Minnesota Pollution Control Agency

Prepared in cooperation with the
Minnesota Department of Natural Resources

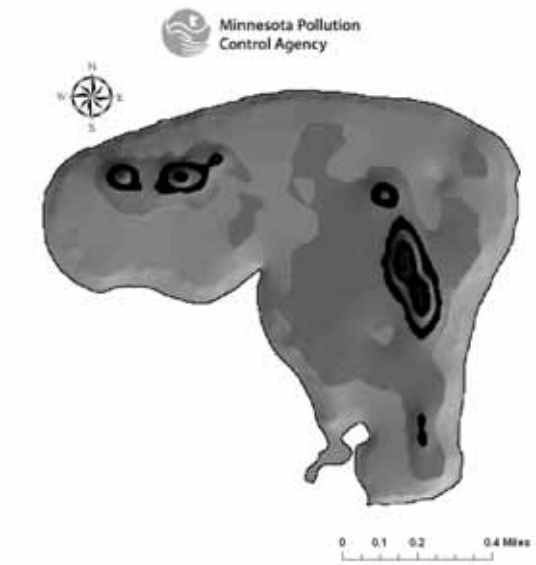
Red Sand Lake

Crow Wing County
Sentinel Lakes

Minnesota Lake ID: 18-0386
Area: 502 acres
Watershed Area: 2,796 acres
Ecoregion: Northern Lakes and Forests (NLF)

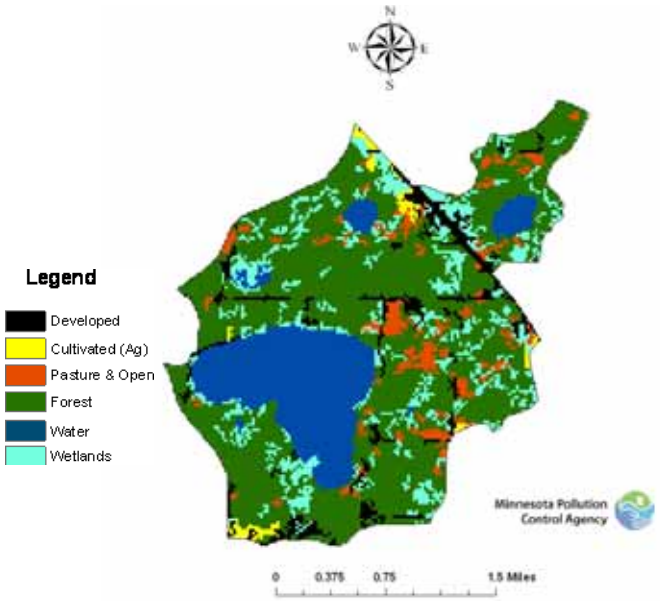
Trophic State: Eutrophic
Maximum Depth: 23 feet
Mean Depth: 3.7 feet
Mixing Status: Not Stratified (Polymictic)

Figure 1. Red Sand Lake 3D depth contour



DNR Ecological Services and Fisheries Divisions 2002
Lake Bathymetric DEM Shaded Relief Image

Figure 2. Red Sand Lake Watershed land use



The National Land Cover Database 2001
Multi-Resolution Land Characteristics (MRLC) Consortium

Table 1. land use compositions

Land use	Red Sand Lake land use percentage	NLF typical land use percentage
Developed	6	0 – 7
Cultivated (Ag)	1	<1
Pasture & Open	6	0 – 6
Forest	56	54 – 87
Water & Wetland	31	14 – 31
Feedlots (#)	0	

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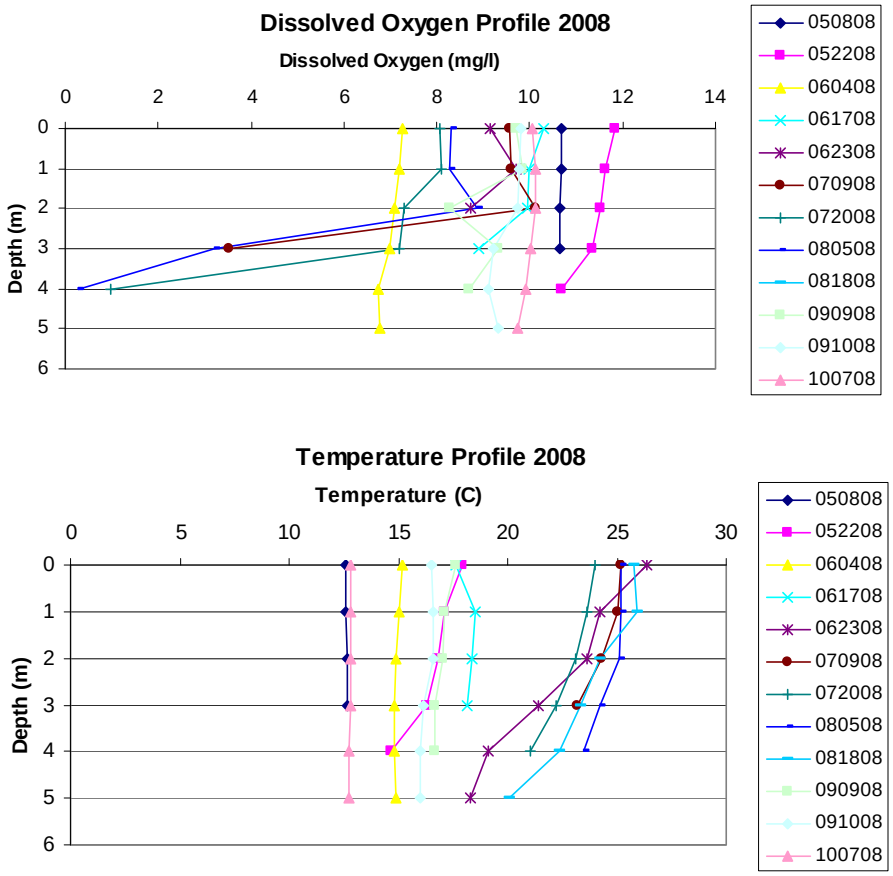
Table 2. Red Sand Lake summer-mean as compared to typical range for NCHF ecoregion reference lakes MPCA data based on 1985-86 and 2008 sample collections

Parameter	Red Sand Lake	NLF
Number of reference lakes		32
Total Phosphorus (µg/L)	23	14 – 27
Chlorophyll mean (µg/L)	2.7	4 – 10
Secchi Disk (feet) (meters)	3.3	2.4 – 4.6
Total Kjeldahl Nitrogen (mg/L)	0.84	0.4 – 0.75
Nitrite + Nitrate-N (mg/L)	< 0.05	< 0.01
Alkalinity (mg/L)	55	40 – 140
Color (Pt-Co U)	5	10 – 35
pH (SU)	8.7	7.2 – 8.3
Chloride (mg/L)	12.7	0.6 – 1.2
Total Suspended Solids (mg/L)	1.2	<1 – 2
Total Suspended Inorganic Solids (mg/L)	1.2	<1 - 2
Conductivity (umhos/cm)	175	50 – 250
TN:TP ratio	36:1	25:1 – 35:1

µg/L = micrograms per liter
mg/L = milligrams per liter
SU = Standard Units
Pt-Co U = Platinum Cobalt units

Figure 3. Red Sand Lake 2008 monthly dissolved oxygen (DO) and temperature profiles

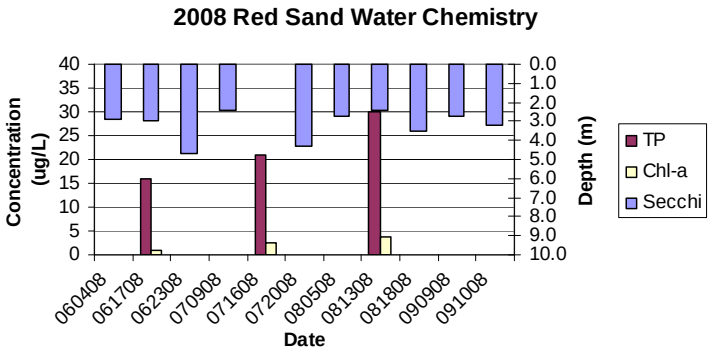


Watershed, water quality, and fishery summary

Red Sand Lake is a shallow lake located just north of Baxter, MN. The lakeshore is quite developed, however, there is a significant fringe of cattails, bulrush, and wild rice on the south and western shores of the lake. Red Sand Lake's watershed is small relative to its surface area (5.5:1 ratio) and land use is dominated by forested, wetland and water land uses, which is typical for a lake in the NLF ecoregion. The lake drains to White Sand Lake via an outlet structure. Fluctuating water level, which is a common occurrence in many shallow lakes, is noted to be a problem. Red Sand Lake was previously sampled by MPCA as a part of a study of shallow west central Minnesota lakes http://www.pca.state.mn.us/publications/reports/lakes-shallow-westcentral.pdf and as part of the Citizen Lake Monitoring Plus Program http://www.pca.state.mn.us/water/clmp-publications.html#reports.

Red Sand Lake was sampled six times during the summer of 2008 by MPCA staff. Secchi depth and temperature and dissolved oxygen (DO) profiles were collected by both staff and volunteer monitor Eldo Schmidt. The lake did not thermally stratify but in mid summer DO fell below 5 mg/l at the point of maximum depth (Figure 3), which represents a very small portion of the lake (Figure 1).

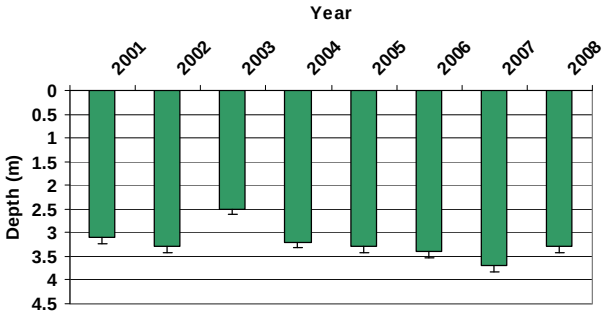
Figure 4. Red Sand Lake Total Phosphorus, Chlorophyll-a and Secchi



The trophic status indicators and other water quality data for Red Sand Lake were generally within the typical range for minimally-impacted NLF ecoregion lakes (Table 2). Total phosphorus and chlorophyll-a increased throughout the summer months (Figure 4) – a common pattern in many shallow lakes. Secchi was variable but tended to decline from over the summer of 2008. Chlorophyll-a was lower than expected, compared to the total phosphorus values. The lake is very heavily vegetated and as a result much of the phosphorus is tied up in the rooted aquatic vegetation instead of algae and the vegetation provides refuge for zooplankton that feed on the algae.

Long-term Secchi disk data are available from 2001 to 2008 (Figure 5). Based on this record, summer-mean Secchi typically ranges between 2.5 and 3.7 meters, which is well within the typical range for a lake in the Northern Lakes and Forests ecoregion. No trend is apparent based on this data.

Figure 5. Red Sand Lake Summer-mean Secchi Transparencies



Red Sand Lake will be assessed in Minnesota's 2010 303(d) "Impaired waters" assessment. Based on current data (2002, 2003, 2006 – 2008) the lake will be considered fully supporting for aquatic recreation use (meets lake eutrophication standards).

Fishery and aquatic plant survey summary

Table 3: Focal species captured during recent surveys and their size and abundance compared with other lakes in its lake class.

Species	Stocked	Abundance	Size	Trend
Walleye*	Y	Not detected	Not detected	Variable
Northern Pike	N	Low	Large	Variable
Largemouth bass	N	Low		Variable
Pumpkinseed	N	Average	Average	Variable
Bluegill	N	Average	Average	Variable
Yellow perch	N	High	Average	Variable

**Primary species managed*

Table 4: Aquatic Plant Summary

Percent cover of aquatic plants ≤ 15ft deep:	99%
Lake depth at which most vegetation disappeared:	5 ft
Number of common species (i.e., ≥ 10% cover):	8
Infested with non-native plants:	Curly-leaf pondweed(Lightly)
Frequency of Chara:	5.1

Winterkill in Red Sand Lake is a natural disturbance that produces an unstable fishery. In 2008, the lake underwent a partial winterkill, severely impacting both the stocked walleye and largemouth bass populations. Black bullheads were also impacted, a desirable result. Re-stocking of walleye following winterkill is a routine management action for Red Sand Lake. The put-grow-take walleye fishery periodically supports high angling pressure by local residents. Several bluegills, pumpkinseeds, and yellow perch of at least 7.0 inches were captured in summer nets, implying these species were not severely affected by low oxygen levels during winter 2008. Aquatic plants cover the entire lake basin and are relatively diverse with 8 species occurring at frequencies of > 10 percent (Figure 6). Red Sand Lake is infested with the non-native curly-leaf pondweed, but this plant generally becomes a nuisance only in highly productive waters or where it is the predominant rooted plant in the lake.