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Rock River Basin Streamflow Assessment Model

by

H. Vernon Knapp and Amy M. Russell

Prepared for the
Illinois Department of Natural Resources
Office of Water Resources

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Illinois State Water Survey
Watershed Science Section
Champaign, Illinois

A Division of the Illinois Department of Natural Resources

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Abstract

The Illinois Streamflow Assessment Model (ILSAM) is an analytical and information tool developed to predict the frequency of streamflows, and water-use impacts on streamflows, for every stream in selected major watersheds in Illinois. Streamflow frequency predictions produced by the model are useful for evaluating in-stream flow levels for the protection of aquatic habitat, providing streamflow estimates for water-quality analyses and regulations, evaluating drought and its impact on water supplies, and classifying Illinois streams by their hydrologic character for use in watershed management.

The current version of ILSAM was developed to operate on a personal computer having a Microsoft Windows 98/2000/XP operating system. The model user can obtain streamflow frequency estimates for any location in the watershed by identifying the desired stream and location. The ILSAM currently is developed for use with streams in eight watersheds: the Fox, Kankakee, Kaskaskia, Little Wabash, Mackinaw, Rock, Sangamon, and Vermilion-Illinois River basins. This report includes a description of the steps used to develop ILSAM for application to the Illinois portion of the Rock River basin, along with a description of the physical characteristics of the watershed, its surface water hydrology, and the factors that influence streamflow variability.

The Rock River basin in northern Illinois and south-central Wisconsin has a total area of approximately 10,915 square miles (mi^2), with about half (5317 mi^2) in Illinois. Variations in landscape, soils, and land use have a substantial influence on the streamflow hydrology within any region. The landscape of the Rock River basin is quite varied and complex when compared to that of most other regions of Illinois, including the dissected, hilly terrain west of the Rock River, rolling hills covering much of the central portion of the basin, and the broad, flat outwash plain of the Green River Lowland. There is also considerable spatial variability in the permeability and drainage characteristics of the soils in the basin. In contrast, land use is comparatively homogeneous, with more than 80 percent of the basin in row crops or rural grassland. Urban and forest areas each account for an additional 5 percent of the land use. Several distinct hydrologic regions were identified as a result of physiographic variations in the basin.

The hydrologic analyses used to develop the model include evaluating the streamflow record from gaging stations in the vicinity of the Rock River basin; evaluating impacts to flow quantity from dams, water supply, and treated wastewaters; and developing regional equations to estimate flows at ungaged sites throughout the watershed. The effects of the various human modifications to the flow in the basin have changed substantially over the history of the available streamflow records. Each flow record was analyzed to separate the effect of these human modifications from unaltered or "virgin flow" conditions influenced primarily by the climate, topography, hydrogeology, and prevailing land-use conditions in the watershed. The regional equations to estimate flow at ungaged sites are based on the virgin flow conditions, which are expected to be relatively homogenous throughout each region. The "present flow" conditions produced by ILSAM are flow frequency estimates that incorporate both the virgin flow and the present level of human modification in the basin as of 2001.

Flow frequency estimates for each gaging record are adjusted to account for differences in period of record and other factors such as the interannual dependence (hydrologic persistence) of low flows. All ILSAM streamflow frequency estimates are representative of the long-term expected flow conditions of streams in the Rock River basin, reflecting hydrologic conditions over a base period of 61 years (1939-2000).

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Introduction

The flow of water in the rivers and streams of Illinois provides several valuable uses. In many locations, it provides for the withdrawal of water for use in public and industrial water supplies. Also of great importance are in-stream uses of water, i.e., water used or needed within the stream channel, including flows for aquatic habitat and biodiversity, assimilation of wastewaters, water-based recreation, and stream aesthetics, as well as hydropower generation and navigation on the largest rivers. A planning and management goal for surface water resources in a watershed is to maintain sufficient streamflow for both in-stream needs and withdrawals (i.e., off-stream needs). Planning also requires estimates of sustainable yields for streams and lakes to determine whether available resources will satisfy existing and future water needs during drought periods.

Water resource management requires an understanding of the quantity and frequency of streamflow within a river's watershed and the effects of various potential water-use practices on the flow characteristics. The impacts of various natural and human factors, such as climate, land and water use, and hydrologic modifications, also must be analyzed as they can greatly affect the quantity, quality, and distribution (both in space and time) of surface waters in a watershed. Estimates of flow frequency and climatic and human impacts on streamflows can be useful for:

- Assessing water availability and public water-supply system yields.
- Evaluating in-stream flow levels.
- Providing streamflow estimates for water quality analyses and regulations.
- Classifying Illinois streams by their hydrologic character for use in watershed management.

There are about 6920 miles of rivers and streams in the Illinois portion of the Rock River basin. The flow character of rivers and streams is monitored by streamgaging stations, which measure the flow of water over a period of time, providing information on the amount and distribution of surface water passing the station. Because it is not feasible to monitor all streams in a basin, gaging stations are established at selected locations, and the data collected are transferred to other parts of the watershed by applying hydrologic principles. Currently, there are 14 active streamgages in the basin, and 11 other locations in the watershed have been gaged over the past 90 years. This report describes the hydrologic principles used to estimate the flow characteristics at these gages and the remaining ungaged locations within the Rock River basin in Illinois.

Acknowledgments

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The Illinois Environmental Protection Agency and the U.S. Geological Survey provided wastewater effluent data and streamgaging records, respectively.

Any opinions, findings, and conclusion or recommendations expressed in this report are those of the authors and do not necessarily reflect those of the Office of Water Resources or the Illinois State Water Survey.

ILSAM Overview

The Illinois Streamflow Assessment Model (ILSAM), a watershed management information tool, was designed to provide managers and planners with needed estimates of the streamflow frequencies along major streams within a watershed of interest. For the purposes of this model, major streams are those that have upstream contributing drainage areas that exceed 10 square miles (mi^2) in size. The specialized software program for ILSAM was developed for use on a personal computer to provide estimates of the long-term expected magnitude and frequency of streamflow for any stream location. The effects of potential or hypothetical water resource projects on the quantity of water in streams also can be examined using options available in the model. An on-line version with reduced functions is also available through the Illinois State Water Survey (ISWS) Web site (http://gismaps.sws.uiuc.edu/ilsam/). With the completion of this study, the hydrologic datasets used by the model have been developed for eight major watersheds in Illinois: the Sangamon, Fox, Kaskaskia, Kankakee, Little Wabash, Mackinaw, Vermilion-Illinois, and Rock River basins. Hydrologic datasets are also being developed for the Spoon and LaMoine River basins.

Basic ILSAM Hydrologic Concepts

The characteristics of streamflow in any watershed will, over time, vary from earlier conditions because of the cumulative impact of human activities in the region, variability in the climate, and other potential factors. Like most locations in Illinois, the Rock River basin has experienced considerable land-use modification since European settlement, including cultivation, drainage modification, removal of wetland areas, deforestation, and urbanization. Most of these modifications to agricultural lands occurred in the late 1800s, prior to the introduction of streamgaging activities in the region, and thus the existing gaging records cannot reflect the impact of these changes. Most of the land in the watershed remains in agriculture, much as it was almost 100 years ago.

For this analysis, the streamflow can be separated into two components: 1) unaltered or "virgin" flow conditions as influenced primarily by the climate, topography, hydrogeology, and prevailing land-use conditions in the watershed, and 2) modifications to flow conditions by human activity that produced a quantifiable change in the temporal response of flow from the watershed. Modifications to the flow conditions that can be quantified include direct additions to or subtractions from the flow in the stream, such as from effluent discharges or water-supply withdrawals, or large changes in the water stored within the watershed, such as might be caused by a major reservoir. The evaluation of flow modifications is limited to water resource projects that can be evaluated objectively using existing data, and for which the impact on present flow conditions can be differentiated from the expected character of the unaltered flow condition.

Streamflow varies considerably over time, not only displaying day-to-day fluctuations as influenced by weather phenomena, but also by climatic variations that may cause flows to remain above or below the long-term expected condition for several decades. The climate during the period for which streamflow records are available also significantly influences the perception and calculation of the expected characteristics of streamflow. Therefore, the estimation of long-term streamflow conditions spanning several decades is necessary to smooth out the impacts of climate variability. Trend analysis of streamflow records throughout many areas of Illinois suggests that the influence of climate variability is usually large enough to mask the impacts of less obtrusive watershed modifications to river flows, including many contemporary land-use changes other than urbanization.

Complete descriptions of the methods used to determine the streamflow characteristics for ILSAM were presented in several earlier reports (Knapp, 1988, 1990, 1992), and the reader is referred to these earlier studies. This report focuses on the development of the data used for ILSAM application to the Rock River basin watershed.

Streamflow Information Produced by ILSAM

The ILSAM produces statistical estimates of flow quantity for 154 different streamflow parameters for any selected stream location, including both gaged and ungaged sites. The ILSAM estimates are representative of long-term climatic conditions, with a base period for the Rock River basin covering 61 years (1939-2000), but also account for recent human-made modifications to the flow amount such as have been caused by reservoirs, water-supply withdrawals, and discharges from wastewater treatment plants.

Each ILSAM-estimated parameter relates the streamflow value to the frequency at which that flow (or series of flows) is expected to occur. Most streamflow parameters fall into one of two basic categories:

- *Flow duration values*: These values relate the streamflow amount to the percentage probability that the flow will be exceeded without regard to the sequence of flow events. For example, the 40-percent flow duration value (Q_{40}) at a gaging location is the flow that is expected to be exceeded 40 percent of the days within a defined period of record at the gage or other defined period of years.

- *Low flows and drought flow values*. These flow values describe average flow values over a sequence of days or months. The one-day flow is most easily computed because it is simply the lowest daily flow experienced within any year of flow record. The 1-day, 10-year low flow ($Q_{1,10}$) is the lowest daily flow that is expected to occur on average only once in 10 years. Thus, in 9 out of 10 years, on average, the annual one-day low flow is expected to be greater than the $Q_{1,10}$. The 7-day low flow is similar to the 1-day low flow, except that it represents the lowest average flow experienced during any consecutive 7-day period within a year; and the 7-day, 10-year low flow ($Q_{7,10}$) is the lowest 7-day flow that is expected to occur on average only once in 10 years. Drought flows are different than low flows in that they are not computed on an annual basis and are computed using monthly rather than daily flows. The 18-month, 10-year drought flow ($Q_{18,10}$) represents the lowest average flow over an 18-month period that is expected to occur on average only once in 10 years.

All flow values are given in units of cubic feet per second (cfs). The 154 flow frequency parameters are defined in the following paragraphs.

Average Flow Values

Description: The average annual flow estimated by ILSAM is the expected average flow over the 61-year base period (1939-2000). The average monthly flow values cover the same base period, but represent only the portion of the daily flow values that occur within each respective calendar month in that period.

ILSAM average flow values: Average annual flow (Q_{mean}) and average flows for each of the 12 months (January - December).

Annual Flow-Duration Values

Description: The 2 percent flow (Q_2), for example, is the daily streamflow rate that is exceeded on exactly 2 percent of the days. The one percent flow (Q_1) is necessarily a higher flow rate because it is exceeded less frequently.

ILSAM annual flow duration values: Q_1, Q_2, Q_5, Q_{10}, Q_{15}, Q_{25}, Q_{40}, Q_{50}, Q_{60}, Q_{75}, Q_{85}, Q_{90}, Q_{95}, Q_{98}, and Q_{99}.

Monthly Flow-Duration Values

Description: Monthly flow-duration values are defined in the same manner as the annual flow-duration values, except that they are determined using only those daily discharges that fall within a certain month of the year.

ILSAM flow-duration values for each of 12 months: Q_2, Q_{10}, Q_{25}, Q_{50}, Q_{75}, Q_{90}, and Q_{98}.

Low Flows

Description: Each low-flow parameter is defined by a duration in consecutive days and a recurrence interval in years. A 7-day low flow for a given year is the lowest average flow that occurred within a consecutive 7-day period during that year. The 7-day, 10-year low flow is the 7-day low flow that occurs on average only once in 10 years. A 2-year low flow is the value expected to occur during an "average" year.

ILSAM low-flow durations: 1, 7, 15, 31, 61, and 91 days.

ILSAM low-flow recurrence intervals: 2, 10, 25, and 50 years.

Drought Flows

Description: Drought flows are similar to low flows, except that the duration of the period is longer and is defined in months instead of days, and the average low flows are developed from monthly records. Drought flows are not computed as an annual series, because a drought period typically encompasses multiple years.

ILSAM drought flow durations: 6, 9, 12, 18, 30, and 54 months.

ILSAM recurrence intervals: 10, 25, and 50 years.

Database Used by ILSAM

The ILSAM uses four basic sets of data for computing streamflow characteristics in a watershed.

- *Estimates of the 154 flow parameters at gaging stations within the watershed.* Streamflow frequency estimates are computed and entered into the database for gaging stations and other selected locations in the watershed where such computations are useful to the operation of the model, such as locations downstream of reservoirs or upstream and downstream of major river confluences. These streamflow frequency estimates may represent both virgin (unaltered) flow conditions and present flow conditions. Appendix A lists basic streamflow frequency data for 55 watershed locations and flow conditions.
- *A dataset of all flow modifiers in the watershed (withdrawals, diversions, and effluent discharges).* This includes the estimated impact of that modification on each of the 154 flow parameters produced by the model. Appendix B lists basic flow data for these modifications.
- *A table of watershed characteristics for 1324 locations in the basin, including stream mileage, drainage area, soils information, and the location of gaging stations, water use projects, reservoirs, and other points of interest in the basin*. Appendix C lists stream network data.
- *The set of regional regression equations used to estimate the virgin flow conditions for each of the 154 flow conditions for ungaged sites in the watershed*. Appendix D presents these equations.

In addition to these four basic datasets, three supplemental datasets provide stream codes that help to identify each stream in the watershed, an index of the stream network in the watershed (which helps the model identify all downstream locations affected by a flow modification), and basic data on the size of each major reservoir in the watershed. All datasets were imported into a Microsoft Access database for direct ILSAM access.

Description of the Rock River Basin

The Rock River basin is located in northern Illinois and south-central Wisconsin, as shown in Figure 1. The Rock River flows south by southwest from its headwaters in Fond du Lac County in Wisconsin to the Illinois border near Beloit, WI. Within Illinois, the Rock River flows 163 miles to the southwest until it meets the Mississippi River at Rock Island. The Rock River basin has a total drainage area of 10,915 mi^2. This report focuses on the Illinois portion of the Rock River basin, and all discussion is limited to Illinois except when specific references are made to the Wisconsin portion of the basin. The Illinois portion of the basin covers about 5387 mi^2, including drainage in 15 Illinois counties: Boone, Bureau, Carroll, DeKalb, Henry, Jo Daviess, Kane, Lee, McHenry, Mercer, Ogle, Rock Island, Stephenson, Whiteside, and Winnebago. The Rock River has three major tributaries in Illinois, the Green, Kishwaukee, and Pecatonica Rivers, each with drainage areas in excess of 1000 mi^2.

Population

The total population of the Rock River basin in both Wisconsin and Illinois is about 1.7 million, and the population for the Illinois portion is about 800,000. The two major population centers in the basin are the cities of Rockford, IL, and Madison, WI. Other cities in the watershed with populations over 25,000 are Moline, Rock Island, Freeport, and DeKalb, IL; and Beloit, and Janesville, WI. Between 1990 and 2000, the population in the Illinois portion of the basin rose approximately 10 percent, a slightly higher percentage increase than the statewide average. The greatest increase in population occurred on the eastern part of the basin in McHenry, Kane, and Boone Counties, with an average increase of more than 30 percent. Winnebago County, which has the largest population in the Illinois portion of the basin, experienced a 10 percent increase from 1990 to 2000. In contrast, the population in the western part of the basin (Bureau, Carroll, Henry, Rock Island, Stephenson, and Whiteside Counties) experienced little or no increase. The eastern part of the basin likely will continue to see significant population growth in future decades as the margins of the Chicago metropolitan area expand into the Rock River basin.

Land Cover

Prior to European settlement, the land cover in the Rock River basin was a mixture of oak savanna (open woodland interspersed with prairie), short and tall grass prairie, and local areas of oak forest. The Rock River also had abundant lakes and large wetlands, covering as much as 15 percent of the land in Wisconsin (Wisconsin Department of Natural Resources, 2002), and probably a similar percentage in Illinois. There were at least three areas of particularly large marshlands, each covering more than 30,000 acres. Eastern Lee County, near the present headwaters of the Green River, contained the Inlet Swamp, and farther to the west, in Henry, Bureau, and western Lee Counties, the Great Winnebago Swamp. Both marshes were drained for agriculture in the late 1800s. The only remaining large marsh in the watershed is the Horicon Marsh, near the headwaters of the Rock River in northern Dodge County, WI, and designated as

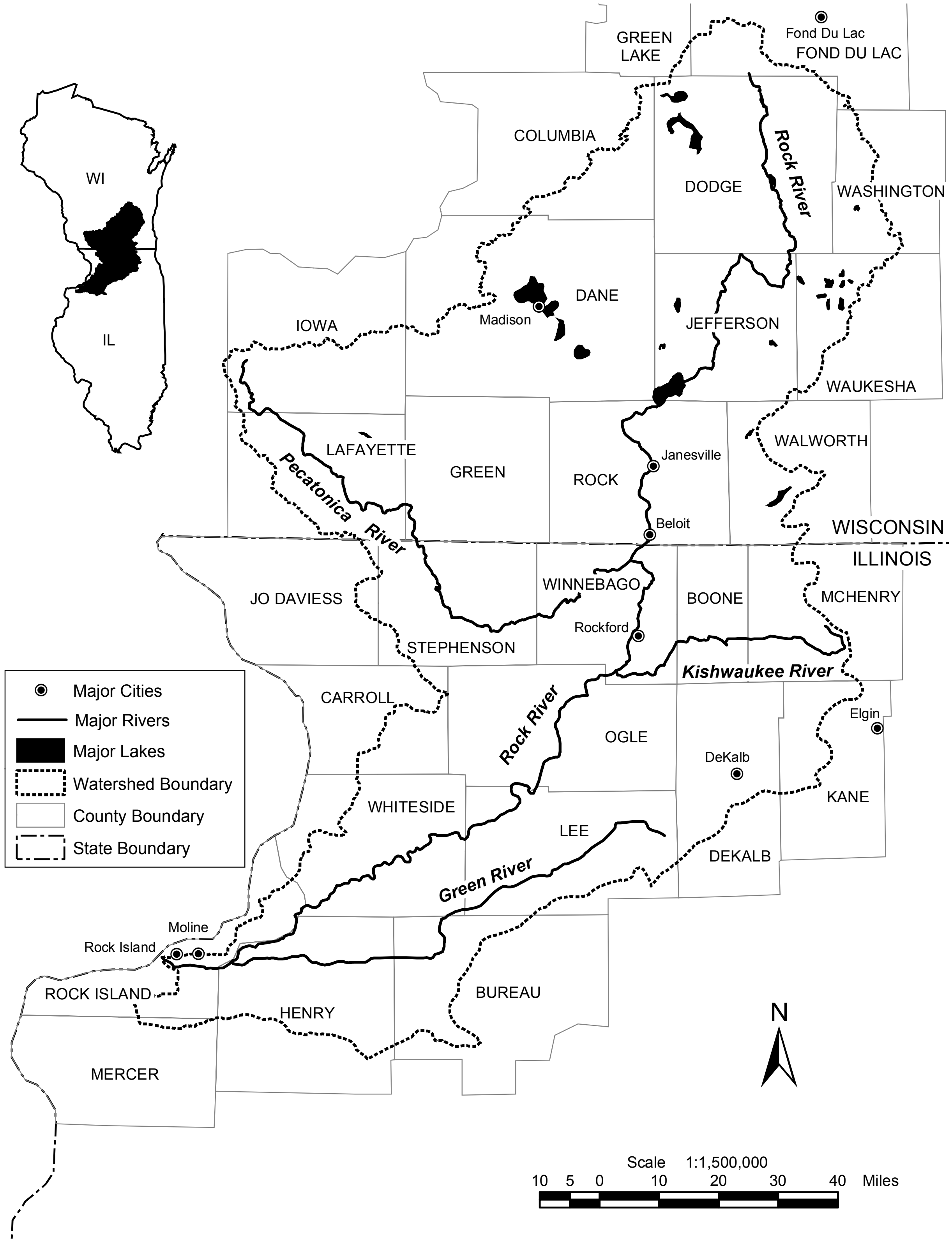

Figure 1. Location of the Rock River basin in Wisconsin and Illinois

a "Wetland of International Importance" (U.S. Fish and Wildlife Service, 2003). Many other wetland areas also existed along the major rivers. For example, before the Rock River was impounded to raise the water level of Lake Koskonong in southwestern Jefferson County, much of that portion of the river was natural wetland.

Table 1 lists the present land use of the Illinois portion of the Rock River basin, as estimated by IDNR (1996) using data from satellite imagery acquired during 1991-1995. Agriculture continues to be the dominant land use in the basin, comprising more than 85 percent of the total land use for the basin. Row crops (59.4 percent) and rural grassland (22.9 percent) are the two largest categories of land use. Urban land (5.3 percent) and forest area (5.1 percent) represent the only other sizeable land uses.

Basin Physiography

The landscape of the Rock River basin is varied and complex as compared to most other regions of Illinois. Figure 2 shows five physiographic regions in the Rock River basin in Illinois defined by Leighton et al. (1948). The two predominant regions are the Rock River Hill Country and the Green River Lowland, with the Bloomington Ridged Plain, the Wheaton Morainal Country, and the Galesburg Till Plain covering smaller portions of the basin.

Table 1. Land Use in the Illinois Portion of the Rock River Basin

Land-use category	*Square miles*	*Percent area*
Agricultural Land	4628.5	85.9
Row crops	3200.3	59.4
Small grains	194.2	3.6
Rural grassland	1231.9	22.9
Orchards and nurseries	2.2	0.0
Forest and Woodland	276.0	5.1
Urban and Built-up Land	286.0	5.3
High density	30.1	0.6
Medium density	49.6	0.9
Low density	50.1	0.9
Transportation	45.9	0.9
Urban grassland	110.4	2.0
Wetland	99.1	1.8
Forested wetland	48.8	0.9
Shallow marsh/wet meadow	37.8	0.7
Other wetland areas	12.5	0.2
Other Land	97.7	1.8
Lakes and streams	93.9	1.7
Barren and exposed	3.9	0.1
Totals	5387.3	100.0

Note: Land-use estimates are from data acquired in 1991-1995 (IDNR, 1996).

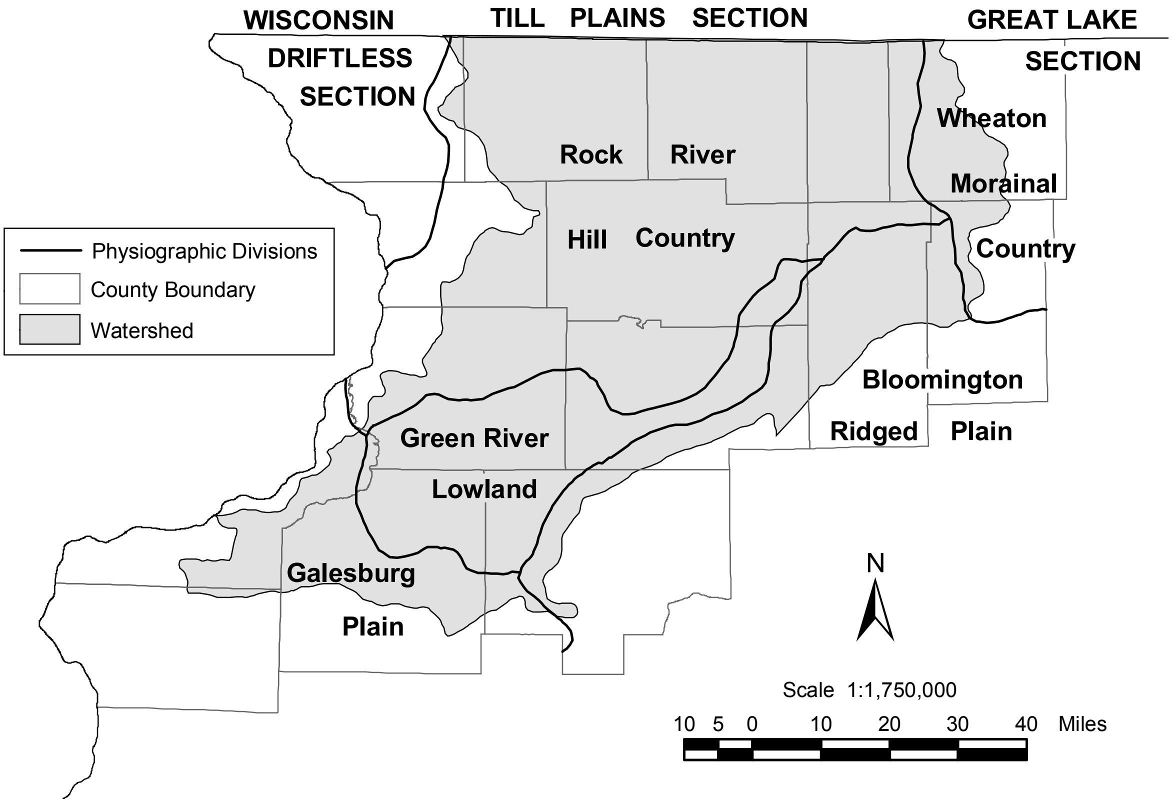

Figure 2. Physiographic divisions of the Rock River basin (after Leighton et al., 1948)

The Rock River Hill Country occupies about 60 percent of the Illinois portion of the Rock River basin. This physiographic region has been glaciated, but the glacial deposition is relatively thin. The resulting topography closely reflects the underlying pre-glacial bedrock surface, and is characterized by rolling hills and well-developed stream valleys. There is considerable variation in the character of the land from the western side of the region to the eastern side. West of the Rock River, the Rock River Hill Country is very hilly, with narrow and V-shaped valleys. The glacial drift is often less than 25 feet (IDNR, 1998a), and the streams have cut narrow gorges into the bedrock in some areas, such as in western Ogle County. East of the Rock River, where the deposition of glacial till is typically greater than 100 feet (IDNR, 1998b), the Rock River Hill Country has more of a gently rolling topography, and stream valleys are broader and do not typically intersect the bedrock.

The Green River Lowland covers about 20 percent of the basin in the southern half of Whiteside County, northern Henry County, northwestern Bureau County, and central Lee County. Most of the area is a glacial outwash plain, described by Leighton et al. (1948) as a "low, poorly drained plain with prominent sand ridges and dunes." The western part of this region coincides with a broad pre-glacial lowland that was occupied by the Mississippi River. Local relief in this area is typically no more than 30 feet.

The southeastern portion of the Rock River basin is located in the Bloomington Ridged Plain. This region, which is predominantly drained by the South Branch Kishwaukee River, is characterized by depositional plains of glacial till, with nearly flat to gently rolling topography crossed by low and broad end moraines. Stream erosion has modified the landscape only slightly, and the headwater streams are generally poorly incised, with many being channelized in the late 1800s.

The eastern fringe of the basin in McHenry County is part of the Wheaton Morainal Country. This area has a complex topography created from glacial deposition, including rolling hills, broad morainic ridges, scattered depressions with wetland areas, and oversized valleys formed by glacial outwash. The primary glacial deposit is till, which forms the hills and ridges, and is normally composed of relatively impermeable silts and clays. Extensive sand-and-gravel outwash deposits, which are highly permeable, are found in the stream valleys.

The southwestern portion of the basin in Rock Island and Henry Counties is located in the Galesburg Till Plain. The topography of this area is characterized by gently sloping upland prairies dissected by downcutting streams that typically create 50 to 75 feet in local relief. Most streams drain north from this region into the Green River Lowland and cross a preglacial bluff-line, which adds a hilly nature to the region.

Land Slopes

Table 2 shows the distribution of land slopes in six counties. Each county was chosen to give a rough indication of topographic characteristics within a particular physiographic region of the Rock River basin. Stephenson County displays the moderately steep slopes of the western portion of the Rock River Hill Country, contrasted with the level to gently rolling slopes of the eastern portion of the Rock River Hill Country, represented by Boone County. The Bloomington Ridged Plain and Green River Lowland areas represent the portion of the basin with the most level land slopes. The slopes within the Bloomington Ridged Plain, represented by DeKalb County, are typical of land slopes throughout much of central Illinois to the south of the Rock River basin. The Green River Lowland (Whiteside County) has a very high percentage of nearly level land. Whiteside County also has some steep land slopes along the bluffs of the Rock and Mississippi Rivers.

Soil Characteristics

The Rock River basin has 35 different soil associations as identified by the State Soil Geographical (STATSGO) database (U.S. Department of Agriculture, 1994). Soil associations are geographical groupings of similar or commonly associated soil types. The four most widespread soil associations in the Rock River basin are the Tama-Muscatine-Sable (11 percent), Rozetta-Fayette-Hickory (9 percent), Saybrook-Drummer-Parr (9 percent), and Drummer-Plano-Elburn (7 percent). The Tama-Muscatine-Sable and Rozetta-Fayette-Hickory are the two

Table 2. Distribution of Land Slopes for Selected Counties

		Percentage of land area		
Overland slope (%)	*Slope description*	*Western portion, Rock River Hill Country, Stephenson County*	*Eastern portion, Rock River Hill Country, Boone County*	*Bloomington Ridged Plain, DeKalb County*
0 - 2	Nearly level	22.9	42.1	52.9
2 - 4	Gently sloping	28.8	43.5	38.9
4 - 7	Moderately sloping	32.8	12.4	7.2
7 -12	Strongly sloping	13.2	1.8	0.8
12 -18	Moderately steep	1.0	0.1	0.1
18 -30	Steep	0.9	0.0	0.1
> 30		0.4	0.2	0.0

		Percentage of land area		
Overland slope (%)	*Slope description*	*Green River Lowland, Whiteside County*	*Galesburg Plain, Henry County*	*Wheaton Morainal Country, McHenry County*
0 - 2	Nearly level	59.1	48.8	43.6
2 - 4	Gently sloping	17.5	17.4	30.0
4 - 7	Moderately sloping	9.2	10.9	17.4
7 -12	Strongly sloping	6.9	14.4	5.9
12 -18	Moderately steep	5.4	6.1	2.5
18 -30	Steep	1.8	2.2	0.5
> 30		0.0	0.2	0.0

Source: Runge et al. (1969).

dominant soil associations in the western portion of the Rock River Hill Country and in the Galesburg Plain. The Saybrook-Drummer-Parr is the most common soil association in the Bloomington Ridged Plain, and the Drummer-Plano-Elburn soil association is present in both the Green River Lowland and Bloomington Ridged Plain. Soils in the eastern portion of the Rock River Hill Country and the Wheaton Morainal Country are more variable, with the most common associations being the Ogle-Durand-Tama, Miami-Strawn-Hennepin, Warsaw-Lorenzo-Dakota, and Flagg-Pecatonica-Kendall.

Most of these soils are developed on loess (windblown silt deposited after the most recent periods of glaciation in Illinois) and the underlying glacial till. The thickness of the loess from 10 feet thick on the western side of the basin diminishes in thickness to the extent that the glacial till generally is considered to be the parent material for soils in the eastern portion of the basin. Most soils in the Rock River basin fall into one of two categories: Mollisols, dark soils developed under prairie or marsh vegetation, or Alfisols, light to medium soils developed under forest. The prairie grassland soils tend to be the most fertile of the two. Sandy soils (Entisols) developed along many of the river valleys and also in areas of glacial outwash, the most notable being in the Green River Lowland area and the glacial outwash areas in Boone and McHenry Counties. The Jasper-LaHogue-Selma soil association in the Green River Lowland area of Lee and Whiteside Counties is comprised mainly of sandy soil, and much of this area has been irrigated. Bowman and Kimpel (1991) indicated that almost 34,000 acres in this region have been irrigated, and it is expected that the number of acres have risen considerably since that report was issued. This is the third largest center of irrigation activity in Illinois, exceeded only by Havana Lowlands in Mason and Tazewell Counties and the Kankakee County area.

Most of the soils in the Rock River basin have moderate permeability, with sandy soils having moderately rapid permeability. Much of the basin is also naturally well drained, particularly in the western portion of the basin. However, several areas of the basin have poor natural drainage, including the Green River Lowland, portions of the Bloomington Ridged Plain that had a poorly developed stream system, and some lowland areas along the major rivers. Some of these poorly drained soils have responded well to stream channelization and tile drainage, particularly many of the soils in the Green River Lowland and Bloomington Ridged Plain. These variations in permeability and drainage are expected to have a noticeable influence on the streamflow hydrology.

Streams and Rivers

There are approximately 6900 miles of rivers and streams in the Illinois portion of the Rock River region, as identified by the National Hydrography Dataset (USGS, 2003) using 1:100,000 scale topographic mapping. The three largest tributaries to the Rock River in Illinois are Green River, with a drainage area of 1121 mi^2, Kishwaukee River (1247 mi^2), and Pecatonica River (2643 mi^2). Other major tributaries to the Rock River are listed in Table 3, and selected tributaries are shown in Figure 3.

Rock River

The length of the Rock River in Illinois is 163 miles, or about 60 percent of the entire 285-mile length of the river, including that part in Wisconsin. Over the 163-mile reach, the river maintains a fairly consistent gradient of about 1 foot per mile, ranging from an elevation of 725 feet at the Wisconsin border to 545 feet at the confluence with the Mississippi River. For most of its length the river flows through a broad valley, but near Grand Detour at the Ogle-Lee County boundary, the river cuts through a narrow valley with 100-foot high rock bluffs. Through Lee, Whiteside, and Rock Island Counties, the river flows through the sandy plain known as the Green River Lowland, cutting its channel to a depth of 25-40 feet. The depth of the river during normal flows generally ranges from 6 feet to 15 feet.

There are seven low-head channel dams on the Rock River in Illinois, located at Rockton, Rockford (Fordham Dam), Oregon, Dixon, Rock Falls (Sinnissippi Dam), Sterling, and Milan (Sears Dam). These dams originally were built in the mid-1800s to early 1900s and are typically 10-15 feet high. All of these dams have been used for the purpose of power generation, although only the Rockton, Dixon, and Sinnissippi Dams continue to serve that purpose. The Sinnissippi

Table 3. Major Illinois Tributaries in the Rock River Basin

Stream name	*Counties*	*Drainage area (mi^2)*	*Tributary of*
Beaver Creek		70	Kishwaukee River
Coal Creek		146	Mud Creek
Coon Creek	Boone, McHenry	154	Kishwaukee River
East Branch Kishwaukee River	DeKalb, Kane	123	South Branch Kishwaukee River
Elkhorn Creek	Whiteside, Carroll, Ogle	244	Rock River
Green River	Henry, Bureau, Whiteside, Lee	1131	Rock River
Killbuck Creek	Ogle	138	Kishwaukee River
Kishwaukee River	Winnebago, Boone, McHenry	1247	Rock River
Kyte River	Ogle	198	Rock River
Leaf River	Ogle	115	Rock River
Mill Creek	Ogle, Winnebago	52	Rock River
Mill Creek	Rock Island	63	Rock River
Mineral Creek	Henry	60	Green River
Mud Creek	Henry, Bureau	241	Green River
Pecatonica River	Winnebago, Stephenson	2643	Rock River
Pine Creek	Ogle	66	Rock River
Piscasaw Creek	Boone, McHenry	128	Kishwaukee River
Raccoon Creek	Winnebago	61	Pecatonica River
Richland Creek	Stephenson	126	Pecatonica River
Rock Creek	Whiteside, Carroll	234	Rock River
Rock Run	Stephenson	54	Pecatonica River
South Branch Kishwaukee River	DeKalb	438	Kishwaukee River
South Branch Kishwaukee River (East)	McHenry, Kane	73	Kishwaukee River
Spring Creek	Henry	73	Green River
Stillman Creek	Ogle	61	Rock River
Sugar River	Winnebago	762	Pecatonica River
Winnebago Ditch – Main Ditch	Bureau, Whiteside, Lee	58	Green River
Yellow Creek	Stephenson	196	Pecatonica River

Dam is the only dam that causes a noticeable increase in the width of the river, creating a pool that is more than 0.5 mile wide, with a surface area of approximately 1250 acres. A diversion upstream of the Sinnissippi Dam also provides the source of flowing water for the Hennepin Canal system.

Green River

The Green River flows 93 miles in a southwesterly direction from eastern Lee County to its confluence with the Rock River in western Henry County. Before drainage and channelization began in the 1880s, the Green River was a meandering stream. It flowed through two vast swamps, the Inlet Swamp in Lee County and the Great Winnebago Swamp, located mainly in northeastern Henry County and northwestern Bureau County, but also

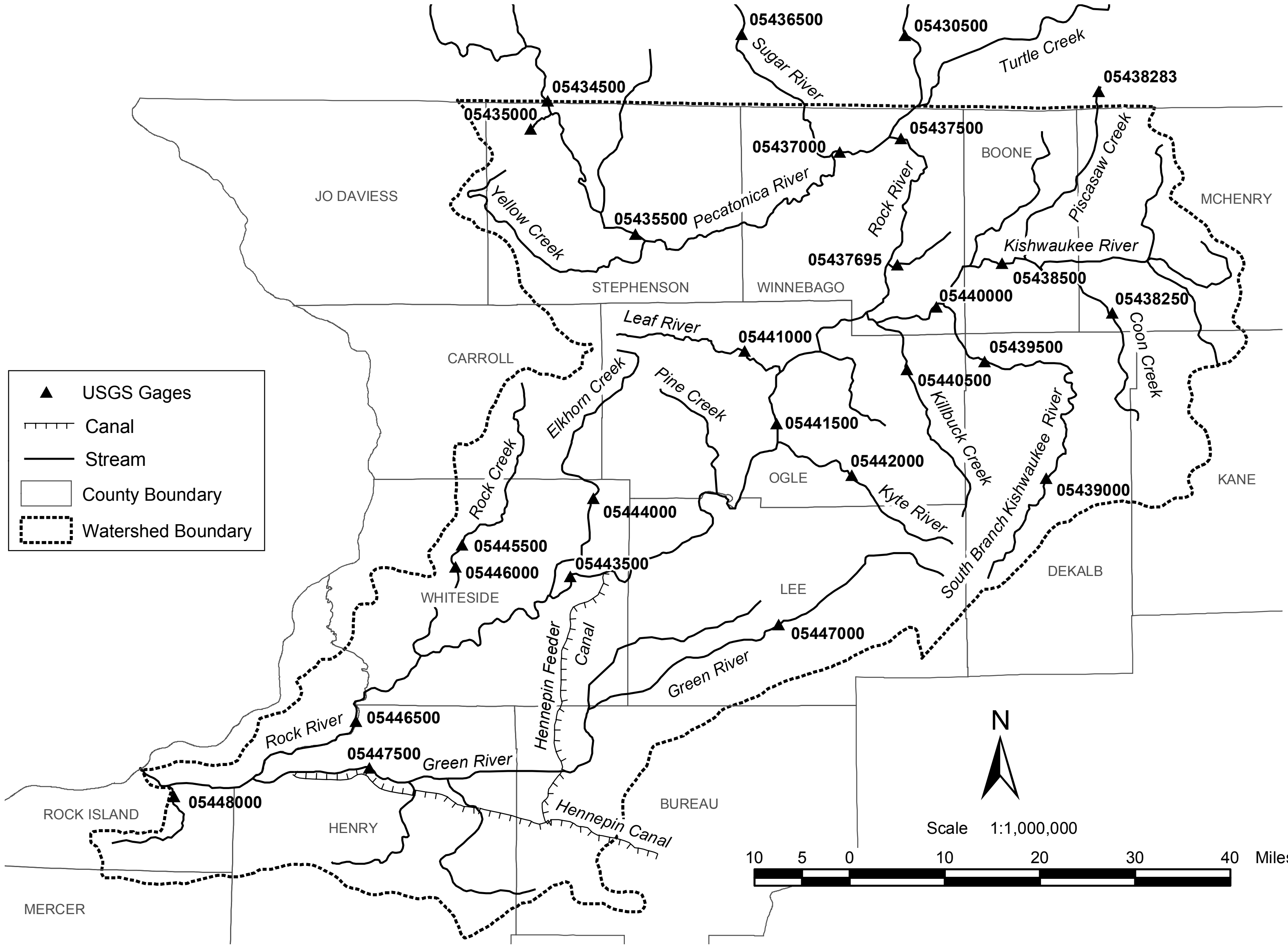

Figure 3. Location of major streams and USGS gaging stations in the Illinois portion of the Rock River basin

extending into portions of Lee and Whiteside Counties (Miller and Dunham, 1969). The river was dredged and channelized throughout its entire length to form a large straight ditch, more than
130 feet wide in its lower reaches. Dredged material forms high banks along the river that prevent overbank flooding into the spreading, adjacent lowland areas under most conditions. The Green River has a low gradient over its lower 40 miles, being less than 2 feet per mile through what originally was the Great Winnebago Swamp. The gradient increases to 4 feet per mile over the river's middle reach, but flattens once again near its headwaters in Lee County in what was the Inlet Swamp.

Most tributaries within the Green River Lowland also have been dredged and channelized. Mattingly and Herricks (1991) indicate that more than 850 stream miles have been channelized in Henry, Lee, and Whiteside Counties. Many of these streams also have been leveed to prevent inundation of nearby fields. Gradients of these tributaries are low, ranging from 1 to 4 feet per mile. Many tributaries on the southern side of the Green River originate in the hilly region of central Henry and Bureau Counties. Streams such as Mud Creek, Mineral Creek, and Spring Creek have moderate to moderately steep gradients, ranging from 5 to 15 feet per mile, and produce rapid runoff rates and heavy, periodic flooding.

Hennepin Canal

The Hennepin Canal across the southern edge of the lower Rock River region runs 75 miles from the Rock River near Moline eastward to the Illinois River. Construction of the canal was completed in 1907, and the canal was operated for barge traffic between the Illinois and Mississippi Rivers until 1951. It never became as commercially successful as originally envisioned, primarily because railways provided a cheaper transportation alternative. The canal is used for canoeing, biking, hiking, and other recreational activities. The canal system contains 29 locks that allow boat traffic to scale the almost 200-foot rise across the watershed divide. Connecting with the main canal is a feeder canal that flows 30 miles south from the Sinnissippi Dam on the Rock River and supplies the canal system with fresh water. Both canals are geographically entwined with the natural streamflow system. The flows in the canals are kept separate from those in streams by the use of culverts, siphons, and aqueducts.

Kishwaukee River

The Kishwaukee River flows 64 miles west from its headwaters near Woodstock in McHenry County, to its confluence with the Rock River. The character of the streams in the Kishwaukee River basin varies significantly depending on location. Stream valleys in the flatter, southern portion of the basin tend to be very poorly defined. Streams in this region have low gradients, with slopes generally less than 3 feet per mile, and have been channelized to improve drainage. In contrast, streams that drain the northern portion of the watershed typically have moderately steep gradients of about 10 feet per mile. Stream valleys in the Rock River Hill Country are generally well defined and V-shaped, whereas valleys in the Wheaton Morainal Country were formed by glacial outwash and tend to be broad, oversized, and have gentle side-slopes. By far, the largest tributary to the Kishwaukee River is the South Branch Kishwaukee River, with a drainage area of 441 mi^2.

The main stem of the Kishwaukee River has steep channel slopes at its headwaters, typical of nearby tributaries. The river maintains a fairly consistent slope of 3 feet per mile over the rest of its reach. The valley of the Kishwaukee River is initially broad near its headwaters, with numerous wetland areas along the river. Farther downstream, the river valley progressively becomes better defined; over its lower 15 miles, the river takes on a unique character as it cuts through a narrow, 100-foot deep valley on its way to joining up with the Rock River.

Pecatonica River

The Pecatonica River originates in Iowa County, WI in the physiographic region called the Driftless Area. The river flows southeast for approximately 75 miles before it reaches the Illinois-Wisconsin border near Winslow, IL. The river continues to flow southward to Freeport, at which point it runs east and flows toward its confluence with the Rock River near Rockton. The total length of the Pecatonica River in Illinois is 92.4 miles.

Whereas the Pecatonica River has a mild slope of less than 1 foot per mile, the slopes of its tributaries are moderately steep, increasing steadily with distance away from the Pecatonica River: almost level in the river's floodplain, averaging 5 feet/mile in downstream reaches, and reaching more than 20 feet/mile in upper reaches. Streams have well-developed drainage patterns, and very few reaches have been channelized (Mattingly and Herricks, 1991). Channel substrates of most tributaries are predominantly gravel and sand (Miller, 1970), whereas the Pecatonica River has a silty substrate. The steep headwater slopes and hilly topography provide the opportunity for quickly accumulating large amounts of runoff during flood conditions. Most streams in the area are perennial, being fed by groundwater and springs. The source of springs is the considerable amount of underground drainage by way of solution channels in the dolomite bedrock. Glacial outwash in the major valleys also provides a source for sustained groundwater flow to the major rivers.

Other Major Tributaries

Four additional tributaries to the Rock River have drainage areas in excess of 100 mi^2: Rock Creek, Elkhorn Creek, Kyte River, and Leaf River. With the exception of Kyte River, these streams drain the western portion of the Rock River Hill Country, have well-developed, incised valleys that intersect pervious bedrock, and, as a consequence, have a sustained groundwater contribution to the flow. Most streams in these areas have relatively steep channel gradients in the range of 15-20 feet per mile. Rock Creek and Elkhorn Creek have developed broader valleys, and their channel gradients are reduced gradually in their downstream reaches, maintaining slopes in the 3-4 foot per mile range for most of their length. The Kyte River flows through the eastern portion of the Rock River Hill County and a portion of the Green River Lowland. Although the slope of the Kyte River is nearly 5 feet per mile, the upper portion of this watershed is poorly drained, and the stream has been channelized.

Lakes

The Illinois portion of the Rock River basin has about 300 lakes as identified by 1:100,000 scale topographic mapping. The only large lake in the region is Sinnissippi Lake (1250 acres) formed by Sinnissippi Dam, a low-head channel dam on the Rock River at Sterling-Rock Falls. Only three other lakes have surface areas greater than 100 acres: Candlewick Lake in Boone County, Pierce Lake in Winnebago County, and Summerset Lake in Stephenson and Winnebago Counties. More than 100 of the 300 lakes are small backwater lakes located alongside the Rock and Green Rivers in the lower portion of the basin in Henry, Lee, and Whiteside Counties. In addition, many hundreds of smaller lakes and ponds not identified by 1:100,000 mapping have surface areas generally less than 2 acres.

In contrast, the Wisconsin portion of the basin has numerous large lakes. The largest of these are Lake Koshkonong (10,459 acres), located on the Rock River roughly 30 miles upstream of the Illinois-Wisconsin border; Lakes Mendota (9843 acres), Monona (3275 acres), Kegonsa (3208 acres), and Waubesa (2082 acres); part of the Chain of Lakes near Madison; Beaver Dam Lake (6542 acres) and Fox Lake (2625 acres), located in Dodge County near the northern edge of the basin; and Delevan Lake (2072 acres), located in Walworth County. Water levels in Lake Koshkonong are raised during the summer to maintain recreational uses of the lake. This lake level management can cause short-term fluctuations in the Rock River immediately downstream of the Indianford Dam, but these fluctuations become dampened farther downstream and are generally not apparent at the Afton gage located 20 miles downstream.

Hydrologic Budget

Precipitation

Sixteen precipitation gages in and near the Rock River basin have periods of record in excess of 60 years. Table 4 lists the average precipitation at each gage for the entire period of record and the period since 1970. The long-term average precipitation for the Rock River basin is about 35 inches. There is not a substantial change in the average precipitation across the basin, although gages in the southern portion of the watershed, on average, have slightly higher precipitation amounts. Since 1970, the average precipitation has been about 2 inches greater than the long-term average.

Figures 4 and 5 show the 1860-2002 annual precipitation values for three precipitation gages: Marengo, located in the northeastern portion of the basin; Dixon, located near the center of the basin; and Galva, located near the southern fringe of the basin. Also plotted in these figures are the long-term average precipitation and the 10-year moving average of the precipitation (the 10-year average value plotted for 1986 represents the 10 years from 1981 to 1990). Even though there are individual differences for each gage, the general characteristics and trends in precipitation for all three gages are about the same. The Marengo gage provides the longest continuous precipitation record in northern Illinois, dating back to 1856.

Table 4. Average Precipitation for Long-Term Gages Located in and near the Rock River Basin

Precipitation gage	*Period of record*	*Average Precipitation (inches)*	
		Period of record	*1970-2002*
Dixon	1892-2002	34.5	37.2
Elgin	1911-2003	34.8	37.4
Freeport	1909-1973	33.8	----
Fulton Lock and Dam	1939-2002	33.9	34.4
Galva	1893-2003	35.1	38.0
Geneseo	1924-2002	35.6	37.6
Kewanee	1939-2002	36.0	36.1
Marengo	1856-2002	33.8	36.1
Moline	1926-2002	36.4	38.4
Morrison	1896-2002	35.4	37.8
Mt. Carroll	1917-2002	35.3	37.5
Paw Paw	1913-2002	34.8	36.7
Rockford	1903-2002	36.1	36.6
Stockton	1943-2002	34.6	35.7
Sycamore	1896-1965	34.2	----
Walnut	1892-2002	34.7	37.0
Average		*34.9*	*36.9*

Examination of the Marengo record indicates decadal variability over the entire period of record. The lowest 10-year average precipitation in the past 150 years at Marengo occurred during the 1930s; the highest 10-year average occurred during the 1970s.

Evapotranspiration

A majority of the water that falls as precipitation is stored by the soil and eventually returns to the atmosphere through evapotranspiration (ET): evaporation predominantly from soil and water surfaces plus transpiration from plants. Evapotranspiration cannot be directly measured, and regional estimates of ET usually are computed from measurements of precipitation (P) and streamflow (Q) using a simplified water budget equation (Jones, 1966):

$$P = ET + Q + \Delta S \tag{1}$$

where ΔS is the change in subsurface storage (soil moisture and groundwater). The streamflow component (Q) in Equation 1 addresses both surface runoff and baseflow (groundwater) contributions to the overall flow. Over a period of numerous years, soil moisture and groundwater are usually replenished such that ΔS is close to zero. One abstraction not accounted for in Equation 1 is the amount of groundwater recharge to replenish water-use withdrawals. Annual water use in the entire watershed from both shallow and deep groundwater, discussed in the “Water Use” section of this report, is equivalent to about 0.6 inches of water distributed over the watershed, and thus is expected to be a minor component in the overall water budget.

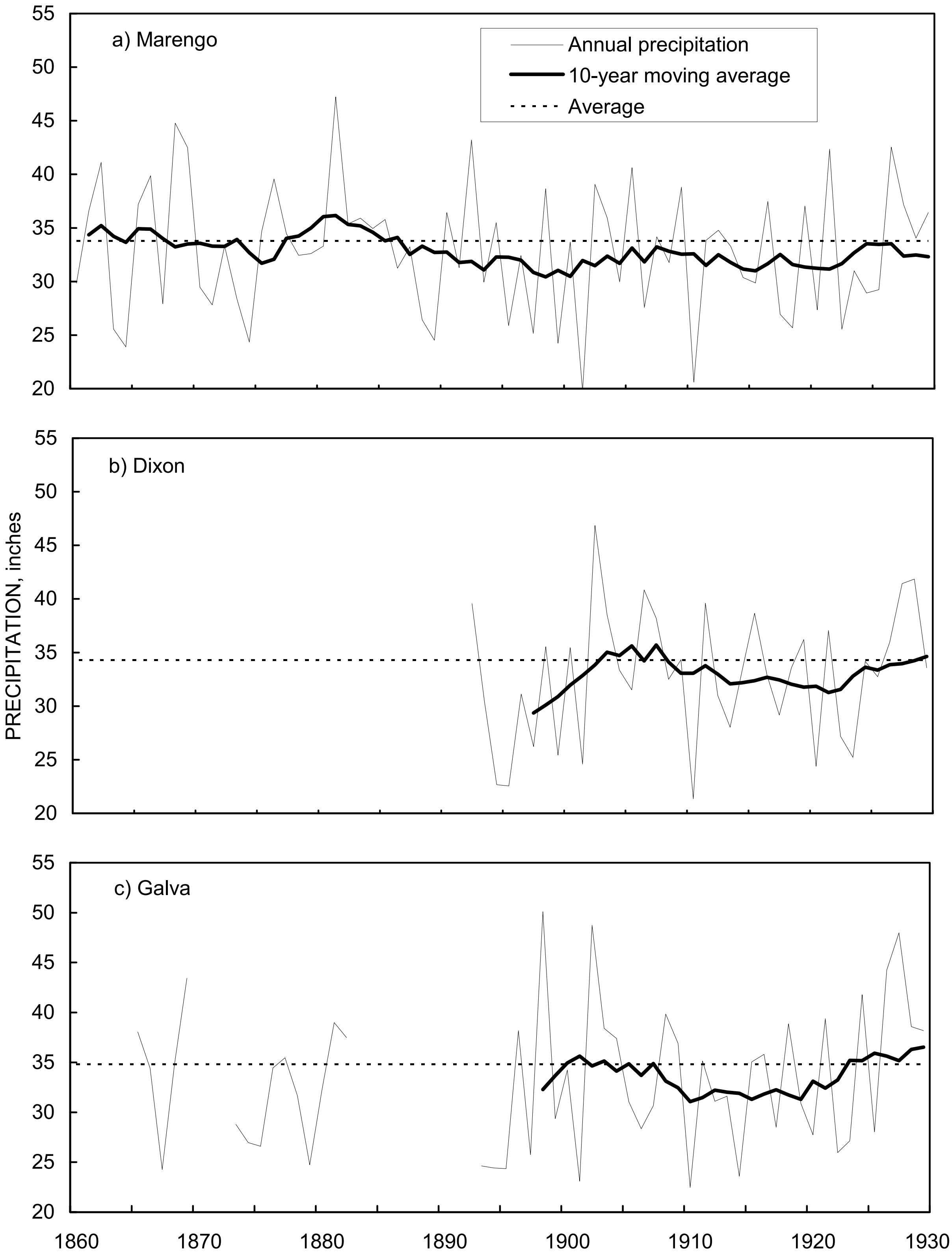

Figure 4. Annual precipitation at Marengo, Dixon, and Galva, 1860-1929

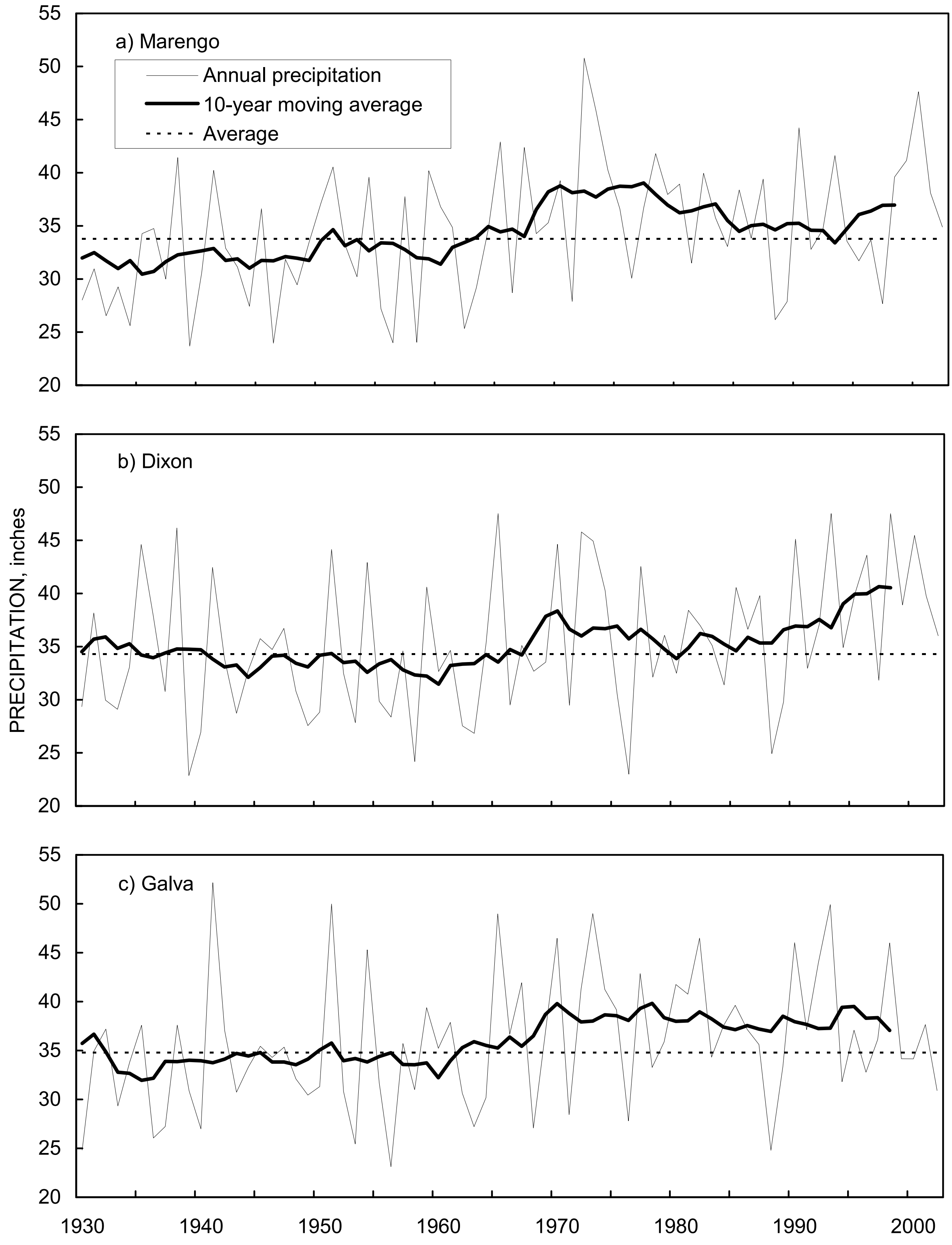

Figure 5. Annual precipitation at Marengo, Dixon, and Galva, 1930-2002

The average annual amount of ET in the Rock River basin, computed using Equation 1, is about 25.5 inches. Based on a regional ET map of Illinois developed by Knapp (1988), it is expected that annual ET will be slightly higher (26 inches) in the southern portion of the watershed and lower (25 inches) to the north.

Monthly Water Budget

Table 5 shows a typical distribution of P, ET, and Q over the Rock River basin for each month of the year. The monthly values of P and Q in Table 5 were taken from available records, and the general monthly distribution of ET was computed using the soil moisture component of a hydrologic model (Durgunoglu et al., 1987), with a slight adjustment to match the average annual ET given above. The sum of the ET and Q not equal the precipitation in any one month due to the effect of ΔS (soil moisture and groundwater). For any one month, the value of ΔS is estimated as the remainder between the P, the ET, and Q, as presented in Equation 1. Total streamflow Q is the sum of both direct runoff and the baseflow that originates from groundwater, as most recharge to shallow groundwater moves laterally and eventually becomes a source of baseflow to streams. Groundwater recharge to deeper aquifers is neglected, but, as explained earlier, it is a comparatively smaller component of the overall water budget.

Evapotranspiration is noticeably greater than P during the peak of the growing season (June-August) when the typical reduction in ΔS occurs. Lowest rates are expected near the end of the growing season (August-October) when soil moisture and groundwater are usually at their annual minimums. Average runoff is highest March-May when soil moisture is usually near its annual maximum.

Table 5. Typical Monthly Distribution (inches) of Precipitation, Evapotranspiration, Streamflow, and Subsurface Storage

Month	*P*	*ET*	*Q*	*ΔS*
January	1.6	0.2	0.7	+0.7
February	1.4	0.4	0.8	+0.2
March	2.6	0.9	1.4	+0.3
April	3.6	1.5	1.2	+0.9
May	4.0	2.8	1.0	+0.2
June	4.2	4.4	0.9	-1.1
July	3.7	5.8	0.7	-2.8
August	3.7	4.7	0.5	-1.5
September	3.6	2.8	0.5	+0.3
October	2.6	1.2	0.5	+0.9
November	2.2	0.6	0.6	+1.0
December	1.7	0.2	0.6	+0.9
Total	*34.9*	*25.5*	*9.4*	*0.0*

Water Use

Table 6 lists the total water use in the Rock River basin and various categories of use. The total use for the entire watershed is 506.9 million gallons per day (mgd), as estimated by the U.S. Geological Survey (USGS) for 1995 (Solley et al., 1998). Of this amount, the Illinois portion of the basin uses 171.9 mgd. In Illinois, the largest single use is for public water supply. There are more than 200 public water-supply systems in the basin (including the Wisconsin portion); all of these systems obtain water from groundwater sources with the exception of water supplied to the Rock Island-Moline area, which is withdrawn from the Mississippi River. Groundwater is also the dominant source for water used by self-supplied industries, irrigation, and domestic and livestock uses. Water is withdrawn from surface sources (streams and lakes) for thermoelectric power generation and mining (typically sand-and-gravel operations).

Water in rivers and streams also is used for many in-stream purposes, including recreation (boating, canoeing, and fishing), aesthetics, habitat aquatic life, and hydroelectric power production. Of these, only the use for power production can be measured directly. In 1995, 1050 mgd passed through turbines for power production at the Rockton, Dixon, and Sinnissippi Dams in Illinois.

Effluent Discharges

Most water that is used for public, commercial, and industrial purposes eventually is discharged into streams as treated wastewater. There are 84 facilities in the watershed with an average effluent discharge equal to or greater than 100,000 gallons per day; of these, 61 facilities are public utilities. The 2001 total effluent discharge from these facilities to streams in the Illinois portion of the Rock River basin was 112 mgd (173 cubic feet per second or cfs), as

Table 6. Water Use in the Entire Rock River basin and the Illinois Portion of the Basin, 1995

Water use	*Predominant source*	*Entire basin (mgd)*	*Illinois portion (mgd)*
Total water use		506.9	171.9
Public water supplies	Groundwater	170.1	72.0
Self-supplied commercial and industrial	Groundwater	41.8	18.6
Domestic	Groundwater	30.5	17.8
Mining	Surface water	6.4	2.1
Livestock	Groundwater	26.0	8.3
Irrigation	Groundwater	38.0	33.8
Thermoelectric power production	Surface water	194.2	19.4
In-stream use for hydroelectric power production	Surface water	1751.8	1050.0

determined from monthly discharge reports supplied by the Illinois Environmental Protection Agency. Effluent discharges from public utilities represent about 80 percent of this total amount. The amount discharged during low-flow conditions is less, 68 mgd (104 cfs). These effluent discharges have caused a marked increase in the low-flow quantity for certain streams in the basin.

Characteristics of Observed Streamflows

Streamgaging Records

There are about 6900 miles of rivers and streams in the Illinois portion of the Rock River basin. Streamgaging stations monitor the status of these rivers and streams at selected locations and measure the flow of water over time. These measurements provide information on the amount and temporal distribution of surface water passing the stations. Streamflow records may be used to evaluate water resource availability and the potential impacts of changes in climate, land use, water use, and other factors on the water resources of a river basin.

The USGS operates 22 streamgages in the Illinois portion of the Rock River basin for which five or more years of continuous daily flow data are available. Table 7 lists these stations, and Figure 3 gives their locations. Also listed in Table 7 are four Wisconsin gaging stations that are located on rivers and streams that drain directly into Illinois; these being on the Rock, Pecatonica, and Sugar Rivers, and Piscasaw Creek. In 2000, an additional continuous discharge station was added on the Rock River at Byron (USGS gage # 05440700), and two more stations were added in 2002 (Rock River at Rockford, USGS gage # 05437610; and Pecatonica River near Shirland, USGS gage # 05437050).

Streamflow Variability

The average annual amount of precipitation in the Illinois portion of the Rock River basin is approximately 35 inches, and ranges from about 34 inches at the Wisconsin border to more than 36 inches at the southern edge of the basin. The average amount of streamflow leaving the watershed, computed using the 1940-2000 flow record from the Rock River gage near Joslin, was about 9.4 inches or 27 percent of the average annual precipitation. This represents an average flow rate of approximately 0.7 cfs per square mile of drainage area. Most precipitated water that does not leave the watershed as streamflow is assumed to be returned to the atmosphere by way of evapotranspiration. As discussed in the section "Hydrologic Budget," other components, such as long-term changes in soil moisture and groundwater, net movement of groundwater from the watershed, and recharge to deep groundwater are expected to be a relatively small percentage of the water budget. Thus, on average, evapotranspiration accounts for more than two-thirds of the average annual precipitation.

Figure 6 shows the annual series of average streamflow for gaging records on the four major rivers in the basin: Rock River near Joslin, Pecatonica River at Freeport, Kishwaukee River near Perryville, and Green River near Geneseo. Flows are presented in units of inches of runoff over each gage's subwatershed. These plots show that average streamflow in the watershed can vary greatly from year to year and also can show sizable variation between decades. However, the series of average annual streamflows are very similar for all four gaging stations, indicating a regional consistency in the annual and decadal streamflow amounts. The greatest annual runoff (in excess of 20 inches) occurred throughout the watershed at all four stations in 1993. The least annual runoff occurred on the Rock River in 1934 (2.8

Table 7. USGS Streamflow Gaging Stations in the Rock River basin with at Least 5 Years of Continuous Discharge Records

USGS gage #	*Station name*	*Drainage area (mi^2)*	*RL (years)*	*Period of record*
05430500	Rock River near Afton, WI	3340	88	1914-present
05434500	Pecatonica River at Martintown, WI	1034	63	1939-present
05435000	Cedar Creek near Winslow	1.3	20	1951-1971
05435500	Pecatonica River at Freeport	1326	88	1914-present
05436500	Sugar River near Brodhead, WI	523	87	1915-present
05437000	Pecatonica River at Shirland	2550	18	1940-1958
05437500	Rock River at Rockton	6363	68	1914-1919; 1939-present
05437695	Keith Creek at Eighth Street at Rockford	13.4	8	1979-1987
05438250	Coon Creek at Riley	85.1	21	1961-1982
05438283	Piscasaw Creek near Walworth, WI	9.6	10	1992-present
05438500	Kishwaukee River at Belvidere	538	63	1939-present
05439000	South Branch Kishwaukee River at DeKalb	77.7	31	1925-1933, 1979-present
05439500	South Branch Kishwaukee River near Fairdale	387	63	1939-present
05440000	Kishwaukee River near Perryville	1099	63	1939-present
05440500	Killbuck Creek near Monroe Center	117	32	1939-1971
05441000	Leaf River at Leaf River	103	18	1940-1958
05441500	Rock River at Oregon	8205	9	1940-1949
05442000	Kyte River near Flagg Center	116	11	1940-1951
05443500	Rock River at Como	8753	78	1914-1971, 1977-1986 1990-present
05444000	Elkhorn Creek near Penrose	146	63	1939-present
05445500	Rock Creek near Morrison	158	15	1943-1958
05446000	Rock Creek at Morrison	166	8	1940-1942, 1978-1986
05446500	Rock River near Joslin	9549	63	1939-present
05447000	Green River at Amboy	201	18	1940-1958
05447500	Green River near Geneseo	1003	66	1936-present
05448000	Mill Creek at Milan	62.4	55	1941-1986, 1989-present

Note:
RL = record length through the end of Water Year 2000.

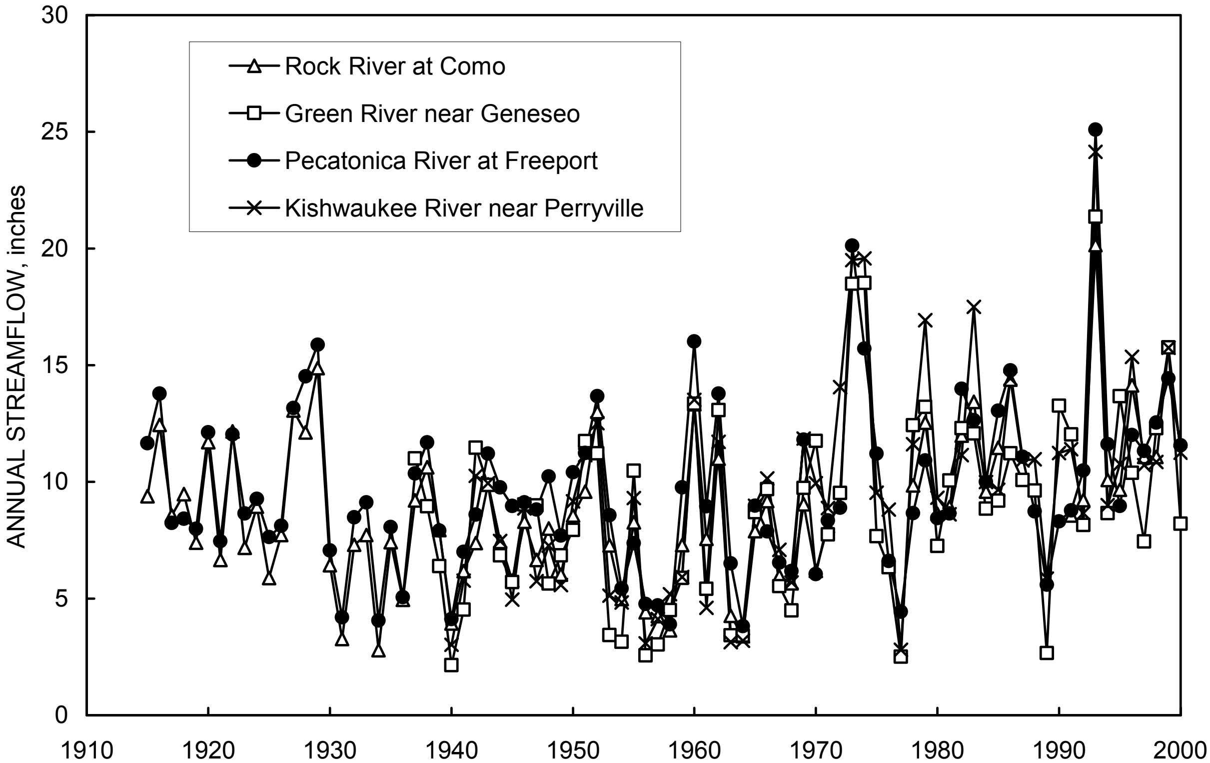

Figure 6. Average annual streamflow for major rivers in the Rock River basin

inches) and on the Green River in 1940 (2.1 inches). In the 30 years prior to 1970, the average annual flow in the Rock River basin was approximately 7.5 inches, but has averaged more than 11 inches since then.

Coincident Increases in Precipitation and Average Streamflow

Figure 7 compares the average streamflow in the Rock River and the average precipitation over the entire Rock River basin. Both precipitation and streamflow values in this figure were averaged over a moving 10-year period. This figure illustrates that the variation in average streamflows is very closely related to changes in average precipitation over time, with a correlation coefficient in the 10-year values of 0.89.

As shown, the highest precipitation amounts have occurred since 1970, and thus have caused high amounts of average streamflow. There is insufficient evidence to conclude whether

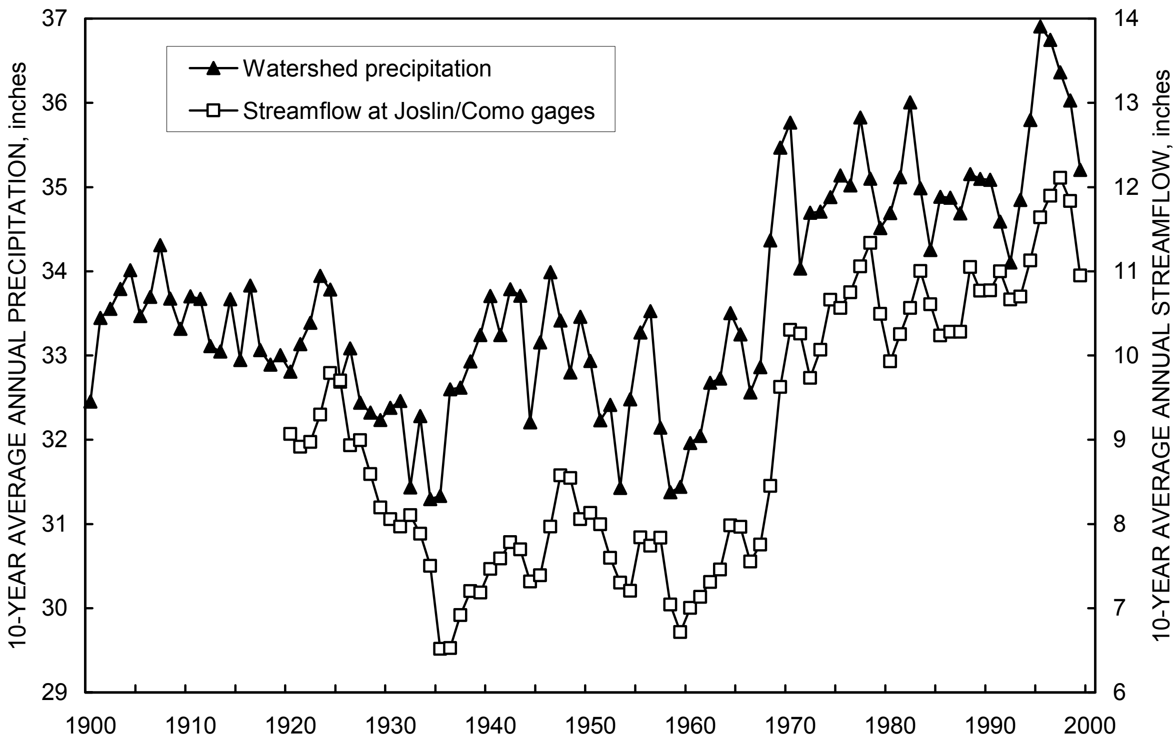

Figure 7. Comparison of 10-year average annual precipitation in the Rock River basin and streamflow measured for the Rock River at Como (1914-1939) and near Joslin (1939-2000)

the recent high values of precipitation are part of normal climate variability or are related to a regional change in climate. To varying degrees, much of the remainder of northern Illinois and neighboring regions in Iowa and Wisconsin also have experienced increases in both precipitation and streamflow over these same years (Knapp, 1994), as has much of the eastern United States (McCabe and Wolock, 2002; Karl and Knight, 1998). A statistical analysis of trends in the average flow in the Rock River basin is presented in the section "Statistical Trend Analysis."

Human Effects on Streamflows

Like most regions in Illinois, the Rock River basin has experienced considerable land modification since European settlement, including cultivation, removal of wetland areas, drainage and channelization, and deforestation. Most of these major modifications to the landscape occurred in the late 1800s, prior to the onset of streamgaging activities; thus, the large-scale effects of these modifications on streamflow hydrology were not measured and can only be inferred. Analysis of the continuous streamflow records, available from as early as 1914, potentially can show the effects of additional human modifications; however, the ability to detect such effects depends upon the scale of the human modifications relative to other factors such as climate variability. Examination of Figure 7 shows that the changes in streamflows due to climate variability can be substantial; in many instances, these changes can be large enough to mask the effects of the less obtrusive human modifications to the rivers' flows, including those associated with many types of land-use modification.

Land-Use Change and Management

Within the Rock River basin, land-use management most noticeably has affected the hydrology of the Pecatonica River watershed, particularly that portion in southwestern Wisconsin, which is part of the physiographic region called the Driftless Area. Potter (1991) and Krug (1996) indicate that flood magnitudes have decreased over the last 50 years for areas in the Wisconsin portion of the Driftless Area and have attributed the change to improvements in land management. In the 1930s, careless agricultural practices caused large gullies to form on the hillslopes of these watersheds. Since then, many gullies were removed through the installation of retaining structures and the application of fill. Runoff from hillslopes also has been reduced by conservation tillage, the return of some cropland to pasture or woodland, and planting of trees and shrubs on the steepest slopes. Analysis of the hydrologic records for the Pecatonica River watershed indicates that consequent flood magnitudes have decreased. Both Potter (1991) and Krug (1996) indicate that baseflows in these watersheds also have increased.

The watershed's relatively steep land and channel slopes may accentuate many runoff and erosion problems in the Pecatonica River watershed, and the resulting improvements from land management practice. Hydrologic impacts of management practices in less steep watersheds, such as those present in other regions of the Rock River basin, may not be as readily observable. Although other hydrologic changes are occurring in other portions of the Rock River basin, decreases in flood magnitude are observed only in the Pecatonica River watershed.

Approximately 5 percent of the Rock River basin in Illinois has been urbanized, with urban land concentrated primarily in the Rockford vicinity. The increase in impervious area caused by urbanization has been shown to increase high flows in urban streams, and analysis also has suggested that urbanization can lead to a small increase in low flows (Meyer and Wilson, 2002). This study does not estimate streamflows for urban streams, and because of the limited amount of urbanization in the Rock River basin, there is no attempt to estimate the impacts of urbanization on flows in major rivers, with the exception of related impacts from water use.

Reservoirs, Diversions, and Effluent Discharges

Other modifications to the watershed, such as the construction of reservoirs, and point withdrawals and discharges to the streams, normally have readily definable impacts on streamflows. Reservoirs in the Rock River basin are small and, for the most part, do not have a noticeable impact on the streamflow records. The largest lake in the basin, Sinnissippi Lake, was formed by the channel dam on the Rock River at Rock Falls.

Most of the water used in the basin comes from groundwater withdrawals, and the only sizable withdrawal from streams is that diverted for hydro- and thermoelectrical power generation. Water use for hydropower generation can cause short-term diurnal fluctuations in the pool levels and flow rates of the Rock River downstream of the Rockton, Dixon, and Sinnissippi (Rock Falls) dams, which are particularly apparent during low streamflow conditions. Occasionally the operation at hydropower dams can cause a particularly large flow reduction downstream lasting several hours, such as shown for the Rock River gages at Rockton and Como (Figures 8 and 9). The specific operating conditions that lead to the downward "spikes" in the flow hydrographs shown in these figures were not analyzed for this study.

Effluent discharges provide a common impact on flows in the Rock River basin, particularly for low streamflow conditions. Most streams in the Rock River basin have a naturally high degree of sustained low flows, and the discharge of treated wastewaters from small communities generally causes only a relatively small increase in low flows. The South Branch Kishwaukee River is a primary exception because it has the lowest natural low flow of the major streams in the watershed and also receives a comparatively large discharge amount from DeKalb and Sycamore. Collectively, the wastewater discharges from communities in the Rock River basin, including those from the major cities of Madison, WI, and Rockford, IL account for about 15 percent of the lows flows in the Rock River. The influence of these discharges is greatest along the Wisconsin portion of the river downstream of Madison.

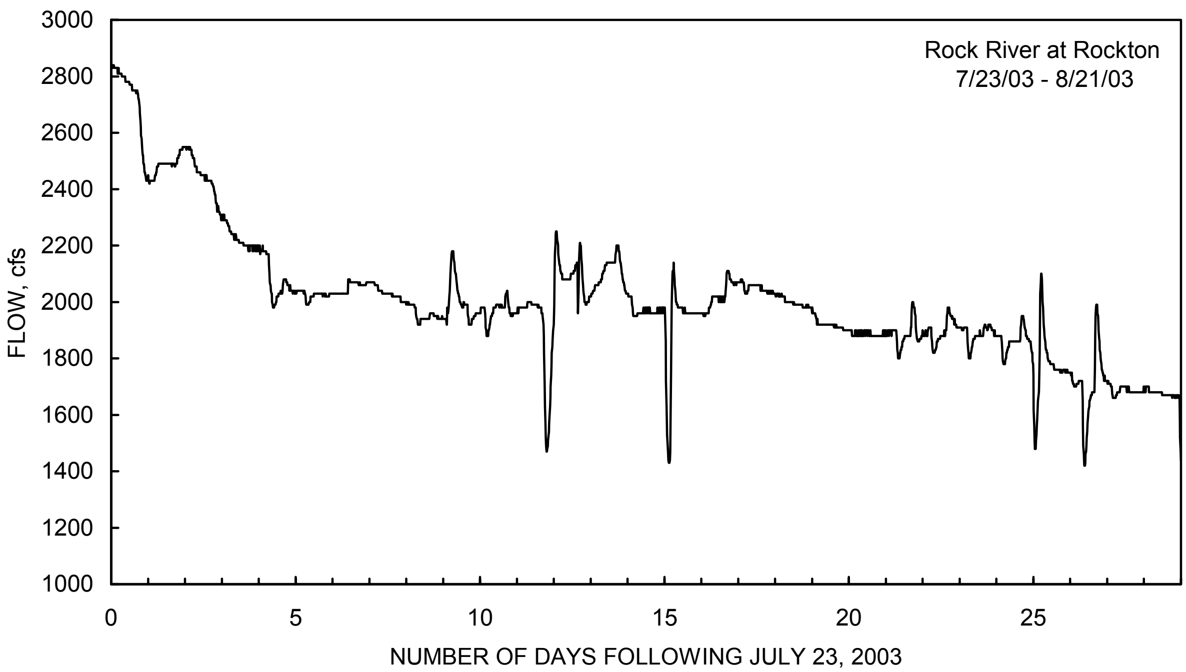

Figure 8. Flow of the Rock River at Rockton, July 23, 2003 – August 21, 2003

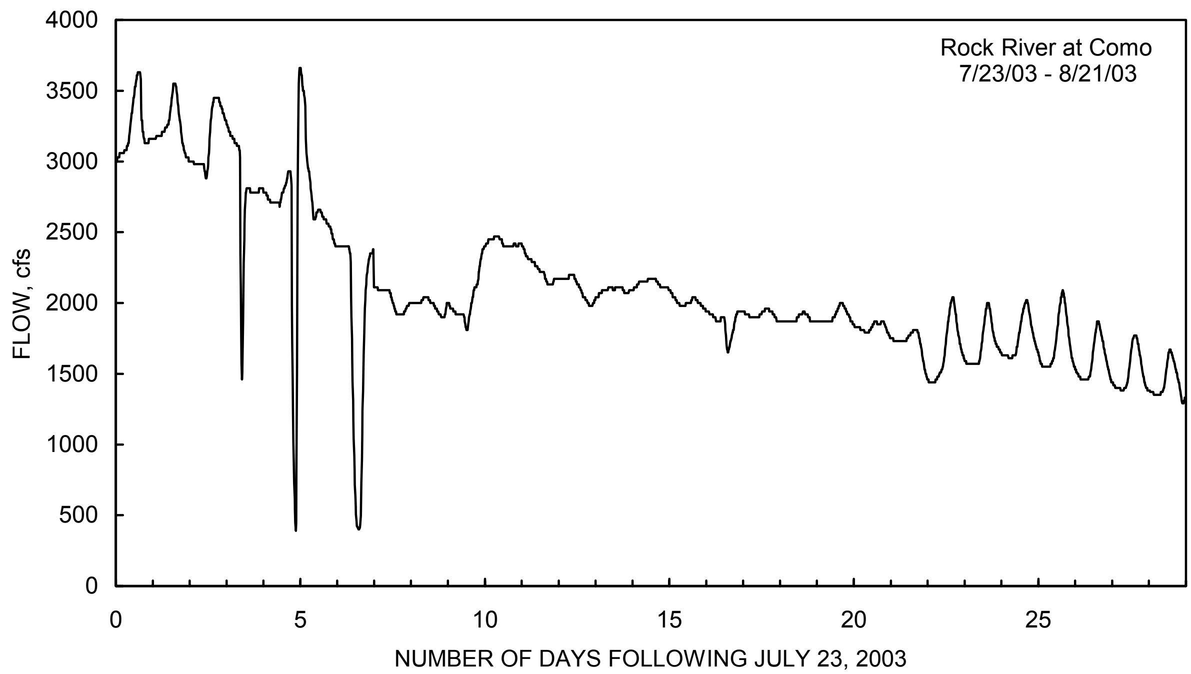

Figure 9. Flow of the Rock River at Como, July 23, 2003 – August 21, 2003

Daily and Seasonal Variation in Flows

Flow-Duration Analysis

Flow-duration curves for many of the gages in the Rock River basin are plotted for larger streams (Figure 10) and small streams (Figure 11). The flow-duration curve provides an estimate of the frequency (probability) with which the various flows are exceeded. Streamflows, or discharges, for each frequency level were computed by using the period of record at each gage and the standard measurement of cubic feet per second. Differences in the physical characteristics of watersheds can lead to variations in the production of runoff and thus affect the shape and slope of the flow-duration curve. Alternatively, an analysis of the shapes and slopes of the flow-duration curves for various streamgage records can help identify important differences in watershed characteristics. Except in cases where there is substantial human modification to the flow, the quantity of flow in Illinois streams is normally very closely related to the total contributing drainage area of the watershed. The Rock River gage at Joslin has the largest drainage area of all gages in the Rock River basin, and thus it has the overall greatest flow quantity, as can be seen in Figure 10. But aside from the differences in flow quantity, most flow-duration curves for larger streams (Figure 10) have roughly similar shapes and slopes. Only the flow-duration curve for the Pecatonica River at Freeport has a noticeably different slope,

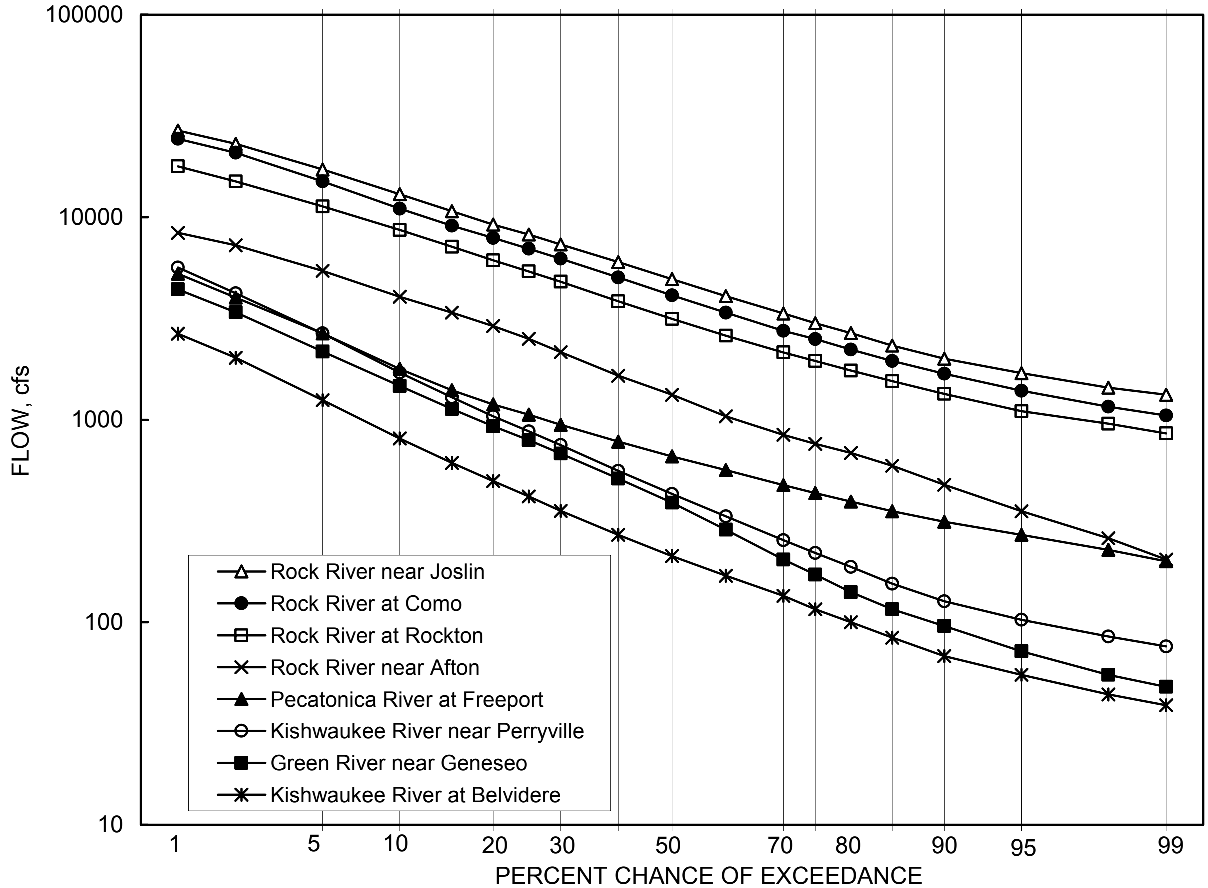

Figure 10. Flow-duration curves (discharge versus probability) for major streams in the Rock River basin

particularly for flows that have exceedance probabilities greater than 30 percent. The milder slope associated with the Pecatonica River indicates a higher amount of streamflow originating from baseflow and groundwater sources.

Figure 11 shows the flow-duration curves for streams that have drainage areas of 200 mi^2 or less. Slopes of the flow-duration curves for these streams show considerably more variation than curves for larger rivers (Figure 10). The slopes of the flow-duration curves for Mill Creek and the South Branch Kishwaukee River are noticeably steeper than those for the other tributaries. This indicates that these streams have greater variability of flow: higher runoff rates during wet periods and lower flows during dry periods. In general, southern edges of the basin in the Galesburg Till Plain and Bloomington Ridged Plain have less permeable soils that promote greater runoff and less percolation of water to the groundwater. The watersheds of the Kyte River, Killbuck Creek, and Coon Creek, located in the eastern portion of the Rock River Hill Country, include a variety of soil types and baseflow conditions.

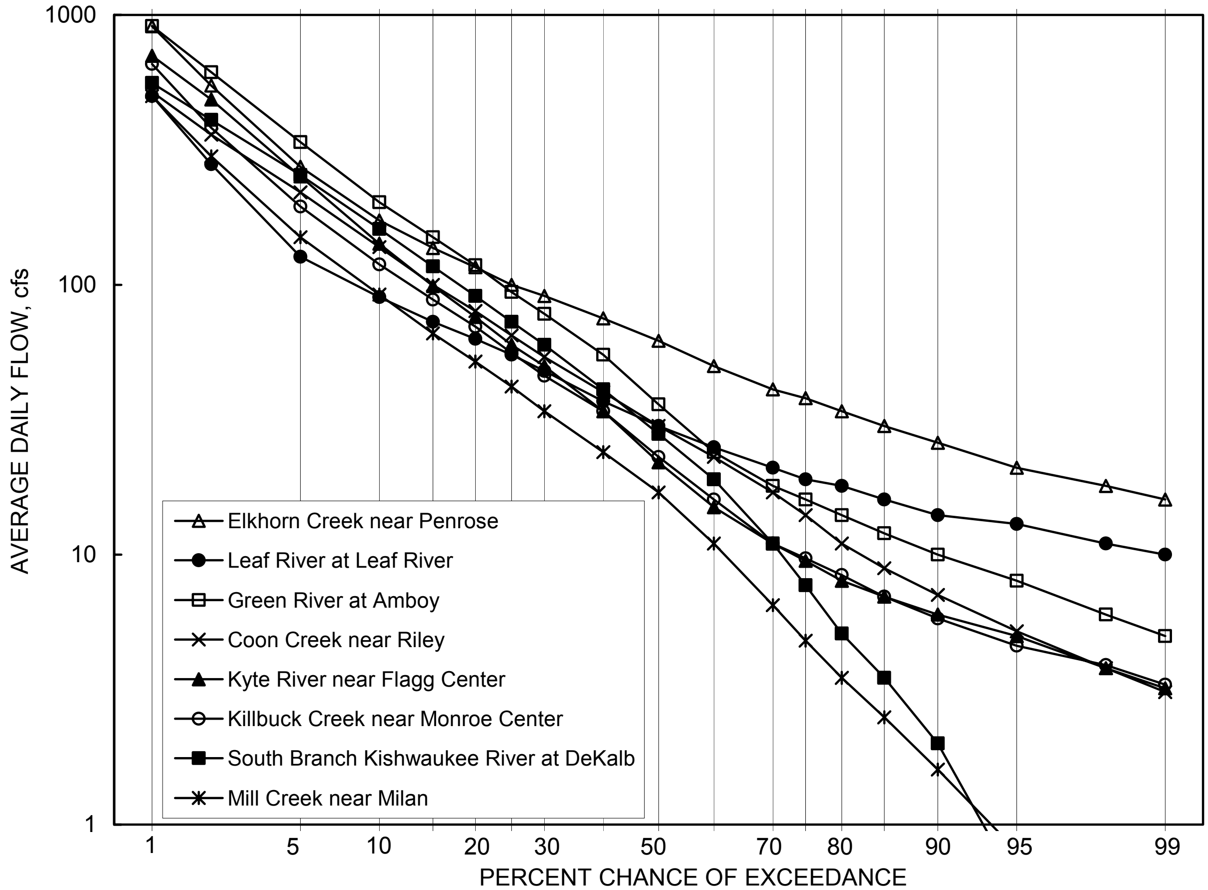

Figure 11. Flow-duration curves (discharge versus probability) for smaller streams in the Rock River basin

Seasonal Differences

As with all other locations in Illinois, streams in the Rock River basin display a well-defined seasonal cycle. Figure 12 shows the monthly probability of flow rates computed using the period of record for three gages, Mill Creek at Milan, the Kishwaukee River near Perryville, and the Pecatonica River at Freeport, which provide a sample of representative conditions throughout the basin.

Mill Creek at Milan. The variation in the monthly flows for Mill Creek at Milan (Figure 12a) is typical for watersheds along the southern edge of the Rock River basin and most other regions of central Illinois that are located in the physiographic regions of the Bloomington Ridged Plain and Galesburg Plain. Low (90 percent) and medium (50 percent) streamflow rates are normally highest in March and April, and lowest in late summer and fall, when they are typically less than 10 percent of flow rates in the spring. The potential for high flows and flooding events is typically greatest throughout the first six months of the year.

Kishwaukee River near Perryville. The seasonal change in flow conditions for the Kishwaukee River (Figure 12b) is typical of a large portion of the Rock River basin. Again, flows tend to be highest in March and April and lowest in late summer and fall. However, low and medium flows in summer are typically 20 to 25 percent of the flow rates in the spring, which is much higher than is typically found in most other regions of Illinois. Although high flows and flooding can occur throughout the year, a most of these events occur between February and April.

Pecatonica River at Freeport. Of all regions in the Rock River basin, flows on the Pecatonia River at Freeport show the highest groundwater contribution to streamflow. The Pecatonica River region is unique in that during the drier season of the year, August-January, flow characteristics of the Pecatonica River remain virtually unchanged, reflecting the high sustained groundwater component. Low and medium flow rates during this low season are typically as high as 50-60 percent of flow rates during the spring (Figure 12c). Almost half of the high flows and flooding events for the Pecatonica River occur during March, typically through a combination of snow melt, saturated soil conditions, and spring rains.

High Flows

Figure 13 shows the annual series of one-day high flows for the a) Pecatonica River at Freeport, b) South Branch Kishwaukee River at Fairdale, and c) Rock River near Joslin, which provide a sample of conditions throughout the basin. The flow series for the Pecatonica River displays a progressive reduction in high flows. This reduction is believed to occur as a result of changes in land-use management, and represents changes that have occurred in the northwestern portion of the Rock River basin and, in particular, in the physiographic region known as the Driftless Area. The three highest flood events in the 87-year record and six of the highest seven events at the Freeport gage all occurred prior to 1940. In contrast, the flow series for the South Branch Kishwaukee River displays what may be an increase in high-flow conditions over its period of record. In addition, the dominant event during this record, the 1996 flood, has flow rates more than double those of any other flood on record. The high-flow series of the Rock River near Joslin is the most representative of the three flow records for conditions throughout most of the Rock River basin, and shows relatively little overall change in flood conditions over time. Although three major floods were recorded at the Joslin gage during the 1990s, there does not appear to be a detectable trend for increased flooding. Statistical analysis of the high-flow records is examined in the section on “Statistical Trend Analysis.”

Low Flows

Minimum flows during droughts and dry periods are usually defined by the average flow experienced during a critical period of low streamflow. The average flow experienced during a short critical period, such as with a 1-day or 7-day low flow, is useful for evaluating short-term impacts of low streamflow on water quality, aquatic habitat, and direct water withdrawals from streams. The average flow experienced during a long critical period 18-54 months in duration is useful in analyzing extended droughts and their effects on reservoir supplies. The 7-day low flows are discussed in the following paragraphs.

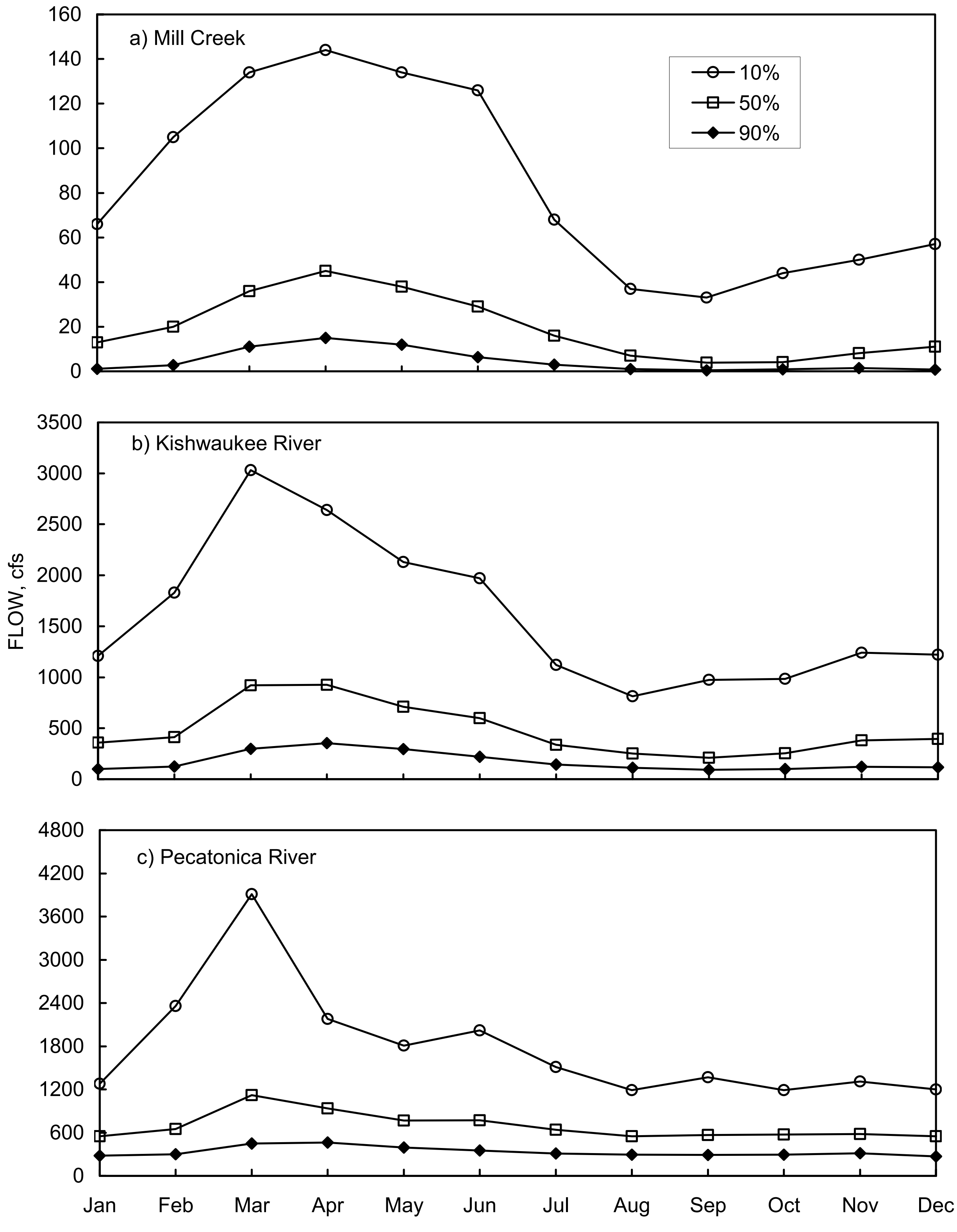

Figure 12. Monthly flow probability of exceedance for a) Mill Creek at Milan, b) Kishwaukee River near Perryville, and c) Pecatonica River at Freeport

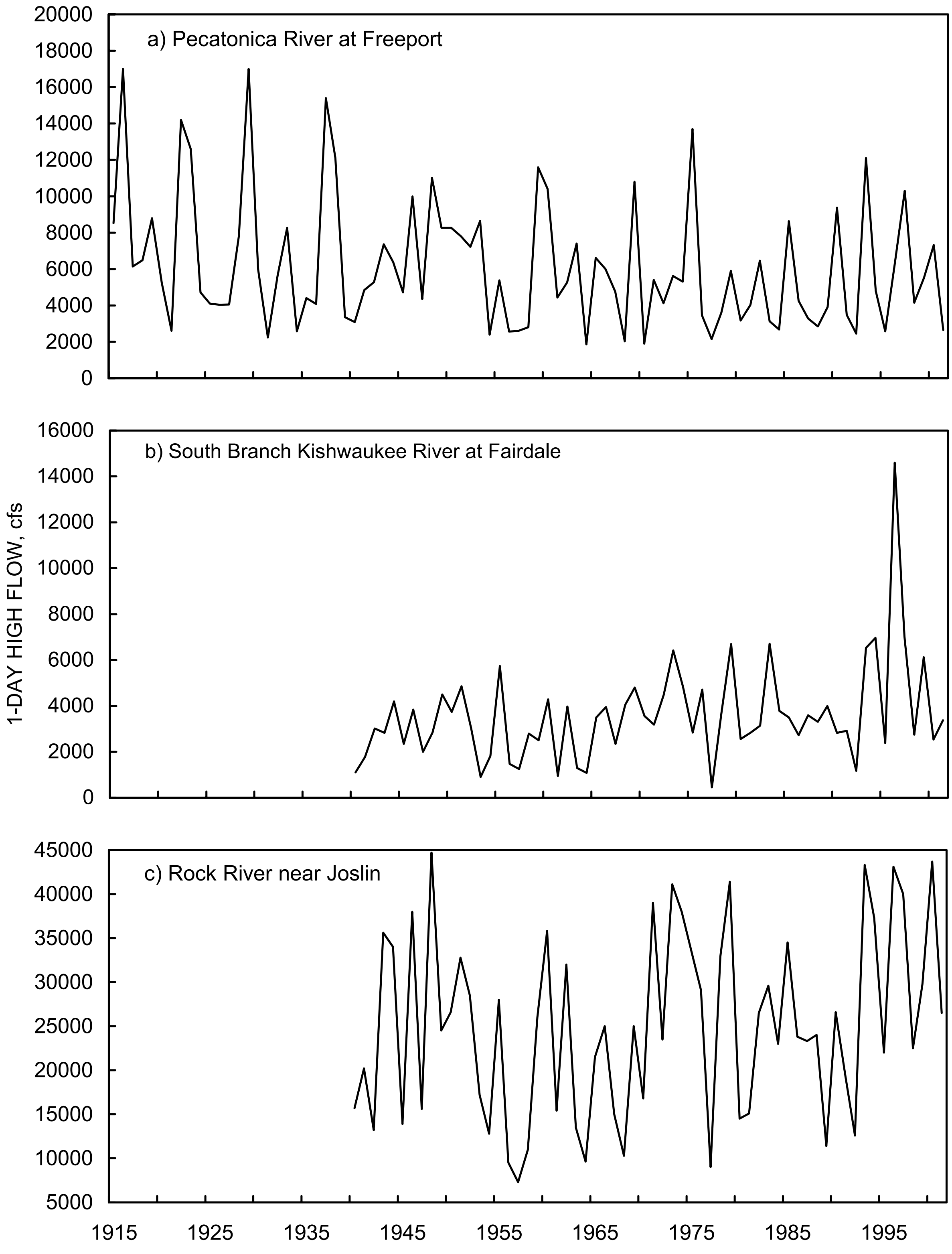

Figure 13. Annual one-day high flows for a) Pecatonica River at Freeport, b) South Branch Kishwaukee River at Fairdale, and c) Rock River near Joslin

Seven-Day Low Flows. Figure 14 presents the 7-day low flows computed for four selected gages. All four gages show a general increasing trend in low flows, ranging from the drought of record in the 1930s to the 1970-2000 period, the wettest period on record based on precipitation records. The two gages with longer records dating back to 1915, the Rock River near Como and the Pecatonica River at Freeport, show that low flows diminished between 1915 and the 1930s drought period. In addition to the record droughts of the 1930s, low flows in the region were experienced during the late 1950s, 1963-1964, 1976-1977, and 1988-1989. Since the late 1960s, the average magnitude of low flows at all gaging stations is noticeably higher than for previous years. As observed by McCabe and Wolock (2002), many locations in the Upper Midwest have experienced what appears to be a step increase in minimum daily flows beginning in about 1970. Statistical analysis of the low flow records is examined in the section on "Statistical Trend Analysis."

Streams throughout the Rock River Hill Country and Green River Lowland tend to have sustained low flows even during drought years, as compared to most other locations in Illinois. Low flows for streams in the Galesburg Till Plain and Bloomington Ridged Plain, on the southern edge of the Rock River basin, tend to be low, and more typical of flows in much of central Illinois.

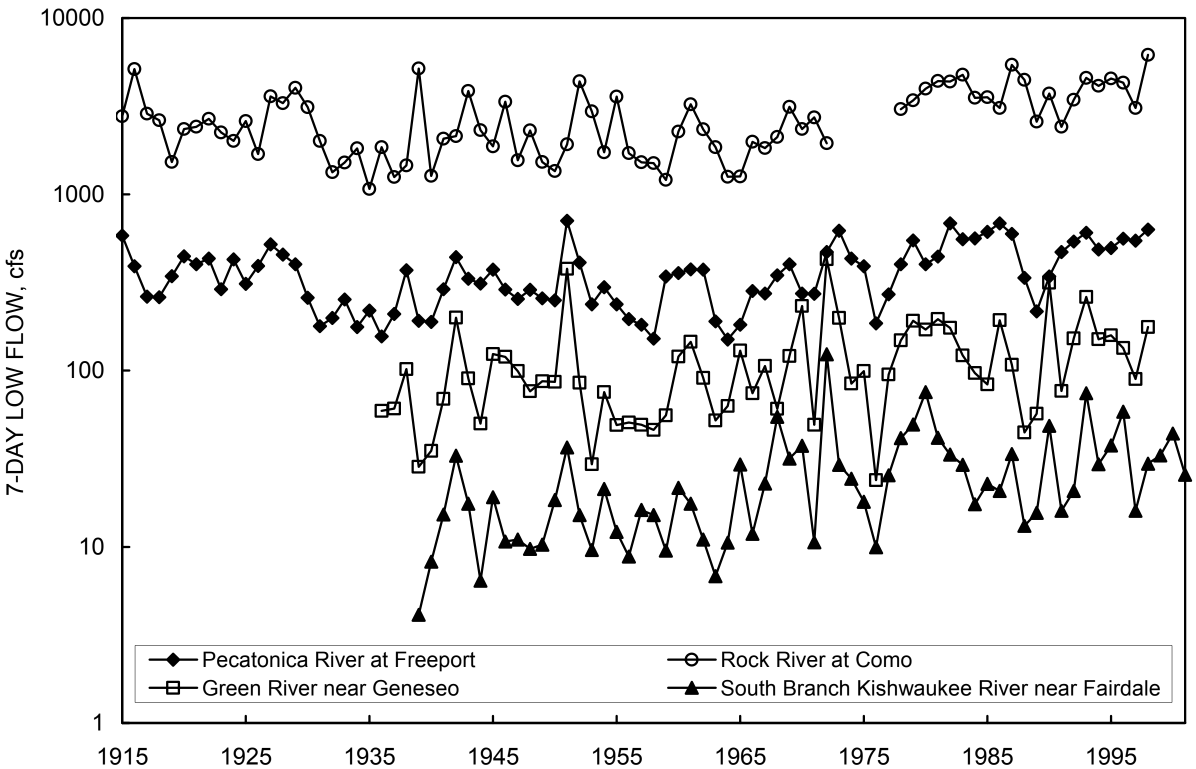

Figure 14. Annual 7-day low flows for four gaging stations in the Rock River basin

Statistical Trend Analysis

Table 8 presents trend correlation coefficients, estimated for the annual flow records for the 11 gaging stations having long-term records (greater than 50 years). The Kendall Tau-β trend statistic was used to provide an indicator of the increase or decrease in the flow values. A correlation coefficient of 1.0 indicates an absolute increasing trend, with each year having a higher flow than the previous year. A coefficient of -1.0 indicates an absolute decreasing trend, and a coefficient of 0.0 indicates no trend. The statistical significance of the correlation coefficient depends, in part, upon the number of years in the streamflow series. The 86-year flow records (1914-2000) with correlation coefficient values greater than 0.120 or less than -0.120 indicate a statistically significant trend; that is, one that can be identified with a 90-percent level of confidence. A 61-year record (1939-2000) requires a somewhat higher correlation coefficient, 0.142, to identify a trend with a 90-percent level of confidence. Finally, a shorter 30-

Table 8. Trend Correlations for Annual Average, High, and Low Flows

		Kendall trend correlation		
Station name	*Years analyzed*	*Average*	*High*	*Low*
Rock River near Afton, WI	1914-2000	0.116	-0.028	0.071
Pecatonica River at Freeport	1914-2000	**0.128**	**-0.143**	**0.226**
Sugar River near Brodhead, WI	1915-2000	**0.121**	**-0.163**	**0.387**
Rock River at Rockton	1939-2000	**0.209**	-0.085	**0.200**
Kishwaukee River at Belvidere	1939-2000	**0.343**	0.102	**0.328**
South Branch Kishwaukee River near Fairdale	1939-2000	**0.313**	**0.187**	**0.367**
Kishwaukee River near Perryville	1939-2000	**0.327**	0.118	**0.318**
Rock River at Como	1914-1971, 1977-1986 1990-present	**0.188**	-0.043	**0.276**
Elkhorn Creek near Penrose	1939-2000	**0.338**	0.048	**0.424**
Rock River near Joslin	1939-2000	**0.345**	0.134	**0.383**
Green River near Geneseo	1936-2000	**0.234**	**0.208**	**0.263**
Rock River near Afton, WI	1970-2000	0.012	0.178	0.080
Pecatonica River at Freeport	1970-2000	**0.226**	0.127	**0.280**
Sugar River near Brodhead, WI	1970-2000	0.170	0.026	**0.264**
Rock River at Rockton	1970-2000	0.144	0.017	0.174
Kishwaukee River at Belvidere	1970-2000	0.045	-0.047	-0.151
South Branch Kishwaukee River near Fairdale	1970-2000	0.028	-0.011	0.004
Kishwaukee River near Perryville	1970-2000	0.075	-0.015	0.019
Elkhorn Creek near Penrose	1970-2000	0.131	-0.062	**0.250**
Rock River near Joslin	1970-2000	0.153	0.054	0.058
Green River near Geneseo	1970-2000	0.054	0.006	-0.019

Note:
Bold type identifies trends that are statistically significant at a 90-percent level of confidence.

year record (1970-2000) requires a correlation coefficient of 0.205 to establish a trend with the same level of confidence. The level of confidence with which a trend can be identified increases as the absolute value of the correlation increases. For example, an 86-year record with a correlation coefficient of 0.143 can identify a trend with a 95-percent level of confidence, and a correlation coefficient of 0.170 can identify a trend with a 98-percent level of confidence.

The trend coefficients in Table 8 were computed for the period of record for each gage and for the 31-year period 1970-2000. Statistically significant trends are identified with bold type. Significant increases in low flows and average flows are shown for the period of record for all gaging records except the Rock River near Afton, WI. The correlation coefficient for average flows exceeds 0.2 for all but the longest flow records starting prior to the 1930s. As can be seen in Figures 6 and 7, average flows from 1915 until 1930 were higher than those in the 1930s; thus, when these earlier years are included, there is a less significant trend of average flows. There is no overall trend of high flows in the basin. Two rivers in the northwestern portion of the region, the Pecatonica and Sugar Rivers, have significant decreasing trends of high flows, whereas two rivers in the southern portion of the region, the Green and South Branch Kishwaukee Rivers, have significant increasing trends.

The period of record can have a substantial influence on the perception of hydrologic trends. The magnitude of the trend coefficients are generally highest when computed over the period 1939-2000, which starts during dry hydrologic conditions (the droughts of the 1930s-1950s) and ends with the 1970s-1990s, a period of above normal precipitation and streamflow. When trend coefficients are computed over a longer period, such as 1915-2000, the trend coefficients are generally less significant. Analysis of gaging records in the Midwest extending back into the late 1800s indicates that these longer records tend to have little or no overall trend of average or high flows (Knapp, 1994). Despite concerns about climate change, there is presently insufficient evidence to predict that the effect of climate on streamflows will be noticeably different in the future than that observed over the course of recorded history. Thus, for this report, streamflows are considered to be stationary; that is, the long-term mean is considered to be relatively constant over time.

Trend coefficients for the 1970-2000 period indicate little change in average, low, and high flows since 1970. However, three locations in the northwestern portion of the Rock River basin, on the Pecatonica River, Sugar River, and Elkhorn Creek show an increasing trend of low flows. The general lack of trends over the 1970-2000 period is consistent with the findings of McCabe and Wolock (2002), who indicate that average and low flows in the 20th Century seem to have experienced a step increase in about 1970. Thus, a significant difference is observed in streamflow conditions when comparing periods before and after 1970; however, there is no additional increase in flow conditions following 1970.

Factors in Estimating Flow Frequency at Gaged Sites

The flow observed at a gaging station represents the cumulative effects of 1) the unaltered or "virgin" hydrologic conditions as influenced primarily by weather and climate phenomena as well as the topography, hydrogeology, and prevailing land-use conditions in the watershed, and 2) modifications to the flow conditions by human activity. Changes in the streamflows over time can occur as a result of climatic variability or from human impacts. Thus, the flow frequency computed directly from a streamgaging record may not always be indicative of the present flow regime on a stream, and it may not be directly comparable to flows measured at different periods of time or at different locations.

Selecting a Representative Period for Estimating Long-Term Conditions

As described in the "Characteristics of Observed Streamflows" section of this report, streamflows can show sizable variation, not only between individual years but also between decades. It is possible that a given 10- or 20-year gaging period may primarily reflect wet or dry conditions within the watershed, and not the full range of expected hydrologic conditions over time. Thus, the years included in a streamgaging record have a significant impact on the estimation of flow frequency at that gage. A primary consideration in the development of flow estimates for ILSAM is that a consistent relationship be maintained between different locations. Thus, it is necessary to define a base period, representative of long-term flow conditions, to which frequency estimates can be related.

For this study, flow duration statistics were developed using a minimum base period, 1939-2000. Considerations in choosing this base period included: 1) a period with a representative number of dry and wet hydrologic conditions, and 2) a period for which many stations have complete records. Examination of Figure 7 illustrates that the base period should extend back into the 1940s to provide a balance between dry conditions from the 1940s to the 1960s and the wet conditions that have prevailed since 1970. Records for 9 of the 13 gaging stations in the region that have more than 50 years of record (listed in Table 7) began in or about 1939. The remaining stations have records that began in 1914-1915. For these remaining stations, flow frequency estimates for the period 1914-2000 are not substantially different than those for the base period 1939-2000. Therefore, if a long-term station's record began prior to 1939, the entire period of record was used.

Estimating Frequencies of Low Flows and Drought Flows

The exceedance probability for a drought or low flow is traditionally calculated by the formula:

$$p = 1 - m/(N+1) \qquad (2)$$

where m is the rank (m = 1 being the lowest drought flow on record, m = 2 being the second lowest flow on record, etc.) and N is the number of years of record. The recurrence interval of the low flow is estimated as $T = 1/(1-p)$.

The relationship between low-flow magnitude and exceedance probability was estimated using two types of mathematical relationships, a Log Pearson Type III (LP3) probability distribution function and a simple log regression function between the flow magnitude and the logarithm of the exceedance probability. The log regression function is described by the equation:

$$Q_n = \alpha \, [\, \ln(X) \,] + \beta \tag{3}$$

where Q is the average streamflow (cfs) for a duration n; X is the exceedance probability (percent); and α /β are constants. The log regression function was applied only to a truncated dataset of low flows with annual exceedance probabilities greater than or equal to 80 percent (5-year recurrence interval). Figure 15 compares low-flow frequency estimates using the log regression function (Equation 3) and the LP3 distribution. For this study, the regression function was determined to be the more adequate of the two functions in describing the measured data for recurrence intervals of 5 years or greater. Graphical adjustments also were used to estimate low-flow frequency in a limited number of cases where neither the LP3 nor regression functions reasonably matched the flow frequency relationship as established by Equation 2.

Adjusting Low-Flow Frequency to Account for Hydrologic Persistence

Use of Equation 2 for determining exceedance probabilities assumes that the low-flow values experienced from year to year are serially independent. Recent research (Douglas et al., 2000), however, found statistically significant serial correlation in the 7-day low flows for approximately 25 percent of the stations studied throughout the United States. The presence of a serial correlation in low flows indicates an increased likelihood that low flows will occur in successive years. For example, during an extended multi-year drought such as the 1963-1965 drought, many streams in the Rock River basin experienced 10-year low flows in both 1963, 1964, and, in some cases, also in 1965. For the Rock River basin and much of Illinois, there is a 25-50 percent chance that a 10-year low flow will be succeeded by another l0-year low flow, depending on location. The significant serial correlation in low flows is directly related to the fact that most severe droughts are multi-year events, lasting 18 months or longer. Thus, use of the annual low-flow series implies multiple observations for a single event, that event being the extended drought.

To account for the serial correlation, or persistence, Douglas et al. (2002) suggest describing low-flow frequency in terms of its “occurrence interval” or the average time until the first event. The recurrence interval, in contrast, represents the average time between a series of events. The average occurrence interval in years, E(T), can be computed using the following expression developed by Vogel (1987) and Fernandez and Salas (1999):

$$E(T) = 1 + p^2 / (q(1 - r)) \tag{4}$$

where p is the probability of exceedance as defined in Equation 2; q is the probability of non-exceedance (l-p), and r is the conditional probability of two events occurring consecutively, each

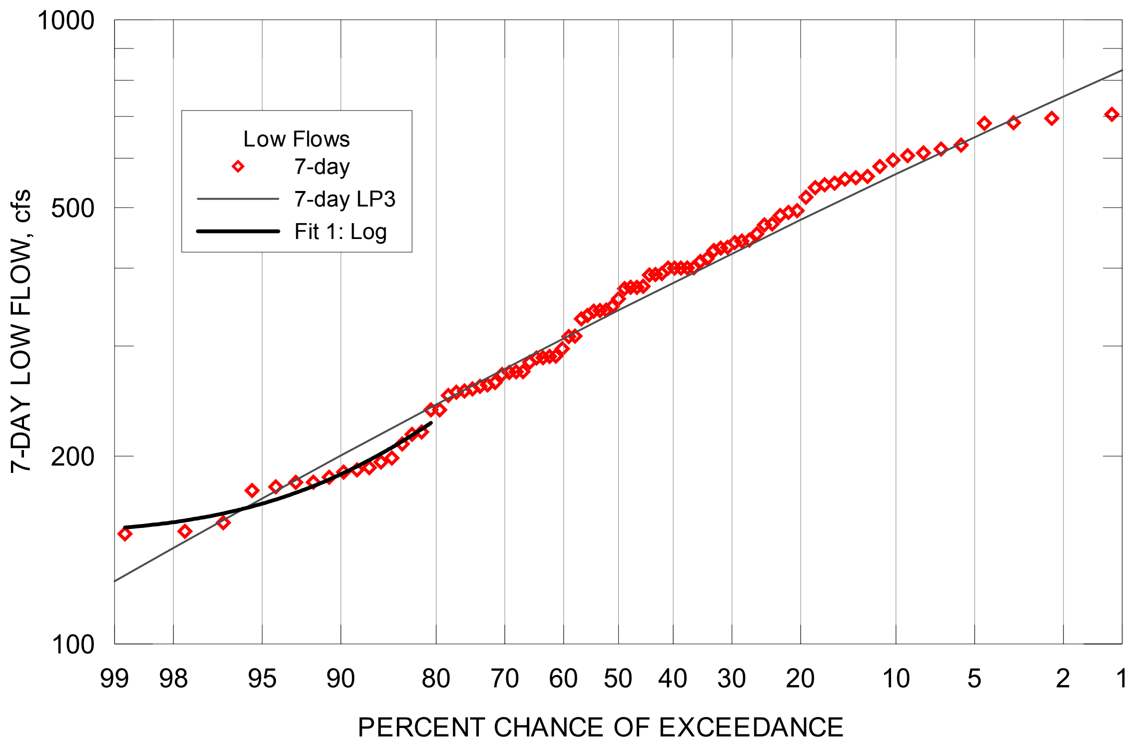

Figure 15. Comparison of two mathematical functions with the ranked values of the annual 7-day low-flow series, Pecatonica River at Freeport, (1914-2000)

having a probability of exceedance equal to or greater than p. Average occurrence intervals were computed using 7-day low-flow data. Figure 16 shows the differences in the probabilities of exceedance for the measured data. The log regression function of Equation 3 was then fit to the adjusted flow data.

The occurrence intervals were computed using 7-day annual low-flow data, which were then applied to all low-flow time series (1-day through 91-day). The drought flow frequency estimates (6-month to 54-month) were not adjusted for persistence because these are not based on an annual series, and are generally not subject to serial correlation. After all low flows were adjusted for persistence, they and drought flows were plotted to fit the log regression functions. Figure 17 provides an example of the distribution functions describing the measured data for selected low-flow and drought flow series. All distributions were inspected for comparative consistency and to identify any sizable deviations between the log regression function and computed occurrence intervals. Graphical adjustments were made when necessary to more closely match the computed occurrence intervals.

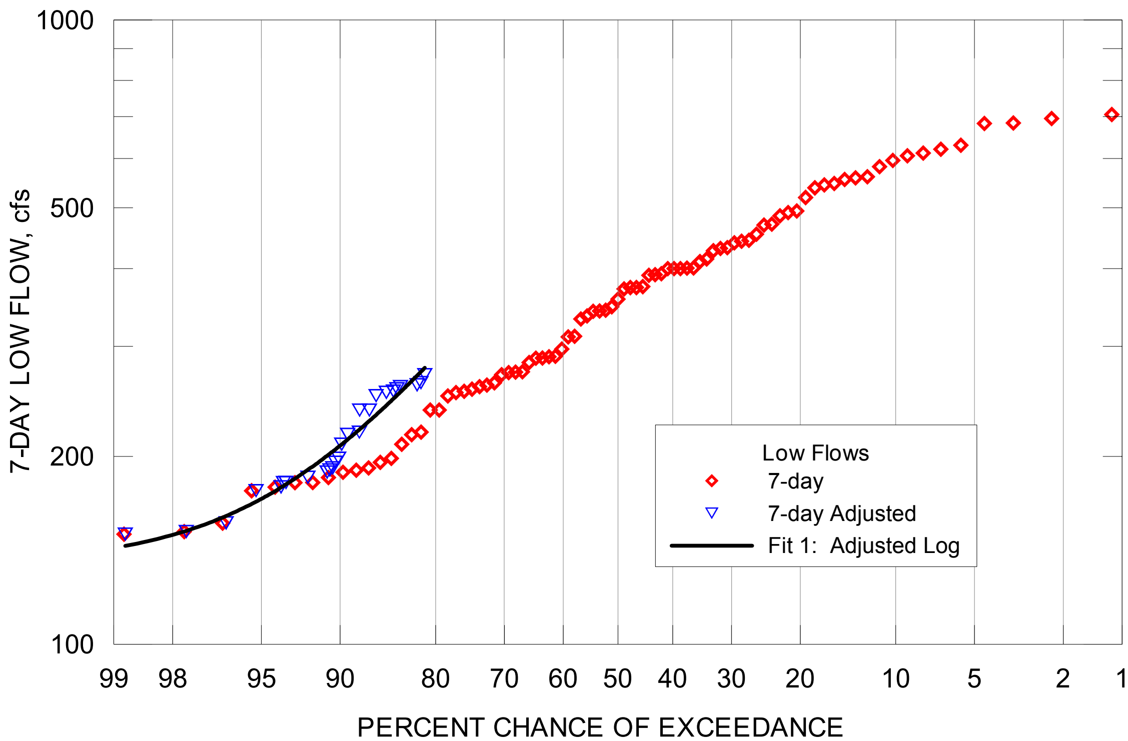

Figure 16. Adjusting exceedance probabilities to account for persistence of annual 7-day low-flow series, Pecatonica River at Freeport, 1914-2000

Record Extension Techniques

Many streamgaging stations, particularly those on smaller streams, have shorter periods of record than the 1939-2000 base period. To provide consistent flow frequency estimates throughout the Rock River watershed, it was necessary to estimate the long-term flow conditions for short-term gaging records using some type of record-extension technique. Different record extension techniques were used for the two types of streamflow parameters.

Flow-Duration Statistics

In developing flow frequencies in previous ILSAM studies, a frequency adjustment or frequency shift

rby long-term gaging record, called an index station, to relate the differences in flow conditions for the short-term versus the longer base period. Details about this method are presented in Knapp (1988, 1990). This frequency adjustment technique has been compared to the MOVE.1 technique (Hirsch, 1982), which is more commonly used for record extension. These comparisons indicate that the frequency shift method generally provides a more accurate estimate of the long-term flow frequency than the MOVE.1 technique when using shorter gaging records in Illinois.

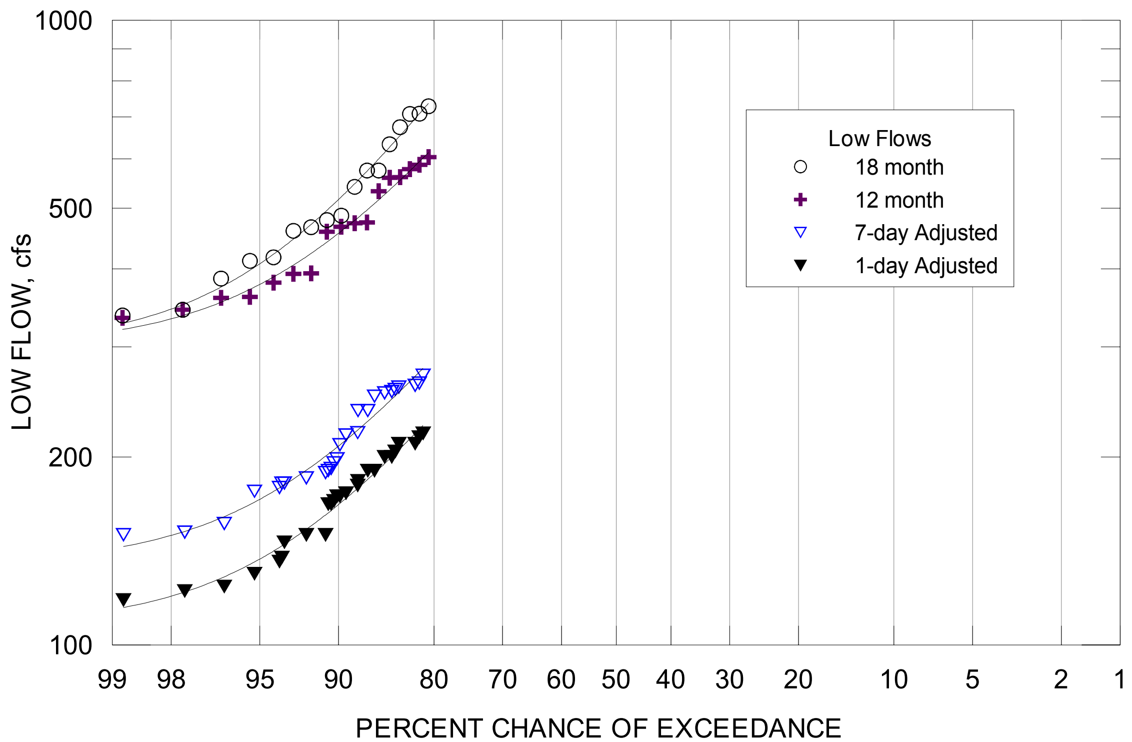

Figure 17. Comparison of the log regression function with the ranked values of the annual low-flow series, with adjustment in exceedance probabilities to account for persistence, Pecatonica River at Freeport, 1914-2000

Frequencies of Low Flows and Drought Flows

The coefficients in the log regression equation (Equation 3) were summarized for all long-term stations. The ratio α /β was regressed against both drainage area and the log-transformed drainage area for all stations in an effort to apply the above log regression function to stations with shorter records. While no relationship could be derived based on the drainage area of a gaging station, there did appear to be some consistency in the ratio α /β. Although the ratio varied from -0.199 to -0.221 for all stations, the variation was smaller between flow parameters for stations in the same physiographic region. Based on this observation, average α /β ratios were calculated for each region of the Rock River watershed. Four regions were used for this purpose: Rock Region I, which contains the eastern portion of the Rock River Hill Country (east of the Rock River); Rock Region II, which includes the Wisconsin Driftless Section and the western portion of the Rock River Hill Country; the Bloomington Ridged Plain; and the Green River Lowland. Table 9 lists the α /β coefficient ratios for each region.

For short-term gaging stations, a 20-year period of record, especially during wet hydrologic conditions, is simply not adequate to calculate a 50-year low flow. However, the record length may be entirely adequate to estimate a 10-year low flow. The coefficient ratios

Table 9. Average α / β Ratio for Four Physiographic Regions

Flow	*Rock Region I*	*Rock Region II*	*Bloomington Ridged Plain*	*Green River Lowland*
$Q_{1\text{-day}}$	-0.208	-0.209	-0.215	-0.211
$Q_{7\text{-day}}$	-0.206	-0.208	-0.216	-0.211
$Q_{15\text{-day}}$	-0.206	-0.207	-0.216	-0.211
$Q_{31\text{-day}}$	-0.206	-0.207	-0.215	-0.210
$Q_{61\text{-day}}$	-0.204	-0.205	-0.214	-0.209
$Q_{91\text{-day}}$	-0.202	-0.205	-0.214	-0.209
$Q_{6\text{-month}}$	-0.204	-0.201	-0.215	-0.208
$Q_{9\text{-month}}$	-0.204	-0.204	-0.215	-0.211
$Q_{12\text{-month}}$	-0.209	-0.208	-0.213	-0.214
$Q_{18\text{-month}}$	-0.211	-0.211	-0.214	-0.215
$Q_{30\text{-month}}$	-0.211	-0.210	-0.213	-0.214
$Q_{54\text{-month}}$	-0.212	-0.211	-0.214	-0.212

described above coupled with the log regression function will now allow for the derivation of a suite of low-flow frequency estimates for shorter periods of record based on low-flow estimates for a single recurrence interval.

Application of Log Distribution

Use of the log distributions to derive other low-flow estimates is illustrated by the following example for Coon Creek at Riley. An estimate of the 7-day, 10-year low flow for this site is 2.5 cfs. Constants for Equation 3 can then be determined as follows:

$Q_{7,10}$ = 2.5 cfs
Exceedance probability = [(1 – (1/10)] * 100 = 90%
Physiographic region = Rock Region I
$\alpha / \beta_{\text{ 7-day}} = -0.206$

Substituting these terms into Equation 3 yields:

$2.5 = -0.206\beta\ [\ \ln(90)\ ] + \beta$

therefore,

$\beta = 34.228$ and $\alpha = -7.051$

The 25-year and 50-year estimates of 7-day low flow are calculated using the coefficients (α,β) computed above:

$Q_{7\text{-day}} = -7.051\ [\ \ln(X)\ ] + 34.228$
$Q_{7\text{-day, 25-year}} = -7.051\ [\ \ln(96)\ ] + 34.228 = 2.0$ cfs
$Q_{7\text{-day, 50-year}} = -7.051\ [\ \ln(98)\ ] + 34.228 = 1.9$ cfs

Use of this approach requires a gaging record that is sufficiently long to estimate the 10-year event. For this study, 10-year low flows and drought flows for stations with shorter records were determined using a method described in Knapp (1990). This method basically involves selecting a nearby long-term station as an index station. The historical record for the index station is studied to determine the recurrence interval associated with each major drought or low-flow event. These recurrence intervals then also are associated with flow events that occurred in the same years coincident with the short-term gage's period of record. For example, if within the period of coincident record, the index station had four events lower than the 10-year low flow, then it is assumed that the short-term gage also experienced four events lower than the 10-year low flow, regardless of the actual length of the coincident record. Adjustments are still made when necessary to ensure continuity between the flow estimates of different low-flow durations, that is, the 1-day low flow must always be less than or equal to the 7-day low flow, which is less than or equal to the 15-day low flow, and so forth.

Evaluating Human Modifications to Streamflows

Evaluation of virgin and present flows for a particular gaging record generally requires simulating a daily time series associated with both the virgin flow and flow associated with a modification such as an effluent discharge. Under conditions when flow modifications have not changed significantly over time, it is sometimes sufficient to describe the flow frequency relationship of the modification; for example, to estimate the amount of effluent discharge associated with the 90-percent exceedance flow (or other flow). Empirical algorithms have been developed for previous studies (Knapp, 1988, 1990) to estimate the impact of such modifications on flows. These algorithms, which are coded within ILSAM, have in themselves become useful for estimating the impacts of flow modifications when evaluating virgin and present flows at gaging locations. In this type of procedure, an existing modification located upstream can be input into the model to estimate the downstream impact on streamflows at a gaging location. An iterative process then can be used to compute the virgin and present flow conditions at that site.

Examples of the algorithms used by ILSAM for evaluating flow modifications include methods for estimating: the impacts of reservoirs on downstream flows, variability of effluent discharges during low-flow conditions, reduction of low flows when effluents are discharged into dry streambeds, and the impact of seasonal flow modification on the annual flow frequency. The reader is referred to detailed descriptions of the empirical algorithms in previous reports (Knapp, 1988, 1990).

Results of Analysis

Table 10 provides examples of the present and virgin flow estimates for selected gages in the Rock River basin using the methods described in this section of the report. Estimates for two

Table 10. Comparison of Estimates of Average Flow and 7-Day, 10-Year Low Flow for Selected Stations

Gaging station	*Estimate of average flow (cfs)* Present flow	Virgin flow	Gage record
Green River at Amboy	123	122	88.3
Green River near Geneseo	661	658	659
Kishwaukee River at Belvidere	382	369	377
Kishwaukee River near Perryville	797	766	781
Kyte River near Flagg Center	68.7	63.7	64.8
Pecatonica River at Freeport	947	941	947
Rock Creek near Morrison	86.4	85.7	97.6
Rock River at Rockton	4411	4210	4283
Rock River at Como	5929	5700	5660
Rock River near Joslin	6690	6456	6527
South Branch Kishwaukee River near Fairdale	300	284	289

Gaging station	*Estimate of the 7-Day, 10-year low flow (cfs)* Present flow	Virgin flow	Gage record
Green River at Amboy	5.9	5.0	4.6
Green River near Geneseo	46.1	44.5	47.0
Kishwaukee River at Belvidere	38	30	34
Kishwaukee River near Perryville	82	63	74
Kyte River near Flagg Center	4.7	1.3	2.3
Pecatonica River at Freeport	208	205	197
Rock Creek near Morrison	16.1	15.9	14.1
Rock River at Rockton	926	801	854
Rock River at Como	1202	1087	1061
Rock River near Joslin	1394	1280	1307
South Branch Kishwaukee River near Fairdale	14.2	4.8	9.5

flow parameters are given: the average flow and the 7-day, 10-year low flow. Also shown are estimates of these flow parameters as based directly on flow records at these gages without consideration for flow modifications or for period of record. Estimates of present flow are consistently higher for all gaging locations, reflecting the general increase in the amount of effluent discharges in the basin and their consequent effect on streamflows. For most gaging locations, there is generally less than a 5-percent difference between the average present flow and the average virgin flow. In contrast, for the 7-day, 10-year low-flow estimates, there can be considerable differences between present flow, virgin flow, and flow estimates based solely on the gage record. For most gages, the greatest difference in flow estimates is caused by the effect of effluent discharges in the basin. For gages with shorter records, such as the Green River at Amboy and Rock Creek near Morrison, the greatest difference in flow estimates is generally related to the period of record at the gage. For other gages, such as the Pecatonica River at Freeport, the difference in low-flow estimates is related to the influence of serial correlation on the low-flow frequency analysis.

Value of Gaging Data in Defining Flow Conditions in the Watershed

There are only 11 active gages in the Illinois portion of the Rock River watershed with periods of record longer than 5 years. Most of these existing gages have long-term records that are extremely valuable in determining long-term flow conditions in the watershed. However, only three gages are located on streams with watershed size less than 300 mi^2. In general, the region would benefit from additional active gages on smaller watersheds so that the regional methods to estimate flow conditions at ungaged sites do not have to rely upon gages on smaller streams located outside the region or on older short-term gaging records that may not accurately reflect present or long-term conditions.

Factors in Estimating Flow Frequency at Ungaged Sites

The ILSAM estimates flow conditions at ungaged sites through the use of three types of information: 1) a set of regional equations to estimate unaltered or "virgin" flow conditions at the ungaged site, 2) data on the extent of flow modification upstream of the site, and 3) a collection of model algorithms to estimate the impact of flow modifications on downstream locations.

Appendices A and B provide data on the human modifications for use in evaluating impacts on flows at ungaged sites. Among the streamflow information listed in Appendix A are the locations and flow modifications related to the major reservoirs in the watershed. Appendix B provides the quantity of flow modification associated with the effluent discharges and water withdrawals within the watershed. Previous ILSAM reports (Knapp, 1988, 1990) describe the algorithms and techniques used to extend these impacts further downstream. The evaluation of flow modifications does not include those major changes to the watershed hydrology in the 1800s and early 1900s caused by cultivation and major drainage modifications. Nor are hydrologic changes from recent drainage or agricultural management practices considered, because insufficient data are available from which to explicitly evaluate these impacts. Thus, the virgin flow, as estimated in this report, essentially reflects the unaltered hydrology associated with the climate and general rural land-use conditions in the watershed throughout the mid- and late 1900s.

Many locations in the Rock River watershed, including those on minor streams, have modification to their flows. Despite these modifications, development of an appropriate set of regional equations still represents the most dominant factor in estimating flows at ungaged sites. The remainder of this section focuses on the development and application of these equations.

Regional Equations for Estimating Virgin Flow at Ungaged Sites

The regional equations used to estimate unaltered flow conditions are based on a regression analysis of streamgage records within geographic regions that are expected to have similar streamflow characteristics. Previous ILSAM studies used the physiographic divisions established by Leighton et al. (1948) to define the geographic areas for which regional equations were developed. Within each region, three watershed characteristics were used to describe the variation in streamflow characteristics: drainage area (DA), soil permeability (K), and average annual net precipitation or PNET (precipitation minus evapotranspiration, which is essentially equivalent to the average annual streamflow in inches). The computation of these watershed characteristics is described below.

To develop and apply the regional flow equations to the Rock River watershed, it was necessary to develop a database of watershed characteristics for all streams within the watershed. A database table, termed the NETWORK table, includes information on DA, K, and PNET for more than 1300 stream locations within the watershed. Drainage areas were measured for all watershed locations. For each watershed location, data from county soil surveys and statewide soil association maps were used to compute an area-weighted estimate of the average permeability of the soil substrate, as represented using permeability values from the deepest layer of each soil type. Long-term precipitation and streamflow records for various locations were used to estimate the net precipitation within the watershed upstream of each location. The resulting NETWORK table is included in the relational database developed for the Rock River ILSAM model, and table values are listed in Appendix C.

The major physiographic divisions in the Rock River watershed in Illinois are the Rock River Hill Country, the Wisconsin Driftless Section, the Bloomington Ridged Plain, and the Green River Lowland. For the current study, equations were developed for two regions: Rock River Region I, which contains the eastern portion of the Rock River Hill Country; and Rock River Region II, which includes the Wisconsin Driftless Section and the western portion of the Rock River Hill Country. Equations for the Bloomington Ridged Plain were updated from those originally developed by Knapp (1990) to take into account 13 years of additional flow data and increase the number of streamgage records used to develop the equations. The Green River Lowland, a minor physiographic region dominated by sandy soils, has an insufficient number of gages with which to develop regional flow equations. Equations originally developed for sandy soils within the Kankakee River basin (Knapp, 1992) were judged to be appropriate for use in the Green River Lowland.

Rock River Regions

A total of eight streamgaging records from watersheds located within Rock River Region I were examined as potential input for developing the set of regional equations. The gages examined had periods of record ranging from 8 to 61 years. One gaging station in the far eastern portion of the Rock River Hill Country, Piscasaw Creek near Walworth, WI, was dropped from consideration after it was observed that its flow characteristics were not representative of long-term flow conditions. This station had only eight years of record (1992-2000), which described predominantly wet hydrologic conditions. Table 11 identifies the remaining seven gages used in the analysis. The flow record at one station, Kyte River near Flagg Center, which is affected by an upstream discharge, was adjusted by subtracting the impact from the Rochelle discharge. This adjusted record, a representation of unaffected flow, was used in developing the regional equations.

Table 11. USGS Streamgage Records Used for Developing Regional Equations

a) Rock River Region I

USGS ID	*Station name*	*Drainage area (mi^2)*	*RL* (years)*	*Period of record*
05435000	Cedar Creek near Winslow	1.31	20	1951-1971
05438250	Coon Creek at Riley	85.1	21	1961-1982
05438500	Kishwaukee River at Belvidere	538	61	1939-2000
05440000	Kishwaukee River near Perryville	1099	61	1939-2000
05440500	Killbuck Creek near Monroe Center	117	32	1939-1971
05442000	Kyte River near Flagg Center	116	12	1939-1951
054310157	Jackson Creek Tributary near Elkhorn, WI	4.34	17	1983-2000

Table 11. Concluded

b) Rock River Region II

USGS ID	*Station name*	*Drainage area (mi²)*	*RL* (years)*	*Period of record*
05414820	Sinsinawa River near Menominee	39.6	33	1967-2000
05415000	Galena River at Buncombe, WI	125	53	1939-1992
05415500	East Fork Galena River at Council Hill, WI	20.1	30	1939-1969
05419000	Apple River near Hanover	247	66	1934-2000
05420000	Plum River below Carroll Creek near Savanna	230	37	1940-1977
05434500	Pecatonica River at Martintown,WI	1034	61	1939-2000
05435500	Pecatonica River at Freeport	1326	86	1914-2000
05441000	Leaf River at Leaf River	103	19	1939-1958
05444000	Elkhorn Creek near Penrose	146	61	1939-2000
05445500	Rock Creek near Morrison	158	16	1942-1958

c) Bloomington Ridged Plain

USGS ID	*Station name*	*Drainage area (mi²)*	*RL* (years)*	*Period of record*
03336500	Bluegrass Creek at Potomac	35	22	1949-1971
03343400	Embarras River near Camargo	186	40	1960-2000
05439000	South Branch Kishwaukee River at Dekalb	77.7	21	1979-2000
05439500	South Branch Kishwaukee River near Fairdale	387	61	1939-2000
05525500	Sugar Creek at Milford	446	52	1948-2000
05526000	Iroquois River near Chebanse	2091	77	1923-2000
05554000	North Fork Vermilion River near Charlotte	186	20	1942-1962
05554500	Vermilion River at Pontiac	579	53	1947-2000
05555300	Vermilion River near Leonore **	1251	69	1931-2000
05559500	Crow Creek near Washburn	115	27	1944-1971
05564400	Money Creek near Towanda ***	49	49	1933-1982
05566500	East Branch Panther Creek at El Paso	30.5	33	1949-1982
05567500	Mackinaw River near Congerville	767	53	1947-2000
05570910	Sangamon River at Fisher	240	22	1978-2000
05572000	Sangamon River at Monticello	550	86	1914-2000
05580000	Kickapoo Creek at Waynesville	227	52	1948-2000
05590000	Kaskaskia Ditch at Bondville	12.4	41	1949-1990
05590800	Lake Fork at Atwood	149	28	1972-2000
05591500	Asa Creek at Sullivan	8.1	32	1950-1982
05591550	Whitley Creek near Allenville	34.6	20	1980-2000
05591700	West Okaw River near Lovington	112	20	1980-2000

Notes:
* RL = record length.
** Record was appended to the record for Vermilion River at Lowell.
*** Record was appended to the record for Money Creek near Hudson.

Eleven streamgaging records were examined as potential input for developing the regional equations for Rock River Region II. The gages examined had periods of record ranging from 16 to 86 years. Cedar Creek near Winslow, located in the western portion of the Rock River Hill Country, was dropped from consideration after it was observed that its low-flow characteristics were quite different than those at the remaining gages, and atypical of flow conditions in this second Rock River region. The drainage area of this gaging station is extremely small (1.3 mi^2), and the record contains significant zero flow. Table 11 identifies the remaining 10 gages used in the second set of regional equations.

Bloomington Ridged Plain

Updating the set of regional equations for the Bloomington Ridged Plain included examining all streamgaging records from watersheds bordering or within the Bloomington Plain with greater than 40 years of record. When this resulted in the inclusion of only three stations with drainage areas less than 200 mi^2, the criteria were expanded to include stations with a combination of at least 20 years of record and drainage areas less than 250 mi^2. A total of 29 streamgaging records were considered as input for the updated set of regional equations. These stations had little or no impact from reservoirs, urbanization, or effluent discharges. Eight gaging stations were later dropped from consideration because their flow characteristics were somewhat different than those at the remaining gages. Three of the stations dropped, Mazon River near Coal City, Terry Creek near Custer Park, and Lake Fork near Cornland, are actually located outside of the Bloomington Ridged Plain. The other five stations omitted were the Iroquois River at Iroquois, Bureau Creek at Princeton, West Bureau Creek at Wyanet, East Bureau Creek near Bureau, and Blackberry Creek near Yorkville. Differences in their flow statistics reflect unique physical characteristics of each station not found throughout the region. Table 11 identifies the remaining 21 gages used in the third set of regional equations. The flow at one station, the South Branch of the Kishwaukee River near Fairdale, which is affected by upstream discharges, was used in developing equations after the record was adjusted by subtracting the impact from the DeKalb and Sycamore discharges. The gaging record for Vermilion River at Pontiac, which is affected by upstream withdrawals, was not used in developing equations for low-flow conditions.

In the development of the regional equations, the relationship between the streamflow quantity and watershed characteristics follows the following form:

$$Q_x = \max \{ Q_{mean} [a + b\,DA + c\,K] - 0.05,\ 0 \} \qquad (5)$$

where Q_x (cfs) is any individual flow parameter estimated by the model; Q_{mean} (cfs) is the annual mean flow at the location of interest; DA (mi^2) is the total drainage area of the watershed; K (inches per hour) is the average subsoil permeability of the watershed; and a, b, and c are equation coefficients that are unique for each flow parameter. The constant -0.05 is used to interpret very low, nonzero flows as essentially representing dry zero-flow conditions. The annual mean flow is determined from estimates of the average annual values for precipitation (inches) and evapotranspiration (inches) over the watershed:

$$Q_{mean} = 0.0738\, DA\, (P - ET) \qquad (6)$$

The difference between average annual precipitation and evapotranspiration, P – ET, was computed for all stream locations in the Rock River watershed, and these are included in the NETWORK table of the ILSAM database and listed in Appendix C. This difference is termed the average annual net precipitation.

The form of Equation 5 and the independent variables used in that equation were developed in previous ILSAM regional studies for various parts of Illinois. Several of these previous studies investigated the use of other watershed factors such as channel slope and land slope for the regional regression equations, and provided little or no improvement in the standard error of the regression analysis. No additional attempt was made in the present study to identify other additional watershed characteristics that could be useful as independent variables in Equation 5.

For each flow variable, least-squares regression was used to compute the values of coefficients a, b, and c in Equation 5. Figure 18 shows the computed values of a, b, and c for each of the annual flow-duration values in Rock River Region I. As can be seen in this figure, there is a systematic trend in each of the three parameters as the flow-duration percentage increases. The coefficients developed using least-squares regression, while they produce minimal estimation error, do not always maintain a consistent flow frequency relationship for all combinations of watershed characteristics. For example, in some cases it is possible to specify a drainage area and subsoil permeability in which the Q_{99} flow duration estimated by the equations exceeds the estimated Q_{98}, thus violating the definitions of these flow values. Thus, the equations were examined to identify potential situations where the model may produce inconsistent estimates of flow frequency. In general, inconsistencies occur when the three coefficients do not follow the smooth curves shown in Figure 18, which relate the coefficient value to change in flow frequency. For example, potential inconsistencies in flow frequency may be expected to occur if the value of coefficient a does not systematically decrease with each increase in flow-duration percentage. If the change in coefficients is not smooth, then the coefficients are adjusted. The adjustment process involves changing the value of coefficient c until it fits on the smooth curve shown in Figure 18, and then recomputing coefficients a and b. This type of adjustment process produces an equation that is not a least-squares estimate but still has low error, while producing flow-duration curves and low-flow frequency estimates that are consistent, thus making sense both hydrologically and statistically.

Appendix D lists the resulting coefficients developed for the 154 flow parameters used in the Rock River ILSAM. Regression analysis determined that the subsoil permeability factor, K, did not have a significant contribution to explain variations in the flow statistics for Rock River Region II. Thus, coefficient c was set to zero in the regional equations. Many streams in this region cut through bedrock, resulting in high baseflow conditions. Therefore the subsoil permeability values most likely have little effect on the total streamflow.

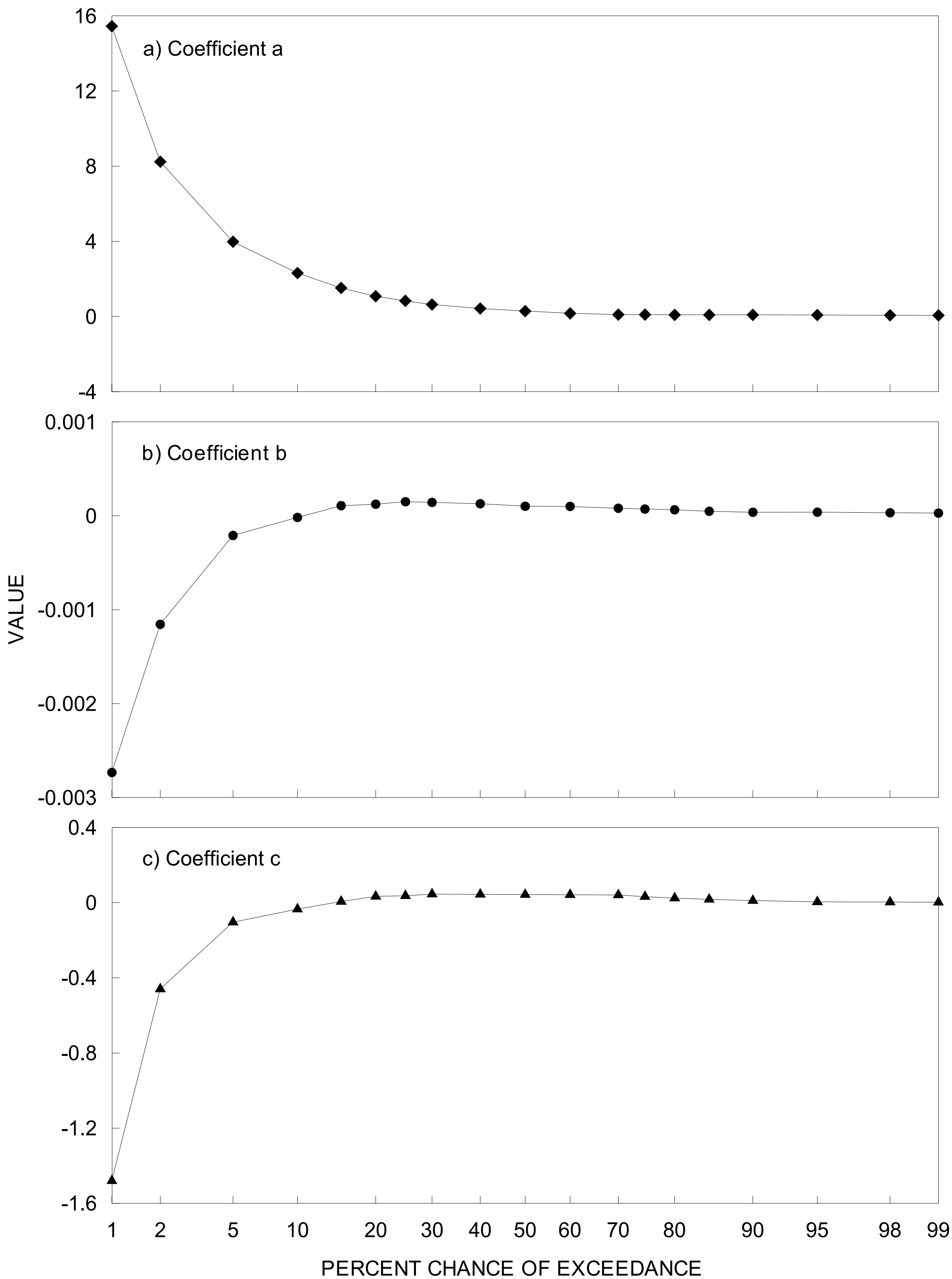

Figure 18. Variability in regional regression coefficients for annual flow-duration parameters, Rock River Region I

Also shown in Appendix D is a coefficient of error, c_e, associated with these equations. This error coefficient is computed as the standard error of the nondimensional linear regression analysis used in developing the regional equations, with DA and K as independent variables and $Q_{x/}\ Q_{mean}$ as the dependent variable. Thus, c_e is neither an absolute error nor a percentage error. To compute the error of a particular flow parameter in units of cfs, c_e for that parameter must be multiplied by the mean flow rate in cfs at the location of interest. The error in the regional equations is generally in the 5 - 30 percent range, but it may be larger for very low flow conditions. An example of the application of the equations is given below. Results are applicable to locations ranging in size from 10 to 1000 mi^2.

Application of Regression Equations

The application of the equations is illustrated by the following example in which various annual flow duration statistics are estimated for the East Branch South Branch Kishwaukee River at its mouth. The watershed for this location has the following characteristics:

Drainage area = 122.7 mi^2
Average soil permeability = 1.11 inches per hour
Average annual excess precipitation (P - ET) = 10.24 inches
Physiographic region: Bloomington Ridged Plain

The following estimates of the annual flow duration are computed: Q_{98}, Q_{90}, Q_{75}, Q_{50}, Q_{25}, Q_{10}, and Q_{02}. Virgin flow coefficients from Appendix D are used in the following computations:

$$Q_{mean} = 0.0738\ (122.7)\ (10.24) = 92.7 \text{ cfs}$$

$$Q_{98} = \max \{\ 92.7\ [-\ 0.018397 + 0.00000522\ (122.7) + 0.03310\ (1.11)] - 0.05,\ 0\ \}$$
$$= \max \{\ 1.71,\ 0\ \} = 1.71 \text{ cfs}$$

$$Q_{90} = 92.7\ [-\ 0.024160 + 0.00000698\ (122.7) + 0.06050\ (1.11)] - 0.05 = 4.02 \text{ cfs}$$

$$Q_{75} = 92.7\ [-\ 0.023736 + 0.00000764\ (122.7) + 0.12600\ (1.11)] - 0.05 = 10.8 \text{ cfs}$$

$$Q_{50} = 92.7\ [0.209335 + 0.00001379\ (122.7) + 0.19300\ (1.11)] - 0.05 = 39.4 \text{ cfs}$$

$$Q_{25} = 92.7\ [0.831725 + 0.00006966\ (122.7) + 0.23200\ (1.11)] - 0.05 = 102 \text{ cfs}$$

$$Q_{10} = 92.7\ [2.268377 + 0.00013046\ (122.7) + 0.22500\ (1.11)] - 0.05 = 235 \text{ cfs}$$

$$Q_{02} = 92.7\ [8.344365 - 0.00024842\ (122.7) - 1.86000\ (1.11)] - 0.05 = 579 \text{ cfs}$$

The ILSAM will adjust the virgin flow estimated by the equations for an ungaged site if there is a gaging station on the same stream at which virgin flow is estimated directly from the gaging record. The technique used in this adjustment is described in previous ILSAM reports (Knapp, 1988, 1990). This adjustment is needed to blend the information at the gage site with the results of the regional equations, and thus maintain a smooth transition between the two types of estimates.

Error in Regression Model

The regression relationship between the flow and watershed characteristics explains much of the flow variance between gaging stations in the sample. However, there still can be considerable variation in flows across the watershed and uncertainties in the flow estimate, particularly for smaller watersheds. The standard error of estimate for the virgin flow equations (s_e), in cfs, is estimated as the product of the coefficient of error given in Appendix D (c_e) and the computed mean flow at the point of interest (Q_{mean}):

$$s_e = c_e Q_{mean} \qquad (7)$$

This method of estimating the standard error is derived by the regression equation (Equation 5), with c_e being a standard term for coefficient of error. The percentage of error can be computed as the standard error of estimate divided by the estimated flow for a given parameter. The standard error in computing Q_{mean} (using Equation 6) is 3.3 percent.

Table 12 provides two examples of the computation of the standard error of estimate, the range of flow values contained within one standard deviation from the computed estimate of the flow parameter, and the resulting percent error. The first example is for the East Branch South Branch Kishwaukee River at its mouth, and the second example is for Yellow Creek, a tributary to the Pecatonica River, near the Pearl City sanitary treatment plant. The drainage area of the Yellow Creek site is more than 30 percent smaller than that for the first site and has a mean flow of 56.9 cfs.

Within a given region, the absolute value of the standard error of estimate (s_e) increases as the size of the watershed increases. Although there are exceptions, the absolute error also usually increases as the flow amount increases, thus generally being greater for high-flow conditions than for low-flow conditions. The percentage error is generally least for moderately high-flow conditions, and is less than 10 percent for the Q_{02}, Q_{10}, and Q_{25} flow parameters in the first example. The percentage error is greatest for extreme low flows and can become particularly large as the value of the estimated flow parameter approaches zero.

Estimation of Present Flow

The estimation of present flow for a given ungaged site includes both the estimate of virgin flow and an estimate of the cumulative impact of all flow modifications located upstream from that site. All modifications located upstream of any site are represented in the model, either explicitly by way of their location on the stream or through summary statistics that estimate the cumulative impacts of all upstream modification for specific locations called control points. The estimation

Table 12. Examples in the Computation of Error in the Regression Model

Example 1. East Branch South Branch Kishwaukee River at mouth
Bloomington Ridged Plain, Drainage Area = 122.7 mi^2

Flow parameter	*Flow estimate (cfs)*	*Standard error of estimate (cfs)*	*Range (cfs)*	*Percent error*
Q_{98}	1.71	92.7 * 0.0041 = 0.38	1.33 - 2.09	22
Q_{90}	4.02	92.7 * 0.0069 = 0.64	3.38 - 4.66	16
Q_{75}	10.8	92.7 * 0.0208 = 1.93	8.9 - 12.7	18
Q_{50}	39.4	92.7 * 0.0460 = 4.3	35.1 - 43.7	11
Q_{25}	102	92.7 * 0.0685 = 6.4	96 - 108	6
Q_{10}	235	92.7 * 0.1778 = 16	219 - 251	7
Q_{02}	579	92.7 * 0.4613 = 43	536 - 622	7

Example 2. Yellow Creek near Pearl City treatment plant
Rock Region II, Drainage Area = 80.9 square miles

Flow parameter	*Flow estimate (cfs)*	*Standard error of estimate (cfs)*	*Range (cfs)*	*Percent error*
Q_{98}	9.8	56.9 * 0.0500 = 2.8	7.0 - 12.6 cfs	29
Q_{90}	13.7	56.9 * 0.0628 = 3.6	10.1 - 17.3 cfs	26
Q_{75}	19.3	56.9 * 0.0798 = 4.5	14.8 - 23.8 cfs	23
Q_{50}	30.5	56.9 * 0.0818 = 4.7	25.8 - 35.2 cfs	15
Q_{25}	53	56.9 * 0.0544 = 3.1	50 - 56 cfs	6
Q_{10}	95	56.9 * 0.1526 = 8.7	86 - 104 cfs	9
Q_{02}	318	56.9 * 1.0999 = 63	255 - 381 cfs	20

of present flow from upstream to downstream starts with flow modifications that exist furthest upstream of the site of interest. As indicated earlier, the ILSAM has a collection of algorithms for evaluating present flow conditions, which are used to estimate the downstream impacts of various types of flow modifications. These algorithms are described in several previous reports Knapp (1988, 1990).

Model Operation

The current version of ILSAM was developed to operate on a personal computer having a Microsoft Windows 98/2000/XP operating system. An on-line version with reduced functions is also available through the ISWS Web site: (http://gismaps.sws.uiuc.edu/ilsam/).

The model user is expected to identify the stream and location for which flow statistics are to be computed. Appendix C provides a list of streams in the Rock River basin and their locations identified by river mile. The model can calculate streamflow statistics for existing conditions in the watershed. The model user also may enter a description of a potential or hypothetical water resources project to identify the potential impact of such an additional flow modification.

Appendix C also contains a table of watershed characteristics for more than 1300 locations in the watershed. The model uses this table to identify watershed characteristics pertinent to the location selected by the model user. These characteristics are used in a set of regional equations to estimate unaltered flow conditions at any ungaged site in the watershed. These equations are described in the previous section of this report ("Factors in Estimating Flow Frequency at Ungaged Sites") and are presented in Appendix D.

The model searches for information on streamflow modifications upstream of the point selected by the model user, and then estimates the cumulative impact of these flow modifications. The model supplies two basic data components from which to compute the impact of these flow modifications and the subsequent streamflow quantity. The first data component is a set of computed flows for selected locations (control points) in the watershed, which include the calculated cumulative impacts of all modifications upstream of that site, given in Appendix A. The impact of reservoirs on streamflow is presented in this dataset. The second data component is a dataset on effluent discharges and water withdrawals in the watershed, given in Appendix B. Additional algorithms are included in the model to estimate downstream impacts from specific types of flow modifications.

Every step in the computation of flow conditions includes some degree of uncertainty. Measurement error in streamgaging, and the resulting estimate of daily flows, are generally considered to be in the 5 - 15 percent range, depending on the quality of the gaging location. Additional uncertainties are associated in the processing of hydrologic information for the model, including 1) record extension techniques used for short periods of record, 2) errors in estimating the frequency of infrequent events such as low flows, 3) separation of the gaging record into virgin flow conditions and the impact of flow modifications, and 4) algorithms that estimate downstream impacts of various types of flow modifications. Only the error in the regional flow equations, given in Appendix D, is readily quantifiable and generally applicable to all locations within the basin. Because the estimated error in developing these regional equations also encompasses many of the other errors listed above, it is reasonable to accept them as a comprehensive error for the entire process of flow estimation.

Conclusions

This report describes some basic hydrologic analyses used to identify the expected long-term virgin and present flow conditions at gaged and ungaged locations throughout the Illinois portion of the Rock River basin. Long-term flow conditions are presented as streamflow frequency statistics that describe either the percent chance that a given flow will be exceeded or the recurrence interval, in years, defining the frequency of a specific low-flow value. The "Introduction" describes the frequency statistics that the model estimates.

This study has produced datasets of water-use quantity, streamflow quantity, and watershed information in the form of databases for use with the current version of the Illinois Streamflow Assessment Model (ILSAM). Most of the basic data used by ILSAM are included in the appendices.

The period of years during which flows are measured on a stream can have a significant effect on the estimation of the expected long-term flow frequency at that stream location. It is possible that a given 10- or 20-year gaging record may reflect either wet or dry conditions within the watershed but not totally reflect the full range of expected hydrologic conditions over time. A primary consideration in the development of flow estimates for ILSAM is maintaining a consistent relationship for all locations. For this reason, a base period (1939-2000) was selected to represent long-term flow conditions, to which frequency estimates have been related.

Climate variability has had a significant effect on the streamflows in the Rock River basin over the period of flow measurement. Analysis of most streamgaging records in the Rock River basin indicates an increasing trend in low flows and average flows over the 1939-2000 period that appears to be the result of coincident increases in the average annual precipitation. The flow records also do not appear to show an overall change in the magnitude of peak flows. The significance of the trend in average streamflows is diminished for longer gaging records, and other studies indicate little overall trend in either precipitation or streamflow in Illinois or the Midwest when evaluated over the past 100-150 years. Despite concerns about climate change, there is presently insufficient evidence to predict that the effect of climate on streamflows will be noticeably different in the future than that observed over the course of recorded history. Thus, for this report, streamflows were considered to be stationary; that is, the long-term mean was considered to be relatively constant over time.

The Rock River basin is hydrologically complex, compared to most other regions of Illinois and has a variety of differences in land physiography and soil characteristics that influence the streamflow properties within the basin. In addition to the natural spatial variability of streamflows in the region, additional flow differences are created by human modification. In particular, wastewater treatment plants from the major population areas introduce additional discharge into many streams. These discharges do not ordinarily cause substantial changes in streamflow quantity during normal to high-flow conditions, but they have noticeable effects on low flows in selected streams. Continued increases in the low-flow amounts of many streams in the eastern side of the basin can be expected as the margins of the Chicago metropolitan area expand into the Rock River basin. The ILSAM accounts for all of these effluent discharges and other flow modifications in its estimates of streamflow amounts. The source of most water supply in the basin is groundwater that is not directly linked to the surface hydrology.

Accurate prediction of expected flow conditions in the future will require additional periodic evaluation to account for flow changes that result from either climatic variability or additional human impacts in the watershed. The ability to perform these periodic evaluations will depend, in part, upon the continued procurement of flow data from streamgaging, particularly from gaging stations representative of regional hydrology. Despite the variability in streamflow characteristics across the watershed, the basin has relatively few active streamgages except on its larger rivers.

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Appendix A. Control Points: Location and Estimated 2001 Flow Conditions

Control point number and location	Flow condition	Stream code	Mile
1 Rock River at Mouth	Virgin	R	0
2 Rock River at Mouth	Present	R	0
3 Rock River at confluence with Green River	Virgin	R	13
4 Rock River at confluence with Green River	Present	R	13
5 Rock River USGS Gage #05446500 Joslin	Virgin	R	26.9
6 Rock River USGS Gage #05446500 Joslin	Present	R	26.9
7 Rock River USGS Gage #05443500 Como	Virgin	R	69.2
8 Rock River USGS Gage #05443500 Como	Present	R	69.2
9 Rock River USGS Gage #05437500 Rockton	Virgin	R	156
10 Rock River USGS Gage #05437500 Rockton	Present	R	156
11 Rock River USGS Gage #05430500 Afton, WI	Virgin	R	171
12 Rock River USGS Gage #05430500 Afton, WI	Present	R	171
13 Mill Creek USGS Gage #05448000 Milan	Virgin	RB	1.2
14 Mill Creek USGS Gage #05448000 Milan	Present	RB	1.2
15 Green River USGS Gage #05447500 Geneseo	Virgin	RD	14.9
16 Green River USGS Gage #05447500 Geneseo	Present	RD	14.9
17 Green River USGS Gage #05447000 Amboy	Virgin	RD	72.1
18 Green River USGS Gage #05447000 Amboy	Present	RD	72.1
19 Rock Creek USGS Gage #05445500 near Morrison	Virgin	RI	19
20 Rock Creek USGS Gage #05445500 near Morrison	Present	RI	19
21 Elkhorn Creek USGS Gage #05444000 near Penrose	Virgin	RL	17.5
22 Elkhorn Creek USGS Gage #05444000 near Penrose	Present	RL	17.5
23 Kyte River USGS Gage #05442000 near Flagg Center	Virgin	RR	14.3
24 Kyte River USGS Gage #05442000 near Flagg Center	Present	RR	14.3
25 Leaf River USGS Gage #05441000 Leaf River	Virgin = Present	RS	7
26 Kishwaukee River USGS Gage #05440000 Perryville	Virgin	RU	9.6
27 Kishwaukee River USGS Gage #05440000 Perryville	Present	RU	9.6
28 Kishwaukee River USGS Gage #05438500 Belvidere	Virgin	RU	21.9
29 Kishwaukee River USGS Gage #05438500 Belvidere	Present	RU	21.9
30 Killbuck Creek USGS Gage #05440500 near Monroe Center	Virgin	RUB	10.1
31 Killbuck Creek USGS Gage #05440500 near Monroe Center	Present	RUB	10.1
32 South Branch Kishwaukee River USGS Gage #05439500 near Fairdale	Virgin	RUE	11
33 South Branch Kishwaukee River USGS Gage #05439500 near Fairdale	Present	RUE	11
34 South Branch Kishwaukee River USGS Gage #05439000 DeKalb	Virgin = Present	RUE	48.5

Note:
Stream codes are as listed in Appendix C.

Appendix A. Continued

Control point number and location	Flow condition	Stream code	Mile
35 Beaver Creek Tributary at Candlewick Lake	Virgin	RUHI	1.7
36 Beaver Creek Tributary at Candlewick Lake	Present	RUHI	1.7
37 Piscasaw Creek USGS Gage #05438283 near Walworth, WI	Virgin = Present	RUK	28
38 Coon Creek USGS Gage #05438250 Riley	Virgin	RUL	12.8
39 Coon Creek USGS Gage #05438250 Riley	Present	RUL	12.8
40 Burlington Creek at mouth	Virgin	RULQ	0
41 Burlington Creek at mouth	Present	RULQ	0
42 Willow Creek at Pierce Lake	Virgin	RW	4.6
43 Willow Creek at Pierce Lake	Present	RW	4.6
44 Pecatonica River USGS Gage #05437000 Shirland	Virgin	RY	8.5
45 Pecatonica River USGS Gage #05437000 Shirland	Present	RY	8.5
46 Pecatonica River USGS Gage #05435500 Freeport	Virgin	RY	61.9
47 Pecatonica River USGS Gage #05435500 Freeport	Present	RY	61.9
48 Pecatonica River USGS Gage #05434500 Martintown, WI	Virgin	RY	92.8
49 Pecatonica River USGS Gage #05434500 Martintown, WI	Present	RY	92.8
50 Sugar River USGS Gage #05436500 near Brodhead, WI	Virgin	RYC	17.5
51 Sugar River USGS Gage #05436500 near Brodhead, WI	Present	RYC	17.5
52 Otter Creek Tributary at Summerset Lake	Virgin	RYCDJ	5.5
53 Otter Creek Tributary at Summerset Lake	Present	RYCDJ	5.5
54 Richland Creek at Mouth	Virgin	RYU	0
55 Richland Creek at Mouth	Present	RYU	0

Note:
Stream codes are as listed in Appendix C.

Appendix A. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Q_{01}	30736	31153	30330	30741	26682	27058	24716	25090	17700	18000
Q_{02}	26059	26450	25714	26100	22901	23253	21016	21367	14900	15180
Q_{05}	19790	20151	19528	19885	17104	17429	15207	15531	11200	11456
Q_{10}	14825	15161	14629	14961	12905	13206	11214	11515	8490	8728
Q_{15}	12136	12454	11976	12289	10584	10867	9221	9504	7000	7225
Q_{25}	9247	9544	9125	9418	8113	8377	7082	7347	5310	5523
Q_{40}	6764	7043	6675	6950	5906	6153	5167	5414	3800	4001
Q_{50}	5508	5775	5435	5699	4875	5111	4224	4461	3120	3315
Q_{60}	4492	4748	4433	4685	3992	4216	3444	3669	2580	2767
Q_{75}	3283	3520	3240	3473	2926	3132	2537	2743	1900	2076
Q_{85}	2518	2738	2485	2702	2271	2462	2008	2200	1480	1648
Q_{90}	2135	2343	2107	2312	1953	2132	1721	1901	1260	1419
Q_{95}	1806	1998	1782	1972	1649	1814	1425	1591	1050	1201
Q_{98}	1515	1683	1495	1661	1383	1524	1193	1336	886	1022
Q_{99}	1397	1545	1379	1525	1282	1404	1065	1189	794	918
Q_{mean}	7354	7620	7257	7519	6456	6690	5700	5934	4210	4411
Low Flows										
$Q_{1,2}$	2088	2228	2060	2199	1869	1984	1491	1608	1170	1291
$Q_{1,10}$	1282	1359	1265	1341	1180	1233	879	933	637	706
$Q_{1,25}$	1057	1132	1043	1117	957	1008	558	610	547	616
$Q_{1,50}$	944	1030	932	1016	861	922	506	569	518	587
$Q_{7,2}$	2227	2420	2198	2388	2010	2174	1737	1902	1390	1547
$Q_{7,10}$	1381	1521	1363	1501	1280	1394	1087	1202	801	926
$Q_{7,25}$	1196	1330	1180	1312	1092	1200	886	996	680	801
$Q_{7,50}$	1079	1213	1065	1197	973	1081	674	784	620	741
$Q_{15,2}$	2334	2536	2303	2502	2054	2227	1852	2026	1450	1609
$Q_{15,10}$	1439	1590	1420	1569	1333	1458	1152	1279	843	973
$Q_{15,25}$	1251	1390	1234	1372	1140	1254	964	1080	750	873
$Q_{15,50}$	1132	1271	1117	1254	1024	1137	702	817	680	802
$Q_{31,2}$	2677	2884	2642	2846	2354	2532	2023	2202	1560	1722
$Q_{31,10}$	1526	1688	1506	1666	1405	1540	1242	1379	908	1044
$Q_{31,25}$	1337	1489	1319	1469	1228	1354	1016	1144	780	914
$Q_{31,50}$	1198	1338	1182	1320	1087	1201	797	913	700	823
$Q_{61,2}$	3069	3286	3028	3243	2791	2979	2310	2499	1830	2000
$Q_{61,10}$	1667	1840	1645	1816	1535	1681	1395	1543	994	1138
$Q_{61,25}$	1494	1645	1474	1623	1356	1481	1114	1241	850	980
$Q_{61,50}$	1366	1512	1348	1492	1234	1354	953	1074	740	867
$Q_{91,2}$	3472	3701	3426	3652	3186	3385	2513	2712	2040	2216
$Q_{91,10}$	1782	1968	1758	1942	1675	1833	1500	1659	1080	1231
$Q_{91,25}$	1582	1744	1561	1721	1418	1553	1264	1401	900	1036
$Q_{91,50}$	1463	1621	1444	1600	1319	1450	1154	1287	810	944

Appendix A. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Drought Flows										
$Q_{6,10}$	2150	2366	2122	2335	1934	2121	1797	1985	1240	1408
$Q_{6,25}$	1748	1945	1725	1919	1596	1764	1410	1580	1050	1207
$Q_{6,50}$	1599	1785	1578	1761	1451	1608	1290	1448	950	1101
$Q_{9,10}$	2665	2893	2630	2855	2437	2635	2304	2502	1490	1669
$Q_{9,25}$	2302	2525	2272	2492	2037	2230	1695	1889	1240	1412
$Q_{9,50}$	2027	2237	2000	2207	1784	1965	1608	1790	1100	1265
$Q_{12,10}$	3210	3458	3168	3412	2900	3116	2884	3101	1980	2170
$Q_{12,25}$	2800	3038	2763	2998	2444	2652	2138	2346	1600	1781
$Q_{12,50}$	2555	2781	2521	2744	2247	2443	1841	2038	1400	1574
$Q_{18,10}$	3727	3988	3678	3935	3417	3646	3312	3541	2170	2367
$Q_{18,25}$	2799	3046	2762	3006	2506	2722	2231	2448	1670	1855
$Q_{18,50}$	2582	2817	2548	2780	2273	2478	2061	2266	1450	1629
$Q_{30,10}$	4743	5014	4680	4948	4151	4390	4021	4260	2850	3053
$Q_{30,25}$	3811	4068	3761	4014	3393	3618	3125	3351	2070	2261
$Q_{30,50}$	3025	3271	2985	3228	2685	2900	2447	2663	1820	2005
$Q_{54,10}$	6214	6497	6132	6411	5506	5756	5533	5784	4060	4270
$Q_{54,25}$	5273	5538	5203	5465	4621	4855	4022	4256	2810	3007
$Q_{54,50}$	4440	4695	4381	4633	3902	4126	3248	3473	2410	2601
January										
Q_{02}	23384	23782	23075	23468	19904	20263	15512	15871	10400	10688
Q_{10}	10818	11149	10675	11002	9505	9801	8254	8550	5750	5988
Q_{25}	7012	7302	6919	7205	6089	6346	5502	5760	3780	3993
Q_{50}	4370	4630	4312	4569	3889	4118	3462	3692	2490	2685
Q_{75}	2866	3105	2828	3064	2611	2820	2583	2793	1700	1876
Q_{90}	1959	2170	1933	2141	1790	1972	1790	1973	1190	1348
Q_{98}	1278	1462	1261	1443	1199	1356	1181	1340	770	914
Q_{mean}	5907	6191	5829	6109	8959	9210	4627	4879	3180	3389
February										
Q_{02}	26796	27199	26442	26839	23483	23845	25974	26335	13800	14096
Q_{10}	14352	14685	14162	14491	12475	12773	13711	14009	8490	8735
Q_{25}	8848	9147	8731	9026	7534	7799	7497	7762	4930	5153
Q_{50}	5357	5630	5286	5556	4588	4830	4476	4718	2940	3141
Q_{75}	3266	3513	3223	3467	2883	3100	2817	3034	1870	2051
Q_{90}	2156	2386	2127	2354	1953	2153	1810	2011	1260	1430
Q_{98}	1639	1847	1617	1823	1489	1669	1250	1428	970	1126
Q_{mean}	7212	7503	7117	7404	9663	9921	6333	6592	3980	4194
March										
Q_{02}	35758	36171	35285	35693	31607	31980	30608	30979	20100	20403
Q_{10}	23106	23458	22800	23148	20488	20804	19374	19689	14800	15056
Q_{25}	15089	15401	14889	15197	13481	13759	12510	12788	9770	10001
Q_{50}	9974	10267	9842	10131	8889	9149	7972	8233	5950	6163
Q_{75}	6673	6945	6585	6853	5841	6081	5487	5727	3890	4087
Q_{90}	4310	4567	4253	4507	3769	3995	3083	3310	2270	2457
Q_{98}	2770	2995	2733	2955	2388	2584	2061	2258	1550	1718
Q_{mean}	12153	12456	11992	12291	12946	13215	9977	10246	7460	7680

Appendix A. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
April										
Q_{02}	32891	33308	32456	32868	28890	29267	25055	25430	20100	20403
Q_{10}	21527	21882	21242	21593	18803	19122	17108	17426	12900	13156
Q_{25}	15656	15977	15449	15766	13700	13987	11385	11672	9140	9375
Q_{50}	10250	10548	10114	10409	9122	9388	7964	8230	6100	6316
Q_{75}	7254	7532	7158	7432	6452	6698	5596	5842	4420	4621
Q_{90}	4907	5170	4842	5102	4373	4605	3830	4063	2960	3151
Q_{98}	3791	4023	3741	3970	3317	3519	2684	2887	2080	2252
Q_{mean}	12238	12542	12076	12376	12195	12465	9391	9661	7240	7460
May										
Q_{02}	26673	27091	26320	26733	23593	23971	19375	19751	15800	16103
Q_{10}	18016	18355	17778	18112	15684	15987	12577	12880	9640	9885
Q_{25}	11943	12243	11785	12081	10198	10464	8273	8539	6480	6701
Q_{50}	8104	8388	7997	8277	7152	7403	5746	5997	4390	4597
Q_{75}	5367	5640	5296	5565	4706	4947	3873	4114	3000	3197
Q_{90}	3836	4096	3785	4042	3359	3588	2610	2840	2070	2260
Q_{98}	2343	2574	2312	2540	2069	2270	1683	1881	1300	1470
Q_{mean}	9781	10073	9652	9940	9668	9927	6765	7025	5280	5494
June										
Q_{02}	28810	29227	28429	28841	24682	25059	21116	21491	14300	14603
Q_{10}	16739	17079	16518	16853	13885	14189	10771	11075	8920	9166
Q_{25}	10317	10613	10181	10473	8938	9201	7176	7439	5620	5839
Q_{50}	6764	7039	6675	6946	5817	6060	4706	4949	3510	3711
Q_{75}	4159	4421	4104	4363	3631	3862	3111	3343	2220	2411
Q_{90}	2942	3191	2903	3149	2590	2809	2206	2426	1600	1783
Q_{98}	2115	2338	2087	2307	1868	2062	1326	1521	1060	1228
Q_{mean}	8578	8850	8465	8733	8691	8931	6028	6268	4520	4722
July										
Q_{02}	25012	25379	24681	25043	22692	23021	18006	18335	13500	13767
Q_{10}	13432	13740	13254	13558	11504	11778	9314	9588	6990	7215
Q_{25}	7798	8072	7695	7965	6894	7135	5701	5942	4490	4695
Q_{50}	4709	4971	4647	4905	4187	4417	3353	3584	2580	2774
Q_{75}	3150	3395	3108	3350	2775	2990	2375	2590	1750	1930
Q_{90}	2380	2607	2349	2573	2121	2318	1697	1895	1220	1390
Q_{98}	1775	1970	1752	1944	1572	1739	1104	1272	852	1003
Q_{mean}	6592	6848	6505	6757	7206	7430	4797	5021	3580	3770
August										
Q_{02}	15512	15862	15307	15652	13592	13905	13171	13483	7790	8045
Q_{10}	8759	9041	8643	8921	7837	8086	7089	7339	5340	5550
Q_{25}	5951	6202	5872	6120	5380	5600	4595	4816	3600	3792
Q_{50}	3903	4140	3851	4085	3473	3680	2783	2990	2090	2269
Q_{75}	2552	2781	2518	2744	2302	2502	1892	2093	1440	1610
Q_{90}	1959	2165	1933	2136	1780	1957	1420	1599	1080	1238
Q_{98}	1523	1694	1503	1672	1333	1477	913	1059	763	899
Q_{mean}	4890	5125	4825	5057	5072	5277	3750	3956	2770	2950

Appendix A. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
September										
Q_{02}	16407	16729	16190	16508	14107	14394	14599	14886	11100	11337
Q_{10}	9059	9321	8939	9198	7844	8075	7183	7414	5380	5579
Q_{25}	5285	5515	5215	5442	4748	4948	4311	4511	3390	3570
Q_{50}	3575	3796	3528	3746	3258	3449	2793	2985	2240	2410
Q_{75}	2255	2469	2225	2436	2068	2253	1778	1964	1420	1579
Q_{90}	1682	1876	1660	1851	1560	1726	1300	1467	1010	1161
Q_{98}	1385	1535	1367	1515	1279	1403	1019	1145	784	908
Q_{mean}	4619	4846	4558	4782	4857	5054	3732	3930	2900	3075
October										
Q_{02}	17070	17401	16844	17171	15166	15462	11204	11500	10100	10344
Q_{10}	9979	10253	9847	10117	8836	9077	7316	7557	5950	6157
Q_{25}	6213	6453	6131	6368	5382	5591	4870	5080	3850	4037
Q_{50}	3806	4026	3756	3973	3520	3710	3082	3273	2400	2570
Q_{75}	2201	2413	2172	2381	2032	2215	1910	2094	1360	1518
Q_{90}	1659	1842	1637	1818	1528	1684	1368	1526	1020	1164
Q_{98}	1330	1476	1312	1456	1215	1335	1104	1226	785	906
Q_{mean}	4996	5225	4930	5156	4464	4663	3839	4038	3050	3226
November										
Q_{02}	17220	17560	16992	17328	15305	15609	14460	14764	10400	10650
Q_{10}	10477	10757	10338	10615	9068	9316	8195	8444	6430	6642
Q_{25}	7455	7708	7356	7606	6583	6805	5746	5968	4310	4507
Q_{50}	4656	4890	4594	4825	4188	4392	3631	3835	2780	2959
Q_{75}	2781	3003	2744	2963	2548	2741	2212	2406	1760	1925
Q_{90}	2023	2218	1996	2189	1852	2020	1682	1851	1280	1431
Q_{98}	1609	1762	1588	1739	1471	1598	1330	1459	974	1099
Q_{mean}	5744	6003	5668	5924	5107	5335	4473	4701	3400	3595
December										
Q_{02}	14363	14754	14173	14559	12703	13055	13578	13929	8800	9084
Q_{10}	9807	10108	9677	9974	8463	8730	8379	8646	5580	5804
Q_{25}	7239	7499	7143	7400	6345	6574	5668	5897	3930	4131
Q_{50}	4911	5159	4846	5091	4373	4590	3602	3820	2830	3015
Q_{75}	2790	3020	2753	2980	2568	2768	2247	2448	1750	1920
Q_{90}	1985	2191	1959	2162	1828	2005	1682	1860	1200	1356
Q_{98}	1451	1620	1432	1599	1332	1474	1268	1412	895	1029
Q_{mean}	5595	5875	5521	5797	4936	5183	4467	4715	3180	3388

Appendix A. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Q_{01}	8357	8613	500	500	4400	4400	1130	1130	949	950
Q_{02}	7257	7494	299	299	3390	3390	779	780	647	648
Q_{05}	5408	5622	150	150	2170	2170	443	444	366	367
Q_{10}	4001	4200	92	92.2	1470	1470	274	275	224	225
Q_{15}	3328	3517	66	66.2	1130	1130	202	203	167	168
Q_{25}	2452	2631	42	42.2	793	796	136	137	112	113
Q_{40}	1602	1771	24	24.2	512	515	80	81.1	75.8	76.5
Q_{50}	1282	1446	17	17.2	390	393	59	60.1	59.9	60.6
Q_{60}	1000	1159	11	11.2	287	289	41	42.1	47.1	47.7
Q_{75}	724	873	4.8	4.94	172	174	22	23	35	35.6
Q_{85}	546	689	2.5	2.62	116	118	16	17	27.1	27.6
Q_{90}	428	564	1.6	1.71	96	98.1	12	13	23.4	23.9
Q_{95}	306	435	0.8	0.89	72	74	9.4	10.4	20	20.4
Q_{98}	221	339	0.3	0.38	55	56.8	7.6	8.53	18	18.3
Q_{99}	166	274	0.1	0.1	48	49.7	6	6.89	16	16.2
Q_{mean}	1859	2028	46	46.2	658	661	122	123	109	110
Low Flows										
$Q_{1,2}$	303	408	0.9	0.97	90	91.7	9.7	10.6	18	18.2
$Q_{1,10}$	137	193	0	0	42.2	43.6	4.7	5.53	14	14.1
$Q_{1,25}$	65	122	0	0	29	30.3	3.4	4.22	10.8	10.9
$Q_{1,50}$	42	99	0	0	23	24.3	2.99	3.81	9.82	9.91
$Q_{7,2}$	476	610	1.3	1.4	98	100	11	12	19.3	19.7
$Q_{7,10}$	200	308	0.1	0.1	44.5	46.1	5	5.89	15.9	16.1
$Q_{7,25}$	125	230	0	0	31	32.6	3.71	4.59	12.6	12.8
$Q_{7,50}$	91	196	0	0	25	26.6	3.29	4.17	11.5	11.7
$Q_{15,2}$	527	663	1.8	1.9	102	104	11.9	12.9	20.3	20.8
$Q_{15,10}$	227	340	0.26	0.26	47.6	49.3	5.8	6.71	16.7	17
$Q_{15,25}$	142	248	0.06	0.06	34	35.6	4.3	5.19	13.5	13.7
$Q_{15,50}$	119	225	0	0	27	28.6	3.82	4.71	12.4	12.6
$Q_{31,2}$	568	707	2.5	2.62	110	112	12.3	13.3	22.9	23.4
$Q_{31,10}$	250	368	0.44	0.44	51.9	53.7	7	7.93	19.6	19.9
$Q_{31,25}$	161	278	0.13	0.13	37	38.6	5.32	6.21	15.8	16
$Q_{31,50}$	147	253	0.01	0.01	30	31.6	4.79	5.68	14.6	14.8
$Q_{61,2}$	668	812	3.6	3.72	153	155	13.2	14.2	26.6	27.1
$Q_{61,10}$	264	387	0.79	0.88	61.4	63.3	8.8	9.75	21	21.3
$Q_{61,25}$	197	310	0.29	0.29	47.3	49.1	6.78	7.69	17.4	17.7
$Q_{61,50}$	173	283	0.15	0.15	42.8	44.5	6.13	7.03	16.3	16.5
$Q_{91,2}$	741	890	5.2	5.34	183	185	14.2	15.2	30	30.6
$Q_{91,10}$	281	410	1.14	1.23	69.8	71.8	11	12	22	22.4
$Q_{91,25}$	229	347	0.56	0.56	54	55.8	8.52	9.45	18.3	18.6
$Q_{91,50}$	204	320	0.3	0.3	49	50.8	7.73	8.65	17.1	17.4

Appendix A. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Drought Flows										
$Q_{6,10}$	420	563	2.99	3.1	93.4	95.6	13	14	29	29.5
$Q_{6,25}$	316	450	1.49	1.6	73.6	75.7	10.2	11.2	25.1	25.5
$Q_{6,50}$	283	412	1.01	1.1	67.2	69.2	9.36	10.3	23.8	24.2
$Q_{9,10}$	538	690	8.18	8.32	154	156	21.3	22.4	36	36.6
$Q_{9,25}$	393	539	4.92	5.05	111	113	15.4	16.4	30.2	30.7
$Q_{9,50}$	354	495	3.88	4	97.7	99.9	13.5	14.5	28.4	28.9
$Q_{12,10}$	829	990	12.7	12.9	235	238	43	44.1	46	46.7
$Q_{12,25}$	567	721	7.27	7.41	146	148	26.7	27.8	36.4	37
$Q_{12,50}$	512	660	5.54	5.68	118	120	21.5	22.5	33.3	33.9
$Q_{18,10}$	876	1042	19.1	19.3	280	283	52	53.1	55	55.7
$Q_{18,25}$	659	816	11.6	11.8	168	170	31.2	32.3	40.2	40.8
$Q_{18,50}$	540	692	9.16	9.3	133	135	24.6	25.7	35.5	36.1
$Q_{30,10}$	1226	1397	27.6	27.8	406	409	70	71.1	70	70.7
$Q_{30,25}$	895	1057	17.5	17.7	259	262	44.6	45.7	52.8	53.5
$Q_{30,50}$	743	900	14.3	14.5	212	214	34.6	35.7	44	44.6
$Q_{54,10}$	1533	1710	44.9	45.1	581	584	88	89.2	106	107
$Q_{54,25}$	1224	1390	28.4	28.6	415	418	62.9	64	77.5	78.2
$Q_{54,50}$	1080	1242	23.1	23.3	363	366	54.9	56	56	56.7
January										
Q_{02}	3614	3856	280	280	3240	3240	731	732	795	796
Q_{10}	2413	2612	66	66.2	1100	1100	215	216	193	194
Q_{25}	1568	1747	35	35.2	610	613	90.3	91.3	84.1	84.9
Q_{50}	989	1153	13	13.2	310	313	50.6	51.7	45.5	46.2
Q_{75}	699	848	4	4.14	140	142	18	19	32.5	33.1
Q_{90}	475	610	1.1	1.21	82	84.1	9	9.99	23	23.4
Q_{98}	259	382	0	0.09	30	31.9	3.5	4.45	13	13.3
Q_{mean}	1257	1433	39	39.2	543	546	105	106	106	107
February										
Q_{02}	5176	5426	487	487	3770	3770	1010	1010	1370	1370
Q_{10}	3013	3218	105	105	1680	1680	286	287	312	313
Q_{25}	1832	2019	48	48.2	930	933	147	148	131	132
Q_{50}	1108	1277	20	20.2	420	423	67.4	68.5	56.7	57.4
Q_{75}	748	902	7	7.14	210	212	26.5	27.6	35.7	36.3
Q_{90}	513	657	2.8	2.93	110	112	14	15	26.4	26.9
Q_{98}	282	415	0.7	0.8	55	57.1	3.89	4.87	13	13.4
Q_{mean}	1504	1685	61	61.2	745	748	147	148	164	165
March										
Q_{02}	9390	9646	450	450	4280	4280	1440	1440	1270	1270
Q_{10}	6326	6540	134	134	2130	2130	431	432	358	359
Q_{25}	4577	4771	67	67.2	1160	1160	241	242	165	166
Q_{50}	2775	2954	36	36.2	726	729	125	126	93.9	94.7
Q_{75}	1467	1633	20	20.2	462	465	69.4	70.5	62.2	62.9
Q_{90}	833	992	11	11.2	311	313	43	44.1	40.1	40.7
Q_{98}	560	703	2.1	2.23	151	153	17.1	18.1	28.2	28.7
Q_{mean}	3284	3469	76	76.2	1035	1040	212	213	185	186

Appendix A. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
April										
Q_{02}	10123	10379	390	390	4300	4300	1060	1060	748	749
Q_{10}	7489	7703	144	144	2220	2220	409	410	377	378
Q_{25}	5367	5564	83	83.2	1340	1340	245	246	152	153
Q_{50}	3579	3761	45	45.2	745	748	142	143	90.8	91.6
Q_{75}	2385	2554	24	24.2	461	464	77.2	78.3	60.5	61.2
Q_{90}	1539	1701	15	15.2	316	319	51	52.1	41.1	41.8
Q_{98}	900	1046	5.3	5.43	168	170	18.5	19.5	33	33.5
Q_{mean}	4054	4239	79	79.2	1077	1080	201	202	137	138
May										
Q_{02}	7511	7767	383	383	4480	4480	1030	1030	625	626
Q_{10}	4721	4926	134	134	1970	1970	377	378	297	298
Q_{25}	3219	3404	72	72.2	1180	1180	202	203	162	163
Q_{50}	2163	2337	38	38.2	658	661	117	118	84.8	85.6
Q_{75}	1392	1558	20	20.2	382	385	69.9	71	52.7	53.4
Q_{90}	821	982	12	12.2	263	266	47.3	48.4	34.5	35.2
Q_{98}	395	539	3.2	3.33	150	152	18.2	19.2	22.6	23.1
Q_{mean}	2533	2714	72	72.2	984	987	179	180	136	137
June										
Q_{02}	5822	6078	389	389	3880	3880	1470	1470	835	836
Q_{10}	3513	3718	126	126	1930	1930	356	357	310	311
Q_{25}	2285	2469	61	61.2	1070	1070	150	151	145	146
Q_{50}	1408	1577	29	29.2	577	580	76.7	77.8	72.7	73.4
Q_{75}	805	967	13	13.2	305	308	44.8	45.9	43	43.7
Q_{90}	489	645	6.4	6.54	197	199	31.9	33	28.6	29.2
Q_{98}	251	394	1.4	1.53	124	126	18.9	19.9	19.7	20.2
Q_{mean}	1767	1937	69	69.2	898	901	158	159	135	136
July										
Q_{02}	5504	5729	278	278	2730	2730	886	887	399	400
Q_{10}	3038	3227	68	68.2	1210	1210	227	228	162	163
Q_{25}	1724	1896	29	29.2	622	625	94.6	95.7	98.7	99.5
Q_{50}	938	1102	16	16.2	325	328	45.9	47	51	51.7
Q_{75}	589	742	7	7.14	207	209	24.6	25.7	32.7	33.3
Q_{90}	362	506	3	3.12	138	140	17.9	18.9	22.6	23.1
Q_{98}	174	303	1	1.09	77	79	9.9	10.9	16.7	17.1
Q_{mean}	1385	1546	42	42.2	567	570	97.9	99	79.1	79.8
August										
Q_{02}	4028	4242	187	187	2160	2160	443	444	443	444
Q_{10}	2382	2559	37	37.2	734	737	98.5	99.7	194	195
Q_{25}	1335	1497	16	16.2	377	380	47.7	48.8	83.7	84.4
Q_{50}	779	931	7	7.14	202	204	29.9	31	43	43.6
Q_{75}	459	603	3	3.11	128	130	17.6	18.6	28	28.5
Q_{90}	271	406	1	1.1	85	87.1	11.1	12.1	20.7	21.1
Q_{98}	123	241	0.2	0.28	57	58.8	6.68	7.61	17	17.3
Q_{mean}	1088	1241	25	25.1	389	391	57.7	58.8	76.8	77.4

Appendix A. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
September										
Q_{02}	5222	5421	145	145	2180	2180	511	512	324	325
Q_{10}	2292	2459	33	33.2	823	826	93.9	95	162	163
Q_{25}	1280	1433	12	12.1	314	316	28.8	29.9	84	84.6
Q_{50}	801	945	3.9	4.02	148	150	19.8	20.8	37.1	37.6
Q_{75}	467	603	1.6	1.7	93	95.1	12.9	13.9	24	24.5
Q_{90}	263	392	0.4	0.49	62	64	9.16	10.1	19	19.4
Q_{98}	132	240	0.1	0.1	46	47.7	6.9	7.79	16	16.2
Q_{mean}	1138	1287	19	19.1	344	346	46.1	47.1	62.5	63.1
October										
Q_{02}	5148	5352	131	131	2110	2110	427	427	244	245
Q_{10}	3023	3197	44	44.2	858	861	163	164	131	132
Q_{25}	1653	1812	14	14.2	455	457	73.7	74.8	81	81.6
Q_{50}	884	1028	4.1	4.21	185	187	20.3	21.3	43.1	43.6
Q_{75}	505	640	2	2.1	99	101	13	14	26.7	27.1
Q_{90}	304	427	0.9	0.99	65	66.9	9.93	10.9	21.4	21.7
Q_{98}	187	292	0.1	0.1	48	49.6	7.7	8.58	17.6	17.8
Q_{mean}	1332	1481	23	23.1	389	391	89.1	90.1	62.9	63.5
November										
Q_{02}	4574	4784	159	159	2190	2190	554	555	397	398
Q_{10}	3166	3345	50	50.2	1040	1040	215	216	193	194
Q_{25}	1934	2100	23	23.2	577	580	103	104	126	127
Q_{50}	1202	1354	8.2	8.34	264	266	26.1	27.2	49.7	50.3
Q_{75}	722	863	2.9	3.02	116	118	14	15	32.9	33.4
Q_{90}	466	595	1.4	1.49	81	83	10.3	11.3	23.8	24.2
Q_{98}	282	390	0.5	0.57	59	60.7	8.7	9.59	19	19.2
Q_{mean}	1516	1680	24	24.2	460	463	78	79.1	80.5	81.2
December										
Q_{02}	3921	4158	150	150	2000	2000	378	379	287	288
Q_{10}	2644	2833	57	57.2	982	985	215	216	150	151
Q_{25}	1887	2056	26	26.2	613	616	115	116	111	112
Q_{50}	1201	1358	11	11.2	297	299	43.4	44.5	62	62.6
Q_{75}	738	882	3	3.13	125	127	16.4	17.4	31	31.5
Q_{90}	495	628	0.8	0.91	80	82.1	9	9.94	22.7	23.1
Q_{98}	286	402	0.3	0.38	55	56.8	6	6.92	17	17.3
Q_{mean}	1417	1592	27	27.2	467	470	74.1	75.2	84.9	85.7

Appendix A. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Q_{01}	906	908	869	876	518	5622	5666	2639	2660	1150
Q_{02}	546	547	627	634	308	4192	4234	2001	2020	616
Q_{05}	279	280	368	374	182	2651	2690	1233	1250	283
Q_{10}	178	179	215	221	122	1692	1728	794	809	167
Q_{15}	141	142	145	151	104	1273	1308	597	612	120
Q_{25}	103	104	87.9	92.9	81.2	861	894	404	418	76.9
Q_{40}	76	77	52.2	57.2	60.9	545	576	257	270	46.4
Q_{50}	62	63	37.1	42	49.6	416	445	200	212	35.4
Q_{60}	51	52	25.7	30.5	38.9	319	348	158	170	24.1
Q_{75}	37	38	13.4	17.9	27.3	207	233	105	116	14
Q_{85}	29	30	9.05	13.4	21	143	169	73	84	9.38
Q_{90}	25	26	6.7	10.9	18	115	139	58	68	7.54
Q_{95}	21	22	4.38	8.38	14.6	92	115	45	55	5.51
Q_{98}	17.5	18	2.67	6.37	13	75	95	36	44	4.25
Q_{99}	15.6	16	2.04	5.5	11	67	86	31	39	3.8
Q_{mean}	105	106	83.7	88.7	73.9	766	797	369	382	77.6
Low Flows										
$Q_{1,2}$	28	28.5	2.9	6.2	14.5	114	131	58	65	5
$Q_{1,10}$	15.5	15.8	0.78	3.7	10	60	76	27	34	3
$Q_{1,25}$	11.8	12	0.62	3.5	7.74	48	62	22	27.5	2.2
$Q_{1,50}$	9.8	10	0.5	3.4	7.02	44	58	15	20.4	1.7
$Q_{7,2}$	29	30	3.82	7.92	15.3	120	144	62	72	5.4
$Q_{7,10}$	16.9	17.3	1.3	4.7	11	63	82	30	38	3.3
$Q_{7,25}$	12.8	13.2	1.06	4.36	8.7	51	69	21	28.5	2.4
$Q_{7,50}$	10.6	11	0.99	4.3	7.96	47	65	18	25.3	1.8
$Q_{15,2}$	31	32	4.89	9.09	16.2	130	154	68	78	5.79
$Q_{15,10}$	17.9	18.3	1.9	5.4	12.1	66	85	33	41	3.6
$Q_{15,25}$	14.1	14.5	1.55	4.9	9.75	54	72	26	33	2.6
$Q_{15,50}$	11.6	12	1.44	4.8	8.5	50	68	24	31	1.9
$Q_{31,2}$	34	35	5.92	10.2	17	148	173	75	86	6.41
$Q_{31,10}$	19	19.5	2.9	6.6	13.7	73	93	35	43	4.2
$Q_{31,25}$	15.2	15.6	2.37	5.8	11	61	80	28	36	3
$Q_{31,50}$	13.1	13.5	1.9	5.3	8.9	57	75	26	33	2.3
$Q_{61,2}$	38	39	7.59	12	18.2	178	204	90	101	7.42
$Q_{61,10}$	20.7	21.2	4.1	7.9	16	84	104	46	54	5
$Q_{61,25}$	17	17.4	3	6.5	13.3	72	91	36	44	3.8
$Q_{61,50}$	15.1	15.5	2.2	5.7	9.4	68	87	33	41	2.9
$Q_{91,2}$	43	44	7.79	12.3	20.6	207	233	105	116	8.67
$Q_{91,10}$	22.4	23	5	9	17.7	92	115	50	60	5.9
$Q_{91,25}$	18.8	19.3	3.8	7.5	14.7	79	99	41	49	4.4
$Q_{91,50}$	17.5	18	3	6.6	10.2	74	94	39	47	3.6

Appendix A. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Drought Flows										
$Q_{6,10}$	26	26.8	12.4	16.7	19.1	114	140	57	68	8.4
$Q_{6,25}$	22.9	23.5	9.4	13.5	16.5	97	121	47	57	6.4
$Q_{6,50}$	21.8	22.4	6.9	10.9	14.4	91	114	43	53	4.7
$Q_{9,10}$	33	34	14.2	18.8	25	181	208	87	98	15.6
$Q_{9,25}$	28.7	29.4	11.9	16.3	21	150	176	70	81	11.5
$Q_{9,50}$	27.2	27.8	9.5	13.8	17.8	141	167	63	74	8.3
$Q_{12,10}$	43	44	28.4	33.2	29	262	291	124	136	23.2
$Q_{12,25}$	34	35	22	26.6	22.9	205	232	92	103	17
$Q_{12,50}$	31	32	17.5	22	20	187	213	82	93	12.9
$Q_{18,10}$	53	54	40	45	40	323	353	148	161	27.6
$Q_{18,25}$	39	40	29.2	33.9	29.2	240	268	101	113	20.2
$Q_{18,50}$	35	36	25	29.6	21.6	214	241	87	98	15.6
$Q_{30,10}$	65	66	50	55	44	474	505	224	237	40
$Q_{30,25}$	48	49	36.5	41.5	33.2	331	360	158	170	26.3
$Q_{30,50}$	43	44	32.2	37.2	26	256	284	128	140	19
$Q_{54,10}$	91	92	57	62	55	661	694	308	322	49
$Q_{54,25}$	67	68	40.1	45.1	40.2	459	489	214	227	34.4
$Q_{54,50}$	59	60	34.6	39.6	35.5	366	395	173	185	26
January										
Q_{02}	635	636	420	427	329	4110	4152	1841	1860	626
Q_{10}	135	136	172	178	93.8	1192	1228	544	559	148
Q_{25}	89	90	65	70	65.5	628	661	294	308	62.7
Q_{50}	53	54	29	34	39.1	346	375	163	175	29.9
Q_{75}	32	33	13.3	17.8	23	197	224	102	113	15.3
Q_{90}	24	25	4.82	8.92	16	89	113	47	57	5.63
Q_{98}	14.5	15	2.59	6.39	8.4	58	78	24	32	3.38
Q_{mean}	98	98.5	66.8	71.8	62.8	624	656	284	298	78.4
February										
Q_{02}	1259	1260	844	851	576	5822	5865	2600	2620	900
Q_{10}	259	260	306	312	116	1812	1850	833	850	253
Q_{25}	110	111	202	208	67	843	877	374	388	97.7
Q_{50}	59	60	41.8	46.8	42.3	397	428	185	198	38.6
Q_{75}	38	39	16	20.6	25	227	254	104	115	18.2
Q_{90}	27	28	7.47	11.9	17.2	113	139	53	64	8.01
Q_{98}	12	16	1.99	6.09	8.99	73	96	33	43	4.45
Q_{mean}	151	152	127	132	79.8	860	893	393	407	117
March										
Q_{02}	1288	1290	841	848	760	6623	6666	3011	3030	1100
Q_{10}	325	326	302	308	198	3011	3050	1433	1450	316
Q_{25}	148	149	142	148	103	1573	1608	745	760	143
Q_{50}	90	91	73.3	78.3	69.1	904	937	430	444	72.3
Q_{75}	60	61	31.7	36.7	45.2	491	521	236	249	39.9
Q_{90}	41	42	18	22.8	29.4	284	313	147	159	20.8
Q_{98}	29	30	9.64	13.9	19	173	199	89	100	8.69
Q_{mean}	179	180	134	139	116	1394	1427	663	677	144

Appendix A. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
April										
Q_{02}	464	466	1260	1270	392	5231	5276	2689	2710	636
Q_{10}	225	226	380	386	189	2621	2660	1253	1270	239
Q_{25}	140	141	182	188	119	1522	1558	725	740	131
Q_{50}	88	89	87.4	92.4	74.6	910	943	429	443	78.1
Q_{75}	60	61	52.9	57.9	46.7	555	586	264	277	43.9
Q_{90}	42	43	30.8	35.8	31	340	369	170	182	27.2
Q_{98}	30	31	8.53	12.9	20	205	231	93	104	10.7
Q_{mean}	126	127	144	149	104	1284	1317	622	636	115
May										
Q_{02}	612	614	770	777	376	4231	4276	2029	2050	678
Q_{10}	229	230	307	313	177	2112	2150	993	1010	239
Q_{25}	135	136	164	169	108	1223	1256	562	576	124
Q_{50}	86	87	70.7	75.7	74	695	727	324	338	62.1
Q_{75}	53	54	37.5	42.5	41.3	412	442	205	218	33.7
Q_{90}	35	36	19.3	24.1	24.9	281	310	138	150	21.6
Q_{98}	21	26	6.73	11.2	18.6	178	204	85	96	10.3
Q_{mean}	128	129	122	127	104	1024	1057	481	495	96.3
June										
Q_{02}	848	850	1360	1370	544	4481	4526	2279	2300	754
Q_{10}	265	266	537	543	145	1952	1990	913	930	225
Q_{25}	134	135	137	142	93.6	1093	1126	476	490	102
Q_{50}	82	83	57.1	62.1	65.5	584	615	257	270	49.7
Q_{75}	51	52	26.9	31.9	38	336	365	155	167	23.9
Q_{90}	31	32	16	20.7	21.2	206	233	101	113	12.3
Q_{98}	21.3	22	6.5	10.8	15.8	139	164	59	70	6.72
Q_{mean}	140	141	126	131	101	944	974	435	448	94.6
July										
Q_{02}	377	378	816	823	356	3602	3641	1612	1630	399
Q_{10}	164	165	154	160	137	1103	1138	511	526	119
Q_{25}	104	105	56.3	61.3	92.8	578	610	277	291	49.2
Q_{50}	61	62	27.9	32.8	52.4	322	351	160	172	21.4
Q_{75}	39	40	16.5	21.1	30.5	193	220	96	107	12.1
Q_{90}	25.3	26	10	14.4	20	132	157	63	74	7.46
Q_{98}	19.4	20	4.05	8.05	13.7	96	119	40	50	3.5
Q_{mean}	93	94.3	68.4	73.2	76	603	631	280	292	60.9
August										
Q_{02}	283	284	826	832	206	3022	3060	1323	1340	347
Q_{10}	120	121	115	120	89.1	798	831	349	363	88.9
Q_{25}	79	80	44.1	49.1	64.3	392	421	198	210	36.9
Q_{50}	48	49	18.5	23.1	36	238	265	123	134	17.6
Q_{75}	31	32	11.1	15.5	22.8	141	167	70	81	10.2
Q_{90}	23.4	24	5.12	9.22	17	102	126	48	58	6.45
Q_{98}	18.5	19	1.71	5.41	12.4	76	96	34	42	3.94
Q_{mean}	75	75.5	55	59.6	56.4	440	466	204	215	38.4

Appendix A. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
September										
Q_{02}	257	258	285	291	271	3303	3339	1685	1700	396
Q_{10}	115	116	70.8	75.8	116	959	990	474	487	70.9
Q_{25}	75	76	23.1	27.7	63.4	368	395	190	201	22.3
Q_{50}	44	45	10.9	15.3	34.3	197	223	100	111	12.5
Q_{75}	29	30	6.75	11	22	108	132	56	66	8.11
Q_{90}	19.4	20	4.07	8.07	14.6	81	104	41	51	5.46
Q_{98}	14.6	15	2.2	5.6	10	66	85	28	36	3.82
Q_{mean}	67	67.3	31.4	35.9	55.2	440	467	232	243	35.9
October										
Q_{02}	243	244	224	230	138	2342	2380	1153	1170	242
Q_{10}	124	125	66	71	86.6	969	1001	486	500	90.7
Q_{25}	72	73	30.9	35.7	61.6	521	550	248	260	41.1
Q_{50}	44	45	15.1	19.5	37.2	242	268	129	140	15.2
Q_{75}	31	32	8.5	12.6	21.9	130	154	68	78	8.76
Q_{90}	20.5	21	4.98	8.78	14.7	89	109	50	58	5.05
Q_{98}	15.6	16	2	5.3	11	67	84	36	43	3.61
Q_{mean}	65	66.1	35.4	39.9	46.5	448	475	223	234	45.6
November										
Q_{02}	245	246	275	281	191	2602	2641	1183	1200	246
Q_{10}	138	139	127	132	126	1224	1257	598	612	109
Q_{25}	85	86	62	67	82	656	686	325	338	54.4
Q_{50}	50	51	26.2	30.8	35.3	369	396	180	191	23.9
Q_{75}	32	33	11.6	15.9	23.6	155	180	84	95	10.7
Q_{90}	22.4	23	5.46	9.46	16.6	111	134	59	69	6.9
Q_{98}	17.6	18	3	6.4	14	89	108	42	50	4.34
Q_{mean}	71	72.2	45.4	50.3	54.1	557	586	272	284	44.3
December										
Q_{02}	236	237	304	311	152	2810	2853	1401	1420	330
Q_{10}	129	130	133	139	111	1203	1238	589	604	134
Q_{25}	88	89	61.8	66.8	82.1	705	736	335	348	63.8
Q_{50}	51	52	27.5	32.2	42	382	410	187	199	36.5
Q_{75}	34	35	11.3	15.7	23	188	214	90	101	12.5
Q_{90}	21.4	22	4.35	8.45	16	107	130	53	63	6.87
Q_{98}	16.5	17	2.56	6.16	12	70	90	33	41	4.46
Q_{mean}	74	74.7	45.9	51.1	53.3	590	622	287	301	54.8

Appendix A. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Q_{01}	1150	2500	2525	521	29.63	24.84	26.60	484	485	304.06
Q_{02}	617	1860	1883	365	17.55	14.89	17.18	342	343	194.97
Q_{05}	284	1100	1120	231	9.07	8.72	9.34	207	208	105.87
Q_{10}	167	666	685	149	5.39	5.75	5.65	128	129	64.11
Q_{15}	120	478	496	107	3.67	4.12	3.95	92.5	93.5	44.87
Q_{25}	76.9	305	322	62.4	2.18	2.62	2.46	60.5	61.5	27.96
Q_{40}	46.4	178	194	30.8	1.22	1.49	1.46	37.1	38.1	16.60
Q_{50}	35.7	127	142	20.3	0.87	1.05	1.08	27.9	28.9	12.36
Q_{60}	24.4	86.9	102	11.3	0.59	0.72	0.78	21	21.5	8.92
Q_{75}	14.3	39.8	53.4	3.53	0.35	0.31	0.48	11.2	11.7	5.61
Q_{85}	9.68	21.3	34.3	1.5	0.26	0.13	0.34	7.87	8.27	3.99
Q_{90}	7.74	15.5	27.8	0.7	0.22	0.07	0.27	6.54	6.94	3.28
Q_{95}	5.71	11	22.6	0.27	0.17	0.01	0.2	5.2	5.6	2.47
Q_{98}	4.35	8	18.4	0.11	0.13	0	0.15	4.05	4.35	1.93
Q_{99}	3.9	6.2	15.6	0.1	0.11	0	0.13	3.5	3.75	1.67
Q_{mean}	78	284	300	57.5	2.38	2.28	2.55	58.4	58.9	28.99
Low Flows										
$Q_{1,2}$	5.1	12.9	21.9	0.4	0.12	0.07	0.2	7.15	7.45	2.42
$Q_{1,10}$	3	3.7	11.2	0	0.02	0	0.04	2.3	2.5	0.68
$Q_{1,25}$	2.2	2.1	9.1	0	0	0	0.02	1.82	2.02	0.45
$Q_{1,50}$	1.7	1.4	8.4	0	0	0	0.01	1.66	1.86	0.32
$Q_{7,2}$	5.6	15	27.1	1.2	0.15	0.1	0.24	7.45	7.85	2.86
$Q_{7,10}$	3.4	4.8	14.2	0.03	0.04	0	0.06	2.5	2.8	0.96
$Q_{7,25}$	2.5	2.9	11.9	0.02	0.02	0	0.04	2.04	2.34	0.71
$Q_{7,50}$	1.9	2.3	11.3	0.01	0.01	0	0.03	1.9	2.2	0.57
$Q_{15,2}$	5.99	17.7	30	1.8	0.18	0.13	0.28	8.08	8.48	3.34
$Q_{15,10}$	3.7	5.6	15.5	0.08	0.06	0	0.09	3.2	3.5	1.26
$Q_{15,25}$	2.7	3.6	12.8	0.04	0.03	0	0.07	2.62	2.92	0.96
$Q_{15,50}$	2	2.8	12	0.03	0.02	0	0.05	2.43	2.73	0.82
$Q_{31,2}$	6.61	22.3	35	2.9	0.21	0.17	0.32	9.11	9.51	3.79
$Q_{31,10}$	4.3	7	17.4	0.18	0.09	0.03	0.13	3.5	3.8	1.7
$Q_{31,25}$	3.1	4.4	13.8	0.1	0.06	0	0.1	2.86	3.16	1.3
$Q_{31,50}$	2.4	3.4	12.6	0.08	0.04	0	0.08	2.66	2.96	1.11
$Q_{61,2}$	7.72	32.1	45	4.4	0.36	0.32	0.49	13.1	13.5	5.65
$Q_{61,10}$	5.2	9.2	20.1	0.44	0.13	0.07	0.17	4.2	4.6	2.17
$Q_{61,25}$	3.9	7.2	17.1	0.28	0.09	0.04	0.13	3.53	3.83	1.7
$Q_{61,50}$	3	6.5	16	0.22	0.06	0	0.11	3.31	3.61	1.46
$Q_{91,2}$	8.97	41.6	55	6.7	0.43	0.41	0.62	17.6	18.1	6.99
$Q_{91,10}$	6.1	10.4	22	0.87	0.17	0.12	0.21	4.6	5	2.61
$Q_{91,25}$	4.5	8.7	19.1	0.55	0.12	0.08	0.17	3.94	4.24	2.1
$Q_{91,50}$	3.7	8.1	18.3	0.44	0.09	0.04	0.15	3.73	4.03	1.87

Appendix A. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Drought Flows										
$Q_{6,10}$	8.7	17.7	30.7	2.9	0.32	0.28	0.37	7	7.4	4.35
$Q_{6,25}$	6.6	12.5	24.6	1.66	0.26	0.22	0.3	5.88	6.28	3.56
$Q_{6,50}$	4.9	10.9	22.5	1.27	0.22	0.17	0.26	5.52	5.92	3.15
$Q_{9,10}$	15.9	41	55	6.7	0.45	0.41	0.51	11.9	12.4	5.95
$Q_{9,25}$	11.8	30	43	3.84	0.37	0.32	0.41	9.4	9.8	4.84
$Q_{9,50}$	8.5	26	39	2.93	0.3	0.25	0.35	7.8	8.2	4.14
$Q_{12,10}$	23.5	76	91	10	0.73	0.71	0.77	14.2	14.7	9.01
$Q_{12,25}$	17.3	61	75	6.69	0.55	0.5	0.58	11	11.5	6.83
$Q_{12,50}$	13.2	56	69	5.63	0.45	0.39	0.5	9.96	10.5	5.84
$Q_{18,10}$	28	112	127	12.4	0.95	0.93	1.03	20.2	20.7	11.82
$Q_{18,25}$	20.5	76	90	7.78	0.69	0.65	0.73	14.8	15.3	8.55
$Q_{18,50}$	15.9	64	78	6.3	0.56	0.5	0.6	11.6	12.1	7.05
$Q_{30,10}$	40.4	166	182	23.4	1.34	1.32	1.44	33	33.5	16.56
$Q_{30,25}$	26.6	108	123	15.7	0.95	0.92	1.01	22	22.5	11.7
$Q_{30,50}$	19.3	90	104	13.2	0.79	0.75	0.83	16	16.5	9.64
$Q_{54,10}$	49.4	241	258	39	1.93	1.92	2.05	51	51.6	23.49
$Q_{54,25}$	34.8	165	180	24.5	1.37	1.35	1.44	35.8	36.3	16.58
$Q_{54,50}$	26.3	141	156	19.8	1.16	1.12	1.23	31	31.5	14.11
January										
Q_{02}	627	1770	1793	311	18.9	17.13	15.73	440	441	183.11
Q_{10}	148	448	467	87.2	4.09	4.09	3.61	92.6	93.6	42.12
Q_{25}	62.7	213	230	31.3	1.62	1.8	1.58	37.4	38	18.49
Q_{50}	30.2	106	121	15.1	0.62	0.8	0.78	24.8	25.3	8.99
Q_{75}	15.6	41	55	3.52	0.31	0.28	0.45	11	11.5	5.22
Q_{90}	5.83	10	22.2	0.85	0.2	0.15	0.25	5.83	6.23	3.01
Q_{98}	3.58	3.3	14.2	0.28	0.13	0	0.13	3.1	3.5	1.75
Q_{mean}	78.8	226	242	38	2.24	2.43	2.03	51.4	52	23.69
February										
Q_{02}	901	2470	2494	443	35.81	32.26	27.29	432	433	319.94
Q_{10}	254	700	719	136	7.75	7.75	6.81	141	142	78.9
Q_{25}	97.7	290	308	58.6	2.31	2.48	2.41	60.4	61.4	27.67
Q_{50}	39	127	143	17.5	1.02	1.2	1.13	29.7	30.2	13.02
Q_{75}	18.5	57	71	3.64	0.4	0.34	0.53	13.6	14.1	6.1
Q_{90}	8.31	16.6	30	1.39	0.18	0.18	0.22	6	6.4	2.72
Q_{98}	4.65	8.5	20.4	0.71	0.13	0.03	0.14	4	4.4	1.79
Q_{mean}	117	317	334	59.9	3.83	3.83	3.26	61.3	61.9	38.03
March										
Q_{02}	1100	2790	2815	649	41.94	38.39	30.09	523	524	356.34
Q_{10}	317	1190	1210	250	11.64	11.64	11.08	249	250	126.7
Q_{25}	143	585	603	137	4.73	5	4.89	125	126	55.89
Q_{50}	72.3	303	320	59.3	2.15	2.41	2.4	68.8	69.8	27.48
Q_{75}	40.3	155	170	23.3	0.96	1.03	1.28	34.3	34.8	14.47
Q_{90}	21.1	75	90	6.3	0.57	0.64	0.8	22.3	22.8	9.1
Q_{98}	8.99	29	42	2.11	0.33	0.38	0.45	9.03	9.43	5.24
Q_{mean}	144	520	537	107	5.44	5.35	4.99	114	115	57.58

Appendix A. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
April										
Q_{02}	637	2410	2435	407	18.23	14.69	20.77	404	405	231.68
Q_{10}	240	1100	1120	228	8.32	8.41	8.81	207	208	99.72
Q_{25}	131	598	617	141	4.76	5.11	5.01	115	116	56.86
Q_{50}	78.5	315	332	64.2	2.24	2.51	2.7	65.1	66.1	30.46
Q_{75}	44.3	165	181	28.2	1.17	1.35	1.58	35.3	36.3	17.69
Q_{90}	27.5	98	113	14.8	0.7	0.77	0.96	23.2	23.7	10.81
Q_{98}	11	35	48	3.67	0.33	0.29	0.47	12.4	12.8	5.43
Q_{mean}	115	498	515	100	3.89	3.73	4.37	99.5	100	49.2
May										
Q_{02}	679	1970	1995	405	16.34	12.79	17.67	322	323	198.03
Q_{10}	240	885	904	204	6.4	6.49	6.67	165	166	75.93
Q_{25}	124	472	489	111	3.34	3.79	3.57	95.6	96.6	40.76
Q_{50}	62.1	253	269	44.8	1.68	1.9	1.89	51.4	52.4	21.62
Q_{75}	34.1	136	151	22.7	0.88	1.02	1.13	30.2	31.2	12.86
Q_{90}	21.9	85	100	12.6	0.47	0.37	0.64	19.3	19.8	7.39
Q_{98}	10.6	42	55	8.69	0.29	0.17	0.41	14.3	14.7	4.83
Q_{mean}	96.7	407	424	88.3	2.98	2.71	3.2	76.3	76.9	36.46
June										
Q_{02}	755	2130	2155	445	20.23	16.68	20.13	446	447	227.45
Q_{10}	226	843	862	189	6.06	6.24	6.48	166	167	73.38
Q_{25}	102	411	428	90	2.81	3.25	2.97	78.2	79.2	34.05
Q_{50}	50.1	215	231	40.3	1.36	1.42	1.47	43.7	44.7	17.01
Q_{75}	24.2	101	116	18.9	0.58	0.54	0.73	23.8	24.3	8.52
Q_{90}	12.6	53	67	8.32	0.35	0.1	0.45	13.7	14.2	5.3
Q_{98}	7.02	30	43	4.45	0.19	0.03	0.24	9.96	10.4	2.97
Q_{mean}	95	376	392	77.7	2.94	2.53	3.12	80.1	80.6	35.46
July										
Q_{02}	400	1680	1701	318	9.91	8.13	10.8	285	286	122.18
Q_{10}	119	429	447	92.2	2.96	3.31	3.29	79	80	37.33
Q_{25}	49.6	192	208	34.4	1.37	1.73	1.59	37.2	38.2	18.17
Q_{50}	21.7	89	104	13	0.73	0.73	0.85	20.9	21.4	9.81
Q_{75}	12.4	44	58	5.39	0.36	0.3	0.48	11.5	12	5.54
Q_{90}	7.76	24	37	2.59	0.22	0	0.27	8.51	8.91	3.32
Q_{98}	3.7	13.2	24.8	0.51	0.15	0	0.17	6.24	6.64	2.17
Q_{mean}	61.2	229	244	45.8	1.71	1.34	1.89	46.3	46.8	21.49
August										
Q_{02}	348	1500	1520	287	8.91	8.02	9.91	212	213	111.57
Q_{10}	88.9	317	334	53.9	2.35	2.53	2.53	46.8	47.8	28.76
Q_{25}	37.2	107	122	14.6	0.91	1.12	1.02	22.1	22.6	11.78
Q_{50}	17.9	47	61	4.22	0.47	0.41	0.55	13	13.5	6.51
Q_{75}	10.5	23.7	37	1.61	0.26	0.15	0.32	7.49	7.89	3.84
Q_{90}	6.65	13.9	26.1	0.6	0.17	0	0.19	4.7	5.1	2.39
Q_{98}	4.04	8.2	18.6	0.2	0.11	0	0.11	3.84	4.14	1.48
Q_{mean}	38.7	161	175	32.6	1.24	0.97	1.31	28.1	28.6	15.12

Appendix A. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
September										
Q_{02}	396	1360	1379	299	12.21	11.86	16.39	246	247	178.32
Q_{10}	70.9	338	354	91	2.23	2.32	3.24	54	55	35.59
Q_{25}	22.6	87	101	12.9	0.79	0.91	1.04	23.2	23.7	11.8
Q_{50}	12.8	29	42	2.19	0.35	0.23	0.44	8.52	8.92	5.21
Q_{75}	8.31	14.8	27	0.48	0.21	0.07	0.25	5.56	5.96	3.05
Q_{90}	5.66	9.3	21	0.13	0.14	0	0.14	3.6	4	1.9
Q_{98}	3.92	6.3	15.7	0.01	0.11	0	0.09	2.67	2.97	1.34
Q_{mean}	36.2	140	154	32.9	1.42	1.29	1.7	31.5	32	19.05
October										
Q_{02}	243	1060	1079	266	10.95	10.95	11.1	181	182	124.85
Q_{10}	90.7	355	371	83.1	2.83	2.92	3.36	66.2	67.2	37.64
Q_{25}	41.4	163	178	27.9	1.1	1.21	1.38	33.1	34.1	15.63
Q_{50}	15.5	40	53	3.54	0.44	0.35	0.61	12.4	12.8	6.97
Q_{75}	8.96	14.7	27	0.68	0.25	0.12	0.33	7.12	7.52	3.88
Q_{90}	5.25	10.5	21.4	0.28	0.18	0.03	0.21	5.39	5.79	2.65
Q_{98}	3.71	7.3	16.3	0.14	0.14	0	0.15	4.19	4.49	1.93
Q_{mean}	45.9	151	165	27.3	1.48	1.43	1.59	30.8	31.3	18.14
November										
Q_{02}	247	1090	1110	265	11.24	10.88	12.56	193	194	139.33
Q_{10}	109	459	476	113	4.45	4.54	4.99	95.2	96.2	55.76
Q_{25}	54.4	221	236	47.9	1.78	1.82	2.21	50.3	51.3	24.75
Q_{50}	24.2	96	110	14.1	0.67	0.7	0.92	22.5	23	10.44
Q_{75}	10.9	20.6	33	1.45	0.29	0.23	0.39	8.67	9.07	4.57
Q_{90}	7.1	12.9	24.5	0.3	0.22	0.08	0.29	6.29	6.69	3.49
Q_{98}	4.44	10	19.4	0.12	0.17	0.02	0.2	4.9	5.2	2.45
Q_{mean}	44.6	186	201	41.7	1.76	1.83	2.07	39.8	40.3	23.25
December										
Q_{02}	331	1180	1203	250	7.16	6.27	8.79	266	267	98.06
Q_{10}	134	441	459	94.7	3.09	3.09	3.52	104	105	39.82
Q_{25}	64.2	234	250	44.9	1.52	1.63	1.88	49	50	21.27
Q_{50}	36.8	113	127	17.6	0.77	0.87	1.02	25.7	26.7	11.58
Q_{75}	12.8	31	44	1.42	0.34	0.3	0.51	12.7	13.1	5.78
Q_{90}	7.07	13.3	25.2	0.25	0.22	0.12	0.29	6.86	7.26	3.41
Q_{98}	4.56	7.1	17.3	0.13	0.14	0.01	0.16	4.33	4.63	2.06
Q_{mean}	55.2	199	215	39.8	1.43	1.55	1.75	45.9	46.5	19.75

Appendix A. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Q_{01}	304.92	124	111	8642	8690	5250	5260	4621	4630	2080
Q_{02}	195.75	70.6	63.1	7265	7310	4000	4010	3181	3190	1470
Q_{05}	106.57	35.7	34.7	5232	5270	2662	2670	1982	1990	872
Q_{10}	64.75	21.1	22.1	3658	3700	1773	1780	1343	1350	584
Q_{15}	45.47	14.2	15.5	2800	2840	1394	1400	1074	1080	472
Q_{25}	28.53	8.3	9.5	1986	2020	1054	1060	809	815	371
Q_{40}	17.13	4.5	5.3	1479	1510	775	781	606	612	294
Q_{50}	12.87	3.2	3.7	1269	1300	655	660	523	528	262
Q_{60}	9.41	2.1	2.5	1077	1110	560	565	447	452	235
Q_{75}	6.07	1.3	1.4	846	874	429	434	347	352	190
Q_{85}	4.42	1	1	686	712	350	354	286	290	165
Q_{90}	3.69	0.9	0.78	614	638	310	314	253	257	150
Q_{95}	2.85	0.77	0.54	536	559	266	270	219	223	133
Q_{98}	2.27	0.61	0.32	454	474	225	228	187	190	115
Q_{99}	1.97	0.54	0.22	405	423	197	200	172	175	103
Q_{mean}	29.52	9.28	9.2	1791	1820	941	947	745	751	359
Low Flows										
$Q_{1,2}$	2.71	0.44	0.4	515	533	303	306	278	281	130
$Q_{1,10}$	0.91	0.18	0.12	370	385	166	168	170	172	73.7
$Q_{1,25}$	0.68	0.13	0.06	286	300	129	131	138	140	59.1
$Q_{1,50}$	0.55	0.09	0.02	259	273	118	120	128	130	54.4
$Q_{7,2}$	3.26	0.54	0.5	539	563	339	343	294	298	147
$Q_{7,10}$	1.26	0.24	0.18	409	428	205	208	180	183	102
$Q_{7,25}$	1	0.17	0.09	323	341	161	164	148	151	85
$Q_{7,50}$	0.86	0.12	0.05	296	314	147	150	136	139	76
$Q_{15,2}$	3.75	0.66	0.61	549	573	360	364	306	310	152
$Q_{15,10}$	1.58	0.31	0.25	442	461	221	224	193	196	111
$Q_{15,25}$	1.25	0.22	0.15	356	375	177	180	157	160	92
$Q_{15,50}$	1.11	0.16	0.09	328	346	163	166	146	149	84
$Q_{31,2}$	4.21	0.76	0.72	614	638	390	394	327	331	171
$Q_{31,10}$	2.04	0.44	0.38	477	497	241	244	208	211	121
$Q_{31,25}$	1.6	0.32	0.26	384	403	197	200	169	172	102
$Q_{31,50}$	1.4	0.23	0.17	354	373	183	186	152	155	90
$Q_{61,2}$	6.09	1.3	1.26	653	680	434	439	359	364	189
$Q_{61,10}$	2.53	0.59	0.53	532	554	266	270	231	235	132
$Q_{61,25}$	2.02	0.43	0.38	441	460	220	223	189	192	110
$Q_{61,50}$	1.77	0.3	0.24	412	431	205	208	167	170	102
$Q_{91,2}$	7.45	1.48	1.46	697	725	469	474	385	390	200
$Q_{91,10}$	2.99	0.74	0.69	554	577	287	291	245	249	141
$Q_{91,25}$	2.44	0.54	0.49	459	479	240	243	199	202	120
$Q_{91,50}$	2.2	0.42	0.36	429	449	225	228	177	180	109

Appendix A. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Drought Flows										
$Q_{6,10}$	4.78	1.34	1.3	667	693	313	317	259	263	156
$Q_{6,25}$	3.96	1.12	1.07	576	600	274	278	212	216	139
$Q_{6,50}$	3.53	0.94	0.9	547	570	262	266	191	195	133
$Q_{9,10}$	6.41	1.82	1.78	773	801	365	370	291	296	174
$Q_{9,25}$	5.28	1.52	1.47	649	676	314	319	240	245	153
$Q_{9,50}$	4.56	1.27	1.22	609	634	299	303	216	220	146
$Q_{12,10}$	9.51	3	3	903	932	451	456	356	361	204
$Q_{12,25}$	7.3	2.3	2.2	714	742	358	363	280	285	173
$Q_{12,50}$	6.29	1.8	1.8	653	680	328	333	245	250	163
$Q_{18,10}$	12.34	3.8	3.8	1100	1130	511	516	403	408	220
$Q_{18,25}$	9.04	2.8	2.8	803	832	381	386	301	306	187
$Q_{18,50}$	7.51	2.3	2.2	708	736	340	345	268	273	176
$Q_{30,10}$	17.1	5.3	5.3	1390	1420	648	654	503	509	269
$Q_{30,25}$	12.21	3.8	3.8	1050	1080	498	503	388	393	225
$Q_{30,50}$	10.13	3.2	3.2	938	967	450	455	351	356	211
$Q_{54,10}$	24.05	7.6	7.6	1520	1550	854	860	677	683	334
$Q_{54,25}$	17.1	5.5	5.4	1110	1140	647	652	495	500	259
$Q_{54,50}$	14.62	4.6	4.6	978	1010	581	586	415	420	235
January										
Q_{02}	183.91	81.9	76.9	5420	5460	3290	3300	2491	2500	1100
Q_{10}	42.76	17.5	17.5	2670	2710	1273	1280	971	978	433
Q_{25}	19.06	6.7	7.2	1660	1690	834	840	618	624	305
Q_{50}	9.5	2.3	2.8	1090	1120	545	550	415	420	230
Q_{75}	5.68	1.1	1	730	758	365	370	300	305	170
Q_{90}	3.41	0.84	0.82	600	624	276	280	221	225	140
Q_{98}	2.11	0.64	0.61	400	422	186	190	146	150	105
Q_{mean}	24.24	9.5	9.5	1470	1500	751	757	580	586	294
February										
Q_{02}	320.77	160	150	8600	8640	5760	5770	3791	3800	2320
Q_{10}	79.57	33	33	4050	4090	2353	2360	1793	1800	775
Q_{25}	28.27	9.1	9.6	2190	2230	1194	1200	774	780	380
Q_{50}	13.55	4	4.5	1370	1400	644	650	474	480	260
Q_{75}	6.57	1.5	1.3	851	879	415	420	315	320	184
Q_{90}	3.16	0.81	0.86	591	618	295	300	245	250	150
Q_{98}	2.18	0.66	0.71	475	499	216	220	186	190	108
Q_{mean}	38.6	16.5	16.3	1970	2000	1114	1120	805	811	430
March										
Q_{02}	357.2	192	182	11600	11600	7010	7020	6391	6400	3400
Q_{10}	127.4	47.6	47.6	7740	7780	3902	3910	3082	3090	1400
Q_{25}	56.51	18.6	19.4	4900	4940	2093	2100	1493	1500	642
Q_{50}	28.05	8.2	8.9	2240	2270	1114	1120	809	815	402
Q_{75}	14.99	3.3	3.5	1510	1540	689	694	535	540	276
Q_{90}	9.59	2	2.2	972	1000	445	450	320	325	200
Q_{98}	5.67	1.2	1.4	714	740	320	324	256	260	165
Q_{mean}	58.17	22.7	22.4	3530	3570	1754	1760	1374	1380	660

Appendix A. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
April										
Q_{02}	232.54	67.2	57.2	9650	9700	4100	4110	3131	3140	1450
Q_{10}	100.42	32.2	32.5	5250	5290	2172	2180	1682	1690	748
Q_{25}	57.5	18.6	19.6	3270	3310	1413	1420	1123	1130	518
Q_{50}	31.04	8.1	8.9	1840	1870	930	936	748	754	368
Q_{75}	18.22	4	4.5	1340	1370	612	618	504	510	277
Q_{90}	11.32	2.4	2.6	954	983	460	465	363	368	223
Q_{98}	5.87	1.2	1.1	798	825	341	346	274	279	178
Q_{mean}	49.79	14.6	14.5	2600	2640	1214	1220	967	973	463
May										
Q_{02}	198.89	62.2	52.2	6280	6330	3430	3440	2801	2810	1110
Q_{10}	76.6	25.1	25.3	3570	3610	1803	1810	1433	1440	602
Q_{25}	41.35	13	14.2	2410	2450	1174	1180	942	948	409
Q_{50}	22.17	6.4	7	1510	1540	762	768	621	627	295
Q_{75}	13.38	3.1	3.5	1030	1060	528	533	421	426	228
Q_{90}	7.89	1.7	1.5	780	809	390	395	313	318	181
Q_{98}	5.27	1.1	1.1	541	568	277	282	230	235	139
Q_{mean}	37.03	11.5	11.5	1990	2020	994	1000	811	817	372
June										
Q_{02}	228.31	80.6	70.6	5180	5230	3580	3590	3081	3090	1460
Q_{10}	74.05	23.4	23.9	3640	3680	2013	2020	1643	1650	657
Q_{25}	34.64	11	12.2	2130	2170	1234	1240	1064	1070	394
Q_{50}	17.54	5.4	5.9	1430	1460	764	770	617	623	275
Q_{75}	9.03	2.1	2.2	998	1030	491	496	387	392	206
Q_{90}	5.78	1.3	0.76	726	754	349	354	276	281	155
Q_{98}	3.4	0.83	0.5	512	538	247	251	204	208	119
Q_{mean}	36	11.5	11.4	1840	1870	1014	1020	849	855	372
July										
Q_{02}	122.92	37.7	32.7	7190	7230	4662	4670	4712	4720	1060
Q_{10}	37.93	11.2	12.2	2930	2970	1504	1510	1234	1240	467
Q_{25}	18.71	5.2	6.2	1680	1710	979	985	842	848	329
Q_{50}	10.32	2.8	3.1	1150	1180	634	639	519	524	235
Q_{75}	6.01	1.3	1.3	829	857	429	434	354	359	175
Q_{90}	3.76	0.92	0.44	614	641	305	310	239	244	138
Q_{98}	2.55	0.69	0.36	448	471	200	204	178	182	109
Q_{mean}	21.99	6.6	6.6	1590	1620	905	910	794	799	304
August										
Q_{02}	112.27	33.5	31	4610	4650	2682	2690	1932	1940	761
Q_{10}	29.32	9.1	9.6	2010	2040	1184	1190	916	922	402
Q_{25}	12.29	3.5	4.2	1380	1410	801	806	679	684	296
Q_{50}	6.97	1.8	1.9	956	984	546	551	473	478	217
Q_{75}	4.28	1.1	0.87	674	701	371	376	309	314	164
Q_{90}	2.79	0.77	0.35	548	572	290	294	238	242	134
Q_{98}	1.82	0.6	0.27	397	417	201	204	174	177	100
Q_{mean}	15.59	4.9	4.9	1210	1240	707	712	581	586	260

Appendix A. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
September										
Q_{02}	178.96	39.8	38.8	6140	6180	3213	3220	1923	1930	1060
Q_{10}	36.11	6.9	7.1	2330	2360	1364	1370	910	916	445
Q_{25}	12.27	2.8	3.1	1460	1490	838	843	640	645	294
Q_{50}	5.65	1.4	1.4	1020	1050	562	567	462	467	222
Q_{75}	3.46	0.91	0.7	650	674	363	367	304	308	165
Q_{90}	2.28	0.73	0.51	516	539	286	290	237	241	137
Q_{98}	1.64	0.65	0.37	443	461	231	234	189	192	98
Q_{mean}	19.5	5.2	5.1	1350	1380	749	754	569	574	297
October										
Q_{02}	125.51	43.3	43.3	5050	5090	2473	2480	1613	1620	920
Q_{10}	38.19	10.3	10.5	2110	2140	1184	1190	899	905	440
Q_{25}	16.12	4	4.3	1370	1400	768	773	608	613	310
Q_{50}	7.41	1.6	1.6	1020	1050	568	573	455	460	239
Q_{75}	4.28	0.98	0.9	673	697	372	376	309	313	177
Q_{90}	3.01	0.81	0.58	556	578	290	294	236	240	148
Q_{98}	2.22	0.69	0.44	455	473	231	234	185	188	125
Q_{mean}	18.59	5.8	5.7	1280	1310	688	693	529	534	284
November										
Q_{02}	140.02	41.9	40.9	5470	5510	2573	2580	1803	1810	965
Q_{10}	56.33	16.7	17	2720	2750	1304	1310	979	985	463
Q_{25}	25.27	6.3	6.4	1560	1590	875	880	690	695	346
Q_{50}	10.9	2.3	2.4	1100	1130	577	582	459	464	258
Q_{75}	4.99	1.1	1.1	760	785	399	403	341	345	196
Q_{90}	3.87	0.9	0.78	607	630	311	315	251	255	161
Q_{98}	2.75	0.77	0.62	490	509	244	247	199	202	127
Q_{mean}	23.76	6.5	6.4	1420	1450	742	747	582	587	307
December										
Q_{02}	98.84	25.2	22.7	2800	2850	2150	2160	1301	1310	672
Q_{10}	40.42	11.5	11.5	2220	2260	1194	1200	873	879	421
Q_{25}	21.8	5.5	5.8	1590	1620	842	848	614	620	320
Q_{50}	12.07	2.7	3	1080	1110	546	551	435	440	240
Q_{75}	6.22	1.14	1.04	739	766	373	378	295	300	177
Q_{90}	3.8	0.88	0.88	546	570	266	270	226	230	145
Q_{98}	2.39	0.69	0.69	450	470	187	190	167	170	118
Q_{mean}	20.3	5.2	5.1	1330	1360	678	684	509	515	271

Appendix A. Continued

Flow type	Location				
	(51)	(52)	(53)	(54)	(55)
Q_{01}	2094	37.6	31.2	783	784
Q_{02}	1483	22.9	19.3	481	482
Q_{05}	884	10.8	10.3	231	232
Q_{10}	595	6.7	7.1	143	144
Q_{15}	483	5.2	5.8	111	112
Q_{25}	381	3.7	4.3	78	79
Q_{40}	304	2.6	2.9	54	55
Q_{50}	272	2.1	2.3	43	44
Q_{60}	244	1.72	1.9	36	36
Q_{75}	199	1.3	1.36	26	26
Q_{85}	174	1.05	0.88	20.5	20.7
Q_{90}	158	0.91	0.63	17.4	17.6
Q_{95}	141	0.77	0.41	14.4	14.5
Q_{98}	122	0.63	0.23	11.3	11.4
Q_{99}	110	0.55	0.14	9.5	9.5
Q_{mean}	369	4	3.84	83.6	83.8
Low Flows					
$Q_{1,2}$	137	0.9	0.8	17.4	17.5
$Q_{1,10}$	80	0.5	0.35	8.2	8.3
$Q_{1,25}$	65	0.36	0.19	5.3	5.3
$Q_{1,50}$	60	0.28	0.11	3.6	3.6
$Q_{7,2}$	155	0.98	0.88	19.2	19.4
$Q_{7,10}$	109	0.55	0.41	9.7	9.7
$Q_{7,25}$	92	0.43	0.26	6.9	6.9
$Q_{7,50}$	83	0.35	0.18	5.2	5.2
$Q_{15,2}$	160	1.06	0.96	20.8	20.9
$Q_{15,10}$	118	0.6	0.46	10.7	10.7
$Q_{15,25}$	99	0.47	0.3	7.9	7.9
$Q_{15,50}$	91	0.38	0.21	6	6
$Q_{31,2}$	179	1.16	1.06	23.2	23.3
$Q_{31,10}$	128	0.67	0.53	12.3	12.4
$Q_{31,25}$	109	0.53	0.39	9.2	9.2
$Q_{31,50}$	97	0.44	0.3	7.2	7.3
$Q_{61,2}$	198	1.37	1.28	27.5	27.7
$Q_{61,10}$	140	0.79	0.65	14.8	14.9
$Q_{61,25}$	117	0.65	0.54	11.6	11.7
$Q_{61,50}$	109	0.54	0.4	9.3	9.4
$Q_{91,2}$	209	1.53	1.49	31	31.2
$Q_{91,10}$	149	0.89	0.77	16.9	17
$Q_{91,25}$	127	0.73	0.63	13.4	13.5
$Q_{91,50}$	116	0.62	0.49	11.1	11.2

Appendix A. Continued

Flow type	Location				
	(51)	(52)	(53)	(54)	(55)
Drought Flows					
$Q_{6,10}$	165	1.07	0.99	20.6	20.8
$Q_{6,25}$	147	0.92	0.82	17.3	17.4
$Q_{6,50}$	141	0.85	0.74	15.8	15.9
$Q_{9,10}$	183	1.39	1.31	27.4	27.6
$Q_{9,25}$	162	1.16	1.06	22.3	22.5
$Q_{9,50}$	154	1.01	0.89	19.2	19.3
$Q_{12,10}$	213	1.77	1.71	35	36
$Q_{12,25}$	182	1.38	1.28	27	27
$Q_{12,50}$	172	1.18	1.07	23	23
$Q_{18,10}$	230	2.25	2.21	45	46
$Q_{18,25}$	196	1.62	1.53	32	32
$Q_{18,50}$	185	1.37	1.26	27	27
$Q_{30,10}$	279	2.7	2.6	55	55
$Q_{30,25}$	234	2	1.9	40	40
$Q_{30,50}$	220	1.7	1.6	34	35
$Q_{54,10}$	344	3.7	3.7	77	77
$Q_{54,25}$	269	2.6	2.6	54	54
$Q_{54,50}$	244	2.2	2.1	45	45
January					
Q_{02}	1113	24.8	22.4	513	513
Q_{10}	444	5.7	5.7	119	119
Q_{25}	315	2.9	3.2	61	61
Q_{50}	240	1.75	1.98	36	36
Q_{75}	179	1.14	1.1	22.5	22.7
Q_{90}	148	0.86	0.85	16.1	16.2
Q_{98}	113	0.57	0.44	9.7	9.8
Q_{mean}	304	3.76	4.07	77.1	77.4
February					
Q_{02}	2334	49	44.3	1004	1004
Q_{10}	787	11.9	11.9	251	251
Q_{25}	391	4.2	4.5	90	90
Q_{50}	270	2	2.3	42	42
Q_{75}	193	1.27	1.2	25	26
Q_{90}	159	0.94	0.97	18.1	18.2
Q_{98}	116	0.64	0.66	11.5	11.6
Q_{mean}	440	6.1	6.1	125	126
March					
Q_{02}	3414	52.8	48.1	1096	1097
Q_{10}	1412	13.7	13.7	301	301
Q_{25}	653	5.8	6.2	129	129
Q_{50}	412	3.4	3.7	72	73
Q_{75}	286	2.1	2.2	44	44
Q_{90}	209	1.34	1.43	26.9	27.1
Q_{98}	174	0.97	1.04	18.6	18.8
Q_{mean}	671	7.2	7.1	154	154

Appendix A. Continued

Flow type	Location				
	(51)	(52)	(53)	(54)	(55)
April					
Q_{02}	1464	19.4	14.7	415	416
Q_{10}	760	8.5	8.6	184	184
Q_{25}	529	5.5	5.9	116	117
Q_{50}	378	3.4	3.8	72	72
Q_{75}	287	2.2	2.4	45	45
Q_{90}	232	1.46	1.56	30	30
Q_{98}	187	1	0.96	19.6	19.8
Q_{mean}	474	4.8	4.5	101.2	101.5
May					
Q_{02}	1124	20.6	15.8	433	433
Q_{10}	614	8.4	8.5	177	178
Q_{25}	420	5	5.6	105	105
Q_{50}	305	3	3.3	63	64
Q_{75}	238	1.86	2.05	38	38
Q_{90}	190	1.23	1.11	24.4	24.6
Q_{98}	148	0.84	0.65	16	16.2
Q_{mean}	382	4.7	4.2	97.6	97.9
June					
Q_{02}	1474	29	24.2	597	598
Q_{10}	669	8.8	9	187	188
Q_{25}	405	4.9	5.5	104	105
Q_{50}	285	2.9	2.9	60	61
Q_{75}	215	1.68	1.43	34	34
Q_{90}	164	1.07	0.53	21	21.2
Q_{98}	128	0.68	0.26	12.5	12.6
Q_{mean}	382	5.1	4.4	105	106
July					
Q_{02}	1073	16.7	14.4	372	372
Q_{10}	478	5.5	6	118	118
Q_{25}	339	3.4	3.9	73	73
Q_{50}	245	2.1	2	44	44
Q_{75}	184	1.32	1.04	26.6	26.7
Q_{90}	147	0.89	0.4	17	17.1
Q_{98}	117	0.57	0.15	10	10.2
Q_{mean}	313	3.6	3	74.9	75.1
August					
Q_{02}	773	12.5	11.3	264	265
Q_{10}	412	4.3	4.6	92	93
Q_{25}	305	2.6	2.9	56	56
Q_{50}	226	1.7	1.48	35	35
Q_{75}	173	1.12	0.77	22.1	22.3
Q_{90}	142	0.84	0.37	15.9	16
Q_{98}	107	0.57	0.15	10	10.1
Q_{mean}	269	2.8	2.3	57.1	57.3

Appendix A. Concluded

Flow type	Location				
	(51)	(52)	(53)	(54)	(55)
September					
Q_{02}	1071	14.5	14	307	307
Q_{10}	455	3.9	4.1	85	86
Q_{25}	303	2.4	2.6	51	51
Q_{50}	231	1.56	1.37	32	33
Q_{75}	173	1.07	0.73	21	21.1
Q_{90}	145	0.77	0.41	14.5	14.6
Q_{98}	105	0.55	0.16	9.8	9.8
Q_{mean}	306	2.7	2.5	57	57.2
October					
Q_{02}	932	10	10	213	213
Q_{10}	450	4.1	4.2	88	88
Q_{25}	319	2.5	2.7	53	53
Q_{50}	248	1.62	1.57	34	34
Q_{75}	185	1.13	0.88	22.3	22.4
Q_{90}	156	0.84	0.49	15.9	16
Q_{98}	132	0.64	0.27	11.3	11.4
Q_{mean}	293	2.42	2.35	50.2	50.4
November					
Q_{02}	977	10.3	9.8	221	221
Q_{10}	473	4.9	5	104	105
Q_{25}	356	2.8	2.8	59	60
Q_{50}	267	1.76	1.81	36	37
Q_{75}	204	1.21	1.23	24	24
Q_{90}	169	0.89	0.61	17.1	17.2
Q_{98}	134	0.71	0.41	13	13.1
Q_{mean}	317	2.65	2.77	55.4	55.6
December					
Q_{02}	685	8.6	7.4	184	184
Q_{10}	432	4.4	4.4	93	93
Q_{25}	330	2.7	2.9	57	58
Q_{50}	249	1.68	1.83	35	35
Q_{75}	186	1.15	1.1	22.7	22.9
Q_{90}	153	0.86	0.86	16.1	16.2
Q_{98}	125	0.62	0.4	10.8	10.9
Q_{mean}	281	2.56	2.77	53	53.3

Note:
Streamflow values published by the U.S. Geological Survey ordinarily have three significant digits for values greater than or equal to 100 cfs, and 2 significant digits for values less than 100 cfs. Additional significant digits have been added to some streamflow frequency estimates in this appendix when used by ILSAM to estimate relative differences in flow values, either between virgin and present flow conditions, or between flows at two different locations. The additional digits do not indicate an improvement in the accuracy of the streamflow estimates.

Appendix B. Withdrawals and Effluent Discharges: Location and Estimated 2001 Flow Conditions

	Facility	Stream name	Code	Mile
1	A.G Communication Systems Discharge	Deer Creek	RUEK	3.2
2	Amboy Discharge	Green River	RD	70.0
3	Annawan STP	Mud Creek	RDH	6.4
4	Ashton Discharge	Beach Creek	RRP	7.0
5	Atkinson STP	Green River Tributary	RDG4G	1.2
6	Atwood Vacuum Machinery Co. Discharge	Rock River	R	142.8
7	Belvidere Discharge	Kishwaukee River	RU	21.91
8	Byron Discharge	Rock River	R	120.6
9	Capron Discharge	Beaver Creek Tributary	RUHJ	2.7
10	Cedarville STP	Cedar Creek	RYUC	1.5
11	Chadwick STP	Rock Creek Tributary	RIT	1.9
12	Commonwealth Edison Byron Withdrawal	Rock River	R	114.4
13	Consumers IL Water Woodhaven Discharge	Green River Tributary	RDU	6.3
14	Consumers IL Water-Candlewick Discharge	Beaver Creek	RUH	10.9
15	Dakota Discharge	Winneshiek Creek	RYN	8.6
16	Dana Corp/Warner Electric Discharge	Rock River	R	151.7
17	Davis STP	Rock Run	RYL	11.4
18	Dean Foods Discharge	Rock River	R	86.5
19	Dean Foods Inc. Discharge	Piscasaw Creek	RUK	20.2
20	Deans Food Discharge	Kent Creek	RV	1.8
21	DeKalb Discharge	South Branch Kishwaukee River	RUE	46.8
22	Dixon Correctional Center Discharge	Rock River	R	89.8
23	Dixon Discharge	Rock River	R	85.6
24	Durand Discharge	Otter Creek	RYCD	6.5
25	Erie Discharge	Rock River	R	38.3
26	Falcon Farms Discharge	Zuma Creek	RE	2.0
27	Forreston Discharge	Leaf River Tributary	RSR	3.6
28	Frank Butler & Company Discharge	Green River	RD	77.2
29	Franklin Grove Discharge	Franklin Creek	RP6	9.2
30	Freeport Discharge	Pecatonica River	RY	60.9
31	Geneseo Discharge	Geneseo Creek	RDE	2.4
32	Genoa Discharge	South Branch Kishwaukee River	RUE	26.1
33	German Valley Discharge	Mud Creek Tributary	RSHJ	6.0
34	Green Rock Discharge	Green River	RD	2.6
35	Hampshire Discharge	Hampshire Creek	RULQD	3.2
36	Harvard Discharge	Mokeler Creek	RUKN	4.9
37	Hillsdale Discharge	Meredosia Creek	RG	0.7
38	Huntley East Discharge	South Branch Kishwaukee River (east)	RUR	13.7
39	Huntley West Discharge	South Branch Kishwaukee River (east)	RUR	11.3
40	IBP Corp Discharge	Rock River	R	24.6
41	Illinois-Mississippi Canal Feeder	Rock River	R	73.6
42	Illinois-Mississippi Canal Outfall	Rock River	R	13.3
43	Industrial Discharges	Rock River	R	139.8
44	Kelly Springfield Discharge	Silver Creek	RYO	1.2
45	Kirkland Discharge	South Branch Kishwaukee River	RUE	15.2

Notes:
Stream codes are as listed in Appendix C.
STP – Sanitary Treatment Plant.

Appendix B. Continued

Facility	Stream name	Code	Mile
46 Lakewood STP	Kishwaukee River	RU	55.4
47 Lanark Discharge	Rock Creek	RI	52.6
48 Landis Gardner Discharge	Rock River	R	162.7
49 Lawrence Brothers Discharge	Union Drainage Ditch	RM	4.9
50 Leaf River Discharge	Leaf River	RS	7.7
51 Lena Discharge	Yellow Creek Tributary	RYQPG	0.4
52 Malta Discharge	Killbuck Creek Tributary	RUBU	3.4
53 Marengo Discharge	Kishwaukee River	RU	40.0
54 Milan STP	Rock River	R	3.7
55 Milledgeville Discharge	Elkhorn Creek	RL	28.0
56 Moline Consumers Company Discharge	Rock River	R	18.3
57 Moline South STP	Rock River	R	7.4
58 Morrison Discharge	Rock Creek	RI	16.0
59 Mt. Morris Discharge	Pine Creek Tributary	RPV	0.8
60 N.W. Steel & Wire Company Discharge	Rock River	R	72.9
61 Orangeville Discharge	Richland Creek	RYU	17.2
62 Oregon Discharge	Rock River	R	108.9
63 Orion Discharge	Mosquito Creek	RDA	5.2
64 Otter Creek Utilities Discharge	South Branch Otter Creek	RYCDJ	5.4
65 Pearl City Discharge	Yellow Creek	RYQ	25.3
66 Pecatonica Discharge	Pecatonica River	RY	31.7
67 Polo Discharge	Buffalo Creek	RLK	9.4
68 Poplar Grove Discharge	Beaver Creek	RUH	14.7
69 Prophetstown Discharge	Rock River	R	49.4
70 Quality Metal Finishing Co. Discharge	Rock River	R	119.8
71 Quebecor Printing	Pine Creek Tributary	RPV	0.81
72 Reynolds STP	Mill Creek Tributary	RBY	2.2
73 Rochelle Discharge	Kyte River	RR	21.6
74 Rochelle Foods Discharge	Kyte River	RR	2.2
75 Rock Falls Discharge	Rock River	R	72.2
76 Rockford Discharge	Rock River	R	133.5
77 Rockton Discharge	Rock River	R	156.4
78 Schlicting and Sons Discharge	Beaver Creek	RUH	1.5
79 Seward STP	Mill Creek	RS5	12.9
80 Shannon Discharge	Lost Creek	RYQL	13.4
81 Sheffield STP	Coal Creek	RDHE	14.7
82 South Beloit Discharge	Rock River	R	162.2
83 Sterling Discharge	Rock River	R	72.1
84 Stillman Valley Discharge	Stillman Creek	RT	4.5
85 Sycamore Discharge	E Branch S Branch Kishwaukee River	RUEP	1.9
86 Tampico STP	County Ditch No. 2	RJD	7.4
87 Techalloy Company Discharge	South Branch Kishwaukee River (east)	RUR	3.0
88 Valspar Corporation discharge	Rock River	R	135.9
89 Walnut Discharge	Walnut Creek	RDN	7.1
90 Winnebago Discharge	Coolidge Creek	RYG	11.6
91 Winslow Discharge	Pecatonica River	RY	91.5
92 Woodstock Discharge	Kishwaukee River	RU	62.8

Notes:
Stream codes are as listed in Appendix C.
STP – Sanitary Treatment Plant.

Appendix B. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Q_{01}	0.16	1.47	0.17	0.28	0.14	0.08	7.89	0.72	0.28	0.34
Q_{02}	0.16	1.31	0.15	0.27	0.14	0.08	7.37	0.66	0.26	0.30
Q_{05}	0.16	1.11	0.14	0.26	0.14	0.08	6.77	0.59	0.23	0.24
Q_{10}	0.16	0.99	0.13	0.25	0.13	0.08	6.38	0.55	0.21	0.21
Q_{15}	0.16	0.91	0.12	0.25	0.13	0.08	6.12	0.52	0.20	0.19
Q_{25}	0.16	0.82	0.12	0.24	0.13	0.08	5.86	0.49	0.18	0.16
Q_{40}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Q_{50}	0.16	0.70	0.11	0.24	0.13	0.08	5.47	0.45	0.16	0.13
Q_{60}	0.16	0.66	0.10	0.24	0.13	0.08	5.34	0.43	0.16	0.12
Q_{75}	0.16	0.57	0.10	0.23	0.13	0.08	5.08	0.40	0.14	0.09
Q_{85}	0.16	0.52	0.09	0.23	0.13	0.08	4.91	0.38	0.14	0.08
Q_{90}	0.16	0.46	0.09	0.22	0.12	0.08	4.74	0.36	0.13	0.06
Q_{95}	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
Q_{98}	0.16	0.31	0.08	0.21	0.12	0.08	4.26	0.31	0.10	0.02
Q_{99}	0.16	0.23	0.07	0.21	0.12	0.08	4.00	0.28	0.09	0.00
Q_{mean}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Low Flows										
$Q_{1,2}$	0.16	0.20	0.07	0.21	0.12	0.08	3.91	0.27	0.09	0.00
$Q_{1,10}$	0.16	0.08	0.06	0.20	0.12	0.08	3.52	0.23	0.07	0.00
$Q_{1,25}$	0.16	0.06	0.06	0.20	0.12	0.08	3.48	0.22	0.06	0.00
$Q_{1,50}$	0.16	0.06	0.06	0.20	0.12	0.08	3.48	0.22	0.06	0.00
$Q_{7,2}$	0.16	0.45	0.09	0.22	0.12	0.08	4.69	0.36	0.12	0.06
$Q_{7,10}$	0.16	0.23	0.07	0.21	0.12	0.08	4.00	0.28	0.09	0.00
$Q_{7,25}$	0.16	0.20	0.07	0.21	0.12	0.08	3.91	0.27	0.09	0.00
$Q_{7,50}$	0.16	0.20	0.07	0.21	0.12	0.08	3.91	0.27	0.09	0.00
$Q_{15,2}$	0.16	0.46	0.09	0.22	0.12	0.08	4.74	0.36	0.13	0.06
$Q_{15,10}$	0.16	0.27	0.07	0.21	0.12	0.08	4.13	0.29	0.10	0.01
$Q_{15,25}$	0.16	0.22	0.07	0.21	0.12	0.08	3.96	0.28	0.09	0.00
$Q_{15,50}$	0.16	0.22	0.07	0.21	0.12	0.08	3.96	0.28	0.09	0.00
$Q_{31,2}$	0.16	0.49	0.09	0.23	0.13	0.08	4.82	0.37	0.13	0.07
$Q_{31,10}$	0.16	0.31	0.08	0.21	0.12	0.08	4.26	0.31	0.10	0.02
$Q_{31,25}$	0.16	0.23	0.07	0.21	0.12	0.08	4.00	0.28	0.09	0.00
$Q_{31,50}$	0.16	0.22	0.07	0.21	0.12	0.08	3.96	0.28	0.09	0.00
$Q_{61,2}$	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
$Q_{61,10}$	0.16	0.35	0.08	0.22	0.12	0.08	4.39	0.32	0.11	0.03
$Q_{61,25}$	0.16	0.27	0.07	0.21	0.12	0.08	4.13	0.29	0.10	0.01
$Q_{61,50}$	0.16	0.24	0.07	0.21	0.12	0.08	4.04	0.28	0.09	0.00
$Q_{91,2}$	0.16	0.57	0.10	0.23	0.13	0.08	5.08	0.40	0.14	0.09
$Q_{91,10}$	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
$Q_{91,25}$	0.16	0.31	0.08	0.21	0.12	0.08	4.26	0.31	0.10	0.02
$Q_{91,50}$	0.16	0.30	0.08	0.21	0.12	0.08	4.22	0.30	0.10	0.02

Appendix B. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Drought Flows										
$Q_{6,10}$	0.16	0.52	0.09	0.23	0.13	0.08	4.91	0.38	0.14	0.08
$Q_{6,25}$	0.16	0.45	0.09	0.22	0.12	0.08	4.69	0.36	0.12	0.06
$Q_{6,50}$	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
$Q_{9,10}$	0.16	0.60	0.10	0.23	0.13	0.08	5.15	0.41	0.15	0.10
$Q_{9,25}$	0.16	0.55	0.09	0.23	0.13	0.08	4.99	0.39	0.14	0.09
$Q_{9,50}$	0.16	0.51	0.09	0.23	0.13	0.08	4.86	0.38	0.13	0.08
$Q_{12,10}$	0.16	0.67	0.10	0.24	0.13	0.08	5.38	0.44	0.16	0.12
$Q_{12,25}$	0.16	0.62	0.10	0.23	0.13	0.08	5.21	0.42	0.15	0.11
$Q_{12,50}$	0.16	0.56	0.10	0.23	0.13	0.08	5.04	0.40	0.14	0.09
$Q_{18,10}$	0.16	0.71	0.11	0.24	0.13	0.08	5.51	0.45	0.17	0.13
$Q_{18,25}$	0.16	0.64	0.10	0.23	0.13	0.08	5.30	0.43	0.15	0.11
$Q_{18,50}$	0.16	0.60	0.10	0.23	0.13	0.08	5.15	0.41	0.15	0.10
$Q_{30,10}$	0.16	0.75	0.11	0.24	0.13	0.08	5.64	0.46	0.17	0.14
$Q_{30,25}$	0.16	0.68	0.11	0.24	0.13	0.08	5.43	0.44	0.16	0.12
$Q_{30,50}$	0.16	0.64	0.10	0.23	0.13	0.08	5.30	0.43	0.15	0.11
$Q_{54,10}$	0.16	0.81	0.12	0.24	0.13	0.08	5.82	0.48	0.18	0.16
$Q_{54,25}$	0.16	0.71	0.11	0.24	0.13	0.08	5.51	0.45	0.17	0.13
$Q_{54,50}$	0.16	0.68	0.11	0.24	0.13	0.08	5.43	0.44	0.16	0.12
January										
Q_{02}	0.16	1.35	0.16	0.28	0.14	0.08	7.50	0.67	0.27	0.31
Q_{10}	0.16	0.99	0.13	0.25	0.13	0.08	6.38	0.55	0.21	0.21
Q_{25}	0.16	0.82	0.12	0.24	0.13	0.08	5.86	0.49	0.18	0.16
Q_{50}	0.16	0.70	0.11	0.24	0.13	0.08	5.47	0.45	0.16	0.13
Q_{75}	0.16	0.57	0.10	0.23	0.13	0.08	5.08	0.40	0.14	0.09
Q_{90}	0.16	0.46	0.09	0.22	0.12	0.08	4.71	0.36	0.13	0.06
Q_{98}	0.16	0.35	0.08	0.22	0.12	0.08	4.39	0.32	0.11	0.03
Q_{mean}	0.16	0.80	0.11	0.24	0.13	0.08	5.77	0.48	0.18	0.16
February										
Q_{02}	0.16	1.42	0.16	0.28	0.14	0.08	7.72	0.70	0.28	0.33
Q_{10}	0.16	1.04	0.13	0.26	0.14	0.08	6.55	0.57	0.22	0.22
Q_{25}	0.16	0.89	0.12	0.25	0.13	0.08	6.08	0.51	0.19	0.18
Q_{50}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Q_{75}	0.16	0.62	0.10	0.23	0.13	0.08	5.21	0.42	0.15	0.11
Q_{90}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{98}	0.16	0.44	0.09	0.22	0.12	0.08	4.65	0.35	0.12	0.06
Q_{mean}	0.16	0.84	0.12	0.25	0.13	0.08	5.91	0.50	0.19	0.17
March										
Q_{02}	0.16	1.47	0.17	0.28	0.14	0.08	7.89	0.72	0.28	0.34
Q_{10}	0.16	1.11	0.14	0.26	0.14	0.08	6.77	0.59	0.23	0.24
Q_{25}	0.16	0.95	0.13	0.25	0.13	0.08	6.25	0.53	0.20	0.20
Q_{50}	0.16	0.82	0.12	0.24	0.13	0.08	5.86	0.49	0.18	0.16
Q_{75}	0.16	0.71	0.11	0.24	0.13	0.08	5.51	0.45	0.17	0.13
Q_{90}	0.16	0.66	0.10	0.24	0.13	0.08	5.34	0.43	0.16	0.12
Q_{98}	0.16	0.52	0.09	0.23	0.13	0.08	4.91	0.38	0.14	0.08
Q_{mean}	0.16	0.88	0.12	0.25	0.13	0.08	6.02	0.51	0.19	0.18

Appendix B. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
April										
Q_{02}	0.16	1.47	0.17	0.28	0.14	0.08	7.89	0.72	0.28	0.34
Q_{10}	0.16	1.11	0.14	0.26	0.14	0.08	6.77	0.59	0.23	0.24
Q_{25}	0.16	0.97	0.13	0.25	0.13	0.08	6.34	0.54	0.21	0.20
Q_{50}	0.16	0.85	0.12	0.25	0.13	0.08	5.95	0.50	0.19	0.17
Q_{75}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Q_{90}	0.16	0.68	0.11	0.24	0.13	0.08	5.43	0.44	0.16	0.12
Q_{98}	0.16	0.55	0.09	0.23	0.13	0.08	4.99	0.39	0.14	0.09
Q_{mean}	0.16	0.88	0.12	0.25	0.13	0.08	6.03	0.51	0.19	0.18
May										
Q_{02}	0.16	1.47	0.17	0.28	0.14	0.08	7.89	0.72	0.28	0.34
Q_{10}	0.16	1.04	0.13	0.26	0.14	0.08	6.55	0.57	0.22	0.22
Q_{25}	0.16	0.87	0.12	0.25	0.13	0.08	6.02	0.51	0.19	0.18
Q_{50}	0.16	0.78	0.11	0.24	0.13	0.08	5.73	0.47	0.18	0.15
Q_{75}	0.16	0.71	0.11	0.24	0.13	0.08	5.51	0.45	0.17	0.13
Q_{90}	0.16	0.67	0.10	0.24	0.13	0.08	5.38	0.44	0.16	0.12
Q_{98}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{mean}	0.16	0.84	0.12	0.25	0.13	0.08	5.90	0.49	0.19	0.17
June										
Q_{02}	0.16	1.47	0.17	0.28	0.14	0.08	7.89	0.72	0.28	0.34
Q_{10}	0.16	1.04	0.13	0.26	0.14	0.08	6.55	0.57	0.22	0.22
Q_{25}	0.16	0.86	0.12	0.25	0.13	0.08	5.99	0.50	0.19	0.17
Q_{50}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Q_{75}	0.16	0.68	0.11	0.24	0.13	0.08	5.43	0.44	0.16	0.12
Q_{90}	0.16	0.63	0.10	0.23	0.13	0.08	5.25	0.42	0.15	0.11
Q_{98}	0.16	0.52	0.09	0.23	0.13	0.08	4.91	0.38	0.14	0.08
Q_{mean}	0.16	0.75	0.11	0.24	0.13	0.08	5.64	0.46	0.17	0.14
July										
Q_{02}	0.16	1.21	0.15	0.27	0.14	0.08	7.07	0.63	0.24	0.27
Q_{10}	0.16	0.91	0.12	0.25	0.13	0.08	6.12	0.52	0.20	0.19
Q_{25}	0.16	0.77	0.11	0.24	0.13	0.08	5.69	0.47	0.17	0.15
Q_{50}	0.16	0.70	0.11	0.24	0.13	0.08	5.47	0.45	0.16	0.13
Q_{75}	0.16	0.60	0.10	0.23	0.13	0.08	5.17	0.41	0.15	0.10
Q_{90}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{98}	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
Q_{mean}	0.16	0.67	0.10	0.24	0.13	0.08	5.38	0.44	0.16	0.12
August										
Q_{02}	0.16	1.11	0.14	0.26	0.14	0.08	6.77	0.59	0.23	0.24
Q_{10}	0.16	0.81	0.12	0.24	0.13	0.08	5.82	0.48	0.18	0.16
Q_{25}	0.16	0.68	0.11	0.24	0.13	0.08	5.43	0.44	0.16	0.12
Q_{50}	0.16	0.60	0.10	0.23	0.13	0.08	5.15	0.41	0.15	0.10
Q_{75}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{90}	0.16	0.46	0.09	0.22	0.12	0.08	4.71	0.36	0.13	0.06
Q_{98}	0.16	0.31	0.08	0.21	0.12	0.08	4.26	0.31	0.10	0.02
Q_{mean}	0.16	0.60	0.10	0.23	0.13	0.08	5.17	0.41	0.15	0.10

Appendix B. Continued

Flow type	Location									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
September										
Q_{02}	0.16	0.99	0.13	0.25	0.13	0.08	6.38	0.55	0.21	0.21
Q_{10}	0.16	0.73	0.11	0.24	0.13	0.08	5.56	0.46	0.17	0.14
Q_{25}	0.16	0.60	0.10	0.23	0.13	0.08	5.17	0.41	0.15	0.10
Q_{50}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{75}	0.16	0.46	0.09	0.22	0.12	0.08	4.74	0.36	0.13	0.06
Q_{90}	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
Q_{98}	0.16	0.23	0.07	0.21	0.12	0.08	4.00	0.28	0.09	0.00
Q_{mean}	0.16	0.57	0.10	0.23	0.13	0.08	5.07	0.40	0.14	0.09
October										
Q_{02}	0.16	1.03	0.13	0.26	0.14	0.08	6.51	0.56	0.22	0.22
Q_{10}	0.16	0.78	0.11	0.24	0.13	0.08	5.73	0.47	0.18	0.15
Q_{25}	0.16	0.66	0.10	0.24	0.13	0.08	5.34	0.43	0.16	0.12
Q_{50}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{75}	0.16	0.46	0.09	0.22	0.12	0.08	4.71	0.36	0.13	0.06
Q_{90}	0.16	0.35	0.08	0.22	0.12	0.08	4.39	0.32	0.11	0.03
Q_{98}	0.16	0.20	0.07	0.21	0.12	0.08	3.91	0.27	0.09	0.00
Q_{mean}	0.16	0.57	0.10	0.23	0.13	0.08	5.06	0.40	0.14	0.09
November										
Q_{02}	0.16	1.08	0.14	0.26	0.14	0.08	6.68	0.58	0.22	0.23
Q_{10}	0.16	0.82	0.12	0.24	0.13	0.08	5.86	0.49	0.18	0.16
Q_{25}	0.16	0.71	0.11	0.24	0.13	0.08	5.51	0.45	0.17	0.13
Q_{50}	0.16	0.60	0.10	0.23	0.13	0.08	5.15	0.41	0.15	0.10
Q_{75}	0.16	0.51	0.09	0.23	0.13	0.08	4.86	0.38	0.13	0.08
Q_{90}	0.16	0.41	0.08	0.22	0.12	0.08	4.56	0.34	0.12	0.05
Q_{98}	0.16	0.23	0.07	0.21	0.12	0.08	4.00	0.28	0.09	0.00
Q_{mean}	0.16	0.70	0.11	0.24	0.13	0.08	5.47	0.45	0.16	0.13
December										
Q_{02}	0.16	1.31	0.15	0.27	0.14	0.08	7.37	0.66	0.26	0.30
Q_{10}	0.16	0.91	0.12	0.25	0.13	0.08	6.12	0.52	0.20	0.19
Q_{25}	0.16	0.74	0.11	0.24	0.13	0.08	5.60	0.46	0.17	0.14
Q_{50}	0.16	0.64	0.10	0.23	0.13	0.08	5.30	0.43	0.15	0.11
Q_{75}	0.16	0.53	0.09	0.23	0.13	0.08	4.95	0.39	0.14	0.08
Q_{90}	0.16	0.44	0.09	0.22	0.12	0.08	4.65	0.35	0.12	0.06
Q_{98}	0.16	0.30	0.08	0.21	0.12	0.08	4.22	0.30	0.10	0.02
Q_{mean}	0.16	0.79	0.11	0.24	0.13	0.08	5.76	0.48	0.18	0.15

Appendix B. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Q_{01}	0.47	0.00	0.22	0.96	0.12	0.64	0.32	1.54	0.42	0.88
Q_{02}	0.41	0.00	0.22	0.87	0.11	0.64	0.28	1.38	0.38	0.76
Q_{05}	0.34	0.00	0.22	0.76	0.10	0.64	0.24	1.20	0.34	0.62
Q_{10}	0.30	0.00	0.21	0.70	0.09	0.64	0.21	1.08	0.31	0.54
Q_{15}	0.27	0.00	0.21	0.65	0.09	0.64	0.20	1.00	0.29	0.48
Q_{25}	0.24	0.00	0.21	0.61	0.08	0.64	0.18	0.92	0.27	0.42
Q_{40}	0.21	0.00	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Q_{50}	0.20	-0.50	0.21	0.54	0.08	0.64	0.15	0.80	0.24	0.33
Q_{60}	0.18	-2.30	0.21	0.51	0.08	0.64	0.14	0.76	0.23	0.30
Q_{75}	0.15	-4.10	0.21	0.47	0.07	0.64	0.12	0.68	0.21	0.24
Q_{85}	0.13	-5.90	0.21	0.44	0.07	0.64	0.11	0.63	0.20	0.20
Q_{90}	0.11	-6.80	0.20	0.41	0.06	0.64	0.10	0.58	0.19	0.17
Q_{95}	0.09	-7.70	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
Q_{98}	0.06	-9.50	0.20	0.33	0.05	0.64	0.07	0.43	0.15	0.06
Q_{99}	0.03	-10.70	0.20	0.28	0.05	0.64	0.05	0.35	0.13	0.00
Q_{mean}	0.21	-11.90	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Low Flows										
$Q_{1,2}$	0.02	-13.10	0.20	0.26	0.05	0.64	0.04	0.32	0.12	0.00
$Q_{1,10}$	0.00	-15.20	0.20	0.20	0.04	0.64	0.02	0.20	0.09	0.00
$Q_{1,25}$	0.00	-17.00	0.20	0.19	0.04	0.64	0.01	0.19	0.09	0.00
$Q_{1,50}$	0.00	-5.90	0.20	0.19	0.04	0.64	0.01	0.19	0.09	0.00
$Q_{7,2}$	0.11	-17.60	0.20	0.40	0.06	0.64	0.10	0.56	0.18	0.16
$Q_{7,10}$	0.03	-20.30	0.20	0.28	0.05	0.64	0.05	0.35	0.13	0.00
$Q_{7,25}$	0.02	-20.60	0.20	0.26	0.05	0.64	0.04	0.32	0.12	0.00
$Q_{7,50}$	0.02	-20.60	0.20	0.26	0.05	0.64	0.04	0.32	0.12	0.00
$Q_{15,2}$	0.11	-12.20	0.20	0.41	0.06	0.64	0.10	0.58	0.19	0.17
$Q_{15,10}$	0.04	-17.00	0.20	0.30	0.05	0.64	0.06	0.39	0.14	0.03
$Q_{15,25}$	0.03	-17.60	0.20	0.27	0.05	0.64	0.05	0.34	0.13	0.00
$Q_{15,50}$	0.03	-17.60	0.20	0.27	0.05	0.64	0.05	0.34	0.13	0.00
$Q_{31,2}$	0.12	-11.90	0.21	0.42	0.07	0.64	0.11	0.60	0.19	0.18
$Q_{31,10}$	0.06	-16.10	0.20	0.33	0.05	0.64	0.07	0.43	0.15	0.06
$Q_{31,25}$	0.03	-17.30	0.20	0.28	0.05	0.64	0.05	0.35	0.13	0.00
$Q_{31,50}$	0.03	-17.30	0.20	0.27	0.05	0.64	0.05	0.34	0.13	0.00
$Q_{61,2}$	0.14	-11.30	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
$Q_{61,10}$	0.07	-15.20	0.20	0.35	0.06	0.64	0.08	0.47	0.16	0.09
$Q_{61,25}$	0.04	-17.00	0.20	0.30	0.05	0.64	0.06	0.39	0.14	0.03
$Q_{61,50}$	0.03	-17.30	0.20	0.29	0.05	0.64	0.05	0.36	0.13	0.01
$Q_{91,2}$	0.15	-10.40	0.21	0.47	0.07	0.64	0.12	0.68	0.21	0.24
$Q_{91,10}$	0.09	-14.30	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
$Q_{91,25}$	0.06	-16.10	0.20	0.33	0.05	0.64	0.07	0.43	0.15	0.06
$Q_{91,50}$	0.05	-16.70	0.20	0.32	0.05	0.64	0.06	0.42	0.15	0.05

Appendix B. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Drought Flows										
$Q_{6,10}$	0.13	-9.50	0.21	0.44	0.07	0.64	0.11	0.63	0.20	0.20
$Q_{6,25}$	0.11	-13.10	0.20	0.40	0.06	0.64	0.10	0.56	0.18	0.16
$Q_{6,50}$	0.09	-15.20	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
$Q_{9,10}$	0.16	-15.50	0.21	0.48	0.07	0.64	0.13	0.70	0.22	0.26
$Q_{9,25}$	0.14	-10.70	0.21	0.45	0.07	0.64	0.12	0.65	0.20	0.22
$Q_{9,50}$	0.13	-12.20	0.21	0.43	0.07	0.64	0.11	0.61	0.19	0.19
$Q_{12,10}$	0.19	-13.10	0.21	0.52	0.08	0.64	0.15	0.77	0.23	0.31
$Q_{12,25}$	0.17	-9.05	0.21	0.49	0.07	0.64	0.13	0.72	0.22	0.27
$Q_{12,50}$	0.15	-10.10	0.21	0.46	0.07	0.64	0.12	0.67	0.21	0.23
$Q_{18,10}$	0.20	-11.00	0.21	0.54	0.08	0.64	0.15	0.81	0.24	0.34
$Q_{18,25}$	0.18	-7.40	0.21	0.51	0.07	0.64	0.14	0.75	0.23	0.29
$Q_{18,50}$	0.16	-8.60	0.21	0.48	0.07	0.64	0.13	0.70	0.22	0.26
$Q_{30,10}$	0.21	-9.80	0.21	0.57	0.08	0.64	0.16	0.85	0.25	0.37
$Q_{30,25}$	0.19	-6.50	0.21	0.53	0.08	0.64	0.15	0.79	0.24	0.32
$Q_{30,50}$	0.18	-8.00	0.21	0.51	0.07	0.64	0.14	0.75	0.23	0.29
$Q_{54,10}$	0.23	-9.05	0.21	0.60	0.08	0.64	0.17	0.91	0.27	0.41
$Q_{54,25}$	0.20	-5.60	0.21	0.54	0.08	0.64	0.15	0.81	0.24	0.34
$Q_{54,50}$	0.19	-7.10	0.21	0.53	0.08	0.64	0.15	0.79	0.24	0.32
January										
Q_{02}	0.42	-8.00	0.22	0.89	0.12	0.64	0.29	1.42	0.39	0.79
Q_{10}	0.30	-4.40	0.21	0.70	0.09	0.64	0.21	1.08	0.31	0.54
Q_{25}	0.24	-6.50	0.21	0.61	0.08	0.64	0.18	0.92	0.27	0.42
Q_{50}	0.20	-7.10	0.21	0.54	0.08	0.64	0.15	0.80	0.24	0.33
Q_{75}	0.15	0.00	0.21	0.47	0.07	0.64	0.12	0.68	0.21	0.24
Q_{90}	0.11	-0.50	0.20	0.40	0.06	0.64	0.10	0.57	0.18	0.16
Q_{98}	0.07	-4.10	0.20	0.35	0.06	0.64	0.08	0.47	0.16	0.09
Q_{mean}	0.23	-6.80	0.21	0.59	0.08	0.64	0.17	0.89	0.26	0.40
February										
Q_{02}	0.45	-9.50	0.22	0.93	0.12	0.64	0.31	1.49	0.41	0.84
Q_{10}	0.32	-12.05	0.22	0.73	0.10	0.64	0.23	1.13	0.32	0.57
Q_{25}	0.26	-14.30	0.21	0.64	0.09	0.64	0.19	0.99	0.29	0.47
Q_{50}	0.21	-4.70	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Q_{75}	0.17	0.00	0.21	0.49	0.07	0.64	0.13	0.72	0.22	0.27
Q_{90}	0.14	0.00	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{98}	0.10	-2.60	0.20	0.39	0.06	0.64	0.09	0.55	0.18	0.15
Q_{mean}	0.25	-5.90	0.21	0.61	0.09	0.64	0.18	0.94	0.27	0.43
March										
Q_{02}	0.47	-8.60	0.22	0.96	0.12	0.64	0.32	1.54	0.42	0.88
Q_{10}	0.34	-10.40	0.22	0.76	0.10	0.64	0.24	1.20	0.34	0.62
Q_{25}	0.28	-12.50	0.21	0.67	0.09	0.64	0.20	1.04	0.30	0.51
Q_{50}	0.24	-3.74	0.21	0.61	0.08	0.64	0.18	0.92	0.27	0.42
Q_{75}	0.20	0.00	0.21	0.54	0.08	0.64	0.15	0.81	0.24	0.34
Q_{90}	0.18	0.00	0.21	0.51	0.08	0.64	0.14	0.76	0.23	0.30
Q_{98}	0.13	-1.40	0.21	0.44	0.07	0.64	0.11	0.63	0.20	0.20
Q_{mean}	0.26	-4.10	0.21	0.63	0.09	0.64	0.19	0.97	0.28	0.46

Appendix B. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
April										
Q_{02}	0.47	-6.50	0.22	0.96	0.12	0.64	0.32	1.54	0.42	0.88
Q_{10}	0.34	-7.70	0.22	0.76	0.10	0.64	0.24	1.20	0.34	0.62
Q_{25}	0.29	-10.70	0.21	0.69	0.09	0.64	0.21	1.07	0.31	0.53
Q_{50}	0.25	-2.96	0.21	0.62	0.09	0.64	0.18	0.95	0.28	0.44
Q_{75}	0.21	0.00	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Q_{90}	0.19	0.00	0.21	0.53	0.08	0.64	0.15	0.79	0.24	0.32
Q_{98}	0.14	-0.80	0.21	0.45	0.07	0.64	0.12	0.65	0.20	0.22
Q_{mean}	0.26	-3.50	0.21	0.63	0.09	0.64	0.19	0.97	0.28	0.46
May										
Q_{02}	0.47	-5.90	0.22	0.96	0.12	0.64	0.32	1.54	0.42	0.88
Q_{10}	0.32	-7.10	0.22	0.73	0.10	0.64	0.23	1.13	0.32	0.57
Q_{25}	0.26	-10.10	0.21	0.63	0.09	0.64	0.19	0.97	0.28	0.45
Q_{50}	0.22	-2.93	0.21	0.58	0.08	0.64	0.17	0.88	0.26	0.39
Q_{75}	0.20	0.00	0.21	0.54	0.08	0.64	0.15	0.81	0.24	0.34
Q_{90}	0.19	0.00	0.21	0.52	0.08	0.64	0.15	0.77	0.23	0.31
Q_{98}	0.14	-2.99	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{mean}	0.24	-5.00	0.21	0.61	0.09	0.64	0.18	0.93	0.27	0.43
June										
Q_{02}	0.47	-6.50	0.22	0.96	0.12	0.64	0.32	1.54	0.42	0.88
Q_{10}	0.32	-7.40	0.22	0.73	0.10	0.64	0.23	1.13	0.32	0.57
Q_{25}	0.25	-10.40	0.21	0.63	0.09	0.64	0.19	0.96	0.28	0.45
Q_{50}	0.21	-3.80	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Q_{75}	0.19	0.00	0.21	0.53	0.08	0.64	0.15	0.79	0.24	0.32
Q_{90}	0.17	0.00	0.21	0.50	0.07	0.64	0.14	0.73	0.22	0.28
Q_{98}	0.13	-3.20	0.21	0.44	0.07	0.64	0.11	0.63	0.20	0.20
Q_{mean}	0.21	-5.90	0.21	0.57	0.08	0.64	0.16	0.85	0.25	0.37
July										
Q_{02}	0.38	-7.10	0.22	0.82	0.11	0.64	0.26	1.29	0.36	0.69
Q_{10}	0.27	-8.30	0.21	0.65	0.09	0.64	0.20	1.00	0.29	0.48
Q_{25}	0.22	-10.70	0.21	0.58	0.08	0.64	0.17	0.87	0.26	0.38
Q_{50}	0.20	-5.63	0.21	0.54	0.08	0.64	0.15	0.80	0.24	0.33
Q_{75}	0.16	0.00	0.21	0.48	0.07	0.64	0.13	0.71	0.22	0.26
Q_{90}	0.14	-2.30	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{98}	0.09	-5.30	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
Q_{mean}	0.19	-6.80	0.21	0.52	0.08	0.64	0.15	0.77	0.23	0.31
August										
Q_{02}	0.34	-8.90	0.22	0.76	0.10	0.64	0.24	1.20	0.34	0.62
Q_{10}	0.23	-10.40	0.21	0.60	0.08	0.64	0.17	0.91	0.27	0.41
Q_{25}	0.19	-13.10	0.21	0.53	0.08	0.64	0.15	0.79	0.24	0.32
Q_{50}	0.16	-7.40	0.21	0.48	0.07	0.64	0.13	0.70	0.22	0.26
Q_{75}	0.14	0.00	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{90}	0.11	-4.40	0.20	0.40	0.06	0.64	0.10	0.57	0.18	0.16
Q_{98}	0.06	-7.10	0.20	0.33	0.05	0.64	0.07	0.43	0.15	0.06
Q_{mean}	0.16	-9.05	0.21	0.48	0.07	0.64	0.13	0.71	0.22	0.26

Appendix B. Continued

Flow type	Location									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
September										
Q_{02}	0.30	-10.40	0.21	0.70	0.09	0.64	0.21	1.08	0.31	0.54
Q_{10}	0.21	-12.05	0.21	0.55	0.08	0.64	0.16	0.83	0.25	0.35
Q_{25}	0.16	-15.20	0.21	0.48	0.07	0.64	0.13	0.71	0.22	0.26
Q_{50}	0.14	-8.90	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{75}	0.11	-0.50	0.20	0.41	0.06	0.64	0.10	0.58	0.19	0.17
Q_{90}	0.09	-6.20	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
Q_{98}	0.03	-8.90	0.20	0.28	0.05	0.64	0.05	0.35	0.13	0.00
Q_{mean}	0.15	-10.40	0.21	0.47	0.07	0.64	0.12	0.68	0.21	0.24
October										
Q_{02}	0.31	-11.90	0.22	0.72	0.10	0.64	0.22	1.12	0.32	0.56
Q_{10}	0.22	-13.10	0.21	0.58	0.08	0.64	0.17	0.88	0.26	0.39
Q_{25}	0.18	-17.00	0.21	0.51	0.08	0.64	0.14	0.76	0.23	0.30
Q_{50}	0.14	-9.56	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{75}	0.11	0.00	0.20	0.40	0.06	0.64	0.10	0.57	0.18	0.16
Q_{90}	0.07	-5.00	0.20	0.35	0.06	0.64	0.08	0.47	0.16	0.09
Q_{98}	0.02	-7.70	0.20	0.26	0.05	0.64	0.04	0.32	0.12	0.00
Q_{mean}	0.15	-10.40	0.21	0.47	0.07	0.64	0.12	0.68	0.21	0.24
November										
Q_{02}	0.33	-12.05	0.22	0.75	0.10	0.64	0.23	1.17	0.33	0.60
Q_{10}	0.24	-14.30	0.21	0.61	0.08	0.64	0.18	0.92	0.27	0.42
Q_{25}	0.20	-17.60	0.21	0.54	0.08	0.64	0.15	0.81	0.24	0.34
Q_{50}	0.16	-9.62	0.21	0.48	0.07	0.64	0.13	0.70	0.22	0.26
Q_{75}	0.13	0.00	0.21	0.43	0.07	0.64	0.11	0.61	0.19	0.19
Q_{90}	0.09	-4.10	0.20	0.38	0.06	0.64	0.09	0.52	0.17	0.13
Q_{98}	0.03	-6.50	0.20	0.28	0.05	0.64	0.05	0.35	0.13	0.00
Q_{mean}	0.20	-9.05	0.21	0.54	0.08	0.64	0.15	0.80	0.24	0.33
December										
Q_{02}	0.41	-11.00	0.22	0.87	0.11	0.64	0.28	1.38	0.38	0.76
Q_{10}	0.27	-13.10	0.21	0.65	0.09	0.64	0.20	1.00	0.29	0.48
Q_{25}	0.21	-17.00	0.21	0.56	0.08	0.64	0.16	0.84	0.25	0.36
Q_{50}	0.18	-6.80	0.21	0.51	0.07	0.64	0.14	0.75	0.23	0.29
Q_{75}	0.14	0.00	0.21	0.45	0.07	0.64	0.12	0.64	0.20	0.21
Q_{90}	0.10	-2.30	0.20	0.39	0.06	0.64	0.09	0.55	0.18	0.15
Q_{98}	0.05	-5.90	0.20	0.32	0.05	0.64	0.06	0.42	0.15	0.05
Q_{mean}	0.23	-8.00	0.21	0.59	0.08	0.64	0.17	0.89	0.26	0.40

Appendix B. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Q_{01}	15.60	1.06	7.39	0.66	0.38	0.24	0.97	1.44	0.32	14.49
Q_{02}	14.40	0.98	6.87	0.58	0.34	0.21	0.86	1.36	0.29	13.22
Q_{05}	13.00	0.88	6.27	0.50	0.30	0.17	0.74	1.28	0.25	11.75
Q_{10}	12.10	0.82	5.88	0.44	0.27	0.15	0.67	1.22	0.23	10.80
Q_{15}	11.50	0.77	5.62	0.40	0.25	0.13	0.61	1.19	0.21	10.16
Q_{25}	10.90	0.73	5.36	0.37	0.23	0.12	0.56	1.15	0.20	9.53
Q_{40}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Q_{50}	10.00	0.67	4.97	0.31	0.20	0.09	0.48	1.10	0.17	8.58
Q_{60}	9.70	0.65	4.84	0.29	0.19	0.08	0.46	1.08	0.16	8.27
Q_{75}	9.10	0.61	4.58	0.26	0.17	0.07	0.41	1.04	0.15	7.64
Q_{85}	8.70	0.58	4.41	0.23	0.16	0.06	0.37	1.02	0.14	7.21
Q_{90}	8.30	0.55	4.24	0.21	0.15	0.05	0.34	1.00	0.13	6.79
Q_{95}	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
Q_{98}	7.20	0.47	3.76	0.14	0.11	0.02	0.24	0.93	0.10	5.63
Q_{99}	6.60	0.43	3.50	0.10	0.09	0.00	0.19	0.89	0.08	5.00
Q_{mean}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Low Flows										
$Q_{1,2}$	6.40	0.42	3.41	0.09	0.08	0.00	0.17	0.88	0.07	4.79
$Q_{1,10}$	5.50	0.35	3.02	0.03	0.05	0.00	0.09	0.83	0.05	3.84
$Q_{1,25}$	5.40	0.35	2.98	0.03	0.05	0.00	0.09	0.82	0.05	3.74
$Q_{1,50}$	5.40	0.35	2.98	0.03	0.05	0.00	0.09	0.82	0.05	3.74
$Q_{7,2}$	8.20	0.54	4.19	0.20	0.14	0.04	0.33	0.99	0.12	6.69
$Q_{7,10}$	6.60	0.43	3.50	0.10	0.09	0.00	0.19	0.89	0.08	5.00
$Q_{7,25}$	6.40	0.42	3.41	0.09	0.08	0.00	0.17	0.88	0.07	4.79
$Q_{7,50}$	6.40	0.42	3.41	0.09	0.08	0.00	0.17	0.88	0.07	4.79
$Q_{15,2}$	8.30	0.55	4.24	0.21	0.15	0.05	0.34	1.00	0.13	6.79
$Q_{15,10}$	6.90	0.45	3.63	0.12	0.10	0.01	0.22	0.91	0.09	5.32
$Q_{15,25}$	6.50	0.42	3.46	0.09	0.09	0.00	0.18	0.89	0.08	4.89
$Q_{15,50}$	6.50	0.42	3.46	0.09	0.09	0.00	0.18	0.89	0.08	4.89
$Q_{31,2}$	8.50	0.56	4.32	0.22	0.15	0.05	0.35	1.01	0.13	7.00
$Q_{31,10}$	7.20	0.47	3.76	0.14	0.11	0.02	0.24	0.93	0.10	5.63
$Q_{31,25}$	6.60	0.43	3.50	0.10	0.09	0.00	0.19	0.89	0.08	5.00
$Q_{31,50}$	6.50	0.42	3.46	0.09	0.09	0.00	0.18	0.89	0.08	4.89
$Q_{61,2}$	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
$Q_{61,10}$	7.50	0.49	3.89	0.16	0.12	0.02	0.27	0.95	0.10	5.95
$Q_{61,25}$	6.90	0.45	3.63	0.12	0.10	0.01	0.22	0.91	0.09	5.32
$Q_{61,50}$	6.70	0.44	3.54	0.11	0.09	0.00	0.20	0.90	0.08	5.11
$Q_{91,2}$	9.10	0.61	4.58	0.26	0.17	0.07	0.41	1.04	0.15	7.64
$Q_{91,10}$	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
$Q_{91,25}$	7.20	0.47	3.76	0.14	0.11	0.02	0.24	0.93	0.10	5.63
$Q_{91,50}$	7.10	0.47	3.72	0.13	0.11	0.01	0.23	0.92	0.09	5.53

Appendix B. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Drought Flows										
$Q_{6,10}$	8.70	0.58	4.41	0.23	0.16	0.06	0.37	1.02	0.14	7.21
$Q_{6,25}$	8.20	0.54	4.19	0.20	0.14	0.04	0.33	0.99	0.12	6.69
$Q_{6,50}$	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
$Q_{9,10}$	9.25	0.62	4.65	0.26	0.18	0.07	0.42	1.05	0.15	7.79
$Q_{9,25}$	8.90	0.59	4.49	0.24	0.16	0.06	0.39	1.03	0.14	7.42
$Q_{9,50}$	8.60	0.57	4.36	0.22	0.15	0.05	0.36	1.01	0.13	7.11
$Q_{12,10}$	9.80	0.65	4.88	0.30	0.19	0.09	0.47	1.09	0.17	8.37
$Q_{12,25}$	9.40	0.63	4.71	0.27	0.18	0.08	0.43	1.06	0.16	7.95
$Q_{12,50}$	9.00	0.60	4.54	0.25	0.17	0.06	0.40	1.04	0.14	7.53
$Q_{18,10}$	10.10	0.68	5.01	0.32	0.20	0.09	0.49	1.10	0.17	8.69
$Q_{18,25}$	9.60	0.64	4.80	0.29	0.19	0.08	0.45	1.07	0.16	8.16
$Q_{18,50}$	9.25	0.62	4.65	0.26	0.18	0.07	0.42	1.05	0.15	7.79
$Q_{30,10}$	10.40	0.70	5.14	0.34	0.21	0.10	0.52	1.12	0.18	9.01
$Q_{30,25}$	9.90	0.66	4.93	0.31	0.20	0.09	0.48	1.09	0.17	8.48
$Q_{30,50}$	9.60	0.64	4.80	0.29	0.19	0.08	0.45	1.07	0.16	8.16
$Q_{54,10}$	10.80	0.73	5.32	0.36	0.23	0.11	0.55	1.15	0.19	9.43
$Q_{54,25}$	10.10	0.68	5.01	0.32	0.20	0.09	0.49	1.10	0.17	8.69
$Q_{54,50}$	9.90	0.66	4.93	0.31	0.20	0.09	0.48	1.09	0.17	8.48
January										
Q_{02}	14.70	1.00	7.00	0.60	0.35	0.22	0.89	1.38	0.30	13.54
Q_{10}	12.10	0.82	5.88	0.44	0.27	0.15	0.67	1.22	0.23	10.80
Q_{25}	10.90	0.73	5.36	0.37	0.23	0.12	0.56	1.15	0.20	9.53
Q_{50}	10.00	0.67	4.97	0.31	0.20	0.09	0.48	1.10	0.17	8.58
Q_{75}	9.10	0.61	4.58	0.26	0.17	0.07	0.41	1.04	0.15	7.64
Q_{90}	8.25	0.55	4.21	0.20	0.14	0.04	0.33	0.99	0.12	6.74
Q_{98}	7.50	0.49	3.89	0.16	0.12	0.02	0.27	0.95	0.10	5.95
Q_{mean}	10.70	0.72	5.27	0.35	0.22	0.11	0.54	1.14	0.19	9.32
February										
Q_{02}	15.20	1.03	7.22	0.63	0.37	0.23	0.93	1.41	0.31	14.06
Q_{10}	12.50	0.84	6.05	0.47	0.28	0.16	0.70	1.25	0.24	11.22
Q_{25}	11.40	0.77	5.58	0.40	0.25	0.13	0.61	1.18	0.21	10.06
Q_{50}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Q_{75}	9.40	0.63	4.71	0.27	0.18	0.08	0.43	1.06	0.16	7.95
Q_{90}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{98}	8.10	0.54	4.15	0.19	0.14	0.04	0.32	0.98	0.12	6.58
Q_{mean}	11.02	0.74	5.41	0.37	0.23	0.12	0.57	1.16	0.20	9.66
March										
Q_{02}	15.60	1.06	7.39	0.66	0.38	0.24	0.97	1.44	0.32	14.49
Q_{10}	13.00	0.88	6.27	0.50	0.30	0.17	0.74	1.28	0.25	11.75
Q_{25}	11.80	0.80	5.75	0.42	0.26	0.14	0.64	1.21	0.22	10.48
Q_{50}	10.90	0.73	5.36	0.37	0.23	0.12	0.56	1.15	0.20	9.53
Q_{75}	10.10	0.68	5.01	0.32	0.20	0.09	0.49	1.10	0.17	8.69
Q_{90}	9.70	0.65	4.84	0.29	0.19	0.08	0.46	1.08	0.16	8.27
Q_{98}	8.70	0.58	4.41	0.23	0.16	0.06	0.37	1.02	0.14	7.21
Q_{mean}	11.28	0.76	5.52	0.39	0.24	0.13	0.59	1.18	0.21	9.93

Appendix B. Continued

Flow Type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
April										
Q_{02}	15.60	1.06	7.39	0.66	0.38	0.24	0.97	1.44	0.32	14.49
Q_{10}	13.00	0.88	6.27	0.50	0.30	0.17	0.74	1.28	0.25	11.75
Q_{25}	12.00	0.81	5.84	0.44	0.27	0.15	0.66	1.22	0.23	10.69
Q_{50}	11.10	0.75	5.45	0.38	0.24	0.12	0.58	1.16	0.20	9.74
Q_{75}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Q_{90}	9.90	0.66	4.93	0.31	0.20	0.09	0.48	1.09	0.17	8.48
Q_{98}	8.90	0.59	4.49	0.24	0.16	0.06	0.39	1.03	0.14	7.42
Q_{mean}	11.29	0.76	5.53	0.39	0.24	0.13	0.60	1.18	0.21	9.94
May										
Q_{02}	15.60	1.06	7.39	0.66	0.38	0.24	0.97	1.44	0.32	14.49
Q_{10}	12.50	0.84	6.05	0.47	0.28	0.16	0.70	1.25	0.24	11.22
Q_{25}	11.27	0.76	5.52	0.39	0.24	0.13	0.59	1.17	0.21	9.92
Q_{50}	10.60	0.71	5.23	0.35	0.22	0.11	0.54	1.13	0.19	9.22
Q_{75}	10.10	0.68	5.01	0.32	0.20	0.09	0.49	1.10	0.17	8.69
Q_{90}	9.80	0.65	4.88	0.30	0.19	0.09	0.47	1.09	0.17	8.37
Q_{98}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{mean}	11.00	0.74	5.40	0.37	0.23	0.12	0.57	1.16	0.20	9.64
June										
Q_{02}	15.60	1.06	7.39	0.66	0.38	0.24	0.97	1.44	0.32	14.49
Q_{10}	12.50	0.84	6.05	0.47	0.28	0.16	0.70	1.25	0.24	11.22
Q_{25}	11.20	0.75	5.49	0.39	0.24	0.12	0.59	1.17	0.20	9.85
Q_{50}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Q_{75}	9.90	0.66	4.93	0.31	0.20	0.09	0.48	1.09	0.17	8.48
Q_{90}	9.50	0.63	4.75	0.28	0.18	0.08	0.44	1.07	0.16	8.06
Q_{98}	8.70	0.58	4.41	0.23	0.16	0.06	0.37	1.02	0.14	7.21
Q_{mean}	10.39	0.70	5.14	0.34	0.21	0.10	0.52	1.12	0.18	8.99
July										
Q_{02}	13.70	0.93	6.57	0.54	0.32	0.19	0.80	1.32	0.27	12.48
Q_{10}	11.50	0.77	5.62	0.40	0.25	0.13	0.61	1.19	0.21	10.16
Q_{25}	10.50	0.70	5.19	0.34	0.22	0.11	0.53	1.13	0.19	9.11
Q_{50}	10.00	0.67	4.97	0.31	0.20	0.09	0.48	1.10	0.17	8.58
Q_{75}	9.30	0.62	4.67	0.27	0.18	0.07	0.42	1.06	0.15	7.85
Q_{90}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{98}	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
Q_{mean}	9.80	0.65	4.88	0.30	0.19	0.09	0.47	1.09	0.17	8.37
August										
Q_{02}	13.00	0.88	6.27	0.50	0.30	0.17	0.74	1.28	0.25	11.75
Q_{10}	10.80	0.73	5.32	0.36	0.23	0.11	0.55	1.15	0.19	9.43
Q_{25}	9.90	0.66	4.93	0.31	0.20	0.09	0.48	1.09	0.17	8.48
Q_{50}	9.25	0.62	4.65	0.26	0.18	0.07	0.42	1.05	0.15	7.79
Q_{75}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{90}	8.25	0.55	4.21	0.20	0.14	0.04	0.33	0.99	0.12	6.74
Q_{98}	7.20	0.47	3.76	0.14	0.11	0.02	0.24	0.93	0.10	5.63
Q_{mean}	9.30	0.62	4.67	0.27	0.18	0.07	0.42	1.06	0.15	7.85

Appendix B. Continued

Flow type	Location									
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
September										
Q_{02}	12.10	0.82	5.88	0.44	0.27	0.15	0.67	1.22	0.23	10.80
Q_{10}	10.20	0.68	5.06	0.32	0.21	0.10	0.50	1.11	0.18	8.79
Q_{25}	9.30	0.62	4.67	0.27	0.18	0.07	0.42	1.06	0.15	7.85
Q_{50}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{75}	8.30	0.55	4.24	0.21	0.15	0.05	0.34	1.00	0.13	6.79
Q_{90}	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
Q_{98}	6.60	0.43	3.50	0.10	0.09	0.00	0.19	0.89	0.08	5.00
Q_{mean}	9.08	0.60	4.57	0.25	0.17	0.07	0.40	1.04	0.15	7.61
October										
Q_{02}	12.40	0.84	6.01	0.46	0.28	0.16	0.69	1.24	0.24	11.11
Q_{10}	10.60	0.71	5.23	0.35	0.22	0.11	0.54	1.13	0.19	9.22
Q_{25}	9.70	0.65	4.84	0.29	0.19	0.08	0.46	1.08	0.16	8.27
Q_{50}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{75}	8.25	0.55	4.21	0.20	0.14	0.04	0.33	0.99	0.12	6.74
Q_{90}	7.50	0.49	3.89	0.16	0.12	0.02	0.27	0.95	0.10	5.95
Q_{98}	6.40	0.42	3.41	0.09	0.08	0.00	0.17	0.88	0.07	4.79
Q_{mean}	9.06	0.60	4.56	0.25	0.17	0.07	0.40	1.04	0.15	7.59
November										
Q_{02}	12.80	0.87	6.18	0.49	0.29	0.17	0.73	1.27	0.25	11.54
Q_{10}	10.90	0.73	5.36	0.37	0.23	0.12	0.56	1.15	0.20	9.53
Q_{25}	10.10	0.68	5.01	0.32	0.20	0.09	0.49	1.10	0.17	8.69
Q_{50}	9.25	0.62	4.65	0.26	0.18	0.07	0.42	1.05	0.15	7.79
Q_{75}	8.60	0.57	4.36	0.22	0.15	0.05	0.36	1.01	0.13	7.11
Q_{90}	7.90	0.52	4.06	0.18	0.13	0.04	0.30	0.97	0.12	6.37
Q_{98}	6.60	0.43	3.50	0.10	0.09	0.00	0.19	0.89	0.08	5.00
Q_{mean}	10.00	0.67	4.97	0.31	0.20	0.09	0.48	1.10	0.17	8.58
December										
Q_{02}	14.40	0.98	6.87	0.58	0.34	0.21	0.86	1.36	0.29	13.22
Q_{10}	11.50	0.77	5.62	0.40	0.25	0.13	0.61	1.19	0.21	10.16
Q_{25}	10.30	0.69	5.10	0.33	0.21	0.10	0.51	1.12	0.18	8.90
Q_{50}	9.60	0.64	4.80	0.29	0.19	0.08	0.45	1.07	0.16	8.16
Q_{75}	8.80	0.58	4.45	0.24	0.16	0.06	0.38	1.03	0.14	7.32
Q_{90}	8.10	0.54	4.15	0.19	0.14	0.04	0.32	0.98	0.12	6.58
Q_{98}	7.10	0.47	3.72	0.13	0.11	0.01	0.23	0.92	0.09	5.53
Q_{mean}	10.68	0.72	5.26	0.35	0.22	0.11	0.54	1.14	0.19	9.30

Appendix B. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Q_{01}	2.69	1.42	0.10	0.94	0.86	2.90	0.14	1.70	0.77	6.55
Q_{02}	2.44	1.29	0.09	0.86	0.78	2.68	0.12	1.52	0.71	5.84
Q_{05}	2.15	1.14	0.08	0.76	0.70	2.41	0.11	1.31	0.63	5.01
Q_{10}	1.97	1.04	0.07	0.70	0.64	2.24	0.10	1.17	0.58	4.47
Q_{15}	1.85	0.98	0.07	0.66	0.60	2.13	0.09	1.08	0.54	4.11
Q_{25}	1.72	0.91	0.06	0.62	0.57	2.01	0.09	0.99	0.51	3.76
Q_{40}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Q_{50}	1.54	0.82	0.06	0.56	0.51	1.84	0.08	0.85	0.46	3.22
Q_{60}	1.48	0.79	0.06	0.54	0.49	1.79	0.07	0.81	0.44	3.04
Q_{75}	1.35	0.72	0.05	0.50	0.46	1.67	0.07	0.72	0.41	2.69
Q_{85}	1.27	0.68	0.05	0.47	0.43	1.60	0.06	0.66	0.39	2.45
Q_{90}	1.19	0.63	0.04	0.44	0.41	1.52	0.06	0.60	0.36	2.21
Q_{95}	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
Q_{98}	0.96	0.51	0.03	0.37	0.34	1.31	0.05	0.43	0.30	1.56
Q_{99}	0.84	0.45	0.03	0.33	0.30	1.20	0.04	0.34	0.27	1.20
Q_{mean}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Low Flows										
$Q_{1,2}$	0.80	0.43	0.03	0.32	0.29	1.16	0.04	0.31	0.26	1.08
$Q_{1,10}$	0.61	0.33	0.02	0.26	0.23	0.99	0.03	0.17	0.21	0.55
$Q_{1,25}$	0.59	0.32	0.02	0.25	0.23	0.97	0.03	0.16	0.20	0.49
$Q_{1,50}$	0.59	0.32	0.02	0.25	0.23	0.97	0.03	0.16	0.20	0.49
$Q_{7,2}$	1.17	0.62	0.04	0.44	0.40	1.50	0.06	0.58	0.36	2.15
$Q_{7,10}$	0.84	0.45	0.03	0.33	0.30	1.20	0.04	0.34	0.27	1.20
$Q_{7,25}$	0.80	0.43	0.03	0.32	0.29	1.16	0.04	0.31	0.26	1.08
$Q_{7,50}$	0.80	0.43	0.03	0.32	0.29	1.16	0.04	0.31	0.26	1.08
$Q_{15,2}$	1.19	0.63	0.04	0.44	0.41	1.52	0.06	0.60	0.36	2.21
$Q_{15,10}$	0.90	0.48	0.03	0.35	0.32	1.26	0.04	0.39	0.28	1.38
$Q_{15,25}$	0.82	0.44	0.03	0.32	0.29	1.18	0.04	0.32	0.26	1.14
$Q_{15,50}$	0.82	0.44	0.03	0.32	0.29	1.18	0.04	0.32	0.26	1.14
$Q_{31,2}$	1.23	0.66	0.05	0.46	0.42	1.56	0.06	0.63	0.37	2.33
$Q_{31,10}$	0.96	0.51	0.03	0.37	0.34	1.31	0.05	0.43	0.30	1.56
$Q_{31,25}$	0.84	0.45	0.03	0.33	0.30	1.20	0.04	0.34	0.27	1.20
$Q_{31,50}$	0.82	0.44	0.03	0.32	0.29	1.18	0.04	0.32	0.26	1.14
$Q_{61,2}$	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
$Q_{61,10}$	1.02	0.55	0.04	0.39	0.36	1.37	0.05	0.48	0.32	1.74
$Q_{61,25}$	0.90	0.48	0.03	0.35	0.32	1.26	0.04	0.39	0.28	1.38
$Q_{61,50}$	0.86	0.46	0.03	0.34	0.31	1.22	0.04	0.36	0.27	1.26
$Q_{91,2}$	1.35	0.72	0.05	0.50	0.46	1.67	0.07	0.72	0.41	2.69
$Q_{91,10}$	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
$Q_{91,25}$	0.96	0.51	0.03	0.37	0.34	1.31	0.05	0.43	0.30	1.56
$Q_{91,50}$	0.94	0.50	0.03	0.36	0.33	1.29	0.05	0.42	0.30	1.50

Appendix B. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Drought Flows										
$Q_{6,10}$	1.27	0.68	0.05	0.47	0.43	1.60	0.06	0.66	0.39	2.45
$Q_{6,25}$	1.17	0.62	0.04	0.44	0.40	1.50	0.06	0.58	0.36	2.15
$Q_{6,50}$	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
$Q_{9,10}$	1.38	0.74	0.05	0.51	0.46	1.70	0.07	0.74	0.42	2.78
$Q_{9,25}$	1.31	0.70	0.05	0.49	0.44	1.64	0.06	0.69	0.40	2.57
$Q_{9,50}$	1.25	0.67	0.05	0.47	0.42	1.58	0.06	0.64	0.38	2.39
$Q_{12,10}$	1.50	0.80	0.06	0.55	0.50	1.81	0.07	0.82	0.45	3.10
$Q_{12,25}$	1.42	0.75	0.05	0.52	0.47	1.73	0.07	0.76	0.43	2.86
$Q_{12,50}$	1.33	0.71	0.05	0.49	0.45	1.65	0.07	0.70	0.40	2.63
$Q_{18,10}$	1.56	0.83	0.06	0.57	0.52	1.86	0.08	0.87	0.46	3.28
$Q_{18,25}$	1.46	0.77	0.05	0.53	0.49	1.77	0.07	0.79	0.44	2.98
$Q_{18,50}$	1.38	0.74	0.05	0.51	0.46	1.70	0.07	0.74	0.42	2.78
$Q_{30,10}$	1.62	0.86	0.06	0.59	0.54	1.92	0.08	0.92	0.48	3.46
$Q_{30,25}$	1.52	0.81	0.06	0.55	0.51	1.82	0.08	0.84	0.45	3.16
$Q_{30,50}$	1.46	0.77	0.05	0.53	0.49	1.77	0.07	0.79	0.44	2.98
$Q_{54,10}$	1.70	0.90	0.06	0.61	0.56	1.99	0.09	0.98	0.50	3.70
$Q_{54,25}$	1.56	0.83	0.06	0.57	0.52	1.86	0.08	0.87	0.46	3.28
$Q_{54,50}$	1.52	0.81	0.06	0.55	0.51	1.82	0.08	0.84	0.45	3.16
January										
Q_{02}	2.50	1.33	0.10	0.88	0.80	2.73	0.13	1.57	0.72	6.02
Q_{10}	1.97	1.04	0.07	0.70	0.64	2.24	0.10	1.17	0.58	4.47
Q_{25}	1.72	0.91	0.06	0.62	0.57	2.01	0.09	0.99	0.51	3.76
Q_{50}	1.54	0.82	0.06	0.56	0.51	1.84	0.08	0.85	0.46	3.22
Q_{75}	1.35	0.72	0.05	0.50	0.46	1.67	0.07	0.72	0.41	2.69
Q_{90}	1.18	0.63	0.04	0.44	0.40	1.51	0.06	0.59	0.36	2.18
Q_{98}	1.02	0.55	0.04	0.39	0.36	1.37	0.05	0.48	0.32	1.74
Q_{mean}	1.68	0.89	0.06	0.61	0.55	1.98	0.08	0.96	0.50	3.64
February										
Q_{02}	2.61	1.38	0.10	0.91	0.83	2.83	0.13	1.64	0.75	6.31
Q_{10}	2.05	1.09	0.08	0.73	0.67	2.32	0.10	1.23	0.60	4.71
Q_{25}	1.83	0.97	0.07	0.65	0.60	2.11	0.09	1.07	0.54	4.05
Q_{50}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Q_{75}	1.42	0.75	0.05	0.52	0.47	1.73	0.07	0.76	0.43	2.86
Q_{90}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{98}	1.15	0.61	0.04	0.43	0.39	1.48	0.06	0.57	0.35	2.09
Q_{mean}	1.75	0.93	0.07	0.63	0.57	2.04	0.09	1.01	0.52	3.83
March										
Q_{02}	2.69	1.42	0.10	0.94	0.86	2.90	0.14	1.70	0.77	6.55
Q_{10}	2.15	1.14	0.08	0.76	0.70	2.41	0.11	1.31	0.63	5.01
Q_{25}	1.91	1.01	0.07	0.68	0.62	2.18	0.10	1.13	0.56	4.29
Q_{50}	1.72	0.91	0.06	0.62	0.57	2.01	0.09	0.99	0.51	3.76
Q_{75}	1.56	0.83	0.06	0.57	0.52	1.86	0.08	0.87	0.46	3.28
Q_{90}	1.48	0.79	0.06	0.54	0.49	1.79	0.07	0.81	0.44	3.04
Q_{98}	1.27	0.68	0.05	0.47	0.43	1.60	0.06	0.66	0.39	2.45
Q_{mean}	1.80	0.96	0.07	0.65	0.59	2.09	0.09	1.05	0.53	3.98

Appendix B. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
April										
Q_{02}	2.69	1.42	0.10	0.94	0.86	2.90	0.14	1.70	0.77	6.55
Q_{10}	2.15	1.14	0.08	0.76	0.70	2.41	0.11	1.31	0.63	5.01
Q_{25}	1.95	1.03	0.07	0.69	0.64	2.22	0.10	1.16	0.57	4.41
Q_{50}	1.76	0.94	0.07	0.63	0.58	2.05	0.09	1.02	0.52	3.88
Q_{75}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Q_{90}	1.52	0.81	0.06	0.55	0.51	1.82	0.08	0.84	0.45	3.16
Q_{98}	1.31	0.70	0.05	0.49	0.44	1.64	0.06	0.69	0.40	2.57
Q_{mean}	1.80	0.96	0.07	0.65	0.59	2.09	0.09	1.05	0.53	3.99
May										
Q_{02}	2.69	1.42	0.10	0.94	0.86	2.90	0.14	1.70	0.77	6.55
Q_{10}	2.05	1.09	0.08	0.73	0.67	2.32	0.10	1.23	0.60	4.71
Q_{25}	1.80	0.95	0.07	0.65	0.59	2.08	0.09	1.05	0.53	3.98
Q_{50}	1.66	0.88	0.06	0.60	0.55	1.96	0.08	0.95	0.49	3.58
Q_{75}	1.56	0.83	0.06	0.57	0.52	1.86	0.08	0.87	0.46	3.28
Q_{90}	1.50	0.80	0.06	0.55	0.50	1.81	0.07	0.82	0.45	3.10
Q_{98}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{mean}	1.74	0.93	0.07	0.63	0.57	2.03	0.09	1.01	0.52	3.82
June										
Q_{02}	2.69	1.42	0.10	0.94	0.86	2.90	0.14	1.70	0.77	6.55
Q_{10}	2.05	1.09	0.08	0.73	0.67	2.32	0.10	1.23	0.60	4.71
Q_{25}	1.78	0.95	0.07	0.64	0.59	2.07	0.09	1.04	0.53	3.94
Q_{50}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Q_{75}	1.52	0.81	0.06	0.55	0.51	1.82	0.08	0.84	0.45	3.16
Q_{90}	1.44	0.76	0.05	0.53	0.48	1.75	0.07	0.78	0.43	2.92
Q_{98}	1.27	0.68	0.05	0.47	0.43	1.60	0.06	0.66	0.39	2.45
Q_{mean}	1.62	0.86	0.06	0.59	0.54	1.92	0.08	0.91	0.48	3.45
July										
Q_{02}	2.30	1.22	0.09	0.81	0.74	2.54	0.12	1.41	0.67	5.42
Q_{10}	1.85	0.98	0.07	0.66	0.60	2.13	0.09	1.08	0.54	4.11
Q_{25}	1.64	0.87	0.06	0.59	0.54	1.94	0.08	0.93	0.49	3.52
Q_{50}	1.54	0.82	0.06	0.56	0.51	1.84	0.08	0.85	0.46	3.22
Q_{75}	1.39	0.74	0.05	0.51	0.47	1.71	0.07	0.75	0.42	2.81
Q_{90}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{98}	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
Q_{mean}	1.50	0.80	0.06	0.55	0.50	1.81	0.07	0.82	0.45	3.10
August										
Q_{02}	2.15	1.14	0.08	0.76	0.70	2.41	0.11	1.31	0.63	5.01
Q_{10}	1.70	0.90	0.06	0.61	0.56	1.99	0.09	0.98	0.50	3.70
Q_{25}	1.52	0.81	0.06	0.55	0.51	1.82	0.08	0.84	0.45	3.16
Q_{50}	1.38	0.74	0.05	0.51	0.46	1.70	0.07	0.74	0.42	2.78
Q_{75}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{90}	1.18	0.63	0.04	0.44	0.40	1.51	0.06	0.59	0.36	2.18
Q_{98}	0.96	0.51	0.03	0.37	0.34	1.31	0.05	0.43	0.30	1.56
Q_{mean}	1.39	0.74	0.05	0.51	0.47	1.71	0.07	0.75	0.42	2.81

Appendix B. Continued

Flow type	Location									
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
September										
Q_{02}	1.97	1.04	0.07	0.70	0.64	2.24	0.10	1.17	0.58	4.47
Q_{10}	1.58	0.84	0.06	0.57	0.52	1.88	0.08	0.88	0.47	3.34
Q_{25}	1.39	0.74	0.05	0.51	0.47	1.71	0.07	0.75	0.42	2.81
Q_{50}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{75}	1.19	0.63	0.04	0.44	0.41	1.52	0.06	0.60	0.36	2.21
Q_{90}	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
Q_{98}	0.84	0.45	0.03	0.33	0.30	1.20	0.04	0.34	0.27	1.20
Q_{mean}	1.35	0.72	0.05	0.50	0.45	1.67	0.07	0.72	0.41	2.67
October										
Q_{02}	2.03	1.08	0.08	0.72	0.66	2.30	0.10	1.22	0.59	4.65
Q_{10}	1.66	0.88	0.06	0.60	0.55	1.96	0.08	0.95	0.49	3.58
Q_{25}	1.48	0.79	0.06	0.54	0.49	1.79	0.07	0.81	0.44	3.04
Q_{50}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{75}	1.18	0.63	0.04	0.44	0.40	1.51	0.06	0.59	0.36	2.18
Q_{90}	1.02	0.55	0.04	0.39	0.36	1.37	0.05	0.48	0.32	1.74
Q_{98}	0.80	0.43	0.03	0.32	0.29	1.16	0.04	0.31	0.26	1.08
Q_{mean}	1.35	0.72	0.05	0.50	0.45	1.67	0.07	0.71	0.41	2.66
November										
Q_{02}	2.11	1.12	0.08	0.75	0.69	2.37	0.11	1.28	0.62	4.89
Q_{10}	1.72	0.91	0.06	0.62	0.57	2.01	0.09	0.99	0.51	3.76
Q_{25}	1.56	0.83	0.06	0.57	0.52	1.86	0.08	0.87	0.46	3.28
Q_{50}	1.38	0.74	0.05	0.51	0.46	1.70	0.07	0.74	0.42	2.78
Q_{75}	1.25	0.67	0.05	0.47	0.42	1.58	0.06	0.64	0.38	2.39
Q_{90}	1.11	0.59	0.04	0.42	0.38	1.45	0.05	0.54	0.34	1.97
Q_{98}	0.84	0.45	0.03	0.33	0.30	1.20	0.04	0.34	0.27	1.20
Q_{mean}	1.54	0.82	0.06	0.56	0.51	1.84	0.08	0.85	0.46	3.22
December										
Q_{02}	2.44	1.29	0.09	0.86	0.78	2.68	0.12	1.52	0.71	5.84
Q_{10}	1.85	0.98	0.07	0.66	0.60	2.13	0.09	1.08	0.54	4.11
Q_{25}	1.60	0.85	0.06	0.58	0.53	1.90	0.08	0.90	0.48	3.40
Q_{50}	1.46	0.77	0.05	0.53	0.49	1.77	0.07	0.79	0.44	2.98
Q_{75}	1.29	0.69	0.05	0.48	0.44	1.62	0.06	0.67	0.39	2.51
Q_{90}	1.15	0.61	0.04	0.43	0.39	1.48	0.06	0.57	0.35	2.09
Q_{98}	0.94	0.50	0.03	0.36	0.33	1.29	0.05	0.42	0.30	1.50
Q_{mean}	1.68	0.89	0.06	0.61	0.55	1.97	0.08	0.96	0.50	3.63

Appendix B. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Q_{01}	-50.00	25.00	10.01	5.62	0.67	0.62	0.97	0.67	0.11	0.08
Q_{02}	-50.00	25.00	8.88	5.23	0.60	0.56	0.86	0.67	0.11	0.08
Q_{05}	-50.00	25.00	7.55	4.78	0.52	0.49	0.74	0.67	0.11	0.08
Q_{10}	-50.00	25.00	6.70	4.48	0.47	0.44	0.67	0.67	0.11	0.08
Q_{15}	-50.00	25.00	6.14	4.29	0.44	0.41	0.61	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.57	4.09	0.40	0.38	0.56	0.67	0.11	0.08
Q_{40}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.72	3.80	0.35	0.33	0.48	0.67	0.11	0.08
Q_{60}	-50.00	25.00	4.43	3.71	0.34	0.32	0.46	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.86	3.51	0.30	0.29	0.41	0.67	0.11	0.08
Q_{85}	-50.00	25.00	3.49	3.38	0.28	0.27	0.37	0.67	0.11	0.08
Q_{90}	-50.00	25.00	3.11	3.25	0.26	0.25	0.34	0.67	0.11	0.08
Q_{95}	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
Q_{98}	-50.00	25.00	2.07	2.89	0.19	0.19	0.24	0.67	0.11	0.08
Q_{99}	-50.00	25.00	1.50	2.70	0.16	0.16	0.19	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Low Flows										
$Q_{1,2}$	-50.00	25.00	1.31	2.64	0.15	0.15	0.17	0.67	0.11	0.08
$Q_{1,10}$	-50.00	25.00	0.46	2.34	0.10	0.10	0.09	0.67	0.11	0.08
$Q_{1,25}$	-50.00	25.00	0.36	2.31	0.09	0.10	0.09	0.67	0.11	0.08
$Q_{1,50}$	-50.00	25.00	0.36	2.31	0.09	0.10	0.09	0.67	0.11	0.08
$Q_{7,2}$	-50.00	25.00	3.01	3.22	0.25	0.24	0.33	0.67	0.11	0.08
$Q_{7,10}$	-50.00	25.00	1.50	2.70	0.16	0.16	0.19	0.67	0.11	0.08
$Q_{7,25}$	-50.00	25.00	1.31	2.64	0.15	0.15	0.17	0.67	0.11	0.08
$Q_{7,50}$	-50.00	25.00	1.31	2.64	0.15	0.15	0.17	0.67	0.11	0.08
$Q_{15,2}$	-50.00	25.00	3.11	3.25	0.26	0.25	0.34	0.67	0.11	0.08
$Q_{15,10}$	-50.00	25.00	1.78	2.80	0.18	0.18	0.22	0.67	0.11	0.08
$Q_{15,25}$	-50.00	25.00	1.41	2.67	0.15	0.15	0.18	0.67	0.11	0.08
$Q_{15,50}$	-50.00	25.00	1.41	2.67	0.15	0.15	0.18	0.67	0.11	0.08
$Q_{31,2}$	-50.00	25.00	3.30	3.32	0.27	0.26	0.35	0.67	0.11	0.08
$Q_{31,10}$	-50.00	25.00	2.07	2.89	0.19	0.19	0.24	0.67	0.11	0.08
$Q_{31,25}$	-50.00	25.00	1.50	2.70	0.16	0.16	0.19	0.67	0.11	0.08
$Q_{31,50}$	-50.00	25.00	1.41	2.67	0.15	0.15	0.18	0.67	0.11	0.08
$Q_{61,2}$	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
$Q_{61,10}$	-50.00	25.00	2.35	2.99	0.21	0.21	0.27	0.67	0.11	0.08
$Q_{61,25}$	-50.00	25.00	1.78	2.80	0.18	0.18	0.22	0.67	0.11	0.08
$Q_{61,50}$	-50.00	25.00	1.59	2.73	0.17	0.17	0.20	0.67	0.11	0.08
$Q_{91,2}$	-50.00	25.00	3.86	3.51	0.30	0.29	0.41	0.67	0.11	0.08
$Q_{91,10}$	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
$Q_{91,25}$	-50.00	25.00	2.07	2.89	0.19	0.19	0.24	0.67	0.11	0.08
$Q_{91,50}$	-50.00	25.00	1.97	2.86	0.19	0.19	0.23	0.67	0.11	0.08

Appendix B. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Drought Flows										
$Q_{6,10}$	-50.00	25.00	3.49	3.38	0.28	0.27	0.37	0.67	0.11	0.08
$Q_{6,25}$	-50.00	25.00	3.01	3.22	0.25	0.24	0.33	0.67	0.11	0.08
$Q_{6,50}$	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
$Q_{9,10}$	-50.00	25.00	4.01	3.56	0.31	0.30	0.42	0.67	0.11	0.08
$Q_{9,25}$	-50.00	25.00	3.68	3.45	0.29	0.28	0.39	0.67	0.11	0.08
$Q_{9,50}$	-50.00	25.00	3.39	3.35	0.27	0.26	0.36	0.67	0.11	0.08
$Q_{12,10}$	-50.00	25.00	4.53	3.74	0.34	0.32	0.47	0.67	0.11	0.08
$Q_{12,25}$	-50.00	25.00	4.15	3.61	0.32	0.30	0.43	0.67	0.11	0.08
$Q_{12,50}$	-50.00	25.00	3.77	3.48	0.30	0.28	0.40	0.67	0.11	0.08
$Q_{18,10}$	-50.00	25.00	4.81	3.84	0.36	0.34	0.49	0.67	0.11	0.08
$Q_{18,25}$	-50.00	25.00	4.34	3.67	0.33	0.31	0.45	0.67	0.11	0.08
$Q_{18,50}$	-50.00	25.00	4.01	3.56	0.31	0.30	0.42	0.67	0.11	0.08
$Q_{30,10}$	-50.00	25.00	5.09	3.93	0.38	0.36	0.52	0.67	0.11	0.08
$Q_{30,25}$	-50.00	25.00	4.62	3.77	0.35	0.33	0.48	0.67	0.11	0.08
$Q_{30,50}$	-50.00	25.00	4.34	3.67	0.33	0.31	0.45	0.67	0.11	0.08
$Q_{54,10}$	-50.00	25.00	5.47	4.06	0.40	0.38	0.55	0.67	0.11	0.08
$Q_{54,25}$	-50.00	25.00	4.81	3.84	0.36	0.34	0.49	0.67	0.11	0.08
$Q_{54,50}$	-50.00	25.00	4.62	3.77	0.35	0.33	0.48	0.67	0.11	0.08
January										
Q_{02}	-50.00	25.00	9.16	5.33	0.62	0.58	0.89	0.67	0.11	0.08
Q_{10}	-50.00	25.00	6.70	4.48	0.47	0.44	0.67	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.57	4.09	0.40	0.38	0.56	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.72	3.80	0.35	0.33	0.48	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.86	3.51	0.30	0.29	0.41	0.67	0.11	0.08
Q_{90}	-50.00	25.00	3.06	3.24	0.25	0.24	0.33	0.67	0.11	0.08
Q_{98}	-50.00	25.00	2.35	2.99	0.21	0.21	0.27	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.38	4.03	0.39	0.37	0.54	0.67	0.11	0.08
February										
Q_{02}	-50.00	25.00	9.64	5.49	0.65	0.60	0.93	0.67	0.11	0.08
Q_{10}	-50.00	25.00	7.08	4.61	0.49	0.46	0.70	0.67	0.11	0.08
Q_{25}	-50.00	25.00	6.04	4.26	0.43	0.41	0.61	0.67	0.11	0.08
Q_{50}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Q_{75}	-50.00	25.00	4.15	3.61	0.32	0.30	0.43	0.67	0.11	0.08
Q_{90}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{98}	-50.00	25.00	2.92	3.19	0.25	0.24	0.32	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.68	4.13	0.41	0.39	0.57	0.67	0.11	0.08
March										
Q_{02}	-50.00	25.00	10.01	5.62	0.67	0.62	0.97	0.67	0.11	0.08
Q_{10}	-50.00	25.00	7.55	4.78	0.52	0.49	0.74	0.67	0.11	0.08
Q_{25}	-50.00	25.00	6.42	4.39	0.46	0.43	0.64	0.67	0.11	0.08
Q_{50}	-50.00	25.00	5.57	4.09	0.40	0.38	0.56	0.67	0.11	0.08
Q_{75}	-50.00	25.00	4.81	3.84	0.36	0.34	0.49	0.67	0.11	0.08
Q_{90}	-50.00	25.00	4.43	3.71	0.34	0.32	0.46	0.67	0.11	0.08
Q_{98}	-50.00	25.00	3.49	3.38	0.28	0.27	0.37	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.93	4.22	0.43	0.40	0.59	0.67	0.11	0.08

Appendix B. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
April										
Q_{02}	-50.00	25.00	10.01	5.62	0.67	0.62	0.97	0.67	0.11	0.08
Q_{10}	-50.00	25.00	7.55	4.78	0.52	0.49	0.74	0.67	0.11	0.08
Q_{25}	-50.00	25.00	6.61	4.45	0.47	0.44	0.66	0.67	0.11	0.08
Q_{50}	-50.00	25.00	5.76	4.16	0.42	0.39	0.58	0.67	0.11	0.08
Q_{75}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Q_{90}	-50.00	25.00	4.62	3.77	0.35	0.33	0.48	0.67	0.11	0.08
Q_{98}	-50.00	25.00	3.68	3.45	0.29	0.28	0.39	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.94	4.22	0.43	0.40	0.60	0.67	0.11	0.08
May										
Q_{02}	-50.00	25.00	10.01	5.62	0.67	0.62	0.97	0.67	0.11	0.08
Q_{10}	-50.00	25.00	7.08	4.61	0.49	0.46	0.70	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.92	4.21	0.43	0.40	0.59	0.67	0.11	0.08
Q_{50}	-50.00	25.00	5.28	4.00	0.39	0.37	0.54	0.67	0.11	0.08
Q_{75}	-50.00	25.00	4.81	3.84	0.36	0.34	0.49	0.67	0.11	0.08
Q_{90}	-50.00	25.00	4.53	3.74	0.34	0.32	0.47	0.67	0.11	0.08
Q_{98}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.66	4.13	0.41	0.39	0.57	0.67	0.11	0.08
June										
Q_{02}	-50.00	25.00	10.01	5.62	0.67	0.62	0.97	0.67	0.11	0.08
Q_{10}	-50.00	25.00	7.08	4.61	0.49	0.46	0.70	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.85	4.19	0.42	0.40	0.59	0.67	0.11	0.08
Q_{50}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Q_{75}	-50.00	25.00	4.62	3.77	0.35	0.33	0.48	0.67	0.11	0.08
Q_{90}	-50.00	25.00	4.24	3.64	0.32	0.31	0.44	0.67	0.11	0.08
Q_{98}	-50.00	25.00	3.49	3.38	0.28	0.27	0.37	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.09	3.93	0.38	0.35	0.52	0.67	0.11	0.08
July										
Q_{02}	-50.00	25.00	8.22	5.00	0.56	0.52	0.80	0.67	0.11	0.08
Q_{10}	-50.00	25.00	6.14	4.29	0.44	0.41	0.61	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.19	3.96	0.38	0.36	0.53	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.72	3.80	0.35	0.33	0.48	0.67	0.11	0.08
Q_{75}	-50.00	25.00	4.05	3.58	0.31	0.30	0.42	0.67	0.11	0.08
Q_{90}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{98}	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	4.53	3.74	0.34	0.32	0.47	0.67	0.11	0.08
August										
Q_{02}	-50.00	25.00	7.55	4.78	0.52	0.49	0.74	0.67	0.11	0.08
Q_{10}	-50.00	25.00	5.47	4.06	0.40	0.38	0.55	0.67	0.11	0.08
Q_{25}	-50.00	25.00	4.62	3.77	0.35	0.33	0.48	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.01	3.56	0.31	0.30	0.42	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{90}	-50.00	25.00	3.06	3.24	0.25	0.24	0.33	0.67	0.11	0.08
Q_{98}	-50.00	25.00	2.07	2.89	0.19	0.19	0.24	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	4.05	3.58	0.31	0.30	0.42	0.67	0.11	0.08

Appendix B. Continued

Flow type	Location									
	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
September										
Q_{02}	-50.00	25.00	6.70	4.48	0.47	0.44	0.67	0.67	0.11	0.08
Q_{10}	-50.00	25.00	4.91	3.87	0.36	0.34	0.50	0.67	0.11	0.08
Q_{25}	-50.00	25.00	4.05	3.58	0.31	0.30	0.42	0.67	0.11	0.08
Q_{50}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.11	3.25	0.26	0.25	0.34	0.67	0.11	0.08
Q_{90}	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
Q_{98}	-50.00	25.00	1.50	2.70	0.16	0.16	0.19	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	3.85	3.50	0.30	0.29	0.40	0.67	0.11	0.08
October										
Q_{02}	-50.00	25.00	6.99	4.58	0.49	0.46	0.69	0.67	0.11	0.08
Q_{10}	-50.00	25.00	5.28	4.00	0.39	0.37	0.54	0.67	0.11	0.08
Q_{25}	-50.00	25.00	4.43	3.71	0.34	0.32	0.46	0.67	0.11	0.08
Q_{50}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.06	3.24	0.25	0.24	0.33	0.67	0.11	0.08
Q_{90}	-50.00	25.00	2.35	2.99	0.21	0.21	0.27	0.67	0.11	0.08
Q_{98}	-50.00	25.00	1.31	2.64	0.15	0.15	0.17	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	3.83	3.50	0.30	0.29	0.40	0.67	0.11	0.08
November										
Q_{02}	-50.00	25.00	7.36	4.71	0.51	0.48	0.73	0.67	0.11	0.08
Q_{10}	-50.00	25.00	5.57	4.09	0.40	0.38	0.56	0.67	0.11	0.08
Q_{25}	-50.00	25.00	4.81	3.84	0.36	0.34	0.49	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.01	3.56	0.31	0.30	0.42	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.39	3.35	0.27	0.26	0.36	0.67	0.11	0.08
Q_{90}	-50.00	25.00	2.73	3.12	0.23	0.23	0.30	0.67	0.11	0.08
Q_{98}	-50.00	25.00	1.50	2.70	0.16	0.16	0.19	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	4.72	3.80	0.35	0.33	0.48	0.67	0.11	0.08
December										
Q_{02}	-50.00	25.00	8.88	5.23	0.60	0.56	0.86	0.67	0.11	0.08
Q_{10}	-50.00	25.00	6.14	4.29	0.44	0.41	0.61	0.67	0.11	0.08
Q_{25}	-50.00	25.00	5.00	3.90	0.37	0.35	0.51	0.67	0.11	0.08
Q_{50}	-50.00	25.00	4.34	3.67	0.33	0.31	0.45	0.67	0.11	0.08
Q_{75}	-50.00	25.00	3.58	3.41	0.28	0.27	0.38	0.67	0.11	0.08
Q_{90}	-50.00	25.00	2.92	3.19	0.25	0.24	0.32	0.67	0.11	0.08
Q_{98}	-50.00	25.00	1.97	2.86	0.19	0.19	0.23	0.67	0.11	0.08
Q_{mean}	-50.00	25.00	5.36	4.02	0.39	0.37	0.54	0.67	0.11	0.08

Appendix B. Continued

Flow type	Location									
	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
Q_{01}	0.92	0.73	1.44	2.62	0.65	2.06	11.47	1.94	1.66	1.15
Q_{02}	0.81	0.65	1.30	2.37	0.57	1.84	10.37	1.78	1.49	1.01
Q_{05}	0.69	0.55	1.15	2.08	0.49	1.59	9.08	1.58	1.29	0.84
Q_{10}	0.62	0.49	1.05	1.89	0.43	1.43	8.25	1.45	1.16	0.74
Q_{15}	0.56	0.44	0.98	1.77	0.39	1.32	7.70	1.37	1.07	0.67
Q_{25}	0.51	0.40	0.92	1.64	0.36	1.21	7.15	1.28	0.99	0.60
Q_{40}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Q_{50}	0.43	0.34	0.82	1.46	0.30	1.05	6.32	1.16	0.86	0.50
Q_{60}	0.41	0.32	0.78	1.40	0.28	0.99	6.05	1.12	0.81	0.46
Q_{75}	0.36	0.28	0.72	1.27	0.25	0.88	5.50	1.03	0.73	0.39
Q_{85}	0.32	0.25	0.67	1.19	0.22	0.81	5.13	0.98	0.67	0.34
Q_{90}	0.29	0.22	0.63	1.10	0.20	0.74	4.76	0.92	0.61	0.30
Q_{95}	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
Q_{98}	0.19	0.14	0.51	0.87	0.13	0.54	3.75	0.76	0.46	0.17
Q_{99}	0.14	0.10	0.44	0.75	0.09	0.43	3.20	0.68	0.37	0.10
Q_{mean}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Low Flows										
$Q_{1,2}$	0.12	0.09	0.42	0.71	0.08	0.39	3.02	0.65	0.34	0.08
$Q_{1,10}$	0.04	0.02	0.32	0.52	0.02	0.23	2.19	0.53	0.21	0.00
$Q_{1,25}$	0.04	0.02	0.31	0.50	0.02	0.21	2.10	0.51	0.20	0.00
$Q_{1,50}$	0.04	0.02	0.31	0.50	0.02	0.21	2.10	0.51	0.20	0.00
$Q_{7,2}$	0.28	0.21	0.62	1.08	0.19	0.72	4.67	0.90	0.60	0.29
$Q_{7,10}$	0.14	0.10	0.44	0.75	0.09	0.43	3.20	0.68	0.37	0.10
$Q_{7,25}$	0.12	0.09	0.42	0.71	0.08	0.39	3.02	0.65	0.34	0.08
$Q_{7,50}$	0.12	0.09	0.42	0.71	0.08	0.39	3.02	0.65	0.34	0.08
$Q_{15,2}$	0.29	0.22	0.63	1.10	0.20	0.74	4.76	0.92	0.61	0.30
$Q_{15,10}$	0.17	0.12	0.47	0.81	0.11	0.48	3.48	0.72	0.41	0.13
$Q_{15,25}$	0.13	0.09	0.43	0.73	0.08	0.41	3.11	0.67	0.36	0.09
$Q_{15,50}$	0.13	0.09	0.43	0.73	0.08	0.41	3.11	0.67	0.36	0.09
$Q_{31,2}$	0.30	0.23	0.65	1.15	0.21	0.77	4.95	0.95	0.64	0.32
$Q_{31,10}$	0.19	0.14	0.51	0.87	0.13	0.54	3.75	0.76	0.46	0.17
$Q_{31,25}$	0.14	0.10	0.44	0.75	0.09	0.43	3.20	0.68	0.37	0.10
$Q_{31,50}$	0.13	0.09	0.43	0.73	0.08	0.41	3.11	0.67	0.36	0.09
$Q_{61,2}$	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
$Q_{61,10}$	0.22	0.16	0.54	0.94	0.15	0.59	4.03	0.81	0.50	0.20
$Q_{61,25}$	0.17	0.12	0.47	0.81	0.11	0.48	3.48	0.72	0.41	0.13
$Q_{61,50}$	0.15	0.11	0.45	0.77	0.10	0.45	3.29	0.69	0.38	0.11
$Q_{91,2}$	0.36	0.28	0.72	1.27	0.25	0.88	5.50	1.03	0.73	0.39
$Q_{91,10}$	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
$Q_{91,25}$	0.19	0.14	0.51	0.87	0.13	0.54	3.75	0.76	0.46	0.17
$Q_{91,50}$	0.18	0.14	0.50	0.85	0.12	0.52	3.66	0.75	0.44	0.16

Appendix B. Continued

Flow type	Location									
	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
Drought Flows										
$Q_{6,10}$	0.32	0.25	0.67	1.19	0.22	0.81	5.13	0.98	0.67	0.34
$Q_{6,25}$	0.28	0.21	0.62	1.08	0.19	0.72	4.67	0.90	0.60	0.29
$Q_{6,50}$	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
$Q_{9,10}$	0.37	0.29	0.73	1.30	0.25	0.91	5.64	1.05	0.75	0.41
$Q_{9,25}$	0.34	0.26	0.69	1.23	0.23	0.85	5.31	1.00	0.70	0.37
$Q_{9,50}$	0.31	0.24	0.66	1.17	0.21	0.79	5.04	0.96	0.66	0.33
$Q_{12,10}$	0.42	0.32	0.79	1.42	0.29	1.01	6.14	1.13	0.83	0.47
$Q_{12,25}$	0.38	0.30	0.75	1.33	0.26	0.94	5.77	1.07	0.77	0.43
$Q_{12,50}$	0.35	0.27	0.71	1.25	0.24	0.86	5.41	1.02	0.71	0.38
$Q_{18,10}$	0.44	0.35	0.83	1.48	0.31	1.06	6.42	1.17	0.87	0.51
$Q_{18,25}$	0.40	0.31	0.77	1.37	0.28	0.97	5.96	1.10	0.80	0.45
$Q_{18,50}$	0.37	0.29	0.73	1.30	0.25	0.91	5.64	1.05	0.75	0.41
$Q_{30,10}$	0.47	0.37	0.86	1.54	0.33	1.12	6.69	1.21	0.91	0.54
$Q_{30,25}$	0.43	0.33	0.81	1.44	0.30	1.03	6.23	1.14	0.84	0.48
$Q_{30,50}$	0.40	0.31	0.77	1.37	0.28	0.97	5.96	1.10	0.80	0.45
$Q_{54,10}$	0.50	0.40	0.91	1.62	0.35	1.19	7.06	1.27	0.97	0.59
$Q_{54,25}$	0.44	0.35	0.83	1.48	0.31	1.06	6.42	1.17	0.87	0.51
$Q_{54,50}$	0.43	0.33	0.81	1.44	0.30	1.03	6.23	1.14	0.84	0.48
January										
Q_{02}	0.84	0.67	1.34	2.44	0.59	1.90	10.64	1.82	1.53	1.04
Q_{10}	0.62	0.49	1.05	1.89	0.43	1.43	8.25	1.45	1.16	0.74
Q_{25}	0.51	0.40	0.92	1.64	0.36	1.21	7.15	1.28	0.99	0.60
Q_{50}	0.43	0.34	0.82	1.46	0.30	1.05	6.32	1.16	0.86	0.50
Q_{75}	0.36	0.28	0.72	1.27	0.25	0.88	5.50	1.03	0.73	0.39
Q_{90}	0.28	0.22	0.62	1.09	0.19	0.73	4.72	0.91	0.61	0.29
Q_{98}	0.22	0.16	0.54	0.94	0.15	0.59	4.03	0.81	0.50	0.20
Q_{mean}	0.49	0.39	0.89	1.60	0.34	1.17	6.97	1.26	0.96	0.58
February										
Q_{02}	0.88	0.70	1.39	2.54	0.62	1.99	11.10	1.89	1.60	1.10
Q_{10}	0.65	0.51	1.09	1.98	0.46	1.50	8.62	1.51	1.22	0.79
Q_{25}	0.56	0.44	0.97	1.75	0.39	1.30	7.61	1.35	1.06	0.66
Q_{50}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Q_{75}	0.38	0.30	0.75	1.33	0.26	0.94	5.77	1.07	0.77	0.43
Q_{90}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{98}	0.27	0.21	0.61	1.06	0.18	0.70	4.58	0.89	0.58	0.27
Q_{mean}	0.52	0.41	0.93	1.67	0.36	1.23	7.26	1.30	1.00	0.61
March										
Q_{02}	0.92	0.73	1.44	2.62	0.65	2.06	11.47	1.94	1.66	1.15
Q_{10}	0.69	0.55	1.15	2.08	0.49	1.59	9.08	1.58	1.29	0.84
Q_{25}	0.59	0.47	1.02	1.83	0.41	1.37	7.98	1.41	1.11	0.70
Q_{50}	0.51	0.40	0.92	1.64	0.36	1.21	7.15	1.28	0.99	0.60
Q_{75}	0.44	0.35	0.83	1.48	0.31	1.06	6.42	1.17	0.87	0.51
Q_{90}	0.41	0.32	0.78	1.40	0.28	0.99	6.05	1.12	0.81	0.46
Q_{98}	0.32	0.25	0.67	1.19	0.22	0.81	5.13	0.98	0.67	0.34
Q_{mean}	0.54	0.43	0.96	1.72	0.38	1.28	7.50	1.34	1.04	0.64

Appendix B. Continued

Flow type	Location									
	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
April										
Q_{02}	0.92	0.73	1.44	2.62	0.65	2.06	11.47	1.94	1.66	1.15
Q_{10}	0.69	0.55	1.15	2.08	0.49	1.59	9.08	1.58	1.29	0.84
Q_{25}	0.61	0.48	1.04	1.87	0.43	1.41	8.16	1.44	1.14	0.73
Q_{50}	0.53	0.42	0.94	1.69	0.37	1.24	7.34	1.31	1.01	0.62
Q_{75}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Q_{90}	0.43	0.33	0.81	1.44	0.30	1.03	6.23	1.14	0.84	0.48
Q_{98}	0.34	0.26	0.69	1.23	0.23	0.85	5.31	1.00	0.70	0.37
Q_{mean}	0.55	0.43	0.96	1.73	0.38	1.28	7.51	1.34	1.04	0.65
May										
Q_{02}	0.92	0.73	1.44	2.62	0.65	2.06	11.47	1.94	1.66	1.15
Q_{10}	0.65	0.51	1.09	1.98	0.46	1.50	8.62	1.51	1.22	0.79
Q_{25}	0.54	0.43	0.96	1.72	0.38	1.28	7.49	1.34	1.04	0.64
Q_{50}	0.49	0.38	0.88	1.58	0.34	1.15	6.88	1.24	0.94	0.56
Q_{75}	0.44	0.35	0.83	1.48	0.31	1.06	6.42	1.17	0.87	0.51
Q_{90}	0.42	0.32	0.79	1.42	0.29	1.01	6.14	1.13	0.83	0.47
Q_{98}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{mean}	0.52	0.41	0.93	1.67	0.36	1.23	7.24	1.30	1.00	0.61
June										
Q_{02}	0.92	0.73	1.44	2.62	0.65	2.06	11.47	1.94	1.66	1.15
Q_{10}	0.65	0.51	1.09	1.98	0.46	1.50	8.62	1.51	1.22	0.79
Q_{25}	0.54	0.42	0.95	1.71	0.38	1.26	7.43	1.33	1.03	0.63
Q_{50}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Q_{75}	0.43	0.33	0.81	1.44	0.30	1.03	6.23	1.14	0.84	0.48
Q_{90}	0.39	0.30	0.76	1.35	0.27	0.96	5.86	1.09	0.79	0.44
Q_{98}	0.32	0.25	0.67	1.19	0.22	0.81	5.13	0.98	0.67	0.34
Q_{mean}	0.47	0.37	0.86	1.54	0.33	1.12	6.68	1.21	0.91	0.54
July										
Q_{02}	0.75	0.60	1.23	2.23	0.53	1.72	9.72	1.68	1.39	0.93
Q_{10}	0.56	0.44	0.98	1.77	0.39	1.32	7.70	1.37	1.07	0.67
Q_{25}	0.48	0.37	0.87	1.56	0.33	1.14	6.78	1.23	0.93	0.55
Q_{50}	0.43	0.34	0.82	1.46	0.30	1.05	6.32	1.16	0.86	0.50
Q_{75}	0.37	0.29	0.74	1.31	0.26	0.92	5.68	1.06	0.76	0.41
Q_{90}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{98}	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
Q_{mean}	0.42	0.32	0.79	1.42	0.29	1.01	6.14	1.13	0.83	0.47
August										
Q_{02}	0.69	0.55	1.15	2.08	0.49	1.59	9.08	1.58	1.29	0.84
Q_{10}	0.50	0.40	0.91	1.62	0.35	1.19	7.06	1.27	0.97	0.59
Q_{25}	0.43	0.33	0.81	1.44	0.30	1.03	6.23	1.14	0.84	0.48
Q_{50}	0.37	0.29	0.73	1.30	0.25	0.91	5.64	1.05	0.75	0.41
Q_{75}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{90}	0.28	0.22	0.62	1.09	0.19	0.73	4.72	0.91	0.61	0.29
Q_{98}	0.19	0.14	0.51	0.87	0.13	0.54	3.75	0.76	0.46	0.17
Q_{mean}	0.37	0.29	0.74	1.31	0.26	0.92	5.68	1.06	0.76	0.41

Appendix B. Continued

Flow type	Location									
	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
September										
Q_{02}	0.62	0.49	1.05	1.89	0.43	1.43	8.25	1.45	1.16	0.74
Q_{10}	0.45	0.35	0.84	1.50	0.31	1.08	6.51	1.19	0.89	0.52
Q_{25}	0.37	0.29	0.74	1.31	0.26	0.92	5.68	1.06	0.76	0.41
Q_{50}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{75}	0.29	0.22	0.63	1.10	0.20	0.74	4.76	0.92	0.61	0.30
Q_{90}	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
Q_{98}	0.14	0.10	0.44	0.75	0.09	0.43	3.20	0.68	0.37	0.10
Q_{mean}	0.35	0.27	0.71	1.27	0.24	0.88	5.48	1.03	0.73	0.39
October										
Q_{02}	0.64	0.51	1.08	1.96	0.45	1.48	8.53	1.50	1.20	0.77
Q_{10}	0.49	0.38	0.88	1.58	0.34	1.15	6.88	1.24	0.94	0.56
Q_{25}	0.41	0.32	0.78	1.40	0.28	0.99	6.05	1.12	0.81	0.46
Q_{50}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{75}	0.28	0.22	0.62	1.09	0.19	0.73	4.72	0.91	0.61	0.29
Q_{90}	0.22	0.16	0.54	0.94	0.15	0.59	4.03	0.81	0.50	0.20
Q_{98}	0.12	0.09	0.42	0.71	0.08	0.39	3.02	0.65	0.34	0.08
Q_{mean}	0.35	0.27	0.71	1.26	0.24	0.88	5.46	1.03	0.72	0.39
November										
Q_{02}	0.68	0.54	1.13	2.04	0.48	1.55	8.90	1.55	1.26	0.82
Q_{10}	0.51	0.40	0.92	1.64	0.36	1.21	7.15	1.28	0.99	0.60
Q_{25}	0.44	0.35	0.83	1.48	0.31	1.06	6.42	1.17	0.87	0.51
Q_{50}	0.37	0.29	0.73	1.30	0.25	0.91	5.64	1.05	0.75	0.41
Q_{75}	0.31	0.24	0.66	1.17	0.21	0.79	5.04	0.96	0.66	0.33
Q_{90}	0.25	0.19	0.58	1.02	0.17	0.67	4.39	0.86	0.56	0.25
Q_{98}	0.14	0.10	0.44	0.75	0.09	0.43	3.20	0.68	0.37	0.10
Q_{mean}	0.43	0.34	0.82	1.46	0.30	1.05	6.32	1.16	0.86	0.50
December										
Q_{02}	0.81	0.65	1.30	2.37	0.57	1.84	10.37	1.78	1.49	1.01
Q_{10}	0.56	0.44	0.98	1.77	0.39	1.32	7.70	1.37	1.07	0.67
Q_{25}	0.46	0.36	0.85	1.52	0.32	1.10	6.60	1.20	0.90	0.53
Q_{50}	0.40	0.31	0.77	1.37	0.28	0.97	5.96	1.10	0.80	0.45
Q_{75}	0.33	0.25	0.68	1.21	0.23	0.83	5.22	0.99	0.69	0.36
Q_{90}	0.27	0.21	0.61	1.06	0.18	0.70	4.58	0.89	0.58	0.27
Q_{98}	0.18	0.14	0.50	0.85	0.12	0.52	3.66	0.75	0.44	0.16
Q_{mean}	0.49	0.39	0.89	1.60	0.34	1.17	6.95	1.25	0.95	0.57

Appendix B. Continued

Flow type	Location									
	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
Q_{01}	0.17	1.01	1.25	0.71	0.34	1.17	0.89	0.28	0.51	0.25
Q_{02}	0.16	0.93	1.13	0.64	0.30	1.05	0.82	0.25	0.47	0.22
Q_{05}	0.14	0.83	0.99	0.57	0.26	0.91	0.73	0.21	0.43	0.19
Q_{10}	0.12	0.77	0.90	0.52	0.23	0.82	0.67	0.19	0.40	0.16
Q_{15}	0.12	0.72	0.84	0.48	0.21	0.76	0.63	0.17	0.38	0.15
Q_{25}	0.11	0.68	0.78	0.45	0.19	0.70	0.59	0.16	0.36	0.13
Q_{40}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Q_{50}	0.10	0.62	0.69	0.40	0.16	0.61	0.53	0.13	0.33	0.11
Q_{60}	0.09	0.60	0.66	0.39	0.15	0.58	0.51	0.12	0.32	0.11
Q_{75}	0.08	0.56	0.60	0.36	0.13	0.52	0.47	0.11	0.30	0.09
Q_{85}	0.08	0.53	0.56	0.33	0.12	0.48	0.45	0.10	0.29	0.08
Q_{90}	0.07	0.50	0.52	0.31	0.11	0.44	0.42	0.09	0.28	0.07
Q_{95}	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
Q_{98}	0.06	0.42	0.41	0.25	0.07	0.33	0.35	0.06	0.24	0.04
Q_{99}	0.05	0.38	0.35	0.22	0.05	0.27	0.31	0.04	0.22	0.03
Q_{mean}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Low Flows										
$Q_{1,2}$	0.05	0.37	0.33	0.21	0.04	0.25	0.30	0.03	0.21	0.03
$Q_{1,10}$	0.04	0.30	0.24	0.16	0.01	0.16	0.24	0.01	0.18	0.00
$Q_{1,25}$	0.03	0.30	0.23	0.16	0.01	0.15	0.23	0.01	0.18	0.00
$Q_{1,50}$	0.03	0.30	0.23	0.16	0.01	0.15	0.23	0.01	0.18	0.00
$Q_{7,2}$	0.07	0.49	0.51	0.31	0.10	0.43	0.41	0.08	0.27	0.07
$Q_{7,10}$	0.05	0.38	0.35	0.22	0.05	0.27	0.31	0.04	0.22	0.03
$Q_{7,25}$	0.05	0.37	0.33	0.21	0.04	0.25	0.30	0.03	0.21	0.03
$Q_{7,50}$	0.05	0.37	0.33	0.21	0.04	0.25	0.30	0.03	0.21	0.03
$Q_{15,2}$	0.07	0.50	0.52	0.31	0.11	0.44	0.42	0.09	0.28	0.07
$Q_{15,10}$	0.05	0.40	0.38	0.24	0.06	0.30	0.33	0.05	0.23	0.04
$Q_{15,25}$	0.05	0.37	0.34	0.21	0.05	0.26	0.30	0.04	0.22	0.03
$Q_{15,50}$	0.05	0.37	0.34	0.21	0.05	0.26	0.30	0.04	0.22	0.03
$Q_{31,2}$	0.08	0.51	0.54	0.32	0.11	0.46	0.43	0.09	0.28	0.08
$Q_{31,10}$	0.06	0.42	0.41	0.25	0.07	0.33	0.35	0.06	0.24	0.04
$Q_{31,25}$	0.05	0.38	0.35	0.22	0.05	0.27	0.31	0.04	0.22	0.03
$Q_{31,50}$	0.05	0.37	0.34	0.21	0.05	0.26	0.30	0.04	0.22	0.03
$Q_{61,2}$	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
$Q_{61,10}$	0.06	0.44	0.44	0.27	0.08	0.36	0.37	0.06	0.25	0.05
$Q_{61,25}$	0.05	0.40	0.38	0.24	0.06	0.30	0.33	0.05	0.23	0.04
$Q_{61,50}$	0.05	0.39	0.36	0.23	0.05	0.28	0.32	0.04	0.22	0.03
$Q_{91,2}$	0.08	0.56	0.60	0.36	0.13	0.52	0.47	0.11	0.30	0.09
$Q_{91,10}$	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
$Q_{91,25}$	0.06	0.42	0.41	0.25	0.07	0.33	0.35	0.06	0.24	0.04
$Q_{91,50}$	0.06	0.42	0.40	0.25	0.07	0.32	0.34	0.05	0.24	0.04

Appendix B. Continued

Flow type	Location									
	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
Drought Flows										
$Q_{6,10}$	0.08	0.53	0.56	0.33	0.12	0.48	0.45	0.10	0.29	0.08
$Q_{6,25}$	0.07	0.49	0.51	0.31	0.10	0.43	0.41	0.08	0.27	0.07
$Q_{6,50}$	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
$Q_{9,10}$	0.09	0.57	0.62	0.36	0.14	0.54	0.48	0.11	0.31	0.09
$Q_{9,25}$	0.08	0.54	0.58	0.34	0.12	0.50	0.46	0.10	0.29	0.09
$Q_{9,50}$	0.08	0.52	0.55	0.33	0.11	0.47	0.44	0.09	0.28	0.08
$Q_{12,10}$	0.09	0.60	0.67	0.39	0.15	0.59	0.52	0.13	0.32	0.11
$Q_{12,25}$	0.09	0.58	0.63	0.37	0.14	0.55	0.49	0.12	0.31	0.10
$Q_{12,50}$	0.08	0.55	0.59	0.35	0.13	0.51	0.47	0.10	0.30	0.09
$Q_{18,10}$	0.10	0.63	0.70	0.41	0.16	0.62	0.54	0.13	0.33	0.12
$Q_{18,25}$	0.09	0.59	0.65	0.38	0.15	0.57	0.50	0.12	0.32	0.10
$Q_{18,50}$	0.09	0.57	0.62	0.36	0.14	0.54	0.48	0.11	0.31	0.09
$Q_{30,10}$	0.10	0.65	0.73	0.43	0.17	0.65	0.56	0.14	0.34	0.12
$Q_{30,25}$	0.09	0.61	0.68	0.40	0.16	0.60	0.52	0.13	0.33	0.11
$Q_{30,50}$	0.09	0.59	0.65	0.38	0.15	0.57	0.50	0.12	0.32	0.10
$Q_{54,10}$	0.11	0.68	0.77	0.45	0.19	0.69	0.58	0.15	0.36	0.13
$Q_{54,25}$	0.10	0.63	0.70	0.41	0.16	0.62	0.54	0.13	0.33	0.12
$Q_{54,50}$	0.09	0.61	0.68	0.40	0.16	0.60	0.52	0.13	0.33	0.11
January										
Q_{02}	0.16	0.95	1.16	0.66	0.31	1.08	0.84	0.26	0.48	0.23
Q_{10}	0.12	0.77	0.90	0.52	0.23	0.82	0.67	0.19	0.40	0.16
Q_{25}	0.11	0.68	0.78	0.45	0.19	0.70	0.59	0.16	0.36	0.13
Q_{50}	0.10	0.62	0.69	0.40	0.16	0.61	0.53	0.13	0.33	0.11
Q_{75}	0.08	0.56	0.60	0.36	0.13	0.52	0.47	0.11	0.30	0.09
Q_{90}	0.07	0.50	0.52	0.31	0.10	0.44	0.42	0.08	0.27	0.07
Q_{98}	0.06	0.44	0.44	0.27	0.08	0.36	0.37	0.06	0.25	0.05
Q_{mean}	0.11	0.67	0.76	0.44	0.18	0.68	0.58	0.15	0.35	0.13
February										
Q_{02}	0.17	0.98	1.21	0.68	0.33	1.13	0.87	0.27	0.50	0.24
Q_{10}	0.13	0.79	0.94	0.54	0.24	0.86	0.69	0.20	0.41	0.17
Q_{25}	0.11	0.72	0.83	0.48	0.21	0.75	0.62	0.17	0.38	0.15
Q_{50}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Q_{75}	0.09	0.58	0.63	0.37	0.14	0.55	0.49	0.12	0.31	0.10
Q_{90}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{98}	0.07	0.49	0.50	0.30	0.10	0.42	0.41	0.08	0.27	0.07
Q_{mean}	0.11	0.69	0.79	0.46	0.19	0.71	0.60	0.16	0.36	0.14
March										
Q_{02}	0.17	1.01	1.25	0.71	0.34	1.17	0.89	0.28	0.51	0.25
Q_{10}	0.14	0.83	0.99	0.57	0.26	0.91	0.73	0.21	0.43	0.19
Q_{25}	0.12	0.75	0.87	0.50	0.22	0.79	0.65	0.18	0.39	0.16
Q_{50}	0.11	0.68	0.78	0.45	0.19	0.70	0.59	0.16	0.36	0.13
Q_{75}	0.10	0.63	0.70	0.41	0.16	0.62	0.54	0.13	0.33	0.12
Q_{90}	0.09	0.60	0.66	0.39	0.15	0.58	0.51	0.12	0.32	0.11
Q_{98}	0.08	0.53	0.56	0.33	0.12	0.48	0.45	0.10	0.29	0.08
Q_{mean}	0.11	0.71	0.82	0.47	0.20	0.74	0.61	0.17	0.37	0.14

Appendix B. Continued

Flow type	Location									
	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
April										
Q_{02}	0.17	1.01	1.25	0.71	0.34	1.17	0.89	0.28	0.51	0.25
Q_{10}	0.14	0.83	0.99	0.57	0.26	0.91	0.73	0.21	0.43	0.19
Q_{25}	0.12	0.76	0.89	0.51	0.23	0.81	0.66	0.19	0.40	0.16
Q_{50}	0.11	0.70	0.80	0.46	0.20	0.72	0.60	0.16	0.37	0.14
Q_{75}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Q_{90}	0.09	0.61	0.68	0.40	0.16	0.60	0.52	0.13	0.33	0.11
Q_{98}	0.08	0.54	0.58	0.34	0.12	0.50	0.46	0.10	0.29	0.09
Q_{mean}	0.11	0.71	0.82	0.47	0.20	0.74	0.61	0.17	0.37	0.14
May										
Q_{02}	0.17	1.01	1.25	0.71	0.34	1.17	0.89	0.28	0.51	0.25
Q_{10}	0.13	0.79	0.94	0.54	0.24	0.86	0.69	0.20	0.41	0.17
Q_{25}	0.11	0.71	0.82	0.47	0.20	0.74	0.61	0.17	0.37	0.14
Q_{50}	0.10	0.66	0.75	0.44	0.18	0.67	0.57	0.15	0.35	0.13
Q_{75}	0.10	0.63	0.70	0.41	0.16	0.62	0.54	0.13	0.33	0.12
Q_{90}	0.09	0.60	0.67	0.39	0.15	0.59	0.52	0.13	0.32	0.11
Q_{98}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{mean}	0.11	0.69	0.79	0.46	0.19	0.71	0.60	0.16	0.36	0.14
June										
Q_{02}	0.17	1.01	1.25	0.71	0.34	1.17	0.89	0.28	0.51	0.25
Q_{10}	0.13	0.79	0.94	0.54	0.24	0.86	0.69	0.20	0.41	0.17
Q_{25}	0.11	0.70	0.81	0.47	0.20	0.73	0.61	0.16	0.37	0.14
Q_{50}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Q_{75}	0.09	0.61	0.68	0.40	0.16	0.60	0.52	0.13	0.33	0.11
Q_{90}	0.09	0.58	0.64	0.38	0.14	0.56	0.50	0.12	0.31	0.10
Q_{98}	0.08	0.53	0.56	0.33	0.12	0.48	0.45	0.10	0.29	0.08
Q_{mean}	0.10	0.65	0.73	0.42	0.17	0.65	0.56	0.14	0.34	0.12
July										
Q_{02}	0.15	0.88	1.06	0.60	0.28	0.98	0.77	0.23	0.45	0.20
Q_{10}	0.12	0.72	0.84	0.48	0.21	0.76	0.63	0.17	0.38	0.15
Q_{25}	0.10	0.65	0.74	0.43	0.18	0.66	0.56	0.15	0.35	0.12
Q_{50}	0.10	0.62	0.69	0.40	0.16	0.61	0.53	0.13	0.33	0.11
Q_{75}	0.09	0.57	0.62	0.37	0.14	0.54	0.49	0.11	0.31	0.10
Q_{90}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{98}	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
Q_{mean}	0.09	0.60	0.67	0.39	0.15	0.59	0.52	0.13	0.32	0.11
August										
Q_{02}	0.14	0.83	0.99	0.57	0.26	0.91	0.73	0.21	0.43	0.19
Q_{10}	0.11	0.68	0.77	0.45	0.19	0.69	0.58	0.15	0.36	0.13
Q_{25}	0.09	0.61	0.68	0.40	0.16	0.60	0.52	0.13	0.33	0.11
Q_{50}	0.09	0.57	0.62	0.36	0.14	0.54	0.48	0.11	0.31	0.09
Q_{75}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{90}	0.07	0.50	0.52	0.31	0.10	0.44	0.42	0.08	0.27	0.07
Q_{98}	0.06	0.42	0.41	0.25	0.07	0.33	0.35	0.06	0.24	0.04
Q_{mean}	0.09	0.57	0.62	0.37	0.14	0.54	0.49	0.11	0.31	0.10

Appendix B. Continued

Flow type	Location									
	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
September										
Q_{02}	0.12	0.77	0.90	0.52	0.23	0.82	0.67	0.19	0.40	0.16
Q_{10}	0.10	0.63	0.71	0.41	0.17	0.63	0.54	0.14	0.34	0.12
Q_{25}	0.09	0.57	0.62	0.37	0.14	0.54	0.49	0.11	0.31	0.10
Q_{50}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{75}	0.07	0.50	0.52	0.31	0.11	0.44	0.42	0.09	0.28	0.07
Q_{90}	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
Q_{98}	0.05	0.38	0.35	0.22	0.05	0.27	0.31	0.04	0.22	0.03
Q_{mean}	0.08	0.55	0.60	0.35	0.13	0.52	0.47	0.11	0.30	0.09
October										
Q_{02}	0.13	0.79	0.93	0.53	0.24	0.85	0.69	0.20	0.41	0.17
Q_{10}	0.10	0.66	0.75	0.44	0.18	0.67	0.57	0.15	0.35	0.13
Q_{25}	0.09	0.60	0.66	0.39	0.15	0.58	0.51	0.12	0.32	0.11
Q_{50}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{75}	0.07	0.50	0.52	0.31	0.10	0.44	0.42	0.08	0.27	0.07
Q_{90}	0.06	0.44	0.44	0.27	0.08	0.36	0.37	0.06	0.25	0.05
Q_{98}	0.05	0.37	0.33	0.21	0.04	0.25	0.30	0.03	0.21	0.03
Q_{mean}	0.08	0.55	0.60	0.35	0.13	0.52	0.47	0.11	0.30	0.09
November										
Q_{02}	0.13	0.82	0.97	0.56	0.25	0.89	0.71	0.21	0.42	0.18
Q_{10}	0.11	0.68	0.78	0.45	0.19	0.70	0.59	0.16	0.36	0.13
Q_{25}	0.10	0.63	0.70	0.41	0.16	0.62	0.54	0.13	0.33	0.12
Q_{50}	0.09	0.57	0.62	0.36	0.14	0.54	0.48	0.11	0.31	0.09
Q_{75}	0.08	0.52	0.55	0.33	0.11	0.47	0.44	0.09	0.28	0.08
Q_{90}	0.07	0.47	0.48	0.29	0.09	0.40	0.39	0.08	0.26	0.06
Q_{98}	0.05	0.38	0.35	0.22	0.05	0.27	0.31	0.04	0.22	0.03
Q_{mean}	0.10	0.62	0.69	0.40	0.16	0.61	0.53	0.13	0.33	0.11
December										
Q_{02}	0.16	0.93	1.13	0.64	0.30	1.05	0.82	0.25	0.47	0.22
Q_{10}	0.12	0.72	0.84	0.48	0.21	0.76	0.63	0.17	0.38	0.15
Q_{25}	0.10	0.64	0.72	0.42	0.17	0.64	0.55	0.14	0.34	0.12
Q_{50}	0.09	0.59	0.65	0.38	0.15	0.57	0.50	0.12	0.32	0.10
Q_{75}	0.08	0.53	0.57	0.34	0.12	0.49	0.45	0.10	0.29	0.08
Q_{90}	0.07	0.49	0.50	0.30	0.10	0.42	0.41	0.08	0.27	0.07
Q_{98}	0.06	0.42	0.40	0.25	0.07	0.32	0.34	0.05	0.24	0.04
Q_{mean}	0.11	0.67	0.76	0.44	0.18	0.68	0.57	0.15	0.35	0.13

Appendix B. Continued

Flow type	Location									
	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)
Q_{01}	0.84	0.26	7.09	0.24	4.66	70.80	0.77	1.10	0.05	0.40
Q_{02}	0.76	0.24	6.57	0.21	4.24	66.22	0.72	1.10	0.05	0.36
Q_{05}	0.68	0.21	5.97	0.18	3.75	60.89	0.66	1.10	0.05	0.30
Q_{10}	0.62	0.19	5.58	0.15	3.43	57.46	0.62	1.10	0.05	0.27
Q_{15}	0.58	0.18	5.32	0.14	3.22	55.17	0.59	1.10	0.05	0.25
Q_{25}	0.55	0.17	5.06	0.12	3.01	52.89	0.57	1.10	0.05	0.22
Q_{40}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Q_{50}	0.49	0.15	4.67	0.10	2.69	49.46	0.53	1.10	0.05	0.19
Q_{60}	0.47	0.15	4.54	0.10	2.59	48.31	0.51	1.10	0.05	0.18
Q_{75}	0.44	0.14	4.28	0.08	2.38	46.03	0.49	1.10	0.05	0.15
Q_{85}	0.41	0.13	4.11	0.07	2.24	44.50	0.47	1.10	0.05	0.14
Q_{90}	0.39	0.12	3.94	0.06	2.10	42.98	0.45	1.10	0.05	0.12
Q_{95}	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
Q_{98}	0.32	0.10	3.46	0.03	1.71	38.79	0.41	1.10	0.05	0.08
Q_{99}	0.28	0.09	3.20	0.02	1.50	36.50	0.38	1.10	0.05	0.06
Q_{mean}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Low Flows										
$Q_{1,2}$	0.27	0.09	3.11	0.02	1.43	35.74	0.37	1.10	0.05	0.05
$Q_{1,10}$	0.21	0.07	2.72	0.00	1.11	32.31	0.33	1.10	0.05	0.02
$Q_{1,25}$	0.21	0.07	2.68	0.00	1.08	31.93	0.33	1.10	0.05	0.01
$Q_{1,50}$	0.21	0.07	2.68	0.00	1.08	31.93	0.33	1.10	0.05	0.01
$Q_{7,2}$	0.38	0.12	3.89	0.06	2.06	42.60	0.45	1.10	0.05	0.12
$Q_{7,10}$	0.28	0.09	3.20	0.02	1.50	36.50	0.38	1.10	0.05	0.06
$Q_{7,25}$	0.27	0.09	3.11	0.02	1.43	35.74	0.37	1.10	0.05	0.05
$Q_{7,50}$	0.27	0.09	3.11	0.02	1.43	35.74	0.37	1.10	0.05	0.05
$Q_{15,2}$	0.39	0.12	3.94	0.06	2.10	42.98	0.45	1.10	0.05	0.12
$Q_{15,10}$	0.30	0.10	3.33	0.03	1.61	37.64	0.39	1.10	0.05	0.07
$Q_{15,25}$	0.27	0.09	3.16	0.02	1.46	36.12	0.38	1.10	0.05	0.06
$Q_{15,50}$	0.27	0.09	3.16	0.02	1.46	36.12	0.38	1.10	0.05	0.06
$Q_{31,2}$	0.40	0.13	4.02	0.07	2.17	43.74	0.46	1.10	0.05	0.13
$Q_{31,10}$	0.32	0.10	3.46	0.03	1.71	38.79	0.41	1.10	0.05	0.08
$Q_{31,25}$	0.28	0.09	3.20	0.02	1.50	36.50	0.38	1.10	0.05	0.06
$Q_{31,50}$	0.27	0.09	3.16	0.02	1.46	36.12	0.38	1.10	0.05	0.06
$Q_{61,2}$	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
$Q_{61,10}$	0.34	0.11	3.59	0.04	1.82	39.93	0.42	1.10	0.05	0.09
$Q_{61,25}$	0.30	0.10	3.33	0.03	1.61	37.64	0.39	1.10	0.05	0.07
$Q_{61,50}$	0.29	0.09	3.24	0.02	1.54	36.88	0.38	1.10	0.05	0.06
$Q_{91,2}$	0.44	0.14	4.28	0.08	2.38	46.03	0.49	1.10	0.05	0.15
$Q_{91,10}$	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
$Q_{91,25}$	0.32	0.10	3.46	0.03	1.71	38.79	0.41	1.10	0.05	0.08
$Q_{91,50}$	0.31	0.10	3.42	0.03	1.68	38.41	0.40	1.10	0.05	0.08

Appendix B. Continued

Flow type	Location									
	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)
Drought Flows										
$Q_{6,10}$	0.41	0.13	4.11	0.07	2.24	44.50	0.47	1.10	0.05	0.14
$Q_{6,25}$	0.38	0.12	3.89	0.06	2.06	42.60	0.45	1.10	0.05	0.12
$Q_{6,50}$	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
$Q_{9,10}$	0.44	0.14	4.35	0.08	2.43	46.60	0.49	1.10	0.05	0.16
$Q_{9,25}$	0.42	0.13	4.19	0.08	2.31	45.26	0.48	1.10	0.05	0.15
$Q_{9,50}$	0.40	0.13	4.06	0.07	2.20	44.12	0.47	1.10	0.05	0.14
$Q_{12,10}$	0.48	0.15	4.58	0.10	2.62	48.69	0.52	1.10	0.05	0.18
$Q_{12,25}$	0.45	0.14	4.41	0.09	2.48	47.17	0.50	1.10	0.05	0.17
$Q_{12,50}$	0.43	0.14	4.24	0.08	2.34	45.65	0.48	1.10	0.05	0.15
$Q_{18,10}$	0.50	0.16	4.71	0.11	2.73	49.84	0.53	1.10	0.05	0.19
$Q_{18,25}$	0.47	0.15	4.50	0.09	2.55	47.93	0.51	1.10	0.05	0.17
$Q_{18,50}$	0.44	0.14	4.35	0.08	2.43	46.60	0.49	1.10	0.05	0.16
$Q_{30,10}$	0.52	0.16	4.84	0.11	2.84	50.98	0.54	1.10	0.05	0.20
$Q_{30,25}$	0.49	0.15	4.63	0.10	2.66	49.08	0.52	1.10	0.05	0.18
$Q_{30,50}$	0.47	0.15	4.50	0.09	2.55	47.93	0.51	1.10	0.05	0.17
$Q_{54,10}$	0.54	0.17	5.02	0.12	2.98	52.51	0.56	1.10	0.05	0.22
$Q_{54,25}$	0.50	0.16	4.71	0.11	2.73	49.84	0.53	1.10	0.05	0.19
$Q_{54,50}$	0.49	0.15	4.63	0.10	2.66	49.08	0.52	1.10	0.05	0.18
January										
Q_{02}	0.78	0.24	6.70	0.22	4.35	67.37	0.73	1.10	0.05	0.37
Q_{10}	0.62	0.19	5.58	0.15	3.43	57.46	0.62	1.10	0.05	0.27
Q_{25}	0.55	0.17	5.06	0.12	3.01	52.89	0.57	1.10	0.05	0.22
Q_{50}	0.49	0.15	4.67	0.10	2.69	49.46	0.53	1.10	0.05	0.19
Q_{75}	0.44	0.14	4.28	0.08	2.38	46.03	0.49	1.10	0.05	0.15
Q_{90}	0.38	0.12	3.91	0.06	2.08	42.79	0.45	1.10	0.05	0.12
Q_{98}	0.34	0.11	3.59	0.04	1.82	39.93	0.42	1.10	0.05	0.09
Q_{mean}	0.53	0.17	4.97	0.12	2.94	52.12	0.56	1.10	0.05	0.22
February										
Q_{02}	0.81	0.25	6.92	0.23	4.52	69.27	0.75	1.10	0.05	0.39
Q_{10}	0.65	0.20	5.75	0.16	3.57	58.98	0.64	1.10	0.05	0.28
Q_{25}	0.58	0.18	5.28	0.14	3.19	54.79	0.59	1.10	0.05	0.24
Q_{50}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Q_{75}	0.45	0.14	4.41	0.09	2.48	47.17	0.50	1.10	0.05	0.17
Q_{90}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{98}	0.37	0.12	3.85	0.06	2.03	42.22	0.44	1.10	0.05	0.12
Q_{mean}	0.55	0.17	5.11	0.13	3.05	53.34	0.57	1.10	0.05	0.23
March										
Q_{02}	0.84	0.26	7.09	0.24	4.66	70.80	0.77	1.10	0.05	0.40
Q_{10}	0.68	0.21	5.97	0.18	3.75	60.89	0.66	1.10	0.05	0.30
Q_{25}	0.60	0.19	5.45	0.15	3.33	56.32	0.60	1.10	0.05	0.26
Q_{50}	0.55	0.17	5.06	0.12	3.01	52.89	0.57	1.10	0.05	0.22
Q_{75}	0.50	0.16	4.71	0.11	2.73	49.84	0.53	1.10	0.05	0.19
Q_{90}	0.47	0.15	4.54	0.10	2.59	48.31	0.51	1.10	0.05	0.18
Q_{98}	0.41	0.13	4.11	0.07	2.24	44.50	0.47	1.10	0.05	0.14
Q_{mean}	0.57	0.18	5.22	0.13	3.14	54.33	0.58	1.10	0.05	0.24

Appendix B. Continued

Flow type	Location									
	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)
April										
Q_{02}	0.84	0.26	7.09	0.24	4.66	70.80	0.77	1.10	0.05	0.40
Q_{10}	0.68	0.21	5.97	0.18	3.75	60.89	0.66	1.10	0.05	0.30
Q_{25}	0.62	0.19	5.54	0.15	3.40	57.08	0.61	1.10	0.05	0.26
Q_{50}	0.56	0.18	5.15	0.13	3.08	53.65	0.57	1.10	0.05	0.23
Q_{75}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Q_{90}	0.49	0.15	4.63	0.10	2.66	49.08	0.52	1.10	0.05	0.18
Q_{98}	0.42	0.13	4.19	0.08	2.31	45.26	0.48	1.10	0.05	0.15
Q_{mean}	0.57	0.18	5.23	0.13	3.15	54.37	0.58	1.10	0.05	0.24
May										
Q_{02}	0.84	0.26	7.09	0.24	4.66	70.80	0.77	1.10	0.05	0.40
Q_{10}	0.65	0.20	5.75	0.16	3.57	58.98	0.64	1.10	0.05	0.28
Q_{25}	0.57	0.18	5.22	0.13	3.14	54.30	0.58	1.10	0.05	0.24
Q_{50}	0.53	0.17	4.93	0.12	2.91	51.74	0.55	1.10	0.05	0.21
Q_{75}	0.50	0.16	4.71	0.11	2.73	49.84	0.53	1.10	0.05	0.19
Q_{90}	0.48	0.15	4.58	0.10	2.62	48.69	0.52	1.10	0.05	0.18
Q_{98}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{mean}	0.55	0.17	5.10	0.13	3.05	53.27	0.57	1.10	0.05	0.23
June										
Q_{02}	0.84	0.26	7.09	0.24	4.66	70.80	0.77	1.10	0.05	0.40
Q_{10}	0.65	0.20	5.75	0.16	3.57	58.98	0.64	1.10	0.05	0.28
Q_{25}	0.57	0.18	5.19	0.13	3.12	54.03	0.58	1.10	0.05	0.23
Q_{50}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Q_{75}	0.49	0.15	4.63	0.10	2.66	49.08	0.52	1.10	0.05	0.18
Q_{90}	0.46	0.14	4.45	0.09	2.52	47.55	0.51	1.10	0.05	0.17
Q_{98}	0.41	0.13	4.11	0.07	2.24	44.50	0.47	1.10	0.05	0.14
Q_{mean}	0.52	0.16	4.84	0.11	2.83	50.94	0.54	1.10	0.05	0.20
July										
Q_{02}	0.72	0.22	6.27	0.19	3.99	63.56	0.69	1.10	0.05	0.33
Q_{10}	0.58	0.18	5.32	0.14	3.22	55.17	0.59	1.10	0.05	0.25
Q_{25}	0.52	0.16	4.89	0.11	2.87	51.36	0.55	1.10	0.05	0.21
Q_{50}	0.49	0.15	4.67	0.10	2.69	49.46	0.53	1.10	0.05	0.19
Q_{75}	0.45	0.14	4.37	0.09	2.45	46.79	0.50	1.10	0.05	0.16
Q_{90}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{98}	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
Q_{mean}	0.48	0.15	4.58	0.10	2.62	48.69	0.52	1.10	0.05	0.18
August										
Q_{02}	0.68	0.21	5.97	0.18	3.75	60.89	0.66	1.10	0.05	0.30
Q_{10}	0.54	0.17	5.02	0.12	2.98	52.51	0.56	1.10	0.05	0.22
Q_{25}	0.49	0.15	4.63	0.10	2.66	49.08	0.52	1.10	0.05	0.18
Q_{50}	0.44	0.14	4.35	0.08	2.43	46.60	0.49	1.10	0.05	0.16
Q_{75}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{90}	0.38	0.12	3.91	0.06	2.08	42.79	0.45	1.10	0.05	0.12
Q_{98}	0.32	0.10	3.46	0.03	1.71	38.79	0.41	1.10	0.05	0.08
Q_{mean}	0.45	0.14	4.37	0.09	2.45	46.79	0.50	1.10	0.05	0.16

Appendix B. Continued

Flow type	Location									
	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)
September										
Q_{02}	0.62	0.19	5.58	0.15	3.43	57.46	0.62	1.10	0.05	0.27
Q_{10}	0.50	0.16	4.76	0.11	2.76	50.22	0.54	1.10	0.05	0.20
Q_{25}	0.45	0.14	4.37	0.09	2.45	46.79	0.50	1.10	0.05	0.16
Q_{50}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{75}	0.39	0.12	3.94	0.06	2.10	42.98	0.45	1.10	0.05	0.12
Q_{90}	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
Q_{98}	0.28	0.09	3.20	0.02	1.50	36.50	0.38	1.10	0.05	0.06
Q_{mean}	0.43	0.14	4.27	0.08	2.37	45.95	0.49	1.10	0.05	0.15
October										
Q_{02}	0.64	0.20	5.71	0.16	3.54	58.60	0.63	1.10	0.05	0.28
Q_{10}	0.53	0.17	4.93	0.12	2.91	51.74	0.55	1.10	0.05	0.21
Q_{25}	0.47	0.15	4.54	0.10	2.59	48.31	0.51	1.10	0.05	0.18
Q_{50}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{75}	0.38	0.12	3.91	0.06	2.08	42.79	0.45	1.10	0.05	0.12
Q_{90}	0.34	0.11	3.59	0.04	1.82	39.93	0.42	1.10	0.05	0.09
Q_{98}	0.27	0.09	3.11	0.02	1.43	35.74	0.37	1.10	0.05	0.05
Q_{mean}	0.43	0.14	4.26	0.08	2.36	45.87	0.49	1.10	0.05	0.15
November										
Q_{02}	0.67	0.21	5.88	0.17	3.68	60.13	0.65	1.10	0.05	0.29
Q_{10}	0.55	0.17	5.06	0.12	3.01	52.89	0.57	1.10	0.05	0.22
Q_{25}	0.50	0.16	4.71	0.11	2.73	49.84	0.53	1.10	0.05	0.19
Q_{50}	0.44	0.14	4.35	0.08	2.43	46.60	0.49	1.10	0.05	0.16
Q_{75}	0.40	0.13	4.06	0.07	2.20	44.12	0.47	1.10	0.05	0.14
Q_{90}	0.36	0.11	3.76	0.05	1.96	41.45	0.44	1.10	0.05	0.11
Q_{98}	0.28	0.09	3.20	0.02	1.50	36.50	0.38	1.10	0.05	0.06
Q_{mean}	0.49	0.15	4.67	0.10	2.69	49.46	0.53	1.10	0.05	0.19
December										
Q_{02}	0.76	0.24	6.57	0.21	4.24	66.22	0.72	1.10	0.05	0.36
Q_{10}	0.58	0.18	5.32	0.14	3.22	55.17	0.59	1.10	0.05	0.25
Q_{25}	0.51	0.16	4.80	0.11	2.80	50.60	0.54	1.10	0.05	0.20
Q_{50}	0.47	0.15	4.50	0.09	2.55	47.93	0.51	1.10	0.05	0.17
Q_{75}	0.42	0.13	4.15	0.07	2.27	44.88	0.48	1.10	0.05	0.14
Q_{90}	0.37	0.12	3.85	0.06	2.03	42.22	0.44	1.10	0.05	0.12
Q_{98}	0.31	0.10	3.42	0.03	1.68	38.41	0.40	1.10	0.05	0.08
Q_{mean}	0.53	0.17	4.96	0.12	2.93	52.05	0.56	1.10	0.05	0.21

Appendix B. Continued

Flow type	Location									
	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
Q_{01}	0.13	6.42	9.35	0.36	6.86	0.19	1.93	0.37	0.39	1.04
Q_{02}	0.12	5.81	8.41	0.33	6.22	0.17	1.72	0.37	0.35	0.92
Q_{05}	0.11	5.09	7.32	0.30	5.46	0.14	1.47	0.37	0.31	0.78
Q_{10}	0.11	4.62	6.61	0.27	4.97	0.12	1.32	0.37	0.28	0.69
Q_{15}	0.11	4.32	6.14	0.26	4.65	0.11	1.21	0.37	0.27	0.63
Q_{25}	0.10	4.01	5.67	0.24	4.32	0.10	1.11	0.37	0.25	0.57
Q_{40}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Q_{50}	0.10	3.55	4.96	0.22	3.84	0.08	0.95	0.37	0.22	0.48
Q_{60}	0.10	3.39	4.73	0.22	3.68	0.08	0.89	0.37	0.21	0.45
Q_{75}	0.09	3.08	4.26	0.20	3.35	0.07	0.79	0.37	0.19	0.39
Q_{85}	0.09	2.88	3.95	0.19	3.14	0.06	0.72	0.37	0.18	0.35
Q_{90}	0.09	2.67	3.63	0.18	2.92	0.05	0.65	0.37	0.17	0.31
Q_{95}	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
Q_{98}	0.08	2.11	2.77	0.15	2.32	0.03	0.46	0.37	0.14	0.20
Q_{99}	0.08	1.80	2.30	0.14	2.00	0.02	0.35	0.37	0.12	0.14
Q_{mean}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Low Flows										
$Q_{1,2}$	0.08	1.70	2.14	0.14	1.89	0.02	0.31	0.37	0.11	0.12
$Q_{1,10}$	0.07	1.24	1.44	0.11	1.41	0.00	0.16	0.37	0.09	0.03
$Q_{1,25}$	0.07	1.18	1.36	0.11	1.35	0.00	0.14	0.37	0.08	0.02
$Q_{1,50}$	0.07	1.18	1.36	0.11	1.35	0.00	0.14	0.37	0.08	0.02
$Q_{7,2}$	0.09	2.62	3.55	0.18	2.86	0.05	0.63	0.37	0.17	0.30
$Q_{7,10}$	0.08	1.80	2.30	0.14	2.00	0.02	0.35	0.37	0.12	0.14
$Q_{7,25}$	0.08	1.70	2.14	0.14	1.89	0.02	0.31	0.37	0.11	0.12
$Q_{7,50}$	0.08	1.70	2.14	0.14	1.89	0.02	0.31	0.37	0.11	0.12
$Q_{15,2}$	0.09	2.67	3.63	0.18	2.92	0.05	0.65	0.37	0.17	0.31
$Q_{15,10}$	0.08	1.95	2.54	0.15	2.16	0.03	0.40	0.37	0.13	0.17
$Q_{15,25}$	0.08	1.75	2.22	0.14	1.95	0.02	0.33	0.37	0.12	0.13
$Q_{15,50}$	0.08	1.75	2.22	0.14	1.95	0.02	0.33	0.37	0.12	0.13
$Q_{31,2}$	0.09	2.78	3.79	0.19	3.03	0.06	0.68	0.37	0.18	0.33
$Q_{31,10}$	0.08	2.11	2.77	0.15	2.32	0.03	0.46	0.37	0.14	0.20
$Q_{31,25}$	0.08	1.80	2.30	0.14	2.00	0.02	0.35	0.37	0.12	0.14
$Q_{31,50}$	0.08	1.75	2.22	0.14	1.95	0.02	0.33	0.37	0.12	0.13
$Q_{61,2}$	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
$Q_{61,10}$	0.08	2.26	3.01	0.16	2.49	0.04	0.51	0.37	0.15	0.23
$Q_{61,25}$	0.08	1.95	2.54	0.15	2.16	0.03	0.40	0.37	0.13	0.17
$Q_{61,50}$	0.08	1.85	2.38	0.14	2.05	0.02	0.37	0.37	0.12	0.15
$Q_{91,2}$	0.09	3.08	4.26	0.20	3.35	0.07	0.79	0.37	0.19	0.39
$Q_{91,10}$	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
$Q_{91,25}$	0.08	2.11	2.77	0.15	2.32	0.03	0.46	0.37	0.14	0.20
$Q_{91,50}$	0.08	2.06	2.69	0.15	2.27	0.03	0.44	0.37	0.13	0.19

Appendix B. Continued

Flow type	Location									
	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
Drought Flows										
$Q_{6,10}$	0.09	2.88	3.95	0.19	3.14	0.06	0.72	0.37	0.18	0.35
$Q_{6,25}$	0.09	2.62	3.55	0.18	2.86	0.05	0.63	0.37	0.17	0.30
$Q_{6,50}$	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
$Q_{9,10}$	0.09	3.16	4.38	0.20	3.43	0.07	0.82	0.37	0.20	0.41
$Q_{9,25}$	0.09	2.98	4.10	0.20	3.24	0.06	0.75	0.37	0.19	0.37
$Q_{9,50}$	0.09	2.83	3.87	0.19	3.08	0.06	0.70	0.37	0.18	0.34
$Q_{12,10}$	0.10	3.44	4.81	0.22	3.73	0.08	0.91	0.37	0.22	0.46
$Q_{12,25}$	0.10	3.24	4.49	0.21	3.51	0.07	0.84	0.37	0.20	0.42
$Q_{12,50}$	0.09	3.03	4.18	0.20	3.30	0.07	0.77	0.37	0.19	0.38
$Q_{18,10}$	0.10	3.60	5.04	0.23	3.89	0.09	0.96	0.37	0.22	0.49
$Q_{18,25}$	0.10	3.34	4.65	0.21	3.62	0.08	0.88	0.37	0.21	0.44
$Q_{18,50}$	0.09	3.16	4.38	0.20	3.43	0.07	0.82	0.37	0.20	0.41
$Q_{30,10}$	0.10	3.75	5.28	0.23	4.05	0.09	1.02	0.37	0.23	0.52
$Q_{30,25}$	0.10	3.49	4.89	0.22	3.78	0.08	0.93	0.37	0.22	0.47
$Q_{30,50}$	0.10	3.34	4.65	0.21	3.62	0.08	0.88	0.37	0.21	0.44
$Q_{54,10}$	0.10	3.96	5.59	0.24	4.27	0.10	1.09	0.37	0.24	0.56
$Q_{54,25}$	0.10	3.60	5.04	0.23	3.89	0.09	0.96	0.37	0.22	0.49
$Q_{54,50}$	0.10	3.49	4.89	0.22	3.78	0.08	0.93	0.37	0.22	0.47
January										
Q_{02}	0.12	5.96	8.65	0.34	6.38	0.17	1.77	0.37	0.36	0.95
Q_{10}	0.11	4.62	6.61	0.27	4.97	0.12	1.32	0.37	0.28	0.69
Q_{25}	0.10	4.01	5.67	0.24	4.32	0.10	1.11	0.37	0.25	0.57
Q_{50}	0.10	3.55	4.96	0.22	3.84	0.08	0.95	0.37	0.22	0.48
Q_{75}	0.09	3.08	4.26	0.20	3.35	0.07	0.79	0.37	0.19	0.39
Q_{90}	0.09	2.65	3.59	0.18	2.89	0.05	0.64	0.37	0.17	0.31
Q_{98}	0.08	2.26	3.01	0.16	2.49	0.04	0.51	0.37	0.15	0.23
Q_{mean}	0.10	3.91	5.51	0.24	4.22	0.10	1.07	0.37	0.24	0.55
February										
Q_{02}	0.13	6.22	9.04	0.35	6.65	0.18	1.86	0.37	0.38	1.00
Q_{10}	0.11	4.83	6.92	0.28	5.19	0.13	1.39	0.37	0.30	0.73
Q_{25}	0.11	4.26	6.06	0.26	4.59	0.11	1.19	0.37	0.26	0.62
Q_{50}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Q_{75}	0.10	3.24	4.49	0.21	3.51	0.07	0.84	0.37	0.20	0.42
Q_{90}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{98}	0.09	2.57	3.48	0.18	2.81	0.05	0.61	0.37	0.16	0.29
Q_{mean}	0.10	4.07	5.76	0.25	4.39	0.10	1.13	0.37	0.25	0.58
March										
Q_{02}	0.13	6.42	9.35	0.36	6.86	0.19	1.93	0.37	0.39	1.04
Q_{10}	0.11	5.09	7.32	0.30	5.46	0.14	1.47	0.37	0.31	0.78
Q_{25}	0.11	4.47	6.38	0.27	4.81	0.12	1.26	0.37	0.27	0.66
Q_{50}	0.10	4.01	5.67	0.24	4.32	0.10	1.11	0.37	0.25	0.57
Q_{75}	0.10	3.60	5.04	0.23	3.89	0.09	0.96	0.37	0.22	0.49
Q_{90}	0.10	3.39	4.73	0.22	3.68	0.08	0.89	0.37	0.21	0.45
Q_{98}	0.09	2.88	3.95	0.19	3.14	0.06	0.72	0.37	0.18	0.35
Q_{mean}	0.11	4.20	5.97	0.25	4.53	0.11	1.17	0.37	0.26	0.61

Appendix B. Continued

Flow type	Location									
	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
April										
Q_{02}	0.13	6.42	9.35	0.36	6.86	0.19	1.93	0.37	0.39	1.04
Q_{10}	0.11	5.09	7.32	0.30	5.46	0.14	1.47	0.37	0.31	0.78
Q_{25}	0.11	4.57	6.53	0.27	4.92	0.12	1.30	0.37	0.28	0.68
Q_{50}	0.10	4.11	5.83	0.25	4.43	0.11	1.14	0.37	0.25	0.59
Q_{75}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Q_{90}	0.10	3.49	4.89	0.22	3.78	0.08	0.93	0.37	0.22	0.47
Q_{98}	0.09	2.98	4.10	0.20	3.24	0.06	0.75	0.37	0.19	0.37
Q_{mean}	0.11	4.21	5.98	0.25	4.54	0.11	1.17	0.37	0.26	0.61
May										
Q_{02}	0.13	6.42	9.35	0.36	6.86	0.19	1.93	0.37	0.39	1.04
Q_{10}	0.11	4.83	6.92	0.28	5.19	0.13	1.39	0.37	0.30	0.73
Q_{25}	0.11	4.20	5.96	0.25	4.52	0.11	1.17	0.37	0.26	0.61
Q_{50}	0.10	3.85	5.44	0.24	4.16	0.10	1.05	0.37	0.24	0.54
Q_{75}	0.10	3.60	5.04	0.23	3.89	0.09	0.96	0.37	0.22	0.49
Q_{90}	0.10	3.44	4.81	0.22	3.73	0.08	0.91	0.37	0.22	0.46
Q_{98}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{mean}	0.10	4.06	5.75	0.25	4.38	0.10	1.12	0.37	0.25	0.58
June										
Q_{02}	0.13	6.42	9.35	0.36	6.86	0.19	1.93	0.37	0.39	1.04
Q_{10}	0.11	4.83	6.92	0.28	5.19	0.13	1.39	0.37	0.30	0.73
Q_{25}	0.10	4.16	5.91	0.25	4.49	0.11	1.16	0.37	0.26	0.60
Q_{50}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Q_{75}	0.10	3.49	4.89	0.22	3.78	0.08	0.93	0.37	0.22	0.47
Q_{90}	0.10	3.29	4.57	0.21	3.57	0.07	0.86	0.37	0.21	0.43
Q_{98}	0.09	2.88	3.95	0.19	3.14	0.06	0.72	0.37	0.18	0.35
Q_{mean}	0.10	3.75	5.27	0.23	4.05	0.09	1.02	0.37	0.23	0.52
July										
Q_{02}	0.12	5.45	7.86	0.31	5.84	0.15	1.60	0.37	0.33	0.85
Q_{10}	0.11	4.32	6.14	0.26	4.65	0.11	1.21	0.37	0.27	0.63
Q_{25}	0.10	3.80	5.36	0.23	4.11	0.09	1.04	0.37	0.24	0.53
Q_{50}	0.10	3.55	4.96	0.22	3.84	0.08	0.95	0.37	0.22	0.48
Q_{75}	0.09	3.19	4.42	0.21	3.46	0.07	0.82	0.37	0.20	0.41
Q_{90}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{98}	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
Q_{mean}	0.10	3.44	4.81	0.22	3.73	0.08	0.91	0.37	0.22	0.46
August										
Q_{02}	0.11	5.09	7.32	0.30	5.46	0.14	1.47	0.37	0.31	0.78
Q_{10}	0.10	3.96	5.59	0.24	4.27	0.10	1.09	0.37	0.24	0.56
Q_{25}	0.10	3.49	4.89	0.22	3.78	0.08	0.93	0.37	0.22	0.47
Q_{50}	0.09	3.16	4.38	0.20	3.43	0.07	0.82	0.37	0.20	0.41
Q_{75}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{90}	0.09	2.65	3.59	0.18	2.89	0.05	0.64	0.37	0.17	0.31
Q_{98}	0.08	2.11	2.77	0.15	2.32	0.03	0.46	0.37	0.14	0.20
Q_{mean}	0.09	3.19	4.42	0.21	3.46	0.07	0.82	0.37	0.20	0.41

Appendix B. Continued

Flow type	Location									
	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
September										
Q_{02}	0.11	4.62	6.61	0.27	4.97	0.12	1.32	0.37	0.28	0.69
Q_{10}	0.10	3.65	5.12	0.23	3.95	0.09	0.98	0.37	0.23	0.50
Q_{25}	0.09	3.19	4.42	0.21	3.46	0.07	0.82	0.37	0.20	0.41
Q_{50}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{75}	0.09	2.67	3.63	0.18	2.92	0.05	0.65	0.37	0.17	0.31
Q_{90}	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
Q_{98}	0.08	1.80	2.30	0.14	2.00	0.02	0.35	0.37	0.12	0.14
Q_{mean}	0.09	3.07	4.24	0.20	3.34	0.07	0.79	0.37	0.19	0.39
October										
Q_{02}	0.11	4.78	6.85	0.28	5.14	0.13	1.37	0.37	0.29	0.72
Q_{10}	0.10	3.85	5.44	0.24	4.16	0.10	1.05	0.37	0.24	0.54
Q_{25}	0.10	3.39	4.73	0.22	3.68	0.08	0.89	0.37	0.21	0.45
Q_{50}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{75}	0.09	2.65	3.59	0.18	2.89	0.05	0.64	0.37	0.17	0.31
Q_{90}	0.08	2.26	3.01	0.16	2.49	0.04	0.51	0.37	0.15	0.23
Q_{98}	0.08	1.70	2.14	0.14	1.89	0.02	0.31	0.37	0.11	0.12
Q_{mean}	0.09	3.06	4.23	0.20	3.33	0.07	0.78	0.37	0.19	0.39
November										
Q_{02}	0.11	4.98	7.16	0.29	5.35	0.14	1.44	0.37	0.30	0.76
Q_{10}	0.10	4.01	5.67	0.24	4.32	0.10	1.11	0.37	0.25	0.57
Q_{25}	0.10	3.60	5.04	0.23	3.89	0.09	0.96	0.37	0.22	0.49
Q_{50}	0.09	3.16	4.38	0.20	3.43	0.07	0.82	0.37	0.20	0.41
Q_{75}	0.09	2.83	3.87	0.19	3.08	0.06	0.70	0.37	0.18	0.34
Q_{90}	0.09	2.47	3.32	0.17	2.70	0.04	0.58	0.37	0.16	0.27
Q_{98}	0.08	1.80	2.30	0.14	2.00	0.02	0.35	0.37	0.12	0.14
Q_{mean}	0.10	3.55	4.96	0.22	3.84	0.08	0.95	0.37	0.22	0.48
December										
Q_{02}	0.12	5.81	8.41	0.33	6.22	0.17	1.72	0.37	0.35	0.92
Q_{10}	0.11	4.32	6.14	0.26	4.65	0.11	1.21	0.37	0.27	0.63
Q_{25}	0.10	3.70	5.20	0.23	4.00	0.09	1.00	0.37	0.23	0.51
Q_{50}	0.10	3.34	4.65	0.21	3.62	0.08	0.88	0.37	0.21	0.44
Q_{75}	0.09	2.93	4.02	0.19	3.19	0.06	0.74	0.37	0.19	0.36
Q_{90}	0.09	2.57	3.48	0.18	2.81	0.05	0.61	0.37	0.16	0.29
Q_{98}	0.08	2.06	2.69	0.15	2.27	0.03	0.44	0.37	0.13	0.19
Q_{mean}	0.10	3.90	5.50	0.24	4.21	0.10	1.07	0.37	0.24	0.55

Appendix B. Continued

Flow type	Location	
	(91)	(92)
Q_{01}	0.10	2.27
Q_{02}	0.09	2.05
Q_{05}	0.08	1.78
Q_{10}	0.07	1.61
Q_{15}	0.07	1.50
Q_{25}	0.06	1.38
Q_{40}	0.06	1.27
Q_{50}	0.06	1.21
Q_{60}	0.06	1.16
Q_{75}	0.05	1.04
Q_{85}	0.05	0.97
Q_{90}	0.04	0.89
Q_{95}	0.04	0.82
Q_{98}	0.03	0.68
Q_{99}	0.03	0.57
Q_{mean}	0.06	1.27
Low Flows		
$Q_{1,2}$	0.03	0.53
$Q_{1,10}$	0.02	0.36
$Q_{1,25}$	0.02	0.34
$Q_{1,50}$	0.02	0.34
$Q_{7,2}$	0.04	0.87
$Q_{7,10}$	0.03	0.57
$Q_{7,25}$	0.03	0.53
$Q_{7,50}$	0.03	0.53
$Q_{15,2}$	0.04	0.89
$Q_{15,10}$	0.03	0.63
$Q_{15,25}$	0.03	0.55
$Q_{15,50}$	0.03	0.55
$Q_{31,2}$	0.05	0.93
$Q_{31,10}$	0.03	0.68
$Q_{31,25}$	0.03	0.57
$Q_{31,50}$	0.03	0.55
$Q_{61,2}$	0.05	0.99
$Q_{61,10}$	0.04	0.74
$Q_{61,25}$	0.03	0.63
$Q_{61,50}$	0.03	0.59
$Q_{91,2}$	0.05	1.04
$Q_{91,10}$	0.04	0.82
$Q_{91,25}$	0.03	0.68
$Q_{91,50}$	0.03	0.66

Appendix B. Continued

Flow type	Location (91)	Location (92)
Drought Flows		
$Q_{6,10}$	0.05	0.97
$Q_{6,25}$	0.04	0.87
$Q_{6,50}$	0.04	0.82
$Q_{9,10}$	0.05	1.07
$Q_{9,25}$	0.05	1.01
$Q_{9,50}$	0.05	0.95
$Q_{12,10}$	0.06	1.18
$Q_{12,25}$	0.05	1.10
$Q_{12,50}$	0.05	1.02
$Q_{18,10}$	0.06	1.23
$Q_{18,25}$	0.05	1.14
$Q_{18,50}$	0.05	1.07
$Q_{30,10}$	0.06	1.29
$Q_{30,25}$	0.06	1.19
$Q_{30,50}$	0.05	1.14
$Q_{54,10}$	0.06	1.36
$Q_{54,25}$	0.06	1.23
$Q_{54,50}$	0.06	1.19
January		
Q_{02}	0.10	2.10
Q_{10}	0.07	1.61
Q_{25}	0.06	1.38
Q_{50}	0.06	1.21
Q_{75}	0.05	1.04
Q_{90}	0.04	0.88
Q_{98}	0.04	0.74
Q_{mean}	0.06	1.35
February		
Q_{02}	0.10	2.20
Q_{10}	0.08	1.69
Q_{25}	0.07	1.48
Q_{50}	0.06	1.27
Q_{75}	0.05	1.10
Q_{90}	0.05	0.99
Q_{98}	0.04	0.85
Q_{mean}	0.07	1.41
March		
Q_{02}	0.10	2.27
Q_{10}	0.08	1.78
Q_{25}	0.07	1.55
Q_{50}	0.06	1.38
Q_{75}	0.06	1.23
Q_{90}	0.06	1.16
Q_{98}	0.05	0.97
Q_{mean}	0.07	1.46

Appendix B. Continued

Flow type	Location (91)	Location (92)
April		
Q_{02}	0.10	2.27
Q_{10}	0.08	1.78
Q_{25}	0.07	1.59
Q_{50}	0.07	1.42
Q_{75}	0.06	1.27
Q_{90}	0.06	1.19
Q_{98}	0.05	1.01
Q_{mean}	0.07	1.46
May		
Q_{02}	0.10	2.27
Q_{10}	0.08	1.69
Q_{25}	0.07	1.45
Q_{50}	0.06	1.33
Q_{75}	0.06	1.23
Q_{90}	0.06	1.18
Q_{98}	0.05	0.99
Q_{mean}	0.07	1.40
June		
Q_{02}	0.10	2.27
Q_{10}	0.08	1.69
Q_{25}	0.07	1.44
Q_{50}	0.06	1.27
Q_{75}	0.06	1.19
Q_{90}	0.05	1.12
Q_{98}	0.05	0.97
Q_{mean}	0.06	1.29
July		
Q_{02}	0.09	1.91
Q_{10}	0.07	1.50
Q_{25}	0.06	1.31
Q_{50}	0.06	1.21
Q_{75}	0.05	1.08
Q_{90}	0.05	0.99
Q_{98}	0.04	0.82
Q_{mean}	0.06	1.18
August		
Q_{02}	0.08	1.78
Q_{10}	0.06	1.36
Q_{25}	0.06	1.19
Q_{50}	0.05	1.07
Q_{75}	0.05	0.99
Q_{90}	0.04	0.88
Q_{98}	0.03	0.68
Q_{mean}	0.05	1.08

Appendix B. Concluded

Flow type	Location (91)	(92)
September		
Q_{02}	0.07	1.61
Q_{10}	0.06	1.25
Q_{25}	0.05	1.08
Q_{50}	0.05	0.99
Q_{75}	0.04	0.89
Q_{90}	0.04	0.82
Q_{98}	0.03	0.57
Q_{mean}	0.05	1.04
October		
Q_{02}	0.08	1.67
Q_{10}	0.06	1.33
Q_{25}	0.06	1.16
Q_{50}	0.05	0.99
Q_{75}	0.04	0.88
Q_{90}	0.04	0.74
Q_{98}	0.03	0.53
Q_{mean}	0.05	1.04
November		
Q_{02}	0.08	1.74
Q_{10}	0.06	1.38
Q_{25}	0.06	1.23
Q_{50}	0.05	1.07
Q_{75}	0.05	0.95
Q_{90}	0.04	0.82
Q_{98}	0.03	0.57
Q_{mean}	0.06	1.21
December		
Q_{02}	0.09	2.05
Q_{10}	0.07	1.50
Q_{25}	0.06	1.27
Q_{50}	0.05	1.14
Q_{75}	0.05	0.99
Q_{90}	0.04	0.85
Q_{98}	0.03	0.66
Q_{mean}	0.06	1.34

Appendix C. NETWORK File Describing the Location of Streams, Control Points, Withdrawals, and Discharges in the Rock River Basin

List of Stream Names and Associated Codes

Stream name	Code
Abbot Ditch	RDHEJ
Beach Creek	RRP
Beaver Creek	RUH
Beaver Creek Tributary	RUHI
Beaver Creek Tributary	RUHJ
Big Slough Drainage Ditch	RDF
Black Lateral	RDHJ
Black Walnut Creek	RTC
Branch F Ditch	RJJ
Brown Creek	RYLG
Brush Creek	RYUM
Buffalo Creek	RLK
Bureau County Ditch	RDK1
Burlington Creek	RULQ
Canoe Creek	RF8
Case Creek	RB3
Cedar Creek	RYUC
Central Special Ditch	RDJD
Chamberlin Creek	RP6A
Clear Creek	RQ
Coal Creek	RC
Coal Creek	RDHE
Coolidge Creek	RYG
Coon Creek	RJ
Coon Creek	RUL
County Ditch	RGGA
County Ditch No. 2	RJD
County Ditch No. 2 Tributary	RJDM
Crane Grove Creek	RYQC
Deer Creek	RK
Deer Creek	RUEK
Devils Slough	RDHEG
Dry Creek	RX5
Dry Run	RDYM
East Branch South Branch Kishwaukee River Tributary	RUEP
Eagle Creek	RLP
Eakin Creek	RURQ
East Branch South Branch	RUEPA
Kiskwaukee River Tributary	RYAE
East Branch Raccoon Creek	RYAE
East Fork Mill Creek	RS5H
Elkhorn Creek	RL
Ellsworth Creek	RJ2
Elm Island Ditch	RDHED
Fairfield Ditch No. 1	RDK
Fairfield Union Special Ditch	RDL
Fivemile Creek	RLV
Franklin Creek	RP6
Franklinville Creek	RUT
French Creek	RIH
Gale Creek	RQ9
Geneseo Creek	RDE
Geryune Creek	RUKF
Green River	RD
Green River Tributary	RDG4
Green River Tributary	RDG4G
Green River Tributary	RDQ
Green River Tributary	RDR
Green River Tributary	RDT
Green River Tributary	RDU
Green River Tributary	RDV
Green River Tributary	RDX
Green River Tributary	RDXH
Green River Tributary	RDZ
Grove Creek	RYJH
Hampshire Creek	RULQD
Harmony Creek	RULP
Hickory Creek	RDHEG
Honey Creek	RRB
Honey Creek	RYY
Howland Creek	RM5
Indian Creek	RYZ
Jordan Creek	RLH
Keith Creek	RU9
Kent Creek	RV
Killbuck Creek	RUB
Killbuck Creek Tributary	RUBO
Killbuck Creek Tributary	RUBU
King Creek	RDHEI

Appendix C. Continued

Stream Names and Associated Codes Continued

Stream name	Code
Kingsbury Creek	RUEF
Kishwaukee Creek	RURJ
Kishwaukee River	RU
Kyte River	RR
Kyte River Tributary	RRD
Kyte River Tributary	RRS
Lawrence Creek	RUKR
Leaf River	RS
Leaf River Tributary	RSK
Leaf River Tributary	RSR
Little Beaver Creek	RUKO
Little Rock Creek	RIL
Lost Creek	RYQL
Lynn Creek	RIC
Main Ditch	RDOL
Main Ditch	RGG
Main Union Special Ditch	RDI
McDonald Creek	RW6
Meredosia Creek	RG
Middle Branch South Branch Kishwaukee River	RUEW
Middle Creek	RLS
Mill Creek	RB
Mill Creek	RS5
Mill Creek Tributary	RBJ
Mill Creek Tributary	RBY
Mineral Creek	RDB
Mokeler Creek	RUKN
Mosquito Creek	RDA
Mosquito Creek	RULB
Mud Creek	RDH
Mud Creek	RSH
Mud Creek	RUM
Mud Creek Tributary	RSHJ
North Branch South Branch Kishwaukee River	RUEV
North Branch Kishwaukee River	RUS
North Kinnikinnick Creek	RX1
Otter Creek	RIR
Otter Creek	RSHC
Otter Creek	RYCD
Owens Creek	RUEE
Pecatonica River	RY

Stream name	Code
Pine Creek	RP
Pine Creek Tributary	RPV
Pink Creek	RYK
Piscasaw Creek	RUK
Preston Creek	RYS
Raccoon Creek	RYA
Red Oak Ditch	RDP
Richland Creek	RYU
Rock Creek	RI
Rock Creek Tributary	RIT
Rock River	R
Rock River Tributary	RF3
Rock River Tributary	RT8
Rock Run	RYL
Rush Creek	RUN
Sevenmile Creek	RO6
Shaffer Creek	RC3
Silver Creek	RR7
Silver Creek	RYO
South Branch Kishwaukee River	RUE
South Branch Kishwaukee River Tributary	RUEA
South Branch Kishwaukee River Tributary	RUEH
South Branch Kishwaukee River(east)	RUR
South Branch Otter Creek	RYCDJ
South Fork Ditch	RJK
South Fork Kent Creek	RVB
South Kinnikinnick Creek	RX
Spring Creek	RULF
Spring Creek	RV3
Spring Creek	RDG
Spring Creek	RLC
Spring Creek Tributary	RDGM
Spring Run	RUBL
Steward Creek	RRQ
Steward Creek Tributary	RRQE
Stillman Creek	RT
Sugar Creek	RLG
Sugar River	RYC
Sumner Creek	RYJ
Threemile Branch	RM6
Trimble Run	RUEC

Appendix C. Continued

Stream Names and Associated Codes Continued

Stream name	Code	Stream name	Code
Union Creek	RURE	West Fork Elkhorn Creek	RLW
Union Ditch No 1	RUEPNB	West Pine Creek	RPT
Union Ditch No 2	RUEPN	Wildcat Ditch	RDJ
Union Drainage Ditch	RM	Willow Creek	RW
Virgil Ditch No 1	RUEPS	Willow Creek	RDY
Virgil Ditch No 2	RUEPW	Winnebago Ditch	RDO
Virgil Ditch No 3	RUEPT	Winneshiek Creek	RYN
Waddams Creek	RYX	Yellow Creek	RYQ
Waddams Creek Tributary	RYXM	Yellow Creek Tributary	RYQP
Walker Creek	RDHO	Yellow Creek Tributary	RYQPG
Walnut Creek	RDN	Yellow Creek Tributary	RYQF
West Branch Mineral Creek	RDBR	Zuma Creek	RE
West Branch Piscasaw Creek	RUKQ		

Notes:

Each stream has a unique code. Along the course of a stream it is possible for the stream name to change, but the stream code will not change. To differentiate between two streams that share the same name, use the location descriptions presented in the remainder of this appendix.

Appendix C. Continued

Watershed Characteristics at Locations of Interest in the Rock River Basin

DA(u) = Drainage area upstream of location (sq mi)
DA(d) = Drainage area downstream of location (sq mi)
K = Average subsoil permeability (inches/hr)
P-ET = Net excess precipitation for the watershed (inches), defined as average annual precipitation (P) minus evapotranspiration (ET)

ID = 0 Basic watershed information
= 1 Tributary inflow
= 2 Effluent discharge
= 3 Water supply withdrawal
= 4 Control point (full set of virgin flow estimates)
= 6 Control point (full sets of virgin and present flow estimates)
= 9 Reservoir

Region = 1 Rock River Region I
= 2 Rock River Region II
= 3 Bloomington Ridged Plain
= 4 Green River Lowland (and other areas with sandy substrata)

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Rock River (R)	170.80	3340.0	3340.0	5.00	7.70	6	1	USGS Gage 05430500 at Afton WI
	162.80	3463.0	3463.0	4.95	7.76	0	1	Illinois-Wisconsin State Line
	162.70	3463.0	3463.0	4.95	7.76	2	1	Landis Gardner Discharge
	162.60	3712.3	3712.3	4.85	7.87	0	1	at Turtle Creek
	162.20	3713.3	3713.3	4.85	7.87	2	1	South Beloit Discharge
	156.40	3720.3	3720.3	4.85	7.87	2	1	Rockton Discharge
	156.30	3720.3	6363.4	4.74	8.55	1	1	at Pecatonica River (RY)
	156.20	6363.4	6363.4	4.74	8.55	6	1	USGS Gage 05437500 Rockton
	154.21	6367.4	6367.4	4.74	8.55	0	1	
	154.20	6367.4	6403.9	4.76	8.56	1	1	at Dry Creek (RX5)
	151.70	6406.2	6406.2	4.76	8.56	2	1	Dana Corp/Warner Electric Discharge
	151.61	6406.4	6406.4	4.76	8.56	0	1	
	151.60	6406.4	6426.4	4.76	8.56	1	1	at North Kinnikinnick Creek (RX1)
	151.41	6426.5	6426.5	4.76	8.56	0	1	
	151.40	6426.5	6447.6	4.75	8.56	1	1	at South Kinnikinnick Creek (RX)
	148.61	6450.0	6450.0	4.76	8.56	0	1	
	148.60	6450.0	6461.3	4.75	8.57	1	1	at McDonald Creek (RW6)
	146.10	6474.8	6474.8	4.76	8.57	0	1	at Rock River Tributary
	145.01	6475.5	6475.5	4.76	8.57	0	1	
	145.00	6475.5	6498.5	4.76	8.57	1	1	at Willow Creek (RW)
	142.80	6510.5	6510.5	4.76	8.57	2	1	Atwood Vacuum Machinery Co. Discharge
	140.90	6511.9	6511.9	4.77	8.57	0	1	
	139.80	6520.7	6520.7	4.77	8.57	2	1	Industrial Discharges
	139.21	6522.6	6522.6	4.77	8.57	0	1	
	139.20	6522.6	6529.0	4.77	8.57	1	1	at Spring Creek (RV3)
	136.60	6532.8	6532.8	4.78	8.57	0	1	Rockford Dam
	136.51	6532.9	6532.9	4.78	8.57	0	1	
	136.50	6532.9	6578.6	4.76	8.58	1	1	at Kent Creek (RV)
	136.21	6578.7	6578.7	4.76	8.58	0	1	
	136.20	6578.7	6592.5	4.76	8.58	1	1	at Keith Creek (RU9)
	135.90	6592.7	6592.7	4.76	8.58	2	1	Valspar Corporation discharge
	135.50	6593.0	6593.0	4.76	8.58	0	1	Michigan Avenue
	133.50	6598.1	6598.1	4.76	8.58	2	1	at Rockford Discharge

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Rock River (R)	131.70	6612.5	6612.5	4.77	8.58	0	1	Beltline Road
	130.01	6615.6	6615.6	4.77	8.58	0	1	
	130.00	6615.6	7862.5	4.57	8.78	1	1	at Kishwaukee River (RU)
	128.31	7873.7	7873.7	4.57	8.78	0	1	
	128.30	7873.7	7895.0	4.56	8.79	1	1	at Rock River Tributary (RT8)
	125.70	7908.9	7908.9	4.56	8.79	0	1	at Rock River Tributary
	121.51	7917.0	7917.0	4.57	8.79	0	1	
	121.50	7917.0	7978.0	4.55	8.79	1	1	at Stillman Creek (RT)
	120.60	7979.1	7979.1	4.56	8.79	2	1	Byron Discharge
	120.30	7979.4	7979.4	4.56	8.79	0	1	Route 72
	119.80	7980.6	7980.6	4.56	8.79	2	1	Quality Metal Finishing Co. Discharge
	119.01	7981.8	7981.8	4.56	8.79	0	1	
	119.00	7981.8	8034.0	4.55	8.80	1	1	at Mill Creek (RS5)
	116.11	8039.5	8039.5	4.56	8.80	0	1	
	116.10	8039.5	8154.9	4.53	8.80	1	1	at Leaf River (RS)
	114.40	8158.2	8158.2	4.53	8.80	3	1	Commonwealth Edison Byron Withdrawal
	113.31	8167.4	8167.4	4.53	8.80	0	1	
	113.30	8167.4	8179.9	4.52	8.80	1	1	at Silver Creek (RR7)
	109.60	8189.4	8189.4	4.52	8.80	0	1	USGS Gage 05441500 at Oregon
	108.90	8190.3	8190.3	4.52	8.81	2	1	Oregon Discharge
	107.81	8191.1	8191.1	4.52	8.81	0	1	
	107.80	8191.1	8388.7	4.45	8.82	1	1	at Kyte River (RR)
	106.21	8390.3	8390.3	4.45	8.82	0	1	
	106.20	8390.3	8401.3	4.45	8.82	1	1	at Gale Creek (RQ9)
	100.61	8417.0	8417.0	4.46	8.82	0	1	
	100.60	8417.0	8434.3	4.45	8.82	1	1	at Clear Creek (RQ)
	98.31	8440.2	8440.2	4.45	8.82	0	1	
	98.30	8440.2	8488.9	4.45	8.82	1	1	at Franklin Creek (RP6)
	97.70	8493.4	8493.4	4.45	8.82	0	1	Route 2
	94.51	8496.8	8496.8	4.45	8.82	0	1	
	94.50	8496.8	8562.7	4.42	8.83	1	1	at Pine Creek (RP)
	91.21	8572.9	8572.9	4.42	8.83	0	1	
	91.20	8572.9	8593.6	4.41	8.83	1	1	at Sevenmile Creek (RO6)
	89.80	8597.7	8597.7	4.42	8.83	2	1	Dixon Correctional Center Discharge
	87.30	8605.6	8605.6	4.42	8.83	0	1	Dixon Dam
	86.50	8609.0	8609.0	4.42	8.83	2	1	Dean Foods Discharge
	85.60	8617.5	8617.5	4.42	8.83	2	1	Dixon Discharge
	79.80	8635.0	8635.0	4.42	8.83	0	1	near Nelson
	76.51	8642.2	8642.2	4.43	8.83	0	1	
	76.50	8642.2	8677.9	4.43	8.83	1	1	at Threemile Branch (RM6)
	76.20	8678.1	8719.6	4.43	8.83	1	1	at Howland Creek (RM5)
	73.60	8726.0	8726.0	4.43	8.83	3	1	Rock Falls Dam - I&M Canal Feeder
	72.90	8727.6	8727.6	4.43	8.83	2	1	N.W. Steel & Wire Company Discharge
	72.20	8729.4	8729.4	4.43	8.83	2	1	Rock Falls Discharge
	72.10	8729.4	8729.4	4.43	8.83	2	1	Sterling Discharge
	71.71	8730.0	8730.0	4.43	8.83	0	1	
	71.70	8730.0	8736.2	4.44	8.83	1	1	Union Drainage Ditch (RM)
	69.20	8739.2	8739.2	4.44	8.83	6	1	USGS Gage 05443500 at Como
	65.21	8755.1	8755.1	4.45	8.83	0	1	
	65.20	8755.1	8996.8	4.36	8.84	1	1	at Elkhorn Creek (RL)
	58.11	9011.1	9011.1	4.37	8.84	0	1	
	58.10	9011.1	9023.9	4.36	8.84	1	1	at Deer Creek (RK)
	52.40	9050.6	9050.6	4.36	8.84	0	1	Road @ Sec. 21 T20N 5E
	50.61	9052.0	9052.0	4.36	8.84	0	1	
	50.60	9052.0	9068.3	4.37	8.84	1	1	at Ellsworth Creek (RJ2)
	49.40	9069.4	9069.4	4.37	8.84	2	1	Prophetstown Discharge

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Rock River (R)	49.21	9069.6	9069.6	4.37	8.84	0	1	
	49.20	9069.6	9174.3	4.40	8.85	1	1	at Coon Creek (RJ)
	41.41	9188.6	9188.6	4.40	8.85	0	1	
	41.40	9188.6	9423.0	4.35	8.86	1	1	at Rock Creek (RI)
	38.30	9434.4	9434.4	4.35	8.86	2	1	Erie Discharge
	30.91	9454.8	9454.8	4.35	8.86	0	1	
	30.90	9454.8	9512.0	4.34	8.87	1	1	at Meredosia Creek (RG)
	29.21	9520.2	9520.2	4.34	8.87	0	1	
	29.20	9520.2	9528.2	4.34	8.87	1	1	at Canoe Creek (RF8)
	26.90	9531.0	9531.0	4.34	8.87	6	1	USGS Gage 05446500 near Joslin
	25.81	9537.3	9537.3	4.34	8.87	0	1	
	25.80	9537.3	9552.2	4.34	8.87	1	1	at Rock River Tributary (RF3)
	24.60	9555.0	9555.0	4.34	8.87	2	1	IBP Corp Discharge
	18.30	9559.0	9559.0	4.34	8.87	2	1	Moline Consumers Company Discharge
	17.21	9568.7	9568.7	4.34	8.87	0	1	
	17.20	9568.7	9599.7	4.33	8.87	1	1	at Zuma Creek (RE)
	14.50	9617.1	9617.1	4.33	8.88	0	1	Burlington Northern RR
	13.30	9619.8	9619.8	4.33	8.88	2	1	Illinois-Mississippi Canal Outfall
	13.00	10740.7	10740.7	4.25	8.93	6	1	at Green River (RD)
	9.81	10749.6	10749.6	4.25	8.93	0	1	
	9.80	10749.6	10756.7	4.25	8.93	1	1	at Shaffer Creek(RC3)
	8.51	10762.3	10762.3	4.25	8.93	0	1	
	8.50	10762.3	10788.5	4.25	8.93	1	1	at Coal Creek (RC)
	7.40	10789.3	10789.3	4.25	8.93	2	1	Moline South STP
	5.51	10796.3	10796.3	4.25	8.93	0	1	
	5.50	10796.3	10811.6	4.25	8.93	1	1	at Case Creek (RB3)
	4.70	10813.8	10813.8	4.25	8.93	0	1	Lock #30 near Milan
	3.91	10815.5	10815.5	4.25	8.93	0	1	
	3.90	10815.5	10877.8	4.25	8.94	1	1	at Mill Creek (RB)
	3.70	10881.0	10881.0	4.25	8.94	2	1	Milan STP
	1.00	10884.3	10884.3	4.25	8.94	0	1	Route 199
	0.00	10884.6	10884.6	4.23	8.94	6	1	
Mill Creek (RB)	22.80	0.0	0.0	0.70	10.45	0	3	
	22.20	7.6	7.6	0.70	10.45	0	3	Route 94
	22.11	13.3	13.3	0.70	10.44	0	3	
	22.10	13.3	17.4	0.70	10.44	1	3	at Mill Creek Tributary (RBY)
	15.20	17.5	17.5	0.70	10.44	0	3	Road @ Sec. 21 16N 2W
	12.40	26.1	26.1	0.70	10.41	0	3	above Mud Creek
	11.20	35.8	35.8	0.73	10.39	0	3	Road @ Sec. 13 16N 2W
	9.01	44.7	44.7	0.81	10.36	0	3	
	9.00	44.7	56.2	0.87	10.34	1	3	at Mill Creek Tributary (RBJ)
	1.20	62.4	62.4	0.90	10.33	0	3	USGS Gage 05448000 Milan
	0.00	62.9	62.9	0.90	10.33	0	3	
Case Creek	10.90	0.0	0.0	1.00	10.23	0	3	
(RB3)	7.00	9.5	9.5	1.00	10.23	0	3	Road @ Sec. 4 16N 1W
	0.00	15.3	15.3	1.00	10.24	0	3	
Mill Creek	7.80	0.0	0.0	1.00	10.26	0	3	
Tributary (RBJ)	3.10	7.6	7.6	1.00	10.26	0	3	Road @ Sec. 21 16N 1W
	0.00	11.5	11.5	1.00	10.26	0	3	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Mill Creek	3.00	0.0	0.0	0.70	10.43	0	3	
Tributary (RBY)	2.20	1.3	1.3	0.70	10.43	2	3	Reynolds STP
	0.00	4.1	4.1	0.70	10.43	0	3	
Coal Creek	13.90	0.0	0.0	1.00	10.10	0	3	
(RC)	6.90	8.1	8.1	1.00	10.10	0	3	at Coal Creek Tributary
	3.70	17.0	17.0	1.00	10.11	0	3	Hwy 150
	1.20	21.3	21.3	1.00	10.11	0	3	Road @ Sec. 27 17N 1W
	0.00	26.2	26.2	1.00	10.11	0	3	
Shaffer Creek	8.80	0.0	0.0	1.00	10.06	0	3	
(RC3)	4.40	4.0	4.0	1.00	10.06	0	3	
	0.00	7.1	7.1	1.00	10.06	0	3	
Green River	91.20	0.0	0.0	2.47	9.44	0	4	topographic divide
(RD)	86.31	7.7	7.7	2.47	9.44	0	4	
	86.30	7.7	24.1	2.24	9.49	1	4	at Green River Tributary (RDZ)
	85.60	29.0	29.0	2.29	9.47	0	4	at Green River Tributary
	84.00	35.9	35.9	2.34	9.46	0	4	Brooklyn Road
	82.70	43.3	43.3	2.40	9.44	0	4	Meridian Road
	80.91	52.8	52.8	2.22	9.42	0	4	
	80.90	52.8	100.1	1.77	9.51	1	4	at Willow Creek (RDY)
	79.21	109.6	109.6	1.74	9.49	0	4	
	79.20	109.6	142.0	2.06	9.47	1	4	at Green River Tributary (RDX)
	77.30	145.6	145.6	2.09	9.46	0	4	Inlet Road
	77.20	146.6	146.6	2.11	9.46	2	4	Frank Butler & Company Discharge
	76.51	153.3	153.3	2.21	9.45	0	4	
	76.50	153.3	165.1	2.31	9.43	1	4	at Green River Tributary (RDV)
	75.70	172.3	172.3	2.45	9.42	0	4	Green Wing Road
	73.40	180.4	180.4	2.71	9.41	0	4	Shaws Road
	73.10	190.4	190.4	2.67	9.39	0	4	Burlington Northern RR
	72.10	198.1	198.1	2.67	9.38	6	4	Hwy 52 at Amboy - USGS Gage 05447000
	70.00	204.5	204.5	2.65	9.37	2	4	Amboy Discharge
	68.71	206.4	206.4	2.65	9.37	0	4	
	68.70	206.4	215.8	2.68	9.35	1	4	Green River Tributary (RDU)
	67.70	219.4	219.4	2.68	9.35	0	4	Morgan Road
	62.11	232.1	232.1	2.91	9.33	0	4	
	62.10	232.1	257.2	3.01	9.30	1	4	at Green River Tributary (RDT)
	55.51	271.1	271.1	3.29	9.28	0	4	
	55.50	271.1	283.3	3.24	9.27	1	4	at Green River Tributary (RDR)
	51.31	293.2	293.2	3.33	9.26	0	4	
	51.30	293.2	304.7	3.31	9.25	1	4	at Green River Tributary (RDQ)
	50.51	305.8	305.8	3.33	9.25	0	4	
	50.50	305.8	316.7	3.29	9.24	1	4	at Red Oak Ditch (RDP)
	48.00	318.7	318.7	3.31	9.24	0	4	Interstate 88
	46.61	320.0	320.0	3.32	9.24	0	4	
	46.60	320.0	378.3	3.70	9.20	1	4	at Winnebago Ditch (RDO)
	41.31	394.8	394.8	3.76	9.20	0	4	
	41.30	394.8	434.8	4.00	9.19	1	4	at Walnut Creek (RDN)
	37.90	446.1	446.1	4.01	9.19	0	4	Road @ Sec. 1 17N 6E
	33.41	448.8	448.8	4.02	9.19	0	4	
	33.40	448.8	475.5	4.00	9.18	1	4	at Fairfield Union Special Ditch (RDL)
	32.11	480.7	480.7	4.00	9.18	0	4	
	32.10	480.7	493.4	4.00	9.18	1	4	at Bureau County Ditch (RDK1)

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Green River	31.81	493.5	493.5	4.00	9.18	0	4	
(RD)	31.80	493.5	512.9	4.00	9.18	1	4	at Fairfield Ditch No. 1 (RDK)
	28.30	526.8	526.8	4.00	9.18	0	4	Road @ Sec. 4 17N 5E
	27.51	527.8	527.8	4.00	9.18	0	4	
	27.50	527.8	552.5	4.10	9.18	1	4	at Wildcat Ditch (RDJ)
	24.81	559.9	559.9	4.10	9.19	0	4	
	24.80	559.9	586.7	4.18	9.19	1	4	at Main Union Special Ditch (RDI)
	24.51	591.6	591.6	4.18	9.19	0	4	
	24.50	591.6	833.2	4.03	9.20	1	4	at Mud Creek (RDH)
	22.01	841.4	841.4	4.03	9.27	0	4	
	22.00	841.4	854.9	4.01	9.27	1	4	at Green River Tributary (RDG4)
	20.01	857.1	857.1	4.01	9.27	0	4	
	20.00	857.1	932.4	3.95	9.29	1	4	at Spring Creek (RDG)
	15.01	953.2	953.2	3.93	9.30	0	4	
	15.00	953.2	993.4	3.90	9.30	1	4	at Big Slough Drainage Ditch (RDF)
	14.90	993.4	993.4	3.94	9.30	6	4	USGS Gage 05447500 Geneseo
	13.51	1000.0	1000.0	3.94	9.3	0	4	
	13.50	1000.0	1027.7	3.87	9.32	1	4	at Geneseo Creek (RDE)
	9.10	1046.9	1046.9	3.87	9.32	0	4	Road @ Sec. 9 17N 2E
	2.81	1059.4	1059.4	3.85	9.33	0	4	
	2.80	1059.4	1097.2	3.78	9.35	1	4	at Mineral Creek (RDB)
	2.60	1097.4	1097.4	3.78	9.35	2	4	Green Rock Discharge
	0.51	1106.8	1106.8	3.77	9.35	0	4	
	0.50	1106.8	1120.8	3.74	9.30	1	4	at Mosquito Creek (RDA)
	0.00	1120.9	1120.9	3.74	9.30	0	4	
Mosquito	10.00	0.0	0.0	0.90	10.05	0	3	
Creek (RDA)	5.20	1.6	1.6	0.90	10.04	2	3	Orion Discharge
	1.10	10.2	10.2	0.90	9.97	0	3	Road @ Sec. 3 16N 1E
	0.00	14.0	14.0	0.90	9.90	0	3	
Mineral Creek	13.50	0.0	0.0	0.90	9.80	0	3	
(RDB)	8.71	7.2	7.2	0.90	9.80	0	3	
	8.70	7.2	16.7	0.90	9.82	1	3	at West Branch Mineral Creek (RDBR)
	4.00	22.6	22.6	0.90	9.8	0	3	Route 6
	0.20	28.2	28.2	0.90	9.8	0	3	above Mud Creek
	0.00	37.8	37.8	0.90	9.83	0	3	
West Branch	8.90	0.0	0.0	0.90	9.85	0	3	
Mineral Creek	3.30	6.4	6.4	0.90	9.85	0	3	Osco Road
(RDBR)	0.00	9.5	9.5	0.90	9.83	0	3	
Geneseo	14.90	0.0	0.0	0.90	9.7	0	3	
Creek (RDE)	8.70	8.4	8.4	0.90	9.7	0	3	Road @ Sec. 31 17N 3E
	7.00	14.5	14.5	0.90	9.7	0	3	Road @ Sec. 32 17N 3E
	3.40	22.7	22.7	0.90	9.68	0	3	US Hwy 6
	2.40	23.7	23.7	0.90	9.68	2	3	Geneseo Discharge
	0.00	27.7	27.7	0.90	9.68	0	3	
Big Slough	12.20	3.0	3.0	6.00	9.32	0	1	Henry-Whiteside County Line
Drainage	9.40	9.1	9.1	6.00	9.37	0	1	Road @ Sec. 9 18N 4E
Ditch (RDF)	8.70	15.1	15.1	6.00	9.40	0	1	Route 92
	7.80	17.7	17.7	6.00	9.4	0	1	Road @ Sec. 20 18N 4E
	4.50	25.6	25.6	6.00	9.44	0	1	Road @ Sec. 36 18N 3E
	0.00	32.6	32.6	6.00	9.47	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Spring Creek	20.30	0.0	0.0	0.90	9.80	0	3	
(RDG)	15.70	5.7	5.7	0.90	9.78	0	3	Route 82
	14.60	11.8	11.8	0.90	9.76	0	3	Ulah Road
	13.30	16.7	16.7	0.90	9.74	0	3	Road @ Sec. 26 16N 3E
	12.30	26.6	26.6	0.90	9.72	0	3	Road @ Sec. 23 16N 3E
	10.01	34.6	34.6	0.90	9.70	0	3	
	10.00	34.6	50.5	0.90	9.68	1	3	at Spring Creek Tributary (RDGM)
	5.60	58.4	58.4	0.90	9.67	0	3	above Oat Creek
	5.30	65.4	65.4	0.90	9.66	0	3	Route 6
	3.30	69.1	69.1	0.90	9.65	0	3	Chicago Rock Island RR
	1.50	74.7	74.7	0.90	9.64	0	3	at Hennepin Canal
	0.00	75.3	75.3	0.90	9.64	0	3	
Green River	7.70	0.0	0.0	0.90	9.45	0	3	
Tributary	1.91	7.2	7.2	0.90	9.45	0	3	
(RDG4)	1.90	7.2	12.0	0.90	9.45	1	3	at Green River Tributary (RDG4G)
	0.00	13.5	13.5	0.90	9.45	0	3	
Green River	3.40	0.0	0.0	0.90	9.45	0	3	
Tributary	1.20	3.5	3.5	0.90	9.45	2	3	Atkinson STP
(RDG4G)	0.00	4.8	4.8	0.90	9.45	0	3	
Spring Creek	8.70	0.0	0.0	0.90	9.65	0	3	
Tributary	3.00	7.0	7.0	0.90	9.65	0	3	Road @ Sec. 32 16N 4E
(RDGM)	0.00	15.9	15.9	0.90	9.64	0	3	
Mud Creek	27.80	0.0	0.0	0.90	9.60	0	3	
(RDH)	23.20	9.0	9.0	0.90	9.60	0	3	at Tomahawk Creek
	19.10	18.0	18.0	0.90	9.60	0	3	Road @ Sec. 9 15N 5E
	15.71	24.5	24.5	0.90	9.60	0	3	
	15.70	24.5	39.6	0.90	9.61	1	1	at Walker Creek (RDHO)
	11.80	45.4	45.4	0.90	9.59	0	1	Road @ Sec. 24 16N 4E
	10.71	51.0	51.0	0.90	9.58	0	1	
	10.70	51.0	63.3	0.90	9.57	1	1	at Black Lateral (RDHJ)
	9.10	72.9	72.9	0.90	9.56	0	1	Road @ Sec. 8 16N 5E
	7.20	79.3	79.3	1.20	9.54	0	1	Hwy 32
	6.40	80.1	80.1	1.20	9.54	2	1	Annawan STP
	4.51	81.3	81.3	1.20	9.54	0	1	
	4.50	81.3	227.7	1.80	9.44	1	1	at Coal Creek (RDHE)
	3.70	237.3	237.3	1.81	9.44	0	1	Road @ Sec. 30 17N 5E
	0.00	241.6	241.6	1.82	9.44	0	1	
Coal Creek	26.30	0.0	0.0	1.20	9.60	0	3	
(RDHE)	20.60	8.8	8.8	1.20	9.60	0	3	Baltimore & Ohio RR
	18.40	13.0	13.0	1.20	9.58	0	3	Road @ Sec. 5 15N 7E
	17.30	19.4	19.4	1.23	9.56	0	3	Road @ Sec. 32 16N 7E
	14.70	23.8	23.8	1.24	9.55	2	3	Sheffield STP
	13.70	24.5	24.5	1.24	9.55	0	3	US Hwy 6
	9.51	27.1	27.1	1.24	9.53	0	3	
	9.50	27.1	36.7	1.25	9.49	1	3	at Abbot Ditch (RDHEJ)
	7.81	37.6	37.6	1.25	9.49	0	3	
	7.80	37.6	60.5	1.25	9.46	1	1	at King Creek (RDHEI)
	6.51	63.4	63.4	1.25	9.45	0	1	
	6.50	63.4	123.4	1.50	9.40	1	1	at Hickory Creek (RDHEG)
	3.41	126.3	126.3	1.51	9.39	0	1	
	3.40	126.3	138.5	1.52	9.39	1	1	at Elm Island Ditch (RDHED)
	0.00	146.4	146.4	1.53	9.39	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Elm Island	5.60	0.0	0.0	2.71	9.34	0	1	
Ditch (RDHED)	3.20	4.8	4.8	2.71	9.34	0	1	Interstate 80
	0.00	12.2	12.2	2.71	9.34	0	1	
Hickory Creek	17.20	0.0	0.0	2.07	9.25	0	1	
(RDHEG)	11.30	7.4	7.4	2.00	9.25	0	1	Road @ Sec. 15 17N 7E
	10.90	10.0	10.0	1.70	9.25	0	1	Chicago & Northwestern RR
	8.50	19.5	19.5	1.70	9.28	0	1	at Ditch No. 4
	5.01	24.6	24.6	1.70	9.30	0	1	
	5.00	24.6	42.5	1.70	9.34	1	1	at Devils Slough (RDHEGH)
	3.50	47.1	47.1	1.80	9.34	0	1	Road @ Sec. 35 17N 6E
	3.30	54.6	54.6	2.20	9.34	0	1	at Smith Ditch
	0.00	60.0	60.0	2.30	9.34	0	1	
Devils Slough	8.80	0.0	0.0	1.33	9.40	0	1	
(RGHEGH)	6.40	8.3	8.3	1.33	9.40	0	1	Interstate 80
	0.00	17.9	17.9	1.32	9.40	0	1	
Kings Creek	8.80	0.0	0.0	1.25	9.45	0	3	
(RDHEI)	4.40	8.4	8.4	1.25	9.45	0	3	Road @ Sec. 25 16N 5E
	1.40	17.4	17.4	1.25	9.41	0	3	
	0.00	22.9	22.9	1.25	9.40	0	3	
Abbot Ditch	6.20	0.0	0.0	1.25	9.41	0	3	
(RDHEJ)	4.00	6.4	6.4	1.25	9.41	0	3	Route 6
	0.00	9.6	9.6	1.25	9.39	0	3	
Black Lateral	6.40	0.0	0.0	0.90	9.60	0	3	
(RDHJ)	5.00	1.1	1.1	0.90	9.60	0	3	
	2.20	4.9	4.9	0.90	9.56	0	3	Road @ Sec. 22 16N 4E
	0.00	12.3	12.3	0.90	9.52	0	3	
Walker Creek	9.00	0.0	0.0	1.27	9.65	0	3	
(RDHO)	3.70	5.9	5.9	1.27	9.65	0	3	Road @ Sec. 19 15N 5E
	0.00	15.1	15.1	1.29	9.62	0	3	
Main Union	12.40	0.0	0.0	6.00	9.20	0	1	
Special Ditch	8.60	5.4	5.4	6.00	9.20	0	1	Route 78
(RDI)	6.40	11.4	11.4	6.00	9.23	0	1	Route 92
	4.70	17.1	17.1	6.00	9.25	0	1	Road @ Sec. 19 18N 5E
	0.00	26.8	26.8	6.00	9.29	0	1	
Wild Ditch	11.10	0.0	0.0	6.00	9.15	0	1	
(RDJ)	6.10	6.7	6.7	6.00	9.15	0	1	Road @ Sec. 23 18N 5E
	1.51	11.9	11.9	6.00	9.21	0	1	
	1.50	11.9	20.9	6.00	9.24	1	1	at Central Special Ditch (RDJD)
	0.00	24.7	24.7	6.00	9.25	0	1	
Central	9.30	0.0	0.0	6.00	9.26	0	1	
Special Ditch	3.20	5.4	5.4	6.00	9.26	0	1	Route 78
(RDJD)	0.00	9.0	9.0	6.00	9.27	0	1	
Fairfield Ditch	13.40	0.0	0.0	6.00	9.00	0	1	
No. 1 (RDK)	10.00	5.0	5.0	6.00	9.00	0	1	Illinois-Mississippi Canal crossing
	4.20	13.0	13.0	6.00	9.07	0	1	Road @ Sec. 19 18N 6E
	0.00	19.4	19.4	6.00	9.11	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Bureau	6.10	0.0	0.0	6.00	9.24	0	1	
County Ditch	3.20	4.3	4.3	6.00	9.24	0	1	above Connely Ditch
(RDK1)	0.00	12.7	12.7	6.00	9.20	0	1	
Fairfield Union	11.50	0.0	0.0	6.00	9.00	0	1	
Special Ditch	7.30	9.7	9.7	6.00	9.00	0	1	Illinois-Mississippi Canal
(RDL)	4.00	18.7	18.7	6.00	9.05	0	1	above Hunt Slough
	0.00	26.7	26.7	6.00	9.08	0	1	
Walnut Creek	16.30	0.0	0.0	3.76	9.10	0	1	
(RDN)	10.70	5.1	5.1	3.76	9.10	0	1	Burlington Northern RR
	7.10	10.2	10.2	5.65	9.09	2	1	Walnut Discharge
	5.60	16.4	16.4	6.00	9.07	0	1	Road @ Sec. 7 18N 7E
	2.20	21.2	21.2	5.81	9.07	0	1	above Allen Creek
	1.70	31.9	31.9	5.69	9.07	0	1	at Normandy Ditch
	0.00	40.0	40.0	5.50	9.08	0	1	
Winnebago	14.10	0.0	0.0	6.57	9.00	0	4	
Ditch (RDO)	6.11	8.3	8.3	6.57	9.00	0	4	
	6.10	8.3	47.7	4.32	9.00	1	4	at Main Ditch (RDOL)
	0.00	58.3	58.3	4.10	9.00	0	4	
Main Ditch	20.70	0.0	0.0	2.15	9.00	0	4	
(RDOL)	15.00	7.1	7.1	2.15	9.00	0	4	Burlington Northern RR
	12.20	16.7	16.7	2.16	9.00	0	4	Route 26
	7.70	25.4	25.4	2.75	9.00	0	4	Atkinson Road
	4.60	31.3	31.3	2.97	9.00	0	4	Indian Head Road
	0.00	39.4	39.4	3.84	9.00	0	4	
Red Oak Ditch	9.30	0.0	0.0	1.28	9.00	0	4	
(RDP)	3.30	7.2	7.2	1.28	9.00	0	4	Indian Head Road
	0.00	10.9	10.9	2.16	9.00	0	4	
Green River	10.80	0.0	0.0	1.62	9.00	0	4	
Tributary	5.20	5.8	5.8	1.62	9.00	0	4	Atkinson Road
(RDQ)	0.00	11.5	11.5	2.68	9.00	0	4	
Green River	8.90	0.0	0.0	1.05	9.00	0	4	
Tributary	5.30	5.8	5.8	1.05	9.00	0	4	Roger Road
(RDR)	0.00	12.2	12.2	2.27	9.00	0	4	
Green River	11.10	0.0	0.0	1.83	9.00	0	1	
Tributary	4.40	9.7	9.7	1.83	9.00	0	1	Road @ Sec. 12 19N 9E
(RDT)	1.20	19.3	19.3	3.50	9.00	0	1	Route 26
	0.00	25.1	25.1	3.95	9.00	0	1	
Green River	8.20	0.0	0.0	3.17	9.05	0	3	
Tributary	6.30	3.5	3.5	3.17	9.05	2	3	CIW Woodhaven Discharge
(RDU)	0.00	9.4	9.4	3.17	9.05	0	3	
Green River	7.20	0.0	0.0	1.37	9.15	0	4	
Tributary	3.80	5.8	5.8	1.37	9.15	0	4	Road @ Sec. 36 21N 10E
(RDV)	0.00	11.8	11.8	3.68	9.18	0	4	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Green River	9.30	0.0	0.0	1.73	9.45	0	3	
Tributary	3.70	7.2	7.2	1.73	9.45	0	3	Road @ Sec. 30 38N 1E
(RDX)	2.81	14.0	14.0	2.67	9.43	0	3	
	2.80	14.0	25.6	2.35	9.44	1	3	at Green River Tributary (RDXH)
	0.00	32.4	32.4	2.35	9.40	0	3	
Green River	8.40	0.0	0.0	1.59	9.50	0	3	
Tributary	3.80	5.8	5.8	1.59	9.50	0	3	Road @ Sec. 21 38N 1E
(RDXH)	0.00	11.6	11.6	1.97	9.45	0	3	
Willow Creek	17.60	0.0	0.0	0.84	9.70	0	3	
(RDY)	14.10	9.7	9.7	0.84	9.70	0	3	Road @ Sec. 32 T38N 2E
	12.40	15.8	15.8	0.88	9.68	0	3	at Willow Creek Tributary
	10.30	25.0	25.0	0.91	9.67	0	3	Hwy 30
	7.91	26.7	26.7	0.93	9.64	0	3	
	7.90	26.7	37.2	0.97	9.66	1	3	at Dry Run (RDYM)
	5.90	41.9	41.9	1.08	9.65	0	3	Hwy 51
	0.00	47.3	47.3	1.26	9.61	0	3	
Dry Run	9.20	0.0	0.0	0.98	9.80	0	4	
(RDYM)	4.50	6.3	6.3	0.98	9.80	0	4	Road@Sec. 15 38N 2E
	0.00	10.5	10.5	1.07	9.72	0	4	
Green River	9.00	0.0	0.0	1.53	9.60	0	4	
Tributary (RDZ)	5.60	6.0	6.0	1.53	9.60	0	4	Steward Road
	4.00	11.3	11.3	1.92	9.54	0	4	Town Hall Road
	0.00	16.4	16.4	2.13	9.51	0	4	
Zuma Creek	13.10	0.0	0.0	2.05	9.75	0	1	
(RE)	7.20	6.7	6.7	2.05	9.72	0	1	Route 2
	6.10	12.1	12.1	1.76	9.73	0	1	Interstate 88
	4.40	20.8	20.8	1.62	9.73	0	1	Road @ Sec. 21 18N 2E
	2.40	25.5	25.5	1.60	9.74	0	1	Road @ Sec. 19 18N 2E
	2.00	27.6	27.6	1.59	9.75	2	1	Falcon Farms Discharge
	0.00	31.0	31.0	1.58	9.76	0	1	
Rock River	9.70	0.0	0.0	7.87	9.56	0	1	
Tributary (RF3)	3.90	6.3	6.3	7.87	9.56	0	1	Route 92
	3.20	10.9	10.9	5.93	9.57	0	1	Road @ Sec. 15 18N 3E
	0.00	14.9	14.9	5.55	9.58	0	1	
Canoe Creek	7.40	0.0	0.0	2.00	9.65	0	1	
(RF8)	1.70	6.2	6.2	2.00	9.65	0	1	Road @ Sec. 36 19N 2E
	0.00	8.0	8.0	1.89	9.64	0	1	
Meredosia	11.70	0.0	0.0	4.86	9.58	0	1	
Creek (RG)	4.70	8.9	8.9	4.86	9.58	0	1	Cordova Road
	2.91	10.9	10.9	4.27	9.58	0	1	
	2.90	10.9	47.5	3.21	9.57	1	1	at Main Ditch (RGG)
	0.70	57.0	57.0	3.12	9.57	2	1	Hillsdale Discharge
	0.00	57.2	57.2	3.12	9.57	0	1	
Main Ditch	11.30	0.0	0.0	2.76	9.55	0	1	
(RGG)	7.10	5.9	5.9	2.76	9.55	0	1	Road @ Sec. 30 20N 4E
	2.31	10.3	10.3	3.38	9.55	0	1	
	2.30	10.3	18.2	2.63	9.55	1	1	at Mineral Springs Creek

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Main Ditch	0.11	23.6	23.6	2.76	9.56	0	1	
(RGG)	0.10	23.6	36.3	2.90	9.56	1	1	at County Ditch (RGGA)
	0.00	36.6	36.6	2.89	9.57	0	1	
County Ditch	9.30	0.0	0.0	4.23	9.58	0	1	
(RGGA)	2.30	6.5	6.5	4.23	9.58	0	1	Road @ Sec. 33 20N 3E
	0.00	12.7	12.7	3.18	9.58	0	1	
Rock Creek	54.90	0.0	0.0	1.30	9.40	0	2	
(RI)	52.60	1.8	1.8	1.30	9.40	2	2	Lanark Discharge
	50.80	9.0	9.0	1.30	9.38	0	2	Road @ Sec. 20 24N 6E
	48.00	15.2	15.2	1.30	9.38	0	2	Road @ Sec. 30 24N 6E
	44.20	24.4	24.4	1.30	9.37	0	2	Route 88
	41.80	27.4	27.4	1.30	9.37	0	2	Burlington Northern RR
	41.71	27.5	27.5	1.30	9.37	0	2	
	41.70	27.5	32.5	1.30	9.37	1	2	Rock Creek Tributary (RIT)
	39.90	35.0	35.0	1.30	9.37	0	2	Road @ Sec. 19 23N 6E
	38.20	42.8	42.8	1.30	9.37	0	2	Road @ Sec. 19 23N 6E
	35.91	45.1	45.1	1.31	9.37	0	2	
	35.90	45.1	78.7	1.31	9.35	1	2	at Otter Creek (RIR)
	33.70	82.8	82.8	1.31	9.35	0	2	USGS Gage 05445000 near Coleta
	29.90	89.8	89.8	1.32	9.35	0	2	at Little Spring Creek
	26.80	105.6	105.6	1.32	9.35	0	2	Road @ Sec. 22N 5E
	23.51	111.8	111.8	1.39	9.35	0	2	
	23.50	111.8	144.3	2.52	9.36	1	2	at Little Rock Creek (RIL)
	19.00	156.5	156.5	2.50	9.36	6	2	USGS Gage 05445500 near Morrison
	16.00	163.2	163.2	2.48	9.36	2	2	Morrison Discharge
	15.20	163.4	163.4	2.48	9.36	0	2	USGS Gage 05446000 at Morrison
	14.41	170.0	170.0	2.46	9.36	0	2	
	14.40	170.0	181.3	2.42	9.36	1	2	at French Creek (RIH)
	12.80	186.3	186.3	2.42	9.36	0	2	Road @ Sec. 31 21N 5E
	4.01	201.5	201.5	2.43	9.36	0	2	
	4.00	201.5	222.3	2.38	9.37	1	2	at Lynn Creek (RIC)
	0.60	234.1	234.1	2.36	9.37	0	2	Route 2
	0.00	234.4	234.4	2.36	9.37	0	2	
Lynn Creek	10.40	0.0	0.0	1.68	9.50	0	2	
(RIC)	2.70	9.2	9.2	1.68	9.50	0	2	Burlington Northern RR
	0.00	20.8	20.8	1.93	9.44	0	2	
French Creek	8.70	0.0	0.0	1.30	9.30	0	2	
(RIH)	4.00	5.2	5.2	1.30	9.30	0	2	Road @ Sec. 16 21N 5E
	0.00	11.3	11.3	1.76	9.33	0	2	
Little Rock	13.20	0.0	0.0	3.62	9.41	0	2	
Creek (RIL)	7.10	8.4	8.4	3.62	9.41	0	2	Whiteside-Carroll County Line
	4.40	18.8	18.8	7.08	9.40	0	2	Road @ Sec. 8 22N 5E
	3.00	26.4	26.4	5.83	9.40	0	2	Road @ Sec. 16 22N 5E
	0.00	32.5	32.5	6.43	9.39	0	2	
Otter Creek	15.80	0.0	0.0	1.30	9.35	0	2	
(RIR)	12.50	7.0	7.0	1.30	9.35	0	2	Road @ Sec. 26 24N 6E
	6.00	15.8	15.8	1.30	9.34	0	2	Road @ Sec. 16 23N 6E
	4.50	23.0	23.0	1.30	9.34	0	2	Road @ Sec. 21 23N 6E
	1.70	28.3	28.3	1.30	9.34	0	2	Road @ Sec. 30 23N 6E
	0.00	33.6	33.6	1.31	9.34	0	2	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Rock Creek	4.20	0.0	0.0	1.30	9.36	0	2	
Tributary (RIT)	1.90	2.5	2.5	1.30	9.36	2	2	Chadwick STP
	0.00	5.0	5.0	1.30	9.36	0	2	
Coon Creek	25.70	0.0	0.0	3.28	9.00	0	4	
(RJ)	20.00	7.4	7.4	3.28	9.00	0	4	Chicago Northwestern RR
	16.10	15.9	15.9	4.93	9.00	0	4	Route 40
	15.00	20.7	20.7	5.91	9.00	0	4	Buell Road
	11.30	27.4	27.4	7.01	9.00	0	4	Illinois-Mississippi Canal
	10.11	31.0	31.0	7.12	9.00	0	4	
	10.10	31.0	42.4	7.69	9.00	1	4	at South Fork Ditch (RJK)
	9.51	42.7	42.7	7.69	9.00	0	4	
	9.50	42.7	51.5	7.67	9.00	1	4	at Branch F Ditch (RJJ)
	5.60	58.7	58.7	7.68	9.01	0	4	Yorktown Road
	3.51	65.1	65.1	7.52	9.02	0	4	
	3.50	65.1	93.8	7.42	9.03	1	4	at County Ditch No. 2 (RJD)
	0.00	104.7	104.7	7.42	9.05	0	4	
Ellsworth	13.70	0.0	0.0	11.94	9.15	0	4	
Creek (RJ2)	6.00	9.0	9.0	11.94	9.15	0	4	Prophet Road
	0.00	16.3	16.3	9.34	9.17	0	4	
County Ditch	9.00	0.0	0.0	8.29	9.00	0	4	
No. 2 (RJD)	7.40	3.7	3.7	8.29	9.00	2	4	Tampico STP
	4.41	11.9	11.9	8.00	9.03	0	4	
	4.40	11.9	21.9	7.33	9.03	1	4	at County Ditch No. 2 Tributary (RJDM)
	0.00	28.7	28.7	7.19	9.06	0	4	
County Ditch	6.30	0.0	0.0	6.14	9.00	0	4	
No. 2 Tributary	3.20	4.4	4.4	6.14	9.00	0	4	Matznick Road
(RJDMF)	0.00	10.0	10.0	6.54	9.03	0	4	
Branch F Ditch	8.70	0.0	0.0	6.63	9.00	0	4	
(RJJ)	4.70	3.7	3.7	6.63	9.00	0	4	Buell Road
	0.00	8.8	8.8	7.55	9.00	0	4	
South Fork	7.20	0.0	0.0	11.70	9.00	0	4	
Ditch (RJK)	3.70	3.1	3.1	11.70	9.00	0	4	Buell Road
	0.00	11.4	11.4	9.23	9.00	0	4	
Deer Creek	9.30	0.0	0.0	1.30	9.23	0	1	
(RK)	4.30	9.0	9.0	1.30	9.23	0	1	Route 30
	0.00	12.8	12.8	1.94	9.21	0	1	
Elkhorn Creek	53.70	0.0	0.0	1.30	9.30	0	2	
(RL)	49.00	8.3	8.3	1.30	9.30	0	2	Summer Hill Road
	45.91	12.1	12.1	1.30	9.30	0	2	
	45.90	12.1	21.7	1.30	9.30	1	2	at West Fork Elkhorn Creek (RLW)
	43.81	25.6	25.6	1.30	9.30	0	2	
	43.80	25.6	39.3	1.30	9.30	1	2	at Fivemile Creek (RLV)
	41.10	46.3	46.3	1.30	9.30	0	2	Hwy 52
	36.41	53.8	53.8	1.30	9.31	0	2	
	36.40	53.8	65.2	1.30	9.31	1	2	at Middle Creek (RLS)
	33.60	68.3	68.3	1.30	9.31	0	2	Road @ Sec. 6 23N 7E

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Elkhorn Creek	30.51	75.1	75.1	1.30	9.31	0	2	
(RL)	30.50	75.1	85.6	1.30	9.31	1	2	at Eagle Creek (RLP)
	28.00	88.1	88.1	1.30	9.31	2	2	Milledgeville Discharge
	24.40	93.1	93.1	1.30	9.31	0	2	Lovers Lane Road
	22.70	99.8	99.8	1.30	9.31	0	2	Carroll-Whiteside County Line
	19.81	107.5	107.5	1.30	9.30	0	2	
	19.80	107.5	138.6	1.30	9.29	1	2	at Buffalo Creek (RLK)
	17.50	141.8	141.8	1.30	9.29	6	2	USGS Gage 05444000 near Penrose
	14.61	150.7	150.7	1.30	9.29	0	2	
	14.60	150.7	158.9	1.30	9.28	1	2	at Jordan Creek (RLH)
	12.41	166.4	166.4	1.30	9.28	0	2	
	12.40	166.4	195.6	1.30	9.25	1	2	at Sugar Creek (RLG)
	9.40	203.3	203.3	1.31	9.25	0	2	Science Ridge Road
	6.30	210.0	210.0	1.31	9.24	0	2	
	4.11	211.8	211.8	1.31	9.24	0	2	
	4.10	211.8	231.0	1.31	9.24	1	2	at Spring Creek (RLC)
	3.00	235.9	235.9	1.31	9.24	0	2	Chicago and Northwestern RR
	0.00	241.7	241.7	1.33	9.23	0	2	
Spring Creek	10.30	0.0	0.0	1.30	9.22	0	2	
(RLC)	3.40	9.6	9.6	1.30	9.22	0	2	above Spring Creek Tributary
	0.00	19.2	19.2	1.30	9.19	0	2	
Sugar Creek	13.20	0.0	0.0	1.29	9.10	0	2	
(RLG)	8.00	5.8	5.8	1.29	9.10	0	2	at Reid Creek
	5.90	16.5	16.5	1.32	9.11	0	2	Mound Hill Road
	3.30	23.1	23.1	1.32	9.12	0	2	Polo Road
	0.00	29.2	29.2	1.31	9.12	0	2	
Jordan Creek	9.30	0.0	0.0	1.30	9.20	0	2	
(RLH)	5.80	5.3	5.3	1.30	9.20	0	2	Polo Road
	0.00	8.2	8.2	1.30	9.20	0	2	
Buffalo Creek	14.50	0.0	0.0	1.30	9.30	0	2	
(RLK)	11.30	5.0	5.0	1.30	9.30	0	2	Route 52
	9.40	10.5	10.5	1.32	9.30	2	2	Polo Dischage
	6.40	18.5	18.5	1.31	9.28	0	2	Freeport Road
	4.10	26.5	26.5	1.32	9.27	0	2	Road @ Sec. 1 22N 7E
	0.00	31.1	31.1	1.32	9.26	0	2	
Eagle Creek	7.70	0.0	0.0	1.30	9.30	0	2	
(RLP)	4.60	3.7	3.7	1.30	9.30	0	2	Brookville Road
	0.00	10.5	10.5	1.30	9.30	0	2	
Middle Creek	8.00	0.0	0.0	1.30	9.33	0	2	
(RLS)	3.20	6.2	6.2	1.30	9.33	0	2	Brookville Road
	0.00	11.4	11.4	1.30	9.33	0	2	
Fivemile Creek	7.50	0.0	0.0	1.30	9.30	0	2	
(RLV)	4.60	3.4	3.4	1.30	9.30	0	2	Route 26
	4.40	5.8	5.8	1.30	9.30	0	2	Summer Hill Road
	0.00	13.7	13.7	1.30	9.30	0	2	
West Fork	5.90	0.0	0.0	1.30	9.35	0	2	
Elkhorn Creek	2.20	3.7	3.7	1.30	9.32	0	2	Fork Creek Road
(RLW)	0.00	9.6	9.6	1.30	9.31	0	2	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Union Drainage	5.10	0.0	0.0	11.19	9.00	0	4	
Ditch (RM)	4.90	0.4	0.4	11.19	9.00	2	4	Lawerence Brothers Discharge
	0.00	6.2	6.2	11.19	9.00	0	4	
Howland Creek	17.70	0.0	0.0	2.54	9.00	0	4	
(RM5)	8.30	5.5	5.5	2.54	9.00	0	4	Holye Road
	7.30	12.1	12.1	2.37	9.00	0	4	above Howland Creek Tributary
	7.20	22.0	22.0	2.38	9.00	0	4	Atkinson Road
	4.90	28.0	28.0	2.45	9.00	0	4	Long Road
	3.30	33.9	33.9	2.55	9.00	0	4	Road @ Sec. 8 20N 8E
	0.00	41.5	41.5	3.17	9.00	0	4	
Threemile	19.60	0.0	0.0	2.51	9.00	0	4	
Branch (RM6)	14.90	8.1	8.1	2.51	9.00	0	4	Red Branch Road
	13.50	15.3	15.3	2.52	9.00	0	4	Eldenn Road
	12.30	18.5	18.5	2.71	9.00	0	4	Illinois Central RR
	9.10	25.1	25.1	2.87	9.00	0	4	Interstate 88
	4.80	29.8	29.8	3.38	9.00	0	4	Walker Road
	0.00	35.7	35.7	4.24	9.00	0	4	
Sevenmile	9.50	0.0	0.0	2.43	9.20	0	1	
Creek (RO6)	7.40	9.3	9.3	2.43	9.16	0	1	Road @ Sec. 27 23N 8E
	4.40	13.3	13.3	2.22	9.15	0	1	Edgewood Road
	0.00	20.7	20.7	1.90	9.13	0	1	
Pine Creek	20.10	0.0	0.0	1.30	9.30	0	2	
(RP)	17.51	3.6	3.6	1.30	9.30	0	2	
	17.50	3.6	6.4	1.30	9.30	1	2	at Pine Creek Tributary (RPV)
	16.90	6.9	6.9	1.30	9.30	0	2	above Coon Creek
	14.51	15.9	15.9	1.30	9.30	0	2	
	14.50	15.9	32.3	1.30	9.30	1	2	at West Pine Creek (RPT)
	10.40	38.8	38.8	1.39	9.28	0	2	Road @ Sec. 4 23N 9E
	5.90	49.4	49.4	1.54	9.25	0	2	Columbian Road
	4.10	57.5	57.5	1.51	9.24	0	2	Henry Road
	0.00	65.9	65.9	1.49	9.22	0	2	
Franklin Creek	14.30	0.0	0.0	1.10	9.10	0	1	
(RP6)	10.10	7.1	7.1	1.10	9.09	0	1	Route 5
	9.20	12.5	12.5	1.23	9.09	2	1	Franklin Grove Discharge
	8.70	20.8	20.8	1.36	9.07	0	1	Chicago & Northwestern RR
	4.90	28.5	28.5	1.87	9.07	0	1	Old Mill Road
	0.11	38.2	38.2	3.09	9.07	0	1	
	0.10	38.2	48.6	3.28	9.07	1	1	at Chamberlin Creek (RP6A)
	0.00	48.7	48.7	3.28	9.07	0	1	
Chamberlin	7.80	0.0	0.0	1.35	9.05	0	1	
Creek (RP6A)	4.80	5.1	5.1	1.35	9.05	0	1	Route 38
	0.00	10.4	10.4	3.96	9.07	0	1	
West Pine	6.80	0.0	0.0	1.30	9.30	0	2	
Creek (RPT)	1.50	7.9	7.9	1.30	9.30	0	2	Route 64
	0.00	16.4	16.4	1.30	9.30	0	2	
Pine Creek	3.00	0.0	0.0	1.30	9.30	0	2	
Tributary (RPV)	0.81	0.8	0.8	1.30	9.30	2	2	Quebecor Printing Discharge
	0.80	0.8	0.8	1.30	9.30	2	2	Mt. Morris Discharge
	0.00	2.8	2.8	1.30	9.30	0	2	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Clear Creek	8.50	0.0	0.0	1.73	9.11	0	1	
(RQ)	3.50	9.7	9.7	1.73	9.11	0	1	Lowden Road
	0.00	17.3	17.3	3.70	9.11	0	1	
Gale Creek	7.60	0.0	0.0	1.30	9.20	0	2	
(RQ9)	3.20	5.9	5.9	1.30	9.20	0	2	Road @ Sec. 8 23N 10E
	0.00	11.0	11.0	2.72	9.19	0	2	
Kyte River	31.30	0.0	0.0	1.45	9.48	0	1	
(RR)	26.30	9.3	9.3	1.45	9.48	0	1	Hemstock Road
	22.81	15.8	15.8	1.76	9.49	0	1	
	22.80	15.8	27.8	1.88	9.51	1	1	at Kyte River Tributary (RRS)
	21.60	28.3	28.3	1.89	9.51	2	1	Rochelle Discharge
	20.80	36.5	36.5	1.92	9.50	0	1	at Kyte River Tributary
	19.41	39.4	39.4	1.97	9.49	0	1	
	19.40	39.4	81.7	1.75	9.53	1	1	at Steward Creek (RRQ)
	18.21	82.8	82.8	1.76	9.52	0	1	
	18.20	82.8	110.4	1.93	9.48	1	1	at Beach Creek (RRP)
	16.10	117.0	117.0	1.93	9.48	0	1	Route 38
	14.30	120.8	120.8	1.91	9.47	6	1	USGS Gage 05442000 Flagg Center
	12.50	127.2	127.2	1.89	9.46	0	1	at Kyte River Tributary
	9.60	131.3	131.3	1.87	9.46	0	1	above Kyte River Tributary
	8.40	142.2	142.2	1.84	9.44	0	1	Chana Road
	6.00	154.6	154.6	1.80	9.43	0	1	Rocky Hollow Road
	4.21	158.9	158.9	1.78	9.42	0	1	
	4.20	158.9	177.4	1.77	9.40	1	1	at Kyte River Tributary (RRD)
	2.20	182.9	182.9	1.78	9.40	2	1	Rochelle Foods Discharge
	1.81	183.1	183.1	1.78	9.40	0	1	
	1.80	183.1	194.4	1.74	9.39	1	1	at Honey Creek (RRB)
	0.00	197.6	197.6	1.73	9.39	0	1	
Silver Creek	7.70	0.0	0.0	1.23	9.30	0	2	
(RR7)	2.60	8.1	8.1	1.23	9.30	0	2	Road @ Sec. 17 24N 10E
	0.00	12.5	12.5	1.20	9.30	0	2	
Honey Creek	5.60	0.0	0.0	1.13	9.30	0	1	
(RRB)	2.50	7.7	7.7	1.13	9.30	0	1	Road @ Sec. 8 23N 11E
	0.00	11.3	11.3	1.09	9.30	0	1	
Kyte River	10.40	0.0	0.0	1.89	9.21	0	1	
Tributary (RRD)	6.80	7.5	7.5	1.89	9.21	0	1	Wood Road
	3.50	10.3	10.3	1.82	9.21	0	1	Prairie Road
	0.00	18.5	18.5	1.64	9.22	0	1	
Beach Creek	8.50	0.0	0.0	2.30	9.24	0	1	
(RRP)	7.00	1.4	1.4	2.30	9.24	2	1	Ashton Discharge
	5.30	10.5	10.5	3.28	9.33	0	1	Route 5
	3.20	19.5	19.5	2.22	9.34	0	1	Brooklyn Road
	0.00	27.6	27.6	2.43	9.36	0	1	
Steward Creek	14.80	0.0	0.0	0.98	9.70	0	1	
(RRQ)	10.10	8.4	8.4	0.98	9.69	0	1	Road @ Sec. 26 39N 2E
	7.60	15.2	15.2	0.98	9.65	0	1	Route 39
	6.00	21.4	21.4	0.99	9.62	0	1	Steward Road
	2.41	27.7	27.7	1.34	9.59	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Steward Creek	2.40	38.8	38.8	1.43	9.57	1	1	at Steward Creek Tributary (RRQE)
(RRQ)	0.00	42.3	42.3	1.54	9.56	0	1	
Steward Creek	7.50	0.0	0.0	0.98	9.60	0	1	
Tributary	3.00	4.9	4.9	0.98	9.60	0	1	Ogle-Lee County Line
(RRQE)	0.00	11.1	11.1	1.66	9.54	0	1	
Kyte River	5.00	0.0	0.0	2.16	9.55	0	1	
Tributary	0.40	6.2	6.2	2.16	9.55	0	1	Road @ Sec. 19 40N 2E
(RRS)	0.00	12.0	12.0	2.03	9.53	0	1	
Leaf River	28.60	0.0	0.0	1.30	9.30	0	2	
(RS)	21.90	8.3	8.3	1.30	9.30	0	2	Route 72
	20.50	17.7	17.7	1.30	9.30	0	2	Hollywood Road
	20.01	18.7	18.7	1.30	9.30	0	2	
	20.00	18.7	23.1	1.30	9.30	1	2	at Leaf River Tributary (RSR)
	18.80	23.3	23.3	1.30	9.30	0	2	Columbine Road
	11.11	31.8	31.8	1.37	9.30	0	2	
	11.10	31.8	48.5	1.45	9.30	1	2	at Leaf River Tributary (RSK)
	7.81	57.4	57.4	2.01	9.30	0	2	
	7.80	57.4	101.4	1.94	9.30	1	2	at Mud Creek (RSH)
	7.70	101.5	101.5	1.95	9.30	2	2	Leaf River Discharge
	7.00	102.3	102.3	2.01	9.30	4	2	USGS Gage 05441000 Leaf River
	4.40	109.2	109.2	2.25	9.30	0	2	Road @ Sec. 5 24N 10E
	0.00	115.4	115.4	2.75	9.30	0	2	
Mill Creek	13.50	0.0	0.0	1.32	9.30	0	2	
(RS5)	12.90	0.5	0.5	1.32	9.30	2	2	Seward STP
	10.00	7.5	7.5	1.32	9.30	0	2	Winnebago-Ogle County Line
	7.20	12.1	12.1	3.08	9.30	0	2	Oak Grove Road
	6.10	18.9	18.9	3.26	9.30	0	2	Water Road
	2.41	25.7	25.7	4.99	9.30	0	2	
	2.40	25.7	49.7	3.58	9.30	1	2	at East Fork Mill Creek (RS5H)
	0.00	52.2	52.2	4.00	9.30	0	2	
East Fork	10.10	0.0	0.0	1.32	9.30	0	2	
Mill Creek	6.00	5.9	5.9	1.32	9.30	0	2	Ogle-Winnebago County Line
(RS5H)	1.30	13.3	13.3	1.61	9.30	0	2	above Middle Creek
	1.10	23.2	23.2	1.70	9.30	0	2	Water Road
	0.00	24.0	24.0	2.06	9.30	0	2	
Mud Creek	12.80	0.0	0.0	1.30	9.30	0	2	
(RSH)	9.80	3.7	3.7	1.30	9.30	0	2	Brush Road
	5.80	10.0	10.0	1.26	9.30	0	2	Rock City Road
	4.71	10.7	10.7	1.26	9.30	0	2	
	4.70	10.7	23.6	1.01	9.30	1	2	at Mud Creek Tributary (RSHJ)
	4.10	25.3	25.3	1.03	9.30	0	2	Lightsville Road
	0.51	28.7	28.7	1.75	9.30	0	2	
	0.50	28.7	43.8	1.82	9.30	1	2	at Otter Creek (RSHC)
	0.00	44.0	44.0	1.86	9.30	0	2	
Otter Creek	7.90	0.0	0.0	1.04	9.30	0	2	
(RSHC)	3.60	7.5	7.5	1.04	9.30	0	2	Sumner Road
	0.00	15.1	15.1	1.95	9.30	0	2	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Mud Creek	7.70	0.0	0.0	0.75	9.30	0	2	
Tributary	6.00	1.9	1.9	0.75	9.30	2	2	German Valley Discharge
(RSHJ)	4.40	6.2	6.2	0.75	9.30	0	2	Stephenson-Ogle County Line
	0.00	12.9	12.9	0.81	9.30	0	2	
Leaf River	9.10	0.0	0.0	1.30	9.30	0	2	
Tributary	6.70	5.9	5.9	1.30	9.30	0	2	Road @ Sec. 2 24N 8E
(RSK)	2.60	12.1	12.1	1.30	9.30	0	2	Route 72
	0.00	16.7	16.7	1.61	9.30	0	2	
Leaf River	4.00	0.0	0.0	1.30	9.30	0	2	
Tributary	3.60	0.5	0.5	1.30	9.30	2	2	Forreston Discharge
(RSR)	0.00	4.4	4.4	1.30	9.30	0	2	
Stillman Creek	18.40	0.0	0.0	1.42	9.36	0	1	
(RT)	14.60	4.5	4.5	1.42	9.35	0	1	Lindenwood Road
	12.40	11.0	11.0	1.42	9.34	0	1	above Stillman Creek Tributary
	9.10	20.6	20.6	1.43	9.34	0	1	Big Mound Road
	6.90	24.9	24.9	1.56	9.34	0	1	above Stillman Creek Tributary
	4.50	32.4	32.4	2.05	9.34	2	1	Stillman Valley Discharge
	1.71	37.3	37.3	3.01	9.34	0	1	
	1.70	37.3	58.7	2.79	9.32	1	1	at Black Walnut Creek (RTC)
	0.00	61.0	61.0	3.03	9.32	0	1	
Rock River	8.50	0.0	0.0	4.80	9.39	0	1	
Tributary	5.70	6.6	6.6	4.80	9.38	0	1	Scott Road
(RT8)	2.70	13.2	13.2	4.77	9.38	0	1	Winnebago-Ogle County Line
	0.00	21.3	21.3	3.93	9.37	0	1	
Black Walnut	9.90	0.0	0.0	1.42	9.30	0	1	
Creek	6.10	6.9	6.9	1.42	9.30	0	1	Holcomb Road
(RTC)	2.80	15.6	15.6	1.42	9.30	0	1	Weld Park Road
	0.00	21.4	21.4	2.40	9.30	0	1	
Kishwaukee	64.20	0.0	0.0	2.50	10.08	0	1	
River (RU)	62.80	0.5	0.5	2.50	10.08	2	1	Woodstock Discharge
	62.10	1.1	1.1	3.59	10.09	0	1	Castle Road
	60.00	5.5	5.5	8.19	10.14	0	1	Doty Road
	57.90	9.7	9.7	5.36	10.17	0	1	Route 176
	55.40	12.4	12.4	5.90	10.18	2	1	Lakewood STP
	54.00	13.9	13.9	6.11	10.18	0	1	Route 47
	51.70	16.3	16.3	6.53	10.18	0	1	Road @ Sec. 6 43N 7E
	48.90	25.5	25.5	5.52	10.15	0	1	McCue Road
	47.80	26.5	26.5	5.63	10.15	0	1	Franklinville Road
	46.61	29.8	29.8	5.77	10.14	0	1	
	46.60	29.8	41.7	5.44	10.11	1	1	at Franklinville Creek (RUT)
	44.61	48.1	48.1	6.07	10.10	0	1	
	44.60	48.1	88.0	4.66	9.99	1	1	at North Branch Kishwaukee River (RUS)
	43.71	88.7	88.7	4.72	9.99	0	1	
	43.70	88.7	161.4	5.69	10.08	1	1	at South Br Kishwaukee River(east) (RUR)
	40.00	167.9	167.9	5.97	10.07	2	1	Marengo Discharge
	39.50	174.5	174.5	6.06	10.07	0	1	at Kishwaukee River Tributary
	35.60	183.4	183.4	6.19	10.05	0	1	Thorn Road
	32.71	186.9	186.9	6.22	10.05	0	1	
	32.70	186.9	217.9	5.71	10.00	1	1	at Rush Creek (RUN)
	32.50	219.4	219.4	5.70	10.00	0	1	Boone-McHenry County Line

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Kishwaukee	29.31	221.7	221.7	5.68	10.00	0	1	
River (RU)	29.30	221.7	241.4	5.39	9.98	1	1	at Mud Creek (RUM)
	28.10	242.3	242.3	5.39	9.97	0	1	Epworth Road
	26.51	243.1	243.1	5.38	9.97	0	1	
	26.50	243.1	396.8	5.01	9.99	1	1	at Coon Creek (RUL)
	24.91	399.6	399.6	5.00	9.99	0	1	
	24.90	399.6	527.5	4.82	9.88	1	1	at Piscasaw Creek (RUK)
	23.60	530.1	530.1	4.87	9.88	0	1	
	21.91	533.0	533.0	4.90	9.88	2	1	Belvidere Discharge
	21.90	532.9	532.9	4.89	9.88	6	1	USGS Gage 05438500 at Belvidere
	20.00	540.4	540.4	4.94	9.88	0	1	at Kishwaukee River Tributary
	16.71	552.0	552.0	5.04	9.87	0	1	
	16.70	552.0	622.5	4.69	9.83	1	1	at Beaver Creek (RUH)
	13.50	635.7	635.7	4.68	9.82	0	1	at Cherry Valley
	11.01	649.2	649.2	4.70	9.81	0	1	
	11.00	649.2	1086.8	3.24	9.89	1	1	at South Branch Kishwaukee River (RUE)
	9.60	1091.0	1091.0	3.24	9.88	6	1	USGS Gage 05440000 near Perryville
	4.90	1102.3	1102.3	3.24	9.88	0	1	Hwy 51
	2.11	1106.5	1106.5	3.24	9.88	0	1	
	2.10	1106.5	1244.1	3.08	9.84	1	1	at Killbuck Creek (RUB)
	0.00	1246.9	1246.9	3.08	9.84	0	1	
Keith Creek	13.90	0.0	0.0	1.40	9.46	0	1	
(RU9)	4.50	6.6	6.6	1.40	9.43	0	1	Alpine Road
	0.00	13.8	13.8	2.47	9.42	0	1	
Killbuck Creek	36.40	0.0	0.0	0.72	9.75	0	1	
(RUB)	31.30	9.7	9.7	0.72	9.70	0	1	South Malta Road
	29.71	12.0	12.0	0.72	9.70	0	1	
	29.70	12.0	18.5	0.72	9.69	1	1	at Killbuck Creek Tributary (RUBU)
	29.10	19.1	19.1	0.72	9.69	0	1	Ogle-DeKalb County Line
	27.30	23.8	23.8	0.72	9.67	0	1	Woodlawn Road
	24.70	31.2	31.2	0.72	9.65	0	1	Chamberlin Road
	21.11	32.9	32.9	0.72	9.64	0	1	
	21.10	32.9	45.8	1.08	9.60	1	1	at Killbuck Creek Tributary (RUBO)
	18.60	51.6	51.6	1.24	9.59	0	1	Mowers Road
	15.91	61.0	61.0	1.30	9.58	0	1	
	15.90	61.0	93.0	1.30	9.56	1	1	at Spring Run (RUBL)
	12.00	98.7	98.7	1.30	9.56	0	1	Big Mound Road
	10.50	108.7	108.7	1.31	9.55	0	1	above Killbuck Creek Tributary
	10.10	115.1	115.1	1.35	9.55	6	1	USGS Gage 05440500 nr Monroe Center
	8.00	122.5	122.5	1.44	9.54	0	1	at Killbuck Creek Tributary
	6.50	127.7	127.7	1.47	9.54	0	1	at Killbuck Creek Tributary
	1.60	135.4	135.4	1.54	9.53	0	1	Route 251
	0.00	137.6	137.6	1.58	9.53	0	1	
Spring Run	6.20	0.0	0.0	1.15	9.65	0	1	
(RUBL)	2.30	6.7	6.7	1.15	9.57	0	1	Road @ Sec. 10 41N 2E
	1.00	12.4	12.4	1.28	9.56	0	1	Chicago Northwestern RR
	0.90	22.3	22.3	1.21	9.54	0	1	at Spring Run Tributary
	0.00	32.0	32.0	1.30	9.53	0	1	
Killbuck Creek	6.70	0.0	0.0	1.75	9.56	0	1	
Tributary	4.20	8.7	8.7	1.75	9.51	0	1	at Killbuck Creek Tributary Tributary
(RUBO)	0.00	12.9	12.9	1.90	9.51	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Killbuck Creek	4.20	0.0	0.0	0.72	9.68	0	1	
Tributary	3.40	0.8	0.8	0.72	9.68	2	1	at Malta Discharge
(RUBU)	2.30	1.2	2.8	0.72	9.68	0	1	
	0.00	6.5	6.5	0.72	9.68	0	1	
South Branch	67.10	0.0	0.0	0.72	10.00	0	3	
Kishwaukee	64.00	6.4	6.4	0.72	10.02	0	3	Road @ Sec. 3 38N 3E
River (RUE)	61.60	13.2	13.2	0.72	10.04	0	3	University Road
	59.21	20.5	20.5	0.72	10.05	0	3	
	59.20	20.5	25.8	0.72	10.05	1	3	at Mid Br S Br Kishwaukee River (RUEW)
	56.11	35.7	35.7	0.75	10.06	0	3	
	56.10	35.7	50.2	0.75	10.07	1	3	at N Br S Br Kishwaukee River (RUEV)
	53.80	58.7	58.7	0.76	10.07	0	3	Gurler Road
	53.40	68.1	68.1	0.77	10.08	0	3	at South Br Kishwaukee River Tributary
	51.90	71.3	71.3	0.78	10.08	0	3	East-West Tollway
	48.51	77.0	77.0	0.79	10.08	0	3	
	48.50	77.0	77.0	0.79	10.08	4	3	USGS Gage 05439000 at DeKalb
	47.30	83.0	83.0	0.79	10.08	0	3	1st Steet
	46.80	84.8	84.8	0.79	10.08	2	3	DeKalb Discharge
	44.10	89.1	89.1	0.79	10.08	0	3	
	39.01	97.7	97.7	0.80	10.08	0	3	
	39.00	97.7	220.4	0.99	10.17	1	3	at East Br S Br Kishwaukee River (RUEP)
	37.40	226.9	226.9	0.99	10.17	0	3	North Grove Road
	34.10	233.9	233.9	0.98	10.17	0	3	Aldrich Road
	32.10	239.4	239.4	0.97	10.16	0	3	Baseline Road
	26.10	247.6	247.6	0.96	10.16	2	3	Genoa Dischage
	24.71	248.4	248.4	0.96	10.16	0	3	
	24.70	248.4	275.9	0.94	10.15	1	3	at Deer Creek (RUEK)
	19.81	285.3	285.3	0.94	10.14	0	3	
	19.80	285.3	298.4	0.94	10.13	1	3	at S Br Kishwaukee River Trib. (RUEH)
	17.80	306.5	306.5	0.94	10.12	0	3	at S Br Kishwaukee River Tributary
	15.20	311.2	311.2	0.94	10.11	2	3	Kirkland Discharge
	13.31	320.0	320.0	0.94	10.10	0	3	
	13.30	320.0	337.2	0.94	10.08	1	3	at Kingsbury Creek (RUEF)
	12.31	337.4	337.4	0.94	10.08	0	3	
	12.30	337.4	382.3	0.93	10.05	1	3	at Owens Creek (RUEE)
	11.00	384.3	384.3	0.93	10.05	6	3	USGS Gage 05439500 near Fairdale
	9.20	394.3	394.3	0.94	10.03	0	3	at South Br Kishwaukee River Tributary
	6.41	399.5	399.5	0.95	10.03	0	3	
	6.40	399.5	410.0	0.96	10.02	1	3	at Trimble Run (RUEC)
	4.10	423.4	423.4	1.02	10.00	0	3	Blomberg Road
	2.11	426.6	426.6	1.03	10.00	0	3	
	2.10	426.6	436.1	1.08	9.99	1	3	at S Br Kishwaukee River Trib. (RUEA)
	0.00	437.6	437.6	1.08	9.99	0	3	
South Branch	6.20	0.0	0.0	2.90	9.56	0	1	
Kishwaukee	2.20	3.8	3.8	2.90	9.54	0	1	Cherry Valley Road
River Trib (RUEA)	0.00	9.5	9.5	2.90	9.52	0	1	
Trimble Run	7.90	0.0	0.0	1.20	9.60	0	1	
(RUEC)	5.30	2.4	2.4	1.20	9.58	0	1	Illinois Central RR
	0.00	10.5	10.5	1.20	9.56	0	1	
Owens Creek	17.20	0.0	0.0	0.86	9.95	0	3	
(RUEE)	13.50	6.3	6.3	0.86	9.95	0	3	Rich Road
	12.40	10.4	10.4	0.86	9.94	0	3	at Owen Creek Tributary
	10.40	20.3	20.3	0.86	9.94	0	3	Route 64
	7.40	29.7	29.7	0.86	9.89	0	3	at Owen Creek Tributary

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Owens Creek	7.20	33.2	33.2	0.86	9.87	0	3	at Owen Creek Tributary
(RUEE)	3.50	37.3	37.3	0.86	9.85	0	3	Baseline Road
	1.20	44.3	44.3	0.86	9.83	0	3	Route 72
	0.00	44.9	44.9	0.86	9.82	0	3	
Kingsbury	8.10	0.0	0.0	0.75	9.67	0	3	
Creek (RUEF)	4.90	3.7	3.7	0.75	9.67	0	3	Illinois Central RR
	4.30	10.8	10.8	0.75	9.66	0	3	Boone-Dekalb County Line
	0.00	17.2	17.2	0.75	9.67	0	3	
South Branch	7.20	0.0	0.0	0.75	9.85	0	3	
Kishwaukee	3.70	7.1	7.1	0.75	9.85	0	3	Glidden Road
River Trib (RUEH)	0.00	13.1	13.1	0.75	9.85	0	3	
Deer Creek	9.50	0.0	0.0	0.75	10.12	0	3	
(RUEK)	5.80	4.6	4.6	0.75	10.10	0	3	Route 23
	3.20	15.8	15.8	0.75	10.09	2	3	A.G Communication Systems Discharge
	2.90	18.6	18.6	0.75	10.09	0	3	North State Road
	0.00	27.5	27.5	0.75	10.08	0	3	
E Branch	18.40	0.0	0.0	1.49	10.32	0	3	
S Branch	14.71	4.6	4.6	1.49	10.30	0	3	
Kishwaukee	14.70	4.6	15.9	1.16	10.31	1	3	at Virgil Ditch No 2 (RUEPW)
River (RUEP)	13.61	16.8	16.8	1.16	10.31	0	3	
	13.60	16.8	44.5	1.18	10.29	1	3	at Virgil Ditch No 3 (RUEPT)
	12.81	45.1	45.1	1.18	10.29	0	3	
	12.80	45.1	53.7	1.21	10.29	1	3	at Virgil Ditch No 1 (RUEPS)
	10.90	58.5	58.5	1.21	10.29	0	3	DeKalb-Kane County Line
	9.21	63.1	63.1	1.21	10.29	0	3	
	9.20	63.1	84.7	1.11	10.27	1	3	at Union Ditch No 2 (RUEPN)
	7.70	88.7	88.7	1.11	10.27	0	3	Barber Greene Road
	5.80	93.0	93.0	1.11	10.27	0	3	Airport Road
	4.40	100.6	100.6	1.11	10.27	0	3	
	2.60	106.1	106.1	1.11	10.26	0	3	Route 23
	1.90	108.1	108.1	1.11	10.26	2	3	Sycamore Discharge
	0.70	110.3	110.3	1.11	10.26	0	3	Motel Road
	0.11	110.5	110.5	1.11	10.26	0	3	
	0.10	110.5	122.6	1.11	10.24	1	3	at E Br Kishwaukee River Trib. (RUEPA)
	0.00	122.7	122.7	1.11	10.24	0	3	
East Branch	5.80	0.0	0.0	0.90	10.18	0	3	
Kishwaukee R.	2.80	6.7	6.7	0.90	10.14	0	3	Route 23
Trib. (RUEPA)	0.00	12.1	12.1	0.90	10.12	0	3	
Union Ditch	6.20	0.0	0.0	0.82	10.29	0	3	
No 2 (RUEPN)	2.40	3.6	3.6	0.82	10.26	0	3	Chicago and Northwestern RR
	0.31	9.6	9.6	0.82	10.25	0	3	
	0.30	9.6	21.5	0.82	10.24	1	3	at Union Ditch No 1 (RUEPNB)
	0.00	21.6	21.6	0.82	10.24	0	3	
Union Ditch	7.20	0.0	0.0	0.82	10.21	0	3	
No 1 (RUEPNB)	3.70	8.4	8.4	0.82	10.22	0	3	I 88
	0.00	11.9	11.9	0.82	10.23	0	3	
Virgil Ditch	6.80	0.0	0.0	1.40	10.32	0	3	
No 1(RUEPS)	4.20	4.5	4.5	1.40	10.31	0	3	Francis Road
	0.00	8.6	8.6	1.40	10.30	0	3	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Virgil Ditch	9.30	0.0	0.0	0.80	10.33	0	3	
No 2 (RUEPW)	5.10	3.9	3.9	0.80	10.32	0	3	Route 47
	1.50	10.2	10.2	1.00	10.31	0	3	Chicago and Northwestern RR
	0.00	11.3	11.3	1.02	10.31	0	3	
N Branch	7.20	0.0	0.0	0.76	10.00	0	3	
S Branch	2.50	5.8	5.8	0.76	10.05	0	3	University Road
Kishwaukee	0.00	14.5	14.5	0.76	10.07	0	3	
River (RUEV)								
Middle Br S Br	5.90	0.0	0.0	0.60	10.00	0	3	
Kishwaukee	3.60	1.7	1.7	0.60	10.03	0	3	Shabbona Road
River (RUEW)	0.00	5.3	5.3	0.60	10.06	0	3	
Beaver Creek	31.40	0.0	0.0	1.34	9.49	0	1	
(RUH)	26.90	8.2	8.2	1.34	9.49	0	1	Blaine Road
	23.20	17.8	17.8	1.37	9.50	0	1	above Beaver Creek Tributary
	20.50	26.0	26.0	1.48	9.50	0	1	Centerville Road
	18.81	27.6	27.6	1.61	9.50	0	1	
	18.80	27.6	32.4	1.63	9.51	1	1	at Beaver Creek Tributary (RUHJ)
	17.00	33.3	33.3	1.69	9.51	0	1	Beaverton Road
	14.70	39.3	39.3	1.75	9.51	2	1	Poplar Grove Discharge
	11.90	47.1	47.1	1.78	9.51	0	1	Route 76
	10.90	47.5	47.5	1.78	9.51	2	1	CIW-Candlewick Discharge
	10.80	47.5	52.2	1.82	9.51	1	1	at Beaver Creek Tributary (RUHI)
	9.70	53.0	53.0	1.82	9.51	0	1	Caledonia Road
	6.10	55.9	55.9	1.91	9.51	0	1	Deneen Road
	5.80	63.9	63.9	1.87	9.51	0	1	Spring Creek Road
	1.50	69.4	69.4	1.95	9.51	2	1	Schlicting and Sons Discharge
	0.00	70.5	70.5	1.96	9.51	0	1	
Beaver Creek	3.50	0.0	0.0	2.19	9.51	0	1	
Tributary (RUHI)	1.70	3.3	3.3	2.19	9.51	9	1	Candlewick Lake
	1.50	3.5	3.5	2.19	9.51	0	1	
	0.00	4.7	4.7	2.19	9.51	0	1	
Beaver Creek	3.50	0.0	0.0	1.75	9.54	0	1	
Tributary (RUHJ)	2.70	0.6	0.6	1.75	9.54	2	1	Capron Discharge
	0.00	4.8	4.8	1.75	9.54	0	1	
Piscasaw	32.20	0.0	0.0	3.50	9.50	0	1	
Creek (RUK)	28.00	9.6	9.6	3.50	9.50	6	1	USGS Gage 05438283 near Walworth, WI
	26.20	14.8	14.8	3.50	9.50	0	1	Illinois-Wisconsin State Line
	24.00	28.6	28.6	3.50	9.50	0	1	Lawrence Road
	21.31	30.0	30.0	3.46	9.51	0	1	
	21.30	30.0	51.5	3.68	9.53	1	1	at Lawrence Creek (RUKR)
	20.41	52.9	52.9	3.65	9.54	0	1	
	20.40	52.9	63.8	3.37	9.54	1	1	at West Branch Piscasaw Creek (RUKQ)
	20.20	63.9	63.9	3.36	9.54	2	1	Dean Foods Inc. Discharge
	17.01	65.6	65.6	3.30	9.54	0	1	
	17.00	65.6	78.4	2.92	9.55	1	1	at Little Beaver Creek (RUKO)
	16.41	78.7	78.7	2.91	9.55	0	1	
	16.40	78.7	88.0	2.79	9.56	1	1	at Mokeler Creek (RUKN)
	15.10	89.2	89.2	2.76	9.56	0	1	Boone-McHenry County Line
	11.70	93.9	93.9	2.92	9.56	0	1	Capron Road

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Piscasaw	6.31	100.1	100.1	3.36	9.56	0	1	
Creek (RUK)	6.30	100.1	115.7	3.77	9.57	1	1	at Geryune Creek (RUKF)
	2.80	122.9	122.9	4.08	9.57	0	1	Squaw Prairie Road
	1.40	127.0	127.0	4.15	9.57	0	1	Marengo Road
	0.00	127.9	127.9	4.23	9.57	0	1	
Geryune Creek	12.20	0.0	0.0	2.01	9.65	0	1	
(RUKF)	5.80	6.4	6.4	2.01	9.64	0	1	Boone-McHenry County Line
	3.80	12.1	12.1	4.27	9.62	0	1	Capron Road
	0.00	15.6	15.6	6.41	9.61	0	1	
Mokeler Creek	10.80	0.0	0.0	1.36	9.67	0	1	
(RUKN)	8.10	1.6	1.6	1.36	9.66	0	1	Route 173
	5.80	4.3	4.3	1.63	9.65	0	1	Road @ Sec. 35 46N 5E
	4.90	4.8	4.8	1.72	9.65	2	1	Harvard Discharge
	3.70	5.6	5.6	1.82	9.65	0	1	Flat Iron Road
	0.30	9.2	9.2	1.74	9.63	0	1	Pagles Road
	0.00	9.3	9.3	1.74	9.63	0	1	
Little Beaver	8.30	0.0	0.0	0.93	9.49	0	1	
Creek (RUKO)	3.10	6.3	6.3	0.93	9.55	0	1	Hunter Road
	0.40	12.7	12.7	0.97	9.58	0	1	McHenry-Boone County Line
	0.00	12.8	12.8	0.97	9.58	0	1	
West Branch	7.20	0.0	0.0	1.17	9.49	0	1	
Piscasaw Creek	3.40	4.7	4.7	1.17	9.55	0	1	Perkins Road
(RUKQ)	0.00	10.9	10.9	1.98	9.57	0	1	
Lawrence	8.30	0.0	0.0	6.62	9.54	0	1	
Creek (RUKR)	4.70	5.7	5.7	6.62	9.55	0	1	Yates Road
	3.30	10.7	10.7	5.27	9.55	0	1	at Lawrence Creek Tributary
	1.70	16.6	16.6	4.55	9.56	0	1	Lawrence Road
	0.00	21.5	21.5	3.99	9.57	0	1	
Coon Creek	29.10	0.0	0.0	2.46	10.26	0	1	
(RUL)	25.80	6.8	6.8	2.46	10.24	0	1	Plank Road
	21.80	16.2	16.2	1.72	10.22	0	1	Route 72
	18.70	18.6	18.6	1.80	10.21	0	1	Hemlock Road
	17.71	19.9	19.9	1.85	10.21	0	1	
	17.70	19.9	55.9	2.82	10.21	1	1	at Burlington Creek (RULQ)
	16.41	56.8	56.8	2.82	10.21	0	1	
	16.40	56.8	65.9	3.87	10.21	1	1	at Harmony Creek (RULP)
	15.60	75.5	75.5	4.60	10.19	0	1	at Coon Creek Tributary
	15.00	81.5	81.5	4.39	10.19	0	1	Coon Creek Road
	12.80	83.7	83.7	4.34	10.18	6	1	USGS Gage 05438250 at Riley
	11.90	89.8	89.8	4.99	10.17	0	1	at Riley Creek
	8.00	97.0	97.0	4.98	10.15	0	1	Grange Road
	6.70	105.6	105.6	5.41	10.13	0	1	at Coon Creek Tributary
	5.71	112.4	112.4	5.49	10.11	0	1	
	5.70	112.4	125.5	5.04	10.08	1	1	at Spring Creek (RULF)
	4.70	127.4	127.4	5.01	10.08	0	1	Garden Prairie Road
	1.01	133.7	133.7	4.91	10.06	0	1	
	1.00	133.7	151.8	4.45	10.02	1	1	at Mosquito Creek (RULB)
	0.00	153.7	153.7	4.42	10.01	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Mosquito Creek	8.50	0.0	0.0	0.99	9.75	0	1	
(RULB)	6.20	4.3	4.3	0.99	9.73	0	1	at Mosquito Creek Tributary
	5.00	12.3	12.3	1.00	9.72	0	1	Reeds Crossing Road
	0.00	18.1	18.1	1.08	9.72	0	1	
Spring Creek	9.40	0.0	0.0	0.98	9.90	0	1	
(RULF)	6.40	1.9	1.9	0.98	9.87	0	1	Hill Road
	4.00	8.5	8.5	1.19	9.86	0	1	Crawford Road
	1.00	12.6	12.6	1.13	9.85	0	1	McHenry-Boone County Line
	0.00	13.1	13.1	1.13	9.85	0	1	
Harmony Creek	7.20	0.0	0.0	8.86	10.20	0	1	
(RULP)	4.00	5.5	5.5	8.86	10.19	0	1	Harmony Road
	1.10	7.8	7.8	10.69	10.18	0	1	DeKalb-Kane County Line
	0.00	9.1	9.1	10.48	10.17	0	1	
Burlington	11.00	0.0	0.0	2.13	10.28	0	1	
Creek (RULQ)	7.70	4.9	4.9	2.13	10.27	0	1	Plank Road
	6.00	11.8	11.8	2.14	10.26	0	1	French Road
	2.90	15.1	15.1	2.20	10.25	0	1	Walker Road
	1.21	16.3	16.3	2.24	10.24	0	1	
	1.20	16.3	29.4	3.73	10.23	1	1	at Hampshire Creek (RULQD)
	0.00	36.0	36.0	3.36	10.22	6	1	at mouth of Burlington Creek
Hampshire	7.10	0.0	0.0	0.88	10.28	0	1	
Creek (RULQD)	3.80	3.3	3.3	0.88	10.24	0	1	Road @ Sec. 21 42N 6E
	3.20	5.5	5.5	1.31	10.24	2	1	Hampshire Discharge
	1.00	12.6	12.6	5.46	10.22	0	1	Walker Road
	0.00	13.1	13.1	5.58	10.22	0	1	
Mud Creek	7.40	0.0	0.0	1.99	9.72	0	1	
(RUM)	5.10	5.4	5.4	1.99	9.71	0	1	Olcott Road
	2.80	7.8	7.8	2.53	9.71	0	1	Garden Prairie Road
	1.90	16.9	16.9	2.11	9.71	0	1	Marengo Road
	0.00	19.7	19.7	2.15	9.71	0	1	
Rush Creek	15.60	0.0	0.0	1.66	9.70	0	1	
(RUN)	11.60	5.6	5.6	1.66	9.70	0	1	Marengo Road
	8.30	13.1	13.1	1.73	9.72	0	1	Bunker Hill Road
	7.00	17.4	17.4	1.88	9.73	0	1	at Rush Creek Tributary
	4.90	26.1	26.1	1.84	9.74	0	1	Fox Farm Road
	2.00	29.4	29.4	2.04	9.74	0	1	River Road
	0.00	31.0	31.0	2.63	9.74	0	1	
South Branch	19.20	0.0	0.0	9.27	10.25	0	1	
Kishwaukee	13.70	8.0	8.0	9.27	10.25	2	1	Huntley East Discharge
River(east)	13.30	9.3	9.3	9.12	10.25	0	1	Chicago and Northwestern RR
(RUR)	11.60	12.4	27.0	7.79	10.25	1	1	at Eakin Creek (RURQ)
	11.30	27.5	27.5	7.63	10.25	2	1	Huntley West discharge
	8.00	35.8	35.8	6.40	10.24	0	1	Chicago and Northwestern RR
	6.31	38.2	38.2	6.06	10.23	0	1	
	6.30	38.2	54.2	5.37	10.22	1	1	at Kishwaukee Creek (RURJ)
	5.50	54.7	54.7	5.41	10.22	0	1	Seeman Road

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
South Branch	3.71	58.6	58.6	5.85	10.21	0	1	
Kishwaukee	3.70	58.6	67.8	6.14	10.19	1	1	at Union Creek (RURE)
River(east)	3.00	71.7	71.7	6.72	10.18	2	1	Techalloy Company Discharge
(RUR)	1.00	72.1	72.1	6.78	10.18	0	1	Route 176
	0.10	72.6	72.6	6.85	10.18	0	1	Millstream Road
	0.00	72.7	72.7	6.86	10.18	0	1	
Union Creek	4.20	0.0	0.0	9.21	10.07	0	1	
(RURE)	1.20	5.7	5.7	9.21	10.07	0	1	Coal East Road
	0.00	9.2	9.2	8.00	10.07	0	1	
Kishwaukee	8.10	0.0	0.0	1.45	10.23	0	1	
Creek (RURJ)	3.40	6.7	6.7	1.45	10.20	0	1	Route 47
	2.20	14.8	14.8	3.25	10.18	0	1	South Union Road
	0.00	16.0	16.0	3.72	10.18	0	1	
Eakin Creek	9.70	0.0	0.0	6.05	10.25	0	1	
(RURQ)	3.50	5.6	5.6	6.05	10.25	0	1	Freeman Road
	2.10	6.8	6.8	7.10	10.25	0	1	Road @ Sec. 8 42N 7E
	0.00	14.6	14.6	7.11	10.25	0	1	
North Branch	18.90	0.0	0.0	1.97	9.74	0	1	
Kishwaukee	16.40	6.2	6.2	1.97	9.78	0	1	Altenburg Road
River (RUS)	14.90	10.8	10.8	2.29	9.78	0	1	Green Road
	12.50	17.2	17.2	2.62	9.79	0	1	Streit Road
	9.50	20.8	20.8	2.74	9.79	0	1	Paulsen Road
	9.00	22.2	22.2	2.70	9.79	0	1	Hwy 14
	7.90	25.2	25.2	2.57	9.79	0	1	Dunham Road
	5.20	31.2	31.2	2.40	9.81	0	1	Kishwaukee Valley Road
	0.70	39.7	39.7	2.94	9.86	0	1	Garden Valley Road
	0.00	39.9	39.9	2.95	9.86	0	1	
Franklinville	5.10	0.0	0.0	4.66	10.02	0	1	
Creek (RUT)	3.10	5.1	5.1	4.66	10.03	0	1	Davis Road
	1.30	10.6	10.6	4.60	10.03	0	1	Garden Valley Road
	0.00	11.9	11.9	4.60	10.03	0	1	
Kent Creek	12.50	0.0	0.0	1.90	9.32	0	1	
(RV)	7.50	9.7	9.7	1.90	9.34	0	1	Meridian Road
	5.10	19.0	19.0	1.93	9.35	0	1	Springfield Avenue
	1.80	29.0	29.0	2.96	9.36	2	1	Deans Food Discharge
	0.51	29.9	29.9	3.02	9.36	0	1	
	0.50	29.9	45.5	2.52	9.37	1	1	at South Fork Kent Creek (RVB)
	0.00	45.7	45.7	2.53	9.37	0	1	
Spring Creek	9.50	0.0	0.0	1.44	9.45	0	1	
(RV3)	5.40	2.4	2.4	1.44	9.43	0	1	McFarland Road
	0.00	6.4	6.4	1.88	9.42	0	1	
South Fork	10.00	0.0	0.0	1.33	9.33	0	1	
Kent Creek	5.20	5.2	5.2	1.33	9.35	0	1	Meridian Road
(RVB)	1.20	14.6	14.6	1.51	9.38	0	1	
	0.00	15.6	15.6	1.56	9.38	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Willow Creek	12.50	0.0	0.0	1.38	9.46	0	1	
(RW)	7.70	7.7	7.7	1.38	9.44	0	1	Belvidere Road
	4.60	13.2	13.2	1.43	9.44	9	1	Pierce Lake Dam
	0.90	18.9	18.9	3.61	9.43	0	1	Hwy 251
	0.00	23.0	23.0	4.70	9.43	0	1	
McDonald	9.60	0.0	0.0	1.38	9.44	0	1	
Creek (RW6)	3.60	4.3	4.3	1.48	9.43	0	1	Interstate 90
	0.00	11.3	11.3	3.20	9.42	0	1	
S. Kinnikinnick	14.40	0.0	0.0	1.38	9.46	0	1	
Creek (RX)	10.40	5.7	5.7	1.38	9.45	0	1	North Boone School Road
	6.90	11.0	11.0	1.38	9.45	0	1	Road @ Sec. 32 46N 13E
	4.00	14.6	14.6	1.44	9.44	0	1	Atwood Road
	0.00	21.1	21.1	2.63	9.43	0	1	
N. Kinnikinnick	13.80	0.0	0.0	1.38	9.45	0	1	
Creek (RX1)	10.50	5.8	5.8	1.38	9.44	0	1	Grade School Road
	7.80	10.3	10.3	1.38	9.44	0	1	Free Church Road
	0.00	20.0	20.0	3.29	9.42	0	1	
Dry Creek	16.80	0.0	0.0	3.16	9.42	0	1	
(RX5)	8.70	14.1	14.1	3.16	9.42	0	1	Illinois-Wisconsin State Line
	6.40	28.3	28.3	6.00	9.41	0	1	Middle Road
	0.00	36.5	36.5	6.00	9.41	0	1	
Pecatonica	92.80	1033.7	1033.7	6.00	9.75	6	2	USGS Gage 05434500 at Martintown
River (RY)	92.40	1035.0	1035.0	5.99	9.75	0	2	Illinois-Wisconsin State Line
	91.50	1035.6	1035.6	5.99	9.75	2	2	Winslow Discharge
	91.41	1035.7	1035.7	5.99	9.75	0	2	
	91.40	1035.7	1049.9	5.92	9.75	1	2	at Indian Creek (RYZ)
	90.21	1054.2	1054.2	5.89	9.75	0	2	
	90.20	1054.2	1089.5	5.73	9.74	1	2	at Honey Creek (RYY)
	86.80	1104.3	1104.3	5.67	9.74	0	2	at Pecatonica River Tributary
	84.00	1115.4	1115.4	5.62	9.73	0	2	at Muddy Creek
	81.41	1125.5	1125.5	5.60	9.73	0	2	
	81.40	1125.5	1146.4	5.54	9.73	1	2	at Waddams Creek (RYX)
	75.50	1158.1	1158.1	5.50	9.72	0	2	Cedarville Road
	71.71	1168.9	1168.9	5.46	9.72	0	2	
	71.70	1168.9	1295.1	5.02	9.69	1	2	at Richland Creek (RYU)
	65.71	1308.9	1308.9	4.98	9.69	0	2	
	65.70	1308.9	1324.7	4.94	9.68	1	2	at Preston Creek (RYS)
	61.90	1335.6	1335.6	4.92	9.68	6	2	USGS Gage 05435500 at Freeport
	60.90	1338.0	1338.0	4.91	9.68	2	2	Freeport Discharge
	56.91	1345.9	1345.9	4.89	9.68	0	2	
	56.90	1345.9	1538.6	4.45	9.65	1	2	at Yellow Creek (RYQ)
	50.61	1549.8	1549.8	4.43	9.64	0	2	
	50.60	1549.8	1562.7	4.41	9.64	1	2	at Silver Creek (RYO)
	48.21	1565.2	1565.2	4.41	9.64	0	2	
	48.20	1565.2	1579.4	4.38	9.64	1	2	at Winneshiek Creek (RYN)
	45.10	1585.7	1585.7	4.37	9.64	0	2	at Miller Creek
	39.31	1597.5	1597.5	4.35	9.63	0	2	
	39.30	1597.5	1651.3	4.24	9.62	1	2	at Rock Run (RYL)
	36.71	1652.8	1652.8	4.24	9.62	0	2	
	36.70	1652.8	1669.6	4.21	9.62	1	2	at Pink Creek (RYK)

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Pecatonica	34.31	1674.2	1674.2	4.20	9.62	0	2	
River (RY)	34.30	1674.2	1711.2	4.14	9.61	1	2	at Sumner Creek (RYJ)
	31.70	1715.2	1715.2	4.14	9.61	2	2	Pecatonica Discharge
	29.20	1722.5	1722.5	4.13	9.61	0	2	at Pecatonica River Tributary
	22.91	1738.6	1738.6	4.11	9.61	0	2	
	22.90	1738.6	1755.9	4.09	9.60	1	2	at Coolidge Creek (RYG)
	17.80	1770.5	1770.5	4.08	9.60	0	2	at Hungry Run
	15.40	1782.2	1782.2	4.07	9.60	0	2	at Tunnison Creek
	8.61	1791.9	1791.9	4.07	9.60	0	2	
	8.60	1791.9	2553.9	4.55	9.51	1	2	at Sugar River (RYC)
	8.50	2553.9	2553.9	4.55	9.51	6	2	USGS Gage 05437000 Shirland
	7.00	2562.3	2562.3	4.54	9.51	0	2	Road @ Sec. 30 46N 1E
	5.40	2573.3	2573.3	4.53	9.51	0	2	at Pecatonica River Tributary
	0.81	2581.8	2581.8	4.53	9.51	0	2	
	0.80	2581.8	2642.5	4.57	9.51	1	2	at Raccoon Creek (RYA)
	0.00	2643.1	2643.1	4.56	9.51	0	2	
Raccoon Creek	8.20	24.9	24.9	7.13	9.30	0	4	USGS Gage 05437140 near Beloit, WI
(RYA)	7.30	26.0	26.0	6.97	9.30	0	4	Illinois-Wisconsin State Line
	5.41	28.6	28.6	6.57	9.30	0	4	
	5.40	28.6	48.1	5.85	9.31	1	4	at East Branch Raccoon Creek (RYAE)
	0.00	60.7	60.7	6.12	9.32	0	4	
East Branch	1.20	17.8	17.8	4.80	9.33	0	4	Illinois-Wisconsin State Line
Raccoon Creek (RYAE)	0.00	19.5	19.5	4.80	9.33	0	4	
Sugar River	17.50	523.0	523.0	7.00	9.30	6	4	USGS Gage 05436500 near Brodhead
(RYC)	9.90	696.0	696.0	6.52	9.30	0	4	Illinois-Wisconsin State Line
	5.41	708.9	708.9	6.46	9.30	0	4	
	5.40	708.9	750.4	6.44	9.30	1	4	at Otter Creek (RYCD)
	0.00	762.0	762.0	6.44	9.30	0	4	
Otter Creek	17.30	0.0	0.0	1.00	9.30	0	2	
(RYCD)	10.60	8.9	8.9	1.00	9.30	0	2	Rock Grove Road
	6.50	15.5	15.5	1.67	9.30	2	2	Durand Discharge
	6.11	15.6	15.6	1.67	9.30	0	2	
	6.10	15.6	35.2	1.37	9.30	1	2	at South Branch Otter Creek (RYCDJ)
	0.00	41.5	41.5	1.55	9.30	0	2	
South Branch	11.30	0.0	0.0	0.87	9.30	0	2	
Otter Creek	5.50	5.9	5.9	0.87	9.30	9	2	Lake Summerset
(RYCDJ)	5.40	5.9	5.9	0.87	9.30	2	2	Otter Creek Utilities Discharge
	3.00	11.8	11.8	0.93	9.30	0	2	Holverston Road
	0.00	19.6	19.6	1.13	9.30	0	2	
Coolidge Creek	12.40	0.0	0.0	1.30	9.30	0	1	
(RYG)	11.60	1.0	1.0	1.30	9.30	2	1	Winnebago Discharge
	6.40	8.9	8.9	1.57	9.30	0	1	Smith Road
	0.00	17.3	17.3	1.96	9.30	0	1	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Sumner Creek	13.20	0.0	0.0	0.73	9.30	0	1	
(RYJ)	7.70	5.5	5.5	0.73	9.30	0	1	South Farwell Bridge Road
	6.90	14.5	14.5	0.86	9.30	0	1	East Greenfield Road
	3.81	18.5	18.5	1.00	9.30	0	1	
	3.80	18.5	33.5	1.27	9.30	1	1	at Grove Creek (RYJH)
	0.00	37.0	37.0	1.29	9.30	0	1	
Grove Creek	8.60	0.0	0.0	1.30	9.30	0	1	
(RYJH)	5.70	5.8	5.8	1.30	9.30	0	1	Cunningham Road
	0.00	15.0	15.0	1.59	9.30	0	1	
Pink Creek	10.20	0.0	0.0	0.36	9.30	0	1	
(RYK)	6.70	3.1	3.1	0.36	9.30	0	1	Pecatonica Road
	3.80	11.1	11.1	0.84	9.30	0	1	Stephenson-Winnebago County Line
	0.00	16.8	16.8	1.02	9.30	0	1	
Rock Run	22.20	0.0	0.0	1.34	9.30	0	2	
(RYL)	17.20	8.1	8.1	1.34	9.30	0	2	East Pleasant View Road
	14.00	12.8	12.8	1.33	9.30	0	2	North Eggert Road
	13.10	22.1	22.1	1.05	9.30	0	2	East Epplyanny Road
	11.40	23.0	23.0	1.06	9.30	2	2	Davis STP
	9.90	28.2	28.2	1.09	9.30	0	2	East Farm School Road
	5.01	34.7	34.7	1.13	9.30	0	2	
	5.00	34.7	47.3	1.13	9.30	1	2	at Brown Creek (RYLG)
	0.00	53.8	53.8	1.12	9.30	0	2	
Brown Creek	8.00	0.0	0.0	0.95	9.30	0	2	
(RYLG)	2.30	7.7	7.7	0.95	9.30	0	2	North Rock City Road
	0.00	12.6	12.6	1.11	9.30	0	2	
Winneshiek	9.90	0.0	0.0	1.11	9.30	0	2	
Creek (RYN)	8.60	0.5	0.5	1.11	9.30	2	2	Dakota Discharge
	5.00	8.7	8.7	1.11	9.30	0	2	East Winneshiek Road
	0.00	14.2	14.2	1.25	9.30	0	2	
Silver Creek	6.20	0.0	0.0	2.45	9.30	0	2	
(RYO)	2.60	5.9	5.9	2.45	9.30	0	2	East Lamm Road
	1.20	10.6	10.6	2.45	9.30	2	2	Kelly Springfield Discharge
	0.00	12.9	12.9	2.47	9.30	0	2	
Yellow Creek	51.10	0.0	0.0	0.98	9.58	0	2	
(RYQ)	47.00	5.5	5.5	0.98	9.58	0	2	Jo Daviess-Stephenson County Line
	45.70	10.2	10.2	1.03	9.59	0	2	Road @ Sec. 32 28N 5E
	42.71	17.8	17.8	1.07	9.59	0	2	
	42.70	17.8	23.4	1.05	9.60	1	2	at Yellow Creek Tributary
	36.30	31.4	31.4	1.11	9.59	0	2	West Green Bush Road
	34.00	39.4	39.4	1.12	9.58	0	2	North Kent Road
	29.61	46.8	46.8	1.12	9.57	0	2	
	29.60	46.8	65.6	1.11	9.55	1	2	at Yellow Creek Tributary (RYQP)
	26.70	73.8	73.8	1.10	9.54	0	2	Route 73
	25.30	80.9	80.9	1.06	9.54	2	2	Pearl City Discharge
	22.40	85.9	85.9	1.05	9.53	0	2	Black Road
	21.21	91.8	91.8	1.03	9.52	0	2	
	21.20	91.8	124.9	1.10	9.49	1	2	at Lost Creek (RYQL)
	17.80	133.0	133.0	1.11	9.49	0	2	at Yellow Creek Tributary

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Yellow Creek	14.40	136.8	136.8	1.12	9.49	0	2	Bolton Road
(RYQ)	11.61	143.1	143.1	1.16	9.48	0	2	
	11.60	143.1	153.8	1.21	9.47	1	2	at Yellow Creek Tributary (RYQF)
	4.41	160.0	160.0	1.24	9.47	0	2	
	4.40	160.0	184.4	1.32	9.45	1	2	at Crane Grove Creek (RYQC)
	1.10	188.1	188.1	1.34	9.45	0	2	Hwy 20
	0.00	192.7	192.7	1.37	9.44	0	2	
Crane Grove	9.20	0.0	0.0	1.26	9.34	0	2	
Creek (RYQC)	6.90	3.2	3.2	1.26	9.33	0	2	Illinois Central RR
	4.00	10.8	10.8	1.46	9.33	0	2	Crane Grove Road
	2.10	14.9	14.9	1.58	9.33	0	2	at South Walnut Creek
	0.00	24.4	24.4	1.85	9.33	0	2	
Yellow Creek	7.60	0.0	0.0	1.31	9.35	0	2	
Tributary (RYQF)	3.80	5.6	5.6	1.37	9.35	0	2	Florence Road
	0.00	10.7	10.7	1.84	9.35	0	2	
Lost Creek	14.10	0.0	0.0	1.30	9.35	0	2	
(RYQL)	13.40	1.5	1.5	1.30	9.35	2	2	Shannon Discharge
	9.00	10.2	10.2	1.30	9.36	0	2	Florence Road
	6.40	15.6	15.6	1.30	9.36	0	2	Shannon Road
	3.10	23.0	23.0	1.32	9.37	0	2	Road @ Sec. 25 26N 6E
	1.40	24.7	24.7	1.31	9.37	0	2	above Boone Branch
	0.00	33.1	33.1	1.30	9.39	0	2	
Yellow Creek	9.40	0.0	0.0	1.05	9.52	0	2	
Tributary (RYQP)	3.20	7.0	7.0	1.05	9.52	0	2	West Green Bush Road
	2.41	7.4	7.4	1.05	9.52	0	2	
	2.40	7.4	17.3	1.06	9.51	1	2	at Yellow Creek Tributary (RYQPG)
	0.00	18.8	18.8	1.08	9.51	0	2	
Yellow Creek	3.90	0.0	0.0	1.08	9.51	0	2	
Trib. (RYQPG)	0.40	0.6	0.6	1.08	9.51	2	2	Lena Discharge
	0.00	9.9	9.9	1.08	9.51	0	2	
Preston Creek	7.80	0.0	0.0	1.33	9.43	0	2	
(RYS)	2.40	5.8	5.8	1.33	9.40	0	2	North Harlem Center Road
	1.60	15.4	15.4	1.35	9.39	0	2	Hwy 20
	0.00	15.8	15.8	1.35	9.39	0	2	
Richland Creek	33.90	0.0	0.0	1.03	9.41	0	2	
(RYU)	21.00	41.9	41.9	1.03	9.41	0	2	Illinois-Wisconsin State Line
	20.00	53.5	53.5	1.03	9.41	0	2	at East Branch Richland Creek
	17.20	61.3	61.3	0.96	9.41	2	2	Orangeville Discharge
	15.41	64.5	64.5	0.94	9.41	0	2	
	15.40	64.5	74.2	0.89	9.41	1	2	at Brush Creek (RYUM)
	10.00	81.9	81.9	0.91	9.41	0	2	Richland Road
	3.71	90.9	90.9	0.92	9.41	0	2	
	3.70	90.9	123.4	0.95	9.41	1	2	at Cedar Creek (RYUC)
	0.00	126.2	126.2	0.96	9.41	6	2	

Appendix C. Continued

Stream (code)	Mileage	DA(u)	DA(d)	K	P-ET	ID	Region	Location description
Cedar Creek	17.00	0.0	0.0	0.70	9.35	0	2	
(RYUC)	12.70	5.3	5.3	0.70	9.35	0	2	Road @ Sec. 11 28N 8E
	7.30	14.4	14.4	0.98	9.35	0	2	East Angle Road
	6.80	18.5	18.5	0.93	9.35	0	2	at Cedar Creek Tributary
	4.70	25.0	25.0	0.98	9.36	0	2	at Coon Creek
	1.50	31.1	31.1	1.00	9.37	2	2	Cedarville STP
	0.00	32.5	32.5	1.01	9.37	0	2	
Brush Creek	7.80	0.0	0.0	0.49	9.35	0	2	
(RYUM)	3.30	5.7	5.7	0.49	9.38	0	2	North Henderson Road
	0.00	9.7	9.7	0.58	9.39	0	2	
Waddams	10.80	0.0	0.0	2.81	9.48	0	2	
Creek (RYX)	7.60	3.7	3.7	2.81	9.48	0	2	Lake Le-Aqua-Na
	5.61	7.0	7.0	2.81	9.48	0	2	
	5.60	7.0	10.6	2.17	9.48	1	2	at Waddams Creek Tributary (RYXM)
	5.30	10.8	10.8	2.17	9.48	0	2	IL Rte 73
	4.20	11.9	15.4	2.14	9.47	0	2	
	2.50	17.8	17.8	2.13	9.47	0	2	North Unity Road
	0.00	20.9	20.9	2.11	9.47	0	2	
Waddams	2.40	0.0	0.0	0.94	9.50	0	2	
Creek Tributary	1.80	0.4	0.4	0.94	9.49	0	2	
(RYXM)	0.00	3.6	3.6	0.94	9.48	0	2	
Honey Creek	1.60	32.8	32.8	0.97	9.52	0	2	
(RYY)	1.00	33.3	33.3	0.97	9.52	0	2	Illinois-Wisconsin State Line
	0.00	35.3	35.3	0.97	9.52	0	2	
Indian Creek	10.90	0.0	0.0	0.50	9.55	0	2	
(RYZ)	6.00	5.8	5.8	0.50	9.55	0	2	West Warren Road
	2.80	11.2	11.2	0.43	9.55	0	2	Illinois-Wisconsin State Line
	0.00	14.2	14.2	0.43	9.55	0	2	

Notes:
Br - Branch
PWS – Public Water Supply
Sec. – Section
STP – Sanitary Treatment Plant
Trib. – Tributary

Appendix D. Coefficients for Virgin Flow Equations

The mean flow for a stream location (Q_{mean}) is computed as: Q_{mean} = 0.0738 DA (P-ET), where the drainage area (DA) and net excess precipitation (P-ET) are included in the NETWORK file, listed in appendix C.

The flow values for the remaining flow parameters, designated by Q_x, are computed using the following equation:

$$Q_x = \max \{ Q_{mean} [a + b\ DA + c\ K] - 0.05, 0\}$$

where K is the average soil permeability for the watershed, also included in the NETWORK file (see Appendix C), and the coefficients a, b, and c are defined in the following table.

Flow type	Rock River Region I				Rock River Region II			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
Q_{01}	15.446193	-0.00273282	-1.480000	1.3617	9.321686	-0.00270827	0	1.1549
Q_{02}	8.243981	-0.00115563	-0.460000	0.5524	5.661813	-0.00099636	0	1.0999
Q_{05}	3.977140	-0.00021000	-0.104000	0.2560	2.666236	0.00015401	0	0.4341
Q_{10}	2.312780	-0.00001767	-0.034300	0.1425	1.658108	0.00018053	0	0.1526
Q_{15}	1.517062	0.00010778	0.006050	0.0492	1.299976	0.00014017	0	0.0794
Q_{25}	0.835724	0.00014973	0.036800	0.0321	0.920110	0.00015130	0	0.0544
Q_{40}	0.424653	0.00012812	0.044200	0.0355	0.648792	0.00013110	0	0.0752
Q_{50}	0.284207	0.00010161	0.043200	0.0274	0.525046	0.00013083	0	0.0818
Q_{60}	0.170568	0.00009976	0.042200	0.0227	0.436264	0.00011865	0	0.0854
Q_{75}	0.092803	0.00007128	0.032100	0.0174	0.332909	0.00009165	0	0.0798
Q_{85}	0.085874	0.00004800	0.018000	0.0225	0.270747	0.00007523	0	0.0703
Q_{90}	0.085096	0.00003748	0.011100	0.0231	0.236420	0.00006949	0	0.0628
Q_{95}	0.082688	0.00003817	0.003630	0.0243	0.202657	0.00006138	0	0.0548
Q_{98}	0.066684	0.00003187	0.002900	0.0275	0.168286	0.00005536	0	0.0500
Q_{99}	0.059380	0.00002808	0.002470	0.0305	0.147547	0.00005311	0	0.0539
Low Flows								
$Q_{1,2}$	0.021828	0.00006065	0.021000	0.0176	0.235204	0.00007652	0	0.0762
$Q_{1,10}$	0.017136	0.00005202	0.004810	0.0147	0.134436	0.00004585	0	0.0479
$Q_{1,25}$	0.013235	0.00004152	0.003780	0.0097	0.101496	0.00004084	0	0.0415
$Q_{1,50}$	0.009659	0.00003894	0.003480	0.0071	0.080725	0.00005036	0	0.0437
$Q_{7,2}$	0.029875	0.00005515	0.023100	0.0168	0.254796	0.00008672	0	0.0786
$Q_{7,10}$	0.021193	0.00004981	0.006430	0.0154	0.148952	0.00006236	0	0.0449
$Q_{7,25}$	0.014159	0.00004111	0.006060	0.0108	0.118423	0.00004963	0	0.0365
$Q_{7,50}$	0.008569	0.00003826	0.006390	0.0076	0.098111	0.00005580	0	0.0385
$Q_{15,2}$	0.038744	0.00005115	0.025400	0.0171	0.272719	0.00008651	0	0.0870
$Q_{15,10}$	0.027067	0.00004267	0.007860	0.0141	0.159699	0.00006523	0	0.0462
$Q_{15,25}$	0.018117	0.00003503	0.007470	0.0098	0.129243	0.00005284	0	0.0372
$Q_{15,50}$	0.009845	0.00003293	0.008600	0.0073	0.106279	0.00006165	0	0.0384
$Q_{31,2}$	0.047497	0.00005869	0.027200	0.0166	0.299307	0.00008835	0	0.0911
$Q_{31,10}$	0.040416	0.00003677	0.008360	0.0164	0.177825	0.00006721	0	0.0512
$Q_{31,25}$	0.027965	0.00003131	0.008050	0.0124	0.143404	0.00005690	0	0.0409
$Q_{31,50}$	0.016183	0.00003033	0.009690	0.0114	0.120436	0.00006320	0	0.0388
$Q_{61,2}$	0.100237	0.00002193	0.030800	0.0312	0.350282	0.00008041	0	0.0994
$Q_{61,10}$	0.056136	0.00003568	0.008510	0.0180	0.207390	0.00006415	0	0.0578
$Q_{61,25}$	0.037660	0.00003148	0.009270	0.0153	0.172561	0.00005114	0	0.0466
$Q_{61,50}$	0.019664	0.00003135	0.012200	0.0146	0.145269	0.00005835	0	0.0407
$Q_{91,2}$	0.099552	0.00000231	0.044800	0.0381	0.390106	0.00007727	0	0.0995
$Q_{91,10}$	0.072676	0.00003145	0.008030	0.0222	0.231128	0.00005956	0	0.0641
$Q_{91,25}$	0.047866	0.00002757	0.010300	0.0192	0.193161	0.00004719	0	0.0521
$Q_{91,50}$	0.030959	0.00002732	0.013000	0.0186	0.165724	0.00005403	0	0.0431

Appendix D. Continued

Flow type	Rock River Region I				Rock River Region II			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
Drought Flows								
$Q_{6,10}$	0.139764	0.00000348	0.006040	0.0332	0.276605	0.00004083	0	0.0670
$Q_{6,25}$	0.119102	0.00000436	0.004170	0.0249	0.239603	0.00003145	0	0.0576
$Q_{6,50}$	0.097162	0.00000675	0.006520	0.0255	0.222131	0.00003071	0	0.0539
$Q_{9,10}$	0.189805	0.00004061	0.007020	0.0351	0.356089	0.00001788	0	0.0670
$Q_{9,25}$	0.161036	0.00003616	0.004330	0.0209	0.298558	0.00001694	0	0.0591
$Q_{9,50}$	0.132231	0.00004206	0.005750	0.0185	0.260943	0.00003106	0	0.0527
$Q_{12,10}$	0.331018	0.00005461	-0.004170	0.0813	0.448411	0.00001693	0	0.0618
$Q_{12,25}$	0.251094	0.00004582	-0.002350	0.0608	0.352744	0.00001456	0	0.0526
$Q_{12,50}$	0.193388	0.00004687	0.004760	0.0444	0.303967	0.00002589	0	0.0510
$Q_{18,10}$	0.409835	0.00003239	0.001120	0.1201	0.568663	-0.00003612	0	0.0910
$Q_{18,25}$	0.311455	0.00002804	-0.002710	0.0840	0.411828	-0.00001690	0	0.0727
$Q_{18,50}$	0.244341	0.00003886	0.001920	0.0781	0.350404	-0.00000071	0	0.0585
$Q_{30,10}$	0.569708	0.00007753	0.001110	0.1229	0.674737	-0.00000293	0	0.0898
$Q_{30,25}$	0.419454	0.00005235	-0.003210	0.0815	0.502799	0.00000963	0	0.0742
$Q_{30,50}$	0.359144	0.00002557	-0.005850	0.0790	0.435561	0.00002695	0	0.0484
$Q_{54,10}$	0.825334	0.00006644	-0.004500	0.0378	0.926290	-0.00000510	0	0.1285
$Q_{54,25}$	0.600045	0.00003911	-0.007270	0.0227	0.661416	0.00001695	0	0.0997
$Q_{54,50}$	0.507322	-0.00000300	-0.004280	0.0347	0.550934	0.00003169	0	0.0619
January								
Q_{02}	10.659233	-0.00014118	-1.310000	1.4616	6.145448	-0.00197268	0	1.8584
Q_{10}	2.197524	0.00025871	-0.226000	0.1609	1.410803	-0.00004596	0	0.2094
Q_{25}	0.781239	0.00022991	-0.043900	0.0746	0.729797	0.00010661	0	0.0664
Q_{50}	0.207249	0.00013823	0.031600	0.0214	0.443041	0.00009094	0	0.0792
Q_{75}	0.075863	0.00007065	0.033200	0.0233	0.294092	0.00007098	0	0.0699
Q_{90}	0.081529	0.00000986	0.009750	0.0316	0.224102	0.00004728	0	0.0592
Q_{98}	0.074868	0.00001135	-0.001110	0.0315	0.152472	0.00003142	0	0.0389
Q_{mean}	1.169361	0.00007231	-0.105000	0.0880	0.941154	-0.00011937	0	0.1035
February								
Q_{02}	21.794811	-0.00165192	-3.220000	1.7114	12.153880	-0.00520642	0	3.5584
Q_{10}	4.153699	-0.00003240	-0.432000	0.7872	2.944738	-0.00030388	0	1.5612
Q_{25}	1.000806	0.00014893	-0.015200	0.0454	1.058545	0.00009993	0	0.1868
Q_{50}	0.411999	0.00007162	0.012200	0.0634	0.513281	0.00011862	0	0.0568
Q_{75}	0.117929	0.00007190	0.029600	0.0385	0.325104	0.00008038	0	0.0619
Q_{90}	0.083209	0.00005744	0.005800	0.0252	0.245280	0.00005592	0	0.0514
Q_{98}	0.078266	0.00003849	-0.002020	0.0292	0.170670	0.00005020	0	0.0377
Q_{mean}	2.125810	-0.00003470	-0.243000	0.1444	1.511287	-0.00028711	0	0.3444
March								
Q_{02}	26.722454	-0.00140283	-4.320000	4.1072	13.079785	-0.00415878	0	1.4912
Q_{10}	5.679391	-0.00023739	-0.399000	0.4954	3.390096	0.00069753	0	0.6956
Q_{25}	2.066658	0.00021916	-0.047000	0.2904	1.445253	0.00059255	0	0.2024
Q_{50}	0.832468	0.00026986	0.031600	0.1897	0.841025	0.00024905	0	0.0672
Q_{75}	0.257750	0.00012381	0.072300	0.1055	0.526231	0.00016363	0	0.0498
Q_{90}	0.134849	0.00004107	0.055300	0.0294	0.341658	0.00008912	0	0.0405
Q_{98}	0.091389	0.00003394	0.029100	0.0421	0.250461	0.00006622	0	0.0618
Q_{mean}	2.784950	-0.00001925	-0.241000	0.2450	1.789098	0.00007093	0	0.1542

Appendix D. Continued

Flow type	Rock River Region I				Rock River Region II			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
April								
Q_{02}	6.684942	-0.00158760	0.381000	1.0605	4.808636	-0.00021599	0	1.2492
Q_{10}	3.489223	-0.00005871	-0.022800	0.3055	2.113013	0.00022133	0	0.4736
Q_{25}	2.024634	0.00002507	-0.022500	0.2416	1.356899	0.00014473	0	0.1855
Q_{50}	0.748917	0.00011282	0.088400	0.1687	0.851704	0.00012622	0	0.0561
Q_{75}	0.295802	0.00008391	0.094100	0.1307	0.547580	0.00009548	0	0.0358
Q_{90}	0.173901	0.00005658	0.060800	0.0557	0.372529	0.00009341	0	0.0321
Q_{98}	0.077395	0.00005872	0.035000	0.0291	0.259848	0.00008203	0	0.0527
Q_{mean}	1.487099	-0.00006749	0.060700	0.0628	1.186409	0.00011145	0	0.1438
May								
Q_{02}	6.601874	-0.00147301	0.063200	1.4118	5.092021	-0.00085375	0	1.7435
Q_{10}	2.757403	0.00019915	-0.049000	0.3518	2.075814	-0.00005351	0	0.4700
Q_{25}	1.392963	0.00019887	0.000339	0.1075	1.240759	0.00002262	0	0.1476
Q_{50}	0.654231	0.00017089	0.026300	0.0782	0.763097	0.00005067	0	0.0374
Q_{75}	0.256404	0.00009228	0.056700	0.0798	0.471564	0.00007746	0	0.0236
Q_{90}	0.132346	0.00011173	0.037900	0.0376	0.314486	0.00008103	0	0.0375
Q_{98}	0.078937	0.00005629	0.028400	0.0325	0.219996	0.00007120	0	0.0460
Q_{mean}	1.232167	0.00008517	0.005740	0.0892	1.166595	-0.00005605	0	0.1640
June								
Q_{02}	9.287842	-0.00192019	-0.433000	0.7202	7.187609	-0.00260111	0	1.1660
Q_{10}	2.508441	0.00000273	0.001240	0.1905	2.180022	0.00003482	0	0.3487
Q_{25}	1.190834	0.00026030	-0.008290	0.1462	1.224055	0.00010997	0	0.1134
Q_{50}	0.573816	0.00019413	0.003210	0.1072	0.727376	0.00006863	0	0.0656
Q_{75}	0.184604	0.00015118	0.033400	0.0738	0.427745	0.00006939	0	0.0552
Q_{90}	0.116694	0.00009226	0.021600	0.0223	0.276512	0.00007245	0	0.0471
Q_{98}	0.080405	0.00008015	0.008860	0.0305	0.179166	0.00007277	0	0.0595
Q_{mean}	1.246603	0.00000381	-0.007810	0.0589	1.264583	-0.00013317	0	0.0768
July								
Q_{02}	3.952413	0.00031189	0.063200	0.3310	4.137263	0.00118385	0	0.8232
Q_{10}	1.152419	0.00009433	0.038200	0.1504	1.364285	0.00019193	0	0.1424
Q_{25}	0.503999	0.00011144	0.036700	0.0457	0.857781	0.00015727	0	0.1516
Q_{50}	0.282338	0.00008524	0.018100	0.0430	0.537508	0.00010245	0	0.0983
Q_{75}	0.110975	0.00006091	0.026100	0.0228	0.337417	0.00009269	0	0.0748
Q_{90}	0.089120	0.00006233	0.009990	0.0227	0.231394	0.00006818	0	0.0568
Q_{98}	0.073621	0.00005054	0.003140	0.0285	0.153878	0.00005398	0	0.0588
Q_{mean}	0.687048	0.00003070	0.016700	0.0344	0.891153	0.00007425	0	0.1144
August								
Q_{02}	3.427983	-0.00009318	0.116000	1.0716	3.095319	-0.00027834	0	0.8654
Q_{10}	0.977157	0.00000159	0.004450	0.1426	1.084656	0.00011324	0	0.1516
Q_{25}	0.363347	0.00011709	0.013600	0.0580	0.661118	0.00015195	0	0.1505
Q_{50}	0.178864	0.00009722	0.015300	0.0298	0.430506	0.00012370	0	0.1189
Q_{75}	0.099137	0.00005503	0.012400	0.0179	0.287918	0.00008184	0	0.0804
Q_{90}	0.084581	0.00005523	0.002070	0.0259	0.218497	0.00006825	0	0.0613
Q_{98}	0.074686	0.00005265	-0.004220	0.0304	0.153677	0.00005117	0	0.0657
Q_{mean}	0.532906	0.00004844	-0.002250	0.0653	0.693868	0.00003364	0	0.1202

Appendix D. Continued

Flow type	Rock River Region I				Rock River Region II			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
September								
Q_{02}	2.902110	-0.00302670	0.981000	1.5755	3.595096	-0.00037334	0	0.9215
Q_{10}	0.384636	-0.00018280	0.252000	0.2228	0.983414	0.00030043	0	0.1808
Q_{25}	0.219876	0.00004618	0.057300	0.0744	0.600800	0.00019946	0	0.1741
Q_{50}	0.123640	0.00007805	0.018800	0.0318	0.397578	0.00014999	0	0.1376
Q_{75}	0.092504	0.00004202	0.006500	0.0217	0.275349	0.00008145	0	0.0970
Q_{90}	0.088365	0.00005261	-0.004020	0.0252	0.201814	0.00007908	0	0.0653
Q_{98}	0.087430	0.00004681	-0.009350	0.0240	0.147818	0.00007680	0	0.0627
Q_{mean}	0.490876	-0.00014066	0.052200	0.1645	0.689422	0.00005728	0	0.1390
October								
Q_{02}	4.910817	-0.00145252	-0.176000	1.0375	2.478104	-0.00001754	0	0.6312
Q_{10}	0.969305	-0.00011590	0.098100	0.2562	1.028807	0.00016398	0	0.1502
Q_{25}	0.346415	0.00010219	0.057900	0.1131	0.632845	0.00012757	0	0.1336
Q_{50}	0.113973	0.00006609	0.039600	0.0393	0.411860	0.00014037	0	0.1131
Q_{75}	0.085985	0.00003284	0.017000	0.0235	0.290893	0.00007465	0	0.0986
Q_{90}	0.085373	0.00003003	0.004650	0.0238	0.219334	0.00006246	0	0.0741
Q_{98}	0.081016	0.00002384	-0.001240	0.0250	0.169792	0.00004647	0	0.0609
Q_{mean}	0.619488	-0.00005231	0.003710	0.0955	0.609203	0.00007838	0	0.1009
November								
Q_{02}	4.286349	-0.00213052	0.164000	1.9912	2.550503	0.00009326	0	0.5979
Q_{10}	1.706326	-0.00051677	0.066900	0.5642	1.221725	0.00011997	0	0.2222
Q_{25}	0.557301	-0.00008588	0.089700	0.2049	0.700580	0.00017751	0	0.1109
Q_{50}	0.161148	0.00008169	0.060600	0.0706	0.446377	0.00011989	0	0.1083
Q_{75}	0.085945	0.00004201	0.023900	0.0328	0.310905	0.00008852	0	0.0898
Q_{90}	0.079823	0.00002070	0.015000	0.0303	0.232150	0.00007026	0	0.0719
Q_{98}	0.081878	0.00002881	0.003690	0.0252	0.188118	0.00005197	0	0.0591
Q_{mean}	0.621693	-0.00016190	0.056100	0.2298	0.666832	0.00009081	0	0.0719
December								
Q_{02}	2.227981	0.00001313	0.335000	0.6350	2.143578	0.00001992	0	0.4590
Q_{10}	1.148756	0.00012808	0.064200	0.2820	1.092023	0.00010402	0	0.1106
Q_{25}	0.485613	0.00013818	0.073300	0.1187	0.681720	0.00014379	0	0.1075
Q_{50}	0.207438	0.00006497	0.058600	0.0732	0.427268	0.00011046	0	0.1031
Q_{75}	0.067292	0.00001850	0.042000	0.0359	0.296516	0.00006926	0	0.0808
Q_{90}	0.078437	0.00001458	0.014600	0.0303	0.223719	0.00004561	0	0.0602
Q_{98}	0.077103	0.00001811	0.001260	0.0315	0.165688	0.00003030	0	0.0437
Q_{mean}	0.471072	0.00004241	0.063200	0.1080	0.645427	0.00004257	0	0.0628

Appendix D. Continued

Flow type	Bloomington Ridged Plain				Green River Lowland			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
Q_{01}	13.981639	-0.00059733	-5.400000	1.1438	10.554910	-0.00357000	-0.648740	1.3163
Q_{02}	8.344365	-0.00024842	-1.860000	0.4613	7.621187	-0.00170000	-0.448960	0.8605
Q_{05}	4.161733	-0.00000422	-0.110000	0.2713	4.313487	0.00009820	-0.219410	0.4202
Q_{10}	2.268377	0.00013046	0.225000	0.1778	2.496603	0.00060400	-0.089380	0.2063
Q_{15}	1.488082	0.00012512	0.287000	0.1080	1.701809	0.00047700	-0.031770	0.1590
Q_{25}	0.831725	0.00006966	0.232000	0.0685	0.945960	0.00029300	0.017731	0.1269
Q_{40}	0.372814	0.00002465	0.223000	0.0511	0.477278	0.00011800	0.044701	0.1012
Q_{50}	0.209335	0.00001379	0.193000	0.0460	0.304856	0.00007910	0.051749	0.0849
Q_{60}	0.079123	0.00000611	0.175000	0.0418	0.179565	0.00003020	0.055214	0.0531
Q_{75}	-0.023736	0.00000764	0.126000	0.0208	0.066637	-0.00004600	0.055645	0.0437
Q_{85}	-0.022239	0.00000817	0.071600	0.0107	0.024087	-0.00004100	0.050787	0.0376
Q_{90}	-0.024160	0.00000698	0.060500	0.0069	0.005731	-0.00003200	0.047982	0.0320
Q_{95}	-0.019639	0.00000610	0.041600	0.0052	-0.007410	-0.00002800	0.044019	0.0290
Q_{98}	-0.018397	0.00000522	0.033100	0.0041	-0.014880	-0.00002000	0.039612	0.0275
Q_{99}	-0.018605	0.00000467	0.030000	0.0033	-0.021180	-0.00000980	0.037485	0.0252
Low Flows								
$Q_{1,2}$	-0.031805	0.00001325	0.052700	0.0081	-0.012000	-0.00001500	0.050000	0.0447
$Q_{1,10}$	-0.016746	0.00000736	0.022400	0.0014	-0.017000	-0.00001500	0.034000	0.0413
$Q_{1,25}$	-0.012544	0.00000573	0.016100	0.0009	-0.019000	-0.00000800	0.030000	0.0427
$Q_{1,50}$	-0.009874	0.00000438	0.012800	0.0008	-0.022000	-0.00000500	0.029000	0.0432
$Q_{7,2}$	-0.031891	0.00001186	0.059100	0.0096	-0.007000	-0.00002000	0.051000	0.0485
$Q_{7,10}$	-0.018107	0.00000817	0.025000	0.0022	-0.015000	-0.00002000	0.036000	0.0449
$Q_{7,25}$	-0.015293	0.00000630	0.020200	0.0010	-0.018000	-0.00001200	0.032000	0.0482
$Q_{7,50}$	-0.013172	0.00000516	0.017400	0.0008	-0.021000	-0.00000700	0.030981	0.0494
$Q_{15,2}$	-0.036548	0.00001104	0.071500	0.0102	-0.002000	-0.00002500	0.052000	0.0511
$Q_{15,10}$	-0.019148	0.00000831	0.027800	0.0030	-0.013000	-0.00002500	0.037437	0.0466
$Q_{15,25}$	-0.017421	0.00000677	0.023500	0.0013	-0.016000	-0.00001800	0.033946	0.0495
$Q_{15,50}$	-0.015423	0.00000567	0.020600	0.0010	-0.019000	-0.00001300	0.032731	0.0517
$Q_{31,2}$	-0.032657	0.00000646	0.080000	0.0118	0.006000	-0.00003000	0.053000	0.0525
$Q_{31,10}$	-0.021181	0.00000969	0.031900	0.0039	-0.011000	-0.00003000	0.039752	0.0479
$Q_{31,25}$	-0.019827	0.00000820	0.026900	0.0018	-0.014000	-0.00002300	0.036000	0.0510
$Q_{31,50}$	-0.018022	0.00000704	0.024000	0.0013	-0.017000	-0.00001800	0.034500	0.0535
$Q_{61,2}$	-0.041099	0.00000669	0.106000	0.0196	0.020000	-0.00005000	0.055000	0.0504
$Q_{61,10}$	-0.019075	0.00000824	0.035400	0.0054	-0.009000	-0.00003500	0.042932	0.0481
$Q_{61,25}$	-0.025455	0.00000976	0.036700	0.0038	-0.012000	-0.00002800	0.038000	0.0509
$Q_{61,50}$	-0.025606	0.00000873	0.036000	0.0034	-0.015000	-0.00002300	0.036000	0.0531
$Q_{91,2}$	-0.025247	0.00000702	0.116000	0.0245	0.040000	-0.00006000	0.060000	0.0565
$Q_{91,10}$	-0.015108	0.00000656	0.035800	0.0058	-0.005000	-0.00004000	0.045000	0.0466
$Q_{91,25}$	-0.026268	0.00000935	0.041100	0.0046	-0.008000	-0.00003500	0.040000	0.0512
$Q_{91,50}$	-0.029322	0.00000879	0.043300	0.0042	-0.012000	-0.00003000	0.038000	0.0542

Appendix D. Continued

Flow type	Bloomington Ridged Plain				Green River Lowland			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
Drought Flows								
$Q_{6,10}$	-0.009670	0.00000754	0.061400	0.0101	0.005000	-0.00004000	0.051000	0.0477
$Q_{6,25}$	-0.009104	0.00000669	0.039200	0.0055	-0.002000	-0.00003500	0.048000	0.0494
$Q_{6,50}$	-0.009017	0.00000664	0.031800	0.0053	-0.006000	-0.00002500	0.045000	0.0522
$Q_{9,10}$	0.061312	0.00001986	0.071200	0.0338	0.130000	-0.00002000	0.046000	0.0481
$Q_{9,25}$	0.009442	0.00000878	0.080500	0.0237	0.070000	-0.00001000	0.045000	0.0407
$Q_{9,50}$	0.010808	0.00000849	0.047900	0.0211	0.030000	-0.00000500	0.046000	0.0429
$Q_{12,10}$	0.131345	0.00002438	0.189000	0.0682	0.337008	0.00006540	0.034453	0.0461
$Q_{12,25}$	0.079737	0.00000515	0.129000	0.0538	0.217173	-0.00005200	0.039355	0.0376
$Q_{12,50}$	0.045352	0.00000112	0.124000	0.0588	0.154615	-0.00001500	0.039858	0.0510
$Q_{18,10}$	0.360139	0.00000881	0.032500	0.0727	0.481288	0.00001270	0.026008	0.0496
$Q_{18,25}$	0.200818	-0.00000236	0.039200	0.0584	0.304443	-0.00007000	0.033136	0.0411
$Q_{18,50}$	0.126438	-0.00000407	0.061000	0.0655	0.171379	0.00001620	0.038849	0.0616
$Q_{30,10}$	0.598281	-0.00003939	0.003530	0.0723	0.674268	-0.00002100	0.017591	0.0518
$Q_{30,25}$	0.427300	-0.00001120	-0.078500	0.0607	0.412472	-0.00007600	0.032603	0.0460
$Q_{30,50}$	0.299258	-0.00001038	-0.009480	0.0760	0.243558	0.00006050	0.038703	0.0630
$Q_{54,10}$	0.824061	-0.00003325	-0.003480	0.1098	0.903503	-0.00006100	0.006880	0.0569
$Q_{54,25}$	0.470141	0.00003162	0.028700	0.0675	0.532042	-0.00001800	0.028550	0.0534
$Q_{54,50}$	0.348638	0.00006153	0.036300	0.0599	0.446283	-0.00005400	0.028590	0.0730
January								
Q_{02}	10.223205	-0.00021168	-4.450000	1.7202	8.461549	-0.00201000	-0.535240	1.3314
Q_{10}	2.646155	0.00028791	-0.628000	0.4917	2.508796	0.00047100	-0.073030	0.4344
Q_{25}	0.858011	0.00014401	-0.005000	0.1531	0.926433	0.00007090	0.026720	0.1577
Q_{50}	0.266360	0.00005724	0.118000	0.0553	0.372278	0.00006010	0.051337	0.1123
Q_{75}	0.019182	0.00001690	0.130000	0.0533	0.135356	-0.00006600	0.055242	0.0583
Q_{90}	-0.004373	0.00000687	0.043200	0.0149	0.020667	-0.00006200	0.051453	0.0456
Q_{98}	-0.002801	0.00000514	0.011800	0.0034	0.001205	-0.00008800	0.042394	0.0497
Q_{mean}	1.079834	0.00005518	-0.214000	0.1450	1.049283	-0.00004700	0.000996	0.1119
February								
Q_{02}	11.728387	-0.00062617	-3.540000	1.6561	10.244680	-0.00181000	-0.683430	1.3079
Q_{10}	3.197064	0.00019648	-0.308000	0.4470	3.593165	0.00054000	-0.167650	0.4135
Q_{25}	1.296135	0.00012751	0.003000	0.1741	1.478149	0.00038900	-0.014800	0.1645
Q_{50}	0.450378	0.00006942	0.115000	0.0948	0.558261	0.00013500	0.041151	0.1272
Q_{75}	0.127906	0.00001272	0.095800	0.0680	0.206311	-0.00003000	0.056921	0.0876
Q_{90}	0.026217	0.00000523	0.047100	0.0387	0.064490	-0.00007200	0.051278	0.0467
Q_{98}	-0.010641	0.00000856	0.031600	0.0058	0.009268	-0.00006100	0.043814	0.0520
Q_{mean}	1.465622	-0.00002200	-0.172000	0.2152	1.439258	0.00011600	-0.028530	0.1073
March								
Q_{02}	9.164414	0.00062660	-1.210000	1.2568	10.312500	-0.00494000	-0.487570	1.4102
Q_{10}	3.286607	0.00022726	0.611000	0.3340	4.682353	-0.00102000	-0.197970	0.5283
Q_{25}	1.609971	0.00021774	0.401000	0.1634	2.389201	-0.00001400	-0.055870	0.2445
Q_{50}	0.696297	0.00005942	0.324000	0.0578	1.169233	0.00004230	0.014644	0.1242
Q_{75}	0.321498	0.00001735	0.205000	0.0539	0.570738	-0.00004100	0.043005	0.0972
Q_{90}	0.127269	-0.00000323	0.158000	0.0630	0.295692	-0.00002800	0.054419	0.0942
Q_{98}	0.025750	0.00001302	0.077400	0.0412	0.087426	0.00001140	0.057228	0.0419
Q_{mean}	1.530667	0.00008705	0.179000	0.0921	2.045213	-0.00039000	-0.039870	0.1819

Appendix D. Continued

Flow type	Bloomington Ridged Plain				Green River Lowland			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
April								
Q_{02}	13.117109	0.00000956	-5.120000	2.1777	10.429970	-0.00382000	-0.611370	1.1391
Q_{10}	4.400575	0.00024347	-0.634000	0.5412	4.918234	-0.00062000	-0.231470	0.5386
Q_{25}	2.026702	0.00022032	0.105000	0.2569	2.539360	0.00045300	-0.077890	0.2826
Q_{50}	0.949485	0.00010374	0.149000	0.1315	1.202432	0.00027600	0.011023	0.1606
Q_{75}	0.450005	0.00000292	0.143000	0.0613	0.581255	0.00007600	0.042065	0.1116
Q_{90}	0.206116	-0.00000084	0.156000	0.0514	0.319224	0.00004850	0.050315	0.0643
Q_{98}	0.023204	0.00000849	0.133000	0.0518	0.165626	-0.00001100	0.053701	0.0623
Q_{mean}	2.060312	0.00005594	-0.283000	0.2159	2.105230	-0.00008300	-0.055770	0.1593
May								
Q_{02}	13.026350	-0.00016995	-4.800000	1.4084	8.150895	-0.00076000	-0.504910	0.7884
Q_{10}	3.643569	0.00015230	-0.162000	0.7417	3.016309	0.00065500	-0.132350	0.2304
Q_{25}	1.585132	0.00015024	0.097400	0.2632	1.330978	0.00047600	-0.011430	0.1582
Q_{50}	0.772455	0.00006561	0.059900	0.1078	0.644321	0.00019600	0.035650	0.0991
Q_{75}	0.404246	0.00002930	0.055000	0.0504	0.341718	0.00015500	0.047929	0.0858
Q_{90}	0.224298	0.00000625	0.066100	0.0387	0.207107	0.00008620	0.049379	0.0670
Q_{98}	0.094318	0.00000213	0.057500	0.0470	0.090345	0.00005330	0.046449	0.0490
Q_{mean}	1.803860	0.00003424	-0.251000	0.1665	1.356728	0.00015500	-0.020530	0.1028
June								
Q_{02}	14.008165	-0.00128113	-6.640000	2.0275	9.174983	-0.00303000	-0.616350	1.5822
Q_{10}	2.984043	-0.00008655	0.090400	0.4047	2.488109	0.00113300	-0.142570	0.3987
Q_{25}	1.164088	0.00005662	0.220000	0.1835	0.904021	0.00055100	0.003690	0.1284
Q_{50}	0.471196	0.00000001	0.189000	0.0931	0.396318	0.00014800	0.043950	0.0995
Q_{75}	0.213666	0.00000424	0.107000	0.0355	0.209118	0.00005830	0.048963	0.0625
Q_{90}	0.084533	-0.00000719	0.090400	0.0289	0.108681	0.00000302	0.048527	0.0625
Q_{98}	-0.024053	-0.00001018	0.111000	0.0201	0.035000	-0.00004000	0.045000	0.0492
Q_{mean}	1.527785	-0.00008734	-0.208000	0.1599	1.191798	0.00001490	-0.024700	0.1434
July								
Q_{02}	7.626152	-0.00050236	-2.500000	1.9457	4.627779	0.00064300	-0.308660	0.8249
Q_{10}	1.297755	0.00010832	0.401000	0.3486	0.972208	0.00115900	-0.023070	0.1652
Q_{25}	0.474337	0.00007289	0.173000	0.1132	0.352010	0.00040400	0.037984	0.0935
Q_{50}	0.162744	0.00002244	0.103000	0.0576	0.154378	0.00010200	0.052086	0.0852
Q_{75}	0.026154	0.00000754	0.096500	0.0299	0.073861	-0.00000620	0.049859	0.0593
Q_{90}	-0.009303	0.00000355	0.068000	0.0152	0.022000	-0.00002000	0.046000	0.0516
Q_{98}	-0.020559	-0.00000012	0.048900	0.0064	-0.007000	-0.00001000	0.040000	0.0485
Q_{mean}	0.772469	-0.00001204	-0.024700	0.1565	0.547034	0.00018500	0.015988	0.0902
August								
Q_{02}	2.356131	-0.00104393	2.140000	1.1694	1.673471	0.00315100	-0.116840	0.6770
Q_{10}	0.157109	-0.00006237	0.710000	0.2079	0.389734	0.00035700	0.041331	0.1334
Q_{25}	0.006872	-0.00000606	0.279000	0.0627	0.156511	0.00000958	0.055721	0.0615
Q_{50}	-0.013887	0.00001046	0.110000	0.0221	0.066876	-0.00005500	0.054160	0.0610
Q_{75}	-0.013434	0.00001077	0.053500	0.0125	0.011000	-0.00001500	0.049000	0.0577
Q_{90}	-0.021907	0.00000547	0.048500	0.0077	-0.011000	-0.00000800	0.041500	0.0516
Q_{98}	-0.021686	0.00000298	0.036900	0.0046	-0.022000	-0.00000700	0.036500	0.0478
Q_{mean}	0.195664	-0.00008616	0.282000	0.0985	0.228033	0.00009850	0.038155	0.0728

Appendix D. Concluded

Flow type	Bloomington Ridged Plain				Green River Lowland			
	(a)	(b)	(c)	Error(c_e)	(a)	(b)	(c)	Error(c_e)
September								
Q_{02}	4.117315	-0.00002765	-0.372000	1.6503	3.792630	-0.00152000	-0.210990	0.8451
Q_{10}	-0.028793	-0.00003190	0.801000	0.2369	0.572209	-0.00028000	0.038158	0.1534
Q_{25}	-0.038674	-0.00000358	0.210000	0.0486	0.120004	-0.00010000	0.057289	0.0635
Q_{50}	-0.012356	0.00000820	0.062500	0.0152	0.020000	-0.00004000	0.056000	0.0594
Q_{75}	-0.023875	0.00000700	0.051000	0.0076	-0.005000	-0.00002500	0.048000	0.0542
Q_{90}	-0.020819	0.00000549	0.037300	0.0054	-0.012000	-0.00002300	0.041000	0.0543
Q_{98}	-0.017494	0.00000352	0.028000	0.0040	-0.023000	-0.00000800	0.035716	0.0488
Q_{mean}	0.265201	-0.00000150	0.086300	0.1213	0.320270	-0.00022000	0.033986	0.0500
October								
Q_{02}	2.722278	0.00004351	0.445000	0.7728	2.695502	0.00050400	-0.058880	0.8500
Q_{10}	0.693787	0.00002745	0.232000	0.2074	0.810084	-0.00001600	0.033751	0.1765
Q_{25}	-0.040187	-0.00003081	0.381000	0.1058	0.271568	-0.00023000	0.063712	0.1118
Q_{50}	-0.018930	0.00000518	0.093000	0.0253	0.064483	-0.00013000	0.061197	0.0600
Q_{75}	-0.021485	0.00000753	0.053000	0.0082	0.005000	-0.00005000	0.053106	0.0595
Q_{90}	-0.024649	0.00000641	0.043800	0.0054	-0.010000	-0.00003000	0.045966	0.0537
Q_{98}	-0.021736	0.00000509	0.033100	0.0045	-0.025000	-0.00000800	0.038000	0.0578
Q_{mean}	0.219188	0.00002020	0.166000	0.0757	0.353925	-0.00016000	0.045747	0.1062
November								
Q_{02}	4.129664	-0.00067910	1.240000	1.3924	3.989761	0.00009400	-0.180440	0.8126
Q_{10}	1.369790	-0.00015792	0.415000	0.5162	1.328579	-0.00006700	0.025014	0.2334
Q_{25}	0.142558	-0.00001128	0.508000	0.1577	0.511781	-0.00014000	0.058340	0.1213
Q_{50}	-0.046064	-0.00001644	0.270000	0.0793	0.166203	-0.00017000	0.061810	0.0728
Q_{75}	-0.011258	0.00001595	0.058200	0.0167	0.047532	-0.00009700	0.057596	0.0574
Q_{90}	-0.016860	0.00000870	0.043500	0.0067	0.005000	-0.00006000	0.050000	0.0518
Q_{98}	-0.022582	0.00000463	0.041100	0.0061	-0.014000	-0.00002500	0.040500	0.0543
Q_{mean}	0.443088	-0.00005863	0.258000	0.1855	0.542369	-0.00014000	0.039341	0.1012
December								
Q_{02}	7.263411	-0.00044187	-1.390000	1.5141	7.120896	-0.00100000	-0.455650	1.1606
Q_{10}	1.666311	-0.00004385	0.637000	0.5992	2.489002	0.00057300	-0.092590	0.2761
Q_{25}	0.546220	-0.00005688	0.497000	0.2412	0.995378	0.00004090	0.029858	0.1579
Q_{50}	0.106466	-0.00002650	0.273000	0.1245	0.406591	-0.00016000	0.058074	0.1091
Q_{75}	-0.012532	0.00001326	0.100000	0.0324	0.114075	-0.00016000	0.060724	0.0719
Q_{90}	-0.020707	0.00001034	0.057000	0.0125	0.003000	-0.00004000	0.053168	0.0680
Q_{98}	-0.014297	0.00000637	0.028500	0.0033	-0.018000	-0.00002500	0.045785	0.0670
Q_{mean}	0.763021	-0.00003494	0.141000	0.2042	1.040118	-0.00013000	0.004070	0.0717

Illinois State WATER Survey (1895)

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