TMDL SUMMARY   APPENDIX B-3

Colley Wright Brook

WATERSHED DESCRIPTION

This **TMDL** applies to an 8.2 mile section of Colley Wright Brook, located in the Town of Windham, Maine. The impaired segment of Colley Wright Brook begins in the northern portion of the watershed, flows south through forest until crossing Route 302, then passes through agriculture. The stream continues through woods bordered by residential development, crossing Brick Hill Road, Pope Road, and Chute Road. The stream then enters into more dense agriculture, crossing Montgomery Road and River Road before meeting the Presumpscot River. The Colley Wright Brook watershed covers an area of 7.65 square miles.

- Colley Wright Brook is on Maine's 303(d) list of Impaired Streams as referenced in the 2016 Integrated Report (Maine DEP, 2018).
- The Colley Wright Brook watershed is predominately non-developed (69%). Of the non-developed area, wooded areas (60.4%) within the watershed absorb and filter pollutants helping protect both water quality in the stream and stream channel stability. Wetlands (7.8%) may also help filter nutrients.
- Non-forested areas within the watershed are predominantly agricultural (18%) and are located in the southern portion of the watershed.
- Developed areas containing impervious surfaces (13%) in close proximity to the stream may impact water quality.
- Runoff from hay/pasture is modeled as the largest source of nonpoint source (NPS) pollution to Colley Wright Brook. Runoff from cultivated lands, active hay lands, and pasture can transport sediment, nitrogen and phosphorus to the stream.

Definitions

- ***Total Maximum Daily Load (TMDL)*** *represents the total amount of pollutants that a waterbody can receive and still meet water quality standards.*
- **Nonpoint Source Pollution** *refers to pollution that comes from many diffuse sources across the landscape, and are typically transported by rain or snowmelt runoff.*

Waterbody Facts

Segment ID: ME0106000103_607R03

Town: Windham, ME

County: Cumberland

Impaired Segment Length: 8.2 miles

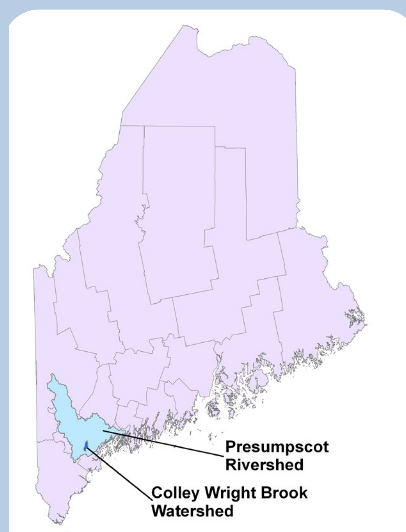
Classification: Class B

Direct Watershed: 7.65 mi^2 (4,896 acres)

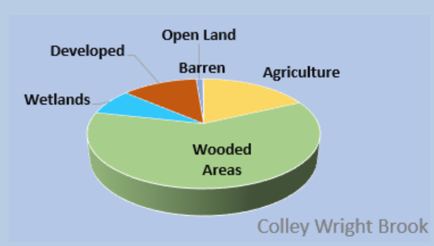
Impairment Listing Cause: Dissolved Oxygen

Watershed Agricultural Land Use: 18%

Major Drainage Basin: Presumpscot River



Watershed Land Uses



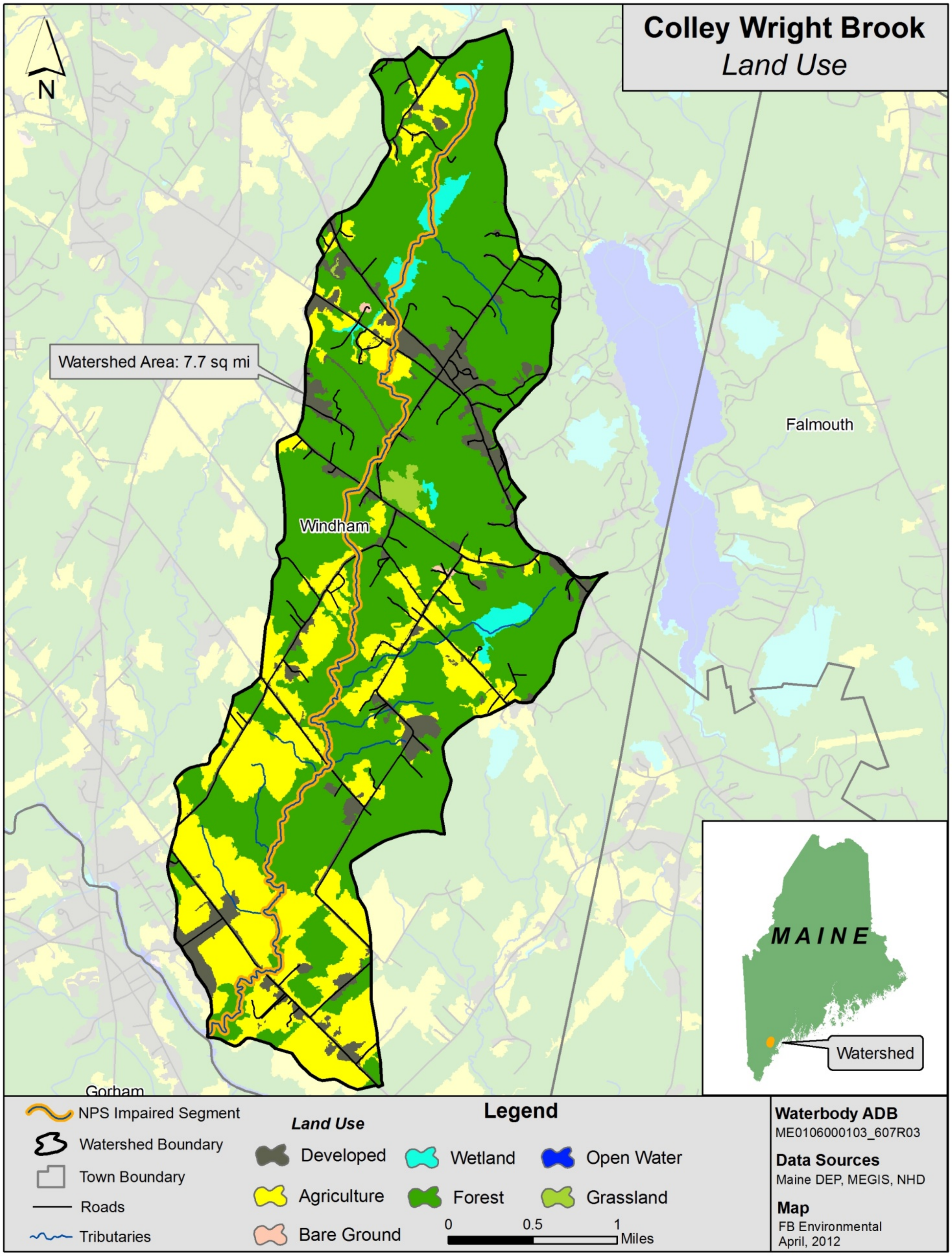


Figure 1: Land Use and Land Cover (from 2011) in the Colley Wright Brook Watershed

WHY IS A TMDL ASSESSMENT NEEDED?

Colley Wright Brook, a Class B freshwater stream, has been assessed by Maine DEP as not meeting water quality standards for the designated use of aquatic life, and placed on the 303(d) list of impaired waters under the Clean Water Act. The Clean Water Act requires that all 303(d)-listed waters undergo a TMDL assessment that describes the impairments and establishes a target to guide the measures needed to restore water quality. The goal is for all waterbodies to comply with state water quality standards.

***Colley Wright Brook** near Station RCW10 – River Road crossing. Photo: FB Environmental*

Agriculture in the Colley Wright Brook watershed makes up 18% of the total land area. This is more than the area of developed land which makes up only 13% of the watershed. Twenty-four percent of the impaired segment length passes through agricultural areas (Figure 1) making agriculture the likely largest contributor of sediment and nutrient enrichment to the stream. The close proximity of many agricultural lands, including a horse farm on River Road, to the stream further increases the likelihood that nutrients from disturbed soils, manure, and fertilizers will reach the stream.

WATER QUALITY DATA ANALYSIS

Maine DEP uses a variety of data types to measure the ability of a stream to adequately support aquatic life, including; dissolved oxygen, benthic macroinvertebrates, and periphyton (algae). For benthic macroinvertebrates, DEP makes aquatic life use determinations using a statistical model that incorporates 30 variables of data collected from rivers and streams, including the richness and abundance of streambed organisms, to determine the probability of a sample meeting Class A, B, or C conditions. Biologists use the model results and supporting information to determine if samples comply with the numeric aquatic life criteria of the class assigned to the stream or river (Davies and Tsomides, 2002). Maine DEP uses an analogous model to aid in the assessment of algal communities but makes aquatic life use determinations based on narrative standards.

The aquatic life impairment in Colley Wright Brook is based on historic dissolved oxygen data, which includes data collected at stations RCW10 and RCW11 in 2011, and station RCW24 in 2007.

TMDL ASSESSMENT APPROACH: NUTRIENT AND SEDIMENT MODELING OF IMPAIRED AND ATTAINMENT STREAMS

NPS pollution is difficult to measure directly because it comes from many diffuse sources spread across the landscape. For this reason, an online nutrient loading model, *Model My Watershed* (v. 1.32.0), was used to estimate the sources of pollution based on well-established hydrological equations (Stroud Water Research Center 2017). *Model My Watershed* makes use of the GWLF-enhanced model engine. The model incorporates detailed maps of soil, land use, and slope, daily weather and localized weather data (from the period 2009-2020), and direct observations of agriculture and other land uses within the watershed. *Model My Watershed* is derived from its parent MapShed developed by Evans and Corradini (2012). *Model My Watershed* replaced MapShed in 2017-2018.

The nutrient loading estimates for the impaired stream were compared to similar estimates for non-impaired (attainment) streams of similar watershed land uses across the state. The TMDL target for the impaired stream was set as the mean nutrient loading estimate of these attainment stream watersheds, and units of mass per unit watershed area per year (kg/ha/year) were used. The difference in loading estimates between the impaired and attainment watersheds represents the percent reduction in nutrient loading required under this TMDL. The attainment streams and their nutrient and sediment loading estimates and TMDL are presented below in Table 1.

Table 1: Numeric Targets for Pollutant Loading Based on Model My Watershed Outputs (2021) for Attainment Streams

Attainment Streams	Town	Total P Load (kg/ha/yr)	Total N Load (kg/ha/yr)	Sediment Load (kg/ha/yr)
Footman Brook	Exeter	0.17	1.73	35.2
Martin Stream	Fairfield	0.13	2.98	57.9
Moose Brook	Houlton	0.18	1.59	48.5
Upper Kenduskeag Stream	Corinth	0.16	1.72	100.5
Upper Pleasant River	Gray	0.16	4.26	86.5
Total Maximum Daily Load		**0.16**	**2.46**	**65.7**

Rapid Watershed Assessment

Habitat Assessment

A habitat assessment survey was conducted on both the impaired and attainment stream. The assessment approach is based on the *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al., 1999), which integrates various parameters relating to the structure of physical habitat. The habitat assessments include a general description of the site and physical characterization and visual assessment of in-stream and riparian habitat quality.

Based on rapid bioassessment protocols for low gradient streams, Colley Wright Brook received a score of 152 out of a total 200 for quality of habitat. Higher scores indicate better habitat. The range of habitat assessment scores for attainment streams was 155 to 179.

Habitat assessments were conducted in 2012 on a relatively short sample reach (about 100-200 meters for a typical small stream) near the most downstream Maine DEP sample station in the watershed. For both impaired and attainment streams, the assessment location was usually near a road crossing for ease of access. In the Colley Wright Brook watershed, the downstream sample station was located at the River Road stream crossing and DEP sample station RCW10. Water was documented as turbid and many sand and fine sediment deposits were observed throughout the reach. An agricultural field was located near the stream reach with a minimal buffer to the east. Trees dominated the surrounding riparian zone of Willow, Alder, Maple and Ash.

Figure 2 (right) shows the range of habitat assessment scores for all attainment and impaired streams, as well as for Colley Wright Brook. Though these scores show that habitat is clearly an issue in the impairment of Colley Wright Brook, it is important to look for other potential sources within the watershed lending to impairment. Consideration should be given to major "hot spots" in the Colley Wright Brook watershed as potential sources of NPS pollution contributing to the water quality impairment.

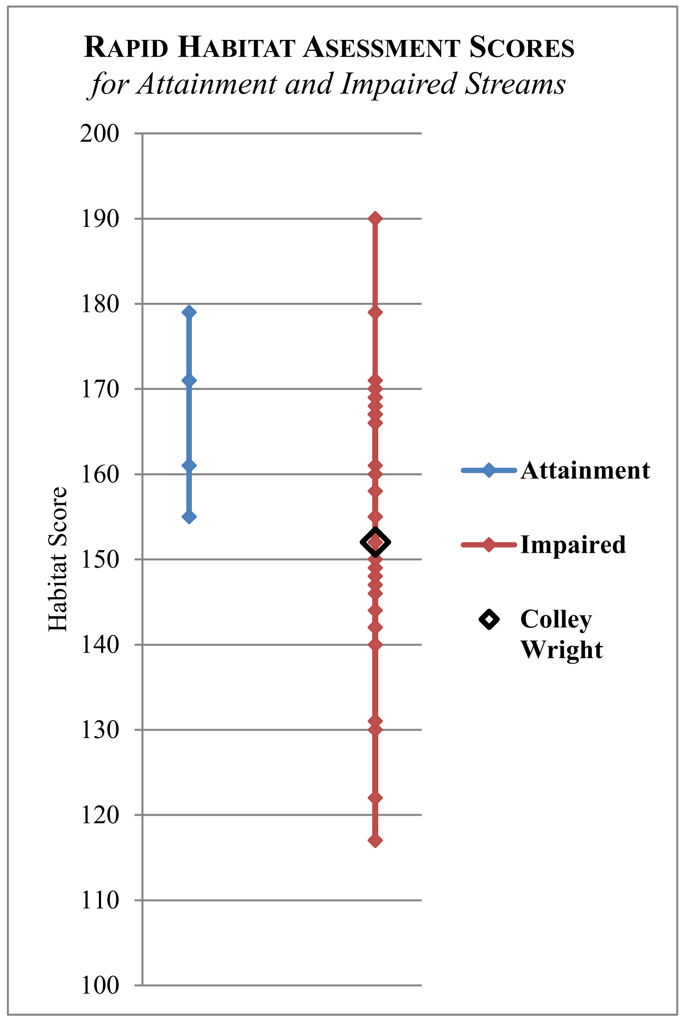


Figure 2: Habitat Assessment Scores for Colley Wright Brook (2012) Compared to Region

Pollution Source Identification

Pollution source identification assessments were conducted for both Colley Wright Brook (impaired) and the attainment streams. The source identification work is based on an abbreviated version of the Center for Watershed Protection's Unified Subwatershed and Site Reconnaissance method (Wright, et al., 2005). The abbreviated method includes both a desktop and field component. The desktop assessment consists of generating and reviewing maps of the watershed boundary, roads, land use and satellite imagery, and then identifying potential NPS pollution locations, such as road crossings, agricultural fields, and large areas of bare soil. When available, multiple sources of satellite imagery were reviewed. Occasionally, the high resolution of the imagery allowed for observations of livestock, row crops, eroding stream banks, sediment laden water, junkyards, and other potential NPS concerns that could affect stream quality. As many potential pollution sources as possible were visited, assessed and documented in the field. Field visits were limited to NPS sites that were visible from roads or a short walk from a roadway. Neighborhoods were assessed for NPS pollution at the whole neighborhood level including streets and storm drains (where applicable). The assessment does not include a scoring component, but does include a detailed summary of findings and a map indicating documented NPS sites throughout the watershed.

The watershed source assessment for Colley Wright Brook was completed in July 2012. In-field observations of erosion, lack of vegetated stream buffer, extensive impervious surfaces, high-density neighborhoods and agricultural activities were documented throughout the watershed (Table 2, Figure 3).

Table 2: Potential Pollution Source ID Assessment (2012) for the Colley Wright Brook Watershed

Potential Source			Notes
ID#	**Location**	**Type**	
3	River Road/Chute Road	Agriculture	• Large active hay field.
3b	River Road	Agriculture	• Active hay field.
3c	River Road	Agriculture	• Horse stables; estimated 20 horses observed. • Active hay fields surrounding.
3d	River Road	Agriculture	• Large hay field. • Adjacent to stream with limited buffer.
4	Highland Cliff Road	Agriculture	• Active hay fields.
4b	Highland Cliff Road	Agriculture	• Large active hay field adjacent to stream with small wooded buffer.
6	Montgomery Road/Chute Road	Agriculture	• Miniature horse breeder with about 24 horses. • Hay fields and pastures. • Greenhouses and Maple house.
6b	Montgomery Road/Chute Road	Agriculture	• Property on Montgomery Road raises Charolais cattle. • About 3 cows estimated.
7	Chute Road	Agriculture	• Hay fields
10	Highland Cliff Road/Land of Nod Road	Forestry	• Active cutting
16	Windham Center Road	Road Crossings/ Agriculture	• Multiple road crossings on major roads. • No erosion issues observed. • Active hay land in immediate surrounding area.
18	Nash Road	Agriculture	• Sand pit
21	River Road	Agriculture	• Cattle, sheep, pigs, chickens, crops, hay. • None observed, information acquired from farm website.

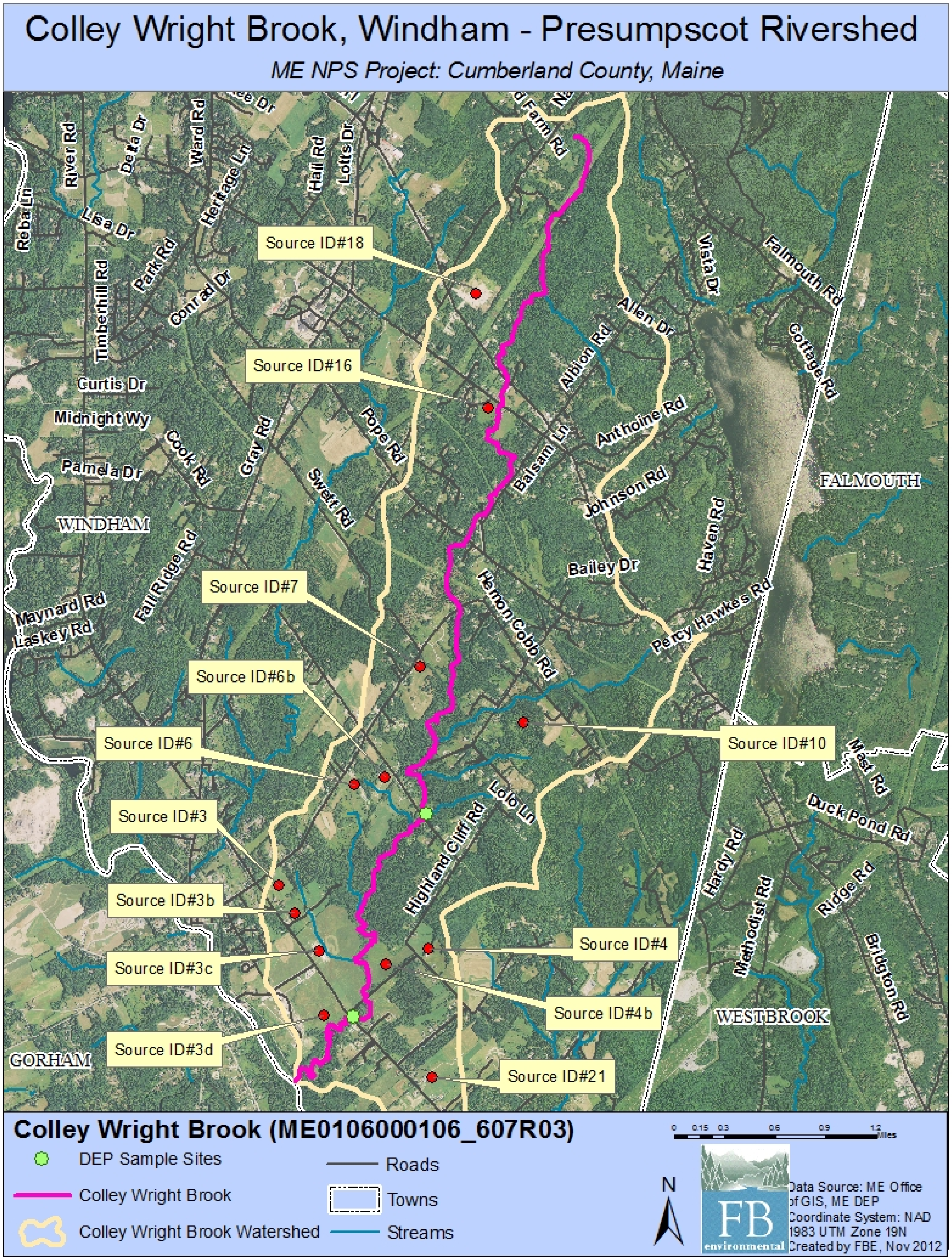


Figure 3: Aerial Photo of Potential Source ID Locations (identified in 2012) in the Colley Wright Brook Watershed

NUTRIENT AND SEDIMENT LOADING – *MODEL MY WATERSHED* ANALYSIS

The *Model My Watershed* model was used to estimate stream loading of total phosphorus, total nitrogen, and sediment in Colley Wright Brook watershed. The model estimated nutrient loads over a 12-year period (2009-2020), which was determined by local (Portland Jetport USW00014764) weather data inserted into *Model My Watershed*. This extended period captures a recent but wide range of hydrologic conditions to account for variations in nutrient and sediment loading over time. Loads for the attainment watersheds (five total; Table 1) were computed using the same model with the same recent inputs (i.e., regional weather, 2016 land use and land cover, 2016 wetland extent, and BMPs similar to the impaired watersheds).

Many quality assured and regionally calibrated input parameters are provided with *Model My Watershed*. However, several updates to some of the default parameters were made in this TMDL effort, and namely more recent land use/cover using **MRLC-NLCD 2016** [1], more recent and local weather (precipitation and temperature) data (as described above), and more regional estimates of Best Management Practices (BMPs; see ensuing discussion). Because land use/cover is more recent, the estimated filtration fraction of wetland and open water and the amount of stream buffer in agricultural land should be more accurate. It is also worth noting that improved classification algorithms were employed by MLRC in the NCLD 2016 and these new algorithms were used in the revisions of all previous NLCD versions (including the first version in 2001).

Livestock Estimates

Livestock waste contains nutrients which can cause water quality impairment. The nutrient loading model considers numbers and types of animals. Table 3 (right) provides livestock (numbers of animals) in the watershed based on the USDA National Agricultural Statistics Service (NASS) estimation for 2012. Some of these totals were modified by direct observations made in the watershed in the 2012 survey. To generate watershed-based livestock counts, NASS county-based livestock totals are converted to a per unit area (based on the total area of the county). The unit area amount is then multiplied by the total watershed area to derive a watershed total count (as seen in Table 3).

Table 3: Livestock Estimates in the Colley Wright Watershed

Type	Colley Wright Brook
Dairy Cows	6
Beef Cows	7
Broilers	9
Layers	37
Hogs/Swine	9
Sheep	24
Horses	44
Turkeys	3
Other	--
Total	**139**

The Colley Wright Brook watershed is predominantly forested, with substantial mixed agricultural land uses scattered through watershed, and consisted of large hay fields and some pasture. A miniature horse farm is home to about 24 horses. The same owners also have Charolais cattle with 3 cows estimated. A horse stable is located on River Road in close proximity to a tributary of Colley Wright Brook. About 20 horses were observed here. A large farm is also located on River Road just southeast of the sample reach station. Another farm and farm stand is located to the north and south of River Road. From the farm's website, they raise and sell cattle, pigs, lamb, turkey and chicken along with growing various vegetable crops. It is unknown whether all animals

[1] MRLC-NLCD 2016 : Multi-Resolution Land Characteristics – National Land Cover Dataset (version 2016) provided by the MRLC Consortium (Jin et al. 2019).

are raised in this location as no livestock or clear signs of pasture were observed during the field visit. No estimates were made for this potential source.

Vegetated Stream Buffer in Agricultural Areas

Vegetated stream buffers are areas of trees, shrubs, and/or grasses adjacent to streams, lakes, ponds or wetlands which provide nutrient loading attenuation (Evans and Corradini 2012). *Model My Watershed* considers natural vegetated stream buffers within agricultural land areas as providing nutrient load attenuation. A width of approximately 98 feet (30 m) on one side of a stream is required to be considered a streamside buffer per the *Model My Watershed* technical manual (Stroud Water Research Center 2017). Analysis of recent aerial photos was used to estimate the number of agricultural land stream miles with and without vegetative buffers, and these estimates were directly entered into the model.

Table 4: Summary of Vegetated Buffers in Agricultural Areas (2012)

Colley Wright Brook
• Agricultural Land Stream Length = 1.9 mi • Agricultural Land Stream Length with Buffer = 1.2 mi (or 63% of total agricultural land stream length) • Percentage of total stream length flowing through non-buffered agricultural land = 7.5%

Colley Wright Brook is an 8.2 mile-long impaired segment as listed by Maine DEP. As modeled, the total stream miles (including tributaries) within the watershed was calculated as 9.3 miles. Of this total, 1.9 stream miles are located within agricultural areas and 1.2 miles or 63% of that area *appear* to have a 98 foot or greater vegetated buffer (Table 4, Figure 4). From a watershed perspective, this equates to 0.7 miles or 7.5% of the total stream length running through agricultural land with less than a 98 foot buffer. By contrast, for attainment stream watersheds, the percentage of total stream miles running through agricultural land without a 75 foot vegetated buffer ranged from 0% to 3.9% with an average of 1.3%. Note, a minimum vegetated buffer width of *75 feet* was used in an earlier (2012) effort to produce Figure 4 shown here. Differences in stream length estimates using a 98-foot or 75-foot buffer were practically insignificant.

Home Septic System Loads

Loads for "normally functioning" septic systems are calculated in *Model My Watershed* using an estimate of the average number of persons per acre in "Low-Density Mixed" areas. In these areas, it is assumed that the populations therein are served by septic systems rather than centralized sewage systems. All homes in such areas are assumed to be connected to "normally functioning" systems rather than those that experience "surface breakouts" (surface failures), "short-circuiting" to underlying groundwater (subsurface failures), or have direct conduits to nearby water bodies. Non-functioning systems would be modeled with a higher load contribution to the waterbody.

Best Management Practices (BMPs)

Best management practices (BMPs) are typically instituted to reduce the loading of sediment and nutrients from upland (i.e., non-point) sources. Ideally, information on BMPs for a specific watershed from local and regional sources would improve this component of the water quality model. Maine DEP sought information on BMP use in early 2021 from local, regional, and state agricultural agencies for rural BMPs and from nearby municipalities for urban BMPs. Very little to no information was returned in the solicitation. Hence, estimates for typical New England watersheds were derived from information available from Vermont. An upper limit of BMP use was garnered from watersheds entering the Chesapeake Bay where BMP use is intensive.

Four agricultural BMPs were used in this modeling effort and in the following manner:

- *Cover Crops:* Cover crops are the use annual or perennial crops to protect soil from erosion during time periods between harvesting and planting of the primary crop. The percent of cropland area in a cover crop BMP deployed was estimated at 25% and selected as the low end of the range (25 to 30 percent) expected for cropland in New England. This value was assigned to the five attainment watersheds.
- *Conservation Tillage:* Conservation tillage is any kind of system that leaves at least 30% of the soil surface covered with crop residue after planting. This reduces soil erosion and runoff. This BMP was estimated to occur in 25% of cropland. This value was assigned to the five attainment watersheds.
- *Strip Cropping / Contour Farming:* This BMP involves tilling, planting and harvesting perpendicular to the gradient of a hill or slope using high levels of plant residue to reduce soil erosion from runoff. Both interview sources suggest this practice is minimal to non-existent for New England watersheds. Hence, no BMP of this type was used in this modeling effort. This value was assigned to the five attainment watersheds.
- *Grazing Land Management:* This BMP consists of ensuring adequate vegetation cover on grazed lands to prevent soil erosion from overgrazing or other forms of over-use. This usually employs a rotational grazing system where hays or legumes are planted for feed and livestock is rotated through several fenced pastures. Both interview sources were not aware of this practice being active and is likely minimal for New England watersheds. Hence, no BMP of this type was used in this modeling effort for both impaired and attaining watersheds.

Note that other agricultural and development BMPs likely exist in the watershed but their location and type were not available in a watershed-wide format that is necessary to include in the model. Agricultural BMPs recommended by Maine DEP to reduce sediment and nutrient loads include vegetated buffers, covered manure storage facilities, and stream exclusion fencing. BMPs for developed areas recommended by the Maine DEP include vegetated buffers, stormwater BMPs, and minimization of impervious cover.

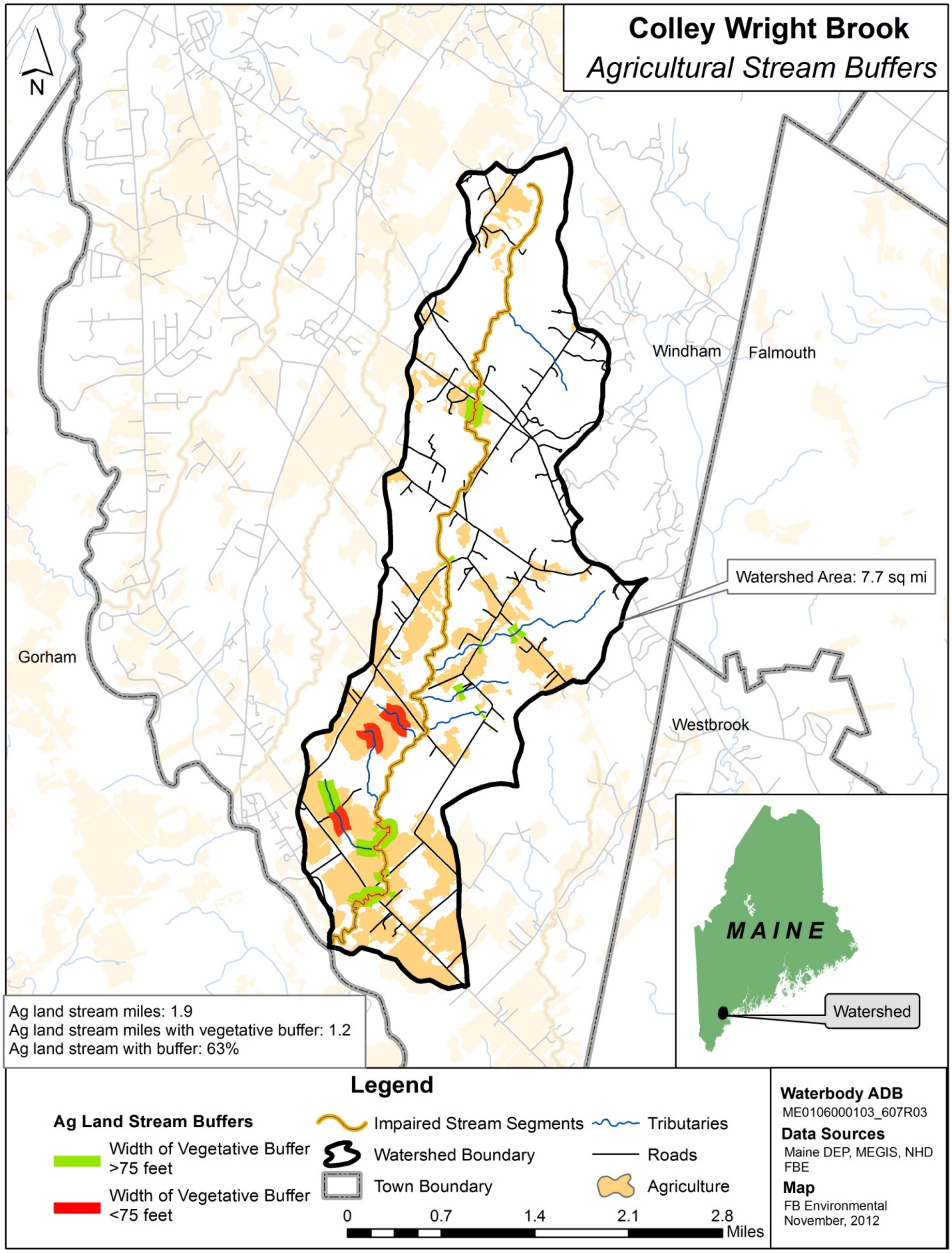


Figure 4: Agricultural Stream Buffers (from 2012) in the Colley Wright Brook Watershed

Pollutant Load Attenuation by Lakes, Ponds and Wetlands

Depositional environments such as lakes, ponds, and wetlands can attenuate watershed sediment and nutrient loading. This information is entered into the nutrient loading model by a simple percentage of watershed area draining to a lake, pond, or wetland. The Colley Wright Brook watershed is 7.9% wetland and open water, per the 2016 NLCD land use/cover. There are a few wetlands that surround tributaries throughout the watershed. It is estimated that 15.7% of land area within the watershed drains to wetlands and open water. The percent of watershed draining to a wetland in the attainment watersheds, based on the 2021 analysis, ranged from 26 to 58 percent, with an average of 40%.

NUTRIENT AND SEDIMENT MODELING RESULTS

Selected results from the watershed loading model are presented here. The TMDL itself is expressed in units of kilograms per hectare per year. The additional results shown below assist in better understanding the likely sources of pollution. The model results for Colley Wright Brook watershed indicate significant reductions of phosphorus and sediment and a small reduction of nitrogen are needed to improve water quality. Below, loading for nitrogen, phosphorus and sediment are discussed individually.

There are two categories of loads – sources and pathways. Sources are determined by land use/cover and the overland flow they generate, livestock counts by animal type, and home sewage treatment systems in developed areas. Pathways represent additional loads derived from subsurface flow and streambank erosion. Subsurface loads are calculated using dissolved N and P coefficients for shallow groundwater and are mainly derived from atmospheric inputs. Sediment and nutrient loads produced by eroding streambanks are estimated using an approach developed by Evans et al. (2003). This pathway is comprised of loads originating from five sources, and listed in order of decreasing importance: amount of developed land area, soil erodibility (K-factor), density of livestock, runoff curve number, and topographic slope. For any given model run, the amount of developed land in the watershed is responsible for just over 72% of the total streambank load, whereas soil erodibility and animal density are responsible for 21% and 7% of the total streambank load, respectively.

Sediment

Aside from stream bank erosion which contributes 60% of the total sediment load, the major source load in Colley Wright Brook watershed originates from hay/pasture land (84.5% of total sources). Residential sources contribute 12.2% of the source load.

Note that total loads by mass cannot be directly compared between watershed TMDLs due to differences in watershed area. See section *TMDL: Target Nutrient and Sediment Levels for Colley Wright Brook* below for loading estimates that have been normalized by watershed area.

Table 5: Total Sediment Load by Source

Colley Wright Brook	**Sediment (1000 kg/year)**	**Sediment (%)**
Source Load		
Hay/Pasture	108.8	84.5%
Cropland	0.4	0.3%
Wooded Areas	2.6	2.0%
Wetlands	0.3	0.2%
Open Land	0.9	0.7%
Barren Areas	0	0
Low-Density Mixed	4.7	3.7%
Medium-Density Mixed	3.9	3.1%
High-Density Mixed	0.6	0.5%
Low-Density Open Space	6.4	5.0%
Farm Animals	0	0
Septic Systems	0	0
Source Load Total:	**128.8**	**100%**
Pathway Load		
Stream Bank Erosion	194.0	-
Subsurface Flow	0	-
Total Watershed Mass Load:	**323**	

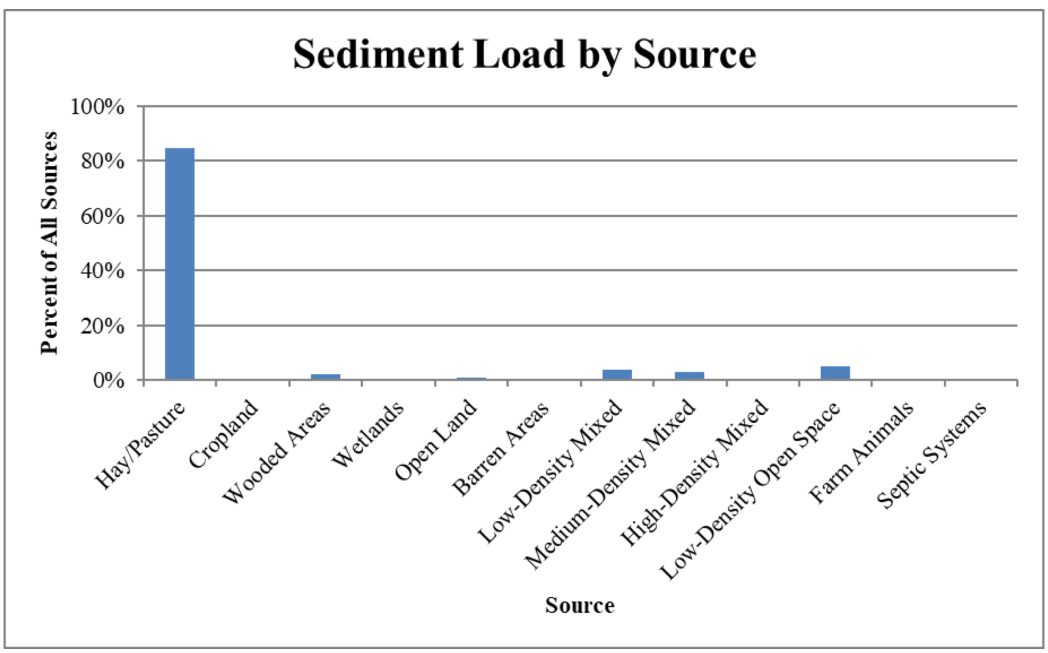


Figure 5: Total Sediment Load by Source in the Colley Wright Brook Watershed

Total Nitrogen

Table 6 and Figure 6 (below) show the estimated total nitrogen load, in terms of mass and percent of total by source, in the Colley Wright Brook watershed. Hay and pasture lands are the largest source of nitrogen loading contributing about 43% of the source load of total N. Residential areas combined (including septic systems) contribute just under 20% of the source load whereas wooded areas and wetlands contribute 22.5% of the source load. Lastly, farm animals contribute about 12% of the source load.

Note that total loads by mass cannot be directly compared between watershed TMDLs due to differences in watershed area. See section *TMDL: Target Nutrient and Sediment Levels for Colley Wright Brook* below for loading estimates that have been normalized by watershed area.

Table 6: Total Nitrogen Load by Source

Colley Wright Brook	Total N (kg/year)	Total N (%)
Source Load		
Hay/Pasture	1,028	43.5%
Cropland	5	0.2%
Wooded Areas	399	16.9%
Wetlands	134	5.6%
Open Land	45	1.9%
Barren Areas	3	0.1%
Low-Density Mixed	132	5.6%
Medium-Density Mixed	84	3.6%
High-Density Mixed	14	0.6%
Low-Density Open Space	179	7.5%
Farm Animals	282	11.9%
Septic Systems	62	2.6%
Source Load Total:	**2,365**	**100%**
Pathway Load		
Stream Bank Erosion	182	-
Subsurface Flow	2,515	-
Total Watershed Mass Load:	**5,061**	

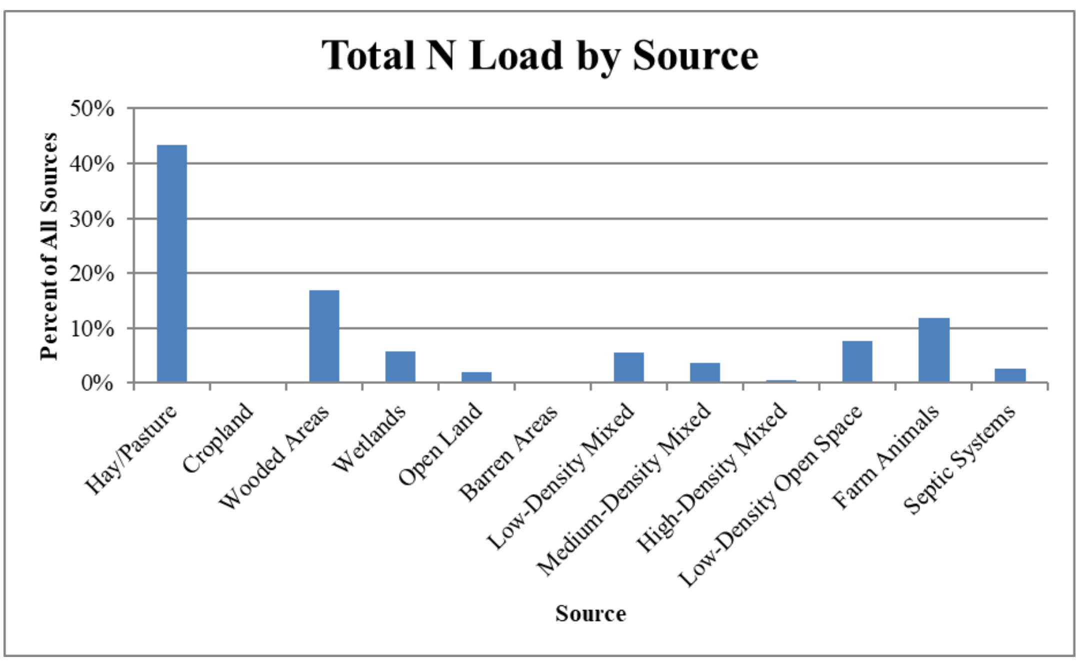


Figure 6: Total Nitrogen Load by Source in the Colley Wright Brook Watershed

Total Phosphorus

Table 7 and Figure 7 (below) show the estimated total phosphorus load in terms of mass and percent of total by source, in the Colley Wright Brook watershed. Hay and pasture lands are the largest source of phosphorus loading contributing almost 65% of the source load. Residential areas combined contribute 10.5% of the source load. Farm animals contribute almost 17% of the source load of total P. Stream bank erosion contributes 7% of the total watershed P load.

Note that total loads by mass cannot be directly compared between watershed TMDLs due to differences in watershed area. See section *TMDL: Target Nutrient and Sediment Levels for Colley Wright Brook* below for loading estimates that have been normalized by watershed area.

Table 7: Total Phosphorus Load by Source

Colley Wright Brook	Total P (kg/year)	Total P (%)
Source Load		
Hay/Pasture	262.2	64.9%
Cropland	0.7	0.2%
Wooded Areas	21.9	5.4%
Wetlands	7.0	1.7%
Open Land	1.5	0.4%
Barren Areas	0.1	0.02%
Low-Density Mixed	13.9	3.4%
Medium-Density Mixed	8.4	2.1%
High-Density Mixed	1.3	0.3%
Low-Density Open Space	18.8	4.7%
Farm Animals	68.3	16.9%
Septic Systems	0	0
Source Load Total:	**404.1**	**100%**
Pathway Load		
Stream Bank Erosion	38.0	-
Subsurface Flow	99.6	-
Total Watershed Mass Load:	**542**	

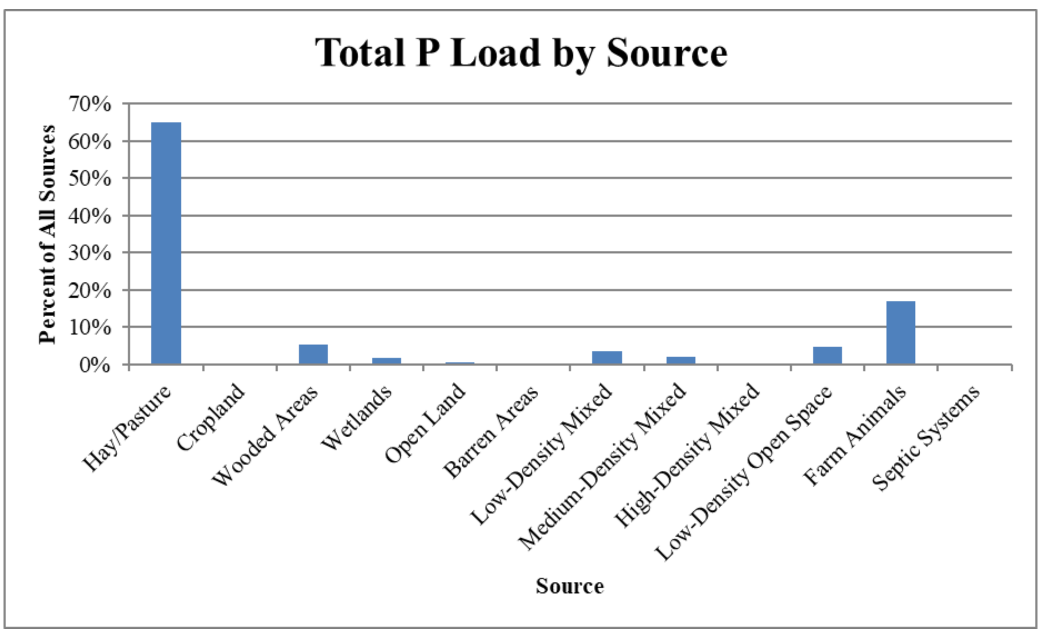


Figure 7: Total Phosphorus Load by Source in the Colley Wright Brook Watershed

TMDL: TARGET NUTRIENT AND SEDIMENT LEVELS FOR COLLEY WRIGHT BROOK

The existing loads for nutrients and sediments in the impaired segment of Colley Wright Brook are listed in Table 8, along with the TMDL (the allowable load) which was calculated from the average loading estimates of five attainment watersheds throughout the state. Table 8 also shows required reductions (as a percent) for each of sediment, total N, and total P pollutants. Table 9 presents a more detailed view of the modeling results and calculations used to compute the existing loads in Table 8. An annual time frame provides a mechanism to address the daily and seasonal variability associated with nonpoint source loads.

Table 8: Colley Wright Brook Pollutant Loading Compared to TMDL Targets

Colley Wright Brook			
Pollutant Load	**Existing Load**	**TMDL**	**Reduction Required**
Total Annual Load per Unit Area		Attainment Streams	
Sediment (kg/ha/yr)	163.3	65.72	59.7%
Total N (kg/ha/yr)	2.56	2.46	4.0%
Total P (kg/ha/yr)	0.27	0.16	41.7%

Future Loading

The prescribed reduction in pollutants discussed in this TMDL reflects reduction from estimated existing conditions. Expansion of agricultural and development activities in the watershed have the potential to increase runoff and associated pollutant loads to Colley Wright Brook. To ensure that the TMDL targets are attained, future agricultural, and to some extent development, activities will need to meet the TMDL targets. Between 2012 to 2017 in Cumberland County, the growth in agricultural lands was decreasing, with a 7% decrease in the total number of farms and a 20.2% decrease in total farm area. Average farm size has also declined significantly (13.8%) during this time period. These values are extracted from the most recent (2017) Census of Agriculture (USDA 2017). Human population in Cumberland County increased by 4.8% from 2000 to 2019 (US Census 2020). Future activities and BMPs that achieve TMDL reductions are addressed below.

Next Steps

The use of agricultural and developed area BMP's can reduce sources of polluted runoff in Colley Wright Brook. It is recommended that municipal officials, landowners, and conservation stakeholders in Windham work together to develop a watershed management plan to:

- Encourage greater citizen involvement through the development of a watershed coalition to ensure the long term protection of Colley Wright Brook;
- Run a "Hot-Spot Analysis" in *Model My Watershed* to determine sub-watershed locations of higher existing contributions of sediment and nutrients to the outlet of Colley Wright Brook watershed; then focus BMP mitigation in these hot-spot sub-areas of the watershed;
- Address existing nonpoint source problems in the Colley Wright Brook watershed by instituting BMPs where necessary; and

- Prevent <u>future</u> degradation of Colley Wright Brook through the development and/or strengthening of local Nutrient Management Ordinance.

Table 9: Annual Loads by Land Use, Other Sources, and Pathways for Colley Wright Brook Based on Modeling

Colley Wright Brook				
	Area (ha)	**Sediment** (1000 kg/yr)	**Total N** (kg/yr)	**Total P** (kg/yr)
Land Uses				
Hay/Pasture	355	108.8	1,028	262.2
Cropland	1	0.4	5	0.7
Wooded Areas	1,195	2.6	399	21.9
Wetlands	154	0.3	134	7.0
Open Land	22	0.9	45	1.5
Barren Areas	2	0.000	3	0.1
Low-Density Mixed	97	4.7	132	13.9
Medium-Density Mixed	17	3.9	84	8.4
High-Density Mixed	3	0.6	14	1.3
Low-Density Open Space	131	6.4	179	18.8
Total Area	1,977			
Other Sources				
Farm Animals		0.0	282	68.3
Septic Systems		0.0	62	0.0
Pathway Load				
Stream Bank Erosion		194.0	182	38.0
Subsurface Flow		0.0	2,515	99.6
Total Annual Load		323	5,061	542
Total Annual Load per Unit Area		0.16	2.56	0.27
		1000 kg/ha/yr	kg/ha/yr	kg/ha/yr

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