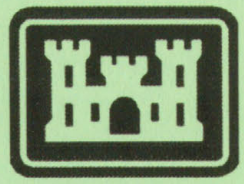


US Army Corps
of Engineers®
Chicago District

LAKE MICHIGAN DIVERSION ACCOUNTING WATER YEAR 2000 ANNUAL REPORT

EXECUTIVE SUMMARY

This document is the Water Year (WY) 2000 Annual Report of the Chicago District, U. S. Army Corps of Engineers activities in the monitoring and review of the accounting of Lake Michigan diversion flows through Chicago, Illinois as directed by the 1980 amendment to the 1967 U. S. Supreme Court Decree. Additionally, this report serves to summarize the Corps' major accomplishments with respect to the mission as mandated by the Water Resources Development Act of 1986, PL99-662, Section 1142. This act gave the Corps complete responsibility for diversion accounting effective 1 October 1987. This report provides an overview and audit of flow measurements and accounting computed by the Corps of Engineers for WY 2000, 1 October 1999 through 30 September 2000 and for WY 2001, 1 October 2000 through 30 September 2001.

The Lake Michigan Diversion Accounting Reports for WY 2000 and WY 2001 have been completed. The State of Illinois diverted 2,584 cfs during WY 2000 and 2,698 cfs during WY 2001. This diversion is 616 cfs and 502 cfs less than the 3,200 cfs 40 year average diversion specified in the modified decree for WY 2000 and WY 2001, respectively. The running average of the diversion for WY 1981 through WY 2000 is 3,318 cfs, or 118 cfs over the annual allocation; the running average of the diversion for WY 1981 through WY 2001 reduces to 3,298 cfs, or 98 cfs over the annual allocation. Also, the annual average diversion has exceeded the 3,680 cfs annual limit three times, once more than the maximum number of times allowed in the decree. Additionally, the absolute annual maximum of 3,840 cfs has been exceeded during the WY93 accounting period. The cumulative deviation is –2,360 cfs-years and –1,858 cfs-years at the end of WY 2000 and WY2001, respectively. The negative sign indicates a cumulative flow deficit. The maximum allowable cumulative flow deficit specified in the decree is -2,000 cfs-years.

Table Of Contents

Executive Summary i

Introduction 1

Authority for Report 1

History of the Diversion 2

Diversion Accounting Procedures 6

WY00 Revisions to Diversion Accounting Procedures 10

Accounting Results 12

Discussions of Results 14

Columns 14

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, United States Geological Survey (USGS) AVM Gage Record 14
Column 2: Diversions from the CSSC above the Gage 14
Column 3: Total Flow through the CSSC 14
Column 4: Groundwater Discharged to the CSSC and Adjoining Channels 15
Column 5: Water Supply Pumpage from Indiana Reaching the CSSC 16
Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC 17
Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC 18
Column 8: Total Deductions from the CSSC Romeoville Gage Record 18
Column 9: Lake Michigan Pumpage Not Discharged to the CSSC 18
Column 10: Total Diversion 20
Column 11 through Column 13: Lake Michigan Diversion Components 20
Column 11 - Lake Michigan Pumpage Accountable to Illinois 21
Column 12 - Runoff from the Diverted Lake Michigan Watershed 21
Column 13 - Direct Diversion through the Lakefront Structures 21
Sum of Columns 11 through 13 22

Budgets **25**

Budget 1 and Budget 2: Water Supply Pumpage 25
Budget 1: Diverted Lake Michigan Water Supply *25*
Budget 2: Groundwater Diverted to the CSSC *25*
Budgets 3 through Budget 6: Stream Gaging Stations 26
Budgets 7 through Budget 13: MWRDGC Water Reclamation Facilities 27
Budget 7: Northside Water Reclamation Facility *27*
Budget 8: Upper Des Plaines Pump Station *28*
Budget 9: Mainstream and Des Plaines TARP Pumping Stations *28*
Budget 10: Stickney Water Reclamation Facility *34*
Budget 11: Calumet TARP Pumping Station *34*
Budget 12: Calumet Water Reclamation Facility *39*
Budget 13: Lemont Water Reclamation Facility *39*
Aggregated Results of Four MWRDGC Water Reclamation Facilities *41*
Budget 14: CSSC System Balance *41*
Summary of Budget Results *44*

Areas for Improvement **47**

Tunnel and Reservoir Plan Models 47
Data Preprocessing 48
MWRDGC Upper Des Plaines Pump Station 48
O'Hare and Egan Basin Flow Transfer 49
HSPF Snowmelt Simulation 49
Budgets 7A and 7B 50
TNET Model Confirmation/Update 50
Baseflow Matching 50
Calibration Period 51
Budgets 7, 12, 13 High Flow Under Prediction 51
Budget 14 Calibration 51

Summary **52**

References **53**

Appendix A - Background of Lake Michigan Diversion Accounting **A-1**

Appendix B - Summary of Daily Diversion Flows **B-1**

List of Tables

Table 1 - Description of the Diversion Accounting Columns 7
Table 2 - Description of the Diversion Accounting Computational Budgets 8
Table 3 - Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified Supreme Court Decree 12
Table 4 - Lake Michigan Diversion Accounting – WY2000 Summary of Diversion Flows 13
Table 5 - Components of the Diversion by the State of Illinois Based on Columns 11 through 13 23
Table 6 - Stream Gage Flow Separation 27
Table 7 - WY 2000 Summary of Simulation Statistics 30
Table 8 – WY 2000 Summary of Flow Components for the CSSC System Balance 46

List of Figures

Figure 1 Development of the Chicago Sanitary and Ship Canal System 4
Figure 2 Location Plan - Lake Michigan Diversion at Chicago 5
Figure 2A Budget and Column Interactions 9
Figure 3 Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13 24
Figure 4 Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility ... 31
Figure 5 Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station 32
Figure 6 Map of Mainstream, Des Plaines and Calumet TARP 36
Figure 7 Budget 9 - Simulation of the MWRDGC Mainstream and Des Plaines TARP Pumping Station 37
Figure 8 Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility .. 38
Figure 9 Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station 40
Figure 10 Budget 12 – Simulation of the MWRDGC Calumet Water Reclamation Facility 42
Figure 11 Budget 13 – Simulation of the MWRDGC Lemont Water Reclamation Facility . 43
Figure 12 Budget 14 – CSSC System Balance 45

Introduction

The diversion of water from the Lake Michigan watershed is of major importance to the Great Lakes states and to the Canadian province of Ontario. The states and province that border the Great Lakes have concerns with both diversions during periods of low lake levels, as well as the long term effects of diversion. To insure that the concerns of these interested parties are considered, the U. S. Army Corps of Engineers has been given the responsibility for the accounting of flow that is diverted from the Lake Michigan watershed.

The Corps of Engineers, Chicago District, is responsible for monitoring the measurements and the computation of the diversion of Lake Michigan water by the State of Illinois. For the water year 1981 and 1982 (WY81 and WY82) reports, the calculations were made for the Illinois Department of Natural Resources - Office of Water Resources (IDNR-OWR), formerly known as the Illinois Department of Transportation - Division of Water Resources (IDOT-DWR), by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), formerly known as the Metropolitan Sanitary District of Greater Chicago (MSDGC). The computations for Water Year 1983 (WY83), WY84 and WY85 (1 October 1982 through 30 September 1985) were performed by the Northeastern Illinois Planning Commission (NIPC) for IDNR-OWR. The Corps reviewed, modified, and updated the WY84 and WY85 diversion accounting performed by NIPC. The computations for WY86 were performed jointly by NIPC (under contract to the Corps of Engineers) and the Corps of Engineers; the computations for WY91 and WY92 were performed jointly by Christopher B. Burke Engineering, Ltd., NIPC and the Corps of Engineers. The computations for WYs 87-90 and 93-97 were performed solely by the Corps of Engineers. The computations for WY 98 and WY 99 were performed jointly by Mead and Hunt (under contract to the Corps of Engineers) and the Corps of Engineers. This report represents the final Lake Michigan diversion accounting for WY00 that was performed by CTE Engineers, Inc. (under contract to the Corps of Engineers).

Authority for Report

Under the provisions of the U.S. Supreme Court Decree in the Wisconsin, et. al. v. Illinois et. al., 388 U.S. 426,87 S.Ct. 1774 (1967) as modified in 449 U.S. 48, 101 S.Ct. 557 (1980), the Chicago District of the Corps of Engineers is responsible for monitoring the measurement and computation of diversion of Lake Michigan water by the State of Illinois. The Water Resources Development Act of 1986 (Section 1142 of PL 99-662) gave the Corps total responsibility for the computation of diversion flows as formerly done by the State of Illinois. The Corps' new mission became effective on October 1, 1987.

History of the Diversion

Water has been diverted from Lake Michigan at Chicago into the Mississippi River Watershed since the completion of the Illinois and Michigan (I & M) Canal in 1848. At that time, the diversion averaged about 500 cubic feet per second (cfs). The I & M Canal was built primarily to serve transportation needs by providing a connecting watercourse between the Great Lakes and the Mississippi River system.

With the development of the Chicago metropolitan area, sewer and drainage improvements led to severe sanitation problems in the mid to late 1800's. The newly constructed sewers moved water and wastes into the Chicago River, which until 1900 drained to Lake Michigan. The water quality of Lake Michigan deteriorated and contaminated the city's primary water supply.

A second problem that occurred during this time period was an increase in the overbank flooding within the city. As more roads were built and buildings constructed, the sewer system was correspondingly expanded. The increase in impervious area from the newly constructed roads and buildings increased the rate and volume of stormwater runoff and resulted in increased flooding.

As a solution to the sanitation and flooding problems, construction of the Chicago Sanitary and Ship Canal (CSSC) was undertaken and was completed in 1900 by the MWRDGC. Construction of the CSSC allowed the flow direction of the Chicago River to be reversed (Figure 1). The CSSC followed the course of the older I & M Canal. The CSSC is much larger than the I & M canal and can handle the Chicago River flow, as well as increased shipping. In 1938, the Chicago River Controlling Works (CRCW) was constructed at the mouth of the Chicago River. The CRCW regulates the amount of Lake Michigan water allowed to pass into the river and restricts river flooding from entering Lake Michigan. The water levels in the CSSC are controlled by the Lockport Lock and Dam.

Between 1907 and 1910, the MWRDGC constructed a second canal called the North Shore Channel. It extended from Lake Michigan at Wilmette in a southerly direction 6.14 miles to the north branch of the Chicago River. The Wilmette Pumping Station, also known as the Wilmette Controlling Works, regulates the amount of Lake Michigan flow allowed down the channel through the use of one vertical lift gate. The four abandoned 250 cfs pumps have not been used for diversion since 70's.

Construction of a third canal, the Calumet Sag Channel, was completed in 1922. The canal connects Lake Michigan through the Grand Calumet River, to the CSSC. The Calumet Sag Channel was constructed to carry sewage from South Chicago, Illinois and East Chicago, Indiana. Flow through the canal was controlled

by the Blue Island Lock and Dam. The O'Brien Lock and Dam, which replaced the Blue Island Lock and Dam, was completed in 1967 and is located on the Calumet River. The O'Brien Lock and Dam regulates the flow of Lake Michigan waters down the Calumet Sag Channel. Figure 2 shows the affected watershed.

The current Supreme Court Decree specifies several limitations on the diversion of Lake Michigan water by the State of Illinois. The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in two accounting periods due to extreme hydrologic conditions in which the average diversion may not exceed 3,840 cfs. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the forty year period beginning with WY81.

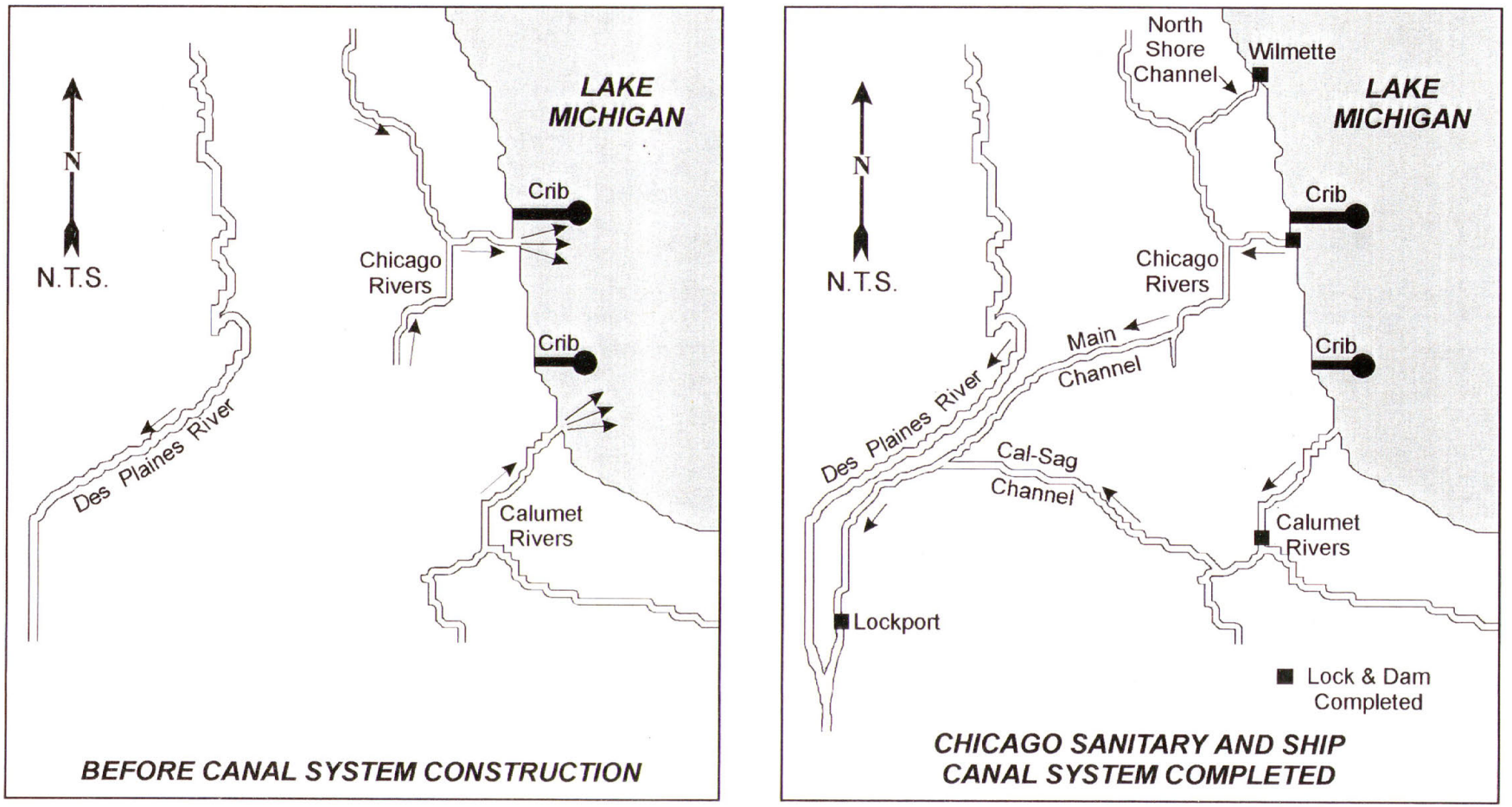


Figure 1 Development of the Chicago Sanitary and Ship Canal System

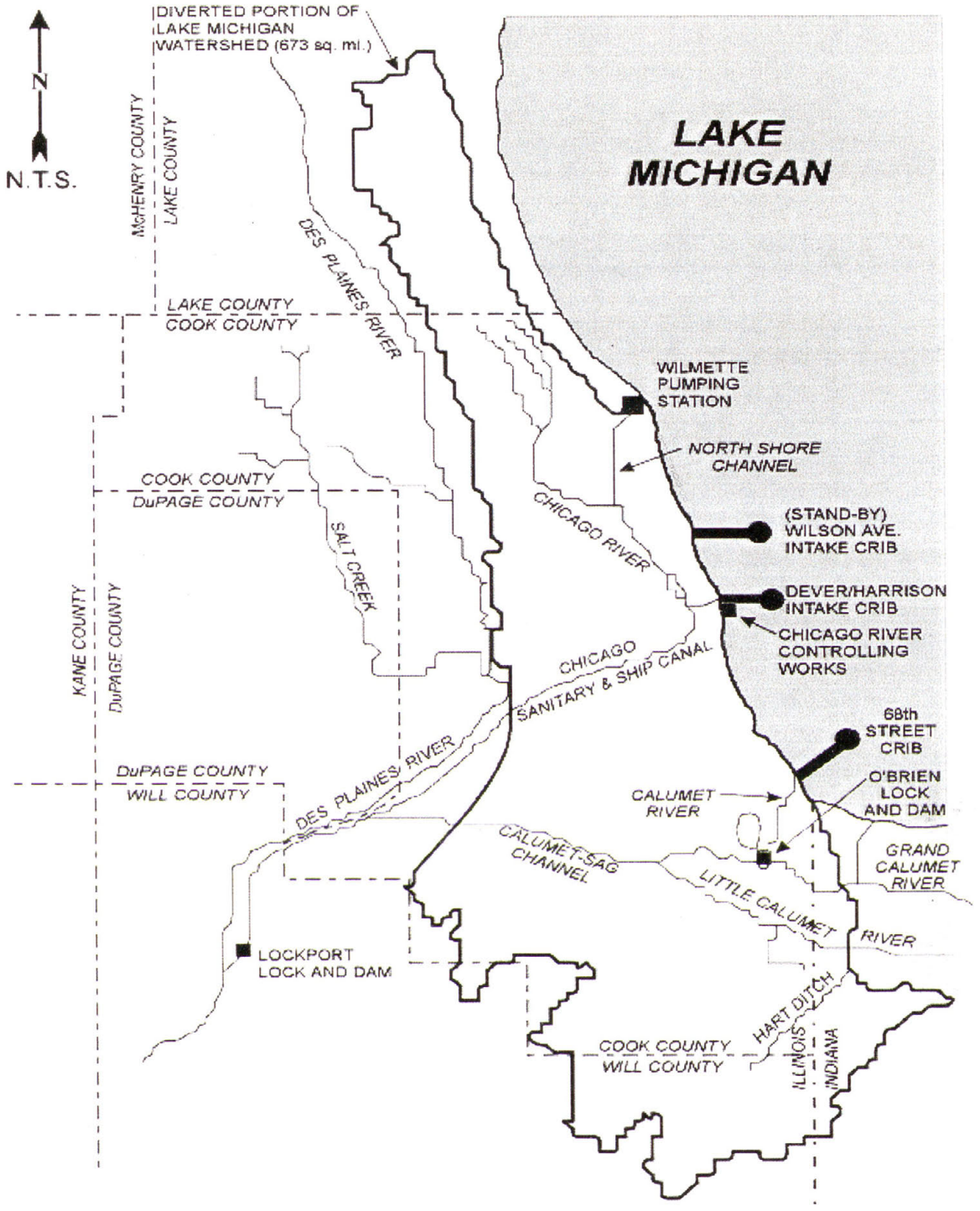


Figure 2 Location Plan - Lake Michigan Diversion at Chicago

Diversion Accounting Procedures

The Lake Michigan diversion accountable to the State of Illinois is calculated by using the AVM (Acoustic Velocity Meter) measured flow in the CSSC at Romeoville and deducting flows that do not constitute Lake Michigan diversion and are not accountable to the State of Illinois. Finally, additions are made to the Romeoville record for diversions that are not discharged to the canal. The deductions include groundwater water supply pumpage whose effluent is discharged to the canal, Lake Michigan water supply pumpage from Indiana discharged to the canal, runoff from the Des Plaines River watershed discharged to the canal, and water supply pumpage from Lake Michigan used for Federal facilities discharged to the canal. The additions to the Romeoville record include flows diverted from the canal upstream of Romeoville, and Lake Michigan water supply whose effluent is not discharged to the canal. This procedure represents the accounting method required by the Supreme Court Decree. A detailed discussion of the background of Lake Michigan Diversion Accounting is presented in Appendix A.

The diversion accounting results are presented as a series of columns that are defined in Table 1. Columns 1 through Column 3 are used to compute the total flow in the CSSC. Columns 4 through Column 7 present the deductions from the canal system flows with the total deduction being presented in Column 8. Column 9 presents the additions to the canal system record. Column 10 is the computed Lake Michigan diversion accountable to Illinois and is equal to the canal system flow minus the deductions plus the additions. Columns 11 through 13 are independent flow estimates for the three sources of diversion: water supply pumpage from Lake Michigan, runoff from the diverted Lake Michigan Watershed, and direct diversion through the lakefront structures. Column 11 through Column 13 are not used in the diversion calculation but are included as another estimate of the diversion for verification of the accounting flows in Column 10 where the sum of Columns 11 through 13 should theoretically equal the flow in Column 10. Note, that beginning in WY97 a consideration of consumptive use was made in the computations of Columns 4, 5, 7, 9 and 11. For a discussion of the reasons for the application of the consumptive use factor, the reader should review the WY1997 Diversion Accounting Report (USACE, 2001).

In addition to the diversion calculations presented in the 13 columns, 16 computational budgets are prepared as input to the diversion calculation and to verify the estimated flows that cannot be measured. A summary of these budgets is presented in Table 2. Budgets 1 and 2 do not compare simulated to measured flows but are summations of critical water supply pumpage data. Budget 3 through Budget 6 partition stream gage records into runoff and sanitary/industrial discharge components to estimate a portion of the runoff from the diverted watershed that is used as input to Column 12, Runoff from the Diverted Lake Michigan Watershed.

Budget 7 through Budget 13, and, beginning in WY2000, Budgets 7A and 7B compare simulated to measured flows at MWRDGC facilities. These budgets simulate all the deductible Des Plaines River Watershed flows contained in Column 6 and the deductible groundwater seepage into TARP contained in Column 4. These budgets also are used for verification of the diversion accounting procedures and give an indication of the accuracy of the diversion accounting models. Budget 14 compares canal system inflows and outflows. It is used primarily as a verification of modeling results as well as an indicator of the accuracy and completeness of measured/reported flows.

Table 1
Description of the Diversion Accounting Columns

Column	Description
1	Chicago Sanitary and Ship Canal (CSSC) at Romeoville AVM Gage Record
2	Diversion from the CSSC above the Romeoville AVM Gage
3	Total Flow Through the CSSC
4	Groundwater Pumpage Discharged into the CSSC and Adjoining Channels
5	Water Supply Pumpage from Indiana Reaching the CSSC
6	Runoff from the Des Plaines River Watershed which Reaches the CSSC
7	Lake Michigan Pumpage by Federal Facilities which Discharge to the CSSC and Adjoining Channels
8	Total Deduction from the CSSC Romeoville AVM Gage Record
9	Lake Michigan Pumpage Which is not Discharged into the CSSC
10	Total Diversion Accountable to the State of Illinois
11	Pumpage from Lake Michigan Which is Accountable to the State of Illinois
12	Runoff from the Diverted Lake Michigan Watershed
13	Direct Diversions Through Lakefront Control Structures Accountable to the State of Illinois

Figure 2A shows how the various budget computations are incorporated into the column computations. The left column lists the budgets while the right column lists what part of the budget calculation is used in each of the column calculations.

Table 2

Description of the Diversion Accounting Computational Budgets

Budget Number	Title	Description
1	Diverted Lake Michigan Pumpage	This budget sums the Lake Michigan water diverted by the State of Illinois in the form of Industrial and Municipal water supply. The results of this budget are used in Column 11.
2	Groundwater Discharged to the CSSC	This budget sums groundwater pumpages that are discharged to the CSSC. The results of this budget are used in Column 4.
3	North Branch Chicago River at Niles, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
4	Little Calumet River at the IL-IN State Line	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
5	Thorn Creek at Thornton, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
6	Little Calumet River at South Holland, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
7	MWRDGC Northside Water Reclamation Plant	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Northside Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Northside service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
7A	MWRDGC North Branch Pumping Station	This budget performs hydrologic and hydraulic simulations of the CSO overflows of the service areas tributary to the North Branch Pumping Station. The budget provides an internal verification of the accounting procedures.
7B	MWRDGC Racine Pumping Station	This budget performs hydrologic and hydraulic simulations of the CSO overflows of the service areas tributary to the Racine Pumping Station. The budget provides an internal verification of the accounting procedures.
8	Upper Des Plaines Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Upper Des Plaines Pumping Station. This budget provides a calibration point to verify models of the Des Plaines River watershed
9	MWRDGC Mainstream TARP Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Mainstream TARP Pumping Station. The results of this simulation are used in Budgets 10 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
10	MWRDGC Stickney Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Stickney Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Stickney service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
11	MWRDGC Calumet TARP Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Calumet TARP Pumping Station. The results of this simulation are used in Budgets 12 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
12	MWRDGC Calumet Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Calumet Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Calumet service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
13	MWRDGC Lemont Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Lemont Water Reclamation Facility. The simulations estimate the runoff from portions of the Des Plaines River watershed within the Lemont service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Column 6.
14	Chicago Canal System	This budget performs a water balance of the Chicago Canal System which includes the CSSC and adjoining channels. This budget provides a verification point for the accounting procedures.

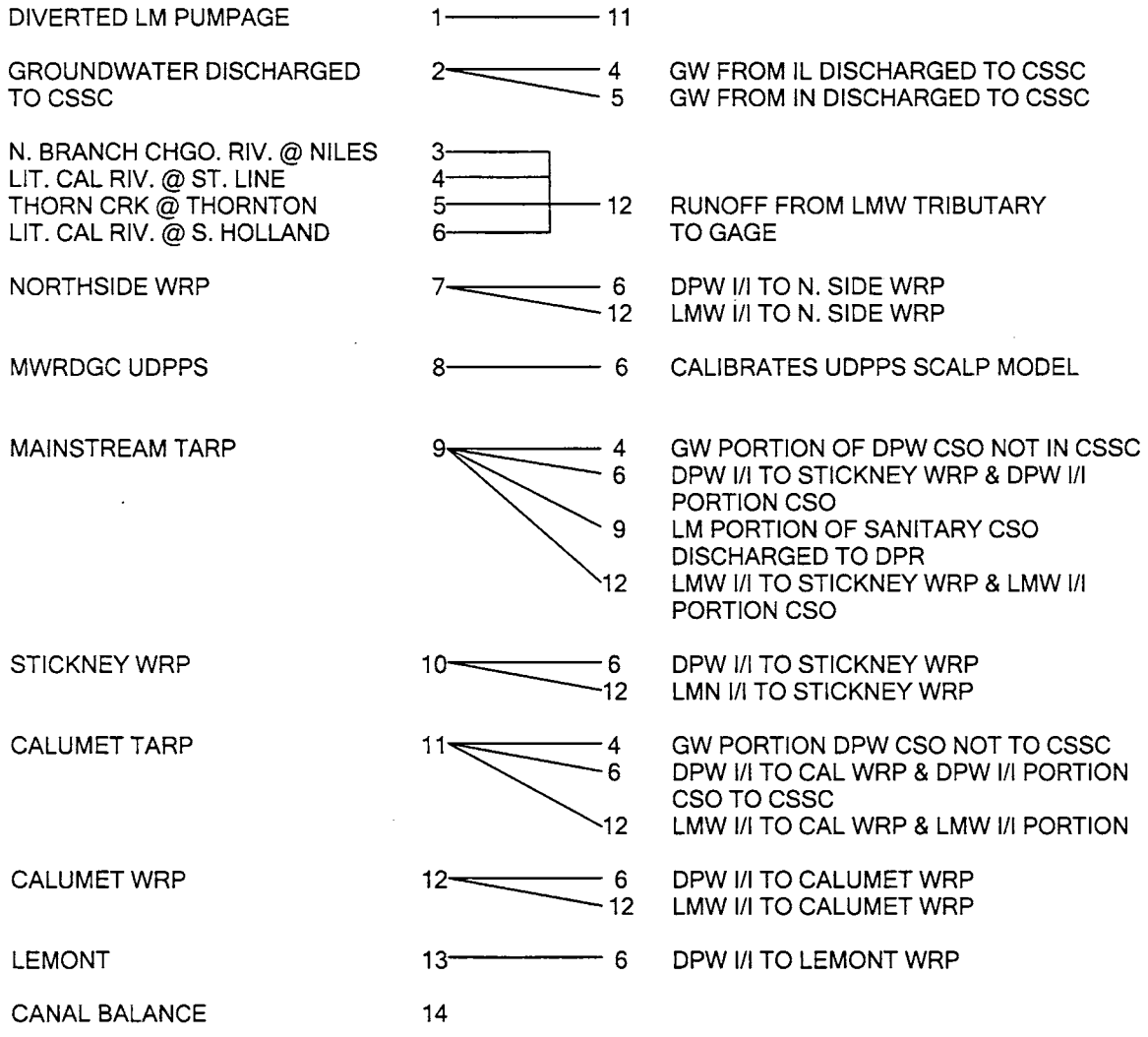


Figure 2A Budget and Column Interactions

Direct diversion flows through the lakefront structures have been estimated based on ratings. Beginning in WY 1997 the total direct diversion at CRCW and O'Brien Lock and Dam was also measured by the USGS' (United States Geological Survey) AVM's. The AVM on the Chicago River was installed in the vicinity of Columbus Drive Bridge during November 1996 and became operational in December 1996. The AVM at O'Brien Lock and Dam was installed during August-September 1996 and became operational in October 1996. Beginning in Water Year 1998 the direct diversion measured by AVM's was used in the Budget 14 and Column 13 computations. This procedure change meant that the best scientific knowledge and engineering practice were used in the Lake Michigan Diversion Accounting mandated by the U.S. Supreme Court. Under the existing Romeoville accounting system Budget 14 and Column 13 do not affect the total diversion accountable to the State of Illinois. Rather the direct diversion flows were used for checking water balances.

The City of Hammond is a primary diverter of Lake Michigan water in Indiana. In addition to providing water supply to the city itself, it also sells lake water to Chicago Heights, Calumet City, Burnham and Lansing (in Illinois) and to Highland, Griffith and Munster (in Indiana). Beginning in Water Year 1998, water supply to Chicago Heights, Calumet City and Burnham was included in computing the pumpage from Lake Michigan accountable to the State of Illinois (Column 11). Under the existing Romeoville accounting system Column 11 does not affect the total diversion accountable to the State of Illinois.

WY00 Revisions to Diversion Accounting Procedures

The following revisions were made to the diversion accounting procedures for WY00. A more detailed description of these changes is included in Appendix A.

- Two new budgets, Budgets 7A and 7B, were added to the accounting procedure. Budget 7A compares simulated and observed pumping at the North Branch Pumping Station. Budget 7B compares simulated and observed pumping at the Racine Pumping Station. These Budgets were added to help determine the accuracy of the TARP CSO simulations and for their potential future use as calibration points for the heretofore uncalibrated CSO overflows.

- Backflows from the CRCW, O'Brien and Wilmette Locks were removed from the Budget 14 accounting of outflows. It was noted that backflows were already accounted for in the Lakefront AVM measurements.

- The HSPF/SCALP/TNET models were calibrated using WY00 and WY01. Previously, the calibration had been done by accounting year. Using a two-year period allows the parameter adjustments to be correlated to the greater variability of conditions over two years. This allows the parameters to better

reflect the landuse conditions which do not change significantly over time within the combined sewer area. The WY99 meteorological data was used as a starting point in the calibration runs to allow the HSPF model to stabilize and have correct (antecedent) conditions at the beginning of the WY00 accounting year.

Accounting Results

The total WY00 Lake Michigan diversion accountable to the State of Illinois is 2,584 cfs (Column 10). This diversion is 616 cfs less than the 3,200 cfs average specified by the Decree. The running average to date, beginning with WY81, and rounded to the nearest cfs is 3,318 cfs. The cumulative deviation from the 3,200 cfs average is -2,360 cfs-years. The negative cumulative deviation indicates a water allocation deficit. The maximum allowable deficit is -2,000 cfs-years. The status of Illinois' diversion to date is shown in Table 3. The WY00 diversion accounting monthly summary is presented in Table 4. Tabular data on daily diversion flows is presented in Appendix B.

Table 3

Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified U.S. Supreme Court Decree

Accounting Year	Certified Flow (cfs)	Running Average (cfs)	Cumulative Deviation (cfs-yrs)
1981	3,106	3,106	94
1982	3,087	3,097	207
1983	3,613	3,269	-206
1984	3,432	3,310	-438
1985	3,472	3,342	-710
1986	3,751	3,410	-1,261
1987	3,774	3,462	-1,835
1988	3,376	3,451	-2,011
1989	3,378	3,443	-2,189
1990	3,531	3,452	-2,520
1991	3,555	3,461	-2,875
1992	3,409	3,457	-3,084
1993	3,841	3,487	-3,725
1994	3,064	3,456	-3,589
1995	3,197	3,439	-3,586
1996	3,108	3,418	-3,493
1997	3,114	3,400	-3,407
1998	3,060	3,382	-3,267
1999	2,909	3,357	-2,976
2000	2,584	3,318	-2,360

Table 4
Lake Michigan Diversion Accounting – WY2000
Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Oct-99	2,018.0	2.2	2,020.2	47.4	15.7	63.0	0.8	126.9	263.6	2,156.9	1,509.9	240.9	406.2
Nov-99	1,511.1	2.5	1,513.6	44.6	13.6	32.4	0.9	91.5	238.3	1,660.4	1,466.7	123.9	94.1
Dec-99	1,951.4	2.4	1,953.8	63.5	13.4	134.4	1.1	212.4	243.2	1,984.6	1,446.7	597.8	35.1
Jan-00	1,611.8	2.6	1,614.4	43.4	11.3	63.7	1.4	119.8	241.9	1,736.5	1,461.0	225.4	4.7
Feb-00	2,069.3	2.8	2,072.1	72.6	12.0	149.0	1.4	235.0	237.7	2,074.8	1,455.0	681.2	(12.6)
Mar-00	1,733.5	3.1	1,736.6	47.1	13.7	73.5	0.6	134.9	232.9	1,834.6	1,428.1	288.2	(5.0)
Apr-00	3,227.7	2.3	3,230.0	82.5	18.8	240.0	0.8	342.1	245.1	3,133.0	1,450.5	1,285.9	82.7
May-00	2,865.7	1.4	2,867.1	89.5	22.5	276.6	0.8	389.4	262.0	2,739.7	1,534.3	1,061.1	151.2
Jun-00	3,841.0	2.1	3,843.1	107.8	27.4	288.0	0.9	424.1	277.7	3,696.7	1,608.0	1,623.5	401.5
Jul-00	3,332.1	2.3	3,334.4	77.8	37.3	195.5	0.7	311.3	310.4	3,333.5	1,746.7	911.9	678.1
Aug-00	2,917.2	3.2	2,920.4	71.0	23.2	119.0	0.7	213.9	310.2	3,016.7	1,813.3	480.8	796.1
Sep-00	3,705.4	2.6	3,708.0	79.9	16.3	228.6	1.0	325.8	289.3	3,671.5	1,689.3	1,137.3	857.7
Averages	2,562.5	2.5	2,565.0	68.8	18.8	154.9	0.9	243.4	262.8	2,584.4	1,551.3	718.2	291.7

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 = Column 3 - Column 8 + Column 9.

Note: The averages presented in the final row are calculated from the daily values contained in Appendix B.

Deductions from the Romeoville Gage Record

Additions to the Romeoville Gage Record

Discussions of Results

The following is a discussion of the column functions and computational budgets. The discussion of the column functions describes the purpose of each column, as well as some observations on the WY00 values in the columns. The discussion of the computational budgets presents the purpose of each budget and the results of the budget flow balances. The results of the computational budgets are used in the diversion calculations where nine (9) budgets are used to verify the diversion simulation models. The columns are discussed first, followed by the discussion of the budgets.

Columns

The first ten (10) columns display the components of the diversion calculation and include the Romeoville flow, as well as the various deductions and additions to the Romeoville record. The final three (3) columns (Columns 11 through 13) display the three (3) diversion components (Lake Michigan pumpage accountable to Illinois, runoff from the diverted watershed, and direct diversion through the lakefront control structures). The sum of Columns 11 through 13 should theoretically equal the Romeoville based diversion calculation. A comparison of the sum of these three (3) columns to the calculated diversion (Column 10) is presented in the discussion of Column 11 through Column 13.

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, United States Geological Survey (USGS) AVM Gage Record

The discharge at Romeoville for WY00 was 2,652.5 cfs (based on an average of WY00 daily flows).

Column 2: Diversions from the CSSC above the Gage

Argonne Laboratories and Citgo Petroleum Corporation were the only major diversions from the CSSC upstream of the Romeoville gage in WY00. The average withdrawal upstream of the AVM for WY00 was 2.5 cfs.

Column 3: Total Flow through the CSSC

Column 3 is the sum of Column 1 and Column 2 and represents the total flow entering the canal system. The average CSSC flow was 2,565.0 cfs for WY00.

Column 4: Groundwater Discharged to the CSSC and Adjoining Channels

Column 4 is groundwater pumpage by communities, industrial users and other private users whose effluent is discharged to the CSSC. The groundwater pumpage data is reported by the Illinois State Water Survey (ISWS). Column 4 also includes the groundwater seepage into the TARP systems discharged to the CSSC. Column 4 is determined by summing all reported groundwater pumpages (with a consideration of consumptive use) tributary to the CSSC, along with the estimated groundwater seepage into the Mainstream and Des Plaines TARP (Budget 9) and Calumet TARP (Budget 11) systems. This total is then adjusted by subtracting the portion of groundwater present in the combined sewer overflows (CSO's) discharged to the Des Plaines River and other watercourses not tributary to the CSSC. This groundwater would normally have been discharged to the canal via treated sewage effluent had a CSO event not occurred. This method prevents double accounting of the combined sewer overflow portion of the groundwater supply pumpage.

Using ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois or if they were located within MWRDGC Water Reclamation Plant (WRP) service boundaries which discharged into the CSSC and adjoining channels. Beginning in WY97 those groundwater pumpage records were reduced by 10% to account for the consumptive use of the water between the point of supply to the point of discharge to the CSSC. Groundwater seepage into the Mainstream and Des Plaines TARP systems and the Calumet TARP system was determined through simulation and is discussed in Budgets 9 and 11. The groundwater constituent of CSO's is determined entirely thorough simulation.

According to the Supreme Court Decree of 1967, groundwater pumpage from the Lake Michigan watershed whose effluent is discharged to the CSSC is a deduction, except to the extent that these groundwater sources are supplied by infiltration from Lake Michigan. Current piezometric levels indicate that groundwater is discharging to the Lake; therefore, groundwater pumpage from within the Lake Michigan watershed that reaches the canal continues to be a deduction. Research literature will be reviewed periodically to verify this assumption, and to identify any changes that would indicate that Lake Michigan is recharging groundwater sources as a result of groundwater pumping.

Groundwater tributary to the canal is composed of 17.8 cfs of groundwater pumpage from the Lake Michigan watershed, 11.0 cfs of groundwater pumpage from outside of the Lake Michigan watershed, 29.6 cfs of groundwater seepage into the Mainstream and Des Plaines TARP systems, and 13.2 cfs of groundwater seepage into the Calumet TARP system. These values reflect the consumptive use factor of 10% as applied to both the groundwater pumpage from the Lake Michigan watershed and groundwater pumpage from outside of the Lake Michigan watershed.

In most years, a small portion of this groundwater supply pumpage (normally tributary to CSSC) is determined, through simulation, to be discharged to the Des Plaines River and other watercourses not tributary to the CSSC in the form of CSO's. The groundwater portion of these CSO's are then subtracted from the groundwater deduction of Column 4. The total of the above components, Column 4, is 68.8 cfs and represents a deduction from the Romeoville record. This flow is an decrease of 49.0 cfs from WY99 mainly due to the revisions to the groundwater seepage to the tunnel during calibration.

Column 5: Water Supply Pumpage from Indiana Reaching the CSSC

Column 5 represents the computation of Indiana water supply reaching the canal through the Grand Calumet and the Little Calumet Rivers. In the case of the Little Calumet River, a drainage divide exists east of the confluence with Hart Ditch. Therefore, flows from Hart Ditch, including virtually all dry weather flows, normally flow westward into Illinois. Under high flow conditions, the drainage divide may shift westward and a portion of the Hart Ditch flows may be diverted eastward to Burns Ditch and ultimately to Lake Michigan. However, it is believed that the occurrence in the shift in the drainage divide is infrequent and the flow that is diverted eastward is insignificant. Therefore, it is assumed that all effluent discharged into Hart Ditch and the Little Calumet River west of the divide flows westward. For WY00, total flow in the Little Calumet River was 33.1 cfs with 6.6 cfs of that flow determined to be Indiana water supply (including a consideration of consumptive use).

The Grand Calumet River has a summit. On one side of the summit the flow is toward Lake Michigan, on the other side of the summit the flow is toward the Calumet Sag Channel which flows into the CSSC. However, the location of the summit is variable and highly influenced by Lake Michigan levels (USGS, 1984). Thus the calculation of this deduction from the Romeoville record is also influenced by Lake Michigan levels. Beginning with the WY92 accounting, Grand Calumet River flow was measured by a gage that was installed in 1991 that began officially measuring flows on 1 October 1991.

Flow in the Grand Calumet River contains a very high proportion of treatment plant discharge. Through WY92, the flow in the Grand Calumet River attributed to Indiana water supply pumpage was set to the sum of water supply for East Chicago, Whiting, and Hammond (whose pumpage includes water supply for Munster, Highland and Griffith). This method is an oversimplification of the actual conditions. Chicago District developed a reconnaissance level, unsteady state model of the river for the United States Environmental Protection Agency (US EPA). From this model, relationships were developed to proportion the treatment plant discharge into the flow to the CSSC and Lake Michigan. The flow summit generally occurs at the Hammond outfall or between the Hammond and East Chicago outfalls.

The equations below determine the percentage of flow from each treatment plant flowing west to the CSSC based on Lake Michigan water level:

For CCD < 0.3 ft

$$Flow = 0.45 * HW$$

For CCD >= 0.3 ft and CCD < 1.5 ft

$$Flow = (0.22 * CCD^3 - 0.15 * CCD^2 + 0.06 * CCD + 0.45) * HW$$

For CCD >= 1.5 ft and CCD < 1.8 ft

$$Flow = HW + (CCD - 1.5) / 0.3 * EC$$

For CCD > 1.8 ft

$$Flow = HW + EC$$

Where CCD is the lake level in feet (Chicago City Datum) measured at Calumet Harbor, HW is the daily combined water supply pumpage by Hammond and Whiting, and EC is the daily water supply pumpage by East Chicago. Low lake levels in WY00 resulted in less water supply pumpage reaching the CSSC.

The total Grand Calumet flow reaching Illinois in WY00 was measured as 14.1 cfs. Of that, 12.2 cfs was determined to be water supply pumpage. Therefore, the total WY00 Indiana water supply deduction, including the flow from the Little Calumet and Grand Calumet Rivers is 18.8 cfs. This flow is 6.6 cfs less than the Indiana water supply deduction for WY99, which was 23.3 cfs.

Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC

The WY00 average discharge of Des Plaines River watershed runoff reaching the canal (Column 6) is 154.9 cfs. This deduction is determined almost entirely through simulation. The runoff is composed of two elements, surface runoff and subsurface runoff. Surface runoff that enters sewers is referred to as inflow, while subsurface runoff is referred to as infiltration. The infiltration and inflow from the Des Plaines River watershed discharged to water reclamation plants tributary to the CSSC is 95.9 cfs, the infiltration and inflow reaching the canal through CSO's is 8.3 cfs and the runoff from the Lower Des Plaines and Summit Conduit areas is 50.7 cfs. The deduction is also influenced by the O'Hare basin flow transfer that contributed 2.4 cfs of the 95.9 cfs of runoff to the water reclamation facilities during WY00. The deductible Des Plaines River watershed runoff reduced 2.0 cfs from WY99 to WY00.

Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC

Column 7 represents Lake Michigan diversions for Federal use, not chargeable to the State of Illinois, and is typically comprised of water supply pumpage used by federal facilities. Beginning in WY97 a 10% consumptive use factor was applied to this water supply component. Pumpage by federal facilities in WY00 includes the following sources:

- Hines VA Hospital
- Fort Sheridan
- USACE emergency navigation makeup water

Note that the emergency navigation makeup water is used for a very rare flood event. Like many other years there is no USACE emergency navigation makeup water use in WY00. Great Lakes Naval Base is a primary diverter of Lake Michigan water; however, the pumpage is not counted in Column 7 as a deduction. This is because the sewage from Great Lakes Naval Base is processed at NSSD – Gurnee WRP and the effluent is discharged to Des Plaines River (i.e., downstream of Lockport and bypass the Romeoville AVM). Column 7 represents a deduction from the Romeoville record and the total amount of the WY00 deduction is 0.9 cfs.

Column 8: Total Deductions from the CSSC Romeoville Gage Record

Column 8 is the sum of Columns 4, 5, 6, and 7 and represents the total deduction from the Romeoville record. The total deduction for WY00 is 243.4 cfs.

Column 9: Lake Michigan Pumpage Not Discharged to the CSSC

This column represents water supply pumpage from Lake Michigan that is not discharged to the canal. The water supply pumpage not discharged to the canal is composed of two components:

- Lake Michigan water supply used by communities serviced by water reclamation facilities that do not discharge to the CSSC (262.2 cfs). This flow increased 1.4 cfs from WY99.

- The Lake Michigan domestic water supply portion of CSO's bypassing the AVM from areas whose water reclamation facility discharge to the CSSC or its tributaries (0.55 cfs).

The communities that make up the flow in the first component are suburbs whose treated effluent is discharged to the Des Plaines River and other watercourses not tributary to the CSSC. Beginning in WY97 a 10% consumptive use factor was applied to the water supply of all of the following agencies and communities:

- Northwest Suburban Joint Action Water Agency (NWJAWA) - Member communities include Elk Grove Village, Hanover Park, Hoffman Estates, Mount Prospect, Rolling Meadows, Schaumburg and Streamwood.

- Northwest Water Commission - Member communities include Arlington Heights, Buffalo Grove, Palatine, Prospect Heights and Wheeling.

- Central Lake County Joint Action Water Agency (CLCJAWA) - Member communities include Grayslake, Gurnee, Lake County Public Works Department (Vernon Hills and Wildwood-Gages Lake), Libertyville, Mundelein, Round Lake, Round Lake Park and Round Lake Beach.

- Lake County Public Water District - Member communities include Illinois Beach State Park, Winthrop Harbor and Zion.

- Du Page Water Commission - Member communities include Addison, Bensenville, Bloomingdale, Carol Stream, Citizen's Utilities (Arrowhead, Country Club Highlands, Lombard Heights and Valley View), Clarendon Hills, Darien, Downers Grove, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Lombard, Naperville, Oak Brook, Oak Brook Terrace, Roselle, Villa Park, Westmont, Wheaton, Willowbrook, Wood Dale, and Woodridge.

- Lincolnshire

- Riverwoods

- Waukegan, Park City, Beach Park and Green Oaks

- Lake County - Bradley Road

The communities of North Chicago and Des Plaines are separated into the percentage of each community that is not tributary to the Chicago River System.

- North Chicago - 76 percent

- Des Plaines - 38.2 percent

The communities of Lake Bluff and Knollwood-Roundout (who receive their water from CLCJAWA) are not included in Column 9, as they discharge their effluent into the Chicago River System.

It should also be noted that the Lake Michigan water supply component of the O'Hare flow transfer is subtracted from the total Lake Michigan water supply of the above communities since:

- The O'Hare flow transfer is treated at the Northside WRP which discharges sanitary effluent that is tributary to the CSSC.

- The entire Lake Michigan water supply component of the O'Hare flow transfer is from communities contained in the above list.

The Lake Michigan water supply for these communities is measured, while the sanitary portion of the CSO's is derived through simulation. Column 9 represents an addition to the Romeoville record and the total WY00 addition is 262.8cfs. This flow is an increase of 1.1 cfs from WY99 to WY00.

Column 10: Total Diversion

Column 10 is equivalent to Column 3 with the subtraction of Column 8 and the addition of Column 9. The total diversion for WY00 is 2,584 cfs. This amount is 616 cfs less than Illinois' long term diversion allocation of 3,200 cfs. The 40-year running average diversion, rounded to the nearest cfs, beginning with WY81, is 3,318 cfs and the cumulative deviation from the 3,200 cfs allocation is -2,360 cfs. The negative deviation indicates that the cumulative diversion is greater than an average of 3,200 cfs for the period.

Column 11 through Column 13: Lake Michigan Diversion Components

Columns 11 through 13 represent the three (3) Lake Michigan diversion components; Lake Michigan Pumpage Accountable to Illinois (Column 11), Runoff from the Diverted Lake Michigan Watershed (Column 12) and Direct Diversions through the Lakefront Structures (Column 13). They do not affect the computed total diversion accountable to the State of Illinois (Column 10). However, the sum of the columns 11 through 13 should theoretically equal the total diversion as shown in Column 10. Differences are expected because Column 12 is based on simulation and simple flow separation for the entire diverted watershed. Therefore, the estimate derived from the sum of Columns 11 through 13 is not expected to be as accurate as the Romeoville AVM based calculations presented in Column 10. A description of Columns 11 through 13 follows:

Column 11 - Lake Michigan Pumpage Accountable to Illinois

Column 11 computes the total pumpage from Lake Michigan accountable to the State of Illinois - which is simply the sum of the water supply for the communities receiving their water from Lake Michigan. Beginning in WY98 water supply to Chicago Heights, Calumet City and Burnham was included. This computation does not include water supply to federal facilities. Beginning in WY97 Column 11 has attempted to account for consumptive use. The consumptive loss factor is estimated as 10% of the water supply pumpage (International Great Lake Diversion Consumptive Use Study Board, 1981), and accounts for the water supply pumpage that is consumed or lost prior to reaching the water reclamation facilities. The application of the consumptive use factor, beginning in WY97, is more in keeping with the Supreme Court Decree and should help facilitate a better comparison between Column 10 and the sum of Columns 11 through 13.

The total Lake Michigan pumpage accountable to Illinois in WY00, inclusive of the 10% consumptive use, was 1,551.3 cfs. Water supply from Lake Michigan reduced 54.0 cfs from WY99 to WY00.

Column 12 - Runoff from the Diverted Lake Michigan Watershed

Column 12 computes the runoff from the diverted Lake Michigan watershed. Stormwater runoff that previously drained to Lake Michigan through the Chicago River and the Calumet River now drains to the Chicago Sanitary and Ship Canal (CSSC) and the Calumet Sag Channel, respectively. The Calumet Sag Channel drains to the CSSC, and the CSSC ultimately drains into the Illinois River and the Mississippi River. The drainage area of the diverted Lake Michigan watershed is approximately 673 square miles. The runoff from the diverted Lake Michigan watershed is accountable to the State of Illinois and is made up of several components including; gaged runoff, ungaged runoff, inflow and infiltration captured at the treatment plants, inflow and infiltration captured by TARP and inflow and infiltration contained in combined sewer overflows.

The total runoff from the diverted Lake Michigan watershed was 718.2 cfs in WY00 that decreased 41.1 cfs between WY99 and WY00.

Column 13 - Direct Diversion through the Lakefront Structures

Direct diversions occur at three lakefront locations; the Chicago River Controlling Works (CRCW), the O'Brien Lock and Dam, and the Wilmette Controlling Works. These controlling structures are located downtown, at the south end, and at the north end of the Chicago area, respectively. The direct diversion at each of these locations consists of four components; lockage, leakage, discretionary

flow and navigation makeup flow. The lockage component is the flow used in locking vessels to and from the lake. The leakage component is water estimated to pass, in an uncontrolled way, through or around the three lakefront structures. The purpose of the discretionary diversion is to dilute effluent from sewage discharges and improve water quality in the canal system. Navigation makeup water is made up of two parts. When large storms are forecast, the canal is drawn down before the storm to prevent flooding - navigation makeup water is used during this draw down period to maintain navigation depths. If the runoff is not enough to refill the canal, additional navigation makeup water is passed.

Based on lakefront AVM flow measurements the total direct diversion through the three lakefront structures was 292 cfs in WY00. Direct diversions decreased 116 cfs between WY99 (408 cfs based on AVM records) and WY00 (primarily due to the fixes of leakage through the Chicago harbor locks.) Included herewith for the reference purpose, the MWRDGC's LMO-6 reported that the mean annual direct diversion through the three lakefront structures was 310.0 cfs -- including 30.3 cfs for lockage, 15.3 cfs for leakage, 11.5 cfs for navigation makeup, and 253.0 cfs for discretionary use.

Sum of Columns 11 through 13

The sum of the columns 11 through 13 (2,561 cfs) should theoretically equal the total diversion as shown in Column 10 (2,584 cfs). Because Column 12 is based on simulation and simple flow separation, the estimate derived from the sum of Columns 11 through 13 is not expected to be as accurate as the Romeoville AVM based calculations. However, a difference between estimates of 23 cfs or 0.9% is considered a very good balance.

Using the figures from these three (3) columns, 60.6% of the WY00 Illinois diversion is attributable to pumpage from Lake Michigan for domestic water supply, runoff from the diverted Lake Michigan Watershed accounted for 28.0% of the diversion, and direct diversion through the lakefront structures accounted for 11.4% of the diversion. A more detailed breakdown of these percentages is shown in Figure 3 and Table 5.

Table 5
Components of the Diversion by the State of Illinois
Based on Columns 11 through 13

Description	Average Flow	Percentage of Total Flow
Lake Michigan Pumpage by the State of Illinois	1551.5	60.6%
Runoff from Diverted Lake Michigan Watershed	718.2	28.0%
Total Direct Diversions	291.7	11.4%
Breakdown of Direct Diversions		
Lockages	28.5	1.1%
Leakages	14.4	0.6%
Navigation Makeup Flow	10.8	0.4%
Discretionary Flow	238.0	9.3%
- There Was No Recorded Backflow for WY00.		

* The direct diversions at CRCW and O'Brien Lock and Dam were measured by the lakefront AVM's. However, the breakdown of direct diversion was proportioned based on the MWRDGC's LMO-6 reports.

Using the direct diversion measured by AVM's the sum of columns 11 through 13 would be 2,561 cfs that is less than a 1% difference from the computed total diversion (i.e., 2,584 cfs) accountable to Illinois following the Romeoville accounting procedures. As the direct diversion measured by AVM's is much more accurate than the estimated values using ratings of the lakefront structures, the measured direct diversion flows were used in Budget 14 computations.

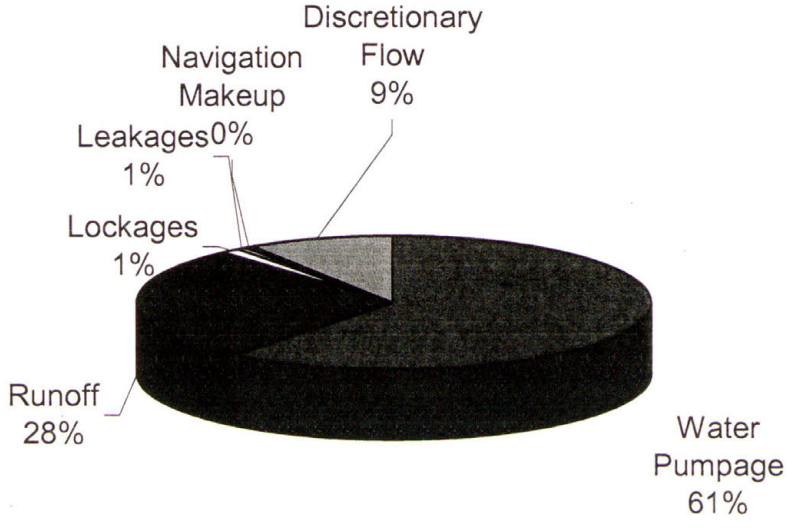


Figure 3 Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13

Budgets

The first two budgets (Budgets 1 and 2) are used to sum the diverted water supply. The next four budgets (Budgets 3 through 6) are of stream gage sites that are not simulated and are used as part of the calculation of the runoff from the diverted Lake Michigan watershed. The next seven budgets (Budgets 7 through 13) compare measured and simulated flows and compute Column inputs used in the diversion computations. The next two budgets (Budgets A and B) compare measured and simulated flows at two pumping stations. The final budget (Budget 14) is a canal balance of total inflows and outflows. These fourteen budgets are listed in Table 2.

Budget 1 and Budget 2: Water Supply Pumpage

Budgets 1 and 2 are summations of critical water supply pumpage data. Budget 1 sums Lake Michigan water supply diverted by the State of Illinois. The Lake Michigan water supply data is supplied by the IDNR-OWR and City of Hammond as daily values for primary users and monthly data for secondary users (LMO-3 reports). Budget 2 sums groundwater pumpages in the Lake Michigan and Des Plaines River watersheds that are diverted to the CSSC. Groundwater pumpage data is recorded by the ISWS as a total annual withdrawal based on calendar years.

Budget 1: Diverted Lake Michigan Water Supply

Budget 1 represents the summation of Lake Michigan pumpage accountable to the State of Illinois. This budget is a duplication of Column 11. For WY00, the average annual Lake Michigan pumpage accountable to Illinois is 1,551.3 cfs. This flow is a reduction of 54.0 cfs from WY99.Budget 2: Groundwater Diverted to the CSSC

Budget 2: Groundwater Diverted to the CSSC

Budget 2 is groundwater water supply pumpage by communities, industrial users, and other private users whose effluent is discharged to the canal. The contents of this budget are also contained in Column 4. The groundwater pumpage data are reported by the ISWS on a calendar year basis. The groundwater quantity is determined by summing all reported groundwater sources in the area tributary to the CSSC, less groundwater not discharged to the CSSC in the form of CSO's.

Using the ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois, or if they were located within MWRDGC service

boundaries in which their effluent was discharged into the CSSC and adjoining channels. For a description of the application of the 10% consumptive use factor see discussion for Column 4.

The total groundwater pumpage by communities, industrial users, and other private users whose sanitary effluent is tributary to the canal is 28.8 cfs for WY00. Simulation determined that all of this flow reached the canal. In most years a small portion of the groundwater normally tributary to the CSSC is discharged to the Des Plaines River or other watercourses not tributary to the canal in the form of CSO's.

In addition to groundwater supply pumpage, there was also a significant amount of groundwater infiltration into the two TARP systems that ultimately reached the canal. Mainstream TARP and Calumet TARP accounted for 29.6 cfs and 13.2 cfs, respectively, of groundwater discharged to the canal during WY00.

The total of the above components is 68.8 cfs and as Column 4, represents a deduction from the Romeoville record. This flow is a decrease of 49.0 cfs from WY99.

Budgets 3 through Budget 6: Stream Gaging Stations

The stream gage budgets are used to make estimates of runoff from portions of the diverted Lake Michigan watershed. Sanitary and other point source flows are subtracted from the stream gaging record to develop the runoff estimates. The runoff estimates are used in Column 12. The flows at the stream gaging sites are also part of Budget 14, the canal system budget.

Table 6 presents the estimated runoff from these budgets. Note that Budgets 4 and 5 contribute flows to Budget 6 in that they are upstream of, or tributary to, the Little Calumet River at South Holland. The streamflow in Budget 6 is the total flow at the gage, while the runoff is an incremental volume that occurs downstream of both the Little Calumet River at the State Line and Thorn Creek at Thornton.

Table 6
Stream Gage Flow Separation

Budget Number	Location	Stream Flow (cfs)	Sanitary Flow (cfs)	Runoff (cfs)
3	North Branch Chicago River at Niles, IL	105.2	19.6	85.6
4	Little Calumet River at IL-IN State Line	33.1	5.4	27.7
5	Thorn Creek at Thornton, IL	81.8	18.5	63.3
6	Little Calumet River at South Holland, IL	135.2	Not computed	19.2 *

* The runoff for Budget 6 is that runoff which occurs in the reach between South Holland and the 2 upstream gages (Little Calumet River at the State Line and Thorn Creek at Thornton). The runoff is computed by taking the measured streamflow at South Holland and subtracting off the measured flow at the two upstream gages and the sanitary portion of the CSOs that occur in the reach between the state line and South Holland. If a negative discharge at South Holland is computed for a day, it is set equal to zero in the annual runoff computation.

Budgets 7 through Budget 13: MWRDGC Water Reclamation Facilities

The budgets for the water reclamation plants compare the simulated flows to the measured inflows at the MWRDGC facilities and perform verifications of the diversion accounting program. The simulated flows were developed from an estimated sanitary flow with a daily, weekly, and monthly flow variation, from hydrologic precipitation-based runoff models, and from hydraulic sewer routing models. The estimated sanitary flow input to the hydraulic simulation models is based on the population estimates for each plant's service basin. Per capita sanitary flows are determined based on the service basin's water supply minus an assumed 10% consumptive loss (International Great Lakes Diversion Consumptive Use Study Board, 1981). Simulated flows were compared with recorded inflows at each facility to assess the accuracy of the simulations. The discussion of the budgets will concentrate on the results of each individual simulation as the development of these models has been discussed in previous reports. Refer to Table 7 for a statistical summary of the simulation results.

Budget 7: Northside Water Reclamation Facility

Budget 7 analyzes the water balance at the MWRDGC Northside Water Reclamation Facility (Figure 4). The balance for WY00 of the inflow to the Northside facility is good. The simulated to adjusted recorded inflow ratio (S/R) for the Northside WRP is 1.01, indicating that the simulated inflow volume is slightly greater than the adjusted observed inflow volume. The coefficient of correlation (R) of

simulated to observed flow is 0.84, indicating that the model predicted the inflow hydrograph to the Northside facility well. Table 7 presents a statistical summary of the simulation results.

Budget 8: Upper Des Plaines Pump Station

Budget 8 analyzes the water balance at Upper Des Plaines Pump Station (UDPPS) (Figure 5). The pump station budget is used to verify simulated flows. Although it has no direct impact on the diversion calculation, it is intended to be used as a primary calibration point for the models that simulate the deductible runoff from the Des Plaines watershed contained in Column 6. This will be possible only after the existing measurement problems at that site are resolved. This has been previously discussed in the WY90 diversion report. Since the full records of the UDPPS were not available from the MWRDGC, a comparison of the simulated with the recorded flows was not possible for WY00.

While the statistical comparisons of simulated and recorded flows at the UDPPS are routinely conducted, there exists a need to investigate alternative flow measurement techniques. This site has continued to experience its share of problems. Normally, a large number of days of records are unavailable due to meter malfunctions, problems with the recording charts which make data transformation impossible, and various other reasons. Since full records for WY00 were unavailable, the quantitative analysis of the simulation was not possible. Additionally, the accuracy of the flow meters at the pump station is questionable and unmetered bypass flows are a frequent occurrence. Therefore, total flow may not be measured in storm events and the recycling of flow is possible. Further investigation of the accuracy of flow measurement at the pump station is required to verify and calibrate the simulation models that compute the deductible runoff from the Des Plaines watershed contained in Column 6.

Budget 9: Mainstream and Des Plaines TARP Pumping Stations

Beginning 6 June 1993 the south and middle legs of the Des Plaines TARP system became operational. Consequently, these tunnels were added to the modeling of the TARP system for WY93. Beginning 4 July 1998 the north branch tunnel of the Mainstream TARP system was put into service. The north branch tunnel was included in the modeling of the TARP system for WY98. The Des Plaines tunnel system, like that of the Mainstream TARP system, flows by gravity to the Stickney Water Reclamation facility in Stickney. Flows are pumped from the Des Plaines tunnel to the Stickney plant using the same pumps used for the Mainstream tunnels. The modeling of the Des Plaines and Mainstream tunnels includes the designation of index points to control inflows to the systems, as well as controlling the pumpout cycling. During the simulation, the model compares the

computed tunnel stage at each index point to the input parameters to determine if changes are necessary. The index points that control the dropshaft inflows are referred to as index drop shafts, and limit the inflow (expressed as a fraction of dropshaft capacity) relative to the computed water surface elevation (CWSEL). The simulated pumping is controlled by the CWSEL at the downstream ends of the tunnels. The user-specified input parameters include the elevations at which the pumping starts and stops.

Beginning 1 October 1998 the bulkhead located at Station 482+09.25 was removed that allowed backflows from the lower portions of the Des Plaines Tunnel and allowed additional groundwater infiltration to enter the tunnel system. Beginning 1 July 1999 the 60-day operation test started. The control structures at the drop shafts were opened to allow limited inflows while the valves and operation were tested. Beginning 30 September 1999 the new tunnel became fully operational and flows were allowed into the branch tunnel according to the operations plan. The above status of the Des Plaines tunnel was included in the modeling of the TARP system for WY00. Budget 9 analyzes the water budget at the MWRDGC Mainstream and Des Plaines TARP Pumping Stations. The results of Budget 9 are used as a verification point for simulated flows. Budget 9 is also used for the purpose of computing a portion of Column 6 (Des Plaines River watershed runoff deduction). The deductible portion of Budget 9 includes groundwater seepage into the TARP tunnel walls and Des Plaines River watershed runoff captured by Mainstream and Des Plaines TARP as overflows. The modeling of Mainstream and Des Plaines TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Mainstream and Des Plaines TARP is contained in Figure 6. A more in-depth description of Mainstream TARP and the simulation model is contained in the Water Year 1986 report, which is an appendix to the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

For WY2000, several changes were made to the Mainstream TNET model. The changes were generally more computational than procedural. The net changes to the TNET input data were developed over the series of calibration model runs. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations and pumping schemes. The index dropshaft scheme was changed, resulting in fewer indices, and basing more of the dropshaft operations on a point farther downstream in the tunnel.

The dropshaft operation data was changed only slightly, and resulted in closing off the inflows at a slightly lower elevation. This change was made, and the model results compared with MWRDGC operations data to confirm that the simulated pressurization levels were reasonably close to the observed levels. A second check was a comparison of weekly average pumping volumes of simulated vs. observed, although this comparison also includes the variance due to the hydrologic modeling as well.

Table 7
WY 2000 Summary of Simulation Statistics

Budget No.	7	8	9	10	11	12	13	14
Description	Northside WRP (1)	Upper Des Plaines Pump Station (1),(3)	Mainstream TARP Pump Station (2)	Stickney WRP (1),(4)	Calumet TARP Pump Station (2)	Calumet WRP (1),(4)	Lemont WRP (1)	Chicago Canal System Balance (1)
Mean Recorded Flow, cfs	383.2	N/A	124.4	983.2	47.7	330.6	3.2	2,574.4
Max. Recorded Flow, cfs	724.3	N/A	379.7	2,145.0	194.8	695.0	6.7	11,573.6
Min. Recorded Flow, cfs	233.9	N/A	13.1	456.0	1.8	278.0	2.0	951.9
Mean Simulated Flow, cfs	388.1	59.6	125.4	929.7	53.3	316.1	3.1	2,747.8
Max. Simulated Flow, cfs	671.7	206.1	314.4	2,670.0	142.3	577.9	5.4	17,006.4
Min. Simulated Flow, cfs	287.4	32.4	18.8	659.5	8.0	211.7	2.0	1,313.5
S/R of Mean Flows	1.01	N/A	1.01	0.95	1.12	0.95	0.98	1.07
Correlation	0.84	N/A	0.70	0.84	0.83	0.77	0.79	0.88

(1) Based on daily values.
(2) Based on weekly values.
(3) Does not include days with missing records.
(4) Does not include pumpage from TARP.
N/A - Data not available

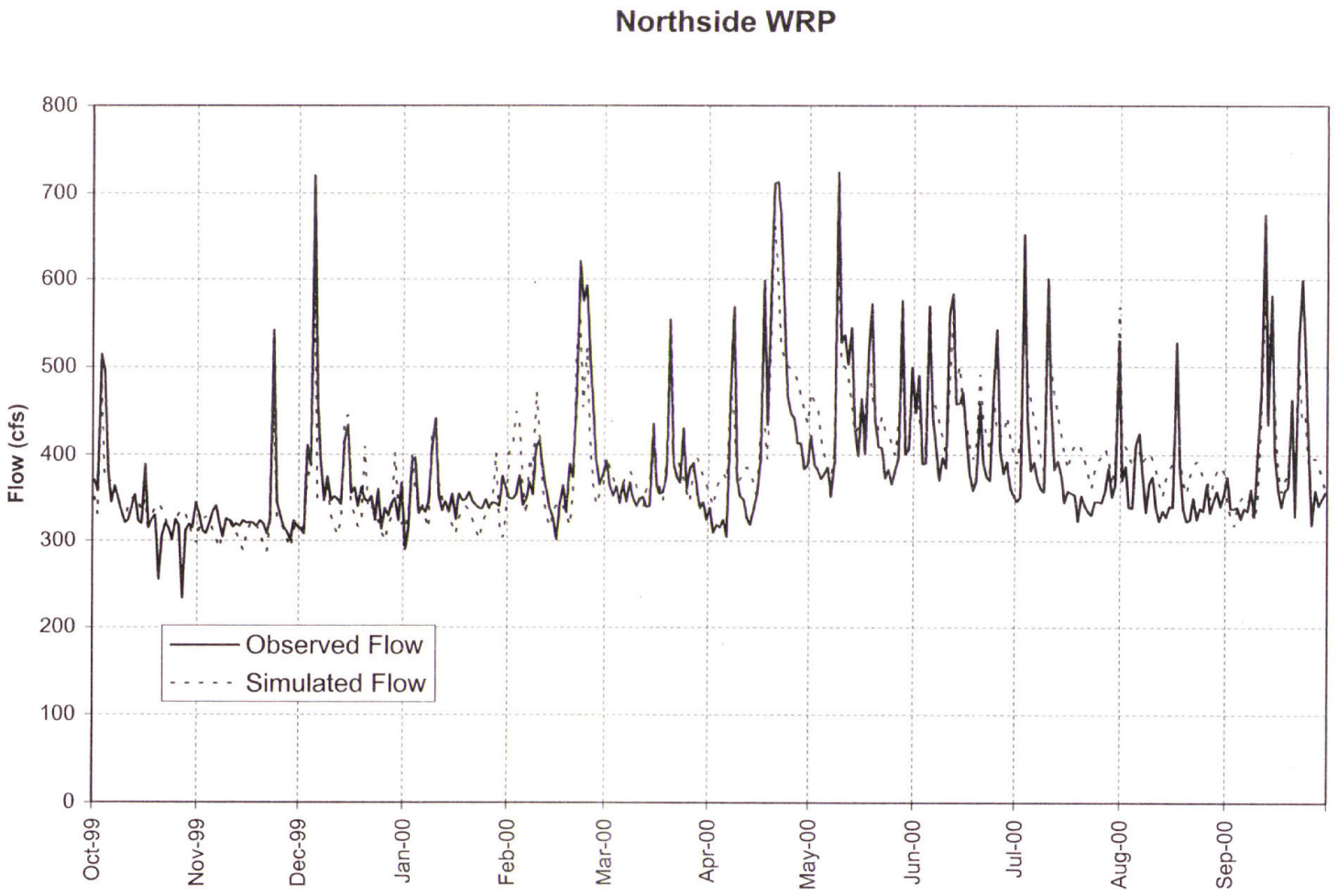


Figure 4 Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility

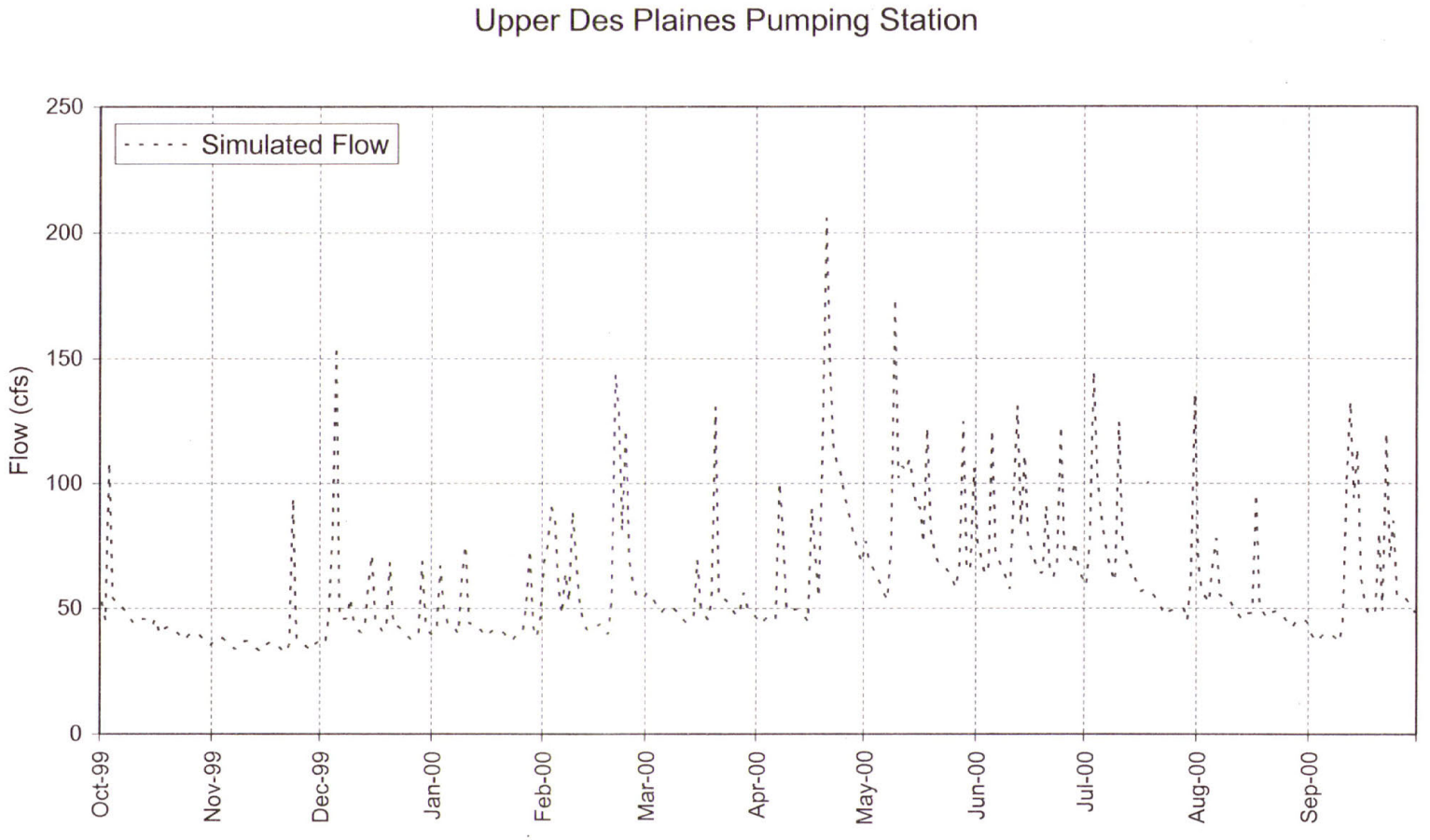


Figure 5 Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station

The pump on/pump off elevations were changed slightly also, and were compared with actual measured values. It was not possible to simulate the pumping of the tunnel down to the level that is used in actual operations because of numerical instability of the model. The final value used in the model was the lowest point to which the tunnel could be pumped without causing excessive numerical instability.

The constant I&I flow was also changed in the TNET model for WY2000. The previous I&I total was 76.59 cfs, which was brought into question after comparing the simulated results to the actual pumpout records. The comparison of simulated vs. observed values also indicated that the model consistently over-predicted the baseflow during low-runoff periods. An analysis of Mainstream/Des Plaines TARP-to-STP pumping averages for WYs 98 through 01 indicated that there were two sustained periods of apparently little or no interceptor overflow into the tunnel. One was 17 October 1999 through 8 November 1999, and the other was 18 December 1999 through 6 February 2000. The composite average value for those two periods was 27.78 cfs. Since pumping occurred on about a third of the days in these time periods, care was taken to select the time periods such that complete inflow and pumpout cycles were accounted for and any incomplete pumping cycle (which tended to be 4-5 days) were not averaged.

In analyzing the balance at the Mainstream and Des Plaines TARP Pumping Stations, weekly flows were used rather than daily flows. While MWRDGC maintains daily pumpage records, days with no pumpage occur frequently. Therefore, it is not appropriate to compute a daily S/R ratio. Additionally, MWRDGC tends to pump from the tunnels at night, while the model simulates pumpage based on water elevations at the downstream end of the tunnel.

The balance for WY00 of the inflow to the Mainstream and Des Plaines TARP Pumping Stations is very good. The simulated to recorded flow ratio (S/R) for the Mainstream and Des Plaines TARP Pumping Stations is 1.01, indicating that the simulated inflow volume is slightly greater than the recorded inflow volume. This is a significant improvement from WY1999 which had an S/R ratio of 1.38. The coefficient of correlation (R) of simulated to recorded flow is 0.70, which is slightly stronger than the 0.68 correlation in WY99. However, there remains room for improvement in the ability of the model to predict trends in the pump station flows. Table 7 presents a statistical summary of the simulation results.

From a review of the plot of the simulated versus recorded flow at the pump station (Figure 7), it appears that the model responds similarly to the recorded pumpage record except for a short period in February. In addition, the model is sometimes out of phase with the observed record. This could be the result of simulated pumpages occurring sooner and more frequently than actual pumpages in order to maintain computational stability during a simulation.

In summary, it appears that the simulation of the Mainstream and Des Plaines TARP systems is very reasonable. However, there remains room for improvement in the ability of the model to predict trends in the pump station flows.

Budget 10: Stickney Water Reclamation Facility

Budget 10 analyzes the water balance at the MWRDGC Stickney Water Reclamation Facility (Figure 8). Beginning in WY90, simulated Mainstream and Des Plaines TARP pumpages from Budget 9 were no longer combined with simulated interceptor inflow to the Stickney Water Reclamation Facility to derive the total simulated inflow to the Stickney Facility. Instead, only simulated interceptor inflows are compared with recorded interceptor inflows to assess the accuracy of the simulation. The decision to not include TARP pumpages in the treatment plant budgets was based on the fact that the TARP systems are already analyzed in separate budgets. Including TARP pumpages in the treatment plant budgets is detrimental to the statistical results of the treatment plant budgets, since the TARP models generally do not respond as well. When simulations of interceptor flows are treated separately, the response of the hydrologic runoff models (HSPF) and the hydraulic sewer routing models (SCALP) can be better isolated and not diluted by the TARP model results, which are analyzed separately on their own merits and contained in their own budgets (Budgets 9 and 11).

Overall, the balance for WY00 of the inflow to the Stickney facility is very good. The simulated to recorded flow ratio (S/R) for the Stickney plant is 0.95, indicating that the simulated interceptor inflow volume is matching the recorded interceptor inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.84, indicating that the model performed reasonably well in predicting the trends in the interceptor inflow hydrographs to the Stickney facility. Refer to Table 7 for a statistical summary of the simulation results.

Budget 11: Calumet TARP Pumping Station

Budget 11 analyzes the water budget at the MWRDGC Calumet TARP Pumping Station (Figure 9). The results of Budget 11 are used as a verification point for simulated flows. The modeling of Calumet TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Calumet TARP is contained in Figure 6. A more in-depth description of Calumet TARP and the simulation model is contained in the Water Year 1987 report contained in the Diversion Accounting Annual Report for WY90-92 (USACE, 1994). Changes that were incorporated in the WY96 modeling are described in the WY96 Diversion Accounting Report contained in the WY97 Annual Report (USACE, 2000).

Several changes were made to the Calumet TARP model for WY00. The changes, as with the Mainstream tunnel, were generally more computational than procedural. The net changes to the TNET input data were developed over the series of calibration model runs. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations.

The dropshaft operation data was changed significantly, and resulted in closing off the inflows at a higher elevation. The TNET model results from the early iterations indicated that the simulated capture (and pumpout) volumes were much lower than observed. This was determined by comparing the weekly average pumping volumes of simulated vs. observed, even though this comparison also includes the variance due to the hydrologic modeling as well. The gate-closing scheme was modified to cause the model to capture more inflows, yet not pressurizing the system. The model input that was developed over the iterations produced a reasonable match of pumpout volumes.

In analyzing the balance at the Calumet TARP Pumping Station, weekly flows were used instead of daily flows. While MWRDGC maintain daily pumpage records, days with no pumpage occur frequently. Additionally, MWRDGC tends to pump at night, while the model pumps more frequently based on water elevations at the downstream end of the tunnel. Therefore, it is not appropriate to compute a daily S/R ratio.

Overall, the balance for WY00 of the inflow to the Calumet TARP Pumping Station is reasonably good. The simulated to recorded flow ratio (S/R) for the Calumet TARP Pumping Station is 1.12 indicating that the simulated inflow volume is greater than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.83, indicating a significant improvement in the ability of the model to predict trends of the recorded Calumet TARP pumpages. Table 7 contains a statistical summary of the simulation results.

Volume matching between the simulated and recorded Calumet TARP pumpages was 1.12 and the correlation coefficient was 0.83 both of which showed a very significant improvement from the results for WY99. Because of the instability of the TARP model, as well as uncertainties in the Calumet TARP system, it was difficult to control this correlation. However, as the system is presently modeled, this does not impact the computed diversion, unless a substantial portion of the under-simulation results from under-estimated groundwater inflow, since all Des Plaines River watershed areas whose overflows are modeled as tributary to Calumet TARP are also modeled such that "non-captured" overflows flow to rivers that are tributary to the CSSC. Therefore, whether or not these Des Plaines River watershed runoff flows enter the tunnel or not, they are presently included in the Des Plaines River watershed runoff deduction in Column 6. This assumption will remain until separately sewered areas are modeled such that actual areas are used instead of

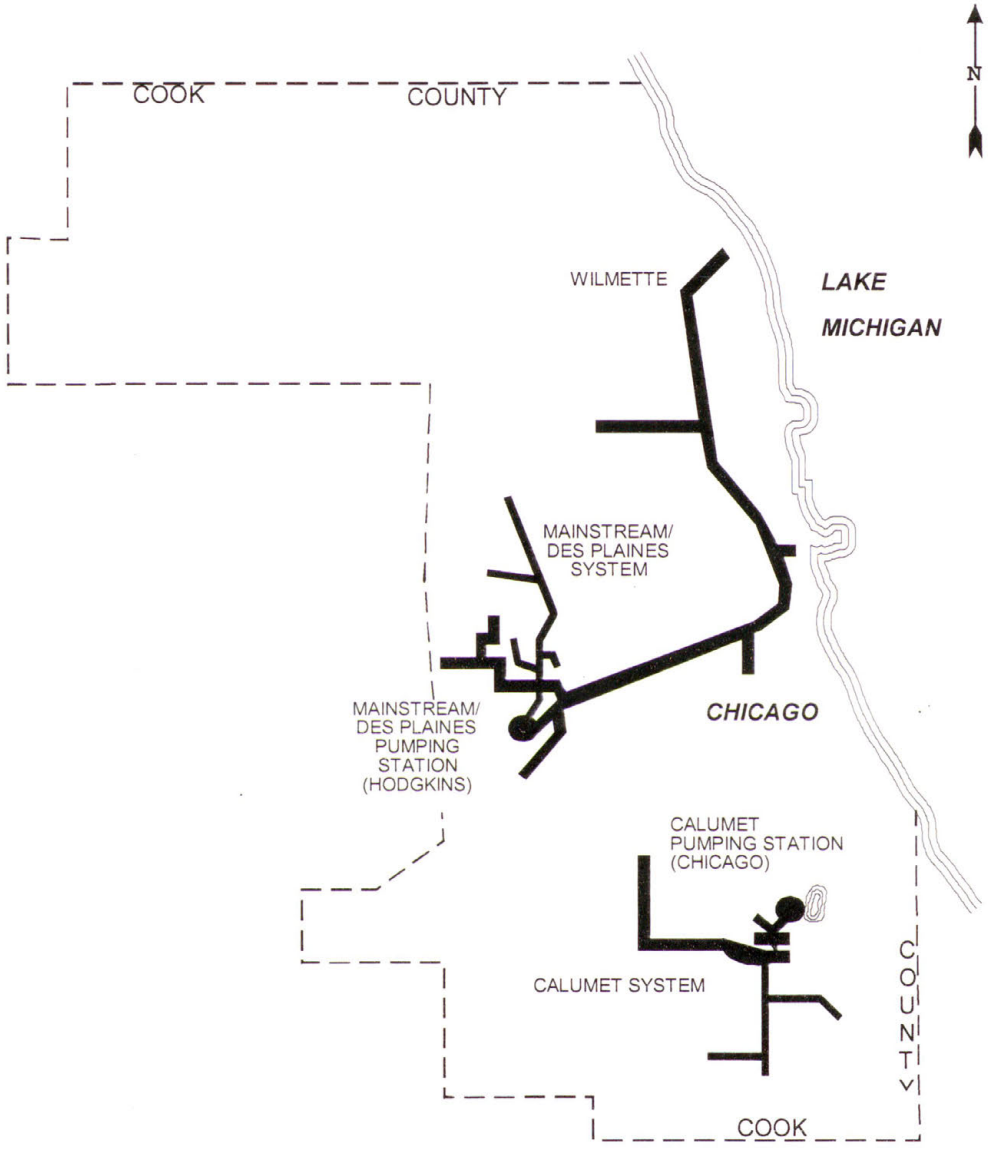


Figure 6 Map of Mainstream, Des Plaines and Calumet TARP

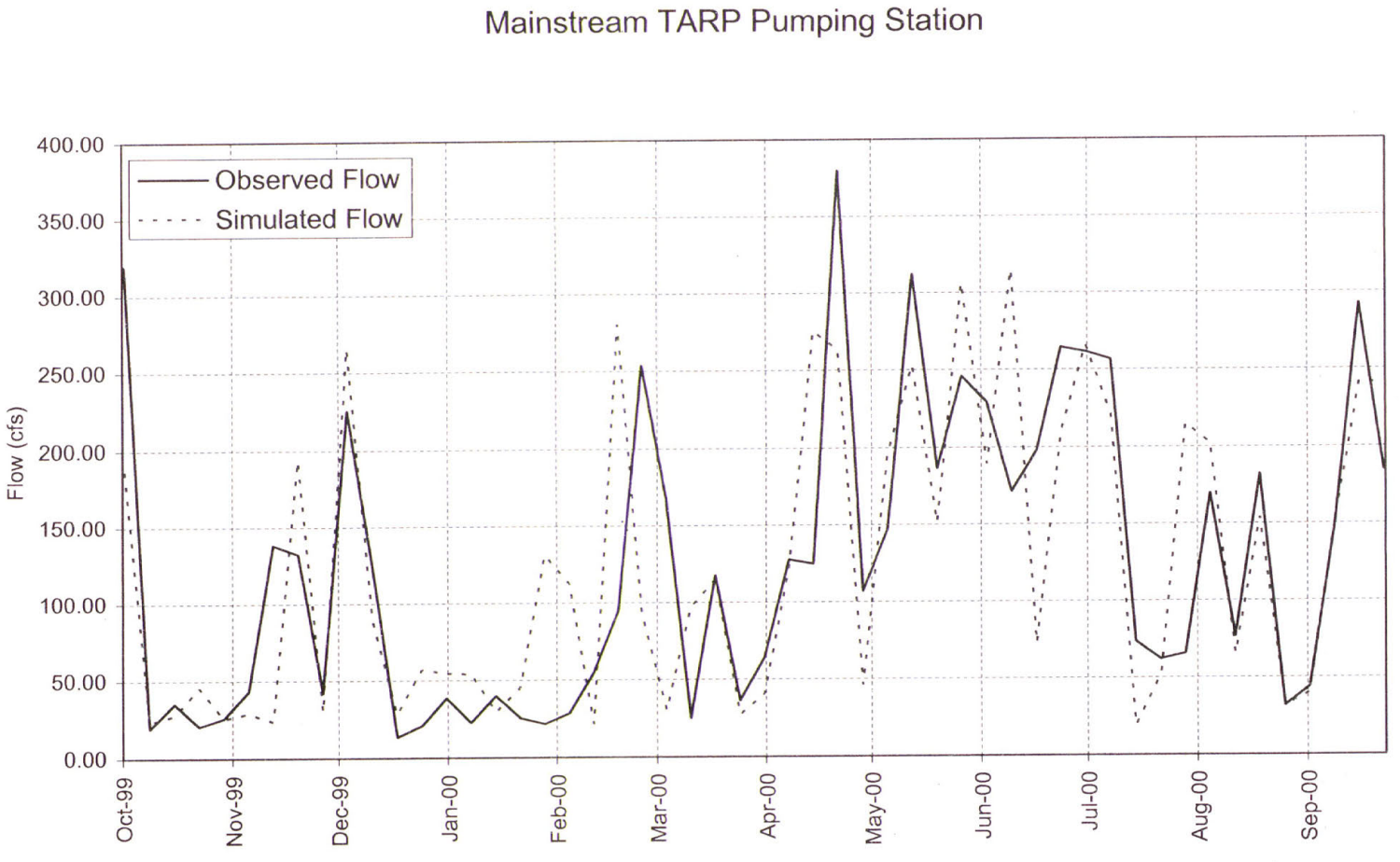


Figure 7 Budget 9 - Simulation of the MWRDGC Mainstream and Des Plaines TARP Pumping Station

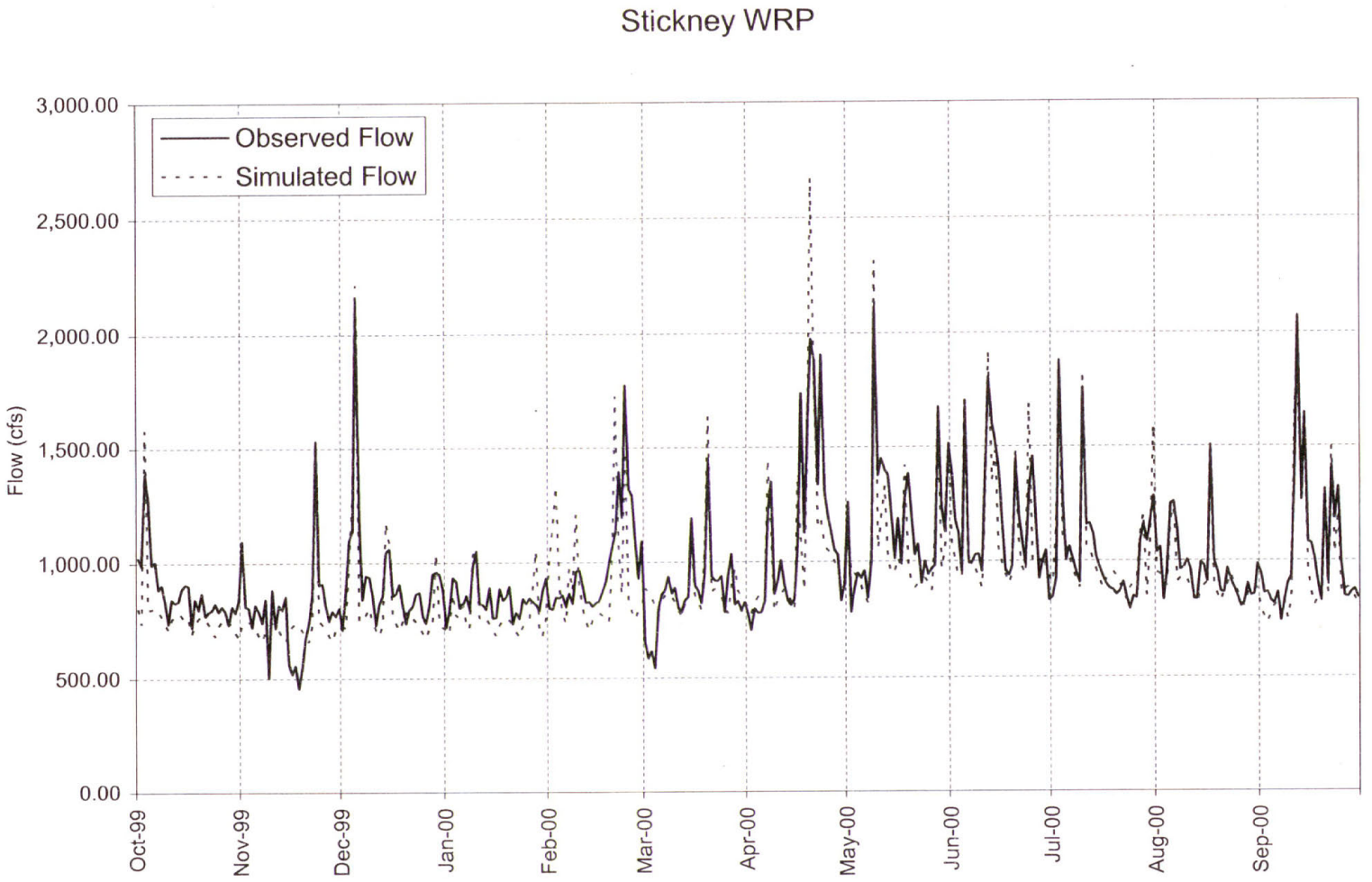


Figure 8 Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility

effective areas in the hydraulic models. This has been discussed in the WY90 diversion accounting report.

Budget 12: Calumet Water Reclamation Facility

Budget 12 analyzes the water balance at the MWRDGC Calumet Water Reclamation Facility (Figure 10). Beginning in WY90, simulated Calumet TARP pumpages from Budget 11 were no longer combined with simulated interceptor inflows to the Calumet Water Reclamation Facility to derive the total simulated inflow to the Calumet Facility. Instead, only simulated interceptor inflows are compared with recorded inflows to assess the accuracy of the simulation. This was revised for the same reasons as outlined previously in the discussion for Budget 10.

The annual simulated to recorded flow ratio (S/R) and the coefficient of correlation for the Calumet Water Reclamation Facility are considered very good. The S/R ratio is 0.95 indicating that the simulated Calumet interceptor flow volume was less than the recorded interceptor flow volume. The coefficient of correlation was 0.77 indicating a reasonably good correlation between simulated and recorded interceptor flows. Refer to Table 7 for a statistical summary of the simulation results.

Budget 13: Lemont Water Reclamation Facility

Budget 13 analyzes the water balance at the MWRDGC Lemont Water Reclamation Facility (Figure 11). Overall, the balance for WY00 of the inflow to the Lemont facility is quite good. The simulated to recorded flow ratio (S/R) for the Lemont is 0.98, indicating that the simulated inflow volume was slightly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.79, indicating that the model predicted the inflow hydrograph to the Lemont facility reasonably well. Table 7 contains a statistical summary of the simulation results.

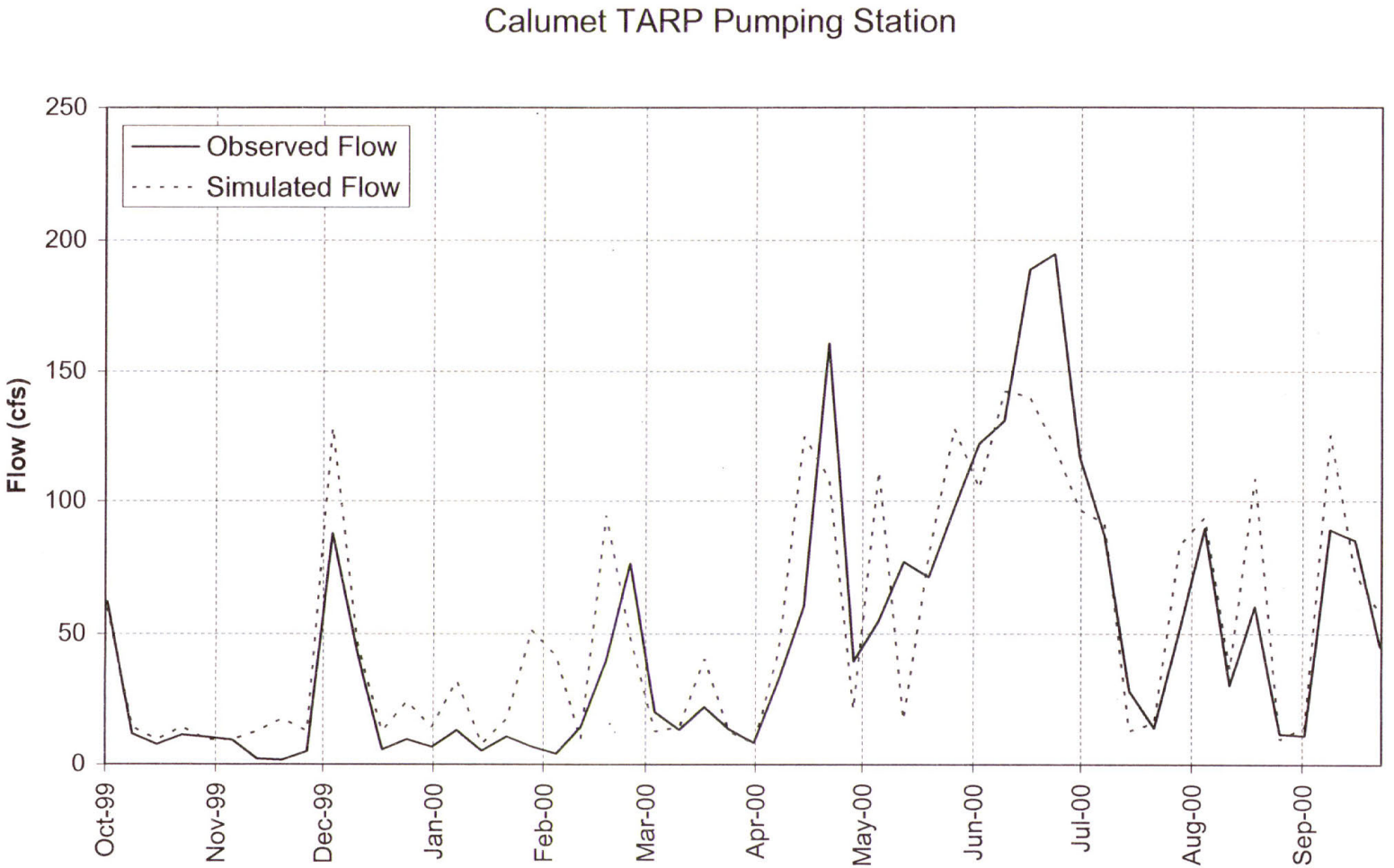


Figure 9 Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station

Aggregated Results of Four MWRDGC Water Reclamation Facilities

The aggregated simulated inflows (not including TARP) to the four modeled MWRDGC water reclamation facilities are 1637.0 cfs while the measured inflows are 1700.2 cfs. This results in a very good aggregated S/R ratio of 0.96.

Budget 14: CSSC System Balance

Budget 14 compares the inflows and outflows to the CSSC system (Figure 12). The inflow components include direct diversions through the lakefront structures (based on AVM measurements), stormwater runoff discharged to the canal system, and domestic water supply whose effluent discharges to the canal system. The outflows from the canal system include the discharge past the Romeoville AVM, backflows through the lakefront structures and withdrawals upstream of Romeoville by Argonne National labs and Citgo Petroleum Corporation. The individual components are presented in Table 8 for WY00.

Overall, the balance for WY00 between the inflows to the canal system and the outflows from the canal system is reasonably good. The S/R (inflow/outflow) for the canal system is 1.07, indicating that the inflow to the canal system is 7% more then the outflow from the canal system. The average measured/simulated inflow was 2,574.4 cfs while the average measured/simulated outflow was 2,747.8 cfs. The difference is 173.4 cfs (6.3%) for WY00, as compared to 171.2 cfs (5.8%) for the previous water year. Refer to Table 7 for a statistical summary of the measured/simulated results.

The coefficient of correlation (R) of inflow to outflow is 0.88, indicating that the time series trends of inflow to outflow are well correlated. The coefficient of correlation is based on daily flows. Timing between inflows and measured outflows at Romeoville is the major factor in the differences, especially during changes in flow that occur at the beginning or end of a day. Also, part of the difference in the correlation is the result of travel time from inflow locations downstream to the Romeoville AVM site. Therefore, variability in the coefficient of correlation from year to year may be attributed to the variability in the timing of significant flow changes during a particular year.

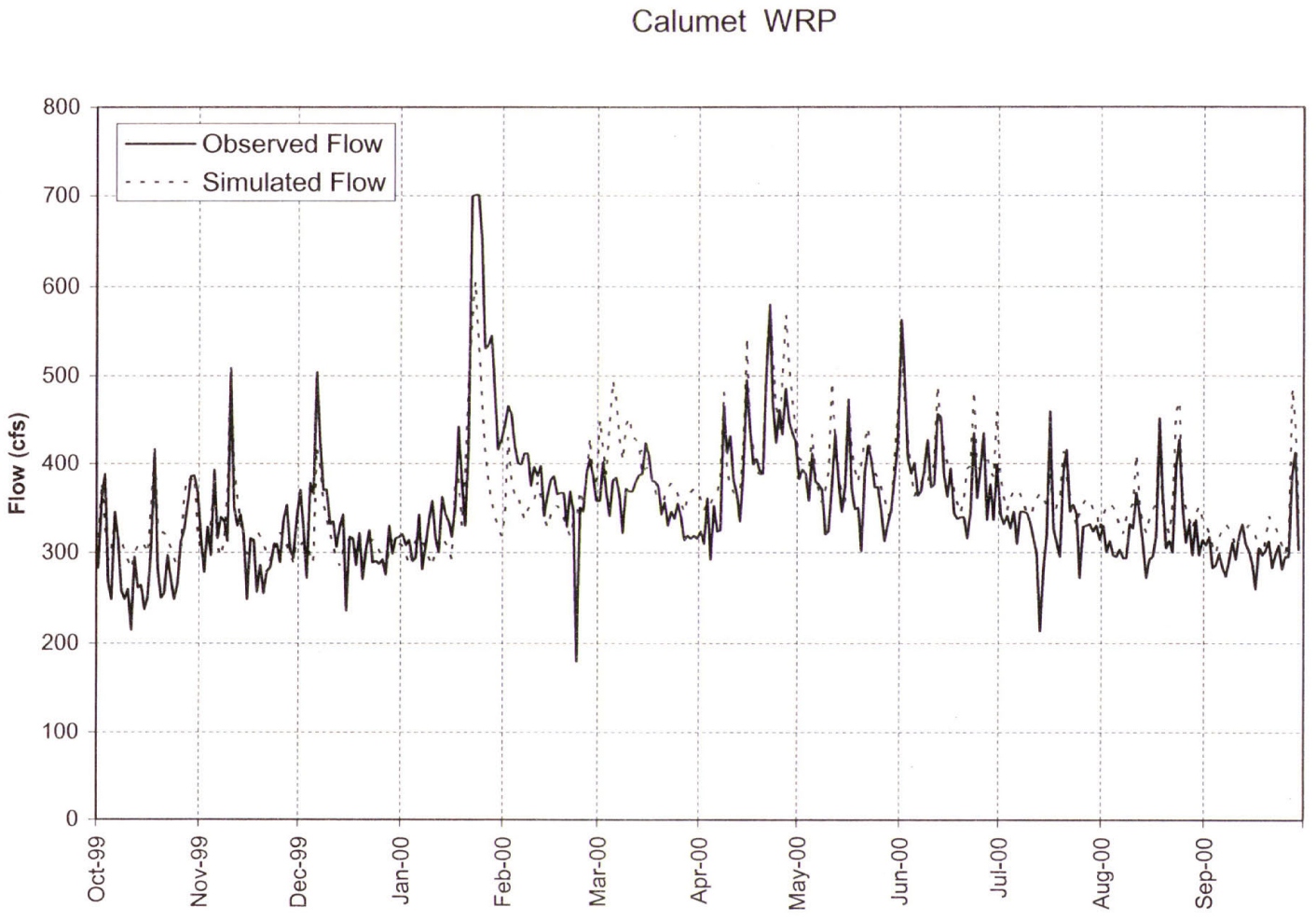


Figure 10 Budget 12 – Simulation of the MWRDGC Calumet Water Reclamation Facility

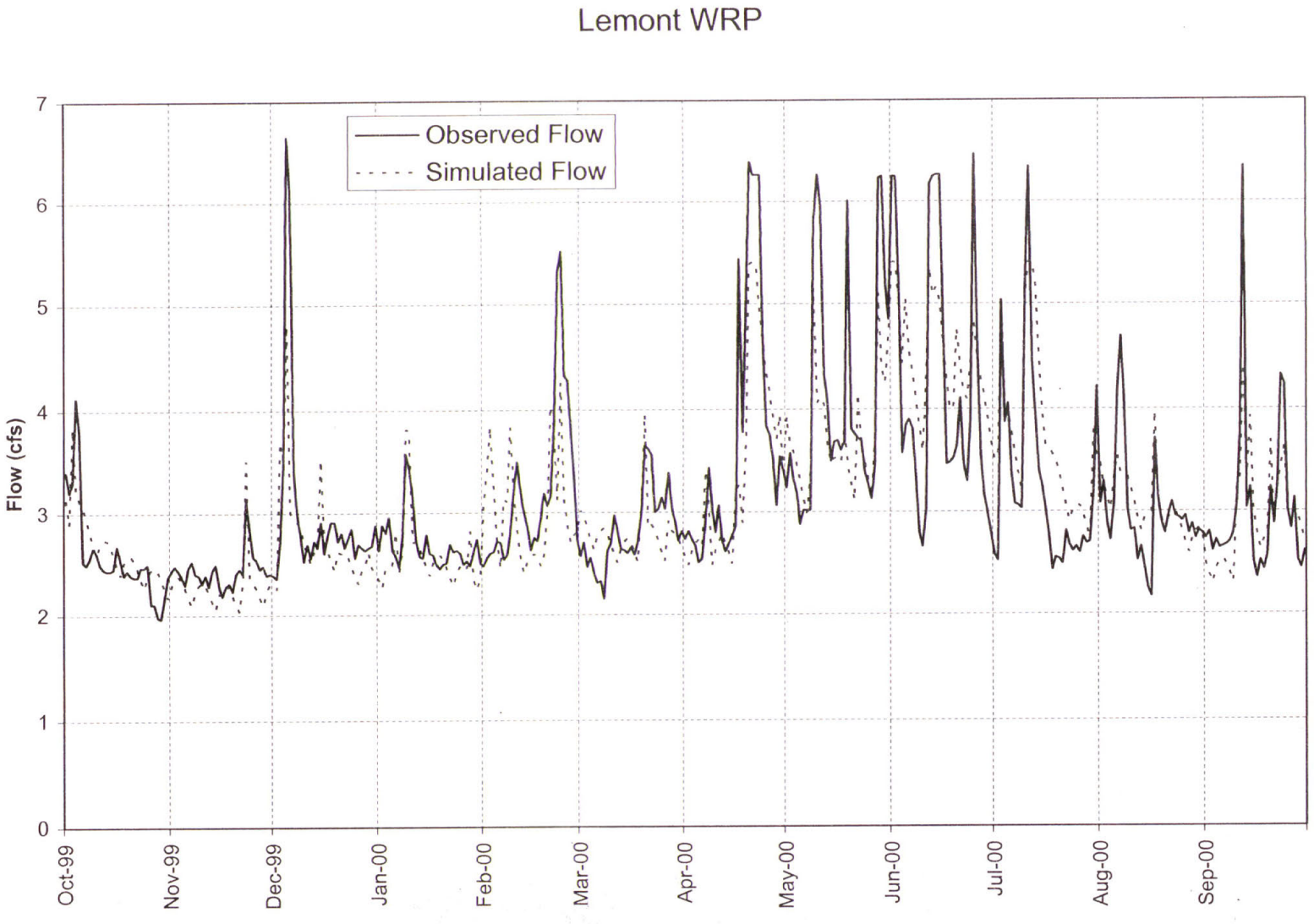


Figure 11 Budget 13 – Simulation of the MWRDGC Lemont Water Reclamation Facility

Summary of Budget Results

Overall, the WY2000 Diversion Accountings results are significantly improved from WY1999. The most significant improvements are in the S/R ratios are for the Mainstream and Calumet Pumping Stations (Budgets 9 and 11, respectively), and for the MWRDGC's Northside and Lemont Water Reclamation Facilities (Budgets 7 and 13, respectively). Budget and 9 and 11 showed sharp improvements from 1999, with simulated to recorded ratios of 1.01 (1.42 for 1999) and 1.03 (0.65 for 1999), respectively. The correlation also improved considerable for Budget 11, the Calumet Pumping Station, to 0.83 (0.46 for 1999). The two most significant budgets in the diversion accounting computations, Budget 7, the Northside Water Reclamation Facility, and Budget 10, Stickney Water Reclamation Facility, performed quite well. These budgets have simulated to recorded ratios of 1.01 and 0.95 and correlations of 0.84 and 0.84, respectively.

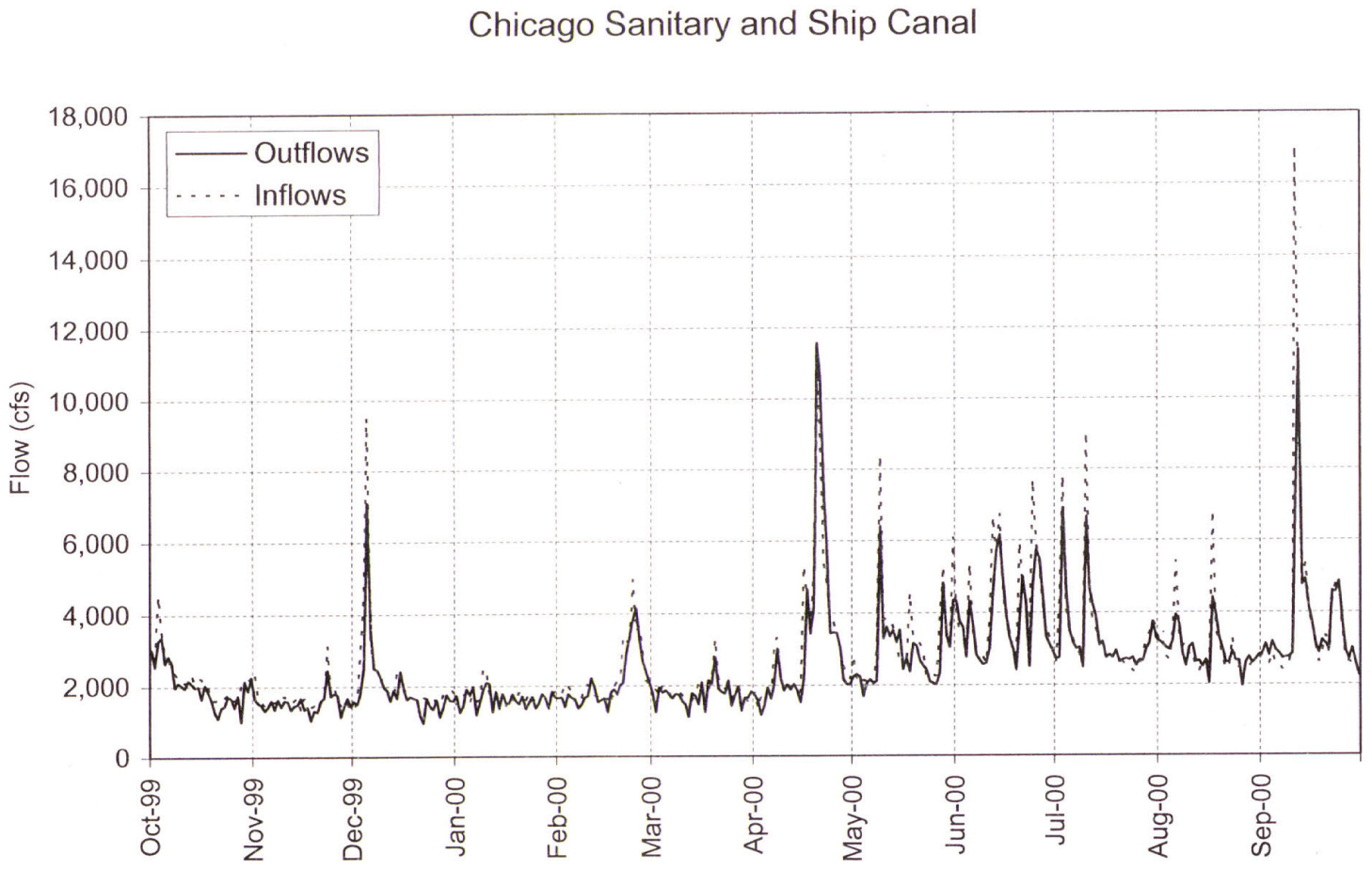


Figure 12 Budget 14 – CSSC System Balance

Table 8 – WY2000 Summary of Flow Components for the CSSC System Balance

INFLOWS (cfs)	
Direct Diversions at Lakefront Structures (measured)	
(includes lockage, leakage, discretionary and navigation makeup flows)	
- Wilmette Controlling Works	26.4
- Chicago River Controlling Works	124.8
- O'Brien Lock and Dam	140.5
Streamflows (measured)	
- North Branch Chicago River at Niles	105.2
- Little Calumet River at South Holland	135.2
- Grand Calumet River at Hohman Ave.	14.1
MWRDGC Water Reclamation Facilities (measured)	
- Northside	383.2
- Stickney	1,107.7
- Calumet	378.3
- Calumet TARP Pumpage to River	0.0
- Lemont	3.2
Other Point Sources (measured)	6.4
Summit Conduit (simulated)	14.9
Combined Sewer Overflows (simulated)	154.1
Direct Runoff to CSSC (simulated)	153.7
TOTAL INFLOWS (cfs)	2,747.8

OUTFLOWS (cfs)	
Cal-Sag Flow Transferred to Calumet WRP as Steel Mill Blow-down	3.6
Argonne Laboratory	0.8
Citgo Petroleum Corporation	7.5
USGS AVM Record	2,562.5
TOTAL OUTFLOWS (cfs)	2,574.4

DIFFERENCE (cfs)	173.4

Areas for Improvement

Tunnel and Reservoir Plan Models

The primary purpose of the TARP models is to accurately estimate deductible components of the diversion such as the Des Plaines River watershed runoff and groundwater infiltration through tunnel walls. Low flows, or dry weather flows, must be modeled accurately so that groundwater infiltration into the two TARP systems is properly modeled. These flows constitute a substantial deduction to the diversion and are included in the deductible groundwater flows of Column 4. Therefore, the estimates of simulated groundwater infiltration rates need to be updated periodically to better match the simulated to the recorded dry-weather flows. (Procedures for updating simulated dry-weather flows are similar to those used for improving the simulated groundwater infiltration rates for WY89 Calumet TARP as discussed in the WY89 Accounting Report in the Lake Michigan Diversion Accounting Annual Report for WY90-92.) In short, the procedure involves an analysis of operations records to identify time periods of little or no interceptor overflows into the TARP system. The underlying assumption is that the I&I flows are constant, and can be quantified as the average pumping rate over the period of time during which there was no interceptor overflows. This was the method used to revise the I&I flows for the Mainstem TARP for this WY00 Accounting Report as discussed in the Budget 9 description.

In the Calumet system, some sanitary sewers are connected to TARP. These sewers must be accurately accounted for in the modeling of groundwater infiltration since they contribute to the baseflow, or dry weather flow, into TARP. Currently, some uncertainty remains as to the connection of the separately sewered areas. For accurate modeling of the Calumet TARP system, these connections need to be verified and adjusted if necessary.

Due to model instability, simulated gate closing and pump operation parameters have been simplified or modified. Improvements for model stability are required before the models can better represent the operating procedures. Even after this change, representation of "actual" operating procedures may be difficult due to deviations from the TARP system operation plan, i.e. pumping at night, down times for various pumps, changes in pump ratings, implementation of forecasting algorithms, etc. If possible, the TARP models should be revised to better represent actual operating conditions. First, the modeling should more accurately simulate MWRDGC operational procedures that include less frequent pumping and pumping during the night. Second, the incorporation of a pseudo-forecasting algorithm would allow the model to simulate MWRDGC dewatering procedures prior to a storm. Third, dynamic constituent (inflow-infiltration versus sanitary versus groundwater) tracking can be incorporated to allow more accurate determination of the deductible

components of TARP flow. Currently, constant constituent proportions, based on annual volumes, are applied to all simulated pumpages from the TARP tunnels. Therefore, constituent flow percentages from TARP remain unchanged during an entire water year. Fourth, the inclusion of an algorithm to operate index dropshafts based on average water surface elevation in a tunnel reach would provide better simulation of "actual" operations. Sudden, localized changes in water surface elevations would not result in frequent opening and closing of control structure gates that regulate the flows into the drop shafts.

Data Preprocessing

The number of DSS-supplied input hydrographs in the Mainstream TNET BC files has reached the maximum dimension for the Diversion Accounting version of TNET (200). Prior to running TNET, some of the inflow hydrographs must be added together and stored in the DSS input file. In each case, the addition of the hydrographs before running TNET accomplishes the same numerical computation that would occur within TNET. The combining of inflows was performed at selected dropshafts that conveyed multiple SCAs to the tunnel. Prior to simulating WY00-01, these combinations were performed using the mathematic functions of HEC-DSSVue, although the same function could have been performed with the DOS-based HEC-DSSMath. If the BC files for WY00-01 are used as a template for future modeling, these merges will need to be performed in the same manner, or the TNET model will fail due to a missing data error.

MWRDGC Upper Des Plaines Pump Station

A review of the Upper Des Plaines pump station and its flow record indicates that the flow at the pump station is suspect and subject to operator error. Better flow measurements are needed at the pump station. With better flow measurements, this site will become the most important point for calibrating and verifying the simulation models for the Des Plaines watershed. In the diversion calculation, the primary purpose of modeling is to calculate the deduction for runoff from the Des Plaines watershed that enters the CSSC. The Upper Des Plaines Pump Station is the only point at which a model of the inflow-infiltration can be calibrated and extrapolated to the remaining portions of the Des Plaines River watershed. Because of the many problems associated with the current measurements of flow at this site, the benefits as the primary model calibration point have yet to be realized. Refer to the discussion of Budget 8 for additional details of some of the problems with the current measurements. Installation of better flow measurement equipment at the pump station and measurement of bypass flows at the facility would allow for better model calibration. Although this continues to be recognized as an area for improvement, the attention and funding of the diversion accounting program has been toward the potential switch to Lakefront Accounting.

The decision on the potential switch to Lakefront Accounting will influence whether or not this improvement is implemented in the near future.

O'Hare and Egan Basin Flow Transfer

A portion of the flows originating in the O'Hare and Egan Water Reclamation Plants' (WRP) service basins is transferred east to the Northside WRP. The extent of this transfer of flow is not known and the diverted flow is not currently measured. An estimate of the annual flow transfer is provided by MWRDGC. The total O'Hare-Egan flow transfer was reported as 5.8 cfs by the MWRDGC.

This transfer is significant to diversion since the O'Hare and Egan facilities discharge outside of the CSSC while the Northside WRP discharges flows that reach the CSSC. Therefore, this transfer contains two components that are deductions to the flow measured in the CSSC. The two deductible components are groundwater pumpage contained in the sanitary portion of the transfer (Column 4), and diverted Des Plaines River watershed runoff (Column 6).

To determine the two deductible components requires an estimate of the sanitary and runoff portions of the flow transfer. Presently the sanitary and runoff portions of the flow transfer are estimated using the same constituent (sanitary, inflow, and infiltration) proportions simulated for the Upper Des Plaines Pump Station by SCALP. Additionally, estimates must be made of the groundwater and Lake Michigan water components of the sanitary portion of the transfer. For WY00, the estimated water supply from the O'Hare and Egan service basins was composed of 1.5% groundwater (1.3 cfs) and 98.5% Lake Michigan water (87.4 cfs). The diverted Des Plaines River watershed runoff was estimated at 2.4 cfs.

For future accounting, simply measuring the basin transfer will not provide any information on the component makeup of the transfer. Thus, a review of the complex hydraulics and hydrology is necessary to determine the best procedure for estimating these flows. Several alternatives, including flow measurement and modeling were considered. A more detailed discussion of the flow transfer can be found in the Lake Michigan Diversion Accounting WY86 Report in the Lake Michigan Diversion Accounting WY90-92 Annual Report.

HSPF Snowmelt Simulation

There appears to be a significant difference in simulated and observed flows during periods with significant snowfall. The snow melt and accumulation routines should be examined over a longer period to identify possible parameter adjustments.

Budgets 7A and 7B

The mean S/R ratio for North Branch (Budget 7A) and Racine (Budget 7B) Pumping Stations were 0.59 and 0.51, respectively. In both cases the simulated flow was much lower than the observed flow.

The operation of the North Branch and Racine Pumping stations are not simulated in TNET and SCALP. Currently, overflows are forced at these locations at the same time all other inflow points are forced to overflow. The overflow rules for these locations would need to be modified to emulate MWRD operations of these pump stations. The S/R ratio being low indicates MWRD tends to start pumping early to save tunnel storage for the other locations without pump stations to minimize basement flooding. A re-examination of the TNET model for the Mainstream/Des Plaines TARP system is recommended.

TNET Model Confirmation/Update

The CTE Team suggests that the performance of a general housekeeping of the TNET model would be beneficial and desirable. A general confirmation of the TNET model would involve checking and updating the structure of the model and confirming that it accurately matches existing conditions and is error free. A thorough check on the TNET model would require a detailed investigation of the as-builts of the tunnels and drop shafts, and would likely require coordination with MWRDGC.

Baseflow Matching

For WY00, baseflows were matched by adjusting SCALP wastewater loading parameters to shift the simulated flow to approximately match the observed baseflows. This matching was perfomed for a period of 2 years and therefore appeared sufficiently valid. The actual model change was performed by indiscriminantly increasing or decreasing all wastewater loading parameters for a particular service area in order to approximate the average change in wastewater loading. In reality, the wastewater loading is a composite of the sum of the products of the population equivalent and the per capita usage factor for each sub area. To more accurately model the actual wasterwater loadings present, both the PE and the per capita usage should to be re-assessed. Census populations and NIPC manufacturing numbers should be considered when developing the revised wastewater loading parameters.

Calibration Period

The current modeling was conducted for a two year period, allowing an extra year of data to aid in calibration and model adjustment. A longer calibration period (10 or more years) should be looked at in the future. This long term calibration would be used to set the hydrologic parameters until a trend of over or under prediction becomes evident or changes in the physical system occur.

Budgets 7, 12, 13 High Flow Under Prediction

The simulation results for Budgets 7, 12 and 13 exhibit a tendency to under predict high flows. The observed high flows were in some cases higher than the SCALP interceptor split totals. Further investigation of this under prediction of high flows is recommended in order to identify the parameter adjustments required to correct this issue.

Budget 14 Calibration

The Budget 14 inflow to outflow ratio has been greater than the desired calibration criteria for several years. The simulated portion of Budget 14 is only 10-15% of the total. The individual simulated components met the calibration criteria established for their simulated to recorded flow ratios. For the Budget 14 criteria to be met, some or all of the individual components would have to be adjusted so as not to meet their calibration criteria by significant amounts. The causes for these differences have been shown to be at least partially related to a high bias in certain flow gage measurements . Future improvements in flow measurement accuracy will likely alleviate this issue.

Summary

The accuracy of the diversion accounting program is maintained and improved. Adjustments in the HSPF calibration, SCALP wastewater loading parameters, and, TNET gate opening operations and Mainstem Inflow and Infiltration parameters, have each contributed to improved simulated to observed ratios for WY00.

In compliance with the 1967 U.S. Supreme Court decree as modified in 1980, the WY00 diversion was computed using the best current engineering practice and scientific knowledge. The WY00 diversion accountable to the State of Illinois is 2,584 cfs. This flow is 616 cfs less than the 3,200 cfs average specified by the Decree. The 40 year running average beginning with WY81 and rounded to the nearest cfs is 3,318 cfs, and the cumulative deviation from the 3,200 cfs average is –2360 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum deficit allowed by the Decree is -2,000 cfs-years.

References

1. Barkau, Robert L. 1991. *Modeling of the Chicago Tunnel and Canal System.* Prepared for Christopher B. Burke Engineering Ltd. as part of reference 2.

2. Christopher B. Burke Engineering, Ltd. 1990. *Infiltration and Inflow Study and Diversion Accounting Model Modification.* Prepared for the U.S. Army Corps of Engineers, Chicago.

3. Christopher B. Burke Engineering, Ltd. 1991. *Data Collection and Model Revisions.* Prepared for the U.S. Army Corps of Engineers, Chicago.

4. Christopher B. Burke Engineering, Ltd. 1999. *Hydrologic and Hydraulic Study of the Calumet Watershed.* Prepared for the U.S. Army Corps of Engineers, Chicago

5. Espey, William H., Harry H. Barnes, and Svein Vigander. 1981. *Lake Michigan Diversion Findings of the Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

6. Espey, William H., Harry H. Barnes, and David Westfall. 1987. *Lake Michigan Diversion Findings of the Second Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

7. Espey, William H., Oscar G. Lara, and Robert L. Barkau. 1994. *Lake Michigan Diversion Findings of the Third Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

8. Espey, William H., Arthur R. Schmidt, and Robert L. Barkau. 2001. *Lake Michigan Diversion Findings of the Fourth Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

9. Hart, Dale E., and Richard G. McGee. 1985. *Final Report - Lockport Power Plant Sluice Gate and Control Works Discharge Evaluation.* Waterways Experiment Station. Vicksburg, MS.

10. International Joint Commission. 1981. *Great Lakes Diversions and Consumptive Uses, Annex F, Consumptive Use.*

11. Keifer Engineering. 1982. *Input Data CRSM for Existing Conditions - Mainstream System.* Prepared for the U.S. Army Corps of Engineers, Chicago.

12. Kleinbaum, David G., and Lawrence L Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods.* Wadsworth Publishing Company.

13. Metropolitan Water Reclamation District of Greater Chicago. 1984. *1984 Facility Planning Study - MSDGC Update Supplement and Summary.*

14. Metropolitan Water Reclamation District of Greater Chicago. 1989. *1988 Annual Report of the Maintenance and Operations Department.*

15. Neubauer, Ronald A. 1990. Request for TARP Information from the Army Corps of Engineers. Memorandum to Mr. William Eyre, Supervising Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago.

16. Northeastern Illinois Planning Commission. 1985. *Lake Michigan Diversion Accounting Manual of Procedures.*

17. Peppler, Randy A., 1991. *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990.* Illinois State Water Survey.

18. RUST Environment & Infrastructure. 1993. *Diversion Accounting Update for the New 25-Gage Precipitation Network.*

19. Soil Conservation Service. 1986. *Urban Hydrology for Small Watersheds,* Technical Release 55.

20. Steel, Robert G. D., and James H. Torrie. 1980. *Principles and Procedures of Statistics - A Biometrical Approach.* McGraw-Hill, Inc.

21. U.S. Army Corps of Engineers. 1990. *Lake Michigan Diversion Accounting 1989 Annual Report Including WY84 and WY85 Accounting.*

22. U.S. Army Corps of Engineers. 1990. *Current Meter Measurements of Discretionary and Leakage Flows at the Chicago River Controlling Works, O'Brien Lock and Dam, and the Wilmette Controlling Works.*

23. U.S. Army Corps of Engineers. 1994. Lake Michigan Diversion Accounting Annual Report Water Years 1990-1992. *Contains Lake Michigan Diversion Accounting Water Year 1986 Report, Water Year 1987 Report, Water Year 1988 Report, and Water Year 1989 Report.*

24. U.S. Army Corps of Engineers. 1995. Lake Michigan Diversion Accounting Water Year 1993 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1990 Report.*

25. U.S. Army Corps of Engineers. 1996. Lake Michigan Diversion Accounting Lakefront Accounting Technical Analysis – DRAFT.

26. U.S. Army Corps of Engineers. 1996. Lake Michigan Diversion Accounting Water Year 1994 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1991 Report and Water Year 1992 Report.*

27. U.S. Army Corps of Engineers. 1997. Lake Michigan Diversion Accounting Water Year 1995 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1993 Report and Water Year 1994 Report.*

28. U.S. Army Corps of Engineers. 1998. Lake Michigan Diversion Accounting Water Year 1996 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1995 Report.*

29. U.S. Army Corps of Engineers. 2000. Lake Michigan Diversion Accounting Water Year 1997 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1996 Report.*

30. U.S. Army Corps of Engineers. 2001. Lake Michigan Diversion Accounting Water Year 1998 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1997 Report.*

31. U.S. Army Corps of Engineers. 2004. Lake Michigan Diversion Accounting Water Year 1999 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1998 Report and Water Year 1999 Report.*

32. U.S. Geological Survey. 1984. *Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois.*

33. U.S. Geological Survey. 1992. *Water Resources Data, Illinois, Water Year 1991, Volume 2, Illinois River Basin.*

34. U.S. Geological Survey. 1994. *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary Ship Canal at Romeoville, Illinois.*

35. U.S. Geological Survey. 1994. *Measurements of Leakage through Chicago River Controlling Works and Other Control Structures Near Chicago Illinois.*

36. U.S. Geological Survey. 2003. *Computation of Discharge and Error Analysis for the Lake Michigan Diversion Project – Lakefront Accounting Streamflow-Gaging Stations – DRAFT.*

37. Westcott, Nancy E. 2000. *Continued Operation of a Raingage Network for Collection, Reduction, and Analysis of Precipitation Data for Lake Michigan Diversion Accounting: Water Year 1999.* Illinois State Water Survey Contract Report 2000-07.

38. Westcott, Nancy E. 2001. *Continued Operation of a Raingage Network for Collection, Reduction, and Analysis of Precipitation Data for Lake Michigan Diversion Accounting: Water Year 2000.* Illinois State Water Survey Contract Report 2000-07.

39. Wisconsin et. al., v. Illinois et. al., Michigan v. Illinois et. al. New York v. Illinois et. al. U.S. 2, 3, and 4, Original 1 - 18, 1980.

Appendix A - Background of Lake Michigan Diversion Accounting

The Decree specifies several limitations on the diversion of Lake Michigan water by the State of Illinois. The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in two accounting periods due to extreme hydrologic conditions in which the average diversion may not exceed 3,840 cfs. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the forty year period beginning with WY81.

Also required by the Decree, a three (3) member technical committee is convened every five (5) years to evaluate the diversion accounting program to ensure that the accounting is accomplished using the best current engineering practice and scientific knowledge.

Prior to the 1983 accounting report, diversion accounting was done by the MWRDGC in the form of monthly hydraulic reports. As required by the Decree, the diversion was calculated by deducting non-diversion flows from the Lockport record measured by MWRDGC and adding those diversion flows not discharging to the CSSC. All of the deductible flows could not be measured, therefore MWRDGC used flow records from gaged areas to obtain typical flow values. To estimate the unmeasured deductible flows, the measured flow values were extrapolated to the areas from which the deductible flows originated.

While the diversion accounting was still being performed by MWRDGC the first technical committee was convened. The committee was primarily concerned with the rating of the various components at the Lockport facility, the primary diversion measurement location (Espey et. al., 1981). In response to the Committee's concerns, the Corps' Waterways Experiment Station (WES) revised the ratings of the two sets of Lockport sluice gates (Hart and McGee, 1985) and the State of Illinois installed an acoustic velocity meter (AVM) at Romeoville five (5) miles upstream of Lockport. The AVM is a highly accurate flow measuring device that proved to provide better flow measurements than the MWRDGC reported Lockport flows and the new Corps rating curves. The AVM became operational 12 June 1984. However, USGS did not publish the AVM flows until 1 October 1985. Because of significant equipment problems with the original AVM, a replacement AVM was installed in November 1988.

Additionally, the State of Illinois contracted with NIPC to revise the diversion accounting calculations. At the same time, the State of Illinois moved from monthly hydraulic reports to annual accounting reports. NIPC adapted computer models of the diverted Lake Michigan and the Des Plaines River watersheds previously

developed for studies in Northeastern Illinois under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), to calculate those flows that could not be measured. Like MWRDGC, NIPC deducted non-diversion flows from the Lockport record and added those flows not discharged to the canal to calculate the Lake Michigan diversion. However, NIPC modeled both the gaged and ungaged areas to calculate much of the deduction and addition flows. Then computational budgets were developed around each of the gaged areas to verify the models. The budgets aid in calibrating the models and verifying the computational procedures. Due to the more rigorous approach and the verification provided by the budgets, the procedure developed by NIPC was a significant improvement over the previous approach.

The second technical committee reviewed the NIPC hydrologic and hydraulic computer models and agreed that the approach was consistent with the requirements of the decree (Espey et. al., 1987). However, the committee felt that some of the parameters used in the models were out of date and in need of revision. To address the committee's concerns, the Corps hired a consultant (Christopher B. Burke Engineering, Ltd., (CBBEL)) in September of 1988 to review and update the modeling parameters. The final report (CBBEL, 1990) concerning the updating of modeling parameters was submitted to the Corps in October 1990.

The Water Resources Development Act of 1986 gave the Corps of Engineers the full responsibility for computation of the Illinois Lake Michigan diversion as of 1 October 1987. When the Corps' new responsibility became effective, the WY84 diversion accounting report, developed by NIPC, had not been certified. As a result, the Corps was responsible for conducting the WY84 and all subsequent reports.

NIPC completed the WY84 diversion accounting analysis in April 1987 and the report was subsequently reviewed by the Corps. The Corps found the report to be adequate with two exceptions. First, the accounting was completed with the model parameters questioned by the second technical committee. Second, the MWRDGC Lockport flows, which were adjusted using the WES rating curves, were used rather than the AVM flows. The Corps, knowing that the modeling parameters required updating and that AVM flows for the period prior to installation could be calculated accurately using regression equations, refrained from certifying the WY84 report until these issues were resolved.

NIPC completed the WY85 diversion accounting report in December 1988 and the report was reviewed by the Corps. Like the WY84 report, the WY85 accounting was done with the modeling parameters questioned by the second technical committee. Additionally, NIPC used the AVM flows published by the USGS in their WY85 Water Resources Data for Illinois report. Since the publication of the WY85 USGS report, more reliable regression equations have been developed for calculating flows when the AVM was malfunctioning. These equations provide

flow estimates based on flow components at Lockport. The equations are used to fill in missing records when the AVM malfunctions.

Over the years, various regression analyses have been performed to relate the MWRDGC reported Lockport flows to the AVM flows. Several sets of equations were proposed by the Corps of Engineers, the United States Geological Survey (USGS), Harza Engineering Co., and the Second Technical Committee. The report, *Chicago Sanitary and Ship Canal at Romeoville Acoustical Velocity Meter Backup System*, was completed September 1989 (USACE, 1989). The report documents the many efforts taken by various parties to develop useful regression equations. The regression equations that were ultimately used to estimate missing AVM flows from WY86 through WY97 were developed by the USGS in a report titled *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary and Ship Canal at Romeoville, Illinois* (USGS, 1994). This report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

Upon completion of the analysis of the modeling parameters by CBBEL, the WY84 and WY85 diversion flows were recalculated using the revised modeling parameters and the Romeoville AVM flows. The diversion flows were certified by the Corps and transmitted to all interested parties in the Lake Michigan Diversion Accounting 1989 Annual Report (USACE, 1990).

The computation of Illinois' diversion from Lake Michigan for WY86 was undertaken as a joint effort between NIPC (under contract to the Corps) and the Corps. The computation of Illinois' diversion from Lake Michigan for WY87 through WY90 was performed solely by the Corps.

Prior to the publication of the WY90 diversion accounting report, the third technical committee reviewed diversion accounting procedures and efforts to meet the recommendations of the first and second committees (Espey et. al., 1994). The committee expressed general satisfaction with the procedures and efforts to meet the recommendations of the previous committees. Emphasis was placed on the need for data and model quality plans, detailed accounting procedures, and more timely reports. Also recommended by the committee were detailed flow measurements at the lakefront structures and at the Upper Des Plaines Pump Station.

The WY91 and WY92 diversion accounting was performed as a joint effort between CBBEL (under contract to the Corps) and the Corps. The WY93, WY94, WY95, WY96 and WY97 accounting was performed solely by the Corps.

In 1998 the fourth technical committee was convened. The committee had several recommendations pertaining to the AVM flow measurements at lakefront controlling works and the QA/QC of water supply pumpage from Lake Michigan.

These are important issues if the accounting procedures will be moved from Lockport to the lakefront.

The WY98 and WY99 diversion accounting was performed as a joint effort between Mead&Hunt (under contract to the Corps) and the Corps. Mead&Hunt performed hydrological and hydraulic model simulations, where as the Corps did the budget and columns computations and statistical data analyses. The WY 2000 diversion accounting was performed by CTE Engineers Inc. (under contract to the Corps).

The WY86 through WY89 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Annual Report covering WY90 through WY92 (USACE, 1994). The WY90 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1993 Annual Report (USACE, 1994). The WY91 and WY92 Diversion Accounting Reports are contained in the LMDA Water Year 1994 Annual Report (USACE, 1996). The WY93 and WY94 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1995 Annual Report. The WY95 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1996 Annual Report (USACE, 1998). The WY96 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1997 Annual Report (USACE, 2000). The WY97 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1998 Annual Report (USACE, 2001). Finally, the WY98 and WY99 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1999 Annual Report (USACE, 2004).

The primary revision implemented for the WY90 diversion accounting was the incorporation of the new 25-gage precipitation network into the runoff simulation models. The 25-gage precipitation network replaces the previously used 13-gage network. The new precipitation network has solved many of the problems associated with the old network, such as poor exposure and distribution patterns. The Illinois State Water Survey (ISWS) installed and maintains the precipitation network for the Corps of Engineers. They also collect the data and adjust it if necessary. A description of the new 25-gage precipitation network can be found in the ISWS report titled *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990* (ISWS, 1991). That report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

In addition to the introduction of the new 25-gage precipitation network were the subsequent modifications to the hydrologic runoff models and hydraulic sewer routing models. These models were revised in order to reflect the changes in the precipitation network and changes in land use and cover. Many of the model changes were completed by RUST Environment and Infrastructure under contact with the Corps. Their work culminated in a report titled *Diversion Accounting Update*

for the New 25-Gage Precipitation Network (Rust, 1993). That report is also contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

RUST's work involved reviewing and correcting map delineations of combined sewer special contributing areas, delineating precipitation gage assigned areas for the 25-gage network, land-use/land-cover delineation, modifying the hydraulic sewer routing model to reflect the revised precipitation network and land cover assignments, and assessing the model parameters used in the hydrologic runoff model, Hydrologic Simulation Program - FORTRAN (HSPF).

The Corps modified the hydraulic sewer model, Special Contributing Area Loading Program (SCALP), in the separate sewer areas in order to incorporate changes in the precipitation network. These changes were also incorporated in the WY90 accounting. Since actual boundaries have not been mapped for those areas, some assumptions as to the location of the separate sewer areas were made. These assumptions were necessary since effective (instead of actual) areas are used for separate sewer areas in the SCALP model. These assumptions will continue until a further study can be accomplished that will reflect actual boundaries for these separately sewered areas. These modifications were also incorporated into accounting procedures beginning with the WY90 accounting.

A study was also done by the Corps to improve the response of the HSPF hydrologic runoff models. Input on parameter improvements were received from NIPC and RUST. The study resulted in some minor parameter modifications to the HSPF runoff model to correct for past inconsistencies and improve parameter accuracy.

Beginning with the WY91 accounting all the computer models were revised to read and write to the Data Storage System (DSS) database, the Corps' standard database. In 1993 Aqua Terra Consultants, under contract to the Corps, revised the HSPF code to be compatible with the DSS database and in 1994 they provided a new release of HSPF, version 11. Christopher B. Burke Engineering in 1995 revised all hydrologic and computational HSPF input files, as well as SCALP input files to work in conjunction with the DSS database. The Corps revised the SCALP code to also work in conjunction with this database.

Beginning with the WY92 accounting, flows in the Grand Calumet were measured instead of estimated through regression equations. These flows are critical in determining portions of the deductible water supply from Indiana contained in Column 5 of the report.

There were three primary revisions to the accounting procedures beginning with the WY93 accounting. The first revision involved a modification to the procedure for estimating the deductible Indiana water supply pumpage contained in the Grand Calumet River. This revision better accounts for the unique hydraulics of

this river. The second revision involved modeling modifications for a portion of the Des Plaines TARP system that became operational in June 1993. These modeling modifications impact the deductible runoff from the Des Plaines River watershed contained in Column 6. The third revision to the accounting involved adjustments to correct for double accounting for a portion of the runoff originating from the ungaged Calumet watershed. This modification is reflected only in the results of Column 12, Runoff from the Diverted Lake Michigan Watershed, and therefore has no effect on the computed diversion.

Four revisions were made to the diversion accounting procedures for WY96. First, a switch to using Argonne National Lab's direct solar radiation values was made because O'Hare Airport changed the way it reported cloud cover. A second revision was the improvement of the snowmelt computation by incorporating the newly available 3-hour meteorologic data at O'Hare Airport. Previously snowmelt was computed using daily values. Thirdly, the Calumet TARP model was updated to include new tunnel legs which went on-line during WY96. Finally, University of Chicago air temperature data is no longer used as input to HSPF due to the fact that records are no longer kept at the site. HSPF subareas that previously referenced the University of Chicago data now reference either the O'Hare airport, Midway airport or Park Forest temperature gage, depending on proximity.

Three revisions were made to the diversion accounting procedures for WY97. First, the monthly and weekly distributions of sanitary loads for the Calumet watershed were improved. Second, a review of the percent imperviousness assigned to the various landuse parameters used in the SCALP model was made. Finally, the inclusion of a 10% consumptive use factor was incorporated in the computation of Columns 4, 5, 7, 9 and 11.

Three revisions were made to the diversion accounting procedures for WY98. First, a new leg of tunnel, North Branch Tunnel, was added to the Mainstream TARP system. Second, the direct diversion flows measured by AVM's installed at Columbus Drive (near CRCW) and O'Brien Lock and Dam were available to compare against the flows estimated by the ratings of lakefront structures. Finally, water supply from Hammond, Indiana to Chicago Heights, Calumet City and Burnham was added to Column 11 (pumpage from Lake Michigan accountable to the State of Illinois).

One revision was made to the diversion accounting procedure for WY99. The Des Plaines Tunnel Branch was added to the Mainstream/Des Plaines TARP system. The tunnel went through a testing period before becoming fully operational.

Several revisions were made to the diversion accounting procedure for WY00. First, it should be noted that the current modeling was conducted for a two year period, WY00 and WY01. Previously, the verification had been done by accounting year. Using a two-year period allows the parameter adjustments to be

correlated to the greater variability of conditions over two years. This allows the parameters to better reflect the landuse conditions which do not change significantly over time within the combined sewer area. The WY99 meteorological data was used as a starting point in the calibration runs to allow the HSPF model to stabilize and have correct (antecedent) conditions at the beginning of the WY00 accounting year.

Secondly, two new budgets (Budgets 7A and 7B) were added. Budget 7A compares simulated and observed pumping at the North Branch Pumping Station. Budget 7B compares simulated and observed pumping at the Racine Pumping Station. These Budgets were added to help determine the accuracy of the TARP CSO simulations and for their potential future use as calibration points for the heretofore uncalibrated CSO overflows.

Thirdly, for Budget 14, backflows at the CRCW, O'Brien and Wilmette locks were removed from the outflows from the canal since they are already accounted for in the Lake front AVM.

For WY00, several adjustments were also made as part of the HSPF, SCALP and TNET calibration effort. HSPF Grass and Impervious parameters were adjusted based on guidance in "USEPA BASINS Technical Note 6 – Estimating Hydrologic and Hydraulic Parameters for HSPF" (2000) and a NIPC report "Application Guide for Hydrologic Modeling in DuPage County Using HSPF" (1996). The following changes were made:

- Grass parameter INTFW adjusted to 10.0 (was 5).
- Grass parameter UZSN adjusted to 0.5 (was 1.8).
- Grass parameter INFILT adjusted to 0.100 (was 0.015).
- Grass parameter CEPSC adjusted to 0.10 (was 0.25).
- Grass parameter LZSN adjusted to 8.5 (was 9.5).
- Impervious parameter RETSC adjusted to 0.10 (was 0.25).

As part of the calibration, the SCALP wastewater loading parameter was adjusted to shift baseflows to more closely match the observed baseflows. The following changes were made to SCALP wastewater loading parameters:

- Wastewater loadings were increased by 3% for the CSO service areas tributary to the Northside Wastewater Treatment Plant.
- Wastewater loadings were decreased by 24% for the CSO service areas tributary to the West Southwest Wastewater Treatment Plant.
- Wastewater loadings were decreased by 20% for the CSO service areas tributary to the Calumet Wastewater Treatment Plant.
- Wastewater loadings were increased by 10% for the CSO service areas tributary to the Lemont Wastewater Treatment Plant.

Several adjustments were made to the TNET model. One significant change to the Mainstream TNET model was a modification to the constant I&I flow. The previous I&I total was 76.59 cfs, which was brought into question after an observation that the operations records indicate that there were several sustained periods where the pumping averages were significantly lower than that value. The comparison of simulated vs. observed values also indicated that the model consistently over predicted the baseflow during low-runoff periods. An analysis of Mainstream/Des Plaines TARP-to-STP pumping averages for WYs 98 through 01 indicated that there were two sustained periods of apparently little or no interceptor overflow into the tunnel. One was 17 October 1999 through 8 November 1999, and the other was 18 December 1999 through 6 February 2000. The composite average value for those two periods was 27.78 cfs. Since pumping occurred on about a third of the days in these time periods, care was taken to select the time periods such that complete inflow and pumpout cycles were accounted for, and not averaging any incomplete pumping cycle (which tended to be 4-5 days).

The other changes to the Mainstream and Calumet TNET models included modifications to the index dropshaft parameters. The net changes to the TNET input data were developed over the series of calibration model runs which involved comparing the recorded pumpout volumes to the simulated, and tunnel stage data for the Mainstream tunnel only. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations and pumping schemes.

For the Mainstream Tunnel, the index dropshaft scheme was changed, resulting in fewer indices, and basing more of the dropshaft operations on a point farther downstream in the tunnel. This change resulted in closing off the inflows at a slightly lower elevation. After this change was made, the model results were compared with MWRDGC operations data to confirm that the simulated pressurization levels were reasonably close to the observed levels. A second check was a comparison of weekly average pumping volumes of simulated vs. observed, although this comparison also includes the variance due to the hydrologic modeling as well.

The pump on/pump off elevations were changed slightly also, and were compared with actual measured values. It was not possible to simulate the pumping of the tunnel down to the level that is used in actual operations because of numerical instability of the model. The final value used in the model was the lowest point to which the tunnel could be pumped without causing excessive numerical instability.

The dropshaft operation data for the Calumet TNET model was changed significantly, and resulted in closing off the inflows at a higher elevation. The TNET model results from the early iterations indicated that the simulated capture (and pumpout) volumes were much lower than observed. This was determined by

comparing the weekly average pumping volumes of simulated vs. observed, even though this comparison also includes the variance due to the hydrologic modeling as well. The gate-closing scheme was modified to cause the model to capture more inflows, yet not pressurizing the system. The model input that was developed over the iterations produced a reasonable match of pumpout volumes. The locations of the index dropshafts were not changed.

Appendix B - Summary of Daily Diversion Flows

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 = Column 3 - Column 8 + Column 9.

Note: The averages presented in the final row are calculated from the daily values contained in Appendix B.

Deductions from the Romeoville Gage Record

Additions to the Romeoville Gage Record

Lake Michigan Diversion Accounting – WY 2000
October 1999 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Oct-99	3,021.0	0.8	3,021.8	40.5	17.6	74.0	0.8	132.8	263.6	**3,152.6**	1,549.1	268.0	504.5
02-Oct-99	2,537.0	0.4	2,537.4	34.5	14.8	51.7	0.8	101.6	263.0	**2,698.8**	1,505.4	191.0	515.0
03-Oct-99	3,270.0	0.5	3,270.5	83.5	21.0	572.8	0.8	678.0	269.3	**2,861.8**	1,495.1	2,324.0	314.5
04-Oct-99	3,376.0	0.9	3,376.9	288.0	17.6	191.7	0.8	498.1	263.3	**3,142.1**	1,519.1	1,315.0	433.0
05-Oct-99	2,643.0	1.3	2,644.3	95.8	17.0	98.2	0.8	211.8	263.4	**2,695.9**	1,510.8	506.0	458.0
06-Oct-99	2,832.0	1.5	2,833.5	33.1	17.0	65.0	0.8	115.8	260.9	**2,978.6**	1,530.7	243.0	458.0
07-Oct-99	2,658.0	2.4	2,660.4	26.0	14.7	57.1	0.8	98.5	265.5	**2,827.4**	1,546.7	181.0	417.5
08-Oct-99	1,965.0	2.3	1,967.3	34.5	15.1	55.9	0.8	106.2	264.0	**2,125.1**	1,532.3	193.0	548.0
09-Oct-99	2,090.0	1.9	2,091.9	33.6	14.8	54.0	0.8	103.1	264.7	**2,253.5**	1,509.1	162.0	492.5
10-Oct-99	2,026.0	1.4	2,027.4	49.7	16.2	59.1	0.8	125.7	263.3	**2,165.0**	1,493.2	180.0	567.0
11-Oct-99	1,948.0	2.3	1,950.3	34.4	16.0	47.5	0.8	98.7	265.5	**2,117.1**	1,555.1	136.0	489.5
12-Oct-99	2,156.0	3.0	2,159.0	33.4	16.2	45.8	0.8	96.1	264.6	**2,327.5**	1,570.9	116.0	508.0
13-Oct-99	2,074.0	2.4	2,076.4	26.0	15.8	39.7	0.8	82.2	261.9	**2,256.1**	1,527.6	85.0	728.0
14-Oct-99	1,967.0	1.7	1,968.7	34.4	15.7	40.3	0.8	91.2	263.4	**2,140.9**	1,515.5	111.0	432.0
15-Oct-99	1,996.0	5.4	2,001.4	26.0	14.9	35.4	0.8	76.9	264.0	**2,188.5**	1,533.8	74.0	473.5
16-Oct-99	1,638.0	2.7	1,640.7	65.4	15.2	66.2	0.8	147.6	263.4	**1,756.5**	1,510.8	257.0	509.5
17-Oct-99	2,032.0	2.4	2,034.4	34.3	15.9	36.3	0.8	87.3	261.9	**2,209.0**	1,459.6	95.0	538.5
18-Oct-99	1,825.0	3.5	1,828.5	26.0	16.2	30.9	0.8	73.9	264.0	**2,018.6**	1,476.7	68.0	430.5
19-Oct-99	1,589.0	3.5	1,592.5	34.4	14.3	32.0	0.8	81.4	262.7	**1,773.8**	1,491.9	94.0	196.0
20-Oct-99	1,260.0	3.5	1,263.5	33.0	14.5	31.2	0.8	79.5	262.1	**1,446.1**	1,494.5	78.0	92.0
21-Oct-99	1,099.0	3.3	1,102.3	26.0	14.4	26.3	0.8	67.5	262.6	**1,297.4**	1,510.2	56.0	77.0
22-Oct-99	1,388.0	2.2	1,390.2	34.5	15.2	27.2	0.8	77.6	264.1	**1,576.7**	1,481.2	79.0	89.0
23-Oct-99	1,446.0	2.2	1,448.2	51.8	16.2	35.4	0.8	104.2	260.6	**1,604.6**	1,454.1	108.0	186.0
24-Oct-99	1,702.0	2.5	1,704.5	26.0	15.3	22.0	0.8	64.1	263.5	**1,903.9**	1,458.5	50.0	133.0
25-Oct-99	1,655.0	0.8	1,655.8	34.4	14.1	23.4	0.8	72.8	264.4	**1,847.4**	1,497.7	73.0	114.0
26-Oct-99	1,389.0	1.2	1,390.2	36.5	13.8	24.5	0.8	75.6	264.4	**1,579.0**	1,498.5	74.0	140.0
27-Oct-99	1,726.0	1.6	1,727.6	26.0	14.0	18.3	0.8	59.0	263.6	**1,932.2**	1,512.2	35.0	274.4
28-Oct-99	997.0	2.3	999.3	74.7	14.3	38.9	0.8	128.6	263.1	**1,133.8**	1,509.6	165.0	659.5
29-Oct-99	2,143.0	2.1	2,145.1	26.0	17.0	16.0	0.8	59.6	261.6	**2,347.1**	1,519.9	34.0	609.0
30-Oct-99	1,859.0	2.4	1,861.4	26.0	16.3	14.9	0.8	58.0	263.0	**2,066.4**	1,511.1	33.0	607.0
31-Oct-99	2,252.0	2.5	2,254.5	42.6	15.4	20.4	0.8	79.2	265.0	**2,440.3**	1,525.7	84.0	596.5
Averages	2,018.0	2.2	2,020.2	47.4	15.7	63.0	0.8	126.9	263.6	**2,156.9**	1,509.9	240.9	406.2

Lake Michigan Diversion Accounting – WY 2000
November 1999 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Nov-99	1,655.0	3.2	1,658.2	26.0	15.2	30.0	0.9	72.0	242.5	**1,828.7**	1,496.5	70.0	587.5
02-Nov-99	1,523.0	2.4	1,525.4	26.0	17.1	12.9	0.9	56.8	236.9	**1,705.5**	1,464.1	48.0	206.0
03-Nov-99	1,465.0	3.2	1,468.2	68.9	13.9	31.3	0.9	114.9	239.3	**1,592.6**	1,468.8	156.0	109.0
04-Nov-99	1,318.0	3.0	1,321.0	26.0	14.3	11.8	0.9	52.9	237.5	**1,505.6**	1,489.3	33.0	54.0
05-Nov-99	1,407.0	1.8	1,408.8	26.0	14.1	11.0	0.9	51.8	239.8	**1,596.8**	1,504.3	28.0	100.0
06-Nov-99	1,596.0	4.4	1,600.4	45.3	13.4	17.9	0.9	77.5	238.2	**1,761.1**	1,496.0	80.0	43.9
07-Nov-99	1,342.0	4.2	1,346.2	26.0	13.6	9.6	0.9	50.0	240.5	**1,536.7**	1,463.9	28.0	22.0
08-Nov-99	1,622.0	3.7	1,625.7	34.6	15.2	13.2	0.9	63.8	240.7	**1,802.6**	1,522.5	45.0	51.0
09-Nov-99	1,418.0	3.2	1,421.2	34.5	12.7	10.9	0.9	59.0	238.0	**1,600.2**	1,529.1	49.0	426.0
10-Nov-99	1,581.0	3.1	1,584.1	47.3	14.6	17.7	0.9	80.5	237.9	**1,741.5**	1,513.2	70.0	150.0
11-Nov-99	1,575.0	1.1	1,576.1	33.7	13.6	10.8	0.9	59.0	238.2	**1,755.3**	1,475.2	37.0	29.0
12-Nov-99	1,335.0	1.3	1,336.3	34.4	13.9	9.4	0.9	58.6	238.5	**1,516.2**	1,479.2	46.0	57.0
13-Nov-99	1,443.0	3.3	1,446.3	26.0	13.8	6.5	0.9	47.1	239.8	**1,639.0**	1,497.5	22.0	186.0
14-Nov-99	1,471.0	3.3	1,474.3	34.3	14.7	10.1	0.9	60.0	238.2	**1,652.5**	1,476.4	39.0	80.0
15-Nov-99	1,662.0	1.2	1,663.2	55.3	13.5	18.7	0.9	88.4	241.5	**1,816.3**	1,485.0	96.0	48.0
16-Nov-99	1,345.0	0.6	1,345.6	26.0	12.4	5.5	0.9	44.8	237.4	**1,538.2**	1,454.2	14.0	275.5
17-Nov-99	1,413.0	2.1	1,415.1	33.8	12.0	9.0	0.9	55.7	236.8	**1,596.2**	1,476.2	65.0	28.0
18-Nov-99	1,025.0	3.2	1,028.2	34.4	12.4	7.5	0.9	55.3	239.6	**1,212.5**	1,491.3	66.0	19.0
19-Nov-99	1,303.0	2.9	1,305.9	26.0	13.0	4.5	0.9	44.4	238.6	**1,500.1**	1,479.0	18.0	23.0
20-Nov-99	1,271.0	2.5	1,273.5	36.9	11.5	9.6	0.9	58.9	239.0	**1,453.6**	1,472.8	43.0	11.8
21-Nov-99	1,582.0	1.9	1,583.9	34.4	13.7	6.9	0.9	55.9	239.2	**1,767.2**	1,448.5	45.0	(37.0)
22-Nov-99	1,658.0	2.6	1,660.6	53.5	13.1	89.5	0.9	157.1	241.4	**1,744.9**	1,480.7	170.0	50.0
23-Nov-99	2,443.0	2.7	2,445.7	189.2	13.8	464.9	0.9	668.9	237.2	**2,014.0**	1,447.4	1,716.0	97.2
24-Nov-99	1,712.0	2.4	1,714.4	173.3	14.7	81.8	0.9	270.6	232.1	**1,675.9**	1,449.4	460.0	64.0
25-Nov-99	1,781.0	1.0	1,782.0	26.0	13.2	10.5	0.9	50.5	236.2	**1,967.7**	1,434.2	52.0	24.0
26-Nov-99	1,753.0	1.7	1,754.7	39.4	12.3	15.6	0.9	68.2	235.6	**1,922.1**	1,360.2	75.0	56.0
27-Nov-99	1,132.0	2.4	1,134.4	26.0	12.4	10.0	0.9	49.2	235.4	**1,320.6**	1,417.9	30.0	34.0
28-Nov-99	1,421.0	2.9	1,423.9	26.0	14.4	9.8	0.9	51.0	237.0	**1,609.9**	1,376.8	26.0	17.4
29-Nov-99	1,662.0	2.3	1,664.3	42.9	14.5	16.2	0.9	74.5	240.2	**1,830.0**	1,436.1	72.0	54.0
30-Nov-99	1,418.0	2.3	1,420.3	26.0	12.4	9.4	0.9	48.7	235.1	**1,606.7**	1,414.6	18.0	(42.0)
Averages	1,511.1	2.5	1,513.6	44.6	13.6	32.4	0.9	91.5	238.3	**1,660.4**	1,466.7	123.9	94.1

Lake Michigan Diversion Accounting – WY 2000
December 1999 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Dec-99	1,567.0	2.0	1,569.0	49.3	10.8	20.3	1.1	81.6	242.5	**1,729.9**	1,446.7	73.0	(35.0)
02-Dec-99	1,473.0	2.9	1,475.9	45.2	9.9	16.7	1.1	73.0	240.8	**1,643.7**	1,437.8	70.0	25.0
03-Dec-99	1,798.0	2.3	1,800.3	71.4	10.8	368.4	1.1	451.8	242.5	**1,591.0**	1,408.1	922.0	146.0
04-Dec-99	2,502.0	1.9	2,503.9	100.4	13.7	654.6	1.1	769.8	244.3	**1,978.4**	1,413.8	2,466.0	168.0
05-Dec-99	7,096.0	0.6	7,096.6	143.8	29.7	978.7	1.1	1,153.3	252.0	**6,195.3**	1,403.6	5,879.0	293.5
06-Dec-99	3,591.0	0.5	3,591.5	300.9	16.0	192.7	1.1	510.8	243.2	**3,323.9**	1,433.5	1,542.0	62.0
07-Dec-99	2,493.0	2.0	2,495.0	168.8	13.1	127.8	1.1	310.9	241.1	**2,425.2**	1,424.3	710.0	(27.0)
08-Dec-99	2,448.0	1.7	2,449.7	34.3	13.5	62.3	1.1	111.3	241.2	**2,579.6**	1,451.0	243.0	(26.0)
09-Dec-99	2,238.0	1.6	2,239.6	34.3	12.8	77.0	1.1	125.3	240.6	**2,354.9**	1,415.7	318.0	(4.0)
10-Dec-99	1,975.0	0.6	1,975.6	26.0	14.1	53.5	1.1	94.7	241.3	**2,122.2**	1,428.5	182.0	69.0
11-Dec-99	1,873.0	0.5	1,873.5	33.8	12.4	54.3	1.1	101.7	240.9	**2,012.7**	1,441.3	164.0	(39.0)
12-Dec-99	1,564.0	0.5	1,564.5	60.5	12.3	63.4	1.1	137.2	243.3	**1,670.6**	1,392.9	220.0	(1.0)
13-Dec-99	1,881.0	1.0	1,882.0	26.0	13.9	46.4	1.1	87.3	244.6	**2,039.3**	1,433.3	116.0	6.0
14-Dec-99	1,636.0	0.8	1,636.8	108.2	14.5	180.0	1.1	303.8	242.8	**1,575.8**	1,421.8	1,211.0	47.0
15-Dec-99	2,404.0	1.3	2,405.3	120.9	15.4	315.7	1.1	453.2	243.9	**2,196.0**	1,416.1	1,113.0	24.3
16-Dec-99	1,910.0	0.6	1,910.6	40.2	13.5	67.1	1.1	121.9	240.8	**2,029.5**	1,422.1	290.0	38.0
17-Dec-99	1,614.0	0.5	1,614.5	26.0	12.7	52.9	1.1	92.7	243.8	**1,765.6**	1,433.1	167.0	(2.0)
18-Dec-99	1,686.0	2.5	1,688.5	31.6	12.7	52.0	1.1	97.5	242.4	**1,833.4**	1,432.5	161.0	(30.0)
19-Dec-99	1,645.0	2.4	1,647.4	36.8	12.4	86.2	1.1	136.5	242.3	**1,753.2**	1,397.8	266.0	(69.0)
20-Dec-99	1,620.0	0.6	1,620.6	62.2	14.7	102.4	1.1	180.4	243.4	**1,683.6**	1,455.5	404.0	(6.0)
21-Dec-99	1,162.0	0.8	1,162.8	26.0	12.0	46.9	1.1	86.1	244.2	**1,320.9**	1,479.7	115.0	5.0
22-Dec-99	941.0	1.2	942.2	26.0	12.7	44.2	1.1	84.0	244.0	**1,102.2**	1,492.1	108.0	106.0
23-Dec-99	1,650.0	1.2	1,651.2	42.7	13.8	48.5	1.1	106.1	241.9	**1,787.0**	1,479.8	147.0	42.0
24-Dec-99	1,413.0	0.6	1,413.6	26.0	12.1	40.2	1.1	79.4	243.8	**1,578.0**	1,455.7	96.0	101.0
25-Dec-99	1,333.0	1.9	1,334.9	47.8	11.9	48.9	1.1	109.7	241.5	**1,466.7**	1,413.5	143.0	126.0
26-Dec-99	1,599.0	7.0	1,606.0	42.7	11.4	43.5	1.1	98.7	240.6	**1,747.9**	1,413.1	132.0	47.0
27-Dec-99	1,113.0	6.9	1,119.9	26.0	13.2	35.5	1.1	75.8	243.6	**1,287.7**	1,494.8	81.0	(43.0)
28-Dec-99	1,380.0	7.0	1,387.0	26.0	13.5	34.2	1.1	74.8	242.8	**1,555.0**	1,513.0	80.0	44.0
29-Dec-99	1,749.0	7.3	1,756.3	123.0	11.7	174.2	1.1	310.0	245.1	**1,691.4**	1,507.1	769.0	(46.0)
30-Dec-99	1,573.0	7.6	1,580.6	28.8	11.2	40.0	1.1	81.1	244.9	**1,744.4**	1,517.6	182.0	80.0
31-Dec-99	1,567.0	7.0	1,574.0	34.5	11.6	37.1	1.1	84.3	248.6	**1,738.3**	1,571.3	161.0	(14.0)
Averages	1,951.4	2.4	1,953.8	63.5	13.4	134.4	1.1	212.4	243.2	**1,984.6**	1,446.7	597.8	35.1

Lake Michigan Diversion Accounting – WY 2000
January 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jan-00	1,725.0	6.4	1,731.4	34.5	10.8	38.1	1.4	84.8	239.8	**1,886.4**	1,391.5	129.0	57.0
02-Jan-00	1,247.0	6.4	1,253.4	26.0	10.6	36.8	1.4	74.8	241.3	**1,419.9**	1,434.6	121.0	36.0
03-Jan-00	1,412.0	6.3	1,418.3	69.0	11.4	108.2	1.4	190.0	244.4	**1,472.7**	1,448.4	457.0	(58.0)
04-Jan-00	1,905.0	6.0	1,911.0	42.7	13.8	50.3	1.4	108.1	239.0	**2,041.9**	1,432.0	188.0	40.0
05-Jan-00	1,723.0	1.8	1,724.8	40.2	11.3	39.6	1.4	92.5	241.1	**1,873.4**	1,479.5	135.0	(106.0)
06-Jan-00	1,975.0	0.5	1,975.5	51.9	11.0	77.9	1.4	142.2	241.7	**2,075.0**	1,466.5	276.0	14.7
07-Jan-00	1,170.0	0.3	1,170.3	26.0	10.9	32.6	1.4	70.8	236.7	**1,336.2**	1,455.5	86.0	(19.0)
08-Jan-00	1,497.0	0.5	1,497.5	26.0	11.0	53.6	1.4	92.0	244.9	**1,650.4**	1,472.3	102.0	36.0
09-Jan-00	1,860.0	0.2	1,860.2	91.7	12.5	234.0	1.4	339.5	242.9	**1,763.6**	1,445.1	1,033.0	45.0
10-Jan-00	2,086.0	0.5	2,086.5	92.2	13.9	229.8	1.4	337.4	243.7	**1,992.8**	1,442.5	938.0	204.0
11-Jan-00	2,064.0	0.5	2,064.5	26.0	12.1	43.2	1.4	82.6	240.9	**2,222.8**	1,450.9	219.0	(38.0)
12-Jan-00	1,255.0	0.8	1,255.8	33.2	11.1	44.4	1.4	90.1	240.2	**1,405.9**	1,462.2	186.0	(158.0)
13-Jan-00	1,835.0	0.5	1,835.5	34.4	12.1	41.8	1.4	89.7	240.7	**1,986.5**	1,453.2	178.0	26.3
14-Jan-00	1,346.0	0.7	1,346.7	26.0	11.2	37.7	1.4	76.2	241.4	**1,511.9**	1,448.8	122.0	(115.0)
15-Jan-00	1,771.0	2.2	1,773.2	67.5	11.7	56.0	1.4	136.6	241.0	**1,877.6**	1,455.4	198.0	4.9
16-Jan-00	1,503.0	1.7	1,504.7	34.5	11.2	37.5	1.4	84.5	242.1	**1,662.3**	1,411.3	122.0	(106.0)
17-Jan-00	1,501.0	1.7	1,502.7	26.0	12.0	34.4	1.4	73.8	243.0	**1,671.9**	1,470.8	114.0	24.0
18-Jan-00	1,750.0	4.7	1,754.7	39.2	11.5	37.8	1.4	90.0	242.2	**1,906.9**	1,461.9	118.0	24.0
19-Jan-00	1,558.0	4.5	1,562.5	26.0	11.0	31.4	1.4	69.7	239.2	**1,732.0**	1,472.1	78.0	(40.0)
20-Jan-00	1,477.0	3.3	1,480.3	26.0	11.1	30.3	1.4	68.8	243.5	**1,655.0**	1,473.6	72.0	202.0
21-Jan-00	1,697.0	3.1	1,700.1	65.9	10.8	47.3	1.4	125.4	240.3	**1,815.0**	1,466.3	168.0	134.0
22-Jan-00	1,342.0	3.3	1,345.3	26.0	10.9	28.3	1.4	66.6	241.1	**1,519.8**	1,472.4	63.0	58.0
23-Jan-00	1,499.0	3.6	1,502.6	35.6	12.3	32.0	1.4	81.3	241.7	**1,663.0**	1,483.6	89.0	89.0
24-Jan-00	1,684.0	1.9	1,685.9	34.4	11.4	29.0	1.4	76.3	245.7	**1,855.3**	1,472.6	91.0	(47.0)
25-Jan-00	1,352.0	0.6	1,352.6	26.0	10.9	25.6	1.4	64.0	241.9	**1,530.5**	1,466.9	58.0	63.0
26-Jan-00	1,495.0	0.8	1,495.8	33.4	11.4	29.6	1.4	75.9	244.8	**1,664.7**	1,490.7	71.0	(61.0)
27-Jan-00	1,757.0	3.1	1,760.1	67.3	11.2	160.0	1.4	239.9	240.7	**1,760.9**	1,492.5	377.0	9.0
28-Jan-00	1,638.0	3.3	1,641.3	114.1	10.0	193.2	1.4	318.7	243.6	**1,566.2**	1,493.7	853.0	(132.0)
29-Jan-00	1,348.0	3.2	1,351.2	35.3	10.1	42.9	1.4	89.7	242.6	**1,504.1**	1,493.3	107.0	(147.0)
30-Jan-00	1,831.0	3.2	1,834.2	34.2	10.1	34.7	1.4	80.4	243.5	**1,997.3**	1,464.4	83.0	(17.0)
31-Jan-00	1,663.0	3.3	1,666.3	34.4	9.8	56.3	1.4	102.0	242.3	**1,806.6**	1,466.3	156.0	122.0
Averages	1,611.8	2.6	1,614.4	43.4	11.3	63.7	1.4	119.8	241.9	**1,736.5**	1,461.0	225.4	4.7

Lake Michigan Diversion Accounting – WY 2000
February 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Feb-00	1,645.0	2.5	1,647.5	84.4	10.1	147.5	1.4	243.4	236.4	**1,640.5**	1,461.9	583.0	40.0
02-Feb-00	1,660.0	2.2	1,662.2	80.7	9.6	215.7	1.4	307.4	238.6	**1,593.4**	1,462.8	741.0	9.0
03-Feb-00	1,385.0	2.1	1,387.1	109.5	10.3	381.3	1.4	502.6	238.7	**1,123.2**	1,460.6	1,188.0	26.0
04-Feb-00	1,749.0	1.6	1,750.6	136.0	10.6	210.3	1.4	358.3	237.2	**1,629.5**	1,469.8	844.0	53.0
05-Feb-00	1,649.0	2.2	1,651.2	33.2	10.2	89.1	1.4	133.9	238.0	**1,755.3**	1,481.0	179.0	12.0
06-Feb-00	1,622.0	2.9	1,624.9	34.5	10.2	63.9	1.4	109.9	239.2	**1,754.2**	1,450.2	158.0	(26.0)
07-Feb-00	1,346.0	3.7	1,349.7	72.0	10.3	169.6	1.4	253.4	239.3	**1,335.6**	1,486.7	525.0	15.4
08-Feb-00	1,452.0	3.4	1,455.4	35.3	10.4	105.8	1.4	153.0	237.5	**1,539.9**	1,464.1	277.0	10.7
09-Feb-00	1,639.0	3.7	1,642.7	88.5	10.3	266.2	1.4	366.5	237.7	**1,513.9**	1,471.3	924.0	(9.0)
10-Feb-00	1,702.0	3.4	1,705.4	44.6	11.3	131.8	1.4	189.1	237.5	**1,753.8**	1,460.1	514.0	18.0
11-Feb-00	2,201.0	2.2	2,203.2	26.0	12.4	79.7	1.4	119.5	237.9	**2,321.6**	1,477.8	239.0	(57.0)
12-Feb-00	1,940.0	1.8	1,941.8	36.5	10.3	56.3	1.4	104.4	238.7	**2,076.1**	1,447.9	197.0	(146.0)
13-Feb-00	1,525.0	3.6	1,528.6	31.6	10.5	43.8	1.4	87.3	238.9	**1,680.2**	1,460.6	143.0	27.0
14-Feb-00	1,577.0	2.9	1,579.9	26.0	10.4	37.2	1.4	75.0	239.7	**1,744.6**	1,448.5	108.0	33.0
15-Feb-00	1,632.0	2.8	1,634.8	41.6	10.3	40.5	1.4	93.8	235.9	**1,776.9**	1,466.4	142.0	12.0
16-Feb-00	1,240.0	3.4	1,243.4	46.4	11.0	42.8	1.4	101.6	236.1	**1,377.9**	1,465.6	148.0	24.0
17-Feb-00	1,802.0	3.6	1,805.6	26.0	12.0	34.2	1.4	73.6	237.9	**1,969.9**	1,445.1	101.0	(205.0)
18-Feb-00	1,884.0	3.4	1,887.4	45.4	11.3	41.6	1.4	99.7	236.3	**2,024.0**	1,442.4	351.0	(91.0)
19-Feb-00	1,728.0	3.4	1,731.4	26.0	11.3	70.7	1.4	109.4	237.5	**1,859.5**	1,440.8	216.0	35.0
20-Feb-00	2,004.0	3.7	2,007.7	99.6	11.1	161.6	1.4	273.7	237.8	**1,971.8**	1,453.8	909.0	(23.0)
21-Feb-00	2,065.0	3.1	2,068.1	78.6	11.2	394.1	1.4	485.2	248.0	**1,830.9**	1,452.7	2,103.0	38.0
22-Feb-00	2,873.0	3.7	2,876.7	265.9	12.2	306.0	1.4	585.5	240.0	**2,531.2**	1,468.3	1,820.0	(14.0)
23-Feb-00	3,341.0	2.5	3,343.5	173.0	12.1	174.6	1.4	361.1	238.4	**3,220.8**	1,469.7	1,193.0	40.0
24-Feb-00	3,823.0	2.6	3,825.6	130.7	20.5	551.7	1.4	704.3	236.3	**3,357.6**	1,414.4	2,590.0	(80.0)
25-Feb-00	4,146.0	2.5	4,148.5	203.3	16.8	187.0	1.4	408.6	236.0	**3,975.9**	1,447.9	1,496.0	(5.0)
26-Feb-00	3,271.0	1.9	3,272.9	28.8	15.3	92.9	1.4	138.3	236.6	**3,371.2**	1,440.9	692.0	108.0
27-Feb-00	2,656.0	1.3	2,657.3	42.0	17.5	85.7	1.4	146.6	237.9	**2,748.6**	1,412.1	601.0	(14.0)
28-Feb-00	2,366.0	2.3	2,368.3	26.0	14.5	72.0	1.4	113.9	236.9	**2,491.3**	1,449.6	409.0	(105.0)
29-Feb-00	2,088.0	1.9	2,089.9	34.7	13.1	68.8	1.4	118.1	227.1	**2,198.9**	1,421.4	364.0	(92.0)
Averages	2,069.3	2.8	2,072.1	72.6	12.0	149.0	1.4	235.0	237.7	**2,074.8**	1,455.0	681.2	(12.6)

Lake Michigan Diversion Accounting – WY 2000
March 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Mar-00	1,775.0	1.4	1,776.4	63.5	13.2	79.2	0.6	156.4	231.2	**1,851.2**	1,434.2	363.0	119.0
02-Mar-00	1,239.0	2.2	1,241.2	26.0	15.1	57.6	0.6	99.3	233.0	**1,374.9**	1,434.2	228.0	(17.0)
03-Mar-00	1,939.0	0.8	1,939.8	38.9	15.1	59.9	0.6	114.4	233.4	**2,058.8**	1,436.1	240.0	(54.0)
04-Mar-00	1,788.0	1.0	1,789.0	26.0	14.3	51.9	0.6	92.8	234.3	**1,930.5**	1,419.0	185.0	25.0
05-Mar-00	1,854.0	1.1	1,855.1	34.5	14.6	51.7	0.6	101.3	232.7	**1,986.5**	1,414.1	189.0	(38.0)
06-Mar-00	1,736.0	2.4	1,738.4	32.6	12.7	49.5	0.6	95.4	235.7	**1,878.7**	1,464.1	162.0	63.0
07-Mar-00	1,628.0	3.0	1,631.0	26.0	13.2	43.5	0.6	83.2	233.3	**1,781.1**	1,463.4	136.0	87.0
08-Mar-00	1,756.0	4.0	1,760.0	64.8	12.6	58.4	0.6	136.3	233.1	**1,856.8**	1,447.1	233.0	42.0
09-Mar-00	1,727.0	3.3	1,730.3	32.2	13.1	41.5	0.6	87.3	230.3	**1,873.3**	1,425.2	136.0	50.0
10-Mar-00	1,552.0	1.6	1,553.6	26.0	12.7	36.8	0.6	76.0	233.3	**1,710.9**	1,440.5	114.0	53.0
11-Mar-00	1,436.0	2.7	1,438.7	34.4	12.8	37.9	0.6	85.7	233.2	**1,586.2**	1,438.9	135.0	22.1
12-Mar-00	1,098.0	3.0	1,101.0	34.5	13.6	38.0	0.6	86.7	234.2	**1,248.5**	1,422.7	122.0	(43.0)
13-Mar-00	1,769.0	2.4	1,771.4	31.6	13.1	34.3	0.6	79.6	236.2	**1,928.0**	1,414.5	114.0	(64.0)
14-Mar-00	1,706.0	3.0	1,709.0	28.8	12.5	31.9	0.6	73.8	231.3	**1,866.5**	1,474.3	103.0	(7.0)
15-Mar-00	1,449.0	3.5	1,452.5	82.1	13.5	141.5	0.6	237.7	234.1	**1,448.9**	1,441.5	580.0	78.0
16-Mar-00	2,083.0	2.5	2,085.5	132.5	14.6	87.9	0.6	235.6	230.8	**2,080.7**	1,437.3	400.0	44.0
17-Mar-00	1,238.0	5.8	1,243.8	26.0	13.5	33.4	0.6	73.4	232.9	**1,403.3**	1,457.4	107.0	(21.0)
18-Mar-00	2,128.0	5.1	2,133.1	26.0	14.7	32.0	0.6	73.2	234.1	**2,294.0**	1,434.2	95.0	(113.0)
19-Mar-00	2,029.0	4.4	2,033.4	52.7	15.3	207.7	0.6	276.3	234.7	**1,991.8**	1,365.0	707.0	(7.0)
20-Mar-00	2,778.0	4.4	2,782.4	192.0	19.3	462.4	0.6	674.3	238.0	**2,346.1**	1,449.8	2,011.0	(37.0)
21-Mar-00	1,901.0	3.3	1,904.3	81.5	13.7	84.6	0.6	180.3	232.9	**1,956.9**	1,429.7	420.0	40.0
22-Mar-00	1,811.0	3.2	1,814.2	26.0	12.9	55.0	0.6	94.5	232.2	**1,951.9**	1,424.2	234.0	(42.0)
23-Mar-00	1,749.0	4.0	1,753.0	41.8	13.0	58.2	0.6	113.6	232.0	**1,871.4**	1,437.8	242.0	(28.0)
24-Mar-00	2,126.0	4.1	2,130.1	26.0	12.7	59.3	0.6	98.6	231.9	**2,263.4**	1,431.4	188.0	(7.0)
25-Mar-00	1,408.0	2.9	1,410.9	26.0	13.3	47.1	0.6	86.9	231.8	**1,555.8**	1,438.9	175.0	(3.0)
26-Mar-00	1,693.0	3.1	1,696.1	71.3	12.7	63.8	0.6	148.3	234.2	**1,782.0**	1,402.5	260.0	(51.0)
27-Mar-00	1,964.0	3.0	1,967.0	26.0	14.7	78.3	0.6	119.5	231.7	**2,079.2**	1,406.6	236.0	29.0
28-Mar-00	1,271.0	3.6	1,274.6	34.4	13.8	64.9	0.6	113.8	230.2	**1,391.0**	1,414.8	330.0	27.0
29-Mar-00	1,638.0	1.7	1,639.7	34.5	13.5	44.2	0.6	92.7	229.9	**1,776.9**	1,415.2	185.0	(79.0)
30-Mar-00	1,647.0	3.1	1,650.1	31.6	12.6	39.2	0.6	84.0	230.8	**1,796.9**	1,417.0	134.0	(75.0)
31-Mar-00	1,823.0	5.7	1,828.7	52.1	12.7	48.2	0.6	113.5	233.2	**1,948.4**	1,338.3	169.0	(148.0)
Averages	1,733.5	3.1	1,736.6	47.1	13.7	73.5	0.6	134.9	232.9	**1,834.6**	1,428.1	288.2	(5.0)

Lake Michigan Diversion Accounting – WY 2000
April 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Apr-00	1,728.0	6.3	1,734.3	35.5	11.8	38.3	0.8	86.5	243.8	**1,891.6**	1,442.6	121.0	129.5
02-Apr-00	1,569.0	6.5	1,575.5	34.4	12.1	34.5	0.8	81.9	244.4	**1,738.0**	1,357.5	121.0	(55.0)
03-Apr-00	1,149.0	4.3	1,153.3	32.7	12.1	33.4	0.8	79.1	241.5	**1,315.7**	1,425.1	107.0	130.0
04-Apr-00	1,394.0	3.0	1,397.0	26.0	14.1	28.5	0.8	69.4	242.1	**1,569.7**	1,434.6	90.0	63.0
05-Apr-00	1,926.0	2.7	1,928.7	31.7	12.2	28.8	0.8	73.6	241.7	**2,096.8**	1,451.9	105.0	9.0
06-Apr-00	1,597.0	4.0	1,601.0	51.5	10.9	37.3	0.8	100.6	243.7	**1,744.1**	1,460.0	146.0	71.0
07-Apr-00	1,987.0	3.4	1,990.4	102.6	23.2	314.0	0.8	440.7	246.2	**1,795.9**	1,424.2	1,533.0	51.0
08-Apr-00	3,005.0	2.7	3,007.7	182.5	28.9	229.9	0.8	442.1	246.5	**2,812.1**	1,428.1	1,447.0	46.0
09-Apr-00	2,187.0	3.0	2,190.0	26.0	14.0	41.3	0.8	82.1	244.9	**2,352.8**	1,428.9	360.0	31.0
10-Apr-00	1,836.0	1.8	1,837.8	26.0	13.7	36.5	0.8	77.0	245.1	**2,005.9**	1,436.6	243.0	16.0
11-Apr-00	2,004.0	2.7	2,006.7	44.0	15.4	45.0	0.8	105.2	242.0	**2,143.5**	1,436.3	274.0	25.0
12-Apr-00	1,860.0	3.2	1,863.2	26.0	13.4	47.6	0.8	87.7	244.2	**2,019.7**	1,457.9	204.0	27.0
13-Apr-00	2,019.0	3.6	2,022.6	57.6	13.2	47.6	0.8	119.2	242.9	**2,146.3**	1,431.2	231.0	22.0
14-Apr-00	1,838.0	4.2	1,842.2	31.6	13.1	31.9	0.8	77.4	242.0	**2,006.8**	1,516.3	155.0	54.0
15-Apr-00	1,501.0	3.2	1,504.2	26.0	14.1	27.8	0.8	68.7	247.7	**1,683.2**	1,507.8	124.0	76.0
16-Apr-00	2,176.0	2.8	2,178.8	42.6	17.7	719.0	0.8	780.1	249.1	**1,647.8**	1,439.3	2,921.0	70.0
17-Apr-00	4,653.0	1.6	4,654.6	239.5	29.1	211.1	0.8	480.5	245.9	**4,420.0**	1,444.8	1,949.0	28.0
18-Apr-00	3,420.0	1.4	3,421.4	258.4	18.3	157.1	0.8	434.6	242.5	**3,229.3**	1,465.7	1,079.0	366.0
19-Apr-00	4,141.0	1.4	4,142.4	141.4	27.4	555.7	0.8	725.4	247.6	**3,664.6**	1,431.7	2,536.0	155.5
20-Apr-00	11,563.0	0.4	11,563.4	124.2	28.8	1,505.3	0.8	1,659.2	259.6	**10,163.8**	1,441.6	8,081.0	126.5
21-Apr-00	10,619.0	0.5	10,619.5	129.7	28.8	858.5	0.8	1,017.8	248.1	**9,849.8**	1,411.6	5,377.0	91.0
22-Apr-00	7,457.0	0.5	7,457.5	192.3	29.1	423.0	0.8	645.3	241.3	**7,053.5**	1,430.6	2,838.0	99.5
23-Apr-00	5,679.0	0.5	5,679.5	186.9	25.5	399.0	0.8	612.2	245.7	**5,313.0**	1,404.6	2,161.0	111.0
24-Apr-00	3,435.0	0.5	3,435.5	163.0	23.6	313.9	0.8	501.3	245.3	**3,179.5**	1,427.7	1,686.0	80.0
25-Apr-00	3,451.0	0.5	3,451.5	63.5	22.4	229.2	0.8	315.9	242.6	**3,378.2**	1,479.7	1,218.0	95.0
26-Apr-00	3,444.0	0.7	3,444.7	34.3	19.5	189.0	0.8	243.7	243.7	**3,444.7**	1,487.6	932.0	86.0
27-Apr-00	3,027.0	0.6	3,027.6	44.7	19.5	174.3	0.8	239.4	244.2	**3,032.4**	1,498.8	783.0	82.0
28-Apr-00	2,143.0	0.6	2,143.6	26.0	17.6	151.7	0.8	196.1	244.5	**2,192.0**	1,514.0	613.0	68.5
29-Apr-00	2,017.0	0.7	2,017.7	41.6	17.8	149.9	0.8	210.1	245.7	**2,053.3**	1,481.7	624.0	219.0
30-Apr-00	2,006.0	1.9	2,007.9	51.9	18.0	140.1	0.8	210.8	247.9	**2,045.0**	1,515.5	517.0	106.5
Averages	3,227.7	2.3	3,230.0	82.5	18.8	240.0	0.8	342.1	245.1	**3,133.0**	1,450.5	1,285.9	82.7

Lake Michigan Diversion Accounting – WY 2000
May 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-May-00	2,222.0	1.9	2,223.9	78.6	24.6	251.3	0.8	355.2	259.5	**2,128.2**	1,488.7	967.0	78.0
02-May-00	2,285.0	1.9	2,286.9	36.6	20.7	123.2	0.8	181.4	259.5	**2,365.0**	1,483.5	492.0	74.0
03-May-00	2,219.0	2.5	2,221.5	35.4	18.0	111.6	0.8	165.8	260.2	**2,315.9**	1,559.5	418.0	51.0
04-May-00	1,671.0	2.8	1,673.8	26.0	18.4	98.9	0.8	144.1	260.5	**1,790.2**	1,594.5	313.0	175.5
05-May-00	2,043.0	2.9	2,045.9	39.7	20.4	94.2	0.8	155.1	265.2	**2,156.0**	1,678.7	316.0	155.5
06-May-00	2,143.0	3.5	2,146.5	26.0	18.6	81.5	0.8	126.8	266.0	**2,285.7**	1,661.1	245.0	105.0
07-May-00	2,039.0	2.3	2,041.3	34.5	17.9	77.6	0.8	130.7	266.8	**2,177.4**	1,606.4	250.0	155.1
08-May-00	2,111.0	3.0	2,114.0	53.8	18.5	434.7	0.8	507.8	268.1	**1,874.3**	1,634.7	1,068.0	240.0
09-May-00	6,392.0	1.3	6,393.3	112.8	32.2	1,159.6	0.8	1,305.3	270.1	**5,358.1**	1,502.1	4,926.0	337.0
10-May-00	3,276.0	0.9	3,276.9	228.7	31.5	294.2	0.8	555.2	258.3	**2,980.0**	1,485.7	1,424.0	73.0
11-May-00	3,599.0	0.9	3,599.9	212.2	27.9	365.9	0.8	606.8	259.5	**3,252.6**	1,493.7	1,489.0	63.5
12-May-00	3,330.0	1.3	3,331.3	152.5	21.9	344.3	0.8	519.4	263.6	**3,075.5**	1,562.7	1,666.0	235.5
13-May-00	3,508.0	1.0	3,509.0	175.5	30.9	280.5	0.8	487.7	260.8	**3,282.1**	1,501.9	1,006.0	76.5
14-May-00	3,160.0	0.7	3,160.7	123.2	28.4	228.4	0.8	380.7	259.4	**3,039.4**	1,448.1	663.0	109.5
15-May-00	3,522.0	0.9	3,522.9	32.1	18.5	157.7	0.8	209.1	262.1	**3,575.9**	1,511.5	360.0	138.5
16-May-00	2,417.0	0.8	2,417.8	56.3	16.0	160.2	0.8	233.3	261.1	**2,445.6**	1,504.9	498.0	350.0
17-May-00	2,728.0	1.2	2,729.2	26.0	14.6	122.0	0.8	163.3	259.5	**2,825.4**	1,509.9	292.0	318.0
18-May-00	2,353.0	1.8	2,354.8	71.6	24.0	532.3	0.8	628.7	264.6	**1,990.7**	1,529.6	1,803.0	347.5
19-May-00	3,151.0	1.5	3,152.5	242.9	31.6	244.1	0.8	519.5	256.7	**2,889.7**	1,442.3	1,480.0	35.5
20-May-00	3,082.0	1.6	3,083.6	144.8	22.0	177.4	0.8	344.9	261.2	**2,999.9**	1,468.6	1,080.0	(47.0)
21-May-00	2,667.0	0.7	2,667.7	32.2	22.4	119.7	0.8	175.1	258.9	**2,751.5**	1,495.9	656.0	117.0
22-May-00	2,527.0	0.7	2,527.7	40.2	22.4	181.5	0.8	244.9	262.3	**2,545.1**	1,512.4	736.0	156.0
23-May-00	2,417.0	1.1	2,418.1	26.0	20.3	104.0	0.8	151.1	261.8	**2,528.8**	1,578.7	446.0	163.0
24-May-00	2,082.0	1.0	2,083.0	42.8	19.5	100.5	0.8	163.6	262.5	**2,181.9**	1,655.6	419.0	169.5
25-May-00	2,040.0	1.0	2,041.0	47.3	18.1	94.8	0.8	160.9	263.9	**2,144.0**	1,689.6	373.0	133.2
26-May-00	1,997.0	0.9	1,997.9	47.0	16.3	86.5	0.8	150.6	265.8	**2,113.1**	1,567.7	391.0	85.5
27-May-00	2,322.0	0.8	2,322.8	31.8	15.7	633.4	0.8	681.6	259.2	**1,900.4**	1,493.7	1,682.0	108.0
28-May-00	4,816.0	0.8	4,816.8	202.0	31.9	610.4	0.8	845.0	259.8	**4,231.6**	1,409.9	2,891.0	324.5
29-May-00	3,349.0	0.7	3,349.7	244.0	22.6	235.8	0.8	503.1	259.4	**3,106.0**	1,459.5	1,100.0	113.5
30-May-00	3,032.0	0.8	3,032.8	83.6	20.4	151.4	0.8	256.1	262.5	**3,039.2**	1,523.7	689.0	133.4
31-May-00	4,338.0	1.2	4,339.2	70.0	32.0	918.4	0.8	1,021.2	264.6	**3,582.6**	1,509.4	2,754.0	111.7
Averages	2,865.7	1.4	2,867.1	89.5	22.5	276.6	0.8	389.4	262.0	**2,739.7**	1,534.3	1,061.1	151.2

Lake Michigan Diversion Accounting – WY 2000
June 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Jun-00	4,331.0	1.0	4,332.0	243.0	32.8	360.9	0.9	637.7	274.4	**3,968.7**	1,543.1	1,918.0	106.4
02-Jun-00	3,756.0	1.0	3,757.0	127.9	23.7	244.1	0.9	396.7	276.2	**3,636.5**	1,531.1	1,221.0	197.0
03-Jun-00	3,590.0	0.8	3,590.8	31.8	16.9	165.0	0.9	214.6	276.2	**3,652.4**	1,536.0	587.0	340.0
04-Jun-00	2,760.0	0.7	2,760.7	34.5	16.9	146.4	0.9	198.6	276.1	**2,838.2**	1,464.4	526.0	428.0
05-Jun-00	4,313.0	0.8	4,313.8	178.3	32.9	544.9	0.9	757.0	277.3	**3,834.1**	1,475.2	2,874.0	416.0
06-Jun-00	3,676.0	0.9	3,676.9	231.9	23.7	236.4	0.9	492.9	274.8	**3,458.8**	1,542.7	1,419.0	609.5
07-Jun-00	2,820.0	0.9	2,820.9	33.3	20.0	134.2	0.9	188.3	276.6	**2,909.2**	1,600.0	626.0	384.5
08-Jun-00	2,683.0	2.8	2,685.8	46.9	19.6	124.8	0.9	192.2	276.9	**2,770.5**	1,717.9	526.0	473.0
09-Jun-00	2,556.0	3.4	2,559.4	26.0	19.1	104.5	0.9	150.5	282.8	**2,691.7**	1,887.4	366.0	473.5
10-Jun-00	2,587.0	5.6	2,592.6	34.5	19.2	96.5	0.9	151.1	285.5	**2,727.0**	1,867.1	326.0	360.5
11-Jun-00	3,002.0	5.9	3,007.9	113.3	17.9	473.9	0.9	606.0	285.4	**2,687.3**	1,666.7	1,473.0	388.5
12-Jun-00	4,513.0	0.8	4,513.8	146.1	33.1	760.1	0.9	940.1	277.7	**3,851.4**	1,533.0	3,574.0	383.0
13-Jun-00	5,692.0	0.9	5,692.9	206.8	33.0	583.0	0.9	823.7	273.7	**5,142.9**	1,555.1	2,732.0	393.0
14-Jun-00	6,142.0	1.2	6,143.2	198.3	33.0	623.2	0.9	855.3	276.2	**5,564.1**	1,555.6	3,539.0	418.0
15-Jun-00	4,909.0	0.9	4,909.9	235.9	32.9	306.2	0.9	575.9	273.3	**4,607.3**	1,578.6	2,148.0	272.0
16-Jun-00	3,933.0	1.0	3,934.0	118.2	25.6	220.5	0.9	365.2	277.1	**3,845.9**	1,560.5	1,264.0	399.0
17-Jun-00	3,286.0	0.7	3,286.7	52.4	22.7	176.9	0.9	252.9	275.2	**3,309.0**	1,539.9	766.0	305.0
18-Jun-00	3,010.0	0.8	3,010.8	36.7	20.1	152.1	0.9	209.8	276.3	**3,077.3**	1,522.7	563.0	383.0
19-Jun-00	2,398.0	3.9	2,401.9	34.3	19.5	135.8	0.9	190.4	282.2	**2,493.7**	1,693.3	454.0	466.0
20-Jun-00	3,802.0	9.1	3,811.1	99.4	33.3	470.0	0.9	603.6	279.4	**3,486.9**	1,619.4	2,578.0	449.0
21-Jun-00	4,987.0	9.1	4,996.1	129.4	33.1	196.1	0.9	359.5	277.2	**4,913.8**	1,604.0	2,488.0	368.0
22-Jun-00	4,230.0	1.3	4,231.3	79.5	33.3	146.9	0.9	260.7	278.7	**4,249.3**	1,671.9	1,885.0	431.5
23-Jun-00	2,495.0	1.3	2,496.3	56.5	28.2	138.3	0.9	223.9	279.8	**2,552.2**	1,709.9	878.0	452.0
24-Jun-00	4,718.0	0.6	4,718.6	52.1	32.7	950.3	0.9	1,035.9	283.5	**3,966.2**	1,581.2	3,981.0	527.0
25-Jun-00	5,725.0	1.2	5,726.2	225.1	33.5	304.7	0.9	564.1	275.4	**5,437.5**	1,523.5	3,223.0	238.5
26-Jun-00	5,485.0	1.3	5,486.3	231.6	33.2	260.4	0.9	526.1	277.5	**5,237.7**	1,618.9	3,045.0	379.5
27-Jun-00	4,480.0	0.9	4,480.9	108.3	33.3	182.1	0.9	324.5	276.2	**4,432.6**	1,642.6	1,598.0	562.5
28-Jun-00	3,327.0	1.0	3,328.0	43.5	33.2	155.7	0.9	233.3	276.6	**3,371.3**	1,599.5	929.0	413.5
29-Jun-00	3,116.0	0.8	3,116.8	31.6	33.5	125.1	0.9	191.1	274.7	**3,200.4**	1,606.1	654.0	427.5
30-Jun-00	2,909.0	1.1	2,910.1	48.5	32.2	121.8	0.9	203.4	278.6	**2,985.3**	1,691.5	544.0	599.5
Averages	3,841.0	2.1	3,843.1	107.8	27.4	288.0	0.9	424.1	277.7	**3,696.7**	1,608.0	1,623.5	401.5

Lake Michigan Diversion Accounting – WY 2000
July 2000 – Summary of Diversion Flows (All in cfs)

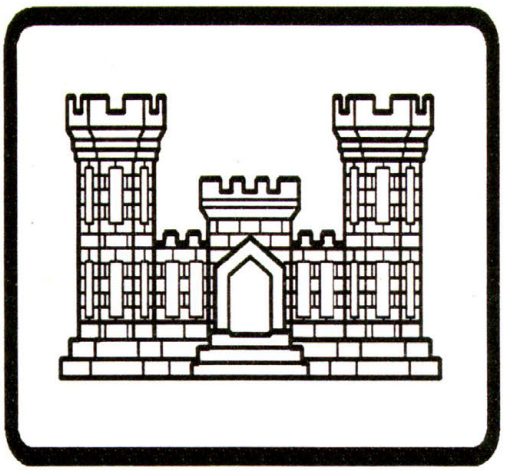
LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Jul-00	2,696.0	0.9	2,696.9	44.2	33.1	108.1	0.7	186.1	307.5	**2,818.3**	1,731.2	450.0	516.5
02-Jul-00	2,746.0	1.2	2,747.2	28.6	30.9	468.6	0.7	528.8	310.3	**2,528.7**	1,680.1	2,193.0	502.5
03-Jul-00	6,896.0	1.4	6,897.4	131.5	37.7	785.9	0.7	955.9	305.6	**6,247.1**	1,511.2	3,827.0	732.0
04-Jul-00	4,636.0	0.9	4,636.9	211.0	37.8	278.2	0.7	527.7	301.0	**4,410.2**	1,512.0	1,394.0	479.0
05-Jul-00	3,491.0	1.1	3,492.1	189.0	37.7	238.5	0.7	466.0	302.6	**3,328.7**	1,602.7	1,090.0	555.5
06-Jul-00	3,172.0	2.4	3,174.4	145.2	38.1	197.8	0.7	381.8	305.7	**3,098.3**	1,688.9	809.0	616.0
07-Jul-00	2,987.0	1.1	2,988.1	26.0	38.7	125.6	0.7	191.0	307.9	**3,105.0**	1,705.5	426.0	423.0
08-Jul-00	3,031.0	1.9	3,032.9	34.5	39.3	112.4	0.7	186.9	305.8	**3,151.8**	1,748.3	382.0	589.0
09-Jul-00	2,469.0	4.3	2,473.3	35.0	39.0	103.1	0.7	177.9	305.9	**2,601.3**	1,716.4	326.0	678.0
10-Jul-00	6,636.0	2.0	6,638.0	119.6	38.1	980.7	0.7	1,139.2	312.5	**5,811.3**	1,621.6	5,231.0	728.0
11-Jul-00	4,613.0	0.9	4,613.9	220.8	37.7	270.2	0.7	529.3	303.7	**4,388.3**	1,585.0	1,715.0	680.0
12-Jul-00	4,221.0	0.9	4,221.9	190.9	38.2	225.7	0.7	455.5	303.6	**4,070.0**	1,665.9	1,232.0	608.5
13-Jul-00	3,863.0	2.0	3,865.0	87.8	38.6	158.7	0.7	285.7	305.6	**3,884.9**	1,750.3	719.0	851.0
14-Jul-00	3,077.0	2.5	3,079.5	26.0	38.7	114.8	0.7	180.1	310.1	**3,209.5**	1,829.7	510.0	591.0
15-Jul-00	3,191.0	1.1	3,192.1	32.8	38.3	104.4	0.7	176.2	311.5	**3,327.4**	1,798.8	464.0	727.5
16-Jul-00	2,730.0	0.9	2,730.9	26.0	39.2	92.0	0.7	157.8	310.2	**2,883.3**	1,760.0	317.0	695.0
17-Jul-00	2,812.0	1.2	2,813.2	33.4	39.5	85.1	0.7	158.8	312.8	**2,967.2**	1,846.0	294.0	786.5
18-Jul-00	2,739.0	1.4	2,740.4	52.2	39.0	87.7	0.7	179.6	314.4	**2,875.2**	1,798.8	293.0	778.5
19-Jul-00	2,939.0	0.8	2,939.8	31.7	38.7	70.3	0.7	141.5	310.3	**3,108.6**	1,702.4	219.0	798.0
20-Jul-00	2,611.0	0.8	2,611.8	34.1	38.9	66.3	0.7	140.1	311.9	**2,783.6**	1,743.8	195.0	846.5
21-Jul-00	2,673.0	3.4	2,676.4	26.0	37.7	57.5	0.7	121.8	312.1	**2,866.7**	1,813.8	159.0	872.0
22-Jul-00	2,707.0	3.1	2,710.1	34.5	38.0	54.8	0.7	128.1	311.1	**2,893.1**	1,800.7	168.0	729.0
23-Jul-00	2,677.0	3.4	2,680.4	32.5	35.2	50.7	0.7	119.2	312.5	**2,873.7**	1,790.6	140.0	743.5
24-Jul-00	2,742.0	2.8	2,744.8	56.8	36.5	57.6	0.7	151.6	317.8	**2,911.0**	1,900.2	179.0	665.0
25-Jul-00	2,511.0	4.8	2,515.8	34.5	34.5	41.2	0.7	110.9	314.8	**2,719.7**	1,962.3	125.0	738.0
26-Jul-00	2,666.0	4.0	2,670.0	41.1	34.8	42.1	0.7	118.7	318.1	**2,869.4**	1,975.2	119.0	798.5
27-Jul-00	2,649.0	4.7	2,653.7	71.3	32.0	101.6	0.7	205.6	318.8	**2,766.9**	1,978.7	552.0	822.0
28-Jul-00	2,964.0	3.7	2,967.7	111.0	39.9	128.4	0.7	280.1	318.3	**3,005.9**	1,917.3	936.0	637.5
29-Jul-00	3,135.0	4.1	3,139.1	122.3	38.5	70.5	0.7	232.1	317.1	**3,224.1**	1,776.8	721.0	858.0
30-Jul-00	3,734.0	2.8	3,736.8	59.5	37.6	344.6	0.7	442.4	312.3	**3,606.7**	1,616.9	1,302.0	541.5
31-Jul-00	3,282.0	4.3	3,286.3	121.5	33.1	437.2	0.7	592.5	310.1	**3,003.9**	1,617.7	1,782.0	433.0
Averages	3,332.1	2.3	3,334.4	77.8	37.3	195.5	0.7	311.3	310.4	**3,333.5**	1,746.7	911.9	678.1

Lake Michigan Diversion Accounting – WY 2000
August 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Aug-00	3,193.0	4.3	3,197.3	189.6	32.7	174.1	0.7	397.2	304.4	**3,104.5**	1,662.3	803.0	769.0
02-Aug-00	3,128.0	3.6	3,131.6	42.4	29.7	85.2	0.7	158.0	305.0	**3,278.6**	1,669.9	416.0	967.5
03-Aug-00	3,017.0	4.3	3,021.3	43.4	29.1	66.4	0.7	139.6	305.7	**3,187.4**	1,673.0	273.0	873.5
04-Aug-00	2,956.0	4.1	2,960.1	26.0	25.2	54.3	0.7	106.2	306.0	**3,159.9**	1,745.7	177.0	796.5
05-Aug-00	3,185.0	3.0	3,188.0	105.2	27.6	277.3	0.7	410.8	309.4	**3,086.6**	1,680.4	1,064.0	607.5
06-Aug-00	3,932.0	1.1	3,933.1	105.6	36.3	649.9	0.7	792.6	306.5	**3,447.0**	1,614.0	2,138.0	555.5
07-Aug-00	3,676.0	2.1	3,678.1	250.4	37.8	185.6	0.7	474.6	305.0	**3,508.5**	1,704.4	1,200.0	703.5
08-Aug-00	2,841.0	1.0	2,842.0	136.9	24.5	118.1	0.7	280.2	305.6	**2,867.4**	1,720.0	650.0	663.0
09-Aug-00	2,505.0	3.5	2,508.5	36.8	23.7	71.8	0.7	133.0	312.0	**2,687.5**	1,866.7	259.0	874.5
10-Aug-00	3,019.0	1.8	3,020.8	26.0	23.2	59.8	0.7	109.7	312.8	**3,223.9**	1,932.9	187.0	798.0
11-Aug-00	3,110.0	2.0	3,112.0	31.6	21.2	55.8	0.7	109.4	312.7	**3,315.3**	1,897.0	175.0	944.0
12-Aug-00	2,620.0	4.1	2,624.1	38.6	20.9	55.2	0.7	115.3	316.2	**2,825.0**	1,876.7	159.0	609.5
13-Aug-00	2,651.0	3.6	2,654.6	34.4	19.5	47.6	0.7	102.2	314.3	**2,866.7**	1,779.3	143.0	749.0
14-Aug-00	2,486.0	1.3	2,487.3	48.7	18.5	52.1	0.7	120.0	317.7	**2,685.0**	1,946.9	158.0	907.5
15-Aug-00	2,677.0	1.2	2,678.2	34.3	19.4	41.5	0.7	95.9	318.1	**2,900.4**	2,093.9	111.0	831.5
16-Aug-00	2,026.0	1.4	2,027.4	34.0	19.4	36.2	0.7	90.4	318.8	**2,255.8**	1,979.1	109.0	863.0
17-Aug-00	4,407.0	1.6	4,408.6	133.6	37.6	867.0	0.7	1,038.8	311.2	**3,681.0**	1,702.6	3,151.0	519.0
18-Aug-00	3,931.0	1.7	3,932.7	257.9	22.9	165.0	0.7	446.6	306.2	**3,792.3**	1,670.6	1,003.0	867.0
19-Aug-00	3,275.0	0.9	3,275.9	121.0	17.0	97.1	0.7	235.9	305.0	**3,345.0**	1,650.8	466.0	749.5
20-Aug-00	2,981.0	3.7	2,984.7	39.1	17.3	56.3	0.7	113.4	305.9	**3,177.2**	1,665.9	196.0	788.0
21-Aug-00	2,610.0	3.0	2,613.0	34.5	16.7	47.8	0.7	99.7	308.2	**2,821.5**	1,781.9	159.0	787.5
22-Aug-00	2,608.0	3.5	2,611.5	26.0	16.4	41.4	0.7	84.5	306.2	**2,833.2**	1,789.2	111.0	686.0
23-Aug-00	2,913.0	4.7	2,917.7	88.0	38.5	113.0	0.7	240.2	307.1	**2,984.6**	1,815.1	757.0	858.0
24-Aug-00	2,652.0	4.2	2,656.2	65.5	20.2	48.7	0.7	135.2	310.3	**2,831.3**	1,879.5	260.0	811.0
25-Aug-00	2,660.0	5.1	2,665.1	56.5	19.1	48.4	0.7	124.7	309.5	**2,849.9**	1,921.8	175.0	790.0
26-Aug-00	1,950.0	4.2	1,954.2	35.3	17.2	38.4	0.7	91.6	310.4	**2,173.0**	1,839.0	131.0	695.5
27-Aug-00	2,597.0	4.4	2,601.4	34.4	17.1	32.2	0.7	84.5	313.3	**2,830.2**	1,800.0	142.0	903.0
28-Aug-00	2,762.0	4.5	2,766.5	32.5	17.9	30.2	0.7	81.3	314.0	**2,999.2**	1,891.0	97.0	826.0
29-Aug-00	2,578.0	5.2	2,583.2	34.4	17.2	27.3	0.7	79.7	313.9	**2,817.4**	1,921.9	100.0	934.5
30-Aug-00	2,682.0	5.1	2,687.1	26.0	18.0	22.7	0.7	67.4	309.5	**2,929.2**	1,927.3	63.0	999.5
31-Aug-00	2,806.0	4.8	2,810.8	31.8	17.5	23.6	0.7	73.7	315.4	**3,052.5**	2,112.3	73.0	951.5
Averages	2,917.2	3.2	2,920.4	71.0	23.2	119.0	0.7	213.9	310.2	**3,016.7**	1,813.3	480.8	796.1

Lake Michigan Diversion Accounting – WY 2000
September 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2000	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Sep-00	2,850.0	6.5	2,856.5	54.8	18.4	30.9	1.0	105.2	302.6	**3,053.9**	2,184.9	131.0	1,001.5
02-Sep-00	3,122.0	7.3	3,129.3	26.0	19.3	16.7	1.0	62.9	300.9	**3,367.3**	2,128.0	47.0	1,085.5
03-Sep-00	2,789.0	5.9	2,794.9	34.2	17.4	19.0	1.0	71.5	298.5	**3,021.9**	1,933.2	68.0	1,000.5
04-Sep-00	3,180.0	5.8	3,185.8	34.4	17.2	16.4	1.0	68.9	289.2	**3,406.1**	1,751.0	73.0	1,210.5
05-Sep-00	2,946.0	5.5	2,951.5	26.0	15.6	12.4	1.0	55.0	289.7	**3,186.2**	1,777.8	41.0	1,048.0
06-Sep-00	2,848.0	3.2	2,851.2	35.9	14.0	15.5	1.0	66.4	290.8	**3,075.6**	1,837.6	59.0	952.5
07-Sep-00	2,714.0	4.9	2,718.9	63.1	14.2	25.5	1.0	103.8	299.1	**2,914.2**	1,961.5	129.0	929.5
08-Sep-00	2,742.0	5.0	2,747.0	33.2	13.8	12.1	1.0	60.1	295.4	**2,982.3**	1,942.3	134.0	988.0
09-Sep-00	2,751.0	4.0	2,755.0	34.5	13.7	10.3	1.0	59.4	293.5	**2,989.1**	1,877.0	60.0	959.0
10-Sep-00	2,836.0	3.6	2,839.6	70.9	22.9	399.2	1.0	494.0	296.5	**2,642.1**	1,818.4	460.0	828.0
11-Sep-00	7,069.0	2.2	7,071.2	70.0	36.9	1,936.2	1.0	2,044.1	305.0	**5,332.1**	1,712.1	10,842.0	485.0
12-Sep-00	11,340.0	0.9	11,340.9	89.2	36.1	865.4	1.0	991.7	293.4	**10,642.6**	1,621.5	5,726.0	360.5
13-Sep-00	4,740.0	0.9	4,740.9	170.6	18.4	446.2	1.0	636.2	285.4	**4,390.1**	1,641.7	2,144.0	828.0
14-Sep-00	4,908.0	0.8	4,908.8	185.8	18.3	497.5	1.0	702.6	288.1	**4,494.3**	1,612.4	2,520.0	715.5
15-Sep-00	4,140.0	0.7	4,140.7	240.8	15.8	258.6	1.0	516.1	283.4	**3,908.0**	1,561.2	1,244.0	978.0
16-Sep-00	3,709.0	0.5	3,709.5	118.0	14.4	158.4	1.0	291.8	284.2	**3,701.9**	1,537.2	620.0	775.0
17-Sep-00	3,132.0	0.7	3,132.7	39.1	13.6	91.9	1.0	145.5	284.9	**3,272.1**	1,571.6	311.0	601.0
18-Sep-00	2,863.0	1.0	2,864.0	34.5	13.4	72.5	1.0	121.3	288.4	**3,031.1**	1,650.3	232.0	817.5
19-Sep-00	3,221.0	1.0	3,222.0	26.0	11.8	59.1	1.0	97.9	286.0	**3,410.1**	1,687.4	175.0	1,188.0
20-Sep-00	3,122.0	0.9	3,122.9	97.1	15.6	320.6	1.0	434.1	287.9	**2,976.7**	1,567.3	1,224.0	491.0
21-Sep-00	2,963.0	0.7	2,963.7	159.6	13.6	117.7	1.0	291.8	281.6	**2,953.5**	1,525.5	592.0	780.0
22-Sep-00	4,581.0	0.5	4,581.5	137.8	13.2	396.2	1.0	548.0	288.8	**4,322.3**	1,528.9	1,994.0	911.0
23-Sep-00	4,542.0	0.8	4,542.8	224.9	16.6	277.2	1.0	519.7	281.5	**4,304.6**	1,471.5	1,566.0	1,361.5
24-Sep-00	4,843.0	0.8	4,843.8	205.6	14.9	379.7	1.0	601.3	286.9	**4,529.4**	1,493.3	1,831.0	917.5
25-Sep-00	3,777.0	0.6	3,777.6	26.0	12.9	81.4	1.0	121.2	283.2	**3,939.6**	1,523.0	483.0	883.5
26-Sep-00	2,924.0	1.5	2,925.5	40.9	11.7	81.6	1.0	135.2	282.6	**3,072.9**	1,535.1	429.0	833.0
27-Sep-00	2,681.0	2.3	2,683.3	26.0	11.3	70.6	1.0	108.8	280.3	**2,854.8**	1,533.0	303.0	847.0
28-Sep-00	3,000.0	1.0	3,001.0	26.0	12.0	65.8	1.0	104.7	282.9	**3,179.2**	1,541.7	252.0	822.0
29-Sep-00	2,593.0	4.7	2,597.7	40.9	11.1	66.9	1.0	119.9	282.8	**2,760.6**	1,561.2	251.0	664.5
30-Sep-00	2,235.0	3.5	2,238.5	26.0	11.1	56.9	1.0	95.0	284.6	**2,428.1**	1,592.5	178.0	467.0
Averages	3,705.4	2.6	3,708.0	79.9	16.3	228.6	1.0	325.8	289.3	**3,671.5**	1,689.3	1,137.3	857.7



US Army Corps of Engineers
Chicago District

Lake Michigan Diversion Accounting

Water Year 2001 Report

Executive Summary

In compliance with the 1967 U.S. Supreme Court decree as modified in 1980 (hereinafter, the Decree), the WY01 diversion was computed using the best current engineering practice and scientific knowledge.

Given the complexity of the hydrologic cycle in the heavily urbanized Chicago metropolitan area, and given the number of human and other factors that cannot be adequately represented in numerical modeling procedures, the results of the simulations which compute diversion flows worked exceptionally well.

The WY01 diversion accountable to the State of Illinois is 2,698 cubic feet per second (cfs). This flow is 502 cfs less than the 3,200 cfs average specified by the Decree. The 40 year running average, rounded to the nearest cfs, beginning with WY81 is 3,298 cfs and the cumulative deviation from the 3,200 cfs average is -1,858 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum deficit allowed by the Decree is -2,000 cfs-years.

Table Of Contents

Executive Summary i

Introduction 1

Authority for Report 1

History of the Diversion 2

Diversion Accounting Procedures 6

WY01 Revisions to Diversion Accounting Procedures 10

Accounting Results 11

Discussions of Results 14

Columns 14

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, United States Geological Survey (USGS) AVM Gage Record 14
Column 2: Diversions from the CSSC above the Gage 14
Column 3: Total Flow through the CSSC 14
Column 4: Groundwater Discharged to the CSSC and Adjoining Channels 15
Column 5: Water Supply Pumpage from Indiana Reaching the CSSC 16
Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC 17
Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC 18
Column 8: Total Deductions from the CSSC Romeoville Gage Record 18
Column 9: Lake Michigan Pumpage Not Discharged to the CSSC 18
Column 10: Total Diversion 20
Column 11 through Column 13: Lake Michigan Diversion Components 20
Column 11 - Lake Michigan Pumpage Accountable to Illinois *21*
Column 12 - Runoff from the Diverted Lake Michigan Watershed *21*
Column 13 - Direct Diversion through the Lakefront Structures *21*
Sum of Columns 11 through 13 ..... *22*

Budgets **25**

Budget 1 and Budget 2: Water Supply Pumpage 25
Budget 1: Diverted Lake Michigan Water Supply *25*
Budget 2: Groundwater Diverted to the CSSC *25*
Budgets 3 through Budget 6: Stream Gaging Stations 26
Budgets 7 through Budget 13: MWRDGC Water Reclamation Facilities 27
Budget 7: Northside Water Reclamation Facility *27*
Budget 8: Upper Des Plaines Pump Station *28*
Budget 9: Mainstream and Des Plaines TARP Pumping Stations *28*
Budget 10: Stickney Water Reclamation Facility *34*
Budget 11: Calumet TARP Pumping Station *34*
Budget 12: Calumet Water Reclamation Facility *39*
Budget 13: Lemont Water Reclamation Facility *39*
Aggregated Results of Four MWRDGC Water Reclamation Facilities *41*
Budget 14: CSSC System Balance *41*
Summary of Budget Results *44*

Areas for Improvement **47**

Tunnel and Reservoir Plan Models 47
Data Preprocessing 48
MWRDGC Upper Des Plaines Pump Station 48
O'Hare and Egan Basin Flow Transfer 49
HSPF Snowmelt Simulation 49
Budgets 7A and 7B 50
TNET Model Confirmation/Update 50
Baseflow Matching 50
Calibration Period 51
Budgets 7, 12, 13 High Flow Under Prediction 51
Budget 14 Calibration 51

Summary **52**

References **53**

Appendix A - Background of Lake Michigan Diversion Accounting **A-1**

Appendix B - Summary of Daily Diversion Flows **B-1**

List of Tables

Table 1 - Description of the Diversion Accounting Columns 7
Table 2 - Description of the Diversion Accounting Computational Budgets 8
Table 3 - Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified Supreme Court Decree 11
Table 4 – Lake Michigan Diversion Accounting — WY 2001 Summary of Diversion Accounting Flows 13
Table 5 - Components of the Diversion by the State of Illinois Based on Columns 11 Through 13 23
Table 6 - Stream Gage Flow Separation 27
Table 7 - WY 2001 Summary of Simulation Statistics 30
Table 8 – WY 2001 Summary of Flow Components for the CSSC System Balance 46

List of Figures

Figure 1 Development of the Chicago Sanitary and Ship Canal System 4
Figure 2 Location Plan - Lake Michigan Diversion at Chicago 5
Figure 2A Budget and Column Interactions 9
Figure 3 Component Breakdown of Illinois' Diversion Based Upon Columns 11 Through 13 24
Figure 4 Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility 31
Figure 5 Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station 32
Figure 6 Map of Mainstream, Des Plaines and Calumet TARP 36
Figure 7 Budget 9 - Simulation of the MWRDGC Mainstream and Des Plaines TARP Pumping Station 37
Figure 8 Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility 38
Figure 9 Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station 40
Figure 10 Budget 12 – Simulation of the MWRDGC Calumet Water Reclamation Facility 42
Figure 11 Budget 13 – Simulation of the MWRDGC Lemont Water Reclamation Facility . 43
Figure 12 Budget 14 – CSSC System Balance 45

Introduction

The diversion of water from the Lake Michigan watershed is of major importance to the Great Lakes states and to the Canadian province of Ontario. The states and province that border the Great Lakes have concerns with both diversions during periods of low lake levels, as well as the long term effects of diversion. To insure that the concerns of these interested parties are considered, the U. S. Army Corps of Engineers has been given the responsibility for the accounting of flow that is diverted from the Lake Michigan watershed.

The Corps of Engineers, Chicago District, is responsible for monitoring the measurements and the computation of the diversion of Lake Michigan water by the State of Illinois. For the water year 1981 and 1982 (WY81 and WY82) reports, the calculations were made for the Illinois Department of Natural Resources - Office of Water Resources (IDNR-OWR), formerly known as the Illinois Department of Transportation - Division of Water Resources (IDOT-DWR), by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), formerly known as the Metropolitan Sanitary District of Greater Chicago (MSDGC). The computations for Water Year 1983 (WY83), WY84 and WY85 (1 October 1982 through 30 September 1985) were performed by the Northeastern Illinois Planning Commission (NIPC) for IDNR-OWR. The Corps reviewed, modified, and updated the WY84 and WY85 diversion accounting performed by NIPC. The computations for WY86 were performed jointly by NIPC (under contract to the Corps of Engineers) and the Corps of Engineers; the computations for WY91 and WY92 were performed jointly by Christopher B. Burke Engineering, Ltd., NIPC and the Corps of Engineers. The computations for WYs 87-90 and 93-97 were performed solely by the Corps of Engineers. The computations for WY 98 and WY 99 were performed jointly by Mead and Hunt (under contract to the Corps of Engineers) and the Corps of Engineers. The computations for WY00 and WY 01 were performed by CTE Engineers, Inc. (under contract to the Corps of Engineers). This report represents the final Lake Michigan diversion accounting for WY01 that was performed by CTE Engineers, Inc. (under contract to the Corps of Engineers).

Authority for Report

Under the provisions of the U.S. Supreme Court Decree in the Wisconsin, et. al. v. Illinois et. al., 388 U.S. 426,87 S.Ct. 1774 (1967) as modified in 449 U.S. 48, 101 S.Ct. 557 (1980), the Chicago District of the Corps of Engineers is responsible for monitoring the measurement and computation of diversion of Lake Michigan water by the State of Illinois. The Water Resources Development Act of 1986 (Section 1142 of PL 99-662) gave the Corps total responsibility for the computation

of diversion flows as formerly done by the State of Illinois. The Corps' new mission became effective on October 1, 1987.

History of the Diversion

Water has been diverted from Lake Michigan at Chicago into the Mississippi River Watershed since the completion of the Illinois and Michigan (I & M) Canal in 1848. At that time, the diversion averaged about 500 cubic feet per second (cfs). The I & M Canal was built primarily to serve transportation needs by providing a connecting watercourse between the Great Lakes and the Mississippi River system.

With the development of the Chicago metropolitan area, sewer and drainage improvements led to severe sanitation problems in the mid to late 1800's. The newly constructed sewers moved water and wastes into the Chicago River, which until 1900 drained to Lake Michigan. The water quality of Lake Michigan deteriorated and contaminated the city's primary water supply.

A second problem that occurred during this time period was an increase in the overbank flooding within the city. As more roads were built and buildings constructed, the sewer system was correspondingly expanded. The increase in impervious area from the newly constructed roads and buildings increased the rate and volume of stormwater runoff and resulted in increased flooding.

As a solution to the sanitation and flooding problems, construction of the Chicago Sanitary and Ship Canal (CSSC) was undertaken and was completed in 1900 by the MWRDGC. Construction of the CSSC allowed the flow direction of the Chicago River to be reversed (Figure 1). The CSSC followed the course of the older I & M Canal. The CSSC is much larger than the I & M canal and can handle the Chicago River flow, as well as increased shipping. In 1938, the Chicago River Controlling Works (CRCW) was constructed at the mouth of the Chicago River. The CRCW regulates the amount of Lake Michigan water allowed to pass into the river and restricts river flooding from entering Lake Michigan. The water levels in the CSSC are controlled by the Lockport Lock and Dam.

Between 1907 and 1910, the MWRDGC constructed a second canal called the North Shore Channel. It extended from Lake Michigan at Wilmette in a southerly direction 6.14 miles to the north branch of the Chicago River. The Wilmette Pumping Station, also known as the Wilmette Controlling Works, regulates the amount of Lake Michigan flow allowed down the channel through the use of one vertical lift gate. The four abandoned 250 cfs pumps have not been used for diversion since 70's.

Construction of a third canal, the Calumet Sag Channel, was completed in 1922. The canal connects Lake Michigan through the Grand Calumet River, to the CSSC. The Calumet Sag Channel was constructed to carry sewage from South Chicago, Illinois and East Chicago, Indiana. Flow through the canal was controlled by the Blue Island Lock and Dam. The O'Brien Lock and Dam, which replaced the Blue Island Lock and Dam, was completed in 1967 and is located on the Calumet River. The O'Brien Lock and Dam regulates the flow of Lake Michigan waters down the Calumet Sag Channel. Figure 2 shows the affected watershed.

The current Supreme Court Decree specifies several limitations on the diversion of Lake Michigan water by the State of Illinois. The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in two accounting periods due to extreme hydrologic conditions in which the average diversion may not exceed 3,840 cfs. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the forty year period beginning with WY81.

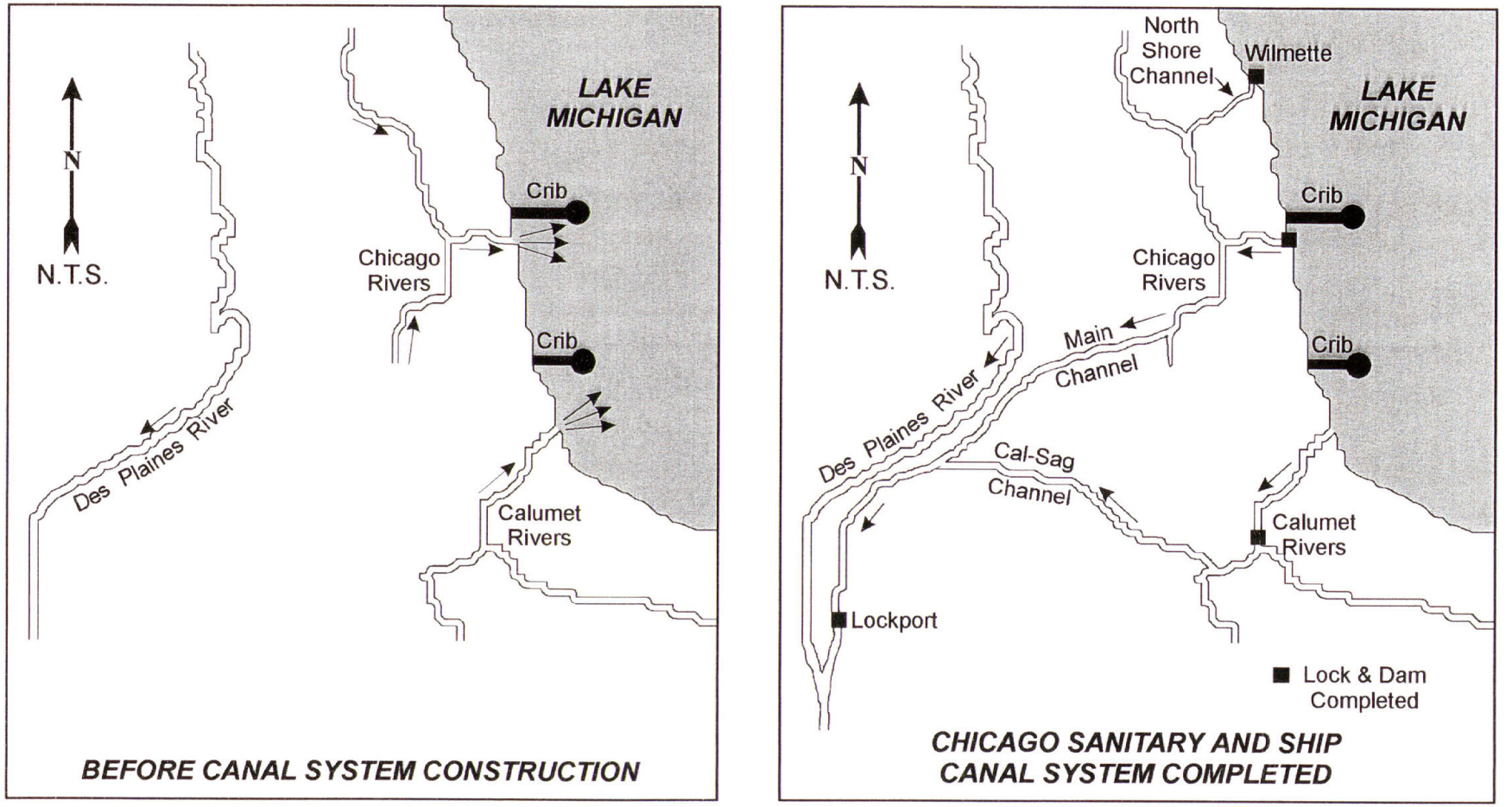


Figure 1 Development of the Chicago Sanitary and Ship Canal System

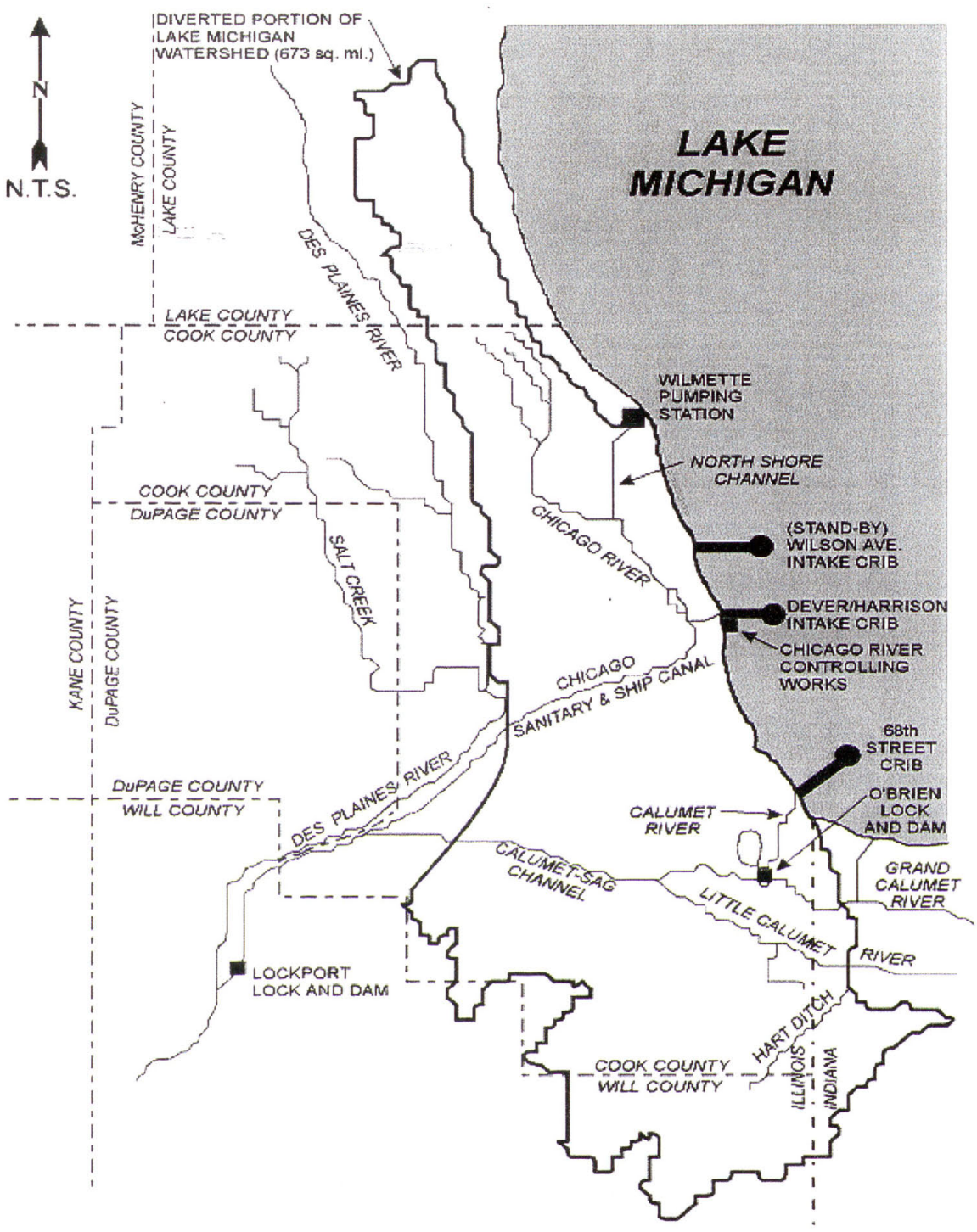


Figure 2 Location Plan - Lake Michigan Diversion at Chicago

Diversion Accounting Procedures

The Lake Michigan diversion accountable to the State of Illinois is calculated by using the AVM (Acoustic Velocity Meter) measured flow in the CSSC at Romeoville and deducting flows that do not constitute Lake Michigan diversion and are not accountable to the State of Illinois. Finally, additions are made to the Romeoville record for diversions that are not discharged to the canal. The deductions include groundwater water supply pumpage whose effluent is discharged to the canal, Lake Michigan water supply pumpage from Indiana discharged to the canal, runoff from the Des Plaines River watershed discharged to the canal, and water supply pumpage from Lake Michigan used for Federal facilities discharged to the canal. The additions to the Romeoville record include flows diverted from the canal upstream of Romeoville, and Lake Michigan water supply whose effluent is not discharged to the canal. This procedure represents the accounting method required by the Supreme Court Decree. A detailed discussion of the background of Lake Michigan Diversion Accounting is presented in Appendix A.

The diversion accounting results are presented as a series of columns that are defined in Table 1. Columns 1 through Column 3 are used to compute the total flow in the CSSC. Columns 4 through Column 7 present the deductions from the canal system flows with the total deduction being presented in Column 8. Column 9 presents the additions to the canal system record. Column 10 is the computed Lake Michigan diversion accountable to Illinois and is equal to the canal system flow minus the deductions plus the additions. Columns 11 through 13 are independent flow estimates for the three sources of diversion: water supply pumpage from Lake Michigan, runoff from the diverted Lake Michigan Watershed, and direct diversion through the lakefront structures. Column 11 through Column 13 are not used in the diversion calculation but are included as another estimate of the diversion for verification of the accounting flows in Column 10 where the sum of Columns 11 through 13 should theoretically equal the flow in Column 10. Note, that beginning in WY97 a consideration of consumptive use was made in the computations of Columns 4, 5, 7, 9 and 11. For a discussion of the reasons for the application of the consumptive use factor, the reader should review the WY1997 Diversion Accounting Report (USACE, 2001).

In addition to the diversion calculations presented in the 13 columns, 16 computational budgets are prepared as input to the diversion calculation and to verify the estimated flows that cannot be measured. A summary of these budgets is presented in Table 2. Budgets 1 and 2 do not compare simulated to measured flows but are summations of critical water supply pumpage data. Budget 3 through Budget 6 partition stream gage records into runoff and sanitary/industrial discharge components to estimate a portion of the runoff from the diverted watershed that is used as input to Column 12, Runoff from the Diverted Lake Michigan Watershed.

Budget 7 through Budget 13, and, beginning in WY2001, Budgets 7A and 7B compare simulated to measured flows at MWRDGC facilities. These budgets simulate all the deductible Des Plaines River Watershed flows contained in Column 6 and the deductible groundwater seepage into TARP contained in Column 4. These budgets also are used for verification of the diversion accounting procedures and give an indication of the accuracy of the diversion accounting models. Budget 14 compares canal system inflows and outflows. It is used primarily as a verification of modeling results as well as an indicator of the accuracy and completeness of measured/reported flows.

Table 1
Description of the Diversion Accounting Columns

Column	Description
1	Chicago Sanitary and Ship Canal (CSSC) at Romeoville AVM Gage Record
2	Diversion from the CSSC above the Romeoville AVM Gage
3	Total Flow Through the CSSC
4	Groundwater Pumpage Discharged into the CSSC and Adjoining Channels
5	Water Supply Pumpage from Indiana Reaching the CSSC
6	Runoff from the Des Plaines River Watershed which Reaches the CSSC
7	Lake Michigan Pumpage by Federal Facilities which Discharge to the CSSC and Adjoining Channels
8	Total Deduction from the CSSC Romeoville AVM Gage Record
9	Lake Michigan Pumpage Which is not Discharged into the CSSC
10	Total Diversion Accountable to the State of Illinois
11	Pumpage from Lake Michigan Which is Accountable to the State of Illinois
12	Runoff from the Diverted Lake Michigan Watershed
13	Direct Diversions Through Lakefront Control Structures Accountable to the State of Illinois

Figure 2A shows how the various budget computations are incorporated into the column computations. The left column lists the budgets while the right column lists what part of the budget calculation is used in each of the column calculations.

Table 2

Description of the Diversion Accounting Computational Budgets

Budget Number	Title	Description
1	Diverted Lake Michigan Pumpage	This budget sums the Lake Michigan water diverted by the State of Illinois in the form of Industrial and Municipal water supply. The results of this budget are used in Column 11.
2	Groundwater Discharged to the CSSC	This budget sums groundwater pumpages that are discharged to the CSSC. The results of this budget are used in Column 4.
3	North Branch Chicago River at Niles, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
4	Little Calumet River at the IL-IN State Line	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
5	Thorn Creek at Thornton, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
6	Little Calumet River at South Holland, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
7	MWRDGC Northside Water Reclamation Plant	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Northside Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Northside service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
7A	MWRDGC North Branch Pumping Station	This budget performs hydrologic and hydraulic simulations of the CSO overflows of the service areas tributary to the North Branch Pumping Station. The budget provides an internal verification of the accounting procedures.
7B	MWRDGC Racine Pumping Station	This budget performs hydrologic and hydraulic simulations of the CSO overflows of the service areas tributary to the Racine Pumping Station. The budget provides an internal verification of the accounting procedures.
8	Upper Des Plaines Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Upper Des Plaines Pumping Station. This budget provides a calibration point to verify models of the Des Plaines River watershed
9	MWRDGC Mainstream TARP Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Mainstream TARP Pumping Station. The results of this simulation are used in Budgets 10 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
10	MWRDGC Stickney Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Stickney Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Stickney service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
11	MWRDGC Calumet TARP Pumping Station	This budget performs hydrologic and hydraulic simulations of the MWRDGC Calumet TARP Pumping Station. The results of this simulation are used in Budgets 12 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
12	MWRDGC Calumet Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Calumet Water Reclamation Facility. The simulations estimate the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Calumet service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
13	MWRDGC Lemont Water Reclamation Facility	This budget performs hydrologic and hydraulic simulations of the service basin tributary to the MWRDGC Lemont Water Reclamation Facility. The simulations estimate the runoff from portions of the Des Plaines River watershed within the Lemont service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Column 6.
14	Chicago Canal System	This budget performs a water balance of the Chicago Canal System which includes the CSSC and adjoining channels. This budget provides a verification point for the accounting procedures.

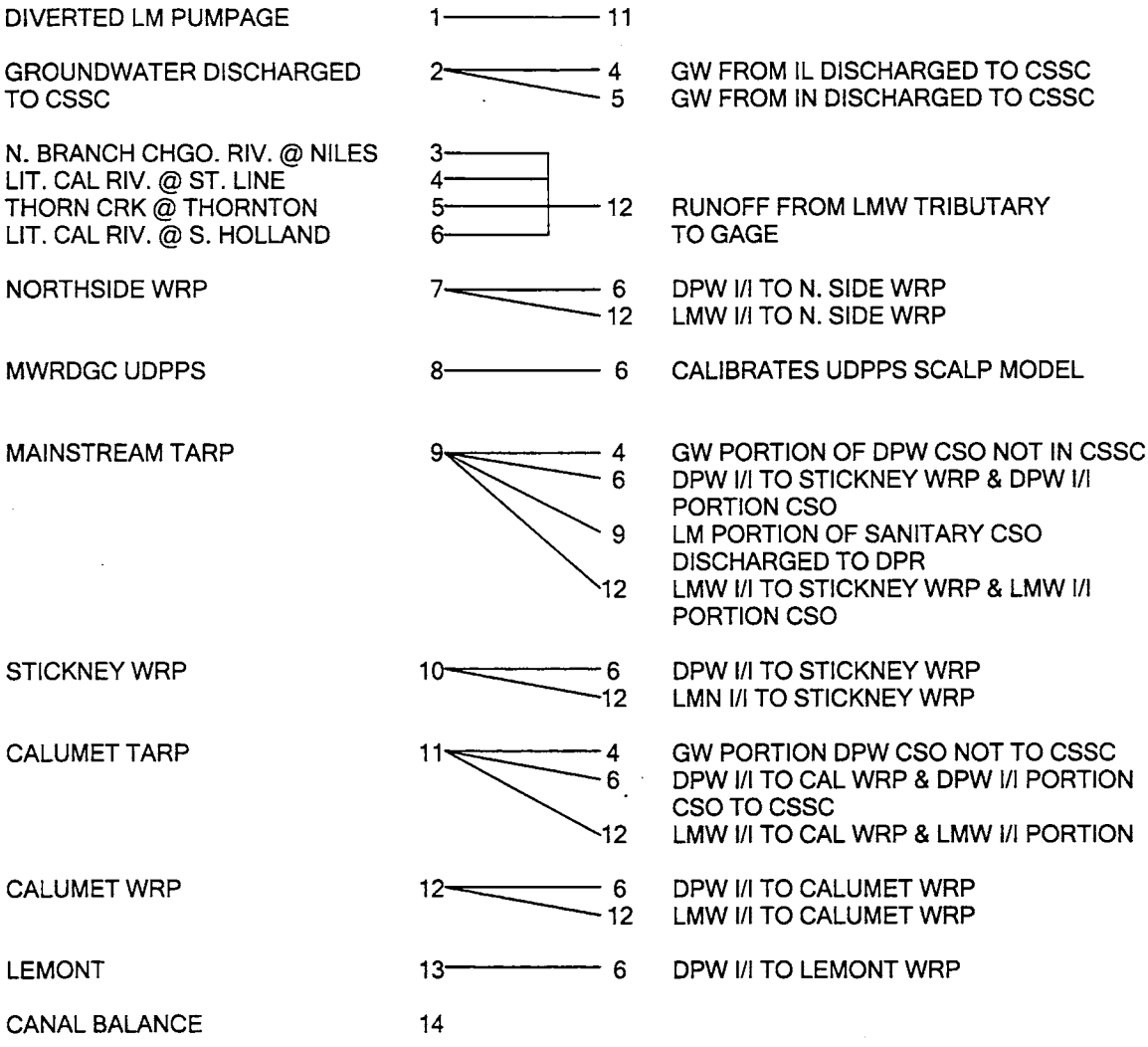


Figure 2A Budget and Column Interactions

Direct diversion flows through the lakefront structures have been estimated based on ratings. Beginning in WY 1997 the total direct diversion at CRCW and O'Brien Lock and Dam was also measured by the USGS' (United States Geological Survey) AVM's. The AVM on the Chicago River was installed in the vicinity of Columbus Drive Bridge during November 1996 and became operational in December 1996. The AVM at O'Brien Lock and Dam was installed during August-September 1996 and became operational in October 1996. Beginning in Water Year 1998 the direct diversion measured by AVM's was used in the Budget 14 and Column 13 computations. This procedure change meant that the best scientific knowledge and engineering practice were used in the Lake Michigan Accounting mandated by the U.S. Supreme Court. Under the existing Romeoville accounting system Budget 14 and Column 13 do not affect the total diversion accountable to the State of Illinois. Rather the direct diversion flows were used for checking water balances.

The City of Hammond is a primary diverter of Lake Michigan water in Indiana. In addition to providing water supply to the city itself, it also sells lake water to Chicago Heights, Calumet City, Burnham and Lansing (in Illinois) and to Highland, Griffith and Munster (in Indiana). Beginning in Water Year 1998, water supply to Chicago Heights, Calumet City and Burnham was included in computing the pumpage from Lake Michigan accountable to the State of Illinois (Column 11). Under the existing Romeoville accounting

system Column 11 does not affect the total diversion accountable to the State of Illinois. Accounting mandated by the U.S. Supreme Court. Under the existing Romeoville accounting system Budget 14 and Column 13 do not affect the total diversion accountable to the State of Illinois. Rather the direct diversion flows were used for checking water balances.

WY01 Revisions to Diversion Accounting Procedures

The following revisions were made to the diversion accounting procedures for WY01 and WY00. A more detailed description of these changes is included in Appendix A.

- Two new budgets, Budgets 7A and 7B, were added to the accounting procedure. Budget 7A compares simulated and observed pumping at the North Branch Pumping Station. Budget 7B compares simulated and observed pumping at the Racine Pumping Station. These Budgets were added to help determine the accuracy of the TARP CSO simulations and for their potential future use as calibration points for the heretofore uncalibrated CSO overflows.
- Backflows from the CRCW, O'Brien and Wilmette Locks were removed from the Budget 14 accounting of outflows. It was noted that backflows were already accounted for in the Lakefront AVM measurements.
- The HSPF/SCALP/TNET models were calibrated using WY00 and WY01. Previously, the calibration had been done by accounting year. Using a two-year period allows the parameter adjustments to be correlated to the greater variability of conditions over two years. This allows the parameters to better reflect the landuse conditions which do not change significantly over time within the combined sewer area. The WY99 meteorological data was used as a starting point in the calibration runs to allow the HSPF model to stabilize and have correct (antecedent) conditions at the beginning of the WY00 accounting year.

Accounting Results

The total WY01 Lake Michigan diversion accountable to the State of Illinois is 2,701 cfs (Column 10). This diversion is 499 cfs less than the 3,200 cfs average specified by the Decree. The running average to date, beginning with WY81, and rounded to the nearest cfs is 3,298 cfs. The cumulative deviation from the 3,200 cfs average is -1,861 cfs-years. The negative cumulative deviation indicates a water allocation deficit. The maximum allowable deficit is -2,000 cfs-years. The status of Illinois' diversion to date is shown in Table 3. The WY01 diversion accounting monthly summary is presented in Table 4. Tabular data on daily diversion flows is presented in Appendix B.

Table 3

Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified U.S. Supreme Court Decree

Accounting Year	Certified Flow (cfs)	Running Average (cfs)	Cumulative Deviation (cfs-yrs)
1981	3,106	3,106	94
1982	3,087	3,097	207
1983	3,613	3,269	-206
1984	3,432	3,310	-438
1985	3,472	3,342	-710
1986	3,751	3,410	-1,261
1987	3,774	3,462	-1,835
1988	3,376	3,451	-2,011
1989	3,378	3,443	-2,189
1990	3,531	3,452	-2,520
1991	3,555	3,461	-2,875
1992	3,409	3,457	-3,084
1993	3,841	3,487	-3,725
1994	3,064	3,456	-3,589
1995	3,197	3,439	-3,586
1996	3,108	3,418	-3,493
1997	3,114	3,400	-3,407
1998	3,060	3,382	-3,267
1999	2,909	3,357	-2,976
2000	2,584	3,318	-2,360
2001	2,698	3,298	-1,858

Table 4
Lake Michigan Diversion Accounting – WY2001
Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Oct-00	2,207.3	2.8	2,210.1	55.6	16.1	98.7	0.7	171.1	250.8	2,289.8	1,496.8	498.5	307.4
Nov-00	2,217.9	1.9	2,219.8	66.8	15.4	140.2	1.0	223.4	234.1	2,230.5	1,431.0	659.5	213.8
Dec-00	1,722.7	3.1	1,725.8	34.2	10.3	38.0	1.2	83.7	239.4	1,881.5	1,449.0	179.3	75.1
Jan-01	2,180.7	0.8	2,181.5	102.9	13.6	318.6	1.3	436.4	240.9	1,986.0	1,455.0	1,258.3	68.1
Feb-01	3,719.5	1.0	3,720.5	90.7	21.3	286.5	0.6	399.1	232.8	3,554.2	1,432.0	1,682.8	101.8
Mar-01	2,342.4	1.9	2,344.3	54.7	18.6	190.9	0.9	265.1	223.4	2,302.6	1,415.2	685.3	235.0
Apr-01	2,520.0	2.1	2,522.1	75.0	16.7	175.4	0.9	268.0	241.0	2,495.1	1,428.1	740.7	244.7
May-01	2,452.4	3.8	2,456.2	71.5	16.3	145.5	1.0	234.3	263.0	2,484.9	1,510.1	742.4	347.4
Jun-01	2,811.1	4.2	2,815.3	75.4	22.1	149.1	1.0	247.6	294.8	2,862.5	1,666.9	751.3	548.7
Jul-01	2,892.9	4.7	2,897.6	79.9	29.6	138.5	1.0	249.0	351.9	3,000.5	1,928.4	679.0	647.0
Aug-01	3,919.0	2.9	3,921.9	102.1	22.2	299.9	0.7	424.9	317.1	3,814.1	1,772.0	1,591.5	685.7
Sep-01	3,648.5	1.4	3,649.9	99.2	16.9	235.0	0.6	351.7	264.2	3,562.4	1,547.8	1,059.0	713.1
Averages	2,710.4	2.6	2,713.0	75.5	18.2	184.0	0.9	278.6	263.1	2,697.5	1,545.6	871.5	350.1

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 = Column 3 - Column 8 + Column 9.

Note: The averages presented in the final row are calculated from the daily values contained in Appendix B.

Deductions from the Romeoville Gage Record

Additions to the Romeoville Gage Record

Discussions of Results

The following is a discussion of the column functions and computational budgets. The discussion of the column functions describes the purpose of each column, as well as some observations on the WY01 values in the columns. The discussion of the computational budgets presents the purpose of each budget and the results of the budget flow balances. The results of the computational budgets are used in the diversion calculations where nine (9) budgets are used to verify the diversion simulation models. The columns are discussed first, followed by the discussion of the budgets.

Columns

The first ten (10) columns display the components of the diversion calculation and include the Romeoville flow, as well as the various deductions and additions to the Romeoville record. The final three (3) columns (Columns 11 through 13) display the three (3) diversion components (Lake Michigan pumpage accountable to Illinois, runoff from the diverted watershed, and direct diversion through the lakefront control structures). The sum of Columns 11 through 13 should theoretically equal the Romeoville based diversion calculation. A comparison of the sum of these three (3) columns to the calculated diversion (Column 10) is presented in the discussion of Column 11 through Column 13.

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, United States Geological Survey (USGS) AVM Gage Record

The discharge at Romeoville for WY01 was 2,710.4 cfs (based on an average of WY01 daily flows).

Column 2: Diversions from the CSSC above the Gage

Argonne Laboratories and Citgo Petroleum Corporation were the only major diversions from the CSSC upstream of the Romeoville gage in WY01. The average withdrawal upstream of the AVM for WY01 was 2.6 cfs.

Column 3: Total Flow through the CSSC

Column 3 is the sum of Column 1 and Column 2 and represents the total flow entering the canal system. The average CSSC flow was 2,713.0 cfs for WY01.

Column 4: Groundwater Discharged to the CSSC and Adjoining Channels

Column 4 is groundwater pumpage by communities, industrial users and other private users whose effluent is discharged to the CSSC. The groundwater pumpage data is reported by the Illinois State Water Survey (ISWS). Column 4 also includes the groundwater seepage into the TARP systems discharged to the CSSC. Column 4 is determined by summing all reported groundwater pumpages (with a consideration of consumptive use) tributary to the CSSC, along with the estimated groundwater seepage into the Mainstream and Des Plaines TARP (Budget 9) and Calumet TARP (Budget 11) systems. This total is then adjusted by subtracting the portion of groundwater present in the combined sewer overflows (CSO's) discharged to the Des Plaines River and other watercourses not tributary to the CSSC. This groundwater would normally have been discharged to the canal via treated sewage effluent had a CSO event not occurred. This method prevents double accounting of the combined sewer overflow portion of the groundwater supply pumpage.

Using ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois or if they were located within MWRDGC Water Reclamation Plant (WRP) service boundaries which discharged into the CSSC and adjoining channels. Beginning in WY97 those groundwater pumpage records were reduced by 10% to account for the consumptive use of the water between the point of supply to the point of discharge to the CSSC. Groundwater seepage into the Mainstream and Des Plaines TARP systems and the Calumet TARP system was determined through simulation and is discussed in Budgets 9 and 11. The groundwater constituent of CSO's is determined entirely thorough simulation.

According to the Supreme Court Decree of 1967, groundwater pumpage from the Lake Michigan watershed whose effluent is discharged to the CSSC is a deduction, except to the extent that these groundwater sources are supplied by infiltration from Lake Michigan. Current piezometric levels indicate that groundwater is discharging to the Lake; therefore, groundwater pumpage from within the Lake Michigan watershed that reaches the canal continues to be a deduction. Research literature will be reviewed periodically to verify this assumption, and to identify any changes that would indicate that Lake Michigan is recharging groundwater sources as a result of groundwater pumping.

Groundwater tributary to the canal is composed of 17.0 cfs of groundwater pumpage from the Lake Michigan watershed, 9.1 cfs of groundwater pumpage from outside of the Lake Michigan watershed, 37.3 cfs of groundwater seepage into the Mainstream and Des Plaines TARP systems, and 14.6 cfs of groundwater seepage into the Calumet TARP system. These values reflect the consumptive use factor of 10% as applied to both the groundwater pumpage from the Lake Michigan watershed and groundwater pumpage from outside of the Lake Michigan watershed.

In most years, a small portion of this groundwater supply pumpage (normally tributary to CSSC) is determined, through simulation, to be discharged to the Des Plaines River and other watercourses not tributary to the CSSC in the form of CSO's. The groundwater portion of these CSO's are then subtracted from the groundwater deduction of Column 4. The total of the above components, Column 4, is 75.5 cfs and represents a deduction from the Romeoville record. This flow is an increase of 6.7 cfs from WY00.

Column 5: Water Supply Pumpage from Indiana Reaching the CSSC

Column 5 represents the computation of Indiana water supply reaching the canal through the Grand Calumet and the Little Calumet Rivers. In the case of the Little Calumet River, a drainage divide exists east of the confluence with Hart Ditch. Therefore, flows from Hart Ditch, including virtually all dry weather flows, normally flow westward into Illinois. Under high flow conditions, the drainage divide may shift westward and a portion of the Hart Ditch flows may be diverted eastward to Burns Ditch and ultimately to Lake Michigan. However, it is believed that the occurrence in the shift in the drainage divide is infrequent and the flow that is diverted eastward is insignificant. Therefore, it is assumed that all effluent discharged into Hart Ditch and the Little Calumet River west of the divide flows westward. For WY01, total flow in the Little Calumet River was 48.3 cfs with 7.0 cfs of that flow determined to be Indiana water supply (including a consideration of consumptive use).

The Grand Calumet River has a summit. On one side of the summit the flow is toward Lake Michigan, on the other side of the summit the flow is toward the Calumet Sag Channel which flows into the CSSC. However, the location of the summit is variable and highly influenced by Lake Michigan levels (USGS, 1984). Thus the calculation of this deduction from the Romeoville record is also influenced by Lake Michigan levels. Beginning with the WY92 accounting, Grand Calumet River flow was measured by a gage that was installed in 1991 that began officially measuring flows on 1 October 1991.

Flow in the Grand Calumet River contains a very high proportion of treatment plant discharge. Through WY92, the flow in the Grand Calumet River attributed to Indiana water supply pumpage was set to the sum of water supply for East Chicago, Whiting, and Hammond (whose pumpage includes water supply for Munster, Highland and Griffith). This method is an oversimplification of the actual conditions. Chicago District developed a reconnaissance level, unsteady state model of the river for the United States Environmental Protection Agency (US EPA). From this model, relationships were developed to proportion the treatment plant discharge into the flow to the CSSC and Lake Michigan. The flow summit generally occurs at the Hammond outfall or between the Hammond and East Chicago outfalls.

The equations below determine the percentage of flow from each treatment plant flowing west to the CSSC based on Lake Michigan water level:

For CCD < 0.3 ft
Flow = 0.45 * HW

For CCD >= 0.3 ft and CCD < 1.5 ft
Flow = $(0.22 * CCD^3 - 0.15 * CCD^2 + 0.06 * CCD + 0.45) * HW$

For CCD >= 1.5 ft and CCD < 1.8 ft
Flow = HW + (CCD - 1.5) / 0.3 * EC

For CCD > 1.8 ft
Flow = HW + EC

Where CCD is the lake level in feet (Chicago City Datum) measured at Calumet Harbor, HW is the daily combined water supply pumpage by Hammond and Whiting, and EC is the daily water supply pumpage by East Chicago. Low lake levels in WY01 resulted in less water supply pumpage reaching the CSSC.

The total Grand Calumet flow reaching Illinois in WY01 was measured as 11.8 cfs. Of that, 11.3 cfs was determined to be water supply pumpage. Therefore, the total WY01 Indiana water supply deduction, including the flow from the Little Calumet and Grand Calumet Rivers is 18.2 cfs. This flow is 0.6 cfs less than the Indiana water supply deduction for WY00, which was 18.8 cfs.

Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC

The WY01 average discharge of Des Plaines River watershed runoff reaching the canal (Column 6) is 184.0 cfs. This deduction is determined almost entirely through simulation. The runoff is composed of two elements, surface runoff and subsurface runoff. Surface runoff that enters sewers is referred to as inflow, while subsurface runoff is referred to as infiltration. The infiltration and inflow from the Des Plaines River watershed discharged to water reclamation plants tributary to the CSSC is 118.3 cfs, the infiltration and inflow reaching the canal through CSO's is 8.4 cfs and the runoff from the Lower Des Plaines and Summit Conduit areas is 57.3 cfs. The deduction is also influe39nced by the O'Hare basin flow transfer that contributed 3.4 cfs of the 118.3 cfs of runoff to the water reclamation facilities during WY01. The deductible Des Plaines River watershed runoff increased 29.0 cfs from WY00 to WY01.

Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC

Column 7 represents Lake Michigan diversions for Federal use, not chargeable to the State of Illinois, and is typically comprised of water supply pumpage used by federal facilities. Beginning in WY97 a 10% consumptive use factor was applied to this water supply component. Pumpage by federal facilities in WY01 includes the following sources:

- Hines VA Hospital
- Fort Sheridan
- USACE emergency navigation makeup water

Note that the emergency navigation makeup water is used for a very rare flood event. Like many other years there is no USACE emergency navigation makeup water use in WY01. Great Lakes Naval Base is a primary diverter of Lake Michigan water; however, the pumpage is not counted in Column 7 as a deduction. This is because the sewage from Great Lakes Naval Base is processed at NSSD – Gurnee WRP and the effluent is discharged to Des Plaines River (i.e., downstream of Lockport and bypass the Romeoville AVM). Column 7 represents a deduction from the Romeoville record and the total amount of the WY01 deduction is 0.9 cfs.

Column 8: Total Deductions from the CSSC Romeoville Gage Record

Column 8 is the sum of Columns 4, 5, 6, and 7 and represents the total deduction from the Romeoville record. The total deduction for WY01 is 278.6 cfs.

Column 9: Lake Michigan Pumpage Not Discharged to the CSSC

This column represents water supply pumpage from Lake Michigan that is not discharged to the canal. The water supply pumpage not discharged to the canal is composed of two components:

- Lake Michigan water supply used by communities serviced by water reclamation facilities that do not discharge to the CSSC (262.5 cfs). This flow increased 0.3 cfs from WY00.

- The Lake Michigan domestic water supply portion of CSO's bypassing the AVM from areas whose water reclamation facility discharge to the CSSC or its tributaries (0.63 cfs).

The communities that make up the flow in the first component are suburbs whose treated effluent is discharged to the Des Plaines River and other watercourses not tributary to the CSSC. Beginning in WY97 a 10% consumptive use factor was applied to the water supply of all of the following agencies and communities:

- Northwest Suburban Joint Action Water Agency (NWJAWA) - Member communities include Elk Grove Village, Hanover Park, Hoffman Estates, Mount Prospect, Rolling Meadows, Schaumburg and Streamwood.

- Northwest Water Commission - Member communities include Arlington Heights, Buffalo Grove, Palatine, Prospect Heights and Wheeling.

- Central Lake County Joint Action Water Agency (CLCJAWA) - Member communities include Grayslake, Gurnee, Lake County Public Works Department (Vernon Hills and Wildwood-Gages Lake), Libertyville, Mundelein, Round Lake, Round Lake Park and Round Lake Beach.

- Lake County Public Water District - Member communities include Illinois Beach State Park, Winthrop Harbor and Zion.

- Du Page Water Commission - Member communities include Addison, Bensenville, Bloomingdale, Carol Stream, Citizen's Utilities (Arrowhead, Country Club Highlands, Lombard Heights and Valley View), Clarendon Hills, Darien, Downers Grove, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Lombard, Naperville, Oak Brook, Oak Brook Terrace, Roselle, Villa Park, Westmont, Wheaton, Willowbrook, Wood Dale, and Woodridge.

- Lincolnshire

- Riverwoods

- Waukegan, Park City, Beach Park and Green Oaks

- Lake County - Bradley Road

The communities of North Chicago and Des Plaines are separated into the percentage of each community that is not tributary to the Chicago River System.

- North Chicago - 76 percent

- Des Plaines - 38.2 percent

The communities of Lake Bluff and Knollwood-Roundout (who receive their water from CLCJAWA) are not included in Column 9, as they discharge their effluent into the Chicago River System.

It should also be noted that the Lake Michigan water supply component of the O'Hare flow transfer is subtracted from the total Lake Michigan water supply of the above communities since:

- The O'Hare flow transfer is treated at the Northside WRP which discharges sanitary effluent that is tributary to the CSSC.

- The entire Lake Michigan water supply component of the O'Hare flow transfer is from communities contained in the above list.

The Lake Michigan water supply for these communities is measured, while the sanitary portion of the CSO's is derived through simulation. Column 9 represents an addition to the Romeoville record and the total WY01 addition is 263.1cfs. This flow is an increase of 0.3 cfs from WY00 to WY01.

Column 10: Total Diversion

Column 10 is equivalent to Column 3 with the subtraction of Column 8 and the addition of Column 9. The total diversion for WY01 is 2,698 cfs. This amount is 502 cfs less than Illinois' long term diversion allocation of 3,200 cfs. The 40-year running average diversion, rounded to the nearest cfs, beginning with WY81, is 3,298 cfs and the cumulative deviation from the 3,200 cfs allocation is -1,858 cfs. The negative deviation indicates that the cumulative diversion is greater than an average of 3,200 cfs for the period.

Column 11 through Column 13: Lake Michigan Diversion Components

Columns 11 through 13 represent the three (3) Lake Michigan diversion components; Lake Michigan Pumpage Accountable to Illinois (Column 11), Runoff from the Diverted Lake Michigan Watershed (Column 12) and Direct Diversions through the Lakefront Structures (Column 13). They do not affect the computed total diversion accountable to the State of Illinois (Column 10). However, the sum of the columns 11 through 13 should theoretically equal the total diversion as shown in Column 10. Differences are expected because Column 12 is based on simulation and simple flow separation for the entire diverted watershed. Therefore, the estimate derived from the sum of Columns 11 through 13 is not expected to be as accurate as the Romeoville AVM based calculations presented in Column 10. A description of Columns 11 through 13 follows:

Column 11 - Lake Michigan Pumpage Accountable to Illinois

Column 11 computes the total pumpage from Lake Michigan accountable to the State of Illinois - which is simply the sum of the water supply for the communities receiving their water from Lake Michigan. Beginning in WY98 water supply to Chicago Heights, Calumet City and Burnham was included. This computation does not include water supply to federal facilities. Beginning in WY97 Column 11 has attempted to account for consumptive use. The consumptive loss factor is estimated as 10% of the water supply pumpage (International Great Lake Diversion Consumptive Use Study Board, 1981), and accounts for the water supply pumpage that is consumed or lost prior to reaching the water reclamation facilities. The application of the consumptive use factor, beginning in WY97, is more in keeping with the Supreme Court Decree and should help facilitate a better comparison between Column 10 and the sum of Columns 11 through 13.

The total Lake Michigan pumpage accountable to Illinois in WY01, inclusive of the 10% consumptive use, was 1,545.6 cfs. Water supply from Lake Michigan reduced 5.7 cfs from WY00 to WY01.

Column 12 - Runoff from the Diverted Lake Michigan Watershed

Column 12 computes the runoff from the diverted Lake Michigan watershed. Stormwater runoff that previously drained to Lake Michigan through the Chicago River and the Calumet River now drains to the Chicago Sanitary and Ship Canal (CSSC) and the Calumet Sag Channel, respectively. The Calumet Sag Channel drains to the CSSC, and the CSSC ultimately drains into the Illinois River and the Mississippi River. The drainage area of the diverted Lake Michigan watershed is approximately 673 square miles. The runoff from the diverted Lake Michigan watershed is accountable to the State of Illinois and is made up of several components including; gaged runoff, ungaged runoff, inflow and infiltration captured at the treatment plants, inflow and infiltration captured by TARP and inflow and infiltration contained in combined sewer overflows.

The total runoff from the diverted Lake Michigan watershed was 871.5 cfs in WY01 that increased 153.3 cfs between WY00 and WY01.

Column 13 - Direct Diversion through the Lakefront Structures

Direct diversions occur at three lakefront locations; the Chicago River Controlling Works (CRCW), the O'Brien Lock and Dam, and the Wilmette Controlling Works. These controlling structures are located downtown, at the south end, and at the north end of the Chicago area, respectively. The direct diversion at

each of these locations consists of four components; lockage, leakage, discretionary flow and navigation makeup flow. The lockage component is the flow used in locking vessels to and from the lake. The leakage component is water estimated to pass, in an uncontrolled way, through or around the three lakefront structures. The purpose of the discretionary diversion is to dilute effluent from sewage discharges and improve water quality in the canal system. Navigation makeup water is made up of two parts. When large storms are forecast, the canal is drawn down before the storm to prevent flooding - navigation makeup water is used during this draw down period to maintain navigation depths. If the runoff is not enough to refill the canal, additional navigation makeup water is passed.

Based on lakefront AVM flow measurements the total direct diversion through the three lakefront structures was 350 cfs in WY01. Direct diversions increased 58 cfs between WY00 (292 cfs based on AVM records) and WY01. Included herewith for the reference purpose, the MWRDGC's LMO-6 reported that the mean annual direct diversion through the three lakefront structures was 342.9 cfs -- including 26.5 cfs for lockage, 16.9 cfs for leakage, 44.4 cfs for navigation makeup, and 255.1 cfs for discretionary use.

Sum of Columns 11 through 13

The sum of the columns 11 through 13 (2,767 cfs) should theoretically equal the total diversion as shown in Column 10 (2,698 cfs). Because Column 12 is based on simulation and simple flow separation, the estimate derived from the sum of Columns 11 through 13 is not expected to be as accurate as the Romeoville AVM based calculations. However, a difference between estimates of 69 cfs or 2.6% is considered a very good balance.

Using the figures from these three (3) columns, 56.0% of the WY01 Illinois diversion is attributable to pumpage from Lake Michigan for domestic water supply, runoff from the diverted Lake Michigan Watershed accounted for 31.6% of the diversion, and direct diversion through the lakefront structures accounted for 12.4% of the diversion. A more detailed breakdown of these percentages is shown in Figure 3 and Table 5.

Table 5
Components of the Diversion by the State of Illinois
Based on Columns 11 Through 13

Description	Average Flow	Percentage of Total Flow
Lake Michigan Pumpage by the State of Illinois	1545.6	55.9%
Runoff from Diverted Lake Michigan Watershed	871.5	31.5%
Total Direct Diversions	350.1	12.7%
Breakdown of Direct Diversions*		
Lockages	27.0	1.0%
Leakages	17.3	0.6%
Navigation Makeup Flow	45.4	1.6%
Discretionary Flow	260.5	9.4%
- There Was 4.4 cfs of Recorded Backflow for WY01.		

* The direct diversions at CRCW and O'Brien Lock and Dam were measured by the lakefront AVM's. However, the breakdown of direct diversion was proportioned based on the MWRDGC's LMO-6 reports.

Using the direct diversion measured by AVM's the sum of columns 11 through 13 would be 2,767 cfs that is less than a 3% difference from the computed total diversion (i.e., 2,698 cfs) accountable to Illinois following the Romeoville accounting procedures. As the direct diversion measured by AVM's is much more accurate than the estimated values using ratings of the lakefront structures, the measured direct diversion flows were used in Budget 14 computations.

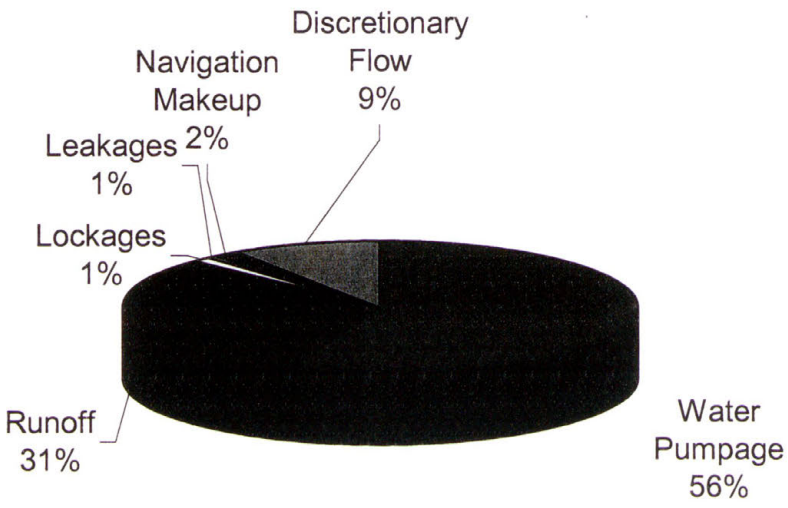


Figure 3 Component Breakdown of Illinois' Diversion Based Upon Columns 11 Through 13

Budgets

The first two budgets (Budgets 1 and 2) are used to sum the diverted water supply. The next four budgets (Budgets 3 through 6) are of stream gage sites that are not simulated and are used as part of the calculation of the runoff from the diverted Lake Michigan watershed. The next seven budgets (Budgets 7 through 13) compare measured and simulated flows and compute Column inputs used in the diversion computations. The next two budgets (Budgets A and B) compare measured and simulated flows at two pumping stations. The final budget (Budget 14) is a canal balance of total inflows and outflows. These fourteen budgets are listed in Table 2.

Budget 1 and Budget 2: Water Supply Pumpage

Budgets 1 and 2 are summations of critical water supply pumpage data. Budget 1 sums Lake Michigan water supply diverted by the State of Illinois. The Lake Michigan water supply data is supplied by the IDNR-OWR and City of Hammond as daily values for primary users and monthly data for secondary users (LMO-3 reports). Budget 2 sums groundwater pumpages in the Lake Michigan and Des Plaines River watersheds that are diverted to the CSSC. Groundwater pumpage data is recorded by the ISWS as a total annual withdrawal based on calendar years.

Budget 1: Diverted Lake Michigan Water Supply

Budget 1 represents the summation of Lake Michigan pumpage accountable to the State of Illinois. This budget is a duplication of Column 11. For WY01, the average annual Lake Michigan pumpage accountable to Illinois is 1,545.6 cfs. This flow is a reduction of 5.7 cfs from WY00.

Budget 2: Groundwater Diverted to the CSSC

Budget 2 is groundwater water supply pumpage by communities, industrial users, and other private users whose effluent is discharged to the canal. The contents of this budget are also contained in Column 4. The groundwater pumpage data are reported by the ISWS on a calendar year basis. The groundwater quantity is determined by summing all reported groundwater sources in the area tributary to the CSSC, less groundwater not discharged to the CSSC in the form of CSO's.

Using the ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake

Michigan watershed in Illinois, or if they were located within MWRDGC service boundaries in which their effluent was discharged into the CSSC and adjoining channels. For a description of the application of the 10% consumptive use factor see discussion for Column 4.

The total groundwater pumpage by communities, industrial users, and other private users whose sanitary effluent is tributary to the canal is 28.8 cfs for WY01. Simulation determined that all of this flow reached the canal. In most years a small portion of the groundwater normally tributary to the CSSC is discharged to the Des Plaines River or other watercourses not tributary to the canal in the form of CSO's.

In addition to groundwater supply pumpage, there was also a significant amount of groundwater infiltration into the two TARP systems that ultimately reached the canal. Mainstream TARP and Calumet TARP accounted for 37.3 cfs and 14.6 cfs, respectively, of groundwater discharged to the canal during WY01.

The total of the above components is 75.5 cfs and as Column 4, represents a deduction from the Romeoville record. This flow is a increase of 6.7 cfs from WY00.

Budgets 3 through Budget 6: Stream Gaging Stations

The stream gage budgets are used to make estimates of runoff from portions of the diverted Lake Michigan watershed. Sanitary and other point source flows are subtracted from the stream gaging record to develop the runoff estimates. The runoff estimates are used in Column 12. The flows at the stream gaging sites are also part of Budget 14, the canal system budget.

Table 6 presents the estimated runoff from these budgets. Note that Budgets 4 and 5 contribute flows to Budget 6 in that they are upstream of, or tributary to, the Little Calumet River at South Holland. The streamflow in Budget 6 is the total flow at the gage, while the runoff is an incremental volume that occurs downstream of both the Little Calumet River at the State Line and Thorn Creek at Thornton.

Table 6
Stream Gage Flow Separation

Budget Number	Location	Stream Flow (cfs)	Sanitary Flow (cfs)	Runoff (cfs)
3	North Branch Chicago River at Niles, IL	136.3	19.4	116.9
4	Little Calumet River at IL-IN State Line	48.3	5.5	42.7
5	Thorn Creek at Thornton, IL	87.1	19.3	67.8
6	Little Calumet River at South Holland, IL	160.2	Not computed	23.7 *

* The runoff for Budget 6 is that runoff which occurs in the reach between South Holland and the 2 upstream gages (Little Calumet River at the State Line and Thorn Creek at Thornton). The runoff is computed by taking the measured streamflow at South Holland and subtracting off the measured flow at the two upstream gages and the sanitary portion of the CSOs that occur in the reach between the state line and South Holland. If a negative discharge at South Holland is computed for a day, it is set equal to zero in the annual runoff computation.

Budgets 7 through Budget 13: MWRDGC Water Reclamation Facilities

The budgets for the water reclamation plants compare the simulated flows to the measured inflows at the MWRDGC facilities and perform verifications of the diversion accounting program. The simulated flows were developed from an estimated sanitary flow with a daily, weekly, and monthly flow variation, from hydrologic precipitation-based runoff models, and from hydraulic sewer routing models. The estimated sanitary flow input to the hydraulic simulation models is based on the population estimates for each plant's service basin. Per capita sanitary flows are determined based on the service basin's water supply minus an assumed 10% consumptive loss (International Great Lakes Diversion Consumptive Use Study Board, 1981). Simulated flows were compared with recorded inflows at each facility to assess the accuracy of the simulations. The discussion of the budgets will concentrate on the results of each individual simulation as the development of these models has been discussed in previous reports. Refer to Table 7 for a statistical summary of the simulation results.

Budget 7: Northside Water Reclamation Facility

Budget 7 analyzes the water balance at the MWRDGC Northside Water Reclamation Facility (Figure 4). The balance for WY01 of the inflow to the Northside facility is good. The simulated to adjusted recorded inflow ratio (S/R) for the Northside WRP is 0.98, indicating that the simulated inflow volume is slightly less than the adjusted observed inflow volume. The coefficient of correlation (R) of simulated to observed flow is 0.82, indicating that the model predicted the inflow

hydrograph to the Northside facility well. Table 7 presents a statistical summary of the simulation results.

Budget 8: Upper Des Plaines Pump Station

Budget 8 analyzes the water balance at Upper Des Plaines Pump Station (UDPPS) (Figure 5). The pump station budget is used to verify simulated flows. Although it has no direct impact on the diversion calculation, it is intended to be used as a primary calibration point for the models that simulate the deductible runoff from the Des Plaines watershed contained in Column 6. This will be possible only after the existing measurement problems at that site are resolved. This has been previously discussed in the WY90 diversion report. Since the full records of the UDPPS were not available from the MWRDGC, a comparison of the simulated with the recorded flows was not possible for WY01.

While the statistical comparisons of simulated and recorded flows at the UDPPS are routinely conducted, there exists a need to investigate alternative flow measurement techniques. This site has continued to experience its share of problems. Normally, a large number of days of records are unavailable due to meter malfunctions, problems with the recording charts which make data transformation impossible, and various other reasons. Since full records for WY01 were unavailable, the quantitative analysis of the simulation was not possible. Additionally, the accuracy of the flow meters at the pump station is questionable and unmetered bypass flows are a frequent occurrence. Therefore, total flow may not be measured in storm events and the recycling of flow is possible. Further investigation of the accuracy of flow measurement at the pump station is required to verify and calibrate the simulation models that compute the deductible runoff from the Des Plaines watershed contained in Column 6.

Budget 9: Mainstream and Des Plaines TARP Pumping Stations

Beginning 6 June 1993 the south and middle legs of the Des Plaines TARP system became operational. Consequently, these tunnels were added to the modeling of the TARP system for WY93. Beginning 4 July 1998 the north branch tunnel of the Mainstream TARP system was put into service. The north branch tunnel was included in the modeling of the TARP system for WY98. The Des Plaines tunnel system, like that of the Mainstream TARP system, flows by gravity to the Stickney Water Reclamation facility in Stickney. Flows are pumped from the Des Plaines tunnel to the Stickney plant using the same pumps used for the Mainstream tunnels. The modeling of the Des Plaines and Mainstream tunnels includes the designation of index points to control inflows to the systems, as well as controlling the pumpout cycling. During the simulation, the model compares the computed tunnel stage at each index point to the input parameters to determine if

changes are necessary. The index points that control the dropshaft inflows are referred to as index drop shafts, and limit the inflow (expressed as a fraction of dropshaft capacity) relative to the computed water surface elevation (CWSEL). The simulated pumping is controlled by the CWSEL at the downstream ends of the tunnels. The user-specified input parameters include the elevations at which the pumping starts and stops.

Beginning 1 October 1998 the bulkhead located at Station 482+09.25 was removed that allowed backflows from the lower portions of the Des Plaines Tunnel and allowed additional groundwater infiltration to enter the tunnel system. Beginning 1 July 1999 the 60-day operation test started. The control structures at the drop shafts were opened to allow limited inflows while the valves and operation were tested. Beginning 30 September 1999 the new tunnel became fully operational and flows were allowed into the branch tunnel according to the operations plan. The above status of the Des Plaines tunnel was included in the modeling of the TARP system for WY01. Budget 9 analyzes the water budget at the MWRDGC Mainstream and Des Plaines TARP Pumping Stations. The results of Budget 9 are used as a verification point for simulated flows. Budget 9 is also used for the purpose of computing a portion of Column 6 (Des Plaines River watershed runoff deduction). The deductible portion of Budget 9 includes groundwater seepage into the TARP tunnel walls and Des Plaines River watershed runoff captured by Mainstream and Des Plaines TARP as overflows. The modeling of Mainstream and Des Plaines TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Mainstream and Des Plaines TARP is contained in Figure 6. A more in-depth description of Mainstream TARP and the simulation model is contained in the Water Year 1986 report, which is an appendix to the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

For WY2001, several changes were made to the Mainstream TNET model. The changes were generally more computational than procedural. The net changes to the TNET input data were developed over the series of calibration model runs. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations and pumping schemes. The index dropshaft scheme was changed, resulting in fewer indices, and basing more of the dropshaft operations on a point farther downstream in the tunnel.

The dropshaft operation data was changed only slightly, and resulted in closing off the inflows at a slightly lower elevation. This change was made, and the model results compared with MWRDGC operations data to confirm that the simulated pressurization levels were reasonably close to the observed levels. A second check was a comparison of weekly average pumping volumes of simulated vs. observed, although this comparison also includes the variance due to the hydrologic modeling as well.

Table 7

WY 2001 Summary of Simulation Statistics

Budget No.	7	8	9	10	11	12	13	14
Description	Northside WRP (1)	Upper Des Plaines Pump Station (1),(3)	Mainstream TARP Pump Station (2)	Stickney WRP (1),(4)	Calumet TARP Pump Station (2)	Calumet WRP (1),(4)	Lemont WRP (1)	Chicago Canal System Balance (1)
Mean Recorded Flow, cfs	414.7	N/A	154.7	1000.3	62.5	335.7	3.2	2,722.7
Max. Recorded Flow, cfs	768.4	N/A	485.6	2,239.0	166.2	650.0	6.6	11,099.8
Min. Recorded Flow, cfs	298.7	N/A	17.7	660.0	11.3	160.9	2.1	1,199.5
Mean Simulated Flow, cfs	405.8	34.2	155.2	972.9	58.4	325.8	3.1	2,991.0
Max. Simulated Flow, cfs	636.4	175.5	495.7	2,345.7	211.5	591.8	5.4	19,051.7
Min. Simulated Flow, cfs	289.7	34.2	12.9	657.8	8.0	221.9	2.1	1,534.8
S/R of Mean Flows	0.98	N/A	1.00	0.97	0.93	0.97	0.97	1.10
Correlation	0.82	N/A	0.65	0.78	0.70	0.66	0.69	0.90

(1) Based on daily values.

(2) Based on weekly values.

(3) Does not include days with missing records.

(4) Does not include pumpage from TARP.

N/A - Data not available

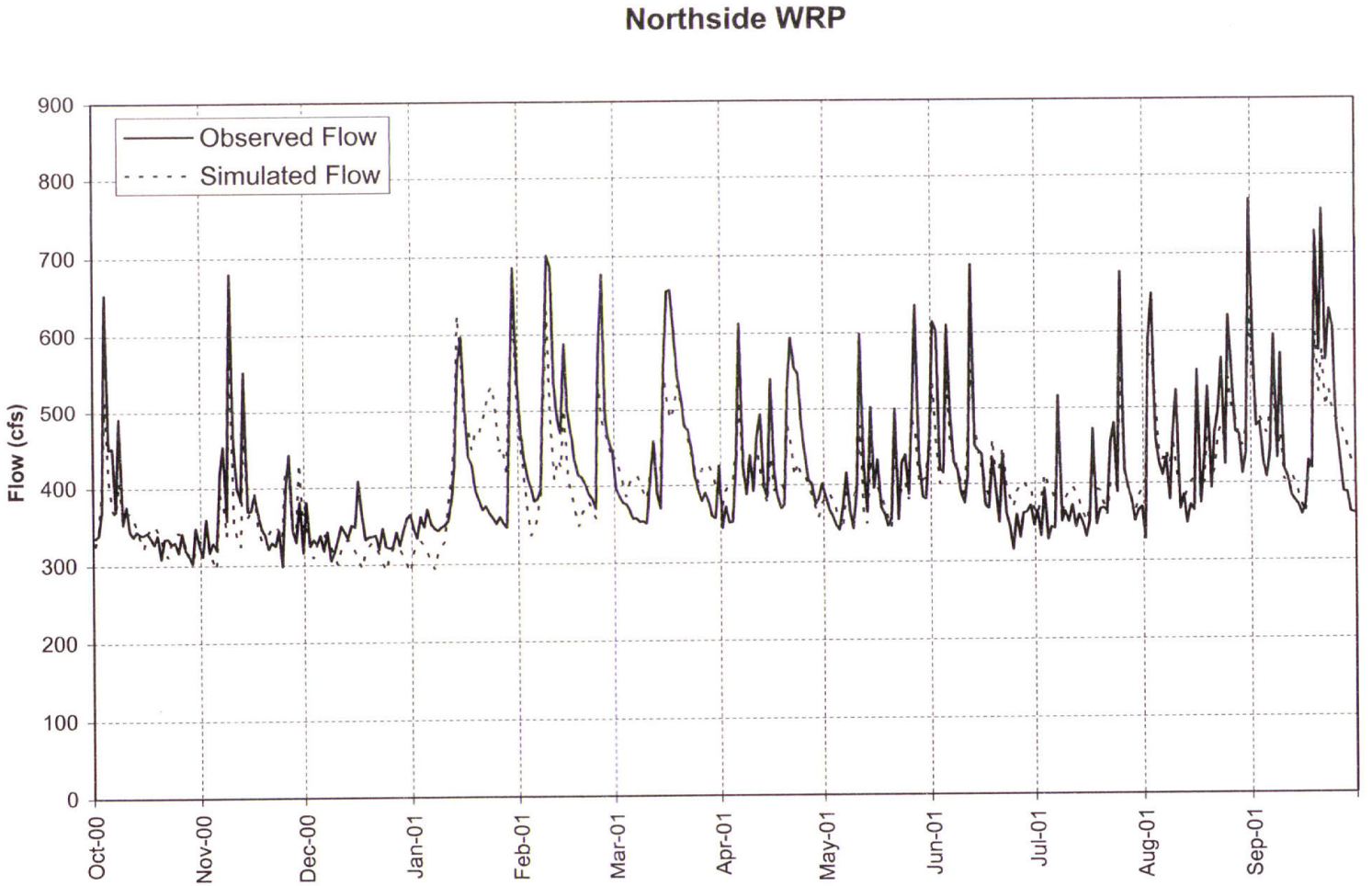


Figure 4 Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility

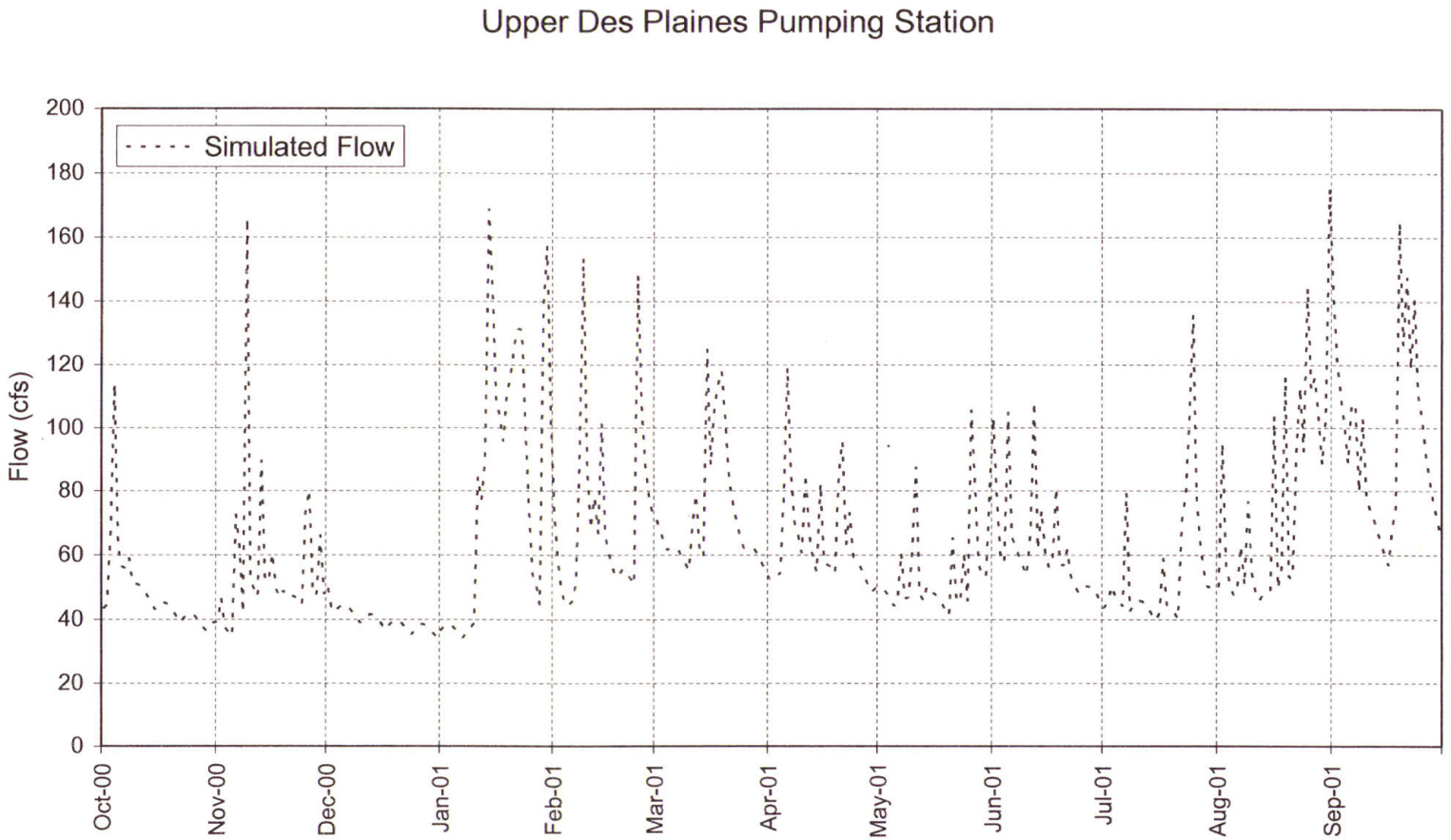


Figure 5 Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station

The pump on/pump off elevations were changed slightly also, and were compared with actual measured values. It was not possible to simulate the pumping of the tunnel down to the level that is used in actual operations because of numerical instability of the model. The final value used in the model was the lowest point to which the tunnel could be pumped without causing excessive numerical instability.

The constant I&I flow was also changed in the TNET model for WY2000. The previous I&I total was 76.59 cfs, which was brought into question after comparing the simulated results to the actual pumpout records. The comparison of simulated vs. observed values also indicated that the model consistently over-predicted the baseflow during low-runoff periods. An analysis of Mainstream/Des Plaines TARP-to-STP pumping averages for WYs 98 through 01 indicated that there were two sustained periods of apparently little or no interceptor overflow into the tunnel. One was 17 October 1999 through 8 November 1999, and the other was 18 December 1999 through 6 February 2000. The composite average value for those two periods was 27.78 cfs. Since pumping occurred on about a third of the days in these time periods, care was taken to select the time periods such that complete inflow and pumpout cycles were accounted for and any incomplete pumping cycle (which tended to be 4-5 days) were not averaged.

In analyzing the balance at the Mainstream and Des Plaines TARP Pumping Stations, weekly flows were used rather than daily flows. While MWRDGC maintains daily pumpage records, days with no pumpage occur frequently. Therefore, it is not appropriate to compute a daily S/R ratio. Additionally, MWRDGC tends to pump from the tunnels at night, while the model simulates pumpage based on water elevations at the downstream end of the tunnel.

The balance for WY01 of the inflow to the Mainstream and Des Plaines TARP Pumping Stations is very good. The simulated to recorded flow ratio (S/R) for the Mainstream and Des Plaines TARP Pumping Stations is 1.00, indicating that the simulated inflow volume is matches the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.65, which is slightly weaker than the 0.70 correlation in WY00. However, there remains room for improvement in the ability of the model to predict trends in the pump station flows. Table 7 presents a statistical summary of the simulation results.

From a review of the plot of the simulated versus recorded flow at the pump station (Figure 7), it appears that the model responds similarly to the recorded pumpage record except for a short period in January. In addition, the model is sometimes out of phase with the observed record. This could be the result of simulated pumpages occurring sooner and more frequently than actual pumpages in order to maintain computational stability during a simulation.

In summary, it appears that the simulation of the Mainstream and Des Plaines TARP systems is very reasonable. However, there remains room for improvement in the ability of the model to predict trends in the pump station flows.

Budget 10: Stickney Water Reclamation Facility

Budget 10 analyzes the water balance at the MWRDGC Stickney Water Reclamation Facility (Figure 8). Beginning in WY90, simulated Mainstream and Des Plaines TARP pumpages from Budget 9 were no longer combined with simulated interceptor inflow to the Stickney Water Reclamation Facility to derive the total simulated inflow to the Stickney Facility. Instead, only simulated interceptor inflows are compared with recorded interceptor inflows to assess the accuracy of the simulation. The decision to not include TARP pumpages in the treatment plant budgets was based on the fact that the TARP systems are already analyzed in separate budgets. Including TARP pumpages in the treatment plant budgets is detrimental to the statistical results of the treatment plant budgets, since the TARP models generally do not respond as well. When simulations of interceptor flows are treated separately, the response of the hydrologic runoff models (HSPF) and the hydraulic sewer routing models (SCALP) can be better isolated and not diluted by the TARP model results, which are analyzed separately on their own merits and contained in their own budgets (Budgets 9 and 11).

Overall, the balance for WY01 of the inflow to the Stickney facility is very good. The simulated to recorded flow ratio (S/R) for the Stickney plant is 0.97, indicating that the simulated interceptor inflow volume is slightly less than the recorded interceptor inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.78, indicating that the model performed reasonably well in predicting the trends in the interceptor inflow hydrographs to the Stickney facility. Refer to Table 7 for a statistical summary of the simulation results.

Budget 11: Calumet TARP Pumping Station

Budget 11 analyzes the water budget at the MWRDGC Calumet TARP Pumping Station (Figure 9). The results of Budget 11 are used as a verification point for simulated flows. The modeling of Calumet TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Calumet TARP is contained in Figure 6. A more in-depth description of Calumet TARP and the simulation model is contained in the Water Year 1987 report contained in the Diversion Accounting Annual Report for WY90-92 (USACE, 1994). Changes that were incorporated in the WY96 modeling are described in the WY96 Diversion Accounting Report contained in the WY97 Annual Report (USACE, 2000).

Several changes were made to the Calumet TARP model for WY01. The changes, as with the Mainstream tunnel, were generally more computational than procedural. The net changes to the TNET input data were developed over the series of calibration model runs. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations.

The dropshaft operation data was changed significantly, and resulted in closing off the inflows at a higher elevation. The TNET model results from the early iterations indicated that the simulated capture (and pumpout) volumes were much lower than observed. This was determined by comparing the weekly average pumping volumes of simulated vs. observed, even though this comparison also includes the variance due to the hydrologic modeling as well. The gate-closing scheme was modified to cause the model to capture more inflows, yet not pressurizing the system. The model input that was developed over the iterations produced a reasonable match of pumpout volumes.

In analyzing the balance at the Calumet TARP Pumping Station, weekly flows were used instead of daily flows. While MWRDGC maintain daily pumpage records, days with no pumpage occur frequently. Additionally, MWRDGC tends to pump at night, while the model pumps more frequently based on water elevations at the downstream end of the tunnel. Therefore, it is not appropriate to compute a daily S/R ratio.

Overall, the balance for WY01 of the inflow to the Calumet TARP Pumping Station is reasonably good. The simulated to recorded flow ratio (S/R) for the Calumet TARP Pumping Station is 0.93 indicating that the simulated inflow volume is less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.70, indicating a slight decrease from the WY00 value which 0.83. Table 7 contains a statistical summary of the simulation results.

Volume matching between the simulated and recorded Calumet TARP pumpages was 0.93 and the correlation coefficient was 0.70. Because of the instability of the TARP model, as well as uncertainties in the Calumet TARP system, it was difficult to control this correlation. However, as the system is presently modeled, this does not impact the computed diversion, unless a substantial portion of the under-simulation results from under-estimated groundwater inflow, since all Des Plaines River watershed areas whose overflows are modeled as tributary to Calumet TARP are also modeled such that "non-captured" overflows flow to rivers that are tributary to the CSSC. Therefore, whether or not these Des Plaines River watershed runoff flows enter the tunnel or not, they are presently included in the Des Plaines River watershed runoff deduction in Column 6. This assumption will remain until separately sewered areas are modeled such that actual areas are used instead of effective areas in the hydraulic models. This has been discussed in the WY90 diversion accounting report.

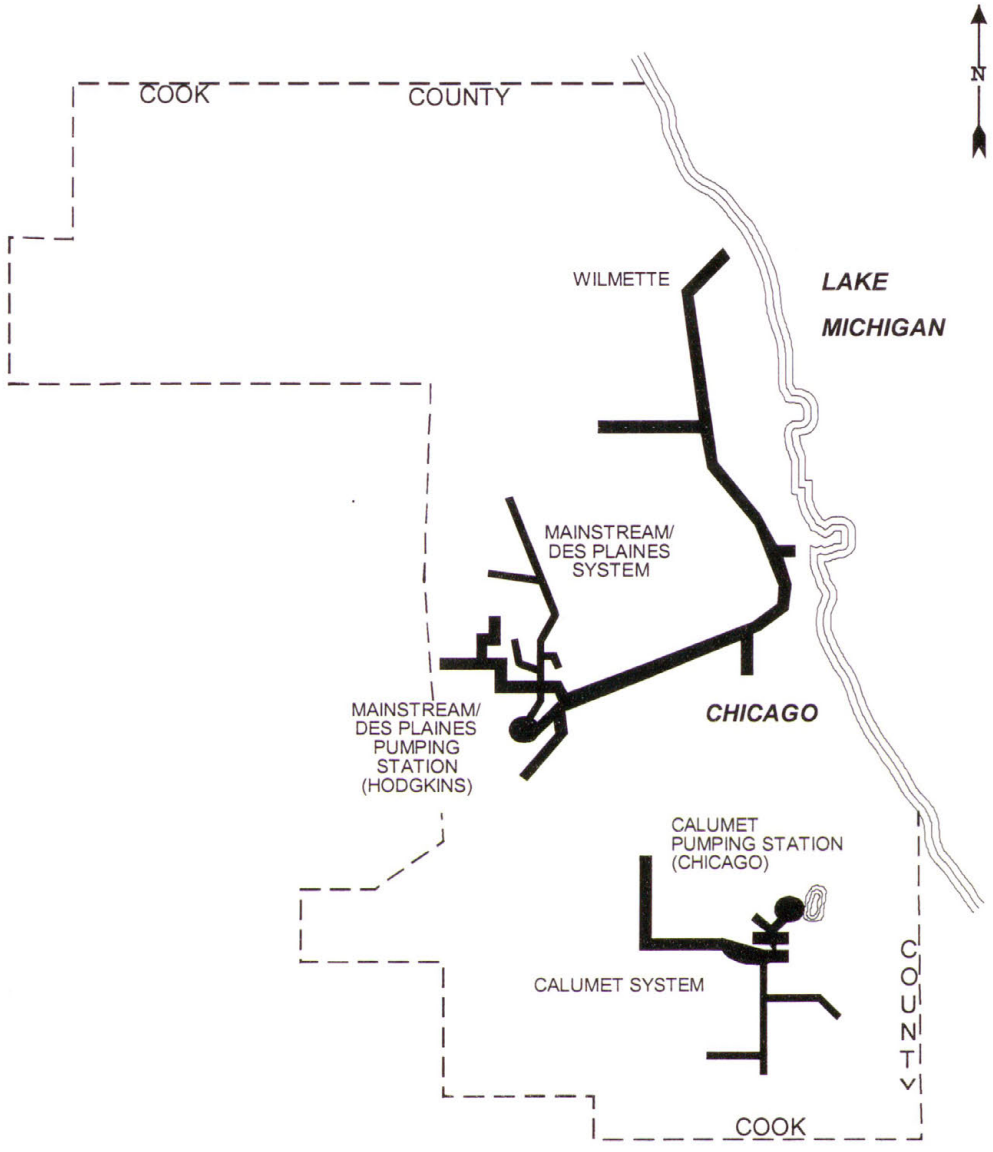


Figure 6 Map of Mainstream, Des Plaines and Calumet TARP

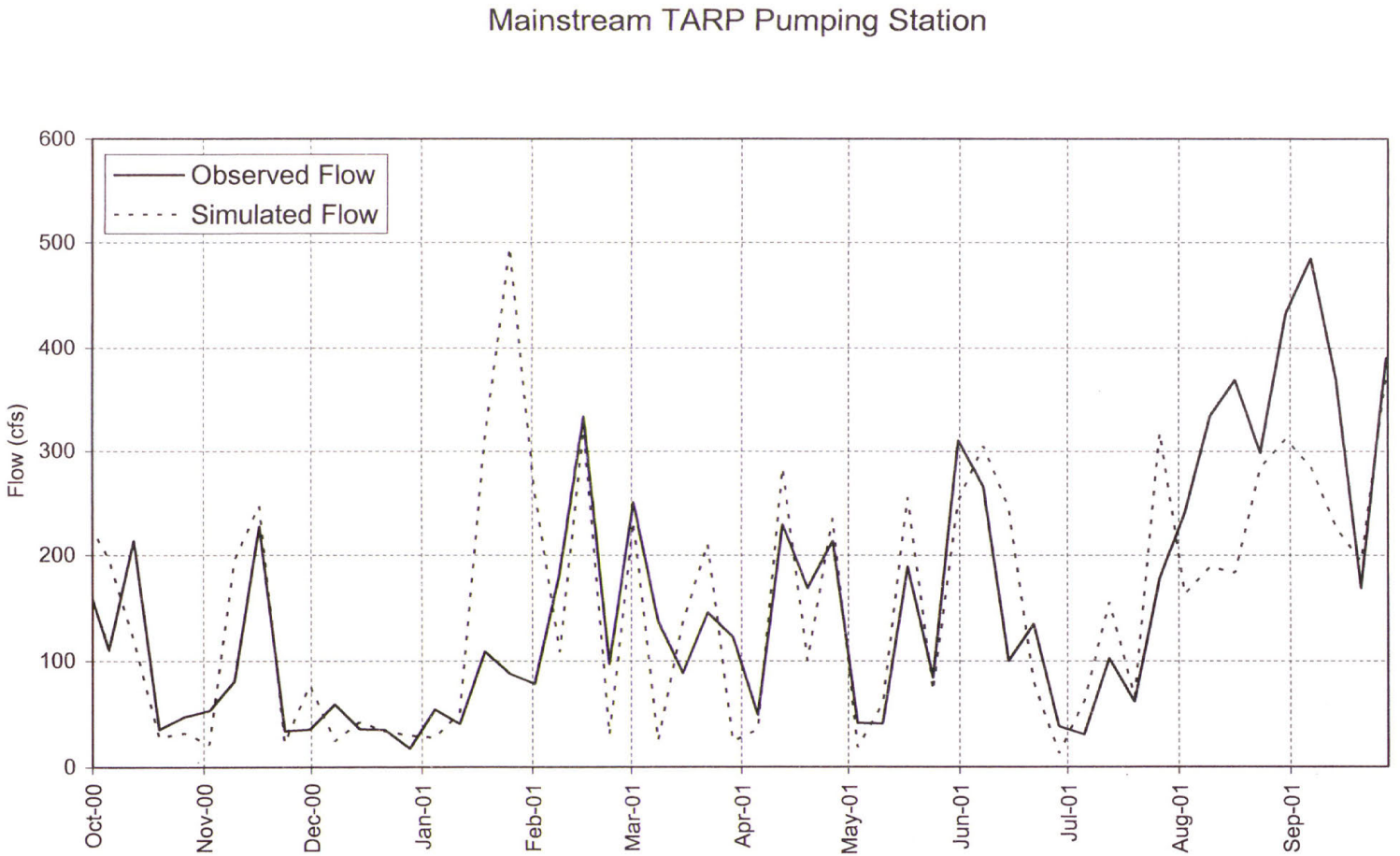


Figure 7 Budget 9 - Simulation of the MWRDGC Mainstream and Des Plaines TARP Pumping Station

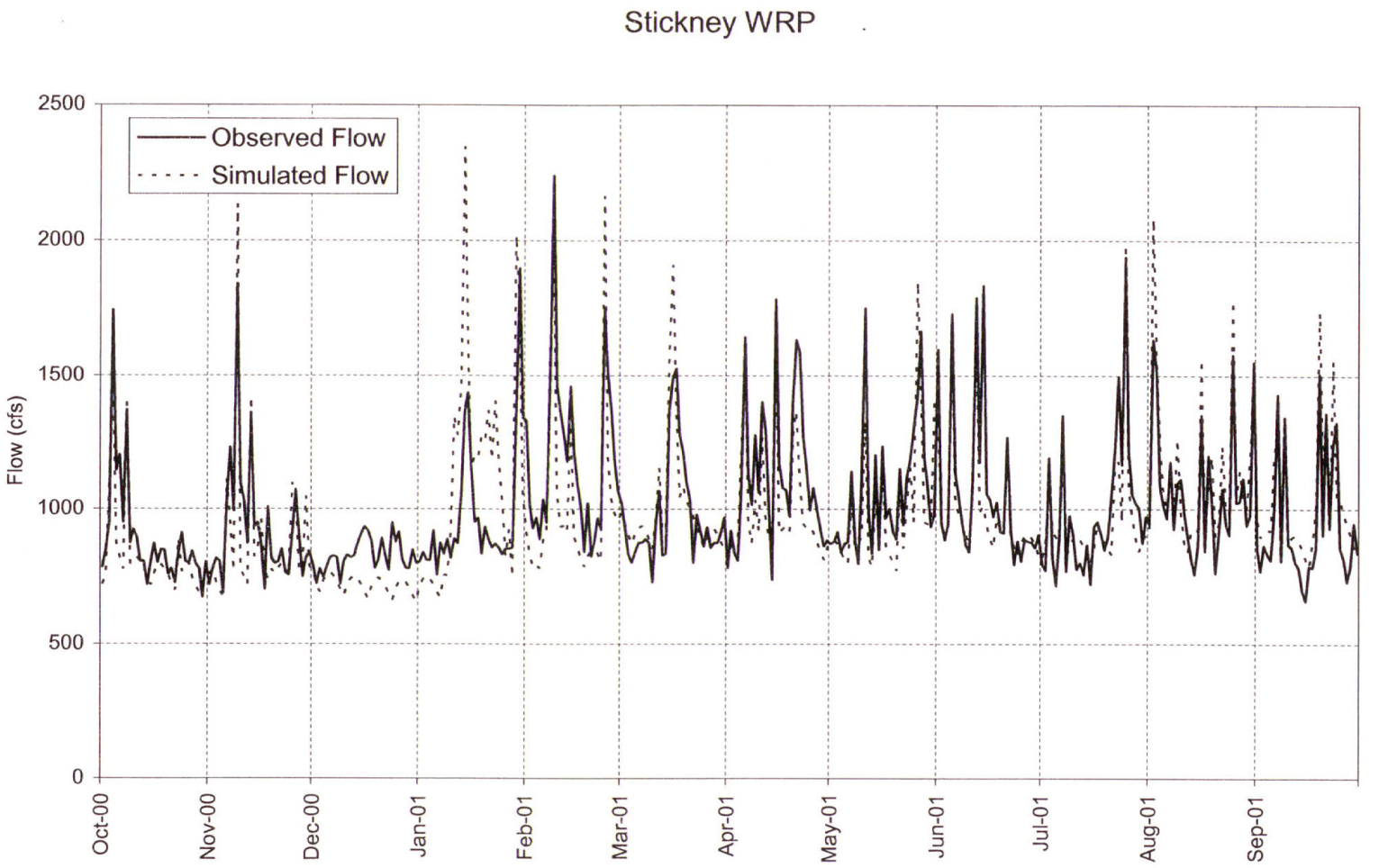


Figure 8 Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility

Budget 12: Calumet Water Reclamation Facility

Budget 12 analyzes the water balance at the MWRDGC Calumet Water Reclamation Facility (Figure 10). Beginning in WY90, simulated Calumet TARP pumpages from Budget 11 were no longer combined with simulated interceptor inflows to the Calumet Water Reclamation Facility to derive the total simulated inflow to the Calumet Facility. Instead, only simulated interceptor inflows are compared with recorded inflows to assess the accuracy of the simulation. This was revised for the same reasons as outlined previously in the discussion for Budget 10.

The annual simulated to recorded flow ratio (S/R) and the coefficient of correlation for the Calumet Water Reclamation Facility are considered very good. The S/R ratio is 0.97 indicating that the simulated Calumet interceptor flow volume was slightly less than the recorded interceptor flow volume. The coefficient of correlation was 0.66 indicating a fair correlation between simulated and recorded interceptor flows. Refer to Table 7 for a statistical summary of the simulation results.

Budget 13: Lemont Water Reclamation Facility

Budget 13 analyzes the water balance at the MWRDGC Lemont Water Reclamation Facility (Figure 11). Overall, the balance for WY01 of the inflow to the Lemont facility is quite good. The simulated to recorded flow ratio (S/R) for the Lemont is 0.97, indicating that the simulated inflow volume was slightly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.69, indicating that the model predicted the inflow hydrograph to the Lemont facility reasonably well. Table 7 contains a statistical summary of the simulation results.

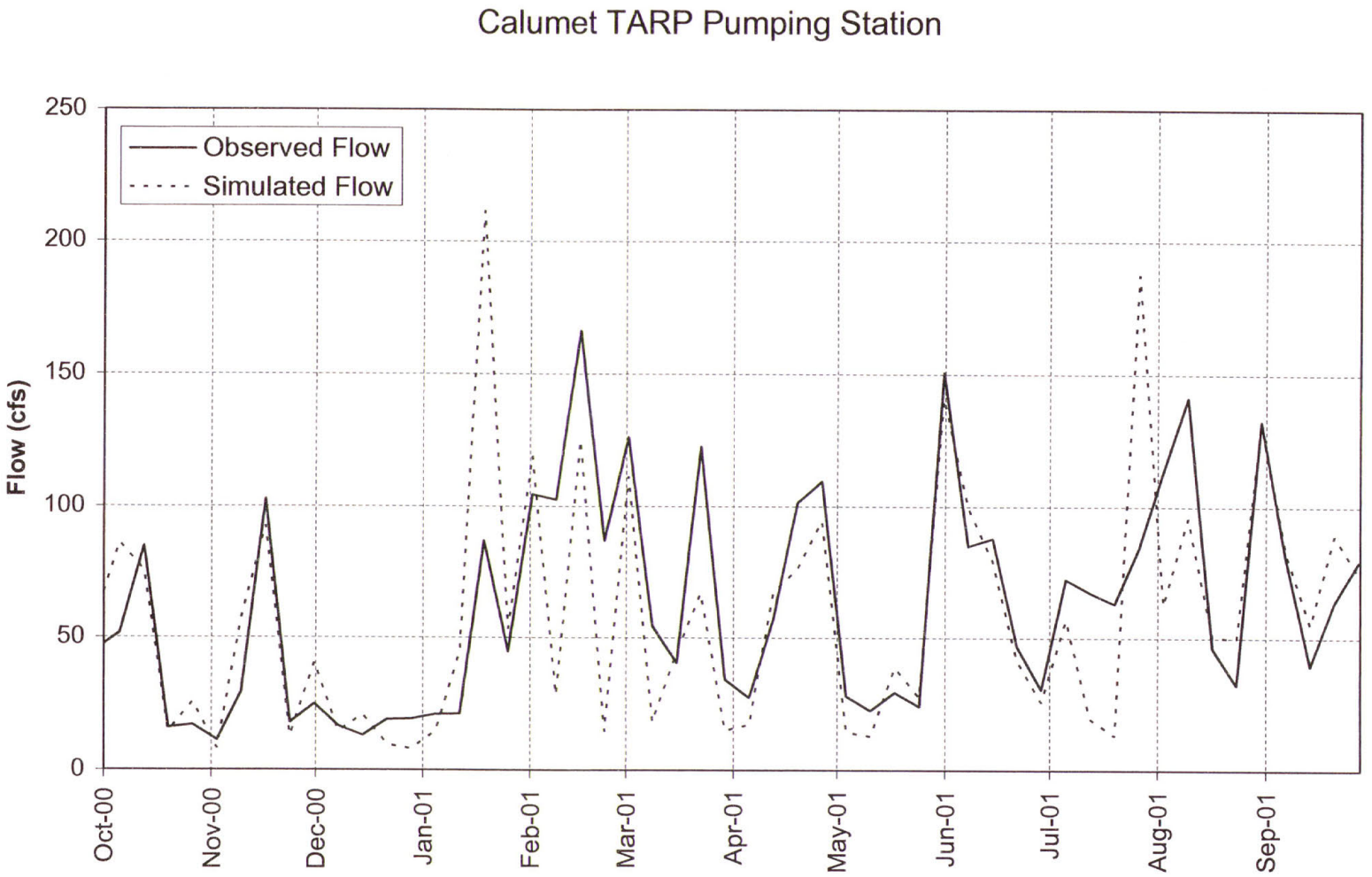


Figure 9 Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station

Aggregated Results of Four MWRDGC Water Reclamation Facilities

The aggregated simulated inflows (not including TARP) to the four modeled MWRDGC water reclamation facilities are 1707.6 cfs while the measured inflows are 1753.9 cfs. This results in a very good aggregated S/R ratio of 0.97.

Budget 14: CSSC System Balance

Budget 14 compares the inflows and outflows to the CSSC system (Figure 12). The inflow components include direct diversions through the lakefront structures (based on AVM measurements), stormwater runoff discharged to the canal system, and domestic water supply whose effluent discharges to the canal system. The outflows from the canal system include the discharge past the Romeoville AVM, backflows through the lakefront structures and withdrawals upstream of Romeoville by Argonne National labs and Citgo Petroleum Corporation. The individual components are presented in Table 8 for WY01.

Overall, the balance for WY01 between the inflows to the canal system and the outflows from the canal system is reasonably good. The S/R (inflow/outflow) for the canal system is 1.10, indicating that the inflow to the canal system is 10% more then the outflow from the canal system. The average measured/simulated inflow was 2,991.0 cfs while the average measured/simulated outflow was 2,722.7 cfs. The difference is 268.3 cfs (9.9%) for WY01, as compared to 173.4 cfs (6.3%) for the previous water year. Refer to Table 7 for a statistical summary of the measured/simulated results.

The coefficient of correlation (R) of inflow to outflow is 0.90, indicating that the time series trends of inflow to outflow are well correlated. The coefficient of correlation is based on daily flows. Timing between inflows and measured outflows at Romeoville is the major factor in the differences, especially during changes in flow that occur at the beginning or end of a day. Also, part of the difference in the correlation is the result of travel time from inflow locations downstream to the Romeoville AVM site. Therefore, variability in the coefficient of correlation from year to year may be attributed to the variability in the timing of significant flow changes during a particular year

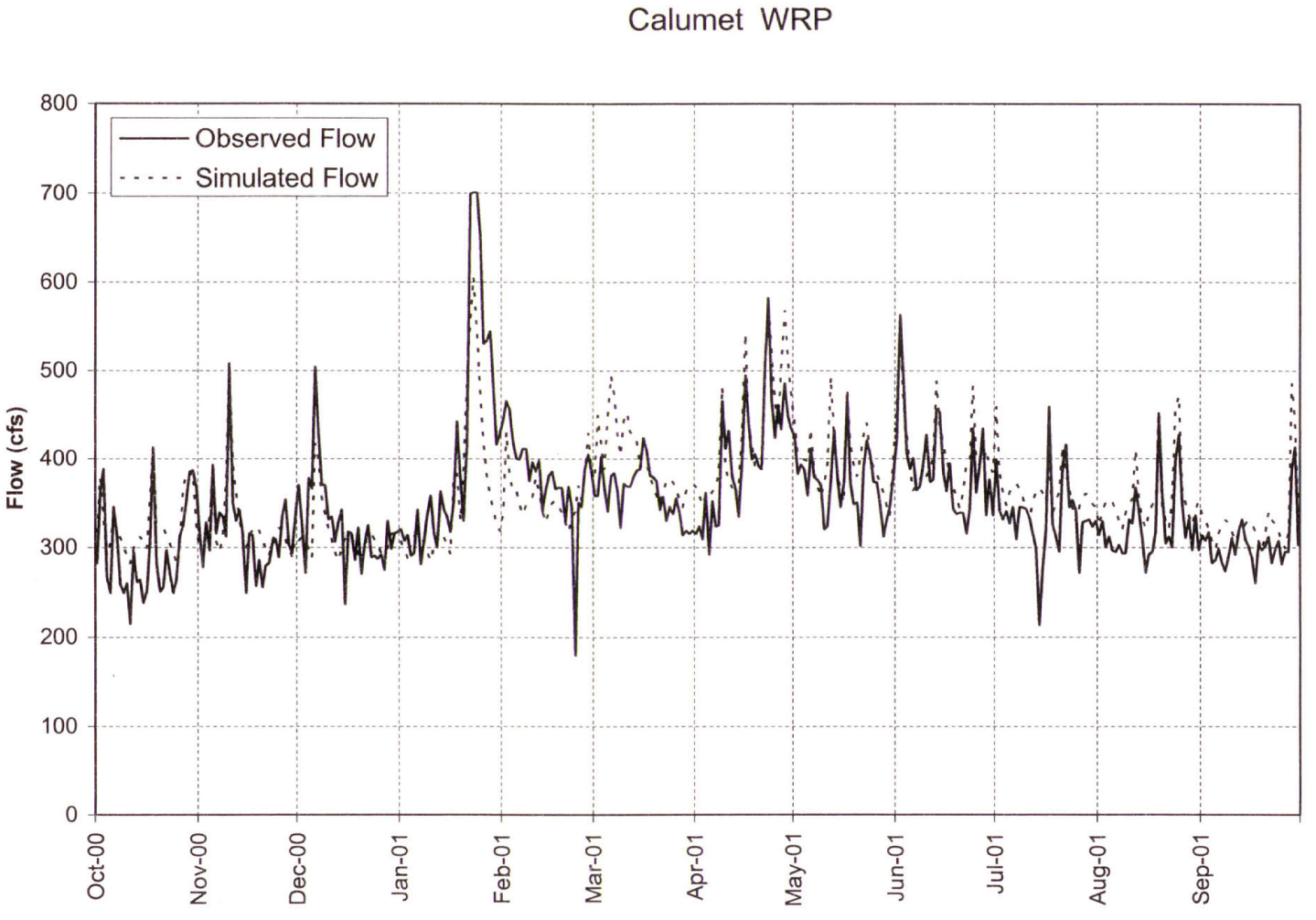


Figure 10 Budget 12 – Simulation of the MWRDGC Calumet Water Reclamation Facility

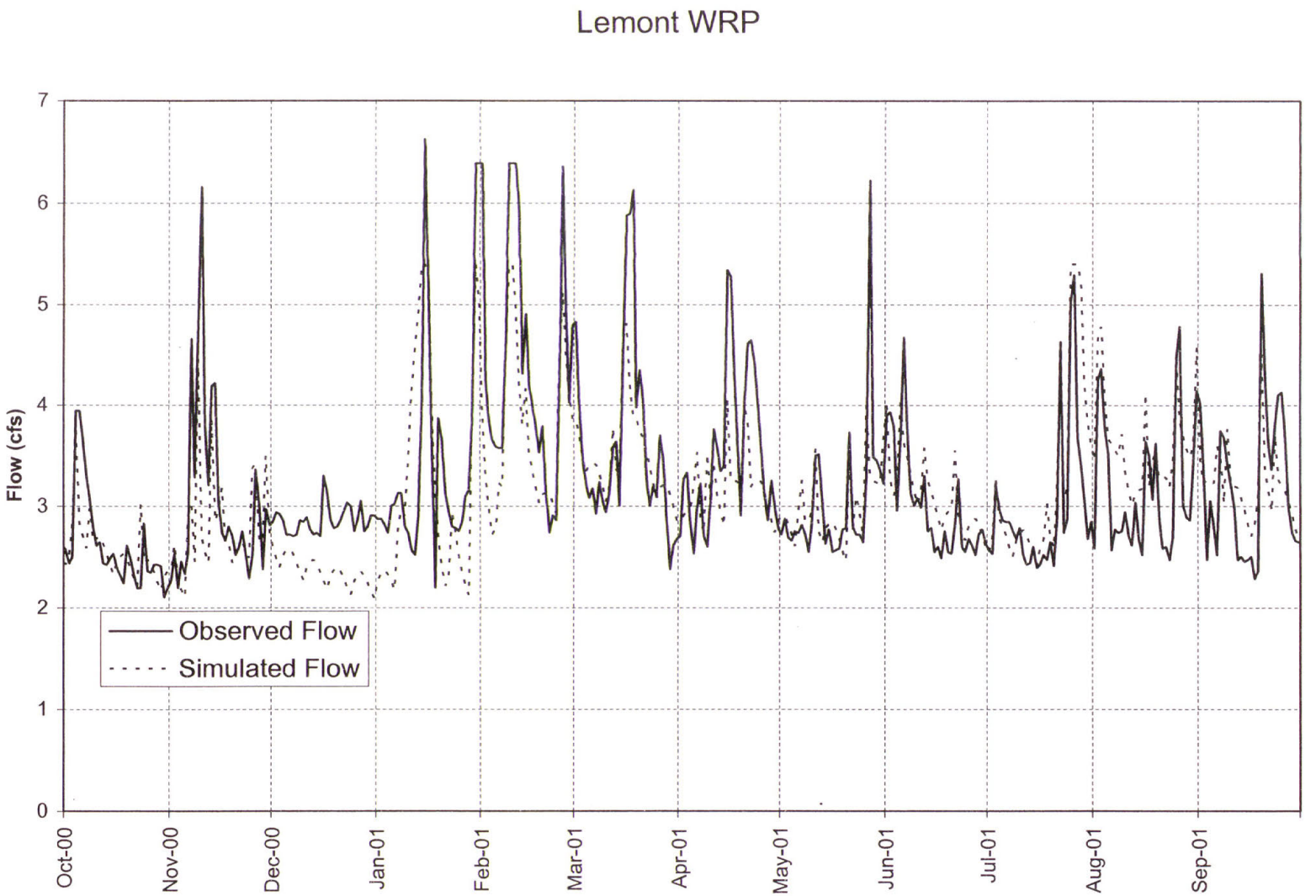


Figure 11 Budget 13 – Simulation of the MWRDGC Lemont Water Reclamation Facility

Summary of Budget Results

Overall, the WY2001 Diversion Accountings results are fairly similar to WY2000, with slight decreases in simulated to recorded ratios and correlation coefficients. The Budgets for the Mainstream and Calumet Pumping Stations (Budgets 9 and 11, respectively), maintained strong simulated to recorded ratios compared to WY00 with ratios of 1.00 (1.01 for WY00) and 0.93 (1.03 for WY00), respectively. The correlation coefficients for both Budgets 9 and 11 were slightly weaker, with correlations of 0.65 (0.70 for WY00) and 0.70 (0.83 for WY00). The two most significant budgets in the diversion accounting computations, Budget 7, the Northside Water Reclamation Facility, and Budget 10, Stickney Water Reclamation Facility, performed quite well. These budgets have simulated to recorded ratios of 0.98 and 0.97 and correlations of 0.82 and 0.78, respectively.

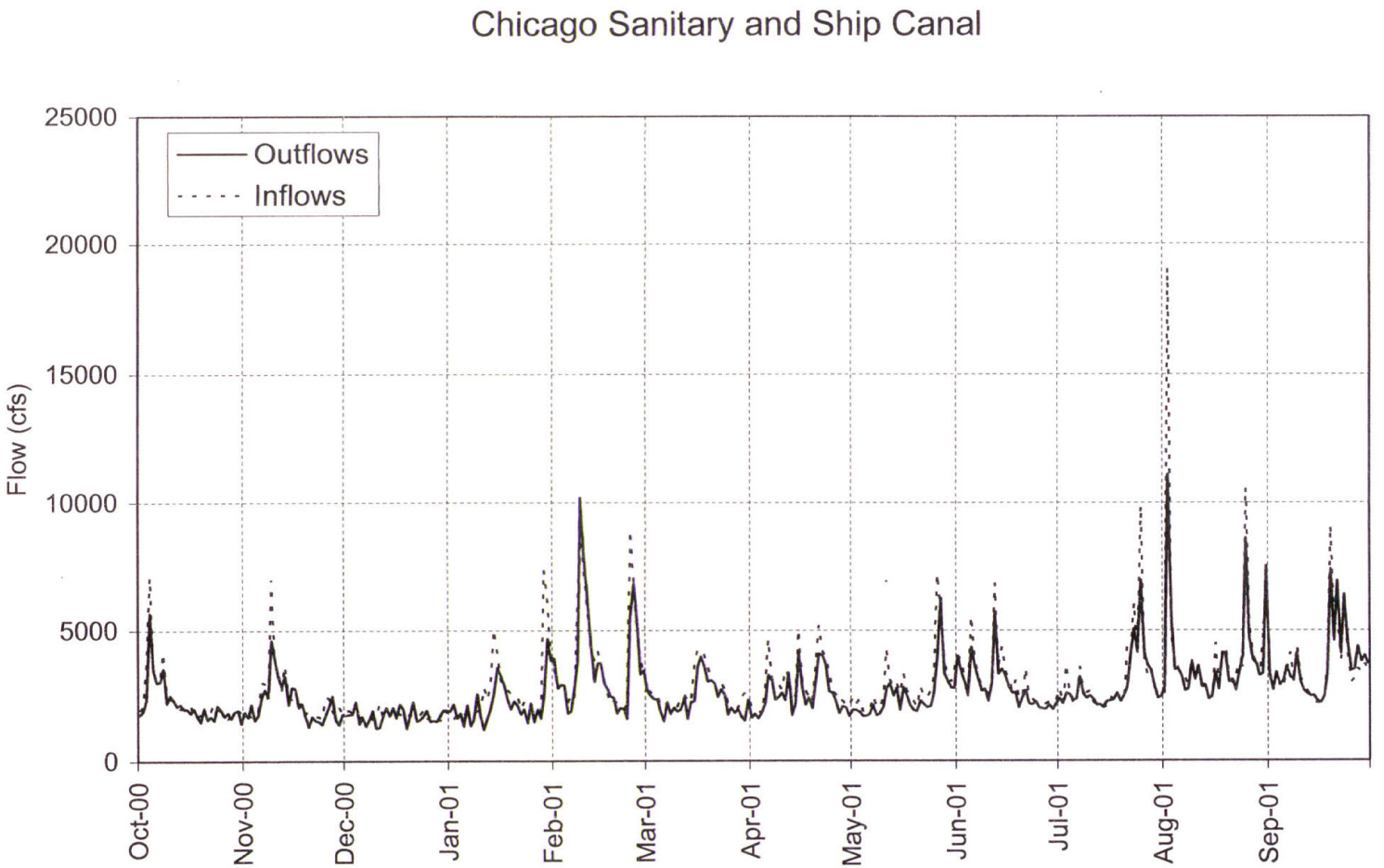


Figure 12 Budget 14 – CSSC System Balance

Table 8 – WY2001 Summary of Flow Components for the CSSC System Balance

INFLOWS (cfs)	
Direct Diversions at Lakefront Structures (measured)	
(includes lockage, leakage, discretionary and navigation makeup flows)	
- Wilmette Controlling Works	40.5
- Chicago River Controlling Works	164.9
- O'Brien Lock and Dam	144.7
Streamflows (measured)	
- North Branch Chicago River at Niles	136.3
- Little Calumet River at South Holland	160.2
- Grand Calumet River at Hohman Ave.	11.8
MWRDGC Water Reclamation Facilities (measured)	
- Northside	414.7
- Stickney	1,159.2
- Calumet	398.3
- Calumet TARP Pumpage to River	0.0
- Lemont	3.2
Other Point Sources (measured)	5.9
Summit Conduit (simulated)	16.0
Combined Sewer Overflows (simulated)	174.5
Direct Runoff to CSSC (simulated)	160.9
TOTAL INFLOWS (cfs)	2,991.1

OUTFLOWS (cfs)	
Cal-Sag Flow Transferred to Calumet WRP as Steel Mill Blow-down	4.6
Argonne Laboratory	0.8
Citgo Petroleum Corporation	6.9
USGS AVM Record	2,710.4
TOTAL OUTFLOWS (cfs)	2,722.7

DIFFERENCE (cfs)	268.4

Areas for Improvement

Tunnel and Reservoir Plan Models

The primary purpose of the TARP models is to accurately estimate deductible components of the diversion such as the Des Plaines River watershed runoff and groundwater infiltration through tunnel walls. Low flows, or dry weather flows, must be modeled accurately so that groundwater infiltration into the two TARP systems is properly modeled. These flows constitute a substantial deduction to the diversion and are included in the deductible groundwater flows of Column 4. Therefore, the estimates of simulated groundwater infiltration rates need to be updated periodically to better match the simulated to the recorded dry-weather flows. (Procedures for updating simulated dry-weather flows are similar to those used for improving the simulated groundwater infiltration rates for WY89 Calumet TARP as discussed in the WY89 Accounting Report in the Lake Michigan Diversion Accounting Annual Report for WY90-92.) In short, the procedure involves an analysis of operations records to identify time periods of little or no interceptor overflows into the TARP system. The underlying assumption is that the I&I flows are constant, and can be quantified as the average pumping rate over the period of time during which there was no interceptor overflows. This was the method used to revise the I&I flows for the Mainstem TARP for this WY00 Accounting Report as discussed in the Budget 9 description.

In the Calumet system, some sanitary sewers are connected to TARP. These sewers must be accurately accounted for in the modeling of groundwater infiltration since they contribute to the baseflow, or dry weather flow, into TARP. Currently, some uncertainty remains as to the connection of the separately sewered areas. For accurate modeling of the Calumet TARP system, these connections need to be verified and adjusted if necessary.

Due to model instability, simulated gate closing and pump operation parameters have been simplified or modified. Improvements for model stability are required before the models can better represent the operating procedures. Even after this change, representation of "actual" operating procedures may be difficult due to deviations from the TARP system operation plan, i.e. pumping at night, down times for various pumps, changes in pump ratings, implementation of forecasting algorithms, etc. If possible, the TARP models should be revised to better represent actual operating conditions. First, the modeling should more accurately simulate MWRDGC operational procedures that include less frequent pumping and pumping during the night. Second, the incorporation of a pseudo-forecasting algorithm would allow the model to simulate MWRDGC dewatering procedures prior to a storm. Third, dynamic constituent (inflow-infiltration versus sanitary versus groundwater) tracking can be incorporated to allow more accurate determination of the deductible components of TARP flow. Currently, constant constituent proportions, based on

annual volumes, are applied to all simulated pumpages from the TARP tunnels. Therefore, constituent flow percentages from TARP remain unchanged during an entire water year. Fourth, the inclusion of an algorithm to operate index dropshafts based on average water surface elevation in a tunnel reach would provide better simulation of "actual" operations. Sudden, localized changes in water surface elevations would not result in frequent opening and closing of control structure gates that regulate the flows into the drop shafts.

Data Preprocessing

The number of DSS-supplied input hydrographs in the Mainstream TNET BC files has reached the maximum dimension for the Diversion Accounting version of TNET (200). Prior to running TNET, some of the inflow hydrographs must be added together and stored in the DSS input file. In each case, the addition of the hydrographs before running TNET accomplishes the same numerical computation that would occur within TNET. The combining of inflows was performed at selected dropshafts that conveyed multiple SCAs to the tunnel. Prior to simulating WY00-01, these combinations were performed using the mathematic functions of HEC-DSSVue, although the same function could have been performed with the DOS-based HEC-DSSMath. If the BC files for WY00-01 are used as a template for future modeling, these merges will need to be performed in the same manner, or the TNET model will fail due to a missing data error.

MWRDGC Upper Des Plaines Pump Station

A review of the Upper Des Plaines pump station and its flow record indicates that the flow at the pump station is suspect and subject to operator error. Better flow measurements are needed at the pump station. With better flow measurements, this site will become the most important point for calibrating and verifying the simulation models for the Des Plaines watershed. In the diversion calculation, the primary purpose of modeling is to calculate the deduction for runoff from the Des Plaines watershed that enters the CSSC. The Upper Des Plaines Pump Station is the only point at which a model of the inflow-infiltration can be calibrated and extrapolated to the remaining portions of the Des Plaines River watershed. Because of the many problems associated with the current measurements of flow at this site, the benefits as the primary model calibration point have yet to be realized. Refer to the discussion of Budget 8 for additional details of some of the problems with the current measurements. Installation of better flow measurement equipment at the pump station and measurement of bypass flows at the facility would allow for better model calibration. Although this continues to be recognized as an area for improvement, the attention and funding of the diversion accounting program has been toward the potential switch to Lakefront Accounting.

The decision on the potential switch to Lakefront Accounting will influence whether or not this improvement is implemented in the near future.

O'Hare and Egan Basin Flow Transfer

A portion of the flows originating in the O'Hare and Egan Water Reclamation Plants' (WRP) service basins is transferred east to the Northside WRP. The extent of this transfer of flow is not known and the diverted flow is not currently measured. An estimate of the annual flow transfer is provided by MWRDGC. The total O'Hare-Egan flow transfer was reported as 8.2 cfs by the MWRDGC.

This transfer is significant to diversion since the O'Hare and Egan facilities discharge outside of the CSSC while the Northside WRP discharges flows that reach the CSSC. Therefore, this transfer contains two components that are deductions to the flow measured in the CSSC. The two deductible components are groundwater pumpage contained in the sanitary portion of the transfer (Column 4), and diverted Des Plaines River watershed runoff (Column 6).

To determine the two deductible components requires an estimate of the sanitary and runoff portions of the flow transfer. Presently the sanitary and runoff portions of the flow transfer are estimated using the same constituent (sanitary, inflow, and infiltration) proportions simulated for the Upper Des Plaines Pump Station by SCALP. Additionally, estimates must be made of the groundwater and Lake Michigan water components of the sanitary portion of the transfer. For WY01, the estimated water supply from the O'Hare and Egan service basins was composed of 1.5% groundwater (1.4 cfs) and 98.5% Lake Michigan water (87.7 cfs). The diverted Des Plaines River watershed runoff was estimated at 3.5 cfs.

For future accounting, simply measuring the basin transfer will not provide any information on the component makeup of the transfer. Thus, a review of the complex hydraulics and hydrology is necessary to determine the best procedure for estimating these flows. Several alternatives, including flow measurement and modeling were considered. A more detailed discussion of the flow transfer can be found in the Lake Michigan Diversion Accounting WY86 Report in the Lake Michigan Diversion Accounting WY90-92 Annual Report.

HSPF Snowmelt Simulation

There appears to be a significant difference in simulated and observed flows during periods with significant snowfall. The snow melt and accumulation routines should be examined over a longer period to identify possible parameter adjustments.

Budgets 7A and 7B

The mean S/R ratio for North Branch (Budget 7A) and Racine (Budget 7B) Pumping Stations were 0.69 and 0.56, respectively. In both cases the simulated flow was much lower than the observed flow.

The operation of the North Branch and Racine Pumping stations are not simulated in TNET and SCALP. Currently, overflows are forced at these locations at the same time all other inflow points are forced to overflow. The overflow rules for these locations would need to be modified to emulate MWRD operations of these pump stations. The S/R ratio being low indicates MWRD tends to start pumping early to save tunnel storage for the other locations without pump stations to minimize basement flooding. A re-examination of the TNET model for the Mainstream/Des Plaines TARP system is recommended.

TNET Model Confirmation/Update

The CTE Team suggests that the performance of a general housekeeping of the TNET model would be beneficial and desirable. A general confirmation of the TNET model would involve checking and updating the structure of the model and confirming that it accurately matches existing conditions and is error free. A thorough check on the TNET model would require a detailed investigation of the as-builts of the tunnels and drop shafts, and would likely require coordination with MWRDGC.

Baseflow Matching

For WY00, baseflows were matched by adjusting SCALP wastewater loading parameters to shift the simulated flow to approximately match the observed baseflows. This matching was performed for a period of 2 years and therefore appeared sufficiently valid. The actual model change was performed by indiscriminately increasing or decreasing all Population Equivalent (PE) parameters for a particular service area in order to approximate the average change in wastewater loading. In reality, the wastewater loading is a composite of the sum of the products of the PE and the per capita usage factor for each sub area. To more accurately model the actual wastewater loadings present, both the PE and the per capita usage should to be re-assessed. Census populations and NIPC manufacturing numbers should be considered when developing the revised PE and per capita usages estimates.

Calibration Period

The current modeling was conducted for a two year period, allowing an extra year of data to aid in calibration and model adjustment. A longer calibration period (10 or more years) should be looked at in the future. This long term calibration would be used to set the hydrologic parameters until a trend of over or under prediction becomes evident or changes in the physical system occur.

Budgets 7, 12, 13 High Flow Under Prediction

The simulation results for Budgets 7, 12 and 13 exhibit a tendency to under predict high flows. The observed high flows were in some cases higher than the SCALP interceptor split totals. Further investigation of this under prediction of high flows is recommended in order to identify the parameter adjustments required to correct this issue.

Budget 14 Calibration

The Budget 14 inflow to outflow ratio has been greater than the desired calibration criteria for several years. The simulated portion of Budget 14 is only 10-15% of the total. The individual simulated components met the calibration criteria established for their simulated to recorded flow ratios. For the Budget 14 criteria to be met, some or all of the individual components would have to be adjusted so as not to meet their calibration criteria by significant amounts. The causes for these differences have been shown to be at least partially related to a high bias in certain flow gage measurements . Future improvements in flow measurement accuracy will likely alleviate this issue.

Summary

The accuracy of the diversion accounting program is maintained and improved. Adjustments in the HSPF calibration, SCALP wastewater loading parameters, and, TNET gate opening operations and Mainstem Inflow and Infiltration parameters, have each contributed to improved simulated to observed ratios for WY01.

In compliance with the 1967 U.S. Supreme Court decree as modified in 1980, the WY01 diversion was computed using the best current engineering practice and scientific knowledge. The WY01 diversion accountable to the State of Illinois is 2,698 cfs. This flow is 502 cfs less than the 3,200 cfs average specified by the Decree. The 40 year running average beginning with WY81 and rounded to the nearest cfs is 3,298 cfs, and the cumulative deviation from the 3,200 cfs average is –1,858 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum deficit allowed by the Decree is -2,000 cfs-years.

References

1. Barkau, Robert L. 1991. *Modeling of the Chicago Tunnel and Canal System.* Prepared for Christopher B. Burke Engineering Ltd. as part of reference 2.

2. Christopher B. Burke Engineering, Ltd. 1990. *Infiltration and Inflow Study and Diversion Accounting Model Modification.* Prepared for the U.S. Army Corps of Engineers, Chicago.

3. Christopher B. Burke Engineering, Ltd. 1991. *Data Collection and Model Revisions.* Prepared for the U.S. Army Corps of Engineers, Chicago.

4. Christopher B. Burke Engineering, Ltd. 1999. *Hydrologic and Hydraulic Study of the Calumet Watershed.* Prepared for the U.S. Army Corps of Engineers, Chicago

5. Espey, William H., Harry H. Barnes, and Svein Vigander. 1981. *Lake Michigan Diversion Findings of the Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

6. Espey, William H., Harry H. Barnes, and David Westfall. 1987. *Lake Michigan Diversion Findings of the Second Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

7. Espey, William H., Oscar G. Lara, and Robert L. Barkau. 1994. *Lake Michigan Diversion Findings of the Third Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

8. Espey, William H., Arthur R. Schmidt, and Robert L. Barkau. 2001. *Lake Michigan Diversion Findings of the Fourth Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures.* Prepared for the U.S. Army Corps of Engineers, Chicago.

9. Hart, Dale E., and Richard G. McGee. 1985. *Final Report - Lockport Power Plant Sluice Gate and Control Works Discharge Evaluation.* Waterways Experiment Station. Vicksburg, MS.

10. International Joint Commission. 1981. *Great Lakes Diversions and Consumptive Uses, Annex F, Consumptive Use.*

11. Keifer Engineering. 1982. *Input Data CRSM for Existing Conditions - Mainstream System.* Prepared for the U.S. Army Corps of Engineers, Chicago.

12. Kleinbaum, David G., and Lawrence L Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods.* Wadsworth Publishing Company.

13. Metropolitan Water Reclamation District of Greater Chicago. 1984. *1984 Facility Planning Study - MSDGC Update Supplement and Summary.*

14. Metropolitan Water Reclamation District of Greater Chicago. 1989. *1988 Annual Report of the Maintenance and Operations Department.*

15. Neubauer, Ronald A. 1990. Request for TARP Information from the Army Corps of Engineers. Memorandum to Mr. William Eyre, Supervising Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago.

16. Northeastern Illinois Planning Commission. 1985. *Lake Michigan Diversion Accounting Manual of Procedures.*

17. Peppler, Randy A., 1991. *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990.* Illinois State Water Survey.

18. RUST Environment & Infrastructure. 1993. *Diversion Accounting Update for the New 25-Gage Precipitation Network.*

19. Soil Conservation Service. 1986. *Urban Hydrology for Small Watersheds,* Technical Release 55.

20. Steel, Robert G. D., and James H. Torrie. 1980. *Principles and Procedures of Statistics - A Biometrical Approach.* McGraw-Hill, Inc.

21. U.S. Army Corps of Engineers. 1990. *Lake Michigan Diversion Accounting 1989 Annual Report Including WY84 and WY85 Accounting.*

22. U.S. Army Corps of Engineers. 1990. *Current Meter Measurements of Discretionary and Leakage Flows at the Chicago River Controlling Works, O'Brien Lock and Dam, and the Wilmette Controlling Works.*

23. U.S. Army Corps of Engineers. 1994. Lake Michigan Diversion Accounting Annual Report Water Years 1990-1992. *Contains Lake Michigan Diversion Accounting Water Year 1986 Report, Water Year 1987 Report, Water Year 1988 Report, and Water Year 1989 Report.*

24. U.S. Army Corps of Engineers. 1995. Lake Michigan Diversion Accounting Water Year 1993 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1990 Report.*

25. U.S. Army Corps of Engineers. 1996. Lake Michigan Diversion Accounting Lakefront Accounting Technical Analysis – DRAFT.

26. U.S. Army Corps of Engineers. 1996. Lake Michigan Diversion Accounting Water Year 1994 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1991 Report and Water Year 1992 Report.*

27. U.S. Army Corps of Engineers. 1997. Lake Michigan Diversion Accounting Water Year 1995 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1993 Report and Water Year 1994 Report.*

28. U.S. Army Corps of Engineers. 1998. Lake Michigan Diversion Accounting Water Year 1996 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1995 Report.*

29. U.S. Army Corps of Engineers. 2000. Lake Michigan Diversion Accounting Water Year 1997 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1996 Report.*

30. U.S. Army Corps of Engineers. 2001. Lake Michigan Diversion Accounting Water Year 1998 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1997 Report.*

31. U.S. Army Corps of Engineers. 2004. Lake Michigan Diversion Accounting Water Year 1999 Annual Report. *Contains Lake Michigan Diversion Accounting Water Year 1998 Report and Water Year 1999 Report.*

32. U.S. Geological Survey. 1984. *Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois.*

33. U.S. Geological Survey. 1992. *Water Resources Data, Illinois, Water Year 1991, Volume 2, Illinois River Basin.*

34. U.S. Geological Survey. 1994. *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary Ship Canal at Romeoville, Illinois.*

35. U.S. Geological Survey. 1994. *Measurements of Leakage through Chicago River Controlling Works and Other Control Structures Near Chicago Illinois.*

36. U.S. Geological Survey. 2003. *Computation of Discharge and Error Analysis for the Lake Michigan Diversion Project – Lakefront Accounting Streamflow-Gaging Stations – DRAFT.*

37. Westcott, Nancy E. 2000. *Continued Operation of a Raingage Network for Collection, Reduction, and Analysis of Precipitation Data for Lake Michigan Diversion Accounting: Water Year 1999.* Illinois State Water Survey Contract Report 2000-07.

38. Westcott, Nancy E. 2001. *Continued Operation of a Raingage Network for Collection, Reduction, and Analysis of Precipitation Data for Lake Michigan Diversion Accounting: Water Year 2000.* Illinois State Water Survey Contract Report 2000-07.

39. Westcott, Nancy E. 2002. *Continued Operation of a Raingage Network for Collection, Reduction, and Analysis of Precipitation Data for Lake Michigan Diversion Accounting: Water Year 2001.* Illinois State Water Survey Contract Report 2000-07.

40. Wisconsin et. al., v. Illinois et. al., Michigan v. Illinois et. al. New York v. Illinois et. al. U.S. 2, 3, and 4, Original 1 - 18, 1980.

Appendix A - Background of Lake Michigan Diversion Accounting

The Decree specifies several limitations on the diversion of Lake Michigan water by the State of Illinois. The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in two accounting periods due to extreme hydrologic conditions in which the average diversion may not exceed 3,840 cfs. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the forty year period beginning with WY81.

Also required by the Decree, a three (3) member technical committee is convened every five (5) years to evaluate the diversion accounting program to ensure that the accounting is accomplished using the best current engineering practice and scientific knowledge.

Prior to the 1983 accounting report, diversion accounting was done by the MWRDGC in the form of monthly hydraulic reports. As required by the Decree, the diversion was calculated by deducting non-diversion flows from the Lockport record measured by MWRDGC and adding those diversion flows not discharging to the CSSC. All of the deductible flows could not be measured, therefore MWRDGC used flow records from gaged areas to obtain typical flow values. To estimate the unmeasured deductible flows, the measured flow values were extrapolated to the areas from which the deductible flows originated.

While the diversion accounting was still being performed by MWRDGC the first technical committee was convened. The committee was primarily concerned with the rating of the various components at the Lockport facility, the primary diversion measurement location (Espey et. al., 1981). In response to the Committee's concerns, the Corps' Waterways Experiment Station (WES) revised the ratings of the two sets of Lockport sluice gates (Hart and McGee, 1985) and the State of Illinois installed an acoustic velocity meter (AVM) at Romeoville five (5) miles upstream of Lockport. The AVM is a highly accurate flow measuring device that proved to provide better flow measurements than the MWRDGC reported Lockport flows and the new Corps rating curves. The AVM became operational 12 June 1984. However, USGS did not publish the AVM flows until 1 October 1985. Because of significant equipment problems with the original AVM, a replacement AVM was installed in November 1988.

Additionally, the State of Illinois contracted with NIPC to revise the diversion accounting calculations. At the same time, the State of Illinois moved from monthly hydraulic reports to annual accounting reports. NIPC adapted computer models of the diverted Lake Michigan and the Des Plaines River watersheds previously

developed for studies in Northeastern Illinois under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), to calculate those flows that could not be measured. Like MWRDGC, NIPC deducted non-diversion flows from the Lockport record and added those flows not discharged to the canal to calculate the Lake Michigan diversion. However, NIPC modeled both the gaged and ungaged areas to calculate much of the deduction and addition flows. Then computational budgets were developed around each of the gaged areas to verify the models. The budgets aid in calibrating the models and verifying the computational procedures. Due to the more rigorous approach and the verification provided by the budgets, the procedure developed by NIPC was a significant improvement over the previous approach.

The second technical committee reviewed the NIPC hydrologic and hydraulic computer models and agreed that the approach was consistent with the requirements of the decree (Espey et. al., 1987). However, the committee felt that some of the parameters used in the models were out of date and in need of revision. To address the committee's concerns, the Corps hired a consultant (Christopher B. Burke Engineering, Ltd., (CBBEL)) in September of 1988 to review and update the modeling parameters. The final report (CBBEL, 1990) concerning the updating of modeling parameters was submitted to the Corps in October 1990.

The Water Resources Development Act of 1986 gave the Corps of Engineers the full responsibility for computation of the Illinois Lake Michigan diversion as of 1 October 1987. When the Corps' new responsibility became effective, the WY84 diversion accounting report, developed by NIPC, had not been certified. As a result, the Corps was responsible for conducting the WY84 and all subsequent reports.

NIPC completed the WY84 diversion accounting analysis in April 1987 and the report was subsequently reviewed by the Corps. The Corps found the report to be adequate with two exceptions. First, the accounting was completed with the model parameters questioned by the second technical committee. Second, the MWRDGC Lockport flows, which were adjusted using the WES rating curves, were used rather than the AVM flows. The Corps, knowing that the modeling parameters required updating and that AVM flows for the period prior to installation could be calculated accurately using regression equations, refrained from certifying the WY84 report until these issues were resolved.

NIPC completed the WY85 diversion accounting report in December 1988 and the report was reviewed by the Corps. Like the WY84 report, the WY85 accounting was done with the modeling parameters questioned by the second technical committee. Additionally, NIPC used the AVM flows published by the USGS in their WY85 Water Resources Data for Illinois report. Since the publication of the WY85 USGS report, more reliable regression equations have been developed for calculating flows when the AVM was malfunctioning. These equations provide

flow estimates based on flow components at Lockport. The equations are used to fill in missing records when the AVM malfunctions.

Over the years, various regression analyses have been performed to relate the MWRDGC reported Lockport flows to the AVM flows. Several sets of equations were proposed by the Corps of Engineers, the United States Geological Survey (USGS), Harza Engineering Co., and the Second Technical Committee. The report, *Chicago Sanitary and Ship Canal at Romeoville Acoustical Velocity Meter Backup System*, was completed September 1989 (USACE, 1989). The report documents the many efforts taken by various parties to develop useful regression equations. The regression equations that were ultimately used to estimate missing AVM flows from WY86 through WY97 were developed by the USGS in a report titled *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary and Ship Canal at Romeoville, Illinois* (USGS, 1994). This report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

Upon completion of the analysis of the modeling parameters by CBBEL, the WY84 and WY85 diversion flows were recalculated using the revised modeling parameters and the Romeoville AVM flows. The diversion flows were certified by the Corps and transmitted to all interested parties in the Lake Michigan Diversion Accounting 1989 Annual Report (USACE, 1990).

The computation of Illinois' diversion from Lake Michigan for WY86 was undertaken as a joint effort between NIPC (under contract to the Corps) and the Corps. The computation of Illinois' diversion from Lake Michigan for WY87 through WY90 was performed solely by the Corps.

Prior to the publication of the WY90 diversion accounting report, the third technical committee reviewed diversion accounting procedures and efforts to meet the recommendations of the first and second committees (Espey et. al., 1994). The committee expressed general satisfaction with the procedures and efforts to meet the recommendations of the previous committees. Emphasis was placed on the need for data and model quality plans, detailed accounting procedures, and more timely reports. Also recommended by the committee were detailed flow measurements at the lakefront structures and at the Upper Des Plaines Pump Station.

The WY91 and WY92 diversion accounting was performed as a joint effort between CBBEL (under contract to the Corps) and the Corps. The WY93, WY94, WY95, WY96 and WY97 accounting was performed solely by the Corps.

In 1998 the fourth technical committee was convened. The committee had several recommendations pertaining to the AVM flow measurements at lakefront controlling works and the QA/QC of water supply pumpage from Lake Michigan.

These are important issues if the accounting procedures will be moved from Lockport to the lakefront.

The WY98 and WY99 diversion accounting was performed as a joint effort between Mead&Hunt (under contract to the Corps) and the Corps. Mead&Hunt performed hydrological and hydraulic model simulations, where as the Corps did the budget and columns computations and statistical data analyses. The WY 2000 and WY 2001 diversion accounting was performed by CTE Engineers Inc. (under contract to the Corps).

The WY86 through WY89 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Annual Report covering WY90 through WY92 (USACE, 1994). The WY90 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1993 Annual Report (USACE, 1994). The WY91 and WY92 Diversion Accounting Reports are contained in the LMDA Water Year 1994 Annual Report (USACE, 1996). The WY93 and WY94 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1995 Annual Report. The WY95 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1996 Annual Report (USACE, 1998). The WY96 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1997 Annual Report (USACE, 2000). The WY97 Diversion Accounting Report is contained in the Lake Michigan Diversion Accounting Water Year 1998 Annual Report (USACE, 2001). Finally, the WY98 and WY99 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1999 Annual Report (USACE, 2004).

The primary revision implemented for the WY90 diversion accounting was the incorporation of the new 25-gage precipitation network into the runoff simulation models. The 25-gage precipitation network replaces the previously used 13-gage network. The new precipitation network has solved many of the problems associated with the old network, such as poor exposure and distribution patterns. The Illinois State Water Survey (ISWS) installed and maintains the precipitation network for the Corps of Engineers. They also collect the data and adjust it if necessary. A description of the new 25-gage precipitation network can be found in the ISWS report titled *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990* (ISWS, 1991). That report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

In addition to the introduction of the new 25-gage precipitation network were the subsequent modifications to the hydrologic runoff models and hydraulic sewer routing models. These models were revised in order to reflect the changes in the precipitation network and changes in land use and cover. Many of the model changes were completed by RUST Environment and Infrastructure under contact with the Corps. Their work culminated in a report titled *Diversion Accounting Update*

for the New 25-Gage Precipitation Network (Rust, 1993). That report is also contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

RUST's work involved reviewing and correcting map delineations of combined sewer special contributing areas, delineating precipitation gage assigned areas for the 25-gage network, land-use/land-cover delineation, modifying the hydraulic sewer routing model to reflect the revised precipitation network and land cover assignments, and assessing the model parameters used in the hydrologic runoff model, Hydrologic Simulation Program - FORTRAN (HSPF).

The Corps modified the hydraulic sewer model, Special Contributing Area Loading Program (SCALP), in the separate sewer areas in order to incorporate changes in the precipitation network. These changes were also incorporated in the WY90 accounting. Since actual boundaries have not been mapped for those areas, some assumptions as to the location of the separate sewer areas were made. These assumptions were necessary since effective (instead of actual) areas are used for separate sewer areas in the SCALP model. These assumptions will continue until a further study can be accomplished that will reflect actual boundaries for these separately sewered areas. These modifications were also incorporated into accounting procedures beginning with the WY90 accounting.

A study was also done by the Corps to improve the response of the HSPF hydrologic runoff models. Input on parameter improvements were received from NIPC and RUST. The study resulted in some minor parameter modifications to the HSPF runoff model to correct for past inconsistencies and improve parameter accuracy.

Beginning with the WY91 accounting all the computer models were revised to read and write to the Data Storage System (DSS) database, the Corps' standard database. In 1993 Aqua Terra Consultants, under contract to the Corps, revised the HSPF code to be compatible with the DSS database and in 1994 they provided a new release of HSPF, version 11. Christopher B. Burke Engineering in 1995 revised all hydrologic and computational HSPF input files, as well as SCALP input files to work in conjunction with the DSS database. The Corps revised the SCALP code to also work in conjunction with this database.

Beginning with the WY92 accounting, flows in the Grand Calumet were measured instead of estimated through regression equations. These flows are critical in determining portions of the deductible water supply from Indiana contained in Column 5 of the report.

There were three primary revisions to the accounting procedures beginning with the WY93 accounting. The first revision involved a modification to the procedure for estimating the deductible Indiana water supply pumpage contained in the Grand Calumet River. This revision better accounts for the unique hydraulics of

this river. The second revision involved modeling modifications for a portion of the Des Plaines TARP system that became operational in June 1993. These modeling modifications impact the deductible runoff from the Des Plaines River watershed contained in Column 6. The third revision to the accounting involved adjustments to correct for double accounting for a portion of the runoff originating from the ungaged Calumet watershed. This modification is reflected only in the results of Column 12, Runoff from the Diverted Lake Michigan Watershed, and therefore has no effect on the computed diversion.

Four revisions were made to the diversion accounting procedures for WY96. First, a switch to using Argonne National Lab's direct solar radiation values was made because O'Hare Airport changed the way it reported cloud cover. A second revision was the improvement of the snowmelt computation by incorporating the newly available 3-hour meteorologic data at O'Hare Airport. Previously snowmelt was computed using daily values. Thirdly, the Calumet TARP model was updated to include new tunnel legs which went on-line during WY96. Finally, University of Chicago air temperature data is no longer used as input to HSPF due to the fact that records are no longer kept at the site. HSPF subareas that previously referenced the University of Chicago data now reference either the O'Hare airport, Midway airport or Park Forest temperature gage, depending on proximity.

Three revisions were made to the diversion accounting procedures for WY97. First, the monthly and weekly distributions of sanitary loads for the Calumet watershed were improved. Second, a review of the percent imperviousness assigned to the various landuse parameters used in the SCALP model was made. Finally, the inclusion of a 10% consumptive use factor was incorporated in the computation of Columns 4, 5, 7, 9 and 11.

Three revisions were made to the diversion accounting procedures for WY98. First, a new leg of tunnel, North Branch Tunnel, was added to the Mainstream TARP system. Second, the direct diversion flows measured by AVM's installed at Columbus Drive (near CRCW) and O'Brien Lock and Dam were available to compare against the flows estimated by the ratings of lakefront structures. Finally, water supply from Hammond, Indiana to Chicago Heights, Calumet City and Burnham was added to Column 11 (pumpage from Lake Michigan accountable to the State of Illinois).

One revision was made to the diversion accounting procedure for WY99. The Des Plaines Tunnel Branch was added to the Mainstream/Des Plaines TARP system. The tunnel went through a testing period before becoming fully operational.

Several revisions were made to the diversion accounting procedure for WY01. First, it should be noted that the current modeling was conducted for a two year period, WY00 and WY01. Previously, the verification had been done by accounting year. Using a two-year period allows the parameter adjustments to be

correlated to the greater variability of conditions over two years. This allows the parameters to better reflect the landuse conditions which do not change significantly over time within the combined sewer area. The WY99 meteorological data was used as a starting point in the calibration runs to allow the HSPF model to stabilize and have correct (antecedent) conditions at the beginning of the WY00 accounting year.

Secondly, two new budgets (Budgets 7A and 7B) were added. Budget 7A compares simulated and observed pumping at the North Branch Pumping Station. Budget 7B compares simulated and observed pumping at the Racine Pumping Station. These Budgets were added to help determine the accuracy of the TARP CSO simulations and for their potential future use as calibration points for the heretofore uncalibrated CSO overflows.

Thirdly, for Budget 14, backflows at the CRCW, O'Brien and Wilmette locks were removed from the outflows from the canal since they are already accounted for in the Lake front AVM.

For WY01, several adjustments were also made as part of the HSPF, SCALP and TNET calibration effort. HSPF Grass and Impervious parameters were adjusted based on guidance in "USEPA BASINS Technical Note 6 – Estimating Hydrologic and Hydraulic Parameters for HSPF" (2000) and a NIPC report "Application Guide for Hydrologic Modeling in DuPage County Using HSPF" (1996). The following changes were made:

- Grass parameter INTFW adjusted to 10.0 (was 5).
- Grass parameter UZSN adjusted to 0.5 (was 1.8).
- Grass parameter INFILT adjusted to 0.100 (was 0.015).
- Grass parameter CEPSC adjusted to 0.10 (was 0.25).
- Grass parameter LZSN adjusted to 8.5 (was 9.5).
- Impervious parameter RETSC adjusted to 0.10 (was 0.25).

As part of the calibration, the SCALP wastewater loading parameter was adjusted to shift baseflows to more closely match the observed baseflows. The following changes were made to SCALP wastewater loading parameters:

- Wastewater loadings were increased by 3% for the CSO service areas tributary to the Northside Wastewater Treatment Plant.
- Wastewater loadings were decreased by 24% for the CSO service areas tributary to the West Southwest Wastewater Treatment Plant.
- Wastewater loadings were decreased by 20% for the CSO service areas tributary to the Calumet Wastewater Treatment Plant.
- Wastewater loadings were increased by 10% for the CSO service areas tributary to the Lemont Wastewater Treatment Plant.

Several adjustments were made to the TNET model. One significant change to the Mainstream TNET model was a modification to the constant I&I flow. The previous I&I total was 76.59 cfs, which was brought into question after an observation that the operations records indicate that there were several sustained periods where the pumping averages were significantly lower than that value. The comparison of simulated vs. observed values also indicated that the model consistently over predicted the baseflow during low-runoff periods. An analysis of Mainstream/Des Plaines TARP-to-STP pumping averages for WYs 98 through 01 indicated that there were two sustained periods of apparently little or no interceptor overflow into the tunnel. One was 17 October 1999 through 8 November 1999, and the other was 18 December 1999 through 6 February 2000. The composite average value for those two periods was 27.78 cfs. Since pumping occurred on about a third of the days in these time periods, care was taken to select the time periods such that complete inflow and pumpout cycles were accounted for, and not averaging any incomplete pumping cycle (which tended to be 4-5 days).

The other changes to the Mainstream and Calumet TNET models included modifications to the index dropshaft parameters. The net changes to the TNET input data were developed over the series of calibration model runs which involved comparing the recorded pumpout volumes to the simulated, and tunnel stage data for the Mainstream tunnel only. The intent of the changes was to enable the model to replicate actual operational practices, specifically with the dropshaft operations and pumping schemes.

For the Mainstream Tunnel, the index dropshaft scheme was changed, resulting in fewer indices, and basing more of the dropshaft operations on a point farther downstream in the tunnel. This change resulted in closing off the inflows at a slightly lower elevation. After this change was made, the model results were compared with MWRDGC operations data to confirm that the simulated pressurization levels were reasonably close to the observed levels. A second check was a comparison of weekly average pumping volumes of simulated vs. observed, although this comparison also includes the variance due to the hydrologic modeling as well.

The pump on/pump off elevations were changed slightly also, and were compared with actual measured values. It was not possible to simulate the pumping of the tunnel down to the level that is used in actual operations because of numerical instability of the model. The final value used in the model was the lowest point to which the tunnel could be pumped without causing excessive numerical instability.

The dropshaft operation data for the Calumet TNET model was changed significantly, and resulted in closing off the inflows at a higher elevation. The TNET model results from the early iterations indicated that the simulated capture (and pumpout) volumes were much lower than observed. This was determined by

comparing the weekly average pumping volumes of simulated vs. observed, even though this comparison also includes the variance due to the hydrologic modeling as well. The gate-closing scheme was modified to cause the model to capture more inflows, yet not pressurizing the system. The model input that was developed over the iterations produced a reasonable match of pumpout volumes. The locations of the index dropshafts were not changed.

Appendix B - Summary of Daily Diversion Flows

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 = Column 3 - Column 8 + Column 9.

Note: The averages presented in the final row are calculated from the daily values contained in Appendix B.

Deductions from the Romeoville Gage Record

Additions to the Romeoville Gage Record

Lake Michigan Diversion Accounting – WY 2001
October 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Oct-00	1,780.0	3.7	1,783.7	53.2	12.0	66.5	0.7	132.4	255.5	**1,906.8**	1,584.1	238.0	382.0
02-Oct-00	1,915.0	3.9	1,918.9	31.5	13.0	53.7	0.7	98.9	254.6	**2,074.6**	1,627.7	169.0	463.0
03-Oct-00	2,339.0	3.6	2,342.6	27.2	14.5	445.8	0.7	488.2	253.6	**2,108.0**	1,577.4	1,599.0	394.0
04-Oct-00	5,674.0	1.6	5,675.6	205.2	32.9	623.6	0.7	862.4	256.0	**5,069.2**	1,530.3	3,889.0	431.0
05-Oct-00	3,450.0	1.9	3,451.9	267.6	20.4	207.5	0.7	496.2	250.6	**3,206.3**	1,461.2	1,320.0	377.0
06-Oct-00	3,005.0	3.6	3,008.6	145.2	19.5	143.9	0.7	309.3	250.4	**2,949.7**	1,466.1	766.0	381.0
07-Oct-00	3,034.0	2.5	3,036.5	30.9	17.6	87.5	0.7	136.7	247.2	**3,147.0**	1,461.8	357.0	316.0
08-Oct-00	3,533.0	2.3	3,535.3	125.4	32.4	204.4	0.7	362.9	248.8	**3,421.2**	1,437.2	1,857.0	376.0
09-Oct-00	2,212.0	2.0	2,214.0	88.1	22.1	95.6	0.7	206.5	252.3	**2,259.8**	1,493.5	624.0	353.0
10-Oct-00	2,501.0	2.2	2,503.2	23.6	19.2	70.3	0.7	113.8	253.4	**2,642.8**	1,501.9	315.0	402.0
11-Oct-00	2,318.0	2.0	2,320.0	32.2	16.3	68.4	0.7	117.6	247.5	**2,449.9**	1,506.6	288.0	456.0
12-Oct-00	2,100.0	2.1	2,102.1	53.7	15.3	76.0	0.7	145.6	252.0	**2,208.5**	1,510.0	296.0	521.0
13-Oct-00	2,170.0	2.1	2,172.1	23.6	15.1	57.7	0.7	97.1	249.3	**2,324.3**	1,533.5	198.0	320.0
14-Oct-00	1,983.0	1.5	1,984.5	32.0	14.0	56.5	0.7	103.3	256.6	**2,137.8**	1,506.5	206.0	412.0
15-Oct-00	1,994.0	1.7	1,995.7	32.6	14.0	55.0	0.7	102.3	253.2	**2,146.6**	1,466.1	190.0	448.0
16-Oct-00	1,832.0	2.7	1,834.7	32.1	15.9	50.4	0.7	99.1	254.8	**1,990.4**	1,476.4	193.0	481.0
17-Oct-00	2,013.0	1.6	2,014.6	23.6	14.0	45.3	0.7	83.6	249.5	**2,180.5**	1,479.9	168.0	129.0
18-Oct-00	1,723.0	2.2	1,725.2	32.7	13.0	47.2	0.7	93.6	252.0	**1,883.6**	1,515.5	166.0	94.0
19-Oct-00	1,492.0	2.5	1,494.5	60.8	13.5	56.6	0.7	131.7	246.8	**1,609.6**	1,513.0	228.0	135.0
20-Oct-00	2,014.0	3.5	2,017.5	31.1	13.2	41.4	0.7	86.5	250.7	**2,181.7**	1,540.0	149.0	216.0
21-Oct-00	1,585.0	3.3	1,588.3	32.0	11.9	38.1	0.7	82.8	251.9	**1,757.4**	1,509.3	170.0	243.5
22-Oct-00	1,702.0	3.2	1,705.2	23.6	12.9	33.7	0.7	70.9	251.1	**1,885.4**	1,464.9	119.0	303.0
23-Oct-00	1,552.0	3.5	1,555.5	66.6	12.8	141.0	0.7	221.1	250.8	**1,585.2**	1,483.7	688.0	211.0
24-Oct-00	2,127.0	3.5	2,130.5	23.6	24.5	34.2	0.7	83.0	247.1	**2,294.6**	1,478.4	210.0	183.0
25-Oct-00	1,943.0	3.3	1,946.3	46.4	13.3	72.4	0.7	132.9	248.4	**2,061.8**	1,478.3	232.0	202.0
26-Oct-00	1,705.0	4.0	1,709.0	41.1	13.3	43.8	0.7	98.9	246.8	**1,856.9**	1,486.4	217.0	163.0
27-Oct-00	1,850.0	3.2	1,853.2	23.6	12.4	30.0	0.7	68.8	247.9	**2,032.3**	1,474.9	126.0	13.0
28-Oct-00	1,625.0	3.4	1,628.4	32.2	12.5	32.3	0.7	77.8	248.0	**1,798.6**	1,448.0	136.0	240.0
29-Oct-00	1,878.0	3.1	1,881.1	29.2	12.3	28.4	0.7	70.6	249.4	**2,059.9**	1,467.0	129.0	287.0
30-Oct-00	1,944.0	4.1	1,948.1	23.6	12.9	25.1	0.7	62.3	250.7	**2,136.5**	1,451.6	97.0	312.0
31-Oct-00	1,433.0	3.4	1,436.4	30.9	11.6	27.1	0.7	70.4	249.1	**1,615.1**	1,469.5	112.0	284.1
Averages	2,207.3	2.8	2,210.1	55.6	16.1	98.7	0.7	171.1	250.8	**2,289.8**	1,496.8	498.5	307.4

Lake Michigan Diversion Accounting – WY 2001
November 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Nov-00	1,867.0	4.9	1,871.9	51.8	13.0	34.1	1.0	100.0	236.2	**2,008.1**	1,480.5	162.0	326.0
02-Nov-00	1,663.0	3.7	1,666.7	23.6	12.2	44.4	1.0	81.1	230.8	**1,816.4**	1,469.7	114.0	350.7
03-Nov-00	2,171.0	2.6	2,173.6	34.4	12.9	25.7	1.0	74.1	236.0	**2,335.5**	1,449.7	115.0	168.0
04-Nov-00	1,561.0	4.0	1,565.0	32.1	11.5	22.0	1.0	66.6	228.9	**1,727.3**	1,417.8	110.0	307.0
05-Nov-00	1,755.0	3.6	1,758.6	33.3	11.4	23.2	1.0	68.9	237.1	**1,926.8**	1,447.8	105.0	473.0
06-Nov-00	2,410.0	3.7	2,413.7	45.9	12.8	401.1	1.0	460.9	238.4	**2,191.2**	1,453.6	998.0	408.0
07-Nov-00	2,715.0	2.0	2,717.0	245.5	19.6	197.6	1.0	463.7	232.7	**2,486.0**	1,419.6	1,221.0	238.0
08-Nov-00	2,437.0	0.8	2,437.8	84.8	11.4	61.3	1.0	158.0	232.5	**2,512.3**	1,431.7	362.0	187.2
09-Nov-00	4,609.0	1.8	4,610.8	118.0	31.1	900.8	1.0	1,050.9	242.8	**3,802.7**	1,421.7	4,354.0	150.0
10-Nov-00	3,885.0	0.6	3,885.6	292.9	24.4	192.6	1.0	510.9	232.2	**3,606.9**	1,454.0	1,946.0	162.0
11-Nov-00	3,178.0	0.6	3,178.6	162.7	15.4	130.6	1.0	309.7	232.1	**3,101.0**	1,423.3	1,021.0	213.0
12-Nov-00	2,840.0	0.8	2,840.8	31.4	15.1	73.3	1.0	120.8	235.0	**2,955.0**	1,418.4	471.0	297.0
13-Nov-00	3,247.0	0.6	3,247.6	149.8	24.7	394.9	1.0	570.5	238.0	**2,915.1**	1,429.3	1,978.0	192.8
14-Nov-00	2,150.0	0.6	2,150.6	37.5	16.3	89.3	1.0	144.1	230.2	**2,236.7**	1,400.0	524.0	190.0
15-Nov-00	2,798.0	0.7	2,798.7	43.2	15.5	97.6	1.0	157.3	233.6	**2,875.0**	1,413.5	482.0	240.0
16-Nov-00	2,776.0	1.1	2,777.1	26.4	14.5	132.6	1.0	174.6	230.2	**2,832.7**	1,414.1	567.0	508.0
17-Nov-00	2,041.0	0.7	2,041.7	59.3	13.5	87.0	1.0	160.8	233.6	**2,114.5**	1,420.8	371.0	431.0
18-Nov-00	2,194.0	0.5	2,194.5	31.2	13.2	68.1	1.0	113.5	233.5	**2,314.5**	1,414.8	237.0	295.0
19-Nov-00	1,713.0	1.8	1,714.8	32.1	13.3	75.0	1.0	121.4	233.0	**1,826.4**	1,406.8	291.0	194.0
20-Nov-00	1,304.0	1.6	1,305.6	23.6	13.6	59.4	1.0	97.6	235.2	**1,443.2**	1,441.3	200.0	274.2
21-Nov-00	1,704.0	0.9	1,704.9	23.6	14.9	56.0	1.0	95.6	236.0	**1,845.3**	1,435.7	169.0	37.0
22-Nov-00	1,548.0	2.8	1,550.8	32.1	14.5	56.0	1.0	103.6	233.8	**1,681.0**	1,474.2	195.0	57.0
23-Nov-00	1,514.0	1.8	1,515.8	23.6	13.9	51.1	1.0	89.5	235.6	**1,661.9**	1,434.1	149.0	98.0
24-Nov-00	1,400.0	0.7	1,400.7	51.9	13.4	60.8	1.0	127.1	232.0	**1,505.6**	1,426.9	217.0	124.0
25-Nov-00	1,747.0	1.6	1,748.6	43.2	15.0	231.5	1.0	290.8	232.3	**1,690.1**	1,416.6	911.0	128.0
26-Nov-00	2,073.0	2.1	2,075.1	104.9	19.3	237.3	1.0	362.6	232.9	**1,945.4**	1,395.3	940.0	35.9
27-Nov-00	2,496.0	2.4	2,498.4	30.6	14.6	65.4	1.0	111.6	235.8	**2,622.6**	1,449.1	259.0	30.8
28-Nov-00	1,576.0	2.2	1,578.2	61.3	13.9	78.5	1.0	154.8	235.2	**1,658.6**	1,431.6	303.0	181.0
29-Nov-00	1,389.0	2.5	1,391.5	40.6	15.4	193.6	1.0	250.6	232.9	**1,373.8**	1,426.6	730.0	67.0
30-Nov-00	1,776.0	2.7	1,778.7	33.6	13.3	64.8	1.0	112.8	233.5	**1,899.4**	1,410.0	283.0	51.0
Averages	2,217.9	1.9	2,219.8	66.8	15.4	140.2	1.0	223.4	234.1	**2,230.5**	1,431.0	659.5	213.8

Lake Michigan Diversion Accounting – WY 2001
December 2000 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Dec-00	1,754.0	2.9	1,756.9	58.0	11.1	81.3	1.2	151.7	239.2	**1,844.4**	1,416.5	383.0	116.0
02-Dec-00	1,773.0	2.7	1,775.7	31.5	10.6	58.4	1.2	101.8	238.8	**1,912.7**	1,430.2	226.0	84.0
03-Dec-00	1,791.0	2.6	1,793.6	23.6	10.6	52.0	1.2	87.5	239.1	**1,945.2**	1,396.1	191.0	178.0
04-Dec-00	2,260.0	2.8	2,262.8	32.0	9.9	52.2	1.2	95.4	243.3	**2,410.7**	1,427.5	205.0	95.0
05-Dec-00	1,427.0	2.3	1,429.3	30.9	9.8	51.0	1.2	92.9	242.6	**1,579.0**	1,439.5	185.0	6.0
06-Dec-00	1,669.0	2.3	1,671.3	28.6	10.2	45.4	1.2	80.4	238.8	**1,829.7**	1,436.2	153.0	114.0
07-Dec-00	1,330.0	2.1	1,332.1	32.1	10.2	46.0	1.2	89.5	241.1	**1,483.7**	1,431.1	173.0	135.0
08-Dec-00	1,594.0	2.8	1,596.8	54.5	9.7	56.6	1.2	122.0	238.8	**1,713.6**	1,424.5	230.0	102.0
09-Dec-00	1,930.0	2.7	1,932.7	23.6	9.9	40.0	1.2	74.7	239.7	**2,097.7**	1,430.2	134.0	28.0
10-Dec-00	1,265.0	2.6	1,267.6	32.1	9.8	40.9	1.2	84.0	239.5	**1,423.1**	1,422.2	152.0	111.0
11-Dec-00	1,284.0	2.7	1,286.7	54.1	11.0	54.8	1.2	121.1	241.8	**1,407.4**	1,431.0	637.0	55.0
12-Dec-00	1,697.0	3.0	1,700.0	23.6	10.2	35.9	1.2	70.9	238.5	**1,867.6**	1,431.4	201.0	(40.0)
13-Dec-00	2,044.0	2.7	2,046.7	53.5	10.5	48.5	1.2	113.8	238.8	**2,171.7**	1,444.5	229.0	185.0
14-Dec-00	1,716.0	2.3	1,718.3	32.1	11.2	35.4	1.2	79.8	239.0	**1,877.5**	1,436.8	181.0	35.3
15-Dec-00	2,041.0	3.2	2,044.2	23.6	9.5	31.5	1.2	65.8	237.7	**2,216.1**	1,463.2	137.0	49.0
16-Dec-00	1,643.0	4.4	1,647.4	31.7	10.8	34.2	1.2	77.9	236.1	**1,805.6**	1,441.6	146.0	49.0
17-Dec-00	2,162.0	2.7	2,164.7	32.0	10.2	31.8	1.2	75.3	238.6	**2,328.0**	1,449.9	152.0	(24.0)
18-Dec-00	1,979.0	2.5	1,981.5	23.6	9.8	28.2	1.2	62.8	241.7	**2,160.4**	1,478.9	117.0	68.0
19-Dec-00	1,240.0	3.0	1,243.0	34.0	9.8	32.2	1.2	77.3	241.0	**1,406.7**	1,481.6	141.0	72.0
20-Dec-00	1,713.0	2.4	1,715.4	61.7	9.7	42.9	1.2	115.5	239.5	**1,839.4**	1,466.8	221.0	164.0
21-Dec-00	2,259.0	3.1	2,262.1	32.3	9.3	29.5	1.2	72.4	238.4	**2,428.1**	1,472.4	135.0	(53.0)
22-Dec-00	1,528.0	3.3	1,531.3	23.6	9.9	24.5	1.2	59.2	239.4	**1,711.5**	1,500.5	109.0	46.2
23-Dec-00	1,570.0	4.6	1,574.6	29.2	10.0	25.4	1.2	65.9	240.0	**1,748.7**	1,470.4	126.0	207.0
24-Dec-00	1,711.0	3.7	1,714.7	32.0	10.6	26.9	1.2	70.8	239.4	**1,883.3**	1,473.4	127.0	79.0
25-Dec-00	1,925.0	0.9	1,925.9	23.6	9.8	22.2	1.2	56.8	237.2	**2,106.3**	1,424.1	104.0	(42.0)
26-Dec-00	1,518.0	3.6	1,521.6	32.1	11.8	24.1	1.2	68.7	238.1	**1,691.0**	1,456.6	129.0	41.5
27-Dec-00	1,539.0	4.0	1,543.0	65.6	10.7	40.9	1.2	118.4	240.2	**1,664.8**	1,477.0	197.0	33.9
28-Dec-00	1,516.0	4.4	1,520.4	23.6	10.3	20.3	1.2	55.4	240.8	**1,705.8**	1,469.9	96.0	121.0
29-Dec-00	1,728.0	4.5	1,732.5	41.1	9.3	26.5	1.2	78.1	239.5	**1,893.9**	1,475.0	148.0	(49.0)
30-Dec-00	1,944.0	4.4	1,948.4	23.6	9.5	19.1	1.2	53.4	238.0	**2,133.0**	1,452.7	97.0	250.0
31-Dec-00	1,855.0	4.3	1,859.3	23.6	15.2	18.6	1.2	58.6	237.5	**2,038.2**	1,466.3	97.0	111.0
Averages	1,722.7	3.1	1,725.8	34.2	10.3	38.0	1.2	83.7	239.4	**1,881.5**	1,449.0	179.3	75.1

Lake Michigan Diversion Accounting – WY 2001
January 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jan-01	1,919.0	0.5	1,919.5	40.1	13.6	24.5	1.3	79.5	237.8	**2,077.8**	1,432.3	145.0	40.2
02-Jan-01	2,176.0	0.7	2,176.7	46.0	12.3	28.3	1.3	87.9	240.3	**2,329.1**	1,499.6	150.0	(72.0)
03-Jan-01	1,636.0	0.7	1,636.7	23.6	15.8	17.1	1.3	57.8	242.9	**1,821.8**	1,477.6	95.0	164.0
04-Jan-01	1,829.0	0.8	1,829.8	39.8	11.3	22.9	1.3	75.2	239.1	**1,993.7**	1,481.9	141.0	124.0
05-Jan-01	1,329.0	0.7	1,329.7	23.6	11.4	16.2	1.3	52.5	240.1	**1,517.3**	1,474.4	94.0	(36.0)
06-Jan-01	2,140.0	0.5	2,140.5	32.7	10.8	20.2	1.3	65.0	237.1	**2,312.6**	1,477.2	166.0	(18.0)
07-Jan-01	1,343.0	0.6	1,343.6	29.2	11.9	22.2	1.3	64.6	240.0	**1,519.0**	1,449.3	180.0	23.0
08-Jan-01	1,578.0	0.7	1,578.7	63.5	12.2	65.5	1.3	142.4	242.8	**1,679.1**	1,496.9	418.0	103.0
09-Jan-01	2,564.0	0.4	2,564.4	23.6	11.4	33.0	1.3	69.3	240.5	**2,735.6**	1,462.9	211.0	107.0
10-Jan-01	1,676.0	0.7	1,676.7	54.7	10.6	166.0	1.3	232.7	239.3	**1,683.3**	1,478.3	496.0	139.0
11-Jan-01	1,192.0	0.7	1,192.7	102.4	10.3	466.0	1.3	580.0	244.6	**857.3**	1,468.8	1,482.0	132.0
12-Jan-01	1,631.0	0.7	1,631.7	181.5	11.4	402.4	1.3	596.5	241.4	**1,276.6**	1,453.9	1,528.0	43.3
13-Jan-01	2,013.0	0.7	2,013.7	143.6	11.4	528.2	1.3	684.5	239.4	**1,568.6**	1,430.6	1,709.0	267.0
14-Jan-01	2,595.0	0.7	2,595.7	128.1	14.5	1,102.7	1.3	1,246.6	241.7	**1,590.8**	1,425.2	3,633.0	173.0
15-Jan-01	3,576.0	0.7	3,576.7	183.2	18.6	742.5	1.3	945.6	243.6	**2,874.7**	1,477.3	2,502.0	65.0
16-Jan-01	3,245.0	2.1	3,247.1	212.5	15.7	468.5	1.3	698.0	243.5	**2,792.6**	1,461.6	1,716.0	(105.0)
17-Jan-01	2,908.0	0.7	2,908.7	127.2	13.1	410.3	1.3	551.8	239.2	**2,596.1**	1,462.3	1,403.0	24.0
18-Jan-01	2,330.0	0.7	2,330.7	78.4	13.3	376.5	1.3	469.5	237.8	**2,099.0**	1,458.5	1,122.0	50.0
19-Jan-01	1,982.0	0.8	1,982.8	91.9	12.5	375.1	1.3	480.8	240.4	**1,742.4**	1,452.7	1,310.0	86.0
20-Jan-01	2,292.0	0.7	2,292.7	129.8	12.3	380.9	1.3	524.2	241.0	**2,009.5**	1,449.9	1,406.0	9.0
21-Jan-01	2,120.0	0.7	2,120.7	128.1	12.4	423.7	1.3	565.5	242.6	**1,797.8**	1,446.5	1,499.0	110.0
22-Jan-01	1,786.0	0.7	1,786.7	196.3	12.8	346.4	1.3	556.8	243.9	**1,473.8**	1,455.6	1,274.0	24.3
23-Jan-01	1,976.0	0.7	1,976.7	157.8	12.0	435.1	1.3	606.2	242.8	**1,613.3**	1,459.5	1,501.0	10.0
24-Jan-01	1,455.0	0.7	1,455.7	196.3	11.8	290.7	1.3	500.1	238.5	**1,194.1**	1,430.8	1,285.0	18.0
25-Jan-01	2,209.0	0.7	2,209.7	191.9	12.0	203.9	1.3	409.1	238.5	**2,039.1**	1,427.4	1,008.0	203.0
26-Jan-01	1,490.0	0.7	1,490.7	23.6	11.7	73.2	1.3	109.8	236.2	**1,617.1**	1,435.3	330.0	28.7
27-Jan-01	1,967.0	0.7	1,967.7	103.1	11.7	95.6	1.3	211.7	238.9	**1,994.9**	1,434.7	700.0	186.0
28-Jan-01	1,619.0	0.7	1,619.7	49.7	13.3	57.3	1.3	121.6	239.0	**1,737.1**	1,432.1	365.0	120.0
29-Jan-01	2,535.0	0.7	2,535.7	50.3	21.4	1,235.2	1.3	1,308.2	253.1	**1,480.6**	1,431.0	5,015.0	61.0
30-Jan-01	4,672.0	3.9	4,675.9	125.2	29.4	672.9	1.3	828.8	243.6	**4,090.7**	1,431.7	3,890.0	36.0
31-Jan-01	3,820.0	0.7	3,820.7	212.9	19.3	373.3	1.3	606.7	237.1	**3,451.1**	1,450.7	2,234.0	(3.0)
Averages	2,180.7	0.8	2,181.5	102.9	13.6	318.6	1.3	436.4	240.9	**1,986.0**	1,455.0	1,258.3	68.1

Lake Michigan Diversion Accounting – WY 2001
February 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Feb-01	3,920.0	0.7	3,920.7	251.7	19.0	273.6	0.6	545.0	231.1	**3,606.8**	1,425.3	1,785.0	58.0
02-Feb-01	2,761.0	0.8	2,761.8	110.0	17.6	162.2	0.6	290.4	235.2	**2,706.6**	1,446.7	961.0	71.0
03-Feb-01	2,903.0	0.7	2,903.7	32.1	16.4	95.5	0.6	144.5	232.6	**2,991.8**	1,442.6	574.0	120.0
04-Feb-01	2,890.0	0.6	2,890.6	23.6	16.3	88.4	0.6	128.9	232.9	**2,994.6**	1,417.5	475.0	113.0
05-Feb-01	1,806.0	0.7	1,806.7	39.1	15.5	76.7	0.6	132.0	234.5	**1,909.2**	1,435.9	352.0	132.0
06-Feb-01	1,887.0	0.7	1,887.7	32.1	17.1	123.6	0.6	173.4	232.3	**1,946.6**	1,435.4	436.0	187.0
07-Feb-01	2,712.0	0.8	2,712.8	61.4	16.0	141.2	0.6	219.2	232.0	**2,725.6**	1,447.9	548.0	140.0
08-Feb-01	3,793.0	0.7	3,793.7	98.8	18.2	705.7	0.6	823.4	234.3	**3,204.6**	1,417.0	3,554.0	169.0
09-Feb-01	10,176.0	0.9	10,176.9	182.2	28.9	1,037.5	0.6	1,249.2	234.6	**9,162.3**	1,434.1	6,196.0	(24.0)
10-Feb-01	7,731.0	0.7	7,731.7	218.2	29.2	462.7	0.6	710.8	231.0	**7,251.9**	1,430.0	4,446.0	12.0
11-Feb-01	6,152.0	0.7	6,152.7	245.7	29.0	370.9	0.6	646.3	231.6	**5,738.0**	1,407.0	3,191.0	122.0
12-Feb-01	4,482.0	0.7	4,482.7	59.9	23.5	240.2	0.6	324.2	232.7	**4,391.2**	1,455.4	1,596.0	126.0
13-Feb-01	3,021.0	0.8	3,021.8	32.0	21.5	173.4	0.6	227.6	233.8	**3,028.0**	1,436.3	1,122.0	191.0
14-Feb-01	3,735.0	0.7	3,735.7	143.5	23.2	364.6	0.6	531.9	232.3	**3,436.1**	1,434.3	1,910.0	177.0
15-Feb-01	3,747.0	0.6	3,747.6	42.3	22.5	161.2	0.6	226.7	228.5	**3,749.4**	1,449.0	1,020.0	175.0
16-Feb-01	2,958.0	0.7	2,958.7	33.1	20.4	141.4	0.6	195.5	232.5	**2,995.7**	1,425.1	822.0	60.0
17-Feb-01	2,761.0	0.7	2,761.7	32.1	20.5	128.1	0.6	181.4	231.7	**2,812.0**	1,430.7	639.0	(76.0)
18-Feb-01	2,481.0	0.6	2,481.6	30.8	18.5	120.2	0.6	170.1	232.6	**2,544.1**	1,411.7	479.0	59.0
19-Feb-01	2,407.0	0.6	2,407.6	59.0	18.4	125.3	0.6	203.3	233.3	**2,437.6**	1,458.4	495.0	28.8
20-Feb-01	1,810.0	1.8	1,811.8	30.6	18.4	109.1	0.6	158.7	232.8	**1,885.9**	1,454.2	363.0	73.0
21-Feb-01	2,011.0	0.8	2,011.8	32.1	17.3	101.6	0.6	151.6	233.5	**2,093.7**	1,426.1	342.0	155.0
22-Feb-01	1,997.0	4.3	2,001.3	23.6	17.3	94.2	0.6	135.7	231.4	**2,097.0**	1,438.2	286.0	(10.0)
23-Feb-01	1,590.0	3.3	1,593.3	39.1	16.2	95.6	0.6	151.6	232.3	**1,674.0**	1,430.1	307.0	182.0
24-Feb-01	5,495.0	1.4	5,496.4	64.1	29.0	1,218.1	0.6	1,311.8	238.3	**4,422.9**	1,412.9	5,533.0	259.0
25-Feb-01	6,788.0	0.7	6,788.7	181.9	29.1	504.7	0.6	716.4	231.1	**6,303.4**	1,394.1	3,985.0	50.0
26-Feb-01	5,385.0	0.7	5,385.7	215.6	29.2	389.7	0.6	635.2	234.3	**4,984.8**	1,435.6	3,007.0	111.0
27-Feb-01	3,292.0	0.7	3,292.7	183.4	24.3	310.1	0.6	518.5	232.2	**3,006.4**	1,435.7	1,732.0	110.0
28-Feb-01	3,454.0	0.7	3,454.7	40.8	22.6	207.6	0.6	271.7	232.2	**3,415.2**	1,428.1	963.0	80.0
Averages	3,719.5	1.0	3,720.5	90.7	21.3	286.5	0.6	399.1	232.8	**3,554.2**	1,432.0	1,682.8	101.8

Lake Michigan Diversion Accounting – WY 2001
March 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Mar-01	2,703.0	0.6	2,703.6	26.4	20.4	177.5	0.9	225.2	220.5	**2,698.9**	1,428.9	696.0	145.0
02-Mar-01	2,492.0	0.5	2,492.5	29.2	19.1	162.0	0.9	211.2	222.7	**2,504.0**	1,419.4	577.0	154.0
03-Mar-01	2,368.0	0.7	2,368.7	31.1	19.5	150.5	0.9	201.9	222.3	**2,389.1**	1,427.9	511.0	94.0
04-Mar-01	2,347.0	0.5	2,347.5	37.6	18.5	143.1	0.9	200.1	221.7	**2,369.1**	1,387.3	467.0	116.0
05-Mar-01	1,892.0	0.7	1,892.7	51.1	18.5	138.6	0.9	209.1	223.1	**1,906.7**	1,436.4	456.0	183.0
06-Mar-01	1,498.0	4.4	1,502.4	23.6	18.3	119.8	0.9	162.6	220.6	**1,560.4**	1,432.6	337.0	175.0
07-Mar-01	2,237.0	5.5	2,242.5	42.9	19.4	120.7	0.9	183.8	224.4	**2,283.1**	1,439.7	373.0	192.0
08-Mar-01	1,794.0	4.2	1,798.2	23.6	16.3	106.6	0.9	147.4	223.3	**1,874.1**	1,444.5	339.0	143.0
09-Mar-01	2,015.0	4.9	2,019.9	32.1	17.4	103.3	0.9	153.6	222.7	**2,089.0**	1,434.2	322.0	233.0
10-Mar-01	1,883.0	5.0	1,888.0	30.6	16.5	98.8	0.9	146.8	222.3	**1,963.5**	1,420.3	272.0	230.0
11-Mar-01	1,963.0	4.1	1,967.1	52.0	18.5	184.7	0.9	256.0	225.9	**1,937.0**	1,428.8	607.0	87.0
12-Mar-01	2,404.0	4.2	2,408.2	114.8	18.5	302.7	0.9	436.9	225.2	**2,196.5**	1,425.2	1,012.0	37.7
13-Mar-01	1,594.0	2.4	1,596.4	49.1	17.2	124.9	0.9	192.1	224.0	**1,628.3**	1,410.4	410.0	345.0
14-Mar-01	2,237.0	1.1	2,238.1	42.5	16.3	110.0	0.9	169.7	222.9	**2,291.3**	1,433.6	365.0	191.0
15-Mar-01	2,270.0	0.5	2,270.5	153.0	20.3	541.8	0.9	716.0	225.4	**1,779.9**	1,389.6	1,909.0	122.0
16-Mar-01	3,575.0	0.5	3,575.5	178.4	23.3	593.1	0.9	795.7	223.8	**3,003.6**	1,405.1	2,692.0	93.0
17-Mar-01	3,986.0	0.7	3,986.7	121.3	24.4	462.2	0.9	608.7	223.4	**3,601.4**	1,395.1	1,841.0	208.0
18-Mar-01	3,560.0	0.8	3,560.8	136.4	23.6	332.5	0.9	493.3	223.9	**3,291.4**	1,408.6	1,403.0	457.0
19-Mar-01	3,020.0	0.7	3,020.7	86.9	21.4	292.3	0.9	401.5	232.1	**2,851.3**	1,381.7	1,222.0	432.0
20-Mar-01	3,077.0	0.7	3,077.7	51.8	20.3	227.4	0.9	300.4	226.2	**3,003.5**	1,471.2	904.0	321.0
21-Mar-01	2,956.0	0.8	2,956.8	23.6	20.2	180.8	0.9	225.5	224.2	**2,955.5**	1,407.0	713.0	176.0
22-Mar-01	2,426.0	0.9	2,426.9	38.6	20.3	168.5	0.9	228.3	222.5	**2,421.1**	1,425.1	654.0	262.0
23-Mar-01	2,722.0	0.8	2,722.8	23.6	19.5	149.2	0.9	193.2	222.0	**2,751.6**	1,410.1	514.0	403.0
24-Mar-01	2,520.0	0.6	2,520.6	60.7	17.2	153.7	0.9	232.5	222.6	**2,510.7**	1,396.7	527.0	217.0
25-Mar-01	1,749.0	0.7	1,749.7	29.9	16.7	131.5	0.9	178.9	223.1	**1,793.9**	1,397.3	379.0	167.0
26-Mar-01	2,024.0	0.6	2,024.6	31.4	16.8	122.4	0.9	171.5	224.7	**2,077.8**	1,426.4	343.0	217.0
27-Mar-01	1,819.0	0.7	1,819.7	23.6	16.2	112.5	0.9	153.1	221.5	**1,888.1**	1,423.6	284.0	127.0
28-Mar-01	1,969.0	0.6	1,969.6	39.6	16.1	111.6	0.9	168.2	223.4	**2,024.8**	1,411.4	303.0	85.0
29-Mar-01	1,685.0	2.1	1,687.1	23.6	16.2	97.6	0.9	138.2	220.7	**1,769.6**	1,397.8	241.0	584.0
30-Mar-01	1,528.0	3.1	1,531.1	49.2	16.1	103.1	0.9	169.2	223.6	**1,585.5**	1,393.6	289.0	730.0
31-Mar-01	2,302.0	6.7	2,308.7	38.4	15.2	95.0	0.9	149.4	220.1	**2,379.4**	1,361.5	281.0	358.0
Averages	2,342.4	1.9	2,344.3	54.7	18.6	190.9	0.9	265.1	223.4	**2,302.6**	1,415.2	685.3	235.0

Lake Michigan Diversion Accounting – WY 2001
April 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Apr-01	1,644.0	9.0	1,653.0	23.6	14.9	80.5	0.9	119.8	237.4	**1,770.6**	1,342.2	222.0	275.0
02-Apr-01	1,788.0	3.9	1,791.9	38.3	15.8	80.9	0.9	135.9	239.8	**1,895.8**	1,430.1	245.0	168.0
03-Apr-01	1,611.0	0.7	1,611.7	23.6	15.7	70.7	0.9	110.9	240.6	**1,741.4**	1,413.5	191.0	191.0
04-Apr-01	1,839.0	6.0	1,845.0	23.6	14.2	66.4	0.9	105.0	240.6	**1,980.6**	1,424.9	181.0	6.0
05-Apr-01	2,160.0	4.0	2,164.0	58.3	16.5	263.0	0.9	338.6	242.2	**2,067.6**	1,429.5	992.0	196.0
06-Apr-01	3,260.0	7.3	3,267.3	166.4	22.6	437.7	0.9	627.6	240.9	**2,880.6**	1,408.9	2,404.0	369.0
07-Apr-01	3,079.0	0.5	3,079.5	181.2	15.7	227.6	0.9	425.3	240.0	**2,894.2**	1,432.5	815.0	427.0
08-Apr-01	2,328.0	1.4	2,329.4	90.9	13.9	143.7	0.9	249.5	240.9	**2,320.8**	1,414.2	482.0	277.0
09-Apr-01	2,416.0	1.4	2,417.4	39.6	16.3	160.6	0.9	217.3	241.8	**2,441.9**	1,432.0	599.0	212.0
10-Apr-01	2,590.0	1.0	2,591.0	23.6	14.6	88.6	0.9	127.6	240.8	**2,704.2**	1,430.0	288.0	248.0
11-Apr-01	2,308.0	2.1	2,310.1	37.8	14.2	340.2	0.9	393.1	239.4	**2,156.4**	1,424.2	1,017.0	333.0
12-Apr-01	3,356.0	1.6	3,357.6	220.4	15.4	199.0	0.9	435.7	239.4	**3,161.3**	1,403.4	1,055.0	386.0
13-Apr-01	1,726.0	1.9	1,727.9	23.6	12.8	89.9	0.9	127.2	238.9	**1,839.6**	1,418.8	394.0	149.3
14-Apr-01	2,167.0	2.8	2,169.8	31.2	13.5	84.1	0.9	129.6	240.6	**2,280.8**	1,468.6	315.0	189.0
15-Apr-01	4,142.0	2.2	4,144.2	144.6	30.0	600.8	0.9	776.2	241.7	**3,609.7**	1,365.6	2,328.0	111.0
16-Apr-01	2,753.0	1.5	2,754.5	164.3	16.8	172.9	0.9	354.9	241.0	**2,640.6**	1,392.3	895.0	253.0
17-Apr-01	2,131.0	0.8	2,131.8	40.7	16.5	110.3	0.9	168.4	240.2	**2,203.6**	1,402.9	429.0	199.0
18-Apr-01	2,396.0	0.5	2,396.5	34.3	14.9	101.2	0.9	151.2	240.7	**2,486.0**	1,427.6	334.0	170.0
19-Apr-01	1,992.0	1.6	1,993.6	29.2	14.7	89.9	0.9	134.7	241.4	**2,100.3**	1,446.0	306.0	140.0
20-Apr-01	3,030.0	0.6	3,030.6	136.2	20.0	314.1	0.9	471.1	240.0	**2,799.5**	1,422.7	1,347.0	406.0
21-Apr-01	4,098.0	0.8	4,098.8	155.8	24.8	478.1	0.9	659.6	245.5	**3,684.7**	1,441.0	2,196.0	579.0
22-Apr-01	4,013.0	0.6	4,013.6	241.1	21.2	291.7	0.9	554.9	242.5	**3,701.2**	1,372.1	1,627.0	139.2
23-Apr-01	3,659.0	0.6	3,659.6	80.1	20.1	159.1	0.9	260.2	241.8	**3,641.2**	1,432.9	921.0	420.0
24-Apr-01	2,648.0	0.6	2,648.6	23.6	16.2	107.2	0.9	147.9	242.2	**2,742.9**	1,417.6	712.0	175.0
25-Apr-01	2,590.0	0.5	2,590.5	32.0	15.5	99.7	0.9	148.1	239.1	**2,681.5**	1,443.3	460.0	179.0
26-Apr-01	2,250.0	0.7	2,250.7	59.1	15.6	105.9	0.9	181.4	240.2	**2,309.5**	1,464.5	415.0	326.0
27-Apr-01	1,817.0	0.7	1,817.7	23.6	15.5	81.2	0.9	121.2	241.9	**1,938.4**	1,444.1	289.0	179.0
28-Apr-01	2,081.0	1.8	2,082.8	32.1	15.0	77.2	0.9	125.1	240.1	**2,197.8**	1,460.2	278.0	174.0
29-Apr-01	2,032.0	2.9	2,034.9	39.1	13.9	75.9	0.9	129.8	243.8	**2,148.9**	1,499.4	258.0	138.0
30-Apr-01	1,697.0	3.6	1,700.6	32.1	15.7	65.1	0.9	113.8	244.4	**1,831.2**	1,537.5	226.0	327.0
Averages	2,520.0	2.1	2,522.1	75.0	16.7	175.4	0.9	268.0	241.0	**2,495.1**	1,428.1	740.7	244.7

Lake Michigan Diversion Accounting – WY 2001
May 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-May-01	1,935.0	5.3	1,940.3	23.6	15.6	57.1	1.0	97.2	265.1	**2,108.2**	1,564.2	183.0	556.0
02-May-01	1,937.0	4.1	1,941.1	39.2	14.6	59.5	1.0	114.3	265.7	**2,092.5**	1,587.7	200.0	393.0
03-May-01	1,862.0	5.4	1,867.4	32.0	14.4	50.0	1.0	97.4	265.3	**2,035.3**	1,631.0	173.0	566.0
04-May-01	1,713.0	0.9	1,713.9	43.1	13.7	52.6	1.0	110.3	267.0	**1,870.6**	1,537.2	176.0	172.0
05-May-01	1,707.0	3.5	1,710.5	33.5	15.6	44.8	1.0	94.8	261.9	**1,877.6**	1,471.0	147.0	180.0
06-May-01	1,779.0	3.6	1,782.6	29.2	14.1	105.7	1.0	149.9	266.2	**1,898.9**	1,488.1	164.0	133.0
07-May-01	2,127.0	4.1	2,131.1	90.5	15.4	158.9	1.0	265.8	266.3	**2,131.6**	1,492.5	559.0	318.0
08-May-01	1,729.0	4.3	1,733.3	23.6	13.8	41.9	1.0	80.2	261.1	**1,914.2**	1,503.9	130.0	333.0
09-May-01	1,785.0	4.5	1,789.5	36.7	13.6	44.2	1.0	95.4	262.3	**1,956.4**	1,565.8	158.0	285.0
10-May-01	2,041.0	4.1	2,045.1	32.0	13.4	80.7	1.0	127.0	264.1	**2,182.2**	1,531.7	218.0	420.0
11-May-01	2,761.0	3.0	2,764.0	169.7	15.0	398.6	1.0	584.3	262.1	**2,441.8**	1,479.4	1,886.0	358.0
12-May-01	2,953.0	3.4	2,956.4	159.9	13.3	117.3	1.0	291.4	258.1	**2,923.1**	1,435.7	976.0	273.0
13-May-01	2,471.0	3.7	2,474.7	31.2	11.2	51.4	1.0	94.7	260.8	**2,640.8**	1,454.2	443.0	271.0
14-May-01	2,763.0	4.1	2,767.1	105.9	16.6	85.1	1.0	208.6	262.7	**2,821.2**	1,480.2	978.0	216.0
15-May-01	1,923.0	4.3	1,927.3	60.7	13.2	59.4	1.0	134.2	262.5	**2,055.6**	1,571.4	610.0	484.0
16-May-01	2,796.0	4.8	2,800.8	99.1	19.3	80.8	1.0	200.2	265.4	**2,866.0**	1,601.9	1,089.0	446.0
17-May-01	2,472.0	5.5	2,477.5	36.9	13.2	46.9	1.0	98.0	262.0	**2,641.5**	1,579.9	414.0	420.0
18-May-01	2,114.0	6.9	2,120.9	23.6	12.6	33.4	1.0	70.5	264.6	**2,315.0**	1,572.9	254.0	482.0
19-May-01	1,931.0	6.7	1,937.7	32.0	12.3	33.1	1.0	78.4	265.6	**2,124.9**	1,613.5	222.0	350.0
20-May-01	1,896.0	4.6	1,900.6	30.7	12.6	31.2	1.0	75.5	265.1	**2,090.2**	1,608.9	171.0	328.0
21-May-01	2,276.0	4.0	2,280.0	74.0	24.2	200.8	1.0	299.8	267.7	**2,247.9**	1,533.7	772.0	306.0
22-May-01	2,172.0	4.5	2,176.5	29.9	13.3	38.5	1.0	82.7	260.9	**2,354.7**	1,498.1	215.0	460.0
23-May-01	2,036.0	2.7	2,038.7	40.7	13.1	72.7	1.0	127.3	258.4	**2,169.8**	1,458.8	340.0	299.0
24-May-01	2,076.0	4.8	2,080.8	102.9	14.2	117.7	1.0	235.8	262.5	**2,107.5**	1,471.7	771.0	270.0
25-May-01	2,637.0	3.2	2,640.2	84.2	22.9	165.7	1.0	273.8	260.0	**2,626.4**	1,456.0	772.0	383.0
26-May-01	3,944.0	3.6	3,947.6	97.7	27.7	986.7	1.0	1,115.0	265.1	**3,097.7**	1,413.9	4,170.0	297.0
27-May-01	6,237.0	0.8	6,237.8	190.2	33.1	333.5	1.0	557.7	257.2	**5,937.3**	1,374.5	2,753.0	452.0
28-May-01	3,338.0	1.6	3,339.6	249.9	19.1	205.0	1.0	475.0	259.4	**3,124.0**	1,422.5	1,447.0	347.0
29-May-01	3,050.0	3.1	3,053.1	122.4	18.4	141.0	1.0	282.8	262.7	**3,033.0**	1,465.1	797.0	384.0
30-May-01	2,790.0	1.5	2,791.5	42.4	16.0	93.6	1.0	153.0	262.2	**2,900.7**	1,475.5	462.0	388.0
31-May-01	2,774.0	1.7	2,775.7	49.1	18.8	520.4	1.0	589.3	262.9	**2,449.3**	1,472.7	1,363.0	199.0
Averages	2,452.4	3.8	2,456.2	71.5	16.3	145.5	1.0	234.3	263.0	**2,484.9**	1,510.1	742.4	347.4

Lake Michigan Diversion Accounting – WY 2001
June 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Jun-01	4,002.0	0.7	4,002.7	181.8	23.0	356.7	1.0	562.5	290.7	**3,730.9**	1,425.4	1,707.0	225.0
02-Jun-01	3,379.0	1.4	3,380.4	196.0	17.8	227.3	1.0	442.2	286.5	**3,224.7**	1,438.8	1,266.0	508.0
03-Jun-01	3,011.0	1.7	3,012.7	23.6	17.1	113.0	1.0	154.7	284.7	**3,142.7**	1,388.8	518.0	452.0
04-Jun-01	2,490.0	1.7	2,491.7	42.2	17.3	110.8	1.0	171.2	287.7	**2,608.2**	1,459.9	439.0	385.0
05-Jun-01	4,354.0	1.2	4,355.2	98.3	36.3	548.8	1.0	684.4	291.9	**3,962.7**	1,468.5	2,723.0	370.0
06-Jun-01	3,604.0	0.8	3,604.8	230.5	29.8	221.0	1.0	482.3	286.3	**3,408.8**	1,450.4	1,738.0	419.0
07-Jun-01	3,145.0	0.9	3,145.9	80.5	23.8	140.6	1.0	245.9	286.5	**3,186.5**	1,477.1	915.0	477.0
08-Jun-01	2,662.0	2.3	2,664.3	34.2	23.2	113.7	1.0	172.1	286.8	**2,779.0**	1,516.3	571.0	440.0
09-Jun-01	2,730.0	2.0	2,732.0	32.1	19.4	102.2	1.0	154.8	291.4	**2,868.6**	1,555.4	449.0	474.0
10-Jun-01	2,274.0	2.6	2,276.6	23.6	17.8	91.3	1.0	133.7	290.0	**2,432.9**	1,568.7	350.0	523.0
11-Jun-01	2,936.0	5.2	2,941.2	85.9	20.1	149.5	1.0	256.6	296.5	**2,981.1**	1,738.0	767.0	515.0
12-Jun-01	5,698.0	6.7	5,704.7	162.5	37.8	513.4	1.0	714.7	297.1	**5,287.1**	1,617.4	3,143.0	1,325.0
13-Jun-01	3,303.0	5.3	3,308.3	230.0	27.8	190.4	1.0	449.2	293.6	**3,152.7**	1,736.6	1,337.0	593.0
14-Jun-01	3,500.0	7.4	3,507.4	149.2	22.8	305.6	1.0	478.6	294.4	**3,323.2**	1,788.7	1,260.0	614.0
15-Jun-01	3,257.0	4.9	3,261.9	47.3	20.7	106.1	1.0	175.1	295.5	**3,382.3**	1,652.1	581.0	1,035.0
16-Jun-01	2,838.0	5.6	2,843.6	23.6	17.5	81.6	1.0	123.7	290.7	**3,010.6**	1,655.4	366.0	504.0
17-Jun-01	2,596.0	4.7	2,600.7	66.9	19.0	98.8	1.0	185.8	292.5	**2,707.4**	1,648.9	423.0	411.0
18-Jun-01	2,597.0	6.5	2,603.5	68.9	18.2	125.5	1.0	213.7	297.8	**2,687.6**	1,671.8	598.0	927.0
19-Jun-01	2,017.0	9.5	2,026.5	31.7	17.2	69.0	1.0	118.9	293.1	**2,200.7**	1,737.8	290.0	547.0
20-Jun-01	2,418.0	9.6	2,427.6	23.6	19.0	61.1	1.0	104.6	291.3	**2,614.3**	1,697.0	206.0	469.0
21-Jun-01	2,684.0	8.3	2,692.3	110.5	36.8	274.4	1.0	422.8	294.1	**2,563.6**	1,594.4	1,258.0	476.0
22-Jun-01	2,179.0	6.3	2,185.3	52.1	21.3	73.5	1.0	147.9	292.6	**2,330.0**	1,566.7	347.0	538.0
23-Jun-01	2,151.0	6.5	2,157.5	30.5	18.8	63.4	1.0	113.7	292.0	**2,335.8**	1,595.7	216.0	556.0
24-Jun-01	2,263.0	7.2	2,270.2	32.0	17.5	57.9	1.0	108.4	294.6	**2,456.4**	1,652.5	199.0	520.0
25-Jun-01	2,019.0	7.0	2,026.0	29.5	18.2	53.6	1.0	102.3	303.1	**2,226.8**	1,825.2	164.0	511.0
26-Jun-01	1,984.0	3.4	1,987.4	23.6	18.1	46.5	1.0	89.1	306.9	**2,205.2**	1,923.8	127.0	535.0
27-Jun-01	1,970.0	1.1	1,971.1	31.8	20.0	45.0	1.0	97.8	305.0	**2,178.3**	1,989.9	142.0	509.0
28-Jun-01	2,132.0	1.4	2,133.4	32.4	21.1	43.3	1.0	97.8	308.9	**2,344.5**	2,024.4	124.0	526.0
29-Jun-01	1,956.0	2.7	1,958.7	48.2	22.1	49.5	1.0	120.8	310.5	**2,148.4**	2,069.8	178.0	507.0
30-Jun-01	2,184.0	1.8	2,185.8	39.5	22.1	38.9	1.0	101.5	310.2	**2,394.5**	2,072.9	137.0	571.0
Averages	2,811.1	4.2	2,815.3	75.4	22.1	149.1	1.0	247.6	294.8	**2,862.5**	1,666.9	751.3	548.7

Lake Michigan Diversion Accounting – WY 2001
July 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Jul-01	2,375.0	1.8	2,376.8	23.6	23.5	29.6	1.0	77.7	352.4	**2,651.5**	1,862.3	85.0	1,095.0
02-Jul-01	2,179.0	3.4	2,182.4	23.6	22.7	28.7	1.0	75.9	352.1	**2,458.6**	1,866.0	77.0	691.0
03-Jul-01	2,582.0	4.0	2,586.0	135.8	32.7	421.3	1.0	590.8	349.2	**2,344.4**	1,758.0	1,109.0	521.0
04-Jul-01	2,530.0	4.9	2,534.9	68.4	23.6	47.9	1.0	140.9	354.9	**2,748.9**	1,831.8	315.0	664.0
05-Jul-01	2,301.0	7.1	2,308.1	29.4	21.9	33.6	1.0	85.9	359.4	**2,581.6**	1,837.0	119.0	722.0
06-Jul-01	2,357.0	7.0	2,364.0	23.6	21.2	28.0	1.0	73.8	356.4	**2,646.6**	1,889.1	78.0	607.0
07-Jul-01	3,195.0	4.1	3,199.1	157.3	23.1	215.5	1.0	396.9	347.7	**3,149.9**	1,698.9	1,358.0	685.0
08-Jul-01	2,545.0	6.0	2,551.0	167.4	22.2	97.8	1.0	288.3	341.2	**2,603.9**	1,737.8	549.0	643.0
09-Jul-01	2,384.0	7.1	2,391.1	29.9	25.0	29.7	1.0	85.6	350.2	**2,655.7**	1,965.4	135.0	753.0
10-Jul-01	2,477.0	5.3	2,482.3	29.4	27.2	25.9	1.0	83.5	357.8	**2,756.6**	2,100.6	98.0	775.0
11-Jul-01	2,352.0	6.9	2,358.9	23.6	27.0	21.6	1.0	73.2	356.0	**2,641.7**	2,072.2	64.0	553.0
12-Jul-01	2,122.0	3.8	2,125.8	30.2	26.0	22.8	1.0	79.9	356.4	**2,402.3**	2,074.3	65.0	580.0
13-Jul-01	2,143.0	4.5	2,147.5	29.2	27.5	19.5	1.0	77.2	359.2	**2,429.5**	2,069.8	64.0	593.0
14-Jul-01	2,013.0	3.6	2,016.6	50.6	26.5	28.7	1.0	106.8	361.0	**2,270.8**	2,111.7	105.0	530.0
15-Jul-01	2,267.0	4.5	2,271.5	33.2	27.1	18.7	1.0	80.0	363.1	**2,554.6**	2,121.0	63.0	567.0
16-Jul-01	2,281.0	4.1	2,285.1	32.0	28.2	15.1	1.0	76.3	367.4	**2,576.2**	2,213.6	64.0	646.0
17-Jul-01	2,338.0	5.8	2,343.8	92.0	37.0	68.1	1.0	198.1	359.0	**2,504.7**	2,074.7	388.0	658.0
18-Jul-01	2,584.0	4.3	2,588.3	37.9	33.6	17.8	1.0	90.3	342.3	**2,840.3**	1,915.4	219.0	576.0
19-Jul-01	2,260.0	4.7	2,264.7	23.6	28.7	10.5	1.0	63.8	344.2	**2,545.1**	1,987.4	74.0	637.0
20-Jul-01	2,493.0	4.7	2,497.7	23.6	27.4	11.8	1.0	63.8	352.0	**2,785.9**	2,114.2	52.0	715.0
21-Jul-01	2,792.0	7.2	2,799.2	51.2	39.3	279.4	1.0	370.8	355.0	**2,783.4**	2,128.3	1,535.0	565.0
22-Jul-01	4,092.0	4.1	4,096.1	127.2	40.0	134.9	1.0	303.1	355.7	**4,148.7**	1,925.5	1,971.0	582.0
23-Jul-01	5,048.0	4.1	5,052.1	238.7	44.5	350.1	1.0	634.3	344.0	**4,761.8**	1,770.8	2,858.0	548.0
24-Jul-01	4,141.0	5.1	4,146.1	246.8	44.1	284.8	1.0	576.7	340.5	**3,909.9**	1,790.4	1,495.0	743.0
25-Jul-01	6,934.0	1.8	6,935.8	123.5	44.4	1,276.2	1.0	1,445.1	346.6	**5,837.3**	1,653.5	5,041.0	678.0
26-Jul-01	4,130.0	4.0	4,134.0	218.1	36.2	289.7	1.0	545.0	340.9	**3,929.9**	1,686.4	1,154.0	693.0
27-Jul-01	3,658.0	4.1	3,662.1	235.0	28.9	215.9	1.0	480.9	344.2	**3,525.4**	1,748.2	961.0	542.0
28-Jul-01	3,454.0	3.8	3,457.8	88.6	26.2	114.6	1.0	230.4	344.5	**3,571.9**	1,746.5	452.0	537.0
29-Jul-01	2,812.0	4.4	2,816.4	31.4	26.0	63.7	1.0	122.1	347.6	**3,041.9**	1,824.8	215.0	655.0
30-Jul-01	2,384.0	5.7	2,389.7	23.6	27.5	48.7	1.0	100.8	354.6	**2,643.5**	2,053.5	147.0	663.0
31-Jul-01	2,456.0	4.8	2,460.8	29.2	29.0	43.6	1.0	102.8	353.9	**2,711.9**	2,149.9	138.0	639.0
Averages	2,892.9	4.7	2,897.6	79.9	29.6	138.5	1.0	249.0	351.9	**3,000.5**	1,928.4	679.0	647.0

Lake Michigan Diversion Accounting – WY 2001
August 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01-Aug-01	2,819.0	5.4	2,824.4	33.8	28.2	38.8	0.7	101.5	332.3	**3,055.2**	2,214.5	142.0	554.0
02-Aug-01	11,087.0	1.9	11,088.9	108.2	43.9	2,508.2	0.7	2,660.9	326.8	**8,754.8**	1,831.9	13,765.0	130.0
03-Aug-01	5,569.0	1.5	5,570.5	192.3	40.0	612.8	0.7	845.8	314.6	**5,039.3**	1,765.6	2,489.0	278.0
04-Aug-01	3,479.0	1.2	3,480.2	165.4	27.6	381.4	0.7	575.0	315.0	**3,220.2**	1,798.6	1,337.0	597.0
05-Aug-01	3,505.0	1.4	3,506.4	114.0	27.2	249.1	0.7	391.1	319.7	**3,435.0**	1,876.9	768.0	611.0
06-Aug-01	3,231.0	1.9	3,232.9	31.9	28.1	133.3	0.7	194.0	325.2	**3,364.1**	2,055.9	384.0	724.0
07-Aug-01	2,671.0	2.5	2,673.5	67.3	26.5	130.6	0.7	225.1	330.4	**2,778.8**	2,099.3	645.0	638.0
08-Aug-01	2,717.0	5.0	2,722.0	46.7	26.3	81.5	0.7	155.2	330.9	**2,897.7**	2,149.4	279.0	769.0
09-Aug-01	3,794.0	5.8	3,799.8	33.5	25.7	259.0	0.7	319.0	336.0	**3,816.8**	2,109.4	953.0	897.0
10-Aug-01	3,080.0	4.5	3,084.5	195.3	33.0	166.2	0.7	395.2	319.2	**3,008.5**	1,816.3	1,121.0	643.0
11-Aug-01	3,628.0	3.6	3,631.6	69.1	24.4	78.9	0.7	173.1	311.5	**3,770.0**	1,790.1	457.0	582.0
12-Aug-01	2,814.0	3.9	2,817.9	38.8	20.3	57.6	0.7	117.5	318.7	**3,019.1**	1,825.7	259.0	536.0
13-Aug-01	2,875.0	4.0	2,879.0	23.6	19.9	77.4	0.7	121.6	320.5	**3,077.9**	1,833.6	182.0	679.0
14-Aug-01	2,351.0	6.0	2,357.0	23.6	16.9	44.8	0.7	86.1	315.9	**2,586.8**	1,850.8	136.0	573.0
15-Aug-01	2,468.0	3.2	2,471.2	51.7	15.4	53.6	0.7	121.5	318.7	**2,668.4**	1,791.1	197.0	530.0
16-Aug-01	3,386.0	1.0	3,387.0	160.2	23.5	518.7	0.7	703.1	313.5	**2,997.4**	1,636.7	2,079.0	648.0
17-Aug-01	2,719.0	5.4	2,724.4	175.8	16.7	123.9	0.7	317.1	311.8	**2,719.1**	1,659.2	688.0	681.0
18-Aug-01	4,140.0	5.1	4,145.1	92.7	23.7	180.0	0.7	297.2	311.0	**4,158.9**	1,643.7	1,101.0	685.0
19-Aug-01	4,078.0	4.2	4,082.2	141.0	24.7	268.0	0.7	434.5	310.2	**3,957.9**	1,531.9	1,311.0	1,414.0
20-Aug-01	2,996.0	4.3	3,000.3	23.6	18.0	61.8	0.7	104.2	310.0	**3,206.1**	1,599.0	558.0	759.0
21-Aug-01	3,104.0	4.6	3,108.6	31.3	15.2	56.2	0.7	103.4	311.8	**3,317.0**	1,661.0	394.0	606.0
22-Aug-01	2,672.0	1.3	2,673.3	63.6	15.8	137.2	0.7	217.2	313.7	**2,769.8**	1,630.2	964.0	753.0
23-Aug-01	3,343.0	1.2	3,344.2	202.2	13.0	208.6	0.7	424.6	311.1	**3,230.7**	1,649.6	1,357.0	793.0
24-Aug-01	4,026.0	1.1	4,027.1	109.5	14.2	153.1	0.7	277.5	308.7	**4,058.3**	1,648.9	1,047.0	777.0
25-Aug-01	8,587.0	1.1	8,588.1	112.5	27.6	953.2	0.7	1,094.1	316.1	**7,810.1**	1,568.2	5,812.0	727.0
26-Aug-01	4,685.0	1.2	4,686.2	211.7	21.5	296.4	0.7	530.3	309.3	**4,465.2**	1,577.2	1,875.0	1,091.0
27-Aug-01	3,860.0	1.2	3,861.2	234.8	13.6	277.3	0.7	526.3	313.7	**3,648.6**	1,643.1	1,605.0	863.0
28-Aug-01	3,733.0	1.2	3,734.2	179.8	12.3	215.0	0.7	407.8	310.2	**3,636.6**	1,665.8	889.0	790.0
29-Aug-01	3,253.0	1.1	3,254.1	82.0	10.8	115.3	0.7	158.8	309.7	**3,405.0**	1,679.0	377.0	662.0
30-Aug-01	3,330.0	1.0	3,331.0	40.2	11.5	349.6	0.7	402.0	314.1	**3,243.1**	1,683.0	2,324.0	391.0
31-Aug-01	7,488.0	2.0	7,490.0	159.6	22.7	508.8	0.7	691.7	318.5	**7,116.8**	1,646.3	3,843.0	877.0
Averages	3,919.0	2.9	3,921.9	102.1	22.2	299.9	0.7	424.9	317.1	**3,814.1**	1,772.0	1,591.5	685.7

Lake Michigan Diversion Accounting – WY 2001
September 2001 – Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 2001	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	**TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS**	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Sep-01	3,277.0	0.8	3,277.8	338.3	12.4	330.7	0.6	682.0	267.6	**2,863.4**	1,566.8	1,414.0	611.0
02-Sep-01	2,699.0	1.8	2,700.8	148.6	11.9	218.9	0.6	379.9	264.4	**2,585.3**	1,542.4	698.0	502.0
03-Sep-01	3,379.0	1.6	3,380.6	35.0	11.8	142.7	0.6	190.1	268.1	**3,458.6**	1,638.2	350.0	535.0
04-Sep-01	2,878.0	1.1	2,879.1	29.2	11.9	121.3	0.6	163.0	270.2	**2,986.3**	1,673.5	291.0	693.0
05-Sep-01	3,033.0	1.8	3,034.8	23.6	11.7	102.0	0.6	137.9	268.9	**3,165.8**	1,659.3	234.0	606.0
06-Sep-01	3,602.0	1.3	3,603.3	54.7	17.6	437.1	0.6	510.0	271.3	**3,364.6**	1,692.0	1,021.0	595.0
07-Sep-01	3,199.0	1.4	3,200.4	203.7	34.8	286.8	0.6	526.0	265.1	**2,939.5**	1,602.0	1,817.0	455.0
08-Sep-01	3,102.0	1.8	3,103.8	160.0	11.0	165.8	0.6	337.5	263.7	**3,030.0**	1,605.9	633.0	367.0
09-Sep-01	4,099.0	1.8	4,100.8	109.3	22.8	430.1	0.6	562.7	268.6	**3,806.7**	1,541.3	1,440.0	976.0
10-Sep-01	3,025.0	0.8	3,025.8	81.0	18.0	129.4	0.6	229.0	263.7	**3,060.5**	1,549.0	456.0	733.0
11-Sep-01	2,686.0	1.2	2,687.2	23.6	11.9	93.1	0.6	129.2	262.1	**2,820.1**	1,553.5	233.0	800.0
12-Sep-01	2,571.0	0.9	2,571.9	40.8	11.3	92.7	0.6	145.5	260.2	**2,686.6**	1,639.9	247.0	768.0
13-Sep-01	2,484.0	1.0	2,485.0	23.6	10.9	79.0	0.6	114.1	263.0	**2,633.9**	1,581.0	176.0	745.0
14-Sep-01	2,494.0	1.2	2,495.2	32.0	10.5	75.9	0.6	119.0	264.8	**2,641.0**	1,564.5	183.0	673.0
15-Sep-01	2,299.0	1.4	2,300.4	60.3	9.8	85.7	0.6	156.5	260.4	**2,404.3**	1,558.8	228.0	613.0
16-Sep-01	2,220.0	0.7	2,220.7	31.2	10.9	67.4	0.6	110.1	264.6	**2,375.2**	1,570.2	153.0	534.0
17-Sep-01	2,423.0	1.2	2,424.2	36.4	15.1	80.0	0.6	132.1	267.9	**2,560.0**	1,563.6	329.0	587.0
18-Sep-01	3,260.0	2.3	3,262.3	90.8	24.3	496.2	0.6	611.9	265.8	**2,916.2**	1,551.3	1,092.0	865.0
19-Sep-01	7,364.0	0.9	7,364.9	160.0	35.7	847.5	0.6	1,043.9	267.7	**6,588.7**	1,526.8	5,501.0	929.0
20-Sep-01	4,596.0	2.0	4,598.0	237.1	15.6	375.6	0.6	629.0	263.7	**4,232.7**	1,502.8	3,027.0	620.0
21-Sep-01	6,899.0	0.9	6,899.9	137.9	10.3	359.2	0.6	508.0	264.0	**6,655.9**	1,529.5	2,517.0	490.0
22-Sep-01	4,103.0	1.8	4,104.8	179.4	9.8	255.4	0.6	445.3	262.1	**3,921.6**	1,483.6	1,339.0	726.0
23-Sep-01	6,369.0	1.9	6,370.9	177.2	26.6	626.5	0.6	830.9	264.7	**5,804.7**	1,453.4	2,844.0	1,262.0
24-Sep-01	4,571.0	0.7	4,571.7	226.1	36.8	296.3	0.6	559.8	261.6	**4,273.5**	1,470.6	1,694.0	320.0
25-Sep-01	3,452.0	0.4	3,452.4	131.8	30.2	225.0	0.6	387.6	260.3	**3,325.1**	1,449.0	1,231.0	142.0
26-Sep-01	3,487.0	1.9	3,488.9	31.9	16.4	150.5	0.6	199.5	260.7	**3,550.1**	1,453.0	741.0	617.0
27-Sep-01	4,369.0	2.2	4,371.2	38.0	15.3	133.7	0.6	187.6	260.7	**4,444.3**	1,486.4	577.0	1,439.0
28-Sep-01	3,791.0	0.8	3,791.8	60.1	13.9	131.8	0.6	206.4	260.6	**3,846.0**	1,463.7	535.0	1,157.0
29-Sep-01	4,012.0	2.4	4,014.4	33.0	14.2	109.7	0.6	157.6	258.5	**4,115.3**	1,496.5	397.0	1,083.0
30-Sep-01	3,712.0	3.0	3,715.0	41.8	13.0	104.5	0.6	159.9	260.0	**3,815.1**	1,466.2	371.0	949.0
Averages	3,648.5	1.4	3,649.9	99.2	16.9	235.0	0.6	351.7	264.2	**3,562.4**	1,547.8	1,059.0	713.1

5161 0846 1
12/07/05 50 MAR