APPLICATION REVIEW Part 1: PROPOSED RESIDENTIAL DEVELOPMENT

EAST OF

CLARK LANE, WATERFORD, CONNECTICUT

IN THE

UPPER FENGER BROOK WATERSHED

APPLICANT: Kingstown Properties, LLC **OWNERS: L & M Archambault**

PREPARED FOR THE WATERFORD CONSERVATION COMMISSION

BY

Carya Ecological Services, LLC **JANUARY 2023**

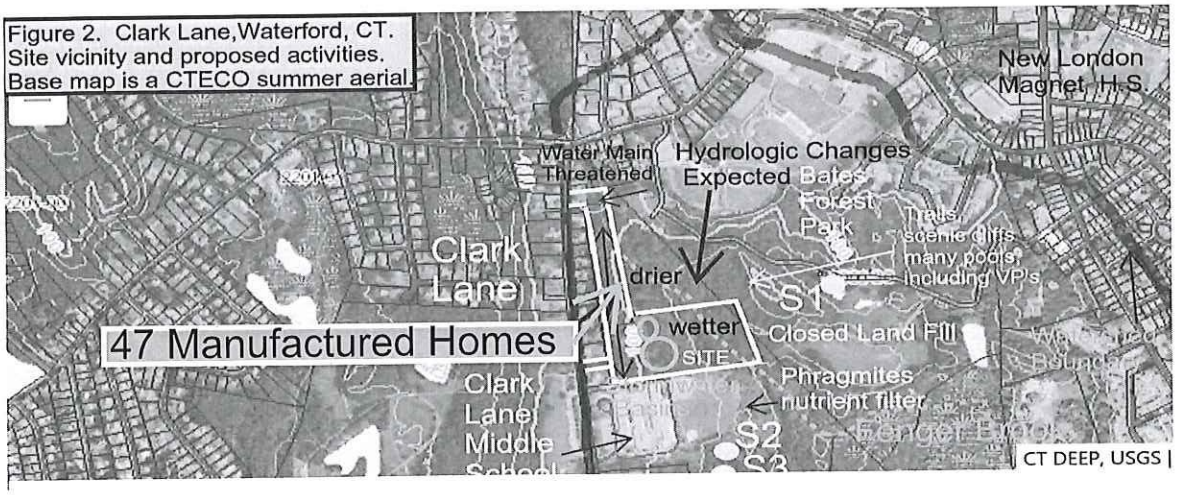

Figure 2. Clark Lane,Waterford, CT. Site vicinity and proposed activities. Base map is a CTECO summer aerial.

C-22-14
109R & 131 CLARK LANE
PUBLIC HEARING
EXHIBIT # 36

Carya Ecological Services, LLC

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January 26, 2023

Conservation Commission, Town of Waterford
15 Rope Ferry Road
Waterford, Connecticut 06385 - 2886

ATTN: Chairman Dimmock and Environmental Planner, Maureen Fitzgerald

RE: ***Application Review, Part 1: App.*** # C22-15. 47-Unit Residential Subdivision, including affordable units; 141 Clark Lane. Owners: L & M Archambault; Applicant Kingstown Properties, LLC

Carya Job No.: 23- WFD 3

Dear Commissioners:

Carya Ecological Services, LLC has conducted a preliminary review of the above-referenced application by Kingston Properties, at the request of several property owners of abutting homes on the east side of Clark Lane, including Arlene Sherman (119 Clark Lane).

1.0 INTRODUCTION

We have reviewed the following sources of information relevant to this application.

1. The most recent set of plans, dated 12-15-22, for this application, prepared by the firm of Provost & Rovero, Inc., offering engineering, surveying, and land planning services. The 21-sheet plan set is available for download on the Town of Waterford web site.
2. The Storm Drainage Report accompanying the plans, dated October 10, 2022
3. The wetland delineation report by soil scientist Joseph Theroux, dated 5-6-22.
4. The Wetland Functions and Values & Impact Analysis by J. Theroux, date 8-11-22.
5. Excerpts of the Technical literature on Stormceptor Pretreatment devices and on the performance of biofiltration basins.
6. Performance Testing Results and design specification for biofiltration basins published by the University of New Hampshire Stormwater Center (2009 and 2012, pp. 20 and 21 in both reports). PDF's may be downloaded from https://www.unh.edu/unhsc/pubs-specs-info .
7. Appendix A of the NY State DEC Stormwater Management Design Manual (Excerpts in Attachment B)[1];

8. Fenger Brook Watershed Management Study, New London and Waterford, 1996. Prepared for Coastal Resources Management, Sea Grant Marine Advisory Program , New Haven, CT.
9. 2015 CTDEEP report on Fenger Brook (CT 2000-30-01) as an impaired portion of the Southeast Shoreline Drainage Area (CT 2000).
10. CTDEEP Fisheries Data from 1993, 2001, and 2010.

Our goal was to evaluate the potential for significant adverse changes to this large, currently well-buffered headwaters wetland system and to downstream regulated resources. These include Alewife Cove, the easternmost cove on the Waterford Shoreline, sensitive to increased nutrient loading. [2] Fenger Brook has overall impairment per the 2015 CTDEEP Report on Connecticut's water resources, but there is no breakdown as to the relative levels of impairment in different segments. Are hydrologic changes reasonably likely to result from the proposed residential project: increased water in wetlands bordering the southern portion by the stormwater discharge, and drier conditions bordering the narrow northern portion? Will the stormwater management system, in particular the bioretention basin, function as intended, preventing increased nutrient loading to the Fenger Brook riparian corridor and the sensitive downstream estuary, Alewife Cove? Significance of impacts is closely tied to the sensitivity and quality of the downgradient wetland resources, under existing conditions, and to functional status.

To make this evaluation, we supplemented the information provided by the applicant with additional natural resource data on the headwaters portion of Fenger Brook, to the extent feasible. We have not yet found recent data on the health and nutrient status of Alewife Cove, key information that should have been provided by the applicant. On Saturday, January 21th, 2023, we conducted a field survey of the site perimeter and downgradient wetland resources, and tested specific conductivity and salinity at several locations, including a station just upstream (north) of Route 1. Local residents were also questioned. Desktop Sources of Natural Resources Data on the site vicinity and the Fenger Brook Watershed included the CTECO website, and the NRCS/USDA web soil survey. The Carya office library has assorted studies and manuals on wetland buffers, stormwater management, functions and values assessment methodology, and potential wetland stressors. The 2020 NY Stormwater Management Design Manual and the University of New Hamshire Stormwater Center Provide guidance on Bioretention Basin Design and Pollutant-loading data.

2.0 EXISTING CONDITIONS

Carya water quality testing results, shown in Table 1 in Attachment A, showed that upper Fenger Brook does not currently have elevated levels of nutrients or salt; specific conductivity was only 146 uS/cm and salinity was 0.1 ppt at the station is just upstream of Route 1. Readings within interior

[2] The 1996 Management Study of the Fenger Brook Watershed prepared by Sea Grant may be found in Attachment 3.. It emphasies the importance and vulnerability of Alewife Cove.

wetlands were also very low. One station did have elevated salinity and conductivity readings (4 ppt and 549 uS/cm), in a small, west-flowing tributary to Fenger Brook, about 250 feet downgradient (east) of the three-story apartment building just south of Clark Middle School. However, without additional data on nutrient concentrations, the reason for the elevated specific conductivity is not known. (Low electrical conductivity means unimpaired water, but conductivity can be elevated due to a variety of dissolved constituents.) Note that the 2015 CTDEEP report did find impairment, but did not specify locations, likely south of Route1 in the lower watershed.

If upper Fenger Brook were significantly impacted by leachate from the closed New London landfill (west of the subject site) the conductivity reading just north of Route 1 would have been much higher. Perhaps this expected nutrient source has diminished since 2015. Otherwise, good water quality is not surprising, in view of breadth of the protected forested open space in the headwaters of Fenger's Brook, about 2/3 mile wide near the subject site. Fortunately, the watershed of this brook does not include the dense residential development along the Thames River and to the west of Clark Lane, as shown in Figures 1 and 2.

Mr. Theroux provided good information on the hydrologic characteristics and functions of the very long swath of wetlands immediately adjacent to the project (about 1/3 mile). These wetlands are primarily groundwater fed, with seasonal saturation and flooding of depressions. Multiple small drainageways flow towards Fenger Brook. He rated wildlife habitat, production export via food chain, and ground water discharge as important functions; water quality was rated very good, consistent with Carya water testing data. However Flood storage function was incorrectly rated as low, not taking into account the irregular ground topography and multiple small and large depressions , that trap and infiltrate precipitation, preventing flooding and downstream channel enlargement. Tree transpiration also prevents flooding. Roots take up and transpire large volumes of surface water, aerating the soil, and creating pore space for infiltration. Mr. Theroux did not assess the functions and values *of the wetland system as a whole* as called for by the USACOE Highway Methodology, and the other extant wetlands assessment methodologies. His assessment should have taken the New London portion into account; it has more embedded pools and high-value upland islands, including cliffs with den-caves suitable for bobcat. This top wetland predator is well-documented at this site. Amphibians and crayfish are important foods for bobcat. Wildlife habitat was rated as a principal wetland function, but the report did not mention the numerous forest pools, some of which are expected to be productive vernal pools or the significance of the wetlands' high ecological integrity. The undeveloped land at the headwaters of Fenger Brook, north of Route 1, is an almost three-square mile contiguous habitat block, a half mile to two third miles across.

We viewed the wetland from the west (Clark Lane back yards); from the South (from the entry Road to Clark Middle School) and from the East. Habitat to the west of the site includes over 100 acres of

forested ridges, scenic rock outcrops, cliffs, and wetlands, which can easily be accessed from Clark Woods Park Road and a network of hiking trails. Undeveloped municipally owned land includes the central and southern portion of New London's 95-acre Clark Woods Park, which includes portions of the subject wetland system. Accordingly it does have significant human use values: recreational, educational and aesthetic value. Trails and vernal pools straddle the unmarked town line.

We also characterized and sampled several water quality parameters in the large forested wetland south of Clark Lane Middle School, which similar to the wetlands located downgradient of the proposed high density, linear development of manufactured rental homes.

Photos of Bates Woods Park

CONCLUSION

It is our professional opinion that the omissions and concerns discussed orally in my presentation today, based on the sources listed above in the footnotes to the materials reviewed, should be addressed by the applicant before a permit is issued,

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

Sigrun N. Gadwa, MS, PWS
Ecologist, Professional Wetland Scientist
Registered Soil Scientist
Carya Ecological Services, LLC, Cheshire Connecticut January 26, 2023

Attachment A: Tables and Figures

TABLE 1: WATER QUALITY DATA FROM FENGERS BROOK HEADWATERS, WATERFORD. FIGURE 2 SHOWS STATION LOCATIONS.

Station ID	Watercourse	DATE	TIME	Specific Conductivity	Salinity	Temperature
				(uS/cm)	(ppt)	(°C)
S. # 1	FENGER BROOK	Jan. 23, 2023	4:15 PM	77.6	0.1	8
S. # 2	FENGER BROOK	Jan. 23, 2023	3:10 PM	112.8	0.1	6.7
S. # 3	FENGER BROOK	Jan. 23, 2023	3:30 PM	549	0.4	7.3
S. # 4	FENGER BROOK	Jan. 23, 2023	4:45 PM	146	0.1	5.5

S. # 1	Shallow, linear, pool 20' S. of Bates Forest Park Rd, 250' N. of landfill in rocky, rugged, forested headswaters terrain
S. # 2	Forested wetland drainageway, 150' south of Clark Middle School Soccer Field, similar to the groundwater-fed, forested wetlands downgradient of the northern half of the proposed Trailer Park along Clark Lane.
S. # 3	East-flowing, 2-ft-wide Intermittent stream coming from the dense thicket behind the AHEPA, 3-story apartment building.
S. # 4	Fenger Brook 50 feet upgradient (north) of brook crossing under Route 1; fast flowing with rocky substrate, incised channel

NOTES: Testing done by Sigrun N. Gadwa, Carya Ecological Services, LLC using a YSI 30 meter. Air temperature was 3-4° C.

TABLE 2: CTDEEP FISHERIES DATA FROM FENGERS BROOK,WATERFORD, CT. SAMPLING STATION ~ 300' S. OF RTE 1.

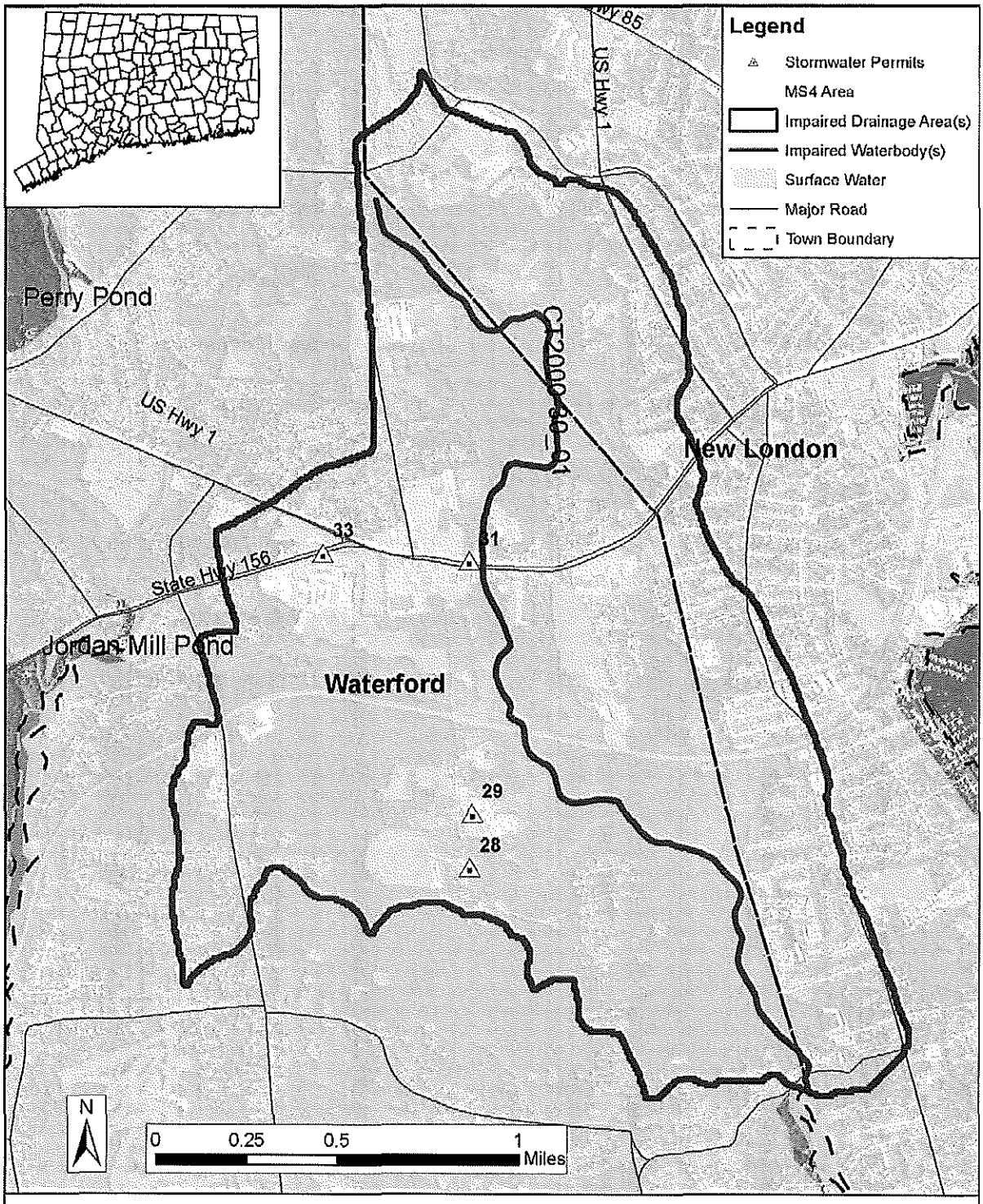
OBJECTID	Station ID	Sample Year	Sample ID	American Eel	Largemouth Bass	Pumpkinseed	Rock Bass	Redfin Pickerel	Tessellated Darter
				Number of Individuals in Electrofishing Sanple					
627	FENGER BROOK (id:14773)	1993	147731993	1	0	0	0	3	0
628	FENGER BROOK	2001	147732001	1	0	0	0	9	0
629	FENGER BROOK	2010	147732010	5	1	4	0	17	29

TABLE 3: 1993 CTDEEP MACROINVERTEBRATE DATA FROM FENGERS BROOK, WATERFORD, CT. ~ 300' S. OF RTE 1

OBJECTID	Station ID	Sample Year	Sample ID	Ancylidae	Athericidae	Chironomidae	Elmidae	Haliplidae	Hydropsychidae	Limnephilidae	Odontoceridae	Psephenidae	Tipulidae
884	FENGER BROOK (id:14773)	1993	147731993	1	1	1	1	1	1	1	1	1	1

Note: 1 means" present". Organisms in the different taxa were not counted.

Figure 1a. Fenger Brook Watershed (CT Basin 2000-30) showing dense developed areas (pale) and CT-DEEP- permitted facilities with stormwater discharges (yellow triangles). This is Figure 5 in an Appendix of the 2015 CTDEEP Report on the water quality status of the SE Basin (CT 2000).



Permits(s) within Fenger Brook Watershed with Impairment to Habitat for Fish, Other Aquatic Life and Wildlife

Created: CT DEEP, July 2012

CT DEEP Fish Community Data -

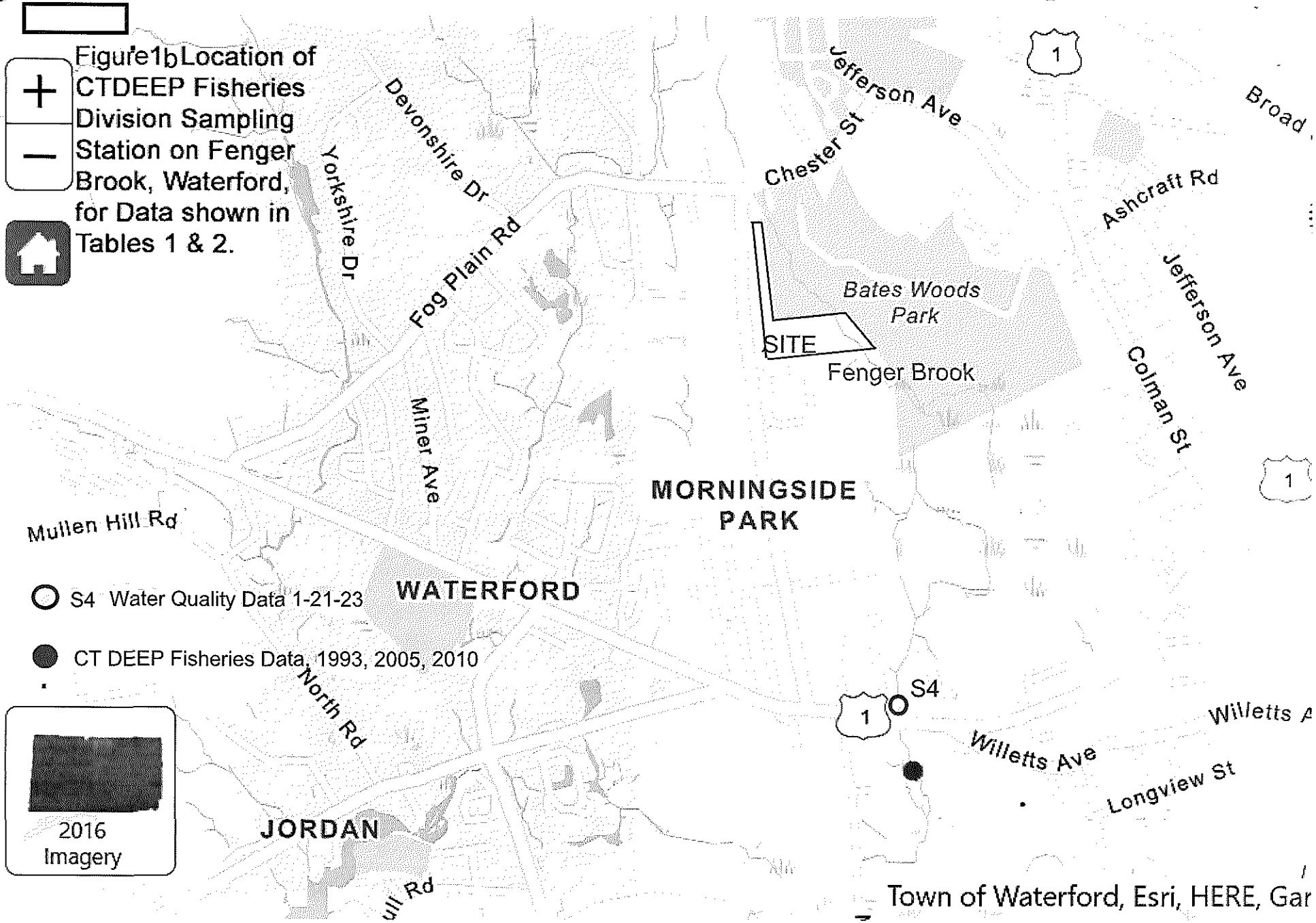


Figure 2. Clark Lane,Waterford, CT.
Site vicinity and proposed activities.
Base map is a CTECO summer aerial.

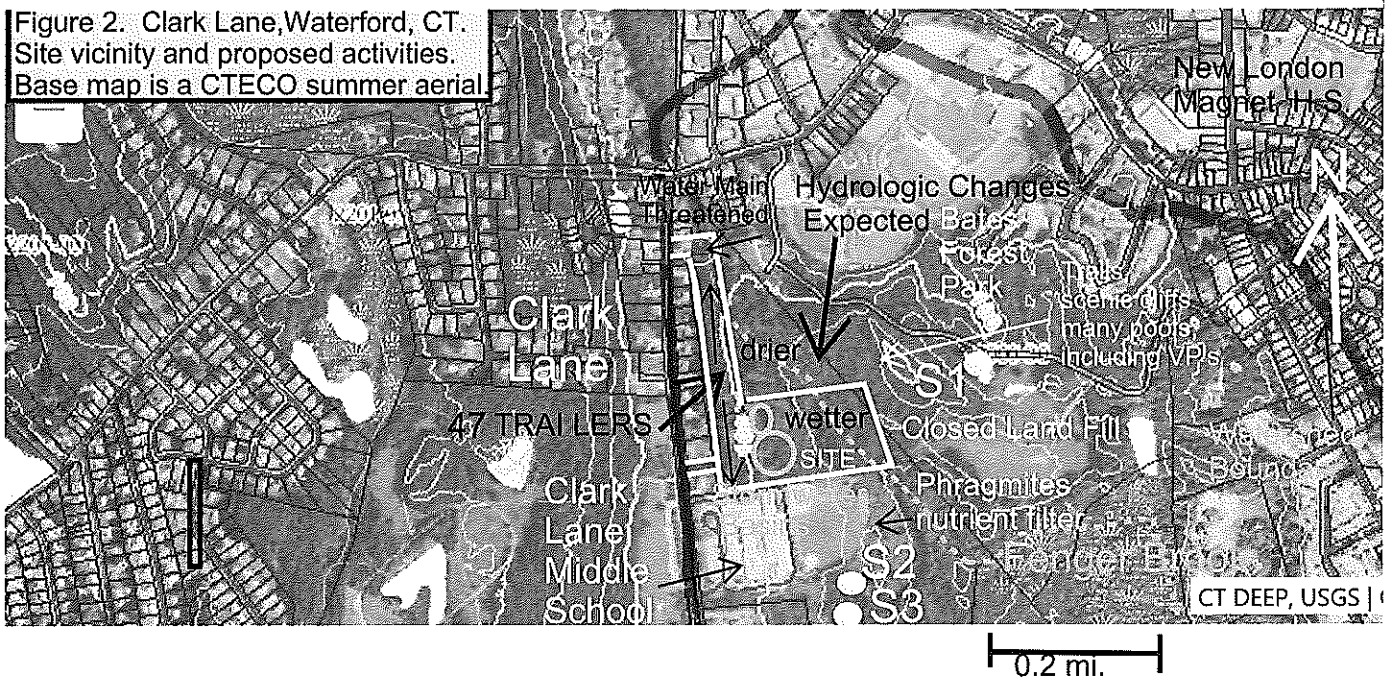


Figure 3. Excerpt of Kingston Properties Drainage map.

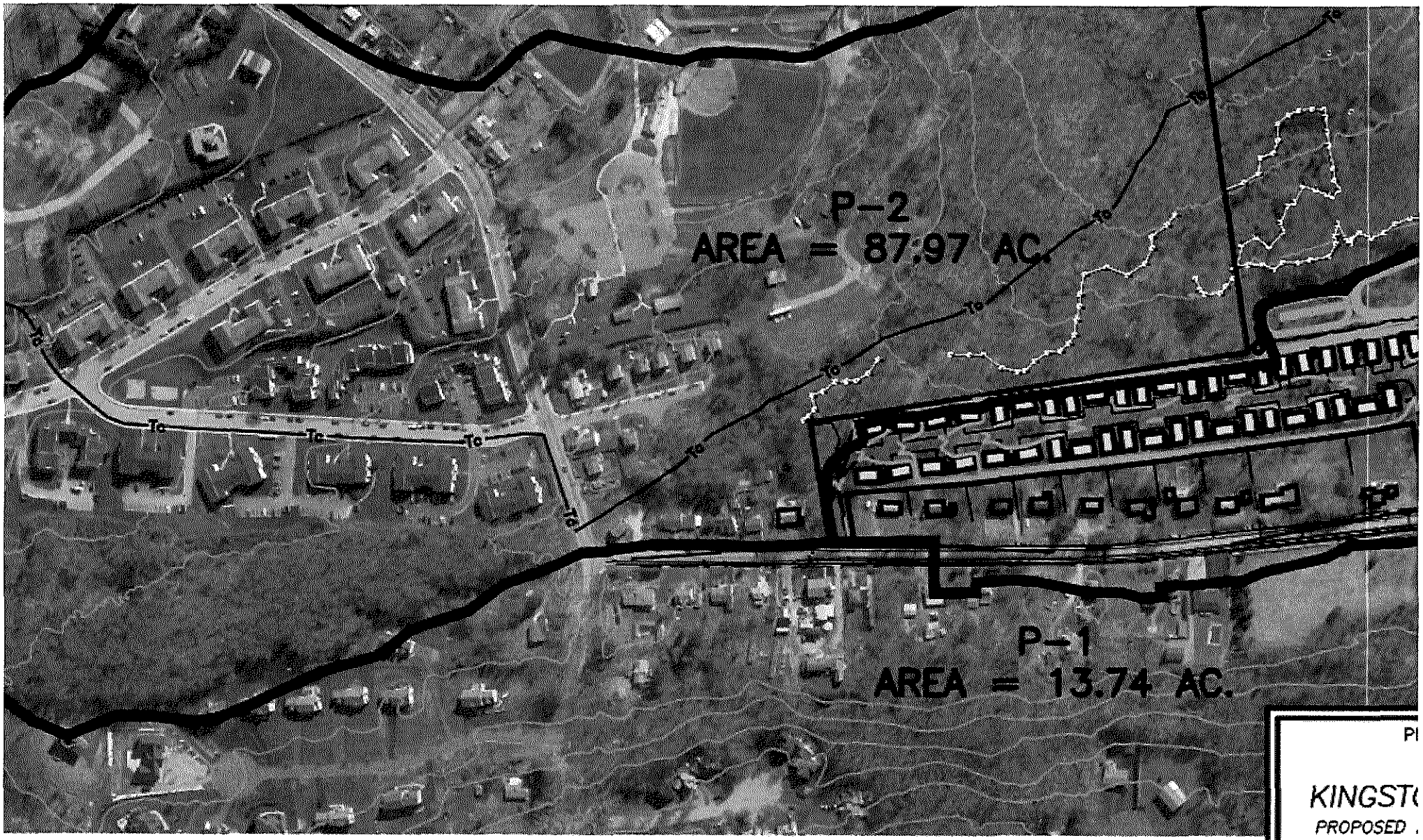
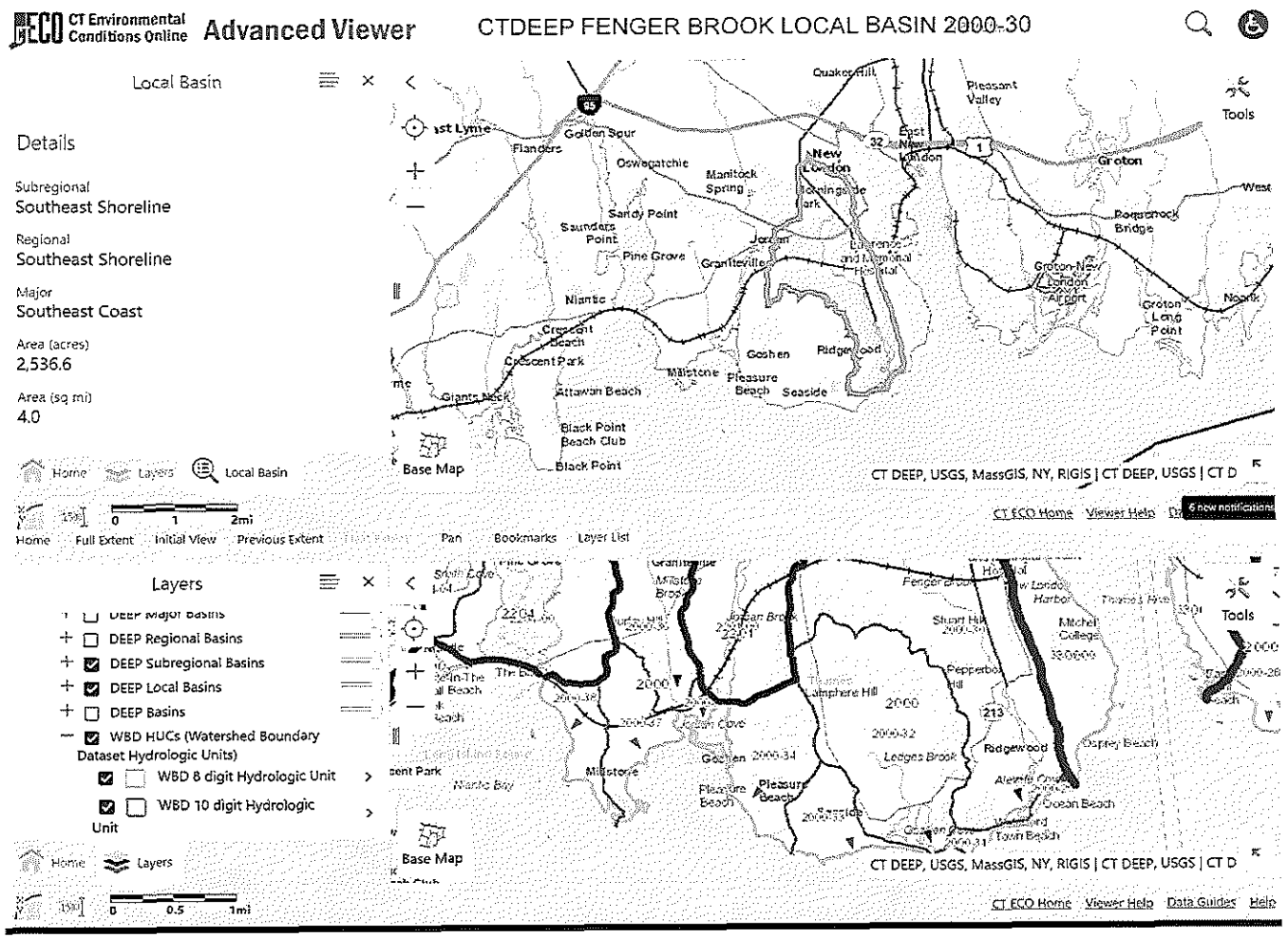


Figure 4a. Nested Drainage Basins of Fenger Brook Waterford and New London, CT



NOTES: Red line delineates CT Major Basins. Basin #2, the Southeast Coastal Major Basin, includes all except the Thames River shorelines areas. Purple Line delineates the Regional Basins. Fenger Brook, Alewife Cove, and East & West sides of Jordan Cove are in Basin # 20, the Southeast Shoreline Regional Basin. Jordan Brook is in Regional Basin #22, the southeast western complex. The blue-highlighted Fenger Brook CTDEEP Local Basin 2020-30 (above) flows entirely into Alewife Cove, the receiving esturary for Fenger Brook. The 8 and 10-digit Hylrologic Unit codes, with tan and gray boundary lines, also separate the Jordan Brook watershed from the Fenger Brook and Ledges Brook watersheds (combined). The CTDEEP system separates the Local Basins of Fenger Brook and Ledges Brook. Ledges Brook drains into Goshen Cove, not Alewife or Jordan Coves.

Table A.2 Pollutant Concentrations from Source Areas							
Constituent	**TSS[1]**	**TP[2]**	**TN[3]**	**F Coli[1]**	**Cu[1]**	**Pb[1]**	**Zn[1]**
	mg/l	mg/L	mg/l	1,000 col/ ml	ug/l	ug/l	ug/l
Resid Roof	19	0.11	1.5	0.26	20	21	312
Comm Roof	9	0.14	2.1	1.1	7	17	256
Indust Roof	17	-	-	5.8	62	43	1,390
C/R Parking	27	0.15	1.9	1.8	51	28	139
Indust Parking	228	-	-	2.7	34	85	224
Res Street	172	0.55	1.4	37	25	51	173
Comm Street	468	-	-	12	73	170	450
Rural Highway	51	-	22	-	22	80	80
Urban Highway	142	0.32	3.0	-	54	400	329
Lawns	602	2.1	9.1	24	17	17	50
Landscaping	37	-	-	94	94	29	263
Driveway	173	0.56	2.1	17	17	-	107
Gas Station	31	-	-	-	88	80	290
Auto Recycler	335	-	-	-	103	182	520
Heavy Industrial	124	-	-	-	148	290	1600

1: Claytor and Schueler (1996)

2: Average of Steuer et al. (1997),Bannerman (1993) and Waschbusch (2000)

3: Steuer et al. (1997)

A.3 Impervious Cover Data

The Simple Method uses different impervious cover values for separate land uses within a subwatershed. Representative impervious cover data, are presented in Table A.3. These numbers are derived from a recent study conducted by the Center for Watershed Protection under a grant from the U.S. Environmental Protection Agency to update impervious cover estimates for a variety of land uses. (Cappiella and Brown, 2001). In addition, some jurisdictions may have detailed impervious cover information if they maintain a detailed land use/land cover GIS database.

Table A.3 Land Use and Impervious Cover Estimates

Land Use Category	Mean Impervious Cover
Agriculture	**2**
Open Urban Land*	**9**
2 Acre Lot Residential	**11**
1 Acre Lot Residential	**14**
1/2 Acre Lot Residential	**21**
1/4Acre Lot Residential	**28**
1/8 Acre Lot Residential	**33**
Townhome Residential	**41**
Multifamily Residential	**44**
Institutional**	**31-38%**
Light Industrial	**50-56%**
Commercial	**70-74%**

* Open urban land includes developed park land, recreation areas, golf courses, and cemeteries.

** Institutional is defined as places of worship, schools, hospitals, government offices, and police and fire stations

A.4 Limitations of the Simple Method

The Simple Method should provide reasonable estimates of changes in pollutant export resulting from urban development activities. However, several caveats should be kept in mind when applying this method.

A.5 SMP Pollutant Removal

The removal efficiencies of various SMP practices also help determine final annual pollutant loads. Table A.4 provides estimates of the average pollutant removal efficiency of the five SMP categories.

Table A.4. Suggested Removal Rates for SMPs

	TSS	TP	TN	Metals[1]	Bacteria
Wet Ponds	80	50 (51)	35 (33)	60 (62)	70
Stormwater Wetlands	80[2] (76)	50 (49)	30	40 (42)	80 (78)
Filtering Practices	85 (86)	60 (59)	40 (38)	70 (69)	35 (37)
Infiltration Practices [4]	90[3] (95)	70	50 (51)	90[3] (99)	90[4]
Water Quality Swales	85 (84)	40 (39)	50[5] (84)	70	0 (-25)[6]

1. Average of zinc and copper. Only zinc for infiltration
2. Many wetland practices in the database were poorly designed, and we consequently adjusted sediment removal upward.
3. It is assumed that no practice is greater than 90% efficient.
4. Data inferred from sediment removal.
5. Actual data is based on only two highly performing practices.
6. Assume 0 rather than a negative removal.

Note: Data in parentheses represent median pollutant removal data reported in the *National Pollutant Removal Database - Revised Edition* (Winer, 2000). These data were adjusted for convenience and to reflect biases in the data.

These efficiencies represent ideal pollutant removal rates that cannot be achieved at all sites, or at a watershed level. Typically, they need to be "discounted" to account for site constraints, and other factors that reduce practice efficiency. For example, the removal rate should be adjusted to reflect the fraction of runoff captured by a practice on an annual basis (90% if this guidance is followed). For more detail on how to apply these discounts, consult Caraco (2001).

One particularly important consideration is how to account for practices applied in series (e.g., two ponds applied in sequence). If the volume within the practices adds up to the total water quality volume, they are assumed to act as a single practice with that volume. Otherwise, total pollutant removal should be determined by the following equation:

$$R = L\,[(E_1)+(1-E_1)E_2+(1-((E_1)+(1-E_1)E_2)E_3+\ldots]$$

Where:

R = Pollutant Removal (lbs)

L = Annual Load from Simple Method (lbs.)

E_i = Efficiency of the ith practice in a series

Another adjustment can be made to these removals to account for loss of effectiveness and "irreducible concentrations." Evidence suggests that, at low concentrations, SMPs can no longer remove pollutants.

Steuer, J., W. Selbig, N. Hornewer, and J. Prey. 1997. "Sources of Contamination in an Urban Basin in Marquette, Michigan and an Analysis of Concentrations, Loads, and Data Quality." U.S. Geological Survey, *Water-Resources Investigations Report 97-4242.*

Waschbusch. 2000. Sources of phosphorus in stormwater and street dirt from two urban residential basins in Madison, Wisconsin, 1994-1995. In: National Conference on Tools for Urban Water Resource Management and Protection. US EPA February 2000: pp. 15-55.

Winer, R. 2000. National Pollutant Removal Database - Revised Edition. Center for Watershed Protection, Ellicott City, Maryland.

Attachment B. Part II. UNH Stormwater Managment Resources on Biofiltration Basins(2009 and 2012 UNH Bienhial Reports, pp 20 to 21in both) Hard copies have been provided separately to the Conservation Commission.

NOTE: Both the 2009 and 2012 UNH Reports are available on line: Performance Testing Results and design guidance for biofiltration basins published by the University of New Hampshire Stormwater Center. PDF's may be downloaded from https://www.unh.edu/unhsc/pubs-specs-info and ac company the electronic submission of this report.