Chapter 6 Citizen Stream Monitoring

Results and Discussion

Citizen monitoring added value to the watershed project in several ways:

- "Hands-on" participation for watershed residents
- An opportunity for residents to observe the South Branch Root River and it's tributaries under a variety of conditions related to seasonality, runoff, and flow
- The observations of volunteers filled in geographic and temporal gaps in the water chemistry data obtained through sampling and lab analysis
- The appearance and physical condition observations of volunteers provide important context to numerical water chemistry data
- Relationships between transparency, turbidity, and total suspended solids developed during the diagnostic phase of the project should allow transparency readings to replace the need for some laboratory and instrument analysis of water samples in the future

Figures C1-C13 show individual and average stream transparency readings taken by citizen volunteers during the project (the figures are ordered from upstream to downstream in the watershed – sites are identified on Map 16). Substantial variability in transparency over time is evident at all sites. With the exception of three sites (CSMP 16, CSMP 179, and CSMP 257), transparency readings greater than or equal to 60 cm are quite common. This generally reflects periods of time when the stream is at or near base-flow. While important, flow is not the only variable affecting transparency, however. The timing and intensity of snow-melt or rainfall may also be important. A slow snow-melt, for example, could create relatively high flows, yet reasonably clear water.

Average transparency ranged from 21 to 48 centimeters for all sites. The three sites with the lowest average transparency are located in the middle section of the South Branch Root River, all within about three miles of each other. This is consistent with the middle site primary monitoring station data showing the highest concentration and yield of total suspended solids (TSS). The watershed areas draining to these three citizen sites will be targeted for upland and streambank erosion and sedimentation control during the implementation phase of the project. While we believe these sites are exhibiting lower overall transparency, it is important to note that the timing of transparency observations can have a large impact on average transparency. A “fair weather” volunteer is more likely to produce higher transparency readings than one who diligently goes out during or just after rainstorms.

Transparency, turbidity, and TSS are closely related as shown in figures C14-C16. The non-linear (logarithmic) nature of the relationships is a function of at least two factors. First, the upper limit of transparency measurements based on the transparency tubes used in this project is 60 cm, while the resolution of turbidity and TSS techniques is higher. Second, differing sizes of sediment particles may impact each of the three parameters differently. Fine suspended sediment particles (e.g. clays) may reduce transparency or increase turbidity without adding a great deal to the total mass of suspended solids. On the other hand, a few sand-sized particles collected in a sample bottle for a TSS analysis can greatly increase a TSS numeric value, while not affecting transparency or turbidity a great deal. In any event, the parameters are closely related overall – low transparency occurs when turbidity and TSS are high; and turbidity and TSS are positively correlated.

An important factor affecting both the biology of a stream as well as its suitability for recreation is the duration and timing of periods of high turbidity or suspended solids. Certain fish, for example, may be able to tolerate short periods of high turbidity; but may have their feeding or breathing impacted if the turbidity lasts many days. High suspended solids leading to sedimentation may be particularly detrimental during fish spawning periods in the fall. From the standpoint of recreation, anglers are essentially unable to fish for trout during period of poor transparency. This may be a particular tourist industry problem during the opening weeks of fishing when large numbers of anglers come to southeastern Minnesota and the Forestville area. Figures C17 and C18 show the transparency response to two rainfall/runoff events of different magnitude.

Even though the minimum transparency is similar (about 4 cm), the “recovery time” (time to return to a transparency of 60 cm) is about twice as long for the July event (Figure C18). Consecutive rains on 7/18 and 7/20 likely delivered fine sediments into the stream systems, and higher sustained flows kept these materials suspended in the water column, thereby reducing transparency for a longer period of time. An important factor in recovery time is drainage area. Streams with smaller drainage areas will both respond more quickly to, and recover more quickly from, rainfall/runoff events.

Numeric water chemistry standards or reference values for water bodies generally have some basis in the desired use of the water body. A standard may be based on the desire to sustain a quality fishery, or support swimming without risk of illness. Even aesthetic values are important. Figure C19 shows how one watershed resident perceives the appearance of “their” stream relative to the more objective transparency measurement. Figure C20 shows the same residents perception that in general, the lower the transparency, the less suitable the water for recreational usage.

Figure C1. Transparency - Mower County JD-1
(Bridge Between Sections 9 & 16 Bennington Twp. - CSMP 36)

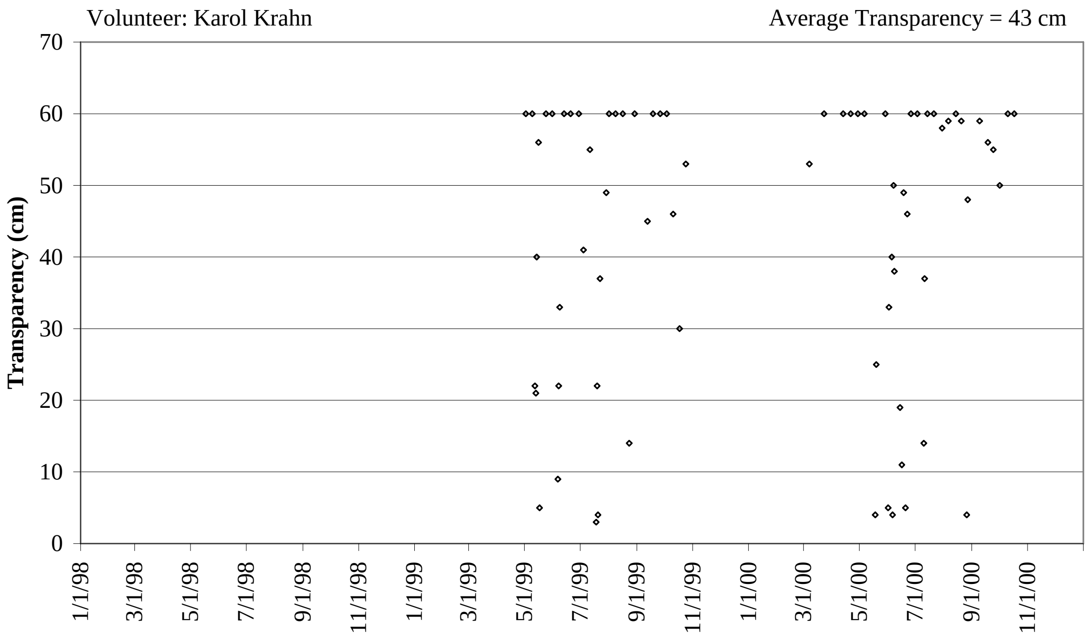

Figure C2. Transparency - South Branch Root River
(Between Sections 16 & 17 Bennington Twp. - CSMP 257)

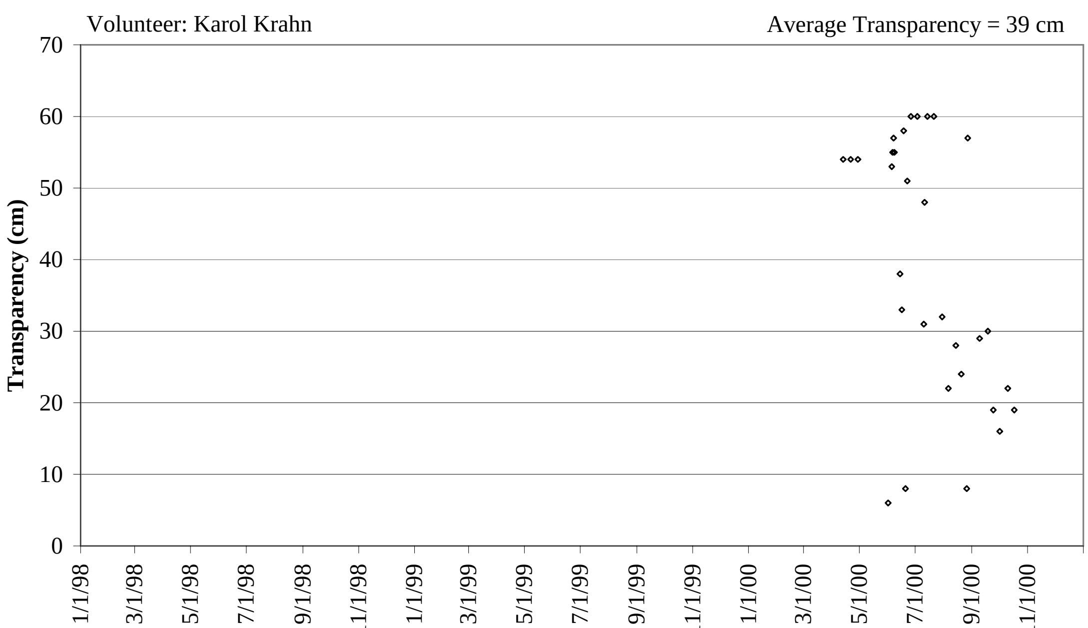

Figure C3. Transparency - South Branch Root River
(Bridge Between Sections 12 & 13 Bennington Twp. - CSMP 16)

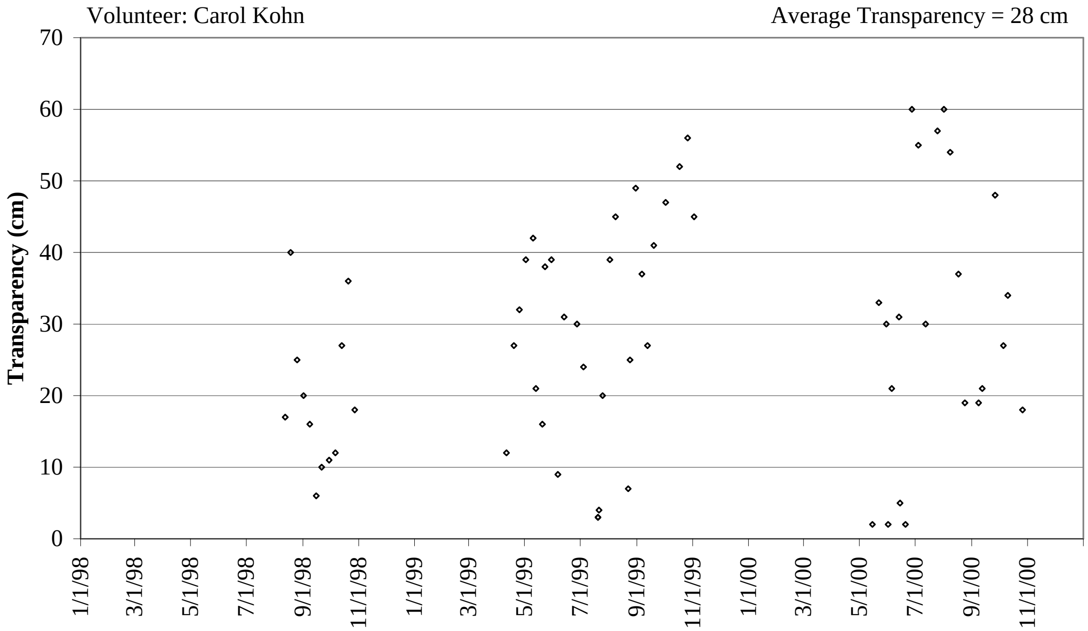

Figure C4. Transparency - South Branch Root River
(County Road 1 - CSMP 179)

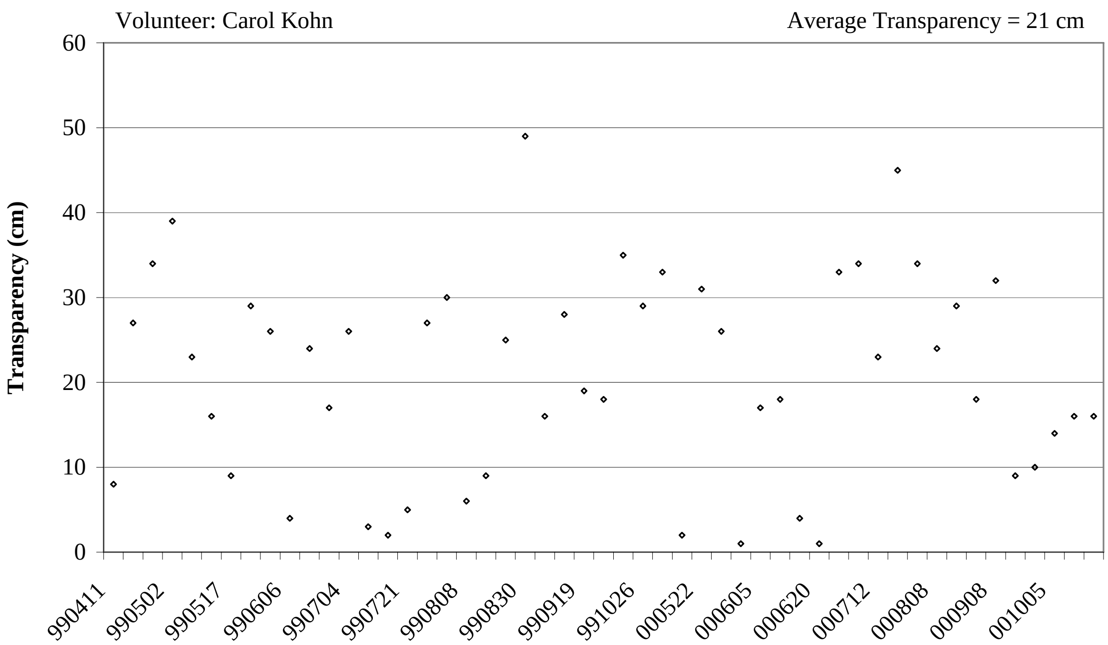

Figure C5. Transparency - South Branch Root River
(Terbeest Bridge - Bloomfield Twp. 21 - CSMP 13)

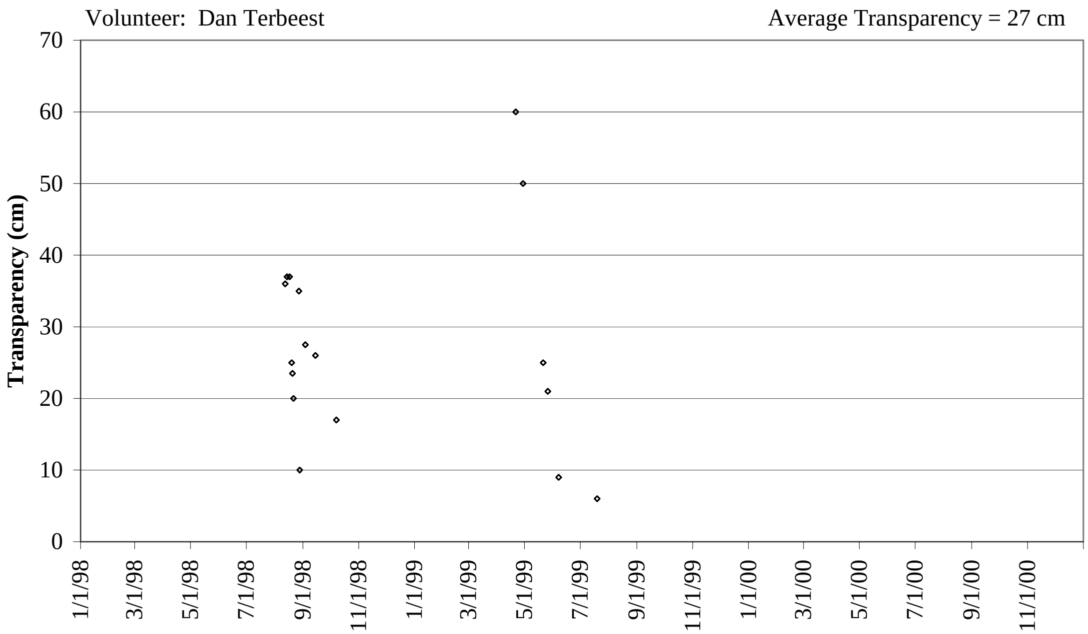

Figure C6. Transparency - South Branch Root River
(Bridge Between Sections 25& 26 Bloomfiled Twp. - CSMP 17)

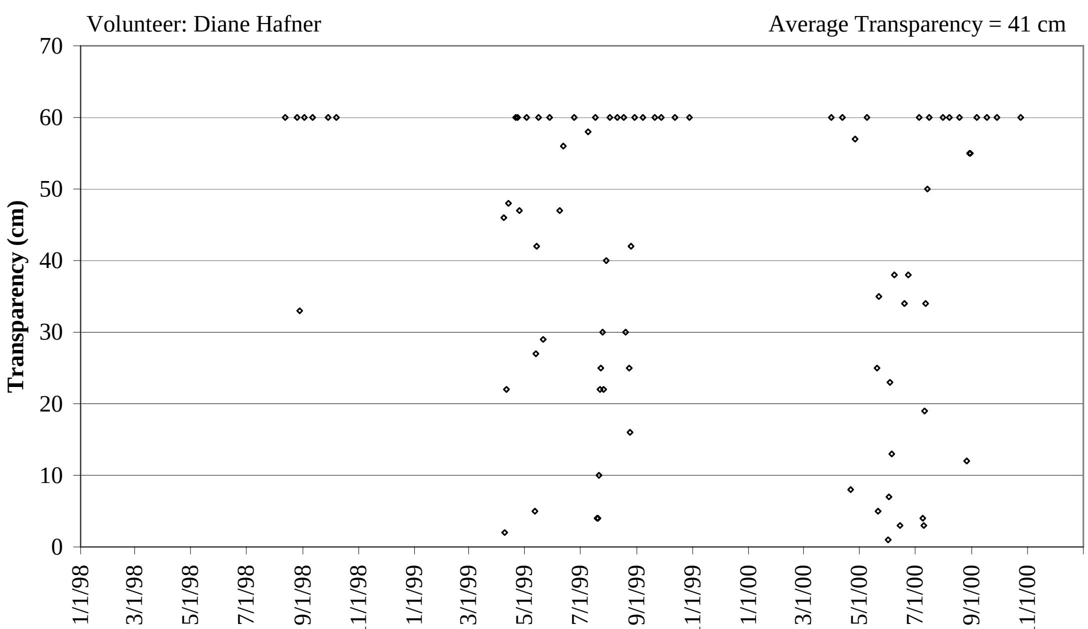

Figure C7. Transparency - South Branch Root River (Mystery Cave Foot Bridge - CSMP 11)

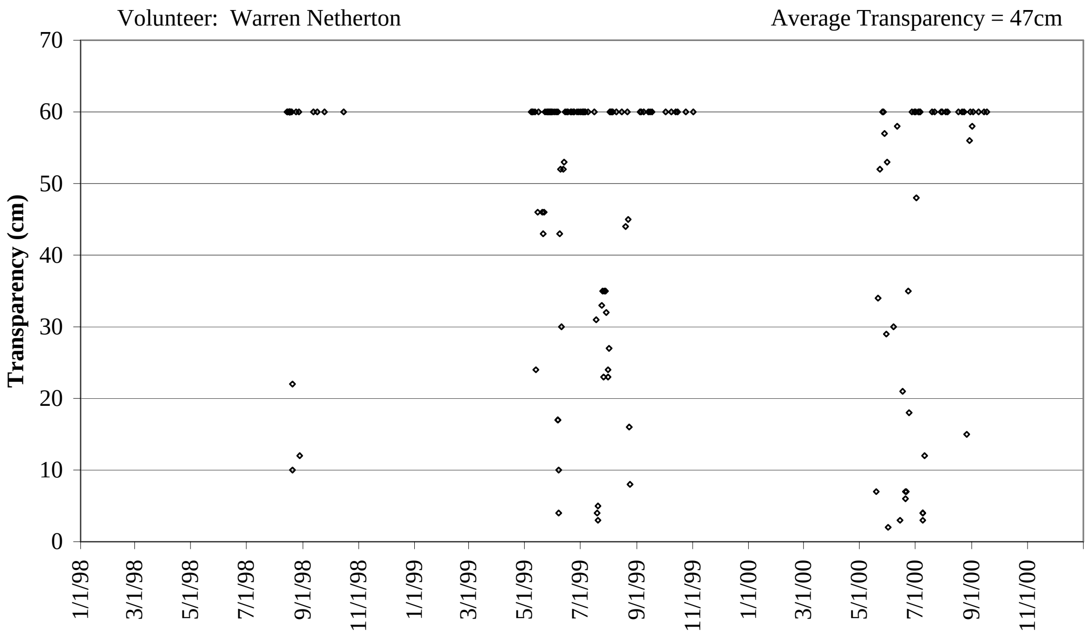

Figure C8. Transparency - South Branch Root River (County Road 5 Bridge - CSMP 12)

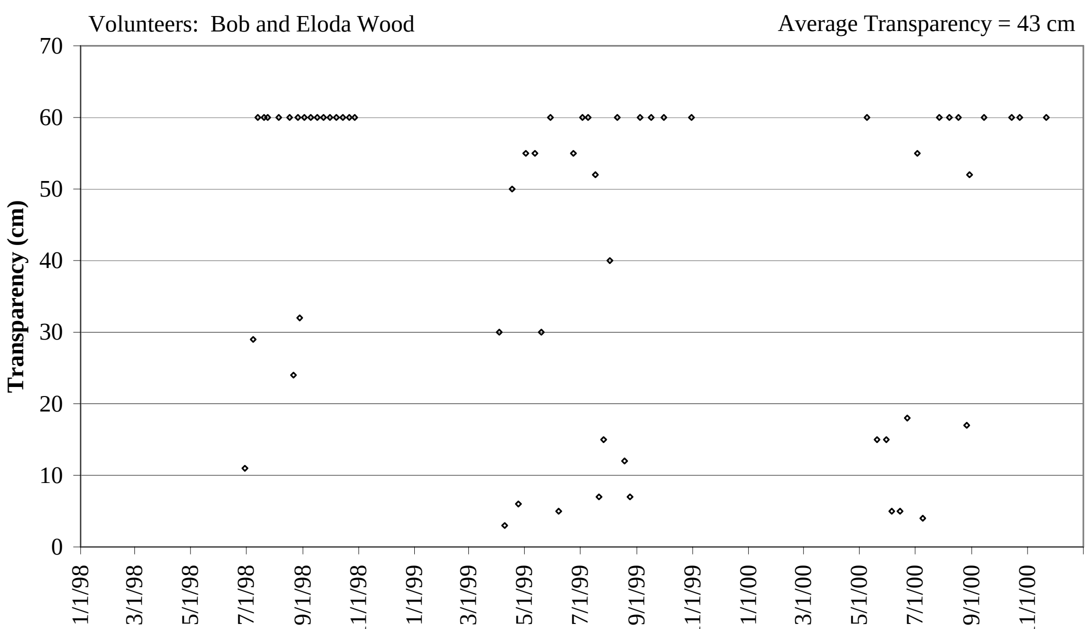

Figure C9. Transparency - Canfield Creek
(Forestville State Park - CSMP 22)

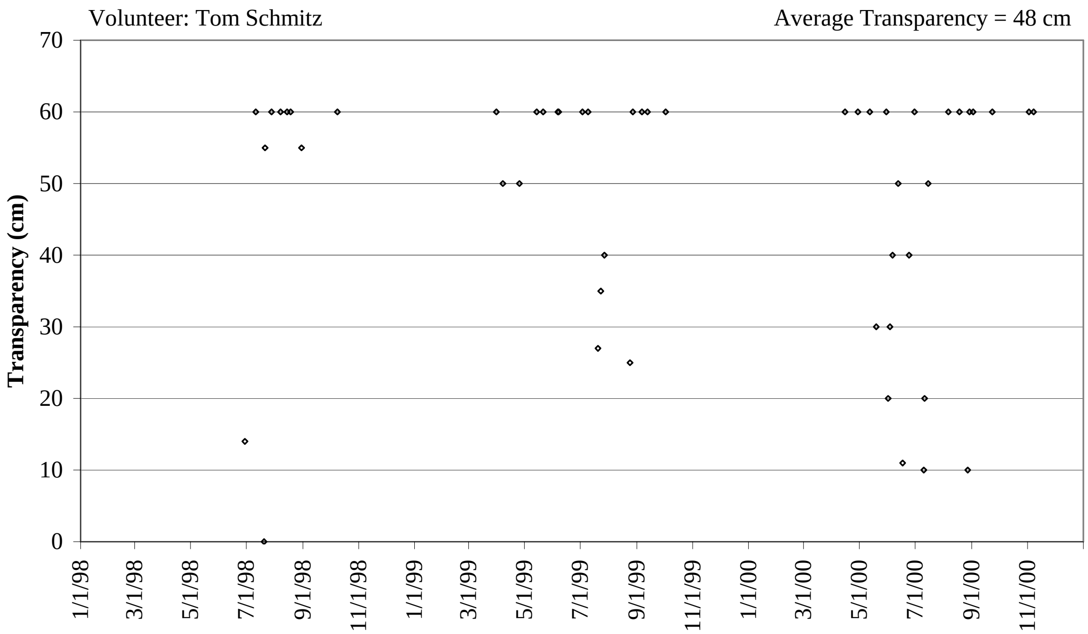

Figure C10. Transparency - Forestville Creek
(Forestville State Park - CSMP 21)

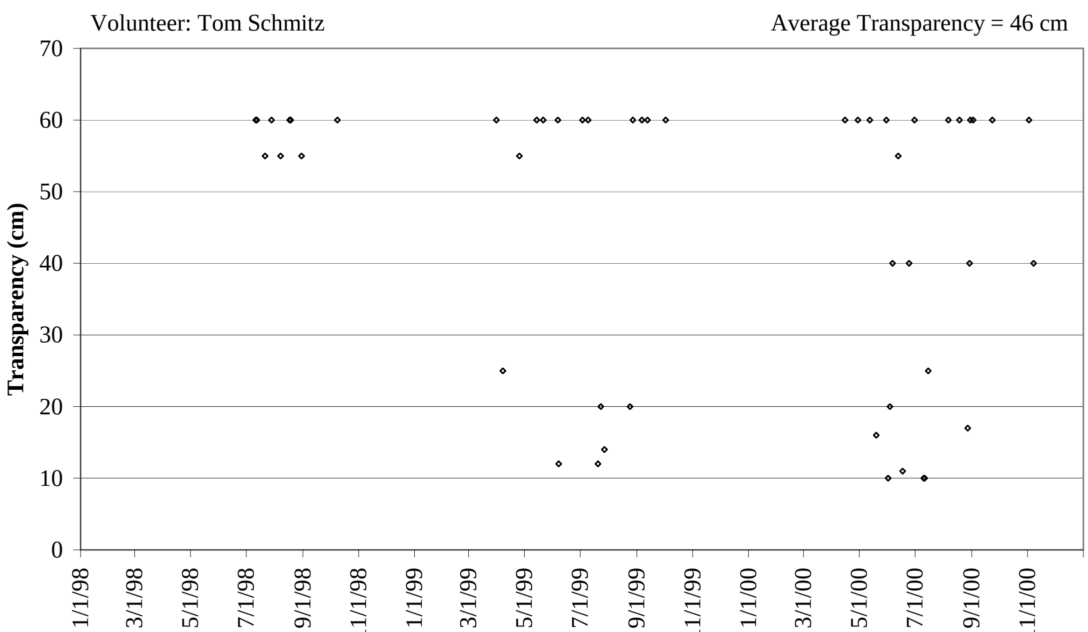

Figure C11. Transparency - South Branch Root River (Below Forestville Housing Development - CSMP 14)

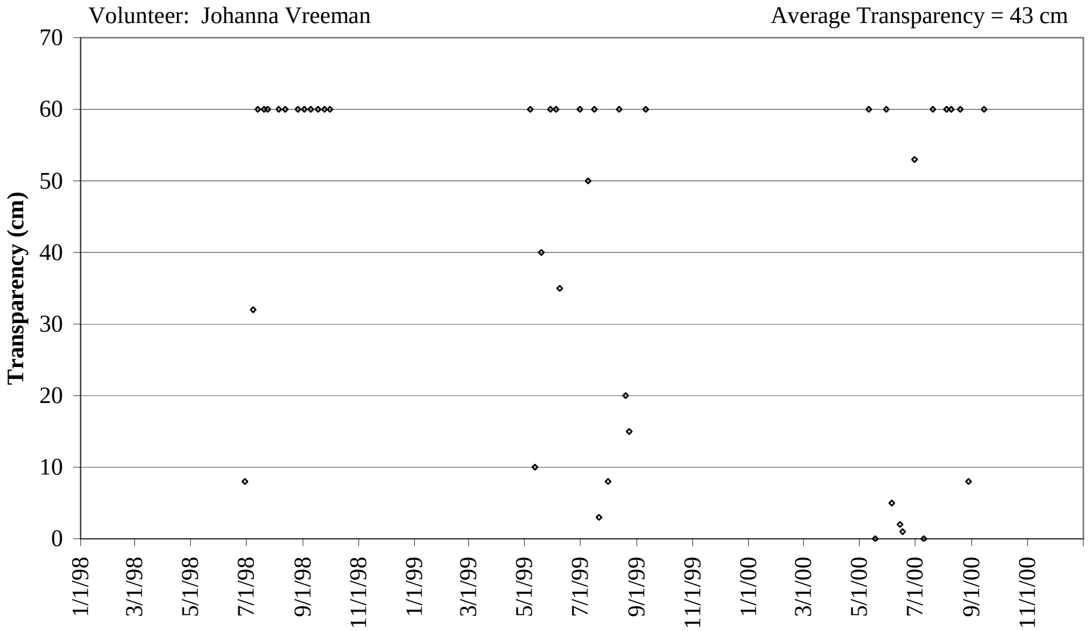

Figure C12. Transparency - South Branch Root River (Forestville State Park - New Bridge - CSMP 20)

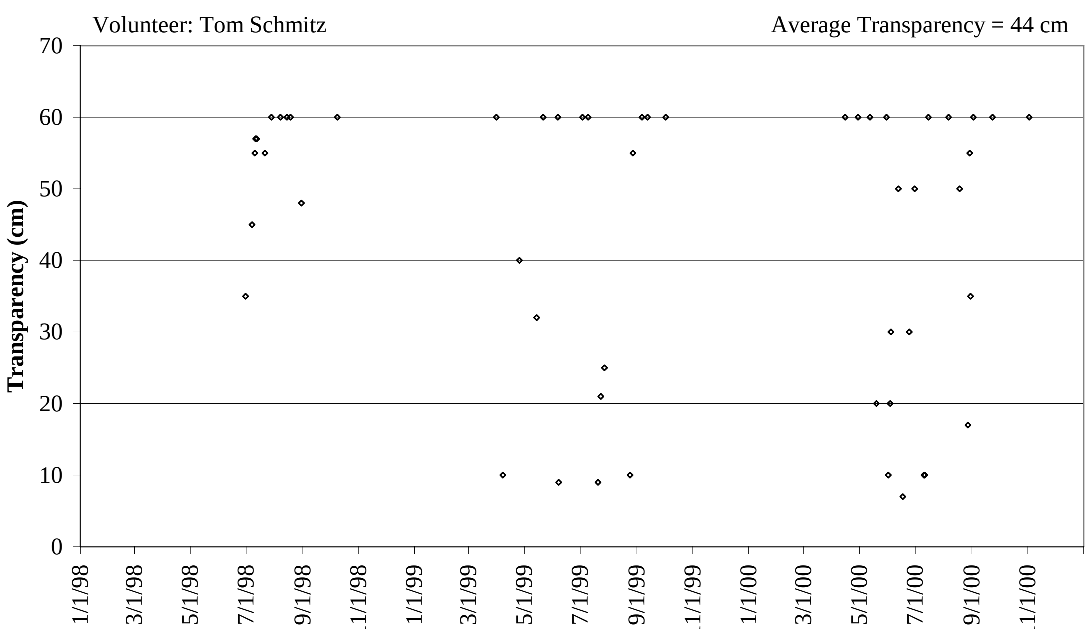

Figure C13. Transparency - South Branch Root River
(Bridge at Historic Forestville - CSMP 19)

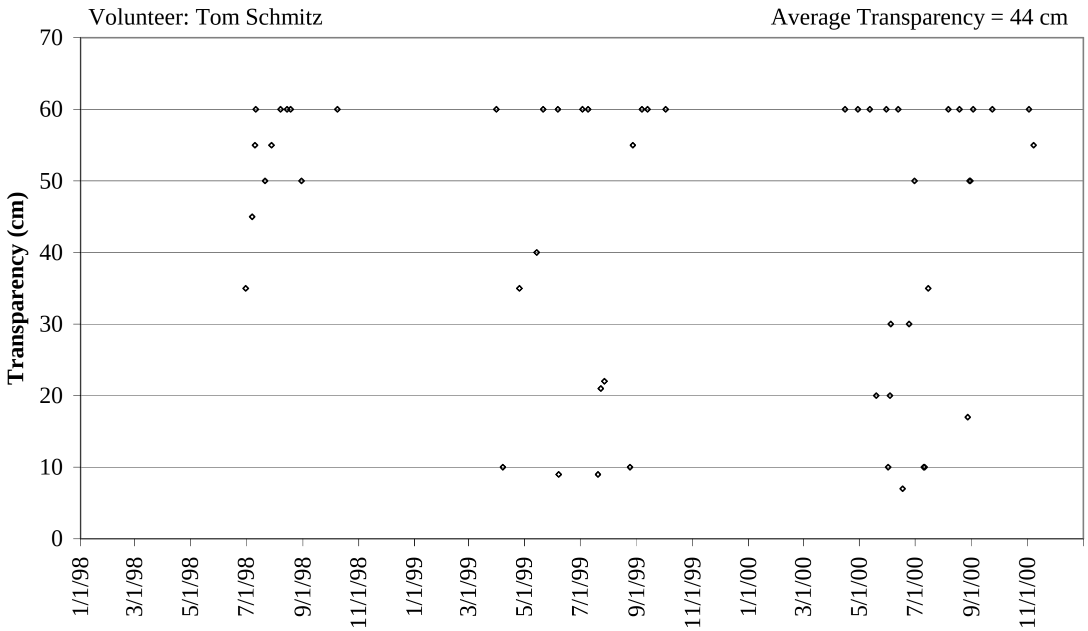

Figure C14. South Branch Root River Watershed
Transparency vs. Total Suspended Solids
(data from primary and secondary monitoring sites 1999-2000)

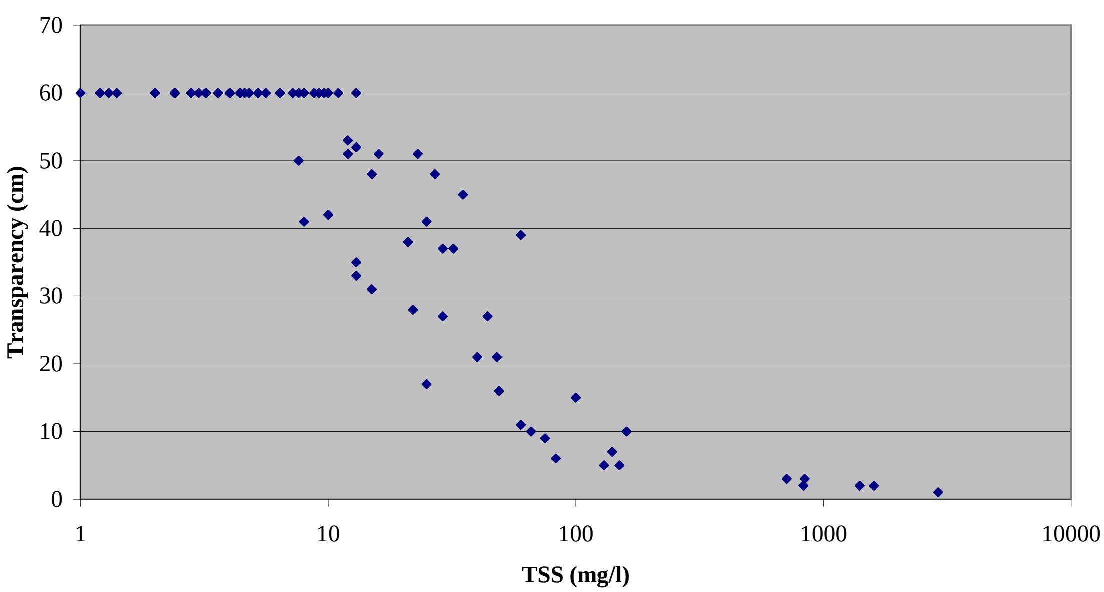

Figure C15. South Branch Root River Watershed
Turbidity vs. Total Suspended Solids
(data from primary and secondary monitoring sites 1999-2000)

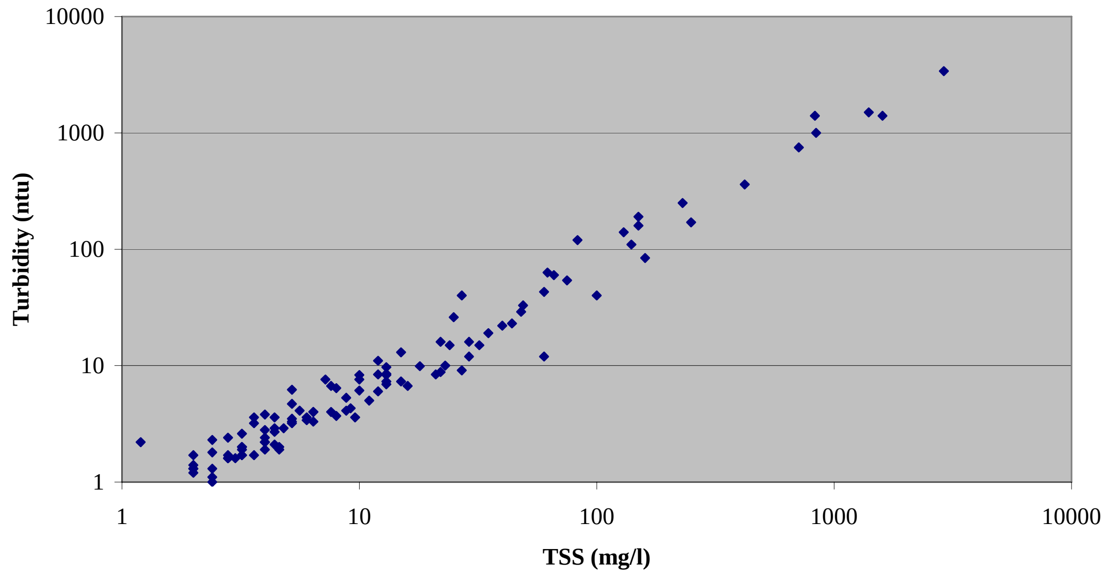

Figure C16. South Branch Root River Watershed
Transparency vs. Turbidity
(data from primary and secondary monitoring sites 1999-2000)

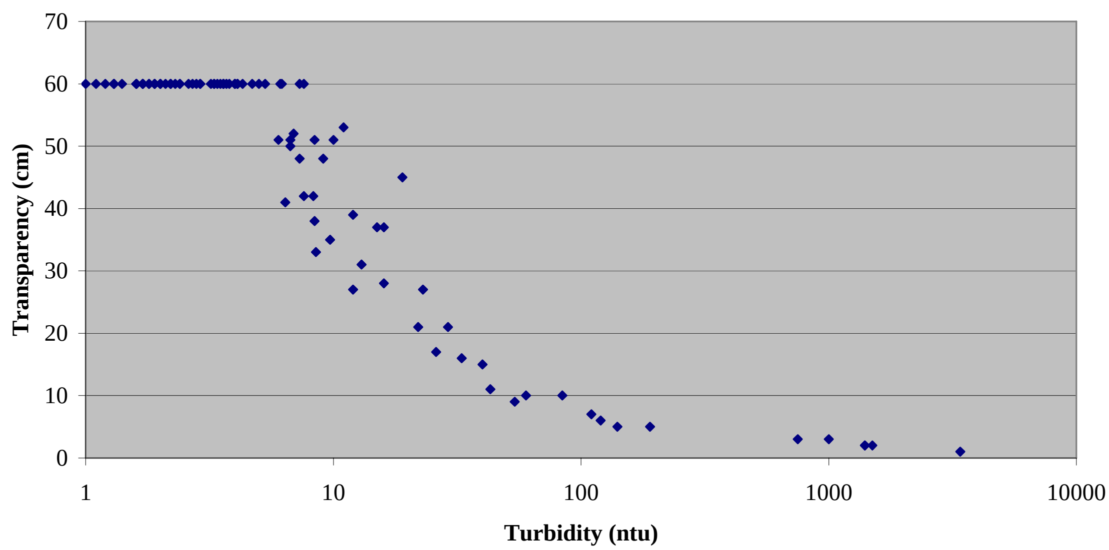

Figure C17. South Branch Root River at Mystery Cave
CSMP 11
Precipitation and Transparency 5/31/99-6/14/99

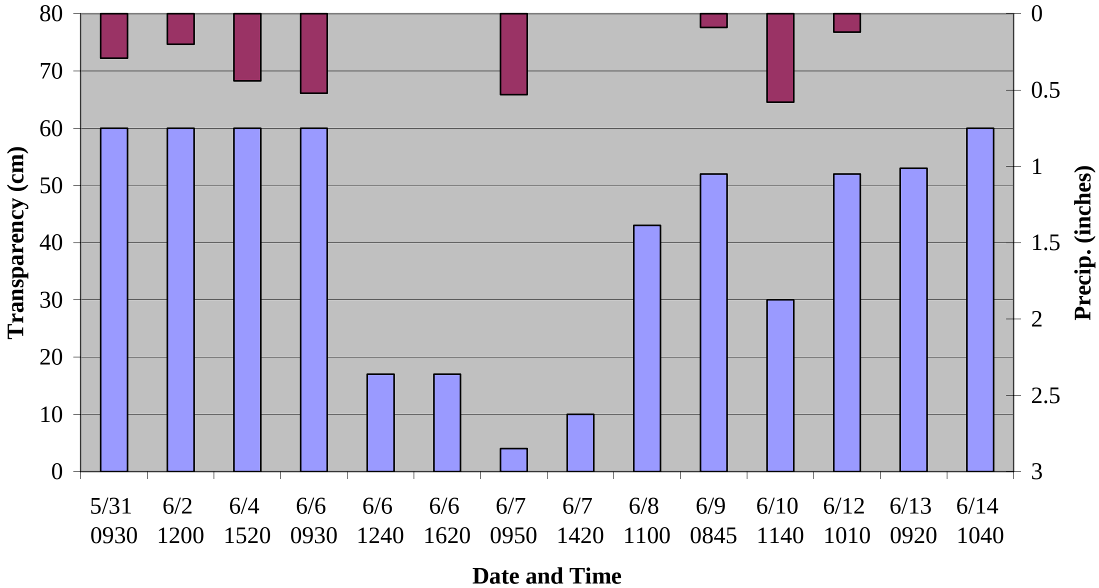

Figure C18. South Branch Root River at Mystery Cave
CSMP 11
Precipitation and Transparency 7/16/99-8/2/99

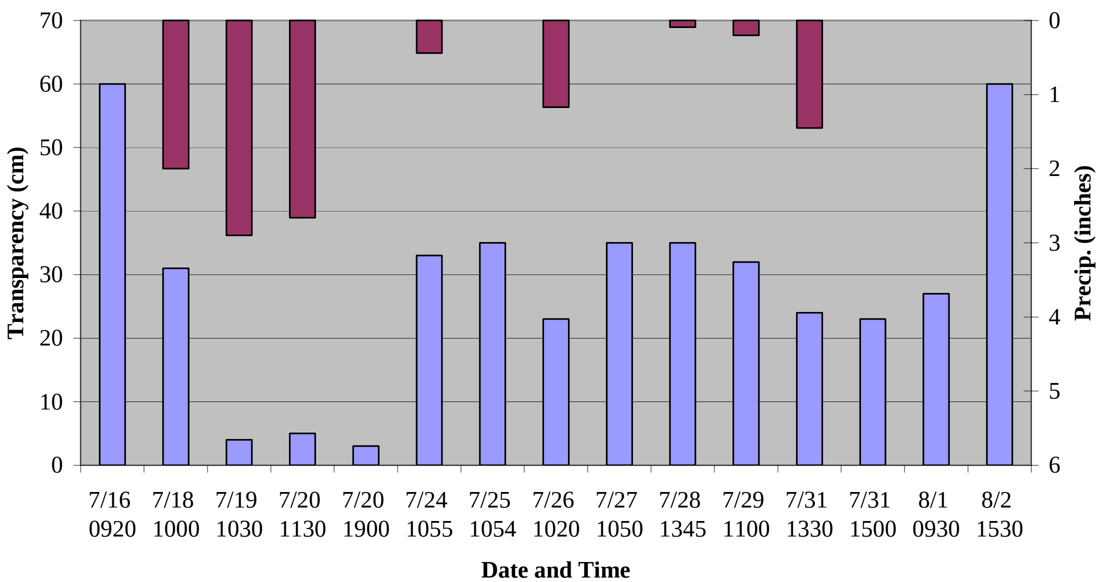

Figure C19. South Branch Root River
County Rd. 5 Bridge - CSMP 12
Transparency and Appearance

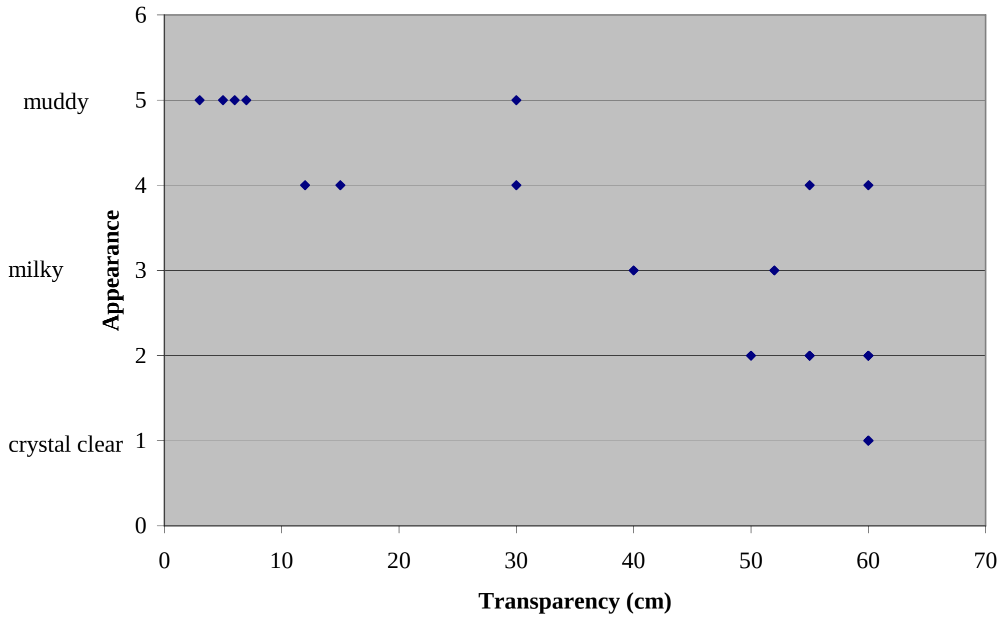

Figure C20. South Branch Root River
County Rd. 5 Bridge - CSMP 12
Transparency and Recreational Suitability

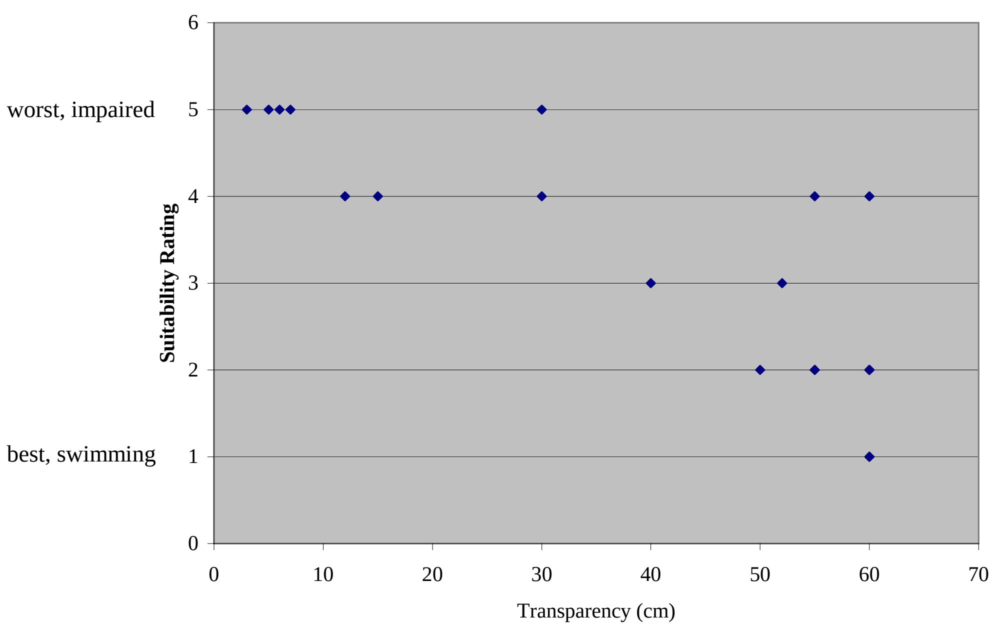

Figure CU-1. Transparency - Mower County JD-1 (Bridge Between Sections 9 & 16 Bennington Twp. - CSMP 36)

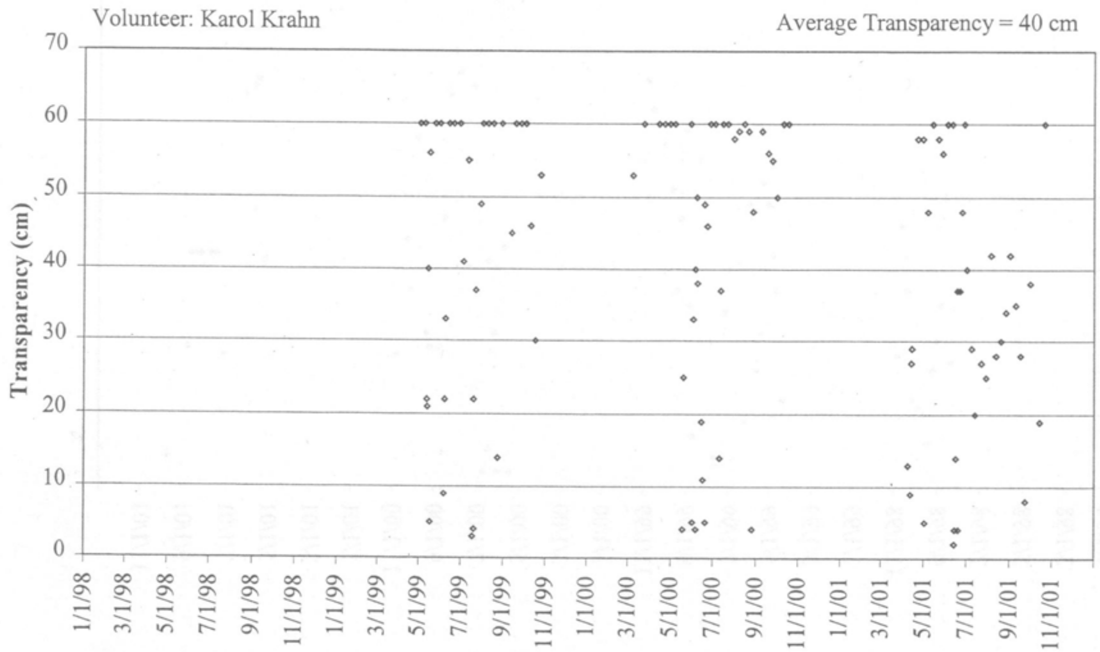

Figure CU-2. Transparency - South Branch Root River (Between Sections 16 & 17 Bennington Twp. - CSMP 257)

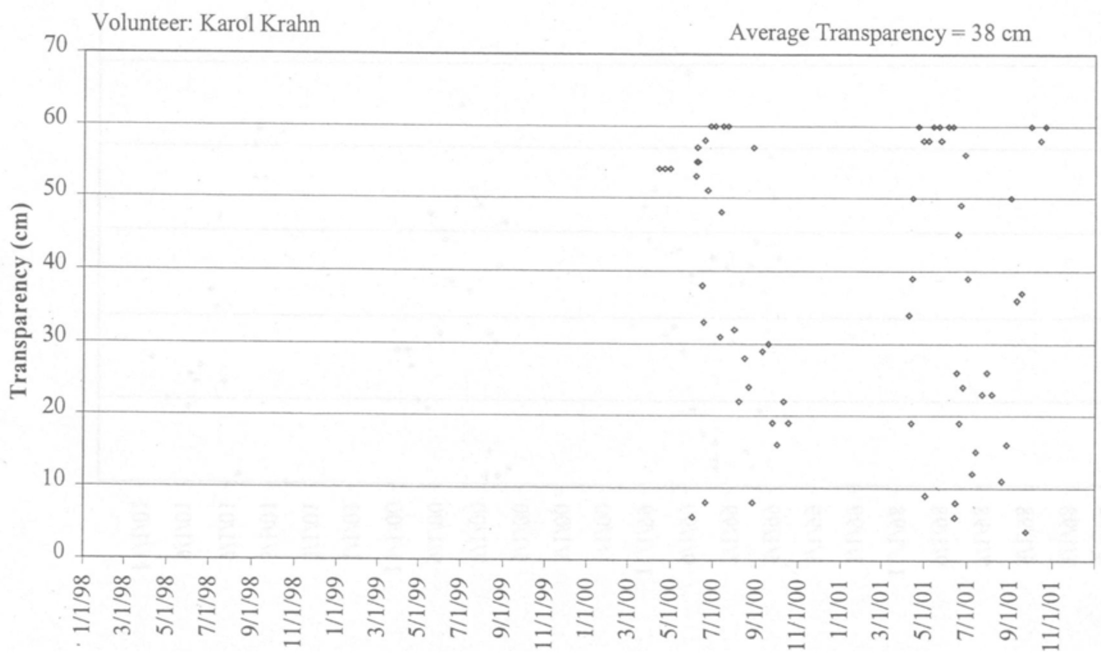

Figure CU-3. Transparency - South Branch Root River
(Bridge Between Sections 12 & 13 Bennington Twp. - CSMP 16)

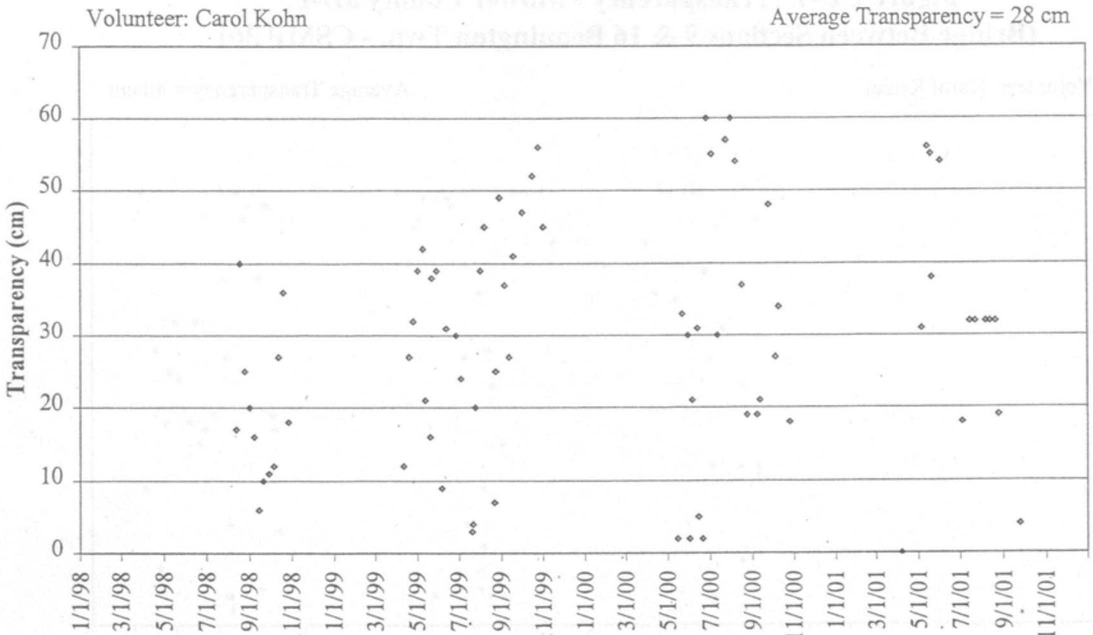

Figure CU-4. Transparency - South Branch Root River
(County Road 1 - CSMP 179)

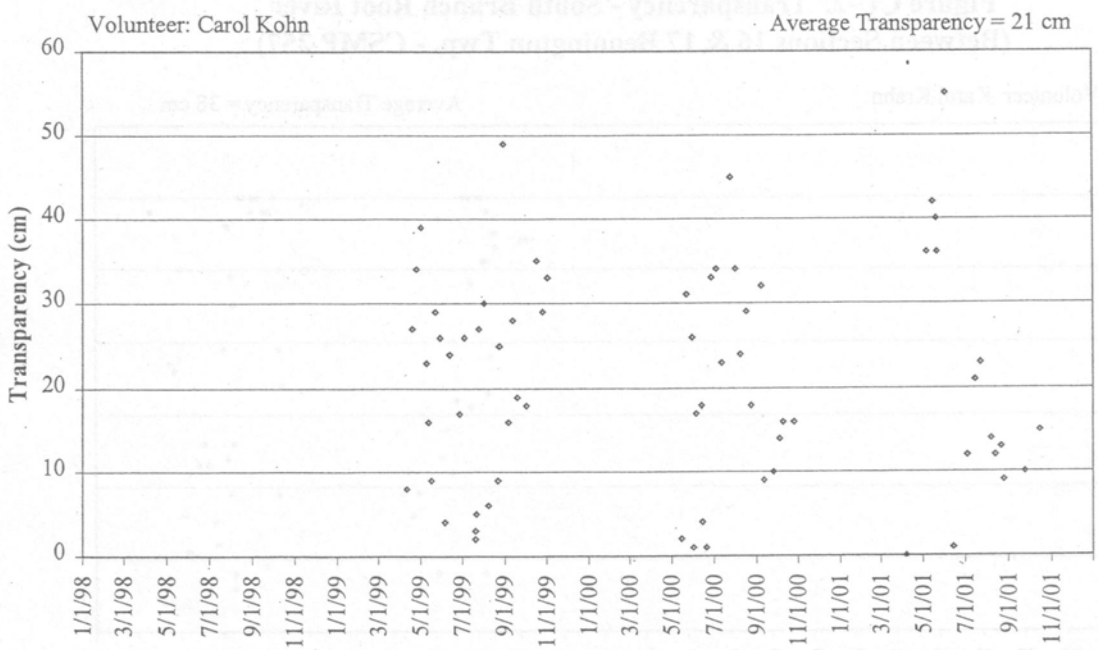

Figure CU-6. Transparency - South Branch Root River (Bridge Between Sections 25& 26 Bloomfiled Twp. - CSMP 17)

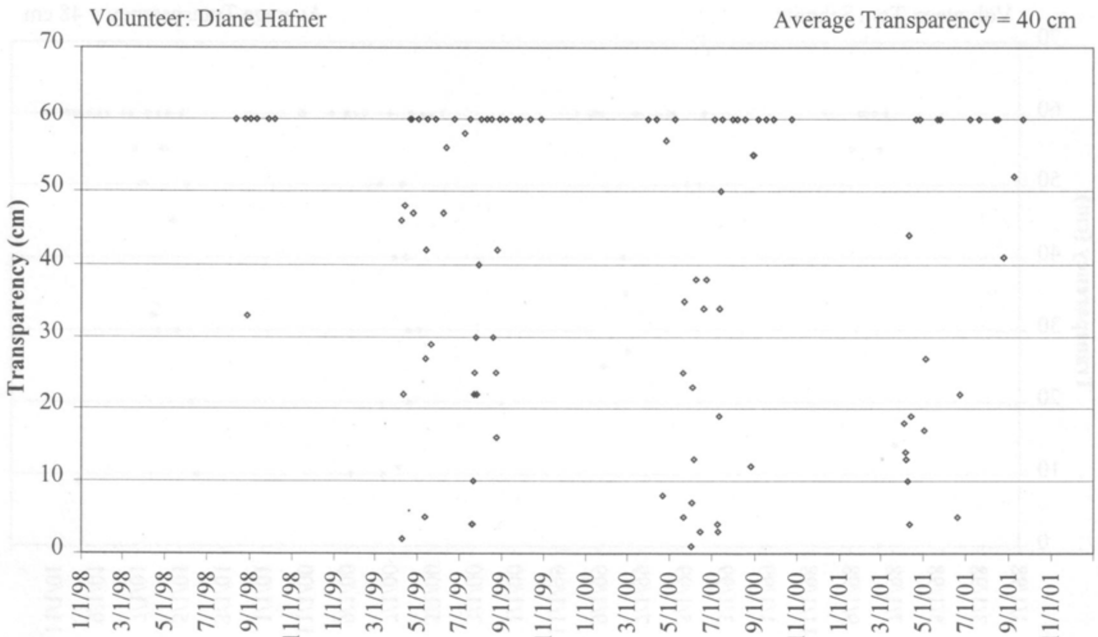

Figure CU-8. Transparency - South Branch Root River (County Road 5 Bridge - CSMP 12)

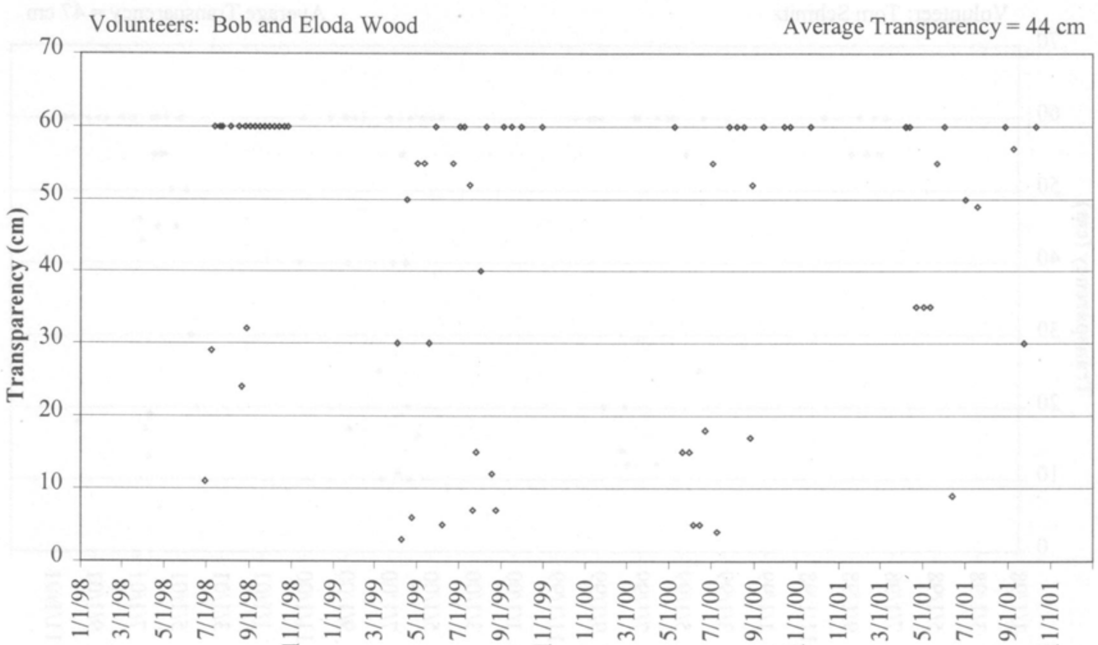

Figure CU-9. Transparency - Canfield Creek (Forestville State Park - CSMP 22)

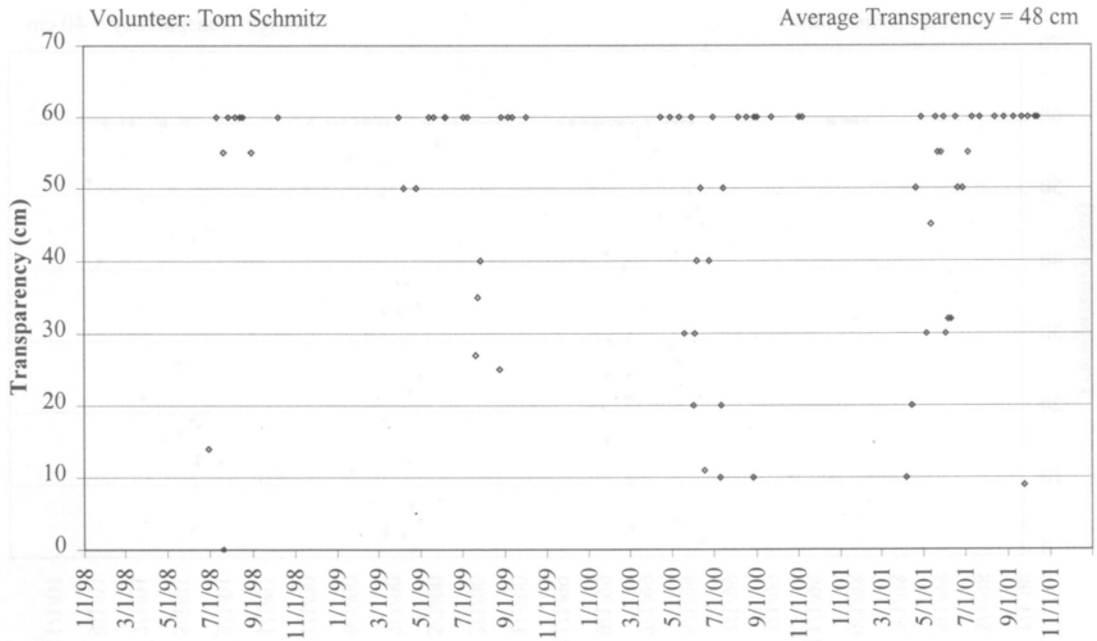

Figure CU-10. Transparency - Forestville Creek (Forestville State Park - CSMP 21)

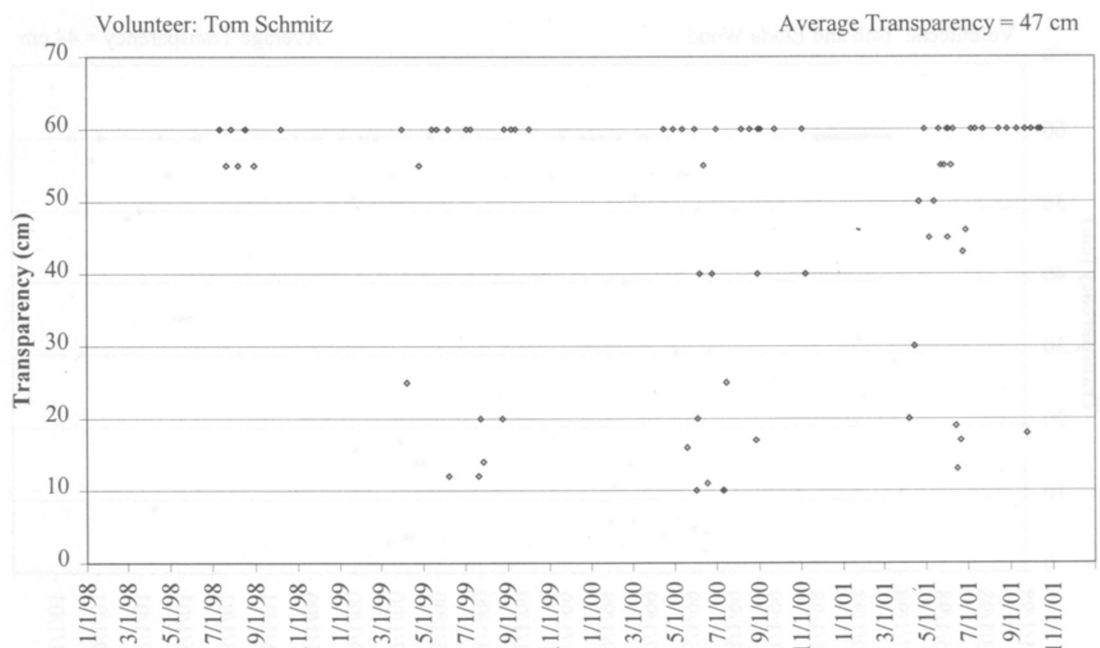

Figure CU-11. Transparency - South Branch Root River (Below Forestville Housing Development - CSMP 14)

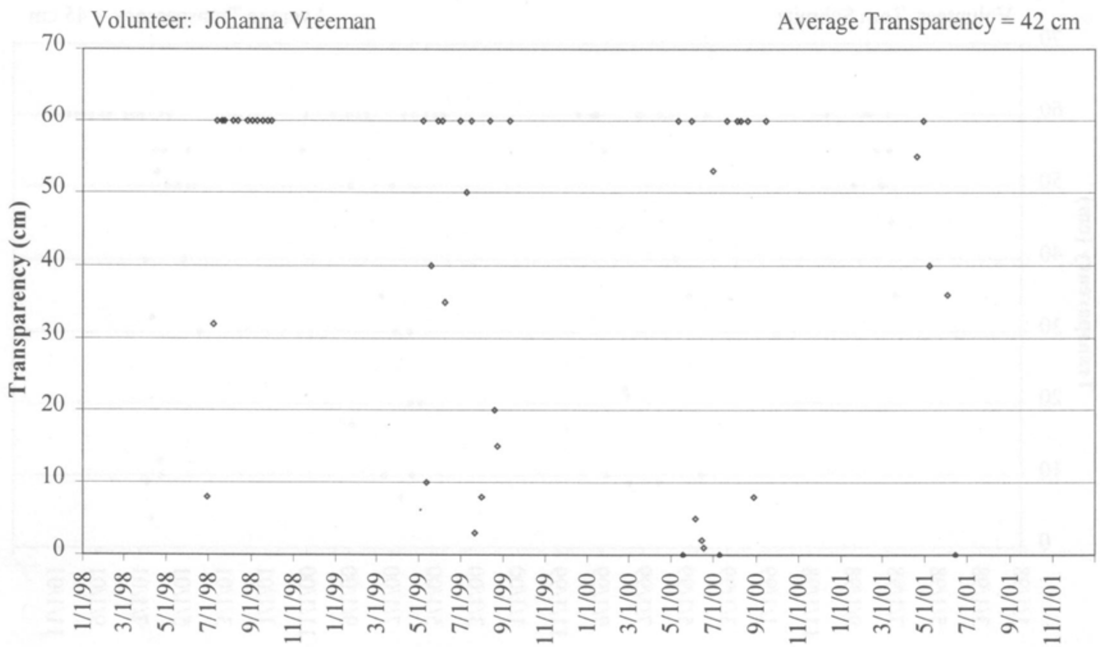

Figure CU-12. Transparency - South Branch Root River (Forestville State Park - New Bridge - CSMP 20)

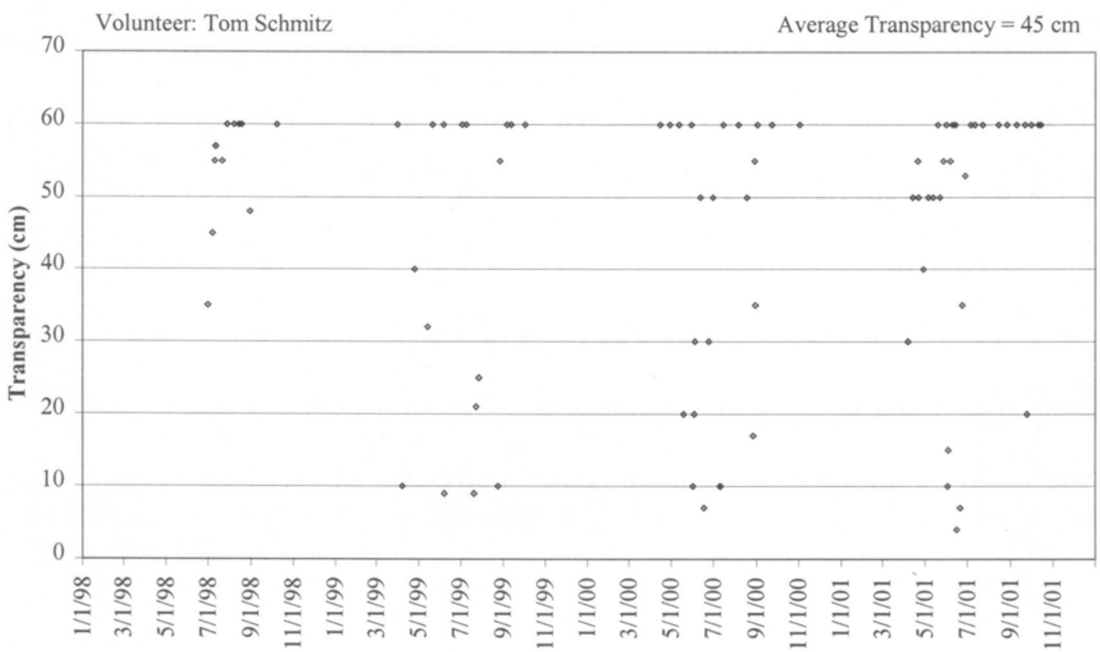

Figure CU-13. Transparency - South Branch Root River (Bridge at Historic Forestville - CSMP 19)