BROWN'S CREEK WATERSHED DISTRICT

2004 ANNUAL REPORT

Prepared by:

Brown's Creek Watershed District Board of Managers
Craig Leiser, President
Gail Pundsack, Vice-President
Connie Taillon, Treasurer
Gerald Johnson, Secretary
Rick Vanzwol

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2004 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 - 2004 BOARD OF MANAGERS

Manager/ Address	Position	Term Expires	Community Liaison
Craig Leiser 10300 Kismet Lane Stillwater, MN 55082	President	10/22/07	Grant
Gail Pundsack 5901 Omaha Ave N Stillwater, MN 55082	Vice-President	10/22/07	Hugo May Tn.
Connie Taillon 3374 Staples Pl Stillwater, MN 55082	Treasurer	10/22/06	Oak Park Heights Lake Elmo
Gerald Johnson 302 Edgewood Avenue Stillwater, MN 55082	Secretary	10/22/06	City of Stillwater
Vacant			Stillwater Twnshp

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. The following is a list of all contract support staff utilized by the BCWD in 2004.

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 55128 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. 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. Maintenance 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 Stabilization			
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

2004 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**

d. Audit Report

The audit of financial management of the District for January 1-December 31, 2004 was performed by the firm of HLB Tautges Redpath, Ltd. This audit revealed that… "in all material respects, the respective financial position of the governmental activities, each major fund and the aggregate remaining fund information of the Brown's Creek Watershed District, as of December 31, 2004, and the respective changes in financial position for the year ended in conformity with accounting principals generally accepted in the United States of America." A full copy of the 2004 audit is enclosed in Appendix A.

e. Citizens Advisory Committee

Continued attempts were made throughout 2004 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.

In 2004, the District resolved a flowage easement issue with a downstream landowner by purchasing flowage rights across the property through a flowage agreement recorded with the Washington County Recorders Office. After continued project monitoring, the District felt as though the project has proven effective. The District applied for and won the Minnesota Association of Watershed District's 2004 project of the year award for the Trout Habitat Preservation Project.

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 22 new permits; closed 10 completed permits, and withdrew two permits in 2004

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, the North Washington Groundwater Study 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. This study was completed in 2004 and is being used as a tool 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. This information was also used to assist Washington County in assessing floodplains for a FEMA map update of the county. The hydrologic information is also available through a GIS tool developed in 2004. The GIS tool is an easy interface to access District geospatial information, such as the 100-year high water levels for each delineated subwatershed in the District.

d. Kern Center Pond

Executed a cooperative agreement with the City of Oak Park Heights to allow the Kern Center Pond to act as a regional storm water treatment facility that 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. Worked with City of Oak Park Heights to develop an operations and maintenance plan for the Kern Center Pond. Established a monitoring plan to be implemented by the District to determine the pond's long-term effectiveness. The District designed and purchased educational signage that will be displayed at the site to demonstrate best management practices that will protect natural resources by meeting the District's rules.

e. Long Lake in City of Stillwater

The District continued to assist the City of Stillwater in analyzing the impacts of various outlet elevations for Long Lake; conducted a sediment survey on Long Lake; and began to prepare to conduct a strategic lake management plan for Long Lake. The District also continues to 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.

f. 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. The District continued to provide education of residents through the District website and also prepared and circulated a newsletter to approximately 3,500 residences.

g. 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.

h. 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 2005

a. 2005 Work Plan

The BCWD will continue to conduct 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 program will be expanded in 2005 by adding an additional long-term automated stream monitoring station and macroinvertebrate monitoring on Brown's Creek as it crossed under Washington County Hwy 15, as well as adding an additional lake-monitoring site on South School Section. These additional monitoring stations are in preparation for potential TMDL studies on the MPCA listed impaired waters.

Long Lake in Stillwater has been identified as an impaired water body by the Minnesota Pollution Control Agency. Through the discussions regarding the lake elevations, citizens noted their concerns with degrading water quality as well. The District will begin a Long Lake Strategic Lake Management Plan to identify implementation activities to improve water quality. The District will apply for a Board of Water and Soil Resources (BWSR) Challenge Grant to assist in the implement of the plan in cooperation with the cities of Oak Park Heights and Stillwater. Associated with this project, the District will also analyze the Stillwater Market Place

Area to determine locations for beneficial storm water retrofits and look for opportunities to collaborate on these improvements with the City of Stillwater.

The District will amend the Second Generation Management Plan to include the Kern Center Pond Expansion as a District capital improvement project. This will allow the District to consider the City of Oak Park Height's request for financial assistance with the construction costs for the Kern Center Pond Expansion. The District has already agreed to monitor the erosion control during construction and monitor the infiltration and overall effectiveness of the regional storm water management facility long-term.

The District will also begin monitoring the infiltration basin at the Bradshaw project to determine the ponds effectiveness over time.

The BCWD will continue to actively issue permits within the watershed and enforce the conditions of permits already issued, as well as review and revise the rules for the permitting program. The District will work harder to educate municipalities and citizens about the permitting program to avoid after-the-fact permits and permit violations. 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 District's permit program is effective in protecting natural resources in areas of new development. However, the permit program cannot require pre-existing development to meet the District's rules. The District will explore the possibilities of developing an incentive program to encourage the installation of best management practices to address nonconforming pre-existing development.

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 2005 and fall/winter 2005); 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. 2005 BCWD Budget

	ADMIN (103D.905,3)	MGMT PLAN (103B.241)	TOTAL
General Expenses			
Accounting	5,500.00		5,500.00
Bonding & Insurance	4,000.00		4,000.00
Secretarial Services	1,500.00		1,500.00
Printing & Notices	750.00		750.00
Postage & Delivery	2,000.00		2,000.00
Manager Per Diem and Expenses	5,500.00		5,500.00
MAWD Dues	2,000.00		2,000.00
MN League of Cities	1,200.00		1,200.00
Miscellaneous Expenses	500.00	2,000.00	2,500.00
Legal Fees	13,000.00	30,000.00	43,000.00
Administrative Services/WCD	30,600.00	29,400.00	60,000.00
Community Relations		3,000.00	3,000.00
Equip. Maintenance and Upgrades		2,000.00	2,000.00
Staff Engineer		69,600.00	69,600.00
Permitting Processing & Inspection		8,300.00	8,300.00
Permitting, Legal Review		5,700.00	5,700.00
Permitting, Engineer Review		66,000.00	66,000.00
Baseline Water Quality Monitoring		44,600.00	44,600.00
Second Generation Plan Implementation			
Education.		10,000.00	
Volunteer Stream Monitoring		4,500.00	
Hwy 36 Feasibility Analysis		28,000.00	
Benz Lake Flooding Management Feasibility		20,000.00	
Groundwater Program		20,000.00	
BMP Monitoring Program-Bradshaw		13,000.00	
Invasive Species Control Program		18,000.00	113,500.00
Kismet Lake Stabilization			
Monitoring, Operation & Maintenance		10,000.00	10,000.00
Trout Habitat Preservation Project:			
Monitoring, Operation & Maintenance		8,000.00	8,000.00
Long Lake Strategic Management Plan			
Data Gathering-two inlet sites		19,100.00	
Data Gathering-pond surveys, etc.		12,500.00	
Watershed & Lake Modeling		15,000.00	
Strategic Management Plan		7,500.00	
Watershed Loading Plan		10,000.00	64,100.00
Permit Escrows		26,220.00	26,220.00

	ADMIN (103D.905,3)	MGMT PLAN (103B.241)	TOTAL
Kern Center Pond Expansion			
Construction Observation & Follow up		3,500.00	
Monitoring, Operations & Maintenance		7,500.00	11,000.00
Miscellaneous Projects & Grant Prep			
Rules Review/Evaluation		10,000.00	
H & H II-Phase III to EOR		10,716.75	
H & H Model Upgrade		5,000.00	
GIS Management Tool		5,000.00	30,716.75
Contingency Reserve		27,500.00	27,500.00
TOTAL, OPERATING EXP. & MGMT. PLAN PROJECTS:	**66,550.00**	**551,636.75**	**618.186.75**

ESTIMATED REVENUES:	
Fund Balance- Designated Cash Flow	50,000.00
Undesignated Funds Balance	70,000.00
Reserved Fund Balance-Permit Escrow	26,220.00
Interest Income	1,000.00
Metropolitan Council WOMP Grant	4,000.00
Permit Fees	68,000.00
Tax Levy	398,966.75
TOTAL, EST. REVENUES:	**618,186.75**

APPENDIX A

2004 AUDIT REPORT

APPENDIX B

2004 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 2004, 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 2004 lake grades for BCWD lakes were: Kismet Basin -- B+, Goggin's Lake -- C- and Long Lake -- C-. All three lakes showed slight improvements in water quality in 2004. 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. Water quality in a lake depends on a number of different variables such as: size of the contributing watershed, depth of the lake, and current amount of nutrients available and periodically released from the lake bottom, as well as external nutrient sources. Low water quality ratings of BCWD lakes are most likely due to the shallowness of the lakes. Shallow lakes do not completely stratify in the summer; therefore, they are capable of continually mixing. Mixing causes phosphorus to be distributed throughout the water column, causing more frequent heavy algal blooms.

Both WCD staff and volunteers monitored water elevations on lakes and wetlands throughout the Brown's Creek Watershed District. The twelve lakes and four wetlands monitored for water elevation showed peaks in spring and early summer of 2004 and then steadily declined until the very end of the monitoring season when heavier precipitation events caused an increase in elevation on many of the lakes. The decrease in elevation throughout the summer was in large part due to the lack of precipitation during this period. Average water elevation in lakes with the exception of Goggin's Lake were in the low to moderate flooding impact ranges, as compared to the Brown's Creek Watershed District's 2003 Hydrologic/Hydraulic Study.

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 six years it has been monitored for water quality. In 2004, average TP and average Secchi transparency each stayed the same and CLA increased slightly when compared to 2003. This increase in CLA may be due to a component of internal loading and existing nutrients allowing for more algal production. In 2004, the water level was

at its highest in mid-June and steadily declined after that point until late in the 2004 monitoring season. 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. 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-June, Kismet Basin's elevation began to decline. The basin remained below the ordinary high water mark for the entire monitoring season. The water quality of Kismet Basin improved in 2004 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. Total chloride ion was collected again in 2004, and the same average concentrations were shown in both 2003 and 2004. However, it is still below the MPCA warning levels. The TSI values in 2004 became slightly poorer for TP, but showed slight improvements for Secchi transparency and CLA. The TSI values indicate that chlorophyll-*a* is being limited mainly by phosphorus and low Secchi disk readings are due to algal turbidity. Some slight divergence in TP and CLA TSI values may be attributed to nutrient inputs from groundwater sources. 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

In 2004 the lake's elevation peaked in June but remained below its ordinary high water mark for the entire 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 2004, all water quality parameters improved. Average Secchi disk transparency doubled from 2003 to 2004 and CLA concentrations decreased by half from 2003 to 2004. In 2003, the Minnesota Pollution Control Agency determined that the improvements in water quality reflected positively for Long Lake indicating that the statistically significant negative trend found in 2002 was not occurring in 2003 based on the latest data and that it showed no recent trend in transparency. 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 2004, 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.

Using a combination of composite and grab samples, total phosphorus and total suspended solid loads were calculated. The results were compared to a chart of export coefficients in a variety of land use scenarios and show the Brown's Creek Watershed within regional averages for total phosphorus at both sites. In 2003 and 2004, the total phosphorus and total suspended solids loading estimates greatly decreased from the loading levels of 2001-2002. The lack in overall runoff during both the 2003 and 2004 seasons is the major contributor to the lesser amounts of total loads that were seen. The minimal snowfall in the winters of 2002-03 and 2003-04 and the dry summers of both 2003 and 2004 primarily caused the runoff reduction experienced in 2003 and 2004. This reduction in total flow may also be a reflection of the diversion structure rerouting the nutrient and sediment-laden storm waters from the urban south tributary away from 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 nor 2004. 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 *good* to *excellent* water quality.