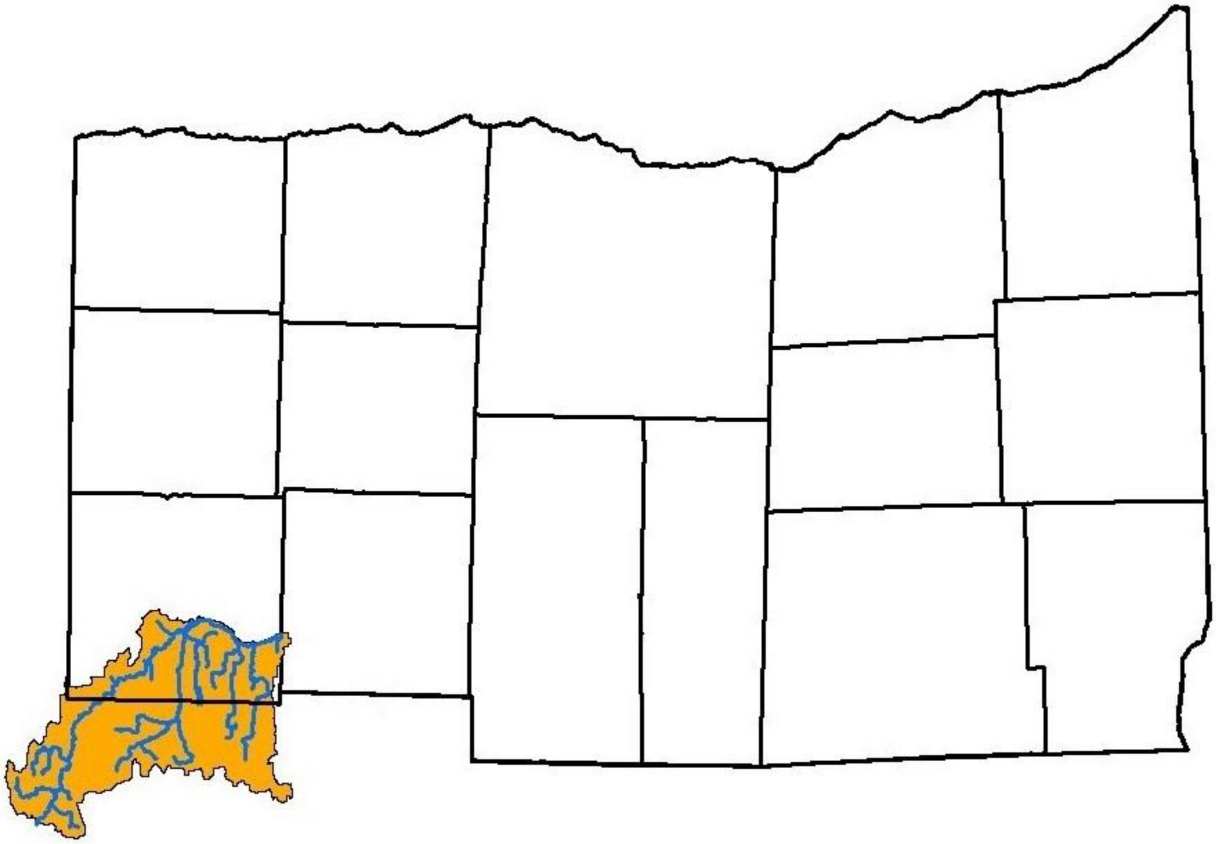

Upper Ganargua Creek Watershed Assessment

2018 - 2019

Wayne County Soil & Water Conservation District

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EXECUTIVE SUMMARY

Upper Ganargua Creek is a Class C stream with impacts that needs verification to determine the extent of possible stress to aquatic life. The NY DEC reports that the creek's pollutants are nutrients (phosphorus), silt/sediment, dissolved oxygen/oxygen demand, and ammonia. The alleged sources of the stress are construct (development), urban storm runoff, agriculture, and municipal. For this assessment, water quality samples were collected at thirteen (13) locations from March 2018 to August 2018 and May 2019 to July 2019. The samples were analyzed for total phosphorus, total nitrogen, nitrate + nitrite, and total suspended solids. Total Kjeldahl Nitrogen was determined by finding the difference between total nitrogen and nitrate + nitrite. Total phosphorus, nitrate + nitrite, and total suspended solids concentrations observed in Upper Ganargua Creek were noticeably elevated in the main channel of the stream system. Nitrate + nitrite concentrations were also elevated in the tributary streams. A comparison between non-event and event conditions suggests that some constituents can be diluted during intense precipitation events. A majority of the soils in the watershed have moderate infiltration rates and moderately low runoff potential. Over half of the Upper Ganargua Creek watershed is composed of agricultural land use. There is approximately 1,678 acres of protected wetlands in the watershed that play an important role in water filtration and nutrient recycling. There are two entities that have SPDES permitted discharges in the watershed, the Town of Macedon and a mobile home park. Runoff from cropland was observed as a potential source of nonpoint source pollution. Water quality impacts by agricultural livestock operations could be attributed to unsuitable grazing practices, confinement areas, and runoff from heavily used areas. The Town of Macedon is MS4 permittee that is required to develop and implement a stormwater management plan to reduce the impact of stormwater runoff on receiving waterbodies. A significant amount of the land use in the watershed can be considered rural, where the proper management and upkeep of onsite wastewater treatments systems is important to protecting water quality. Stream corridor conditions show that there are a number of streambank stabilization issues that are affecting or will soon affect private and public property.

INTRODUCTION AND BACKGROUND

The health of our waters is the principle measure of how we live on the land.

- Luna Leopold

A watershed can be defined as any land area in which water drains to a common point. When beginning to look at how land is managed and the resulting impacts upon water quality, it becomes increasingly clear that what is done on the land will ultimately affect the receiving waterbody. The concept of *Watershed Management* is to look broadly at the multiple land uses (agriculture, development, etc.) to determine the effects and to find ways to mitigate those impacts to protect these waterbodies.

Through a combination of field work, resource evaluation and mapping, an assessment of the watershed can help determine and outline upland actions that affect water quality. This *Watershed Assessment* then serves as the basis for prioritizing corrective measures and finding appropriate funding opportunities to address sources of pollution within the watershed.

The resulting document will expectantly serve as a guideline for restoration and improvements within the watershed, which will ultimately improve the water quality and ecology.

STREAM AND WATERSHED CHARACTERISTICS

Upper Ganargua Creek (0704-0013) originates at the confluence of Great Brook (0704-0034), Fish Creek (0704-0037), and Mud Creek (0704-0030), near the intersection of Plaster Mill Road and State Route 96 in Victor, NY. Upper Ganargua Creek (UGC) flows north-west and drains into the Erie-Barge Canal at the Macedon-Palmyra Aqueduct Park (2685 Route 31, Palmyra, NY 14522). The UGC watershed, excluding Great Brook, Fish Creek, and Mud Creek, is 19,634 acres and the main channel is 12.5 miles in length. Minor tributaries to UGC include two streams on Creek Road, in Macedon; Trapp Brook on Erie Street between Paddy Lane and Jupiter Drive; Victor Road south of Canandaigua Road; Farmington Road south of Victor Road; and Route 31 between Kemp Drive and Victor Road UGC has 34.8 miles of tributary streams. The entire drainage basin of UGC-Great Brook-Fish Creek-Mud Creek is 78,963 acres and originates as far south as South Bristol, Ontario County, NY. This includes the towns of Bristol, Canandaigua, West and East Bloomfield, Farmington, Victor, Macedon, and small portions of Mendon, Perinton, Manchester, and Palmyra.

The area of interest for this assessment is the main channel of Upper Ganargua Creek that extends from near Allen Padgham Road (upstream) to the creek's outlet at Aqueduct Park in Palmyra.

STREAM MORPHOLOGY AND CLASSIFICATION

Upper Ganargua Creek is a fourth order stream. Using USGS StreamStats (https://streamstats.usgs.gov/ss/), UGC has the following approximate bankfull statistics:

Bankfull Area: 150 $ft.^2$
Bankfull Depth: 2.91 ft.
Bankfull Streamflow: 509 $ft.^3/s$
Bankfull Width: 51.8 ft.

StreamStats also estimated that the mean annual runoff for the basin is 11.9 inches.

Using USGS Quadrangle topographic maps (Macedon, Palmyra, Victor, and Farmington NY, 7.5-minute series), the slope of the main channel of UGC was found to be approximately 0.044 percent. The slopes of the tributaries to this stream range from approximately 0.51 to 0.76 percent.

New York State Department of Environmental Conservation (NYS DEC) *2008 Oswego River/Finger Lakes Basin Waterbody Inventory/Priority Waterbodies List* Report (WI/PWL) classified Upper Ganargua Creek as a C stream with *MINOR IMPACTS* that stress aquatic life (Appendix I). For Class C waters, the best usage is fishing. “These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes” (Chapter X – Division of Water, Section 701.8). Waterbodies with ‘*MINOR IMPACTS*’ are waters with “less severe water quality impacts are apparent, but uses are still considered fully supported.”

The Waterbody Inventory Data Sheet for UGC states that the type of pollutants are as follows:

Known: NUTRIENTS (phosphorus)
Suspected: Silt/Sediment
Possible: D.O./Oxygen Demand, Ammonia

Nutrients are expressed as the major pollutant of concern. The Data Sheet states that the source of the pollutants are:

Known: CONSTRUCTION (development), URBAN/STORM RUNOFF
Suspected: Agriculture, Municipal

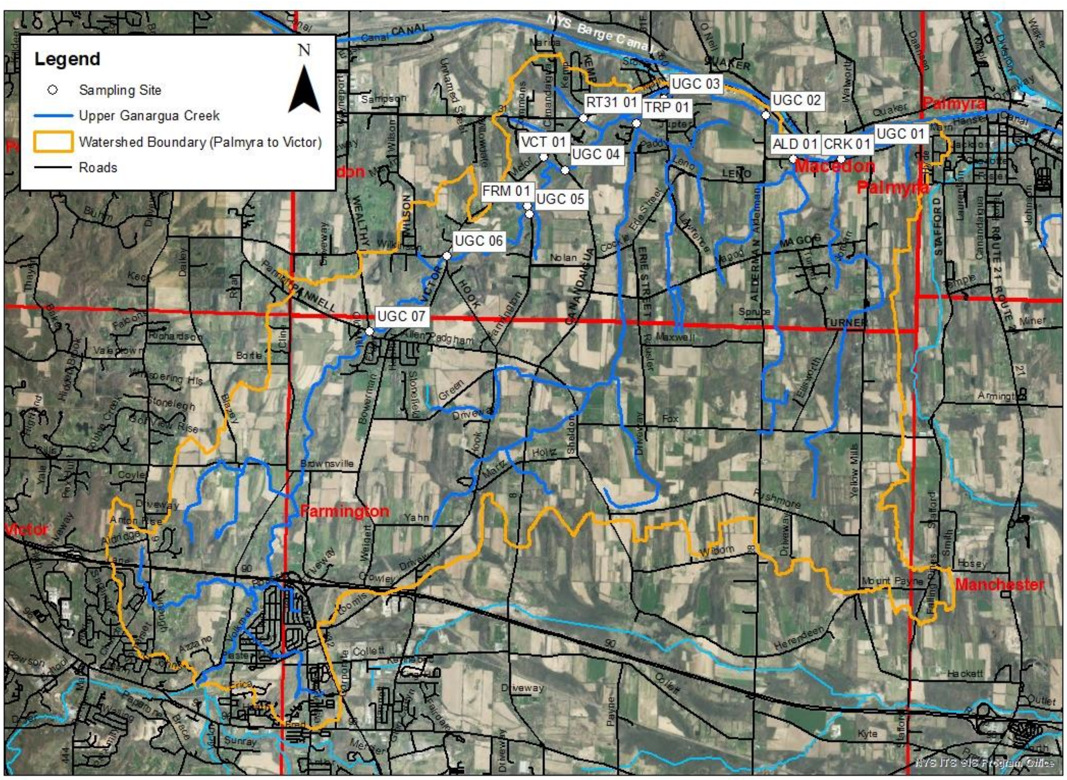
The Data Sheet indicates the *Resolvability* of the impairment requires the evaluation of possible solutions and/or the development of management action (*NEEDS VERIFICATION/STUDY*). The *Resolution Potential* noted is *MEDIUM*, meaning the resources necessary to address the problem are beyond what are currently available. The ‘*Further Details*’ section of the Data Sheet continues discussing that past water quality impacts in Upper Ganargua Creek were a result of suburban development in the town of Victor and from municipal discharges from Victor and Farmington.

The Villages of Victor and Farmington Wastewater Treatment Plants (WWTP) have been updated and are meeting permit discharge limits.

WATER QUALITY

Upper Ganargua Creek was selected for assessment based on SWCD's objective to complete an inventory of the NYS Barge Canal Corridor of Wayne County. This watershed assessment was designed to evaluate and further identify potential nutrient and sediment sources that impact the stream. The thirteen (13) sampling sites were chosen based on location along the main channel, at the outlet of sub-watersheds, and safety/ease of access (Figure 1 and Appendix II). Samples were collected at the 13 locations from March 2018 to August 2018 and May 2019 to July 2019. A total of 9 sampling efforts were completed between the previously stated dates. Sampling was completed to reflect random seasonal variations in water quality. Sampling included collection during what could be classified as "Event" conditions (i.e. noticeable precipitation runoff). Water samples were not collected during winter months. Samples were transported on ice to the water chemistry laboratory at Upstate Freshwater Institute in Syracuse, NY for water chemistry analysis of total phosphorus (TP), nitrate + nitrite (NO_x), total nitrogen (TN), and total suspended solids (TSS). Total Kjeldahl Nitrogen (TKN) was determined by finding the difference between TN and NO_X. Variability existed in the concentrations of constituents from the 13 sampling sites. This is most likely due to differences in land uses as well as point and nonpoint sources across the watershed.

Figure 1. Upper Ganargua Creek Watershed and Sampling Sites



For samples collected along the main channel of Upper Ganargua Creek (UGC 01 – UGC 07), sampling site UGC 07 is used to establish stream water quality entering Wayne County and eliminating what is potentially contributed from upstream in Ontario County. Tributary streams that originate in Ontario County (ex. Trapp Brook) have only a single outfall location. Further assessment of these drainage basin contributions may require a linear sampling protocol or stressed stream analysis.

Table 1a. Mean, Non-event concentrations for Upper Ganargua Creek from March 2018 to August 2018 and May 2019 to July 2019 and Mean, Non-event concentrations from various Wayne County tributaries.

UPPER GANARGUA CREEK 2018-19 NON-EVENT					
SITE ID	TP (µg/L)	TN (mg/L)	NOx (mg/L)	TKN (µg/L)	TSS (mg/L)
UGC 01	188.1	2.608	1.993	615.0	45.5
UGC 02	199.3	2.568	2.000	568.0	41.5
UGC 03	191.5	2.408	1.866	542.0	32.1
UGC 04	181.7	2.268	1.706	562.0	31.8
UGC 05	197.5	2.618	2.024	690.0	34.1
UGC 06	188.0	2.960	2.408	552.0	29.2
UGC 07	171.5	2.920	2.356	564.0	22.2
CRK 01	51.8	1.097	0.493	603.4	8.1
ALD 01	59.6	1.646	0.984	662.2	7.4
TRP 01	83.5	1.938	1.271	667.2	12.1
RT31 01	32.3	2.070	1.439	631.5	3.6
VCT 01	79.9	1.678	1.240	573.5	7.7
FRM 01	37.8	1.420	0.889	531.0	10.6
WAYNE COUNTY TRIBUTARIES NON-EVENT					
Waterbody	TP (µg/L)	TN (mg/L)	NOx (mg/L)	TKN (µg/L)	TSS (mg/L)
Canandaigua Outlet '09-'10	47.8	N/A	1.032	590.2	3.0
Glenmark Creek '09-'10	39.2	N/A	0.774	535.9	3.2
Crusoe Creek '09-'10	103.5	N/A	0.110	1201.9	3.4
Black Brook '09-'10	55.3	N/A	0.464	848.7	11.0
Red Creek East '09-'10	127.7	N/A	0.282	939.9	4.4
Red Creek West '09-'10	98.5	N/A	0.238	710.4	3.2
Salmon Creek West '10	N/A	N/A	N/A	N/A	N/A
Maxwell Creek '10	252.3	N/A	0.340	754.0	2.0
Ganargua Creek Lower '12-'13	61.4	N/A	0.790	448.2	11.2
Red Creek West '16-'17	70.0	1.198	0.222	976.4	9.4
Red Creek East '17-'18	269.5	1.018	0.161	856.4	5.1

Table 1b. Mean, Event concentrations for Upper Ganargua Creek from March 2018 to August 2018 and May 2019 to July 2019 and Mean, Non-event concentrations from various Wayne County tributaries.

UPPER GANARGUA CREEK 2018-19 EVENT					
SITE ID	TP (µg/L)	TN (mg/L)	NOx (mg/L)	TKN (µg/L)	TSS (mg/L)
UGC 01	104.5	2.015	0.941	1073.8	39.0
UGC 02	118.8	2.085	1.021	1063.8	32.8
UGC 03	108.1	1.948	1.071	876.5	37.6
UGC 04	104.6	1.873	0.971	901.8	37.2
UGC 05	98.3	1.014	0.881	1014.0	43.4
UGC 06	94.7	1.718	0.771	947.0	40.5
UGC 07	93.6	1.442	0.710	1022.3	35.3
CRK 01	16.7	0.911	0.346	564.5	6.5
ALD 01	31.9	1.405	0.454	951.0	12.8
TRP 01	45.3	2.000	0.821	1179.5	10.2
RT31 01	35.0	2.148	1.251	896.5	6.6
VCT 01	80.9	2.148	1.082	743.0	13.9
FRM 01	28.1	1.565	1.009	556.5	7.3
WAYNE COUNTY TRIBUTARIES EVENT					
Waterbody	TP (µg/L)	TN (mg/L)	Nitrate (mg/L)	TKN (µg/L)	TSS (mg/L)
Canandaigua Outlet '09-'10	72.3	N/A	1.795	1449.0	13.6
Glenmark Creek '09-'10	91.4	N/A	0.793	800.8	20.5
Crusoe Creek '09-'10	138.5	N/A	0.170	1067.9	7.5
Black Brook '09-'10	70.3	N/A	0.828	968.6	17.7
Red Creek East '09-'10	132.6	N/A	0.489	842.4	9.8
Red Creek West '09-'10	110.5	N/A	0.348	743.0	7.1
Salmon Creek West '10	162.2	N/A	2.130	990.0	4.6
Maxwell Creek '10	222.4	N/A	1.260	802.0	8.4
Ganargua Creek Lower '12-'13	106.3	N/A	0.907	430.0	33.9
Red Creek East 17-18	181.9	1.1	0.311	667.7	15.4

Total Phosphorus (TP)

Phosphorus as phosphate is one of the major nutrients required for plant growth and is often considered the 'limiting' nutrient in New York freshwaters. Sources of phosphorus include animal wastes, sewage, detergent, fertilizer and disturbed land. U.S. Environmental Protection Agency recommended water quality standard for flowing waters entering a lake is 50 µg/L and 100 µg/L for all other streams (USEPA, 2012). Wisconsin Department of Natural Resources established a phosphorus water quality standard for flowing waters entering lakes at 75 µg/L and 100 µg/L for all other streams and rivers (Wisconsin, 2010). The NYS DEC Stream Biomonitoring Team, in conjunction with the University of Albany - Department of Biological Sciences, suggests a phosphorus threshold limit of 65 µg/L between mesotrophic and eutrophic conditions in flowing streams (Smith et al., 2006). During non-precipitation event conditions, 9 of the 13 UGC sampling sites had mean concentrations of TP exceeding 65 µg/L. Sites UGC 02 and UGC 05 had the highest observed mean concentration at 199.3 µg/L and 197.5 µg/L, respectively (Table 1a). Compared to other streams assessed in Wayne County, UGC's TP results were found to be quite high.

During precipitation event conditions, 8 of 13 sampling sites exceeded 65 µg TP/L. Site UGC 02 had the highest observed TP concentration at 118.8 µg/L (Table 1b). The event concentrations observed in Upper Ganargua Creek were fairly similar to those of other tributaries in Wayne County.

Total Kjeldahl Nitrogen (TKN)

Total Kjeldahl Nitrogen is the combination of organically bound nitrogen and ammonia. Sources of these forms of nitrogen include sewage effluent and runoff from land where manure has been applied or stored. U.S. Environmental Protection Agency water quality criteria recommendations for New York State region provided data that un-impacted waterbodies have a TKN concentration of 200.0 µg/L (USEPA, 2000). For this report, TKN was calculated by finding the difference between the concentrations of Total Nitrogen (TN) and Nitrate + Nitrite (NO_x). All 13 sample sites exceeded 200.0 µg/L for non-event conditions, although the concentrations observed could be considered low for waterbodies with some level of land use impact. Concentrations ranged from 531.0 µg/L at FRM 01 and 690.0 µg/L at UGC 05 (Table 1a). Upper Ganargua Creek TKN non-event concentrations for this report are slightly lower than other streams in Wayne County.

During event conditions, all 13 sampling sites exceeded 200.0 µg/L. Results for sites CRK 01 (564.5 µg/L) and FRM 01 (556.5 µg/L) could be considered low for having some level of impact in its drainage basin. Sites UGC 01, UGC 02, UGC 05, UGC 07, and TRP 01 all exceeded 1000 µg/L. The tributary stream known as Trapp Brook (TRP 01) had the highest observed concentration. Upper Ganargua Creek mean, event concentrations were fairly similar to others seen throughout Wayne County.

Nitrate + Nitrite (NO_x)

Nitrate is the form of nitrogen that is most readily available for plant uptake. It is more easily detected as Nitrate + Nitrite, or NO_x (Nitrite is not commonly found in surface waters but is created as nitrate converts to nitrogen gas during denitrification). Nitrate sources include soil, animal wastes (including birds and fish), sewage and septic systems, fertilizers and decaying vegetation. The NYSDEC water quality standard for nitrate in drinking water is 10 mg/L. The United States Geological Survey (USGS) states that background nitrate concentrations for undeveloped watersheds is 0.6 mg/L (USGS, 1999). Twelve of the 13 sites sampled during non-event conditions surpassed 0.6 mg/L, with the highest being UGC 06 at mean concentration of 2.408 mg/L. The lowest non-event concentration observed was at CRK 01 at 0.493 mg/L.

Compared to other Wayne County streams, Upper Ganargua Creek NO_x results were relatively high throughout the basin.

Mean NO_x concentrations observed under event conditions were relatively high in 11 out of the 13 sampling sites. Overall, the event concentrations ranged from 1.251 mg/L at RT31 01 to 0.346 mg/L at CRK 01. Compared to other Wayne County streams, UGC displayed slightly higher concentrations during precipitation events.

Total Suspended Solids (TSS)

Total suspended solids is a measure of soil particles and other materials suspended in water. Water-borne sediments act as an indicator, facilitator and agent of pollution (Makerawicz et al. 2011). As an indicator, TSS adds hue to water. As a facilitator, sediments transport other pollutants such as nutrients and toxic substances. As an agent, sediments smother organisms and cover habitats used by some species for spawning (Makerawicz et al. 2011). Mean non-event concentration of TSS ranged from 3.6 mg/L at site RT31 01 to 45.5 mg/L at UGC 01. All seven sampling sites along the main channel of UGC exceeded 22.0 mg/L, while the highest observed in the tributary streams was 12.1 mg/L (TRP 01). The concentrations observed throughout Upper Ganargua Creek main channel were significantly higher than other Wayne County streams, while results from tributary streams were more comparable.

Mean event concentrations of TSS in Upper Ganargua Creek ranged from 6.5 mg/L at CRK 01 to 43.4 mg/L at UGC 05. The main channel TSS concentrations observed during event conditions were significantly higher than those observed in its tributary streams and other Wayne County streams.

When comparing non-event conditions to that of event conditions, a common observation is that samples collected during event conditions will have higher

concentrations. This is due to increases in overland runoff and erosion. There were noticeable exceptions to this during this assessment, suggesting that some constituents may be diluted during intense precipitation events or lost to floodplains.

HYDROLOGIC SOIL GROUPS

Hydrologic soil group (HSG) is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting, and when not frozen. Wetness characteristics, water transmission after prolonged wetting, and depth to slowly permeable layers are properties that influence runoff potential. Changes in soil properties caused by land management or climate changes also cause the HSG to change. Hydrologic soil groups are important in the planning watershed-protection and flood-prevention projects as well as for planning or designing structures for the use, control and disposal of water.

The HSGs are described as:

Group A—Soils in this group have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/hour).

Group B—Soils in this group have moderately low runoff potential and moderate infiltration rates when thoroughly wetted. They consist of 10 – 20 percent clay and 50 – 90 percent sand. These soils have a moderate rate of water transmission (0.15-0.30 in/hour).

Group C—Soils in this group have moderately high runoff potential and low infiltration rates when thoroughly wetted. These soils have a low rate of water transmission (0.05-0.15 in/hour).

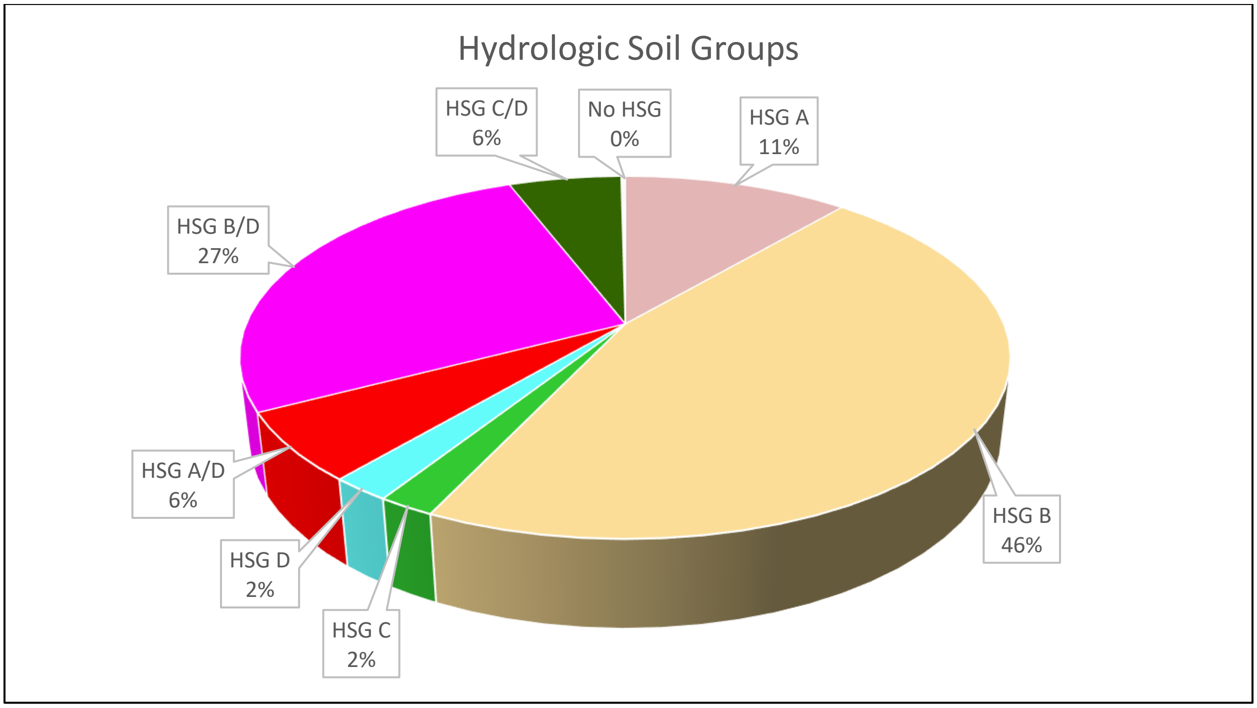
Group D—Soils in this group have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, a permanent high water table, a claypan or clay layer at or near the surface and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hour).

Dual hydrologic soil groups—Certain wet soils are placed in group D based solely on the presence of a water table within 24 inches of the surface even though the ease with which pores of a saturated soil permit water movement may be favorable for water transmission. If these soils can be adequately drained, then they are assigned to dual hydrologic soil groups (A/D, B/D and C/D) based on their ability to allow water movement and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition.

Table 2. Hydrologic soil groups for the Upper Ganargua Creek Watershed.

Hydrologic Soil Groups		Acres	%
	HSG A	2215	11%
	HSG B	8983	46%
	HSG C	397	2%
	HSG D	421	2%
	HSG A/D	1202	6%
	HSG B/D	5270	27%
	HSG C/D	1104	6%
	No HSG	42	0%
	TOTAL	19634	

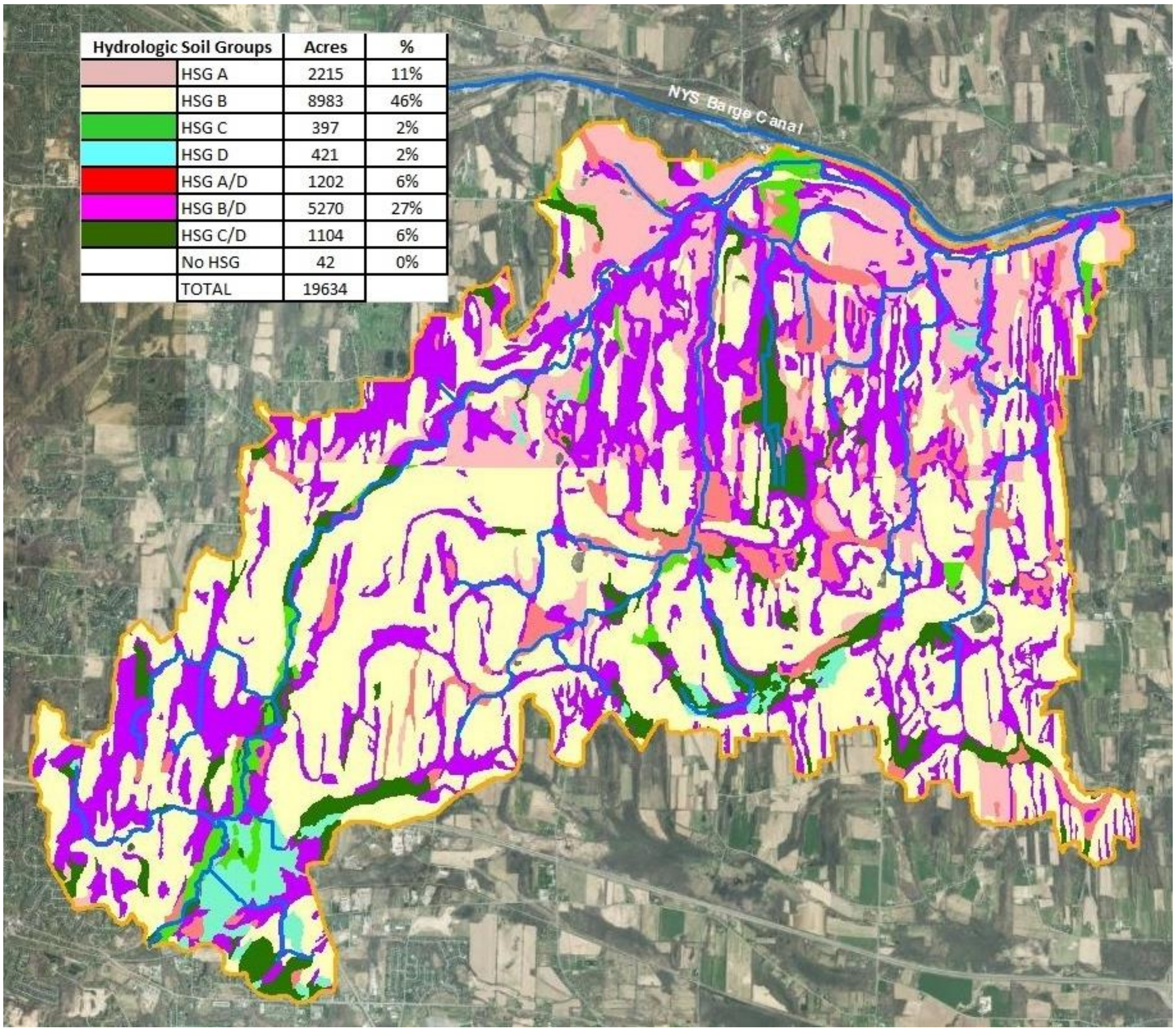
Figure 2. Percent acreage of hydrologic soil groups for the Upper Ganargua Creek Watershed.



As evident in Table 2, a majority of the watershed area is soil that has moderate infiltration rates when saturated. These soils also have moderately low runoff potential. As a result of any soil disturbance, the soil profile can be changed from its natural state and listed soil groups may no longer apply. The map below displays the distribution of the HSGs in the Upper Ganargua Creek watershed. Any land disturbances in areas with moderately high or high runoff potential have a greater chance of impacting the water quality of the stream.

High infiltration rates can pose an increased risk for groundwater and surface water contamination. Soil straining or filtration usually removes suspended solids and particulate phosphorus, but dissolved phosphorus (phosphates) can remain untreated. Fine- to mediumtextured soils have a larger capacity to hold phosphate, while coarse-textured soils do not (Busman et al, 2002). The same can be stated for nitrate-N. Water-soluble nitrate leaches below root zones with excess water. This nitrogen form has the potential to enter ground and surface water in areas of coarse-textured soils (Lamb et al, 2014). Fertilizer and manure spreading on land with high infiltration rates (HSG A soils) can be cost ineffective and have a negative impact on water quality.

Figure 3. Hydrologic Soil Groups of the Upper Ganargua Creek Watershed.



LAND USE

The land use and land cover patterns (permeability) in a watershed have a significant impact on the overall quality of the receiving waterbody. Knowing the extent of development in a watershed and where the development is located can play a key role in the contaminant loading to a waterbody. In general, as land uses occur, stream systems and overall waterbody health can become diminished through changes in runoff and other human impacts.

Land use categories observed in the UGC watershed are categorized as:

- *Cropland* – includes mucklands, field crops and dairy products
- *Low Density Residential* – includes rural, primary residence with acreage (including agricultural land)
- *Forest* – includes various vacant lands, wooded public parks and private forests
- *Medium Density Residential* – includes multi-family residence, mobile homes and residence with commercial uses
- *Hay/Pasture* – includes plant and tree nurseries, fruit orchards, livestock grazing areas
- *Roads* – includes paved roadways
- *Medium Density Mixed Urban* – includes commercial operations such as shopping centers, office buildings, downtown row-type structures, apartments buildings, inns and lodging; community services such as schools, hospitals, emergency services, religious and cultural facilities; industry such as light and heavy manufacturing process; and public services such as electric, gas, telephone, and sewages treatment
- *Turf/Golf* – includes golf courses and country clubs
- *Low Density Mixed Urban* – includes small commercial operations and mobile home parks
- *Open Land* – includes outdoor recreation facilities, skiing center, cemeteries, landfill

Table 3. Land uses of the Upper Ganargua Creek watershed and acreages

Land Use		Acres	%
	Cropland	9067	46
	Low Density Residential	4596	23
	Forest	1899	10
	Medium Density Residential	1676	9
	Hay/Pasture	975	5
	Roads	390	2
	Medium Density Mixed Urban	315	2
	Turf/Golf	266	1
	Low Density Mixed Urban	233	1
	Open Land	216	1

Figure 4. Percent acreage of land uses for Upper Ganargua Creek watershed.

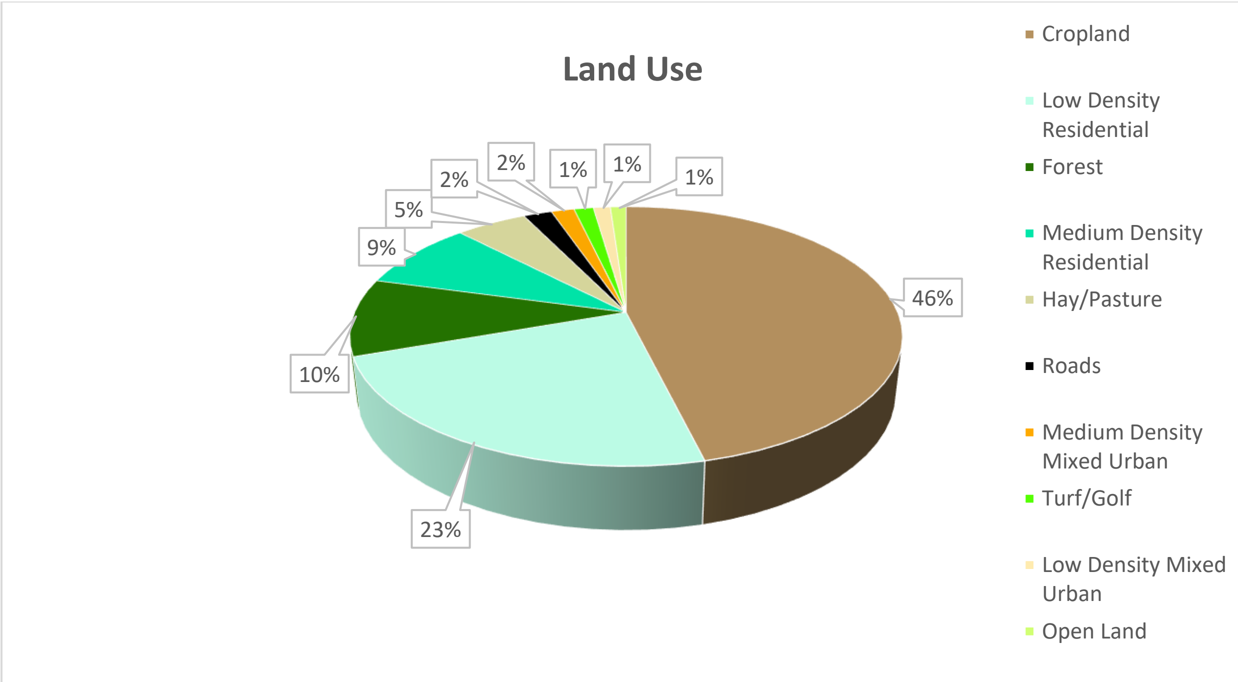
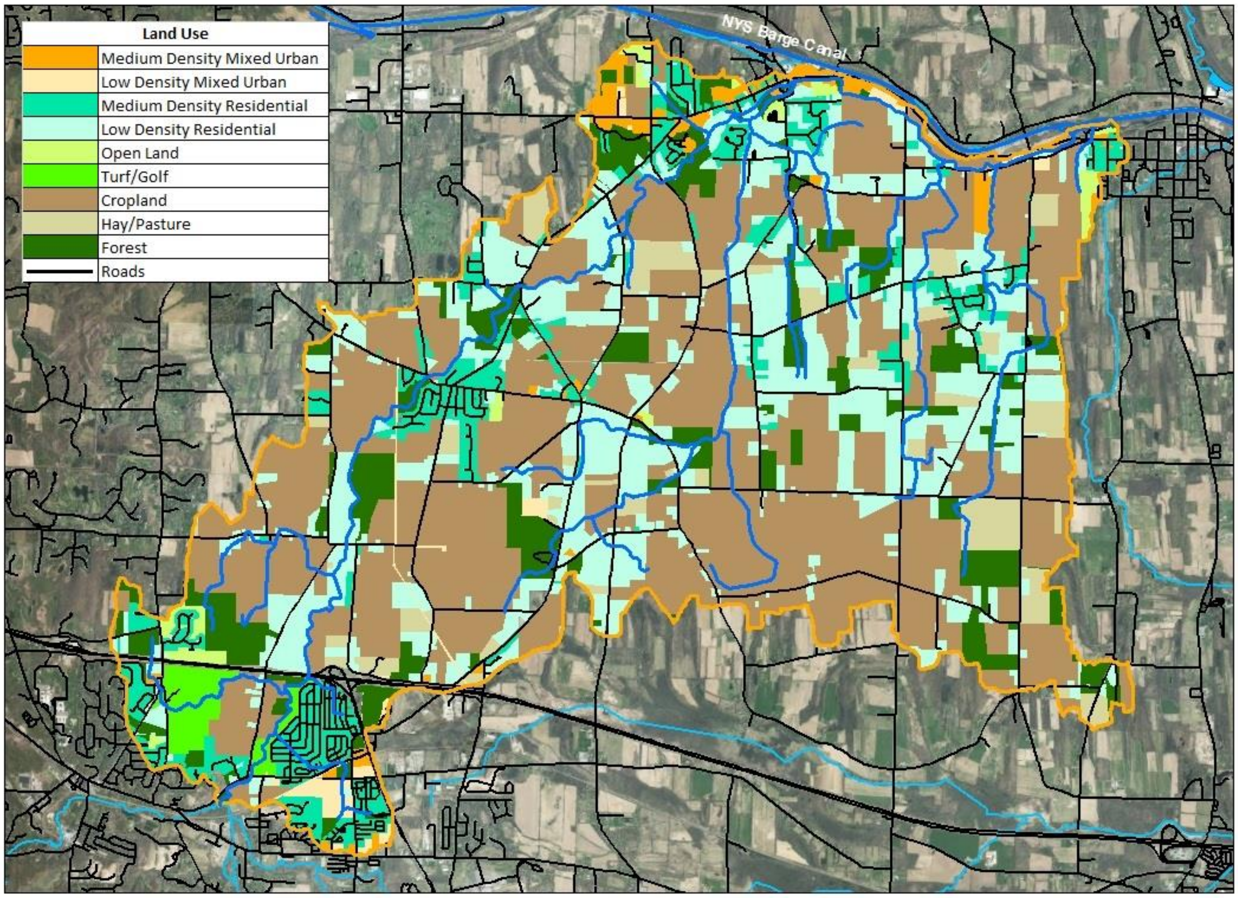


Figure 4 provides a fairly accurate representation of current land uses within the UGC watershed. It is important to note that the *Low Density Residential* category has a high likelihood of containing Agricultural Lands. With that in mind, in combination with *Cropland* and *Hay/Pasture*, almost 75% of the watershed is made up of some form of agricultural land.

Land use information can be used in conjunction with water quality results to determine potential areas of concern and aide in prioritizing implementation efforts to reduce pollution loading. Using Stressed Stream Analysis, an approach developed by Dr. Joseph Makarewicz, priority subwatersheds can be systematically sampled to locate point and nonpoint sources (Makarewicz, 1993).

Figure 5. Land Use Distribution of the Upper Ganargua Creek Watershed.



WETLANDS

Wetlands are defined as "areas saturated by surface or ground water sufficient to support distinctive vegetation adapted for life in saturated soil conditions." Wetlands provide flood- and stormwater control by absorbing, storing and slowing the movement of runoff. Wetlands provide erosion control by slowing water velocity, filtering sediment and by buffering streambanks and shorelines. Wetlands treat pollution and cycle nutrients back into the environment by filtering out natural and manmade pollutant. Wetlands provide important habitat for feeding, nesting and spawning fish and wildlife including rare and endangered species. Lastly, wetlands give humans areas for recreation, education and research opportunities.

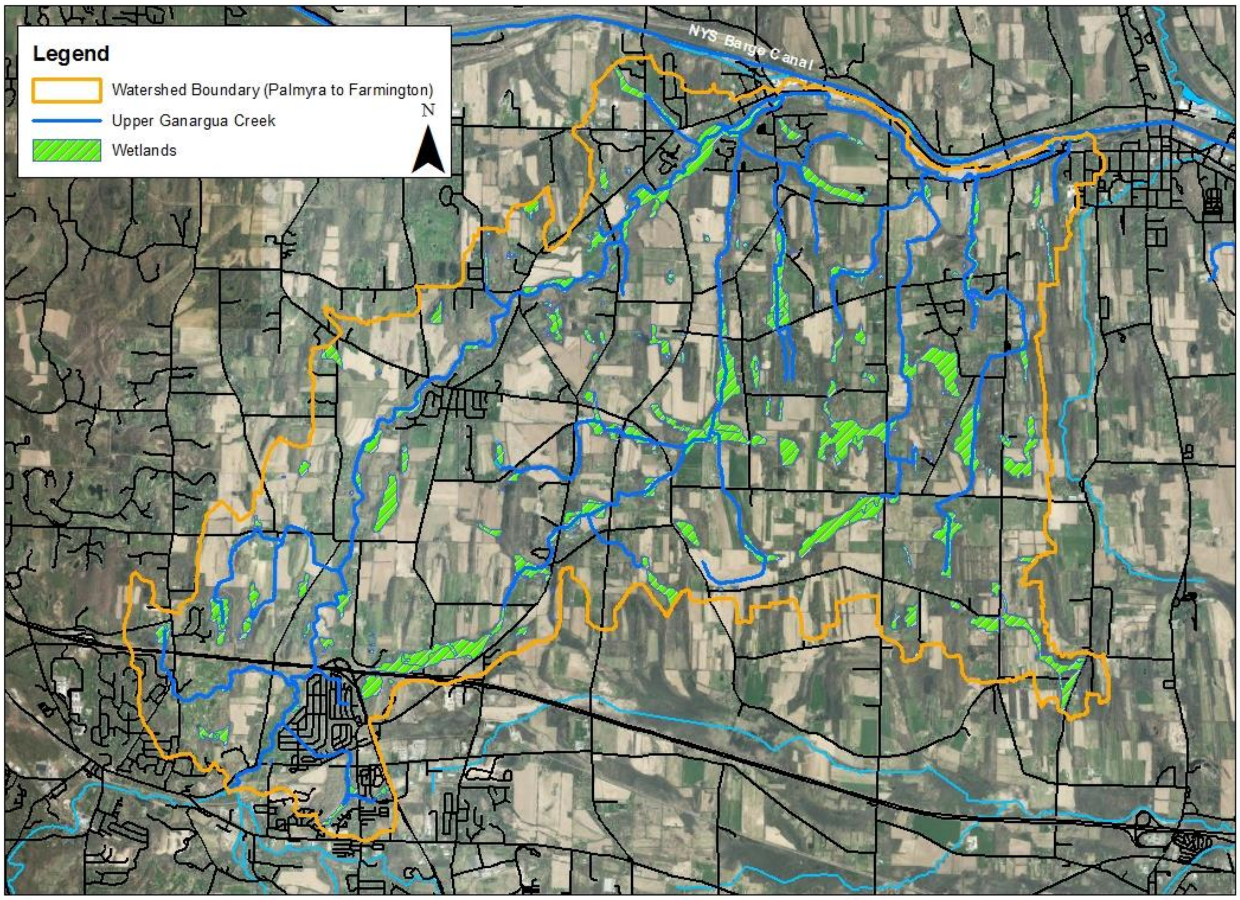
Wetlands may act as a sink for nutrients and sediment, meaning they act as filters. The biological and chemical process of the nitrogen cycle in wetlands causes up to 90% to be removed.

Phosphorus enters wetlands as dissolved phosphorus or attached to suspended solids. Its removal occurs through uptake by plants, and chemical reactions with soil and soil components. However, wetlands can become saturated with phosphorus and may release it from the system. This loss of phosphorus from wetlands occurs in late summer, early fall and winter as organic matter decomposes causing low oxygen conditions.

Wetlands filter suspended solids from water that comes into contact with wetland vegetation. The plants also create friction on water flow, slowing movement, thus allowing suspended material to settle.

The Upper Ganargua Creek watershed has approximately 1,678 acres of NYSDEC regulated wetlands consisting of forest/shrub wetlands, ponds, lakes, emergent wetlands, and riverine wetlands. Wetlands in NYS are protected by the Freshwater Wetlands Act (1975) “with the intent to preserve, protect and conserve freshwater wetlands and their benefits, consistent with the general welfare and beneficial economic, social and agricultural development of the state.”

Figure 6. Freshwater Wetlands of Upper Ganargua Creek Watershed.



WATER QUALITY ISSUES AND RECOMMENDATIONS

Point Sources

State Pollution Discharge Elimination System (SDPES) permit is designed to control point source discharges to groundwaters and surface waters.

Wastewater

Town of Macedon operates a SPDES-permitted wastewater treatment plant (WWTP) in the UGC watershed. The facility is located on State Route 31 in the Town of Macedon. Due to aging of the facility and the infrastructure, the Town of Macedon has entered into an intermunicipal agreement with the Wayne County Water and Sewer Authority, Town of Marion and the Village of Palmyra to explore options and funding opportunities for the establishment of a Regional Wastewater Treatment Plant that would serve the three communities. The new facility would be located adjacent to the existing Palmyra WWTP. This would eliminate any adverse impacts that the Macedon facility may have had on the water quality of UGC. Water quality data from site UGC 02, located east of the WWTP, had significantly elevated concentrations of nutrients and sediment during both non-event and event conditions. Results from monitoring site UGC 03, upstream of the WWTP, generally had slightly lower concentrations of nutrients and sediment compared to that of UGC 02, suggesting that there is are possible sources between the two sites. The WWTP may be a source contributing to the stream at UGC 02.

There is mobile home park located of the Yellow Mills Road in the Town of Macedon that submitted a request for renewal of a SPDES permits in March 2018. No current information could be found on this facility. The facility is described as 'Sanitary services' with a flow rate of 0.0050 million gallons per day. This facility is located immediately adjacent to a direct tributary of Ganargua Creek, represented by sampling site CRK 01. NYS regulations require that septic leach/absorption fields have to be a minimum of 100 feet away from a waterbodies mean high water mark. This particular facility is possibly located within less than 50 feet of the tributary. Any deficiencies to the system's performance would have a negative effect on water quality.

Nonpoint Sources

Agriculture Nonpoint Source Pollution

Cropland

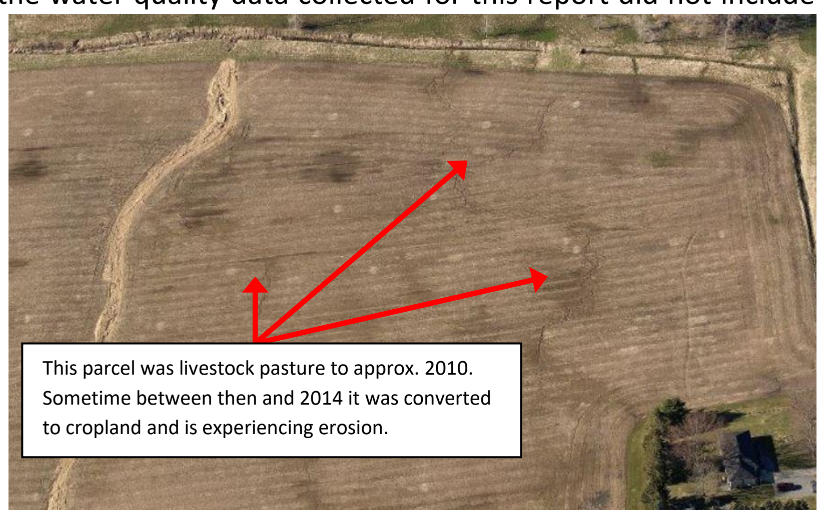
Cropland in the Upper Ganargua Creek watershed consist of approximately 9,067 acres, roughly 46% of the total watershed (19,634 acres excluding Great Brook, Fish Creek, and Mud Creek). There are two subcategories of cropland recognized in New York State: cultivated and non-cultivated. Cultivated cropland involve row crops or close-grown crops. Non-cultivated cropland includes permanent hay land and horticultural cropland (fruit, nut, vineyard crops and nurseries). "*Cropland*" used above in "*Land Use*" is composed of cultivated cropland. Orchards and Nursery are bundled with "*Hay/Pasture*" land use category.

Cultivated cropland is the dominant land use in the Upper Ganargua Creek watershed. By no means does this prove that it is solely responsible for degradation of water quality. It means that significant consideration should be made regarding conservation practices.

Cropland activities have the potential to contribute to nonpoint source pollution. Application of commercial fertilizer to cropland can introduce surplus nitrogen and phosphorous to surface or groundwater. When excess nutrients are introduced to natural waterbodies through runoff, they can potentially increase the "productivity" of the water system, referred to as eutrophication.

Pesticides and herbicides can be transported to surface and groundwater through runoff and/or soil infiltration. Chemicals that are resistant to degradation can persist in natural waterbodies and can bioaccumulate in aquatic organisms. This can result in chemicals biomagnifying through the food chain. As noted above, the water quality data collected for this report did not include the analysis of pesticide or herbicide components.

The cultivation of croplands destabilizes soils and can lead to excess soil erosion and sedimentation in a waterbody. Soils eroded from cropland often contain nutrients which further impact water quality in the receiving waterbodies. Salts


This parcel was livestock pasture to approx. 2010. Sometime between then and 2014 it was converted to cropland and is experiencing erosion.

produced from natural weathering of soil can also be transported in runoff, which can negatively affect water quality.


Above: 6/11/2019, No cover crop on cropland parcel, located approx. 0.5 mile upstream of Site ALD 01. Results for 6/11/2019, after 0.7 inches of rain the night before, had TSS concentration of 34.0 mg/L, which was 2.7 times more than the mean, event TSS concentration (Appendix III).

Where manure is applied to cropland, there is a possibility of excessive concentrations of pathogens and nutrients entering adjacent waterbodies through surface or ground water. Soil characteristics, soil types, crops grown, amount of manure applied, rate of application and seasonal timing of application determine the potential for adverse impacts to water quality.

To address pollutants caused by cropland activities, Best Management Practices (BMPs) can be designed to either prevent runoff or to treat polluted runoff before it reaches a waterbody.

The simplest BMP to use for cropland activities is sound farm administration and planning. Whole-farm planning is the holistic approach to farm management used to identify and prioritize issues on a farm without compromising the farm business. Often for administrative BMPs to be successful, they require the implementation of structural BMPs.

Structural BMPs for cropland have the goal of improving water quality in waterbodies adjacent to cropland by preventing excessive erosion and intercepting and filtering possibly contaminated runoff. Cropland BMPs that can be used to meet this goal includes:

- Nutrient management planning;
- Crop rotation;
- Strip cropping;
- Contour farming;
- Cover cropping;

- Inter-seeding cover cropping;
- Residue management;
- Vegetated filter strips;
- Grassed swales (picture);
- Riparian buffers;
- Diversions;
- No-till/conservation tillage;
- Water and sediment control basin; and
- Grade stabilization structures.


Cover crop of Sorghum-sudangrass


Grassed waterway with heavy use access road


Wayne Co. SWCD's No-Till Drill

In many situations, the use of multiple BMPs may be needed to reduce nonpoint source pollution on agricultural operations. The appropriate BMP(s) to implement can be dependent on numerous onsite factors (climate, topography, installation costs, etc.) and may require management from a natural resource professional. Management and conservation plans should contain BMPs that are most applicable to the farm location, with each practice functioning with all others to achieve the operation’s goals.

Livestock

Livestock production is an important component of the agricultural economy of Wayne County, comprising 24% of the county’s 179,000 acres of farmland. Depending on management, livestock operations can either degrade or contribute to the quality of natural resources. Livestock operations that can contribute nutrients and sediment to UGC include grazing, animal feeding operation and animal waste.

Overgrazing of livestock exposes soils, increases erosion, encourages invasive species colonization, destroys aquatic habitat and destroys streambank and floodplain vegetation.

Animals with direct access to streams can degrade water quality by excreting manure directly into the stream and by disturbing streambank stability. Vegetation along a stream corridor is necessary for wildlife habitat and water quality filtration. Over used grazing lots can be devoid of vegetation and saturated with animal waste. These areas are susceptible to causing contaminated runoff of nutrients and sediment.

To reduce the negative impacts of overgrazing on water quality, farmers can adjust grazing intensity, exclude livestock from sensitive areas, provide alternative sources of water and shade, and promote the revegetation of damaged areas.

Confined animal systems for beef and dairy cattle, swine and poultry have greatly increased farm production efficiency, but this concentration of animals can bring about water resource concerns. Contaminated runoff from these operations can contain excessive amounts of nutrients, pathogens and sediment. Such operations have to manage manure in the confinement areas and utilize/dispose of manure in an appropriate way.

Pollution of surface waters is not the only concern associated with livestock manure. Manure applied to agricultural land can be beneficial because of its nutrients and soil building characteristics, but over-application may lead to groundwater contamination, especially nitrate and fecal coliform bacteria. This is a significant concern to rural areas where residential drinking water comes from wells.

Livestock operations, including beef and horses, are found in various parts of the watershed. These farms can be found in the subwatersheds of sampling sites TRP 01 and ALD 01, and between UGC 05 and UGC 06. The water quality results observed during this report may be a result of activities associated with livestock production. The District may use the information acquired from this report to gauge landowner interest in becoming involved in the available conservation programs.

Farm operations identified during the course of this assessment will not be identified by name in this publication to maintain producer privacy but will be contacted through the SWCD.

The following sections of this publication briefly describe best management practices (BMP) for activities associated with livestock operations. Some the farms in this watershed have already implemented a variety of these practices.

Managing livestock grazing land to protect water quality and aquatic and riparian habitat should include the following measures:

- Improving and/or maintaining the health of a stable and desired forage plant community that, at the same time, stabilizes soil and improves water quality;

- Ensure adequate residual vegetative cover (Pasture picture);
- Provide adequate regrowth time and rest for plants;
- Excluding livestock from riparian zones and wetlands using fencing and, where necessary, providing stable stream crossings;
- Determining a grazing system for each individual farm;
- Providing water facilities away from streams; and
- Stabilizing heavily used areas (Access Road/Heavy Use Area).


Pasture Lot with Fencing


Heavy Use Area Stabilization

Animal feeding operations (AFOs) should be managed to minimize impacts on water quality and public health. To meet this goal, management of AFOs should address the following:

- Divert clean water away from feedlots and holding pens, animal manure and manure storage systems;
- Prevent seepage of contaminated effluent into ground and surface water;
- Provide adequate, safe storage of animal manure (Manure Storage);
- Apply manure to farmland in accordance with a nutrient management plan;


Manure spreading on a perennial vegetation

- Land receiving manure should be managed to minimize the movement of nutrients and organic material and buffer/treat runoff;
- Operators should document the quantity of waste produced and its utilization/disposal; and
- Deceased animals should be managed so to not adversely affect ground and surface waters.

Numerous BMPs can be implemented to achieve the management efforts stated above. The most recent practices used by Wayne County SWCD include:

- Roof runoff management (Barnyard);
- Diversions channels;
- Heavy use area protection;
- Waste storage facility (Manure Storage); and
- Vegetated filter strips.


Barn Yard and Heavy Use Area

The livestock operations observed during this watershed assessment exhibited varying degrees of water resource concerns. These farms could strongly benefit from the management practices stated above.

NYS Department of Agriculture and Market's *Agricultural Environmental Management* (AEM) program is a specific program that addresses nonpoint source pollution associated with agriculture. AEM is a voluntary, incentive-based program that provides farmers with technical assistance to help plan and implement conservation practices to meet business objectives and that address natural resource concerns. Wayne County SWCD, the local AEM resource professional, has over 300 agricultural operations enrolled in the program since 2005. Eight (8) farms within the Upper Ganargua Creek watershed are enrolled in the AEM 5-tier approach. By participating in AEM, agricultural operations can document environmental stewardship and further improve contributions to the community, economy, and environment.

More detailed information regarding AEM can be found at:

http://www.agriculture.ny.gov/SoilWater/aem/index.html

Stormwater Runoff

Stormwater runoff is rain or snowmelt that flows over land and does not percolate into the soil. It occurs naturally from almost any type of land surface, especially during larger storm events. Impervious surfaces such as roads, sidewalks, parking lots and roofs can significantly alter the natural hydrology of the land by increasing the volume, velocity and temperature of runoff and by decreasing its infiltration capacity.

US EPA regulation, commonly known as Stormwater Phase II, requires permits for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas. MS4 Permittees are required to develop Stormwater Management Program (SWMP) and submit annual reports to the DEC. The SWMP is designed to reduce the amount of pollutants carried by stormwater during storm events to waterbodies to the "maximum extent practicable" (NYS DEC).

The northern portion of the Upper Ganargua Creek watershed includes part of the Town of Macedon's MS4 system, specifically the Route 31 corridor and adjacent residential developments. MS4 stormwater programs have 6 elements, or minimum control measures (MCMs), that are expected to result in a pollutant discharge reduction when implemented together. The MCMs are as follows:

1. Public Education and Outreach- distribution of educational material to inform citizens about the impact of stormwater runoff.

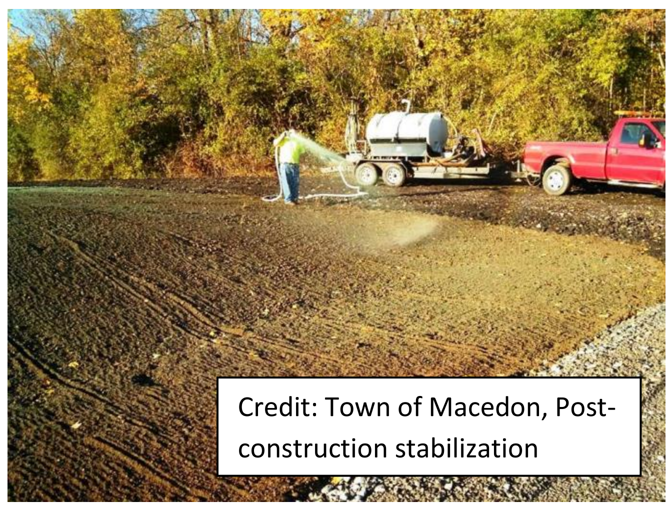
2. Public Participation/Involvement- provide opportunities for citizens to participate in water quality improvement programs.

3. Illicit Discharge Detection and Elimination- actively search, identify, and correct any potential illicit discharges.

4. Construction Site Runoff Control- develop, implement, and enforce a sediment and erosion control program for construction site activities.

5. Post-Construction Stormwater Management- develop, implement, and enforce a program to address discharges of post-construction stormwater runoff from new development.

Credit: Town of Macedon, Construction site runoff control



Credit: Town of Macedon, Post-construction stabilization

6. Stormwater Management for Municipal Operations- develop and implement a program that reduces or prevents pollutant runoff from municipal operations.

As illustrated by the water quality analysis above, the elevated levels of nutrients and sediment in the main channel of the creek may indicate a need for improvements to managing stormwater.

As more and more natural areas are developed for commercial or residential uses, natural stormwater conveyance systems are disrupted or replaced with manufactured structures. Man-made or –manipulated conveyance systems usually prioritize moving stormwater away as fast as possible, bypassing the potential for infiltration. Green Infrastructure (GI) uses practices that mimic natural conveyance systems to manage stormwater. Examples of GI practices include:

- Rain gardens;
- Vegetative swales;
- Bioretention areas;
- Rain barrels; and
- Pervious pavement.

Green Infrastructure practices would prove to be very beneficial in what used to be known as the Village of Macedon and also in the residential neighborhoods of the MS4 boundaries. These are where the most impervious surfaces occur in the watershed. GI practices could become community pride events involving all ages of residents. Town buildings and parks provide numerous opportunities to install practices that are appealing, educational and benefit water quality. Commercial properties could be seen as taking a vested interest in the community by implementing GI and they could use the event as a team building exercise for employees.

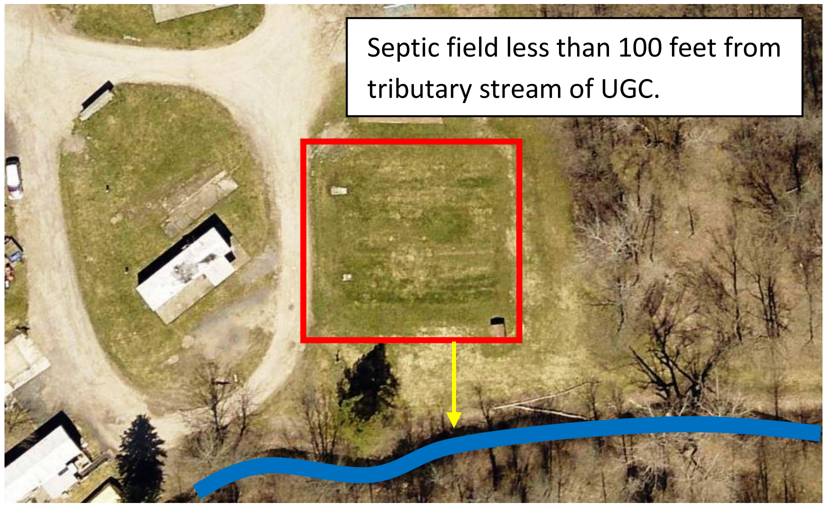
Educating the public on the importance of GI and how they can use certain practices for their own benefit will improve to overall appeal of the community, while also protecting water resources.

> For example: A rain garden can be installed to collect and absorb runoff from rooftops, sidewalks, and streets, while increase the 'curb appeal' of a home. The water-tolerant plants of the rain garden also act as habitat and food for birds and pollinators. Community groups could be used to promote, coordinate and implement GI practice in the residential neighborhoods.
>
> Potential stormwater runoff from the commercial properties in the former village area would result from impervious land cover (parking lots, roofs). Those location with close proximity to surface waterbodies should provide adequate buffer space. Potentially contaminated runoff could also be rerouted away from sensitive areas to locations where it could be absorbed and filtered into the ground.

Onsite Wastewater Systems (Septic)

Sewage is a source of both phosphorus and nitrogen. As stated above, concentrations of these nutrients were found at elevated and varying levels throughout the watershed. Septic system failure may be attributed to a number of causes including damaged distribution pipes, saturated soils, improper location and poor design/installation. A system could be perfectly designed but still contribute excess nutrients to a waterbody simply by being in a close proximity to said waterbody. NYS regulations require that septic leach/absorption fields have to be a minimum of 100 feet away from a waterbody's mean high-water mark. These septic systems would pose the immediate attention in identifying contributing sewage sources. Researchers at SUNY College of Brockport and Cornell University have evaluated the use of aerial imagery in identifying and mapping septic fields in NYS watersheds (Richards et al. 2016). Under optimal conditions (no canopy cover or shadows), the researchers were able to identify over 80% of the systems in an observed watershed. They were able to identify systems that were located less than 100 feet from surface waters and produced maps of septic field “hotspots”, or areas of high septic system concentration. Thus, the importance of septic management should not be overlooked.

A small number of systems were identified along the riparian corridors of UGC using aerial imagery. Of those observed, a majority of the drain fields appeared to be in conformance with minimum separation distant for a waterbody. More use of this technique and improvements in aerial imaging will ultimately advance the user’s ability and confidence with it.



The lack of an adequate system, lack of routine maintenance, increased density of homes served by septic systems, undersized/overused systems and the installation on unacceptable land conditions can lead to onsite system failure and water quality impacts.

A typical septic system consists of a septic tank and a drainfield, or soil absorption field. The following are signs that a septic system is failing:

- Wastewater backing up into household drains;
- Bright green, spongy grass on the drainfield, even during dry weather;
- Pooling water or muddy soil around your septic system or in your basement; and
- A strong odor around the septic tank and drainfield.

Successful upkeep of a septic system should include:

- Inspect and pump frequently: The average household septic system should be inspected at least every three years by a septic service professional and is typically pumped every three to five years.
- Water efficiency: Efficient water use can improve the operation of a septic system and reduce the risk of failure.
- Proper waste disposal: Septic systems are designed to process only human waste and bath tissue. Disposing of chemicals and/or pharmaceuticals via toilets or drains can damage the living organisms that digest and treat septic system waste.
- Drainfield maintenance: Avoid driving across or parking on the drainfield. Avoid planting trees near the leach lines. Keep roof drains, sump pumps, and other rainwater drainage systems away from the drainfield area.

Streambank Erosion

Erosion of a stream channel is a natural process for any stream system. Streams constantly change, adjust, and move. The natural movement is often incompatible with development and infrastructure. The question then arises to take corrective action or to allow the stream to re-establish a dynamic equilibrium with in the floodplain.

During high flow conditions, excess water in the stream results in more energy than the stream can expend. This increased energy is dispersed by eroding material from the channel. The eroded material typically makes up a minor component of the stream's sediment load. The erosion can be accelerated by man-made drainage practices and unsuited stabilization practices.

Upper Ganargua Creek has a number of areas exhibiting streambank erosion. Some of these threaten personal property and road beds. Wayne County SWCD identified 23 streambank erosion sites from Allen Padgham Rd (upstream) to the creek's outlet at Aqueduct Park in Palmyra. Each site will require further assessment to prioritize potential projects.

Streambank protection projects are primarily designed to protect the adjacent property. There are numerous techniques that can be used to protect the bank against erosive forces. The techniques implemented will be site-specific and can vary in cost. Each project needs to be evaluated thoroughly before installing a protection technique. The appropriate technique can be categorized as Vegetative or Structural methods.

Vegetative methods include:

- Wattle/Fascines
- Brush Layering/Branch Packing
- Brush Mattress
- Live Staking
- Vegetated Geogrids
- Live Cribwall
- Coconut Fiber Rolls
    - Live Siltation

Structural methods include:

- Rock Riffle
- Tree Reventment
- Log/Rootwad/Boulder Reventment
- Rock Riprap
- Stream Barbs/Bendway Weir
- Dormant Post Plantings

Some situations may require to use of multiple techniques. Whichever streambank protective measures are used, there is no guarantee that it will succeed unless the underlying cause of the erosion problem is identified and addressed. Installing a protective measure may even create or amplify erosion somewhere else. Stream management is successful when it is based on working with the stream, not against it.

CONCLUSION

Water is one of our most precious natural resources. As populations increase and development expands to meet the demands of more people, it places a harmful strain on our waterbodies. It is imperative that these natural systems are maintained in a way where they can continue to support their ecosystem. Watershed management is a tool to evaluate and address how a waterbody responds to human activities.

A significant portions of Upper Ganargua Creek's watershed is composed of rural and agricultural land use, making the management of the associated nonpoint sources of pollution important. Managing runoff from grazing land, animal feeding lots and cultivated cropland would prove beneficial to the ecology of the stream. The remediation of aging infrastructure of the Macedon WWTP to a new regional WWTP would eliminate any adverse impacts the facility may be contributing to degraded water quality. Municipal stormwater runoff management in the watershed have and will continue to promote beneficial actions that the community can take to promote water quality and stream health. Land uses in the watershed have changed the flow regime of the creek and accelerated the natural migration of the stream to a point where it may impact infrastructure and personal property by eroding streambanks

Land development expansion and agricultural operations within the watershed are not likely to end in the near future. It becomes imperative to manage these land use activities in a whole watershed approach to protect water resources. Irresponsible management of lands can degrade the water quality and aquatic ecosystem of Upper Ganargua Creek and its tributaries. Protection of water resources is dependent on not just a single entity but an entire watershed community. This assessment is intended to summarize water resource issues within the watershed and to improve awareness of them. It is the duty of landowners within the watershed to be stewards of this stream so that future generations may enjoy it.

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APPENDIX I. NYS DEC PRIORITY WATERBODY LIST DATA SHEET

Ganargua Creek, Upper, and minor tribs (0704-0013) MinorImpacts

Waterbody Location Information

Revised: 08/09/2007

Water Index No:	Ont 66-12-52-23			**Drain Basin:**	Oswego-Seneca-Oneida
Hydro Unit Code:	04140201/160	**Str Class:**	C		Seneca/Clyde Rivers
Waterbody Type:	River			**Reg/County:**	8/Wayne Co. (59)
Waterbody Size:	67.1 Miles			**Quad Map:**	MACEDON (I-11-3)
Seg Description:	stream and selected tribs, from Palmyra to Victor				

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
Aquatic Life	Stressed	Known

Type of Pollutant(s)

Known: NUTRIENTS (phosphorus)
Suspected: Silt/Sediment
Possible: D.O./Oxygen Demand, Ammonia

Source(s) of Pollutant(s)

Known: CONSTRUCTION (development), URBAN/STORM RUNOFF
Suspected: Agriculture, Municipal
Possible: - - -

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 4 (Source Identified, Strategy Needed)
Lead Agency/Office: ext/WQCC
Resolution Potential: Medium
TMDL/303d Status: n/a

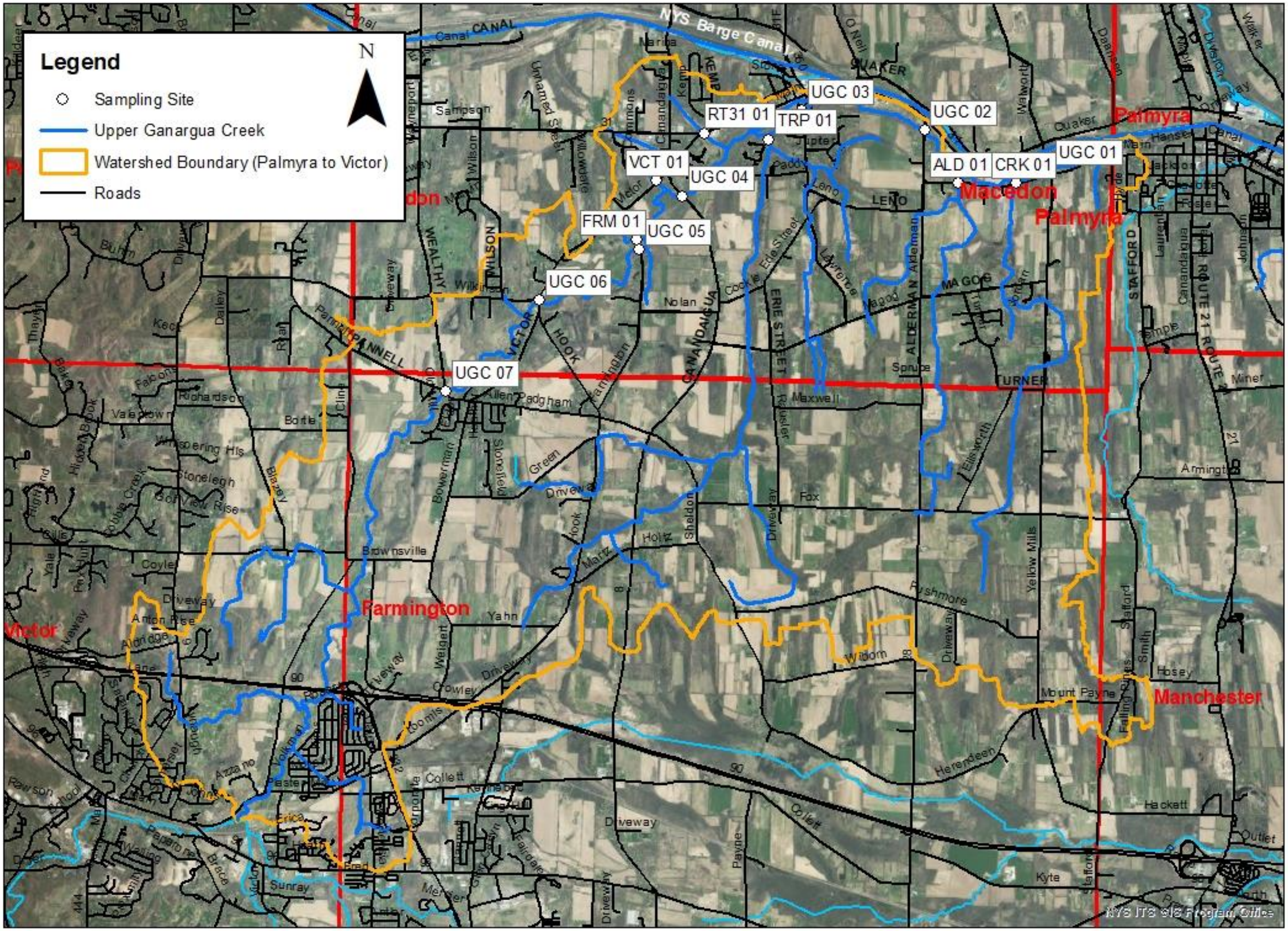
Further Details

Aquatic life support in this portion of Ganargua Creek is known to experience minor impacts due to nutrients from primarily nonpoint sources. Impacts from municipal discharges had been identified in the past, but additional sampling is recommended to determine the whether these impacts continue.

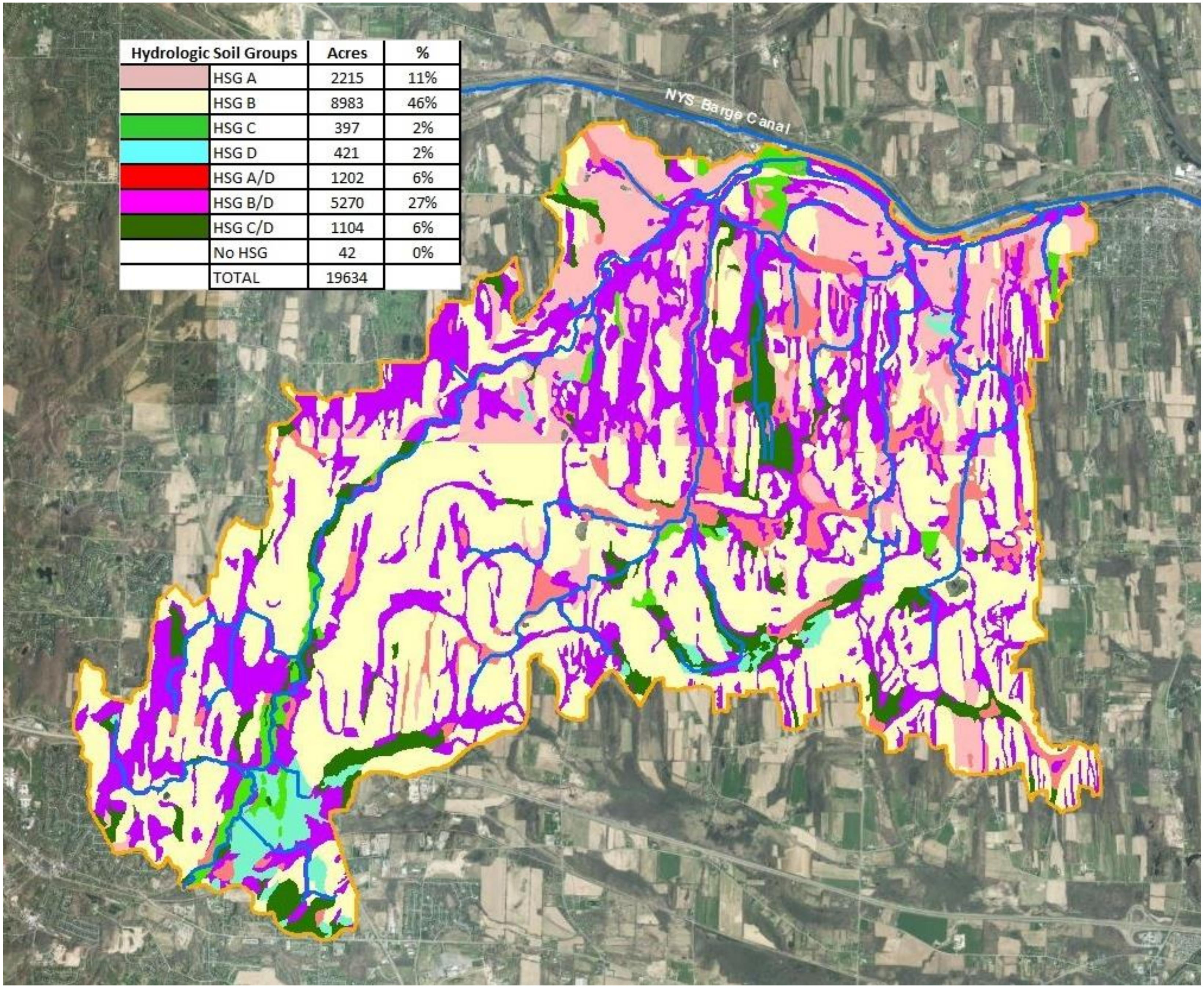
NYSDEC Rotating Intensive Basin Studies (RIBS) Intensive Network monitoring of Ganargua Creek in Macedon, Wayne County, (at Erie Road) was conducted in 2002. Intensive Network sampling typically includes macroinvertebrate community analysis, water column chemistry, sediment and invertebrate tissues analysis and toxicity evaluation. During this sampling the biological (macroinvertebrate) sampling results indicated slightly impacted water quality conditions. The impacts are attributed to nonpoint source nutrient enrichment. Water column sampling revealed dissolved solids and iron to be parameters of concern, however these finding are thought to be more reflective of natural conditions in the basin than a source of water quality impacts. Toxicity testing of the water column showed significant mortality and reproductive impacts in one of the three tests conducted. (DEC/DOW, BWAM/RIBS, January 2005)

APPENDIX II. DETAILED MAPS

Upper Ganargua Creek 2018-19 Sampling Sites

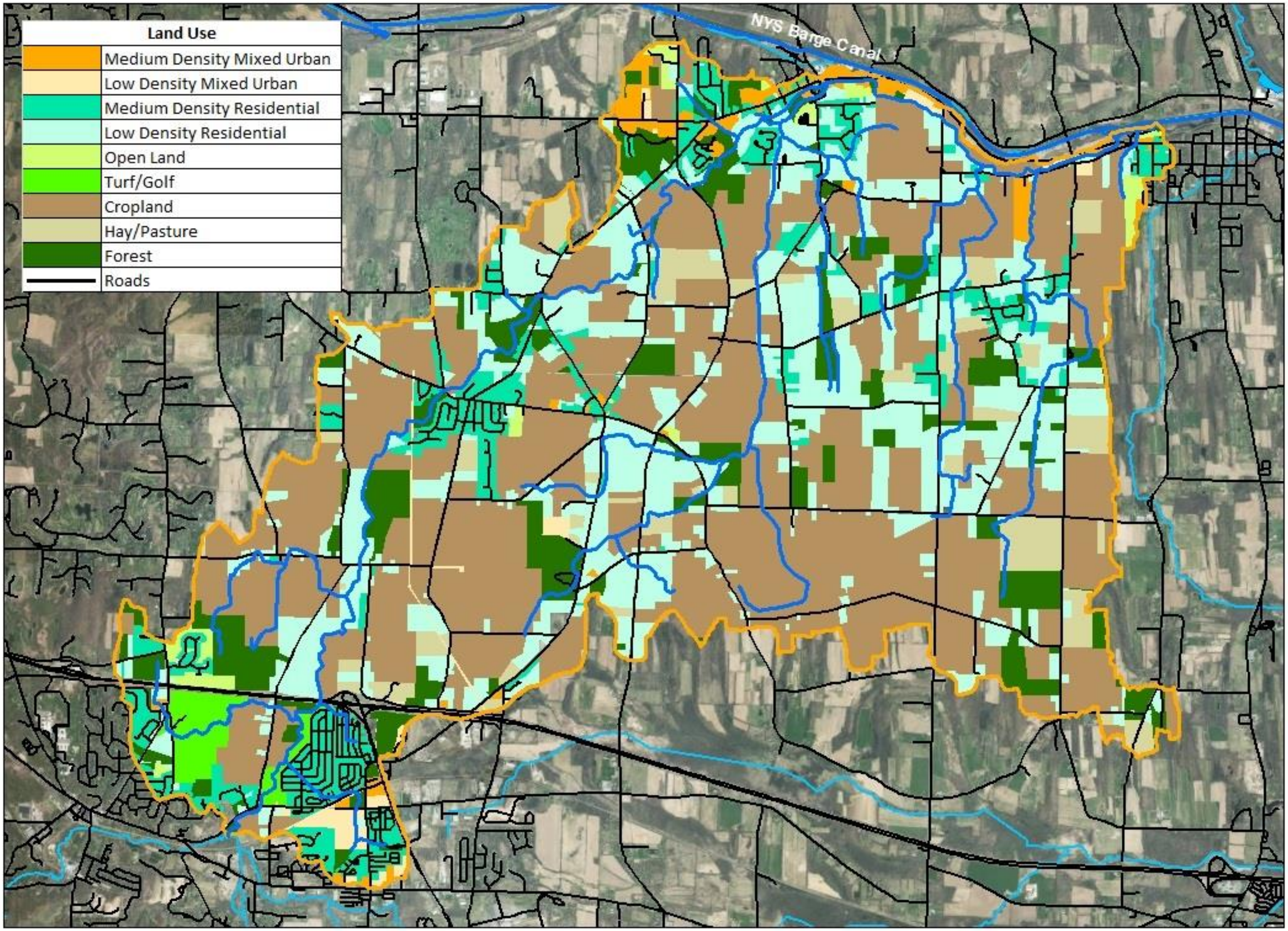


Upper Ganargua Creek Hydrologic Soil Groups

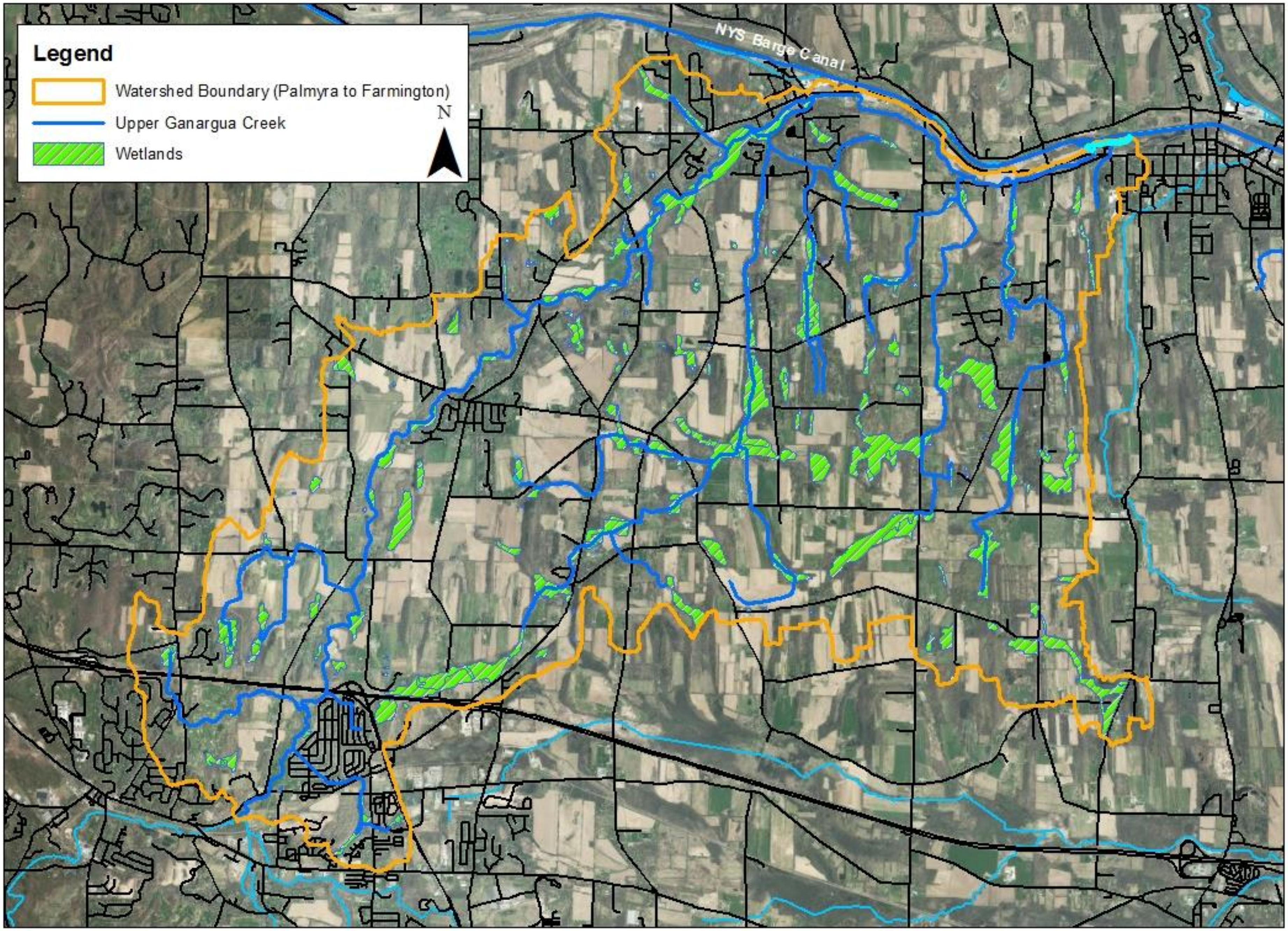


Hydrologic Soil Groups		Acres	%
	HSG A	2215	11%
	HSG B	8983	46%
	HSG C	397	2%
	HSG D	421	2%
	HSG A/D	1202	6%
	HSG B/D	5270	27%
	HSG C/D	1104	6%
	No HSG	42	0%
	TOTAL	19634	

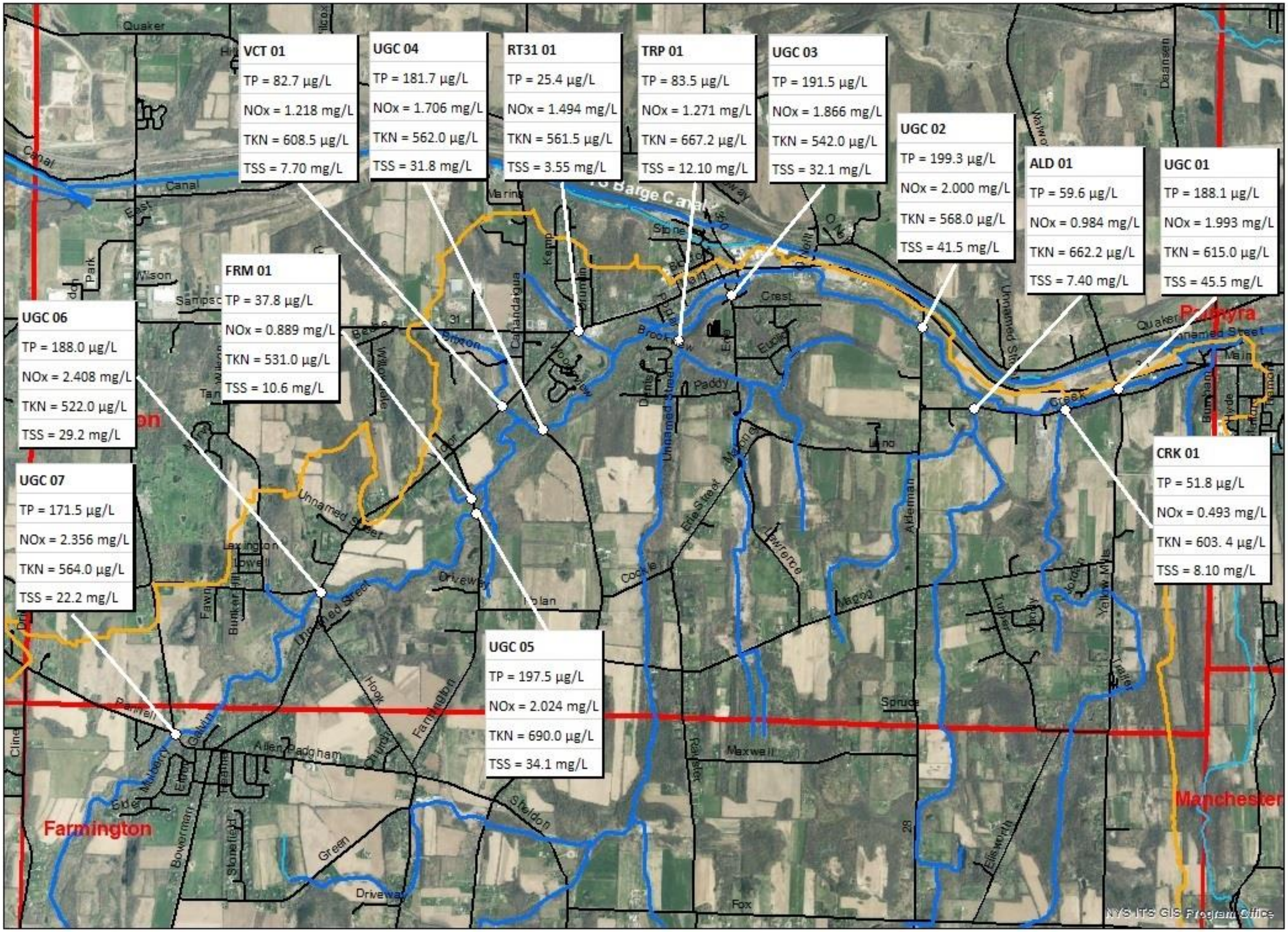
Upper Ganargua Creek Land Use


Land Use
Medium Density Mixed Urban
Low Density Mixed Urban
Medium Density Residential
Low Density Residential
Open Land
Turf/Golf
Cropland
Hay/Pasture
Forest
Roads
NYS Barge Canal

Upper Ganargua Creek Wetlands

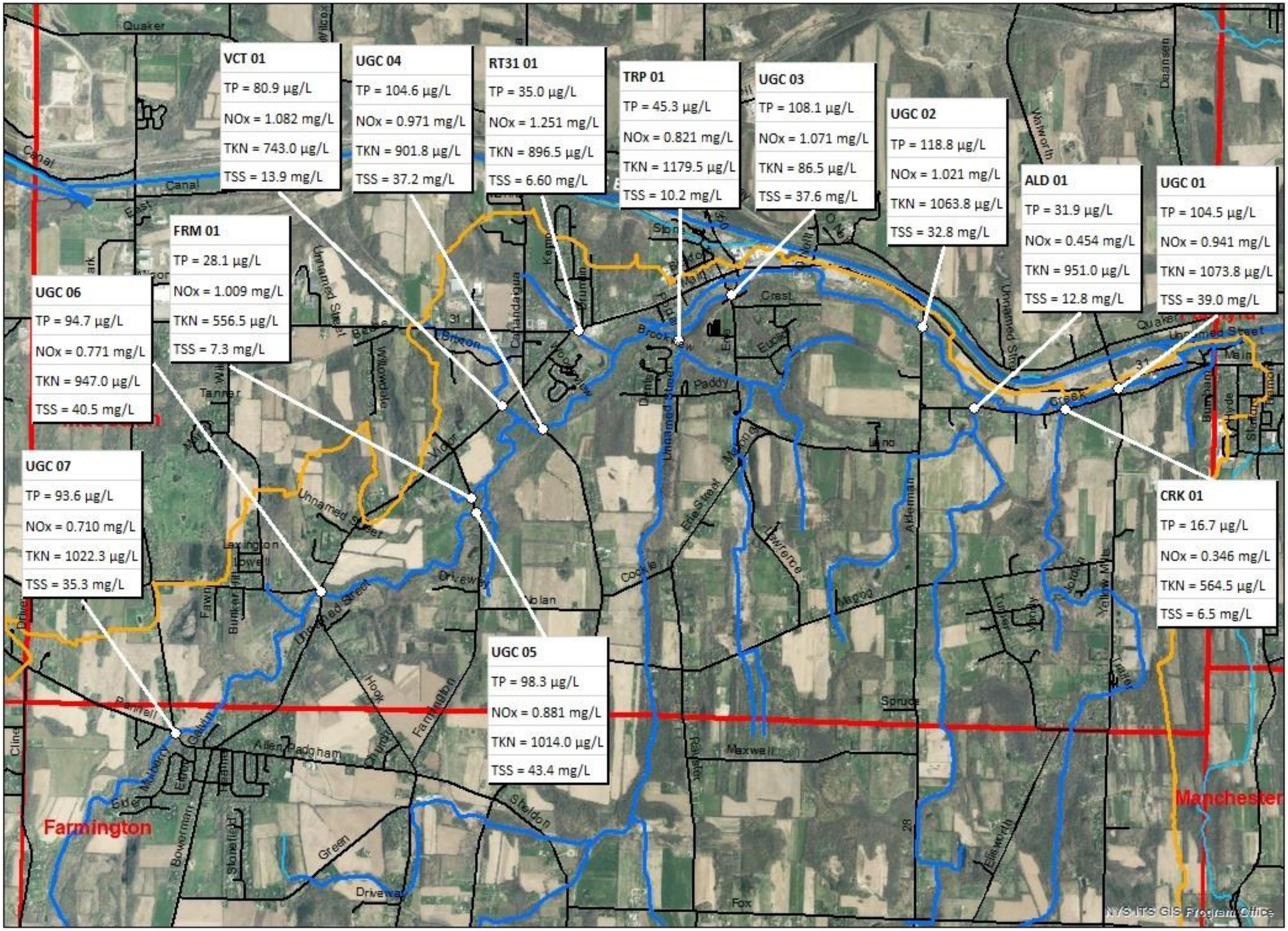


Mean, Non-event Concentrations for Upper Ganargua Creek, 2018-19; TP = total phosphorus, NOx = nitrate-nitrite, TKN = total Kjeldahl nitrogen; TSS = total



suspended solids

Mean, Event Concentrations for Upper Ganargua Creek, 2018-19; TP = total phosphorus, NOx = nitrate-nitrite, TKN = total Kjeldahl nitrogen; TSS = total suspended solids


VCT 01
TP = 80.9 µg/L
NOx = 1.082 mg/L
TKN = 743.0 µg/L
TSS = 13.9 mg/L
UGC 04
TP = 104.6 µg/L
NOx = 0.971 mg/L
TKN = 901.8 µg/L
TSS = 37.2 mg/L
RT31 01
TP = 35.0 µg/L
NOx = 1.251 mg/L
TKN = 896.5 µg/L
TSS = 6.60 mg/L
TRP 01
TP = 45.3 µg/L
NOx = 0.821 mg/L
TKN = 1179.5 µg/L
TSS = 10.2 mg/L
UGC 03
TP = 108.1 µg/L
NOx = 1.071 mg/L
TKN = 86.5 µg/L
TSS = 37.6 mg/L
UGC 02
TP = 118.8 µg/L
NOx = 1.021 mg/L
TKN = 1063.8 µg/L
TSS = 32.8 mg/L
ALD 01
TP = 31.9 µg/L
NOx = 0.454 mg/L
TKN = 951.0 µg/L
TSS = 12.8 mg/L
UGC 01
TP = 104.5 µg/L
NOx = 0.941 mg/L
TKN = 1073.8 µg/L
TSS = 39.0 mg/L
FRM 01
TP = 28.1 µg/L
NOx = 1.009 mg/L
TKN = 556.5 µg/L
TSS = 7.3 mg/L
UGC 06
TP = 94.7 µg/L
NOx = 0.771 mg/L
TKN = 947.0 µg/L
TSS = 40.5 mg/L
UGC 07
TP = 93.6 µg/L
NOx = 0.710 mg/L
TKN = 1022.3 µg/L
TSS = 35.3 mg/L
UGC 05
TP = 98.3 µg/L
NOx = 0.881 mg/L
TKN = 1014.0 µg/L
TSS = 43.4 mg/L
CRK 01
TP = 16.7 µg/L
NOx = 0.346 mg/L
TKN = 564.5 µg/L
TSS = 6.5 mg/L
Farmington
Manchester
NYS ITS GIS Program Office

APPENDIX III. WATER QUALITY DATA

Non-event Concentrations for Upper Ganargua Creek

UGC 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	42.9	1.520	0.945	575	31.8
5/23/2018	140.6	2.320	1.270	1050	6.9
6/26/2018	188.7	3.770	3.420	350	2.70
8/9/2018	410.4	2.070	1.310	760	182.0
7/16/2019	158.0	3.360	3.020	340	4.2

UGC 02					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	72.7	1.500	1.000	500	33.0
5/23/2018	157.2	2.330	1.440	890	19.2
6/26/2018	191.4	3.240	2.850	390	8.6
8/9/2018	394.1	2.220	1.390	830	143.3
7/16/2019	181.0	3.550	3.320	230	3.4

UGC 03					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	87.0	1.450	1.040	410	15.2
5/23/2018	150.5	2.170	1.360	810	13.5
6/26/2018	193.3	2.900	2.470	430	4.2
8/9/2018	322.5	2.200	1.380	820	119.0
7/16/2019	204.0	3.320	3.080	240	8.4

UGC 04					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	78.6	1..590	1.110	480	29.0
5/23/2018	128.6	1950	1.170	780	4.0
6/26/2018	191.4	2.650	2.290	360	2.8
8/9/2018	312.7	2.140	1.360	780	116.5
7/16/2019	197.0	3.010	2.600	410	6.5

UGC 05					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	77.9	1.610	1.100	990	30.8
5/23/2018	141.9	2.000	1.080	920	9.8
6/26/2018	197.6	3.540	3.180	360	4.4
8/9/2018	358.3	2.220	1.450	770	119.5
7/16/2019	212.0	3.720	3.310	410	6.2

UGC 06					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	86.4	1.660	1.080	580	27.2
5/23/2018	113.6	1.770	1.040	730	4.3
6/26/2018	225.6	4.610	4.230	380	4.0
8/9/2018	286.6	2.240	1.430	810	106.4
7/16/2019	228.0	4.520	4.260	260	4.2

UGC 07					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	43.5	1.700	1.070	630	21.6
5/23/2018	46.8	1.870	1.150	720	5.4
6/26/2018	248.6	4.720	4.290	430	2.0
8/9/2018	276.7	2.120	1.420	700	75.6
7/16/2019	242.0	4.190	3.850	340	6.5

ALD 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	27.2	1.270	0.670	600	4.9
5/23/2018	80.8	1.440	0.590	850	5.4
6/26/2018	26.2	2.190	1.700	490	4.6
8/9/2018	61.8	1.410	0.789	621	9.6
7/16/2019	102.0	1.920	1.170	750	12.4

RT31 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	12.2	2.520	2.230	290	1.3
5/23/2018	38.6	1.590	0.757	833	5.8
6/26/2018					
8/9/2018					
7/16/2019					

CRK 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	17.1	0.846	0.343	503	2.7
5/23/2018	32.1	1.070	0.217	853	5.0
6/26/2018	21.3	1.180	0.820	360	8.7
8/9/2018	37.4	0.998	0.474	524	6.1
7/16/2019	151.0	1.390	0.613	777	17.9

TRP 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	32.0	1.700	1.190	510	1.6
5/23/2018	91.5	1.970	0.775	1195	22.5
6/26/2018	53.5	2.240	1.820	420	15.2
8/9/2018	94.4	1.490	0.789	701	11.2
7/16/2019	146.0	2.290	1.780	510	10.2

VCT 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	25.9	2.550	2.120	430	2.5
5/23/2018	56.8	1.520	0.693	827	5.8
6/26/2018					
8/9/2018	123.8	0.822	0.145	677	4.5
7/16/2019	154.0	3.380	2.880	500	19.7

FRM 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (µg N/L)	TKN (µg P/L)	TSS (mg/L)
4/18/2018	28.2	1.540	1.200	340	18.4
5/23/2018	47.4	1.300	0.578	722	2.7
6/26/2018	52.9	0.251	0.148		5.8
8/9/2018					
7/16/2019					

Event Concentrations for Upper Ganargua Creek

UGC 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	160.3	1.530	0.805	725	89.6
6/4/2018	193.5	2.570	0.181	2389	22.9
5/7/2019	47.3	1.330	0.769	561	9.5
6/11/2019	16.7	2.630	2.010	620	34.0

UGC 02					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	152.1	1.440	0.819	621	69.0
6/4/2018	219.2	2.630	0.195	2435	26.6
5/7/2019	53.8	1.530	0.951	579	5.4
6/11/2019	49.9	2.740	0.2120	620	30.0

UGC 03					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	155.4	1.140	0.842	298	88.0
6/4/2018	217.5	2.490	0.186	2304	25.2
5/7/2019	48.8	1.450	0.976	474	5.3
6/11/2019	10.5	2.710	2.280	430	32.0

UGC 04					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	127.6	1.380	0.883	497	70.7
6/4/2018	214.0	2.280	0.156	2124	29.8
5/7/2019	50.6	1.330	0.914	416	5.1
6/11/2019	26.2	2.500	1.930	570	43.0

UGC 05					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	147.2	1.540	0.853	687	90.3
6/4/2018	188.4	2.240	0.141	2099	38.4
5/7/2019	50.1	1.290	0.790	500	6.0
6/11/2019	7.6	2.510	1.740	770	39.0

UGC 06					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	147.1	1.660	0.894	766	78.3
6/4/2018	157.8	2.080	0.136	1944	36.4
5/7/2019	45.8	1.170	0.722	448	5.3
6/11/2019	28.2	1.960	1.330	630	42.0

UGC 07					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	142.3	0.736	0.876		56.7
6/4/2018	169.7	2.070	0.124	1946	35.6
5/7/2019	48.6	1.150	0.679	471	6.0
6/11/2019	13.7	1.810	1.160	650	43.0

CRK 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	19.0	0.972	0.471	501	2.4
6/4/2018	25.4	0.420	1.090	670	8.1
5/7/2019	12.7	0.653	0.220	433	3.3
6/11/2019	9.8	0.927	0.273	654	12.0

ALD 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	22.3	1.380	0.690	690	5.0
6/4/2018	64.3	1.820	0.980	1722	9.2
5/7/2019	33.7	1.040	0.524	516	3.0
6/11/2019	7.1	1.380	0.504	876	34.0

TRP 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	28.8	.1710	1.130	580	1.2
6/4/2018	111.7	2.770	0.178	2592	19.8
5/7/2019	33.0	1.380	0.844	536	3.6
6/11/2019	7.7	2.140	1.130	1010	16.0

RT31 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	77.9	2.950	1.750	1200	3.4
6/4/2018	41.8	2.100	1.376	724	12.4
5/7/2019	14.3	1.930	1.640	290	4.5
6/11/2019	6.1	1.610	0.890	720	6.0

VCT 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	22.3	2210	1550	660	1.3
6/4/2018	233.6	1410	618	792	38.0
5/7/2019	32.5	1990	1510	480	10.3
6/11/2019	35.1	1690	650	1040	6.0

FRM 01					
Date	TP (µg P/L)	TN (mg N/L)	Nitrate (mg N/L)	TKN (µg P/L)	TSS (mg/L)
3/28/2018	23.9	1.450	0.891	559	12.6
6/4/2018	49.4	1.510	0.988	522	7.0
5/7/2019	28.7	1.620	1.230	390	3.4
6/11/2019	10.5	1.680	0.925	755	6.0