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FOX RIVER AND GREEN BAY PCB FATE AND TRANSPORT MODEL EVALUATION

TECHNICAL MEMORANDUM 2b -

Computation of Watershed Solids and PCB Load Estimates for Green Bay

January 6, 1999

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TABLE OF CONTENTS

1. SUMMARY 1
2. INTRODUCTION 2
3. AVAILABLE INFORMATION RELATED TO SOLIDS 4
3.1 PREVIOUS STUDIES 4
3.2 AVAILABLE DATA 5
4. WATERSHED LOADING MODELS 9
4.1 SOIL AND WATER ASSESSMENT TOOL (SWAT) 9
4.2 HYDROLOGIC SIMULATION PROGRAM - FORTRAN (HSPF) 10
4.3 GEOWAMS LEVEL 0/1 LOADING MODEL 10
4.4 GENERALIZED WATERSHED LOADING FUNCTION (GWLF) 10
4.5 UNIVERSAL SOIL LOSS EQUATION (USLE) + ROUTING 10
4.6 WDNR WINHUSLE 11
4.7 NATURAL RESOURCES INVENTORY (NRI) ESTIMATES 11
5. EMPIRICAL LOADING MODELS 12
5.1 BEALE'S UNSTRATIFIED RATIO ESTIMATOR 12
5.1.1 Description of BURE 13
5.1.2 Accuracy and Precision Associated with BURE 14
5.1.3 Application of BURE 14
5.1.4 Discussion of Results 18
5.1.5 Factors Considered in Application of BURE 21
5.2 OTHER EMPIRICAL LOADING MODELS 26
5.2.1 Minimum Variance Unbiased Estimator (MVUE) 27
5.2.2 USGS MVUE 30
6. ESTIMATION OF PCB LOADS 31
6.1 PREVIOUS STUDIES 31
6.2 REVIEW OF AVAILABLE DATA 32
6.2.1 Water Column PCB Concentration Data 32
6.2.2 Atmospheric Deposition Data 32
6.2.3 Peat and Lake Core Data 34
6.2.4 Urban Stormwater Loads 36
6.2.5 Other Data and Information 37
6.3 DESCRIPTION OF PROPOSED APPROACH 37
6.4 APPLICATION OF PROPOSED APPROACH AND RESULTS 38
6.4.1 Obtaining an Atmospheric Deposition Rate for 1989-1991 39
6.4.2 Estimation of Atmospheric Deposition Rates: 1981-1995 39
6.4.3 Estimation of Annual Atmospheric PCB Deposition Rates: 1954-1981 41
6.4.4 Conversion of Rates to Loads 41
6.4.5 Estimation of Apparent Delivery Ratios 42
6.4.6 Estimation of Loadings to Green Bay 43
7. DISCUSSION OF UNCERTAINTY 45
7.1 SOURCES OF UNCERTAINTY IN LOAD ESTIMATIONS 45
7.2 ESTIMATED NORMALIZED STANDARD ERRORS OF LOAD ESTIMATES 50

7.2.1 SOLIDS *50*
7.2.2 PCBs *51*
7.3 ESTIMATED STANDARD ERRORS OF LOAD ESTIMATES 52
8. REFERENCES 54

LIST OF FIGURES

Figure 1. Watershed map..... 6
Figure 2. Graphs of solids concentration vs. flow..... 29
Figure 3. Measured and predicted PCB deposition rates (1954-1981) 35
Figure 4. Estimated rates based on decline in water column concentration data 40
Figure 5. Estimated deposition rates for hindcast period 41

LIST OF TABLES

Table 1. Green Bay tributaries and direct drainage 3
Table 2. Available data 7
Table 3. Data sets used 15
Table 4. BURE-predicted ratio of load to flow for the tributaries and time periods indicated. 16
Table 5. Conversions used to correct loads estimated at gage to loads at mouth of each river. 17
Table 6. BURE average total solids loads 18
Table 7. Percent growth in population and urban population by decade. 23
Table 8. Estimate of percent of land in farms in the study area by year 23
Table 9. Significance of MVUE regression 28
Table 10. Comparison of LTI Predicted Solids Loads to Robertson's Loads (1996) 30
Table 11. Atmospheric PCB deposition to Lake Michigan from Hoff et al., 1996 34
Table 12. Comparison of atmospheric PCB deposition rates from core data 35
Table 13. Mean stormwater PCB concentrations 36
Table 14. Estimated apparent delivery ratios 42
Table 15. Estimated total PCB loads to Green Bay (1954-1995) 44
Table 16. Uncertainty in Solids Loads 46
Table 17. Uncertainty in PCB Loads 48
Table 18. Normalized Standard Error Calculated for Each of the Five Monitored Tributaries 50
Table 19. Summary of LTI/Literature PCB Load Ratios Estimated for All Tributaries and Years for Which Literature Load Estimates Were Available 51
Table 20. Statistical Information for Analysis of LTI/Literature PCB Load Ratio 51
Table 21. Summary of Uncertainty for Average Annual Solids Loads Presented as Standard Errors, 1/1/54 – 12/31/95. 52
Table 22. Summary of Uncertainty for Average Annual PCB Loads Presented as Standard Errors, 1/1/54 - 12/31/95. 53

1. SUMMARY

Solids sorption has a significant impact on PCB fate and transport in the Lower Fox River and Green Bay. Estimation of suspended solids delivered to the system from all sources is an important component of the overall solids balance. Estimates of historical solids and PCB loadings will assist in using hindcasts for model evaluation. This technical memorandum describes an assessment of available approaches for computing watershed solids and PCB loads to Green Bay, exclusive of loads delivered by the Lower Fox River. Recommended approaches for estimating these loads are described.

Deterministic watershed models were evaluated as a means of estimating solids loads; however, a thorough review of available continuous simulation watershed modeling tools identified significant shortfalls in necessary supporting data, such as land use, hydrologic, and hydraulic information. Given this paucity of supporting information, continuous simulation modeling appears to be inappropriate for this application. Therefore, the continuous simulation modeling approach is not proposed for the Green Bay watershed. Empirical methods were found to be the best available techniques, given data availability, for estimating monthly watershed solids loads to Green Bay. A time series of historical solids loads was calculated using Beale's Unstratified Ratio Estimator (BURE). A time series of historical PCB loads delivered to Green Bay was computed based on estimates of historical atmospheric deposition rates for the region, conversion of these rates to loads based on watershed sizes, and multiplication of these loads by apparent delivery ratios (estimated based on water column PCB data).

Both solids and PCB loads, estimated by these methods, are small relative to other loadings to Green Bay. Estimated watershed biotic solids loads (excluding the Lower Fox River) are almost two orders of magnitude smaller than estimated Green Bay internal biotic solids loads alone (LTI, 1998). The estimated uncertainty of the tributary load estimate is small (approximately 10-21%), therefore the upper bound of the biotic solid loading estimate is also small relative to the Green Bay biotic solids load. Consideration of Lower Fox River watershed solids loads would further accentuate the difference in magnitudes. Likewise, 1980-83 data indicate watershed PCB loads to Green Bay (excluding the Lower Fox River) to have been only a small fraction of total loads to Green Bay (Marti and Armstrong, 1990). Because Green Bay watershed solids and PCB loadings (excluding the Lower Fox River) are a small fraction of total loadings to Green Bay, the performance of models of PCB fate and transport in Green Bay is likely to be robust to variations in estimation methods. In order to verify this, the sensitivity of the Green Bay hindcast to these tributary loads will be checked as part of the modeling effort.

2. INTRODUCTION

LTI is currently participating as a member of the Model Evaluation Workgroup in an evaluation of the suite of models used to assess the fate and transport of PCBs in the Lower Fox River and Green Bay. This work is conducted in partial fulfillment of the Agreement between the State of Wisconsin and seven paper companies, dated January 31, 1997. One component of the evaluation is the development of historical and current solids and PCB loads to the Lower Fox River and Green Bay (Task 2), as discussed in the "Workplan to Evaluate the Fate and Transport Models for the Fox River and Green Bay", dated September 19, 1997. The computation of Green Bay watershed loadings is Subtask 2b, which involves the calculation of monthly solids and PCB loads delivered to Green Bay exclusive of Lower Fox River loads for the hindcast period, 1954-1995.

The Green Bay watershed excluding the Lower Fox River covers about 25,000 square kilometers, with approximately 70% of the area drained by the Menominee, Peshtigo, Oconto, and Escanaba rivers (Table 1). Smaller tributaries and direct drainage account for about 30% of the total drainage area.

In order to most accurately model the dynamics of PCBs in Green Bay, it is necessary to consider historical tributary loads of both solids and PCBs. In tributaries affected by atmospheric deposition and urban runoff, organic contaminants, such as PCBs, are commonly bound to the transported solids. Additionally, solids are central to PCB dynamics within Green Bay.

A monthly time scale for estimation of solids and total PCBs from tributaries and direct drainage to Green Bay for the period 1954-1995 is recommended, due to the spatial and temporal coarseness of field observations. This temporal scale permits seasonal variations in loadings to be incorporated into model analysis and applications. Because of data limitations, it is necessary to characterize the uncertainty of the load estimates. This uncertainty is discussed qualitatively and quantitatively in Section 7.

Table 1. Green Bay tributaries and direct drainage

Tributary	Area (km^2)	Percentage of Study Area
Duck	394	(2%)
Pensaukee	386	(1%)
Oconto	2,513	(10%)
Peshtigo	2,957	(11%)
Menominee	10,526	(40%)
Cedar	918	(4%)
Ford	1,283	(5%)
Escanaba	2,391	(9%)
Rapid	352	(1%)
Tacoosh	76	(0%)
Whitefish	811	(3%)
Fishdam	243	(1%)
Sturgeon	522	(2%)
Direct	2,700	(10%)
Total	**26,071**	**(100%)**

The general procedure for evaluating approaches to estimate solids and PCB loads is to first review previous studies and available data; review available approaches for estimating loads; recommend the most appropriate approach to the Model Evaluation Workgroup based on available data and the relative merits of the approaches; obtain Model Evaluation Workgroup Agreement on a proposed approach; and then apply the proposed approach to the hindcast period. Section 3.0 discusses previous studies and available data related to solids. Section 4.0 describes deterministic continuous simulation watershed loading models and discusses the reasons this approach is not recommended for the solids evaluation. Section 5.0 describes available empirical loading models that are considered for estimation of solids loads, and describes the application of the recommended model. Section 6.0 describes the proposed approach and application developed to estimate PCB loads, and Section 7.0 provides references.

3. AVAILABLE INFORMATION RELATED TO SOLIDS

Previous studies and available solids data were first reviewed, and are discussed in this section. Available loading models were then assessed to determine the most appropriate method given the constraints of the data.

Two basic approaches exist for watershed solids load estimation:

1. Deterministic watershed modeling (Section 4.0)

2. Development of empirical relationships between observed flows and measured solids concentrations (Section 5.0)

Several approaches in each category were evaluated, and a proposed empirical approach was applied to estimate a time series of historical solids loads. The first step in determining appropriate approaches was to evaluate all previous studies and available data. Sections 3.1 and 3.2 discuss this evaluation.

3.1 PREVIOUS STUDIES

Several estimates of watershed solids loads to Green Bay are reported in the literature. None of the studies provide loading information for the entire period of interest, confirming the need for this estimation task.

Robertson (1996) estimated solids loads to Green Bay between 1975 and 1990 using a regression based on streamflow, time of year, and observed suspended sediment concentrations. Additionally, 1989 daily solids loads were estimated by performing a modified minimum variance unbiased estimator (MVUE) regression analysis on intensively sampled flow and concentration data for the Green Bay Mass Balance Study (Bierman et al, 1992). Roznowski and Auer (1984) estimated annual solids loads for the Menominee, Peshtigo, and Oconto Rivers for 1978-1982. Their procedure was to correct gaged flow records to the mouth of each river, multiply flows by concentration and a correction factor to estimate base solids loads at the mouth of each tributary, and then to add point source loads to the base load to obtain a total load at the mouth. Bannerman, et al. (1984) conducted an intensive nonpoint source monitoring program for Wisconsin tributaries to Lake Michigan, focusing on runoff events. Estimates were made of base flow and event loadings of solids and other constituents using a stratified random sampling model enhanced by a ratio estimator. Finally, Sonzogni et al. (1978) estimated tributary solids loads from the Menominee, Peshtigo, Oconto and Escanaba Rivers for Water Years 1975 and 1976, using the ratio estimator method for these monitored rivers. The watershed area of each unmonitored river was multiplied by the annual unit area load estimated from a monitored river with similar basin characteristics to provide an annual loading for unmonitored rivers.

3.2 AVAILABLE DATA

An intensive effort was made to obtain all available flow and suspended solids data for tributaries within the Green Bay watershed, excluding the Lower Fox River watershed. Data on climate, land use, and other potential determinants of solids loadings were also collected.

Hydrologic units draining to Green Bay were identified from USGS national hydrologic boundary information obtained from the Internet. Other spatial information, including USGS DLG (digital line graph), DEM (digital elevation model), and LULC (land use/land cover) data were also obtained for these areas. The USGS national hydrologic boundary information and the DEM were used by LTI to digitize the subwatershed boundaries shown in Figure 1. Climatological data were obtained from the National Climatic Data Center. Soil surface texture data, along with United States Department of Agriculture (USDA) National Resource Inventory (NRI) data were collected from the Wisconsin and the Michigan Natural Resources Conservation Service (NRCS). NRI data provide an analysis of land use changes for 8-digit hydrologic units. Agricultural Statistics Reports as well as agricultural and population census data were also obtained for the Wisconsin and Michigan counties lying within the watershed.

Using the USGS hydrologic unit codes for the identified tributary hydrologic units, USGS and U.S. Environmental Protection Agency (EPA) STORET databases were searched for all available flow and solids data. Local agencies were interviewed by telephone to verify that all available data had been obtained. Available data are summarized in Table 2.

Available solids data primarily represent routine monitoring grab sampling. For this reason, they do not fully capture high flow events, when solids concentrations would tend to peak for relatively short periods of time. Estimates of solids loadings to the bay using these data may, therefore, be underestimates. However, not all tributaries to Green Bay exhibit predictable increases in solids concentrations under higher flow conditions. Bannerman, et al. (1984) found that the Lower Fox and Menominee Rivers, for example, experience slow and less predictable changes in flow during storm events, and that slower changes in flow are associated with lower variability in concentrations.

Solids concentration data in two forms are available: total non-filterable (TNF) solids dried at 105°C (STORET parameter 530) and suspended sediments (SS) evaporated at 110°C (STORET parameter 80154). The difference between these two parameters is primarily in the method used to collect and prepare the samples before analysis (Greg Koltun, USGS, personal communication), as outlined below:

Total Non-Filterable Solids:

- Grab samples collected.
- A sub-sample of the volume collected is filtered.

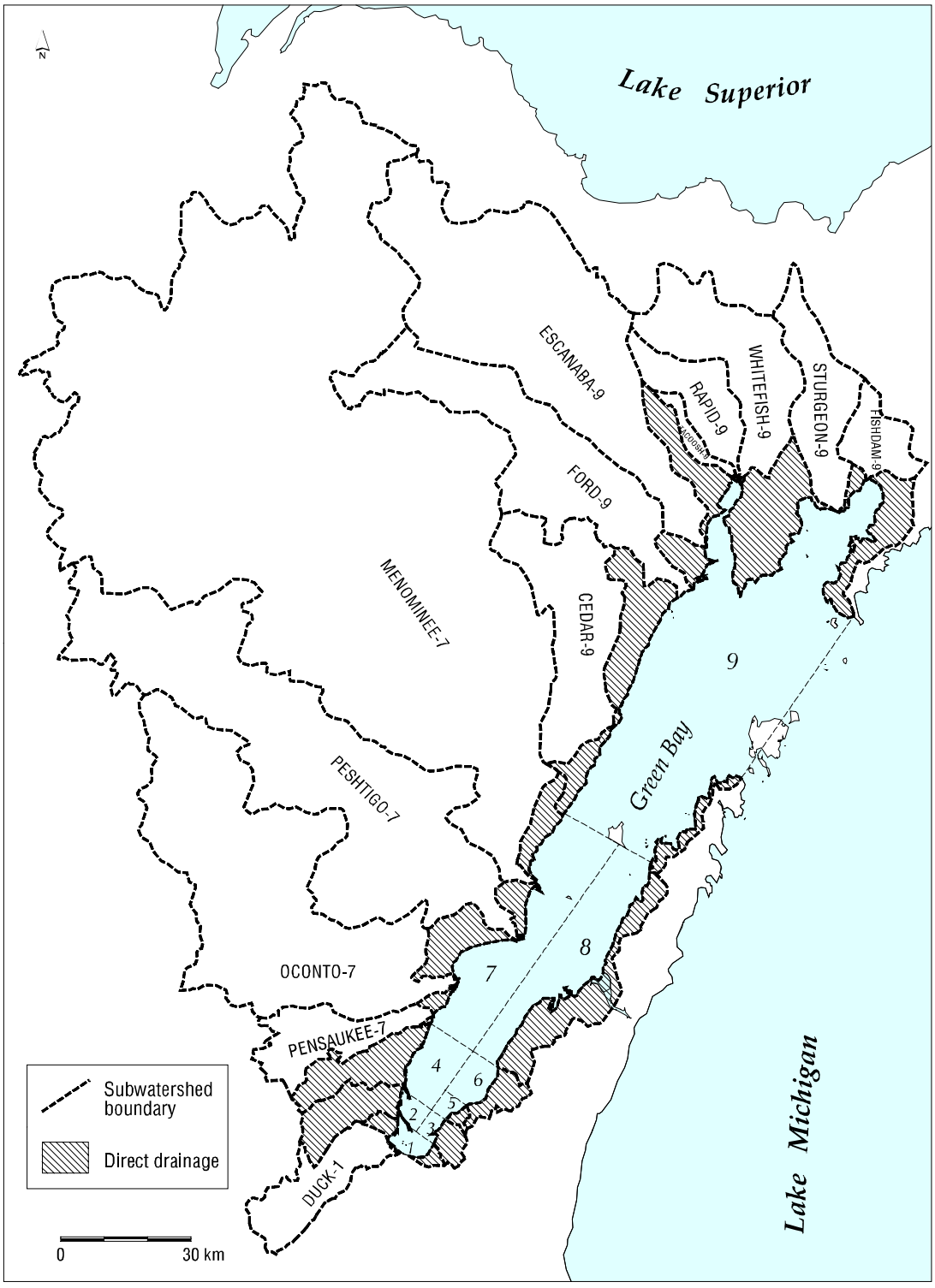

Figure 1. Watershed map

Table 2. Available data

Station	***Description***	***Flow record***	***Total non-filt (STORET 530)***	***Susp. Sediment (STORET 80154)***
4069500	Peshtigo R. at Peshtigo, WI	6/53 - 12/95	6/88 - 4/90	
4069530	Peshtigo R. at mouth	5/88 - 9/90	none	5/88 - 12/90
383001	STORET at Peshtigo		4/61 - 12/93	
4071000	Oconto R. at Gillett, WI	1/54 - 12/95		5/71 - 3/76
4071775	Oconto R. at mouth	10/88 - 9/90	6/88 - 4/90	6/88 - 4/90
433003	STORET at Gillett		4/74 - 2/93	
4066003	Menominee R. at Pembine, MI	1/54 - 12/95		
4067651	Menominee R. at mouth	6/88 - 9/90	6/88 - 10/95	6/88 - 5/90
383002	STORET at Marinette		4/61 - 2/80	
383088	STORET at McAllister		4/80 - 8/82	
4059000	Escanaba R. at Cornell, MI	1/54 - 12/95		12/74 - 9/94
4059345	Escanaba R. at mouth	1/88 - 12/90	6/88 - 4/90	6/88 - 4/90
4059500	Ford R. at Hyde, MI	10/54 - 12/95		12/74 - 9/93

Suspended Sediment:

- Samples collected using a depth-integrated sampler, which collects the sample when the velocity at the intake is the same as the velocity in the stream. The lowest zone (3-6 inches from the bottom) is not sampled.
- Entire volume collected is filtered.

Concurrent data collected on the Escanaba, Oconto, and Menominee Rivers were examined for the 6/88 through 5/90 period to determine if there is a significant difference between TNF and SS. For all three rivers, the median of the ratios of TNF/SS was found to be 1.0, that is, half of the TNFs were higher and half were lower than SS values. The mean of the TNF/SS ratios was 1.12 for the Menominee, 1.19 for the Escanaba, and 1.25 for the Oconto, therefore the concentration of TNF was found to be approximately 19% higher than the concentration of SS for these data sets.

The comparison of concurrent TNF and SS data indicated that neither method produces consistently higher or lower values, but the average of the TNF concentrations is generally larger than that of the SS concentrations by approximately 19%. Given that more TNF data are available than SS data for the study tributaries (see Table 2), a decision was made to use the larger data set (TNF), recognizing that some bias may be introduced into the analysis. For locations and times where only SS data were available, a conversion factor was used to estimate TNF values (see Section 5.1.2). The selection of TNF over SS may introduce an overprediction bias in the solids load estimates by approximately 12-25%. However, because neither the TNF nor SS method consistently produces higher or lower values, this overprediction may or may not occur. Given that the monitoring data are collected approximately weekly at most stations by USGS, the solids data likely miss many high flow/high solids events, and are biased low. Therefore, the selection of TNF over SS may reduce the magnitude of the potential underprediction in solids load estimates due to the limited high-flow event monitoring data.

4. WATERSHED LOADING MODELS

The feasibility of applying deterministic continuous simulation watershed models for estimation of solids and PCB loadings to Green Bay was evaluated. These watershed models simulate the physical processes that control the fate and transport of constituents of interest over land and through streamcourses to the ultimate receiving waters. These processes may include rainfall, runoff, infiltration, and chemical interactions.

Several watershed models were considered for use including:

1. Soil and Water Assessment Tool (SWAT)
2. Hydrologic Simulation Program - FORTRAN (HSPF)
3. GeoWAMS Level 0/1 loading model.
4. Generalized Watershed Loading Function (GWLF)
5. Universal Soil Loss Equation (USLE) + routing
6. Wisconsin Department of Natural Resources (WDNR) WINHUSLE
7. National Resources Inventory (NRI) estimates

In evaluating these models, LTI found that available data were not sufficient to accurately characterize the watersheds and routing mechanisms in a manner consistent with the application of a continuous simulation watershed model. The application of such a model would be highly suspect, because the precision and accuracy of the model predictions would reflect the precision and accuracy - or lack thereof - of the data used to run the model. In general, these methods would require significantly greater time and resources than empirical methods, for this application, with little likely improvement in the estimates.

4.1 SOIL AND WATER ASSESSMENT TOOL (SWAT)

SWAT was considered first because it was used by Fox Wolf Basin 2000 (FWB2000) to produce solids loading estimates for the Lower Fox River in the southern portion of the Green Bay watershed. SWAT is attractive because it can take advantage of the linkage with a Geographic Information System (GIS) using Arc Macro Languages (AMLs). It is not recommended, however, because of the great difficulty of obtaining the necessary model inputs for historical runs over the time period of interest, such as detailed rainfall records and land use/land cover information, disaggregated by subwatershed. Rainfall data are available for only a few stations, and most sub-watersheds have no rainfall data. Land use data are very limited. Pre-1980s data are reported by county, not by sub-watershed, and non-farm land use is not recorded. Although urban populations are available from census data, urban acreage would need to be estimated from aerial

photographs, with interpolation between available photographs. Historical construction data are not available. SWAT is not recommended because of these temporal and spatial data gaps.

4.2 HYDROLOGIC SIMULATION PROGRAM - FORTRAN (HSPF)

HSPF is one of the most data-intensive models available at this time and has been used in a number of other large watershed modeling projects, including the Chesapeake Bay watershed modeling project. One implementation of this model uses the BASINS (Better Assessment Science Integrating Point and Nonpoint Sources) database, which comprises USGS, EPA STORET, Permit Compliance System (PCS) Sites and Industrial Facilities Discharge (IFD) Sites sampling data, among other databases. The BASINS water quality monitoring data, however, were computed by station for 5-year intervals from 1970 to 1994. Based on a review of the database, it was determined that insufficient data were available for the study area for the time period of interest to run the model at the temporal scale needed. Specifically, monthly loading estimates are required to capture seasonal variations, while the data provided in BASINS would only provide steady state estimates based on 5-year averages. For these reasons, this approach is not recommended.

4.3 GEOWAMS LEVEL 0/1 LOADING MODEL

The GeoWAMS Level 0/1 loading model, which uses the Soil Conservation Service's curve number approach to predict runoff water quantity and event-mean concentrations for runoff water quality, was also considered. Previously applied to Long Island, NY and the Buffalo River, NY, it is not recommended because of the unavailability of spatially accurate soils and rainfall data, and the absence of data to support the development of event-mean concentrations for the constituents of concern. Furthermore, the large size of the watersheds involved would make estimating sediment delivery ratios difficult.

4.4 GENERALIZED WATERSHED LOADING FUNCTION (GWLF)

This model uses a modified version of the USLE to predict runoff and solids from rural lands and a buildup and washoff function to estimate runoff from urban lands. It does not predict solids loads from urban areas. A shortcoming of this model is the lack of a routing mechanism to route the eroded soil to the outlet of the watershed. Instead, GWLF applies a single delivery ratio for each subwatershed modeled. While a delivery ratio is sufficient on smaller watersheds, it would be difficult to accurately determine the delivery ratio for the subwatersheds being considered in this study because of their large sizes. Additionally, this model is not recommended due to the unavailability of complete historical land use, crop practice, and detailed soils data necessary to accurately apply this model.

4.5 UNIVERSAL SOIL LOSS EQUATION (USLE) + ROUTING

Another similar approach considered was to use the USLE or RUSLE (Revised USLE) and develop a routing mechanism to predict solids loads to Green Bay. This approach was

investigated and like GWLF, is not recommended due to the unavailability of data for characterization of the 26,000 square kilometer watershed for accurate runoff generation. In addition, development of the routing model would require channel morphology and other hydraulic parameters not readily available for the extended area of the tributary watersheds.

4.6 WDNR WINHUSLE

Another approach considered for estimating solids loads was to estimate erosion using the USLE and then estimate the amount of solids delivered to the mouth of the watershed based on the delivery ratios developed by the Wisconsin DNR for use in the WINHUSLE model. The delivery ratio estimated by the WDNR was based on intensive sampling at several locations throughout the state of Wisconsin. This approach is not recommended due to the fact that the majority of the available data are for the late 1980s and 1990s. The delivery ratio may have changed between the 1950s and the time period when sampled data are available, due to observed differences in land use and population in the watershed. Furthermore, only a few counties (Dade and Brown) are in GIS, and they are not categorized by the same subwatersheds necessary for this study. Michigan subwatersheds are also excluded from the existing WINHUSLE modeling.

Direct application of the WDNR WINHUSLE model was also considered. However, the majority of the data available from the WINHUSLE modeling are only available for the late 1980s and 1990s, and substantial efforts would be required to obtain data from historical records for model runs prior to this time period. Again, no routing mechanism is included, so the available results would only define erosion, not sediments delivered to Green Bay.

4.7 NATURAL RESOURCES INVENTORY (NRI) ESTIMATES

The USDA NRCS Natural Resources Inventory (NRI) data were requested for Wisconsin and Michigan. LTI was provided with erosion estimates for large areas of each state for 1982, 1987 and 1992. While these reports provide erosion estimates, they do not provide any estimate of actual solids loading to Green Bay, and a routing mechanism is lacking. Furthermore, the NRI data are only available for 1982, 1987 and 1992, and the estimates are by hydrologic units, which do not correspond directly to subwatersheds. In addition, no delivery ratios are provided. The units are much larger than the subwatersheds of interest, because the coverage is coarse relative to Green Bay model segmentation. Finally, the erosion estimates were made on an annual basis, whereas monthly estimates are needed to capture seasonal variations believed important to accurately reproduce solids and PCB dynamics in Green Bay. For these reasons, the use of the NRI data is not recommended.

5. EMPIRICAL LOADING MODELS

Watershed solids loads may be estimated empirically by developing a statistical estimator which relates flow, generally a well-sampled parameter, and concentration, which is measured at much lower frequency. A number of estimators exist which minimize load estimate error and are unbiased and efficient (Preston et al., 1992). Watershed loads may also be estimated through deterministic simulation of natural processes in the watershed, as discussed in more detail in Section 4.0.

Based on the availability of adequate records of daily flow, total non-filterable solids (STORET parameter code 530) and suspended sediments (STORET parameter code 80154) at major tributary locations, three empirical methods for estimating TSS were considered:

1. Beale's unstratified ratio estimator (BURE): development from data of a site-specific ratio of load to flow, which is then used to calculate annual loads (Richards, 1997)

2. Minimum variance unbiased estimator (MVUE): development from data of a site-specific estimator by performing a log-log regression of concentration on observed flow (Cohn et al., 1989)

3. USGS MVUE: application of site-specific MVUE coefficients determined by USGS for a second-order log-log regression of concentration on flow including a seasonal term (Robertson, 1996)

BURE emerged as the recommended method because of its simplicity, its acceptance as the "standard method for calculating loads" (Sonzogni et al., 1978), and its appropriateness for the current application. Statistically significant relationships between flow and concentration were not consistently found in applying MVUE, ruling out its use. For a majority of the tributaries, the F statistic, testing the hypothesis that the regression coefficients are zero, produced a p-value greater than 20%. The USGS MVUE provided a consistent methodology for estimating solids and PCB loads based on daily flows, but again, statistically significant relationships between flow and concentration were not consistently found. The approach also uses suspended sediments instead of total non-filterable solids, which are more limited than total non-filterable solids data for the study tributaries. All three methods are discussed in more detail in Sections 5.1 and 5.2.

5.1 BEALE'S UNSTRATIFIED RATIO ESTIMATOR

Beale's unstratified ratio estimator (BURE) calculates a total load at the river mouth for the period of application. Total load for the period is based on the ratio of total load to total flow for days on which both were recorded. In this way, the method employs all available concentration data to estimate the aggregate load for the period. It is not designed to estimate accurate daily load estimates for tributaries where concentration is

strongly dependent on flow. Because BURE assumes constant solids concentration in the water column for all flows, the large variations in solids concentrations for some rivers observed in the historic data set is lost in the predicted historic loads. Therefore, a limitation of the BURE approach is that it will capture general trends, but not necessarily short-term high flow events. The method is generally accepted by the Great Lakes research community as the "preferred and, importantly, standard method for calculating tributary loads" (Sonzogni et al., 1978), and continues to be used by the IJC for estimation of tributary loadings to the Great Lakes (Rathke and McRae, 1987). In particular, it has been found to perform well in cases where both the mean and variance of loads increase with tributary flow rate (Preston et al, 1992).

5.1.1 Description of BURE

Loads are calculated as the product of the total annual flow volume (Q), the ratio of mean daily load ($\bar{l}$) to mean daily discharge ($\bar{q}$), and a bias correction term (Preston et al., 1992):

$$\hat{L} = Q\left(\frac{\bar{l}}{\bar{q}}\right)\left[\frac{1+\left(\frac{(1-f)}{n}\right)\left(\frac{S_{lq}}{(\bar{l})(\bar{q})}\right)}{1+\left(\frac{(1-f)}{n}\right)\left(\frac{S_q^2}{(\bar{q}^2)}\right)}\right]$$

where:

$\hat{L}$ = estimated annual load

Q = total annual flow volume

$\left(\frac{\bar{l}}{\bar{q}}\right)$ = mean daily load/mean daily discharge

and the term in the brackets is the bias correction term. Symbols used in the bias correction term are defined below:

f = sampling fraction (n/N)

n = number of samples

N = total possible samples

S_{lq} = load/discharge covariance

S_q^2 = discharge variance

5.1.2 Accuracy and Precision Associated with BURE

Ratio estimators have been shown to be the best (minimum variance) linear unbiased estimators under two conditions: (1) the relation between load and flow is a straight line through the origin, and (2) the variance of load about this line is proportional to flow, where load is the dependent variable and flow is the auxiliary variable (Cochran, 1977 as cited in Preston, et al., 1989). Concerns about the accuracy and precision of BURE may arise when conditions deviate significantly from these assumptions. In particular, if concentration increases with flow, then load is a nonlinear function of flow. If sampling of high flows is sparse, ratio methods may underestimate the ratio of load to flow because of the predominance of low-flow data. BURE load estimates may also be subject to substantial uncertainty unless special effort is devoted to sampling the event flows, because of their disproportionate role in determining annual loads.

In order to evaluate these possible sources of bias and uncertainty, Preston, et al. conducted Monte Carlo sampling studies, in which they randomly subsampled more complete concentration and flow records, for five Michigan and Ohio tributaries. Two (the Grand and Saginaw Rivers) were chosen to represent stable tributaries, and the other three (the Maumee, the Sandusky, and Honey Creek) to represent the most event-responsive of Great Lakes tributaries. Preston, et al. found ratio estimators to be less precise than other methods in some cases, but also found them to be virtually unbiased in every test case, which "implies that the ratio estimator is more robust than other approaches with respect to bias caused by tributary and constituent characteristics." In comparing the overall levels of normalized bias between different estimation methods in a second set of Monte Carlo sampling studies, Preston, et al. (1992) found very low bias when the ratio estimator was used (approximately 0-10% underprediction), compared to significantly higher normalized bias when averaging or MVUE approaches were used (approximately 0-40% underprediction). Normalized standard errors of prediction for the ratio estimator ranged from about 5-30% for the test cases examined, and were significantly reduced when event sampling was simulated by the Monte Carlo technique.

The Preston, et al. experiments provide some assurance that any bias arising from application of BURE in this study is likely to be small. Their estimated range for the normalized standard error under non-event sampling conditions is consistent with the range estimated for this study, as presented in Section 7.2.1 below.

5.1.3 Application of BURE

The observed data were examined, and adequate records of daily flow, total non-filterable solids and suspended sediments were found at several locations along the Escanaba, Ford Menominee, Oconto, and Peshtigo Rivers. The data sets used for load estimation are presented in Table 3.

Table 3. Data sets used

Station	*Description*	*Flow record*	*Total non-filt (STORET 530)*	*Susp. Sediment (STORET 80154)*
4069500	Peshtigo R. at Peshtigo, WI	6/53 - 12/95		
383001	Peshtigo R. at Peshtigo		4/61 - 12/93	
4071000	Oconto R. at Gillett, WI	1/54 - 12/95		
433003	Oconto R. at Gillett, WI		4/74 - 2/93	
4066003	Menominee R. at Pembine, WI	1/54 - 12/95		
383088	Menominee R. at McAllister, WI		4/80 - 8/82	
4059000	Escanaba R. at Cornell, MI	1/54 - 12/95		12/74 - 9/94
4059500	Ford R. at Hyde, MI	10/54 - 12/95		12/74 - 9/93

Daily flow and TSS measurements at the mouth of each river were initially considered for the loading analysis. However, Roznowski and Auer (1984) indicated that "seiche-related flow reversals are noted in the Oconto, Peshtigo, and Menominee Rivers, and that on the Fox River, seiches have caused flow reversals more than seven miles upstream. Due to this seiche effect, water samples collected during times of flow reversal may represent conditions in the bay, rather than in the river. Therefore, a true river loading cannot be calculated from the river mouth measurements of flow and/or concentration."

In order to avoid the influence of seiches, daily flows at upstream monitoring locations were obtained and corrected, using a drainage area ratio (DAR), to reflect flows at the mouth. Drainage area information was available from the USGS report, Drainage Area Data for Wisconsin Streams (Henrich and Daniel, 1983) as well as from queries of the GIS.

For each tributary, concentrations were taken from sampling locations upstream of the mouth, in order to avoid the influence of seiches. Following the methodology of Roznowski and Auer (1984), concentrations were assumed to remain constant between the sampling location and the mouth. BURE was then applied to estimate annual total non-filterable solids loads for the Menominee, Oconto, and Peshtigo Rivers, and suspended sediments for the Escanaba and Ford Rivers, which did not have adequate total non-filterable solids information upstream of the mouth, for application of the estimator. The ratio of the total load to the total flow was calculated for a maximum of ten years of data at a time, dependent upon data availability. The BURE ratio of load to flow for the time period investigated was analyzed and determined to be fairly consistent between all rivers, except the Ford River (See Table 4 below). The site-specific, BURE-estimated ratio of load to flow was then extrapolated to years in which the tributaries were not

sampled. This was done by multiplying the ratio (MT/cfs) by daily flow to obtain a daily estimated solids load for unmonitored time periods.

Table 4. BURE-predicted ratio of load to flow for the tributaries and time periods indicated.

Monitored Periods		Ratio of load to flow (MT/cfs)
Escanaba R.	1975-1984	0.012
	1985-1994	0.014
Ford R.	1974-1983	0.028
	1984-1993	0.040
Menominee R.	1980-1982	0.014
Oconto R.	1974-1983	0.018
	1984-1993	0.019
Peshtigo R.	1961-1969	0.014
	1970-1979	0.018
	1980-1989	0.011
	1990-1993	0.008

For the Escanaba and Ford Rivers, the two rivers for which only suspended sediment data were available for a location upstream of the mouth, it was necessary to convert the suspended sediment (SS) load estimates to total non-filterable (TNF) solids loads. The data records for the Escanaba and Ford Rivers were examined and it was determined that both total non-filterable solids and suspended sediment were sampled concurrently in the Escanaba River at the mouth. The ratio of TNF solids to SS was calculated for this time period and determined to be 1.19. This conversion was therefore applied to the BURE-estimated daily sediment loads to calculate total non-filterable solids loads. Since a similar data set, containing paired suspended sediment and total non-filterable solids data, was not available for the Ford River, all available paired TNF-SS data in the watershed were analyzed. The average ratio of TNF to SS for paired data from the Escanaba, Menominee, and Oconto Rivers was also estimated as 1.19. Therefore, this same ratio was also applied to the Ford River to convert suspended sediment loads to total non-filterable solids loads.

Since loads estimated in this manner are reflective of loads at the solids sampling location, it was necessary to convert these upstream loads to the loads at the mouth. A Drainage Area Ratio (DAR) approach was used for this conversion. The daily loads were multiplied by a correction factor to convert them to loads at the mouth, as indicated in Table 5 below. Daily solids loads at the mouth of each river were summed in order to obtain monthly and annual solids loads. These loads are presented in Appendix A.

Table 5. Conversions used to correct loads estimated at gage to loads at mouth of each river.

Tributary	Drainage area at mouth/Drainage area at solids sampling location (mi^2)	Reference locations
Peshtigo	1143/1080	DA at mouth/DA at Peshtigo, WI gage
Oconto	971/705	DA at mouth/DA at Gillett, WI gage
Menominee	4069/3140	DA at mouth/DA at Pembine, MI gage
Escanaba	924/870	DA at mouth/DA at Cornell, MI gage
Ford	496/450	DA at mouth/DA at Hyde, MI gage

For the remaining rivers in the basin, solids estimates were determined by applying a drainage area ratio to the estimate for the reference river. The Ford River was used as the reference river for all unmonitored areas. This is consistent with the reference rivers identified by USGS, except that the USGS identified the Manitowoc River as the reference river for Duck Creek and the Pensaukee River. Since flow data for the reference Manitowoc River were only available from 1972 to the present, the Ford River was used as the reference river instead.

Annual average estimated total solids loads for the period 1954-1995 are shown below in Table 6. They are expressed in metric tons (tonnes), which equal 1000 kg. Monthly estimated loads are presented in Appendix A.

Table 6. BURE average total solids loads

Tributary	Load (MT/yr)
Cedar	3,641
Direct	10,711
Duck	1,562
Escanaba	4,778
Fishdam	966
Ford	5,089
Menominee	18,780
Oconto	5,374
Pensaukee	1,531
Peshtigo	4,917
Rapid	1,398
Sturgeon	2,070
Tacoosh	301
Whitefish	3,216
TOTAL	**64,334**

The estimated average annual total solids load of 64,334 tonnes per year corresponds to an estimated average annual biotic solids load of about 16,000 tonnes per year assuming a biotic carbon fraction of 0.25. This assumed fraction is based on summary statistics for Green Bay tributaries, presented by Bierman et al. (1992, Appendix B). The biotic carbon fraction is the portion of the solids load, which is most important to the physiochemical dynamics of PCBs in the GBTOX model.

5.1.4 Discussion of Results

The solids loads were compared to estimates of other investigators for tributaries to Green Bay. They were also compared to estimates of internal solids loadings in Green Bay.

5.1.4.1 Comparisons to Other Loading Estimates

The BURE-estimated solids loads were compared to other reported unit loads for Great Lakes tributaries, as well as loads for the same tributaries estimated using different estimation methods.

Comparison to Reported Unit Loads

Novotny and Chesters (1981) report ranges of unit loads of sediment from pilot watershed studies in the Great Lakes region. For primarily forested watersheds, a range of 0.2-90 MT/km^2/yr is reported. For watersheds that are dominated by cropland, a range of 3-510 MT/km^2/yr is reported. The BURE-estimated solids loads fall in the range of 2-4

MT/km^2/yr, with an average load of 2.5 MT/km^2/yr. These estimates fall at the low end of the wide range of unit loads reported by Novotny and Chesters.

Robertson (1996) also reported a wide range of unit loads (for example, 1.8-108 MT/km^2/yr for forested watersheds in the Lake Michigan basin), and determined that these wide ranges indicate that factors other than land use are important. He concluded that the topography of the area and the types of surficial deposits are the two most important factors affecting suspended sediment yields. Robertson's estimated sediment loads for reference tributaries in the Green Bay watershed (2.3-7.9 MT/km^2/yr) are on the low end of his reported range of unit loads for Lake Michigan and Lake Superior tributaries (up to 108 MT/km^2/yr). Robertson's loads are similar to the BURE-estimated loads, as discussed in Section 5.2.2. In summary, estimated sediment yields for Green Bay tributaries are relatively low compared to reported unit loads for Great Lakes tributaries, and compared to other Lake Michigan tributaries, and the differences are primarily due to topography, surficial deposits and land uses.

Comparison to Other Loading Estimates for Green Bay Tributaries

The results summarized in Table 6 were compared to other estimates of solids loadings. Bannerman, et al. (1984) used a Stratified Ratio Estimator to estimate solids loadings for several tributaries to Lake Michigan. The primary goal of the sampling design was to characterize the variability in the concentration values during runoff events. The study included estimates of loadings for the Menominee and Lower Fox Rivers. While monitoring focused on collecting samples every day during high flow events, the Menominee and Lower Fox Rivers were sampled only once a week. This was because long-term flow records indicated that these tributaries experience slow and less predictable changes in flow during events. Previous studies had indicated that "a larger variability in concentrations is usually associated with faster changes in flow, and that settling of pollutants behind a dam can normalize downstream concentrations." Approximately 40% of the samples on the Menominee River were collected under greater than average flow conditions, approximately the same as the samples evaluated for this study (see Figure 2). Bannerman, et al. estimated solids loadings for the Menominee of 21,104, 28,434, and 15,200 metric tons for 1980, 1981 and 1982 respectively. The 95% confidence limits for these estimates were very large (approximately 23%-85%). LTI's estimated loadings of 18,103, 21,307, and 22,201 metric tons for the same years (with an uncertainty of approximately 10-21%), fall within the confidence limits for the Bannerman estimates. While this comparison is useful in that it confirms that similar approaches and data sets produce similar results, it does not speak to the precision of either estimate.

A similar comparison was made to Robertson's (1996) estimates of solids loadings for several reference tributaries. While Robertson used a minimum variance unbiased estimator (MVUE) for his loading calculations, the calculations produced similar results. This comparison is discussed in Section 5.2.2, and shown in Table 10. Again, the fact that the estimates compare well to each other is not a measure of the precision of these

estimates, rather it shows that somewhat similar approaches using similar sets of data produce similar results.

Comparison of Duck Creek Loads

FWB2000 produced solids loading estimates for the Lower Fox River in the southern portion of the Green Bay watershed using SWAT as an estimation tool (FWB2000, 1998). FWB2000 also estimated an average annual solids load for Duck Creek (24 MT/km^2-yr). This compares to 4 MT/km^2-yr average annual load estimated by LTI using BURE. While the FWB2000 estimate is greater than the LTI estimate by a factor of 6, both estimates are in the range of values for cropland (3-510 MT/km^2-yr), as reported by Novotny and Chesters, 1981.

No solids data were available for the BURE analysis for Duck Creek, therefore LTI estimated Duck Creek loads by scaling Ford River loads using a drainage area ratio. FWB2000 used Bower Creek as a reference. FWB2000 compared the Duck Creek solids loading estimate to data collected by University of Wisconsin-Green Bay students during a moderate-sized event in 1995 (FWB2000, 1998). The SWAT-simulated load estimate for this event was over 2.5 times the estimated load from observed solids and flow data during this event. Another moderate event was monitored in 1991. While the simulated load compared well to the observed load during this period, the simulated streamflow was 28% lower than the observed streamflow. If the observed streamflows were modeled, predicted loads would have again overpredicted the solids loadings. FWB2000 discusses the uncertainties in the Duck Creek loading, saying that "there was insufficient water quality data to calibrate the model for TSS", and "the model seems to be overstating soil moisture and potential runoff during, or after extended dry periods."

In addition to the apparent overprediction of Duck Creek loadings by FWB2000, the difference in loading estimates may be due to the use of different reference rivers. Robertson found that the three most important factors in selecting a reference river for unmonitored rivers are the stream gradient, the texture of surficial deposits, and land-use type. The information presented in Table 4 of Robertson's report indicates that while Duck Creek and the Ford River both drain relatively small watersheds, and have similar stream gradients, they differ in land use (Ford is 8% agricultural, Duck is 98% agricultural) and surficial deposits (Ford is primarily loam, Duck is primarily clay). According to Robertson, Duck Creek shares the most environmental characteristics with the Manitowoc River, and fewer with the Ford River. However, flow data for the Manitowoc River are only available from 1972 to the present, therefore the Ford was selected in this investigation as the reference river for all unmonitored tributaries.

Ideally, the application of both BURE and SWAT to a single watershed would provide an opportunity to compare the accuracy of the two techniques. In this case, however, the scarcity of data on Duck Creek itself, and the use of different reference rivers for the two estimation techniques made the interpretation of that comparison problematic. In particular, the relative accuracy of the predictions depends not only on the properties of the techniques themselves, but also on the relative similarity of the Duck Creek watershed

to the Ford River and Bower Creek watersheds, respectively. Broad conclusions about differences between BURE and SWAT estimates for other watersheds, based on this comparison, would be unwarranted.

Duck Creek is a special case in that no data were available, therefore scaling to loads computed for a reference river was necessary. Data were available for the largest rivers in the Green Bay watershed, which drain approximately 70% of the non-Lower-Fox Green Bay watershed, therefore using a reference river was not necessary for these tributaries. The uncertainty introduced by the use of reference rivers for the remaining 30% of the non-Lower Fox Green Bay watershed is likely to be small.

5.1.4.2 Comparison to Green Bay Internal Solids Loadings

Green Bay watershed solids loads (excluding the Lower Fox River) are a small fraction of total solids loads to Green Bay. For comparison, Green Bay internal solids loads alone are estimated to have been approximately 820,000 MT/yr, which exceeds total estimated watershed biotic solids loads in Section 5.1.3 by one to two orders of magnitude. This internal solids loading estimate is based on an average annual loading of 327,000 MT/yr internal carbon in the form of phytoplankton (LTI, 1998), assuming that phytoplankton solids are 40% carbon. Preliminary analyses indicate that there is considerably less uncertainty in the tributary loadings compared to the estimate of uncertainty in the Green Bay internal loadings. The uncertainty analysis for the present study (Section 7) indicates an overall uncertainty in the estimates of solids loads from non-Lower-Fox tributaries of approximately 10-21%. This uncertainty is small in comparison to the preliminary estimate of uncertainty in estimates of internal solids loads in Green Bay (approximately 30%). Assuming 30% uncertainty, a lower bound estimate of internal production for the bay would be approximately 574,000 MT/yr, still considerably higher than the upper bound estimate of 19,000 MT/yr for internal solids loads from the non-Lower-Fox tributaries (using 21% uncertainty).

When point and nonpoint sources of solids in the Lower Fox River watershed are also taken into account, the relative role of non-Lower-Fox Green Bay watershed solids loads will diminish further. This indicates that the overall performance of models of PCB fate and transport in Green Bay is likely to be robust with respect to the assumptions and methodological choices made for Green Bay watershed solids (excluding the Lower Fox). In order to verify this, the sensitivity of the Green Bay hindcast to these tributary loads will be checked as part of the modeling effort.

5.1.5 Factors Considered in Application of BURE

Several potential complicating factors were reviewed in the application of BURE:

1. Dams
2. Land use changes
3. Point sources
4. Shoreline erosion

These factors were considered and accounted for as follows:

Dams: The presence of dams in a watershed can markedly affect the relationship between flow and solids. The National Inventory of Dams (USACE, 1996), a computer database created by the Army Corps of Engineers in partnership with state, territory and federal agencies, was reviewed to determine if any dams are located upstream of the sampling locations, or between the mouth and the sampling locations for flows and constituent concentrations. The review indicated that the dams located on the study tributaries were built before 1954, and were not removed before the end of the hindcast period. This was confirmed with WDNR (personal communication, Meg Galloway). Therefore, dams were judged not to invalidate an assumption of relatively consistent flow routing in these watersheds.

Land use changes: Land use is one factor affecting both flow and erosion. It is important to determine whether the land use has changed significantly within the study area, in order to determine whether the estimates developed using data series beginning in the 60s, 70s, and 80s are appropriate to apply to the beginning of the hindcast period. The approach adopted for this effort is to assume that land use changes had little effect on constituent generation and therefore estimated loads. This is reasonable because the magnitude of land use changes was not great, and because changes that did occur were primarily among land uses that generate similar solids loads.

The Green Bay watershed includes portions of both Wisconsin and Michigan. It is predominantly rural in nature, comprising approximately 60 percent forest, 20 percent forested wetland, 16 percent cropland and pasture, 1 percent lakes, 1 percent nonforested wetland and 1 percent urban land. These estimates are from United States Geologic Survey (USGS) Geographic Information Retrieval and Analysis System (GIRAS) Land Use/Land Cover data, which were based on aerial photography acquired during the 1970's and 1980's. While these data reveal land use patterns during this time, they do not reveal anything about land use patterns in the 1950s and 1960s. No other land use analyses for the study area were discovered for the 1950s and 1960s.

In order to determine how land use has changed between 1954 and 1995, an effort was made to obtain all readily available land use and related data. United States Department of Agriculture (USDA) National Resource Inventory (NRI) data were obtained from both the Wisconsin and Michigan Natural Resources Conservation Service (NRCS). NRI data provide analyses of land use changes for 8-digit hydrologic units. These units are very large in size (1 million to 1.5 million acres), and it was determined that they would not support a precise analysis on a smaller scale, based on discussions with Wisconsin NRCS personnel. Therefore, the conclusions that can be drawn from this database are very general in nature.

Based on an analysis of the Wisconsin NRI data, it appears that land use did not change significantly between 1982 and 1992, when estimate error (provided by the Wisconsin NRCS) is considered. Land use analysis prior to 1982 was not possible using NRI data because NRI data were only available for 1982, 1987, and 1992.

Analysis of the Michigan NRI data for 1982, 1987, and 1992 shows that cropland and pasture decreased during the 1982-1992 period by about 3 percent and 10 percent respectively in the portions of the Upper Peninsula of Michigan that are within the study area, while urban lands have increased by approximately 20 percent. Unlike the Wisconsin NRI data, it is not possible to analyze the error of this analysis given the data provided by the Michigan NRI.

In order to assess what was occurring during this time period, additional searches were performed. Two other sources were identified which could serve as surrogates for analyzing any land use changes over the study period; agricultural census reports, which survey the acres of land in farms by county, and U.S. population census reports, which provide information on the number of people in urban and non-urban areas by county. Since these data were available by county, it was necessary to use GIS to determine what proportion of each county lay in the watershed. This information was used to scale the agricultural census and population census report data, assuming that the land in farms and the population are evenly distributed within each county. Several trends were observed in this analysis, as summarized in Tables 7 and 8.

Table 7. Percent growth in population and urban population by decade.

	% Growth	*% Growth of Urban pop.*
1950-1960	4%	10%
1960-1970	6%	10%
1970-1980	9%	0%
1980-1990	3%	4%

Table 8. Estimate of percent of land in farms in the study area by year.

Year	*% of land in farms*
1954	18%
1959	16%
1987	10%
1992	9%

These data indicate that farmland has decreased and that both total population and urban populations have increased over the study period. It should be noted that farmland includes all land in farms: not just cultivated earth, but also forest, wetland, buildings, idle land, pasture, etc.

This discussion of land use changes shows that land use during the period of interest was becoming less agricultural and more urban. However, this transition probably has little

effect on overall watershed solids loads. The national range of solids event-mean concentrations ranges from 3 to 11,000 mg/L in urban areas, while agricultural areas range from 1060 to 6579 (NURP, 1983); runoff from urban areas in the Southeast US range from 90 to 279 mg/L (ARSWCS, 1993), and agricultural areas average around 300 mg/L (Humenik et al., 1984). Similarly, erosion from urban areas in the Chattahoochee River basin was approximately 6 tons/acre/year, compared to 5 tons/acre/year for agricultural areas (LTI, 1997). This suggests that net changes in solids runoff due to changes in land use from agricultural to urban will be small and will add little uncertainty to hindcast estimates for periods when land use may have been more rural.

Also, Robertson (1996) concluded that, "the most important environmental characteristic was the topography of the area, and the second most important characteristic was the type of surficial deposit." In choosing a reference river for an unmonitored river in his study of solids loadings, "land use was only considered if the topography and surficial deposits of an unmonitored river were similar to more than one reference river, then the reference river with the most similar land use was chosen." Similarly, land use change is treated as a less important factor for the BURE, and no adjustment for changes in land use is included in the estimates.

Point sources: Constituent contributions from point sources upstream of the sampling locations used for estimation are included in the loading estimate, but some point sources lie between the mouth and these locations. The U.S.EPA STORET database was examined to identify all dischargers within the Green Bay watershed; the dischargers were then mapped within a GIS to select discharger locations between the mouth and the estimation location for reference tributaries, or which discharged into another tributary near Green Bay or directly to Green Bay. Discharge flows and suspended solids concentrations were then retrieved from STORET, when available, to estimate and sum annual loads for comparison to annual tributary loads.

However, the retrieved data were found to lack either flow or concentration data for most samples, making the estimation of point source loads difficult. Additional attempts were made to acquire historical point source information through requests to U.S. Environmental Protection Agency, Wisconsin Department of Natural Resources, Michigan Department of Environmental Quality, and industry groups for historical Permit Compliance System data and other information. Little additional comprehensive information was found, although the Great Lakes Water Quality Board reported that that Michigan and Wisconsin pulp and paper industry suspended solids dischargers may have realized an 80% reduction in loadings from 1967 to 1977 (Great Lakes Water Quality Board, 1978).

Roznowski and Auer (1984) estimated that point sources in the Menominee, Peshtigo, and Oconto rivers contributed less than 10% of the estimated solids loads at the mouth for the period 1978 to 1982, with the exception of 1978-1980 in the Peshtigo River. This suggests that point source contributions to tributary solids loads have been relatively small for the past twenty years. The high point source contribution in the Peshtigo River

is attributable to the loads from a single point source, the Peshtigo Water and Sewer Utility, which were sharply reduced in 1981.

Applying the reported fivefold 1967-1977 reduction in loadings to all point source dischargers for the purpose of illustration, estimating point source contributions to be 10 percent of watershed loads, and assuming that nonpoint loads remained the same, pre-1967 loads would have been at most 40 percent higher:

$$\frac{W_{67}}{W_{77}} = \frac{W_{67_{np}} + W_{67_{ps}}}{W_{77}} = \frac{W_{77_{np}} + 5 \cdot W_{77_{ps}}}{W_{77}} = \frac{0.9 \cdot W_{77} + 5 \cdot 0.1 \cdot W_{77}}{W_{77}} = 1.4$$

The change would only be applicable to the first few years of the period. Because the estimated reduction in point source loads could not be confidently applied to all dischargers, this adjustment was not included in the estimates.

Shoreline erosion: This task focused on solids loads from non-Lower-Fox tributaries to Green Bay, not including loads directly to Green Bay from shoreline erosion. Shoreline erosion may, however, be a significant source of solids to Green Bay. Monteith and Sonzogni (1976) estimated that average erosion along the U.S. Great Lakes shoreline contributes about 40 million metric tons of material to the nearshore waters every year. This was estimated to be nine times higher than the load of sediment contributed by tributaries. While the shoreline erosion load to Lake Michigan is estimated to be high, studies suggest that the shoreline erosion loading to Green Bay is small relative to other shoreline areas on Lake Michigan.

An intensive shoreline erosion loading study conducted as part of the Great Lakes Pollution for Land Use Activities Reference Group (PLUARG) of the International Joint Commission (Monteith and Sonzogni, 1976) indicated that the amount of sediment contributed by shoreline erosion varies widely from one lake and shoreline to another. While Lake Michigan shorelines have the highest erosion rates per kilometer of shoreline compared to other Great Lakes shorelines, Green Bay shoreline contributions are small relative to other Lake Michigan shorelines. The height of the erodible bluff appears to be the controlling physical feature affecting the volume of material eroded. According to the authors, an area can have a very high recession rate, but if it has a low bluff, it will contribute a relatively minor amount of material to the lake. Monteith and Sonzogni estimated average erosion rates per year for Lake Michigan counties, including those bordering Green Bay. Average shoreline erosion rates for counties bordering Green Bay ranged from 3,000 m^3/yr (Oconto County) to 113,000 m^3/yr (Delta County). Door County, with one of the longest shorelines (230 km), had one of the lowest erosion rates (18,000 m^3/yr total for Green Bay and Lake Michigan shorelines). Based on these estimates, the total average shoreline erosion rate for the six counties with Green Bay shorelines is 146,000 m^3/yr (assuming half of the shoreline erosion in Door county is a load to Green Bay). Approximately 113,000 m^3/yr (or 77%) of this load is from the shoreline along Delta County, on the outermost portion of Green Bay. This estimated loading to Green Bay is less than 2% of the estimated total average solids loading from

shoreline erosion to Lake Michigan (8,376,000 m^3/yr as reported in Monteith and Sonzogni, 1976).

While shoreline erosion is, in part, a continuous process, it is also influenced by wind/wave events that occur during storms. In an investigation of the factors and mechanics of bluff erosion on Wisconsin's Great Lakes shorelines, Sterrett (1980) found that up to 96% of all soil lost from a bluff face can occur in the spring as a result of slab slides and mudflows. A Great Lakes shoreline damage survey in Brown, Douglas, and Racine Counties (Lasca, et al., 1976) was conducted to determine shoreland damages related to the 1972-1974 high-water period. The survey found that the 41 miles of shoreline bordering Brown County on Green Bay are prone to both flooding and bluff erosion. The shore east of the mouth of the Lower Fox River is primarily affected by water wave erosion of the low-lying to moderately high bluffs. In order to represent higher loadings due to shoreline erosion during high water periods and storm events, Monteith and Sonzogni present maximum erosion estimates, which within the study area range from 7,000 m^3/yr for Marinette County, to 172,000 m^3/yr for Delta County. The total maximum erosion rate reported for all the Green Bay counties is 251,000 m^3/yr.

Assuming a density of 2.6 g/cc (as used by Monteith and Sonzogni), the average annual shoreline erosion estimate converts to 379,600 metric tons of sediment, which is approximately six times the estimated loading from non-Lower-Fox tributaries to Green Bay (64,334 metric tons). The maximum shoreline erosion estimate of 251,000 m^3/yr converts to 652,600 metric tons of sediment per year. These calculations suggest that shoreline erosion may be a significant source of solids to Green Bay relative to tributary loads.

The nature of the sediments eroded from the shoreline varies by county. Based on a review of the soil texture map for the area bordering Green Bay (Sonzogni et al., 1979) which shows that up to 75% of the Green Bay shoreline is sandy in texture, it is expected that shoreline erosion along Green Bay is dominated by coarse-grained sand particles. Monteith and Sonzogni's particle size analysis data confirm this for Brown county (no data were found for other counties). Coarse, abiotic particles from shoreline erosion settle out rapidly near the shoreline so that their primary impact would be to contribute to sedimentation in near-shore areas. In a Lake Michigan Coastal Erosion study, Folger (1992) found that sediment eroding from bluffs provides most of the sand to the nearshore zone. Under high energy conditions, however, coarse-grained material, as well as the fine-sediment fraction, may be transported further offshore than under more quiescent conditions. The extent of the contribution of shoreline erosion to the net deposition velocities in Green Bay has not been fully evaluated, and the significance of this source of solids is unknown.

5.2 OTHER EMPIRICAL LOADING MODELS

Two other empirical loading models were evaluated. These were determined to be less appropriate for the purposes of this study than the BURE.

5.2.1 Minimum Variance Unbiased Estimator (MVUE)

Another empirical method considered for the estimation of tributary loads was the minimum variance unbiased estimator (MVUE) (Cohn et al., 1989). This method assumes that flow and concentration can be characterized by a bivariate log-normal distribution. In order to evaluate the applicability of this method's tributary specific log-log regressions between historical flow and solids data were developed. Separate regressions were estimated for successive decades, in order to allow for temporal change in the flow-concentration relationship. As with the BURE, daily flows at upstream monitoring locations were obtained and corrected to reflect flows at the mouth.

$$\hat{W} = \sum_{i=1}^{days} q_i \left[\exp\left(\beta_0 + \beta_1 \ln q_i\right) \right] \times BCF_{MVUE}$$

where:

W = load

β_0, β_1 = model coefficients

q = flow

BCF_{MVUE} = MVUE bias correction factor

However, the f-tests calculated for the MVUE in the different subwatersheds did not consistently show significant relationships between flow and concentration (Table 9). Figure 2 shows the weakness of the relationship between flow and concentration for all but the Ford River. This figure also shows that the monitoring program is not focused on high flow events, as only about 10% of the plotted points appear to be at flows above the 10% exceedence flows from USGS.

Because of the significance of the F statistic for the Ford River, the regression method was investigated further for this river. In order to analyze the ability of the MVUE to describe the relationship between concentration and flow, graphs of flow, measured concentration and predicted concentration were made. A review of these graphs revealed that the MVUE consistently under-predicts concentrations, and therefore loads, at higher flows. Thus, the MVUE would provide little gain over the BURE in capturing and simulating event-related loads. Because of this, and in order to use a consistent method for all tributaries, the BURE is recommended for use on the Ford River, in spite of the acceptable significance of F for the Ford River regression.

Table 9. Significance of MVUE regression

River	***Years***	***Sig. of F***
Escanaba River	1975-1984	0.21
	1985-1994	0.093
Ford River	1974-1983	0
	1984-1993	0.00003
Menominee River	1980-1982	0.453
Oconto River	1974-1983	0
	1984-1993	0.205
Peshtigo River	1961-1969	0.911
	1970-1979	0.516
	1980-1989	0.211
	1990-1993	0.976

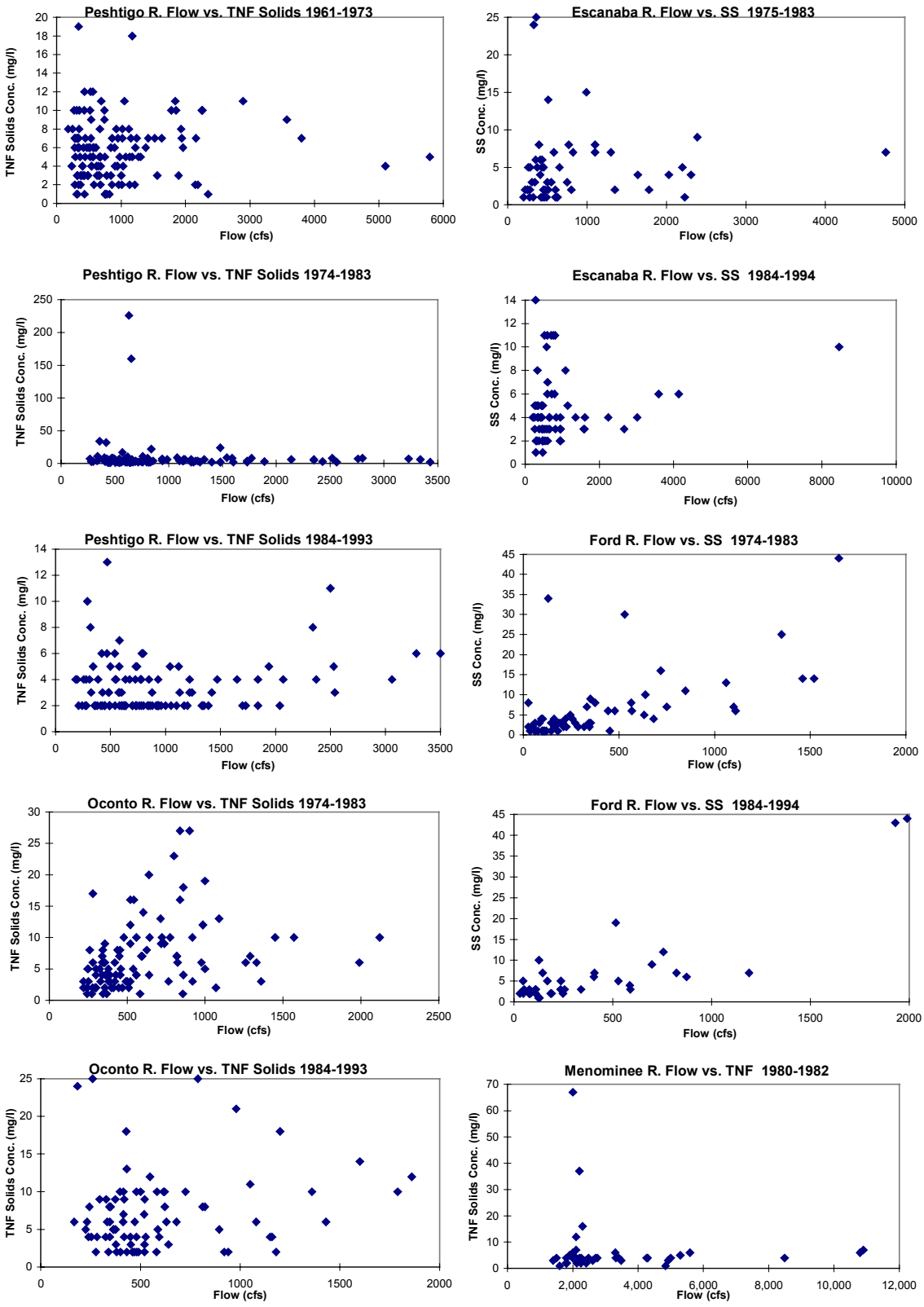

Figure 2. Graphs of solids concentration vs. flow

5.2.2 USGS MVUE

An alternative MVUE regression relation between suspended sediments, flow, and time of year for Great Lakes tributaries was developed by the USGS (Robertson, 1996). The general form of the model is:

$$\log(\text{daily load}) = a + b(\log(Q)-c) + d(\log(Q)-c)^2 + e(\sin(T)) + f(\cos(T))$$

Values for the regression coefficients a, b, c, d, e, and f were determined by use of multiple regression analyses between daily loads, daily streamflows (Q) and time of year (T) at each site, using all available data from 1970 through 1993. Site-specific coefficients for estimating suspended sediment loads were supplied for the Menominee, Ford, and Escanaba rivers; estimates for the remaining rivers are to be determined by applying a drainage area ratio to the estimates for a reference river selected by USGS on the basis of similarity in environmental characteristics "thought to be the most important factors affecting suspended sediment loading - texture of the surficial deposits, land use type, and stream gradient (Robertson, 1996)."

Although this method provides a convenient estimator for all tributaries, its basis on suspended sediment observations rather than total non-filterable solids would require an additional conversion for this study with attendant additional uncertainty. The lack of a consistent relationship between flow and concentration as discussed in Section 5.2.1, and the simplicity and acceptance of BURE, led to the recommendation of BURE for the solids loading estimation.

In order to show the effects of these two different methods, the solids loadings estimated by Robertson using USGS MVUE were compared to the solids loadings estimated by LTI using BURE. Table 10 shows this comparison for the Escanaba, Ford and Menominee. The comparison indicates that the two different approaches produce fairly similar estimates. This comparison does not demonstrate that either estimate is correct; rather, it demonstrates that somewhat similar approaches using similar data sets produce similar results.

Table 10. Comparison of LTI Predicted Solids Loads to Robertson's Loads (1996)

Tributary	***Estimated Solids Load Using BURE (LTI) MT/km^2-yr***	***Estimated Average Solids Load Using USGS MVUE (Robertson, 1996) MT/km^2-yr***
Escanaba	2.0	1.7
Ford	4.0	6.8
Menominee	1.8	2.3

6. ESTIMATION OF PCB LOADS

A review of past studies was first conducted to determine whether estimates of historical tributary PCB loads had previously been reported in the literature. Different methods of estimating loads were then evaluated. The empirical loading models described in Section 5.0 were considered for the estimation of PCB loads. An alternate approach would be to regress PCB concentration on flow and solids data, and use this relationship to develop a time series of PCB loads for the hindcast period. Such an approach would assume that the flow/solids/PCB relationship was the same in the past when no PCB data were available, which is unlikely given the changing conditions in PCB loads and in the sediments over the hindcast period. These empirical approaches are not recommended, primarily because of the very limited availability of PCB concentration data (see Section 6.2).

An approach for estimating loads based on available water column data, peat core data, and atmospheric data was developed and applied. This approach is proposed as an independent methodology for estimating PCB loads for the hindcast period. The approach involves estimating the shape of the historic PCB loads from 1954 based on historic atmospheric loading predictions calculated form peat core data. The magnitude of the historic loads is then scaled based on measured water column data between 1980 and 1990, essentially calibrating to the tail of the expected loading curve. The contributions from sources from other than atmospheric deposition (i.e., spills and urban runoff) was assumed to follow the same general curve as the estimated atmospheric deposition lacking any data to indicate otherwise.

6.1 PREVIOUS STUDIES

Robertson (1996) estimated PCB loads to Green Bay between 1975 and 1990 by multiplying suspended sediment load by the estimated concentration of PCBs in sediments. His approach assumes that concentrations in suspended solids are the same as sediment PCB concentrations. When Robertson's approach was tested against two sets of water column data (Marti and Armstrong, 1990 and Bierman, et al., 1992), results were highly variable and were orders of magnitude smaller than loads computed from flows and concentrations.

USGS (1993) also estimated PCB concentrations and loads in major tributaries entering Green Bay, 1989-1990. "Loads of total PCBs entering Green Bay from each tributary were calculated by use of the total integration method. This method involved estimating the average total PCBs for each day by use of linear interpolation between sample concentration values. The estimated daily total PCB concentration is multiplied by the average streamflow for that day to obtain a load of total PCBs. The total integration method is best suited for computing loads where there is only a gradual change in concentration values between sequential samples or where frequent sampling provides a well-defined time series of concentrations" (USGS, 1993). This method would not be

appropriate for the time period in this study, given the sparseness of available PCB concentration data. No other studies estimating PCB loads from these tributaries were found, confirming the need for this estimation task.

6.2 REVIEW OF AVAILABLE DATA

Some recent (1980-1990) PCB concentration data are available for the four major tributaries (Peshtigo, Oconto, Menominee, and Escanaba). Numerous estimates of atmospheric deposition rates over the Great Lakes are available. Limited information is available on PCB concentrations in urban stormwater, and it was collected in primarily larger, industrialized cities in the U.S. and Canada. These various studies were first reviewed to determine the most appropriate data to use for the purposes of the current study, and to evaluate the most appropriate approaches, given the data limitations.

6.2.1 Water Column PCB Concentration Data

Water column PCB concentrations were measured during two intensive monitoring studies. Concentration data are available for 1980-83 (Marti and Armstrong, 1990) and October 1988 - September 1990 (Bierman et al., 1992). Both references include water-column concentration data for the Oconto, Peshtigo, Menominee, and Escanaba Rivers. After removal of two outliers that Marti and Armstrong describe as "atypical", these data show:

1. reported 1980-83 water-column PCB concentrations for these tributaries ranging from 7 to 17 ng/L, with an average of 11 ng/L, and
2. reported 1988-90 concentrations for these tributaries ranging from 2 to 7 ng/L, with an average of 4 ng/L.

6.2.2 Atmospheric Deposition Data

PCBs are deposited on the Green Bay watershed through both dry and wet (precipitation) deposition. In addition to the direct deposition of PCBs from air to water, for example as rain on the water surface, PCBs deposited on soil and vegetation can also reach the waterbody as a result of washout with precipitation from the catchment area. Although PCBs are a mixture of hydrophobic compounds, they will dissolve to a limited extent in water and are transported in this phase. Suspended particles and organic compounds in the water will, however, largely facilitate the transport (Mackay, 1989). Gas-phase partitioning to vegetation (McLachlan et al., 1995) and soil (Hippelein and McLachlan, 1998) has also been measured in experimental settings, and could contribute to watershed loadings. Because tributary loadings can be calculated from atmospheric deposition loading estimates, available estimates were reviewed and evaluated.

Numerous researchers have attempted to quantify present-day and historical PCB deposition rates in the Great Lakes region, using many different approaches. Approaches for estimating atmospheric loadings have included: modeling based on past production or

usage rates (Looney and Eisenreich, 1986); use of a mass balance approach (Strachan and Eisenreich, 1988, Bierman et al., 1992); measurement of deposition rates (EPA, 1978); a combination of measurement, and calculation (Eisenreich et al., 1981, Sweet and Harlin**,** 1996); and examination of lake sediment cores (Swackhamer and Armstrong, 1986, Muir et al., 1996) and peat core records (Rapaport and Eisenreich, 1988).

Estimates of historical deposition rates over the Great Lakes reported in the literature vary tremendously. For example, Looney and Eisenreich (1986) estimated that atmospheric PCB loadings to Lake Superior in 1969 were approximately 280 ug/m^2/yr. This estimate was based on historical production rates of PCBs. Eisenreich, et al. (1981) estimated a rate of 119.4 ug/m^2/yr for the period 1978-1981. Andren (1982) and Murphy et al. (1982) estimated rates ranging from 11.25-17.3 ug/m^2/yr for Lake Michigan. Estimates of deposition rates during the same time period based on lake sediment cores from remote lakes in Wisconsin ranged from 2.0-3.0 ug/m^2/yr. While the estimates based on cores represented a net flux, compared to the higher gross loading rates reported by Looney and Eisenreich (1986), incorporating loss rates such as decay and volatilization would only roughly double the deposition rate (Swackhamer and Armstrong, 1986).

Since the mid-1980s, the impact of atmospheric PCB deposition to the Great Lakes has been recognized as being large and potentially dominant (Hoff et al., 1996). Strachan and Eisenreich (1988) estimated that up to 96% of the PCB inputs to the Great Lakes are atmospheric in origin. The recognition of the significance of atmospheric deposition as a continuing source of PCBs led to an increased focus in the 1980s on the processes affecting atmospheric deposition, leading to a better understanding and more accurate estimates of deposition rates.

Because estimates of atmospheric deposition rates made before approximately 1990 exhibit a high variability and high uncertainty, and they were not used in this evaluation. They were often based on insufficient data and, additionally, the sampling and analytical methods were not standardized (Hillery et al., 1997). More recent estimates reflect improved and standardized techniques, and a more complete understanding of the processes affecting atmospheric deposition rates, such as temperature variations and gas flux terms.

In recognition of the significance of atmospheric loadings, and the uncertainties in past estimates of loadings, the Integrated Atmospheric Deposition Network (IADN) was formed in the late 1980s. The IADN program provides a systematic approach for regularly updating estimates of atmospheric loadings to the Great Lakes, and comparing those inputs to other sources (Hoff, et al., 1996). A workshop was held in Windsor, Ontario in June, 1994 to update and revise past loading estimates of atmospheric inputs to the lakes, based on the IADN data and other information. The first published integrated deposition estimates from the IADN (which were the product of the workshop) were reported in 1996 (Hoff, et al., 1996). The PCB depositional estimates for Lake Michigan are presented in Table 11 below, and are compared to earlier estimates. The deposition rate per unit area was calculated by dividing the total annual atmospheric PCB deposition to Lake Michigan by the surface area of this lake (57,800 km^2).

Table 11. Atmospheric PCB deposition to Lake Michigan from Hoff et al., 1996

Date of Estimate	Loading to Lake Michigan (kg/yr)	Atmospheric Deposition Rate (ug/m^2*yr)	Original Reference	Comments
1988	400	6.92	IJC, 1986	Based on early-mid 1980s data
1992	110	1.903	Pearson, et al., 1996	1989-1991 data used to update "1988" estimate
1994	69	1.194	Hoff, et al., 1996	1990-1993 data from IADN program used to update "1992" estimate

The data presented in Table 11 represent the sum of wet and dry atmospheric PCB deposition rates, and do not account for gas-phase exchange or for loss processes subsequent to deposition. The reported estimates reflect estimates from three different original sources, and "updates" of those past estimates based on different data and assumptions. Note that the dates of the estimates, which are presented as in Hoff et al., reflect the year the estimate was made, not the year of the data used to compute deposition rates.

6.2.3 Peat and Lake Core Data

PCB production in the U.S. began in 1929, peaked around 1969, and ended in 1977 (Rodgers et al., 1986). Atmospheric deposition of PCBs likely followed a similar trend over this time period. Researchers who examined peat cores in the US and Canada (Rapaport and Eisenreich, 1988) and sediment cores in remote lakes in the study area and in Canada (Swackhamer and Armstrong, 1986; Muir et al., 1996) noted evidence of varying PCB deposition over time that roughly paralleled production rates.

Core data are less variable than the estimates of historical deposition rates discussed above because they provide a continuous time series without the confounding effects of varying approaches and assumptions, or variability due to locational and seasonal effects. The core data reviewed for this evaluation were collected from either remote lakes far from urban areas or ombrotrophic bogs, which allowed the isolation of atmospheric PCB inputs from urban stormwater runoff loads or spills. The estimates of atmospheric deposition rates from these studies represent flux rates net of loss processes, rather than gross rates, because they are based on the levels remaining in the peat years later.

Table 12 presents the peat core and lake core data reported in studies that were reviewed for this evaluation.

Table 12. Comparison of atmospheric PCB deposition rates from core data

Date	PCB Flux (ug/m^2*yr)	Source	Reference	Notes
1940-1981	0.1 - 4.5	Peat bog cores in North Carolina and northeastern and north central US, and Canada	Rapaport & Eisenreich, 1988	Maximum flux around 1969.
1935 - 1983	0.2 - 6.2	Sediment cores from four remote Wisconsin lakes	Swackhamer & Armstrong, 1986	Maximum flux varies between lakes
1920 - 1990	0.11 - 4.25	Sediment cores from 11 remote Canadian mid-latitude and Arctic lakes	Muir, et al., 1996	Maximum flux observed in Trout lake (nearest station to Green Bay)

Based on their peat core studies, Rapaport and Eisenreich developed a fifth-order polynomial equation to describe net atmospheric PCB deposition from 1954-1981. Figure 3 illustrates a time series of deposition rates derived from this equation, compared to the lake core data from the Swackhamer and Armstrong study. The equation from the Rapaport and Eisenreich study is scaled to two different peak depositional rates. These depositional rates reflect the range of rates that they estimated for 1969. The range of depositional rates reflected by the peat data is shaded. As this figure shows, these data appear to be fairly consistent, considering the differences in conditions between sampling stations.

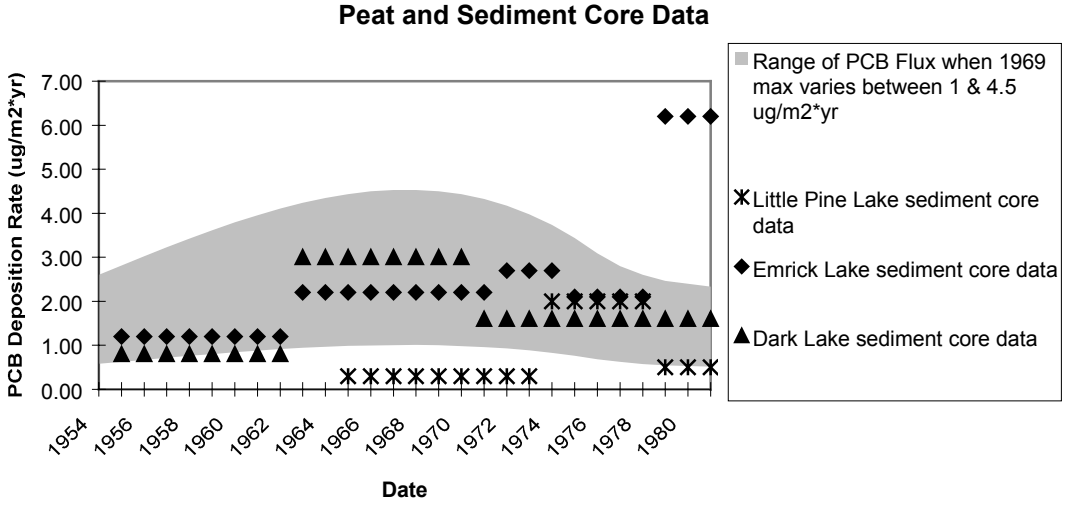

Figure 3. Measured and predicted PCB deposition rates (1954-1981)

6.2.4 Urban Stormwater Loads

Urban stormwater loads contribute to total PCB loads to Green Bay. These loads result from the "industrial use of PCBs for such uses as heat transfer fluids, hydraulic fluids, in die casting operations, etc. As there was little or no control over the use or discharge of PCBs prior to 1971, it is not known how much of these materials were discharged and reached Green Bay, or where these discharges occurred (IJC, 1978)." One method for estimating urban stormwater PCB loads is to multiply an average, or "typical" stormwater PCB concentration by a stormwater flow volume.

Urban Stormwater PCB Concentrations: Urban stormwater PCB concentration data were obtained from a report entitled "Quality of Wisconsin Stormwater, 1989-94" (USGS, 1996). This study involved sampling urban stormwater runoff in Wisconsin, and results indicated PCB concentrations above the detection limit in approximately 20% of the samples. An event mean PCB concentration of 0.11 ug/l, considering all data values including non-detects, was computed. As Table 13 indicates, this compares well with reported PCB concentrations for three Canadian cities: Sarnia, Sault Ste. Marie, and Windsor (Marsalek and Ng, 1989). A study of urban stormwater runoff in Madison, Wisconsin (USGS, 1996) reported non-detects in all samples collected, but this may have been due to the high detection limit (1 ug/l).

Table 13. Mean stormwater PCB concentrations

Location	PCB Concentration (ug/l)	Reference
Wisconsin Cities	0.11	USGS, 1996
Madison, WI	0.131	NWRI Data Base (Marsalek and Schroeter, 1984)
Sarnia, Ontario	0.179	Marsalek & Ng, 1989
Sault Ste. Marie	0.0269	Marsalek & Ng, 1989
Windsor	0.0888	Marsalek & Ng, 1989

Urban Stormwater Flow: Urban stormwater runoff for each subwatershed can be predicted by multiplying total annual precipitation by the urban area in each subwatershed. This value can then be multiplied by an area-weighted urban runoff coefficient to estimate the volume of urban runoff by subwatershed on an annual basis.

The sizes of urban areas in the watershed have increased over the 1954-1995 time period, and a time series of historical urban acreage could be constructed from aerial photos. Urban areas for the 1980s can also be obtained from the GIS (Geographic Information System) and could be adjusted by decade, according to information on urban population growth in the study area. This approach would be based on the assumption that the rate of urban area growth is equal to the rate of growth in urban population.

6.2.5 Other Data and Information

Data sources already described in Section 3.2 were consulted for information relevant to the estimation of PCB loads. Subwatersheds digitized using a GIS were based on information in the USGS digital elevation model (DEM). USGS land use/land cover (LULC) data were also obtained for the study area. A query of the GIS database provided information on the area of each of the subwatersheds. A subsequent query revealed the composition of urban and non-urban lands for each of these basins. This information was later useful in estimating watershed PCB loads.

USGS national hydrologic boundary information was obtained from the internet and added to the GIS database. Queries of the USGS and USEPA STORET databases were subsequently made by hydrologic unit, to obtain all available flow and polychlorinated biphenyl (PCB) data.

The BASINS database was investigated to determine if it provides access to any additional data that could be used in PCB load estimation. BASINS uses the STORET database for water quality data, USGS for flows, USGS for GIS land use/land cover data, and NCDC for weather data. All environmental monitoring data and point source data available in the BASINS database were found to have already been obtained and used in this evaluation.

6.3 DESCRIPTION OF PROPOSED APPROACH

An approach based on estimates of atmospheric deposition rates of PCBs in the Great Lakes region was developed and applied to the watershed under consideration. Estimates of atmospheric deposition based on the data from the IADN program and related research provide the most reliable estimates available for deposition rates in recent years. The rate of decline of deposition rates can be inferred for the post-1981 period from the observed trend in riverine PCB loads. Peat core data provide the most consistent record of historical atmospheric loading rates, and are available through 1981. Together these three sets of data can be used to create a long-term time series of atmospheric deposition rates for the entire hindcast period. These atmospheric deposition rates can then be multiplied by watershed areas to estimate loads. The proportion of these loads delivered to Green Bay can be computed by multiplying the load deposited on each watershed by an apparent delivery ratio, which can be estimated based on PCB loads calculated from water column data.

The proposed approach involves estimation of delivery ratios, and the uncertainty in this step was discussed previously as a disadvantage of using deterministic watershed models to estimate solids loads. The rich data set for solids, however, allows selection of an alternative approach that does not require estimation of a delivery ratio. In estimating PCB loads, however, water column concentration data are limited, precluding the use of BURE or other standard empirical loading approaches.

This proposed approach does not model urban stormwater loads explicitly. Urban loads could be computed for data-rich periods by multiplying the stormwater runoff volume by the mean stormwater PCB concentration. The resulting load could then be multiplied by an estimated delivery ratio that reflects the proportion of urban stormwater PCB load that is delivered to Green Bay. However, this would require an estimate of the delivery ratio for urban loads, which is unknown. Furthermore, the limited concentration data discussed in Section 6.2.4 primarily represent current levels of PCBs in industrialized cities, and may not be representative of the less-industrialized towns in these sub-watersheds. No other estimates of historical stormwater PCB concentrations were found, so that data for only a single point in time are available. Most importantly, no trend data are available to extrapolate estimated stormwater loads forward or backward in time, other than the trend data already being employed to extend the atmospheric loading time series.

Given the small proportion of urban area in the watershed (less than 1%), this approach was not pursued. Rather, urban loads were modeled implicitly, by assuming that they have been proportional to atmospheric deposition, both being driven by the same time trends in the production and use of PCBs. Likewise, gas-phase adsorption to soils and vegetation is not explicitly estimated, because the data required to do so for a watershed are not known to be available. An apparent delivery ratio is estimated for each tributary, with the understanding that it may reflect urban stormwater loads and gas-phase transfer as well as wet and dry atmospheric deposition.

This approach is proposed as an independent methodology for estimating a time series of PCB loads over the hindcast period. Section 6.4 describes the steps involved in this approach in detail, and describes the application and results when this approach is applied to the Green Bay watershed.

6.4 APPLICATION OF PROPOSED APPROACH AND RESULTS

The following sections describe the application of the proposed approach for estimating a time series of historical watershed PCB loads to Green Bay (exclusive of the Lower Fox River). The steps involved in this approach are:

1. Obtain an atmospheric deposition rate for 1989-1991 from Hoff et al., 1996.
2. Estimate gross atmospheric deposition rates (ug/m^2/yr) for 1981-1995 based on observed trends in water column PCB concentration data.
3. Estimate gross atmospheric deposition rates (ug/m^2/yr) for 1954-1981 based on the equation derived from peat core data (predicts net deposition), and scaling it up based on the predicted 1981 rate from Step #2 to estimate gross deposition.
4. Create a time trend of PCB loads for the entire hindcast period by converting these rates to loads based on watershed size.

5. Estimate percent delivered to Green Bay (delivery ratio) in each watershed based on observed PCB concentrations.
6. Use these delivery ratios to estimate total loading to Green Bay for each watershed.

More details on the calculations involved in this approach can be found in Appendix B.

6.4.1 Obtaining an Atmospheric Deposition Rate for 1989-1991

The estimates reported in Hoff, et al. (1996) represent "updates" of estimates based on more reliable and current information. As indicated in Table 11, the "1992" and "1994" estimates were based on different sets of data. These updated estimates were also based on new developments in the field, including the progress made in determining gas-transfer fluxes across the air-water interface in the lakes. These estimates are based on original studies, which employed different methodologies, and the applicable periods for the estimates are not precisely dated. For this reason, they are not ideal for estimating a temporal rate of change. Nevertheless, they can provide a credible point estimate of the atmospheric loading rate, around which a time trend can be extended.

For the current study, the "1992" estimate of 1.903 was selected to represent loadings during the Green Bay Mass Balance Study period. Because this estimate was based on 1989-1991 data, it was possible to combine it with 1988-1990 Green Bay Mass Balance Study water column data to estimate apparent delivery ratios, as described in section 6.4.5 below.

The estimate, which was based on data for Lake Michigan, included wet and dry deposition and excludes gas-phase exchange with the water column. These inclusions and exclusions are appropriate for application to the nearby land surface of the Green Bay watershed. It should be recognized, however, that the atmospheric deposition rate employed here does not take account of gas-phase transfer to surfaces, such as soils and vegetation, which may also contribute to tributary PCB loads.

6.4.2 Estimation of Atmospheric Deposition Rates: 1981-1995

In order to produce reliable estimates of atmospheric PCB loadings for the period of the hindcast, it is necessary to use the best available estimates of the time trend in loadings to extend the series forward and backward from the 1989-1991 estimate of 1.903 ug/m^2/yr. This can be done for the period 1981-1995 by employing load estimates, obtained about eight years apart, for the four largest tributaries in the study area.

The rate of decline in PCB loads from 1981 to 1989 can be estimated from water column concentration data for 1980-83 (Marti and Armstrong, 1990) and October 1988 - September 1990 (Bierman et al., 1992). Both references include water-column concentration data for the Oconto, Peshtigo, Menominee, and Escanaba Rivers. After removal of two outliers that Marti and Armstrong describe as "atypical", these data show:

1. reported 1980-83 water-column PCB concentrations for these tributaries ranging from 7 to 17 ng/L, with an average of 11 ng/L, and
2. reported 1988-90 concentrations for these tributaries ranging from 2 to 7 ng/L, with an average of 4 ng/L.

An interpolation approach was taken to describe the observed temporal decline in PCB loads. The months of December 1981 and September 1989 were chosen as representative midpoint months for the respective sample periods. On average, the time elapsed between these sample periods is 7 years and 9 months. The decline in the average PCB load (estimated as a product of concentrations and flow) over this period over this period is approximately 16% per year. Note that the decline in the average PCB concentration from 11 ng/L to 4 ng/L over this 7.75-year period reflects an average rate of decline of 12% per year. The rate of decline in loads, however, rather than concentrations, is more appropriate to use for this analysis because the object is to construct a time series of loads. Concentrations declined at a lower rate than loads because of the large difference in flows between the 1980-1983 and 1988-1990 studies. Flows during the earlier period were much higher; for example, the average flow on the Menominee River was approximately 50% higher in 1980-1983 compared to 1988-1990.

Annual atmospheric deposition values for the period 1989-1995 were then calculated by beginning with an estimated atmospheric PCB deposition rate in 1989 of 1.903 ug/m^2/yr, and then applying the approximately 16% average annual rate of decline in loads that was obtained for the Oconto, Peshtigo, Menominee, and Escanaba Rivers. Similarly, annual values for 1981-1989 were calculated by projecting concentrations backward in time at an approximately 16% annual rate of increase. In this way, the rate of decline can be used to project rates for the entire 1981-1995 period, beginning with the estimate for 1989 (1.903 ug/m^2/yr). This approach results in a time series of deposition rates as shown in Figure 4.

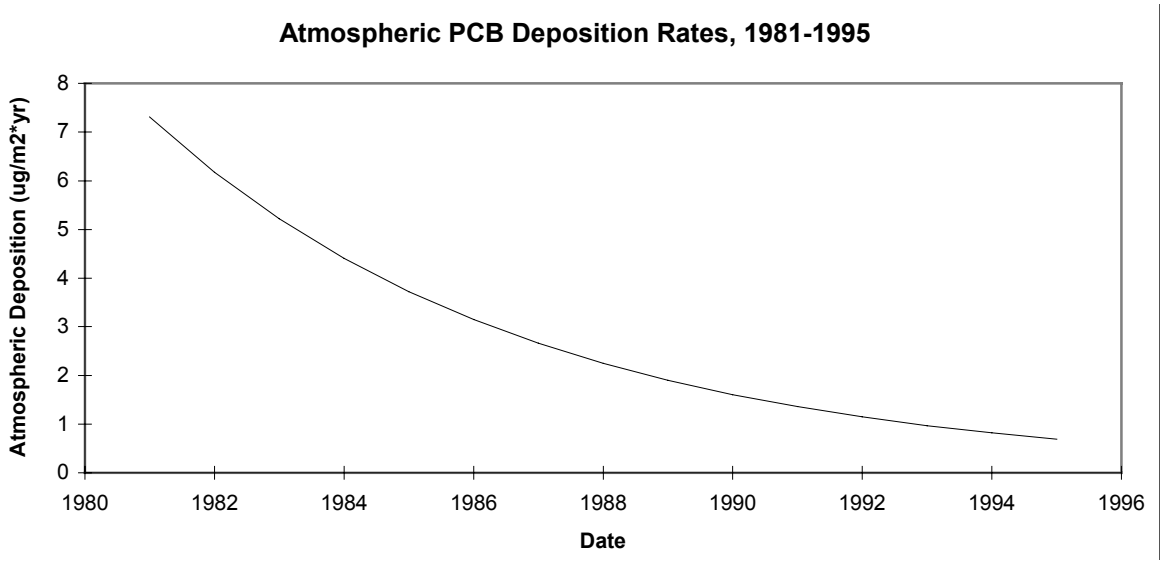

Figure 4. Estimated rates based on decline in water column concentration data

6.4.3 Estimation of Annual Atmospheric PCB Deposition Rates: 1954-1981

The equation derived by Rapaport and Eisenreich (1988) from the peat core data, as shown graphically in Figure 3, can be used to extend the historical series of atmospheric PCB deposition rates back from 1981 to 1954. To do so, two adjustments in the peat core data are necessary. First, a decline in their estimated time series to zero after 1981, which contradicts their own empirical data (see Figure 2 of their study) and is an artifact of the polynomial curve fitting, must be modified. This requires altering values for 1980-1982 to approximate the data shown in Rapaport and Eisenreich's Figure 2, which is a graph of the data values to which their polynominal was fitted. Implicit in this use of the peat core data is the assumption that the proportion of PCBs lost to volatilization, decay, and other losses is constant throughout the cores.

Next, the curve (which is presented by Rapaport and Eisenreich as a dimensionless percentage distribution function) must be scaled to units of mass per area per unit time, in such a way that it is continuous (i.e., produces the same 1981 value) with the curve shown in Figure 4. The result is shown in Figure 5, and represents gross atmospheric deposition, with a peak of about 14 ug/m^2/yr. In contrast, the maximum value of 4.5 ug/m^2/yr estimated by Rapaport and Eisenreich from the peat cores is net of losses.

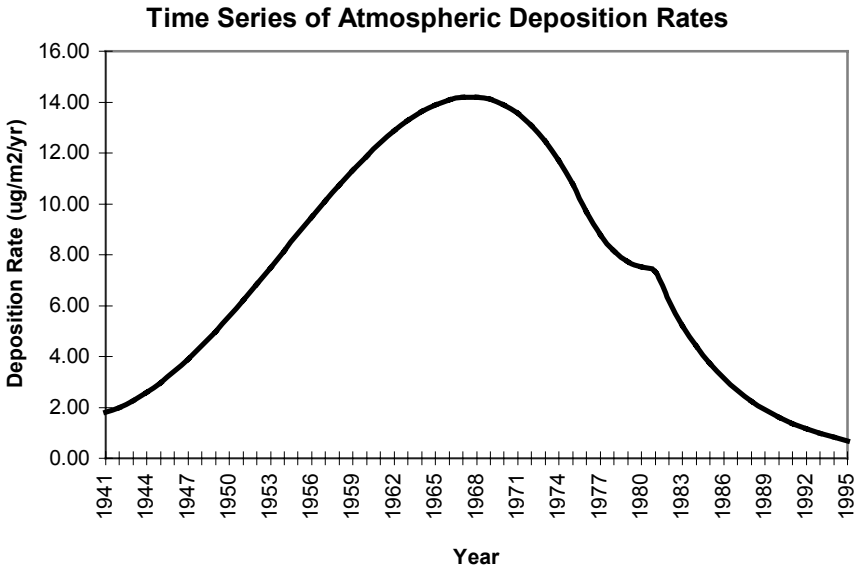

Figure 5. Estimated deposition rates for hindcast period

6.4.4 Conversion of Rates to Loads

Once an annual PCB deposition rate for the Green Bay watershed is determined, it can be converted to a load based on watershed areas. Each subwatershed area can be multiplied by the annual average deposition rate for each year between 1954 and 1995 to estimate a background PCB load to the watershed:

Atmospheric PCB Load = Atmospheric Deposition Rate * Watershed Area

The subwatersheds and their respective areas are listed in Table 14.

While this is an estimate of PCB load deposited onto the watershed, it is not an estimate of PCB load exported from the watershed to Green Bay, because much of the PCB load may not delivered to the Bay. The estimate of the percent deposited which is transported to the Bay requires the estimation of an apparent delivery ratio.

6.4.5 Estimation of Apparent Delivery Ratios

The percent of the atmospheric PCB load which is transported to Green Bay can be estimated from water column PCB data. Because both flow and PCB concentration data were available for four rivers (Escanaba, Menominee, Oconto, and Peshtigo) for the time period September 1988 - October 1990, these data were used to estimate the apparent delivery ratio for each of these four basins.

Tributary-specific PCB concentrations were used to calculate watershed-specific delivery ratios based on the following equation:

Apparent Delivery Ratio = (Measured Concentration * Measured Flow)/Atm. PCB Load

The estimated delivery ratios are listed in Table 14. These are assumed to remain unchanged over the 1954-1995 time period.

Table 14. Estimated apparent delivery ratios

Watershed Name	Watershed Area (km^2)	Apparent Delivery Ratio	Watershed Name	Watershed Area (km^2)	Apparent Delivery Ratio
Escanaba9	2,391	0.76	Direct7	360	0.58
Menominee7	10,526	0.22	Pensaukee7	386	0.58
Oconto7	2,513	0.20	Direct8	338	0.58
Peshtigo 7	2,957	0.79	Direct9	1335	0.58
Duck1	394	0.58	Cedar9	918	0.58
Direct1	46	0.58	Fishdam9	243	0.58
Direct2	211	0.58	Ford9	1283	0.58
Direct3	55	0.58	Rapid9	352	0.58
Direct4	255	0.58	Sturgeon9	522	0.58
Direct5	15	0.58	Tacoosh9	76	0.58
Direct6	85	0.58	Whitefish9	811	0.58

Notes: Apparent delivery ratios for Escanaba, Menominee, Oconto and Peshtigo were chosen to match atmospheric loading and tributary concentration and flow data for the period of the Green Bay Mass Balance Study. Apparent delivery ratios for all other basins were calculated as the average delivery ratio for the Escanaba, Oconto and Peshtigo.

Watershed names are a combination of the watershed name and the GBTOX model segment the load flows into (i.e., Direct1 is the direct drainage to Green Bay which enters into GBTOX model segment #1).

These ratios will be referred to herein as "apparent delivery ratios" because the water column loads used to compute them include urban loads and any other sources of PCBs, in addition to wet and dry atmospheric deposition. Water column loads also may include gas-phase transfer to soil and vegetation, for which no deposition rate estimates were available. The apparent delivery ratio for the other tributaries in the watershed was estimated by averaging the delivery ratios for the smaller sub-watersheds (Oconto, Peshtigo and Escanaba), obtaining 0.58. This approach assumes that the apparent delivery ratio is a function of watershed size.

The estimated apparent delivery ratios, ranging from 0.20-0.76, are generally higher than expected, indicating that urban stormwater loads and or gas-phase transfer to surfaces may indeed be significant contributors, inflating the apparent roles of wet and dry deposition. Using estimates of deposition of lead, mercury and PCBs to the Lake Superior watershed, Dolan, et al., 1993 estimated that roughly 10% of the material that is wet and dry deposited in the Lake Superior watershed reaches the Great Lakes by fluvial transport. An additional check to verify the appropriateness of the delivery ratios listed in Table 14, was found in Bierman et al., 1992. In this report, an estimate of Total Green Bay PCB Loads (Max), 1989 for Major Source Categories is provided in Figure 6-4. From this figure, it is possible to estimate the delivery ratio used for the Escanaba, Menominee, Oconto, and Peshtigo Rivers. The lumped delivery ratio estimated from the Bierman et al. report for the four subwatersheds equals 0.30. The area-weighted delivery ratio estimated using the method outlined above equals 0.38. This is similar to the delivery ratio estimated from the Bierman et al. (1992) report.

These estimated PCB delivery ratios are also generally higher than reported sediment delivery ratios. The Soil Conservation Service method (SCS) estimates a sediment delivery ratio of approximately 0.25 for the Green Bay watershed. However, the sediment delivery ratio is expected to be lower than the PCB delivery ratio because the sediment delivery ratio accounts for sediments of all size classes, while the PCB delivery ratio accounts for primarily the smaller size fractions which travel farther in the watershed. Furthermore, PCBs dissolved in rainwater (i.e., wet deposition) will travel with water and a higher delivery ratio is expected. Finally, the high apparent delivery ratios reported in Table 14 are based on tributary loads that include PCBs delivered from all sources in the watershed, including urban stormwater loads.

6.4.6 Estimation of Loadings to Green Bay

The estimated loads to Green Bay are presented in Table 15. A total of approximately 4,000 kg of PCBs delivered to Green Bay over the hindcast period was estimated. Monthly (flow-weighted) load estimates for the hindcast period are presented in the Appendix C. These estimates are subject to considerable uncertainty, due to factors discussed above and summarized in Section 7. The uncertainty analysis discussed in Section 7 indicates a high uncertainty (approximately +/-100%), but because the estimated standard errors are based on comparisons to literature values rather than true values, they are probably overestimates. Using the estimated uncertainties, the range of estimated load of PCBs delivered to Green Bay over the hindcast period is 0-8,000 kg.

Table 15. Estimated total PCB loads to Green Bay (1954-1995)

Watershed Name	Total PCB Load (kg)	Watershed Name	Total PCB Load (kg)
ESCANABA9	643	DIRECT7	74
MENOMINEE7	819	PENSAUKEE7	80
OCONTO7	178	DIRECT8	70
PESHTIGO7	827	DIRECT9	276
DUCK1	81	CEDAR9	189
DIRECT1	10	FISHDAM9	50
DIRECT2	44	FORD9	265
DIRECT3	11	RAPID9	73
DIRECT4	53	STURGEON9	108
DIRECT5	3	TACOOSH9	16
DIRECT6	17	WHITEFISH9	167
		Total PCB Load	**4,053**

Note: Watershed names are a combination of the watershed name and the GBTOX model segment the load flows into (i.e., Direct1 is the direct drainage to Green Bay which enters into GBTOX model segment #1).

These loads represent total PCB loads from each subwatershed, and include urban stormwater loads. As discussed above, urban stormwater loads were not modeled explicitly; rather, urban loads were modeled implicitly, by assuming that they have been proportional to atmospheric deposition, both driven by the same time trends in the production and use of PCBs. Urban loads constituted an unknown proportion of total loads historically, but an approximation can be made for recent years, using the available data for 1989-1994 (USGS, 1996). PCB loads can be calculated from these data as a product of concentration and runoff, where runoff is calculated based on rainfall and subwatershed-specific, urban-area runoff coefficients. The runoff coefficient calculations used values from Dunne and Leopold (1978), weighted according to the distribution of land use by area in each subwatershed, and ranged from 0.4 to 0.5 with an average for the watershed of 0.42. Using this approach for the years 1989-1994, urban stormwater loads are estimated to comprise approximately 3-11% of the total PCB load from these tributaries to Green Bay.

7. DISCUSSION OF UNCERTAINTY

The process of estimating historical loads always involves uncertainty, unless sampling data are available for the entire study period. Because the record of data necessary to estimate loads over the entire study period is incomplete, the methods recommended in this report contain a level of uncertainty. However, every effort was made to reduce this uncertainty and the methods recommended were based, to a great extent, on their ability to produce as accurate an estimate of historical loads as possible.

The uncertainties in the recommended methods are discussed qualitatively, and where possible, quantitatively, in this section, beginning with the factors contributing to the overall uncertainty in the proposed approach for estimating PCB loads. Estimated coefficients of variation and standard errors of the load estimates are then presented and discussed in Section 7.2 and 7.3.

7.1 SOURCES OF UNCERTAINTY IN LOAD ESTIMATIONS

Table 16 summarizes the major factors contributing to uncertainty in solids load estimates, the range of values, where known, and comments pertaining to the uncertainty. Several factors also affect the uncertainty in the PCB load estimation, as summarized in Table 17.

Table 16. Uncertainty in Solids Loads

Factor	Range	Comments
Suspended sediment (SS) data were used as a surrogate for total non-filterable solids (TNF), when TNF solids data were not available. Suspended sediment data were converted to total non-filterable solids by multiplying SS loads by 1.19.	Range of TNF/SS: Escanaba: 0.6 - 2 Menominee: 0.04 - 6 Oconto: 0.04 - 3 Median=1 for all tributaries.	While Escanaba River was sampled for both TNF and SS, the conversion for the Ford River SS data was based on the average ratio from three tributaries, none of which were the Ford.
Absence of data for smaller tributaries and direct drainage areas necessitated the selection and *use of reference tributaries to estimate loads* from unmonitored subwatersheds.	29% of the study area is unmonitored.	The delivery of solids from larger watersheds may be different from the processes occurring in smaller basins closer to Green Bay. Delivery ratios are typically higher for smaller watersheds, therefore the use of solids loads from larger watersheds may underpredict loads from smaller watersheds. Also, land use in larger watersheds further from the bay may be more rural than smaller watersheds closer to Green Bay. The impact of this differing land use is unknown.
Solids concentrations were assumed to remain constant between the upstream sampling location and the mouth.	Peshtigo River total non-filterable solids measured concurrently at the upstream, Peshtigo, WI station and at the mouth of the Peshtigo River, were the same in 96% of the paired samples. Sonzogni, 1979 estimated point sources contributed 4% of the tributary solids load (1975-76).	Upstream sampling was necessary to avoid seiche effects. However, the use of upstream solids instead of solids at the mouth may result in a lower load estimate than expected because solids concentration may increase between an upstream sampling location and the mouth. This may be due, in part, to point sources entering the tributary downstream of the solids sampling location.

Table 16. Uncertainty in Solids Loads (Continued)

Factor	Range	Comments
A *drainage area ratio approach* was used to convert flows gaged upstream of the mouth to flows at the mouth.	Total gaged area for the Peshtigo, Menominee, Oconto, Escanaba & Ford Rivers = 6,245 mi^2. Total area at mouth of these same rivers = 7,603 mi^2. 82% of the watershed of these 5 rivers is gaged. 62% of the entire study area is gaged.	Flows were measured upstream, to avoid any seiche effects. Since runoff patterns are likely different closer to the mouth of the tributaries than upstream, it is possible that the drainage area ratio is not an exact estimate of the flows at the mouth. Changes in land use patterns may affect the flows, i.e., large urban areas are often located at the mouth of rivers, and aren't as common upstream.
None of the tributaries had complete solids data sets for the study period. *Incomplete solids data sets* were used to estimate solids over the hindcast period.	The percent of the 42 year hindcast period with solids data is indicated by tributary: Escanaba 48% Peshtigo 79% Oconto 48% Menominee 7% Ford 48%	The sampling programs from which the data were obtained, were not necessarily designed for the purpose of load estimation. Loads may be underestimated since high flow events tend to be undersampled in many data collection efforts.
The BURE approach used *assumes that the load to flow ratio is constant over time*.	The percent of the 42 year hindcast period with solids data is indicated by tributary: Escanaba 48% Peshtigo 79% Oconto 48% Menominee 7% Ford 48%	Over time, changes in the solids to flow relationship may have occurred. While no trend in concentration over time was observed in the available data, it is possible that a trend does exist, but that the time periods covered by solids data are too short to notice such a trend.
Laws may have affected the contribution of solids from point sources over time.	The Water Pollution Control Act controlling discharge into surface waters was enacted in 1972.	

Table 17. Uncertainty in PCB Loads

Factor	Range	Comments
Water column PCB data vary over a range for each tributary, but an average concentration for each tributary in the 1988-90 period was used to estimate the delivery ratio	1988-90 Data: Range for 4 tributaries was 2-7 ng/l	Delivery ratio was estimated based on data collected between 1988-90. Sampling program was not designed for purposes of estimating a delivery ratio.
Tributary-specific *delivery ratios were assumed to remain constant* for the entire hindcast period.	Total population in the study area grew 22% between 1950-90. Percent of land in farms decreased from 18% to 9% between 1954-92.	Delivery ratios are known to depend, in part on land use. Land use did change over the hindcast period, but information is limited, and effect on delivery ratio is unknown.
Water column PCB data vary within and between tributaries, but an *average concentration of four tributaries was used to estimate the trend* in PCB loading between 1981-present.	1980-83 Data: Range for 4 tributaries was 7-17 ng/l 1988-90 Data: Range for 4 tributaries was 2-7 ng/l	Small number of samples, particularly during 1980-83 period, introduces uncertainty. Potentially different methods employed in sampling during the two time-periods.
Because data are available for only four tributaries, it was necessary to *assume that trends based on these tributaries are applicable to unmonitored drainages.*	Unmonitored areas comprise 29% of the study area.	Data were available only for 4 largest tributaries. There are no data available for smaller tributaries from which any comparisons can be made.
Some studies have shown that *atmospheric PCB deposition varies spatially over land.* Approach used assumes no spatial variability across the watershed.	Range of maximum deposition to peat bogs in 1969 given as 1 - 4.5 ug/m^2/yr	Peat core data were collected from bogs in North Carolina, northeastern U.S., and Canada. Atmospheric PCB concentrations have been shown to vary based on proximity to urban areas and large water bodies (such as Lake Michigan).

Table 17. Uncertainty in PCB Loads (Continued)

Factor	Range	Comments
Atmospheric deposition rates may vary temporally, within a year. This approach assumes the rate is constant throughout each year.	Wet + dry deposition to Lake Michigan was estimated by Hoff et al., 1996 by season (kg/yr) Winter 15.6 Spring 14.5 Summer 17.2 Fall 21.3	Differences in precipitation rates, atmospheric PCB concentrations, and volatilization rates, for example, affect deposition rates.
There was a *high uncertainty in the "1992" estimate of atmospheric deposition rate* that was used as a key input in the approach.	Pearson, et al. (study that reports "1992" estimate of 1.903 ug/m^2/yr) reports 1580 kg/yr of unknown input in mass balance, which may be due to higher rates in the Chicago area.	Estimating atmospheric PCB deposition rates over the Great Lakes is an evolving science. With a greater understanding of the processes involved, estimates are being updated, and variability is decreasing.
Delivery ratio includes point sources, however, *contribution from point sources likely changed significantly* after PCB ban.	All US production of PCB was banned in 1977 and its use was limited to existing closed electrical systems (Rodgers et al., 1986).	Records of PCB loads from point sources were very sparse.
Time Series of urban stormwater loads and gas-phase transfer to surfaces *are assumed proportional* to wet and dry deposition.	Independent time-trend information on these loads is not available.	All loads are fundamentally driven by time trends in PCB manufacture and use, but time patterns of discharge and intermediate storage (such as on soils or sediments) may differ.

7.2 ESTIMATED NORMALIZED STANDARD ERRORS OF LOAD ESTIMATES

In order to bound the uncertainty of the solids and PCB load estimates, two analyses were conducted. First, the root mean square error (RMSE) was calculated for the solids load estimates. This error term is calculated as part of the Beale's Unstratified Ratio Estimator (BURE) approach that was used by LTI to estimate tributary solids loads. A second approach was applied for PCBs. This approach involved comparison of literature load estimates to LTI load estimates for corresponding tributaries and time periods, and calculation of the RMSE, normalized to mean literature values. The LTI model error for PCBs is likely overstated using this second approach because it includes the assumption that the literature values reflect the true loads. The following discussion explains the methods for determining load estimation uncertainty for solids and PCBs.

7.2.1 SOLIDS

The BURE load estimation program used by LTI to estimate solids loads includes a calculation of the root mean square error (RMSE) of the mean daily load estimate. The RMSE was calculated for each of the tributaries for which both flow and solids data were available (Peshtigo, Oconto, Menominee, Ford, and Escanaba). The RMSE was then divided by the average daily load for the corresponding tributary to obtain a tributary-specific normalized standard error (NSE). The NSEs estimated for each of the five monitored tributaries are presented in Table 18. Because the solids loads for the unmonitored tributaries were based on a drainage area ratio to the Ford River loads, the NSE estimated for the Ford River was assumed to reflect the NSE of the unmonitored tributaries. These values, which range from 10-21%, are consistent with the range of 5-30% found by Preston et al. (1992) and discussed in Section 5.1.2 above. The absolute standard error of the load estimates is discussed in Section 7.3.

Table 18. Normalized Standard Error Calculated for Each of the Five Monitored Tributaries

Tributary	NSE
Escanaba9	0.10
Peshtigo7	0.10
Menominee7	0.21
Oconto7	0.07
Ford9	0.21

7.2.2 PCBs

PCB load estimates were available in the literature for four tributaries; the Peshtigo, Oconto, Menominee and Escanaba. The PCB loads estimated by LTI for the time periods corresponding to the literature-reported estimates were divided by the literature PCB load estimates to obtain a LTI/literature ratio for each estimate available in the literature. All estimates were obtained from two documents: Bierman et al., 1992 and USGS, 1993. Table 19 below summarizes the tributaries and time periods for which PCB load estimates were available as well as the LTI/literature ratios of PCB load estimates.

Table 19. Summary of LTI/Literature PCB Load Ratios Estimated for All Tributaries and Years for Which Literature Load Estimates Were Available

Year	River	Literature Source for PCB Load Estimate	LTI load/literature load
WY 1989	Escanaba	USGS, 1993	1.21
WY 1990	Escanaba	USGS, 1993	2.00
WY 1989	Menominee	USGS, 1993	0.12
WY 1990	Menominee	USGS, 1993	0.16
WY 1989	Peshtigo	USGS, 1993	1.25
WY 1990	Peshtigo	USGS, 1993	1.50
WY 1989	Oconto	USGS, 1993	3.43
WY 1990	Oconto	USGS, 1993	2.60
WY 1990	Escanaba	Bierman et al, 1992	1.57
WY 1990	Oconto	Bierman et al, 1992	3.20
WY 1990	Peshtigo	Bierman et al, 1992	0.49
WY 1990	Menominee	Bierman et al, 1992	0.17

For each row of Table 19, the relative error in LTI's load estimates was estimated as the deviation of the LTI/literature load ratio from 1. Normalized standard errors were then calculated for each tributary as root mean squared values of these relative errors. The average NSE for these four tributaries was also calculated. These values are summarized in Table 20 below.

Table 20. Statistical Information for Analysis of LTI/Literature PCB Load Ratio

Tributary	NSE
Escanaba	0.67
Menominee	0.85
Oconto	2.10
Peshtigo	0.44
Average	1.02

7.3 ESTIMATED STANDARD ERRORS OF LOAD ESTIMATES

The normalized standard errors presented in Tables 18 and 20 for solids and PCB load estimates were used to calculate absolute standard errors for the load estimates. The standard error can be estimated by multiplying the NSE by the estimated load. The average annual 42-year solids load estimates for all of the tributaries in the study area are presented in Table 21 below. Also presented in Table 21 are the standard errors calculated for each load using the NSEs presented in Table 18. As noted previously, the NSE estimated for the Ford River was used for all of the unmonitored watersheds.

Table 22 presents the same information for PCBs: the average annual 42-year load and standard error estimated by applying the NSEs presented in Table 20. For tributaries for which LTI/literature PCB load values could not be computed, the average value presented in Table 20 was applied. Because the estimated standard errors are based on comparisons to literature estimates (which embody additional error) rather than true values, these estimated standard errors are probably overestimates.

Table 21. Summary of Uncertainty for Average Annual Solids Loads Presented as Standard Errors, 1/1/54 – 12/31/95.

Tributary	1954-95 Average Annual Solids Load (MT/yr)	NSE	Standard Error (MT/yr)
Escanaba9	4778	0.10	477.8
Peshtigo7	4917	0.10	491.7
Menominee7	18780	0.21	3943.9
Oconto7	5374	0.07	376.2
Ford9	5089	0.21	1068.7
Duck1	1562	0.21	328.0
Direct1	183	0.21	38.4
Direct2	836	0.21	175.6
Direct3	217	0.21	45.6
Direct4	1013	0.21	212.7
Direct5	60	0.21	12.6
Direct6	336	0.21	70.5
Direct7	1430	0.21	300.2
Pensaukee7	1531	0.21	321.5
Direct8	1340	0.21	281.3
Direct9	5297	0.21	1112.5
Cedar9	3641	0.21	764.7
Fishdam9	966	0.21	202.8
Rapid9	1398	0.21	293.6
Sturgeon9	2070	0.21	434.6
Tacoosh9	301	0.21	63.3
Whitefish9	3216	0.21	675.3

Table 22. Summary of Uncertainty for Average Annual PCB Loads Presented as Standard Errors, 1/1/54 - 12/31/95.

Tributary	1954-95 Average Annual PCB Load (kg/yr)	NSE	Standard Error (kg/yr)
Escanaba9	15.31	0.67	10.32
Peshtigo7	19.51	0.44	8.53
Menominee7	4.23	0.85	3.60
Oconto7	19.68	2.10	41.43
Ford9	1.94	1.02	1.97
Duck1	0.23	1.02	0.23
Direct1	1.04	1.02	1.05
Direct2	0.27	1.02	0.27
Direct3	1.25	1.02	1.28
Direct4	0.07	1.02	0.08
Direct5	0.42	1.02	0.42
Direct6	1.77	1.02	1.80
Direct7	1.90	1.02	1.93
Pensaukee7	1.66	1.02	1.69
Direct8	6.56	1.02	6.67
Direct9	4.51	1.02	4.59
Cedar9	1.20	1.02	1.22
Fishdam9	6.30	1.02	6.41
Rapid9	1.73	1.02	1.76
Sturgeon9	2.56	1.02	2.61
Tacoosh9	0.37	1.02	0.38
Whitefish9	3.98	1.02	4.05

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APPENDIX A. ESTIMATED SOLIDS LOADS

Estimated Solids loads to Green Bay from Tributaries, 1954-1995

Total solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Total Load, metric tons																							
	200,675	206,507	788,773	225,700	213,737	65,600	7,671	35,116	9,116	42,542	2,514	14,101	60,050	64,303	56,263	222,494	152,933	40,556	58,717	86,921	12,662	135,058	2,702,010
Annual load, metric tons																							
1954	5,427	4,820	23,135	4,671	6,315	1,938	227	1,037	269	1,257	74	417	1,774	1,900	1,662	6,573	4,518	1,198	1,735	2,568	374	3,990	75,880
1955	3,944	3,807	17,795	3,880	3,548	1,089	127	583	151	706	42	234	997	1,067	934	3,694	2,539	673	975	1,443	210	2,242	50,681
1956	3,786	3,818	16,452	3,600	3,505	1,076	126	576	149	698	41	231	985	1,055	923	3,649	2,508	665	963	1,425	208	2,215	48,653
1957	3,501	3,515	13,900	3,742	3,562	1,093	128	585	152	709	42	235	1,001	1,071	938	3,707	2,548	676	978	1,448	211	2,250	45,992
1958	3,760	3,751	14,444	3,930	3,835	1,177	138	630	164	763	45	253	1,078	1,154	1,010	3,992	2,744	728	1,054	1,560	227	2,423	48,860
1959	4,767	5,232	19,028	4,786	5,167	1,586	185	849	220	1,029	61	341	1,452	1,555	1,360	5,379	3,697	981	1,420	2,101	306	3,265	64,767
1960	7,474	8,092	26,309	7,568	8,102	2,487	291	1,331	346	1,613	95	535	2,276	2,438	2,133	8,434	5,797	1,537	2,226	3,295	480	5,120	97,977
1961	4,336	4,948	17,728	5,226	4,353	1,336	156	715	186	866	51	287	1,223	1,309	1,146	4,531	3,114	826	1,196	1,770	258	2,750	58,312
1962	3,710	5,225	16,372	5,469	4,049	1,243	145	665	173	806	48	267	1,138	1,218	1,066	4,215	2,897	768	1,112	1,647	240	2,559	55,032
1963	2,668	3,419	12,452	3,616	2,223	682	80	365	95	442	26	147	624	669	585	2,314	1,590	422	611	904	132	1,405	35,469
1964	3,842	3,484	13,566	3,782	4,049	1,243	145	665	173	806	48	267	1,138	1,218	1,066	4,215	2,897	768	1,112	1,647	240	2,558	48,928
1965	4,865	5,665	20,856	5,904	6,201	1,903	223	1,019	264	1,234	73	409	1,742	1,866	1,632	6,455	4,437	1,177	1,704	2,522	367	3,918	74,437
1966	5,033	4,459	19,332	4,942	5,702	1,750	205	937	243	1,135	67	376	1,602	1,715	1,501	5,935	4,080	1,082	1,566	2,319	338	3,603	67,921
1967	4,962	5,845	22,802	6,061	5,028	1,543	180	826	214	1,001	59	332	1,413	1,513	1,324	5,234	3,598	954	1,381	2,045	298	3,177	69,790
1968	5,913	5,798	22,710	5,913	6,849	2,102	246	1,125	292	1,363	81	452	1,924	2,060	1,803	7,129	4,900	1,300	1,881	2,785	406	4,328	81,360
1969	4,972	5,322	19,797	6,274	5,013	1,539	180	824	214	998	59	331	1,408	1,508	1,320	5,219	3,587	951	1,377	2,039	297	3,168	66,395
1970	4,107	6,205	17,112	5,196	4,382	1,345	157	720	187	872	52	289	1,231	1,318	1,153	4,561	3,135	831	1,204	1,782	260	2,769	58,868
1971	5,661	7,101	19,992	5,734	6,155	1,889	221	1,011	262	1,225	72	406	1,729	1,852	1,620	6,407	4,404	1,168	1,691	2,503	365	3,889	75,357
1972	5,586	7,639	24,136	6,140	6,385	1,960	229	1,049	272	1,271	75	421	1,794	1,921	1,681	6,647	4,569	1,212	1,754	2,597	378	4,035	81,750
1973	5,806	10,693	26,079	8,565	6,935	2,129	249	1,139	296	1,380	82	458	1,948	2,086	1,826	7,219	4,962	1,316	1,905	2,820	411	4,382	92,687
1974	4,006	6,458	17,925	5,584	5,643	1,732	203	927	241	1,123	66	372	1,585	1,698	1,485	5,874	4,037	1,071	1,550	2,295	334	3,566	67,775
1975	4,638	6,767	19,005	5,342	5,421	1,664	195	891	231	1,079	64	358	1,523	1,631	1,427	5,643	3,879	1,029	1,489	2,205	321	3,425	68,226
1976	4,368	6,461	17,425	4,966	4,635	1,423	166	762	198	923	55	306	1,302	1,395	1,220	4,825	3,317	880	1,273	1,885	275	2,929	60,988
1977	4,059	5,039	14,608	4,095	5,032	1,545	181	827	215	1,002	59	332	1,414	1,514	1,325	5,239	3,601	955	1,382	2,047	298	3,180	57,946
1978	5,615	5,724	17,893	5,450	6,577	2,018	236	1,080	280	1,309	77	434	1,848	1,979	1,731	6,846	4,706	1,248	1,807	2,675	390	4,156	74,078
1979	6,912	9,741	24,993	7,179	7,695	2,362	276	1,264	328	1,532	91	508	2,162	2,315	2,025	8,010	5,506	1,460	2,114	3,129	456	4,862	94,918
1980	3,514	3,877	18,103	5,051	3,751	1,151	135	616	160	747	44	247	1,054	1,129	987	3,905	2,684	712	1,031	1,526	222	2,370	53,017
1981	4,416	3,696	21,307	4,594	4,764	1,462	171	783	203	948	56	314	1,338	1,433	1,254	4,959	3,409	904	1,309	1,937	282	3,010	62,552
1982	5,697	4,285	22,201	5,590	6,979	2,142	250	1,147	298	1,389	82	460	1,961	2,100	1,837	7,264	4,993	1,324	1,917	2,838	413	4,410	79,577
1983	5,766	5,077	24,722	6,327	6,682	2,051	240	1,098	285	1,330	79	441	1,877	2,010	1,759	6,956	4,781	1,268	1,836	2,717	396	4,222	81,919
1984	5,156	4,253	18,599	6,491	5,376	1,650	193	883	229	1,070	63	355	1,510	1,617	1,415	5,596	3,846	1,020	1,477	2,186	318	3,397	66,703
1985	7,173	5,237	24,815	7,491	6,620	2,032	238	1,088	282	1,318	78	437	1,860	1,992	1,743	6,892	4,737	1,256	1,819	2,692	392	4,183	84,375
1986	4,916	4,462	19,722	6,634	4,559	1,399	164	749	194	907	54	301	1,281	1,372	1,200	4,746	3,262	865	1,253	1,854	270	2,881	63,045
1987	3,553	2,711	12,768	3,786	3,011	924	108	495	128	599	35	199	846	906	793	3,134	2,154	571	827	1,224	178	1,902	40,854
1988	5,333	2,772	14,088	3,489	4,019	1,234	144	660	171	800	47	265	1,129	1,209	1,058	4,184	2,876	763	1,104	1,635	238	2,540	49,761
1989	4,878	2,392	13,920	3,635	4,321	1,326	155	710	184	860	51	285	1,214	1,300	1,137	4,498	3,092	820	1,187	1,757	256	2,730	50,708
1990	3,882	2,664	13,550	5,051	3,573	1,097	128	587	152	711	42	236	1,004	1,075	941	3,720	2,557	678	982	1,453	212	2,258	46,552
1991	4,833	3,310	18,932	5,897	5,600	1,719	201	920	239	1,115	66	369	1,573	1,685	1,474	5,830	4,007	1,063	1,538	2,278	332	3,539	66,519
1992	5,416	3,147	18,864	6,699	5,791	1,777	208	951	247	1,153	68	382	1,627	1,742	1,524	6,028	4,143	1,099	1,591	2,355	343	3,659	68,815
1993	5,507	3,830	19,639	7,768	5,728	1,758	206	941	244	1,140	67	378	1,609	1,723	1,508	5,963	4,099	1,087	1,574	2,330	339	3,620	71,060
1994	3,248	2,565	14,689	4,896	2,807	862	101	461	120	559	33	185	789	845	739	2,923	2,009	533	771	1,142	166	1,774	42,217
1995	3,669	3,198	17,008	4,689	3,793	1,164	136	623	162	755	45	250	1,066	1,141	998	3,949	2,714	720	1,042	1,543	225	2,397	51,287

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-54	180,869	182,650	1,088,349	208,683	221,130	67869	7936	36331	9431	44014	2601	14589	62127	66527	58209	230191	158223	41959	60748	89928	13100	139729	2,985,194
Feb-54	153,649	184,158	1,119,753	218,392	187,851	57,655	6,742	30,863	8,012	37,390	2,210	12,393	52,777	56,515	49,449	195,548	134,411	35,645	51,605	76,394	11,129	118,701	2,801,241
Mar-54	190,150	337,224	1,284,665	343,419	232,477	71,352	8,343	38,195	9,915	46,273	2,735	15,337	65,315	69,941	61,196	242,003	166,342	44,112	63,865	94,543	13,773	146,900	3,548,075
Apr-54	1,423,554	782,413	3,778,448	604,145	1,740,433	534,176	62,462	285,945	74,227	346,418	20,475	114,824	488,978	523,613	458,140	1,811,747	1,245,313	330,246	478,123	707,790	103,109	1,099,758	17,014,338
May-54	925,388	704,365	3,717,436	624,324	1,131,377	347,243	40,604	185,880	48,252	225,191	13,310	74,642	317,862	340,377	297,816	1,177,735	809,522	214,678	310,806	460,102	67,026	714,903	12,748,839
Jun-54	508,820	654,182	2,762,057	596,464	622,082	190,930	22,326	102,205	26,531	123,820	7,318	41,041	174,775	187,155	163,753	647,571	445,111	118,040	170,895	252,985	36,854	393,086	8,248,002
Jul-54	222,331	287,464	1,443,835	360,986	271,821	83,428	9,755	44,659	11,593	54,104	3,198	17,933	76,369	81,778	71,552	282,959	194,493	51,578	74,673	110,543	16,104	171,760	3,942,916
Aug-54	226,106	194,804	1,196,556	218,569	276,436	84,844	9,921	45,417	11,790	55,022	3,252	18,238	77,665	83,166	72,767	287,763	197,795	52,454	75,941	112,420	16,377	174,677	3,491,981
Sep-54	447,719	375,540	1,584,881	333,608	547,380	168,002	19,645	89,932	23,345	108,951	6,440	36,113	153,787	164,681	144,089	569,809	391,661	103,865	150,373	222,606	32,429	345,883	6,020,738
Oct-54	595,488	504,962	2,296,570	525,686	636,760	195,435	22,853	104,617	27,157	126,742	7,491	42,010	178,899	191,571	167,617	662,851	455,614	120,825	174,927	258,954	37,724	402,361	7,737,113
Nov-54	335,454	348,699	1,539,301	368,135	306,913	94,198	11,015	50,424	13,089	61,088	3,611	20,248	86,228	92,336	80,790	319,489	219,602	58,237	84,314	124,814	18,183	193,935	4,430,103
Dec-54	216,981	263,715	1,323,246	269,041	139,962	42,957	5,023	22,995	5,969	27,858	1,647	9,234	39,323	42,108	36,843	145,697	100,145	26,558	38,450	56,919	8,292	88,440	2,911,401
Jan-55	164,568	219,277	1,239,983	232,436	99,515	30,543	3,571	16,350	4,244	19,808	1,171	6,565	27,959	29,939	26,196	103,592	71,205	18,883	27,338	40,470	5,896	62,882	2,452,389
Feb-55	124,011	200,836	1,019,262	192,129	91,550	28,099	3,286	15,041	3,905	18,222	1,077	6,040	25,721	27,543	24,099	95,302	65,506	17,372	25,150	37,231	5,424	57,850	2,084,655
Mar-55	154,897	374,816	1,308,173	409,152	144,350	44,304	5,181	23,716	6,156	28,732	1,698	9,523	40,555	43,428	37,998	150,264	103,285	27,390	39,655	58,703	8,552	91,213	3,111,739
Apr-55	1,625,404	1,079,045	4,347,656	998,492	1,940,846	595,687	69,655	318,872	82,775	386,309	22,833	128,046	545,284	583,908	510,896	2,020,372	1,388,713	368,275	533,179	789,293	114,982	1,226,397	19,676,918
May-55	513,344	365,844	1,993,124	420,458	473,017	145,179	16,976	77,714	20,174	94,150	5,565	31,207	132,895	142,308	124,514	492,398	338,452	89,755	129,945	192,364	28,023	298,893	6,126,298
Jun-55	334,815	387,919	1,792,322	373,459	272,586	83,663	9,783	44,785	11,625	54,256	3,207	17,984	76,584	82,008	71,754	283,756	195,041	51,723	74,884	110,854	16,149	172,244	4,521,399
Jul-55	154,866	165,913	945,509	193,118	64,708	19,860	2,322	10,631	2,760	12,880	761	4,269	18,180	19,468	17,033	67,360	46,300	12,278	17,776	26,315	3,834	40,888	1,847,030
Aug-55	185,752	226,017	1,066,277	192,357	71,419	21,920	2,563	11,734	3,046	14,215	840	4,712	20,065	21,487	18,800	74,345	51,102	13,552	19,620	29,044	4,231	45,129	2,098,227
Sep-55	110,955	139,661	692,668	160,467	42,955	13,184	1,542	7,057	1,832	8,550	505	2,834	12,068	12,923	11,307	44,715	30,735	8,151	11,800	17,469	2,545	27,142	1,361,062
Oct-55	202,832	215,658	1,109,345	216,795	113,378	34,798	4,069	18,627	4,835	22,567	1,334	7,480	31,854	34,110	29,845	118,024	81,124	21,513	31,147	46,108	6,717	71,642	2,423,802
Nov-55	204,002	235,713	1,175,561	263,743	129,601	39,777	4,651	21,293	5,527	25,796	1,525	8,550	36,412	38,991	34,115	134,912	92,732	24,592	35,603	52,706	7,678	81,893	2,655,374
Dec-55	168,624	196,237	1,105,397	227,847	104,197	31,980	3,740	17,119	4,444	20,740	1,226	6,874	29,274	31,348	27,428	108,467	74,555	19,771	28,624	42,374	6,173	65,841	2,322,281
Jan-56	148,657	183,510	1,168,204	188,098	89,670	27,522	3,218	14,732	3,824	17,848	1,055	5,916	25,193	26,977	23,604	93,344	64,161	17,015	24,634	36,467	5,312	56,661	2,225,623
Feb-56	124,323	190,356	1,014,955	166,601	76,618	23,516	2,750	12,588	3,268	15,250	901	5,055	21,526	23,051	20,168	79,757	54,821	14,538	21,048	31,158	4,539	48,414	1,955,201
Mar-56	137,894	324,075	977,989	200,520	78,461	24,081	2,816	12,891	3,346	15,617	923	5,176	22,044	23,605	20,654	81,676	56,141	14,888	21,554	31,908	4,648	49,579	2,110,488
Apr-56	1,008,312	665,476	2,090,923	687,699	1,130,314	346,917	40,566	185,705	48,206	224,979	13,297	74,572	317,564	340,057	297,536	1,176,628	808,761	214,476	310,514	459,670	66,963	714,232	11,223,370
May-56	727,984	372,433	1,910,578	442,893	585,915	179,830	21,028	96,263	24,989	116,621	6,893	38,655	164,614	176,274	154,232	609,923	419,234	111,177	160,960	238,277	34,711	370,233	6,963,718
Jun-56	279,782	372,961	1,627,769	357,387	343,747	105,503	12,337	56,476	14,660	68,420	4,044	22,678	96,576	103,417	90,486	357,832	245,958	65,226	94,432	139,793	20,365	217,210	4,697,060
Jul-56	502,627	458,986	2,254,579	449,712	474,344	145,586	17,024	77,932	20,230	94,414	5,580	31,294	133,268	142,707	124,863	493,780	339,402	90,006	130,309	192,904	28,102	299,732	6,507,384
Aug-56	221,083	375,208	1,489,594	285,139	205,924	63,202	7,390	33,832	8,782	40,987	2,423	13,586	57,855	61,953	54,206	214,362	147,343	39,074	56,570	83,744	12,200	130,121	3,604,577
Sep-56	188,154	242,363	1,124,957	201,686	192,060	58,947	6,893	31,555	8,191	38,228	2,259	12,671	53,960	57,782	50,557	199,930	137,423	36,443	52,762	78,106	11,378	121,361	2,907,666
Oct-56	120,158	178,760	915,183	188,884	89,707	27,533	3,219	14,738	3,826	17,855	1,055	5,918	25,203	26,989	23,614	93,383	64,187	17,022	24,644	36,482	5,315	56,685	1,940,359
Nov-56	161,152	238,488	917,695	228,760	130,191	39,958	4,672	21,390	5,552	25,913	1,532	8,589	36,577	39,168	34,271	135,526	93,154	24,704	35,765	52,945	7,713	82,266	2,325,983
Dec-56	165,972	215,115	959,147	202,598	108,290	33,236	3,886	17,792	4,618	21,554	1,274	7,144	30,424	32,579	28,505	112,727	77,483	20,548	29,749	44,039	6,415	68,427	2,191,525
Jan-57	124,323	154,061	956,456	161,810	57,777	17,733	2,074	9,492	2,464	11,500	680	3,812	16,232	17,382	15,209	60,144	41,340	10,963	15,872	23,496	3,423	36,508	1,742,751
Feb-57	98,663	125,803	792,261	154,611	45,867	14,078	1,646	7,536	1,956	9,130	540	3,026	12,887	13,799	12,074	47,747	32,819	8,703	12,600	18,653	2,717	28,983	1,446,099
Mar-57	193,660	361,169	1,304,225	277,305	235,126	72,165	8,438	38,630	10,028	46,800	2,766	15,512	66,059	70,738	61,893	244,760	168,237	44,615	64,593	95,620	13,930	148,573	3,544,841
Apr-57	976,334	661,345	2,326,897	573,319	1,234,437	378,875	44,302	202,812	52,647	245,704	14,522	81,441	346,817	371,383	324,945	1,285,018	883,264	234,234	339,118	502,015	73,132	780,026	11,932,588
May-57	464,036	481,469	1,632,973	474,073	695,569	213,485	24,963	114,279	29,665	138,447	8,183	45,890	195,421	209,264	183,097	724,070	497,693	131,984	191,083	282,871	41,208	439,522	7,219,244
Jun-57	239,661	295,501	1,245,904	284,023	250,058	76,748	8,974	41,083	10,665	49,772	2,942	16,497	70,254	75,231	65,824	260,304	178,922	47,448	68,695	101,692	14,814	158,009	3,563,023
Jul-57	141,186	162,912	804,643	224,222	89,928	27,601	3,227	14,775	3,835	17,899	1,058	5,933	25,265	27,055	23,672	93,613	64,345	17,064	24,705	36,571	5,328	56,824	1,871,662
Aug-57	99,989	133,222	675,261	212,510	48,227	14,802	1,731	7,923	2,057	9,599	567	3,182	13,549	14,509	12,695	50,203	34,507	9,151	13,249	19,613	2,857	30,474	1,409,879
Sep-57	299,499	245,439	921,284	325,445	144,350	44,304	5,181	23,716	6,156	28,732	1,698	9,523	40,555	43,428	37,998	150,264	103,285	27,390	39,655	58,703	8,552	91,213	2,656,369
Oct-57	195,579	195,151	972,067	271,602	146,267	44,892	5,249	24,031	6,238	29,113	1,721	9,650	41,094	44,005	38,502	152,260	104,657	27,754	40,182	59,483	8,665	92,424	2,510,586
Nov-57	434,335	435,523	1,199,069	462,184	456,572	140,132	16,386	75,013	19,472	90,877	5,371	30,122	128,275	137,361	120,185	475,280	326,686	86,634	125,427	185,676	27,049	288,502	5,266,132
Dec-57	233,359	263,639	1,068,610	320,984	157,365	48,299	5,648	25,854	6,711	31,322	1,851	10,382	44,212	47,344	41,424	163,813	112,598	29,860	43,230	63,996	9,323	99,437	2,829,261

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-58	175,955	188,320	1,049,768	227,011	100,399	30,815	3,603	16,495	4,282	19,984	1,181	6,624	28,207	30,205	26,428	104,513	71,838	19,051	27,581	40,830	5,948	63,441	2,242,481
Feb-58	139,142	151,136	899,032	183,535	72,709	22,316	2,609	11,946	3,101	14,472	855	4,797	20,428	21,875	19,140	75,689	52,025	13,797	19,974	29,569	4,308	45,944	1,808,399
Mar-58	175,643	341,220	1,126,033	283,389	147,299	45,209	5,286	24,201	6,282	29,319	1,733	9,718	41,384	44,315	38,774	153,335	105,395	27,950	40,465	59,903	8,726	93,077	2,808,658
Apr-58	1,014,708	656,911	1,944,314	715,001	1,118,810	343,386	40,153	183,815	47,716	222,690	13,162	73,813	314,332	336,597	294,508	1,164,653	800,530	212,294	307,354	454,992	66,282	706,962	11,032,983
May-58	405,899	402,320	1,131,058	443,222	494,623	151,810	17,751	81,264	21,095	98,451	5,819	32,632	138,965	148,808	130,201	514,890	353,912	93,854	135,880	201,151	29,303	312,546	5,345,456
Jun-58	329,932	254,305	1,157,616	291,907	250,058	76,748	8,974	41,083	10,665	49,772	2,942	16,497	70,254	75,231	65,824	260,304	178,922	47,448	68,695	101,692	14,814	158,009	3,531,694
Jul-58	535,822	446,968	2,389,344	442,817	693,394	212,817	24,885	113,921	29,572	138,014	8,157	45,746	194,810	208,609	182,524	721,806	496,137	131,571	190,486	281,986	41,079	438,147	7,968,613
Aug-58	136,069	175,036	864,219	235,579	61,906	19,000	2,222	10,171	2,640	12,322	728	4,084	17,393	18,625	16,296	64,443	44,295	11,747	17,007	25,176	3,668	39,118	1,781,742
Sep-58	235,247	316,325	1,021,954	298,169	295,852	90,803	10,618	48,607	12,618	58,887	3,480	19,519	83,120	89,008	77,878	307,974	211,688	56,138	81,275	120,316	17,527	186,945	3,643,947
Oct-58	164,241	284,614	785,621	293,707	141,142	43,319	5,065	23,189	6,020	28,093	1,660	9,312	39,654	42,463	37,153	146,925	100,990	26,782	38,774	57,399	8,362	89,186	2,373,669
Nov-58	308,312	321,587	1,197,812	320,375	344,706	105,798	12,371	56,634	14,701	68,611	4,055	22,742	96,846	103,706	90,738	358,830	246,644	65,408	94,696	140,183	20,421	217,815	4,212,991
Dec-58	138,830	212,582	877,499	195,323	114,373	35,104	4,105	18,791	4,878	22,765	1,346	7,546	32,133	34,410	30,107	119,060	81,836	21,702	31,420	46,513	6,776	72,271	2,109,369
Jan-59	96,557	182,862	877,140	184,422	69,760	21,411	2,504	11,461	2,975	13,885	821	4,602	19,599	20,987	18,363	72,618	49,914	13,237	19,164	28,370	4,133	44,080	1,758,865
Feb-59	80,646	171,296	759,781	166,170	45,831	14,066	1,645	7,530	1,955	9,122	539	3,024	12,876	13,788	12,064	47,708	32,793	8,696	12,590	18,638	2,715	28,960	1,452,434
Mar-59	120,423	359,149	1,088,529	288,612	85,651	26,288	3,074	14,072	3,653	17,048	1,008	5,651	24,064	25,768	22,546	89,161	61,285	16,252	23,530	34,832	5,074	54,122	2,369,791
Apr-59	970,875	665,929	1,961,362	814,704	1,088,170	333,982	39,053	178,781	46,409	216,591	12,802	71,791	305,723	327,379	286,443	1,132,758	778,607	206,480	298,937	442,532	64,467	687,602	10,931,375
May-59	589,732	568,263	1,914,167	695,406	761,494	233,719	27,329	125,110	32,477	151,569	8,958	50,239	213,943	229,097	200,451	792,696	544,864	144,493	209,194	309,681	45,113	481,179	8,329,174
Jun-59	214,656	254,124	1,058,382	312,466	190,770	58,551	6,847	31,343	8,136	37,971	2,244	12,586	53,597	57,394	50,217	198,587	136,500	36,198	52,407	77,581	11,302	120,545	2,982,405
Jul-59	229,116	234,235	921,104	233,500	203,675	62,512	7,310	33,463	8,686	40,540	2,396	13,437	57,223	61,276	53,614	212,020	145,733	38,647	55,952	82,829	12,066	128,700	2,838,037
Aug-59	368,461	441,223	1,537,327	255,048	381,798	117,182	13,702	62,728	16,283	75,994	4,492	25,189	107,267	114,865	100,502	397,442	273,184	72,446	104,886	155,268	22,619	241,254	4,889,158
Sep-59	501,598	771,782	2,572,740	404,589	686,683	210,758	24,644	112,819	29,286	136,679	8,078	45,303	192,925	206,590	180,758	714,820	491,335	130,298	188,642	279,257	40,681	433,907	8,364,172
Oct-59	782,003	661,254	2,825,222	579,251	935,636	287,166	33,579	153,721	39,904	186,230	11,007	61,728	262,868	281,488	246,291	973,973	669,465	177,536	257,033	380,499	55,430	591,217	10,452,502
Nov-59	516,729	495,266	2,011,607	480,791	478,547	146,876	17,174	78,623	20,409	95,251	5,630	31,572	134,449	143,972	125,970	498,156	342,410	90,804	131,464	194,613	28,351	302,388	6,371,051
Dec-59	296,238	426,913	1,500,182	370,619	239,476	73,500	8,595	39,345	10,213	47,666	2,817	15,799	67,281	72,047	63,038	249,289	171,350	45,441	65,788	97,389	14,187	151,322	4,028,497
Jan-60	247,398	569,982	1,537,866	475,823	289,621	88,891	10,394	47,583	12,352	57,647	3,407	19,107	81,369	87,133	76,238	301,488	207,229	54,955	79,563	117,781	17,158	183,008	4,565,994
Feb-60	190,150	313,354	1,258,825	290,386	169,422	51,999	6,080	27,835	7,226	33,722	1,993	11,177	47,599	50,971	44,597	176,364	121,225	32,148	46,543	68,900	10,037	107,056	3,067,608
Mar-60	176,735	366,341	1,216,654	295,583	131,813	40,456	4,731	21,656	5,622	26,236	1,551	8,696	37,033	39,656	34,698	137,214	94,315	25,012	36,211	53,605	7,809	83,291	2,844,921
Apr-60	1,752,223	1,306,133	4,492,649	1,127,372	1,893,762	581,236	67,965	311,136	80,767	376,937	22,279	124,939	532,056	569,743	498,502	1,971,359	1,355,024	359,340	520,245	770,145	112,193	1,196,645	20,022,650
May-60	1,976,535	2,168,343	6,733,232	1,716,967	2,837,952	871,027	101,851	466,262	121,035	564,870	33,386	187,232	797,327	853,804	747,044	2,954,237	2,030,609	538,500	779,628	1,154,124	168,129	1,793,267	29,595,361
Jun-60	602,959	687,265	2,372,656	652,969	591,925	181,674	21,243	97,251	25,245	117,818	6,964	39,052	166,302	178,082	155,815	616,179	423,534	112,317	162,611	240,721	35,068	374,030	7,861,680
Jul-60	443,539	454,070	1,668,145	510,527	323,874	99,404	11,623	53,211	13,813	64,464	3,810	21,367	90,993	97,438	85,254	337,145	231,738	61,455	88,973	131,711	19,187	204,652	5,016,394
Aug-60	352,753	483,776	1,325,400	582,978	263,516	80,879	9,457	43,294	11,239	52,451	3,100	17,385	74,035	79,279	69,366	274,314	188,551	50,002	72,392	107,165	15,612	166,513	4,323,457
Sep-60	564,368	445,732	1,418,354	469,916	481,755	147,861	17,290	79,150	20,546	95,889	5,667	31,783	135,350	144,937	126,814	501,495	344,705	91,413	132,345	195,918	28,541	304,415	5,784,243
Oct-60	259,768	340,707	1,143,440	428,190	188,521	57,861	6,766	30,973	8,040	37,523	2,218	12,438	52,965	56,717	49,625	196,245	134,890	35,772	51,789	76,667	11,169	119,124	3,301,408
Nov-60	602,320	622,486	1,830,186	664,783	677,539	207,951	24,316	111,317	28,896	134,858	7,971	44,700	190,356	203,839	178,351	705,301	484,792	128,563	186,130	275,538	40,140	428,129	7,778,463
Dec-60	305,504	333,590	1,311,582	352,824	252,307	77,438	9,055	41,453	10,761	50,220	2,968	16,646	70,886	75,907	66,416	262,646	180,531	47,875	69,313	102,607	14,948	159,430	3,814,906
Jan-61	162,540	218,116	1,044,385	253,882	73,631	22,599	2,643	12,097	3,140	14,656	866	4,858	20,687	22,152	19,382	76,648	52,685	13,971	20,228	29,944	4,362	46,527	2,119,998
Feb-61	134,150	214,286	884,676	247,544	42,696	13,104	1,532	7,015	1,821	8,498	502	2,817	11,996	12,845	11,239	44,446	30,550	8,102	11,729	17,364	2,529	26,979	1,736,424
Mar-61	234,451	588,815	1,530,867	619,178	192,540	59,095	6,910	31,633	8,212	38,323	2,265	12,703	54,094	57,926	50,683	200,429	137,766	36,534	52,894	78,301	11,407	121,664	4,126,689
Apr-61	1,206,418	856,631	2,701,583	788,390	1,340,367	411,387	48,104	220,216	57,165	266,789	15,768	88,430	376,578	403,253	352,830	1,395,289	959,059	254,334	368,219	545,094	79,408	846,962	13,582,272
May-61	928,649	648,392	3,511,251	718,753	1,121,244	344,133	40,240	184,215	47,820	223,174	13,191	73,973	315,015	337,329	295,149	1,167,186	802,271	212,755	308,022	455,982	66,426	708,500	12,523,670
Jun-61	313,912	388,673	1,523,869	421,979	308,351	94,639	11,066	50,661	13,151	61,375	3,628	20,343	86,632	92,768	81,168	320,986	220,631	58,509	84,709	125,399	18,268	194,843	4,495,560
Jul-61	207,138	330,303	1,122,983	328,842	177,533	54,489	6,371	29,168	7,572	35,337	2,089	11,713	49,878	53,411	46,733	184,808	127,029	33,687	48,771	72,198	10,518	112,181	3,052,750
Aug-61	163,258	309,720	1,060,535	324,482	95,016	29,162	3,410	15,611	4,052	18,912	1,118	6,269	26,695	28,586	25,011	98,910	67,986	18,029	26,102	38,641	5,629	60,040	2,427,175
Sep-61	154,585	279,970	922,002	285,494	96,786	29,706	3,474	15,901	4,128	19,264	1,139	6,385	27,192	29,118	25,477	100,752	69,252	18,365	26,589	39,360	5,734	61,158	2,221,831
Oct-61	268,753	373,836	1,053,716	386,843	283,353	86,967	10,169	46,554	12,085	56,399	3,333	18,694	79,608	85,247	74,588	294,963	202,744	53,766	77,841	115,232	16,787	179,047	3,780,526
Nov-61	302,915	442,399	1,217,552	498,942	372,433	114,307	13,366	61,189	15,884	74,130	4,381	24,571	104,636	112,047	98,037	387,693	266,483	70,669	102,313	151,459	22,064	235,336	4,692,805
Dec-61	259,269	297,099	1,154,745	351,657	248,657	76,318	8,924	40,853	10,605	49,493	2,925	16,405	69,861	74,809	65,455	258,846	177,919	47,183	68,310	101,123	14,731	157,123	3,552,311

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-62	139,766	242,242	1,009,034	274,061	108,364	33,259	3,889	17,804	4,622	21,569	1,275	7,149	30,445	32,601	28,525	112,804	77,536	20,562	29,769	44,069	6,420	68,474	2,314,236
Feb-62	99,989	208,390	877,499	220,673	63,676	19,544	2,285	10,462	2,716	12,674	749	4,201	17,890	19,157	16,762	66,285	45,561	12,082	17,493	25,895	3,772	40,236	1,787,991
Mar-62	179,075	447,315	1,322,529	389,100	194,973	59,841	6,997	32,033	8,315	38,808	2,294	12,863	54,778	58,658	51,323	202,962	139,507	36,996	53,562	79,291	11,551	123,201	3,505,974
Apr-62	1,089,270	1,045,509	2,689,381	1,065,974	1,683,525	516,709	60,420	276,595	71,800	335,091	19,805	111,069	472,989	506,492	443,160	1,752,507	1,204,594	319,448	462,489	684,647	99,737	1,063,799	15,975,012
May-62	742,445	831,299	2,628,189	834,908	911,522	279,765	32,713	149,759	38,875	181,431	10,723	60,137	256,094	274,233	239,943	948,871	652,212	172,961	250,409	370,693	54,001	575,980	10,497,163
Jun-62	331,929	476,131	1,677,835	589,746	266,466	81,784	9,563	43,779	11,364	53,038	3,135	17,580	74,864	80,167	70,143	277,384	190,661	50,562	73,202	108,365	15,786	168,377	4,671,860
Jul-62	120,455	336,334	991,986	362,761	77,539	23,798	2,783	12,739	3,307	15,434	912	5,116	21,785	23,328	20,411	80,717	55,481	14,713	21,301	31,533	4,594	48,996	2,276,023
Aug-62	133,760	316,687	932,410	294,518	71,198	21,852	2,555	11,697	3,036	14,171	838	4,697	20,003	21,420	18,742	74,115	50,943	13,510	19,559	28,954	4,218	44,989	2,103,873
Sep-62	260,283	446,501	1,222,756	417,112	237,190	72,799	8,512	38,969	10,116	47,211	2,790	15,648	66,639	71,359	62,436	246,909	169,714	45,007	65,160	96,459	14,052	149,878	3,767,501
Oct-62	213,393	351,413	1,154,566	402,941	185,092	56,809	6,643	30,410	7,894	36,841	2,177	12,211	52,002	55,685	48,722	192,676	132,437	35,121	50,847	75,272	10,965	116,957	3,231,075
Nov-62	221,785	269,610	937,255	320,071	129,232	39,664	4,638	21,232	5,512	25,723	1,520	8,526	36,308	38,880	34,018	134,528	92,468	24,522	35,502	52,556	7,656	81,660	2,522,867
Dec-62	177,515	253,476	928,821	296,901	120,457	36,971	4,323	19,791	5,137	23,976	1,417	7,947	33,843	36,240	31,708	125,393	86,189	22,857	33,091	48,987	7,136	76,115	2,378,292
Jan-63	127,521	201,997	919,489	255,276	57,187	17,552	2,052	9,396	2,439	11,383	673	3,773	16,067	17,205	15,053	59,530	40,918	10,851	15,710	23,256	3,388	36,136	1,846,851
Feb-63	85,248	140,083	744,887	211,674	36,576	11,226	1,313	6,009	1,560	7,280	430	2,413	10,276	11,004	9,628	38,075	26,171	6,940	10,048	14,875	2,167	23,112	1,400,993
Mar-63	128,379	417,263	1,004,906	339,439	80,968	24,851	2,906	13,303	3,453	16,116	953	5,342	22,748	24,360	21,314	84,286	57,934	15,364	22,243	32,928	4,797	51,163	2,375,015
Apr-63	651,113	484,319	1,474,341	560,822	477,589	146,582	17,140	78,466	20,369	95,060	5,618	31,509	134,179	143,684	125,717	497,158	341,724	90,622	131,201	194,223	28,294	301,782	6,031,510
May-63	547,287	631,504	2,018,426	554,687	930,658	285,639	33,400	152,903	39,691	185,240	10,949	61,399	261,470	279,991	244,980	968,792	665,904	176,592	255,666	378,475	55,135	588,071	9,326,857
Jun-63	396,196	362,300	1,831,262	332,619	269,268	82,644	9,664	44,239	11,484	53,596	3,168	17,765	75,651	81,010	70,880	280,301	192,666	51,093	73,972	109,505	15,952	170,147	4,535,384
Jul-63	137,395	161,042	871,038	193,574	85,799	26,333	3,079	14,096	3,659	17,077	1,009	5,660	24,105	25,813	22,585	89,314	61,391	16,280	23,570	34,892	5,083	54,215	1,877,012
Aug-63	93,749	179,001	808,770	190,304	47,195	14,485	1,694	7,754	2,013	9,394	555	3,114	13,259	14,199	12,423	49,129	33,769	8,955	12,965	19,193	2,796	29,822	1,554,537
Sep-63	100,847	228,762	711,330	259,231	46,420	14,247	1,666	7,627	1,980	9,240	546	3,063	13,042	13,966	12,219	48,323	33,215	8,808	12,752	18,878	2,750	29,333	1,578,243
Oct-63	94,997	202,690	682,798	242,550	47,674	14,632	1,711	7,833	2,033	9,489	561	3,145	13,394	14,343	12,549	49,627	34,112	9,046	13,097	19,388	2,824	30,125	1,508,619
Nov-63	173,772	231,868	665,212	257,913	77,355	23,742	2,776	12,709	3,299	15,397	910	5,103	21,733	23,272	20,362	80,525	55,349	14,678	21,251	31,458	4,583	48,880	1,792,147
Dec-63	131,187	177,780	719,405	217,682	66,073	20,279	2,371	10,855	2,818	13,151	777	4,359	18,563	19,878	17,393	68,780	47,276	12,537	18,151	26,870	3,914	41,750	1,641,851
Jan-64	91,643	168,793	731,787	184,904	39,747	12,199	1,426	6,530	1,695	7,911	468	2,622	11,167	11,958	10,463	41,375	28,440	7,542	10,919	16,164	2,355	25,116	1,415,224
Feb-64	91,565	132,272	624,836	163,407	40,116	12,312	1,440	6,591	1,711	7,985	472	2,647	11,271	12,069	10,560	41,759	28,703	7,612	11,020	16,314	2,377	25,349	1,252,386
Mar-64	109,972	197,971	812,718	196,996	55,491	17,031	1,991	9,117	2,367	11,045	653	3,661	15,590	16,694	14,607	57,764	39,705	10,529	15,244	22,567	3,287	35,064	1,650,065
Apr-64	771,209	440,635	1,271,027	413,994	434,450	133,342	15,592	71,378	18,529	86,474	5,111	28,662	122,059	130,705	114,362	452,251	310,857	82,437	119,350	176,680	25,738	274,523	5,499,364
May-64	861,137	883,125	2,674,128	855,796	1,479,997	454,242	53,115	243,157	63,120	294,581	17,411	97,642	415,808	445,261	389,585	1,540,640	1,058,967	280,829	406,577	601,878	87,680	935,192	14,139,866
Jun-64	247,617	248,606	1,088,170	282,857	267,166	81,999	9,588	43,894	11,394	53,177	3,143	17,626	75,061	80,378	70,327	278,114	191,163	50,695	73,395	108,650	15,828	168,819	3,467,666
Jul-64	218,743	163,485	806,437	205,894	164,813	50,585	5,915	27,078	7,029	32,805	1,939	10,873	46,304	49,584	43,384	171,566	117,927	31,273	45,277	67,025	9,764	104,143	2,381,844
Aug-64	278,362	214,693	1,054,434	242,500	314,029	96,382	11,270	51,594	13,393	62,505	3,694	20,718	88,227	94,476	82,663	326,897	224,694	59,587	86,269	127,708	18,604	198,431	3,671,130
Sep-64	329,293	299,346	1,198,889	382,585	374,829	115,043	13,452	61,583	15,986	74,607	4,410	24,729	105,309	112,768	98,668	390,188	268,198	71,124	102,971	152,434	22,206	236,850	4,455,466
Oct-64	280,811	249,586	1,015,673	305,875	300,313	92,172	10,778	49,340	12,808	59,775	3,533	19,813	84,374	90,350	79,053	312,619	214,880	56,984	82,501	122,130	17,792	189,764	3,650,923
Nov-64	367,042	313,022	1,226,345	325,445	431,463	132,425	15,485	70,887	18,401	85,879	5,076	28,465	121,220	129,807	113,576	449,142	308,720	81,870	118,529	175,465	25,561	272,636	4,816,463
Dec-64	194,206	172,563	1,061,612	221,434	146,562	44,983	5,260	24,079	6,251	29,172	1,724	9,669	41,177	44,093	38,580	152,567	104,868	27,810	40,263	59,603	8,683	92,611	2,527,768
Jan-65	150,997	159,067	1,011,008	196,591	100,621	30,883	3,611	16,531	4,291	20,028	1,184	6,638	28,270	30,272	26,487	104,744	71,996	19,093	27,642	40,920	5,961	63,581	2,120,414
Feb-65	110,128	142,767	791,364	173,775	72,046	22,112	2,586	11,837	3,073	14,340	848	4,753	20,241	21,675	18,965	74,998	51,550	13,671	19,792	29,299	4,268	45,525	1,649,612
Mar-65	125,883	234,854	1,018,006	249,572	90,039	27,635	3,231	14,793	3,840	17,921	1,059	5,940	25,297	27,088	23,701	93,728	64,424	17,085	24,735	36,616	5,334	56,894	2,167,677
Apr-65	1,060,100	1,137,400	3,122,029	1,135,687	1,399,545	429,550	50,228	229,939	59,689	278,568	16,465	92,334	393,205	421,056	368,407	1,456,891	1,001,401	265,563	384,476	569,160	82,914	884,355	14,838,961
May-65	1,429,669	1,255,166	6,076,633	1,170,645	1,987,562	610,025	71,331	326,547	84,767	395,607	23,382	131,128	558,409	597,963	523,193	2,069,002	1,422,139	377,139	546,013	808,291	117,750	1,255,916	21,838,276
Jun-65	284,165	478,935	1,821,572	525,205	428,218	131,429	15,368	70,354	18,263	85,233	5,038	28,251	120,309	128,830	112,721	445,765	306,399	81,254	117,638	174,146	25,369	270,586	5,675,050
Jul-65	109,941	221,102	965,428	237,759	89,191	27,374	3,201	14,654	3,804	17,753	1,049	5,884	25,058	26,833	23,478	92,845	63,818	16,924	24,502	36,272	5,284	56,358	2,068,512
Aug-65	142,028	178,338	828,151	210,812	80,342	24,659	2,883	13,200	3,426	15,991	945	5,300	22,572	24,171	21,149	83,634	57,486	15,245	22,071	32,673	4,760	50,767	1,840,602
Sep-65	293,353	432,568	994,140	464,846	271,997	83,481	9,762	44,688	11,600	54,139	3,200	17,945	76,418	81,831	71,599	283,142	194,619	51,611	74,721	110,614	16,114	171,871	3,814,256
Oct-65	304,677	465,289	1,175,202	491,717	375,788	115,337	13,487	61,740	16,027	74,797	4,421	24,792	105,578	113,057	98,920	391,186	268,884	71,306	103,235	152,824	22,263	237,456	4,687,982
Nov-65	414,993	432,417	1,438,452	435,921	633,184	194,337	22,724	104,029	27,005	126,030	7,449	41,774	177,894	190,495	166,675	659,128	453,055	120,146	173,945	257,500	37,512	400,101	6,514,766
Dec-65	438,797	527,218	1,614,131	611,268	672,672	206,457	24,141	110,517	28,689	133,890	7,913	44,379	188,988	202,375	177,070	700,235	481,310	127,639	184,793	273,559	39,851	425,054	7,220,948

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-66	271,109	269,656	1,491,927	356,651	395,993	121,539	14,212	65,060	16,889	78,819	4,659	26,125	111,255	119,135	104,239	412,219	283,341	75,140	108,785	161,041	23,460	250,223	4,761,476
Feb-66	186,719	323,683	1,080,992	402,180	194,494	59,694	6,980	31,954	8,295	38,712	2,288	12,832	54,643	58,514	51,197	202,463	139,164	36,905	53,430	79,096	11,522	122,898	3,158,658
Mar-66	643,454	721,705	2,676,999	664,909	851,127	261,229	30,546	139,836	36,300	169,410	10,013	56,152	239,126	256,064	224,045	886,002	608,998	161,501	233,817	346,132	50,424	537,817	9,805,607
Apr-66	1,244,417	769,626	3,010,233	730,769	1,423,880	437,019	51,101	233,937	60,727	283,411	16,751	93,939	400,041	428,377	374,813	1,482,223	1,018,813	270,180	391,161	579,056	84,355	899,732	14,284,563
May-66	700,172	519,483	2,384,499	556,030	823,327	252,696	29,548	135,269	35,114	163,876	9,686	54,318	231,315	247,700	216,727	857,063	589,106	156,226	226,180	334,826	48,777	520,250	9,092,188
Jun-66	722,618	530,445	2,157,678	610,939	1,113,058	341,621	39,946	182,870	47,471	221,545	13,094	73,433	312,716	334,866	292,994	1,158,666	796,415	211,202	305,774	452,653	65,941	703,328	10,689,272
Jul-66	123,528	222,564	845,557	333,355	67,842	20,822	2,435	11,146	2,893	13,503	798	4,476	19,060	20,411	17,858	70,622	48,543	12,873	18,637	27,590	4,019	42,869	1,931,402
Aug-66	206,061	271,390	1,238,188	270,131	139,224	42,731	4,997	22,874	5,938	27,711	1,638	9,185	39,115	41,886	36,649	144,929	99,618	26,418	38,247	56,619	8,248	87,974	2,819,772
Sep-66	116,134	169,758	839,635	200,672	66,073	20,279	2,371	10,855	2,818	13,151	777	4,359	18,563	19,878	17,393	68,780	47,276	12,537	18,151	26,870	3,914	41,750	1,721,996
Oct-66	264,854	235,638	1,287,536	264,351	207,214	63,598	7,437	34,044	8,837	41,244	2,438	13,671	58,217	62,341	54,546	215,705	148,266	39,319	56,925	84,269	12,276	130,936	3,293,663
Nov-66	255,291	227,103	1,181,483	272,489	174,067	53,425	6,247	28,598	7,424	34,647	2,048	11,484	48,905	52,369	45,820	181,200	124,549	33,029	47,819	70,789	10,312	109,991	2,979,089
Dec-66	298,812	197,820	1,136,800	279,333	245,560	75,368	8,813	40,344	10,473	48,877	2,889	16,201	68,991	73,877	64,640	255,622	175,703	46,595	67,459	99,863	14,548	155,166	3,383,753
Jan-67	230,084	201,213	1,207,682	274,111	171,450	52,621	6,153	28,168	7,312	34,126	2,017	11,311	48,169	51,581	45,131	178,475	122,676	32,532	47,100	69,724	10,157	108,337	2,940,130
Feb-67	158,017	175,805	1,207,682	233,526	119,240	36,597	4,279	19,591	5,085	23,734	1,403	7,867	33,501	35,874	31,388	124,126	85,319	22,626	32,757	48,492	7,064	75,347	2,489,319
Mar-67	226,496	468,727	1,509,154	422,638	173,920	53,380	6,242	28,574	7,417	34,617	2,046	11,474	48,863	52,324	45,782	181,046	124,443	33,001	47,778	70,729	10,304	109,898	3,668,854
Apr-67	1,753,159	1,697,580	5,384,863	1,561,773	2,368,807	727,037	85,014	389,184	101,027	471,491	27,867	156,280	665,520	712,661	623,549	2,465,868	1,694,927	449,480	650,746	963,334	140,336	1,496,820	24,587,323
May-67	622,505	562,457	2,538,286	583,028	715,332	219,550	25,672	117,526	30,508	142,381	8,415	47,193	200,974	215,209	188,299	744,643	511,834	135,734	196,512	290,908	42,379	452,010	8,591,355
Jun-67	489,056	626,045	2,431,156	655,175	436,072	133,840	15,650	71,645	18,598	86,796	5,130	28,769	122,515	131,193	114,789	453,940	312,018	82,744	119,795	177,339	25,834	275,549	6,813,649
Jul-67	324,987	508,822	1,724,132	556,537	197,775	60,701	7,098	32,494	8,435	39,366	2,327	13,048	55,565	59,501	52,061	205,879	141,512	37,528	54,332	80,430	11,717	124,972	4,299,220
Aug-67	172,368	301,985	1,266,182	338,475	78,461	24,081	2,816	12,891	3,346	15,617	923	5,176	22,044	23,605	20,654	81,676	56,141	14,888	21,554	31,908	4,648	49,579	2,549,019
Sep-67	116,305	265,720	1,003,650	299,259	52,283	16,047	1,876	8,590	2,230	10,406	615	3,449	14,689	15,729	13,763	54,425	37,409	9,921	14,363	21,262	3,097	33,037	1,998,126
Oct-67	354,797	426,959	1,565,321	402,079	284,090	87,193	10,196	46,675	12,116	56,546	3,342	18,743	79,816	85,469	74,782	295,731	203,272	53,906	78,044	115,532	16,830	179,513	4,450,951
Nov-67	344,845	402,531	1,792,861	417,973	316,610	97,174	11,363	52,018	13,503	63,019	3,725	20,888	88,952	95,253	83,342	329,583	226,541	60,077	86,978	128,757	18,757	200,062	4,854,811
Dec-67	169,248	207,048	1,170,895	315,964	114,226	35,058	4,099	18,767	4,872	22,736	1,344	7,536	32,092	34,365	30,068	118,906	81,731	21,674	31,380	46,453	6,767	72,178	2,547,408
Jan-68	109,348	198,136	977,092	270,309	51,324	15,753	1,842	8,432	2,189	10,216	604	3,386	14,420	15,441	13,510	53,427	36,724	9,739	14,100	20,872	3,041	32,431	1,862,335
Feb-68	97,805	169,547	1,063,406	253,020	48,891	15,006	1,755	8,033	2,085	9,731	575	3,226	13,736	14,709	12,870	50,894	34,982	9,277	13,431	19,883	2,896	30,893	1,876,650
Mar-68	390,596	351,971	1,365,237	411,712	253,709	77,869	9,105	41,683	10,820	50,499	2,985	16,738	71,280	76,329	66,785	264,104	181,533	48,141	69,698	103,177	15,031	160,315	4,039,316
Apr-68	923,610	902,742	2,265,167	831,232	1,193,326	366,257	42,827	196,058	50,894	237,521	14,039	78,729	335,267	359,015	314,123	1,242,222	853,848	226,433	327,824	485,296	70,696	754,048	12,071,175
May-68	612,475	717,785	1,999,405	805,400	922,288	283,070	33,100	151,528	39,334	183,574	10,850	60,847	259,118	277,473	242,777	960,079	659,915	175,004	253,366	375,071	54,639	582,783	9,659,881
Jun-68	1,016,580	876,822	3,087,216	830,421	1,102,734	338,452	39,576	181,174	47,030	219,490	12,973	72,752	309,815	331,760	290,277	1,147,919	789,028	209,243	302,938	448,454	65,330	696,804	12,416,787
Jul-68	630,991	579,391	2,716,118	594,208	906,581	278,249	32,536	148,947	38,665	180,447	10,665	59,811	254,706	272,747	238,643	943,728	648,676	172,023	249,051	368,684	53,709	572,858	9,951,434
Aug-68	275,102	329,745	1,499,284	319,184	291,575	89,490	10,464	47,904	12,435	58,036	3,430	19,236	81,918	87,721	76,752	303,522	208,628	55,326	80,100	118,576	17,274	184,243	4,169,947
Sep-68	701,326	615,716	2,871,879	509,057	1,040,275	319,282	37,334	170,912	44,366	207,058	12,238	68,631	292,267	312,969	273,835	1,082,900	744,337	197,392	285,779	423,054	61,629	657,337	10,929,575
Oct-68	401,250	374,725	1,810,985	353,102	424,421	130,264	15,232	69,730	18,101	84,477	4,993	28,001	119,242	127,688	111,722	441,811	303,681	80,534	116,595	172,601	25,144	268,186	5,482,485
Nov-68	381,393	347,764	1,573,935	351,987	321,588	98,702	11,541	52,835	13,715	64,009	3,783	21,216	90,351	96,750	84,653	334,765	230,102	61,021	88,345	130,782	19,052	203,207	4,581,498
Dec-68	372,954	334,118	1,480,442	383,193	291,870	89,581	10,475	47,953	12,448	58,094	3,434	19,256	82,001	87,810	76,830	303,829	208,839	55,382	80,181	118,696	17,291	184,429	4,319,106
Jan-69	348,323	359,963	1,611,439	384,815	241,873	74,236	8,681	39,739	10,316	48,143	2,845	15,957	67,955	72,768	63,669	251,784	173,065	45,895	66,446	98,364	14,329	152,837	4,153,441
Feb-69	277,504	363,582	1,464,292	359,719	189,148	58,053	6,788	31,076	8,067	37,648	2,225	12,479	53,141	56,905	49,790	196,898	135,339	35,891	51,962	76,922	11,206	119,520	3,598,155
Mar-69	280,156	495,266	1,491,209	537,423	197,444	60,600	7,086	32,439	8,421	39,299	2,323	13,026	55,472	59,401	51,974	205,534	141,275	37,465	54,241	80,295	11,697	124,762	3,986,808
Apr-69	1,698,875	951,779	3,708,463	1,072,287	1,875,991	575,781	67,327	308,216	80,009	373,400	22,070	123,767	527,063	564,396	493,823	1,952,859	1,342,307	355,968	515,362	762,918	111,140	1,185,416	18,669,217
May-69	797,290	590,579	2,946,350	687,750	857,211	263,096	30,764	140,836	36,559	170,621	10,084	56,554	240,835	257,894	225,647	892,335	613,351	162,655	235,489	348,606	50,784	541,661	10,156,952
Jun-69	474,019	680,977	2,049,291	649,801	681,706	209,230	24,466	112,001	29,074	135,688	8,020	44,975	191,526	205,093	179,448	709,639	487,774	129,353	187,275	277,233	40,386	430,762	7,937,735
Jul-69	281,139	538,407	1,488,338	729,780	359,565	110,358	12,904	59,075	15,335	71,568	4,230	23,722	101,020	108,176	94,650	374,298	257,276	68,227	98,778	146,226	21,302	227,205	5,191,578
Aug-69	125,867	270,771	885,933	305,140	84,545	25,949	3,034	13,890	3,606	16,828	995	5,578	23,753	25,436	22,255	88,009	60,494	16,042	23,226	34,382	5,009	53,423	2,094,164
Sep-69	116,446	205,058	679,119	256,873	49,849	15,300	1,789	8,190	2,126	9,922	586	3,289	14,005	14,997	13,122	51,892	35,668	9,459	13,694	20,273	2,953	31,499	1,556,111
Oct-69	245,854	344,929	1,175,561	396,629	177,607	54,511	6,374	29,180	7,575	35,351	2,089	11,717	49,899	53,433	46,752	184,884	127,081	33,701	48,791	72,228	10,522	112,228	3,226,899
Nov-69	196,328	289,213	1,200,504	464,922	191,286	58,710	6,865	31,427	8,158	38,074	2,250	12,620	53,742	57,549	50,353	199,124	136,869	36,296	52,549	77,791	11,332	120,871	3,296,835
Dec-69	129,939	231,612	1,096,425	428,671	106,962	32,829	3,839	17,573	4,562	21,290	1,258	7,057	30,051	32,180	28,156	111,345	76,534	20,296	29,384	43,499	6,337	67,588	2,527,387

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-70	113,872	255,432	1,223,832	281,133	72,857	22,361	2,615	11,970	3,107	14,502	857	4,807	20,469	21,919	19,178	75,842	52,130	13,825	20,015	29,629	4,316	46,037	2,310,707
Feb-70	92,501	229,518	882,882	240,320	63,639	19,532	2,284	10,456	2,714	12,667	749	4,199	17,880	19,146	16,752	66,247	45,535	12,075	17,483	25,880	3,770	40,213	1,826,441
Mar-70	121,827	424,637	1,096,425	412,701	99,072	30,407	3,556	16,277	4,225	19,719	1,166	6,536	27,834	29,806	26,079	103,132	70,888	18,799	27,217	40,290	5,869	62,602	2,649,064
Apr-70	779,944	770,061	1,823,008	589,670	1,069,809	328,347	38,394	175,765	45,626	212,936	12,586	70,580	300,565	321,854	281,609	1,113,644	765,469	202,996	293,892	435,064	63,379	675,999	10,371,196
May-70	641,754	1,013,720	2,085,360	658,344	719,351	220,784	25,817	118,186	30,679	143,181	8,463	47,459	202,103	216,418	189,357	748,826	514,709	136,496	197,616	292,542	42,617	454,549	8,708,332
Jun-70	540,611	922,276	2,578,123	638,469	704,639	216,269	25,289	115,769	30,052	140,253	8,290	46,488	197,970	211,992	185,485	733,512	504,183	133,705	193,575	286,559	41,745	445,253	8,900,506
Jul-70	280,952	265,618	1,051,383	248,786	96,417	29,593	3,460	15,841	4,112	19,191	1,134	6,361	27,089	29,007	25,380	100,368	68,988	18,295	26,487	39,211	5,712	60,925	2,424,312
Aug-70	128,800	218,510	889,522	212,789	44,356	13,614	1,592	7,287	1,892	8,829	522	2,926	12,462	13,345	11,676	46,173	31,737	8,416	12,185	18,038	2,628	28,028	1,715,327
Sep-70	183,318	352,323	870,680	316,700	87,605	26,888	3,144	14,393	3,736	17,437	1,031	5,780	24,613	26,356	23,061	91,195	62,683	16,623	24,066	35,627	5,190	55,357	2,247,805
Oct-70	284,118	427,121	1,132,673	324,786	283,426	86,990	10,172	46,566	12,088	56,414	3,334	18,699	79,629	85,270	74,607	295,040	202,797	53,780	77,861	115,262	16,791	179,094	3,866,519
Nov-70	517,743	829,456	1,854,052	683,871	658,588	202,134	23,636	108,203	28,088	131,086	7,748	43,450	185,031	198,138	173,362	685,573	471,232	124,967	180,924	267,831	39,017	416,154	7,830,284
Dec-70	421,794	496,512	1,623,642	588,124	481,939	147,917	17,296	79,180	20,554	95,926	5,670	31,796	135,402	144,993	126,863	501,687	344,837	91,448	132,396	195,993	28,552	304,532	6,017,049
Jan-71	229,616	351,826	1,214,860	309,525	178,455	54,772	6,405	29,319	7,611	35,520	2,099	11,773	50,137	53,689	46,975	185,767	127,688	33,862	49,024	72,573	10,572	112,764	3,174,833
Feb-71	209,337	293,347	990,551	280,373	167,394	51,377	6,008	27,502	7,139	33,318	1,969	11,044	47,030	50,361	44,064	174,253	119,774	31,763	45,986	68,075	9,917	105,774	2,776,353
Mar-71	357,215	619,565	1,501,976	385,322	414,060	127,084	14,860	68,028	17,659	82,415	4,871	27,317	116,331	124,571	108,994	431,026	296,268	78,568	113,748	168,388	24,530	261,639	5,344,437
Apr-71	1,762,518	1,854,490	4,624,723	1,269,916	2,435,691	747,565	87,414	400,172	103,879	484,804	28,654	160,693	684,311	732,783	641,155	2,535,493	1,742,784	462,171	669,120	990,534	144,298	1,539,083	24,102,252
May-71	732,836	965,562	2,610,962	723,265	830,922	255,028	29,821	136,517	35,438	165,388	9,775	54,819	233,449	249,985	218,727	864,969	594,541	157,667	228,267	337,915	49,226	525,050	10,010,128
Jun-71	485,141	517,419	1,601,390	513,011	530,756	162,900	19,048	87,201	22,636	105,643	6,244	35,016	149,117	159,679	139,713	552,504	379,766	100,711	145,807	215,845	31,444	335,378	6,296,370
Jul-71	299,889	372,847	1,197,992	342,430	238,002	73,048	8,542	39,103	10,150	47,372	2,800	15,702	66,867	71,603	62,650	247,754	170,295	45,161	65,383	96,789	14,100	150,390	3,638,867
Aug-71	152,464	348,672	855,785	328,640	70,645	21,682	2,535	11,607	3,013	14,061	831	4,661	19,848	21,254	18,596	73,539	50,548	13,405	19,407	28,729	4,185	44,639	2,108,746
Sep-71	142,465	283,811	786,519	264,022	62,201	19,091	2,232	10,219	2,653	12,381	732	4,104	17,476	18,713	16,373	64,750	44,506	11,803	17,088	25,296	3,685	39,304	1,849,422
Oct-71	501,988	538,479	1,677,296	427,454	433,823	133,149	15,569	71,275	18,502	86,349	5,104	28,621	121,883	130,517	114,197	451,599	310,409	82,318	119,178	176,425	25,701	274,127	5,743,962
Nov-71	412,559	501,118	1,465,907	454,579	415,904	127,650	14,926	68,331	17,738	82,782	4,893	27,439	116,849	125,126	109,480	432,945	297,587	78,917	114,255	169,138	24,639	262,804	5,325,565
Dec-71	375,294	454,086	1,463,574	435,262	376,968	115,699	13,529	61,934	16,077	75,032	4,435	24,870	105,910	113,412	99,231	392,414	269,728	71,529	103,559	153,303	22,333	238,201	4,986,381
Jan-72	214,485	330,613	1,186,148	239,306	150,433	46,171	5,399	24,715	6,416	29,942	1,770	9,925	42,264	45,258	39,599	156,597	107,638	28,545	41,326	61,177	8,912	95,057	2,871,697
Feb-72	155,677	249,966	985,167	248,432	108,585	33,327	3,897	17,840	4,631	21,613	1,277	7,164	30,507	32,668	28,583	113,034	77,694	20,604	29,830	44,159	6,433	68,613	2,289,701
Mar-72	199,042	394,442	1,254,338	453,261	202,790	62,240	7,278	33,317	8,649	40,364	2,386	13,379	56,974	61,010	53,381	211,099	145,100	38,479	55,709	82,470	12,014	128,140	3,515,863
Apr-72	916,123	1,778,430	3,904,779	1,304,519	1,617,526	496,453	58,051	265,752	68,985	321,955	19,029	106,715	454,447	486,636	425,787	1,683,804	1,157,371	306,925	444,358	657,807	95,827	1,022,095	17,593,373
May-72	1,614,594	1,312,954	4,470,936	896,001	1,760,474	540,327	63,181	289,238	75,082	350,407	20,711	116,146	494,608	529,643	463,416	1,832,609	1,259,653	334,049	483,628	715,941	104,296	1,112,422	18,840,316
Jun-72	322,382	379,823	1,572,140	346,613	281,583	86,424	10,106	46,263	12,009	56,047	3,313	18,577	79,111	84,715	74,122	293,121	201,478	53,430	77,355	114,513	16,682	177,929	4,307,734
Jul-72	248,365	369,312	1,283,588	311,097	171,818	52,735	6,166	28,229	7,328	34,199	2,021	11,336	48,273	51,692	45,228	178,859	122,939	32,602	47,201	69,874	10,179	108,570	3,241,612
Aug-72	311,993	626,578	1,930,138	518,157	421,065	129,234	15,112	69,179	17,958	83,810	4,954	27,779	118,299	126,679	110,839	438,319	301,280	79,897	115,673	171,237	24,945	266,066	5,909,191
Sep-72	349,992	486,479	1,646,431	406,819	356,947	109,555	12,810	58,645	15,223	71,047	4,199	23,549	100,285	107,388	93,960	371,573	255,402	67,731	98,059	145,161	21,147	225,550	5,027,954
Oct-72	526,930	731,400	2,340,176	520,718	606,858	186,257	21,779	99,704	25,882	120,790	7,139	40,037	170,498	182,575	159,745	631,724	434,219	115,151	166,713	246,794	35,952	383,466	7,754,506
Nov-72	512,392	621,342	2,161,266	511,718	548,270	168,276	19,677	90,078	23,383	109,129	6,450	36,172	154,037	164,948	144,323	570,735	392,298	104,034	150,618	222,968	32,481	346,445	7,091,041
Dec-72	213,861	357,979	1,401,127	383,294	158,729	48,717	5,697	26,078	6,770	31,594	1,867	10,472	44,595	47,754	41,783	165,233	113,574	30,119	43,605	64,551	9,404	100,299	3,307,102
Jan-73	222,128	466,680	1,505,565	494,328	222,516	68,295	7,986	36,558	9,490	44,290	2,618	14,680	62,516	66,944	58,574	231,633	159,214	42,222	61,128	90,492	13,183	140,605	4,021,646
Feb-73	168,936	313,413	1,168,204	351,100	136,975	42,041	4,916	22,504	5,842	27,264	1,611	9,037	38,483	41,209	36,056	142,588	98,008	25,991	37,629	55,704	8,115	86,553	2,822,181
Mar-73	804,279	1,938,577	4,150,263	1,467,521	1,231,709	378,037	44,205	202,364	52,531	245,161	14,490	81,261	346,051	370,562	324,227	1,282,178	881,311	233,716	338,369	500,905	72,970	778,302	15,738,988
Apr-73	1,102,061	1,768,684	4,325,942	1,172,952	1,394,272	427,932	50,039	229,072	59,464	277,518	16,403	91,986	391,723	419,470	367,019	1,451,403	997,629	264,562	383,027	567,016	82,601	881,024	16,721,800
May-73	1,355,231	2,204,787	5,101,156	1,550,923	1,612,511	494,914	57,871	264,928	68,772	320,957	18,970	106,384	453,038	485,128	424,467	1,678,584	1,153,783	305,973	442,981	655,768	95,530	1,018,926	19,871,581
Jun-73	447,376	1,107,840	1,732,028	904,925	656,191	201,399	23,550	107,809	27,986	130,609	7,720	43,292	184,358	197,417	172,731	683,078	469,517	124,512	180,265	266,856	38,875	414,639	8,122,974
Jul-73	302,774	411,795	1,241,418	446,290	241,172	74,021	8,655	39,623	10,286	48,003	2,837	15,911	67,758	72,557	63,485	251,054	172,564	45,762	66,254	98,079	14,288	152,394	3,846,981
Aug-73	300,341	487,855	1,413,329	416,300	328,556	100,841	11,792	53,980	14,013	65,396	3,865	21,676	92,308	98,847	86,487	342,019	235,088	62,343	90,259	133,616	19,465	207,611	4,585,989
Sep-73	316,236	462,170	1,224,191	388,086	298,470	91,607	10,712	49,037	12,729	59,408	3,511	19,691	83,856	89,795	78,567	310,700	213,561	56,634	81,994	121,380	17,682	188,599	4,178,618
Oct-73	250,581	517,285	1,321,452	433,538	249,395	76,544	8,950	40,974	10,636	49,640	2,934	16,454	70,068	75,031	65,649	259,614	178,447	47,323	68,512	101,423	14,775	157,589	4,016,814
Nov-73	296,114	594,568	1,599,596	540,313	375,714	115,315	13,484	61,728	16,024	74,783	4,420	24,787	105,558	113,035	98,901	391,109	268,831	71,292	103,214	152,794	22,259	237,409	5,281,246
Dec-73	239,989	418,961	1,295,611	398,707	187,783	57,635	6,739	30,852	8,009	37,377	2,209	12,389	52,758	56,495	49,431	195,478	134,363	35,632	51,587	76,367	11,125	118,658	3,478,154

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-74	142,418	291,627	1,250,750	286,710	112,972	34,674	4,054	18,561	4,818	22,486	1,329	7,453	31,740	33,988	29,738	117,601	80,834	21,436	31,035	45,943	6,693	71,386	2,648,248
Feb-74	119,253	239,647	1,171,793	274,035	96,860	29,728	3,476	15,914	4,131	19,279	1,139	6,390	27,213	29,140	25,497	100,829	69,305	18,379	26,609	39,390	5,738	61,205	2,384,951
Mar-74	195,298	615,361	1,330,604	477,090	222,516	68,295	7,986	36,558	9,490	44,290	2,618	14,680	62,516	66,944	58,574	231,633	159,214	42,222	61,128	90,492	13,183	140,605	3,951,297
Apr-74	779,632	1,116,822	2,572,022	894,658	1,335,205	409,803	47,919	219,368	56,945	265,761	15,708	88,089	375,128	401,700	351,471	1,389,915	955,365	253,354	366,801	542,994	79,102	843,700	13,361,462
May-74	610,603	608,194	1,868,767	565,689	731,297	224,450	26,245	120,149	31,189	145,558	8,603	48,247	205,459	220,012	192,502	761,262	523,257	138,763	200,898	297,400	43,324	462,098	8,033,968
Jun-74	519,443	671,030	1,864,819	545,814	723,960	222,199	25,982	118,943	30,876	144,098	8,517	47,763	203,398	217,805	190,570	753,624	518,007	137,371	198,883	294,416	42,890	457,461	7,937,868
Jul-74	242,984	325,721	1,168,383	302,934	378,701	116,231	13,591	62,219	16,151	75,377	4,455	24,984	106,397	113,933	99,687	394,218	270,968	71,858	104,035	154,008	22,435	239,296	4,308,567
Aug-74	248,833	735,757	1,420,507	474,428	449,345	137,914	16,126	73,825	19,164	89,438	5,286	29,645	126,244	135,187	118,283	467,757	321,515	85,263	123,442	182,737	26,621	283,936	5,571,256
Sep-74	223,766	575,706	1,241,239	333,786	466,933	143,312	16,758	76,715	19,914	92,939	5,493	30,806	131,186	140,478	122,912	486,065	334,099	88,600	128,273	189,890	27,663	295,049	5,171,581
Oct-74	219,664	290,099	1,008,675	305,875	239,034	73,365	8,579	39,272	10,195	47,578	2,812	15,770	67,157	71,914	62,922	248,828	171,033	45,357	65,666	97,209	14,161	151,043	3,256,205
Nov-74	470,291	607,640	1,685,910	437,037	657,813	201,897	23,608	108,076	28,055	130,932	7,739	43,399	184,814	197,905	173,159	684,767	470,678	124,820	180,711	267,516	38,971	415,664	7,141,401
Dec-74	234,264	380,320	1,341,909	685,468	228,046	69,992	8,184	37,467	9,726	45,391	2,683	15,045	64,070	68,608	60,029	237,391	163,172	43,272	62,648	92,741	13,510	144,100	4,008,036
Jan-75	168,468	372,847	1,213,066	413,461	180,667	55,451	6,484	29,683	7,705	35,960	2,125	11,919	50,759	54,354	47,558	188,070	129,271	34,282	49,632	73,473	10,703	114,161	3,250,100
Feb-75	139,142	338,353	1,073,096	246,150	100,731	30,917	3,615	16,550	4,296	20,050	1,185	6,646	28,301	30,305	26,516	104,859	72,075	19,114	27,672	40,965	5,968	63,651	2,400,155
Mar-75	197,950	602,384	1,222,038	349,579	127,094	39,008	4,561	20,881	5,420	25,297	1,495	8,385	35,707	38,237	33,455	132,302	90,938	24,116	34,915	51,686	7,529	80,309	3,133,286
Apr-75	1,087,398	1,575,839	3,248,360	994,233	1,603,515	492,152	57,548	263,450	68,388	319,166	18,864	105,791	450,510	482,421	422,099	1,669,218	1,147,346	304,266	440,509	652,109	94,997	1,013,241	16,511,422
May-75	1,035,595	1,016,300	3,763,554	758,654	1,259,915	386,694	45,217	206,998	53,734	250,775	14,822	83,122	353,975	379,048	331,652	1,311,540	901,493	239,068	346,117	512,376	74,641	796,125	14,121,417
Jun-75	602,117	655,913	2,075,311	461,424	824,654	253,104	29,596	135,487	35,170	164,140	9,701	54,406	231,688	248,099	217,077	858,444	590,056	156,478	226,545	335,366	48,855	521,089	8,734,720
Jul-75	198,137	292,698	963,275	261,031	150,175	46,092	5,390	24,673	6,405	29,891	1,767	9,908	42,192	45,181	39,531	156,329	107,453	28,496	41,255	61,072	8,897	94,894	2,614,739
Aug-75	146,786	242,838	732,146	229,672	84,176	25,835	3,021	13,830	3,590	16,755	990	5,553	23,649	25,325	22,158	87,625	60,230	15,972	23,124	34,232	4,987	53,190	1,855,686
Sep-75	271,233	507,290	1,124,060	436,124	344,964	105,877	12,380	56,676	14,712	68,662	4,058	22,759	96,918	103,783	90,806	359,099	246,828	65,457	94,767	140,288	20,437	217,979	4,405,158
Oct-75	164,568	282,970	813,795	287,598	137,307	42,142	4,928	22,559	5,856	27,330	1,615	9,059	38,577	41,309	36,144	142,933	98,246	26,054	37,720	55,839	8,135	86,763	2,371,447
Nov-75	273,542	397,672	1,208,400	312,593	273,176	83,844	9,804	44,882	11,651	54,373	3,214	18,023	76,749	82,186	71,909	284,370	195,463	51,835	75,046	111,094	16,184	172,617	3,828,625
Dec-75	353,206	482,217	1,568,372	591,166	334,530	102,674	12,006	54,962	14,267	66,585	3,935	22,070	93,987	100,644	88,059	348,237	239,362	63,477	91,900	136,045	19,819	211,385	4,998,904
Jan-76	175,487	389,282	1,372,774	315,103	137,344	42,154	4,929	22,565	5,858	27,337	1,616	9,061	38,587	41,320	36,154	142,972	98,272	26,061	37,730	55,854	8,137	86,786	3,075,383
Feb-76	171,744	416,190	1,290,228	297,357	106,557	32,705	3,824	17,507	4,545	21,209	1,254	7,030	29,937	32,058	28,049	110,923	76,243	20,219	29,273	43,334	6,313	67,332	2,813,831
Mar-76	379,833	1,215,547	1,776,890	836,048	395,625	121,426	14,198	64,999	16,873	78,746	4,654	26,101	111,151	119,025	104,142	411,835	283,077	75,070	108,684	160,891	23,438	249,990	6,578,242
Apr-76	1,868,591	1,845,508	5,097,567	1,304,266	2,416,739	741,748	86,734	397,059	103,071	481,031	28,431	159,442	678,987	727,081	636,167	2,515,764	1,729,223	458,575	663,914	982,827	143,175	1,527,108	24,593,009
May-76	736,985	975,786	2,722,758	701,439	929,478	285,276	33,358	152,709	39,641	185,005	10,935	61,322	261,138	279,636	244,670	967,563	665,060	176,368	255,341	377,995	55,065	587,326	10,704,854
Jun-76	358,182	405,756	1,480,801	327,904	384,748	118,087	13,808	63,212	16,409	76,581	4,526	25,383	108,096	115,752	101,278	400,513	275,294	73,006	105,696	156,467	22,794	243,117	4,877,411
Jul-76	151,715	214,822	720,015	220,546	62,828	19,283	2,255	10,322	2,680	12,505	739	4,145	17,652	18,902	16,538	65,402	44,955	11,922	17,260	25,551	3,722	39,700	1,683,459
Aug-76	113,560	234,449	638,797	207,618	48,854	14,994	1,753	8,026	2,084	9,724	575	3,223	13,726	14,698	12,860	50,856	34,956	9,270	13,421	19,868	2,894	30,870	1,487,075
Sep-76	90,583	176,410	542,937	176,893	28,944	8,883	1,039	4,755	1,234	5,761	341	1,910	8,132	8,708	7,619	30,130	20,710	5,492	7,951	11,771	1,715	18,289	1,160,205
Oct-76	108,740	206,069	571,899	197,402	45,609	13,998	1,637	7,493	1,945	9,078	537	3,009	12,814	13,722	12,006	47,478	32,634	8,654	12,530	18,548	2,702	28,820	1,357,325
Nov-76	101,861	188,335	561,456	198,492	47,010	14,428	1,687	7,724	2,005	9,357	553	3,101	13,208	14,143	12,375	48,937	33,637	8,920	12,914	19,118	2,785	29,705	1,331,751
Dec-76	111,064	192,443	649,241	183,282	31,672	9,721	1,137	5,204	1,351	6,304	373	2,090	8,898	9,529	8,337	32,970	22,662	6,010	8,701	12,880	1,876	20,013	1,325,757
Jan-77	98,273	231,047	600,790	170,607	30,308	9,302	1,088	4,979	1,293	6,033	357	2,000	8,515	9,118	7,978	31,550	21,686	5,751	8,326	12,325	1,796	19,151	1,282,271
Feb-77	82,518	247,864	604,379	161,481	30,603	9,393	1,098	5,028	1,305	6,091	360	2,019	8,598	9,207	8,056	31,857	21,897	5,807	8,407	12,445	1,813	19,338	1,279,563
Mar-77	382,017	697,230	1,386,771	670,055	303,669	93,202	10,898	49,891	12,951	60,443	3,572	20,034	85,316	91,359	79,936	316,111	217,281	57,621	83,422	123,494	17,990	191,884	4,955,150
Apr-77	954,387	1,096,106	2,326,179	781,343	1,454,261	446,343	52,192	238,928	62,022	289,458	17,108	95,944	408,577	437,518	382,810	1,513,850	1,040,552	275,945	399,507	591,412	86,155	918,930	13,869,528
May-77	232,517	318,535	1,234,779	314,241	277,564	85,190	9,961	45,602	11,838	55,247	3,265	18,312	77,982	83,506	73,064	288,937	198,602	52,668	76,251	112,878	16,444	175,389	3,762,773
Jun-77	162,213	244,310	902,083	229,444	166,066	50,969	5,960	27,284	7,083	33,054	1,954	10,956	46,657	49,961	43,714	172,871	118,824	31,511	45,621	67,535	9,838	104,935	2,532,844
Jul-77	200,804	235,786	731,787	202,041	194,899	59,819	6,995	32,021	8,312	38,793	2,293	12,858	54,757	58,636	51,304	202,885	139,454	36,982	53,542	79,261	11,546	123,155	2,537,932
Aug-77	143,447	210,025	557,902	186,172	99,109	30,419	3,557	16,283	4,227	19,727	1,166	6,539	27,845	29,817	26,089	103,170	70,914	18,806	27,227	40,305	5,872	62,626	1,691,242
Sep-77	469,230	414,050	1,517,768	258,546	612,720	188,057	21,990	100,667	26,132	121,957	7,208	40,424	172,145	184,338	161,288	637,826	438,413	116,263	168,323	249,178	36,300	387,171	6,329,994
Oct-77	445,411	406,769	1,710,674	304,303	664,303	203,889	23,841	109,142	28,332	132,224	7,815	43,827	186,637	199,857	174,867	691,522	475,321	126,051	182,494	270,155	39,355	419,765	6,846,552
Nov-77	577,237	517,648	1,428,762	436,707	918,196	281,814	32,953	150,855	39,160	182,759	10,802	60,577	257,969	276,241	241,700	955,819	656,987	174,227	252,242	373,407	54,397	580,197	8,460,654
Dec-77	310,574	419,477	1,605,876	379,745	280,772	86,175	10,077	46,129	11,975	55,885	3,303	18,524	78,883	84,471	73,909	292,276	200,898	53,276	77,132	114,183	16,634	177,416	4,397,590

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-78	221,504	315,516	1,234,599	269,219	193,941	59,525	6,960	31,864	8,271	38,602	2,282	12,795	54,488	58,348	51,052	201,888	138,768	36,800	53,278	78,871	11,490	122,549	3,202,609
Feb-78	172,524	218,816	943,894	213,448	120,752	37,061	4,334	19,839	5,150	24,035	1,421	7,967	33,926	36,329	31,786	125,700	86,400	22,913	33,172	49,107	7,154	76,302	2,272,028
Mar-78	178,763	459,972	1,072,558	317,384	129,970	39,890	4,664	21,353	5,543	25,869	1,529	8,575	36,515	39,102	34,212	135,295	92,996	24,662	35,705	52,855	7,700	82,126	2,807,241
Apr-78	1,096,602	1,002,827	1,976,435	880,994	1,343,022	412,202	48,199	220,652	57,278	267,317	15,800	88,605	377,324	404,051	353,528	1,398,052	960,958	254,838	368,948	546,173	79,565	848,639	13,002,011
May-78	813,638	647,543	2,030,988	567,387	917,569	281,621	32,930	150,752	39,133	182,634	10,795	60,536	257,793	276,053	241,535	955,166	656,538	174,108	252,070	373,152	54,360	579,801	9,556,101
Jun-78	376,791	369,618	1,444,194	396,578	357,537	109,736	12,832	58,742	15,249	71,165	4,206	23,588	100,451	107,566	94,116	372,187	255,825	67,842	98,221	145,401	21,182	225,923	4,728,947
Jul-78	301,729	390,964	1,373,851	396,705	355,103	108,989	12,744	58,342	15,145	70,680	4,178	23,428	99,767	106,834	93,475	369,654	254,083	67,381	97,552	144,412	21,037	224,386	4,590,438
Aug-78	443,164	461,807	1,737,950	386,717	814,662	250,037	29,237	133,845	34,744	162,152	9,584	53,747	228,881	245,093	214,446	848,043	582,907	154,582	223,800	331,303	48,263	514,775	7,909,738
Sep-78	876,767	670,877	2,105,099	656,138	1,120,985	344,054	40,231	184,173	47,809	223,123	13,188	73,956	314,943	337,251	295,081	1,166,918	802,087	212,706	307,951	455,877	66,411	708,337	11,023,960
Oct-78	574,835	507,844	1,757,509	577,274	717,802	220,309	25,761	117,932	30,613	142,872	8,444	47,356	201,668	215,952	188,950	747,214	513,601	136,203	197,191	291,912	42,525	453,571	7,717,340
Nov-78	322,788	368,108	1,069,507	428,874	328,815	100,920	11,801	54,023	14,024	65,448	3,868	21,693	92,381	98,925	86,555	342,288	235,273	62,392	90,330	133,721	19,480	207,774	4,158,987
Dec-78	236,323	310,165	1,146,670	359,212	176,353	54,127	6,329	28,974	7,521	35,102	2,075	11,635	49,547	53,056	46,422	183,579	126,184	33,463	48,447	71,719	10,448	111,436	3,108,786
Jan-79	198,964	332,142	1,064,124	261,487	117,839	36,167	4,229	19,360	5,026	23,455	1,386	7,774	33,107	35,452	31,019	122,668	84,316	22,360	32,372	47,922	6,981	74,461	2,562,614
Feb-79	158,095	343,226	976,195	244,629	102,944	31,596	3,695	16,913	4,390	20,490	1,211	6,792	28,922	30,971	27,098	107,162	73,658	19,533	28,280	41,865	6,099	65,049	2,338,811
Mar-79	339,588	1,412,080	1,543,249	671,779	365,944	112,316	13,133	60,123	15,607	72,838	4,305	24,143	102,812	110,095	96,329	380,938	261,840	69,438	100,530	148,820	21,680	231,235	6,158,821
Apr-79	1,899,945	2,186,059	4,161,030	1,495,913	2,602,347	798,715	93,395	427,553	110,987	517,975	30,615	171,688	731,134	782,922	685,025	2,708,978	1,862,030	493,794	714,903	1,058,309	154,171	1,644,391	25,331,878
May-79	1,163,053	1,587,324	4,187,409	1,170,899	1,480,587	454,423	53,137	243,253	63,145	294,698	17,418	97,681	415,974	445,438	389,740	1,541,254	1,059,389	280,941	406,739	602,118	87,715	935,565	16,977,899
Jun-79	864,646	1,059,204	2,966,986	748,007	924,427	283,726	33,177	151,879	39,426	183,999	10,875	60,988	259,719	278,116	243,340	962,305	661,445	175,409	253,954	375,941	54,766	584,134	11,176,470
Jul-79	404,261	371,089	1,628,846	457,570	278,523	85,484	9,996	45,760	11,879	55,438	3,277	18,375	78,251	83,794	73,316	289,935	199,288	52,850	76,514	113,268	16,501	175,995	4,530,210
Aug-79	360,631	367,554	1,723,056	440,814	411,295	126,235	14,761	67,574	17,541	81,865	4,839	27,135	115,554	123,739	108,267	428,147	294,289	78,043	112,989	167,263	24,366	259,892	5,355,847
Sep-79	310,574	527,700	1,325,041	363,623	210,975	64,753	7,572	34,662	8,998	41,993	2,482	13,919	59,274	63,472	55,536	219,620	150,957	40,032	57,958	85,798	12,499	133,313	3,790,750
Oct-79	422,465	518,565	1,765,585	415,337	380,102	116,661	13,641	62,449	16,211	75,656	4,472	25,077	106,790	114,355	100,056	395,677	271,970	72,124	104,420	154,578	22,518	240,182	5,398,890
Nov-79	505,248	635,675	2,153,730	530,985	528,065	162,074	18,952	86,759	22,521	105,107	6,212	34,839	148,361	158,870	139,004	549,702	377,841	100,200	145,067	214,751	31,284	333,678	6,988,923
Dec-79	284,056	400,691	1,497,310	377,971	291,612	89,502	10,466	47,910	12,437	58,043	3,431	19,239	81,929	87,732	76,762	303,561	208,654	55,333	80,110	118,591	17,276	184,266	4,306,881
Jan-80	224,000	262,191	1,338,679	382,534	157,992	48,491	5,670	25,957	6,738	31,447	1,859	10,423	44,388	47,532	41,589	164,465	113,046	29,979	43,403	64,251	9,360	99,833	3,153,828
Feb-80	158,953	166,219	1,039,001	251,981	89,854	27,578	3,225	14,763	3,832	17,885	1,057	5,928	25,245	27,033	23,653	93,536	64,293	17,050	24,684	36,542	5,323	56,778	2,154,411
Mar-80	171,900	261,733	989,653	330,566	105,635	32,422	3,791	17,355	4,505	21,026	1,243	6,969	29,678	31,781	27,807	109,963	75,584	20,044	29,020	42,959	6,258	66,750	2,386,642
Apr-80	858,563	696,123	2,265,346	827,632	1,107,675	339,969	39,753	181,986	47,241	220,473	13,031	73,078	311,203	333,247	291,577	1,153,062	792,563	210,181	304,295	450,464	65,622	699,926	11,283,009
May-80	340,212	328,021	1,362,366	439,851	406,317	124,707	14,582	66,756	17,329	80,874	4,780	26,806	114,155	122,241	106,956	422,966	290,728	77,098	111,621	165,239	24,072	256,747	4,904,426
Jun-80	217,511	484,784	1,501,258	662,172	202,126	62,037	7,254	33,208	8,620	40,232	2,378	13,335	56,788	60,810	53,206	210,408	144,625	38,353	55,527	82,200	11,975	127,721	4,076,528
Jul-80	181,711	242,586	1,256,312	305,596	100,178	30,747	3,595	16,459	4,272	19,940	1,179	6,609	28,145	30,139	26,370	104,283	71,679	19,009	27,520	40,740	5,935	63,301	2,586,307
Aug-80	184,426	362,522	1,304,404	430,674	286,007	87,782	10,264	46,990	12,198	56,927	3,365	18,869	80,354	86,046	75,287	297,727	204,644	54,270	78,570	116,312	16,944	180,725	3,995,306
Sep-80	481,194	382,092	2,574,355	462,894	640,263	196,510	22,978	105,192	27,306	127,439	7,532	42,241	179,883	192,625	168,539	666,498	458,120	121,490	175,890	260,379	37,931	404,574	7,735,925
Oct-80	285,865	271,037	1,773,301	352,139	281,915	86,526	10,118	46,317	12,023	56,113	3,317	18,599	79,204	84,815	74,209	293,466	201,715	53,493	77,446	114,648	16,702	178,139	4,371,106
Nov-80	251,828	237,840	1,444,373	322,226	247,994	76,114	8,900	40,744	10,577	49,361	2,917	16,361	69,674	74,609	65,280	258,155	177,444	47,057	68,128	100,853	14,692	156,704	3,741,833
Dec-80	158,079	182,218	1,253,621	282,730	125,361	38,476	4,499	20,596	5,346	24,952	1,475	8,271	35,220	37,715	32,999	130,498	89,698	23,787	34,439	50,981	7,427	79,214	2,627,603
Jan-81	123,543	193,589	1,279,461	234,743	87,015	26,707	3,123	14,296	3,711	17,320	1,024	5,741	24,447	26,179	22,905	90,581	62,261	16,511	23,904	35,387	5,155	54,984	2,352,587
Feb-81	142,574	282,279	1,295,611	355,916	156,812	48,129	5,628	25,763	6,688	31,212	1,845	10,346	44,057	47,177	41,278	163,237	112,202	29,755	43,079	63,771	9,290	99,088	3,015,736
Mar-81	260,345	368,219	1,376,901	427,581	351,011	107,733	12,597	57,669	14,970	69,866	4,129	23,158	98,617	105,602	92,398	365,393	251,155	66,604	96,428	142,747	20,795	221,799	4,535,720
Apr-81	1,063,688	700,587	3,212,650	821,523	1,352,830	415,212	48,551	222,264	57,697	269,269	15,915	89,252	380,080	407,002	356,110	1,408,262	967,976	256,699	371,642	550,162	80,146	854,837	13,902,351
May-81	589,264	480,978	2,780,540	699,284	678,092	208,121	24,336	111,407	28,920	134,969	7,977	44,737	190,511	204,006	178,497	705,877	485,188	128,668	186,282	275,763	40,172	428,478	8,612,067
Jun-81	603,521	468,597	3,192,013	440,941	681,927	209,298	24,474	112,037	29,083	135,732	8,022	44,990	191,589	205,159	179,506	709,869	487,932	129,395	187,335	277,323	40,400	430,901	8,790,043
Jul-81	274,728	221,535	1,747,819	278,218	313,329	96,167	11,245	51,478	13,363	62,365	3,686	20,672	88,030	94,266	82,479	326,167	224,193	59,454	86,076	127,423	18,563	197,989	4,399,245
Aug-81	387,710	160,545	1,508,616	209,950	396,030	121,550	14,213	65,066	16,890	78,826	4,659	26,128	111,265	119,147	104,248	412,257	283,367	75,147	108,795	161,056	23,462	250,247	4,639,175
Sep-81	177,344	164,410	940,664	208,835	111,534	34,232	4,003	18,325	4,757	22,200	1,312	7,358	31,336	33,555	29,360	116,105	79,805	21,164	30,640	45,358	6,608	70,477	2,159,381
Oct-81	386,182	282,232	1,479,366	362,355	340,982	104,655	12,237	56,022	14,542	67,870	4,011	22,496	95,799	102,585	89,758	354,954	243,979	64,701	93,673	138,669	20,201	215,462	4,552,731
Nov-81	229,085	205,877	1,292,381	272,185	176,685	54,228	6,341	29,029	7,535	35,168	2,079	11,657	49,640	53,156	46,509	183,925	126,422	33,526	48,538	71,853	10,467	111,645	3,057,932
Dec-81	177,796	167,476	1,200,684	282,401	117,913	36,190	4,232	19,373	5,029	23,470	1,387	7,779	33,128	35,474	31,039	122,745	84,369	22,374	32,392	47,952	6,986	74,508	2,534,695

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-82	147,254	195,586	1,082,069	236,517	113,525	34,843	4,074	18,652	4,842	22,596	1,336	7,490	31,895	34,154	29,884	118,177	81,230	21,541	31,187	46,168	6,726	71,735	2,341,481
Feb-82	139,454	208,156	1,135,903	216,237	104,935	32,207	3,766	17,240	4,475	20,886	1,234	6,923	29,482	31,570	27,622	109,234	75,083	19,911	28,827	42,674	6,217	66,307	2,328,343
Mar-82	178,451	360,149	1,074,891	449,458	152,166	46,703	5,461	25,000	6,490	30,287	1,790	10,039	42,751	45,780	40,055	158,401	108,878	28,873	41,802	61,882	9,015	96,152	2,974,476
Apr-82	1,221,549	803,184	3,320,677	1,061,589	1,900,694	583,363	68,214	312,275	81,062	378,317	22,360	125,397	534,003	571,828	500,326	1,978,575	1,359,983	360,656	522,149	772,964	112,603	1,201,025	17,792,795
May-82	870,574	360,654	3,211,753	477,622	861,636	264,454	30,923	141,563	36,748	171,501	10,137	56,846	242,078	259,225	226,811	896,941	616,517	163,495	236,704	350,406	51,046	544,457	10,082,090
Jun-82	221,613	191,169	1,006,342	340,453	216,395	66,416	7,766	35,553	9,229	43,072	2,546	14,276	60,797	65,103	56,962	225,262	154,835	41,061	59,447	88,002	12,820	136,738	3,055,857
Jul-82	535,089	392,535	1,782,094	665,543	756,812	232,281	27,161	124,341	32,277	150,637	8,903	49,930	212,628	227,689	199,218	787,822	541,513	143,605	207,907	307,776	44,836	478,220	7,908,817
Aug-82	291,793	156,011	1,070,584	270,030	192,466	59,072	6,907	31,621	8,208	38,309	2,264	12,698	54,074	57,904	50,663	200,352	137,713	36,520	52,873	78,271	11,402	121,617	2,941,354
Sep-82	528,475	297,514	1,856,385	347,500	639,968	196,420	22,968	105,144	27,294	127,380	7,529	42,221	179,800	192,536	168,461	666,191	457,909	121,434	175,809	260,259	37,914	404,388	6,863,497
Oct-82	603,147	403,507	2,473,505	421,548	797,259	244,696	28,613	130,986	34,002	158,688	9,379	52,599	223,991	239,857	209,865	829,927	570,454	151,279	219,019	324,225	47,232	503,778	8,677,556
Nov-82	582,322	506,422	2,299,082	582,597	733,436	225,107	26,322	120,500	31,280	145,984	8,628	48,388	206,060	220,656	193,065	763,488	524,787	139,169	201,486	298,270	43,451	463,449	8,363,949
Dec-82	377,665	409,827	1,887,968	521,022	509,224	156,292	18,275	83,663	21,718	101,357	5,991	33,596	143,067	153,201	134,045	530,089	364,359	96,625	139,891	207,088	30,168	321,772	6,246,903
Jan-83	266,117	268,265	1,649,123	351,353	281,694	86,458	10,110	46,281	12,014	56,069	3,314	18,584	79,142	84,748	74,151	293,236	201,557	53,451	77,385	114,558	16,688	177,999	4,222,297
Feb-83	196,546	262,767	1,428,403	366,056	202,606	62,184	7,271	33,287	8,641	40,327	2,384	13,367	56,922	60,954	53,333	210,907	144,968	38,444	55,659	82,395	12,003	128,024	3,467,447
Mar-83	590,574	679,677	2,372,656	784,334	837,854	257,155	30,070	137,655	35,733	166,768	9,857	55,277	235,397	252,070	220,551	872,185	599,501	158,982	230,171	340,734	49,637	529,430	9,446,267
Apr-83	993,914	625,289	2,596,247	722,581	1,335,132	409,780	47,916	219,356	56,942	265,747	15,707	88,084	375,107	401,677	351,451	1,389,838	955,312	253,340	366,780	542,964	79,097	843,653	12,935,918
May-83	873,117	818,761	3,371,102	886,090	1,075,782	330,180	38,609	176,746	45,881	214,125	12,656	70,974	302,243	323,651	283,182	1,119,862	769,743	204,129	295,533	437,493	63,733	679,773	12,393,363
Jun-83	725,473	446,783	3,083,089	576,082	704,197	216,133	25,273	115,696	30,033	140,164	8,284	46,459	197,845	211,859	185,368	733,051	503,867	133,621	193,453	286,379	41,719	444,974	9,049,803
Jul-83	200,524	227,350	1,473,265	355,739	120,531	36,993	4,326	19,803	5,140	23,991	1,418	7,952	33,863	36,262	31,728	125,470	86,242	22,871	33,112	49,017	7,141	76,162	2,978,898
Aug-83	199,120	227,491	1,341,191	298,245	136,717	41,961	4,907	22,462	5,831	27,212	1,608	9,020	38,411	41,132	35,989	142,319	97,824	25,942	37,558	55,599	8,100	86,390	2,885,029
Sep-83	278,596	422,795	1,370,979	467,102	230,296	70,683	8,265	37,836	9,822	45,838	2,709	15,194	64,702	69,285	60,621	239,732	164,781	43,698	63,266	93,655	13,643	145,521	3,919,021
Oct-83	590,855	505,306	1,969,796	595,222	740,847	227,381	26,588	121,718	31,596	147,459	8,716	48,877	208,142	222,885	195,016	771,203	530,090	140,575	203,522	301,284	43,890	468,132	8,099,098
Nov-83	465,050	339,263	2,135,605	515,242	642,438	197,178	23,056	105,550	27,399	127,872	7,558	42,384	180,494	193,279	169,111	668,762	459,677	121,902	176,487	261,263	38,060	405,949	7,303,581
Dec-83	385,651	253,146	1,930,856	408,898	373,834	114,737	13,416	61,419	15,944	74,408	4,398	24,663	105,029	112,469	98,406	389,152	267,485	70,935	102,698	152,029	22,147	236,221	5,217,942
Jan-84	208,089	216,731	1,415,841	358,025	159,835	49,057	5,736	26,260	6,817	31,814	1,880	10,545	44,906	48,087	42,074	166,385	114,365	30,329	43,909	65,001	9,469	100,998	3,156,154
Feb-84	417,270	493,606	1,982,896	494,239	527,622	161,938	18,936	86,686	22,502	105,019	6,207	34,809	148,236	158,736	138,888	549,242	377,524	100,116	144,946	214,571	31,258	333,398	6,548,646
Mar-84	303,398	319,751	1,629,384	442,563	367,640	112,836	13,194	60,401	15,679	73,176	4,325	24,255	103,289	110,605	96,775	382,704	263,053	69,759	100,996	149,510	21,780	232,307	4,897,381
Apr-84	1,033,738	514,985	2,221,561	757,445	1,121,133	344,099	40,236	184,197	47,815	223,152	13,189	73,966	314,984	337,295	295,120	1,167,071	802,192	212,734	307,992	455,937	66,420	708,430	11,243,692
May-84	707,488	547,982	2,458,791	770,537	765,145	234,839	27,460	125,710	32,632	152,296	9,001	50,480	214,969	230,195	201,412	796,496	547,476	145,186	210,197	311,165	45,330	483,486	9,068,270
Jun-84	260,080	338,875	1,277,667	535,157	244,860	75,153	8,788	40,229	10,443	48,737	2,881	16,154	68,794	73,667	64,455	254,893	175,202	46,462	67,267	99,578	14,506	154,724	3,878,570
Jul-84	221,473	199,099	1,075,429	403,527	167,431	51,388	6,009	27,508	7,141	33,326	1,970	11,046	47,040	50,372	44,073	174,291	119,800	31,770	45,996	68,090	9,919	105,797	2,902,494
Aug-84	357,464	182,794	977,989	341,251	201,426	61,822	7,229	33,093	8,591	40,092	2,370	13,289	56,591	60,599	53,022	209,679	144,124	38,220	55,335	81,915	11,933	127,278	3,066,105
Sep-84	446,596	270,731	1,374,209	445,372	390,131	119,739	14,001	64,097	16,639	77,652	4,590	25,739	109,608	117,372	102,695	406,116	279,146	74,027	107,175	158,656	23,113	246,519	4,873,924
Oct-84	350,663	365,130	1,403,818	618,952	446,580	137,065	16,027	73,371	19,046	88,888	5,254	29,463	125,467	134,355	117,555	464,879	319,537	84,738	122,682	181,613	26,457	282,189	5,413,728
Nov-84	465,112	511,955	1,370,800	811,878	589,086	180,803	21,142	96,784	25,124	117,253	6,930	38,864	165,505	177,228	155,067	613,224	421,502	111,779	161,831	239,566	34,899	372,236	6,688,568
Dec-84	385,043	291,441	1,410,996	512,313	394,924	121,211	14,173	64,884	16,843	78,606	4,646	26,055	110,955	118,814	103,957	411,106	282,576	74,937	108,492	160,606	23,397	249,548	4,965,521
Jan-85	312,109	235,643	1,369,185	352,725	139,741	42,889	5,015	22,959	5,960	27,814	1,644	9,219	39,260	42,041	36,784	145,467	99,987	26,516	38,389	56,829	8,279	88,300	3,106,756
Feb-85	202,473	210,975	951,072	304,759	94,094	28,880	3,377	15,459	4,013	18,729	1,107	6,208	26,436	28,309	24,769	97,950	67,326	17,854	25,849	38,266	5,574	59,457	2,232,936
Mar-85	414,671	711,041	1,570,346	804,246	437,657	134,326	15,707	71,905	18,666	87,112	5,149	28,874	122,961	131,670	115,206	455,590	313,152	83,045	120,231	177,984	25,928	276,550	6,122,019
Apr-85	1,917,108	856,821	4,169,464	1,155,699	1,671,578	513,043	59,991	274,632	71,291	332,714	19,665	110,281	469,633	502,898	440,015	1,740,071	1,196,047	317,181	459,207	679,789	99,030	1,056,250	18,112,408
May-85	782,465	441,814	2,392,574	667,210	760,941	233,549	27,309	125,019	32,453	151,459	8,952	50,202	213,788	228,931	200,305	792,121	544,468	144,388	209,042	309,456	45,081	480,830	8,842,357
Jun-85	429,455	298,207	1,870,023	417,732	381,982	117,238	13,709	62,758	16,291	76,030	4,494	25,201	107,319	114,920	100,551	397,634	273,316	72,481	104,936	155,343	22,630	241,370	5,303,619
Jul-85	223,657	190,488	1,236,753	332,426	121,969	37,435	4,377	20,039	5,202	24,277	1,435	8,047	34,267	36,695	32,106	126,967	87,271	23,144	33,507	49,602	7,226	77,071	2,713,958
Aug-85	215,771	286,108	1,227,960	415,797	111,276	34,153	3,994	18,282	4,746	22,149	1,309	7,341	31,263	33,478	29,292	115,836	79,620	21,115	30,569	45,253	6,592	70,314	2,812,218
Sep-85	333,258	253,581	1,584,701	428,756	271,112	83,210	9,730	44,542	11,563	53,962	3,189	17,886	76,169	81,565	71,366	282,220	193,986	51,443	74,478	110,254	16,062	171,312	4,224,346
Oct-85	926,388	629,107	3,148,228	892,705	881,730	270,622	31,644	144,864	37,605	175,501	10,373	58,171	247,724	265,271	232,101	917,859	630,895	167,308	242,224	358,578	52,237	557,155	10,878,289
Nov-85	1,042,603	774,357	3,103,905	1,094,747	1,377,828	422,884	49,449	226,371	58,763	274,245	16,209	90,901	387,103	414,523	362,690	1,434,284	985,863	261,442	378,510	560,328	81,627	870,633	14,269,264
Dec-85	372,939	349,119	2,191,055	624,358	370,552	113,730	13,299	60,880	15,804	73,755	4,359	24,447	104,107	111,482	97,542	385,736	265,137	70,312	101,796	150,694	21,953	234,148	5,757,204

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-86	274,267	272,529	1,688,602	505,635	207,214	63,598	7,437	34,044	8,837	41,244	2,438	13,671	58,217	62,341	54,546	215,705	148,266	39,319	56,925	84,269	12,276	130,936	3,982,315
Feb-86	217,680	230,945	1,724,491	399,102	155,042	47,586	5,564	25,473	6,612	30,860	1,824	10,229	43,559	46,645	40,812	161,395	110,936	29,419	42,592	63,052	9,185	97,969	3,500,972
Mar-86	384,080	557,509	1,860,871	871,611	388,988	119,389	13,960	63,909	16,590	77,425	4,576	25,663	109,287	117,028	102,395	404,927	278,328	73,810	106,861	158,192	23,045	245,797	6,004,238
Apr-86	1,993,960	988,269	4,851,544	1,341,734	2,233,822	685,607	80,169	367,006	95,270	444,623	26,279	147,375	627,596	672,051	588,017	2,325,353	1,598,343	423,867	613,664	908,439	132,339	1,411,525	22,556,854
May-86	358,403	285,756	1,650,200	487,164	233,135	71,554	8,367	38,303	9,943	46,403	2,743	15,381	65,500	70,139	61,369	242,687	166,812	44,237	64,046	94,810	13,812	147,315	4,178,077
Jun-86	182,155	184,274	959,506	327,523	83,918	25,756	3,012	13,787	3,579	16,703	987	5,536	23,577	25,247	22,090	87,357	60,045	15,923	23,054	34,127	4,972	53,027	2,156,156
Jul-86	179,396	228,067	928,103	391,920	92,325	28,336	3,313	15,169	3,938	18,376	1,086	6,091	25,939	27,776	24,303	96,108	66,060	17,519	25,363	37,546	5,470	58,339	2,280,542
Aug-86	214,480	231,109	1,125,854	327,126	124,955	38,351	4,485	20,530	5,329	24,871	1,470	8,244	35,106	37,593	32,892	130,075	89,408	23,710	34,327	50,816	7,403	78,958	2,647,093
Sep-86	251,933	362,287	1,292,920	457,006	231,328	70,999	8,302	38,006	9,866	46,044	2,721	15,262	64,992	69,596	60,893	240,807	165,520	43,894	63,549	94,075	13,705	146,173	3,749,877
Oct-86	499,180	619,768	1,606,594	757,180	544,251	167,042	19,533	89,418	23,212	108,329	6,403	35,907	152,908	163,739	143,265	566,552	389,422	103,271	149,514	221,333	32,243	343,906	6,742,969
Nov-86	220,527	286,296	969,376	399,923	169,274	51,954	6,075	27,811	7,219	33,693	1,991	11,168	47,558	50,927	44,559	176,210	121,119	32,120	46,502	68,840	10,028	106,962	2,890,132
Dec-86	139,874	214,969	1,063,586	368,096	95,090	29,185	3,413	15,623	4,055	18,927	1,119	6,273	26,716	28,608	25,031	98,986	68,039	18,043	26,123	38,671	5,633	60,086	2,356,146
Jan-87	155,435	188,644	995,934	308,734	76,286	23,414	2,738	12,533	3,253	15,184	897	5,033	21,433	22,951	20,081	79,412	54,584	14,475	20,957	31,024	4,519	48,204	2,105,725
Feb-87	129,441	154,331	897,238	264,743	57,445	17,631	2,062	9,438	2,450	11,434	676	3,790	16,139	17,282	15,121	59,799	41,103	10,900	15,781	23,361	3,403	36,299	1,789,867
Mar-87	289,563	297,538	1,322,349	423,959	245,708	75,413	8,818	40,369	10,479	48,906	2,891	16,210	69,032	73,922	64,678	255,775	175,809	46,623	67,500	99,923	14,557	155,260	3,805,280
Apr-87	554,740	396,236	1,339,756	551,932	711,276	218,306	25,527	116,859	30,335	141,574	8,368	46,926	199,834	213,989	187,232	740,421	508,932	134,964	195,398	289,258	42,138	449,447	7,103,446
May-87	273,966	250,386	745,964	351,480	248,362	76,228	8,913	40,805	10,592	49,434	2,922	16,385	69,778	74,720	65,377	258,539	177,708	47,127	68,229	101,003	14,714	156,937	3,109,569
Jun-87	287,971	170,671	810,924	254,725	194,826	59,796	6,992	32,009	8,309	38,778	2,292	12,853	54,737	58,614	51,285	202,809	139,402	36,968	53,522	79,231	11,542	123,108	2,691,363
Jul-87	315,787	151,876	1,099,655	227,403	263,000	80,720	9,439	43,210	11,217	52,348	3,094	17,351	73,890	79,124	69,230	273,776	188,182	49,904	72,250	106,955	15,581	166,187	3,370,179
Aug-87	226,929	157,209	1,362,725	198,438	216,875	66,563	7,783	35,631	9,249	43,167	2,551	14,308	60,931	65,247	57,089	225,761	155,178	41,152	59,579	88,197	12,848	137,040	3,244,452
Sep-87	179,838	146,707	764,985	210,893	133,915	41,101	4,806	22,002	5,711	26,655	1,575	8,835	37,624	40,289	35,251	139,402	95,819	25,410	36,788	54,460	7,934	84,619	2,104,620
Oct-87	307,193	201,542	835,149	247,888	202,974	62,297	7,285	33,348	8,657	40,400	2,388	13,391	57,026	61,065	53,430	211,291	145,232	38,514	55,760	82,545	12,025	128,257	2,807,656
Nov-87	389,933	317,766	1,153,489	375,225	350,974	107,721	12,596	57,663	14,969	69,858	4,129	23,155	98,607	105,591	92,388	365,355	251,129	66,597	96,418	142,732	20,793	221,776	4,338,864
Dec-87	442,416	278,273	1,440,067	370,269	309,125	94,877	11,094	50,788	13,184	61,529	3,637	20,394	86,849	93,001	81,372	321,792	221,185	58,656	84,921	125,714	18,314	195,333	4,382,790
Jan-88	198,052	190,653	951,072	218,631	110,318	33,859	3,959	18,125	4,705	21,958	1,298	7,278	30,994	33,189	29,039	114,838	78,934	20,933	30,306	44,863	6,536	69,708	2,219,248
Feb-88	155,170	182,195	852,376	213,066	74,516	22,871	2,674	12,243	3,178	14,832	877	4,916	20,935	22,418	19,615	77,569	53,318	14,139	20,471	30,304	4,415	47,086	1,849,183
Mar-88	289,121	397,140	1,136,083	442,563	233,725	71,735	8,388	38,400	9,968	46,521	2,750	15,420	65,665	70,317	61,524	243,301	167,234	44,349	64,208	95,050	13,847	147,688	3,664,995
Apr-88	1,400,316	586,688	2,184,415	701,370	1,452,123	445,687	52,115	238,577	61,931	289,033	17,083	95,803	407,976	436,874	382,247	1,511,623	1,039,022	275,540	398,920	590,542	86,028	917,579	13,571,493
May-88	301,782	252,982	995,755	318,884	255,331	78,366	9,164	41,950	10,890	50,821	3,004	16,845	71,736	76,817	67,212	265,793	182,694	48,449	70,143	103,837	15,127	161,340	3,398,920
Jun-88	135,383	80,208	619,991	156,514	57,998	17,801	2,081	9,529	2,474	11,544	682	3,826	16,295	17,449	15,267	60,374	41,499	11,005	15,933	23,586	3,436	36,648	1,339,523
Jul-88	121,908	118,644	667,904	185,691	39,673	12,177	1,424	6,518	1,692	7,897	467	2,617	11,146	11,936	10,443	41,299	28,387	7,528	10,899	16,134	2,350	25,069	1,331,802
Aug-88	336,901	126,738	849,361	188,474	117,213	35,975	4,207	19,257	4,999	23,330	1,379	7,733	32,931	35,264	30,854	122,015	83,868	22,241	32,200	47,667	6,944	74,065	2,203,615
Sep-88	304,841	121,769	820,793	165,047	124,071	38,080	4,453	20,384	5,291	24,695	1,460	8,185	34,858	37,327	32,660	129,154	88,775	23,542	34,084	50,456	7,350	78,399	2,155,674
Oct-88	460,100	145,674	867,450	217,041	252,861	77,608	9,075	41,544	10,784	50,330	2,975	16,682	71,042	76,074	66,561	263,221	180,927	47,980	69,465	102,832	14,980	159,779	3,204,984
Nov-88	1,183,007	366,727	2,414,646	394,464	952,854	292,451	34,197	156,549	40,638	189,658	11,210	62,864	267,706	286,668	250,823	991,897	681,786	180,804	261,763	387,502	56,450	602,097	10,066,762
Dec-88	446,855	203,022	1,727,901	287,242	348,799	107,054	12,518	57,306	14,876	69,425	4,103	23,012	97,996	104,937	91,815	363,091	249,572	66,184	95,820	141,848	20,664	220,402	4,754,440
Jan-89	269,492	155,318	1,216,654	236,917	153,493	47,110	5,509	25,218	6,546	30,552	1,806	10,127	43,124	46,179	40,405	159,783	109,828	29,125	42,167	62,422	9,093	96,991	2,797,859
Feb-89	193,454	124,048	927,744	191,336	89,965	27,612	3,229	14,781	3,837	17,907	1,058	5,935	25,276	27,066	23,682	93,651	64,372	17,071	24,715	36,586	5,330	56,848	1,975,502
Mar-89	301,145	300,486	1,405,074	453,428	297,622	91,346	10,681	48,898	12,693	59,239	3,501	19,635	83,617	89,540	78,344	309,817	212,954	56,474	81,761	121,035	17,632	188,064	4,242,989
Apr-89	1,138,446	493,735	2,122,506	592,610	1,292,361	396,653	46,381	212,329	55,118	257,234	15,204	85,262	363,091	388,810	340,193	1,345,316	924,709	245,225	355,031	525,571	76,564	816,627	12,088,975
May-89	635,853	282,314	1,451,731	411,875	618,435	189,811	22,195	101,606	26,376	123,094	7,275	40,801	173,750	186,058	162,793	643,776	442,502	117,348	169,893	251,502	36,638	390,782	6,486,408
Jun-89	1,081,470	336,878	2,520,162	528,054	1,095,139	336,121	39,303	179,926	46,706	217,978	12,884	72,251	307,681	329,475	288,277	1,140,012	783,593	207,802	300,851	445,365	64,880	692,005	11,026,815
Jul-89	243,639	109,411	784,365	215,690	159,503	48,955	5,724	26,206	6,803	31,748	1,876	10,523	44,813	47,987	41,987	166,039	114,128	30,266	43,818	64,866	9,449	100,788	2,308,585
Aug-89	164,259	113,005	721,918	202,466	99,072	30,407	3,556	16,277	4,225	19,719	1,166	6,536	27,834	29,806	26,079	103,132	70,888	18,799	27,217	40,290	5,869	62,602	1,795,123
Sep-89	168,910	93,059	677,056	170,055	85,430	26,220	3,066	14,036	3,643	17,004	1,005	5,636	24,002	25,702	22,488	88,930	61,127	16,210	23,469	34,742	5,061	53,982	1,620,834
Oct-89	199,025	112,782	628,874	197,987	82,185	25,224	2,950	13,503	3,505	16,358	967	5,422	23,090	24,726	21,634	85,553	58,805	15,595	22,577	33,423	4,869	51,932	1,630,985
Nov-89	322,224	179,646	780,417	256,581	289,436	88,834	10,388	47,553	12,344	57,610	3,405	19,095	81,318	87,078	76,189	301,296	207,097	54,920	79,512	117,707	17,147	182,891	3,272,689
Dec-89	159,679	91,074	683,695	177,555	58,367	17,914	2,095	9,589	2,489	11,617	687	3,851	16,398	17,560	15,364	60,758	41,762	11,075	16,034	23,736	3,458	36,881	1,461,639

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-90	163,923	71,470	782,391	188,686	59,952	18,401	2,152	9,850	2,557	11,933	705	3,955	16,844	18,037	15,781	62,409	42,897	11,376	16,470	24,381	3,552	37,883	1,565,604
Feb-90	143,676	68,030	751,885	168,015	52,172	16,013	1,872	8,572	2,225	10,384	614	3,442	14,658	15,696	13,733	54,310	37,330	9,900	14,333	21,217	3,091	32,967	1,444,136
Mar-90	572,671	301,741	1,456,755	614,633	572,900	175,835	20,561	94,125	24,433	114,031	6,740	37,797	160,957	172,358	150,806	596,374	409,921	108,707	157,384	232,984	33,940	362,008	6,377,662
Apr-90	440,365	125,164	770,907	302,029	381,356	117,046	13,686	62,655	16,264	75,906	4,486	25,160	107,142	114,732	100,386	396,982	272,867	72,362	104,764	155,088	22,593	240,974	3,922,913
May-90	851,129	359,347	2,075,491	623,987	1,134,849	348,309	40,728	186,450	48,400	225,882	13,351	74,871	318,838	341,422	298,730	1,181,349	812,006	215,337	311,760	461,515	67,232	717,097	10,708,080
Jun-90	370,322	508,463	1,651,994	830,455	423,462	129,969	15,198	69,573	18,060	84,287	4,982	27,938	118,972	127,400	111,469	440,813	302,995	80,352	116,331	172,211	25,087	267,581	5,897,915
Jul-90	185,532	168,510	798,542	352,937	98,703	30,294	3,542	16,216	4,210	19,646	1,161	6,512	27,731	29,695	25,982	102,748	70,624	18,729	27,115	40,140	5,848	62,369	2,096,788
Aug-90	161,695	163,462	831,919	333,486	74,074	22,735	2,658	12,170	3,159	14,744	871	4,887	20,811	22,285	19,499	77,109	53,001	14,055	20,349	30,124	4,388	46,806	1,934,287
Sep-90	157,929	295,686	1,035,592	513,824	116,586	35,783	4,184	19,154	4,972	23,205	1,372	7,692	32,755	35,075	30,689	121,363	83,419	22,122	32,028	47,412	6,907	73,669	2,701,418
Oct-90	362,435	245,726	1,405,792	423,615	299,097	91,799	10,734	49,140	12,756	59,533	3,519	19,733	84,032	89,984	78,732	311,352	214,009	56,753	82,166	121,635	17,719	188,996	4,229,257
Nov-90	264,488	202,775	930,256	360,066	201,942	61,980	7,247	33,178	8,613	40,195	2,376	13,323	56,736	60,755	53,158	210,216	144,493	38,318	55,476	82,125	11,964	127,605	2,967,284
Dec-90	208,220	153,485	1,058,023	339,581	158,213	48,559	5,678	25,994	6,748	31,491	1,861	10,438	44,450	47,599	41,647	164,696	113,204	30,021	43,463	64,341	9,373	99,973	2,707,058
Jan-91	161,094	115,591	943,894	243,807	56,154	17,235	2,015	9,226	2,395	11,177	661	3,705	15,777	16,894	14,782	58,455	40,180	10,655	15,426	22,837	3,327	35,483	1,800,770
Feb-91	141,643	102,518	961,839	239,037	43,618	13,387	1,565	7,166	1,860	8,682	513	2,878	12,255	13,123	11,482	45,406	31,210	8,277	11,983	17,738	2,584	27,562	1,706,325
Mar-91	422,629	319,338	1,773,839	643,969	545,800	167,517	19,588	89,672	23,278	108,637	6,421	36,009	153,343	164,205	143,673	568,164	390,530	103,565	149,939	221,963	32,335	344,884	6,429,298
Apr-91	1,360,016	578,558	2,845,141	1,006,102	1,682,603	516,426	60,387	276,444	71,761	334,908	19,795	111,008	472,730	506,215	442,917	1,751,547	1,203,935	319,273	462,236	684,272	99,683	1,063,216	15,869,173
May-91	648,178	379,842	2,582,789	645,479	970,220	297,781	34,820	159,403	41,379	193,114	11,414	64,009	272,585	291,893	255,394	1,009,975	694,211	184,099	266,534	394,564	57,479	613,070	10,068,235
Jun-91	279,819	393,741	1,865,896	594,677	401,524	123,236	14,410	65,968	17,125	79,920	4,724	26,490	112,809	120,799	105,695	417,976	287,298	76,189	110,305	163,290	23,788	253,718	5,539,396
Jul-91	296,972	227,905	1,526,202	337,249	243,606	74,768	8,743	40,023	10,389	48,488	2,866	16,072	68,442	73,289	64,125	253,588	174,305	46,224	66,922	99,068	14,432	153,932	3,847,609
Aug-91	180,210	180,603	997,908	310,377	90,813	27,872	3,259	14,920	3,873	18,076	1,068	5,991	25,514	27,321	23,905	94,534	64,978	17,232	24,948	36,931	5,380	57,384	2,213,097
Sep-91	175,683	159,144	1,192,609	289,097	96,565	29,638	3,466	15,865	4,118	19,220	1,136	6,371	27,130	29,052	25,419	100,522	69,094	18,323	26,528	39,270	5,721	61,018	2,394,988
Oct-91	249,775	198,182	1,117,241	323,283	213,999	65,681	7,680	35,159	9,127	42,595	2,518	14,118	60,123	64,382	56,332	222,767	153,120	40,606	58,789	87,028	12,678	135,223	3,170,404
Nov-91	494,317	367,329	1,496,952	719,761	695,790	213,553	24,971	114,315	29,675	138,491	8,185	45,904	195,484	209,330	183,155	724,300	497,851	132,026	191,144	282,960	41,221	439,662	7,246,376
Dec-91	422,540	287,206	1,627,589	543,796	559,626	171,761	20,084	91,944	23,867	111,389	6,584	36,921	157,228	168,365	147,312	582,557	400,423	106,189	153,738	227,586	33,154	353,621	6,233,481
Jan-92	223,410	165,225	1,322,529	346,365	182,400	55,982	6,546	29,968	7,779	36,305	2,146	12,034	51,246	54,876	48,014	189,874	130,511	34,610	50,108	74,178	10,806	115,257	3,150,167
Feb-92	177,274	116,709	1,046,179	298,664	111,940	34,357	4,017	18,391	4,774	22,281	1,317	7,385	31,450	33,677	29,466	116,527	80,095	21,241	30,752	45,523	6,632	70,734	2,309,385
Mar-92	338,634	289,485	1,665,453	647,361	296,294	90,939	10,634	48,680	12,637	58,975	3,486	19,548	83,244	89,141	77,995	308,435	212,004	56,222	81,396	120,495	17,553	187,225	4,715,836
Apr-92	1,409,883	640,481	3,449,521	1,114,808	1,699,010	521,462	60,975	279,139	72,461	338,174	19,988	112,091	477,340	511,151	447,236	1,768,627	1,215,675	322,386	466,743	690,945	100,655	1,073,584	16,792,335
May-92	584,094	373,469	1,870,203	846,488	642,696	197,257	23,066	105,592	27,410	127,923	7,561	42,401	180,567	193,357	169,179	669,031	459,862	121,951	176,558	261,368	38,075	406,112	7,524,221
Jun-92	174,657	127,520	918,951	362,186	108,327	33,248	3,888	17,798	4,620	21,562	1,274	7,147	30,435	32,590	28,515	112,765	77,510	20,555	29,759	44,054	6,418	68,450	2,232,227
Jul-92	648,108	143,078	1,610,542	316,181	479,137	147,057	17,196	78,720	20,435	95,368	5,637	31,611	134,614	144,150	126,125	498,770	342,832	90,916	131,626	194,853	28,386	302,761	5,588,101
Aug-92	225,284	101,048	899,032	276,377	199,361	61,188	7,155	32,754	8,502	39,681	2,345	13,153	56,011	59,978	52,478	207,530	142,647	37,829	54,767	81,075	11,811	125,974	2,695,979
Sep-92	284,664	247,050	1,293,279	547,162	269,121	82,599	9,658	44,215	11,478	53,566	3,166	17,755	75,610	80,966	70,842	280,148	192,561	51,065	73,931	109,445	15,944	170,054	3,984,277
Oct-92	273,365	203,600	1,149,721	431,141	325,791	99,992	11,692	53,526	13,895	64,846	3,833	21,494	91,532	98,015	85,759	339,140	233,110	61,819	89,500	132,491	19,301	205,863	4,009,425
Nov-92	619,425	451,665	1,896,581	871,399	903,300	277,242	32,418	148,408	38,525	179,794	10,627	59,594	253,784	271,760	237,779	940,312	646,328	171,401	248,150	367,349	53,514	570,784	9,250,140
Dec-92	457,500	287,688	1,742,256	640,444	573,379	175,982	20,578	94,203	24,454	114,126	6,745	37,828	161,092	172,502	150,933	596,873	410,264	108,798	157,516	233,179	33,969	362,311	6,562,622
Jan-93	256,849	213,465	1,534,277	429,313	236,527	72,595	8,489	38,860	10,088	47,079	2,783	15,605	66,453	71,160	62,262	246,218	169,239	44,881	64,977	96,189	14,013	149,458	3,850,778
Feb-93	185,409	163,780	1,329,706	335,500	125,177	38,419	4,492	20,566	5,339	24,915	1,473	8,258	35,169	37,660	32,951	130,306	89,566	23,752	34,388	50,906	7,416	79,098	2,764,245
Mar-93	279,041	220,715	1,310,147	476,484	227,715	69,890	8,172	37,412	9,712	45,325	2,679	15,023	63,977	68,508	59,942	237,045	162,934	43,209	62,557	92,606	13,491	143,890	3,650,474
Apr-93	1,076,024	547,424	2,433,309	1,097,715	1,274,221	391,085	45,730	209,348	54,344	253,623	14,990	84,066	357,995	383,352	335,418	1,326,432	911,730	241,783	350,047	518,194	75,489	805,165	12,787,483
May-93	1,206,844	548,877	2,991,929	1,075,640	1,362,416	418,154	48,895	223,839	58,105	271,177	16,028	89,884	382,773	409,886	358,633	1,418,241	974,835	258,518	374,276	554,060	80,714	860,894	13,984,620
Jun-93	678,912	714,188	2,844,962	1,380,028	824,654	253,104	29,596	135,487	35,170	164,140	9,701	54,406	231,688	248,099	217,077	858,444	590,056	156,478	226,545	335,366	48,855	521,089	10,558,045
Jul-93	282,861	363,149	1,351,599	750,608	251,865	77,303	9,039	41,380	10,742	50,132	2,963	16,617	70,762	75,774	66,299	262,185	180,214	47,791	69,191	102,427	14,921	159,150	4,256,973
Aug-93	239,926	172,819	963,454	449,294	179,561	55,111	6,444	29,501	7,658	35,740	2,112	11,846	50,448	54,021	47,267	186,919	128,480	34,072	49,328	73,023	10,638	113,463	2,901,125
Sep-93	339,642	234,622	1,269,053	446,273	354,108	108,683	12,709	58,178	15,102	70,482	4,166	23,362	99,487	106,534	93,213	368,617	253,371	67,192	97,279	144,007	20,978	223,757	4,410,816
Oct-93	349,615	226,099	1,234,958	428,147	318,859	97,865	11,443	52,387	13,599	63,466	3,751	21,036	89,584	95,930	83,934	331,925	228,150	60,503	87,595	129,672	18,890	201,483	4,148,894
Nov-93	385,795	250,903	1,163,538	503,011	397,947	122,138	14,282	65,381	16,972	79,208	4,682	26,254	111,804	119,723	104,753	414,253	284,739	75,510	109,322	161,835	23,576	251,458	4,687,086
Dec-93	226,168	174,445	1,212,348	396,240	175,358	53,821	6,293	28,810	7,479	34,904	2,063	11,569	49,267	52,757	46,160	182,543	125,472	33,274	48,173	71,314	10,389	110,807	3,059,653

Estimated Monthly Solids Loads to Green Bay from Tributaries, 1954-1995

Solids	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
DA (mi^2)	924.4	1143.3	4069.3	971.5	496.0	152.2	17.8	81.5	21.2	98.7	5.8	32.7	139.3	149.2	130.6	516.3	354.9	94.1	136.3	201.7	29.4	313.4	
Monthly load, kg																							
Jan-94	149,688	167,934	1,112,575	291,774	64,635	19,838	2,320	10,619	2,757	12,865	760	4,264	18,159	19,445	17,014	67,283	46,247	12,264	17,756	26,285	3,829	40,842	2,109,154
Feb-94	117,063	150,509	1,040,796	276,933	46,236	14,191	1,659	7,596	1,972	9,203	544	3,050	12,990	13,910	12,171	48,131	33,083	8,773	12,702	18,803	2,739	29,216	1,862,271
Mar-94	182,668	211,771	1,169,460	439,091	93,689	28,755	3,362	15,393	3,996	18,648	1,102	6,181	26,322	28,187	24,662	97,528	67,036	17,777	25,738	38,101	5,550	59,201	2,564,218
Apr-94	639,478	344,649	1,559,040	722,040	633,995	194,586	22,753	104,162	27,039	126,191	7,458	41,827	178,122	190,739	166,889	659,973	453,636	120,300	174,168	257,830	37,560	400,614	7,063,050
May-94	533,697	266,410	1,541,993	540,086	555,681	170,550	19,943	91,296	23,699	110,604	6,537	36,661	156,120	167,178	146,274	578,450	397,601	105,440	152,654	225,982	32,920	351,128	6,210,902
Jun-94	361,993	160,701	1,296,688	290,952	309,052	94,854	11,092	50,776	13,181	61,514	3,636	20,389	86,829	92,979	81,353	321,715	221,132	58,642	84,901	125,684	18,309	195,286	3,961,658
Jul-94	257,344	140,309	1,583,984	286,420	141,510	43,433	5,079	23,249	6,035	28,166	1,665	9,336	39,758	42,574	37,250	147,309	101,253	26,852	38,875	57,549	8,384	89,419	3,115,752
Aug-94	177,009	110,921	917,874	274,336	87,826	26,956	3,152	14,429	3,746	17,481	1,033	5,794	24,675	26,423	23,119	91,425	62,842	16,665	24,127	35,717	5,203	55,496	2,006,250
Sep-94	194,126	301,371	1,435,401	462,253	202,311	62,093	7,261	33,239	8,628	40,268	2,380	13,347	56,839	60,866	53,255	210,600	144,757	38,388	55,578	82,275	11,986	127,838	3,605,060
Oct-94	267,406	328,532	1,152,951	558,451	307,503	94,379	11,036	50,521	13,115	61,206	3,618	20,287	86,394	92,513	80,945	320,103	220,024	58,349	84,476	125,054	18,217	194,308	4,149,386
Nov-94	200,298	216,080	859,913	406,416	216,985	66,597	7,787	35,650	9,254	43,189	2,553	14,315	60,962	65,280	57,118	225,876	155,257	41,173	59,609	88,242	12,855	137,110	2,982,520
Dec-94	167,018	166,274	1,018,724	347,372	148,073	45,447	5,314	24,328	6,315	29,473	1,742	9,769	41,601	44,548	38,978	154,141	105,949	28,097	40,678	60,218	8,772	93,566	2,586,398
Jan-95	116,356	105,270	976,195	263,153	47,969	14,723	1,722	7,881	2,046	9,548	564	3,165	13,477	14,432	12,627	49,935	34,323	9,102	13,178	19,508	2,842	30,311	1,748,324
Feb-95	103,270	95,552	906,210	206,971	37,830	11,611	1,358	6,215	1,613	7,530	445	2,496	10,628	11,381	9,958	39,380	27,068	7,178	10,392	15,384	2,241	23,904	1,538,615
Mar-95	386,148	248,194	1,513,820	483,401	368,303	113,040	13,218	60,510	15,708	73,308	4,333	24,299	103,475	110,805	96,950	383,394	263,528	69,885	101,178	149,780	21,819	232,726	4,837,823
Apr-95	579,691	306,205	1,417,636	595,260	711,903	218,498	25,549	116,962	30,362	141,698	8,375	46,967	200,010	214,178	187,397	741,073	509,380	135,083	195,570	289,513	42,175	449,843	7,163,330
May-95	609,877	341,871	2,470,993	628,121	768,279	235,801	27,573	126,225	32,766	152,919	9,038	50,687	215,849	231,138	202,237	799,759	549,718	145,780	211,058	312,440	45,515	485,466	8,653,109
Jun-95	249,174	174,006	1,315,351	364,836	220,783	67,763	7,924	36,274	9,416	43,945	2,597	14,566	62,029	66,423	58,117	229,829	157,974	41,893	60,652	89,787	13,080	139,510	3,425,930
Jul-95	228,396	108,693	1,096,784	260,980	149,438	45,866	5,363	24,552	6,373	29,744	1,758	9,859	41,985	44,959	39,337	155,561	106,926	28,356	41,053	60,773	8,853	94,428	2,590,035
Aug-95	192,570	157,588	1,268,515	386,408	152,277	46,737	5,465	25,018	6,494	30,309	1,791	10,046	42,782	45,813	40,084	158,516	108,957	28,894	41,833	61,927	9,021	96,222	2,917,269
Sep-95	185,214	105,477	1,100,911	263,550	213,888	65,647	7,676	35,141	9,122	42,573	2,516	14,111	60,092	64,349	56,302	222,652	153,041	40,585	58,758	86,983	12,671	135,153	2,936,413
Oct-95	443,124	639,249	1,956,158	493,391	547,643	168,083	19,654	89,975	23,356	109,004	6,443	36,130	153,861	164,760	144,158	570,083	391,849	103,915	150,446	222,713	32,444	346,049	6,812,489
Nov-95	373,629	563,628	1,686,448	461,909	431,537	132,448	15,487	70,899	18,405	85,894	5,077	28,470	121,241	129,829	113,595	449,219	308,773	81,884	118,550	175,495	25,566	272,683	5,670,664
Dec-95	201,766	352,399	1,299,200	281,173	143,243	43,964	5,141	23,534	6,109	28,511	1,685	9,450	40,244	43,095	37,706	149,113	102,493	27,180	39,351	58,253	8,486	90,514	2,992,614

APPENDIX B. DESCRIPTION OF APPROACH USED TO ESTIMATE PCB LOADS

APPENDIX B: CALCULATING HISTORICAL WATER COLUMN PCB CONCENTRATIONS.

Step 1. ***Obtain an atmospheric deposition rate for 1989-1991 from Hoff et al., 1996.***

- A value of 1.903 ug/(m^2*yr) was based on data collected between 1989 and 1991. This value was assigned to 1989 because it was possible to combine it with 1988-1990 Green Bay Mass Balance Study water column data to estimate apparent delivery ratios, as described in Step 5 below.

- Assume atmospheric PCB deposition rates are the same throughout the watershed.

Step 2. ***Estimation of atmospheric deposition rates: 1981-1995.***

- Assume rate of decline of water column PCB loads is the same as the rate of decline in atmospheric PCB deposition rates.

- Calculate the exponential rate of decline in PCB loads in rivers in the study area between 1981 and 1995. Use estimated 1981 and 1989 loads for this purpose.

    - Calculate 1981 PCB load using 1980-83 Marti and Armstrong data.

        a) Calculate average annual flow for Menominee, Peshtigo, Oconto, and Escanaba Rivers over 1980-1983 time period.

        b) Calculate average annual PCB concentrations for same rivers for same time period.

        c) Use the flow and concentration data to calculate an average annual PCB load for each of the four rivers for the 1980-1983 time period.

        d) Average the PCB loads for the four rivers. Assume this load is representative of December 1981, the midpoint of the 1980-1983 time period.

    - Calculate 1989 PCB loads using 1988-1990 data from the Green Bay Mass Balance Study.

        a) Repeat the method used to calculate December 1981 PCB load, but use data for time period between 1988 and 1990 for the Menominee, Peshtigo, Oconto, and Escanaba Rivers.

        b) Assume the average 1988-1990 PCB loads for the four rivers is representative of September 1989 PCB loads.

- Calculate the exponential rate of decline in PCB load over the 7.75 year period between December 1981 and September 1989. Exponential rate of decline is calculated using the following formula:

$$\text{Rate of decline} = 1 - \left[\frac{\text{Avg. Sept. 1989 PCB load}}{\text{Avg. Dec. 1981 PCB load}}\right]^{(1/7.75)}$$

The rate of decline in water column loads, and therefore atmospheric deposition rates, equals 16 % .

- Scale the exponentially declining curve for the 1981 – 1995 period such that it passes through the atmospheric deposition rate of 1.903 ug/m^2*yr in 1989.

- Use the scaled curve to identify the predicted atmospheric deposition rate in 1981. 7.31 ug/m^2*yr is the resulting estimate of the 1981 atmospheric deposition rate.

Step 3. ***Estimation of annual atmospheric PCB deposition rates: 1954-1981.***

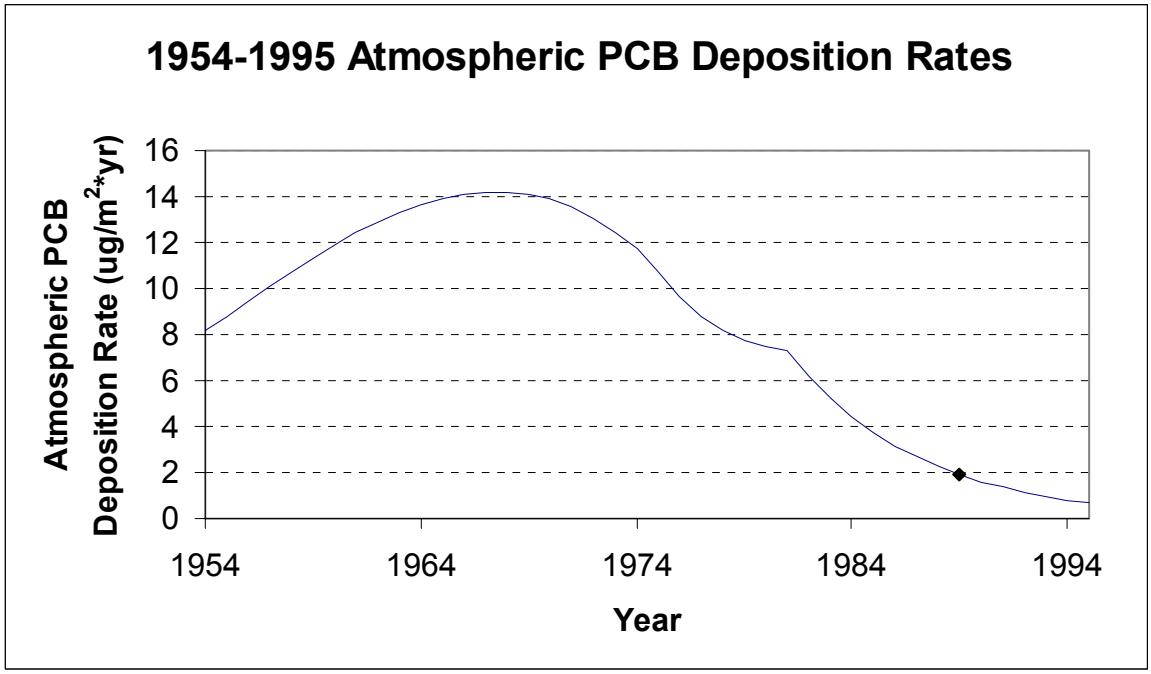
- Use atmospheric PCB deposition data obtained from peat cores (Rapaport and Eisenreich, 1988) to estimate PCB deposition between 1954-1981. Use the equation for the dimensionless percentage distribution of PCBs in peat cores, making two adjustments.

  - The Rapaport and Eisenreich, 1988 paper shows the PCB deposition declining to zero in 1981. Alter the values for 1980-1982 to approximate the data shown in Figure 2 of the Rapaport and Eisenreich (1988) paper.

  - Scale this curve so that it passes through 7.31 ug/m^2*yr in 1981. This is the same value calculated for 1981 in step 2 above. In this way, the two curves (1954 through 1981 and 1981 through 1995) will be continuous.

This produces a single curve which estimates annual atmospheric PCB deposition rates for each year from 1954 to 1995 (Figure 1). This curve passes through the 1989 value of 1.903.

Figure 1. Curve estimating 1954-1995 atmospheric PCB deposition rates



STEP 4. ***CONVERSION OF RATES TO LOADS***

- Calculate annual PCB load deposited to each watershed by multiplying the area of each subwatershed (square meters) by the atmospheric deposition rate (ug/m^2*yr).

STEP 5. ***ESTIMATION OF APPARENT DELIVERY RATIOS***

- Assume delivery ratios remain constant over time.

- For each of the four subwatersheds with measured flow and concentration data (Menominee, Peshtigo, Oconto, and Escanaba), calculate the average PCB load over the September 1988 – October 1990 period. Divide this observed PCB load (measured concentration * measured flow) by the predicted PCB load (atmospheric deposition rate * subwatershed area) deposited on the watershed for the same period. This produces an apparent delivery ratio for each of these four subwatersheds.

- Estimate the apparent delivery ratios for all other subwatersheds as the average of the apparent delivery ratios estimated for the three smaller subwatersheds (Peshtigo, Oconto and Escanaba). Average apparent delivery ratio = 0.58.

STEP 6. ***ESTIMATION OF LOADINGS TO GREEN BAY***

- Annual subwatershed load (ug/yr) = subwatershed area (m^2) * year-specific annual PCB deposition rate (ug/m^2*yr) * subwatershed-specific apparent delivery ratio

- Total load for year *X* from study area equals sum of subwatershed PCB loads for year *X*.

APPENDIX C. ESTIMATED PCB LOADS

Estimated Total PCB Loads to Green Bay from Tributaries, 1954-1955

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Total load, kg																							
	643.02	819.38	177.83	826.68	81.27	9.50	43.51	11.29	52.71	3.12	17.47	74.40	79.67	69.70	275.65	189.47	50.25	264.80	72.74	107.69	15.69	167.32	4,053.15
Annual load, kg																							
1954	14.83	18.89	4.10	19.06	1.87	0.22	1.00	0.26	1.22	0.07	0.40	1.72	1.84	1.61	6.36	4.37	1.16	6.11	1.68	2.48	0.36	3.86	93.46
1955	16.03	20.42	4.43	20.60	2.03	0.24	1.08	0.28	1.31	0.08	0.44	1.85	1.99	1.74	6.87	4.72	1.25	6.60	1.81	2.68	0.39	4.17	101.01
1956	17.21	21.93	4.76	22.13	2.18	0.25	1.16	0.30	1.41	0.08	0.47	1.99	2.13	1.87	7.38	5.07	1.35	7.09	1.95	2.88	0.42	4.48	108.50
1957	18.38	23.42	5.08	23.62	2.32	0.27	1.24	0.32	1.51	0.09	0.50	2.13	2.28	1.99	7.88	5.41	1.44	7.57	2.08	3.08	0.45	4.78	115.83
1958	19.50	24.85	5.39	25.07	2.47	0.29	1.32	0.34	1.60	0.09	0.53	2.26	2.42	2.11	8.36	5.75	1.52	8.03	2.21	3.27	0.48	5.07	122.93
1959	20.58	26.23	5.69	26.46	2.60	0.30	1.39	0.36	1.69	0.10	0.56	2.38	2.55	2.23	8.82	6.06	1.61	8.48	2.33	3.45	0.50	5.36	129.73
1960	21.60	27.52	5.97	27.76	2.73	0.32	1.46	0.38	1.77	0.10	0.59	2.50	2.68	2.34	9.26	6.36	1.69	8.89	2.44	3.62	0.53	5.62	136.12
1961	22.54	28.72	6.23	28.97	2.85	0.33	1.52	0.40	1.85	0.11	0.61	2.61	2.79	2.44	9.66	6.64	1.76	9.28	2.55	3.77	0.55	5.86	142.04
1962	23.38	29.80	6.47	30.06	2.96	0.35	1.58	0.41	1.92	0.11	0.64	2.71	2.90	2.53	10.02	6.89	1.83	9.63	2.65	3.92	0.57	6.09	147.40
1963	24.13	30.75	6.67	31.02	3.05	0.36	1.63	0.42	1.98	0.12	0.66	2.79	2.99	2.62	10.34	7.11	1.89	9.94	2.73	4.04	0.59	6.28	152.11
1964	24.76	31.55	6.85	31.83	3.13	0.37	1.68	0.43	2.03	0.12	0.67	2.86	3.07	2.68	10.61	7.30	1.93	10.20	2.80	4.15	0.60	6.44	156.07
1965	25.26	32.18	6.98	32.47	3.19	0.37	1.71	0.44	2.07	0.12	0.69	2.92	3.13	2.74	10.83	7.44	1.97	10.40	2.86	4.23	0.62	6.57	159.20
1966	25.61	32.63	7.08	32.92	3.24	0.38	1.73	0.45	2.10	0.12	0.70	2.96	3.17	2.78	10.98	7.55	2.00	10.55	2.90	4.29	0.62	6.66	161.41
1967	25.80	32.87	7.13	33.16	3.26	0.38	1.75	0.45	2.11	0.12	0.70	2.98	3.20	2.80	11.06	7.60	2.02	10.62	2.92	4.32	0.63	6.71	162.59
1968	25.81	32.88	7.14	33.18	3.26	0.38	1.75	0.45	2.12	0.13	0.70	2.99	3.20	2.80	11.06	7.60	2.02	10.63	2.92	4.32	0.63	6.72	162.66
1969	25.62	32.65	7.09	32.94	3.24	0.38	1.73	0.45	2.10	0.12	0.70	2.96	3.17	2.78	10.98	7.55	2.00	10.55	2.90	4.29	0.63	6.67	161.52
1970	25.23	32.16	6.98	32.44	3.19	0.37	1.71	0.44	2.07	0.12	0.69	2.92	3.13	2.74	10.82	7.44	1.97	10.39	2.85	4.23	0.62	6.57	159.06
1971	24.62	31.37	6.81	31.65	3.11	0.36	1.67	0.43	2.02	0.12	0.67	2.85	3.05	2.67	10.55	7.25	1.92	10.14	2.79	4.12	0.60	6.41	155.19
1972	23.76	30.28	6.57	30.55	3.00	0.35	1.61	0.42	1.95	0.12	0.65	2.75	2.94	2.58	10.19	7.00	1.86	9.79	2.69	3.98	0.58	6.18	149.79
1973	22.65	28.86	6.26	29.12	2.86	0.33	1.53	0.40	1.86	0.11	0.62	2.62	2.81	2.46	9.71	6.67	1.77	9.33	2.56	3.79	0.55	5.89	142.77
1974	21.26	27.09	5.88	27.34	2.69	0.31	1.44	0.37	1.74	0.10	0.58	2.46	2.63	2.30	9.11	6.27	1.66	8.76	2.41	3.56	0.52	5.53	134.02
1975	19.58	24.95	5.42	25.18	2.48	0.29	1.32	0.34	1.61	0.09	0.53	2.27	2.43	2.12	8.39	5.77	1.53	8.06	2.22	3.28	0.48	5.10	123.43
1976	17.59	22.42	4.87	22.62	2.22	0.26	1.19	0.31	1.44	0.09	0.48	2.04	2.18	1.91	7.54	5.18	1.37	7.24	1.99	2.95	0.43	4.58	110.89
1977	15.94	20.31	4.41	20.49	2.01	0.24	1.08	0.28	1.31	0.08	0.43	1.84	1.97	1.73	6.83	4.70	1.25	6.56	1.80	2.67	0.39	4.15	100.47
1978	14.80	18.86	4.09	19.03	1.87	0.22	1.00	0.26	1.21	0.07	0.40	1.71	1.83	1.60	6.35	4.36	1.16	6.10	1.67	2.48	0.36	3.85	93.30
1979	14.04	17.89	3.88	18.05	1.77	0.21	0.95	0.25	1.15	0.07	0.38	1.62	1.74	1.52	6.02	4.14	1.10	5.78	1.59	2.35	0.34	3.65	88.51
1980	13.66	17.41	3.78	17.57	1.73	0.20	0.92	0.24	1.12	0.07	0.37	1.58	1.69	1.48	5.86	4.03	1.07	5.63	1.55	2.29	0.33	3.56	86.12
1981	13.28	16.93	3.67	17.08	1.68	0.20	0.90	0.23	1.09	0.06	0.36	1.54	1.65	1.44	5.69	3.91	1.04	5.47	1.50	2.22	0.32	3.46	83.73
1982	11.22	14.30	3.10	14.43	1.42	0.17	0.76	0.20	0.92	0.05	0.30	1.30	1.39	1.22	4.81	3.31	0.88	4.62	1.27	1.88	0.27	2.92	70.75
1983	9.48	12.09	2.62	12.19	1.20	0.14	0.64	0.17	0.78	0.05	0.26	1.10	1.18	1.03	4.07	2.79	0.74	3.91	1.07	1.59	0.23	2.47	59.78
1984	8.01	10.21	2.22	10.30	1.01	0.12	0.54	0.14	0.66	0.04	0.22	0.93	0.99	0.87	3.44	2.36	0.63	3.30	0.91	1.34	0.20	2.09	50.52
1985	6.77	8.63	1.87	8.71	0.86	0.10	0.46	0.12	0.56	0.03	0.18	0.78	0.84	0.73	2.90	2.00	0.53	2.79	0.77	1.13	0.17	1.76	42.69
1986	5.72	7.29	1.58	7.36	0.72	0.08	0.39	0.10	0.47	0.03	0.16	0.66	0.71	0.62	2.45	1.69	0.45	2.36	0.65	0.96	0.14	1.49	36.07
1987	4.84	6.16	1.34	6.22	0.61	0.07	0.33	0.08	0.40	0.02	0.13	0.56	0.60	0.52	2.07	1.42	0.38	1.99	0.55	0.81	0.12	1.26	30.48
1988	4.09	5.21	1.13	5.25	0.52	0.06	0.28	0.07	0.33	0.02	0.11	0.47	0.51	0.44	1.75	1.20	0.32	1.68	0.46	0.68	0.10	1.06	25.76
1989	3.45	4.40	0.95	4.44	0.44	0.05	0.23	0.06	0.28	0.02	0.09	0.40	0.43	0.37	1.48	1.02	0.27	1.42	0.39	0.58	0.08	0.90	21.76
1990	2.92	3.72	0.81	3.75	0.37	0.04	0.20	0.05	0.24	0.01	0.08	0.34	0.36	0.32	1.25	0.86	0.23	1.20	0.33	0.49	0.07	0.76	18.39
1991	2.47	3.14	0.68	3.17	0.31	0.04	0.17	0.04	0.20	0.01	0.07	0.29	0.31	0.27	1.06	0.73	0.19	1.02	0.28	0.41	0.06	0.64	15.54
1992	2.08	2.65	0.58	2.68	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.89	0.61	0.16	0.86	0.24	0.35	0.05	0.54	13.13
1993	1.76	2.24	0.49	2.26	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.46	11.10
1994	1.49	1.90	0.41	1.91	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	9.38
1995	1.26	1.60	0.35	1.62	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	7.92

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-54	0.49	0.72	0.19	0.85	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	5.36
Feb-54	0.42	0.72	0.20	0.89	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.49	0.34	0.09	0.47	0.13	0.19	0.03	0.30	5.04
Mar-54	0.52	1.32	0.23	1.40	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.58
Apr-54	3.89	3.07	0.67	2.47	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	13.10
May-54	2.53	2.76	0.66	2.55	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	11.60
Jun-54	1.39	2.56	0.49	2.43	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	9.88
Jul-54	0.61	1.13	0.26	1.47	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.57
Aug-54	0.62	0.76	0.21	0.89	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	5.59
Sep-54	1.22	1.47	0.28	1.36	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	7.34
Oct-54	1.63	1.98	0.41	2.14	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	9.26
Nov-54	0.92	1.37	0.27	1.50	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	7.06
Dec-54	0.59	1.03	0.23	1.10	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.07
Jan-55	0.67	1.18	0.31	1.23	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.75
Feb-55	0.50	1.08	0.25	1.02	0.16	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.53	0.36	0.10	0.51	0.14	0.21	0.03	0.32	5.89
Mar-55	0.63	2.01	0.33	2.17	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	8.50
Apr-55	6.60	5.79	1.08	5.30	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	22.03
May-55	2.09	1.96	0.50	2.23	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	10.13
Jun-55	1.36	2.08	0.45	1.98	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	9.12
Jul-55	0.63	0.89	0.24	1.03	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.14
Aug-55	0.75	1.21	0.27	1.02	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.61
Sep-55	0.45	0.75	0.17	0.85	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	5.47
Oct-55	0.82	1.16	0.28	1.15	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.77
Nov-55	0.83	1.26	0.29	1.40	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	7.04
Dec-55	0.69	1.05	0.28	1.21	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.58
Jan-56	0.68	1.05	0.34	1.16	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	6.82
Feb-56	0.57	1.09	0.29	1.02	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.34
Mar-56	0.63	1.86	0.28	1.23	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	7.60
Apr-56	4.58	3.82	0.60	4.23	0.18	0.02	0.10	0.02	0.12	0.01	0.04	0.16	0.17	0.15	0.60	0.42	0.11	0.58	0.16	0.24	0.03	0.37	16.72
May-56	3.31	2.14	0.55	2.72	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	12.32
Jun-56	1.27	2.14	0.47	2.20	0.18	0.02	0.10	0.02	0.12	0.01	0.04	0.16	0.17	0.15	0.60	0.42	0.11	0.58	0.16	0.24	0.03	0.37	9.56
Jul-56	2.29	2.64	0.65	2.76	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	11.94
Aug-56	1.01	2.16	0.43	1.75	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	8.94
Sep-56	0.86	1.39	0.33	1.24	0.18	0.02	0.10	0.02	0.12	0.01	0.04	0.16	0.17	0.15	0.60	0.42	0.11	0.58	0.16	0.24	0.03	0.37	7.29
Oct-56	0.55	1.03	0.26	1.16	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	6.60
Nov-56	0.73	1.37	0.27	1.41	0.18	0.02	0.10	0.02	0.12	0.01	0.04	0.16	0.17	0.15	0.60	0.42	0.11	0.58	0.16	0.24	0.03	0.37	7.25
Dec-56	0.75	1.24	0.28	1.25	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.43	0.11	0.60	0.16	0.24	0.04	0.38	7.11
Jan-57	0.65	1.03	0.35	1.02	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	6.90
Feb-57	0.52	0.84	0.29	0.98	0.18	0.02	0.10	0.02	0.12	0.01	0.04	0.16	0.17	0.15	0.60	0.42	0.11	0.58	0.16	0.24	0.03	0.37	6.10
Mar-57	1.02	2.41	0.48	1.75	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	9.50
Apr-57	5.13	4.41	0.85	3.62	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.65	0.45	0.12	0.62	0.17	0.25	0.04	0.39	17.73
May-57	2.44	3.21	0.60	2.99	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	13.08
Jun-57	1.26	1.97	0.46	1.79	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.65	0.45	0.12	0.62	0.17	0.25	0.04	0.39	9.20
Jul-57	0.74	1.09	0.29	1.42	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	7.39
Aug-57	0.52	0.89	0.25	1.34	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	6.85
Sep-57	1.57	1.63	0.34	2.05	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.65	0.45	0.12	0.62	0.17	0.25	0.04	0.39	9.32
Oct-57	1.03	1.30	0.36	1.71	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	8.25
Nov-57	2.28	2.90	0.44	2.92	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.65	0.45	0.12	0.62	0.17	0.25	0.04	0.39	12.26
Dec-57	1.22	1.76	0.39	2.03	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.19	0.17	0.67	0.46	0.12	0.64	0.18	0.26	0.04	0.41	9.25

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-58	0.91	1.25	0.39	1.45	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	8.09
Feb-58	0.72	1.00	0.34	1.17	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.64	0.44	0.12	0.62	0.17	0.25	0.04	0.39	6.92
Mar-58	0.91	2.26	0.42	1.81	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	9.49
Apr-58	5.26	4.35	0.73	4.56	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	18.86
May-58	2.11	2.67	0.42	2.83	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	12.11
Jun-58	1.71	1.68	0.43	1.86	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	9.65
Jul-58	2.78	2.96	0.89	2.83	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	13.54
Aug-58	0.71	1.16	0.32	1.50	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	7.78
Sep-58	1.22	2.10	0.38	1.90	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	9.55
Oct-58	0.85	1.89	0.29	1.87	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	8.99
Nov-58	1.60	2.13	0.45	2.04	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	10.18
Dec-58	0.72	1.41	0.33	1.25	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	7.79
Jan-59	0.42	0.92	0.26	1.02	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	6.93
Feb-59	0.35	0.86	0.23	0.92	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.18	0.20	0.17	0.68	0.47	0.12	0.65	0.18	0.26	0.04	0.41	6.25
Mar-59	0.52	1.80	0.33	1.60	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	8.55
Apr-59	4.19	3.34	0.59	4.50	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.20	0.21	0.18	0.73	0.50	0.13	0.70	0.19	0.28	0.04	0.44	16.79
May-59	2.55	2.85	0.57	3.84	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	14.12
Jun-59	0.93	1.27	0.32	1.73	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.20	0.21	0.18	0.73	0.50	0.13	0.70	0.19	0.28	0.04	0.44	8.42
Jul-59	0.99	1.17	0.28	1.29	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	8.04
Aug-59	1.59	2.21	0.46	1.41	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	9.98
Sep-59	2.17	3.87	0.77	2.24	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.20	0.21	0.18	0.73	0.50	0.13	0.70	0.19	0.28	0.04	0.44	13.21
Oct-59	3.38	3.31	0.85	3.20	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	15.05
Nov-59	2.23	2.48	0.60	2.66	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.20	0.21	0.18	0.73	0.50	0.13	0.70	0.19	0.28	0.04	0.44	12.15
Dec-59	1.28	2.14	0.45	2.05	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.52	0.14	0.72	0.20	0.29	0.04	0.45	10.23
Jan-60	0.71	1.94	0.35	1.75	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	9.26
Feb-60	0.55	1.07	0.29	1.07	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.21	0.19	0.73	0.50	0.13	0.70	0.19	0.29	0.04	0.45	7.19
Mar-60	0.51	1.25	0.28	1.08	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	7.63
Apr-60	5.06	4.44	1.02	4.14	0.22	0.03	0.12	0.03	0.15	0.01	0.05	0.20	0.22	0.19	0.76	0.52	0.14	0.73	0.20	0.30	0.04	0.46	19.03
May-60	5.71	7.37	1.53	6.30	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	25.42
Jun-60	1.74	2.34	0.54	2.40	0.22	0.03	0.12	0.03	0.15	0.01	0.05	0.20	0.22	0.19	0.76	0.52	0.14	0.73	0.20	0.30	0.04	0.46	11.38
Jul-60	1.28	1.54	0.38	1.87	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	9.59
Aug-60	1.02	1.65	0.30	2.14	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	9.62
Sep-60	1.63	1.52	0.32	1.72	0.22	0.03	0.12	0.03	0.15	0.01	0.05	0.20	0.22	0.19	0.76	0.52	0.14	0.73	0.20	0.30	0.04	0.46	9.56
Oct-60	0.75	1.16	0.26	1.57	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	8.25
Nov-60	1.74	2.12	0.42	2.44	0.22	0.03	0.12	0.03	0.15	0.01	0.05	0.20	0.22	0.19	0.76	0.52	0.14	0.73	0.20	0.30	0.04	0.46	11.08
Dec-60	0.88	1.13	0.30	1.29	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.78	0.54	0.14	0.75	0.21	0.31	0.04	0.48	8.12
Jan-61	0.84	1.27	0.37	1.41	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	8.61
Feb-61	0.70	1.24	0.31	1.37	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.21	0.19	0.74	0.51	0.14	0.71	0.20	0.29	0.04	0.45	7.89
Mar-61	1.22	3.42	0.54	3.43	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	13.33
Apr-61	6.27	4.97	0.95	4.37	0.23	0.03	0.13	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.79	0.55	0.14	0.76	0.21	0.31	0.05	0.48	21.13
May-61	4.83	3.76	1.23	3.98	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	18.53
Jun-61	1.63	2.26	0.54	2.34	0.23	0.03	0.13	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.79	0.55	0.14	0.76	0.21	0.31	0.05	0.48	11.33
Jul-61	1.08	1.92	0.39	1.82	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	9.93
Aug-61	0.85	1.80	0.37	1.80	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	9.54
Sep-61	0.80	1.62	0.32	1.58	0.23	0.03	0.13	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.79	0.55	0.14	0.76	0.21	0.31	0.05	0.48	8.90
Oct-61	1.40	2.17	0.37	2.14	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	10.80
Nov-61	1.57	2.57	0.43	2.77	0.23	0.03	0.13	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.79	0.55	0.14	0.76	0.21	0.31	0.05	0.48	11.90
Dec-61	1.35	1.72	0.41	1.95	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.56	0.15	0.79	0.22	0.32	0.05	0.50	10.15

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-62	0.88	1.38	0.40	1.51	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	9.07
Feb-62	0.63	1.19	0.35	1.21	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.19	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	7.80
Mar-62	1.13	2.55	0.52	2.14	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	11.24
Apr-62	6.87	5.96	1.06	5.86	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	24.49
May-62	4.68	4.74	1.04	4.59	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	19.95
Jun-62	2.09	2.72	0.66	3.24	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	13.45
Jul-62	0.76	1.92	0.39	1.99	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	9.96
Aug-62	0.84	1.81	0.37	1.62	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	9.54
Sep-62	1.64	2.55	0.48	2.29	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	11.70
Oct-62	1.35	2.00	0.46	2.22	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	10.92
Nov-62	1.40	1.54	0.37	1.76	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	9.81
Dec-62	1.12	1.45	0.37	1.63	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.59	0.16	0.82	0.22	0.33	0.05	0.52	9.46
Jan-63	1.15	1.82	0.49	2.19	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	10.71
Feb-63	0.77	1.26	0.40	1.82	0.23	0.03	0.13	0.03	0.15	0.01	0.05	0.21	0.23	0.20	0.79	0.55	0.14	0.76	0.21	0.31	0.05	0.48	8.81
Mar-63	1.16	3.75	0.54	2.91	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	13.42
Apr-63	5.89	4.36	0.79	4.81	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.58	0.15	0.82	0.22	0.33	0.05	0.52	20.74
May-63	4.95	5.68	1.08	4.76	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	21.53
Jun-63	3.58	3.26	0.98	2.85	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.58	0.15	0.82	0.22	0.33	0.05	0.52	15.57
Jul-63	1.24	1.45	0.47	1.66	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	9.87
Aug-63	0.85	1.61	0.43	1.63	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	9.58
Sep-63	0.91	2.06	0.38	2.22	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.58	0.15	0.82	0.22	0.33	0.05	0.52	10.47
Oct-63	0.86	1.82	0.37	2.08	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	10.19
Nov-63	1.57	2.09	0.36	2.21	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.22	0.85	0.58	0.15	0.82	0.22	0.33	0.05	0.52	11.12
Dec-63	1.19	1.60	0.39	1.87	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	10.09
Jan-64	0.59	1.53	0.37	1.56	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	9.22
Feb-64	0.59	1.20	0.32	1.38	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.58	0.15	0.81	0.22	0.33	0.05	0.51	8.32
Mar-64	0.71	1.79	0.41	1.66	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	9.74
Apr-64	4.97	3.99	0.64	3.48	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.23	0.25	0.22	0.87	0.60	0.16	0.84	0.23	0.34	0.05	0.53	18.09
May-64	5.55	8.00	1.35	7.20	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	27.27
Jun-64	1.60	2.25	0.55	2.38	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.23	0.25	0.22	0.87	0.60	0.16	0.84	0.23	0.34	0.05	0.53	11.78
Jul-64	1.41	1.48	0.41	1.73	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	10.20
Aug-64	1.79	1.94	0.53	2.04	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	11.49
Sep-64	2.12	2.71	0.61	3.22	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.23	0.25	0.22	0.87	0.60	0.16	0.84	0.23	0.34	0.05	0.53	13.67
Oct-64	1.81	2.26	0.51	2.57	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	12.33
Nov-64	2.37	2.83	0.62	2.74	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.23	0.25	0.22	0.87	0.60	0.16	0.84	0.23	0.34	0.05	0.53	13.57
Dec-64	1.25	1.56	0.54	1.86	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.55	10.39
Jan-65	0.78	0.90	0.34	1.08	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	8.40
Feb-65	0.57	0.81	0.27	0.96	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.83	0.57	0.15	0.80	0.22	0.32	0.05	0.50	7.38
Mar-65	0.65	1.33	0.34	1.37	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	8.99
Apr-65	5.50	6.46	1.05	6.25	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	24.38
May-65	7.42	7.13	2.04	6.44	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	28.32
Jun-65	1.48	2.72	0.61	2.89	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	12.82
Jul-65	0.57	1.26	0.32	1.31	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	8.75
Aug-65	0.74	1.01	0.28	1.16	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	8.48
Sep-65	1.52	2.46	0.33	2.56	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	11.99
Oct-65	1.58	2.64	0.39	2.70	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	12.61
Nov-65	2.15	2.46	0.48	2.40	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	12.61
Dec-65	2.28	3.00	0.54	3.36	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	14.47

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-66	1.38	1.97	0.55	2.38	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	11.64
Feb-66	0.95	2.37	0.40	2.68	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.58	0.15	0.81	0.22	0.33	0.05	0.51	11.24
Mar-66	3.27	5.28	0.98	4.43	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	19.33
Apr-66	6.33	5.63	1.10	4.87	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	23.13
May-66	3.56	3.80	0.87	3.70	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	17.31
Jun-66	3.68	3.88	0.79	4.07	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	17.61
Jul-66	0.63	1.63	0.31	2.22	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	10.15
Aug-66	1.05	1.99	0.45	1.80	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	10.65
Sep-66	0.59	1.24	0.31	1.34	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	8.67
Oct-66	1.35	1.72	0.47	1.76	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	10.67
Nov-66	1.30	1.66	0.43	1.82	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	10.40
Dec-66	1.52	1.45	0.42	1.86	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	10.61
Jan-67	1.20	1.13	0.38	1.50	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	9.61
Feb-67	0.82	0.99	0.38	1.28	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.25	0.21	0.85	0.58	0.15	0.81	0.22	0.33	0.05	0.51	8.35
Mar-67	1.18	2.64	0.47	2.31	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	12.00
Apr-67	9.11	9.55	1.68	8.55	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.25	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.36	0.05	0.55	34.12
May-67	3.24	3.16	0.79	3.19	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	15.79
Jun-67	2.54	3.52	0.76	3.59	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.25	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.36	0.05	0.55	15.64
Jul-67	1.69	2.86	0.54	3.05	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	13.54
Aug-67	0.90	1.70	0.40	1.85	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	10.25
Sep-67	0.60	1.49	0.31	1.64	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.25	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.36	0.05	0.55	9.28
Oct-67	1.84	2.40	0.49	2.20	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	12.34
Nov-67	1.79	2.26	0.56	2.29	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.25	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.36	0.05	0.55	12.13
Dec-67	0.88	1.16	0.37	1.73	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.65	0.17	0.90	0.25	0.37	0.05	0.57	9.54
Jan-68	0.48	1.12	0.31	1.52	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	8.82
Feb-68	0.43	0.96	0.33	1.42	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.25	0.22	0.88	0.60	0.16	0.84	0.23	0.34	0.05	0.53	8.19
Mar-68	1.70	2.00	0.43	2.31	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	11.83
Apr-68	4.03	5.12	0.71	4.66	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.35	0.05	0.55	19.74
May-68	2.67	4.07	0.63	4.52	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	17.28
Jun-68	4.44	4.97	0.97	4.66	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.35	0.05	0.55	20.26
Jul-68	2.75	3.29	0.85	3.33	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	15.62
Aug-68	1.20	1.87	0.47	1.79	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	10.72
Sep-68	3.06	3.49	0.90	2.86	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.35	0.05	0.55	15.53
Oct-68	1.75	2.13	0.57	1.98	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	11.82
Nov-68	1.66	1.97	0.49	1.98	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.91	0.62	0.17	0.87	0.24	0.35	0.05	0.55	11.32
Dec-68	1.63	1.89	0.47	2.15	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.94	0.64	0.17	0.90	0.25	0.37	0.05	0.57	11.53
Jan-69	1.80	2.21	0.58	2.02	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	11.97
Feb-69	1.43	2.23	0.52	1.89	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.58	0.15	0.81	0.22	0.33	0.05	0.51	10.92
Mar-69	1.44	3.04	0.53	2.82	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	13.21
Apr-69	8.76	5.84	1.33	5.63	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	26.75
May-69	4.11	3.62	1.05	3.61	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	17.77
Jun-69	2.44	4.18	0.73	3.41	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	15.96
Jul-69	1.45	3.30	0.53	3.83	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	14.49
Aug-69	0.65	1.66	0.32	1.60	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	9.60
Sep-69	0.60	1.26	0.24	1.35	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	8.65
Oct-69	1.27	2.12	0.42	2.08	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	11.26
Nov-69	1.01	1.77	0.43	2.44	0.27	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.87	0.24	0.35	0.05	0.55	10.85
Dec-69	0.67	1.42	0.39	2.25	0.28	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.24	0.93	0.64	0.17	0.90	0.25	0.36	0.05	0.57	10.10

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-70	0.70	1.32	0.50	1.76	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	9.56
Feb-70	0.57	1.19	0.36	1.50	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.83	0.57	0.15	0.80	0.22	0.32	0.05	0.50	8.39
Mar-70	0.75	2.20	0.45	2.58	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	11.26
Apr-70	4.79	3.99	0.74	3.68	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.22	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	18.32
May-70	3.94	5.25	0.85	4.11	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	19.44
Jun-70	3.32	4.78	1.05	3.99	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.22	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	18.26
Jul-70	1.73	1.38	0.43	1.55	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	10.37
Aug-70	0.79	1.13	0.36	1.33	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	8.90
Sep-70	1.13	1.83	0.36	1.98	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.22	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	10.40
Oct-70	1.75	2.21	0.46	2.03	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	11.74
Nov-70	3.18	4.30	0.76	4.27	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.22	0.89	0.61	0.16	0.85	0.23	0.35	0.05	0.54	17.62
Dec-70	2.59	2.57	0.66	3.67	0.27	0.03	0.15	0.04	0.18	0.01	0.06	0.25	0.27	0.23	0.92	0.63	0.17	0.88	0.24	0.36	0.05	0.56	14.79
Jan-71	1.00	1.55	0.41	1.71	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	9.83
Feb-71	0.91	1.30	0.34	1.55	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.81	0.56	0.15	0.78	0.21	0.32	0.05	0.49	8.75
Mar-71	1.55	2.74	0.51	2.13	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	12.09
Apr-71	7.66	8.19	1.58	7.01	0.26	0.03	0.14	0.04	0.17	0.01	0.05	0.23	0.25	0.22	0.87	0.60	0.16	0.83	0.23	0.34	0.05	0.53	29.43
May-71	3.19	4.27	0.89	3.99	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	17.49
Jun-71	2.11	2.29	0.55	2.83	0.26	0.03	0.14	0.04	0.17	0.01	0.05	0.23	0.25	0.22	0.87	0.60	0.16	0.83	0.23	0.34	0.05	0.53	12.76
Jul-71	1.30	1.65	0.41	1.89	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	10.41
Aug-71	0.66	1.54	0.29	1.81	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	9.47
Sep-71	0.62	1.25	0.27	1.46	0.26	0.03	0.14	0.04	0.17	0.01	0.05	0.23	0.25	0.22	0.87	0.60	0.16	0.83	0.23	0.34	0.05	0.53	8.59
Oct-71	2.18	2.38	0.57	2.36	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	12.65
Nov-71	1.79	2.21	0.50	2.51	0.26	0.03	0.14	0.04	0.17	0.01	0.05	0.23	0.25	0.22	0.87	0.60	0.16	0.83	0.23	0.34	0.05	0.53	12.01
Dec-71	1.63	2.01	0.50	2.40	0.26	0.03	0.14	0.04	0.17	0.01	0.06	0.24	0.26	0.23	0.90	0.62	0.16	0.86	0.24	0.35	0.05	0.54	11.70
Jan-72	0.91	1.31	0.32	1.19	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	8.70
Feb-72	0.66	0.99	0.27	1.24	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.81	0.55	0.15	0.78	0.21	0.32	0.05	0.49	7.80
Mar-72	0.85	1.56	0.34	2.26	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	9.97
Apr-72	3.90	7.05	1.06	6.49	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.57	0.15	0.80	0.22	0.33	0.05	0.51	23.31
May-72	6.87	5.20	1.22	4.46	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	22.71
Jun-72	1.37	1.51	0.43	1.72	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.57	0.15	0.80	0.22	0.33	0.05	0.51	9.83
Jul-72	1.06	1.46	0.35	1.55	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	9.38
Aug-72	1.33	2.48	0.53	2.58	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	11.88
Sep-72	1.49	1.93	0.45	2.02	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.57	0.15	0.80	0.22	0.33	0.05	0.51	10.70
Oct-72	2.24	2.90	0.64	2.59	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	13.33
Nov-72	2.18	2.46	0.59	2.55	0.25	0.03	0.13	0.03	0.16	0.01	0.05	0.23	0.24	0.21	0.84	0.57	0.15	0.80	0.22	0.33	0.05	0.51	12.58
Dec-72	0.91	1.42	0.38	1.91	0.25	0.03	0.14	0.04	0.16	0.01	0.05	0.23	0.25	0.22	0.86	0.59	0.16	0.83	0.23	0.34	0.05	0.52	9.58
Jan-73	0.87	1.26	0.36	1.68	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	8.91
Feb-73	0.66	0.85	0.28	1.19	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.74	0.51	0.14	0.72	0.20	0.29	0.04	0.45	7.27
Mar-73	3.14	5.23	1.00	4.99	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	19.10
Apr-73	4.30	4.77	1.04	3.99	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.80	0.55	0.15	0.77	0.21	0.31	0.05	0.48	18.69
May-73	5.29	5.95	1.23	5.27	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	22.48
Jun-73	1.75	2.99	0.42	3.08	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.80	0.55	0.15	0.77	0.21	0.31	0.05	0.48	12.82
Jul-73	1.18	1.11	0.30	1.52	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	8.85
Aug-73	1.17	1.32	0.34	1.42	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	8.99
Sep-73	1.23	1.25	0.29	1.32	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.80	0.55	0.15	0.77	0.21	0.31	0.05	0.48	8.69
Oct-73	0.98	1.40	0.32	1.47	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	8.91
Nov-73	1.16	1.60	0.38	1.84	0.24	0.03	0.13	0.03	0.15	0.01	0.05	0.22	0.23	0.20	0.80	0.55	0.15	0.77	0.21	0.31	0.05	0.48	9.57
Dec-73	0.94	1.13	0.31	1.36	0.24	0.03	0.13	0.03	0.16	0.01	0.05	0.22	0.24	0.21	0.82	0.57	0.15	0.79	0.22	0.32	0.05	0.50	8.48

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-74	0.76	1.22	0.41	1.40	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	8.25
Feb-74	0.63	1.01	0.38	1.34	0.21	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.18	0.70	0.48	0.13	0.67	0.18	0.27	0.04	0.42	7.39
Mar-74	1.04	2.58	0.44	2.34	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	10.85
Apr-74	4.14	4.69	0.84	4.38	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.51	0.14	0.72	0.20	0.29	0.04	0.45	18.36
May-74	3.24	2.55	0.61	2.77	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	13.63
Jun-74	2.76	2.82	0.61	2.67	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.51	0.14	0.72	0.20	0.29	0.04	0.45	13.17
Jul-74	1.29	1.37	0.38	1.48	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	8.98
Aug-74	1.32	3.09	0.47	2.32	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	11.65
Sep-74	1.19	2.42	0.41	1.63	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.51	0.14	0.72	0.20	0.29	0.04	0.45	9.96
Oct-74	1.17	1.22	0.33	1.50	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	8.67
Nov-74	2.50	2.55	0.55	2.14	0.22	0.03	0.12	0.03	0.14	0.01	0.05	0.20	0.22	0.19	0.75	0.51	0.14	0.72	0.20	0.29	0.04	0.45	12.05
Dec-74	1.24	1.60	0.44	3.36	0.23	0.03	0.12	0.03	0.15	0.01	0.05	0.21	0.22	0.20	0.77	0.53	0.14	0.74	0.20	0.30	0.04	0.47	11.09
Jan-75	0.71	1.37	0.35	1.95	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	8.48
Feb-75	0.59	1.25	0.31	1.16	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.19	0.16	0.64	0.44	0.12	0.62	0.17	0.25	0.04	0.39	7.01
Mar-75	0.84	2.22	0.35	1.65	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	9.16
Apr-75	4.59	5.81	0.93	4.69	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	19.98
May-75	4.37	3.75	1.07	3.58	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	16.87
Jun-75	2.54	2.42	0.59	2.17	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	11.70
Jul-75	0.84	1.08	0.27	1.23	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	7.52
Aug-75	0.62	0.90	0.21	1.08	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	6.91
Sep-75	1.15	1.87	0.32	2.06	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	9.36
Oct-75	0.69	1.04	0.23	1.36	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	7.43
Nov-75	1.15	1.47	0.34	1.47	0.20	0.02	0.11	0.03	0.13	0.01	0.04	0.19	0.20	0.17	0.69	0.47	0.13	0.66	0.18	0.27	0.04	0.42	8.41
Dec-75	1.49	1.78	0.45	2.79	0.21	0.02	0.11	0.03	0.14	0.01	0.05	0.19	0.21	0.18	0.71	0.49	0.13	0.68	0.19	0.28	0.04	0.43	10.61
Jan-76	0.71	1.35	0.38	1.44	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	7.55
Feb-76	0.69	1.44	0.36	1.35	0.18	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.60	0.41	0.11	0.57	0.16	0.23	0.03	0.36	7.29
Mar-76	1.53	4.22	0.50	3.81	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	13.73
Apr-76	7.53	6.40	1.42	5.94	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.42	0.11	0.59	0.16	0.24	0.04	0.38	24.85
May-76	2.97	3.39	0.76	3.19	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	13.98
Jun-76	1.44	1.41	0.41	1.49	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.42	0.11	0.59	0.16	0.24	0.04	0.38	8.31
Jul-76	0.61	0.75	0.20	1.00	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	6.24
Aug-76	0.46	0.81	0.18	0.95	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	6.07
Sep-76	0.36	0.61	0.15	0.81	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.42	0.11	0.59	0.16	0.24	0.04	0.38	5.49
Oct-76	0.44	0.72	0.16	0.90	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	5.89
Nov-76	0.41	0.65	0.16	0.90	0.18	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.62	0.42	0.11	0.59	0.16	0.24	0.04	0.38	5.68
Dec-76	0.45	0.67	0.18	0.83	0.19	0.02	0.10	0.03	0.12	0.01	0.04	0.17	0.18	0.16	0.64	0.44	0.12	0.61	0.17	0.25	0.04	0.39	5.81
Jan-77	0.39	0.93	0.18	0.85	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	5.69
Feb-77	0.32	1.00	0.18	0.81	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	5.33
Mar-77	1.50	2.81	0.42	3.35	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	11.42
Apr-77	3.75	4.42	0.70	3.91	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	16.01
May-77	0.91	1.28	0.37	1.57	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	7.48
Jun-77	0.64	0.98	0.27	1.15	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	6.27
Jul-77	0.79	0.95	0.22	1.01	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	6.31
Aug-77	0.56	0.85	0.17	0.93	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	5.85
Sep-77	1.84	1.67	0.46	1.29	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	8.50
Oct-77	1.75	1.64	0.52	1.52	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	8.77
Nov-77	2.27	2.09	0.43	2.19	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.15	0.16	0.14	0.56	0.39	0.10	0.54	0.15	0.22	0.03	0.34	10.20
Dec-77	1.22	1.69	0.48	1.90	0.17	0.02	0.09	0.02	0.11	0.01	0.04	0.16	0.17	0.15	0.58	0.40	0.11	0.56	0.15	0.23	0.03	0.35	8.64

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-78	0.58	1.04	0.28	0.94	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	5.95
Feb-78	0.45	0.72	0.22	0.75	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.49	0.33	0.09	0.47	0.13	0.19	0.03	0.30	4.94
Mar-78	0.47	1.52	0.25	1.11	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.44
Apr-78	2.89	3.30	0.45	3.08	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	12.72
May-78	2.14	2.13	0.46	1.98	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	9.83
Jun-78	0.99	1.22	0.33	1.38	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	6.93
Jul-78	0.80	1.29	0.31	1.39	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.88
Aug-78	1.17	1.52	0.40	1.35	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	7.54
Sep-78	2.31	2.21	0.48	2.29	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	10.30
Oct-78	1.52	1.67	0.40	2.02	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	8.71
Nov-78	0.85	1.21	0.24	1.50	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.52	0.36	0.10	0.50	0.14	0.20	0.03	0.32	6.81
Dec-78	0.62	1.02	0.26	1.25	0.16	0.02	0.09	0.02	0.10	0.01	0.03	0.15	0.16	0.14	0.54	0.37	0.10	0.52	0.14	0.21	0.03	0.33	6.26
Jan-79	0.40	0.61	0.17	0.66	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	4.78
Feb-79	0.32	0.63	0.15	0.62	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.12	0.13	0.12	0.46	0.32	0.08	0.44	0.12	0.18	0.03	0.28	4.38
Mar-79	0.69	2.59	0.24	1.69	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	8.15
Apr-79	3.86	4.02	0.65	3.76	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.49	0.34	0.09	0.48	0.13	0.19	0.03	0.30	15.13
May-79	2.36	2.92	0.65	2.94	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	11.82
Jun-79	1.76	1.95	0.46	1.88	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.49	0.34	0.09	0.48	0.13	0.19	0.03	0.30	8.89
Jul-79	0.82	0.68	0.25	1.15	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	5.85
Aug-79	0.73	0.68	0.27	1.11	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	5.73
Sep-79	0.63	0.97	0.21	0.91	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.49	0.34	0.09	0.48	0.13	0.19	0.03	0.30	5.57
Oct-79	0.86	0.95	0.27	1.04	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	6.07
Nov-79	1.03	1.17	0.33	1.34	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.49	0.34	0.09	0.48	0.13	0.19	0.03	0.30	6.71
Dec-79	0.58	0.74	0.23	0.95	0.15	0.02	0.08	0.02	0.10	0.01	0.03	0.14	0.15	0.13	0.51	0.35	0.09	0.49	0.13	0.20	0.03	0.31	5.44
Jan-80	0.87	1.18	0.28	1.33	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	6.51
Feb-80	0.62	0.75	0.22	0.88	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.13	0.13	0.12	0.46	0.32	0.08	0.45	0.12	0.18	0.03	0.28	5.13
Mar-80	0.67	1.18	0.21	1.15	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	6.05
Apr-80	3.34	3.13	0.47	2.88	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	12.58
May-80	1.32	1.47	0.28	1.53	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	7.46
Jun-80	0.85	2.18	0.31	2.30	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	8.40
Jul-80	0.71	1.09	0.26	1.06	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	5.98
Aug-80	0.72	1.63	0.27	1.50	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	6.97
Sep-80	1.87	1.72	0.54	1.61	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	8.50
Oct-80	1.11	1.22	0.37	1.22	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	6.78
Nov-80	0.98	1.07	0.30	1.12	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	6.23
Dec-80	0.61	0.82	0.26	0.98	0.15	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.13	0.50	0.34	0.09	0.48	0.13	0.19	0.03	0.30	5.53
Jan-81	0.37	0.89	0.22	0.87	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	5.13
Feb-81	0.43	1.29	0.22	1.32	0.13	0.02	0.07	0.02	0.08	0.00	0.03	0.12	0.13	0.11	0.44	0.30	0.08	0.42	0.12	0.17	0.02	0.27	5.78
Mar-81	0.78	1.69	0.24	1.59	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	7.08
Apr-81	3.20	3.21	0.55	3.05	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.47	0.32	0.09	0.45	0.12	0.18	0.03	0.28	12.71
May-81	1.77	2.20	0.48	2.60	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	9.84
Jun-81	1.82	2.15	0.55	1.64	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.47	0.32	0.09	0.45	0.12	0.18	0.03	0.28	8.84
Jul-81	0.83	1.01	0.30	1.03	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	5.96
Aug-81	1.17	0.74	0.26	0.78	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	5.73
Sep-81	0.53	0.75	0.16	0.78	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.47	0.32	0.09	0.45	0.12	0.18	0.03	0.28	4.92
Oct-81	1.16	1.29	0.26	1.35	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	6.84
Nov-81	0.69	0.94	0.22	1.01	0.14	0.02	0.07	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.47	0.32	0.09	0.45	0.12	0.18	0.03	0.28	5.56
Dec-81	0.53	0.77	0.21	1.05	0.14	0.02	0.08	0.02	0.09	0.01	0.03	0.13	0.14	0.12	0.48	0.33	0.09	0.46	0.13	0.19	0.03	0.29	5.34

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-82	0.29	0.65	0.15	0.61	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	4.06
Feb-82	0.27	0.69	0.16	0.56	0.11	0.01	0.06	0.02	0.07	0.00	0.02	0.10	0.11	0.09	0.37	0.25	0.07	0.35	0.10	0.14	0.02	0.22	3.81
Mar-82	0.35	1.20	0.15	1.16	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	5.22
Apr-82	2.41	2.68	0.46	2.74	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.11	0.10	0.40	0.27	0.07	0.38	0.10	0.15	0.02	0.24	10.57
May-82	1.72	1.20	0.45	1.23	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	6.95
Jun-82	0.44	0.64	0.14	0.88	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.11	0.10	0.40	0.27	0.07	0.38	0.10	0.15	0.02	0.24	4.37
Jul-82	1.05	1.31	0.25	1.72	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	6.68
Aug-82	0.57	0.52	0.15	0.70	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	4.29
Sep-82	1.04	0.99	0.26	0.90	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.11	0.10	0.40	0.27	0.07	0.38	0.10	0.15	0.02	0.24	5.47
Oct-82	1.19	1.35	0.35	1.09	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	6.32
Nov-82	1.15	1.69	0.32	1.50	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.11	0.10	0.40	0.27	0.07	0.38	0.10	0.15	0.02	0.24	6.94
Dec-82	0.74	1.37	0.26	1.34	0.12	0.01	0.06	0.02	0.08	0.00	0.03	0.11	0.12	0.10	0.41	0.28	0.07	0.39	0.11	0.16	0.02	0.25	6.07
Jan-83	0.44	0.64	0.17	0.68	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	3.92
Feb-83	0.32	0.63	0.15	0.71	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.09	0.08	0.31	0.21	0.06	0.30	0.08	0.12	0.02	0.19	3.60
Mar-83	0.97	1.62	0.25	1.51	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	6.34
Apr-83	1.64	1.49	0.28	1.39	0.10	0.01	0.05	0.01	0.06	0.00	0.02	0.09	0.10	0.08	0.33	0.23	0.06	0.32	0.09	0.13	0.02	0.20	6.71
May-83	1.44	1.95	0.36	1.71	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	7.44
Jun-83	1.19	1.06	0.33	1.11	0.10	0.01	0.05	0.01	0.06	0.00	0.02	0.09	0.10	0.08	0.33	0.23	0.06	0.32	0.09	0.13	0.02	0.20	5.62
Jul-83	0.33	0.54	0.16	0.69	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	3.70
Aug-83	0.33	0.54	0.14	0.57	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	3.57
Sep-83	0.46	1.01	0.15	0.90	0.10	0.01	0.05	0.01	0.06	0.00	0.02	0.09	0.10	0.08	0.33	0.23	0.06	0.32	0.09	0.13	0.02	0.20	4.43
Oct-83	0.97	1.20	0.21	1.15	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	5.52
Nov-83	0.77	0.81	0.23	0.99	0.10	0.01	0.05	0.01	0.06	0.00	0.02	0.09	0.10	0.08	0.33	0.23	0.06	0.32	0.09	0.13	0.02	0.20	4.72
Dec-83	0.63	0.60	0.20	0.79	0.10	0.01	0.05	0.01	0.07	0.00	0.02	0.09	0.10	0.09	0.35	0.24	0.06	0.33	0.09	0.13	0.02	0.21	4.22
Jan-84	0.32	0.52	0.17	0.57	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	3.26
Feb-84	0.65	1.19	0.24	0.78	0.08	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.08	0.07	0.27	0.19	0.05	0.26	0.07	0.11	0.02	0.17	4.42
Mar-84	0.47	0.77	0.19	0.70	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	3.81
Apr-84	1.61	1.24	0.26	1.20	0.08	0.01	0.04	0.01	0.05	0.00	0.02	0.08	0.08	0.07	0.28	0.19	0.05	0.27	0.07	0.11	0.02	0.17	5.93
May-84	1.10	1.32	0.29	1.22	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	5.61
Jun-84	0.40	0.81	0.15	0.85	0.08	0.01	0.04	0.01	0.05	0.00	0.02	0.08	0.08	0.07	0.28	0.19	0.05	0.27	0.07	0.11	0.02	0.17	3.84
Jul-84	0.34	0.48	0.13	0.64	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	3.27
Aug-84	0.56	0.44	0.12	0.54	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	3.33
Sep-84	0.69	0.65	0.16	0.71	0.08	0.01	0.04	0.01	0.05	0.00	0.02	0.08	0.08	0.07	0.28	0.19	0.05	0.27	0.07	0.11	0.02	0.17	3.84
Oct-84	0.55	0.88	0.17	0.98	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	4.25
Nov-84	0.72	1.23	0.16	1.29	0.08	0.01	0.04	0.01	0.05	0.00	0.02	0.08	0.08	0.07	0.28	0.19	0.05	0.27	0.07	0.11	0.02	0.17	5.02
Dec-84	0.60	0.70	0.17	0.81	0.09	0.01	0.05	0.01	0.06	0.00	0.02	0.08	0.08	0.07	0.29	0.20	0.05	0.28	0.08	0.11	0.02	0.18	3.95
Jan-85	0.29	0.39	0.10	0.41	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	2.62
Feb-85	0.19	0.35	0.07	0.35	0.07	0.01	0.04	0.01	0.04	0.00	0.01	0.06	0.06	0.06	0.22	0.15	0.04	0.21	0.06	0.09	0.01	0.14	2.25
Mar-85	0.39	1.17	0.12	0.93	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	4.04
Apr-85	1.81	1.41	0.31	1.34	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.06	0.07	0.06	0.24	0.16	0.04	0.23	0.06	0.09	0.01	0.14	6.25
May-85	0.74	0.73	0.18	0.78	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	3.84
Jun-85	0.41	0.49	0.14	0.49	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.06	0.07	0.06	0.24	0.16	0.04	0.23	0.06	0.09	0.01	0.14	2.90
Jul-85	0.21	0.31	0.09	0.39	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	2.42
Aug-85	0.20	0.47	0.09	0.48	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	2.67
Sep-85	0.31	0.42	0.12	0.50	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.06	0.07	0.06	0.24	0.16	0.04	0.23	0.06	0.09	0.01	0.14	2.72
Oct-85	0.87	1.04	0.24	1.04	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	4.61
Nov-85	0.98	1.28	0.23	1.27	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.06	0.07	0.06	0.24	0.16	0.04	0.23	0.06	0.09	0.01	0.14	5.14
Dec-85	0.35	0.58	0.17	0.73	0.07	0.01	0.04	0.01	0.05	0.00	0.02	0.07	0.07	0.06	0.25	0.17	0.04	0.24	0.07	0.10	0.01	0.15	3.24

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-86	0.32	0.45	0.14	0.56	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	2.66
Feb-86	0.25	0.38	0.14	0.44	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.05	0.05	0.05	0.19	0.13	0.03	0.18	0.05	0.07	0.01	0.11	2.29
Mar-86	0.45	0.91	0.15	0.97	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	3.67
Apr-86	2.32	1.62	0.39	1.49	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.05	0.06	0.05	0.20	0.14	0.04	0.19	0.05	0.08	0.01	0.12	6.97
May-86	0.42	0.47	0.13	0.54	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	2.76
Jun-86	0.21	0.30	0.08	0.36	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.05	0.06	0.05	0.20	0.14	0.04	0.19	0.05	0.08	0.01	0.12	2.11
Jul-86	0.21	0.37	0.07	0.43	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	2.29
Aug-86	0.25	0.38	0.09	0.36	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	2.28
Sep-86	0.29	0.59	0.10	0.51	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.05	0.06	0.05	0.20	0.14	0.04	0.19	0.05	0.08	0.01	0.12	2.66
Oct-86	0.58	1.01	0.13	0.84	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	3.76
Nov-86	0.26	0.47	0.08	0.44	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.05	0.06	0.05	0.20	0.14	0.04	0.19	0.05	0.08	0.01	0.12	2.41
Dec-86	0.16	0.35	0.09	0.41	0.06	0.01	0.03	0.01	0.04	0.00	0.01	0.06	0.06	0.05	0.21	0.14	0.04	0.20	0.05	0.08	0.01	0.13	2.21
Jan-87	0.21	0.43	0.10	0.51	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.26
Feb-87	0.18	0.35	0.09	0.43	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.04	0.05	0.04	0.16	0.11	0.03	0.15	0.04	0.06	0.01	0.10	1.97
Mar-87	0.39	0.68	0.14	0.70	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.92
Apr-87	0.75	0.90	0.14	0.91	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.17	0.12	0.03	0.16	0.04	0.07	0.01	0.10	3.68
May-87	0.37	0.57	0.08	0.58	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.61
Jun-87	0.39	0.39	0.08	0.42	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.17	0.12	0.03	0.16	0.04	0.07	0.01	0.10	2.26
Jul-87	0.43	0.35	0.12	0.37	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.28
Aug-87	0.31	0.36	0.14	0.33	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.15
Sep-87	0.24	0.33	0.08	0.35	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.17	0.12	0.03	0.16	0.04	0.07	0.01	0.10	1.99
Oct-87	0.42	0.46	0.09	0.41	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	2.38
Nov-87	0.53	0.72	0.12	0.62	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.17	0.12	0.03	0.16	0.04	0.07	0.01	0.10	2.97
Dec-87	0.60	0.63	0.15	0.61	0.05	0.01	0.03	0.01	0.03	0.00	0.01	0.05	0.05	0.04	0.18	0.12	0.03	0.17	0.05	0.07	0.01	0.11	3.01
Jan-88	0.15	0.36	0.08	0.33	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.77
Feb-88	0.12	0.34	0.07	0.32	0.04	0.00	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.14	0.10	0.03	0.13	0.04	0.05	0.01	0.08	1.65
Mar-88	0.22	0.75	0.09	0.67	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	2.58
Apr-88	1.07	1.10	0.18	1.06	0.04	0.00	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.14	0.10	0.03	0.14	0.04	0.06	0.01	0.09	4.23
May-88	0.23	0.48	0.08	0.48	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	2.12
Jun-88	0.10	0.15	0.05	0.24	0.04	0.00	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.14	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.37
Jul-88	0.09	0.22	0.05	0.28	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.50
Aug-88	0.26	0.24	0.07	0.28	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.70
Sep-88	0.23	0.23	0.07	0.25	0.04	0.00	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.14	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.60
Oct-88	0.35	0.27	0.07	0.33	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	1.88
Nov-88	0.91	0.69	0.19	0.59	0.04	0.00	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.14	0.10	0.03	0.14	0.04	0.06	0.01	0.09	3.21
Dec-88	0.34	0.38	0.14	0.43	0.04	0.01	0.02	0.01	0.03	0.00	0.01	0.04	0.04	0.04	0.15	0.10	0.03	0.14	0.04	0.06	0.01	0.09	2.15
Jan-89	0.19	0.29	0.08	0.29	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	1.57
Feb-89	0.14	0.23	0.06	0.23	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.08	0.02	0.11	0.03	0.04	0.01	0.07	1.32
Mar-89	0.21	0.55	0.10	0.55	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	2.14
Apr-89	0.81	0.91	0.15	0.72	0.04	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.04	0.03	0.12	0.08	0.02	0.12	0.03	0.05	0.01	0.07	3.28
May-89	0.45	0.52	0.10	0.50	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	2.30
Jun-89	0.77	0.62	0.17	0.64	0.04	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.04	0.03	0.12	0.08	0.02	0.12	0.03	0.05	0.01	0.07	2.90
Jul-89	0.17	0.20	0.05	0.26	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	1.41
Aug-89	0.12	0.21	0.05	0.25	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	1.34
Sep-89	0.12	0.17	0.05	0.21	0.04	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.04	0.03	0.12	0.08	0.02	0.12	0.03	0.05	0.01	0.07	1.24
Oct-89	0.14	0.21	0.04	0.24	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	1.36
Nov-89	0.23	0.33	0.05	0.31	0.04	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.04	0.03	0.12	0.08	0.02	0.12	0.03	0.05	0.01	0.07	1.63
Dec-89	0.11	0.17	0.05	0.22	0.04	0.00	0.02	0.01	0.02	0.00	0.01	0.03	0.04	0.03	0.13	0.09	0.02	0.12	0.03	0.05	0.01	0.08	1.27

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-90	0.12	0.10	0.05	0.14	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.02
Feb-90	0.11	0.09	0.04	0.12	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.02	0.10	0.07	0.02	0.09	0.03	0.04	0.01	0.06	0.92
Mar-90	0.43	0.42	0.09	0.46	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	2.01
Apr-90	0.33	0.17	0.05	0.22	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.10	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.37
May-90	0.64	0.50	0.12	0.46	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	2.34
Jun-90	0.28	0.71	0.10	0.62	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.10	0.07	0.02	0.10	0.03	0.04	0.01	0.06	2.29
Jul-90	0.14	0.24	0.05	0.26	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.30
Aug-90	0.12	0.23	0.05	0.25	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.26
Sep-90	0.12	0.41	0.06	0.38	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.10	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.57
Oct-90	0.27	0.34	0.08	0.31	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.62
Nov-90	0.20	0.28	0.06	0.27	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.10	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.40
Dec-90	0.16	0.21	0.06	0.25	0.03	0.00	0.02	0.00	0.02	0.00	0.01	0.03	0.03	0.03	0.11	0.07	0.02	0.10	0.03	0.04	0.01	0.06	1.30
Jan-91	0.08	0.11	0.03	0.13	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	0.87
Feb-91	0.07	0.10	0.03	0.13	0.02	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.02	0.02	0.08	0.06	0.01	0.08	0.02	0.03	0.00	0.05	0.80
Mar-91	0.22	0.30	0.06	0.35	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	1.45
Apr-91	0.69	0.55	0.10	0.54	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.08	0.02	0.03	0.00	0.05	2.39
May-91	0.33	0.36	0.09	0.35	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	1.65
Jun-91	0.14	0.37	0.07	0.32	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.08	0.02	0.03	0.00	0.05	1.40
Jul-91	0.15	0.22	0.05	0.18	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	1.12
Aug-91	0.09	0.17	0.04	0.17	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	0.98
Sep-91	0.09	0.15	0.04	0.16	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.08	0.02	0.03	0.00	0.05	0.94
Oct-91	0.13	0.19	0.04	0.17	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	1.05
Nov-91	0.25	0.35	0.05	0.39	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.08	0.02	0.03	0.00	0.05	1.54
Dec-91	0.22	0.27	0.06	0.29	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.03	0.02	0.09	0.06	0.02	0.09	0.02	0.04	0.01	0.05	1.36
Jan-92	0.09	0.14	0.04	0.14	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	0.84
Feb-92	0.07	0.10	0.03	0.12	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.07	0.05	0.01	0.07	0.02	0.03	0.00	0.04	0.73
Mar-92	0.13	0.24	0.05	0.26	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	1.12
Apr-92	0.54	0.54	0.11	0.45	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.07	0.05	0.01	0.07	0.02	0.03	0.00	0.04	2.05
May-92	0.22	0.32	0.06	0.34	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	1.37
Jun-92	0.07	0.11	0.03	0.14	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.07	0.05	0.01	0.07	0.02	0.03	0.00	0.04	0.77
Jul-92	0.25	0.12	0.05	0.13	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	0.98
Aug-92	0.09	0.09	0.03	0.11	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	0.75
Sep-92	0.11	0.21	0.04	0.22	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.07	0.05	0.01	0.07	0.02	0.03	0.00	0.04	1.00
Oct-92	0.11	0.17	0.04	0.17	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	0.92
Nov-92	0.24	0.38	0.06	0.35	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.07	0.05	0.01	0.07	0.02	0.03	0.00	0.04	1.45
Dec-92	0.18	0.24	0.05	0.26	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.08	0.05	0.01	0.07	0.02	0.03	0.00	0.05	1.16
Jan-93	0.08	0.13	0.04	0.13	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.74
Feb-93	0.06	0.10	0.03	0.10	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.01	0.06	0.04	0.01	0.06	0.02	0.02	0.00	0.04	0.62
Mar-93	0.09	0.13	0.03	0.14	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.76
Apr-93	0.34	0.32	0.06	0.32	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.02	0.00	0.04	1.40
May-93	0.39	0.32	0.07	0.31	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	1.46
Jun-93	0.22	0.42	0.07	0.40	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.02	0.00	0.04	1.46
Jul-93	0.09	0.21	0.03	0.22	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.92
Aug-93	0.08	0.10	0.02	0.13	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.70
Sep-93	0.11	0.14	0.03	0.13	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.02	0.00	0.04	0.76
Oct-93	0.11	0.13	0.03	0.12	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.77
Nov-93	0.12	0.15	0.03	0.15	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.02	0.00	0.04	0.80
Dec-93	0.07	0.10	0.03	0.12	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.02	0.02	0.02	0.06	0.04	0.01	0.06	0.02	0.03	0.00	0.04	0.69

Estimated Monthly PCB Loads to Green Bay from Tributaries, 1954-1995

PCBs	*Escanaba9*	*Peshtigo7*	*Menominee7*	*Oconto7*	*Ford9*	*Duck1*	*Direct1*	*Direct2*	*Direct3*	*Direct4*	*Direct5*	*Direct6*	*Direct7*	*Pensaukee7*	*Direct8*	*Direct9*	*Cedar9*	*Fishdam9*	*Rapid9*	*Sturgeon9*	*Tacoosh9*	*Whitefish9*	**All tribs**
Monthly load, kg																							4053.15
Jan-94	0.07	0.12	0.03	0.11	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.65
Feb-94	0.05	0.11	0.03	0.11	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.05	0.01	0.02	0.00	0.03	0.58
Mar-94	0.08	0.16	0.03	0.17	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.76
Apr-94	0.29	0.25	0.04	0.28	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	1.17
May-94	0.24	0.20	0.04	0.21	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	1.01
Jun-94	0.17	0.12	0.04	0.11	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.74
Jul-94	0.12	0.10	0.04	0.11	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.69
Aug-94	0.08	0.08	0.03	0.11	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.61
Sep-94	0.09	0.22	0.04	0.18	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.83
Oct-94	0.12	0.24	0.03	0.22	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.93
Nov-94	0.09	0.16	0.02	0.16	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.74
Dec-94	0.08	0.12	0.03	0.14	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.05	0.04	0.01	0.05	0.01	0.02	0.00	0.03	0.68
Jan-95	0.04	0.07	0.02	0.09	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.49
Feb-95	0.04	0.07	0.02	0.07	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.43
Mar-95	0.13	0.17	0.03	0.17	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.76
Apr-95	0.20	0.21	0.03	0.21	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.90
May-95	0.21	0.23	0.05	0.22	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.97
Jun-95	0.09	0.12	0.03	0.13	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.61
Jul-95	0.08	0.07	0.02	0.09	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.53
Aug-95	0.07	0.11	0.03	0.13	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.60
Sep-95	0.06	0.07	0.02	0.09	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.50
Oct-95	0.15	0.20	0.04	0.17	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.82
Nov-95	0.13	0.17	0.03	0.16	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.75
Dec-95	0.07	0.11	0.03	0.10	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.05	0.03	0.01	0.04	0.01	0.02	0.00	0.03	0.56