Amendment to the
Atlantic County Water Quality Management Plan, the Lower Delaware Water Quality Management Plan, the Ocean County Water Quality Management Plan and the Tri-County Water Quality Management Plan

Total Maximum Daily Loads for Pathogens to Address 17 Lakes in the Lower Delaware Water Region

Watershed Management Area 17
(Cedar Lake, Sunset Lake, Eastern Gate Lake, Franklinville Lake, Holly Green Campground Pond, Iona Lake, Malaga Lake, Wilson Lake, Four Seasons Campground Pond, and Parvin Lake)
Watershed Management Area 18
(Lake Silvestro)
Watershed Management Area 19
(Lake Coxtoxen, Lake James, Mirror Lake, Timber Lake, and Sturbridge Lake)
Watershed Management Area 20
(Upper Sylvan Lake)

Proposed: July 16, 2007
Established: September 21, 2007
Approved: September 28, 2007
Adopted: October 19, 2009

Prepared by:
New Jersey Department of Environmental Protection
and
TETRA TECH, INC.

With assistance provided by:
United States Environmental Protection Agency, Region 2

TABLE OF CONTENTS

TABLES

FIGURES

EXECUTIVE SUMMARY

In accordance with Section 305(b) and 303(d) of the Federal Clean Water Act (CWA), the State of New Jersey, Department of Environmental Protection (Department) is required to assess the overall water quality of the State's waters and identify those waterbodies with a water quality impairment for which TMDLs may be necessary. A TMDL is developed to identify all the contributors of a pollutant of concern and the load reductions necessary to meet the Surface Water Quality Standards (SWQS) relative to that pollutant. The Department fulfills its assessment obligation under the CWA through the Integrated Water Quality Monitoring and Assessment Report, which includes the Integrated List of Waterbodies, issued biennially. On October 4, 2004 the Department adopted the *2004 Integrated List of Waterbodies* as an amendment to the Statewide Water Quality Management Plan (36 NJR 4543(a)), as part of the Department's continuing planning process pursuant to the Water Quality Planning Act at N.J.S.A. 58:11A-7 and the Water Quality Management Planning rules at N.J.A.C. 7:15-6.4(a). The *2004 Integrated List of Waterbodies* identifies seventeen lakes as impaired with respect to pathogens in the Lower Delaware Water Region.

The Department has recently adopted the *2006 Integrated Water Quality Monitoring and Assessment Report*, including the *2006 Integrated List of Waterbodies*, which identifies impairments based on HUC 14 Assessment Units rather than stream segments associated with discrete monitoring locations. This change in assessment methodology allows establishment of a stable base of assessment units for which the attainment or non-attainment status of all designated uses within each subwatershed or assessment unit will be identified. In addition, lakes are assessed and listed separately when impaired. The *2006 Integrated List of Waterbodies* identifies seventeen lakes that are impaired with respect to pathogens in the Lower Delaware Water Region. A lake is determined to be impaired if it does not fully support primary contact recreation as evidenced by beach closings in accordance with Health Department standards. The water quality trigger for beach closings is exceedance of 200 cfu/100 ml of fecal coliform (NJDOH, 2004). TMDLs are adopted for the impaired lakes listed in Table 1.

Table 1. Lakes in the Lower Delaware Water Region impaired for pathogens for which TMDLs are adopted.

TMDL Number	WMA	Lake Assessment Unit Name	County*
1	17	Cedar Lake	Cumberland
2	17	Sunset Lake	Cumberland
3	17	Eastern Gate Lake	Gloucester
4	17	Franklinville Lake	Gloucester
5	17	Holly Green CG	Gloucester

TMDL Number	WMA	Lake Assessment Unit Name	County*
6	17	Iona Lake	Gloucester
7	17	Malaga Lake	Gloucester
8	17	Wilson Lake	Gloucester
9	17	4 Seasons CG	Salem
10	17	Parvin Lake	Salem
11	18	Lake Silvestro	Gloucester
12	19	Lake Coxtoxen	Burlington
13	19	Lake James	Burlington
14	19	Mirror Lake	Burlington
15	19	Timber Lake	Burlington
16	19	Sturbridge Lake	Camden
17	20	Upper Sylvan Lake	Burlington

*The drainage area/lakeshed for each lake may encompass municipalities beyond the identified County in which the lake is located.

Nonpoint and stormwater point sources are the primary sources of fecal coliform loads to the impaired lakes. Source loads were estimated for land uses in each watershed using the Watershed Treatment Model (WTM) (WTM, 2001). The WTM model is a series of spreadsheets that quantifies the loading of pathogen indicators based on land use distribution, stream network length in the watershed, and annual rainfall. Traditional point sources, i.e., treatment facilities that have a sanitary waste component, were considered de minimus due to the use of effective disinfection practices by these facilities. TMDLs were developed based on an analysis of the existing pathogen indicator data compared to Health Department indicator criteria and the loading capacity has been allocated among the point and nonpoint sources.

This report establishes seventeen TMDLs that have been adopted as amendments to the appropriate area-wide water quality management plan in accordance with N.J.A.C. 7:15-3.4(g). This report was developed consistent with EPA's May 20, 2002 guidance document entitled: "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992," (Sutfin, 2002) which describes the statutory and regulatory requirements for approvable TMDLs. These TMDLs were approved by EPA on September 28, 2007, and will be adopted as amendments to the Atlantic County, Lower Delaware, Ocean County and Tri-County Water Quality Management Plans in accordance with N.J.A.C. 7:15-3.4 (g).

1.0 INTRODUCTION

In accordance with Section 303(d) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of New Jersey, Department of Environmental Protection (Department) is required biennially to prepare and submit to the EPA a report that identifies waters that do not meet or are not expected to meet water quality standards after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. In accordance with Section 305(b) of the CWA, the Department is also required biennially to prepare and submit to the EPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. The Integrated Water Quality Monitoring and Assessment Report combines these two assessments and assigns waterbodies to one of five sublists on the Integrated List of Waterbodies. Sublists 1 through 4 include waterbodies that are generally unimpaired (Sublist 1 and 2), have limited assessment or data availability (Sublist 3), are impaired due to pollution rather than pollutants, or have had a TMDL or other enforceable management measure approved by EPA (Sublist 4). Sublist 5 constitutes the traditional 303(d) list for waters impaired or threatened by one or more pollutants, for which a TMDL may be required.

In the New Jersey 2004 *Integrated Water Quality Monitoring and Assessment Report* the water quality impairments were identified by segment name and pollutant(s) or non-attained designated use responsible for the finding that the segment was impaired. Each segment was assessed using the data from one or more discrete monitoring locations that were determined to be representative of the water quality in that segment. This impaired segment delineation method was changed in 2006.

The *New Jersey 2006 Integrated Water Quality Monitoring and Assessment Report* now identifies impairments based on designated use attainment and then lists the parameters responsible for the non-attainment of the designated use. The assessments are conducted for each of the seven categories of designated use, which include aquatic life, recreational use (primary and secondary contact), drinking water, fish consumption, shellfish harvesting (if applicable), agricultural water supply use and industrial water supply use. In addition, lakes are assessed and listed separately if impaired. In the Lower Delaware Water Region, the *2006 Integrated List of Waterbodies* currently identifies seventeen lakes as impaired for pathogens. These lakes do not fully support primary contact recreation as evidenced by beach closings and water quality data that demonstrate exceedance of the water quality criterion that triggers closings.

A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, natural background, and surface water withdrawals. A TMDL quantifies the amount of a pollutant a waterbody can assimilate and still conform to applicable water quality standards and support designated uses. The TMDL or loading capacity is allocated to known point and nonpoint sources in the form of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS).

Recent EPA guidance (Sutfin, 2002) describes the statutory and regulatory requirements for approvable TMDLs, as well as additional information generally needed for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations. These TMDLs address the following required items in the May 20, 2002 guideline document:

1. Identification of waterbody(ies), pollutant of concern, pollutant sources and priority ranking.
2. Description of applicable water quality standards and numeric water quality target(s).
3. Loading capacity – linking water quality and pollutant sources.
4. Load allocations.
5. Wasteload allocations.
6. Margin of safety.
7. Seasonal variation.
8. Reasonable assurances.
9. Monitoring plan to track TMDL effectiveness.
10. Implementation (USEPA is not required to and does not approve TMDL implementation plans).
11. Public Participation.

This report establishes seventeen TMDLs for pathogens to address the impaired lakes in the Lower Delaware Water Region. All of the impaired lakes were listed for fecal coliform and assigned a high priority on the *2004 Integrated List of Waterbodies* and a high priority ranking on the *2006 Integrated List of Waterbodies* Sublist 5. These TMDLs include management approaches to reduce pathogen contributions from various sources in order to attain applicable surface water quality standards and fully support the designated primary contact recreation use. These TMDLs affect the drainage areas of the impaired lakes due to the fact that the implementation measures must be applied to the contributing drainage areas, not just the impaired lakes. Following approval of the TMDLs by EPA, pathogens will be removed as a basis of impairment in the next Integrated List. In addition to the pathogen impairments, Sunset Lake, Wilson Lake, Malaga Lake, and Mirror Lake were listed for mercury and Timber Lake was listed for unknown pollutants on the *2006 Integrated List*. These pollutants will be addressed in future TMDL efforts.

2.0 POLLUTANT OF CONCERN AND AREA OF INTEREST

The pollutant of concern for these TMDLs is pathogens. Standards are established in terms of indicator organisms which, when present in excess of the standard, suggest that the waterbody is not suitable for primary contact recreation because of an elevated risk of disease. New Jersey Surface Water Quality Standards (SWQS) include pathogen indicator criteria for the assessment of the recreational use (primary and secondary contact recreation) for all waterbodies. However, for lakes with bathing beaches, the New Jersey Health Department Standards N.J.A.C. 8:26-7.18 establish the basis for beach closings. These standards are more stringent than the Surface Water Quality Standards. As a result, the Health Department Standards will serve as the water quality target for these TMDLs. The Health Department Standards and SWQS are summarized as follows:

> **As stated in N.J.A.C. 8:26-7.18 Microbiological water quality standards for bathing beaches:**
>
> The multiple-tube fermentation technique for fecal coliforms shall be conducted in accordance with the procedures set for in Method 9222D Fecal Coliform Membrane Filter Procedure or Method 9221E.2. Fecal Coliform MPN Procedure (A-1 medium) found in the 19th edition of "Standard Methods for the Examination of Water and Wastewater." American Public Health Association, incorporated herein by reference, as amended and supplemented. The estimated fecal coliform concentrations shall not exceed 200 fecal coliform per 100 milliliters.

As stated in N.J.A.C. 7:9B-1.14(d) of the New Jersey Surface Water Quality Standards and 7:9B-1.14(b) 2ii, Fresh Water 2 (FW2) and Pinelands (PL) waters:

1. Bacterial quality (Counts/100 ml)

    ii. Primary Contact Recreation:

    (2) E. Coli levels shall not exceed a geometric mean of 126/100 ml or a single sample maximum of 235/100 ml.

The lakes assessed as impaired based on water quality data and for which TMDLs have been developed are identified in Table 2 and depicted in Figures 1 and 2.

Table 2. Impaired Waterbodies as identified on the *2004 Integrated List of Waterbodies* and the *2006 Integrated List* for which Pathogen TMDLs are being adopted.

TMDL Number	WMA	Lake Assessment Unit Name	Lake Assessment Unit ID	2004 Status	2006 Status	County(s)*	Action
1	17	Cedar Lake	Cedar Lake-17	Sublist 5	Sublist 5	Cumberland	Adopt TMDL
2	17	Sunset Lake	Sunset Lake-17	Sublist 5	Sublist 5	Cumberland	Adopt TMDL
3	17	Eastern Gate Lake	Eastern Gate Lake-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL

TMDL Number	WMA	Lake Assessment Unit Name	Lake Assessment Unit ID	2004 Status	2006 Status	County(s)*	Action
4	17	Franklinville Lake	Franklinville Lake-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
5	17	Holly Green CG	Holly Green Campground Pond-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
6	17	Iona Lake	Iona Lake-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
7	17	Malaga Lake	Malaga Lake-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
8	17	Wilson Lake	Wilson Lake-17	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
9	17	4 Seasons CG	4 Seasons Campground Pond-17	Sublist 5	Sublist 5	Salem	Adopt TMDL
10	17	Parvin Lake	Parvin Lake-17	Sublist 5	Sublist 5	Salem	Adopt TMDL
11	18	Lake Silvestro	Lake Silvestro-18	Sublist 5	Sublist 5	Gloucester	Adopt TMDL
12	19	Lake Coxtoxen	Lake Coxtoxen-19	Sublist 5	N/A	Burlington	Adopt TMDL
13	19	Lake James	Lake James-19	Sublist 5	Sublist 5	Burlington	Adopt TMDL
14	19	Mirror Lake	Mirror Lake-19	Sublist 5	Sublist 5	Burlington	Adopt TMDL
15	19	Timber Lake	Timber Lake-19	Sublist 5	Sublist 5	Burlington	Adopt TMDL
16	19	Sturbridge Lake	Sturbridge Lake-19	Sublist 5	Sublist 5	Camden	Adopt TMDL
17	20	Upper Sylvan Lake	Upper Sylvan Lake-20	Sublist 5	Sublist 5	Burlington	Adopt TMDL

*The drainage area/lakeshed for each lake may encompass municipalities beyond the identified County in which the lake is located.

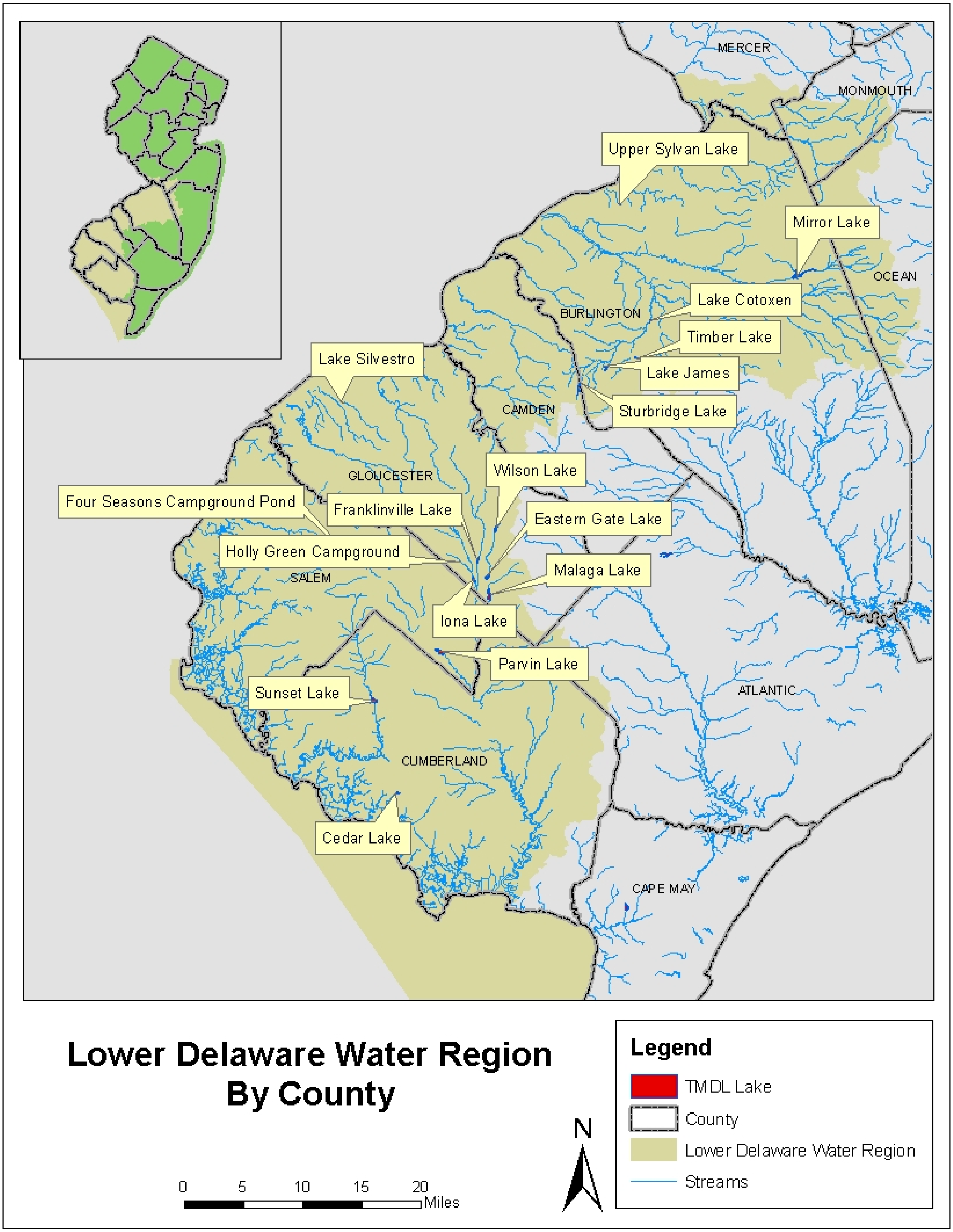


Figure 1. Pathogen Impaired Lakes in the Lower Delaware Water Region by County

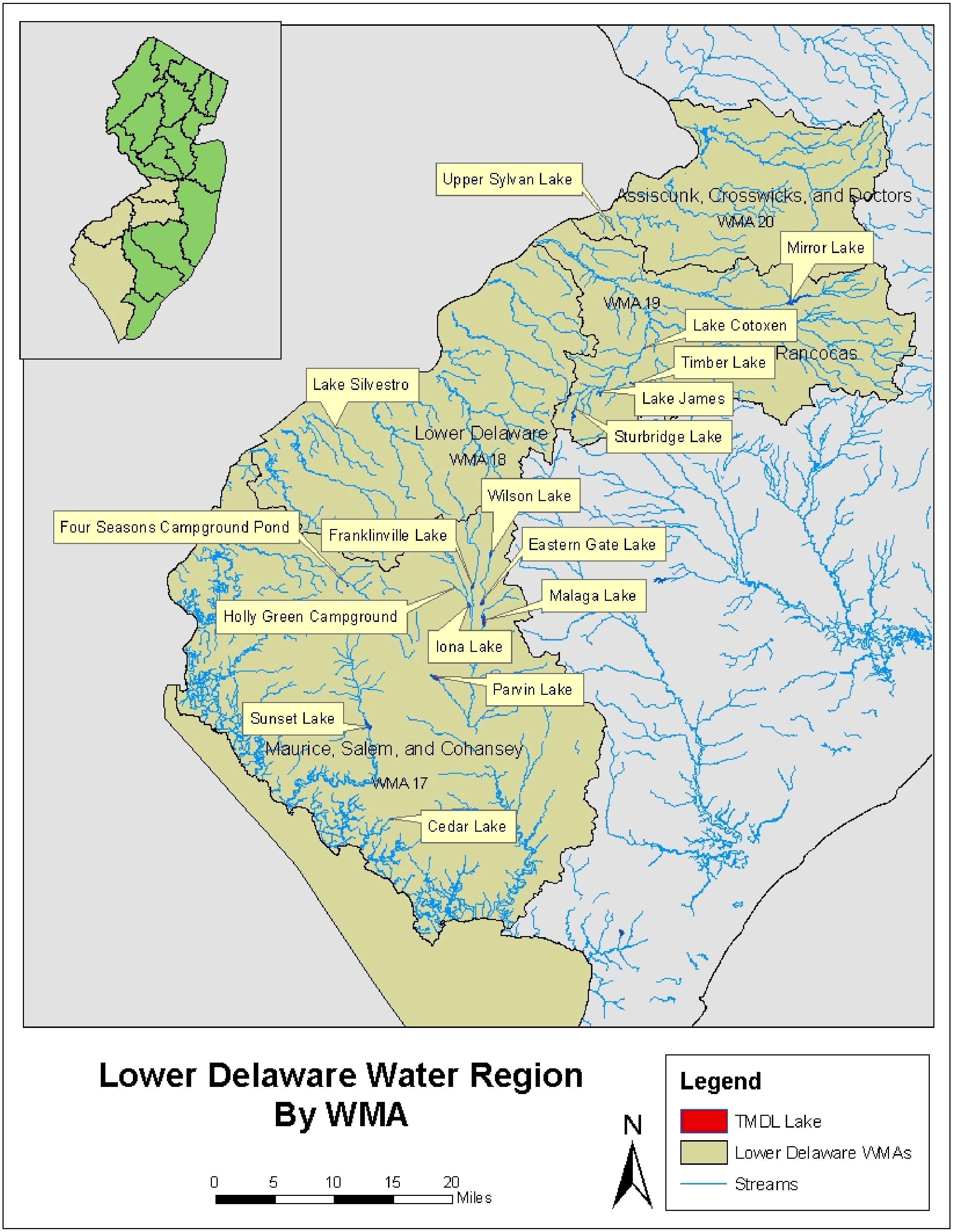


Figure 2. Pathogen Impaired lakes in the Lower Delaware Water Region by WMA

Mirror Lake, Lake James, Sturbridge Lake, and Timber Lake are classified as Pinelands (PL). All other impaired lakes addressed in this document are classified as Fresh Water 2 (FW2), Non-Trout (NT).

In all PL waters the designated uses are:

1. Cranberry bog water supply and other agricultural uses;
2. Maintenance, migration and propagation of the natural and established biota indigenous to this unique ecological system;
3. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection;
4. Primary and secondary contact recreation; and
5. Any other reasonable uses.

In all FW2 waters, the designated uses are (NJAC 7:9B-1.12):

1. Maintenance, migration and propagation of the natural and established aquatic biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

3.0 SOURCE ASSESSMENT

A source assessment was conducted to identify and characterize potential pathogen sources that may be impacting water quality in the listed waters. Both point and nonpoint sources were considered in TMDL development. Source assessment also includes the determination of the relative contribution of the primary bacteria sources to facilitate proper management responses through TMDL implementation. A variety of information was used to characterize possible pathogen sources including land use information gathered for each watershed, point source information, literature sources, and other available data.

3.2 Assessment of Point Sources

For TMDL development purposes, point sources include domestic and industrial wastewater treatment plants that discharge to surface waters, as well as surface water discharges of stormwater subject to regulation under the National Pollutant Discharge Elimination System

(NPDES). This includes facilities with individual or general industrial stormwater permits, Tier A municipalities, and federal, interstate agency, state, and county facilities regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) municipal stormwater permitting program. Tier A municipalities are generally located within the more densely populated regions of the state or along the coast. These municipalities meet the population size requirements of EPA's Municipal Separate Storm Sewer System (MS4) program for regulating urban stormwater discharges. Stormwater point sources, like stormwater nonpoint sources, derive their pollutant loads from runoff from land surfaces and load reduction is accomplished through the use of best management practices (BMPs). The distinction is that stormwater point sources are regulated under the Clean Water Act (under the MS4 program). Stormwater point sources will be addressed through the management practices required through the MS4 permits.

Wastewater treatment facilities and Tier A municipalities that directly discharge to the pathogen impaired lakes in the Lower Delaware Water Region are identified in Appendix B. Per Department NJPDES Regulation, N.J.A.C. 7:14A-12.5(a), "All wastewater that could contain pathogenic organisms such as fecal coliform and/or enterococci organisms shall be subject to continuous year round disinfection prior to discharge into surface waters." Therefore, loads from wastewater treatment facilities were considered de minimus, consistent with previous pathogen TMDLs developed by the Department. The NJPDES permit limits for these point sources will not be changed as a result of these TMDLs and will remain a 200 cfu/100 ml monthly geometric mean and a 400 cfu/100 ml weekly geometric mean. Stormwater loads from Tier A MS4 systems are point sources that can be significant. These loads were estimated using the watershed loading methods described in the nonpoint source section, as they will be addressed through BMPs.

3.3 Assessment of Nonpoint Sources

Nonpoint sources that may affect lakes include stormwater discharges that are not subject to regulation under the Clean Water Act, including Tier B municipalities, direct stormwater runoff from land surfaces, as well as malfunctioning sewage conveyance systems, failing or inappropriately located septic systems, and direct contributions from wildlife, livestock and pets. Tier B municipalities are generally located in more rural, non-coastal regions of the state.

Watershed Treatment Model (WTM) (WTM, 2001), a steady-state spreadsheet model, was chosen to estimate nonpoint source bacteria loads for these TMDLs. WTM simulates loadings generated by watershed washoff processes. The WTM model was selected because it encompasses local rainfall data and stream length information to better tailor load estimates. In addition, it has been successfully applied in previous coastal TMDL studies, including the development of pathogen TMDLs for impaired shellfish waterbodies in New Jersey. The goal of applying WTM is to characterize all the point and nonpoint sources, as available data allows, in the existing system and to determine their relative contributions to the waterbody of interest. The loading values thus derived serve as the reference point from which reductions are made to meet TMDL targets.

The WTM model is a series of spreadsheets that quantifies the loading of pathogen indicators based on land use distribution, stream network length in the watershed, and annual rainfall. The model is designed as a planning level tool for watersheds that do not have sufficient data for complex modeling applications. Pathogen concentrations in runoff and receiving waters are highly variable due to many factors, therefore average annual land use loads derived using the WTM model are gross estimates. Although the WTM model has several tiers of data specificity, loading estimates can be calculated with simple land use data, as they were for these lake TMDLs. Land use loads are calculated on an annual basis by using a series of coefficients for runoff volume and pathogen loading derived from scientific literature. General land use categories are assigned either a coefficient that is then multiplied by an annual runoff volume to calculate an annual load (e.g., urban land uses) or an annual unit area load that is applied as a function of land use (e.g., rural land uses). These coefficients are presented in Table 3 and discussed in the WTM user manual (Caraco, 2001). According to the WTM user manual, the urban loading coefficient was based on the median urban runoff value derived from Nationwide Urban Runoff Program (NURP) monitoring data (Pitt, 1998). Loading values for rural land uses were taken from Horner et. al., 1994. Note that barren land is not represented in the WTM model, therefore it was assumed that the forest loading value was reasonable for this land use type.

Table 3. Default WTM land use categories and loading variables

WTM Land Use	Corresponding New Jersey Land Uses	Average % Impervious Cover	Fecal Coliform Conc. (MPN/100 ml) or Annual Load (billion/acre)
Low Density Residential	Low Density Residential, Rural Residential, Recreational Land, Athletic Fields	19	20,000
Medium Density Residential	Medium Density Residential, Mixed Residential, Mixed Urban or Built-Up, Other Urban or Built-Up, Military Reservations, No Longer Military	35	20,000
High Density Residential	High Density Residential	56	20,000
Commercial	Commercial Services	71	20,000
Roadway	Transportation/Communication/Utilities	39	20,000
Industrial	Industrial, Industrial/Commercial	78	20,000
Forest	Forest/Wetland	0	Load: 12 billion/acre
Rural	Agriculture	0	Load: 39 billion/acre
Barren (replaced "Vacant Lots" category in WTM)	Barren	2	Load: 12 billion/acre (estimated)

The watershed for each TMDL waterbody was delineated using the Hydrologic Unit Coverage (HUC-14 digit) developed by NJDEP, digital elevation model (DEM) data, the National Hydrography Dataset (NHD) stream coverage for New Jersey, and ArcHydro, a watershed delineation tool available as an extension for the ArcGIS geospatial mapping software suite. Land use data for each watershed was obtained from the 2002 land use coverage developed for New Jersey's WMAs. Land use categories were consolidated into broader groups for use in estimating land-based loads using the WTM model and for presenting the loading results. The percent impervious information for each land use category was derived from the percent impervious information in the Department's GIS land use coverage, averaged across similar land uses. The bacterial loads for urban areas in each watershed were calculated based on the default fecal coliform concentration literature value for urban land uses, the average percent impervious cover, and the annual runoff volume calculated by the WTM model. Agricultural, forest, and barren land use loads were calculated based on the specific loading rate for each category. The literature loading rate for forested land was applied to wetland areas to estimate a wetland land use load. Waterways were not included in loading calculations based on WTM model assumptions.

Direct contributions from illicit discharges, livestock, pets, and wildlife (e.g. seagulls, geese, and other waterfowl in particular) were not estimated based on the lack of site-specific information needed to represent these sources. Population estimates, bacteria production rates, and other information would be needed to estimate these sources. Bacteria may also be present in the sediment in some areas, as a result of contamination from stormwater, failing septic systems, malfunctioning sewer systems, agricultural runoff, and other sources. For these TMDLs, the loads contributed by wildlife, sediment, and the other sources were assumed to be included in the land use loading coefficients.

The drainage area and land use distribution of the impaired watersheds are presented in Table 4. Maps of the watershed land use distributions are presented in Appendix C.

Table 4. Land use area distributions for impaired watersheds in the Lower Delaware Water Region

WMA	Lake Assessment Unit ID	Agriculture		Barren Land		Forest		Urban		Water		Wetland		Total Area
		km²	%	km²	%	km²	%	km²	%	km²	%	km²	%	km²
17	4 Seasons Campground Pond-17	0	0.00	0	0.00	0	2.90	0.09	84.80	0.01	8.30	0	4.00	0.1
17	Cedar Lake-17	3.28	20.80	0.02	0.10	8.88	56.40	1.81	11.50	0.18	1.20	1.58	10.00	15.73
17	Eastern Gate Lake-17	4.59	10.90	0.58	1.40	16.03	37.90	14.26	33.70	0.6	1.40	6.23	14.70	42.28
17	Franklinville Lake-17	6.19	17.80	0.31	0.90	10.26	29.50	9.54	27.40	0.2	0.60	8.3	23.80	34.8
17	Holly Green Campground Pond-17	0.3	81.10	0	0.00	0.02	5.30	0.05	12.80	0	0.80	0	0.00	0.37
17	Iona Lake-17	24.02	35.10	0.55	0.80	15.56	22.70	14.4	21.00	0.83	1.20	13.1	19.10	68.46
17	Malaga Lake-17	10	13.80	0.81	1.10	28.47	39.30	20.34	28.10	1	1.40	11.87	16.40	72.49
17	Parvin Lake-17	66.24	53.60	0.43	0.30	23.36	18.90	15.32	12.40	1.42	1.10	16.82	13.60	123.59
17	Sunset Lake-17	81.51	68.90	0.8	0.70	13.39	11.30	14.67	12.40	0.89	0.80	7	5.90	118.26
17	Wilson Lake-17	3.19	13.30	0.44	1.80	7.52	31.30	9.11	37.90	0.33	1.40	3.42	14.30	24.01

18	Lake Silvestro-18	2.29	24.70	0.03	0.30	0.36	3.90	4.36	47.00	0.11	1.10	2.14	23.00	9.29
19	Lake Coxtoxen-19	10.02	7.20	1.69	1.20	35.63	25.70	55.93	40.40	3.72	2.70	31.48	22.70	138.46
19	Lake James-19	0	0.00	0	0.00	0.07	3.60	0.81	42.90	0.28	15.00	0.73	38.50	1.9
19	Mirror Lake-19	0.69	1.00	0.41	0.60	41.69	58.40	14.68	20.60	1.51	2.10	12.4	17.40	71.38
19	Sturbridge Lake-19	0	0.00	0.02	0.70	0.63	22.40	1.95	69.90	0.11	4.00	0.09	3.10	2.8
19	Timber Lake-19	0.26	1.20	0.16	0.70	7.91	37.40	9.79	46.30	0.89	4.20	2.16	10.20	21.17
20	Upper Sylvan Lake-20	0	0.00	0	0.00	0	0.80	0.27	90.30	0.03	8.40	0	0.50	0.3

4.0 WATER QUALITY ANALYSIS

Relating pathogen sources to concentrations of indicator organisms in the impaired waters is distinguished from quantifying that relationship for other pollutants given the inherent variability in population size and dependence not only on physical factors such as temperature and soil characteristics, but also on less predictable factors such as re-growth media. Since bacteria loads and concentrations can vary many orders of magnitude over short distances and over time at a single location, dynamic water quality models can be very difficult to calibrate. Options available to control nonpoint sources of bacteria typically include measures such as sewage infrastructure improvements, goose management strategies, pet waste ordinances, agricultural conservation management plans, and septic system replacement and maintenance. The effectiveness of these control measures is not easily measured relative to observed ambient concentrations. Given these considerations, detailed water quality modeling was not selected for determining the load reductions needed to attain standards and support the designated primary contact recreation use.

Fecal coliform data collected by county and township municipal health departments were used as the basis for TMDL development for the listed pathogen impaired lakes. These data were reviewed to identify potential data excursions in accordance with the Quality Assurance Project Plan (QAPP) that was developed for this study (QAPP, 2007). The percent reduction required to meet New Jersey bathing beach requirements was calculated based on comparing the maximum fecal coliform concentration recorded for each lake to the TMDL target (200 cfu/100 ml). The data available for each lake are included in Appendix D.

4.1 Seasonal Variation/Critical Conditions

The technical approach used to develop these TMDLs includes consideration of seasonal variability and critical conditions. The TMDL lakes are listed as impaired based on the designated primary contact bathing use. Water quality criteria for bathing beaches are established by the New Jersey Department of Health (NJDOH), which conducts monitoring at the municipal level in support of meeting the applicable criteria. Bathing beaches are typically in use during the late spring and summer months and data collection efforts are coordinated to coincide with this time period (May-September). TMDL loading reductions are based on the single sample maximum concentration identified in the record of observed in-lake water quality, therefore, TMDL development is based on the highest concentration observed for the time period of greatest exposure. Seasonal variability is of less importance because of the need to meet NJDOH bathing beach requirements during the summer critical condition period. TMDL loads are presented as average annual loads, which incorporate the summer critical condition period and the average load contributed during the other seasons.

4.2 Margin of Safety

A Margin of Safety (MOS) is provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). For these TMDLs, both an implicit and explicit Margin of Safety (MOS) were incorporated. An implicit MOS was incorporated by using conservative assumptions including treating fecal coliform as a conservative substance (source loads were estimated without including die-off rates, soil incorporation, etc.) and using conservative methods to estimate land-based loads. In addition, a 5% explicit MOS was calculated for each lake.

5.0 TMDL CALCULATIONS

Pathogen load percent reductions were calculated by comparing the maximum fecal coliform concentration recorded for each lake to the TMDL target concentration (200 cfu/100 ml). Load capacities were the remaining loads after applying the required reductions on the current loads. In addition 5% of the load capacity was reserved as the explicit MOS (see example below). The percent reduction specified for each lake was applied equally to pathogen sources in each watershed except in cases where load reductions could be met without reducing the loads contributed by forest, wetlands and barren lands: in such cases these loadings were not reduced in the TMDL allocation. In cases where load reductions on these land use sources were greater than or equal to 99.5%, the percent reduction specified for each lake was applied equally to all pathogen sources including forest and barren land loads.

Percent Reduction = (1 – TMDL target concentration/max concentration) x 100
Load Capacity = (1 – percent reduction) * overall current load (using WTM)
MOS = 5% * Load capacity
Overall percent reduction = 1 – (Load capacity – MOS) / overall current load
Overall current load = Agricultural and Urban land use loads + forest and barren land loads

When $1-\dfrac{Load\ Capacity - MOS - Forest,\ Wetland\ and\ Barren\ Land\ Load}{Agricultural\ and\ Urban\ Land\ Use\ Load} \geq 99.5\%$,

Require the same percent reduction on Forest, Wetlands and Barren land loads as on other land use loads;

Otherwise,

Zero percent reduction on Forest, Wetlands and Barren lands loads

5.1 Wasteload Allocations and Load Allocations

WLAs were established for municipal stormwater discharges subject to regulation under the CWA. LAs were established for all stormwater sources that are not subject to regulation under the CWA and for all other nonpoint sources. Stormwater point sources that received a WLA were distinguished from stormwater sources receiving a LA on the basis of land use type and municipal tier designation (Tier A/Tier B).

This distribution of loading capacity between WLAs and LAs is consistent with recent EPA guidance that clarifies existing regulatory requirements for establishing WLAs for stormwater discharges (Wayland, November 2002). Stormwater discharges are captured within the runoff sources quantified according to land use, as described previously. Distinguishing between regulated and unregulated stormwater is necessary in order to express WLAs and LAs numerically; however, "EPA recognizes that these allocations might be fairly rudimentary because of data limitations and variability within the system" (Wayland, November 2002, p.1). Therefore, allocations are established according to source categories as shown in Table 5. This demarcation between WLAs and LAs based on land use source categories is not perfect, but it represents the best estimate defined as narrowly as data allow. The Department acknowledges that there may be stormwater sources in the residential, commercial, industrial, and mixed urban runoff source categories that are not NJPDES-regulated. Nothing in these TMDLs shall be construed to require the Department to regulate a stormwater source under NJPDES that would not already be regulated as such, nor shall anything in these TMDLs be construed to prevent the Department from regulating a stormwater source under NJPDES.

Table 5. Assignment of WLAs and LAs for stormwater point sources and nonpoint sources

Land Use Source Category	Municipal Tier	TMDL Allocation Type
High density residential	A	WLA
Medium density residential (incl. mixed residential, mixed urban, other urban, military reservations, and no longer military)	A	WLA
Low density residential (incl. rural residential, recreational land, and athletic fields)	A	WLA
Commercial	A	WLA
Industrial	A	WLA
Roadways	A	WLA
High density residential	B	LA
Medium density residential (incl. mixed residential, mixed urban, other urban, military reservations, and no longer military)	B	LA
Low density residential (incl. rural residential, recreational land, and athletic fields)	B	LA

Land Use Source Category	Municipal Tier	TMDL Allocation Type
Commercial	B	LA
Industrial	B	LA
Roadways	B	LA
Agricultural	N/A	LA
Forest/Wetland	N/A	LA
Barren land	N/A	LA

A summary of the WLAs, LAs, and MOS is provided for each lake in Table 6 and source loads and allocations are presented in Table 7. As described above, when the loads contributed by forest/wetland/barren lands were not reduced in the TMDL allocation table, the load reduction for urban lands and agricultural lands was increased proportionally to meet the overall percent reduction required for each lake. Note that the overall percent reduction shown in Tables 6 and 7 takes into account the 5% explicit MOS if not based on the previously established stream Fecal Coliform TMDL.

In cases where impaired lakeshed is hydrologically connected to a streamshed addressed in an established Fecal Coliform TMDL or to another impaired lakeshed, different approaches were utilized to calculate the load reduction for each "nested" watershed.

<u>Lakeshed connected with the Fecal Coliform TMDL established streamshed</u>

If the entire lakeshed is located within the impaired streamshed, the more stringent overall percent reduction between the lake and the stream is applied to the lakeshed. When the streamshed is part of the lakeshed, the rivershed is treated as an upper stream "lake" shed. The same approach, as described below for the nested lakesheds, was used to determine the adjusted load reduction for different areas.

<u>Lakeshed connected with another impaired lakeshed</u>

The following methodology was used to determine the adjusted percent reduction for the nested lake watersheds:

1. Existing pathogen loads calculated for each lake watershed (using WTM) were reduced based on the overall percent reduction that was calculated from the observed lake water quality data. The reduced load was termed the target load.
2. The target load for the upstream watershed was subtracted from the target load of the downstream watershed, giving a target load for the downstream (local) watershed area. The existing load for the downstream (local) watershed was calculated similarly.
3. If the target load for the downstream (local) watershed area was less than or equal to zero, the downstream lake's higher percent reduction needed to be applied to the upper stream lakeshed. This means that the entire drainage area of the downstream lake is ruled by the downstream lake's reduction percentage.

4. If the target load of the downstream (local) watershed area was higher than zero, the percent difference between the existing and target loads for the downstream (local) watershed was calculated. This adjusted percent reduction superseded the original downstream lake percent reduction and was used as the required percent reduction for the downstream (local) watershed area while the upstream lakeshed stayed with the original overall percent reduction. The adjusted percent reduction would be higher than the original overall percent reduction for the downstream lake when the upstream lake required a less percent reduction than the downstream lake and less than the original value if the upstream lake required a higher percent reduction than the downstream lake.

Table 6. TMDL calculations for pathogen impaired lakes in the Lower Delaware Water Region

WMA	Lake Assessment Unit ID	WLA (10^6 colonies/ yr)	LA (10^6 colonies/ yr)	MOS (10^6 colonies/ yr)	TMDL (10^6 colonies/ yr)	Overall % Reduction	% MOS	Reduction from associated Stream TMDL
17	4 Seasons Campground Pond-17[f]	0.00E+00	2.27E+02	1.19E+01	2.39E+02	93.62%	5.00%	84%
17	Cedar Lake-17	0.00E+00	1.39E+04	7.30E+02	1.46E+04	91.36%	5.00%	
17	Eastern Gate Lake-17[b]	1.30E+04	2.37E+03	8.07E+02	1.61E+04	95.00%	5.00%	
17	Franklinville Lake-17[f]	1.31E+04	5.73E+04	3.70E+03	7.40E+04	90.26%	5.00%	67%
17	Holly Green Campground Pond-17	2.18E+02	3.35E+02	2.91E+01	5.82E+02	89.44%	5.00%	
17	Iona Lake-17	1.20E+05	2.49E+05	1.94E+04	3.89E+05	68.24%	5.00%	
17	Malaga Lake-17[c]	2.64E+05	1.44E+05	2.15E+04	4.30E+05	70.59%	5.00%	
17	Parvin Lake-17	3.72E+03	1.29E+05	6.98E+03	1.40E+05	91.36%	5.00%	
17	Sunset Lake-17[g]	9.32E+01	8.31E+03	4.42E+02	8.84E+03	97.93%	5.00%	66%
17	Wilson Lake-17[a]	2.93E+04	3.22E+03	1.71E+03	3.43E+04	95.00%	5.00%	
18	Lake Silvestro-18	1.61E+02	1.40E+02	1.58E+01	3.16E+02	86.81%	5.00%	
19	Lake Coxtoxen-19[e]	6.97E+05	1.71E+05	4.56E+04	9.13E+05	70.14%	5.00%	88%
19	Lake James-19[d]	7.13E+02	2.25E+01	3.87E+01	7.74E+02	99.05%	5.00%	
19	Mirror Lake-19	6.81E+03	7.76E+03	7.67E+02	1.53E+04	98.81%	5.00%	
19	Sturbridge Lake-19[d]	2.99E+03	2.17E+03	2.71E+02	5.43E+03	96.78%	5.00%	
19	Timber Lake-19[d]	5.80E+04	3.06E+04	4.66E+03	9.33E+04	85.38%	5.00%	
20	Upper Sylvan Lake-20	1.09E+03	1.17E+01	5.82E+01	1.16E+03	94.57%	5.00%	

a. located within the watershed of Eastern Gate Lake and goes with Eastern Gate Lake's reduction.
b. located within the watershed of Malaga Lake and stays with its own overall percent reduction.
c. pollutant load reductions in upstream Eastern Gate Lake watersheds may meet the lake water quality requirements. However, as a conservative assumption, the overall reduction selected is the original overall percent reduction without incorporating reductions in the Eastern Gate Lake watershed.
d. Lakeshed located within the watershed of Lake Coxtoxen and stays with its own reduction
e. In addition to three lakes located within its watershed, there is a FC TMDL established streamshed (Sharps Run at route 541, a required reduction of 88%) located within it. The adjusted reduction for the local watershed is reported here.
f. Lakeshed located within the streamshed and stays with its own reduction

- 4 Seasons Campground Pond is nested with the watershed of Salem River at Courses Landing, on which a reduction of 84% was required (NJDEP, 2003).
- Franklinville Lake is nested with the watershed of Little Ease Run at Porchtown, on which a reduction of 67% was required (NJDEP, 2003).

g. Stream shed located within the lake shed and the lake reduction rules

- Sunset Lake is nested with the watershed of Cohansey River at Seeley, on which a reduction of 66% was required (NJDEP, 2003).

Table 7. Lower Delaware Water Region land-based load allocations

WMA	Lake ID Assessment Unit	Overall % Reduction	Agriculture			Barren Land			Forest/Wetland			Urban Total (WLA)			Urban Total (LA)		
			Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load ((10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)
17	4 Seasons Campground Pond-17	94%	0.00E+00	94%	0.00E+00	0.00E+00	0%	0.00E+00	2.06E+01	0%	2.06E+01	0.00E+00	94%	0.00E+00	3.54E+03	94%	2.06E+02
17	Cedar Lake-17	91%	3.16E+04	91%	2.73E+03	4.51E+01	91%	3.90E+00	3.10E+04	91%	2.68E+03	0.00E+00	91%	0.00E+00	9.81E+04	91%	8.47E+03
17	Eastern Gate Lake-17	95%	1.35E+04	95%	6.76E+02	3.94E+02	95%	1.97E+01	3.36E+04	95%	1.68E+03	2.59E+05	95%	1.30E+04	0.00E+00	95%	0.00E+00
17	Franklinville Lake-17	90%	5.97E+04	98%	1.29E+03	9.20E+02	0%	9.20E+02	5.50E+04	0%	5.50E+04	6.05E+05	98%	1.31E+04	1.03E+03	98%	2.21E+01
17	Holly Green Campground Pond-17	89%	2.90E+03	90%	2.77E+02	0.00E+00	0%	0.00E+00	5.84E+01	0%	5.84E+01	2.29E+03	90%	2.18E+02	0.00E+00	90%	0.00E+00
17	Iona Lake-17	68%	2.29E+05	74%	6.00E+04	1.62E+03	0%	1.62E+03	8.49E+04	0%	8.49E+04	4.57E+05	74%	1.20E+05	3.90E+05	74%	1.03E+05
17	Malaga Lake-17[a]	71%	9.64E+04	77%	2.18E+04	2.39E+03	0%	2.39E+03	1.20E+05	0%	1.20E+05	1.17E+06	77%	2.64E+05	0.00E+00	77%	0.00E+00
17	Parvin Lake-17	91%	6.38E+05	99%	5.46E+03	1.28E+03	0%	1.28E+03	1.19E+05	0%	1.19E+05	4.35E+05	99%	3.72E+03	3.41E+05	99%	2.92E+03
17	Sunset Lake-17	98%	1.42E+05	99%	7.89E+02	2.10E+02	0%	2.10E+02	5.97E+03	0%	5.97E+03	1.68E+04	99%	9.32E+01	2.41E+05	99%	1.34E+03
17	Wilson Lake-17	95%	3.07E+04	95%	1.54E+03	1.31E+03	95%	6.56E+01	3.24E+04	95%	1.62E+03	5.87E+05	95%	2.93E+04	0.00E+00	95%	0.00E+00
18	Lake Silvestro-18	87%	1.84E+01	92%	1.39E+00	0.00E+00	0%	0.00E+00	1.38E+02	0%	1.38E+02	2.12E+03	92%	1.61E+02	0.00E+00	92%	0.00E+00

WMA	Lake ID Assessment Unit	Overall % Reduction	Agriculture			Barren Land			Forest/Wetland			Urban Total (WLA)			Urban Total (LA)		
			Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load ((10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)	Existing Load (10^6 colonies/yr)	Percent Reduction	Allocated Load (10^6 colonies/yr)
19	Lake Coxtoxen-19	70%	5.45E+04	74%	1.41E+04	3.76E+03	0%	3.76E+03	1.53E+05	0%	1.53E+05	2.69E+06	74%	6.97E+05	0.00E+00	74%	0.00E+00
19	Lake James-19	99%	0.00E+00	99%	0.00E+00	0.00E+00	99%	0.00E+00	2.37E+03	99%	2.25E+01	7.50E+04	99%	7.13E+02	0.00E+00	99%	0.00E+00
19	Mirror Lake-19	99%	6.67E+03	99%	7.93E+01	1.21E+03	99%	1.44E+01	1.60E+05	99%	1.90E+03	5.74E+05	99%	6.81E+03	4.85E+05	99%	5.76E+03
19	Sturbridge Lake-19	97%	0.00E+00	98%	0.00E+00	5.50E+01	0%	5.50E+01	2.12E+03	0%	2.12E+03	1.58E+05	98%	2.99E+03	0.00E+00	98%	0.00E+00
19	Timber Lake-19	85%	2.52E+03	90%	2.55E+02	4.62E+02	0%	4.62E+02	2.99E+04	0%	2.99E+04	5.73E+05	90%	5.80E+04	0.00E+00	90%	0.00E+00
20	Upper Sylvan Lake-20	95%	0.00E+00	95%	0.00E+00	0.00E+00	0%	0.00E+00	1.17E+01	0%	1.17E+01	2.03E+04	95%	1.09E+03	0.00E+00	95%	0.00E+00

[a] Based on the original overall percent reduction without taking into account the required reductions for the nested lakes and stream

5.2 Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. Reserve capacities are not included for the lakes addressed in these TMDLs. Wastewater treatment facilities will continue to be required to achieve disinfection. Nonpoint source reduction strategies applied to land uses will be equally effective with respect to existing and future use of the land.

6.0 FOLLOW - UP MONITORING

Monitoring requirements for the listed lakes are established under NJDOH regulations for state bathing beaches. NJDOH regulations include sampling requirements before and during seasonal operation. Before bathing beaches are opened each year, NJDOH requires a pre-operational assessment, which includes

- A review of historical sampling and epidemiological data
- A field investigation of the bathing and surrounding areas to identify sources of potential contamination
- A sampling of waters in the bathing area and in areas of suspected sources of contamination

During the bathing season, NJDOH requires that bathing beach water be sampled one week prior to opening and at one-week intervals once in use. Samples are collected during periods of maximum user load and from depths used for bathing. In cases where water samples were found to meet the NJDOH water quality criterion for three consecutive months in the prior year, operators can apply for biweekly sampling responsibilities (NJDOH, 2004).

7.0 IMPLEMENTATION

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint and stormwater source pollution control practices, technologies, processes, citing criteria, operating methods, or other alternatives" (USEPA, 1993).

Development of effective management measures depends on accurate source assessment. Coliform bacteria are contributed to the environment from a number of categories of sources including human, domestic or captive animals, agricultural practices, and wildlife. Coliform bacteria from these sources can reach waterbodies directly, through overland runoff, or through sewage or stormwater conveyance facilities. Each potential source will respond to one or more management strategies designed to eliminate or reduce that source of coliform bacteria. Each management strategy has one or more entities that can take lead responsibility to effect the strategy. Various funding sources are available to assist in accomplishing the management strategies. The Department will address the sources of impairment by matching strategies with sources, selecting responsible entities and aligning available resources to effect implementation.

For example, the stormwater discharged to the impaired waterbodies through "municipal separate storm sewer systems" (MS4s) are regulated under the Department's Municipal Stormwater Regulation Program. Under these rules and associated general permits, many municipalities (and various county, State, and other agencies) are required to implement various control measures that should substantially reduce bacteria loadings, including measures to eliminate "illicit connections" of domestic sewage and other waste to the MS4s. Measures that are currently in effect include ordinances to manage pet waste, prohibit feeding of unconfined wildlife on public property, clean catch basins, perform good housekeeping at maintenance yards, and provide related public education and employee training. These measures are required in accordance with the Department's Municipal Stormwater Regulation program. The Department has provided State funds as well as a portion of its Clean Water Act 319(h) pass through grant funds to assist municipalities in meeting these requirements.

Sewage conveyance facilities are potential sources of fecal coliform in that equipment failure or operational problems may result in the release of untreated sewage. These sources, once identified, can be eliminated through appropriate corrective measures that can be affected through the Department's enforcement authority. Inadequate on-site sewage disposal can also be a source of fecal coliform. Systems that were improperly designed, located or maintained may result in surfacing of effluent; illicit remedies such as connections to storm sewers or streams add human waste directly to waterbodies. Once these problems have been identified through local health departments, sanitary surveys, or other means, alternatives to address the problems can be evaluated and the best solution implemented. The New Jersey Environmental Infrastructure Financing Program, which includes New Jersey's State Revolving Fund, provides low interest loans to assist in correction of water quality problems related to stormwater and wastewater management.

The following lakes have a known geese population problem: Lake James, Lake Coxtoxen, Mirror Lake, Timber Lake, Upper Sylvan Lake, Franklinville Lake, Iona Lake, Malaga Lake and Wilson Lake. Geese are migratory birds that are protected by the Migratory Bird Treaty Act of 1918 and other Federal and State Laws. Resident Canada geese do not migrate, but are nevertheless protected by this and other legislation. The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS)-Wildlife Services program reports that the 1999 estimated population of non-migratory geese in New Jersey was 83,000. Geese may produce up to 1½ pounds of fecal matter a day and when the congregate in large numbers they can represent a locally significant source of coliform bacteria. This may warrant taking steps to reduce populations in these areas.

Because geese are free to move about and commonly graze and rest on large grassy areas associated with schools, parks, golf courses, corporate lawns, and cemeteries, measures to reduce populations, where necessary, are best developed and conducted at the community level through a community-based goose damage management program. USDA's Wildlife Services program recommends that a community prepare a written Canada Goose Damage Management Plan that may include the following actions:

- Initiate a fact-finding and communication plan

- Enact and enforce a “no feeding” ordinance (already required per MS4 permits)
- Conduct goose damage control activities such as habitat modification
- Review and update land use policies
- Reduce or eliminate goose reproduction (permit required)
- Hunt geese to reinforce nonlethal actions (permit required)

Procedures such as handling nests and eggs, capturing and relocating birds, and the hunting of birds require a depredation permit from either the USDA APHIS Wildlife Services or U.S. Fish and Wildlife Services. Procedures requiring permits should be a last resort after a community has exhausted the other listed measures. The Department’s draft guide *Management of Canada Geese in Suburban Areas, March 2001,* which may be found at www.state.nj.us/dep/watershedmgt under publications, provides extensive guidance on how to modify habitat to serve as a deterrent to geese as well as other prevention techniques such as education through signage and ordinances.

In coastal areas, other waterfowl are naturally present in significant numbers and vary seasonally with migratory patterns. Other wildlife contributions may include deer populations, which have been identified as a potential fecal coliform source in the impaired watersheds. The forested and low-density residential areas that provide deer habitat can be found in close proximity to the impaired watersheds. Deer have been evaluated in fecal coliform TMDLs by other States (e.g. Alabama and South Carolina) and could be a fecal coliform source in New Jersey. Management measures to reduce coliform bacteria contributed by wildlife are not generally practicable, but could respond to measures such as improved riparian buffers.

Agricultural activities are another example of potential sources of coliform bacteria. Possible contributors are direct contributions from livestock permitted to traverse streams and stream corridors, manure management from feeding operations, or use of manure as a soil fertilizer/amendment. Implementation of conservation management plans and best management practices are the best means of controlling agricultural sources of coliform bacteria. Several programs are available to assist farmers in the development and implementation of conservation management plans and best management practices. The Natural Resource Conservation Service is the primary source of assistance for landowners in the development of resource management pertaining to soil conservation, water quality improvement, wildlife habitat enhancement, and irrigation water management. The USDA Farm Services Agency performs most of the funding assistance. All agricultural technical assistance is coordinated through the locally led Soil Conservation Districts. The funding programs include:

- **The Environmental Quality Incentive Program (EQIP)** is designed to provide technical, financial, and educational assistance to farmers/producers for conservation practices that address natural resource concerns, such as water quality. Practices under this program include integrated crop management, grazing land management, well sealing, erosion control systems, agri-chemical handling facilities, vegetative filter strips/riparian buffers, animal waste management facilities and irrigation systems.

- **The Conservation Reserve Program (CRP)** is designed to provide technical and financial assistance to farmers/producers to address the agricultural impacts on water quality and to maintain and improve wildlife habitat. CRP practices include the establishment of filter strips, riparian buffers and permanent wildlife habitats. This program provides the basis for the Conservation Reserve Enhancement Program (CREP).

- **The Conservation Reserve Enhancement Program** The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, have established a $100 million dollar CREP agreement. The program matches $23 million of State money with $77 million from the Comodity Credit Corporation within USDA. Through CREP, financial incentives are offered for agricultural landowners to voluntarily implement conservation practices on agricultural lands. NJ CREP will be part of the USDA's Conservation Reserve Program (CRP). There will be a ten-year enrollment period, with CREP leases ranging between 10-15 years. The State intends to augment this program thereby making these leases permanent easements. The enrollment of farmland into CREP in New Jersey is expected to improve stream health through the installation of water quality conservation practices on New Jersey farmland.

Management strategies are summarized below in Table 8.

Table 8. Implementation management strategies

Source Category	Responses	Potential Responsible Entity	Funding options
Human Sources			
Inadequate (per design, operation, maintenance, location, density) on-site disposal systems	Sanitary surveys, septic management programs/ordinances	Municipality	CWA 604(b) for confirmation of inadequate condition; Environmental Infrastructure Financing Program for construction of selected option
Inadequate or improperly maintained stormwater facilities; illicit connections	Measures required under Municipal Stormwater permitting program including any additional measures determined in the future to be needed through TMDL process	Municipality, State and County regulated entities, stormwater utilities	CWA 319(h); Environmental Infrastructure Financing Program for construction of selected option
Malfunctioning sewage conveyance facilities	Identify through source trackdown and repair	Owner of malfunctioning facility--compliance issue	User fees
Domestic/captive animal sources			
Pets	Pet waste ordinances	Municipalities for ordinance adoption and compliance	State source and CWA 319(h) assistance to municipalities to implement municipal stormwater regulations

Source Category	Responses	Potential Responsible Entity	Funding options
Horses, livestock, zoos	Confirm through source trackdown: SCD/NRCS develop conservation management plans	Property owner	EQIP, CRP, CREP
Agricultural practices	Confirm through source trackdown; SCD/NRCS develop conservation management plans, exercise CAFO/AFO authority if applicable	Property owner	EQIP, CRP, CREP
Wildlife			
Locally excessive populations of resident Canada geese or other waterfowl	Feeding ordinances; Goose Management BMPs	Municipality for ordinance; local community groups for BMPs	State source; CWA 319(h)
Indigenous wildlife	Confirm through trackdown; riparian buffer restoration; consider revising designated uses	State	State source

7.1 Specific Projects

In addition to the more generalized strategies described previously, a number of projects have been undertaken which are expected to aid in achieving the load reductions assigned to the impaired waterbodies. Ongoing activities to develop and implement watershed restoration plans are expected to result in additional specific projects to reduce pollutant loads.

Table 9. Lower Delaware Water Region Outreach and Restoration Projects

WMA	FY	Funding Source	Recipient	Project Title	Grant Amount
17	2005	319	Rutgers	Watershed Restoration Plan for the Upper Cohansey River Watershed (Sunset Lake)	$314,165

<u>Microbial Source Tracking Efforts</u>

MST methods have already been successfully employed at the Department in the past decade. Since 1988, the Department has worked cooperatively with the University of North Carolina in developing and determining the application of RNA coliphage as a pathogen indicator. This research was funded through USEPA and Hudson River Foundation grants. These studies showed that the RNA coliphages are useful as an indicator of fecal contamination, particularly in chlorinated effluents and that they can be serotyped to distinguish human and animal fecal contamination. Through these studies, the Department has developed an extensive database of the presence of coliphages in defined contaminated areas (point human, nonpoint human, point animal, and nonpoint animal).

More recently, the Department has established a MST methodolgy that utilizes both genotype (genotyping of F+RNA coliphages) and phenotype (MAR testing) tests The results of these tests are collectively evaluated to best determine sources of fecal contamination. The Bureau's methodology includes evaluation of long-term microbial results as well as data (GIS Land use coverage, aerial photographs, visual assesments) of actual and potential sources, stormwater monitoring to deliniate location of major sources and the use of MAR and F+ coliphage in conjunction with conventional microbial indicators. This methodology has been successfully applied in several areas including; Seaside Park, Long Swamp, Atlantic City, and Parvin State Park. As a result of established stream Fecal coliform TMDLs, a TMDL source tracking project was completed which included this MST methodology as well as collection of additional conventional microbial indicators. Data has been collected at over 220 sites in select TMDL watersheds throughout the state. Five of these sites fall within the lakesheds of Franklinville Lake and Malaga Lake as identified below. The table summarizes the results of the conventional microbial indicator sampling as well as the MST tests.

Lake	MST Station ID	Station Name	Fecal Coliform* CFU/100ml			Potential Sources	
			Min	Max	Geo Mean	Coliphage Genotype	MAR Profile
Franklinville Lake	BA64B	Trib to Little Ease Run on Carpenter Road in Clayton	Non Detect	2400	104	NA	NA
	BA65	Little Ease Run on Academy Street (Route 610) in Clayton	20	2400	178	NA	NA
	BA66	Little Ease Run on Grant Avenue in Franklinville	Non Detect	16000	177	No Phage+	Wildlife
	BA67	Little Ease Run on 538 (Coles Mill Rd) Franklinville	Non Detect	9000	180	No Phage+	Wildlife/ Domestic Animal
Malaga Lake	BA 69	Indian Br on Rt 47 Bridge # 0812-153/54.17	17*	60*	29*	No Phage+	Wildlife

*E.coli in CFU/100ml

+No coliphage was found in sample and therefore was not used in source assessment, further monitoring is recommended during adverse pollution conditions.

8.0 REASONABLE ASSURANCE

With the implementation of source reduction measures such as reducing the number of failing septic systems, leaching sewer lines, and controlling agricultural runoff, the Department has reasonable assurance that a significant improvement in the support of primary contact recreation in the impaired lakes will be attained. The results from on-going existing monitoring programs will be evaluated to determine effectiveness of the identified measures and if additional measures are needed.

9.0 PUBLIC PARTICIPATION

The Water Quality Management Planning Rules at N.J.A.C. 7:15-7.2 require the Department to initiate a public process prior to the development of each TMDL and to allow public input to the Department on policy issues affecting the development of the TMDL. Further, the Department shall propose each TMDL as an amendment to the appropriate area-wide water quality management plan in accordance with procedures at N.J.A.C. 7:15-3.4(g). As part of the public participation process for the development and implementation of the subject TMDLs, the Department solicited information from stakeholder groups and from the general public directly and through a web posting beginning in October 2006. Additionally in November 2006, the list of impaired lakes was distributed to the New Jersey volunteering monitoring community, through the Watershed Watch Network. The Watershed Watch Network is a program acting as an umbrella for all of the volunteer monitoring programs within New Jersey. Interested parties had the opportunity to supply the Department with information about each lake via e-mail. The Department specifically solicited information regarding potential sources and/or current nonpoint sources of pollution reduction projects within the impaired watersheds. Information received regarding potential sources of fecal contamination were assessed in the development of these TMDLs.

10.0 AMENDMENT PROCESS

Notice proposing these TMDLs appeared in the July 16, 2007 New Jersey Register and in a newspaper of general circulation in order to provide the public an opportunity to review the TMDL document and submit formal comments. In addition, a public hearing was held on August 17, 2007 at the New Jersey Department of Environmental Protection Public Hearing Room, 401 E. State St., Trenton, NJ 08608. There was an informal presentation from 1:00 p.m. to 2:00 p.m., followed by the public hearing from 2:00 p.m. until the end of testimony, whichever was earlier. Notice of the proposal and hearing was provided to affected municipalities, and lake associations in the watershed.

There were no comments received during the public notice period or at the public hearing. This TMDL was approved by EPA on September 28, 2007 and was adopted on October 19, 2009 as an amendment to the Atlantic County, Lower Delaware Ocean County and Tri-County Water Quality

Management Plans in accordance with New Jersey's Water Quality Management Planning Rules at N.J.A.C. 7:15-3.4 (g).

APPENDIX A: REFERENCES

WTM 2001, Bacteria Load Estimation methods used to estimate land-based bacteria load contributions: Watershed Treatment Model (WTM). Developed by the Center for Watershed Protection in July 2001.

Caraco, D. 2001. The Watershed Treatment Model, Version 3.0. Center for Watershed Protection, Ellicott City, MD.

Fecal Coliform Bacteria Total Maximum Daily Load, Limetree Bay, St. Thomas, U.S. Virgin Islands. Final Draft. Tetra Tech. May 2005.

New Jersey Department of Environmental Protection (NJDEP). Total Maximum Daily Loads for Fecal Coliform to Address 27 Streams in the Lower Delaware Water Region. September, 2003

New Jersey Department of Environmental Protection, Integrated Water Quality Monitoring and Assessments Methods, November 2003

New Jersey Department of Environmental Protection, New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)

New Jersey Department of Environmental Protection, Surface Water Quality Standards, N.J.A.C. 7:9B, June 2005

"NJDEP 2004 Integrated Water Quality Monitoring and Assessment Report", published 6/2004 by NJDEP, Watershed Assessment Group (WAT). Online at: http://www.nj.gov/dep/gis/irshp2004.html Key shapefile coverage includes ir_lake2004.shp.

"NJDEP 2002 Land use/Land cover by WMA", published 2/06/2007 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), and delineated by watershed management area. Online at: http://www.nj.gov/dep/gis/lulc02cshp.html

"NJDEP 2002 Stream Update", published 06/2006 by NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA). Online at: http://www.nj.gov/dep/gis/hydro02shp.html

"NJDEP 30-meter Digital Elevation Model (DEM) for New Jersey by WMA" published 06/01/2002 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), and delineated by watershed management area. Online at: http://www.nj.gov/dep/gis/wmalattice.html

"NJDEP 14 Digit Hydrologic Unit Code delineations for New Jersey (DEPHUC14)", published 01/20/2006 by NJDEP, New Jersey Geological Survey (NJGS). Online at: http://www.nj.gov/dep/gis/stateshp.html

"NJDEP County Boundaries for the State of New Jersey", published 01/2005 by NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), Online at: http://www.nj.gov/dep/gis/stateshp.html

"NJDEP Lakes (Open Water Areas) by County", published by NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), Online at: http://www.nj.gov/dep/gis/lakesshp.html

"NJDEP Municipality Boundaries for the State of New Jersey", published 01/2005 by NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS). Online at: http://www.nj.gov/dep/gis/stateshp.html

New Jersey Department of Health and Senior Services, New Jersey State Sanitary Code Chapter IX Public Recreational Bathing, March 2004

"NJDEP Sewer Service Areas for State of New Jersey", published 10/2006 by NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS). Online at: http://www.nj.gov/dep/gis/stateshp.html

"NJPDES Surface Water Discharges", published 05/16/2006 by NJDEP. Online at http://www.nj.gov/dep/gis/stateshp.html

NJPDES point sources, provided by NJDEP on 4/12/2007.

QAPP 2007, Development of New Jersey 2007 Lake Fecal Coliform TMDLs. Contract No. 68-C-02-108. U.S. Environmental Protection Agency Region 2.

Sutfin, C.H. May 2002. Memo: EPA Review of 2002 Section 303(d) Lists and Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992. Office of Wetlands, Oceans and Watersheds, U.S. EPA.

U.S. Environmental Protection Agency (EPA). 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-92-002. Washington, DC.

U.S. Environmental Protection Agency (EPA). January 2001. Protocol for Developing Pathogen TMDLs, First Edition, EPA 841-R-00-002, ("Pathogen Protocol"), Washington, DC.

Wayland, R.H. III. November 22, 2002. Memo: Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. Office of Wetlands, Oceans and Watersheds, U.S.E.P.A.

APPENDIX B: NJPDES WASTEWATER TREATMENT FACILITIES, TIER A MUNICIPALITIES, TIER B MUNICIPALITIES

Lower Delaware Water Region Wastewater Treatment Facilities

NJPDES ID	Facility Name	Pipe	FC Limit	Permit Category*	Receiving Waters/Associated Lake
NJ0024031	Evesham Twp MUA - Elmwood	001A	NA	A	Rancocas Creek S B/Lake Coxtoxen
NJ0021326	Medford Lakes Boro	001A	NA	A	Aetna Run (Rancocas Ck SB)/Timber Lake

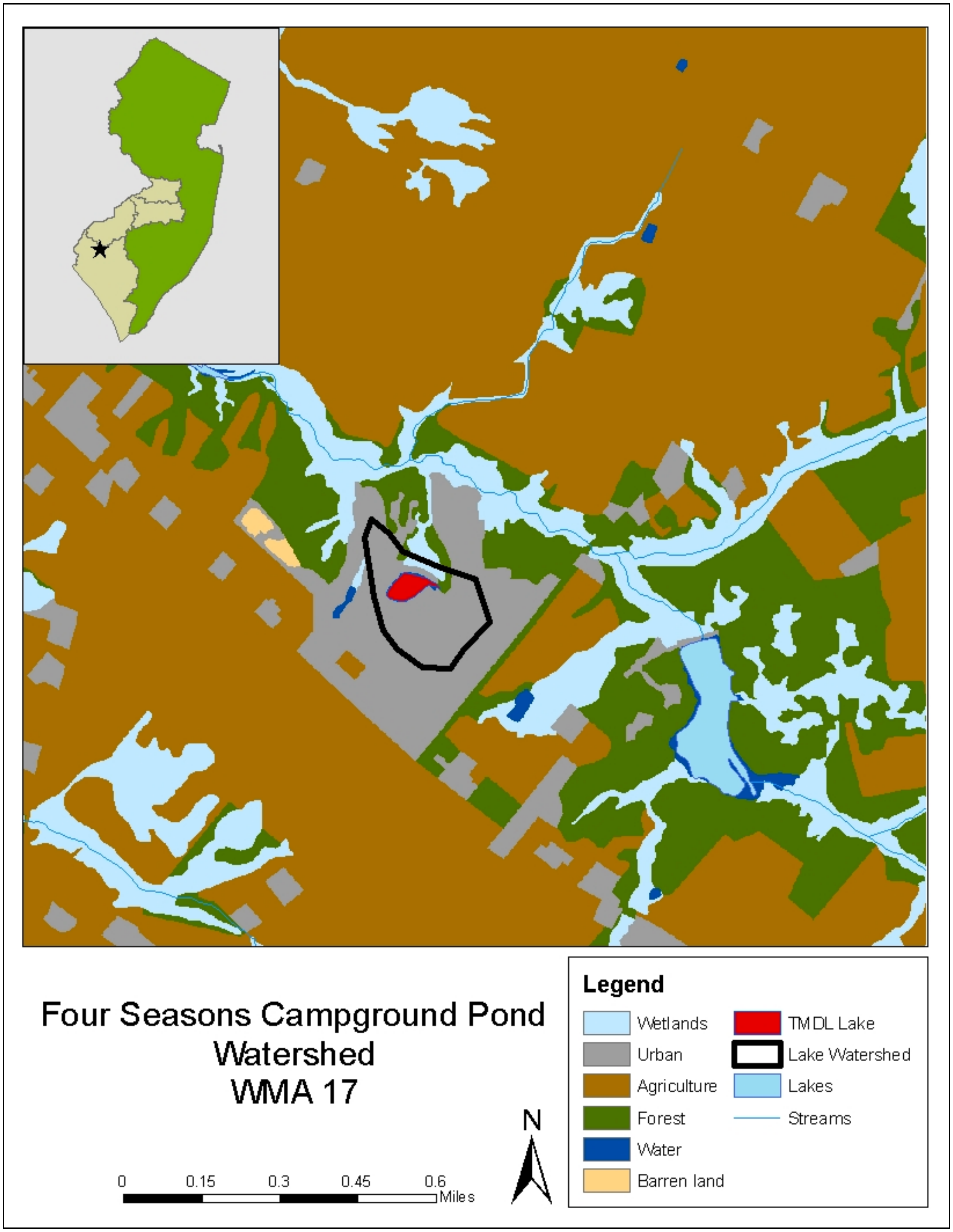
*Permit Categories: A = Sanitary Surface Water Discharge

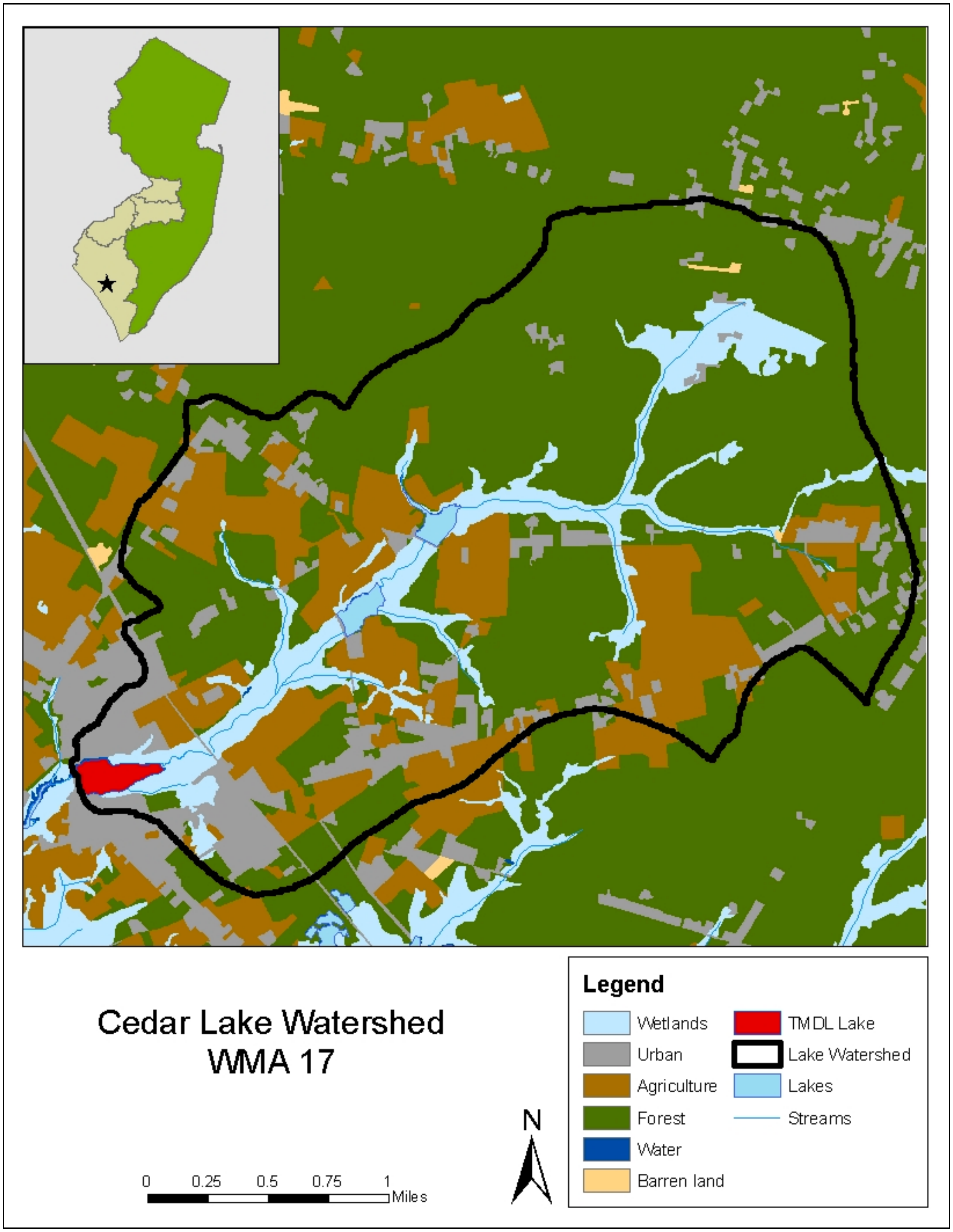
Lower Delaware Water Region Tier A and Tier B Municipalities

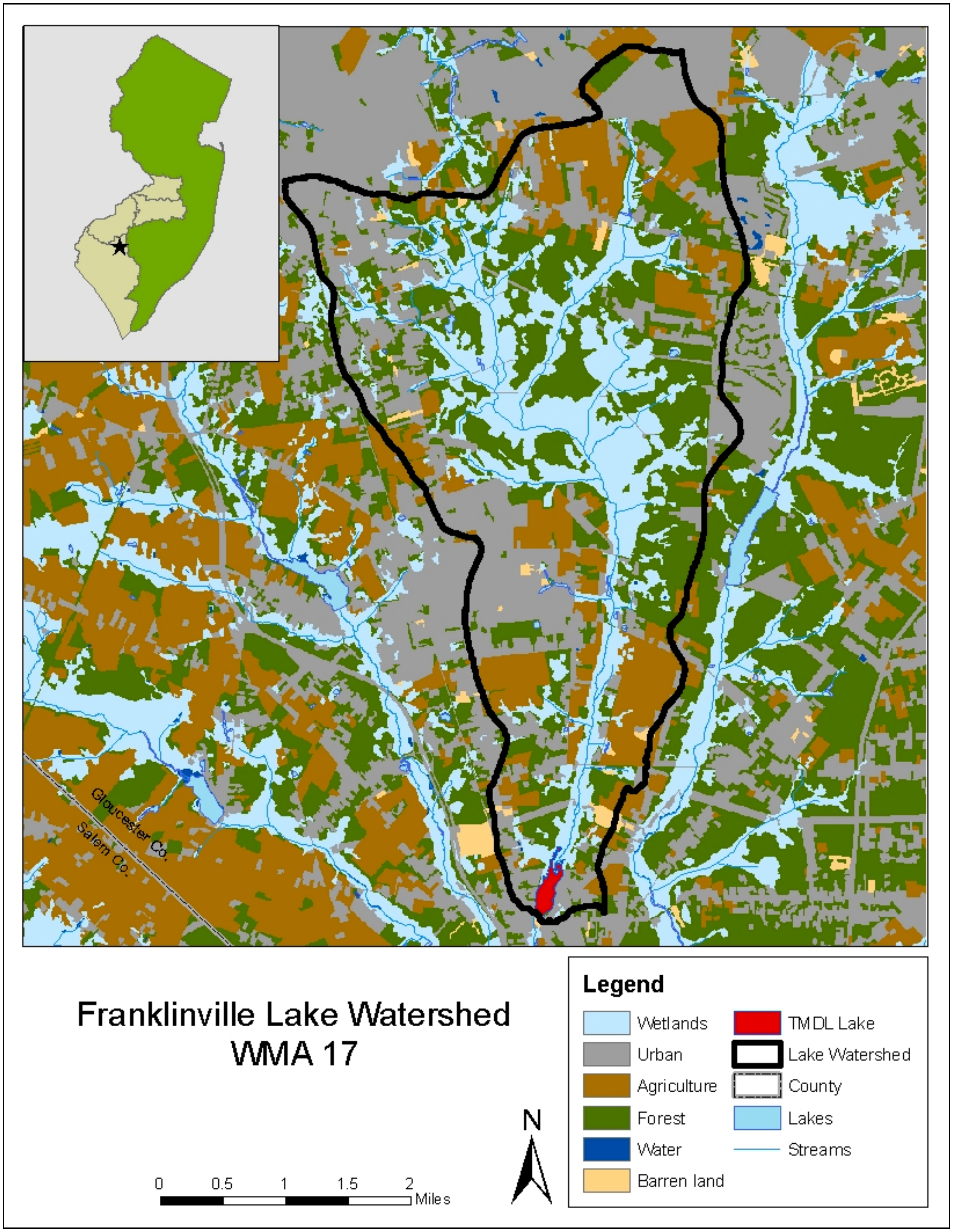
Tier	Watershed	Municipality	WMA	Permit #
A	Franklinville Lake	Washington Twp	17	NJG0153664
		Glassboro Boro	17	NJG0148270
		Monroe Twp	17	NJG0148946
		Clayton Boro	17	NJG0150754
		Franklin Twp	17	NJG0151025
	Malaga Lake	Monroe Twp	17	NJG0148946
		Clayton Boro	17	NJG0150754
		Franklin Twp	17	NJG0151025
		Washington Twp	17	NJG0153664
	Iona Lake	Glassboro Boro	17	NJG0148270
		Clayton Boro	17	NJG0150754
		Franklin Twp	17	NJG0151025
		Pittsgrove Twp	17	NJG0154512
	Parvin Lake	Pittsgrove Twp	17	NJG0154512
	Sunset Lake	Bridgeton City	17	NJG0147826
	Eastern Gate Lake	Washington Twp	17	NJG0153664
		Monroe Twp	17	NJG0148946
		Franklin Twp	17	NJG0151025
		Clayton Boro	17	NJG0150754
	Holly Green Campground	Franklin Twp	17	NJG0151025
	Wilson Lake	Washington Twp	17	NJG0153664
		Monroe Twp	17	NJG0148946
		Clayton Boro	17	NJG0150754
		Franklin Twp	17	NJG0151025
	Lake Silvestro	Greenwich Twp	18	NJG0151009
	Mirror Lake	Jackson Twp	19	NJG0150665
		Manchester Twp	19	NJG0152951
		Pemberton Twp	19	NJG0148652
	Lake Coxtoxen Timber Lake	Mount Laurel Twp	19	NJG0150029
		Medford Twp	19	NJG0151661
		Evesham Twp	19	NJG0153451
		Tabernacle Twp	19	NJG0150126
		Voorhees Twp	19	NJG0151653

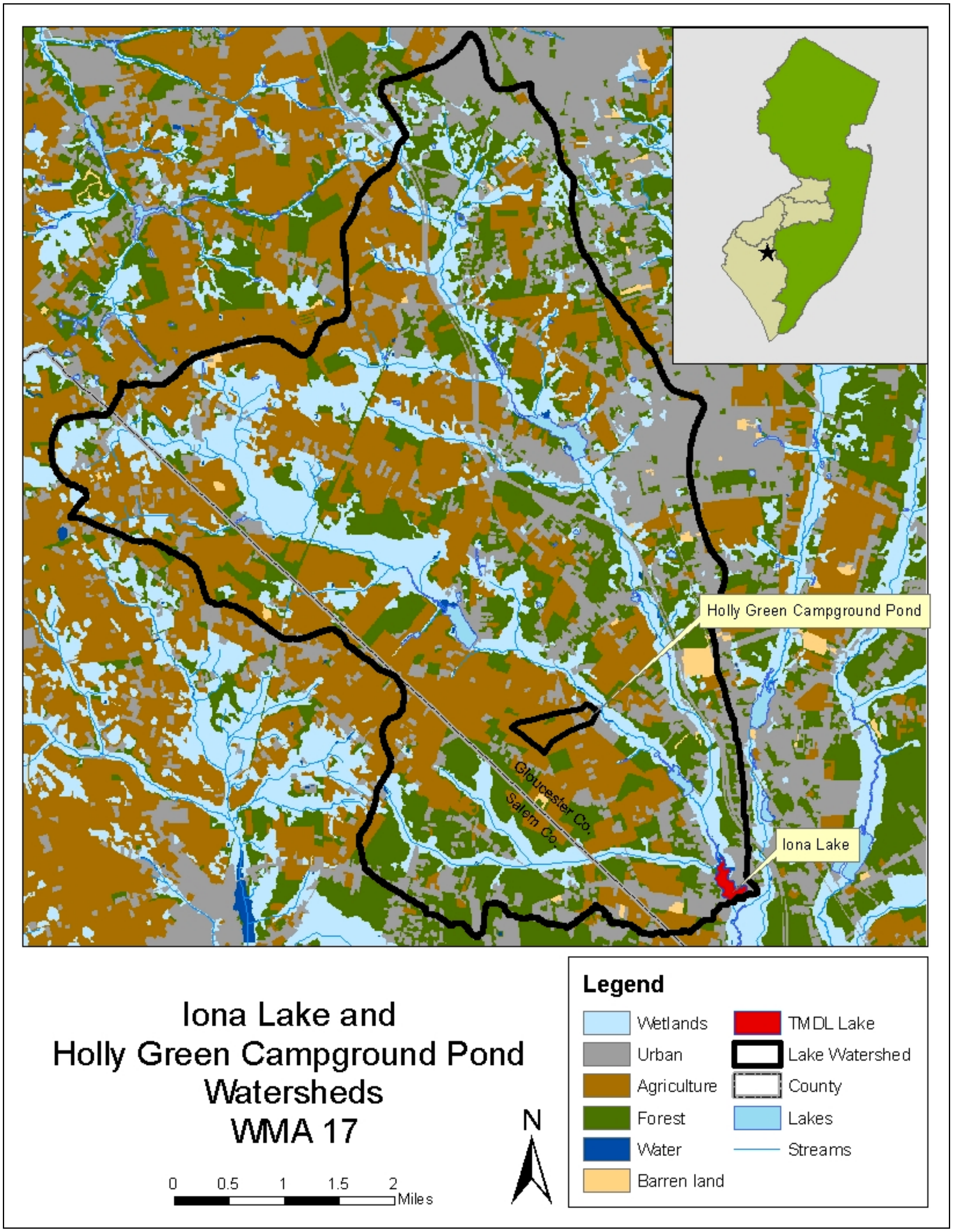
		Medford Lakes Boro	19	NJG0150851
		Gibbsboro Boro	19	NJG0152773
		Shamong Twp	19	NJG0148296
		Berlin Twp	19	NJG0153222
		Medford Twp	19	NJG0151661
		Tabernacle Twp	19	NJG0150126
		Medford Lakes Boro	19	NJG0150851
		Shamong Twp	19	NJG0148296
	Lake James	Evesham Twp	19	NJG0153451
	Sturbridge Lake	Berlin Twp	19	NJG0153222
		Evesham Twp	19	NJG0153451
		Voorhees Twp	19	NJG0151653
	Upper Sylvan Lake	Burlington Twp	20	NJG0149454
B	Franklinville Lake	Elk Twp	17	NJG0148997
	Iona Lake	Elk Twp	17	NJG0148997
		Upper Pittsgrove Twp	17	NJG0155110
	Cedar Lake	Lawrence Twp	17	NJG0151696
	Parvin Lake	Upper Pittsgrove Twp	17	NJG0155110
		Elmer Boro	17	NJG0148377
		Upper Deerfield Twp	17	NJG0149624
		Deerfield Twp	17	NJG0154750
	Sunset Lake	Upper Pittsgrove Twp	17	NJG0155110
		Alloway Twp	17	NJG0152731
		Upper Deerfield Twp	17	NJG0149624
		Hopewell Twp	17	NJG0154903
		Stow Creek Twp	17	NJG0154962
		Shiloh Boro	17	NJG0154857
	4 Seasons Campground	Pilesgrove Twp	17	NJG0152714
	Mirror Lake	Plumsted Twp	19	NJG0154351
		New Hanover Twp	19	NJG0152722

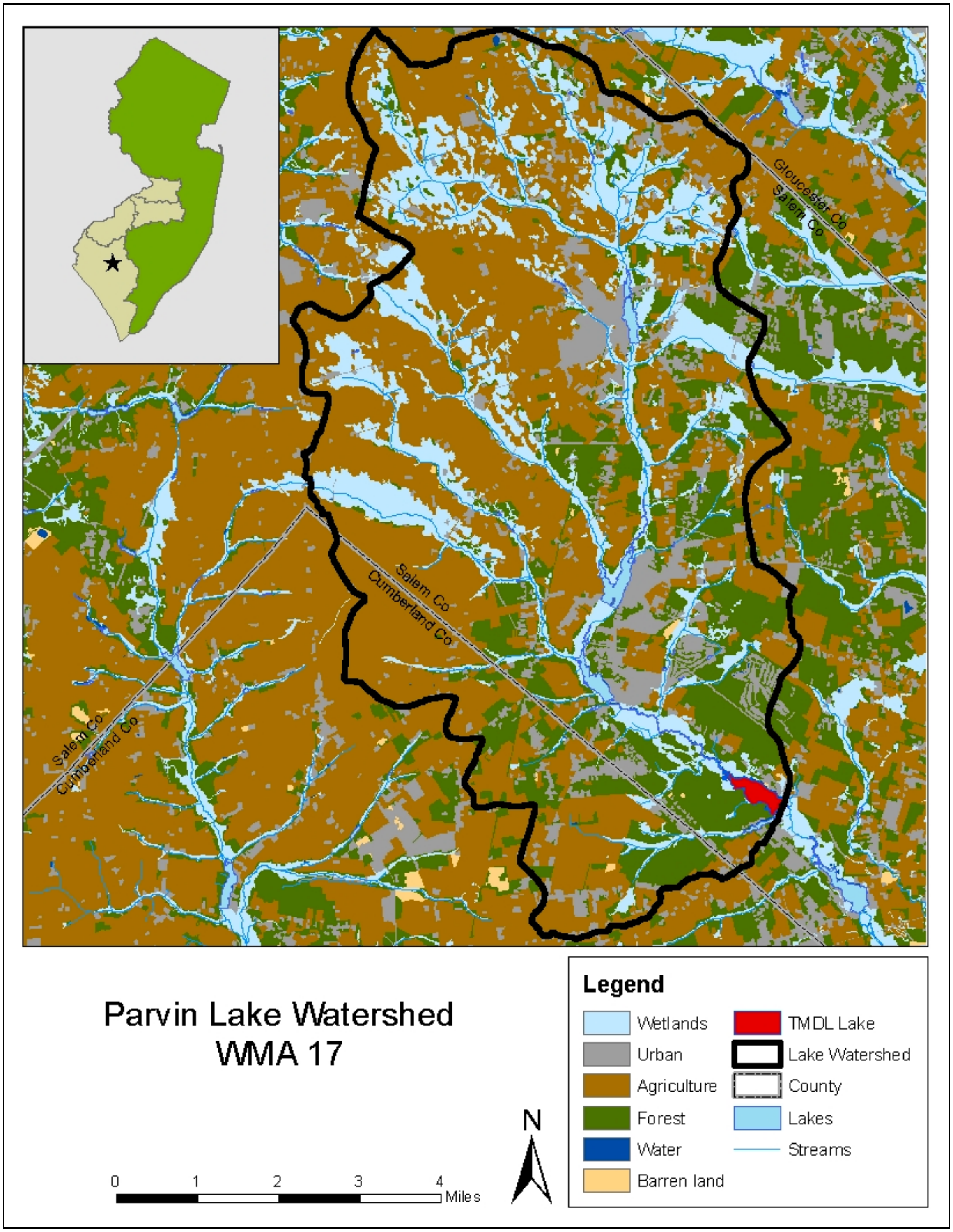
APPENDIX C: LAKE WATERSHED MAPS

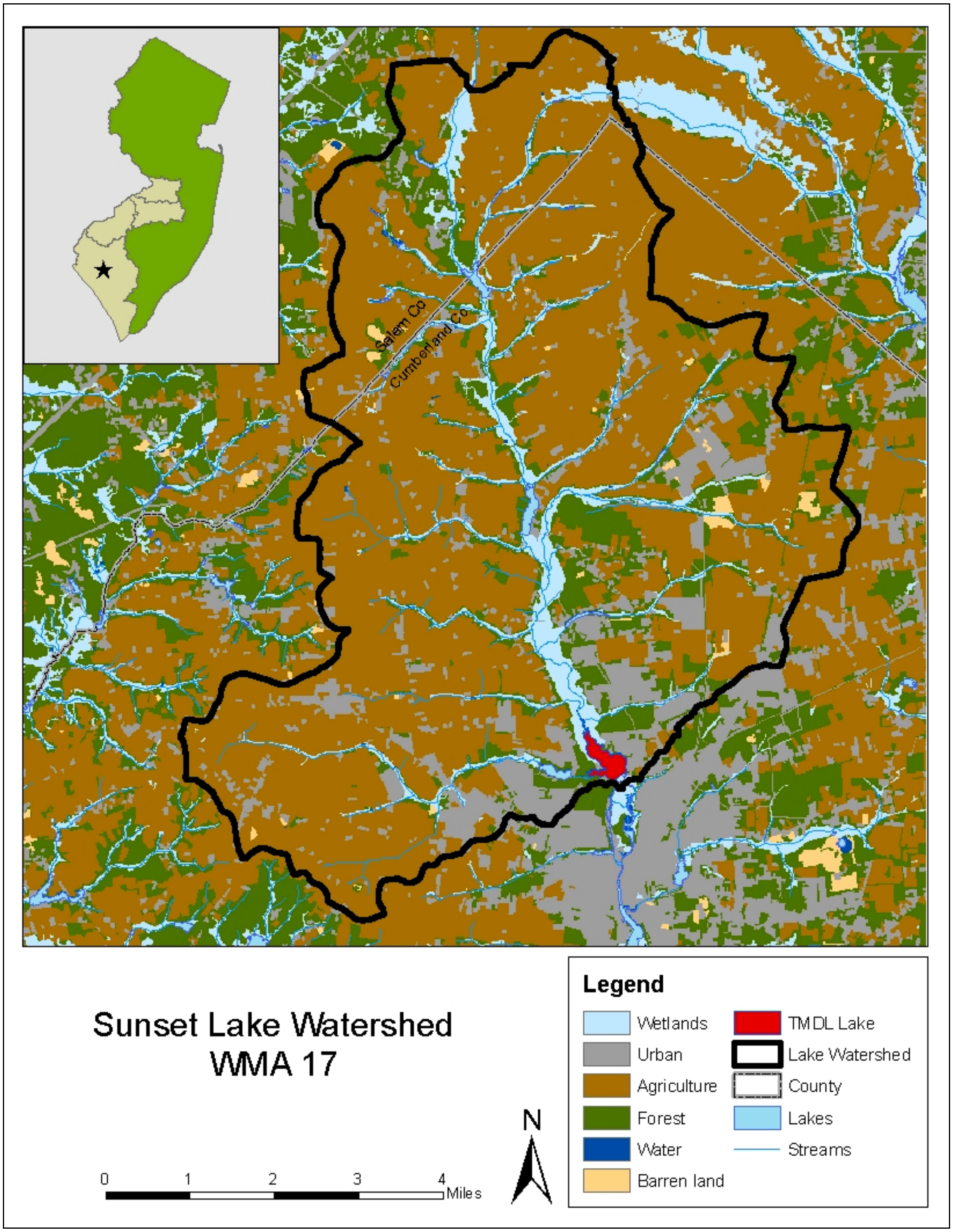



Cedar Lake Watershed
WMA 17
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
Lakes
Streams
N
0
0.25
0.5
0.75
1
Miles

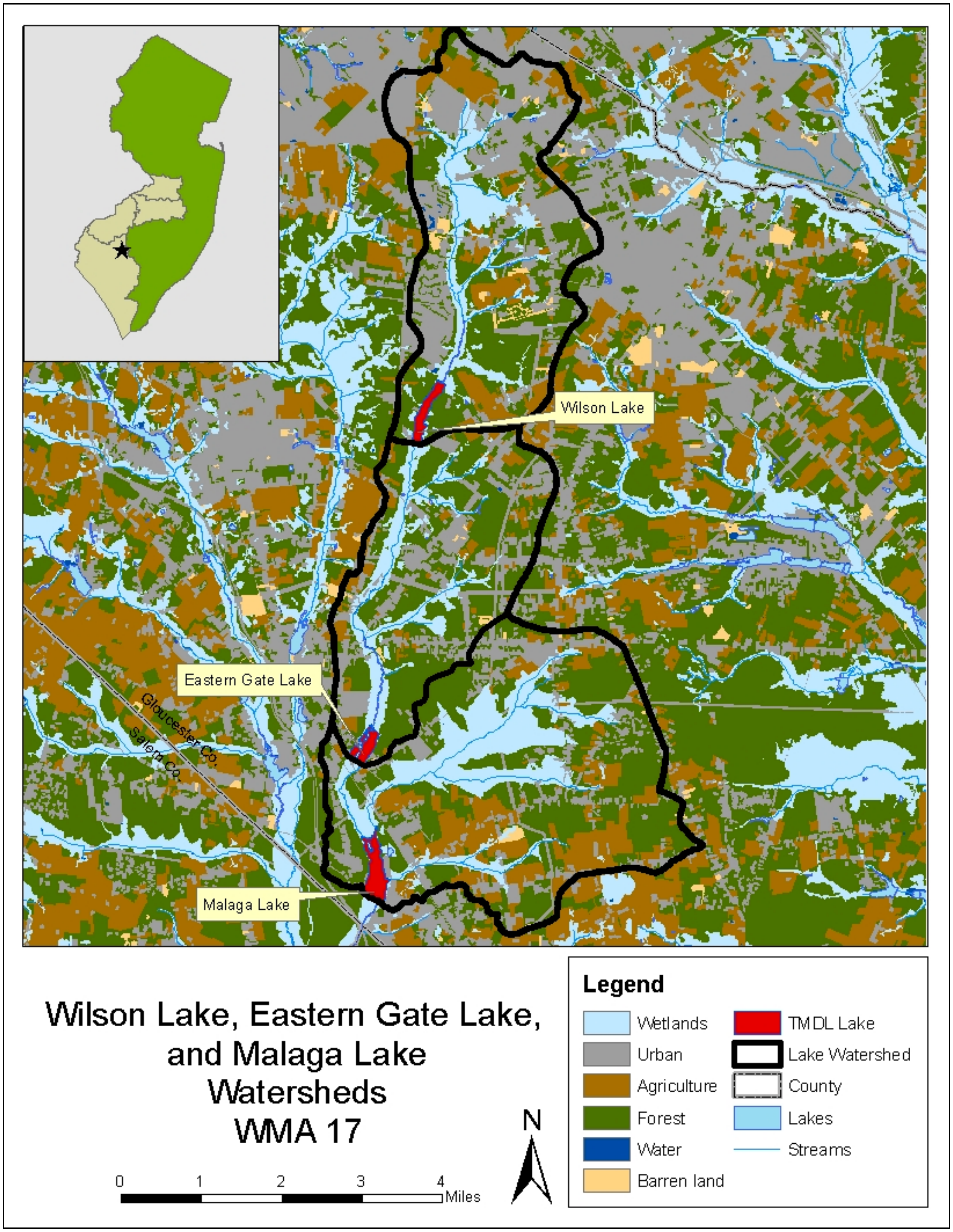

Gloucester Co.
Salem Co.
Franklinville Lake Watershed
WMA 17
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams
N
0
0.5
1
1.5
2
Miles

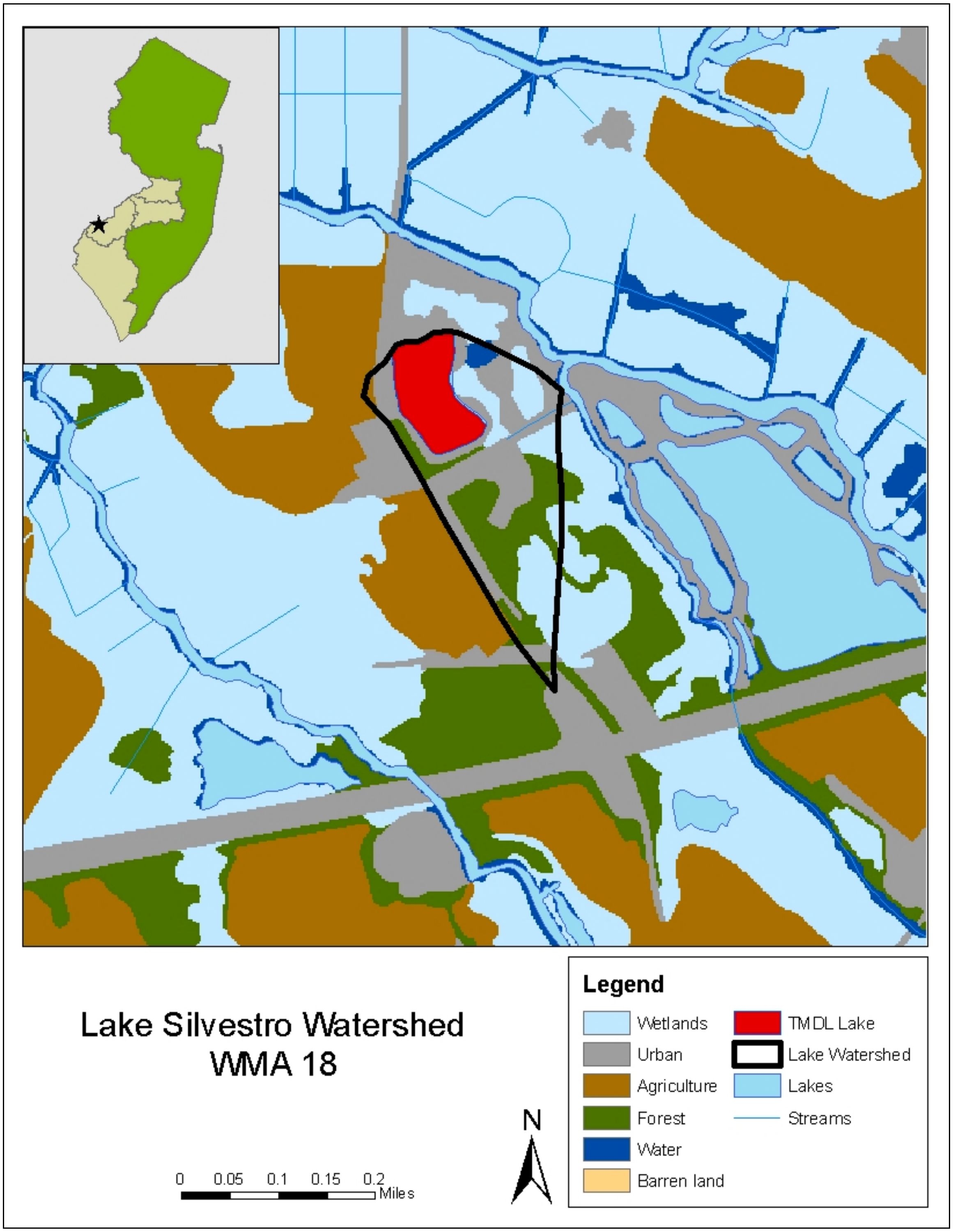

Holly Green Campground Pond
Iona Lake
Gloucester Co.
Salem Co.
Iona Lake and
Holly Green Campground Pond
Watersheds
WMA 17
0
0.5
1
1.5
2
Miles
N
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams

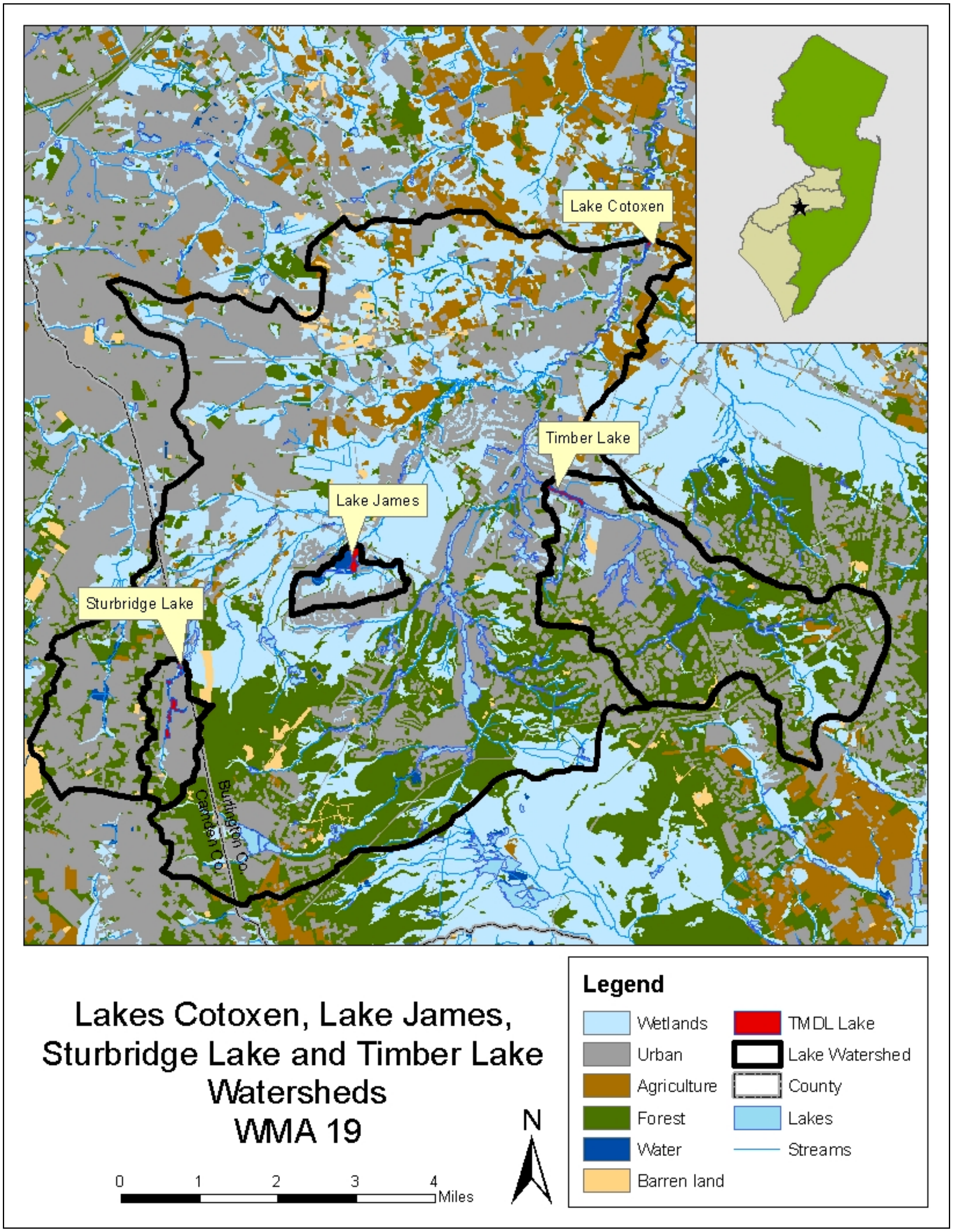

Parvin Lake Watershed
WMA 17
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams
0
1
2
3
4
Miles
N
Gloucester Co
Salem Co
Salem Co
Cumberland Co
Salem Co
Cumberland Co

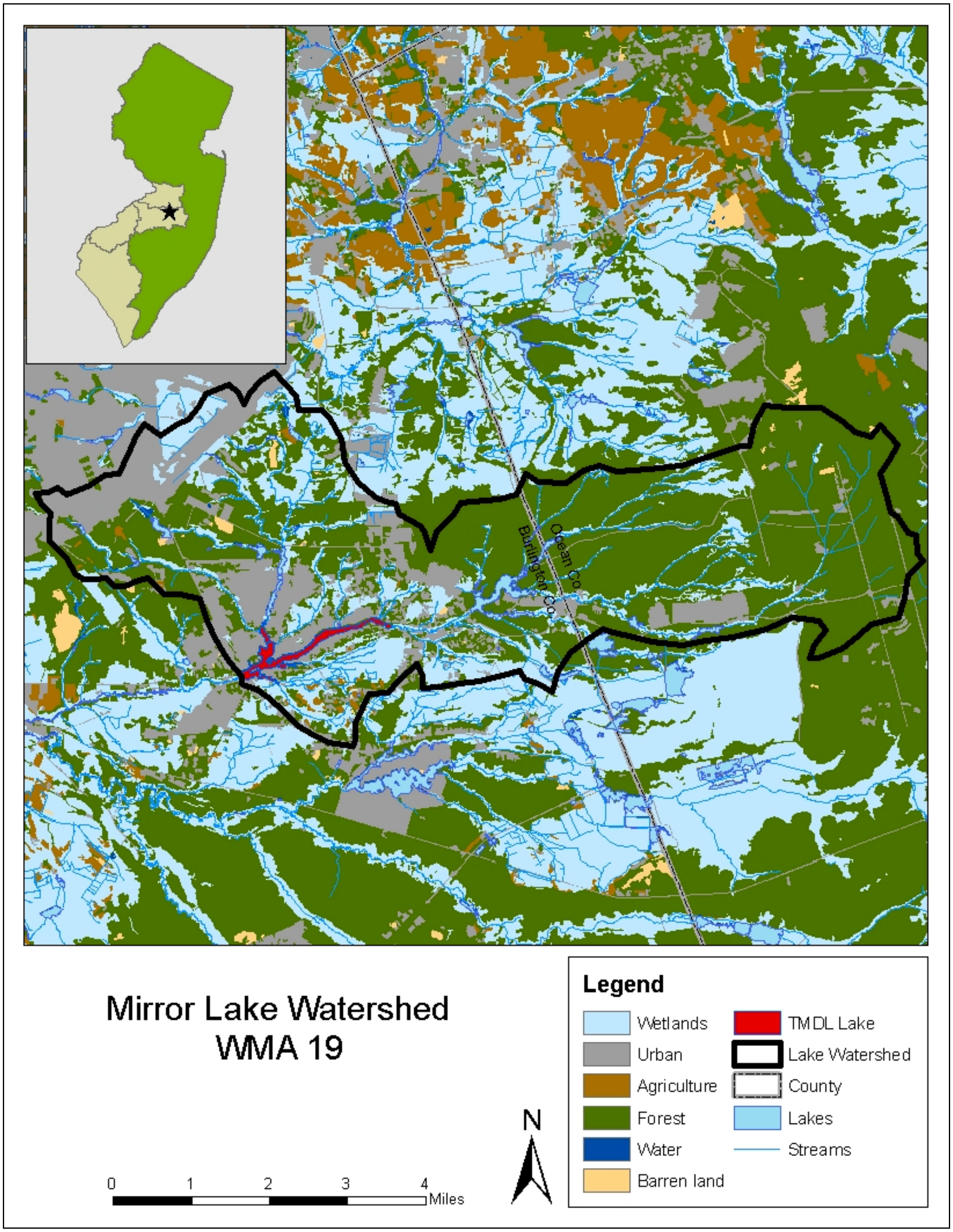


Salem Co
Cumberland Co
Sunset Lake Watershed
WMA 17
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams
N
0
1
2
3
4
Miles

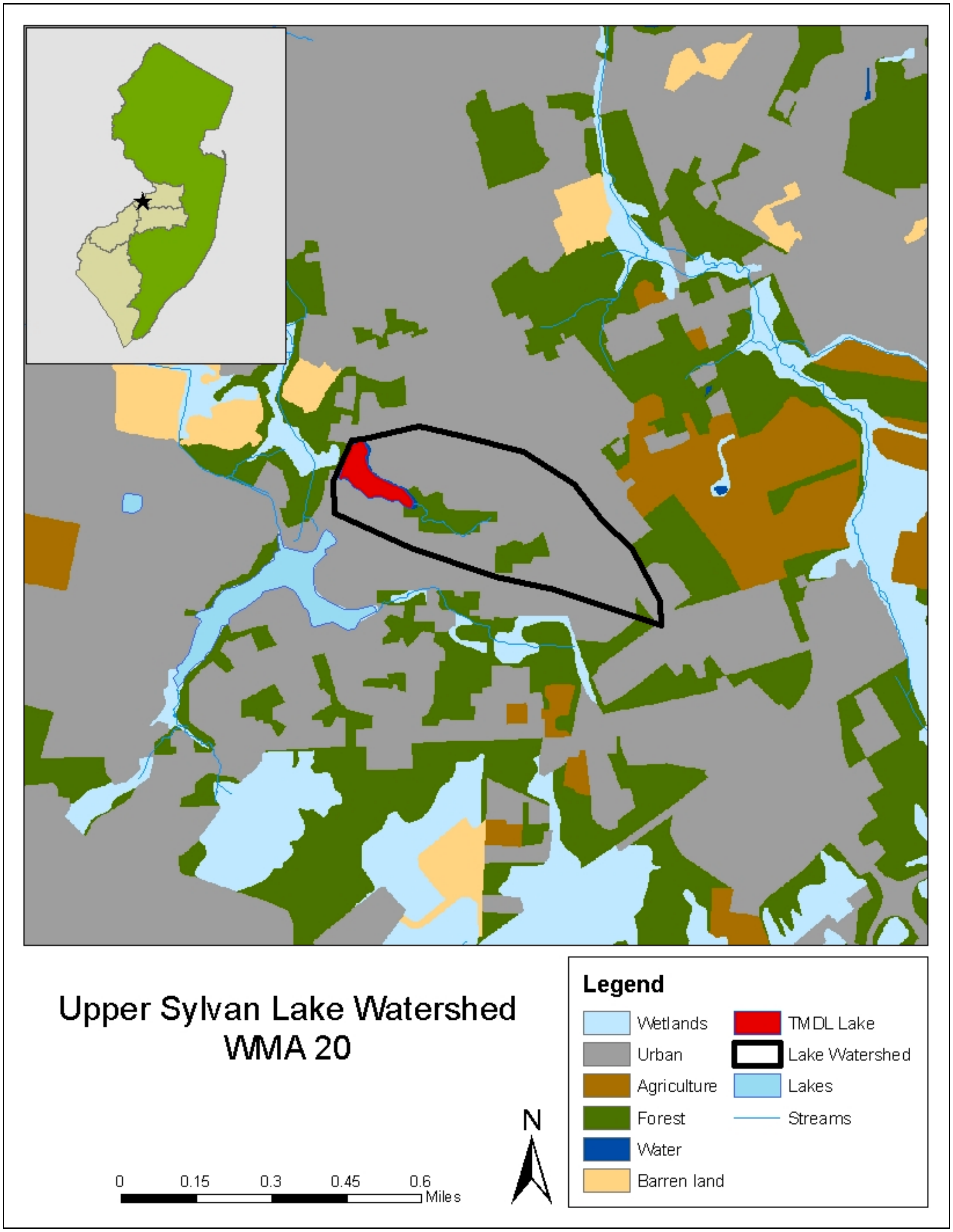

Wilson Lake
Eastern Gate Lake
Malaga Lake
Gloucester Co.
Salem Co.
Wilson Lake, Eastern Gate Lake, and Malaga Lake Watersheds WMA 17
0
1
2
3
4
Miles
N
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams


Lake Silvestro Watershed
WMA 18
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
Lakes
Streams
N
0 0.05 0.1 0.15 0.2
Miles


Lake Cotoxen
Timber Lake
Lake James
Sturbridge Lake
Burlington Co.
Camden Co.
Lakes Cotoxen, Lake James, Sturbridge Lake and Timber Lake Watersheds
WMA 19
0
1
2
3
4
Miles
N
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams



Ocean Co.
Burlington Co.
Mirror Lake Watershed
WMA 19
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
County
Lakes
Streams
N
0
1
2
3
4
Miles



Upper Sylvan Lake Watershed
WMA 20
Legend
Wetlands
Urban
Agriculture
Forest
Water
Barren land
TMDL Lake
Lake Watershed
Lakes
Streams
N
0
0.15
0.3
0.45
0.6
Miles

APPENDIX D: LOWER DELAWARE WATER REGION WATER QUALITY DATA

* Highlighted values are greater than 200 cfu/100 ml of fecal coliform bacteria

WMA 17

4 Seasons CG			
count	105	mean+3stdev	1284
median	30	% reduction	93%
Max	2980		
stdev	375	**no data excluded**	
mean	158		
mean+3stdev	1284		

Station	Date	Value	Remark
SA1007	05/18/98	10	K
SA1007	05/26/98	30	
SA1007	06/01/98	10	
SA1007	06/08/98	10	K
SA1007	06/15/98	20	
SA1007	06/22/98	10	
SA1007	06/29/98	10	K
SA1007	07/06/98	10	K
SA1007	07/13/98	10	K
SA1007	07/20/98	10	K
SA1007	07/27/98	10	
SA1007	08/04/98	40	
SA1007	08/11/98	190	
SA1007	08/17/98	90	
SA1007	08/25/98	110	
SA1007	09/01/98	80	
FSC	05/24/99	1110	
FSC	05/27/99	160	
FSC	06/01/99	150	
FSC	06/08/99	160	
FSC	06/15/99	900	
FSC	06/22/99	400	
FSC	06/24/99	190	
FSC	06/29/99	450	
FSC	07/02/99	320	
FSC	07/06/99	190	
FSC	07/13/99	70	
FSC	07/20/99	1140	
Four Seasons Campground	05/23/00	1500	
Four Seasons Campground	05/25/00	10	K
Four Seasons Campground	05/30/00	10	K
Four Seasons Campground	06/05/00	10	K
Four Seasons Campground	06/12/00	10	K
Four Seasons Campground	06/19/00	20	
Four Seasons Campground	06/26/00	10	K
Four Seasons Campground	07/05/00	20	
Four Seasons Campground	07/10/00	10	
Four Seasons Campground	07/17/00	10	K
Four Seasons Campground	07/24/00	10	K
Four Seasons Campground	08/01/00	10	
Four Seasons Campground	08/07/00	10	K
Four Seasons Campground	08/15/00	10	
Four Seasons Campground	08/21/00	10	K
Four Seasons Campground	08/28/00	10	K
	05/29/01	90	
	06/07/01	180	
	06/12/01	170	
	06/18/01	510	
	06/22/01	TNTC	
	06/26/01	160	
	07/05/01	540	
	07/10/01	900	
	07/13/01	240	
	07/17/01	330	
	07/19/01	10	
	07/24/01	130	
	07/31/01	150	
	08/07/01	180	
	08/14/01	10	k
	08/21/01	120	
	08/28/01	100	
Four Seasons	05/30/02	50	
	06/04/02	20	
	06/11/02	2980	L
	06/13/02	90	Resample
	06/18/02	10	
	06/25/02	50	
	07/02/02	30	
	07/09/02	190	
	07/16/02	70	
	07/23/02	30	
	08/01/02	30	
	08/06/02	20	
	08/20/02	50	
	08/15/02	30	
	08/29/02	260	L
	08/30/02	70	Resample
Four Seasons Campground	05/20/03	20	
	05/27/03	440	L conference
	05/29/03	20	K resample
	06/03/03	20	
	06/10/03	30	
	06/19/03	40	
	06/24/03	10	
	07/02/03	10	
	07/08/03	20	
	07/16/03	50	
	07/24/03	90	
	07/29/03	10	
	08/05/03	110	
	08/13/03	180	
	08/19/03	10	
	08/28/03	10	lake closed for season
Four Seasons Campground	05/27/04	10	K
	06/03/04	10	K
	06/08/04	10	K

	06/17/04	10	K
	06/22/04	10	K
	06/29/04	10	K
	07/07/04	10	K
	07/21/04	10	
	08/04/04	10	K
	08/10/04	10	K
	08/19/04	40	
	08/24/04	10	K
	09/02/04	40	

Cedar Lake			
count	44	mean+3stdev	1198
median	50	% reduction	91%
max	2200		
Stdev	349	**no data excluded**	
mean	152		
mean+3stdev	1198		

Station	**Date**	**Value**	**Remark**
CUL501	05/20/98	20	K
CUL502	05/28/98	20	
CUL503	06/03/98	20	K
CUL504	06/10/98	20	K
CUL505	06/17/98	70	
CUL506	06/24/98	270	
CUL507	07/01/98	60	
CUL508	07/08/98	20	K
CUL509	07/15/98	20	K
CUL510	07/23/98	790	
CUL511	07/29/98	20	K
CUL512	08/05/98	20	K
CUL513	08/12/98	270	
CUL514	08/18/98	110	
CUL515	08/26/98	130	
CUL516	09/02/98	20	
		20	
		20	
		20	
** From Cumberland		50	
1999		20	
		20	
		20	

		20	
		50	
		50	
		20	
		90	
		2200	
		40	
Cedar Lake (surveillance)	05/29/01	102	
Cedar Lake (surveillance)	06/04/01	178	
Cedar Lake (surveillance)	06/11/01	118	
Cedar Lake (surveillance)	06/18/01	62	
Cedar Lake (surveillance)	06/25/01	68	
Cedar Lake (surveillance)	07/02/01	192	
Cedar Lake (surveillance)	07/09/01	22	
Cedar Lake (surveillance)	07/16/01	176	
Cedar Lake (surveillance)	07/23/01	130	
Cedar Lake (surveillance)	07/30/01	2	
Cedar Lake (surveillance)	08/06/01	400	L
Cedar Lake (surveillance)	08/13/01	2	K
Cedar Lake (surveillance)	08/20/01	382	
Cedar Lake (surveillance)	08/27/01	348	

Eastern Gate Lake			
count	99	mean+3stdev	1811
median	171	% reduction	95%
max	3800		
stdev	499	**no data excluded**	
mean	315		
mean+3stdev	1811		

Station	**Date**	**Value**	**Remark**
GC0501	05/21/98	1	K
GC0501	05/21/98	1	K
GC0501	06/04/98	1	K
GC0501	06/10/98	10	K
GC0501	06/18/98	130	
GC0501	06/26/98	150	
GC0501	07/03/98	90	
GC0501	07/13/98	220	
GC0501	07/17/98	370	Closed
GC0501	07/22/98	50	
GC0501	07/23/98	20	
GC0501	07/30/98	50	
GC0501	08/06/98	480	
GC0501	08/11/98	350	Closed
GC0501	08/13/98	220	Resample
GC0501	08/16/98	3800	
GC0501	08/19/98	1300	
GC0501	08/22/98	200	Reopen
GC0501	08/29/98	460	Closed
GC0501	09/04/98	310	
?The Rock Lake (East Gate)?	05/20/02	640	
	05/22/02	304	closed
	06/06/02	384	remain closed
	06/10/02	148	resample, reopen
	06/17/02	177	
	06/24/02	84	
	07/01/02	85	
	07/08/02	198	
	07/17/02	153	
	07/22/02	309	
	07/24/02	287	resample, closed
	07/30/02	105	reopen
	08/05/02	77	
	08/14/02	67	
	08/20/02	16	
	08/26/02	121	
	09/06/02	232	
	09/13/02	31	
	05/18/99	24	
	05/24/99	142	
	06/01/99	30	
	06/07/99	26	
	06/14/99	82	

	06/21/99	12	
	06/28/99	100	
	07/08/99	5	
	07/12/99	44	
	07/19/99	49	
	07/26/99	39	
	08/02/99	89	
	08/09/99	142	
	08/16/99	360	
	08/23/99	197	
	08/30/99	121	
	09/07/99	270	
	09/13/99	39	
	05/19/03	5	
The Rock Lake (East Gate)	05/28/03	82	
	06/02/03	35	
	06/09/03	35	
	06/16/03	124	
	06/30/03	409	
	07/03/03	188	RESAMPLE
	07/07/03	157	
	07/15/03	596	
	07/18/03	600	CLOSED
	07/23/03	2400	CLOSED
	07/25/03	810	CLOSED
	07/30/03	290	CLOSED
	08/01/03	470	CLOSED
	08/04/03	1020	CLOSED
	08/06/03	1380	cLOSED
	08/11/03	580	CLOSED
	08/13/03	1080	CLOSED
	05/17/04	21	
	05/24/04	92	
The Rock Lake	06/02/04	880	
	06/04/04	353	CLOSED
	06/07/04	193	REOPEN
	06/18/04	343	
	06/22/04	291	CLOSED
	06/23/04	103	REOPEN
	06/30/04	315	
	07/01/04	171	
	07/09/04	63	
	07/14/04	356	
	07/16/04	248	CLOSED
	07/21/04	584	CLOSED
	07/22/04	552	CLOSED
	07/26/04	393	CLOSED
	07/29/04	600	CLOSED
	08/02/04	720	CLOSED
	08/04/04	256	CLOSED
	08/05/04	108	REOPEN
	08/13/04	161	
	08/20/04	516	
	08/23/04	197	
	09/03/04	11	
	09/10/04	3	

Franklinville Lake			
count	127	mean+3stdev	1135
median	173	% reduction	90%
max	1950		
stdev	292	**no data excluded**	
mean	258		
mean+3stdev	1135		

Station	**Date**	**Value**	**Remark**
GC0502	05/18/98	92	
GC0502	05/26/98	176	
GC0502	06/01/98	380	
GC0502	06/08/98	330	Closed
GC0502	06/15/98	316	Closed
GC0502	06/22/98	130	Reopen
GC0502	06/29/98	90	
GC0502	04/30/85	230	
GC0502	07/13/98	362	Closed
GC0502	07/20/98	138	Reopen
GC0502	07/27/98	440	
GC0502	08/03/98	350	Closed
GC0502	08/10/98	52	Reopen
GC0502	08/17/98	132	
GC0502	08/27/98	440	
GC0502	08/31/98	46	
	05/24/99	64	
	06/01/99	280	
	06/06/99	46	
	06/14/99	170	
	06/21/99	12	
	06/28/99	80	
	07/08/99	174	
	07/12/99	40	
	07/19/99	85	
	07/26/99	121	
	08/02/99	220	
	08/09/99	136	
	08/16/99	296	
	08/23/99	248	Closed
	08/30/99	174	Reopen
	09/07/99	137	
Franklinville Lake	05/22/00	3	
	05/30/00	75	
	06/05/00	17	
	06/12/00	60	
	06/19/00	320	
	06/26/00	39	
	07/03/00	161	
	07/11/00	31	
	07/17/00	129	
	07/24/00	41	
	08/07/00	73	
	08/14/00	450	
	08/17/00	450	Closed
	08/22/00	29	Reopen
	08/28/00	141	
	09/05/00	64	
Franklinville Lake	05/30/01	427	
	06/01/01	173	resample
	06/06/01	424	
	06/08/01	296	resample, closed
	06/11/01	280	closed
	06/13/01	360	closed, resample
	06/15/01	1140	closed
	06/18/01	1250	closed
	06/20/01	377	closed, resample
	06/22/01	463	closed, resample
	06/25/01	580	closed
	06/27/01	768	closed, resample
	06/29/01	260	closed,

			resample
	07/02/01	600	closed
	07/05/01	1950	closed, resample
	07/09/01	1500	closed
	07/11/01	151	reopen, resample
	07/18/01	392	
	07/20/01	752	closed, resample
	07/23/01	79	reopen, resample
	07/25/01	67	
	08/01/01	191	
	08/08/01	800	
	08/10/01	212	closed, resample
	08/13/01	916	closed, resample
	08/15/01	295	closed
	08/17/01	299	closed, resample
	08/20/01	181	
	08/22/01	TNTC	closed for season
Franklinville Lake	05/14/02	60	
	05/20/02	516	
	05/28/02	33	
	06/03/02	153	
	06/10/02	207	
	06/17/02	393	closed
	06/24/02	317	Closed
	06/28/02	154	Resample
	07/01/02	52	
	07/08/02	60	
	07/17/02	21	
	07/22/02	289	
	07/30/02	241	closed
	08/01/02	187	reopen
	08/05/02	141	
	08/14/02	548	
	08/20/02	217	closed
	08/27/02	75	
Franklinville Lake	05/30/03	10	
	06/03/03	190	

	06/09/03	50	
	06/16/03	180	
	03/23/03	600	L
	06/25/03	180	RESAMPLE
	06/30/03	90	
	07/09/03	50	
	07/14/03	70	
	07/21/03	20	
	07/29/03	30	
	08/06/03	600	L
	08/08/03	510	CLOSED
	08/11/03	70	REOPEN
	08/18/03	130	
	08/25/03	90	
Franklinville Lake	06/03/04	190	
	06/07/04	10	
	06/14/04	120	
	06/21/04	190	
	06/28/04	170	
	07/08/04	150	
	07/12/04	140	
	07/19/04	440	
	07/21/04	320	CLOSED
	07/23/04	30	REOPEN
	07/26/04	120	
	08/02/04	30	
	08/09/04	600	L
	08/11/04	180	RETEST
	08/19/04	90	
	08/23/04	140	
	08/30/04	40	

Holly Green Campground			
count	114	mean+3stdev	747
median	40	% reduction	89%
max	1800		
stdev	212	**no data excluded**	
mean	112		
mean+3stdev	747		

Station	**Date**	**Value**	**Remark**
GC0503	05/19/98	60	
GC0503	05/26/98	1	K
GC0503	06/02/98	30	
GC0503	06/09/98	10	
GC0503	06/16/98	40	
GC0503	06/23/98	40	
GC0503	06/30/98	250	
GC0503	07/07/98	40	
GC0503	07/14/98	1	K
GC0503	07/21/98	130	
GC0503	07/28/98	170	
GC0503	08/04/98	50	
GC0503	08/11/98	170	
GC0503	08/18/98	120	
GC0503	08/25/98	10	
GC0503	09/01/98	1	K
GC0503	09/09/98	1	K
	05/25/99	100	
	06/01/99	140	
	06/08/99	1800	
	06/11/99	60	
	06/15/99	240	
	06/21/99	130	
	06/29/99	210	
	07/02/99	230	Closed
	07/06/99	190	Reopen
	07/15/99	140	
	07/13/99	680	
	07/20/99	460	Closed
	07/23/99	340	
	07/27/99	60	Reopen
	08/03/99	60	
	08/17/99	1	neg
	08/24/99	60	
	08/31/99	1	neg
Holly Green Campground	05/23/00	30	
	05/30/00	10	
	06/06/00	10	K
	06/13/00	70	
	06/20/00	60	
	06/27/00	50	
	07/05/00	20	
	07/10/00	10	
	07/17/00	10	
	07/24/00	10	

	08/01/00	90	
	08/07/00	30	
	08/15/00	10	
	08/21/00	10	K
	08/28/00	180	
	09/05/00	10	K
Holly Green Campground	05/21/01	460	K,resample
	05/24/01	10	
	05/30/01	30	
	06/05/01	10	
	06/11/01	10	
	06/19/01	40	
	06/26/01	250	
	06/28/01	100	resample
	07/02/01	30	
	07/10/01	40	
	07/17/01	120	
	07/24/01	130	
	07/31/01	60	
	08/06/01	240	
	08/08/01	10	K,resample
	08/14/01	20	
	08/20/01	70	
	08/28/01	100	
Holly Green Campground	06/14/02	190	
	06/20/02	120	
	06/26/02	10	K
	07/03/02	10	
	07/08/02	130	
	07/19/02	30	
	07/22/02	490	
	07/24/02	600	L
	07/26/02	110	
	07/31/02	50	
	08/05/02	600	L
	08/06/02	90	Lake closed 8/10/02 for remaining season
Holly Green Lake	05/29/03	10	K
	06/02/03	320	
	06/03/03	10	RESAMPLE
	06/09/03	10	K

	06/16/03	50	
	06/23/03	10	K
	06/30/03	570	
	07/02/03	130	RESAMPLE
	07/08/03	90	
	07/14/03	60	
	07/21/03	30	
	07/28/03	190	
	08/06/03	120	
	08/06/03	10	K
	08/18/03	10	
	08/25/03	70	
	09/03/03	10	K
Holly Green Campground	05/27/04	10	K
	06/03/04	10	K
	06/07/04	10	K
	06/16/04	10	K
	06/21/04	10	K
	06/28/04	10	K
	07/08/04	10	K
	07/14/04	100	
	07/21/04	30	
	07/30/04	10	K
	08/02/04	10	K
	08/09/04	10	K
	08/18/04	10	
	08/23/04	10	K
	08/30/04	10	K
	09/09/04	30	

Iona Lake			
count	108	mean+3stdev	517
median	60	% reduction	67%
max	600		
stdev	135	**no data excluded**	
mean	112		
mean+3stdev	517		

Station	**Date**	**Value**	**Remark**
GC0504	05/26/98	164	
GC0504	06/01/98	256	
GC0504	06/08/98	56	

GC0504	06/15/98	110	
GC0504	06/22/98	128	
GC0504	06/29/98	146	
GC0504	07/06/98	84	
GC0504	07/13/98	126	
GC0504	07/20/98	286	
GC0504	07/27/98	270	Closed
GC0504	08/03/98	136	Reopen
GC0504	08/10/98	206	
GC0504	08/17/98	104	
GC0504	08/27/98	82	
GC0504	08/31/98	16	
	05/24/99	22	
	06/01/99	40	
	06/06/99	28	
	06/14/99	420	
	06/21/99	10	
	06/28/99	350	
	07/08/99	114	
	07/12/99	34	
	07/19/99	258	
	07/26/99	81	
	08/02/99	88	
	08/09/99	85	
	08/16/99	19	
	08/23/99	316	
	08/30/99	17	
	09/07/99	556	
Iona Lake	05/22/00	1	
	05/30/00	59	
	06/05/00	5	
	06/12/00	24	
	06/19/00	75	
	06/26/00	12	
	07/03/00	20	
	07/11/00	9	
	07/17/00	100	
	07/24/00	11	
	08/07/00	38	
	08/14/00	400	
	08/17/00	400	Closed
	08/22/00	11	Reopen
	08/28/00	48	
	09/05/00	13	
Iona Lake	05/30/01	584	

	06/01/01	16	resample
	06/06/01	93	
	06/13/01	25	
	06/27/01	79	
	07/02/01	56	
	07/11/01	245	
	07/16/01	15	resample
	07/18/01	8	
	07/25/01	56	
	08/01/01	12	
	08/08/01	157	
	08/15/01	191	
	08/22/01	44	
	08/29/01	51	
Iona Lake	05/14/02	16	
	05/20/02	124	
	05/28/02	21	
	06/03/02	101	
	06/10/02	51	
	06/17/02	53	
	06/24/02	149	
	07/08/02	9	
	07/17/02	104	
	07/22/02	49	
	07/30/02	41	
	08/05/02	89	
	08/14/02	37	
	08/20/02	41	
	08/26/02	15	
Iona Lake	05/30/03	40	
	06/03/03	10	K
	06/09/03	130	
	06/16/03	50	
	06/23/03	80	
	06/30/03	20	
	07/09/03	80	
	07/14/03	20	
	07/21/03	20	
	07/29/03	60	
	08/06/03	130	
	08/11/03	580	
	08/14/03	60	RESAMPLE
	08/18/03	150	
	08/25/03	160	
Iona Lake	06/03/04	20	

	06/07/04	40	
	06/14/04	20	
	06/21/04	10	
	06/28/04	10	
	07/08/04	40	
	07/12/04	70	
	07/19/04	600	L
	07/21/04	170	RETEST
	07/26/04	90	
	08/02/04	480	
	08/04/04	190	RETEST
	08/09/04	10	K
	08/19/04	190	
	08/23/04	90	
	08/30/04	80	

Parvin Lake			
count	406	mean+3stdev	1565
median	83	% reduction	91%
max	2200		
stdev	436	**no data excluded**	
mean	259		
mean+3stdev	1565		

Station	**Date**	**Value**	**Remark**
Swim Area	05/26/98	413	
Swim Area	05/27/98	173	
Swim Area	06/02/98	220	
Swim Area	06/03/98	55	
Swim Area	06/08/98	30	
Swim Area	06/15/98	1470	
Swim Area	06/16/98	390	
Swim Area	06/17/98	230	
Swim Area	06/18/98	77	
Swim Area	06/22/98	107	
Swim Area	06/30/98	70	
Swim Area	07/06/98	113	
Swim Area	07/13/98	420	
Swim Area	07/14/98	83	
Swim Area	07/21/98	280	
Swim Area	07/21/98	38	
Swim Area	07/27/98	2000	L
Swim Area	07/28/98	2000	L
Swim Area	08/03/98	28	
Swim Area	08/11/98	1030	
Swim Area	08/13/98	153	
Swim Area	08/19/98	340	
Swim Area	08/20/98	107	
Swim Area	08/25/98	28	
Swim Area	09/01/98	23	
Lake Parvin-C	05/22/00	437	
Lake Parvin-C	05/24/00	48	
Lake Parvin-C	05/30/00	230	
Lake Parvin-C	06/01/00	3	K
Lake Parvin-C	06/05/00	5	
Lake Parvin-C	06/12/00	35	
Lake Parvin-C	06/19/00	183	
Lake Parvin-C	06/26/00	25	
Lake Parvin-C	07/05/00	2000	K
Lake Parvin-C	07/06/00	900	
Lake Parvin-C	07/07/00	127	
Lake Parvin-C	07/10/00	18	
Lake Parvin-C	07/17/00	58	
Lake Parvin-C	07/24/00	13	
Lake Parvin-C	07/31/00	43	
Lake Parvin-C	08/07/00	40	
Lake Parvin-C	08/14/00	50	
Lake Parvin-C	08/15/00	2200	
Lake Parvin-C	08/16/00	520	
Lake Parvin-C	08/17/00	90	
Lake Parvin-C	08/21/00	157	
Lake Parvin-C	08/28/00	33	
Lake Parvin-L	05/22/00	660	L
Lake Parvin-L	05/24/00	67	
Lake Parvin-L	05/30/00	55	
Lake Parvin-L	06/01/00	5	
Lake Parvin-L	06/05/00	190	
Lake Parvin-L	06/12/00	5	
Lake Parvin-L	06/19/00	73	
Lake Parvin-L	06/26/00	8	
Lake Parvin-L	07/05/00	33	
Lake Parvin-L	07/06/00	100	
Lake Parvin-L	07/07/00	70	
Lake Parvin-L	07/10/00	8	
Lake Parvin-L	07/17/00	10	
Lake Parvin-L	07/24/00	10	
Lake Parvin-L	07/31/00	5	
Lake Parvin-L	08/07/00	15	

Lake Parvin-L	08/14/00	30	
Lake Parvin-L	08/15/00	910	
Lake Parvin-L	08/16/00	470	
Lake Parvin-L	08/17/00	104	
Lake Parvin-L	08/21/00	8	
Lake Parvin-L	08/28/00	45	
Lake Parvin-R	05/22/00	207	
Lake Parvin-R	05/24/00	48	
Lake Parvin-R	05/30/00	43	
Lake Parvin-R	06/01/00	5	
Lake Parvin-R	06/05/00	43	
Lake Parvin-R	06/12/00	40	
Lake Parvin-R	06/19/00	173	
Lake Parvin-R	06/26/00	30	
Lake Parvin-R	07/05/00	78	
Lake Parvin-R	07/06/00	43	
Lake Parvin-R	07/07/00	43	
Lake Parvin-R	07/10/00	35	
Lake Parvin-R	07/17/00	77	
Lake Parvin-R	07/24/00	23	
Lake Parvin-R	07/31/00	77	
Lake Parvin-R	08/07/00	120	
Lake Parvin-R	08/14/00	590	
Lake Parvin-R	08/15/00	1300	
Lake Parvin-R	08/16/00	290	
Lake Parvin-R	08/17/00	117	
Lake Parvin-R	08/21/00	73	
Lake Parvin-R	08/28/00	2000	L
Center	05/21/01	25	
Center	05/29/01	430	
Center	05/30/01	620	closed
Center	05/31/01	77	reopened
Center	06/04/01	170	
Center	06/11/01	5	
Center	06/18/01	440	
Center	06/19/01	580	retest
Center	06/20/01	630	closed
Center	06/21/01	70	reopened
Center	06/25/01	830	
Center	06/26/01	170	retest
Center	07/02/01	33	
Center	07/09/01	1100	
Center	07/10/01	183	retest
Center	07/16/01	50	
Center	07/23/01	10	

Center	07/30/01	2000	l
Center	07/31/01	1550	closed
Center	08/01/01	30	reopened
Center	08/06/01	87	
Center	08/13/01	15	
Center	08/20/01	3	k
Center	08/27/01	80	
Center	05/20/02	440	
Center	05/22/02	48	
Center	05/28/02	10	
Center	06/03/02	120	
Center	06/10/02	270	
Center	06/12/02	450	
Center	06/13/02	140	
Center	06/17/02	530	
Center	06/18/02	710	
Center	05/19/02	83	
Center	06/24/02	510	
Center	06/25/02	93	
Center	07/01/02	55	
Center	07/02/02	167	
Center	07/03/02	270	
Center	07/04/02	10	
Center	07/08/02	13	
Center	07/15/02	190	
Center	07/22/02	25	
Center	07/29/02	93	
Center	08/05/02	38	
Center	08/12/02	663	
Center	08/13/02	23	
Center	08/19/02	1970	
Center	08/20/02	230	
Center	08/21/02	24	
Center	08/26/02	15	
Left	05/21/01	33	
Left	05/29/01	370	
Left	05/30/01	240	closed
Left	05/31/01	48	reopened
Left	06/04/01	133	
Left	06/11/01	15	
Left	06/18/01	1470	
Left	06/19/01	1070	retest
Left	06/20/01	230	closed
Left	06/21/01	167	reopened
Left	06/25/01	710	

Left	06/26/01	163	retest
Left	07/02/01	43	
Left	07/09/01	470	
Left	07/10/01	340	retest
Left	07/16/01	15	
Left	07/23/01	13	
Left	07/30/01	80	
Left	07/31/01	2000	closed
Left	08/01/01	18	reopened
Left	08/06/01	97	
Left	08/13/01	15	
Left	08/20/01	8	
Left	08/27/01	18	
Left	05/20/02	270	
Left	05/22/02	80	
Left	05/28/02	3	
Left	06/03/02	27	
Left	06/10/02	68	
Left	06/12/02	67	
Left	06/13/02	143	
Left	06/17/02	260	
Left	06/18/02	33	
Left	06/19/02	23	
Left	06/24/02	210	
Left	06/25/02	8	
Left	07/01/02	250	
Left	07/02/02	2000	
Left	07/03/02	240	
Left	07/04/02	5	
Left	07/08/02	8	
Left	07/15/02	28	
Left	07/22/02	3	
Left	07/29/02	8	
Left	08/05/02	28	
Left	08/12/02	297	
Left	08/13/02	5	
Left	08/19/02	840	
Left	08/20/02	86	
Left	08/21/02	5	
Left	08/26/02	28	
Right	05/21/01	20	
Right	05/29/01	390	
Right	05/30/01	117	retest
Right	05/31/01	53	
Right	06/04/01	137	

Right	06/11/01	5	
Right	06/18/01	2000	
Right	06/19/01	910	retest
Right	06/20/01	400	closed
Right	06/21/01	220	reopened
Right	06/25/01	1010	
Right	06/26/01	147	retest
Right	07/02/01	38	
Right	07/09/01	540	
Right	07/10/01	117	retest
Right	07/16/01	107	
Right	07/23/01	15	
Right	07/30/01	8	
Right	07/31/01	2000	closed
Right	08/01/01	143	reopened
Right	08/06/01	75	
Right	08/13/01	23	
Right	08/20/01	3	
Right	08/27/01	87	
Right	05/20/02	530	
Right	05/22/02	48	
Right	05/28/02	5	
Right	06/03/02	10	
Right	06/10/02	123	
Right	06/12/02	48	
Right	06/13/02	133	
Right	06/17/02	360	
Right	06/18/02	130	
Right	06/19/02	83	
Right	06/24/02	23	
Right	06/25/02	20	
Right	07/01/02	23	
Right	07/02/02	2000	
Right	07/03/02	120	
Right	07/04/02	15	
Right	07/08/02	10	
Right	07/15/02	193	
Right	07/22/02	5	
Right	07/29/02	5	
Right	08/05/02	15	
Right	08/12/02	7	
Right	08/13/02	35	
Right	08/21/02	12	
Right	08/26/02	38	
Lake Parvin-C	05/19/03	3	

Lake Parvin-C	05/27/03	473	
Lake Parvin-C	05/28/03	500	CLOSED
Lake Parvin-C	05/29/03	390	CLOSED
Lake Parvin-C	05/30/03	100	REOPENED
Lake Parvin-C	06/02/03	58	
Lake Parvin-C	06/09/03	280	
Lake Parvin-C	06/10/03	88	CLOSED
Lake Parvin-C	06/12/03	28	REOPENED
Lake Parvin-C	06/16/03	330	
Lake Parvin-C	06/17/03	660	CLOSED
Lake Parvin-C	06/19/03	780	CLOSED
Lake Parvin-C	06/20/03	390	CLOSED
Lake Parvin-C	06/23/03	200	CLOSED
Lake Parvin-C	06/24/03	123	REOPENED
Lake Parvin-C	06/25/03	73	
Lake Parvin-C	06/30/03	30	
Lake Parvin-C	07/07/03	15	
Lake Parvin-C	07/14/03	20	
Lake Parvin-C	07/21/03	43	
Lake Parvin-C	07/28/03	20	
Lake Parvin-C	08/04/03	180	
Lake Parvin-C	08/05/03	240	CLOSED
Lake Parvin-C	08/06/03	2000	L, CLOSED
Lake Parvin-C	08/07/03	290	CLOSED
Lake Parvin-C	08/08/03	280	CLOSED
Lake Parvin-C	08/11/03	100	REOPENED
Lake Parvin-C	08/18/03	48	
Lake Parvin-C	08/25/03	3	
Lake Parvin-L	05/19/03	5	
Lake Parvin-L	05/27/03	136	
Lake Parvin-L	05/28/03	500	CLOSED
Lake Parvin-L	05/29/03	260	CLOSED
Lake Parvin-L	05/30/03	93	REOPENED
Lake Parvin-L	06/02/03	97	
Lake Parvin-L	06/09/03	640	
Lake Parvin-L	06/10/03	393	CLOSED
Lake Parvin-L	06/12/03	38	REOPENED
Lake Parvin-L	06/16/03	340	
Lake Parvin-L	06/17/03	173	CLOSED
Lake Parvin-L	06/19/03	760	CLOSED
Lake Parvin-L	06/20/03	240	CLOSED
Lake Parvin-L	06/23/03	247	CLOSED
Lake Parvin-L	06/24/03	70	REOPENED
Lake Parvin-L	06/25/03	55	
Lake Parvin-L	06/30/03	38	

Lake Parvin-L	07/07/03	15	
Lake Parvin-L	07/14/03	18	
Lake Parvin-L	07/21/03	23	
Lake Parvin-L	07/28/03	10	
Lake Parvin-L	08/04/03	173	
Lake Parvin-L	08/05/03	350	CLOSED
Lake Parvin-L	08/06/03	1090	CLOSED
Lake Parvin-L	08/07/03	400	CLOSED
Lake Parvin-L	08/08/03	290	CLOSED
Lake Parvin-L	08/11/03	70	REOPENED
Lake Parvin-L	08/18/03	35	
Lake Parvin-L	08/25/03	13	
Lake Parvin-R	05/19/03	5	
Lake Parvin-R	05/27/03	1810	
Lake Parvin-R	05/28/03	540	CLOSED
Lake Parvin-R	05/29/03	290	CLOSED
Lake Parvin-R	05/30/03	117	REOPENED
Lake Parvin-R	06/02/03	55	
Lake Parvin-R	06/09/03	340	
Lake Parvin-R	06/10/03	240	CLOSED
Lake Parvin-R	06/12/03	50	REOPENED
Lake Parvin-R	06/16/03	270	
Lake Parvin-R	06/17/03	218	CLOSED
Lake Parvin-R	06/19/03	830	CLOSED
Lake Parvin-R	06/20/03	420	CLOSED
Lake Parvin-R	06/23/03	270	CLOSED
Lake Parvin-R	06/24/03	170	REOPENED
Lake Parvin-R	06/25/03	52	
Lake Parvin-R	06/30/03	130	
Lake Parvin-R	07/07/03	20	
Lake Parvin-R	07/14/03	40	
Lake Parvin-R	07/21/03	5	
Lake Parvin-R	07/28/03	15	
Lake Parvin-R	08/04/03	340	
Lake Parvin-R	08/05/03	238	CLOSED
Lake Parvin-R	08/06/03	538	CLOSED
Lake Parvin-R	08/07/03	310	CLOSED
Lake Parvin-R	08/08/03	370	CLOSED
Lake Parvin-R	08/11/03	110	REOPENED
Lake Parvin-R	08/18/03	53	
Lake Parvin-R	08/25/03	13	
Lake Parvin	05/24/04	540	
	05/24/04	20	
	05/24/04	80	
	05/25/04	40	

	05/25/04	48	
	05/25/04	33	
	06/01/04	25	
	06/01/04	55	
	06/01/04	20	
	06/07/04	350	
	06/07/04	25	
	06/07/04	123	
	06/08/04	40	
	06/08/04	3	
	06/08/04	63	
	06/14/04	35	
	06/14/04	43	
	06/14/04	73	
	06/21/04	2000	L
	06/21/04	38	
	06/21/04	67	
	06/22/04	23	
	06/22/04	35	
	06/22/04	13	
	06/28/04	30	
	06/28/04	33	
	06/28/04	157	
	07/06/04	35	
	07/06/04	5	
	07/06/04	103	
	07/12/04	450	
	07/12/04	23	
	07/12/04	260	
	07/14/04	1160	
	07/14/04	900	
	07/14/04	850	
	07/15/04	210	
	07/15/04	370	
	07/15/04	300	
	07/16/04	380	
	07/16/04	200	
	07/16/04	258	
	07/17/04	150	
	07/17/04	70	
	07/17/04	197	
	07/19/04	280	
	07/19/04	240	
	07/19/04	213	
	07/20/04	1010	

	07/20/04	137	
	07/20/04	212	
	07/21/04	173	
	07/21/04	50	
	07/21/04	83	
	07/26/04	154	
	07/26/04	133	
	08/02/04	55	
	08/02/04	210	
	08/02/04	80	
	08/03/04	70	
	08/03/04	58	
	08/03/04	10	
	08/09/04	28	
	08/09/04	28	
	08/09/04	23	
	08/16/04	1970	
	08/16/04	80	
	08/16/04	210	
	08/17/04	93	
	08/17/04	83	
	08/17/04	88	
	08/23/04	5	
	08/23/04	10	
	08/23/04	8	
	08/30/04	3	k
	08/30/04	3	k
	08/30/04	3	

Sunset Lake			
count	115	mean+3stdev	2978
median	20	% reduction	98%
max	9200		
Stdev	918	**no data excluded**	
mean	223		
mean+3stdev	2978		

Station	**Date**	**Value**	**Remark**
CUL101	05/20/98	20	K
CUL102	05/28/98	20	K
CUL103	06/03/98	20	K
CUL104	06/10/98	20	K
CUL105	06/17/98	2400	L
CUL105S	06/19/98	20	RESAMPLE
CUL106	06/24/98	20	K
CUL107	07/01/98	20	K
CUL108	07/08/98	20	K
CUL109	07/15/98	20	K
CUL110	07/23/98	40	
CUL111	07/29/98	20	
CUL112	08/05/98	20	K
CUL113	08/12/98	1700	L
CUL113E	08/12/98	110	RESAMPLE
CUL114	08/19/98	50	
CUL115	08/26/98	20	K
CUL115E	08/26/98	20	REPLICATE SAMPLE
CUL116	09/02/98	20	K
CUL116E	09/02/98	20	REPLICATE SAMPLE
Sunset	05/26/99	110	
	06/02/99	140	
	06/15/99	20	K
	06/24/99	20	K
	06/29/99	20	K
	07/06/99	20	K
	07/15/99	20	K
	07/20/99	20	K
	07/27/99	20	K
	08/04/99	20	
	08/17/99	20	K
	08/24/99	20	
	08/31/99	20	K
CUL101	05/16/00	20	
CUL102	05/23/00	20	K
CUL103	05/30/00	20	K
CUL104	06/06/00	20	K
CUL105	06/13/00	20	K
CUL106	06/20/00	20	K
CUL107	06/27/00	140	
CUL108	07/03/00	20	K
CUL109	07/11/00	20	K
CUL110	07/18/00	20	K
CUL111	07/25/00	20	
CUL112	08/01/00	330	L
CUL113	08/08/00	9200	L
CUL114	08/14/00	1400	L
Sunsent Lake	05/29/01	90	

Sunset Lake	06/04/01	168	
Sunset Lake	06/11/01	2	
Sunset Lake	06/18/01	2	K
Sunset Lake	06/25/01	178	
Sunset Lake	07/02/01	36	
Sunset Lake	07/09/01	132	
Sunset Lake	07/16/01	126	
Sunset Lake	07/23/01	164	
Sunset Lake	07/30/01	37	
Sunset Lake	08/06/01	400	L
Sunset Lake	08/08/01	31	resample
Sunset Lake 30 feet East	08/08/01	37	resample
Sunset Lake 30 feet West	08/08/01	68	resample
Sunset Lake	08/13/01	2	K
Sunset Lake	08/20/01	182	
Sunset Lake	08/27/10	75	
Sunset Lake	05/21/02	26	
	05/28/02	2	K
	06/03/02	4	
	06/10/02	48	
	06/17/02	1	K
	06/24/02	3	
	07/01/02	7	
	07/08/02	2	K
	07/15/02	2	K
	07/22/02	2	K
	07/29/02	400	L
	07/31/02	2	K
	08/02/02	12	
	08/05/02	374	
	08/06/02	2	
	08/12/02	1	K
	08/19/02	1	K
	08/26/02	398	
	08/27/02	162	
Sunset Lake	06/11/03	2	K
	06/16/03	10	
	06/23/03	8	
	06/30/03	10	
	07/07/03	140	
	07/14/03	6	
	07/21/03	86	
	07/28/03	396	
	07/31/03	1900	resample
	08/04/03	160	
	08/11/03	146	
	08/18/03	24	
	08/25/03	88	
Sunset Lake	06/02/04	42	
	06/07/04	22	
	06/14/04	51	
	06/21/04	12	
	06/28/04	12	
	07/06/04	99	
	07/12/04	128	
	07/19/04	1000	L,TNTC
	07/20/04	724	
	07/21/04	252	
	07/22/04	76	
	07/22/04	68	
	07/22/04	48	
	07/26/04	74	
	08/02/04	52	
	08/09/04	56	
	08/16/04	282	
	08/18/04	152	
	08/23/04	42	
	08/30/04	4	

Timber Lake			
count	110	mean+3stdev	740
median	93	% reduction	85%
max	1300		
stdev	198	**no data excluded**	
mean	147		
mean+3stdev	740		

Station	Date	Value	Remark
GC1102	05/18/98	496	
GC1102	06/01/98	156	
GC1102	06/08/98	144	
GC1102	06/15/98	114	
GC1102	05/04/98	1	K
GC1102	06/22/98	48	
GC1102	06/29/98	66	
GC1102	07/06/98	90	
GC1102	07/13/98	138	
GC1102	07/20/98	74	
GC1102	07/27/98	192	
GC1102	08/03/98	34	
GC1102	08/10/98	74	
GC1102	08/17/98	10	
GC1102	08/24/98	92	
GC1102	08/31/98	22	
	06/23/99	2	K
	06/30/99	128	
	07/07/99	94	
	07/14/99	350	
	07/21/99	142	
	07/26/99	103	
	07/28/99	95	
	08/04/99	63	
	08/19/99	64	
	08/25/99	23	
Timber Lake	05/31/00	74	
	06/09/00	14	
	06/16/00	53	
	06/23/00	454	CLOSED
	06/27/00	350	Resample
	06/29/00	130	REOPEN
	06/30/00	466	
	07/07/00	24	
	07/14/00	37	
	07/21/00	17	
	07/28/00	11	
	08/11/00	27	
	08/16/00	330	
	08/25/00	141	
	08/30/00	54	
Timber Lake	05/17/01	10	K
	05/31/01	30	
	06/07/01	185	
	06/12/01	40	
	06/19/01	125	
	06/27/01	80	
	07/05/01	5	
	07/11/01	115	
	07/19/01	195	
	07/25/01	1120	
	07/28/01	50	
	08/01/01	280	

	08/05/01	430	closed, resample
	08/07/01	115	retest
	08/15/01	325	
	08/18/01	625	closed, resample
	08/20/01	90	reopen
	08/29/01	115	
Timber Lake	05/16/02	5	
	05/23/02	5	
	05/30/02	70	
	06/06/02	130	
	06/12/02	30	
	06/19/02	30	
	06/27/02	105	
	07/02/02	125	
	07/09/02	10	
	07/16/02	25	
	07/23/02	30	
	07/30/02	45	
	08/06/02	65	
	08/13/02	165	
	08/20/02	125	closed for season
	08/29/02	65	
Timber Lake	05/19/03	15	
	05/25/03	10	
	05/31/03	5	
	06/08/03	40	
	06/13/03	1300	
	06/17/03	25	RESAMPLE
	06/20/03	60	
	06/25/03	60	
	07/01/03	40	
	07/10/03	15	
	07/17/03	150	
	07/24/03	135	
	07/31/03	350	
	08/03/03	455	CLOSED
	08/05/03	90	REOPEN
	08/14/03	190	
	08/21/03	125	
	08/27/03	315	
	08/30/03	160	
Timber Lake	05/21/04	320	
	05/25/04	120	RETEST

	05/30/04	150	
	06/05/04	50	
	06/12/04	695	
	06/17/04	105	
	06/22/04	115	
	06/30/04	35	
	07/07/04	140	
	07/16/04	80	
	07/21/04	115	
	07/30/04	180	
	08/04/04	195	
	08/18/04	190	
	08/26/04	95	
	08/31/04	50	

Wilson Lake			
count	28	mean+3stdev	930
median	45	% reduction	75%
max	910		
stdev	257	**no data excluded**	
mean	159		
mean+3stdev	930		

Station	**Date**	**Value**	**Remark**
GC0101	06/11/98	40	
GC0101	06/15/98	70	
GC0101	06/22/98	140	
GC0101	06/29/98	30	
GC0101	07/06/98	140	
GC0101	07/13/98	40	
GC0101	07/20/98	10	
GC0101	07/27/98	230	
GC0101	07/30/98	910	
GC0101	08/03/98	100	
GC0101	08/10/98	80	
GC0101	08/18/98	10	
GC0101	08/24/98	10	
GC0101	08/31/98	1	K
Wilson Lake	06/05/01	10	
	06/12/01	50	
	06/19/01	10	K
	07/02/01	10	K
	07/24/01	160	

	08/07/01	770	
	08/09/01	220	
	08/14/01	810	
	08/16/01	40	
	09/06/01	20	
Wilson Lake-Scotland Run	07/29/03	10	
	08/05/03	460	
	08/07/03	50	
	08/19/03	10	no swimming

WMA 18

Lake Silvestro			
count	67	mean+3stdev	891
median	30	% reduction	86%
max	1440		
stdev	255	**no data excluded**	
mean	127		
mean+3stdev	891		

Station	**Date**	**Value**	**Remark**
Lake Silvestro	06/21/01	50	
	07/17/01	200	
	07/24/01	10	
	07/31/01	1440	
	08/03/01	750	closed, resample
	08/06/01	260	closed, resample
	08/08/01	10	K
	08/14/01	200	
	08/21/01	1000	
	08/22/01	300	
	09/11/01	10	K
	09/18/01	10	K
	09/25/01	30	
Lake Silvestro	05/23/02	30	
	05/29/02	10	K
	06/03/02	10	K
	06/12/02	110	

	06/24/02	10	
	06/18/02	10	K
	06/24/02	10	
	07/01/02	10	K
	07/10/02	30	
	07/16/02	130	
	07/23/02	350	
	07/25/02	10	
	07/30/02	600	L
	08/01/02	50	
	08/07/02	10	K
	08/15/02	60	
	08/20/02	110	
	08/27/02	10	K
	09/03/02	10	K
Lake Silvestro	05/20/03	50	
	05/29/03	10	K
	06/04/03	20	
	06/11/03	10	K
	06/17/03	10	K
	07/01/03	20	
	07/08/03	10	K
	07/15/03	10	K
	07/22/03	10	
	07/29/03	50	
	08/05/03	580	
	08/07/03	180	RESAMPLE
	08/12/03	10	K
	08/19/03	90	
	08/27/03	60	
Lake Silvestro	05/18/04	90	
	05/26/04	30	
	06/01/04	30	
	06/09/04	10	
	06/15/04	10	K
	06/22/04	10	K
	06/29/04	10	K
	07/06/04	10	
	07/20/04	10	K
	07/26/04	10	K
	08/02/04	420	
	08/04/04	80	
	08/09/04	10	
	08/18/04	10	K
	08/23/04	10	K
	08/31/04	600	L
	09/02/04	60	
	09/08/04	60	
	09/21/04	30	
	09/27/04	30	

WMA 19

Lake Coxtoxen			
count	20	mean+3stdev	961
Median	265	%reduction	74%
Max	780		
stdev	206	**no data excluded**	
mean	343		
mean+3stdev	961		

Lake	Date	Value	Remark
Camp Darkwaters	06/23/99	280	
Camp Darkwaters	06/30/99	TNTC	
Camp Darkwaters	07/07/99	310	
Camp Darkwaters	07/14/99	TNTC	
Camp Darkwaters	07/21/99	230	
Camp Darkwaters	07/29/99	260	
Camp Darkwaters	08/05/99	290	
Camp Darkwaters	08/12/99	240	
Camp Darkwaters	06/26/03	140	
Camp Darkwaters	07/02/03	150	
Camp Darkwaters	07/09/03	730	
Camp Darkwaters	07/15/03	190	
Camp Darkwaters	07/24/03	180	
Camp Darkwaters	07/30/03	150	
Camp Darkwaters	08/07/03	520	
Camp Darkwaters	08/14/03	150	
Camp Darkwaters	08/19/03	230	
Camp Darkwaters	06/09/04	270	
Camp Darkwaters	06/23/04	570	
Camp Darkwaters	06/17/04	780	
Camp Darkwaters	06/29/04	620	
Camp Darkwaters	07/08/04	560	

Lake James			
count	93	mean+3stdev	11242
median	350	% Reduction	99%
Max	20000		
stdev	3217	**no data excluded**	
mean	1592		
mean+3stdev	11242		

Lake	Date	Value	Remark
Kings Grant	06/05/99	20	
Kings Grant	06/22/99	40	
Kings Grant	06/27/99	90	
Kings Grant	07/03/99	10	
Kings Grant	07/11/99	32	
Kings Grant	07/19/99	60	
Kings Grant	07/25/99	40	
Kings Grant	08/02/99	100	
Kings Grant	08/08/99	31	
Kings Grant	05/31/00	40	
Kings Grant	06/07/00	560	
Kings Grant	06/12/00	100	Resample
Kings Grant	06/14/00	230	
Kings Grant	06/20/00	400	
Kings Grant	06/27/00	50	
Kings Grant	07/05/00	130	
Kings Grant	07/13/00	10	K
Kings Grant	07/20/00	8200	
Kings Grant	07/24/00	1100	Resample
Kings Grant	07/27/00	1600	
Kings Grant	07/28/00	4500	Resample
Kings Grant	07/31/00	3700	
Kings Grant	08/08/00	510	
Kings Grant	08/15/00	860	
Kings Grant	08/18/00	860	Resample
Kings Grant	08/22/00	200	
Kings Grant	08/29/00	640	
Kings Grant	06/04/01	310	
Kings Grant	06/11/01	210	
Kings Grant	06/14/01	150	
Kings Grant	06/20/01	560	

Kings Grant	06/25/01	310	
Kings Grant	06/29/01	160	
Kings Grant	07/05/01	8400	
Kings Grant	07/10/01	570	
Kings Grant	07/16/01	310	
Kings Grant	07/18/01	210	
Kings Grant	07/20/01	3900	
Kings Grant	07/25/01	4700	
Kings Grant	07/28/01	6700	Resample
Kings Grant	07/31/01	5500	
Kings Grant	08/08/01	6600	
Kings Grant	08/15/01	4600	
Kings Grant	08/20/01	16000	
Kings Grant	08/21/01	20000	Resample
Kings Grant	05/21/02	230	
	06/03/02	500	
	06/04/02	30	Resample
	06/13/02	100	
	06/19/02	180	
	06/27/02	210	
	07/08/02	270	
	07/15/02	40	
	07/16/02	170	
	07/25/02	70	
	08/01/02	430	
	08/05/02	460	
	08/07/02	570	
	08/16/02	590	
	08/21/02	200	
Kings Grant	05/29/03	360	
	06/03/03	290	
	06/10/03	350	
	06/13/03	350	
	06/19/03	210	
	06/23/03	210	
	06/25/03	880	
	07/01/03	330	
	07/08/03	150	
	07/15/03	300	
	07/17/03	140	Resample
	07/21/03	240	
	07/30/03	530	
	08/01/03	930	
	08/05/03	730	
	08/13/03	1500	
	08/18/03	2400	
	08/28/03	530	
Kings Grant	06/01/04	4200	
Kings Grant	06/04/04	430	Resample
Kings Grant	07/01/04	430	
Kings Grant	07/05/04	100	
Kings Grant	07/16/04	180	
Kings Grant	07/22/04	220	
Kings Grant	07/28/04	3500	
Kings Grant	07/30/04	3000	
Kings Grant	08/03/04	6000	
Kings Grant	08/05/04	430	
Kings Grant	08/10/04	210	
Kings Grant	08/19/04	270	
Kings Grant	08/24/04	1800	
Kings Grant	08/27/04	9100	
Kings Grant	09/07/04	410	

Malaga Lake			
count	119	mean+3stdev	719
median	90	% reduction	69%
max	646		
stdev	184	**no data excluded**	
mean	167		
mean+3stdev	719		

Station	**Date**	**Value**	**Remark**
GC0505	05/18/98	432	
GC0505	05/26/98	122	
GC0505	06/01/98	118	
GC0505	08/06/98	88	
GC0505	06/15/98	210	
GC0505	06/22/98	374	Closed
GC0505	06/29/98	184	Reopen
GC0505	07/06/98	110	
GC0505	07/13/98	80	
GC0505	07/20/98	110	
GC0505	07/27/98	212	
GC0505	08/03/98	78	
GC0505	08/10/98	42	
GC0505	08/17/98	62	
GC0505	08/27/98	324	
GC0505	08/31/98	104	
	05/24/99	222	
	06/01/99	100	
	06/06/99	330	
	06/14/99	136	
	06/21/99	32	
	06/28/99	350	
	07/08/99	300	Closed
	07/12/99	280	
	07/19/99	29	Reopen
	07/26/99	51	
	08/02/99	121	
	08/09/99	144	
	08/16/99	90	
	08/23/99	79	
	08/30/99	53	
	09/07/99	36	
Malaga Lake	05/22/00	3	
	05/30/00	37	
	06/05/00	18	
	06/12/00	56	
	06/19/00	171	
	06/26/00	55	
	07/03/00	51	
	07/11/00	440	
	07/17/00	45	
	07/24/00	5	
	08/07/00	13	
	08/14/00	118	
	08/22/00	5	
	08/28/00	128	
	09/05/00	21	
Malaga Lake	05/30/01	73	
	06/06/01	197	
	06/13/01	600	
	06/15/01	574	closed, resample
	06/18/01	580	closed, resample
	06/20/01	73	reopen
	06/27/01	415	
	06/29/01	380	closed, resample
	07/02/01	80	reopen
	07/10/01	103	
	07/18/01	540	

	07/20/01	140	resample
	07/25/01	160	
	08/01/01	600	
	08/03/01	276	closed, resample
	08/06/01	41	reopen, resample
	08/08/01	435	
	08/10/01	55	resample
	08/15/01	49	
	08/22/01	36	
	08/29/01	47	
Malaga Lake	05/14/02	67	
	05/20/02	580	
	05/28/02	181	
	06/03/02	136	
	06/10/02	97	
	06/17/02	173	
	06/24/02	TNTC	
	06/28/02	646	resample, closed
	07/01/02	17	
	07/08/02	1	
	07/17/02	7	
	07/22/02	27	
	07/30/02	11	
	08/05/02	15	
	08/14/02	8	
	08/20/02	15	
	08/26/02	39	
Malaga Lake	05/30/03	20	
	06/04/03	10	
	06/09/03	600	L
	06/16/03	20	RESAMPLE
	06/23/03	600	L
	06/25/03	600	L CLOSED
	06/26/03	20	REOPEN
	06/30/03	90	
	07/09/03	180	
	07/14/03	70	
	07/21/03	10	K
	07/29/03	10	K
	08/06/03	420	
	08/08/03	600	L CLOSED
	08/11/03	100	REOPEN
	08/18/03	120	

	08/25/03	20	
Malage Lake	05/24/04	190	
	06/03/04	40	
	06/07/04	50	
	06/14/04	30	
	06/21/04	10	K
	06/28/04	60	
	07/08/04	40	
	07/12/04	50	
	07/19/04	250	
	07/21/04	600	L CLOSED
	07/23/04	70	REOPEN
	07/26/04	20	
	08/02/04	600	L
	08/04/04	180	RETEST
	08/09/04	130	
	08/19/04	120	
	08/23/04	80	
	08/30/04	190	

Mirror Lake			
count	97	mean+3stdev	5755
median	50	% reduction	99%
max	16000		
stdev	1777	**no data excluded**	
mean	424		
mean+3stdev	5755		

Lake	**Date**	**Value**	**Remark**
Mirror Lake	05/19/99	1	K
Mirror Lake	05/24/99	1	K
Mirror Lake	06/07/99	1	K
Mirror Lake	06/14/99	40	
Mirror Lake	06/21/99	35	
Mirror Lake	07/12/99	20	K
Mirror Lake	07/19/99	20	K
Mirror Lake	07/26/99	20	K
Mirror Lake	08/02/99	20	K
Mirror Lake	08/09/99	270	
Mirror Lake	08/11/99	20	K
Mirror Lake	08/18/99	20	K
Mirror Lake	08/25/99	20	K
Mirror Lake	05/24/00	80	

Mirror Lake	05/31/00	20	K
Mirror Lake	06/07/00	20	K
Mirror Lake	06/14/00	50	
Mirror Lake	06/19/00	330	
Mirror Lake	06/21/00	80	Resample
Mirror Lake	06/26/00	110	
Mirror Lake	07/03/00	40	
Mirror Lake	07/10/00	230	
Mirror Lake	07/12/00	70	Resample
Mirror Lake	07/17/00	50	
Mirror Lake	07/24/00	20	K
Mirror Lake	07/31/00	40	
Mirror Lake	08/07/00	20	K
Mirror Lake	08/16/00	330	
Mirror Lake	08/21/00	80	
Mirror Lake	08/28/00	1100	
Mirror Lake	08/30/00	50	Resample
Mirror Lake	06/13/01	140	
Mirror Lake	06/20/01	20	
Mirror Lake	06/27/01	40	
Mirror Lake	07/02/01	70	
Mirror Lake	07/09/01	50	
Mirror Lake	07/16/01	490	
Mirror Lake	07/18/01	220	Resample
Mirror Lake	07/23/01	50	
Mirror Lake	07/30/01	140	
Mirror Lake	08/06/01	60	
Mirror Lake	08/13/01	170	
Mirror Lake	08/20/01	1300	
Mirror Lake	08/22/01	20	Resample
Mirror Lake	08/27/01	50	
Mirror Lake	06/10/02	20	K
	06/17/02	20	
	06/24/02	20	K
	07/01/02	20	
	07/08/02	20	K
	07/15/02	110	
	07/22/02	40	
	07/29/02	20	K
	08/05/02	20	K
	08/12/02	20	
	08/19/02	40	
	08/26/02	20	
Mirror Lake	05/19/03	20	K
	05/28/03	70	

	06/04/03	500	
	06/09/03	40	
	06/16/03	130	
	06/23/03	20	
	06/30/03	20	
	07/07/03	20	K
	07/14/03	90	
	07/21/03	20	
	07/28/03	170	
	08/04/03	500	
	08/04/03	230	Resample
	08/11/03	5000	
	08/13/03	5000	
	08/20/03	300	
	08/25/03	16000	
	08/27/03	3000	Resample
Mirror Lake	05/18/04	20	
Mirror Lake	05/24/04	80	
Mirror Lake	06/01/04	220	
Mirror Lake	06/03/04	80	Resample
Mirror Lake	06/07/04	300	
Mirror Lake	06/09/04	170	Resample
Mirror Lake	06/14/04	20	K
Mirror Lake	06/21/04	20	
Mirror Lake	06/28/04	300	
Mirror Lake	06/30/04	270	Resample
Mirror Lake	07/06/04	270	
Mirror Lake	07/08/04	40	Resample
Mirror Lake	07/12/04	20	
Mirror Lake	07/16/04	800	
Mirror Lake	07/19/04	110	Resample
Mirror Lake	07/26/04	80	
Mirror Lake	08/04/04	220	
Mirror Lake	08/06/04	300	Resample
Mirror Lake	08/04/04	80	
Mirror Lake	08/16/04	80	
Mirror Lake	08/23/04	80	
Mirror Lake	08/30/04	20	

Sturbridge Lake			
count	167	mean+3stdev	2322
median	60	% reduction	97%
Max	5900		

Stdev	698	**no data excluded**	
mean	229		
mean+3stdev	2322		

Station	**Date**	**Value**	**Remark**
CAL6901	05/23/98	20	
CAL6901	05/30/98	40	
CAL6901	06/09/98	50	
CAL6901	06/18/98	50	
CAL6901	06/26/98	80	
CAL6901	07/03/98	40	
CAL6901	07/10/98	40	
CAL6901	07/17/98	40	
CAL6901	07/22/98	70	
CAL6901	08/06/98	10	K
CAL6901	08/11/98	20	
CAL6901	08/19/98	100	
CAL6901	08/29/98	10	
CAL6902	05/23/98	80	
CAL6902	05/30/98	50	
CAL6902	06/09/98	30	
CAL6902	06/18/98	150	
CAL6902	06/26/98	70	
CAL6902	07/03/98	50	
CAL6902	07/10/98	10	K
CAL6902	07/17/98	10	K
CAL6902	07/22/98	60	
CAL6902	07/30/98	30	
CAL6902	08/06/98	10	K
CAL6902	08/11/98	40	
CAL6902	08/19/98	90	
CAL6902	08/29/98	30	
CAL6901	06/05/99	30	
CAL6901	06/20/99	20	
CAL6901	07/05/99	30	
CAL6901	07/16/99	90	
CAL6901	07/20/99	100	
CAL6901	07/24/99	20	
CAL6901	08/01/99	30	
CAL6901	08/10/99	10	K
CAL6901	08/17/99	30	
CAL6901	08/28/99	20	
CAL6902	07/05/99	40	
CAL6902	07/16/99	10	K
CAL6902	07/20/99	90	
CAL6902	07/24/99	10	K
CAL6902	08/01/99	60	
CAL6902	08/10/99	10	
CAL6902	08/17/99	20	
CAL6902	08/28/99	80	
CAL6901	05/31/00	40	K
CAL6901	06/07/00	370	K
CAL6901	06/12/00	250	K
CAL6901	06/14/00	200	RETEST
CAL6901	06/20/00	190	K
CAL6901	06/27/00	30	K
CAL6901	07/05/00	20	K
CAL6901	07/13/00	10	K
CAL6901	07/20/00	60	K
CAL6901	07/31/00	340	K
CAL6901	08/04/00	610	K
CAL6901	08/11/00	50	RETEST
CAL6901	08/15/00	70	K
CAL6901	08/22/00	10	K
CAL6901	08/29/00	180	K
CAL6902	05/31/00	10	K
CAL6902	06/07/00	40	K
CAL6902	06/20/00	390	K
CAL6902	06/23/00	50	K
CAL6902	06/27/00	60	K
CAL6902	07/05/00	50	K
CAL6902	07/13/00	10	K
CAL6902	07/20/00	70	K
CAL6902	07/31/00	40	K
CAL6902	08/08/00	20	K
CAL6902	08/15/00	90	K
CAL6902	08/22/00	40	K
CAL6902	08/29/00	180	K
CAL6901	06/04/01	30	K
CAL6901	06/12/01	160	K
CAL6901	06/20/01	5900	
CAL6901	06/25/01	140	retest
CAL6901	07/05/01	480	
CAL6901	07/10/01	110	retest
CAL6901	07/16/01	320	
CAL6901	07/18/01	60	retest
CAL6901	07/20/01	70	K
CAL6901	07/25/01	800	
CAL6901	07/28/01	130	retest

CAL6901	07/31/01	710	
CAL6901	08/08/01	80	K
CAL6901	08/15/01	170	K
CAL6901	08/21/01	540	
CAL6901	08/24/01	120	retest
CAL6902	06/04/01	1	K
CAL6902	06/20/01	250	
CAL6902	06/25/01	20	retest
CAL6902	07/05/01	220	
CAL6902	07/10/01	40	retest
CAL6902	07/16/01	120	K
CAL6902	07/31/01	10	K
CAL6902	08/08/01	50	K
CAL6902	08/15/01	110	K
CAL6902	08/21/01	40	K
	05/21/02	120	K
	05/30/02	140	K
	06/04/02	40	K
	06/13/02	220	K
	06/27/02	100	RETEST
	07/03/02	210	K
	07/16/02	40	RETEST
	07/25/02	130	K
	08/01/02	320	K
	08/14/02	30	K
	08/21/02	30	K
	08/27/02	170	K
	05/21/02	60	K
	05/30/02	230	K
	06/03/02	60	RETEST
	06/13/02	50	K
	06/19/02	140	K
	06/27/02	110	K
	07/03/02	130	K
	07/16/02	100	K
	07/25/02	2900	K
	07/29/02	60	RETEST
	08/01/02	510	K
	08/14/02	50	RETEST
	08/21/02	40	K
	08/27/02	150	K
Chatham Lake	05/29/03	120	
	06/03/03	10	K
	06/10/03	120	

	06/19/03	3600	**Closed**
	06/23/03	90	Resample, **Reopened**
	07/01/03	70	
	07/17/03	50	
	07/21/03	1400	**Closed**
	07/30/03	50	Resample, **Reopened**
	08/05/03	1000	**Closed**
	08/13/03	50	Resample, **Reopened**
	08/18/03	40	
	08/28/03	40	
Foxview Beach	05/29/03	190	
	06/03/03	90	
	06/10/03	140	
	06/19/03	5000	**Closed**
	06/23/03	710	Resample, **still closed**
	06/25/03	60	Resample, **reopened**
	07/01/03	60	
	07/08/03	560	**Closed**
	07/17/03	260	Resample, **still closed**
	07/21/03	330	Resample, **still closed**
	07/29/03	130	Resample, **reopened**
	08/05/03	160	
	08/13/03	120	
	08/18/03	20	
	08/28/03	40	
Chatham Lake	07/05/04	70	
	08/05/04	110	
	08/12/04	50	
	08/19/04	30	
	08/24/04	10	K
Foxview Beach	06/01/04	10	
	06/08/04	190	
	06/17/04	470	
	06/24/04	160	
	07/05/04	40	
	08/05/04	100	
	08/12/04	80	
	08/19/04	40	
	08/24/04	80	

WMA 20

Upper Sylvan Lake			
count	85	mean+3stdev	1750
median	20	% reduction	94%
max	3500		
stdev	523	**no data excluded**	
mean	182		
mean+3stdev	1750		

Lake	**Date**	**Value**	**Remark**
Sylvan Lake	05/19/99	1	K
Sylvan Lake	06/14/99	1	K
Sylvan Lake	06/21/99	1	K
Sylvan Lake	07/12/99	40	
Sylvan Lake	07/19/99	20	K
Sylvan Lake	07/26/99	20	K
Sylvan Lake	08/02/99	20	K
Sylvan Lake	08/11/99	20	K
Sylvan Lake	08/18/99	20	K
Sylvan Lake	08/25/99	20	K
Sylvan Lake	05/24/00	20	
Sylvan Lake	05/24/00	20	
Sylvan Lake	05/31/00	20	
Sylvan Lake	06/07/00	20	K
Sylvan Lake	06/14/00	40	
Sylvan Lake	06/19/00	1300	
Sylvan Lake	06/21/00	50	Resample
Sylvan Lake	06/26/00	20	
Sylvan Lake	07/03/00	20	K
Sylvan Lake	07/10/00	20	K
Sylvan Lake	07/17/00	90	
Sylvan Lake	07/24/00	20	K
Sylvan Lake	07/31/00	20	
Sylvan Lake	08/07/00	80	
Sylvan Lake	08/14/00	3500	
Sylvan Lake	08/16/00	330	
Sylvan Lake	08/21/00	20	K
Sylvan Lake	08/28/00	790	

Sylvan Lake	08/30/00	20	Resample
Sylvan Lake	06/13/01	330	
Sylvan Lake	06/18/01	2400	
Sylvan Lake	06/20/01	170	
Sylvan Lake	06/27/01	170	
Sylvan Lake	07/02/01	90	
Sylvan Lake	07/09/01	40	
Sylvan Lake	07/16/01	20	
Sylvan Lake	07/23/01	20	
Sylvan Lake	07/30/01	20	K
Sylvan Lake	08/06/01	1700	
Sylvan Lake	08/08/01	50	Resample
Sylvan Lake	08/13/01	20	K
Sylvan Lake	08/20/01	20	K
Sylvan Lake	08/27/01	20	
Sylvan Lake	06/10/02	20	K
	06/17/02	80	
	06/24/02	40	
	07/01/02	20	
	07/08/02	20	
	07/15/02	20	K
	07/22/02	20	
	07/29/02	20	K
	08/05/02	20	K
	08/12/02	90	
	08/19/02	20	K
	08/26/02	20	
Sylvan Lake	05/19/03	20	K
	05/28/03	500	
	06/04/03	300	
	06/09/03	1300	
	06/11/03	20	Resample
	06/16/03	20	
	06/23/03	20	K
	06/30/03	40	
	07/07/03	20	
	07/14/03	20	K
	07/21/03	20	K
	07/28/03	20	K
	08/04/03	20	
	08/11/03	40	
	08/20/03	20	
	08/25/03	20	K
Sylvan Lake	06/14/04	20	K
Sylvan Lake	06/21/04	90	

Sylvan Lake	06/28/04	40	
Sylvan Lake	07/06/04	40	
Sylvan Lake	07/12/04	20	
Sylvan Lake	07/19/04	230	
Sylvan Lake	07/22/04	20	Resample
Sylvan Lake	07/26/04	80	
Sylvan Lake	08/04/04	300	
Sylvan Lake	08/06/04	20	Resample
Sylvan Lake	08/04/04	20	
Sylvan Lake	08/16/04	110	
Sylvan Lake	08/23/04	20	K
Sylvan Lake	08/30/04	20	