BROWN'S CREEK WATERSHED DISTRICT

2003 ANNUAL REPORT

Prepared by:

Brown's Creek Watershed District Board of Managers
Craig Leiser, President
E.J. Gordon, Acting Treasurer
Gerald Johnson, Secretary

July 2004

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2003 Brown's Creek Watershed District Annual Report

1. Introduction

The Brown's Creek Watershed District was established by order of the Board of Water and Soil Resources (BWSR) of the State of Minnesota under statutory authority in October of 1997. The Watershed District was formed following the dissolution of the Brown's Creek Watershed Management Organization (BCWMO), a joint powers agency. A board of five managers was initially appointed by the BWSR and subsequently re-appointed by the Washington County commissioners. From the appointed board of managers the positions of President, Vice-President, Treasurer, and Secretary was elected. In one of its first actions, the newly selected board adopted the Watershed Management Plan that had been developed by its predecessor: the BCWMO. This action included two flood relief capital improvement amendments.

Since its inception, the Brown's Creek Watershed District Board has been committed to the two primary objectives of any watershed: preservation of water quality, and, reduction of risk to property owners due to flooding. The initial challenge was directed solely at surface water, but later events have focused increasing attention on the groundwater resources of the Watershed District as well. The Watershed board has also been active in attempting to integrate its plans and actions with various interests in land use and development of the governmental units within the boundaries of the Watershed.

2. Organization and Budget

a. Brown's Creek Watershed District – Board of Managers & Staff

BROWN'S CREEK WATERSHED DISTRICT - 2003 BOARD OF MANAGERS

Manager/ Address	Position	Term Expires	Community Liaison
Craig Leiser 10300 Kismet Lane Stillwater, MN 55082	President	10/22/04	Grant
Karen Kilberg 12945 Keller Avenue North Hugo, MN 55038	Vice-President	10/22/04	Hugo May Tn.
Barbara Medinger 8802 Stonebridge Trail Stillwater, MN 55082	Treasurer	10/22/05	Stillwater Tn
Gerald Johnson 302 Edgewood Avenue Stillwater, MN 55082	Secretary	10/22/06	City of Stillwater
Edward "Ned" Gordon 2970 Marine Circle Stillwater, MN 55082		10/22/06	Oak Park Heights Lake Elmo

The BCWD does not have any employees. The BCWD does contract with several organizations for professional services. In January of 2003, the BCWD solicited proposals for engineering and legal services. At that time the firms of Emmons Olivier Resources, Inc. and Smith Parker P.L.L.P. were retained for engineering and legal services respectively. What follows is a listing of all contract support staff utilized by the BCWD.

BROWN'S CREEK WATERSHED DISTRICT CONTRACT SUPPORT STAFF

Administrator	**Attorney**	**Engineer**	**Recording Secretary**
Karen Kill Washington Conservation District 1380 West Frontage Rd, Hwy 36 Stillwater, MN 55082 651.275.1136 x26 karen.kill@mnwcd.org	Chuck Holtman/Louis Smith Smith Parker, P.L.L.P. 808 Colwell Building 123 North Third Street Minneapolis, MN 55401 612.344.1400 smith@smithparker.com holtman@smithparker.com	Cecilio Olivier, P.E. Emmons Olivier Resources, Inc. 651 Hale Avenue Oakdale, MN 55 651.770.8448 colivier@eorinc.com	Julie Johnson Wk 651.439.4439

b. District Information

The Brown's Creek Watershed District (BCWD) is the governmental unit with primary responsibility for protecting the water resources of the Brown's Creek Watershed. The District was established in 1997 under the Minnesota Watershed District Act.

The District covers approximately 18,000 acres that drain into Brown's Creek, which then enters the St. Croix River. The watershed includes Brown's Creek—a DNR designated trout stream, and several small tributaries. The watershed includes twelve major lakes and numerous wetlands. The District includes portions of the Cities of Oak Park Heights, Grant, Hugo, Lake Elmo, and Stillwater along with portions of May and Stillwater Townships. The upper portion of the District is largely rural with farms, large-lot development and undeveloped grassland, cropland and forestland dominant. The lower portion of the District includes rapidly developing urban areas within the Cities of Stillwater and Oak Park Heights.

The goal of the BCWD is to protect the valuable natural resources of the watershed while protecting public and private property and infrastructure from the impacts of flooding. The BCWD seeks to achieve this goal through an increased understanding of water quality and quantity impacts on natural resources, public information and education, regulation of land use and capital improvement projects.

c. 2003 BCWD Budget

Operating Expense	ADMIN (103D.905,3)	MGMT PLAN (103B.241)	TOTAL
Monitoring/Data Acquisition		20,000.00	20,000.00
Accounting	6,600.00		6,600.00
Legal Fees	10,000.00	30,000.00	40,000.00
Staff Engineer		59,000.00	59,000.00
Bonding & Insurance	3,500.00		3,500.00
Secretarial Services	1,200.00		1,200.00
Administrative Services/WCD	25,500.00	26,500.00	52,000.00
Miscellaneous Expenses	500.00	2,000.00	2,500.00
Printing & Notices	3,500.00		3,500.00
Postage & Delivery	4,000.00		4,000.00
Manager Per Diem and Expenses	4,500.00		4,500.00
MAWD Dues	2,000.00		2,000.00
MN League of Cities	1,000.00		1,000.00
Community Relations		3,000.00	3,000.00
Equip. Maint. and Upgrades		2,000.00	2,000.00
Permitting Processing & Inspection		4,700.00	4,700.00
Permitting, Legal Review		3,600.00	3,600.00
Permitting, Engineer Review		52,500.00	52,500.00
SUBTOTAL, OPER. EXP.:	**62,300.00**	**203,300.00**	**265,600.00**
MANAGEMENT PLAN PROJECT EXPENSES:			
Second Generation Plan Implementation			
Education.		15,250.00	
Volunteer Stream Monitoring		6,000.00	
Capital Improvement Project Feasibility Analysis		25,000.00	
Groundwater Program		10,000.00	
Demonstration Project		20,000.00	
BMP Monitoring Program		7,000.00	
Two-foot Contour Data		30,000.00	113,250.00
Kismet Lake Stabil (Flood Damage Rlf)			
Contingency Reserve		10,000.00	
Monitoring, Operation & Maintenance		5,000.00	15,000.00
Trout Habitat Preservation Project:			
Contingency Reserve		10,000.00	
Monitoring, Operation & Maintenance		13,000.00	23,000.00
Trout Stream Mitigation Project Review		5,000.00	5,000.00

2003 BCWD Budget, Cont.

Miscellaneous Projects & Grant Prep			
Rules Review/Evaluation		10,000.00	
H & H Model Upgrade		30,000.00	
Sunnybrook Lake Review		10,000.00	
Market Place		15,000.00	
Kern Center		12,000.00	
Grant Preparation, Acquisition		10,000.00	87,000.00
Contingency Reserve		25,000.00	25,000.00
TOTAL MGMT. PLAN PROJECTS			**268,250.00**
TOTAL, OPERATING EXP. & MGMT. PLAN PROJECTS:	**62,300.00**	**471,550.00**	**533,850.00**
ESTIMATED REVENUES:			
2002 Funds Balance			78,000.00
BWSR Challenge Grant- Demonstration			10,000.00
Metropolitan Council WOMP Grant			1,500.00
Permit Fees			39,520.00
Tax Levy			404,830.00
TOTAL, EST. REVENUES:			**533,850.00**

d. Audit Report

The audit of financial management of the District for January 1-December 31, 2003 was performed by the firm of HLB Tautges Redpath, Ltd. This audit revealed "…no instances of noncompliance that are required to be reported under *Government Auditing Standards..."* nor any "material weaknesses" in internal control over operations or financial reporting. A full copy of the 2003 audit is enclosed in Appendix A.

e. Citizens Advisory Committee

Attempts were made throughout 2003 to reactivate the Citizen's Advisory Committee. A list of CAC members follows.

Kent Pearson 2309 Van Tassel Drive Stillwater, MN 55082	Greg & Elizabeth Germaine 11719 North Dellwood Road Stillwater, MN 55082	Dean Hansen 402 South 6th Street Stillwater, MN 55082
Dan Kalmon 309 Willow Street East Stillwater, MN 55082	Norton & Kathy Cross 14491 North Dellwood Road Stillwater, MN 55082	Pamela Bjorum 12515 Keller Ave., North Hugo, MN 55038

3. Projects and Programs

a. Capital Improvement Projects: Two capital improvement projects were incorporated into the BCWMO management plan adopted by the BCWD in 1997. These were the mitigation of periodic flooding in the School Section/Goggins/Plaisted Lake basin, and, a similar though smaller project in the Kismet basin.

1. Trout Habitat Preservation Project

Design and construction of the Goggins/School Section/Plaisted Lake project was initiated in 1999 and completed in 2001. This project was not merely a "drainage" project. Rather, it became known as the Trout Habitat Preservation Project (THPP) owing to the fact that it focused on protection and enhancements of the sensitive spring-fed headwaters of Brown's Creek, as well as stabilization of water levels in the landlocked basin of the lakes. In operation, overflow from the lakes flows through a system of wetlands and into an infiltration basin that provides significant groundwater recharge into the headwater springs from which Brown's Creek rises. This project was continued to be monitored in accordance with the Operation & Maintenance Plan.

2. Kismet Basin

The second project was the Kismet Basin project. After extensive negotiation with affected landowners, consideration of several alternate designs, each with varying degrees of drainage and infiltration, a final design was selected and the project ordered in 2001. The project called for selection of a contractor and completion of most of the earth moving and heavy equipment phase in late 2001. Planting and landscape alterations took place in early 2002. This project also has residual monitoring and review by the BCWD into the future.

b. Rules and Permits

In accordance with statutory authority, the BCWD has developed "Rules" which derive from the management plan and are directed at providing consistent evaluation and approval for development of land, modifications in land usage, and preservation of natural resources as they relate to water management. These rules apply to volume and rate of water movement, buffers adjacent to water resources, shoreline/streambank modifications, stream and lake crossings, floodplain delineation and erosion control in instances of significant surface construction. Private parties, developers, and governmental agencies are required to submit plans and calculations to show how the proposed activity will be managed to comply with the rules. The process results in the issuance of a permit, which also directs certain measurement and enforcement activities to insure compliance. The BCWD issued more than a dozen permits in 2003. The District worked to streamline the permitting process, clarified the fees schedule and billing process, and developed a permit tracking system.

c. Hydraulic and Hydrologic Study Phase II

The Brown's Creek Watershed District has invested approximately $80,000 over 18 months and in three phases to develop a very exact Hydraulic and Hydrological study of the district

watershed and sub-watersheds. The study incorporates the two-foot contour mapping, GIS location, a natural resources inventory and an extensive update to the computerized modeling (XP-SWMM) necessary to manage the water resources of the District's lakes, ponds, wetlands, streams and Brown's Creek. These are the tools that are being used to evaluate and permit building sites, developments, conditional use permits or other projects that directly or indirectly affect the quality and quantity of the District's water resources.

d. Trout Stream Mitigation Project

The Trout Stream Mitigation Project (TSMP) was completed by the City of Stillwater in June 2003. This project diverts stormwater from the 1800-acre Annexation Area away from Brown's Creek, through McKusick Lake, to the St. Croix. The system protects the designated trout stream from warm, nutrient-rich stormwater and also protects several rare plant communities and rare species habitats in the Brown's Creek Ravine that would have been adversely affected by storm water impacts. The BCWD was directly involved in the review of the TSMP. BCWD negotiated a joint cooperative agreement between BCWD, City of Stillwater, and Oak Park Heights to exempt new development from the District's volume control rule in designated areas that will be diverted by the TSMP.

e. Long Lake Outlet Evaluation

The Long Lake Outlet Project was proposed by the City of Stillwater to modify the outlet structures and related downstream improvements to manage lake levels and stormwater flows from Long Lake. The District participated in a series of public meetings, issue evaluation and recommendation development on the Long Lake project within the City of Stillwater. The District used the Hydraulic and Hydrologic Study to evaluate the outcomes of several alternatives to determine their impact on Long Lake levels and downstream resources.

f. Kern Center Pond

Completed feasibility analysis, preliminary design and final design of the Kern Center Regional Infiltration Facility. The facility will provide rate, water quality and runoff volume control for about 90 acres of Commercial and SFR development before discharging to Long Lake. This design is the result of a collaborative effort with the City of Oak Park Heights.

g. Rice Property Flooding Problem

Joined with the City of Hugo, Washington County, DNR, and FEMA in a final resolution to the Rice property flooding issue after nine years of the problem.

h. Water Monitoring and Education Program

The BCWD supported several education and monitoring projects during the year. Specifically, the BCWD monitored three lakes for water quality and two stream sites for water quality, flow, and temperature to develop a profile of healthy watershed system so as to support its management of rules and permits. The monitoring projects are done in conjunction with the Metropolitan Council's Water Outlet Monitoring Program (WOMP) and the Citizen Assisted

Monitoring Program (CAMP). The District also sponsored three high school groups in the Volunteer Stream Monitoring Program where three sites on Brown's Creek are monitored for benthic macroinverebrates.

i. Washington County Groundwater Plan

Representatives of the BCWD have been active in the Washington County Groundwater Advisory Committee, which is developing a management plan for the responsible utilization of the groundwater resources of the County. This is vitally important to the long-term health of all residents of the County and is currently dealt with separate from surface water management because the aquifers do not conform to the hydrologic boundaries of watershed districts or the boundaries of political jurisdictions. Washington County adopted the plan and the District will continue to integrate the groundwater plan into the watershed management plan in the future.

j. North Washington Groundwater Study

Accepted the final report of the North Washington County Groundwater project where BCWD was a funding participant. Data from this study was used to further refine the District's Hydraulic and Hydrologic Study.

k. Washington County Water Consortium

The BCWD has also been an active participant in the Washington County Water Consortium. The Water Consortium, which was identified in the County's water governance study, is the process to be implemented to assure consistent performance between watershed districts in accounting, rules development, groundwater management, budgetary development and sharing of information regarding studies or research.

4. Goals for 2004

a. 2004 Work Plan

The BCWD will continue to conducting project monitoring and maintenance on two capital improvement projects, which include the Kismet Basin project and the Trout Habitat Preservation Project (THPP).

In accordance with the management plan, the BCWD will continue the baseline monitoring program, which includes macroinvertebrate monitoring, conducting water quality and flow monitoring on two sites in Brown's Creek and monitoring the water quality and level of the District's lakes.

The District will continue to assist the City of Stillwater in determining an appropriate outlet elevation for Long Lake; will conduct a sediment survey on Long Lake; and will prepare to conduct a strategic lake management plan for Long Lake. The District will also work towards identifying alternatives to retain more storm water south of State Highway 36 to reduce the impact of storm water surges to the Long Lake water body.

The District will continue to work jointly with the City of Oak Park Heights to approve a cooperative agreement for the Kern Center Infiltration Pond. This work will include preparing the final design plans, creating project education materials such as site signage, and preparing a monitoring plan to be implemented by the BCWD.

The BCWD will actively facilitate integration of the Washington County Groundwater management plan and the technical detail of the North Washington County Groundwater study into rules application, revision, and enforcement.

The BCWD will continue to actively issue permits within the watershed and enforce the conditions of permits already issued, as well as review the rules for the permitting program. The District will determine the conditions under which the watershed district may choose to relinquish certain permitting activities to the LGU's having an interest in accepting the responsibility of routine management, thus reducing citizen frustration.

The BCWD will also perform a number of administrative tasks, such as: conducting an annual audit; preparing and submitting an annual report; preparing and distributing two newsletters (spring/summer 2004 and fall/winter 2004); establish a second generation Citizens Advisory Committee to become an active participant in the future direction, priorities, and investment to be made by the BCWD to enhance the water resource entrusted to the District; as well as addressing inter-community drainage issues with the City of Stillwater, the City of Oak Park Heights (OPH), and Valley Branch Watershed District (VBWD).

b. 2004 BCWD Budget

Operating Expense	ADMIN (103D.905,3)	MGMT PLAN (103B.241)	TOTAL
Monitoring/Data Acquisition		21,000.00	21,000.00
Accounting	6,600.00		6,600.00
Legal Fees	12,000.00	30,000.00	42,000.00
Staff Engineer		59,000.00	59,000.00
Bonding & Insurance	4,000.00		4,000.00
Secretarial Services	1,500.00		1,500.00
Administrative Services/WCD	27,000.00	28,000.00	55,000.00
Miscellaneous Expenses	500.00	2,000.00	2,500.00
Printing & Notices	750.00		750.00
Postage & Delivery	2,000.00		2,000.00
Manager Per Diem and Expenses	5,100.00		5,100.00
MAWD Dues	2,000.00		2,000.00
MN League of Cities	1,200.00		1,200.00
Community Relations		3,000.00	3,000.00
Equip. Maint. and Upgrades		2,000.00	2,000.00
Permitting Processing & Inspection		7,500.00	7,500.00
Permitting, Legal Review		3,800.00	3,800.00
Permitting, Engineer Review		55,000.00	55,000.00
SUBTOTAL, OPER. EXP.:	**62,650.00**	**211,300.00**	**273,950.00**
MANAGEMENT PLAN PROJECT EXPENSES:			
Second Generation Plan Implementation			
Education.		15,250.00	
Volunteer Stream Monitoring		6,000.00	
Capital Improvement Project Feasibility Analysis		25,000.00	
Groundwater Program		5,000.00	
Demonstration Project		10,000.00	
BMP Monitoring Program		7,000.00	68,250.00
Kismet Lake Stabil (Flood Damage Rlf)			
Contingency Reserve		2,500.00	
Monitoring, Operation & Maintenance		5,000.00	7,500.00
Trout Habitat Preservation Project:			
Contingency Reserve		5,000.00	
Monitoring, Operation & Maintenance		13,000.00	18,000.00

2003 BCWD Budget, Cont.

Miscellaneous Projects & Grant Prep			
Rules Review/Evaluation		10,000.00	
Lake Management Plan/Water Quality Standard		10,000.00	
H & H Model Upgrade		2,500.00	
Kern Center		5,000.00	
GIS Management Tool		25,000	
Grant Preparation, Acquisition		10,000.00	
Rice Property Acquisition		18,333.00	80,833.00
Contingency Reserve		25,000.00	25,000.00
Cash Flow Levy		50,000.00	50,000.00
TOTAL MGMT. PLAN PROJECTS			**249,583.00**
TOTAL, OPERATING EXP. & MGMT. PLAN PROJECTS:	**62,650.00**	**460,883.00**	**523,533.00**
ESTIMATED REVENUES:			
2002 Funds Balance			58,000.00
Metropolitan Council WOMP Grant			4,000.00
Permit Fees			63,800.00
Tax Levy			397,733.00
TOTAL, EST. REVENUES:			**523,533.00**

APPENDIX A

2003 AUDIT REPORT

APPENDIX B

2003 WATER MONITORING SUMMARY

The focus of this report is the summary and comparison of lake and stream water quality in Brown's Creek Watershed District (BCWD). The BCWD has monitored three lakes: Goggin's Lake, Kismet Basin and Long Lake, and two stream sites on Brown's Creek: McKusick Road and Highway 96 (mouth) during its existence. Three stream sites on Brown's Creek were sampled for macroinvertebrate data collected by volunteer stream monitors. The purpose of the monitoring program was to assess and document the current water quality conditions of the lakes and streams and to continue a long-term monitoring program, which will enable the BCWD to identify trends associated with land use changes in their watershed.

Lake Water Quality

In 2003, the three lakes monitored had fair to very poor water quality ratings and were classified as mesotrophic (Kismet) and hypereutrophic (Goggin's and Long). The overall 2003 lake grades for BCWD lakes were: Kismet Basin -- B, Goggin's Lake -- D+, and Long Lake -- D-. Goggin's Lake and Long Lake remained consistent with previous years' ratings and grades, but Kismet Basin showed improvements in water quality in 2003. Both Goggin's and Long Lakes were considered worse than the ecoregion range for total phosphorus, total Kjeldahl nitrogen, chlorophyll-*a* and Secchi disk transparency. Kismet Basin was within the ecoregion range for total phosphorus, total Kjeldahl nitrogen, chlorophyll-*a* and Secchi disk transparency. The Minnesota Pollution Control Agency monitors statistically significant trends in water quality throughout the state. They have found for the first time in 2002, that Long Lake has shown a statistically significant negative trend in Secchi transparencies over the past years of monitoring.

In addition to surface water quality measurements, a temperature and dissolved oxygen profile was taken at each lake during each sampling event. Long and Goggin's Lakes exhibited thermal stratification during the summer months at approximately two and three meters respectively. This shows that Goggin's and Long Lakes are less likely to completely mix during the summer months; whereas, Kismet Basin may mix throughout the summer allowing for some internal loading. Both WCD staff and volunteers monitored staff gages located on lakes and wetlands throughout the Brown's Creek Watershed District.

Goggin's Lake

Secchi disk transparency, total phosphorus, and chlorophyll-*a* averages have remained relatively consistent in Goggin's Lake (C- to D+) in the five years it has been monitored for water quality. In 2003, average TP and average CLA each increased slightly while average Secchi transparency stayed the same when compared to 2002. In 2003, the water level was at its highest in May and steadily declined after late June. As in previous years, Goggin's Lake's TSI values indicate that the transparency is better than the amount of TP and CLA would indicate. Therefore, this may show that the lake's algal population is composed primarily of large particulates, such as filamentous algae. These large particles would still affect the chlorophyll-a concentration but would allow more light to penetrate, which would account for the deeper than expected transparency. Another possible explanation is that zooplankton may be grazing and limiting the

algal biomass. The chlorophyll-a concentration may still be higher than expected because the zooplankton community is being included in the sample. It is recommended that bi-weekly water quality samples and lake level readings continue to be taken to monitor this situation.

Kismet Basin

After peaking in mid-May, Kismet Basin's elevation began to decline and dropped below the ordinary high water mark in late July. The water quality of Kismet Basin improved in 2003 with an overall grade of a B, continuing a 4-year trend in improvement. Kismet Basin is the only lake monitored that is within the ecoregion ranges for Secchi disk transparency, total phosphorus, chlorophyll-*a,* or total Kjeldahl nitrogen. This was the second year that total chloride ion was collected and a slight increase was shown for 2003. However, it is still below the MPCA warning levels. The TSI values in 2003 improved for TP, Secchi transparency, and CLA. The TSI values indicate that chlorophyll-*a* is being limited by phosphorus and low Secchi disk readings are due to algal turbidity. The lake elevation of Kismet Basin has decreased overall as the water quality has improved. This may show that as surface water inputs are limited, higher quality groundwater has a larger impact on the overall water quality of the lake. Continued bi-weekly water quality and level monitoring are recommended.

Long Lake

After 2002, a year in which some of the highest water levels were recorded, Long Lake's elevation began to decline. In 2003 the lake's elevation peaked in May and then fell below its ordinary high water mark for the remainder of the monitoring season. The water quality in Long Lake has remained consistently poor in the years the lake has been monitored. The Minnesota Pollution Control Agency determined the presence of a statistically significant negative trend in 2002 for Secchi disk transparency over the period of record. In 2003, all water quality parameters worsened with the only exception of chlorophyll-*a* concentrations, which showed a slight improvement. The TSI values indicate that chlorophyll-*a* is being limited by phosphorus and low Secchi disk readings are due to algal turbidity. Continued bi-weekly water quality and level monitoring are recommended to determine what these results may conclude.

Brown's Creek Water Quality

From 1998 to 2003, WCD took grab samples and flow-weighted samples during both baseflow and storm event conditions at two locations within the stream. Two automated samplers continuously monitored stream flow and collected storm and baseflow composite samples from March through November. Brown's Creek was monitored at McKusick Road, approximately 1.7 miles from the mouth and at Highway 96, 0.2 miles from the mouth of the Creek.

The stream monitoring sites on Brown's Creek are producing valuable baseline water quality information that will be a helpful tool in determining a healthy balance of resources as the watershed continues to experience growth and changes in land use. To determine the health of the stream, discharge (base and storm), chemical, physical and biological parameters are compared on a year-to-year basis and with other streams in the region.

Baseflow at the mouth of the stream averaged approximately 7 cfs in 2001, 10 cfs in 2002 and 7 cfs in 2003. This reflects the observations from the previous years' monitoring efforts. While

the base flow may fluctuate with climatic cycles, it provides a good point of reference for overall groundwater recharge to the stream. A drop in baseflow during periods of normal or high precipitation may suggest a loss of groundwater recharge in the watershed. This was not seen in 2003.

In 2003, there were two large runoff events: 89 cfs on May 12th, 140 cfs on June 26th. Both of these events were the result high magnitude rainfall. These two storms dominated the hydrology of Brown's Creek in 2003. Brown's Creek was at baseflow levels for the majority of the year.

While phosphorous has not been identified as a problem nutrient at the mouth or within other reaches of the stream, it is a common nutrient associated with lake eutrophication and is therefore routinely monitored in streams throughout the state. Total loading and loading per unit area are additional tools to help assess the health of the stream. In 2003, the average concentration of total phosphorus of 0.46 mg/L was slightly greater than in 2002. The trend from 2000-2003 has been a steady increase in the average concentration of total phosphorus in Brown's Creek. This trend should be closely monitored.

Total suspended solids (TSS) concentration is a good measure of the particulate matter in the stream and can be correlated to disturbances within the watershed. The average TSS in 2002 at the mouth was 264 mg/L and at McKusick Road was 162 mg/L. This is above both the existing conditions sampled in 1993 and 1994 and the modeled condition from the H&H Study. During 2003, TSS concentrations averaged 633 mg/L at the mouth, and 54 mg/L at McKusick. The TSS concentration can be considered high impact at the mouth according to the modeled concentrations for the H&H study. Therefore turbidity or suspended solids are and should continue to be a concern for Brown's Creek.

Temperature and fisheries in Brown's Creek have been were monitored by the DNR in past years. Temperatures were recorded at various locations in Browns' Creek to monitor existing conditions and to identify areas where warming or cooling may occur. Daily maximum and mean water temperatures in Brown's Creek generally decrease in the downstream direction. Recent years have been some of the best recorded for the brown trout population in Brown's Creek, although the DNR did not survey Brown's Creek in 2003. They now find trout over a mile upstream of the bridge. Sampling has been extended to include this upstream habitat. This upstream expansion is directly linked to habitat improvement projects through the golf course. The upstream expansion and overall increase in trout numbers is viewed by the DNR as a positive sign for Brown's Creek. Brown's Creek was also monitored in three locations by volunteers for benthic macroinvertebrates and analyzed through the use of Hilsenhoff's biotic index. The biotic index for Brown's Creek reflects *very good* to *excellent* water quality.