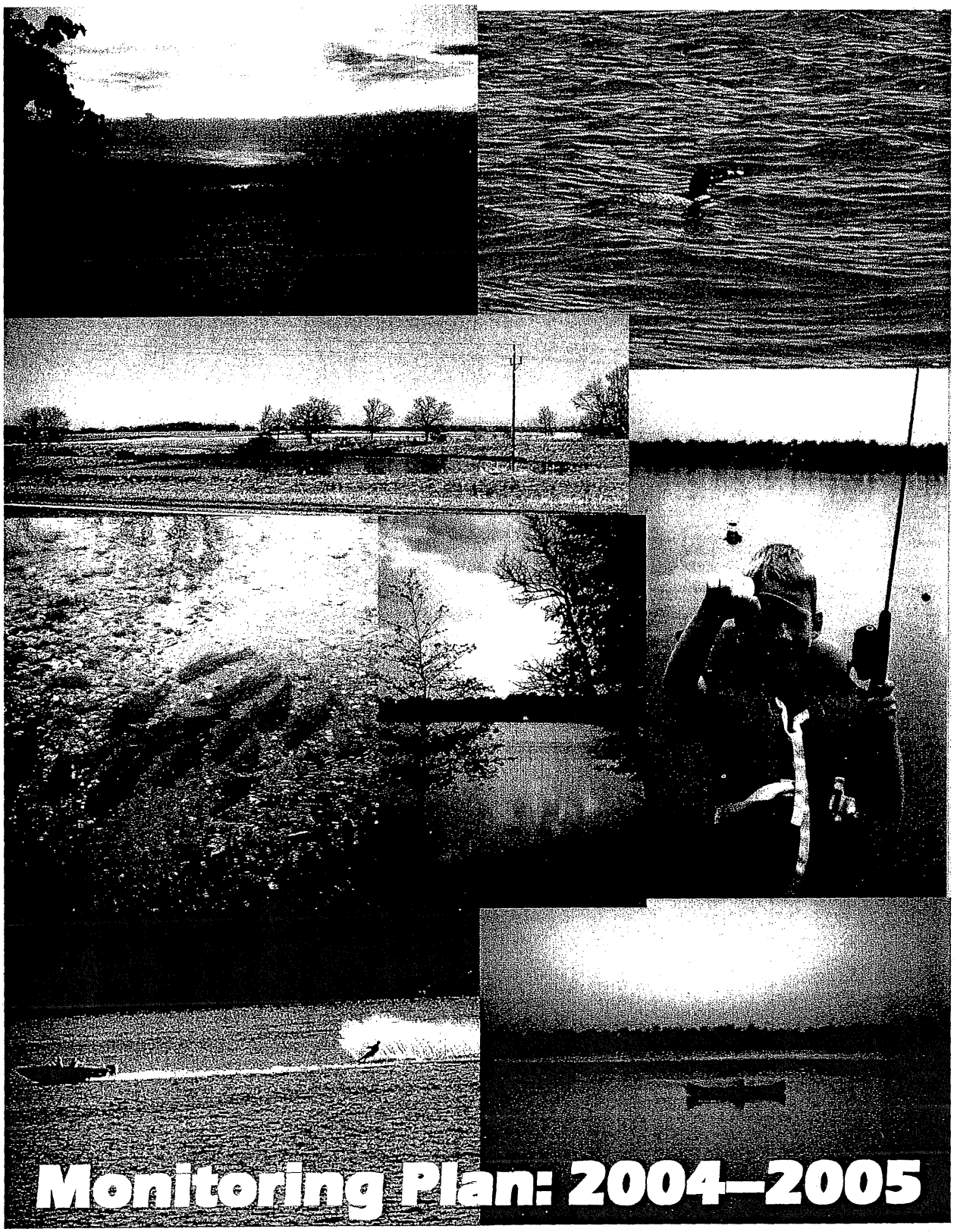
Norway/Games Lake Improvement Association



Monitoring Plan: 2004–2005

Date Plan Completed:	April 20, 2004
Organization Name:	Norway/Games Lake Improvement Lake Association
Name of Program:	Norway/Games Lake Monitoring Program
Monitoring Plan Author(s):	Ron Dilley Ralph Howell Mark Weimerskirch Sally Packer Rob Spitzley
Primary Contact:	Sally Packer
Address:	19112 Co Rd 5 NW New London MN 56273
Contact Phone:	320.354.5499
Contact email:	norwaygameslakeassn@hotmail.com
Website (if any):	www.chippewariver.com

Funding for this project was recommended by the Legislative Commission on Minnesota Resources (LCMR) from the Minnesota Environment and Natural Resources Trust Fund.

The goal of this grant is to enhance and expand the ability of citizen volunteers to collect water quality data that will be useful for lake and stream assessments and management. Minnesota Lakes Association and Rivers Council of Minnesota, with assistance from River Network, will work collaboratively to provide training, technical support, education and communications for individuals and organizations statewide interested in citizen volunteer lake and stream monitoring.

Plan Contents

INTRODUCTION AND OVERVIEW

Introduction Narrative

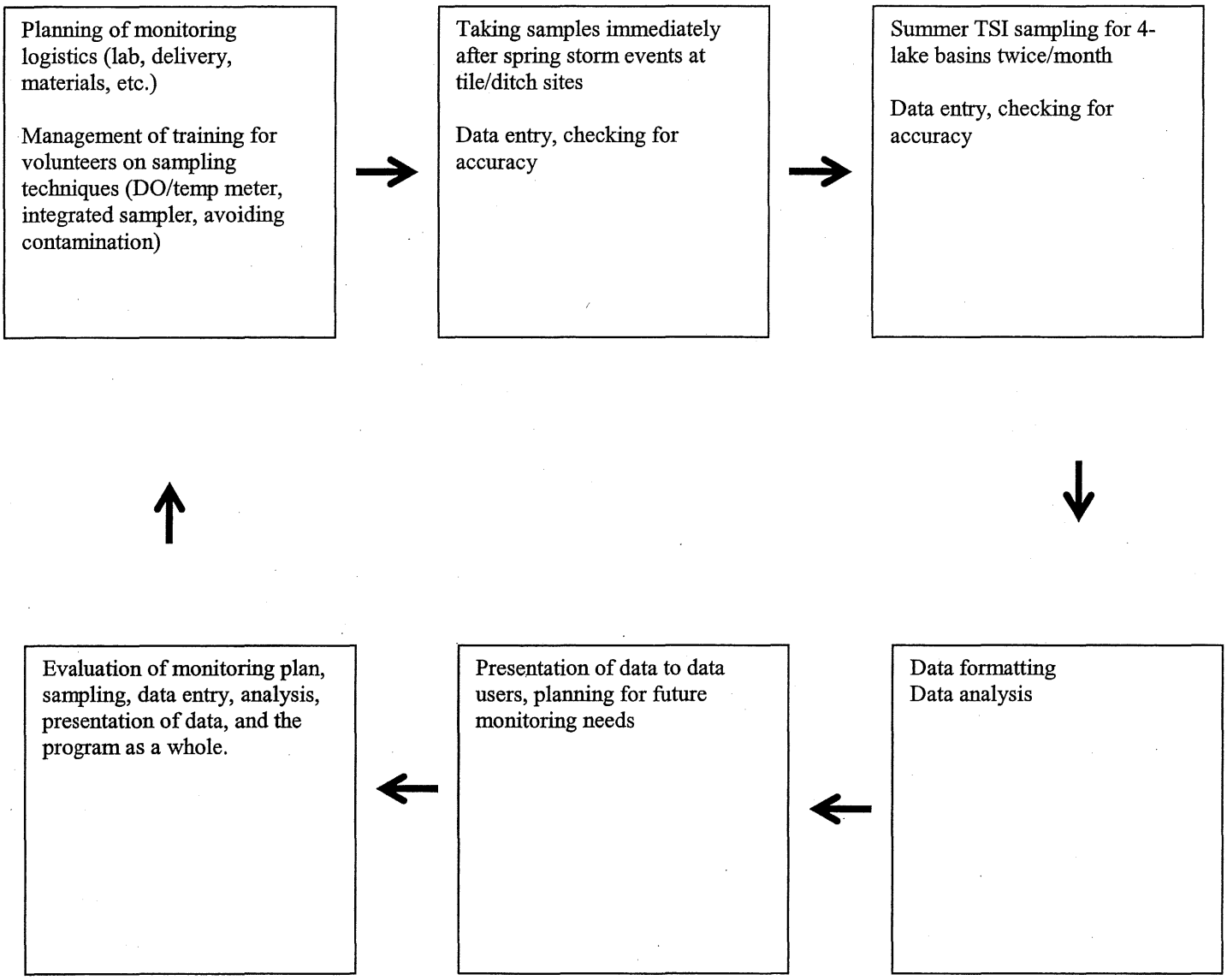
The Norway-Games Lake Improvement Association is an organization committed to promoting the stewardship of Norway and Games lakes through education and fellowship among members and to partner with other organizations and agencies for the common good. The following monitoring plan is an effort to further promote this stewardship ethic and to expand cooperation with partnering organizations that have parallel goals.

The Shakopee Creek Headwaters Project (SCHP) is a cooperative partnership of government agencies, local organizations, and landowners who seek to enhance water quality in the Shakopee Creek Headwaters watershed through water quality monitoring, education, and incentive based programs.

The Norway-Games Lake Improvement Association (NGLIA) in conjunction with the Shakopee Creek Headwaters Project (SCHP) have created this monitoring plan to create a long-term, self sustaining monitoring program in the Norway-Games lake system. The plan was funded by a Rivers Council of Minnesota (RCM) / Minnesota Lakes Association (MLA) grant and guided by the "Monitoring Plan Pilot Training for Citizen Volunteer Water Quality Monitoring Programs" developed by MLA, RCM, and the River Network.

Through this monitoring plan we will seek to monitor changes in water quality in order to preserve the uniqueness and value of this irreplaceable natural resource. Pressed with the urgency of increased urban-like development on and near the shoreline, this monitoring effort is essential because it can provide guidance for land use planning and change that will be needed to limit the potentially severe negative impacts development can have on water quality, fishing, swimming, and other uses. We hope that through this plan we can together bring about our shared future vision of clear water, healthy riparian areas, thriving wetlands, and the protection of our natural areas so that future generations may be able to share in the enjoyment and beauty that this resource has brought to so many past generations.

Flow Chart of Annual Citizen Monitoring Cycle



WATERSHED BACKGROUND AND INFORMATION

1.1 Watershed Maps:

Figure 1.11

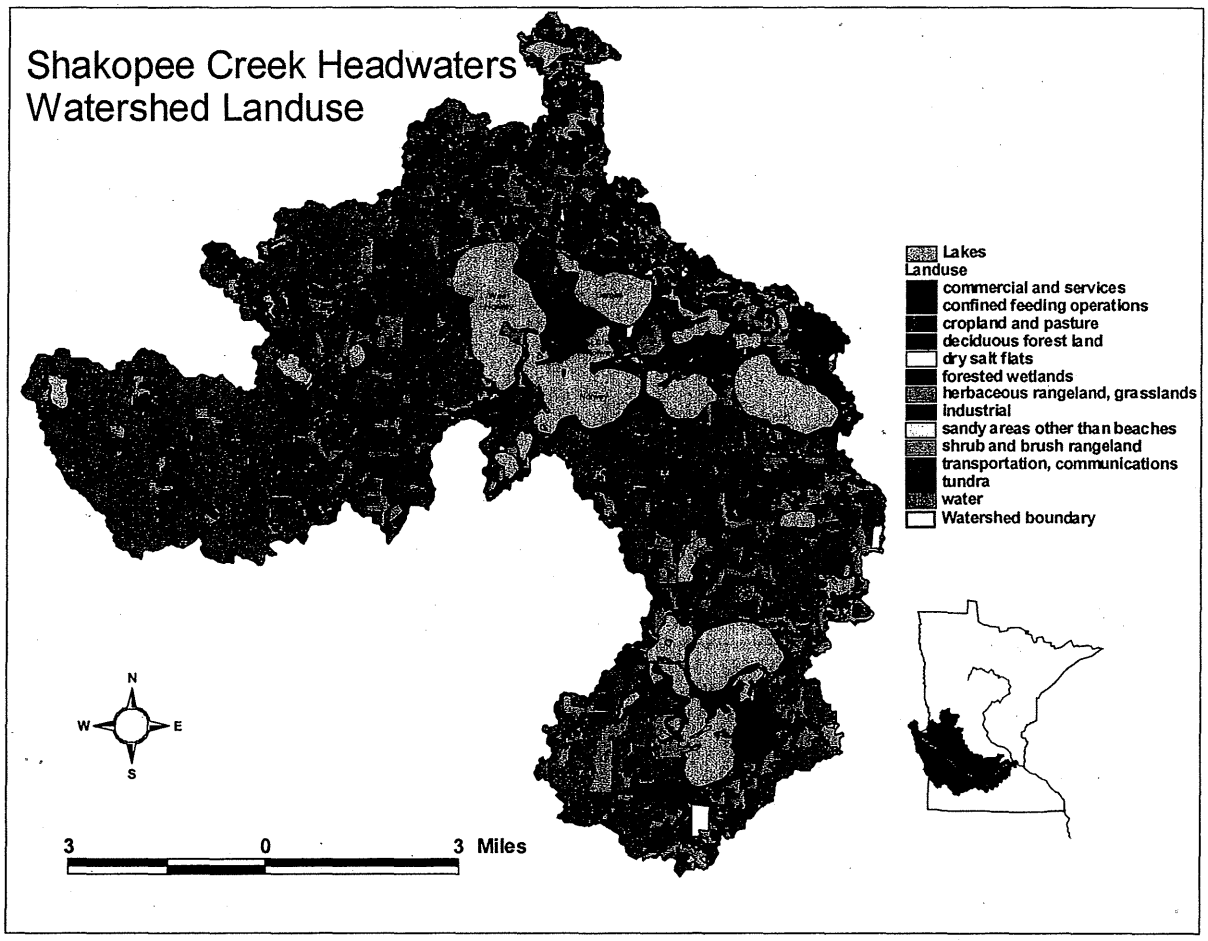


Figure1.12

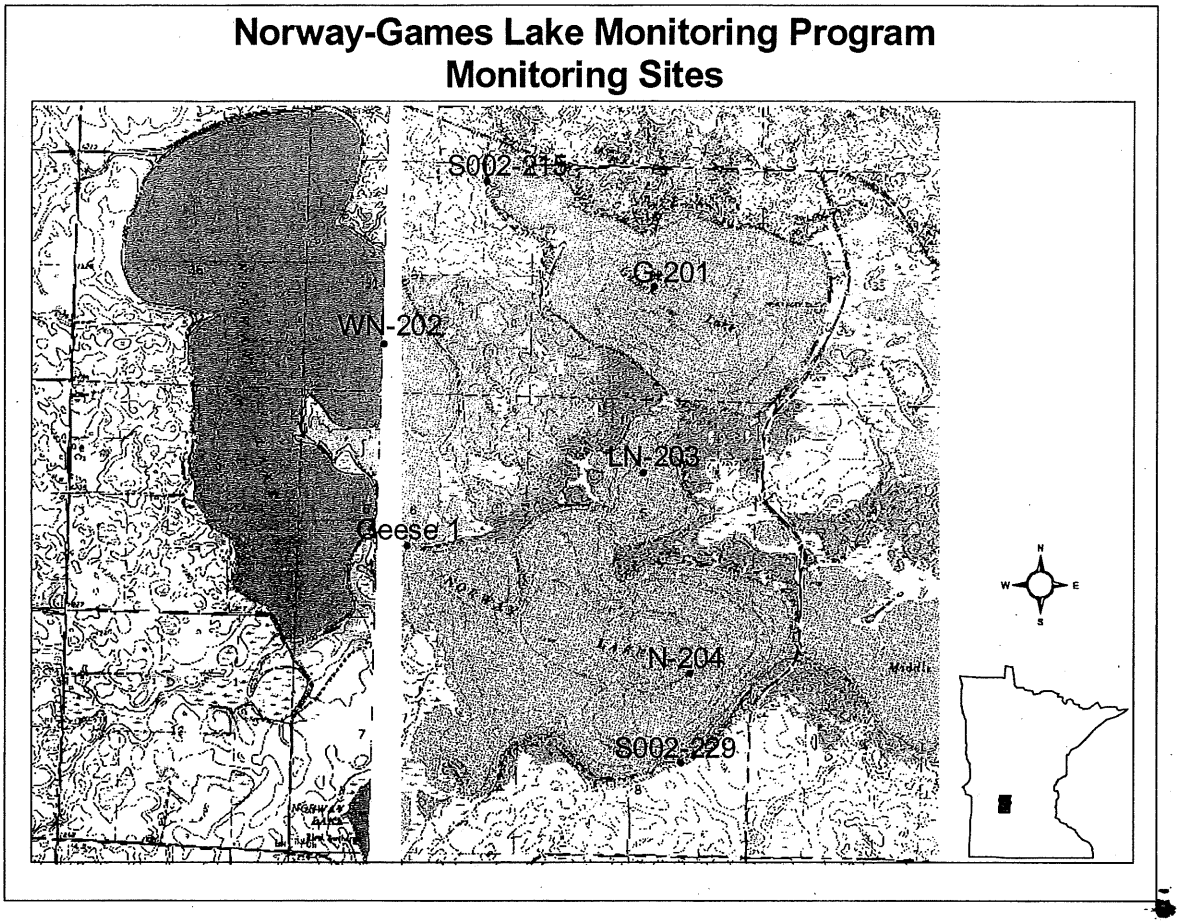
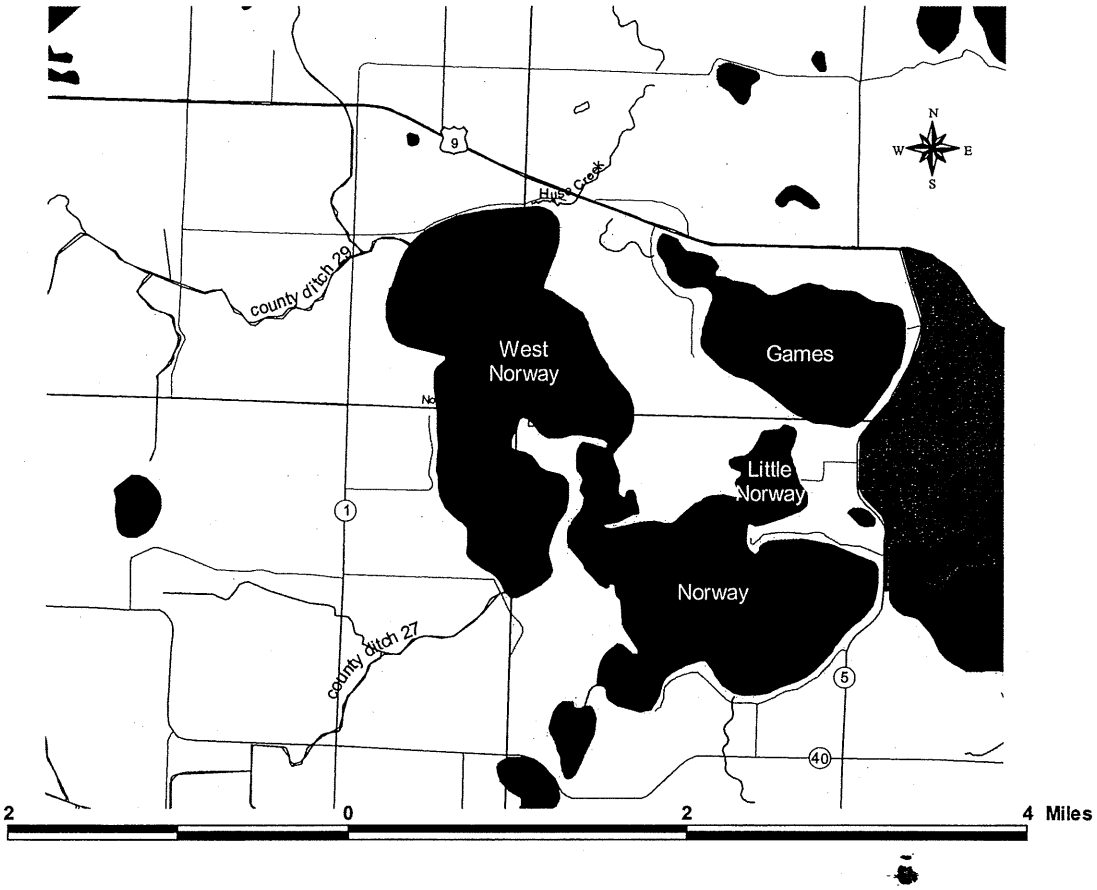

Norway-Games Lake Monitoring Program
Monitoring Sites
S002-215
G-201
WN-202
LN-203
Geese 1
N-204
S002-229
N
W
E
S

Figure1.13


N
W
E
S
9
Hule Creek
county ditch 29
West Norway
Games
Little Norway
Norway
county ditch 27
1
5
40
2
0
2
4 Miles

1.2 General Information on your watershed and surface water:

A diagnostic study done by the MN DNR and Shakopee Creek Headwaters Project identified high levels of sediment, phosphorus, and fecal coliform bacteria in the county ditches that enter West Norway Lake – especially after storm events. This very flashy system of ditches has the propensity to deliver large amounts of water, and in turn sediment, nutrients, and bacteria, into the lakes very quickly following rainfall events. Those ditch and stream systems in the watershed with more water storage capacity (i.e. wetlands) and riparian buffers showed lower and later peak discharges and better water quality than did those systems without storage or riparian buffers.

The suspected sources of sediment, nutrients, and bacteria in the watershed include unbuffered agricultural lands, tile outlets, feedlots, poorly controlled construction sites, unbuffered riparian lakeshores, and non-compliant / failing septic systems.

In the past, data from Norway, West Norway, and Little Norway lakes have been pooled into one reading for each parameter of study. Given what we now know about the differences in the characteristics of these lakes, especially in terms of water quality and clarity, it would be beneficial to establish separate sets of data for each basin. For instance, in 2001 site 202 on West Norway Lake exhibited much different Secchi disk transparency readings than that of Norway Lake site 204 and Little Norway site 203. Site 204 had a maximum reading nearly four times greater than the maximum reading from Site 202 in the same year. The table below, along with the 1999 graph, shows this apparent difference in water clarity at times between each of Norway Lake's basins. For separate readings see Attachments.

Lake Name	Lake ID	Site	NS	Mean	Min	Max	Volunteers
West Norway	34-0251	202	6	3.3 ft	1.5	5.5	Totushek, Jim
Little Norway	34-0251	203	13	3.8 ft	2.5	9.5	Torison, Joel
Norway Lake	34-0251	204	8	9.4 ft	3.0	20.0	Packer, Marvin

* Table taken from the MPCA's Citizen Lake-Monitoring Program 2001 Report on the Transparency of Minnesota Lakes

Specific Area of Interest: Norway – Games Watershed

INFORMATION TOPIC	ANSWER
Major Basin	Minnesota River Watershed, Chippewa River Sub watershed
Watersheds	48.4 sq miles, Shakopee Creek Headwaters watershed
Ecoregion	North Central Hardwood Forest (CHF)
Location of water	Kandiyohi
HUC	0702000526042

Specific Area of Interest: Norway Lake

***The statistics for Norway Lake from DNR/MPCA combine West Norway Lake, Norway Lake, Little Norway Lake and Games Lakes as one. See explanation above in 1.2 General Information on your watershed and surface water.**

INFORMATION TOPIC	ANSWER
Township	Lake Andrew
Lake ID number	34-0251 (MNDNR)
DNR Fisheries Class	Walleye, Centrachid (MNDNR)
Surface Area (Acres)	2496 (MPCA)
Water Clarity '02*	3.13 feet (NGLIA)
Maximum Depth (feet)	30 (MNDNR)
Mean Depth (feet)	10 (MNDNR)
Trophic Status	Eutrophic (MPCA)
Bottom	Sand, gravel, silt (MPCA)
Aquatic Plants	Abundant 16 feet (MPCA)
OHW Elevation	1197.7 feet (MNDNR)
Land Use	See Fig. 1.11

Specific Area of Interest: Little Norway Lake

INFORMATION TOPIC	ANSWER
Township	Lake Andrew
Lake ID number	Same as above
DNR Fisheries Class	Same as above
Acres	110 acres
Water Clarity '02*	3.07 feet
Trophic Status	Same as above
Bottom	Same as above
Aquatic Plants	Same as above
OHW Elevation	Same as above
Land Use	Same as above

Specific Area of Interest: West Norway Lake

INFORMATION TOPIC	ANSWER
Township	Norway Lake, Colfax, Lake Andrew, and Arctander
Lake ID number	Same as above
DNR Fisheries Class	Same as above
Acres	1173
Water Clarity '02*	2.93 feet
Trophic Status	Same as above
Bottom	Same as above
Aquatic Plants	Eurasian water milfoil
OHW Elevation	Same as above
Land Use	Same as above

Specific Area of Interest: Games Lake

INFORMATION TOPIC	ANSWER
Township	Colfax
Lake ID number	34-0224 (MPCA)
DNR Fisheries Class	Centrachid (MNDNR)
Surface Area (Acres)	515 (MPCA)
Maximum Depth (feet)	42 (MNDNR)
Water Clarity '02*	8.0 feet (NGLIA)
Trophic status	Eutrophic (MPCA)
Bottom	Sand, gravel, silt (MPCA)
Aquatic Plants	Abundant 15 feet (MPCA)
OHW Elevation	1197.7 feet (MNDNR)
Land Use	See Fig. 1.11

Specific Area of Interest: Drainage Ditches

INPUTS INTO NORWAY/GAMES LAKE SYSTEM	CHARACTERISTIC
County Ditch 27 (Is being monitored by SCHP)	Intermittent-SW portion of West Norway Drains 10, 241 Acres Landuse: 81% cultivated, 11% grassland, 4% forest, 3% water/wetlands, 1% other
County Ditch 29 (Is being monitored by SCHP) (North branch of County Ditch 29 is being monitored by SCHP)	Intermittent-NW portion of West Norway Drains 5,630 Acres Landuse: 73% cultivated, 13% grassland, 9% forest, 2% water/wetlands, 3% other
Huse Creek (Is being monitored by SCHP)	Intermittent Drains 2,246 Acres Landuse: 23% cultivated, 27% grassland, 27% forest, 22% water/wetlands, 1% other
Private tiles and ditches (two will be monitored in this assessment) Peterson ditch on NW side of Games Lake Pierce ditch on SE side of Norway Lake	Intermittent
Games Lake Dam (will not be monitored at this time)	Outlet

1.3 Inventories on your Uses of Watershed and Surface Water:

SPECIFIC AREA OF INTEREST: Norway Lake

USES	ANSWER
Primary water uses	Recreation
Wastewater systems	Individual Sewage Treatment Systems (ISTS's)
Exotic Species	Curlyleaf pondweed (MNDNR)
Native Species	See Norway Lake survey (MN DNR-Fisheries)
Public Access # and Locations	3: MNDNR south shore West Norway lake 1 mile east of County road 1, MNDNR south shore of main basin of Norway Lake 1 mile north of county road 40, access from Games lake via the Little Norway outlet channel along the north side of Little Norway lake (MNDNR)
County Access	
Organizations with data	SCHP, MN DNR, MPCA, Kandiyohi County Water Plan, Norway/Games Lake Improvement Association
General perception	
Historical events	1938 – drought brought water levels down low enough that a baseball park was used on "Tom's Point" near the south access of Norway Lake (NGLIA)
High Water Years	1984 (MNDNR)

SPECIFIC AREA OF INTEREST: Little Norway Lake

USES	ANSWER
Primary water uses	Same as above
Wastewater systems	Same as above
Exotic Species	Same as above
Native Species	Same as above
Public Access # and Locations	Same as above
County Access	
Organizations with data	Same as above
General perception	
Historical events	Same as above
High Water Years	Same as above

SPECIFIC AREA OF INTEREST: West Norway Lake

USES	ANSWER
Primary water uses	Same as above
Wastewater systems	Same as above
Exotic Species	Eurasian Water Milfoil, Curly leaf pondweed
Native Species	Same as above
Public Access # and Locations	Same as above
County Access	
Ditches	County ditch #29 NW shoreline, #27 SW shoreline
Organizations with data	Same as above
General perception	Sometimes marginal for swimming
Historical events	Same as above
High Water Years	Same as above

SPECIFIC AREA OF INTEREST: Games Lake

USES	ANSWER
Primary water uses	Recreational
Wastewater systems	ISTS's
Exotic Species	Curlyleaf pondweed (MNDNR)
Native Species	See Games Lake survey (MNDNR Fisheries)
Public Access # and Locations	MNDNR Access on east side of lake next to the outlet, Access from Norway Lake via the Little Norway outlet channel along the south side of Games Lake (MNDNR)
County Access	Southeast side of lake in Kandiyohi County Park #7 (MNDNR)
Organizations with data	SCHP, MN DNR, MPCA, Kandiyohi County Water Plan, Norway-Games Lake Improvement Association
General perception	
Historical events	
High Water Years	1965 (MNDNR)

1.4 Current Status of Your Waters of Interest:

1) **Water of Interest** (name, location, and/ or segment/ lake number)	2) **Use Classifications** WQS-7050	3) Lakes: **What is the Carlson Trophic Status?** 305(b)	4) **Assessed**	5) **Are there Uses that are Fully Supported?** 305(b) (List)	6) **Are there Uses that are NOT Fully Supported?** 305(b) (List)	7) Streams **Does Ecoregion Data Indicate any Threats?** 305(b) (List)	8) **If Impaired, what is the Affected Use?** 303(d)	9) **If Impaired, what is the Pollutant or Stressor?** 303(d)	10) **Suspected Sources** 305(b)
Norway Lake 34-0251	2B, 3B, 4A, 4B, 5, 6	Eutrophic 60	M	No	Yes – swimming, aquatic life		Aquatic life	Mercury	
Little Norway Lake 34-0251	2B, 3B, 4A, 4B, 5, 6	Eutrophic 60	M	No	Yes – swimming, aquatic life		Aquatic life	Mercury	
West Norway Lake 34-0251	2B, 3B, 4A, 4B, 5, 6	Eutrophic 60	M	No	Yes – swimming, aquatic life		Aquatic life	Mercury	
Games Lake 34-0224	2B, 3B, 4A, 4B, 5, 6	Eutrophic 55	M	Supported but threatened	Yes – swimming				

1.6 What are the things you value in your watershed?

Recreation water use (boating, water sports, fishing, camping, Sibley State Park, sunken island, supports Loon population) Peterson Chapel, Wildlife areas, Native American history, Swedish & Norwegian immigrant history

1) **Water of Interest** Norway & Games Lakes

2) **Use Classifications**
2B-cool & warm water fish
3B-general industry but not food processing
4A-irrigation
4B-livestock & wildlife
5-enjoyment & navigation
6-limited resource

Actual Uses and Values Fishing, Swimming, Boating, Aesthetics

1) **Water of Interest**	2) **Use Classifications**	**Actual Uses and Values**
Norway Lake 34-0251	2B, 3B, 4A, 4B, 5, 6	Fishing, Swimming, Boating
Little Norway Lake	Same as above	Same as above
West Norway Lake	Same as above	Same as above
Games Lake 35-0224	2B, 3B, 4A, 4B, 5, 6	Fishing, Swimming, Boating

What is known about the watershed?

1) Water quality improvement projects happening in the watershed (see map of Shakopee Creek Headwaters Project BMPs map below):
Five lakeshore restoration projects
>70 acres of buffer strips installed
Rudningen wetland restoration
Hamburg wetland restorations
1st Lutheran wetland restoration
County ditch 29-weir structure
>20 Septic upgrades
Games Lake Aquatic Management Area (AMA)
West Norway-Norway channel stabilization project
Netland WPA
Tom Peterson CREP project
Olson/Strootman sediment basin

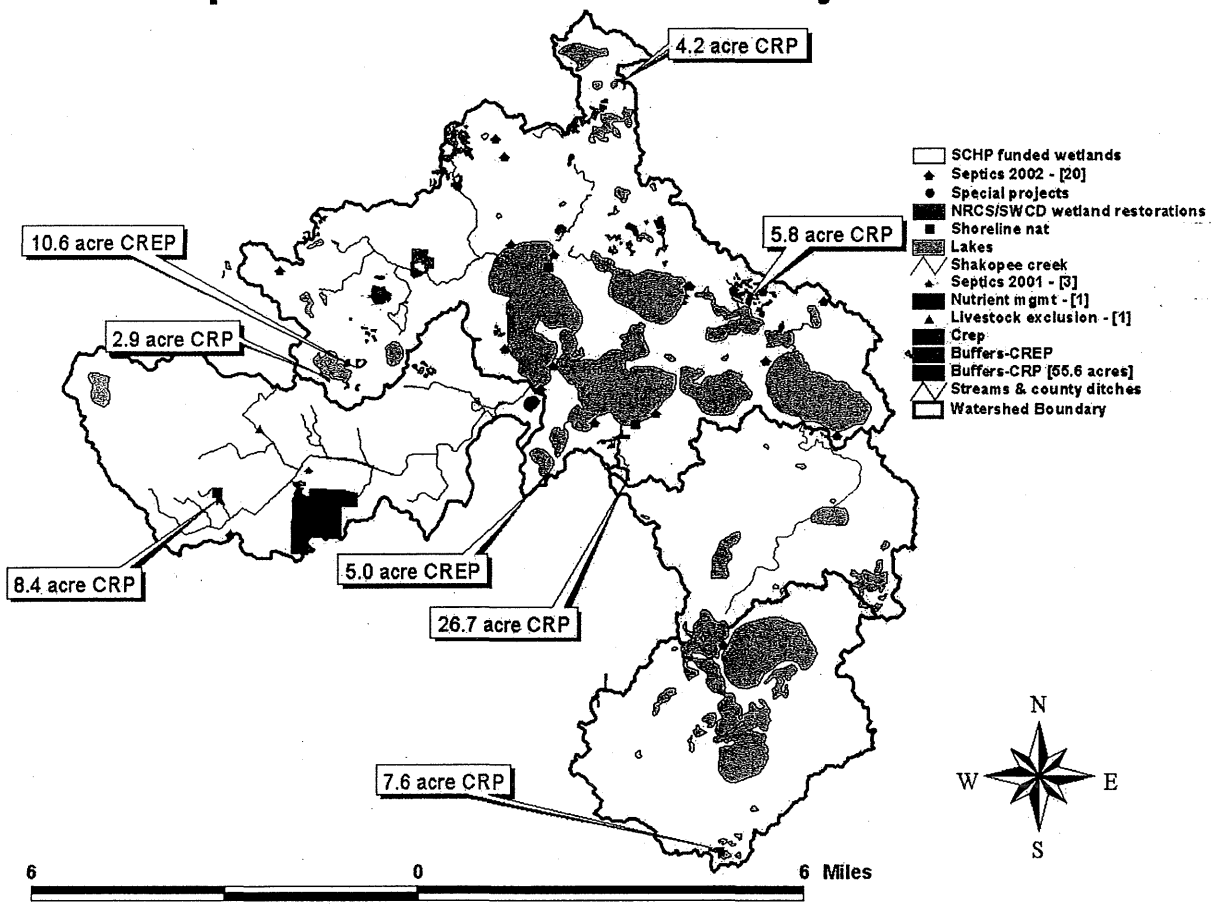
2) Potential hot spots or pollution concerns:

Sediment and nutrients from county ditches #27 & 29, which enter West Norway on the west side of the lake
Eurasian watermilfoil on West Norway
Nutrient inputs from cattle & geese into the lake
Private ditches on southeast side of Norway and the west side of Games Lake

3) Potential monitoring sites:

West Norway Lake
Norway Lake
Little Norway Lake
Games Lake
Private ditches on SE side of Norway and west side of Games Lake

Shakopee Creek Headwaters Project BMPs



2.1 Issues, Efforts to Address those Issues, and Evaluation

Issue	Known Effort to Address the Issue	Evaluating Known Efforts, Identifying Niches
Phosphorus	SCHP monitors county ditches and some lake monitoring, 1994 LAP report (MPCA)	Continue program, expand lake monitoring efforts
Fecal Coliform	SCHP monitors county ditches and some lake monitoring	Continue program, potential for expanding lake monitoring for fecal coliform bacteria
Eurasian Watermilfoil	MN DNR fisheries/County Water Plan does annual survey Management plan done	Report findings outside of West Norway Lake, continual education needed
Sediment	SCHP monitors county ditches	Need for historic accounts of water quality/clarity before ditching
Water Clarity	MPCA, SCHP, & NGLIA monitor Secchi readings, 1994 LAP report (MPCA)	Continue with TSI Index sampling
Algae Blooms	MPCA, SCHP, & NGLIA monitor Secchi readings, 1994 LAP report (MPCA)	Continue with TSI Index sampling
Unsupported use for aquatic life	MPCA efforts	Possible need for citizen macroinvertebrate monitors
All basins of Norway Lake are combined for analysis	This monitoring plan will attempt to define the characteristics of each basin of Norway Lake to more accurately assess its condition	Citizen volunteer help to monitor West Norway Lake, Norway Lake, Little Norway Lake, and Games Lake

MONITORING GOALS

2.2 From Issues to Indicators

Current Issues or Problems to be Addressed	Desired Outcomes	Benchmarks	Indicators
Murky water in lakes from algae and sediment	Landowners of lake property and farming community implement more best management practices that will reduce nutrients and sediment from reaching waterways	Past phosphorus loads in county ditches Past observed number of days of algae blooms in summer months Past Secchi readings	County ditch nutrient load values decreasing Visual observation, Secchi readings increasing
Lack of septic system maintenance	Improved maintenance of existing septic systems on the lake 100% compliance in all systems around the lake	Increased response to septic survey Survey responses report better maintenance	Lower average system age Visually see more pumping activity during summer months
Nutrients from private and county drainage tiles/ditches	Lower nutrient loads and flow-weighted mean concentrations for phosphorus and nitrogen especially during years of high runoff Lower concentrations of nutrients during high runoff storm events	Decreasing flow weighted mean concentrations for phosphorus and nitrogen on county ditches Decreasing sample concentrations for phosphorus and nitrogen from similar runoff periods	Increased transparency – even during high flows Less occurrences of severe algae blooms in West Norway Lake
Sediments from private and county drainage tiles/ditches	Lower total suspended solid (TSS) loads and flow weighted mean concentrations especially during years of high runoff Lower turbidity readings	Decreased TSS load values during similar runoff years Decreased average turbidity readings – especially during storm events	Increased transparency – even during high flows Less occurrences of severe algae blooms in West Norway Lake

3.1 Data Users and Uses

Question or Hypothesis	User/Decision Maker	Uses/Decisions
Will phosphorus in lakes be reduced if the phosphorus in county ditches is reduced?	SCHP (1) Soil & Water Conservation District (SWCD) (2) NGLIA (3)	1. Continue targeting county ditches for incentive programs and education 2. Continue targeting county ditches for CREP and other conservation programs 3. Continue educating landowners in that area
Has phosphorus in lakes decreased as upgrades of septic systems have increased?	SCHP (1) NGLIA (2) MPCA (3)	1. Target lakeshore property owners with septic upgrade program 2. Educate lakeshore owners 3. Target grant dollars to lakeshore areas move these
How does land use affect water quality?	SCHP (1) County Zoning (2)	1. Education and research into the effects of land use on hydrology and water quality 2. Make land use decisions with water quality concerns in mind
How does the lake's water quality (trophic status index) compare to 10 years ago?	SCHP (1) SWCD (1) DNR (1) MPCA (2)	1. Evaluation of programs, efforts in the area 2. May have impacts on TMDLs
How has the lakeshore owners' behavior changed regarding septic system maintenance?	SCHP (1) NGLIA (1) SWCD (1)	1. Do other measures need to be taken to promote proper septic maintenance
What impact do the private and county ditches/tiles have on Norway/Games Lake and how has it changed since the 1996-1998 period?	SCHP (1,2) SWCD (1,2) DNR (1,2) MPCA(3)	1. BMP and education targeting 2. Future education and monitoring targets 3. Determine if impacts have changed since LAP study.

4.5 Monitoring Goal

We would like to take another survey of lakeshore homeowners on Norway/Games Lake to compare the responses to the survey taken 10 years ago. This will be an impact assessment that will measure behavior change regarding septic system maintenance, which may have an impact on the quality of the water in the Norway-Games Lake system. It will be used to gauge the effort that will be needed in the future from the lake association and agency personnel to ensure proper sewage treatment. Presentations of the information will be made at lake association meetings.

We plan on performing a trophic status index assessment of Norway/Games Lake including West Norway, Norway, Little Norway, and Games Lakes. The lake association, SCHP, DNR, SWCD, and MPCA will use this data to compare to the 1994 LAP report data and with other data gathered in between 1994-2004 to measure eutrophication of the lake. It can also be used by MPCA for an impaired waters assessment. The monitoring for trophic status assessment is currently only funded for two years, but may continue for three years if funding sources are identified.

Storm event samples will be taken at 2 different sites in an effort to identify nutrient levels in the runoff entering Norway and Games lakes from private drainage. The SCHP is conducting similar monitoring on the county ditches and Huse Creek. Both SCHP's and Norway/Games Lake Monitoring Program's data sets will be used to assess ditch/tile impacts on Norway and Games lakes.

5.2 Sources of Stressors, Parameters and Scale

Sources of Stressors	Parameters	Scale
Nutrients	Total Phosphorus (TP)	Lake
Nutrients	Chlorophyll a	Lake
Nutrients	Dissolved Oxygen/Temperature (DO/T)	Lake
Nutrients	Secchi Disk (SD)	Lake
Nutrients	TP, Ortho-phosphorus (OP), Total suspended solids (TSS), Nitrite-nitrate nitrogen (NO_2+NO_3), Total Kjeldahl nitrogen (TKN), Ammonia (NH_3), turbidity	Ditch/Tile

5.3 Data Quality Objectives for Sampling

Sampling Method / Parameter	Completeness	Representativeness	Comparability
Integrated sampler / TP & chlorophyll a samples from the epilimnion	1 samples/month/site 4 sites 5 months (May-Sept) 20 total samples/year	Measurements collected at the deepest part of each lake basin once a month from May - September	Use standardized sampling procedures, Methods and sites used are comparable with 1994 LAP study
Visual observation of water clarity using a Secchi disk	1 measurements/mo/site 4 sites 5 months (May-Sept) 20 total samples/year	Measurements collected at the deepest part of the lake once every month from May-September	Annual duplicate readings between paired volunteers. Annual duplicate readings with a reader from another organization.
Direct measure of dissolved oxygen profile using DO/temp meter	1 measurements/mo/site 4 sites 5 months (May-Sept) 20 total measurements/yr	Measurements collected at the deepest part of the lake once every month from May-September	Make sure methods used and sites are comparable with historical data
Grab samples taken for TP, OP, TSS, NO_2+NO_3, TKN, NH_3, turbidity from below surface of water flowing out of private ditches emptying into Norway/Games lake	5 storm events per year 2 sites 10 total samples/yr	Samples taken at the tile/ditch outlet into the lake	Make sure methods used and sites are comparable with historical data

5.4 Sample Collection Methods:

Parameter	What will be sampled	What will be used to collect sample	Sample Containers/ Preservation	Quantity of sample to be collected	Number of samples to be collected per site	Sampling Methods Reference and Source
Lake Sampling						
TP (Total phosphorus)	Epilimnion	Integrated sampler,	Cool to 4°C H_2SO_4 to pH < 2	100 mL	1	EPA 365.1 – 365.3 SM 4500P-F
Chlorophyll a	Epilimnion	Integrated sampler,	Cool to 4°C use dark colored bottles	1 liter	1	SM 10200H
Secchi Disk	Epilimnion	Secchi disk	na – done in field w/ Secchi disk	na – done in field w/ Secchi disk	na – done in field w/ Secchi disk	CLMP Manual
Dissolved Oxygen / Temperature	Water column	YSI meter w/ 50' cord for DO/temp	na – done in field w/ O2 /temp meter	na – done in field w/ O2 /temp meter	1 meter intervals	
Tile/Ditch Sampling						
TP (Total phosphorus)	Tile/ditch mid-channel	Plastic bottle	Cool to 4°C H_2SO_4 to pH < 2	100 mL	1	EPA 365.1 – 365.3 SM 4500P-F
OP (ortho-phosphorus)	Tile/ditch mid-channel	Plastic bottle	Cool to 4°C	100 mL	1	EPA 365.1
TSS (Total suspended solids)	Tile/ditch mid-channel	Plastic bottle	Cool to 4°C	1 Liter	1	SM 2540D
Turbidity	Tile/ditch mid-channel	Plastic bottle	Cool to 4°C	100 mL	1	EPA 180.1
NO_2-NO_3 (Nitrate-nitrite nitrogen)	Tile/ditch mid-channel	Plastic bottle	Cool to 4°C	100 mL	1	EPA 354.1
TKN (Total Kjeldahl nitrogen)	Tile/ditch mid-channel	Plastic bottle	H_2SO_4 to pH < 2, Cool to 4°C	100 mL	1	EPA 351.3
NH_3 (Ammonia nitrogen)	Tile/ditch mid-channel	Plastic bottle	H_2SO_4 to pH < 2, Cool to 4°C	400 mL	1	SM 4500-NH3 C

5.5 Data Quality Objectives for Analysis

Parameter	Accuracy	Precision	Detection Limit/Measurement Range
TP	80-120% recovery for QC standards and lab spikes	± 0.005 if less than 0.050 mg/L or 20% RPD if more than 0.050 mg/L	DL = 0.005 mg/L Range = 0.005-0.500 mg/L
Chlorophyll a	75-125% recovery for QC standard	± 2.0 if less than 15 µg /L or 25% RPD if more than 15 µg /L	DL = 1 µg/L Range = 1 – 100 µg/L
Secchi Disk	NA	± 0.2m for duplicate readings	DL = 0.2m
Dissolved Oxygen	+0.5 for zero standard	<0.5 difference between duplicates	DL = 0.0 mg/L Range = 0.0 – 15.0 mg/L
OP (ortho-phosphorus)	Same as TP	Same as TP	Same as TP
TSS (Total suspended solids)	75-125% recovery for QC std.	± 1.0 or 25% RPD whichever is higher	DL = .01 mg/L Range .01-500 mg/L
Turbidity	90-110% recovery of turbidity std.	± 5 NTU if less than 1 NTU or 20% RPD if more than 1 NTU	DL = 0.1 NTU Range 0.1 – 200 NTU
NO_2-NO_3 (Nitrate-nitrite nitrogen)	80-120% recovery for QC std. and lab fortified matrix	± 0.02 if less than 0.1 mg/L or 20% RPD if more than 0.1 mg/L	DL = 0.01 mg/L Range = 0.01 – 2 mg/L
TKN (Total Kjeldahl nitrogen)	80-120% recovery for QC std. and lab fortified matrix	± 0.20 if less than 0.5 mg/L or 20% RPD if more than 0.5 mg/L	DL = 0.25 mg/L Range = 0.25 – 2 mg/L
NH_3 (Ammonia nitrogen)	80-120% recovery for QC std. and lab fortified matrix	± 0.01 if less than 0.1 mg/L or 20% RPD if more than 0.1 mg/L	DL = 0.01 mg/L Range = 0.01 1.0 mg/L

*Measurement ranges are less than the detection limit for all parameters

5.6. Sample Analysis Methods:

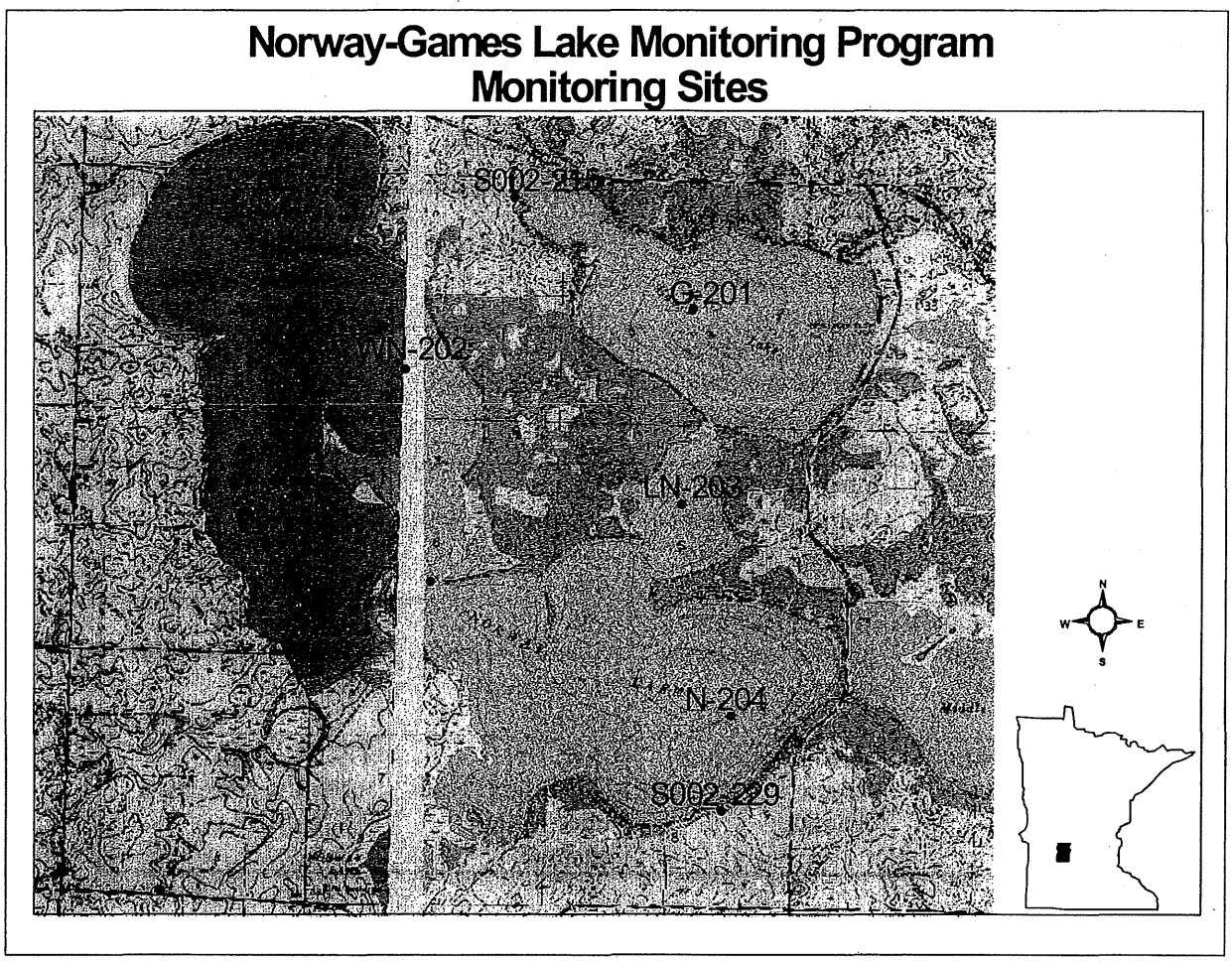
Parameter	Where samples will be analyzed	How Sample Transported to Lab	Maximum holding time before Analysis	Analytical Method Reference and Source	Brief Description of Method	Reporting Units
TP	ERA labs	Cooler on ice (Speedy delivery)	28 days	EPA 365.1-365.3, SM 4500P-F	A sample is appropriately treated to convert all phosphorus of interest to reactive orthophosphate. Ammonium molybdate and antimony potassium tartrate are added to the treated sample reacting with orthophosphate in an acidic medium to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The concentration of the orthophosphate is measured by detecting the absorbance of the complex with a spectrophotometer.	mg/L as P
Chlorophyll a	ERA labs	Cooler on ice in dark bottles	30 days	SM 10200H	An integrated water sample collected using a clean container, subsample is filtered, filters are analyzed immediately, pigment is extracted, color is read with spectrophotometer, add HCl to sample, color is read and pheophytin calculated	ug/L
Secchi Disk	Field	NA	NA	CLMP Handbook	Lower secchi disk into the water until it disappears from sight, bring disk up until it appears again, calculate average of these two depths for secchi transparency	Feet or meters
Dissolved Oxygen	Field	NA	NA	YSI instruction manual	Lower DO/temp meter probe to desired depth, stir the probe while measurement stabilizes, record DO/temp readings	mg/L
OP (ortho-phosphorus)	ERA labs	Cooler on ice	48 hours	EPA 365.1	Collect a sample in a phosphorus-free container, boil, acidify, and oxidize a sub-sample to convert all forms of phosphorus to orthophosphate, analyze orthophosphate by adding ascorbic acid reagent, which turns the sample blue in proportion to the amount of phosphorus in the sample, measure the intensity of this blue color using a spectrophotometer or colorimeter and compare with results for a set of standard concentrations.	mg/L as P

Parameter	Where samples will be analyzed	How Sample Transported to Lab	Maximum holding time before Analysis	Analytical Method Reference and Source	Brief Description of Method	Reporting Units
TSS (Total suspended solids)	ERA labs	Cooler on ice	7 days	SM 2540D, USGS I-3765	A well-mixed sample is filtered through a weighed standard glass fiber filter. The suspended solids are retained on the filter, which is dried at 105°C and weighed. The increased mass on the filter represents the nonfilterable matter. The filtrate may be used to determine the filterable matter. The filtered sample (liquid phase) is evaporated to dryness and heated to 180°C in a tared vessel to a constant weight.	mg/L
Turbidity	ERA labs	Cooler on ice	48 hours	EPA 180.1	The method is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. The higher the intensity of scattered light, the higher the turbidity. Readings, in NTU's, are made in a nephelometer designed according to specifications outlined in the method. A standard suspension (i.e., formazin, AMCO-AEPA-1, or Hach Stablcal) is used to calibrate the instrument.	NTU
NO_2-NO_3 (Nitrate-nitrite nitrogen)	ERA labs	Cooler on ice	48 hours	EPA 353.2	A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that originally present plus that reduced to nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye which is measured colorimetrically. Separate, rather than combined nitrate-nitrite, values are readily obtained by carrying out the procedure first with, and then without, the Cu-Cd reduction step.	mg/L as NO_3-N
TKN (Total Kjeldahl nitrogen)	ERA labs	Cooler on ice	28 days	SM 4500-NH3BE, EPA 351.3 digest,distill, titr.	The sample is heated in the presence of sulfuric acid, potassium sulfate, and mercuric sulfate, and evaporated until sulfite fumes are obtained and the solution becomes colorless or pale yellow. The residue is cooled, diluted, and is treated and made alkaline with a hydroxide-thiosulfate solution. The ammonia is distilled and determined after distillation by titrimetry or other procedure.	mg/L as N
NH_3 (Ammonia nitrogen)	ERA labs	Cooler on ice	7 days	SM 4500NH3H, EPA 350.2 titr.	A sample is buffered at alkaline pH with borate buffer to decrease hydrolysis of cyanates and organic nitrogen compounds, and is distilled into a solution of boric acid. The ammonia distillate is determined using a colorimetric titration, or by other options given in the method.	mg/L as NH_4 -N

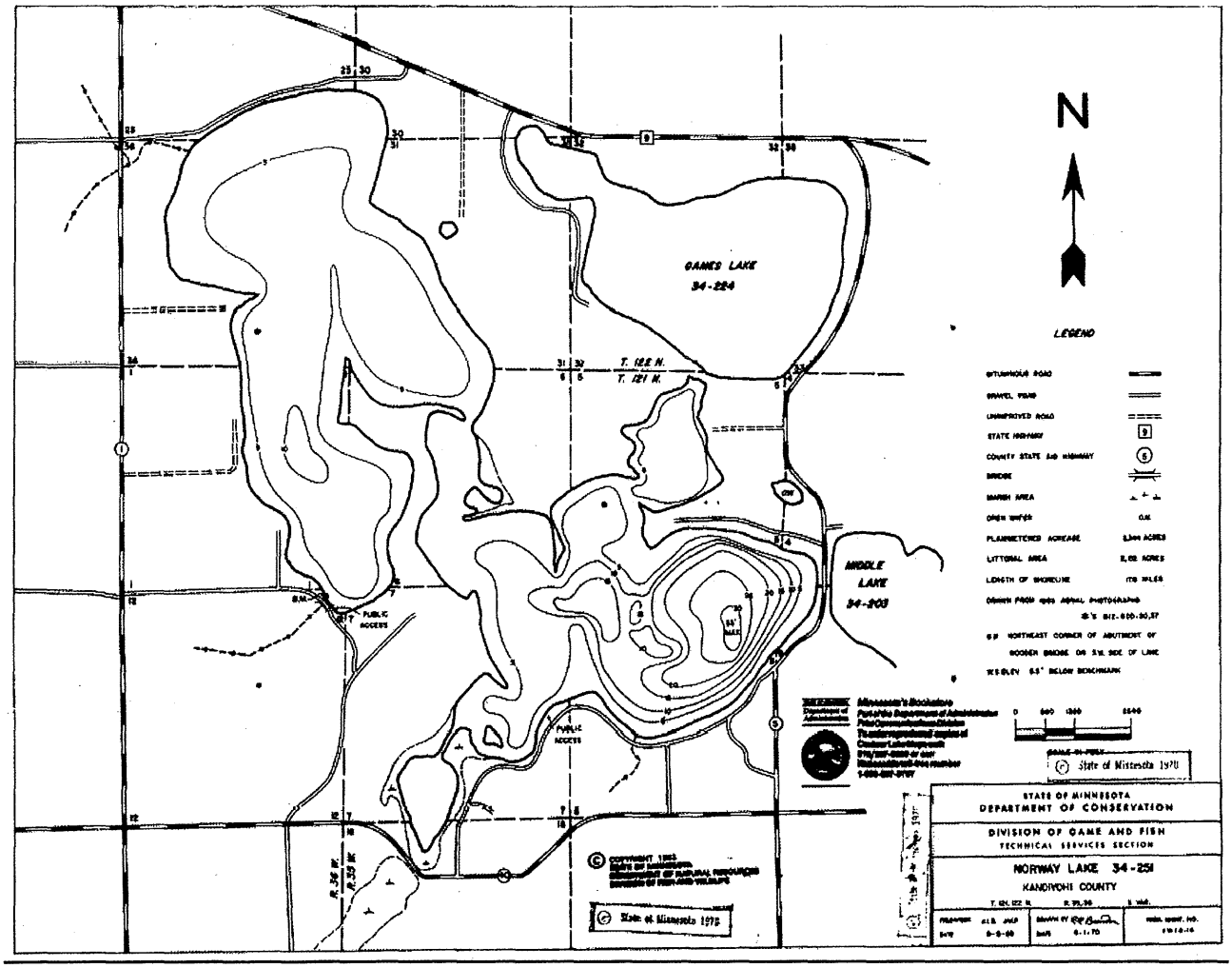
6.1 Sampling Site List

Site #	Brief Description of Location (Code for Segment, if any)	How and Where the Site Will Be Sampled	Type of Site	Parameters
WN-202	Located at the deepest part of the lake	Integrated sampler from boat at lake's deepest point for epilimnion	B.1. Condition/Trend Lake – deepest site	TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature
N-204	Located at the deepest part of the lake	Integrated sampler from boat at lake's deepest point for epilimnion	B.1. Condition/Trend Lake – deepest site	TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature
LN-203	Located at the deepest part of the lake	Integrated sampler from boat at lake's deepest point for epilimnion	B.1. Condition/Trend Lake – deepest site	TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature
G-201	Located at the deepest part of the lake	Integrated sampler from boat at lake's deepest point for epilimnion	B.1. Condition/Trend Lake – deepest site	TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature
S002-215 (GAME-NW)	Located at the inlet of a tile/ditch on the west side of Games Lake	Storm event grab sample from mid-channel	B.2. Condition/Trend Inlet – mid-channel	TP, OP, TSS, turbidity, NO_2-NO_3, TKN, NH_3
S002-229 (NOR-SE)	Located at the inlet of a tile/ditch on the southeast side of Norway Lake	Storm event grab sample from mid-channel	B.2. Condition/Trend Inlet – mid-channel	TP, OP, TSS, turbidity, NO_2-NO_3, TKN, NH_3

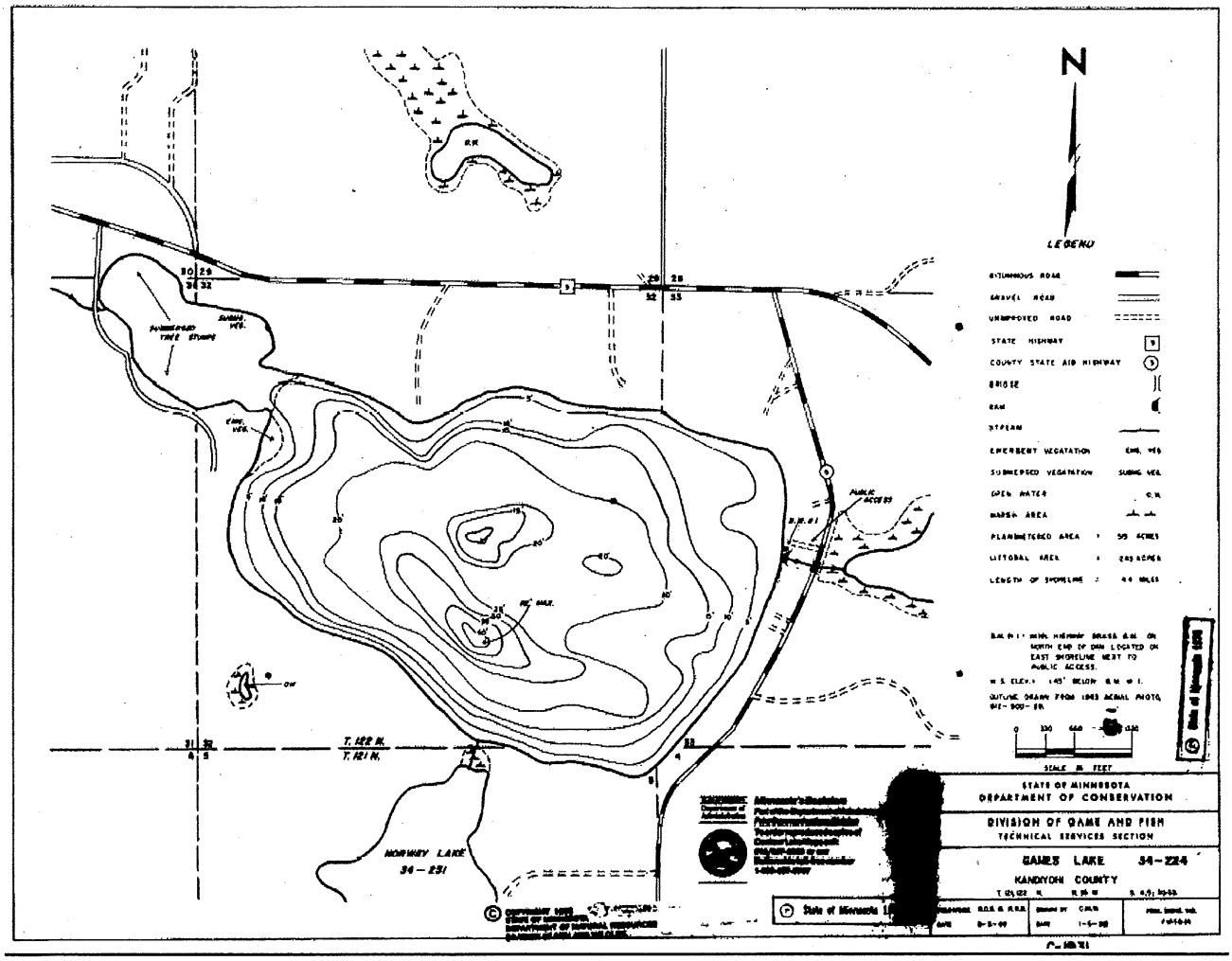
6.2 Sampling Site Map



Bathymetric Map for Norway Lake (34-0251)



Bathymetric Map for Games Lake (34-0224)



6.3 Site Specific Sampling:

Parameters Monitored	Site #	Where In the Water Column?	Where Across Transect?
TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature	West Norway WN202	Epilimnion (DO/temp in whole water column)	Deepest depth
TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature	Norway N204	Epilimnion, (DO/temp in whole water column)	Deepest depth
TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature	Little Norway LN203	Epilimnion (DO/temp in whole water column)	Deepest depth
TP, chlorophyll a, Secchi disk, dissolved oxygen, temperature	Games G201	Epilimnion, (DO/temp in whole water column)	Deepest depth
TP, OP, TSS, turbidity, NO_2-NO_3, NH_3, TKN	Peterson tile/ditch S002-215	Mid-channel of inlet just below water surface	Mid-channel
TP, OP, TSS, turbidity, NO_2-NO_3, NH_3, TKN	Pierce tile/ditch S002-229	Mid-channel of inlet just below water surface	Mid-channel

6.4 Sampling Schedule

Parameter(s)	Frequency	Time of Day	Time of Year	# of Years	Special Weather Conditions
TP, chlorophyll a	1/mo	Between 10am-3pm	May-September	3	On bright calm days
Secchi disk	1/mo	Between 10am-3pm	May-September	3	On bright calm days
Dissolved Oxygen, temperature	1/mo	Between 10am-3pm	May-September	3	On bright calm days
OP, TSS, turbidity, NO_2-NO_3, NH_3, TKN	5 storm events per year (Private Ditches / County Ditches)	Storm dependant	Ice out through freeze up	1	High runoff storm events

QUALITY ASSURANCE AND QUALITY CONTROL

7.1 Quality Control Measures

Quality Control Measures	Evaluation: Statistical Methods	Parameters and % Quality Control Samples							
		TP	Chl a	Secchi	DO	Temp	OP	NO_2-NO_3, TKN, NH_3	TSS, turbidity
Internal									
Field Duplicates (lab checks)	Relative percent difference (RPD)	5% of all sites	5% of all sites	Each sample	5% of all sites	Each profile	5% of all sites	5% of all sites	5% of all sites
Sampler Blanks	Should be zero contamination	EACH RUN					EACH RUN	EACH RUN	
Calibration Blanks	Read as the expected concentration within defined limits	EACH RUN			Each time using distilled water sample		EACH RUN	EACH RUN	
External									
Knowns	Relative percent difference (RPD)	1/yr	1/yr				1/yr	1/yr	
Unknowns									1/yr

Response Action:
All data will be analyzed for accuracy immediately so we have the ability to re-run sample within the holding time if the data is suspect.

7.2 Instrument and Equipment Requirements

Narrative Format:

Equipment Type: Portable YSI Model 95 dissolved oxygen/temperature meter
Documentation: Manufacturer's instruction manual
Inspection and Frequency: Prior to each sampling event
Maintenance: Inspect membrane, replace as needed
Calibration Frequency: calibrate to elevation prior to each sampling event, calibrate to Winkler method each season
Reference Standards Used: Elevation 1200', distilled water = ~7 mg/L
Calibration Instrument Used: NA

Table Format:

Equipment Type	Inspection Frequency	Maintenance	Calibration Frequency	Standards or Calibration Instrument Used
Portable YSI DO/temp meter w/ 50' cord / Manufacturer's instructions are used for troubleshooting, maintenance, and calibration	Prior to each sampling event	Check membrane, replace as necessary Check meter lengths on 50' cord	Prior to each sampling event	Elevation of sites where instrument is being used 1200', also check DO reading with pure, distilled water (~7mg/L)
Secchi disk	Prior to each sampling event	Check to ensure tape is calibrated and secured tightly to Secchi disk	1/yr	Tape measure
Integrated sampler	Prior to each sampling event	Wash between each sample taken three times with water from the site	NA	NA

7.3 Instructions, Documentation, Records and Manuals

Instructions

Reference: MPCA, "Water Quality Sampling Standard Operating Procedures Revision 1.1," June 25, 2003

Who is responsible: We will use the SOPs recommended for MN River watershed projects created by MPCA and housed at the Shakopee Creek Headwaters Project office at 1005 High Ave NE, Willmar, MN 56201

Documentation and records

All laboratory report information including parameters, readings, and comments will be stored with the field information, which will include time of sample, sampler name, weather conditions, comments, and DO/temp profile sheets indefinitely at both the Shakopee Creek Headwaters Project office and with the Norway/Games Lake Association clerk.

Manuals used by volunteer monitors

ERA Quality Assurance Manual April 1996:

On file at Shakopee Creek Headwaters Project (SCHP) office and available from
ERA Laboratories, Inc.
24 North 21st Ave W
Duluth, MN 55806-2017
218-727-6380

7.4 Training

Training Aspect	Description
What is the training about?	Teaching proper sampling techniques, avoiding contamination, meter calibration, when to sample, how to record data, where to bring samples, and other logistics.
Training provider?	SCHP technician
How often is training provided and when is it?	Once in the spring before each new monitoring season, and as needed for new volunteers
Who is trained?	All volunteers – new and seasonal
Evaluation Criteria?	On a trial run, the sampler will be evaluated based upon following proper sampling procedure

DATA STORAGE AND MANAGEMENT

8.1 Data Management - What are you recording and where?

Type of Sheet: SCHP DO/Temp Profile Sheet
Copies Attached (Y/N): Yes

Type of Sheet: Field Sample Sheets (MPCA)
Copies Attached: Yes

Type of Sheet: ERA chain of custody sheets
Copies Attached (Y/N): Yes

Type of Sheet: ERA electronic lab results
Copies Attached: Yes

D/O Profile Sheet

W. Norway Lake			Norway Lake			Little Norway Lake			Games Lake		
Depth	Temp.	D/O	Depth	Temp.	D/O	Depth	Temp.	D/O	Depth	Temp.	D/O
0			0			0			0		
1			1			1			1		
2			2			2			2		
3			3			3			3		
4			4			4			4		
5			5			5			5		
6			6			6			6		
7			7			7			7		
8			8			8			8		
9			9			9			9		
10			10			10			10		
11			11			11			11		
12			12			12			12		
13			13			13			13		
14			14			14			14		
15			15			15			15		
16			16			16			16		
17			17			17			17		
18			18			18			18		
19			19			19			19		
20			20			20			20		
21			21			21			21		
22			22			22			22		
23			23			23			23		
24			24			24			24		
25			25			25			25		
26			26			26			26		
27			27			27			27		
28			28			28			28		
29			29			29			29		
30			30			30			30		
31			31			31			31		
32			32			32			32		
33			33			33			33		
34			34			34			34		
35			35			35			35		
36			36			36			36		
37			37			37			37		
38			38			38			38		
39			39			39			39		
40			40			40			40		
41			41			41			41		
42			42			42			42		
43			43			43			43		
44			44			44			44		
45			45			45			45		
46			46			46			46		
47			47			47			47		
48			48			48			48		
49			49			49			49		
50			50			50			50		

MINNESOTA POLLUTION CONTROL AGENCY / STREAM FIELD SHEET

FIELD INFO.	A	B	C	D	E	F
PROJECT NAME*						
STORET ESTAB. STATION NUMBER						
FIELD CODE OR STREAM NAME*						
DATE						
TIME (military hh:mm)						
SITE ID						
QA*						
TEMP °C						
CONDUCTIVITY @ 25 ° C (umho/cm)						
DO (mg/l)						
PH						
TURBIDITY, NTU						
W.L. GAGE (ft.)*						
W.L. GAGE TYPE*						
TRANSPARENCY* 60 cm tube (to the nearest cm)						
TRANSPARENCY* 100 cm tube (to the nearest cm)						
APPEARANCE*						
RECREAT. SUIT. *						
STRM CONDITION*						
STREAM FLOW MEAS. (cfs)*						
SAMPLING DEVICE*						
SAMPLE TYPE*						

* See back of sheet for additional instructions/information

FIELD OBSERVATIONS (station name/location, weather, gage type, stream width, picture #, GPS file name, etc.)

A	

ADDITIONAL INSTRUCTIONS/INFORMATION

PROJECT NAME
Write down project this data is being collected for (examples: Milestones, Duluth Snow Melt Study, River Nutrient Study, etc...)

FIELD CODE OR STREAM NAME
If this is an unestablished site and you want the site established and data entered in STORET, please supply us with GPS reading and station description/location. Note these in the field observation section.

QA
FD = Field Dup, SB = Sampler Blank, TB = Trip Blank, BB = Bottle Blank, RB = Reagent Blank

WATER LEVEL GAGE (WL), feet:
Water level, also called "stage", determined by reading a staff gage, recording gage, wire weight gage or by subtracting a tape down measurement to water level from a measuring point elevation. A description of the gage should be noted in "field observations", as well as any unusual conditions that affect the measurement (debris around the staff, wind catching the tape, standing waves, etc.)

W.L. GAGE TYPE	ABBREVIATION	DEFINITION
USGS Staff or Wire Weight	U-R	USGS outside reference gage, such as staff or wire-weight, at an active gage
Tape-down from Elev. Elevation	TD	Tape-down to water level subtracted from established measuring point elevation (describe in comments)
Other Staff or Wire Weight	R	Outside reference gage, such as staff or wire-weight, that is maintained by a non-USGS agency (describe in comments)

TRANSPARENCY READINGS

INSTRUCTIONS:
- Make sure your back is to the sun when taking a measurement
- Fill your tube until the symbol disappears
- Release water until you can JUST make out the symbol. Note depth
- Release a bit more water until the symbol is visible. Note depth
- Record the average of the two depths to the nearest centimeter
- If the symbol is visible when the tube is full, record as ">60cm".

APPEARANCE:
1 = Clear crystal, clear transparent water
2 = Milky not quite clear, cloudy white or gray
3 = Foamy natural or from pollution
4 = Tea-colored clear but tea-colored due to wetland or bog influences
5 = Muddy – cloudy brown due to high sediment levels
6 = Green – might indicate excess nutrients released into the sun
7 Green OR Muddy and either extensive floating scum or strong odor

RECREATIONAL SUITABILITY:
1 Beautiful, could not be better
2 = Very minor aesthetic problems: excellent for body-contact recreation.
3 = Body-contact recreation and aesthetic enjoyment slightly impaired
4 Recreation potential and level of enjoyment of the stream substantially reduced (would not swim but boating/canoeing is okay)
5 = Swimming and aesthetic enjoyment of the stream nearly impossible

STRM CONDITION
N=Normal,L=Low,H High / SW Swift,SL=Slow,MO=Moderate / C Clear,M=Muddy,O=Other

STREAM FLOW MEAS. (cfs)
Total instantaneous stream flow by direct measure with current meter at the time of sampling, or by dam gate rating, but NOT estimated by stage-discharge relationship.

SAMPLING DEVICE

ABBREVIATION	STORET CONFIG ID	NAME
SIM	SIMPLE	Simple Open Plastic Bucket
ROD	ROD	Telescoping Rod with Bottle
ICE1	ICE 1	Ice Conditions Water Sampler (straight rod with bottle attached to lower through ice)
DI		Depth Integrating (USGS type)
WB	WEIGHTED	Weighted Bucket with Cover (aka triple sampler, "labline")
Other		Another type of sampler (describe in notes)
None		Sample collected directly into sample bottle
AS		Automatic Sampler

SAMPLE TYPE	ABBREVIATION	DEFINITION
Grab	G	Sampling vessel or bottle filled at one point in water column and cross section of a waterbody
Composite-F	CF	Flow-weighted with auto-sampler
Composite-M	CM	Samples from multiple locations on a waterbody, combined w/churn splitter (describe in comments)
Composite-O	CO	Composite -- Other (describe in comments)

№ 69016

CHAIN OF CUSTODY RECORD

Era Laboratories Inc.
24 North 21st Avenue West
Duluth, Minnesota 55806-2017
(218) 727-6380

Era Project # _____
Priority _____
Carrier _____

Client Name _____
Client Address _____
Client Contact _____
Phone( ) _____ Fax( ) _____

Report to _____
Bill to _____
Client P.O. # _____
Sampled by _____
Representing _____

Item #	Sample I.D./Description	Matrix	Date	Time	# of Containers	Preservatives: Unpreserved	Nutrient (H_2SO_4)	Metals (HNO_3)	HCl	NaOH			Analyses Request	Lab #
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														

Sample disposal
return to client _____ disposal by lab _____

Item #	Relinquished by/Affiliation	Date	Time	Accepted by/Affiliation	Date	Time	°C

Additional Comments:

Era Laboratories, Inc.
24 North 21st Avenue West Duluth Minnesota 55806-2017 (218)727-6380 Fax: (218)727-3049

Laboratory Report

ROB SPITZLEY
SHAKOPEE CREEK HEADWATERS
1005 HIGH AVENUE NE
WILLMAR MN 56201

Project Number: 015381
COC Number: 66585
Temperature (°C): 12.5
Date Received: 8/6/2003
Report Date: 8/19/2003

Site: 1 Date: 08/05/2003 Time: 12 15 Matrix: Surface Water

Parameter		Results:	Units:	Date Analyzed:	QC Comments:
Nitrogen, Ammonia		0.20	mg/L	8/15/2003	
Nitrogen, Nitrate + Nitrite		0.72	mg/L	8/15/2003	
Nitrogen, Total Kjeldahl		1.6	mg/L	8/13/2003	
Phosphorus, Ortho		0.111	mg/L	8/6/2003	
Phosphorus, Total		0.167	mg/L	8/11/2003	
Solids, Total Suspended		4	mg/L	8/11/2003	
Turbidity		2.1	NTU	8/7/2003	

Site: 2 Date: 08/05/2003 Time. 11:50 Matrix: Surface Water

Parameter:		Results:	Units:	Date Analyzed:	QC Comments.
Nitrogen, Ammonia		0.26	mg/L	8/15/2003	
Nitrogen, Nitrate + Nitrite		1.1	mg/L	8/15/2003	
Nitrogen, Total Kjeldahl		2.5	mg/L	8/13/2003	
Phosphorus, Ortho		0.208	mg/L	8/6/2003	
Phosphorus, Total		0.415	mg/L	8/11/2003	
Solids, Total Suspended		57	mg/L	8/11/2003	
Turbidity		29	NTU	8/7/2003	

Site: 3 Date: 08/05/2003 Time: 11:35 Matrix: Surface Water

Parameter:		Results:	Units:	Date Analyzed:	QC Comments.
Nitrogen, Ammonia		0 14	mg/L	8/15/2003	
Nitrogen, Nitrate + Nitrite		10	mg/L	8/15/2003	
Nitrogen, Total Kjeldahl		0.8	mg/L	8/13/2003	
Phosphorus, Ortho		0.035	mg/L	8/6/2003	
Phosphorus, Total		0.049	mg/L	8/11/2003	
Solids, Total Suspended		2	mg/L	8/11/2003	EL
Turbidity		1.5	NTU	8/7/2003	

Site: 5 Date: 08/05/2003 Time: 11:00 Matrix: Surface Water

Parameter:		Results.	Units:	Date Analyzed:	QC Comments:
Nitrogen, Ammonia		0.18	mg/L	8/15/2003	
Nitrogen, Nitrate + Nitrite	<	0.01	mg/L	8/15/2003	ND
Nitrogen, Total Kjeldahl		1.3	mg/L	8/13/2003	
Phosphorus, Ortho		0.002	mg/L	8/6/2003	
Phosphorus, Total		0.031	mg/L	8/11/2003	
Solids, Total Suspended		2	mg/L	8/11/2003	EL
Turbidity		2.0	NTU	8/7/2003	

Site: 6 Date: 08/05/2003 Time: 10:40 Matrix: Surface Water

Parameter:		Results:	Units:	Date Analyzed.	QC Comments:
Nitrogen, Ammonia		0.14	mg/L	8/15/2003	
Nitrogen, Nitrate + Nitrite	<	0.01	mg/L	8/15/2003	ND
Nitrogen, Total Kjeldahl		1.0	mg/L	8/13/2003	
Phosphorus, Ortho		0.001	mg/L	8/6/2003	EL
Phosphorus, Total		0.026	mg/L	8/11/2003	
Solids, Total Suspended		4	mg/L	8/11/2003	EL
Turbidity		2.9	NTU	8/7/2003	

Report Approved By:

ND = Not detected. Less than MDL.
EL = Estimate. Result between MDL and LOQ

MN Certification #027-137-152 WI Certification #999446800

8.2 Data Management. Handling of field and laboratory sheets and electronic data transfer

Name of Sheet Or Database	From Field to Lab	From Lab to Data	Data Entry/Validation	Final Resting Place
SCHP DO/temp profile sheet	Data does not go to lab	Field data is recorded in the field	SCHP technician/N-G Assn. clerk	SCHP database
Lab Sample Sheets (MPCA)	Not applicable	Not applicable	SCHP technician/N-G Assn. clerk	SCHP database/N-G Assn. database
ERA chain of custody sheets	Sampler to Northern States Supply to Speedy Delivery to ERA labs	ERA labs	SCHP technician/N-G Assn. clerk	SCHP database/N-G Assn. database
ERA electronic lab results	Not applicable	ERA labs	SCHP technician/N-G Assn. clerk	SCHP database/N-G Assn. database

8.3 Data Management. Meta-data.

*(Modified from PCA Volunteer Surface Water Monitoring Guide Appendix F) Place a check in the columns where the meta-data can be found. Leave the row blank if particular meta-data element is not used. **Note: We will check this again at the end of the season and note what the actual placement of these items are.*

PROJECT INFORMATION *Check Where Found:*

Meta-data element	In the Plan	On Field Sheet	On Lab Sheet	In Computer Program	Other:
Project ID	X	X			
Project name	X	X			
Project purpose	X				
Start date	X	X			
Planned duration	X				
Lead organization name	X				
Project manager (with contact info	X				
Other Contact (like MPCA rep, SWCD rep)	X				
Sampling personnel		X			
Sample medium		X			
Sample collection methods	X				
Equipment Used	X				
Field measurement methods	X				
Comments about data transfer, submission		X			
Project Study Area	X				
Design & sampling frequency	X				
Programs associated	X				
Cooperating Org.'	X				
QA plan summary/reference	X				

LABORATORY

Check Where Found:

Meta-data element	In the Plan	On Field Sheet	On Lab Sheet	In Computer Program	Other:
Lab ID			X		
Laboratory name (w/ address and contact info			X		
Citation for lab (Manual or Handbook).	X				
Parameter		X	X		
Sample fraction		X	X		
Reporting units			X		
Comparable standard method	X				
Field preservation method	X				
Detection limit	X				
Lab certified for parameter?	X				
Length of Analysis			X		
Temperature basis			X		

STATION INFORMATION

Check Where Found:

Meta-data element	In the Plan	On Field Sheet	On Lab Sheet	In Computer Program	Other:
Project station ID		X			
Related station		X			
Station name		X			
Station type	X				
Waterbody type (stream, lake, wetland)	X				
Station description	X				
Site ID		X			
Ecoregion name	X				
Travel directions	X				
Station latitude-longitude or UTM	X				
Geo-positioning method	X				
Datum	X				
Map scale	X				
Site lat-long	X				
State/county	X				
HUC code	X				
River Reach	X				
DNR Lake ID	X				
Habitat Type	X				

MONITORING RESULTS *Check Where Found*:

Meta-data element	In the Plan	On Field Sheet	On Lab Sheet	In Computer Program	Other:
Station and site ID		X	X		
Date		X	X		
Time		X	X		
Station ID		X	X		
Site ID		X	X		
Activity ID, type and category		X	X		
Medium		X	X		
Sample depth		X	X		
Sampling personnel		X	X		
Activity comments		X	X		
Sample collection method and equipment	X				
Sample preservation	X				
Lab ID	X				
Lab sample ID			X		
Lab certified?	X				
Results			X		
Field/lab ID	X				
Lab Sample Temperature			X		
Remark codes		X	X		

OTHER:

Meta-data element	In the Plan	On Field Sheet	On Lab Sheet	In Computer Program	Other:
Field notes		X			
Lab notes			X		
Analysis notes				X	

8.4 Data Management - Entering and validating data

Parameter	Reporting Units Entered (e.g. mg/l, taxa, etc.)	Source of Data (for external data)	Computer Application (s) Used for Data Entry	Who Will Enter Data	Validation Steps and Who
TP	mg/L or ppm as P		Microsoft Excel	SCHP technician and Norway-Games clerk	Same people check computer entries against lab and field sheets, look for suspicious lab data.
Chlorophyll a	mg/L or ppm		Same as above	Same as above	Same as above
OP	mg/L or ppm as P		Same as above	Same as above	Same as above
TSS	mg/L or ppm		Same as above	Same as above	Same as above
Turbidity	NTU		Same as above	Same as above	Same as above
NH_4	mg/L or ppm as NH_4-N		Same as above	Same as above	Same as above
TKN	mg/L or ppm as N		Same as above	Same as above	Same as above
NO_2-NO_3	mg/L or ppm as NO_3 -N		Same as above	Same as above	Same as above
Dissolved Oxygen	mg/L or ppm		Same as above	Same as above	Sampler validates in the field, SCHP technician and N-G clerk checks computer entries against field sheets and looks for suspicions data
Temperature	°C		Same as above	Same as above	Same as above
Secchi Disk Transparency	feet		Same as above	Same as above	Same as above

8.5 Data Management. Miscellaneous problem data.

Parameter	Data Entry Protocol for "Problem" Data
TP, chlorophyll a, OP, TSS, turbidity, NO_2-NO_3, TKN, NH_4	"Less than's" will be entered as the upper detection limit for analytical purposes, nonsensical data will be re-run by the laboratory if within the holding time
Dissolved oxygen, temperature	If there is nonsensical data, the instrument will be reset and recalibrated and the data re-measured
Secchi readings	If there is nonsensical data, the readings will be retaken immediately if possible

9.1 Data Analysis – Summarizing and Comparing Your Data to Benchmarks and Interpretation

Parameter	Data User(s)	Statistical Summaries To Be Used	Types of Graphs	Benchmark Used (Note Use Class if WQS Used)	How Data Will Be Compared with Benchmark	How Comparison Will Be Interpreted
TP, chlorophyll -a, Secchi	SCHP, DNR, N-G MPCA	TSI conversions, mean values Quartiles	Bar graphs showing means w/ Ecoregion values, etc.	Ecoregion values, 1994 TSI index	Quartiles, Trend analysis	The measured change in the TSI since 1994 will be interpreted in the context of a broader analysis of the Shakopee Creek Headwaters watershed, and possible sources of the change for or against the suspected trend will be presented along with our data. Use support status based on TSI.
OP, TSS, turbidity, NO_2-NO_3, TKN, NH_4	SCHP, DNR, N-G	Mean concentrations within certain flow regimes	Bar graphs showing past and present data	Past 1996-1998 data and other ditch sites in the watershed	Comparisons in concentrations between similar flows or storm events	Land use changes on the contributing upland acreages, climate, and other factors will be interpreted as potential sources of the change when comparing to benchmark
Dissolved O_2, Temp	SCHP, DNR, N-G	Min, max, mean values	DO/temp profile graphs	Dissolved oxygen criteria for lakes	Quartiles, trend analysis	Data must account for seasonality, storms, and other extraordinary variables before a trend may be suspected

9.2 Data Interpretation and Analysis

1) Decide how you will develop findings

How have Secchi transparencies along with total phosphorus and chlorophyll a concentrations changed since 1994 (LAP report)?

Are designated uses generally supported in the lake?

How do each of the four smaller lake basins compare to each other and to the system as a whole in terms of nutrient concentrations, transparency, and trophic status?

How have attitudes/behaviors toward septic system maintenance and repair changed since 1994 (LAP septic survey)?

How does land use change from well-drained row-crop agriculture to a new residential development (increased impervious surface but w/ good storm water plan) impact nutrient inputs during storm events? DNR Hydrology report for the Shakopee Creek Headwaters watershed, which included water quality–landuse data and connections, will be compared with current water quality data and landuse assessments currently underway. Monitoring the private ditches/tile on Games Lake that are currently facing development will allow for examination of the effectiveness of the storm water plan going into effect for the development.

2) Decide how you will develop conclusions

The lakes' trophic status will be characterized from the data. Differences in trophic status will allow us to make some conclusions about the overall improving or decreasing trends in water quality in the lake.

We will list use-support data for each site and possible explanations for the results in the context of trends appearing in the larger Shakopee Creek and Chippewa River watersheds.

We will hopefully be able to show whether or not a new local, residential development with a sound stormwater management plan contributes more or less nutrient rich runoff to the lake than the former well-drained row crop agriculture land use.

10.1 Reporting, Presenting, and Planning for Change

1) Who will be preparing the reports and presentations?

SCHP technician, Norway-Games Assn. volunteers

2) Who are the target audiences for reporting and presenting your information?

Lake association meeting attendees, lakeshore owners, state and federal environmental agencies, and community members within the watershed will all be targets of information dissemination.

3) What formats will be used to present the story?

Newsletters, oral/visual presentations, display booths.

4) What tools will be used to tell your story?

Photographs, maps, graphs, PowerPoint, storytelling.

5) What kind of report information do your data users need?

Data User/ Target Audience	Report Information Needed
Lake Association	Interpreted data (Is it better or worse?), recommendations
MPCA	STORET database submittals
SWCD	Trend analysis
SCHP	Raw data
County Zoning	Trend analysis

6) When/Where will the message be delivered?

Lake Association meetings and Lake Association newsletters in the spring and fall of the year. Shakopee Creek Headwaters Project Meetings (monthly), common conversation.

7) What would you expect to happen as a result of your report or presentation?

More people will begin to care about their lake, more volunteers will come forward for monitoring, more people will upgrade their septic systems, and more people will be aware of what goes into the lake.

12.1 - FEEDBACK AND EVALUATION

1) Follow-up:

Group/Audience	*How Follow-up will happen:*	*When follow-up will occur (and times/year)*
Volunteer Monitors	Send monitoring report, training session, lake association meeting	4 times/year (each follow-up will occur once/yr)
Data users	Send data, monitoring report, phone call	2 times/year

2) Evaluation

Evaluations Done Annually *(Program and/or Outcome Based Components)*	*Tools used for evaluation*
Quality of monitoring data	QA/QC plan
Cost of analysis	Budget
Equipment inspection	Internal check w/ equipment manual
Questions raised by data analysis – what other information do we need	Conversations with data users on monitoring data and information
Impact on BMP implementation	Coordination w/ SCHP programs

Evaluations Done Every 3 to 5 Years *(Program and/or Outcome Based Components*	*Tools used for evaluation*
Public perception evaluations	Lake association surveys, questionnaires, returned comments from lake association/watershed bulletins
Re-evaluation of impaired waters by MPCA	STORET submittals

3) Where can the results of my evaluation be accessed?

Annual Evaluation Report

Norway/Games Lake Improvement Association meetings, Lake association officers, Shakopee Creek Headwaters Project (SCHP) office

VOLUNTEER, NAMES, TASKS, TIMELINES

11.1 Task Identification and Timeline

Monitoring Goal or Assessment:

Dates covered by timeline: March 04 – March 05

Target Start Date	**Target End Date**	**Main Category** (Planning, Mgt,, Monitoring, Post-Monitoring)	**Task / Activity Description**	**Person(s) Responsible to Organize/ Evaluate**	**Other Resources** (human or financial) **to Carry-Out Task**	**Fill in Date** when done
March 1, '04	March 31 '04	Planning	Order sample bottles/cooler from lab – set up delivery	SCHP technician/N-G Assn. volunteers		
March 1, '04	March 31 '04	Management	Volunteer training on sample technique	SCHP technician	Boat, integrated sampler, sample bottles, cooler, ice	
April 1, '04	Sept 30, '04	Monitoring	Spring storm event sampling – tile/ditches (data entry)	Norway-Games Monitoring Volunteers	Boat, integrated sampler, sample bottles, cooler, ice	
April 1, '04	April 30, '04	Planning	Set up and print out survey questions	SCHP technician/N-G Assn. Volunteers		
May 1, '04	May 31, '04	Planning/Monitoring	Send out Septic Surveys (or hand deliver) and get them back by Memorial Day	Norway-Games Lake Assn. Volunteers		
June 1, '04	Sept 30, '04	Monitoring	In-lake TSI sampling and data entry	Norway-Games Lake Assn. Volunteers	Boat, integrated sampler, sample bottles, cooler, ice	
Sept 30, '04	March 30 '05	Post Monitoring	Data analysis, final report writing	SCHP technician		

11.2 Volunteer Monitors

NAME	NOTES	Address	Phone	Email
Ralph Howell		516 Julii St. SE Willmar, MN 56201	235-2599	None
Ron Dilley		6499 NW 193rd Ave Pennock, MN 56279	354-4266	None
Sally Packer		19112 Co Rd 5 NW New London, MN 56273	354-5499	norwaygameslakeassn@hotmail.com
Rob Spitzley		1005 High Ave NE Willmar, MN 56201	231-0008 x132	rob.spitzley@mn.usda.gov
Mark Weimerskirch		1155 150th Ave SE Kerkhoven, MN 56252	264-5167	NA

11.3 Committees and Data Users

Committee: Monitoring Water Plan Team

Name/Organization	Area of Expertise	Address	Phone	Email
Sally Packer		19112 Co Rd 5 NW New London, MN 56273	354-5499	norwaygameslakeassn@hotmail.com
Ron Dilley		6499 NW 193rd Ave Pennock, MN 56279	354-4266	None
Ralph Howell		516 Julii St. SE Willmar, MN 56201	235-2599	None
Mark Weimerskirch		1155 150th Ave SE Kerkhoven, MN 56252	264-5167	NA
Rob Spitzley		1005 High Ave NE Willmar, MN 56201	231-0008 x132	rob.spitzley@mn.usda.gov

Data Users

Name/Organization	Expected Data Use	Address	Phone	Email
Rob Spitzley SCHP	Condition/trend assessment w/ recommendations	1005 High Ave Willmar, MN 56201	320-231-0008 x132	rob.spitzley@mn.usda.gov
Skip Wright MN DNR Waters	Condition/trend assessment w/ recommendations	P.O. Box 457 Spicer, MN 56288	320-796-6272	skip.wright@dnr.state.mn.us
Bruce Gilbertson MN DNR Fisheries	Condition/trend assessment w/ recommendations	P.O. Box 457 Spicer, MN 56288	320-796-2161	bruce.gilbertson@dnr.state.mn.us
Wade Gillingham MPCA	305(b) assessment, Storet	1420 E College Dr. Ste 900, Marshall, MN 56258	(507) 537-7163	Wade.gillingham@pca.state.mn.us
Kandyohi County Water Task Force Committee	Land use ordinance recommendations	400 SW Benson Ave. Willmar, MN 56201	(320) 231-6288	Jeff_b@co.kandiyohi.mn.us

11.4 Over-all Budget

Norway/Games Lake Association Monitoring Plan Cost Projections

*4 sites x 1 sample/mo x 5 months/yr (May-Sept) x 2 year (2004)
**2 sites x 5 storm event samples

1. In-Lake Testing

Parameter/Item	Detection Limit	Cost (ERA labs, Duluth)	*Quantity	Total Cost
Total Phosphorus (TP)	0.001 mg/L	$ 10.00	40	$ 400.00
Chlorophyll a (lab filtered)	0.001 mg/L	$ 18.00	40	$ 720.00
Delivery charge per sample run		$ 9.00	10	$ 90.00
Equipment				
Integrated sampler		$ 30.00		$ 30.00
Secchi Disk		$ 30.00		$ 30.00
Cooler, Ice, etc.		$ 60.00		$ 60.00
QA/QC Samples (5% of samples)		$ 28.00	4	$ 112.00
Mileage		$0.375/mi	250	$ 93.75
			TOTAL IN-LAKE TESTING COST:	**$ 1,535.75**

2. Storm Event Sampling

Parameter/Item	Detection Limit	Cost (ERA labs, Duluth)	**Quantity	Total Cost
Total phosphorus	.001 mg/L	$ 10.00	10	$ 100.00
Ortho phosphorus	.001 mg/L	$ 8.00	10	$ 80.00
Total suspended solids	1 mg/L	$ 7.00	10	$ 70.00
turbidity	0.1 NTU	$ 7.00	10	$ 70.00
nitrate-nitrite nitrogen	0.01 mg/L	$ 8.00	10	$ 80.00
ammonia nitrogen	0.02 mg/L	$ 8.00	10	$ 80.00
total kjeldahl nitrogen	0.2 mg/L	$ 16.00	10	$ 160.00
Delivery charge per sample run		$ 9.00	5	$ 45.00
QA/QC samples (5% of samples)		$ 64.00	1	$ 64.00
Mileage		$0.375/mi	125	$ 46.88
			TOTAL STORM EVENT SAMPLING:	**$ 795.88**

3. Septic System Survey

Item	Price	Per	Quantity	Total Cost
Postage (2 mailings)	$ 0.37	piece of mail	1000	$ 370.00
Printing	$ 0.06	page	2000	$ 127.80
Paper	$ 4.99	500 sht ream	4	$ 21.26
Address labels	$ 8.99	750/box	2	$ 19.15
				$ -
			TOTAL SEPTIC SURVEY COSTS:	**$ 538.21**

4. Administration/Dissemination

Item	Price	Per	Quantity	Total Cost
Printing copies of monitoring plan	$ 0.06	page	1200	$ 76.68
0.5" Binders	$ 1.89	each	20	$ 40.26
Phone calls / meeting expenses				$ 13.22
			TOTAL ADMIN/DISSEMINATION COSTS:	**$ 130.16**

Program Elements

1. In-lake Testing	**$ 1,535.75**
2. Storm Event Sampling	**$ 795.88**
3. Septic System Survey	**$ 538.21**
4. Administration/Dissemination	**$ 130.16**
GRAND TOTAL	**$ 3,000.00**

Revenues:

Item	*Description*	*Budget*
RCM/MLA Grant		$ 3,000.00
TOTAL REVENUE		**$ 3,000.00**

Expenses:

Type of Expense	*(Unit price)*	*(Number of units)*	*Budget*
Total phosphorus	$10.00	30	**$ 500.00**
Chlorophyll a	$18.00	20	**$ 720.00**
Ortho-phosphorus	$ 8.00	10	**$ 80.00**
Total suspended solids	$ 7.00	10	**$ 70.00**
Turbidity	$ 7.00	10	**$ 70.00**
Nitrate-nitrite nitrogen	$ 8.00	10	**$ 80.00**
Ammonia nitrogen	$ 8.00	10	**$ 80.00**
Total Kjeldahl nitrogen	$16.00	10	**$ 160.00**
Delivery charge	$ 9.00	10	**$ 135.00**
Integrated sampler	~$30	1	**$ 30.00**
Secchi disk	~$30	1	**$ 30.00**
Cooler, ice, other	~$60	1	**$ 60.00**
Postage (2 mailings)	$ 0.37	1000	**$ 370.00**
Printing	$ 0.06	2000	**$ 127.80**
Paper	$ 4.99	4	**$ 21.26**
Address labels	$ 8.99	2	**$ 19.15**
Printing copies of plan	$ 0.06	1200	**$ 76.68**
0.5" binders	$ 1.89	20	**$ 40.26**
Phone calls/meeting expenses			**$ 13.22**
QA/QC Samples			**$ 176.00**
Mileage	$0.375	250	**$ 140.63**
TOTAL EXPENSES 2004			**$3,000.00**

BALANCE (revenue minus expense): ***$ 0.00***

In-Kind Contributions:

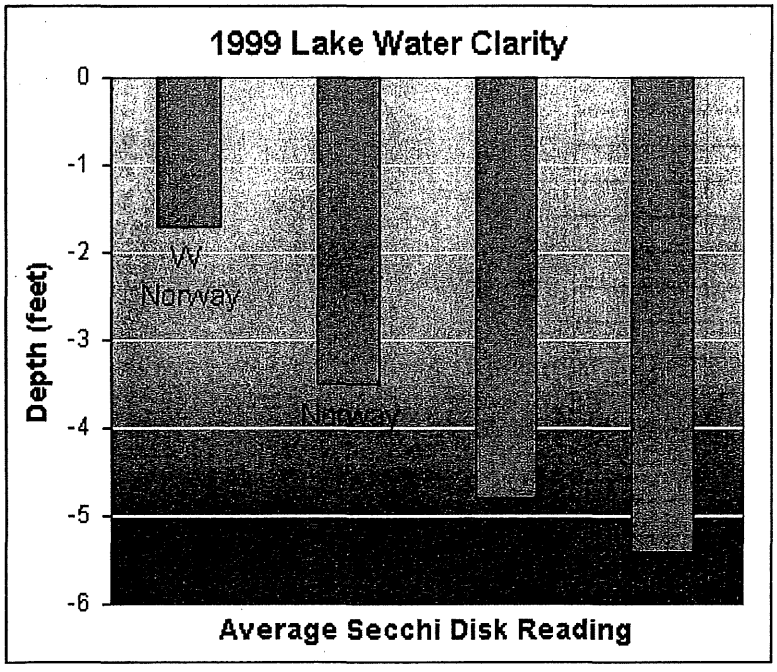
Item	*Description*	*Value*
Plan Development	Meeting participation, information recording & entry (74 hours x $30/hr)	$2220.00
Volunteer Time (monitoring)	Sampling (~5 hrs/run x 13 sample runs x $15/hr)	$ 975.00
Volunteer Time (septic survey)	Survey planning, delivery (~40 hrs x $15/hr)	$ 600.00
Use of YSI DO/Temp meter		$ 795.00
TOTAL IN-KIND VALUE		**$4,590.00**

ATTACHMENTS:

ACTUAL SECCHI DISK READINGS June-Sept				
	W NORWAY	NORWAY	L NORWAY	GAMES
	Site #202	Site #204	Site #203	Site #202
2001				
		20.00		
	5.50	16.00	9.50	
	4.50	12.00	5.00	
	3.50	9.00	4.50	
	3.00	8.00	3.50	
	1.50	4.00	3.00	
		3.50	3.50	
		3.00	2.50	
			2.50	
			3.00	
				N/A
Average	3.60	9.44	4.11	
2002				
			6.00	
	4.00	4.50	3.00	
	4.00	4.00	2.00	
	3.50	3.50	3.00	
	3.00	3.00	2.50	
	2.50	3.00	2.50	
	2.00	2.50	2.50	
	1.50	2.50		
		2.00		
				8.00
Average	2.93	3.13	3.07	
2003				
		7.50	9.00	
	4.50	7.00	8.00	
	7.50	4.00	6.50	
	6.00	4.00	3.00	
	4.00	4.00	3.00	
	3.00	4.00	3.00	
	3.00		2.50	
	3.50			
	2.50			
	2.50			
Average	4.06	5.08	5.00	

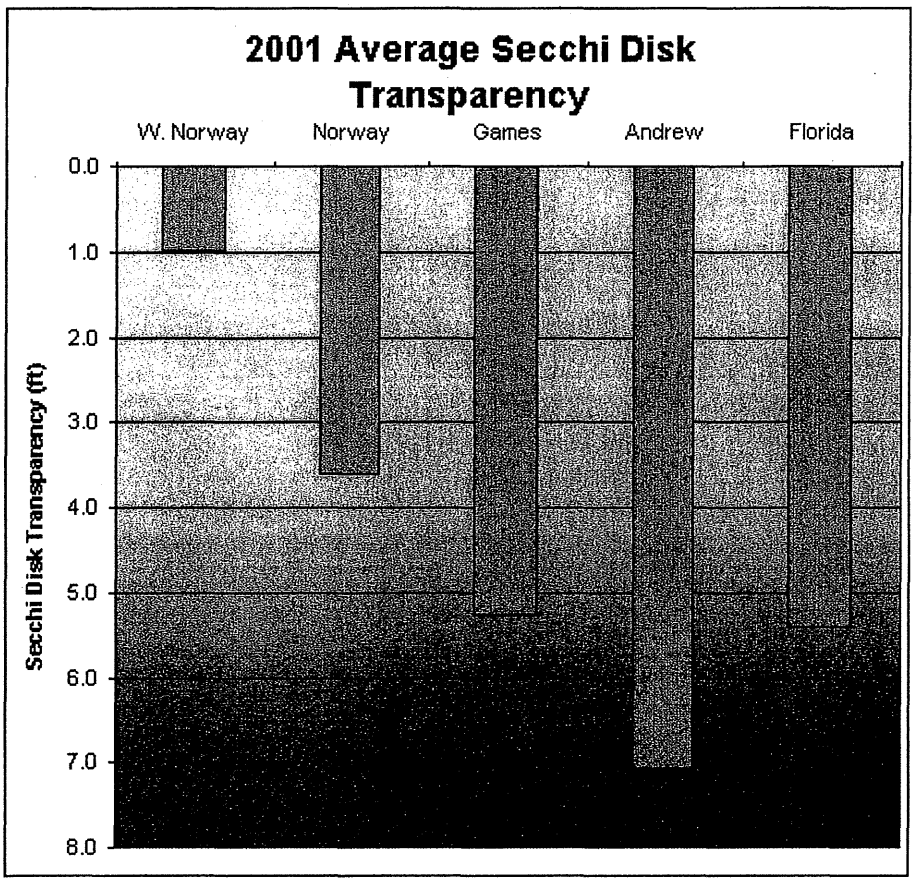
1999 Secchi Disk (feet)				
Date	W. Norway	Norway	Games	Andrew
6/16/1999	-2.5	-6.5	-6.5	-8
7/23/1999	-1.6	-2.6	-5.4	-5.4
7/26/1999	-2	-2.5	-6	-5
8/4/1999	-1.7	-3.2	-5.9	-5.9
8/9/1999	-1.3	-3.2	-3.6	-5.4
8/17/1999	-1.2	-3.5	-4.2	-5
8/25/1999	-1.4	-3	-3.3	-4.2
9/2/1999	-1.5	-3.2	-3.6	-4.5
	-1.7	-3.5	-4.8	-5.4

AVERAGES	
W. Norway	-1.7
Norway	-3.5
Games	-4.8
Andrew	-5.4



2001 Secchi Disk (ft)

	W. Norway	Norway	Games	Andrew	Florida
6/29	1.0	6.5	7.5	11.5	7.0
7/10	1.0	4.0	5.0	9.0	4.5
7/25	1.0	3.0	4.8	7.0	6.5
8/8	1.2	2.0	5.7	3.3	5.0
9/5	0.7	2.5	3.3	4.5	4.0
Average	1.0	3.6	5.3	7.1	5.4



NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION
19112 Co Rd 5 NW
New London, MN 56273

March 25, 2005

To:
Legislative Commission on Minnesota Resources
Minnesota Pollution Control Agency
Minnesota Lakes Association
Rivers Council of Minnesota

We very much appreciated receiving the grant to develop our Monitor Plan and the funds for implementation.

The workshops held to generate the plan were extremely helpful. They enabled us to gain insight as to what should be included in a monitor plan as well as an understanding of the components of a lake.

Our team worked very hard to design this plan and we feel the knowledge we acquired resulted in a beneficial plan that would be informative and highlight the direction our Lake Association will need to follow to educate our members and the data users of the plan.

The results of the testing shows us that work needs to be done to improve the quality of our lakes. The phosphorus levels are higher than we expected and the clarity has not improved over the years. Agriculture ditches that empty into the lakes and septic system education should be addressed.

Thank you on behalf of all our Lake Association members.

Monitor Team members,

Ralph Howell, Ron Dilley, Mark Weimerskirch, Sally Packer, Rob Spitzley

REQUEST FOR
IMPLEMENTATION FUNDING

Congratulations on finishing your monitoring plan. We hope to make this next phase as painless as possible. Please submit your funding request using the form below as soon as possible. The request may be for up to $3000.

A. **Name and contact information** (checks will be made out to your organization, - please note if the check should be sent with attention to another person, if different from the contact:)

Sally Packer

Norway/Games Lake Improvement Association

19112 Co. Rd. 5 NW

New London, MN 56273

B. Write a Brief Description of your citizen-monitoring project (You should be able to take this out of your Introduction Narrative in the monitoring plan – 1 paragraph maximum.)

In this monitoring plan for the Norway-Games lake system we will be doing three things. First, a trophic status index assessment will be done to compare the overall health of the lakes today versus what they were ten years ago. Second, storm water sampling will be done on private ditches entering the lake that are of concern. Third, a septic system survey will be done to assess the level of education of lakeshore owners and the maintenance performed on systems around the lakes compared to ten years ago. Through this monitoring plan we will seek to monitor changes in water quality in order to preserve the uniqueness and value of this irreplaceable natural resource. Pressed with the urgency of increased urban-like development on and near the shoreline, this monitoring effort is essential because it can provide guidance for land use planning and change that will be needed to limit the potentially severe negative impacts development can have on water quality, fishing, swimming, and other uses. We hope that through this plan we can together bring about our shared future vision of clear water, healthy riparian areas, thriving wetlands, and the protection of our natural areas so that future generations may be able to share in the enjoyment and beauty that this resource has brought to so many past generations.C. Total Amount requested (up to $3000): $3,000.00

D. Budget from Step 11: (Please attached the table of your budget, highlighting the budget items that will be covered by this grant, with estimates of what specific items will cost. If not specified in the budget, please listed what specific items will be funded by this grant) Please also attach your In-kind/ Other contributions.

11.4 Over-all Budget

Norway/Games Lake Association Monitoring Plan Cost Projections

*4 sites x 1 sample/mo x 5 months/yr (May-Sept) x 2 year (2004)
**2 sites x 5 storm event samples

1. In-Lake Testing

Parameter/Item	Detection Limit	Cost (ERA labs, Duluth)	*Quantity	Total Cost
Total Phosphorus (TP)	0.001 mg/L	$ 10.00	40	$ 400.00
Chlorophyll a (lab filtered)	0.001 mg/L	$ 18.00	40	$ 720.00
Delivery charge per sample run		$ 9.00	10	$ 90.00
Equipment				
Integrated sampler		$ 30.00		$ 30.00
Secchi Disk		$ 30.00		$ 30.00
Cooler, Ice, etc.		$ 60.00		$ 60.00
QA/QC Samples (5% of samples)		$ 28.00	4	$ 112.00
Mileage		$0.375/mi	250	$ 93.75
			TOTAL IN-LAKE TESTING COST:	**$1,535.75**

2. Storm Event Sampling

Parameter/Item	Detection Limit	Cost (ERA labs, Duluth)	*Quantity	Total Cost
Total phosphorus	.001 mg/L	$ 10.00	10	$ 100.00
Ortho phosphorus	.001 mg/L	$ 8.00	10	$ 80.00
Total suspended solids	1 mg/L	$ 7.00	10	$ 70.00
Turbidity	0.1 NTU	$ 7.00	10	$ 70.00
Nitrate-nitrite nitrogen	0.01 mg/L	$ 8.00	10	$ 80.00
Ammonia nitrogen	0.02 mg/L	$ 8.00	10	$ 80.00
Total kjeldahl nitrogen	0.2 mg/L	$ 16.00	10	$ 160.00
Delivery charge per sample run		$ 9.00	5	$ 45.00
QA/QC samples (5% of samples)		$ 64.00	1	$ 64.00
Mileage		$0.375/mi	125	$ 46.88
			TOTAL STORM EVENT SAMPLING:	**$ 795.88**

3. Septic System Survey

Item	Price	Per	*Quantity	Total Cost
Postage (2 mailings)	$ 0.37	piece of mail	1000	$ 370.00
Printing	$ 0.06	page	2000	$ 127.80
Paper	$ 4.99	500 sht ream	4	$ 21.26
Address labels	$ 8.99	750/box	2	$ 19.15
			TOTAL SEPTIC SURVEY COSTS:	**$ 538.21**

4. Administration / Dissemination

Item	Price	Per	*Quantity	Total Cost
Printing copies of monitoring plan	$ 0.06	page	1200	$ 76.68
0.5" Binders	$ 1.89	each	20	$ 40.26
Phone calls / meeting expenses				$ 13.22
			TOTAL ADMINISTRATION/DISSEMINATION:	**$ 130.16**

Program Elements

1. In-lake Testing	**$ 1,535.75**
2. Storm Event Sampling	**$ 795.88**
3. Septic System Survey	**$ 538.21**
4. Administration/Dissemination	**$ 130.16**
GRAND TOTAL:	**$ 3,000.00**

In-Kind Contributions:

Item	*Description*	*Value*
Plan Development	Meeting participation, information recording & entry (74 hours x $30/hr)	$2220.00
Volunteer Time	Sampling (~5 hrs/run x 13 sample runs x $15/hr)	$ 975.00
	Survey planning, delivery (~40 hrs x $15/hr)	$ 600.00
Use of YSI DO/Temp meter		$ 795.00
TOTAL IN-KIND VALUE		**$4,590.00**

SUMMARY of 2004 MONITOR PLAN

The 2004 data shows a positive trend in the health of the lakes. While W Norway and Norway have slightly elevated levels of phosphorus since the 1994 study, the Shakopee Creek Watershed Project has implemented many projects in the watershed and should eventually show improvement. The most disturbing data comes from the samples collected from the agriculture ditch (#NOR-SE) that enters Norway Lake at the East End of 189th Av NW (#NOR-PAI). High levels of Ortho Phosphorus were noted. This ditch, as well as the ditch at the West End of 189th Av, should be monitored in 2005. Kandiyohi County ditches # 27 and #29 are still a concern and efforts to encourage buffer strips and BMP should be on going. The improvement in Games Lake overall data shows the benefit of the natural filtering system through the lake basins.

Secchi transparencies show a positive trend in the past ten years for Games Lake. The citizen volunteers who monitor 5 sites on the lakes throughout the summer are to be commended for their efforts. These readings are a valuable tool in assessing the lake clarity and should be continued.

The Septic survey had a disappointing return of 31%. While 8 property owners reported new systems installed there were still 7 systems over 31 years old. 10% of the returned forms didn't know how old their systems are. It was encouraging to note that the frequency of times pumped increased over the 1994 study. (23 Lake property owners actually replaced failing systems under a loan program from SCWP)

Four shoreland restoration sites were implemented in 2003 and 2004 through a Shakopee Creek Watershed program. Increased awareness needs to be instilled in the property owners to protect the lakes from runoff. The State of Minnesota has signed into law, effective January 1, 2005; the 0 phosphorous content for lawn fertilizer and this should help.

New lakeshore and near lakeshore housing developments have been platted in the past two years. Continued monitoring will determine if these will have an impact on the lake quality.

Lake properties in 2004 were 463, 126 year round and 337 seasonal. Total 2004 membership in the Norway/Games Lake Improvement Association was 304 plus 3 supporting members, 3 resorts & Kandiyohi Co Park 7.

Thanks to Rob Spitzley, SCWP Coordinator, for his guidance, expertise, and team training and to Skip Wright, Minnesota DNR, Paul Wymer, Chippewa River Watershed and Lucas Youngsma, Shakopee Creek Watershed Project for their help with the 2004 data analysis.

COMPARISON WITH 1994 LAKE ASSESSMENT PROGRAM

Norway and Games Lakes were sampled during the summer of 1994 by the Minnesota Pollution Control Agency staff and citizens from the Norway Lake Association.

The 2004 Monitor Plan was developed under a grant from The Legislative Commission on Minnesota Resources from the Minnesota Environmental and Natural Resources Trust Fund, administered through the Minnesota Pollution Control Agency, Minnesota Lakes Association and Minnesota Rivers Council.

Data was collected May through September 2004. Monitor Team members were Elden Bartz, Mike Jensen, Ralph Howell, Mike Meyer, Marv & Sally Packer, Rob Spitzley. Data entry was done by Joan Mallory.

	1994	*2004*	*1994*	*2004*
	Norway		**Games**	
phosphorus (TP)	48		34	30
chlorophyll a	23		15	4.2
Secchi transparency	4.9 ft		5.6 ft	6.7 ft
		W Norway		
phosphorus (TP)		56.8		
chlorophyll a		15		
Secchi transparency		2.3 ft		
		Norway		
phosphorus (TP)		53.8		
chlorophyll a		10.4		
Secchi transparency		3.9 ft		
		L Norway		
phosphorus (TP)		41.4		
chlorophyll a		9.4		
Secchi transparency		3.6 ft		
note-in 1994 there was no distinction between the 3 Norway Lake basins.				

* Note detailed 2004 data analysis on following pages

Norway Lake Average Summer Water Quality and Trophic Status Indicators.
Based on 1994 and 2004 epilimnetic data.

Parameter	1994 Mean	2004 Mean	Typical Range[1] for Ecoregion
Total Phosphorus (ug/l)	47.8	53.8	23 - 50
Chlorophyll (ug/l)	23	10.4	5 - 22
Chlorophyll (ug/l) maximum	47	25	7 - 37
Secchi Disk[2] (feet)	3.6	3.9	4.9 - 10.5
Total Kjeldahl Nitrogen (mg/l)	1.25	ND	<0.6 - 1.2
Nitrite + Nitrate-N (mg/l)	0.06	ND	<0.01
Alkalinity (mg/l)	183	ND	75 - 150
Color (Pt-Co Units)	20	ND	10 - 20
pH (SU)	8.4	ND	8.6 - 8.8
Chloride (mg/l)	11	ND	4 - 10
Total Suspended Solids (mg/l)	6.6	ND	2 - 6
Turbidity (NTU)	3.5	ND	1 - 2
Conductivity (umhos/cm)	375	ND	300 - 400
TN:TP ratio	32	ND	25:1 - 35:1

Trophic Status Indicators:

Carlson Trophic State Index Values			Percentiles [3]	
	1994	2004	1994	2004
TP TSIP =	59	62	~45	~53
Chl a TSIC =	60	54	~50	~26
Secchi TSIS =	57	58	~90	~92
Mean TSI =	57	58	68	~ND

[1]25-75th percentile for representative-minimally impacted lakes in the North Central Hardwood Forests ecoregion (Heiskary and Wilson, 1990)
[2]Includes CLMP measurements
[3]Relative to approximately 530 assessed lakes in NCHF ecoregion. One hundred percent level implies lowest TP and chlororphyll concentration or deepest Secchi disk measurement for that ecoregion.

Little Norway Lake Average Summer Water Quality and Trophic Status Indicators.
Based on 2004 epilimnetic data.

Parameter	2004 Mean	Typical Range[1] for Ecoregion
Total Phosphorus (ug/l)	41.4	23 - 50
Chlorophyll (ug/l)	9.4	5 - 22
Chlorophyll (ug/l) maximum	18	7 - 37
Secchi Disk[2] (feet)	3.6	4.9 - 10.5

Trophic Status Indicators:

Carlson Trophic State Index Values	2004	Percentiles [3] 2004
TP TSIP =	62	~52
Chl a TSIC =	57	~37
Secchi TSIS =	65	~20
Mean TSI =	62 (Eutrophic)	

West Norway Lake Average Summer Water Quality and Trophic Status Indicators.
Based on 2004 epilimnetic data.

Parameter	2004 Mean	Typical Range[1] for Ecoregion
Total Phosphorus (ug/l)	56.8	23 - 50
Chlorophyll (ug/l)	15	5 - 22
Chlorophyll (ug/l) maximum	32	7 - 37
Secchi Disk[2] (feet)	2.3	4.9 - 10.5

Trophic Status Indicators:

Carlson Trophic State Index Values	2004	Percentiles [3] 2004
TP TSIP =	58	~40
Chl a TSIC =	53	~52
Secchi TSIS =	59	~25
Mean TSI =	56 (Eutrophic)	

[1]25-75th percentile for representative-minimally impacted lakes in the North Central Hardwood Forests ecoregion (Heiskary and Wilson, 1990)
[2]Includes CLMP measurements
[3]Relative to approximately 530 assessed lakes in NCHF ecoregion. One hundred percent level implies lowest TP and chlororphyll concentration or deepest Secchi disk measurement for that ecoregion.

Games Lake Average Summer Water Quality and Trophic Status Indicators.
Based on 1994 and 2004 epilimnetic data.

Parameter	1994 Mean	2004 Mean	Typical Range[1] for Ecoregion
Total Phosphorus (ug/l)	33.5	30	23 - 50
Chlorophyll (ug/l)	15	4.2	5 - 22
Chlorophyll (ug/l) maximum	24	9	7 - 37
Secchi Disk[2] (feet)	4.4	6.7	4.9 - 10.5
Total Kjeldahl Nitrogen (mg/l)	1.3	ND	<0.6 - 1.2
Nitrite + Nitrate-N (mg/l)	0.08	ND	<0.01
Alkalinity (mg/l)	183	ND	75 - 150
Color (Pt-Co Units)	15	ND	10 - 20
pH (SU)	8.5	ND	8.6 - 8.8
Chloride (mg/l)	11	ND	4 - 10
Total Suspended Solids (mg/l)	6	ND	2 - 6
Turbidity (NTU)	2.4	ND	1 - 2
Conductivity (umhos/cm)	375	ND	300 - 400
TN:TP ratio	49	ND	25:1 - 35:1

Trophic Status Indicators:

Carlson Trophic State Index Values			Percentiles[3]	
	1994	2004	1994	2004
TP TSIP =	54	53	~30	~26
Chl a TSIC =	56	45	~36	~11
Secchi TSIS =	53	50	~37	~61
Mean TSI =	54	49	46	~ND

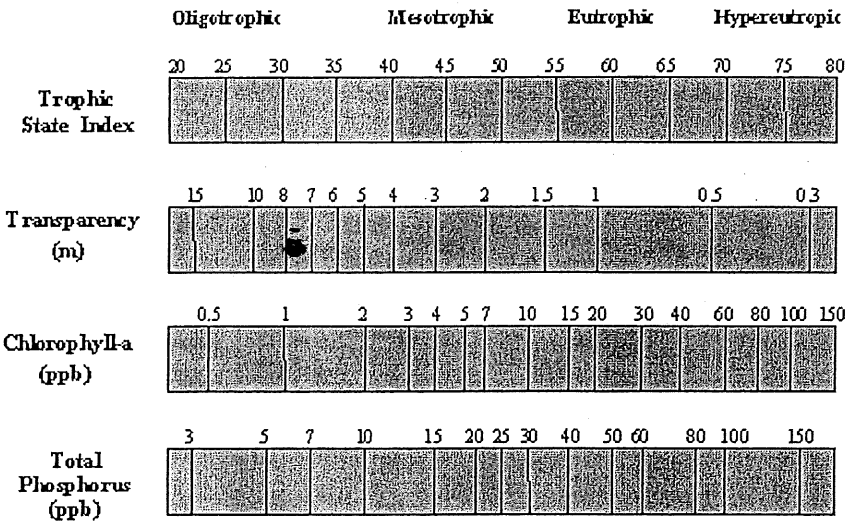
[1]25-75th percentile for representative-minimally impacted lakes in the North Central Hardwood Forests ecoregion (Heiskary and Wilson, 1990)
[2]Includes CLMP measurements
[3]Relative to approximately 530 assessed lakes in NCHF ecoregion. One hundred percent level implies lowest TP and chlororphyll concentration or deepest Secchi disk measurement for that ecoregion.

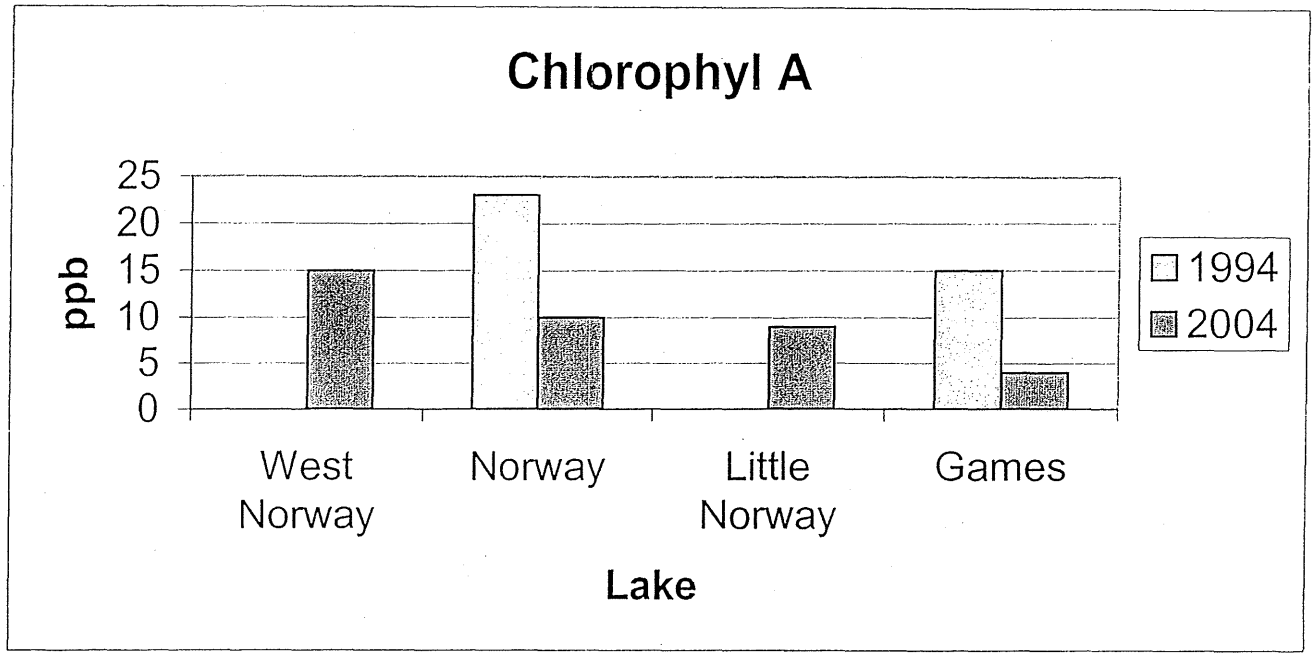
Trophic Status Indicators:

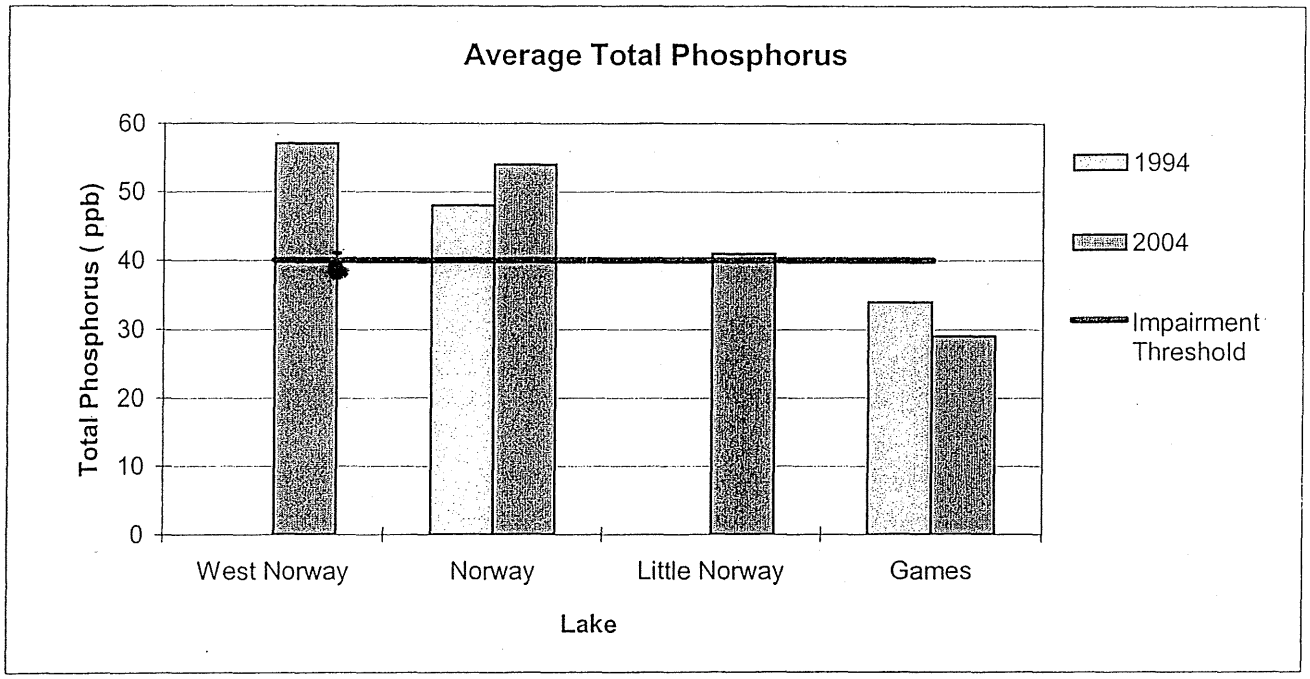
Carlson Trophic State Index Values

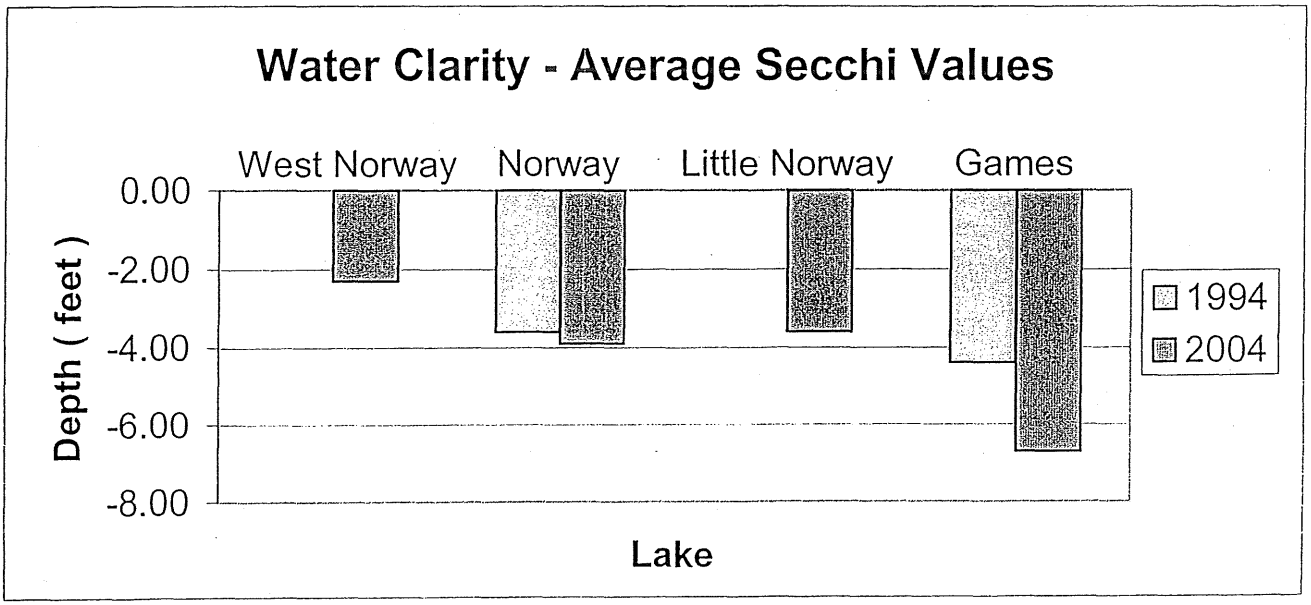
Lake	1994	Trophic Status	2004	Trophic Status
Games Lake Mean TSI =	54	Mesotrophic, almost Eutrophic	49	Mesotrophic
Norway Mean TSI =	57	Eutrophic	58	Eutrophic

Carlson Trophic State Index




Chlorophyl A
ppb
25
20
15
10
5
0
West Norway
Norway
Little Norway
Games
Lake
1994
2004


Average Total Phosphorus
Total Phosphorus (ppb)
60
50
40
30
20
10
0
West Norway
Norway
Little Norway
Games
Lake
1994
2004
Impairment Threshold


Water Clarity - Average Secchi Values
West Norway
Norway
Little Norway
Games
Depth (feet)
0.00
-2.00
-4.00
-6.00
-8.00
Lake
1994
2004

Agriculture Ditch #NOR-SE - Storm Event Data

Date	Sample	TP	OP	TSS	Turbidity	NH 4	NO2-NO3	Total	Conditions
2004	Method	(mg/L)	(mg/L)	(mg/L)	(ntu)	nitrogen	nitrogen	Kjeldahl N	
6/2	Grab	0.105	0.085	2	0.9	<.02	5.5	0.9	
6/9	Grab	0.28	0.019	32	30	0.04	4	1.2	
9/6	Grab	0.432	0.39	3	3.5	0.04	1.4	1.4	2"rain Sun nite-samples collected Mon
11/1	Grab	0.153	0.133	<1	<0.2	<.02	5.8	0.8	4"rain Thurs-samples collected Mon
	This is the first year of monitoring for this site. Continued data collection and buffer strips								
	is encouraged								

2004 MONITOR PLAN - SEPTIC SURVEY

1994 - 2004 comparison

	forms sent	forms returned		
1994	417	92	22%	both surveys had a very poor return rate.
2004	454	139	31%	2004 survey included Norway & Games Lks

	1994	2004
Type of System		
Tank w/drainfield	83%	71%
Tank w/drywell	4%	4%
Privy/Cesspool	5%	3%
Holding tank	5%	6%
Mound	1%	8%
don't know	1%	8%
Age of System		
1-10 yrs	42%	53%
11-20 yrs	32%	20%
21 & older	9%	17%
don't know	17%	10%
How often pumped		
1-2 yrs	10%	27%
2-5 yrs	35%	32%
5-7 yrs		15%
8+ yrs	55%	15%
when needed		9%
never		1%

Any other source of solid waste

(bunkhouse,travel trailer,outhouse,etc)

	2004
yes	12
no	127

Use septic system

	2004
yes	6
no	133

8 new systems reported installed in 2004

7 of these systems were over 31 yrs old

Minnesota Extention Service recommends pumping every 1-3 years for year round use and every five years for seasonal use. Efforts should be increased to encourage older systems to be brought up to date and education continued for proper maintenance

SEPTIC SYSTEM SURVEY RESULTS

LAKE: W Norway, Norway, L Norway, Games — **DATE COMPLETED: 9/4/04**

Kandiyohi County

PARTICIPATION:

Numbers of survey forms sent	454		
Surveys returned	139	31	%

Type of system

A	tank w/drainfield	99	71%
B	cesspool	3	2%
C	tank w/drywell	5	4%
D	privy	2	<1%
E	direct to lake	0	0
F	direct to land or ditch	0	0
G	holding tank	8	6%
H	other		
	mound	11	8%
don't know		11	8%

Any other source of solid waste

Yes	12	
No	127	

Use septic ststem

Yes	6	
No	133	

Age of system

0-3	30	22%	
4-8	32	24%	
9-15	27	21%	
15+	36	27%	
don't know	14	10%	

Distance from system to lake

0-100'	49	
101-150'	53	
151-200'	18	
201-250'	10	
252-300'	4	
over 300'	2	
don't know	3	

Type of dwelling

Seasonal	72	52%	
Year round	53	38%	
Yr round, not primary	14	10%	

Describe problems you have

had with your system - none stated

of bedrooms

1	14		
2	57		
3	59		
more than 3	9		

How often maintained (tank pumped)

1-2 yrs	38	27%	
3 yrs	25	18%	
3-5 yrs	19	14%	
5-7 yrs	21	15%	
8+ yrs	21	15%	
when needed	13	9%	
never	2	<1%	

Pollution concerns/questions

non conforming systems - 7 run off from farm tiles entering the lake - 6

cattle in lake - 2 lawn fertilizer - 3 Eurasian Water Milfoil - 2

buffers needed, more than 1 home on a system, extra trailers on 1 lot, all systems should be inspected,

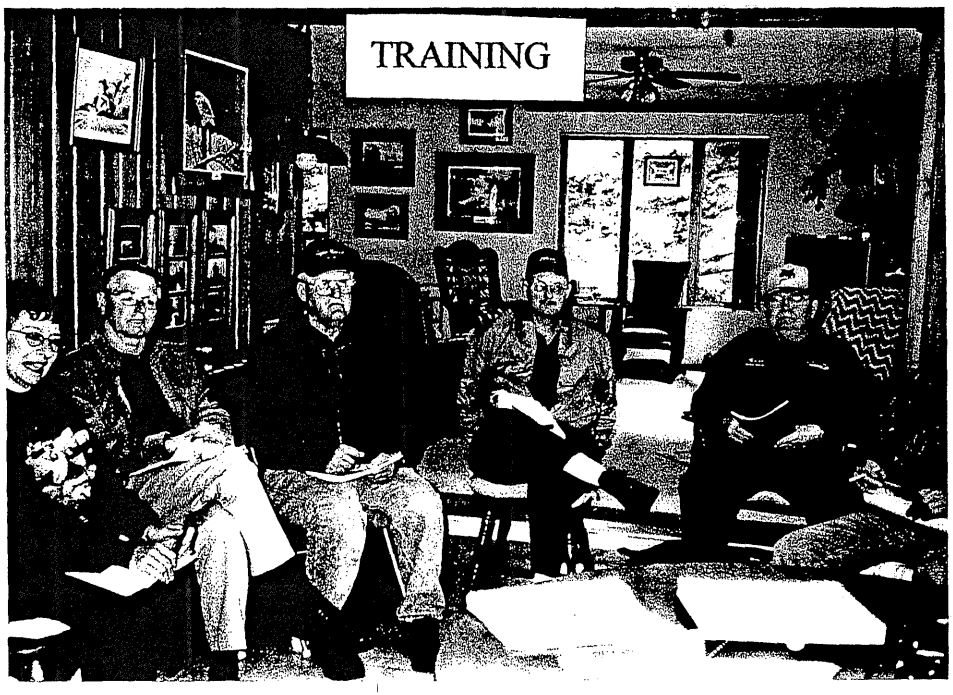
garbage burning, oversized dwelling, algae, worm spray, dogs, garbage on ice

*

Ralph Howell, Mike Meyer

Rob Spitzley, Sally Packer

MONITOR PLAN in action



WATER SAMPLE TEAM

Eldon Bartz, Mike Jensen

NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION

2005 Monitor Plan Data Summary

Lakes:

The overall results show the lakes have retained a stable level in the sampling conducted over the summer of 2005. W. Norway and Norway show a slightly elevated Total Phosphorus and Chlorophyll a. While this is of a concern, the equal/decline of the T/P and CHLa levels in L. Norway and Games compared to 2004 is encouraging. The clarity (Secchi) of all 4 lakes improved, with Games Lake gaining 2.68' over 2004.

Ditches:

The two agriculture ditches sampled reveled high levels of all components tested after rain events. T tube readings were also less favorable after rains. Low rainfall in the spring resulted in less run off from fields which was a great benefit.

The Monitor Team recommends:

- Continued sampling of the ditches and lakes with two sites added to the Secchi testing.
- Educate and encourage property owners on proper maintenance of septic systems and promote inspection of older systems.
- Inform property owners of the harm done by throwing leaves & grass clippings in the lakes and by the use of fertilizer containing phosphorus. (a lake set back in fertilizing should be practiced)
- Continued support of the programs and efforts of the Norway/Games Lake Improvement Assn and of the Shakopee Creek Watershed Project.

Team members, 2005:
Elden Bartz, Jerry Welter, Ralph Howell, Mike Meyer, Sally & Marv Packer
Lucas Youngsma, SCWP coordinator

NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION MONITOR PLAN 2004 - 2005

Lake	***W Norway***											
Lake ID	34-251											
Site	WN202											
Date	5/27/04	6/29/04	7/27/04	8/30/04	9/28/04		5/31/05	7/20/05	8/15/05	9/18/05		*Mean 04/05*
						MEAN-2004					**MEAN-2005**	
T/P(mg/L)	0.050	0.079	0.039	0.053	0.063	**0.057**	0.051	0.059	0.049	0.053	**0.053**	***0.055***
CHL-a(ug/L)	19	20	32	3	1	**15**	19	33	8	13	**18**	***17***
PHEO(ug/L)	<1	<1	<1	<1	<1	**0**	<1	<1	<1	<1	**0**	***0***
SECCHI(ft)	(2.50)	(2.00)	(2.00)	(2.50)	(2.50)	**(2.30)**	(3.50)	(2.00)	(2.50)	(2.50)	**(2.63)**	***(2.46)***
Appearance *	6	5-6	4	5-6	7-6		4	6	6	6		
Rec Suitability *	3	3	3	4	3		3	3	3	3		

			*Appearance			*Rec Suitability						
			1-Clear	5-Muddy		1-Beautiful	4-Reduced					
			2-Cloudy	6-Green		2-Minor	5-Impossible					
			3-Foamy	7-Scumy		3-Impaired						
			4-Tea color									

NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION MONITOR PLAN 2004 - 2005

Lake	***Norway***											
Lake ID	34-251											
Site	N204											
Date	5/27/04	6/29/04	7/27/04	8/30/04	9/28/04		5/31/05	7/20/05	8/15/05	9/18/05		***Mean 04/05***
						MEAN-2004					**MEAN-2005**	
T/P(mg/L)	0.059	0.063	0.027	0.045	0.075	**0.054**	0.059	0.054	0.044	0.070	**0.057**	***0.055***
CHL-a(ug/L)	12	25	12	2	<1	**10**	3	20	8	15	**12**	***11***
PHEO(ug/L)	<1	<1	<1	<1	4	**1**	<1	<1	<1	<1	**0**	***0***
SECCHI(ft)	(4.00)	(3.50)	(3.00)	(5.00)	(4.00)	**(3.90)**	(12.50)	(4.00)	(3.50)	(4.00)	**(6.00)**	***(4.95)***
Appearance	6	6-5	4	5-6	6		1	6	6	6		
Rec Suitability	3	3	3	3	3		1	2	3	4		

				*Appearance			*Rec Suitability					
				1-Clear	5-Muddy		1-Beautiful	4-Reduced				
				2-Cloudy	6-Green		2-Minor	5-Impossible				
				3-Foamy	7-Scumy		3-Impaired					
				4-Tea color								

NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION MONITOR PLAN 2004 - 2005

Lake	L Norway											
Lake ID	34-251											
Site	LN203											
Date	5/27/04	6/29/04	7/27/04	8/30/04	9/28/04		5/31/05	7/20/05	8/15/05	9/18/05		Mean 04/05
						MEAN-2004					MEAN-2005	
T/P(mg/L)	0.043	0.044	0.041	0.039	0.04	0.041	0.035	0.041	0.045	0.044	0.041	0.041
CHL-a(ug/L)	14	18	13	1	<1	9	4	17	8	16	11	10
PHEO(ug/L)	<1	<1	<1	<1	<1	0	<1	<1	<1	<1	0	0
SECCHI(ft)	(5.50)	(3.00)	(3.00)	(3.00)	(3.50)	(3.60)	(8.50)	(3.92)	(3.00)	(3.00)	(4.61)	(4.10)
Appearance	4	3-4	4	5-6	6		6	6	5	6		
Rec Suitability	3	3	3	3	3		2	2	2	3		

				*Appearance			*Rec Suitability					
				1-Clear	5-Muddy		1-Beautiful	4-Reduced				
				2-Cloudy	6-Green		2-Minor	5-Impossible				
				3-Foamy	7-Scumy		3-Impaired					
				4-Tea color								

Comparisons between lakes:

T/P	2004	2005	MEAN
(mg/L)			
W Norway	0.057	0.053	0.055
Norway	0.054	0.057	0.055
L Norway	0.041	0.041	0.041
Games	0.030	0.029	0.030

CHL-a	2004	2005	MEAN
(ug/L)			
W Norway	15	18	17
Norway	10	12	11
L Norway	9	11	10
Games	4	7	5

PHEO	2004	2005	MEAN
(ug/L)			
W Norway	0	0	0
Norway	0	0	0
L Norway	0	0	0
Games	0	0	0

SECCHI	2004	2005	MEAN
(ft)			
W Norway	(2.30)	(2.63)	(2.47)
Norway	(3.90)	(6.00)	(4.95)
L Norway	(3.60)	(4.61)	(4.10)
Games	(6.70)	(9.38)	(8.04)

NORWAY / GAMES LAKE IMPROVEMENT ASSOCIATION MONITOR PLAN 2004 - 2005

Lake	***Games***											
Lake ID	34-224											
Site	G201											
Date	5/27/04	6/29/04	7/27/04	8/30/04	9/28/04		5/31/05	7/20/05	8/15/05	9/18/05		*Mean 04/05*
						MEAN-2004					**MEAN-2005**	
T/P(mg/L)	0.025	0.031	0.023	0.032	0.039	**0.030**	0.03	0.023	0.031	0.032	**0.029**	***0.030***
CHL-a(ug/L)	4	9	5	2	<1	**4**	3	7	6	10	**7**	***5***
PHEO(ug/L)	<1	<1	<1	<1	<1	**0**	<1	<1	<1	<1	**0**	***0***
SECCHI(ft)	(9.50)	(6.00)	(6.00)	(6.00)	(6.00)	**(6.70)**	(17.50)	(8.00)	(6.00)	(6.00)	**(9.38)**	***(8.04)***
Appearance	4	4	2	6-5	6		1	1	1	6		
Rec Suitability	2	2-3	2	3	3		1	1	2	3		

				*Appearance			*Rec Suitability						
				1-Clear	5-Muddy		1-Beautiful	4-Reduced					
				2-Cloudy	6-Green		2-Minor	5-Impossible					
				3-Foamy	7-Scumy		3-Impaired						
				4-Tea color									

Comparisons between lakes:

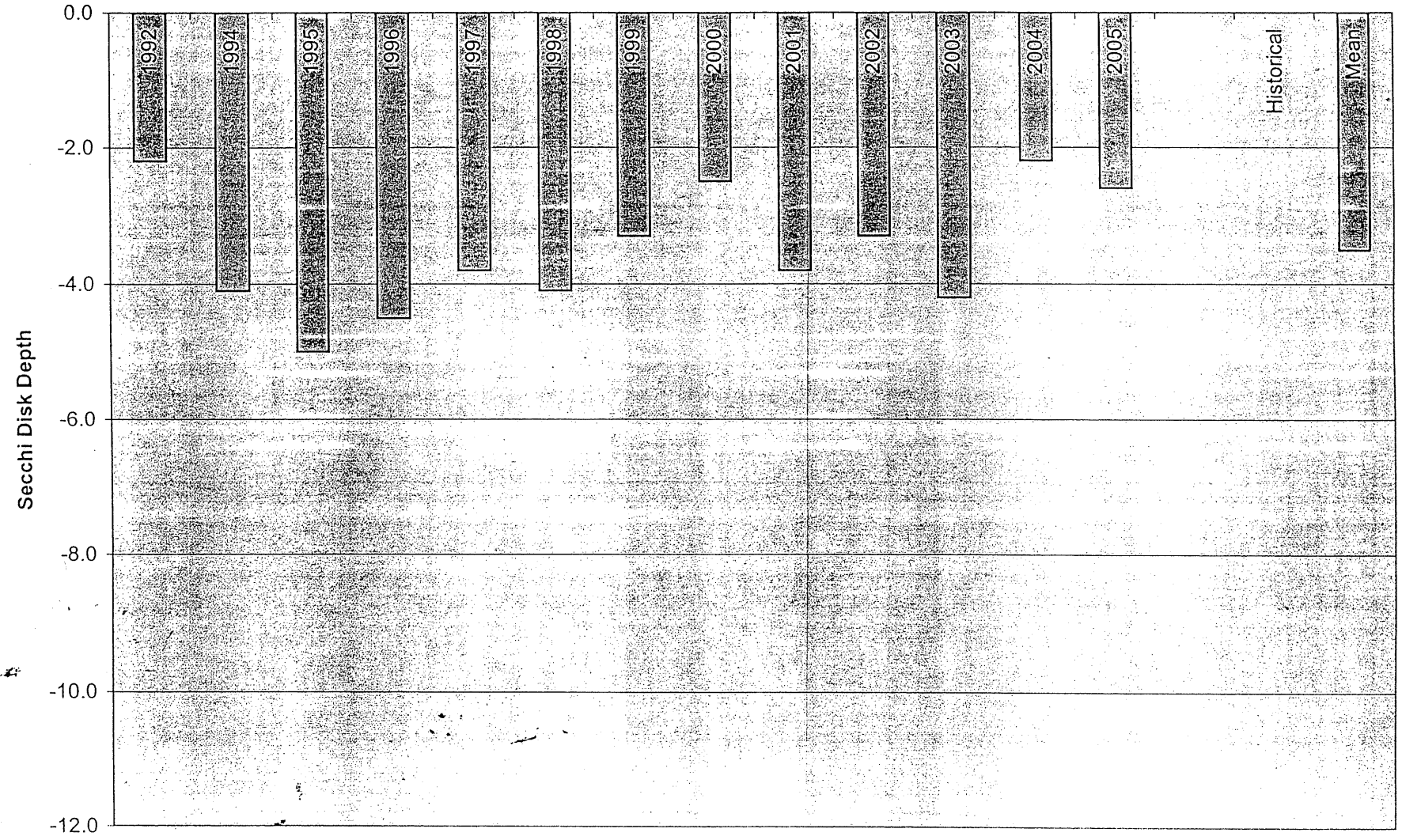
T/P	2004	2005	MEAN
(mg/L)			
W Norway	0.057	0.053	0.055
Norway	0.054	0.057	0.055
L Norway	0.041	0.041	0.041
Games	0.030	0.029	0.030

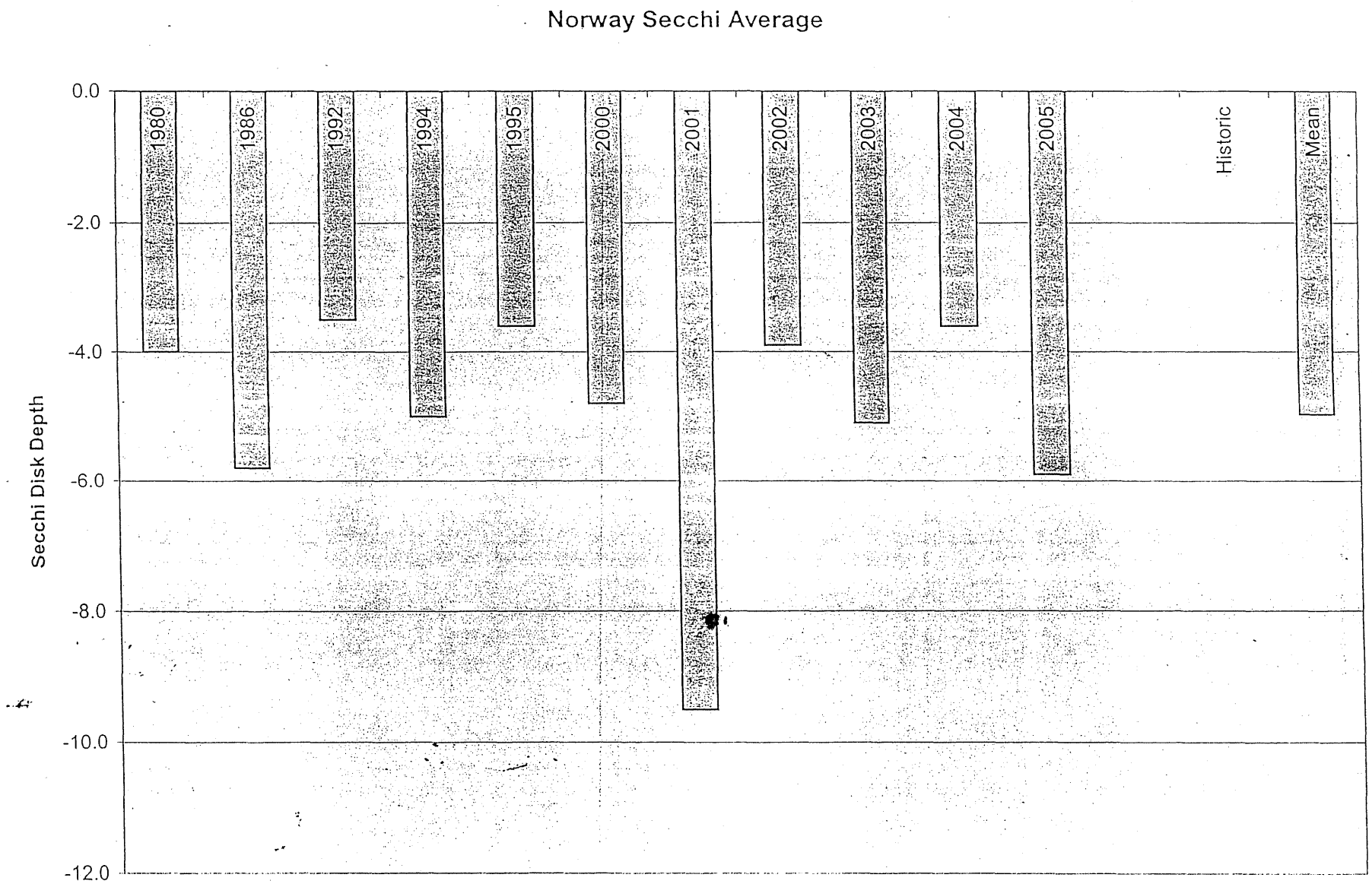
CHL-a	2004	2005	MEAN
(ug/L)			
W Norway	15	18	17
Norway	10	12	11
L Norway	9	11	10
Games	4	7	5

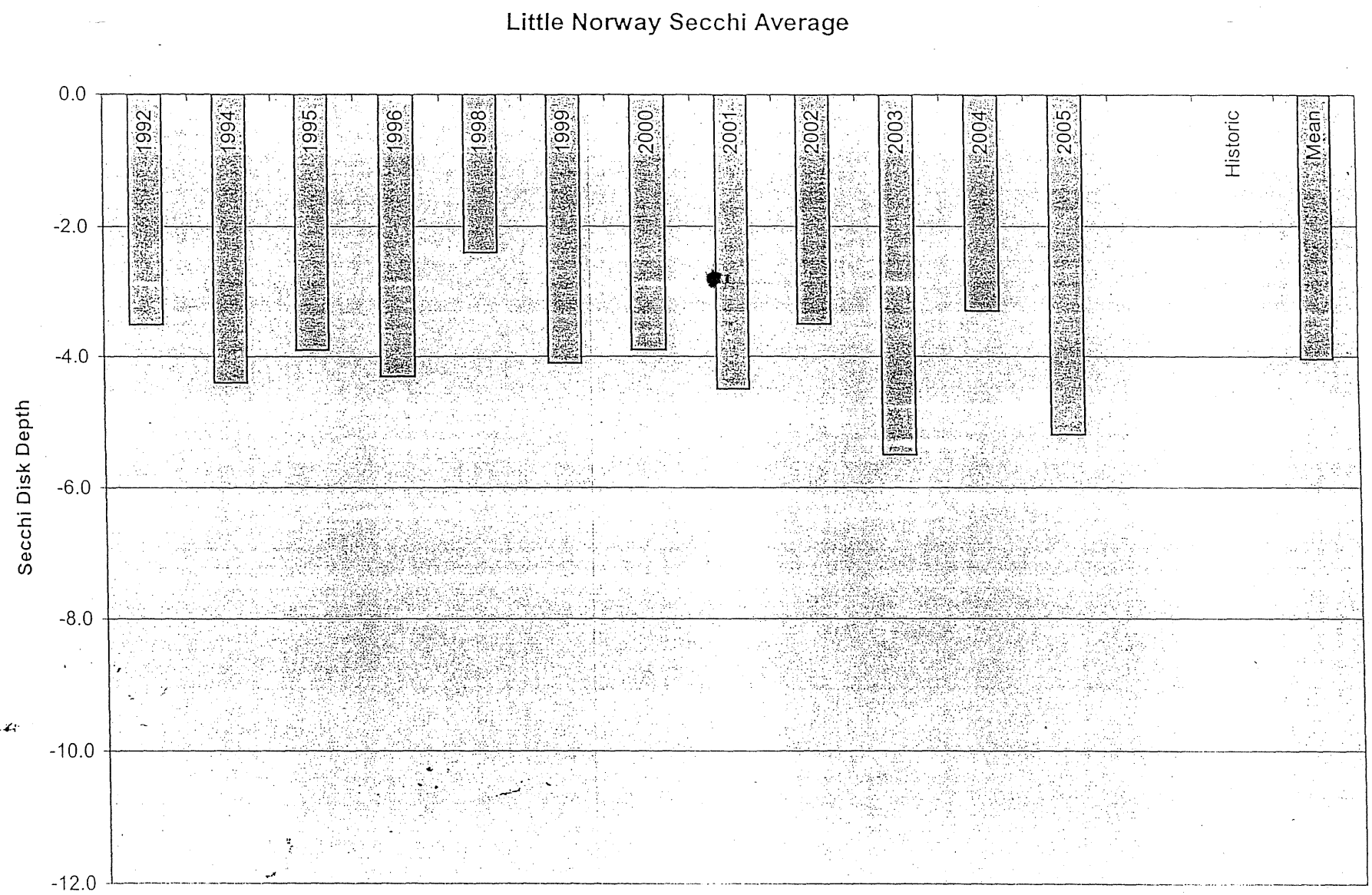
PHEO	2004	2005	MEAN
(ug/L)			
W Norway	0	0	0
Norway	0	0	0
L Norway	0	0	0
Games	0	0	0

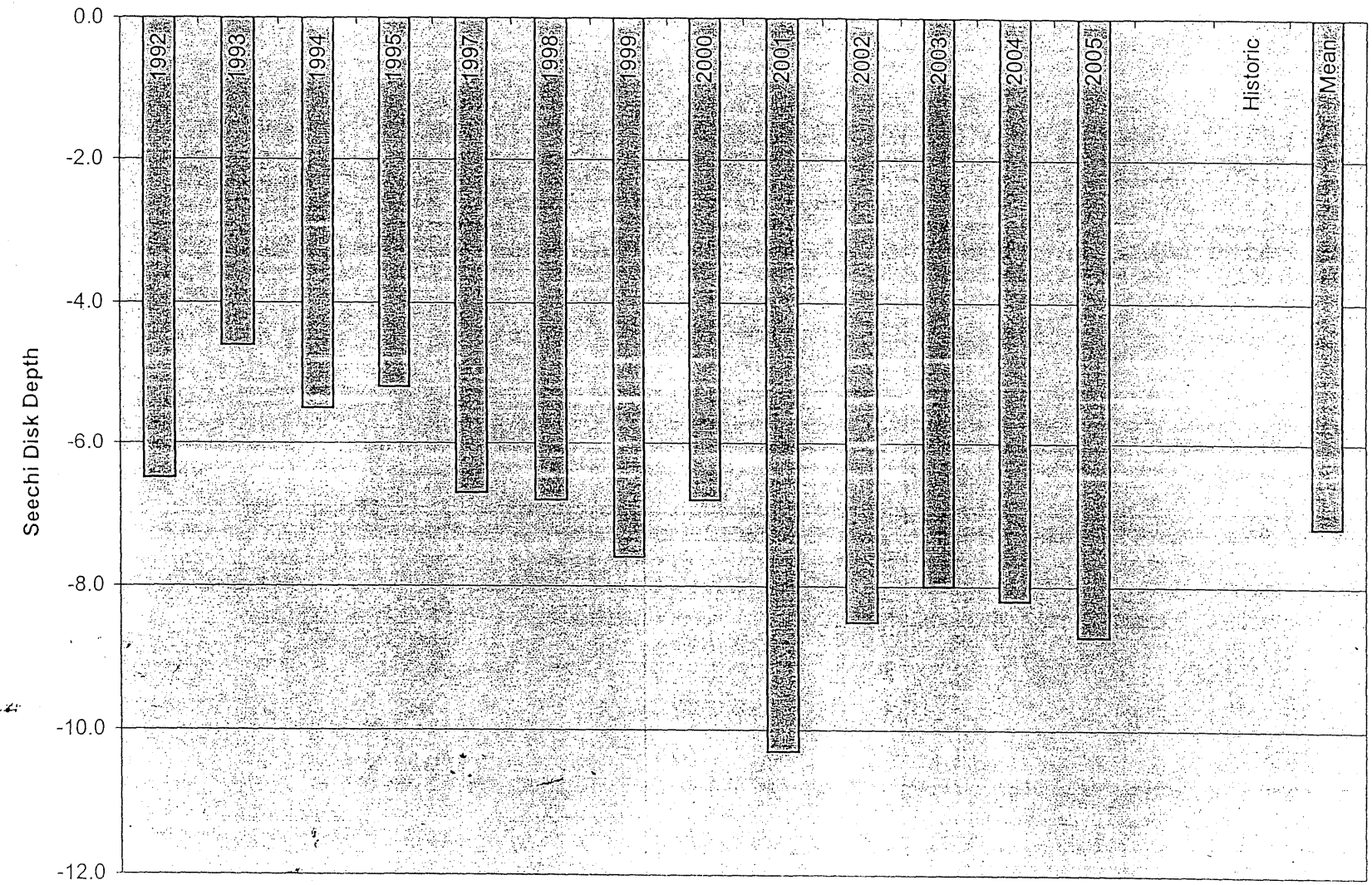
SECCHI	2004	2005	MEAN
(ft)			
W Norway	(2.30)	(2.63)	(2.47)
Norway	(3.90)	(6.00)	(4.95)
L Norway	(3.60)	(4.61)	(4.10)
Games	(6.70)	(9.38)	(8.04)

West Norway Secchi Average




Norway Secchi Average
Secchi Disk Depth
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
1980
1986
1992
1994
1995
2000
2001
2002
2003
2004
2005
Historic Mean


Little Norway Secchi Average
Secchi Disk Depth
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
1992
1994
1995
1996
1998
1999
2000
2001
2002
2003
2004
2005
Historic Mean


Games Average
Seechi Disk Depth
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
1992
1993
1994
1995
1997
1998
1999
2000
2001
2002
2003
2004
2005
Historic Mean

T TUBE samples - ag ditches

	DATE	T Tube	Conditions	Nitrogen	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Solids	Turbitidy
				Ammonia	Nitrate+Nitrate	Ortho	Total Kjeldahl	Total	Suspended	
		C/M		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
# NOR SE - Pierce										
2004	6/2			<.02	5.500	0.085	0.900	0.105	2.000	0.900
	6/9			0.040	4.000	0.019	1.200	0.280	32.000	30.000
	9/7			0.040	1.400	0.390	1.400	0.432	3.000	3.500
	11/1			0.020	5.800	0.133	0.800	0.153	<1	<0.2
2005	4/13	60+	3" rain							
	5/18	60+	disked,lt							
			rain 4 days							
	5/19	60+	9/10" rain	<.02	4.000	0.122	1.000	0.155	3.000	2.000
	6/13	50.00	2" rain last							
			3 days, corn up 6"							
	7/10	no water	no rain for							
		to sample	4 wks, 80's							
	8/26	35.00	7" rain							
	9/12	54.00	2" rain							
	9/13		4" rain	0.120	1.300	0.376	1.500	0.475	12.000	21.000
			last 2 days							
	10/6	14.00	3.5" rain							
	11/14	60+	1 1/2" rain	<.02	5.700	0.097	0.800	0.109	<1	0.600

T TUBE samples - ag ditches

	DATE	T Tube	CONDITIONS	Nitrogen	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Solids	Turbitidy
				Ammonia	Nitrate+Nitrate	Ortho	Total Kjeldahl	Total	Suspended	
		C/M		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
# NOR-PAI-Hatlestad										
2004										
2005	4/13	60+	3" rain							
	5/18	60+	disked, lt							
			rain 4 days							
	5/19	60+	9/10" rain	<.02	2.500	0.068	1.000	0.087	3.000	1.100
	6/13	60+	2" rain last,							
			3 days, bns up 6"							
	7/10	60+	no rain for							
			4 wks, 80's							
	8/26	45.20	7" rain							
	9/12	34.00	2" rain							
	9/13		4" rain	0.030	0.950	0.194	1.200	0.253	5.000	11.000
			last 2 days							
	10/6	12.00	3.5" rain							
			beans picked							
	11/14	60+	1 1/2" rain	<.02	2.200	0.083	0.800	0.096	<1	2.400
			field disked							