PHOSPHORUS CONTROL ACTION PLAN

and Total Maximum Daily (Annual Phosphorus) Load Report

Daigle Pond- New Canada

Aroostook County, Maine

Daigle Pond PCAP - TMDL Report

Maine DEPLW - 0789

Maine Department of Environmental Protection

and Maine Association of Conservation Districts

Final EPA Review Document– September 27, 2006

DAIGLE POND - New Canada

Phosphorus Control Action Plan (PCAP)

Table of Contents

APPENDICES

DAIGLE POND - New Canada

Total Maximum Daily (Annual Phosphorus) Load

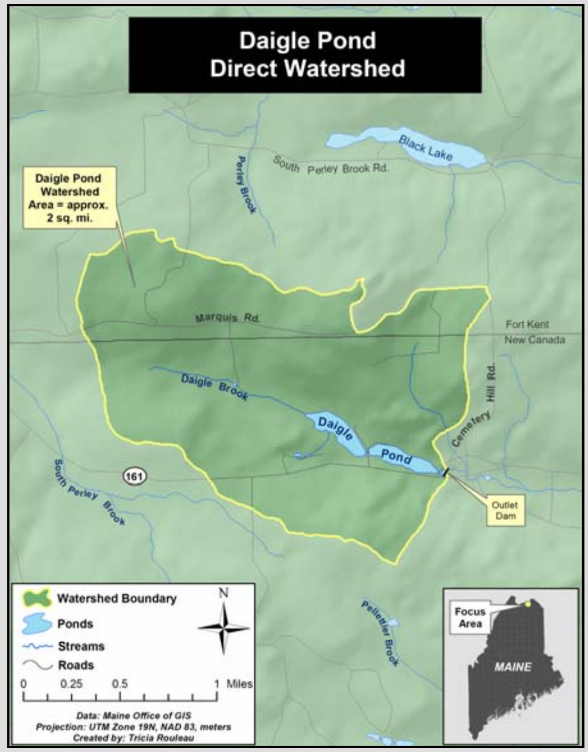
ACKNOWLEDGMENTS

In addition to Maine DEP (Division of Environmental Assessment - Lakes Assessment Section and Watershed Management Division-Augusta and Presque Isle) and U.S. EPA New England Region I staff, the following individuals, groups and agencies were instrumental in the preparation of this Daigle Pond combined Phosphorus Control Action Plan and Total Maximum Daily Load report: MACD staff (Forrest Bell, Fred Dillon, Jennifer Jespersen, and Tricia Rouleau); Maine Department of Agriculture (David Rocque); Maine Forest Service (Chris Martin); Maine Department of Inland Fisheries and Wildlife (Dave Basley); the Saint John Valley Soil and Water Conservation District (Heidi Royal), and Maine Volunteer Lake Monitoring Program volunteers Don Eno and Beau Daigle (1998-2001).

Daigle Pond - New Canada Phosphorus Control Action Plan Summary Fact Sheet

Background

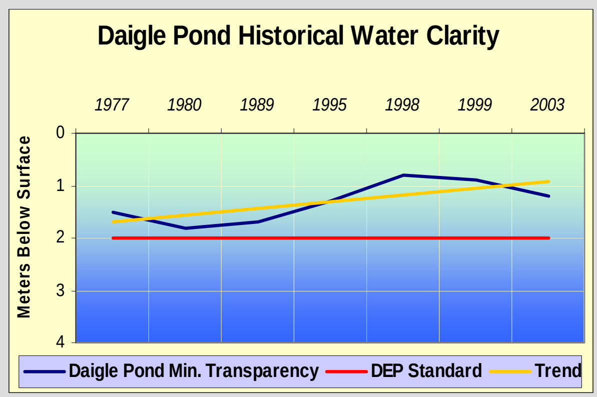
DAIGLE POND (Midas No. 1665) is a 34- acre colored pond located in New Canada Plantation in Aroostook County, Maine. Daigle Pond has a direct drainage (see map at right and on pg. 8) area of approximately 2.2 square miles; a maximum depth of 12 feet (4 meters), a mean depth of 7 feet (2 meters); and a relatively high **flushing rate** of 21.3 times per year.



Historical Information

Daigle Pond is a shallow, impounded dual-basin pond which has historically received non-point source (NPS) runoff from surrounding agricultural lands and roads (Bouchard 1995). Nutrient contamination, and persistent nuisance algal blooms, have been documented in Daigle Pond since 1977. In the early 1990's a Watershed Survey identified 47 separate NPS problem sites (SJV-SWCD 1996). In addition to residential lots, roads and agricultural NPS sites, the survey found that water quality was affected by a deteriorating causeway culvert between the upper and lower basins which caused stagnation of the water in the upper basin (DPRC 2003).

NPS pollution in Daigle Pond stems primarily from soil erosion in the surrounding **watershed** and stormwater runoff from area roads and agricultural sites (external load). Soil erosion can have far reaching impacts, as soil particles effectively transport **phosphorus**, which serves to "fertilize" the lake and decreases water clarity. Because Daigle Pond is an impounded stream, it collects a substantial amount of sediments over time. When resuspended (internal load), these nutrient rich sediments can be a source of high phosphorus (Bouchard 1996), especially during the warm summer months. Excess phosphorus can also harm fish habitat and lead to nuisance algae blooms—floating mats of green scum—or dead and dying algae. Studies have shown that as lake water clarity decreases, lakeshore residential property values also decline.



Daigle Pond's minimum water clarity has deteriorated over the period of record.

Although there have been significant efforts to reduce erosion and phosphorus loading in the watershed, phosphorus levels are still high enough to affect water quality and promote algal growth. Daigle Pond is listed by DEP as "water quality limited" which means that it is well below the minimum standard. It is also listed on Maine's 303(d) list of impaired waterbodies.

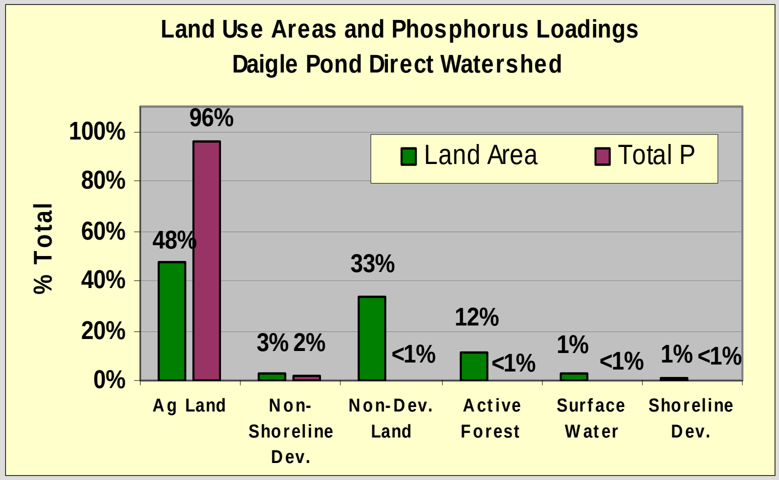
Key Terms

- ***Flushing rate*** *refers to how often the water in the entire lake is replaced on an annual basis.*
- ***Watershed*** *is a drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.*
- ***Phosphorus****: is one of the major nutrients needed for plant growth. It is naturally present in small amounts and limits the plant growth in lakes. Generally, as phosphorus increases, the amount of algae also increases.*

What We Learned

The land use assessment conducted for the Daigle Pond watershed helped to determine the potential sources of phosphorus that may run off from land areas during storm events and springtime snow melting. This assessment utilized many resources, including generating and interpreting maps, inspecting and verifying aerial photos using local knowledge, and visiting the watershed.

A land-use model (p.7) estimated that approximately 1,269 kg of phosphorus is exported annually (external load) to Daigle Pond from the direct watershed (p.25). The bar chart (right) illustrates the land area representative land uses as compared to the phosphorus export load for each land use.



Agricultural land uses make up the highest proportion of total phosphorus exported to Daigle Pond (see pages 12-15 for explanation).

Sampling data collected in 1995 revealed that the amount of **total phosphorus (TP)** being recycled internally (internal load - 26 kg/year) from Daigle Pond bottom sediments during the summer-time is approximately 22% of the pond's natural capacity (116 kg/year) for in-lake phosphorus assimilation (assuming a target goal of 16 ppb for a colored lake).

Phosphorus Reduction Needed

Daigle Pond's average summertime TP concentration (originating from a combination of external and internal loading) approximates 50 ppb (365 kg) - equal to an additional 248 kg more than the lake's natural capacity. Including a 3.65 kg allocation for future development, the total annual amount of phosphorus needed to be reduced to support Maine water quality standards (algal bloom-free total phosphorus concentrations of 16 ppb or less) in Daigle Pond approximates 252 kg (see In-Lake Concentration Method p.16).

What You Can Do To Help!

As a watershed resident, there are many things you can do to protect the water quality of Daigle Pond. Lakeshore owners can use phosphorus-free fertilizers and maintain natural vegetation adjacent to the lake. Agricultural and commercial land users can consult the St. John Valley Soil and Water Conservation District or the Maine Department of Environmental Protection for information regarding **Best Management Practices** (BMPs) for reducing phosphorus loads. Watershed residents can always become involved by participating in events sponsored by State agencies and local organizations. The estimated phosphorus loading to Daigle Pond originates from both shoreline and non-shoreline areas, so all watershed residents must take ownership of maintaining suitable water quality. Lake stakeholders and watershed residents in New Canada and Fort Kent can learn more about their lake and the many resources available, including review of the Daigle Pond Phosphorus Control Action Plan and **TMDL** report. Following final EPA approval, copies of this detailed report, with recommendations for future NPS/BMP work, will be available online at www.maine.gov/dep/blwq/docmonitoring/tmdl2.htm, or can be viewed and/or copied (at cost) at Maine DEP offices in Presque Isle and Augusta (Bureau of Land and Water Quality, Ray Building, AMHI Campus).

Key Terms

- ***Total Phosphorus (TP)*** *- the total concentration of phosphorus found in the water including organic and inorganic forms.*
- ***Best Management Practices*** *are techniques to reduce sources of polluted runoff and their impacts. BMP's are low cost, common sense approaches to reduce storm runoff and velocity to keep soil out of lakes and tributaries.*
- ***TMDL****, an acronym for Total Maximum Daily Load, represents the total amount of a pollutant (e.g., phosphorus) that a waterbody can receive on an annual basis and still meet water quality standards.*

Project Premise

This lakes PCAP-TMDL project, funded through a Clean Water Act Section 319-grant from the United States Environmental Protection Agency (EPA), was directed and administered by the Maine Department of Environmental Protection (Maine DEP) under contract with the Maine Association of Conservation Districts (MACD), from 2005 to 2006.

The objectives of this project were twofold: First, a comprehensive land use inventory was undertaken to assist Maine DEP in developing a Phosphorus Control Action Plan (PCAP) and a Total Maximum Daily Load (TMDL) report for the Daigle Pond watershed (see study methodology, p.7). Simply stated, a TMDL is the total amount of phosphorus that a lake can receive without harming water quality. Maine DEP, with assistance from the MACD, will fully address and incorporate public comments before final submission to the US EPA. *(For more specific information on the TMDL process and results, refer to the Appendices or contact Dave Halliwell at the Maine DEP Augusta Office at 287-7649 or at david.halliwell@maine.gov*).

Secondly, watershed assessment work was conducted by the Maine DEP-MACD project team to help assess total phosphorus reduction techniques that would be beneficial for the Daigle Pond watershed. The results of this assessment include recommendations for future conservation work in the watershed to help citizens, organizations, and agencies restore and protect Daigle Pond.
Note: *To protect the confidentiality of landowners in the Daigle Pond watershed, site-specific information has not generally been provided as part of this PCAP-TMDL report.*

This Phosphorus Control Action Plan (PCAP) report compiles and refines land use data derived from various sources, including the Maine Office of Geographic Information Systems, the St. John Valley Soil & Water Conservation District (SJV-SWCD), and the Maine Forest Service (MFS). Local citizens, active and/or developing watershed organizations, and conservation agencies will benefit from this compilation of both historical and recently collected data as well as the watershed assessment and the NPS Best Management Practice (BMP) recommendations. Above all, this document is intended to help Daigle Pond stakeholder groups to effectively prioritize future BMP work in order to obtain the funding resources necessary for further **NPS pollution** mitigation work in their watershed.

> ***Nonpoint Source (NPS) Pollution*** *- is polluted runoff that cannot be traced to a specific origin or starting point, but accumulates from overland flow from many different watershed sources*

Study Limitations

Land use data gathered for the Daigle Pond watershed is as accurate as possible given all of the available information and resources utilized. However, final numbers for the land use analysis and phosphorus loading numbers are approximate, and should be viewed only as carefully researched estimations. Land uses in the Daigle Pond watershed have changed since the 1995 land-use data was developed, and continue to change each growing season. As such, a combination of GIS and field observations would likely have provided a more accurate summary of watershed land uses.

Study Methodology

Daigle Pond background information was obtained using several methods, including a review of previous surveys of the pond and watershed, numerous phone conversations and personal communications with regional organizations and state agencies, and a field tour of the watershed.

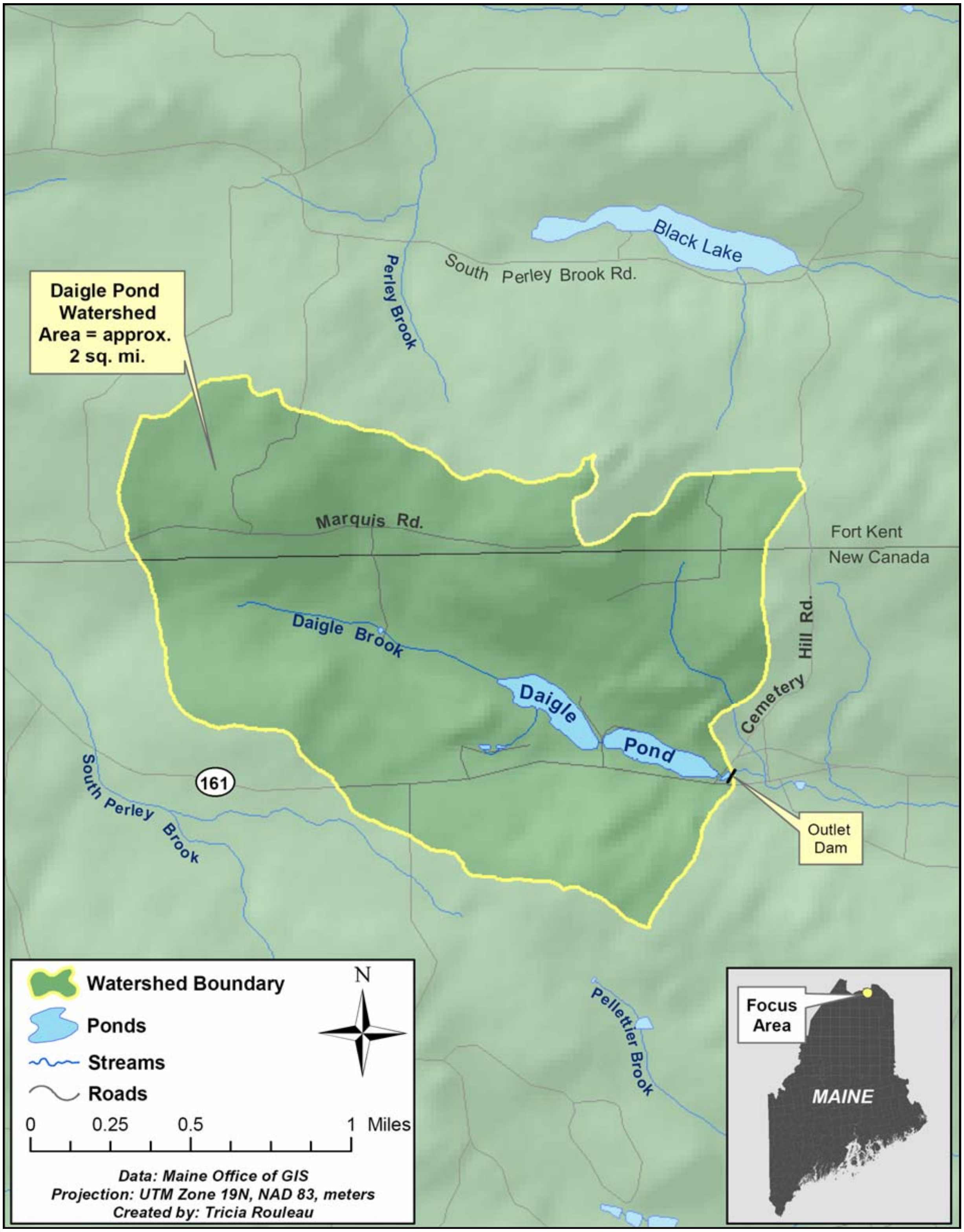
Land use data were determined using several methods, including (1) **Geographic Information System (GIS)** map analysis, (2) analysis of topographic maps, and (3) analysis of aerial photographs. Much of the non-developed land use area (i.e., forest, wetland, grassland) was determined using a GIS layer which is a combination of Maine Gap Analysis (GAP) landcover and USGS Multi Resolution Landcover Characterization (MRLC) landcover layers. It was created at the request of Maine DEP Bureau of Land and Water Quality (BLWQ) staff. It includes those classes in each layer which are best suited to calculating impermeability of watersheds. Both MRLC and GAP (and so Maine COMBO) are based on 1995 LandSat imagery. The developed land use areas were obtained using the best possible information available through analysis of methods 1 through 3 listed above.

Final adjusted phosphorus loading numbers (see Table 2, page 25) were modeled using overlays of soils and slope. All of the land use coverage data for agricultural areas were re-configured using aerial overlays, and reviewed and confirmed by the SJV-SWCD in conjunction with the USDA/NRCS. Information regarding forest harvest operations were reviewed by the Maine Forest Service, Department of Conservation.

Roadway widths were estimated from previous PCAP reports where actual measurements were made for the various road types. In general, state-owned roads were found to be 22 meters wide; town-owned roads were found to be 16 meters wide; and privately-owned roads were found to be 6 meters wide. GIS was used to calculate total road surface area.

GIS*—or* ***geographic information system*** *combines layers of information about a place to give you a better understanding of that place. The information is often represented as computer generated maps.*

Figure 1. Map of Daigle Pond Direct Watershed*



** The Daigle Pond direct watershed area has been adjusted to reflect changes in the landscape which have affected the direction of water flow. According to the St. John Valley Soil and Water Conservation District, with time and severe rain events, gullies have diverted some of the flow from the Cross Lake watershed (to the east) to the Daigle Pond watershed.*

DAIGLE POND Phosphorus Control Action Plan

DESCRIPTION of WATERBODY (MIDAS Number 1665) and WATERSHED

Daigle Pond Direct Watershed: *The **direct watershed** refers to the land area that drains to a waterbody without first passing through an associated lake or pond.*

DAIGLE POND is a 34-acre (14 hectare) colored waterbody situated in the town of New Canada (DeLorme Atlas, Map 68), within Aroostook County, Maine. Daigle Pond has a **direct watershed** area (see Figure 1) of approximately 1,417 acres (2.2 square miles) including pond surface area. The Daigle Pond direct watershed is located within two towns: New Canada (70%) and Fort Kent (30%). Daigle Pond has a maximum depth of 12 feet (4 meters), overall mean depth of 7 feet (2 meters), and a relatively high flushing rate of 21.3 times/year.

Drainage System:

Daigle Pond is an impounded stream divided into two basins by a causeway culvert. The pond was created in 1874 when a dam was constructed to power a sawmill on Daigle Brook. Daigle Pond's only outflow is the man-made concrete dam outlet on the southern end of the pond. There are no boat launches on Daigle Pond - the only access is by paved road. Daigle Brook, a water quality impaired 303(d) listed stream, flows into the pond from the northwest and into 303(d) -listed Cross Lake to the southeast. The poor water quality of Daigle Brook is caused by excessive pollutants (total phosphorus) from Daigle Pond and the brook's direct watershed within the Cross Lake drainage.

Water Quality Information

Daigle Pond is listed on the Maine DEP's 2004 303(d) list of lakes that do not meet State water quality standards. Daigle Brook is also listed on the Maine DEP's **Non-Point Source** (NPS) **Priority Watersheds** list. Therefore, a combined Phosphorus Control Action Plan and TMDL report was prepared during the spring-summer of 2006.

Non Point Source Priority Watersheds

*Waterbodies within designated **NPS priority watersheds** have significant value from a regional or statewide perspective and have water quality that is either impaired or threatened due to NPS water pollution. This list identifies watersheds where state and federal agency resources for NPS water pollution prevention or restoration should be targeted.*

Based on **Secchi disk transparencies (SDT),** measures of total phosphorus (TP), and **chlorophyll-a**, (Chl-a), the water quality of Daigle Pond is considered to be poor and the potential for nuisance summertime algae blooms is high (Maine VLMP 2005). Together, these water quality data document a trend of increasing **trophic state,** in direct violation of the Maine DEP Class GPA lakes water quality criteria requiring a stable or decreasing trophic state.

Secchi Disk Transparency - *a vertical measure of the transparency of water (ability of light to penetrate water) obtained by lowering a black and white disk into the water until it is no longer visible.*

Chlorophyll-a *is a measurement of the green pigment found in all plants including microscopic plants such as algae. It is used as an estimate of algal biomass; the higher the Chl-a number, the higher the amount of algae in the lake.*

Trophic state *- the degree of eutrophication of a lake. Transparency, chlorophyll-a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can all be used to assess trophic state.*

A variety of nonpoint sources of pollution may be contributing to the poor water quality in Daigle Pond. The water quality of Daigle Pond is heavily influenced by runoff events from the watershed. During storm events, nutrients such as phosphorus – naturally found in Maine soils - drain into the pond from the surrounding watershed by way of streams and overland flow, eventually being deposited and stored in pond sediments (26 kg based on 1995 measures). Years of soil erosion have resulted in a buildup of sediment in the Daigle Pond, which contributes to internal phosphorus loading (Bouchard 1996).

Phosphorus is naturally limited in lakes and can be thought of as a fertilizer, a primary food for plants, including algae. When lakes receive excess phosphorus from NPS pollution, it "fertilizes" the lake by feeding the algae. Too much phosphorus can result in nuisance algae blooms, which can damage the ecology and aesthetics of a lake, as well as the economic well-being of the entire lake watershed.

Historically, poor water quality in Daigle Pond has been attributed to nonpoint source runoff from primarily agricultural land and roads. A Watershed Survey conducted in the early 1990's revealed 47 separate problem sites in the Daigle Pond watershed. The primary sources of nonpoint source pollution were identified as residential (driveways, house lots, roads) and agricultural sites (row crops, animal feedlots) (SJV-SWCD 1996). Additional organic and nutrient loading to Daigle Pond has been noted in recent years (2004-2005), when poor potato seasons resulted in a large number of cull potatoes and excess potato waste was spread on fields or used as feed at cattle operations (Heidi Royal/SJV-SWCD, Personal Communication).

Stabilizing eroding waterways with stone rip-rap helps to prevent soil erosion.

Principle Uses & Human Development:

The prevalent human uses of the Daigle Pond watershed are primarily agricultural (48%) (Figure 2). With approximately 64% (903 acres) of the land area consisting of developed land, NPS pollution is a significant concern for the watershed. Consequently, Daigle Pond is on the State's 303(d) list due primarily to excessive phosphorus (sediments), lake enrichment and the historical prevalence of nuisance algal blooms.

Daigle Pond Fish Assemblage & Fisheries Status

Based on records provided by the Maine Department of Inland Fisheries and Wildlife (Maine DIF&W) and recent communication with fisheries biologist Dave Basley (Region G, Ashland DIF&W office), 36-acre (maximum depth 12 feet) Daigle Pond (New Canada, Cross Lake drainage system) is currently managed as a coldwater (brook trout) fishery. Daigle Pond was originally surveyed by Maine DIF&W in 1959, while their lake fisheries report was previously revised in 1963 and 2001. A total of **5** native indigenous fish species are found to occur, including brook trout, banded killifish, and three northern minnow species (pearl dace, finescale dace, and northern redbelly dace). Daigle Pond was chemically reclaimed in 1967 (rotenone treatment) "to remove competing species and provide for intensive management of brook trout." In the years immediately following reclamation, an attractive sport fishery was created with annual stockings of fingerling brook trout. In recent years, in-lake habitat degradation, in terms of poor water quality, has reduced the number of anglers fishing Daigle Pond.

Brook trout

Generally, increases in trophic state as result of nonpoint source phosphorus loading increases water temperature and reduces dissolved oxygen concentrations. Improvements in water quality, reducing the prevalence of nuisance summertime algal blooms, may serve to enhance fisheries conditions in Daigle Pond. Given that the trophic state of Daigle Pond has been disturbed by cumulative human impacts over the past several decades - then a significant reduction in the total phosphorus loading from the Daigle Pond watershed may lead to maintaining in-lake nutrient levels within the natural assimilative capacity of this lake to effectively process total phosphorus - and enhance existing brook trout fisheries. Brook trout fisheries in downstream Daigle Brook would also be expected to benefit.

General Soils Description

The Daigle Pond watershed is characterized by the following general soil association (Ferwerda et al. 1997): Plaisted-Penquis-Thorndike-Howland, which consists of the somewhat excessively drained Thorndike silt loam, the well drained Plaisted gravelly loam, and the moderately well drained Howland gravelly loam. These soils, formed from glacial till parent materials, have moderate permeability in the solum, and moderately slow or slow permeability in the dense substratum. Some areas of moderately well drained Machias gravelly loam (formed over gravel and cobble stream deposits) also occur along Daigle Brook. Although the loamy surface soils allow for high water holding capacity, approximately 380 acres of the soils in the Daigle Pond watershed are highly erodible. Of the 679 acres of agricultural land in the watershed, 113 acres (17%) are classified as highly erodible and 566 acres (83%) are considered potentially highly erodible.

Soils in the Daigle Pond watershed generally fall within the C and D hydrologic soil groups, which have slow and very slow infiltration rates, allowing for the potential for greater amounts of surface runoff. Surface runoff in the watershed is slow to rapid, depending on slope.

Land Use Inventory

The results of the Daigle Pond watershed land use inventory are depicted in Figure 2 (right) and Table 1 (p.13) The dominant land uses in the watershed are agriculture and unmanaged forest. In Table 1, watershed land uses are categorized by developed land vs. non-developed land. The developed land area comprises approximately 64% of the watershed and the undeveloped land, including the water surface area of Daigle Pond, comprises the remaining 36% of the watershed. These numbers may be used to help make future planning and conservation decisions relating to the Daigle Pond watershed. The information in Table 1 was also used as a basis for preparing the Total Maximum Daily (Annual Phosphorus) Load report (see Appendices).

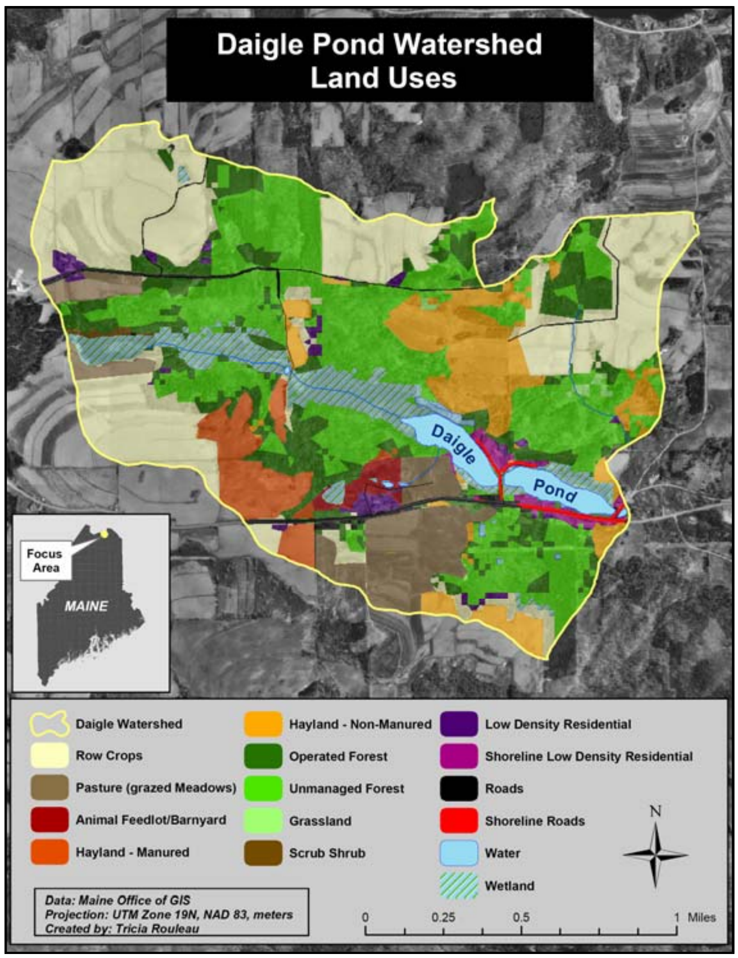


Figure 2: *Map of Daigle Pond watershed land uses.*

Table 1. Daigle Pond Direct Watershed—Land Use Inventory and External Phosphorus Loads

LAND USE CLASS	Land Area Acres	Land Area %	TP Export Load kg TP	TP Export Total %
Agricultural Land				
Hayland (non-manured)	131	9%	42	3%
Hayland (manured)	60	4%	44	3%
Row Crops	367	26%	407	32%
Animal Feedlot/Barnyard	13	1%	681	54%
Pasture (Grazed Meadows)	108	8%	44	3%
Sub-Totals	**679**	**48%**	**1,218**	**96%**
Actively Managed Forest	162	12%	7	<1%
Sub-Totals	**162**	**12%**	**7**	**<1%**
Shoreline Development				
Low Density Residential	11	<1%	3	<1%
Roads	6	<1%	5	<1%
Sub-Totals	**17**	**1%**	**8**	**<1%**
Non-Shoreline Development				
Roads	23	>1%	17	>1%
Low Density Residential	22	>1%	6	<1%
Sub-Totals	**45**	**3%**	**23**	**2%**
Total: DEVELOPED LAND	**903**	**64%**	**1,256**	**99%**
Non-Developed Land				
Inactive/Passively Managed Forest	381	27%	8	<1%
Grassland/Reverting Fields	4	<1%	<1	<1%
Scrub-Shrub	3	<1%	<1	<1%
Wetlands	86	6%	<1	<1%
Total: NON-DEVELOPED LAND	**474**	**33%**	**10**	**<1%**
Total: Surface Water (Atmospheric)	**40**	**3%**	**3**	**<1%**
TOTAL: DIRECT WATERSHED	**1,417**	**100%**	**1,269**	**100%**

Descriptive Land Use and Phosphorus Export Estimates

Agriculture: Agricultural land is estimated to comprise 679 acres (48%) of the watershed area including: non-manured hayland (9%), manured hayland (4%), row crops (26%), animal feedlot/ barnyard (1%) and pasture (8%). These agricultural land uses contribute nearly 1,218 kg (96%) of the total phosphorus loading to Daigle Pond. Animal feedlots/barnyards are the largest agricultural contributor, accounting for approximately 54% of the total phosphorus load to Daigle Pond. Row crops are also a large contributor, accounting for 32% of the load. These data were mapped using GIS software and verified by aerial photography and information from the St. John Valley Soil and Water Conservation District.

Actively Managed Forest Land: The estimated operated forest land for the Daigle Pond direct watershed consists of 162 acres. This estimate is based on a GIS analysis of land uses and represents 12% of the total land area, contributing less than 1% of the total phosphorus load to Daigle Pond. While poorly managed forestry operations have the potential to negatively impact a waterbody through erosion and sedimentation from logging sites, properly managed forestry operations generally do not. Sustainable forest management can enhance water quality through sequestering excess nutrients, particularly in forested riparian areas. Harvested forest acres in Maine typically regenerate as forest, whether or not they are under any type of planned forest management or under the supervision of a Licensed Forester.

Shoreline Development consists of all lands within the immediate shoreland area (250 feet) of Daigle Pond. This type of development can have a large total phosphorus loading impact in comparison to their relatively small percentage of the total land area in the watershed. This is not the case for Daigle Pond, given the sparse extent of shoreline development. There are approximately 11 houses (primarily year-round) along the Daigle Pond shoreline. Shoreline residential land use is estimated to consist of only 0.8% of the total watershed land area and contribute less than 1% of the total phosphorus load to Daigle Pond.

Shoreline Roads: NPS pollution associated with shoreline roads (roads within 250 feet of the shoreline) can vary widely, depending upon road type, slope and proximity to a surface water resource. Total phosphorus loading from shoreline roads was estimated using GIS land use data to determine the overall area occupied by this category. The average width for shoreline roads in the Daigle Pond watershed was estimated to be about 22 meters for state-owned roads and 16 meters for town-owned roads (based on the findings from previous Maine lake PCAP reports). Based on these factors, shoreline roads were determined to cover about 6 acres and contribute less than 1% (5 kg/yr) of the total phosphorus load to the direct watershed.

State-Owned Route 161 passes along the south side of Daigle Pond.

Overall, shoreline development comprises just over 1% of the total watershed area and contributes approximately 8 kg of total phosphorus annually, accounting for less than 1% of the estimated phosphorus load.

Non-Shoreline Development and Land Uses

Non-Shoreline Development consists of all lands outside the immediate shoreline of Daigle Pond - including public and private roads, low density residential areas and commercial/industrial areas. The total land area covered by these land-uses was calculated with GIS land use data.

Roads: Road widths were estimated from previous PCAP reports and from on-screen viewing of aerial photography (private roads were estimated to be 6 meters average width) to determine the amount of total phosphorus loading from this land use category. Based on these factors, non-shoreline roads contribute an estimated 17 kg/year (~1%) of the total phosphorus load to Daigle Pond's direct watershed.

Low Density Residential: Low density residential land use consists of approximately 22 acres and contributes an estimated 6 kg/year (< 1%) of the total phosphorus loading to the Daigle Pond direct watershed.

Phosphorus Loading from Non-Developed Lands and Water

Inactive/Passively Managed Forests: Of the total non-developed land area within the Daigle Pond watershed, 381 acres are forested, characterized by privately-owned non-managed deciduous and mixed forest plots. Less than 1% of the phosphorus load (8 kg/year) is estimated to be derived from non-commercial forested areas within Daigle Pond's direct drainage area.

Other Non-Developed Land Areas: Combined wetlands, grasslands/reverting fields and scrub-shrub account for approximately 6% of the remaining land area and less than 1% of the total phosphorus export load.

Atmospheric Deposition (Open Water): Surface waters for Daigle Pond's direct watershed comprise 3% of the total land area (40 acres) and account for an estimated 3 kg of total phosphorus per year, representing less than 1% of the total direct watershed load entering Daigle Pond. The total phosphorus loading coefficient chosen (0.16 kg/ha) is similar to that used for central Maine lakes in Kennebec County. This value represents the median of a range of values from Reckhow (1980) of 0.11 kg/ha to 0.21 kg/ha. The upper range generally reflects a watershed that is 50 percent forested, combined with agricultural areas interspersed with urban/suburban land use.

- *To convert kilograms (kg) of total phosphorus to pounds - multiply by 2.2046*

PHOSPHORUS LOADS – Watershed, Sediment and In-Lake Capacity

Supporting documentation for the phosphorus loading analysis includes water quality monitoring data from Maine DEP and the Volunteer Lake Monitoring Program, and the development of a phosphorus retention model (see Appendices, p.21, for detailed information). Please note that two methods were used in our total phosphorus loading analysis to assist with the preparation of this report: 1) a GIS-based model to provide a relative estimation of impacts from watershed land uses for the development of phosphorus reduction strategies by stakeholders; and 2) an in-lake phosphorus concentration model to determine the phosphorus reduction needed for the Daigle Pond TMDL. These two methods may yield different overall phosphorus loading results depending on the available water quality data and particular characteristics of the watersheds and water bodies being modeled.

1. GIS-Based Land Use and Indirect Load Method

Watershed Land Uses: Total phosphorus loadings to Daigle Pond originate from a combination of external watershed and internal lake sediment sources. Watershed total phosphorus sources, totaling approximately 1,269 kg annually (corrected GIS) have been identified and accounted for by land use (See Table 2 - page 25). Internal lake sediment P-loadings of 26 kg were estimated to be present during the 1995 growing season (only suitable year of record). In light of relatively high measures of TP in the water column, this is probably a gross under-estimate of the actual sediment phosphorus load in Daigle Pond (personal communication, Roy Bouchard 2006).

2. In-Lake Concentration Method (TMDL)

Pond Capacity: The assimilative capacity for all existing and future non-point pollution sources for Daigle Pond is 116 kg of total phosphorus per year, based on a target goal of 16 ppb (See Phosphorus Retention Model - page 29).

Target Goal: A change in 1 ppb in phosphorus concentration in Daigle Pond is equivalent to 7.3 kg. The difference between the target goal of 16 ppb and the measured average summertime total phosphorus concentration (50 ppb or 365 kg) is 34 ppb or 248 kg (34 x 7.3).

Future Development: The annual total phosphorus contribution to account for future development for Daigle Pond is 3.65 kg (0.50 x 7.3) (see page 28).

Reduction Needed: Given the target goal and a 3.65 kg allocation for future development, the total amount of phosphorus needed to be reduced, on an annual basis, to restore water quality standards in Daigle Pond approximates 252 kg (248 + 3.65).

PHOSPHORUS CONTROL ACTION PLAN

Recent and Current NPS/BMP Efforts

The St. John Valley SWCD, the Aroostook County– St. John Valley Natural Resources Conservation Service (NRCS), and local residents have long recognized the need for reducing NPS pollution to Daigle Pond.

In the early 1990's, in an effort to address water quality concerns, local residents formed the Daigle Pond restoration Committee. In 1997, the group was awarded Environmental Protection Agency (EPA) Section 319 funding to implement erosion control practices in the watershed. Between 1997 and 2002, the Committee, in conjunction with the SJV-SWCD, the Natural Resources Conservation Service, the Town of New Canada, the Maine Forest Service, and other agencies worked on several erosion control projects throughout the watershed. These included planting a vegetative buffer around the northern perimeter of the pond and installing multiple driveway projects. Additionally, a new concrete dam outlet was constructed, and the causeway culvert separating the two basins was repaired. Finally, a modified Nutrient and Sediment Control System (NSCS) was installed on local cropland to reduce soil loss. This is one of many agricultural BMPs that have been installed in the Daigle Pond watershed.

The Aroostook County– St. John Valley Natural Resources Conservation Service (NRCS) has an ongoing relationship with land owners in the Daigle Pond watershed and has helped them establish voluntary conservation management plans to reduce nutrient export from agricultural operations. Between 1990 and 2004, seventeen erosion control and nutrient management projects were completed on a local cattle farm, including the construction of a waste storage structure, heavy use area protection, and a riparian forest buffer, among others.

Several BMPs have also been installed along state-owned roads in the watershed. In the early 1990's, Maine Route 161 ditches were unstable and washed plumes of soil into Daigle Pond each year. This erosion problem contributed to sedimentation in Daigle Pond. However, in 1994-1995, several BMPs were installed, thus eliminating this major source of soil materials to the pond (Maine NPS Control Program). Additionally, between 1992 and 2003, 12 septic systems in the Daigle Pond watershed were replaced with funding from the Maine Department of Environmental Protection.

Continued efforts for installing BMPs and reducing NPS pollution in the Daigle Pond watershed are imperative given the current poor water quality conditions. Due to a buildup of sediment in the pond over the years, Daigle Pond is still influenced by historical land management practices in the watershed, and new phosphorus is introduced each year (Bouchard 1996). A continued reduction in nonpoint inputs to Daigle Pond, primarily through animal grazing and feedlot BMP installation and proper maintenance, is crucial to achieving suitable long-term water quality.

Construction of a stable, concrete dam outlet and repairs to a deteriorating causeway culvert served to decrease bank erosion, restore historic water levels, and improve fish habitat in Daigle Pond.

Recommendations for Future NPS/BMP Work

Daigle Pond has impaired water quality primarily due to historical high phosphorus inputs from nonpoint source (NPS) pollution and resultant internal lake sediment recycling of phosphorus. Specific recommendations regarding recent and current efforts in the watershed, Best Management Practices (BMPs), and actions to reduce (1) external watershed and (2) accumulated bottom sediment total phosphorus loadings in order to improve water quality conditions in Daigle Pond are as follows:

Watershed Management: Several agencies (i.e., Maine DEP, SJV-SWCD, USDA/NRCS) have been involved in attempting to restore the water quality of Daigle Pond. This PCAP-TMDL report will serve as a compilation of existing information about the past and present restoration projects that have been undertaken in order to adequately assess future NPS BMP needs in the watershed.

Action Item #1 : Coordinate existing watershed management efforts		
Activity	**Participants**	**Schedule & Cost**
Initiate efforts to develop a Daigle Pond Advisory Team	SJV-SWCD, NRCS, Maine DEP, interested watershed citizens—stakeholders.	Annual roundtable meetings—beginning in summer 2006—minimal cost

Agriculture: Agricultural land encompass the greatest land area of the land-uses in the watershed, and contributes the greatest phosphorus load. BMP recommendations for agricultural land uses include providing education on grazing conservation practices and feedlot planning assistance. The Natural Resources Conservation Service provides technical assistance for using proper agricultural BMPs. For more information contact the NRCS office in Aroostook County (207-834-3311).

Action Item # 2: Conduct workshops for agricultural landowners		
Activity	**Participants**	**Schedule & Cost**
Conduct workshops encouraging the use of phosphorus control measures within the Daigle Pond watershed. Update, inspect, and maintain installed BMPs in the watershed.	SJV-SWCD, NRCS, agricultural landowners and watershed municipalities (Fort Kent and New Canada).	Annually beginning in 2006 Variable cost depending on type of activities.

Shoreline Residential: Densely developed residential dwellings have the potential to negatively effect water quality. An effort should be undertaken to encourage landowners to follow Land Use Regulation Commission (LURC) standards for maintaining adequate and effective vegetated shoreline buffers. For a copy of *The Buffer Handbook*, contact Maine DEP's Bureau of Land & Water Quality in Augusta (287-2112) or for technical assistance, contact the SJV-SWCD at 834-6435.

Action Item # 3: Educate watershed citizens about shoreline buffers		
Activity	**Participants**	**Schedule & Cost**
Develop a Buffer Awareness Campaign	Maine DEP, LURC, SJV-SWCD, Towns of New Canada and Fort Kent, interested watershed citizens.	Begin immediately - $1,500/yr

Roadways: A common cause of NPS pollution in lake/pond watersheds is often related to roads, which if not properly designed and maintained can be a major source of erosion and sedimentation into ponds, lakes and streams. This PCAP report estimates that public and private roads combined contribute approximately 2% of the total phosphorus load per year to Daigle Pond. As such, efforts should be undertaken to identify pollution sources from roads so that appropriate BMPs can be designed and installed to remediate problem areas.

Action Item # 4: Implement roadway best management practices		
Activity	**Participants**	**Schedule & Cost**
Conduct survey of public and private roads in watershed to determine NPS pollution sources and establish/ implement roadway BMPs.	Maine DEP, SJV-SWCD, Towns of Fort Kent and New Canada, interested watershed citizens.	2006-2007 $1,000 - Approximately 617 acres (1 sq. mi.) of the soils in the Daigle watershed have a low to very low suitability for development.

Septic Systems: Older, poorly designed and installed septic systems may contribute significantly to water quality problems, adding to the cumulative phosphorus load to Daigle Pond. While Daigle Pond septic systems – when properly sited, constructed, maintained, and set back from the water – should not affect water quality, many septic systems may not meet all of these criteria and thus have the potential to contribute phosphorus and other contaminants to lake water. Examples include septic systems sited in coarse, sandy soils with minimal filtering capacity, as well as soils that are shallow to bedrock., as well as older septic systems which pre-date Maine's 1974 Plumbing Code. Approximately 589 acres of the soils in the Daigle watershed have a low to very low suitability for development. Daigle watershed residents who believe they may have problems with their septic systems are encouraged to contact Maine-DEP for possible technical and/or financial assistance.

Action Item # 5: Develop septic/sewage system inspection program		
Activity	**Participants**	**Schedule & Cost**
Conduct septic/sewage system inspections to identify any potential malfunctions and promote regular pumping to ensure proper operation	Maine DEP, SJV-SWCD, and watershed citizens.	Annually beginning in 2006 $1,500/yr

Individual Action: All watershed residents should be encouraged through continued education and outreach efforts, including: retention or planting of natural vegetation of buffer strips, use of non-phosphate cleaning detergents, elimination of phosphorus-containing fertilizers, adequate maintenance of septic systems.

Municipal Action: Should include ensuring public compliance with local and state water quality laws and ordinances (Shoreland Zoning, Erosion and Sedimentation Control Law, plumbing code) through education and enforcement action, when necessary. Municipalities can also provide stormwater management education for local homeowners and businesses (see Action Item #6).

Action Item # 6: Expand homeowner education & technical assistance programs		
Activity	**Participants**	**Schedule & Cost**
Provide stormwater management education to. Home owners, small business owners, and industrial facilities in the	Maine DEP, SJV-SWCD, Towns of Fort Kent and New Canada.	Begin immediately—$2,000

An MACD field visit in July of 2006 noted low flow from the Daigle Pond upper basin to the lower basin through a single culvert crossing under Martin Road. Likewise, the culverts connecting the lower basin to the outflow dam also appeared to be restricting flow. ME-DEP staff agreed that the current conditions may not be reflective of the high flushing rates calculated for the pond, and that this should be a point of further investigation. Lower flushing rates caused by the culvert restrictions may be leading to higher than normal phosphorus retention that would normally be flushed naturally from the system.

Action Item # 7: Investigate the hydrology of the upper and lower basins.		
Activity	**Participants**	**Schedule & Cost**
Study the hydrology of the two basins and the potential need for additional culverts to increase flow.	Maine DEP, SJV-SWCD, Towns of Fort Kent and New Canada.	Begin immediately—$3,000

WATER QUALITY MONITORING PLAN

Historically, the water quality of Daigle Pond has been monitored via measures of Secchi disk transparencies during the open water months since 1977 (Maine DEP and VLMP). Continued long-term water quality monitoring (water transparencies) for Daigle Pond will be conducted monthly, from May to October, through the continued efforts of Maine DEP and VLMP. Under this planned, post-TMDL water quality-monitoring plan, sufficient data will be acquired to adequately track seasonal and inter-annual variation and long-term trends in water quality in Daigle Pond. A post-TMDL adaptive management status report will be prepared 5 to 10 years following EPA approval.

PCAP CLOSING STATEMENT

The Maine Association of Conservation Districts and the Saint John Valley Soil and Water Conservation District, in cooperation with lake stakeholders, have initiated the process of addressing nonpoint source pollution in the Daigle Pond watershed. Technical assistance by SJV-SWCD is available to both watershed towns (New Canada and Fort Kent) to mitigate phosphorus export from existing NPS pollution sources and to prevent excess loading from future sources. It is critical that the towns of New Canada and Fort Kent recognize the inherent value of Daigle Pond and its vital link to the community by providing strong support to restoration efforts. Both towns should cooperate with the SJV-SWCD and NRCS in the pursuit of local and regional lake protection and improvement strategies. This teamwork approach should result in an eventual and overall improvement in Daigle Pond through NPS-BMP implementation and increased public involvement and awareness.

APPENDICES

DAIGLE POND (New Canada)

Total Maximum Daily (Annual Phosphorus) Load

Maine Lake TMDLs and Phosphorus Control Action Plans (PCAPs)

You may be wondering what the acronym 'TMDL' represents and what it is all about. TMDL is actually short for 'Total Maximum Daily Load' as historically applied to point-source pollutants. This information, no doubt, does little to clarify TMDLs in most people's minds. However, when we think of this as an annual phosphorus load (*Annual Total Phosphorus Load),* it begins to make more sense, for nonpoint source pollution. Following EPA guidance (Spring 2006), we now report both daily and annual total phosphorus loads.

Simply stated, excess nutrients or phosphorus in lakes promote nuisance algae growth/blooms - resulting in the violation of water quality standards as measured by water clarity depths of less than 2 meters. A lake TMDL is prepared to estimate the total amount of total phosphorus that a lake can accept on an annual basis without harming water quality. Historically, development of TMDLs was first mandated by the Clean Water Act in 1972, and was applied primarily to *point sources* of water pollution. As a result of public pressure to further clean up water bodies, lake and stream TMDLs are now being prepared for watershed-generated *Non-Point Sources* (NPS) of pollution.

Nutrient enrichment of lakes through excess total phosphorus originating from watershed soil erosion has been generally recognized as the primary source of NPS pollution. Major land use activities contributing to the external phosphorus load in lakes include residential-commercial developments, roadways, agriculture, and commercial forestry. Statewide, there are 32 lakes in Maine which do not meet water quality standards due to excessive amounts of in-lake total phosphorus - the great majority of which are located in south-central Maine.

The first Maine lake TMDL was developed (1995) for Cobbossee Lake by the Cobbossee Watershed District (CWD) - under contract with Maine DEP and U.S. EPA. Recently (June 2006), Cobbossee Lake was officially removed from the TMDL listing of “impaired” waterbodies, in light of 8 years of above standard water clarity measures. TMDLs have been approved by U.S. EPA for Madawaska Lake (Aroostook County), Sebasticook Lake, East Pond (Belgrade Lakes), China Lake, Webber, Threemile and Threecornered ponds (Kennebec County), Mousam Lake, the Highland lakes in Falmouth and Bridgton, Annabessacook Lake, Pleasant Pond, Upper Narrows Pond and Little Cobbossee Lake (under contract with CWD), Sabattus, Toothaker, and Unity ponds and Long Lake (with assistance from Lakes Environmental Association), Togus Pond, Duckpuddle Pond, Lovejoy Pond, Lilly Pond, and Sewall Pond. PCAP-TMDLs are presently being prepared by Maine DEP, with assistance from the Maine Association of Conservation Districts (MACD) and County Soil and Water Conservation Districts (SWCD’s) - for Hermon and Hammond Ponds, and Cross Lake. PCAP-TMDL studies have also been initiated for Trafton Lake, as well as several other remaining 2004 303(d) listed PCAP-TMDL waterbodies in Aroostook County.

Lake PCAP-TMDL reports are based in part on available water quality data, including seasonal measures of total phosphorus, chlorophyll-a, Secchi disk transparencies, and dissolved oxygen-water temperature profiles. Actual reports include: a lake description; watershed GIS assessment and estimation of NPS pollutant sources; selection of a total phosphorus target goal (acceptable amount); allocation of watershed/land-use phosphorus loadings, and a public participation component to allow for stakeholder review.

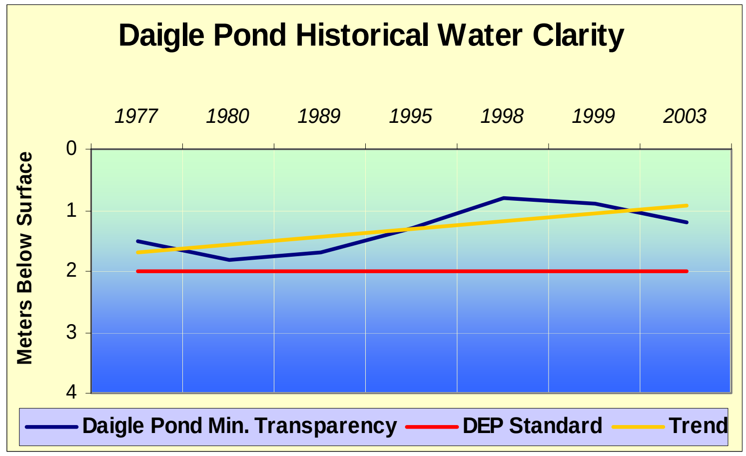
PCAP-TMDLs are important tools for maintaining and protecting acceptable lake water quality and are designed to 'get a handle' on the magnitude of the NPS pollution problem and to develop plans for implementing Best Management Practices (BMPs) to effectively address the lake’s water pollution problem. Landowners and watershed groups are eligible to receive technical and financial assistance from state and federal natural resource agencies to reduce watershed total phosphorus loadings to the lake. **Note:** for non-stormwater regulated lake watersheds, the *development of phosphorus-based lake PCAP-TMDLs are not generally intended by Maine DEP to be used for regulatory purposes*.

For further information, contact Dave Halliwell, Maine Department of Environmental Protection, Lakes PCAP-TMDL Program Manager, SHS #17, Augusta, ME 04333 (207-287-7649).
E-mail: david.halliwell@maine.gov

Water Quality, Priority Ranking, and Algae Bloom History

Water Quality Monitoring: (Source: Maine DEP and VLMP 2005) Water quality monitoring data for Daigle Pond (station 1, deep hole, east basin) has been collected since 1977 (77, 80, 89, 95, 98, 03-05). Hence, this present water quality assessment is based on seven years of water quality data including 8 years of Secchi disk transparency (SDT) measures, combined with 4 years of epilimnion core total phosphorus (TP) data, 5 years of water chemistry and 5 years of chlorophyll-a measures.

Water Quality Measures: (Source: Maine DEP and VLMP 2005) Historically, Daigle Pond has had a range of SDT measures from 1.0 to 2.1 m, with an average of 1.6 m; an epilimnion core TP range of 23 to 162 with an average of 97 parts per billion (ppb), and chlorophyll-a measures ranging from 16 to 132 ppb, with an average of 53.1 ppb. Due to shallow depth, Daigle Pond does not thermally stratify in the summer. As such, recent dissolved oxygen (DO) profiles show little DO depletion in deep areas of the pond. While late summer dissolved oxygen levels in 2003 showed a slight improvement since the late 1990's, about 70% of the water column was unsuitable for fish in contrast to 50% in 1980. The potential for total phosphorus to leave the bottom sediments and become available to algae in the water column (internal loading) is low based on recent oxygen profiles (Maine DEP 2005). However, it is believed that bottom sediments are a source of high phosphorus in the pond, especially during warmwater months (Bouchard 2006).



Daigle Pond minimum water clarity declined from 1980 to 1998.

Priority Ranking, Pollutant of Concern and Algae Bloom History: Daigle Pond is listed on the State's 2004 303(d) list of waters in non-attainment of Maine State water quality standards and was moved up in the priority development order due to the need to complete an accelerated approach to lakes TMDL development. This Daigle Pond TMDL has been developed for total phosphorus, the major limiting nutrient to algae growth in freshwater lakes in Maine.

As indicated by the chart above, the water quality of Daigle Pond has generally been poor during the entire historical monitoring period, and has somewhat improved since 1998. However, since sampling began in 1977, minimum transparencies have never met the state's water quality limit of two meters. Consequently, summertime nuisance algal blooms have been a regular occurrence.

Natural Environmental Background levels for Daigle Pond were not separated from the total non-point source load because of the limited and general nature of available information. Without more and detailed site-specific information on non-point source loading, it is very difficult to separate natural background from the total non-point source load (US-EPA 1999). There are no known point sources of pollutants to Daigle Pond.

WATER QUALITY STANDARDS & TARGET GOALS

Maine State Water Quality Standard for nutrients which are narrative, are as follows *(July 1994 Maine Revised Statutes Title 38, Article 4-A)*: "Great Ponds Class A (GPA) waters shall have a stable or decreasing trophic state (based on appropriate measures, e.g., total phosphorus, chlorophyll-a, Secchi disk transparency) subject only to natural fluctuations, and be free of culturally induced algae blooms which impair their potential use and enjoyment."

Maine DEP's functional definition of nuisance algae blooms include episodic occurrence of Secchi disk transparencies (SDTs) < 2 meters for lakes with low levels of apparent color (<30 SPU) and for higher color lakes where low SDT readings are accompanied by elevated chlorophyll a levels (>8 ppb). Daigle Pond is a colored lake (average color 63 SPUs), with low late summer SDT readings (annual average of 1.6 meters), in association with high chlorophyll-a levels (53.1 ppb late summer average). Currently, Daigle Pond does not meet water quality standards primarily due to non-attainment of water transparency measures over time. This water quality assessment uses historic documented conditions as the primary basis for comparison.

Designated Uses and Antidegradation Policy: Daigle Pond is designated as a GPA (Great Pond Class A) water in the Maine DEP state water quality regulations. Designated uses for GPA waters in general include: water supply; primary/secondary contact recreation (swimming and fishing); hydro-electric power generation; navigation; and fish and wildlife habitat. No change of land use in the watershed of a Class GPA water body may, by itself or in combination with other activities, cause water quality degradation that would impair designated uses of downstream GPA waters or cause an increase in their trophic state. Maine's anti-degradation policy requires that "existing in-stream water uses, and the level of water quality necessary to sustain those uses, must be maintained and protected."

Numeric Water Quality Target: The numeric (in-lake) water quality target for Daigle Pond is set at 16 ppb total phosphorus (116 kg/yr). Since numeric criteria for phosphorus do not exist in Maine's state water quality regulations - and would be less accurate targets than those derived from this study - we employed best professional judgment to select a target in-lake total phosphorus concentration that would attain the narrative water quality standard. Spring-time (late May - June) total phosphorus levels in Daigle Pond historically averaged 36 ppb, while summertime levels averaged 50 ppb.

In summary, the numeric water quality target goal of 16 ppb for total phosphorus in Daigle Pond was based on observed late spring - early summer pre-water column stratification measures, generally corresponding to non-bloom conditions, as reflected in suitable (water quality attainment) measures of both Secchi disk transparency (> 2.0 meters) and chlorophyll-a (< 8.0 ppb).

Notably, the development of the Daigle Pond TMDL (DEPLW 2006-0789) and selection of a numeric water quality target of 16 ppb total phosphorus is protective of downstream uses in Daigle Brook, which is also water quality impaired and 303(d) listed. The water quality impairment of Daigle Brook is due to dissolved oxygen loss related to primary productivity caused by excessive pollutants (total phosphorus) from Daigle Pond and the brook's direct watershed within the Cross Lake drainage system. The planned reduction of total phosphorus loading to Daigle Brook (a primary nutrient source for downstream Cross Lake) coupled with the attainment of the in-lake target of 16 ppb in Daigle Pond will provide for attainment and maintenance of water quality standards in the brook. Following final EPA approval of the Daigle Pond and Cross Lake TMDL (DEPLW 2006-0790), Daigle Brook will be re-designated from the 303(d) list to category 4A (TMDL approved).

ESTIMATED PHOSPHORUS EXPORT BY LAND USE CLASS

Table 2 details the numerical data used to determine external phosphorus loading for the Daigle Pond watershed. The key below Table 2 on the next page explains the columns and the narrative that follows (page 26) relative to each of the representative land use classes.

Table 2. Daigle Pond Direct Watershed - Estimated Phosphorus Export by Land Use

LAND USE CLASS	Land Area Acres	Land Area %	TP Coeff. Range kg TP/ha	TP Coeff. Value kg TP/ha	Land Area Hectares	TP Export Load Kg TP/ha	TP Export Total %
Agricultural Land							
Hayland (non-manured)	131	9%	0.35-1.34	0.64	53	42	3%
Hayland (manured)	60	4%	0.35-1.34	1.51	24	44	4%
Row Crops	367	26%	0.26-18.6	2.24	149	407	32%
Animal Feedlot/Barnyard	13	1%	21-795	103	5	681	54%
Pasture (Grazed Meadows)	108	8%	.14-4.9	0.81	44	44	3%
Sub-Totals	**679**	**48%**			**275**	**1,218**	**96%**
Actively Managed Forest	162	12%	0.04-0.6	0.08	66	7	0.5%
Sub-Totals	**162**	**12%**			**66**	**7**	**0.5%**
Shoreline Development							
Low Density Residential	11	0.8%	0.25 - 1.75	0.5	5	3	0.2%
Roads	6	0.4%	0.60 - 10.0	2	2	5	0.4%
Sub-Totals	**17**	**1%**			**7**	**8**	**0.6%**
Non-Shoreline Development							
Roads	23	1.6%	0.60 - 10.0	1.5	9	17	1.4%
Low Density Residential	22	1.5%	0.25 - 1.75	0.5	9	6	0.4%
Sub-Totals	**45**	**3%**			**18**	**23**	**1.8%**
Total: DEVELOPED LAND	**903**	**64%**			**366**	**1,256**	**99%**
Non-Developed Land							
Inactive/Passively Managed Forest	381	27%	0.01-0.08	0.04	154	8	0.63%
Grassland/Reverting Fields	4	0.3%	0.1 - 0.2	0.2	1	0.3	0.02%
Scrub-Shrub	3	0.2%	0.1 - 0.2	0.15	1	0.2	0.02%
Wetlands	86	6%	0-0.05	0.01	35	0.4	0.03%
Total: NON-DEVELOPED LAND	**474**	**33%**			**192**	**10**	**0.7%**
Total: Surface Water (Atmospheric)	**40**	**3%**	**0.11-0.21**	**0.16**	**16**	**3**	**0.2%**
TOTAL: DIRECT WATERSHED	**1,417**	**100%**			**574**	**1,269**	**100%**

Key for Columns in Table 2

Land Use Class: The land use category that was analyzed for this report

Land Area in Acres: The area of each land use as determined by GIS mapping and aerial photography.

Land Area %: The percentage of the watershed covered by the land use.

TP Coeff. Range kg/ha: The range of the total phosphorus coefficient values listed in the literature associated with the corresponding land use.

TP Coeff. Value kg/ha: The selected coefficient for each land use category. The total phosphorus coefficient is determined from previous research – usually the median value, if listed by the author. The coefficient is often adjusted using best professional judgment based on conditions including soil type, slope, and best management practices (BMPs) installed.

Land Area in Hectares: Conversion, 1.0 acre = 0.404 hectares

TP Export Load kg P: The GIS adjusted TP Export Load, accounting for soils and slope and based on total hectares x the applicable total phosphorus coefficient.

TP Export Total %: The percentage of estimated phosphorus exported by the land use.

Total Phosphorus Land Use Loads

Estimates of total phosphorus export from different land uses found in the Daigle Pond watershed as presented on the previous page in Table 2 represent the extent of the current direct watershed phosphorus loading to the lake (1,269 kg/yr).

Total phosphorus loading measures are provided as a range of values to reflect the degree of uncertainty generally associated with such relative estimates (Walker 2000). The watershed total phosphorus loading values were primarily determined using literature and locally-derived export coefficients as found in Schroeder (1979), Reckhow et al. (1980), Dennis (1986), Dennis et al. (1992), and Bouchard et al. (1995) for residential properties, roadways, agriculture and other types of land uses.

Agriculture: Phosphorus loading coefficients as applied to agricultural land uses were adopted from: Dennis and Sage (1981): manured hayland (1.51 kg/ha/yr), non-manured hayland (0.64 kg/ha/yr), Reckhow et al. (1980): animal feedlot/barnyard (103 kg TP/ha/yr)*, pasture/grazed meadow (0.81 kg TP/ha/yr), and row crops/tillage/cultivation (2.24 kg TP/ha/yr).

*The land use coefficient used in previous TMDL's for animal feedlot/barnyards (224 kg TP/ha/yr) is the median of a range of coefficients (21-795 kg TP/ha/yr) adopted from Reckhow et al. (1980). Using the EPA-STEPL model, this feedlot/barnyard coefficient was adjusted for this report based on documented information about previously installed BMPs obtained from the SJV-SWCD in conjunction with the USDA/NRCS. The EPA-STEPL model calculates phosphorus delivery from animal feedlots using a variety of inputs including annual rainfall, contributing land area, percent paved area, number and types of animals, manure application rates, soils, and types of installed BMPs. The resulting coefficient of 103 kg/ha/yr assumes that all BMPs are functional and properly maintained. It is important to note that even using the lowest coefficient in the range of feedlot/barnyard coefficients (21kg/ha/yr) results in significant loading to Daigle Pond.

Actively Managed Forest Land: The phosphorus loading coefficient applied to actively managed forest land (0.08 kg/ha/yr) was changed beginning with the Long Lake PCAP-TMDL report following consultation with Lakes Environment Association and Maine Forest Service staff. The rationale for this change was based on the fact that properly managed harvest areas will generally act as phosphorus sinks during periods of regeneration. According to the Maine Forest Service, of the nearly 3,500 water quality inspections conducted throughout the state in 2003, approximately 7% of the harvested sites posed "unacceptable" risks to water quality.

PCAP-TMDL reports prior to the Long Lake report identified a "worst case" upper limit phosphorus loading coefficient of 0.6 kg/ha/yr for operated forestland. Therefore, for any given watershed in Maine we determined that applying this "worst case" coefficient to 7% of operated forest land while applying the "best case" coefficient (0.04 kg/ha/yr) to the remaining operated forest land would provide a relatively accurate estimate of total phosphorus loading from operated forest land. Combining worst case and best case coefficients yields the new phosphorus loading coefficient for operated forest land of 0.08 kg/ha/yr [(0.07 x 0.6) + (0.93 x 0.04)].

Residential Development: The range of phosphorus loading coefficients used for low density residential, including seasonal camps (0.25 – 1.75 kg/ha/yr) was developed from information on residential lot stormwater export of phosphorus as derived from Dennis et al (1992), and first implemented in the 1995 Cobbossee Lake TMDL. Phosphorus loading coefficients for low density residential development was estimated to be 0.50 kg/ha/yr.

Private and Public Roads: The total phosphorus loading coefficient for private/camp and public roads (2.0 kg/ha/yr for private/camp roads and 1.5 kg/ha/yr for public roads) was chosen, in part, from previous studies of rural Maine highways (Dudley et al. 1997) and phosphorus research by Jeff Dennis (Maine DEP).

Total Developed Lands Phosphorus Loading: A total of 99% (1,256 kg) of the phosphorus loading to Daigle Pond is estimated to have been derived from the cumulative effect of the preceding cultural land use classes: agriculture (96% - 1,218 kg); shoreline development (<1% - 8 kg); and non-shoreline development 1.8% - 23 kg) as depicted in Table 2.

Non-Developed Lands Phosphorus Loading: The phosphorus export coefficient for inactive/ passively managed forest land (0.04 kg/ha/yr) is based on a New England regional study (Likens et al 1977) and phosphorus availability recommendation by Jeff Dennis (Maine DEP). The phosphorus export coefficient for grassland/reverting fields (0.20 kg/ha/yr) and scrub/shrub (0.10 kg/ha/yr) is based on research by Bouchard in 1995 (0.20 kg/ha/yr). The export coefficient for wetlands is based on research by Bouchard 1995 and Monagle 1995 (0.01 kg/ha/yr). The phosphorus loading coefficient chosen for surface waters (atmospheric deposition -0.16 kg/ha/yr), was originally used in the China Lake TMDL (Kennebec County), and subsequent PCAP-TMDL lake studies in Maine.

Shoreline Erosion: Undeveloped areas of the lake shoreline that may be eroding due to natural causes (i.e., wind, wave and ice action) are not included as a source of phosphorus due to the difficulty in quantifying impact area and assigning suitable phosphorus loading coefficients.

Phosphorus Load Summary

It is our professional opinion that the selected export coefficients are appropriate for the Daigle Pond watershed. Results of the land use analysis indicate that a best estimate of the present total phosphorus loading from external nonpoint source nutrient pollution approximates 1,269 kg/yr.

LINKING WATER QUALITY and POLLUTANT SOURCES

Annual/Daily Load Capacity: Total Phosphorus (TP) serves as a surrogate measure of Maine's narrative water quality standards for lake trophic status. The TP TMDL is originally calculated as an annual load (kg TP/yr), which is based on an in-lake numeric water quality target (ppb or ug/l TP) and the annual flushing rate of the lake, using generally accepted response models for lakes. It is appropriate and justifiable to express the Daigle Pond TMDL as a monthly load even though the pond has an annual flushing rate of 21.3 (see discussion below and seasonal variation narrative on page 30). The annual flushing rate, or the theoretical rate at which water in a lake is replaced on an annual basis, is calculated as:

 # Flushes/year = (Watershed area * Runoff/year) / Lake volume

This TMDL also presents daily pollutant loads of TP in addition to the annual load. Daily flushing rates were determined by first calculating the monthly discharge from Dudley (2004). A number of parameters were required for input into these formulas including: Drainage area; % of significant sand and gravel aquifers; distance from the watershed to a predetermined line off the Maine coast; and mean annual precipitation. These parameters were determined using GIS (ArcMap 8.3).

Once the monthly discharge was determined, this information was used to ascertain the following:

% Total Monthly Discharge = (Total monthly discharge/ Total annual discharge) *100

 # Flushes/month = (Total # of flushes/year * % of total monthly discharge)

 # Flushes/day = (Flushes/month)/(Days/month)

The majority of the parameters used for calculating the annual loading capacity (kg TP/yr) on page 29 (Dillon and Rigler 1974, where L= (Azp)/(1-R)), remain unchanged for use in calculating the daily loading capacity. The exception is p, where p now equals flushes/month. Thus, the monthly loading capacity is expressed as a proportion of the annual loading capacity, based on the discharge expected for that month. The daily loading capacity was then calculated as follows:

Daily Loading Capacity (kg/day) = (Monthly Load Capacity)/(Days/month)

The daily loads for Daigle Pond are presented on page 31.

Assimilative Loading Capacity: The Daigle Pond basin lake assimilative capacity is capped at 116 kg TP/yr, as derived from the empirical phosphorus retention model based on a target goal of 16 ppb. This value reflects the modeled phosphorus loading responsible for current trophic state conditions, based on a long term goal of maintaining average phosphorus concentrations at or below 16 ppb. This TMDL target concentration is expected to be met at all times (daily, monthly, seasonally, and annually). However, because the annual load of TP as a TMDL target is more easily aligned with the design of best management practices used to implement nonpoint source and stormwater TMDLs for lakes than daily loads of specific pollutants, this TMDL report recommends that the annual load target in the TMDL be used to guide implementation efforts. Ultimate compliance with water quality standards for the TMDL will be determined by measuring in-lake water quality to determine when standards are attained.

Future Development: The Maine DEP water quality goal of maintaining a stable trophic state includes a reduction of current P-loading which accounts for both recent P-loading as well as potential future development in the watershed. The methods used by Maine DEP to estimate future growth (Dennis et al. 1992) are inherently conservative, as they provide for relatively high-end regional growth estimates and largely non-mitigated P-export from new development. This provides an additional non-quantified margin of safety to ensure the attainment of state water quality goals. Previously unaccounted P-loading from anticipated future development on Daigle Pond watershed approximates 3.65 kg annually (0.5 x 1 ppb change in trophic state or 7.3 kg).

Human population growth will continue to occur in the Daigle Pond watershed, contributing new sources of phosphorus to the lake. Hence, existing phosphorus source loads must be reduced by at least 3.65 kg to allow for anticipated new sources of phosphorus to Daigle Pond.

Overall, the presence of nuisance algae blooms in Daigle Pond may be reduced, along with halting the trend of increasing trophic state, if the existing phosphorus loading is reduced by approximately 252 kg TP/yr.

Internal Lake Sediment Phosphorus Mass: The relative contribution of internal sources of total phosphorus within Daigle Pond - in terms of sediment TP recycling - were analyzed (using lake volume-weighted mass differences between early and late summer) and estimated on the basis of water column TP data. The only year for which adequate lake profile TP concentration was available to derive reliable estimates (26 kg) of internal lake mass was in 1995.

Linking Pollutant Loading to a Numeric Target: The basin loading assimilative capacity for colored Daigle Pond was set at 116 kg/yr of total phosphorus to meet the numeric water quality target of 16 ppb of total phosphorus. A phosphorus retention model, calibrated to in-lake phosphorus data, was used to link phosphorus loading to numeric target.

Supporting Documentation for the Daigle Pond TMDL Analysis includes the following: Maine DEP and VLMP water quality monitoring data, and specification of a phosphorus retention model – including both empirical models and retention coefficients.

Daigle Pond Total Phosphorus Retention Model
(after Dillon and Rigler 1974 and others)

L = P (A z p) / (1-R) where, **1 ppb change = 7.3 kg**

116 = **L** = external total phosphorus load capacity (kg TP/year)
16 = **P** = total phosphorus concentration (ppb) = Target Goal = **16 ppb**
0.14 = **A** = lake basin surface area (km^2)=14 ha or 34 acres
2.0 = **z** = mean depth of lake basin (m) **A z p = 6.0**
21.3 = **p** = annual flushing rate (flushes/year)
0.82 = **1- R** = phosphorus retention coefficient, where:
0.18 = **R = 1 / (1+ sq. rt. p)** (Larsen and Mercier 1976)

Previous use of the Vollenwieder (Dillon and Rigler 1974) type empirical model for Maine lakes, e.g., Cobbossee, Madawaska, Sebasticook, East, China, Mousam, Highland (Falmouth), Webber, Threemile, Threecornered, Annabessacook, Pleasant, Sabattus, Toothaker, Unity, Upper Narrows, Highland (Bridgton), Little Cobbossee, Long (Bridgton), Togus, Duckpuddle, Lovejoy, Lilly and Sewall PCAP-TMDL reports (Maine DEP 2000-2006) have all shown this approach to be effective in linking watershed total phosphorus (external) loadings to existing in-lake total phosphorus concentrations.

Strengths and Weaknesses in the Overall TMDL Analytical Process: The Daigle Pond TMDL was developed using existing lake water quality monitoring data, derived watershed export coefficients (Reckhow et al. 1980, Maine DEP 1981 and 1989, Dennis 1986, Dennis et al. 1992, Bouchard et al. 1995, Soranno et al. 1996, and Mattson and Isaac 1999) and a phosphorus retention model which incorporates both empirically derived and observed retention coefficients (Vollenwieder 1969, Dillon 1974, Dillon and Rigler 1974 a and b, and 1975, Kirchner and Dillon 1975). Use of the Larsen and Mercier (1976) total phosphorus retention term, based on localized data (northeast and north-central U.S.) from 20 lakes in the US-EPA National Eutrophication Survey (US-EPA-New England) provides a more accurate model for northeastern regional lakes.

Strengths:

- Approach is commonly accepted practice in lake management
- Makes best use of available water quality monitoring data
- Based upon experience with other lakes in the northeastern U.S. region, the empirical phosphorus retention model was determined to be an adequate estimator of future lake conditions. However, some uncertainty exists due to the relatively higher annual flushing rate of 21.3 and the complicated hydrology of Daigle Pond.

Weaknesses:

- Inherent uncertainty of TP load estimates (Reckhow 1979, Walker 2000) and associated variability and generality of TP loading coefficients.

Critical Conditions occur in Daigle Pond during the summertime, when the potential (both occurrence and frequency) of nuisance algae blooms are greatest. The loading capacity of 16 ppb of total phosphorus was set to achieve desired water quality standards during this critical time period, and will also provide adequate protection throughout the year (see Seasonal Variation).

LOAD ALLOCATIONS (LA's) - The load allocation for Daigle Pond equals 116 kg TP on an annual basis and represents, in part, that portion of the lake's assimilative capacity allocated to non-point (overland) sources of phosphorus (from Table 2). Direct external TP sources (totaling 1,269 kg annually) have been identified and accounted for in the land-use breakdown portrayed in Table 2 (corrected GIS). Further reductions in non-point source phosphorus loadings are expected from the continued implementation of NPS best management practices (see summary, pages 17-20). As previously mentioned, it was not possible to separate natural background from non-point pollution sources in this watershed because of the limited and general nature of the available information. As in other Maine TMDL lakes (see Sebasticook Lake, East Pond, China Lake, and subsequent TMDLs), in-lake nutrient loadings in Daigle Pond originate from a combination of direct external and internal (lake sediment) sources of total phosphorus.

WASTE LOAD ALLOCATIONS (WLA's): Since there are no known existing point sources of pollution (including regulated storm-water sources) in the Daigle Pond watershed, the waste load allocation (WLA) is set at 0 (zero) and all of the loading capacity is allocated as a gross allotment to the "load allocation".

MARGIN OF SAFETY (MOS): The TMDL expressed in terms of annual and daily loads includes an implicit MOS through the relatively conservative selection of the numeric water quality target (based on a state-side database for lakes, supported by in-lake data). Based on both the Daigle Pond historical records and a summary of statewide Maine lakes water quality data for colored (> 30 SPU) lakes - the target of 16 ppb (116 kg/yr in Daigle Pond) represents a highly conservative goal to assure future attainment of Maine DEP water quality goals of non-sustained and non-repeated blue-green summer-time algae blooms due to NPS pollution or cultural eutrophication and stable or decreasing trophic state. The statewide data base for colored Maine lakes indicate that summer nuisance algae blooms (growth of algae which causes water transparency to be less than 2 meters) are more likely to occur at 18 ppb or above.

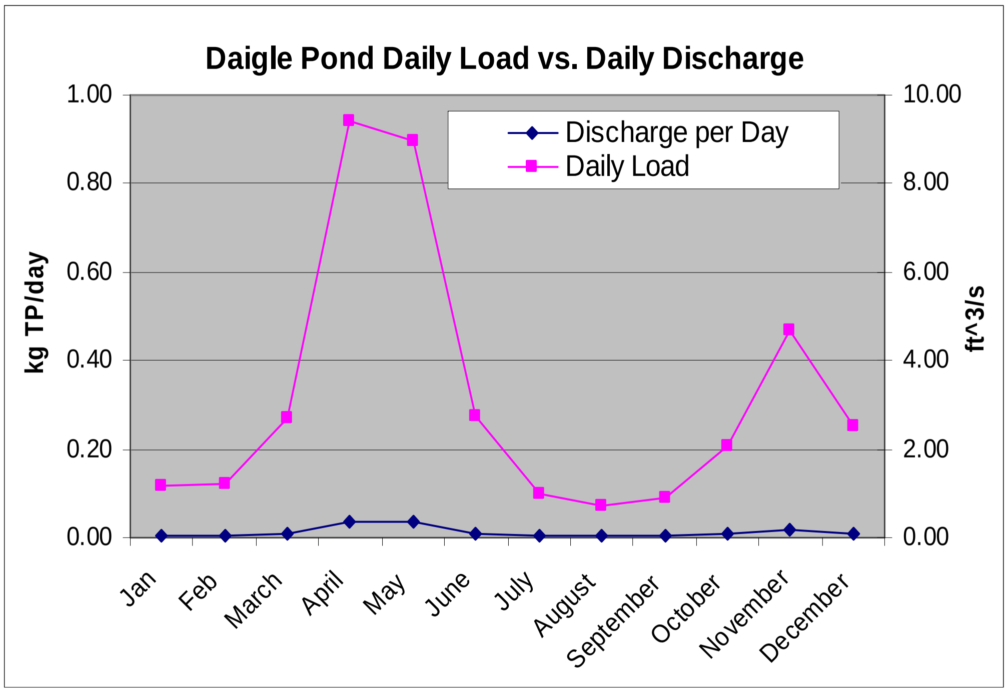
SEASONAL VARIATION: The Daigle Pond TMDL is protective of all seasons, as the allowable annual load was developed to be protective of the most sensitive time of year – during the summer, when conditions most favor the growth of algae and aquatic macrophytes. Maine DEP lake biologists, as a general rule, use more than six flushes annually (bi-monthly) as the cutoff for considering seasonal variation as a major factor (to distinguish lakes vs. rivers) in the evaluation of total phosphorus loadings in aquatic environments in Maine. With an average flushing rate of 21.3 flushes/ year, average monthly phosphorus loads are most critical to the water quality in Daigle Pond. Nonpoint source best management practices (BMPs) proposed for the Daigle Pond watershed have been generally designed to address total phosphorus loading during all seasons.

This variation is further accounted for in calculations of seasonal (May-October, November– April), monthly, and daily TP load calculations (see page 31). These numbers are derived from formulas developed by Dudley (2004) for ungauged rivers in Maine, and are based on several physical and geographic parameters including: 1) drainage area of the waterbody, 2) percent of sand and gravel aquifers in the drainage area, 3) distance from a stationary line along the Maine coast, and 4) mean annual precipitation. Daily loading rates are then determined using variables from Dillon and Rigler (1974) for calculating the external total phosphorus load capacity (page 27) for the lake.

View of the Daigle Pond watershed looking south-east, towards Cross Lake.

Daigle Pond Daily Load Calculations

Month	Discharge/ Month (ft^3/s)	% of Total	Flushes/ Month	Monthly Load Capacity (kg)	Discharge/ Day (ft^3/s)	Flushes/Day	Daily Load Capacity (kg)
Jan	1.45	3%	0.66	3.6	0.05	0.02	0.12
Feb	1.36	3%	0.62	3.4	0.05	0.02	0.12
March	3.35	7%	1.53	8.3	0.11	0.05	0.27
April	10.41	24%	5.19	28.3	0.35	0.17	0.94
May	11.22	24%	5.11	27.9	0.36	0.16	0.90
June	3.33	7%	1.52	8.3	0.11	0.05	0.28
July	1.25	3%	0.57	3.1	0.04	0.02	0.10
August	0.92	2%	0.42	2.3	0.03	0.01	0.07
September	1.11	2%	0.51	2.8	0.04	0.02	0.09
October	2.59	6%	1.18	6.4	0.08	0.04	0.21
November	5.65	12%	2.57	14.0	0.19	0.09	0.47
December	3.15	7%	1.44	7.8	0.10	0.05	0.25



Vollenweider: L = P (Azp) / (1-R)	
L = external P load capacity (kg TP/yr)	**116**
P = total P concentration (ppb)	16
A = lake basin surface area (km2)	0.14
z = mean depth of lake basin (m)	2
p = annual flushing rate	21.3
1-R = P retention coefficient	0.82
R = 1 / (1 + sq. rt. p)	0.18

Season	% of Total	# Flushes
May-October	44%	9.3
November - April	56%	12.0

PUBLIC PARTICIPATION: Adequate ('full and meaningful') public participation in the Daigle Pond PCAP-TMDL development process was ensured - during which land use and phosphorus load reductions were discussed - through the following avenues:

1. **September 26, 2005:** MACD staff traveled to Aroostook County to meet with staff from Maine DEP and the SJV-SWCD to gather information and discuss the water quality of Daigle Pond.

2. **September 27, 2005:** MACD staff met with Maine DEP and SJV-SWCD staff in the field and were given a tour of the Daigle Pond watershed..

3. **February 1, 2006:** MACD staff Tricia Rouleau contacted the SJV-SWCD to discuss BMPs that have been installed in the watershed.

4. **February 7, 2006:** MACD staff Jennifer Jespersen contacted Kathy Hoppe and Heidi Royal , SA-SWCD and SJV-SWCD staff, to gather historical information about the Daigle Pond watershed.

5. **February 8, 2006:** MACD staff Tricia Rouleau contacted Heidi Royal at the SJV-SWCD about the Daigle Pond watershed survey.

6. **February 9, 2006:** MACD staff Tricia Rouleau created and sent GIS land use maps to Heidi Royal at the SJV-SWCD for review.

7. **May 2, 2006:** MACD sent a pre-draft report to the SJV-SWCD Board and staff for review.

8. **June 29, 2006:** MACD and SJV-SWCD sponsored a public meeting at the New Canada Community Center to discuss the Daigle Pond TMDL and to receive stakeholder feedback.

9. **June 30, 2006:** MACD staff reviewed land use maps of the Daigle Pond watershed at the SJV-SWCD office in Ft. Kent.

STAKEHOLDER AND PUBLIC REVIEW PROCESS

A two-week stakeholder review was distributed electronically on July 5, 2006 to the following individuals who expressed a specific interest, participated in the field work or helped develop the draft Daigle Pond PCAP-TMDL report: Maine DEP (Kathy Hoppe and Bill Sheehan); St. John Valley SWCD staff (Heidi Royal); Maine Department of Inland Fisheries and Wildlife (Dave Basley); Maine Forest Service (Chris Martin) and Maine Department of Agriculture (David Rocque).

The following statement was advertised in the Bangor Daily News over a month long (2-weekend) period (August 12-13 and August 19-20, 2006), and in the St. John Valley Times over a four-week period beginning the week of August 7, 2006:

DAIGLE POND - New Canada and Fort Kent

In accordance with Section 303(d) of the Clean Water Act, and implementation regulations in 40 CFR Part 130 - the Maine Department of Environmental Protection has prepared a combined Phosphorus Control Action Plan (PCAP) and Total Maximum Daily Load (TMDL) nutrient report (DEPLW 0789) for the **DAIGLE POND WATERSHED**, located within the Towns of New Canada and Fort Kent. This PCAP-TMDL report identifies and provides best estimates of non-point source phosphorus loads for all representative land use classes in the **DAIGLE POND** direct watershed and the total phosphorus reductions required to restore and maintain acceptable water quality conditions. A Public Review draft of this report may be viewed at Maine DEP Northern Maine Regional offices in Presque Isle (1235 Central Drive, Skyway Park) or at the Central Maine DEP offices in Augusta (Ray Building, Hospital Street - Route 9, Land & Water Bureau) or on-line: http://www.maine.gov/dep/blwq/comment.htm. Please send all comments, in writing by September 1, 2006 to Dave Halliwell, Lakes TMDL Program Manager, Maine DEP, State House Station #17, Augusta, ME 04333. or e-mail: david.halliwell@maine.gov

PUBLIC REVIEW Comments Received

No further comments were received during this 30-day public review period for Daigle Pond.

Subsequently, an internal review by Maine-DEP requested the inclusion of 303(d) listed Daigle Brook - outlet stream from Daigle Pond, into the lake PCAP-TMDL report. The following Addendum was added to the report and released for Public Review during the 10-day period (August 28th to September 8th, 2006), as advertised in the Bangor Daily News and posted on the Maine DEP website.

DAIGLE Brook, Aroostook County - Total Maximum Daily Load (TMDL) Report Addendum (change notification)

*The development of the Daigle Pond TMDL (DEPLW 2006-0789) and selection of a numeric water quality target of 16 ppb total phosphorus is protective of downstream uses in Daigle Brook, which is also water quality impaired and 303(d) listed. The water quality impairment of Daigle Brook is due to dissolved oxygen loss related to primary productivity caused by excessive pollutants (total phosphorus) from Daigle Pond and the brook's direct watershed within the Cross Lake drainage system. The planned reduction of total phosphorus loading to Daigle Brook (a primary nutrient source for downstream Cross Lake) coupled with the attainment of the in-lake target of 16 ppb in Daigle Pond will provide for attainment and maintenance of water quality standards in the brook. Following final EPA approval of the Daigle Pond and Cross Lake TMDL (DEPLW 2006-0790), Daigle Brook will be re-designated from the 303(d) list to category 4A (TMDL approved). Please send any public comments, in writing by **September 8, 2006** to Dave Halliwell, Lakes TMDL Program Manager, Maine DEP, State House Station #17, Augusta , ME 04333, or e-mail: David Halliwell.*

No further comments were received during this 10-day public review period for Daigle Brook

Final changes to the draft Public Review report, as a result of this addendum, include naming Daigle Brook as a 303 (d) listed water body in the 'Drainage System' section of this report (page 9), and addition of language from the Daigle Brook addendum into the 'Numeric Water Quality Target' section (page 24).

Further agency review (US-EPA) comments requested additional justification of the link between the annual load and the annual flushing rate of Daigle Pond. Changes were made to the 'Annual/Daily Load Capacity' section (page 27), as well as the 'Seasonal Variation' section (page 30), to further discuss and account for the relatively high annual flushing rate.

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