

N 3043

SARATOGA_NHP
WATER_RESOURCE_MANAGEMENT_PROGRAM
"BASELINE_INVENTORY"
ANNUAL_REVIEW_AND_SUMMARY
1987

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TABLE OF CONTENTS

INTRODUCTION	PAGE 1
GOALS/OBJECTIVES	PAGE 1
POSITIONS/EQUIPMENT/MATERIALS	PAGE 1
SAMPLE TIMES/LOCATIONS/PROCEDURES	PAGE 2
STATE AND SARATOGA SURFACE WATER SATANDARDS	PAGE 3
SARATOGA WATER SAMPLE AVERAGES	PAGE 5 AND 6
RESULTS AND DISCUSSION	PAGE 7
SUMMARY	PAGE 9

APPENDICES

A - PROGRAM COST BREAKDOWN	PAGE 10
B - RAW SAMPLE DATA	PAGE 11
 BIBLIOGRAPHY	 PAGE 13

INTRODUCTION

THIS REPORT IS A REVIEW AND SUMMARY OF THE PROGRESS ON THE SARATOGA WATER RESOURCE MANAGEMENT PROGRAM FOR FISCAL YEAR 1987. THIS PROGRAM ALONG WITH THE ECOLOGICAL BASELINE INVENTORY ARE PARK BASE FUNDED THROUGH THE ENTRANCE FEE PROGRAM WITH PARTIAL FINANCIAL FUNDING FROM THE REGIONAL SCIENCE OFFICE AND TECHNICAL ASSISTANCE THROUGH THE NPS WATER RESOURCE LAB IN DENVER. ALL FIELD WORK COLLECTIONS AND MOST ANALYSIS WAS PERFORMED BY PARK RESOURCE MANAGEMENT STAFF. A PORTION OF LABORATORY ANALYSIS WAS CONTRACTED OUT TO C.T. MALE LABORATORIES OF LATHAM, NEW YORK. (SEE APPENDIX "A" FOR FINANCIAL DISCLOSURE)

PROGRAM GOALS AND OBJECTIVES

1. TO DETERMINE ANY LEVELS OF CONTAMINATION IN PARK WATERS OR SEDIMENTS, WITH FIRST YEAR CONCENTRATION ON PCB POLLUTION ALONG THE PARKS NORTHEASTERN BOUNDARY (THE HUDSON RIVER).
2. TO COLLECT BASELINE DATA FROM PARK SURFACE WATER RESOURCES TO GAUGE FOR COMPLIANCE WITH STATE STANDARDS.
3. TO DETERMINE ANY IMPACTS ON THE WATER RESOURCE THROUGH PRESENT PARK OPERATIONS (INCLUDING MONITORING OF SEPTIC FIELDS AND POTENTIAL IMPACTS FROM PARK INHOLDERS AND SPECIAL USE PERMITEES).
4. TO ADVISE PARK MANAGERS ON ANY VISITOR HEALTH AND SAFETY PROBLEMS THAT MAY BE PRESENT DUE TO UNSAFE WATER RESOURCE CONTAMINATION.

POSITIONS, EQUIPMENT AND MATERIALS

THESE PARK PROGRAMS OF WATER RESOURCE AND ECOLOGICAL INVENTORY AND MONITORING WERE CONDUCTED IN THE FIELD, MAINLY THROUGH THE EFFORTS OF ONE SEASONAL BIOLOGICAL TECHNICIAN (GS-404-05) AND THE PARKS' RESOURCE MANAGEMENT SPECIALIST WITH GRATEFUL ASSISTANCE FROM THE RANGER AND MAINTENANCE STAFF. MOST IN PARK LAB EQUIPMENT CAME TO THE PARK ALONG WITH THE RESOURCE MANAGER AFTER THE RMS TRAINING PROGRAM. (SEE APPENDIX "A" FOR BREAKDOWN)

SAMPLE TIMES, LOCATIONS AND PROCEDURES

WATER RESOURCE SAMPLING COMMENCED ON APRIL 30, 1987 WITH THE COLLECTION OF 4 PCB SAMPLES ALONG THE PARK HUDSON RIVER BOUNDARY AREA AND PROCEEDED ON A BIWEEKLY CYCLIC BASIS UNTIL THE FINAL SAMPLES WERE TAKEN ON SEPTEMBER 23, 1987.

THE LOCATIONS OF SAMPLES VARIED DEPENDING UPON THE STANDARD BEING LOOKED AT. FOR EXAMPLE, LEAD SAMPLES WERE TAKEN FROM PARK WATERS ALONG ROUTE 4 LOOKING FOR ANY MAJOR CONTAMINATION FROM OIL OR GASOLINE SPILLS THAT COULD HAVE OCCURRED OVER THE YEARS. THESE LEAD SAMPLES WERE NOT TAKEN FROM MID PARK STREAMS DUE TO THE UNLIKELY OCCURANCE OF THIS TYPE OF POLLUTION IN ISOLATED AREAS. THIS TYPE OF DISCRIMINATION HELPED THE PROGRAM STAY WITHIN BUDGET.

(SEE THE FOLLOWING PAGE FOR EXACT SAMPLE LOCATIONS)

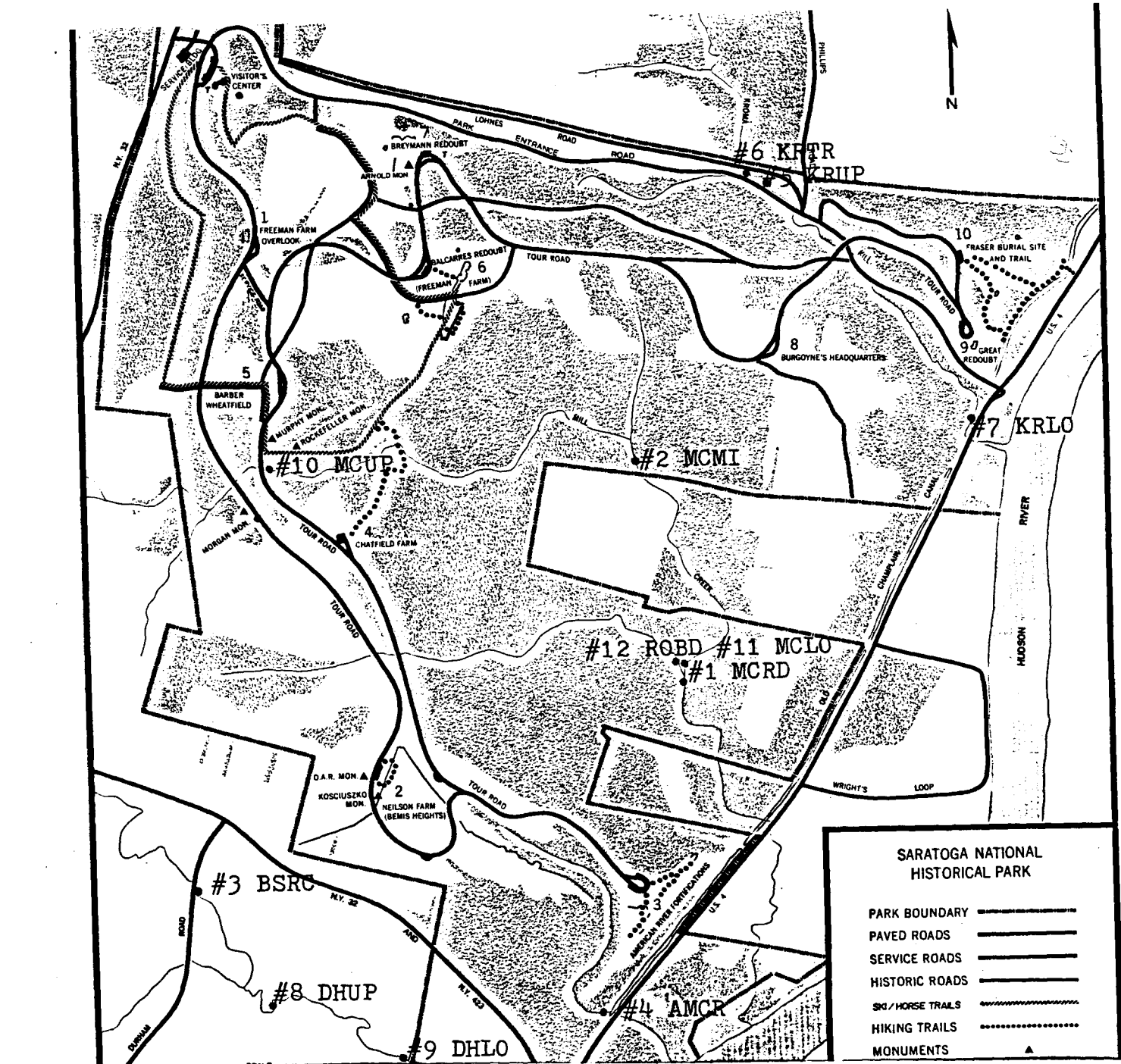
THE PROCEDURES FOR TAKING WATER SAMPLES AGAIN VARIED UPON THE TYPE OF SAMPLE BEING INVESTIGATED.
THE BIWEEKLY CYCLIC SAMPLES GATHERED THE FOLLOWING DATA;

- AIR TEMPERATURE
- WATER TEMPERATURE
- WATER ELECTRICAL CONDUCTIVITY
- FECAL COLIFORM
- DISSOLVED OXYGEN
- pH

THE "AS NEEDED" SAMPLES WHICH WERE TAKEN ONLY ONCE DURING THE SEASON DUE TO FINANCIAL RESTRAINTS WERE:

- NITRATE (07-23-87)
- TOTAL PHOSPHORUS (07-23-87)
- LEAD (07-23-87)
- PCB (04-30-87)

(SEE APPENDIX "B" FOR A COMPLETE LISTING OF RAW SAMPLE DATA)



SARATOGA SURFACE WATER STANDARDS

THE SURFACE WATER STANDARDS FOR SARATOGA NHP ARE DERIVED FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY FOR GENERIC STANDARDS AND FROM THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION FOR PARTICULAR WATER USAGE.

THE STATE STANDARD FOR CLASS "D" SURFACE WATERS ARE MOST APPLICABLE TO THE WATER RESOURCE AT SARATOGA NHP. THAT STANDARD FOR BEST USAGE OF WATER STATES, "THE WATERS ARE SUITABLE FOR FISHING. THE WATER QUALITY SHALL BE SUITABLE FOR PRIMARY AND SECONDARY CONTACT RECREATION EVEN THOUGH OTHER FACTORS MAY LIMIT THE USE FOR THAT PURPOSE. DUE TO SUCH NATURAL CONDITIONS AS INTERMITTENCY OF FLOW, WATER CONDITIONS NOT CONDUCTIVE TO PROPAGATION OF GAME FISHERY OR STREAM BED CONDITIONS, THE WATERS WILL NOT SUPPORT FISH PROPAGATION. THE WATERS MUST BE SUITABLE FOR FISH SURVIVAL.

QUALITY STANDARDS FOR CLASS "D" WATERS

COLIFORM

THE MONTHLY MEDIAN COLIFORM VALUE FOR 100 ml OF SAMPLE SHALL NOT EXCEED 2,400 FROM A MINIMUM OF FIVE EXAMINATIONS, AND PROVIDED THAT NOT MORE THAN 20% OF THE SAMPLES SHALL EXCEED A COLIFORM VALUE OF 5,000 FOR 100 ml OF SAMPLE AND THE MONTHLY GEOMETRIC MEAN FECAL COLIFORM VALUE FOR 100 ml OF SAMPLE SHALL NOT EXCEED 200 FROM A MINIMUM OF FIVE EXAMINATIONS.

pH

THE pH VALUES IN PARK WATERS SHALL BE BETWEEN 6.0 AND 9.5.

DISSOLVED OXYGEN

THIS VALUE SHALL NOT BE LESS THAN 3 MILLIGRAMS (ml) PER LITER OF WATER AT ANY ONE TIME.

NITRATE

THIS VALUE SHALL NOT BE MORE THAN 25 mg/L PER LITER OF WATER AT ANY ONE TIME.

TOTAL PHOSPHORUS

TO PREVENT THE DEVELOPMENT OF BIOLOGICAL NUISANCES AND TO CONTROL ACCELERATED OR CULTURAL EUTROPHICATION, TOTAL PHOSPHORUS (P) SHOULD NOT EXCEED 50 ug/L (MICROGRAMS PER LITER) IN ANY STREAM.

LEAD

THE LEVELS OF LEAD SHALL NOT EXCEED CONCENTRATIONS OF 80 ug/L.

POLYCHLORINATED BIPHENYL (PCB's)

ANY LEVELS OF PCB'S THAT ARE ANY MORE THAN NATURAL TRACE OCCURANCES ARE TO BE CONSIDERED ABOVE STANDARD. TRACE OCCURANCE OF PCB'S ARE IN THE AQUATIC ENVIRONMENT AND THESE TRACES SHOW UP IN LAB TESTING AND ARE NOT CONSIDERED DANGEROUS. THIS SITUATION IS ANALOGOUS TO RADON IN THAT IT WILL OCCUR AND SHOW UP IN TRACES IN SAMPLING.

MEAN_AVERAGE

	<u>AIR TEMP.</u>	<u>WATER TEMP.</u>	<u>CONDUCTIVITY</u>	<u>DISSOLVED OXYGEN</u>	<u>pH</u>
MCRD	18.1 C.	15.1 C.	290 X 1	9.28 MG/L	7.8
MCM1	18.8 C.	16.8 C.	400 X 1	8.3 MG/L	7.8
BSRC	n/a *	n/a *	n/a *	n/a *	n/a*
AMCR	21.8 C.	18.4 C.	260 X 1	8.9 MG/L	7.9
KRUP	20.3 C.	14.3 C.	264 X 1	8.4 MG/L	8.0
KRTR	21.0 C.	17.4 C.	330 X 1	9.0 MG/L	7.8
KRLO	20.6 C.	17.6 C.	276 X 1	9.5 MG/L	8.1
DHUP	21.9 C.	17.4 C.	295 X 1	7.8 MG/L	7.7
DHLO	22.3 C.	16.6 C.	390 X 1	8.4 MG/L	7.9
MCUP	20.8 C.	16.9 C.	443 X 1	9.0 MG/L	7.9
MCLO	18.3 C.	17.9 C.	211 X 1	8.8 MG/L	7.7
ROBD	18.5 C.	15.5 C.	304 X 1	5.6 MG/L	7.7

n/a * = no samples taken

FECAL COLIFORM
MEAN_AVERAGE

1. MCRD- 350/100 ML OR (350 COLIFORM COLONIES PER 100 MILLILETERS OF WATER)
2. MCM1- 253/100 ML OR (253 COLIFORM COLONIES PER 100 MILLILETERS OF WATER)
3. BSRC- 378/100 ML OR (378 COLIFORM COLONIES PER 100 MILLILETERS OF WATER)
4. AMCR- 338/100 ML OR (338 COLIFORM COLONIES PER 100 MILLILETERS OF WATER)
5. KRUP- 251/100 ML OR (251 COLIFORM COLONIES PER 100 MILLILETERS OF WATER)

POB SAMPLES
SAMPLE DATE - APRIL 30, 1987.

1. CHAMPLAIN CANAL AND DUCK POND - <0.1 UG/G
2. KROMA KILL AND RT. 4 CULVERT - <0.1 UG/G
3. VLYE POND-RIVER BACKWATER AREA- <0.1 UG/G
4. AMERICAN CREEK / RT.4 CULVERT - <0.1 UG/G

NITRATE, TOTAL PHOSPHORUS, AND LEAD SAMPLES
SAMPLE DATE - JULY 23, 1987.

	NITRATE	PHOSPHATE PHOSPHORUS	LEAD
LOWER MILL CREEK	8.5 MG/L	<50 ug/L	N/A
MILL CREEK/ MURPHY MONUMENT	1.6 MG/L	<50 ug/L	N/A
UPPER KROMA KILL	N/A	N/A	50 ug/L
DUCK POND (RT.4)	N/A	N/A	62 ug/L
LOWER KROMA KILL	6.3 MG/L	<50 ug/L	53 ug/L
VLYE POND (RT.4)	N/A	N/A	81 ug/L
AMERICANS CREEK	9.3 MG/L	100 ug/L	56 ug/L
BILL SMITH ROAD	2.1 MG/L	<50 ug/L	N/A

RESULTS AND DISCUSSION

1. AIR AND WATER TEMPERATURE

THESE TWO PARAMETERS REPRESENT AMBIENT TEMPERATURES IN CELSIUS AND ARE THE MEAN AVERAGE FOR THE ENTIRE SAMPLING SEASON (MAY THROUGH SEPTEMBER). HIGHER WATER TEMPERATURES CAN BE ATTRIBUTED TO SAMPLING LATER IN THE DAY, POOLING OF SLOW MOVING WATER ETC..

2. CONDUCTIVITY

IS THE MEASURE OF TOTAL IONIC CONCENTRATIONS IN WATER AND IS A GOOD INDEX FOR GAUGING MANY POLLUTANTS IN WATER. IN OTHER WORDS, IF YOUR CONDUCTIVITY IS EXCESSIVELY HIGH, THERE MAY BE A PROBLEM. THERE IS NO SET STANDARD FOR CONDUCTIVITY, HOWEVER A HIGH LEVEL INDICATES THAT FURTHER INVESTIGATION IS NEEDED.

THE UPPER MILL CREEK NEAR THE MURPHY MONUMENT AND THE MILL CREEK AS IT ENTERS PHIL GRIFFEN PROPERTY SHOWED THE HIGHEST LEVELS THROUGHOUT THE SEASON. THIS WAS FOLLOWED IN DESCENDING ORDER BY THE STREAM AT DEVILS HOLLOW AND FINALLY A TRIBUTARY TO THE KROMA KILL.

THE LEVELS OF CONDUCTIVITY, ESPECIALLY IN THE MILL CREEK ARE NOT ALARMINGLY HIGH BUT DO POSE SOME CONCERN AND WARRANT FUTURE INVESTIGATION.

3. DISSOLVED OXYGEN

IS AN IMPORTANT CONSTITUENT IN THE OVERALL DETERMINATION OF THE QUALITY OF WATER. INSUFFICIENT D.O. CAN LEAD TO UNSUITABLE CONDITIONS FOR AQUATIC LIFE, AND ITS ABSENCE CAN BE ASSOCIATED WITH ANAEROBIC DECOMPOSITION (EUTROPHICATION) OR WATER DEATH.

THE STATE STANDARD FOR D.O. OF CLASS D WATERS IS NOT LESS THAN 3 MG/L WAS ONLY UNMENT TWICE, BOTH TIMES AT THE MILL CREEK TRIBUTARY OF ROBBIES DITCH.

THIS SMALL STREAM OCCASIONALLY DRIES UP TO A TRICKLE IN THE SUMMER MONTHS AND THIS COULD EXPLAIN THE LOW READINGS AT THIS SITE.

THE REST OF THE PARK STREAMS SHOWED GOOD RANGES OF DISSOLVED OXYGEN.

4. pH

pH IS A MEASURE OF HYDROGEN ION ACTIVITY. pH IS AN IMPORTANT DESCRIPTION OF THE CHEMICAL AND BIOLOGICAL SYSTEMS OF NATURAL WATERS. CHANGES IN pH CAN AFFECT THE TOXICITY OF MANY COMPOUNDS. THE STATE STANDARDS FOR CLASS D WATERS CALL FOR RANGES BETWEEN 6.0 AND 9.5.

THE pH OF PARK STREAMS WERE WELL WITHIN THIS RANGE.

5. FECAL COLIFORM

THESE SAMPLES ARE USED BASICALLY TO IDENTIFY ENVIRONMENTAL CHANGES, TO QUANTIFY POLLUTION LEVELS, AND TO STUDY, UNDER CONTROLLED LAB CONDITIONS, PHENOMENA WHICH COULD OCCUR IN THE NATURAL ENVIRONMENT. THESE SAMPLES WILL YIELD DATA ON FECAL BACTERIA FROM ANIMALS OR MAN.

THE MEAN AVERAGE OF ALL 5 PARK SAMPLE SITES DID EXCEED THE STATE STANDARD FOR FECAL COLIFORMS IN CLASS "D" WATERS. THERE ARE SEVERAL EXPLANATIONS FOR THIS PHENOMENA;

- A) SAMPLES WERE TAKEN IN AREAS THAT ARE FREQUENTED OFTEN BY DEER AND OTHER WILDLIFE. THESE ANIMALS WILL OFTEN DRINK THE WATER AND THEN DEPOSIT THEIR WASTE RIGHT IN OR NEAR THE STREAM.
- B) THIS PARTICULAR STATE STANDARD IS EXTREMELY STRINGENT AND IN MOST STATES THE STANDARD IS MUCH HIGHER FOR THIS CLASS OF STREAM.
- C) THE HIGHEST MEAN READINGS OF 378 AND 350 PER 100 MILLILETERS OF WATER DO EXCEED THE STATE STANDARD BUT IN THE CASE OF THE SARATOGA ECOSYSTEM BEING SO RICH AND DIVERSE IN ITS' WILDLIFE CONSTITUENTS THAT READINGS OF THIS LEVEL COULD BE CONSTRUED AS NORMAL. THIS HYPOTHESIS WILL BE TESTED IN THE FUTURE.

6. POLYCHLORINATED BIPHENYL (PCB'S)

SEDIMENT SAMPLES WERE TAKEN IN LATE APRIL FOR PCB'S.

ALL 4 SAMPLES TAKEN ALONG THE PARKS NORTHEASTERN BOUNDARY (HUDSON RIVER AREA) WERE TESTED AND RESULTS SHOWED NOTHING BUT TRACE AMOUNTS OF PCB'S.

SUMMARY

THE FIRST YEAR OF IMPLEMENTATION OF THE SARATOGA WATER RESOURCE MANAGEMENT PROGRAM MET ALL PROGRAM GOALS AND OBJECTIVES AND EXCEEDED EXPECTATIONS BY POINTING OUT DEFECIENCIES IN SAMPLING TECHNIQUE AND AREAS OF NEW CONCERN.

ALL FIELD PROCEDURES WERE EXAMINED AND CRITIQUED BY DR. TERRENCE BOYLE OF THE NPS WATER RESOURCES LAB IN DENVER. HIS REVIEW AND NEW DIRECTION GUIDANCE WILL (IF FUNDING PERMITS) BRING THIS PROGRAM TO BETTER LEVELS OF WATER EXAMINATION AND ANALYSIS.

DIRECTLY INFLUENCED BY THIS PROGRAM IS THE HEALTH AND SAFETY OF THE HUMAN, FAUNAL AND FLORAL RESOURCE. NO GREAT LEVELS OF CONTAMINATION WERE FOUND THIS FIRST YEAR, HOWEVER THE PCB PROBLEM WITH THE HUDSON RIVER AND THE FLOOD PLAIN AREA OF THE BATTLEFIELD HAVE SHOWN THAT CLOSURE OF THE KROMA KILL CREEK BELOW ROUTE 4 TO FISHING WAS NEEDED AND THIS HAS BEEN ACCOMPLISHED THROUGH SIGNS OBTAINED THROUGH THE STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION.

CERATIN PARAMETERS THAT WERE SAMPLED FOR LAST YEAR SHOULD BE CONTINUED IN YEAR 2 OF THIS PROGRAM.

THESE PARAMETERS INCLUDE AIR AND WATER TEMPERATURE; CONDUCTIVITY READINGS, SPECIFIC FECAL COLIFORM READINGS, DISSOLVED OXYGEN, pH, SPECIFIC NITRATE SAMPLES AND SOME MORE SPECIFIC PCB SAMPLES. ALSO, BASELINE DATA ACQUISITION FOR THE BIOLOGICAL INVERTEBRATES SHOULD BE STARTED AS SOON AS POSSIBLE THIS UPCOMING FIELD SEASON. THIS WILL YIELD A MORE COMPLETE BASELINE OF INFORMATION THAT COULD BE USED IN FUTURE YEARS IF WATER RESOURCE DEGRADATION BECOMES A REALITY.

ALSO, A MAJOR FLAW IN YEAR #1 DATA ACQUISITION WAS THE LACK OF STREAM "FLOW" DATA. THIS WAS DUE PARTLY TO THE FACT THAT A FLOW METER THAT WAS PROMISED ON LOAN TO THE PARK FROM THE ALBANY GROUP OF THE U.S. GEOLOGIC SURVEY NEVER MATERIALIZED DUE TO THE USGS NEEDING ALL THEIR FLOW METERS TO STUDY THE SCOHARIE CREEK PROBLEM.

FINALLY, AS IN ANY BEGINNING WATER RESOURCE STUDY THERE WERE GROWING PAINS AND LACK OF ATTENTION TO CERTAIN DETAILS LIKE SKIPPING OF A SAMPLE SITE DUE TO A RAINY DAY ETC..

TO REMEDY THIS SITUATION, A MORE STRINGENT ADHERANCE TO SAMPLING PROTOCOL WILL BE DEVELOPED THIS YEAR (IF FUNDING BECOMES AVAILABLE).

THE PARK SURFACE WATERS ARE A PRIMARY RESOURCE THAT IF CONTAMINATED COULD HAVE FAR REACHING IMPACTS ALL THE WAY UP THE ECOLOGICAL FOOD CHAIN. PARK WATERS SHOULD BE PROVIDED THE BEST OF PROTECTION AND TECHNOLOGICAL STUDY. THIS BASELINE INFORMATION MUST BE COLLECTED NOW WHILE THE RESOURCE IS IN FAIRLY GOOD CONDITION.

PROTECTION AND RESEARCH OF THIS RESOURCE NOW HINGES UPON THE AVAILABILTY OF "DISCRETIONARY" PARK FUNDING!

appendix "a"

SARA ECOLOGICAL BASELINE INVENTORY
COSTS/PURCHASES

1. OKI-DATA PARALLEL PRINTER	\$548.01
2. TOMAHAWK LIVE TRAPS (VARIOUS SIZES)30 TRAPS	\$1057.00
3. PLANT ECOLOGIST (HERBARIUM COLLECTION)	\$500.00
4. SHERMAN SMALL MAMMAL (FOLDING TRAPS)130 TRAPS	\$753.00
5. SWIFT BINOCULARS	\$135.00
6. 250 MUSEUM SPECIAL MAMMAL TRAPS	\$835.00
7. RAT TRAPS (204)	\$122.40
8. PIT FALL TRAP BUCKETS (100)	\$22.67
9. CUMULATIVE TRAP BAITs	\$98.00
10. SPECIMEN PREPERATION SUPPLIES	\$467.55
TOTAL	\$4538.63

SARA WATER RESOURCE BASELINE INVENTORY
COSTS/PURCHASES

1. LAB SERVICES (C.T.MALE LABS)	\$1620.11
2. IN PARK LAB EQUIPMENT	\$788.38
3. EQUIPMENT PACKS/SUPPLIES	\$319.00
4. BOAT, OARS, P.F.D.'S	\$595.16
TOTAL	\$3322.65

BIOLOGICAL TECH. SALARY
GS401-05

TOTAL	\$3772.00
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TOTAL 180 ACCOUNT EXPENDITURES	\$11,633.23
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appendix "b"
raw sample data

Record#	DATE	SITE	AIR_TEMP	H2O_TEMP	CONDUCTIV	FECOL_COLI	DISSOLVEDO	PH
1	05/13/87	MCRD	22.C	15.C	240 X 1	18/100 ML	N/A	0.00
2	05/13/87	MCMI	19.4	17.5	300 X 1	25/100 ML	N/A	0.00
3	05/13/87	BSRC	0000	0000	0000000	80/100 ML	000	0.00
4	05/13/87	AMCR	20.5	14.C	290 X 1	77/100 ML	N/A	0.00
5	05/13/87	KRUP	17.5	15.5	220 X 1	32/100 ML	N/A	0.00
6	05/13/87	KRTR	20.5	15.C	260 X 1	NONE	N/A	0.00
7	05/13/87	KRLD	15.5	11.C	210 X 1	NONE	N/A	0.00
8	05/13/87	DHUP	17.8	13.5	240 X 1	NONE	N/A	0.00
9	05/13/87	DHLD	21.1	12.C	290 X 1	NONE	N/A	0.00
10	05/13/87	MCUP	24.4	13.5	300 X 1	NONE	N/A	0.00
11	05/13/87	MCLO	N/A	N/A	N/A	NONE	N/A	0.00
12	05/13/87	ROBD	22.2	14.C	240 X 1	NONE	N/A	0.00
13	05/27/87	MCRD	15.5	13.5	300 X 1	10/100 ML	N/A	7.90
14	05/27/87	MCMI	14.0	14.0	300 X 1	40/100 ML	N/A	7.95
15	05/27/87	BSRC	000	000	000	30/100 ML	N/A	0.00
16	05/27/87	AMCR	16.0	15.0	305 X 1	50/100 ML	N/A	7.92
17	05/27/87	KRUP	17.5	16.0	255 X 1	50/100 ML	N/A	8.07
18	05/27/87	KRTR	000	000	000	000	000	0.00
19	05/27/87	KRLD	19.0	17.5	250 X 1	N/A	N/A	8.15
20	05/27/87	DHUP	17.0	17.0	295 X 1	N/A	N/A	8.32
21	05/27/87	DHLD	20.0	14.0	443 X 1	N/A	N/A	7.94
22	05/27/87	MCUP	17.0	15.0	330 X 1	N/A	N/A	8.23
23	05/27/87	MCLO	14.0	14.0	220 X 1	N/A	N/A	7.91
24	05/27/87	ROBD	14.0	13.0	385 X 1	N/A	N/A	7.95
25	06/10/87	MCRD	17.0	14.0	220 X 1	280/100 ML	9.45 MG/L	7.86
26	06/10/87	MCMI	19.0	15.0	310 X 1	130/100 ML	10.17MG/L	7.90
27	06/10/87	BSRC	N/A	N/A	N/A	360/100 ML	N/A	0.00
28	06/01/87	AMCR	27.0	20.0	310 X 1	460/100 ML	9.61 MG/L	7.98
29	06/10/87	KRUP	20.5	17.5	250 X 1	90/100 ML	10.11MG/L	7.99
30	06/10/87	KRTR	22.0	17.0	290 X 1	N/A	N/A	0.00
31	06/10/87	KRLD	23.0	15.5	380 XI	N/A	9.68 MG/L	8.06
32	06/10/87	MCUP	18.0	14.5	400 X 1	N/A	9.30 MG/L	7.97
33	06/10/87	MCLO	N/A	N/A	N/A	N/A	N/A	0.00
34	06/10/87	ROBD	17.0	14.5	320 X 1	N/A	N/A	0.00
35	07/02/87	MCRD	18.0	18.0	400 X 1	220/100 ML	9.11 MG/L	7.75
36	07/02/87	MCMI	21.0	18.0	400 X 1	290/100 ML	8.66 MG/L	7.75
37	07/02/87	BSRC	N/A	N/A	N/A	300/100 ML	N/A	0.00
38	07/02/87	AMCR	22.0	19.0	285 X 1	110/100 ML	8.80 MG/L	7.75
39	05/07/87	KRUP	21.0	17.5	390 X 1	220/100 ML	10.43MG/L	8.06
40	07/02/87	KRTR	21.0	16.5	405 X 1	N/A	9.86 MG/L	8.00
41	07/02/87	KRLD	20.0	17.0	335 X 1	N/A	10.32MG/L	7.96
42	07/02/87	DHUP	0000	0000	0000	0000	0000	0.00
43	07/02/87	DHLD	0000	0000	0000	0000	0000	0.00
44	07/02/87	MCUP	21.0	18.0	380 X 1	N/A	9.39 MG/L	7.98
45	07/02/87	MCLO	0000	0000	0000	0000	0000	0.00
46	07/02/87	ROBD	18.0	17.0	435 X 1	N/A	3.24 MG/L	7.75
47	07/21/87	MCRD	0000	0000	0000	770/100 ML	0000	0.00
48	07/21/87	MCMI	25.0	23.0	550 X 10	460/100 ML	7.65 MG/L	7.87
49	07/21/87	BSRC	0000	0000	0000	670/100 ML	0000	0.00
50	07/21/87	AMCR	28.0	26.0	310 X 1	>800/100M*	7.72 MG/L	7.95
51	07/21/87	KRUP	28.0	25.0	300 X 1	180/100 ML	9.38 MG/L	8.23
52	07/21/87	KRTR	27.5	23.5	390 X 1	N/A	8.16 MG/L	7.92

54	07/21/87	DHUP	30.0	24.0	340 X 1	N/A	8.43	MG/L	7.22
55	07/21/87	DHLO	28.0	22.0	500 X 1	N/A	6.40	MG/L	7.30
56	07/21/87	MCUP	29.5	24.0	100X10**	N/A	8.90	MG/L	7.27
57	07/21/87	MCLD	29.0	29.0	260 X 1	N/A	8.49	MG/L	7.32
58	07/21/87	ROBD	29.0	20.0	380 X 1	N/A	1.83	MG/L	7.41
59	08/05/87	MCRD	0000	0000	0000	130/100 ML	0000		0.00
60	08/05/87	MCMI	20.0	20.0	230 X 1	190/100 ML	4.85	MG/L	7.66
61	08/05/87	BSRC	0000	0000	0000	>800/100M*	0000		0.00
62	08/05/87	AMCR	22.0	22.0	255 X 1	480/100 ML	10.29	MG/L	8.20
63	08/05/87	KRUP	22.0	21.0	230 X 1	470/100 ML	9.72	MG/L	8.21
64	08/05/87	KRTR	22.0	20.0	330 X 1	N/A	9.95	MG/L	7.97
65	08/05/87	KRLO	22.0	21.0	210 X 1	N/A	9.10	MG/L	8.16
66	08/05/87	DHUP	20.0	16.0	500X1***	N/A	8.11	MG/L	7.96
67	08/05/87	DHLO	20.0	15.0	600X1***	N/A	8.13	MG/L	7.31
68	08/05/87	MCUP	20.5	20.0	490 X 1	N/A	7.22	MG/L	7.69
69	08/05/87	MCLD	19.0	20.0	190 X 1	N/A	8.01	MG/L	7.55
70	08/05/87	ROBD	19.0	18.0	285 X 1	N/A	1.95	MG/L	7.40
71	08/27/87	MCRD	0000	0000	0000	760/100 ML	0000		0.00
72	08/27/87	MCMI	14.0	14.0	250 X 1	300/100 ML	8.46	MG/L	7.97
73	08/27/87	BSRC	0000	0000	0000	250/100 ML	0000		0.00
74	08/27/87	AMCR	15.0	16.0	170 X 1	90/100 ML	0000		0.00
75	08/27/87	KRUP	15.0	14.0	285 X 1	220 /100ML	9.46	MG/L	7.96
76	08/27/87	KRTR	15.0	14.0	325 X 1	N/A	8.11	MG/L	7.30
77	08/27/87	KRLO	0000	0000	0000	0000	0000		0.00
78	08/27/87	DHUP	0000	0000	0000	0000	0000		0.00
79	08/27/87	DHLO	0000	0000	0000	0000	0000		0.00
80	08/27/87	MCUP	0000	0000	0000	0000	0000		0.00
81	08/27/87	MCLD	14.0	13.5	180 X 1	N/A	8.63	MG/L	7.62
82	08/27/87	ROBD	14.0	13.5	290 X 1	N/A	8.16	MG/L	7.78
83	09/10/87	MCRD	0000	0000	0000	>800/100M*	0000		0.00
84	09/10/87	MCMI	22.0	17.0	210 X 1	750/100 ML	8.60	MG/L	7.59
85	09/10/87	BSRC	0000	0000	0000	>800/100M*	0000		0.00
86	09/10/87	AMCR	30.0	20.0	210 X 1	>800/100M*	8.23	MG/L	7.65
87	09/10/87	KRUP	25.5	20.0	210 X 1	>800/100M*	8.79	MG/L	7.80
88	09/10/87	KRTR	25.0	20.0	220 X 1	N/A	8.43	MG/L	7.74
89	09/10/87	KRLO	0000	0000	0000	N/A	0000		0.00
90	09/10/87	DHUP	29.0	20.0	210 X 1	N/A	8.62	MG/L	7.40
91	09/10/87	DHLO	28.0	23.0	310 X 1	N/A	8.96	MG/L	8.00
92	09/10/87	MCUP	20.5	17.0	270 X 1	N/A	9.05	MG/L	7.62
93	09/10/87	MCLD	13.5	17.5	210 X 1	N/A	9.12	MG/L	7.72
94	09/10/87	ROBD	18.5	17.0	175 X 1	N/A	8.67	MG/L	7.76
95	09/23/87	MCRD	0000	0000	0000	110/100 ML	0000		0.00
96	09/23/87	MCMI	15.0	14.0	1000X1**	90/100 ML	9.38	MG/L	7.75
97	09/23/87	BSRC	0000	0000	000				

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