,11	U	U	msof-4-wate	87h
07020011	010		COBB R	I	–	DEFG	11,18,19	S	T	msof-4-wate	86b
07020011	010		COBB R	I		DEF	11,19,77	TWZ	–	mdow-4-mank	87h
07020011	010		COBB R	–	–	DEFG	19,11	S	T	msof-4-wate	87h
07020011	017		COBB R	I		DEFG	11,18,19	S	T	msof-4-wate	86b
07020011	017		COBB R	I	all	DEF	11,19,77	TWZ	–	mdow-4-mank	87h
07020011	017		COBB R	–		DEFG	19,11	S	T	msof-4-wate	87h
07020008	001		COTTONWOOD R	–	–	DEFG	19,11	S	T	msof-4-wate	87h
07020008	003		COTTONWOOD R	–		DEFG	19,11	S	T	msof-4-wate	87h
07020011	001		LE SUEUR R	I	–	DEFG	11,18,19	T	U	msof-4-wate	86b
07020011	001		LE SUEUR R	–	–	DEFG	19,11	T	U	msof-4-wate	87h
07020011	009		LE SUEUR R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020011	009		LE SUEUR R	–		DEFG	19,11	T	U	msof-4-wate	87h
07020011	013		LE SUEUR R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020011	013		LE SUEUR R	–		DEFG	19,11	T	U	msof-4-wate	87h
07020011	014		LE SUEUR R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020007	024		LITTLE COTTONWOOD CR	–	–	DEFG	19,11	S	T	msof-4-wate	87h
07020011	002		MAPLE R	I	–	DEFG	11,18,19	S	T	msof-4-wate	86b
07020011	002		MAPLE R	I		DEF	11,19,77	TWZ	–	mdow-4-mank	87h
07020011	002		MAPLE R	–	–	DEFG	19,11	S	T	msof-4-wate	87h
07020011	004		MAPLE R	I		DEFG	11,18,19	S	T	msof-4-wate	86b
07020011	004		MAPLE R	I		DEF	11,19,77	TWZ	–	mdow-4-mank	87h
07020011	004		MAPLE R	–		DEFG	19,11	S	T	msof-4-wate	87h
07020011	008		MAPLE R	I	all	DEF	11,19,77	TWZ	–	mdow-4-mank	87h
07020011	005		MINNESOTA L (MAPLE R)	I		DEFG	11,18,19	S	T	msof-4-wate	86b
07020007	001		MINNESOTA R	I	–	DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	003		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	004		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	004		MINNESOTA R	–	–	DEFG	19,11	UV	UV	msof-4-wate	87h
07020007	005		MINNESOTA R	–		DEFG	19,11	UV	UV	msof-4-wate	87h
07020007	008		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	009		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	010		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	011		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	013		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020007	006		SWAN L OUTLET	–		DEFG	19,11	UV	UV	msof-4-wate	87h
07020010	001		WATONWAN R	I	–	DEFG	11,18,19	T	U	msof-4-wate	86b
07020010	001		WATONWAN R	I	all	DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	001		WATONWAN R	–	–	DEFG	19,11	T	U	msof-4-wate	87h
07020010	002		WATONWAN R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020010	002		WATONWAN R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	003		WATONWAN R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020010	004		WATONWAN R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020010	006		WATONWAN R	I		DEFG	11,18,19	T	U	msof-4-wate	86b
07020010	013		WATONWAN R, S FK	–		DEFG	19,11	T	U	msof-4-wate	87h

N= 58

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By County, Waterbody Type, Name

CO=08 CNTYNAME=BROWN WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020008		08-0054	Altermatt Lk	T	-	H	11	SW	-	swcd-8	87a
07020008		08-0096	Boise Lk	T	-	H	11	SW	-	swcd-8	87a
07020008		08-0011	Clear Lk	T	-	H	11	TW	-	swcd-8	87a
07020008		08-0011	Clear Lk	T	-	ABDFH	11,14,16,90	TWY	UXY	cza-8	87b
07020008		08-0011	Clear Lk	I	all	H	11,90	ST	T	cza-8	86a
07020007		08-0035	Gilman Lk	T	-	H	11	SW	-	swcd-8	87a
07020010		08-0026	Hanska Lk	I	-	F	19,11	S	T	msof-4-wate	86b
07020010		08-0026	Hanska Lk	I	-	B	11,16,72	SW	-	swcd-8	87a
07020010		08-0026	Hanska Lk	T	-	BDFH	11,14,16,19,65,72,90	TW	UX	cza-8	87b
07020010		08-0026	Hanska Lk	I	1844ac	ABCDEFGH	11,19,65,76,71	TW	UX	mdow-4-nu	87b
07020010		08-0026	Hanska Lk	-	-	F	19,11	S	T	msof-4-wate	87d
07020010		08-0026	Hanska Lk	I	all	DFH	11,90	ST	U	cza-8	86a
07020007		08-0016	Juni Lk	T	-	H	11	SW	-	swcd-8	87a
07020007		08-0004	Linden Lk	T	-	H	11	SW	-	swcd-8	87a
07020007		08-0073	Lone Tree Lk	T	-	H	11	SW	-	swcd-8	87a
07020007		08-0010	Omsrud Lk	T	-	H	11	SW	-	swcd-8	87a
07020008		08-0014	School Lk	T	-	H	11	SW	-	swcd-8	87a
07020008		08-0045	Sleepy Eye Lk	I	-	F	19,11	S	T	msof-4-wate	86b
07020008		08-0045	Sleepy Eye Lk	T	-	H	11,72	TW	-	swcd-8	87a
07020008		08-0045	Sleepy Eye Lk	T	-	ABDFH	11,90	SY	UY	cza-8	87b
07020008		08-0045	Sleepy Eye Lk	I	290ac	ABCDEFGH	11,19,41,43,76,71	SW	UX	mdow-4-nu	87b
07020008		08-0045	Sleepy Eye Lk	-	-	F	19,11	S	T	msof-4-wate	87d
07020008		08-0045	Sleepy Eye Lk	I	all	H	90	ST	T	cza-8	86a
07020008		08-0027	Zanders Lk	T	-	H	11	SW	-	swcd-8	87a

N= 24

CO=08 CNTYNAME=BROWN WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020008	001		COTTONWOOD R	I	-	DEFG	11,18,19	S	U	msof-4-wate	86b
07020008	001		COTTONWOOD R	T		FH	11,14,16,41,90	Y	Y	cza-8	87b
07020008	001		COTTONWOOD R	T	-	DE	11,16,18	TW	-	swcd-8	87e
07020008	001		COTTONWOOD R	T		FH	11,90	Y	Y	cza-8	86a
07020008	003		COTTONWOOD R	T		FH	11,14,16,41,90	Y	Y	cza-8	87b
07020008	003		COTTONWOOD R	T		DE	11,16,18	TW	-	swcd-8	87e
07020008	003		COTTONWOOD R	T		FH	11,90	Y	Y	cza-8	86a
07020008	005		COTTONWOOD R	T		FH	11,14,16,41,90	Y	Y	cza-8	87b
07020008	005		COTTONWOOD R	T		DE	11,16,18	TW	-	swcd-8	87e
07020008	005		COTTONWOOD R	T	all	FH	11,90	Y	Y	cza-8	86a
07020008	006		COTTONWOOD R	T	-	FH	11,14,16,41,90	Y	Y	cza-8	87b
07020008	006		COTTONWOOD R	T		DE	11,16,18	TW	-	swcd-8	87e
07020008	019		COTTONWOOD R	T		FH	11,14,16,41,90	Y	Y	cza-8	87b
07020007	024		LITTLE COTTONWOOD CR	I	-	DEFG	11,18,19	S	T	msof-4-wate	86b
07020007	024		LITTLE COTTONWOOD CR	T	-	DE	11,16,18	SW	-	swcd-8	87e
07020007	010		MINNESOTA R	T		FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	010		MINNESOTA R	T		DE	11,16,18	UW	-	swcd-8	87e

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=08 CNTYNAME=BROWN WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020007	011		MINNESOTA R	T		FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	011		MINNESOTA R	T		DE	11,16,18	UW	–	swcd-8	87e
07020007	011		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020007	013		MINNESOTA R	T		FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	013		MINNESOTA R	T		DE	11,16,18	UW	–	swcd-8	87e
07020007	013		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020007	015		MINNESOTA R	T		FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	015		MINNESOTA R	T		DE	11,16,18	UW	–	swcd-8	87e
07020007	015		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020007	016		MINNESOTA R	T		FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	016		MINNESOTA R	T		DE	11,16,18	UW	–	swcd-8	87e
07020007	016		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020007	018		MINNESOTA R	T	–	FH	11,14,16,41,90	TY	UY	cza-8	87b
07020007	018		MINNESOTA R	T		DE	11,16,18	UW	–	swcd-8	87e
07020007	018		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020007	019		MINNESOTA R	T	–	DE	11,16,18	UW	–	swcd-8	87e
07020007	019		MINNESOTA R	T	all	FH	11,90	Y	Y	cza-8	86a
07020007	021		MINNESOTA R	T		FH	11,90	Y	Y	cza-8	86a
07020012	004		MINNESOTA R	I	–	DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020012	008		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020012	013		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020012	019		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020012	020		MINNESOTA R	I		DEFG	11,18,19	UV	UV	msof-4-wate	86b
07020008	017		MOUND CR	T	–	DE	11,16,18	SW	–	swcd-8	87e

N= 41

CO=09 CNTYNAME=CARLTON WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		09-?	Big Lk	I	800ac	BC	65	X	–	mdof-211	87i
04010201		09-0032	Big Lk	I	–	DB	77,32	T	U	swcd-9	87e
04010201		09-0032	Big Lk	I	566ac	BG	43,65	TWZ	UXZ	cza-9	87i
04010201		09-0032	Big Lk	I	all	BCG	40,65	UX	–	cza-9	86a
04010201		09-0008	Chub Lk	I	–	BDG	32,65	TW	UX	swcd-9	87e
04010201		09-0008	Chub Lk	I	400ac	BC	65	X	–	mdof-211	87i
04010201		09-0008	Chub Lk	I	274ac	B	43,65	TWZ	UXZ	cza-9	87i
04010201		09-0008	Chub Lk	I	all	BCG	40,65	UX	–	cza-9	86a
07010103		09-0068	Cole Lk	T	149ac	B	43,30,65	TW	TW	cza-9	87i
07010103		09-0057	Eagle Lk	I	600ac	BC	65	UX	–	mdof-211	87i
07010103		09-0057	Eagle Lk	I	410ac	GB	18,43,30,65	TWZ	UXZ	cza-9	87i
07010103		09-0057	Eagle Lk	I	all	BG	40,18	UX	–	cza-9	86a
07030003	006	09-0038	Hanging Horn Lk	T	–	DG	77	T	U	swcd-9	87e
07030003	006	09-0038	Hanging Horn Lk	I	420 ac	B	43,65	TWZ	UXZ	cza-9	87i
07010103	009	09-0060-01	Island Lk	I	600ac	BC	65	UX	–	mdof-211	87i
07010103	009	09-0060-02	Island Lk	I		BC	65	UX	–	mdof-211	87i
07010103	009	09-0060	Island Lk	I	456ac	B	43,62	TW	UX	cza-9	87i

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=09 CNTYNAME=CARLTON WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010103	009	09-0060-01	Island Lk	I	all	BC	40,65	UX	–	cza-9	86a
07010103	009	09-0060-02	Island Lk	I		BC	40,65	UX	–	cza-9	86a
07030003	006	09-0035	Little Hanging Horn Lk	I	–	D	31,32,43,76,77	T	U	swcd-9	87e
07030003	006	09-0035	Little Hanging Horn Lk	T	127ac	BG	43,30	TWZ	TWZ	cza-9	87i
07030003		09-0058	Merwin Lk	I	51ac	B	11,18	TW	UX	cza-9	87i
07030003	006	09-0041	Moosehead Lk	I	–	B	65	T	U	swcd-9	87e
07030003		09-0029	Park Lk	I	373ac	BG	43,65	TWZ	UXZ	cza-9	87i
07030003		09-0029	Park Lk	I	all	BC	40,65	UX	–	cza-9	86a
07010103	009	09-0067	Tamarack Lk	I	120ac	BC	65	UX	–	mdof-211	87i
07010103		09-0063	Woodbury Lk	I	60ac	BC	14,65	UX	–	mdof-211	87i

N= 27

CO=09 CNTYNAME=CARLTON WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
04010301	x15		Blackhoof Cr	I	4mi	ABCDF	18	TV	–	mdof-211	87i
04010301	x15		Blackhoof R	T	–	DFG	71,31,74,75,77	V	U	swcd-9	87e
04010201	010		MIDWAY R	T	–	C	16,18,14	W	X	swcd-9	87e
04010301	015		NEMADJI R	I	–	DF	76,77	T	U	swcd-9	87e
04010201	x09		Otter Cr	I	4mi	ABCDE	63	VT	–	mdof-211	87i
04010201	003		ST LOUIS R	I		CE	63	U	–	mdof-211	87i
04010201	004		ST LOUIS R	I		CE	63	U	–	mdof-211	87i
04010201	005		ST LOUIS R	I		CE	63	U	–	mdof-211	87i
04010201	006		ST LOUIS R	I		CE	63	U	–	mdof-211	87i
04010201	007		ST LOUIS R	I		CE	63	U	–	mdof-211	87i
04010201	008		ST LOUIS R	I	30mi	CE	63	U	–	mdof-211	87i
04010201	009		ST LOUIS R	I		DE	64,62,61,75,31	S	U	swcd-9	87e
04010201	011		ST LOUIS R	I	–	DE	64,62,61,75,31	S	U	swcd-9	87e

N= 13

CO=10 CNTYNAME=CARVER WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		10-0044-01	auburn,w	I		AB	11,14,19,32,76	Z	–	wd-mc	87k
07020012		10-0012	Ann Lk	T	121ac	B	32,43	T	U	swcd-10	87f
07020012		10-0063	Assumption Lk	T	132	ABEFG	11,16,19	Z	–	msow-6-shak	87d
07010206		10-0044-01	Auburn Lk	I	347ac	AB	11,14,19,32,76	Z	–	wd-mc	87h
07010206		10-0044-02	Auburn Lk	I		AB	11,14,19,32,76	Z	–	wd-mc	87h
07010206		10-0044-02	Auburn Lk,e Arm	–	–	B	–	–	–	wd-mc	87k
07010206		10-0044-01	Auburn Lk,w Arm	–	–	B	–	–	–	wd-mc	87k
07010206		10-0044-02	Auburn,e	I	347ac	AB	11,14,19,32,76	Z	–	wd-mc	87k
07020012		10-0109	Barnes Lk	I	175	ABEFG	11,16,19	Z	–	msow-6-shak	87d

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=10 CNTYNAME=CARVER WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012		10-0109	Barnes Lk	T	175ac	DF	11,18,19	Z	-	wmo-bc	87j
07010205		10-0103	Berliner Lk	I	222	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		10-0110	Brand Lk	T	134ac	DF	11,18,19	Z	-	wmo-bc	87j
07010205		10-0121	Eagle Lk	I	261ac	B	11,18,19	S	T	swcd-10	87f
07020012		10-0089	Goose Lk	I	407	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07010206		10-0015	Lk Virginia	T	121ac	B	32,41,43,76	Y	-	wd-mc	87k
07020012		10-0007	Lucy Lk	T	127ac	B	32,43	T	U	swcd-10	87f
07020012		10-0058	Maria Lk	T	169	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		10-0058	Maria Lk	T	169ac	DF	11,18,19	Z	-	wmo-bc	87j
07020012		10-0029	Miller Lk	I	180ac	D	11,18,19	Z	Z	swcd-10	87f
07010206		10-0009	Minnewashta Lk	-	-	-	-	-	-	wd-mc	87k
07020012		10-0068	Myers Lk	T	81ac	DF	11,18,19	Z	-	wmo-bc	87j
07010206		10-0042	Parley	I	409ac	BH	11,14,43,32	Z	-	wd-mc	87k
07010206		10-0042	Parley Lk	I	409ac	BH	11,14,43,32	Z	-	wd-mc	87h
07010206		10-0042	Parley Lk	-	-	B	-	-	-	wd-mc	87k
07020012		10-0086	Patterson Lk	-	558	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07010206		10-0053	Pierson Lk	-	-	B	-	-	-	wd-mc	87k
07020012	002	10-0078	Rice Lk	I	347	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		10-0001	Rice Marsh Lk	I	183ac	B	32,43,62	S	T	swcd-10	87f
07020012		10-0002	Riley Lk	I	284ac	B	32,43	T	U	swcd-10	87f
07020012		10-0002	Riley Lk	T	296ac	B	11,14,43	UZ	UXZ	cd-27	87j
07010206	008	10-0018	Schutz Lk	T	-	H	32,41,43,76	Z	-	wd-mc	87d
07010206	008	10-0018	Schutz Lk	T	140ac	H	32,41,43,76	Z	-	wd-mc	87k
07010206	008	10-0018	Schutz Lk	-	-	B	-	-	-	wd-mc	87k
07010206		10-0045	Stieger Lk	-	-	B	-	-	-	wd-mc	87k
07010206		10-0056	Stone Lk	-	-	B	-	-	-	wd-mc	87k
07020012		10-0013	Susan Lk	I	88ac	B	32,43	T	U	swcd-10	87f
07010205		10-0108	Tiger Lk	I	575	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07010206		10-0015	Virginia Lk	T	-	B	32,41,43,76	Y	-	wd-mc	87d
07010206		10-0015	Virginia Lk	-	-	B	-	-	-	wd-mc	87k
07020012		10-0059	Waconia Lk	T	3196mi	B	11,18,19,43	U	U	swcd-10	87f
07020012	002	10-0066	Winkler Lk	I	129	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		10-0105	Young America Lk	T	110ac	DF	11,18,19,43	Z	-	wmo-bc	87j
07010206	008	10-0041	Zumbra Lk	-	-	B	-	-	-	wd-mc	87k

N= 43

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By County, Waterbody Type, Name

CO=10 CNTYNAME=CARVER WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012	x01		Bluff Cr	T	4mi	GF	11,19,32,43	Z	Z	swcd-10	87f
07020012	005		BEVENS CR	T	14mi	EF	11,18,19	Z	Z	swcd-10	87f
07020012	006		BEVENS CR	T		EF	11,18,19	Z	Z	swcd-10	87f
07020012	006		BEVENS CR	T	14mi	EF	11,18,19	Z	Z	wmo-bc	87j
07020012	x01		Chaska Cr	T	5mi	EF	11,18,19,43	Z	Z	swcd-10	87f
07020012	002		CARVER CR	T	15mi	EF	11,18,19	Z	Z	swcd-10	87f
07010205	001		CROW R, S FK	T	14mi	EF	11,18,19	T	T	swcd-10	87f
07010206	x08		Six-mile Cr	T	5mi	IH	11,14,19	Z	–	wd-mc	87k
07020012	007		SILVER CR	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07020012	007		SILVER CR	T	10mi	EF	11,18,19	Z	Z	swcd-10	87f

N= 10

CO=11 CNTYNAME=CASS WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010106	004	11-0305	Gull Lk	–	–	H	65	–	–	mpca-2	87i
		11-?	Haddy Lk	–	–	H	80	–	–	mpca-2	87i
07010102	006	11-0203-01	Leech Lk	I	111000ac	C	65,41	UX	–	swcd-11	87a
07010102	006	11-0203-02	Leech Lk	I		C	65,41	UX	–	swcd-11	87a
07010102	006	11-0203-03	Leech Lk	I		C	65,41	UX	–	swcd-11	87a
07010102	006	11-0203-04	Leech Lk	I		C	65,41	UX	–	swcd-11	87a
07010102	006	11-0203-01	Leech Lk-waboose Bay	I	300ac	B	90	T	U	mdof-112	87h
07010102		11-0489	Little Moss Lk	T	60ac	B	90	Z	Z	mdof-112	87h
07010102		11-0487	Little Twin Lk	T	60ac	B	90	Z	Z	mdof-112	87h
07010101		11-0505	Little Wolf Lk	I	–	BDH	90	SW	UXZ	cza-29	87a
07010101		11-0505	Little Wolf Lk	I	517ac	CEG	61,63,65	TW	UX	mdow-1-bemi	87b
07010101		11-0505	Little Wolf Lk	T	490	B	31,32,65	UX	–	msof-1-bemi	87h
07010101		11-0505	Little Wolf Lk	T	500ac	B	43	UX	UX	mdof-112	87h
		11-?	Lower Sucker Lk	I	20ac	B	90	Z	Z	mdof-112	87h
		11-?	Middle Sucker Lk	I	40ac	B	90	Z	Z	mdof-112	87h
07010101		11-0415	Pike Bay Lk	I	4760	H	21,22,31,65,63,66	UX	–	msof-1-bemi	87h
07010101		11-0026	Sugar Lk	–	–	H	43,65	–	–	mpca-2	87i
07010102		11-0483	Swamp Lk	I	700ac	B	90	Z	Z	mdof-112	87h
07010102		11-0413	Ten Mile Lk	–	–	H	65	–	–	mpca-2	87i
07010102		11-0493	Welsh Lk	I	160ac	B	90	Z	Z	mdof-112	87h
07010102		11-0201	Woman Lake & Chain	I	–	C	65	UX	–	swcd-11	87a

N= 21

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By County, Waterbody Type, Name

CO=11 CNTYNAME=CASS WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010106	001		CROW WING R	-		EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010106	010		CROW WING R	-		EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010106	012		CROW WING R	-		EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010106	013		CROW WING R	-		EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010106	015		CROW WING R	-		EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010106	017		CROW WING R	-	-	EDF	11,12,14,18,19,41	T	U	swcd-11	87a
07010105	009		PINE R	I	all	E	11,14,19,41	T	U	swcd-11	87a
07010106	006		STONEY BR	T	10mi	DE	14,19	S	V	mdof-323	87h
07010106	007		STONEY BR	T		DE	14,19	S	V	mdof-323	87h

N= 9

CO=12 CNTYNAME=CHIPPEWA WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020001		37-0046-01	Lac Qui Parle Lk	I	-	ABDE	11,16,19	T	U	swcd-12	87a
07020001		37-0046-02	Lac Qui Parle Lk	I		ABDE	11,16,19	T	U	swcd-12	87a
07020005		12-0030	Shakopee Lk	I	-	DB	11,19	S	T	swcd-12	87a

N= 3

CO=12 CNTYNAME=CHIPPEWA WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205	014			T	-	D	11,19	Y	Y	swcd-12	87a
07020005	001		CHIPPEWA R	I		EDA	11,19	T	U	swcd-12	87a
07020005	001		CHIPPEWA R	I		D	11	S	U	cza-12	86a
07020005	003		CHIPPEWA R	I		EDA	11,19	T	U	swcd-12	87a
07020005	003		CHIPPEWA R	I	all	D	11	S	U	cza-12	86a
07020005	004		CHIPPEWA R	I	-	EDA	11,19	T	U	swcd-12	87a
07020001	001		L QUI PARLE (MINNESOTA R)	I		EDA	11,19	T	U	swcd-12	87a
07020001	006		L QUI PARLE (MINNESOTA R)	I	-	EDA	11,19	T	U	swcd-12	87a
07020004	001		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	005		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	006		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	008		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	010		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	011		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	015		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	016		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	017		MINNESOTA R	I		EDA	11,19	T	U	swcd-12	87a
07020004	017		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020004	019		MINNESOTA R	I		EDA	11,19	T	U	swcd-12	87a
07020004	019		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=12 CNTYNAME=CHIPPEWA WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020004	019		MINNESOTA R	I	all	D	11	S	U	cza-12	86a
07020004	020		MINNESOTA R	I	–	EDA	11,19	T	U	swcd-12	87a
07020004	020		MINNESOTA R	I	all	DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020004	020		MINNESOTA R	I	all	D	11	S	U	cza-12	86a
07020004	031		MINNESOTA R	I		EDA	11,19	T	U	swcd-12	87a
07020004	031		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020004	031		MINNESOTA R	I		D	11	S	U	cza-12	86a

N= 27

CO=13 CNTYNAME=CHISAGO WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030005		13-0012	Chisago Lk	T	930ac	B	11,43,65	T	U	swcd-13	87f
07030005		13-0012-01	Chisago Lk	I	873	BFG	12,14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0012-02	Chisago Lk	I		BFG	12,14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0053	Comfort Lk	I	220ac	B	11,43,65	T	U	swcd-13	87f
07030005	032	13-0083-01	Goose Lk	T	323ac	B	11,43,65	T	U	swcd-13	87f
07030005	032	13-0083-02	Goose Lk	T		B	11,43,65	T	U	swcd-13	87f
07030005		13-0041-01	Green Lk	I	1830ac	B	11,43,65	T	U	swcd-13	87f
07030005		13-0041-02	Green Lk	I		B	11,43,65	T	U	swcd-13	87f
07030005		13-0041-01	Green Lk	I	1714	ABFG	14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0041-02	Green Lk	I		ABFG	14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0032	N Center Lk	I	760ac	B	11,43,65	T	U	swcd-13	87f
07030005		13-0032	N Center Lk	I	725	BFG	14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0035	N Lindstrom Lk	T	160ac	B	11,43,65	T	U	swcd-13	87f
07030005	031	13-0069-01	Rush Lk	I	3170ac	B	11,43,65	T	U	swcd-13	87f
07030005	031	13-0069-02	Rush Lk	I		B	11,43,65	T	U	swcd-13	87f
07030005	031	13-0069-01	Rush Lk	I	2832	BFG	14,16,32,43	UW	–	msof-3-hink	87g
07030005	031	13-0069-02	Rush Lk	I		BFG	14,16,32,43	UW	–	msof-3-hink	87g
07030005	031	13-0069-01	Rush Lk	–	–	H	65	–	–	mpca-2	87i
07030005	031	13-0069-02	Rush Lk	–	–	H	80	–	–	mpca-2	87i
07030005		13-0027	S Center Lk	I	913ac	B	11,43,65	T	U	swcd-13	87f
07030005		13-0027	S Center Lk	I	835	BFG	12,14,16,32,43	UW	–	msof-3-hink	87g
07030005		13-0028	S Lindstrom Lk	I	669ac	B	11,43,65	T	U	swcd-13	87f
07030005		13-0028	S Lindstrom Lk	I	450	BFG	12,14,16,32,43	UW	–	msof-3-hink	87g

N= 23

CO=13 CNTYNAME=CHISAGO WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030005	x35		Co Ditch 3 (Sunrise R)	I	14mi	E	13,19	Y	Y	swcd-13	87f
07030005	x35		Co Ditch 5 (Sunrise R)	I	7.2mi	E	13,19	Y	Y	swcd-13	87f

N= 2

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By County, Waterbody Type, Name

CO=14 CNTYNAME=CLAY WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020106		14-0049	Lee Lk	T	-	D	11	TX	-	swcd-14	87a
09020106		14-0100	Silver Lk	T	-	D	11	SX	-	swcd-14	87a

N= 2

CO=14 CNTYNAME=CLAY WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020106	001		BUFFALO R	I	-	EGI	11	S	U	mdow-1-dl	87h
09020106	009		BUFFALO R	I	all	BCF	11,19	TW	UW	wd-br	87h
09020106	009		BUFFALO R	I		EGI	11	S	U	mdow-1-dl	87h
09020107	001		RED R	I	all	BCFE	11,18,19,41	TW	UW	wd-br	87h
09020107	002		RED R	I		BCFE	11,18,19,41	TW	UW	wd-br	87h
09020107	003		RED R	I		BCFE	11,18,19,41	TW	UW	wd-br	87h

N= 6

CO=15 CNTYNAME=CLEARWATER WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		15-0231	Al Johnson Pond	T	15ac	DF	31	Z	-	swcd-15	87f
09020305		15-0159	Anderson Lk	T	20ac	BCDE	11,14,19,18,74,72	Z	-	swcd15	87a
09020305		15-0040	Bagley Lk	T	200ac	BDE	11,14,18	TZ	-	swcd15	87a
07010101		15-0025	Berg Lk	T	50ac	BCD	14,16,18,65	T	-	swcd-15	87a
07010101		15-0001	Big LaSalle Lk	T	400ac	ABG	22,23,32,43,65,76,77	UX	-	swcd-15	87a
09020305		15-0085	Carver Lk	T	90ac	BE	11,14,19	Z	-	swcd15	87a
09020305		04-0343	Clearwater Lk	T	1500ac	BDEF	11,12,14,16,18,19,21,22,65,74,77	UXZ	-	swcd15	87a
07010101		15-0023	Dahlberg Lk	T	50ac	BCD	11,18,16,14	T	-	swcd-15	87a
07010101		15-0022	Daniel Lk	T	100ac	BDE	11,14,31,65,76,77	-	-	swcd-15	87a
09020305		15-0090	Deep Lk	T	120ac	BCE	11,14,18,19	TZX	-	swcd15	87a
09020305		15-0027	E Four Legged Lk	T	600ac	AB	11,14,19	Z	-	swcd-15	87a
09020305		15-0030	Fence Lk	T	40ac	BDE	11,14,19	Z	-	swcd15	87a
09020305		15-0139	First Lk	T	50ac	ABC	11,19	T	-	swcd-15	87a
09020305		15-0139	First Lk	I	58	B	11,14,18,19	SW	-	msof-1-bemi	87h
09020305		15-0157	Five Lake	T	70ac	BEF	11,19	Z	-	swcd15	87a
09020305		15-0153	Four Lk	T	60ac	BE	11,14,19	Z	-	swcd15	87a
09020302		15-0002	Haggerty Lk	T	160ac	BE	11,14,19	Z	-	swcd15	87a
07010101		15-0058	Heart Lk	T	400ac	ABG	22,23,32,43,65,76,77	UX	-	swcd-15	87a
09020305		15-0063	Huff Lk	T	50ac	BE	18,19	Z	-	swcd-15	87f
09020108		15-0127	Island Lk	T	38	H	21	VW	-	msof-1-bemi	87h
07010101		15-0016	Itasca Lk	T	1200ac	EFG	43,32,66,77	UX	-	swcd-15	87a
09020305		15-0086	Johnson Lk	T	90ac	BE	11,14,19	Z	-	swcd15	87a
09020305		15-0086	Johnson Lk	-	-	-	-	-	-	wd-rl	87h
09020305		15-0047	Kings Lk	T	40ac	BE	21,22,65	UXZ	-	swcd-15	87f

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By County, Waterbody Type, Name

CO=15 CNTYNAME=CLEARWATER WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020305		15-0081	Lamond Lk	T	160ac	ABC	65	TX	-	swcd-15	87a
09020305		15-0087	Leon Lk	T	160ac	BE	11,14,19	Z	-	swcd15	87a
09020305		15-0144	Lindberg Lk	T	300ac	BAEF	11,19	TX	-	swcd-15	87a
09020305		15-0144	Lindberg Lk	I	-	AB	11,14	TW	-	wd-rl	87e
09020305		15-0144	Lindberg Lk	T	88	H	11,14,18,19	TW	-	msof-1-bemi	87h
07010101		15-0015	Little Elk Lk	I	all	ABDFH	19,11,65	TW	UX	msof-3-mont	86b
09020305		15-0081	Lomond Lk	T	91	B	31,32,43	UX	-	msof-1-bemi	87g
09020305		15-0104	Lone Lk	T	120ac	BC	65	TX	-	swcd-15	87a
07010101		15-0057	Long Lk	T	300ac	ABG	22,23,32,43,65,76,77	UX	-	swcd-15	87a
09020305		15-0050	Long Lk	T	80ac	BDG	31	UXZ	-	swcd-15	87f
09020103		15-0068	Long Lost Lk	T	500ac	ABG	65,76,77,22,23,31,32,43	UX	-	swcd-15	87a
09020108		15-0130	Lower Rice Lk	T	1600ac	ABCDE	16,19,21,22,23,65,66,74	UX	-	swcd-15	87a
09020108		15-0079	Minerva Lk	T	300ac	ABG	87,14,32,43,65,76,77	UX	-	swcd-15	87a
09020108		15-0079	Minerva Lk	T	236	AB	11,14,18,65	UX	-	msof-1-bemi	87g
09020305		15-0137	Minnow Lk	T	120ac	BC	11,14,19,65	T	-	swcd-15	87a
09020305		15-0137	Minnow Lk	T	107	AB	11,14,18,65	SW	UX	msof-1-bemi	87g
09020108		15-0061	Mud Lk	T	300ac	AE	12,19	SW	-	swcd-15	87a
09020305		15-0082	Mud Lk	T	40ac	BCE	11,19,14,65	TZ	-	swcd-15	87a
09020305		15-0037	Nels Olson Lk	T	200ac	BE	11,14,19	SZ	-	swcd15	87a
09020305		15-0105	One Lk	T	100ac	BE	11,14,19	Z	-	swcd15	87a
09020305		15-0083	Peterson Lk	T	160ac	AB	11,14,65,18,19	TZ	-	swcd-15	87a
09020302		15-0003	Pickeral Lk	T	80ac	BE	65	UXZ	-	swcd-15	87f
09020305		15-0142	Pike Lk	T	50ac	BCD	11,14,18,19	TX	-	swcd-15	87a
09020305		15-0149	Pine Lk	T	1000ac	ABCDEF	11,14,19,65	TXZ	-	swcd15	87a
09020305		15-0149	Pine Lk	I	-	AB	11,65	UX	-	wd-rl	87e
09020305		15-0149	Pine Lk	T	1188	A	11,14,31,32,65	SW	UX	msof-1-bemi	87g
09020305		15-0138	Sabe Lk	T	50ac	AB	65	TX	-	swcd-15	87a
09020108		15-0135	Sand Lk	T	100ac	BE	11,19,31	Z	-	swcd-15	87a
09020305		15-0140	Second Lk	T	80ac	ABC	11,19,	T	-	swcd-15	87a
09020305		15-0140	Second Lk	T	69	AB	11,14,18	SW	UX	msof-1-bemi	87g
09020305		15-0156	Six Lk	T	80ac	ABDE	11,14,18,19,65	SZ	-	swcd15	87a
09020305		15-0035	Spike Lk	T	100ac	BE	18,65	TZ	-	swcd15	87a
09020305		15-0035	Spike Lk	I	-	AB	18	SW	-	wd-rl	87h
09020305		15-0029	Stenlund Lk	T	320ac	D	31,77	Z	-	swcd-15	87a
07010101		15-0020	Sucker Lk	T	150ac	ABG	22,23,32,43,65,76,77	UX	-	swcd-15	87a
09020305		15-0141	Third Lk	T	60ac	BDEC	11,14,19	T	-	swcd-15	87a
09020305		15-0152	Three Lk	T	50ac	BE	11,14,19	Z	-	swcd15	87a
09020305		15-0151	Two Lk	T	40ac	BE	11,14,19	Z	-	swcd15	87a
		15-0293	Unnamed	T	160ac	BE	11,14,19	Z	-	swcd-15	87a
09020108		15-0059	Upper Rice Lk	T	1500ac	AGE	12,19,74	SW	-	swcd-15	87a
09020305		15-0028	W Four Legged Lk	T	600ac	AB	11,14,19	Z	-	swcd-15	87a
09020305		15-0060	Walker Brook Lk	T	150ac	BDE	11,19,32,65,73,74,76,77	UX	-	swcd-15	87a
09020305		15-0158	Wilmor Lk	T	80ac	BCE	11,14,19,18	Z	-	swcd15	87a

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By County, Waterbody Type, Name

CO=15 CNTYNAME=CLEARWATER WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT
09020108	x12		Auganaush Cr	T	.5mi	CE
07010101	x33		Bear Cr	T	3mi	BCDE
09020305	001		CLEARWATER R	T		AEG
09020305	005		CLEARWATER R	T		AEG
09020305	007		CLEARWATER R	T		AEG
09020305	013		CLEARWATER R	T		AEG
09020305	013		CLEARWATER R	I	–	ADF
09020305	013		CLEARWATER R	T	35mi	ABCDEG
09020305	015		CLEARWATER R	T	–	AEG
09020305	015		CLEARWATER R	I		ADF
09020305	015		CLEARWATER R	T		ABCDEG
09020108	x14		Hier Cr	T	4mi	BCDE
09020305	112		LOST RIVER	T	22mi	ABCDEFG
09020305	212		LOST RIVER	T		ABCDEFG
09020108	x13		Mosquito Cr	T	8mi	BCDE
07010101	033		MISSISSIPPI R	T	4.5mi	BCDE
?	?		Nasset Cr	T	2mi	G
09020108	011		RICE L (WILD RICE R)	T		BDECGA
09020305	014		RUFFY BK	I	3mi	G
09020305	014		RUFFY BK	T	19mi	ABCDEF
09020305	312		SILVER CREEK	T	15mi	ABCDEF
07010101	x33		Unnamed To Bear Cr	T	1.5mi	BCDE
09020108	x12		Unnamed To Buckboard Cr	T	1mi	BCDE

SOURCE	USE ACT	USE POT	RMO	DSN
65	Z	–	swcd-15	87i
11,14,18,19	Z	–	swcd-15	87i
12,13,71,74	S	U	mdow-1-bemi	87b
12,13,71,74	S	U	mdow-1-bemi	87b
12,13,71,74	S	U	mdow-1-bemi	87b
12,13,71,74	S	U	mdow-1-bemi	87b
90(11,13,19,71)	S	TU	mdow-1-trf	87c
11,12,13,14,15,19,10,22,31,41,43,51,62,63,64,65,66,71,72,73,74,75,76,77	–	–	swcd-15	87i
12,13,71,74	S	U	mdow-1-bemi	87b
90(11,13,19,71)	S	TU	mdow-1-trf	87c
11,12,13,14,15,19,10,22,31,41,43,51,62,63,64,65,66,71,72,73,74,75,76,77	–	–	swcd-15	87i
11,14,18,19	Z	–	swcd-15	87i
11,12,13,14,18,19,22,31,51,65,66,71,72,74,77,62,41,43	TWZ	–	swcd-15	87i
11,12,13,14,18,19,22,31,51,65,66,71.72,74,77,62,41,43	TWZ	–	swcd-15	87i
11,14,15,19,71,72,76,77	Z	–	swcd-15	87i
11,14,18,19	TWZ	–	swcd-15	87i
11,12,14,32,77	SW	V	msof-1-bemi	87g
11,14,16,18,19,31,71,72,73,74,75	TXZ	–	swcd-15	87f
11,14,18,77	SW	V	msof-1-bemi	87g
11,14,18,19,65,12,13,71,72,74,76,77,66	Z	–	swcd-15	87i
11,14,18,19,73,74	Z	–	swcd-15	87i
11,19	Z	–	swcd-15	87i
11,14,19	Z	–	swcd-15	87f

CO=15 CNTYNAME=CLEARWATER WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI.	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020305	x15		Unnamed To Clearwater R	T	.5mi	BC	14,18	Z	–	swcd-15	87i
09020305	x15		Unnamed To Clearwater R	–	3mi	ABCDE	11,14,18,19,65,73,74	Z	–	swcd-15	87i
09020305	x15		Unnamed To Clearwater R	T	6mi	BCDE	11,14,18,19,65	Z	–	swcd-15	87i
09020305	x15		Unnamed To Clearwater R	T	2mi	BCDE	11,14,18,19,32,43,65	Z	–	swcd-15	87i
09020305	x15		Unnamed To Clearwater R	T	1mi	CEG	41,43,62,63,64,65,66	SW	–	swcd-15	87i
09020305	x15		Unnamed To Clearwater R	T	2mi	BCDE	11,14,19	2	–	swcd-15	87i
09020305	x15		Unnamed To Little Mississippi	T	7mi	BCDE	11,14,18,65	SW	–	swcd-15	87i
09020305	x12		Unnamed To Lost R	T	1mi	ABCDE	11,14,18,19,74	Z	–	swcd-15	87i
09020305	x12		Unnamed To Lost R	T	1mi	BC	65	Z	–	swcd-15	87i
09020305	x12		Unnamed To Lost R	T	2mi	BCDE	11,14,18,19	Z	–	swcd-15	87i
09020305	x12		Unnamed To Lost R	T	1mi	ABCDE	11,14,18,19	Z	–	swcd-15	87i
09020305	x12		Unnamed To Lost R	T	3mi	ABCDEF	11,14,18,19	Z	–	swcd-15	87i
07010101	x33		Unnamed To Mississippi R	T	1.5mi	BCDE	11,14,18,19	Z	–	swcd-15	87i
09020305	x14		Unnamed To Ruffy Bk	T	.5mi	BDE	11,19	Z	–	swcd-15	87i
09020305	x14		Unnamed To Ruffy Bk	T	1.5	BDEF	11,14,19	Z	–	swcd-15	87i
09020305	x12		Unnamed To Silver Cr	T	2mi	BCDE	11,14,18,19	Z	–	swcd-15	87i
09020305	x12		Unnamed To Silver Cr	T	2.5mi	ABCDEF	11,14,18,19,41,43,32,51,62,64,65,66,73,74,76,77	WZ	–	swcd-15	87i
?	?		Unnamed To Unnamed	T	2mi	BCD	11,14,19	Z	–	swcd-15	87i
09020305	x15		Unnamed To Unnamed	T	2.5mi	BCDE	11,14,18,65	SW	–	swcd-15	87i
09020305	x15		Unnamed To Unnamed	T	1mi	BC	14,18,19,65	2	–	swcd-15	87i
09020305	x15		Unnamed To Walker Bk	T	3mi	BCDE	11,14,18,65	SW	–	swcd-15	87i
09020305	x15		Walker Bk	T	4mi	BCDEG	11,14,18,19,31,43,51,65,73,74	TWZ	–	swcd-15	87i
09020108	010		WILD RICE R	T		BDECGA	11,14,16,18,19,31;71,72,73,74,75	TXZ	–	swcd-15	87f

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=15 CNTYNAME=CLEARWATER WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020108	010		WILD RICE R	T		G	11,14,18,77	SW	UX	msof-1-bemi	87g
09020108	014		WILD RICE R	T	5mi	BDECGA	11,14,16,18,19,31,71,72,73,74,75	TXZ	-	swcd-15	87f
09020108	014		WILD RICE R	T	1.5mi	BDEC	11,14,18,19	Z	-	swcd-15	87f
09020108	014		WILD RICE R	T	10mi	G	11,14,18,77	SW	UX	msof-1-bemi	87g

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CO=15 CNTYNAME=CLEARWATER WBT=WETLAND ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		15-0235w	Anderson Lk	T	5ac	BE	11,14,19	Z	-	swcd15	87a
		15-0039w	Clearbrook Lk	T	60ac	BE	11,14,19	SZ	-	swcd15	87a
		15-0024w	Duncan Lk	T	30ac	BCD	14,16,18,65	T	-	swcd-15	87a
		15-0161w	Larson Lk	T	10ac	G	31	Z	-	swcd-15	87f
		15-0353w	Little Carver Lk	T	5ac	BE	11,14,19	Z	-	swcd15	87a
		15-0080w	Moon Lk	T	100ac	ABCDEF	16,19	-	TX	swcd-15	87a
		15-0089w	Steenerson Lk	T	5ac	E	64,66	Z	-	swcd15	87a
		15-0160w	Talge Lk	T	20ac	BDE	11,14,18,19	Z	-	swcd-15	87f
		15-0291w	Unnamed	T	80ac	BE	11,14,19	Z	-	swcd-15	87a
		15-0143w	Unnamed	T	20ac	BE	11,19	Z	-	swcd-15	87a
		15-0447w	Unnamed	T	40ac	BE	11,14,19	Z	-	swcd-15	87a
		15-0450w	Unnamed	T	10ac	D	11,14,74	Z	-	swcd-15	87a
		15-0294w	Unnamed	T	5ac	BC	11,14,18	Z	-	swcd-15	87a
		15-0347w	Unnamed	T	20	B	14,65	Z	-	swcd-15	87a
		15-0300w	Unnamed	T	10ac	BD	11,19	Z	-	swcd15	87a
		15-0301w	Unnamed	T	5ac	BD	11,19	Z	-	swcd15	87a
		15-0234w	Unnamed	T	5ac	BC	11,18,14,19	Z	-	swcd15	87a
		15-0088w	Unnamed	T	10ac	BE	11,19	Z	-	swcd15	87a
		15-0233w	Unnamed	T	10ac	BE	11,14,19	Z	-	swcd15	87a
		15-0232w	Unnamed	T	5ac	BE	11,14,19	Z	-	swcd15	87a
		15-0041w	Unnamed	T	25ac	BDE	11,14,18	Z	-	swcd15	87a
		15-0049w	Unnamed	T	40ac	BE	21,22,65	UXZ	-	swcd-15	87f
		15-0051w	Unnamed	T	30ac	BDE	11,14,19,65	Z	-	swcd-15	87f
		15-0053w	Unnamed	T	40ac	BDE	11,14,19	Z	-	swcd-15	87f
		15-0455w	Unnamed	T	30ac	BDE	11,14,19	Z	-	swcd-15	87f
		15-0454w	Unnamed See 19 T148r38	T	60ac	ABE	11,14,19	Z	-	swcd-15	87a
		15-0298w	Unnamed See 20 T148r38	T	10ac	E	66	Z	-	swcd-15	87a
		15-0292w	Unnamed See 23 T147r38	T	40ac	BE	11,14,19	Z	-	swcd-15	87a
		15-0452w	Unnamed See 7 T148r38	T	40ac	ABCDF	11,14,18,19	Z	-	swcd-15	87a

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=16 CNTYNAME=COOK WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		16-?	Caribou Lk	I	all	BC	65	TW	UX	cza-16	86a
04010101	006	16-0360	Caribou Lk	I	714ac	ABC	32	TW	UX	swcd-16	87e
04010101	006	16-0360	Caribou Lk	T	714ac	C	65	TX	UX	msof-2-gm	87g
04010101	006	16-0360	Caribou Lk	T	714ac	C	65	T	U	mdof-255	87h
04010101	024	16-0143	Devil Track Lk	T	1873ac	C	65	UX	UX	msof-2-gm	87g
04010101	024	16-0143	Devils Track Lk	T	all	BC	65	UX	UX	cza-16	86a
04010101		16-0227	Hungry Jack Lk	T	all	BC	65	UX	UX	cza-16	86a
04020300		16-0001	Lake Superior	-	-	DEF	77,80,90	VZ	-	msof-2-ls	87i
04020300		16-0001	Lk Superior	T	-	F	30	-	VZ	msof-2-ls	86b
04020300		16-0001	Lk Superior	T	-	C	65	UW	UW	cza-16	86a
04010101		16-0239	Poplar Lk	I	all	BC	65	TX	UX	cza-16	86a

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CO=16 CNTYNAME=COOK WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
04010101	028		CASCADE L	T	17.5mi	D	21	U	U	msof-2-gm	87g
04010101	022		DEVIL TRACK R	T	1500ac	ABC	32	UX	UX	swcd-16	87e
04010101	x06		Jonvick Ck	T	20mi	E	63	S	T	msof-2-gm	87g
04010101	x06		Jonvick Ck	T	1.5mi	E	63	U	U	mdof-255	87h
04010101	021		KIMBALL CR	T	.8mi	E	63	U	U	msof-2-gm	87g
04010101	021		KIMBALL CR	T	8mi	E	63	U	U	mdof-255	87h
04010101	030		POPLAR R	I		DFG	32	T	U	swcd-16	87e
04010101	030		POPLAR R	T	-	D	21	U	U	msof-2-gm	87g
04010101	033		POPLAR R	I		DFG	32	T	U	swcd-16	87e
04010101	033		POPLAR R	T		D	21	U	U	msof-2-gm	87g
04010101	037		POPLAR R	I	3mi	DFG	32	T	U	swcd-16	87e
04010101	034		RICE L (POPLAR R)	I		DFG	32	T	U	swcd-16	87e
04010101	039		TEMPERANCE R	T	-	DE	21,63	U	U	msof-2-gm	87g
04010101	039		TEMPERANCE R	T	4mi	E	63	U	U	mdof-255	87h

N= 14

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=17 CNTYNAME=COTTONWOOD WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001		17-0022		I	146ac	ABCDEFGH	11,19,65,76,71	TW	UX	mdow-4-nu	87b
07020008		17-0033	Augusta Lk	I	499ac	BFD	11,14	SZ	Z	msow-4-wind	87d
07020010		17-0007	Bingham Lk	T	whole	ABCE	11,19,65	TX	–	swcd-17	87f
07020008		17-0049	Carey Lk	I	117ac	BF	11	ZS	–	msow-4-wind	87d
07100001		17-0022	Cottonwood Lk	I	146ac	BF	11,14	XT	–	msow-4-wind	87d
07100001		17-0022	Cottonwood Lk	T	whole	ABCE	11,18,19,65	UX	–	swcd-17	87f
07020010		17-0003	Mountain Lk	–	all	H	40,19,11,18	–	–	msof-4-wind	86b
07020010		17-0003	Mountain Lk	I	241ac	ABCDEFGH	11,19,65,76,71	WU	XU	mdow-4-nu	87b
07020010		17-0003	Mountain Lk	T	241ac	FD	41,18,11	T	W	msow-4-wind	87d
		17-0002	Mt Lk	I	whole	ABCDFG	11,16,19	T	W	swcd-17	87f
07020010		17-0003	Mt Lk	I	whole	ABCDFG	11,16,19	T	W	swcd-17	87f
		17-0042	Oaks Lk	I	whole	ADEF	11,18,19	S	W	swcd-17	87f
07100001		17-0044	Oaks Lk	I	whole	ADEF	11,18,19	S	W	swcd-17	87f
07100001		17-0024	String Lk	I	402ac	BF	11,19	SWZ	–	msow-4-wind	87d
07100001		17-0024	String Lk	I	whole	ADF	11,19	SW	–	swcd-17	87f
07100001		17-0024	String Lk	T	25ac	AD	11,19	SW	SW	swcd-32	87g
07100001		17-0060	Talcott Lk	I	928ac	ABCDEFGH	11,19,76,71	WT	UX	mdow-4-nu	87b
07100001		17-0060	Talcott Lk	–	50ac	–	–	T	U	swcd-51	87g
07100001		17-0013	Wolf Lk	I	124ac	BF	11	Z	S	msow-4-wind	87d

N= 19

CO=17 CNTYNAME=COTTONWOOD WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001	001		DES MOINES R	I	160mi	ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07100001	001		DES MOINES R	T	all	DE	11,12,13,14,15,16,17,18,19	U	W	swcd-17	87f
07100001	002		DES MOINES R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07100001	002		DES MOINES R	T		DE	11,12,13,14,15,16,17,18,19	U	W	swcd-17	87f
07020007	024		LITTLE COTTONWOOD CR	I	75mi	ABCDEFGH	11,19,41,43,71,76	YT	UY	mdow-4-nu	87b
07020010	006		WATONWAN R	T		DEG	11,12,13,14,15,16,17,18,19,65,62,71	S	W	swcd-17	87f
07020010	005		WATONWAN R, N FK	T	all	DEG	11,12,13,14,15,16,17,18,19,65,62,71	S	W	swcd-17	87f

N= 7

CO=18 CNTYNAME=CROW WING WBT=? ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
insufdef			too numerous to list	–	–	–	–	–	–	swcd-18	87k

N= 1

CO=18 CNTYNAME=CROW WING WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010104		18-0256	Bass Lk	T	340ac	ABD	43,65,76	TX	TX	wd-tl	87d
07010106		18-0306	Bass Lk	-	427ac	-	-	-	-	wd-tl	87d
07010105		18-0259	Bonnie Lk	I	83ac	ABD	43,65,76	TW	Y	wd-tl	87d
07010106		18-0374	Clark Lk	T	309	B	-	-	-	mdow-3-brai	87c
07010106		18-0374	Clark Lk	I	361ac	ABCD	43,65,76	TX	Y	wd-tl	87d
07010106		18-0341	Crystal Lk	-	119ac	-	-	-	-	wd-tl	87d
07010105		18-0305	Edward Lk	T	2985ac	ABD	43,65,76	UX	WT	wd-tl	87d
07010106		18-0329	Garden Lk	I	283ac	ABD	14,18,19	SW	Y	wd-tl	87d
07010106		18-0338	Gladstone Lk	T	481ac	ABD	43,65,76	UX	Y	wd-tl	87d
07010106		18-0392	Hartley Lk	T	129ac	ABD	43,65,76	Y	Y	wd-tl	87d
07010106		18-0392	Hartley Lk	-	-	H	63	-	-	mpca-2	87i
07010106		18-0375	Hubert Lk	T	1341ac	ABD	43,65,76	UX	Y	wd-tl	87d
07010106		18-0375	Hubert Lk	-	-	H	63	-	-	mpca-2	87i
07010105		18-0183	Island Lk	T	256	B	-	-	-	mdow-3-brai	87c
07010106		18-0340	Little Hubert Lk	I	281ac	ABD	43,65,76	UW	Y	wd-tl	87d
07010105	010	18-0351	Little Pelican Lk	T	402ac	ABD	43,65,76	UW	Y	wd-tl	87d
07010106		18-0372	Long Lk	T	6337ac	ABD	41,43,65,76	UX	Y	wd-tl	87d
		18-?	Long Lk,s	-	-	H	18	-	-	mpca-2	87i
07010105	010	18-0342	Lougee Lk	T	190ac	ABD	43,65,76	UX	Y	wd-tl	87d
07010105	010	18-0343	Markee Lk	I	119ac	ABD	43,65	UW	Y	wd-tl	87d
07010106		18-0377	Middle Cullen Lk	-	-	I	90	-	-	mpca-2	87i
07010106		18-0389	Moburg Lk	I	45ac	ABD	43,65	Y	Y	wd-tl	87d
07010106		18-0335	Mollie Lk	I	270ac	ABCD	14,16,18	SW	Y	wd-tl	87d
07010105		18-0308	Pelican Lk	T	8468ac	ABD	32,41,43,65,76	UX	UW	wd-tl	87d
07010106		18-0304	Perch Lk	I	226ac	ABD	80	SW	SW	wd-tl	87d
07010106		18-0327	Rice Lk	I	222ac	ABD	14,16	SW	Y	wd-tl	87d
07010105		18-0251-01	Sandbar Lk	T	977ac	ABD	43,65,76	TX	TX	wd-tl	87d
07010105		18-0251-02	Sandbar Lk	T		ABD	43,65,76	TX	TX	wd-tl	87d
07010104		18-0090	Serpent Lk	-	-	HG	16,65	-	-	mpca-2	87i
07010105		18-0348	Shaffer Lk	I	114ac	ABD	80	SW	Y	wd-tl	87d
07010106		18-0404	Sibley Lk	T	412ac	BD	43,65	TW	UX	mdof-323	87h
07010106		18-0239	Silver Lk	-	209ac	-	-	-	-	wd-tl	87d
07010106		18-0337	Slough Lk	-	72ac	-	-	-	-	wd-tl	87d
07010106		18-0323	Sorenson Lk	T	114ac	ABD	43,65,76	TX	Y	wd-tl	87d
07010106		18-0336	Twin Lk	-	54ac	-	-	-	-	wd-tl	87d
07010105		18-0412	Upper Hay Lk	T	640ac	B	43,65	UW	UX	mdof-323	87h
07010104	011	18-0096	Upper Long Lk	I	79.3	B	-	-	-	mdow-3-brai	87c

N= 37

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=19 CNTYNAME=DAKOTA WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012		19-0081	Augusta Lk	T	40ac	BD	32,43	Y	Y	wmo-gc	87j
07010206		19-0061	Bald Lk	T	11ac	BDF	31,32,43	YX	YWZ	wmo-gc	87j
07040002		19-0020	Chub Lk	I	261ac	ABFG	11,16,19	SWZ	SWZ	sfm-10	87j
07040001		19-0029	Crystal Lk	T	292ac	ABDF	41,43	UX	UX	wmo-bd	87k
07020012		19-0033	Earley Lk	T	42ac	DFH	41,43	Z	Z	wmo-bd	87k
07040001		19-0023	Farquar Lk	T	67ac	DF	32,43	W	–	mdow-6-sp	87b
07020012		19-0057	Fish Lk	T	24ac	ABF	31,41	T	UW	mdow-6-sp	87b
07020012		19-0057	Fish Lk	I	30ac	ABDF	31,32,41,43	TZ	UX	wmo-gc	87j
07020012		19-0071	Jensen Lk	T	55ac	ABD	31,32,43	SY	TX	wmo-gc	87j
07040001		19-0025	Keller Lk	I	60ac	ABDF	32,41,43	S	Y	wmo-bd	87k
		19-?	Lac Laven	T	69ac	ABDF	32,43	X	UX	wmo-bd	87k
07020012		19-0032	Lee Lk	I	25ac	GABDF	19,11,14,32	Y	Y	wmo-bd	87k
07020012		19-0055	LeMay Lk	I	40ac	ABDF	31,32,41,42	TY	UX	wmo-gc	87j
07040002	006	19-0006	Lk Byllesby	I	–	BDEFGI	11,19,65,18,30	UWZ	UXZ	msof-5-lc	86b
07040002	006	19-0006	Lk Byllesby	T	2255ac	ABFG	11,19	TWZ	TWZ	sfm-10	87j
07040002	006	19-0006	Lk Byllesby	I	all	ABDFG	11,19	SW	UX	swcd-25	87k
07040001		19-0022	Long Lk	T	39ac	D	32,43	W	–	mdow-6-sp	87b
07010206		19-0076	McDonough Lk	T	20ac	ABDF	32,43	Y	UXZ	wmo-gc	87j
07020012		19-0072	O'Brien Lk	T	40ac	ABD	43	Y	UXZ	wmo-gc	87j
07010206		19-0054	Shanahan Lk	I	12ac	ABDF	32,43	TY	TY	wmo-gc	87j
		19-?	Sunset Pond	T	60ac	GDI	32,41,43	Z	Z	wmo-bd	87k
07020012		19-0067	Thomas Lk	I	45ac	ABDF	41,43,31,32	SW	TXZ	wmo-gc	87j
07010206		19-0036	Unnamed Pond	T	14ac	BD	32,43	Y	Y	wmo-gc	87j
07020012		19-0056	Unnamed Pond	T	19ac	BD	32,41,43	Y	Y	wmo-gc	87j
07020012		19-0077	Unnamed Pond	I	13ac	ABDF	43,65	Y	Y	wmo-gc	87j

N= 25

CO=19 CNTYNAME=DAKOTA WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	003		PINE CR	T	–	D	11	Z	Z	sfm-10	87j
07040001	012		VERMILLION R	T	5	ABCDEFGH	11,12,14,16,18,19	U	U	mdof-534	87i

N= 2

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=19 CNTYNAME=DAKOTA WBT=WETLAND ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		19-0059w	Blackhawk Lk	I	43ac	ABDF	31,32,41,43	Y	TX	wmo-gc	87j
		19-0068w	Cliff Lk	T	14ac	ABDF	31,32,41,43	Y	T	wmo-gc	87j
		19-0069w	Gerhardt Lk	I	15ac	ABDF	31,32,41,43	Y	Y	wmo-gc	87j
		19-0062w	Hay Lk	I	24ac	ABD	31,32,41,43	Y	Y	wmo-gc	87j
		19-0065w	Holland Lk	T	30ac	ABD	32,43	Y	Z	wmo-gc	87j
		19-0082w	LeMay Lk	T	32ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0060w	McCarthy Lk	T	11ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0155w	Quigley Lk	I	26ac	ABDF	32,41,43	Y	Y	wmo-gc	87j
		19-0075w	Schultz Lk	T	13ac	B	32,43	YX	TX	wmo-gc	87j
		19-0063w	Schwanz Lk	T	16ac	BD	32	Y	Y	wmo-gc	87j
		19-0161w	Thomas Lk,E	I	10ac	ABDF	31,32,41,43	SW	TXZ	wmo-gc	87j
		19-0064w	Unnamed Wetland	I	9ac	BD	31,32,41,43	Y	Y	wmo-gc	87j
		19-0073w	Unnamed Wetland	T	13ac	ABD	43	Y	Z	wmo-gc	87j
		19-0070w	Unnamed Wetland	I	10ac	BD	31,32,41,43	Y	Y	wmo-gc	87j
		19-0176w	Unnamed Wetland	I	5ac	BD	31,32,41,43	Y	Y	wmo-gc	87j
		19-0053w	Unnamed Wetland	T	10ac	ABD	31,32,41,43	TY	TY	wmo-gc	87j
		19-0169w	Unnamed Wetland	T	4ac	BD	32	Y	Y	wmo-gc	87j
		19-0066w	Unnamed Wetland	I	12ac	ABDF	32,41,43	Y	Y	wmo-gc	87j
		19-0292w	Unnamed Wetland	T	5ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0291w	Unnamed Wetland	T	4ac	BD	32,43	YZ	YZ	wmo-gc	87j
		19-0175w	Unnamed Wetland	T	4ac	BDF	32,41,43	Y	Z	wmo-gc	87j
		19-0153w	Unnamed Wetland	T	8ac	BDF	32,43	Y	Y	wmo-gc	87j
		19-0123w	Unnamed Wetland	T	5ac	BD	31,32,41	Y	Y	wmo-gc	87j
		19-0256w	Unnamed Wetland	T	9ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0295w	Unnamed Wetland	T	6ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0259w	Unnamed Wetland	I	10ac	ABDF	32,41,43	SW	TX	wmo-gc	87j
		19-0144w	Unnamed Wetland	T	8ac	BD	32,43	Y	Y	wmo-gc	87j
		19-0362w	Unnamed Wetland	T	6ac	D	19,11,32,43	Z	Z	wmo-bd	87k
		19-0361w	Unnamed Wetland	T	5ac	D	19,11,14,32,41,43	Z	Z	wmo-bd	87k
		19-0360w	Unnamed Wetland	T	8ac	D	19,11,14,32,41,43	Z	Z	wmo-bd	87k
		19-0359w	Unnamed Wetland	T	10ac	D	19,41,43	Z	Z	wmo-bd	87k
		19-0028w	Unnamed Wetland	T	26ac	D	41,43	Z	Z	wmo-bd	87k
		19-0024w	Unnamed Wetland	T	19ac	D	32,41,43	Z	Z	wmo-bd	87k
		19-0364w	Unnamed Wetland	T	10ac	D	32,41,43	Z	Z	wmo-bd	87k
		19-0115w	Unnamed Wetland	T	13ac	D	32,41,43	Z	Z	wmo-bd	87k
		19-0116w	Unnamed Wetland	T	13ac	D	41,43	Z	Z	wmo-bd	87k
		19-0211w	Unnamed Wetland	T	16ac	D	32,43	Z	Z	wmo-bd	87k
		19-0210w	Unnamed Wetland	T	10ac	D	32,43	Z	Z	wmo-bd	87k
		19-0195w	Unnamed Wetland	T	6ac	D	41,43	Z	Z	wmo-bd	87k
		19-0194w	Unnamed Wetland	T	6ac	D	41,43	Z	Z	wmo-bd	87k
		19-0193w	Unnamed Wetland	T	16ac	D	41,43	Z	Z	wmo-bd	87k
		19-0192w	Unnamed Wetland	T	13ac	D	41,43	Z	Z	wmo-bd	87k
		19-0114w	Unnamed Wetland	T	16ac	D	41,43	Z	Z	wmo-bd	87k
		19-0174w	Unnamed Wetland	T	7ac	D	41,43	Z	Z	wmo-bd	87k
		19-0172w	Unnamed Wetland	T	13ac	D	41,43	Z	Z	wmo-bd	87k
		19-0171w	Unnamed Wetland	T	6ac	D	41,43	Z	Z	wmo-bd	87k
		19-0170w	Unnamed Wetland	T	6ac	D	41,43	Z	Z	wmo-bd	87k
		19-0152w	Unnamed Wetland	T	10ac	D	41,43	Z	Z	wmo-bd	87k
		19-0178w	Wetland	T	13ac	ABD	43	Y	Z	wmo-gc	87j
		19-0179w	Wetland	T	6ac	ABD	43	Y	Z	wmo-gc	87j

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=19 CNTYNAME=DAKOTA WBT=WETLAND ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		19-0180w	Wetland	T	8ac	ABD	43	Y	Z	wmo-gc	87j
		19-0074w	Wetland	T	11ac	ABD	43	Y	Z	wmo-gc	87j
		19-0073w	Wetland	T	8ac	BD	43	TY	TZ	wmo-gc	87j
		19-0308w	Wetland	T	30ac	ABD	43	Y	Z	wmo-gc	87j

N= 54

CO=20 CNTYNAME=DODGE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040004	009		ZUMBRO R, M FK	I	-	BDEFGI	11,18,19,80	TWZ	UXZ	msof-5-lc	86b
07040004	010		ZUMBRO R, M FK	I		BDEFGI	11,18,19,80	TWZ	UXZ	msof-5-lc	86b
07040004	012		ZUMBRO R, M FK	I		BDEFGI	11,18,19,80	TWZ	UXZ	msof-5-lc	86b
07040004	013		ZUMBRO R, M FK, S BR	I	-	BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	015		ZUMBRO R, M FK, S BR	I	-	BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b

N= 5

CO=21 CNTYNAME=DOUGLAS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005		21-0242	Aaron Lk	I	545ac	BDF	11,14,16,19,65,76	TW	UX	msof-i-glen	87f
07010108		21-0053	Agnes Lk	T	137ac	ABCDF	11,14,16,19,41,43,32,62,65	SW	UY	msof-i-glen	87f
07020005		21-0374	Alberts Lk	I	157ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0222	Aldrich Lk	I	178ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0293	Amos Lk	I	96ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0302	Barsness Lk	I	96ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0151	Blackwell Lk	I	307ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108	011	21-0057	Carlos Lk	I	2520ac	ABG	11,14,19,32,41,43,65,76	TV	UY	msof-i-glen	87f
07010108		21-0199	Crooked LK	I	253ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0338	Davidson Lk	I	158ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0213	Devils Lk	I	221ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0178	East Olaf Lk	I	102ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0157	Echo Lk	I	107ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0190	Elizabeth Lk	I	76ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0274	Eng Lk	I	185ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0341	Erwin Lk	I	123ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0336	Fanny Lk	I	40ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
		21-0612	Freeborn Lk	I	-	BDFG	19,11,16	UW	UX	msof-i-glen	87d
07020005		21-0162	Freeborn Lk	I	all	BDFG	11,19,18	UW	UX	msof-1-glen	86b
07020005		21-0189	Gilbert Lk	I	51ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0150	Grants Lk	I	180ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0051	Henry Lk	T	159ac	ABCDF	11,14,32,41,43,62,65,76	SW	UY	msof-i-glen	87f
07020005		21-0304	Holleque Lk	I	128ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=21 CNTYNAME=DOUGLAS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005		21-0347	Hubrid Lk	I	109ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0123	Ida Lk	I	all	BDG	18,11,65	TX	UV	msof-1-glen	86b
07010108		21-0123	Ida Lk	I	–	BDG	11,65,16	TX	UV	msof-i-glen	87d
07010108		21-0136	Indian Lk	I	all	BFG	11,18	TW	V	msof-1-glen	86b
07010108		21-0136	Indian Lk	I	76ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0136	Indian Lk	I	–	BFG	11,16	TW	V	msof-i-glen	87d
07010108		21-0076	Irene Lk	I	all	BG	65	TW	UV	msof-1-glen	86b
07010108		21-0076	Irene Lk	I	–	BG	65	TW	UX	msof-i-glen	87d
07020005		21-0323	Jennie Lk	I	301ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0310	Jorgrson Lk	I	97ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0155	Kron Lks	I	26ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0060	Krueger Slough	I	120ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005		21-0257	Lake Oscar	I	806ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0261	Lake Thorstad	I	276ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0305	Lake Venus	I	196ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0056	Le Homme Dieu Lk	T	all	BG	40	UX	UX	msof-1-glen	86b
07010108		21-0056	Le Homme Dieu Lk	I	–	BG	19	UX	UX	msof-i-glen	87d
07020005	022	21-0212	Little Chippewa Lk	I	176ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0242	Lk Aaron	I	545ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0120	Lk Charlie	I	93ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0083	Lk Miltona	I	5838ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0245	Lk Moses	I	822ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0144-01	Lobster Lk	I	all	BDFG	19,11,65,18	TW	UVX	msof-1-glen	86b
07010108		21-0144-02	Lobster Lk	I		BDFG	19,11,65,18	TW	UVX	msof-1-glen	86b
07010108		21-0144-01	Lobster Lk	I	1308ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0144-02	Lobster Lk	I		ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0144-01	Lobster Lk	I	–	BDFG	19,11,65,16	TW	UVX	msof-i-glen	87d
07010108		21-0144-02	Lobster Lk	I		BDFG	19,11,65,16	TW	UVX	msof-i-glen	87d
		21-?	Long Lk	I	125ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0230	Long Lk	I	190ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0343	Long Lk	I	218ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0208	Lower Hunt Lk	I	120ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0329	Mahla Lk	I	52ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0079	Maple Lk	I	all	BFG	40,65,18	TX	U	msof-1-glen	86b
07020005		21-0079	Maple Lk	I	835ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0079	Maple Lk	I	–	BFG	43,65,16,19	TX	U	msof-i-glen	87d
07020005		21-0171	Mattson Lk	I	264ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0180	Mill Lk	I	all	BFG	19,11,65	TX	U	msof-1-glen	86b
07010108		21-0180	Mill Lk	I	–	BFG	19,11,65	TX	U	msof-i-glen	87d
07020005		21-0185	Minister Lk	I	97ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0226	Moon Lk	I	127Aac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
		21-?	Mud Lk	I	139ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0231	Nelson Lk	I	102ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0156	North Oscar Lk	I	256ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0257	Oscar Lk	I	all	BDFG	19,11,65,18	TW	UVX	msof-1-glen	86b
07020005		21-0257	Oscar Lk	I	–	BDFG	19,11,65,16	TW	UVX	msof-i-glen	87d
07010108		21-0140	Pocket Lk	I	all	ABDFG	19,11,65,18	SW	TX	msof-1-glen	86b
07010108		21-0140	Pocket Lk	I	–	ABDFG	19,11,65,16	SW	TX	msof-i-glen	87d
07020005		21-0315	Quam Lk	I	178ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0291	Red Rock Lk	I	all	BDFG	19,11,65,18	TW	UX	msof-1-glen	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=21 CNTYNAME=DOUGLAS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005		21-0291	Red Rock Lk	I	964ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0291	Red Rock Lk	I	-	BDFG	19,11,65,16	TW	UX	msof-i-glen	87d
07020005		21-0281	Roland Lk	I	88ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0197	Round LK	I	64ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010202		21-0014	Schulz Lk	I	-	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07010202		21-0016	Smith Lk	I	all	BDFG	19,11,18	TW	UX	msof-1-glen	86b
07010202		21-0016	Smith Lk	I	-	BDFG	19,11,16	TW	UX	msof-i-glen	87d
07010202		21-0016	Smith Lk	I	648ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005		21-0348	Solberg Lk	I	291ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0154	South Oscar Lk	I	55ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0264	Stone Lk	I	367ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0264	Stowe Lk	I	all	BDFG	19,11,18	SW	TX	msof-1-glen	86b
07020005		21-0264	Stowe Lk	I	-	BDFG	19,11,16	SW	TX	msof-i-glen	87d
07010202		21-0003	Swim Lk	I	-	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005		21-0294	Thorson Lk	I	106ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005	019	21-0090	Turtle Lk	I	220ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0233	Upper Hunt Lk	I	106ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0177	West Olaf Lk	I	54ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0216	Whiskey Lk	I	162ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		21-0187	Williams Lk	I	261ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07010108		21-0081-01	Winona Lk	T	190ac	ABCDF	11,14,16,19,32,41,43,61,62,65,76	SW	TY	msof-i-glen	87f
07010108		21-0081-02	Winona Lk	T		ABCDF	11,14,16,19,32,41,43,61,62,65,76	SW	TY	msof-i-glen	87f
07020005		21-0289	Wolley Lk	I	135ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87a

N= 96

CO=21 CNTYNAME=DOUGLAS WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005	622		CD 60 (CHIPPEWA R)	I		ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005	722		CD 60 (CHIPPEWA R)	I		ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005	022		CHIPPEWA R	I	-	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07020005	522		HUNT LKS+WOLF CK (CHIPPEWA R)	I		ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07010108	007		LONG PRAIRIE R	I		DFG	11,12,14,16,19,76,77	TW	UY	msof-i-glen	87f
07010108	007		LONG PRAIRIE R	I		ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07010108	010		LONG PRAIRIE R	I	-	DFG	11,12,14,16,19,76,77	TW	UY	msof-i-glen	87f
07010108	010		LONG PRAIRIE R	I	-	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
09020102	001		MUSTINKA R	I	-	DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f
09020102	002		MUSTINKA R	I		DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f
09020102	006		MUSTINKA R	I		DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f
09020102	010		MUSTINKA R	I		DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f
09020102	003		MUSTINKA R, W BR	I		DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f
09020102	004		MUSTINKA R, W BR	I		DFG	71,76,77,11,12,14,16,18,19	SW	TY	msof-i-glen	87f

N= 14

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=22 CNTYNAME=FARIBAULT WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020011		22-0074	Bass Lk	T	-	AB	19,65,40	S	U	msof-4-wate	86b
07020011		22-0074	Bass Lk	-	-	AB	19,65	S	U	msof-4-wate	87d
07020011		22-0074	Bass Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h

N= 3

CO=22 CNTYNAME=FARIBAULT WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020009	013		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	015		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	016		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	018		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	019		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	021		BLUE EARTH R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	023		BLUE EARTH R, E BR	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	025		BLUE EARTH R, E BR	I	all	DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020009	020		BLUE EARTH R, W BR	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h

N= 9

CO=23 CNTYNAME=FILLMORE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040008	039		*D	I	4	ACEGH	11,18,19	S	U	swcd-23	87e
07040007	x09		Big Springs Cr	T	-	CDF	14	S	U	mdof-533	87i
07040008	x09		Big Springs Cr	I	6	ACFGH	11,14,18,19	S	UX	swcd-23	87e
07040008	038		CAMP CR	I	4	ACEFH	11,14,18,19	S	U	swcd-23	87e
?	?		Pine Cr	I	5	ACFGH	11,14,18,19	S	U	swcd-23	87e
?	?		Raaen Cr	T	-	CDF	14	S	U	mdof-533	87i
07040008	x12		Rice Cr	T	-	CDF	14	S	U	mdof-533	87i
07040008	045		RICEFORD CR	I	10	ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	145		RICEFORD CREEK	I		ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	245		RICEFORD CREEK	I		ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	345		RICEFORD CREEK	I		ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	445		RICEFORD CREEK	I		ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	545		RICEFORD CREEK	I		ACFGH	11,14,18,19	S	U	swcd-23	87e
07040008	010		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	012		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	013		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	015		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	019		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	021		ROOT R, M BR	T		CDF	14	T	U	mdof-533	87i
07040008	025		ROOT R, M BR	T	-	CDF	14	T	U	mdof-533	87i

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=23 CNTYNAME=FILLMORE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040008	016		ROOT R, N BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	018		ROOT R, N BR	I	15	ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	029		ROOT R, S BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	029		ROOT R, S BR	T		CDF	14	T	U	mdof-533	87i
07040008	030		ROOT R, S BR	I	15	ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	030		ROOT R, S BR	T		CDF	14	T	U	mdof-533	87i
07040008	032		ROOT R, S BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	032		ROOT R, S BR	T		CDF	14	T	U	mdof-533	87i
07040008	033		ROOT R, S BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	033		ROOT R, S BR	T		CDF	14	T	U	mdof-533	87i
07040008	034		ROOT R, S BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	034		ROOT R, S BR	T		CDF	14	T	U	mdof-533	87i
07040008	035		ROOT R, S BR	I		ACEGH	11,14,18,19	SX	YU	swcd-23	87e
07040008	035		ROOT R, S BR	T	-	CDF	14	T	U	mdof-533	87i
07040008	040		ROOT R, S FK	T		CDF	14	T	U	mdof-533	87i
07040008	041		ROOT R, S FK	T		CDF	14	T	U	mdof-533	87i
07040008	042		ROOT R, S FK	T		CDF	14	T	U	mdof-533	87i
07040008	043		ROOT R, S FK	T	-	CDF	14	T	U	mdof-533	87i
07040008	007		RUSH CR	T	-	CDF	14	S	U	mdof-533	87i
07040008	027		SPRING VALLEY CR	I	10	ACEGH	11,14,18,19	S	U	swcd-23	87e
07040008	027		SPRING VALLEY CR	I	-	CDEF	14,41,66	S	U	mdof-533	87i
07040008	127		SPRING VALLEY CREEK	I		ACEGH	11,14,18,19	S	U	swcd-23	87e
07040008	127		SPRING VALLEY CREEK	I		CDEF	14,41,66	S	U	mdof-533	87i
07040008	227		SPRING VALLEY CREEK	I		ACEGH	11,14,18,19	S	U	swcd-23	87e
07040008	227		SPRING VALLEY CREEK	I		CDEF	14,41,66	S	U	mdof-533	87i
07040008	031		WATSON CR	I	4	ACEGH	11,14,18,19	S	U	swcd-23	87e
07040008	031		WATSON CR	I	-	CDF	14	S	U	mdof-533	87i
07040008	144		WEISEL CREEK	T		CDF	14	T	U	mdof-533	87i
07040008	244		WEISEL CREEK	T		CDF	14	T	U	mdof-533	87i
07040008	037		WILLOW CR	I	2	ACEGH	11,14,18,19	S	U	swcd-23	87e
07040008	044		WISEL CR	T	-	CDF	14	T	U	mdof-533	87i

N= 51

CO=24 CNTYNAME=FREEBORN WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020009		24-0043	(Alden Lk)morin Lk	T	20ac	E	43	XT	-	swcd-24	87a
07080202		24-0024	(Chapau Lk)white Lk	I	144ac	DEC	18,19,65,43,	Z	-	swcd-24	87a
07080202	011	24-0014	Albert Lea Lk	I	2625ac	CDEFA	41,42,11,18,19,62	S	TX	swcd-24	87a
07080202	011	24-0014	Albert Lea Lk	I	-	BD	19	SW	-	cza-24	87b
07080202	011	24-0014	Albert Lea Lk	I	2654ac	ABF	11,19,41,43,66	SW	TW	mdow-5-roch	87c
07080202	011	24-0014	Albert Lea Lk	T	all	ABF	65,19,40	Z	Z	cza-24	86a
07080203		24-0028	Bear Lk	I	1560ac	CDEFA	11	ZT	U	swcd-24	87a
07080203		24-0028	Bear Lk	-	-	B	19	-	-	cza-24	87b
07080203		24-0028	Bear Lk	T	1560ac	DFG	11,19,71,77	-	-	mdow-5-roch	87c
07080203		24-0028	Bear Lk	I	1600ac	BDFG	11,19,71,76	TWZ	S	msow-5-owat	87c

CO=24 CNTYNAME=FREEBORN WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07080203		24-0028	Bear Lk	I	all	ABF	19	T	Z	cza-24	86a
07080202		24-0032	Eberhart Lk	I	140ac	DE	11,19	Z	–	swcd-24	87a
07080202	013	24-0018-01	Fountain Lk	I	490ac	DCE	41,42,11,18,19	TMZ	VZ	swcd-24	87a
07080202	013	24-0018-02	Fountain Lk	I		DCE	41,42,11,18,19	TMZ	VZ	swcd-24	87a
07080202	013	24-0018-01	Fountain Lk	–	–	B	41,43,	TW	UV	cza-24	87b
07080202	013	24-0018-02	Fountain Lk	–		B	41,43,	TW	UV	cza-24	87b
07080202	013	24-0018-01	Fountain Lk	I	555ac	ABDFG	11,19,41,43,77,71	TW	UX	mdow-5-roch	87c
07080202	013	24-0018-02	Fountain Lk	I		ABDFG	11,19,41,43,77,71	TW	UX	mdow-5-roch	87c
07080202	013	24-0018-01	Fountain Lk	T	555ac	ABD	11,19,71,72	VX	SX	msow-5-owat	87c
07080202	013	24-0018-02	Fountain Lk	T		ABD	11,19,71,72	VX	SX	msow-5-owat	87c
07080202	013	24-0018-01	Fountain Lk	I	all	B	19	UW	XV	cza-24	86a
07080202	013	24-0018-02	Fountain Lk	I		B	19	UW	XV	cza-24	86a
07020011		24-0044	Freeborn Lk	I	2125ac	CDE	11,14	–	–	swcd-24	87a
07080201		24-0015	Geneva Lk	I	1944ac	ED	19,11,18	T	–	swcd-24	87a
07080201		24-0015	Geneva Lk	–	–	B	19	–	–	cza-24	87b
07080201		24-0015	Geneva Lk	I	1875ac	BFG	11,19,74	SW	Z	mdow-5-roch	87c
07080201		24-0015	Geneva Lk	I	1900ac	BDF	11,19,65,71	SW	–	msow-5-owat	87c
07080201		24-0015	Geneva Lk	I	all	ABF	19	S	Z	cza-24	86a
07080202		24-0038	Halls Lk	T	144ac	DE	11,19	Z	–	swcd-24	87a
07080202		24-0027	Lower Twin Lk	I	1095ac	DE	11,14,19	Z	–	swcd-24	87a
07080202		24-0027	Lower Twin Lk	–	–	B	19	–	–	cza-24	87b
07020011		24-0048	Penny Lk	I	99ac	DE	11,19,	Z	–	swcd-24	87a
07080202		24-0025	Pickeral Lk	I	563 ac	CDE	11	–	–	swcd-24	87a
07080202		24-0040	School Sec Lk	I	99ac	DE	11,19	Z	–	swcd-24	87a
07020011		24-0045	Spicer Lk	I	100ac	DE	11,19	Z	–	swcd-24	87a
07080203		24-0030	State Line Lk	I	425ac	DE	11,14,19	TZ	U	swcd-24	87a
07080202		24-0037	Sugar Lk	T	130ac	DE	11,19	Z	–	swcd-24	87a
07020011		24-0049	Trenton Lk	I	200ac	DE	11,19	Z	–	swcd-24	87a
		24-?	Twin Lk	I	all	ABF	19	S	Z	cza-24	86a
07080202		24-0031	Upper Twin Lk	I	1095	DE	11,14,19	Z	–	swcd-24	87a
07080202		24-0031	Upper Twin Lk	–	–	B	19	–	–	cza-24	87b

N= 41

CO=25 CNTYNAME=GOODHUE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?		Bear Valley	T	all	DEF	11,19	S	S	swcd-25	87k
07040002	035		BELLE CR	I	–	DEFGI	11,18,19,80	S	U	msof-5-lc	86b
07040002	035		BELLE CR	T	all	DEF	11,19	V	V	swcd-25	87k
07040001	104		BULLARD CREEK	T	–	DEFGI	11,18,19	S	U	msof-5-lc	86b
07040001	104		BULLARD CREEK	T	all	DEF	11,19,32	S	S	swcd-25	87k
07040002	001		CANNON R	T		DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k
07040002	002		CANNON R	T		DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k
07040002	004		CANNON R	T	all	DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k
07040002	005		CANNON R	T		DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k
07040002	006		CANNON R	T		DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=25 CNTYNAME=GOODHUE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	008		CANNON R	T		DEF	11,19,32,41,43,74	TW	UXZ	swcd-25	87k
07040001	013		HAY CR	I	–	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040001	013		HAY CR	T	all	DEF	11,19,32	T	U	swcd-25	87k
07040002	034		LITTLE CANNON R	I	–	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040002	034		LITTLE CANNON R	T	all	DEF	11,19,32	T	U	swcd-25	87k
07040004	210		M FK ZUMBRO R	I		CDEFG	11,19,32,41,43,62	S	UZ	swcd-25	87k
07040001	001		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	001		MISSISSIPPI R	T	35	ABCDE	11	U	U	mdof-534	87i
07040001	001		MISSISSIPPI R	I	all	BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	002		MISSISSIPPI R	T	–	ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	002		MISSISSIPPI R	T		ABCDE	11	U	U	mdof-534	87i
07040001	002		MISSISSIPPI R	I		BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	004		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	004		MISSISSIPPI R	T		ABCDE	11	U	U	mdof-534	87i
07040001	004		MISSISSIPPI R	I		BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	005		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	005		MISSISSIPPI R	I		BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	006		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	006		MISSISSIPPI R	I		BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	008		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	008		MISSISSIPPI R	I		BCDEFG	62,72,74,11,19,32,41,43	TW	UX	swcd-25	87k
07040001	010		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040001	011		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVXWZ	UVXZ	msof-5-lc	86b
07040004	x08		Pine Island Cr	T	11	CDEG	11,14,19	Y	Y	mdof-534	87i
07040002	003		PINE CR	T	2	CDEG	11,14,19	Y	Y	mdof-534	87i
07040002	033		PRAIRIE CR	T	6	CDEG	11,14,19	S	T	mdof-534	87i
07040002	033		PRAIRIE CR	T	all	DEF	11,19	S	S	swcd-25	87k
07040004	x07		Shingle Cr	T	5	CDEG	11,14,19	Y	Y	mdof-534	87i
07040004	x07		Silver Cr	T	5	CDEG	11,14,19	Y	Y	mdof-534	87i
?	?		Spring Cr	T	all	DEF	11,19	S	U	swcd-25	87k
07040001	x05		Spring Cr	I	–	DEFGI	11,19,18,30	S	U	msof-5-lc	86b
07040002	x01		Spring Cr	I	–	DEFGI	11,18,19,80	S	T	msof-5-lc	86b
07040002	x06		Spring Cr	I	–	DEFGI	11,19,18,30	S	U	msof-5-lc	86b
07040004	106		TROUT BROOK	T		DEF	11,19	T	U	swcd-25	87k
07040004	206		TROUT BROOK	T	all	DEF	11,19	T	U	swcd-25	87k
07040004	306		TROUT BROOK	T		DEF	11,19	T	U	swcd-25	87k
07040001	014		WELLS CR	I	–	DEFGI	11,18,19,80	S	U	msof-5-lc	86b
07040001	014		WELLS CR	T	all	DEF	11,19	S	T	swcd-25	87k
07040004	011		ZUMBRO R, M FK, N BR	I	–	DEFGI	11,18,19,80	SWZ	TXZ	msof-5-lc	86b
07040004	011		ZUMBRO R, M FK, N BR	I	all	CDEFG	11,19,32,41,43,62	S	UZ	swcd-25	87k
07040004	005		ZUMBRO R, N FK	I		DEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	007		ZUMBRO R, N FK	I	–	DEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	007		ZUMBRO R, N FK	I		CDEFG	11,19,32,41,43,62	S	UZ	swcd-25	87k
07040004	006		ZUMBRO R, N FK, TROUT BR	T	7	CDEG	11,14,19	Y	Y	mdof-534	87i

N= 54

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By County, Waterbody Type, Name

CO=26 CNTYNAME=GRANT WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002	002	26-0095	Barrett Lk	I	all	BDFG	19,40,11,18	TW	UX	msof-1-glen	86b
07020002	002	26-0095	Barrett Lk	I	1.5sq	D	11,19	TX	UY	swcd-26	87a
07020002	002	26-0095	Barrett Lk	I	–	BDFG	43,19,11,16.	TW	UX	msof-i-glen	87d
09020102		26-0194	Big Lk	I	.75sqmi	D	11,19	Y	Y	swcd-26	87a
09020102		26-0185	Cottonwood Lk	T	.25sq	D	11,19	Z	Z	swcd-26	87a
09020102		26-0185	Cottonwood Lk	I	247	BD	11,16,19	TW	UX	msow-1-morr	87d
09020102		26-0185	Cottonwood Lk	T	220ac	ABDF	11,12,14,16,18,19,65,76	TW	UX	msof-i-glen	87f
09020102		26-0140	Elbow Lk	I	1sq	D	11,19	Z	Z	swcd-26	87a
		26-?	Elk Lk	T	1sq	D	11,19	TX	UY	swcd-26	87a
09020102		26-0160	Field Lk	T	.5sq	D	11,19	Z	Z	swcd-26	87a
09020102		26-0159	Four Mile Lk	T	.5sq	D	11,19	Z	Z	swcd-26	87a
09020102		26-0282	Lightning Lk	I	1sqmi	BD	11,18	TW	UY	swcd-26	87a
09020102		26-0282	Lightning Lk	I	–	ABDG	19,11,65	UW	X	cza-26	86a
		26-0239	Moses Lk	T	.25sqmi	D	11,19	Z	Z	swcd-26	87a
07020002	008	26-0002	Pelican Lk	I	all	ABDFG	19,11,65	TW	UX	msof-1-glen	86b
07020002	008	26-0002	Pelican Lk	I	8sq	D	11,19	TW	UY	swcd-26	87a
07020002	008	26-0002	Pelican Lk	I	–	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020002	008	26-0002	Pelican Lk	I	–	ABDFG	19,11,65	TW	UX	msof-i-glen	87d
07020002	004	26-0097	Pomme De Terre Lk	I	4sqmi	BD	11,19	UX	UY	swcd-26	87a
07020002	004	26-0097	Pomme De Terre Lk	I	1794ac	ABDF	11,12,14,16,19,65,76	TW	UX	msof-i-glen	87f
07020002	004	26-0097	Pomme De Terre Lk	I	–	BDFG	19,11,65	UW	X	cza-26	86a
		26-?	Round Lk	T	1sq	D	11,19	Z	Z	swcd-26	87a

N= 22

CO=26 CNTYNAME=GRANT WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002	004			T		ED	19,11,65	Z	Z	cza-26	86a
07020005	022		CHIPPEWA R	I	11mi	D	11,19	Z	T	swcd-26	87a
09020102	010		MUSTINKA R	I		D	11,72,19	Z	Z	swcd-26	87a
09020102	010		MUSTINKA R	T	–	ED	19,11,65	YZ	Y	cza-26	86a
09020102	014		MUSTINKA R	I	23mi	D	11,72,19	Z	Z	swcd-26	87a
09020102	014		MUSTINKA R	T		ED	19,11,65	YZ	Y	cza-26	86a
07020002	003		POMME DE TERRE (POMME DE TERR)	T		ED	19,11,65	Z	Z	cza-26	86a
07020002	002		POMME DE TERRE R	I	26mi	D	11,19	Z	T	swcd-26	87a
07020002	002		POMME DE TERRE R	T	–	ED	19,11,65	Z	Z	cza-26	86a

N= 9

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By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=AQUIFER ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-?	Glacial Drift Aqf	T	-	-	-	Z	-	wmo-sc	87k
		aqf-112brd0	Glacial Drift Aquifer	T	-	CE	63,64,65,66	Z	-	wmo-wm	87j
		aqf-1120tsh	Glacial Drift Aquifer	T	-	CE	63,64,65,66	Z	-	wmo-sc	87j
		aqf-371mshk	Mt.simon-hinkley Aqf	T	-	-	-	Z	-	wmo-sc	87k
		aqf-371jrdn	Prairie Du Chien-jordan Aqf	T	-	CE	62,64,65,66	Z	-	wmo-wm	87j
		aqf-371jrdn	Prairie Du Chien-jordan Aqf	T	-	CE	62,64,65,66	Z	-	wmo-sc	87j
		aqf-378pdjc	Prairie Du Chien-jordan Aqf	T	-	-	-	Z	-	wmo-sc	87k

N= 7

CO=27 CNTYNAME=HENNEPIN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		27-0111-02	pike lk	I		F	32,41,43,31	XT	-	wmo-sc	87j
07010204		27-0153	Admore Lk	T	11ac	B	43	S	UZ	cd-27	87j
07020012		27-0062-01	Anderson Lk	T	431ac	B	41	-	Z	cd-27	87j
07020012		27-0062-02	Anderson Lk	T		B	41	-	Z	cd-27	87j
07020012		27-0062-03	Anderson Lk	T		B	41	-	Z	cd-27	87j
07010206		27-0015	Bass Lk	I	55ac	BDI	41,43,32	Z	-	wd-mc	87h
07010206		27-0015	Bass Lk	I	55ac	BDI	41,43,32	Z	-	wd-mc	87k
07010206		27-0098	Bass Lk	I	175ac	F	31,32,41,43	XT	-	wmo-sc	87j
07010206		27-0098	Bass Lk	I	175ac	BA	41,43	-	UX	cd-27	87j
07010206	008	27-0133-02	Brown's Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0038	Brownie Lk	I	11ac	ABDEF	41,43,80	Z	-	wd-mc	87d
07010206		27-0038	Brownie Lk	I	21ac	B	41	-	Z	cd-27	87j
07010206		27-0038	Brownie Lk	I	11ac	ABDEF	41,43,80	Z	-	wd-mc	87k
07010206		27-0038	Brownie Lk	-	-	B	-	-	-	wd-mc	87k
07020012		27-0067	Bryant Lk	T	199ac	B	11,14,43	-	UX	cd-27	87j
07020012		27-0047	Bush Lk	I	207ac	B	41	-	UX	cd-27	87j
07010206		27-0031	Calhoun Lk	I	416ac	B	41	-	ZUX	cd-27	87j
07010206		27-0031	Calhoun Lk	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0133-05	Carmen's Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0119	Cedar Island Lk	I	80ac	F	31,32,41,43	XT	-	wmo-sc	87j
07010206		27-0119	Cedar Island Lk	T	88ac	B	41,43	Z	Z	cd-27	87j
07010206		27-0039	Cedar Lk	T	all	AB	41,43	S	X	mdow-co	87c
07010206		27-0039	Cedar Lk	T	170ac	BC	41,43	X	-	wd-mc	87d
07010206		27-0039	Cedar Lk	I	167ac	B	41	-	Z	cd-27	87j
07010206		27-0039	Cedar Lk	T	170ac	BC	41,43	X	-	wd-mc	87k
07010206		27-0039	Cedar Lk	-	-	B	-	-	-	wd-mc	87k
07010206	007	27-0061	Champlin Mill Pond	I	38ac	BDH	11,14,43	-	ZX	cd-27	87j
07010206		27-0137	Christmas Lk	-	-	-	-	-	-	wd-mc	87k
07010206		27-0120	Cook Lk	T	43ac	B	11,14,43	S	UZ	cd-27	87j
07010206	008	27-0133-05	Cooks Bay	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0133-05	Crane Is	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0133-10	Crystal Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0034	Crystal Lk	I	70ac	F	41,43	XT	-	wmo-sc	87j
07010206		27-0034	Crystal Lk	I	74ac	B	41	-	ZUX	cd-27	87j

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		27-0593	Curtis Lk	I	31ac	F	31,32	-	T	wmo-sc	87j
07010206	008	27-0133-14	Deering Island	-	-	B	-	-	-	wd-mc	87k
07010206		27-0022	Diamond Lk	I	58ac	ADEFI	31,32,41,43,80	Z	-	wd-mc	87h
07010206		27-0022	Diamond Lk	I	58ac	ADEFI	31,32,41,43,80	Z	-	wd-mc	87k
07010206		27-0125	Diamond Lk	I	408ac	B	11,14,18	S	UZ	cd-27	87j
07010206		27-0161	Dickeys Lk	T	13ac	B	43	S	Z	cd-27	87j
07010206		27-0181	Dutch Lk	T	241ac	BH	11,14,41,43,76	Z	-	wd-mc	87d
07010206		27-0181	Dutch Lk	T	170ac	B	41	T	UZ	cd-27	87j
07010206		27-0181	Dutch Lk	T	241ac	BH	11,14,41,43,76	Z	-	wd-mc	87k
07010206		27-0181	Dutch Lk	-	-	B	-	-	-	wd-mc	87k
07010206		27-0111-01	Eagle Lk	I	544ac	F	32,41,43,31	XT	-	wmo-sc	87j
07010206		27-0111-01	Eagle Lk	T	470ac	B	41,43	TXZ	UXZ	cd-27	87j
07010206		27-0111-02	Eagle Lk	T		B	41,43	TXZ	UXZ	cd-27	87j
07010206		27-0118	Fish Lk	T	221ac	B	41,43	TXZ	UXZ	cd-27	87j
07010206		27-0139	Forest Lk	T	127ac	BH	41,43	Z	-	wd-mc	87d
07010206		27-0139	Forest Lk	T	127ac	BH	41,43	Z	-	wd-mc	87k
07010206		27-0139	Forest Lk	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0133-?	Gale Is	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0144	Galpin Lk	I	45ac	BG	41,43,31,32	Z	-	wd-mc	87d
07010206	008	27-0144	Galpin Lk	I	45ac	BG	41,43,31,32	Z	-	wd-mc	87k
07010206	008	27-0144	Galpin Lk	-	-	B	-	-	-	wd-mc	87k
		27-?	Garfield Lk	I	800ac	B	90	S	S	mdof-112	87h
07010206		27-0095	Gleason	I	190ac	ABDF	32,41,43,76	Z	-	wd-mc	87k
07010206		27-0095	Gleason Lk	I	190ac	ABDF	32,41,43,76	Z	-	wd-mc	87h
07010206		27-0095	Gleason Lk	I	167ac	B	41	-	Z	cd-27	87j
07010206		27-0095	Gleason Lk	-	-	B	-	-	-	wd-mc	87k
07010206		27-0109	Hadley Lk	I	59ac	ABDF	41,43,76	Z	-	wd-mc	87h
07010206		27-0109	Hadley Lk	I	39ac	B	41	-	Z	cd-27	87j
07010206		27-0109	Hadley Lk	I	59ac	ABDF	41,43,76	Z	-	wd-mc	87k
07010204		27-0199	Haften Lk	T	52ac	B	11,14	S	UZ	cd-27	87j
07010205		27-0152	Half Moon Lk	T	32ac	B	11,14	S	UZ	cd-27	87j
07010206	008	27-0133-09	Halstead Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0051	Hannon	I	32ac	ABDE	32,41,43	Z	-	wd-mc	87k
07010206		27-0052	Hannon Lk	I	32ac	ABDE	32,41,43	Z	-	wd-mc	87h
07010206		27-0016	Harriet Lk	T	341ac	H	41,43	Z	-	wd-mc	87h
07010206		27-0016	Harriet Lk	I	337ac	B	41	-	ZUX	cd-27	87j
		27-?	Hart Lk	I	180ac	B	90	Z	Z	mdof-112	87h
07010206		27-0018	Hiawatha Lk	I	66ac	ABCDE	41,43,80	Z	-	wd-mc	87h
07010206		27-0158	Holy Name Lk	I	80ac	BA	11,14	S	UZ	cd-27	87j
07010205		27-0187	Hughey Lk	T	50ac	B	11,14	S	UZ	cd-27	87j
07020012		27-0048	Hyland Lk	I	87ac	BD	41	-	Z	cd-27	87j
07010205		27-0176	Independence Lk	I	828ac	B	11,14,65	T	UZ	cd-27	87j
07020012		27-0081	Island Lk	T	163ac	B	41	-	Z	cd-27	87j
07010206	008	27-0133-15	Jennings Bay	-	-	B	-	-	-	wd-mc	87k
07010206	007	27-0165	Jubert Lk	I	75ac	B	11,14	S	UZ	cd-27	87j
07010206		27-0040	Lake Of The Isles	T	all	AB	41,43	S	W	mdow-co	87c
07010206		27-0182	Langdon Lk	I	182ac	ABDI	62,41,43,80	Z	-	wd-mc	87h
07010206		27-0182	Langdon Lk	T	168ac	BA	41,62	S	UZ	cd-27	87j
07010206		27-0182	Langdon Lk	I	182ac	ABDI	62,41,43,80	Z	-	wd-mc	87k
07010206		27-0182	Langdon Lk	-	-	B	-	-	-	wd-mc	87k

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		27-0016	Lk Harriet	T	341ac	H	41,43	Z	-	wd-mc	87k
07010206		27-0018	Lk Hiawatha	I	66ac	ABCDE	41,43,80	Z	-	wd-mc	87k
07010206	008	27-0133-01	Lk Minnetonka	I	22ac	ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-02	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-03	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-04	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-05	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-06	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-07	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-08	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-09	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-10	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-11	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-12	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-13	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-14	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206	008	27-0133-15	Lk Minnetonka	I		ABD	14,11,18,19,32,31,41,43,65,72,76,77	UXZ	-	wd-mc	87k
07010206		27-0040	Lk Of The Isles	I	128ac	ABCE	41,43	Z	-	wd-mc	87d
07010206		27-0040	Lk Of The Isles	I	157ac	B	41	-	Z	cd-27	87j
07010206		27-0040	Lk Of The Isles	I	128ac	ABCE	41,43	Z	-	wd-mc	87k
07010206		27-0040	Lk Of The Isles	-	-	B	-	-	-	wd-mc	87k
		27-0634	Lk Success	I	8ac	F	41,43	Z	-	wmo-sc	87j
07010206		27-0160	Long Lk	I	320ac	ABFG	11,14,18,32,31,41,43,76	Z	-	wd-mc	87d
07010206		27-0160	Long Lk	I	279ac	B	11,14	T	UZ	cd-27	87j
07010206		27-0160	Long Lk	I	320ac	ABFG	11,14,18,32,31,41,43,76	Z	-	wd-mc	87k
07010206		27-0065	Magda Lk	I	12ac	F	41,43	Z	-	wmo-sc	87j
07010206	008	27-0133-11	Maxwell Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0057	Meadow Lk	I	11ac	F	41,43	Z	-	wmo-sc	87j
07010206		27-0054	Meadowbrook Lk	I	83ac	BD	41,43,76,77	Z	-	wd-mc	87h
07010206		27-0054	Meadowbrook Lk	I	83ac	BD	41,43,76,77	Z	-	wd-mc	87k
07010206		27-0104	Medicine Lk	I	924ac	B	11,41,43,14	-	UXZ	cd-27	87j
07020012		27-0088	Minnetoga Lk	T	16ac	B	41	-	UZX	cd-27	87j
07010206	008	27-0133	Minnetonka	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0133-01	Minnetonka Lk	I	22	ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-02	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-03	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-04	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-05	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-06	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-07	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-08	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-09	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-10	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-11	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-12	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-13	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-14	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-15	Minnetonka Lk	I		ABD	14,11,18,19,32,31,41,43,65,72,77,76	VXZ	-	wd-mc	87d
07010206	008	27-0133-01	Minnetonka Lk	T	14310ac	B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-02	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206	008	27-0133-03	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-04	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-05	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-06	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-07	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-08	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-09	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-10	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-11	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-13	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-14	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07010206	008	27-0133-15	Minnetonka Lk	T		B	11,14,18,41,43	UZ	UZ	cd-27	87j
07020012		27-0070	Mitchell Lk	T	116ac	B	41	–	Z	cd-27	87j
07010206		27-0134	Mooney	I	118ac	ABD	11,14,32,43,80	Z	–	wd-mc	87k
07010206		27-0134	Mooney Lk	I	118ac	ABD	11,14,32,43,80	Z	–	wd-mc	87h
07010206		27-0134	Mooney Lk	–	–	B	–	–	–	wd-mc	87k
07010206	002	27-0019	Nokomis Lk	I	201ac	ABCH	41,43,80	Z	–	wd-mc	87d
07010206	002	27-0019	Nokomis Lk	I	199ac	B	41	–	ZUX	cd-27	87j
07010206	002	27-0019	Nokomis Lk	I	201ac	ABCH	41,43,80	Z	–	wd-mc	87k
07010206	002	27-0019	Nokomis Lk	–	–	B	–	–	–	wd-mc	87k
07010206	008	27-0133-13	North Arm	–	–	B	–	–	–	wd-mc	87k
07010206		27-0059	Palmer Lk	I	271ac	AB	32,41,43	S	–	wmo-sc	87j
07010206		27-0107	Parkers Lk	T	92ac	B	41	–	UXZ	cd-27	87j
07010206		27-0107	Parkers Lk	–	–	B	–	–	–	wd-mc	87k
07010206	008	27-0138	Peavey Lk	I	9ac	ABDI	62,43,80	Z	–	wd-mc	87k
07010206	008	27-0138	Peavey Pond	–	–	B	–	–	–	wd-mc	87k
07010206	008	27-0138	Peavy Lk	I	9ac	ABDI	62,43,80	Z	–	wd-mc	87h
07010205		27-0147	Peter Lk	T	53ac	B	11,14	T	UZ	cd-27	87j
07010206		27-0100	Pomerleau Lk	I	35ac	F	32,41,43	Z	–	wmo-sc	87j
07010205		27-0192	Rebecca Lk	T	290ac	B	11,14	T	UZ	cd-27	87j
07020012		27-0076	Red Rock Lk	T	83ac	B	41	–	Z	cd-27	87j
07010206		27-0021	Richfield Lk	–	28ac	H	41,43	Z	–	wd-mc	87h
07010206		27-0021	Richfield Lk	–	28ac	H	41,43	Z	–	wd-mc	87k
07020012		27-0071	Round Lk	T	34ac	B	41	–	Z	cd-27	87j
07010206		27-0058	Ryan Lk	I	35ac	B	41,43	Z	–	wmo-sc	87j
07010206		27-0058	Ryan Lk	T	32ac	B	41	–	UXZ	cd-27	87j
07010204		27-0191	Sarah Lk	I	586ac	B	11,14,65	UW	UZX	cd-27	87j
07010204		27-0196	Schandell Lk	T	64ac	B	11,14	S	UZ	cd-27	87j
07010206		27-0102	Schmidt Lk	I	47ac	F	32,41,43	T	X	wmo-sc	87j
07020012		27-0089-01	Shady Oak Lk	T	90ac	B	41	–	ZX	cd-27	87j
07020012		27-0089-02	Shady Oak Lk	T		B	41	–	ZX	cd-27	87j
07020012		27-0089-03	Shady Oak Lk	T		B	41	–	ZX	cd-27	87j
07010206		27-0102	Smith Lk	T	46ac	B	41,43	–	Z	cd-27	87j
07010206		27-0108	Snyder Lk	T	16ac	B	41	–	Z	cd-27	87j
07010205		27-0149	Spurzem Lk	T	67ac	B	11,14	T	UZ	cd-27	87j
07020012		27-0078	Staring Lk	I	155ac	B	11,14,43	–	UZ	cd-27	87j
		27-?	Steamboat Lk	T	1800ac	BD	90	T	T	mdof-112	87h
07010206	008	27-0133-12	Stubbs Bay	–	–	B	–	–	–	wd-mc	87k
07010206		27-0035-01	Sweeney Lk	T	96ac	B	41	–	ZUX	cd-27	87j
07010204		27-0171	Sylvan Lk	I	–	BF	16,18	Y	Z	mdow-6-sp	87b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010204		27-0171	Sylvan Lk	I	-	BF	16,18	Y	Z	mdow-6-sp	87f
07010206	008	27-0141	Tanager	I	74ac	BFI	14,32,43,76	Z	-	wd-mc	87k
07010206	008	27-0141	Tanager Lk	I	74ac	BFI	14,32,43,76	Z	-	wd-mc	87h
07010206	008	27-0141	Tanager Lk	T	50ac	B	11,14,43	S	UZ	cd-27	87j
07010206	008	27-0141	Tanager Lk	-	-	B	-	-	-	wd-mc	87k
07010206	008	27-0141	Tanager Lk	-	-	B	-	-	-	wd-mc	87k
07010206		27-0156	Thies Lk	T	11ac	B	11,14	S	UZ	cd-27	87j
		27-0656	Twin Lk	I	13ac	ABDEFG	31,32,41,43,80	Z	-	wd-mc	87d
		27-0656	Twin Lk	I	13ac	ABDEFG	31,32,41,43,80	Z	-	wd-mc	87k
07010206		27-0035-02	Twin Lk	T	-	B	41	-	ZXU	cd-27	87j
07010206		27-0042-01	Twin Lk	I	201ac	B	41	-	UX	cd-27	87j
07010206		27-0042-02	Twin Lk	I		B	41	-	UX	cd-27	87j
07010206		27-0042-03	Twin Lk	I		B	41	-	UX	cd-27	87j
07010206		27-0042-01	Twin Lk	-	-	B	-	-	-	wd-mc	87k
07010206		27-0042-02	Twin Lk	-		B	-	-	-	wd-mc	87k
07010206		27-0042-03	Twin Lk	-		B	-	-	-	wd-mc	87k
07010206		27-0042-01	Twin Lks	I	229ac	B	41,43	XT	-	wmo-sc	87j
07010206		27-0042-02	Twin Lks	I		B	41,43	XT	-	wmo-sc	87j
07010206		27-0042-03	Twin Lks	I		B	41,43	XT	-	wmo-sc	87j
07010206	008	27-0133-02	Wayzata Bay	-	-	B	-	-	-	wd-mc	87k
07010206		27-0117	Weaver Lk	T	-	B	41,43,14	TX	UX	mdow-6-sp	87b
07010206		27-0117	Weaver Lk	T	-	B	41,43,14	TX	UX	mdow-6-sp	87f
07010206		27-0117	Weaver Lk	T	155ac	B	41,43	TXZ	UXZ	cd-27	87j
07010206	008	27-0133-14	West Arm	-	-	B	-	-	-	wd-mc	87k
07010205		27-0184-01	Whaletail Lk	T	582ac	B	11,14	T	UZ	cd-27	87j
07010205		27-0184-02	Whaletail Lk	T		B	11,14	T	UZ	cd-27	87j
07010205		27-0148	Winterhalter Lk	T	16ac	B	11,14	S	UZ	cd-27	87j
07010206		27-0037	Wirth Lk	T	37ac	B	41,43	-	UXZ	cd-27	87j
07010206		27-0157	Wolsfeld Lk	I	36ac	B	11,14	S	UZ	cd-27	87j
07010206		27-0157	Wolsfeld Lk	I	45ac	B	90	Z	-	wd-mc	87k
07010206		27-0157	Wolsfeld Lk	-	-	B	-	-	-	wd-mc	87k
07010206		27-0157	Wolsteld Lk	I	45ac	B	90	Z	-	wd-mc	87d
07010206		27-0026	Wood Lk	-	122ac	H	41,43	Z	-	wd-mc	87h
07010206		27-0026	Wood Lk	-	122ac	H	41,43	Z	-	wd-mc	87k

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=27 CNTYNAME=HENNEPIN WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206	108			I	5.5mi	ADF	11,14,18,19,32,43	Z	–	wd-mc	87k
07010206	x02		Bass Cr	I	3mi	FD	32,41,43	–	T	wmo-sc	87j
07010204	001		CROW R	T	20	BDE	11,14,19,21,43,62,65	TX	UW	msof-1-pr	87h
07010206	x08		Dutch Lake Cr	T	0.8mi	EH	43,66	Z	–	wd-mc	87k
07010206	x08		Dutch Lk Ck	T	.8mi	EH	43,66	Z	–	wd-mc	87h
07010206	x02		Eagle Cr	I	0.8mi	FD	32,41,43	–	T	wmo-sc	87j
07010206	x02		Edinbrook	I	5.3mi	DF	31,32,41,43	Z	–	wmo-wm	87j
?	?		Fish Hook R	T	7	BEH	12,19,62,74	T	U	msof-1-pr	87h
07010206	x08		Gleason Lake Cr	T	3mi	IHC	32,43	Z	–	wd-mc	87k
07010206	x08		Gleason Lk Ck	T	3mi	IHC	32,43	Z	–	wd-mc	87h
07010206	x02		Long Lake Cr	I	2.2mi	F	11,14,19,43,65	Z	–	wd-mc	87k
07010206	x08		Long Lk Ck	I	2.2mi	F	11,14,19,43,65	Z	–	wd-mc	87h
07010206	502		MINNEHAHA CR	T	22mi	ICEG	41,43,31,32	Z	–	wd-mc	87h
07010206	502		MINNEHAHA CR	T	22mi	ICEG	41,43,31,32	Z	–	wd-mc	87k
07010206	004		MISSISSIPPI R	I	–	DF	32,41,43	TX	–	wmo-wm	87j
07010206	202		MISSISSIPPI R	I		DF	32,41,43	TX	–	wmo-wm	87j
07010206	202		MISSISSIPPI R	–	–	FD	32,41,43	TX	–	wmo-sc	87j
07010206	x04		Oxbow Cr	I	1.6mi	DF	11,14,32	Z	–	wmo-wm	87j
07010206	x08		Painter Ck	I	5.5mi	ADF	11,14,18,19,32,43,	Z	–	wd-mc	87h
07010206	902		RYAN CREEK	I	1.8mi	FD	41,43	–	T	wmo-sc	87j
07010206	x08		Six-mile Ck	T	5mi	IH	11,14,19	Z	–	wd-mc	87h
07010206	802		SHINGLE CREEK	I	11.2mi	FD	32,41,43	T	–	wmo-sc	87j

N= 22

CO=27 CNTYNAME=HENNEPIN WBT=WETLAND ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		27-0060w	Wetland	I	45ac	H	32,41,43	Z	–	wmo-wm	87j
		27-0206w	Wetland	I	12ac	H	11,14	Z	–	wmo-wm	87j
		27-0248w	Wetland	I	7ac	H	32,41,43	Z	–	wmo-wm	87j
		27-0249w	Wetland	I	16ac	H	32,41,43	Z	–	wmo-wm	87j
		27-0559w	Wetland	I	8ac	H	12,32	Z	–	wmo-wm	87j
		27-0560w	Wetland	I	26ac	H	32,41,43	Z	–	wmo-sc	87j
		27-0563w	Wetland	I	17ac	H	32,41,43	Z	–	wmo-sc	87j
		27-0562w	Wetland	I	130ac	H	32,41,43	Z	–	wmo-sc	87j

N= 8

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=28 CNTYNAME=HOUSTON WBT=STREAM ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040008	046		BEAVER CR	T	15	DEFG	11,14,19	U	U	mdof-532	87i
07040008	X02		Crystal Cr	T	8	DEFG	11,14,19	T	V	mdof-532	87i
07060001	022		CROOKED CR	T	28	DEFG	11,14,19	T	V	mdof-532	87i
07040008	x10		Money Cr	I	10	ACFGH	11,14,18,19	S	U	swcd-23	87e
07040006	001		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040006	001		MISSISSIPPI R	T		D	11,19	U	TU	cza-28	87a
07040006	001		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040006	001		MISSISSIPPI R	I	36	DEBAG	19,11,72,61,62,66,41	WTZ	XVZ	mdof-532	87i
07040006	002		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040006	002		MISSISSIPPI R	T		D	11,19	U	TU	cza-28	87a
07040006	002		MISSISSIPPI R	I		DEBAG	19,11,72,61,62,66,41	WTZ	XVZ	mdof-532	87i
07040006	008		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040006	008		MISSISSIPPI R	T	–	D	11,19	U	TU	cza-28	87a
07040006	008		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040006	009		MISSISSIPPI R	T	–	ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040006	009		MISSISSIPPI R	T	–	ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07060001	012		MISSISSIPPI R	T	–	D	11,19	U	TU	cza-28	87a
07060001	012		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07060001	013		MISSISSIPPI R	T		ABCDEFGHI	19,11,65,18,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07060001	013		MISSISSIPPI R	T		D	11,19	U	TU	cza-28	87a
07060001	013		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07060001	017		MISSISSIPPI R	T		ABCDEFGHI	19,11,65,18,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07060001	017		MISSISSIPPI R	T		D	11,19	U	TU	cza-28	87a
07060001	017		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07060001	017		MISSISSIPPI R	T		DEFG	11,14,19	WT	XV	mdof-532	87i
07060001	017		MISSISSIPPI R	I		C	90	TW	UX	cza-28	86a
07060001	021		MISSISSIPPI R	T	–	ABCDEFGHI	19,11,65,18,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07060001	021		MISSISSIPPI R	T		D	11,19	U	TU	cza-28	87a
07060001	021		MISSISSIPPI R	T	–	ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07060001	021		MISSISSIPPI R	T	14	DEFG	11,14,19	WT	XV	mdof-532	87i
07060001	021		MISSISSIPPI R	I	all	C	90	TW	UX	cza-28	86a
07040008	004		MONEY CR	T	6	DEFG	11,14,19	T	V	mdof-532	87i
07040006	010		PINE CR	I	11	DEFG	41,11,14,19	T	V	mdof-532	87i
07040008	001		ROOT R	T	–	D	11,19	T	TW	cza-28	87a
07040008	001		ROOT R	T	24mi	DFG	19,11,14,63,41	WTZ	XUZ	mdof-532	87i
07040008	001		ROOT R	I		DE	19	T	UX	cza-28	86a
07040008	002		ROOT R	T		D	11,19	T	TW	cza-28	87a
07040008	002		ROOT R	T		DFG	19,11,14,63,41	WTZ	XUZ	mdof-532	87i
07040008	002		ROOT R	I		DE	19	T	UX	cza-28	86a
07040008	003		ROOT R	T		D	11,19	T	TW	cza-28	87a
07040008	003		ROOT R	T		DFG	19,11,14,63,41	WTZ	XUZ	mdof-532	87i
07040008	003		ROOT R	I		DE	19	T	UX	cza-28	86a
07040008	005		ROOT R	T		D	11,19	T	TW	cza-28	87a
07040008	005		ROOT R	T		DFG	19,11,14,63,41	WTZ	XUZ	mdof-532	87i
07040008	005		ROOT R	I	all	DE	19	T	UX	cza-28	86a
07040008	040		ROOT R, S FK	T	14	DEFG	11,14,19	WT	XV	mdof-532	87i
07040008	041		ROOT R, S FK	T		DEFG	11,14,19	WT	XV	mdof-532	87i
07040008	042		ROOT R, S FK	T		DEFG	11,14,19	WT	XV	mdof-532	87i
07040008	043		ROOT R, S FK	T		DEFG	11,14,19	WT	XV	mdof-532	87i
07040008	047		THOMPSON CR	I	18	DEFG	41,11,14,19	T	V	mdof-532	87i

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By County, Waterbody Type, Name

CO=28 CNTYNAME=HOUSTON WBT=STREAM ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07060002	004		WATERLOO CR	T	6	DEFG	11,14,19	T	V	mdof-532	87i
07060001	023		WINNEBAGO CR	I	19	DEFG	41,11,14,19	T	V	mdof-532	87i

N= 52

CO=29 CNTYNAME=HUBBARD WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010101		29-0235	Arrow Lk	T	47ac	H	61	T	-	swcd-29	87a
07010106		29-0146	Belle Taine Lk	T	-	DI	32,90,65	TX	UX	cza-29	87a
07010106		29-0146	Belle Taine Lk	I	all	BH	40,65,19,30	TW	UXZ	cza-29	86a
07010106		29-0036	Eleventh Crow Wing Lk	I	all	DH	40,65,19,30,80	SW	UYZ	cza-29	86a
07010106		29-0242	Fishhook Lk	T	-	D	43,65,90	TXZ	VXZ	cza-29	87a
07010106		29-0242	Fishhook Lk	I	all	D	40,65,19,30	TX	UZ	cza-29	86a
07010101		29-0071	Grace Lk	I	868	B	32,65,31	UX	-	msof-1-bemi	87h
07010106	030	29-0161	Long Lk	T	-	D	32,65,90	TX	UX	cza-29	87a
07010106	030	29-0161	Long Lk	I	all	H	40,65,19,30,11	TX	UYZ	cza-29	86a
07010102		29-0066	Midge Lk	T	-	DH	90	TX	UX	cza-29	87a
07010102		29-0066	Midge Lk	I	521	AB	14,31,32,65	SW	UX	msof-1-bemi	87g
07010106	028	29-0157	North Twin Lk	I	-	BDAH	90,62,41	SW	UXZ	cza-29	87a
07010101	034	29-0156	Plantaganette	I	2529.4	H	32,65	UX	-	msof-1-bemi	87g
07010101	034	29-0156	Plantagenet Lk	T	2620ac	BF	11,14,21,65	U	U	mdow-1-bemi	87b
07010106		29-0250	Portage Lk	I	-	BD	90	SW	XV	cza-29	87a
07010106		29-0250	Portage Lk	I	all	AB	40,19	SW	UZ	cza-29	86a

N= 16

CO=29 CNTYNAME=HUBBARD WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010101	x34		Alcohol Ck	T	1mi	E	80	-	Z	mdof-113	87h
07010106	x31		Fish Hook R	I	all	G	90	S	T	msof-1-pr	86b
07010106	029		HAY CR	T		BDH	41,62,80,90	SW	UX	cza-29	87a
07010106	030		HAY CR	T	-	BDH	41,62,80,90	SW	UX	cza-29	87a
07010106	031		STRAIGHT R	-	all	H	90	V	-	msof-1-pr	86b
07010106	031		STRAIGHT R	T	9.5mi	H	90,19,62	V	-	swcd-29	87a
07010106	031		STRAIGHT R	T	-	I	90	V	S	cza-29	87a
07010106	031		STRAIGHT R	T	all	AGI	12,13,62	TV	UV	mdow-1-bemi	87b

N= 8

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=30 CNTYNAME=ISANTI WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010207		30-0107-01	Blue Lk	I	-	B	12,19	UX	-	swcd-30	87i
07010207		30-0107-02	Blue Lk	I		B	12,19	UX	-	swcd-30	87i
07010207		30-0043	Fannie Lk	I	282	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07010207		30-0035	Florence Lk	T	-	A	65	T	W	swcd-30	87i
07010207		30-0080	Francis Lk	I	-	B	65	S	W	swcd-30	87i
07010207		30-0100	German Lk	I	-	B	65	S	W	swcd-30	87i
07010207		30-0136	Green Lk	I	802	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07010207		30-0136	Green Lk	I	-	B	65,11,19,80	UX	-	swcd-30	87i
07010207		30-0044	Little Stanchfield Lk	I	-	BDF	11,18,19	U	X	swcd-30	87i
		30-?	Long Lk	I	2sqmi	B	65	T	W	swcd-30	87i
07010207		30-0096	Lory Lk	T	-	-	11,18,19	U	-	swcd-30	87i
07010207		30-0143	No Stanchfield Lk	I	-	A	11,18,19	S	W	swcd-30	87i
07010207		30-0048	Rum Lk	I	-	D	11,18,19	S	W	swcd-30	87i
07010207		30-0022	Skogman Lk	I	215	BFG	12,14,16,32,43,	UW	-	msof-3-hink	87g
07010207		30-0022	Skogman Lk	T	-	B	11,18,19	T	W	swcd-30	87i
07010207		30-0138	So Stanchfield Lk	I	-	A	11,18,19	S	W	swcd-30	87i
07010207		30-0135	Spectacle Lk	T	-	B	65,11,19	UW	-	swcd-30	87i
07030005		30-0009	Typo Lk	T	-	AF	80	SW	TX	mdow-6-sp	87b
07030005		30-0009	Typo Lk	T	-	AF	80	SW	TX	mdow-6-sp	87f

N= 19

CO=30 CNTYNAME=ISANTI WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010207	009		RUM R	I	-	BDFG	11,18,19	UW	-	swcd-30	87i

N= 1

CO=31 CNTYNAME=ITASCA WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030006		31-0786	Jessie Lk	T	6sqmi	B	65	TX	UX	mdof-221	87h
07010101		31-0928	Kenogama Lk	T	600ac	B	90	T	T	mdof-112	87h
07010103	028	31-0231	Lawrence Lk	I	382ac	BF	90	-	-	mdow-2-gr	87c
09030006		31-0784	Little Jessie Lk	T	2sqmi	B	65	TX	UX	mdof-221	87h
		31-?	Mn Power Drainage Basin	T	-	E	66	TW	TW	msof-2-gr	87g
07010101		31-0722	Moose Lk	T	5sqmi	B	65	TX	UX	mdof-221	87h
		31-?	Portage Lk	T	1300ac	B	90	S	S	mdof-112	87h
09030006	015	31-0826	Sand Lk	T	10sqmi	B	65	TX	UX	mdof-221	87h
07010103		31-0077	Spot Lk	T	25ac	CE	63	Y	Y	mdof-332	87i
07010103	013	31-0067-01	Swan Lk	I	2300ac	BC	65	TX	-	swcd-31	87a
07010103	013	31-0067-02	Swan Lk	I		BC	65	TX	-	swcd-31	87a
07010103	013	31-0067-01	Swan Lk	I	-	ABCH	43,50,65,90	TWZ	UX	cza-31	87b

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By County, Waterbody Type, Name

CO=31 CNTYNAME=ITASCA WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010103	013	31-0067-02	Swan Lk	I		ABCH	43,50,65,90	TWZ	UX	cza-31	87b
07010103	013	31-0087-01	Swan Lk	I	2600ac	BD	51,65,80	W	X	mdow-2-gr	87c
07010103	013	31-0067-02	Swan Lk	I		BD	51,65,80	W	X	mdow-2-gr	87c
07010103	013	31-0067-01	Swan Lk	I	-	ABCH	43,50,65,90	TWZ	UX	cza-31	87f
07010103	013	31-0067-02	Swan Lk	I		ABCH	43,50,65,90	TWZ	UX	cza-31	87f
07010103	013	31-0067-01	Swan Lk	T	-	E	63	TW	TW	msof-2-gr	87g
07010103	013	31-0067-02	Swan Lk	T		E	63	TW	TW	msof-2-gr	87g
07010103	013	31-0067-01	Swan Lk	I	2000ac	B	90	TW	UX	mdof-231	87i
07010103	013	31-0067-02	Swan Lk	I		B	90	TW	UX	mdof-231	87i
07010103	013	31-0067-01	Swan Lk	I	all	ABCG	40,51,65,19,90	TWZ	UX	cza-31	86a
07010103	013	31-0067-02	Swan Lk	I		ABCG	40,51,65,19,90	TWZ	UX	cza-31	86a
07010103		31-0216	Trout Lk	T	-	E	66	TW	TW	msof-2-gr	87g
07010103		31-0216	Trout Lk	I	6	BD	62,57	UT	ST	mdof-223	87h

N= 25

CO=31 CNTYNAME=ITASCA WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010101	002			-		H	41,43	U	U	mdof-223	87h
07010101	002			T		DF	74	UX	UX	mdof-221	87h
07010101	015			-		H	41,43	U	U	mdof-223	87h
07010101	015			T		DF	74	UX	UX	mdof-221	87h
?	?		Bruce Cr	T	3.5mi	DE	32,43,31	S	S	mdof-332	87i
07010101	004		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010101	004		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010101	005		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010101	005		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010101	008		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010101	008		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010101	011		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010101	011		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010101	019		MISSISSIPPI R	-	-	H	41,43	U	U	mdof-223	87h
07010101	019		MISSISSIPPI R	T	20	DF	74	UX	UX	mdof-221	87h
07010101	036		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010101	036		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010103	022		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010103	022		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010103	023		MISSISSIPPI R	-		H	41,43	U	U	mdof-223	87h
07010103	023		MISSISSIPPI R	T		DF	74	UX	UX	mdof-221	87h
07010103	031		MISSISSIPPI R	-	-	H	41,43	U	U	mdof-223	87h
07010103	031		MISSISSIPPI R	T	20	DF	74	UX	UX	mdof-221	87h
?	?		Small Ck	I	.5	FH	90	Y	Y	mdof-223	87h
07010103	013		SWAN R	T	20mi	DFE	14,32,43	TW	SW	mdof-332	87l
?	?		Twin Springs	I	2.5mi	ABI	73,76	TV	S	mdof-332	87i
07010103	117		TREE L OUT,OXHIDE L,OXHIDE CR	T	-	E	18	T	T	msof-2-gr	86b
07010103	117		TREE L OUT,OXHIDE L,OXHIDE CR	T	-	E	63	TW	TW	msof-2-gr	87g

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By County, Waterbody Type, Name

CO=32 CNTYNAME=JACKSON WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001		32-0015	Boot Lk	T	160ac	AE	11,19	S	Y	swcd-32	87a
10230003		32-0008	Chandler Lk	T	40ac	ADE	11,19	S	Y	swcd-32	87a
10230003	055	32-0022	Clear Lk	T	600ac	A	11,19	TW	UX	swcd-32	87a
07020010	013	32-0018	Fish Lk	T	80ac	A	11,19	T	U	swcd-32	87a
07020010	013	32-0018	Fish Lk	I	204ac	ABCDEFGH	11,19,65,76,71	TW	UX	mdow-4-nu	87b
07020010	013	32-0018	Fish Lk	T	whole	CE	11,19,65	UX	-	swcd-17	87f
07100001		32-0045	Flaherty Lk	T	1	ABDF	11,18,90	SX	UW	cza-32	87a
07100001		32-0045	Flahtery Lk	T	600ac	AD	11,19	SW	SW	swcd-32	87a
07100001		32-0057-01	Heron Lk	T	6400ac	AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-02	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-03	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-04	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-05	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-06	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-07	Heron Lk	T		AD	11,19	SW	TW	swcd-32	87a
07100001		32-0057-01	Heron Lk	I	13	ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-02	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-03	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-04	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-05	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-06	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-07	Heron Lk	I		ABDF	11,41,62,90	TWZ	UXZ	cza-32	87a
07100001		32-0057-01	Heron Lk	I	8251ac	ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-02	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-03	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-04	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-05	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-06	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-07	Heron Lk	I		ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b
07100001		32-0057-01	Heron Lk	I	8251ac	BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-02	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-03	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-04	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-05	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-06	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-07	Heron Lk	I		BDF	11	SW	-	msow-4-wind	87d
07100001		32-0057-01	Heron Lk	I	all	ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-02	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-03	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-04	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-05	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-06	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
07100001		32-0057-07	Heron Lk	I		ABDFG	40,11,80	SWZ	TX	cza-32	86a
10230003		32-0072	Illinois Lk	I	246ac	BDF	11	Z	-	msow-4-wind	87d
10230003		32-0072	Illinois Lk	T	200ac	A	11,19	SW	SW	swcd-32	87g
07020009		32-0017	Independence Lk	T	80ac	A	11,19	T	U	swcd-32	87a
10230003		32-0084	Iowa Lk	T	235ac	DF	11,18,19,61	TW	UX	swcd-53	87g
10230003		32-0084	Iowa Lk	T	70ac	A	11,19	SW	SW	swcd-32	87g
10230003		32-0024	Little Spirit Lk	T	600ac	AD	11,19	TW	UX	swcd-32	87a
10230003	053	32-0020	Loon Lk	-	all	H	19,11,40	-	-	msof-4-wind	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=32 CNTYNAME=JACKSON WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
10230003	053	32-0020	Loon Lk	T	600ac	A	11,19	TW	UY	swcd-32	87a
10230003	053	32-0020	Loon Lk	T	2	BD	11,90	TW	UX	cza-32	87a
10230003	053	32-0020	Loon Lk	I	720ac	ABCDEFGH	11,19,65,76,71	UW	UX	mdow-4-nu	87b
10230003	053	32-0020	Loon Lk	I	all	BD	11,80	UW	UX	cza-32	86a
07020009		32-0016	Lowers Lk	T	40ac	AE	11,19	S	Y	swcd-32	87a
10230003		32-0033	Pearl Lk	T	160ac	AD	11,19	SW	SW	swcd-32	87a
10230003		32-0071	Plum Lk	T	120ac	A	11,19	SW	SW	swcd-32	87g
10230003	067	32-0069	Round Lk	-	all	H	19,11,40	-	-	msof-4-wind	86b
10230003	067	32-0069	Round Lk	T	3	BD	11,90	UW	UX	cza-32	87a
10230003	067	32-0069	Round Lk	T	800ac	AD	11,19	TW	UX	swcd-32	87g
10230003		32-0031	Rush Lk	T	320ac	AD	11,19	SW	SW	swcd-32	87a
10230003		32-0031	Rush Lk	T	1	DFB	11,90	TW	UX	cza-32	87a
10230003		32-0063	Rush Lk	T	160ac	A	11,19	SW	SW	swcd-32	87g
10230003		32-0059	Skunk Lk	T	180ac	ADE	11,19	SW	SW	swcd-32	87a
10230003		32-0023	Spirit Lk	T	-	AD	11,19	TX	UX	swcd-32	87a
07100001		32-0058	Timber Lk	T	30ac	AD	11,19	SW	TW	swcd-32	87a

N= 66

CO=32 CNTYNAME=JACKSON WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001	001		DES MOINES R	T	24	DF	11,18,41,62	T	U	cza-32	87a
07100001	001		DES MOINES R	T	35mi	AD	11,19,41,43,77	SW	TW	swcd-32	87g
07100002	013		DES MOINES R	T	24	DF	11,18,41,62	T	U	cza-32	87a
07100002	013		DES MOINES R	I	160mi	ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07100002	013		DES MOINES R	T	35mi	AD	11,19,41,43,77	SW	TW	swcd-32	87g
07020009	007		ELM CR	T	-	AD	11,19	YY	YY	swcd-32	87g
07100001	015		HERON L OUTLET	T	-	AD	11,19,77	YY	YY	swcd-32	87g
07100001	020		JACK CR	T		AD	11,19,14,77	YY	YY	swcd-32	87g
07100001	021		JACK CR	T	12	D	11,71,77	S	T	cza-32	87a
07100001	021		JACK CR	T		AD	11,19,14,77	YY	YY	swcd-32	87g
07100001	123		JACK CREEK	T		AD	11,19,14,77	YY	YY	swcd-32	87g
07100001	223		JACK CREEK	T	25mi	AD	11,19,14,77	YY	YY	swcd-32	87g
10230003	057		LITTLE SIOUX R	T	-	AD	11,19,14,77	YY	YY	swcd-32	87g
10230003	059		LITTLE SIOUX R	T		AD	11,19,14,77	YY	YY	swcd-32	87g
10230003	060		LITTLE SIOUX R	T		AD	11,19,14,77	YY	YY	swcd-32	87g
07100001	029		OKABENA CR	I		ADF	11,62	S	T	cza-32	87a
07100001	029		OKABENA CR	T	15mi	ADC	11,19,14,41,43	YY	YY	swcd-32	87g
07100001	131		OKABENA CREEK	I	16	ADF	11,62	S	T	cza-32	87a
07100001	131		OKABENA CREEK	T		ADC	11,19,14,41,43	YY	YY	swcd-32	87g
07100001	231		OKABENA CREEK	T		ADC	11,19,14,41,43	YY	YY	swcd-32	87g
07100002	x13		Stony Bk Cr	T	-	AD	11,19	YY	YY	swcd-32	87g

N= 21

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=33 CNTYNAME=KANABEC WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030004	014	33-0040	Ann Lk	I	all	B	43	T	-	msow-3-hinc	87d
07030004	014	33-0040	Ann Lk	-	-	H	18	-	-	mpca-2	87i
07030004	014	33-0036	Fish Lk	I	all	B	43,18	TY	-	msow-3-hinc	87d
07030004	014	33-0036	Fish Lk	I	407	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07030004		33-0028	Knife Lk	I	all	B	18,43	T	-	msow-3-hinc	87d
07030004		33-0028	Knife Lk	I	1258	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07010207	007	33-0032	Lewis Lk	T	all	H	43	T	-	msow-3-hinc	87d
07030004	004	33-0015	Quamba (Mud) Lk	T	all	B	43,14	T	-	msow-3-hinc	87d

N= 8

CO=33 CNTYNAME=KANABEC WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030004	015		GROUNDHOUSE R	-	-	H	18	-	-	mpca-2	87i
07030004	016		GROUNDHOUSE R	-		H	18	-	-	mpca-2	87i

N= 2

CO=34 CNTYNAME=KANDIYOHI WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005		34-0206	Andrew Lk	I	781	BDF	14,16,18,19,65	UW	-	msof-4-spic	87h
07010205		34-0086	Big Kandiyohi	I	2877ac	BDF	12,18,19,65	WT	U	mdow-4-spic	87c
07010205		34-0086	Big Kandiyohi Lk	T	2880ac	BG	11,16,19,74	TW	UX	swcd-34	87a
07010205		34-0086	Big Kandiyohi Lk	I	2877	BDF	14,18,19	UW	-	msof-4-spic	87h
07010204		34-0062	Calhoun Lk	I	1400ac	BD	11,19	T	U	swcd-34	87a
07010204		34-0062	Calhoun Lk	I	1396	BDF	14,16,18,19	TW	-	msof-4-spic	87h
07010204		34-0044	Diamond Lk	T	1700	BD	11,16,19,65	TW	UX	swcd-34	87a
07010204		34-0044	Diamond Lk	I	1697ac	BDF	12,18,19	W	UX	mdow-4-spic	87c
07010204		34-0044	Diamond Lk	I	1697	BDF	14,16,18,19,65	UW	-	msof-4-spic	87h
07010204		34-0044	Diamond Lk	T	-	BF	11,16,19	TX	U	mpca-4	87i
07020004		34-0246	E Solomon Lk	I	733	ABDF	14,16,18,19	SW	-	msof-4-spic	87h
07020004		34-0171	Eagle Lk	T	890	BD	11,16,19	TW	UX	swcd-34	87a
07020004		34-0171	Eagle Lk	T	891ac	BF	19,32	T	UX	mdow-4-spic	87c
07020004		34-0171	Eagle Lk	T	891	BDF	14,16,18,19	UW	-	msof-4-spic	87h
07020004		34-0246	East Solomon Lk	I	730	BD	11,19	S	T	swcd-34	87a
07010205		34-0022	Elizabeth	I	1150ac	BC	19,14,16	S	T	swcd-34	87a
07010205		34-0022	Elizabeth Lk	I	1153	BDFA	14,16,18,19	TW	-	msof-4-spic	87h
07010204		34-0119	Elkhorn Lk	I	79	BDF	14,16,18,19	UW	-	msof-4-spic	87h
07010205		34-0033	Ella Lk	I	153	ABDF	14,16,18,19	TW	-	msof-4-spic	87h
07020005		34-0217	Florida Lk	I	801	BDF	14,16,18,19,65	UW	-	msof-4-spic	87h
07020004		34-0181	Foot Lk	T	580ac	ABG	19,41,43,72	SW	TX	swcd-34	87a
07020004		34-0181	Foot Lk	I	576ac	DEF	41,43,66,72	WS	TV	mdow-4-spic	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=34 CNTYNAME=KANDIYOHI WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020004		34-0181	Foot Lk	I	576	ABDF	14,16,18,19,41,43,65	TW	–	msof-4-spic	87h
07020005		34-0224	Games Lk	I	560ac	B	11,19	TX–	UX+	swcd-34	87a
07020005		34-0224	Games Lk	I	557	BDF	14,16,18,19,65	UW	–	msof-4-spic	87h
07020004		34-0142	George Lk	I	250ac	BC	19,65	TX	UX	swcd-34	87a
07010204		34-0079	Green Lk	I	5280ac	B	11,19,41,43	VX	–	swcd-34	87a
07010204		34-0079	Green Lk	T	5821	BDF	19,14,41,43,62,65	UX	–	msof-4-spic	87h
07020004		34-0116	Henderson Lk	I	91	BDF	14,16,18,19	UW	–	msof-4-spic	87h
07010205		34-0072	Lillian Lk	I	1608ac	BDF	12,19	WT	U	mdow-4-spic	87c
07010205		34-0072	Lillian Lk	I	1608	ABDF	14,16,18,19	TW	–	msof-4-spic	87h
07010204		34-0066	Long (Irving)	I	360ac	BD	12,19	TW	VX	swcd-34	87a
07020004		34-0192	Long Lk	T	1720ac	BCD	11,16,19,65	TW	VX	swcd-34	87a
07020004		34-0192	Long Lk	T	1715ac	FG	18,19,32	T	U	mdow-4-spic	87c
07020004		34-0192	Long Lk	I	1715	ABDF	14,16,15,19,65	UW	–	msof-4-spic	87h
07010204		34-0154	Nest Lk	T	1020ac	B	11,19,65	TW	VX	swcd-34	87a
07010204		34-0154	Nest Lk	I	1019ac	BDG	14,19	WT	UX	mdow-4-spic	87c
07010204		34-0154	Nest Lk	I	1019	BDF	14,16,18,19,62	UW	–	msof-4-spic	87h
07020005		34-0251	Norway Lk	I	2500ac	BDC	11,16,19,65	TW	VX	swcd-34	87a
07020005		34-0251	Norway Lk	I	2496	ABDF	14,16,18,19	UW	–	msof-4-spic	87h
07020004		34-0193	Point Lk	I	157	ABDF	14,19,65	UW	–	msof-4-spic	87h
07020004		34-0193	Point Lk	I	135ac	BD	11,19	SW	TX	swcd-34	87h
07020004		34-0196	Skatons Lk	I	218	ABDF	14,16,18,19,65	SW	–	msof-4-spic	87h
07020004		34-0283	St. Johns Lk	I	240ac	BD	11,19,65	SW	TX	swcd-34	87a
07020005		34-0321	Swenson Lk	I	123	ABDF	14,16,18,19	TW	–	msof-4-spic	87h
07010205		34-0169-01	Wagonga Lk	I	1796	ABDF	14,16,18,19,62	SW	–	msof-4-spic	87h
07010205		34-0169-02	Wagonga Lk	I		ABDF	14,16,18,19,62	SW	–	msof-4-spic	87h
07010205		34-0169-03	Wagonga Lk	I		ABDF	14,16,18,19,62	SW	–	msof-4-spic	87h
07010205		34-0169-04	Wagonga Lk	I		ABDF	14,16,18,19,62	SW	–	msof-4-spic	87h
07010205		34-0169-05	Wagonga Lk	I		ABDF	14,16,18,19,62	SW	–	msof-4-spic	87h
07020004		34-0180	Willmar Lk	I	761ac	DEF	41,43,66,72	WS	TV	mdow-4-spic	87c
07020004		34-0180	Willmar Lk	I	761	ABDF	14,16,18,19,65	TW	–	msof-4-spic	87h
07020004		34-0180	Willmar Lk	T	760ac	BD	11,19	SW	TX	swcd-34	87h

N= 53

CO=34 CNTYNAME=KANDIYOHI WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010204	014		CROW R, M FK	T	–	BCD	12,14,16,19	–	–	swcd-34	87h
07010204	012		CROW R, N FK	T	–	BCD	12,14,16,19	–	–	swcd-34	87h
?	?		Suck Cr	T	all	D	11	V	V	msof-4-hutc	86b

N= 3

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=35 CNTYNAME=KITTSON WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		35-0008	Beaches Lk	T	600ac	ADEG	11,18,19,71	Z	Z	msow-1-karl	87b
09020312		35-0003	Bronson Lk	I	300	ABCDEFG	11,18,19,65,71	SW	UX	msow-1-karl	87b
09020312		35-0003	Bronson Lk	I	313ac	AB	90(11,19,71,?)	UX	-	mdow-1-trf	87c
09020312		35-0003	Bronson Lk	I	1	BD	11,12,19	TW	UX	swcd-35	87e
09020312		35-0003	Bronson Lk	T	-	BD	19,11	UX	-	msof-1-baud	87h
09020312		35-0004	Scull Lk	T	35	ADEG	11,18,19,71	Z	Z	msow-1-karl	87b
		35-0017	Skull Lk Impnd	T	300ac	ADEG	11,18,19,71	Z	Z	msow-1-karl	87b
09020311		35-0005	Stella Lk	I	25	ABCDEFG	11,18,19,65,71	Z	ZT	msow-1-karl	87b
09020312		35-0002	Twin Lk, Lower	T	450	ADEG	11,19,71	Z	Z	msow-1-karl	87b
09020312		35-0001	Twin Lk, Upper	T	450	ADEG	11,19,71	Z	Z	msow-1-karl	87b
		35-0006	Twistal Swamp	T	1700ac	ADEG	11,19	Z	Z	msow-1-karl	87b

N= 11

CO=35 CNTYNAME=KITTSON WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020311	001			T	-	ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020311	002		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020311	002		RED R	T		DFH	11,19	SW	Y	swcd-35	87e
09020311	002		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020311	003		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020311	003		RED R	T		DFH	11,19	SW	Y	swcd-35	87e
09020311	003		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020311	004		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020311	004		RED R	T		DFH	11,19	SW	Y	swcd-35	87e
09020311	005		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020311	005		RED R	T	66	DFH	11,19	SW	Y	swcd-35	87e
09020311	005		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020311	006		RED R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020312	001		TWO RIVERS	T		DG	19,11	TX	-	msof-1-baud	86b
09020312	001		TWO RIVERS	T	-	ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020312	001		TWO RIVERS	T	-	BCD	19,11	UX	-	msof-1-baud	87h
09020312	003		TWO RIVERS	T	all	DG	19,11	TX	-	msof-1-baud	86b
09020312	003		TWO RIVERS	T		ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020312	003		TWO RIVERS	T		BCD	19,11	UX	-	msof-1-baud	87h
09020312	005		TWO RIVERS, M BR	T		ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020312	005		TWO RIVERS, M BR	T		BCD	19,11	UX	-	msof-1-baud	87h
09020312	006		TWO RIVERS, N BR	T		BCD	19,11	UX	-	msof-1-baud	87h
09020312	007		TWO RIVERS, N BR	T		ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020312	007		TWO RIVERS, N BR	T		BCD	19,11	UX	-	msof-1-baud	87h
09020312	004		TWO RIVERS, S BR	T		ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020312	004		TWO RIVERS, S BR	T		BCD	19,11	UX	-	msof-1-baud	87h

N= 26

CO=36 CNTYNAME=KOOCHICHING WBT=LAKE ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020302		36-0018	Bartlett Lk	T	300	A	90	SW	UX	msow-2-if	87c
09020302		36-0018	Bartlett Lk	I	-	ABD	41,43,62	SW	-	wd-rl	87h

N= 2

CO=36 CNTYNAME=KOOCHICHING WBT=STREAM ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030006	001		BIG FORK R	T	-	E	62,63,66	UW	UX	mdof-263	87h
09030006	002		BIG FORK R	T		E	62,63,66	UW	UX	mdof-263	87h
09030004	002		BLACK R	-	5	C	11,14,22,19	Z	Z	mdof-132	87h
09030004	004		BLACK R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030004	005		BLACK R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030004	006		BLACK R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030004	003		BLACK R, W FK	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030004	001		RAINY R	I	all	EI	65,80	U	UW	msof-2-if	86b
09030004	001		RAINY R	I	34	CA	11,14,18,19	UW	UX	mdof-132	87h
09030004	001		RAINY R	-	-	EI	90,80	U	U	msof-2-if	87i
09030004	011		RAINY R	I		EI	65,80	U	UW	msof-2-if	86b
09030004	011		RAINY R	I		CA	11,14,18,19	UW	UX	mdof-132	87h
09030004	011		RAINY R	-		EI	90,80	U	U	msof-2-if	87i
09030004	012		RAINY R	I		EI	65,80	U	UW	msof-2-if	86b
09030004	012		RAINY R	I		CA	11,14,18,19	UW	UX	mdof-132	87h
09030004	012		RAINY R	-		EI	90,80	U	U	msof-2-if	87i
09030004	013		RAINY R	I		EI	65,80	U	UW	msof-2-if	86b
09030004	013		RAINY R	I		CA	11,14,18,19	UW	UX	mdof-132	87h
09030004	013		RAINY R	-		EI	90,80	U	U	msof-2-if	87i
09030008	001		RAINY R	I	all	EI	65,80	U	UW	msof-2-if	86b
09030008	005		RAINY R	I		EI	65,80	U	UW	msof-2-if	86b
09030008	007		RAINY R	I		EI	65,80	U	UW	msof-2-if	86b
09030007	001		RAPID R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	002		RAPID R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	004		RAPID R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	005		RAPID R	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	006		RAPID R	-	10	C	11,14,22,19	Z	Z	mdof-132	87h
09030007	009		RAPID R, E FK	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	011		RAPID R, E FK	-		C	11,14,22,19	Z	Z	mdof-132	87h
09030007	003		RAPID R, W BR	-		C	11,14,22,19	Z	Z	mdof-132	87h
09020302	045		TAMARACK R	T	8	E	19	T	-	mdof-152	87i

N= 31

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=37 CNTYNAME=LAC QUI PARLE WBT=? ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
insufdef			all waterbodies nps impaired	-	-	-	-	-	-	swcd-37	87k

N= 1

CO=37 CNTYNAME=LAC QUI PARLE WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020001		37-0046-01	Lac Qui Parle	I	-	ABDF	11,16,19	SW	U	mpca-4	87i
07020001		37-0046-02	Lac Qui Parle	I	-	ABDF	11,16,19	SW	U	mpca-4	87i
07020001		37-0046-01	Lac Qui Parle Lk	I	all	BDF	65,11,18,19	UW	S	cza-37	87b
07020001		37-0046-02	Lac Qui Parle Lk	I		BDF	65,11,18,19	UW	S	cza-37	87b
07020001		37-0046-01	Lac Qui Parle Lk	I	8400ac	ABDF	11,19,71,72,76	TW	UX	msow-4-madi	87c
07020001		37-0046-02	Lac Qui Parle Lk	I		ABDF	11,19,71,72,76	TW	UX	msow-4-madi	87c
07020001		37-0046	Lac Qui Parle Lk	T	10sqmi	ABCDEFI	62,65,11,12,14,19,80	UXZ	SWY	swcd-37	87k
07020001		37-0046-01	Lac Qui Parle Lk	I	all	DF	40,19,65,18,90	U	X	cza-37	86a
07020001		37-0046-02	Lac Qui Parle Lk	I		DF	40,19,65,18,90	U	X	cza-37	86a

N= 9

CO=37 CNTYNAME=LAC QUI PARLE WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020003	001		LAC QUI PARLE R	I		ADCEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020003	002		LAC QUI PARLE R	T	52mi	ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	002		LAC QUI PARLE R	I	-	ADCEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020003	012		LAC QUI PARLE R	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	012		LAC QUI PARLE R	I		ADCEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020003	016		LAC QUI PARLE R	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	003		LAC QUI PARLE R, W BR	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	005		LAC QUI PARLE R, W BR	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	006		LAC QUI PARLE R, W BR	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020003	014		LAZARUS CR	I	-	ACDEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020001	011		MARSH L	I		ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020001	013		MARSH L	I		ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020001	007		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020001	007		MINNESOTA R	I		ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020001	018		MINNESOTA R	T		BDF	65,41,43,11,18,19	UWY	Y	cza-37	87b
07020001	018		MINNESOTA R	I		ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020001	019		MINNESOTA R	T		BDF	65,41,43,11,18,19	UWY	Y	cza-37	87b
07020001	019		MINNESOTA R	T	74mi	ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020001	019		MINNESOTA R	I	40mi	ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020001	020		MINNESOTA R	T	60mi	BDF	65,41,43,11,18,19	UWY	Y	cza-37	87b
07020001	020		MINNESOTA R	I		ACDEFGI	11,12,14,18,19,62,65,71,80	TW	SW	swcd-37	87k
07020004	010		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=37 CNTYNAME=LAC QUI PARLE WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020004	011		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	015		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	016		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	017		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	019		MINNESOTA R	T		ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	020		MINNESOTA R	I	60mi	BDF	65,41,43,11,18,19	UWY	Y	cza-37	87b
07020004	020		MINNESOTA R	T	74mi	ABDF	11,19,71,72,76	U	-	msow-4-madi	87c
07020004	020		MINNESOTA R	I	all	DCF	19,11,65,18	U	X	cza-37	86a
07020001	036		YELLOW BANK R	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020001	036		YELLOW BANK R	I		ACDEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020001	037		YELLOW BANK R, N FK	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020001	037		YELLOW BANK R, N FK	I	-	ACDEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k
07020001	038		YELLOW BANK R, S FK	T	18mi	ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020001	038		YELLOW BANK R, S FK	I		ACDEGI	11,12,14,18,19,31,65,71,74,77,80	SW	Y	swcd-37	87k

N= 36

CO=38 CNTYNAME=LAKE WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030001		38-0811	Fall Lk	T	-	ABC	65,62	V	-	cza-38	87a
09030001		38-0811	Fall Lk	T	all	H	80	UX	UX	cza-38	86a
04010202		38-0751	Thomas Lk	T	all	B	65	T	-	cza-38	87a

N= 3

CO=38 CNTYNAME=LAKE WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
04010101	050		BAPTISM R	T	all	H	80	UX	-	msof-2-finl	86b
04010101	050		BAPTISM R	-	8	H	80	U	U	msof-2-finl	87i
04010101	051		BAPTISM R, E BR	T	-	E	66,80	U	-	cza-38	87a
04010101	051		BAPTISM R, E BR	-		H	80	U	U	msof-2-finl	87i
04010101	051		BAPTISM R, E BR	T	all	H	80	UW	UW	cza-38	86a
04010101	052		BAPTISM R, W BR	-		H	80	U	U	msof-2-finl	87i
?	?		Skunk Cr	T	all	H	80	Y	Y	cza-38	86a
04010102	x07		Skunk Cr	T	1	E	66	S	-	cza-38	87a

N= 8

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By County, Waterbody Type, Name

CO=39 CNTYNAME=LAKE OF THE WOODS WBT=LAKE ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030009	014	39-0002	Lk Of The Woods	-	-	E	80	UX	UX	swcd-39	87e
		39-?	Zippel Bay	I	7	DEFG	11,19,71,77	U	U	cza-39	87i

N= 2

CO=39 CNTYNAME=LAKE OF THE WOODS WBT=STREAM ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030008	001		RAINY R	-	-	E	80	UX	UX	swcd-39	87e
09030008	005		RAINY R	-		E	80	UX	UX	swcd-39	87e
09030008	007		RAINY R	-		E	80	UX	UX	swcd-39	87e
?	?		Williams Cr	T	all	ACE	40,19,11	SY	-	msof-1-baud	86b
09030009	116		WILLIAMS CK (CD-1)	T	-	ABCD	19,41,43	SY	-	msof-1-baud	87h

N= 5

CO=40 CNTYNAME=LE SUEUR WBT=AQUIFER ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		40 -0044	Steele Lk	I	-	ABF	19,11	S	T	msof-4-wate	86b

N= 1

CO=40 CNTYNAME=LE SUEUR WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012	021	40-0079	Clear Lk	I	-	ABF	19,11,65,40	T	U	msof-4-wate	86b
07020012	021	40-0079	Clear Lk	-	-	ABF	19,11,65	T	U	msof-4-wate	87d
07020012	021	40-0079	Clear Lk	I	313ac	B	11,19,43	TW	TX	swcd-40	87e
07040002		40-0013	Diamond Lk	I	120ac	BDF	71,11,19,18	Z	Z	msow-4-gayl	87c
		40-?	Emily Lk	I	-	B	19,11,18,40	Z	U	msof-4-wate	86b
		40-?	Emily Lk	-	-	B	19,11	W	U	msof-4-wate	87d
07020007		40-0118	Emily Lk	I	273ac	DF	11,71	ZT	ZU	msow-4-gayl	87c
07020007		40-0124	Emily Lk	T	235ac	B	11,19,43,65	T	U	swcd-40	87e
07040002		40-0051	Fish Lk	T	-	B	19	U	U	msof-4-wate	86b
07040002		40-0051	Fish Lk	-	-	B	19	U	U	msof-4-wate	87d
07040002		40-0057	Frances Lk	T	-	B	19,11,65,40	U	U	msof-4-wate	86b
07040002		40-0057	Frances Lk	I	870ac	DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002		40-0057	Frances Lk	-	-	B	19,11,65	U	U	msof-4-wate	87d
07040002		40-0057	Frances Lk	T	1902ac	B	11,19,43,65	TW	UX	swcd-40	87e
07040002		40-0063	German Lk	I	-	B	19,11,18,40	U	U	msof-4-wate	86b

CO=40 CNTYNAME=LE SUEUR WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002		40-0063	German Lk	I	975ac	DF	11,71	ZT	ZU	msow-4-gayl	87c
07040002		40-0063	German Lk	-	-	B	19,11,	U	U	msof-4-wate	87d
07040002		40-0063	German Lk	T	968ac	B	11,19,43,65	TW	UX	swcd-40	87e
07040002	017	40-0032	Gorman Lk	I	-	ABDF	19,11,65,40	Z	U	msof-4-wate	86b
07040002	017	40-0032	Gorman Lk	I	590ac	DF	11,71	Z	Z	msow-4-gayl	87c
07040002	017	40-0032	Gorman Lk	-	-	ABDF	19,11,65	W	U	msof-4-wate	87d
07040002	017	40-0032	Gorman Lk	I	499ac	AB	11,19,65	W	UX	swcd-40	87e
07020012	025	40-0020	Greenleaf Lk	I	-	ABF	19,11,65,40	S	U	msof-4-wate	86b
07020012	025	40-0020	Greenleaf Lk	I	306ac	DF	11,71	Z	Z	msow-4-gayl	87c
07020012	025	40-0020	Greenleaf Lk	-	-	ABF	19,11,65	S	U	msof-4-wate	87d
07020012	025	40-0020	Greenleaf Lk	I	299ac	B	11,19	T	T	swcd-40	87e
07020007		40-0104	Henry Lk	I	-	AB	11,19	S	U	msof-4-wate	86b
07020007		40-0104	Henry Lk	I	360ac	DF	11,71	Z	ZT	msow-4-gayl	87c
07020007		40-0104	Henry Lk	-	-	AB	19,11,	S	T	msof-4-wate	87d
07040002		40-0001	Horseshoe Lk	T	-	AB	19,11,65,40	U	U	msof-4-wate	86b
07040002		40-0001	Horseshoe Lk	-	-	AB	19,11,65	U	U	msof-4-wate	87d
07040002		40-0001	Horseshoe Lk	T	393ac	B	11,19	T	U	swcd-40	87e
07040002		40-0092-01	Jefferson Lk	I	-	B	19,11,18,40	U	U	msof-4-wate	86b
07040002		40-0092-02	Jefferson Lk	I		B	19,11,18,40	U	U	msof-4-wate	86b
07040002		40-0092-03	Jefferson Lk	I		B	19,11,18,40	U	U	msof-4-wate	86b
07040002		40-0092-04	Jefferson Lk	I		B	19,11,18,40	U	U	msof-4-wate	86b
07040002		40-0092-01	Jefferson Lk	I	2290ac	DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002		40-0092-02	Jefferson Lk	I		DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002		40-0092-03	Jefferson Lk	I		DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002		40-0092-04	Jefferson Lk	I		DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002		40-0092-01	Jefferson Lk	-	-	B	19,11	U	U	msof-4-wate	87d
07040002		40-0092-02	Jefferson Lk	-		B	19,11	U	U	msof-4-wate	87d
07040002		40-0092-03	Jefferson Lk	-		B	19,11	U	U	msof-4-wate	87d
07040002		40-0092-04	Jefferson Lk	-		B	19,11	U	U	msof-4-wate	87d
07040002		40-0092-01	Jefferson Lk	T	2247ac	B	11,19,43,65	TW	UX	swcd-40	87e
07040002		40-0092-02	Jefferson Lk	T		B	11,19,43,65	TW	UX	swcd-40	87e
07040002		40-0092-03	Jefferson Lk	T		B	11,19,43,65	TW	UX	swcd-40	87e
07040002		40-0092-04	Jefferson Lk	T		B	11,19,43,65	TW	UX	swcd-40	87e
07040002		40-0092	Jefferson Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h
07020007		40-0120	No Goldsmith Lk	I	153ac	DF	11,71	Z	Z	msow-4-gayl	87c
07020012		40-0028	Pepin Lk	I	403ac	DF	11,71	ZT	ZU	msow-4-gayl	87c
07020012		70-0076	Pike Lk	I	57ac	D	11	Z	Z	swcd-70	87j
07040002		40-0056	Rays Lk	I	-	AB	19,11,65,40	Z	U	msof-4-wate	86b
07040002		40-0056	Rays Lk	-	-	AB	19,11,65	W	U	msof-4-wate	87d
07020012		40-0016	Rice Lk	I	375ac	BDF	71,11,19,18	Z	ZU	msow-4-gayl	87c
07040002		40-0039	Roemhildt Lk	I	-	B	19	U	U	msof-4-wate	86b
07040002		40-0039	Roemhildts Lk	-	-	B	19	U	U	msof-4-wate	87d
07040002	017	40-0014	Sabre Lk	I	-	ABDF	19,11,65,40	Z	U	msof-4-wate	86b
07040002	017	40-0014	Sabre Lk	-	-	ABDF	19,11,65	W	U	msof-4-wate	87d
07040002	017	40-0014	Sabre Lk	I	268ac	B	11,19	T	T	swcd-40	87e
07040002	017	40-0002	Sakatah Lk	I	881ac	DF	11,71	TZ	UZ	msow-4-gayl	87c
07020012		40-0027	Sanborn Lk	I	448ac	BDF	71,11,19,18	Z	Z	msow-4-gayl	87c
07020007		40-0109	Scotch Lk	T	-	AB	19,11	T	T	msof-4-wate	86b
07020007		40-0109	Scotch Lk	I	590ac	DF	11,71	ZT	ZU	msow-4-gayl	87c
07020007		40-0109	Scotch Lk	-	-	AB	19,11	T	T	msof-4-wate	87d

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=40 CNTYNAME=LE SUEUR WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020007		40-0108	So Goldsmith Lk	I	86ac	DF	11,71	Z	Z	msow-4-gayl	87c
07040002		40-0044	Steele Lk	-	-	ABF	19,11	S	T	msof-4-wate	87d
07040002		40-0009	Sunfish Lk	T	-	AB	19	U	U	msof-4-wate	86b
07040002		40-0009	Sunfish Lk	-	-	AB	19	U	U	msof-4-wate	87d
07040002		40-0009	Sunfish Lk	T	118ac	B	11,19	T	U	swcd-40	87e
07040002	017	40-0031	Tetonka Lk	I	-	BDFG	40,19,11,65,18	T	U	msof-4-wate	86b
07040002	017	40-0031	Tetonka Lk	I	1336ac	DF	11,71	TZ	UZ	msow-4-gayl	87c
07040002	017	40-0031	Tetonka Lk	-	-	BDFG	43,19,11,65	T	U	msof-4-wate	87d
07040002	017	40-0031	Tetonka Lk	I	1336ac	B	11,19,65,43	T	UX	swcd-40	87e
07040002	017	40-0031	Tetonka Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h
07040002	017	40-0002	Upper Sakata	I	-	BDF	19,11,65	T	U	msof-4-wate	86b
07040002	017	40-0002	Upper Sakatah Lk	-	-	BDF	19,11,65	T	U	msof-4-wate	87d
07040002	017	40-0002	Upper Sakatah Lk	I	990ac	B	11,19,65,43	TW	UX	swcd-40	87e
07040002		40-0033	Volney Lk	I	-	ABDF	19,11,18,65,40	T	U	msof-4-wate	86b
07040002		40-0033	Volney Lk	I	268ac	DF	11,71	ZT	ZU	msow-4-gayl	87c
07040002		40-0033	Volney Lk	-	-	ABDF	19,11,65	T	U	msof-4-wate	87d
07040002		40-0033	Volney Lk	I	259ac	B	18,16,11,65,43,19	TW	UX	swcd-40	87e
07040002		40-0033	Volney Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h
07020007	028	40-0117	Washington Lk	I	-	B	19,11,18,40	U	U	msof-4-wate	86b
07020007	028	40-0117	Washington Lk	-	-	B	19,11	U	U	msof-4-wate	87d
07020007	028	40-0117	Washington Lk	T	1503ac	B	16,11,19,43,65	TW	UX	swcd-40	87e
07020007	028	40-0117	Washington Lk	I	all	ABDF	11,18,19,65	UXZ	-	mdow-4-mank	87h

N= 87

CO=40 CNTYNAME=LE SUEUR WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	017		CANNON R	I	all	DEFC	11,19,77	UZ	-	mdow-4-mank	87h
07020007	001		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020007	002		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020007	003		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020007	004		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020007	005		MINNESOTA R	I	all	DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020012	019		MINNESOTA R	I		DEF	11,19,77	UWZ	-	mdow-4-mank	87h
07020012	020		MINNESOTA R	I	all	DEF	11,19,77	UWZ	-	mdow-4-mank	87h

N= 8

CO=41 CNTYNAME=LINCOLN WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020006	008	41-0043	Benton Lk	–	all	H	40,19,11	–	–	msof-4-wind	86b
07020006	008	41-0043	Benton Lk	I	2000ac	BD	11,19,65	TW	UX	swcd-41	87c
07020006	008	41-0043	Benton Lk	I	2875ac	ABDF	11	UW	UX	msow-4-mars	87d
07020006	008	41-0043	Benton Lk	I	–	ABDF	11,16,19	TW	UX	mpca-4	87i
07020004		41-0058	Curtis Lk	I	120ac	ABDEF	11,14,19	Y	–	swcd-41	87c
07020006	007	41-0021	Dead Coon Lk	I	500ac	DEF	11,19	TW	–	swcd-41	87c
07020006	007	41-0021	Dead Coon Lk	I	555ac	ABDF	11	UW	UX	msow-4-mars	87d
07020004		41-0070	Drietz Lk	I	70ac	ABDF	11,14,16,19	SW	–	swcd-41	87c
07020004		41-0034	E Stay Lk	I	360ac	ABD	11,14,16,19,62	SW	–	swcd-41	87c
07020004		41-0034	E Stay Lk	I	220ac	ABDF	11	S	TW	msow-4-mars	87d
07020003		41-0108	E Twin Lk	I	320ac	ABDEF	11,14,19	SW	–	swcd-41	87c
07020004		41-0024	Gislason Lk	I	90ac	ABD	11,19	Y	–	swcd-41	87c
07020004		41-0045	Hawks Nest Lk	I	300ac	ABDEF	11,14,19	SW	–	swcd-41	87c
07020003		41-0110	Hendricks Lk	I	720ac	BD	11,19,65	TW	UX	swcd-41	87c
07020003		41-0110	Hendricks Lk	I	1634ac	ABDF	11	UW	UX	msow-4-mars	87d
07020003		41-0110	Hendricks Lk	I	–	ABDF	11,16,19	SW	U	mpca-4	87i
07020004		41-0055	No Ash Lk	I	250ac	ABDF	11,14,16,19	SW	–	swcd-41	87c
07020004		41-0062	Oak Lk	I	80ac	ABDF	11,19,51	SW	–	swcd-41	87c
07020004		41-0067	Perch Lk	I	300ac	DE	11,14,19,31	UW	–	swcd-41	87c
07020004		41-0067	Perch Lk	I	206ac	ABDF	11	T	UX	msow-4-mars	87d
07020004		41-0089	Shakotan Lk	I	–	ABDF	11,16,19	UW	UX	mpca-4	87i
07020004		41-0089	Shaokatan Lk	I	720ac	D	11,16	TX	UX	swcd-41	87c
07020004		41-0089	Shaokatan Lk	I	1043ac	ABDF	11	UW	UX	msow-4-mars	87d
07020004		41-0057	So Ash Lk	I	250ac	ABDF	11,14,16,19	SW	–	swcd-41	87c
07020004		41-0082	Steep Bank Lk	I	300ac	ABD	11,14,19	SW	U	swcd-41	87c
07020004		41-0082	Steep Bank Lk	I	208ac	ABDF	11	T	UX	msow-4-mars	87d
07020004		41-0035	W Stay Lk	I	360ac	ABD	11,14,16,19,62	SW	–	swcd-41	87c
07020003		41-0102	W Twin Lk	I	320ac	ABDEF	11,14,19	SW	–	swcd-41	87c

N= 28

CO=42 CNTYNAME=LYON WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020004		42-0014	Cottonwood Lk	I	383ac	ABDF	11	W	X	msow-4-mars	87d
07020004		42-0014	Cottonwood Lk	I	450ac	D	11	SX	–	swcd-42	87g
07020004		42-0014	Cottonwood Lk	I	383	ABDF	14,16,18,19,41	SW	–	msof-4-spic	87h
07020006		42-0070	E Twin Lk	T	300ac	D	11	T	–	swcd-42	87g
		42-0095	Goose Lk	–	150ac	A	90	S	–	swcd-42	87g
07020006		42-0093	Goose Lk	I	151ac	ABDF	11	SW	UX	msow-4-mars	87d
07020006		42-0093	Goose Lk	–	150ac	A	90	S	–	swcd-42	87g
07020006		42-0096	Island Lk	T	150ac	D	23	S	–	swcd-42	87g
07020004		42-0020	Lady Slipper Lk	I	262ac	ABDF	11	Z	T	msow-4-mars	87d
07020004		42-0020	Lady Slipper Lk	I	300ac	D	76	T	–	swcd-42	87g
07020004		42-0020	Lady Slipper Lk	T	262	ABDF	14,16,18,19	SW	–	msof-4-spic	87h
07020004		42-0028	Lone Tree Lk	I	82ac	ABDF	11	Z	Z	msow-4-mars	87d
07100001		42-0029	Long Lk	–	23ac	–	–	–	–	swcd-51	87g

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By County, Waterbody Type, Name

CO=42 CNTYNAME=LYON WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020006		42-0078	Marguerite Lk	I	351ac	ABDF	11	Z	UX	msow-4-mars	87d
07020008		42-0037	Marshall Lk	T	300ac	D	77	S	–	swcd-42	87g
07020008		42-0052	Rock Lk	I	422ac	ABDF	11	T	UX	msow-4-mars	87d
07020008		42-0052	Rock Lk	I	360ac	AD	19	U	–	swcd-42	87g
07020006		42-0002	School Grove Lk	I	348ac	ABDF	11	TW	UX	msow-4-mars	87d
07020006		42-0002	School Grove Lk	T	350ac	D	14	U	–	swcd-42	87g
07020006		42-0002	School Grove Lk	I	348	ABDF	14,16,18,19	TW	–	msof-4-spic	87h
07020006		42-0066	Section Thirty-three	–	7ac	–	–	–	–	swcd-51	87g
07020006		42-0074	W Twin Lk	T	320ac	H	11	T	–	swcd-42	87g
07100001		42-0047	Yankton Lk	I	382ac	ABDF	11	TW	UX	msow-4-mars	87d
07100001		42-0047	Yankton Lk	I	540ac	B	31,75	XT	–	swcd-42	87g

N= 24

CO=42 CNTYNAME=LYON WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020008	011		COTTONWOOD R	T	–	D	11	Y	–	swcd-42	87g
07020008	010		MEADOW CR	I	–	D	11	Z	–	swcd-42	87g
07020006	001		REDWOOD R	–	all	H	19,11,40,18	–	–	msof-4-wind	86b
07020006	003		REDWOOD R	–		H	19,11,40,18	–	–	msof-4-wind	86b
07020006	004		REDWOOD R	–		H	19,11,40,18	–	–	msof-4-wind	86b
07020006	004		REDWOOD R	I		GD	11	V	–	swcd-42	87g
07020006	006		REDWOOD R	–		H	19,11,40,18	–	–	msof-4-wind	86b
07020006	009		REDWOOD R	–		H	19,11,40,18	–	–	msof-4-wind	86b
07020006	009		REDWOOD R	I	all	GD	11	V	–	swcd-42	87g
07020006	106		REDWOOD R	I		GD	11	V	–	swcd-42	87g
07020006	206		REDWOOD R	I		GD	11	V	–	swcd-42	87g
07020006	306		REDWOOD R	I		GD	11	V	–	swcd-42	87g
07020006	005		THREEMILE CR	I	17mi	I	19	Y	–	swcd-42	87g

N= 13

CO=43 CNTYNAME=MC LEOD WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205		43-0061	Addie Lk	I	251	DF	11,71	Z	Z	msow-4-gayl	87c
07010205		43-0061	Addie Lk	I	–	AD	11,18,19	S	T	swcd-43	87g
07010205		43-0061	Addie Lk	–	–	ABDE	11,16,18,19	–	UX	cza-43	87h
07010205		43-0099	Allen Lk	I	238	DF	11,71	Z	Z	msow-4-gayl	87c
07020012		43-0048	Baker's Lk	I	469	DF	11,71	Z	Z	msow-4-gayl	87c
07020012		43-0048	Bakers Lk	T	–	DA	11	Z	Z	swcd-43	87g
		43-?	Barker Lk	–	–	ABDE	11,16,18,19	–	UX	cza-43	87h
07010205		43-0103	Clear Lk	–	–	ABDE	11,16,18,19	–	UX	cza-43	87h

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By County, Waterbody Type, Name

CO=43 CNTYNAME=MC LEOD WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205		43-0098	Eagle Lk	-	-	ABDE	11,16,18,19	-	UX	cza-43	87h
07010204		43-0073	Hook Lk	T	-	AD	11,18,19	T	U	swcd-43	87g
07010205		43-0084	Marion Lk	I	616ac	ABF	19,32,43,65	WT	U	mdow-4-spic	87c
07010205		43-0084	Marion Lk	I	-	BD	11,18,19	TW	UX	swcd-43	87g
07010205		43-0084	Marion Lk	-	-	ABDE	11,16,18,19	-	UX	cza-43	87h
07010205		43-0056	Mary Lk	-	-	ABDE	11,16,18,19	-	UX	cza-43	87h
07010205	006	43-0085	Otter Lk	I	729	DF	11,71	Z	ZT	msow-4-gayl	87c
07010205	006	43-0085	Otter Lk	T	.7sqmi	CF	11,19,32,43,65	SW	TX	cza-43	87f
07010205	006	43-0085-01	Otter Lk	T	-	AD	11,18,19,41,	Y	Y	swcd-43	87g
07010205	006	43-0085-02	Otter Lk	T		AD	11,18,19,41,	Y	Y	swcd-43	87g
07010205	006	43-0085-03	Otter Lk	T		AD	11,18,19,41,	Y	Y	swcd-43	87g
07010205		43-0058	Ryan Lk	-	-	ABDE	11,16,18,19	-	UX	cza-43	87h
07010205		43-0034	Silver Lk	I	450ac	BDF	41,11,14,65	SW	X	cza-43	87f
07010205		43-0034	Silver Lk	I	-	B	41,43	-	-	swcd-43	87g
07010205		43-0104	Stahl Lk	I	-	AD	11,18,19	T	U	swcd-43	87g
		43-0041	Swan Lk	I	-	AD	11,18,19	T	U	swcd-43	87g
07010205		43-0117	Unknown	T	-	ABDEFGH	-	-	-	swcd-65	87e
07010205		43-0097	Whitney Lk	-	-	ABDE	11,16,18,19	-	-	cza-43	87h
07010205		43-0012	Winsted Lk	I	407ac	ABDEF	19,32,41,61	WS	Y	mdow-4-spic	87c
07010205		43-0012	Winsted Lk	I	410ac	ABDE	14,19,43	SWZ	UXZ	cza-43	87e
07010205		43-0012	Winsted Lk	I	-	BD	11,18,19,41,43,	SW	UX	swcd-43	87g

N= 29

CO=43 CNTYNAME=MC LEOD WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?			I	6mi	BE	14,18,19	Z	Z	cza-43	87e
07010205	007		BUFFALO CR	I		DFG	11,71,76,77	S	T	msow-4-gayl	87c
07010205	007		BUFFALO CR	I	-	FAD	11,18,19,41	S	T	swcd-43	87g
07010205	007		BUFFALO CR	-	-	ADE	11,16,18,19,23,41,43	-	UX	cza-43	87h
07010205	008		BUFFALO CR	I	32mi	DFG	11,71,76,77	S	T	msow-4-gayl	87c
07010205	008		BUFFALO CR	I		FAD	11,18,19,41	S	T	swcd-43	87g
07010205	001		CROW R, S FK	I	all	ABDGFH	40,19,65,18	TW	UX	msof-3-mont	86b
07010205	001		CROW R, S FK	I	9mi	CDF	11,19,32,41,43,65	SW	TX	cza-43	87f
07010205	002		CROW R, S FK	I		ABDGFH	40,19,65,18	TW	UX	msof-3-mont	86b
07010205	002		CROW R, S FK	I		CDF	11,19,32,41,43,65	SW	TX	cza-43	87f
07010205	002		CROW R, S FK	T		ADF	11,18,19,63,41,	S	U	swcd-43	87g
07010205	004		CROW R, S FK	I		ABDGFH	40,19,65,18	TW	UX	msof-3-mont	86b
07010205	004		CROW R, S FK	I		DFG	11,71,76,77	S	T	msow-4-gayl	87c
07010205	004		CROW R, S FK	I		CDF	11,19,32,41,43,65	SW	TX	cza-43	87f
07010205	004		CROW R, S FK	T		ADF	11,18,19,63,41,	S	U	swcd-43	87g
07010205	006		CROW R, S FK	I		ABDGFH	40,19,65,18	TW	UX	msof-3-mont	86b
07010205	006		CROW R, S FK	I	25mi	DFG	11,71,76,77	S	T	msow-4-gayl	87c
07010205	006		CROW R, S FK	I		CDF	11,19,32,41,43,65	SW	TX	cza-43	87f
07010205	006		CROW R, S FK	T	-	ADF	11,18,19,63,41,	S	U	swcd-43	87g
?	?		Ditch 4	-	-	ABDE	11,16,18,19,23	Y	-	cza-43	87h

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By County, Waterbody Type, Name

CO=43 CNTYNAME=MC LEOD WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012	012		HIGH ISLAND CR	T	–	AD	11,18,19,71	Y	Y	swcd-43	87g
07010205	x01		Private Dt	I	3mi	BE	14,18,64	Z	Z	cza-43	87e

N= 22

CO=44 CNTYNAME=MAHNOMEN WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020108		44-0242	Beaulieu Lk	T	250ac	H	11,18,19	Y	Y	swcd-44	87g
09020108		44-0092	Eric Lk	T	200ac	H	63	T	T	swcd-44	87g
09020108		44-0215	Fish Lk	T	350ac	BD	11,14,19	S	T	swcd-44	87g
09020108		44-0207	Gardner Lk	T	150ac	H	11,19	Y	Y	swcd-44	87g
09020305		44-0038	Island L	I	–	ABFG	65	TW	UX	msof-1-dl	87d
09020305		44-0038	Island Lk	I	all	ABFG	40,65	TW	UX	msof-1-dl	86b
09020305		44-0038	Island Lk	T	700ac	CH	65	V	V	swcd-44	87g
09020305		44-0038	Island Lk	I	all	B	65	TU	–	mdow-1-dl	87h
09020305		44-0038	Island Lk	T	all	ABCG	65,30	TXZ	Z	cza-44	86a
09020108		44-0001	Roy Lk	T	600ac	ABG	32,43,65,66,76,77	UX	–	swcd-15	87a
09020108		44-0014	S Twin Lk	T	1000ac	H	65	V	V	swcd-44	87g
09020108		44-0014	S Twin Lk	T	all	ABCG	65,30	TXZ	Z	cza-44	86a
09020108		44-0208	Sandy Lk	I	200ac	BE	11,19	W	X	swcd-44	87g
09020108		44-0045	Snider Lk	T	650ac	–	–	T	V	swcd-44	87i
09020108		44-0201	Sqirrel Lk	T	200ac	H	11,18,19	Y	Y	swcd-44	87g
09020108		44-0003	Tulaby Lk	T	800ac	H	65	V	V	swcd-44	87i
09020108		44-0003	Tulaby Lk	T	all	ABCG	65,30	TXZ	Z	cza-44	86a
09020108		44-0179	Vanose Lk	I	650ac	BD	11,19	T	U	swcd-44	87g

N= 18

CO=44 CNTYNAME=MAHNOMEN WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020108	013			T		CDE	19,11,18	SWZ	Z	cza-44	86a
09020108	x15		CD 91	I	–	DE	14,18	S	T	swcd-44	87g
09020108	x15		CD 92	I	–	DE	14,18	S	T	swcd-44	87g
09020108	015		MARSH R	I	10-15mi	DE	11,19	S	T	swcd-44	87g
09020301	013		SAND HILL CR	I	3mi	DEF	11,19	Y	T	swcd-44	87g
09020108	104		SPRING CREEK	T	4mi	DE	11,14,19	–	Y	swcd-44	87g
09020108	x05		Whiskey Ck	I	6mi	DE	11,19	–	Y	swcd-44	87g
09020108	005		WHITE EARTH R	T	5mi	DE	11,14,18,19,77	T	U	swcd-44	87g
09020108	005		WHITE EARTH R	I	–	D	11	U	S	mdow-1-dl	87h
09020108	004		WILD RICE R	T	20mi	DEF	11,19,18,14,41,	TW	UW	swcd-44	87g
09020108	004		WILD RICE R	T	all	CDE	19,11,18	SWZ	Z	cza-44	86a
09020108	006		WILD RICE R	T		DEF	11,19,18,14,41,	TW	UW	swcd-44	87g

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By County, Waterbody Type, Name

CO=44 CNTYNAME=MAHNOMEN WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020108	006		WILD RICE R	T		CDE	19,11,18	SWZ	Z	cza-44	86a
09020108	008		WILD RICE R	T		DEF	11,19,18,14,41,	TW	UW	swcd-44	87g
09020108	008		WILD RICE R	T		CDE	19,11,18	SWZ	Z	cza-44	86a
09020108	010		WILD RICE R	T		DEF	11,19,18,14,41,	TW	UW	swcd-44	87g
09020108	010		WILD RICE R	T		CDE	19,11,18	SWZ	Z	cza-44	86a
09020108	014		WILD RICE R	T		DEF	11,19,18,14,41,	TW	UW	swcd-44	87g
09020108	014		WILD RICE R	T		CDE	19,11,18	SWZ	Z	cza-44	86a

N= 19

CO=45 CNTYNAME=MARSHALL WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		45-0119		T	1ac	D	11	UX	UX	swcd-45	87e
		45-0011	East Park WMA (Nelson Slough)	T	1700ac	ADEG	11,18,19,71	Z	Z	msow-1-karl	87b
09020304		45-0002	Mud L	I	23700ac	D	11,71,72	Z	-	mdow-1-trf	87c
09020304		45-0002	Mud Lk	T	10000ac	D	76	Z	-	msow-1-trf	87f

N= 4

CO=45 CNTYNAME=MARSHALL WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020309	011		MIDDLE R	T	-	ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020309	011		MIDDLE R	T	all	-	11,19	T	T	cza-45	86a
09020304	013		MOOSE R	T	all	-	11,19	S	S	cza-45	86a
09020304	007		MUD R	T	all	-	11,19	S	S	cza-45	86a
09020306	001		RED R	T	-	ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020306	002		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020306	003		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020306	004		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020306	005		RED R	T		ABCDEI	19,43,11	UWY	X	msof-1-baud	87h
09020309	001		SNAKE R	I	60mi	AC	18,80	Y	Y	swcd-45	87e
09020309	001		SNAKE R	T	all	-	11,19	S	S	cza-45	86a
09020309	002		SNAKE R	I		AC	18,80	Y	Y	swcd-45	87e
09020309	002		SNAKE R	T		-	11,19	S	S	cza-45	86a
09020309	003		SNAKE R	I		AC	18,80	Y	Y	swcd-45	87e
09020309	003		SNAKE R	T		-	11,19	S	S	cza-45	86a
09020309	007		SNAKE R	T		-	11,19	S	S	cza-45	86a
09020309	009		SNAKE R	T		-	11,19	S	S	cza-45	86a
09020311	007		TAMARAC R	T	-	ACDEG	11,18,19,65,71,77	SW	TX	msow-1-karl	87b
09020311	007		TAMARAC R	T	all	-	11,19	TX	TX	cza-45	86a
09020311	107		TAMARAC RIVER	T	25mi	AC	18,80	Y	Y	swcd-45	87e
09020311	207		TAMARAC RIVER	T		AC	18,80	Y	Y	swcd-45	87e

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By County, Waterbody Type, Name

CO=45 CNTYNAME=MARSHALL WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020304	001		THIEF R	T	all	–	11,19	TW	TW	cza-45	86a

N= 22

CO=45 CNTYNAME=MARSHALL WBT=WETLAND ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		45-0119w	Unnamed (Overton Imp Florian)	I	80ac	ABCDEFG	11,18,19,65,71	SW	TX	msow-1-karl	87b

N= 1

CO=46 CNTYNAME=MARTIN WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020009		46-0034	Amber Lk	I	–	H	43,90	–	–	cza-46	87b
07020009		46-0034	Amber Lk	I	–	H	43,90	–	–	cza-46	87f
07020009	012	46-0030	Budd Lk	I	–	H	43,90	–	–	cza-46	87b
07020009	012	46-0030	Budd Lk	I	–	H	43,90	–	–	cza-46	87f
07020009	011	46-0109	Fox Lk	–	all	H	19,11,40,70	–	–	msof-4-wind	86b
07020009	011	46-0109	Fox Lk	I	–	ABCDE	19,11,65,16,90	SWY	–	cza-46	87b
07020009	011	46-0109	Fox Lk	I	–	ABCDE	19,11,65,16,90	SWY	–	cza-46	87f
07020009	011	46-0109	Fox Lk	–	all	ABCDE	19,11,65,18,90	SWY	–	cza-46	86a
07020009		46-0024	George Lk	I	–	H	43,90	–	–	cza-46	87b
07020009		46-0024	George Lk	I	–	H	43,90	–	–	cza-46	87f
07020009	012	46-0031	Hall Lk	–	all	H	40,19,11	–	–	msof-4-wind	86b
07020009	012	46-0031	Hall Lk	I	–	H	43,90	–	–	cza-46	87b
07020009	012	46-0031	Hall Lk	I	–	H	43,90	–	–	cza-46	87f
07020009		46-0020	S Silver Lk	I	–	ABCDE	19,11,65,16,90	SWY	–	cza-46	87f
07020009		46-0020	S Silver Lk	–	all	ABCDE	19,11,65,18,90	SWY	–	cza-46	86a
07020009		46-0025	Sisseton Lk	I	–	H	43,90	–	–	cza-46	87b
07020009		46-0025	Sisseton Lk	I	–	H	43,90	–	–	cza-46	87f
07020009		46-0020	South Silver Lk	I	–	ABCDE	19,11,65,16,90	SWY	–	cza-46	87b

N= 18

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=46 CNTYNAME=MARTIN WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020009	010		CENTER CR	I	15	H	19,41,62,77	S	S	swcd-46	87e
07020009	012		CENTER CR	-	all	H	40,19,11,18	-	-	msof-4-wind	86b
07020009	612		Dutch Cr	I	2	DF	61	S	T	swcd-46	87e
07100003	021		DES MOINES R, E BR	I	10	I	77	S	S	swcd-46	87e
07020009	004		ELM CR	I		EI	63,72,77	S	T	swcd-46	87e
07020009	006		ELM CR	I		EI	63,72,77	S	T	swcd-46	87e
07020009	007		ELM CR	I	35	EI	63,72,77	S	T	swcd-46	87e

N= 7

CO=47 CNTYNAME=MEEKER WBT=AQUIFER ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-?	Darwin Outwash Plain	T	40000ac	EI	65,90,11,12,13,19,51	-	-	swcd-47	87e
		aqf-?	Manannan Outwash Plain	T	40000ac	EI	65,90,11,12,13,19,51	-	-	swcd-47	87e

N= 2

CO=47 CNTYNAME=MEEKER WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205		47-0049	Belle Lk	I	1035ac	ABDF	12,18,19	T	U	mdow-4-spic	87c
07010205		47-0049	Belle Lk	I	1040	BCD	11,19,65,90	TW	UW	swcd-47	87g
07010205		47-0049	Belle Lk	T	-	AD	11,18,19	TX	UX	swcd-43	87g
07010205		47-0171	Belle Lk	T	190	-	-	-	-	swcd-47	87g
07010203	015	47-0042	Betty Lk	I	180	BCDF	65,71,90,11,14,18,19	TW	UW	swcd-47	87g
07010204	004	47-0038	Big Swan Lk	I	770	BCDF	11,19,65,90	TW	UX	swcd-47	87g
07010205		43-0115	Cedar Lk	I	-	-		-	-	swcd-47	87g
07010203	015	47-0095	Clear Lk	I	703ac	BDF	14,19,43,65	Y	Y	mdow-4-spic	87c
07010203	015	47-0095	Clear Lk	I	700	ABCD	11,19,65,71,90	SW	UX	swcd-47	87g
07010204		47-0082	Dunns Lk	I	150	ABCD	11,19,65,71,90	SW	UX	swcd-47	87g
07010205		47-0064	Eric Lk	I	200	BC	11,19,16,90	SW	UW	swcd-47	87g
07010204		47-0002	Francis Lk	I	1172ac	BG	65	SW	UX	mdow-3-sc	87c
07010204		47-0002	Francis Lk	I	1170	BCF	11,19,65,71,90	TX	UX	swcd-47	87g
07010205		47-0062	Greenleaf Lk	I	280	ABC	11,19	SW	UW	swcd-47	87e
07010204		47-0081	Hannon Lk	-	-	B	-	-	-	wd-mc	87k
07010205		47-0106	Hoff Lk	I	160	AB	11,19,71,90	SW	TW	swcd-47	87g
07010204		47-0015	Jennie Lk	I	1089ac	BDF	14,16,19,65	T	U	mdow-4-spic	87c
07010204		47-0015	Jennie Lk	I	1090	ABC	11,19,65,16,90	TW	UX	swcd-47	87g
07010204		47-0050	Lake Manuella	T	all	BDF	11	XS	-	msof-4-hutc	87i
07010203		47-0096	Little Lk	I	210	B	11,19	VW	VW	swcd-47	87e
07010204		47-00050	Lk Manuella	T	all	D	11	U	U	msof-4-hutc	86b
07010204		47-0026	Long Lk	I	870	ABC	11,19,65,90	SW	UX	swcd-47	87g
07010204		47-0066	Long Lk	I	160	ABC	11,19,16,65,71,90	SW	TW	swcd-47	87g

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=47 CNTYNAME=MEEKER WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010204		47-0050	Manuella Lk	I	350	BCF	11,19,65,71,90	TX	UX	swcd-47	87g
07010204		47-0140	Minnesota Lk	I	170	-	-	-	-	swcd-47	87g
07010205		47-0119	Minnie Belle Lk	I	560	ABCD	90,11,19,65,74	TX	UX	swcd-47	87g
07010204		47-0088	Richardson Lk	I	-	ABCD	11,19,65,90	SW	UX	swcd-47	87g
07010204	017	47-0134	Ripley Lk	I	1060ac	BDF	19,32,41,65	WT	UX	mdow-4-spic	87c
07010204	017	47-0134	Ripley Lk	I	1060	ABC	90,19,65	SW	UX	swcd-47	87g
07010204		47-0102	Round Lk	I	280	AB	11,19,90	SW	TW	swcd-47	87g
07010204		47-0032	Spring Lk	I	202ac	BF	14,19,43	Y	Y	mdow-4-spic	87c
07010204		47-0032	Spring Lk	I	200	ABC	11,19,62,65,90	SW	UX	swcd-47	87g
07010205		47-0129	Star Lk	T	554ac	BF	19,32,65	W	UX	mdow-4-spic	87c
07010205		47-0129	Star Lk	I	550	ABCD	11,19,65,71,90	SW	TW	swcd-47	87g
07010204		47-0068	Stella Lk	I	630	BC	11,19,65,71,90	TW	UW	swcd-47	87g
07010205		47-0159	Thompson Lk	I	220	AB	11,19,71,90	SW	UX	swcd-47	87g
07010204	019	47-0046	Washington Lk	I	2520	ABC	11,19,65,71,90	TW	UX	swcd-47	87g
07010205		47-0061	Willie Lk	I	200	AB	11,19,90	SW	TW	swcd-47	87g
07010204		47-0016	Wolf Lk	I	300	AB	11,19,90	SW	TW	swcd-47	87g

N= 39

CO=47 CNTYNAME=MEEKER WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	011		CLEARWATER CR	I		ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010203	015		CLEARWATER CR	I	-	CF	23,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87e
07010203	015		CLEARWATER CR	I	-	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010204	013		CROW R, M FK	I		CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	014		CROW R, M FK	I	-	CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	004		CROW R, N FK	I		CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	005		CROW R, N FK	I		CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	005		CROW R, N FK	I		ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010204	006		CROW R, N FK	I		CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	006		CROW R, N FK	I		ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010204	007		CROW R, N FK	I		CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010204	007		CROW R, N FK	I	-	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010204	012		CROW R, N FK	I	40.8mi	CF	22,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87g
07010205	004		CROW R, S FK	I		ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010205	006		CROW R, S FK	I	-	CF	23,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87e
07010205	006		CROW R, S FK	I	-	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010204	304		SUCKER CREEK	I	-	CF	23,61,62,63,65,66,71,75,90,11,12,14,16,18,19	TW	TW	swcd-47	87e
07010204	304		SUCKER CREEK	T	3mi	D	11	S	-	msof-4-hutc	87i

N= 18

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=48 CNTYNAME=MILLE LACS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010207		48-0003	Fog Lk	T	41ac	BF	11,14,19	Y	-	mdof-2	87h
07010207		48-0002	Mille Lacs	T	132,000	H	13	UXZ	Z	msof-3-aitk	87i
07010207		48-0002	Mille Lacs	-	-	H	80	-	-	mpca-2	87i
07010207		48-0006	Mud Lk	T	43ac	BF	11,14,19	T	-	mdof-2	87h
07010203		48-0010	Rice Lk	I	487ac	BF	11,14,19	Z	-	mdof-2	87h
07010207		48-0004	Silver Lk	I	181ac	BF	11,14,19	T	-	mdof-2	87h

N= 6

CO=48 CNTYNAME=MILLE LACS WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	x03			T	-	F	11,14,19	Y	-	mdof-2	87h
07010207	026		ESTES BR	T	-	EF	11,14,19	Y	-	mdof-2	87h
07010207	014		L ONAMIA (RUM R)	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	018		OGECHIE LK *D(RUM R)	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	010		RUM R	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	012		RUM R	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	013		RUM R	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	017		RUM R	T		C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	021		RUM R	T	-	C	11,14,18,19	TWZ	UWZ	swcd-5	87e
07010207	025		RUM RIVER, W BR	T	-	EF	11,14,19	T	-	mdof-2	87h

N= 10

CO=49 CNTYNAME=MORRISON WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010108	017	49-0137	Fish Trap Lk	T	1320ac	C	65	U	Y	cza-49	87f
07010108	017	49-0137	Fish Trap Lk	T	-	C	65	Z	-	swcd-49	87g
07010108	017	49-0137	Fish Trap Lk	I	all	BC	65	TW	XU	cza-49	86a
07010201		49-0024	Pierz Fish Lk	T	190ac	C	65	TW	U	cza-49	87f
07010201		49-0024	Pierz Fish Lk	T	-	C	65	Z	-	swcd-49	87g
07010201		49-0024	Pierz Lk	I	all	BC	65,90	TW	XU	cza-49	86a

N= 6

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=49 CNTYNAME=MORRISON WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010201	106		BUCKMAN CREEK	T	5	C	65	Y	Y	cza-49	87f
07010201	106		BUCKMAN CREEK	T	-	C	41,65	Z	-	swcd-49	87g
07010201	206		BUCKMAN CREEK	T		C	65	Y	Y	cza-49	87f
07010201	206		BUCKMAN CREEK	T		C	41,65	Z	-	swcd-49	87g
07010201	306		BUCKMAN CREEK	T		C	65	Y	Y	cza-49	87f
07010201	306		BUCKMAN CREEK	T		C	41,65	Z	-	swcd-49	87g
?	?		Hazel Ck	T	-	-	-	Z	-	swcd-49	87g
07010201	x13		Hazel Cr	-	all	C	11,18	Y	-	cza-49	86a
?	?		Little Elk Ck	T	-	C	16	Z	-	swcd-49	87g
07010201	003		LITTLE ROCK CR	T	all	H	19,18	UVW	U	msof-3-lf	87i
07010108	001		LONG PRAIRIE R	T		F	19,11,18	TW	U	msof-3-lf	87i
07010108	002		LONG PRAIRIE R	T		F	19,11,18	TW	U	msof-3-lf	87i
07010108	004		LONG PRAIRIE R	T		F	19,11,18	TW	U	msof-3-lf	87i
07010108	005		LONG PRAIRIE R	T		F	19,11,18	TW	U	msof-3-lf	87i
07010108	007		LONG PRAIRIE R	T	all	F	19,11,18	TW	U	msof-3-lf	87i
07010104	001		MISSISSIPPI R	-	25	C	19,65,90	U	Y	cza-49	87f
07010104	001		MISSISSIPPI R	I	-	CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010104	002		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010104	002		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010104	003		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010104	003		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010104	005		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010104	005		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010104	013		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010104	013		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010201	012		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010201	012		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010201	013		MISSISSIPPI R	-		C	19,65,90	U	Y	cza-49	87f
07010201	013		MISSISSIPPI R	I		CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010201	014		MISSISSIPPI R	-	25	C	19,65,90	U	Y	cza-49	87f
07010201	014		MISSISSIPPI R	I	-	CD	77,76,31,32,56,66	Z	-	swcd-49	87g
07010201	005		PLATTE R	T	25	C	19,16	T	Y	cza-49	87f
07010201	005		PLATTE R	T	-	E	12,19	Z	-	swcd-49	87g
07010201	007		PLATTE R	T		C	19,16	T	Y	cza-49	87f
07010201	007		PLATTE R	T		E	12,19	Z	-	swcd-49	87g
07010201	011		PLATTE R	T		C	19,16	T	Y	cza-49	87f
07010201	011		PLATTE R	T		E	12,19	Z	-	swcd-49	87g
07010104	030		SWAN R	T	10	C	16,19	Y	Y	cza-49	87f
07010104	030		SWAN R	T	-	C	14,16,	Z	-	swcd-49	87g
07010104	030		SWAN R	-	all	C	11,18	YT	-	cza-49	86a

N= 40

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=50 CNTYNAME=MOWER WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07080201	020	50-0002	E Side Lk	I	36ac	BCD	18,19,41,43,65	TW	UX	cza-50	87c
07080201	020	50-0002	E Side Lk	I	all	ABCDEFG	40,19,11,65,18,30	SWZ	UXZ	cza-50	86a
07060002		50-0001	Louise Lk	I	35ac	ABCDF	14,16,18,19	T	U	cza-50	87c

N= 3

CO=50 CNTYNAME=MOWER WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07060002	015		BEAVER CR	-		BCDF	40,19,65,18	TW	UX	cza-50	86a
?	?		Cary's Cr	I	all	BCDEFG	19,11,65	SW	UXZV	cza-50	86a
07080201	016		CEDAR R	I	30mi	ABCDEFG	11,12,14,16,18,19,41,43,62,65	T	U	cza-50	87c
07080201	016		CEDAR R	I		ACEF	40,19,11,65,18	T	U	cza-50	86a
07080201	018		CEDAR R	I		ABCDEFG	11,12,14,16,18,19,41,43,62,65	T	U	cza-50	87c
07080201	018		CEDAR R	I		ACEF	40,19,11,65,18	T	U	cza-50	86a
07080201	019		CEDAR R	I		ABCDEFG	11,12,14,16,18,19,41,43,62,65	T	U	cza-50	87c
07080201	019		CEDAR R	I		ACEF	40,19,11,65,18	T	U	cza-50	86a
07080201	021		CEDAR R	I		ABCDEFG	11,12,14,16,18,19,41,43,62,65	T	U	cza-50	87c
07080201	021		CEDAR R	I		ACEF	40,19,11,65,18	T	U	cza-50	86a
07080201	023		CEDAR R	I	all	ACEF	40,19,11,65,18	T	U	cza-50	86a
07080201	020		DOBBIN CR	I	15mi	BCDEFG	11,14,16,18,19,63,65	S	T	cza-50	87c
07080201	020		DOBBIN CR	I	all	ABCDEFG	40,19,11,65,18,30	SWZ	UXZ	cza-50	86a
07080201	009		LITTLE CEDAR R	I	10mi	ACEF	141,16,18,19,65	S	U	cza-50	87c
07080201	009		LITTLE CEDAR R	I	all	ACDEF	40,19,11,18	T	U	cza-50	86a
07060002	017		LITTLE IOWA R	-		BCDF	40,19,65,18	TW	UX	cza-50	86a
?	?		Orchard Cr	I	all	ACDEF	40,19,11,18	T	U	cza-50	86a
07080201	x16		Orchard Cr	I	5mi	AE	14,19,65	S	V	cza-50	87c
07080201	014		OTTER CR	T	10mi	EF	14,19	S	T	cza-50	87c
07080201	014		OTTER CR	I	all	ACDEF	40,19,11,18	T	U	cza-50	86a
?	?		Robinson Cr	I	all	BCDEFG	19,11,65	SW	UXZV	cza-50	86a
07080201	022		ROBERTS CR	I	8mi	ABCDEF	14,18,19,41,62,65	S	U	cza-50	87c
07040008	018		ROOT R, N BR	I	all	BCDEFG	19,11,65	SW	UXZV	cza-50	86a
07080201	017		ROSE CR	I	23mi	CEF	16,18,19	S	T	cza-50	87c
07080201	017		ROSE CR	I	all	ACDEF	40,19,11,18	T	U	cza-50	86a
07080201	024		TURTLE CR	I	8mi	DEF	13,19,71	S	U	cza-50	87c
07080201	024		TURTLE CR	I	all	ACEFG	40,19,11,65,18	S	U	cza-50	86a
07060002	013		UPPER IOWA R	T	12mi	BCDEF	14,16,18,19	T	UV	cza-50	87c
07060002	013		UPPER IOWA R	-		BCDF	40,19,65,18	TW	UX	cza-50	86a
07060002	014		UPPER IOWA R	T		BCDEF	14,16,18,19	T	UV	cza-50	87c
07060002	014		UPPER IOWA R	-		BCDF	40,19,65,18	TW	UX	cza-50	86a
07060002	016		UPPER IOWA R	T		BCDEF	14,16,18,19	T	UV	cza-50	87c
07060002	016		UPPER IOWA R	-		BCDF	40,19,65,18	TW	UX	cza-50	86a
07060002	018		UPPER IOWA R	T		BCDEF	14,16,18,19	T	UV	cza-50	87c
07060002	018		UPPER IOWA R	-	all	BCDF	40,19,65,18	TW	UX	cza-50	86a

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=51 CNTYNAME=MURRAY WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		51-0014		–	35ac	–	–	–	–	swcd-51	87g
		51-0016		–	24ac	–	–	–	–	swcd-51	87g
		51-0017		–	133ac	–	–	–	–	swcd-51	87g
		51-0022		–	25ac	–	–	–	–	swcd-51	87g
		51-0032		–	25ac	–	–	–	–	swcd-51	87g
		51-0037		–	21ac	–	–	–	–	swcd-51	87g
		51-0055		–	31ac	–	–	–	–	swcd-51	87g
		51-0058		–	93ac	–	–	–	–	swcd-51	87g
		51-0071		–	15ac	–	–	–	–	swcd-51	87g
		51-0073		–	38ac	–	–	–	–	swcd-51	87g
		51-0093		–	59ac	–	–	–	–	swcd-51	87g
		51-0100		–	49ac	–	–	–	–	swcd-51	87g
07100001		51-0051		–	31ac	–	–	–	–	swcd-51	87g
07100001		51-0052		–	27ac	–	–	–	–	swcd-51	87g
07100001		51-0078	Bear Lk	–	1110ac	–	–	–	–	swcd-51	87g
		51-0061	Beauty Lk	–	201ac	–	–	–	–	swcd-51	87g
		51-0004	Berry Lk	–	39ac	–	–	–	–	swcd-51	87g
07100001	005	51-0040	Bloody Lk	I	248	AB	19	T	–	msow-4-slay	87d
07100001	005	51-0040	Bloody Lk	–	248ac	–	–	–	–	swcd-51	87g
07100001		51-0018	Buffalo Lk	I	124	B	14	T	Z	msow-4-slay	87d
07100001		51-0018	Buffalo Lk	T	124ac	BDF	18	–	–	swcd-51	87g
		51-0003	Central Lk	–	135ac	–	–	–	–	swcd-51	87g
		51-0060	Clear Lk	–	69ac	–	–	–	–	swcd-51	87g
07020008		51-0047	Clear Lk	–	105ac	–	–	–	–	swcd-51	87g
07100001		51-0054	Corabelle Lk	–	99ac	–	–	–	–	swcd-51	87g
		51-0072	Crooked Lk	–	283ac	–	–	–	–	swcd-51	87g
07100001		51-0082	Currant Lk	I	394ac	D	19,14	T	–	cza-51	87b
07100001		51-0082	Currant Lk	T	394ac	BDF	–	T	U	swcd-51	87g
07100001		51-0090	Current Lk	–	45ac	–	–	–	–	swcd-51	87g
07100001		51-0030	Dibble Marsh	–	16ac	–	–	–	–	swcd-51	87g
		51-0015	Duck Lk	–	35ac	–	–	–	–	swcd-51	87g
		51-0057	Elsie Lk	T	83ac	BDF	–	–	–	swcd-51	87g
		51-0005	Field Lk	–	149ac	–	–	–	–	swcd-51	87g
07100001		51-0021	First Fulda Lk	T	122ac	ABCD	19	T	–	cza-51	87b
07100001		51-0021	First Fulda Lk	T	122	AB	19,65,41,64	T	–	msow-4-slay	87d
07100001		51-0021	First Fulda Lk	T	122ac	BD	19	T	U	swcd-51	87g
07020008		51-0043	Fox Lk	I	174ac	D	19	T	–	cza-51	87b
07020008		51-0043	Fox Lk	I	174	AB	14,19	S	Z	msow-4-slay	87d
07020008		51-0043	Fox Lk	–	174ac	–	–	–	–	swcd-51	87g
		51-0036	Francis Siegel	–	90ac	–	–	–	–	swcd-51	87g
07100001		51-0039	Freemont Lk	I	204	AB	14,16,19	T	–	msow-4-slay	87d
07100001		51-0039	Freemont Lk	T	204ac	BDF	18	–	–	swcd-51	87g
		51-?	Fulda Lk	I	–	ABDF	11,16,19	SW	UX	mpca-4	87i
		51-0074	Great Oasis	–	1466ac	–	–	–	–	swcd-51	87g
07100001		51-0089	Hjermstad's Lk	–	119ac	–	–	–	–	swcd-51	87g
07100001		51-0079	Iron Lk	–	227ac	–	–	–	–	swcd-51	87g
		51-0096	Ivadelle Lk	–	203ac	–	–	–	–	swcd-51	87g
07020008		51-0002	Julia Lk	–	93ac	–	–	–	–	swcd-51	87g
07100001		51-0099	Lange Marsh	–	50ac	–	–	–	–	swcd-51	87g
07100001		51-0024	Lime Lk	I	316ac	ADB	19,11	T	–	cza-51	87b

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By County, Waterbody Type, Name

CO=51 CNTYNAME=MURRAY WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001		51-0024	Lime Lk	I	316	B	14,19,62	T	-	msow-4-slay	87d
07100001		51-0024	Lime Lk	T	316ac	BDF	65	T	U	swcd-51	87g
07100001	005	51-0046	Lk Shetek	I	-	ABDF	11,16,19	TW	UX	mpca-4	87i
		51-0009	Long Lk	-	327ac	-	-	-	-	swcd-51	87g
07020008		51-0006	Louisa Lk	I	211ac	DE	14,18,19	S	-	cza-51	87b
07020008		51-0006	Louisa Lk	I	211	B	14,19	T	-	msow-4-slay	87d
07020008		51-0006	Louisa Lk	-	211ac	BDF	18	-	-	swcd-51	87g
07100001		51-0062	Maria Lk	T	425ac	D	19	Y	-	cza-51	87b
07100001		51-0062	Maria Lk	I	425	B	14,16,19	Z	-	msow-4-slay	87d
07100001		51-0062	Maria Lk	-	425ac	-	-	-	-	swcd-51	87g
10170204		51-0069	Moon Lk	-	26ac	-	-	-	-	swcd-51	87g
		51-0059	Mud Lk	T	125ac	BDF	-	-	-	swcd-51	87g
07100001		51-0050	N Badger Lk	-	210ac	-	-	-	-	swcd-51	87g
07100001		51-0050	No Badger Lk	T	210ac	D	19	Y	-	cza-51	87b
		51-0080	Oscar Lk	-	547ac	-	-	-	-	swcd-51	87g
07100001		51-0028	Park Lk	-	38ac	-	-	-	-	swcd-51	87g
07020008		51-0038	Round Lk	T	162ac	D	19	Y	-	cza-51	87b
07020008		51-0038	Round Lk	-	162ac	-	-	-	-	swcd-51	87g
		51-0010	Rush Lk	-	103ac	-	-	-	-	swcd-51	87g
		51-0077	Rush Lk	-	849ac	-	-	-	-	swcd-51	87g
07100001		51-0049	S Badger Lk	-	300ac	-	-	-	-	swcd-51	87g
07100001	006	51-0063	Sarah Lk	I	1176ac	DB	19,11	T	-	cza-51	87b
07100001	006	51-0063	Sarah Lk	I	1176	AB	14,16,19	T	Z	msow-4-slay	87d
07100001	006	51-0063	Sarah Lk	T	1176ac	BDF	-	T	U	swcd-51	87g
07100001		51-0020	Second Fulda Lk	I	65ac	ABD	19,43	T	-	cza-51	87b
07100001		51-0020	Second Fulda Lk	T	65	AB	19,65,41,64	T	-	msow-4-slay	87d
07100001		51-0020	Second Fulda Lk	T	65ac	BD	19	T	U	swcd-51	87g
07100001	005	51-0046	Shetek Lk	-	all	H	40,19,11	-	-	msof-4-wind	86b
07100001	005	51-0046	Shetek Lk	I	3596ac	D	19,11	T	-	cza-51	87b
07100001	005	51-0046	Shetek Lk	I	3596	AB	14,16,19	T	Z	msow-4-slay	87d
07100001	005	51-0046	Shetek Lk	T	3596ac	BDF	-	T	U	swcd-51	87g
07100001		51-0027	Smith Lk	-	93ac	-	-	-	-	swcd-51	87g
		51-0001	Snow Lk	-	61ac	-	-	-	-	swcd-51	87g
07100001		51-0049	So Badger Lk	T	264ac	D	19	Y	-	cza-51	87b
		51-0008	Star Lk	-	69ac	-	-	-	-	swcd-51	87g
07100001		51-0068	Summit Lk	T	80ac	-	-	T	U	swcd-51	87g
07020006		51-0085	Unnamed	-	38ac	-	-	-	-	swcd-51	87g
07020006		51-0087	Unnamed	-	22ac	-	-	-	-	swcd-51	87g
07020006		51-0088	Unnamed	-	16ac	-	-	-	-	swcd-51	87g
07020006		51-0091	Unnamed	-	10ac	-	-	-	-	swcd-51	87g
07020006		51-0092	Unnamed	-	11ac	-	-	-	-	swcd-51	87g
07020006		51-0094	Unnamed	-	21ac	-	-	-	-	swcd-51	87g
07020008		51-0007	Unnamed	-	42ac	-	-	-	-	swcd-51	87g
07020008		51-0013	Unnamed	-	38ac	-	-	-	-	swcd-51	87g
07020008		51-0041	Unnamed	-	49ac	-	-	-	-	swcd-51	87g
07100001		51-0019	Unnamed	-	199ac	-	-	-	-	swcd-51	87g
07100001		51-0023	Unnamed	-	50ac	-	-	-	-	swcd-51	87g
07100001		51-0025	Unnamed	-	27ac	-	-	-	-	swcd-51	87g
07100001		51-0029	Unnamed	-	25ac	-	-	-	-	swcd-51	87g
07100001		51-0033	Unnamed	-	150ac	-	-	-	-	swcd-51	87g

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By County, Waterbody Type, Name

CO=51 CNTYNAME=MURRAY WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07100001		51-0053	Unnamed	-	50ac	-	-	-	-	swcd-51	87g
07100001		51-0056	Unnamed	-	27ac	-	-	-	-	swcd-51	87g
07100001		51-0064	Unnamed	-	17ac	-	-	-	-	swcd-51	87g
07100001		51-0066	Unnamed	-	47ac	-	-	-	-	swcd-51	87g
07100001		51-0075	Unnamed	-	58ac	-	-	-	-	swcd-51	87g
07100001		51-0076	Unnamed	-	31ac	-	-	-	-	swcd-51	87g
07100001		51-0095	Unnamed	-	21ac	-	-	-	-	swcd-51	87g
07100001		51-0097	Unnamed	-	18ac	-	-	-	-	swcd-51	87g
07100001		51-0098	Unnamed	-	20ac	-	-	-	-	swcd-51	87g
10170204		51-0065	Unnamed	-	18ac	-	-	-	-	swcd-51	87g
		51-0044	Willow Lk	-	52ac	-	-	-	-	swcd-51	87g
07100001		51-0048	Willow Lk	-	55ac	-	-	-	-	swcd-51	87g
07100001	013	51-0081	Wilson Lk	-	164ac	-	-	-	-	swcd-51	87g

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CO=51 CNTYNAME=MURRAY WBT=WETLAND ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		51-0045w	Armstrong Slough	-	34ac	-	-	-	-	swcd-51	87g
		51-0011w	Buffalo Marsh	-	61ac	-	-	-	-	swcd-51	87g
		51-0070w	Degreef Slough	-	16ac	-	-	-	-	swcd-51	87g
		51-0012w	Douray Marsh	-	87ac	-	-	-	-	swcd-51	87g
		51-0026w	Hanover Slough	-	49ac	-	-	-	-	swcd-51	87g
		51-0031w	Hanson Marsh	-	168ac	-	-	-	-	swcd-51	87g
		51-0083w	Klinkers Marsh	-	98ac	-	-	-	-	swcd-51	87g
		51-0034w	Metty Marsh	-	30ac	-	-	-	-	swcd-51	87g
		51-0084w	Nelsons Marsh	-	167ac	-	-	-	-	swcd-51	87g
		51-0042w	Robbins Marsh	-	245ac	-	-	-	-	swcd-51	87g
		51-0086w	Ruthton Marsh	-	37ac	-	-	-	-	swcd-51	87g
		51-0067w	Stoderl Slough	-	38ac	-	-	-	-	swcd-51	87g
		51-0035w	Webster Slough	-	37ac	-	-	-	-	swcd-51	87g

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=52 CNTYNAME=NICOLLET WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		52-0023	Middle Lk	T	4000ac	EC	16,18,19	Z	Z	swcd-52	87c
		52-0023	Middle Lk	T	all	H	90	Z	Y	cza-52	86a
07020007		52-0010	Oak Leaf Lk	T	150ac	EC	18,19	Z	Z	swcd-52	87c
07020007		52-0037	Peterson Lk	T	118ac	E	19	Z	Z	swcd-52	87c
07020012		52-0033	Rice Lk	T	121ac	EC	14,18,19	SZ	SZ	swcd-52	87c
07020012		52-0015	Sand Lk	T	80ac	DEC	18,14,16,19,32	SZ	TZ	swcd-52	87c
07020007		52-0034	Swan Lk	T	10000ac	EC	14,18,19	Z	Z	swcd-52	87c
07020007		52-0034	Swan Lk	T	all	H	90	Z	Y	cza-52	86a

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CO=52 CNTYNAME=NICOLLET WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020007	x11		Fritsche Cr	T	4mi	EDC	19,18,43	Z	Z	swcd-52	87c
07020007	001		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	002		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	003		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	004		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	004		MINNESOTA R	T		H	90	Z	Y	cza-52	86a
07020007	005		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	005		MINNESOTA R	T		H	90	Z	Y	cza-52	86a
07020007	008		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	008		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	008		MINNESOTA R	T		H	90	Z	Y	cza-52	86a
07020007	009		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	009		MINNESOTA R	T		H	90	Z	Y	cza-52	86a
07020007	010		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	010		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	010		MINNESOTA R	T		H	90	Z	Y	cza-52	86a
07020007	011		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	011		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	011		MINNESOTA R	T	all	H	90	Z	Y	cza-52	86a
07020007	013		MINNESOTA R	T		DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	013		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	015		MINNESOTA R	T	100mi	DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
07020007	015		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	016		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	018		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	019		MINNESOTA R	I		DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020007	021		MINNESOTA R	I	all	DEF	11,19,77	UWZ	–	mdow-4-mank	87h
07020012	020		MINNESOTA R	T	100mi	DEGC	75,41,43,62,74,18,19,31,32	TW	SW	swcd-52	87c
?	?		Robarts Cr	T	4mi	EDC	19,18	Z	Z	swcd-52	87c
07020007	006		SWAN L OUTLET	T	8mi	EC	19,18	Z	Z	swcd-52	87c

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=53 CNTYNAME=NOBLES WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		53-0045	Bella Lk	T	182ac	DF	11,19,61,74	SW	UX	swcd-53	87g
07100001		53-0016	Clear Lk	T	78ac	DF	11,18,19	TW	UX	swcd-53	87g
07100001		53-0020	E Graham Lk	I	523	AB	14,19	T	-	msow-4-slay	87d
07100001		53-0020	E Graham Lk	I	520ac	ABDF	11,18,19,61,65	TW	UX	swcd-53	87g
10230003	068	53-0007	Indian Lk	T	260ac	DF	11,18,19,61	TW	UX	swcd-53	87g
07100001		53-0019	Jack Lk	T	78ac	BDF	11,32,43,65	SW	TX	swcd-53	87g
10230003		53-0024	Ocheda Lk	I	1778	AB	14,19,41,43	Z	-	msow-4-slay	87d
10230003		53-0024	Ocheda Lk	I	2060ac	ABDF	11,14,16,18,19,61,65,74,76	SW	TW	swcd-53	87g
10230003	084	53-0028	Okabena Lk	-	all	H	40,19,11	-	-	msof-4-wind	86b
10230003	084	53-0028	Okabena Lk	I	785	AB	14,19,41,43	T	-	msow-4-slay	87d
10230003	084	53-0028	Okabena Lk	T	762ac	DF	11,18,19,32,41,43,74	TX	UX	swcd-53	87g
07100001		53-0021	W Graham Lk	I	526	AB	14,19	T	-	msow-4-slay	87d
07100001		53-0021	W Graham Lk	I	520ac	ABDF	11,18,19,61,65	TW	UX	swcd-53	87g

N= 13

CO=53 CNTYNAME=NOBLES WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
10170204	015		*C	T	31mi	CDEF	11,14,16,18,19,61,71,76,77	S	S	swcd-53	87g
10170204	021		*D	T	22mi	CDEF	11,14,16,18,19,41,43,61,71,76,77	S	S	swcd-53	87g
10170204	028		CHAMPEPADAN CR	T	23mi	DF	11,14,16,18,19,71,76,77	S	S	swcd-53	87g
10170204	026		ELK CR	I	17mi	ACDF	11,14,16,18,19,71,76,77,61	Y	Y	swcd-53	87g
07100001	123		JACK CREEK	I	53mi	ACDEF	11,14,16,18,19,61,71,76,77	S	S	swcd-53	87g
07100001	223		JACK CREEK	I		ACDEF	11,14,16,18,19,61,71,76,77	S	S	swcd-53	87g
10170204	020		KANARANZI CR	T	90mi	-	11,14,16,18,19,41,43,61,71,76,77	S	S	swcd-53	87g
10170204	022		KANARANZI CR	T		-	11,14,16,18,19,41,43,61,71,76,77	S	S	swcd-53	87g
10170204	023		KANARANZI CR	T		-	11,14,16,18,19,41,43,61,71,76,77	S	S	swcd-53	87g
10170204	013		LITTLE ROCK R	T		CDEF	11,14,16,18,19,61,71,76,77	S	S	swcd-53	87g
10170204	014		LITTLE ROCK R	T	23mi	CDEF	11,14,16,18,19,61,71,76,77	S	S	swcd-53	87g
07100001	029		OKABENA CR	T		DEF	11,14,16,18,19,41,43,61,65,71,76,77	S	S	swcd-53	87g
07100001	031		OKABENA CR	-	all	H	40,19,11,18	-	-	msof-4-wind	86b
07100001	131		OKABENA CREEK	T	9mi	DEF	11,14,16,18,19,41,43,61,65,71,76,77	S	S	swcd-53	87g
07100001	231		OKABENA CREEK	T		DEF	11,14,16,18,19,41,43,61,65,71,76,77	S	S	swcd-53	87g

N= 15

CO=54 CNTYNAME=NORMAN WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020107	001		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020107	002		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020107	003		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020107	009		RED R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b

N= 4

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By County, Waterbody Type, Name

CO=55 CNTYNAME=OLMSTED WBT=AQUIFER ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-371frnc	Franconia Aqf	T	–	CEI	19	Z	Z	cza-55	87i
		aqf-364glen	Galena Aqf	I	–	CEI	11,14,16,18,19,41,43,23,63,65,66	Z	Z	cza-55	87i
		aqf-?	Groundwater	T	all	CEI	19,11,65,18,40	Z	Z	cza-55	86a
		aqf-371jrdn	Jordan Aqf	T	–	CEI	11,14,16,18,19,41,23,63,65,66	Z	Z	cza-55	87i
		aqf-?	Shakopee Oneola Agf	I	–	CEI	11,14,16,18,19,41,23,63,65,66	Z	Z	cza-55	87i
		aqf-364stpr	St Peter Aqf	I	–	CEI	11,14,16,18,19,41,43,23,63,65,66	Z	Z	cza-55	87i

N= 6

CO=55 CNTYNAME=OLMSTED WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040008		55-0001	Florence Lk	I	70ac	ABCDFG	11,16,19,41,	S	TWZ	mdow-5-roch	87c
07040008		55-0001	Florence Lk	I	70ac	ABCDFG	11,77,16,19,41	S	ZTW	swcd-55	87g
07040004	008	55-0004	Lk Zumbro	I	–	BCDEFGI	19,11,18,30,65	UWZ	UX	msof-5-lc	86b
07040004	019	55-0002	Mayowood Lk	I	20ac	ABCDFG	11,16,17,19,77	S	TWZ	mdow-5-roch	87c
07040004	019	55-0002	Mayowood Lk	I	20ac	ABCDFG	11,16,19,77	S	ZTW	swcd-55	87g
07040004	010	55-0005	Shady Lk	I	–	BDEFGI	19,11,65,18,70	SW	TX	msof-5-lc	86b
07040004	010	55-0005	Shady Lk	I	120ac	ABCDFG	11,16,18,65,77,74	SZ	TWZ	mdow-5-roch	87c
07040004	010	55-0005	Shady Lk	I	120ac	ABCDFG	11,16,19,65,74,77	SZ	TZW	swcd-55	87g
07040004	010	55-0005	Shady Lk	I	–	BCDEFG	11,14,16,19,65	S	T	cza-55	87i
07040004	016	55-0003	Silver Lk	I	–	BDEFGI	40,19,11,18,30	TW	UX	msof-5-lc	86b
07040004	016	55-0003	Silver Lk	I	60ac	ABCDEFG	11,16,18,19,31,32,41,43,66,77	TZ	TZ	mdow-5-roch	87c
07040004	016	55-0003	Silver Lk	I	60ac	ABCDFGE	41,43,66,77,11,16,18,19,31,32	TZ	TZ	swcd-55	87g
07040004	008	55-0004	Zumbro Lk	I	360ac	ABCDEFG	11,16,18,19,32,41,43,51,63,65,66,74,77	TWZ	UXZ	mdow-5-roch	87c
07040004	008	55-0004	Zumbro Lk	I	360ac	ABCDEFG	41,43,51,63,65,66,11,16,18,19,31,32,74,77	TWZ	UXZ	swcd-55	87g
07040004	008	55-0004	Zumbro Lk	I	–	BCDEFG	11,14,16,19,65	UT	U	cza-55	87i

N= 15

CO=55 CNTYNAME=OLMSTED WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040004	017		•B	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	022		BEAR CR	I	–	DEFGI	11,18,19	T	U	msof-5-lc	86b
07040004	022		BEAR CR	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	024		BEAR CR	I		DEFGI	11,18,19	T	U	msof-5-lc	86b
07040004	024		BEAR CR	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	024		BEAR CR	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040008	024		BEAR CR	T	15mi	CDEF	14,16,18,19,65	S	U	cza-50	87c
07040008	x18		Carv's Cr	T	15	ABE	18,65	T	V	cza-50	87c
07040003	420		CR TO N FK WHITEWATER	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	322		CR TO S FK WHITEWATER R	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040008	026		DEER CR	T	12mi	CDEF	11,14,18,19,43	T	U	cza-50	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=55 CNTYNAME=OLMSTED WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040004	014		DODGE CENTER CR	I		ABCDFG	11,16,19,77	SW	TW	mdow-5-roch	87c
07040004	014		DODGE CENTER CR	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040004	014		DODGE CENTER CR	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	210		M FK ZUMBRO R	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040003	120		N FK WHITEWATER R	T	83280ac	BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	220		N FK WHITEWATER R	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	320		N FK WHITEWATER R	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040008	x18		Robinson Cr	T	15mi	ABE	18,65	T	V	cza-50	87c
07040008	012		ROOT R, M BR	I		DFG	19,11,18	SY	UY	cza-55	86a
07040008	013		ROOT R, M BR	I		DFG	19,11,18	SY	UY	cza-55	86a
07040008	015		ROOT R, M BR	I		DFG	19,11,18	SY	UY	cza-55	86a
07040008	016		ROOT R, N BR	I		ABCDFG	11,16,19,77,62	TWZ	UWZ	swcd-55	87g
07040008	016		ROOT R, N BR	I		CDFGE	11,14,16,19,77	S	TU	cza-55	87i
07040008	016		ROOT R, N BR	I		DFG	19,11,18	SY	UY	cza-55	86a
07040008	018		ROOT R, N BR	I	–	ABCDFG	11,16,19,62,77	ZTW	ZUW	mdow-5-roch	87c
07040008	018		ROOT R, N BR	T	15mi	ABE	18,65	T	V	cza-50	87c
07040008	018		ROOT R, N BR	I	99520ac	ABCDFG	11,16,19,77,62	TWZ	UWZ	swcd-55	87g
07040008	018		ROOT R, N BR	I	–	CDFGE	11,14,16,19,77	S	TU	cza-55	87i
07040008	018		ROOT R, N BR	I	all	DFG	19,11,18	SY	UY	cza-55	86a
07040008	034		ROOT R, S BR	T		DFGE	11,14,16,31,77	V	V	mdow-5-roch	87c
07040008	034		ROOT R, S BR	T		DEFG	14,16,18,19,71	S	U	cza-50	87c
07040008	035		ROOT R, S BR	T	–	DFGE	11,14,16,31,77	V	V	mdow-5-roch	87c
07040008	035		ROOT R, S BR	T	5mi	DEFG	14,16,18,19,71	S	U	cza-50	87c
07040003	122		S FK WHITEWATER R	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	222		S FK WHITEWATER R	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040004	020		SALEM CR	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	112		TRIB TO M FK ZUMBRO R	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040003	018		WHITEWATER R	T		BCDG	11,14,16,19,77	VW	VW	mdow-5-roch	87c
07040003	021		WHITEWATER R, M FK	T		BCDG	11,14,16,19,77	VW	VW	mdow-5-roch	87c
07040003	021		WHITEWATER R, M FK	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	021		WHITEWATER R, M FK	I	–	CDEFG	11,14,16,19,77	UTS	U	cza-55	87i
07040003	019		WHITEWATER R, N FK	T		BCDG	11,14,16,19,77	VW	VW	mdow-5-roch	87c
07040003	019		WHITEWATER R, N FK	T		BCDG	11,16,14,19,77	VW	VW	swcd-55	87g
07040003	020		WHITEWATER R, N FK	T	–	BCDG	11,14,16,19,77	VW	VW	mdow-5-roch	87c
07040003	020		WHITEWATER R, N FK	I		CDEFG	11,14,16,19,77	UTS	U	cza-55	87i
07040003	022		WHITEWATER R, S FK	T		BCDG	11,14,16,19,77	VW	VW	mdow-5-roch	87c
07040004	023		WILLOW CR	I	–	ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	008		ZUMBRO R	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	009		ZUMBRO R, M FK	I	239600ac	ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040004	009		ZUMBRO R, M FK	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	010		ZUMBRO R, M FK	I		ABCDFG	11,16,19,77	SW	TW	mdow-5-roch	87c
07040004	010		ZUMBRO R, M FK	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	012		ZUMBRO R, M FK	I	–	ABCDFG	11,16,19,77	SW	TW	mdow-5-roch	87c
07040004	012		ZUMBRO R, M FK	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040004	012		ZUMBRO R, M FK	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	011		ZUMBRO R, M FK, N BR	I		ABCDFG	11,16,19,77	SW	TW	mdow-5-roch	87c
07040004	011		ZUMBRO R, M FK, N BR	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040004	011		ZUMBRO R, M FK, N BR	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	013		ZUMBRO R, M FK, S BR	I		ABCDFG	11,16,19,77	SW	TW	mdow-5-roch	87c
07040004	013		ZUMBRO R, M FK, S BR	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=55 CNTYNAME=OLMSTED WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040004	013		ZUMBRO R, M FK, S BR	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i
07040004	015		ZUMBRO R, M FK, S BR	I		ABCDFG	11,16,19,77	SW	TW	swcd-55	87g
07040004	016		ZUMBRO R, S FK	I	–	BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	016		ZUMBRO R, S FK	I	239600ac	ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	018		ZUMBRO R, S FK	I		BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	018		ZUMBRO R, S FK	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	019		ZUMBRO R, S FK	I		BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	019		ZUMBRO R, S FK	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	021		ZUMBRO R, S FK	I		BDEFGI	11,18,19,80	SWZ	UXZ	msof-5-lc	86b
07040004	021		ZUMBRO R, S FK	I	–	ABCDEFG	11,16,19,32,41,43,63,65,66,77	ZTW	UWZ	mdow-5-roch	87c
07040004	021		ZUMBRO R, S FK	I		ABCDEFG	11,16,19,31,32,41,43,63,65,66,77	TWZ	UWZ	swcd-55	87g
07040004	021		ZUMBRO R, S FK	I		ABCDEFG	11,14,16,19,41,43,76,77	STW	UX	cza-55	87i

N= 73

CO=56 CNTYNAME=OTTER TAIL WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002		56-0427	Dane Lk	I	120	AB	18	S	–	msof-1-ff	87k
07020002		56-0615	Hansel Lk	I	124	B	18	S	–	msof-1-ff	87k
07020002		56-0295	Holo Lk	I	83	A	16	S	–	msof-1-ff	87k
07020002		56-0393	Johnson Lk	I	372	B	18	U	–	msof-1-ff	87k
09020103		56-0747	Lida Lk	T	7277	C	18	U	–	msof-1-ff	87k
09020103		56-0658	Wall Lk	I	756	B	18	U	–	msof-1-ff	87k

N= 6

CO=56 CNTYNAME=OTTER TAIL WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020103	?-?		Balmoral Ck	I	–	CB	16	Y	–	msof-1-ff	87k
09020103	001		OTTER TAIL R	I	30mi	D	11	S	–	msof-1-ff	87k
09020103	002		OTTER TAIL R	T	20mi	E	12	U	–	msof-1-ff	87k
09020103	006		OTTER TAIL R	T		E	12	U	–	msof-1-ff	87k
09020103	016		PELICAN R	I	–	BC	18	Z	–	msof-1-ff	87k

N= 5

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=57 CNTYNAME=PENNINGTON WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020303		57-0001	Goose Lk	T	40ac	H	90	SW	SW	swcd-57	87f

N= 1

CO=57 CNTYNAME=PENNINGTON WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020303	017		*D	-	-	H	90	Y	Y	cza-57	87e
09020303	017		*D	T	4	DF	11,19	SW	TW	swcd-57	87f
09020303	017		*D	T	all	H	90	Y	Y	cza-57	86a
09020305	013		CLEARWATER R	-	-	H	11,19	Y	Y	cza-57	87e
09020305	013		CLEARWATER R	T	5	FD	11,12,13,14,19	SW	TW	swcd-57	87f
09020305	013		CLEARWATER R	T	all	H	19	Y	Y	cza-57	86a
09020303	012		RED LAKE R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	013		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	013		RED LAKE R	-		DFH	11,19,90	TWZ	TWZ	cza-57	87e
09020303	014		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	014		RED LAKE R	-		DFH	11,19,90	TWZ	TWZ	cza-57	87e
09020303	014		RED LAKE R	T	50	FD	11,18,19	SW	TW	swcd-57	87f
09020303	014		RED LAKE R	T	-	ABCDI	19,43,11	UXY	-	msof-1-baud	87h
09020303	015		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	015		RED LAKE R	-	-	DFH	11,19,90	TWZ	TWZ	cza-57	87e
09020303	015		RED LAKE R	T		FD	11,18,19	SW	TW	swcd-57	87f
09020303	015		RED LAKE R	T	all	DFH	19,11	TW	TW	cza-57	86a
09020304	001		THIEF R	-	-	H	11,19,90	Y	Y	cza-57	87e
09020304	001		THIEF R	T	5	FD	11,19	SW	TW	swcd-57	87f
09020304	001		THIEF R	T	all	H	19,11	Y	Y	cza-57	86a

N= 20

CO=58 CNTYNAME=PINE WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030003		58-0137	Bass Lk	T	all	H	43	T	-	msow-3-hinc	87d
07030003	020	58-0138	Big Pine Lk	T	all	H	43	T	-	msow-3-hinc	87d
07030003	020	58-0138	Big Pine Lk	I	387	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07030004	001	58-0119	Cross Lk	I	all	B	43	T	-	msow-3-hinc	87d
07030004	001	58-0119	Cross Lk	I	all	B	43,41,65,76	SW	-	swcd-58	87e
07030004	001	58-0119	Cross Lk	I	938	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07030003		58-0062	Island Lk	T	all	H	43	TX	-	msow-3-hinc	87d
07030003		58-0062	Island Lk	I	500ac	B	18,43	V	V	mdof-341	87i
07030003	003	58-0107	Long Lk	T	all	F	43	Y	-	msow-3-hinc	87d
04010301	016	58-0038	Net Lk	T	35ac	G	43,30	TW	TW	cza-9	87i
07030004		58-0142	Pokegama Lk	I	all	B	43,14	T	-	msow-3-hinc	87d

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By County, Waterbody Type, Name

CO=58 CNTYNAME=PINE WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030004		58-0142	Pokegama Lk	I	all	BC	43,76,65	SW	-	swcd-58	87e
07030004		58-0142	Pokegama Lk	I	1474	BFG	12,14,16,32,43	UW	-	msof-3-hink	87g
07030004		58-0142	Pokegama Lk	I	1300ac	AB	14,80	Y	Y	mdof-344	87h
07030003		58-0081	Sand Lk	T	all	H	43	TX	-	msow-3-hinc	87d
07030003		58-0067	Sturgeon Lk	T	all	H	43	TX	-	msow-3-hinc	87d
07030001		58-0024	Tamarack Lk	T	all	H	43,32	T	-	msow-3-hinc	87d

N= 17

CO=58 CNTYNAME=PINE WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030003	001		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	002		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	003		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	005		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	009		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	010		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	011		KETTLE R	-		H	18	-	-	mpca-2	87i
07030003	013		KETTLE R	-	-	H	18	-	-	mpca-2	87i
07030004	x03		Pokegama Cr	I	-	CB	62,65	SW	-	swcd-58	87e
07030005	029		ROCK CR	I	1mi	DGB	43	Z	-	swcd-58	87e
07030004	001		SNAKE R	I		DG	31,75,77	TW	-	swcd-58	87e
07030004	001		SNAKE R	-		GH	16,18,51	-	-	mpca-2	87i
07030004	003		SNAKE R	I	2mi	DG	31,75,77	TW	-	swcd-58	87e
07030004	003		SNAKE R	-	-	GH	16,18,51	-	-	mpca-2	87i

N= 14

CO=59 CNTYNAME=PIPESTONE WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		59-0002	Indian Lk	T	all	DEFI	19,80,90	Z	-	cza-59	86a
10170203		59-0001	Split Rock Lk	I	24.0sqmi	ABCDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UX	swcd-59	87h

N= 2

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=59 CNTYNAME=PIPESTONE WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
10170203	024		BEAVER CR	I	8.7sqmi	DFG	11,14,16,18,19,31,65,71,74,77	SW	TW	swcd-59	87h
10170204	034		CHANARAMBIE CR	I	14.0sqmicdfg	CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	TW	swcd-59	87h
10170204	435		E BR ROCK RIVER	I	114.0sqmi	ABCDEFG	11,14,16,18,19,31,32,41,43,51,62,63,65,71,74,77	SW	UW	swcd-59	87h
10170203	148		FLANDREAU CREEK	I	55.8sqmi	CDFG	11,14,16,18,19,31,65,71,74,77	SW	TW	swcd-59	87h
10170203	248		FLANDREAU CREEK	I		CDFG	11,14,16,18,19,31,65,71,74,77	SW	TW	swcd-59	87h
?	?		Hardwick	T	0.3sqmi	-	11,19,65	SW	SW	swcd-59	87h
?	?		Jd #1	T	all	DEFI	19,80,90	Z	-	cza-59	86a
10170203	033		PIPESTONE CR	-	all	H	40,19,11,18	-	-	msof-4-wind	86b
10170203	033		PIPESTONE CR	T	134.8sqmi	ABCDFG	11,12,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	033		PIPESTONE CR	-		-	-	-	-	cza-59	86a
10170203	034		PIPESTONE CR	-		H	40,19,11,18	-	-	msof-4-wind	86b
10170203	034		PIPESTONE CR	T		ABCDFG	11,12,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	034		PIPESTONE CR	-	-	-	-	-	-	cza-59	86a
10170204	036		POPLAR CR	T	3	EC	71,43	Y	Y	swcd-67	87c
10170204	036		POPLAR CR	I	31.0sqmi	CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
07020006	009		REDWOOD R	I	22.4sqmi	DFG	11,14,16,18,19,31,32,41,43,51,62,65,71,73,74,77	SW	UW	swcd-59	87h
10170204	033		ROCK R	T		DFG	11,16,18,19,31,65	SW	SW	swcd-59	87h
10170204	135		ROCK RIVER	T	5.1sqmi	DFG	11,16,18,19,31,65	SW	SW	swcd-59	87h
10170204	235		ROCK RIVER	T		DFG	11,16,18,19,31,65	SW	SW	swcd-59	87h
10170204	335		ROCK RIVER	T		DFG	11,16,18,19,31,65	SW	SW	swcd-59	87h
10170203	028		SPLIT ROCK CR	I		CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	029		SPLIT ROCK CR	I		CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	031		SPLIT ROCK CR	I		CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	032		SPLIT ROCK CR	I	52.4sqmi	CDFG	11,14,16,18,19,31,32,41,43,51,62,65,71,74,77	SW	UW	swcd-59	87h
10170203	053		SPRING CR	T	1.5sqmi	-	11,14,16,18,19,65	SW	SW	swcd-59	87h
10170203	036		W PIPESTONE CR	I	20.7sqmi	DFG	11,14,16,18,19,65,71,74,77	SW	TW	swcd-59	87h

N= 26

CO=60 CNTYNAME=POLK WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020305		60-0214	Badger Lk	I	80ac	ADIE	11,19	S	U	swcd-60e	87a
09020305		60-0214	Badger Lk	I	-	AB	62	SW	-	wd-rl	87e
09020305		60-0144	Breeze Lk	I	50ac	ABDE	16,11,19,14,	S	U	swcd-60e	87g
		60-?	Cable Lk	I	80ac	BED	11,19	S	U	swcd-60e	87a
		60-?	Cable Lk	T	-	AB	11,32,65	UX	-	wd-rl	87e
09020305		60-0189	Cameron Lk	I	-	ABD	41,43,62	SW	-	wd-rl	87e
09020305		60-0189	Cameron Lk	I	200ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
09020305		60-0027	Cross Lk	I	-	ABF	11,18	TW	-	wd-rl	87e
09020305		60-0027	Cross Lk	I	300ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
09020305		60-0142	Hill River Lk	I	120ac	ABDE	16,11,19,14	SZ	UZ	swcd-60e	87a
09020305		60-0142	Hill River Lk	I	-	ABD	11,14,16	TW	-	wd-rl	87e
		60-?	Jeppson	I	50ac	ABDE	16,11,19,14	S	U	swcd-60e	87a
09020301		60-0305	Maple Lk	I	all	ABDFG	11,19,40,65	TW	UX	msof-1-dl	86b
09020301		60-0305	Maple Lk	I	620ac	ED	41,43,11,19,14,16	TX	UX	swcd-60e	87a
09020301		60-0305	Maple Lk	I	-	ABDFG	19,11,65	TW	UX	msof-1-dl	87d

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By County, Waterbody Type, Name

CO=60 CNTYNAME=POLK WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020301		60-0305	Maple Lk	T	-	AB	11,32,43,65	UX	-	wd-rl	87e
09020305		60-0212	Mitchell Lk	I	40ac	ADIE	11,19	Z	Z	swcd-60e	87a
09020301		60-0119	Oaff Lk	T	120ac	AE	11,19	Z	Z	swcd-60e	87a
09020305		60-0185	Oak Lk	I	-	AB	11	SW	-	wd-rl	87e
09020305		60-0185	Oak Lk	I	250ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
		60-?	Perch Lk	I	-	ABF	11,18	SW	-	wd-rl	87e
09020305		60-0029	Perch Lk	I	50ac	ADE	11,19	S	T	swcd-60e	87a
09020305		60-0006	Poplar Lk	I	80ac	ADE	14,11,19	S	U	swcd-60e	87a
09020305		60-0006	Poplar Lk	-	-	-	-	-	-	wd-rl	87e
09020301		60-0069	Sand Hill Lk	I	500ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
09020305		60-0202	Sarah Lk	I	200ac	ABDE	16,11,19,14	SW	UX	swcd-60e	87g
09020305		60-0012	Spring Lk	I	100ac	DE	41,43	YU	SW	swcd-60e	87a
09020305		60-0012	Spring Lk	T	-	-	43	TX	-	wd-rl	87e
09020305		60-0130	Store Lk	I	100ac	ABDE	11,14,16,19	S	U	swcd-60e	87g
09020305		60-0032	Turtle Lk	I	-	ABF	11,18	SW	-	wd-rl	87e
09020305		60-0032	Turtle Lk	I	500ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
09020301		60-0217	Union Lk	I	910ac	FGH	90(19,32,65,76,?)	UX	-	mdow-1-trf	87c
09020301		60-0217	Union Lk	I	500ac	ABDE	11,14,16,19	SW	UX	swcd-60e	87g
09020305		60-0015	White Fish Lk	I	200ac	ADCE	16,11,19,18	S	U	swcd-60e	87a
09020305		60-0015	Whitefish Lk	I	-	AB	11,14	TW	-	wd-rl	87e

N= 35

CO=60 CNTYNAME=POLK WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020305	006		BADGER CR	T	6mi	E	11,19	Z	Z	swcd-60e	87a
09020305	013		CLEARWATER R	I	5mi	DGE	71,72,43,19,11	Z	Z	swcd-60e	87g
09020305	008		LOST R	I		E	11,19	S	T	swcd-60e	87a
09020305	010		LOST R	I		E	11,19	S	T	swcd-60e	87a
09020305	112		LOST RIVER	I	12mi	E	11,19	S	T	swcd-60e	87a
09020305	212		LOST RIVER	I		E	11,19	S	T	swcd-60e	87a
09020305	009		POPLAR R	T	30mi	E	11,19	Z	Z	swcd-60e	87a
09020303	001		RED LAKE R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	001		RED LAKE R	T	36mi	CDE	11,18,19	TX	SW	swcd-60w	87e
09020303	003		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	003		RED LAKE R	T		CDE	11,18,19	TX	SW	swcd-60w	87e
09020303	007		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	007		RED LAKE R	T		CDE	11,18,19	TX	SW	swcd-60w	87e
09020303	009		RED LAKE R	T		CDE	11,18,19	TX	SW	swcd-60w	87e
09020301	001		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020301	001		RED R	T	48mi	CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	003		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020301	003		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	004		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020301	004		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	008		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=60 CNTYNAME=POLK WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020301	008		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	010		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020301	010		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	011		RED R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020301	011		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020306	001		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020306	002		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020306	003		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020306	004		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020306	004		RED R	T	48mi	CDE	11,18,19	TW	SW	swcd-60w	87e
09020306	005		RED R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020306	005		RED R	T		CDE	11,18,19	TW	SW	swcd-60w	87e
09020301	012		SAND HILL CR	T	15mi	E	14,11,19,16	Z	Z	swcd-60e	87a
09020301	013		SAND HILL CR	T		E	14,11,19,16	Z	Z	swcd-60e	87a

N= 35

CO=61 CNTYNAME=POPE WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005	009	61-0064	Amelia Lk	I	all	BG	19,11,65,18,40	TX	U	msof-1-glen	86b
07020005	009	61-0064	Amelia Lk	I	–	BG	19,11,65,16	TX		msof-i-glen	87d
07020005	009	61-0064	Amelia Lk	T	–	BDFG	11,12,14,18,19,65	TW	UX	swcd-61	87g
07020005		61-0122	Ann Lk	I	–	ABDF	19,11,20,16	SW	UX	cza-61	87b
07020005		61-0122	Ann Lk	I	–	ABDF	19,11,20,16	SW	UX	cza-61	87f
07020005		61-0122	Ann Lk	I	all	ABDF	19,11,20,18	SW	UX	cza-61	86a
07020005	009	61-0072	Gilchrist Lk	I	321ac	ABDG	11,12,14,16,19,65,76	TW	UY	msof-i-glen	87f
07020005	009	61-0072	Gilchrist Lk	I	–	ABDG	11,12,14,18,19,65,76	TW	UX	swcd-61	87g
07010204	012	61-0023	Grove	I	all	ABDFG	19,11,65	SW	TX	msof-1-glen	86b
07010204	012	61-0023	Grove Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87b
07010204	012	61-0023	Grove Lk	I	–	ABDFG	19,11,65	SW	TX	msof-i-glen	87d
07010204	012	61-0023	Grove Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87f
07010204	012	61-0023	Grove Lk	I	–	ABDFG	11,12,14,18,19,71,65	TW	UX	swcd-61	87g
07010204	012	61-0023	Grove Lk	I	376ac	ABDFG	11,14,19	TX	S	wd-nfcr	87k
07010204	012	61-0023	Grove Lk	I	all	ABDF	19,11,20,40	TW	UX	cza-61	86a
07020005		61-0006	Johanna Lk	I	–	DFG	11,12,16,18,19,65	SW	UX	swcd-61	87g
07020005		61-0078	Lake Reno	I	–	ABDF	11,18,19	SWZ	TZ	swcd-21	87a
07020005		61-0066	Leven Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87b
07020005		61-0066	Leven Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87f
07020005		61-0066	Leven Lk	I	all	ABDF	19,11,20	TW	UX	cza-61	86a
07020005	009	61-0037	Linka Lk	I	–	BDFG	11,12,14,16,18,19,65	TW	UX	swcd-61	87g
07020005	009	61-0037	Linka Lk	I	600ac	B	14	T	U	mdof-151	87h
07020005	016	61-0130	Minnewaska Lk	T	all	BFG	40,19,11,65,18	UVX	UVX	msof-1-glen	86b
07020005	016	61-0130	Minnewaska Lk	I	–	BDFG	43,19,11,20	UW	X	cza-61	87b
07020005	016	61-0130	Minnewaska Lk	I	–	BFG	43,19,11,65,16	UVX	UVX	msof-i-glen	87d
07020005	016	61-0130	Minnewaska Lk	I	–	BDFG	43,19,11,20	UW	X	cza-61	87f
07020005	016	61-0130	Minnewaska Lk	T	–	BFG	11,12,18,19,41,43	TW	UX	swcd-61	87g

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=61 CNTYNAME=POPE WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005	016	61-0130	Minnewaska Lk	I	all	BDFG	40,19,11,20	UW	X	cza-61	86a
07020005		61-0111	Pelican Lk	I	all	ABDFG	19,11,65	TX	UX	msof-1-glen	86b
07020005		61-0111	Pelican Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87b
07020005		61-0111	Pelican Lk	I	–	ABDFG	19,11,65	TX	UX	msof-i-glen	87d
07020005		61-0111	Pelican Lk	I	–	ABDF	19,11,20	TW	UX	cza-61	87f
07020005		61-0111	Pelican Lk	I	–	BDFG	11,18,19,65	TW	UX	swcd-61	87g
07020005		61-0111	Pelican Lk	I	all	ABDF	20,19,11,40	TW	UX	cza-61	86a
07020005		61-0078	Reno Lk	I	3722ac	BDG	11,12,14,16,19,65,76	TW	UX	msof-i-glen	87f
07020005		61-0078	Reno Lk	T	–	BDFG	11,14,16,18,19,65,71,76	TW	UX	swcd-61	87g
07020005		61-0034	Simon Lk	I	–	ABDFG	11,14,18,19,71	Z	Z	swcd-61	87g

N= 37

CO=61 CNTYNAME=POPE WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002	004			I		DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020005	004		CHIPPEWA R	I		DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020005	010		CHIPPEWA R	I		DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020005	017		CHIPPEWA R	I		DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020005	017		CHIPPEWA R	I		DFG	11,12,14,16,18,19,71,76,77	SW	UX	swcd-61	87g
07020005	022		CHIPPEWA R	I	–	DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020005	022		CHIPPEWA R	I	–	DFG	11,12,14,16,18,19,71,76,77	SW	UX	swcd-61	87g
07020005	007		CHIPPEWA R, E BR	I	–	DFG	11,12,14,16,18,19,71,76,77	SW	TY	msof-i-glen	87f
07020005	009		CHIPPEWA R, E BR	I		DFG	11,12,14,16,18,19,71,76,77	SW	TY	msof-i-glen	87f
07020005	009		CHIPPEWA R, E BR	I	–	DFG	11,12,14,16,18,19,71,76,77	SW	UX	swcd-61	87g
07020002	001		POMME DE TERRE R	I	–	DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f
07020002	002		POMME DE TERRE R	I		DFG	11,12,14,16,18,19,71,76,77	TW	UY	msof-i-glen	87f

N= 12

CO=62 CNTYNAME=RAMSEY WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		62-0002	Bald Eagle Lk	I	1046ac	ABD	41,43,65	TW	UX	mdow-co	87c
07010206		62-0002	Bald Eagle Lk	I	10120ac	–	63,65,43	XZU	–	wd-rc	87e
07010206		62-0002	Bald Eagle Lk	I	10120ac	–	63,65,43	XZU	–	wd-rc	87k
07010206		62-0080	Emily Lk	I	12ac	AB	41,43	S	T	mdow-co	87c
07010206		62-0007	Gervais Lk	I	–	BDG	41,43,31,32,77	TW	UX	wd-rw	87e
07010206		62-0075-01	Island Lk	I	56ac	–	32	U	–	wd-rc	87e
07010206		62-0075-02	Island Lk	I		–	32	U	–	wd-rc	87e
07010206		62-0075-01	Island Lk	I	56ac	–	32	U	–	wd-rc	87k
07010206		62-0075-02	Island Lk	I		–	32	U	–	wd-rc	87k
07010206		62-0078	Johanna Lk	I	200ac	–	32	XU	–	wd-rc	87e

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=62 CNTYNAME=RAMSEY WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010206		62-0078	Johanna Lk	I	200ac	–	32	XU	–	wd-rc	87k
07010206		62-0076	Jones Lk	I	13	–	43	S	–	wd-rc	87e
07010206		62-0076	Jones Lk	I	13ac	–	43	S	–	wd-rc	87k
07010206		62-0057	Josephine Lk	I	118ac	–	43	XU	–	wd-rc	87e
07010206		62-0057	Josephine Lk	I	118ac	–	43	XU	–	wd-rc	87k
07010206		62-0081	Judy Lk	I	16ac	ABDG	41,43	S	T	mdow-co	87c
07010206		62-0072	Karth Lk	I	15ac	–	32,43	S	–	wd-rc	87e
07010206		62-0072	Karth Lk	I	15ac	–	32,43	S	–	wd-rc	87k
07010206		62-0044	Langton Lk	I	30ac	–	43	S	–	wd-rc	87k
07010206		62-0049-01	Langton Lk	I	30ac	–	43	S	–	wd-rc	87e
07010206		62-0049-02	Langton Lk	I		–	43	S	–	wd-rc	87e
07010206		62-0058	Little Johanna	I	35ac	–	43	S	–	wd-rc	87k
07010206		62-0058	Little Johanna Lk	I	35ac	–	43	S	–	wd-rc	87e
07010206		62-0007	Lk Gervais	I	234ac	BDG	41,43,31,32,77	TW	UX	wd-rwm	87j
07010206		62-0013	Lk Phalen	I	193ac	BD	41,43,31,32,77	SW	UX	wd-rwm	87j
07010206		62-0067	Long Lk	I	178ac	–	32,43	XZT	Z	wd-rc	87e
07010206		62-0067	Long Lk	I	178ac	–	32,43	XZT	Z	wd-rc	87k
07010206		62-0059	Marsden Lk	I	260ac	–	–	S	–	wd-rc	87e
07010206		62-0059	Marsden Lk	I	260ac	–	–	S	–	wd-rc	87k
07010206		62-0056	Owasso Lk	I	360ac	ABD	41,43	WT	WU	mdow-co	87c
07010206		62-0013	Phalen Lk	I	–	BD	41,43,31,32,77	SW	UX	wd-rw	87e
07010206		62-0069	Pike Lk	I	35ac	–	43	T	–	wd-rc	87e
07010206		62-0069	Pike Lk	I	35ac	–	43	T	–	wd-rc	87k
07010206		62-0077	Poplar Lk	I	11ac	–	32,43	S	–	wd-rc	87e
07010206		62-0077	Poplar Lk	I	11ac	–	32,43	S	–	wd-rc	87k
07010206		62-0036	Priebe Lk	I	6ac	–	43	S	–	wd-rc	87e
07010206		62-0036	Priebe Lk	I	6ac	–	43	S	–	wd-rc	87k
07010206		62-0070	Round	I	122ac	–	32,43	S	–	wd-rc	87k
07010206		62-0070	Round Lk	I	122ac	–	32,43	S	–	wd-rc	87e
07010206		62-0068	Rush Lk	I	36ac	–	–	ZS	–	wd-rc	87e
07010206		62-0068	Rush Lk	I	36ac	–	–	ZS	–	wd-rc	87k
07010206	002	62-0083	Silver Lk	I	69.5ac	–	32,43	U	–	wd-rc	87e
07010206	002	62-0083	Silver Lk	I	69.5ac	–	32,43	U	–	wd-rc	87k
07010206		62-0065	Sunfish Lk	I	14ac	–	41	S	–	wd-rc	87e
07010206		62-0065	Sunfish Lk	I	14ac	–	41	S	–	wd-rc	87k
07010206		62-0061	Turtle Lk	T	444ac	DF	41,43,	UX	UX	mdow-co	87c
07010206		62-0061	Turtle Lk	I	502ac	–	32,43	XU	–	wd-rc	87e
07010206		62-0061	Turtle Lk	I	502ac	–	32,43	XU	–	wd-rc	87k
07010206		62-0071	Valentine Lk	I	56ac	–	–	S	–	wd-rc	87e
07010206		62-0071	Valentine Lk	I	56ac	–	–	S	–	wd-rc	87k
07010206		62-0082	Wabasso Lk	I	47ac	ABD	41	WT	XU	mdow-co	87c

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=63 CNTYNAME=RED LAKE WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020303	107			I		F	11,18,14	UX	-	wd-rl	87h
09020303	207			I		F	11,18,14	UX	-	wd-rl	87h
09020303	017		*D	T	8	DF	11,18,19	SW	SW	swcd-63	87e
09020305	013		CLEARWATER R	T	35	DF	11,12,19	TW	UX	swcd-63	87e
09020305	013		CLEARWATER R	T	-	F	11,12,56,71	TX	-	wd-rl	87h
09020305	013		CLEARWATER R	T	all	D	11	U	Z	cza-63	86a
09020305	015		CLEARWATER R	T		F	11,12,56,71	TX	-	wd-rl	87h
09020305	011		HILL R	T	13	DF	11,19	SW	SW	swcd-63	87e
09020305	011		HILL R	I	-	F	11,18	TW	-	wd-rl	87h
09020305	012		LOST R	I	-	ACF	11,41,18	TW	-	wd-rl	87h
09020305	012		LOST R	T	all	D	11,40	T	-	cza-63	86a
09020305	112		LOST RIVER	T	13	DF	11,19	SW	SW	swcd-63	87e
09020305	212		LOST RIVER	T		DF	11,19	SW	SW	swcd-63	87e
09020305	009		POPLAR R	T	7	DF	11,19	SW	VY	swcd-63	87e
09020303	001		RED LAKE R	I	-	F	11,18,14	UX	-	wd-rl	87h
09020303	003		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	009		RED LAKE R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	009		RED LAKE R	T	18	DF	11,19	TW	UX	swcd-63	87e
09020303	009		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	010		RED LAKE R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020303	010		RED LAKE R	T		DF	11,19	TW	UX	swcd-63	87e
09020303	010		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	012		RED LAKE R	T		DF	11,19	TW	UX	swcd-63	87e
09020303	012		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	013		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	014		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	015		RED LAKE R	I		F	11,18,14	UX	-	wd-rl	87h
09020303	015		RED LAKE R	T	all	D	11	U	Z	cza-63	86a
09020304	001		THIEF R	I	-	AF	11,18	SW	-	wd-rl	87h

N= 29

CO=64 CNTYNAME=REDWOOD WBT=AQUIFER ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-1120tsh	Surficial Aqf	T	-	-	19	-	-	swcd-64	87i

N= 1

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=64 CNTYNAME=REDWOOD WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020008		64-0070	Daub Lk	T	120ac	DG	11,76	Z	-	swcd-64	87i
07020006		64-0058	Redwood Lk	I	-	BHI	90	SW	TX	cza-64	87b
07020006		64-0058	Redwood Lk	I	67ac	ABCDEFGH	11,19,41,43,76,71	SW	UX	mdow-4-nu	87b
07020006		64-0058	Redwood Lk	I	60ac	BDAGF	11,16,19,41,43,77	SWZ	-	swcd-64	87i
07020006		64-0058	Redwood Lk	I	-	ADF	11,16,19	SW	UX	mpca-4	87i
07020006		64-0058	Redwood Lk	I	all	BDH	90	SW	TX	cza-64	86a
07020008		64-0044	Willow Lk	I	162ac	ABCDEFGH	11,19,76,71	SW	SW	mdow-4-nu	87b

N= 7

CO=64 CNTYNAME=REDWOOD WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020008	001		COTTONWOOD R	I		ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	003		COTTONWOOD R	I		ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	005		COTTONWOOD R	I		ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	006		COTTONWOOD R	I		HI	11,16,90	SW	YW	cza-64	87b
07020008	006		COTTONWOOD R	I		ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	006		COTTONWOOD R	I		DH	11,18,90	SW	YW	cza-64	86a
07020008	007		COTTONWOOD R	I		HI	11,16,90	SW	YW	cza-64	87b
07020008	007		COTTONWOOD R	I		ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	007		COTTONWOOD R	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	007		COTTONWOOD R	I		DH	11,18,90	SW	YW	cza-64	86a
07020008	008		COTTONWOOD R	I	150mi	ABCDEFGH	11,19,41,43,76,71	TVW	UVX	mdow-4-nu	87b
07020008	008		COTTONWOOD R	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	008		COTTONWOOD R	I		DH	11,18,90	SW	YW	cza-64	86a
07020008	009		COTTONWOOD R	I	-	HI	11,16,90	SW	YW	cza-64	87b
07020008	009		COTTONWOOD R	I	65mi	CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	009		COTTONWOOD R	I	all	DH	11,18,90	SW	YW	cza-64	86a
07020008	016		DRY CR	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	013		DUTCH CHARLIE CR	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	014		DUTCH CHARLIE CR	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020008	015		HIGHWATER CR	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020004	001		MINNESOTA R	I	-	HI	11,16,90	TW	TW	cza-64	87b
07020004	001		MINNESOTA R	I		CDFG	11,74,77	TZ	-	swcd-64	87i
07020004	005		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020004	005		MINNESOTA R	I		CDFG	11,74,77	TZ	-	swcd-64	87i
07020004	005		MINNESOTA R	T	all	DH	11,18,90	TW	TW	cza-64	86a
07020004	006		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020004	006		MINNESOTA R	I		CDFG	11,74,77	TZ	-	swcd-64	87i
07020004	006		MINNESOTA R	T		DH	11,18,90	TW	TW	cza-64	86a
07020004	008		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020004	008		MINNESOTA R	I	42mi	CDFG	11,74,77	TZ	-	swcd-64	87i
07020004	008		MINNESOTA R	T		DH	11,18,90	TW	TW	cza-64	86a
07020004	010		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020004	010		MINNESOTA R	T	all	DH	11,18,90	TW	TW	cza-64	86a
07020007	018		MINNESOTA R	I	-	HI	11,16,90	TW	TW	cza-64	87b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=64 CNTYNAME=REDWOOD WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020007	018		MINNESOTA R	I	42mi	CDFG	11,74,77	TZ	-	swcd-64	87i
07020007	019		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020007	019		MINNESOTA R	I		CDFG	11,74,77	TZ	-	swcd-64	87i
07020007	021		MINNESOTA R	I		HI	11,16,90	TW	TW	cza-64	87b
07020007	021		MINNESOTA R	I		CDFG	11,74,77	TZ	-	swcd-64	87i
07020008	012		PLUM CR	I		CDF	11,14,19,51,43,77,76	TZ	-	swcd-64	87i
07020006	002		RAMSEY CR	I	-	HI	11,16,90	WV	YW	cza-64	87b
07020006	002		RAMSEY CR	I	30mi	ABCDEFGH	11,19,41,43,71,76	VYT	UVY	mdow-4-nu	87b
07020006	002		RAMSEY CR	I	25mi	CDFG	11,19,72,77,76	V	-	swcd-64	87i
07020006	002		RAMSEY CR	T	all	DH	11,18,90	WV	YW	cza-64	86a
07020006	001		REDWOOD R	I	-	HI	11,16,90	SW	YW	cza-64	87b
07020006	001		REDWOOD R	I		ABCDEFGH	11,19,41,43,76,71	SW	UX	mdow-4-nu	87b
07020006	001		REDWOOD R	I	40mi	CDEFG	11,16,19,63,66,71,72,77,76	SZ	-	swcd-64	87i
07020006	003		REDWOOD R	I		HI	11,16,90	SW	YW	cza-64	87b
07020006	003		REDWOOD R	I		ABCDEFGH	11,19,41,43,76,71	SW	UX	mdow-4-nu	87b
07020006	003		REDWOOD R	I		CDEFG	11,16,19,63,66,71,72,77,76	SZ	-	swcd-64	87i
07020006	004		REDWOOD R	I		HI	11,16,90	SW	YW	cza-64	87b
07020006	004		REDWOOD R	I	50mi	ABCDEFGH	11,19,41,43,76,71	SW	UX	mdow-4-nu	87b
07020006	004		REDWOOD R	I		CDEFG	11,16,19,63,66,71,72,77,76	SZ	-	swcd-64	87i

N= 53

CO=65 CNTYNAME=RENVILLE WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205		65-0006	Alley Lk	I	-	ABDF	11,16,19	TW	U	mpca-4	87i
07010205		65-0006	Allie Lk	I	510ac	ABCDEFGH	11,19,65,76,71	UW	UX	mdow-4-nu	87b
07010205		65-0006	Allie Lk	I	510ac	ABDEFGH	11,18,19,65	SW	UX	swcd-65	87f
07020004		65-0108	Beckendorf Lk	T	59	ABDEFGH	-	-	-	swcd-65	87e
07010205		65-0013	Boon Lk	I	857ac	ABDEFGH	11,18,19	Z	Z	swcd-65	87f
07010205		65-0010	Hodgson Lk	I	156ac	ABDEFGH	11,19	Z	Z	swcd-65	87f
07020004		65-0100	Long Lk	T	443	ABDEFGH	-	-	-	swcd-65	87e
		??-?	Mud Lk	I	-	ABDEFGH	11,18,19	Z	Z	swcd-65	87f
07010205		65-0012	Phare Lk	I	137ac	ABDEFGH	11,19	Z	Z	swcd-65	87f
07010205		65-0002	Preston Lk	I	678ac	ABCDEFGH	11,19,65,76,71	UW	UX	mdow-4-nu	87b
07010205		65-0002	Preston Lk	I	678ac	ABDEFGH	11,18,19,65	SW	UX	swcd-65	87f
07020007		65-0028	Round Lk	I	148ac	ABDEFGH	11,19	Z	Z	swcd-65	87f
07020004		65-0124	Unknown	T	-	ABDEFGH	-	-	-	swcd-65	87e

N= 13

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=65 CNTYNAME=RENVILLE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020007	x20		Birch Cooley Cr	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f
07020004	002		BEAVER CR	T	-	DEFGH	11,18,19,63	Z	Z	swcd-65	87f
07020004	004		BEAVER CR, W FK	T		DEFGH	11,18,19,63	Z	Z	swcd-65	87f
07020004	103		BEAVER CREEK (CD 63)	T		DEFGH	11,18,19,63	Z	Z	swcd-65	87f
07020004	203		BEAVER CREEK (CD 63)	T		DEFGH	11,18,19,63	Z	Z	swcd-65	87f
07010205	007		BUFFALO CR	T		DEFGH	-	-	-	swcd-65	87e
07010205	008		BUFFALO CR	T	-	DEFGH	-	-	-	swcd-65	87e
?	?		Cd 35a	T	all	I	80	YZ	YZ	cza-65	86a
07020004	013		CHETOMBA CR	T	12	DEFGH	-	-	-	swcd-65	87e
07020007	017		FORT RIDGLEY CR	T	-	DEFGH	-	-	-	swcd-65	87e
07020004	012		HAWK CR	I		ABCDEFGH	11,19,41,43,71,76	YT	UY	mdow-4-nu	87b
07020004	012		HAWK CR	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f
07020004	014		HAWK CR	I	50mi	ABCDEFGH	11,19,41,43,71,76	YT	UY	mdow-4-nu	87b
07020004	014		HAWK CR	T		DEFGH	11,18,19	Z	Z	swcd-65	87f
?	?		Jd 15	T	all	GH	18	YZ	YZ	cza-65	86a
07020007	014		LITTLE ROCK CR	T	-	DEFGH	-	-	-	swcd-65	87e
07020004	x06		Middle Cr	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f
07020004	001		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	005		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020004	005		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	006		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	008		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020004	008		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	010		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020004	010		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	011		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020004	011		MINNESOTA R	I	-	DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	015		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020004	016		MINNESOTA R	I	115mi	ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	001		MINNESOTA R	I	115mi	ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	010		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	011		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	013		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	015		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	016		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	018		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	018		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020007	019		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	019		MINNESOTA R	I		DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020007	021		MINNESOTA R	I		ABCDEFGH	11,19,41,43,76,71	TW	UX	mdow-4-nu	87b
07020007	021		MINNESOTA R	I	-	DEFGH	66,11,18,19,62	TW	UZ	swcd-65	87f
07020004	x06		Smith Cr	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f
07020004	009		SACRED HEART CR	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f
07020007	x18		Three Mile Cr	T	-	DEFGH	-	-	-	swcd-65	87e
07020004	007		TIMMS CR	T	-	DEFGH	11,18,19	Z	Z	swcd-65	87f

N= 45

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=65 CNTYNAME=RENVILLE WBT=WETLAND ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		65-0004w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e
		65-0117w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e
		65-0129w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e
		65-0082w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e
		65-0129w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e
		65-0144w	Unknown	T	–	ABDEFGH	–	–	–	swcd-65	87e

N= 6

CO=66 CNTYNAME=RICE WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	015	66-0008	Cannon Lk	I	–	BDF	19,11,65	T	U	msof-4-wate	86b
07040002	015	66-0008	Cannon Lk	I	1476ac	ABDF	11,19,80	TW	UX	mdow-5-roch	87c
07040002	015	66-0008	Cannon Lk	I	1476ac	BCDEF	11,14,19,41,43,65,72,76	TW	UX	msow-5-owat	87c
07040002	015	66-0008	Cannon Lk	T	1476ac	BCF	11,16,19	U	U	swcd-66	87g
07040002	015	66-0008	Cannon Lk	–	–	BDF	19,11,65	T	U	msof-4-wate	87h
07040002	015	66-0008	Cannon Lk	T	–	BD	14	UX	–	mdof-545	87h
07040002	015	66-0008	Cannon Lk	I	all	ABCDFG	40,19,11,50,65,18,30	T	U	cza-66	86a
07040002		66-0052	Cedar Lk	T	927ac	BC	11,19,65	TW	UX	mdow-5-roch	87c
07040002		66-0052	Cedar Lk	T	927ac	BCF	11,16,19	U	U	swcd-66	87g
07040002		66-0052	Cedar Lk	I	all	ABCDFG	11,19,18,65,40,30	–	–	cza-66	86a
07040002		66-0027	Circle Lk	T	–	ABF	19,11	U	U	msof-4-wate	86b
07040002		66-0027	Circle Lk	–	–	ABF	19,11	U	U	msof-4-wate	87d
07040002		66-0027	Circle Lk	T	976ac	BDF	11,16,19	U	U	swcd-66	87g
07040002		66-0027	Circle Lk	T	–	B	11	U	–	mdof-545	87h
07040002		66-0027	Circle Lk	I	all	ABCDFG	11,19,65,18,40,30	S	U	cza-66	86a
07040002		66-0014	Dudley Lk	T	–	B	19;11	U	U	msof-4-wate	86b
07040002		66-0014	Dudley Lk	–	–	B	19,11,	U	U	msof-4-wate	87d
07040002		66-0014	Dudley Lk	I	all	ABCD	19,11,65,18,30	T	U	cza-66	86a
07040002		66-0029	Fox Lk	I	–	B	19,11	T	U	msof-4-wate	86b
07040002		66-0029	Fox Lk	–	–	B	19,11	T	U	msof-4-wate	87d
07040002		66-0029	Fox Lk	T	330ac	BCD	11,16,19	U	U	swcd-66	87g
07040002		66-0029	Fox Lk	I	all	ABCDFG	11,19,65,18,40,30	T	U	cza-66	86a
07040002		66-0038	French Lk	T	–	B	19,11,65,40	U	U	msof-4-wate	86b
07040002		66-0038	French Lk	I	842ac	ABCF	11,18,19,65	UW	UX	mdow-5-roch	87c
07040002		66-0038	French Lk	–	–	B	19,11,65	U	U	msof-4-wate	87d
07040002		66-0038	French Lk	T	842ac	CE	11,16,19	U	U	swcd-66	87g
07040002		66-0038	French Lk	T	–	BC	16	UX	–	mdof-545	87h
07040002		66-0038	French Lk	I	all	ABCDFG	11,19,65,18,40,30	T	U	cza-66	86a
07040002	017	66-0047	Hunt Lk	I	–	BF	19,65,40	T	U	msof-4-wate	86b
07040002	017	66-0047	Hunt Lk	–	–	BF	19,11,65	T	U	msof-4-wate	87d
07040002	017	66-0047	Hunt Lk	T	190ac	BC	11,16,19	U	U	swcd-66	87g
07040002	017	66-0047	Hunt Lk	I	all	ABCDFG	11,19,18,65,40,30	–	–	cza-66	86a
07040002		66-0015	Kelly	T	–	B	19,11	U	U	msof-4-wate	86b
07040002		66-0015	Kelly Lk	–	–	B	19,11	U	U	msof-4-wate	87d
07040002		66-0015	Kelly Lk	I	all	ABCD	19,11,65,18,30	T	U	cza-66	86a

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By County, Waterbody Type, Name

CO=66 CNTYNAME=RICE WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002		66-0044	Lower Sakatah	T	-	BDF	19,11,65	S	S	msof-4-wate	86b
07040002		66-0044	Lower Sakatah Lk	-	-	BDF	19,11,65	S	S	msof-4-wate	87h
		66-0095	Lyman Lk	I	-	BDEFG	19,11,30	SW	UX	msof-5-lc	86b
07040002		66-0039	Mazaska Lk	T	-	B	19,11,65,40	U	U	msof-4-wate	86b
07040002		66-0039	Mazaska Lk	I	687ac	BC	11,19,65	TW	UX	mdow-5-roch	87c
07040002		66-0039	Mazaska Lk	-	-	B	19,11,65	U	U	msof-4-wate	87d
07040002		66-0039	Mazaska Lk	T	687ac	BC	11,16,19	U	U	swcd-66	87g
07040002		66-0039	Mazaska Lk	I	all	ABCDFG	11,19,65,18,40,30	T	U	cza-66	86a
07040002		66-0048	Rice Lk	I	-	BD	19,11	S	T	msof-4-wate	86b
07040002		66-0048	Rice Lk	-	-	BD	19,11	S	T	msof-4-wate	87d
07040002		66-0018	Roberdg Lk	I	654ac	B	11,19,65	TW	UX	mdow-5-roch	87c
07040002		66-0018	Roberds Lk	T	-	ABFG	19,11,65,18,40	U	U	msof-4-wate	86b
07040002		66-0018	Roberds Lk	-	-	ABFG	19,11,65	U	U	msof-4-wate	87d
07040002		66-0018	Roberds Lk	T	654ac	BCDF	11,16,19	U	U	swcd-66	87g
07040002		66-0018	Roberds Lk	T	-	BC	16	UX	-	mdof-545	87h
07040002		66-0018	Roberds Lk	I	all	ABCDFG	19,11,65,18,30,40	T	U	cza-66	86a
07040002		66-0055	Shields Lk	T	-	B	19,11,65,40	U	U	msof-4-wate	86b
07040002		66-0055	Shields Lk	-	-	B	19,11,65	U	U	msof-4-wate	87d
07040002		66-0055	Shields Lk	T	877ac	BCF	11,16,19	U	U	swcd-66	87g
07040002		66-0055	Shields Lk	I	all	ABCDFG	11,19,18,65,40,30	-	-	cza-66	86a
07040002		66-0032	Union	I	-	ABF	19,11	S	T	msof-4-wate	86b
07040002		66-0032	Union Lk	-	-	ABF	19,11	S	T	msof-4-wate	87d
07040002		66-0032	Union Lk	T	498ac	BCDF	11,16,19	S	U	swcd-66	87g
07040002		66-0032	Union Lk	I	all	ABCDFG	11,19,65,18,40,30	S	T	cza-66	86a
07040002		66-0010	Wells Lk	T	-	BDF	19,11	S	S	msof-4-wate	86b
07040002		66-0010	Wells Lk	I	634ac	BCDEF	11,19,43	SW	-	msow-5-owat	87c
07040002		66-0010	Wells Lk	-	-	BDF	19,11	S	S	msof-4-wate	87h

N= 62

CO=66 CNTYNAME=RICE WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	015			I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	016			I		BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c
07040002	016			I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	014		CANNON L (CANNON R)	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	014		CANNON L (CANNON R)	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	001		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	002		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	004		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	005		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	006		CANNON R	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	006		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	008		CANNON R	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	008		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	008		CANNON R	I		BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c

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By County, Waterbody Type, Name

CO=66 CNTYNAME=RICE WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	008		CANNON R	I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	010		CANNON R	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	010		CANNON R	I	-	BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	010		CANNON R	I		BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c
07040002	010		CANNON R	I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	012		CANNON R	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	012		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	012		CANNON R	I		BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c
07040002	012		CANNON R	I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	013		CANNON R	T		DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	013		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	013		CANNON R	I		BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c
07040002	013		CANNON R	I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	017		CANNON R	T	-	DEFG	11,18,19	U	U	msof-4-wate	86b
07040002	017		CANNON R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	017		CANNON R	I	110mi	BCDEFG	11,19,43,41,65,73,74	TW	U	msow-5-owat	87c
07040002	017		CANNON R	I	all	ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	020		CRANE CR	T	8	DEFG	11,14,71,76,77	T	T	msof-5-lc	87h
07040002	009		HEATH CR	T	5	DEFG	11,14,76,77	SZ	SZ	msof-5-lc	87h
07040002	031		MAPLE CR	T	15	CDEFG	11,14,62,71,73,76,77	SZ	SZ	msof-5-lc	87h
07040002	018		STRAIGHT R	I	-	BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	018		STRAIGHT R	I		CDEFG	71,73,77,11,19,41,43,18	SW	U	msow-5-owat	87c
07040002	018		STRAIGHT R	I	all	ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	019		STRAIGHT R	I		ABCDFG	40,19,11,50,65,18,30	SW	UX	cza-66	86a
07040002	021		STRAIGHT R	I		CDEFG	71,73,77,11,19,41,43,18	SW	U	msow-5-owat	87c
07040002	022		STRAIGHT R	I		CDEFG	71,73,77,11,19,41,43,18	SW	U	msow-5-owat	87c
07040002	023		STRAIGHT R	I	45mi	CDEFG	71,73,77,11,19,41,43,18	SW	U	msow-5-owat	87c
07040002	028		STRAIGHT R	I	-	BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	030		TURTLE CR	T	17	DEFG	11,14,71,76,77	TWZ	TWZ	msof-5-lc	87h
07040002	011		WOLF CR	T	3	DEFG	11,14,76,77	SZ	SZ	msof-5-lc	87h

N= 44

CO=67 CNTYNAME=ROCK WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
10170204	037		*G	T	9	EC	71	Y	Y	swcd-67	87c
10170204	x25		Ash Cr	T	8	EC	71	Y	Y	swcd-67	87c
10170203	020		BEAVER CR	T	25	EC	43	Y	Y	swcd-67	87c
10170203	021		BEAVER CR	T		EC	43	Y	Y	swcd-67	87c
10170203	022		BEAVER CR	T		EC	43	Y	Y	swcd-67	87c
10170203	024		BEAVER CR	T		EC	43	Y	Y	swcd-67	87c
10170204	028		CHAMPEPADAN CR	T	5	EC	71	Y	Y	swcd-67	87c
?	?		Devil Run	T	4	EC	71	Y	Y	swcd-67	87c
10170204	026		ELK CR	T	10	EC	71	Y	Y	swcd-67	87c
10170204	020		KANARANZI CR	T		EC	71	Y	Y	swcd-67	87c
10170204	022		KANARANZI CR	T	8	EC	71	Y	Y	swcd-67	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=67 CNTYNAME=ROCK WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
10170204	x38		Mud Cr	T	10	EC	71,43	Y	Y	swcd-67	87c
10170204	025		ROCK R	T	30	EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	027		ROCK R	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	029		ROCK R	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	031		ROCK R	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	032		ROCK R	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	033		ROCK R	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	135		ROCK RIVER	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	235		ROCK RIVER	T		EC	11,18,19,43	Y	Y	swcd-67	87c
10170204	335		ROCK RIVER	T		EC	11,18,19,43	Y	Y	swcd-67	87c
?	?		Springwater Cr	T	6	EC	-	Y	Y	swcd-67	87c
10170203	031		SPLIT ROCK CR	T	4	EC	-	Y	Y	swcd-67	87c

N= 23

CO=68 CNTYNAME=ROSEAU WBT=LAKE ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030009	014	39-0002	Lk Of The Woods	T	-	E	19,56	UW	-	swcd-68	87e
		68-0021	S Hanks Lk	T	60ac	ADEG	11,18,19,71	Z	Z	msow-1-karl	87b

N= 2

CO=68 CNTYNAME=ROSEAU WBT=STREAM ECOREGN=NMW

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020314	202		BADGER CREEK	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020314	102		DT TO ROSEAU RIVER	T	-	ED	11,14,19,71	SW	-	swcd-68	87e
09020314	006		HAY CR	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020312	104		LATERAL 2 OF STATE DT 95	T		ED	11,14,19	S	-	swcd-68	87e
09020314	002		ROSEAU R	I	-	ACDEFG	11,18,19,65,71,77	T	UW	msow-1-karl	87b
09020314	002		ROSEAU R	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020314	003		ROSEAU R	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020314	005		ROSEAU R	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020314	004		ROSEAU R, S FK	T		ED	11,14,19,71	SW	-	swcd-68	87e
09020312	004		TWO RIVERS, S BR	T	-	ED	11,14,19	S	-	swcd-68	87e
09030009	008		WARROAD R	T	-	ED	11,14,19	SW	-	swcd-68	87e
09030009	010		WARROAD R, E BR	T		ED	11,14,19	SW	-	swcd-68	87e
09030009	009		WARROAD R, W BR	T		ED	11,14,19	SW	-	swcd-68	87e

N= 13

CO=69 CNTYNAME=ST LOUIS WBT=? ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
insufdef			many lakes affected by sewage	-	-	-	-	-	-	mdow-2-gr	87c

N= 1

CO=69 CNTYNAME=ST LOUIS WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
04010202		69-0506	Baby Grand Lk	I	-	BC	65	UX	-	mdof-211	87i
		69-?	Bass Lk	T	-	B	65	TX	UX	mdof-214	87h
04010201		69-0553	Bass Lk	T	3mi	B	65	TW	TW	swcd-69n	87g
		69-1012	Bryan Lk	T	.5mi	B	43	SW	SW	swcd-69n	87g
04010202		69-0489	Caribou Lk	T	700ac	EC	80,65	T	U	mdof-252	87i
09030002	003	69-0616	Crane Lk	I	all	EB	90,65	U	UX	msof-2-if	86b
09030002	003	69-0616	Crane Lk	-	3088	EB	90,65	UX	UX	msof-2-if	87i
04010201		69-0666	Deep Lk	I	-	DF	43	T	-	mdof-234	87b
04010201		69-0717	Elbow Lk	I	all	AB	41,65,62	Y	Y	mdow-2-gr	87c
04010201		69-0717	Elbow Lk	I	-	B	90	Y	Y	msow-2-virg	87c
04010201		69-0660	Ely Lk	I	-	B	43	T	-	mdof-234	87b
04010201		69-0660	Ely Lk	T	12mi	BF	43,65	TX	TX	swcd-69n	87g
04010201	035	69-0565	Esquagama Lk	T	4.5mi	B	65	TW	TW	swcd-69n	87g
09030001	028	69-0481	Fat Lk	-	102	EI	90	U	U	msof-2-if	87i
04010202	004	69-0491	Fish Lk	T	2500ac	C	65	T	U	mdof-252	87i
04010202		69-0511	Grand Lk	I	2500ac	BC	65	UX	-	mdof-211	87i
09030003	020	69-0845	Kabetogama L	-	24800	BF	65	UX	UX	msof-2-if	87i
09030003	020	69-0845	Kabetogama Lk	T	all	BF	65	UX	UX	msof-2-if	86b
		69-?	Kinney Pit	T	-	FG	51	SW	SW	msof-2-gr	87g
04010202		69-0513	Little Grand Lk	I	-	BC	65	UX	-	mdof-211	87i
09030002		69-0729	Little Sandy Lk	I	-	E	57	Z	-	msow-2-virg	87c
04010201		69-0653	Long Lk	I	-	BH	80,65,62	Y	Y	mdow-2-gr	87c
04010201		69-0653	Long Lk	T	4mi	B	65	TW	TW	swcd-69n	87g
04010201		69-0857	Longyear Kl	T	3mi	BCF	41,43,62	SW	SW	swcd-69n	87g
04010201		69-0857-01	Longyear Lk	I	all	AB	41,65,62	Y	Y	mdow-2-gr	87c
04010201		69-0857-02	Longyear Lk	I		AB	41,65,62	Y	Y	mdow-2-gr	87c
04010201		69-0611	Lost Lk	I	-	B	90	Y	Y	msow-2-virg	87c
04010201		69-0721	Majestic Lk	T	all	ABDFG	11,65,18	TY	-	msof-2-ely	86b
04010201		69-0721	Majestic Lk	I	-	ABDFG	11,16,65	TY	-	msof-2-ely	87d
04010201		69-0721	Majestic Lk	T	2.5mi	B	65	T	T	swcd-69n	87g
09030003	015	69-0693	Namakan L	-	14050	E	90	U	UX	msof-2-if	87i
09030002		69-0862	Pelican Lk	T	7.5mi	B	65	TW	TW	swcd-69n	87g
09030002	008	69-0841	Pelican Lk	T	all	B	65	U	U	msof-2-if	86b
09030002	008	69-0841	Pelican Lk	T	-	B	65,41	T	UX	msow-2-virg	87c
09030002	008	69-0841	Pelican Lk	-	10945	B	65	U	U	msof-2-if	87i
04010201	012	69-0490	Pike Lk	T	600ac	C	65	T	U	mdof-252	87i
09030003		69-0694	Rainy Lk	T	500ac	B	14,41,43	T	U	msow-2-if	87c
09030003		69-0694	Rainy Lk	-	54140	E	90	UX	UX	msof-2-if	87i
09030005		69-0736	Sand Lk	T	3.5mi	B	65	TW	TW	swcd-69n	87g
09030003	029	69-0617	Sand Point Lk	I	all	E	90,65	U	UX	msof-2-if	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=69 CNTYNAME=ST LOUIS WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030003	029	69-0617	Sandpoint Lk	–	5680	E	90	U	UX	msof-2-if	87i
09030002		69-0730	Sandy Lk	I	–	E	57	Z	–	msow-2-virg	87c
04010201		69-0662	Silver Lk	T	–	FU	41,43	TW	TX	msow-2-virg	87c
04010201		69-0662	Silver Lk	T	1.5mi	BCF	43	TW	TX	swcd-69n	87g
04010201		69-0651	St Mary's Lk	T	3mi	B	65	TW	TW	swcd-69n	87g
04010201		69-0651	St Marys	I	–	H	19	T	–	mdof-234	87b
09030002	011	69-0378	Vermillion Lk	T	25mi	B	43,65	TX	TX	swcd-69n	87g
04010201		69-0663	Virginia Lk	T	1mi	BCF	43	T	T	swcd-69n	87g

N= 48

CO=69 CNTYNAME=ST LOUIS WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09030001	x35		Beartrap Cr	I	1mi	CE	63	V	–	mdof-211	87i
04010201	140		BARBER CK (E SWAN R)	I	–	BCF	65	S	T	msof-2-gr	86b
04010201	240		BARBER CK (E SWAN R)	I		BCF	65	S	T	msof-2-gr	86b
09030004	002		BLACK R	I		I	90,51,57	YW	Y	mdow-2-gr	87c
09030004	004		BLACK R	I		I	90,51,57	YW	Y	mdow-2-gr	87c
09030004	005		BLACK R	I		I	90,51,57	YW	Y	mdow-2-gr	87c
09030004	006		BLACK R	I	–	I	90,51,57	YW	Y	mdow-2-gr	87c
04010201	040		E SWAN R	T	–	BCF	65	S	T	msof-2-gr	87g
04010201	042		FLOODWOOD R	I	10mi	FC	14,16,77	T	U	swcd-69s	87e
04010201	042		FLOODWOOD R	I	–	ACDFG	16,18,19	UX	VZ	mdof-213	87h
?	?		Kingsbury Cr	T	5mi	FG	41,43,32	S	U	swcd-69s	87e
?	?		Kinney Cr	T	–	FG	51	SW	SW	msof-2-gr	87g
04010201	x38		Kinney Cr	T	–	FG	30,50	T	T	msof-2-gr	86b
04010102	012		KNIFE R	T	5mi	F	23,76,77,90	T	U	swcd-69s	87e
04010102	015		LESTER R	T	2mi	C	41,43	T	U	mdow-co	87c
04010201	x03		Miller Cr	T	4mi	DG	41,43,32,77	S	U	swcd-69s	87e
09030002	019		SAND R	I	–	I	90,51,57	Y	Y	mdow-2-gr	87c
04010201	003		ST LOUIS R	T		BCDEFG	41,43,64,77,80,90	T	V	swcd-69s	87e
04010201	006		ST LOUIS R	T	18mi	BCDEFG	41,43,64,77,80,90	T	V	swcd-69s	87e
04010201	009		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	011		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	011		ST LOUIS R	T	–	F	21	U	U	mdof-214	87h
04010201	011		ST LOUIS R	I	30mi	CE	63	U	–	mdof-211	87i
04010201	011		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	013		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	013		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	013		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	014		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	014		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	016		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	016		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	017		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	017		ST LOUIS R	T		F	21	U	U	mdof-214	87h

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=69 CNTYNAME=ST LOUIS WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
04010201	017		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	018		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	018		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	018		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	019		ST LOUIS R	I	50mi	F	77	T	V	swcd-69s	87e
04010201	019		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	019		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	029		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	029		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	029		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	030		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	030		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	030		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	031		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	031		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	031		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	032		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	032		ST LOUIS R	T		F	21	U	U	mdof-214	87h
04010201	032		ST LOUIS R	T		E	64,66	T	U	mdof-252	87i
04010201	033		ST LOUIS R	I		F	77	T	V	swcd-69s	87e
04010201	033		ST LOUIS R	T	10mi	E	64,66	T	U	mdof-252	87i
04010201	039		SWAN R	T		BCF	65	S	T	msof-2-gr	87g

N= 55

CO=70 CNTYNAME=SCOTT WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012		70-0065	Buck Lk	T	-	DHG	32,43	Y	Y	swcd-70	87g
07020012		70-0065	Buck Lk	T	81ac	DHG	32,43	Y	Y	swcd-70	87j
07020012		70-0091	Cedar Lk	T	823ac	ABFG	11,19	U	-	mdow-6-sp	87b
07020012		70-0091	Cedar Lk	T	749	AB	43,65	TX	TX	swcd-70	87g
07020012		70-0091	Cedar Lk	T	749ac	AB	43,65	TX	TX	swcd-70	87j
07020012		70-0139	Clarks Lk	I	316	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		70-0061	Crystal Lk	T	106ac	B	11,32,19	Z	Z	wd-plsl	87g
07020012		70-0061	Crystal Lk	T	106ac	B	11,32,19	Z	Z	wd-plsl	87k
07020012		70-0052	Cynthia Lk	T	195	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		70-0069	Fish Lk	T	175	AB	11	TW	UX	swcd-70	87g
07020012		70-0069	Fish Lk	I	434ac	B	11,14,18,32,19	UW	UXZ	wd-plsl	87g
07020012		70-0069	Fish Lk	T	175ac	AB	11	TW	UX	swcd-70	87j
07020012		70-0069	Fish Lk	I	434ac	B	11,14,18,32,19	UW	UXZ	wd-plsl	87k
07020012		70-0110	Geis Lk	I	185	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		70-0018	Hidden Lk	T	27	B	43	Y	Y	swcd-70	87g
07020012		70-0018	Hidden Lk	T	27ac	B	43	Y	Y	swcd-70	87j
07020012		70-0018	Hidden Or Cates Lk	T	-	BD	41,43	Z	Z	wd-plsl	87g
07020012		70-0024	Kane Lk	T	276	H	32,65	Z	Z	swcd-70	87g
07020012		70-0024	Kane Lk	T	276ac	H	32,65	Z	Z	swcd-70	87j

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=70 CNTYNAME=SCOTT WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012		70-0035	Lennon Lk	-	204	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		70-0026	Lower Prior Lk	T	820	BD	41,43,32	UX	UX	swcd-70	87g
07020012		70-0026	Lower Prior Lk	T	2090ac	B	32,41,43	UX	UXZ	wd-plsl	87g
07020012		70-0026	Lower Prior Lk	T	820ac	BD	41,43,32	UX	UX	swcd-70	87j
07020012		70-0026	Lower Prior Lk	T	2090ac	B	32,41,43	UX	UXZ	wd-plsl	87k
07020012		70-0113	Mill Pond	T	17ac	ABF	43	SW	TW	swcd-70	87j
07020012		70-0113	Miu Pond	T	17	ABF	43	SW	TW	swcd-70	87g
07020012		70-0095	O'Dowd Lk	T	307ac	ABD	11,14,32,43	T	UW	mdow-6-sp	87b
07020012		70-0095	O'Dowd Lk	T	256	H	32,43	TW	TW	swcd-70	87g
07020012		70-0095	O'Dowd Lk	T	256ac	H	32,43	TW	TW	swcd-70	87j
07020012		70-0076	Pike Lk	I	57	D	11	Z	Z	swcd-70	87g
07020012		70-0076	Pike Lk	I	1990ac	BCF	11,14,18,32,19	SW	XUZ	wd-plsl	87g
07020012		70-0076	Pike Lk	I	1990ac	BCF	11,14,18,32,19	SW	XUZ	wd-plsl	87k
07020012		70-0098	Pleasant Lk	I	269ac	ABEFG	11,16,19	Z	-	msow-6-shak	87d
		70-0328	Potters Lk	T	-	H	32,43	Y	Y	swcd-70	87g
07020012		70-0060	Rice Lk	T	1144ac	B	11,32,19	Z	Z	wd-plsl	87g
07020012		70-0060	Rice Lk	T	1144ac	B	11,32,19	Z	Z	wd-plsl	87k
07020012		70-0054	Spring Lk	T	696ac	B	11,19	U	-	mdow-6-sp	87b
07020012		70-0054	Spring Lk	I	690	BD	11,43	TW	UX	swcd-70	87g
07020012		70-0054	Spring Lk	I	13500ac	BACDF	11,14,18,32,19	UW	XUZ	wd-plsl	87g
07020012		70-0054	Spring Lk	I	690ac	BD	11,43	TW	UX	swcd-70	87j
07020012		70-0054	Spring Lk	I	13500ac	BACDF	11,14,18,32,19	UW	XUZ	wd-plsl	87k
07020012		70-0094	Sutton Lk	I	463	ABEFG	11,16,19	Z	-	msow-6-shak	87d
07020012		70-0094	Sutton Lk	T	1168ac	BDE	11,14,18,19	SW	Z	wd-plsl	87g
07020012		70-0094	Sutton Lk	T	1168ac	BDE	11,14,18,19	SW	Z	wd-plsl	87k
07020012		70-0111	Swamp Lk	T	791ac	B	11,14,18,19	Z	Z	wd-plsl	87g
07020012		70-0111	Swamp Lk	T	791ac	B	11,14,18,19	Z	Z	wd-plsl	87k
07020012		70-0120	Thole Lk	T	131	H	32,43	TW	TW	swcd-70	87g
07020012		70-0120	Thole Lk	T	131ac	H	32,43	TW	TW	swcd-70	87j
07020012		70-0085	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0328	Unnamed Lk	T	13ac	H	32,43	Y	Y	swcd-70	87j
07020012		70-0018	Unnamed Pond	T	32	BD	41,43	Z	Z	wd-plsl	87k
07020012		70-0085	Unnamed Pond	T	77ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
07020012		70-0072	Upper Prior	T	326ac	BD	41,43	TX	UX	swcd-70	87j
07020012		70-0072	Upper Prior Lk	T	326	BD	41,43	TX	UX	swcd-70	87g
07020012		70-0072	Upper Prior Lk	I	3450ac	BF	11,14,32,41,43,	UW	UXZ	wd-plsl	87g
07020012		70-0072	Upper Prior Lk	I	3450ac	BF	11,14,32,41,43	UW	UXZ	wd-plsl	87k

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=70 CNTYNAME=SCOTT WBT=WETLAND ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		70-0065w	Buck Lk	I	3402ac	B	11,32,19	Z	Z	wd-plsl	87g
		70-0065w	Buck Lk	I	3402ac	B	11,32,19	Z	Z	wd-plsl	87k
		70-0003w	Duck Lk	T	-	H	32,43	Y	Y	swcd-70	87g
		70-0249w	Unnamed	I	-	BCF	11,14,18,19,32	Z	Z	wd-plsl	87g
		70-0077w	Unnamed	I	-	BF	11,14,18,19	Z	Z	wd-plsl	87g
		70-0180w	Unnamed	T	-	BD	41,43	Z	Z	wd-plsl	87g
		70-0181w	Unnamed	T	-	BD	41,43	Z	Z	wd-plsl	87g
		70-0183w	Unnamed	T	-	BD	41,43,	Z	Z	wd-plsl	87g
		70-0191w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0193w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0068w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0067w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0168w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0206w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0112w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0145w	Unnamed	T	-	BG	41,43	Z	Z	wd-plsl	87g
		70-0153w	Unnamed	T	-	BD	41,43,	Z	Z	wd-plsl	87g
		70-0186w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0194w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0192dw	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0173w	Unnamed	T	-	BD	41,43,	Z	Z	wd-plsl	87g
		70-0183w	Unnamed	T	-	BD	41,43	Z	Z	wd-plsl	87g
		70-0059w	Unnamed	T	-	BD	11,14,18,19	Z	Z	wd-plsl	87g
		70-0186w	Unnamed Wetland	T	32ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0194w	Unnamed Wetland	T	26	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0192w	Unnamed Wetland	T	38	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0173w	Unnamed Wetland	T	19	BD	41,43	Z	Z	wd-plsl	87k
		70-0183w	Unnamed Wetland	T	13	BD	41,43	Z	Z	wd-plsl	87k
		70-0059w	Unnamed Wetland	T	90	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0249w	Unnamed Wetland	I	8ac	BCF	11,14,18,19,32	Z	Z	wd-plsl	87k
		70-0077w	Unnamed Wetland	I	54ac	BF	11,14,18,19	Z	Z	wd-plsl	87k
		70-0180w	Unnamed Wetland	T	6ac	BD	41,43	Z	Z	wd-plsl	87k
		70-0181w	Unnamed Wetland	T	11ac	BD	41,43	Z	Z	wd-plsl	87k
		70-0183w	Unnamed Wetland	T	12ac	BD	41,43	Z	Z	wd-plsl	87k
		70-0191w	Unnamed Wetland	T	12ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0193w	Unnamed Wetland	T	12ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0068w	Unnamed Wetland	T	51ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0067w	Unnamed Wetland	T	62ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0168w	Unnamed Wetland	T	8ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0206w	Unnamed Wetland	T	26ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0112w	Unnamed Wetland	T	38ac	BD	11,14,18,19	Z	Z	wd-plsl	87k
		70-0145w	Unnamed Wetland	T	6ac	BG	41,43	Z	Z	wd-plsl	87k
		70-0153w	Unnamed Wetland	T	13ac	BD	41,43	Z	Z	wd-plsl	87k
		70-0003w	Wetland	T	40ac	H	32,43	Y	Y	swcd-70	87j

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=71 CNTYNAME=SHERBURNE WBT=AQUIFER ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-112brd0	Aquifer Sec34	-	40ac	E	19,65	Z	Z	swcd-71	87h
		aqf-1120tsh	Surficial Aquifers	T	county	EH	19,65,63	Z	Z	swcd-71	87h

N= 2

CO=71 CNTYNAME=SHERBURNE WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	004	71-0141	Big Elk Lk	I	352	BF	90	TW	UX	mdow-3-sc	87c
07010203		71-0082	Big Lk	-	-	H	65	-	-	mpca-2	87i
07010203		71-0146	Briggs Lk	I	all	BDFH	19,11,65	TW	UX	msof-3-mont	86b
07010203		71-0146	Briggs Lk	I	-	BDFH	19,65	TX	U	msof-3-mont	87d
07010203		71-0146	Briggs Lk	I	406ac	B	65	TW	UX	swcd-71	87h
07010203		71-0145	Briggs Lk Chain	I	704ac	B	90	SW	UX	mdow-3-sc	87c
07010203		71-0146	Briggs Lk Chain	I	704ac	B	90	SW	UX	mdow-3-sc	87c
07010203		71-0147	Briggs Lk Chain	I	704ac	B	90	SW	UX	mdow-3-sc	87c
07010203		71-0123	Camp Lk	T	120ac	B	14	Y	Y	mdof-352	87h
07010203	004	71-0067	Eagle Lk	I	426ac	B	65	SW	UX	swcd-71	87h
07010203		71-0055	Elk Lk	I	336ac	B	65	TW	UX	swcd-71	87h
07010203	004	71-0141	Elk Lk	I	352ac	B	65	TW	UX	swcd-71	87h
07010203		71-0016	Fremont Lk	T	466	AB	43,65	SW	TX	mdow-3-sc	87c
07010203		71-0016	Fremont Lk	I	466ac	B	65	S	T	swcd-71	87h
07010203		71-0129	Jones Lk	I	77ac	B	16,18	S	U	swcd-71	87h
07010203		71-0145	Julia Lk	I	all	ABDFH	19,11,65	TW	UX	msof-3-mont	86b
07010203		71-0145	Julia Lk	I	-	ABDFH	19,65	TW	UX	msof-3-mont	87d
07010203		71-0145	Julia Lk	I	137ac	B	65	TW	UX	swcd-71	87h
07010203		71-0123	Lamp Lk	I	83ac	B	16,18	S	U	swcd-71	87h
		71-?	Little Elk Lk	T	600ac	B	80	U	U	mdof-352	87h
07010203		71-0055	Little Elk Lk	I	336	ABF	65,90	SW	UX	mdow-3-sc	87c
07010203	009	71-0013	Orono Lk	I	300	D	73,77	SW	TW	mdow-3-sc	87c
07010203	009	71-0013	Orono Lk	I	300ac	BD	65	SW	UX	swcd-71	87h
07010203		71-0147	Rush Lk	I	-	BDFH	19,65	TW	UX	msof-3-mont	87d
07010203		71-0147	Rush Lk	I	161ac	B	65	TW	UX	swcd-71	87h

N= 25

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=72 CNTYNAME=SIBLEY WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012		72-0039	Altnow Lk	I	269	BDF	71,11,18,19	Z	Z	msow-4-gayl	87c
07020012		72-0089	Clear Lk	T	289ac	ABD	90	SWZ	–	swcd-72	87a
07020012		72-0089	Clear Lk	T	245ac	EC	14,18,19	SZ	TZ	swcd-52	87c
07020012		70-0050-01	High Island Lk	T	1634ac	ABD	90	SWZ	–	swcd-72	87a
07020012		70-0050-02	High Island Lk	T		ABD	90	SWZ	–	swcd-72	87a
07020012		72-0050-01	High Island Lk	I	1634	BDF	71,11,18,19	Z	ZU	msow-4-gayl	87c
07020012		72-0050-02	High Island Lk	I		BDF	71,11,18,19	Z	ZU	msow-4-gayl	87c
07020012		72-0018	Mud Lk	I	1051	DF	11,71	Z	Z	msow-4-gayl	87c
07010205		72-0049	Schilling Lk	–	–	ABDE	11,16,18,19	–	UX	cza-43	87h
07020012		72-0013	Silver Lk	T	687ac	ABD	90	SZ	–	swcd-72	87a
07020012		72-0042	Titloe Lk	T	924ac	ABD	90	SWZ	–	swcd-72	87a
07020012		72-0042	Titlow Lk	I	924ac	DF	11,71	Z	ZT	msow-4-gayl	87c
07020012	006	72-0017	Washington Lk	T	700ac	ABD	90	Z	–	swcd-72	87a
07020012	006	72-0017	Washington Lk	I	700	DF	11,71	Z	Z	msow-4-gayl	87c

N= 14

CO=72 CNTYNAME=SIBLEY WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020012	009		HIGH ISLAND CR	T	27mi	D	90	Y	–	swcd-72	87a
07020012	012		HIGH ISLAND CR	T		D	90	Y	–	swcd-72	87a
07020012	012		HIGH ISLAND CR	I	15mi	DFG	11,71,76,77	S	TZ	msow-4-gayl	87c
07020012	008		MINNESOTA R	T	23mi	D	90	TZ	–	swcd-72	87a
07020012	013		MINNESOTA R	T		D	90	TZ	–	swcd-72	87a
07020012	019		MINNESOTA R	T		D	90	TZ	–	swcd-72	87a
07020012	020		MINNESOTA R	T		D	90	TZ	–	swcd-72	87a
07020012	014		RUSH R	T	15mi	D	90	Y	–	swcd-72	87a
07020012	015		RUSH R	T		D	90	Y	–	swcd-72	87a
07020012	016		RUSH R	T		D	90	Y	–	swcd-72	87a
07020012	016		RUSH R	I	12mi	DFG	11,71,76,77	S	T	msow-4-gayl	87c
07020012	017		RUSH R, MIDDLE BR	I		DFG	11,71,76,77	S	T	msow-4-gayl	87c
07020012	007		SILVER CR	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i

N= 13

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=73 CNTYNAME=STEARNS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010202	002	73-0156	Baker Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202	002	73-0156	Becker Lk	I	222	ABDF	14,16,18,19,65,62	TW	-	msof-4-spic	87h
07010202	002	73-0156	Becker Lk	I	all	ABCDEGF	19,11,65,18,30,40	TW	UX	cza-73	86a
07010201		73-0106	Big Fish Lk	I	590ac	B	43	WT	XU	wd-sr	87e
07010201		73-0106	Big Fish Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010201		73-0106	Big Fish Lk	I	all	ABDF	11,14,16,19.43.65,76	TW	UX	swcd-73	87g
07010202		73-0159	Big Lk	I	all	BDFG	11,18,19	T	U	swcd-73	87g
07010202		73-0159	Big Lk	I	446	BDF	14,16,18,19	UW	-	msof-4-spic	87h
07010201		73-0117	Big Spunk Lk	T	410ac	B	90	TX	UX	mdow-3-sc	87c
07010201		73-0117	Big Spunk Lk	I	-	BDFH	19,65	UX	-	msof-3-mont	87d
07010201		73-0117	Big Spunk Lk	I	all	ABDF	11,14,16,41,19,43,65,76	TW	UX	swcd-73	87g
07010201		73-0102	Big Watah Lk	I	all	ABDF	11,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0241	Black Oak Lk	I	-	H	90	S	U	swcd-73	87g
07010203		73-0038	Carnation Lk	I	all	ABDFG	11,12,14,16,19,32,43,65,76	TW	UX	swcd-73	87f
07010202		73-0133-01	Cedar Island Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0133-02	Cedar Island Lk	I		ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0133-03	Cedar Island Lk	I		ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0133-04	Cedar Island Lk	I		ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0133-01	Cedar Island Lk	I	995	BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010202		73-0133-02	Cedar Island Lk	I		BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010202		73-0133-03	Cedar Island Lk	I		BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010202		73-0133-04	Cedar Island Lk	I		BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010202		73-0133-01	Cedar Island Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0133-02	Cedar Island Lk	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0133-03	Cedar Island Lk	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0133-04	Cedar Island Lk	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0133-01	Cedar Island Lk Chain	I	3000ac	BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0133-02	Cedar Island Lk Chain	I		BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0133-03	Cedar Island Lk Chain	I		BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0133-04	Cedar Island Lk Chain	I		BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0255	Cedar Lk	I	all	ABDF	11,14,16,19,43	TW	UX	swcd-73	87g
07010201		73-0122	Cohette Lk	I	all	ABDF	11,14,16,19,41,43,65,76	TW	UX	swcd-73	87g
07010204		73-0279	Crow Lk	I	all	ABF	11,12,14,16,43	SW	TX	swcd-73	87g
07010202		73-0150	Eden Lk	I	all	BDFG	11,14,18,19,65	T	UX	swcd-73	87f
07010202		73-0150	Eden Lk	T	-	B	90	S	U	swcd-73	87g
07010202		73-0150	Eden Lk	I	290	BDF	14,16,18,19,62	UW	-	msof-4-spic	87h
07010204		73-0258	George Lk	I	all	ABF	11,12,14,16,19,43,76	TW	UX	swcd-73	87g
07010202	016	73-0076	Goodners Lk	T	-	H	90	S	U	swcd-73	87g
07010202	016	73-0055	Grand Lk	I	666ac	ABF	11,18,65	TW	UX	mdow-3-sc	87c
07010202	016	73-0055	Grand Lk	I	666ac	B	11,14,16	WT	XU	wd-sr	87e
07010202	016	73-0055	Grand Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202	016	73-0055	Grand Lk	T	-	H	90	T	U	swcd-73	87g
07010202	002	73-0083	Great Northern Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202	002	73-0083	Great Northern Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0237	Henry Lk	I	all	ABF	11,14,16,19,43	TW	UX	swcd-73	87g
07010202		73-0157	Horseshoe Chain Of Lks	I	-	AB	11,14,16	WT	XU	wd-sr	87e
07010202		73-0157	Horseshoe Lk	I	all	ABDF	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0157	Horseshoe Lk	I	995	BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010202		73-0157	Horseshoe Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0086	Horseshoe Lk Chain	I	3000ac	BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=73 CNTYNAME=STEARNS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010202		73-0087	Horseshoe Lk Chain	I	3000ac	BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0157	Horseshoe Lk Chain	I	3000ac	BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202	002	73-0083	Horseshoe Lk Chain	I	3000ac	BDE	11,12,16,62,65,71	TW	UX	mdow-3-sc	87c
07010202		73-0233	Kings Lk	T	all	BCD	11,18,19,65	TX	UX	swcd-73	87f
07010202		73-0086	Knaus Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010204	010	73-0200	Koronis Lk	T	3471ac	B	11,12,18,65,71	TX	UX	mdow-3-sc	87c
07010204	010	73-0200	Koronis Lk	I	all	BCD	11,18,19,65	TW	UX	swcd-73	87f
07010204	010	73-0200	Koronis Lk	I	all	ADF	11,12,14,16,19,41,43,65,76	TW	UX	swcd-73	87f
07010204	010	73-0200	Koronis Lk	I	3471	BCDF	11,19,65,71,90	TX	UX	swcd-47	87g
07010204	010	73-0200	Koronis Lk	I	3471	BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010204	010	73-0200	Koronis Lk	T	all	BDEFG	19,11,65,18	UX	UX	cza-73	86a
07010201		73-0064	Kraemer Lk	T	-	H	90	S	U	swcd-73	87g
07010201		73-0064	Kramer Lk	I	all	ABDF	11,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0087	Krays Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
		73-?	Long Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202		73-0139	Long Lk	I	all	BDFG	11,18,19,65	T	UX	swcd-73	87f
07010202		73-0139	Long Lk	I	478	BDF	14,16,18,19	UW	-	msof-4-spic	87h
07010201	018	73-0123	Lower Spunk	I	-	H	65,90	UX	-	msof-3-mont	87d
07010201	018	73-0123	Lower Spunk Lk	-	all	H	19,11,18,65	UX	-	msof-3-mont	86b
07010201	018	73-0123	Lower Spunk Lk	I	all	ABDF	11,14,16,19,41,43,65,76	TW	UX	swcd-73	87g
		73-?	Marie Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010203	015	73-0014	Marie Lk	I	-	ABDFGH	43,19,65,16,	TW	UX	msof-3-mont	87d
07010203	015	73-0014	Marie Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87f
07010201		73-0128	Middle Spunk Lk	-	all	H	90,65	UX	-	msof-3-mont	86b
07010201		73-0128	Middle Spunk Lk	I	-	H	65,90	UX	-	msof-3-mont	87d
07010201		73-0128	Middle Spunk Lk	I	all	ABDF	11,14,16,19,41,43,65,76	TW	UX	swcd-73	87g
07010201		73-0128	Middle Spunk Lk	I	all	E	19,11,65	TW	UX	cza-73	86a
07010202		73-0151	Mud Lk	I	all	BFG	11,18,19	T	UX	swcd-73	87f
07010202		73-0151	Mud Lk	I	171	ABDF	14,16,18,19,62	UW	-	msof-4-spic	87h
07010202		73-0147	N Browns Lk	I	all	BDFG	11,14,16,19,43,65,76	TW	UX	swcd-73	87f
07010202		73-0147	N Browns Lk	I	312	BDF	14,16,18,19,62	UW	-	msof-4-spic	87h
07010202		73-0147	N Browns Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010201		73-0122	Oschotto Lk	-	-	H	18	-	-	mpca-2	87i
07010203		73-0015	Otter Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202	016	73-0037	Pearl Lk	I	all	ABDFG	11,14,16,19,43,65	TW	UX	swcd-73	87f
07010202	016	73-0037	Pearl Lk	T	-	H	65,19	T	U	swcd-73	87g
07010201		73-0118	Pelican Lk	I	all	ABDF	11,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010202		73-0051	Pleasant Lk	I	220ac	B	11,14,16	WS	XT	wd-sr	87e
07010202		73-0051	Pleasant Lk	I	-	BCD	65	SW	TX	swcd-73	87g
07010204		73-0196	Rice Lk	I	1568ac	BD	11,12,18,65,71	TW	UX	mdow-3-sc	87c
07010204		73-0196	Rice Lk	I	all	BCD	11,18,19,65	TW	UX	swcd-73	87f
07010204		73-0196	Rice Lk	I	all	BDFG	11,18,19,43,65	TW	UX	swcd-73	87f
07010204		73-0196	Rice Lk	I	1568	BDF	14,16,18,19,62,65	UW	-	msof-4-spic	87h
07010204		73-0196	Rice Lk	I	all	BDEFG	19,11,65,18	TW	UX	cza-73	86a
07010202	008	77-0150-01	Sauk Lk	I	all	ABDFG	11,12,16,19,41,43,62,65,76	TW	UX	swcd-73	87g
07010202	008	77-0150-02	Sauk Lk	I		ABDFG	11,12,16,19,41,43,62,65,76	TW	UX	swcd-73	87g
07010202		73-0080	School Lk	I	all	ABCDFG	11,14,16,19	SW	T	swcd-73	87f
07010203		73-0035	School Lk	I	all	BFG	11,12,14,18,19	S	UX	swcd-73	87f
		73-?	Spunk Lk	-	-	H	18	-	-	mpca-2	87i
07010202		73-0183	St Anna Lk	I	all	ABDF	11,14,16,19,43	TW	UX	swcd-73	87g

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=73 CNTYNAME=STEARNS WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010204		73-0278	Tamarack Lk	I	all	AB	11,12,43,80	SW	-	swcd-73	87g
07010201	017	73-0138	Two Rivers Lk	I	all	BDFH	19,11,65,18	TW	UX	msof-3-mont	86b
07010201	017	73-0138	Two Rivers Lk	I	756ac	BDG	90	TW	UX	mdow-3-sc	87c
07010201	017	73-0138	Two Rivers Lk	I	-	BDFH	19,65,16	TW	UX	msof-3-mont	87d
07010201	017	73-0138	Two Rivers Lk	I	all	ABDF	11,14,16,19,41,43,65,76,77	TW	UX	swcd-73	87g
		73-?	Upper Spunk Lk	-	all	BDFH	90,65	UX	-	msof-3-mont	86b
07010203		73-0034	Willow Lk	I	all	ABCDFG	11,14,16,19,43	SW	-	swcd-73	87f

N= 107

CO=73 CNTYNAME=STEARNS WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	011		CLEARWATER CR	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010203	015		CLEARWATER CR	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010204	004		CROW R, N FK	I	all	BDEFG	19,11,65,18	TW	UX	cza-73	86a
07010204	005		CROW R, N FK	I		BDEFG	19,11,65,18	TW	UX	cza-73	86a
07010204	006		CROW R, N FK	I		BDEFG	19,11,65,18	TW	UX	cza-73	86a
07010204	007		CROW R, N FK	I		BDEFG	19,11,65,18	TW	UX	cza-73	86a
07010202	001		SAUK R	-		H	18	-	-	mpca-2	87i
07010202	001		SAUK R	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202	002		SAUK R	-		H	18	-	-	mpca-2	87i
07010202	002		SAUK R	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202	004		SAUK R	-		H	18	-	-	mpca-2	87i
07010202	004		SAUK R	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202	006		SAUK R	-	-	H	18	-	-	mpca-2	87i
07010202	006		SAUK R	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a

N= 14

CO=74 CNTYNAME=STEELE WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	024	74-0023	Beaver Lk	T	-	BGH	11,65,76,19,32	TVX	-	cza-74	87b
07040002	024	74-0023	Beaver Lk	I	all	HG	40,90	TX	TXY	cza-74	86a
07040002		74-0004	Oak Glen Lk	T	-	BDFH	11,14,19,90	SW	Z	cza-74	87b
07040004		74-0001	Rice Lk	I	750ac	BDF	11,14,19,73	SW	SXZ	cza-74	87b

N= 4

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=74 CNTYNAME=STEELE WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040002	119		MEDFORD CREEK	T	20	DEFG	11,14,71,76,77	S	S	msof-5-lc	87h
07040002	019		STRAIGHT R	I	—	BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	019		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	021		STRAIGHT R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	021		STRAIGHT R	T		EFGH	41,43,65,77,11,14,16,19,32,90	TW	U	cza-74	87b
07040002	021		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	022		STRAIGHT R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	022		STRAIGHT R	T		EFGH	41,43,65,77,11,14,16,19,32,90	TW	U	cza-74	87b
07040002	022		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	023		STRAIGHT R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	023		STRAIGHT R	T	—	EFGH	41,43,65,77,11,14,16,19,32,90	TW	U	cza-74	87b
07040002	023		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	025		STRAIGHT R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	025		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	027		STRAIGHT R	I		BDEFGI	11,18,19,80	TVWZ	UVXZ	msof-5-lc	86b
07040002	027		STRAIGHT R	I		CDEG	40,19,11,65,18	SW	UX	cza-74	86a
07040002	028		STRAIGHT R	I	all	CDEG	40,19,11,65,18	SW	UX	cza-74	86a

N= 17

CO=75 CNTYNAME=STEVENS WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002		75-0183	Drywood Lk	I	400ac	AD	12	—	—	swcd-75	87f
09020102		75-0277	Fish Lk	I	320ac	AD	12	—	—	swcd-75	87f
07020002		75-0203	Gorden Lk	I	750ac	BAD	12	—	—	swcd-75	87f
07020002		75-0200	Hattie	I	all	BDFG	19,11,18	SW	TX	msof-1-glen	86b
07020002		75-0200	Hattie Lk	I	—	BDFG	19,11,16	SW	TX	msof-i-glen	87d
07020002		75-0200	Hattie Lk	I	488	BDF	11,16,19	TW	UX	msow-1-morr	87d
07020002		75-0200	Hattie Lk	I	400ac	AD	12	WT	—	swcd-75	87f
07020002		75-0200	Hattie Lk	I	all	DF	11,19	W	X	cza-75	86a
07020005		75-0024	Long Lk	I	—	BDFG	19,11,16	TW	U	msof-i-glen	87d
07020005		75-0024	Long Lk	I	588	BD	11,16,19	SW	UW	msow-1-morr	87d
07020005		75-0024	Long Lk	I	800ac	AD	12	T	—	swcd-75	87f
07020005		75-0024	Long Lk	I	all	DF	11,19	T	U	cza-75	86a
07040002		74-0024	Long Lk	I	all	BDFG	19,11,18	TW	U	msof-1-glen	86b
07020002		75-0074	Mid Pomme De Terre Lk	I	1500ac	DBA	12	WT	—	swcd-75	87f
07020002		75-0074	Middle Pomme De Terre	I	193	BDF	11,16,19	SWX	SWXZ	msow-1-morr	87d
07020002		75-0061	N Pomme De Terre Lk	I	425	BDF	11,16,19	SWZ	Z	msow-1-morr	87d
07020002		75-0061	N Pomme De Terre Lk	I	1500ac	DBA	12	WT	—	swcd-75	87f
07020002		75-0061	N Pomme De Terre Lk	I	all	DF	11,19	T	U	cza-75	86a
07020005		75-0019	Page Lk	I	all	ABDFG	19,11,18	SW	TX	msof-1-glen	86b
07020005		75-0019	Page Lk	I	—	ABDFG	19,11,16	SW	TX	msof-i-glen	87d
07020005		75-0019	Page Lk	I	364	BD	11,16,15	SW	UX	msow-1-morr	87d
07020005		75-0019	Page Lk	I	400ac	BAD	12	S	—	swcd-75	87f
07020005		75-0019	Page Lk	I	all	DF	11,19,80	W	X	cza-75	86a
07020002	002	75-0075	Perkins Lk	—	—	ABDFG	19,11,18	SW	TX	msof-1-glen	86b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=75 CNTYNAME=STEVENS WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020002	002	75-0075	Perkins Lk	I	-	ABDFG	19,11,16	SW	TX	msof-i-glen	87d
07020002		75-0096	Pomme De Terre	I	200ac	AD	12	-	-	swcd-75	87f
07020002	002	75-0075	S Pomme De Terre Lk	I	1500ac	DBA	12	WT	-	swcd-75	87f
07020002	002	75-0075	S Pomme De Terre Lk	I	all	DF	11,19,65	T	U	cza-75	86a
07020002	002	75-0075	So Pomme De Terre Lk	I	519	BDF	11,16,19	TW	UX	msow-1-morr	87d
07020005		75-0056	Swan Lk	T	500ac	AD	12	-	-	swcd-75	87f
07020002		75-0105	Winter Mote Lk	T	375ac	AD	12	-	-	swcd-75	87f
07020002		75-0125	Winter Mote Lk	T	375ac	AD	12	-	-	swcd-75	87f

N= 32

CO=75 CNTYNAME=STEVENS WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005	022		CHIPPEWA R	I	4mi	AD	16	-	-	swcd-75	87f
09020102	x05		Harstad Slough	I	500ac	AD	16	-	-	swcd-75	87f
07020002	111		MUDDY (MUD) CREEK	I		ADE	12,19	-	-	swcd-75	87f
07020002	211		MUDDY (MUD) CREEK	I	25mi	ADE	12,19	-	-	swcd-75	87f
07020002	001		POMME DE TERRE R	I		ADC	16,12,19	S	-	swcd-75	87f
07020002	002		POMME DE TERRE R	I	25mi	ADC	16,12,19	S	-	swcd-75	87f
09020102	205		12 MILE CREEK (CD 1)	T	12mi	AD	12	-	-	swcd-75	87f

N= 7

CO=76 CNTYNAME=SWIFT WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020005		76-0072	Camp Lk	I	216	ABDF	14,16,18,19	TW	-	msof-4-spic	87h
07020005		76-0033	Monson Lk	I	143	ABDF	14,16,18,19	TW	-	msof-4-spic	87h

N= 2

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By County, Waterbody Type, Name

CO=77 CNTYNAME=TODD WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010202		77-0084	Big Birch Lk	T	all	BCD	11,1'8,19,65	UX	UX	swcd-73	87f
07010202		77-0084	Big Birch Lk	I	all	BDFG	11,14,16,19,65,43	TW	UX	swcd-73	87g
07010202		77-0084	Big Birch Lk	–	–	H	65	–	–	mpca-2	87i
07010202	008	77-0150	Big Sauk Lk	T	all	BDF	19,11	UW	U	msof-3-lf	87i
07010202		77-0154	Fairy Lk	T	all	BCD	11,18,19,65	TX	UX	swcd-73	87f
07010202		77-0154	Fairy Lk	T	–	B	11	TW	TX	mdof-319	87h
07010202		77-0182	Guerney Lk	T	all	BCD	11,18,19	TW	UY	swcd-73	87f
07010108		77-0105	Latimer Lk	T	–	B	11,14,19	TW	TX	mdof-319	87h
07010202	005	77-0089	Little Birch Lk	–	793ac	–	14	–	–	wd-sr	87e
07010202	005	77-0089	Little Birch Lk	T	all	BCD	11,18,19,65	UW	UX	swcd-73	87f
07010202	005	77-0089	Little Birch Lk	I	all	ABDF	11,14,10,19,43,65	TW	UX	swcd-73	87g
07010202		77-0164	Little Sauk Lk	T	all	BCD	11,18,19	TW	UY	swcd-73	87f
07010202		77-0164	Little Sauk Lk	T	–	B	11,19	TW	UX	mdof-319	87h
		77-?	Long Lk	–	–	H	65	–	–	mpca-2	87i
07010202		77-0181	Maple Lk	T	–	B	11,19	TW	UX	mdof-319	87h
07010201	016	77-0019	Mary Lk	I	all	ABDF	11,14,16,19,43	TW	UX	swcd-73	87g
07010202	013	77-0215	Osakis Lk	I	all	BDFG	19,40,11,65,18	TX	U	msof-1-glen	86b
07010202	013	77-0215	Osakis Lk	I	–	BDFG	43,19,11,65,16	TX	U	msof-i-glen	87d
07010202	013	77-0215	Osakis Lk	I	–	B	–	–	–	wd-sr	87e
07010202	013	77-0215	Osakis Lk	I	834ac	ABDF	11,18,19	SWZ	TZ	swcd-21	87f
07010202	013	77-0215	Osakis Lk	–	–	H	18	–	–	mpca-2	87i
		??-?	Sauk Chain Of Lks	I	all	BCD	11,18,19,65	TW	UX	swcd-73	87f
07010202	008	77-0150-01	Sauk Lk	I	2111ac	BDFG	90	SW	UX	mdow-3-sc	87c
07010202	008	77-0150-02	Sauk Lk	I		BDFG	90	SW	UX	mdow-3-sc	87c
07010202	008	77-0150-01	Sauk Lk	–	–	B	–	–	–	wd-sr	87e
07010202	008	77-0150-02	Sauk Lk	–		B	–	–	–	wd-sr	87e
07010202	008	77-0150-01	Sauk Lk	I	all	BCD	11,18,19,65	TW	UX	swcd-73	87f
07010202	008	77-0150-02	Sauk Lk	I		BCD	11,18,19,65	TW	UX	swcd-73	87f
07010202	008	77-0150-01	Sauk Lk	T	–	BG	41,43,76	UW	UX	mdof-319	87h
07010202	008	77-0150-02	Sauk Lk	T		BG	41,43,76	UW	UX	mdof-319	87h
07010202	008	77-0150-01	Sauk Lk	–	–	H	63	–	–	mpca-2	87i
07010202	008	77-0150-02	Sauk Lk	–		H	63	–	–	mpca-2	87i
07010202	008	77-0150-01	Sauk Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010202	008	77-0150-02	Sauk Lk	I		ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a

N= 34

CO=77 CNTYNAME=TODD WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	002		ELK R	I	70mi	AF	11,12,41,65,16,18,19	S	U	swcd-71	87h
07010203	004		ELK R	I		AF	11,12,41,65,16,18,19	S	U	swcd-71	87h
07010203	006		ELK R	I		AF	11,12,41,65,16,18,19	S	U	swcd-71	87h
07010108	004		LONG PRAIRIE R	T	–	FG	11,14,19	TW	TX	mdof-319	87h
07010108	005		LONG PRAIRIE R	T		FG	11,14,19	TW	TX	mdof-319	87h
07010108	007		LONG PRAIRIE R	T		FG	11,14,19	TW	TX	mdof-319	87h
07010108	010		LONG PRAIRIE R	T		FG	11,14,19	TW	TX	mdof-319	87h

N= 7

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By County, Waterbody Type, Name

CO=78 CNTYNAME=TRAVERSE WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020101		78-0024	Mud Lk	I	4600	BDF	11,16,19	Z	Z	msow-1-morr	87d
09020101		78-0024	Mud Lk	I	4500ac	ABCDE	11,16,19,62,74,77	SW	UW	swcd-78	87f
09020101		78-0024	Mud Lk	I	-	D	73,74	SWZ	SWZ	cza-78	87k
09020101		78-0024	Mud Lk	I	all	ABCE	19,11,18	SW	SX	cza-78	86a
09020102		78-0001	St Mary's Lk	T	320ac	ABCDE	11,14,19	Z	TZ	swcd-78	87f
09020101	010	78-0025	Traverse Lk	I	11600	BD	11,16,19	T	U	msow-1-morr	87d
09020101	010	78-0025	Traverse Lk	I	11000ac	ABCDE	11,16,19,62,74,77	TW	UX	swcd-78	87f
09020101	010	78-0025	Traverse Lk	I	-	BD	73,74	TW	UX	cza-78	87k
09020101	010	78-0025	Traverse Lk	I	all	ABCE	19,11,18	UW	UX	cza-78	86a
09020102		78-0004	Unnamed	T	400ac	ABCDE	11,19	Z	TZ	swcd-78	87f

N= 10

CO=78 CNTYNAME=TRAVERSE WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020101	002		BOIS DE SIOUX R	T	13mi	CEF	11,16,19	SW	UW	swcd-78	87f
09020102	101		EIGHTEEN MILE CREEK	T	11mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
09020102	007		FIVEMILE CR	T	12mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
07020001	028		LITTLE MINNESOTA R	T	2mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
09020102	001		MUSTINKA R	I	24mi	EFGB	11,16,19,41,43,77	SW	TW	swcd-78	87f
09020102	001		MUSTINKA R	I	-	D	11	TW	TW	cza-78	87k
09020102	001		MUSTINKA R	I	all	ABCE	19,11,18	UW	UX	cza-78	86a
09020102	002		MUSTINKA R	I		EFGB	11,16,19,41,43,77	SW	TW	swcd-78	87f
09020102	002		MUSTINKA R	I		D	11	TW	TW	cza-78	87k
09020102	002		MUSTINKA R	I		ABCE	19,11,18	UW	UX	cza-78	86a
09020102	006		MUSTINKA R	I		EFGB	11,16,19,41,43,77	SW	TW	swcd-78	87f
09020102	006		MUSTINKA R	I		D	11	TW	TW	cza-78	87k
09020102	006		MUSTINKA R	I		ABCE	19,11,18	UW	UX	cza-78	86a
09020102	010		MUSTINKA R	I		EFGB	11,16,19,41,43,77	SW	TW	swcd-78	87f
09020102	010		MUSTINKA R	I		ABCE	19,11,18	UW	UX	cza-78	86a
09020102	014		MUSTINKA R	I		EFGB	11,16,19,41,43,77	SW	TW	swcd-78	87f
09020102	004		MUSTINKA R, W BR	T	18mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
09020102	x05		Twelvemile Cr, E Fk	T	14mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
09020102	x05		Twelvemile Cr, W Fk	T	14mi	BCEFG	11,16,19,77	SW	UW	swcd-78	87f
09020102	205		12 MILE CREEK (CD 1)	T		BCEFG	11,16,19,77	SW	UW	swcd-78	87f

N= 20

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By County, Waterbody Type, Name

CO=79 CNTYNAME=WABASHA WBT=STREAM ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040003	x08		Indian Cr,e	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
07040004	025		INDIAN CR	I	-	DEFGI	11,18,19	T	U	msof-5-lc	86b
07040004	x02		Long Cr	I	-	DEFGI	11,18,19,80	S	T	msof-5-lc	86b
07040004	x02		Middle Cr	I	-	DEFGI	11,18,19,80	S	T	msof-5-lc	86b
07040003	001		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	002		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	006		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	007		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	008		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	009		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	017		MISSISSIPPI R	T	-	ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	024		MISSISSIPPI R	T		ABCDEFGHI	40,19,11,65,70,80,30	UVWXZ	UVXZ	msof-5-lc	86b
07040003	120		N FK WHITEWATER R	I	-	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040003	220		N FK WHITEWATER R	I		DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040003	320		N FK WHITEWATER R	I		DEFGI	11,18,19,80	T	U	msof-5-lc	86b
?	?		Unnamed (28-110-11)	T	1	CDG	14	-	U	mdof-534	87i
07040004	x02		West Albany Cr	T	3	CEFG	11,14,16	-	U	mdof-534	87i
07040003	019		WHITEWATER R, N FK	I		DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040004	001		ZUMBRO R	I		BDEFGI	11,18,19,70,80	TVWZ	UVXZ	msof-5-lc	86b
07040004	002		ZUMBRO R	I		BDEFGI	11,18,19,70,80	TVWZ	UVXZ	msof-5-lc	86b
07040004	004		ZUMBRO R	I		BDEFGI	11,18,19,70,80	TVWZ	UVXZ	msof-5-lc	86b
07040004	008		ZUMBRO R	I	-	BDEFGI	11,18,19,70,80	TVWZ	UVXZ	msof-5-lc	86b

N= 22

CO=80 CNTYNAME=WADENA WBT=LAKE ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010106		80-0034	Blue Berry Lk	T	280ac	DE	11	X	-	swcd-80	87a
07010106		80-0034	Blueberry Lk	T	555	B	-	-	-	mdow-3-brai	87c
07010106		80-0034	Blueberry Lk	T	-	B	65,80	U	U	cza-80	86a
		80-?	Lower Twin Lk	I	-	B	65,80	T	U	cza-80	86a
07010106		80-0037	Stocking Lk	-	-	B	65	U	U	cza-80	86a
		80-0115	Tanners Lk	I	73ac	BDG	32,41,43	TW	UX	wd-rwm	87j

N= 6

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By County, Waterbody Type, Name

CO=80 CNTYNAME=WADENA WBT=STREAM ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010107	006		LEAF R	T		DE	12	U	–	swcd-80	87a
07010107	007		LEAF R	T	1120ac	DE	12	U	–	swcd-80	87a
07010106	038		PARTRIDGE R	T	140ac	DE	12	U	–	swcd-80	87a
07010106	038		PARTRIDGE R	–	–	H	18	–	–	mpca-2	87i
07010107	001		REDEYE R	T	260ac	DE	12	S	T	swcd-80	87a
07010107	002		REDEYE R	T		DE	12	S	T	swcd-80	87a
07010107	003		REDEYE R	T		DE	12	S	T	swcd-80	87a
07010107	012		WING R	T	120ac	DE	12	U	–	swcd-80	87a

N= 8

CO=80 CNTYNAME=WADENA WBT=WETLAND ECOREGN=NLF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		80-?w	Type III, IV, V Wetland (45)	T	120ac	DE	12,19	–	–	swcd-80	87a

N= 1

CO=81 CNTYNAME=WASECA WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020011		81-0083	Buffalo Lk	I	–	DEG	14,19	Z	–	swcd-81	87f
07040002		81-0014	Clear Lk	I	–	BF	40,70	S	U	msof-4-wate	86b
07040002		81-0014	Clear Lk	–	–	BF	43,19	S	U	msof-4-wate	87d
07040002		81-0014	Clear Lk	I	–	BC	41,43	UW	–	swcd-81	87f
07040002		81-0014	Clear Lk	I	all	ABFG	40,19,65,18	TWZ	UXZ	cza-81	86a
07020011	016	81-0095	Elysian Lk	I	–	BF	19,65	T	U	msof-4-wate	86b
07020011	016	81-0095	Elysian Lk	–	–	BF	19,65	T	U	msof-4-wate	87d
07020011	016	81-0095	Elysian Lk	I	–	ABEG	14,19,76	WU	–	swcd-81	87f
07020011	016	81-0095	Elysian Lk	I	all	ABDF	11,18,19,65	UXZ	–	mdow-4-mank	87h
07020011	016	81-0095	Elysian Lk	I	all	ABDFG	19,11,65,18	TWZ	UXZ	cza-81	86a
07040002		81-0067	Lilly Lk	I	–	AE	19,43	–	S	swcd-81	87f
07040002		81-0015	Loon Lk	I	–	BF	40	T	U	msof-4-wate	86b
07040002		81-0015	Loon Lk	–	–	BF	43,19	T	U	msof-4-wate	87d
07040002		81-0015	Loon Lk	I	–	AE	41,43,62	UW	–	swcd-81	87f
07040002		81-0015	Loon Lk	I	all	ABD	40,18	TZ	UXZ	cza-81	86a
07020011		81-0055	Reeds Lk	T	–	BF	19,65	V	V	msof-4-wate	86b
07020011		81-0055	Reeds Lk	–	–	BF	19,65	V	V	msof-4-wate	87d
07020011		81-0055	Reeds Lk	I	–	CDEG	19,43	TX	–	swcd-81	87f
07020011		81-0055	Reeds Lk	I	all	ABDFG	19,11,65	TX	TU	cza-81	86a
		81-?	Rice Lk	T	all	ABDFG	19,11,18	Z	Z	cza-81	86a
07040002		81-0022	Rice Lk	I	–	DG	19	Z	–	swcd-81	87f
07020011		81-0044	Silver Lk	I	–	DE	14,19	Z	–	swcd-81	87f
07020011		81-0003	St Olaf Lk	–	–	BF	19,65	V	V	msof-4-wate	87d

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=81 CNTYNAME=WASECA WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020011		81-0003	St Olaf Lk	I	–	BE	19,43	–	WS	swcd-81	87f
07020011		81-0003	St Olaf Lk	I	all	ABDFG	19,11,65	TX	UX	cza-81	86a
07020011		81-0003	St. Olaf Lk	I	–	BF	19,65	V	V	msof-4-wate	86b
07040002		81-0013	Watkins Lk	I	–	DCE	14,19	S	–	swcd-81	87f
07040002		81-0013	Watkins Lk	T	all	ABDFG	19,11,18	Z	Z	cza-81	86a

N= 28

CO=81 CNTYNAME=WASECA WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020011	614		BOOT CREEK	I		DEG	14,19	–	Y	swcd-81	87f
07020011	714		BOOT CREEK	I	–	DEG	14,19	–	Y	swcd-81	87f
07020011	012		BULL RUN CR	I	–	CDEG	14,19	–	Y	swcd-81	87f
07020011	x14		Little LeSueur R	I	–	DEG	19,76,77	–	S	swcd-81	87f
07020011	001		LE SUEUR R	I	all	DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020011	009		LE SUEUR R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020011	013		LE SUEUR R	I		CDEG	14,19,76,77	W	S	swcd-81	87f
07020011	013		LE SUEUR R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020011	014		LE SUEUR R	I	–	CDEG	14,19,76,77	W	S	swcd-81	87f
07020011	014		LE SUEUR R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020011	011		LITTLE COBB R	I	–	DEG	14,19	–	Y	swcd-81	87f

N= 11

CO=82 CNTYNAME=WASHINGTON WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030005		82-0054	Bone Lk	I	all	B	11,14	T	U	msow-6-fl	87c
07010206		82-0163	Clear Lk	I	434	–	32,43	U	–	wd-rc	87h
07010206		82-0163	Clear Lk	I	434ac	–	32,43	U	–	wd-rc	87k
07010206		82-0129	Echo Lk	I	32ac	–	65	–	–	wd-rc	87e
07010206		82-0129	Echo Lk	I	32ac	–	65	–	–	wd-rc	87k
07010206		82-0147	Egg Lk	I	106ac	–	63,32,43	–	–	wd-rc	87e
07010206		82-0147	Egg Lk	I	106ac	–	63,32,43	–	–	wd-rc	87k
07010206		82-0137	Fish Lk	I	20.6ac	–	–	S	–	wd-rc	87e
07010206		82-0137	Fish Lk	I	20.6ac	–	–	S	–	wd-rc	87k
		82-?	Goose Lk	I	all	B	11,14	T	U	msow-6-fl	87c
07010206		82-0138	Horseshoe Lk	I	53	–	65,43	S	–	wd-rc	87h
07010206		82-0138	Horseshoe Lk	I	53ac	–	65,43	S	–	wd-rc	87k
07010206		82-0130	Long Lk	I	48ac	–	16,11,65,43	S	–	wd-rc	87e
07010206		82-0130	Long Lk	I	48ac	–	16,11,65,43	S	–	wd-rc	87k
07010203	015	86-0282	Louisa Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87d
07030005		82-0121	Mann Lk	I	74ac	–	11,65	–	–	wd-rc	87e

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By County, Waterbody Type, Name

CO=82 CNTYNAME=WASHINGTON WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07030005		82-0121	Mann Lk	I	74ac	-	11,65	-	-	wd-rc	87k
07010206		82-0168	Mud Lk	I	187	-	-	S	-	wd-rc	87h
07010206		82-0168	Mud Lk	I	187ac	-	-	S	-	wd-rc	87k
07010206		82-0140	Oneka Lk	I	416	-	65	-	-	wd-rc	87h
07010206		82-0140	Oneka Lk	I	416ac	-	65	-	-	wd-rc	87k
07010206		82-0122	Pine Tree Lk	I	174ac	-	11,65,43	T	-	wd-rc	87e
07010206		82-0122	Pine Tree Lk	I	174ac	-	11,65,43	T	-	wd-rc	87k
07010206		82-0146	Rice Lk	I	277	-	-	S	-	wd-rc	87h
07010206		82-0146	Rice Lk	I	277ac	-	-	S	-	wd-rc	87k
07030005		82-0136	Round Lk	I	26ac	-	11,65	-	-	wd-rc	87e
07030005		82-0136	Round Lk	I	26ac	-	11,65	-	-	wd-rc	87k
07030005		82-0162	Shield Lk	I	all	B	80	Y	Y	msow-6-fl	87c
07010206		82-0153	Sunset Lk	I	124ac	-	11,65,43	S	-	wd-rc	87e
07010206		82-0153	Sunset Lk	I	124ac	-	11,65,43	S	-	wd-rc	87k
07010206		82-0115	Tanners Lk	I	-	BDG	32,41,43	TW	UX	wd-rw	87e
07010206		82-0167	White Bear Lk	I	8416ac	-	65,43,41	XU	-	wd-rc	87e
07010206		82-0167	White Bear Lk	I	8416ac	-	65,43,41	XU	-	wd-rc	87k
07030005		82-0072	White Rock Lk	I	65	-	65	-	-	wd-rc	87h
07030005		82-0072	White Rock Lk	I	65ac	-	65	-	-	wd-rc	87k

N= 35

CO=82 CNTYNAME=WASHINGTON WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
?	?		Anoka/ramsey JD1	-	-	-	31,32	-	-	wd-rc	87h
?	?		Clearwater Cr	-	-	-	16,32	-	-	wd-rc	87h
?	?		Hardwood Cr	-	-	-	16	-	-	wd-rc	87h
07010206	x02		Hardwood Cr	-	-	-	16	-	-	wd-rc	87k
07010206	602		RICE CREEK	-	-	B	63,66	-	-	wd-rc	87h

N= 5

CO=83 CNTYNAME=WATONWAN WBT=LAKE ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020010		83-0036	Kansas Lk	I	388ac	ABCDEFGH	11,19,76,71	YT	UY	mdow-4-nu	87b
07020010		83-0040	Long Lk	I	256ac	ABCDEFGH	11,19,41,43,71,76	XT	UX	mdow-4-nu	87b
07020010		83-0043	St James Lk	I	252ac	ABCDEFGH	11,19,41,43,76,71	UW	XU	mdow-4-nu	87b
07020010		83-0060	Wood Lk	T	-	H	11	TW	-	swcd-8	87a

N= 4

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=83 CNTYNAME=WATONWAN WBT=STREAM ECOREGN=WCBP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020010	009		JAMES CR	-	all	H	40,19,11,18	-	-	msof-4-wind	86b
07020010	009		JAMES CR	I	40mi	ABCDEFGH	11,19,41,43,71,76	XT	UX	mdow-4-nu	87b
07020010	009		JAMES CR	-	all	E	-	-	-	cza-83	86a
07020010	003		WATONWAN R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	004		WATONWAN R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	006		WATONWAN R	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	005		WATONWAN R, N FK	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	010		WATONWAN R, S FK	I	all	DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	011		WATONWAN R, S FK	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h
07020010	013		WATONWAN R, S FK	I		DEF	11,19,77	UWZ	V	mdow-4-mank	87h

N= 10

CO=84 CNTYNAME=WILKIN WBT=LAKE ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020103		84-0023	Breckenridge Lk	T	60ac	BDE	11,19	-	-	swcd-84	87h

N= 1

CO=84 CNTYNAME=WILKIN WBT=STREAM ECOREGN=RRV

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
09020101	001		BOIS DE SIOUX R	T		DE	11,19	-	-	swcd-84	87h
09020101	002		BOIS DE SIOUX R	T	26mi	DE	11,19	-	-	swcd-84	87h
09020103	001		OTTER TAIL R	T	22mi	DE	11,19	-	-	swcd-84	87h
09020103	002		OTTER TAIL R	T		DE	11,19	-	-	swcd-84	87h
09020103	101		OTTERTAIL RIVER	T		DE	11,19	-	-	swcd-84	87h
09020103	301		OTTERTAIL RIVER	T		DE	11,19	-	-	swcd-84	87h
09020101	014		RABBIT R	T	29mi	DE	11,19	-	-	swcd-84	87h
09020104	001		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020104	002		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020104	003		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020104	004		RED R	I		EG	40,19,11	UWY	X	msof-1-baud	86b
09020104	004		RED R	T		DE	11,19	-	-	swcd-84	87h
09020104	004		RED R	I	all	BCFE	11,18,19,41	TW	UW	wd-br	87h
09020104	005		RED R	I	all	EG	40,19,11	UWY	X	msof-1-baud	86b
09020104	005		RED R	T	35mi	DE	11,19	-	-	swcd-84	87h
09020104	005		RED R	I		BCFE	11,18,19,41	TW	UW	wd-br	87h

N= 16

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=85 CNTYNAME=WINONA WBT=AQUIFER ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
		aqf-112brd0	Shallow Aquifers	I	-	EC	11,18,19,65	-	-	mdof-531	87h

N= 1

CO=85 CNTYNAME=WINONA WBT=LAKE ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040003		85-0011-01	Lk Winona	T	-	AB	11,19,40	UXZ	UX	msof-5-lc	86b
07040003		85-0011-02	Lk Winona	T		AB	11,19,40	UXZ	UX	msof-5-lc	86b
07040003		85-0011-01	Winona Lk	T	-	B	76	U	-	swcd-85	87e
07040003		85-0011-02	Winona Lk	T		B	76	U	-	swcd-85	87e

N= 4

CO=85 CNTYNAME=WINONA WBT=STREAM ECOREGN=DA

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07040003	001		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	002		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	006		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	007		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	008		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	009		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	017		MISSISSIPPI R	T	-	ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040003	024		MISSISSIPPI R	T		ADEFG	11,14,19,41,63,66,76,77	TWZ	UXZ	msow-5-wino	87d
07040006	010		PINE CR	I	-	DEFGI	11,18,19,80	T	U	msof-5-lc	86b
07040003	122		S FK WHITEWATER R	T	-	DEFGI	11,18,19,80	U	U	msof-5-lc	86b
07040003	222		S FK WHITEWATER R	T		DEFGI	11,18,19,80	U	U	msof-5-lc	86b
07040003	123		UPPER GARVIN BROOK	T	-	DEFGI	11,18,19,30	U	U	msof-5-lc	86b
07040003	018		WHITEWATER R	I	-	DEFGI	11,18,19,80	TV	UV	msof-5-lc	86b
07040003	021		WHITEWATER R, M FK	T		DEFGI	11,18,19,80	U	U	msof-5-lc	86b

N= 14

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=86 CNTYNAME=WRIGHT WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010204		86-0190	Ann Lk	I	900ac	BFED	11,19,65,80	—	UX	cza-86	87b
07010203	015	86-0284	Augusta Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	015	86-0284	Augusta Lk	I	800ac	ABCDEFG	11,14,16,18,19	—	UX	cza-86	87b
07010203	015	86-0284	Augusta Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87d
07010203	015	86-0284	Augusta Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010203	015	86-0284	Augusta Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010204	020	86-0090	Buffalo Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	020	86-0090	Buffalo Lk	T	1510ac	B	41,90	TW	UX	mdow-3-sc	87c
07010204	020	86-0090	Buffalo Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0281	Caroline Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203		86-0281	Caroline Lk	I	400	ABCDEFG	11,14,16,18,19	—	UX	cza-86	87b
07010203		86-0281	Caroline Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87d
07010203		86-0281	Caroline Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010203		86-0227	Cedar Lk	I	1000ac	BF	11,19,65,80	—	UX	cza-86	87b
07010204		86-0011	Charlotte Lk	T	1000ac	BE	11,19,65,80	—	UX	cza-86	87b
07010203	014	86-0252	Clearwater Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	014	86-0252	Clearwater Lk	I	2700ac	ABCDEFG	11,14,16,18,19,80	—	UX	cza-86	87b
07010203	014	86-0252	Clearwater Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87d
07010203	014	86-0252	Clearwater Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87f
07010203	014	86-0252	Clearwater Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010203	014	86-0252	Clearwater Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
07010203		86-0243	Clearwater Lk Chain	I	4000ac	BDF	11,19,65,72	TW	UX	mdow-3-sc	87c
07010203	014	86-0252	Clearwater Lk Chain	I	4000ac	BDF	11,19,65,72	TW	UX	mdow-3-sc	87c
07010203	015	86-0284	Clearwater Lk Chain	I	4000ac	BDF	11,19,65,72	TW	UX	mdow-3-sc	87c
07010204	004	86-0263	Cokato Lk	I	all	BDH	—	TW	UX	msof-3-mont	86b
07010204	004	86-0263	Cokato Lk	I	—	BDH	19,65,16	TW	UX	msof-3-mont	87d
07010204		86-0293	Collinwood Lk	I	—	ABC	11,19,65,90	TW	UX	swcd-47	87g
07010204		86-0041	Dean Lk	I	204ac	ABG	11,?	SW	UX	mdow-3-sc	87c
07010204		86-0107	Deer Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0107	Deer Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0184	Dutch Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0184	Dutch Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0273	French Lk	I	all	BDH	11,19,18,65	TW	UX	msof-3-mont	86b
07010204		86-0273	French Lk	I	408ac	AB	11,65	SW	UX	mdow-3-sc	87c
07010204		86-0273	French Lk	I	—	BDH	19,65,16	TW	UX	msof-3-mont	87d
07010204		86-0217	Granite Lk	I	800ac	BF	11,19,65,80	—	UX	cza-86	87b
07010204		86-0217	Granite Lk	I	358ac	B	11,65	TW	UX	mdow-3-sc	87c
		86-?	Grass Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Grass Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0243	Grass Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87g
07010204		86-0199	Howard Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0199	Howard Lk	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0223	Indian Lk	I	400ac	B	11,19,65	—	UX	cza-86	87b
07010204		86-0106	L Waverly	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0181	Little Rock Lk	T	all	H	19,18	UW	U	msof-3-lf	87i
07010204		86-0106	Little Waverly Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203		86-0168	Locke	I	—	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010203		86-0168	Locke Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	015	86-0282	Louisa Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	015	86-0282	Louisa Lk	I	600ac	ABCDEFG	11,14,16,18,19	—	UX	cza-86	87b

MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=86 CNTYNAME=WRIGHT WBT=LAKE ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010203	015	86-0282	Louisa Lk	I	all	ABDFG	11,12,14,16,19,43,65,76	TW	UX	swcd-73	87f
07010203	015	86-0282	Louisa Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a
		86-?	Maple Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Maple Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0134	Maple Lk	I	1000ac	BE	11,19,14,16,80	–	UX	cza-86	87b
07010203		86-0137	Marie Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0009	Martha Lk	I	101ac	B	11,65	TW	TX	mdow-3-sc	87c
		86-?	Mary Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Mary Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
		86-?	Mink Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Mink Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
		86-?	Mink Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0229	Mink Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Mud Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
		86-?	Mud Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0123	No Twin Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0123	North Twin Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203		86-0251	Pleasant Lk	I	800ac	BDEF	11,13,19,41,43,80	U	X	cza-86	87b
07010204		86-0053	Pulaski Lk	I	800ac	CG	77,80	–	UX	cza-86	87b
07010204		86-0120	Ramsey Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0120	Ramsey Lk	I	355ac	AB	11,41,43,65	SW	UX	mdow-3-sc	87c
07010204		86-0120	Ramsey Lk	I	–	ABDFGH	43,19,65,16,	TW	UX	msof-3-mont	87c
		86-?	Silver Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010203		86-0141	Silver Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0126	So Twin Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0230	Somers	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87i
07010203		86-0230	Somers Lk	I	all	ABDFGH	40,65,19,18	TW	UX	msof-3-mont	86b
07010204		86-0126	South Twin Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203		86-0223	Sugar Lk	T	1000ac	B	11,19,65	–	UY	cza-86	87b
07010203		86-0289	Sylvia Lk	T	1000ac	B	32,11,65	–	UX	cza-86	87b
07010204		86-0114	Waverly	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010204		86-0114	Waverly Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204		86-0114	Waverly Lk	I	900ac	BEDF	11,19,14,16,80	–	UX	cza-86	87b
07010204		86-0114	Waverly Lk	I	498ac	B	43,65	SW	UX	mdow-3-sc	87c
07010203		86-0242	Wiegand Lk	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203		86-0242	Wiegand Lk	I	–	ABDFGH	43,19,65,16	TW	UX	msof-3-mont	87c
07010203		86-0242	Wiegand Lk	I	all	ABCDEFG	19,11,65,18,30,40	TW	UX	cza-73	86a

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=86 CNTYNAME=WRIGHT WBT=STREAM ECOREGN=NCHF

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07010205	003		*A	I	2600sqmi	-	-	-	-	cza-86	87b
07010203	011		CLEARWATER CR	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	015		CLEARWATER CR	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010203	012		CLEARWATER L (CLEARWATER CR)	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	013		CROW R, M FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	014		CROW R, M FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	002		CROW R, N FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	002		CROW R, N FK	I		ABCDEFGHI	all	-	U	cza-86	87b
07010204	004		CROW R, N FK	I	all	ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	004		CROW R, N FK	I		ABCDEFGHI	all	-	U	cza-86	87b
07010204	005		CROW R, N FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	005		CROW R, N FK	I	2600sqmi	ABCDEFGHI	all	-	U	cza-86	87b
07010204	006		CROW R, N FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	007		CROW R, N FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	012		CROW R, N FK	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b
07010204	008		L KORONIS (CROW R, N FK)	I		ABDFGH	40,19,65,18	TW	UX	msof-3-mont	86b

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CO=87 CNTYNAME=YELLOW MEDICINE WBT=LAKE ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020004		87-0096	Burton Lk	I	126ac	ABDF	11,19	SW	SW	swcd-87	87c
		87-0095	Burton Marsh	I	126ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0016	Curtis Lk	I	440	ABDF	14,16,18,19	SW	-	msof-4-spic	87h
07020004		87-0016	Curtiss Lk	I	440ac	ABDF	11,19	SW	SW	swcd-87	87c
		87-?	Del Clark Lk	I	147ac	ABDF	11,19	VSX	UX	swcd-87	87c
07020004		87-0012	High Bank Lk	I	123ac	ABDF	11,19	SW	SW	swcd-87	87c
		87-?	John Lk	I	17ac	ABDF	11,19	SX	TX	swcd-87	87c
07020004		87-0015	Kvistad Lk	I	113ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0013	Lone Tree Lk	I	163ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0061	Mieda Lk	I	146ac	ABDF	11,19	SW	SW	swcd-87	87c
07020003		87-0102	Miller Lk	I	147ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0032	Mud Lk	I	98ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0060	Spellman Lk	I	300ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0017	Timm Lk	I	237ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0019	Tyson Lk	I	180ac	ABDF	11,19	SW	SW	swcd-87	87c
07020004		87-0019	Tyson Lk	I	180	ABDF	14,16,18,19	SW	-	msof-4-spic	87h
07020004	029	87-0030	Wood Lk	I	484ac	ABDF	11,19	TW	UW	swcd-87	87c
07020004	029	87-0030	Wood Lk	I	484	ABDF	14,16,18,19	TW	-	msof-4-spic	87h

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MPCA 1987 Nonpoint-Source Survey

By County, Waterbody Type, Name

CO=87 CNTYNAME=YELLOW MEDICINE WBT=STREAM ECOREGN=NGP

HUC	SEG	AUXID	RCHNAME	TI	AMNT AFECT	EFFECT	SOURCE	USE ACT	USE POT	RMO	DSN
07020003	013		CANBY CR	I		DF	11,19,14	SW	UW	swcd-87	87e
07020003	013		CANBY CR	I	all	D	19,11,65	V	[illegible]	cza-87	86a
07020003	015		CANBY CR	I		D	19,11,65	V	[illegible]	cza-87	86a
07020003	115		CANBY CREEK	I	10mi	DF	11,19,14	SW	UW	swcd-87	87e
07020003	215		CANBY CREEK	I		DF	11,19,14	SW	UW	swcd-87	87e
07020003	011		FLORIDA CR	I	10mi	DF	11,19,14	SW	SW	swcd-87	87e
07020003	011		FLORIDA CR	–	all	D	19,11,65	–	–	cza-87	86a
07020003	001		LAC QUI PARLE R	–	all	D	19,11,65	U	–	cza-87	86a
07020003	002		LAC QUI PARLE R	–		D	19,11,65	U	–	cza-87	86a
07020003	012		LAC QUI PARLE R	I	20mi	DF	11,19	SW	SW	swcd-87	87e
07020003	012		LAC QUI PARLE R	–		D	19,11,65	U	–	cza-87	86a
07020003	016		LAC QUI PARLE R	I		DF	11,19	SW	SW	swcd-87	87e
07020003	016		LAC QUI PARLE R	–		D	19,11,65	U	–	cza-87	86a
07020003	014		LAZARUS CR	I	18mi	DF	11,19,14	SW	SW	swcd-87	87e
07020003	014		LAZARUS CR	–	all	D	19,11,65	–	–	cza-87	86a
07020004	010		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	011		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	011		MINNESOTA R	–		D	19,11,20,65,70	U	–	cza-87	86a
07020004	015		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	015		MINNESOTA R	–	all	D	19,11,20,65,70	U	–	cza-87	86a
07020004	016		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	017		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	019		MINNESOTA R	I	30mi	DF	11,19	TW	UW	swcd-87	87e
07020004	031		MINNESOTA R	I		DF	11,19	TW	UW	swcd-87	87e
07020004	026		MUD CR	I	20mi	DF	11,19	SW	SW	swcd-87	87e
07020003	x16		Spring Cr	I	27mi	DF	11,19	SW	SW	swcd-87	87e
07020004	022		YELLOW MEDICINE R	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020004	022		YELLOW MEDICINE R	I		DF	11,19	TW	TW	swcd-87	87e
07020004	022		YELLOW MEDICINE R	–		D	19,11,20,65	U	–	cza-87	86a
07020004	024		YELLOW MEDICINE R	T		ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020004	024		YELLOW MEDICINE R	I	28mi	DF	11,19	TW	TW	swcd-87	87e
07020004	024		YELLOW MEDICINE R	–		D	19,11,20,65	U	–	cza-87	86a
07020004	025		YELLOW MEDICINE R, N BR	T	29mi	ABDF	11,19,71,72,76	Y	Y	msow-4-madi	87c
07020004	025		YELLOW MEDICINE R, N BR	–	all	D	19,11,20,65	U	–	cza-87	86a

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APPENDIX H

Assessment By Fish Tissue Contamination

KEY TO THE FISH TISSUE CONTAMINATION TABLE

LOC	-	Location of the water body.
ID	-	Minnesota Department of Natural Resources lake identification number (MDNR. 1968. An Inventory of Minnesota Lakes. Bulletin 25. St. Paul, Minnesota) or Minnesota Pollution Control Agency Routine Monitoring Program station identification number.
COUNTY	-	County
POLLUTANT	-	HG, mercury; PCB, polychlorinated biphenol; TCDD, dioxin.
AREA	-	Lake area, in acres, with fish tissue contamination.
MILES	-	Stream area, in miles, with fish tissue contamination.
HUC	-	U.S. Geological Survey hydrologic unit code. USGS. 1974. Hydrologic Unit Map, State of Minnesota. Denver, Colorado.
SEG	-	U.S. Environmental Protection Agency stream segment numbering system or the Minnesota Pollution Control Agency stream segment numbering system.
ON	-	Identifies if the sampling site is ON the stream segment listed or OFF the stream segment, but still represents the stream segment listed.
ME	-	Type of assessment - M, monitored; E, evaluated.

A. LAKES (> 5,000 Acres)

ACRES FULLY SUPPORTING RECREATIONAL FISHING

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
BIG STONE	AT ORTONVILLE	06-0152	BIG STONE		12610	07020001	022	OFF	M
DEAD	AT STAR LAKE	56-0383	OTTER TAIL		7901	09020103			M
TRAVERSE	1 MI NW BROWNS VALLEY	78-0025	TRAVERSE		11528	09020101	010	OFF	M
WINNIBIGOSHISH	AT BENA	11-0147	CASS		53425	07010101			M
					85,464				

ACRES PARTIALLY SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
BASSWOOD-WHOLELAKE	9 MI NE OF ELY	38-0645	LAKE	HG	29400	09030001			M
BEMIDJI	AT BEMIDJI	04-0130	BELTRAMI	HG	6420	07010101	029	ON	M
BIG SANDY	10 MI N OF MCGREGOR	01-0062	AITKIN	HG	6571	07010103			M
BIRCH	2 MI E OF BABBIT	69-0003	ST LOUIS	HG	7628	09030001	006	ON	M
BURNTSIDE	3 MI NW OF ELY	69-0118	ST LOUIS	HG	10236	09030001	025	ON	M
CASS	AT CASS LAKE	04-0030	BELTRAMI	HG	29775	07010101			M
GULL	AT NISSWA	11-0305	CASS	HG	9541	07010106	004	OFF	M
LAKE OF THE WOODS	(WHOLE LAKE) AT WARROAD	39-0002-01	L OF WOODS	HG	312010	09030009	014	ON	M
KABETOGAMA	AT KABETOGAMA	69-0845	ST LOUIS	HG	19903	09030003	020	ON	M
LAC LA CROIX	7 MI E OF CRANE LAKE	69-0224	ST LOUIS	HG	34070	09030001			M
LEECH	(MAIN BASIN) AT BREVIK	11-0203-01	CASS	HG	109175	07010102	006	OFF	M
MILLE LACS	AT GARRISON	48-0002	MILLE LACS	HG	132516	07010207			M
MINNETONKA	(LOWER LAKE) AT ORONO	27-0133-02	HENNEPIN	PCB	6128	07010206	008	OFF	M
MINNEWASKA	AT GLENWOOD	61-0130	POPE	HG	7110	07020005	016	OFF	M
NAMAKAN	12 MI NE OF CRANE LAKE	69-0693	ST LOUIS	HG	28260	09030003	015	ON	E
OSAKIS	AT OSAKIS	77-0215	TODD	HG	6758	07010202	013	OFF	M
OTTER TAIL	AT OTTERTAIL	56-0242	OTTER TAIL	HG	14753	09020103			M
PELICAN	AT BREEZY POINT	18-0308	CROW WING	HG	8253	07010105			M
PELICAN	3 MI W OF ORR	69-0841	ST LOUIS	HG	10945	09030002	008	ON	E
RAINY	2 MI SE OF ISLAND VIEW	69-0694	ST LOUIS	HG	220800	09030003			M
SAGANAGA	44 MI NW OF GRD MARAIS	16-0633	COOK	HG	19610	09030001	045	ON	M
TROUT	11 MI N OF TOWER	69-0498	ST LOUIS	HG	7641	09030002	028	ON	E
VERMILION	AT TOWER	69-0378	ST LOUIS	HG	40557	09030002	011	ON	E
WHITEFACE RESVR.	9 MI SE OF MAKINEN	69-0375	ST LOUIS	HG	5600	04010201	026	OFF	M
WHITEFISH	AT CROSS LAKE	18-0310	CROW WING	HG	7370	07010105	007	OFF	M
					1091030				

ACRES NOT SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
SAND POINT	7.5 MI N OF CRANE LAKE	69-0617	ST LOUIS	HG	8890	09030003	029	ON	M
					8890				

TOTAL > 5,000 ACRES 1,185,384

B. LAKES (< 5,000 acres)

ACRES FULLY SUPPORTING RECREATIONAL FISHING

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
BLACKDUCK	1 MI W OF BLACKDUCK	04-0069	BELTRAMI		2742	09020302	030	OFF	M
BYLLESBY RESERVOIR	AT RANDOLPH	19-0006	DAKOTA		1435	07040002	006	OFF	M
CANNON	2.5 MI W OF FARIBAULT	66-0008	RICE		1591	07040002	015	OFF	M
CARIBOU	7 MI NW OF DULUTH	69-0489	ST LOUIS		569	04010202			M
COON	AT COON LAKE BEACH	02-0042	ANOKA		1466	07030005			M
CRYSTAL	IN BURNSVILLE	19-0027	DAKOTA		292	07020012			M
DAYTON	2 MI SW OF FERGUS FLLS	56-0824	OTTER TAIL		275	09020103	001	OFF	E
ELYSIAN	AT ELYSIAN	81-0095	WASECA		2289	07020011	016	OFF	M
ESQUAGAMAH	10 MI W OF PALISADE	01-0147	AITKIN		835	07010104	025	OFF	M
FINGER	8 MI NW OF TOFTE	16-0646	COOK		193	04010101			M
FOREST	IN FOREST LAKE	82-0159	WASHINGTON		1098	07030005			M
HALL	2 MI SW OF FAIRMONT	46-0031	MARTIN		552	07020009	012	OFF	M
HIGH	5 MI N OF ELY	69-0071	ST LOUIS		277	09030001			M
ISLAND	9 MI S OF MARCELL	31-0644	ITASCA		19	07010101			M
KREMER	9 MI SE OF MARCELL	31-0645	ITASCA		64	07010101			M
LITTLE WOLF	2 MI W OF CASS LAKE	11-0505	CASS		490	07010101			M
LONG	IN NEW BRIGHTON	62-0067	RAMSEY		184	07010206			M
LONG	6 MI W OF TOGO	31-0175	ITASCA		86	09030006			M
MINNETONKA(UPPER LAKE)	1.5 MI SE OF MOUND	27-0133-05	HENNEPIN		4280	07010206	008	OFF	M
PIKE	9 MI W OF GRND MRAIS	16-0252	COOK		810	04010101	032	ON	M
REBECCA	IN HASTINGS	19-0003	DAKOTA		41	07040001			M
REBECCA	4 MI NW OF MAPLE PLAIN	27-0192	HENNEPIN		234	07010205			M
SHETEK	3 MI E OF MASON	51-0046	MURRAY		3351	07100001	005	OFF	M
SQUAW	2.5 MI SW OF OUTING	18-0207	CROW WING		82	07010105			M
STAR	3 MI SW OF DENT	56-0385	OTTER TAIL		4721	09020103			M
TETONKA	AT WATERVILLE	40-0031	LE SUEUR		1209	07040002	017	OFF	M
TOM	17 MI NE OF GR MARAIS	16-0019	COOK		576	04010101	015	OFF	E
WACONIA	AT WACONIA	10-0059	CARVER		2607	07020012			M
WENCH	24 MI NW OF GR MARAIS	16-0398	COOK		24	04010101	029	OFF	M
WHITE BEAR	IN WHITE BEAR LAKE	82-0167	WASHINGTON		2585	07010206			M
WILLMAR	AT WILLMAR	34-0180	KANDIYOHI		761	07020004			M
					35,738				

ACRES PARTIALLY SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
ADAMS	16 MI NE OF FOREST CTR	38-0153	LAKE	HG	448	09030001	021	OFF	E
AGATE	3.5 MI S OF LAKE SHORE	11-0216	CASS	HG	150	07010106	005	OFF	M
ALPINE	28 MI NE OF FOREST CTR	16-0759	COOK	HG	834	09030001	045	OFF	M
AMBER	12 MI NE OF FOREST CTR	38-0336	LAKE	HG	135	09030001	021	OFF	E
ASH	13 MI NW OF ORR	69-0864	ST LOUIS	HG	669	09030003			M
ASPEN	1 MI S OF BIGFORK	31-0690	ITASCA	HG	96	09030006			M
BALL CLUB	10 MI NW OF GRND MRAIS	16-0182	COOK	HG	188	04010101			M
BALL CLUB	6 MI W OF DEER RIVER	31-0812	ITASCA	HG	3936	07010101	010	OFF	M
BASS	11 MI E OF EFFIE	31-0316	ITASCA	HG	125	09030006			M
BASSETT	6 MI N OF BRIMSON	69-0041	ST LOUIS	HG	453	04010202			M
BEAR HEAD	9 MI SE OF TOWER	69-0254	ST LOUIS	HG	674	04010201			M
BEAR ISLAND	3 MI N OF BABBITT	69-0115	ST LOUIS	HG	2667	09030001			M
BELLO	8 MI SW OF BIGFORK	31-0726	ITASCA	HG	493	09030006			M
BIG	14 MI NW OF ELY	69-0190	ST LOUIS	HG	1740	09030001			E
BIG	9 MI W OF CLOQUET	09-0032	CARLTON	HG	507	04010201			M
BIG CARNELIAN	4 MI S OF MARIN-ST-CR	82-0049	WASHINGTON	HG	444	07030005			M
BIG MARINE	3 MI W OF MARINE-ST-CR	82-0052	WASHINGTON	HG	1577	07030005			M
BIG MOOSE	14 MI NW OF ELY	69-0316	ST LOUIS	HG	1032	09030001	033	ON	E
BIG PINE	5 MI W OF FINLAYSON	58-0138	PINE	HG	387	07030003	020	OFF	M
BIG TAMARACK	4 MI S OF DUXBURY	58-0024	PINE	HG	75	07030001			M
BLACK ISLAND	9 MI SE OF MARCELL	31-0416	ITASCA	HG	102	07010103			M
BLACKDUCK	10 MI N OF ORR	69-0842	ST LOUIS	HG	1264	09030003	024	ON	E
BRULE	19 MI N OF LUTSEN	16-0348	COOK	HG	4162	04010101	029	ON	M
BUCK	10 MI N OF NASHWAUK	31-0069	ITASCA	HG	492	07010103			M
CARIBOU	4 MI N OF LUTSEN	16-0360	COOK	HG	728	04010101	006	ON	M
CASCADE	15 MI N OF LUTSEN	16-0346	COOK	HG	435	04010101	006	ON	M
CHRISTIANSON	4 MI S OF MCNAIR	38-0750	LAKE	HG	158	04010102			M
CHRISTMAS	IN SHOREWOOD	27-0137	HENNEPIN	HG,PCB	276	07010206			M
COE	10 MI SW OF AURORA	69-0562	ST LOUIS	HG	51	04010201			M
COFFEE	11 MI E OF FOREST CTR	38-0064	LAKE	HG	126	09030001			E
CRANE	24 MI NE OF ORR	69-0616	ST LOUIS	HG	3088	09030002	003	ON	E
CRESCENT	16 MI N OF TOFTE	16-0454	COOK	HG	836	04010101	038	ON	E
CRUM	14 MI E OF EFFIE	31-0171	ITASCA	HG	21	09030005			M
CUT FOOT SIOUX	(MAIN BASIN)7 SW OF INGER	31-0857-01	ITASCA	HG	2128	07010101	013	OFF	M
DAVIS	24 MI NW OF GR MARAIS	16-0435	COOK	HG	465	04010101			E
DEER	9 MI NW OF GRD RAPIDS	31-0719	ITASCA	HG	3926	07010101	007	OFF	M
DEVIL TRACK	3 MI N OF GRND MRAIS	16-0143	COOK	HG	1873	04010101	024	ON	E
DEVIL'S	4 MI SE OF OGILVIE	33-0033	KANABEC	HG	121	07030004			M
DEVILFISH	12 MI NW OF HOVLAND	16-0029	COOK	HG	398	04010101			M
DISAPPOINTMENT	13 MI N OF FOREST CTR	38-0488	LAKE	HG	976	09030001	021	OFF	M
DUMBELL	4 MI E OF ISABELLA	38-0393	LAKE	HG	476	04010101			M
DUNNIGAN	14 MI NW OF ISABELLA	38-0664	LAKE	HG	83	09030001	011	OFF	M
E. BEARSKIN	19 MI N OF GRND MRAIS	16-0146	COOK	HG	643	04010101			E
EAGLENEST #4	2 MI S OF ROBINSON	69-0285	ST LOUIS	HG	1471	09030002			M
EAGLES NEST NO. 4	8 MI E OF SOUDAN	69-0218	ST LOUIS	HG	202	09030002			M
EAST CHUB	22.5 MI S OF ELY	38-0674	LAKE	HG	64	09030001	011	OFF	M
ECHO	18 MI NE OF ORR	69-0615	ST LOUIS	HG	1054	09030002			M
ELBOW	9 MI SE OF ORR	69-0744	ST LOUIS	HG	1852	09030002	029	ON	M
ELBOW (MAIN BAY)	10 MI NW OF TOFTE	16-0805-01	COOK	HG	516	04010101			M
FALL	.5 MI NE OF WINTON	38-0811	LAKE	HG	2173	09030001			E
FARM ISLAND	7 MI SW OF AITKIN	01-0159	AITKIN	HG	2054	07010104			M
FAT	32 MI NW OF ELY	69-0481	ST LOUIS	HG	102	09030001	028	OFF	M

ACRES PARTIALLY SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
FISH	6.5 MI NW OF DULUTH	69-0491	ST LOUIS	HG	3071	04010202	004	OFF	M
FIVE	13 MI W OF SANDSTONE	33-0003	KANABEC	HG	42	07030003			E
FREAR	12 MI NW OF TOFTE	16-0806	COOK	HG	277	04010101			M
FROST	26 MI NE OF FOREST CTR	16-0571	COOK	HG	236	09030001			E
GABIMICHIGAMI	23 MI NE OF FOREST CTR	16-0811	COOK	HG	1236	09030001	043	OFF	E
GARDEN	4 MI SE OF ELY	38-0738	LAKE	HG	670	09030001			M
GE-BE-ON-EQUAT	28 MI NW OF ELY	69-0350	ST LOUIS	HG	607	09030001	028	OFF	M
GREENWOOD	13 MI SW OF ISABELLA	38-0656	LAKE	HG	1469	09030001	011	OFF	M
GREENWOOD	19 MI NE OF GR MARAIS	16-0077	COOK	HG	1783	04010101	017	ON	M
GULL	AT TENSTRIKE	04-0120	BELTRAMI	HG	2243	07010101			M
GUN	3 MI SW OF PALISADE	01-0099	AITKIN	HG	760	07010104			M
GUNFLINT	30 MI N OF LUTSEN	16-0356	COOK	HG	4047	09030001			M
HANGING HORN	2 MI S OF BARNUM	09-0038	CARLTON	HG	409	07030003	006	OFF	M
HANGING KETTLE	4 MI S OF AITKIN	01-0170	AITKIN	HG	302	07010104			M
HARRIET	IN MINNEAPOLIS	27-0016	HENNEPIN	HG,PCB	353	07010206			M
HIGHLIFE	13 MI NW OF ISABELLA	38-0673	LAKE	HG	20	09030001	011	OFF	M
HILL	(MAIN BASIN) AT HILL CITY	01-0142-02	AITKIN	HG	750	07010103			M
HOBSON	5 MI NW OF CHISOLM	69-0923	ST LOUIS	HG	66	07010103			M
HOMER	17 MI N OF LUTSEN	16-0406	COOK	HG	516	04010101			E
HORSEHEAD	5.5 MI N OF KEEWATIN	31-0047	ITASCA	HG	18	07010103			M
HORSESHOE	1 MI S OF RICHMOND	73-0157	STEARNS	HG	995	07010202			M
HUSTLER	26 MI NW OF ELY	69-0343	ST LOUIS	HG	272	09030001			M
ISABELLA	1 MI NE OF FOREST CTR	38-0396	LAKE	HG	1516	09030001			M
ISLAND	11.5 MI N OF DULUTH	69-0372	ST LOUIS	HG	1715	04010202	008	OFF	M
JEANETTE	10 MI E OF BUYCK	69-0456	ST LOUIS	HG	293	09030001			M
JESSIE	18 MI N OF DEER RIVER	31-0786	ITASCA	HG	1635	09030006			M
JOHNSON	4 MI NW OF CRANE LAKE	69-0691	ST LOUIS	HG	1685	09030003			M
JULIA	2 MI SE OF PUPOSKY	04-0166	BELTRAMI	HG	450	09020302			M
LAKE OF THE WOODS	(FOUR MI BAY)AT WHEELERS PT	39-0002-02	L OF WOODS	HG,TCDD	5000	09030008			M
KANE	1.5 MI SE OF MCNAIR	38-0651	LAKE	HG	110	04010202			M
KAWISHIWI	10 MI E OF FOREST CTR	38-0080	LAKE	HG	400	09030001	021	OFF	M
KJOSTAD	11 MI NE OF ORR	69-0748	ST LOUIS	HG	444	09030002			E
LAKE FOURTEEN	14 MI N OF BUHL	69-0793	ST LOUIS	HG	402	09030005	012	OFF	M
LAX	4 MI NW OF SILVER BAY	38-0406	LAKE	HG	274	04010102			E
LITTLE	2 MI NE OF LINDSTROM	13-0033	CHISAGO	HG	159	07030005			M
LITTLE BASS	2 MI NW OF FINLAYSON	58-0127	PINE	HG	16	07030003			M
LITTLE CASCADE	16 MI NW OF GR MARAIS	16-0347	COOK	HG	262	04010101			E
LONGYEAR	(S. BAY) IN CHISHOLM	69-0857-01	ST LOUIS	HG	70	04010201			M
LOON	29 MI N OF LUTSEN	16-0448	COOK	HG	1197	09030001			M
LOON	30 MI N OF TOWER	69-0470	ST LOUIS	HG	2616	09030001			E
MCDONALD	12 MI NW OF GR MARAIS	16-0235	COOK	HG	99	04010101			E
MEDICINE	5 MI NW OF TENSTRIKE	04-0122	BELTRAMI	HG	446	09020302			M
MIDGE	8 MI SE OF BEMIDJI	29-0066	HUBBARD	HG	588	07010102			M
MINNETONKA	(GRAYS BAY) AT WAYZATA	27-0133-01	HENNEPIN	PCB	188	07010206	008	OFF	M
MINNEWAWA	4 MI NE OF MCGREGOR	01-0033	AITKIN	HG	2513	07010103			M
MOOSE	3 MI NE OF ORR	69-0806	ST LOUIS	HG	977	09030002	007	ON	M
MOOSEHEAD	AT MOOSE LAKE	09-0041	CARLTON	HG	291	07030003	006	OFF	M
MORGAN	18 MI N OF GR MARAIS	16-0220	COOK	HG	82	04010101			M
MUSQUASH	11 MI N OF GR MARAIS	16-0104	COOK	HG	141	04010101	026	OFF	E

ACRES PARTIALLY SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
MYRTLE	7 MI E OF ORR	69-0749	ST LOUIS	HG	889	09030002	007	OFF	M
NORTH CONE	23 MI NW OF GR MARAIS	16-0412	COOK	HG	86	04010101	029	OFF	M
NORTHERN LIGHT	12 MI NE OF GR MARAIS	16-0089	COOK	HG	433	04010101	018	OFF	E
NOSE	9 MI SE OF MARCELL	31-0417	ITASCA	HG	96	07010103			M
ONE	10 MI NW OF FOREST CTR	38-0605	LAKE	HG	876	09030001	021	OFF	M
OSSAWINNAMAKEE	AT BREEZY POINT	18-0352	CROW WING	HG	644	07010105			M
OX HIDE	.5 MI NW OF PENGILLY	31-0106	ITASCA	HG	130	07010103			E
OYSTER	24 MI NW OF ELY	69-0330	ST LOUIS	HG	714	09030001			E
PAPOOSE	2 MI S OF OUTING	18-0206	CROW WING	HG	94	07010105			M
PARENT	12 MI NW OF FOREST CTR	38-0526	LAKE	HG	1571	09030001	021	OFF	E
PERRY	7 MI N OF CUYUNA	18-0186	CROW WING	HG	144	07010105			M
PICKERAL	AT WEST ST PAUL	19-0079	DAKOTA	HG	52	07010206	001	OFF	M
PIGSEYE	IN ST PAUL	62-0004	RAMSEY	PCB	511	07010206	001	OFF	M
PLEASANT	AT ANNANDALE	86-0251	WRIGHT	HG	639	07010203			M
POKEGAMA	(MAIN) AT GRAND RAPIDS	31-0532-01	ITASCA	HG	3180	07010101	003	OFF	M
POPLAR	20 MI NW OF GRND MRAIS	16-0239	COOK	HG	755	04010101			E
PRAIRIE	6 MI N OF GRAND RAPIDS	31-0384	ITASCA	HG	991	07010103	026	OFF	M
PRAIRIE	8 MI S OF FLOODWOOD	69-0848	ST LOUIS	HG	853	07010103	010	OFF	M
RED ROCK	29 MI NE OF FOREST CTR	16-0793	COOK	HG	353	09030001	045	OFF	M
RICE	AT BRAINERD	18-0145	CROW WING	HG	434	07010104	026	OFF	M
RICE	4 MI S OF COHASSET	31-0717	ITASCA	HG	830	07010101			M
ROUND	AT SQUAW LAKE	31-0896	ITASCA	HG	2964	09030006	014	ON	M
ROUND	32 MI NW OF GR. MARAIS	16-0606	COOK	HG	145	09030001			M
ROUND	4 MI NW OF MCGREGOR	01-0070	AITKIN	HG	186	07010103			M
RUSH	24 MI NW OF GR MARAIS	16-0299	COOK	HG	274	09030001			E
SALLIE	AT SHOREHAM	03-0359	BECKER	HG	1267	09020103			M
SAND	13 MI W OF ISABELLA	38-0735	LAKE	HG	506	09030001	011	OFF	M
SAND	3 MI NW OF DUESLER	09-0016	CARLTON	HG	123	04010301			M
SANDPIT	10 MI NE OF ELY	38-0786	LAKE	HG	65	09030001			M
SAUK (NORTH BAY)	3 MI NE OF SAUK CENTRE	77-0150-02	TODD	HG	1611	07010202			M
SAWBILL	20 MI N OF TOFTE	16-0496	COOK	HG	944	04010101	041	ON	E
SEA GULL	28 MI NE OF FOREST CTR	16-0629	COOK	HG	3736	09030001	022	ON	M
SHAGAWA	AT ELY	69-0069	ST LOUIS	HG	2370	09030001	024	ON	M
SHANNON	3.5 MI SE OF SIDE LAKE	69-0925	ST LOUIS	HG	191	09030005			M
SIDE	8 MI SE OF TOGO	69-0933	ST LOUIS	HG	372	09030005	012	OFF	M
SILVER	AT ROCHESTER	55-0003	OLMSTED	HG,PCB	62	07040004	016	OFF	M
SLETTEN	6 MI N OF ELY	69-0084	ST LOUIS	HG	18	09030001			M
SLIM	9 MI NW OF ELY	69-0181	ST LOUIS	HG	296	09030001			E
SNELLING	AT FORT SNELLING	27-0001	HENNEPIN	HG,PCB	110	07020012			M
SNOWBALL	2 MI W OF PENGILLY	31-0108	ITASCA	HG	196	07010103			E
SNOWBANK	14 MI NW OF FOREST CTR	38-0529	LAKE	HG	3303	09030001	023	ON	M
SPLIT ROCK	1 MI S OF IHLEN	59-0001	PIPESTONE	HG	80	10170203			M
SQUINT	19.5 MI N GRAND MARAIS	16-0202	COOK	HG	18	04010101			M
STEVENS	8 MI SE OF LONGVILLE	11-0116	CASS	HG	88	07010102			E
STRAWBERRY	8 MI E OF WHITE EARTH	03-0323	BECKER	HG	1522	09020108			M
STUART	21 MI NW OF ELY	69-0205	ST LOUIS	HG	752	09030001			M
STUMP	5 MI NE OF BEMIDJI	04-2001	BELTRAMI	HG	200	07010101	027	ON	E
SWAN	(MAIN BASIN) AT PENGILLY	31-0067-02	ITASCA	HG	9	07010103	017	OFF	M
TAMARACK	5 MI W OF CROMWELL	09-0067	CARLTON	HG	228	07010103	009	OFF	M
THOMSON RESERVOIR	AT THOMSON	09-0001	CARLTON	HG	384	04010201	010	OFF	E

ACRES PARTIALLY SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT	AREA	HUC	SEG	ON	ME
TOOHEY	11 MI NW OF TOFTE	16-0645	COOK	HG	406	04010101			E
TROUT	9 MI W OF HOVLAND	16-0049	COOK	HG,PCB	257	04010101			M
TROUT	1 MI S OF COLERAINE	31-0216	ITASCA	HG	1890	07010103			M
TWO ISLAND	7 MI NW OF GRND MRAIS	16-0156	COOK	HG	794	04010101	026	OFF	E
UNNAMED (MINARS)	3 MI E. OF TAFT	69-0951	ST LOUIS	HG	10	04010202			M
WABANA	6 MI NW OF COLERAINE	31-0392	ITASCA	HG	2133	07010103			M
WASHBURN	4 MI NW OF OUTING	11-0059	CASS	HG	1768	07010105			M
WAUKENABO	5 MI W OF PALISADE	01-0136	AITKIN	HG	644	07010104			M
WHITE EARTH	4 MI NE WHITE EARTH	03-0328	BECKER	HG	2005	09020108			M
WHITE IRON	2 MI SE OF ELY	69-0004	ST LOUIS	HG	3429	09030001			E
WHITE SWAN	15 MI E OF MARCELL	31-0260	ITASCA	HG	148	07010103			M
WHITEWATER	2 MI SE OF AURORA	69-0376	ST LOUIS	HG	1210	04010201	034	OFF	M
WILSON	13 MI E OF ISABELLA	38-0047	LAKE	HG	622	04010101			M
WINDY	11 MI SE OF FOREST CTR	38-0068	LAKE	HG	450	09030001			E
WINONA	(SOUTH BAY) IN WINONA	85-0011-01	WINONA	HG	300	07040003			M
ZUMBRO	2 MI NE OF ORONOCO	55-0004	OLMSTED	PCB (HG)	991	07040004	008	OFF	M
					146,009				

TOTAL 181,747 ACRES (< 5,000)

1,367,131 ACRES ASSESSED

C. GREAT LAKES

SHORELINE MILES NOT SUPPORTING RECREATIONAL USES

LOC		ID	COUNTY	POLLUTANT •	MILES	HUC	SEG	ON	ME
SUPERIOR	SE OF FRENCH RIVER	16-0001-N036	ST LOUIS	PCB (HG)	.	04020300			M
SUPERIOR	SW OF SPLIT ROCK POINT	16-0001-N035	LAKE	PCB (HG)	.	04020300			M
SUPERIOR	2.5 MI E OF BEAVER BAY	16-0001-N037	LAKE	PCB	.	04020300			M
SUPERIOR	S OF TERRACE POINT	16-0001-N034	COOK	PCB (HG)	.	04020300			M
SUPERIOR	S OF HAT POINT	16-0001-N033	COOK	PCB	.	04020300			M
					272 MILES				

• ( ) pollutant found at partially supporting levels

D. RIVERS

MILES SUPPORTING RECREATIONAL FISHING

PRINCIPLE LOCATION / ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT	MILES	ASSOCIATED REACHES HUC	SEG	ON	ME
CANBY CK AT RD BTN S13/18 3.5 MI SW OF CANBY	CNB-15.6	YELLOW MEDICINE		16.5	07020003	015	ON	M
CEDAR R. CSAH-1 W OF WALTHAM	CD-31	MOWER		26.5	07080201	321	ON	E
					07080201	023	ON	
CENTER CR BELOW DAM AT GEORGE LK AT FAIRMONT	CEC-29.6	MARTIN		20.3	07020009	010	ON	M
					07020009	112	ON	
GARVIN BROOK AT STOCKTON	GB-11.3	WINONA		17.1	07040003	023	ON	E
MISSISSIPPI R. BY LAKE ITASCA	UM-1365	CLEARWATER		34.5	07010101	033	ON	E
ROCK RIVER 1 MILE EAST OF HOLLAND	RO-84.4	PIPESTONE		26.6	10170204	035	ON	E
ROCK R.-EAST BRANCH 2.5 MI W. OF WOODSTOCK	ROE-1.5	PIPESTONE						
STRAIGHT R AT CR-13 1 MI N OF MEDFORD	ST-15	STEELE		29.4	07040002	019	ON	M
					07040002	018	ON	
					07040002	021	ON	
					07040002	122	ON	
STRAIGHT RIVER AT CR BR 1 MI N OF HOPE	ST-40	STEELE		24.0	07040002	023	ON	M
					07040002	222	ON	
					07040002	025	ON	
					07040002	027	ON	
					07040002	028	ON	
MID BR WHITEWATER R NEAR MN-74 2.5 MI SW OF ELBA	WWM-4	WINONA		10.7	07040003	021	ON	M
N BR WHITEWATER R 2 MI W OF ELBA	WWN-3.5	WINONA		26.3	07040003	020	ON	M
S BR WHITEWATER R CR-20 3.5 MI SW OF ALTURA	WWR-23	WINONA		24.4	07040003	022	ON	M
WHITEWATER RIVER N.W. OF UTICA	WWR-26	WINONA			07040003	022	ON	E
				256.3	Miles			

MILES PARTIALLY SUPPORTING RECREATIONAL USES

PRINCIPLE LOCATION / ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT	MILES	ASSOCIATED REACHES HUC	SEG	ON	ME
BUFFALO CK AT CR-54 4.5 MI NE OF STEWART	BFC-39.5	MCLEOD	HG	40.9	07010205	007	ON	M
BIG FORK RIVER NEAR BIG FORK, MINNESOTA	BF-134	ITASCA	HG	5.4	09030006	008	ON	M
BIG FORK RIVER NE OF WIRT NEAR HARRISON LANDING	BF-155	ITASCA	HG	32.5	09030006	009	ON	M
BLUE EARTH RIVER AT MANKATO	BE-0	BLUE EARTH	PCB	7.1	07020009	001	ON	M
					07020009	102	ON	
BLUE EARTH RIVER BY RAPIDAN DAM	BE-11	BLUE EARTH	HG	8.8	07020009	202	ON	M
CANNON RIVER NE OF NORTHFIELD	CA-38	DAKOTA	HG	8.3	07040002	108	ON	E
					07040002	006	ON	
					07040002	005	ON	
CANNON RIVER SE OF NORTHFIELD	CA-41.5	RICE	HG	23.3	07040002	208	ON	E
					07040002	010	ON	
					07040002	012	ON	
CEDAR RIVER 2.5 MI. W. OF LYLE	CD-0	MOWER	HG,PCB	17.6	07080201	015	ON	E
CEDAR RIVER 3 MI S. OF AUSTIN	CD-10	MOWER	HG,PCB		07080201	016	ON	E
					07080201	018	ON	
					07080201	019	ON	
					07080201	121	ON	

MILES PARTIALLY SUPPORTING RECREATIONAL USES

PRINCIPLE LOCATION / ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT	MILES	ASSOCIATED REACHES: HUC	SEG	ON	ME
S FK CROW R AT CSAH-2 5 MI N OF GLENCOE	CRS-49	MCLEOD	HG	26.5	07010205	004	ON	M
					07010205	106	ON	
MAIN BR LAC QUI PARLE R AT CR-56 S OF DAWSON	LQP-18	LAC QUI PARLE	HG	16.6	07020003	012	ON	M
W BR LAC QUI PARLE R AT US-75 4 MI S OF MADISON	LQPW-8.8	LAC QUI PARLE	HG	18.6	07020003	005	ON	M
					07020003	203	ON	
W BR LAC QUI PARLE R BELOW DAM AT DAWSON	LQPW-0.7	LAC QUI PARLE	HG,PCB	1.5	07020003	103	ON	M
LESEUER R MN-66 1.5 MI NW OF RAPIDAN	LSR-1	BLUE EARTH	PCB	5.2	07020011	001	ON	E
MINNESOTA R. CSAH-9 N OF JORDAN	MI-39	SCOTT	PCB,HG	26.6	07020012	004	ON	M
					07020012	008	ON	
					07020012	003	ON	
MINNESOTA R. SH-22 AT ST. PETER	MI-88	NICOLLET	PCB	5.7	07020007	002	ON	E
MINNESOTA R. USH-71 AT MORTON	MI-196	RENVILLE	PCB	42.8	07020007	021	ON	E
					07020004	117	ON	
					07020004	016	ON	
					07020004	015	ON	
					07020004	011	ON	
					07020004	010	ON	
					07020004	008	ON	
					07020004	006	ON	
					07020004	005	ON	
					07020004	001	ON	
MINNESOTA R.,USH-212 AT GRANITE FALLS	MI-252	YELLOW MEDICINE	HG	14.9	07020004	317	ON	E
					07020004	019	ON	
					07020004	031	ON	
MISSISSIPPI R. USH-169 AT ANOKA	UM-872	ANOKA	PCB,HG	60.8	07010206	006	ON	M
					07010206	204	ON	
					07010206	005	ON	
					07010203	001	ON	
MISSISSIPPI RIVER AT MONTICELLO	UM-895	SHERBURNE	PCB,HG		07010203	009	ON	E
					07010203	110	ON	
MISS R BLO MILL ISLE ABV RR BRIDGE, LITTLE FALLS	UM-973.6	MORRISON	HG,PCB,TCDD	8.6	07010104	102	ON	M
					07010104	001	ON	
MISSISSIPPI RIVER AT JACOBSON	UM-1137	AITKIN	HG	89.7	07010103	012	ON	E
					07010104	226	ON	
					07010104	014	ON	
					07010104	015	ON	
					07010104	024	ON	
					07010103	001	ON	
					07010103	002	ON	
MISSISSIPPI R. BY GRAND RAPIDS	UM-1172	ITASCA	HG	26.1	07010103	023	ON	M
					07010103	022	ON	
					07010103	131	ON	
MISSISSIPPI R. CSAH-62 COHASSET	UM-1178	ITASCA	HG	3.4	07010103	331	ON	E
N BR PIPESTONE CK AT CR 71 4 MI W OF PIPESTONE	PCN-2.6	PIPESTONE	HG	21.2	10170203	035	ON	M
RAINY RIVER BRIDGE AT BAUDETTE	RA-12	L OF WOODS	HG	13.4	09030008	005	ON	E
					09030008	001	ON	
RAINY R BY CR-85 BLO RAPIDS 2 MI NE OF BIRCHDALE	RA-39.3	KOOCHICHING	TCDD	47.7	09030004	001	ON	M
RED LAKE RIVER-EAST GRAND FORKS	RL-0.2	POLK	HG,PCB	38.1	09020303	001	ON	E
					09020303	003	ON	
					09020303	107	ON	

MILES PARTIALLY SUPPORTING RECREATIONAL USES

PRINCIPLE LOCATION ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT	MILES	ASSOCIATED REACHES			
					HUC	SEG	ON	ME
RED R OF THE N ON MN-171 AT ST. VINCENT	RE-157	KITTSON	HG	42.6	09020311	003	ON	M
					09020311	004	ON	
					09020311	105	ON	
RED RIVER SH-1 BRIDGE AT OSLO	RE-274	MARSHALL	HG,PCB	88.3	09020306	004	ON	M
					09020311	205	ON	
					09020311	006	ON	
					09020306	001	ON	
					09020306	002	ON	
					09020306	003	ON	
					09020306	005	ON	
					09020301	001	ON	
					09020301	103	ON	
RED RIVER AT GRAND FORKS	RE-300	POLK	HG,PCB	112.0	09020301	004	ON	M
					09020301	203	ON	
					09020301	008	ON	
					09020301	010	ON	
					09020301	011	ON	
					09020107	001	ON	
RED RIVER SH-200 BY HALSTAD	RE-373	NORMAN	HG,PCB		09020107	002	ON	M
					09020107	003	ON	
					09020107	009	ON	
					09020104	001	ON	
					09020104	102	ON	
RED RIVER MAIN & FIRST AT FARGO	RE-452	CLAY	HG,PCB	68.5	09020104	202	ON	M
					09020104	003	ON	
					09020104	004	ON	
					09020104	105	ON	
RED R ABOVE DAM AT BRECKENRIDGE	RE-547	WILKIN	HG,PCB	2.3	09020104	205	ON	M
RUM RIVER AT ANOKA	RUM-0.6	ANOKA	HG	11.2	07010207	001	ON	E
					07010207	002	ON	
RUM RIVER CSAH-24, ST. FRANCIS	RUM-18	ANOKA	PCB	34.9	07010207	005	ON	M
					07010207	004	ON	
SAUK RIVER AT CSAH-58 IN COLD SPRING	SA-21.9	STEARNS	HG	5.5	07010202	102	ON	M
SAUK RIVER AT CSAH-65 BRIDGE NEAR MELROSE	SA-74	STEARNS	HG	47.9	07010202	106	ON	M
					07010202	202	ON	
					07010202	004	ON	
SAUK R AT MELROSE 2000 FEET ABOVE DAM	SA-75.9	STEARNS	HG	16.0	07010202	206	ON	M
SAUK RIVER AT CSAH-13 IN MELROSE	SA-78.1	STEARNS	HG,PCB		07010202	206	ON	M
ST.LOUIS R .5 MI E OF SCANLON AT SCANLON DAM	SL-21.9	CARLTON	PCB	3.8	04010201	111	ON	M
ST. LOUIS R. USH-2 BY BROOKSTON	SL-38	ST LOUIS	HG	30.4	04010201	013	ON	E
					04010201	017	ON	
					04010201	016	ON	
					04010201	014	ON	
ZUMBRO RIVER ON CSAH-2 AT MILLVILLE	ZUM-34.3	WABASHA	HG,PCB	41.0	07040004	002	ON	E
					07040004	001	ON	
S BR ZUMBRO RIVER BELOW ZUMBRO LAKE DAM	ZUM-57.3	WABASHA	HG,PCB	5.5	07040004	118	ON	M
					07040004	004	ON	
				1121.2 Miles				

MILES NOT SUPPORTING RECREATIONAL USES

PRINCIPLE LOCATION ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT •	MILES	ASSOCIATED REACHES HUC	SEG	ON	ME
LESUEUR R AT CR-54 5.5 MI S OF JANESVILLE	LSR-40.2	WASECA	PCB (HG)	18.7	07020011	013	ON	M
MINNESOTA R. USH-169 AT SHAKOPEE	MI-25	SCOTT	PCB (HG)	30.8	07020012	001	ON	E
MINNESOTA R. AT FT. SNELLING PK.	MI-3.5	HENNEPIN	PCB		07020012	001	ON	M
MINNESOTA R. SH-19 AT HENDERSON	MI-64	SIBLEY	PCB (HG)	20.4	07020012	013	ON	E
					07020012	019	ON	
					07020012	020	ON	
					07020007	001	ON	
MINNESOTA R. 3.5 MILES S.E. OF NORTH STAR	MI-94	NICOLLET	PCB	40.5	07020007	003	ON	E
					07020007	004	ON	
					07020007	005	ON	
					07020007	008	ON	
					07020007	009	ON	
					07020007	010	ON	
MINNESOTA R.,CSAH-35 BY NEW ULM	MI-155.5	NICOLLET	PCB	43.4	07020007	011	ON	E
					07020007	019	ON	
					07020007	018	ON	
					07020007	016	ON	
					07020007	015	ON	
					07020007	013	ON	
MISSISSIPPI R. AT LA CROSSE	UM-698	HOUSTON	PCB (HG)	22.3	07040006	001	ON	M
					07040006	002	ON	
					07040006	108	ON	
					07060001	021	ON	
					07060001	217	ON	
MISSISSIPPI RIVER AT DAKOTA	UM-707	WINONA	PCB (HG)	15.2	07040006	208	ON	M
MISSISSIPPI R. BY LA MOILLE	UM-714	WINONA	PCB		07040006	009	ON	M
MISSISSIPPI R. BY WINONA	UM-728	WINONA	PCB	11.4	07040003	102	ON	M
					07040003	024	ON	
					07040003	001	ON	
MISSISSIPPI R AT FOUNTAIN CITY, WI	UM-733	WINONA	PCB	10.0	07040003	202	ON	M
					07040003	006	ON	
					07040003	107	ON	
MISSISSIPPI R 1 MI SW OF BUFFALO, WI	UM-744	WABASHA	PCB (HG)	15.5	07040003	207	ON	M
					07040003	008	ON	
MISSISSIPPI R. BY KELLOGG	UM-752	WABASHA	PCB		07040003	109	ON	E
MISSISSIPPI R. AT WABASHA	UM-760	WABASHA	PCB	49.4	07040003	017	ON	M
					07040003	209	ON	
MISSISSIPPI R 1 MI S OF PEPIN, WI	UM-767	WABASHA	PCB		07040001	001	ON	M
MISSISSIPPI R. AT LAKE CITY	UM-772	WABASHA	PCB		07040001	001	ON	M
					07040001	002	ON	
MISSISSIPPI R.-HEAD OF LAKE PEPIN	UM-785	GOODHUE	PCB		07040001	004	ON	E
MISSISSIPPI RIVER AT RED WING	UM-790.5	GOODHUE	PCB		07040001	005	ON	M
					07040001	006	ON	
					07040001	108	ON	
MISSISSIPPI R. AT RED WING	UM-797	GOODHUE	PCB (HG)	18.3	07040001	208	ON	M
MISSISSIPPI R. 1.5 MI NW OF DIAMOND BLUFF,WI	UM-802	GOODHUE	PCB		07040001	208	ON	M
					07040001	010	ON	
MISSISSIPPI R. BY CONFLUENCE WITH ST. CROIX R.	UM-811.5	DAKOTA	PCB		07040001	011	ON	M
MISSISSIPPI R. AT HASTINGS	UM-815	DAKOTA	PCB (HG)		07010206	101	ON	M
MISSISSIPPI RIVER 2.5 MI NW OF HASTINGS	UM-817	DAKOTA	PCB (HG)	19.7	07010206	201	ON	M
MISSISSIPPI R.-SPRING LAKE N. E. OF SEDIL	UM-821	DAKOTA	PCB (HG)		07010206	201	ON	E
MISS R. AT GREY CLOUD ISLAND	UM-826	WASHINGTON	PCB (HG)		07010206	201	ON	M
MISSISSIPPI R. S OF ST. PAUL	UM-830	WASHINGTON	PCB		07010206	301	ON	E

• ( ) pollutants at partially supporting levels

MILES NOT SUPPORTING RECREATIONAL USES

PRINCIPLE LOCATION ASSOCIATED LOCATION	ID	COUNTY	POLLUTANT •	MILES	ASSOCIATED REACHES HUC	SEG	ON	ME
MISS RIVER WABASHA ST-ST. PAUL	UM-840	RAMSEY	PCB (HG)	12.6	07010206	401	ON	M
					07010206	102	ON	
MISSISSIPPI RIVER - MINNEAPOLIS	UM-853.5	HENNEPIN	PCB (HG)	5.5	07010206	202	ON	M
MISSISSIPPI R. AT FRIDLEY	UM-859	HENNEPIN	PCB (HG)	12.8	07010206	302	ON	E
MISSISSIPPI RIVER BELOW COON RAPIDS DAM	UM-866	HENNEPIN	PCB (HG)		07010206	104	ON	M
MISSISSIPPI R. AT SAUK RAPIDS	UM-930	BENTON	PCB (HG)	5.9	07010203	210	ON	M
					07010203	001	ON	
RAINY RIVER AT CLEMENTSON	RA-19.7	L OF WOODS	TCDD (HG)	2.4	09030008	007	ON	M
RAINY R 2 MI E OF LOMAN NEAR WATROUS IS	RA-61.5	KOOCHICHING	TCDD (HG)	4.5	09030004	011	ON	M
RAINY R. AT INTERNATIONAL FALLS	RA-83	KOOCHICHING	TCDD (HG)	19.3	09030004	113	ON	M
					09030004	012	ON	
SAUK R 0.5 MI NW OF ST CLOUD	SA-3.5	STEARNS	PCB (HG)		07010202	001	ON	M
SAUK RIVER CSAH-1 ST. CLOUD	SA-0	STEARNS	PCB (HG)	13.2	07010202	001	ON	E
ST CROIX R AT AFTON	SC-11	WASHINGTON	PCB	32.2	07030005	003	ON	M
					07030005	001	ON	
ST. CROIX RIVER NEAR HUDSON	SC-17	WASHINGTON	PCB (HG)		07030005	003	ON	M
ST. CROIX R.SH-212 AT STILLWATER	SC-23	WASHINGTON	PCB		07030005	007	ON	M
ST CROIX R AT MARINE-ON-ST CROIX	SC-31	WASHINGTON	PCB (HG)	37.9	07030005	118	ON	M
ST LOUIS BAY AT DULUTH-SUPERIOR	SLB-1	ST LOUIS	PCB (HG)	15.9	04010201	003	ON	M
ST. LOUIS BAY 0.5 MILES E. OF DULUTH	SLB-2.8	ST LOUIS	PCB (HG)		04010201	003	ON	E
ST LOUIS BAY ON ST LOUIS R .5 MI S OF DULUTH	SLB-5.7	ST LOUIS	PCB (HG)		04010201	003	ON	E
ST. LOUIS BAY ON ST. LOUIS R 2 MI NE OF GARY	SLB-8.6	ST LOUIS	TCDD (HG,PCB)		04010201	006	ON	M
					04010201	109	ON	
				477.8	miles			
				1855.3	miles assessed			

• ( ) pollutant at partially supporting levels

APPENDIX I

Information Related to Minnesota's Acid Rain Program

MINNESOTA POLLUTION CONTROL AGENCY

ACID PRECIPITATION PROGRAM

WORKPLAN AND BUDGET

1988-89 BIENNIUM

(March 28, 1988)

INTRODUCTION

In July, 1986, the Minnesota Pollution Control Agency (MPCA) Board adopted Minnesota Rules parts 7005.4010-7005.4050 relating to an Acid Deposition Standard and Control Plan. The adoption of the 11 kilogram per hectare per year (kg/ha/yr) wet sulfate deposition standard and the control plan, which requires SO2 emission reductions from two coal-fired power plants and places a cap on statewide SO2 emissions as well as state utility emissions fulfilled most of the four major mandates of the Acid Deposition Control Act of 1982 (Minnesota Statutes 116.42-116.45). The Acid Precipitation Program's 1986 Biennial Report to the Legislature provides a brief review of the standard and control plan development process, the proposed standard and control plan, the resulting Acid Rain Hearings, Findings of Fact from the Hearings, and the Board's adoption of the stated Rules.

Beginning in 1980, the Acid Precipitation Program had four broad objectives:

A. Characterize and quantify acidic deposition in the state.

B. Determine where acid rain in Minnesota comes from.

C. Determine the resources at risk to acid precipitation.

D. Determine the effect of acid rain on Minnesota's environment.

In general, these four objectives have been met through the various studies conducted by the Acid Precipitation Program, through research conducted by other state agencies, university scientists, the National Acid Precipitation Assessment Program, and industry funded projects. However, testimony during the Acid Rain Hearings, conducted from January-May, 1986, indicated that further work remains, including characterizing dry deposition, the deposition and effects of nitrogen oxides, episodic impacts to streams and wetlands, and the effects of acid deposition on toxic metals such as mercury. The general lack of long term precipitation chemistry, deposition, and lake and watershed data was also brought out in the Hearings. Long term data, on the order of decades, is needed for trend analysis and to fully assess the impacts of acid deposition on the environment. Since Minnesota is on the edge of the "effects area," this long term data is critical for evaluating impacts from acid deposition.

Continued funding for the Acid Precipitation Program was approved by the Legislature during the 1987 legislative session. This continued funding will allow the Program to continue working toward the following broad objectives:

A. Monitor compliance with the acid deposition standard and control plan.

B. Continue assessing the sensitivity of Minnesota's resources to acid deposition.

C. Establish long term data bases for evaluating acid deposition impacts on Minnesota's environment.

To address the ongoing research and regulatory activities required by the adopted Acid Rain Rules, and to satisfy the requirements of the 1987 legislation, the Acid Precipitation Program has developed a workplan which is outlined in the following pages. In brief, the workplan focuses on deposition monitoring, potential episodic impacts on streams during snowmelt, and long term seasonal and intensive lake monitoring.

ACID PRECIPITATION PROGRAM WORKPLAN FOR THE 1988-89 BIENNIUM

DEPOSITION MONITORING

BACKGROUND

Precipitation has been monitored in the state since the late 1970's by a variety of groups, using a variety of collection and analytical techniques. Data comparisons between the networks has been difficult due to the different collection and analytical techniques used. Table 1 indicates the monitoring sites that have been operated in Minnesota, and some of their characteristics. A more complete description of the monitoring networks can be found in the Agency's Statement of Need and Reasonableness Pertaining to an Acid Deposition Standard and Control Plan (1985). Currently, all the monitoring networks operating in the state use an Aerochemetrics wet/dry collector (Figure 1) at their sites. Figure 2 provides a spatial view of the monitoring sites currently operating. The networks are described below:

National Atmospheric Deposition Program/National Trends Network (NADP/NTN)

This is a nation-wide research program under the direction of the U.S. Geological Survey. NADP/NTN sites in Minnesota are located at the Marcell Experimental Forest near Grand Rapids, Fernberg Road near Ely, Agricultural Experiment Station near Lamberton, and Camp Ripley near Brainerd. Precipitation is collected on a weekly basis, analyzed in the field for pH and conductivity, and sent to the Central Analytical Laboratory at the Illinois Institute of Natural Resources, State Water Survey Division. Laboratory and field data are rigorously reviewed by program staff at Colorado State University and validated data are available as hard copy or on magnetic tape.

Great Lakes Deposition Program (GLDP)

The GLDP operates in those states bordering the Great Lakes. At one time, the GLDP operated four wet deposition sites in Minnesota. Currently, only the Hovland site is operated by GLDP, with Agency staff overseeing field operations and assisting in site maintenance. Samples are collected on a weekly basis and mailed to the Environmental Protection Agency Region V Laboratory in Chicago, Illinois.

Minnesota Pollution Control Agency (MPCA)

The Agency's deposition program was initiated in 1983 as a direct result of the Acid Deposition Control Act of 1982. The primary goals of the monitoring network were to spatially characterize acid deposition in the state and its effect on vegetation, soils, lakes, and streams; and validate long range transport model results to determine the contribution of in-state and out-of-state sources to deposition at various locations in the state. From 1983-1986,

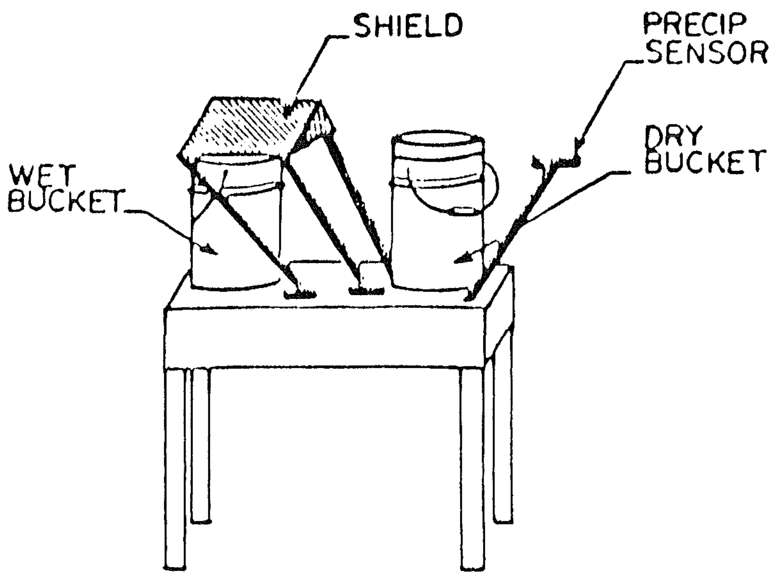
Table 1. Precipitation Monitoring Sites Operated in Minnesota (1977 to 1987).

Site Locations	Monitoring Network	Sampling Frequency	Type of Collector
Fernberg Road, Ely (Lake County)	MP	Event (year round)	Aerochemetrics
	MWPS	Event (April-Oct.)	Krupa sampler
	NADP/NTN*	Weekly (year round)	Aerochemitrics
	APIOS*	Weekly (year round)	Aerochemitrics
Lamberton (Redwood County)	NADP/NTN*	Weekly (year round)	Aerochemetrics
	MWPS	Event (April-Oct.)	Krupa sampler
Marcell (Itasca County)	NADP/NTN*	Weekly (year round)	Aerochemetrics
Camp Ripley (Morrison)	NADP/NTN*	Weekly (year round)	Aerochemetrics
Agassiz (Marshall County)	MPCA	Weekly (year round)	Aerochemetrics
Cedar Creek (Anoka Cnty)	MPCA*	Weekly (year round)	Aerochemetrics
Forestville (Fillmore)	MPCA	Weekly (year round)	Aerochemetrics
Hovland (Cook County)	MPCA	Weekly (year round)	Aerochemetrics
	GLDP*	Weekly (year round)	Aerochemetrics
Birch Lake (Cook County)	MPCA*	Weekly (year round)	Aerochemetrics
Sandstone (Pine County)	MPCA*	Weekly (year round)	Aerochemetrics
	MWPS	Event (April-Oct.)	Krupa sampler
Voyageurs Park (Koochiching)	MPCA*	Weekly (year round)	Aerochemetrics
Isabella (Lake County)	MP	Event (year round)	Aerochemetrics
	MPCA*	Weekly (year round)	Aerochemetrics
Grand Rapids (Itasca)	MWPS	Event (April-Oct.)	Krupa sampler
Big Lake (Sherburne)	MWPS	Event (April-Oct.)	Krupa sampler
Monticello (Wright)	MWPS	Event (April-Oct.)	Krupa sampler
Duluth (St. Louis County)	GLDP	Weekly (year round)	Aerochemetrics
Gooseberry Falls (Lake)	GLDP	Weekly (year round)	Aerochemetrics
Gull Lake (Crow Wing)	GLDP	Weekly (year round)	Aerochemetrics

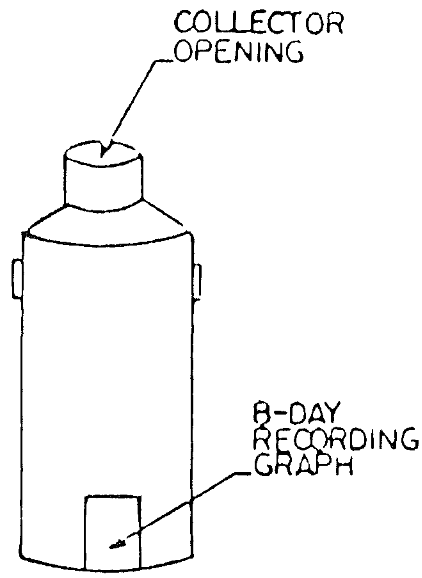
* sites currently in operation

NADP/NTN = National Atmospheric Deposition Program/National Trends Network
MWPS = Minnesota-Wisconsin Power Suppliers
MPCA = Minnesota Pollution Control Agency
GLDP = Great Lakes Deposition Program
MP = Minnesota Power
APIOS = Acid Precipitation in Ontario Study

FIGURE 1



AEROCHEM WET/DRY
PRECIP SAMPLER



BELFORT RECORDING
RAIN GUAGE

FIGURE 2. Deposition Monitoring Sites Currently Operating in Minnesota.

● National Atmospheric Deposition Program/National Trends Network
Minnesota Pollution Control Agency
* Great Lakes Deposition Program

seven sites were operated by the Agency. Currently only five sites are in operation at 1) Cedar Creek Natural History Area near East Bethel in Anoka County; 2) Grindstone Lake near Sandstone in Pine County; 3) Voyageurs National Park near International Falls in Koochiching County; 4) the Environmental Learning Center near Isabella in Lake County; and 5) Birch Lake on the Gunflint Trail near Grand Marais in Cook County.

Precipitation samples are collected on a weekly basis by the local site operators and analyzed for pH in the field. Samples are mailed to the Agency the same day they are collected. Upon arrival at the Agency, the samples are assigned an identification number and taken to the laboratory for analysis.

Low-volume filterpack collectors are also operated by the Agency at Cedar Creek, Sandstone, Isabella, Birch Lake, and the Marcell and Ely NADP/NTN sites (Figure 3). Ambient concentrations of sulfur dioxide are determined from the filterpacks and the data are used to estimate dry deposition of sulfur species in the sensitive areas.

Lab analyses on both the precipitation and filterpack samples are performed at the contract analytical laboratory (currently Interpoll, Inc.). Parameters analyzed in the samples are listed in Table 2. Table 3 lists the detection limits for each of the parameters. Quality assurance guidelines require ten percent of the precipitation and filterpack samples be submitted for duplicate analysis. Spikes, spotted samples, knowns, sample splits, and interlaboratory audits are included in the quality assurance process.

DEPOSITION MONITORING GOALS AND OBJECTIVES

The goals of the Acid Rain Program's monitoring network are:

A. Monitor compliance with the acid deposition standard of 11 kg/ha/yr wet sulfate in the sensitive areas of the state.

B. Collect data needed to characterize acid deposition and its effect on lakes, streams, and wetlands and the biota inhabiting these aquatic environments.

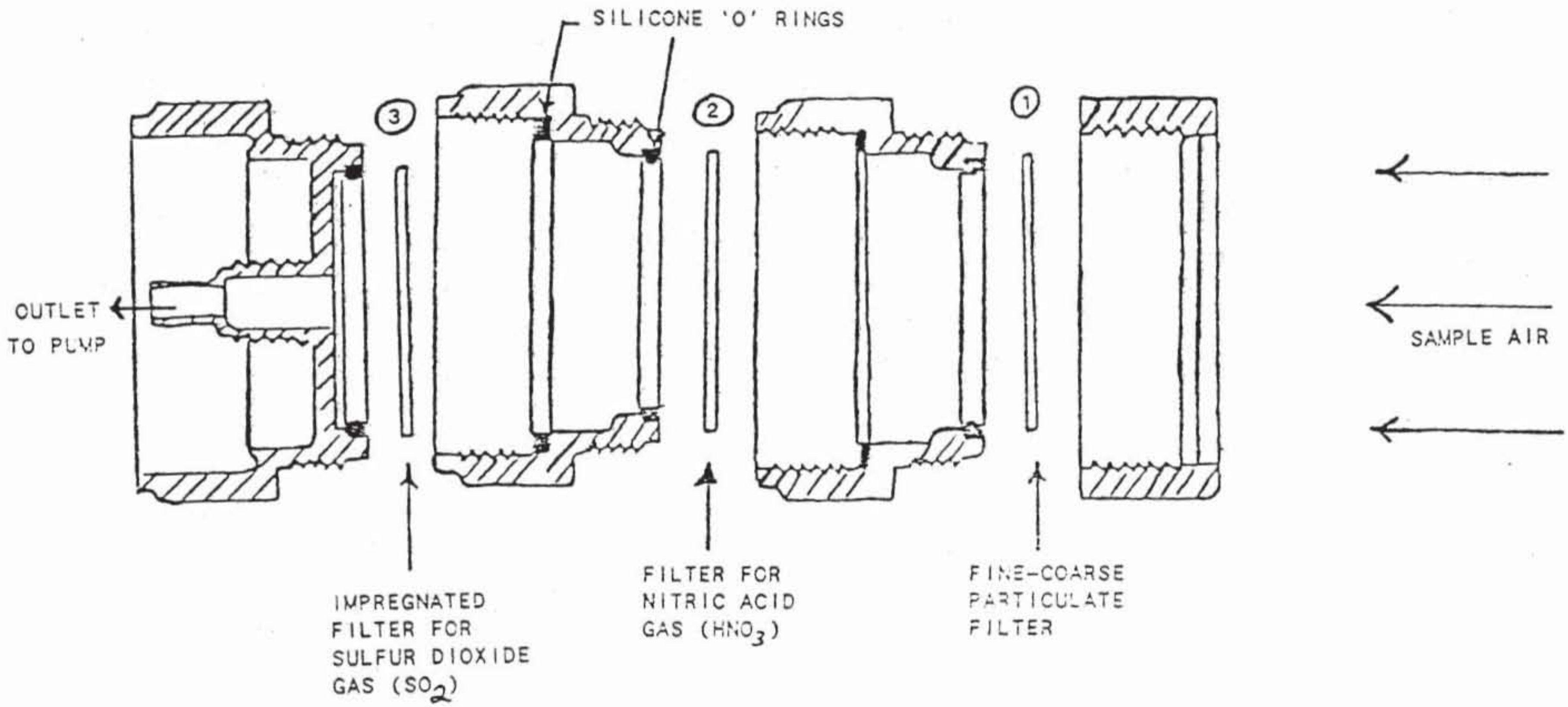
C. Develop data on the dry deposition of acidic and toxic substances. Data on dry deposition in the state is minimal.

D. Refine and update the spatial and temporal variations in the composition of atmospheric deposition in Minnesota.

E. Determine the role of Minnesota in acid deposition trends, both as a contributor and a receptor,on a regional and national basis.

F. If needed, determine approximate contribution of in-state and out-of-state sources to deposition at selected monitoring sites.

FIGURE 3. Disassembled Filter Pack Used in the Minnesota Pollution Control Agency's Acid Deposition Monitoring Network.



1 - 47 MM GELMAN PTFE TEFLON; 1 MICRON PORE
2 - 47 MM GELMAN NYLASORB; .2 MICRON PORE
3 - 47 MM WHATMAN CELLULOSE #41; IMPREGNATED WITH 0.5 N KOH

Table 2. Parameters to be Analyzed in Wet and Dry Deposition Samples From the Minnesota Pollution Control Agency's Monitoring Network.

Wet Deposition:	pH Conductivity Ammonium, sodium, and potassium by ion chromatography Cations by Inductively Coupled Argon Plasma Spectroscopy (Ca, Mg, Mn, Fe, Ni, Cu, Zn, and B) Elements by Atomic Absorption (Furnace) [Pb and Al] Anions by Ion Chromatography (SO4, NO2, SO3, NO3, PO4, Cl, F,Br) All samples will be filtered after pH measurement
Fine Filter:	Anions by Ion Chromatography (SO4, NO2, NO3, PO4, Cl, F, Br) Cations by PIXE (Ca, K, Mn, Al, Pb, Fe, V, Zn, As, Ba, Si, Hg) Ammonium by EPA Method 350.2 (Direct Colorimetric) Sample splitting for ion chromatographic work
KOH-impregnated:	SO2 analyzed as SO4 by Ion Chromatograph
Nylon Filter:	HNO3 analyzed as NO3 by Ion Chromatograph SO2 analyzed as SO4 by Ion Chromatograph

PIXE = Proton Induced X-ray Emission

Table 3. Parameters to be analyzed from Wet and Dry Deposition Samples and Attendant Detectable Limits and Analytical Methods.

		Wet Sample			Dry Sample		
Parameter	Note	ppb	ueq/l	Anal. Method	ng/cm2	Total ug	Anal. Method
pH	1	-	-	pH meter	-	-	
Conductivity	2	-	-	Cond. meter	-	-	
Alkaline Earth: elements and metals							
Al	3	4.0	0.44	AA	75.0	0.472	PIXE
As	4	-	-		19.0	0.120	PIXE
B	5	5.0	1.40	ICAP	-	-	
Ba	4	-	-		N/A	0.900	PIXE
Ca	3	30.0	1.30	ICAP	42.0	0.264	ICAP, PIXE
Cu	5	0.4	0.01	ICAP	-	-	
Fe	3	4.0	0.21	ICAP	15.0	0.094	ICAP, PIXE
Hg	4	-	-		70.0	0.440	PIXE
K	3	40.0	1.02	IC	55.0	0.346	PIXE
Mg	5	1.0	0.08	ICAP	-	-	
Mn	3	3.0	0.15	ICAP	17.0	0.107	ICAP, PIXE
Na	5	30.0	1.30	IC	-	-	
Ni	5	0.4	0.01	ICAP	-	-	
Pb	3	4.0	0.04	AA	40.0	0.252	PIXE
S	4	-	-		70.0	0.440	PIXE
Si	4	-	-		60.0	0.377	PIXE
V	4	-	-		22.0	0.138	PIXE
Zn	3	32.0	1.0	ICAP	11.0	0.060	ICAP, PIXE
Anions:							
Br	3	10.0	N/A	IC	-	-	IC
Cl	3	10.0	0.28	IC	-	-	IC
F	3	5.0	0.26	IC	-	-	IC
NO2	3	10.0	0.22	IC	-	-	IC
NO3	3	10.0	0.16	IC	-	-	IC
PO4	3	50.0	1.58	IC	-	-	IC
SO3	3	50.0	0.62	IC	-	-	IC
SO4	3	10.0	0.21	IC	-	-	IC
NH4	3	25.0	1.38	IC	-	-	Color
SO2 as SO4	6	-	-		N/A	N/A	IC
HNO3 as NO3	7	-	-		-	-	IC

Notes: 1 = Acceptable accuracy for pH is 0.05 pH units
2 = Minimum detectable limit for conductivity is 1 umhos/cm
3 = Analyses for both wet and dry samples (fine filters)
4 = Analyses for dry samples only (fine filters)
5 = Analyses for wet samples only
6 = Analyses of KOH-impregnated filters
7 = Analyses of Nylon Filter for HNO3 as NO3

NA = Not applicable
IC = Ion chromatography
ICAP = Inductively coupled argon plasma
PIXE = Proton induced X-ray emission
AA = Atomic Absorption

MONITORING ACTIVITIES

To meet these goals, the following objectives and tasks are outlined for the 1988-89 biennium:

1. Continue monitoring acid deposition at the 5 sites currently in operation.

2. Continue full chemical analyses of precipitation and filter-pack samples to accomplish goal (A) to (D).

3. Maintain consistency with NADP/NTN network for precipitation samples to accomplish goal (E).

4. Maintain consistency with past Agency sample collection methods to ensure meeting goal (D).

5. Continue operation of the filterpack samplers at the monitoring sites to accomplish goal(C).

6. Initiate changes in the filterpack beginning July 1, 1987:

   a. remove the coarse filter from the pack, and collect total particulates on the fine filter. The large majority of ambient sulfur dioxide particles are in the fine-size fraction, thus they pass through the coarse filter, and are collected on the fine filter. By eliminating the coarse filter, the Agency obtains comparable data at a reduced cost. The KOH-impregnated filter will remain in the pack and be analyzed as before. This change will provide greater compatibility with collection methods used by Canada and the National Acid Precipitation Assessment Program thereby helping meet goal (E).

   b. add a nylon filter to the pack for the purpose of collecting nitric acid gas. The filter will be analyzed for nitrate by ion chromatography. Since the filter may collect some sulfur dioxide, sulfate will also be analyzed on the nylon filter. This change in the methodology will provide data for the preliminary investigation of nitrogen species in dry deposition to meet goal (C).

7. Based on staff time, funds available, and need, conduct long range transport modeling to determine the relative contribution of in-state and out-of-state sources for a particular year for which data is available. This will accomplish goal (F). This task will only be undertaken if the emission projections for Minnesota sources changes substantially from those submitted during the Acid Rain Hearings.

REPORTS

Chemical species of interest will be reported for each calendar year (January 1 - December 31) beginning with 1986 data for each of the MPCA sites. Mean chemical concentrations in precipitation and deposition data will be reported after all the data has been received from the laboratory for a particular year, and Agency staff have reviewed and validated the laboratory data.

A regional assessment of depositon data was prepared by Agency staff for the Statement of Need and Reasonableness Pertaining to an Acid Deposition Standard and Control Plan (1985). Another regional assessment is planned for 1991. The state of Wisconsin is also interested in regional assessments of deposition data, and Agency staff will cooperate with Wisconsin if their assessment is prior to our planned 1991 date.

National assessments of deposition data will be conducted in cooperation with the NADP/NTN network, and the National Acid Precipitation Assessment Program (NAPAP). Currently, Agency staff cooperate with NADP/NTN coordinators on supplementing the NADP/NTN data base with quality assured data from the state monitoring network. NAPAP plans an assessment of national deposition data for 1990, which will be very helpful in our planned regional assessment.

Filterpack data will be reviewed, quality assured, and utilized in determining dry deposition at the various monitoring sites. No estimate of when this product will be available can be made at this time. Some preliminary work along these lines is currently being conducted at the University of Minnesota and should be completed in FY 88. Since this is new information, and there are no established techniques for this type of work, the Agency will be cautious in its approach to determing dry deposition contributions to the sensitive areas.

FUNDING AND FUTURE WORK

Funding for the deposition monitoring is approximately $91,000 per year, excluding staff salaries. These costs should remain fairly stable during the next several years.

Future work is projected to remain at current levels, with developing the dry deposition data base and evaluating nitric acid in dry deposition a high 33priority.

REGULATORY COMPLIANCE

BACKGROUND

Minnesota Rules 7005.4010-7005.4050 require two coal-fired power plants in the state to reduce emissions of sulfur dioxide (SO2) on January 1, 1990, by requiring Reasonably Available Control Technology (RACT), caps the system-wide SO2 emissions of Northern States Power and Minnesota Power at 130% of 1984 levels, respectively, and places a statewide cap on SO2 emissions of 224,000 tons per year by January 1, 1990, and 194,000 tons per year by January 1, 1994. The implementation of RACT for each power plant and the system-wide emission caps will be handled through the Division of Air Quality's Permits Unit, with review by the Acid Precipitation Program staff. The statewide emissions cap will primarily involve the Division of Air Quality's Program Development and Air Analysis Units.

REGULATORY COMPLIANCE GOALS AND OBJECTIVES

A. Develop and formalize a process to track statewide and utility sulfur dioxide emissions for compliance with Minnesota Rules 7005.4050 and the specific requirements of the Acid Deposition Control Plan regarding a statewide emissions cap and system-wide emissions cap for the Minnesota Power and Northern States Power Generating Systems.

B. Review and modify permits for two coal-fired power plants to meet emission limits set in the Acid Deposition Control Plan through the application of RACT.

REGULATORY ACTIVITIES

1. RACT

   a. Draft permit for Minnesota Power's Clay Boswell plant. This permit has been in negotiation since July 1987.

   b. Draft permit for Northen States Power's Allen S. King plant. Negotiations are expected to begin in the summer of 1988.

2. System-wide SO2 emissions

   a. Power generation system permits for both NSP and MP.

   b. Determination of actual 1984 SO2 emissions for each utility system.

   c. Annual reports from each utility detailing projected emissions for the next calendar year beginning in July 1989. These reports are to indicate potential for exceeding the emissions cap.

   d. Enforcement discretion used in dealing with exceedances of the respective utility system emission caps.

3. Statewide SO2 emissions

a. Analysis of Emission inventory data.

b. Review projections of future emissions from various sources.

REPORTS

Minnesota Rules 7005.4050 require staff to provide the Agency with a status report by February 1, 1988 on the need for additional control requirements to meet the 1990 statewide emission cap, the 1990 utility system caps, and the RACT requirements (also by 1990) for the two coal-fired power plants. This report has been prepared and is attached in Appendix A. A second report is due by February 1, 1992 on the need for additional regulatory requirements needed to be imposed on emission facilities in Minnesota to maintain or achieve a statewide sulfur dioxide emission limitation of 194,000 tons per year on and after January 1, 1994.

Individual permits for the Clay Boswell and Allen S. King generating plants need to be finalized and implemented by January 1, 1990.

Power generation system permits must be finalized and implemented by January 1, 1990. Reports on the projected emissions from the NSP and MP systems for calendar year 1990 must be made available to Agency staff by July or August 1989 for review and comment to ensure all modifications are made prior to January 1, 1990. These emission projection reports are to be submitted by the respective utility to Agency staff in July or August of each succeeding year.

FUNDING AND FUTURE WORK

Funding for the regulatory compliance work is approximately $16,850 per year, which is solely for staff salary. These costs will rise approximately 4 percent per year due to annual salary increases.

Permit modifications for the Clay Boswell and Allen S. King plants are expected to be completed by the end of 1988. The system generation pemits are also expected to be completed by the end of 1988, or in early 1989. This should reduce the need for staff time from the Division's Permits Unit.

SEASONAL LONG TERM LAKE MONITORING

BACKGROUND

As part of the state's ongoing program to assess the impact of acid precipitation on aquatic resources, the MPCA and Minnesota DNR cooperatively undertook a comprehensive survey of fifteen lakes in northeast and central Minnesota in the spring of 1981. Additional lakes were added in 1982 and 1983, respectively, to bring the total to 36 study lakes. These surveys consisted of:

1. fisheries assessments - conducted every third year after the initial survey of a lake.

2. fish tissue analysis - conducted every third year after the initial survey of a lake.

3. water chemistry - seasonal samples collected each year after ice-out, during mid-summer, and during fall turnover from a depth of one-meter below the water surface at a mid-lake site.

The intent of the program was to monitor the chemical and biological components of the study lakes over an extended period of time to assess the possible impacts from acid deposition. Several reports have been prepared by Heiskary and Helwig (1983; 1985) and describe the project in more detail. Sampling of the lakes has been completed through the fall of 1986. Based on information from the Acid Rain Hearings (January-May, 1986), Acid Rain staff have suggested the following changes which will be incorporated into the new phase of the project:

1. lakes included in the study have alkalinities less than 100 ueq/l.

2. lakes included in the study should be headwater lakes, located near the top of the major watershed.

3. have color values less than 30 Platinum-Cobalt Units (clear lakes).

In addition to the Agency's seasonal lake monitoring, Dr. Pat Brezonik from the University of Minnesota has conducted seasonal lake sampling on eleven lakes in the state since 1982 as part of the Cluster Lakes Program, which collected data from lakes in Minnesota, Wisconsin, and the upper peninsula of Michigan. Dr. Brezonik's program was part of the National Surface Water Survey's Long Term Monitoring (LTM) Project funded by the National Acid Precipitation Assessment Program. The LTM Project was designed to detect and measure trends in the chemistry of low acid neutralizing capacity (ANC) surface waters over gradients of hydrogen and sulfate ion deposition in different geographic regions. Funding for the project was terminated in 1987, but as of March 1988, has been renewed at a reduced level. Dr. Brezonik will continue to sample his cluster lakes, in conjunction with the Agency's lake sampling program.

SEASONAL LAKE MONITORING GOALS AND OBJECTIVES

The goals of the seasonal lake sampling program are to:

A. Monitor water chemistry of select low alkalinity lakes over several years (at least 10) to evaluate lake response to changing deposition.

B. Monitor lakes over a gradient of hydrogen and sulfate ion deposition.

C. Maintain compatibility with similar lake sampling being conducted by the Wisconsin Department of Natural Resources in Wisconsin and the upper peninsula of Michigan to assess lake chemistry response to changing deposition on a regional basis.

Specific objectives and tasks to meet these goals are outlined below:

1. Select lakes with alkalinities less than 100 ueq/l. These very dilute systems are most likely to respond to changes in deposition and meet goal (A).

2. Select one or two lakes with alkalinities between 100-200 ueq/l to provide information on less susceptible systems.

3. Select lakes which provide good geographic coverage of the state (Figure 4) to meet goal (B). Table 4 provides background information on each of the proposed study lakes.

4. Each study lakes will be sampled 3 times each year; early May, late July, mid-October. Samples will be analyzed by the Natural Resources Research Institute Lab in Duluth for the parameters listed in Table 5.

5. Adopt the protocols in Appendix B to maintain compatibility with data being collected in Wisconsin and Michigan to meet goal (C). As these protocols are changed for the Temporally Integrated Monitoring of Ecosystems (TIME) study, which is eventually to replace the LTM Project, the changes will be adapted into the seasonal lake sampling.

Changes which we would like to incorporate into the seasonal lake sampling program, and which differ slightly from those in Appendix B, are;

1. Alkalinity (Acid Neutralizing Capacity, ANC) - The two end-point titrimetric procedure has been compared to the Gran plot titration by the Acid Precipitation Mitigation Program for surface waters in Minnesota. A difference of less than 5% has been found between the two methods if the ANC is greater than 50 microequivalents per liter (ueq/L). The Gran plot will be run on a small number of samples to determine if the relationship holds for the low alkalinity lakes sampled by the MPCA on a seasonal basis. If the relationship does not hold, the Gran plot will be used exclusively.

FIGURE 4. Distribution of Lakes to be Sampled by the Minnesota Pollution Control Agency Acid Precipitation Program on a Long Term Seasonal Basis.

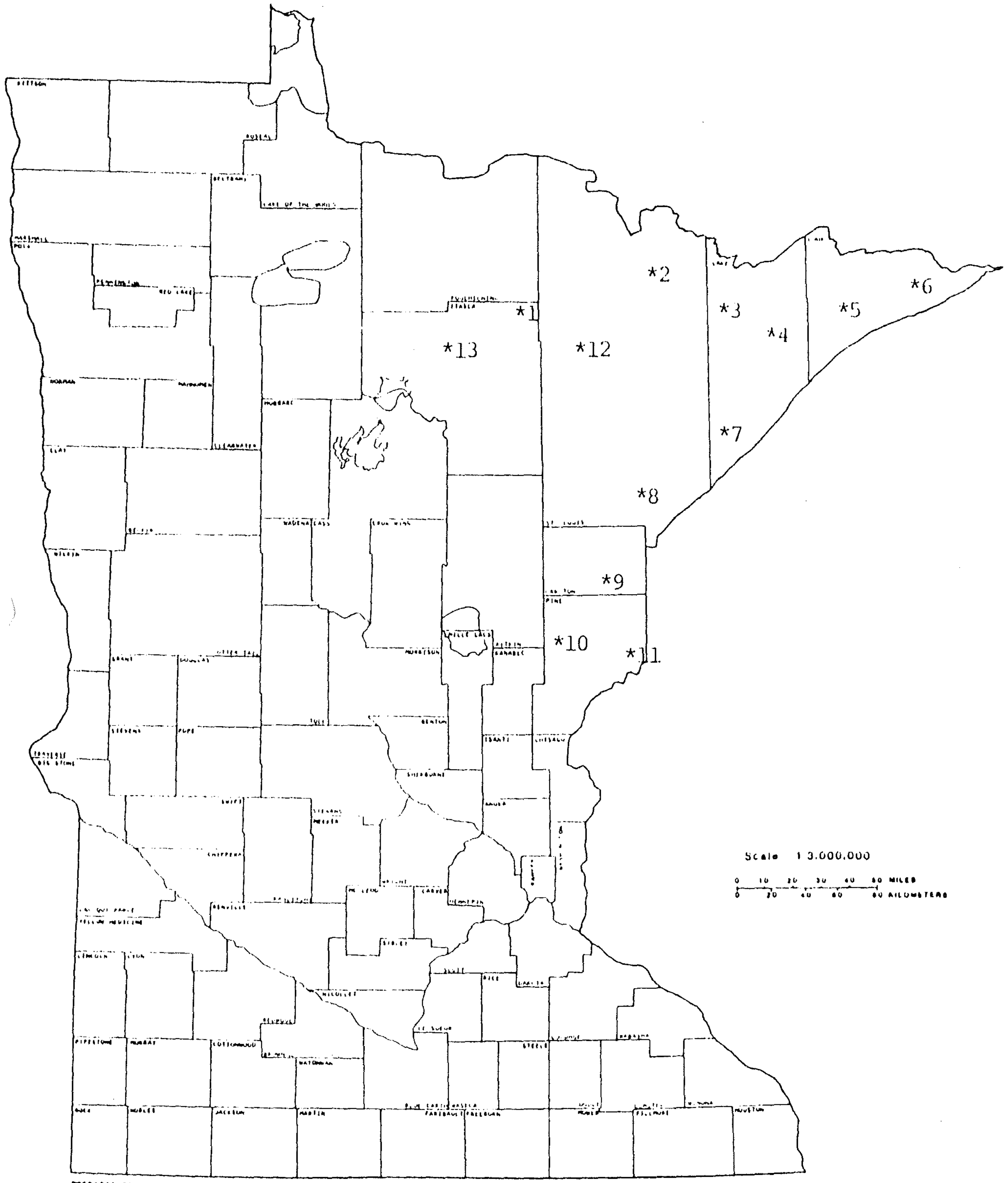


Table 4. Background Information on Proposed Long Term Seasonal Lakes.

Map #	Lake	County	Township & Range	MDNR I.D.	Comments
1	Crum	Itasca	T62N R23W	31-171	MPCA instrumented study lake from 1983-85. Mean alkalinity of 44 ueq/l. 18.5 acres.
2	Meander	St. Louis	T65N R14W	69-329	MPCA instrumented study lake from 1983-85. Mean alkalinity of 65 ueq/l. 101 acres. To be included in LCMR-funded mercury study.
3	Dunnigan	Lake	T60N R10W	38-664	MPCA instrumented study lake from 1983-85. Mean alkalinity of 56 ueq/l. 85 acres. To be included in LCMR-funded mercury study.
4	Divide	Lake	T59N R7W	38-256	Special interest lake due to its fishery decline in the mid-1970's and its alkalinity of 30 ueq/l. 69 acres.
5	Bobble	Cook	T62N R2W	16-257	Special interest lake due to its alkalinity of 40 ueq/l; location along east-west gradient. 23 acres
6	Chester	Cook	T64N R3E	16-033	MPCA instrumented study lake from 1983-85. Mean alkalinity of 88 ueq/l. 50 acres.
7	Kane	Lake	T56N R10W	38-651	MPCA Division of Water Quality intensive study lake from 1983-86. Mean alkalinity of 86 ueq/l. 108 acres.
8	Deepwater	St. Louis	T52N R15W	69-399	Special interest lake due to location along north-south gradient. 18 acres.
9	Sand	Carlton	T47N R17W	09-016	MPCA Division of Water Quality intensive study lake from 1980-86. Mean alkalinity of 100 ueq/l. 123 acres.
10	Bass	Pine	T43N R21W	58-126	Special interest lake due to its alkalinity of 36 ueq/l during the spring of 1981. 32 acres.
11	Tamarack	Pine	T41N R17W	58-024	MPCA Division of Water Quality intensive study lake from 1982-86. Mean alkalinity of 130 ueq/l. 80 acres.
12	Deepwater	St. Louis	T59N R20W	69-858	Special interest lake due to its low alkalinity of 51 ueq/l, and high sulfate level of 88 ueq/l (Northern States Power Company data, 1985). 25 acres.
13	Little Neck	Itasca	T60N R25W	31-520	Special interest lake due to its low alkalinity (27.8 ueq/l) and relatively high sulfate (54 ueq/l). Data from Northern States Power Company, 1985. 40 acres.

Special interest lakes will be visited by MPCA staff to determine their suitability for inclusion in the study.

TABLE 5. Parameters to be Analyzed from Lake, Stream, and Snow Samples, Minimum Detection Limits, and Analytical Methods.

PARAMETER	UNITS	TYPE OF SAMPLE Lake	Stream	Snow	METHOD	METHOD #	REFERENCE
*pH (air equilibrated) pH (closed headspace)	SU	+- .02	+- .02	+- .02	Potentiometric	410.3	Hillman et al. 1986
Conductivity	uS/cm	<1.0	<1.0	<1.0	Wheatstone bridge	120.1	USEPA 1983
Acid Neutralizing Capacity; ANC	ueq/l	5	5	5	Titrimetric, two end-point	310.1	USEPA 1983
Acid Neutralizing Capacity; ANC	ueq/l	5	5	5	Gran plot titration		Gran 1952; Hillman et al. 1986
Organic Carbon, dissolved	mg/l	0.1	0.1	—	Oxidation (IR detection)	415.2	USEPA 1983
Cations:							
Calcium, dissolved	ueq/l	0.5	0.5	0.5	Atomic absorption**	215.1	USEPA 1983
Magnesium, dissolved	ueq/l	0.8	0.8	0.8	Atomic absorption**	242.1	USEPA 1983
Potassium, dissolved	ueq/l	0.3	0.3	0.3	Atomic absorption**	258.1	USEPA 1983
Sodium, dissolved	ueq/l	0.4	0.4	0.4	Atomic absorption**	273.1	USEPA 1983
Ammonium, dissolved	ueq/l	0.6	0.6	0.6	Salicylate method	350.2	USEPA 1983
Anions:							
Sulfate, dissolved	ueq/l	1.0	1.0	1.0	Ion chromatography	Dionex Corp. 1984;	Small et al. 1975
Nitrate, dissolved	ueq/l	0.1	0.1	0.1	Ion chromatography	Dionex Corp. 1984;	Small et al. 1975
Chloride, dissolved	ueq/l	0.3	0.3	0.3	Ion chromatography	Dionex Corp. 1984;	Small et al. 1975
Total Phosphorus	mg/l	0.002	—	—	Colorimetric, automated (ascorbic acid)	365.1	USEPA 1983
Aluminum							
Total dissolved	mg/l	0.005	0.005	—	Atomic absorption, furnace	202.2	USEPA 1983
Total monomeric	mg/l	—	0.005	—	Extraction, atomic absorption, furnace	202.2	USEPA 1983; Barnes 1975; Driscoll 1984
SiO2, dissolved (reactive)	mg/l	0.05	0.05	—	Colorimetric, automated (heteropoly blue)	425 E	APHA 1985
True Color	Pt-Co	0	—	—	Platinum Cobalt	110.2	USEPA 1983

* only lake samples will be bubbled with standard air containing 300 ppm CO2 for 20 minutes for air equilibrated pH; stream samples are assumed to be air-equilibrated at time of sampling.

** Atomic absorption by direct aspiration.

uS/cm = microsemens per centimeter
ueq/l = microequivalents per liter
mg/l = milligrams per liter
Pt-Co = Platinum cobalt units

2. Ammonium - The phenate method (USEPA method 350.1) is usually specified by the USEPA (1983) for the analysis of ammonium in lake water. However, phenol is a hazardous compound and known sensitizer which can create potential health and waste disposal problems. An automated salicylate method does not require the use of phenol and the method is more stable and gives better sensitivity to low ammonium concentrations than the phenate method. In the MPCA lake samples, the automated salicylate method (Method 350.2, USEPA, 1983) will be used to determine ammonium concentrations.

3. Total phosphorus - The laboratory will use an ammonium persulfate digestion of the sample in an autoclave followed by an automated ascorbic acid method using the Lachat autoanalyzer. This is equivalent to USEPA method 365.1 (1983).

4. Silica, dissolved - Dissolved silica will be determined by the automated heteropoly blue method using the Lachat autoanalyzer. This is an automated version of USEPA method 370.1 listed as Method 425E in Standard Methods (APHA, 1985).

5. Filtering of samples will occur in the lab, rather than in the field, to simplify field procedures during inclement weather.

6. Additional information to be collected includes:

   a. annual precipitation volume from the nearest operating rain gage (by month).

   b. precipitation chemistry from the nearest wet deposition site (mean annual volume-weighted concentrations of ions).

   c. watershed characteristics: watershed area, forest vegetation, slopes and aspect, soils (depth, textures, types, available chemistry data), and estimates of inflow and outflow stream discharge.

This supplemental information may help explain a significant amount of among-lake, or within-lake variability and help considerably in building models to analyze time trends in some of the chemical parameters (Newell et al., 1987).

REPORTS

This study is anticipated to run approximately 10 years. The Agency will produce yearly progress reports on the project, and an interim report after 5 years. The interim report will assess data collected up to that point in time. Preliminary analysis of the data will be conducted for the interim report and will provide a basis for the more sophisticated analysis in the 10 year report.

FUNDING AND FUTURE WORK

Funding for the seasonal lake sampling program is approximately $13,300 per year, excluding staff salaries. These costs should remain fairly stable over the course of the study period.

Future work is projected to remain at current levels. There may be some sediment core analysis to determine when sulfate deposition increased in selected study lakes. This may be a potential indicator for acidification and if funds are available, will be investigated through the University of Minnesota. Dr. Larry Baker has submitted a study proposal to the Water Resources Research Center at the University of Minnesota for potential funding.

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EPISODIC ACIDIFICATION STUDY

BACKGROUND

Studies conducted by the Minnesota Department of Natural Resources (MDNR) and the U.S. Environmental Protection Agency - Duluth Lab have documented episodic pH and alkalinity depressions during spring snowmelt on several North Shore streams and rivers. It is unclear due to the lack of stream discharge data whether the observed depression is occuring in response to dilution or the release of acidic deposition stored in the snowpack. Also unclear is the biological significance of these episodes relative to the associated fishery.

The purpose of the proposed study is to resolve the uncertainties of past investigations and to address questions raised with regard to episodic events during the Acid Deposition Rulemaking Hearing. Episodic snowmelt impacts were not considered in formulating the 11 kg/ha wet deposition standard. Results of the proposed study should provide information needed to evaluate the effectiveness of the acid deposition standard in protecting Minnesota streams from episodic acidification.

STUDY GOALS AND OBJECTIVES

A phased approach involving increased levels of sampling intensity will be initiated to test the hypothesis that pH and alkalinity depressions in North Shore streams are due primarily to dilution. Study goals and objectives are as follows:

A. Document chemical and discharge characteristics of select North Shore streams during snowmelt to assess their sensitivity to episodic impacts and provide the background data needed to select two streams for intensive study.

B. Document snowpack chemistry in select North Shore stream watersheds and determine the relative contribution and source of sulfates and nitrates in the intensively studied watersheds.

C. If declines in stream alkalinity and pH are found, assess the importance of sulfate and nitrate to these declines.

Due to the need for background chemistry data, the study will be implemented in phases, which are explained in the following paragraphs.

PHASE I

Due to an overall lack of data the goal of Phase I is to develop a chemical database and discharge rating curves for several North Shore streams. Data from Phase I monitoring will be analyzed and a preliminary assessment made regarding the sensitivity of these streams to acidic episodes and the role of dilution on any observed chemical depressions. In addition, Phase I will provide the needed background information to select two streams for Phase II monitoring.

PHASE I ACTIVITIES

Stream Selection

Seven streams within the Superior Highlands Region have been selected from a list of 30 candidates for semi-intensive water quality and discharge monitoring. Thirty streams were identified as potential candidates by MPCA and sampled during Fall 1987 to assess baseflow pH and alkalinity. Additional information regarding general watershed charcteristics, ease of access, suitability for in-channel discharge gaging, and apparent cultural impact were also gathered. Fisheries information was solicited from the Minnesota Department of Natural Resources and the Tofte and Gunflint Districts of the U.S. Forest Service. Dischage characteristics of North Shore streams and gaging techniques were discussed with researchers from the University of Minnesota.

In general the seven streams can be characterized as second or third order trout streams with year-round flow and fish populations. In general these streams do not originate in extensive surface impoundments (lakes), drain extensive bog areas, or are culturally impacted. Streams were chosen to represent a range of water quality, watershed characteristics, snowfall accumulation, and geographical distribution. The following list identifies the selected streams and proposed sampling locations:

West Split Rock River	- County Rd 3, T55N R9W, Lake County
Little Marais River	- Hwy 61, T57N R6W, Lake County
Blind Temperence Creek	- Forest Service Rd 116, T60N R4W, Cook County
Indian Camp Creek	- Hwy 61, T60N R2W, Cook County
Gauthier Creek	- Judge Magney Park, T62N R3E, Cook County
Timber Creek	- Gunflint Trail, T63N R1E, Cook County
Irish Creek	- Arrowhead Trail, T63N R4E, Cook County

Stream Discharge Measurement

Accurate stream discharge measurements will be critical in assessing the role of dilution on water chemistry. Stream discharge is the total volume of water flowing past a given point in a known unit of time and is a function of the cross-sectional area of the stream and the speed with which the water is flowing.

Discharge gaging sites have been selected and equipped at Blind Temperance Creek and Gauthier Creek. Discharge gaging prior to ice-free conditions will only be conducted at these two sites. Gaging will be initiated at the remaining sites when conditions ensure a stable control section.

At Blind Temperance Creek a culvert will be serve as the control section. A 14 foot section at the downstream edge of the culvert was equipped in January 1988 with a heated enclosure to maintain ice-free conditions in order that discharge gaging could commence at the onset of sample collection. At Gauthier Creek, natural constrictions of the stream bed by exposed bedrock provide ready-made gaging sites. A heated enclosure was not neccessary at Gauthier Creek. In both cases, the control sections provide a channel of known proportions with a relatively smooth bottom.

Discharge rating curves will be developed for Blind Temperance and Gauthier Creek from point-in-time velocity measurements and stream stage data. Continuous stream stage will be recorded using a Campbell CR10 datalogger and Geokon vibrating-wire pressure transducers. The transducers were pinned to the stream bottom adjacent the discharge control section of each respective stream in Feburary 1988. Each datalogger was programmed to read stream stage at 10 second intervals and average and store these readings every 15 minutes. Minimum and maximum data will be recorded on a 24-hour interval.

Water Sampling

Sampling for a full suite of chemical parameters began the week of March 14, 1988 and will continue for 12 weeks or until post-melt base flow conditions are reached. Semi-weekly (Monday and Thursday) grab samples will be collected from each stream by Agency staff. Samples will be submitted to the Natural Resources Research Institute Analytical Lab in Duluth within 24 hours after collection. Samples for monomeric aluminum will be filtered in the field at the time of sampling. All remaining samples will be filtered and preserved upon arrival at the analytical lab by agency staff.

Chemical analyses of stream water samples will follow methodologies outlined for lake water samples. Pages 15 and 16 of this document outline modifications that will be made in these methods. One additional change is for dissolved monomeric aluminum. Samples for monomeric aluminum analysis will be collected and filtered in 50 mL syringes in the field. Samples will be extracted upon arrival at the lab. Samples will be complexed with buffered 8-hydroxyquinolan and extracted into methyl isobutyl ketone in accordance with the method of Driscoll (1984). Aluminum determination is run on the extract by atomic absorption usin graphite furnace atomization.

Snow Sampling

Snow sampling for chemical analyses will be conducted to determine the snowpack concentration of sulfate and nitrate. Bulk snow collectors (Nipher gages) have been borrowed from the Ontario Ministry of the Environment, Thunder Bay District, and placed in the watershed of Gauthier and Blind Temperance Creeks, respectively. Samples are to be collected monthly and submitted to the Natural Resources Research Institute Lab for chemical analysis. Parameters to be analyzed, methods of analysis, and detection limits are presented in Table 5. Snow courses will be run to calculate mean snow depth within the watershed of Gauthier and Blind Temperence Creeks, respectively.

Phase II

The goal of Phase II monitoring is to document stream chemistry and discharge characteristics of two North Shore stream watersheds over several years to document the frequency and magnitude of acidic snowmelt or storm related episodes. Two streams will be instrumented for continuous discharge measurement and automated water sample collection. Continuous discharge data will provide the needed information to test the dilution hypothesis. Watershed data will be collected and analyzed to determine the relative contribution and source of individual acidity components (natural versus anthropogenic acidity).

ISCO automatic water samplers will be placed on the two instrumented streams to provide stage actuated or sequential sampling. All samples will be shuttled to the lab the day of collection in order to ensure timely filtering, preservation and analyses. The sampling schedule will be developed once the final number of streams is determined. Phase II streams will be selected after data collected in Phase I has been thoroughly evaluated.

Phase III

Phase III is dependent on the results of Phase II monitoring. If continued monitoring is warranted Phase III will assess the biological significance of acidic snowmelt or storm related episodes. Phase II monitoring activities will continue in conjunction with Phase III. Design of Phase III monitoring will not be detailed in this work plan.

REPORTS

Data collected during Phase I study will be reported before the selection of Phase II streams. This report will be developed as data becomes available to insure the timely selection of Phase II streams.

FUNDING AND FUTURE WORK

Funding for the Episodic Acidification Study is approximately $30,000 per year, excluding staff salaries. It is expected that costs will remain the same for the Phase II portion of the study.

ACID PRECIPITATION PROGRAM BUDGET

Fiscal Year 1989

Salary & Fringe (5 positions)		$169,015
Repair Services		$ 1,120
Printing		$ 900
Professional Services		$108,804
Precipitation Lab Analysis	$72,654	
Stream/Snowmelt Samples	$24,410	
Lake Samples	$11,740	
Purchased Services (precip monitoring contracts)		$ 4,380
Data Processing		$ 1,220
Communications		$ 2,000
In-state Travel		$ 9,615
Out-state Travel		$ 2,780
Utilities		$ 500
Supplies		$ 3,166
Equipment		$ 400
Total		$303,900

APPENDIX A

DEPARTMENT : MN POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE : January 26, 1988

TO : MPCA Board Members

FROM : Gerald L. Willet G.L.W.
Commissioner

PHONE : 296-7301

SUBJECT : ACID DEPOSITION CONTROL REQUIREMENTS

In July 1986, the MPCA Board adopted Minnesota Rules 7005.4010-7005.4050 which: 1) established an acid deposition standard of 11 kilograms per hectare per year wet sulfate in the sensitive areas of the state; 2) requires reductions in sulfur dioxide (SO_2) emissions from two electric generating facilities by requiring Reasonably Available Control Technology (RACT); 3) established a system-wide cap on Northern States Power (NSP) and Minnesota Power (MP), respectively, to 130% of 1984 SO_2 emissions effective January 1, 1990; and 4) established a state-wide SO_2 emission limit of 224,000 tons per year by January 1, 1990, and an SO_2 emission limit of 194,000 tons per year by January 1, 1994. The rule requires staff to provide the Agency with a status report by February 1, 1988, including any additional control requirements necessary to meet the 1990 emission cap.

With respect to RACT for the Minnesota Power Clay Boswell Steam Electric Station at Cohasset, Agency staff has proposed and Minnesota Power has agreed to defining this as 0.33 pounds of SO_2 emissions per million Btu heat input (lb SO_2/MMBtu) for Unit No. 4. By reducing the emission rate of Unit No. 4 from 0.6 lb SO_2/MMBtu heat input (1984 reference year) to 0.33 lb SO_2/MMBtu by 1990, the annual average emission factor for all four units should be approximately 0.75 lb SO_2/MMBtu heat input, which is consistent with the definition of RACT proposed in the Acid Rain Hearings (1986).

For Northern States Power Company's Allen S. King Generating Plant, the Agency staff has proposed RACT as 1.2 lb SO_2/MMBtu heat input. NSP has undertaken a fuel suitability test and monitoring program which should be completed by February 15, 1988. This test program includes the firing of Wyoming coal or blends of Wyoming and Kentucky coal in lieu of Montana coal to get lower SO_2 emissions without an unacceptable derate in power generating capacity. A progress report on this testing and monitoring program is being prepared by NSP for the Agency's review.

Draft electric utility power generation system permits for implementation of the system-wide SO_2 emissions caps were submitted to both MP and NSP for comment. NSP has indicated agreement to a system cap of 93,500 tons SO_2 per year, and MP to 40,300 tons SO_2 per year by 1990. These emission limits are slightly higher than the emission limits discussed in the Acid Rain Hearings (91,000 tons/yr for NSP, 39,000 tons/yr for MP) and Agency staff are currently investigating the reasons for the differences. These system permits are new to both the Agency and the utilities, but the concept has been well received by both NSP and MP and it is presently anticipated the unresolved issues can be negotiated to achieve program objectives.

The state-wide SO_2 emission limit of 224,000 tons per year (tons/yr) by January 1, 1990, will be met. The most recent data available from 1984/1985 shows 155,541 tons of SO_2 being emitted in the state. These emissions are expected to increase slightly over the next several years, but should be well below the 224,000 tons/yr limit in 1990. This information indicates no additional regulatory requirements need to be imposed on emission facilities in Minnesota in order to maintain or achieve a statewide sulfur dioxide emission limitation of 224,000 tons/yr on and after January 1, 1990.

For further information on the activities associated with the Acid Deposition Control Requirements in Minnesota, please contact David Thornton (612/296-7265) or Cliff Twaroski (612/296-7800) in the Division of Air Quality.

GLW:vmm

APPENDIX B

WORKING PROTOCOL FOR SAMPLING, SAMPLE ANALYSIS, AND QA/QC FOR THE EPA LONG-TERM SURFACE WATER MONITORING PROGRAM

Environmental Research Laboratory -- Corvallis
U.S. Environmental Protection Agency
200 S.W. 35th Street
Corvallis, Oregon 97333

May 1985

WORKING PROTOCOL FOR SAMPLING, SAMPLE ANALYSIS, AND QA/QC FOR THE USEPA LONG-TERM SURFACE WATER MONITORING PROGRAM

Introduction

An EPA program for long-term monitoring of lakes and streams was initiated in 1982 within the NAPAP organizational framework. An ad hoc committee, with representation from USEPA, USGS, TVA, USD-FS, USFWS, USNPS, and Brookhaven National Laboratory, developed a draft sampling and analysis protocol to standardize monitoring efforts among the member Task Group E agencies. This document, with periodic reviews and updates, has served as the standard protocol for the EPA surface water monitoring program since its inception.

In 1984, EPA initiated the National Surface Water Survey (NSWS). This three-phase program is scheduled to culminate in the selection of geographically representative lakes for long-term monitoring in the east, upper midwest, and mountainous west. This third phase of NSWS is expected to subsume the existing long-term monitoring program. Most of the existing sites are probably compatible with Phase III owing to their location in low alkalinity regions and their positioning with respect to minimization of extraneous effects that could compromise interpretations of observed changes or trends.

The methods manual developed for NSWS (Hillman et al.) has been used, together with the Task Group E sampling and analysis protocol document, to produce the present "working protocol" for the long-term monitoring program. Laboratory analytical methodology, detection limits, and QA/QC procedures are more adequately and precisely specified; site selection criteria are not included. The objective has been to align the long-term monitoring methodology with that of NSWS, without undue disruption of existing monitoring procedures. The present document replaces the Task Group E protocol (Aquatic Effects Task Group, March 1984 revised) as the procedural document for the EPA monitoring program. Participating agencies and institutions must be able to demonstrate their use of these or equivalent sampling, analysis, and QA/QC procedures. Audits will be conducted to determine compliance with these procedures.

This document recognizes that U.S. Geological Survey protocols used in their stream research and monitoring program are not necessarily identical with those set forth here. By prior agreement with the EPA project officer, USGS protocols are acceptable in the existing cooperative EPA-USGS stream studies. Differences are few, and are noted where appropriate in this document. The USGS laboratory at Denver, where samples from the cooperative studies are analyzed, is a participant in the NSWS. Therefore, there should be no differences in laboratory analytical methodology.

1.0 COLLECTION OF SAMPLES IN THE FIELD

1.1 Lakes

Lakes should be sampled near their deepest points (at least 20 m from shore if possible). If the water column is not thermally stratified, one sample should be collected approximately one-half meter beneath the water surface. If the water body is stratified, one sample should be collected approximately one-half meter beneath the water surface and a second one or two meters above bottom. These two samples should not be mixed or composited. A plastic closing sampling device of the Van Dorn type should be used to obtain samples at depth; do not use a metal sampler. Samples should be collected from the sampling device in plastic bottles that have been treated as described in 3.0. (See 6.1 regarding replicate samples).

1.2 Streams

Samples are obtained by hand as near mid-stream as possible, using a properly cleaned and rinsed plastic container of appropriate size. (See 6.1 regarding replicate samples). Keep hand away from mouth of container, and minimize the number of persons handling samples.

1.3 Carefully record any observed conditions that might affect analysis or interpretation of samples in field notes or sampling log.

1.4 Key project personnel who are responsible for sample integrity must be identified.

2.0 MEASUREMENTS

A set of "core" measurements are specified for the EPA monitoring program. These measurements, which are considered to provide sufficient characterization of stream or lake water quality for assessment of sensitivity and changes related to acidification, are:

pH (field and laboratory air-equilibrated)
total alkalinity
specific conductance
temperature
Secchi disc transparency (lakes)
true color
major cations (Ca, Mg, Na, K)

major anions (SO_4, NO_3, Cl)
total aluminum (filtered)

Additional measurements, including titrated acidity, DIC, DOC, F^-, Fe, Mn, NH_4, SiO_2, and total P, are being made by NSWS; some of these analyses, while not required, are also being made by some cooperators in the monitoring program.

Care must be taken to assure that the highest quality deionized water is used throughout all stages of sampling and analysis. Specific conductance of such water should not exceed 1.0 μS/cm.

3.0 SAMPLE CONTAINERS

3.1 Type

Containers should be composed of high density linear polyethylene, with polypropylene caps (do not use polyseal caps).

3.2 Cleaning of Plastic Containers

3.2.1 Containers to be used for pH, acidity, alkalinity, and anion determinations will be rinsed three times with deionized water, filled with deionized water and allowed to stand for 48 hours, then emptied and sealed in clean plastic bags until used in the field.

3.2.2 Sample containers for cations and metals will be rinsed three times with deionized water, rinsed three times with 3N HNO_3 (prepared from Baker Instra-Analyzed HNO_3 or equivalent), then rinsed six times with deionized water. They will then be filled with deionized water and allowed to stand for 48 hours. They are then emptied, capped, and placed in clean plastic bags.

3.2.3 After the initial cleaning, 5 percent of the containers will be checked by filling with deionized water, capping, and slowly rotating the container so water touches all surfaces. Check conductivity; if greater than 1 μS/cm in any of the checked containers, rerinse all containers and retest 5 percent.

4.0 SAMPLE FILTRATION

4.1 For anion analysis (including SO_4, NO_3, Cl): Rinse a cleaned 250 ml bottle three times with sample water which has been filtered directly into the sample bottle (discarding each rinse). Then fill to 250 ml with filtered sample. Use a 0.45 μm pore size membrane filter (e.g., Nucleopore polycarbonate or cellulose acetate). Ice or refrigerate. A good portable unit for filtering samples at field sites is described by Kennedy et al., 1976.

4.2 For metals and cation analyses (including Ca, Mg, Na, K): Filter 100 ml of sample into an acid-washed bottle (see 3.2.2) after rinsing three times by passing 100 ml of sample through a 0.45 μm filter and discarding each rinse. Add a 1-ml ampoule of concentrated ultrapure nitric acid (Baker Ultrex or equivalent) to the sample. Ice or refrigerate.

4.2.1 U.S. Geological Survey presently uses 0.1 μm filters for Al, Fe, and Mn in their stream work. (They are conducting comparisons of various pore sizes).

4.3 Samples for pH, alkalinity, specific conductance, and true color are not filtered.

5.0 SAMPLE PRESERVATION AND MAXIMUM HOLDING TIMES

5.1 Refrigeration at 4°C is the only recommended method of preservation for the following constituents. (Maximum allowable holding times appear in parentheses). For present purposes, icing must be considered equivalent to 4°C refrigeration.

specific conductance (14 days)
color (48 hr)
pH (no approved holding time; field sample should be analyzed immediately, and air-equilibrated laboratory samples as soon as possible)
alkalinity (14 days, according to NSWS protocol)
sulfate (28 days)
chloride (28 days)
silica (28 days)
nitrate-nitrogen (7 days)

5.2 Refrigeration at 4°C plus acidification with nitric acid to pH < 2 is recommended for the following constituents:

calcium (6 months)
magnesium (6 months)
sodium (6 months)
potassium (6 months)
aluminum (6 months)

5.3 Labels on all containers should include sufficient information to permit tracing the sample back to point and time of collection.

6.0 QA/QC SAMPLES: LAKES

Replicate samples, filtration blanks, and container blanks (total of four additional samples) are to be obtained one time for approximately every ten lakes sampled, as described below in Sections 6.1, 6.2, and 6.3. These are minimum requirements. For each project, this results in the following:

Project	No. of Rep/Blank Sets Per Sampling Interval*	Per Year
University of Minnesota	3 (1/state)	9
University of Maine	1	3
Vermont	2	8
Syracuse University	2	8
TVA	1	4
USGS Colorado	2	6

* Sampling intervals are:
Minnesota, Maine -- spring, summer, fall.
Vermont, TVA -- spring, summer, fall, winter.
Syracuse -- quarterly (17 lakes are sampled monthly; 2 rep/blank sets per quarter).
Colorado -- monthly, summer only.

6.1 Replicate Samples

Obtain a replicate sample by repeating step 1.1 or 1.2. These replicate samples are analyzed to determine the adequacy of the sampling process in obtaining a representative sample of the lake or stream at a particular point in time.

6.2 Filtration Blanks

Prepare two filtration blanks by filtration of deionized water into properly cleaned (1) anion container (3.2.1) and (2) cation container (3.2.2). Analysis of the filtrate for the appropriate ions determines the adequacy of the filtration process and the cleanliness of the sample containers.

6.3 Container Blanks

Prepare one unfiltered container blank by filling a properly cleaned container (see 3.2.1) with deionized water. Analysis of this sample for pH, alkalinity, specific conductance, and strong/weak acidity (if applicable) provides a check on the adequacy of the container.

6.4 EPA-USGS Cooperative Stream Monitoring Projects

Replicate samples, filtration blanks, and container blanks will be taken at the primary (intensive) stream site each time that site is sampled. In addition, replicates will be obtained on two satellite streams three times yearly under low, intermediate, and high flow conditions.

7.0 MEASUREMENT METHODS

7.1 pH

7.1.1 Field measurement. Measure as soon after collection as possible. pH should be measured to ± 0.02 units using a high quality pH meter with an expanded or digital scale. A good electrode is the Corning No. 476182 glass combination or the Ross Model 81-02. The electrode should be calibrated in the field in pH 4 and 7 buffer solutions and checked with a sulfuric acid solution with a theoretical pH of 4 (5×10^{-5} molar H_2SO_4). Rinse probe copiously with sample or deionized water and immerse in sample. Do not stir. The electrode should remain in the sample until there is no discernable drift in the pH reading, but no longer than 15 minutes. At least 10 percent of samples must be measured in replicate. Upon completion of measurement of a sample batch, recheck pH of acid solution.

7.1.2 Laboratory (air-equilibrated) measurement. For normalization of pH values obtained by various participating investigators, air-equilibrated pH measurements should be obtained in the laboratory. Equilibration is achieved by bubbling samples with standard air containing 300 ppm CO_2 for 20 minutes while stirring on a magnetic stirrer. Use an acid-washed (see 3.2.2) fritted glass diffuser for dispersal of air in the sample. Measure pH immediately following equilibration, following procedure in Section 7.1.1. At least 10 percent of samples must be measured in replicate (Ref: Hillman et al.).

7.2 Specific Conductance (μS/cm at 25°C). Measured in the laboratory using a wheatstone bridge type conductivity meter. See Section 8.2 for calibration and QA/QC instructions (Ref: Hillman et al.).

7.3 True color. Comparison of centrifuged sample with platinum-cobalt color standards. (Ref: USEPA, 1979).

7.4 Total alkalinity. Titration with 0.020 N H_2SO_4 using Gran plot calculations. Fixed endpoint titration is not acceptable (Ref: Gran, 1950, 1952; Golterman and Clymo, 1969; Zimmerman and Harvey, 1978-1979; Hillman et al.).

7.5 Calcium, magnesium, sodium, and potassium. Atomic absorption spectrometry, direct aspiration (Ref: USEPA, 1979).

7.6 Sulfate, chloride, nitrate. Ion chromatography (Ref: Hillman et al.).

7.7 Aluminum, total filtered. Graphite furnace atomic absorption (EPA Method 202.2) (Ref: Hillman et al.; USEPA, 1979).

7.8 Phosphorus, total. Colorimetric, automated, block digestor AAII (USEPA, 1979), or USGS colorimetric, phosphomolybdate, automated (Hillman et al.).

7.9 Ammonium. Colorimetric, automated phenate (USEPA, 1979).

7.10 Kjeldahl nitrogen. Colorimetric, automated phenate (USEPA, 1979).

7.11 Table 1 states desired minimum analytical detection limits and within-laboratory relative precision goals.

8.0 QUALITY CONTROL PROCEDURES

Procedures normally followed by participants in the long-term monitoring program should be continued. The intent of this section is to ensure the common use of standardized quality control procedures for comparability of results. Any of the procedures given here that are not now being followed by cooperating agencies or institutions should be added to their QA/QC programs.

8.1 Precision and Accuracy

8.1.1 Precision

8.1.1.1 Definition: Precision is a measure of agreement among individual measurements of the same property, under prescribed similar conditions. In this program we recognize (1) intralaboratory and (2) sampling and analysis precision.

8.1.1.2 Intralaboratory Precision

Intralaboratory precision is determined by analyzing an individual sample in replicate. This should be done for at least one sample per batch for each variable being measured. The difference between the two resultant values is multiplied by 0.89 to approximate the standard deviation. The standard deviation divided by the mean of the duplicate values and multiplied by 100 yields the relative standard deviation (RSD) in percent. The RSD is an operational statistic (also called the coefficient of variation) indicating the dispersion of a set of replicate measurements as a percentage of the mean value. In reporting precision for a given variable, show the number of replicate analyses, range of RSD values, and average RSD.

Table 1. Required minimum analytical detection limits (note reporting units), within-laboratory relative precision, and bias limits. (NOTE: Some listed measurements may not apply to the existing long-term monitoring program. See 2.0).

Parameter (a)	Units	Required Detection Limit	Intralab Relative Precision Goal (%) (b)	Bias Upper Limit (%)
Acidity	µeq/l	5	10	10
Alkalinity	µeq/l	5	10	10
Al, Total	mg/l	0.005	10 Al>0.01), 20 (Al<0.01)	10/20
Ca	µeq/l	0.5	5	10
Cl^-	µeq/l	0.3	5	10
Color	ALPH units	0	± 5 (c)	--
DIC	mg/l	0.05	10	10
DOC	mg/l	0.1	5 (DOC>5), 10 (DOC<5)	10
F^-	µeq/l	0.3	5	10
Fe	mg/l	0.01	10	10
K	µeq/l	0.3	5	10
Mg	µeq/l	0.8	5	10
Mn	mg/l	0.01	10	10
Na	µeq/l	0.4	5	10
NH_4	µeq/l	0.6	5	10
NO_3	µeq/l	0.1	10	10
pH, field	pH units	-	± 0.1 (c)	--
pH, lab	pH units	-	± 0.05 (c)	--
SiO_2	mg/l	0.05	5	10
SO_4^{2-}	µeq/l	1.0	5	10
Specific Conductance	µS/cm	(d)	1	5
Total P	mg/l	0.002	10 (P>0.01), 20 (P<0.01)	10/20

(a) Dissolved ions and metals are determined, except where noted.
(b) Unless otherwise noted, this is the relative precision at concentrations above about 10 times instrumental detection limits.
(c) Absolute precision goal in terms of applicable units.
(d) Blank must be <1.0 µS/cm.

8.1.1.3 Sampling and Analysis Precision

Sampling precision cannot be estimated directly. However, the precision in the combined sampling and analysis procedure can be estimated from the analysis of the duplicate samples taken in the field (see 6.1). Then the sampling variance can be estimated by subtracting the analytical variance obtained in 8.1.1.2. The precision in the combined sampling and analysis operation is estimated by applying the same methodology described for intralaboratory precision (8.1.1.2).

8.1.2 Accuracy

8.1.2.1 Definition: Accuracy is a measure of the closeness of an individual measurement or an average of a number of measurements to the true values. Accuracy includes both precision and recovery and can be expressed as a percent recovery or percent bias interval.

8.1.2.2 Evaluation of Accuracy

Two approaches are specified:

8.1.2.2.1 Fortify an actual sample with a known amount of material, analyze the fortified (spiked) sample, and calculate the percent recovery. This should be done for at least one sample per batch for each variable being measured. In reporting accuracy for a given variable, show the number of spiked analyses, concentration of spike, range of bias (+ and - percent), and average bias (+ or - percent).

8.1.2.2.2 Audit samples are provided three times each year by an independent contractor. Analysis results are compared with the known concentrations to determine (1) intralaboratory bias and (2) comparability of measurements among the various monitoring projects.

8.2 Cautions Regarding Specific Conductance and Alkalinity

8.2.1 Specific Conductance

After calibration and prior to measuring the first sample, measure the conductance of a QC standard. The standard should have a theoretical or certified conductance of about 50 μS/cm (0.0005000 M KCl has a conductance of 73.90 μS/cm at 25°C). It must be prepared from a stock solution that is different from that from which the calibration standard is prepared. If the measured conductivity is not within ± 1 percent of the certified value, then restandardize the meter and cell and repeat the measurement.

Remeasure the conductance of the QC standard at least once every 10 samples. One sample per batch must be measured in duplicate.

8.2.2 Alkalinity

At least 10 percent of alkalinity titrations must be run in replicate. Agreement must be ± 10 percent or less. If not, run a third determination.

8.3 Further Procedural Checks

Once each variable in a sample has been determined, there are several procedures which must be followed to check the correctness of the analyses. These are outlined below.

8.3.1 Cation-Anion Balance

Theoretically, the sum of equivalents of anions equals the sum of equivalents of cations in a sample. In practice, this rarely occurs due to analytical variability and ions which are present but not measured. For each sample, the sums of the measured anion and cation equivalents, total ion strength, and ion percent difference are calculated as follows:

$$\sum \text{anions} = [Cl^-] + [F^-] + [NO_3^-] + [SO_4^{2-}] + [HCO_3^-] + [CO_3^{2-}]$$

$$\sum \text{cations} = [Na^+] + [K^+] + [Ca^{2+}] + [Mg^{2+}] + [NH_4^+] + [H^+]$$

$$\%\ \text{Ion Difference} = \frac{\sum \text{anions} - \sum \text{cations}}{\sum \text{anions} + \sum \text{cations}} \times 100$$

$$\text{Total ion strength} = \sum \text{anions} + \sum \text{cations}$$

[Omission of F^-, CO_3^{2-}, and NH_4^+ will not significantly affect results. Alkalinity plus H^+ (calculated from pH) may be used for HCO_3^-].

All concentrations are expressed as microequivalents/liter (µeq/l). Table 2 lists factors for converting mg/l to µeq/l for each of the parameters.

Samples which have a poor ion balance may have to be reanalyzed. Table 3 lists the reanalysis criteria.

8.3.2 Specific Conductance Balance

An estimate of the specific conductance of a sample can be calculated by summing the equivalent conductance values for each measured ion at infinite dilution.

The calculated conductance is determined by multiplying the concentration of each ion (in $\mu eq/l$) by the appropriate factor (F) in Table 4.

The calculated conductance for the entire sample is obtained from the relationship,

$$\text{Calculated Conductance} = \frac{\sum (\text{F x Conc. in } \mu\text{eq/l})}{1000}$$

The percent difference between measured conductance and calculated conductance is given by

$$\text{\% Conductance Difference} = \frac{\text{Calculated - Measured}}{\text{Measured}} \times 100$$

Samples which have percent conductance differences exceeding the limits listed in Table 3 may have to be reanalyzed.

Table 2. Factors to convert mg/l to μeq/l

Ion	Factor (μeq/l per mg/l)
Ca^{2+}	49.9
Cl^-	28.2
CO_3^{2-}	33.3
F^-	52.6
K^+	25.6
Mg^{2+}	82.3
Na^+	43.5
NH_4^+	55.4
NO_3^-	16.1
SO_4^{2-}	20.8
Alkalinity (as $CaCO_3$)	20.0

Table 3. Chemical reanalysis criteria

A. Cation-Anion Balance

Total Ion Strength ($\mu eq/l$)	% Ion Difference*
< 50	> ± 60
≥ 50 < 100	> ± 30
≥ 100	> ± 15

B. Calculated vs. Measured Conductance

Measured Conductance ($\mu S/cm$)	% Conductance Difference*
< 5	> 50
≥ 5 < 30	> 30
≥ 30	> 20

* If the percent difference exceeds these values, the sample is reanalyzed. When reanalysis is indicated, the data for each parameter are examined for possible analytical error. Any suspect parameters are then reanalyzed and the above percent differences recalculated.

Table 4. Conductance factors (F) of ions

Ion[a]	Conductance ($\mu S/cm$ at 25°C) per $\mu eq/l$	Ion[a]	Conductance ($\mu S/cm$ at 25°C) per $\mu eq/l$
Ca^{2+}	0.052	NO_3^-	0.071
Mg^{2+}	0.047	Cl^-	0.076
Na^+	0.049	SO_4^{2-}	0.074
K^+	0.072	HCO_3^-	0.044
H^+	0.350	OH^-	0.198
NH_4^+	0.075		

[a] H^+ and OH^- calculated as: $[H^+] = 10\text{-pH} \times 10^6$ $\mu eq/l$.

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APPENDIX J

The Clean Water Partnership Program

Minnesota Clean Water Partnership Act

115.091 CITATION

Sections 15.091 to 115.102 may be cited as the "Minnesota clean water partnership act."
History: 1987 c 392 s 1

115.092 PURPOSE

(a) It is the purpose of the legislature in enacting the Minnesota clean water partnership act to protect and improve surface and ground water in Minnesota, through financial and technical assistance to local units of government to control water pollution associated with land use and land management activities.
(b) It is also the purpose of the legislature to:
(1) identify water quality problems and their causes;
(2) direct technical and financial resources to resolve water quality problems and to abate their causes;
(3) provide technical and financial resources to local units of government for implementation of water quality protection and improvement projects;
(4) coordinate a nonpoint source pollution control program with elements of the existing state water quality program and other existing resource management programs; and
(5) provide a legal basis for state implementation of federal laws controlling nonpoint source water pollution.
History: 1987 c 392 s 2

115.093 DEFINITIONS

Subdivision 1. Applicability. The definitions in this section apply to sections 115.091 to 115.102.
Subd. 2. Agency. "Agency" means the pollution control agency.
Subd. 3. Best management practices. "Best management practices" means practices, techniques, and measures, that prevent or reduce water pollution from nonpoint sources by using the most effective and practicable means of achieving water quality goals. Best management practices include, but are not limited to, official controls, structural and nonstructural controls, and operation and maintenance procedures.
Subd. 4. Director. "Director" means the director of the pollution control agency.
Subd. 5. Local unit of government. "Local unit of government" means a statutory or home rule charter city, town, county, soil and water conservation district, watershed district, an organization formed for the joint exercise of powers under section 471.59, and any other special purpose district or

authority exercising authority in water and related land resources management
at the local level.

Subd. 6. Nonpoint source. "Nonpoint source" is a land management activity or land use activity that contributes or may contribute to ground and surface water pollution as a result of runoff, seepage, or percolation and that is not defined as a point source in section 115.01, subdivision 15. Nonpoint sources include, but are not limited to rural and urban land management activities and land use activities and specialty land use activities such as transportation.

Subd. 7. Official controls. "Official controls" means ordinances and regulations that control the physical development of the whole or part of a local government unit or that implement the general objectives of the local government unit.

Subd. 8. Project. "Project" means the diagnostic study of water pollution caused by nonpoint sources water pollution, a plan to implement best management practices, and the physical features constructed or actions taken by a local unit of government to implement best management practices.

Subd. 9. Water pollution. "Water pollution" means water pollution as defined in section 115.01, subdivision 5.

Subd. 10. Waters of the state. "Waters of the state" means waters as defined in section 115.01, subdivision 9.

History: 1987 c 392 s 3

115.094 CLEAN WATER PARTNERSHIP PROGRAM ESTABLISHED

A clean water partnership program is established as provided in sections 115.091 to 115.102. The agency shall administer the program in accordance with those sections. As a basis for the program, the agency and the metropolitan council shall conduct an assessment of waters in accordance with section 115.095. The agency shall then provide financial and technical assistance in accordance with section 115.096 to local units of government for projects in geographical areas that contribute to surface or ground water flows. The projects shall provide for protection and improvement of surface and ground water from nonpoint sources of water pollution.

History: 1987 c 392 s 4

115.095 STATEWIDE RESOURCE ASSESSMENT

The agency shall conduct an assessment of waters of the state that have been polluted by nonpoint sources and of geographical areas with waters of the
state that have a high potential for water pollution caused by nonpoint sources. The metropolitan council shall conduct the assessment in the metropolitan area, as defined in section 473.121, subdivision 2, in cooperation with the agency. The assessment shall be completed by July 1, 1988.

History: 1987 c 392 s 5

115.096 FINANCIAL AND TECHNICAL ASSISTANCE: ELIGIBILITY

Subdivision 1. Financial assistance. The agency may award grants for up to 50 percent of the eligible cost for (1) the development of a diagnostic study and implementation plan, and (2) the implementation of that plan. The agency shall determine which costs are eligible costs and grants shall be made and used only for eligible costs.

Subd. 2. Technical assistance. The agency may provide technical assistance to local units of government in order to ensure efficient and effective development and implementation of projects and coordination of projects with other water management activities.

History: 1987 c 392 s 6

115.097 ELIGIBILITY FOR ASSISTANCE

Subdivision 1. Generally. To be eligible for the financial or technical assistance or both as provided in section 115.096, a local unit of government applying for assistance must (1) have authority to coordinate and enter into contracts with local, state, and federal agencies and private organizations, raise funds, and adopt and enforce official controls; and (2) provide the agency with those documents required in subdivision 2.

Subd. 2. Documents required. (a) An applicant for assistance shall submit the following to the agency:

(1) an application form as prescribed by the agency;

(2) evidence that the applicant has consulted with the local soil and water conservation districts and watershed districts, where they exist, in preparing the application; and

(3) one of the following documents:

(i) the comprehensive water plan authorized under chapter 110B;

(ii) a surface water management plan required under section 473.878;

(iii) an overall plan required under chapter 112; or

(iv) any other local plan that provides an inventory of existing physical and hydrologic information on the area, a general identification of water quality problems and goals, and that demonstrates a local commitment to water quality protection or improvement. After July 1, 1991, only projects that are a part of, or are responsive to a local water plan under chapters 110B, 112, or sections 473.875 to 473.883 will be eligible under this clause.

(b) The document submitted in compliance with paragraph (a), clause (3) must identify existing and potential nonpoint source water pollution problems and must recognize the need and demonstrate the applicant's commitment to abate or prevent water pollution from nonpoint sources in the geographic areas for which the application is submitted.

History: 1987 c 392 s 7

115.098 AGENCY REVIEW OF APPLICATIONS; RANKING OF PROJECTS

The agency shall rank applications for technical and financial assistance in order of priority and shall, within the limits of available appropriations, grant those applications having the highest priority. The agency shall be rule adopt appropriate criteria to determine the priority of projects.

The criteria shall given the highest priority to projects that best demonstrate compliance with the following objectives:

(a) The project demonstrates participation, coordination, and cooperation between local units of government and other public agencies, including soil and water conservation districts or watershed districts, or both those districts.

(b) The degree of water quality improvement or protection is maximized relative to the cost of implementing the best management practices.

(c) Best management practices provide a feasible means to abate or prevent nonpoint source water pollution.

(d) The project goals and objectives are consistent with the state water quality management plans, the statewide resource assessment conducted under section 115.095, and other applicable state and local resource management programs.

History: 1987 c 392 s 8

115.099 PLAN IMPLEMENTATION

Subdivision 1. Implementation according to law and contract. A local unit of government receiving technical or financial assistance or both from the agency shall carry out the implementation plan approved by the agency according to the terms of that plan, any contract or grant agreement made with
the agency and according to sections 115.091 to 115.102, the rules of the agency, and applicable federal requirements.

Subd. 2. Review by agency. The director or the director's designee may, at any reasonable time, inspect any project and review the expenditure of financial assistance funds granted by the agency in order to determine whether
the local unit of government has complied with subdivision 1.

Subd. 3. Enforcement of agreements. The agency may bring a civil action in district court to recover from a local governmental unit any financial assistance funds used in violation of subdivision 1.

History: 1987 c 392 s 9

115.10 RULES

The agency shall adopt permanent rules necessary to implement sections 115.091 to 115.102. The rules shall contain at a minimum:

(1) procedures to be followed by local units of government in applying for technical or financial assistance or both;

(2) conditions for the administration of assistance;

(3) procedures for the development, evaluation, and implementation of best management practices;

(4) requirements for a diagnostic study and implementation plan;

(5) criteria for the evaluation and approval of a diagnostic study and implementation plan;

(6) criteria for the evaluation of best management practices;

(7) criteria for the ranking of projects in order of priority for assistance;

(8) criteria for defining and evaluating eligible costs and cost-sharing by local units of government applying for assistance; and

(9) other matters as the agency and the director find necessary for the proper administration of sections 115.091 to 115.102, including any rules determined by the director to be necessary for the implementation of federal programs to control nonpoint source water pollution.

History: 1987 c 392 s 10

115.101 NONPOINT SOURCE POLLUTION CONTROL PLAN AND PROGRAM EVALUATION

For the purpose of coordinating the programs and activities used to control nonpoint sources of pollution to achieve Minnesota's water quality goals, the agency shall:

(1) develop a state plan for the control of nonpoint source water pollution in order to meet the requirements of the federal Clean Water Act;

(2) work through the environmental quality board to coordinate the activities and programs of federal, state, and local agencies involved in nonpoint source pollution control and, where appropriate, develop agreements with federal and state agencies to accomplish the purposes and objectives of the state nonpoint source pollution control plan; and

(3) evaluate the effectiveness of programs in achieving water quality goals and recommend to the legislature, under section 3.195, subdivision 1, any necessary amendments to sections 115.091 to 115.102.

History: 1987 c 392 s 11

115.102 INTEGRATION OF DATA

The data collected for the activities of the clean water partnership program that have common value for natural resources planning must be provided and integrated into the Minnesota land management information system's geographic and summary data bases according to published data compatibility guidelines. Costs associated with this data delivery must be borne by this activity.

History: 1987 c 392 s 12

115.103 PUBLIC AGENCY COORDINATION

Subdivision 1. Project coordination team; membership. The director shall establish and chair a project coordination team made up of representatives of the pollution control agency, department of natural resources, soil and water conservation board, department of agriculture, department of health, state planning agency, Minnesota extension service, University of Minnesota agricultural experiment stations, United States Army Corps of Engineers, United States Environmental Protection Agency, United States Department of Agriculture Agriculture Stabilization and Conservation Service, United States Department of Agriculture Soil Conservation Service, water resources board, metropolitan council, Association of Minnesota Counties, League of Minnesota Cities, Minnesota Association of Townships, and other agencies as the director may determine.

Subd. 2. Duties. The project coordination team shall advise the agency in preparation of rules, evaluate projects, and recommend to the director those projects that the team believes should receive financial or technical assistance or both from the agency. After approval of assistance for a project by the agency, the team shall review project activities and assist in the coordination of the state program with other state and federal resource management programs.

History: 1987 c 392 s 13

9/19/88

Adopted Permanent Rules Relating to Clean Water Partnership

CHAPTER 7076
MINNESOTA POLLUTION CONTROL AGENCY
WATER QUALITY DIVISION
CLEAN WATER PARTNERSHIP GRANTS

7076.0100 PURPOSE

This chapter provides for the administration of the state clean water partnership grant program and the federal nonpoint source management program as provided by United States Code, title 33, section 1329. Parts 7076.0100 to 7076.0290 implement these programs by establishing the substantive criteria and procedural conditions under which the agency may award state matching grants and provide technical assistance for the development and implementation of nonpoint source projects.

7076.0110 DEFINITIONS

Subpart 1. Scope. The terms used in Parts 7076.0100 to 7076.0290 have the meanings given them in Minnesota Statutes, chapters 115 and 116 and rules adopted under those chapters and the meanings given them in this part. If terms defined in this part conflict with the definitions in Minnesota Statutes, chapters 115 and 116 and the rules adopted under those chapters, the definitions in this part govern.

Subp. 2. Agency. "Agency" means the Pollution Control Agency.

Subp. 3. Best management practices. "Best management practices" has the meaning given it in Minnesota Statutes, section 115.093, subdivision 3.

Subp. 4. Commissioner. "Commissioner" means the Commissioner of the Pollution Control Agency.

Subp. 5. Land occupier. "Land occupier" means a person, who possesses lands in the project area whether as owner, lessee, renter, tenant, or otherwise, including successors of a land occupier who received a payment during the minimum effective life of a best management practice.

Subp. 6. Local share. "Local Share" means the contributions of a local unit of government to the eligible cost of a project, including the value of cash expenditures and in-kind contributions of labor, equipment, material and real property used for and expended on eligible project activities.

Subp. 7. Local unit of government. "Local unit of government" has the meaning given it in Minnesota Statutes, section 115.093, subdivision 5.

Subp. 8. Local water plan. "Local water plan" means a comprehensive water plan authorized under Minnesota Statutes, ch. 110B, a surface water management plan required under Minnesota Statutes, section 473.878, an overall plan, required under Minnesota Statutes, ch. 112, or until July 1, 1991 any other local plan that provides an inventory of existing physical and hydrologic information on the area, a general identification of water quality problems and goals, and that demonstrates a local commitment to water quality protection or improvement.

Subp. 9. Nonpoint source. "Nonpoint Source" has the meaning given it in Minnesota Statutes, section 115.093, subdivision 6.

Subp. 10. Official controls. "Official controls" has the meaning given it in Minnesota Statutes, section 115.093, subdivision 7.

Subp. 11. Person. "Person" has the meaning given to it in Minn. Stat. section 115.01 Subd. 10.

Subp. 12. Project. "Project" has the meaning given it in Minnesota Statutes, section 115.093, subdivision 8.

Subp. 13. Project area. "Project area" means the area identified as hydrologically contributing to the water of concern for which the diagnostic study and implementation plan are developed and implemented.

Subp. 14. Project continuation grant amendment. "Project continuation grant amendment" means an amendment to an existing project implementation grant, to provide funds to continue implementation of activities identified in an approved diagnostic study and implementation plan that were not funded in the initial project implementation grant.

Subp. 15. Project coordination team. "Project coordination team" means the public interagency group established in Minnesota Statutes, section 115.103, subdivision 1.

Subp. 16. Project development. "Project development" means the development of a diagnostic study and implementation plan.

Subp. 17. Project development grant. "Project development grant" means a grant from the agency to the project sponsor for the preparation of a diagnostic study and implementation plan.

Subp. 18. Project implementation. "Project implementation" means the implementation of an approved diagnostic study and implementation plan or their equivalent.

Subp. 19. Project implementation grant. "Project implementation grant" means a grant from the agency to the project sponsor for the implementation of a diagnostic study and implementation plan or their equivalent.

Subp. 20. Project sponsor. "Project sponsor" means the local unit of government that applies for a grant, enters into a grant contract and is responsible for development and implementation of the project.

Subp. 21. Water pollution. "Water pollution" has the meaning given it in Minnesota Statutes, section 115.01, subdivision 5.

Subp. 22. Waters of the state. "Waters of the state" has the meaning given it in Minnesota Statutes, section 115.01, subdivision 9.

Subp. 23. Water of concern. "Water of concern" means the specific water of the state which the project is focused on improving or protecting.

7076.0120 AVAILABLE ASSISTANCE

Subpart 1. Financial assistance. There are two types of grants available or nonpoint source projects: (1) project development grants, and (2) project implementation grants. The grants are for a maximum of 50 percent of the eligible cost of the project. Grants must be awarded, within the limits of available appropriations, to those applicants having the highest priority.

Subp. 2. Technical assistance. The agency may provide technical assistance to local units of government in order to ensure efficient and effective development and implementation of projects. Technical assistance must be given to local units of government that receive grants, within the limits of available resources.

7076.0130 ELIGIBILITY CRITERIA

Subpart 1. Eligible applicants. Only local units of government are eligible to apply for grants and receive technical assistance. A local unit of government is eligible to apply for state matching grants and request technical assistance if they have the following:

A. the authority to coordinate and enter into contracts with local, state and federal agencies and private organizations for the purpose of carrying out a project;

B. the authority to generate cash revenues and in-kind contributions for the local share of a project; and

C. the authority to adopt, implement and enforce official controls.

Subp. 2. Eligible costs. Project costs are eligible for state matching grants if the costs are reasonable and necessary and allocable for the development of a diagnostic study and implementation plan, or for the implementation of the plan, and if the costs are related to any of the following activities:

A. water quality monitoring, water resource and project area data and information collection, data and information analysis and assessment, and related tasks;

B. fiscal and management activities including report preparation;

C. selection, design, layout and installation of best management practices;

D. development, review and inspection of installation, operation and maintenance procedures for best management practices;

E. development and implementation of public education materials and activities;

F. development and implementation of official controls;

G. acquisition of easements and property; and

H. other activities determined by the agency or established by federal regulation to be necessary to develop and implement the project.

Subp. 3. Ineligible costs. Ineligible costs include any costs that are not related to the activities in subpart 2. In addition, the following costs are ineligible whether or not they relate to the activities in Subpart 2:

A. installation of best management practices prior to the grant award;

B. operation and maintenance of best management practices;

C. activities regulated by the National Pollutant Discharge Elimination System permit program, Minnesota Rules, Parts 7001.1000 to 7001.1100, the State Disposal System permit program, the Petroleum Tank Release Clean-up Act, Minnesota Statutes, chapter 115C, the Environmental Compensation and Liability Act, Minnesota Statutes, chapter 115B, the Comprehensive Environmental Response, Compensation and Liability Act, United States Code, title 42, section 9601 to 9675; and the Resource Conservation and Recovery Act, United States Code, title 42, section 6901 to 6991;

D. activities regulated by a condition of a solid waste or hazardous waste permit or the agency solid waste rules, Minn. Rules chapter 7035, or the agency hazardous waste rules, Minn. Rules chapter 7045;

E. activities funded by state or federal grants for wastewater treatment facilities;

F. regulated practices to control spills of pesticides, fertilizer, petroleum and related materials from bulk storage facilities;

G. regulated practices to manage toxic or hazardous materials;

H. commercial operations and industrial processes and land use and land management activities directly related to commercial operations and industrial processes including plant yards, access roads, drainage ponds, refuse piles, storage piles and material product loading areas;

I. active and inactive mining activities;

J. building and utility construction;

K. highway and road construction;

L. dredging of harbors, lakes and ditches;

M. activities intended primarily for flood control; and

N. activities that violate local, state and federal statutes, rules and regulations.

Subp. 4. Eligible local share. At least 30 percent of the project costs must be derived from nonstate and nonfederal sources. Costs incurred by a land occupier for the installation of best management practices may be considered a part of the local share paid by the local unit of government provided the following conditions are met:

A. the primary purpose of the best management practices is for improvement and protection of water quality;

B. the best management practices must be designed for a minimum effective life of ten years;

C. the best management practices are a part of an approved implementation plan; and

D. there must be an operation and maintenance plan for the minimum effective life of the best management practices.

7076.0140 NOTICE OF GRANT AVAILABILITY

Subpart 1. Notice. The agency will publish in the State Register a notice that applications for project development grants and project implementation grants will be accepted whenever the agency determines that funds are available to award such grants. The notice will contain a deadline for application submittal, which must be no less than 60 days from the date of publication.

Subp. 2. Notification list. The agency shall maintain a list of those local governmental bodies that wish to be notified of grant application periods. Any local governmental body that wishes to be placed on the list shall notify the agency by writing to the director of the public information office. Whenever the agency publishes notice in the State Register, the agency shall mail notice of the grant application period to those local governmental bodies on the list.

Subp. 3. Grant application periods. The agency may establish a grant application period from time to time but there must be at least one application period each calendar year if funds are available.

7076.0150 GRANT APPLICATION

Subpart 1. General requirements. The grant application shall be submitted by the local unit of government that will be the project sponsor. A grant application must be submitted in a timely fashion to be considered. The grant application must be submitted on a form provided by the agency and must contain the information required in the form and by this part.

Subp. 2. Project development grant. Any applicant submitting an application for a project development grant must submit the following information:

A. a resolution by the local unit of government that will be the project sponsor, authorizing the filing of the application and designating an official authorized to execute the grant application, the grant contract and other related project documents;

B. written documentation that the project sponsor has consulted with soil and water conservation districts and watershed districts in the project area, in preparing the grant application;

C. identification of agencies and organizations that will be involved in project development;

D. resolutions from each participating local unit of government which identifies their role in project development and identification of their contribution to the local share of project development costs;

E. the amount of grant funding requested;

F. a list identifying the amount, type, and source of the local share;

G. a work plan and schedule that contain the following:

(1) the identification of each water of the state that will be affected by the project;

(2) a description of the existing or potential surface and ground water problems that are to be addressed in the project;

(3) a workplan listing the activities that the grant would make possible; and

(4) a schedule containing milestones for project development.

H. a local water plan that provides an inventory of existing physical and hydrologic information on the project area, a general identification of water quality problems, and goals for resource use, and demonstrates a local commitment to water quality protection or improvements; and

I. documents required by state or federal statutes, rules and regulations.

Subp. 3. Project implementation grant. Any applicant submitting an application for a project implementation grant shall submit the following information:

A. a resolution by the local unit of government that will be the project sponsor, authorizing the filing of the application and designating an official authorized to execute the grant application, the grant contract and other related project documents;

B. written documentation that the project sponsor has consulted with soil and water conservation districts and watershed districts in the project area, in preparing the grant application;

C. a diagnostic study and implementation plan that has been approved under Part 7076.0260, or an equivalent study and plan that addresses the requirements of a diagnostic study and implementation plan and that has been approved under Part 7076.0260 and which contains a local water plan that provides an inventory of existing physical and hydrologic information on the project area, a general identification of water quality problems, and goals for resource use, and demonstrates a local commitment to water quality protection or improvements;

D. resolutions from each participating local unit of government that identify their role in project implementation and their contribution to the local share of project implementation costs;

E. a detailed work plan and schedule for project implementation during the grant period;

F. a detailed budget for the grant period including the identification of the amount requested in the grant;

G. a list identifying the amount, type, and source of the local share;

H. a description of the work and the budget for project implementation beyond the grant period, including an indication of whether the project sponsor anticipates applying for a project continuation grant amendment; and

I. documents required by state or federal statutes, rules and regulations.

7076.0160 REJECTION OF GRANT APPLICATION

Subpart 1. Grounds. An application for a project development grant or a project implementation grant shall be rejected by the Commissioner for the following reasons:

A. an ineligible applicant;

B. ineligible costs;

C. a late submittal; or
D. failure to comply with any requirement of statute or rule.

Subp. 2. Procedure. The commissioner shall review each grant application within 30 days after the deadline for application submittal. The commissioner shall notify each rejected grant applicant of the rejection of its application and the reasons for the rejection.

Subp. 3. Effect of rejection. A grant applicant whose application is rejected for a reason other than for late submittal has 14 days from receipt of the notice of rejection to correct any deficiencies, if correction is possible. If the application is corrected within the 14 days, the application must be accepted and the project must be ranked with other approved grant applications. An application that cannot be or is not corrected must not be further considered. A grant applicant whose application is rejected and not corrected must reapply in a subsequent application period in order to be considered for a grant.

7076.0170 PROJECT RANKING

Subpart 1. Process of ranking. Upon completion of the commissioner's review of the grant applications for acceptability, the agency shall proceed to rank the acceptable grant applications in order of priority. Each project for which an acceptable grant application has been submitted must be awarded the number of priority points the project is entitled to under subparts 2 and 3. The project with the highest number of priority points will be given the highest priority. All projects will be given a ranking depending on the number of points awarded. The project development grant applications shall be ranked separately from the project implementation grant applications.

Subp. 2. Priority points for project development grant applications. The following criteria must be used to determine the number of priority points to be awarded in the evaluation of each project development grant application. The agency shall award each project between zero and ten points under each of the following criteria, depending on how well the project satisfies the criterion. The number of points awarded under each criterion must be added together to determine the project's total point value. This total number must be used to determine the project's overall ranking and priority. The criteria are as follows:

A. the extent to which the proposed project demonstrates a high potential for project success based on community support and involvement as well as participation, coordination and cooperation of federal, state and local agencies and units of government for water quality protection and improvement;

B. the extent to which the proposed project takes place where local units of government have adopted and implemented authorities or official controls to abate or prevent water pollution from nonpoint sources;

C. the extent to which the water of concern is identified as a priority water in the local water plan;

D. the extent to which the proposed project affects waters identified in the statewide resource assessment conducted under Minnesota Statutes, section 115.095, as waters that could not be expected to attain or maintain compliance with applicable water quality standards or goals without additional control of nonpoint sources;

E. the extent to which the project demonstrates a likelihood of transferability to similar resources;

F. the extent to which the project is of a size and scale to promote successful project management and water quality protection and improvement; and

G. the priority placed on each project by the project coordination team.

Subp. 3. Priority points for project implementation grant applications. The following criteria must be used to determine the number of priority points to be awarded in the evaluation of each project implementation grant application. The agency shall award each project between zero and ten points under each of the following criteria, depending on how well the project satisfies the criterion. The number of points under each criterion must be added together to determine the project's total point value. This total number must be used to determine the project's overall ranking and priority. The criteria are as follows:

A. the extent to which the project demonstrates a high potential for successful water quality protection and improvement based on a comparison of existing water quality and the project's goals and objectives with maximum contaminant levels and recommended allowable limits for drinking water, water quality standards and regional lake and stream water quality criteria published by the agency, the Minnesota Department of Health and the United States Environmental Protection Agency;

B. the extent to which the project employs best management practices which provide a technically and economically feasible means to abate or prevent water pollution from nonpoint sources;

C. the extent to which the project maximizes water quality protection or improvement relative to the cost of project implementation;

D. the extent to which the project goals and objectives are consistent with state water quality management plans and other applicable state and federal resource management programs;

E. the extent to which the project demonstrates a high potential for project success based on community support and involvement as well as participation, coordination and cooperation of federal, state and local agencies and units of government for water quality protection and improvement;

F. the extent to which the project demonstrates a significant degree of transferability to similar local units of government; and

G. the priority placed on each project by the project coordination team.

Subp. 4. Project coordination team. The project coordination team has 60 days from the close of the application period to assign points to each project seeking a grant. In the event that the project coordination team fails to assign points to all projects with approved grant applications, the projects must be ranked without considering any points under the category for the project coordination team. The project coordination team must use the criteria established in Minnesota Statutes, section 115.098, to assign points to each project seeking a grant.

7076.0180 ALLOCATION OF FUNDING

Subpart 1. Project continuation grant amendments. Each year by March 1, the agency shall determine how much of the available funds will be set aside to meet that year's anticipated requests for project continuation grant amendments. If the agency subsequently determines that the amount set aside for project continuation grant amendments is more than is required for grant amendments in that year, the agency may reallocate this money to other project development grants and project implementation grants or carry over the money to another grant application period.

Subp. 2. Grant fund allocation. Within 90 days of the close of an application period, the agency shall determine how much of the remaining funds, after setting aside funds for project continuation grant amendments, will be made available for project development and project implementation grant awards. In deciding how much money to make available for new grant awards, the agency shall consider the necessity to have money available for subsequent grant periods, the necessity to have money available for anticipated project continuation grant amendments in the next year, and other factors relating to the agency's ability to ensure that money will be available for upcoming projects.

Subp. 3. Development; implementation split. Within 90 days of the close of an application period, the agency shall determine how much of the funds available for new grants in that application period will be available for project development and project implementation grants. In determining the allocation of funds between project development and project implementation grants, the agency shall consider:

A. the availability and conditions for use of federal funds; and

B. the phasing in and continuity of projects in the program.

If the money intended for project development or project implementation grants, or both, is not awarded during a grant period, the agency may reallocate the funds to the other kind of grant or to a subsequent grant period.

7076.0190 SELECTION OF PROJECTS FOR GRANT AWARD

Subpart 1. Ranking. The agency shall complete its ranking of all projects for which an acceptable grant application has been submitted within 90 days of the close of the application period. The agency shall rank development projects separately from implementation projects.

Subp. 2. Projects funded. The agency shall select those projects that will be awarded grant funds by awarding grants to the highest priority project development and project implementation applications within the limits of available funds established under 7076.0180 subpart 2. A project that receives less than 40 points will not be considered for award of grant funds.

Subp. 3. Agency decision. All decisions of the agency in ranking projects and awarding grants must be made at a regular or special board meeting.

Subp. 4. Timing. The agency shall make its decision on fund allocation, project ranking, and projects to which grants will be awarded within 90 days of the close of the application period.

Subp. 5. Reapplication. A grant applicant whose application is not awarded grant funds must reapply in a subsequent application period to be considered for a grant.

7076.0200 PROJECT CONTINUATION GRANT AMENDMENT

Subpart 1. Eligibility. A project sponsor who has been awarded a project implementation grant is eligible for a project continuation grant amendment to continue the project after the expiration of the initial grant. The requirements that applied to the initial grant apply to the project continuation grant amendment. A project sponsor is eligible for one project continuation grant amendment on a particular project.

Subp. 2. Request. A project sponsor who seeks a project continuation grant amendment shall submit a request for the grant amendment in the year that the activities funded through the initial project implementation grant will be completed and additional funds will be required to continue project implementation. The request shall be submitted on a form provided by the agency and may be submitted at any time during the calendar year the funds will be needed. A project sponsor who fails to submit a request for a project continuation grant amendment in the year the funds are required forfeits the right to an amendment. That project sponsor may apply in a subsequent grant period to continue the project and compete with other applicants for a project implementation grant.

Subp. 3. Approval. The agency shall approve the project sponsor's request for a project continuation grant amendment if it meets the following conditions:

A. the project sponsor has satisfied the terms and conditions of the grant to date; and

B. the project sponsor has identified the source of the local share of funds necessary for the project continuation grant amendment.

7076.0210 GRANT CONDITIONS

Subpart 1. Amount. A grant that is made must be for the amount requested by the applicant, up to a maximum of 50 percent of the eligible cost of project development or project implementation.

Subp. 2. Grant period. The grant period for a project development grant will be for a period of two years. The grant period for a project implementation grant will be for a period of three years and may be extended an additional three years with agency approval of a request for a project continuation grant amendment in accordance with part 7076.0200.

Subp. 3. Grant contract. The project sponsor must enter into a contract with the agency before a grant will be awarded. The contract must include the provisions established in Part 7076.0220.

Subp. 4. Records. The project sponsor shall maintain all records relating to the receipt and expenditure of grant funds for a period of at least three years from the date of termination of the grant contract.

Subp. 5. Audit. The project sponsor must agree that the books, records, documents and accounting procedures and practices of the project sponsor relevant to this program may be examined at any time by the commissioner or commissioner's designee.

Subp. 6. Annual progress report. The project sponsor shall submit an annual progress report to the commissioner by February 1 of each year the grant in effect. The report must include the following information:

A. a discussion of work progress relative to the schedule, and difficulties encountered meeting the schedule during the year;

B. a discussion of the project findings appropriate to the work conducted during the year;

C. a report of expenditures in the year and those anticipated during the upcoming year;

D. a discussion and summary analysis of monitoring data and a discussion of the changes in water quality that appear to have resulted from the protective and restorative activities implemented during the year; and

E. water quality monitoring data collected during the year must be included in the format required by the agency.

Subp. 7. Mid-year update. The project sponsor shall give the commissioner a mid-year update by August 1 of each year the grant is in effect. The mid-year update shall include a brief report on project progress and difficulties encountered in meeting the project schedule.

Subp. 8. Monitoring plan. The project sponsor shall submit a monitoring plan to the commissioner within 60 days of the award of the grant. The monitoring plan must be revised annually and submitted to the commissioner by January 31. The monitoring plan must comply with the requirements of Part 7076.0230.

Subp. 9. Diagnostic study and implementation plan. The project sponsor for a project development grant shall submit to the commissioner before the final grant payment is made a diagnostic study and implementation plan that meets the requirements of Parts 7076.0240 and 7076.0250.

Subp. 10. Eligible costs. No grant funds shall be used to reimburse the project sponsor for costs incurred after the end of the contract period.

7076.0220 GRANT CONTRACT

Subpart 1. Contents. The agency and the project sponsor shall enter into a grant contract. The grant contract must:

A. establish the term and conditions of the grant;

B. provide that the project sponsor may enter into contracts, under terms and conditions specified by the agency, to complete the work specified in the contract;

C. provide that the cost overruns are the sole responsibility of the project sponsor;

D. require that that project sponsor submit periodic progress reports and a final report to the agency in a format prescribed by the agency; and

E. incorporate terms and conditions required by federal or state statutes, rules and regulations.

Subp. 2. Amendments. A grant contract may be amended upon agreement of the agency and the project sponsor.

Subp. 3. Contract period. Grant contracts for project development will be for a period of up to two years. Grant contracts for project implementation will be for a period of up to six years. The agency may allow one year extensions of either of these grant contracts.

7076.0230 MONITORING PLAN

Subpart 1. Requirements. The monitoring plan required to be submitted to the commissioner as a condition of the grant must:

A. identify and provide rationale for the selection of monitoring sites, monitoring frequency and parameters to be monitored; and

B. identify laboratories that will do analyses and explain their quality assurance and quality control procedures.

Subp. 2. Review. The commissioner will review the monitoring plan and approve it or identify deficiencies in writing within 45 days of its receipt. The project sponsor shall have 15 days to correct any deficiencies.

Subp. 3. Grant payment. No grant payments shall be paid after March 31 in any year in which a monitoring plan has not been approved.

7076.0240 DIAGNOSTIC STUDY

Subpart 1. General requirements. The diagnostic study required to be submitted by a project sponsor under part 7076.0210, subpart 9, must include:

A. a detailed description of the water of concern;

B. a detailed description of the project area;

C. an analysis and assessment of the data and information collected as a requirement of subparts 2 and 3; and

D. the identification and documentation of the methods, procedures, model and other tools used to prepare and complete the diagnostic study.

Subp. 2. Description of water of concern. The diagnostic study must contain a detailed description of the water of concern that includes:

A. a summary of historical uses and changes resulting from water quality degradation;

B. a discussion of previous studies and other historic baseline physical, chemical and biological data; and

C. current data or information for the following:

(1) if the water of concern is a lake, the description shall include the following:

(a) identification or measurement of lake surface area, maximum depth, average depth, one in ten year low and high as well as average hydraulic residence time, temperature profiles, secchi disk transparencies, the area of the watershed draining to the lake, its tributaries, their estimated contribution to inflows and a hydrologic budget including ground water flow;

(b) measurement of dissolved oxygen, total phosphorus, dissolved inorganic phosphorus, total Kjeldahl nitrogen, nitrite plus nitrate nitrogen, total suspended solids, total alkalinity, chloride concentrations, color, pH, conductivity; determination of mass loadings of total phosphorus, total Kjeldahl nitrogen, and total suspended solids from major tributaries and completion of nutrient and sediment budgets for the lake.

(c) measurement of average summer epilimnetic chlorophyll a, a description of predominant phytoplankton, zooplankton and submerged, floating and emergent vascular plant communities; measurement of fecal streptococcus and fecal coliform bacteria where human health may be impacted; and

(d) a summary of available fisheries information.

(2) if the water of concern is a stream, the description shall include the following:

(a) identification or measurement of stream length, sinuosity, order, substrate, estimated maximum high flow for 24 consecutive hours that has a recurrence interval of 25 years, mean flow for the available period of record, and annual minimum flow for seven consecutive days that has a recurrence interval of ten years;

(b) measurement of flow and biochemical oxygen demand, total phosphorus, nitrite plus nitrate nitrogen, ammonia nitrogen, organic nitrogen, total dissolved solids, total suspended solids, and diurnal dissolved oxygen concentrations, turbidity, pH, and conductivity;

(c) measurement of fecal streptococcus and fecal coliform bacteria where human health may be impacted; and

(d) completion of invertebrate and fishery assessments using standard benthological and ichthyological techniques; identification of significant biological habitats including riparian vegetation and spawnings areas; and

(3) if the water of concern is an aquifer, the description shall include the following:

(a) identification or measurement of the aquifer physical type, size, temperature, saturated thickness, recharge sources, discharge sources, transmissivity, hydraulic residence time, range of hydraulic gradients and underlying lithology and stratigraphy;

(b) measurement of chemical oxygen demand, total organic carbon, total Kjeldahl nitrogen, ammonia nitrogen, nitrite plus nitrate nitrogen, total phosphorus, chloride, sulfate, calcium, magnesium, iron, manganese, potassium,sodium, bicarbonate, and alkalinity concentrations, oxidation potential, pH, and specific conductance;

(c) measurement of organic compounds, pesticides and metals in areas where they are pollutants of concern;

(d) measurement of fecal streptococcus and fecal coliform bacteria where human health may be impacted; and

(4) if the water of concern is water other than a lake, stream or aquifer, the data and information requirements will be determined jointly by the agency and the project sponsor.

Subp. 3. Description of project area. The diagnostic study must contain a detailed description of the project area that includes:

A. a map of the project area;

B. an aerial photo of the project area;

C. maps of general topographic relief based on United States Geological Survey topographic maps;

D. a map of the project area divided into subunits on a hydrologic basis including boundaries and flow directions for each subunit;

E. a description of important aquifer systems, confining layers, and flow characteristics;

F. a description of ground and surface water interconnections, such as recharge and discharge areas;

G. a description of known geologic conditions, such as karst areas, buried valleys or sand plains that may pose concerns relating to water quality;

H. a description of waters of the state and public drainage ditches including dams and control structures;

I. soil:

(1) a general soils map and description of soils infiltration characteristics; and

(2) a map of erosion-prone soils.

J. land use:

(1) existing and future land uses;

(2) areas served by storm sewers, sanitary sewers, and public water system;

(3) the location of community public water supply, intakes and wells;

(4) irrigated acreage;

(5) domestic animal density and feedlots;

(6) on-site wastewater treatment systems;

(7) existing management practices;

(8) known tiling and drainage systems;

(9) estimates of pesticide and fertilizer use;

(10) known closed and open sanitary landfills, closed and operating open dumps and hazardous waste sites;

(11) known abandoned wells not sealed in accordance with state statutes and rules;

(12) underground storage tank sites;

(13) permitted wastewater disposal systems and discharges under Minnesota Rules Chapter 7001;

(14) wetlands identified under the National Wetlands Inventory and a summary of applicable management plans;

(15) areas delineated as floodplain;

(16) areas with known flooding problems;

(17) a summary of the state ecological and management classifications;

(18) a summary of state management plans for fish and wildlife;

(19) unique features and scenic areas with relationships to water including state designated natural and scientific areas outstanding resource value waters, areas containing county, state and federal rare and endangered speciesand other features such as waterfalls and springs;

(20) the ownership of local, state and federal and Indian tribal lands;

(21) lands with easements that relate to water resources;

(22) population characteristics; and

(23) a summary of recreational land uses;

K. precipitation:

(1) a map and list of the location of precipitation gaging stations in the project area;

(2) a map showing isolines of normal annual total precipitation;

(3) a map showing isolines of normal precipitation in inches for the period May through September; and

(4) a summary of precipitation information for the project area; and

L. hydrology:

(1) an estimate of the maximum high flow for 24 consecutive hours that has a recurrence interval of 25 years, mean flow for the available period of record, the annual minimum flow for seven consecutive days that has a recurrence interval of ten years;

(2) a description of permitted withdrawals from lakes and streams, including location, source, use and amounts withdrawn;

(3) a description of protected levels or flows that have been established for lakes and streams;

(4) a description of known water use conflicts, including those caused by ground water pumping that affect surface waters;

(5) a description of wells covered by state appropriation permits including location, amounts of water appropriated, type of use and aquifer source;

(6) a description of known well interference problems and water use conflicts; and

(7) a list of state observation wells including location, unique well number, aquifers measured, years of record and average monthly levels.

Subp. 4. Analysis and assessment. The diagnostic study must contain an analysis and assessment of the data and information collected as a requirement of subparts 2 and 3 including the following:

A. the identification of existing and potential water quality problems;

B. the identification of water quality goals for the water of concern;

C. the identification of project objectives in terms of:

(1) specific water chemical, biological and physical measurements; and

(2) economic, recreational and health factors.

D. an estimate of the pollutants coming from the subunit of project area defined on hydrologic basis and the identification of the target levels of pollutant reduction necessary to meet the project objectives and water quality goals; and

E. the identification and ranking of the subunit of project area defined on a hydrologic basis into priority management areas on which to focus implementation of best management practices.

Subp. 5. Exemption. Upon written request from the project sponsor, the agency may allow an exemption from a specific diagnostic study requirement that does not provide data or information useful for diagnosis of the problem or solutions.

7076.0250 IMPLEMENTATION PLAN

The implementation plan required to be submitted by a project sponsor under Part 7076.0210 subpart 9 must include:

A. an analysis of the need for best management practices that will aid in the achievement of target levels of pollutant reduction in the areas identified as priority management areas, that includes:

(1) identification of best management practices;

(2) an estimate of costs for practice installation;

(3) a schedule for implementation;

(4) an estimate of engineering and other assistance needs, including best management practice design, and inspection of installation, operation and maintenance;

(5) an estimate of pollutant reduction; and

(6) identification of the standards and criteria for best management

B. a project implementation water quality monitoring and evaluation plan identifying procedures and schedules for determining project progress and accomplishments, that includes:

(1) a monitoring plan that includes the chemical, physical and biological parameters that will be measured to enable comparisons with goals an objectives established in the diagnostic study;

(2) a procedure to document and evaluate the implementation of best management practices; and

(3) a procedure to identify effectiveness of the best management practices on water quality, and their impact on water resources in the project area;

C. a plan and schedule to implement an information and education program in the project area;

D. an identification of roles and responsibilities of the project sponsor, its representatives, and cooperating agencies in implementing the project;

E. a proposed schedule for project implementation, segmented into three- year periods;

F. an estimated budget for project implementation segmented into three-year periods;

G. a plan to maintain project goals and accomplishments and prevent further nonpoint source pollution;

H. a list of any federal, state, or local permits and approvals required to complete the project; and

I. an opinion and supporting documentation from the project sponsors attorney that the project sponsor and participating local units of government have the legal authority to implement the project.

7076.0260 DIAGNOSTIC STUDY AND IMPLEMENTATION PLAN APPROVAL

Subpart 1. Review and decision. The commissioner shall review and approve or disapprove of the diagnostic study and implementation plan within 90 days of its receipt. The commissioner shall approve the diagnostic study and implementation plan if the commissioner determines that:

A. the diagnostic study and implementation plan meet the requirements for a diagnostic study and implementation plan identified in Parts 7076.0240 and 7076.0250;

B. the diagnostic study provides information in sufficient detail to technically define the water quality problems, sources of pollution, and project goals and objectives for water quality protection and improvement;

C. the implementation plan provides a technically feasible means to abate nonpoint sources of water pollution and achieve project objectives; and

D. the diagnostic study and implementation plan are consistent with state and federal statutes, rules and regulations.

Subp. 2. Reasons for disapproval. If the diagnostic study and implementation plan are disapproved, the commissioner shall provide the project sponsor with a written statement of reasons for disapproval.

Subp. 3. Resubmittal. A disapproved diagnostic study and implementation plan must be revised by the project sponsor and resubmitted to the commissioner. Upon receipt of the revised diagnostic study and implementation plan, the commissioner shall review the revised diagnostic study and implementation plan.

7076.0270 BEST MANAGEMENT PRACTICE EVALUATION

In selecting best management practices for inclusion in an implementation plan, the project sponsor shall consider the following factors in evaluating the best management practices:

A. whether the best management practice will achieve the desired project objectives;

B. whether the best management practice implementation would create other water quality or environmental problems;

C. the degree of nonpoint source control achieved for the amount ofresources allocated for that control;

D. whether a less costly best management practice could achieve a similar result; and

E. whether the best management practice is reasonably suited for the individual site.

7076.0280 GRANT PAYMENTS

Subpart1. Reimbursement. The project sponsor may submit a request for reimbursement of expenditures for each of the standard calendar quarters ending March 31st, June 30th, September 30th and December 31st. The agency shall pay the reimbursement within 45 days of the request if the grantee is in compliance with conditions of the grant contract and requirements of parts 7077.0100 to 7075.0290.

Subp. 2. Final payment. The agency shall withhold reimbursement on the final ten percent of the grant contract amount until such time as the agency is satisfied that the project has been completed in accordance with the terms of the grant contract and parts 7076.0100 to 7076.0290.

Subp. 3. Withholding of reimbursement. The agency shall withhold reimbursement if the project sponsor has failed to comply with any requirements of the grant contract or parts 7076.0100 to 7076.0290. The funds will not be released until the agency determines that the project sponsor has corrected the deficiencies causing noncompliance.

Subp. 4. Advance. The project sponsor may submit a request for an advance of grant funds after the commissioner approves the project monitoring plan. The advance is limited to ten percent of the grant award or $50,000, whichever amount is less.

7076.0290 GRANT RECISSION

The agency may rescind a grant if the project is not being completed in accordance with the terms and conditions of the grant, including time schedules.

APPENDIX K

State Strategies for Pest and Nutrient Management and Ground Water

MINNESOTA GROUND WATER PROTECTION STRATEGY

September, 1988

RUDY PERPICH
GOVERNOR

STATE OF MINNESOTA

OFFICE OF THE GOVERNOR

ST. PAUL 55155

August 18, 1988

To the People of Minnesota:

Minnesota is a state known for its abundant water resources, both ground and surface water. The current drought has dramatically underscored the dependence of human institutions on natural systems, and highlights the need for effective stewardship of the resources in our state.

This Ground Water Protection Strategy has as its central themes, the need for protection of our ground water resource from pollution and misuse and the need for strong efforts toward public information and education on the myriad of ways in which human activities impact ground water. Effective protection will not be possible without an informed public, able to make and support strong decisions aimed at protecting our ground water resource for generations of Minnesotans to come.

I urge you to read this document and to become involved in this state's ground water protection efforts.

Sincerely,

Rudy Perpich

RUDY PERPICH
Governor

MINNESOTA ENVIRONMENTAL QUALITY BOARD
300 Centennial Building · 658 Cedar Street · St. Paul, Minnesota 55155
612-296-2603

RESOLUTION
MINNESOTA ENVIRONMENTAL QUALITY BOARD

ADOPTION OF THE
MINNESOTA GROUND WATER PROTECTION STRATEGY

WHEREAS, ground water is a resource vital to the public health and economic well-being of all Minnesotans, and its protection from contamination and misuse requires a timely, concerted effort by all State and federal agencies, local governments, private concerns and citizens; and

WHEREAS, the Minnesota Ground Water Protection Strategy was developed by the Minnesota Pollution Control Agency based upon the advice of an interagency work group with representatives from all State agencies with ground water related authorities along with federal and local government representation, and reflects the recommendations of the Environmental Quality Board's Advisory Committee on Ground Water and other comments received during the public review period and at fourteen public meetings, and is consistent with Environmental Quality Board policies and priorities, and

WHEREAS, the Strategy stresses the urgent need for prevention of ground water impacts and recommends programmatic change and legislative initiatives to improve the State's ground water protection policies and programs;

NOW THEREFORE BE IT RESOLVED that the Environmental Quality Board adopts the Minnesota Ground Water Protection Strategy as the blueprint for ground water protection in Minnesota. Implementation of the Strategy will be consistent with EQB policies and priorities, including those governing interpretation of inter-local and local-state ties established in the 1987-89 Water Resources Priority Recommendations report.

BE IT FURTHER RESOLVED that the chairman transmit this resolution and adopted Strategy to the governor for approval and signature.

Moved by Commissioner Leonard Levine, seconded by Dr. C. Edward Buchwald.

Passed unanimously with Kawamura, Levine, Dunn, Ashton, Hughes, Ditmore, Buchwald, Willet, Ogaard, and Pavelich voting aye.

ACKNOWLEDGEMENTS

The Minnesota Ground Water Protection Strategy (Strategy) was prepared by staff of the Minnesota Pollution Control Agency (MPCA), based upon the efforts of a work group composed of representatives from the following governmental agencies:

Minnesota Department of Health,
Minnesota Department of Agriculture,
Minnesota Department of Natural Resources,
State Planning Agency,
Minnesota Geological Survey,
Minnesota Board of Water and Soil Resources,
Minnesota Department of Transportation,
Minnesota Waste Management Board,
Attorney General's Office,
United States Geological Survey,
Metropolitan Council, and
United States Soil Conservation Service.

This document is based upon the March 10, 1988, Public Review Draft of the Strategy with modifications suggested from a number of commentors. These comments were received in a series of 14 public meetings which were held in April and in written comments received during the public review period which ended May 31. Staff involved would like to thank all who participated in the meetings and who provided written comments.

Special gratitude is extended to the Environmental Quality Board's (EQB) Advisory Committee on Ground Water Protection for their intensive review and comments. This committee was composed of representatives from a wide variety of Minnesota interests. Their unanimous report was accepted by the EQB on June 16, 1988, and their summary letter to the EQB is included at the end of this document. The members of the committee were:

Tom Anding, Committee Chair
Center for Urban and Regional Affairs, University of Minnesota

E. Calvin Alexander, Jr.
Department of Geology and Geophysics, University of Minnesota

Jack Anderson, Irrigators Association of Minnesota

Stephen Bloom, Martin County Coordinator

William Bryson, Freeborn Soil and Water Conservation District Supervisor

Marianne Curry, Minnesota Chamber of Commerce and Industry

Dick Eischens, New Prague Farmer

Terry Gips, International Alliance for Sustainable Agriculture

Verne Jacobsen, North Central Section, American Water Works Association

Diane Jensen, Clean Water Action Project

Linda Lehman, Minnesota Ground Water Association

Christine Olsenius, Freshwater Foundation

Richard Post, Kandiyohi County Commissioner, Member of the Association of Minnesota Counties Physical Development Committee

Newell Searle, Cargill, Minnesota Business Partnership

Lois Yellowthunder, Citizens League

Copies of the Report of the Environmental Quality Board Advisory Committee on Ground Water Protection (June 1988) are available from Marilyn Lundberg, State Planning Agency, Centennial Office Building, 658 Cedar Street, St. Paul, Minnesota 55155; phone 612/296-0676.

For more information on the Minnesota Ground Water Protection Strategy, contact:

Gretchen Sabel
Minnesota Pollution Control Agency
Ground Water and Solid Waste Division
520 Lafayette Road
St. Paul, Minnesota 55155
612/296-7358

Partial funding for development of this Strategy was provided by the U.S. Environmental Protection Agency, Office of Ground Water, through their Region 5 offices in Chicago, Illinois.

PREAMBLE TO STRATEGY

Minnesota's ground water is a vital resource of immeasurable value. Three quarters of Minnesota's citizens depend on it to provide, with little or no treatment, their drinking water supply. Ground water is crucial for many other uses, notably irrigation, and it provides inflow to our streams and lakes. No other Minnesota resource is more important or more deserving of protection and wise management.

Prevention: Protecting and managing this resource poses unique challenges. Most of our ground water is of high natural quality, but it is threatened to varying degrees from a wide range of sources. Once contaminated, ground water can be very difficult and costly to clean up. Cleanup often requires long-term commitments of resources; even so, ground water normally cannot be cleaned up completely.

Prevention must be the main long-term focus for ground water protection programs. Preventing contamination is more cost-effective and likely to produce a greater level of success. For this reason, pollution sources must be identified and controlled with the consistent goal of preventing ground water impacts. Current cleanup and remediation efforts must be continued as well to correct the historical backlog of ground water contamination.

New emphases: Although some sources of ground water pollution have received publicity, such as hazardous waste sites, Minnesota's ground water quality is also being altered by many other far more commonplace and widespread activities, including unsealed abandoned wells, septic systems, animal confinement facilities, and application of pesticides and fertilizers by farmers and urban homeowners. The total area and quantity of ground water affected by these activities is vastly larger than the areas impacted by more localized sources. More program effort is needed to address each of these areas.

To be successful in minimizing pollution from these much more numerous and dispersed sources, a different approach will be needed than has worked for the smaller numbers of "point" sources currently being addressed through regulatory programs. Success will rest largely on bringing about voluntary action by individuals, increased awareness, and changes in individual habits and behaviors. Education, information, and incentives will be more powerful tools in this effort, although regulation must remain an important part of the overall approach. Much is not known about the severity and solutions to these problems, so it is also vital that the State increase its support for applied research, monitoring, and resource evaluation, and adopt a careful, well-founded approach to change.

Local government: Local governments are much closer to where the problems occur than State government, and could be much better positioned than the State to take the lead on some ground water management issues. This will not happen without substantially increased funding to local governments. Equally important are the availability of technical assistance from the State and a State regulatory framework to back up local programs. The Strategy strongly recommends these changes to create a substantial new local role in ground water management.

Stable additional funding: These initiatives depend upon substantially increased funding for ground water protection and management. Success also depends on stability in funding levels to maintain continuity. Funding is a complex and controversial issue; there is not one "right" way to fund ground water protection. Ground water benefits all Minnesotans, not just those who directly consume or use it, so part of the funding should be from a general revenue base. Some groups are more directly benefitted, however, so fees should be considered for a wide range of activities, such as waste disposal, use of products that impact ground water quality, well construction, and ground water use/withdrawal. Fee-based funding will ensure that those who affect ground water and benefit from it also help support the programs, and it will tend to provide a more secure long-term funding base.

PURPOSE OF THE STRATEGY

This Strategy will serve as the blueprint for future ground water management activities at the State level, and also help define the local role in ground water management and protection. The Strategy is built on the strong regulatory framework which the State has established. State agencies already have statutory authority to establish ground water standards and regulate pollution sources, to protect and monitor drinking water supplies, to regulate water appropriation, and to regulate the sale and use of agricultural chemicals which may impact ground water quality. These water related functions are coordinated through the Water Resources Committee of the EQB, a board composed of the top executive officers of the major environmental agencies together with citizen members.

The Strategy has been structured around four major initiatives:

I. To protect ground water quality now and for the future, to ensure safe drinking water supplies, and to prevent ground water contamination by effectively regulating sources of pollution.

II. To ensure adequate water supplies, to regulate water appropriation and use for protection of highest priority users, and to improve coordination of quality and quantity aspects of regulatory programs.

III. To enhance the current body of knowledge on Minnesota's ground water resource, delineating problem areas and providing information needed to effectively manage the resource.

IV. To provide the public, decision-makers, regulators, and the regulated community with the necessary information and education for making environmentally sound decisions in areas which may impact ground water.

MAJOR LEGISLATIVE CONCEPTS

The Strategy recommends the following major legislative initiatives.

*Prevention of contamination should be the top priority. This includes establishment of a goal of nondegradation for all ground water, development of numerical limits on ground water pollutants, and delineation of the especially sensitive areas of the State where special protective measures must be taken at the land surface to ensure protection of the resource below. Strong continued support is needed for cleanup of existing problems.

*Drinking water protection is crucial to the health and welfare of all Minnesotans. Components of this effort include the State developing a Wellhead Protection Program, promotion of better contingency planning and conservation measures, registration of all wells on property deeds and testing of wells at the time of property transfer, development of a prioritization scheme and incentive fund to address the problem of abandoned wells, and enforcement of the Water Well Construction Code.

*Ground water information and education are vital to the success of the prevention and cleanup efforts. Components of this effort are the development of educational opportunities for children and adults, the dissemination of information on our ground water resource and State programs to protect it, specialized training for target groups, and the furtherance of intergovernmental communication.

*Enhancement of local government participation in environmental protection is a critical need as well. The Strategy recommends development of a grant mechanism which would provide funds to local government for the development and implementation of local programs to address environmental concerns. State agencies should be authorized to develop rules for delegation of certain programs to local governments, and have staff in place for technical assistance to aid local governments in program development and implementation.

*Ground water resource evaluation, monitoring, and research are needed for effective management of the resource. The extent of existing contamination is not documented, minor aquifers are not mapped, and recharge areas of major aquifers are not fully and clearly delineated. Research is also needed in the development of alternative technologies to replace current practices which impact ground water. The Strategy recommends development of a fund which would help to foster stable, long-term resource evaluation, monitoring, and research.

*Control of pollution sources is a necessary component. Increased funding for staff in regulatory programs and for programs such as the Clean Water Partnership is needed to continue these efforts. Another important area is pollutant source reduction for both current and potential sources of pollution. Technical assistance in source control and reduction will be a necessary component.

More detail on these legislative initiatives follows in later sections of the Strategy.

TABLE OF CONTENTS

A separate volume entitled "Supporting Documentation for the Minnesota Ground Water Protection Strategy" will also be available. It will contain:

Full report of the Advisory Committee;
Reports on:
    The Ground Water Protection Public Meetings, and
    Written Comments Received on the Ground Water Strategy
Report of the Minnesota Department of Health Commissioner's
    Task Force on Drinking Water
Issue Papers prepared for the Minnesota Ground Water Protection
    Strategy; and other supporting documentation.

INTRODUCTION

Minnesota is blessed with abundant, high-quality ground water. With a growing awareness of threats to our ground water Minnesotans have enacted a variety of programs to preserve and protect the ground water resource. These efforts have been successful in many respects, but it is clear that there is substantial room for improvement.

The Strategy was developed by an interagency work group led by the MPCA, which has received federal funding to help support the effort. The public review draft of the Strategy presented issues relating to ground water management, then listed the recommendations of the work group for resolving those issues. Now in its final form, the Strategy reflects comments received on the public review draft. Considerable modification has been made, based upon views expressed in a series of 14 public meetings held in April 1988, and on the more detailed written comments received during the public comment period which was extended until May 31, 1988. This version of the Strategy also incorporates the recommendations of the EQB's Advisory Committee on Ground Water Protection.

It is intended that the Strategy will guide Minnesota's ground water protection priorities far into the future. Since it is impossible to foresee all future concerns regarding ground water, it is essential that the Strategy be regularly updated and reincorporated into the State's ground water protection programs. The Water Resources Committee of the EQB is the appropriate vehicle for this periodic review. It is recommended that the Strategy be reviewed and updated every two years, and that legislative and program changes be identified through this biennial update.

Related Efforts:

The Strategy builds upon a long series of previous efforts. No attempt will be made to list all of them or to describe their contents. Some of the more important previous documents include the following:

1. The Environmental Quality Board's "Protecting Minnesota's Waters, an Agenda for Action in the 1987-1989 Biennium";
2. The Legislative Auditor's 1987 Report "Water Quality Monitoring";
3. The Executive Branch Policy Development Program Issue Team Report, "Ground Water Management Strategy," February 27, 1985;
4. The MPCA's June 1983 "Ground Water Protection Strategy Framework for Minnesota";
5. The Minnesota Water Planning Board's 1979 "Toward Efficient Allocation and Management: A Strategy to Preserve and Protect Water and Related Land Resources"; and
6. The U.S. Environmental Protection Agency's "Ground-Water Protection Strategy" (1984) and "Guidelines for Ground Water Classification" (1986).

In the past year, other related strategies have also been developed by the State. Staff involved in these efforts have been working closely together to ensure consistency between the strategies. They include the "Water Resources Strategy for the Control of Pests and Management of Nutrients," developed by the Water Resources Committee of the EQB and the "Nonpoint Source Pollution

Management Program," which was developed in response to the passage of Minnesota's Clean Water Partnership and the federal reauthorization of the Clean Water Act. The ground water related portions of these strategies have been incorporated herein, in much less detail. The strategies themselves will be available under separate cover.

Minnesota's Ground Water:

Nature of the Resource. Minnesota's extensive surface waters are well-known, but the State also has substantial reserves of extremely high quality ground water. As with surface waters, the ground water resource is unevenly distributed. Some areas of Minnesota have several abundant aquifers; other areas have no major aquifers, and only very meager quantities of ground water are available to domestic wells. The most plentiful aquifers are the surficial and buried sands located throughout the State, especially in central and north central Minnesota, and the bedrock formations of southeast Minnesota. Many of these aquifers have little natural protection from contamination.

Several statistics dramatically underscore the importance of ground water to Minnesota. Statewide, 75 percent of all Minnesotans receive their drinking water from ground water sources. Ninety-three percent of the State's municipal water supply systems use ground water. Finally, ground water supplies 60 to 80 percent of the irrigation water used in the State. In addition to these critical uses, ground water is important in food and beverage processing and other industrial uses, air conditioning and heating, livestock production, and other purposes, and it plays a vital role in the hydrologic cycle, supplying high-quality replenishment of wetlands, streams, and lakes.

Minnesota's ground water generally is of much higher quality than drinking water quality standards, and the State has fewer occurrences of naturally brackish or saline ground water than almost any other state. Natural ground water quality rarely fails to meet any of the health-based primary drinking water standards, with the possible exception of radionuclides, which are only beginning to be tested. Secondary drinking water standards, nonenforceable guidelines which reflect the aesthetic quality (e.g., taste and odor) rather than health risk, are commonly exceeded. The secondary standards for iron and manganese are exceeded in up to half the samples tested statewide by the MPCA's Ground Water Quality monitoring program. In western Minnesota, there are frequent exceedances of the secondary standards for sulfate and total dissolved solids.

Human Impacts. Ground water is vulnerable to pollution, and it is threatened from a variety of sources in Minnesota. These include "point sources," such as uncontrolled hazardous waste disposal sites, leaking liquid storage tanks, and landfills, and "nonpoint sources" including agricultural chemicals, concentrations of septic tanks, and other widespread land use practices. Improperly constructed, multi-aquifer wells or abandoned wells and high capacity withdrawals also influence ground water movement and migration of contaminants. Porous soils and fractured bedrock do little to restrict contaminant movement to the ground water in many areas throughout the State. And, once polluted, ground water is difficult to clean up and may remain polluted for decades or longer. Ground water may also be threatened locally by overuse, if withdrawals exceed the rate of replenishment of an aquifer. Because of these characteristics--many and widespread contaminant sources and points of use, susceptible areas, and persistence of pollution--protecting ground water is a challenge that requires efforts at many different levels.

Ground water quality impacts from land use practices and nonpoint sources of pollution have been partially known for years, but have been the subject of much greater concern very recently. Nitrate contamination, from fertilizers and human and animal wastes, is common, particularly in southern Minnesota, where concentrations of nitrate in ground water frequently exceed the primary drinking water standard. Recent studies by the Minnesota Departments of Health and Agriculture concentrating on farming areas in more vulnerable hydrogeologic settings found pesticide concentrations at generally very low levels, normally well below drinking water standards, in up to 40 percent of the ground water sampled.

In urban and rural areas throughout the State, ground water contamination has also occurred from specific localized sources. The most significant of these render the ground water unuseable as a potential source of drinking water or other use. The highest priority sites, which are candidates for thorough investigation and possible corrective actions, are listed on the State's Permanent List of Priorities. A breakdown of this list into source categories gives some indication of the relative importance of Minnesota's various sources of localized ground water contamination. The listed sources, and the numbers of sites in each category, are as follows:

Contaminant Source	Contaminating Substances	Number of Listed Sites
Industrial/manufacturing (on-site spills, illegal or uncontrolled disposal, industrial impoundments)	Solvents, metals, wood preservatives, pesticides	75
Solid waste landfills and dumps	Leachate: organic chemicals, metals	55
Storage and transportation of petroleum and other products	Gasoline, fuel oil, and breakdown products, other materials	5
Agricultural chemical handling facilities	Pesticides, nitrates	4

The listed sites represent only the highest priority sites identified to date; many other sites have not yet been identified or have lesser impacts on ground water quality. Petroleum leaks and spills could overtake the others as the largest source of localized ground water contamination because of the widespread nature of petroleum storage and transportation. The State has provided for regulation and, through the State Superfund and Petrofund, for corrective action at these sites. However, certain other kinds of facilities, such as gravel pits, salt storage piles and land treatment and disposal of wastewater, have not been monitored as much as the above sites, and they may also result in localized impacts.

Existing Framework:

There are many parties involved in ground water management and protection, and coordination between these parties is essential for effective management of our ground water resource. The federal government has limited authority to regulate ground water, but it affects ground water and State regulatory programs indirectly through the programs administered by the U.S. Environmental Protection Agency under the Safe Drinking Water Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation and Liability Act (Superfund); Federal Insecticide, Fungicide, and Rodenticide Act; and Clean Water Act.

The federal government is also active in ground water research, resource evaluation, development of practices and technologies to avoid ground water pollution, and technical assistance. The U.S. Geological Survey conducts aquifer, ground water quality, and geologic resource evaluations and research. The U.S. Environmental Protection Agency conducts and supports research on ground water contamination and monitoring. The U.S. Department of Agriculture, through several service branches, provides technical assistance to landowners and supports research on land management practices. In this Strategy, federal programs are described briefly under each initiative to set the framework in which State and local programs operate.

Local governments are becoming more active in ground water protection issues. They exercise control over some activities through their zoning, permitting, and licensing authorities; they have responsibilities for protecting public health; and they directly affect ground water quality through activities such as wastewater treatment and disposal and water supply systems. Through their authorities over land use, local governments are uniquely able to regulate some land use practices that may affect ground water. In addition, local knowledge of soils and geologic conditions is often better than State government's. The local government role in ground water protection is likely to increase further as a result of the local water planning efforts now under way in 54 counties under the Comprehensive Local Water Management Act.

Lack of funds for program development and implementation will severly hamper local governments in their efforts to initiate environmental programs. A consistent level of program guidance is also needed from the State to local government in many programs, to aid in establishment of environmental goals and criteria. In the Strategy, we will examine in more detail these local needs, and recommend ways to enhance the local role in ground water protection.

State government is the level of government most actively involved in ground water protection and regulation, since ground water, as one of the "waters of the State," is under the common ownership of the citizenry of the State. Several different agencies have authorities over ground water (see the table on the following three pages), particularly the Minnesota Department of Natural Resources (DNR), MPCA, and Minnesota Department of Health (MDH).

The division of authorities among these agencies places water quantity management in the DNR; ground water quality issues and pollution control requirements within the MPCA; and health-related and domestic supply matters in the MDH. Two other agencies have expanded authorities related to ground water. The Minnesota Department of Agriculture regulates the registration, sale, use, storage, and disposal of pesticides and has recently been given responsibilities for monitoring the impacts of pesticides on water resources. The Board of Water and Soil Resources, composed of local government representatives and private citizens, administers the local water planning effort, as well as the Soil and Water Conservation Districts, watershed districts and water management organizations.

In addition, State government is involved in research, education, and information, mainly through the University of Minnesota and the Minnesota Geological Survey. The Minnesota Geological Survey compiles hydrogeologic information, including well logs and mapping. The University of Minnesota is active in various lines of ground water research, and the Minnesota Extension Service provides information and education on water quality issues.

Recommended Changes:

The Strategy describes recommended modifications in State programs, and suggests ways to coordinate the programs. Some new organizational links are recommended to enhance research and educational efforts. In addition, the EQB's Ground Water Advisory Committee recommended the creation of a Joint Legislative Commission on Water, which would create a focus at the legislature for water issues and programs and complement the coordinating function of the EQB. The Ground Water Advisory Committee further recommended that the EQB should continue its strong role relating to water issues.

MINNESOTA STATE GROUND WATER AND RELATED MANAGEMENT PROGRAMS

ENVIRONMENTAL QUALITY BOARD

-Water Resources Committee-
Interagency Coordination and Policymaking

Statewide Framework Water and Related Land Resources Planning
Environmental Impact Assessment
Environmental Policy Planning

MINNESOTA POLLUTION CONTROL AGENCY

-Ground Water and Solid Waste Division-
Site Response (Superfund) Program
Solid Waste Facility Permits
Program Development
Statewide Ambient Ground Water Monitoring
Minnesota Ground Water Protection Strategy

-Water Quality Division-
Water Quality Management Planning
NPDES Permits Program
Nonpoint Source Pollution Control
State Disposal System Permits
Agricultural Waste
Municipal Sludge Disposal

-Hazardous Waste Division-
Hazardous Waste Generator Program
Hazardous Waste Facility and Transportation Permits
Storage Tank Regulation and Cleanup
Emergency Response (Spills)

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

-Division of Waters-
Water Appropriation
Ground Water Resource Investigations
Water Level Observation Wells Network
Ground Water Hydrologic Data
Underground Gas and Liquid Storage Permits
Water Use Informational Systems Development

MINNESOTA DEPARTMENT OF HEALTH

-Division of Environmental Health-
Safe Drinking Water Program
Wellhead Protection
Water Well Construction/Abandonment
Health Risk Assessment

-Division of Public Health Laboratories-

STATE PLANNING AGENCY

-Environmental Division-
Staff to the Environmental Quality Board

-Land Management Information Center-
Systems for Water Information Management

MINNESOTA DEPARTMENT OF AGRICULTURE

-Agronomy Services Division-

Pesticide Regulation | Fertilizer Regulation

Environmental Assessment of Pesticides and Fertilizers

Agricultural Chemical Emergency Response

-Planning Division-

Sustainable Agriculture Program

-Laboratory Services Division-

-Plant Industry Division-

Plant Pest Survey | Biological Pest Control Project

Implemenation and Enforcement of Plant and Animal Pest Control Statutes

UNIVERSITY OF MINNESOTA

-Minnesota Geological Survey-

Hydrogeologic Mapping (Statewide) | Water Well Logs Data Base

Hydrogeochemistry Mapping | High Capacity Well Data Base

-Institute of Technology-

Civil and Mineral Engineering | Geology and Geophysics

-College of Agriculture-

-College of Forestry-

-School of Public Health-

-Minnesota Extension Service-

-Water Resources Research Center-

-Center for Agricultural Impacts on Water Quality-

BOARD OF WATER AND SOIL RESOURCES

Local Water Management/Local Water Planning

Oversight of Soil and Water Conservation Districts

Watershed District Formation and Plan Review

Water Policy Conflict Resolution

WASTE MANAGEMENT BOARD

Hazardous Waste Management Plan | Solid Waste Management

Siting of Hazardous Waste Stabilization and Containment Facility

MINNESOTA DEPARTMENT OF TRANSPORTATION

-Technical Services Division-

BASIC TENETS OF THE STRATEGY

1. Ground water is a resource vital to to the economic and public health of Minnesota. It is necessary for the State to develop a comprehensive strategy to adequately manage the resource.

2. The State needs a strong, prevention based program when dealing with potential sources of ground water contamination. Cleanup of existing contamination must continue to be a priority as well. A balance must be struck between regulatory and nonregulatory approaches.

3. Clear goals for ground water protection should be incorporated into all programs which control potential sources of ground water contamination. These goals should include nondegradation where possible, and conformance to specific numeric standards where not possible or for existing problems. All ground water quality impacts should be met with action commensurate with the level of environmental and health risk posed by the impacts.

4. Even in a water-rich State like Minnesota, ground water is a finite resource, although it is to a certain extent a renewable resource. Fostering of water conservation measures, and their enforcement, must be a high priority with the State. Withdrawals should not be allowed which result in "mining" of water beyond the amount replenished by recharge.

5. More basic information on Minnesota's ground water resource is critical. A greater effort is needed to develop information on the State's geologic framework and the quality and flow of water within it, and to see that the information is maintained in a way useable by Minnesotans for varied purposes. Research must be coordinated, and the findings disseminated in a timely manner.

6. Ground water programs should be conducted at the most local level appropriate. Local governments have a crucial role to play in the management and protection of ground water and ground water users. Some problems can be addressed most effectively at the local level, but are limited by availability of resources and technological expertise. The State should support and enhance local efforts, and provide local governments with guidelines and regulations to aid in their program efforts.

7. Coordination between levels of government and governmental entities is vital to efficient ground water protection. Mechanisms such as interagency agreements, and work groups on various topics should be used to the greatest extent possible. The EQB should continue its strong role in coordination of the State agencies, and should extend its role to aid in communication of State programs to local governments.

8. People must understand the impacts that their various practices and activities have on the environment, and be educated in ways to minimize or alleviate those impacts. While education alone is not enough to cause changes in people's behavior, it is a necessary component of both regulatory and nonregulatory programs. Specialized training is also necessary for target groups.

Initiative I. To protect ground water quality now and for the future; to ensure safe drinking water supplies and to prevent ground water contamination by effectively regulating sources of pollution.

Topics Covered in This Initiative:

Initiative I. To protect ground water quality now and for the future; to ensure safe drinking water supplies and to prevent ground water contamination by effectively regulating sources of pollution.

Part One: Goals and Priorities for Ground Water Quality Protection.

Federal Government Role

There is no federal ground water nondegradation policy or statutory direction. However, the U.S. Environmental Protection Agency has been directed by Congress to develop numerical standards for pollutants which may be found in drinking water. The U.S. Environmental Protection Agency has also developed guidelines for a ground water classification system which sets up a differential protection scheme for aquifers based on current water quality and use.

Minnesota State and Local Role

Nondegradation Goal: Minn. Rules ch. 7060 sets forth a "nondegradation policy" for ground water, stating that ground water may not be contaminated in such a way that it can no longer be used as a safe source of drinking water. This policy was developed in 1973, citing the interconnected nature of ground water in the State, and states that economic benefits must be weighed when applying the policy.

Recommendations: Statement of Legislative Intent. Nondegradation (meaning prevention of further contamination and appropriate actions to improve ground water quality in areas already impacted) should be the policy goal of the State in the regulation of all potential sources of contamination. The nondegradation goal means that ground water impacts should be prevented to the maximum extent practicable regardless of whether the water is already impacted by human activities. While this goal is not currently achievable for many activities, the nondegradation goal will provide impetus for adopting improved technologies as they are developed. In areas already impacted, containment of pollutant sources should be the first priority, and should be followed up by a level of cleanup activity appropriate to the circumstances at each site. In some instances, active cleanup will be necessary, while in others passive cleanup (removing the contaminant source or implementing best management practices then allowing natural processes to flush contaminants from the system) may be appropriate. Time frame for implementation - 1989 Legislative Session.

Rule Revision. Minn. Rules ch. 7060 should be revised so that the nondegradation goal applies to all activities and all ground water. This would be implemented by requiring the use of "Best Available Technology" for permitted facilities and practices, and developing incentives for use of "Best Management Practices" for nonpoint sources of pollution. These "Best" technologies would be used, even if a lesser technology can be used and still meet the numerical limits for ground water contaminants discussed below. Time frame for implementation - rules proposed by December 1990.

Programmatic Change. Detection of manmade compounds in ground water, or levels of naturally occurring compounds beyond background levels, indicate that impacts have occurred. Therefore, regulatory programs should develop a plan for response actions commensurate with the observed level of potential health or environmental hazard. Time frame for implementation - plans developed by December 1990.

Numerical Limits on Ground Water Pollutants: For some practices, it is likely that the nondegradation goal cannot currently be achieved, even if "Best" technologies are used (and especially where they are not). For this reason, numerical limits on ground water pollutants are also necessary for effective ground water protection. Minn. Rules ch. 7050.0220 sets ground water quality standards which are based on the mandatory and recommended provisions of the 1962 U.S. Public Health Service Drinking Water Standards or subsequent revisions. Because of the number of revisions which have been set forth for different purposes, a variety of different numbers has been applied, which leads to variable levels of ground water quality protection from program to program and sometimes from site to site.

Recommendations: Statement of Legislative Intent. The legislature should direct MPCA to establish criteria which would be used to develop numerical ground water limits. The purpose of the numerical limits would be twofold: 1) to serve as a consistent upper limit on the allowable impacts from those practices where ground water impacts cannot currently be avoided, and 2) to serve as a goal for cleanups and remedial activities if still cleaner conditions cannot be restored. Time frame for implementation - 1989 Legislative Session.

Rule Revision. The MPCA should establish a work group, with representatives from other State agencies and the University of Minnesota to begin to revise Minn. Rules ch. 7050.0220 to establish a mechanism for development of numerical ground water quality limits. The rules should specify the process to be used to develop interim limits for compounds detected in ground water. This work group will be responsible for recommending the programmatic steps to be followed, discussing and resolving the technical questions, and recommending staffing levels for the various agencies which would be needed to develop these standards. Existing goals and standards set by the federal government and other states should be considered, and existing information used, in development of the numerical limits. Time frame for implemenation - rules proposed by December 1989.

Rule Revision, Programmatic Change. All State and local agencies dealing with ground water should incorporate these limits in their programs, and strive toward adequate and consistent application of the "Best" technologies. Nondegradation should be a prescribed goal for prevention. Incorporation of limits throughout State ground water programs should be a priority of the EQB's Water Resources Committee. Time frame for implementation - programs guidance developed by July 1991.

Protection of Sensitive Areas: A scheme for ground water classification based on the vulnerability of the particular resource is also given in Minn. Rules ch. 7050.0220. This classification system allows for less stringent protection of areas sensitive to pollution, and so is no longer appropriate. The "writing off" of aquifers in this manner is antithetical to Minnesota's nondegradation goal for all waters, and should not be allowed.

Recommendations: Statement of Legislative Intent. The Strategy recommends enactment of a legislative statement of intent which acknowledges the need for applying special protective measures in areas where ground water is more sensitive to contamination. Time frame for implementation - 1989 Legislative Session.

Rule Revision. The revisions to Minn. Rules ch. 7050 should include a set of criteria for defining areas of the State where more stringent control measures must be taken on the land surface to assure the same level of protection to aquifers below. This revision would provide greater levels of protection to vulnerable ground water, by requiring more stringent controls on potentially polluting activities. Criteria would be established in the rule on geologic susceptibility to contamination from potentially polluting activities. The goal would be to protect all ground water from degradation which threatens its use as a source of drinking water. Time frame for implementation - rules proposed by July 1990.

Resource Evaluation and Mapping. Additional information and research is needed in the area of aquifer evaluation and mapping of sensitive areas. Time frame for implementation - initial development work funded in 1989 Legislative Session.

Local Government Role. Local governments have a role in helping to delineate sensitive areas, possibly as part of the development of water plans, and to use zoning and land use controls to protect sensitive areas. Time frame for implementation - to coincide with implementation of water plans, beginning in 1990.

Funding: Additional staff will be needed at MPCA to work on the rule revisions outlined. Although existing data on the toxicity of pollutants will be used in the setting of numerical ground water quality limits, additional staff will be needed at the MDH to work on this effort as well. The research needed to delineate sensitive areas will be costly; only a limited amount of this information has been gathered to date. It was the recommendation of the Citizen's Advisory Committee that funds for such basic regulatory work as this come from broad-based, general revenues, and that the rules should be structured to avoid a major commitment of resources to ongoing development and maintenance of numerical limits.

Initiative I. Part Two: Drinking Water Protection.

Drinking water protection differs from ground water quality protection in that these programs operate at the point of water use, not at the potential sources of contamination. This issue relates both to public water supplies and private water supplies.

Federal Government Role

The Safe Drinking Water Act defines the federal program and permits states with an equivalent program to be given primary enforcement reponsibility or "primacy."

Minnesota State and Local Role

Water Supply Planning: Public water utilities are responsible for the development of their water supplies, including locating sufficient amounts of suitable quality water to meet the needs of their citizens, and for obtaining the necessary approvals and permits from State agencies. Consultants take an active role in this effort, providing technical assistance to utilities during the planning process.

Recommendation: Legislative Change, Program Development. The legislature should direct the MDH and the Minnesota Department of Natural Resources to work more closely with the public water utilities during their planning process. This should include development of Wellhead Protection guidelines, under which utilities would delineate the recharge areas of wells and work with local government to enact special protective land use restrictions in those areas to prevent future problems with the wells. Additional staff will be needed by the agencies to conduct this effort. Time frame for implementation - 1989 Legislative Session; program development started in July 1989.

Enforcement of Water Well Construction Code: Private well owners have inadequate protection under the current programs. Although Minnesota currently has a water well construction regulatory program, the program has not been effective enough because of understaffing and lack of effective enforcement mechanisms. Minnesota needs adequate funding for the water well program at the State or county level to ensure ground water protection.

Recommendation: Legislative Change; Programmatic Change: The MDH well program should be funded at a level to increase staff to meet legislative obligations for the enforcement of the water well construction code. Also, additional legislation is necessary to implement new regulations to increase the effectiveness of the well program. Legislation should be introduced to cause abandoned wells to be sealed. Such legislation should include disclosure laws and the requirements that abandoned wells be sealed at the time of property transfer. Other legislative initiatives are needed to increase enforcement effectiveness, including a system of fines, impounding equipment, and a system of State well permits and bonding. The MDH should continue to encourage the delegation of the water well program to county governments through a delegation agreement and the adoption of the model well ordinance developed by the MDH and Southeast Minnesota community health programs. Time frame for implementation - 1989 Legislative Session.

Local Assumption of the Water Well Construction Program: Statewide, about 75 percent of all Minnesotans receive their drinking water from ground water sources. Much of this drinking water is supplied by an estimated 300,000-400,000 private wells throughout the State. These large numbers make it difficult to effectively regulate well construction and abandonment, and the testing of drinking water from these wells at the State level. Local governments are already directly involved and experienced in public health protection programs and are in a position to more effectively regulate and test drinking water wells. Current funding through the Community Health Services subsidies must support many other public health programs as well. As a result, most counties have not assumed the well program.

Recommendation: Legislative/Funding, Programmatic Change. Counties should be encouraged to adopt county water well programs including enforcement and well sealing, either through their Community Health Services subsidies, or through another source of funding. The State should provide financial and technical assistance to counties in developing and implementing well sealing programs and water testing services, including development of a model county well ordinance by MDH. Local testing services should be certified by the State. Time frame for implementation - 1989 Legislative Session; program development at county level beginning in July 1990.

Sealing of Unused and Other Problem Wells: Unsealed, abandoned wells may be a major source of ground water contamination. Estimates of the number of unsealed, abandoned wells range from 300,000 to 2 million. Multi-aquifer wells can allow the lower-quality, near surface water to move down into lower aquifers whether the wells are currently in use or not. Improperly cased wells, and wells with casings which have deteriorated over time, are also a significant cause for concern.

Recommendation: Legislative Change, Program Development. The legislature should develop an incentive fund to aid well owners in the sealing of multi-aquifer wells in current use. Pilot projects should also be developed to demonstrate how effective local government can be at dealing with the issue of unused wells, including conducting an inventory of unused wells and developing ways to assure that the most critical of these are sealed in accordance with the Water Well Construction Code. The MDH would be responsible for developing a prioritization scheme to determine the highest-priority wells for sealing. Research is also needed into development of more cost-effective well sealing techniques. Time frame for implementation - 1989 Legislative Session; rules for grant program and prioritization scheme developed by June 1990; initial research funded in 1989 Legislative Session.

Private Water Well Testing: Testing of private wells at the time of construction may be performed by the MDH laboratory or certified private laboratories. Most counties offer testing services to private well owners for coliform bacteria and nitrate to assure the sanitary quality of their water. If private well owners desire to test their water for a broader suite of parameters, such as pesticides or volatile organic compounds, they must contact private laboratories for these services. Because MDH is only beginning to certify laboratories for water chemistry analysis, there is little guidance for people in choosing reputable laboratories. The cost of these analyses is also quite high, and may be prohibitive.

Recommendation: Program Development. MDH should continue rapidly to develop a laboratory certification program, with minimum requirements for quality assurance to aid consumers in selecting laboratories capable of performing the work accurately and precisely. In addition, counties should consider expanding their well testing programs to include more parameters and to use this data to aid in delineating problem areas and developing the baseline water quality information needed to more adequately manage the resource. Counties may choose to share the cost of this analysis with the homeowner, and at least may arrange the testing so that lower rates can be obtained by application of a quantity discount. Time frame for implementation - certification of laboratories will begin in January of 1989; counties should consider expanded water well testing as part of the water planning efforts now under way.

Wells and Property Transfer: There is currently no requirement in Minnesota for registration of wells on property deeds, which hinders governmental efforts in enforcing sealing of unused wells. Some lending institutions are requiring testing of private wells at the time of property transfer, but this too is not a State requirement.

Recommendation Legislative Change. The legislature should require registration of all drilled wells, whether in current use or not, on the property deed at the time of transfer. In addition, it is recommended that the legislature require testing of all domestic water supply wells at the time of property transfer to ensure that the water is of sufficient sanitary quality for a drinking water source. This testing should be done by certified laboratories, and the results reported to the MDH or the county community health agency if they have been delegated authorities under the provisions of the Minnesota Water Well Construction Code. A portion of the well testing fee should be retained by the agency to whom the data is reported for data management. Time frame for implementation - 1989 Legislative Session.

Funding: The funding required under the Water Supply Planning for Drinking Water Protection would be for a staff person at the MDH, and should include sufficient amounts for development and publication of the guidelines on Wellhead Protection. Funds for this could come from an additional fee on public water supplies.

Enforcement of the Water Well Construction Code will require major staff additions at the State or local level. This could be funded by a permit fee for wells, either on a one-time basis when the well is constructed or an annual well-permit fee. The well sealing demonstration projects could be funded from broad-based, general revenues. The cost of the laboratory certification program will be covered in large part by fees paid by the laboratories desiring certification, and the increased testing of private wells could be paid for by well owners.

The cost of registering wells on deeds and testing of wells at the time of property transfer would also be borne by the well owner. County well programs could be funded by a per annum tax on private wells, paid on property taxes for those homes not served by public or rural water supply systems.

Initiative I. Part Three: Programs to Control Pollution.

Federal Government Role

Programs administered by the U.S. Environmental Protection Agency including those under the Safe Drinking Water Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation and Liability Act (Superfund); Federal Insecticide, Fungicide, and Rodenticide Act; and Clean Water Act. The federal government is also active in ground water research, resource evaluation, development of practices and technologies to avoid ground water pollution, and technical assistance.

Minnesota State Government Role

Review of State Programs: Many of Minnesota's serious ground water contamination problems result from improper waste disposal and treatment. Approximately 136,000 facilities of various types are regulated by 15 programs operated by State government; most of the waste facilities are regulated by MPCA. The Minnesota Department of Agriculture is responsible for regulation of pesticides and fertilizers. Ground water protection is frequently not the major regulatory focus of the programs, which results in differential levels of protection for the resource. In addition, large differences in staffing and funding among regulatory programs result in varying abilities to address ground water issues.

Recommendations: Legislative Mandate for Program Review. The Strategy recommends the following set of criteria be used to review regulatory programs in a more objective and consistent manner. These criteria are:

1. goals for ground water protection;
2. enforceable regulations and facility standards for design, construction, operation and closure (also including minimum standards for monitoring and quality assurance);
3. sufficient staff and funds to match the scope of the problems;
4. adequate review of individual facilities and effective enforcement mechanisms; and
5. prioritization of facilities based on judgement of probable environmental risk.

Time frame for implementation - the programs will self-evaluate based on these criteria, then report back to the Water Resources Committee with their findings and recommendations by September 1989, with subsequent EQB report to the legislature for the 1990 session.

Source Control/Reduction: Reducing the amount of waste which must be disposed through reuse and recycling, as well as disincentives on purchase of potentially polluting substances, will result in less pollutants being discharged into the environment.

Recommendation: Legislative Change. The legislature should adopt reuse/recycling legislation with the goal of waste reduction of consumer goods. Pickup programs for household hazardous waste should be expanded and waste agricultural chemical collections should be continued beyond the current demonstration projects. Fees should be imposed on products which have been shown to impact ground water as disincentives to use. Time frame for implementation - 1989 Legislative Session.

Expand and Enhance Irrigation Regulatory Programs: State law establishes authority for developing requirements for application of pesticides through irrigation systems, including the requirement of obtaining a permit from the Minnesota Department of Agriculture. Such a permitting program does not exist for controlling the application of fertilizers through irrigation systems, even though this practice is more widespread and requires similar precautionary measures. The DNR issues permits for the appropriation of water for irrigation and must consider in that process the impacts of the use of the water.

Recommendation: Legislative Change, Program Development. The Minnesota Department of Agriculture should be authorized to develop requirements to control fertilizer applications through irrigation systems. This should be undertaken in cooperation with farm chemical industry, commodity grower's groups, and irrigators association. Requirements should be distinct from those governing pesticide application through irrigation systems, and should be geared toward best management practices for protecting the environment. Time frame for implementation - 1989 Legislative Session.

Recommendation: Programmatic Change. DNR should develop agreements/ procedures with the Minnesota Department of Agriculture, MPCA, and MDH for reviewing, revoking, and denying appropriations permits and requiring monitoring for irrigation where ground water contamination is present or is a concern. Time frame for implementation - agreements in place by June 1989.

Development of Local Programs: Those contaminant sources which are more numerous and widely dispersed may be controlled more effectively at the local level. Local governments are in a unique position of knowing local conditions and having the available tools to regulate certain types of land use and protect public health. Options available to local governments include land use regulation through zoning and permitting, operation of water supply utilities, and planning and operation of waste treatment and disposal systems. Controlling sources of contamination will require resources which most local governments do not presently have available. In addition, Comprehensive Local Water Planning has been initiated by 54 of the 80 greater Minnesota counties and one metropolitan county has initiated a ground water plan. These plans are important in assessing local problems and needs.

Recommendation: Legislative/Funding; Programmatic Change. Grants to Local Governments. The Ground Water Protection Strategy recommends that the legislature establish a grant mechanism which would help local governments develop and implement environmental programs to address problem areas identified in the Comprehensive Local Water Planning process. This grant could be administered by the Board of Water and Soil Resources, with the local governments reportable to the State agencies which are responsible for the programs which they seek to administer. Examples of programs of this type are the feedlot regulation program, the on-site sewage treatment system program, gravel and other industrial mineral mines, and other pollution sources which are locally important but are not regulated by the State. Agencies should be authorized to develop rules for delegation of these programs. Highest priority for grants would be given to those with the most comprehensive approach, and those in sensitive areas of the State. Time frame for implementation - 1989 Legislative Session; grant program in place by July 1990.

Technical Assistance and Program Review. The State must have staff in place for technical assistance to aid local governments in ground water information assessment as well as program development/implementation, not only to ease the process of program transfer but to enhance intergovernmental communication. It would be the responsibility of the State programs to oversee local efforts to ensure that minimum environmental protection goals are being met as a condition of continuance of the delegated authority. Time frame for implementation - 1989 Legislative Session.

Nonpoint Sources of Contamination: Nonpoint source impacts are a major cause of ground water contamination in rural and urban parts of the State. Accepted agricultural practices are coming under closer scrutiny as certain pesticides and nutrients are being detected in ground water in areas away from possible point sources of pollution. Many other nonpoint source land use activities also have the potential to adversely impact ground water quality. Pollution sources that do not have adequate prevention programs include: animal waste, urban infiltration ponds, construction sites, on-site sewage treatment systems, underground injection wells, junkyards, backyard dumps, and stockpile storage areas.

Recommendations: Legislative/Funding; Program Development. The State should follow recommendations made in the "Nonpoint Source Ground Water Strategy" and the "Water Resources Strategy for the Control of Pests and Management of Nutrients," which detail specific recommendations for addressing the concerns listed above, including pesticides and nutrients. Appropriate agencies and the University of Minnesota should monitor and research ground water impacts resulting from the various nonpoint pollution sources as recommended in the strategies. Expanded educational and informational opportunities should be provided for the public regarding nonpoint source pollution of ground water. Nonpoint source pollution issues should be addressed by a combination of voluntary best management practices and regulation. A need exists for funding of research, monitoring, and education regarding nonpoint source pollution in areas such as the fate and transport of chemicals in ground water. In addition, the legislature should increase funding for the Clean Water Partnership Program and other programs that address nonpoint source pollution of ground water (e.g., Wellhead Protection Program). State programs such as Reinvest in Minnesota and the State cost share program should be expanded to aid in implementing best management practices to alleviate pollution from pesticides and nutrients. Time frame for implementation - tie in with other recommendations of this Strategy for education and information. Funding for Clean Water Partnership, expanded Reinvest in Minnesota program, and expanded State cost share program - 1989 Legislative Session.

Program Development. Minnesota should develop a State Pesticide Management Plan with Minnesota Department of Agriculture as the lead agency, with strong interagency coordination through the EQB. It should stress problem prevention and nondegradation, should delineate what to do when problems or issues arise, and include: 1) designating special protection areas,

2) taking preventative actions, and 3) initiating specific management plans for a pesticide following detection. Time frame - plan developed by December 1989.

Local Government Role. Due to the widespread nature of nonpoint source pollution, local governments will have a vital role to play in source identification and control through the local water plans. Local governments do not have a large role in issues such as pesticide regulation, or cleanup of past ground water contamination. Time frame - in implementation of local water plans, beginning in 1988.

Underground Injection Control: In 1979 the State decided not to seek primacy from the U.S. Environmental Protection Agency on the Underground Injection Control program, based largely on the fact that there were no known injection wells in the State. Since that time, the federal program has begun to address wells which have been found to occur in the State to some extent, including agricultural drainage wells, stormwater drainage wells, heat-pump return wells, and cesspools and other nonconforming sewage systems.

Recommendation: Program Review. An inventory and assessment of these types of wells in Minnesota should be conducted. A work group should be established to discuss the need for the State to seek primacy in this program, and to determine the steps which need to be taken to receive federal authorization.

Data Management: Regulatory programs at all levels of government are hampered by the lack of adequate computerized data storage and retrieval systems to allow efficient evaluation of the ground water impacts of facilities and practices regulated.

Recommendation: Legislative/Funding. Develop an information management system (an interface, not a new, central system) to link ground water data collections from programs in all State agencies in a consistent and useable format, which would be coordinated among the various agencies and consistent with the State Water Information Management committee data standards. The Integrated Ground Water Information System currently under development by MPCA needs additional funding to become a viable system. The Integrated Ground Water Information System can serve as a template for programs being developed by other agencies. It also will have a PC-based version, which can be used by local units of government. Time frame for implementation - 1989 Legislative Session.

Funding: Additional staff for State programs traditionally comes from the General Fund, reimbursed by permit fees to the extent possible. Grants for local programs should come from the broad-based, general revenues, as should funds for data management. Nonpoint source pollution control efforts could be funded by a combination of General Fund revenues and fees on polluting substances. Source control/reduction should be financed by taxes on nonrecyclable materials, permit fees to stores which sell household materials which become hazardous waste.

Initiative II. To ensure adequate water supplies, to regulate water appropriation and use for protection of highest priority users, and to improve coordination of quality and quantity aspects of regulatory programs.

Topics Covered in This Initiative:

Initiative II. To ensure adequate water supplies, to regulate water appropriation and use for protection of highest priority users, and to improve coordination of quality and quantity aspects of regulatory programs.

The protection and management of the State's ground water resources are incomplete without taking into account ground water quantity concerns and the interrelationship between ground water quantity and quality. The policy which directs ground water programs administered by various State agencies in Minnesota is one of nondegradation of the resource for both quality and quantity.

Federal Government Role

The federal government has no authority to regulate water use in Minnesota. The U.S. Geological Survey is involved in aquifer evaluations which are used in decision-making on appropriation permits.

Minnesota State and Local Role

Water Use Priorities: Appropriation of water from the natural environment is regulated by the DNR through its water appropriation permit system. A water use priority system is laid out in statute, and is applied by DNR when making appropriation permit decisions. This system is called upon increasingly to address types of appropriations which involve both water quantity and quality concerns, such as pumpouts of contaminated water for cleanups.

> Recommendation: Programmatic Review. The DNR should lead the EQB's Water Resource Committee in evaluating the State's current water allocation framework and priorities to determine whether they still meet the needs of the State, especially in the areas of contamination cleanups, conservation and efficient use of ground water, and the interactive relationship of ground water and surface water. Time frame for implementation - recommendations to Water Resources Committee in October 1988.

Conservation: Conservation of water in a water-rich State like Minnesota typically has not been a high priority, yet it is of critical importance, especially in time of drought. Enforcement of water conservation and efficient use of ground water has not been adequately implemented. There is a need for a policy which clearly states water conservation goals and provides more "muscle" for promoting conservation and efficient use of ground water. Ground water withdrawals in the Twin Cities during the summer cause large drawdowns. Much of this water is used for climate control in downtown office buildings. Current regulatory policy and programmatic restrictions make it difficult to encourage reuse of noncontact temperature control water, as well as treated water from contamination pumpouts. This tacet policy leads to wasting and inefficient use of ground water.

> Recommendation: Programmatic Change. State programs should stress water conservation and efficient use of ground water. As a part of this effort, the DNR should revive the program to get unpermitted water appropriators under permit. Time frame for implementation - conservation should be a topic at the next conference in the "Minnesota Water '88" series. DNR program upgrade by July 1990.

Programmatic Change. Agencies should work together to recommend and encourage uses for contaminated ground water (pumpout water) and ground water used for noncontact temperature control. Time frame - immediate.

Rules Revision. The MPCA and MDH should consider changes in rules which would facilitate reinjection of ground water, under controlled circumstances, where water to be injected meets appropriate quality standards. The injection of waste, or contaminated water, should not be allowed under any circumstances. A work group should be established to discuss these issues, and to direct the State in the decision as to whether to seek primacy on the Underground Injection Control Program from the U.S. Environmental Protection Agency. Time frame for implementation - work group report due to Water Resources Committee by October 1989.

Contingency Planning: A coordinated approach which addresses both quality and quantity concerns is needed to deal with issues of water supply and ground water pollution remediation, both in developing public water supplies and in contingency planning.

Proposed Recommendation: Programmatic Change. Contingency planning for public water supplies should be expanded to better cover emergencies of water quality and availability, especially at the local level. Interagency agreements between DNR, MPCA, and MDH should be used to develop a coordinated approach to deal with problems of water supply and ground water pollution remediation. Federal agencies also have roles in contingency water supply planning. Time frame for implementation - as part of the Water Supply Planning recommendations, outlined herein on page 13.

Coordination of Quantity and Quality Concerns: A coordinated approach which addresses both quality and quantity concerns is needed to deal with issues of water supply and ground water pollution remediation. Remedial actions and alternative water supplies at ground water contamination sites may be designed without adequately considering water conservation and efficient use of ground water. In addition, little has been done to coordinate water supply needs for growing communities with water availability considerations.

Recommendation: Programmatic Change. Interagency agreements between DNR, MPCA, and MDH should be used to develop a coordinated approach to deal with problems of water supply and ground water pollution remediation. In addition, these agencies, along with the Minnesota Department of Agriculture, should develop agreements/procedures for reviewing, revoking, and denying appropriation permits and requiring monitoring for irrigation where ground water contamination is a concern. Staff should be educated about the goals, programs and rules of other agencies. The Minnesota Department of Agriculture should also be involved in issues where agricultural concerns are involved. Time frame for implementation - agreements developed by March 1989; education of staff beginning in January of 1989.

Programmatic Change. The MPCA needs to consider quantity issues when evaluating cleanup options. Uses of pumpout water should be planned as part of remedial measures. DNR may need additional staffing to deal with the increased number of appropriation permits requested as a result of these pumpouts. Time frame for implementation - interagency discussion beginning in October 1988.

Programmatic Change. The DNR should consider water quality impacts of ground water appropriations before approving permits, bearing in mind the State's policy of nondegradation. More research will be necessary in determining these possible impacts. Time frame - immediate.

Funding: The initial implementation of these recommendations is not anticipated to require major expense, but will require staff time to implement. The rules revision stage is more costly. Funding from this comes from the General Fund currently, which is reimbursed by permit fees which the water appropriators pay.

Initiative III. To enhance the current body of knowledge on Minnesota's ground water resource, delineating problem areas and providing information needed to effectively manage the resource.

Topics Covered in This Initiative:

Initiative III. To enhance the current body of knowledge on Minnesota's ground water resource, delineating problem areas and providing information needed to effectively manage the resource.

Federal Government Role

The U.S. Environmental Protection Agency has a ground water research program consisting of five functional areas: monitoring, fate and transport, aquifer reclamation, source control, and technology transfer and technical assistance. The U.S. Geological Survey is also involved in generating information on ground water through hydrogeological studies of specific aquifers and the National Water Use program. The U.S. Department of Agriculture Soil Conservation Service, through its soil survey program, has information available to help identify areas sensitive or susceptible to ground water contamination relative to soil properties.

Minnesota State and Local Role

Coordination: Resource evaluation, monitoring, and research information have been generated by a variety of sources including research institutions and units of government at all levels. Information needs and subsequent data generation are normally accomplished by individual researchers and governmental units with little or no interaction among them. More coordination is needed in these efforts to ensure information is collected in those areas with the greatest need and to avoid a duplication of effort.

> Recommendation: Legislative Change/Programmatic Change. All data generation activities at the State level should be coordinated through a Ground Water Technical Committee made up of technical staff from federal, State, and local agencies and research institutions. This committee would be responsible for recommending to EQB the dissemination of funds from a dedicated research fund and overseeing the development, implementation, and the evaluation of programs in monitoring, research, and resource evaluation. Dissemination of results and findings of the research would be done by the committee. This committee would also make recommendations to other bodies such as the Water Resources Research Center and the Legislative Commission on Minnesota Resources as to research and resource evaluation needs and priorities. The committee should be tied to or formed from existing committees within the State. Time frame for implementation - committee should be formed in July of 1989, and with the first awards for research projects in January of 1990.

Resource Evaluation: It is critical for the regulation and protection of ground water resources to be able to evaluate the resource to be protected. The data needed to define aquifer extent, ground water availability, and water use are often not available. With the exception of several sand plain aquifers and the Twin Cities area aquifer system, the yield potential of most ground water sources in the State has not been thoroughly explored. Except in limited areas that have been the subject of special studies, the data currently available are inadequate to sufficiently define the ground water resource and provide long-term background information for analysis. The basic information needed includes:

1. further ground water resource evaluative studies, including detailed mapping of surficial and buried aquifers for the entire State, especially in recharge areas;

2. development of sufficient ground water quality information to accurately define baseline conditions statewide, and preparation of comprehensive reports to organize and interpret this information;

3. accelerated development of county geologic atlases;

4. more complete information on the patterns of water use, both permitted and unpermitted;

5. update of State land use data base at the Land Management Information Center which is now 20 years old;

6. more detailed monitoring of water levels, and creation of a depth-to-water map to facilitate evaluation of the ground water contamination potential throughout various parts of the State; and

7. testing of aquifer hydrogeologic properties, and related testing of the tightness of confining beds and low permeability formations to assess the degree of protection these aquifers are afforded.

Recommendations: Legislative/Funding. A new emphasis on the gathering of basic data and the stated purpose for such data collection is needed in Minnesota for the successful implementation of any ground water protection strategy. It is recommended additional funding be allocated as follows:

Need 1: DNR, with advice from the Water Resources Committee agencies, should prioritize aquifers for evaluation and cooperative studies, and work with the U.S. Geological Survey and local governments to develop aquifer study reports;
Need 2: MPCA should reexamine and possibly refocus the objectives of their ambient ground water monitoring program, and also use data from other programs to develop sufficient ground water quality information to meet State and local information needs;
Need 3: Minnesota Geological Survey should accelerate creation of county geologic atlases; with the goal of completing all counties in the State by year 2000;
Need 4: State agencies should develop computer-compatible maps showing sites of water use and known or suspected pollution;
Need 5: Land Management Information Center should update the 1969 land use files, using current information;
Need 6: DNR and U.S. Geological Survey should expand the observation well network for monitoring water levels where needed to adequately evaluate the effects of climate and water withdrawals on the available resource; and
Need 7: Minnesota Geological Survey and U.S. Geological Survey should evaluate the hydrologic properties of aquifers and aquitards, with results going into a computerized file accessible by all interested Minnesotans. Existing aquifer test data should also be automated.

Time frame for implementation - 1989 Legislative Session; initial funding for projects in July 1989.

Monitoring: Although information is constantly growing, ground water monitoring activities are not normally well coordinated. This lack of coordination results in information gaps, and hinders the transfer of information. State programs that monitor ground water quality and quantity should be better coordinated. This coordination would be most effective if it occurred at both the management level and through less formal staff interaction.

Recommendation: Programmatic Change. Monitoring programs need to be evaluated at the management level through a coordinative body consisting of managers from all State agencies with ground water programs. The Water Resources Committee should coordinate development of a statewide interagency monitoring plan, with biennial reports on the nature and quality of ground water in the State and recommendations for modification of the monitoring plan. Other suggestions include creating more opportunities for staff interaction, creation of an electronic bulletin board for monitoring programs and establishment of a yearly statewide monitoring seminar such as "Minnesota Water '88" to display the programs and exchange information. Time frame for implementation - immediate; funding for electronic bulletin board in July 1989.

Research: State agencies have not effectively conveyed their research needs to colleges and universities, nor have they consistently looked to these research institutions to conduct ground water research. Research results are often poorly disseminated, and not well publicized.

Recommendation: Legislative Change/programmatic Change: A continuing source of funding should be provided for ground water research. The submittal of proposed research projects for funding should be coordinated between State agencies and research institutions. This coordination has begun to occur as the University of Minnesota and state agencies are currently working together in developing Legislative Commission on Minnesota Resources proposals. There should also be a coordinated effort to disseminate statewide research results generated in Minnesota and from elsewhere when results may be applicable to Minnesota. Time frame for implementation - 1989 Legislative Session; first projects funded in January 1990.

Funding: This initiative may be costly to implement. Some funds should come from a stable, dedicated source of money such as user fees to allow for long-term research and resource evaluation efforts. This source should be supplemented from broad-based, general revenues. Other funding sources such as federal and local matching funds and grants from public and private sources should also be an important component of overall funding.

Initiative IV. To provide the public, decision-makers, regulators, and the regulated community with the necessary information and education for making environmentally sound decisions in areas which may impact ground water.

Topics Covered in This Initiative:

Initiative IV. To provide the public, decision-makers, regulators, and the regulated community with the necessary information and education for making environmentally sound decisions in areas which may impact ground water.

Part One: Information and Education.

Informing and educating the public about ground water is a crucial but complex task. Major components of this effort include:

1. Public information on existing knowledge and new findings about ground water, and the publicizing of new programs, availability of services and technical assistance, upcoming events and developments throughout the State and elsewhere.

2. Ground water education of various audiences including children, the general public, and regulated persons and activities.

3. Training for regulators, planners, and other officials at all levels of government.

4. Technical assistance to provide continued support in regulatory and planning efforts at all levels of government.

5. Dissemination of research results and any published information relating to the ground water resource.

Federal Government Role

The federal role in this area has primarily been in the publication of information and technology transfer by primarily the U.S. Environmental Protection Agency and U.S. Geological Survey. The U.S. Department of Agriculture Soil Conservation Service, through its association with local soil and water conservation districts, has responsibility for information and technology transfer to private land users as an integral part of the conservation planning process.

Minnesota State and Local Role

Policy: An informed and educated public is essential in protecting ground water resources as many sources of degradation can be directly attributed to individual behaviors and widespread practices of the public. Ground water protection requires not only the enforcement of regulatory programs but the fostering of appropriate voluntary actions by individuals to prevent degradation. Information and education must, therefore, be a key component of any ground water protection program.

Recommendation: Legislative/Funding: The legislature should enact a Statement of Policy establishing information and education as vital components of an overall ground water protection program. This statement should be backed up by committing funds to both an overall information and education program and to specific ground water management programs with information and education components. Time frame for implementation - 1989 Legislative Session.

Information: Ground water information is developed and disseminated by different State agencies with little or no coordination. The main purpose of these information efforts has been primarily to raise awareness of ground water resources and the issues involved with existing ground water related programs. This information has reached some specific audiences and not others. The development of published information has also been hampered by a lack of funds. Historically, information is published when agencies can scrape enough funds together but may be among the first programs to be cut when budgets are tight. Demonstrating the benefits of public information efforts is complicated by the difficulty in quantifying the results and measuring the effectiveness of these efforts.

Recommendation: Legislative/Funding: The development and dissemination of ground water information should be coordinated through a newly formed committee, which includes State agency personnel and private organizations and citizens with educational and information dissemination expertise. This committee should perform activities consistent with the priorities and policies of EQB, be provided with appropriate staffing levels, and should be responsible to the Minnesota Environmental Education Board. Funding should be provided to agencies to develop sufficient published materials on subjects, such as best management practices, household hazardous wastes, and septic tanks, for distribution throughout the State to a wide range of audiences including the general public, local decision-makers and officials, industries, and farmers. This committee should determine the types of information to be developed for specifically targeted audiences, how it will be disseminated, and how funds will be spent. Time frame for implementation - 1989 Legislative Session.

Education: The State requires environmental education at the elementary school level, but does not presently have a program of ground water education in the schools or for the general public. The objective of education is to provide information on ground water and attempt to develop new attitudes toward ground water protection and to foster good environmental stewardship. Attitudes and awareness should be developed to a point where they lead to actions that prevent ground water degradation. This development will be most successful through personal interaction between teacher and pupil at the primary and secondary education levels.

Recommendation: Legislative/Funding: Funding should be provided for the development of curriculum and in-service training of teachers at both the primary and secondary education levels. This curriculum should be incorporated into existing school programs K through 12. At the primary level general concepts of ground water and sources of contamination could be introduced. More detailed ground water study could be included in the earth sciences and/or general science curriculum at the junior high level while ground water policy issues could be covered in social studies at the high school level. The Minnesota Environmental Education Board, through the above proposed committee, should oversee curriculum development and dissemination. Time frame for implementation - 1989 Legislative Session; curriculum development beginning in July 1989.

Legislative/Funding. An essential component of any ground water education program is the training of State and local regulators. To maintain well-trained staff, technical assistance is required at all levels of government. The general public and specific audiences need to be educated through seminars, workshops, and demonstration projects. An example of a demonstration project is showing ways of reducing environmental impacts of pesticide and nutrient applications in specific areas of the State. Again, funds will be needed to develop education programs for these audiences. The above committee should coordinate with the local government umbrella organizations to develop education materials and the delivery of educational services to the various audiences. Time frame for implementation - beginning when committee formed, July 1989.

Funding: The cost of generating information and participating in educational activities is relatively low, especially compared to the cost of remedial efforts after pollution has occurred. Possible sources of funding for information and education activities include broad-based, general revenues and grants from public and private agencies.

Part Two: Information Access.

Federal Government Role

The U.S. Environmental Protection Agency provides opportunities to states for getting together to discuss data management concerns including data needs, storage, access, and analysis. The agency also encourages states to work toward a common language, standards, and formats so data can be shared between states and federal agencies. A part of this effort is that the U.S. Environmental Protection Agency is currently studying changes needed in the STORET data base to make it more useful for ground water data. States are further encouraged to develop an implementation strategy for ground water data management.

State and Local Role in Minnesota

Access: Knowledge of and access to information is a major obstacle to widespread adoption of practices that protect ground water quality. Although several major ground water data bases have been automated, funding constraints have left gaps in the current system, where key data bases are still in manual form or only partially automated.

Recommendation: Legislative/Funding. The Water Resources Committee should review the recommendations of the Systems for Water Information Management Ground Water Subcommittee's position paper that identifies needs for additional ground water data collection, automation and/or enhancements of automated systems, and integration of data. The Water Resources Committee should make recommendations for funding based on this paper and the discussions that it engenders.

The Systems for Water Information Management Committee should be directed by the Water Resources Committee to provide statewide funding recommendations for data base development. These recommendations should be eventually adopted by the Water Resources Committee and include specific data automation and integration needs. The Water Resources Committee should further direct the Systems for Water Information Management to continue interacting with MPCA (in the development of the Integrated Ground Water Information System) and DNR and Minnesota Geological Survey (in the maintenance of WELLS and WELLOG systems), and promote use of these data bases by other agencies.

Time frame for implementation - position paper complete by October 1988; 1989 Legislative Session for funding; these activities are ongoing and should continue but will require funding to maintain these efforts.

Coordination: Coordination of data management activities can aid the efficiency of many programs. Although State agencies' activities are coordinated through the Systems for Water Information Management Committee, local governments are not.

Recommendation: Programmatic Change: The Water Resources Committee should affirm and promote the Systems for Water Information Management data consistency standards for State agency data collections, and continue working with local governments to encourage them to conform to these standards as well. In this way, the State agencies will be able to access information collected at the local level, and to better transfer ground water information to local units of government.

The Systems for Water Information Management Ground Water Subcommittee should establish uniform file structures and data coding procedures, to be used by all agencies collecting ground water data. Since a central computer will not be used to house all the data, documentation should be developed to facilitate communication between the various systems' users to aid in data transfer.

Time frame for implementation - coordination is ongoing, with uniform file structures and data coding procedure recommendations to Water Resources Committee by July 1989.

Funding: Cost of information system development is high, often requiring purchase of new equipment and software, programming costs, and data entry. These costs may be offset, however, in increased ease of data access and transfer. Staff time is saved and environmental protection enhanced. Possible sources of funds are broad-based, general revenues and permit fees. All programs should make efficient, accessible data management a priority, and funds should be earmarked for these efforts.

TABLE SUMMARIZING STRATEGY RECOMMENDATIONS

The following table provides a summary of major elements identified in the strategy according to initiative with a brief description of the goal and the mechanism to achieve each goal.

	Environmental Goal	Mechanism to Achieve	Lead Agency	Possible Funding Source	Time Frame to Initiate
Initiative 1 A. Ground Water Quality Protection					
1. Nondegradation (page 13)	prevention of contamination	1. Make nondegradation a legislative policy goal for the State 2. Apply goal to ground water and all activities through revisions of State rules 3. Develop response actions according to observed levels of ground water impact	MPCA		July 1988
2. Numeric Limits (page 14)	limit contaminants in ground water	1. Legislature direct MPCA to promulate criteria for developing numerical ground water limits 2. Establish process for developing numerical limits through revisions of State rules 3. Incorporate limits into local and other State agency programs	MPCA, MDH		July 1988
3. Protection of Sensitive Areas (page 15)	tailor management to local conditions	1. Legislative statement acknowledging the need for special protective measures in sensitive areas 2. Establish criteria to provide control measures that protect all ground water from degradation	MPCA	extra fees on development in sensitive areas	July 1988

	Environmental Goal	Mechanism to Achieve	Lead Agency	Possible Funding Source	Time Frame to Initiate
		3. Provide additional data on aquifers and sensitive areas 4. Local governments assist in delineating these areas			
B. Drinking Water Protection:					
1. Water Supply and Wellhead Protection (page 16)	protect public water supplies with zoning controls	Delineate and protect ground water recharge areas of water supply wells	MDH, local	EPA grant; local water utility fees	July 1989
2. Water Well Code Enforcement (page 16)	protect drinking water of well owners	Increase staff for enforcement and develop model well ordinance for local government	MDH	permit fees on wells	July 1989
3. Local Assumption of Water Well Code (page 17)	protect drinking water of well owners	Encourage counties to adopt local water well programs	local	permit fees on wells	July 1989
4. Well Sealing (page 17)	seal unused wells, prevent contamination	Develop pilot projects at the local level to deal with the issue of unused wells. Also, develop prioritization for sealing wells and conduct research on cost-effective sealing techniques	MDH, local	permit fees on wells	July 1989
5. Private Well Testing (page 18)	provide representative drinking water quality data	Develop State laboratory certification program and expand county well testing programs	MDH, local	laboratory fees, permit fees on wells	July 1989
6. Property Transfers (page 18)	protect drinking water quality	Register wells in property deeds, and require well testing in property transfers	local	registration fees	July 1989

	Environmental Goal	Mechanism to Achieve	Lead Agency	Possible Funding Source	Time Frame to Initiate
C. Program to Control Program:					
1. Review of State Programs (page 20)	provide a greater focus on ground water protection	State agencies self-evaluate programs affecting ground water resources	MPCA, MDA		July 1989
2. Source Control/Reduction (page 20)	reduce potential contaminants to ground water	Legislation adopted on the reuse/recycling of waste	MPCA, local	fees on polluting sources	July 1989
3. Expand and Enhance Irrigation Regulatory Programs (page 21)	prevent ground water contamination	Develop requirements on fertilizer applications through irrigation	MDA, DNR		July 1989
4. Development of Local Programs (page 21)	protect ground water at the local level	1. Legislature establish grant mechanism to help local governments develop and implement environmental programs 2. State provide technical assistance in ground water resource assessment, and program development/implementation	BWSR, local		July 1989
5. Nonpoint Source Pollution (page 22)	control nonpoint sources of pollution	1. Expand education, research, and monitoring efforts regarding nonpoint source pollution 2. Develop State pesticide management plan with strong interagency coordination 3. Involve local governments in source identification and control through local water plans	MPCA, local	federal funds; fees on polluting substances	July 1988
6. Underground Injection Control (page 23)	protect ground water from injected fluids	Establish a State inter-agency work group to assess need for an injection program	MPCA, DNR, MDH	federal funds	July 1988

	Environmental Goal	Mechanism to Achieve	Lead Agency	Possible Funding Source	Time Frame to Initiate
7. Data Management (page 23)	coordinate, develop, and maintain automated data bases	Develop an information management system to link ground water data from programs in all State agencies	EQB/SWIM, interagency	permit fees	July 1989
Initiative 2 A. Water Use Priorities (page 27)	ensure adequate supply	Evaluate State's current water allocation framework and priorities	DNR	permit fees	July 1988
B. Conservation (page 27)	ensure adequate supply	1. Revive program of getting unpermitted water appropriations under permit 2. Encourage uses for non-contract cooling water and contaminated ground water 3. Revise State rules for reinjection of ground water under controlled conditions	DNR	permit fees	July 1988
C. Contingency Planning (page 28)	ensure adequate quality and supply	Expand contingency planning efforts for public water supplies	DNR	permit fees	July 1988
D. Coordination of Quantity and Quality Concerns (page 28)	ensure adequate quality and supply	Develop coordinated approach among State agencies on problems of water supply and ground water pollution remediation	DNR	permit fees	July 1988
Initiative 3 A. Coordination (page 33)	effective and efficient generation of information	Establish a committee of technical staff from State and federal agencies, and research institutions to coordinate State programs in monitoring, research, and resource evaluation	EQB/interagency		July 1989

	Environmental Goal	Mechanism to Achieve	Lead Agency	Possible Funding Source	Time Frame to Initiate
B. Research Evaluation (page 33)	increase basic knowledge of the resource	Collect pertinent baseline data on ground water resources needed to successfully implement the Strategy	DNR, MGS, local	federal and local matching funds	July 1989
C. Monitoring (page 35)	better information on ground water, coordination	Evaluate and coordinate State monitoring programs at both the staff and management levels	WRC/interagency	fees on polluters/ responsible parties	July 1988
D. Research (page 35)	increase knowledge of impacts and prevention	Coordinate efforts to develop and conduct research projects on a statewide basis	EQB/interagency	grants from public and private agencies	July 1989
Initiative 4					
A. Information and Education					
1. Policy (page 39)	foster voluntary actions in ground water protection	Legislative statement establishing information and education as vital components in ground water protection programs	EQB/interagency local		July 1989
2. Information (page 40)	raise public awareness	Coordinate the development and dissemination of information statewide to a wide range of audiences through a coordinative body	MEEB/interagency local	grants from public and private agencies	July 1989
3. Education (page 40)	promote stewardship	Coordinate the development of curriculum and in-service training for teachers at the elementary and secondary school levels	MEEB/interagency local	grants from public and private agencies	July 1989
B. Information Access					
1. Access (page 42)	improve availability of ground water information	Adopt and develop a statewide automated and integrated data base system	EQB/SWIM	federal government	July 1988
2. Coordination (page 42)	improve the exchange of data between State and local governments	Promote consistency standards for State agency and local government data	EQB/interagency local	local government federal government	July 1988

LEGISLATIVE CONCEPTS

The Strategy recommends the following major legislative initiatives, as outlined in the preamble to this document. These components represent a multi-pronged, integrated approach which will become a major ground water initiative for the 1989 Legislative Session. The EQB's Ground Water Advisory Committee recommended creation of a Joint Legislative Commission on Water at their June 3, 1988, meeting. At the time of publication of this document, this idea has not undergone in-depth review by State agencies, but preliminary indications are in favor of this commission's creation. If this commission is formed, it should have both surface water and ground water subcommittees, so ground water issues receive adequate attention from the commission.

*Prevention of contamination should be the top priority. This includes establishment of a goal of nondegradation for all ground water, development of numerical limits on ground water pollutants, and delineation of the especially sensitive areas of the State where special protective measures must be taken at the land surface to ensure protection of the resource below. Strong continued support is needed for cleanup of existing problems.

*Drinking water protection is crucial to the health and welfare of all Minnesotans. Components of this effort include the State developing a Wellhead Protection Program, promotion of better contingency planning and conservation measures, registration of all wells on property deeds and testing of wells at the time of property transfer, development of a prioritization scheme and incentive fund to address the problem of abandoned wells, and enforcement of the Water Well Construction Code.

*Ground water information and education are vital to the success of the prevention and cleanup efforts. Components of this effort are the development of educational opportunities for children and adults, the dissemination of information on our ground water resource and State programs to protect it, specialized training for target groups, and the furtherance of intergovernmental communication.

*Enhancement of local government participation in environmental protection is a critical need as well. The Strategy recommends development of a grant mechanism which would provide funds to local government for the development and implementation of local programs to address environmental concerns. State agencies should be authorized to develop rules for delegation of certain programs to local governments, and have staff in place for technical assistance to aid local governments in program development and implementation.

*Ground water resource evaluation, monitoring and research are needed for effective management of the resource. The extent of existing contamination is not documented, minor aquifers are not mapped, and recharge areas of major aquifers are not fully and clearly delineated. Research is also needed in the development of alternative technologies to replace current practices which impact ground water. The Strategy recommends development of a fund which would help to foster stable, long-term resource evaluation, monitoring and research.

*Control of pollution sources is a necessary component. Increased funding for staff in regulatory programs and for programs such as the Clean Water Partnership is needed to continue these efforts. Another important area is pollutant source reduction for both current and potential sources of pollution. Technical assistance in source control and reduction will be a necessary component.

More detail on these legislative initiatives follows.

Prevention of Contamination:

Ground water is an economically vital resource which provides drinking water for most Minnesotans. In many parts of the State, ground water quality has already been impacted by human-induced pollution. The cost of active cleanup is great, and it is not always possible to return the water to uncontaminated conditions. For these reasons, prevention of further contamination must be the cornerstone of Minnesota's ground water protection effort.

Nondegradation Goal. The Strategy recommends that the legislature state that nondegradation (meaning prevention of further contamination and appropriate actions to improve ground water quality in areas already impacted) is the policy goal of the State in the regulation of all potential sources of contamination. The nondegradation goal means that ground water impacts should be prevented to the maximum extent practicable regardless of whether the water is already impacted by human activities. While this goal is not currently achievable for many activities, the nondegradation goal will provide impetus for adopting improved technologies as they are developed. In areas already impacted, containment of pollutant sources should be the first priority, and should be followed up by a level of cleanup activity appropriate to the circumstances at each site.

In keeping with a goal of nondegradation, detection in ground water of manmade compounds, or levels of naturally occuring compounds beyond background levels, indicate that impacts have occurred. A plan for response actions should be developed commensurate with the observed level of potential health or environmental hazard.

The Strategy recommends that the State establish numerical limits for ground water pollutants, to be based on affording protection to human health and the environment. Adoption of these limits would not restrict the State from taking appropriate action when impacts are detected, however, they would form a "bottom line" of protection to all ground water from all activities and a goal for cleanups.

Numerical Limits on Ground Water Pollutants. The legislature is asked to direct MPCA to promulgate the criteria which would be used to develop these numerical limits, then to provide sufficient staff at both the MPCA and the MDH to develop the numbers based on the promulgated criteria. A statement of legislative intent is also necessary, clarifying the relationship between the goal of nondegradation and the numerical limits which will be established.

Due to the large degree of geologic diversity across the State, the sensitivity of ground water to pollution is greater in some areas than in others. In order to protect the quality of all ground water to the same degree, additional protective measures must be applied to pollution sources in these sensitive areas. Minnesota needs to delineate these areas, as well as in developing alternate technologies to be used for greater protection.

Special Protective Measures. The Strategy recommends enactment of a legislative statement of intent which acknowledges the need for applying special protective measures in areas where ground water is more sensitive to contamination.

Delineation of Sensitive Areas. Legislation is also needed to authorize MPCA, with guidance from an interagency work group, to develop criteria for defining sensitivity, and to provide funds to DNR, Minnesota Geological Survey, and local governments to work to delineate these areas. Regulatory programs should be directed to assess their protection efforts in light of the criteria and maps developed, to determine whether the extra measure of protection required in sensitive areas is being given. Legislation may also be needed to enact some of these protective measures, such as allowing RIM funds to be used to acquire easements in sensitive areas, and enabling local units of government to zone for ground water protection.

Drinking Water Protection:

Seventy-five percent of all Minnesotans depend on ground water for drinking water. Of these, about half are served by public water utilities, and the rest obtain their water from private domestic water wells.

Water Supply Planning. Public water utilities are responsible development of water supplies, including locating sufficient amounts of suitable quality water to meet the needs of their citizens, and for obtaining the necessary approvals and permits from State agencies. The Strategy recommends that the legislature direct MDH and DNR to work more closely with the public water utilities during their planning process. MDH should develop guidelines for the utilities to adopt regarding Wellhead Protection, a program where the recharge areas of wells are delineated and special protective land use restrictions enacted in the wells' capture zone to prevent future problems with the wells. Additional staff will be needed by the agencies to conduct this effort.

Wells and Property Transfer. The legislature is further recommended to require testing of all domestic water supply wells at the time of property transfer to ensure that the water is of sufficient sanitary quality for a drinking water source. This testing should be done by certified laboratories, and the results reported to MDH or the county community health agency if they have been delegated authorities under the provisions of the Minnesota Water Well Construction Code. A portion of the well testing fee should be retained by the agency to whom the data are reported for data management. In addition, the legislature should require registration of all drilled wells, whether in current use or not, on the property deed at the time of transfer.

Sealing of Unused Wells. The Strategy recommends that the legislature develop a pilot program to demonstrate the effectiveness of counties in dealing with the issue of unused, unsealed wells. Components of this project would be an inventory of wells within the project area, then developing ways to assure that the most critical of these are properly sealed in accordance with the Water Well Construction Code. MDH would be responsible for developing a prioritization scheme to aid in determining which wells to seal first. While methods of sealing are straightforward, lodged debris and equipment in wells can significantly increase costs of sealing. Research is needed into the development of technology for preparing problem wells for sealing.

Enforcement of Water Well Construction Code. MDH has identified the need for a significant increase in staff for enforcement of the Water Well Construction Code, as well as the addition of administrative penalties to its regulatory authorities. An expanded State program combined with delegation agreements in interested counties may be an effective approach. In this way, the need for additional staff at the State level could be partially offset over time by the assumption of the Water Well regulatory program by county governments. Initially, funds will be needed by counties in order to establish these programs. Once established, the programs can be maintained by permit fees on wells, or a private well tax added to the property tax for homes and businesses not served by public water supplies.

Ground Water Information/Education:

Ground water is a largely unseen and misunderstood resource. It becomes contaminated subtly and invisibly, without notice until wells are impacted. For these reasons, it is imperative that all Minnesotans are aware of the potential impacts of their actions. Development of a ground water education effort must be a cooperative project, growing from both government and private efforts, with input from concerned citizens. Without a strong education and information program, incentives and regulations are significantly less effective.

Need for Comprehensive Information and Education Efforts. The Strategy recommends that the legislature enact a statement of policy establishing information and education as vital components in an overall ground water program.

The Strategy recommends the following specific legislative package for promoting ground water education and information dissemination:

Education. The Minnesota Environmental Education Board should receive funding for additional staff responsible for ground water education for children and adults, along with sufficient funds to oversee development and dissemination of curriculum for all levels of school children in grades K through 12. Work done by the Minnesota Environmental Education Board should be coordinated through the Ground Water Information and Education Committee, with representatives from State agencies, as well as with educational personnel, the University of Minnesota and the Minnesota Extension Service. The target groups of this educational effort are adults and children in both urban and rural areas.

Information on Programs and the Resource. State agencies need to maintain effective information dissemination offices, not only to respond to public questions but to initiate informational efforts. The legislature should direct State agencies to take a more aggressive role in information dissemination and to fund their efforts.

Specialized Training. The Minnesota Extension Service should offer specific information to targeted groups on the impacts of activities such as row-crop agriculture, animal confinement areas, lawn fertilization and pest control, etc. This should include information on alternate practices which lessen the impact of these activities on ground water quality. Technology transfer from researchers to the general public is a vital part of this effort.

Intergovernmental Communication. Information exchange and training is needed for regulators, planners, and other officials at all levels of government. These decision-makers must be informed on the vulnerability of the ground water resource in areas with which they are involved, and on the development and implementation of programs with the potential to impact ground water. Increased communication is vital as well between the levels of government and all agencies involved. Funding is needed for the EQB to continue developing events and opportunities for communication and information exchange.

Enhancement of Local Government Participation:

Local governments are key players in the ground water protection effort, both in the areas of planning and in land use management. Many counties are participating in the creation of Comprehensive Local Water Plans which will enable them to identify local ground water impacts and to develop plans to address these impacts. Fifty-four of these counties received seed money from the Legislative Commission on Minnesota Resources to develop their plans, and several other counties are proceeding on their own with plan development. In the metropolitan area, Hennepin County has begun developing a ground water plan, and several other counties are considering whether they should create such a plan as well.

Grants to Local Governments. The Strategy recommends that the legislature establish a grant mechanism which would help local governments develop and implement environmental programs to address problem areas identified in the development of water plans, or to develop the plans if not already in progress. This grant could be administered by the Board of Water and Soil Resources, with the local governments reportable to the State agencies which are responsible for the programs which they seek to administer. Examples of programs of this type are the feedlot regulation program, the on-site sewage treatment system program, and other pollution sources which are locally important but are not regulated by the State. Agencies should be authorized to develop rules for delegation of these programs. Highest priority of grants would be given to those with the most comprehensive approach and those in sensitive areas of the State.

Water Well Construction and Abandonment Program. The legislature is further recommended to encourage counties to assume responsibility for the Water Well Construction Program and to provide additional funds to share the costs of program development through the Community Health Services subsidies, or another mechanism such as the grants to local governments described above. MDH should develop a model county well code ordinance, which would serve as baseline county requirements in order to receive authorization for the program.

Technical Assistance and Program Review. The State must have staff in place for technical assistance to aid local governments in program development and implementation, not only to ease the process of program transfer but to enhance intergovernmental communication. Implementation of local water plans will also require cooperation between State and local governments. It would be the responsibility of the State programs to oversee local efforts to ensure that minimum environmental protection goals are being met as a condition of continuance of the delegated authority.

Ground Water Resource Evaluation, Monitoring, and Research:

The current state of knowledge about ground water in Minnesota is not adequate for effective management of the resource. The extent of existing contamination is not documented, minor aquifers are not mapped, and recharge areas of major aquifers are not fully and clearly delineated. Research is also needed in the development of alternative technologies to replace current practices which impact ground water.

Long-term Research. All data generation activities at the State level should be coordinated through a Ground Water Technical Committee made up of technical staff from federal, State, and local agencies and research institutions, which the Strategy recommends the legislature create and provide staff. This committee would be responsible for recommending to EQB the dissemination of funds from a dedicated research fund and overseeing the development, implementation, and the evaluation of programs in monitoring, research, and resource evaluation. Dissemination of results and findings of the research would be done by the committee. The committee should be tied to or formed from existing committees within the State. Time frame for implementation - committee should be formed in July of 1989, and with the first awards for research projects in January of 1990.

Resource Evaluation. Aquifer studies are needed to accelerate delineation of aquifers and to determine aquifer characteristics. This information would be used by DNR in making decisions on appropriation requests, by MPCA in pollution investigations and cleanup as well as in establishment of monitoring requirements, by the Minnesota Department of Agriculture in tailoring pesticide training to local conditions, and by local governments in making land use decisions. Funding for these projects should come from a fund such as that described above, and should include funds for management of the data electronically in a format consistent with other State data collections.

Baseline Monitoring. Baseline monitoring is conducted by State agencies to determine existing, background ground water conditions. This is especially important when stress is exerted on the resource, such as pumpage, drought or widespread contamination from nonpoint sources of pollution. The Strategy recommends that the legislature increase funding to the agencies which conduct this research; MPCA for ambient ground water monitoring, the Minnesota Department of Agriculture for monitoring of pesticides in agricultural areas, and DNR for water level monitoring. These agencies in conjunction with MDH, State Planning Agency, and other interested agencies, coordinated through the Water Resources Committee, should be required to prepare a statewide interagency monitoring plan and subsequently publish results from their studies in a joint report biennially which describes the nature and current quality of ground water in Minnesota and makes recommendations for modifications to the monitoring plan.

Control of Pollution Sources:

Minnesota has in place a number of effective programs to regulate sources or to fund cleanup of ground water contamination, including programs which regulate solid and hazardous waste and the State Superfund and Petroleum Tank Release Cleanup Fund. Other programs have developed with other environmental foci, but may impact ground water as well. A detailed evaluation of these programs will be conducted by September 1989, with a report to the legislature prepared in time for the 1990 Session. A number of needs have already been identified through the Strategy development process, including those listed below.

Scope of Programs Which Regulate Point Sources. The level of staffing and funding should be adequate to match the scope of the problem which it is intended to regulate. Scope of the problem is defined both by the number and relative size of the facility and by the potential severity of its impacts.

Source Control/Reduction. The Strategy recommends that the legislature adopt reuse/recycling legislation with the goal of waste reduction of consumer goals. Statewide pickup programs for household hazardous waste and waste agricultural chemicals should be expanded beyond the current demonstration projects. Fees should be imposed on products which have been shown to impact ground water as disincentives to use.

Irrigation Regulatory Programs. The Minnesota Department of Agriculture should be authorized to develop requirements to control fertilizer applications through irrigation systems. This should be undertaken in cooperation with farm chemical industry, commodity grower's groups, and irrigators' associations. Requirements should be distinct from those governing pesticide application through irrigation systems, and should be geared through best management practices for protecting the environment.

Nonpoint Sources of Pollution. Nonpoint sources of pollution are a problem of increasing concern. Appropriate agencies and the University of Minnesota should monitor or research ground water impacts resulting from the various nonpoint pollution sources as recommended in the strategies. Expanded educational and informational opportunities should be provided for the public regarding nonpoint source pollution of ground water. Nonpoint source pollution issues should be addressed by a combination of voluntary best management practice implementation and regulation. A need exists for funding of research, monitoring, and education regarding nonpoint source pollution. In addition, the legislature should increase funding for the Clean Water Partnership Program and other programs that address nonpoint source pollution impacting ground water (e.g., Wellhead Protection Program).

Information Management. Data management is a critical need for effective regulatory programs. The Strategy recommends that the legislature grant funds for development and maintenance of data management systems; and further that they should require that all ground water data collected be managed electronically, using consistent data elements and with sufficient documentation that other parties interested in the data can have ready access to it.

State Pesticide Management Plan. The Strategy recommends that the legislature direct and fund the Minnesota Department of Agriculture to develop a State Pesticide Management Plan with the Minnesota Department of Agriculture as the lead agency, strong interagency coordination through the EQB and strong involvement of growers. The plan should stress problem prevention and nondegradation, should delineate what to do when problems or issues arise, and include: 1) designating special protection areas, 2) taking preventative actions, and 3) initiating specific management plans for a pesticide following detection, including trigger levels for follow-up actions and enactment of pesticides use restriction where appropriate.

More Flexible Enforcement Tools. The addition of statutory authority to levy administrative penalties (fines) in less severe cases would enable the State to take action against less severe polluters without burdensome court procedures which are often not cost effective. In addition, agencies may identify the need for authority to invoke criminal penalties on those who intentionally discharge nonhazardous waste, similar to those for hazardous waste discharges.

SUMMARY OF THE

REPORT OF THE

ENVIRONMENTAL QUALITY BOARD

ADVISORY COMMITTEE ON GROUND WATER PROTECTION

JUNE, 1988

COMMITTEE PURPOSE

The EQB appointed an Advisory Committee on Ground Water Protection in January 1988. The charge was to:

1. Review the draft Minnesota Ground Water Protection Strategy under development by the Pollution Control Agency (and by mutual agreement with PCA, for review and approval by the EQB);

2. Review the draft Water Resources Strategy for the Control of Pests and the Management of Nutrients under development by the EQB Water Resources Committee; and,

3. Advise the EQB on the adequacy, policy choices, directions, priorities, justification, and implementation options of both strategies.

COMMITTEE PROCESS

The Committee met at three week intervals: February 19, 1988; March 11, 1988; March 31, 1988; April 21, 1988; May 13, 1988; and June 3, 1988. Thomas Anding, Associate Directer of the Center for Urban and Regional Affairs at the University of Minnesota, chaired the Committee.

A diverse membership representing farmers, industry, local governments, researchers, and citizen groups, brought a wealth of knowledge to the Committee. To expedite the review of the two strategies, two subcommittees were formed: A Ground Water Protection Subcommittee, chaired by Linda Lehman, and a Pest and Nutrient Management Subcommittee, chaired by Newell Searle. Each subcommittee thoroughly reviewed the relevant strategy and brought concerns and recommendations to the full Committee for its resolution.

Marilyn Lundberg, State Planning Agency, served as Committee Administrator. Staff from the State Planning Agency, Pollution Control Agency, Minnesota Geological Survey, Department of Health, Department of Agriculture, Department of Natural Resources, the Attorney General's Office, and University of Minnesota Center for Regional and Urban Affairs, and the University of Minnesota Center for Agricultural Impacts on Water Quality, assisted the Committee as it studied and discussed the two strategies.

To further help the Committee understand the issues associated with these strategies, Richard Kelly, Environmental Specialist Iowa DNR, and David Belluck, Ground Water Toxicologist Wisconsin Department of Health and Social Services, met with the Committee to discuss the ground water programs of their respective states.

The commitment of the members has been tremendous and reflects the concern and interest of the public. It is important to recognize that even though the Committee members represent very diverse interests, the recommendations were made unanimously.

MINNESOTA ENVIRONMENTAL QUALITY BOARD
300 Centennial Building · 658 Cedar Street · St. Paul, Minnesota 55155
612-296-2603

June 16, 1988

To: Environmental Quality Board

Fr: EQB Advisory Committee on Ground Water Protection

Re: Committee Report

The Report of the EQB Advisory Committee on Ground Water Protection is attached. Our Committee recognizes the importance of the Ground Water Protection Strategy and the Strategy for the Control of Pests and the Management of Nutrients and offers its support for passage of the legislative package needed to carry them out.

We would like to highlight our major recommendations. The Committee:

* Strongly supports implementing these strategies. Members are concerned about problems resulting from the control of pests and management of nutrients, as well as contamination from other sources, such as improperly constructed wells or leaking storage tanks.

* Recommends that there be a preamble to the two strategies that provides a context for the two strategies. In addition, this preamble should provide highlights of both strategies, and convey a sense of urgency for implemention.

* Recommends that prevention of further contamination be the cornerstone of Minnesota's ground water protection efforts. In addition, cleanup of appropriate areas should continue to be an important part of Minnesota's efforts.

* Supports Minnesota having nondegradation (meaning prevention of further contamination) for a goal in order to have continued movement toward improvement of ground water quality.

* Supports Minnesota revising and updating the current framework that establishes the degree of actions required. This framework would include numerical limits, or a process for developing them, as a way of gaging the severity of contamination, identifying appropriate preventive actions, and defining clean-up requirements.

* Recommends applying water quality protection to all ground water. It does not support "writing off" any aquifers. Special protection should also be given in areas sensitive to ground water contamination.

* Recommends that the strategies need to be carried out as a whole, since no single effort, whether it be education, research, monitoring, incentives, coordination, or regulation can alone achieve the desired results.

* Recommends the creation of a Joint Legislative Commission on Water. This Commission would create a focus at the legislature for water issues and programs and complement the coordinating function of the Environmental Quality Board. This Commission could also evaluate the present state structure for its effectiveness in carrying out the strategies.

* Recommends that the Environmental Quality Board (EQB) continues its strong role relating to water issues. The EQB should also take a lead role in ensuring that state programs, rules, and other activities recommended in the strategies are communicated to local government.

* Recommends that the state significantly increase funding for local water management activities, since local government has an essential role in protecting ground water.

* Recommends that the funding needed to carry out the strategies be a combination of broad based (all potential beneficiaries) and those related to specific impacts on water. Every user of water should pay the costs of general, statewide functions, such as coordinating, education, and research. Special taxes or fees should be used to underscore the relationship between specific activities and problems or benefits.

* Recommends the state obtain information to characterize aquifers in terms of quantity and quality. To do this, the state must establish clear goals for information needs that outline the purpose, scope, value, and coordination efforts.

* Recommends that state ensure water resources data compatibility between agencies and with local government. It should have clear goals that outline the purpose, scope, value, and coordination efforts of its monitoring programs. Water testing should be required at real estate transfers.

* Recommends that in considering the Strategy for the Control of Pests and Management of Nutrients, the state must recognize the significant role the federal farm programs play in shaping agriculture practices, and work to impact the direction of the new federal farm program as it is drafted in 1989 or 1990.

* Recommends a research project to better evaluate the number of abandoned wells, the priorities for sealing, and the methods and process for sealing.

The enclosed Committee Report contains more information about each recommendation as well as a number of specific recommendations about portions of the strategies.

Protecting Minnesota's Waters:

A Strategy for the Wise Use of Pesticides and Nutrients

Public Review Draft

September 1988

prepared by

EQB Water Resources Committee

Preface

This document was prepared by the Environmental Quality Board (EQB) Water Resources Committee (WRC) as part of its ongoing efforts to ensure that the state's water resources continue to serve the present and future needs of Minnesotans. It represents the combined efforts of the WRC and WRC Technical Committee. The strategy could not have been prepared without the valuable input provided by the Minnesota Extension Service, University of Minnesota Center of Agricultural Impacts on Water Quality, US Department of Agriculture Soil Conservation Service, Minnesota Plant Food and Chemicals Association, and other organizations and individuals who participated in public meetings and provided comments.

Special thanks is extended to the EQB Advisory Committee on Ground Water Protection for their review and evaluation of the policy directions for the strategy and of the options the state should pursue in addressing contamination associated with the use of pesticides and nutrients. Their insights and unanimous recommendations have guided the development of this proposed strategy and are reflected throughout the document.

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Protecting Minnesota's Waters: A Strategy for the Wise Use of Pesticides and Nutrients

EXECUTIVE SUMMARY

Pesticides and nutrients are widely used throughout society for the control of plant and animal pests and promotion of healthly vegetative growth. The benefits of their use are evident in agricultural production, landscape management, noxious weed control and health protection. These same substances, however, have the potential to contaminate water resources if they are not managed wisely.

Contamination of surface and ground waters resulting from the use of pesticides and nutrients has been observed throughout the United States and in Minnesota. Sources of contamination include spills and leaks, mishandling during application, improper disposal, and use in vulnerable areas. Once contaminated, waters can be difficult and costly to cleanup, making prevention of contamination the most prudent course of action.

Minnesota has a strong history of environmental protection, and has many authorities and programs which serve to prevent contamination of our water resources. These include the pesticide control, safe drinking water, and water pollution control laws and programs. These authorities provide the framework for the state's efforts to address pesticide and nutrient contamination.

As part of its continuing efforts to evaluate state water resources problems and develop policies for dealing with those problems, the Environmental Quality Board (EQB) has prepared a strategy outlining the actions which should be taken to protect water resources from pesticide and nutrient contamination. The ultimate goal of the strategy is to safeguard the health of Minnesotans while ensuring that economic development and environmental protection objectives are met.

Policy Directions

The policy directions were developed to define the course of action to be taken to achieve the strategy goals. These policies call for an integrated approach, recognizing that education, research, monitoring, incentives, regulation and coordination are all necessary, and for reliance on existing authorities and programs. They further emphasize the role of individual behavior and actions in resource protection and the need to focus on overall resource sustainability. Finally, they establish prevention of contamination as the cornerstone of the state's efforts, and nondegradation as the long-term goal toward which program, research and other efforts would be geared.

Initiatives

Specific methods and approaches to be taken to promote the wise use of pesticides and nutrients and protect water resources have been structured around three initiatives.

Information, education and incentives. Wise use of pesticides and nutrients can best be achieved by ensuring that individuals are provided with the necessary education and information to make informed management decisions and to understand the consequences of mismanagement. Specific recommendations include: 1. establishing a water resources education advisory committee to coordinate the development and dissemination of educational materials; 2. Improving and expanding public information and education efforts and training programs; 3. expanding the use of demonstration projects; and, 4. developing financial incentives.

Resource evaluation and research. Additional efforts are needed to improve our knowledge of pesticide and nutrient contamination problems, prevention practices and alternative management approaches, and, therefore, our ability to prevent contamination and advise individuals on wise management. Efforts recommended include: 1. developing and implementing a coordinated monitoring plan to better characterize contamination problems; 2. establishing an interagency and academic technical committee to identify research needs, examine practices and disseminate research results; 3. increasing efforts to identify best management practices; and, 4. continuing research efforts.

Preventive planning and regulatory efforts. Existing authorities and programs directly or indirectly influence the use of pesticides and nutrients and the prevention or mitigation of impacts on water resources. Wise use and prevention of contamination can be fostered through better coordination, application and modification of these efforts. Specific recommendations include: 1. adopting a nondegradation goal and numerical limits and factoring these into existing programs; 2. expanding drinking water protection efforts, including enforcement of the water well construction code; 3. developing a state pesticide management plan to guide prevention efforts and delineate actions to be taken when contamination occurs; 4. integrating pest and nutrient management into existing efforts, including government uses of pesticides and nutrients; and, 5. enhancing control efforts in such areas as the application of fertilizers through irrigation systems and the disposal of wastes.

Funding

Expanding our efforts to prevent contamination of water resources and promote the wise use of pesticides and nutrients requires increased resources and stable funding. Enforcement efforts related to the state Pesticide Control Law are currently supported by fees, and should continue to be so supported.

Funding for overall, nonregulatory efforts such as education, research and monitoring should be broad based, since all users of water, pesticides and nutrients benefit. General fund dollars derived from income and sales taxes, including sales taxes on pesticides and nutrients, should be used for these purposes. Moneys from dedicated funds should also be pursued.

Finally, methods of funding cleanup and pesticide and container disposal should be developed.

Preamble

Water resources are precious and vital to Minnesota's high quality of life and sense of place or identity. The name Minnesota evokes images of abundant streams and lakes and the host of recreational and aesthetic opportunities they provide. These surface water resources are integrally entwined with our abundant ground water resources, which provide drinking water to three quarters of Minnesota's citizens and inflow to our streams and lakes. Together, our surface and ground waters supply us with the water for drinking, swimming, fishing, farming, boating, and industrial processing that we have come to expect.

To fulfill our needs and expectations, our waters must be of high quality. One threat to this quality comes from the widespread use of pesticides and nutrients. Contamination with pesticides and nutrients can impair the uses of our waters and render them unsafe for human consumption. Contamination can also lead to such problems as habitat destruction, overenrichment of lakes, and fish kills. Once contaminated, waters can be difficult and costly to clean up, requiring long-term commitments of resources and disrupting both the environment and human lives.

Minnesotans, however, have come to rely upon these same pesticides and nutrients to maintain agriculture, to control nuisance and health-threatening pests, and to control weeds and promote growth of landscape vegetation. Agriculture and related industries, together with the rural communities which they support, are also key to the state's economic vitality, quality of life and sense of place. Any efforts to influence the use of pesticides or nutrients must be compatible with the well-being of the state's agriculture.

The state has an obligation to ensure that Minnesota's waters are adequate for the economic well-being of future generations, and that they continue to provide for the high quality of life we have come to expect. The state recognizes that its ability to act is greatly influenced by federal actions, including federal farm policies and programs and environmental protection action or inaction. However, we can not afford to rely totally on federal actions, and must reserve the right to both act in the face of federal inaction and be more stringent in our actions when necessary for the good of the state.

Minnesotans have a right to clean, safe water. They also have the responsibility to conduct their activities in a manner that will prevent contamination of water resources. Preserving our quality of life and water resources is the responsibility of all Minnesotans.

The purpose of this document is to set forth a course of action for preventing contamination of water resources due to the use of pesticides and nutrients which will preserve and enhance both our waters and our economy.

Introduction

Pesticides and nutrients are used widely in today's society. They are used on cropland and rangeland, on residential lawns, golf courses and parks, on highway and utility rights-of-way, and on nurseries and gardens. To a large extent, we have come to rely on pesticides and nutrients to maintain our agriculture as a major economic factor, to control nuisance and health-threatening pests and organisms, to control noxious weeds, and for cosmetic control of weeds and growth of landscaping vegetation.

Nationally, it is estimated that we are using three times more pesticides today then we did in 1964, with agricultural uses accounting for 79 percent of all uses. The Minnesota Crop and Livestock Reporting Service conducted surveys of pesticide use in Minnesota from 1969 to 1984. These surveys, which did not cover non-farm uses, showed that in 1960, about 72 percent of the corn acreage harvested was treated for weed control, while in 1984, about 97 percent was treated. They further estimated that pesticides were applied at least once to over 16 million acres of cropland.

Urban and other non-farm uses of pesticides are not well documented. Resources for the Future, a Washington D.C.-based research group, developed estimates of pesticides use nationwide for agricultural and selected nonagricultural uses, specifically urban applicators and nurseries. They estimated that 40-45 million pounds of pesticides were applied in Minnesota. Applications to field corn and soybeans dominate the national totals.

Minnesota fertilizer use has likewise increased, according to information compiled by the Minnesota Department of Agriculture from sales records. Nitrogen fertilizer use increased from approximately 50,000 tons in 1960 to 850,000 tons in 1985. This increase can be attributed in small part to a 13 percent increase in cropland over the same period, as well as to emphasis on higher yielding, and, therefore, more nutrient-demanding, crop varieties.

The Problem

While the societal benefits of pesticide and nutrient use are many, some of these same chemicals are now being detected in surface and ground waters, posing a potential threat to the use and health of our water resources. Pesticides vary considerably in their toxic effects on humans and other non-target organisms, and have the potential to cause chronic health effects including cancer and birth defects. Some can cause these effects when levels in drinking water are in the parts per billion range. Phosphorus can lead to increased algal populations and weed growth in surface waters, and nitrate in drinking water can cause methemoglobinemia or "blue baby syndrome" in infants, and may be associated with other human and livestock health effects. Further chronic health effects and effects of mixtures of substances are still to be ascertained.

Water resources can become contaminated at any point in the life cycle of a pesticide, including manufacturing, distribution, storage, use and disposal. Contamination can result from spills and leaks at manufacturing or bulk storage and handling facilities, from mishandling during application, and from improper disposal of waste products and unrinsed containers.

Contamination may also result from normal pesticide use. Specific properties of a pesticide, together with the specific characteristics or vulnerability of the site at which it is used, determine how easily it can be transported to ground water. For some pesticides and sites the potential is quite low, while for others it is quite high. In addition, pesticides can be transported by surface runoff into streams and lakes, and into ground water through sinkholes and improperly abandoned or constructed wells.

Surface or ground water contamination can likewise result from the use of nutrients, including fertilizers and animal wastes. In addition to site vulnerability, surface runoff transport and other factors associated with pesticide contamination, the time and rate of application are probably the most important determinants. Studies in Minnesota by the Minnesota Pollution Control Agency and University of Minnesota have clearly shown that nitrate losses increase as fertilizer application rates exceed the amount that the crop can use.

The extent of pesticide and fertilizer contamination of surface and ground waters in the nation and state is not well defined. Prior to the late 1970's, it was generally believed that ground waters were protected from pesticide contamination. Consequently, pesticide monitoring was minimal, and was focused on surface water and urban drinking water supplies.

Pesticide monitoring capabilities and efforts have increased in recent years, but have focused on a limited number of pesticides in specific geographic areas. The U.S.Environmental Protection Agency reported that by 1986, 19 different pesticides had been detected in ground water in 24 states, with the contamination most probably resulting from agricultural application rather than spills or other handling problems. Included in the 24 are Minnesota, Iowa and Wisconsin.

Between July 1985 and June 1987 a cooperative Minnesota Department of Health (MDH) and Department of Agriculture (MDA) survey was conducted in an effort to develop baseline information on the extent of agricultural pesticide contamination in the state's ground water. Over 700 wells were tested, including observation wells located near farm fields and public and private drinking water wells. Wells were generally chosen in places where local hydrogeology made the ground water especially susceptible to contamination.

Pesticides were detected in 39 percent of the wells tested, generally at levels below current guidelines for drinking water. Long-term health implication of ingesting low levels of pesticides are not known. Sixteen drinking water wells, however, did have pesticide levels higher than the limits currently recommended by the Department of Health.

Pesticides were most commonly found in wells in parts of the state considered to be hydrogeologically vulnerable to contamination. These were wells completed in 1) the karst formations in southeastern Minnesota; 2) the shallow, outwash sand and gravel aquifers in central Minnesota; and, 3) the shallow, alluvial sand and gravel aquifers in southwestern Minnesota. These efforts provide a "snap shot" of our pesticides in ground water situation, and must be expanded and combined with surface water efforts to provide a full picture of the impacts on Minnesota's waters. In addition, urban and other non-farm use areas must be evaluated.

Nitrate contamination has also been observed. In the above survey, MDH and MDA found that 42 percent of 199 private drinking water wells and 7.1 percent of 395 public water supply wells had nitrate concentrations in excess of drinking water standards (10ppm). Data from Winona and Olmsted counties indicate that nitrate contamination is increasing in deeper aquifers.

Nitrate contamination is not new to Minnesota, and was observed in an investigation of water supplies which were reported to be, or suspected of being, involved in cases of methemoglobinemia in the late 1940's. The investigation followed indications that the condition was widespread in certain rural parts of the United States. None of the wells investigated had nitrate concentrations below the current drinking water standard, and none of the wells was both constructed and located satisfactorily, as judged by Minnesota Health Department standards. Problems included locating too close to barnyards and cesspools. A comparison of rural school wells and similarly constructed nearby farm wells indicated that nitrate content of school well water was less than that of farm wells, further highlighting the importance of location. At this same time, 3.1 percent of the 514 municipal supplies in the state were found to contain 10ppm or more of nitrate.

The Minnesota Pollution Control Agency, using data collected primarily by the PCA and U.S. Geological Survey between 1978 and 1986, compared ground water quality in surficial sand aquifers in limited, moderate and intense agricultural counties. Analysis showed elevated levels of nitrate in the moderate and intense agricultural areas, as compared to the limited agricultural areas.

Additional studies by the USGS have also explored influences of land use practices on ground water quality in surficial sand aquifers in several Minnesota counties. In one study, they found that 1. nitrite plus nitrate nitrogen levels had increased in local agricultural areas when comparing 1978 and 1979 data with that from the mid to late 1960's; 2. high concentrations of agricultural chemicals were found following major recharge events; and 3. concentrations of nitrite plus nitrate nitrogen increased significantly downgradient from major agriculture and irrigation areas. In other studies, USGS found concentrations of nitrate to be higher in irrigated and residential areas as compared to non-irrigated cultivated and undeveloped areas.

Surface water impacts have also been noted by the PCA. Through their routine monitoring program, PCA has noted increasing concentrations of nitrate and suspended solids over the past twelve years, particularly in areas of intensive and extensive agricultural activity and urban development. In addition, based on monitored and evaluated data, nutients were found to be the only pollutants causing nonsupport of designated uses of Minnesota's lakes.

The Programs

Recognition of the importance of environmental protection to our economic and physical well being has been an evolutionary process. As the demands we placed on the environment increased through increased population and increased use of the land and its natural resources, we came to realize that the bounty of the land was not limitless. We could no longer move on to a new spot when the waters or lands became despoiled with our wastes, because the new spots were already occupied. We were forced to face the consequences of our impacts on the environment and devise ways to minimize those impacts.

This evolutionary process was furthered by an increased understanding of the magnitude of our impacts. Increased efforts to monitor our environment continue to increase our knowledge of the extent of our impacts. Enhancement of analytical techniques has enabled us to detect contaminants that we previously had thought were being kept out of the environment. Increased research in toxicology and environmental health has led to a better understanding of the links between what we eat, drink and breathe and our health. Finally, we have gained a better understanding of the interrelationship of organisms within a community and how impacts on one member can impact the whole.

State and federal laws and programs have developed and expanded along with our identification and understanding of contamination problems. They began as efforts to address overall nuisance and sanitation, and have evolved to form the basis of our efforts to ensure that our waters are suitable for aquatic habitat, recreation, and consumption. These current programs provide an excellent framework for increased efforts to protect water resources from contamination caused by the use of pesticides and nutrients. Our efforts to address these impacts have evolved along with our overall water resource protection efforts.

Federal Efforts

Federal efforts to address water resource contamination issues began primarily in the early 1970's. This period saw the passage of three major pieces of legislation that form the basis for our efforts to protect water resources from pesticide and nutrient impacts: the Federal Water Pollution Control Act (Clean Water Act), the Safe Drinking Water Act, and the amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Solid and hazardous waste efforts were also advanced by the end of the decade with passage of the Resource Conservation and Recovery Act covering the tracking of hazardous wastes from cradle to grave and solid waste disposal requirements, and the Comprehensive Environmental Response, Compensation and Liability Act (Superfund) dealing with releases of hazardous wastes.

The primary agency for pesticide management and regulation of water quality impacts of pesticides and nutrients at the federal level is the US Environmental Protection Agency (EPA). Pesticides are regulated by EPA through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). First enacted in 1947 to primarily deal with issues of interstate commerce, it was amended in 1972 to include issues related to potential chronic health effects, adverse ecological effects and environmental fate. More recently, EPA has begun to address ground water concerns and to evaluate the potential of pesticides to leach.

The act covers classification, registration, sale, use and disposal of pesticides, and provides that pesticides must be registered and must have labels detailing how the product may be used. It also establishes certification requirements for persons desiring to use pesticides.

Through FIFRA, EPA must evaluate pesticides to determine if benefits of use outweigh risks. Many pesticides in use today, however, were in use prior to the current FIFRA requirements. These must be reevaluated to determine necessary restrictions. The process is slow, however, and products may continue to be used during this reevaluation.

Pesticides and nutrients are also regulated by EPA through the Safe Drinking Water Act, which provides for regulation of public drinking water supplies and requires monitoring of those supplies to ensure compliance. The act was passed in 1974, to replace a previous program governing standards for water use in interstate commerce. Surveys in the early 1970's had shown that many water supplies were not meeting these standards.

Through the Safe Drinking Water Act, EPA sets drinking water standards and requires specific treatment technologies. Currently, there are standards for only six pesticides; however, 1986 amendments to the act require the regulation of an increased number of parameters by 1989, including over 20 pesticides. The amendments further call for development of wellhead protection areas around wells in public drinking water systems.

Regulation is also afforded through the Clean Water Act, which covers such areas as water quality standards, feedlot regulation and the control of point and nonpoint sources of pollution, such as agricultural runoff. While amended in 1977 to cover nonpoint source pollution control and the development of strategies for ground water protection, the main emphasis was on surface water and control of point sources of pollution through permit and grant programs.

Progress toward the act's goal of restoring and maintaining the chemical, physical and biological integrity of the nation's waters has been significant. In Minnesota, control of point source discharges has led to major water quality improvements in streams and lakes. However, there is a growing recognition that further improvements and attainment of the goals will require control of nonpoint sources. Amendments to the act in 1987 call for the development of nonpoint source management programs to address surface and ground water.

EPA efforts to address issues of pesticide and nutrient contamination have also extended to development of strategy and guidance documents. These have included: 1. "Protecting Ground Water: Pesticides and Agricultural Practices", which presents an evaluation of impacts of various agronomic, irrigation and pesticide application practices; and, 2. "Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy", which presents EPA's approach for addressing the pesticides in ground water concern. EPA intends to develop a proposed approach for addressing fertilizer and ground water concerns in the near future.

The US Department of Agriculture is also involved in pesticide and nutrient management, and offers educational programs and financial and technical assistance for nonpoint source pollution control. Past environmental protection efforts within USDA have emphasized erosion control and soil conservation. However, water quality has been recognized as a priority issue and is becoming an integral part of ongoing efforts.

USDA research efforts, and cooperative efforts with state extension services and universities, provide on-site evaluation of management practices, the results of which are conveyed through publications and field days. Water quality is also becoming more integral to these efforts. State extension services are also instrumental in developing materials for use in pesticide applicator training sessions.

State Efforts

Environmental protection is a long-standing tradition in Minnesota. The state's first law to prevent pollution of rivers and other sources of water supply was enacted in 1885, and the first law to require dischargers to obtain permits was enacted in 1945. These efforts, which focused on surface waters and point sources of pollution, were augmented over the years as new information on threats to our water resources became evident.

Recognition of problems and potential impacts has led to creation of the Pollution Control Agency in 1967, passage of the water well construction contractor licensing law in 1971, passage of the pesticide control law in 1976, and passage of the safe drinking water act in 1977, to name but a few. We now have laws, programs, rules or guidelines that cover many of the threats to our waters.

There are four principal agencies in the state involved in protecting our waters from pesticide and nutrient contamination: the Departments of Agriculture (MDA), Health (MDH), and Natural Resources (DNR), and the Pollution Control Agency (PCA). These agencies are responsible for implementing state legislation and also take an active role in the implementation and enforcement of federal legislation.

MDA is the lead agency for regulation of pesticides in Minnesota. It has authority through delegation from EPA under FIFRA and through the state Pesticide Control Law. MDA is responsible for the regulation of the distribution, use, storage, handling and disposal of pesticides, rinsates and containers. It administers the state's certification, licensing and training programs and has the authority to deny, cancel or restrict the use of products.

Amendments to the state Pesticide Control Law in 1987 significantly enhanced MDA's enforcement abilities and expanded its ground water protection responsibilities. The amendments further established a pesticide regulatory account and imposed fee increases to ensure that funding for administration and enforcement of the law was adequate. The law prohibits pesticide use that will cause unreasonable adverse impacts on the environment.

DNR becomes involved when pesticides are applied to public waters. DNR maintains a list of aquatic herbicides and algicides that it approves of, and issues permits for the use of pesticides in public waters. MDA provides financial support to DNR for its enforcement efforts, and DNR assists MDA with training and testing of aquatic pesticide applicators. DNR is also responsible for the state's efforts to control the proliferation of purple loosestrife.

MDA also has authority to regulate the registration, storage and handling of fertilizers. This includes the requirement that commercial applicators maintain records of amounts applied. No agency has authority over the rate of application of fertilizers. Application rates for animal wastes are only regulated in connection with PCA feedlot permits. Manure management plans are required with these permits, and must provide for the application of manure at agronomic rates.

MDH has authority under the federal and state safe drinking water acts to regulate public drinking water supplies for protection of public health. This includes adoption of drinking water standards and protection relative to pesticide and nutrient contamination. MDH also is responsible for enforcement of the state's water well construction and abandonment code and develops health advisories for contaminants in situations where no standards exist.

PCA's authorities derive through the federal Clean Water Act and state statutes, and cover broad overall regulation of surface and ground water quality. Its authorities include classifying waters and setting standards for all parameters, and extend to regulation of discharges from municipal and industrial facilities, feedlots, disposal and management of solid and hazardous wastes, storage facilities and nonpoint source pollution control.

Current PCA rules regarding ground water stress nondegradation, or prevention of contamination. The rule allows for such activities as the use of septic systems and agricultural chemicals and fertilizers, provided that such use does not pose a significant pollution problem.

PCA is also responsible for preparing the state's ground water protection strategy and nonpoint source management plan. They administer the state's Clean Water Partnership program which, together with the cost-share programs of the Board of Water and Soil Resources, provide funding to address nonpoint source problems.

Relationship of Strategy to Other Efforts

This strategy and its policies and recommendations are directed toward the wise use of pesticides and nutrients. While necessary, these policies and recommendations are not adequate in and of themselves to ensure that our water resources are protected. They must be coupled with other state, federal and local efforts to control sources of water pollution. These include efforts related to septic systems, municipal and industrial discharges, waste disposal, and even air emissions that lead to deposition of pollutants on our land and in our waters. These other efforts must be continued and enhanced as well.

The strategy builds upon past state water planning efforts, including EQB's "Protecting Minnesota's Waters: An Agenda for Action in the 1987-1989 Biennium". It is part of EQB's continuing efforts to evaluate state water resources problems and develop policies for dealing with those problems.

The strategy was developed in conjunction with development of the state's "Ground Water Protection Strategy" and "Nonpoint Source Pollution Management Program" and is intended to expand upon the recommendations of those efforts in the area of pesticide and nutrient use. The state's strategies and water resources programs and efforts will continue to be reevaluated through the interagency and citizen forum provided by the EQB in order to ensure that they continue to address Minnesota's current and future needs.

The Strategy

Goal of the Strategy

To safeguard public health and protect water resources from pesticide and nutrient contamination , while maintaining a strong economy.

Policy Directions

In considering how to address problems associated with the contamination of Minnesota's water resources due to the use of pesticides and nutrients, the Environmental Quality Board Water Resources Committee proposes nine basic policies. These policies define the course of action to be taken to achieve the overall goal of protecting Minnesota's water resources from pesticide and nutrients contamination. These policies build upon the framework established in the Minnesota Ground Water Protection Strategy.

1. ***An integrated approach must be pursued.*** No single effort or initiative can be expected to alone achieve the desired results. Education, research, monitoring, incentives, regulation and coordination are all vital parts.

2. ***Individual behavior and actions must be modified.*** Changing the ways in which pests and nutrients are managed requires changing individual behavior and actions. These modifications in turn require that individuals have the necessary information to make wise management decisions. Individuals must be better educated in the consequences of use and misuse of pesticides and nutrients, and alternatives to existing approaches. In addition, motivations and incentives should be provided as a means for changing behavior and actions and encouraging the use of best management practices.

3. ***Land stewardship and resources sustainability must be emphasized.*** Pest control and nutrient management decisions can have an influence on water resources that extends beyond the geographical and temporal framework in which the decisions are made. The citizens of Minnesota have a responsibility to be good custodians of the state's water resources and to ensure that actions taken today do not jeopardize the health and welfare of future Minnesotans. Education and policy efforts should, therefore, stress an overall land stewardship ethic, and emphasize resource sustainability and long-term profitability. Research efforts should emphasize alternative pest control strategies and optimizing pesticide and nutrient use.

4. ***Prevention must be the cornerstone.*** The cleanup of water contaminated by pesticides and nutrients can be costly and technically complex, and with respect to widespread contamination of ground water, may be economically and technologically infeasible. In addition, provision of alternative water supplies or treatment, where cleanup is not feasible, is also costly and may be impractical where contamination is widespread. Consequently, contamination of water resources by pesticides and nutrients must be prevented to the maximum extent possible.

5. ***Nondegradation must be the goal.*** Nondegradation, meaning prevention of further contamination, must be the policy goal of the state in dealing with potential sources of

contamination. This means that impacts should be prevented to the maximum extent practicable even in situations where waters have already been impacted by human activities. All programs, research and other efforts must be geared toward attainment of this goal. This will lead to the development of better and better practices, taking us ever closer to the nondegradation goal. We should be striving to keep the pesticides and nutrients we use on target and out of our waters.

Synthetic pesticides are not a naturally occurring constituent in waters. In addition, while nitrates are found naturally in waters, elevated levels can be induced by human activities. The presence of pesticides in surface or ground waters or of nitrates beyond natural background levels is considered to have lowered or degraded the quality of those waters.

6. ***Degradation must be met with action.*** Due to the potential problems of environmental and health risks, and the difficulties associated with cleanup, instances of degradation can not be disregarded. All instances of degradation must be met with appropriate actions to prevent further degradation. These actions may include investigations, evaluations, education, enforcement actions, land use and land management changes, active cleanup, and/or environmental correction or restoration.

7. ***Actions must be geared toward environmental and health protection.*** The particular actions appropriate in instances of degradation must be determined, and priorities for taking action must be established. State priorities for action and the levels of cleanup required must be based on acute and long-term or chronic health risks, environmental protection and maintanence of other beneficial water resource uses. Health and environmental protection based numerical limits must serve as the upper limit for activities and as cleanup levels.

8. ***Existing framework should be retained.*** Minnesota has a strong history of environmental protection, and has developed excellent agencies and programs to protect our water resources. We should build upon this existing framework of agencies and programs when increasing our efforts to protect water resources from contamination caused by the use of pesticides and nutrients.

Specific methods and approaches to be taken in protecting water resources from contamination by the use of pesticides and nutrients have been structured around three initiatives:

I. To provide the public, decision-makers, regulators and the regulated community with necessary information, education, and incentives.

II. To enhance the current body of knowledge of pesticide and nutrient contamination problems, prevention practices and alternative management approaches.

III. To enhance preventive planning, corrective actions, and regulatory efforts.

Initiative I

To provide the public, decision-makers, regulators and the regulated community with necessary information, education and incentives.

The USEPA has suggested in its 1988 report entitled "Protecting Ground Water: Pesticides and Agricultural Practices", that ground water can be protected from pesticide contamination through measures aimed at: 1. preventing spills or eliminating pathways of contaminant entry into ground water; 2. avoiding application when conditions are most likely to promote leaching; 3. using products with less potential to leach; and 4. reducing the quantities of pesticides used. Measures include careful timing of application relative to climate, crop economic thresholds and pest cycles; crop rotation; proper maintenance and calibration of application equipment; and mechanical cultivation. These sorts of measures, and corollary measures for addressing surface water and nutrient contamination issues, to a large extent rely upon voluntary actions of individuals.

Wise, responsible and reduced usage of pesticides and supplemental nutrients can best be achieved by ensuring that individuals are provided with the necessary education and information to make informed management decisions and to understand the consequences of mismanagement. Overall environmental and stewardship education and information is necessary, as well as specific efforts geared toward pest control and nutrient management. In addition, incentives can be a useful tool to promote and reinforce desired behavioral changes.

Overall Environmental Protection Recommendations

Environmental protection requires voluntary actions by individuals. Such voluntary actions, however, can only be expected if individuals understand the consequences of their actions and the importance of environmental protection to the future quality of life and economic vitality of Minnesota. Efforts to foster environmental awareness and stewardship of the land and resources will have positive impacts on preventing pesticide and nutrient contamination problems, as well as overall environmental benefits.

Support and expansion of the recommendation of the "Minnesota Ground Water Protection Strategy" and "EQB Task Force on Environmental Education" dealing with environmental education will serve to foster this overall awareness.

Recommendations

1. The Legislature should enact a Statement of Policy establishing information and education as a vital component of overall environmental protection, and commit funding to environmental stewardship and ground water information and education programs.

2. The Minnesota Environmental Education Board (MEEB) should establish a Water Resources Education Advisory Committee to coordinate the development and dissemination of environmental education information. This would include efforts related to ground water, pesticides, nutrients and overall environmental stewardship. The committee should be broadly based and should provide for input from state agencies, MnExt, the University of Minnesota and other educational institutions, and private and

public specialists in education, information and technical fields. The committee's activities should be coordinated with those of the Environmental Quality Board (EQB), and should be performed consistent with EQB priorities and policies.

Specific tasks should include: a) identifying informational needs, b) seeking ways to obtain information, c) ensuring that environmental/health aspects of pest and nutrient management are integrated into educational programs, d) ensuring that research is factored into educational materials quickly, and e) recommending deletion of obsolete materials.

3. The Water Resources Education Advisory Committee should develop and disseminate curriculum and in-service training for teachers at both the primary and secondary education level.

4. Education/training sessions should be conducted for all agencies' staffs on overall state and federal pollution control regulations. These should be offered on a regular basis as part of the state's training efforts, and should be part of the orientation program for new employees. Department of Employee Relations should work with appropriate state agencies to prepare these sessions.

Pesticide and Nutrient Management Recommendations

Issue

Improve and expand public educational and informational efforts. State agencies (including MDA, Pollution Control Agency (PCA), and Minnesota Department of Health (MDH)), federal agencies, local agencies (including counties and soil and water conservation districts), and the Minnesota Extension Service (MnExt) are actively involved in training efforts within the state. MnExt is the primary source of information and training for the public on pest control and nutrient management. By building upon and coordinating the work of these agencies we can improve and focus our efforts.

Recommendations

General Public Education and Information:

Pesticides and nutrients are widely used throughout Minnesota on such areas as farms, lawns, lakeshore property, parks, forests, and highway rights-of-way. Broad-based general educational efforts are required in order to reach all potential users. Educational efforts should promote overall stewardship; should focus on reducing and optimizing fertilizer and pesticide use and on alternatives; and should be updated regularly to reflect the most recent research and practice identification efforts. MDA, MDH and MnExt, in cooperation with the MEEB Environmental Education Committee, should expand general information and education efforts on fertilizer use and pest control. They should:

1. Develop general public information/education materials on safety precautions, overall environmental concerns, integrated pest management, and alternatives for such uses as advertising in farm journals, TV spots, billboards and pamphlets in stores.

2. Develop educational and informational materials, to be available for free at dealerships and

stores and for display, to help users understand label restrictions and be aware of safety and environmental concerns and precautions.

3. *Increase risk communication efforts* by developing materials to inform the public of the risk of exposure, comparative risks and risk avoidance techniques.

4. Foster development of courses and course materials on pest and nutrient management through such avenues as UM Continuing Education, Department of Conferences and Professional Development, and community colleges.

General education should also be fostered through continued legislative encouragement for establishment of the Sustainable Agriculture Chair or a Sustainable Agriculture Center at the University of Minnesota, and urging for the integration of sustainable agriculture principles throughout the university system, including MnExt and Experiment Stations.

Target Group/Issue Specific Education and Information:

Significant responsibility rests with the user of a pesticide or nutrient in determining when, where and how to use a particular product, and how and where to dispose of any waste products and containers. The U.S. Environmental Protection Agency (EPA), in its "Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy", has suggested that as more restrictions on use of pesticides are developed relative to hydrogeologic sensitivity, users will be relied upon to determine when these restrictions apply. Any assistance that can be provided to users in making such decisions should benefit both the individual and the public at large. The following efforts should be undertaken in cooperation with the MEEB Water Resources Education Advisory Committee:

1. ***Develop and expand information systems and programs to assist pesticide and nutrient users.*** Efforts should be expanded to ensure that accurate and consistant information is available at the local level on recommended application rates and possible environmental impacts. This specifically includes:

   a) Implementation of the soil laboratory certification program by MDA;

   b) Requiring that information on the harmful results of mismanagement or overuse be included with all soil test results;

   c) Encouraging completion and implementation of a system for providing landowners with pesticide and nutrient recommendations and information on hydrogeologic sensitivity through SCS and SWCD offices. SCS is currently developing a procedure through UM that will allow landowners to receive pesticide and nutrient recommendation through SCS and SWCD offices consistant with those given by MnExt. This procedure should be completed and implemented.

   In addition, the procedure should be expanded into an overall information system to provide landowners with information on hydrogeologic sensitivity. The system would assist landowners in determining if particular future product label restrictions, such as depth to water, apply to their situation, and in selecting best management practices.

   The system should include such information as soils, depth to water, depth to bedrock, and presence of sinkhole and wells. It should be based on integrated, automated data bases, and be compatible with existing data management systems. Methods of involving dealers and private organizations in such a system should also be explored. The effort should be cooperative and draw on PCA sensitivity assessments, UM and MGS hydrogeologic efforts, SCS systems development, and ARS modeling efforts. SPA should be involved in system design to ensure overall compatibility with existing data management systems.

System development should be pursued in priority areas identified through the state nonpoint source pollution control plan and pesticide management plan, and in conjunction with demonstration farms or watersheds.

2. ***Intensify promotion of soil and manure testing.*** The Minnesota Department of Agriculture (MDA) and MnExt should prepare promotional materials and conduct promotional campaigns to show the importance of soil and manure testing and encourage it as a routine practice. Campaigns should be conducted in conjunction with agricultural field days and county fairs and should be targeted to priority areas, as delineated in the pesticide management plan and nonpoint source pollution control plan, and to demonstration project areas. Effort should include providing information on the environmental and economic costs of having used amounts above recommended levels and providing tests at reduced rates.

3. ***Expand pest survey.*** Surveys undertaken by MDA and MnExt to determine the levels of pest populations and dissemination of information so that actions to control pests are taken at appropriate times are integral to an effective integrated pest management (IPM) program. While these efforts received increased funding through the '88 legislative session, consistant sustained funding is required. Necessary efforts should be delineated in the state IPM Approach, recommended in Initiative III, and should be coordinated and integrated with efforts of private pest consultants.

4. ***Develop informational brochures on disposal and handling.*** MDA, PCA and MnExt should cooperatively develop brochures for the various container types covering the regulations and procedures which apply to pesticide and container storage, handling and disposal, and the options users have in complying with those regulations. Emphasis should be placed on the environmental and economic problems associated with current pesticide and container disposal practices, and should include information on storage to prevent waste generation and contamination, disposal practices on private land, and triple rinsing. Brochures should be made available to pesticide users at time of sale and through MnExt offices. Brochures should also be distributed to landfill owners to increase awareness of triple rinse and disposal requirements.

5. ***Develop brochures for homeowner and urban users.*** MnExt, in cooperation with MDA and DNR, should develop informational materials directed specifically at homeowner and urban users of pesticides and fertilizers. Materials should emphasize safety, disposal, alternatives, and potential environmental impacts, including lake eutrophication. Materials should be made available to municipalities for distribution through water bills and other local mailings, and to state and local agencies.

6. ***Develop informational materials on alternatives and sustainable agriculture.*** MnExt should develop additional materials on alternatives for agricultural, home and other uses of pesticides. These should include organic agriculture, gardening and landscape maintenance, and sustainable agricultural systems. Materials should be updated regularly based on research results.

7. ***Develop a water quality assessment system.*** Efforts are currently underway within the PCA, USDA and MnExt to evaluate or devise ways to evaluate the water quality impacts of management practices. The Center for Agricultural Impacts on Water Quality should promote and coordinate these efforts to finalize and implement a water quality assessment system for evaluating practices. The system should be based on existing models and should be used by SCS and SWCD personnel in developing conservation plans, evaluating practices, and working with landowners to upgrade conservation plans. Emphasis should be placed on application in priority areas and demonstration projects.

Issue

Expand and enhance training programs and requirements. Training programs are established by MDA, in cooperation with MnExt, to ensure that users of pesticides in the state maintain a sufficient level of competency and ability to use pesticides properly and safely. Commercial applicators of pesticides, dealers of bulk and restricted use pesticides and other applicators of restricted use pesticides are required to attend these training courses, or to demonstrate competency through examination. These training programs offer an important opportunity to educate users of pesticides on the latest information on risks and environmental impacts.

In addition, the numerous rules and programs that impact or influence pest and nutrient management are contained within different agencies and different divisions within agencies. In order to serve the public and promote sound management, agencies' staffs must be informed on overall rules, programs and findings.

MDA and MnExt training efforts should be coordinated with the MEEB Water Resources Education Advisory Committee.

Recommendations

1. ***Enhance and expand training and certification requirements.*** MDA, through its ongoing responsibility, should improve the content requirements of applicator and dealer training courses. Improvements should be developed in cooperation with MnExt, PCA, MDH and other appropriate agencies, and should emphasize environmental and health aspects of pesticide use and alternatives.

   Possible improvements to consider should include a) providing for regional differentiation of training courses, b) more rigorous testing, c) developing ground water training modules focusing on vulnerable sites, d) pesticide and fertilizer application through irrigation systems, and e) increasing emphasis on integrated pest management, disposal and storage.

2. ***Enhance cooperative workshops.*** MDA and MnExt should enhance their cooperative workshops and training programs for pesticide users and dealers by involving other state, local and federal agencies and the chemical industry in course design.

3. ***Conduct inter-agency workshops.*** The MDA and MnExt, in cooperation with other

appropriate agencies, should sponsor joint training workshops throughout the state on pest and nutrient management to ensure that staff from all relevant agencies are providing the most up-to-date information to clients.

Issue

Institute and expand on the use of demonstration projects as a direct method to promote change. Demonstration projects provide an important addition to general educational efforts. They provide the means for the individual to personally gain from the experiences of others, thus eliminating some of the reluctance toward adoption of new practices. Due to the diverse physical and environmental character of the state, results of projects from one area cannot always be transfered to other parts of the state. Consequently, projects are needed in many different locations. Current demonstration efforts of MnExt, USDA-ARS and others have proved beneficial, and should form the basis for expanded efforts. Efforts here should be tied to the current grant program for sustainable agriculture discussed under financial incentives.

Recommendations

1. ***Establish demonstration farms and demonstration watersheds.*** The Board of Water and Soil Resources (BWSR) and MDA, in cooperation with the University of Minnesota and the MEEB Water Resources Education Advisory Committee, should promote the establishment and publicizing of farm-based and watershed-based demonstration projects on best management practices for reduced chemical use, alternatives to chemical use or added nutrients and sustainable agriculture. These must be coordinated with the demonstration project efforts of MnExt, ARS and PCA Clean Water Partnership, and must draw upon their expertise for project design and evaluation and communication of results.

   Demonstration farms and watersheds should: a) be pursued in the priority areas identified through the state nonpoint source pollution control plan and pesticide management plan, b) stress the overall environmental and economic costs and benefits, and c) be based upon comprehensive soil and water conservation farm plans.

   As part of the educational efforts carried on in conjunction with demonstration farms and watersheds, the state should pursue subsidizing well-water analyses for area residents. This would be used to make residents more aware of how their practices may be impacting their own wells. Tests should be conducted at state certified laboratories.

2. ***Expand research-based demonstration plots.*** The Center for Agricultural Impacts on Water Quality, in cooperation with other departments of the University of Minnesota, USDA-SEA, MDA and other appropriate agencies, should expand research-based plot studies to document risks and benefits of different approaches to pest and nutrient management. Efforts should be pursued at established experiment stations and research sites, and results should be routinely conveyed to the public.

3. ***Establish ties between demonstration projects.*** Demonstration projects are currently being conducted by several private organizations as well as state and federal agencies. In addition, projects are ongoing in other states that could provide beneficial information for Minnesota. BWSR and MDA, in cooperation with MnExt, should work to establish ties between private and public demonstration projects and between Minnesota projects and those of neighboring states in order to derive the maximum benefit. These efforts should also be tied with recommended efforts to coordinate research.

Issue

Promote better data coordination, dissemination and information management. Data of value in pest and nutrient management are gathered by various state, federal and local agencies as well as through research efforts. Management efforts within Minnesota could benefit by improving access to these data and by coordinating efforts prior to monitoring to promote efficiency and ensure compatibility of techniques.

Recommendations

1. ***Develop a data management system.*** The Environmental Quality Board (EQB), through the Systems for Water Information Management Committee, should continue to facilitate development of interagency data management systems for handling water quality data, including data on the occurrences of pesticides in water resources. The system should include federal, state, local and university efforts and address accessibility to all parties. The system must be tied with overall data management systems through EQB, as recommended in the "Minnesota Ground Water Protection Strategy".

2. ***Evaluate data systems.*** Different computerized data systems are used by the various agencies that gather and maintain information that could be used for pest and nutrient management. This includes information on soils, hydrogeology, and land use and management. In order for this information to be readily available, the data systems must be compatible. SPA should evaluate the computerized data systems in use by federal, state and local governments and make recommendations regarding uniformity.

3. ***Promote information repository.*** Efforts are being conducted at the federal level and in other states that could provide data of use to Minnesota in its pest and nutrient management efforts. Keeping abreast of these efforts, however, is difficult and time consuming. SPA should explore the possibility of EPA serving as a repository for and distributor of this information. Local repositories are also needed and ties of local information/data to the rest of the system.

An information repository on education materials, resources and speakers is also needed. Development of such a system should be explored by the MEEB Water Resources Education Advisory Committee.

Issue

Develop financial incentives. Pest and nutrient management activites primarily involve actions of individuals on private land. One way to influence these actions is through providing cost-sharing, loans or other financial incentives. These incentives are provided to ease the transition to new management practices, and to encourage or reinforce appropriate activities.

Incentives and financial assistance are also needed for proper well abandonment and are addressed in the "Minnesota Ground Water Protection Strategy". Efforts in this area will benefit pesticide and nutrient contamination efforts.

Recommendations

The state should encourage sound pest and nutrient management, including manure management, and protection of water sources through direct cost-sharing with landowners/users for water resource protection best management practices. Such cost-sharing should be concentrated in and coupled with demonstration farms and watersheds and priority areas, as identified through the nonpoint source pollution control plan and pesticide management plan. Specifically, the state should:

1. Retire areas for water quality purposes through purchase or long-term easements. This should be pursued by adding ground water protection as an eligibility consideration under the Re-Invest in Minnesota Program.

2. Develop pest and nutrient management and ground water protection practices for use in state erosion and water quality cost-sharing programs, including the Clean Water Partnership. These should include consideration of startup cost-sharing for adoption of integrated pest management (IPM) practices for use in the state's programs (similar to startup cost-sharing for establishment of conservation tillage). Cost-sharing would cover such activities as scouting for pests. Practices should be developed and revised to reflect the latest research findings on water quality protection.

3. Continue grant and loan programs for sustainable agriculture with an overall environmental protection emphasis. Current programs funded in the 1988 legislative session for MDA and the Agricultural Utilization Research Institute should be continued. Interest-share loan programs should also be considered for necessary equipment purchases.

   In addition, the state should encourage the establishment of cost-sharing similar to those mentioned above within existing federal Agricultural Stabilization and Conservation Service cost-share programs.

Initiative II

To enhance the current body of knowledge of pesticide and nutrient contamination problems, prevention practices and alternative management approaches.

Current efforts to prevent contamination are hampered by information gaps. These include lack of information on the extent, nature and magnitude of contamination problems, lack of accurate data on pesticide use, and needs in the area of basic research on the actions of contaminants in the environment. In addition, further identification is needed of management practices that both achieve pest and nutrient management and environmental protection goals.

Overall Environmental Protection Recommendations

Research and monitoring are currently being conducted by numerous educational and governmental entities. While the focus and intent of these efforts may often be different, all parties could gain by coordinating efforts, having better access to each other's results and exchanging information on areas within their respective disciplines regarding future needs. Recommendations of the "Minnesota Ground Water Protection Strategy" address this need.

Recommendations

1. ***Develop and implement a coordinated statewide monitoring plan.*** The EQB should coordinate development of a statewide interagency ground water monitoring plan, with biennial reports on the nature and quality of ground water in the state and recommendations for modification of the monitoring plan.

2. ***Establish an interagency and academic technical committee.*** EQB should establish an ongoing inter-agency and academic committee to identify research priorities; to examine practices and needs for state regulatory programs; and to disseminate research results through existing channels such as Minnesota Extension and MDA certification and training programs. This effort should be coordinated with and provide input to the efforts of the university, such as those of the Water Resources Research Center, Limnological Research Center, and Center for Agricultural Impacts on Water Quality, and research funding entities, such as the Legislative Commission on Minnesota Resources (LCMR) and dedicated research funds.

   The committee should also work to foster coordination of research efforts between neighboring states, and discussion and exchange of research ideas and findings. The committee should be combined with the Ground Water Technical Committee recommended in the Ground Water Protection Strategy.

Pesticide and Nutrient Management Recommendations

Issue

Monitoring. Information from monitoring efforts forms the basis for our understanding of the scope of water resources problems and trends in those problems. The soundness of decisions and actions and the degree to which public health and water resources are protected are directly related to the soundness of the data used. Although various state and local agencies monitor for pesticides and nutrients, the monitoring is limited. Minnesota has no interagency, coordinated monitoring program which tests for pesticides, pesticide breakdown products, and nutrients on a regular basis. Efforts must be increased and coordinated if sound information for decision making is to be obtained.

Recommendations

1. ***Develop and implement a coordinated monitoring program.*** As part of the efforts to develop an overall ground water monitoring plan, the EQB should facilitate development of a coordinated inter-agency monitoring program which tests for pesticides, pesticide breakdown products and nutrients on a regular basis. At a minimum, the following major monitoring programs should be considered:

   a) Ambient ground and surface water monitoring for pesticides should be conducted to establish water quality baselines and trends.

   b) Public drinking water systems should be monitored for pesticides and pesticide breakdown products on a regular basis.

   c) Selected private drinking water wells should be monitored for pesticides and pesticide breakdown products. While fiscal resources are not available to sample all of the estimated 300,000-400,000 private wells in the state, private wells located near known or suspected pesticide contamination sites should be sampled. In addition, certain private wells should be selected for sampling based on representative conditions, such as source aquifer, well depth/construction, soils or hydrogeological conditions, area pesticide use, land use, geographic location, intended water use, etc. Some private wells should also be randomly selected and sampled.

   d) Soil and ground-water monitoring efforts should be increased near bulk pesticide storage and handling facilities, especially those facilities with historically poor handling practices which are located in hydrogeologically sensitive areas. Partial responsibility for this monitoring should be born by the facility.

   e) Intensive, area-specific pesticide monitoring should be conducted with special emphasis on hydrogeologically vulnerable areas with potential contaminant sources. Joint industry/state pesticide monitoring studies should also be pursued.

   f) Fish tissue, aquatic impacts, soil and unsaturated zone monitoring should be conducted for commonly used pesticides in Minnesota.

   g) Monitoring of state uses of pesticides, including highway, forest, and park applications.

2. ***Develop laboratory procedures.*** Analyzing for pesticides can be difficult, due to the procedures involved and the dilute nature of the sample, and can yield erroneous results. Public and private laboratory capabilities must be improved for detecting trace amounts of commonly used pesticides and their breakdown products. MDH and MDA should work jointly with the University of Minnesota to develop standard laboratory procedures for use in Minnesota through the MDH Laboratory Certification Program.

3. ***Enhance pesticide use information.*** Pesticide use surveys were conducted in Minnesota from 1962 through 1984 by the Minnesota Agricultural Statistics Service. These surveys yielded crop-specific acreage treated with major pesticides on a statewide basis. No county or sub-county data is or was available, and no quantification of urban use has been

made. Accurate pesticide use information is needed to effectively and efficiently target water quality monitoring efforts.

MDA should pursue the gathering of accurate pesticide use information through a statistically designed pesticide use survey aimed at major crops and substate units. Additional more detailed surveys may be necessary in priority areas. Such a survey must be conducted on established intervals and must be coupled with separate efforts to gather information on urban uses and speciality crop uses. In addition, state government uses should be routinely compiled. Data management systems should be compatible with existing state systems so that information is readily available for other state agency and local water planning efforts.

Issue

Increase efforts to identify best management practices. Efforts to identify alternatives to current pest and nutrient management practice must be increased in order to promote preventative actions and minimize disruption if practice modifications are necessitated by contamination. Our goals should be to identify economically feasible management practices which 1. maximize efficiency of uptake and use; 2. minimize leaching, runoff and water quality impacts; and, 3. employ nonchemical approaches. Research on alternatives should be encouraged within the university system and U.S. Department of Agriculture, and should be an integral part of MDA and PCA efforts to identify management practices to prevent contamination. In addition, evaluation of existing practices is needed in order to ensure that they are compatible with ground water protection.

Recommendations

1. ***Support biological control and establish biological control agents.*** The state, through MDA, should continue the long-term process of establishing effective biological control agents. Biological control can offer an alternative means of pest control. MDA is currently developing a biological pest control program, with the assistance of the University of Minnesota and a grant from the Legislative Commission on Minnesota Resources; however, continued funding is necessary. The state should provide consistant, sustained support for establishment of the biological pest control organism laboratory and program, in order to increase our pest control options. This effort must include evaluation of impacts of control on the food chain and of costs.

2. ***Enhance IPM research.*** Additional research on integrated pest management techniques is needed, specifically with regard to Minnesota applications. These include research on alternative management strategies relative to weed threshold levels, cultural weed controls, effective green manure crops for Minnesota, and efficient crop rotations.

3. ***Increase research on alternatives.*** Increased emphasis should be directed toward chemical free farming, reduced chemical farming, and alternatives to current uses and use patterns for pesticides and nutrients. Research goals should be oriented toward maximizing profits versus yields and protecting resources. The research needs identified in the 1980 USDA "Report and Recommendations on Organic Farming" should be reviewed and pursued as appropriate.

4. ***Evaluate existing practices.*** Some existing practices were not developed with pesticide use and water quality impacts in mind. These practices should be evaluated to ensure that

impacts on water resources are positive or neutral. The state should neither fund nor promote practices with negative water resources impacts. Application rates for pesticides and fertilizers through irrigation systems should also be reviewed, as should rinsate recycling systems and other spill prevention techniques.

Issue

Continue and enhance research efforts. Many questions remain to be answered concerning the actions of pesticides and nutrients in the environment. Further research in the area of basic environmental processes is needed in order to develop wise, informed management recommendations.

Recommendations

1. *Conduct needed research.* Basic research is needed to resolve questions related to:
   a) the transport and fate of pesticides and nitrate-nitrogen in the environment, including transport processes in soil and nonaquifers;
   b) formation, transport, and health/environmental effects of breakdown products;
   c) cumulative and synergistic health/environmental effects;
   d) pesticide and breakdown product leaching characteristics and mechanisms;
   e) aquatic impacts;
   f) site vulnerability; and
   g) effectiveness of management practices for ground and surface water quality protection.
   h) refinement of pest damage thresholds
   i) development of more accurate techniques for assessing nitrogen content of soils
2. *Increase funding and water quality assessments.* State agricultural research funding should be increased to ensure that the research priorities and needs of the state are met. The state should encourage the incorporation of water quality components in appropriate research and require that a water quality impact assessment be incorporated into each research project which receives state funding, as appropriate.

Initiative III

To enhance preventive planning, corrective actions and regulatory efforts.

Pesticide and nutrient contamination of water resources is regulated through the provisions of the state Pesticide Control Law and other state laws dealing with waste disposal, storage, pollution control, and water use. In addition, numerous state, federal and local programs directly or indirectly impact pesticide and nutrient contamination. Our ability to manage pesticide and nutrient use and prevent or mitigate impacts on water resources could be greatly enhanced through better coordination and direction of existing programs, application and modification of existing statutes and rules, and more aggressive enforcement and implementation efforts. In addition, existing statutes and rules should be reviewed regularly in order to identify those that have become outdated and to recommend changes.

Overall Environmental Protection Recommendations

In addition to efforts directed specifically at pest and nutrient management, pesticide and nutrient contamination of ground water can be prevented or minimized through overall ground water protection efforts recommended in the state's "Ground Water Protection Strategy". Specific recommendations include:

Goals and Priorities for Water Quality Protection

Pesticide and nutrient contamination issues can be addressed through overall efforts to achieve the nondegradation goal for ground water and enforce standards and guidelines in dealing with existing and proposed pollution sources and contamination. Specific recommendations of the "Ground Water Protection Strategy" should be supported and expanded as they relate to pesticide and nutrient contamination issues.

1. Adopt a nondegradation goal for prevention of pesticide and nutrient contamination. Nondegradation, meaning the prevention of further contamination, should be the policy goal of the state in dealing with potential sources of pesticide and nutrient contamination. This means that impacts should be prevented to the maximum extent practicable. While further contamination cannot currently be prevented in all situations of pesticide and nutrient use today, having nondegradation as the state's goal will provide the impetus for the continued development and refinement of management practices which protect water resources. All state efforts, including research, management practice development and programs should be geared toward this goal. As we strive to develop and implement even better management practices that both protect our water resources and achieve our pest control and nutrient management needs, we will come ever closer to achieving our nondegradation goal.

2. Adopt health and environmental protection numerical limits. Numerical limits are needed to serve as the upper limit on the allowable impacts of practices in those situations where impacts cannot currently be avoided. Practices which cause impacts greater than the

numerical limits would not be allowed. Limits are also needed to serve as goals for cleanup actions. The PCA should establish criteria which would be used to develop numerical limits, and adopt specific numerical limits as appropriate. Limits should be based on impacts to human health, aquatic life and wildlife, and should be incorporated into existing programs. These limits should be used to define "unreasonable adverse effect on the environment" in the state's Pesticide Control Law.

Drinking Water Protection

Ground water serves as a drinking water source for the majority of Minnesotans. However, if not properly constructed, these same wells that extract ground water can provide pathways for pollutants on the surface of the land to enter our aquifers. They can also allow for the transport for pollutants between aquifers. Enhancement of efforts to ensure that wells are constructed, maintained, and abandoned properly, will help keep all pollutants out of our aquifers, including pesticides and nutrients. Protecting the land areas where surface infiltration provides the recharge waters for our aquifers is also important.

1. Water Supply Planning - MDH should develop a state Wellhead Protection program, where the recharge areas of public water supply wells are delineated and special protective land use restrictions enacted.

2. Enforcement of Water Well Contruction Code - Enforcement should be enhanced through increasing MDH enforcement staff and regulatory authorities, and through delegation agreements with interested counties.

3. Sealing of Unused Wells - A pilot program for inventorying and sealing unused, unsealed wells should be developed to demonstrate the effectiveness of a county government program.

4. Wells and Property Transfers - Testing of domestic water supplies and registration on the property deed of all drilled wells should be required at the time of property transfer.

5. Local Assumption of the Water Well Construction Program - Counties should be encouraged to adopt water well programs.

Development of Local Programs

Protection and prevention efforts often involve land use controls and individual actions that can most effectively be addressed at the local level. The state should promote local control efforts, including local water planning, wellhead protection, feedlot regulation, and water well code enforcement. The BWSR should establish a grant mechanism through the counties which would help local governments develop and implement environmental programs to address problem areas identified in the comprehensive local water planning process.

Such local efforts must conform to state guidelines and regulations, and not duplicate existing fee structures. In addition, state review and monitoring of such efforts will be necessary to ensure adequacy and conformity.

Pesticide and Nutrient Management Recommendations

Issue

Develop a state pesticide management plan. In order to be used within Minnesota, a pesticide must be registered with the Environmental Protection Agency (EPA) and the state Department of Agriculture (MDA). Through the state Pesticide Control Law, MDA has the authority to approve, deny, cancel or impose state use restrictions on a pesticide. In addition, MDA may specifically take actions necessary to prevent pesticide contamination of ground water.

EPA has suggested, in its "Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy", that states take a more active role in determining necessary actions to protect ground water from pesticide contamination through development of state management plans. EPA has further suggested the possibility of federally imposed state product bans for states deciding not to prepare such plans. The plan would guide Minnesota's efforts in preventing and responding to pesticide contamination, including those relating to the development and imposition of Minnesota use restrictions.

Recommendations

1. ***MDA should develop a State Pesticide Management Plan.*** MDA should develop a management plan which is both prevention oriented, delineating what to do to foster nondegradation, and action oriented, delineating what to do when problems or issues arise. The plan should be framed around the concept of nondegradation and the policies and direction of this strategy, and should include:

   a) Designating special protection areas where more stringent protection measures are required. Areas should be designated based on PCA's delineation of hydrogeologic sensitivity and nonpoint source problem areas, MDH's delineation of wellhead protection areas, and levels of pesticides detected in water.

      The plan should specify actions to be taken within the special protection areas by federal, state and local entities. These should include increased educational efforts, increased compliance inspections, including of private applicators' storage and disposal operations and application equipment, and increased enforcement efforts.

   b) Initiating specific management plans for a pesticide following detection. Criteria for triggering a response should be developed that distinguish between sporadic detections and patterns. Actions taken should be commensurate with the severity of the problem.

   c) Delineating the roles of federal, state and local governments. The roles of government entities and ties with other programs should be delineated, including the role of SCS and SWCD's in applying farm planning standards. In addition, MDA should facilitate more effective working relationships between state resource agencies and local units by developing model state-local delegation agreements covering pesticide management.

2. ***Plan development should be coordinated through the EQB.*** The plan must be developed through the Environmental Quality Board (EQB) to ensure an interagency and interprogram focus and coordination with other state plans, particularly the state "Ground Water Protection Strategy", state Nonpoint Source Pollution Control Plan and this

strategy. In addition, environmental organizations, farm groups and industry should be involved in plan development.

Issue ***Integrate pest and nutrient management and overall land stewardship and sustainable agriculture principles into existing government programs and planning efforts.***

Many state, federal and local programs directly or indirectly impact the way pests and nutrients are managed. In order to ensure that the impacts of these programs are positive for pest control, nutrient management and water quality, the programs should be evaluated and modified as necessary. Programs should foster overall resource sustainability and land stewardship, to ensure that Minnesota's land and water resources continue to provide for a high quality of life and economic vitality.

Wise, responsible and reduced usage of pesticides and supplemental nutrients can be promoted by fostering the use of integrated pest management and integrated farm management or sustainable agriculture, together with the best management practices for water quality protection identified through our research efforts. With integrated pest management, ecological principles are combined with management techniques and biological and chemical control methods to maintain pest populations at tolerable levels. The IPM approach can be readily applied to all pest control situations, from the city lawn to the northern forest. With integrated farm management or sustainable agriculture, long range, comprehensive planning is used in order to promote the viability of the entire farm system and its supporting community.

Recommendations

1. *Foster overall land stewardship approach in government efforts.* Programs and priorities at all levels have often been geared toward specific short-term problems or issues. The land stewardship approach, on the other hand, stresses long-term and overall impacts, cherishing our land and resources, and striving to leave them in a better condition for future generations. This approach is necessary for sound pest and nutrient management, and should be fostered by government. State agencies and local units of government should adopt an overall land stewardship approach in applicable plans, including the Pesticide Management Plan, the state Nonpoint Source Pollution Control Plan, and comprehensive local water plans.

   The state should ensure that pest and nutrient management are built into new and ongoing programs, such as the Clean Water Partnership, the Community Health Services program, the Soil Loss Limits program, the Board of Water and Soil Resources (BWSR) Cost-Sharing Program, the feedlot control program, and the Wellhead Protection program. It should further ensure that research results identifing improved practices are regularly factored into all efforts.

   Finally, government entities, such as highway and parks departments, universities, and state facility maintenance departments, should adopt Integrated Pest Management in their management programs, and should explore and adopt planting regimes that minimize the need for pesticides.

2. *Support continued development and implementation of the Nonpoint Source Pollution Control Plan.* Development of a Nonpoint Source Pollution Control Plan is mandated by

both the federal Clean Water Act and state statute. This plan is intended to identify priority areas and guide the efforts of federal, state and local agencies in preventing and correcting nonpoint source pollution problems. The EQB member agencies should work together with the PCA to ensure that the plan: 1. promotes the recommendations of this strategy and the "Ground Water Protection Strategy"; 2. is consistent with overall state policy and the State Pesticide Management Plan recommended to be prepared by the MDA; and 3. is used for program development, priority setting and local level plan development. In addition, the state should continue to support development, refinement and implementation of the plan.

3. ***Better integrate principles into SWCD plans.*** SWCD's should ensure that the policies and recommendations of this strategy, the "Ground Water Protection Strategy", the Pesticide Management Plan and Nonpoint Source Pollution Control Plan are factored into their annual and long-range plans. Plans should contain a strategy to protect water quality from pesticide and nutrient impacts, should be based on sustainability principles and should be keyed to ground and surface watersheds or systems within the district.

4. ***Continue development of comprehensive local water plans.*** Comprehensive local water plans can be a valuable tool in delineating problems and priorities, and directing resources. Local governments should be encouraged to continue developing plan elements and updates necessary to:

   a) Reflect and incorporate appropriate elements of the state's Nonpoint Source Pollution Control Plan and Pesticide Management Plan.

   b) Guide soil and water conservation districts in setting priorities for cost-sharing and other resource protection programs.

   c) Provide background information to help guide ASCS County Committee cost-share priorities.

   d) Guide the development of MnExt county program plans.

5. ***Encourage USDA to adopt an overall sustainability focus.*** The state should encourage USDA to evaluate all of its programs with respect to a) impacts on water quality, pest and nutrient management, sustainable agriculture, and integrated pest management (IPM), and b) need for modifications, including adoption of pest and nutrient management practices. Best management practices for pest and nutrient management and water quality protection should be regularly evaluated and revised to reflect current research results. The state should work with USDA, private groups and our Congressional delegation to foster changes to federal farm legislation and programs to deemphasize production and promote sustainable principles.

6. ***Develop state IPM approach and state support for IPM efforts.*** Efforts to promote integrated pest management (IPM) are underway within MDA, MnExt other agencies and the private sector. These efforts, however, are not guided by an overall state approach and therefore have not always received the priority warranted. MDA, in cooperation with EQB and the university, should develop an overall state approach or memoranda of understanding for the promotion of IPM which would delineate the roles of the state, the

university, the extension service and the private sector; establish information and data exchange and integration systems; define a procedure for identifying research needs and reviewing and preparing informational materials; outline educational needs; and, include procedures for factoring IPM into all government uses of pesticides.

Issue

Enhance state pesticide and nutrient control efforts. In most instances, existing state statutes provide the framework for pesticide and nutrient contamination control efforts. There are situations, however, where authorities are lacking or unclear, or program support is inadequate. Specific needs relate to irrigation regulatory programs, container and product disposal, spills, and aquatic nuisance control.

Recommendations

1. ***Expand and enhance irrigation regulatory programs.*** State law establishes authority for developing requirements for application of pesticides through irrigation systems, including the requirement of obtaining a permit from MDA. Such a permitting program does not exist for controlling the application of fertilizers through irrigation systems, even though this practice is more widespread and requires similar precautionary measures. The Department of Natural Resources (DNR) issues permits for the appropriation of water for irrigation and must consider in that process the impacts of the use of the water. To address these areas:

   a) MDA should be authorized to develop requirements to control fertilizer applications through irrigation systems. This should be undertaken in cooperation with farm chemical industry, commodity grower's groups and irrigators association. Requirements should be distinct from those governing pesticide application through irrigation systems, and should be geared toward best management practices for protecting the environment.

   b) DNR should develop agreements/procedures with MDA, PCA and MDH for reviewing, revoking and denying appropriations permits and requiring monitoring where ground water contamination is present or is a concern.

2. ***Improve container/product disposal practices and compliance.*** Options for managing the disposal of unused, unwanted or banned pesticides and empty containers are limited, difficult, and in some cases expensive. Disposal is governed by both waste and pesticide management rules, and liability is a major concern. Traditional disposal options which are widely used, such as burying at the farm site, disposal at sanitary landfills, and open burning, are becoming prohibited or unavailable.

   Currently, the state is addressing some of these issues through PCA's Waste Pesticide Collection Pilot Project. Container issues are also being studied by MDA through an EPA grant. Based on results of these efforts to date, disposal practices and compliance for non-household waste pesticides and containers should be improved through:

   a. Clean sweep program. Banned and cancelled products, which are estimated by PCA to constitute 25 percent of current waste or about 133,000 gallons, should be collected through "clean sweep" programs.

   b. Alternative disposal options. In order to deal with the remaining waste, alternative disposal options should be researched to determine the most promising options for the state. Options should then be field tested to determine limitations and necessary enhancements for full application.

c. Manufacturer return. Waste pesticides and container disposal problems could be greatly reduced through the use of either bulk or returnable containers with one-way valves, whereby the unused products are returned to dealers. Such an approach would minimize waste generation, take advantage of existing distribution systems, and require that users pay only for the amount of product actually needed. This should be pursued through implementation of financial incentives in the form of a tax on pesticide products sold in non-returnable containers. The state should also consider prohibiting the sale of products in non-returnable containers by a specific date in the future.

d. Incentives for proper disposal. Other incentives for pesticide users to properly dispose of their wastes and containers should be pursued, particularly in priority or sensitive areas. These include: increasing enforcement of existing storage and disposal regulations; increasing research into practical waste reduction activities and providing technical assistance on waste minimization; and developing more effective education programs on the importance and specifics of proper disposal.

3. ***Enhance spills prevention and response efforts.*** The impact of pesticide and nutrient spills can be significant due to the volumes, types and concentrations of chemicals involved. Cleanup can be difficult, particularly in situations where leaks have gone undetected for long periods and in hydrogeologically sensitive areas, making prevention and early detection the most viable course of action. This objective can be met in the following ways:

   a) MDA and PCA should evaluate the spills log to ascertain the causes of spills and develop better prevention programs.

   b) MDA should increase surveillance/enforcement efforts at bulk storage facilities, including increasing inspection and developing procedures and criteria for determining when further requirements such as monitoring should be imposed.

4. ***Better ensure that aquatic nuisance control activities do not result in undesirable consequences.*** Pesticides are used in the management of the aquatic environment, most notably to control mosquitoes, blackflies and nuisance growths of aquatic plants. Use of herbicides to control aquatic plants in public waters is regulated through a DNR permit program in addition to the labeling and use requirements imposed by MDA. In recent years, the number of permit applications has increased to the point where timely review is difficult. Information on pesticide sales suggests that use without permits may be occurring. The permit fees have increased to the point where they may encourage illegal activity. This is particularly of concern in situations where the waters to which pesticides are applied are used for body contact recreation or for providing fish for consumption.

   Mosquito and blackfly control is carried out on public waters primarily by the Metropolitan Mosquito Control District. There is increasing interest in nuisance insect control on public waters, primarily by resorts and local units of government.

a) Improve enforcement of permit requirements. DNR enforcement efforts must be improved in order to ensure that individuals are not applying pesticides to public waters without permits and that the necessary state review of permits takes place. This should be accomplished by increasing the level of effort and staffing assigned to the aquatic nuisance control program to ensure that all permits receive adequate review, on-site inspections and enforcement. In addition, information on requirements for permits should be posted and made available at places of sale and distributed with mail order products. The feasibility of requiring signatures by purchasers of aquatic herbicides should be investigated.

b) Clarify statutory language concerning state control over nuisance insect control operations. These control operations should be subjected to adequate state agency review in order to ensure that overall state environmental and health protection goals are achieved. The Attorney General should review existing statutory language covering control activities and make recommendations for changes to clarify state review and/or permit requirements, especially on public waters.

   Specific pesticides are approved by the EPA for use in managing the aquatic environment, most notably to control mosquitos and blackflies, and nuisance growths of aquatic plants. The use of these chemicals in public waters of Minnesota is regulated by the DNR through a permit program as set forth in Minnesota Statutes Section 84.092, Subd. 1, Part 3. Additionally, Section 18.121,Subd. 2 states that the commissioner shall approve or modify mosquito abatement plans to protect public water, animals and natural resources. It is unclear whether the statute authorizing the Metropolitan Mosquito Control District (MMCD) under Chapter 399 (repealed in 1975 and now found in Sections 473.701 to 473.71) supercedes or was intended to supercede review as put forth in Section 18.121. The scope of section 84.092, Subd. 1, Part 3 is also subject to interpretation. Permits are clearly required for the control of nuisance aquatic plants, however, only an experimental permit has been issued to the MMCD for the control of blackflies in streams and rivers, and currently no permits are issued for mosquito control, the majority of which occurs in public waters. Without clear permitting or review authority for the use of pesticides in public waters, state agencies cannot regulate or monitor the use of these chemicals.

c) Better integrate aquatic plant and algae controls into overall lake management. Addressing such control in the absence of overall lake management can result in solutions to one set of problems that actually cause additional problems. In addition, aquatic plant problems may be due to influxes of nutrients from the lake's watershed, and thus would return if the influxes themselves are not addressed. Evaluating a lake's needs based on overall management objectives and problem assessments would alleviate these concerns.

   The legislature should establish the goal of requiring that control efforts be part of an overall comprehensive lake management plan. Such plans must take into account overall management objectives for the lake as well as problems within the watershed that preclude achievement of those objectives. Plans must be prepared by the DNR and should be consistent with comprehensive local water plans. DNR must provide for input of affected local units of government and interested parties in plan development.

Specific requirements for comprehensive lake plans and the time frame for implementation should be established by DNR through the EQB Comprehensive Lake Management Policy to be completed in 1989. Control activities on lakes for which plans have not been developed would not be affected by this requirement.

Funding

Implementation of the recommendations of this strategy will require funding at both the state and local level. The precise amount of funding required will be dependent upon the level of program effort desired and the speed with which we wish to pursue the recommendations. For example, numerous recommendations could be pursued 1. in designated high priority areas only, 2. uniformly statewide, or 3. statewide with added emphasis in priority areas.

In addition, funding of the recommendations in the overall "Minnesota Ground Water Protection Strategy" are necessary for full realization of our protection goals for pesticide and nutrient use.

Regardless of the level of funding and effort desired, the following approaches to funding, which are based on the recommendations of the EQB Advisory Committee on Ground Water Protection, are recommended:

Stable program funding must be provided for monitoring, incentives, education, information, enforcement, and research. Past funding for environmental programs, including those associated with pesticides and nutrients, has been subject to instability. This has hampered efforts to evaluate and track problems, to provide adequate enforcement and education, and to maintain research efforts. If the state's pest and nutrient management efforts are to be improved, stable funding must be obtained.

The establishment of dedicated accounts for these efforts should be considered. This should include consideration of an overall water resources fund for specific program efforts, with allotments from the fund being made by the Legislature on a biennial basis.

Pesticide regulatory controls and enforcement efforts should be supported by fees. Fees and penalties associated with product registration and applicator and dealer licenses are currently levied through state regulatory control statutes and credited to a pesticide regulatory account. Funds from this account are then made available for administration and enforcement of these laws. This includes water quality monitoring to assist in enforcement and to assess the adequacy of regulations. This system of supporting the regulatory function through fees imposed on the regulated community should be continued. As increased funds are needed, changes in fee structures should be considered, such as basing fees on the amount of product sold.

Funding sources for overall, nonregulatoy efforts should be broad-based. Every user of water should pay the costs of general, statewide resource efforts, such as coordination, education, monitoring and research, since every user benefits. Taxes or broad-based fees should be used as the main source of funds for these efforts.

Fees further serve to influence behavior and underscore the relationship between specific activities and problems or benefits. Currently, pesticides and fertilizers used for producing products for retail are exempt from state sales tax. One option is to partially or totally eliminate this exemption so that all users of these products, urban and rural alike, contribute to overall efforts and are made aware of the connection between the use of such products and potential problems. A pollution control tax or fee that could be noted on products is another option.

Methods for funding cleanup efforts should be developed. The costs of cleanup of contamination can be substantial, and in many cases may be higher than the person who was responsible for causing the contamination is able to pay. In other cases, persons responsible for the contamination may not be readily identifiable. Consequently, methods for dealing with the funding of cleanup must be identified in order to protect the state's water resources. Methods to be evaluated should include: 1. a pesticide superfund; and, 2. a reduced liability cleanup program similar to the Underground Storage Tank program.

Funding for pesticide and container disposal should be developed. Proper disposal of pesticides and containers can be costly and difficult. Methods must be identified to ensure that the funds needed for disposal are available. The state should explore creation of a fund, either through public monies, a tax on pesticide manufacturers, a tax on non-returnable containers, or other sources which would provide a subsidy for disposal efforts.

Legislative Actions and Concepts

Implementation of this "Strategy for the Wise Use of Pesticides and Nutrients" will require actions on the part of the legislature, governmental units and agencies, industry, and individuals. While actions in some areas require new authorities, implementation primarily requires the commitment of resources and changes in our approach to both our water and land and our use of pesticides and nutrients.

Overall Environmental Protection Recommendations

The recommendations and legislative actions of this strategy are intended to complement and build upon those of the "Minnesota Ground Water Protection Strategy". In many cases, implementation of the ground water recommendations is crucial to the success of any efforts to protect water resources from pesticide and nutrient contamination. Critical legislative actions include:

1. ***Prevention of Contamination*** - The legislature should a) adopt nondegradation as the policy goal of the state in the regulation of all potential sources of contamination, b) authorize the promulgation of criteria for the development of numerical limits to serve as the upper limit for activities and a goal for cleanups, and c) acknowledge the need for applying special protection measures in sensitive areas and authorize the development of criteria defining sensitivity.

2. ***Drinking Water Protection*** - The legislature should a) direct MDH and DNR to work more closely with public water utilities in water supply planning; b) direct MDH to develop guidelines for wellhead protection; c) require testing of all domestic wells at the time of property transfer; d) develop a pilot program to demonstrate the effectiveness of counties in dealing with the issue of unused, unsealed wells; and e) increase MDH staff and regulatory authorities for water well code enforcement.

3. ***Ground Water Information and Education*** - The legislature should enact a statement of policy establishing information and education as vital components in water resource protection programs, and should fund a) MEEB for overall coordination of water resource education efforts and development and dissemination of curricula, b) state agencies for dissemination of information on programs and resources, c) MnExt for specific information for target groups on impacts of activities and alternative practices, and d) EQB for information exchange and training for decision-makers.

4. **Enhancement of Local Government Participation** - The legislature should a) establish a grant program to help local governments develop and implement environmental programs and local water plans, b) encourage counties to assume responsibility for the water well construction program, and c) provide state agencies with funds necessary for the technical assistance staff to aid local governments.

5. ***Water Resource Evaluation, Monitoring and Research*** - The legislature should increase funding for a) accelerated delineation of aquifers and determination of aquifer

characteristics, b) baseline monitoring to determine existing, background ground water conditions, and c) EQB establishment and administration of an interagency and academic technical committee. The legislature should further require that data be managed electronically in a format compatible with other state data collections and that the EQB Water Resources Committee coordinate preparation of the statewide interagency monitoring plan and biennial publication of results.

Pesticide and Nutrient Management Recommendations

In addition to the legislative action for overall environmental protection, specific legislative actions are needed related to pesticides and nutrients in order to implement this strategy. They include:

1. *Statement of Legislative Intent* - The legislature should endorse the policy directions of this strategy as the appropriate direction for Minnesota to take in protecting water resources from contamination due to the use of pesticides and nutrients.

2. *Information, Education and Incentives* - The legislature should provide increased funding for a) expanded general information and education efforts on fertilizer use and pest control and impacts on water resources; b) informational materials on disposal, handling, home and urban uses, alternative management practices, and sustainable agriculture; and, c) workshops and other training opportunities for users. Stable funding for surveys of pest populations should also be provided.

   The legislature should also provide funding for development and expansion of information systems and programs for pesticide and nutrient users, to ensure that accurate and consistant information is available at the local level on recommended application rates and possible environmental impacts. Funding should also be provided for the continued development of data management systems.

   The legislature should provide increased funding for demonstration projects, including farm, watershed and plot studies on best management practices for reduced chemical use, alternatives and sustainable agriculture.

   Finally, the legislature should provide increase funding for incentives and cost-share efforts. This should include continuation of grants and loans for sustainable agriculture; adding funds for cost-sharing for pesticide and nutrient management and ground water protection practices to existing erosion and water quality cost-share programs, and providing funds and eligibility for ground water protection under the Re-Invest in Minnesota Program.

3. *Resource Evaluation and Research* - The legislature should provide funding for regularized surveys of pesticide use in the state, and require that these be conducted and the results compiled, together with information on state government uses.

   The legislature should further provide funding for monitoring of pesticides and nutrients in the environment, and ensure that the necessary funds are available for the development of standard laboratory procedures for sample analysis.

The legislature should also provide funding for a) continued biological control efforts and establishment of biological control agents, b) research on integrated pest management and alternatives to current pesticide use practices, c) evaluation of existing practices, and d) basic research efforts.

4. *Preventive Planning and Regulatory Efforts* - The legislature should require and fund preparation of a State Pesticide Management Plan to guide state efforts in preventing and responding to contamination. The legislature should further require that a state approach to the promotion of integrated pest management be developed, and support implementation of the approach.

   The legislature should urge adoption of an overall land stewardship approach in all government efforts and programs, and require the use of integrated pest management and planting regimes that minimize the need for pesticides and nutrients by state government. The legislature should further urge the federal government and congress to incorporate resource sustainability and protection into federal farm programs and amendments to the federal farm bill.

   The legislature should authorize a) establishment of a program to regulate the use of fertilizers in irrigation systems, and b) a waste pesticide "clean sweep" program, incentives for use of returnable containers,and development of alternatives for waste pesticide management. Finally, the legislature should clarify the statutory intent regarding aquatic nuisance control permitting requirements, increase funding for overall aquatic nuisance control enforcement efforts, and establish the goal of having all lake management activities be guided by comprehensive plans.

5. *Funding Mechanisms* - The legislature should ensure that stable funding mechanisms are provided for strategy implementation. They should reaffirm the use of fees to support administration and enforcement of the Pesticide Control Law, and should ensure that all persons who benefit from the use of pesticides and nutrients contribute to the costs of protection efforts by imposing taxes on products and non-returnable containers. Finally, they should establish funding mechanisms for cleanup efforts and disposal of waste products and containers.

Appendix A: Abbreviations and Definitions

ASCS	USDA Agricultural Stabilization and Conservation Service
BWSR	Minnesota Board of Water and Soil Resources
EQB	Minnesota Environmental Quality Board
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
IPM	Intergrated Pest Management
LCMR	Legislative Commission on Minnesota Resources
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
DNR	Minnesota Department of Natural Resources
MnExt	Minnesota Extension Service
MPCA	Minnesota Pollution Control Agency
SCS	USDA Soil Conservation Service
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture

Integrated Pest Management

Integrated pest management, or "IPM," means use of a combination of approaches to keeping pests below levels where they do economic damage to crops.

IPM is an approach which emphasizes use of natural pest controls. It stresses finding and taking advantage of the weak links in life cycles of pests. It utilizes man-initiated actions only when it is likely that a pest population will cause economic losses. This requires regular field scouting of pests, maintaining conditions which are unfavorable to pests, and routine analyzing of potential pest problems, based on knowledge of each pest and its natural enemies.

Pesticides may be used in IPM, but only after systematic monitoring of pests and the success of other control factors indicate a need. The point is not to completely eliminate pests, but rather to keep them below the threshhold where they do economic damage.

Sustainable Agriculture

Sustainable agriculture is agriculture designed to be self-reliant, resource-conserving and productive in both the short and long term. To be sustainable, agriculture must be ecologically sound and economically viable, taking into account hidden costs such as those associated with ground water contamination. It also must recognize social values like the need for fair wages, a safe working and home environment, and stewardship of the land. Sustainable agriculture must be tailored to each locality.

Land Stewardship

An approach to the management of our lands which recognizes that the same land that is now in one person's care will soon pass on to care by others, and that the present owner, therefore, has a responsibility to society for the way the land is used and the care it receives. This approach acknowledges the need to leave land in as good or better condition as when received, and to manage land in such a way as to assure that it will continue to provide benefits over the *long run*.

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Strategy Development Process

This "Strategy for the Wise Use of Pesticides and Nutrients" is the result of a one and one-half year planning effort of the Environmental Quality Board (EQB) Water Resources Committee (WRC). Input was provided by numerous agencies and individuals in its development.

The EQB Water Resources Committee

In November 1985, the Environmental Quality Board (EQB) established the EQB Water Resources Committee (WRC) to examine state water resources issues and develop a comprehensive state water resources strategy to safeguard the public health and preserve the quality of life for present and future generations. As part of that process, WRC developed a twelve-point water program, "Protecting Minnesota's Waters", containing recommendations for actions needed in the period from 1987 to 1989. These recommendations acknowledged the need for continued interagency efforts to address issues associated with protecting water resources from all toxic substances, including pesticides and nutrients.

Following from these recommendations and amid emerging reports on the occurrence of pesticides and nitrates in ground and surface waters in Minnesota, the WRC resolved to lead an interagency effort to develop a strategy to ensure that pesticides and nutrients are used in a manner that safeguards Minnesota's water resources.

Developing the Strategy

WRC's approach in developing a water resources strategy for the wise use of pesticides and nutrients has thus far involved five main steps:

1. Identifying and evaluating current state and federal responsibilities and authorities related to pesticides and nutrients;
2. Evaluating other states' efforts to deal with pesticide and nutrient contamination issues;
3. Delineating the major pesticide and nutrient contamination and management issues facing Minnesota;
4. Developing possible options available for addressing the major issues, and the basic policies to direct the strategy; and,
5. Developing a proposed strategy, based on the input received on the options.

The WRC Technical Committee, an interagency technical advisory committee comprised of representatives of key state agencies, assisted WRC in carrying out these steps. Work products of these efforts included two reports ("Pest and Nutrient Management and Water Resources: Federal and State Authorities" and "Pest and Nutrient Management and Water Resources: Programs of Other States"), a paper identifying twelve issue areas requiring further exploration, and individual papers delineating the options available to address the problems associated with the twelve identified issue areas.

The twelve issue areas identified for further exploration were: education/ information, integrated pest management/biological control, irrigation, local restrictions/local controls, spills, environmental review, coordination/integration, risk assessment/standards, monitoring, fate/practice impacts, aquatic environment use, container and unused/unwanted products.

In March 1988, a report describing the identified options was completed. The purpose of the report, "Water Resources Strategy for the Control of Pests and Management of Nutrients: Public Review Draft, the Options" (options report), was to solicit public input in selecting options for the strategy. The comment period on the report ran through the end of May.

Based on the comments received and subsequent discussions at WRC, WRC Technical Committee, and EQB meetings in June, July and August, the proposed strategy was prepared. The strategy will be presented to EQB for consideration in October. Once the strategy is adopted by EQB, it will be used as a guide for the development of state programs and proposed legislation.

Public Involvement

Steps taken to involve the public in development of the strategy included 1. creating of a special interests mailing list, 2. holding public meetings throughout the state, and 3. forming a special Advisory Committee on Ground Water Protection. In addition, press releases and notices concerning the strategy and options report were issued to newspapers throughout the state and placed in the "EQB Monitor".

A list of over ninety interested parties was created, with the assistance of the Minnesota Department of Agriculture. The individuals and organizations on this list were solicited for ideas on the issues to be explored and received notices of the public meetings, availability of draft documents, and review periods.

Public meetings were held in cooperation with the PCA in April 1988 in eight cities: Rochester, Mankato, Marshall, Morris, Grand Rapids, Detroit Lakes, St. Cloud and St. Paul. The purpose of the meetings was to give the public an opportunity to hear about the strategy development efforts, to voice opinions and concerns, and to obtain a copy of the options report. Over 600 people attended these meetings.

In addition to the comments received at the public meetings, WRC received recommendations and comments on the options identified from 35 individuals or organizations. These included comments from environmental groups, governmental entities and a compilation of comments jointly submitted by sixteen agricultural organizations. WRC also received over 400 general letters from citizens urging continuation of efforts to protect ground water from contamination.

EQB Advisory Committee on Ground Water Protection

The EQB appointed an Advisory Committee on Ground Water Protection in January 1988 to review the draft "Ground Water Protection Strategy" and the pesticide and nutrient management options report, and advise EQB on adequacy, policy choices and directions. The committee was composed of a diverse membership representing farmers, industry, local governments, researchers, and citizen groups.

The committee adopted unanimous recommendations, which were presented to EQB in June. The committee's deliberations and recommendations have been instrumental in shaping the proposed "Strategy for the Wise Use of Pesticides and Nutrients". Their recommendations are contained in "Report of the Environmental Quality Board Advisory Committee on Ground Water Protection", and are summarized in a memorandum to EQB contained in this appendix.

Environmental Congresses

Finally, the proposed strategy will be one of the subjects of discussion at a series of Environmental Congresses being held by EQB in September and October in five Minnesota cities. These congresses will give the public a further opportunity to comment on approaches to protecting the state's water resources, and will help to shape the final strategy and legislative directions.

June 16, 1988

To:Environmental Quality Board

Fr:EQB Advisory Committee on Ground Water Protection

Re:Committee Report

The Report of the EQB Advisory Committee on Ground Water Protection is attached. Our Committee recognizes the importance of the Ground Water Protection Strategy and the Strategy for the Control of Pests and the Management of Nutrients and offers its support for passage of the legislative package needed to carry them out.

We would like to highlight our major recommendations. The Committee:

- Strongly supports implementing these strategies. Members are concerned about problems resulting from the control of pests and management of nutrients, as well as contamination from other sources, such as improperly constructed wells or leaking storage tanks.

- Recommends that there be a preamble to the two strategies that provides a context for the two strategies. In addition, this preamble should provide highlights of both strategies, and convey a sense of urgency for implemention.

- Recommends that prevention of further contamination be the cornerstone of Minnesota's ground water protection efforts. In addition, cleanup of appropriate areas should continue to be an important part of Minnesota's efforts.

- Supports Minnesota having nondegradation (meaning prevention of further contamination) for a goal in order to have continued movement toward improvement of ground water quality.

- Supports Minnesota revising and updating the current framework that establishes the degree of actions required. This framework would include numerical limits, or a process for developing them, as a way of gaging the severity of contamination, identifying appropriate preventive actions, and defining clean-up requirements.

- Recommends applying water quality protection to all ground water. It does not support "writing off" any aquifers. Special protection should also be given in areas sensitive to ground water contamination.

- Recommends that the strategies need to be carried out as a whole, since no single effort, whether it be education, research, monitoring, incentives, coordination, or regulation can alone achieve the desired results.

- Recommends the creation of a Joint Legislative Commission on Water. This Commission would create a focus at the legislature for water issues and programs and complement the coordinating function of the Environmental Quality Board. This Commission could also evaluate the present state structure for its effectiveness in carrying out the strategies.

- Recommends that the Environmental Quality Board (EQB) continues its strong role relating to water issues. The EQB should also take a lead role in ensuring that state programs, rules, and other activities recommended in the strategies are communicated to local government.

- Recommends that the state significantly increase funding for local water management activities, since local government has an essential role in protecting ground water.
- Recommends that the funding needed to carry out the strategies be a combination of broad based (all potential beneficiaries) and those related to specific impacts on water. Every user of water should pay the costs of general, statewide functions, such as coordinating, education, and research. Special taxes or fees should be used to underscore the relationship between specific activities and problems or benefits.
- Recommends the state obtain information to characterize aquifers in terms of quantity and quality. To do this, the state must establish clear goals for information needs that outline the purpose, scope, value, and coordination efforts.
- Recommends that state ensure water resources data compatibility between agencies and with local government. It should have clear goals that outline the purpose, scope, value, and coordination efforts of its monitoring programs. Water testing should be required at real estate transfers.
- Recommends that in considering the Strategy for the Control of Pests and Management of Nutrients, the state must recognize the significant role the federal farm programs play in shaping agriculture practices, and work to impact the direction of the new federal farm program as it is drafted in 1989 or 1990.
- Recommends a research project to better evaluate the number of abandoned wells, the priorities for sealing, and the methods and process for sealing.

The enclosed Committee Report contains more information about each recommendation as well as a number of specific recommendations about portions of the strategies.

EQB Advisory Committee on Ground Water Protection

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NONPOINT SOURCE - GROUND WATER STRATEGY

APRIL 1988

MINNESOTA POLLUTION CONTROL AGENCY

DIVISION OF WATER QUALITY

PROGRAM DEVELOPMENT SECTION

3-30-88

Nonpoint Source Ground Water Strategy

Outline of Assessment and Recommendations

I. Executive summary of Governor's Issues Team report and purpose of the strategy.

II. Statewide potential ground water polluting land use activities

A. Introduction and Overview

B. Potential of specific activities to impact ground water

Topic 1 Pesticides

Topic 2 Fertilizers

Topic 3 Animal Waste

Topic 4 Urban Infiltration and Construction

Topic 5 On-site Sewage Treatment and Septage

Topic 6 Hydrologic Modifications

Topic 7 Underground Injection

Topic 8 Junkyards and Backyard Dumps

Topic 9 Stockpile Storage

Topic 10 Point Source Topics Not Considered

C. Recommendations

1) Research and monitoring

2) Information and education

3) Regulation

4) Funding

III. Controlling NPS Pollution through Best Management Practices

A. Overview

B. Minnesota Clean Water Partnership Program

C. Federal Clean Water Act - Section 319

D. Wellhead Protection Program

E. MPCA Experiences from current resource focused efforts

IV. The process for identifying and developing ground water protection BMP's.

Appendix

- Ground water matrix used to select topics
- State assessment of ground water resources

A. 305 (b) report

B. Regional water quality trends in surficial sand and gravel aquifers.

I. EXECUTIVE SUMMARY OF THE NOVEMBER, 1986 GOVERNORS ISSUES TEAM REPORT

Nonpoint sources of water pollution are the major reason that a number of Minnesota surface and ground waters are not clean enough to support desired uses, ranging from drinking water to fishing, swimming and boating.

The 1972 Clean Water Act established a nationwide goal to restore and maintain the chemical, physical and biological integrity of the nation's waters. This is a goal that the State of Minnesota is committed to achieving and maintaining.

A twelve year tread analysis indicates that water quality impacts from municipal and industrial point sources are declining as a direct result of improved wastewater treatment. However, nonpoint sources of pollution continue to degrade water quality, particularly in highly agricultural areas of the state. Many human activities and land uses result in pollution when nutrients, sediment, bacteria, toxic chemicals, and other pollutants are carried from agricultural and urban areas into surface and ground water.

Nonpoint sources of pollution are defined as land management or land use activities that contribute to pollution as a result of runoff, seepage or percolation and are not defined as point sources under Minnesota Statutes Section 115.01, subd. 15. This definition includes rural and urban land uses, as well as specialty land uses such as transportation, and recognizes that both surface and ground water can be affected by nonpoint sources of pollution.

Major sources of nonpoint source pollution include: agricultural runoff; pesticide and fertilizer use; feedlot runoff; urban runoff from streets, yards and construction sites; leachate from septic systems; runoff from forestry and mining activities; highway de-icing chemicals; dredging and drainage activities; and the impacts from the loss of wetlands.

These sources of pollution result in a wide variety of water resource use impairments ranging from reduced recreational opportunities from degraded fisheries, impaired boating and loss of swimming opportunities, increased treatment costs for industrial and consumptive uses, to loss by toxic contamination.

Degradation of water quality from nonpoint sources of pollution may be the most serious and complex environmental problem in Minnesota today. It encompasses a wide range of pollutants generated by a large number of sources and causes serious impacts and use impairments of surface and ground water quality across the state.

Recognizing the seriousness of this problem, the Energy/Environment/Resources Subcabinet approved the charge to the Nonpoint Source Pollution (NPS) Issues Team, "to develop recommendations for a state and local program to protect and improve the water quality of Minnesota's lakes, rivers and ground water through control of nonpoint sources of pollution."

Nonpoint source - Ground Water (NPS-GW) Strategy

The objective and charge of the strategy is to:

1) Further identify statewide ground water problems associated with nonpoint source type land use activities.

2) Strengthen ground water concerns mentioned in the Issues Team Report by further addressing the potential for specific NPS activities to pollute ground water.

3) Provide recommendations in the areas of: 1) Research and monitoring, 2) Information and Education, 3) Regulation, and 4) Funding.

4) Discuss a resource focused ground water management approach.

II. STATEWIDE POTENTIAL GROUND WATER POLLUTING LAND USE ACTIVITIES.

The intent of this document is to continue previous efforts. Therefore, the following topics are similar to the topics presented in the Issues Team Report. The purpose of this strategy was not to separate surface water, and ground water issues, but enhance the Issues Team Report by clarifying more of the ground water concerns.

The process began by identifying the universe of potential polluting land use activities. Evaluation categories were created to discuss what activities should be included under the NPS-GW strategy. These categories included: A) impacted area, B) type of pollutants, C) related hydrologic characteristics, D) severity of both the individual and collective impacts of the activity, E) type of regulation, F) type of program management and funding, G) source type, and lastly, H) overall priority rating.

The selection of topics discussed in this report is not necessarily tied to the source type being point or nonpoint, i.e., drainage wells-a clear example of point source. The key factors used to determine which activities to include in this NPS-GW Strategy are regulation and management. Regulation from the perspective of current authority to prevent pollution, i.e. solid waste rules. Secondly, does the rule have sufficient resources to do an adequate job of managing the potential polluting land use activity. For example, the feedlot program has been established at the MPCA since 1975 with Mn. Rule Chapter 7020 as the enforcement tool. However, the program has never had enough resources to regulate all 90,000 feedlots in Minnesota. By contrast, there are many ground water pollution situations where there has not been an established program and associated regulatory tools. Yet, Superfund has stepped in to address the problem. Another example would be the new underground tank program which will create regulatory tools and management necessary to control pollution from under ground storage tanks scattered throughout the state.

Lastly, the format of discussion focuses on the potential of specific activities to impact ground water. A general area is listed under the topic heading with specific land uses listed under the activity heading. Where needed, some background information has been given to help the reader understand how the land use could pollute ground water. Recommendations for future action of each topic area are stated following discussion of the activities' potential to impact ground water.

TOPIC 1 PESTICIDES

Overview

Pesticides are used for a variety of land use activities in Minnesota; including cropland, rangeland, turf, forests, and acuatic environments. In 1983 approximately 76 percent of Minnesota's cropland was treated with pesticides. Pesticides sales exceeded $250,000,000 for that year. No estimate exists for the amount spent on pesticides used in urban areas.

During the late 1970's the potential threat of pesticides leaching to ground water was recognized. Since then, detections of certain pesticides have been found in many of Minnesota's aquifers. There is great variation in the susceptibility of an aquifer for contamination from leaching pesticides. Leaching depends on the climate, geology, and soil properties (e.g. soil texture, structure, porosity, moisture, and organic matter content). Major differences exist in the chemical properties of pesticides which control their tendency to leach to ground water. These properties include their solubility in water, adsorption to soil, volatility, and soil dissipation. Soil dissipation is a function of a pesticide's ability to breakdown and transform with sunlight, water, and microbes. Some pesticides degrade too quickly or move too slowly in soil to be considered much of a leaching threat to ground water with normal application; however, others have the capability to move into aquifers rapidly.

In addition to leaching, pesticides may enter ground water by surface runoff into sinkholes, surface waters that recharge ground water, or improperly abandoned, granted, sealed, or cased wells. It is possible for pesticides to impact ground water during manufacture, distribution, storage, application, cleanup, and container disposal.

Pesticides vary considerably in their toxic effects upon humans and other vertebrate animals. In general, insecticides in drinking water pose a more serious health threat to man than herbicides. However, concentrations of herbicides, insecticides, and fungicides being found in wells have a potential for chronic health effects; which may include cancer, mutations, immunological changes, and birth defects. Currently, their is need for more information on health effects of certain pesticides to humans, risks associated with drinking water with low levels of various pesticides, and synergistic effects associated with drinking water with several different pesticides or pesticides and nitrate.

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1. Agricultural Application. In 1983 Minnesota farmers applied pesticides to 97% of their soybean and sugarbeet acreage, 95% of corn acreage, 94% of flax acreage, 93% of sunflower acreage, 92% of wheat acreage, 56% of small grain acreage, 1% of hay acreage, 2% of pasture acreage, and 30% of cropland idled by government programs.* When multiple applications were considered, herbicides accounted for 9 out of 10 acres treated. Insecticide usage was dominated by corn pre-emergence insecticides, which accounted for 67% of total treatment for insect pests. Few farmers applied

* Data from "Pesticides Used on Minnesota Farms," MN Agricultural Statistic Service. April 1984.

insecticides to a crop more than once. Most sugarbeet acres were treated with multiple applications of fungicides.

Pesticides are applied to Minnesota crops by aerial spraying, topsoil application (granular, [illegible]t, or liquid formulation), soil injection, soil incorporation, or through irrigation waters. Soil injection and incorporation are generally considered to pose the greatest likelihood for leaching to occur. However, topsoil application and spraying will result in greater amounts of pesticides running off the soil surface. In areas with sinkholes or improperly constructed or abandoned wells, it is possible that surface runoff of pesticides may threaten ground water more than leaching of injected pesticides. Aerially applied pesticides can move by wind into ditches and surface water bodies where the water may eventually recharge ground water.

It has been estimated that 20 to 50 center pivot irrigation systems (less than 2 percent of all systems) are used in any one year in Minnesota to apply insecticides and fungicides.** Herbicides are not generally being applied with irrigation systems in Minnesota. Principal concerns with chemigation are possible back-siphoning of the chemical solution down the well, leaks in the chemical feed line or from chemical storage tanks, and spillage around the well. Also, since irrigated soils often have a relatively high permeability, there is a

** Data from personal contact with Jerry Wright, Area Extension Agricultural Engineer, West Central Experiment Station-Moris, Minnesota.

potential for pesticides to leach through the soil with percolating irrigation water and subsequent rainfall.

In addition to the method of pesticide application, other factors that influence leaching of pesticides include: type of pesticide used, rate area at low concentrations which may build up over the years of pesticide use. At the present time, there are no easy techniques available for cleaning up contamination that involves a large geographical area. Therefore, prevention is the key to controlling pesticide concentrations from these diffuse sources.

Activity 2. Forestry Application. Forest application of pesticides in Minnesota was summarized in a quarterly update of the forest vegetation management cooperative.* From 1983 to 1986 herbicides were applied to an average of 29,167 forested acres in Minnesota by 2 state agencies, 4 federal agencies, 10 counties, and 4 industrial firms. In 1986, sixteen percent of the 28,421 acres of forested land where herbicides were being used were applied by private of application, timing of application, and cultivation practices. Generally, contamination from application of pesticides to cropland extends over a wide industry. In the period between 1983 and 1986 approximately 69 percent of the herbicides applied to forested acres were used for release and 31 percent for site preparation. The most commonly used herbicides in forested areas are glyphosate, hexazinone, picloram, 2-4-b, sulfometuron methyl, and triclopyr. Many other pesticides are applied to a limited extent.

*Forest vegetation Management Cooperative, Vol. 1, No. 2, June 1987.

There has been a decrease of aerial application in recent years. In 1983, 73 percent of all herbicides were applied to forests by air and 27 percent were ground applied. By 1986, only 35 percent of herbicides were applied by air.

Forest applied pesticides may impact ground water by leaching through forest soils or by entering ponds, wetlands, and other surface water bodies that could potentially recharge ground water.

The Minnesota Department of Natural Resources (MDNR) and forest service have recently begun to analyze ground water impacts due to hexazinone application to forests. More studies and monitoring efforts are needed on the other forest applied pesticides.

Insecticides are applied on orchards and nurseries for control of pests such as the gypsy moth. There is a potential for these pesticides to leach into ground water or to runoff into wells.

Activity 3. Turf Application. There is no accurate estimate of total pesticide use in urban areas for home lawns, golf courses, parks, and other public and commercial landscaping. Pesticides applied to lawns are used primarily for pre-emergence and post-emergence crab grass control and post emergence broad leaf control. Insecticides are also applied less frequently for control of lawn insect pests.

While the impact of a single lawn may not pose a significant threat to ground water, the collective sum of lawns in urban environments receiving pesticides may be great enough to impact ground water quality. Pesticide leaching could likely be greatest in heavily watered sandy soils. Private wells are often surrounded by turf, and thus there is potential for lawn applied pesticides to be transported to ground water through improperly sealed wells. Little information is known about the impact pesticides applied to turf are having on ground water quality in Minnesota.

Insecticides and fungicides are applied in urban areas to trees and gardens. The impact of these pollution sources are also unknown.

Activity 4. Aquatic Environment Application. Pesticides are commonly applied to aquatic environments for mosquito and fly abatement and for control of aquatic nuisances. Pesticides used for fly and mosquito control are applied primarily in the seven county metro area and in other scattered urban areas. The insecticides are applied primarily by helicopters or trucks. Insecticides that are used for fly and mosquito control are quick to degrade, lasting from less than a day to up to 150 days. However, since some of the marshes, ponds, and wetlands that receive insecticides recharge ground water, it is possible that this practice may be impacting ground water. Certain insecticides being applied photo-degrade. This degradation would be slowed upon entering soil or ground water. Insecticides used in water bodies must generally pass a higher level of EPA standards.

Aquatic nuisances in Minnesota lakes may be caused by excessive growth of rooted aquatic plants and algae, leeches, or large numbers of snails that carry the organism causing swimmer's itch. Pesticides are used to control each of these nuisances. In 1986 71,000 tons of cooper sulfate were applied to Minnesota lakes to control algae and other pests. Other pesticides that can be legally applied include Diquot, hydrothal, erdathal, and aquathal.

Proper use of copper sulfate and other approved herbicides have not been demonstrated to adversely impact ground water; however, more studies may be needed. Illegal application of pesticides to surface waters is suspected. The illegal pesticides are persistent and tend to bio-accumulate. Therefore, illegal use of pesticides in lakes may have serious consequences to both surface and ground water quality.

Activity 5. <u>On Site Loading, Cleanup and Disposal</u>. Ground water contamination may result from small but frequent spills at pesticide mixing, loading, and rinsing areas on the farm field. Rinsate from the cleaning of spray equipment may be washed into the soil; the large amounts of pesticides and infiltrating water involved in cleaning may increase pesticide leaching. Frequently mixing, loading, and rinsing operations are done near barns or sheds which are often in the general vicinity of farm wells. Surface runoff into improperly sealed wells could result in high pesticide concentrations in the underlying aquifer(s).

Unrinsed pesticide containers that are dumped on land will eventually corrode and release high concentrations of pesticides to the environment. Extremely high levels of pesticides enter ground water when unwanted or unused pesticides are improperly disposed. Currently, proper disposal of unwanted or unused pesticides is prohibitively expensive for many pesticide users.

Activity 6. Manufacture and Bulk Storage. Rinsate originating from pesticide storage and handling facilities in rural towns can impact ground water by running off into sinkholes, abandoned wells, or leaching through the soil. The magnitude of this problem is unknown.

Accidental spills and leaks of pesticides at manufacturing facilities and at other establishments where bulk pesticides are stored and handled are generally considered point sources of pollution. A variety of federal and state environmental laws and regulations contain provisions to prevent contamination from these point sources. Should contamination occur, it can usually be characterized as a concentrated plume that is relatively localized.

Activity 7. Other Applications. Herbicides are also used in pastureland, ditches, and feedlots to control weed growth. Ground water can be impacted from these sources by any of the transport paths previously discussed (e.g., leaching, discharging surface water, improperly sealed wells, etc.). Little information is available as to the amounts of pesticides used for these types of land uses.

RECOMMENDATIONS

1. Refer to the Pest and Nutrient Management and Water Resources Strategy recommendations options.

TOPIC 2 COMMERCIAL FERTILIZERS

Overview

Of the state's approximately 54 million acres of total area, land in production accounts for 30 million acres, with cropland being about 23 million acres. Fertilizers are applied on most of the 23 million acres of cropland. Additional fertilizers are applied to turf (residential lawns, golf courses, parks, etc.), tree nurseries, and gardens. The three primary nutrients that are formulated and applied to soil for increased plant growth include nitrogen, phosphorus and potassium. Magnesium, calcium, sulfur and other micro-nutrients are applied in lesser amounts in localized areas.

Phosphorus (P) and potassium (K) in ground water are not generally considered a health threat. However, when ground water with high relatively phosphorus concentrations discharges into a lake directly or indirectly via streams, it can lead to increased algal populations and weed growth. Both phosphorus and potassium fertilizers are usually attenuated by the soil, and thus have a low susceptibility to leaching to ground water. Of the three primary nutrients, nitrogen has the greatest potential to have adverse effects on ground water quality.

From the basic compound, NH_3, many different fertilizer nitrogen compounds are manufactured. Fertilizer that is not already in a nitrate form can be converted by bacteria into nitrate. Due to its negative charge and high solubility, nitrate has a high potential to leach (i.e., move downward in the soil with percolating water).

The rate of leaching is variable, depending on such factors as soil texture, soil structure (eg. macropores), amount of rainfall or irrigation, and timing of nitrogen inputs in relation to use by plants. In addition to leaching, nitrate can reach ground water by direct channeling of surface water into improperly sealed or cased wells, agricultural drainage wells, or sinkholes.

Nitrate-N in drinking water at concentrations above 10 mg/l have caused a serious blood disorder known as methemoglobinemia or "blue baby syndrome" in infants less than six months of age. When infants ingest nitrate, methemoglobin is formed in the blood. This blocks the formation of blood's oxygen carrier hemoglobin. Methemoglobinemia can result in death. High nitrate concentrations in drinking water have also been implicated in such problems as cardiovascular disorders, hypertension, increased cancer rates and congenital malformations. Further studies are needed on these chronic adverse health effects. Livestock that drink water with high nitrate concentrations have been reported to have suffered poor growth, infertility problems, abortions and general unhealthiness.

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1. Agricultural Application. Between 0.8 and 1.3 billion pounds of nitrogen fertilizers were applied to Minnesota cropland annually between 1980 and 1986. Due to inaccurate assessments of legume-N and manure-N, and to unrealistic yield goals, nitrogen fertilizers are often greatly over-applied. Nitrogen fertilizer that is applied in excess of the plants ability to use this nutrient nitrogen may be lost to the soil water and ground water below the rooting zone or to the atmosphere. In addition to nitrogen fertilizer application rates, several other farm management practices will influence the amount of leaching nitrate. These factors include: type of fertilizer used, timing of application(s), placement of fertilizer, tillage practices, and irrigation management. There is a need to continue research on how to best manage fertilizers and cropping systems to minimize leaching of nitrate into ground water. It is also very important to educate fertilizer applicators on the most up to date "Best Management Practices" regarding fertilizer application.

One method used to apply agricultural fertilizers in Minnesota is through irrigation systems. Roughly 75 percent of the 4,000 irrigation systems in Minnesota are equipped to inject fertilizer into irrigation water. However, the higher cost of the required liquid N fertilizer often discourages farmers from using irrigation systems for fertilizing. Most operators use irrigation equipment to apply the last 1/6 to 1/3 of the crops total nitrogen needs. For corn this is commonly 20 to 60 pounds applied in one to three applications. This accounts for a very small percentage of N fertilizer use in Minnesota. Contamination of ground water due to nitrogen fertilizer applied through irrigation waters may occur primarily by accidental backflow or siphoning of chemicals down wells, and leaching through the soil with irrigation water and subsequent rainfall.

While improper irrigation management may contribute to ground water contamination, research has shown that N application via irrigation to supply a part of a crops nitrogen needs can be a best management practice on sandy soils where rapid percolation exists.

Activity 2. Turf Application. Fertilizers are used extensively on turf for home lawns, golf courses, parks, and corporate lawns to maintain and improve landscape quality and beauty. Although individual areas of application are usually small relative to agricultural fields, the total area of fertilized turf in urban and suburban environments is great enough to present a potential threat to both surface and ground water. Ground water contamination from lawn fertilizers may occur primarily in three ways: 1) leaching through the soil, 2) runoff into improperly sealed wells located in the fertilized area, and 3) infiltration from stormwater collection systems.

Due to extremely high root length densities, an established lawn can rapidly absorb fertilizer nitrogen. However, when fertilizer application rates and infiltration rates exceed the ability of turf to use the nitrogen, leaching of nitrate can result. The primary concern is for leaching of nitrogen fertilizers to ground water in sandy soils that are heavily watered. Leaching nitrate from starter fertilizers can also be a problem in lawns that have been recently seeded and are not well established. Very little ground water monitoring has been done in Minnesota under areas where turf fertilizers are being used.

Activity 3. Manufacturing, Storage and Handling. Spills and rinsate runoff at fertilizer manufacture, storage or handling facilities could reach ground water by leaching, or running off into sinkholes and improperly sealed wells. Several Minnesota rules and statutes have been written which grant responsibilities to state agencies to handle spills related to fertilizer storage, manufacture, and handling. However, it is possible that many smaller spills go unrecognized. Of special concern is the storage of 28%-N solution. Distributors often store this corrosive liquid fertilizer throughout the winter so that it may be applied during the spring. It is often difficult to check the contents in storage to insure that there are no leaks in the system. Leaking 28%-N solution has a high potential to rapidly leach into aquifer systems.

Activity 4. Other Applications. Nitrate contamination of ground water may result from nitrogen fertilizers applied to gardens, orchards, tree nurseries and sod farms. The extent of ground water contamination from these sources is unknown.

RECOMMENDATIONS

Refer to the Pest and Nutrient Management and Water Resources Strategy recommendation options.

TOPIC 3 ANIMAL WASTE

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1. Feedlots. A typical feedlot consists of some form of confined area where manure will accumulate for a period of time. An outdoor facility may have some concrete pad to facilitate manure handling, but many feedlots exist over bare soil. Soil type is an important variable affecting movement of pollutants in manure to ground water. However, due to the sealing ability of manure other variables have a greater impact on contamination of GW from feedlots or leaching directly below the feedlot is not as great of a concern. The degree of animal activity or inactivity has an effect on biological breakdown of the seal. Feedlot start up and area of compaction affect the rate of seal development. Runoff to areas adjacent to the feedlot which have higher infiltration rates may be the primary pollutant recharge areas. Pollutants of primary concern are nitrogen, phosphorus and bacterial/viral pathogens. The relative area of impact may be small, yet the concentrations of pollutants will be relatively high compared to manure land application. A plume in the ground water could be small and narrow and directly impact a lake or domestic water well.

Activity 2. Manure Storage. Typical manure storage in Minnesota consists of an earth basin, concrete pit or above ground slurry store. The earthen basins generally have a higher potential for seepage and subsequent ground water pollution. Yet, in a study conducted for the MPCA in 1980*, the manure was found to be behave more like a sealant. Problems appear to occur where the seal desiccates and fracture zones are created, allowing rapid transmission of pollutants beyond the biologically created seal. Plumbing failures have resulted in both surface and ground water pollution with above ground tanks. Generally, concrete pits work ideally, except when they are not properly managed and the manure overflows the pit. The pollutants are the same as feedlots. The area of impact is approximately the same as feedlots. However, given a catastrophic collapse of soil and carbonate rock under a storage facility in S.E. Minnesota, the area of impact would become significant.

Activity 3. Land Application. Land application of manure is common practice in Minnesota. Land application of manure for its fertilizer value is effective resource recovery from a waste product. Yet, proper land application practices have not been widely used because the nitrogen content is often not understood by those applying manure to land. Over application of manure or a combination of manure and nitrogen fertilizer is common. In areas with high animal populations, such as S.E. Minnesota, over application may be the key reason for elevated nitrate levels in ground water. Other pollutants may be present, yet the incidence of detection for biological

*Dalen, L. 1980. Ground water investigations near animal manure ponds submitted to MPCA by Barr Engineering Co., Minneapolis, Minnesota pollutants is highly variable. The area of extent, at a minimum, is field scale and usually more regional depending on the region's animal density.

RECOMMENDATIONS

1. Research and Monitoring

It is recommended that USGS, U of M in cooperation with MDA and MPCA further evaluate N-isotope-technology as a diagnostic tool to assess sources of nitrogen in ground water.

It is recommended that the U of M, in cooperation with MPCA, and USGS study potential ground water impacts under different manure management scenarios.

It is recommended that the U of M develop a manure/soil testing program to better assess available nitrogen and account for environmental losses.

2. Information and Education

It is recommended that Minnesota extension service further develop informational material to explain the findings of current animal waste/ground water related research.

3. Regulation

It is recommended that a ground water hydrologist be added to the MPCA feedlot program to provide ground water review.

It is recommended that more counties be drawn into the feedlot program.

4. Funding

It is recommended that state funding be provided for the above referenced staff position.

It is recommended that ASCS and state funding be made available to counties to manage a county feedlot program.

It is recommended that LCMR funding be sought to conduct the activities listed under research and monitoring.

TOPIC 4 URBAN INFILTRATION AND CONSTRUCTION

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1. Runoff seepage basins. In the past, the major concern of parking lot runoff was water volume, sediment, and nutrient impacts on a receiving body of surface water. Large volumes of water may tend to increase flooding problems, nutrients will accelerate lake eutrophication, and sediments may destroy fish spawning areas, as well as decrease dissolved oxygen levels. Because of these problems, parking lot runoff is often kept on-site in large catchment basins. These basins are designed to allow the runoff to gradually percolate into the soil. Soils generally provide excellent treatment of the nutrients and sediments contained in the runoff water. Recently, however, there has been much concern over other contaminants which are contained in the runoff. These contaminants, including certain heavy metals, toxic organic chemicals and deicing salts, can cause health problems.

Parking lot runoff contains a variety of compounds. Typically the aromatic hydrocarbons, and heavy metals from gasoline and crank case oil can be transported into ground water via seepage basins. Little research has been done to assess the magnitude of the problem.

Activity 2. Construction. Runoff waters from construction activities carrying sediment and chemicals can have direct impacts to surface water. However, impacts to ground water are less obvious. Not every construction site has a portable satellite to address sanitary concerns. Disposal of refuse, paints and solvents sometimes occurs on site. Small scale leaks and spills of petroleum hydrocarbons at the construction site can also be easily covered over with soil. There is potential for many pollutants to remain behind when the construction crew leaves. The unsuspecting property owner may end up with a contaminated well or contaminate his neighbors well.

Another example would be cut/fill of earth such that ground water recharge is altered or subsurface flow patterns may be altered so as to flood a previously dry basement or drainfield. In southeastern Minnesota, construction activities can alter the surface and ground water flow regimes by creating new sinkholes, allowing sediment and other debris to enter ground water. Sediment, along with its attached chemicals, has been reported in domestic water wells in loess covered uplands of southeastern Minnesota.

RECOMMENDATIONS

1. Research and Monitoring

   It is recommended that the MPCA in cooperation with the MDOT, Met council or other local units of government conduct some initial studies to further describe and characterize the quality of seepage basin water.

2. Information and Education

   It is recommended that regional DNR hydrologists, local soil and water conservation districts be contacted for technical assistance in reviewing construction plans for possible hydrologic impacts. It is recommended that local community building inspectors receive NPS and Hazardous waste training, such that poor construction site practices can be identified.

3. <u>Regulation</u>

   It is recommended that developers/builders submit to the local unit of government their waste management plan.

4. <u>Funding</u>

   It is recommended that LCMR funds be sought to conduct the above referenced runoff seepage basin study.

TOPIC 5 ON-SITE SEWAGE TREATMENT AND SEPTAGE

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1: Septic tank soil absorption systems (ST/SAS) are used by approximately one-third of Minnesota's residents. Typically, these users are in a rural setting. However, there has been an increasing number of housing subdevelopments in the past decade relying on individual sewage treatment systems. Around popular rural lakes there has been second and third tier development. Individual sewage treatment is not always a viable option do to poor site conditions. Thus, off site large soil absorption systems have proven to be a cost effective alternative.

The potential to pollute ground water exists with any size system. The septic tank is designed to treat and remove primary pollutants, i.e. solids, and BOD. The soil absorption system is designed to further treat the wastewater, i.e. some pathogens and nutrients. However, not everything is treated or removed by ST/SAS. Some nutrients such as NO_3-N, virus', and toxic organic chemicals will move through the ST/SAS and enter ground water. Typically, the lower volume of wastewater delivered to the ST/SAS, the lower the pollutant concentrations will be in ground water, due primarily to dilution. However, large soil absorption systems, or a high density of individual systems can significantly stress the surficial aquifer in a given region. The degree of impact is a function of the cumulative pollutant loading and the specific aquifer characteristics and uses. Further, if the ground water of concern discharges into a lake, there is a potential to impact the lake resource.

Activity 2: Septage. Authorities recommend that the septic tank portion of these systems be pumped or cleaned at least every 2 to 5 years. The pumpings from septic tanks, commonly referred to as "septage", must then be disposed of. Current septage disposal practices in Minnesota involve either land application or discharge to a municipal wastewater treatment plant (MWTP). The Metropolitan Waste Control Commission allows septage to be disposed in any of ten interceptors located throughout the seven county metro area.

Land application of septage can pose a threat to ground water quality if not managed properly. Septage contains nutrients (nitrogen, phosphorus), pathogens (disease-causing viruses and bacteria), and household toxic wastes (benzene, toluene, naphthalene, trichloro-ethylene, trichloroethane). Often septic tank pumpers have only a few parcels of land available to dispose septage on a continuous basis. During winter, pumpers frequently back up to the edge of these parcels and dump without uniformly applying the waste over the entire area. These practices can result in ground water contamination of nitrates, pathogens, and toxic compounds. Minnesota rule Chapter 7040 addresses the land application of municipal sewage sludge. This rule provides a model for how septage could be better regulated.

RECOMMENDATIONS

1. <u>Research and Monitoring</u>

   It is recommended that further study be made by the MPCA of the potential pathways for toxic organic chemicals to reach ground water via ST/SAS.

   It is recommended that maximum ST/SAS densities be developed by the MPCA for various hydrogeologic settings.

2. <u>Information and Education</u>

   It is recommended that the MPCA in conjunction with the ISTS committee, further develop the training workshops for this topic area.

3. <u>Regulation</u>

   It is recommended that MN rule Chapter 7080 be made mandatory statewide.

   It is recommended that after the above research items have been completed that Mn rule Chapter 7080 be revised to better protect ground water.

   It is recommended that the MPCA, along with septic tank pumpers and county solid waste officers, promulgate rules and regulations governing proper septage disposal. The current sludge rules along with examples from other states which have such regulations may be used as a guide. Also, the Environmental Protection Agency is currently drafting regulations which would require states to develop septage management programs.

4. Funding

It is recommended that LCMR or EPA funding be pursued to conduct the items listed under Research and Monitoring.

It is recommended that the legislature act to insure funding for the educational needs of on-site sewage treatment.

It is recommended that the current state grant program for on-site systems be revised to provide grant dollars to counties to better manage their on-site sewage treatment program.

TOPIC 6 HYDROLOGIC MODIFICATIONS

POTENTIAL TO IMPACT GROUND WATER

Activity 1. <u>Wetland Filling.</u> Wetlands that exist primarily due to slowly permeable soils (i.e. terrestrialized as bogs) are valuable for recharging ground water. If the wetland is filled the surface and subsurface runoff flow path is altered. Net recharge will probably be reduced along with an increase in surface runoff to creeks, streams, ditches and lakes. The effect of reduced recharge, means less head to drive water to discharge areas. Less hydraulic head to move water, results in flatter hydraulic gradients potentially allowing pollutants to migrate deeper into the aquifer. With a sufficiently steep hydraulic gradient, pollutants will tend to stay near the top of aquifer. Further, wetlands provide good treatment of downward percolating water. The organic rich and tighter wetland soils can physically and chemically remove some pollutants.

Activity 2. <u>Surface Runoff Reduction Practices</u>. Any practice which reduces surface runoff and increases infiltration, can potentially increase the amount of pollutants entering ground water. It is difficult to predict the trade off between enhanced surface water protection vs. some degree of ground water degradation. This analysis will typically be site specific.

Activity 3. <u>Drainage</u>. (Drainage will not be dealt with in this strategy because the impacts are primarily related to surface water.)

Activity 4. Induced Recharge / High Volume Discharge. High capacity irrigation and municipal wells can alter natural ground water flow. The cone of depression created by pumping can pull pollutants that are near the water table deeper into the aquifer. When the well is not in use then these pollutants will remain at the draw down depth and move with advective flow. With the pollutants at a similar elevation as a domestic water well screen, it is possible for the pollutants to move in a flow stream line toward the domestic water well.

Activity 5. Sinkholes and Losing Streams. Anytime a direct conduit is opened at the land surface, surface water pollutants can be carried directly into ground water. Many sinkholes are filled with sediment, thus they provide some limited removal of pollutants. However, the sediment itself, is not stable and tends to move into ground water. Sinkhole formation occurs often in S.E. Minnesota, many of these conduits are small and often refill themselves via sediment transport. Sinkhole formation is a dynamic process.

Another phenomenon that occurs in S.E. Minnesota is losing streams. A losing stream is a stream that recharges ground water. Typically ground water will discharge into a stream and feed the stream causing it to gain volume. However, where upper carbonate aquifers (i.e., galena) discharge their water above a confining bed, a spring will occur and create a stream. This stream may cut down through the confining bed and either disappear via a sinkhole or eventually go dry via seepage and evaporation losses. These losing streams will carry pollutants along their flow path, either above or below ground.

Activity 6. Acid Precipitation. Aci rain can impact ground water by altering existing soil chemistry. Soils naturally hold many different organic and inorganic compounds. If the pH of soil water is reduced, often the soil will release some of these compounds, including heavy metals, which could move down into the ground water.

Activity 7. Ground Water Impacts on Surface Water. Some lakes are primarily controlled by ground water. If the ground water contains high phosphorus ornitrate, either from agriculture, on-site sewage or natural the lake could be impacted.

Activity 8. Radioactive well water. The practice of drilling deep wells into cambrian or precambrian formations may yield nitrate free ground water; however, zones of high radioactivity may be tapped by the construction of the water well.

Radium* is a naturally occurring element that is formed from the radioactive decay of uranium. There are two (2) isotopes of concern; radium 226 and radium 228. Radium 226 has the longest half-life, 1,620 years. A half-life is the time it takes for an isotope to decay to one-half its level. Uranium occurs widely throughout the geologic environment although usually it is in minute quantities. Since radium is a product of the decay of uranium, older rocks will generally

*Lehman, L. 1988. Radium in drinking water. Prepared for the City of Savage by L. Lehman and Asso. Burnsville, Minnesota contain higher concentrations of radium. The highest concentrations have been observed in old cambrian rocks. Higher than normal concentrations of radium have been reported in Great Lakes/Midwest States, including Wisconsin, Illinois and Iowa. In Minnesota, several municipalities have discovered radium levels above federal drinking water standards. Other states with reported high concentrations are North Carolina and Maine; areas which are also underlain by old granitic-type rocks. Radon, which is a gas, is another problem, particularly in basements of older homes.

RECOMMENDATIONS

1. <u>Research and Monitoring</u>

   All of the discussed activities need to be further evaluated. The MDH, MGS, MPCA, DNR, SCS, and USGS should work cooperatively to assess potential polluting hydrologic modifications.

2. <u>Funding</u>

   Proposals dealing with the above areas should be made to the LCMR.

TOPIC 7 UNDERGROUND INJECTION

Class V of the Federal underground injection control (UIC) program is the general catch all category of the underground injection classification system. Due to the broad nature of this category, Class V systems will be in included in the NPS-GW strategy. (For further information on the UIC program see the UIC issue paper of the Comprehensive Ground Water Strategy.)

POTENTIAL FOR IMPACTING GROUND WATER

Activity 1. Drainage Wells. The number of agricultural drainage wells in Minnesota is unknown. However, most wells are suspected to be in the southern Clayey till and loess areas of the state. The potential to contaminate ground water can be very high, depending on the land use of the drained area. Researchers from Iowa have documented the nature of their use and the quality of the water. Baker* (1984) has observed agricultural drainage wells to have a great potential to deliver nitrates, sediment, bacteria, and pesticides to the underlying aquifer. An urban storm water drainage well has equal potential to deliver nitrates, pesticides, heavy metals and other toxic pollutants to ground water.

*Baker, J.L., and T.A. Austin. 1984. Impact of agricultural drainage wells on ground water quality. EPA completion report. Dept of Agri. Engr., Iowa State University, Ames, Iowa.

Activity 2. Explosion Wells. Another UIC example can be found in the mining of metals, or water well development in cambrian shield bedrock. The technique of using explosives to fracture the rock can introduce pollutants to the associated aquifer, i.e. Biwabik Iron Formation.

Activity 3. Sewage Disposal Wells. Another name used to describe this activity is "seepage pit." These systems are typically associated with older rural homes in coarse textured soils. The well or pit option was popular because coarser textured soils did not need a large area extent to transmit the sewage. Clearly, ground water protection was not an issue during the installation of these systems. Direct disposal of on-site sewage represents a threat to ground water. Concern exists not only for human pathogens and nutrients transported to ground water, but other toxic household chemicals that could be disposed through a seepage pit.

Activity 4. Abandoned Wells and Improperly Sealed/Cased Wells. Abandoned wells represent an implied potential impact to ground water by their mere existence. Given stable conditions, surface transport of pollutants may never occur for a given abandoned well. Nevertheless, the land use could change. If the abandoned well were ignored during land development of the given area, pollutants could be delivered to the well and then directly transported to the ground water.

*MDH, Ground Water Quality Control Unit

Cross contamination of an upper aquifer to a lower aquifer is a serious concern not only with abandoned wells, but existing wells that are improperly sealed and cased. Extensive ground water contamination in southeastern Minnesota has been linked to poor well construction.*

RECOMMENDATIONS

1. <u>Research and Monitoring</u>

   Previous inventory efforts have been targeted toward generating a general data base on Class V activity. This type of data is applicable only for general assessments of potential injection well contamination problems. To provide a more focused evaluation, MDH and MPCA should select several small areas or counties to conduct an intensive field inventory of all types of Class V wells.

2. <u>Information and Education</u>

   It is recommended that Minnesota Extension Service develop informational material to increase the awareness of the public to these polluting land use practices.

3. <u>Regulation</u>

   It is recommended that MDH, inconjunction with local units of government, increase their enforcement efforts to control these sources (drainage wells and the other types of wells discussed) of ground water pollution.

It is recommended the SWCD's staff be used at the local level to identify problems.

4. <u>Funding</u>

It is recommended that cost sharing programs include dollars for proper abandonment of these systems.

Real estate resale tax credits should be considered as a way of financing the elimination of these sources of ground water pollution.

TOPIC 8 JUNKYARDS AND BACKYARD DUMPS

POTENTIAL TO IMPACT GROUND WATER

Activity 1. Junkyards. Junkyards have been around Minnesota for a long time. However, more recently the type of items stored in junkyards has expanded. Because many landfills are not accepting items like used barrels or batteries, they often end up being stored in junkyards. Less obvious pollutants such as fuel and crank case oil from junked autos can potentially move into and through the soil. Even items such as old appliances, which appear to be no more than an eye sore, are a potential threat to ground water quality. PCBs were used in the capacitors and ballasts on motors from 1930 to 1977. If the appliance is not disturbed, there is perhaps little chance for PCBs to enter ground water. However, it has been reported that in the waste product of scrap metal processors, PCB's have been detected. MDOT has some regulatory authority to relocate junkyards. Currently MPCA is working with MDOT to evaluate potential problems; i.e. a check list of hazardous material that MDOT staff can use when they assess a junkyard.

Activity 2. Backyard Dumps. In rural areas of Minnesota, many land owners have typically disposed of their waste on their own property. The waste stream includes everything, including the kitchen sink. Of particular concern, are hazardous materials that are knowingly or unknowingly discarded in the "back 40" refuse pile. These items can be petroleum, pesticide or solvent containers. The potential to contaminate ground water is further exacerbated when these piles are placed over coarse textured soils and sinkholes.

Activity 3. Abandon Dumps

See MDA Abandon Dump Inventory

RECOMMENDATIONS

1. Research and Monitoring

   It is recommended that the MPCA along with other appropriate units of government further study ground water below junkyards and backyard dumps.

2. Information and Education

   It is recommended that Minnesota extension service along with the MPCA and other local units of government prepare and discriminate information on the hazards of these practices.

3. Regulation

   It is recommended that MDOT and the MPCA work together to develop a regulatory approach to protect ground water from junkyards. It is recommended that local units of government take a more active role in regulating backyard dumps.

4. Funding

   It is recommended that a legislative initiative be made to provide funding to address the above issues.

TOPIC 9 STOCKPILE STORAGE

POTENTIAL FOR IMPACTING GROUND WATER

Activities: Current large scale stockpiling activities in Minnesota include: waste rock, road salt, power plant coal, fly ash, lime sludge, salt whey, and silage. These activities vary in the types of pollutants they contain and their potential to impact ground water.

Salts, nutrients, metals, and other organic compounds can leach either directly below a stockpile or adjacent to the stockpile. The porosity of the underlying and adjacent material, along with infiltrating precipitation, will control the physical potential to leach. However, the unique biochemistry of the stockpile can also significantly influence leaching potential. For example silage stockpiles tend to have low pH leachate. The low pH can mobilize ions that under higher pH conditions would not normally move.

RECOMMENDATIONS

Research and Monitoring

1. It is recommended that stockpiling activities for waste rock, road salt, lime sludge, salt whey, and silage be further evaluated by the MPCA and appropriate industry and/or local units of government.

2. Based on the above analysis, where issues are identified, BMP's should be developed to minimize ground water impacts.

Regulation

1. Where local units of government have statutory authority, i.e. zoning, land use permits should be issued to better control stockpiles in the given unique local hydrogeologic setting.

2. These permits should request monitoring to obtain data needed to address the above ground water concerns.

TOPIC 10 POINT SOURCE TOPICS

The following topics were initially considered in the universe of potential polluting land use activities. However, they will not be addressed in this portion of the ground water strategy. Adequate program management was used to differentiate these topics from NPS topics. The following topics have a framework that is currently addressing potential ground water pollution. Complete adequacy is not necessarily implied, merely sufficient management to be able to delineate nonpoint sources from point source control.

Activity	Management
New well installation	-Mn Rule Chapter 4725, MDH
Municipal sewage sludge	-Mn Rule Chapter 7040, MPCA
Municipal wastewater	-Mn Rule Chapter 7001 and 7050, MPCA NPDES or SDS permits
Industrial wastewater	-Mn Rule Chapter 7001 and 7050, MPCA NPDES or SDS permits
Industrial sludge	-Mn Rule Chapter 7001 and 7050, MPCA NPDES or SDS permits and/or solid waste permits
Solid waste, compost, and facilities	-Mn Rule 7001, and 7035, MPCA solid waste RDF permits, SARA and State Superfund, RCRA

Mining	-Mn Rule 7001 and 7050, MPCA NPDES and/or SDS permits
Silviculture and wood products industry	-Mn Rule 7001 and 7050, MPCA NPDES and/or SDS permits
Toxic, radioactive, and hazardous waste	-Mn Rule Chapters 7001, 7045, 7046, MPCA hazardous waste permits, SARA and State Superfund, RCRA
Underground storage, transportation and spills	-Mn Rule (Currently being developed), MPCA, UST

III. Controlling NPS Pollution through Best Management Practices

A) Overview

Potential polluting activities where a resposible party can generally be identified and brought into compliance are ofter controlled through state and federal regulation. The state and federal regulated activities are often aimed at preventing pollution of lcoalized waters. While this type of an approace works well for many "point sources" of pollution, it is often an improper approach to take for controlling diffuse or nonpoint sources of pollution that may be impacting waters over a broad regional scale.

An approach to control nonpoint source pollution is to use Best Management Practices (BMPs). BMPs are defined as practices, techniques, and measures that prevent or reduce water pollution from nonpoint sources by using the most effective and practicable means of achieving water quality goals. Practices such as pesticide and fertilizer management and filling abandoned wells; techniques such as providing financial incentives and education; and measures such as ordinances and regulation, are all included in the broad definition of Best Management Practices.

Ground water resource management programs encouraging BMP use can be most effective if fed at the local level. Local units of government have the most knowledge of their land uses, water resources, pollution problems, and concerns of individuals. Since local government typically does not have the technical or financial resources to resolve NPS contamination problems, state and federal level assistance may be necessary.

Program have already begun in Minnesota which aim to control nonpoint sources of pollution through BMP cooperative partnership efforts between state and local units of government. It is recommended that current programs that address NPS ground water pollution by encouraging BMP implementation be continued and expanded. The fulfillment of research, monitoring, and education recommendations stated in the NPS Issues Team Report, EQB Water Resources Strategy, and Section II of this report should lead to an enhancement of the general body of knowledge concerning BMPs. Therefore, from these recommendations improvements could be made in statewide programs geared towards controlling NPS pollution through BMPs.

The fulfillment of research, monitoring, and education recommendations stated in the NPS Issues Team Report, EQB Water Resources Strategy, and Section II of this report will lead to an enhancement of the general body of knowledge concerning BMPs; thus, benefiting statewide and localized NPS pollution controlling efforts. In addition, what is learned from partnership programs aimed at improving water in selected local areas can be applied to statewide programs.

B) CLEAN WATER PARTNERSHIP PROGRAM

Purpose

Achievement of Minnesota's water quality goals will require a comprehensive water quality program implemented through a coordinated state and local partnership which provides the flexibility to meet the variety and complexity of problems resulting from nonpoint sources of pollution. The purpose of the Clean Water Partnership Program, proposed and enacted in 1987, is to protect and improve surface and ground water quality in Minnesota by controlling water pollution associated with land use and land management activities. Through the program, State financial and technical assistance will be given to the local units of government leading the programs.

THE CLEAN WATER PARTNERSHIP PROJECT PROCESS

A Clean Water Partnership project will consist of several phases; a Diagnostic Study, Implementation Plan Preparation, BMP Implementation, and follow-up monitoring.

Diagnostic Study: The process begins by defining the boundaries of the project area. This will involve topographic map interpretation, modeling and field assessment. Next the monitoring network must be design based on the above analysis. Sampling will usually occur for two years, at which time ideas should be generated for preparing an implementation plan.

Implementation Plan: This phase involves the analysis of the data collected in the diagnostic study for purposes of defining water quality problems and their causes and water quality goals and objectives. The combination of education, incentives, official controls and BMPs necessary to solve specific water quality problems are identified in the plan. The plan will layout the necessary action needed at the local level to correct or prevent further pollution. Project administration and coordination with existing land-use programs, controls and activities of local units of government are defined. The plan will need to layout some time frames based on predicted ground water flow rates.

BMP Implementation: The project implementation phase will involve the implementation of the activities identified in the implementation plan. This stage will perhaps be the most costly and take the longest amount of time to complete. Implemention will require clear local involvement, down to the owner/manager of a parcel of land. Implementation consists of structural changes i.e. grouting an abandon well and institutional changes or land use management i.e. rate and timing of fertilizer application.

Follow-up Monitoring: Due to the generally slow response time of ground water, it is unlikely any improvement in water quality will be made during the implementation phase. Therefore long term follow-up monitoring will be necessary to determine if the BMPs implemented were successful. BMPs will need to be in use for more than a few years, such that over all trends can be observed. Key low cost indicator parameters will be needed to measure the long term trends.

LOCAL UNITS OF GOVERNMENT

Each project must be led by a local unit of government with authority to:

- raise funds;
- enter into contracts with local, state and federal agencies and organizations, and
- adopt official controls.

Local Units of Government include:

- municipalities;
- towns;
- counties;
- watershed districts;
- soil and water conservation districts (SWCD's do not currently have authority to raise funds or adopt official controls, but can be part of a project through joint powers or contract with other local units of government);
- organizations formed for the joint exercise of powers under section 471.59, and

- any other special purpose district or authority exercising authority in water and land resources management of the local level.

To be eligible, local units of government must submit a project application and one of the following:

- comprehensive water plan authorized under Chapter 110B;
- surface water management plan required under section 473.878;
- an overall plan required under Chapter 112; or until 1991;
- Other local plan that provides an inventory of existing hydrologic information on the area, general identification of water quality problems and goals, and demonstrates a commitment to water quality protection and improvement.

MPCA ADMINISTRATION OF THE CLEAN WATER PARTNERSHIP PROGRAM

Through the Clean Water Partnership Program the MPCA may:

- provide grants for up to 50 percent of the eligible costs of a project, and
- provide technical assistance with the development and implementation of projects.

The MPCA shall:

- adopt rules to implement this program;

- develop a state plan to control nonpoint source pollution in order to meet the requirements of the federal Water Quality Act of 1987; and
- chair an interagency project coordination team.

The program will be closely coordinated with state and federal programs.

C) FEDERAL CLEAN WATER ACT - SECTION 319

STATE ASSESSMENT REPORT

The Governor shall, after public comment submit to EPA a report which:

- identifies waters in the State which, without additional action to control NPS pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or goals and requirements of this Act.
- identifies major pollutants and significant contributors;
- identifies best management practices (BMPs) that will be used to solve the range of problems;
- identifies and describes State and local programs for controlling NPS pollution.

The State may rely upon existing information (208, 305b, 314, etc).

STATE MANAGEMENT PROGRAMS

The Governor shall, after public comment, submit to EPA a Management Program the State proposes to implement the first four fiscal years which:

- identifies BMPs and measures to reduce NPS pollutants;
- identifies programs to achieve implementation of BMPs (including as appropriate, nonregulatory and regulatory programs for enforcement technical assistance, financial assistance, education, training, technology transfer and demonstration projects);
- identifies a schedule for implementation of BMPs and programs identified above;
- Attorney General certification of adequate authority to implement the proposed management program;
- identifies sources of funding to implement the proposed program; and
- identifies federal programs and projects to be reviewed for their effect on water quality.

In developing and implementing a management program, a State shall to the extent practicable, involve local public and private agencies and organizations which have expertise in control of NPS.

A State shall, to the maximum extent practicable, develop and implement the NPS management program on a watershed basis.

ADMINISTRATIVE PROVISIONS

The Assessment Report and State Management Program shall be submitted to EPA within 18-months of the date of enactment (August 1988).

The EPA must approve or disapprove within 180 days of submission. If disapproved, EPA must notify the state of revisions of modifications necessary to obtain approval within 6 months.

GRANT PROGRAM

205(j5) may be used to develop and implement the management program.

Once the management program is approved, EPA shall make grants (subject to such terms and conditions as EPA considers appropriate) to assist the State in implementing the approved management program. Application for any fiscal year will be in the form that EPA requires.

The federal share shall not exceed 60% of the management program costs. Priority in making grants will be given to:

i) difficult or serious NPS problems

ii) innovative methods or practices for controlling NPS problems

iii) interstate NPS problems

iv) ground water quality protection activities

A progress report must be submitted to EPA annually. Administrative costs on the form of salaries, overhead, or indirect costs shall not exceed 10% of grant in any fiscal year, except cost of enforcement and regulatory activities, education, training and technical assistance demonstration projects, and technology transfer are not subject to this limit.

Grants For Protecting Ground Water Quality

The EPA shall make grants for purpose of carrying out ground water quality protection. The Federal share will be 50% with a $150,000 maximum. $70 Million is authorized for 1988, $100 Million per fiscal year for 1989 and 1990, and $130 Million for 1991.

D. WELLHEAD PROTECTION PROGRAM

Minnesota is currently beginning a wellhead protection program. The purpose of the wellhead protection program is to prevent contamination of public water supplies as opposed to correction of existing pollution problems. Wellhead protection is, by definition, protection of the area surrounding a well. The "wellhead protection area" (WHPA) is defined by statute as the surface and subsurface area surrounding a well or wellfield that supplies a public water system through which contaminants are likely to pass and eventually reach the water well or wellfield. WHPA boundaries are determined based on factors such as well pumping rates, time-of-travel of ground water flowing to the well, aquifer boundaries, and degree of aquifer confinement. All of these hydrogeologic characteristics have a direct effect on the likelihood and extent of pollutants entering well water. A well head protection area can range anywhere from a distance of a few hundred feet to several miles from wells.

The areas surrounding water well supplies can be particularly vulnerable to nonpoint sources (NPS) of pollution, since NPS contaminants introduced within the well recharge area may move into ground water and then be drawn toward that well. Management activities that can be employed within the protection area include: regulation of land use though special ordinances and permits, prohibition of specified activities, and acquisition of land.

At the time of the writing of this report, $25,000 has been granted to Minnesota by the EPA for wellhead protection purposes. This money will be used by the USGS to continue its wellhead protection efforts in the City of Rochester. Further, wellhead protection efforts will continue only if state and/or federal money is appropriated.

E. MPCA EXPERIENCES FROM CURRENT RESOURCE FOCUSED EFFORTS

The Minnesota Pollution Control Agency (MPCA) has worked with four local units of government in ground water monitoring demonstration projects since January 1987. What the MPCA has discovered in the process involved with these resource focused projects is:

1) Local units of government must have a genuine concern and interest in the water resource.

2) Local units of government must have a coordinator to act as the primary link of communication between the land users and the state.

3) Local units of government typically do not have adequate technical ground water expertise and will, therefore, either need to hire a consultant or rely on MPCA technical assistance.

4) Local units of government are genuinely interested in protecting their ground water. In general, they believe they have a problem and they want to try to do something about it. Local units of government have a desire to know the benefits of a particular cost before authorizing the expenditure.

5) Local units of government expect contractors to stay within the limits of their bid because they don't have the extra money to spend.

6) State technical staff need to track the budget with the administrative staff in order to stay within the financial boundaries of the project.

7) Tighter contract specifications are needed between the local units of government and contractors, i.e., drilling contractor or laboratory.

8) Soil and water conservation district staff should be receiving some training on how the partnership process will work in order to prevent false expectations.

9) Responsiveness and courtesy to Board members is critical to build the state/local partnership.

10) Local units of government, in particular Boards, need to see state personnel face to face on a regular basis in order to get beyond any stereotypes of bureaucracy and to develop good personal working relationships.

11) Local units of government need to have technical problems explained to them in laymen's terms, i.e., the use of visuals on how ground water is being contaminated.

12) Time spent communicating details and educating local units of government and their constituency is perhaps the most powerful and effective best management practice for protecting ground water.

13) Local units of government, particularly the Board, need to see and believe they have an important role in the partnership process. This, of course, is being perceived as responsive politicians to their constituency.

14) Following up on the local unit of government's request conveys our (the state) interest in the project.

15) The land owner must be given respect by asking for his permission to enter the property and, thus, it is necessary to check and double check with landowners prior to entering their land to explore or place a well.

16) Communication and, in particular, details with local staff is important. They need to receive clear instructions from state staff to obtain accurate data. Local staff need to communicate problems with state staff in order for resolutions to occur. Resolve problems in a timely manner.

17) It is important for state staff to keep in mind that the project is being locally led and that state staff are providing assistance.

18) It is important to give positive feedback to the local staff for their help. They need to feel that they have a important role to play.

19) Modeling will be an essential tool in the diagnostic phase for deciding where detailed monitoring should occur.

20) A thorough review of existing data is critical for setting up a diagnostic study.

21) Local units of government expect to have regular progress reports so that they can stay abreast of the project.

IV. <u>THE PROCESS FOR DEVELOPING BEST MANAGEMENT PRACTICES</u>

<u>BEST PRACTICES</u>

Working Definition: "Alternate combination of land use practices, and management techniques which, when applied to a unit of land, will result in the opportunity for a reasonable economic return within acceptable environmental standards."

The following items will be used to evaluate Best Management Practices (BMPs) for selection under the Clean Water Partnership Program. Due to the extreme site specific nature of BMPs more exact selection criteria is not feasible. There will be a certain amount of judgement involved, and this cannot be avoided.

WATER QUALITY BENEFITS

- Will the practice achieve the desired level of water quality?
- Will another problem be created by this practice? (Shift surface water quality problem to a ground water quality problem, or solve a sediment problem, but create a pesticide problem, etc.)

ECONOMICS (PUBLIC)

- How much water quality benefit is there per dollar spent?
- Is there a less expensive practice that will achieve the same result?

REASONABLE AND PRACTICAL

- Does the practice meet the land user's needs and operation?
- Are costs such that a reasonable economic return can be expected?
- What are the O&M requirements, is it reasonable to expect that they will be done?
- Is the practice well suited to the individual site?

TECHNICAL

- For technical practices, are there proven standards for then with known

TECHNICAL

- For technical practices, are there proven standards for then with known results?
- What type of quality assurance will there be for technical practices?

MISCELLANEOUS

- Are there detrimental affects to the environment such as loss of wildlife habitat, etc?
- If the practice is an educational program, is it different from existing ones, and why will it work better?

EVALUATION CATEGORIES OF LAND USE IMPACTING GROUND WATER

POTENTIAL POLLUTING LAND USE ACTIVITIES	IMPACTED AREA INDIV.CORP	POLLUTANTS BIOL.INORG.ORG	HYDROLOGY RECHARG.FL FIELD	SEVERITY INDIV.CORP	REGULATIONS RULE.PERMIT	MANAGEMENT PROG.FUNDING	SOURCE TYPE PT.SEMI.NONPT	PRIORITY RATING
ANIMAL WASTE								
feedlots								
manure storage facility								
runoff seepage pond								
manure land applic.								
COMMERCIAL FERTILIZERS								
agric. ground applic.								
manuf. & formulation								
bulk storage & handling								
spill/release								
fertigation								
resid. lawn applic.								
golf course applic.								
other soil ammendments								
PESTICIDES								
ground applic.								
aerial applic.								
manuf. & formulation								
bulk storage & handling								
spill/release								
pestigation								
residential lawn applic.								
golf course applic.								
cleanup & disposal								
HYDROLOGIC MODIFICATIONS								
wetland filling								
terraces & grassed buffers								
agric. runoff seepage basin								
urban runoff seepage basin								
drainage inlets								
drainage tiles								
irrig. induced recharge								
sinkholes/losing streams								
WELLS								
injection								
improper sealed/cased								
abandoned								
ag drainage								
MUNICIPAL SLUDGE (storage land applic.)								
facility owned								
facility not owned								

INDUSTRIAL SLUDGE (storage
& land applic.)
- paper mill
- salt whey
- lime
- hazardous (refinery)
- hazardous (other)

CONTAMINATED SOIL (storage
& land applic.)
- petroleum/hydrocarbons
- pesticides
- metals
- other

SEPTAGE (storage &
land applic.)

MUNICIPAL WASTEWATER
(storage & land applic.)
- stabilization ponds
- spray irrigation
- rapid infiltration
- overlnd flow, furrow irrig
- leaky steady state ponds

INDUSTRIAL WASTEWATER
(storage and land appl.)
- silage wastewater
- cannery
- potato
- sugar beet
- other non-hazardous WW
- hazardous wastewater

ON-SITE SEWAGE TREATMENT
- individual
- clustered ISTS
- lg. soil absorption syst.

MINING
- open pit metal minin
- tailings basins
- runoff seepage basins
- sand and gravel operations
- abandoned mines

SILVICULTURE
- management (herbicides)
- harvesting operations

STOCKPILE STORAGE
- Road salt
- coal (power plant)

CONSTRUCTION ACTIVITIES
road constuction
land development

SOLID WASTE
ash disposal facility
refuse derived fuel facility
munic./solid waste landfill
demolition landfill
industrial waste landfill

HAZARDOUS WASTE
treatment
storage
disposal

RADIOACTIVE WASTE
treatment
storage
disposal

HYDROCARBON STORE & TRANSP.
undergrnd storage tanks
above grnd storage tanks
transporting vehicles
pipelines

KEY

IMPACTED AREA - size of both the indiv. activity and the collective area of the land use activity	small (sm), medium (med), broad (bd), variable (var)
POLLUTANTS - biological, inorganic, and organic pollutants originating from the land use activity.	BIOLOGICAL, INORGANIC, ORGANIC (bact., viral), (metals,nutrients), (soc's,voc's)
HYDROLOGY - potential recharge and type of flow field created by the land use activity.	RECHARGE POTENTIAL contained (con), <.06 in/hr (v.l.), .06-.6 (low), 0.6-6.0 (med), >6.0 (hi), variable (var) FLOW FIELD local (loc), regional (reg)
SEVERITY - severity of both the individual activity and the collective impacts of the activity state-wide based on the type, quantity and concentration of pollutants, and the related hydraulics.	low (lw), medium (med), high (hi)
REGULATIONS - rules and/or permits that govern the activity as related to groundwater.	related rule number, type of permit required (if any)
MANAGEMENT - government agency/department that manages or regulates the activity, and sources of funding for managing.	agency/program, funding source
SOURCE TYPE - is the pollutant generally considered to derive from a point source, non-point source, or somewhere in between.	point (pt), semi-nonpoint (snp), non-point (np)
PRIORITY RATING - relative importance of each activity in influencing water quality in Minnesota.	(1, 2, 3, 4, 5, 6, 7, 8, 9, 10) low priority...............high priority

Minnesota Pollution Control Agency

MINNESOTA POLLUTION CONTROL AGENCY
WATER QUALITY MONITORING STRATEGY
Division of Water Quality
1988

SEPTEMBER 30, 1988

FINAL DRAFT

TABLE OF CONTENTS

(1) INTRODUCTION

The Minnesota Pollution Control Agency conducts a variety of monitoring programs under the authorities granted by federal and state legislation. These programs collect and evaluate data which define the water quality of the state. The data are used to indentify pollution, assess abatement programs, enforce environmental regulations, and report the changes in the state's water quality.

The Routine Water Quality Monitoring Program was the first monitoring program established, and it continues to be the cornerstone of the the monitoring efforts conducted by the Agency. The program began in 1953 and monitors surface water quality throughout the state. In addition to this fixed ambient network, a variety of special monitoring programs also exist. Lake monitoring is conducted in conjuction with special lake studies, the Clean Lakes Program, a Lake Assessment Program, and a volunteer Citizen's Lake Monitoring Program. Additional stream information is collected by the Intensive Survey Program, the Border Waters Program, and the Nonpoint Source Pollution Program. Specialized data are collected by the Toxic Substances Monitoring Program, the Acid Rain Program, the Biomonitoring Program, and the Dredge and Fill Program. Data on permitted dischargers is collected by the Compliance Monitoring Program. Because much of this information is related and important to more than one program, a Data Management Program was established to computerize the data and make it available in a usable format to everyone. A Quality Assurance-Quality Control Program insures that the samples are collected, preserved, shipped, and analyzed by approved methods.

The Division of Water Quality has monitoring priorities and management goals which reflect the Agency's legislative authorities and responsibilites and which, in turn, have become part of the program plan. The Monitoring Strategy relates these goals back to the organizational structure of the Agency. Each program is examined in depth to define its monitoring objectives, the types of data collected and the ways in which those data are used. Since data and the professional expertise used to evaluate and interpret that data are often shared between programs, the cooperation with other programs and agencies is listed. The future needs for each program are also discussed. These needs define what remains to be done in each of the monitoring programs to fully meet the objectives of the program and the goals of the Division.

A schedule of activities is also included as part of the Monitoring Strategy. Ongoing activities are identified for each of the monitoring programs in the Division of Water Quality. Specific tasks are listed for Fiscal Year 1988 and Fiscal Year 1989 for each of the programs. These tasks define what each program will accomplish during the two fiscal years.

The appendix includes lists of monitoring stations for each of the specific programs where such locations have been identified. Also included are the parameter lists for those programs.

(2) PRIORITIES AND MANAGEMENT GOALS

Priority

* Manage water quality program activities with emphasis on restoration and maintenance of priority water bodies (PWB) including Great Lakes areas of concern and ground water.

* Develop and implement a watershed management program that provides adequate protection for surface impoundments, wetlands, and PWBs.

  > Develop and implement nonpoint source strategies to control nonpoint sources of pollutants discharged to surface and ground waters where point source controls are insufficient to meet water quality objectives:

    1) Point/Nonpoint Trading Strategy
    2) Clean Water Partnership
    3) Section 319 of the CWA Amendments

  > Continue to manage Clean Lakes projects and update lake classification surveys and use them as a basis to develop new Clean Lakes projects.

  > Review and update the Section 401 certification process to minimize the loss or degradation of wetlands through vigorous implementation of Section 401 of the Clean Water Act.

  > Develop and implement a sediment criteria program that coordinates the activities of pesticide application programs, urban runoff programs, and water quality standards.

Priority

* Control the discharge of toxic pollutants to surface and ground waters and the environment to protect human health and aquatic life.

  > Incorporate water quality criteria and sediment criteria for toxic pollutants into water quality standards.

  > Use bioassesments to measure water quality conditions, establish water quality standards, determine effluent limitations, and control toxic discharges.

  > Develop and implement an in-place toxic pollutant control strategy.

  > Continue to clean up existing problems, using federal and state superfunds and other state authorities.

  > Implement a statewide sludge management strategy.

Priority

* Continue to implement a monitoring program to ensure adequate collection and utilization of environmental data that will facilitate program decision-making.

> Evaluate current point source monitoring programs using the Water Quality Management Plan. Identify reaches where point source water quality monitoring data are needed.

> Coordinate the development of the monitoring strategy among the programs to eliminate duplication of effort and meet data needs for decision making.

> Coordinate the development of the monitoring strategy among other state and federal agencies to eliminate duplication of effort and meet data needs for decision making.

> Develop a revised surface water ambient monitoring station network and parameter list based on the reach evaluation and data needs of all monitoring programs.

> Revise the ambient ground water quality monitoring program to provide more meaningful information on ground water quality trends and current parameters of concern, such as pesticides.

Combined Priority With Ground Water and Solid Waste Division

* Improve ground water protection by developing and implementing a state ground water protection strategy which will:

> Recommend modifications in existing rules (7050.220,7060) governing ground water quality to make them more clear, applicable and enforceable.

> Recommend programatic changes for more effective control of ground water pollution sources.

> Examine data collections and work toward establishing standards to ensure data compatibility.

> Seek to coordinate programs of different groups and agencies to minimize duplication and promote efficient use of resources.

Combined Priority With Division of Air Quality

* Continue to assess the sensitivity of Minnesota's resources to acid deposition and establish long term data bases for evaluating acid deposition impacts on sensitive resources.

> Monitor water chemistry of select low alkalinity lakes on a long term basis to evaluate lake response to changes in acidic deposition.

> Maintain compatibility with similar lake sampling being conducted in Wisconsin and Michigan to assess lake chemistry response to changing deposition on a regional basis.

> Address the potential for acid snowmelt impacts in streams along the North Shore of Lake Superior.

> Investigate the relationship between acid deposition and mercury contamination of fish in nothern Minnesota lakes.

- Obtain preoperational "background" samples for new county and municipal incinerators (fish, sediment, water).

(3) ORGANIZATION AND PROGRAM GOALS

Program Development Section: Units and Programs	Goals
Standards Development Unit Water Quality Standards Team Wasteload Allocations Team Standards Program Intensive Surveys Program	To develop water quality standards that protect the designated water uses To develop wasteload allocations for pollutants to ensure that water quality standards are met
Water Monitoring and Data Management Unit Water Monitoring Team Data Management Team Routine Monitoring Program National Fixed Station Network Program Data Management Program Border Waters Program Citizen Lake-Monitoring Program (CLMP) Water Quality Management Program	To provide valid water quality data that can be used to identify water quality problems and evaluate the success of the water pollution control program in solving those problems To insure that the data are in a computerized format so that evaluations on Minnesota's water quality can be accomplished accurately and efficiently
Watershed and Nonpoint Program Unit Program Team Technical Assistance Team Clean Lakes Program Nonpoint Source Pollution Program Dredge and Fill Program	To continue to develop and implement a program to deal with nonpoint sources of pollution through the Clean Water Partnership and Section 314 and 319 of the CWA amendments

Program Development Section: Units and Programs	Goals
Toxic Abatement and Lake Evaluation Unit Toxics Abatement Team Lake Evaluation Team Toxic Substances Monitoring Program Lakes Studies Program Bioassay Program Lake Assessment Program (LAP)	To continue to develop and implement a program to deal with special toxic pollutants through toxic substances monitoring, bioassays, research, literature searches, and Remedial Action Plan (RAP) To continue to develop and and implement a program to evaluate lake conditions and develop standards for lakes To provide valid water quality data on MN lakes and technical assistance to citizens, local state and federal officials so that lake water quality problems are identified, and mitigated or resolved.

Additional Water Monitoring Programs Outside of the Program Development Section

Program	Responsible Division/Section
Compliance Monitoring Program	Water Quality/Regulatory Compliance
Emergency Response Program	Hazardous Waste/Tanks and Spills
Acid Rain Program	Air Quality/Program Development and Air Analysis
Ambient Ground Water Monitoring Program	Ground Water and Solid Waste/Program Development
Site Specific Ground Water Monitoring	
- Site Response	Ground Water and Solid Waste/Site Response
- Solid Waste Facilities	Ground Water and Solid Waste/Solid Waste
- Underground tanks	Hazardous Waste/Tanks and Spills
Hazardous Waste	Hazardous Waste/Hazardous Waste

(4) PROGRAM OBJECTIVES, DATA TYPES, DATA USES, COOPERATION WITH OTHER PROGRAMS NEEDS AND SCHEDULE OF ACTIVITIES

Biomonitoring Program

Objectives:
* Detect NPDES permitted dischargers which are toxic to aquatic life.
* Provide valid water quality data that can be used in the program evaluation and decision-making process.
* Use biomonitoring tests to determine effluent limitations and control toxic discharges, determine if controls have abated toxic discharges and measure water quality conditions; and establish water quality standards. Send appropriate reports to EPA's Region V Clearinghouse.
* Review biological monitoring as it relates to future RAP activities.

Data Types:
* Screening acute static test
* Definative acute static test
* Definative acute flow-through test
* Definative chronic static test
* Acute test

Data Usage:
* Determination of the acute and chronic toxicity of permitted discharges.
* Determination of compliance with existing state rules and NPDES Permits.
* Determination of the toxic component of the effluent.

Cooperation:
* USEPA
* Regulatory Compliance Section, MPCA
* Minnesota Department of Natural Resources
* University of Minnesota (fish)
* Data Management Program, MPCA
* Municipalities
* Industries

Needs:
* Determine the responsible toxic agent for those assessments where they have not already been determined or where conditions have changed.
* Determine which discharges need a toxicity assessment in order to justify an effluent standard for toxicity.
* Continue to determine if site specific water quality standards, for selected parameters, are appropriate or should be changed.
* Develop capability to perform bioaccumulation tests.

Schedule of Activities

Ongoing:
* Investigate and prepare reports on significant fish and wildlife kills due to pollution.
* Develop the capability to conduct effluent chronic bioassays. to measure toxic substances in point source discharges.
* Participate in the Regional Biomonitoring Task Force.
* Utilize biomonitoring data in toxic control program.

FY 88:
* Conduct 25 static bioassays on point source dischargers. Submit a list to EPA of facilities targeted for biomonitoring by March 1, 1988, including the number and location of 7-day static renewal bioassays.
* Conduct 1 flow-through bioassay on a point source discharger.

FY 89:
* Conduct 12 static bioassays on point source dischargers.

Submit a list of targeted dischargers to EPA by April 30, 1989.
* Screen one point source discharger for toxicity using 7-day fathead and cerriodaphnia tests. Schedule the test by February 28, 1989
* Send completed toxicity reports to Region V Clearinghouse and enter data into CETIS.

Lakes Studies

Objectives:

* To propose, initiate and develop a methodology to determine lake water quality nutrient eutrophication standards or criteria for lake water quality protection or restoration.
* To investigate the effects of acid rain impacts on lakes.
* To verify water quality changes after lake restoration efforts have ended.
* To investigate lake water quality trends accross the state
* To verify impacts from point and nonpoint sources in order to
* develop control programs.

Data Types:

* Chemical characteristics
* Hydrological characteristics
* Physical characteristics
* Biological characteristics

Data Usage:

* Determination of water quality and trophic state of the lake.
* Determination of point source effluent discharge standards for phosphorus
* Determination of nutrient budgets for lakes.
* Modeling

Cooperation:

* Nonpoint Source Program, MPCA
* Standards Program, MPCA
* Toxics Abatement and Lake Evaluation (TALE)
* Citizens
* Data Management Program, MPCA
* Minnesota Department of Natural Resources
* Division of Air Quality, MPCA
* Regulatory Compliance Section, MPCA
* Ground Water and Solid Waste Division, MPCA
* Hazardous Waste Division, MPCA
* Lake Associations
* Municipalities
* USEPA

Needs:

* Conduct regional water quality surveys to fill in data gaps.
* Establish a network of routine lake stations in various regions in the state to: 1) provide a basis for assessing year to year fluctuations in water quality, 2) provide valuable information for modelling lake responses on a regional basis, and 3)provide data which can aid in the development of lake water quality criteria for the various regions in the state.
* Explore the possibility of obtaining quality assured data from various sources, such as University of Minnesota, Minnesota Department of Natural Resources, counties, etc. which is not currently in STORET. In particular, data which may be computerized on different systems and could lend itself to efficient transfer.
* Conduct post lake restoration studies to verify water quality changes.
* Increase the use of existing lake models, and research and develop the use of additional lake models.

Schedule of Activities

Ongoing:
* Plan and initiate three sewage-impacted lakes studies as needed.
* Special investigations as necessary - generally related to enforcement issues or cooperative ventures with DNR. (Number of lakes sampled range from 10 in 1985, to 30 in 1986)

FY88/FY89:
* Sample 25 lakes to further define and refine ecoregion concept.
* Three sewage impacted lake studies will be planned and initiated as needed.
* Develop basis and support for establishing phosphorous standards for lakes by ecoregion.

Citizen Lake-Monitoring Program

Objectives:
* To provide a good long term data base for numerous lakes around the state.
* To allow Minnesotans an opportunity to become actively involved in the collection of water quality data and help them learn more about the quality of their lakes, while at the same time providing MPCA with needed lake information.
* To prepare lake associations, etc. to develop means to protect or restore lake resources through local initiatives.

Data Types:
* Secchi disc (water clarity)

Data Usage:
* Used as an index of lake water quality that helps to determine whether a lake has water quality problems by defining the changes that may occur in summer water clarity.
* Used to track changes in water quality over time.
* Provide baseline data for future water quality studies.

Cooperation:
* Lake Assessment Program, MPCA
* Lake Studies, MPCA
* Data Management Program, MPCA
* Citizens
* Minnesota Department of Natural Resources

Needs:
* Double or triple the number of lakes in the CLMP to increase the state-wide data base by involving more people, especially in those areas of the state that are not currently or have never been represented.
* Make sure participation continues so that long term trends can be measured.
* Improve the ability of citizen groups to collect water quality data.

Schedule of Activities

Ongoing:
* Work to increase citizen participation and increase the number of lakes monitored each year.
* Continue to operate the Citizen Lake-Monitoring Program for obtaining water quality data.

FY88/89:
* All data collected by volunteers and submitted to the MPCA will be entered in STORET.
* The CLMP report for the previous year's work will be completed and mailed to participants by the May 30th of each year.

Lake Assessment Program (LAP)

Objectives:
* Assist lake associations or local units of government in the collection of baseline lake water quality data.
* Provide a basis for defining protection, improvement or restoration needs.
* Build local responsibility to implement future protection and restoration efforts.

Data Types:
* Chemical characteristics
* Physical characteristics
* Hydrologic characteristics

Data Usage:
* Serves as a basis for assessing the current trophic status of the lake.
* Provides an opportunity to assess changes in the lake water quality as a function of changes in land use practices in the watershed.
* Provides LAP or local unit with basic knowledge necessary to more adequately protect or improve water quality of lake.
* Recommends follow up actions leading to future protection and restoration activity.

Cooperation:
* Citizen Lake-Monitoring Program
* Clean Water Partnership/Clean Lakes Program
* Data Management Program
* Regional offices, MPCA
* Local units of government
* Citizens

Needs:
* Establish a program to assist lake associations and other groups interested in collecting water quality information, functioning on a cost share or match basis (volunteer).
* Integrate LAP activities with CWP, 314, 319 and local water quality management planning.

Schedule of Activities

Ongoing:
* Complete 4-5 LAP reports and consult with local units of government and the public on the need for follow up action.

FY88/89:
* All LAP reports for the previous year's sampling will be completed by June 30th of each year.

Acid Rain Program - Division of Air Quality

Objectives:
* Monitor compliance with the acid deposition standard of 11 kilograms per hectare per year wet sulfate.
* Adequately characterize acid deposition (wet and dry) to determine impacts on lake, stream, and wetland resources.
* Determine spatial and temporal trends in the composition of atmospheric deposition in Minnesota.
* Determine the response of low alkalinity lakes to changing patterns of deposition in Minnesota (trend analysis).
* Develop and formalize a process to track state-wide and utility emissions for compliance with the Acid Rain Control

Plan.

* Review and modify permits for two utility-owned, coal fired power plants in the state to meet emission limits set in the Acid Rain Control Plan.
* Document chemical and discharge characteristics of selected Lake Superior tributaries during snowmelt to assess their sensitivity to episodic impacts.
* Document snowpack chemistry in selected Lake Superior tributary watersheds and determine the relative contribution and source of sulfates and nitrates in the intensively studied watersheds.
* If declines in stream alkalinity and pH are found in the intensively studied watersheds, assess the importance of sulfate and nitrate to these declines.

Data Types:

* Ambient precipitation for volume
* Precipitation chemistry
* Stream flow measurements
* Lake levels
* Water chemistry
* Fish samples for tissue analysis
* Filterpack chemistry (dry deposition)

Data Usage:

* Long-term trend analysis of selected anions and ion ratios in selected lakes.
* Monitoring for toxic levels of selected metals.
* Identification of acid sensitive lakes.
* Correlation with acidic deposition data gathered by MPCA and USEPA.

Cooperation:

* Lake Studies, MPCA
* Toxic Substances, MPCA
* Citizen Lake-Monitoring Program, MPCA
* Minnesota Department of Natural Resources

Needs:

* Broaden studies to address: 1) episodic acidification due to snow melt, 2) impacts to aquatic life making up the food chain in lakes and streams, 3) sensitivity of wetlands and small lakes, and 4) the relationship of mercury contamination to acid rain.
* Continue acid rain long term lake monitoring.

Schedule of Activities

Ongoing:

* Continue wet deposition monitoring at 5 locations.
* Continue dry deposition monitoring at 7 locations.
* Monitor compliance with the acid deposition standard in the sensitive areas and implement the control plan.
* Annual workplan and budget submitted to MPCA Board and to Legislative Commission on Minnesota Resources for approval.
* Semiannual progress reports to utility companies, environmental groups and other interested parties.
* Monitor ambient air quality at 50 sites throughout the state.

FY88/FY89:

* New funding was recieved for monitoring 13 low alkalinity lakes and to investigate chemistry of 7 streams during snowmelt.
* Prepare biennial report to the Minnesota Legislature.
* Prepare annual report on wet and dry deposition for calandar year 1987.
* Prepare special report on stream chemistry during the spring 1988 snowmelt.

Toxic Substances Monitoring Program

Objectives:

* Determine potential impacts to human consumers.
* Discover sources and locations of contaminants that aren't readily measured in other media.
* Determine impacts on aquatic life.
* Establish baseline levels which can be evaluated in the future for trend analysis.
* Collect data to support restoration, remedial action, and maintenance of designated uses.
* Assist in developing an in-place toxicant strategy that will enhance the ability to control point and nonpoint sources of in-place toxicants.

Data Types:

* Chemical characteristics of water and sediment
* Physical characteristics of water and sediment
* Chemical and physical characteristics of fish tissue
* Chemical and physical characteristics of limited wildlife tissue

Data Usage:

* To protect human consumers of fish which may be contaminated with toxic pollutants (edible portion samples).
* To provide investigations with a "warning system". Because fish can bioaccumulate trace amounts of some environmental contaminants, pollution problems may be detected early (edible portion and whole fish samples).
* To define geographical areas of toxic pollutant contamination. (edible portion or whole fish samples).
* To establish base line levels of toxic pollutant contamination that can be used for trend analysis (sediment, whole fish, or specific organ samples).
* To evaluate the effectiveness of toxic pollutant control measures (edible portion, sediment, whole fish or specific organ samples).

Cooperation:

* Regulatory Compliance, MPCA
* Minnesota Department of Natural Resources
* Great Lakes Program Office, USEPA
* Minnesota Department of Health
* International Joint Commission
  - Ontario Ministry of Environment
  - Environment Canada
* North Dakota
* Wisconsin

Needs:

* Develop sensitive analytical scanning techniques in tissue samples. As the number and variety of chemicals discharged to waterways increase, it becomes increasing difficult to monitor their levels in the environment. A sensitive scanning technique could identify chemicals at a level of concern which then could be worked on separately in more detail.
* Develop field manuals to identify fish tumors for fish managers. The manuals should also include techniques for preserving specimens for lictological study and techniques to determine when the frequency of tumors is significant.
* Develop regional fish tissue banks. Trend analyses are expensive and require years of study. If fish tissue samples were regularly banked, trend analysis for new chemicals could be established quickly with less expense.
* Develop standard techniques for calculating fish consumption advisories throughout the nation. Several waterways which form boundaries receive different advisories depending upon the

approach taken by each state. National and international guidance in this area is needed
* Develop statistical guidance to determine the appropriate number of sites and fish samples to characterize a waterway.
* Monitor fish-eating wildlife to determine if they are accumulating contaminants to deliterious levels.
* Develop sediment standards that relate the levels in the sediment to impacts on the aquatic environment.
* Research to determine the antagonistic or synergistic actions of contaminants along with quick scanning techniques to characterize the water samples.
* Coordinate efforts with Health Department and Department of Natural Resources State Fisheries Managers.

Schedule of Activities

Ongoing:

* Provide one copy of all toxics reports within 30 days of publishing to Region 5 Clearing House.

FY88:

* Participate in Regional Work Group on strategy development as resources allow.
* Review and comment on sediment quality criteria documents under development by USEPA and other reports and data.
* Collect 3 fish samples from 4 sites on Lake Superior for PCBs and mercury. One sample from each location will be analyzed for pesticides.
* Collect 1 whole fish sample for dioxin analysis from 1 site on the Mississippi River and from 5 lake sites. Twelve fillet samples will be analyzed for mercury and PCBs.
* Four fish samples from 7 locations on the Mississippi River will be analyzed for PCBs to determine PCB trends.
* Three fish samples from twelve lakes will be analyzed for mercury.
* Three mine pit lakes will have two fish samples analyzed for mercury and one sample analyzed for PCBs.
* Four waterbodies or waterways receiving present or past municipal effluent will have 2 fish samples collected and analyzed for PCB and mercury analysis. One sample will be analyzed from each for pesticides.
* Three fish samples from 5 lakes will be analyzed for mercury, cadmium, and lead for the acid rain program.
* Two fish samples will be taken from 10 sites and analyzed for PCBs. mercury, or pesticides for screening, followup investigation or other reasons. Parameter analysis will be on a case by case basis.
* Sediment samples from 10 locations on the St. Croix River will be analyzed for PCBs.
* Feathers and livers from 8 loon carcasses will be analyzed for mercury.
* Sediment samples from 8 St. Louis Bay sites will be analyzed for mercury, metals and PCBs.

FY89:

* Collect 20 fish samples from 2 Mississippi River sites for PCB's and mercury. Two samples will be analyzed for pesticides.
* Collect 85 Fish samples from 7 northeastern Minnesota lakes for mercury. Data will be compared to previous data for trend analysis.
* Collect 80 fish samples from 8 popular northeastern Minnesota lakes for mercury. Three Voyageurs National Park lakes are included.
* Forty fish samples from 4 Lake Superior sites will be collected and analyzed for PCB's and selected pesticides if funded

through USEPA.

Compliance Monitoring Program

Objectives:
* To ensure that water quality standards are met by verifying the quality of point source dischargers.
* To ensure that point source dischargers are meeting permitted effluent limits.

Data Types:
* Chemical characteristics
* Flow measurements

Data Usage:
* To determine compliance of permitted dischargers with permit requirements and water quality standards.

Cooperation:
* USEPA
* Regulatory Compliance Program, MPCA
* Wastewater Treatment Section, MPCA
* Regional offices, MPCA
* Municipalities
* Industries

Needs:
* Valid and accurate data collected by dischargers that follows proper QA/QC procedures.
* Storage and retrieval capability for all data through PCS and STORET.

Schedule of Activities

Ongoing:
* Improve compliance of facilities.
* Improve effectiveness of compliance inspection activities.
* Increase use of the PCS system as the primary source of NPDES program data.
* Oversee effectiveness of federal pretreatment program implementation.
* Prepare and implement an annual inspection schedule for
* for major dischargers to be incorporated into the annual program plan.

FY88:
* Use and maintain PCS for all required data elements for all majors, priority P.L. 92-500 facilities, and NMP.
* Monitor and track compliance of all federally approved pretreatment programs.
* Identify existing compliance problems.
* Identify toxic discharges.

FY89:
* Identify existing compliance problems, noting priority and toxics-impacted waterbodies.
* Maintain PCS as the primary source of NPDES program information and compliance data.
* Prepare and implement an annual inspection schedule.
* Monitor and track compliance of all federally-approved pretreatment programs.

Standards Program

Objectives:
* Maintain an adequate and sufficient WQS program.
* Assure that waterways are properly classified in terms of beneficial uses and where attainable, as part of the triennial standards review process. Upgrade uses consistent with the goals of Section 101 of the CWA.

* Review and, where appropriate, revise water quality standards within the context of Section 303(c) of the Clean Water Act and 40 CFR Part 130 and 131.
* Develop WQS for toxic pollutants and procedures for applying narrative toxic criteria for water quality based permit limits.
* Assist in developing a toxicant control strategy that will enhance the ability to control point and nonpoint sources of toxicants.
* Complete the development and begin to implement anti-degradation procedures and policies.
* Develop a comprehensive water quality assessment of State waters.

Data Types:
* Habitat assessments
* Cost/benefit information
* Physical, chemical, and biological characteristics

Data Usage:
* To develop water quality standards for toxic pollutants.
* To reclassify lakes and streams.
* To develop rules to implement federal nondegradation requirements.
* To revise Minnesota's definition of secondary treatment.

Cooperation:
* Attorney General
* Revisor of Statutes
* Regulated community
* Lake Studies Program, MPCA
* Toxic Substances Monitoring Program, MPCA
* Regulatory Compliance Section, MPCA
* Minnesota Department of Natural Resources

Needs:
* Develop phosphorous standards to control lake eutrophication.
* Develop rules to regulate nonpoint sources.
* Develop sediment criteria.

Schedule of Activities

Ongoing:
* Consider nonpoint source loads and impacts in the water quality standards (WQS) review/revision process.
* Consider consistency of WQS revisions with International Joint Commission (IJC) water quality objectives and identify WQS that do not support IJC objectives.
* Participate in the Regional Work Group, coordinated by EPA, on toxicant strategy development.

FY88:
* Initiate during FY 88 and complete during FY89 the development of numerical WQS for all toxicants where USEPA criteria are available.
* Develop procedures for applying "free froms" or other narrative criteria by the first qarter of FY 1988.
* Adopt new criteria for toxicants through application of "free froms" (narrative) procedures as needed.
* Develop anti-degradation requirements in the water quality rules, and apply to proposed projects.
* Identify all waters needing water quality based controls for toxics and non-toxics.

FY89:
* Complete the development of WQS for all toxicants where USEPA criteria are available.
* Initiate the WQS review/revision process for the next triennial review process.
* Undertake use attainability analyses and site-specific criteria modification studies as a means of ensuring sound water quality basis for permit, construction grants, NPS control and enforcement decisions.

* Reference watersheds for ecoregions should be identified and monitored.

Schedule of Activities

Ongoing:

* Enter monitoring data into STORET (including intensive survey data) within 60 days after receipt from the laboratory.
* As changes occur, update the existing Quality Assurance Plan for new parameters and methods.
* Revise and implement existing methodologies identified in the existing approved Quality Assurance Plan to reflect revisions in 40 CFR 136 in order to conform with specific guidance and methodologies as provided by EPA's Quality Assurance Office (revisions and implementation will occur as needed and practicable).
* Implement the approved Quality Assurance Program Plan.
* Provide valid water quality data that can be used in the program evaluation and decision making process and implement the Guidance for State Water Monitoring and Wasteload Allocation Programs, subject to review. Send appropriate final reports to EPA's Region V Clearinghouse.
* Collect water samples on a monthly basis (8 months a year) from 75 stations including 19 fixed stations.

FY88/FY89:

* Prepare and submit monitoring checklists pursuant to the regional strategies and the Guidance for State Water Monitoring & Wasteload Allocation Programs.
  1) Submit monitoring checklists for monitoring fixed stations and intensive surveys by January 1 of each year.
  2) Identify toxic substance monitoring locations and indicate whether they coincide with National Ambient Monitoring Station locations.

Nonpoint Source Pollution Program

Objectives:

* Develop and implement a nonpoint source pollution control program of integrated water quality and land-use management for surface and ground water protection.
* Coordinate the water quality planning process and serve as an interagency liaison so that water quality/land-use management actions of existing programs are implemented to control nonpoint source pollution.
* Administer the lake restoration grants program in order to improve water quality and assist the Agency in addressing nonpoint source pollution concerns.
* Develop an assessment strategy for the ranking of watersheds in the state for non-point pollution control and abatement.
* Verify improvement or degradation of water quality after lake restoration efforts have ended.
* Develop and refine the U.S. EPA ecoregion concept in Minnesota.
* Develop a draft statewide Nonpoint Source (NPS) Assessment Report which has recieved public comment by April 1988 and a final document approved by the MPCA Board and Governor by August 1988.
* Develop and implement the State NPS program.
* Prepare the annual NPS Report by September 30, 1988.

Data Types:

* Chemical characteristics
* Physical characteristics
* Hydrologic and hydraulic characteristics
* Biological characteristics

* Land use
* Topographic chacteristics

Data Usage:
* Determine nonpoint source best management practices (BMP) or BMP's incorporated with point source effluent standards to protect water quality.
* Evaluate and monitor the impacts of best management practices for nonpoint source control on surface and ground water.
* Determination the need for and effectiveness of lake restoration projects under the 314(a) program.
* Identify NPS impacted or potentially impacted areas and waterbodies.

Cooperation:
* Counties
* Watershed districts
* USGS
* Minnesota Department of Natural Resources
* Soil and Water Conservation Districts
* Lake Studies Program, MPCA
* Intensive Surveys Program, MPCA
* Routine Monitoring Program, MPCA
* Ground Water and Solid Waste Division, MPCA
* Hazardous Waste Division, MPCA
* All state, local and federal groups dealing with land or resource management.

Needs:
* Evaluate the relationships between surface water best management practices and ground water quality.
* Conduct post-restoration studies on water quality after restoration efforts have been implemented.
* Establish a stream assistance program to assist local managers in identifying stream pollution problems.

Schedule of Activities

Ongoing:
* Cooperate with and provide assistance to existing local water quality management efforts and governmental programs in order to promote and establish a watershed management approach to nonpoint source pollution control.
* Coordinate and work closely with watershed management projects (e.g. Big Stone, Clearwater River, and Garvin Brook) so that successful administrative and technical solutions to water quality/land-use management problems are demonstrated and appropriate experience is gained for future nonpoint source program implementation.
* Update and implement a public education and information strategy designed to communicate to the public, government agencies, and the legislature the significance of land-based water pollution on the economic and recreational welfare of the state so that support for integrated water quality/land-use management will be increased. Provide information to land users to improve land-use management for water quality protection.
* Develop technical and administrative tools for managing NPS programs including, as necessary, standards, BMP criteria, administrative procedures, etc.
* Implement the strategy for the MPCA's participation in the Metropolitan Surface Water Management Act of 1982 and the Local Water Planning Act of 1985 through:
  (1) Provision of available water quality data and assistance in locating such data.
  (2) Assistance in using pollutant delivery models.
  (3) Assistance in resource use and attainability assessments.

Intensive Surveys Program

Objectives:

* Target and conduct total maximum daily loads wasteload allocations (TMDLs/WLAs) in accordance with the continuing planning process and with emphasis in PWB areas for the support of key NPDES permit, enforcement, and construction grant funding actions.
* Determine that construction of advanced treatment projects, based on permit requirements more stringent than secondary treatment, will result in significant receiving water quality improvements or will mitigate an existing public health problem.
* Develop water quality based controls (TMDLs/WLAs) for waterbodies that are not expected to attain or maintain WQS through application of technology based controls for point sources. For such waterbodies impacted by toxics, supplement the TMDL/WLA with a control strategy for point sources that achieves WLA limitations within three years of adoption of the strategy.
* Determine that construction of AT projects, based on permit requirements more stringent than secondary treatment, will result in significant receiving water quality improvements or will mitigate an existing public health problem.
* Provide water quality data that can be used in the program evaluation and decision-making process.
* Ensure water programs address priority problem areas.
* Ensure that Water Quality Management Plans are updated.
* Evaluate if uses of the resource associated with the present use classification are being attained.
* If uses are not being attained, define sources of use impairment and predict potential uses pending mitigation.

Data Types:

* Chemical characteristics
* Biological characteristics
* Hydrological and hydraulic characteristics
* Diurnal fluctuations

Data Usage:

* Calculation of wasteload allocation effluent limitations needed to maintain water quality standards.
* Calculation of critical low flow periods for waste load allocations.
* Identification of toxic discharges of metals.
* Determination of the water quality in the zone of influence downstream of a discharger.
* Provide justification for advanced treatment.

Cooperation:

* USEPA
* Minnesota Department of Natural Resources
* USGS
* State Climatologist Office
* Permits, Enforcement, and Construction Grants Programs, MPCA
* Industrial and municipal dischargers
* Nonpoint Source Program, MPCA

Needs:

* After AT facilities are completed, special studies should be conducted to compare 'before' and 'after' water quality and to verify the accuracy of the mathematical models used to establish effluent limitations.
* The success and merits of use attainability should be documented by demonstrating improvements in fisheries and recreational uses after improvements have been implemented.

Schedule of Activities

Ongoing:

* Document procedures which are used to implement nondegradation

policies and utilize these procedures.
* Update identification of waterbodies where technology-based effluent limits are insufficient to achieve applicable WQS.
* Ensure that permits and construction grant projects are consistent with the Water Quality Management Plan.

FY88:
* Schedule and develop TMDL/WLAs in advance of permit expiration to support permit limit development.
* Schedule and develop control strategies for waterbodies impacted by point sources of toxics.
* Develop a list and schedule for AT reviews based on projections of AT projects for FY 88 and FY 89.
* Incorporate reviews of WQS and development of TMDL/WLAs as fundamental components of the AT justification process.
* Complete AT reviews consistent with schedule to ensure no delay in construction grant projects.

FY89:
* One advanced treatment study will be done at Bock, Minnesota.
* One intensive survey will be done at Eveleth, Minnesota to establish final effluent standards.
* Two wasteload allocation studies will be done.
* Seven reference wateshed studies will be done within the Western Corn Belt Plains Ecoregion.

Routine Monitoring and National Fixed Station Network

Objectives:
* Provide background water quality data used in: 1) development of water quality standards, 2) preparation of reports to ASIWPCA and the IJC, 3) fishery and biological studies, 4) characterization of ecoregions, 5) EPA required reports 305(b) and Water Quality Management Plan.
* Provides background information necessary to answer water quality inquiries asked by the general public, governmental agencies, academic communities, municipalities, and industries.

Data Types:
* Chemical characteristics
* Physical characteristics
* Biological characteristics

Data Usage:
* Determination of ambient water quality.
* Determine compliance with state rules and water quality standards.
* Determine long term trends of water quality.
* Provide for baseline data and allow for national data comparability.

Cooperation:
* USEPA
* States including Wisconsin, North Dakota, South Dakota, and Iowa
* Manitoba
* Ontario
* Environment Canada

Needs:
* Additional stations and parameters need to be added to comprehensively monitor the state, particularly if the impact of nonpoint source contributions are going to be quanitified.
* Metals should be collected and analyzed twice yearly at all stations.
* Organics should be collected at all stations yearly.
* Samples should be collected twelve months of the year rather than the present eight months.
* Routine event monitoring should be done for NPS.

(4) Assistance in designing pollution abatement programs.
(5) Assistance in coordinating water quality management efforts with other units of government.
(6) Review of plans for consistency with the Act and sound watershed management activities.
(7) Coordination with other agencies in the review of local watershed plans.

* Review and evaluate monitoring data from clean lakes restoration grants for pre- and post-project evaluation within 90 days of receipt.
* Ensure that quality Lake Restoration Grant applications are prepared and submitted so that Minnesota may receive the maximum funding from EPA Region V's allocation.
* Ensure that projects in the program meet federal and state requirements, remain on schedule, and achieve intended water quality improvements. Completion of this activity is contingent upon EPA making timely (30 to 45 days) decisions regarding grants, budget period extensions, and the like.
* Coordinate closely with the Regulatory Compliance Section so that lake restoration grants serve as an integral part of a total water media program.

FY88:

* Complete NPS Water Body Assessment using ecoregions analysis of watersheds and existing water quality information. Develop goal and criteria setting process for lakes and streams.
* Identify categories and subcategories of NPS which provide significant contributions.
* Develop process to identify and document best management practices (BMP) for control of NPS and their probable effect on ground water.
* Establish an interagency team to identify and describe the state and local program for controlling NPS.
* Complete the assesment of the Minnesota River Basin for NPS impacts as funding is obtained.
* Develop a report which identifies the state management program, is approved by the Governor and submitted to USEPA by August 1988 which identifies: BMPs, programs, schedules, certification of AG of authorities and sources of funding which will be sent to implement the program.
* Adopt permanent rules and implement the Clean Water Partnership Program.
* Develop technical and administrative tools for managing NPS programs including as necessary standards, BMP criteria, administrative procedures, etc.
* Begin implementation of Clean Water Partnership Projects and projects funded through Section 319 of the Water Quality Act through administrative and technical assistance to projects.
* Facilitate implementation of BMPs for control of NPS to meet water quality standards and international agreements by providing technical assistance to management agencies.
* Assist project sponsors in establishing site specific control measures to improve water quality in association with spcefic NPS control projects.
  (1) Assist project sponsors in monitoring and evaluating BMP installation.
  (2) Promote state/local technical information exchange.
* Assist NPS management agencies to factor in water quality objectives into operating programs.
* Setup a tracking system to evaluate impacts of state programs on water quality.
* Based on reauthorized CWA, update the State 314(a) report by April 1, 1988 ensuring consistency with the NPS Assessment Report.
* Prepare applications for 314(a) projects by February 1988, based on the 314(a) program report.

(1) Provide a list of Candidate projects to Region V by October 15, 1987.
(2) Send draft projects to Region V by January 15, 1988.
(3) Send final projects to Region V by January 15, 1988.
(4) Submit final applications by February 15, 1988.

* Prepare applications for 314(b) demonstration program.
  (1) Propose projects that reflect geographical requirements of 314(b), regional guidance and state priorities.

FY89:

* Provide a list of the components of the state NPS program which need to be developed in order to gain USEPA approval and a schedule for completing the development of the components.
* Develop technical and administrative tools for managing NPS programs.
* Develop guidance documents for Clean Water Partnership (CWP) and section 319 projects for monitoring, computer modeling, BMP project evaluation and reporting, project administration, application procedures, rules, and project development.
* Facilitate implementation of BMPs or control of NPS to meet water quality standards and international agreements by providing technical assistance to management agencies.
* Assist project sponsors in establishing site specific control measures to improve water quality in association with specific NPS control projects.
* Assist NPS management agencies to factor in water quality objectives into operating programs.
* Provide a description and schedule for demonstration projects to be funded during fiscal year.
* Coordinate development, training and implementation of AGNPS model.
* Prepare the annual NPS report by September 1, 1989.
* Develop and implement ground water related NPS projects.
* Provide a schedule to EPA Region V for implementation and/or devlopment of ground water NPS activities by December 30, 1988.

Border Waters Programs

Objectives:

* Support the IJC Water Quality Board initiatives and priorities for the Great Lakes Area of Concern.
* Support Article VI and Annex 7 of the GLWQA by participating in an in-place pollutants research program to the extent that State resources allow if funded by Congress.
* Support the CWA and Article IV of the GLWQA by developing a candidate list of "Outstanding Natural Resource Waters" within the Great Lakes basin and report on the statutory, administrative, and socioeconomic barrier remedies related to declaration of Great Lakes waters as Outstanding Resource Waters. Lake Superior is designated an "Outstanding Resource Value Waters" by Minnesota Rule.
* Support Article IV and Annexes 11 and 12 of the GLWQA by participating in the development, promulgation and monitoring of water quality standards (WQS) for the Great Lakes and their tributaries.
* Support the efforts to determine and control toxics loading of the Great Lakes as called for by Annex 12 of the GLWQA evaluating the need for implementing the ground water data management practices recommended by the Region V Ground Water Data Management Task Force.
* Support Annex 11 and 12 of the GLWQA by implementing Great Lakes monitoring described in Activity A and report loadings to IJC by

entering data into STORET.
* Ensure State participation in U.S.-Canada Water Quality Board and activities of the IJC.

Data Types:
* Chemical characteristics
* Tissue data
* Sediment data

Data Usage:
* Determination of ambient water quality.
* Determine compliance with state rules and water quality standards.
* Determine compliance with IJC water quality objectives.
* Determine long term trends of water quality.
* Provide for baseline data and allow for national data comparability.

Cooperation:
* USEPA
* Environment Canada
* Ontario
* Manitoba
* North Dakota

Needs:
* Complete assessment of areas of concern.

Schedule of Activities

Ongoing:
* Report annually on the level of the 11 critical pollutants of the Water Quality Board as monitored in sediment, water, and effluents discharged to the Great Lakes. Data collected on any of the eleven critical pollutants will be placed in STORET within 30 days of receipt from laboratory.
* Appoint appropriate state personnel to IJC committees. (Staff will be appointed to IJC committees as needed to accurately represent Minnesota's interests and needs.)
* Participate in the Red River Pollution Control Board by:
  (a) Preparing a draft annual report and attending the annual meeting as needed.
  (b) Chairing the Red River Contingency Plan Work Group and completing annual updates of the plan.
  (c) Chairing the Red River Objectives Task Force and preparing a report to the Commission.
* Participate in the Rainy River Pollution Control Board by:
  (a) Preparing a draft annual report and attending the annual meeting as needed.
  (b) Co-chairing the Rainy River Study Plan Work Group and coordinating study with Boise Cascade.

FY88:
* Continue assistance in the completion of Area of Concern (AOC) Remedial Action Plan for sediments in the St. Louis River.
  (1) Provide assistance to and consultation with the EPA consultant on the development of the LAP.
  (2) Review draft RAP developed by EPA consultant within 60 days of receipt.
  (3) Draft sections of the RAP not completed by the EPA consultant as resources allow.
* Initiate implementation of RAP
  (1) Comply with implementation schedule of RAP when completed as resources allow.
* Provide inventory if not completed of major and minor dischargers in the Great Lakes AOCs by January 1, 1988. Develop a schedule by March 1, 1988 for incorporation of control limits and report compliance to GLNPO for phosphorous.

(1) Inventory will be provided and control limits scheduled for St. Louis Bay AOC.

* Ensure that inventories are incorporated into the RAP where appropriate.
* Initiate the promulgation of numerical water quality standards for the Great Lakes for at least those parameters having EPA criteria documents. Emphasis will be placed on the IJC Water Quality Board 11 critical pollutants and the priority pollutant metals needed to protect aquatic and terrestrial life and human health. Priority will be given to IJC areas of concern.
* Monitor receiving waters known or reasonably expected to be violating WQS at tributary mouths. With priority given to AOC tributaries to the extent that analytical methods exist.
* To the extent that completed monitoring will permit, report waterbodies or segments thereof within the GL basin which exceed the WQS for any of the pollutants identified.
* Monitor GLISP tribs monthly for TP, Na, Cl, NO2+NO3, and TSS for the purpose of calculating loads to the Great Lakes.
  - Stations on the Beaver River (BV-4) and St. Louis Bay (SLB-1) will be monitored nine times per year for the routine parameters and for Cl, total Pb, total Ca, total Na, total sulfate, and reactive silica.
* Depending on availability of resources, participate in EPA sponsored workshop on high flow sampling strategies and GL load estimation.
* Provide a self-evaluation of State ability to routinely generate and report reliable automated load estimates to the Great Lakes from individual tributaries, individual point sources, from all point sources to a tributary, and from all tributaries combined, per requirements of the Lake Michigan Toxics Strategy and Green Bay study, and recommendations of the 1985 WQB Report, Report On Capabilities, and identify needs for staff, hardware, software, and methods.
  (1) USEPA will provide guidance on other appropriate documentation outlining the procedures for conducting automated local estimates by September 30, 1987.
  (2) Self-evaluation will be provided by September 30, 1988.
* Assess sampling and analytical capability to detect appropriate levels of toxic substances in effluents and surface waters by September 30, 1988. Participate with USEPA in demonstration projects and screening surveys for those substances.
* Report annually on data collected by the MPCA on the level of 11 critical pollutants of WQB monitored in sediment, water, biota, and effluents discharging into the Great Lakes by entering data in STORET within 60 days of receipt from the laboratory.
* Collect spottail shiners at St. Louis Bay if available or other young of the year and send to GLNPO for analysis.
* Collect fall run coho salmon at French River if available and send to FDA according to Federal/State Great Lakes Fish Monitoring Strategy.
* Complete uniform Great Lakes-wide risk based fish advisory.
* Implement monitoring called for in AOC RAP to further define or to track progress as resources allow.
* Appoint appropriate State personnel to IJC committees.
* Actively participate in IJC committees as requested.
* Participate in the Red River Pollution Control Board.
  (1) Prepare an annual report and attend the annual meeting.
  (2) Chair the Red River Contingency Plan Work Group and cmplete annual updates of the plan.
  (3) Chair the Red River Objectives Task Force and prepare an annual report.
* Participate in the Rainy River Pollution Control Board.

(1) Prepare an annual report and attend the annual meeting.
(2) Co-chair the Rainy River Study Plan Work Group and participate in the preparation of the final report.

* Participate in the Lake Superior Surveillance Task Force.
* Participate in IJC round robin laboratory comparisons for IJC parameters measured in State programs.

FY89:

* Participate in the Great Lakes Water Quality Agreement Integration Work Group (GLWQAWG). Attend meetings and serve on committees as appropriate.
* Ensure State participation in the International Joint Commission (IJC) Great Lakes Water Quality Board.
* Actively participate on IJC Committees.
* (1) Participate in the Red River Pollution Control Board.
  (a) Prepare an annual report and attend annual meeting.
  (b) Chair the Red River Contingency Plan Work Group and complete annual updates of the plan.
  (c) Chair the Red River Objectives Task Force and prepare an annual report.
* (2) Participate in the Rainy River Pollution Control Board.
  (a) Prepare an annual report and attend the annual meeting.
  (b) Co-chair the Rainy River Study Workplan Group and participate in the preparation of the final report.
* Participate in the Lake Superior Surveillance Task Force.
* Participate in the IJC round-robin laboratory comparisons for IJC parameters measured in State monitoring programs.
* Assist the USEPA in preparing for the semiannual meeting with Canada to coordinate respective workplans and evaluate progress made in meeting the terms of the GLWQA.
* Support the IJC Water Quality Board's initiatives and priorities for the Great Lakes Area of Concern (AOC).
* Incorporate appropriate portions of completed AOC RAP into the Minnesota Water Quality Management Plan.
* Implement AOC RAP when the plan is approved and as resources allow.
* Develop a schedule for State Watershed Management Plans for Great Lake Areas impacting AOCs.
* Participate in the development of a Monitoring Program Strategy that supports plans for each adjacent St. Louis Bay
* Complete an inventory of those facilities discharging to Great AOC which need but do not currently have water-quality based effluent limits in place by March 31, 1989.
* Continue to provide Monthly Discharge Monitoring Report data for point source dischargers to the Great Lakes and their tributaries through PCS or STORET.
* Participate in activities related to Lake Superior LMP as resources allow.
* Provide an assessment of State sampling and analytical capability to detect levels of toxic substances in effluents and surface waters for use in preparing LMPs by March 31, 1989.
* Identify, by report in 305(b) Report and 304(l) lists, those Great Lakes waters known or reasonably expected to be violating WQS and initiate or continue monitoring for approriate parameters.
* Participate in a GLNPO sponsored In Place Pollutants (IPP) demonstration program for the removal, stabilization, or treatment of toxic bottoms sediments and in the Great Lakes IPP Demonstration Program Interagency Work Group when they are applicable to Minnesota waters as resources allow.
* Develop and promulgate appropriate WQS for the Great Lakes and their tributaries.
* Implement GL monitoring; report loadings to IJC and enter

data into STORET.

* Monitor GLISP tribs monthly for TP, NA, CL, TKN, NO2+NO3, and TSS.
  - Stations on the Beaver River (BV-4) and St. Louis Bay (SLB-1) will be monitored eight times per year for the routine parameters and for Cl, total Pb, total Ca, total Na, total sulfate, and reactive silica.
* Report annually analyses for the 11 Critical Pollutants in sediment, biota, water and effluents discharging into the Great Lakes.
* Implement Great Lakes wide risk-based methodology for fish advisories, conforming to methodolohy agreed upon among the Great Lakes States.

Emergency Response Program - Hazardous Waste Division

Objectives:
* Return contaminated spill sites to acceptable condition in a reasonable time frame and minimize the impact of spills by prompt effective actions.

Data Types:
* Chemical characteristics for surface and ground water
* Soils and sediment data

Data Usage:
* Determine nature and extent of spill.
* Determine toxic components.
* Determine compliance with state rules and standards.
* Evaluate cleanup procedures and success.

Cooperation:
* Local governmental agencies including police and fire departments
* Ground Water and Solid Waste Division, MPCA
* Water Quality Division, MPCA
* Regional offices, MPCA
* Minnesota Department of Natural Resources
* Minnesota Department of Transportation
* USEPA

Needs:
* Provide more on-site monitoring of spill cleanups.

Schedule of Activities

Ongoing:
* Mitigate the effects of spills of petroleum products and hazardous materials by maintaining an effective emergency response program.

FY88/FY89:
* Pursue legal actions against responsible parties.
* Respond to all major and intermediate incidents.
* Respond to all major spill sites consistent with the state contingency plan, and report to the National Responce Center.
* Compile necessary followup reports with recommended actions and provide them to appropriate agencies.
* Notify USEPA of all spill response activities.
* Initiate and issue, as appropriate, Notices of Violations based on significant noncompliance.

Dredge and Fill Program

Objectives:

* Review applications and issue or deny permits and certify compliance under the State Disposal System permit program and Section 401 of the Clean Water Act related to dredge and fill activities in order to prevent pollution of waters and protect sensitive aquatic ecosystems from the adverse impacts of discharged dredged and fill materials.
* Evaluate 404 permit assumption through an interagency task force.

Data Types:

* Sediment samples/Evaluation
* Chemical characteristics

Data Usage:

* Analyze water quality impacts of federal actions

Cooperation:

* Wisconsin
* U.S. Army Corps of Engineers
* U.S. Fish and Wildlife Service
* Minnesota Department of Natural Resources

Needs:

* Criteria development for sediments
* Criteria applications for sediments
* Implement a wetland protection program
* Define a wetland protection strategy

Schedule of Activities

Ongoing:

* Participate in the AID Program to identify sensitive aquatic corridors for the purposes of reducing the environmental impact in those areas as needed. Enter into an agreement with the DNR for coordination of the AID program.
* Report actions quarterly to USEPA.
* Consider USEPA proposals for development of a wetland protection strategy.

FY88:

* Review all (approximately 150) public notices under Section 404 of the Clean Water Act for impacts on designated uses of water bodies or wetlands and recommend approval, waiver, or denial of 401 Certification.
* Act upon approximately 120 applications for certifications under Section 401 of the Clean Water Act within the time allotted.
* Monitor the memorandum of agreement with Corps of Engineers on nationwide and general permits.
* Issue or deny State Disposal System permits for dredging projects with emphasis on permits for navigation purposes.
* Refer for enforcement unauthorization nonproper actions under 401 jurisdiction and comment on proposed EPA enforcement actions as appropriate.
* Participate in an interagency task force evaluating the assumption of the 404 process.

FY89:

* Review all public notices under Section 404 (CWA) for impacts on designated uses of water bodies or wetlands.
* Waive or deny certifications under section 401 (CWA) within the time alloted.
* Refer projects requiring State Disposal Systems Permits to the Regulatory Compliance Section for proper action.
* Refer for enforcement unauthorization or nonproper actions under 401 jurisdiction and comment on proposed EPA enforcement actions as appropriate.
* Participate in an interagency task force evaluating the assumptin of the 404 permit process.

* Draft a proposed program for review of wetland policies and a strategy to gain the necessary consensus of the affected agencies.

Data Management Program

Ojectives:
* Coordinate a system of water quality data storage and retrieval so that water quality information can be furnished to Agency personnel and the public.
* Insure that quality assurance and quality control are maintained for the data base.

Data Types:
* Chemical characteristics for both surface and ground water
* Physical characteristics for both surface and ground water
* Fish tissue data
* Turtle tissue data
* Loon tissue data
* Sediment data

Data Usage:
* Uses of the data are listed under the individual program descriptions.

Cooperation:
* USEPA
* All programs within the Minnesota Pollution Control Agency
* Other state agencies including, State Planning, Department of Health, Department of Natural Resources, Department of Transportation, Department of Agriculture, Minnesota Geological Survey
* Local units of governments and watershed districts
* Industry
* Academic community
* Public

Needs:
* Develop capability to electronically transfer analytical results from the Department of Health so that the data is ready for storage in STORET without being keyed into the system.
* Develop the capability to electronically transfer data generated by other state agencies and local units of government so that a comprehensive data base is maintained in STORET without the rekeying of information.

Schedule of Activities

Ongoing:
* Coordinate the storage of all data in STORET.
* Coordinate the editing and correction of all STORET data.
* Provide assistance for data retrievals and statistical analysis for the Program Development Section and the Division of Water Qualtiy, as well as the general public and other state and federal agencies.

FY88/FY89:
* Prepare, store, edit and correct all Routine Water Quality Monitoring Program Data within 30 days after it is received from the laboratory.
* Prepare and store all other water related data collected by the Section, including toxics, lake studies, special studies, nonpoint source, and groundwater information.
* Store data collected by other groups, including, the Metropolitan Council, Ramsey County, Rice Creek Watershed District, Clearwater Watershed District, and lake restoration projects.

Quality Assurance/Quality Control Program

Objectives:	* Administer the Discharge Monitoring Report Quality Assurance (DMRQA) program for the state. * Evaluate lab certification programs and make recommendations for setting up a program in the state. * Review alternate test procedure applications relating to NPDES permit requirements. * Coordinate quality control efforts between the Water Quality Division and the Health Department Laboratory. * Review treatment facility laboratories.
Data Types:	* Chemical lab results * Physical characteristics
Data Usage	* Determination of accuracy of lab data. * Determination of compliance with permit conditions. * Determination of comparability of data for alternate test procedure applications.
Cooperation:	* USEPA * Regulatory Compliance Section MPCA * Minnesota Department of Health * Municipalities * Industry * Consulting Firms
Needs:	* Establish a Lab Certification Program to provide assurance that high quality data is reported to the state. * Determine which permittees are reporting correct data and using acceptable procedures and quality control. * Improve the quality of analytical data through training and certification program.

Schedule of Activities

Ongoing:	* Coordinate the inter-laboratory quality control program as a continuing in-house activity. * Evaluate lab certification programs and make recommendations for their implementation. * Evaluate Agency analytical and sampling methods and make recommendations to ensure quality assurance in this methodology. * Instruct permit holder labs in proper lab techniques as requested. * Review and comment on alternate test procedure applications. * Inspect labs after reviewal of DMRQA program results.
FY88/FY89	* Conduct 25 onsite lab inspections. * Recommend lab certification program by June 30, 1987. * Prepare DMRQA report. * Inventory private and public labs that provide data under NPDES program. * Review the existing Quality Assurance Plan for new parameters and methods, including biomonitoring and update the Quality Assurance Plan as needed. * Revise field methods, including sampling procedures and analytical methodologies, currently being used as needed. * Implement the approved Quality Assurance Program Plan.

(6) SUMMARY

Environmental protection begins and ends with monitoring. Monitoring defines the pollution problem, helps determine what kind of pollution control is necessary, and measures the effectiveness of that control. Recognizing this, the Minnesota Pollution Control Agency operates a variety of monitoring programs.

Although this monitoring effort is extensive, many of the programs should be expanded to better define the pollution problems which still exist. The Routine Ambient Monitoring Program needs to be expanded to include more streams in the state and more frequent sample collection. Heavy metals and other toxics should be collected regularly as part of this monitoring program. Without this data, baseline information on a statewide basis will not exist. Similarly, special studies also need to be done to collect information on dioxin and pesticides as part of the Toxic Monitoring Program. Cuts in federal funding in Fiscal Year 1989 have reduced the operation of the Routine Ambient Monitoring Program to sampling during eight months of the year. This decreased level of funding has also resulted in an 80% reduction of the monies available for laboratory analysis of toxic substances.

The Agency is requesting an additional $250,000 from the 1989 State Legislature in order to mantain these monitoring programs. The additional funding will allow the ambient program to emphasize monitoring by ecoregion. The program will consist of two components. A state-wide monitoring network of 50 stations will be maintained to collect data throughout the state for trend analyses. In addition, 50 more stations will be added to characterize the water quality in 3 of the state's ecoregions one year, and 4 of the ecoregions the following year. Monitoring will include biological surveys (fish and macro-invertebrates), intensive monitoring of runoff events, and tissue and sediment monitoring. Water samples will be collected during 12 months of the year. Parameters monitored will be season specific and will include new generation pesticides and toxic metals.

Water Quality data on Minnesota's lakes is very limited. The Citizen Lake-Monitoring Program, the Lake Assessment Program, and the Lake Studies Program all need to be expanded to include lakes which are currently not being monitored. In addition, the elimination of funding for the Clean Lakes Program from the Federal Fiscal Year 1988 and 1989 budgets will greatly reduce the Agency's efforts to improve lake resources in Minnesota. The Minnesota Pollution Control Agency is requesting additional personnel from the 1989 State Legislature to expand the lake monitoring and public assistance programs. One additional person will be requested for the first year of the biennium, and two persons will be requested for the second year.

Biomonitoring presently consists of bioassays which are conducted on effluents. There is a need to develop the capability to perform bioaccumulation tests for both effluents and insitu conditions for this program. Monitoring of both surface and ground water needs to begin for the Nonpoint Source Program so that sources of this type of pollution can be identified. This program should also include storm event monitoring. Expansion of all of these monitoring programs will help the Agency to determine where pollution problems exist in the state and what kind of pollution control is necessary to correct those problems.

Other monitoring programs need to be expanded to better determine the effectiveness of the abatement work which has been done by the Agency and by municipalities and industries. The Intensive Surveys Program should document the success and merits of use attainability by demonstrating changes in fisheries and recreational uses after improvements have been implemented. The Biomonitoring Program should be expanded to measure the effectiveness of land use management practices employed to control nonpoint source pollution. Follow up monitoring should be conducted on lake restoration work which has been federally funded to evaluate the success of those projects. These monitoring Programs would help the Agency judge how effective pollution control has been throughout the state. Current levels of federal funding in fiscal years 1988 and 1989 will not allow these necessary monitoring evaluations to be made.

The Agency will need additional funding to expand any of its monitoring programs. These funds will need to be provided by both the state and federal governments if an increase in monitoring activities is to occur. The need for additional monitoring is clear; the commitment to support that monitoring is not.

It is also clear that with the decrease in the availability of additional funding, it will become more important for agencies to coordinate their monitoring programs. This is true not only for state and local agencies within Minnesota, but also for state and federal agencies. Coordination will avoid duplication and stretch diminishing monitoring dollars. It will also foster cooperation between agencies in other areas. All agencies in Minnesota who are involved in environmental monitoring should insure that the data resulting from these programs are in a format that is easily accessable by all the other agencies so that it can be used by everyone. In the case of water quality data, this may mean the inclusion of all of the data in one or two main data bases; i.e. STORET for surface water and IGWIS for ground water. Data that are not easily available for use by other agencies do not serve the best interests of either the agency collecting the data or the monitoring community as a whole.

If Minnesota is going to remain in the forefront of pollution control nationally, a commitment to continue existing monitoring and to expand monitoring where it is necessary needs to be made. This commitment involves the financial support of both the State Legislature and the U.S. Environmental Protection Agency.

6. APPENDIX

Station and Parameter Lists for Fiscal Years 1988 and 1989

Biomonitoring Program
Lake Studies
Citizen Lake-Monitoring Program
Lake Assessment Program
Acid Rain Program
Toxic Substances Monitoring Program
Intensive Surveys Program
Routine Monitoring and National Fixed Station Network

APPENDIX L

Memoranda of Agreement

Memorandum of Agreement Between
The Minnesota Pollution Control Agency and
The Minnesota Department of Natural Resources
Pertaining to Control of Nonpoint Sources of Pollution

I. Description

The Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Natural Resources (MDNR) agree that nonpoint sources of pollution (NPS) must be controlled to achieve and maintain a full range of uses of Minnesota's water resources. Nonpoint source pollution contributes to the degradation of the quality of all waters of the state, impairs a wide variety of water resource uses and limits resource management and conservation options.

II. Purpose

The purpose of this Memorandum of Agreement is to focus coordination and cooperation between the MPCA and the MDNR in support of common objectives, interests and statutory requirements toward implementation of nonpoint source pollution control for protection, management and conservation of water and other natural resources.

III. Authorities

Nothing in this agreement alters the statutory authorities or responsibilities of the MPCA or MDNR.

The MPCA is charged with the responsibility to prevent and abate water, air and land pollution throughout the State of Minnesota. This includes the control of nonpoint source pollution. The importance of a comprehensive statewide approach to nonpoint source pollution was recognized in 1987 by the Legislature with its enactment of the Clean Water Partnership Act. This Act sets forth a comprehensive program under the direction of the MPCA to address nonpoint sources of pollution. The Act directs the MPCA to compile an assessment of waters of the state impacted by NPS, provide financial and technical assistance to local units of government to abate NPS, coordinate programs used to control NPS and develop a state plan for control of NPS to meet the requirements of the federal Water Quality Act of 1987. The MPCA's authority is specifically described in Minnesota Statute Chapters 115, 115B, and 116.

The MDNR purpose as defined in Minnesota Statute Chapter 84 is "to best serve the public in the development of a long range program to conserve the natural resources of the State." The MDNR is charged with responsibility for managing public lands and waters for recreation, timber, minerals and fish, wildlife and native plants of the State in Minnesota Statutes Chapters 84 through 112 and other applicable laws. Minnesota Statutes Chapters 104 through 112 provide for conservation and utilization of water resources in the best interests of people in the State and to promote public health, safety and welfare; Minnesota Statutes Chapters 85, 88, 89, 90, 92, 93 provide for management of lands for parks, recreation, forests and minerals; and Minnesota Statutes Chapters 97A, 97B, and 97C provide for the management of fish and wildlife through harvest regulations, habitat protection and manipulation, enforcement and the collection of data.

It is clear from these authorities that the MDNR shares directly in the responsibility to abate nonpoint source pollution in the State of Minnesota.

IV. Implementation

The MPCA and MDNR fully support the concepts of cooperation and coordination and are committed to developing efficient mechanisms to establish close working relationships to support common objectives, interests and statutory requirements for control of NPS and protection, management and conservation of natural resources. To advance this effort, the following will be undertaken.

1. The MPCA and MDNR will facilitate and monitor the implementation of this agreement through the establishment of a joint coordinating team called the NPS Coordination Committee (NCC). The NCC shall consist of two (2) people from the MDNR and two (2) people from the MPCA, each designated by their respective Commissioners. The Commissioners shall designate their respective members of the Committee by July 15, 1988, and ensure that replacements are appointed as necessary. Chairperson of the Committee shall be designated by the Commissioner of the MPCA. a) The NCC shall meet quarterly and report results, issues and other matters of interest in writing to the Director of the Division of Water Quality, MPCA, and the Assistant Commissioner for Operations, MDNR.

b) The NCC shall be responsible for the collective oversight and implementation of this agreement.

c) The NCC shall be responsible for the coordination and communication of agency activities, regulations, policies, programs, interagency agreements or other issues deemed relevant to NPS issues.

d) The NCC will rely on the Interagency Coordinating Committee (created in the "Memorandum of Agreement between the MPCA and the MDNR for Establishing the Procedures for Cooperative Involvement in the Regulation of Mining Industries of Minnesota," signed September 21, 1987) to consider NPS issues related to mining.

2. The MPCA and MDNR will share information which is useful on nonpoint source pollution control and natural resources management.

3. The MDNR will identify and use best management practices for nonpoint source control in resource management policies, guidelines and rules of the Divisions of: Forestry; Parks; Minerals; Fish and Wildlife; Waters; and Trails and Waterways.

4. The MDNR will provide the MPCA with an annual report in August, which identifies MDNR activities and accomplishments to abate NPS.

5. The MPCA will develop a state management program for the control of NPS to meet the requirements of Section 319 of the federal Water Quality Act of 1987.

   a. The MDNR will participate in the preparation of the State Assessment Report to be drafted by April 1, 1988.

   b. The MDNR will participate in the development of the State Management Program. The MDNR with assistance from MPCA will develop a four-year strategy for incorporating NPS management activities into MDNR programs, based on the State Assessment Report and the recommendations in the 1986 NPS Issues Team Report. The strategy will include identification of specific programs and activities, measures to be incorporated, time frame for implementation, and sources and needs for staffing and funds. A draft strategy shall be completed by July 1988.

   c. To implement the state management program for control of NPS, the MPCA and MDNR will use existing programs to maximize nonpoint source prevention and control and pursue funding and staff through budget and legislative initiatives to achieve NPS objectives.

6. The MPCA will coordinate activities and programs of federal, state and local agencies involved in control of NPS through the Project Coordination Team established by Laws of Minnesota 1987, Chapter 392, Section 13.

7. The MPCA will prepare an annual report by November 1, which will identify activities, accomplishments and the effectiveness of programs toward management of nonpoint sources of pollution and achieving water quality goals in the State.

V. Modification, Termination and Expiration

This Agreement shall become effective upon the signature of both parties and shall remain effective until modified or terminated. This Agreement may be amended or reissued upon the written mutal agreement of both of the parties. The MPCA or the MDNR may cancel this agreement by written notification to the other party. Termination shall occur thirty days after written notification is received. Termination may occur earlier by the mutual agreement of both parties.

Joseph N. Alexander Commissioner Minnesota Department of Natural Resources	Gerald L. Willet Commissioner Minnesota Pollution Control Agency
Date 24 June 88	Date June 13, 1988

IN THE MATTER OF A STRATEGY FOR PLANNING FOR THE ABATEMENT OF NONPOINT SOURCES OF POLLUTION IN THE METROPOLITAN AREA

MEMORANDUM OF UNDERSTANDING

I. Introduction.

The Minnesota Pollution Control Agency (Agency) and the Metropolitan Council (Council), in cooperation with the Metropolitan Waste Control Commission (Commission), agree that nonpoint sources of pollution must be controlled to achieve and maintain a full range of uses of Minnesota's water resources. Historically, attention was given to pollution produced by municipal and industrial sewage treatment plants and by on-site systems or septic tanks. This has been true in the Twin Cities area as well as throughout the country. In recent years, experience has shown that this is not the only, maybe not even the major, source of water pollution. In early 1981, the very first set of comprehensive, metropolitan-wide, scientifically collected data on nonpoint source pollution prevalent in the metropolitan area became available for study and evaluation. This data revealed that, indeed, nonpoint source pollution is a major problem for all receiving waters in the metropolitan area. It is particularly severe for the lakes, streams, and the minor rivers. These are the same waters most often used for fishing and swimming.

The impact of nonpoint sources of pollution on the metropolitan area's three major rivers -- the Mississippi, Minnesota, and St. Croix -- is more difficult to measure than on other waters because there are also numerous point sources discharging pollutants into these rivers. It is possible that additional improvement in the water quality of the major rivers may be achieved through reducing nonpoint source pollution. This could possibly serve as a trade-off for expensive advanced sewage treatment facilities.

II. Parties.

The Agency is charged with the responsibility to prevent and abate water, air, and land pollution throughout the State of Minnesota. This includes the control of nonpoint source pollution. The importance of a comprehensive statewide approach to nonpoint source pollution was recognized in 1987 by the Legislature with its enactment of the Clean Water Partnership Act. This Act sets forth a comprehensive program under the direction of the Agency to address nonpoint source pollution. The Act directs the Agency to compile an assessment of waters of the State polluted by nonpoint sources, provide financial and technical assistance to local units of government, coordinate programs used to control nonpoint sources, and develop a state plan for control of nonpoint sources to meet the requirements of the Water Quality Act of 1987. The Agency's authority is specifically described in Minn. Stat. chs. 115, 115B, and 116.

The Council, a regional agency created under the laws of Minnesota, is charged with the authority to coordinate the planning and development of the metropolitan area. The metropolitan area generally includes the counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. The Clean Water Partnership Act requires the Council to conduct, in cooperation with the Agency, an assessment of waters in the metropolitan area that have been polluted or have the potential for water pollution caused by nonpoint sources. The Council's authorities are specifically described in Minn. Stat. ch. 473.

The Commission, a metropolitan agency created under the laws of Minnesota, is charged with the authority to acquire, construct, equip, operate, and maintain all interceptors and treatment works necessary for the collection, treatment, and disposal of sewage in the metropolitan area. To provide cost-efficient wastewater treatment to users of the Metropolitan Disposal System while ensuring that environmental benefits are optimized, the Commission assists the Council by implementing its policies and by providing services to Council staff in support of the Council's goals. The Commission's authority is specifically described in Minn. Stat. ch. 473.

III. Purpose and Objectives.

The purpose of this Memorandum of Understanding is to provide for a continuing working relationship between the Agency and the Council, cooperatively with the Commission, in support of common objectives, interests, and statutory requirements, and to enhance coordination related to planning for the abatement of nonpoint sources of pollution in the seven-county metropolitan area.

The objectives of this Memorandum of Understanding include:

1. The identification of joint efforts to undertake a forty percent reduction in nonpoint source pollution on the Minnesota River.
2. The establishment of a coordinated statewide nonpoint source management program.
3. The advancement of nonpoint source management activities in the seven-county metropolitan area.

IV. Responsibilities of the Parties.

A. Minnesota Pollution Control Agency, Metropolitan Council, Metropolitan Waste Control Commission.

The Agency, Council, and Commission will jointly undertake the following efforts during the term of this Memorandum of Understanding.

1. Minnesota River Pollution Assessment. The Agency, Council, and Commission will jointly pursue funding to conduct a comprehensive assessment of the Minnesota River system. This assessment will include:

a. Identification of the sources and relative quantities of suspended sediments, major nutrients, and oxygen demanding substances for the major tributaries and segments of the main river.

b. Identification of the relative contribution of stream bank erosion and bed load to the pollution load of the river.

c. Time of travel determinations for the river from Mankato to the confluence with the Mississippi River.

d. Further evaluation of watersheds identified to be contributing high pollutant loadings to the system.

2. Minnesota River Pollution Reduction. The Agency, Council, and Commission will jointly identify, develop proposals, and pursue institutional mechanisms needed to accomplish water quality goals on the Minnesota River.

B. Metropolitan Council.

The Council will undertake the following work program during the term of this Memorandum of Understanding.

1. Work Program.

a. Metropolitan Area Nonpoint Assessment Report. The Council will use existing data to prepare the metropolitan area portion of the

State Assessment Report to meet the requirements of Section 319 of the Water Quality Act of 1987, Environmental Protection Agency's Nonpoint Source Guidance, and the Clean Water Partnership Act. This effort will be coordinated with the Agency's assessment effort so that a consistent and complementary approach is used.

b. Identify and Assist the Development of Priority NPS Abatement Projects.

(1) The Council will review existing information to identify waterbodies and watersheds which should be priorities for nonpoint source abatement projects.

(2) The Council will assist water management organizations in the preparation of diagnostic studies in selected critical areas to meet the requirements of the Clean Water Partnership Act.

(3) The Council will assist water management organizations in the development of abatement plans based on problems identified in the diagnostic studies and assist in preparation of applications to the Agency for grants through the Clean Water Partnership Act and the federal programs under Sections 314 and 319 of the Clean Water Act.

c. Financing Mechanisms for Nonpoint Source Abatement. The Council will review and make recommendations on the State's statutory framework for financing local surface water management and local water pollution control programs.

d. Assessment of Adequacy of Institutions. The Council will review and make recommendations on the State's statutory framework with respect to nonpoint source pollution abatement and surface water management programs in the seven-county metropolitan area. This will include:

(1) the need for uniform development and construction ordinances throughout the metropolitan area,

(2) the need for additional statutory authority to address areas where local units of government lack adequate authority, and

(3) the need for additional development controls for certain waters within the metropolitan area.

e. Evaluation of Runoff Management Practices. The Council will monitor the effectiveness of a limited number of runoff management practices to assess their value for water quality management.

f. Assessment of Lake Impacts.

(1) The Council will continue to monitor the water quality of a number of lakes in the metropolitan area to document changes in water quality in lakes.

(2) The Council will analyze existing lake data to assist the Agency in its assessment of "use impairment" in the seven-county metropolitan area.

(3) The Council will generate a range of total phosphorus export values (kg/ha/yr) for land uses in the seven-county metropolitan area to be used when modeling water quality changes resulting from land use.

(4) The Council will assess the extent of lake data in the seven-county metropolitan area to focus future data collection.

g. Assessment of Impacts and Abatement of NPS on Minnesota River. The Council will develop and undertake a program of monitoring the volume of discharges and quality of the discharges of the major creeks within the metropolitan area flowing to the Minnesota River for the purpose of identifying nonpoint source loadings under varying flow conditions. This program may be developed and implemented through local units of government and other cooperators. The major creeks are: Bevens Creek, Carver Creek, Bluff Creek, Riley Creek, Nine Mile Creek, Sand Creek, and Credit River.

h. Survey of Stream Bank Erosion. The Council will conduct in the metropolitan area a survey of stream bank erosion of the major creeks listed in paragraph IV.B.1.g.

2. Work Plan and Annual Report.

a. By March 1, 1988, the Council will prepare and submit to the Agency a work plan for the activities described in paragraph IV.B.1. The work plan will, at a minimum, contain a description, estimated budgets, and projected timelines for each activity listed. In addition, the work plan may identify those projects or activities the Agency will fund from the monies in the Metropolitan Area Clean Water Management Account.

b. By October 1, 1988, and annually each year thereafter during the term of this Memorandum of Understanding, the Council will prepare an annual report to the Agency, which will describe the Council's progress on its work plan.

c. The Council may modify its work plan at any time during the term of this Memorandum of Understanding.

3. Metropolitan Area Clean Water Management Account Funds. The Agency agrees to establish an account known as the Metropolitan Area Clean

Water Management Account and to deposit in it all monies paid to the Agency pursuant to the Consent Decree between the Agency, Council, and Commission. This account shall be used for nonpoint source projects as defined in the Clean Water Partnership Act. The parties agree that the Council, as the designated 208 agency, is entitled to select those projects to be funded from this account so long as any project meets the eligibility requirements of the Clean Water Partnership Act. Any project funded in whole or in part by the monies in the Metropolitan Area Clean Water Management Account will not be precluded solely because of such funding from receiving additional funding through the Clean Water Partnership program.

4. Administration of Selected Projects. The Agency will be responsible for contract and administrative management of any project selected pursuant to paragraph IV.B.3.

C. Metropolitan Waste Control Commission.

The Commission agrees, in support of the Council in its nonpoint source pollution program, to undertake the following activities:

1. The Commission will evaluate its routine monitoring programs for effectiveness in relation to nonpoint source program activities and assist the Council in reviewing existing water quality data in the metropolitan area.

2. The Commission will assist with the development and application of the pollutant delivery, tributary, and river response models as they relate to the lower Minnesota River basin and the evaluation of the effects of both point and nonpoint source management practices.

3. The Commission will cost share selected demonstration and pilot projects related to the selection of best management practices within the lower Minnesota River Basin Watersheds.

4. The Commission will assist with the implementation of program monitoring of the volume of discharges and quality of the dischargers of the major tributaries within the metropolitan area flowing to the lower Minnesota River.

D. Minnesota Pollution Control Agency.

The Agency will undertake the following program during the term of this Memorandum of Understanding.

1. Nonpoint Source Program Coordination. The Agency will coordinate programs and activities statewide to complement efforts in the seven-county metropolitan area to achieve water quality goals.

2. Funding. The Agency will award to the Council at least thirty-five (35%) percent of the amount allocated to regional public comprehensive planning organizations and appropriated to the State under Section 205(j)(3) of the Water Quality Act of 1987.

3. State Assessment Report and Management Program. By April 1, 1988, the Agency will prepare the statewide portion of the State Assessment Report and State Management Program to meet the requirements of Section 319 of the Water Quality Act of 1987, Environmental Protection Agency's Nonpoint Source Guidance, and the Clean Water Partnership Act.

4. Report of Program Effectiveness. By November 1, 1988, and annually each year thereafter, the Agency will prepare an annual report which will identify activities, accomplishments, and effectiveness of programs toward management of nonpoint sources of pollution and achieving water quality goals in the State.

V. Administration of Memorandum of Understanding.

The terms of this Memorandum of Understanding may be amended only in writing by the parties. Immediately after execution of this Memorandum of Understanding, the Council, Commission, and Agency will identify the staff persons who will serve as the principal agency contacts for implementation of this Memorandum of Understanding.

VI. Term of Agreement.

This Memorandum of Understanding shall become effective upon signature by all the parties and shall remain in effect for five (5) years from the last dated signature.

VII. Termination.

Upon the occurrence of any of the following events, the Memorandum of Understanding shall be void at the discretion of any of the parties:

A. If the NPDES/SDS permits for the Blue Lake and Seneca wastewater treatment facilities are not issued by the Agency in the form and language agreed to by the parties and attached hereto as Exhibits A and B; or

B. If the Agency issued NPDES/SDS permits for the Blue Lake and Seneca wastewater treatment facilities are objected to by the United States Environmental Protection Agency and such objections are not resolved in a timely manner to the satisfaction of any party; or

C. If the Consent Decree in the form and language agreed to by the parties and attached hereto as Exhibit C is not entered as a court order.

MINNESOTA POLLUTION CONTROL AGENCY

By Janet C. Green
for Keith H. Langmo, Chairman

Date 9/22/87

By Michael Robertson Deputy
for Thomas J. Kalitowski, Commissioner

Date 9-23-87

METROPOLITAN COUNCIL

By Steve Keefe
Steve Keefe, Chair

Date 10/14/87

By
David Renz, Executive Director

Date 10/14/87

METROPOLITAN WASTE CONTROL COMMISSION

By Peter E. Meintsma
Peter E. Meintsma, Chairman

Date

By Louis J. Breimhurst
Louis J. Breimhurst, Chief Administrator

Date 10-28-87

KK088A/CHLGL1

MEMORANDUM OF AGREEMENT
BETWEEN THE MINNESOTA POLLUTION CONTROL AGENCY AND THE
MINNESOTA DEPARTMENT OF NATURAL RESOURCES FOR
ESTABLISHING PROCEDURES FOR COOPERATIVE INVOLVEMENT IN THE REGULATION
OF MINING INDUSTRIES OF MINNESOTA

DESCRIPTION

The Minnesota Pollution Control Agency (PCA) and the Minnesota Department of Natural Resources (DNR) each have major authorities and responsibilities for the regulation of metallic mineral and peat mining activities in the state. These authorities and responsibilities frequently overlap, resulting in duplication of work effort.

PURPOSE AND OBJECTIVES

To promote efficiency, reduce duplication of work efforts, and improve communications, this Memorandum of Agreement (MOA) between the PCA and the DNR establishes procedures for coordinating regulatory and non-regulatory functions for mining activities. It also identifies authorities and establishes procedures to be followed by the PCA and the DNR.

IMPLEMENTATION

This MOA shall be implemented by each agency's mutual acceptance of the designated areas of responsibility defined in the Authorities and General Provision sections of this MOA, and the coordinating procedures and activities of an Interagency Coordinating Committee (ICC) defined in the Specific Provisions section of this MOA.

AUTHORITIES

Nothing in this MOA shall be construed as altering the statutory authorities of the PCA or the DNR.

1) The PCA is mandated to enforce state laws and regulations, addressing air and water pollution, solid and hazardous waste disposal, and noise control. As such, the PCA is recognized as the lead agency for:

   a) identification and evaluation of air quality impacts,

   b) solid and hazardous waste disposal and management,

   c) noise control and abatement,

   d) establishment and enforcement of effluent limitations, water quality standards, and compliance monitoring,

   e) regulation of groundwater quality and surface water quality point and non-point source pollution,

   f) implementation of EPA's CERCLA program and the state's MERLA program.

2) The DNR is mandated to enforce state laws and regulations addressing mineland reclamation, alteration of protected waters, water appropriations, and dam safety. As such, the DNR is recognized as the lead agency for:

   a) reclamation of lands disturbed by mining after August 1980, including the siting, design, construction, operation and deactivation of all mining facilities,

   b) mining activities affecting the alteration of protected waters (coordination of these activities covered under protected waters Cooperative Agreement dated October, 1984).

   c) mining activities affecting the quantity aspects of the taking or disposing of water,

   d) mining activities associated with the location, construction materials, operation and ultimate safety of dams,

   e) serving as the Responsible Government Unit for the environmental review of mining projects.

GENERAL PROVISIONS

It is mutually agreed that:

1) The PCA and DNR shall coordinate regulatory activities, so as to not duplicate or contradict requirements of either agency or deviate from the lead roles outlined in the AUTHORITIES section.

2) The PCA and DNR shall cooperatively identify and resolve mining-related environmental problems of mutual concern, including, but not limited to, those associated with new proposals, reclamation matters, violations of permit provisions, air or water quality standards violations, and monitoring results.

3) Where compliance monitoring or other reliable information shows that air quality standards or water quality effluent limitations or standards have been violated and remedial action may affect the terms or conditions of both agencies' permits, the DNR and PCA shall meet to resolve changes in their permitting requirements.

4) The PCA and DNR shall exchange and utilize, to the extent practical, all resource information, including permit applications, associated with environmental impact evaluation and mining proposals.

5) Additional agreements will be developed where needed, in the form of an addendum to this agreement, or memoranda/letters referencing this agreement.

6) The PCA and DNR shall use the attached RESPONSE DIAGRAM for interagency environmental review and regulatory coordination of new industry proposals.

SPECIFIC PROVISIONS

The PCA and DNR shall form an Interagency Coordinating Committee (ICC), comprised of the following representatives:

PCA Division of Water Quality - Permits Unit Supervisor

PCA Office of Planning and Review - Resource Development Coordinator

DNR Minerals Division - Mineland Reclamation Manager

DNR Waters Division - Mining Hydrologist

The ICC shall be responsible for:

1) Keeping each agency's management and staff informed of pertinent mining development issues or problems.
2) Coordinating and/or supplying input to the environmental review process for mining proposals.
3) Coordinating all inter- and intra-agency permitting matters for mining.
4) Coordinating review and input of new mining-related rules or regulations.
5) Coordinating identification and resolution of any mining-related environmental problems of mutual concern, including, but not limited to, those associated with new proposals, reclamation matters, violations of permit provisions, air or water quality standards violations, and monitoring results.
6) Coordinating PCA and DNR regulatory programs so as to minimize duplicative requirements, particularly with respect to non-point source pollution and mineland reclamation.

7) Initiate the involvement of appropriate technical, administrative, or managerial staff.

8) Coordinating PCA and DNR involvement associated with actions proposed by other federal, state and local governmental units associated with mining.

The ICC members shall meet no less than quarterly to discuss matters of joint agency interest. Matters requiring more immediate attention shall be dealt with on an as-needed basis.

MODIFICATION, TERMINATION AND EXPIRATION

This Agreement shall become effective upon the signature of both parties and shall remain effective until modified or terminated. This Agreement may be amended or reissued upon the written mutal agreement of both of the parties. This agreement shall be amended to include the state's administration of the EPA's proposed Subtitle D Mining Waste Program upon the EPA's promulgation of rules and guidelines for Subtitle D.

The DNR or the PCA may cancel this agreement by written notification to the other party. Termination shall occur thirty days after written notification is received. Termination may occur earlier by the mutual agreement of both parties.

WCB

Joseph N. Alexander
Commissioner
Minnesota Depart. of Natural Resources

September 21, 1987
Date

Thomas J. Kalitowski
Commissioner
Minnesota Pollution Control Agency

September 21, 1987
Date

RESPONSE DIAGRAM

Initial Review/ Response

INITIAL INDUSTRY PROPOSAL

↓

INTERAGENCY COORDINATING COMMITTEE (ICC) MEETING

- .situation/alternative discussion
- .discussion with agency managers and technical staff

NO ACTION NECESSARY ← ↓

ACTION NECESSARY

Scoping Discussions

STATE (ICC AND/OR OTHER STAFF) AND INDUSTRY MEETING(S)

- .situation/alternative discussion
- .potential environmental issues
- .potential regulatory requirements
  - .EAW/EIS
  - .permits
  - .data/info needs
  - .time schedules
  - .constraints
  - .local governmental unit involvement
  - .public involvement
  - .direction to industry

Proposal Withdrawal

Proposal Modification

↓

FINAL INDUSTRY PROPOSAL

Environmental Review Permitting Process

EAW/EIS REQ'D ←

- .scoping
- .data/info req'd
- .time schedules
- .public involvement

↓

NO EAW/EIS REQ'D

↓

PERMITTING PROCESS:

PREAPPLICATION MEETING

- .identify specific environmental issues
- .data/info needs
- .time schedules
- .public involvement

↓

PERMITS ISSUED

- .compliance monitoring data review

MEMORANDUM OF AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES
PERTAINING TO COORDINATION AND COOPERATION
OF ACTIVITIES AND PROGRAMS RELATED TO
PROTECTION, MANAGEMENT AND CONSERVATION OF
LAKE ASSOCIATED NATURAL RESOURCES

I. DESCRIPTION

The Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (MDNR) agree that a wide variety of problems affecting Minnesota lakes requires a comprehensive interdisciplinary approach to protection, management and conservation of lake associated natural resources. Problems involving lakes include both technical and institutional problems of: water quantity, water quality, recreational use, fish and wildlife management, watershed/land use management, shoreland development and data management.

II. GOAL

The goal of this Memorandum of Agreement is to establish policies and administrative procedures that will provide for a more effective working relationship between the MPCA and MDNR in achieving sound lake management. It is intended to facilitate the support of common objectives, interests and statutory requirements; to resolve differences; and to enhance coordination and sharing of agency expertise. This effort will minimize duplication of program activities related to development, protection, management and conservation of lakes and related natural resources. Finally it is the goal to convey to the public that lake management is, in fact, interdisciplinary and the primary lake management agencies do maintain a coordinated and cooperative framework to address lake problems and issues.

III. AUTHORITIES

Nothing in this agreement alters the statutory authorities of the MPCA or MDNR. This Memorandum of Agreement is intended to facilitate cooperative implementation of those statutory requirements and efforts.

The DNR has as its prime responsibility the development and implementation of programs to conserve and manage the natural resources of the state. The programs relating to protection, management and conservation of lake associated natural resources include:

- water allocation: the development and management of surface and ground water resources to ensure a supply adequate to meet long range seasonal requirements for domestic, municipal, industrial, agricultural, fish and wildlife, recreation, power generation, navigation and quality control purposes, M.S. 105.05 through 105.418.
- lake level management: the regulation of water levels to maintain natural flow and natural water level conditions to the maximum feasible extent, M.S. 105.
- shoreland management: to provide guidance for the wise development of shorelands of public waters and thus preserve and enhance the quality of surface waters, preserve the economic and natural environmental values of shoreland and provide for the wise utilization of water and related land resources, M.S. 105.485
- alteration of current and cross section (work in beds of public waters): to control and supervise any activity which will alter or change the course, current or cross-section of public waters, M.S. 105.38 and 105.42.
- flood plain management: to reduce flood damages by integrating structural and non-structural measures stressing floodplain zoning, floodproofing and floodwarning, M.S. 104.01.

- fisheries and wildlife management: the management of fish and wildlife population associated with lake resources through harvest regulations, stocking, habitat protection, habitat manipulation, enforcement and collection of systematic data, M.S. 97A, 97B and 97C.
- river management: to preserve, enhance and provide for the wise use of the natural, educational, recreational and economic values of all of Minnesota's rivers and their adjacent lands, M.S. 105; 104; 85.
- dam safety: to inspect dams, review and approve the construction of new dams and reconstruction or removal of existing dams, the examination of repair and operation of dams and reservoirs, M.S. 105.52.
- hydraulic and hydrologic analyses: to conduct stream, lake and watershed modelling and technical analyses of dams, bridges, culverts, ditch systems, and other activities affecting lakes and streams, M.S. 105; 326; 106; 112.
- water surface use zoning: to establish rules for the regulation of the surface use of public waters, and to approve or disapprove water surface use controls proposed by local units of government, M.S. 378 and M.S. 361.
- lake aeration: to regulate lake aeration through permit issuanace, enforcement and cost-sharing on aeration projects and providing technical advise to the public and other units of government, M.S. 378.22.
- aquatic nuisance control: the control of nuisance growths of aquatic plants through permit issuance, enforcement licensing of aquatic sprayers and providing technical advice to the public and other units of government, M.S. 18B, 84.
- access to public waters: providing adequate public access to public waters of the state, M.S. 97A.
- recreation: establishment, development, maintenance and operation of recreational facilities on lakes and streams, M.S. 85.
- aquatic plant management: the management of aquatic plants for the benefit of fish and wildlife through habitat protection and manipulation, M.S. 84.

- surveys and investigation of water resources of the state: to undertake surveys, mapping, investigations, and studies of water resources and topography of the state as necessary to formulate and carryout the MDNRs programs, M.S. 105.39.
- lake improvement districts: to coordinate and supervise a local-state program for establishment of lake improvement districts for the purpose of preserving and protecting lakes and to increase and enhance the use and enjoyment of Minnesota's lakes, M.S. 378.41
- waterbank program: to preserve the wetlands of the Minnesota and thereby conserve surface waters, preserve wildlife habitat, reduce runoff, provide for floodwater detention, reduce stream sedimentation, contribute to improved subsurface moisture and enhance the natural beauty of the landscape, M.S. 105.392.
- lake improvement grants: to make an assessment of the need for various types of lake improvements relating to low and high water levels and any other resource management considerations, except pollution problems, and develop criteria for allocating state funds among projects, M.S. 105.484.

The MPCA is charged with responsibility to achieve a reasonable degree of purity of water, air and land resources through investigations and control of problems relating to water, air and land pollution, M.S. 116.01. The MPCA water pollution control authorities relating to lake associated natural resources include:

- the administration and enforcement of all laws relating to pollution of any waters of the state, M.S. 115.03.
- the investigation of the extent, character and effect of pollution of the waters of the state, M.S. 115.03.
- the establishment of reasonable pollution standards for any waters of the state, M.S. 115.03.
- the adoption, issuance, reissuance, modification, denial or revocation, enforcement of reasonable orders, permits, variances, standards, regulations, schedules of compliance and stipulation agreements under such conditions it may prescribe in order to prevent, control or abate water pollution, M.S. 115.03.

- development and implementation of water quality control planning processes, management plans and programs authorized or required by the state and/or federal Water Pollution Control Act (including NPDES, 401, 404 certification) and M.S. 115.03.
- intergovernmental cooperation, M.S. 116.05.
- state agent to apply for, receive and disburse federal funds made available to the state by federal law or rules and regulations, M.S. 116.03.
- set forth a comprehensive program to address nonpoint sources of pollution, provide financial and technical assistance to local units of government and coordinate programs used to control nonpoint sources of pollution, Laws of Minnesota 1987, Chapter 392.

IV. IMPLEMENTATION

The MPCA and MDNR fully support the concepts of cooperation and coordination and are committed to developing efficient mechanisms to establish close working relationships to support common objectives, interests and statutory requirements for lake protection and management. To advance this effort, the following will be undertaken.

1. The MDNR and MPCA will facilitate and monitor the implementation of this agreement through the establishment of a joint coordinating team called the Lake Coordination Committee (LCC). The LCC shall consist of two (2) people from the MDNR and two (2) people from the MPCA, each designated by their respective Commissioners. The Commissioners shall designate their respective members of the LCC by March 1, 1988 and ensure that replacements are appointed as necessary. Chairpersons of the LCC shall be designated by the respective Commissioners, and shall alternate between the Departments on an annual basis with the first chairperson from the MPCA. The LCC shall meet quarterly and report results, issues and other matters of interest in writing to the Director of Water Quality, MPCA, the Director of the Division of Waters, MDNR, the Director of Fish and Wildlife, MDNR and the Assistant Commissioner for Operations. The LCC shall be responsible for:

a. the collective responsibility for oversight and implementation of this agreement;

b. the coordination and communication of the departments' activities, regulations, policies, programs, interagency agreements or other issues deemed relevant to lake management;

c. the development of procedures to provide for coordination and communication of emergency or other situations related to lake resources requiring immediate response;

d. the exchange and review of lists of proposed annual lake monitoring activities, including a brief statement of the nature and extent of the sampling, the purpose of such sampling and program contact(s) of persons responsible for implementation of the sampling activities. The LCC shall establish a timeframe for this review to ensure adequate interaction and coordination;

e. the sharing of lake information and monitoring data as follows:
   1. The MPCA will help provide the MDNR with an introductory account to the U.S. Environmental Protection Agency's (USEPA's) STORET system and provide introductory instruction in its use. Additionally, the MPCA agrees to perform periodic data retrievals as requested.
   2. The MDNR will provide MPCA with training and access to available lake information data bases.
   3. Representatives from the MDNR and the MPCA shall be recommended by the lake coordinating committee, and designated by the respective Commissioner, for the purpose of developing working knowledge of the departments' data management systems. These representatives shall determine and prepare a brief written summary by March 1, 1988 which defines the feasibility and timetable for:
      (a) producing methods of annually communicating lake management activities;

(b) exchanging information about computerized methods used for tabulating citizen complaint summaries;

(c) exchanging information on data management specifically defining data entry procedures and methods; and

(d) evaluating the need for lake data base compatibility (not necessarily integration), and as appropriate, developing a strategy for achieving compatibility.

f. the review of the respective department's written quality assurance methods for field and laboratory activities relating to routine lake monitoring and develop minimum standards for the appropriate field and laboratory activities;

g. the development and implementation of joint investigations and studies by the departments;

h. the review of lake related program priorities, areas of current concern, progress toward and success of departments in meeting the intent of this agreement.

i. to biennially review and recommend amendments to this agreement;

j. the development and implementation of an effective process for communicating integrated lake management to local interests. The LCC will develop lake biographics on three lakes that will incoporate available information relating to the lakes water quality, water quantity, recreational setting, land use, physiology and biology, socio-economic setting, geological setting, hydrologic setting and history, past and present issues and concerns, current management activities (state & local), etc. The report will provide an interpretation of the information and recommend reasonable strategies to address the identified issues and problems for that specific lake. The LCC will direct development of the biography outline and select 3 lakes for which lake biographies will be prepared by June 30, 1989. Upon completion of this activity the LCC shall prepare an evaluation of the benefits and costs of the effort.

2. The MPCA will continue to participate, as a member, on the DNR shoreland management advisory committee and provide assistance in the development and promulgation of shoreland management regulations.

3. The DNR will participate on the Clean Water Partnership Project Coordination Team.

4. The DNR will continue to participate on the Individual Sewage Treatment System Technical Advisory Committee.

V. MODIFICATION, TERMINATION AND EXPIRATION

This Agreement shall become effective upon the signature of both parties and shall remain effective until terminated. This Agreement may be amended or reissued upon the written mutual agreement of both of the parties. The DNR or the PCA may terminate this agreement, with cause, by written notification to the other party. Termination shall occur thirty days after written notification is received.

Joseph N. Alexander	Gerald Willet
Joseph N. Alexander	Gerald Willet
Commissioner	Commissioner
Department of Natural Resources	Minnesota Pollution Control Agency
Date 18 Feb 88	Date 2/24/88

1/22/88