2011

Pleasant River Watershed Management Plan

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Pleasant River

Watershed Management Plan

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Prepared by Heather True
June 2011

Acknowledgments

This report was funded through the Casco Bay Estuary Partnership.

The following organizations contributed to this report:

Casco Bay Estuary Partnership

Cumberland County Soil and Water Conservation District

Maine Department of Environmental Protection

Maine Department of Inland Fisheries and Wildlife

Presumpscot River Watch

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Introduction

GOAL

To attain State of Maine's designated water quality standards.

The primary purpose of this watershed-based management plan is to establish long-term priorities, goals and methods in attaining the State of Maine's water quality standards for the Pleasant River and its tributaries, located in the Towns of Gray and Windham in Cumberland County, Maine. The Pleasant River and Thayer Brook, a main tributary to the Pleasant River, are both designated as Class B waters under the State of Maine's classification system to establish water quality goals. Class B waters are the 3rd highest classification, and:

> *"…must be of such quality that they are suitable for the designated uses of drinking water supply after treatment; fishing; agriculture; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation, except as prohibited under Title 12, section 403; navigation; and as habitat for fish and other aquatic life. The habitat must be characterized as unimpaired."*[1]

Pleasant River and Thayer Brook are impaired due to low dissolved oxygen. Pleasant River is also impaired due to high bacteria counts.

Unfortunately, the Pleasant River and Thayer Brook are not currently meeting Class B water quality standards, and are thus considered to be impaired. The Maine Department of Environmental Protection (MEDEP) lists both the main stem of the Pleasant River and Thayer Brook as impaired streams under what is called the 303(d) list, referring to Section 303(d) of the federal Clean Water Act. The 303(d) list is now combined with MEDEP's broader 305(b) water quality assessment report, which is released every two years.[2] In the 305(b) report, the main stem of the Pleasant River is listed as being impaired due to high bacteria counts, and both the Pleasant River and Thayer Brook are listed as being impaired due to low levels of dissolved oxygen. The Pleasant River and Thayer Brook fall under Category 5 for the MEDEP's 2008 303(d) list, which means that a Total Maximum Daily Load (TMDL) is needed for waters that are impaired or threatened due to one or more designated uses by a pollutant(s). TMDLs represent the total amount of a pollutant (e.g. bacteria) that a waterbody can receive while still meeting water quality standards. MEDEP has released a draft of the 2010 Integrated Water Quality Monitoring and Assessment Report (currently pending the U.S. Environmental Protection Agency's [EPA] approval)[3], which continues to list both the Pleasant River and Thayer Brook under Category 5 for dissolved oxygen. One change, however, is that MEDEP now lists the main stem of the Pleasant River under Category 4 due to EPA's approval of a state-wide TMDL for bacteria. A Category 4 listing thus does not require a watershed-specific TMDL report for that given impairment.

A watershed-based management plan is necessary in outlining the steps needed for the Pleasant River and Thayer Brook to attain Class B water quality standards. The plan is also required by EPA prior to expending federal implementation funds from Section 319 of the Clean Water Act towards on-the-ground water quality improvements. In establishing an EPA accepted watershed-based management plan, the following nine elements must be achieved:

1. **Causes and Sources of Pollution:** Identification of the causes and sources of pollution needed to be controlled to achieve the load reductions estimated in this watershed-based plan.
2. **Water Quality-Based Goals:** Estimated water quality-based goals or load reductions to occur in the implementation of the management measures listed in this watershed-based plan.
3. **NPS Management Measures:** Description of Non-Point Source (NPS) pollution management measures that will need to be implemented to achieve the estimated water quality-based goals or load reductions and the identification of the critical areas in which those measures will be needed to implement this plan.
4. **Technical and Financial Assistance:** Estimated amounts of technical and financial assistance needed along with associated costs, and/or the sources and authorities that will be relied upon to implement this plan.
5. **Information and Education:** Description of information and education components needed to enhance public understanding and encourage early and continued participation in designing and implementing this plan.
6. **Schedule:** Timetable that is reasonably expeditious for implementing the NPS management measures listed in this plan.
7. **Milestones:** Description of the interim, measurable milestones to be used to determine how well the NPS management measures or other control actions are being implemented.
8. **Criteria:** Criteria used to determine whether water quality-based goals are being achieved or if not, criteria for determining whether this plan needs to be revised.
9. **Monitoring:** Monitoring component to be used to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established.

The above nine elements are met through this plan's ***Action Items*** starting on page 13.

Description of the Watershed

The Pleasant River Watershed is 29 square miles and is located in the Towns of Gray and Windham in Cumberland County, Maine. The headwaters of the Pleasant River originate at both Gray Meadows and Thayer Brook in Gray. Many smaller tributaries and wetlands feed the Pleasant River, including: Wiggins Brook (also known as Thayer River), Allen Bog, Baker Brook, and Ditch Brook which drains Collins Pond. Near River Road in South Windham, the Pleasant River joins the Presumpscot River, a MEDEP *Nonpoint Source Priority Watershed* river, which drains into Casco Bay. Pleasant River is also on MEDEP's *Nonpoint Source Priority Watershed List* due to high bacteria counts, its support of a cold-water fishery, and its proximity to a densely populated area.

WATERSHED

All the area of land in which water drains into the same waterbody

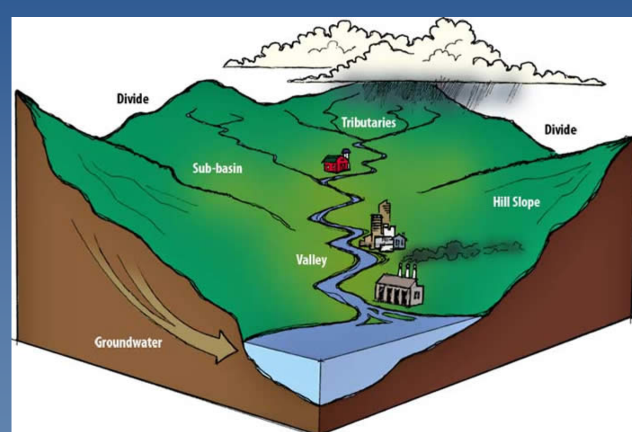
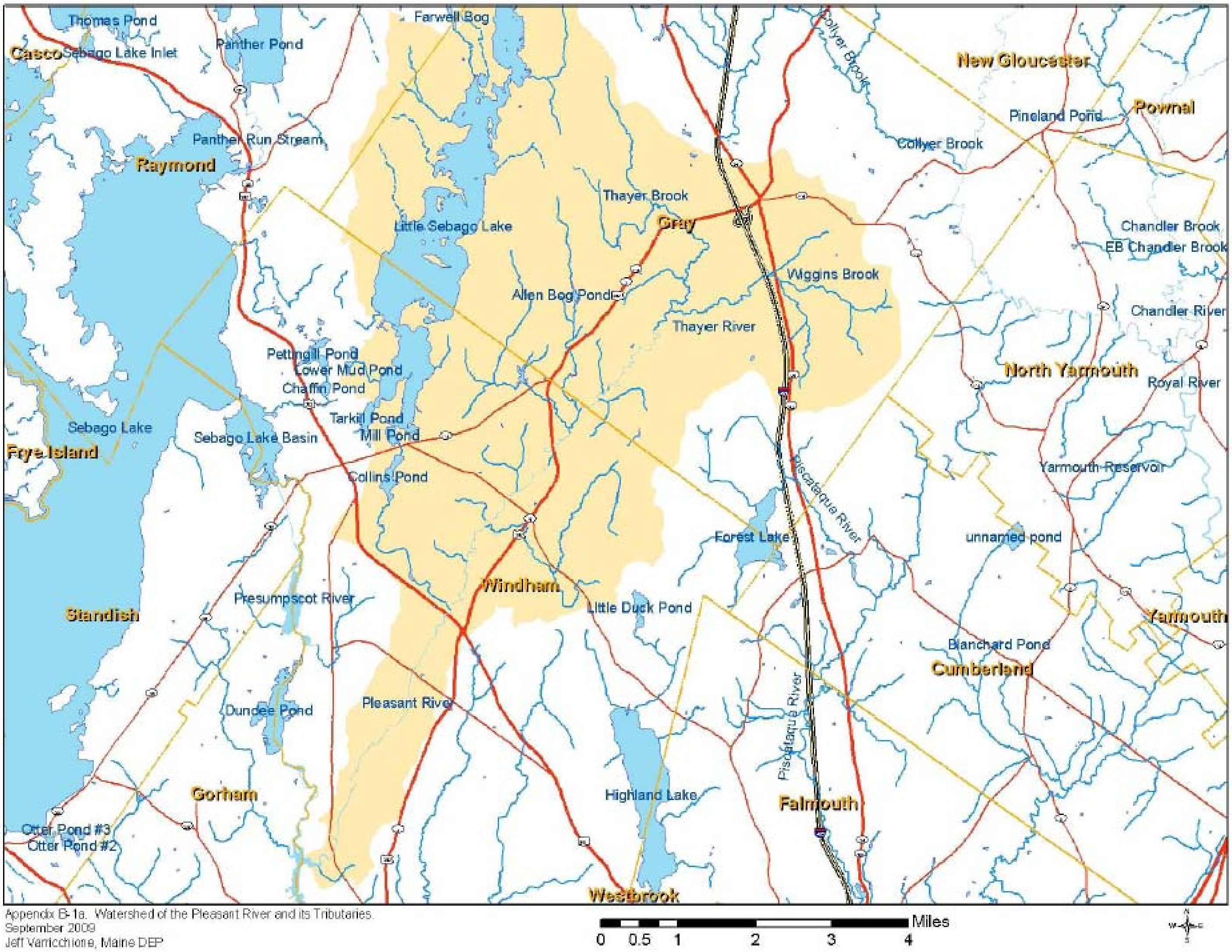


Photo credit: www.twp.west-bloomfield.mi.us/departments/Watersheds.cfm



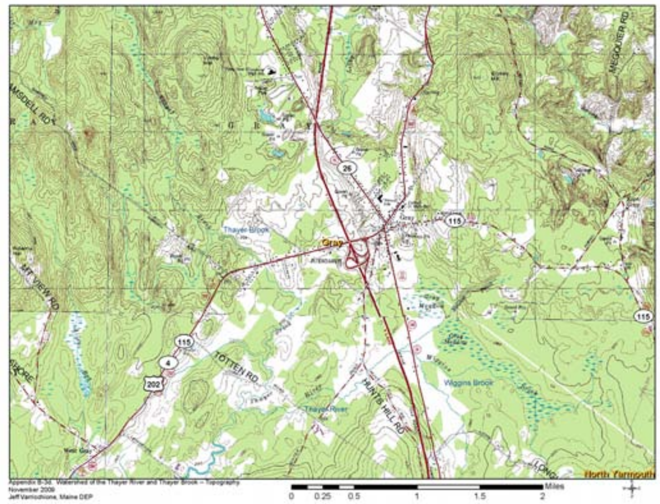
The map above highlights the Pleasant River Watershed including the sub-watersheds of Little Sebago Lake and Colins Pond which drain into Pleasant River via Ditch Brook. Map from Pleasant River and Tributaries Reconnaissance Study, Maine DEP 2009.

The Maine Department of Inland Fisheries and Wildlife (IF&W) manages the Pleasant River by stocking the River in the fall, and throughout April and June, with both Brown Trout and Brook Trout. Native Brook Trout populations which require cold water to thrive are also present in the River and its tributaries. As a result, the River is one of the most highly prized fly-fishing rivers in southern Maine, attracting thousands of local and out-of-state anglers annually.

The Pleasant River Watershed is comprised of 69% forest land, 14% agricultural land, 4% wetlands, 4% open space, 4% high intensity development, 3% low intensity development, and 2% medium intensity development (see Appendix A: Land Use Map, p. 21). Portions of Thayer Brook and the upper portion of Wiggins Brook flow adjacent to large wetland complexes with much of downtown Gray and approximately four miles each of the Maine Turnpike and Route 26 draining into these waterbodies. From 1990 to 2000, development pressure within the watershed's towns increased rapidly: by 14.5% for the Town of Windham and by 15.5% for the Town of Gray.[4]

Pleasant River and its tributaries contain a variety of stream and river habitat types. A moderate to plentiful amount of large woody debris that had fallen in the stream is evident along forested areas, providing habitat diversity and several ecological functions. Most of the Pleasant River and particularly its tributaries are fairly slow-flowing and meandering with mostly sandy-silty stream beds. The main

stem of the River has areas of moderately-fast waters flowing over exposed ledge, ledge cascades and rock-gravel stream beds.



Above map is a topographic map of the headwaters of Pleasant River near downtown Gray. Map from Pleasant River and Tributaries Reconnaissance Study, Maine DEP 2009. (See Appendix A: Topography Maps for larger map).

According to geological maps, the dominant surficial geology is composed of thick deposits of silt and sand as a result of the retreat of the glaciers from the last Ice Age with the Atlantic Ocean following right up to the foot of the glaciers. They surround the Pleasant River and Wiggins Brook and are called the Presumpscot Formation, which is comprised mostly of a fine-grained marine mud (silt and clay with local sandy beds and lenses). Stream Alluvium is a modern sediment deposit along the Pleasant River, Wiggins Brook and Thayer Brook. It is composed of sand, silt, and minor amounts of gravel on flood plains. The River corridor between Windham Center Road and Swett Road (including the area around Pope Road) is comprised largely of end moraines which are Ice Age deposits which are a mixture of till, sand and gravel, in part or wholly covered by the Presumpscot Formation.[5] (see Appendix A: Geology Maps, p. 22-23)

The topography of the Pleasant River and its tributaries has a fairly low gradient. Exceptions include certain stretches of Thayer Brook, which alternate through areas comprised primarily of glacial till (a glacial deposit from the bottom or insides of a glacier consisting of poorly sorted mixture gravel, sand, silt and clay), areas of flat wetlands, and areas of cascades flowing over exposed ledge / bedrock at a few locations along Pleasant River. The topography of the land adjacent to the Pleasant River and its tributaries appears to have moderately steep slopes with the stream banks becoming steeper in areas along the main branch of the Pleasant River prior to flowing into Presumpscot River. (see Appendix A: Topography Maps, p. 24-26)

Water Quality

The Pleasant River has been identified by MEDEP, EPA, Presumpscot River Watch (PRW), and partners as an emerging threat to the water quality of the Presumpscot River and Casco Bay. Since 1989, PRW has been monitoring water quality (dissolved oxygen, bacteria, and temperature) at four sites along the Pleasant River. Data collected by PRW (collected under a MEDEP and EPA approved Quality Assurance Project Plan) indicate that the Pleasant River has experienced an increased rate of bacterial contamination, with E. coli counts repeatedly exceeding Class B standards in both dry and wet weather since 1999.

Maine Bacteria Water Quality Standards

Class A and AA: As naturally occurs

Class B: Not to exceed a geometric mean of 64 counts / 100 mL between 5/15 and 9/30

Class C: Not to exceed a geometric mean of 126 counts / 100 mL between 5/15 and 9/30

In addition to PRW's water quality monitoring program, MEDEP also conducts biomontioring along the Pleasant River and Baker Brook. Biomonitoring consists of sampling the number and diversity of aquatic organisms to assess the condition of the ecosystem. MEDEP conducts biomonitoring approximately

every five years, and samples taken since 1991 have shown the Pleasant River and Baker Brook to be in attainment of Class B standards for macroinvertebrates. MEDEP also monitors sites along the Pleasant River and Baker Brook for algae. There are no official state algal density standards.

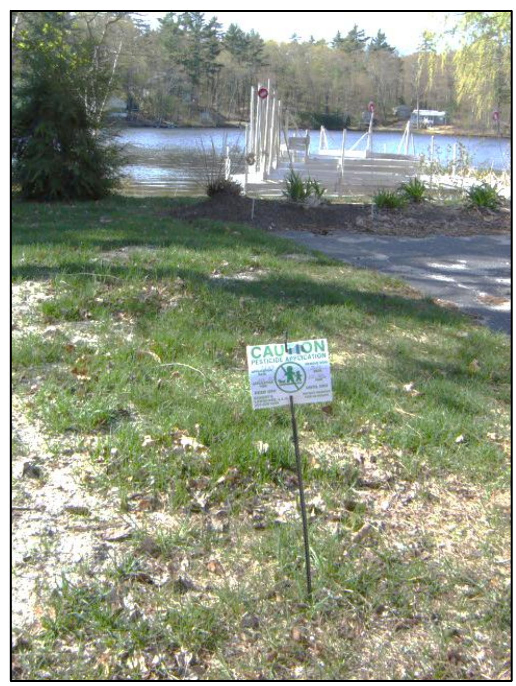
The Windham School Wastewater Treatment Facility currently has a permit for a point-source discharge on the main stem of the Pleasant River about a half mile downstream from the Windham Center Road crossing. Since 2000, this treatment facility has experienced sporadic non-compliance of Total Suspended Solids (TSS) and Biological Oxygen Demand (BOD). MEDEP is currently working with the treatment facility to develop solutions to reduce the number of non-compliance violations. The Town of Windham is also in the beginning stages of considering a wastewater sewer system for the North Windham business district to which this School Treatment Facility could connect.

Site of Maine DEP macroinvertebrate sampling location, upstream of Pope Road crossing (Photo Credit: Maine DEP)

Sources of Water Quality Impairment

Polluted runoff is likely the greatest source of water quality impairment to the Pleasant River Watershed. Unlike point source pollution in which pollutants are discharged from a single identifiable source (pipes, channels, sewers, etc.), polluted runoff cannot be traced back to a single origin. It occurs when rainfall, and / or snowmelt wash over the land surface picking up pollutants and depositing them into a water resource. Polluted runoff can include:

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas with many lawns and grassy public lands such as athletic fields
- Oil, grease and toxic chemicals from urban runoff, especially large parking lots and roads and spills of heating oil near streams
- Sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks caused by changed hydrology and flooding or stormwater discharges from the uplands
- Salt and sand from private, local and state roads
- Bacteria and nutrients from livestock, pet wastes, faulty septic systems, storm sewers and malfunctions from permitted development such as treatment plants
- Atmospheric deposition and hydromodification[6]



This photo is of a pesticide application caution sign on a shorefront property on Little Sebago Lake in Windham.

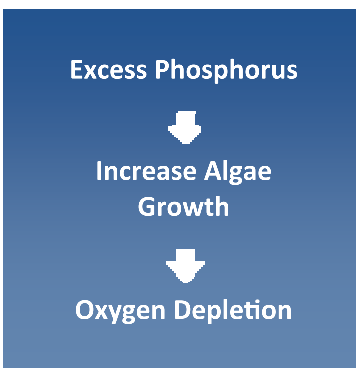
In the State of Maine, the biggest source of pollution to surface waters is soil erosion. Soil erosion can originate from a number of locations including gravel roads and road shoulders and ditches,

boat launches on lakes, areas of unstable over-used water access, ATV trails, agricultural fields, logging operations, stream crossings and unstable stream banks. Sediment is of concern because it can directly affect water clarity while simultaneously transporting attached pollutants. Direct impacts of soil include:

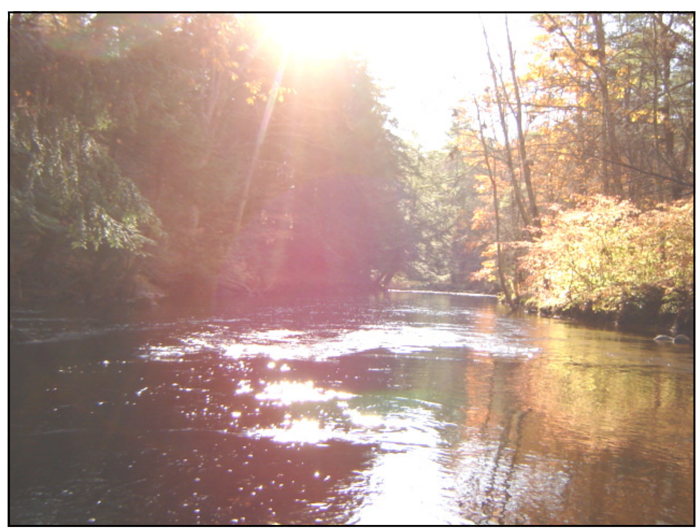
Sediment from erosion sites such as this one on Little Sebago Lake in Windham is the biggest source of pollution to surface waters in Maine.

- Increased turbidity making it difficult for fish to navigate, respirate, and feed properly
- Smothering of fish and aquatic insect eggs laying at the bottom of stream beds
- Decreased stream depth, resulting in increased flooding, stream bank erosion and rises in water temperature which affect cold water fish such as trout
- Loss of critical in-stream and partial wetland habitat

Soil particles readily bind to other pollutants such as phosphorus and oil, fertilizers, and pesticides. These pollutants can also negatively affect water quality and natural ecosystems. Toxins eaten by small organisms will bio-accumulate when these organisms are consumed by higher trophic-level organisms, causing illnesses, birth defects, and death. An excess amount of the nutrient phosphorus can lead to algae blooms and excessive aquatic plant growth in areas of low channel gradient and reduced riffles. When excessive aquatic plants start to decay, dissolved oxygen is used by bacteria breaking down the decaying plants, resulting in low dissolved oxygen levels (hypoxic). These factors can asphyxiate aquatic organisms that rely on dissolved oxygen to survive or cause those that can avoid the area to leave. In addition to a loss in fish, algae blooms and associated poor water quality can affect the local economy by deterring tourist recreation and decreasing property values.



Vegetated areas next to water resources help to protect water quality by filtering sediment and pollutants before they reach the river.
These vegetated buffers have intertwined root systems that also protect shorelines from erosion and provide valuable wildlife habitat. The loss of vegetated strips of land along the river can degrade water quality by allowing unfiltered pollutants to flow directly into a waterbody, causing shorelines to erode due to the lack of root systems, and an increasing the amount and velocity of stormwater flow. Loss of vegetative cover and the lack of shade it produces can also increase water temperature reducing the population of fish and bottom-dwelling insects that need cold water to thrive and increasing nuisance and invasive aquatic plants and algae.



Vegetated buffers along stream banks provide a number of benefits including stream shading, habitat, stormwater filtering, and bank erosion protection.

Surveys Conducted

WATER QUALITY IMPACT RATING

High: large sites with significant erosion that flows directly into a stream or the river

Medium: sediment is transported off site but not in high magnitude

Low: sites with limited soil transported off site

Pleasant River Watershed Survey[7]

In the spring and summer of 2008, a watershed survey focused on polluted runoff was conducted throughout the Pleasant River Watershed. Results from the 2008 Watershed Survey identified 95 sources. Most of the sites documented were associated with town roads (35%), private roads (15%) and residential areas (13%). Other NPS sites documented included state roads, agriculture sites, businesses/commercial properties, trails/paths or boat access, and construction sites.

A Pleasant River Watershed Survey volunteer documents road shoulder erosion above a culvert washing into a tributary of the Pleasant River.

Soil erosion was the most common type of NPS pollution observed followed by inadequate vegetative riparian buffers, poorly functioning culverts and winter sand. Other types of pollutants observed included drainage from impervious surfaces, livestock access, trash, bare soil, lawn clippings, pet waste, and roof runoff. Of the 95 sites, more than half were rated as having either a medium or high impact to water quality. Soil loss estimates for the high and medium impact sites amounted to over 200 tons of sediment being washed into the Pleasant River each year. This amounts to a little over 191 pounds of phosphorus entering the river each year.

Pleasant River and Tributaries Reconnaissance Study[5]

In mid-October of 2008, stream corridor surveys were performed on portions of Wiggins Brook (Thayer River) and Thayer Brook. An abbreviated adaption of the stream corridor survey method was also conducted along the Pleasant River from Falmouth Road to River Road in Windham. This survey noted that the riparian habitats of many of the reaches of the Pleasant River, Wiggins Brook and Thayer Brook appeared to be in fairly good condition due to extensive widths of mature deciduous and coniferous forests. However, the presence of poorly managed riparian lands in many of the agricultural portions of the streams/rivers was also observed. Stretches of Wiggins Brook had riparian buffers that were in fairly good condition. Exceptions included areas of sparse streamside buffers reverting agricultural land and beaver activity. Along Thayer Brook and portions of the main stem of Pleasant River, a substantial amount of adjacent land was used for agriculture in which many of the trees and shrubs had been removed leaving mostly grasses. These areas left the stream bank with poor shading of the water and without a significant network of tree and shrub root systems to bind soils together. This was causing areas of the stream bank to slump into the river. Many of these fields also showed signs of water access by grazing livestock, which is contributing sediment, bacteria, and nutrient loading to the river.

RIPARIAN:

Meaning adjacent to a river, stream, or waterbody, typically provides some of the most important habitat in an ecosystem.

A few areas along the Pleasant River were documented in which extreme river widening or bank slumping were occurring. Causes for these observations could include high flow events, geological conditions, sharp bends in the river, human or animal activities, or a combination of these factors.

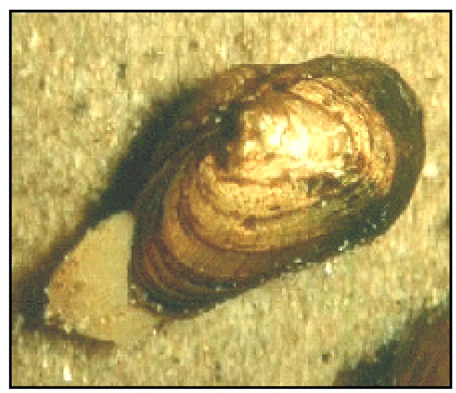
Signs of cattle access to main stem of Pleasant River resulting in stream bank erosion.

During the stream corridor survey of Wiggins Brook and Thayer Brook, a portion of Wiggins Brook was noted to have potential water quality problems because suspended silt was observed entering the river via an eroding ditch that had been trampled by livestock. Thick filamentous algae growth was also observed downstream of this ditch. Land adjacent to Thayer Brook also supported livestock grazing and watering leading to sediment, nutrient, and bacterial pollution problems. One portion of Thayer Brook was noted as only being 25% shaded due to the removal of streamside trees and shrubs on agricultural lands.

Stream crossings throughout most of the surveyed stretches of the Pleasant River, Wiggins Brook and Thayer Brook appeared to allow fish passage. Exceptions included culverts at the lower end of Wiggins Brook. They may prevent fish passage during low flows during the summer. An undersized culvert on Thayer Brook at an ATV trail / road may also interrupt fish passage. It was observed that most of the main stem of the Pleasant River had bridges which typically provide the most desirable flow and fish passage conditions. In contrast, Wiggins Brook and Thayer Brook had many undersized culverts with deep and wide scour pools and notable amounts of stream bank erosion downstream.

Brook Floater Surveys[8]

During the summer of 2009, the Maine Department of Inland Fisheries and Wildlife (IF&W) surveyed a portion of the Pleasant River for the brook floater (*Alasmidonta varicose*), a small freshwater mussel that is listed as a "Threatened" species in the State of Maine and federally as a "Species of Special Concern". The 2009 survey revealed a significant decline in numbers and habitat quality since the site was last surveyed in 2001. In 2001, 125 live brook floaters were found in the 0.75 mile stretch of Pleasant River between the Falmouth Road and Brand Road bridge crossings. In 2009, only 17 live individuals were observed in the same area, and extensive bank erosion and sediment deposits were evident. This finding is of high concern to IF&W since the Pleasant River contains the only known population of brook floaters in southern Maine.



Brook floater (Alasmidonta varicose)

Photo Credit: www.mass.gov/dfwele/dfw/nhesp/images/al_varicosa.jpg

A follow-up survey by IF&W in the summer of 2010 found only six live brook floaters in two days of surveying. Surveyors noted that turbidity was so high that it was nearly impossible to conduct visual surveys in water more than 1 ½ feet deep throughout most of the upper river. Unfenced cattle and horse access to the stream was noted to damage stream banks. The stream banks appeared to have suffered a tremendous amount of additional damage from recent floods, with some of the turbidity likely related to natural clays, tannins and algal production.

Sediment delta along stretch of Pleasant River in which Brook Floater habitat has been documented. Photo Credit: Maine Dept. IF&W

As a result of IF&W's concern about the brook floater population in the Pleasant River, both the Presumpscot River Watershed Coalition and the Casco Bay Estuary Partnership's Habitat Restoration Committee have identified the Pleasant River as a priority focus area. Although the exact cause for the population decline in Brook Floaters is unknown, observations and current site conditions strongly suggest that polluted runoff and unstable bank erosion may be primary factors.

Casco Bay Watershed Fish Barrier Survey[9]

Casco Bay Estuary Partnership (CBEP) in conjunction with the US Fish and Wildlife Service's Gulf of Maine Coastal Program conducted a survey of fish passage barriers throughout the Casco Bay Watershed in 2009-2010. Preliminary data for the Pleasant River Watershed and the larger connecting Little Sebago Lake Watershed identified over 40 sites in which potential and severe fish passage barriers were observed. Stream road crossings were assessed using the *Maine Road-Stream Crossing Manual*. See Appendix A, p. 28 and 29 for preliminary map and survey data for the Pleasant River Watershed. A full data set is available through the Casco Bay Estuary Partnership.

Neighborhood Source Assessment[7]

A Neighborhood Source Assessment (NSA) and Hotspot Site Investigation (HSI) were conducted in August and September of 2009. The NSA evaluated pollutant producing behaviors in three distinct areas of the watershed: downtown Gray, Route 302 in Windham, and Falmouth Road in Gray. The survey looked at housing type, lot size, driveway conditions, roof runoff, yard and lawn status, lawn care, and typical lot features. A polluted runoff severity rating of moderate was listed for both the Route 302 and Falmouth Road areas due to the presence of a septic system and high turf management. The polluted runoff severity for the downtown Gray area was rated as low due to a high percentage of trash or junk observed on individual properties. All three areas surveyed had high percentages of pavement and buildings and semi-impervious areas of lawn and appeared to lack significant amounts of trees, shrubs and ground cover.

Recently seal-coated driveway in the Pleasant River Watershed; Stormwater picks up harmful polyaromatic hydrocarbons (PAHs) from seal-coating washing them into nearby streams and waterbodies.

Hotspot Site Investigation[7]

The Hotspot Site Investigation (HSI) evaluated vehicle operations and parking, outside storage of potentially dangerous materials, turf management, waste management and stormwater infrastructure. Out of 17 commercial properties surveyed (located in the Route 302 and downtown Gray areas), seven were determined to be potential hotspot sites. Out of the seven potential hotspots, six were commercial

and one was a municipal property. None of the sites were ranked as confirmed hotspots or severe hotspots. More analysis is needed to develop an approach to contact landowners and assist them in developing site management plans to prevent them from becoming larger problems in the future.

Downspouts draining onto impervious surfaces rather than being filtered into the ground are considered potential "hotspots" due to the potential pollutants the stormwater can pick up and wash into the Pleasant River.

Action Plan

Class B water quality standards can be met for the Pleasant River and Thayer Brook following the guidance of EPA's nine elements for watershed-based management plans (described on p. 5). The remainder of this document follows EPA's nine elements to determine the best course of action in achieving compliance with water quality standards. This Plan will be overseen by a steering committee formed through Phase I of the Pleasant River Watershed Implementation grant scheduled to begin in the spring of 2011. Members will include representatives from CCSWCD, MEDEP, PRW, CBEP, the Towns of Gray and Windham, PRWC and watershed residents.

1. Causes and Sources of Pollution

The Pleasant River is listed by the MEDEP as an impaired waterbody due to high levels of bacteria, and both the Pleasant River and Thayer Brook are listed by the MEDEP as impaired waters due to low levels of dissolved oxygen. Based on survey documentation and general knowledge of watershed impairment, NPS pollution is the likely culprit causing both low dissolved oxygen readings and high bacteria counts.

As previously discussed, erosion can contribute excess nutrients into the river causing excess algae and aquatic plant growth. This causes the amount of dissolved oxygen in the water to decline as excessive amounts of plants then subsequently start to decay. Reducing the amount of erosion sites throughout the watershed will help to improve the amount of available dissolved oxygen. Potential sites from a variety of land uses contributing sediment and excess nutrients to the Pleasant River were identified in the Pleasant River Watershed Survey in which 95 erosion sites were recorded (see Appendix A: Pleasant River Watershed Survey Map, p. 27). The Hotspot Site Investigation also listed seven potential hotspot sites which may also be contributing excess nutrients into the Pleasant River.

In addition to erosion sites, nutrients can also be contributed through the waste of livestock and the application of fertilizer from both agricultural and residential properties. Both agricultural and residential properties were identified in the Pleasant River Watershed Survey. Impacts of cattle access to the river and removed / non-sufficient vegetative riparian buffers along agricultural land was also documented through the Pleasant River and Tributaries Reconnaissance Survey. Residential and commercial lawns likely to be treated with fertilizer were also documented in both the Hotspot Site Investigation and the Neighborhood Source Assessment.

Bacteria can also be contributed to a waterbody through point-source pollution. A permitted point-source sewer system discharges to the Pleasant River slightly downstream of the Windham Center Road

crossing. Bacteria samples for this discharge meet current permitted levels. With the data collected and observed through the Pleasant River Watershed Survey and Pleasant River and Tributaries Reconnaissance Survey, and given that PRW's data also shows high levels of bacteria upstream from this discharge site, Pleasant River's high bacterial contamination is likely due to the widespread livestock operations abutting the stream bank.

2. Water Quality-Based Goals

The primary long-term goal of this plan is to improve dissolved oxygen readings in the Pleasant River and Thayer Brook and reduce E. coli levels in the main stem of the Pleasant River so that both waterbodies will meet current Class B standards. As previously discussed under sources of water quality impairment, dissolved oxygen, sediment loading and bacteria can often be strongly connected. The sediment washing into a river or stream from soil erosion often carries bacteria and nutrients with it. The nutrient phosphorus, which readily attaches to soil particles, can increase algal growth which in turn decreases the amount of dissolved oxygen available in the water. In the Pleasant River Watershed, numerous erosion sites have clearly been documented and water turbidity has frequently been observed. Surveys have also observed livestock access to the Pleasant River and its tributaries which is most likely to be contributing to high levels of bacteria counts.

To quantify pollutant loading into the entire Pleasant River Watershed, estimates were obtained using Tetra Tech, Inc.'s Spreadsheet Tool for Estimating Pollutant Loads (STEPL).[10] STEPL uses simple algorithms to calculate sediment and nutrient loads from different land uses. For the Pleasant River Watershed, land use data was obtained from the Maine Office of GIS. Out of the 2,560 acres of agriculture land, it was estimated that approximately 20% was cropland, slightly less than 1% was feedlot, and the remaining acres were pastureland. Assuming the implementation of best management practices (BMPs) to remediate 60% to 80% of the sites, the following annual pollutant loads were calculated: 41,739 lbs of Nitrogen (N), 5,672 lbs of Phosphorus (P), 147,246 lbs of Biological Oxygen Demand (BOD), and 1,049 tons of sediment (see Table 1 below).

Table 1: STEPL results for Pleasant River Watershed

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	19,961	3,073	77,097	458
Cropland	2,507	610	8,798	239
Pastureland	14,428	1,431	45,483	352
Forest	0	0	0	0
Feedlots	4,656	485	15,107	0
User Defined	0	0	0	0
Septic	187	73	762	0
Gully	0	0	0	0
Stream bank	0	0	0	0
Groundwater	0	0	0	0
Total	41,739	5,672	147,246	1,049

The STEPL model estimates that addressing the highest priority erosion sites throughout the watershed will reduce the overall watershed sediment loading by 30-40%. Additional sediment loading can also be reduced by installing and enhancing vegetative riparian buffers along the stream bank.

In addition to the STEPL model estimates, the 2008 Pleasant River Watershed Survey Report (previously discussed on p. 10) estimated approximately 205 tons of sediment per year are washing into the Pleasant River just from the highest impact sites identified during the survey (approximately 24% of the total number of sites identified). In the spring of 2011, an implementation project is scheduled to begin which will address these highest rated water quality impact sites. This first phase will reduce STEPL model estimates by 20%.

A TMDL has not yet been completed for dissolved oxygen for the Pleasant River. However, dissolved oxygen levels are anticipated to improve by reducing the amount of sediment flowing into the Pleasant River and its tributaries, and by diverting and infiltrating stormwater runoff using vegetative riparian buffers and other conservation practices. Reducing the amount of phosphorus flowing into the river will reduce the amount of algal and aquatic plant growth, which tends to decrease the amount of dissolved oxygen available in the water column.

In regards to bacteria, the State of Maine recently implemented a Statewide Bacteria TMDL report.[11] This report states that for Class B waters, E. coli of human and domestic animal origin shall not exceed a geometric mean of 64 colonies per 100 mL, or an instantaneous level of 236 colonies per 100 mL, between the dates of May 15th and September 30th.

3. *NPS Management Measures*

To meet the previously stated water quality-based goals, a combination of Conservation Practices or Best Management Practices (BMPs) will need to be installed. BMPs are any structural or non-structural practice that treats or prevents polluted runoff from entering a water resource. For the Pleasant River Watershed, the following BMPs are recommended to treat most of the NPS problems identified throughout the watershed: *(Responsible party: T=towns, P=private road associations, L=landowners, S=state)*

Erosion on Roads and Driveways

- Add new surface material to gravel roads/driveways, reshape or crown to shed water quickly *(P,L)*
- Install runoff diverters (ex. Broad-based dips, rubber razors, water bars) *(P,L)*
- Install turnouts to direct runoff off road and into stable areas *(T,P,L)*
- Use detention basins at ditch turnouts to retain water between runoff events and remove suspended sediments and adsorbed pollutants *(T,P,L,S)*
- Remove excess winter sand *(T,S)*
- Reshape/vegetate eroding road shoulders *(T,P,S)*
- Consider paving dirt roads along steep sections or areas experiencing chronic washouts *(T,P,L)*

Inadequate Vegetated Buffer and Bare Eroding Soil

- Establish vegetated buffer to reduce direct flow of runoff to waterbody *(T,P,L)*
- Extend buffers to a minimum of 75 feet on all streams *(T)*
- Plant native trees, shrubs and ground covers to stabilize soil and reduce runoff *(T,L)*

Inadequate Vegetated Buffer and Bare Eroding Soil (continued)

- Seed and hay or spread erosion control mulch over all areas of bare soil to provide temporary or permanent cover *(T,P,L,S)*
- Use sod transplants to stabilize erosion prone areas *(T,P,L,S)*

Construction Site Erosion Controls

- Put up fences and signs to contain damage caused by heavy equipment *(T,P,L,S)*
- Use grading plans to minimize erosion *(T,S)*
- Use filter strips and buffers to prevent runoff, stabilize erosion prone slopes *(T,P,L,S)*
- Place soil piles where they will not erode into watercourse *(T,P,L,S)*
- Seed and install effective erosion barriers around spoil piles *(T,P,L,S)*
- Stage projects to minimize area of exposed soil at any one time *(T,P,L,S)*
- Select and protect trees to the maximum extent possible, prior to construction *(T,P,L,S)*
- Dewater with well points/cofferdams and pumps to remove ground and surface water from construction site to reduce scarring and erosion *(T,L,S)*
- Install filters of crushed stone, straw or geotextile to remove sediment from stormwater before it exits a construction site *(T,L,S)*

Poorly Functioning Culverts

- Clean out culverts regularly to minimize blockage and backflow *(T,P,L,S)*
- Enlarge, replace, or lengthen culvert to account for type of flow *(T,P,S)*
- Install plunge pool at culvert outlet to reduce downstream erosion *(T,P,S)*
- Stabilize inlet and outlet with riprap to reduce erosion *(T,P,L,S)*
- Eliminate hanging culverts that prevent adequate fish and other aquatic organism passage *(T,P,S)*
- When replacing culverts, install culverts that are 1.2 times the mean stream bank-width *(T,P,S)*

Inadequate Ditches

- Install ditches to improve road drainage *(T,P)*
- Reshape existing ditches to reduce steep side slopes *(T,P,S)*
- Depending on ditch slope, armor with riprap, turf reinforcement mats (TRM) or grass to minimize erosion by runoff water *(T,P,S)*
- Install turnouts to direct water into stable areas and reduce flow to waterbody *(T,P,S)*
- Install check dams to slow high velocity water, preventing ditch scouring *(T,P,S)*

Direct Flow from Roof Runoff

- Install crushed stone-filled drip line trench under roof line to capture and infiltrate rainwater *(L)*
- Install a drywell at gutter downspout to capture and infiltrate stormwater *(L)*

Unstable Shoreline / Beach Access

- Re-vegetate or terrace eroding slopes *(T,P,L)*
- Eliminate raking to bare soil *(L)*
- Establish a defined path for foot traffic *(T,P,L)*
- Install infiltration steps to reduce erosion on steep foot paths *(T,P,L)*
- Create meandering paths to eliminate direct flow of stormwater runoff into waterbody *(T,P,L)*
- Minimize path widths *(T,P,L)*

Agricultural Impacts

- Install fencing to keep livestock away from waterbody and its tributaries *(L)*
- Create a vegetated buffer between agricultural lands and waterbody to filter runoff *(L)*
- Install alternative drinking sources/watering ponds for livestock to access instead of waterbody *(L)*
- Work with Natural Resources Conservation Services (NRCS) to establish nutrient management plan *(L)*

Specific sites to be addressed, and specific practices recommended, are listed in the 2008 Pleasant River Watershed Survey Report. In addition to implementing the practices above, effort will be made by MEDEP to address the Windham School Wastewater Treatment Facility depending on future data readings.

4. Technical and Financial Assistance

Current and potential technical and financial assistance in implementing this plan are to be provided by the organizations listed below. A detailed breakdown of technical assistance provided and funding sources is listed in Appendix B: Table 2-Action Items Timeline, p. 31.

- Casco Bay Estuary Partnership (CBEP)
- Cumberland County Soil and Water Conservation District (CCSWCD)
- Maine Department of Environmental Protection Agency (MEDEP)
- Presumpscot River Watch (PRW)
- Presumpscot River Watershed Coalition (PRWC)
- Town of Windham
- Town of Gray
- US Environmental Protection Agency (USEPA)
- USDA Natural Resources Conservation Service (NRCS)
- Inland Fish and Wildlife (IF&W)

5. Information and Education

Building upon the momentum of the 2008 Pleasant River Watershed Survey, a steering committee will be formed to guide project activities for the Pleasant River Watershed Implementation Project, with Phase I scheduled to begin in the spring of 2011. These steering committee members, along with additional watershed stakeholders, will also oversee the execution of this plan and work together to enhance public understanding of the NPS management measures to be implemented under the guidance of this plan. Steering committee members will include representatives from CCSWCD, MEDEP, PRW, CBEP, the Towns of Gray and Windham, PRWC and watershed residents. Outreach efforts will include the printing and distribution of this plan throughout the local communities of the watershed, discussion of plans, goals, and accomplishments at various individual stakeholder organizational meetings, and publicity of the plan and its implementation goals through various local media outlets (newspapers, public television, stakeholder websites, etc.).

Upon the plans distribution, initial public education and outreach efforts of implementation projects will occur through the outreach component (Task 4) of Phase I of the Pleasant River Watershed Implementation Project. Through this 2-year grant project, implementation efforts will be introduced to the municipal councils of Windham and Gray in the spring of 2011. A tour for town councilors, watershed stakeholders and interested community members will be conducted upon completion of selected BMP sites. A summary of the sites addressed, including before and after photos, will be created at the end of this 2-year project and distributed to the Towns of Windham and Gray, steering committee members, project partners and interested watershed residents. This summary will also be posted on CCSWCD and municipal websites.

Additionally, CCSWCD will continue to provide public outreach to the residents of Windham through the Interlocal Stormwater Working Group to meet each municipality's need for public stormwater education. One of the education programs currently being offered by CCSWCD is YardScaping, a program designed to encourage landowners to reduce their use of pesticides and fertilizer on their lawns. Since turf management was one of the top concerns recorded through the Neighborhood Source Assessment and Hotspot Site Inventory, CCSWCD's YardScaping program will greatly benefit this watershed.

6. Schedule

The timeline for implementing the goals stated in this plan over the next 5-10 years are listed in Appendix B: Table 2-Action Items Timeline, p. 31. This schedule includes periodic check-ins and milestones to achieve to ensure the ultimate goal of this plan is being met.

7. Milestones

In order to measure progress in implementing this plan, it is important to create milestones to determine if action items are being addressed on schedule. Milestones are listed in the project timeline in Appendix B: Table 2-Action Items Timeline, p. 31.

8. *Criteria*

As projects are implemented in the watershed, water quality benchmarks will need to be used to track progress. Over the next 5-10 years, water quality data collected by the PRW will be analyzed by the steering committee and partners of CBEP to determine if E.coli concentrations are decreasing and dissolved oxygen readings are increasing. During this time, IF&W will be periodically surveying the Pleasant River to see if Brook Floater population numbers are increasing. Based on these field assessments, steering committee members and partners of CCSWCD will review the plan to determine if changes are needed in order to accomplish water quality improvement goals enabling Pleasant River and Thayer Brook to attain state water quality standards.

9. *Monitoring*

PRW will continue collecting and analyzing water quality samples in the Pleasant River Watershed for E.coli and low dissolved oxygen on a yearly basis. IF&W will continue to conduct periodic surveys of the Brook Floater population until numbers show signs of significant increases. The MEDEP will also conduct periodic biomonitoring surveys to regulate that the watershed continues to attain state aquatic life standards. A program to conduct additional water quality monitoring through CBEP and the University of Southern Maine will be pursued by the Management Plan's steering committee.

Conclusion

The Pleasant River Watershed is a natural resource to be enjoyed by all. Improving the water quality of the Pleasant River will help to improve ecology of the watershed and the water quality of the Presumpscot River. The improvement efforts listed in this plan will involve the cooperation and assistance of a variety of stakeholders and volunteers. For information on how you can help in this important effort, please contact the Cumberland County Soil & Water Conservation District at 207-892-4700.

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[1] State of Maine. *Maine Revised Statutes: Title 38: Waters and Navigation, Chapter 3: Protection and Improvement of Waters, Subchapter 1: Environmental Protection Board, Article 4-A: Water Classification Program.* Retrieved February 11, 2011, from www.mainelegislature.org/legis/statutes/38/title38sec465.html.

[2] Maine Department of Environmental Protection. *2008 Integrated Water Quality Monitoring and Assessment Report (Maine DEP Document Number: DEPLW0895)*

[3] Maine Department of Environmental Protection. *2010 Integrated Water Quality Monitoring and Assessment Report (Maine DEP Document Number: DEPLW1187)*

[4] U.S. Census Bureau. *U.S. Census of Population and Housing 1990 and 2000: Summary Population and Housing Characteristics: Cumberland County, Maine*. Washington: Government Printing Office, 1991 and 2001.

[5] Varricchione, Jeff, Maine Stream Team Program, Maine Department of Environmental Protection. *Pleasant River and Tributaries Reconnaissance Study: Thayer River and Thayer Brook Stream Corridor Survey and Pleasant River Reconnaissance Survey by Canoe.* December 7, 2009.

[6] United State Environmental Protection Agency. What is Nonpoint Source Pollution? *EPA.* Retrieved February 11, 2011, from http://water.epa.gov/polwaste/nps/whatis.cfm

[7] Presumpscot River Watch. *Pleasant River Watershed Survey Report*. September 2009.

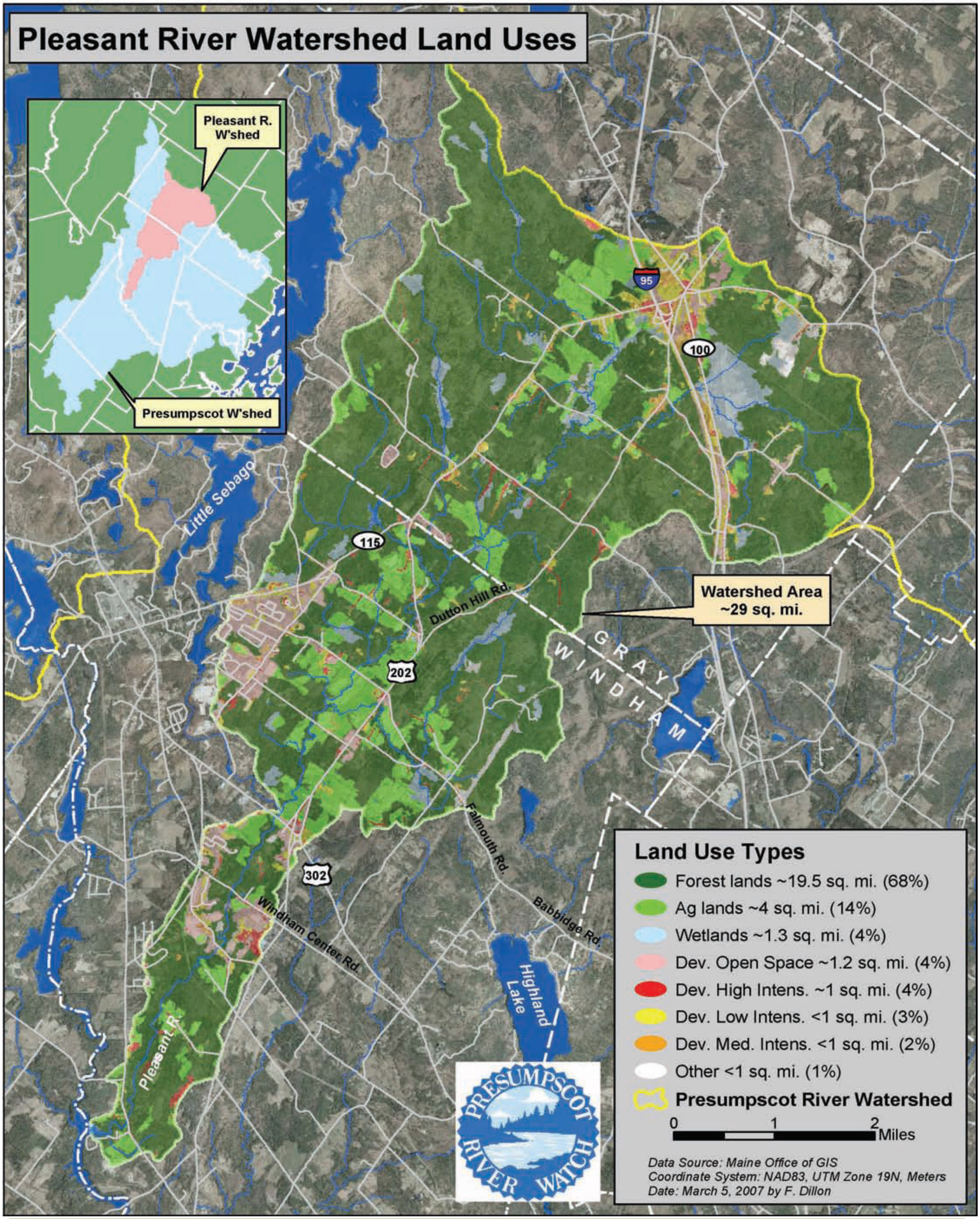
[8] Swartz, Beth, Maine Department of Inland Fisheries and Wildlife. Brook Floater Surveys – Direct correspondence 2010.

[9] Casco Bay Estuary Partnership. Casco Bay Watershed Fish Barrier Data. 2009-2010.

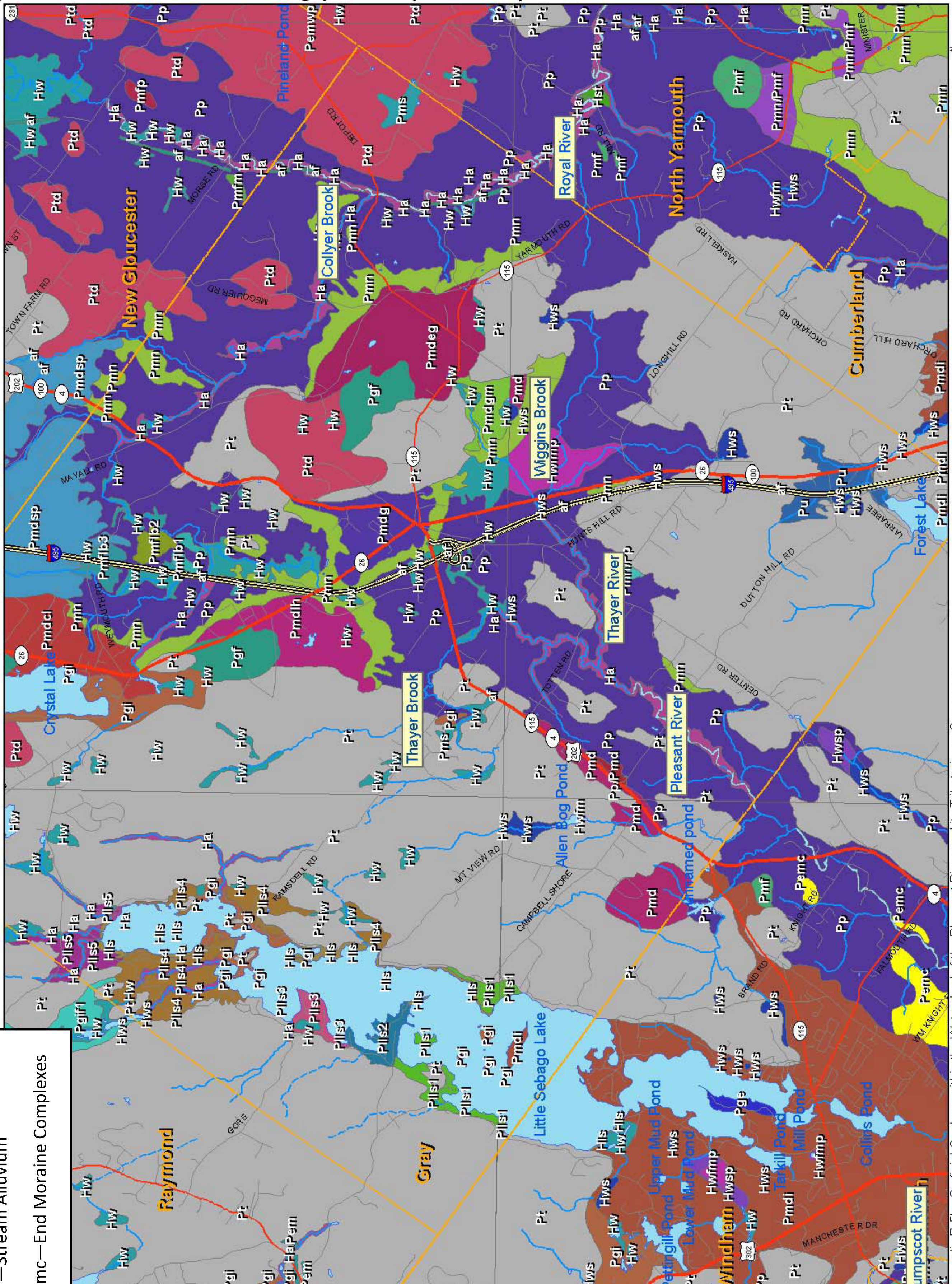
[10] United States Environtmental Protection Agency. Spreadsheet Tool for Estimating Pollutant Load (STEPL). Downloaded November, 10, 2010 from https://wiki.epa.gov/watershed2/index.php/Spreadsheet_Tool_for_Estimating_Pollutant_Load_(STEPL)

[11] ENSR, Maine Department of Environmental Protection. *Maine Statewide Bacterial TMDL (Total Maximum Daily Loads).* August 2009. (Maine DEP Document Number: DEPLW-1002)

Appendix A: Land Use Map



Appendix A: Geology Map-Gray



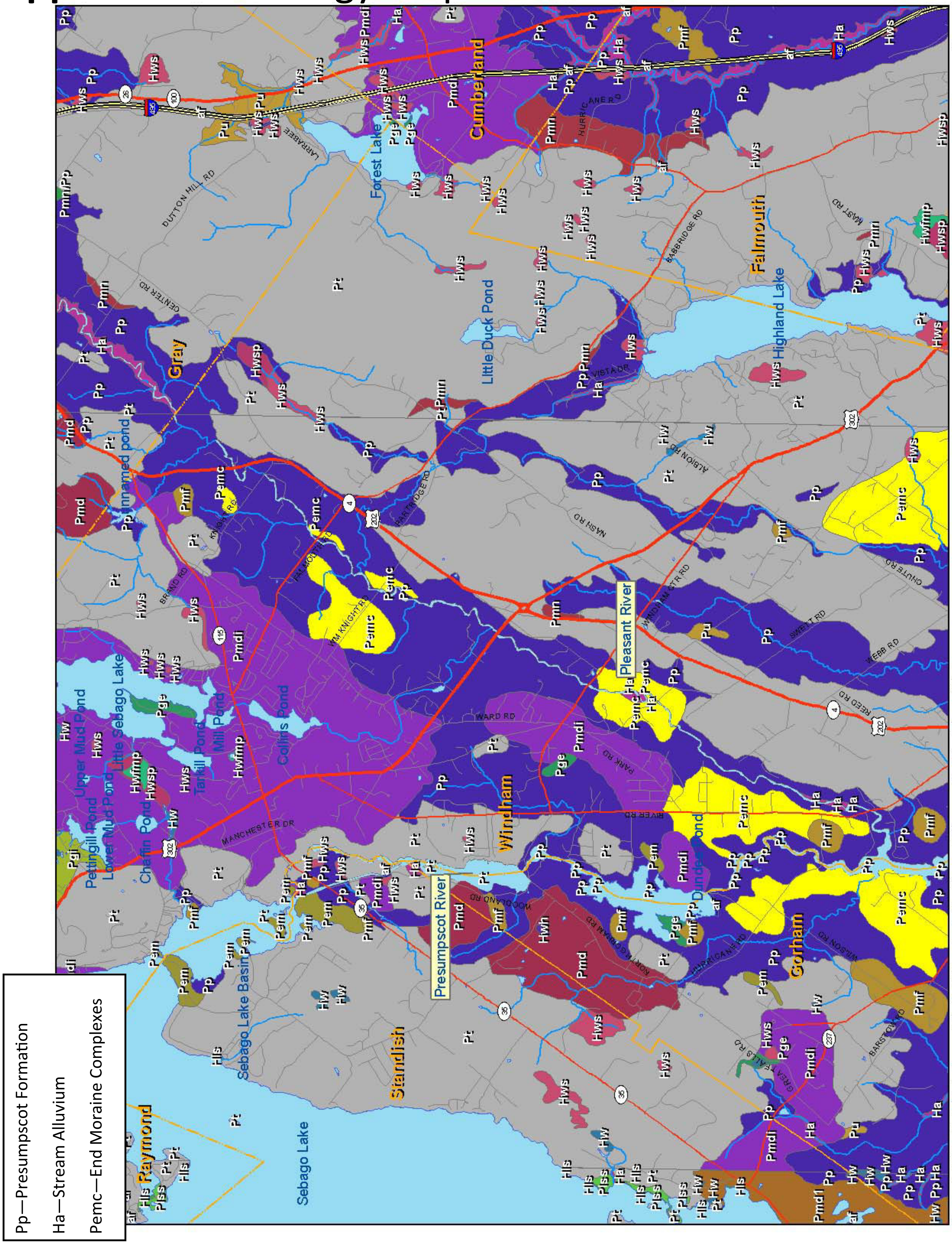
Pp—Presumpscot Formation

Ha—Stream Alluvium

Pemc—End Moraine Complexes

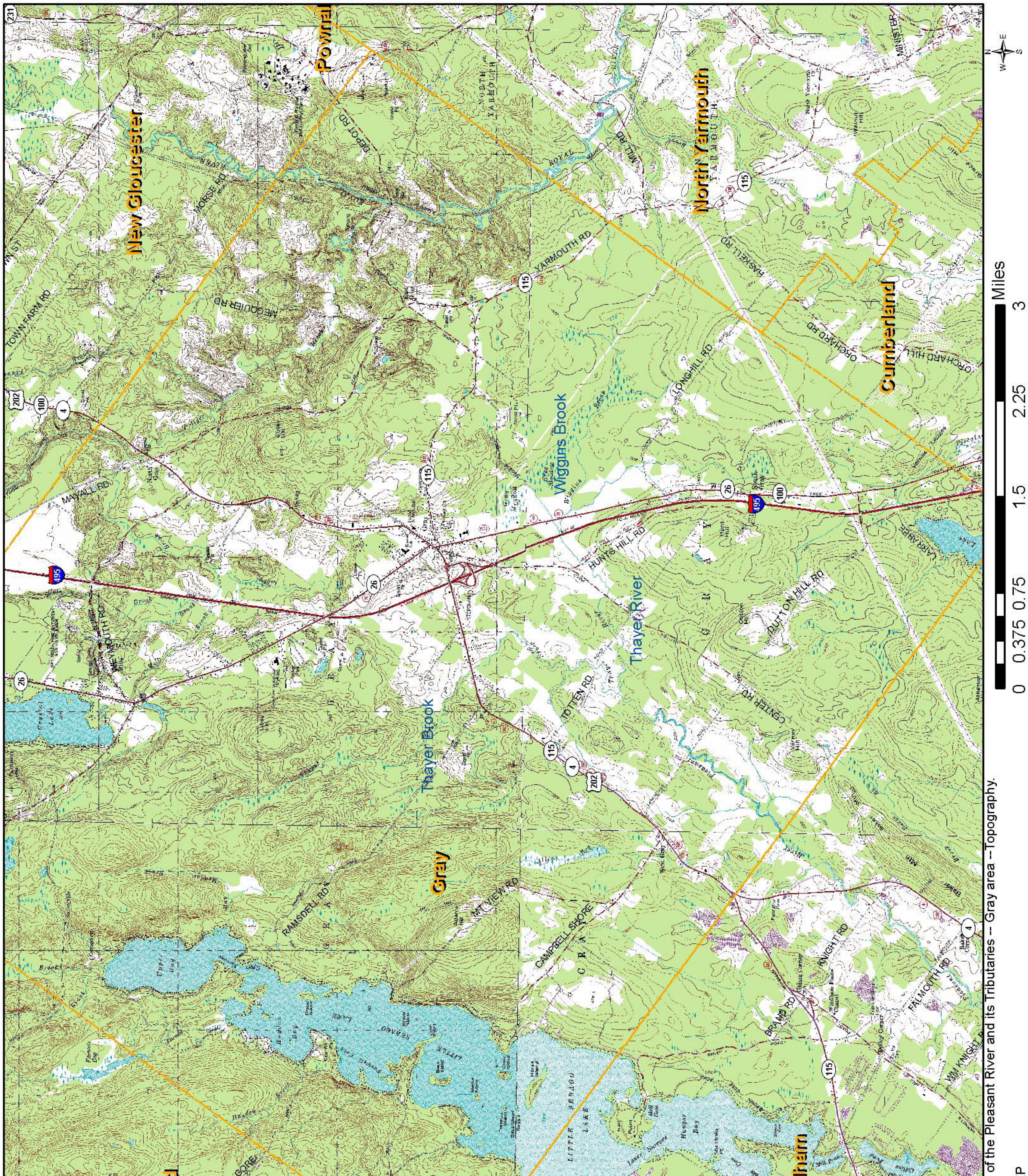
Appendix B-5b. Surficial Geology within the Watershed of the Pleasant River and its Tributaries -- Gray area. November 2009. Note that not all the colors are the same between maps B-5b and B-5c.
Jeff Varricchione, Maine DEP

Appendix A: Geology Map-Windham



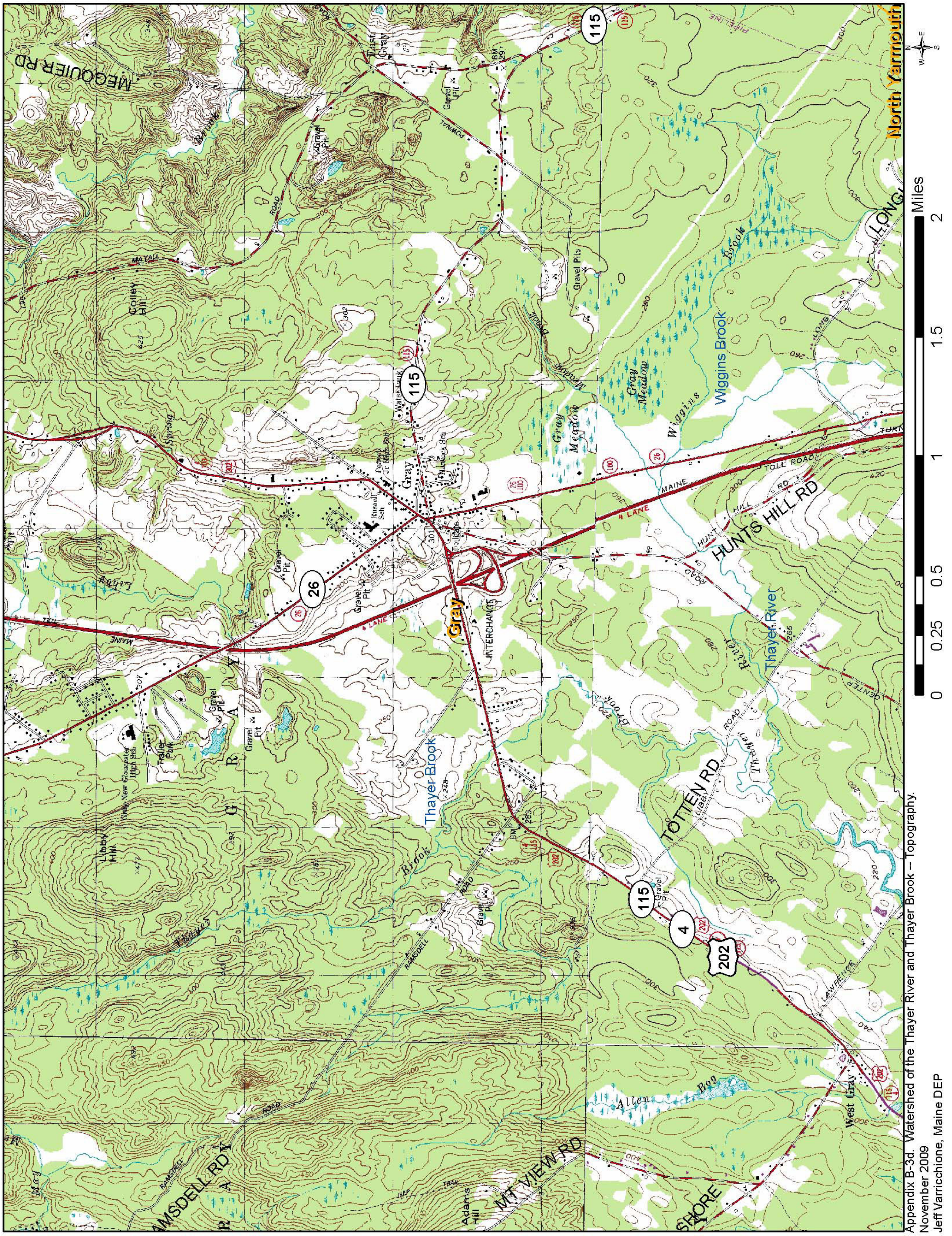
Appendix B-5c. Surficial Geology within the Watershed of the Pleasant River and its Tributaries -- Windham area
November 2009. Note that not all the colors are the same between maps B-5b and B-5c.
Jeff Varricchione, Maine DEP

Appendix A: Topography Map-Pleasant River Watershed

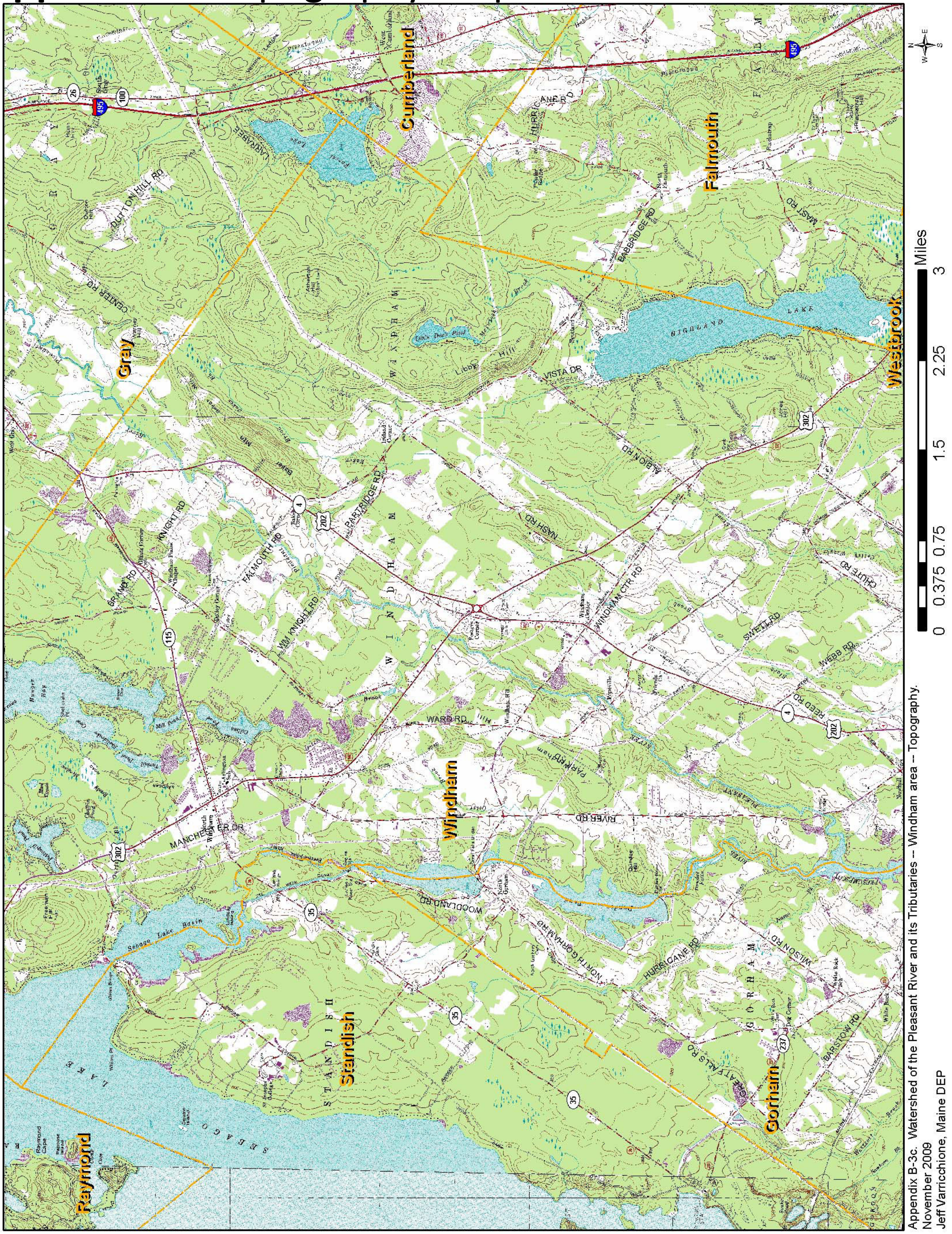


Appendix B-3b. Watershed of the Pleasant River and its Tributaries -- Gray area --Topography.
November 2009
Jeff Varricchione, Maine DEP

Appendix A: Topography Map-Gray

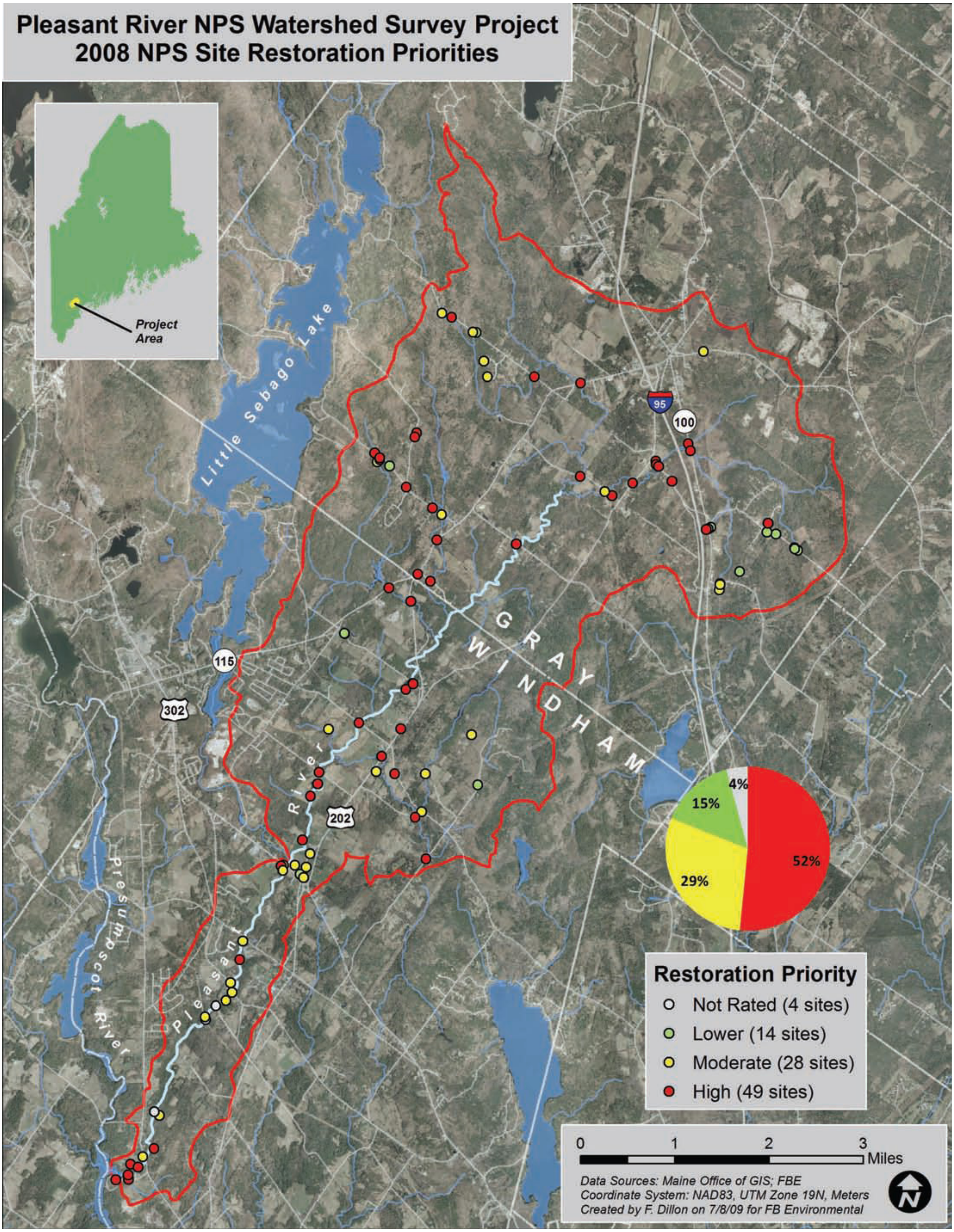


Appendix A: Topography Map-Windham

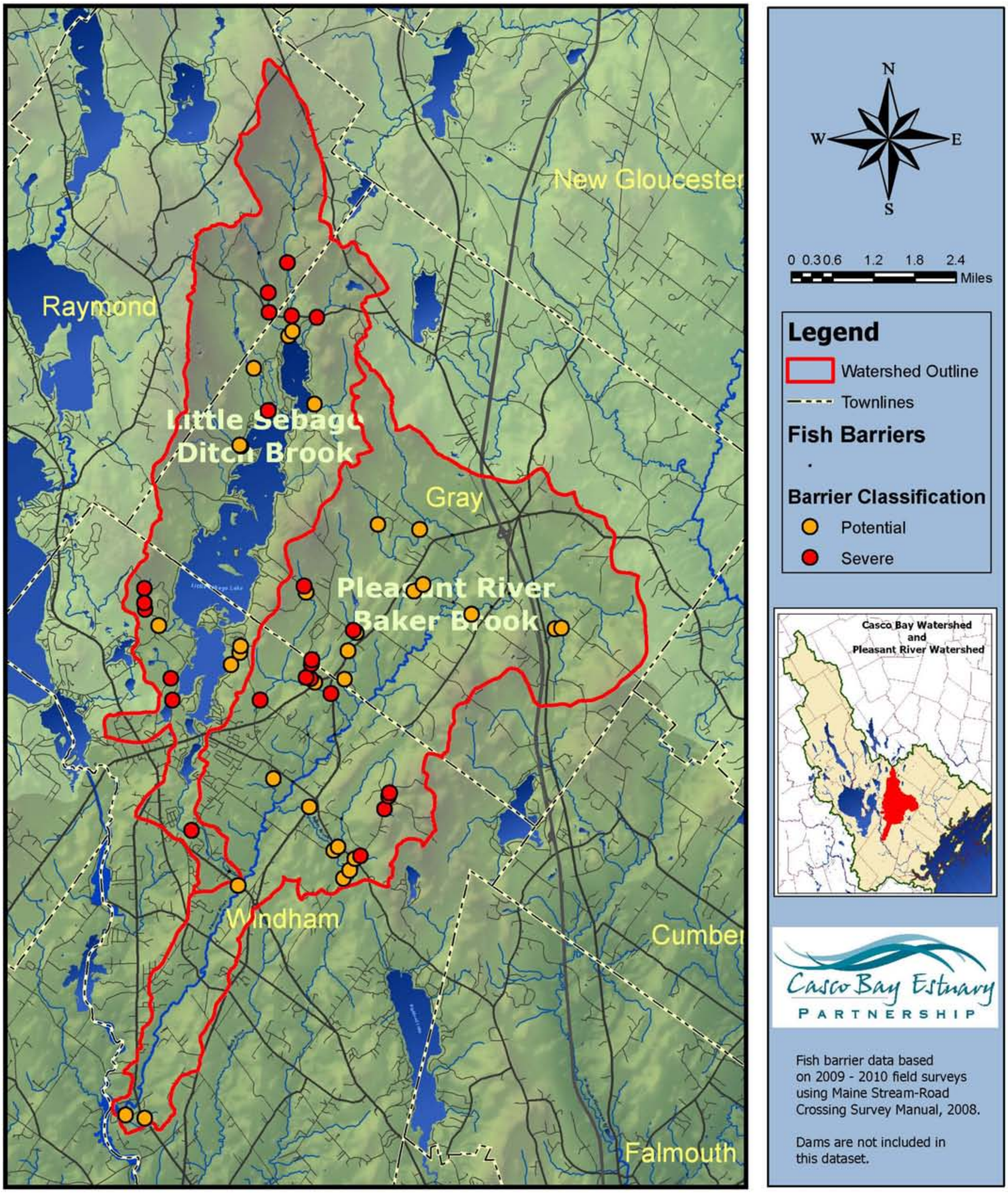


Appendix B-3c. Watershed of the Pleasant River and its Tributaries – Windham area – Topography.
November 2009
Jeff Varrichione, Maine DEP

Appendix A: Pleasant River Watershed Survey Map



Appendix A: Pleasant River Fish Barriers Map



Pleasant River Watershed Fish Barriers
Casco Bay Watershed, Maine

Map produced by Matt Craig
Casco Bay Estuary Partnership
Base map by R. Mosher.
GIS data provided by USFWS, MEGIS.

4 APR 2011

Appendix A: Pleasant River Fish Barriers Data

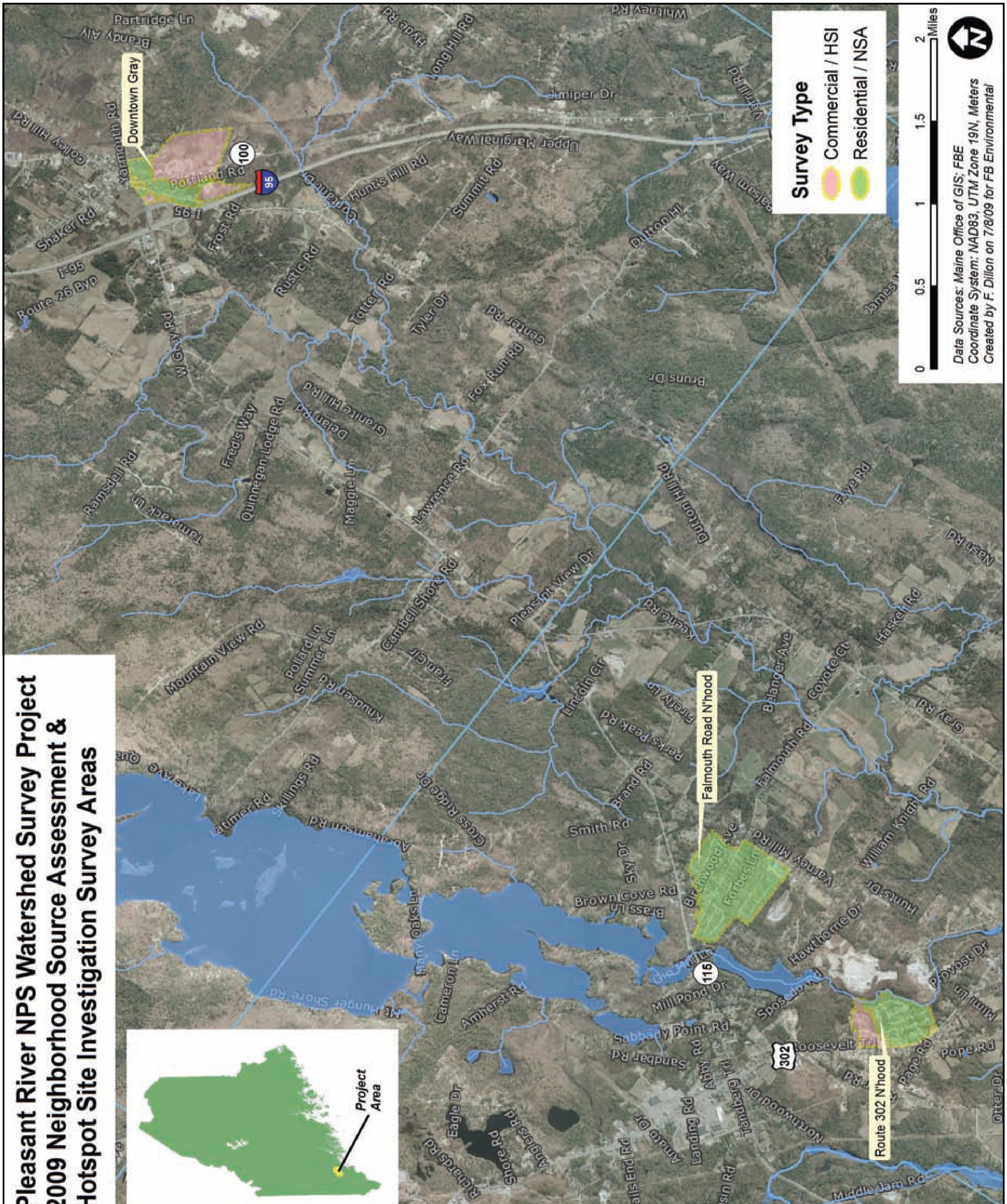
Pleasant River Watershed Fish Barriers at Stream/Road Crossings

Site ID	Stream Name	Tributary To	Town	Road Name	Road Type	UTM East	UTM North	Flow	# Culverts	Specific Structure Type	Inlet Condition	Outlet Condition	Tailwater Scour Pool	Alignment	Barrier Classification
8111	Dutton Hills Brook	Baker Brook	Windham	Nash Rd	Paved	389410	4852010	Low	1	Round Culvert	At Stream Grade	Perched	Small	Skewed	Severe
9084	Ditch Brook	Pleasant River	Windham	Provost Dr	Paved	385446	4852616	Moderate	1	Pipe Arch Culvert	At Stream Grade	Perched	Small	Flow-aligned	Severe
8275	Tarkill Pond	Little Sebago Lake	Windham	Pride Lane	Paved	384999	4855666	Moderate	1	Round Culvert	At Stream Grade	Perched	None	Flow-aligned	Severe
8663	Ollie Brook	Pleasant River	Windham	Brand Rd	Paved	387047	4855666	Low	1	Round Culvert	At Stream Grade	Perched	Large	Flow-aligned	Severe
8665	Glantz Brook	Pleasant River	Windham	Rte. 202	Paved	388708	4855820	Low	1	Box Culvert	At Stream Grade	Perched	Large	Flow-aligned	Severe
8655	Unknown Stream	Little Sebago Lake	Windham	Sand Bar Rd	Paved	384954	4856173	Low	1	Round Culvert	At Stream Grade	Perched	Small	Skewed	Severe
8651	Unknown Stream	Pleasant River	Gray	Cambell Shore Rd	Paved	389239	4857304	Moderate	3	Round Culvert	At Stream Grade	Perched	Small	Flow-aligned	Severe
8640	Glantz Brook	Ollie Brook	Gray	Cambell Shore Rd	Paved	388078	4858345	Moderate	3	Round Culvert	At Stream Grade	Cascade	None	Flow-aligned	Severe
8065	Unknown Stream	Little Sebago Lake	Gray	Aquilla Ln	Paved	386599	4861627	Low	1	Round Culvert	Inlet Drop	Perched	Large	Flow-aligned	Severe
8614	Unknown Stream	Little Sebago Lake	Gray	Egypt Rd	Paved	388389	4864648	Low	1	Pipe Arch Culvert	At Stream Grade	Perched Above Cascade	Small	Flow-aligned	Severe
8397	Sucker Brook	Little Sebago Lake	Gray	Egypt Rd	Paved	387795	4864682	Low	1	Pipe Arch Culvert	At Stream Grade	Perched Above Cascade	Small	Flow-aligned	Severe
8613	Sand Brook	Little Sebago Lake	Raymond	Egypt Rd	Paved	387261	4864763	Low	1	Round Culvert	At Stream Grade	Perched	Large	Flow-aligned	Severe
9039	Sand Brook	Little Sebago Lake	Raymond	Unnamed	Unpaved	387236	4865224	Low	1	Round Culvert	At Stream Grade	Perched	None	Flow-aligned	Severe
8710	Unknown Stream	Presumpscot River	Windham	River Rd	Paved	384348	4845861	Low	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8794	Inkhorn Brook	Presumpscot River	Windham	Laskey Rd	Paved	383898	4845941	Moderate	1	Pipe Arch Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8797	Pleasant River	Presumpscot River	Windham	Rte. 302	Paved	386534	4851315	Low	2	Pipe Arch Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8863	Dutton Hills Brook	Baker Brook	Windham	Nash Rd	Paved	389004	4851482	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8862	Dutton Hills Brook	Pleasant River	Windham	Nash Rd	Paved	389153	4851678	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8112	Dutton Hills Brook	Baker Brook	Windham	Falmouth Rd	Paved	389270	4851939	Low	2	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8686	Barker Brook	Pleasant River	Windham	Partridge Rd	Paved	388778	4852139	Low	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8680	Baker Brook	Dutton Hills Brook	Windham	Falmouth Rd	Paved	388877	4852220	Moderate	2	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8106	Pleasant River	Presumpscot River	Windham	Gray Rd	Paved	388202	4853153	Low	1	Pipe Arch Culvert	At Stream Grade	At Stream Grade	Large	Flow-aligned	Potential
9076	Stanley Hall Brook	Pleasant River	Windham	Unnamed	Unpaved	387359	4853828	None	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8473	Glantz Brook	Pleasant Brook	Windham	Rte. 114	Paved	388340	4856078	Low	1	Box Culvert	At Stream Grade	At Stream Grade	Large	Flow-aligned	Potential
8246	Allen Bog	Pleasant River	Gray	Pleasant River Rd	Paved	389031	4856155	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8657	Unknown Stream	Little Sebago Lake	Windham	Brown Cove Rd	Paved	386372	4856501	Low	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8260	Unknown Stream	Little Sebago Lake	Windham	Sebago Woods Tr	Paved	386575	4856782	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8086	Unnamed	Pleasant River	Gray	Route 202	Paved	389108	4856819	Low	1	Round Culvert	At Stream Grade	no data	no data	Flow-aligned	Potential
8861	Unknown Stream	Little Sebago Lake	Windham	Ridge Dr.	Paved	386589	4856927	Low	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8650	Unknown Stream	Pleasant River	Gray	Cambell Shore Rd	Paved	389314	4857240	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8783	Unknown Stream	Wiggins Brook	Gray	Longhill Rd	Paved	393967	4857343	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8784	Unknown Stream	Wiggins Brook	Gray	Longhill Rd	Paved	394121	4857361	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow aligned	Potential
8646	Unknown Stream	Little Sebago Lake	Windham	Mt Hunger Shore Rd	Unpaved	384668	4857411	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8398	Pleasant River	Presumpscot River	Gray	Totten Rd	Paved	392015	4857680	Moderate	2	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
9060	Glantz Brook	Ollie Brook	Gray	Knodsen	Unpaved	388131	4858190	Moderate	2	Round Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
9158	Unknown Stream	Thayer Brook	Gray	Delan Rd.	Unpaved	390653	4858218	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8399	Unknown Stream	Thayer Brook	Gray	Totten Rd	Paved	390880	4858382	Moderate	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Skewed	Potential
8787	Unknown Stream	Thayer Brook	Gray	Ramsdell Rd	Paved	390789	4859669	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Large	Flow-aligned	Potential
8089	Unknown Stream	Thayer Brook	Gray	Tamarack Ln	Unpaved	389819	4859787	Low	2	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
9433	Unknown Stream	Little Sebago Lake	Gray	Gore Rd	Paved	386568	4861645	Low	1	Round Culvert	Inlet Drop	At Stream Grade	Large	Skewed	Potential
8351	May Meadow Brook	Little Sebago Lake	Gray	Birchwood Ave	Unpaved	388329	4862608	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential
8625	Farewell Bog	Farewell Brook	Gray	Johnson	Unpaved	386903	4863446	Low	1	Box Culvert	At Stream Grade	At Stream Grade	Large	Flow-aligned	Potential
8620	Sand Brook	Little Sebago Lake	Gray	Westwood Rd	Paved	387717	4864205	Low	1	Pipe Arch Culvert	At Stream Grade	At Stream Grade	None	Flow-aligned	Potential
8621	Sucker Brook	Little Sebago Lake	Gray	Westwood Ave	Paved	387816	4864321	Low	1	Round Culvert	At Stream Grade	At Stream Grade	Small	Flow-aligned	Potential

Fish barrier data based on 2009 - 2010 field surveys using *Maine Road-Stream Crossing Manual* (2008). http://www.gulfofmaine.org/kb/files/8989/MaineRoad-StreamCrossingSurveyManual2008.pdf

The table above is a partial data set. The full data set is available from the Casco Bay Estuary Partnership

Appendix A: Pleasant River NSA and HSI Survey Areas



Appendix B: Table2-Action Items Timeline

Actions	Lead Organization	Partners	Funding	Timeframe	Goals/Mgmt Plan Milestones
Pleasant River Watershed Implementation Plan, Phase I	CCSWCD	Maine DEP, EPA, PRW*, CBEP*, Town of Gray, Town of Windham	EPA and Maine DEP - Section 319 Watershed Grant	January 2011 – December 2012	Improvement of at least 14 priority impact sites as guided from the Pleasant River Watershed Survey.
Brook Floater Survey	Maine IF&W	CBEP	State Wildlife Grant	Summer 2011	Quantitative count of individuals along stretch of the main stem of the Pleasant River between Falmouth Road and Brand Road.
Water Quality Monitoring	PRW		PRW	Summer 2011 and 2012	Dissolved oxygen, bacteria, and temperature readings for four sites within the Pleasant River between the months of May and September.
Review Windham School Wastewater Treatment Facility discharge data (2000-2010) to determine if TSS and BOD violations can be prevented	Maine DEP	Town of Windham, PRW		Fall 2011/ongoing	Review of data, plan of action based on data results and timeline for action steps to occur
Review watershed need, logistics and costs for conducting a geomorphological study	CBEP	CCSWCD, Maine DEP	CBEP	November/ December 2011	Review of data, proposal draft listing cost and watershed benefit
Pursue funding opportunities available through Natural Resources Conservation Services (NRCS) - for example, NRCS's Emergency Watershed Protection Program funds for extremely eroded portions of the river's stream bank	Pleasant River Mgmt Plan Steering Committee	NRCS, CCSWCD, CBEP, PRW	NRCS	November/ December 2011	List of potential funding opportunities and sites that may apply for that assistance. Timeline for pursuing potential funds identified.
Review ordinances, look into increasing buffer to 75ft and exploring methods that Code Enforcement Officers can use to pursued landowners to help protect the River's water quality	Town of Windham and Town of Gray	CCSWCD, PRW, PRWC, CBEP	Town of Windham and Town of Gray	November/ December 2011	Meeting held to discuss logistics of proposed action, list of next steps generated

* Will also provide technical assistance

**Timeframe depends on funding being awarded

Appendix B: Table2-Action Items Timeline

Actions	Lead Organization	Partners	Funding	Timeframe	Goals/Mgmt Plan Milestones
Evaluate and address road maintenance needs	Town of Windham, Town of Gray, Private Road Associations, Maine Department of Transportation (Maine DOT)	CCSWCD*, CBEP*	Town of Windham, Town of Gray, Private Road Associations, Maine DOT	April / May 2012	List of maintence needs compiled, available funding used to address priority sites, cost estimates determined to address any remaining sites
Check-in on Mgmt Plan Progress	Pleasant River Mgmt Plan Steering Committee	CCSWCD, Maine DEP, PRW, CBEP, PRWC, Town of Gray, Town of Windham		March 2012	Meeting held to discuss progress of achieving action items listed in Management Plan; Timeline of future action items adjusted to reflect current need
Evaluate and address road maintenance needs	Town of Windham, Town of Gray, Private Road Associations, Maine DOT	CCSWCD*, CBEP*	Town of Windham, Town of Gray, Private Road Associations, Maine DOT	April / May 2013	List of maintence needs compiled, available funding used to address priority sites, cost estimates determined to address any remaining sites
Proposal written and submitted for Phase II Implementation Funds	CCSWCD	CBEP, PRW	CCSWCD Project Development funds, CBEP	May 2013	Phase II proposal written and submitted to Maine DEP
Water Quality Monitoring	PRW		PRW	Summer 2013	Dissolved oxygen, bacteria, and temperature readings for four sites within the Pleasant River between the months of May and September.
Pleasant River Watershed Geomorphology Study	CBEP	CCSWCD*, Maine DEP*	CBEP	Summer-Fall 2013**	Geomorphological data collected for entire watershed
Pleasant River Watershed Geomorphology Study	CBEP	CCSWCD, Maine DEP	CBEP	Winter 2013	Report compiled based on Geomorphology Study
Pleasant River Watershed Implementation Plan, Phase II	CCSWCD	Maine DEP, EPA, PRW*, CBEP*, Town of Gray, Town of Windham	EPA and Maine DEP - Section 319 Watershed Implementation Grant	January 2014 - December 2015**	Improvement of at least 15 priority impact sites as guided from the Pleasant River Watershed Survey.

* Will also provide technical assistance

**Timeframe depends on funding being awarded

Appendix B: Table2-Action Items Timeline

Actions	Lead Organization	Partners	Funding	Timeframe	Goals/Mgmt Plan Milestones
Water Quality Monitoring	PRW		PRW	Summer 2014 and 2015	Dissolved oxygen, bacteria, and temperature readings for four sites within the Pleasant River between the months of May and
Check-in on Mgmt Plan Progress	Pleasant River Mgmt Plan Steering Committee	CCSWCD, Maine DEP, PRW, CBEP, PRWC, Town of Gray, Town of Windham		Winter 2015	Meeting held to discuss progress of achieving action items listed in Management Plan; Timeline of future action items adjusted to reflect current need
Proposal written and submitted for Phase III Implementation Funds	CCSWCD	CBEP, PRW	CCSWCD Project Development funds, CBEP	May 2016	Phase III proposal written and submitted to Maine DEP
Water Quality Monitoring	PRW		PRW	Summer 2016	Dissolved oxygen, bacteria, and temperature readings for four sites within the Pleasant River between the months of May and September.
Pleasant River Watershed Implementation Plan, Phase III	CCSWCD	Maine DEP, EPA, PRW*, CBEP*, Town of Gray, Town of Windham	EPA and Maine DEP - Section 319 Watershed Implementation Grant	January 2017- December 2018**	Improvement of at least 10 remaining priority impact sites as guided from the Pleasant River Watershed Survey and previous implementation grant work.
Water Quality Monitoring	PRW		PRW	Summer 2017 and 2018	Dissolved oxygen, bacteria, and temperature readings for four sites within the Pleasant River between the months of May and September.
Check-in on Mgmt Plan Progress	Pleasant River Mgmt Plan Steering Committee	CCSWCD, Maine DEP, PRW, CBEP, PRWC, Town of Gray, Town of Windham		Winter 2018	Meeting held to discuss progress of achieving action items listed in Management Plan; Timeline of future action items adjusted to reflect current need
Brook Floater Survey	Maine IF&W	CBEP	State Wildlife Grant	Summer 2019	Quantitative count of individuals along stretch of the main stem of the Pleasant River between Falmouth Road and Brand Road.

* Will also provide technical assistance
**Timeframe depends on funding being awarded

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