East-of-Hudson Stormwater Retrofit Plan (Years 6 – 10)

FAD and Connected Basin Phosphorus Reduction - 391 KG

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1. INTRODUCTION & PURPOSE

The East of Hudson Coalition (EOHC) consists of 19 municipal entities located within the East of Hudson Watershed, who are required to reduce the levels of phosphorus that discharge into the East of Hudson Watershed via stormwater runoff, in order to comply with their NYSDEC MS4 General Permit requirements. These permitting requirements have been developed to protect the water quality of the East of Hudson Watershed, which supplies drinking water to New York City, and parts of Westchester and Putnam Counties.

The EOHC consists of the following 19 municipal entities: Bedford, Brewster, Carmel, Cortlandt, Kent, Lewisboro, Mount Kisco, New Castle, North Castle, North Salem, Patterson, Pound Ridge, Putnam County, Putnam Valley Somers, Southeast, Town of Pawling, Village of Pawling, and Yorktown. Phosphorus reduction is achieved via the construction of NYSDEC approved Stormwater Retrofit Practices (SRPs) that collect and treat stormwater runoff.

The initial MS4 General Permit required the EOHC municipal entities to collectively reduce phosphorus by 459.5 kg/year, over a 5-year implementation period (i.e. Years 1-5). Stormwater retrofit plans for Years 1-5 of the program were completed, and consisted of identifying potential stormwater retrofit projects to achieve a phosphorus reduction of 459.5 kg/year. The results of the Years 1-5 stormwater retrofit plans continue to be implemented and administered by the East of Hudson Watershed Corporation (EOHWC).

Woodard & Curran, in conjunction with its partners Paggi Engineering and Rennia Engineering, was contracted by the EOHC to develop a new stormwater retrofit plan. This plan consists of identifying stormwater retrofit projects within the Filtration Avoidance Determination (FAD) basins, including those basins that are hydrologically connected to the FAD basins, over a new 5-year implementation period; Years 6-10.

The Stormwater Retrofit Plan (Years 6-10), located in Appendix A, identifies 86 projects with the potential to achieve a phosphorus reduction of 391 kg/year, and includes estimated design/construction costs. Corresponding project plans titled "Stormwater Retrofit Concept Plans" and calculations for each individual project are located in Appendix B. All calculations and removal efficiencies have been performed in accordance with the latest NYSDEC approved design parameters and calculations, which are also captured in the latest version of the EOHWC Design Manual.

The remaining sections of the report narrative discuss the process implemented to develop the Stormwater Retrofit Plan (Years 6-10), and conclusions/recommendations to assist in the implementation of the proposed conceptual stormwater retrofit projects during Years 6 - 10 of the NYSDEC MS4 program.

2. PLAN DEVELOPMENT & PROCESS

The goal of the EOHC and the Woodard & Curran team was to generate a successful Stormwater Retrofit Plan for Years 6-10 that took into account the experience gained and lessons learned from the development, administration, and implementation of the stormwater retrofit plans in Years 1-5 of the program.

Based on feedback from the EOHC and municipal staff, as well as our team's experience involved in the feasibility, design, permitting, and construction oversight of numerous Years 1-5 stormwater retrofit projects, our goal was to develop a plan and identify stormwater retrofit projects using the following criteria:

- Identify sites that contain a high density of impervious surfaces in order to focus on high phosphorus loading opportunities; focus on sites with a minimum of 3.5 acres of impervious surfaces; avoid large watershed areas that are exclusively wooded or developed open space.
- Consider sites and practices that rely on natural runoff pathways (sheet, open channel flow) or existing pipe networks to collect and convey runoff to proposed SRPs. Based on our experience, projects that require the design and construction of runoff collection and conveyance infrastructure significantly increases the overall SRP cost.
- Ensure accessibility to the project site and the SRP; confirm that any new SRP would not interfere with existing site operations.
- Consider sites that contain eroded channels or outfall locations with ongoing erosion or the potential for erosion (on both public and private property).
- Identify any recently designed/constructed stormwater improvement projects that may qualify for eligible phosphorus reduction credits as part of the EOHC MS4 program.
- Consider public/private partnerships with commercial landowners with large areas of existing impervious surfaces (i.e. corporate parks, large corporations, & retail centers) that are in good standing with the Town/Village.
- Focus on the more cost effective SRPs constructed in Years 1-5 such as water quality ponds, surface sand filters, and channel stabilization projects. Calculate any potential channel stabilization phosphorus credits using the NYSDEC approved revised channel stabilization calculation methodology.
- Consider the logistics and magnitude of SRP operations and maintenance with the understanding that long-term cost is a major concern for the municipalities.
- Use the above criteria to generate a list of projects to maximize the phosphorus reduction goal.

The Woodard & Curran team took into consideration the above-mentioned criteria, and developed the Stormwater Retrofit Plan (Years 6-10) by implementing the following process to identify applicable project sites and SRPs:

- We obtained and reviewed historical records related to Years 1 - 5, to ensure we did not duplicate efforts, and to determine if there remained any potential feasible projects.

- The latest version of the NYCDEP GIS database was obtained and customized to include additional data layers related to environmental features such as wetlands and floodplains, and we added other features to more efficiently identify and measure impervious areas.

- Standardized calculation worksheets were developed based upon NYSDEC feedback regarding calculation methodology and input parameter updates. Such updates included the confirmation that the actual calculated Rv is to be used in the water quality volume calculations (i.e. a minimum Rv of 0.2 is not applicable), and the EMC value for open developed space has been reduced by 50%.

- Upon updating and customizing the GIS database, we completed a desktop analysis to identify applicable project sites that met the SRP qualification criteria noted on the previous page. We created maps of all potential project sites for future discussions with the 19 EOHC municipal entities.

- A standard agenda was developed prior to meeting with each municipal entity that included the SRP selection criteria. The agenda and potential project sites maps were sent to each municipal entity, and a meeting was scheduled and conducted with municipal staff. The agenda and initially identified project sites were discussed, and revised project lists were developed based upon municipal staff input. We also met separately with large private commercial property owners such as IBM in Somers, as noted on the Stormwater Retrofit Concept Plans located in Appendix B. We discussed the likelihood of gaining future approvals from private homeowners for proposed channel stabilization projects that were located entirely or partially within private lots. We only included those in which the Towns were confident that private homeowners would not oppose the project.

- The Woodard & Curran team conducted site visits to further assess the proposed SRP feasibility. A revised SRP list was developed including proposed phosphorus reduction values and design/construction cost estimates, and distributed to each municipal entity for a last round of input.

- Once the SRP list was finalized, all Stormwater Retrofit Concept Plans were developed and the Stormwater Retrofit Plan (Years 6-10) was finalized. Multiple SRPs are proposed for certain project sites to allow for flexibility with the regulatory approval process, in the event that future subsurface site investigations result in the determination that the primary SRP is infeasible.

- During this overall process, we submitted a request to the NYSDEC to expand the currently approved SRP list to include the StormBasin with FABPHOS catch basin filter proprietary product, manufactured by FABCO. This SRP is a product that can be inserted into existing catch basins to treat phosphorus. Refer to Appendix C for a complete version of the submittal including product details and specifications, and a copy of the subsequent NYSDEC approval. This approved product provides the EOHC with an additional SRP option for sites where traditional practices identified in the Stormwater Retrofit Plan (Years 6-10) are not feasible.

3. CONCLUSION & RECOMMENDATIONS

Based upon the due diligence described in the previous report sections, the Stormwater Retrofit Plan (Years 6-10) located in Appendix A achieves the following objectives:

- The lessons learned and valuable experience gained from Years 1 through 5 of the program have been factored into the preparation of the plan, maximizing the likelihood of implementing feasible and cost effective SRPs.
- The proposed SRP's are highly focused to obtain the best phosphorus removal and the best cost.

In conclusion, we offer the following recommendations to further improve the implementation of the Stormwater Retrofit Plan (Years 6-10):

- Consider first implementing the design and construction of all channel stabilization projects as they have the greatest variability in the final potential phosphorus reduction values, due to the involved nature of the calculation methodology. The selection and implementation of the remaining SRPs included in the Stormwater Retrofit Plan (Years 6-10) can be re-evaluated once the phosphorus figures for the channel stabilization projects have been finalized.
- Next, consider implementing those practices that fit within the footprint of municipally owned or controlled properties and which do not require advanced permitting with state and federal agencies.
- Then work with the identified private landowners to continue the implementation of public/private partnership projects that have the potential for large phosphorus reductions.
- We recommend that the EOHC work closely with the EOHWC to ensure communications are maintained between the municipal entities and any private property owners during the Years 6 - 10 implementation process on a continuous basis to keep key or new points of contact up to date.
- Lastly, in order to streamline the overall implementation process and minimize change orders during the engineering design phase, we first recommend completing the "Initial Evaluation" (as referenced in the latest version of the EOHWC Design Manual) prior to engaging in contracts for 100% design/bid documents. Completing the Initial Evaluation (this process includes subsurface field investigations including deep holes and percolation testing) up front will result in the determination of the feasibility of all SRPs. By determining the feasibility of all SRPs prior to engaging in the final design process, EOHC can minimize the potential for change orders during the design process and investing too much time and resources in projects that may ultimately fail.

APPENDIX A: STORMWATER RETROFIT PLAN (YEARS 6 – 10)

East of Hudson Coalition Years 6 - 10 Project List

August 12, 2016

Revised: September 2, 2016 *(remove all non-FAD Basin projects)*

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General Notes:

A. This project list represents the Phase 1 level of vetting as included in our proposal. It was developed based on GIS desktop reviews of the NYCDEP, EOHWC, and W&C databases and customized layers, meetings with Town representatives and initial discussions with property owners, and site visits to confirm SRP compatibility with the property constraints and operations.

B. This list has been developed with the review and input of the host municipalities.

C. The cost data reflected in this table is based on a compilation and analysis of EOHWC records to date for projects in Years 1-5, in which accurate cost data exists for design and constructions costs (a function of construction bids or EOPCCs based on 100% design documents in the absence of construction bids). The cost data included in the table accounts for a 15% contingency due to the preliminary and conceptual nature of the SRP identification process and design/calculations, as well as having less opportunity for projects on public lands. The costs also reflect 5 years of inflation at 3% per year.

D. The column titled "Estimated Project Cost (Design + Construction)" is a function of the weighted average cost per Kg per SRP (design and construction) as calculated in Table 2 listed at the bottom of this document, based on EOHWC records. The table also includes the lowest and highest design and construction costs per SRP encountered in Year 1-5, to provide a comprehensive view of potential expected costs in Years 6-10.

E. Channel stabilization projects presented in this table do not account for any potential additional phosphorus removal credits associated with proposed design/construction of upgradient SRP's, unless noted otherwise on the conceptual project plan. The removal credits presented in the table have been calculated under the latest NYSDEC approved BANCS method equations, and assume a soil loss depth of 0.065.

F. The SRPs presented in this table are the primary proposed SRPs for each project, intended to maximize phosphorus removal and cost efficiency. Consistent with the approach included in our initial project approach, Conceptual Project Plans may include secondary and tertiary proposed SRP options. These secondary/tertiary options (as applicable) will only be included in the Conceptual Project Plans, and are intended to provide flexibility during the regulatory review phase in the event that the primary SRP is deemed infeasible.

Summary of Proposed Year 6-10 Phosphorus Reduction	
***FAD Basin Total (not including upstream hydrologically connected basins)** *(kg/yr) / # of projects / total estimated project cost*	*74.14 / 20 / $7,023,627
FAD Basin Total (including upstream hydrologically connected basins) *(kg/yr) / # of projects / total estimated project cost*	391.35 / 86 / $36,646,028

*Only includes values for the following drainage basins: Cross River, Croton Falls, Boyd Corners and West Branch.

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
1	VB-1, Putnam Terrace	Public	19 Putnam Terrace	Putnam	Brewster	Surface Sand Filter	Diverting	Yes	-	0.78	$52,380	$31,586 - $113,133
2	VB-2, Railroad Ave (Commuter Parking Lot)	Public	390 Railroad Ave (Park Street)	Putnam	Brewster	Surface Sand Filter	Diverting	Yes	-	2.08	$139,680	$84,229 - $301,689
3	VB-3, Southeast Museum/Brewster Library (Rear Parking Lot)	Public	67/79 Main Street	Putnam	Brewster	Surface Sand Filter	Diverting	Yes	-	1.05	$70,511	$42,520 - $152,295
4	Carmel-1A, Arborview Rd - A	Public	Arborview Rd	Putnam	Carmel	Wet Extended Detention Pond [3]	Croton Falls	Yes	-	7.28	$891,969	$305,849 - $2,097,931
5	Carmel-1B, Arborview Rd - B	Public	Arborview Rd	Putnam	Carmel	Wet Extended Detention Pond [3]	Croton Falls	Yes	-	4.24	$519,499	$178,132 - $1,221,872

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
6	Carmel-2, Eleanor Drive - A	Public	14 Eleanor Dr	Putnam	Carmel	Channel Stabilization	Croton Falls	Yes	-	4.22	$184,108	$42,585 - $289,851
7	Carmel-4A, Putnam Hospital Center - A	Private	670 Stoneleigh Ave	Putnam	Carmel	Wet Extended Detention Pond [3]	Croton Falls	Yes	-	4.14	$507,246	$173,931 - $1,193,054
8	Carmel-4B, Putnam Hospital Center - B	Private	670 Stoneleigh Ave	Putnam	Carmel	Wet Extended Detention Pond [3]	Croton Falls	Yes	No	6.21	$760,870	$260,896 - $1,789,582
9	Carmel-5A, Putnam Plaza - A	Private	1906 US-6	Putnam	Carmel	Proprietary Filtering Practices	Croton Falls	Yes	No	0.93	$67,244	$48,037 - $228,073
10	Carmel-5B, Putnam Plaza - B	Private	1906 US-6	Putnam	Carmel	Proprietary Filtering Practices	Croton Falls	Yes	-	0.41	$29,645	$21,178 - $100,548
11	Carmel-5C, Putnam Plaza - C	Private	1906 US-6	Putnam	Carmel	Proprietary Filtering Practices	Croton Falls	Yes	-	1.32	$95,443	$68,182 - $323,717
12	Carmel-5D, Putnam Plaza - D	Private	1906 US-6	Putnam	Carmel	Proprietary Filtering Practices	Croton Falls	Yes	-	1.01	$73,028	$52,170 - $247,692
13	Carmel-7, Tanya Lane	Public	Tanya Lane	Putnam	Carmel	Wet Extended Detention Pond	Croton Falls	Yes	No	5.41	$662,851	$227,286 - $1,559,040
14	Carmel-9A, Willow Road East	Private	Willow Rd	Putnam	Carmel	Channel Stabilization	Lake Gleneida	Yes	-	8.00	$349,019	$80,730 - $549,480
15	Carmel-9B, Willow Road West	Private	Willow Rd	Putnam	Carmel	Channel Stabilization	Lake Gleneida	Yes	-	5.88	$256,529	$59,336 - $403,868
16	Kent-1, Kent Highway Garage	Public	62 Ludington Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	1.82	$122,220	$73,700 - $263,978
17	Kent-2, Montrose Drive Outfall	Public	Montrose Dr & Greenridge Ct	Putnam	Kent	Multiple Pond System	Middle Branch	Yes	-	20.50	$2,511,727	$861,252 - $5,907,637
18	Kent-3, Chuang Yen Monastery	Private	2020 Rt 301	Putnam	Kent	Surface Sand Filter	Boyd Corners	Yes	-	3.05	$204,819	$123,509 - $442,380
19	Kent-4, Lakeview Restaurant	Private	47 Route 311	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	0.54	$39,045	$27,893 - $132,430
20	Kent-5A, Lake Carmel - A	Public	Lakeshore Dr E & Lakeshore Dr S	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	10.18	$1,247,287	$427,685 - $2,933,646
21	Kent-5B, Lake Carmel - B	Public	Lakeshore Dr E & Harriman Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	0.86	$62,182	$44,422 - $210,906
22	Kent-5C, Lake Carmel - C	Public	Lakeshore Dr E & Harriman Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	2.45	$177,147	$126,550 - $600,838

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
23	Kent-5D, Lake Carmel - D	Public	Lakeshore Dr E & Caryl Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	1.09	$78,812	$56,302 - $267,311
24	Kent-5E, Lake Carmel - E	Public	Lakeshore Dr E & Hawthorne Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	2.50	$180,762	$129,133 - $613,100
25	Kent-5F, Lake Carmel - F	Public	Lakeshore Dr E & Lockwood Rd	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	1.75	$214,416	$73,521 - $504,310
26	Kent-5G, Lake Carmel - G	Public	Lakeshore Dr E & Stanwich Rd	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	2.00	$245,047	$84,025 - $576,355
27	Kent-5H, Lake Carmel - H	Public	Lakeshore Dr E & Huguenot Rd	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	2.31	$283,029	$97,048 - $665,690
28	Kent-5I,Lake Carmel - I	Public	Lakeshore Dr E & Yorktown Rd	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	2.23	$273,227	$93,687 - $642,636
29	Kent-5J, Lake Carmel - J	Public	Lakeshore Dr E & Clubhouse Dr	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	4.26	$521,949	$178,972 - $1,227,636
30	Kent-5K, Lake Carmel - K	Public	Lakeshore Dr E & Woodland Dr	Putnam	Kent	Wet Extended Detention Pond	Middle Branch	Yes	-	4.39	$537,877	$184,434 - $1,265,099
31	Kent-5L, Lake Carmel - L	Public	Lakeshore Dr E & Fleetwood Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	1.63	$117,857	$84,195 - $399,741
32	Kent-5M, Lake Carmel - M	Public	Lakeshore Dr E & Placid Rd	Putnam	Kent	Proprietary Filtering Practices	Middle Branch	Yes	-	2.44	$176,424	$126,034 - $598,385
33	Kent-6A, Kent Elementary School - A	School	1065 Rt 52	Putnam	Kent	Subsurface Infiltration	West Branch	Yes	-	4.75	$755,117	$296,884 - $1,714,293
34	Kent-6B, Kent Elementary School - B	School	1065 Rt 52	Putnam	Kent	Surface Sand Filter	West Branch	Yes	-	2.86	$192,060	$115,815 - $414,822
35	Kent-6C, Kent Primary School	School	1065 Rt 52	Putnam	Kent	Surface Sand Filter	Middle Branch	Yes	-	4.21	$282,717	$170,483 - $610,630
36	L-4, Lewisboro Elementary School	School	79 Bouton Rd	Westchester	Lewisboro	Surface Sand Filter	Cross River	Yes	-	2.64	$177,286	$106,906 - $382,913
37	L-5, Lewisboro Town Park	Public	890 Rt 35	Westchester	Lewisboro	Subsurface Infiltration	Cross River	Yes	-	3.00	$476,916	$187,506 - $1,082,711
38	L-6, Long Pond Preserve	Private	Mead St & Tarry A Bit Dr	Westchester	Lewisboro	Channel Stabilization	Cross River	Yes	Class "C" [4]	14.62	$956,749	-
39	Pat-1, Big Elm Detention Pond	Private	1 Bradley Dr	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	2.71	$332,038	$113,853 - $780,961

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
40	Pat-10A, Robin Hill Corporate Park - A	Private	20 Jon Barrett Road	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	6.94	$850,312	$291,565 - $1,999,951
41	Pat-10B, Robin Hill Corporate Park - B	Private	40 Jon Barrett Road	Putnam	Patterson	Pocket Pond [3]	East Branch	Yes	-	2.12	$259,749	$89,066 - $610,936
42	Pat-10C, Robin Hill Corporate Park - C	Private	50 Jon Barrett Road	Putnam	Patterson	Pocket Pond [3]	East Branch	Yes	-	2.26	$276,903	$94,948 - $651,281
43	Pat-10D, Robin Hill Corporate Park - D	Private	60 Jon Barrett Road	Putnam	Patterson	Pocket Pond [3]	East Branch	Yes	-	3.72	$455,787	$156,286 - $1,072,020
44	Pat-10E, Robin Hill Corporate Park - E	Private	70 Jon Barrett Road	Putnam	Patterson	Pocket Pond [3]	East Branch	Yes	-	2.48	$303,858	$104,190 - $714,680
45	Pat-11A, Watchtower Education Center - A	Private	100 Watchtower Dr	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	6.09	$746,167	$255,855 - $1,755,000
46	Pat-11B, Watchtower Education Center - B	Private	100 Watchtower Dr	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	3.16	$387,174	$132,759 - $910,641
47	Pat-12B, CT Stream - B	Private	Valley Road	Putnam	Patterson	Multiple Pond System	East Branch	Yes	Class "C" [4]	19.80	$2,425,961	$831,843 - $5,705,913
48	Pat-13, Dayton Road	Public	15 Dayton Road	Putnam	Patterson	Channel Stabilization	East Branch	Yes	-	11.63	$1,424,946	$488,603 - $3,351,503
49	Pat-2, Clancy Relocation & Logistics	Private	2963 Rt 22	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	No	4.14	$507,246	$173,931 - $1,193,054
50	Pat-3, Devon Road	Private	Devon Rd & Cornwall Hill Rd	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	No	2.70	$330,813	$113,433 - $778,079
51	Pat-4, Fox Run Condominiums	Private	Fox Run Ln	Putnam	Patterson	Wet Extended Detention Pond [3]	Middle Branch	Yes	-	6.28	$769,446	$263,837 - $1,809,754
52	Pat-5, Gottwald Property [1]	Public/Private	384 Fair Street	Putnam	Patterson	Pocket Pond	Middle Branch	Yes	-	5.92	$725,338	$248,713 - $1,706,010
53	Pat-6, Indian Hill Road	Private	16 Indian Hill Road	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	5.71	$699,608	$239,890 - $1,645,493
54	Pat-7, JRS Pharma	Private	2981 Rt 22	Putnam	Patterson	Subsurface Infiltration	East Branch	Yes	-	6.02	$957,012	$376,262 - $2,172,641
55	Pat-8A, Manor Road - A	Private	21 Manor Rd	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	1.22	$149,478	$51,255 - $351,576
56	Pat-8B, Manor Road - B	Private	14 Kings Way	Putnam	Patterson	Wet Extended Detention Pond [3]	East Branch	Yes	-	3.60	$441,084	$151,244 - $1,037,439

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
57	Pat-9A, Putnam Lake - A	Private	Lake Shore Dr & Jackson Rd	Putnam	Patterson	Proprietary Filtering Practices	East Branch	Yes	-	1.16	$83,874	$59,918 - $284,478
58	Pat-9B, Putnam Lake - B	Private	Lake Shore Dr & Dayton Rd	Putnam	Patterson	Proprietary Filtering Practices	East Branch	Yes	-	5.23	$378,155	$270,146 - $1,282,604
59	Pat-9C/D, Putnam Lake - C/D	Private	Lake Shore Dr & Fulton Dr	Putnam	Patterson	Proprietary Filtering Practices	East Branch	Yes	-	13.81	$998,532	$713,331 - $3,386,762
60	Pat-12A, CT Stream - A [2]	Private	Purdum Rd	New Fairfield	Patterson	Channel Stabilization	East Branch	Yes	Class "C" [4]	25.13	$1,096,356	$253,592 - $1,726,054
61	PR-1, Ambler Way	Private	Ambler Way & Boutonville Road	Westchester	Pound Ridge	Channel Stabilization	Cross River	Yes	No	0.25	$10,907	$2,523 - $17,171
62	PR-3, Parkview Drive	Private	114 Parkview Drive	Westchester	Pound Ridge	Channel Stabilization	Cross River	Yes	No	1.39	$60,642	$14,027 - $95,472
63	PR-4, Dingee Road	Private	26 Dingee Road	Westchester	Pound Ridge / Lewisboro	Channel Stabilization	Cross River	Yes	No	2.31	$100,779	$23,311 - $158,662
64	PC-2, Putnam County Sheriff's Facility	Public	3 County Center & 40 Gleneida Avenue	Putnam	Putnam County	Stormfilter	Cross River	Yes	-	4.10	$296,450	$211,778 - $1,005,483
65	PC-1_Stagecoach Road	Public	Stagecoach Road	Putnam	Putnam County	Channel Stabilization	East Branch	Yes	No	2.25	$98,162	$22,705 - $154,541
66	SE-11, Highview Terrace - Channel	Public / Private	33 Highview Terrace	Putnam	Southeast	Channel Stabilization	Diverting	Yes	No	1.74	$75,912	$17,559 - $119,512
67	SE-12, Federal Hill Road - Channel	Private	118-120 Federal Hill Rd	Putnam	Southeast	Channel Stabilization	East Branch	Yes	No	2.64	$115,176	$26,641 - $181,328
68	SE-1A, Upper Brewster Hill Road - Channel	Private	Brewster Hill Road	Putnam	Southeast	Channel Stabilization	Diverting	Yes	Class "C" [4]	9.77	$639,359	-
69	SE-1B, Lower Brewster Hill Road - Channel	Public / Private	Brewster Hill Road	Putnam	Southeast	Channel Stabilization	Diverting	Yes	Class "C" [4]	21.95	$1,436,432	-
70	SE-2, Eagles Ridge	Private	304 Eagles Ridge Road	Putnam	Southeast	Surface Sand Filter	Diverting	Yes	-	5.54	$372,032	$224,341 - $803,537
71	SE-3, Garden Homes Brewster (Upgrade Existing Detention Facility)	Private	1618-1624 Rt 22	Putnam	Southeast	Pocket Pond	Bog Brook	Yes	-	4.69	$574,634	$197,038 - $1,351,552
72	SE-4, Lake Tonetta	Public	140 Pumphouse Road	Putnam	Southeast	Subsurface Infiltration	Diverting	Yes	-	1.83	$290,919	$114,379 - $660,454
73	SE-5, Midtown Trackage Ventures LLC (MTA Parking Lot)	Private	Independent Way	Putnam	Southeast	Surface Sand Filter	Diverting	Yes	-	5.69	$382,105	$230,415 - $825,293

	Project Name	Ownership	Site Address	County	Municipality	Proposed Retrofit	Reservoir	FAD Basin?	Classified Stream?	Estimated Phosphorus Reduction (kg/yr)	Estimated Project Cost (Design + Construction)	Historical Project Cost Range (Design + Construction)
74	SE-6, Mount Kisco Medical Group	Private	185 NY-312	Putnam	Southeast	Surface Sand Filter	Middle Branch	Yes	-	2.35	$157,811	$95,163 - $340,850
75	SE-7, Powers Products III LLC	Private	2 Powers Lane	Putnam	Southeast	Surface Sand Filter	Bog Brook	Yes	-	3.71	$249,141	$150,236 - $538,109
76	SE-8, Scolpino Park	Public	Doansburg Rd	Putnam	Southeast	Surface Sand Filter	East Branch	Yes	-	1.34	$89,986	$54,263 - $194,357
77	SE-10, 16 Mt. Ebo Road South	Private	16 Mt. Ebo Road South	Putnam	Southeast	Surface Sand Filter	East Branch	Yes	-	1.58	$106,103	$63,982 - $229,168
78	SE-9, 15 Mt. Ebo Road South	Private	15 Mt. Ebo Road South	Putnam	Southeast	Surface Sand Filter	Bog Brook	Yes	-	3.39	$227,651	$137,277 - $491,695
79	PW-1, 158 Route 22 LLC	Private	158 Route 22	Dutchess	Town of Pawling	Pocket Pond	East Branch	Yes	-	6.16	$754,743	$258,796 - $1,775,173
80	PW-2, Daley, John	Private	3874 Route 55	Dutchess	Town of Pawling	Channel Stabilization	East Branch	Yes	No	3.00	$130,882	$30,274 - $206,055
81	PW-3, Pawling Fire Dept Inc.	Public	25 South Street	Dutchess	Town of Pawling	Proprietary Filtering Practices	East Branch	Yes	-	1.87	$135,210	$96,591 - $458,599
82	PW-4, South Street	Public	53 South Street	Dutchess	Town of Pawling	Multiple Pond	East Branch	Yes	-	3.77	$461,913	$158,386 - $1,086,429
83	VPW-1, Mizzentop Day School	Private	535 Route 22	Dutchess	Village of Pawling	Pocket Pond	East Branch	Yes	-	2.55	$312,434	$107,131 - $734,852
84	VPW-2, Lappas Inc.	Private	63 East Main Street	Dutchess	Village of Pawling	Proprietary Filtering Practices	East Branch	Yes	-	1.84	$133,041	$95,042 - $451,241
85	VPW-3, Saint John's Church	Private	39 E Main St	Dutchess	Village of Pawling	Surface Sand Filter	East Branch	Yes	-	1.13	$75,884	$45,759 - $163,898
86	VPW-4, Fairway Drive	Public	45 Fairway Dr	Dutchess	Village of Pawling	Proprietary Filtering Practices	East Branch	Yes	-	3.64	$263,190	$188,018 - $892,673

TOTALS:	**391.35**	**$36,646,028**
ESTIMATED UNIT COST	**$98,694**	**per kg**

Table 2 - Project Cost Information Based on Years 1-5 (See General Notes C & D Above)				
Stormwater Retrofit Practice	**Weighted Average (Design + Construction) per KG**	**Weighted Average Plus 15% Contingency & 5 Year Inflation (3% per year) per KG**	**Lowest Design + Construction (Plus Contingency & Inflation) per KG**	**Highest Design + Construction (Plus Contingency & Inflation) per KG**
Subsurface Infiltration	$119,244	$158,972	$62,502	$360,904
Water Quality Pond	$91,904	$122,523	$42,012	$288,177
Surface Filters	$50,372	$67,154	$40,495	$145,043
Dry Swale	$67,925	$90,555	$37,330	$147,033
Stormfilter	$54,236	$72,305	$51,653	$245,240
Channel Stabilization	$32,725	$43,627	$10,091	$68,685
Bioretention	$165,648	$220,836	$204,506	$244,995

Footnotes:

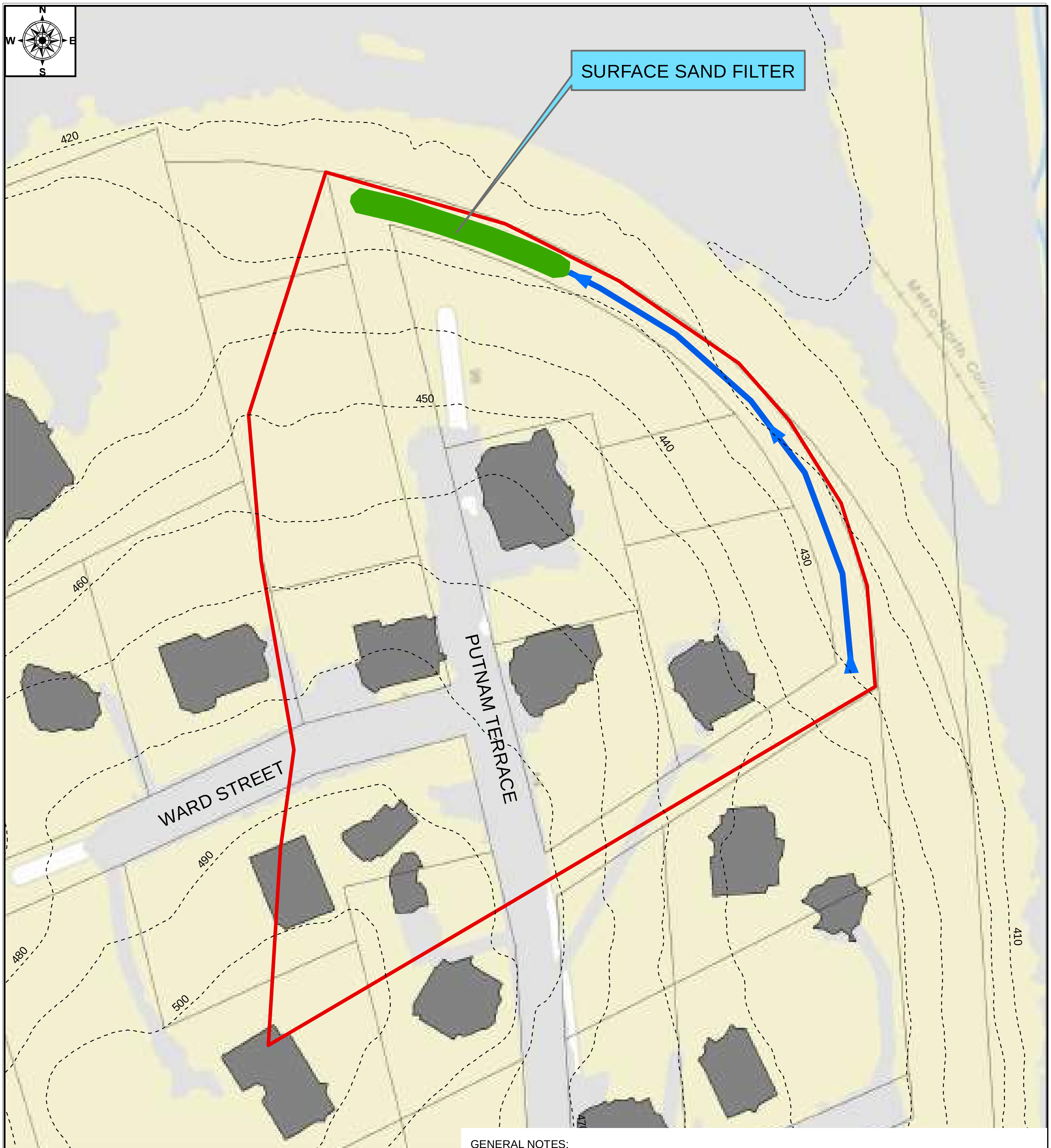
1 Previously Year 3 Project (formerly Pat-MB-05), fully designed and requires construction easement.

2 Project proposes stabilization of eroded stream in Connecticut. Contributing drainage area and proposed stabilization is within EOH Watershed and stream is tributary to Putnam Lake in Patterson.

3 Project proposes retrofitting existing stormwater detention practice to water quality pond.

4 Estimated project costs for channel stabilization projects within classified streams have been increased by a factor of 50% to account for natural and more expensive stabilization measures (in conjunction with stone riprap) that may potentially be required by the NYSDEC. Historical cost range information has also been omitted for these projects since historical cost data only exists for channels stabilized exclusively with riprap.

APPENDIX B: STORMWATER RETROFIT CONCEPT PLANS AND CALCULATIONS



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER

Legend

Diversion Swale
Proposed SRP Location
Drainage Basins
Parcels

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STORMWATER RETROFIT CONCEPT PLAN

PUTNAM TERRACE
19 PUTNAM TERRACE

VILLAGE OF BREWSTER

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 80'

VB-1

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF MOUNT KISCO

0 40 80 120 160 Feet

Legend

Diversion Swale
Proposed SRP Location
Drainage Basins
Parcels

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STORMWATER RETROFIT CONCEPT PLAN

PUTNAM TERRACE
19 PUTNAM TERRACE

VILLAGE OF BREWSTER

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 80'

VB-1

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PAGGI ENGINEERING Since 1989

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VB-1
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"VB-1: PUTNAM TERRACE"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.76297	acres	where:	A =	Contributing Area (acres)
I =	0.658	23.81%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.2643			WQv =	Water Quality Volume
Rv (min)**** =**	0.2643				
WQv (acre-ft) =	**0.073**				
WQv (cu-ft) =	**3181**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2643		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.76297		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.76
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.24
Develped Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**2.90**	lb/yr
	1.31	kg/yr
P Removal -------------------->	**1.71**	lb/yr
	0.78	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**2.8**	Phosphorus Loading (kg/yr)	**1.31**
Water Quality Volume (cf)	**3181**	Phosphorus Reduction (kg/yr)	**0.78**

ASSUMPTIONS/COMMENTS:

Install practice in within "paper street" owned by the Village of Brewster.
Drainage area consists of a residential district.
A diversion swale will be required for this location.
Further exploration should be completed to determine if additional areas could be directed to this location.

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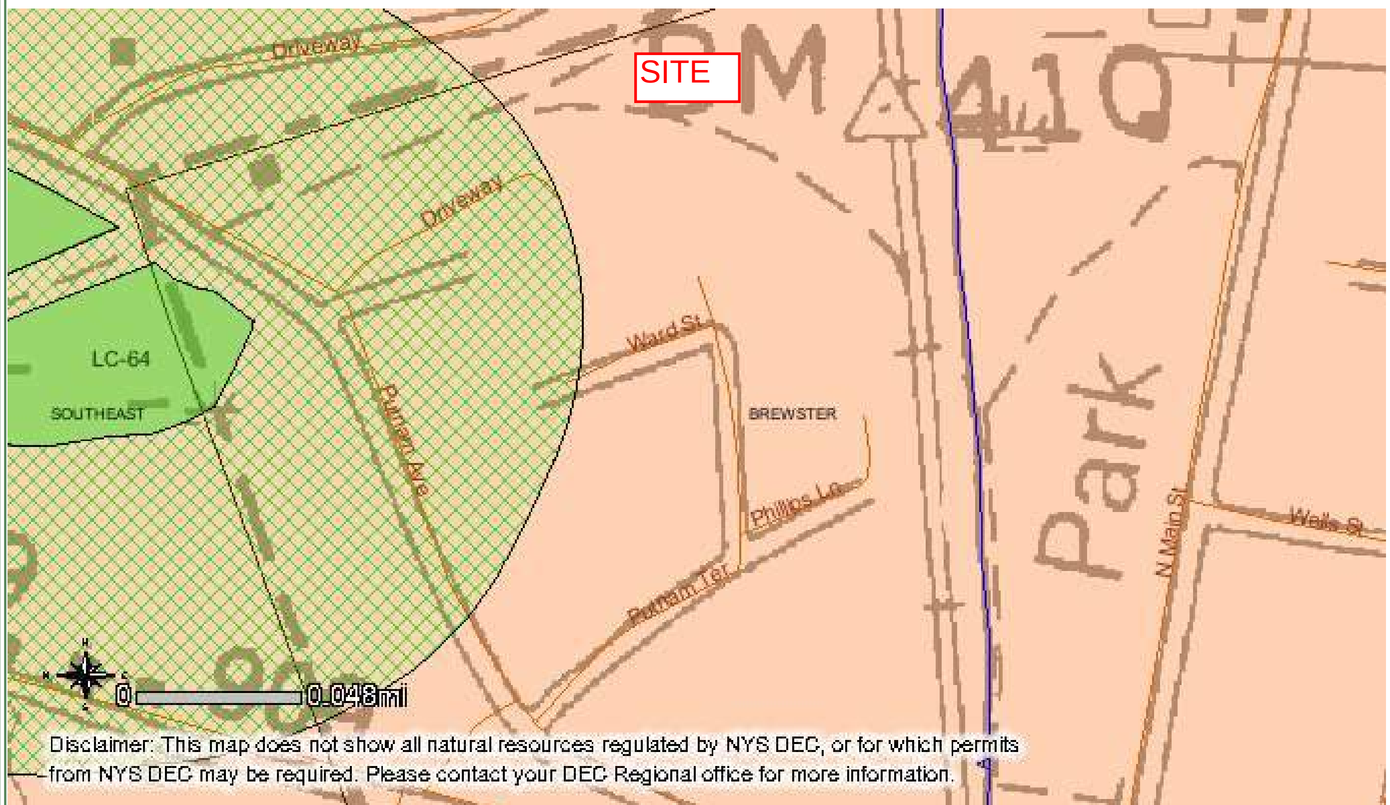
Please set your printer orientation to "Landscape".

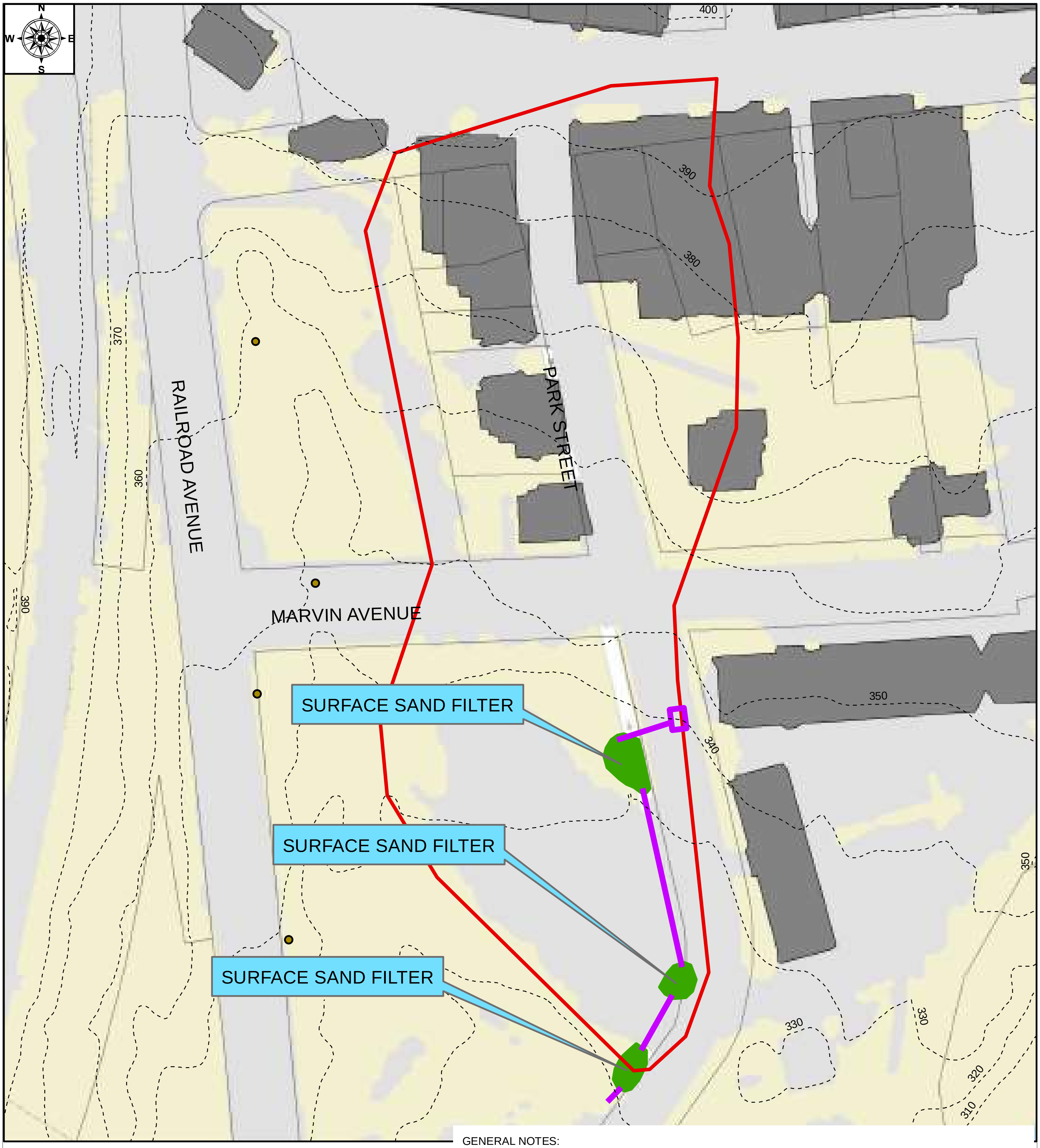
Putnam Terrace



MinX: 614896, MaxX: 615533, MinY: 4584282, MaxY: 4583969

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER

0 50 100 150 200 Feet

Legend

- Proposed Pipe
- Proposed SRP Location
- Drainage Basins
- Parcels

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STORMWATER RETROFIT CONCEPT PLAN

RAILROAD AVENUE
390 RAILROAD AVENUE

VILLAGE OF BREWSTER

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

VB-2

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER

0 50 100 150 200 Feet

Legend

- Proposed Pipe
- Drainage Basins
- Proposed SRP Location
- Parcels

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STORMWATER RETROFIT CONCEPT PLAN		RAILROAD AVENUE 390 RAILROAD AVENUE	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 100'
DESIGNED BY: RAR	CHECKED BY: RAR	VILLAGE OF BREWSTER	VB-2
DRAWN BY: JBM			

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VB-2
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"VB-2: RAILROAD AVE"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.44	acres	where:	A =	Contributing Area (acres)
I =	1.86	54.07%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.5366			WQv =	Water Quality Volume
Rv (min)**** =**	0.5366				
WQv (acre-ft) =	**0.185**				
WQv (cu-ft) =	**8041**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5366		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.44		Rv =	Runoff Coefficient
C =	0.46		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.46
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.54
Develped Open Space	0
Weighted "C":	*0.46*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**7.78**	lb/yr
	3.53	kg/yr
P Removal -------------------->	**4.59**	lb/yr
	2.08	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**3.4**	Phosphorus Loading (kg/yr)	**3.53**
Water Quality Volume (cf)	**8041**	Phosphorus Reduction (kg/yr)	**2.08**

ASSUMPTIONS/COMMENTS:

Install practices within existing parking lot property that is owned by NYCDEP and leased to the Village of Brewster for commuter use.
Add curbs along Park Street to contain practice at the parking lot end cap.
The parking lot entrance is onto Park Street.
Bioretention could be considered as an alternative practice because it has a larger phosphorus removal capacity.
Further investigation may find additional area that drains to this catchment area.

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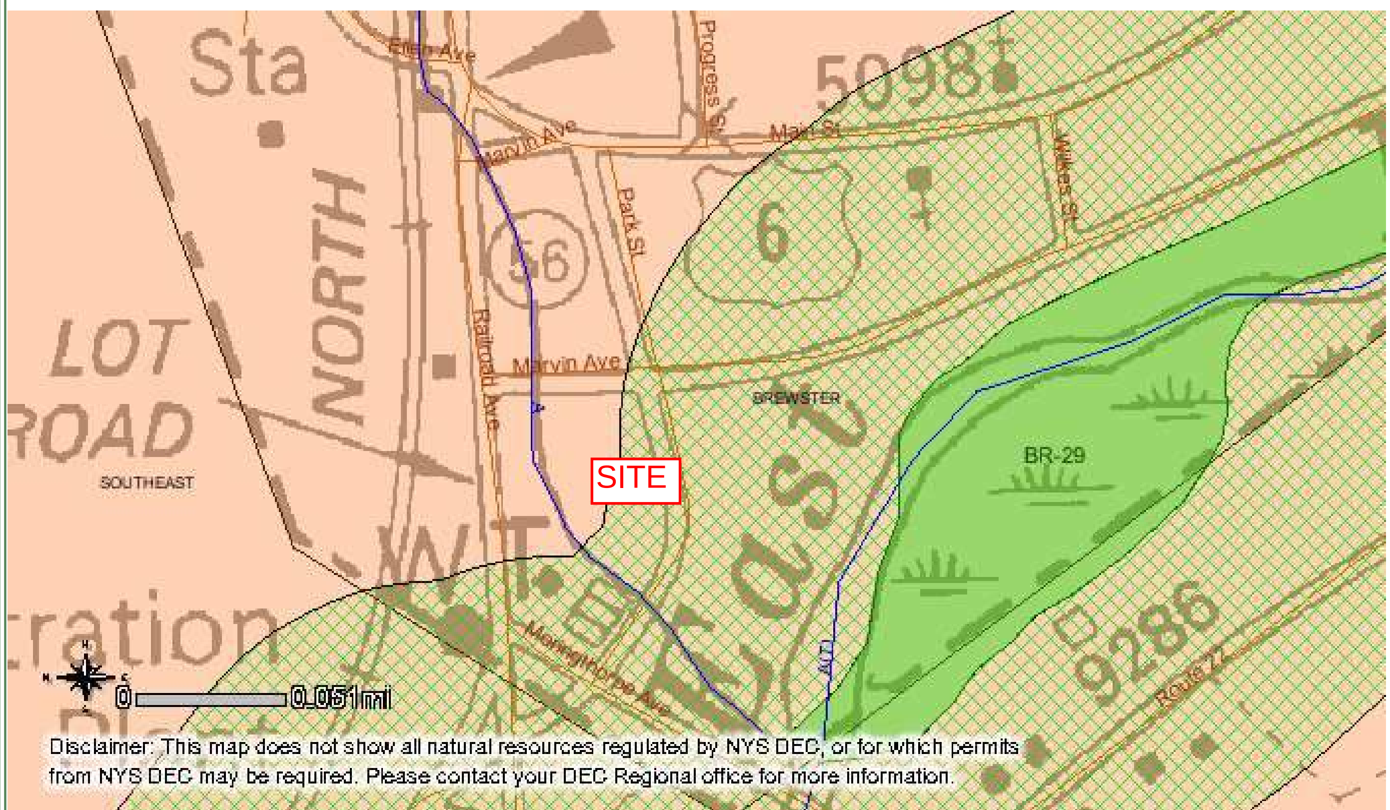
Please set your printer orientation to "Landscape".

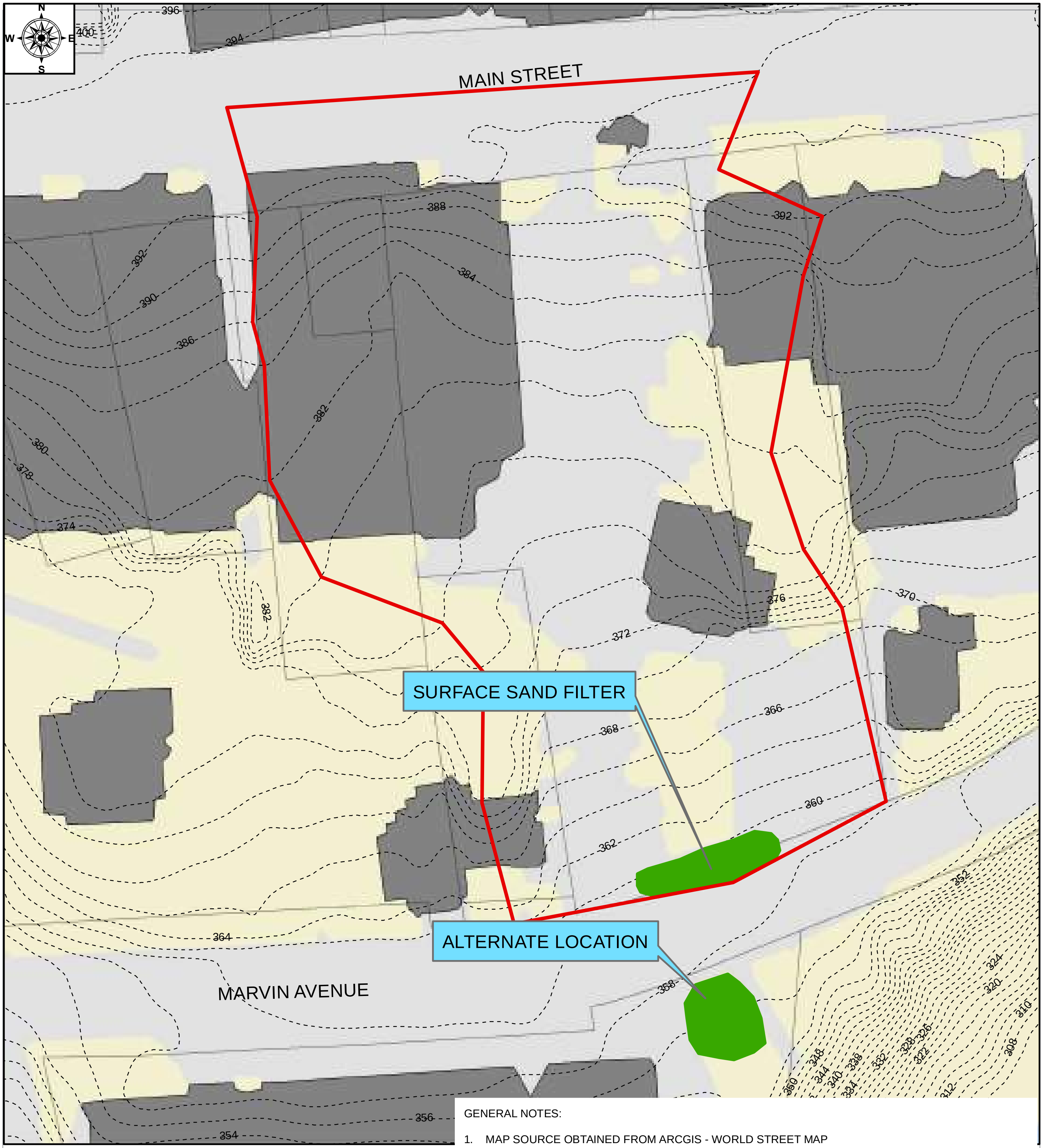
Railroad Ave.



MinX: 615153, MaxX: 615905, MinY: 4583502, MaxY: 4583133

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER

0 30 60 90 120 Feet

Legend

- Drainage Basins
- Proposed SRP Location
- Parcels

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STORMWATER RETROFIT CONCEPT PLAN

SOUTHEAST MUSEUM & BREWSTER LIBRARY
4-10 MARVIN AVENUE

VILLAGE OF BREWSTER

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 60'

VB-3

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER

0 30 60 90 120 Feet

Legend

- Drainage Basins
- Proposed SRP Location
- Parcels

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STORMWATER RETROFIT CONCEPT PLAN

SOUTHEAST MUSEUM & BREWSTER LIBRARY
4-10 MARVIN AVENUE

VILLAGE OF BREWSTER

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 60'

VB-3

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

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Since 1989

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VB-3
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"VB-3: SOUTHEAST MUSEUM/BREWSTER LIBRARY"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.71	acres	where:	A =	Contributing Area (acres)
I =	1	58.48%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.5763			WQv =	Water Quality Volume
Rv (min)**** =**	0.5763				
WQv (acre-ft) =	**0.099**				
WQv (cu-ft) =	**4293**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5763		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.71		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.42
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.58
Develped Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**3.92**	lb/yr
	1.78	kg/yr
P Removal -------------------->	**2.31**	lb/yr
	1.05	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**1.7**	Phosphorus Loading (kg/yr)	**1.78**
Water Quality Volume (cf)	**4293**	Phosphorus Reduction (kg/yr)	**1.05**

ASSUMPTIONS/COMMENTS:

Install practice within existing parking lot property that is owned by the Town of Southeast.
Alternatively this practice could be installed across Marvin Ave. on Village of Brewster Property.
Bioretention could be considered as an alternative practice because it has a larger phosphorus removal capacity.
Bioretention could be considered as an alternative practice at this location.

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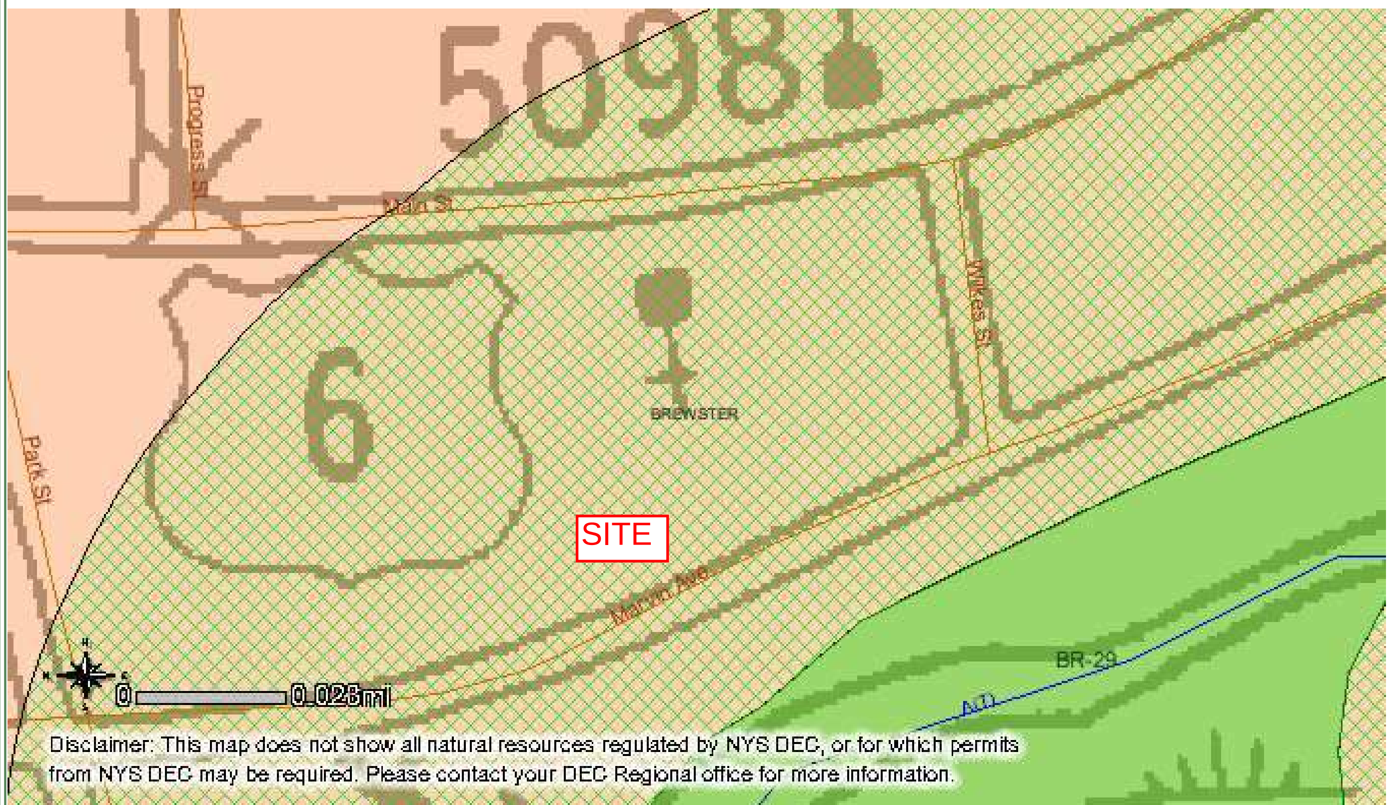
Please set your printer orientation to "Landscape".

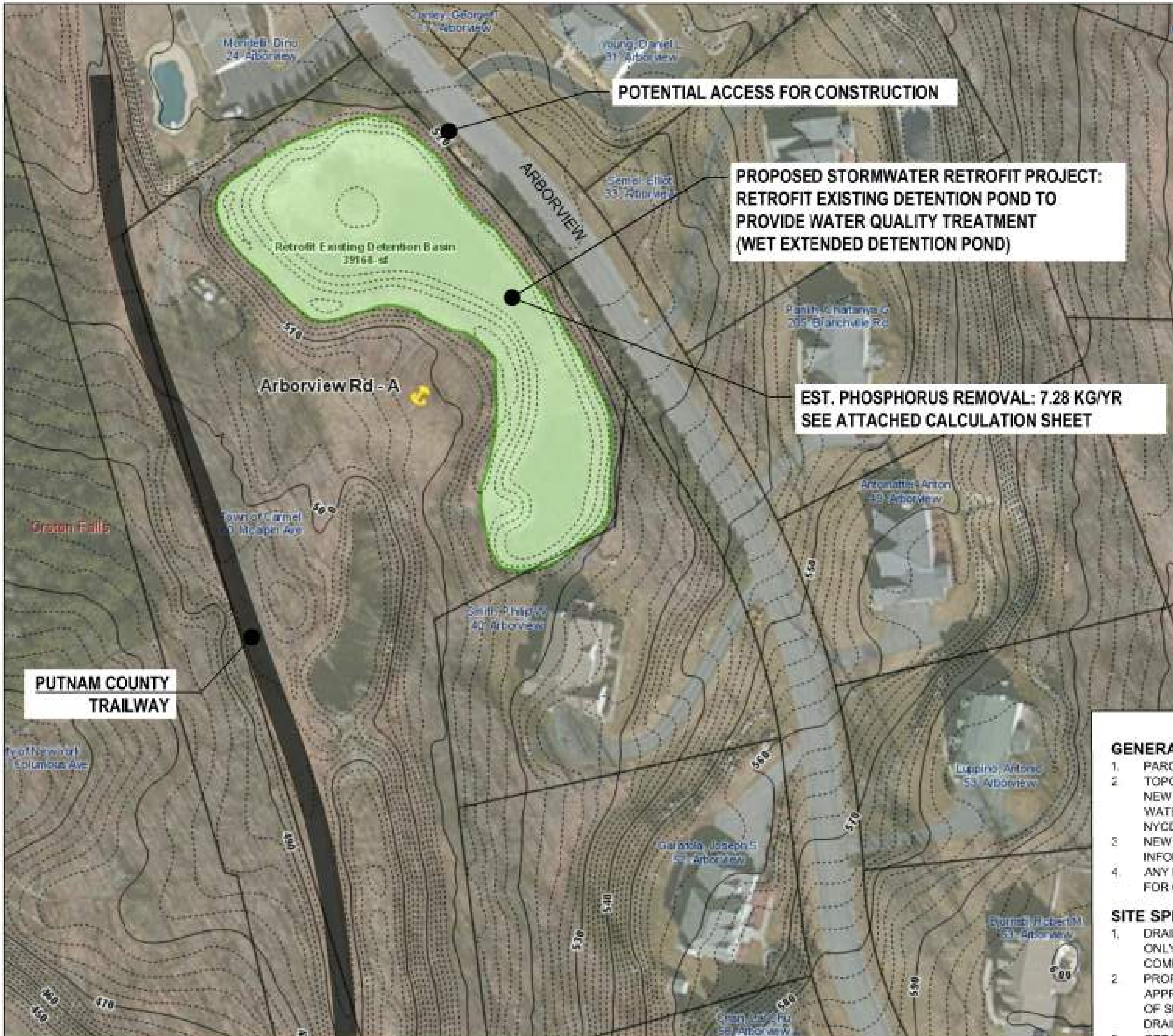
Southeast Museum and Brewster Library



MinX: 615488, MaxX: 615829, MinY: 4583502, MaxY: 4583334

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



LOCATION MAP: SCALE: 1" = 4000'
Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY. AREA IS PART OF APPROVED SUBDIVISION AND CONTAINS EXISTING DETENTION POND FOR PORTION OF SUBDIVISION RUNOFF. SEE ATTACHED AS-BUILT PLANS FOR EXISTING DRAINAGE COLLECTION/CONVEYANCE INFORMATION.
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

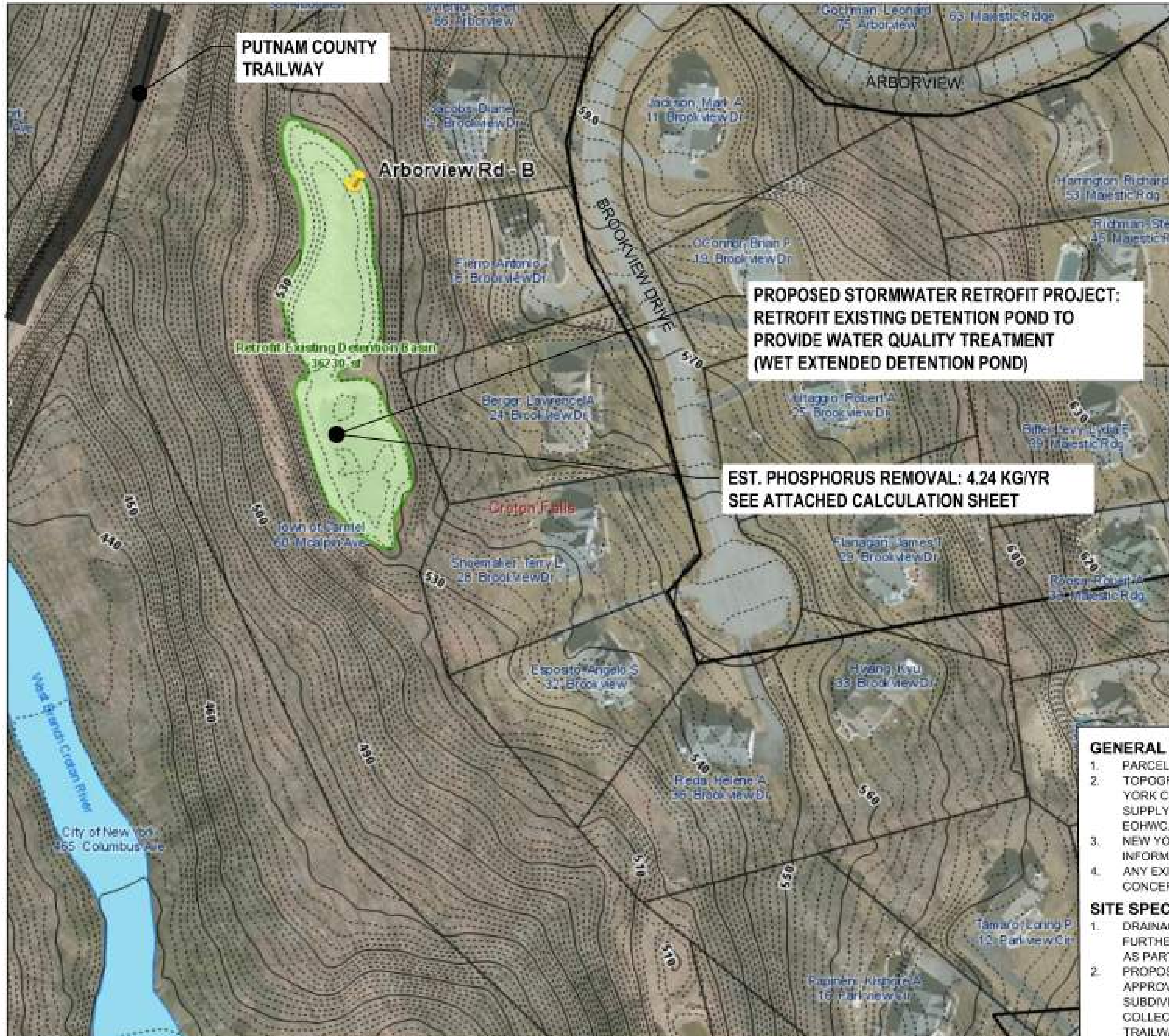
DESIGNED BY: CRP/RGL CHECKED BY: LJP
DRAWN BY: CRP/RGL ARBORVIEW_A-B_CONCEPTPLAN_FIGURE

RETROFIT EXISTING DETENTION POND
ARBORVIEW SUBDIVISION – A

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

CARMEL-1A



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY. AREA IS PART OF APPROVED SUBDIVISION AND CONTAINS EXISTING DETENTION POND FOR PORTION OF SUBDIVISION RUNOFF. SEE ATTACHED AS-BUILT PLANS FOR EXISTING DRAINAGE COLLECTION/CONVEYANCE INFORMATION. COORDINATION WITH PUTNAM COUNTY TRAILWAY AND/OR ADJACENT PROPERTY OWNERS WILL BE REQURIED FOR ACCESS TO EXISTING POND DURING CONSTRUCTION.
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

ARBORVIEW_A-B_CONCEPTPLAN_FIGURE_11x17.mxd

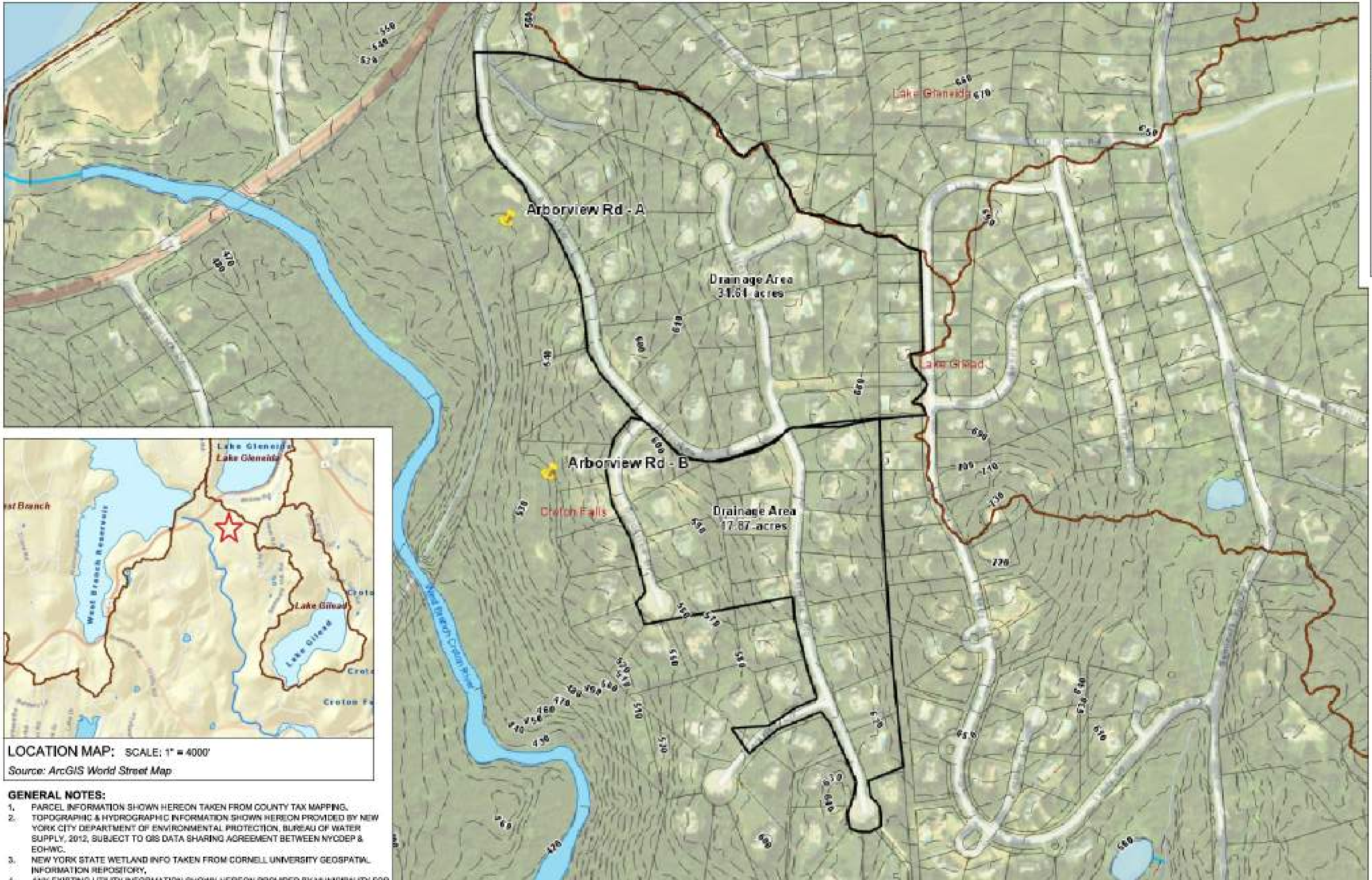
RETROFIT EXISTING DETENTION POND
ARBORVIEW SUBDIVISION – B

TOWN OF CARMEL

JOB NO:	
DATE:	8/12/16
SCALE:	1"=120'

CARMEL-1B

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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WOODARD & CURRAN
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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

ARBORVIEW_A-B_DRAINAGE AREA_FIGURE

DRAINAGE AREA PLAN
ARBORVIEW SUBDIVISION – A-B

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=350'

CARMEL-1A-1B

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-1A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-1A: Arborview - A

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	31.6	acres	where:	A =	Contributing Area (acres)
I =	9	28.48%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3063			WQv =	Water Quality Volume
Rv (min)** =	0.3063				
WQv (acre-ft) =	**0.968**				
WQv (cu-ft) =	**42166**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3063		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	31.6		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------>	**36.49**	lb/yr
	16.55	kg/yr
P Removal ------------------>	**20.07**	lb/yr
	9.10	kg/yr
	7.28	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**31.6**	Phosphorus Loading (kg/yr)	**16.55**
Water Quality Volume (cf)	**42166**	Phosphorus Reduction (kg/yr)	**7.28**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-1B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-1B: Arborview - B

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	17.9	acres	where:	A =	Contributing Area (acres)
I =	5.27	29.44%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3150			WQv =	Water Quality Volume
Rv (min)** =	0.3150				
WQv (acre-ft) =	**0.564**				
WQv (cu-ft) =	**24559**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3150		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	17.9		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

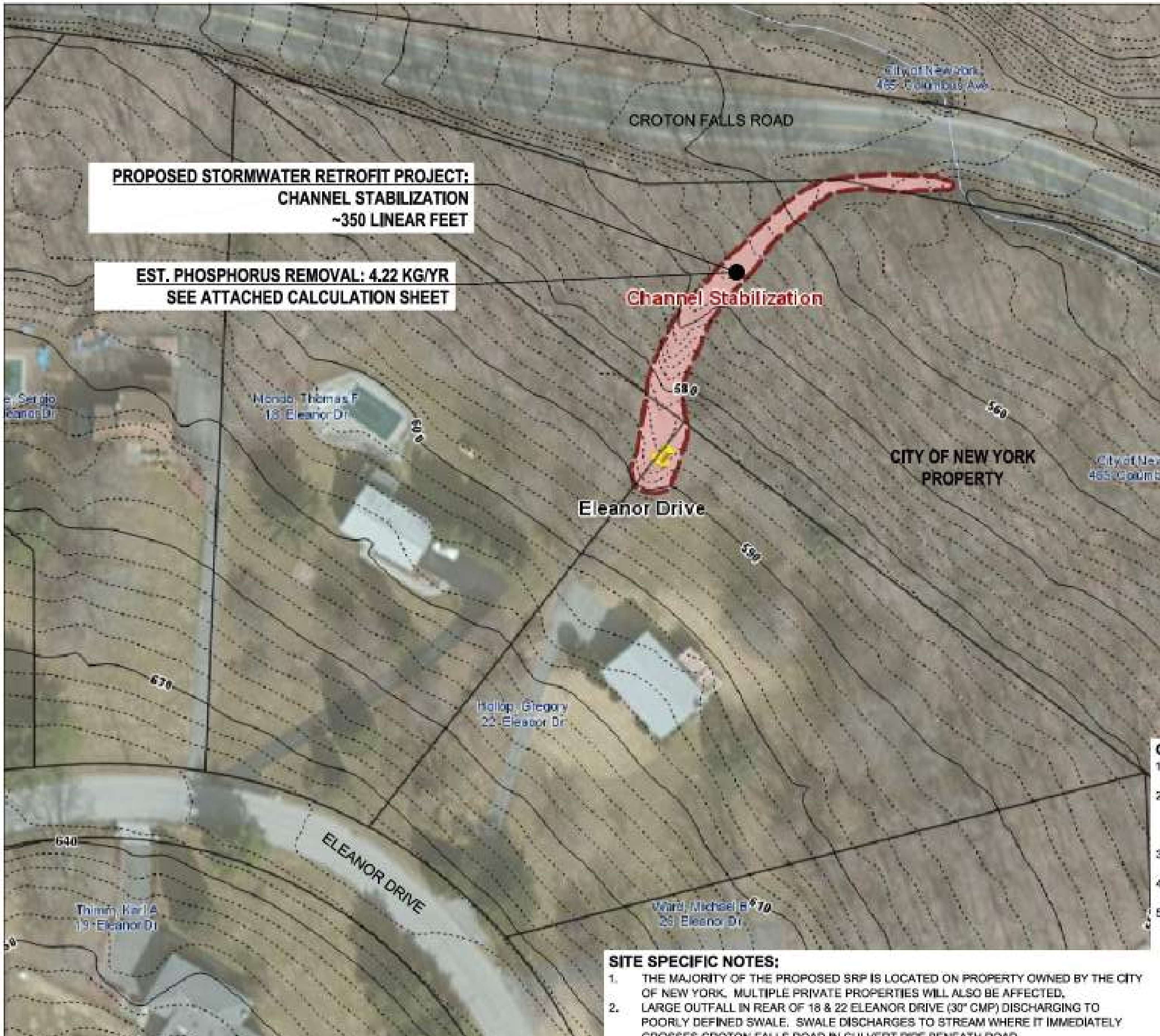
Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------>	**21.25**	lb/yr
	9.64	kg/yr
P Removal ------------------>	**11.69**	lb/yr
	5.30	kg/yr
	4.24	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**17.9**	Phosphorus Loading (kg/yr)	**9.64**
Water Quality Volume (cf)	**24559**	Phosphorus Reduction (kg/yr)	**5.30**



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

SITE SPECIFIC NOTES:

1. THE MAJORITY OF THE PROPOSED SRP IS LOCATED ON PROPERTY OWNED BY THE CITY OF NEW YORK. MULTIPLE PRIVATE PROPERTIES WILL ALSO BE AFFECTED.
2. LARGE OUTFALL IN REAR OF 18 & 22 ELEANOR DRIVE (30" CMP) DISCHARGING TO POORLY DEFINED SWALE. SWALE DISCHARGES TO STREAM WHERE IT IMMEDIATELY CROSSES CROTON FALLS ROAD IN CULVERT PIPE BENEATH ROAD.

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATIONS WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATIONS SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

ELEANORDRIVE_CONCEPTPLAN_FIGURE_11X17.MXD

CHANNEL STABILIZATION
ELEANOR DRIVE

TOWN OF CARMEL

JOB NO:	
DATE:	8/12/16
SCALE:	1"=60'

CARMEL-2

Carmel-2: Eleanor Drive Channel Stabilization

Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	2.0	5.0				
Channel Bottom Width - B (ft)	6.0	10.0				
Channel Top Width -T (ft)	8.0	12.0				
Wetted Perimeter Calculation-P (ft)	10.47	20.20				
Channel Length-L (ft)	210	140				
Soil Erosion Depth-D (ft)	0.065	0.065				
Soil Erosion Volume-V (ft^3)	142.9	183.8				
Weight* (lbs)	13,579.7	17,461.2				
Weight (Kg)	6,159.8	7,920.4				
P Load** (mg/Yr)	1,847,931.3	2,376,120.7				
P Load (Kg/Yr)	1.85	2.38				
					ESTIMATED TOTAL (KG/YR):	4.22

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P= T+ [(8/3)^* (y^2/T)]$

Soil Erosion Volume: $V= P^*L^*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON PUTNAM HOSPITAL PROPERTY. COORDINATION WITH PUTNAM HOSPITAL WILL BE REQUIRED TO FURTHER INVESTIGATE SITE, OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND EXISTING COLLECTION SYSTEM.
3. ONCE ADEQUATE AS-BUILT INFORMATION IS OBTAINED, SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
PUTNAMHOSPITAL_A-B_CONCEPTPLAN_FIGURE_11X17.DWG

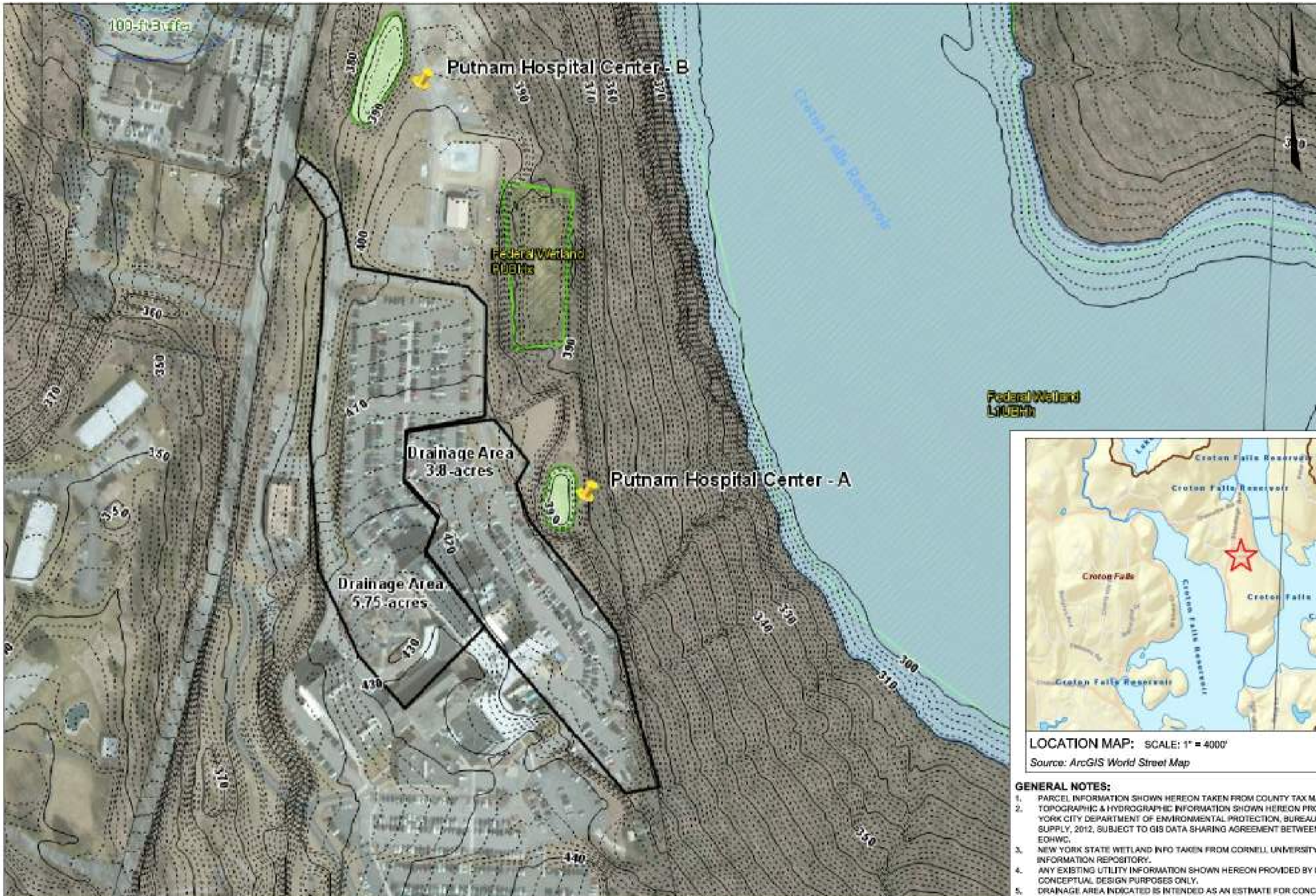
RETROFIT EXISTING DETENTION POND
PUTNAM HOSPITAL CENTER - A

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

CARMEL-4A

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	PUTNAMHOSPITAL_A–B_DRAINAGEAREA_FIGURE_TEMP.DWG	

DRAINAGE AREA MAP
PUTNAM HOSPITAL CENTER A–B

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=200'

CARMEL-4A-4B

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-4A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-4A: Putnam Hospital Center - A

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.8	acres	where:	A =	Contributing Area (acres)
I =	3.8	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.361**				
WQv (cu-ft) =	**15725**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.8		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**16.59**	lb/yr
	7.53	kg/yr
P Removal ------------------->	**9.13**	lb/yr
	4.14	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**3.8**	Phosphorus Loading (kg/yr)	**7.53**
Water Quality Volume (cf)	**15725**	Phosphorus Reduction (kg/yr)	**4.14**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-4B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-4B: Putnam Hospital Center - B

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	5.7	acres	where:	A =	Contributing Area (acres)
I =	5.7	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.542**				
WQv (cu-ft) =	**23588**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	5.7		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

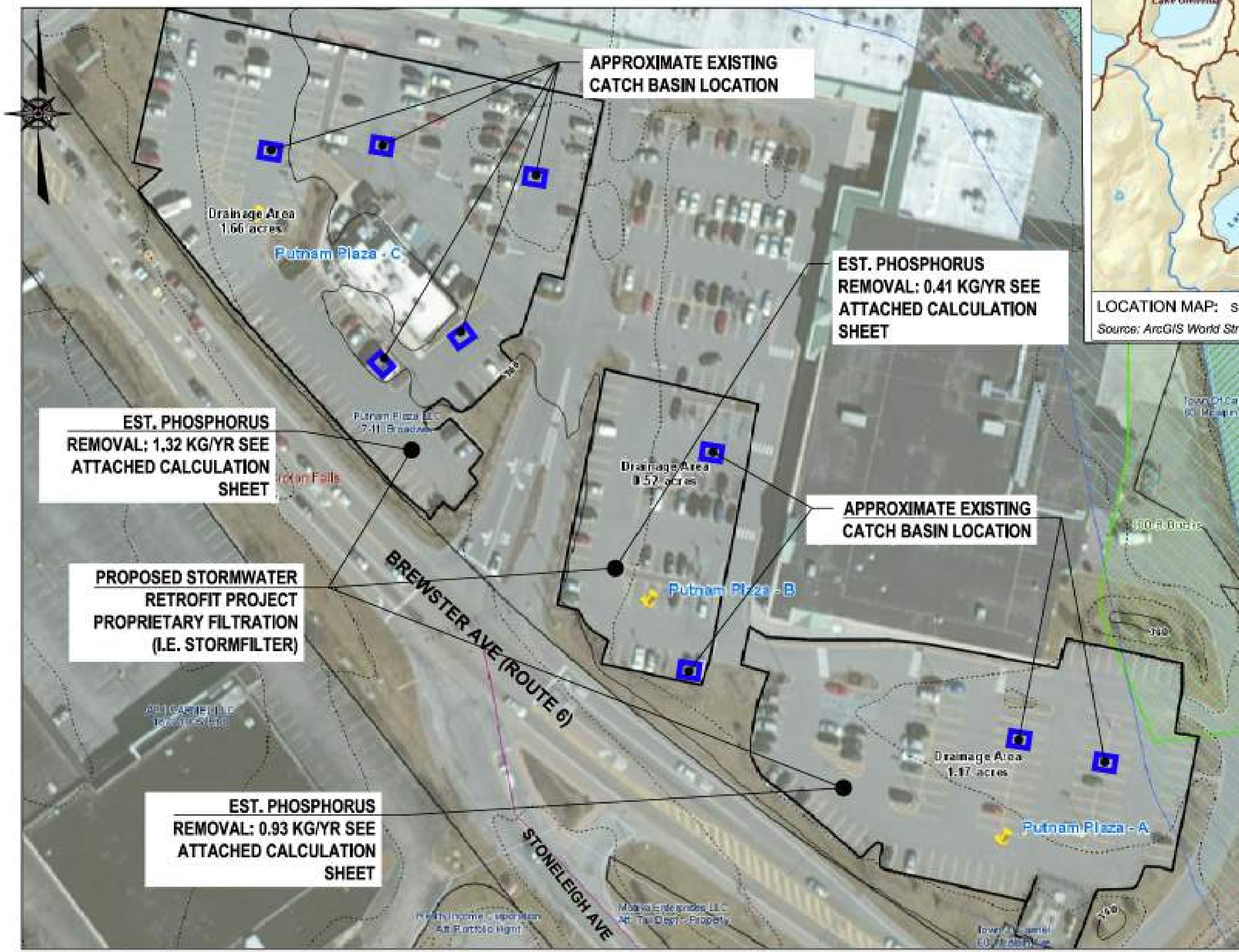
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**24.89**	lb/yr
	11.29	kg/yr
P Removal ------------------->	**13.69**	lb/yr
	6.21	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**5.7**	Phosphorus Loading (kg/yr)	**11.29**
Water Quality Volume (cf)	**23588**	Phosphorus Reduction (kg/yr)	**6.21**

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. DRAINAGE AREA INDICATED IS BASED ON APPARENT COLLECTION AREA OF EXISTING CATCH BASINS OBSERVED ON SITE DURING FIELD INSPECTION.
3. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY. COORDINATION WITH PROPERTY OWNER TO OBTAIN EASEMENT WILL BE REQUIRED.
4. PROPOSED PROPRIETARY FILTERING PRACTICES (I.E. STORMFILTER OR APPROVED OTHER) IN PARKING LOT. EXISTING STORMWATER COLLECTION/CONVEYANCE SYSTEM NEEDS TO BE VERIFIED TO DETERMINE LOCATION OF SRP, TREATED WATER QUALITY VOLUME AND PHOSPHORUS REDUCTION.
5. ALTERNATIVE PRACTICES INCLUDE CATCH BASIN INSERTS (FABCO STORM BASIN) WITHIN EXISTING CATCH BASINS.

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WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	PUTNAMPLAZA_A-C_CONCEPTPLAN

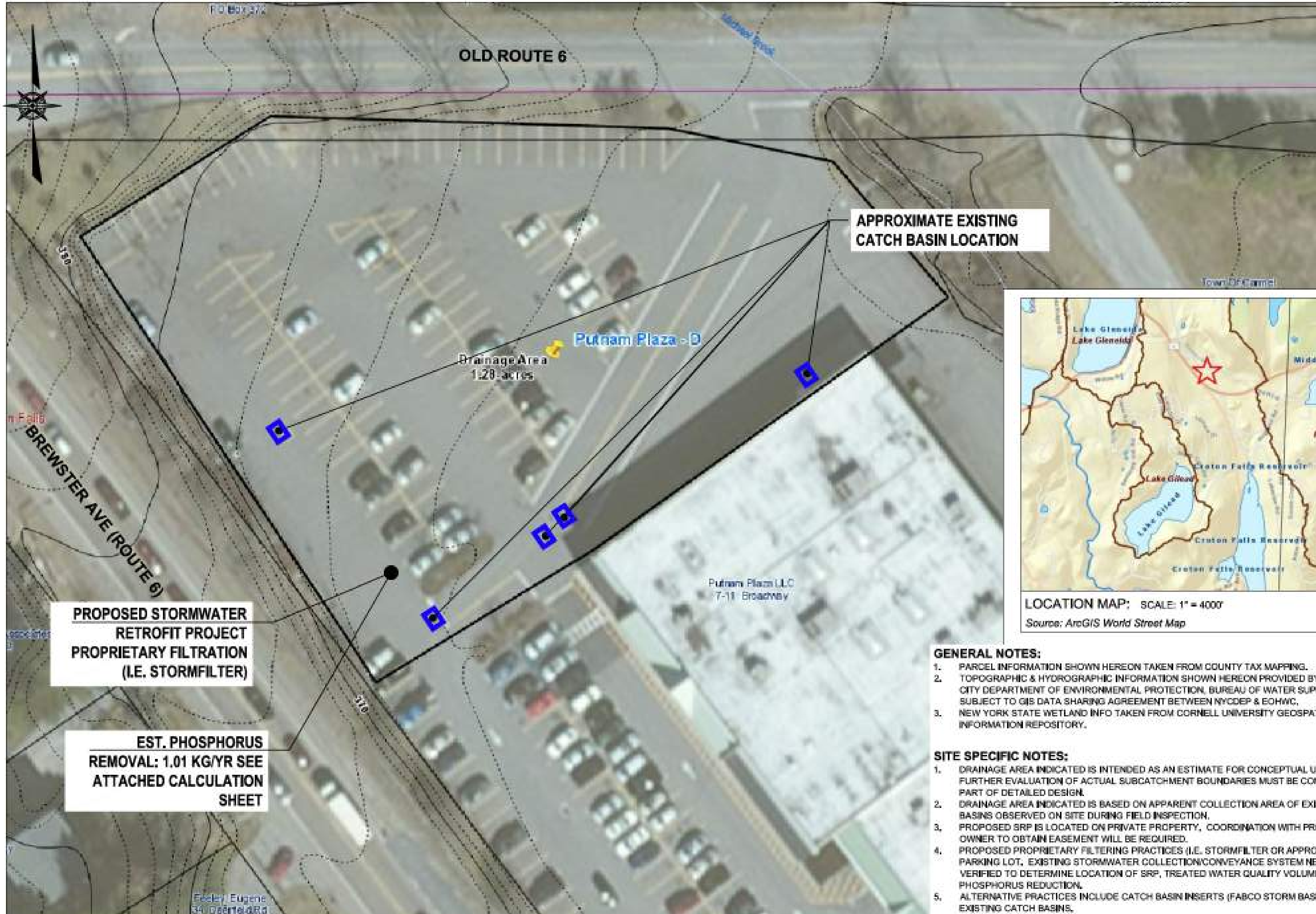
PROPRIETARY FILTERING PRACTICE
PUTNAM PLAZA A-C

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

CARMEL-5A-5C

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. DRAINAGE AREA INDICATED IS BASED ON APPARENT COLLECTION AREA OF EXISTING CATCH BASINS OBSERVED ON SITE DURING FIELD INSPECTION.
3. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY. COORDINATION WITH PROPERTY OWNER TO OBTAIN EASEMENT WILL BE REQUIRED.
4. PROPOSED PROPRIETARY FILTERING PRACTICES (I.E. STORMFILTER OR APPROVED OTHER) IN PARKING LOT. EXISTING STORMWATER COLLECTION/CONVEYANCE SYSTEM NEEDS TO BE VERIFIED TO DETERMINE LOCATION OF SRP, TREATED WATER QUALITY VOLUME AND PHOSPHORUS REDUCTION.
5. ALTERNATIVE PRACTICES INCLUDE CATCH BASIN INSERTS (FABCO STORM BASIN) WITHIN EXISTING CATCH BASINS.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP
FIGURE:	PUTNAMPLAZA_A-D_CONCEPTPLAN

PROPRIETARY FILTERING PRACTICE
PUTNAM PLAZA – D

TOWN OF CARMEL

JOB NO:	
DATE:	8/12/16
SCALE:	1"=40'

CARMEL-5D

1:1

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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COMMITMENT & INTEGRITY DRIVE RESULTS

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FIGURE

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	PUTNAMPLAZA_A-D_DRAINAGEAREA

DRAINAGE AREA PLAN
PUTNAM PLAZA

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

CARMEL-5A-5D

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-5A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-5A: Putnam Plaza - A

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.17	acres	where:	A =	Contributing Area (acres)
I =	1.17	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.111**				
WQv (cu-ft) =	**4842**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.08	hours	Tc =	Time of Concentration (hours)
CN =	99		CN =	Curve Number
qu =	569.691		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.18727	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.17		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Stormfilter**	
Removal Efficiency:	***40%***	
P Load ------------------->	**5.11**	lb/yr
	2.32	kg/yr
P Removal ------------------->	**2.04**	lb/yr
	0.93	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**1.2**	Phosphorus Loading (kg/yr)	**2.32**
Water Quality Volume (cf)	**4842**	Phosphorus Reduction (kg/yr)	**0.93**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-5B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-5B: Putnam Plaza - B

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	0.52	acres	where:	A =	Contributing Area (acres)
I =	0.52	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.049**				
WQv (cu-ft) =	**2152**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.08	hours	Tc =	Time of Concentration (hours)
CN =	99		CN =	Curve Number
qu =	569.691		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	0.52768	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	0.52		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**2.27**	lb/yr
	1.03	kg/yr
P Removal ------------------->	**0.91**	lb/yr
	0.41	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**0.5**	Phosphorus Loading (kg/yr)	**1.03**
Water Quality Volume (cf)	**2152**	Phosphorus Reduction (kg/yr)	**0.41**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-5C
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-5C: Putnam Plaza - C

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.66 acres	where:	A =	Contributing Area (acres)
I =	1.66 100.00%		I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500		WQv =	Water Quality Volume
Rv (min)** =	0.9500			
WQv (acre-ft) =	**0.158**			
WQv (cu-ft) =	**6869**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.08 hours	Tc =	Time of Concentration (hours)
CN =	99	CN =	Curve Number
qu =	569.691	qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.6845 CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.66		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**7.25**	lb/yr
	3.29	kg/yr
P Removal ------------------->	**2.90**	lb/yr
	1.32	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**1.7**	Phosphorus Loading (kg/yr)	**3.29**
Water Quality Volume (cf)	**6869**	Phosphorus Reduction (kg/yr)	**1.32**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-5D
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-5D: Putnam Plaza - D

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.28	acres	where:	A =	Contributing Area (acres)
I =	1.28	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.122**				
WQv (cu-ft) =	**5297**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.08	hours	Tc =	Time of Concentration (hours)
CN =	99		CN =	Curve Number
qu =	569.691		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.29889	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.28		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

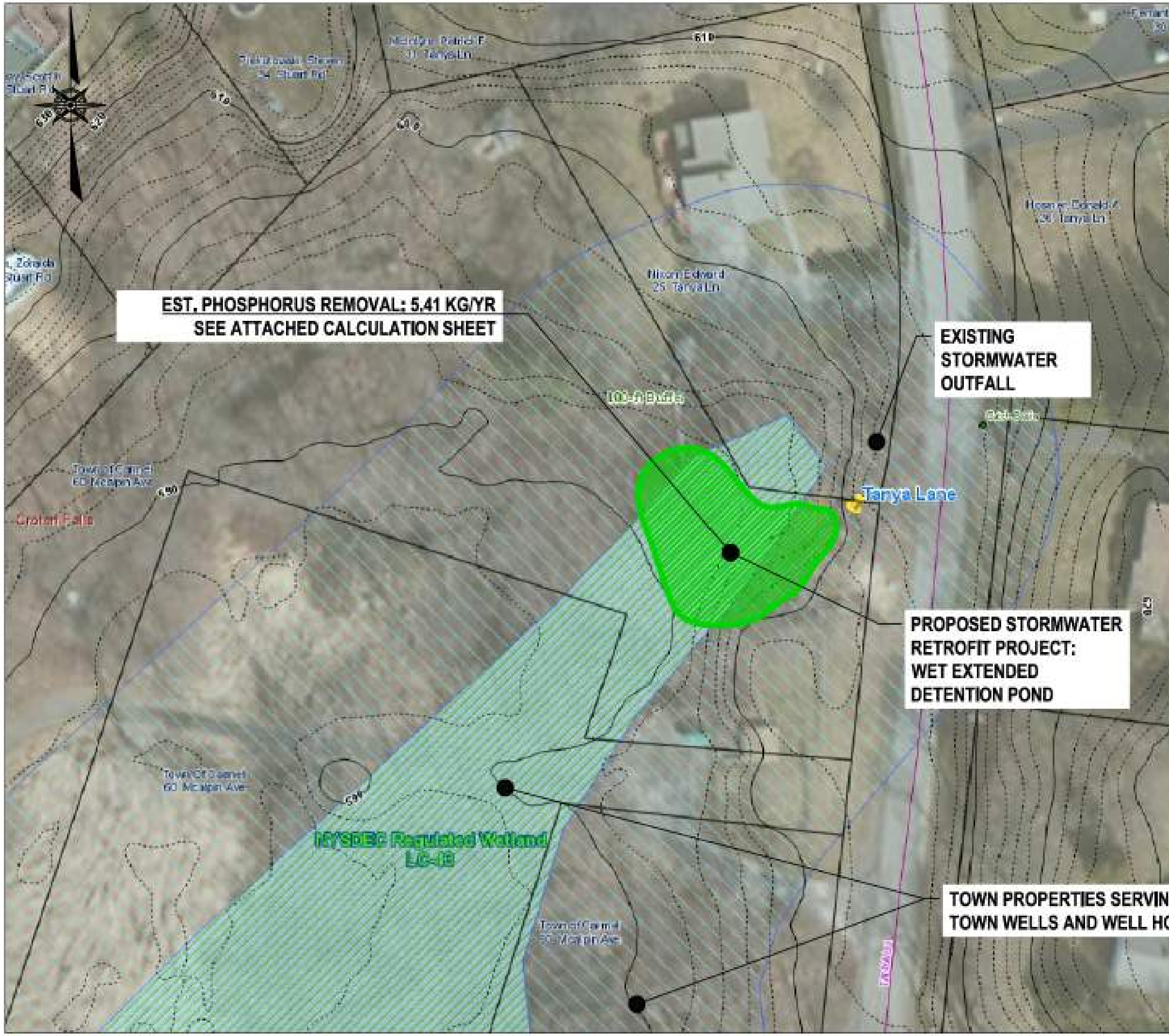
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**5.59**	lb/yr
	2.54	kg/yr
P Removal ------------------->	**2.24**	lb/yr
	1.01	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**1.3**	Phosphorus Loading (kg/yr)	**2.54**
Water Quality Volume (cf)	**5297**	Phosphorus Reduction (kg/yr)	**1.01**

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED WET EXTENDED DETENTION POND TO TREAT RUNOFF DISCHARGE FROM EXISTING OUTFALL.
4. COORDINATION AND PERMITTING WILL BE REQUIRED WITH NYSDEC TO DETERMINE FEASIBILITY OF PROJECT DUE TO PROPOSED LOCATION WITHIN MAPPED JURISDICTIONAL WETLAND. BASED ON SITE VISIT, IT APPEARS THAT ACTUAL WETLAND LIMITS MAY NOT EXTEND AS FAR INTO THE PROPOSED SRP AREA AS SHOWN ON AVAILABLE MAPPING. ADDITIONAL WETLAND MAPPING AND/OR SITE VISITS WITH THE NYSDEC MAY BE REQUIRED TO DETERMINE FEASIBILITY OF PROPOSED SRP.
5. ALTERNATIVE SRP's THAT MAY AVOID IMPACT TO MAPPED WETLAND AREA INCLUDE PROPRIETARY FILTERING PRACTICE (I.E. STORMFILTER) AT END OF PIPE.

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COMMITMENT & INTEGRITY DRIVE RESULTS

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

TANYALANE_CONCEPTPLAN_FIGURE_11X17.DWG

WET EXTENDED DETENTION POND
TANYA LANE

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

CARMEL-7

1:1

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
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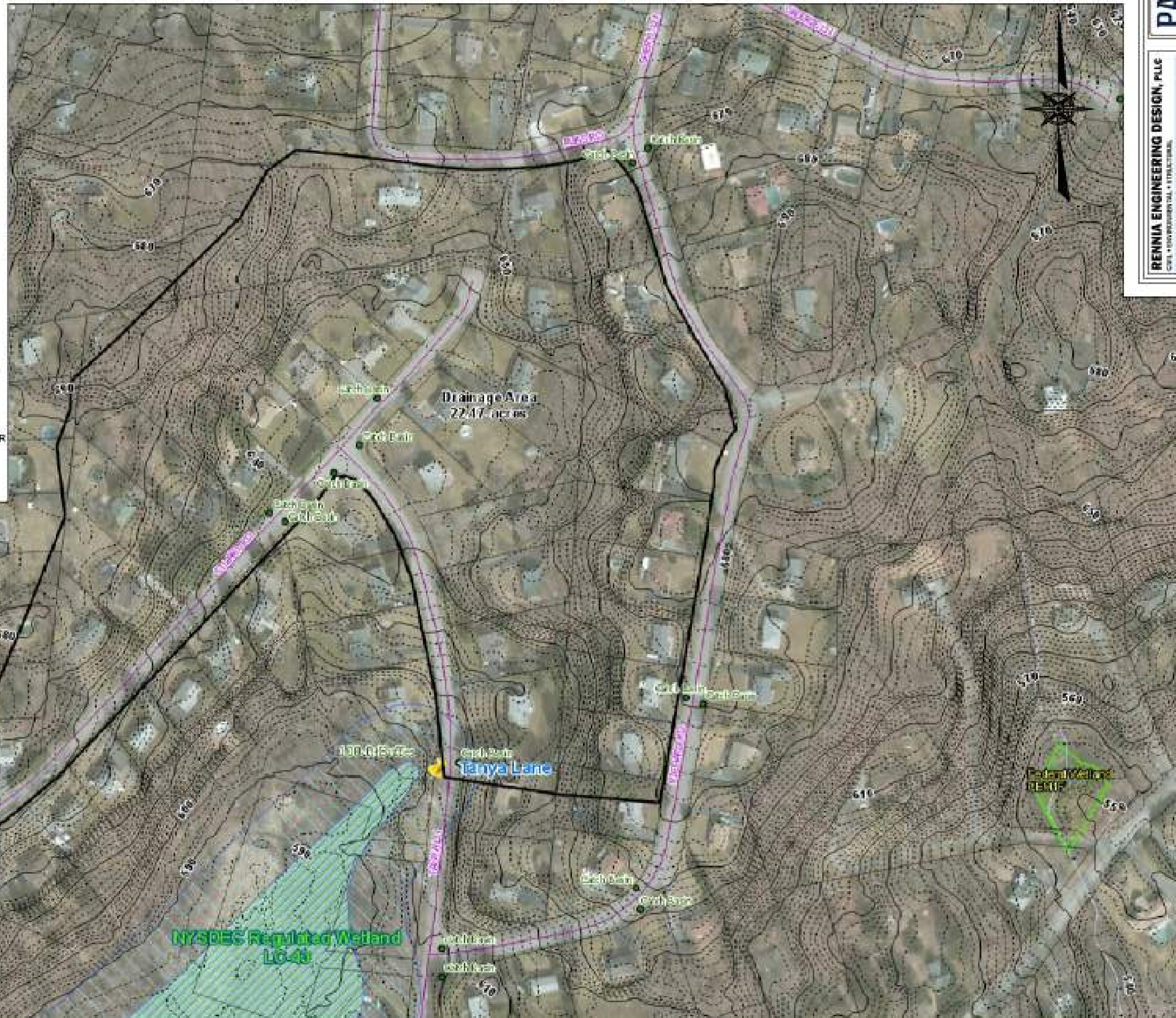
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.



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WOODARD & CURRAN

TANYALANE_DRAINAGEAREA_FIGURE_11X17.DWG

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

DRAINAGE AREA PLAN
TANYA LANE

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=200'

CARMEL-7

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Carmel-7
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Carmel-7: Tanya Lane

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	22.47	acres	where:	A =	Contributing Area (acres)
I =	6.74	30.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3200			WQv =	Water Quality Volume
Rv (min)** =	0.3200				
WQv (acre-ft) =	**0.719**				
WQv (cu-ft) =	**31317**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.45 hours		Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	406.531		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	5.48016 CFS		Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3200		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	22.47		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

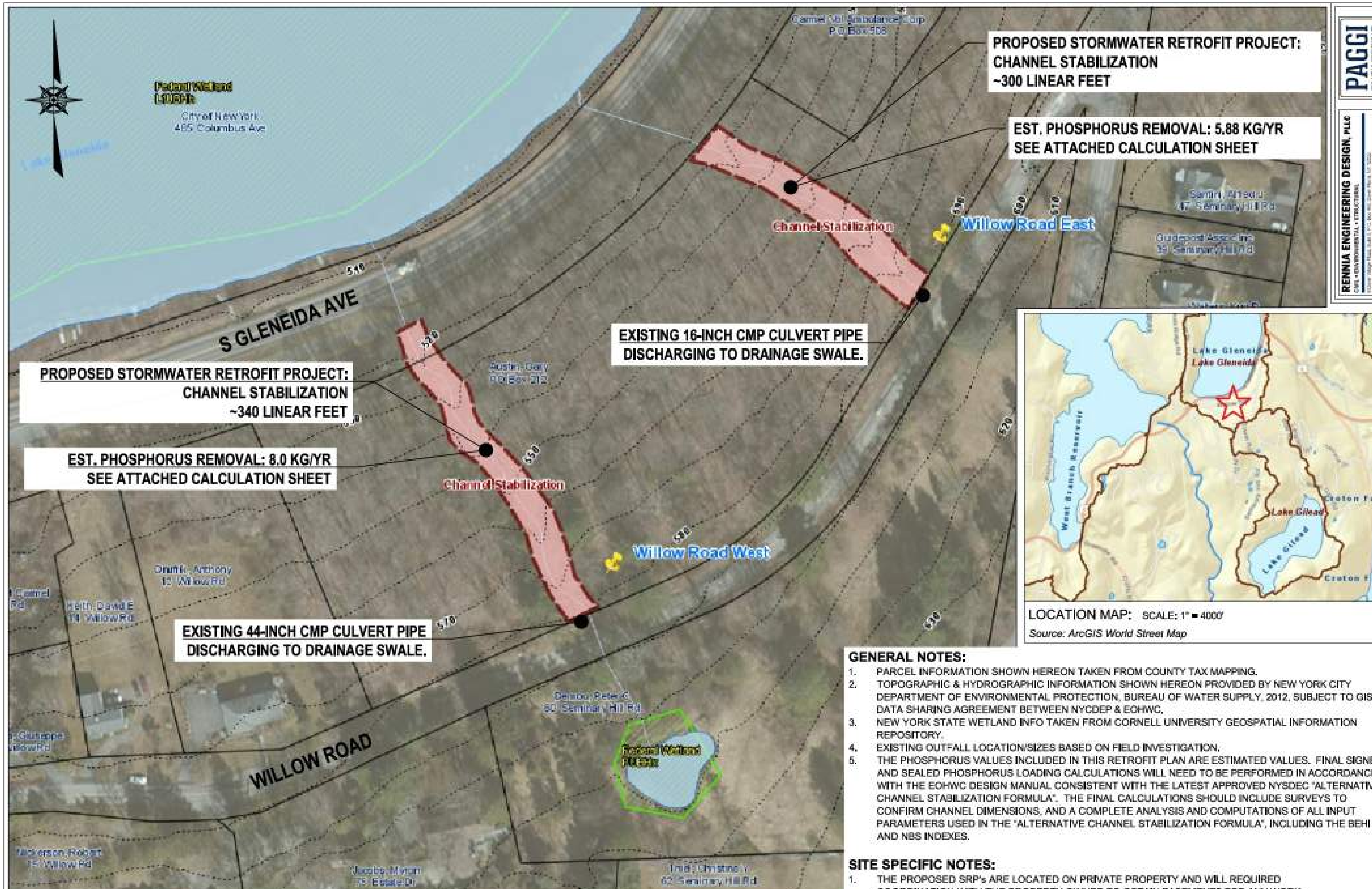
Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**27.10**	lb/yr
	12.29	kg/yr
P Removal ------------------->	**14.90**	lb/yr
	6.76	kg/yr
	5.41	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**22.5**	Phosphorus Loading (kg/yr)	**12.29**
Water Quality Volume (cf)	**31317**	Phosphorus Reduction (kg/yr)	**5.41**



GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. EXISTING OUTFALL LOCATION/SIZES BASED ON FIELD INVESTIGATION.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATIONS WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATIONS SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

SITE SPECIFIC NOTES:

1. THE PROPOSED SRP's ARE LOCATED ON PRIVATE PROPERTY AND WILL REQUIRED COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	WILLOWROAD_CONCEPTPLAN_FIGURE_11X17.DWG

CHANNEL STABILIZATION
WILLOW ROAD EAST & WEST

TOWN OF CARMEL

JOB NO:
DATE: 8/12/16
SCALE: 1"=100'

CARMEL-9A-9B

Carmel-9A: Willow Road West Channel Stabilization

Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	6.0					
Channel Bottom Width - B (ft)	15.0					
Channel Top Width -T (ft)	20.0					
Wetted Perimeter Calculation-P (ft)	28.00					
Channel Length-L (ft)	340					
Soil Erosion Depth-D (ft)	0.065					
Soil Erosion Volume-V (ft^3)	618.8					
Weight* (lbs)	58,786.0					
Weight (Kg)	26,665.3					
P Load** (mg/Yr)	7,999,598.9					
P Load (Kg/Yr)	8.00					
					ESTIMATED TOTAL (KG/YR):	8.00

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P = T + [(8/3)^* (y^2/T)]$

Soil Erosion Volume: $V = P^*L^*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

Carmel-9B: Willow Road East Channel Stabilization						
Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	6.0					
Channel Bottom Width - B (ft)	10.0					
Channel Top Width -T (ft)	15.0					
Wetted Perimeter Calculation-P (ft)	23.00					
Channel Length-L (ft)	300					
Soil Erosion Depth-D (ft)	0.065					
Soil Erosion Volume-V (ft^3)	448.5					
Weight* (lbs)	42,607.5					
Weight (Kg)	19,326.8					
P Load** (mg/Yr)	5,798,028.6					
P Load (Kg/Yr)	5.80					
					ESTIMATED TOTAL (KG/YR):	5.80

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

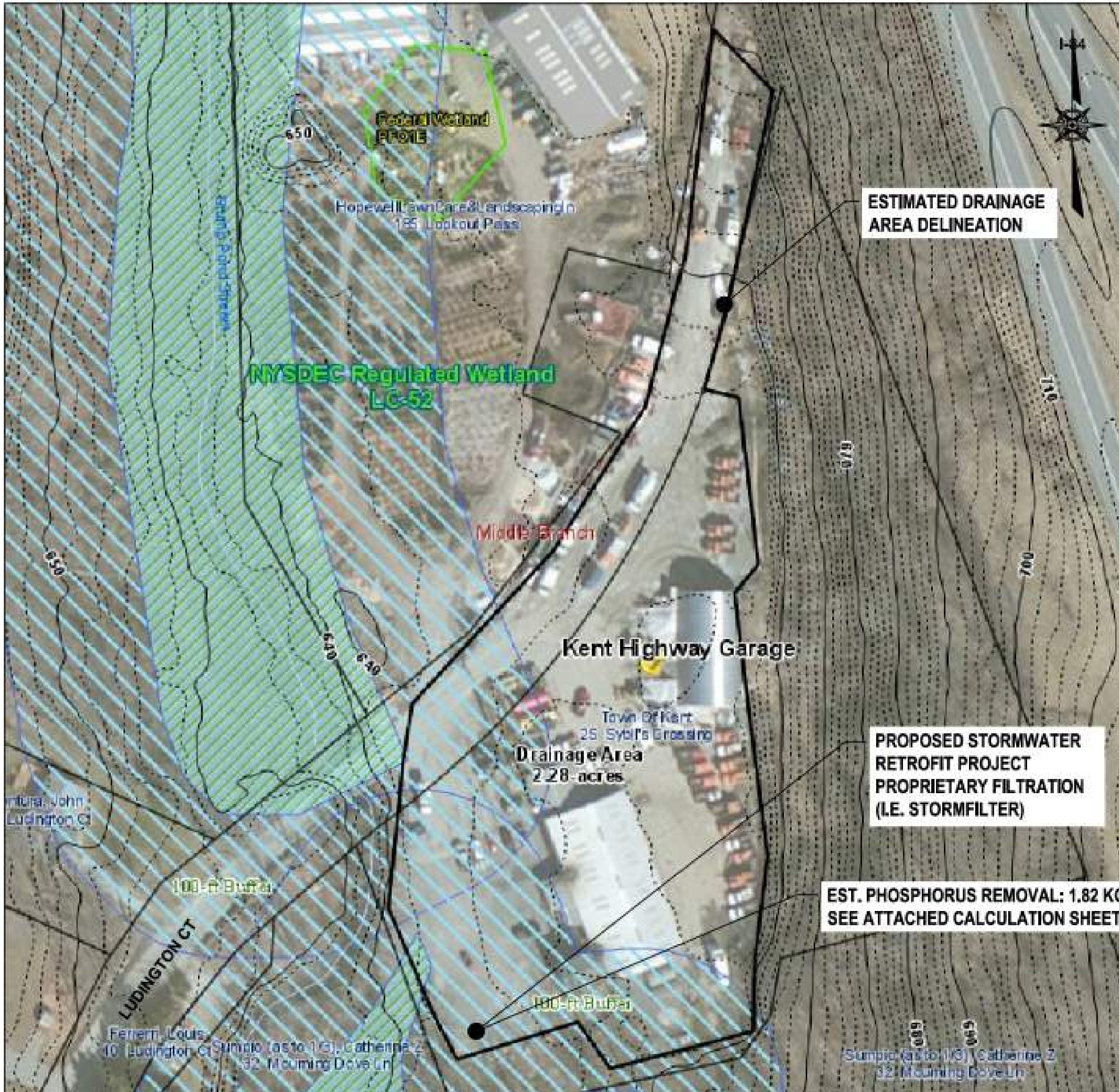
Wetted Perimeter (P) approximately: $P= T+ [(8/3)* (y^2/T)]$

Soil Erosion Volume: $V= P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. WETLAND PERMITTING LIKELY REQUIRED DUE TO PROPOSED SRP LOCATION WITHIN MAPPED STATE REGULATED WETLAND BUFFER AREA.
4. ALTERNATIVE SRP LOCATIONS INCLUDE NORTH OF SITE ENTRANCE OR SOUTHEAST OF MAIN BUILDING IN PARKING LOT AREA.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

HIGHWAYGARAGE_DRAINAGEAREA_FIGURE_1

PROPRIETARY FILTRATION STRUCTURE
KENT HIGHWAY GARAGE

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=80'

Kent-1

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-1
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-1: Kent Highway Garage

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.3	acres	where:	A =	Contributing Area (acres)
I =	2.3	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.219**				
WQv (cu-ft) =	**9518**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.15	hours	Tc =	Time of Concentration (hours)
CN =	99		CN =	Curve Number
qu =	531.274		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	2.17656	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.3		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

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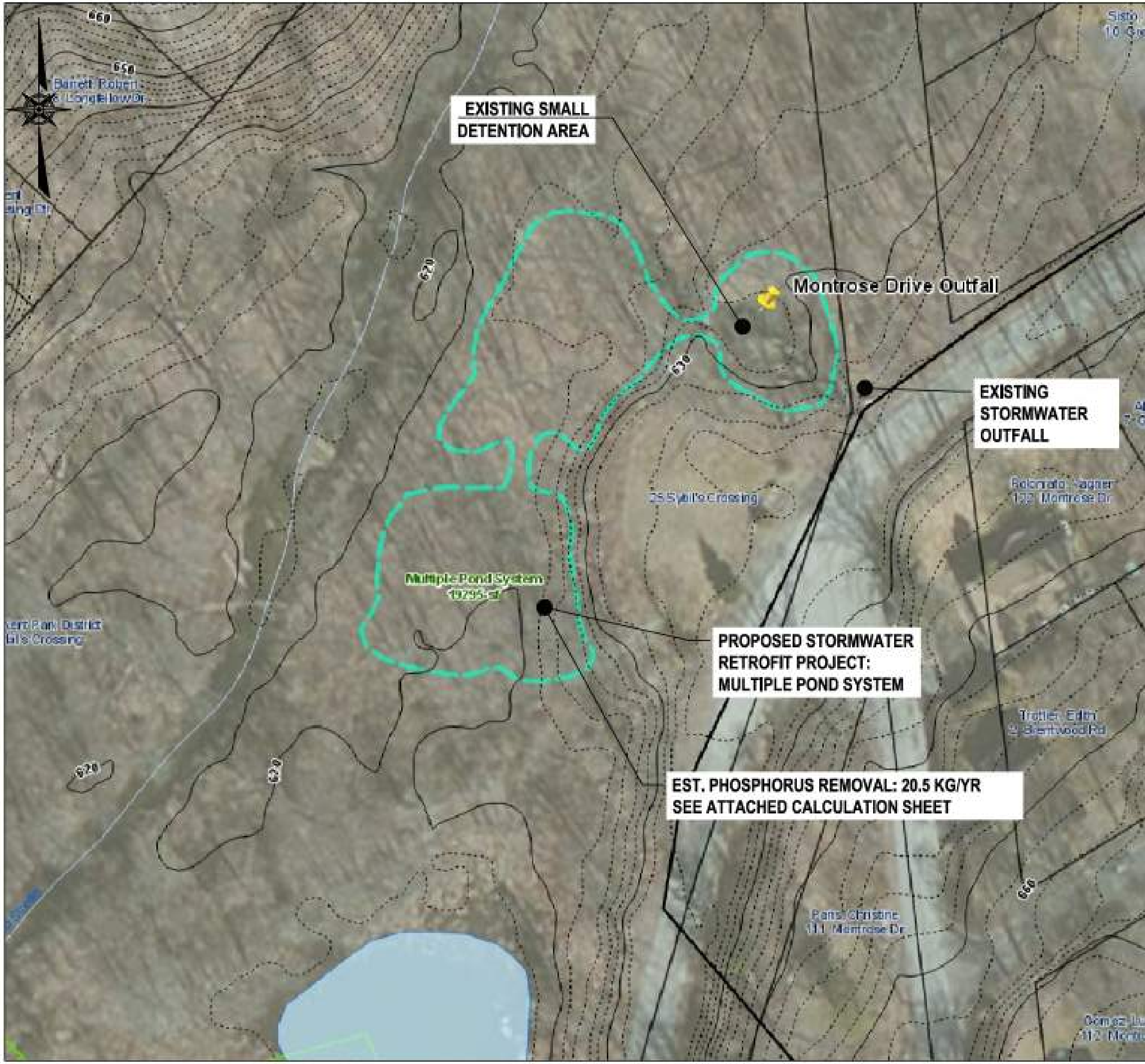
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**10.04**	lb/yr
	4.56	kg/yr
P Removal ------------------->	**4.02**	lb/yr
	1.82	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**2.3**	Phosphorus Loading (kg/yr)	**4.56**
Water Quality Volume (cf)	**9518**	Phosphorus Reduction (kg/yr)	**1.82**

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED MULTIPLE POND SYSTEM TO TREAT RUNOFF DISCHARGE FROM EXISTING TOWN OUTFALLS FOR TREATMENT PRIOR TO DISCHARGE TO LAKE CARMEL.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

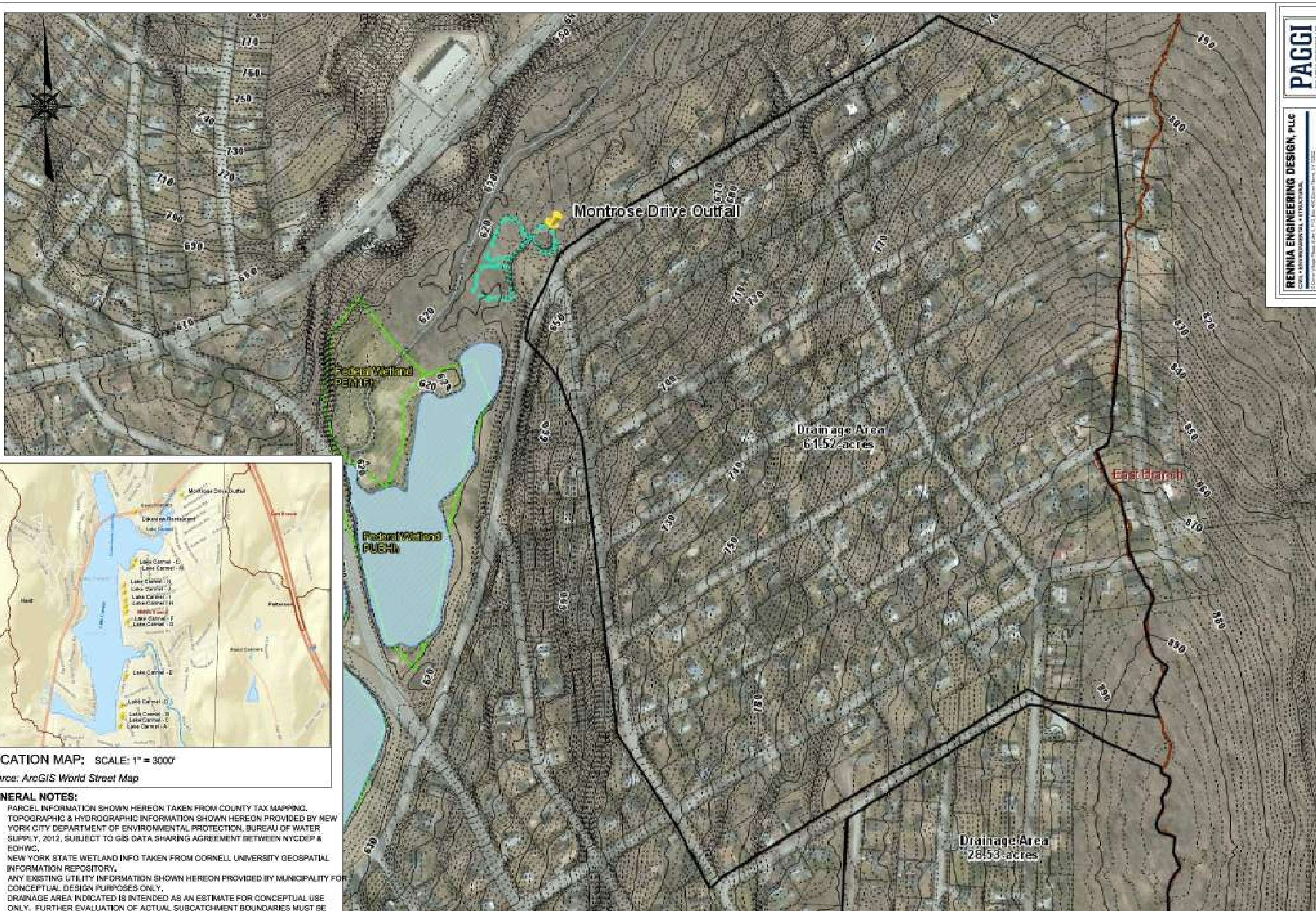
MULTIPLE POND SYSTEM
MONTROSE DRIVE OUTFALL

TOWN OF KENT

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

KENT-2

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

DRAINAGEAREA_FIGURE.DWG

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	MONTROSEDRIVEOUTFALL_DRAINAGEAREA_FIGURE.DWG	

DRAINAGE AREA PLAN
MONTROSE DRIVE OUTFALL

TOWN OF KENT

JOB NO:
DATE: 8/12/16
SCALE: 1"=250'

KENT-2

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent - 2
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-2: Montrose Drive Outfall

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	61.5	acres	where:	A =	Contributing Area (acres)
I =	18.5	30.08%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.3207		WQv =	Water Quality Volume
WQv (acre-ft) =		**1.973**			
WQv (cu-ft) =		**85922**			

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3207		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	61.5		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

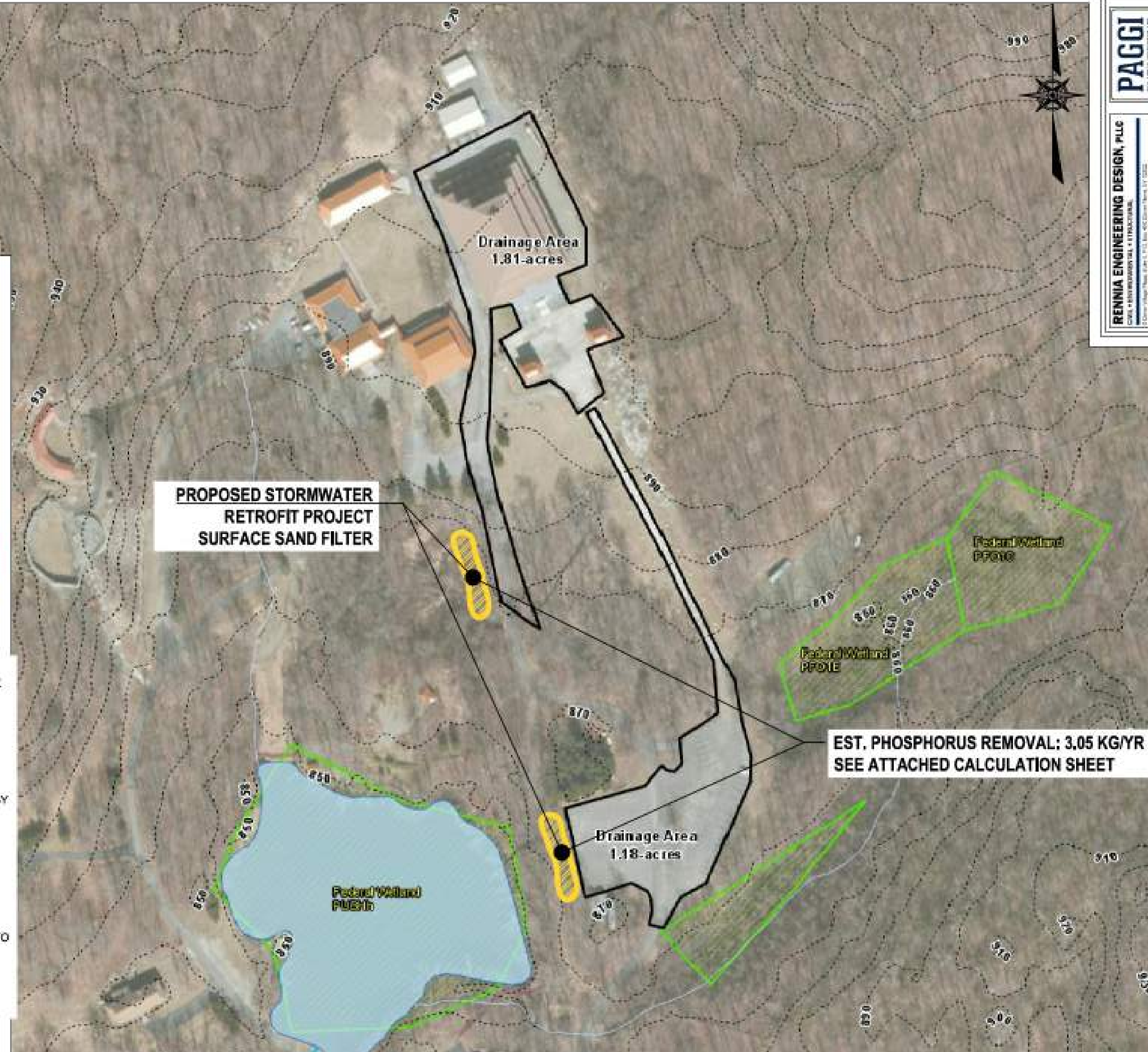
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Multiple Pond**	
Removal Efficiency:	***76%***	
P Load ------------------->	**74.35**	lb/yr
	33.73	kg/yr
P Removal ------------------->	**56.51**	lb/yr
	25.63	kg/yr

20.50 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Multiple Pond		
Drainage Area (acres)	**61.5**	Phosphorus Loading (kg/yr)	**33.73**
Water Quality Volume (cf)	**85922**	Phosphorus Reduction (kg/yr)	**20.50**



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY. COORDINATION WITH THE PROPERTY OWNER WILL BE REQUIRED TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
CHAUNGYENMONASTERY_CONCEPTPLAN_FIGURE.DWG

SURFACE SAND FILTER
CHAUNG YEN MONASTERY

TOWN OF KENT

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

KENT-3

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-3
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-3: Chuang Yen Monastery

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3	acres	where:	A =	Contributing Area (acres)
I =	3	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.285**				
WQv (cu-ft) =	**12415**				

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.73
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.27
Develped Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load ------------------->	**11.38**	lb/yr
	5.16	kg/yr
P Removal ------------------->	**6.71**	lb/yr
	3.05	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**3.0**	Phosphorus Loading (kg/yr)	**5.16**
Water Quality Volume (cf)	**12415**	Phosphorus Reduction (kg/yr)	**3.05**

1:1

LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

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2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY.
3. PROPOSED FILTERING IN EXISTIGN GRAVEL PARKING LOT PRIOR TO DISCHARGE TO LAKE CARMEL.
4. ALTERNATIVE SRP's INCLUDE CATCH BASIN INSERTS (I.E. FABCO STORMBASIN).

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL CHECKED BY: LJP
DRAWN BY: CRP/RGL
LAKEVIEWRESTAURANT_CONCEPTPLAN_FIGURE.DWG

PROPRIETARY FILTERING SYSTEM
LAKEVIEW RESTAURANT

TOWN OF KENT

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

KENT-4

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-4
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-4: Lakeview Restaurant

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.24	acres	where:	A =	Contributing Area (acres)
I =	0.7	31.25%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.3313			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.074**				
WQv (cu-ft) =	**3232**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.15	hours	Tc =	Time of Concentration (hours)
CN =	89		CN =	Curve Number
qu =	618.115		qu =	Unit Peak Discharge ($cfs/mi^2/inch$)
Qp =	0.85995	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3313		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.24		Rv =	Runoff Coefficient
C =	0.44		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

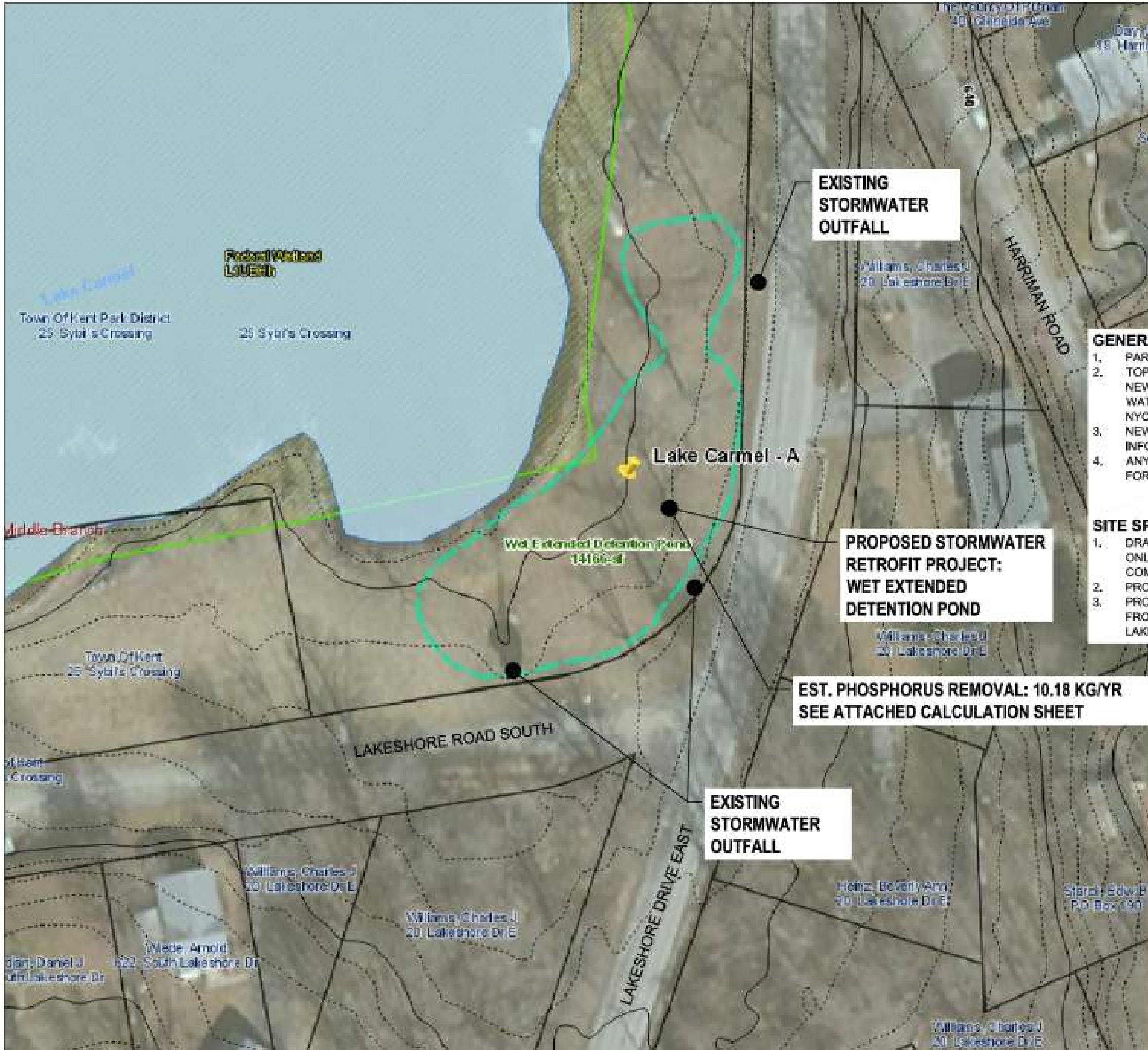
Land Use	**% of Total Area**
Residential	0.69
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.31
Develped Open Space	0
Weighted "C":	*0.44*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**2.99**	lb/yr
	1.35	kg/yr
P Removal ------------------->	**1.19**	lb/yr
	0.54	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**2.2**	Phosphorus Loading (kg/yr)	**1.35**
Water Quality Volume (cf)	**3232**	Phosphorus Reduction (kg/yr)	**0.54**



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3. PROPOSED WET EXTENDED DETENTION POND TO TREAT RUNOFF DISCHARGE FROM THREE (3) EXISTING OUTFALLS FOR TREATMENT PRIOR TO DISCHARGE TO LAKE CARMEL.

LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

LAKECARMEL_A-M_CONCEPTPLAN_FIGURE_...

WET EXTENDED DETENTION POND
LAKE CARMEL - A

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=50'

Kent-5A

1:1

LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP
LAKECARMEL_A-M_DRAINAGEAREA

DRAINAGE AREA PLAN
LAKE CARMEL - A

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: DATE
SCALE: 1"=200'

Kent-5A

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 A: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	42	acres	where:	A =	Contributing Area (acres)
I =	12.7	30.24%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3221			WQv =	Water Quality Volume
Rv (min)** =	0.3221				
WQv (acre-ft) =	**1.353**				
WQv (cu-ft) =	**58937**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3221		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	42		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

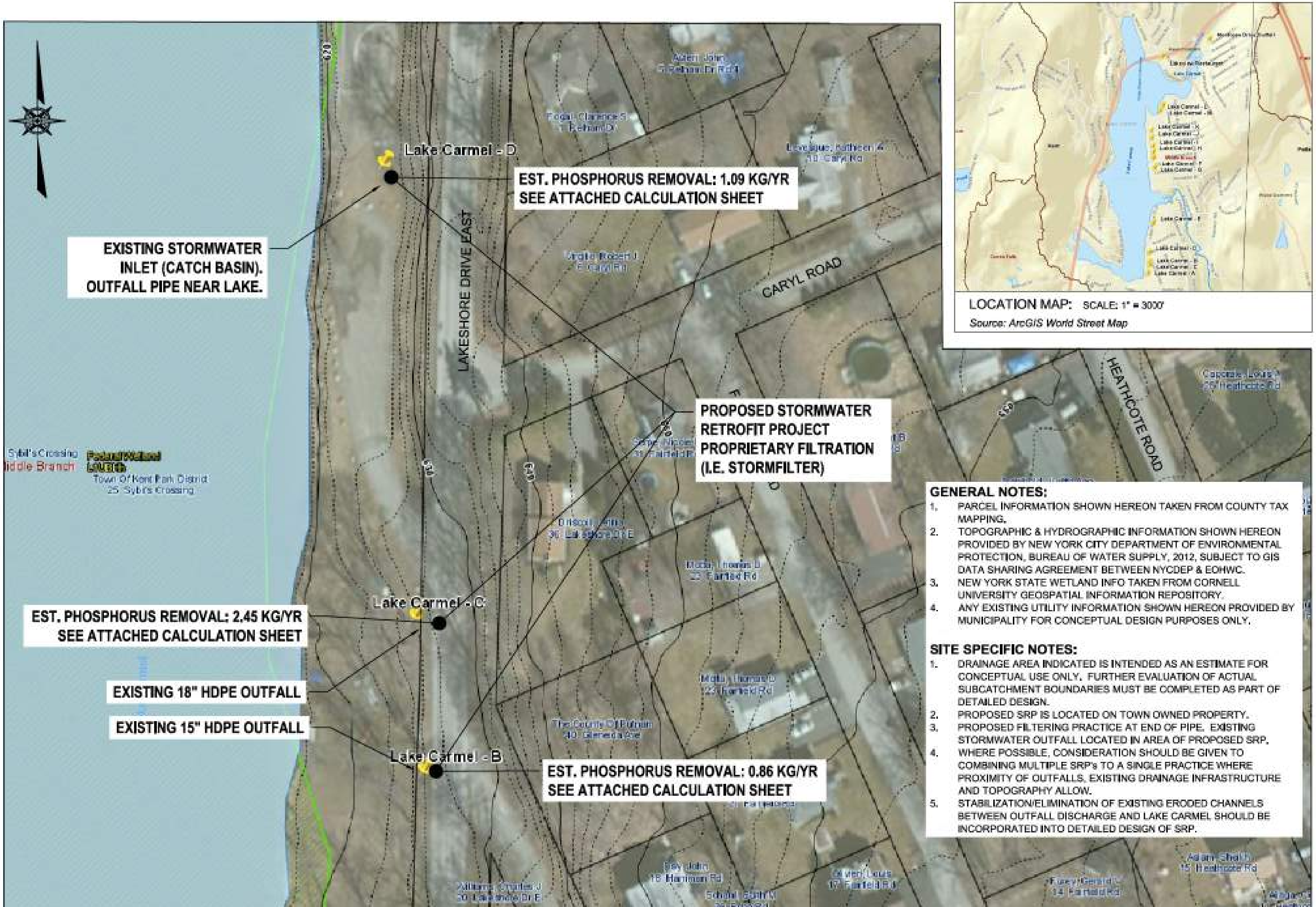
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice: Wet ED Pond
Removal Efficiency: *55%*
P Load -------------------> **51.00** lb/yr
23.13 kg/yr
P Removal -------------------> **28.05** lb/yr
12.72 kg/yr

10.18 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**42.0**	Phosphorus Loading (kg/yr)	**23.13**
Water Quality Volume (cf)	**58937**	Phosphorus Reduction (kg/yr)	**10.18**



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED FILTERING PRACTICE AT END OF PIPE. EXISTING STORMWATER OUTFALL LOCATED IN AREA OF PROPOSED SRP.
4. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
5. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CCP/RL
CHECKED BY: LJP
LAKECARMEL_A-M_CONCEPTPLAN_FIGURE

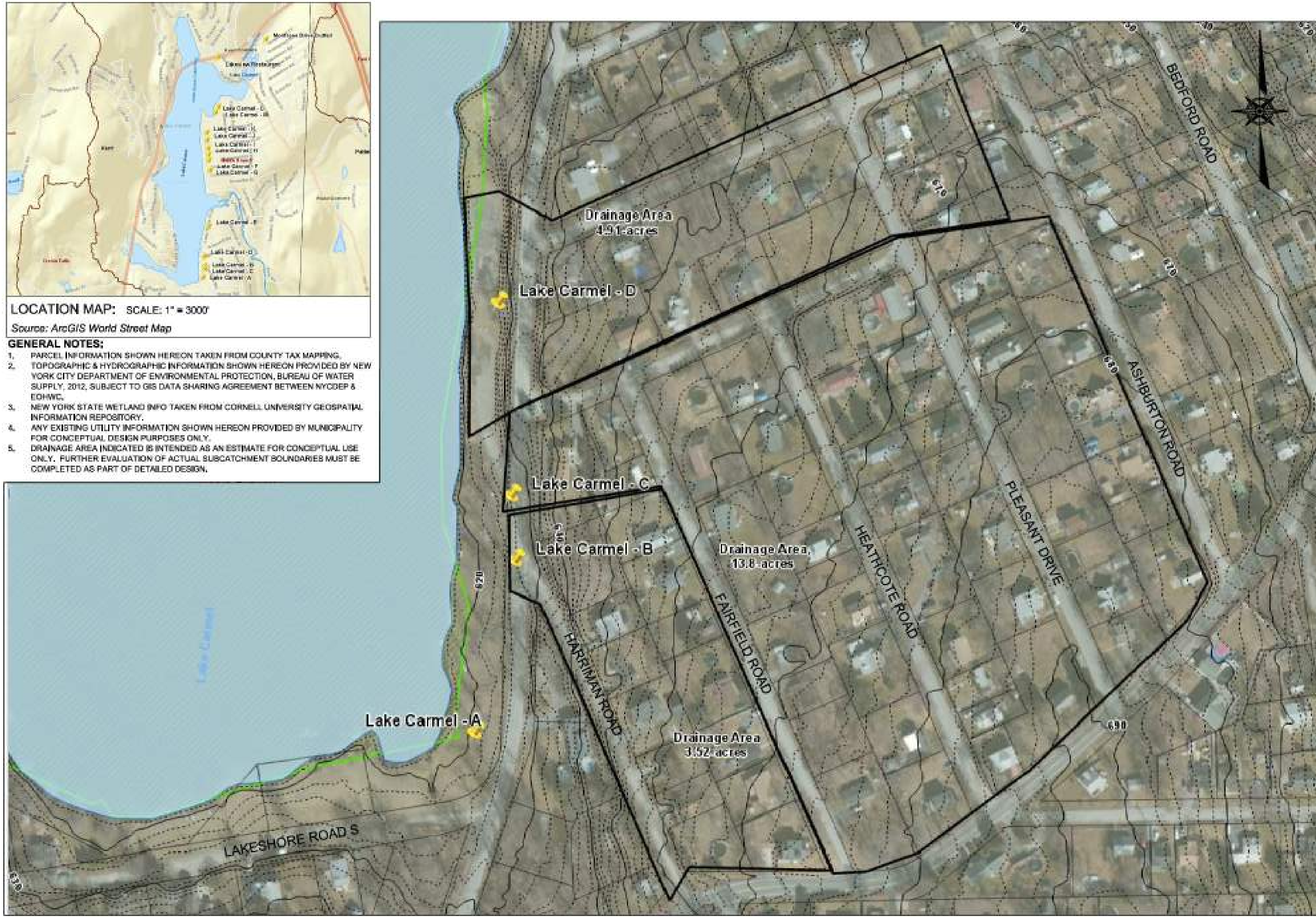
PROPRIETARY FILTERING PRACTICES
LAKE CARMEL - B-D

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=60'

Kent-5B-5D

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CP/RL	CHECKED BY:	LJP
DRAWN BY:	CP/RL	LAKECARMEL_A-M_DRAINAGEAREA_FIGURE	

DRAINAGE AREA PLAN
LAKE CARMEL - B-D

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=150'

Kent-5B-5D

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 B: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.5	acres	where: A =	Contributing Area (acres)
I =	1.2	34.29%	I =	Impervious Area (acres/%)
P =	1.2	inches	P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3586		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.126**			
WQv (cu-ft) =	**5467**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.15	hours	Tc =	Time of Concentration (hours)
CN =	89		CN =	Curve Number
qu =	618.115		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.4545	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where: P Load=	Annual load (kg/yr)
Pj =	0.9	P =	Annual Rainfall (inches)
Rv =	0.3586	Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.5	Rv =	Runoff Coefficient
C =	0.41	C =	Pollutant Concentration (mg/l)
		A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**4.73**	lb/yr
	2.15	kg/yr
P Removal ------------------->	**1.89**	lb/yr
	0.86	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**3.5**	Phosphorus Loading (kg/yr)	**2.15**
Water Quality Volume (cf)	**5467**	Phosphorus Reduction (kg/yr)	**0.86**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 C
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 C: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	13.8	acres	A =	Contributing Area (acres)
I =	4.2	30.43%	I =	Impervious Area (acres/%)
P =	1.2	inches	P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3239		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.447**			
WQv (cu-ft) =	**19471**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.25	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	513.485		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	4.30364	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	P Load=	Annual load (kg/yr)
Pj =	0.9	P =	Annual Rainfall (inches)
Rv =	0.3239	Pj =	Fraction of rainfall producing Runoff = 0.9
A =	13.8	Rv =	Runoff Coefficient
C =	0.41	C =	Pollutant Concentration (mg/l)
		A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**16.85**	lb/yr
	7.64	kg/yr
P Removal ------------------->	**6.74**	lb/yr
	3.06	kg/yr
	2.45	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**13.8**	Phosphorus Loading (kg/yr)	**7.64**
Water Quality Volume (cf)	**19471**	Phosphorus Reduction (kg/yr)	**2.45**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 D
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 D: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	4.9 acres	where:	A =	Contributing Area (acres)
I =	1.5	30.61%	I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3255		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.160**			
WQv (cu-ft) =	**6948**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.16 hours	Tc =	Time of Concentration (hours)
CN =	88	CN =	Curve Number
qu =	595.594	qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.7812 CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3255		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	4.9		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Stormfilter**	
Removal Efficiency:	***40%***	
P Load ------------------->	**6.01**	lb/yr
	2.73	kg/yr
P Removal ------------------->	**2.40**	lb/yr
	1.09	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**4.9**	Phosphorus Loading (kg/yr)	**2.73**
Water Quality Volume (cf)	**6948**	Phosphorus Reduction (kg/yr)	**1.09**

LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

LAKECARMEL_A-M_CONCEPTPLAN_FIGURE_

PROPRIETARY FILTERING PRACTICE
LAKE CARMEL – E

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=50'

KENT-5E

1:1

LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

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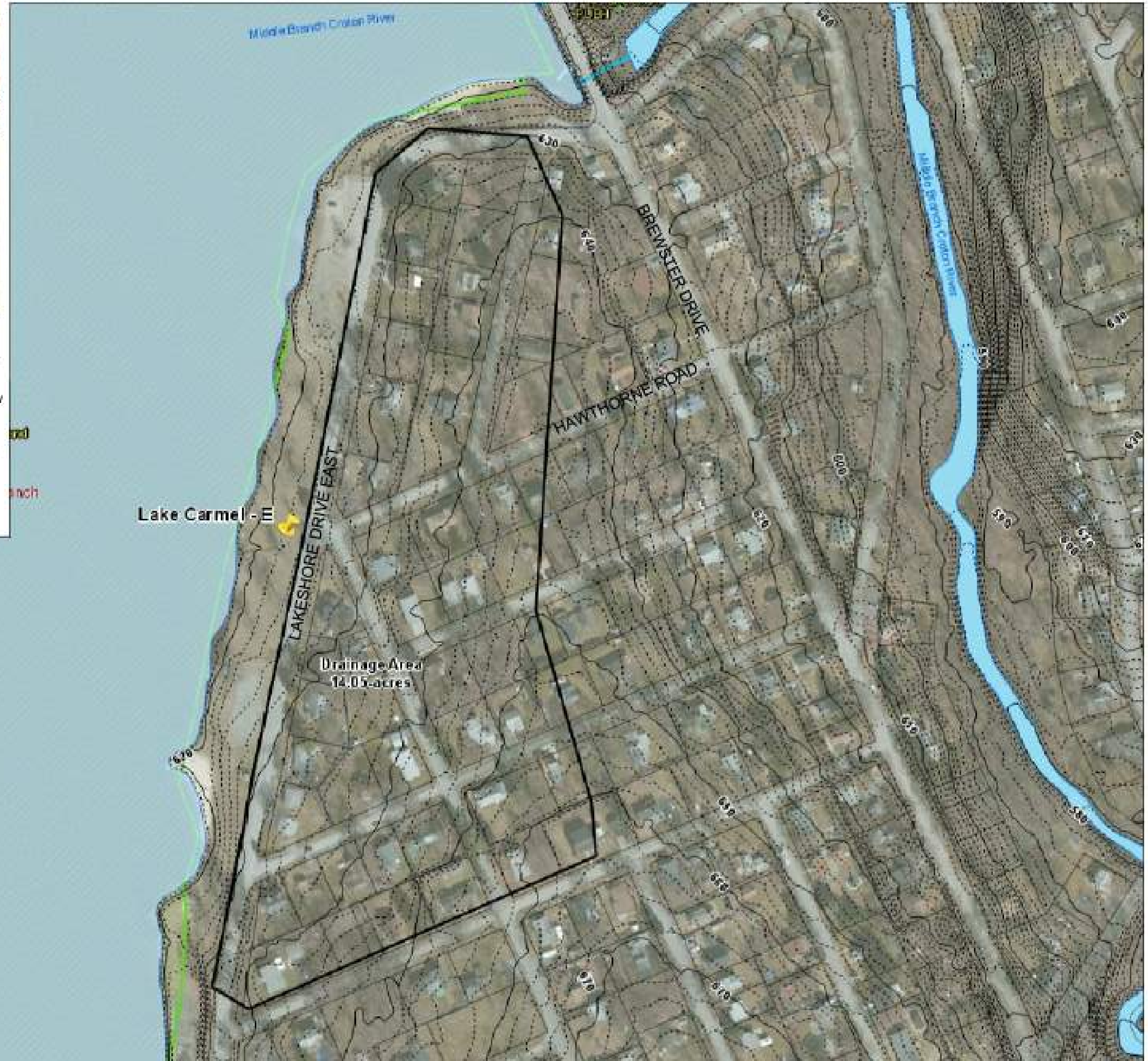

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CP/RL	CHECKED BY:	LJP
DRAWN BY:	CP/RL	LAKECARMEL_A--M_DRAINAGEAREA_FIGURE_KENT-5E	

DRAINAGE AREA PLAN
LAKE CARMEL – E

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1" = 200'

KENT-5E

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: Kent-5 E
Prepared for: East of Hudson Coalition
Prepared by: CRP
Project County: Putnam

Kent-5 E: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	14 acres	where:	A =	Contributing Area (acres)
I =	4.3 30.71%		I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3264		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.457**			
WQv (cu-ft) =	**19907**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.3 hours	Tc =	Time of Concentration (hours)
CN =	88	CN =	Curve Number
qu =	479.823	qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	4.11149 CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3264		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	14		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

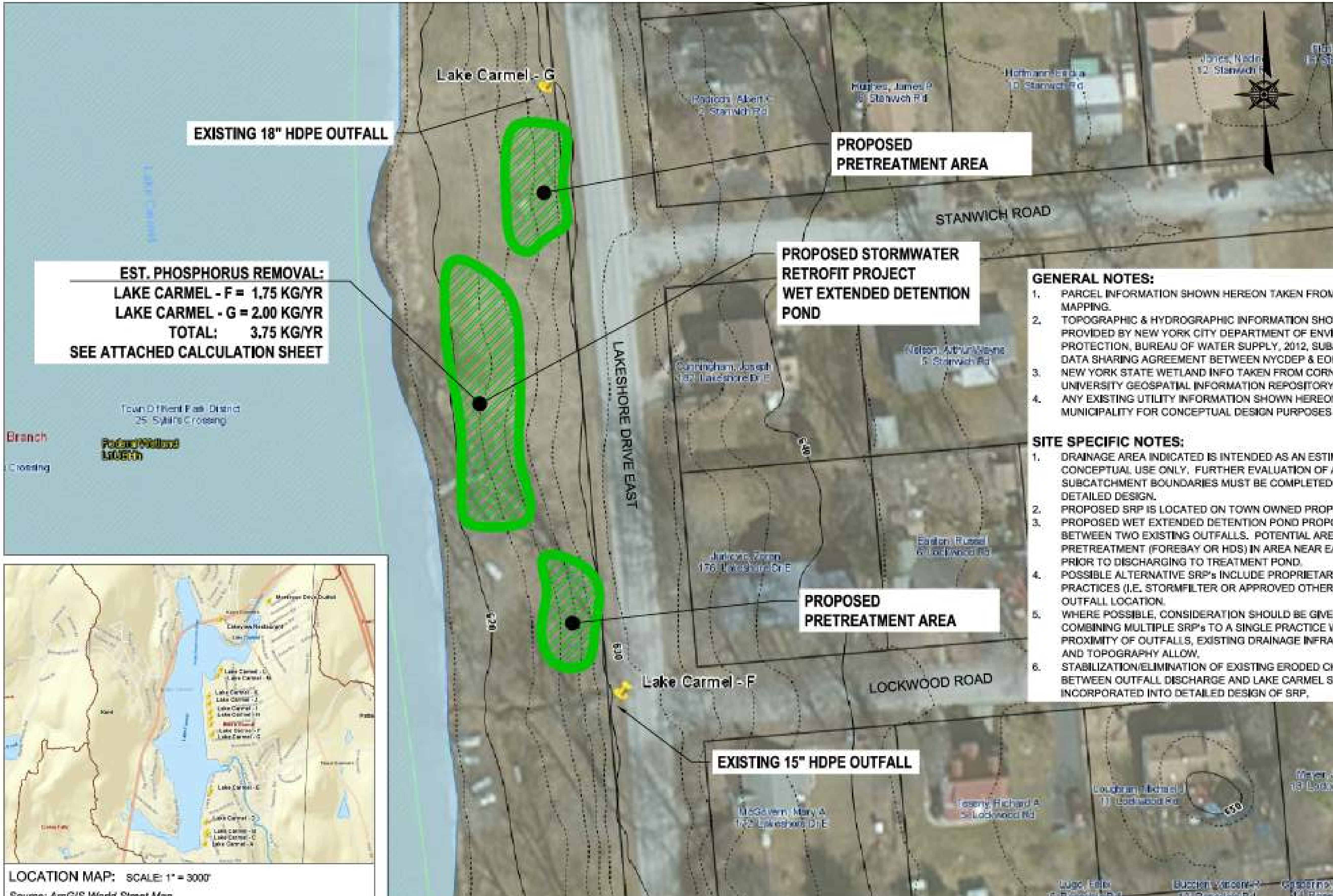
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**17.23**	lb/yr
	7.81	kg/yr
P Removal ------------------->	**6.89**	lb/yr
	3.13	kg/yr

2.50 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**14.0**	Phosphorus Loading (kg/yr)	**7.81**
Water Quality Volume (cf)	**19907**	Phosphorus Reduction (kg/yr)	**2.50**



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED WET EXTENDED DETENTION POND PROPOSED IN AREA BETWEEN TWO EXISTING OUTFALLS. POTENTIAL AREA FOR PRETREATMENT (FOREBAY OR HDS) IN AREA NEAR EACH OUTFALL PRIOR TO DISCHARGING TO TREATMENT POND.
4. POSSIBLE ALTERNATIVE SRP's INCLUDE PROPRIETARY FILTERING PRACTICES (I.E. STORMFILTER OR APPROVED OTHER) AT EACH OUTFALL LOCATION.
5. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
6. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CP/RL	CHECKED BY:	LJP
DRAWN BY:	CP/RL	LAKECARMEL_A-M_CONCEPTPLAN_FIGURE	

WET EXTENDED DETENTION POND
LAKE CARMEL – F-G

TOWN OF KENT

JOB NO:	JOB NUMBER
DATE:	08/12/16
SCALE:	1"=50'

KENT- 5F-5G

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 F
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 F: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	7	acres	where:	A =	Contributing Area (acres)
I =	2.2	31.43%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3329			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.233**				
WQv (cu-ft) =	**10149**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.2	hours	Tc =	Time of Concentration (hours)
CN =	89		CN =	Curve Number
qu =	565.468		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	2.47039	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3329		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	7		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**8.78**	lb/yr
	3.98	kg/yr
P Removal ------------------->	**4.83**	lb/yr
	2.19	kg/yr

1.75 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**7.0**	Phosphorus Loading (kg/yr)	**3.98**
Water Quality Volume (cf)	**10149**	Phosphorus Reduction (kg/yr)	**1.75**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 G
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 G: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	8.3	acres	where:	A =	Contributing Area (acres)
I =	2.5	30.12%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3211			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.267**				
WQv (cu-ft) =	**11609**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.2	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	554.75		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	2.77202	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3211		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	8.3		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

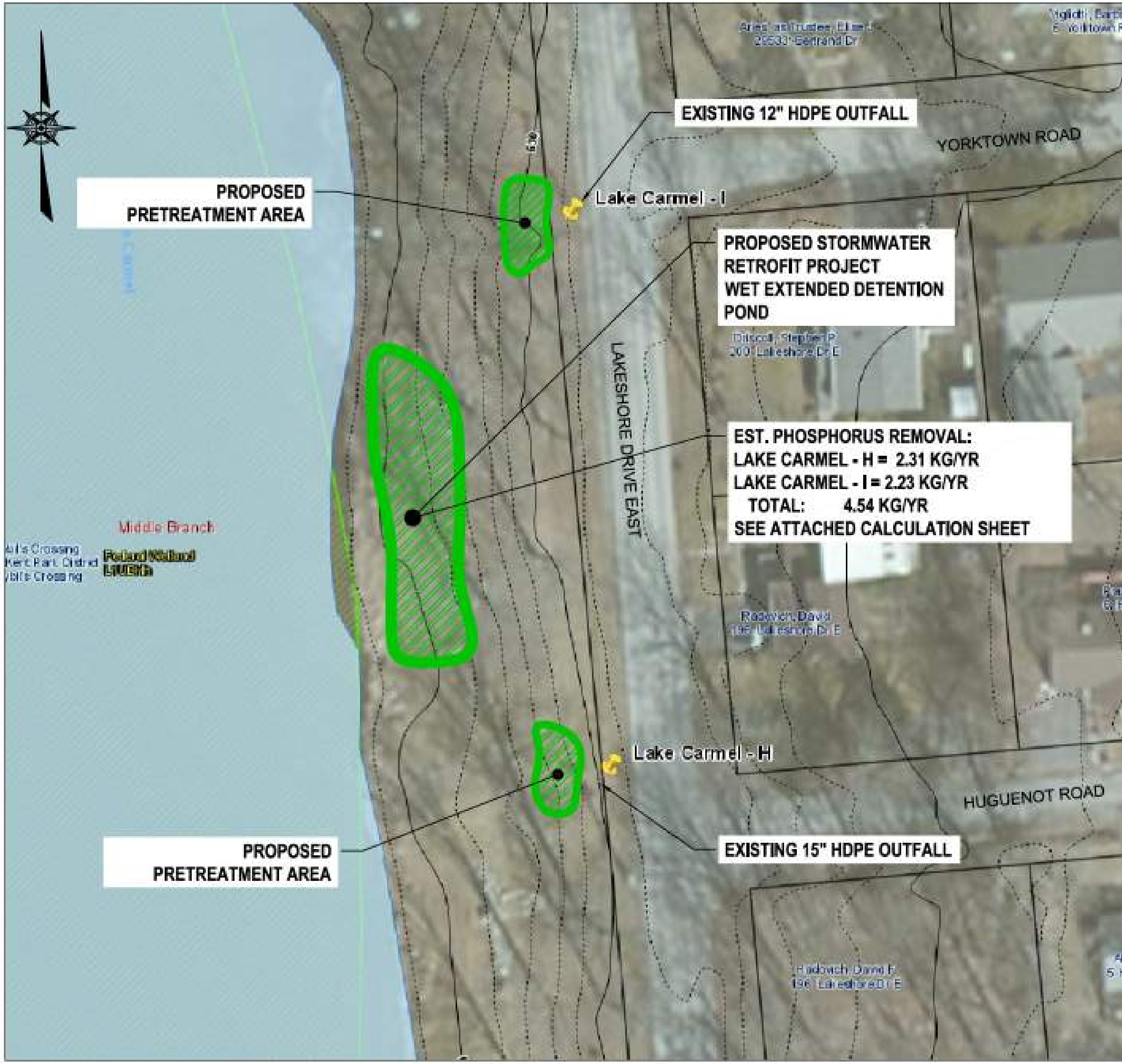
Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**10.05**	lb/yr
	4.56	kg/yr
P Removal ------------------->	**5.52**	lb/yr
	2.51	kg/yr

2.00 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**8.3**	Phosphorus Loading (kg/yr)	**4.56**
Water Quality Volume (cf)	**11609**	Phosphorus Reduction (kg/yr)	**2.00**

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED WET EXTENDED DETENTION POND PROPOSED IN AREA BETWEEN TWO EXISTING OUTFALLS. POTENTIAL AREA FOR PRETREATMENT (FOREBAY OR HDS) IN AREA NEAR EACH OUTFALL PRIOR TO DISCHARGING TO TREATMENT POND.
4. POSSIBLE ALTERNATIVE SRP's INCLUDE PROPRIETARY FILTERING PRACTICES (I.E. STORMFILTER OR APPROVED OTHER) AT EACH OUTFALL LOCATION.
5. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
6. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP
LAKECARMEL_A-M_CONCEPTPLAN_

WET EXTENDED DETENTION POND
LAKE CARMEL - H-I

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=40'

KENT- 5H-5I

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 H
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 H: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	9.3	acres	where:	A =	Contributing Area (acres)
I =	2.9	31.18%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3306			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.308**				
WQv (cu-ft) =	**13395**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =		hours	Tc =	Time of Concentration (hours)
CN =	89		CN =	Curve Number
qu =	#NUM!		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	#NUM!	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3306		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	9.3		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**11.59**	lb/yr
	5.26	kg/yr
P Removal ------------------->	**6.37**	lb/yr
	2.89	kg/yr

2.31 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**9.3**	Phosphorus Loading (kg/yr)	**5.26**
Water Quality Volume (cf)	**13395**	Phosphorus Reduction (kg/yr)	**2.31**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 I
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 I: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	9	acres	where:	A =	Contributing Area (acres)
I =	2.8	31.11%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3300			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.297**				
WQv (cu-ft) =	**12937**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.2	hours	Tc =	Time of Concentration (hours)
CN =	89		CN =	Curve Number
qu =	565.468		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	3.14895	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3300		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	9		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

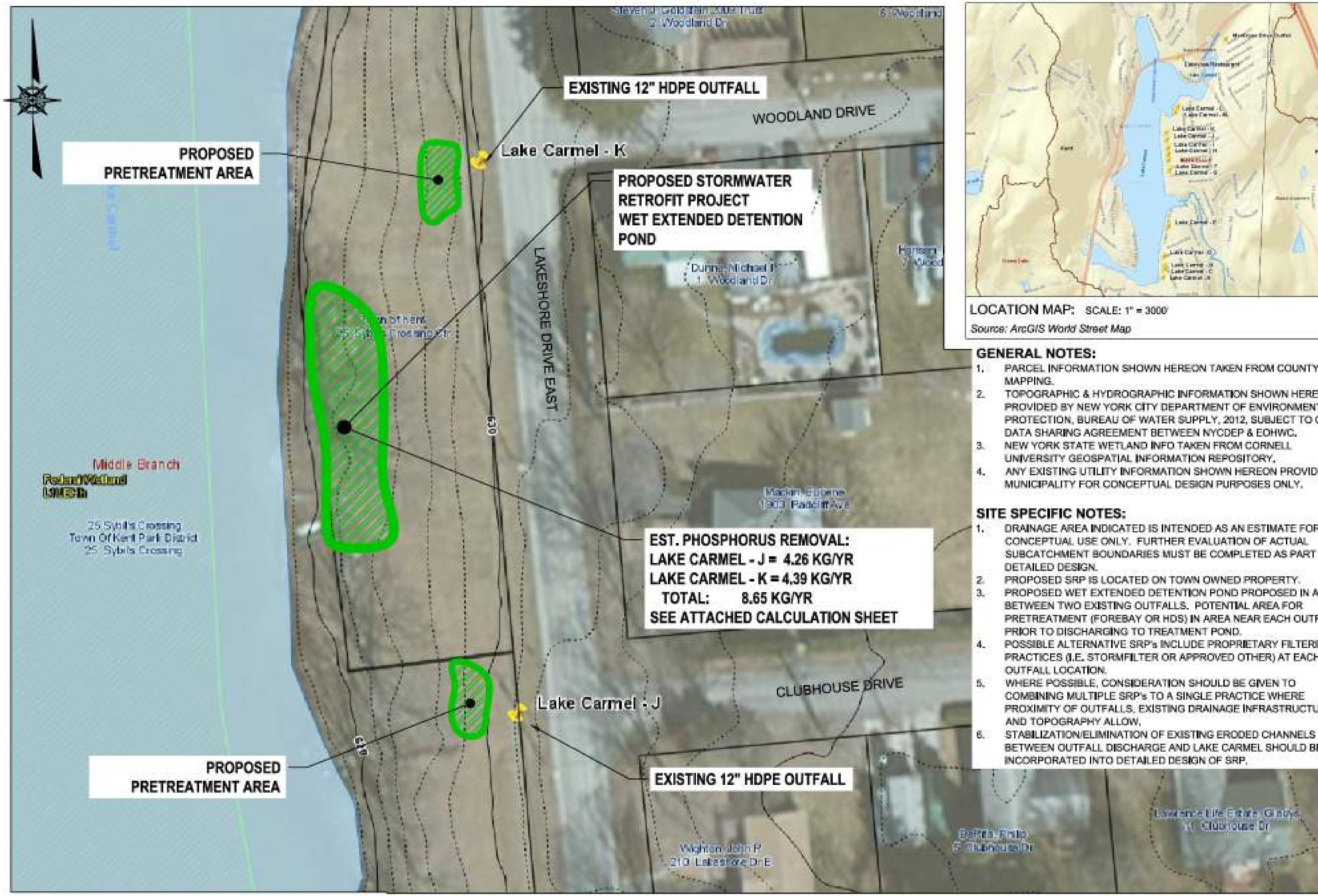
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**11.19**	lb/yr
	5.08	kg/yr
P Removal ------------------->	**6.16**	lb/yr
	2.79	kg/yr

2.23 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**9.0**	Phosphorus Loading (kg/yr)	**5.08**
Water Quality Volume (cf)	**12937**	Phosphorus Reduction (kg/yr)	**2.23**



GENERAL NOTES:

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6. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

WET EXTENDED DETENTION POND
LAKE CARMEL - J-K

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=40'

KENT- 5J-5K

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 J
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 J: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	28	acres	where:	A =	Contributing Area (acres)
I =	8.5	30.36%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3232			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.905**				
WQv (cu-ft) =	**39422**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.34	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	456.895		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	7.75294	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3232		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	28		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**34.11**	lb/yr
	15.47	kg/yr
P Removal ------------------->	**18.76**	lb/yr
	8.51	kg/yr
	4.26	kg/yr **Assume 50% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**28.0**	Phosphorus Loading (kg/yr)	**15.47**
Water Quality Volume (cf)	**39422**	Phosphorus Reduction (kg/yr)	**4.26**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: Kent-5 K
Prepared for: East of Hudson Coalition
Prepared by: CRP
Project County: Putnam

Kent-5 K: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	28.5	acres	where:	A =	Contributing Area (acres)
I =	8.8	30.88%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3279			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.935**				
WQv (cu-ft) =	**40707**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.34	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	456.895		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	8.00566	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3279		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	28.5		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

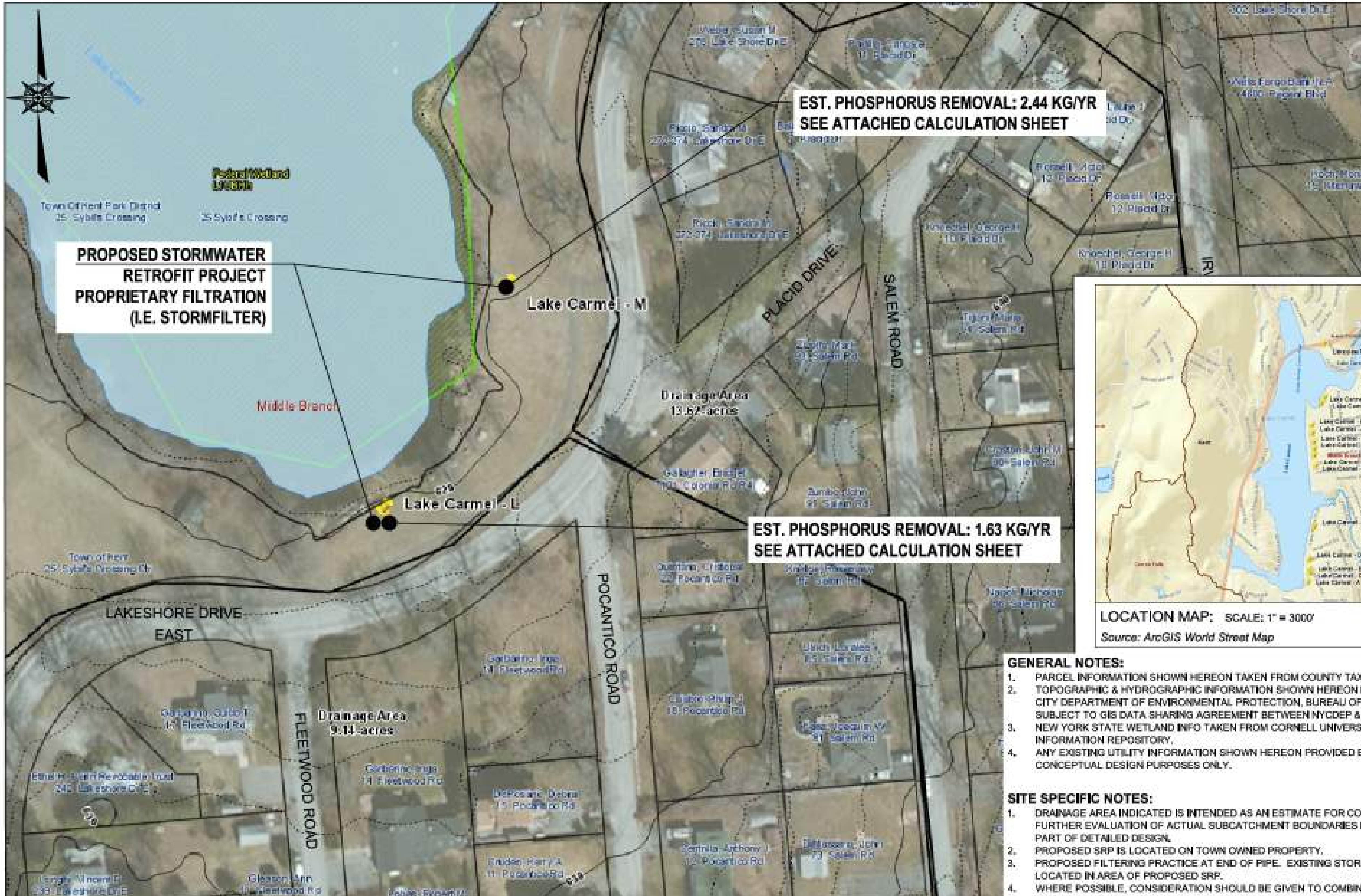
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load -------------------->	**35.22**	lb/yr
	15.98	kg/yr
P Removal -------------------->	**19.37**	lb/yr
	8.79	kg/yr
	4.39	kg/yr **Assume 50% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**28.5**	Phosphorus Loading (kg/yr)	**15.98**
Water Quality Volume (cf)	**40707**	Phosphorus Reduction (kg/yr)	**4.39**

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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2. PROPOSED SRP IS LOCATED ON TOWN OWNED PROPERTY.
3. PROPOSED FILTERING PRACTICE AT END OF PIPE. EXISTING STORMWATER OUTFALL LOCATED IN AREA OF PROPOSED SRP.
4. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
5. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CCP/RL
CHECKED BY: LJP

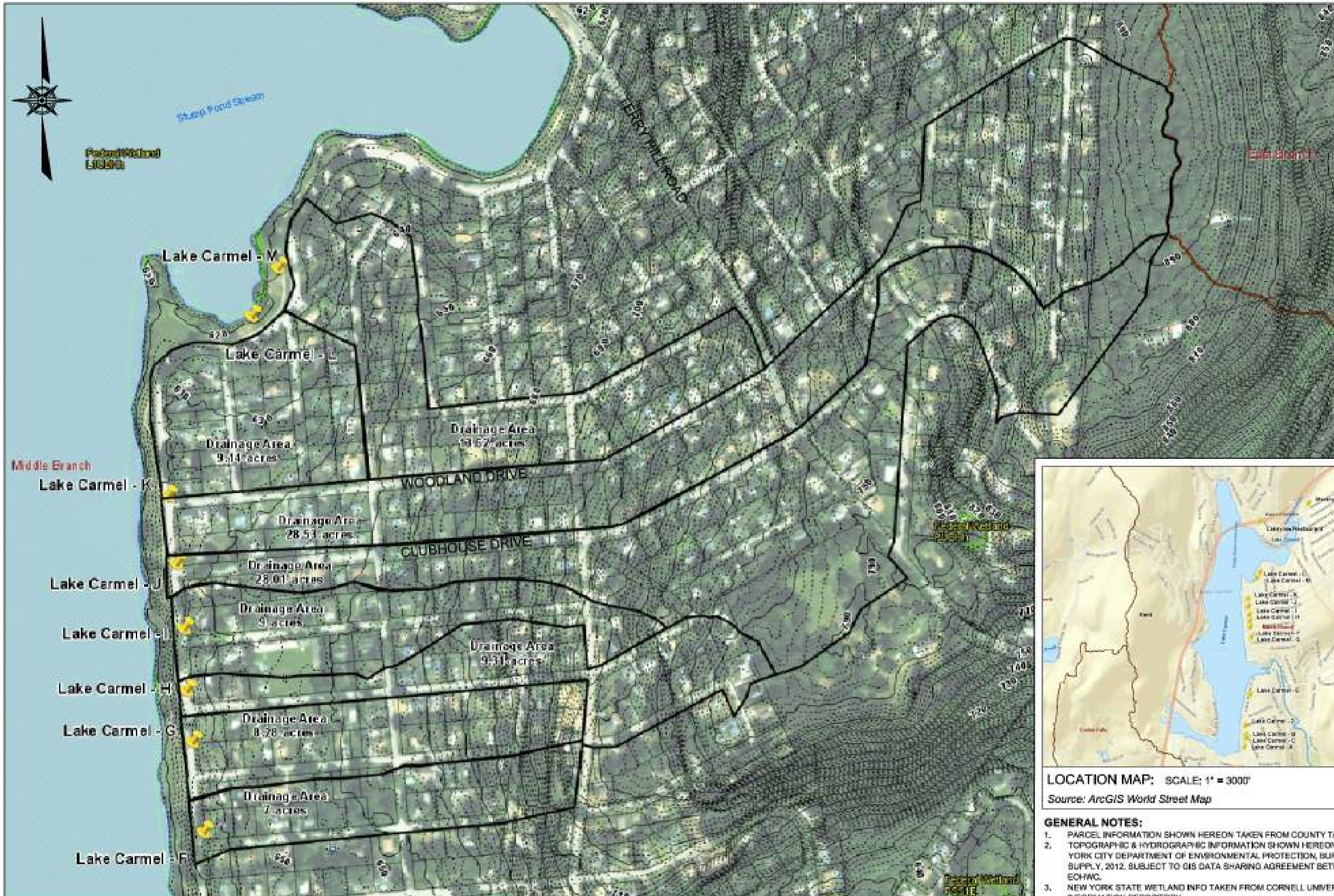
PROPRIETARY FILTERING PRACTICES
LAKE CARMEL – L–M

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=80'

Kent-5L-5M

1:1



LOCATION MAP: SCALE: 1" = 3000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL	CHECKED BY: LJP
DRAWN BY: CP/RL	LAKECARMEL_A-M_DRAINAGEAREA_FIGURE

DRAINAGE AREA PLAN
LAKE CARMEL - F-M

TOWN OF KENT

JOB NO:	JOB NUMBER
DATE:	08/12/16
SCALE:	1" = 350'

KENT-5F-5M

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 L
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 L: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	9.1 acres	where:	A =	Contributing Area (acres)
I =	2.8 30.77%		I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3269		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.298**			
WQv (cu-ft) =	**12959**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.2 hours	Tc =	Time of Concentration (hours)
CN =	88	CN =	Curve Number
qu =	554.75	qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	3.09447 CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3269		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	9.1		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**11.21**	lb/yr
	5.09	kg/yr
P Removal ------------------->	**4.49**	lb/yr
	2.03	kg/yr

1.63 kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**9.1**	Phosphorus Loading (kg/yr)	**5.09**
Water Quality Volume (cf)	**12959**	Phosphorus Reduction (kg/yr)	**1.63**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-5 M
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-5 M: Lake Carmel

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	13.6	acres	where:	A =	Contributing Area (acres)
I =	4.2	30.88%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3279			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.446**				
WQv (cu-ft) =	**19428**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual, Appendix B-2

Tc =	0.25	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	513.485		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	4.29401	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3279		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	13.6		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load -------------------->	**16.81**	lb/yr
	7.63	kg/yr
P Removal -------------------->	**6.72**	lb/yr
	3.05	kg/yr
	2.44	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**13.6**	Phosphorus Loading (kg/yr)	**7.63**
Water Quality Volume (cf)	**19428**	Phosphorus Reduction (kg/yr)	**2.44**

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON CARMEL SCHOOL DISTRICT PROPERTY. COORDINATION WITH THE SCHOOL DISTRICT WILL BE REQUIRED TO FURTHER INVESTIGATE SITE, OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION EXISTING COLLECTION SYSTEM AND TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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COMMITMENT & INTEGRITY DRIVE RESULTS

FIGURE_11X17.DWG

STORMWATER RETROFIT CONCEPT PLAN

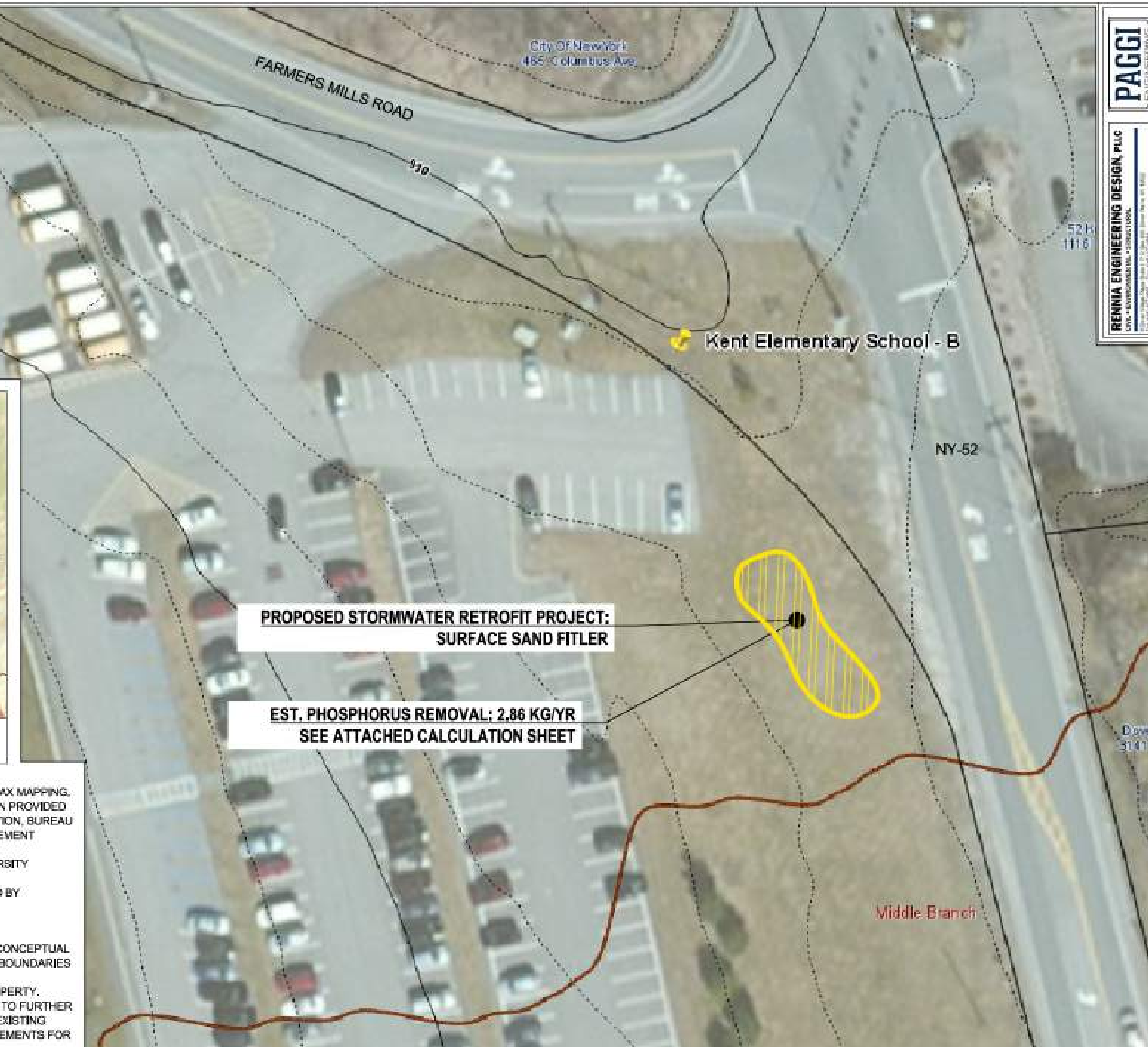
DESIGNED BY: CP/RL	CHECKED BY: LJP
DRAWN BY: CP/RL	KENTELEMENTARY&PRIMARYSCHOOLS_A-B

SUBSURFACE INFILTRATION
KENT ELEMENTARY SCHOOL - A

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=50'

Kent-6A



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON CARMEL SCHOOL DISTRICT PROPERTY. COORDINATION WITH THE SCHOOL DISTRICT WILL BE REQUIRED TO FURTHER INVESTIGATE SITE, OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION EXISTING COLLECTION SYSTEM AND TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

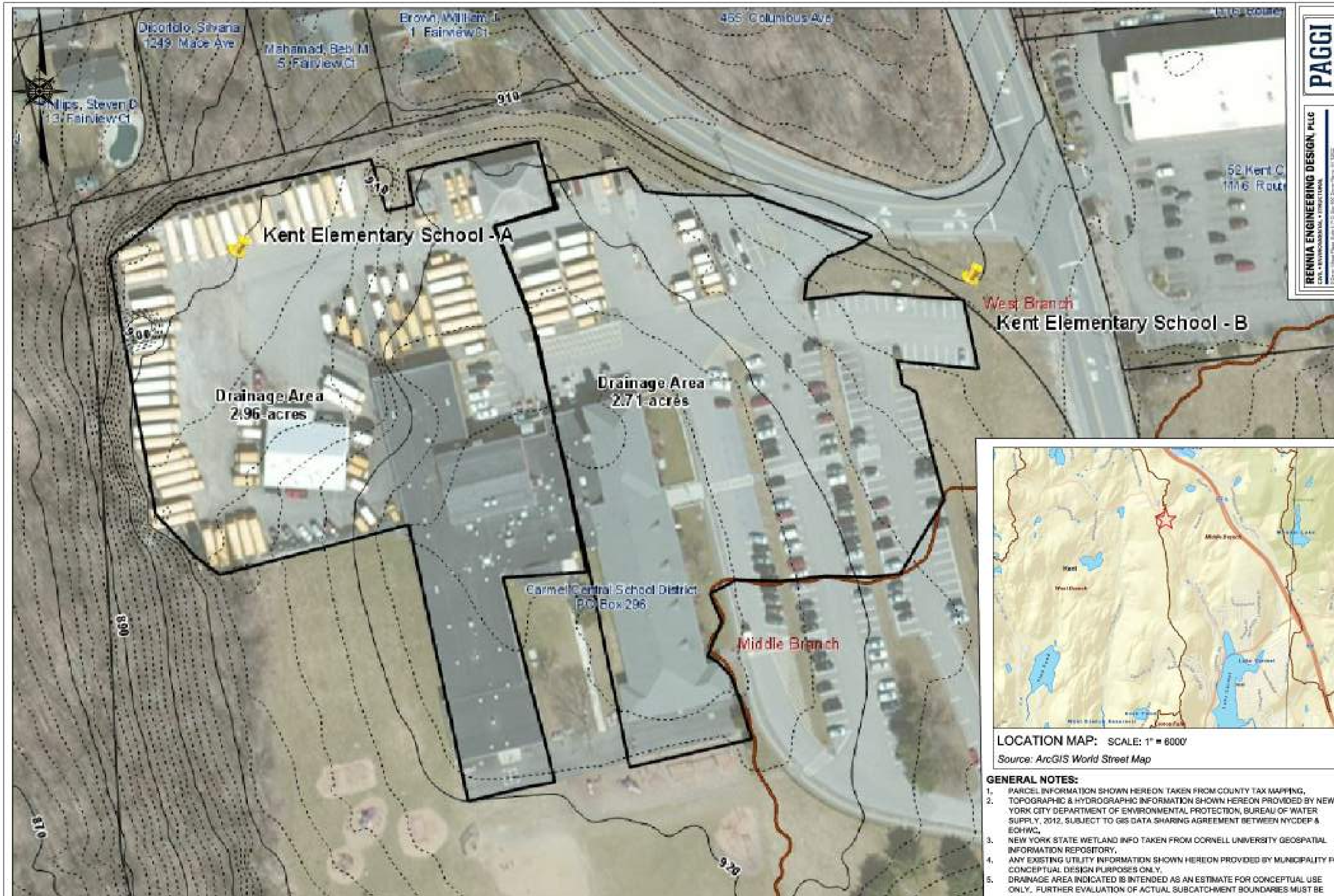
SURFACE SAND FILTER
KENT ELEMENTARY SCHOOL – B

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=40'

Kent-6B

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CP/RL	CHECKED BY:	LJP
DRAWN BY:	CP/RL	KENTELEMENTARY&PRIMARYSCHOOLS_A-B_DRAINAGEAREA_FIGURE_11X17.DWG	

DRAINAGE AREA PLAN
KENT ELEMENTARY SCHOOL A-B

TOWN OF KENT

JOB NO:	JOB NUMBER
DATE:	08/12/16
SCALE:	1"=80'

Kent-6A-6B

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CIVIL • ENVIRONMENTAL • STRUCTURAL

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-6 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-6 A: Kent Elementary School - A

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3	acres	where:	A =	Contributing Area (acres)
I =	3	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.285**				
WQv (cu-ft) =	**12415**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Subsurface Infiltration	
Removal Efficiency:	*100%*	
P Load ------------------->	**13.10**	lb/yr
	5.94	kg/yr
P Removal ------------------->	**13.10**	lb/yr
	5.94	kg/yr
	4.75	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Subsurface Infiltration		
Drainage Area (acres)	**3.0**	Phosphorus Loading (kg/yr)	**5.94**
Water Quality Volume (cf)	**12415**	Phosphorus Reduction (kg/yr)	**4.75**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Kent-6 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Kent-6 B: Kent Elementary & Primary Schools

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.7	acres	where:	A =	Contributing Area (acres)
I =	2.5	92.59%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.8833			WQv =	Water Quality Volume
Rv (min)** =	0.8833				
WQv (acre-ft) =	**0.239**				
WQv (cu-ft) =	**10389**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.8833		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.7		Rv =	Runoff Coefficient
C =	0.49		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.93
Develped Open Space	0.073
Weighted "C":	*0.49*

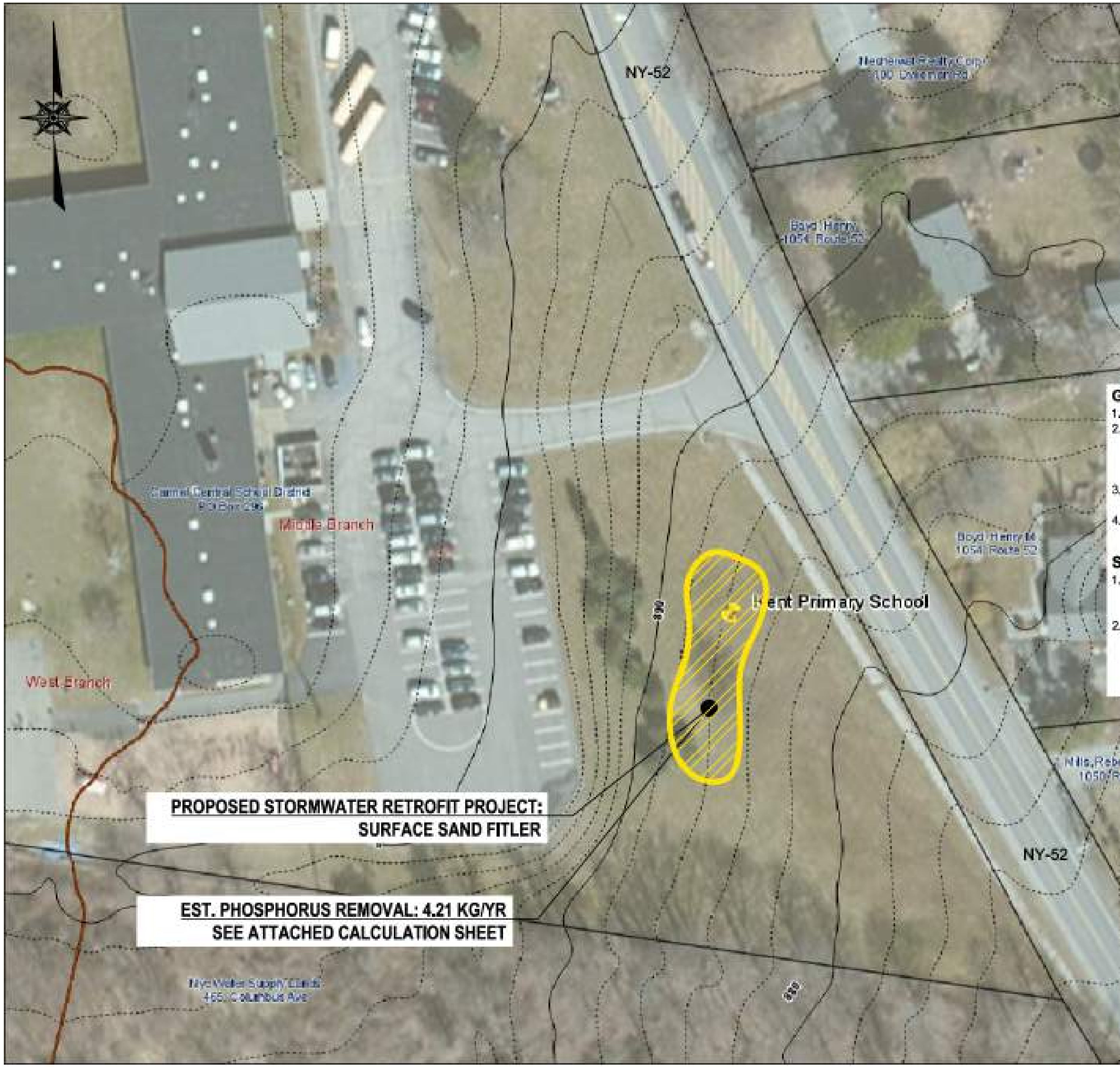
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Surface Sand Filter	
Removal Efficiency:	*59%*	
P Load ------------------->	**10.67**	lb/yr
	4.84	kg/yr
P Removal ------------------->	**6.29**	lb/yr
	2.86	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**2.7**	Phosphorus Loading (kg/yr)	**4.84**
Water Quality Volume (cf)	**10389**	Phosphorus Reduction (kg/yr)	**2.86**

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON CARMEL SCHOOL DISTRICT PROPERTY. COORDINATION WITH THE SCHOOL DISTRICT WILL BE REQUIRED TO FURTHER INVESTIGATE SITE, OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION EXISTING COLLECTION SYSTEM AND TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

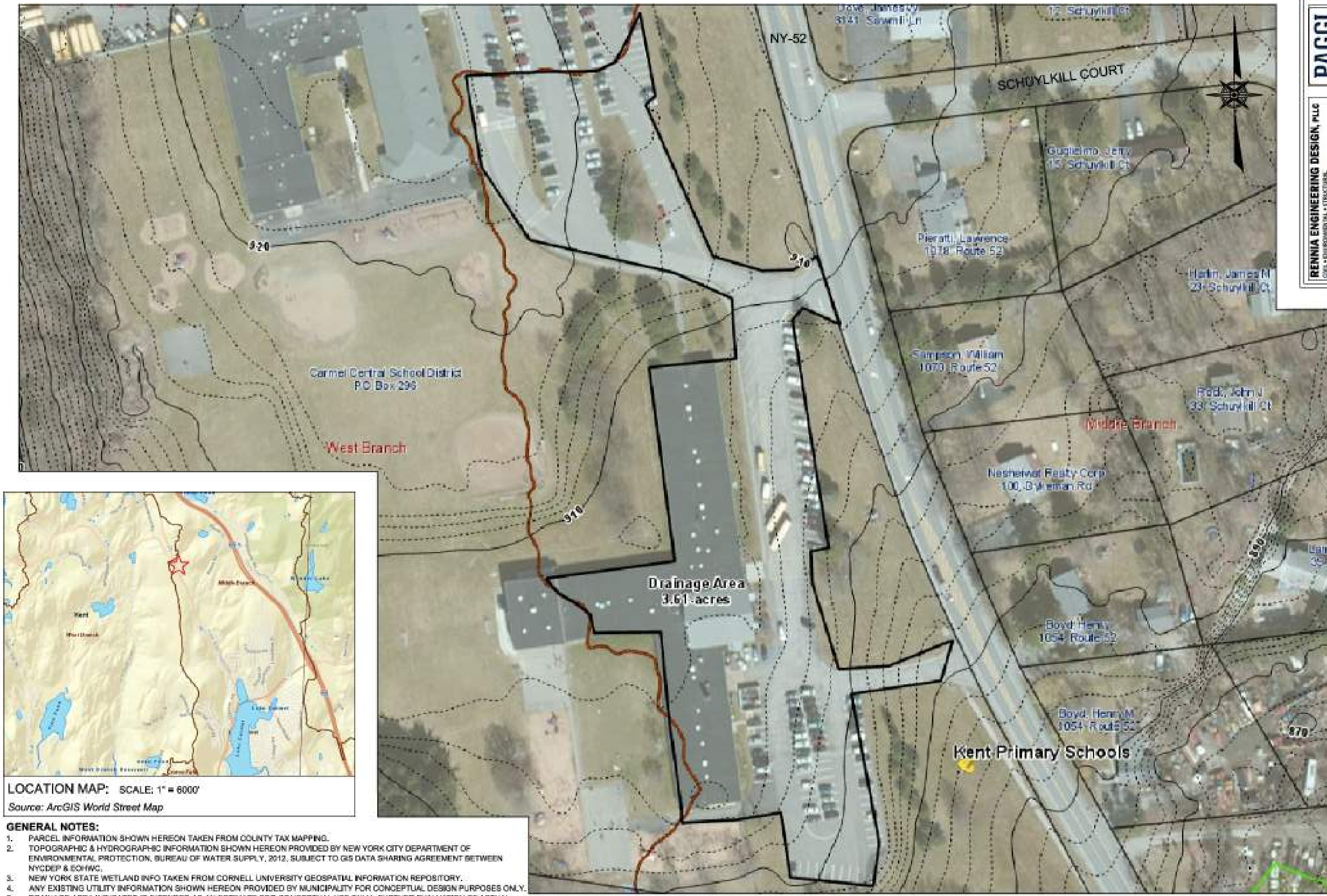
KENTELEMENTARY&PRIMARYSCHOOLS_A-B_CONCEPTPLAN_FIGURE_11X17.DWG

SURFACE SAND FILTER
KENT PRIMARY SCHOOL

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=60'

Kent-6C



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
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COMMITMENT & INTEGRITY DRIVE RESULTS

KENTELEMENTARY&PRIMARYSCHOOLS_A-B_DRAINAGE AREA_FIGURE_11X17.DWG

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CP/RL
DRAWN BY: CP/RL
CHECKED BY: LJP

DRAINAGE AREA PLAN
KENT PRIMARY SCHOOL

TOWN OF KENT

JOB NO: JOB NUMBER
DATE: 08/12/16
SCALE: 1"=100'

Kent-6C

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: Kent-6C
Prepared for: East of Hudson Coalition
Prepared by: CRP
Project County: Putnam

Kent-6C: Kent Elementary & Primary Schools

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.6	acres	where:	A =	Contributing Area (acres)
I =	3.6	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.342**				
WQv (cu-ft) =	**14898**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.6		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Surface Sand Filter	
Removal Efficiency:	*59%*	
P Load ------------------->	**15.72**	lb/yr
	7.13	kg/yr
P Removal ------------------->	**9.28**	lb/yr
	4.21	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**3.6**	Phosphorus Loading (kg/yr)	**7.13**
Water Quality Volume (cf)	**14898**	Phosphorus Reduction (kg/yr)	**4.21**

1:1

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON SCHOOL PROPERTY. COORDINATION WITH THE SCHOOL DISTRICT WILL BE REQUIRED TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	LEWISBOROELEMENTARYSCHOOL_CONCEPTPLAN_11X17.DWG

SURFACE SAND FILTER
LEWISBORO ELEMENTARY SCHOOL

TOWN OF LEWISBORO

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

L-4

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: L-4
Prepared for: East of Hudson Coalition
Prepared by: CRP
Project County: Westchester

L-4: Lewisboro Elementary School

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.9	acres	where:	A =	Contributing Area (acres)
I =	2.4	61.54%		I =	Impervious Area (acres/%)
P =	1.3	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.6038			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.255**				
WQv (cu-ft) =	**11113**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =		hours	Tc =	Time of Concentration (hours)
CN =	94		CN =	Curve Number
qu =	#NUM!		qu =	Unit Peak Discharge ($cfs/mi^2/inch$)
Qp =	#NUM!	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	48.6	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.6038		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.9		Rv =	Runoff Coefficient
C =	0.42		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

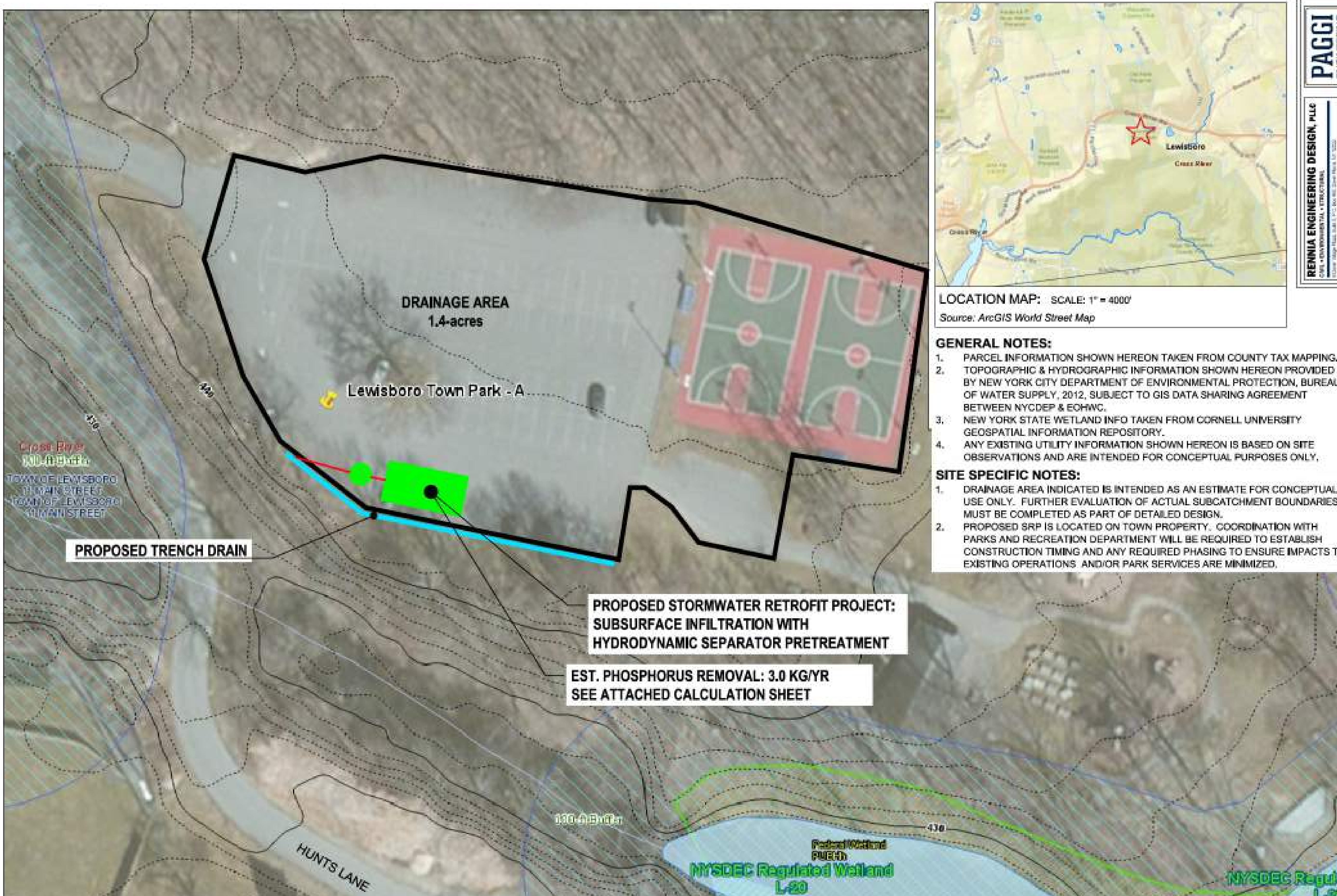
Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.62
Develped Open Space	0.38
Weighted "C":	*0.42*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load ------------------->	**9.87**	lb/yr
	4.48	kg/yr
P Removal ------------------->	**5.82**	lb/yr
	2.64	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**3.9**	Phosphorus Loading (kg/yr)	**4.48**
Water Quality Volume (cf)	**11113**	Phosphorus Reduction (kg/yr)	**2.64**



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON IS BASED ON SITE OBSERVATIONS AND ARE INTENDED FOR CONCEPTUAL PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON TOWN PROPERTY. COORDINATION WITH PARKS AND RECREATION DEPARTMENT WILL BE REQUIRED TO ESTABLISH CONSTRUCTION TIMING AND ANY REQUIRED PHASING TO ENSURE IMPACTS TO EXISTING OPERATIONS AND/OR PARK SERVICES ARE MINIMIZED.

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WOODARD & CURRAN

COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

LEWISBOROTOWNPARK_A-B_CONCEPT PLAN_ADDITIONALLY.DWG

SUBSURFACE INFILTRATION
LEWISBORO TOWN PARK

TOWN OF LEWISBORO

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

L-5

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	L-5
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Westchester

L-5: Lewisboro Town Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.4	acres	where:	A =	Contributing Area (acres)
I =	1.4	100.00%		I =	Impervious Area (acres/%)
P =	1.3	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.144**				
WQv (cu-ft) =	**6276**				

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	48.6	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.4		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

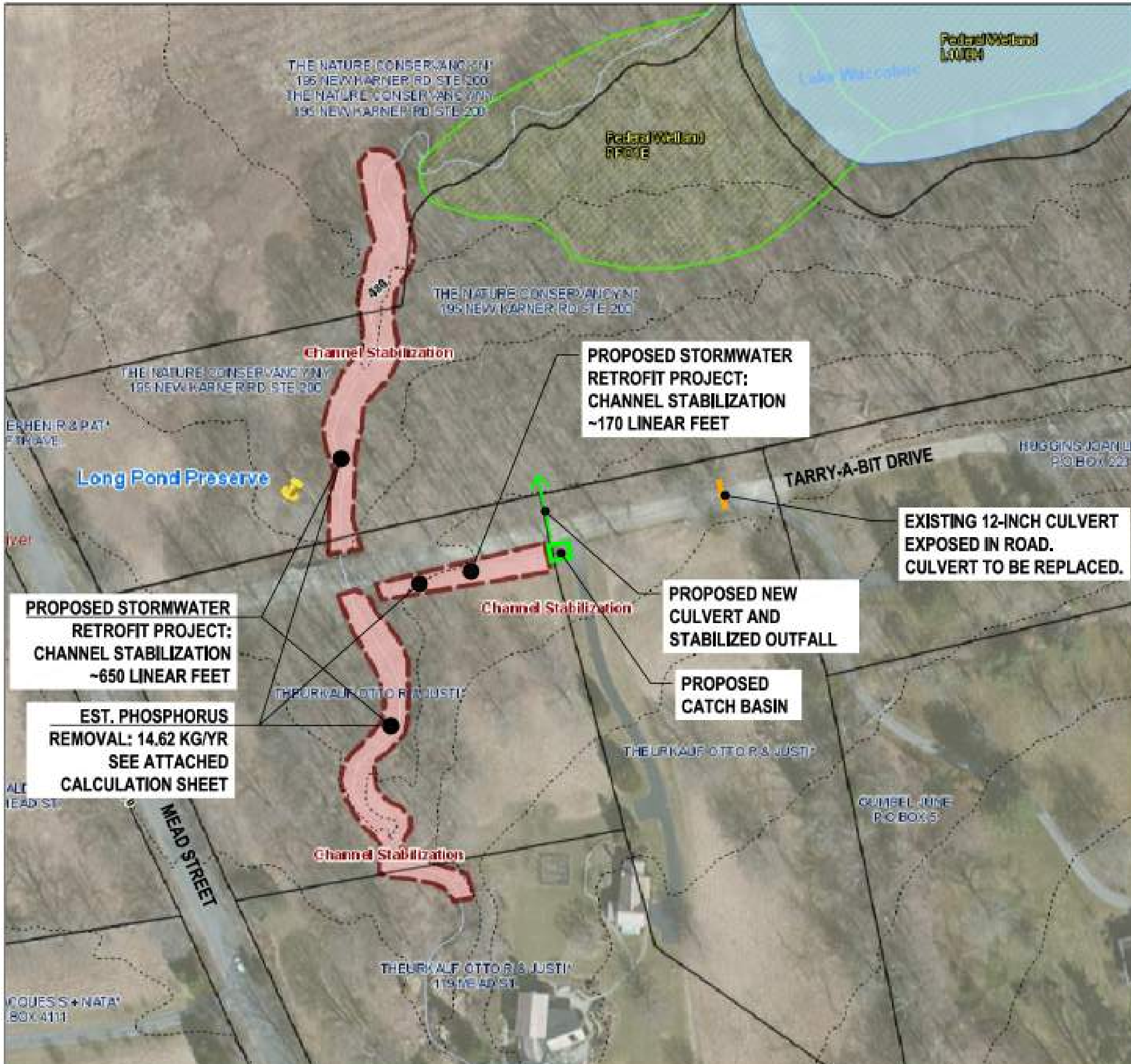
Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Subsurface Infiltration**	
Removal Efficiency:	***100%***	
P Load ------------------->	**6.60**	lb/yr
	3.00	kg/yr
P Removal ------------------->	**6.60**	lb/yr
	3.00	kg/yr

Summary:

Proposed Retrofit Practice	Subsurface Infiltration		
Drainage Area (acres)	**1.4**	Phosphorus Loading (kg/yr)	**3.00**
Water Quality Volume (cf)	**6276**	Phosphorus Reduction (kg/yr)	**3.00**



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATIONS WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATIONS SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

SITE SPECIFIC NOTES:

1. PROJECT INCLUDES STABILIZATION OF CLASSIFIED STREAM AND EXISTING ERODED DRAINAGE CHANNELS ON PRIVATE PROPERTIES, INCLUDING LONG POND PRESERVE.
2. GRAVEL ROAD (TARRY-A-BIT DRIVE) HAS EXISTING ROADSIDE SWALES AND CROSSING CULVERT PIPES DISCHARGING TO LONG POND PRESERVE PROPERTY AND DIRECTLY TO STREAM.
3. NEW DISCHARGE ACROSS TARRY-A-BIT DRIVE TO LONG POND PRESERVE PROPERTY PROPOSED TO REDUCE VOLUME OF RUNOFF DISCHARGING DIRECTLY TO STREAM. NEW CROSSING INCLUDES A NEW CATCH BASIN INLET, CULVERT PIPE AND OUTLET STABILIZATION ON LONG POND PRESERVE PROPERTY.
4. DAMAGED CULVERT IN TARRY-A-BIT DRIVE, WHICH APPEARS TO BE CAUSING RUTTING AND WASHING OUT OF PORTIONS OF THE GRAVEL ROAD, IS PROPOSED TO BE REPLACED.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

LEWISBOROLONGPONDPRESERVE_CONCEPTPLAN-11X17.DWG

STREAM & CHANNEL STABILIZATION LONG POND PRESERVE

TOWN OF LEWISBORO

JOB NO:
DATE: 8/12/16
SCALE: 1"=100'

L-6

L-6: Long Pond Preserve

Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	4.0	2.0	3.0	4.0		
Channel Bottom Width - B (ft)	15.0	3.0	3.0	15.0		
Channel Top Width -T (ft)	20.0	5.0	5.0	20.0		
Wetted Perimeter Calculation-P (ft)	24.43	7.47	9.32	24.43		
Channel Length-L (ft)	350	40	130	300		
Soil Erosion Depth-D (ft)	0.065	0.065	0.065	0.065		
Soil Erosion Volume-V (ft^3)	555.9	19.4	78.8	476.5		
Weight* (lbs)	52,807.9	1,845.6	7,485.3	45,264.0		
Weight (Kg)	23,953.7	837.2	3,395.3	20,531.7		
P Load** (mg/Yr)	7,186,104.7	251,151.6	1,018,597.8	6,159,518.3		
P Load (Kg/Yr)	7.19	0.25	1.02	6.16		
					ESTIMATED TOTAL (KG/YR):	14.62

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

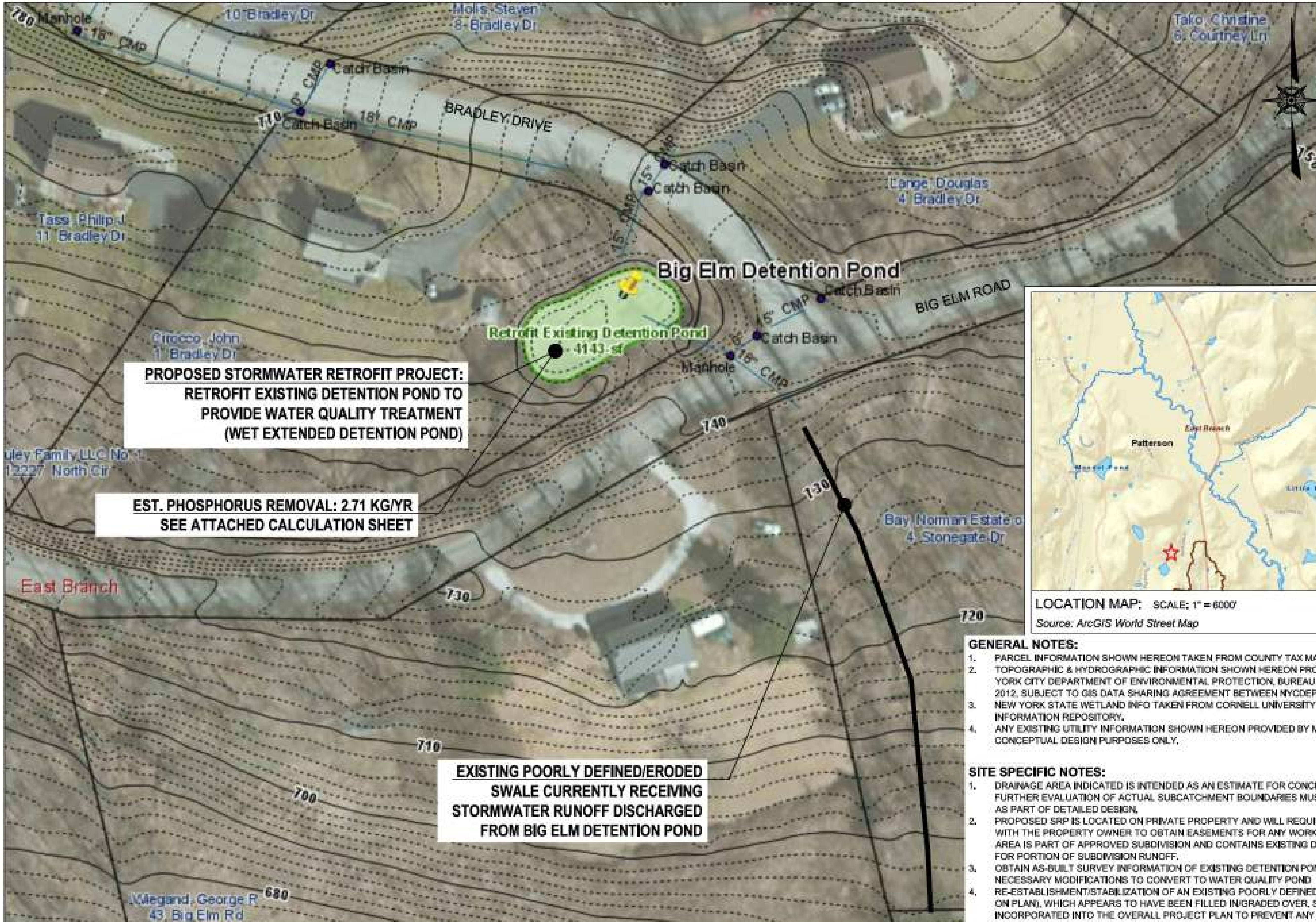
Wetted Perimeter (P) approximately: $P= T+ [(8/3)*(y^2/T)]$

Soil Erosion Volume: $V= P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED. AREA IS PART OF APPROVED SUBDIVISION AND CONTAINS EXISTING DETENTION POND FOR PORTION OF SUBDIVISION RUNOFF.
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.
4. RE-ESTABLISHMENT/STABILIZATION OF AN EXISTING POORLY DEFINED SWALE (INDICATED ON PLAN), WHICH APPEARS TO HAVE BEEN FILLED IN/GRADED OVER, SHOULD BE INCORPORATED INTO THE OVERALL PROJECT PLAN TO PREVENT ANY ADDITIONAL EROSION OR SEDIMENT TRANSPORT TO DOWNSTREAM PROPERTIES OR RECEIVING WATERBODIES.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

BIGELMDETENTIONPOND_CONCEPTPLAN_FIGURE_ITKI.DWG

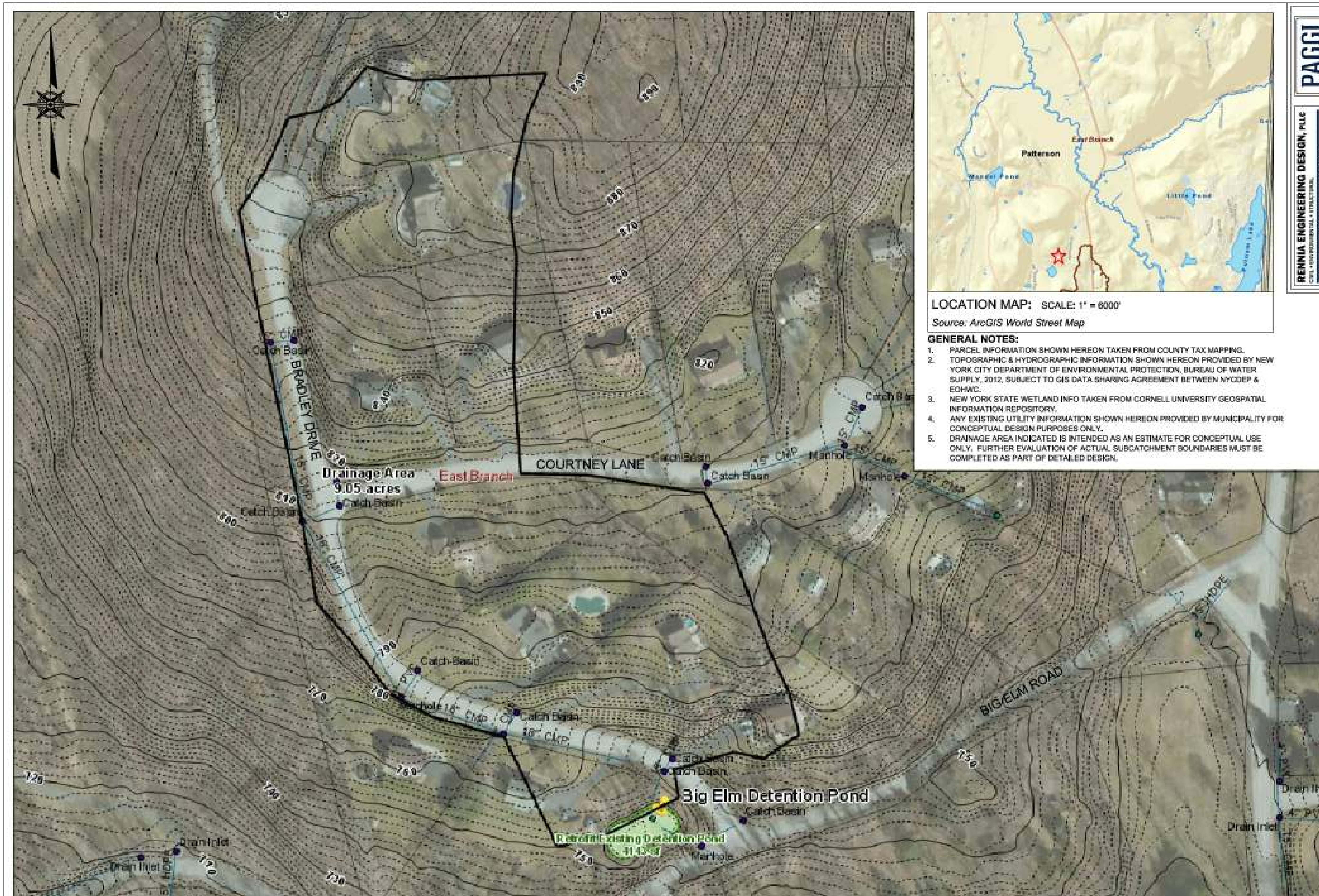
RETROFIT EXISTING DETENTION POND
BIG ELM DETENTION POND

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=60'

PAT-1

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

BIGELMDETENTIONPOND_DRAINAGEAREA_FIGURE_VBMRDWG

DRAINAGE AREA PLAN
BIG ELM DETENTION POND

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=120'

PAT-1

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Since 1989

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-1
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-1: Big Elm Detention Pond

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	9	acres	where:	A =	Contributing Area (acres)
I =	2.7	30.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3200			WQv =	Water Quality Volume
Rv (min)** =	0.3200				
WQv (acre-ft) =	**0.288**				
WQv (cu-ft) =	**12545**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3200		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	9		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

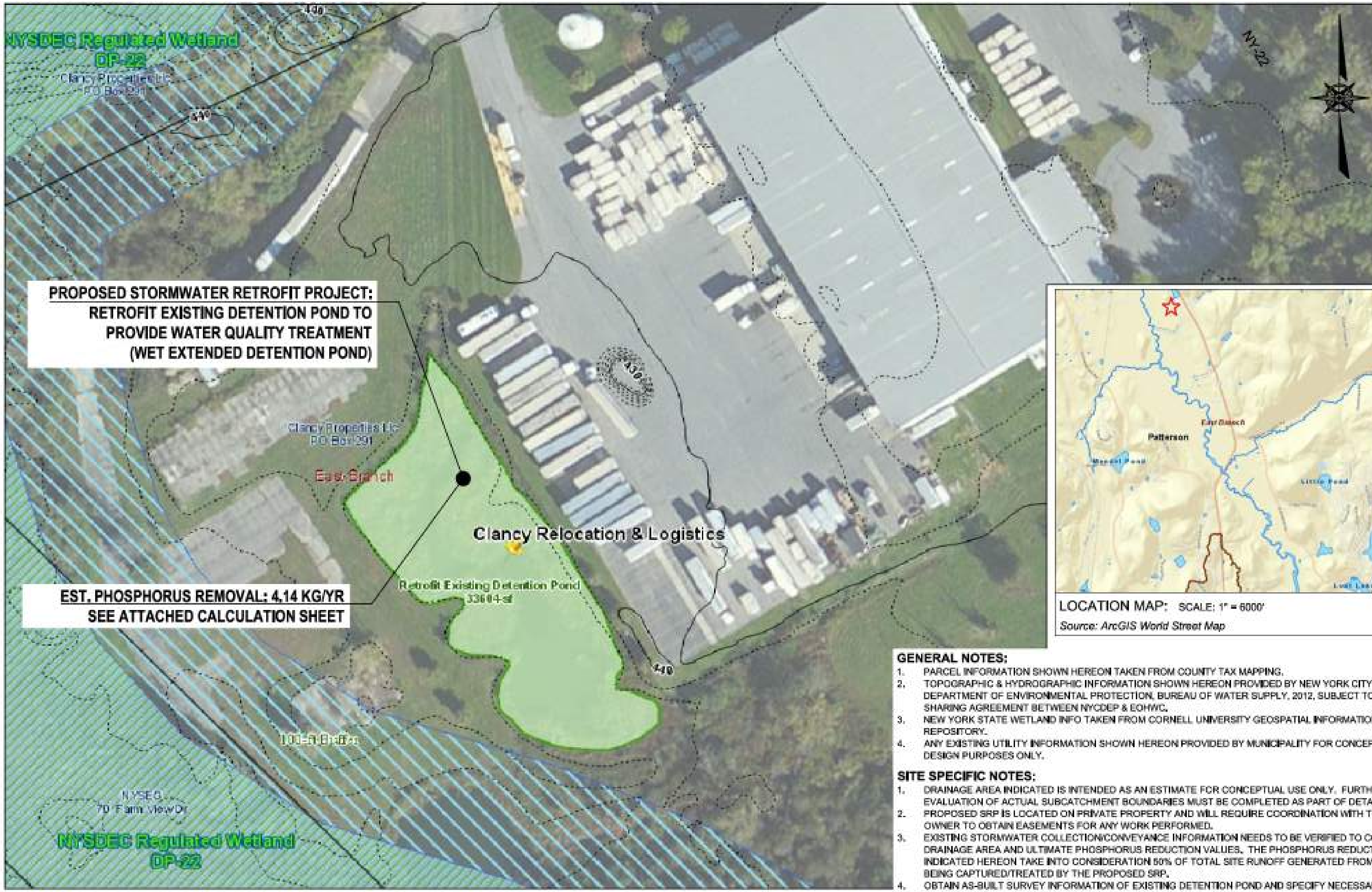
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------>	**10.86**	lb/yr
	4.92	kg/yr
P Removal ------------------>	**5.97**	lb/yr
	2.71	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**9.0**	Phosphorus Loading (kg/yr)	**4.92**
Water Quality Volume (cf)	**12545**	Phosphorus Reduction (kg/yr)	**2.71**

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.
3. EXISTING STORMWATER COLLECTION/CONVEYANCE INFORMATION NEEDS TO BE VERIFIED TO CONFIRM DRAINAGE AREA AND ULTIMATE PHOSPHORUS REDUCTION VALUES. THE PHOSPHORUS REDUCTION VALUES INDICATED HEREON TAKE INTO CONSIDERATION 50% OF TOTAL SITE RUNOFF GENERATED FROM IMPERVIOUS BEING CAPTURED/TREATED BY THE PROPOSED SRP.
4. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND
5. EXISTING DETENTION POND ABUTS UP TO STATE REGULATED WETLAND BUFFER AREA. ADDITIONAL WETLAND MAPPING AND/OR SITE INVESTIGATION WITH THE NYSDEC MAY BE REQUIRED TO DETERMINE THE PERMITTING REQUIREMENTS ASSOCIATED WITH THE PROPOSED RETROFIT.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL		CLANCYRELOCATION&LOGISTICS_CONCEPTSKETCH_11X17.DWG

RETROFIT EXISTING DETENTION POND
CLANCY RELOCATION & LOGISTICS

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-2

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
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STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	CLANCYRELOCATION&LOGISTICS_DRAINAGEAREA_FIGURE_11X17.DWG	

DRAINAGE AREA PLAN
CLANCY RELOCATION & LOGISTICS

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

PAT-2

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-2
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-2: Clancy Relocation & Logistics

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	7.6	acres	where:	A =	Contributing Area (acres)
I =	7.6	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.722**				
WQv (cu-ft) =	**31450**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	7.6		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

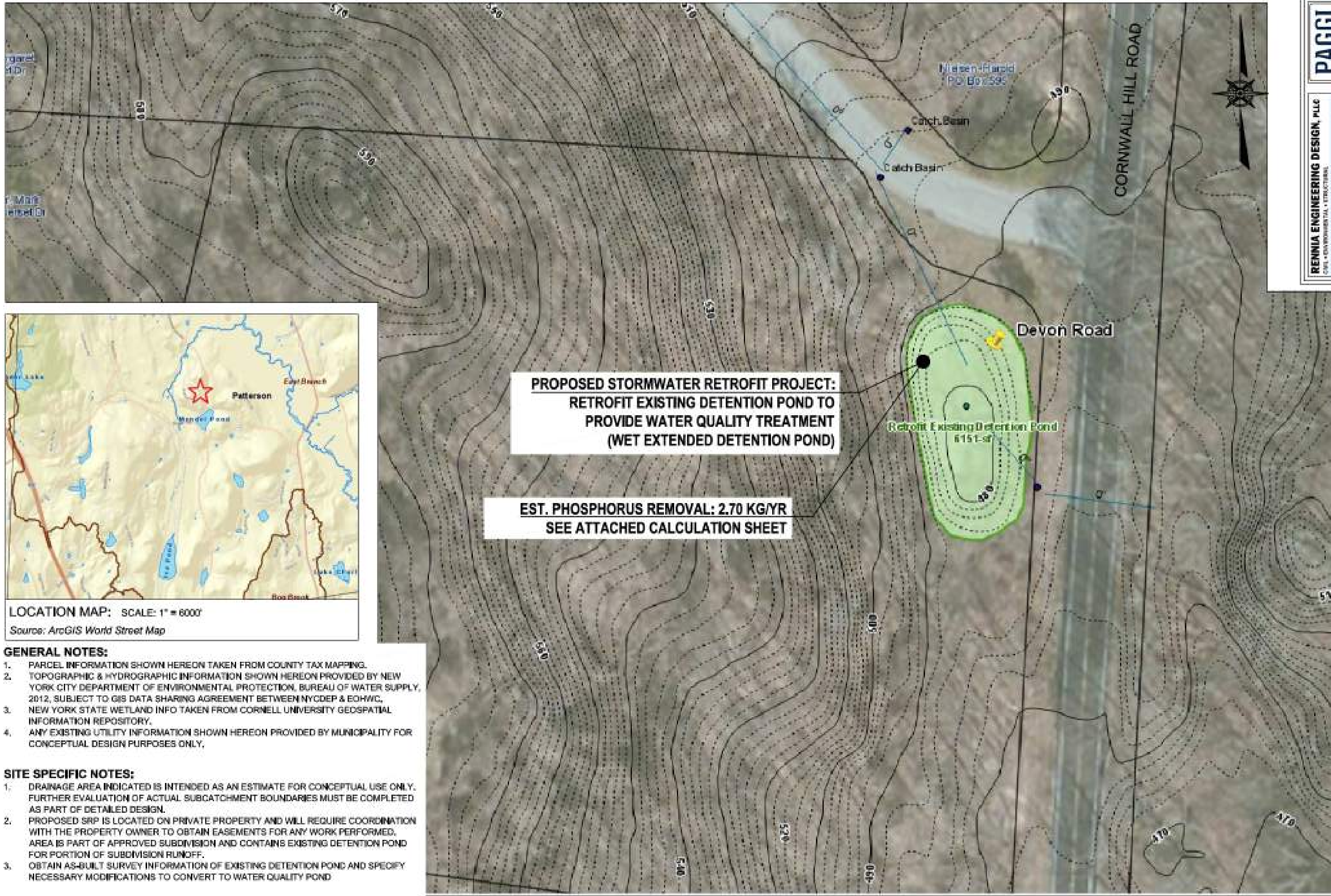
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------>	**33.19**	lb/yr
	15.05	kg/yr
P Removal ------------------>	**18.25**	lb/yr
	8.28	kg/yr
	4.14	kg/yr **Assume 50% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**7.6**	Phosphorus Loading (kg/yr)	**15.05**
Water Quality Volume (cf)	**31450**	Phosphorus Reduction (kg/yr)	**4.14**

1:1



PROPOSED STORMWATER RETROFIT PROJECT:
RETROFIT EXISTING DETENTION POND TO PROVIDE WATER QUALITY TREATMENT (WET EXTENDED DETENTION POND)

EST. PHOSPHORUS REMOVAL: 2.70 KG/YR
SEE ATTACHED CALCULATION SHEET

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.

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COMMITMENT & INTEGRITY DRIVE RESULTS
WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

DEVONROAD_CONCEPTSKETCH_FIGURE_11X17.DWG

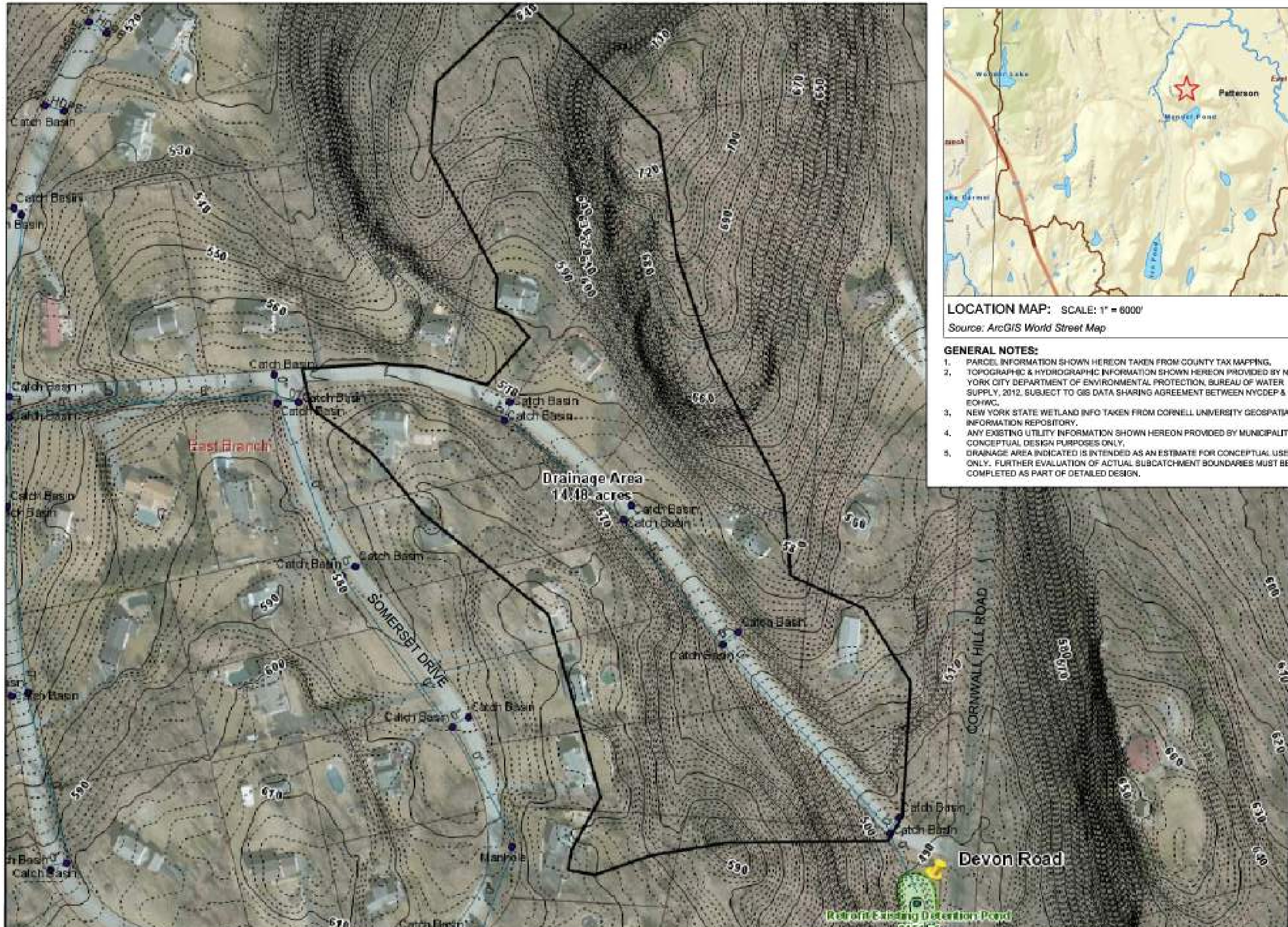
RETROFIT EXISTING DETENTION POND DEVON ROAD

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=50'

PAT-3

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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COMMITMENT & INTEGRITY DRIVE RESULTS

11X17.DWG

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	DEVONROAD_DRAINAGEAREA_FIGURE	

DRAINAGE AREA PLAN
DEVON ROAD

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

PAT-3

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: Pat-3
Prepared for: East of Hudson Coalition
Prepared by: CRP
Project County: Putnam

Pat-3: Devon Road

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	14.5 acres	where:	A =	Contributing Area (acres)
I =	2.6 17.93%		I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.2114		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.307**			
WQv (cu-ft) =	**13351**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2114		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	14.5		Rv =	Runoff Coefficient
C =	0.38		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.9
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0.1
Impervious	0
Develped Open Space	0
Weighted "C":	*0.38*

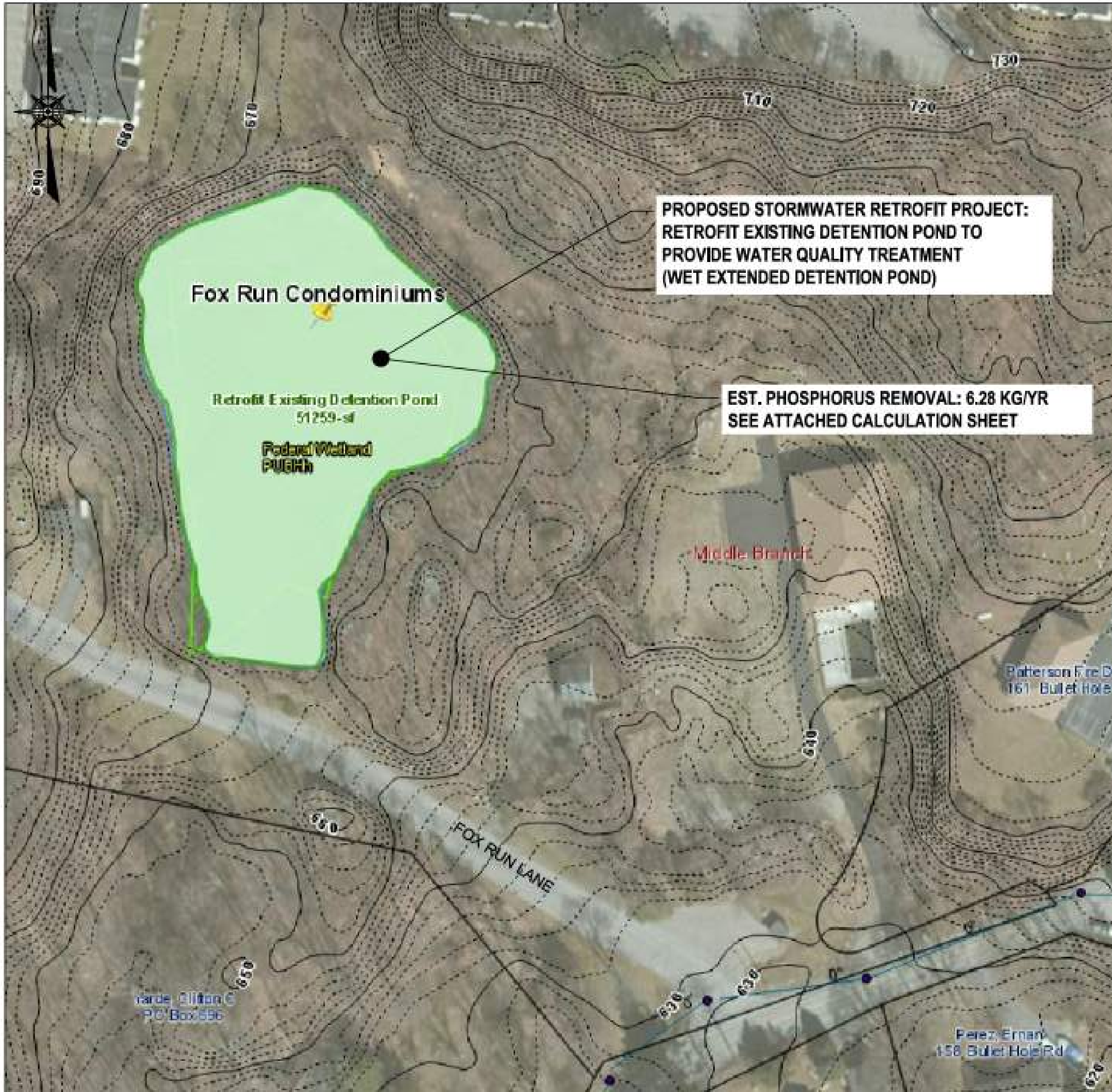
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**10.82**	lb/yr
	4.91	kg/yr
P Removal ------------------->	**5.95**	lb/yr
	2.70	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**14.5**	Phosphorus Loading (kg/yr)	**4.91**
Water Quality Volume (cf)	**13351**	Phosphorus Reduction (kg/yr)	**2.70**

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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SITE SPECIFIC NOTES:

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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
FOXRUNCONDOS_CONCEPTPLAN_FIGURE_11X17.DWG

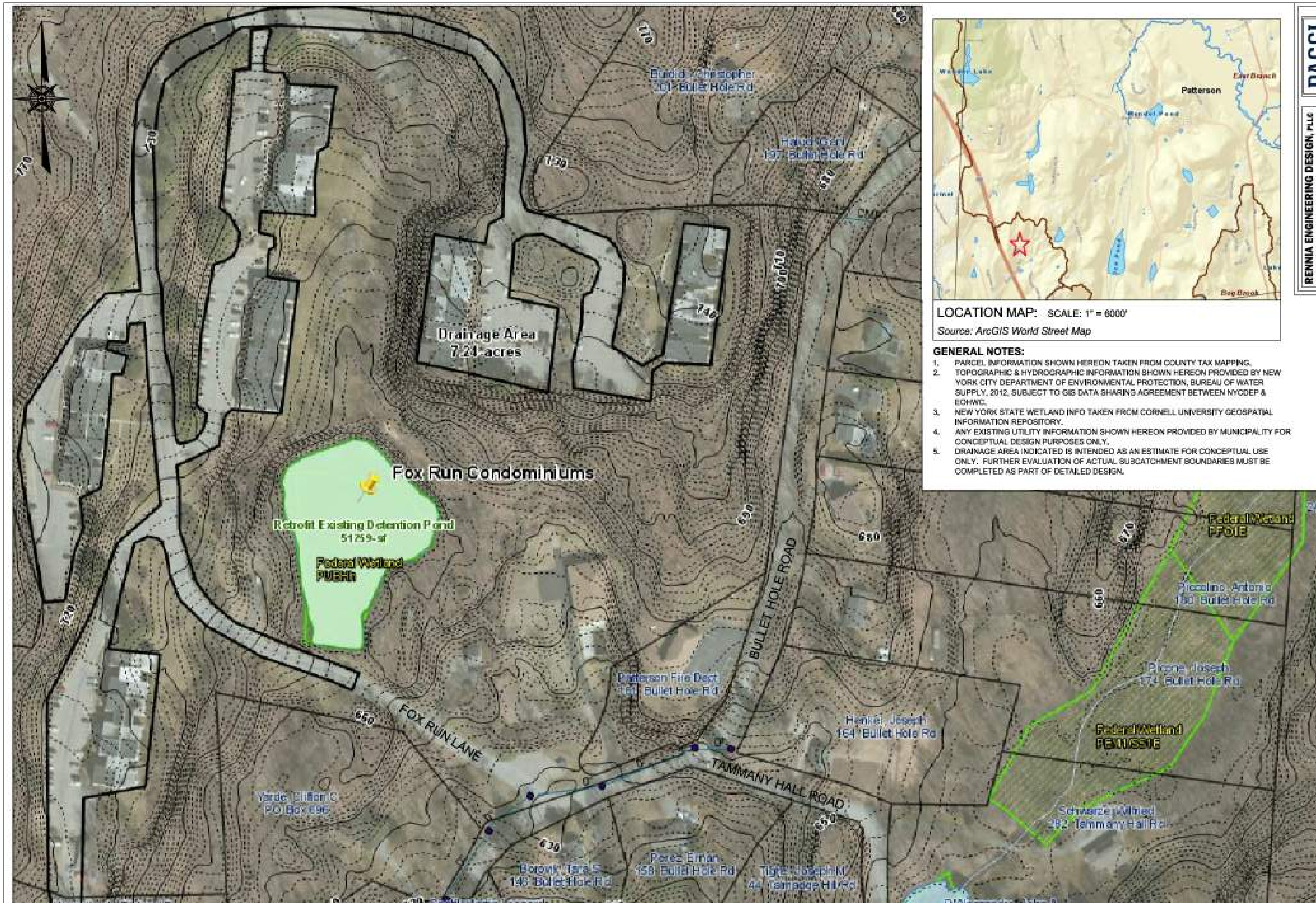
RETROFIT EXISTING DETENTION POND
FOX RUN CONDOS

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-4

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

FOXRUNCONDOS_DRAINAGEAREA_FIGURE_11x17

DRAINAGE AREA PLAN
FOX RUN CONDOS

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=150'

PAT-4

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-4
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-4: Fox Run Condos

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	7.2	acres	where:	A =	Contributing Area (acres)
I =	7.2	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.684**				
WQv (cu-ft) =	**29795**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	7.2		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

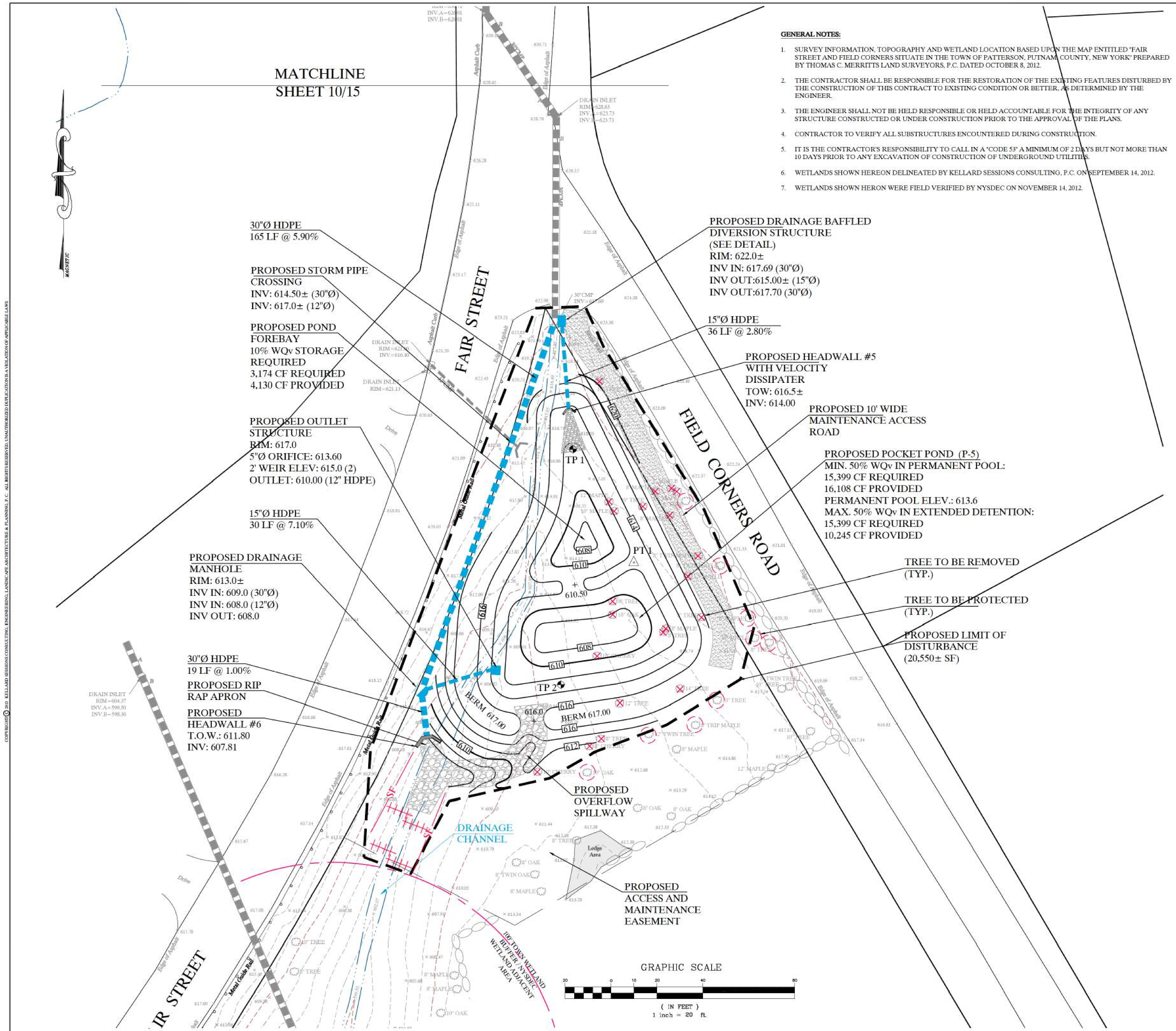
Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**31.44**	lb/yr
	14.26	kg/yr
P Removal ------------------->	**17.29**	lb/yr
	7.84	kg/yr
	6.28	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**7.2**	Phosphorus Loading (kg/yr)	**14.26**
Water Quality Volume (cf)	**29795**	Phosphorus Reduction (kg/yr)	**6.28**



GENERAL NOTES:

1. SURVEY INFORMATION, TOPOGRAPHY AND WETLAND LOCATION BASED UPON THE MAP ENTITLED "FAIR STREET AND FIELD CORNERS SITUATE IN THE TOWN OF PATTERSON, PUTNAM COUNTY, NEW YORK" PREPARED BY THOMAS C. MERRITTS LAND SURVEYORS, P.C. DATED OCTOBER 8, 2012.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE RESTORATION OF THE EXISTING FEATURES DISTURBED BY THE CONSTRUCTION OF THIS CONTRACT TO EXISTING CONDITION OR BETTER, AS DETERMINED BY THE ENGINEER.
3. THE ENGINEER SHALL NOT BE HELD RESPONSIBLE OR HELD ACCOUNTABLE FOR THE INTEGRITY OF ANY STRUCTURE CONSTRUCTED OR UNDER CONSTRUCTION PRIOR TO THE APPROVAL OF THE PLANS.
4. CONTRACTOR TO VERIFY ALL SUBSTRUCTURES ENCOUNTERED DURING CONSTRUCTION.
5. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CALL IN A "CODE 53" A MINIMUM OF 2 DAYS BUT NOT MORE THAN 10 DAYS PRIOR TO ANY EXCAVATION OF CONSTRUCTION OF UNDERGROUND UTILITIES.
6. WETLANDS SHOWN HEREON DELINEATED BY KELLARD SESSIONS CONSULTING, P.C. ON SEPTEMBER 14, 2012.
7. WETLANDS SHOWN HERON WERE FIELD VERIFIED BY NYSDEC ON NOVEMBER 14, 2012.

DEEP TEST PIT RESULTS		10/12/2012
TEST PIT	DEPTH FROM SURFACE(INCH)	SOIL DESCRIPTION
TP-1	0" - 4"	TOPSOIL
	4" - 36"	BROWN LOAMY SAND
	36" - 84" +	MIXED SANDS WITH BROKEN ROCK / SHALE MIX
TP-2	0" - 6"	TOPSOIL
	6" - 32"	BROWN LOAMY SAND
	32" - 84" +	MIXED SANDS WITH BROKEN ROCK / SHALE MIX

PERCOLATION TEST RESULTS	10/12/12
PERC HOLE #	PERC RATE
P1	13.3 MIN/INCH

LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- EXISTING SPOT GRADE — × 447.07
- WETLAND BOUNDARY
- WETLAND FLAG — × WF A5
- 100' TOWN WETLAND BUFFER
- EXISTING TREE
- EXISTING DRAINAGE PIPE
- EXISTING MONITORING WELL
- EXISTING STONE WALL
- PROPOSED 2' CONTOUR — 446
- PROPOSED 1' CONTOUR — 445
- PROPOSED 10' CONTOUR — 450
- PROPOSED ASPHALT CURB
- PROPOSED DRAINAGE PIPE
- PROPOSED HEADWALL WITH VELOCITY DISSIPATER
- PROPOSED DRAINAGE MANHOLE
- PROPOSED DRAIN INLET
- PROPOSED OUTLET STRUCTURE
- DEEP TEST HOLE LOCATION — TP 5
- PERCOLATION TEST HOLE LOCATION — PT 4
- PROPOSED SILT FENCE — SF
- TEMPORARY STONE CHECK DAMS
- PROPOSED TREE TO BE RMEOVED
- PROPOSED TREE PROTECTION
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED MAINTENANCE AND ACCESS EASEMENT

NOT FOR CONSTRUCTION

KELLARD SESSIONS CONSULTING

ENGINEERING, LANDSCAPE ARCHITECTURE & PLANNING, P.C.

500 MAIN STREET
ARMONK, N.Y. 10504
P: (914) 273-2323
F: (914) 273-2329
WWW.KELSES.COM

STORMWATER MANAGEMENT PLAN
FAIR ST. & FIELDS CORNER (MB-05)
EOHWC CONTRACT 2012 - 01
STORMWATER RETROFITS

TOWN OF PATTERSON — PUTNAM COUNTY, NEW YORK

REVISIONS	
10.	
9.	
8.	
7.	
6.	
5.	
4.	
3.	
2.	FEBRUARY 1, 2013 - 90% SUBMISSION
1.	JANUARY 22, 2013 - GENERAL REVISIONS

9 / 15

PROJECT I.D.: EHW100

DATE: NOVEMBER 16, 2012

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-5
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-5: Gottwald Property

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	25.7	acres	where:	A =	Contributing Area (acres)
I =	5.91	23.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.2570			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.660**				
WQv (cu-ft) =	**28767**				

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2570		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	25.7		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.77
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.23
Develped Open Space	0
Weighted "C":	*0.43*

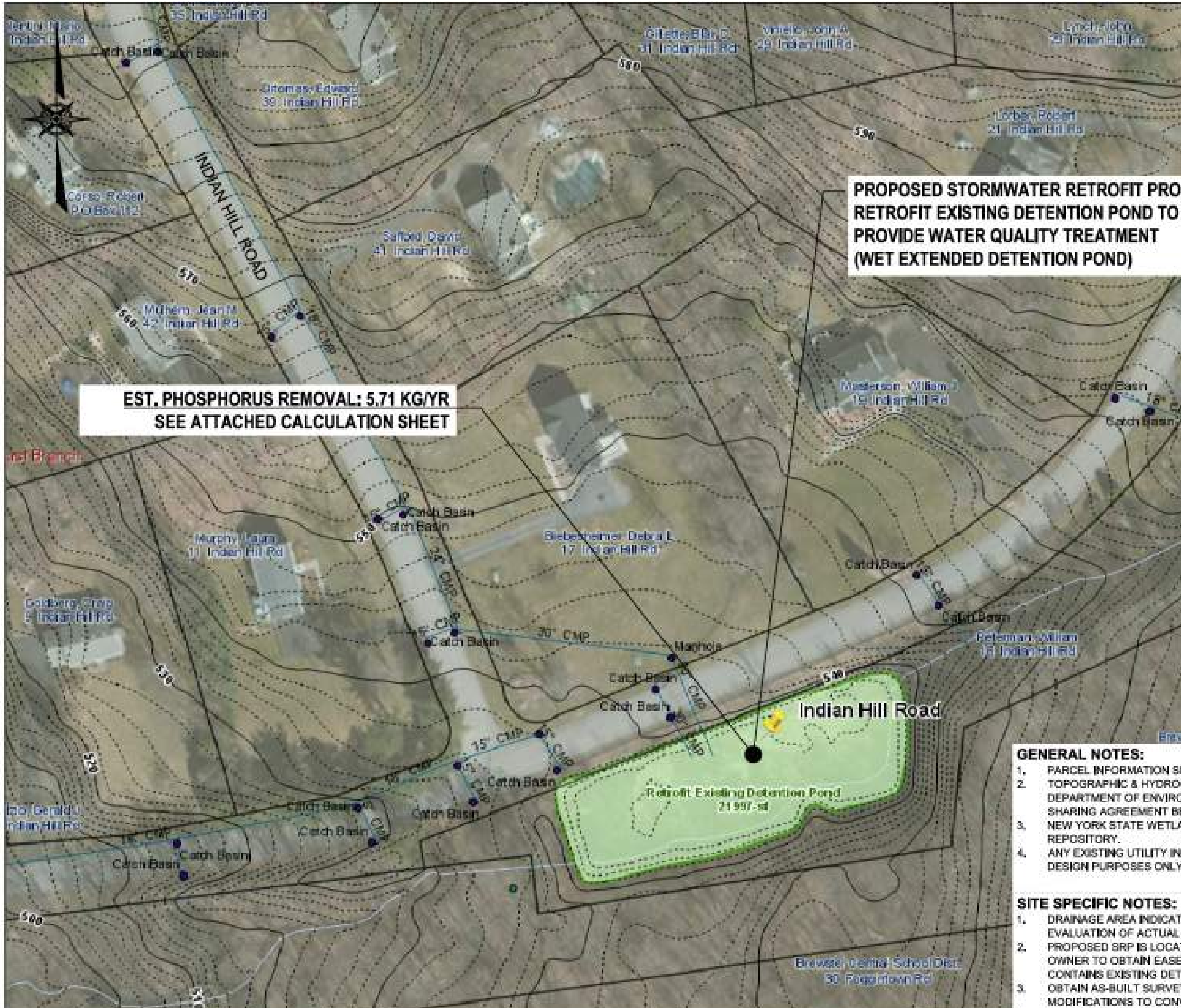
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Pocket Pond	
Removal Efficiency:	*67%*	
P Load ------------------->	**26.15**	lb/yr
	11.86	kg/yr
P Removal ------------------->	**17.52**	lb/yr
	7.95	kg/yr
	5.92	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**25.7**	Phosphorus Loading (kg/yr)	**11.86**
Water Quality Volume (cf)	**28767**	Phosphorus Reduction (kg/yr)	**5.92**

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & ECHWC.
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SITE SPECIFIC NOTES:

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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND
4. AVAILABLE MAPPING INDICATES THAT THE EXISTING DETENTION POND IS WITHIN A STATE REGULATED WETALAND. COORDINATION AND PERMITTING WILL BE RECUIRED WITH NYSDEC TO DETERMINE FEASIBILITY OF PROJECT. BASED ON SITE VISITS AND INFORMATION FROM TOWN PLANNING DEPARTMENT,THE EXISTING POND IS MAINTAINED AS CONSTRUCTED STORMWATER DETENTION POND. ADDITIONAL WETLAND MAPPING AND/OR SITE VISITS WITH THE NYSDEC MAY BE REQUIRED TO DETERMINE FEASIBILITY OF PROPOSED SRP.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	INDIANHILLROAD_CONCEPTSKETCH_FIGURE_

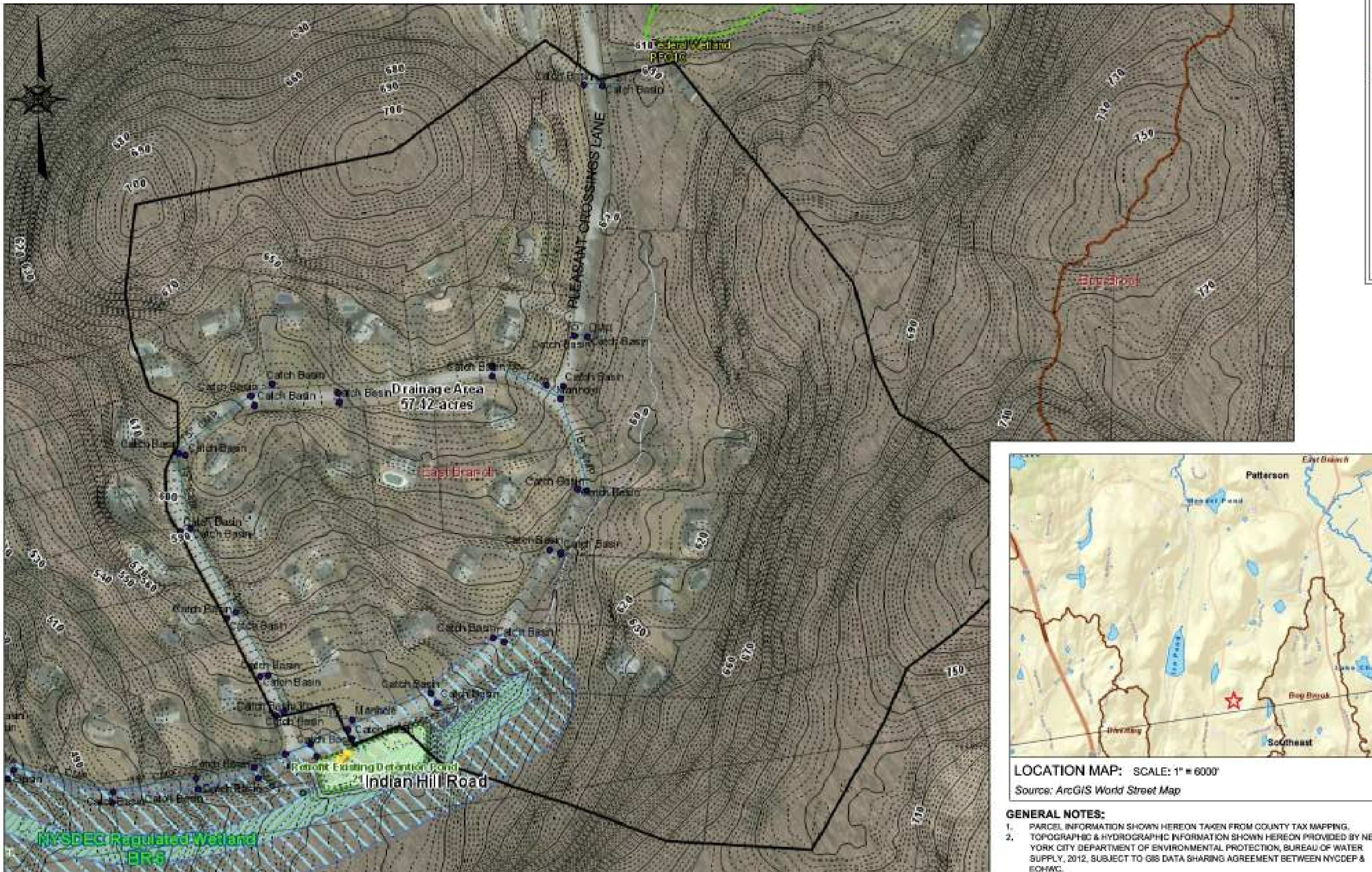
RETROFIT EXISTING DETENTION POND
INDIAN HILL ROAD

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

PAT-6

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
INDIANHILLROAD_DRAINAGEAREA_FIGURE_11x17.DWG

DRAINAGE AREA PLAN
INDIAN HILL ROAD

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-6

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Since 1989

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-6
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-6: Indian Hill Road

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	57.4	acres	where:	A =	Contributing Area (acres)
I =	8.2	14.29%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.1786		WQv =	Water Quality Volume
WQv (acre-ft) =		**1.025**			
WQv (cu-ft) =		**44649**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.1786		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	57.4		Rv =	Runoff Coefficient
C =	0.30		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.59
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0.41
Impervious	0
Develped Open Space	0
Weighted "C":	*0.30*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**28.59**	lb/yr
	12.97	kg/yr
P Removal ------------------->	**15.72**	lb/yr
	7.13	kg/yr
	5.71	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**57.4**	Phosphorus Loading (kg/yr)	**12.97**
Water Quality Volume (cf)	**44649**	Phosphorus Reduction (kg/yr)	**5.71**

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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SITE SPECIFIC NOTES:

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2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.
3. PROPOSED SRP IS SHOWN IN AREA OF EXISTING CATCH BASIN AND APPARENT LOW POINT IN REAR PARKING LOT PRIOR TO DISCHARGE TO WETLAND. EXISTING STORMWATER COLLECTION/CONVEYANCE INFORMATION INCLUDING BUILDING ROOF DRAINAGE INFORMATION IS REQUIRED TO VERIFY DRAINAGE.
4. ALTERNATE SRP's INCLUDE PROPRIETARY FILTERING PRACTICES (I.E. STORMFILTER) OR CATCH BASIN INSERTS (I.E. FABCO STORM BASIN).

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WOODARD & CURRAN
COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LP

JRSPHARMA_CONCEPTPLAN_FIGURE_11X17.DWG

SUBSURFACE INFILTRATION
JRS PHARMA

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=40'

PAT-7

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

JRSPHARMA_DRAINAGEAREA_FIGURE

DRAINAGE AREA PLAN
JRS PHARMA

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=150'

PAT-7

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PAGGI ENGINEERING Since 1989

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-7
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-7: JRS Pharma

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.8	acres	where:	A =	Contributing Area (acres)
I =	3.8	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =	0.9500			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.361**				
WQv (cu-ft) =	**15725**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.8		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Subsurface Infiltration**	
Removal Efficiency:	***100%***	
P Load ------------------->	**16.59**	lb/yr
	7.53	kg/yr
P Removal ------------------->	**16.59**	lb/yr
	7.53	kg/yr

6.02 kg/yr **Assume 80% of WQv treated**

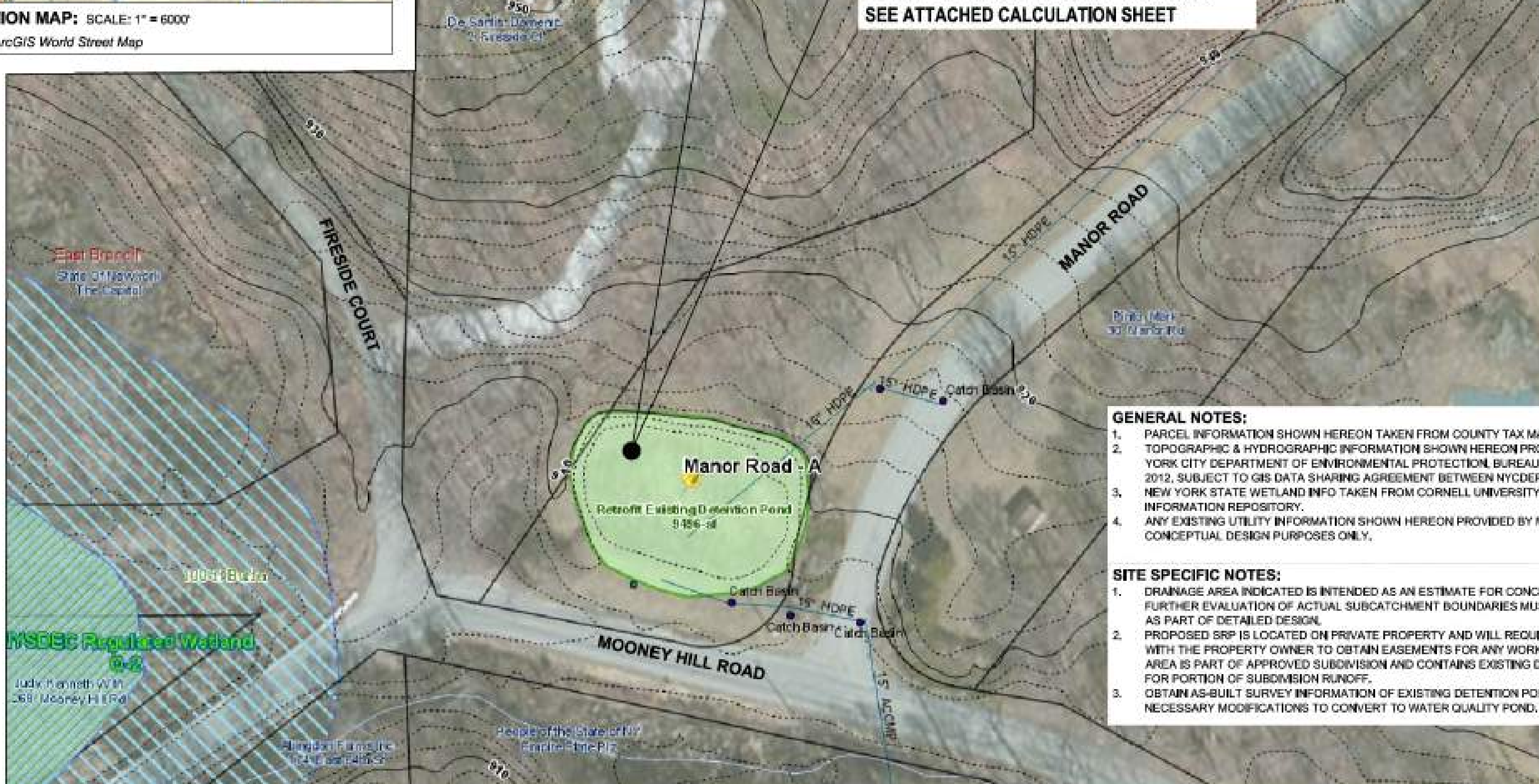
Summary:

Proposed Retrofit Practice	Subsurface Infiltration		
Drainage Area (acres)	**3.8**	Phosphorus Loading (kg/yr)	**7.53**
Water Quality Volume (cf)	**15725**	Phosphorus Reduction (kg/yr)	**6.02**

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map



GENERAL NOTES:

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SITE SPECIFIC NOTES:

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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.

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COMMITMENT & INTEGRITY DRIVE RESULTS

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	MANORROAD_CONCEPTSKETCHA_FIGURE_11X17.DWG	

RETROFIT EXISTING DETENTION POND
MANOR ROAD – A

TOWN OF PATTERSON

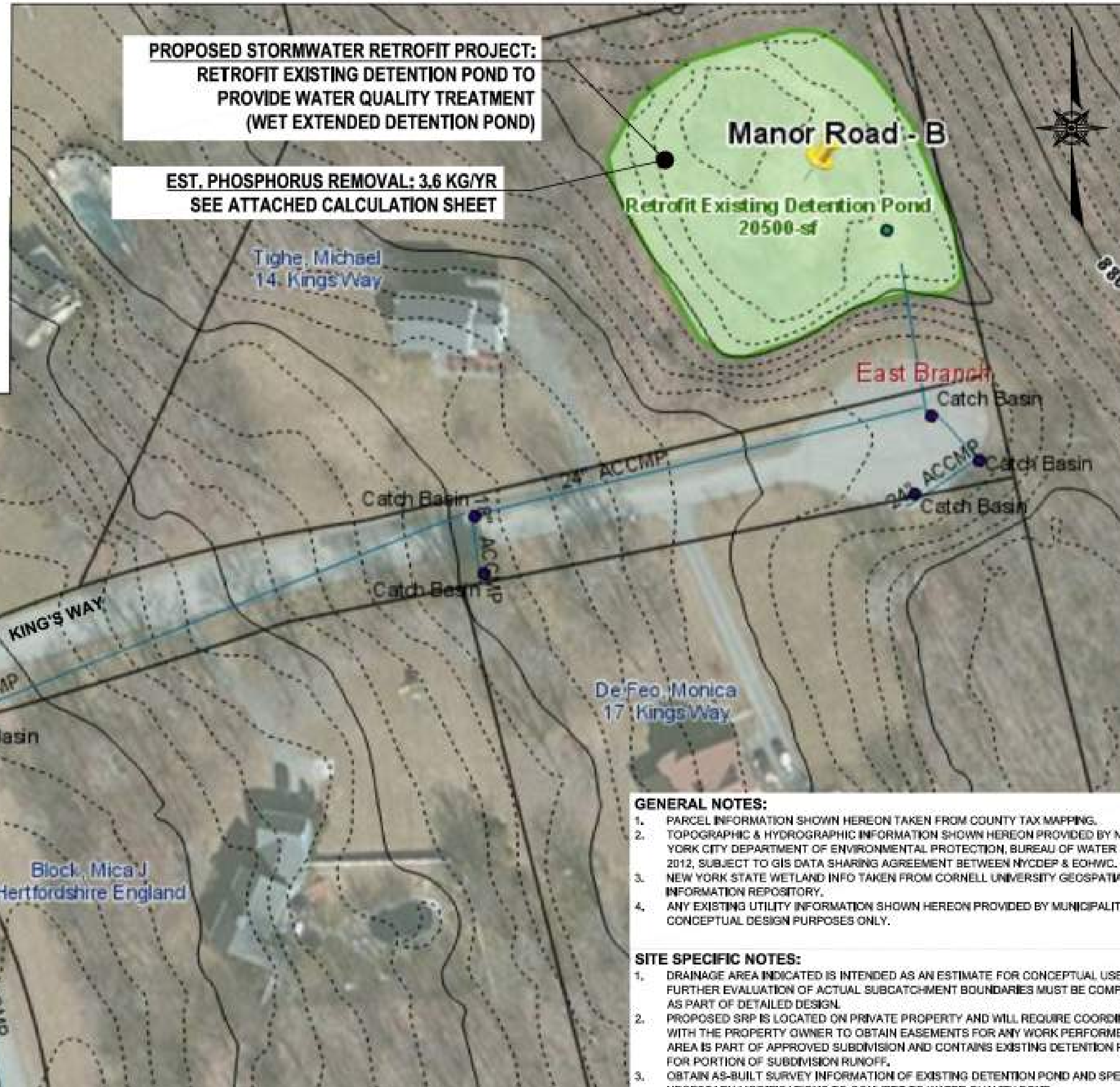
JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

PAT-8A

1:1

LOCATION MAP; SCALE; 1" = 6000'

Source: ArcGIS World Street Map



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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL CHECKED BY: LJP

DRAWN BY: CRP/RGL

MANORROAD_CONCEPTSKETCHB_FIGURE_11X17.DWG

RETROFIT EXISTING DETENTION POND
MANOR ROAD – B

TOWN OF PATTERSON

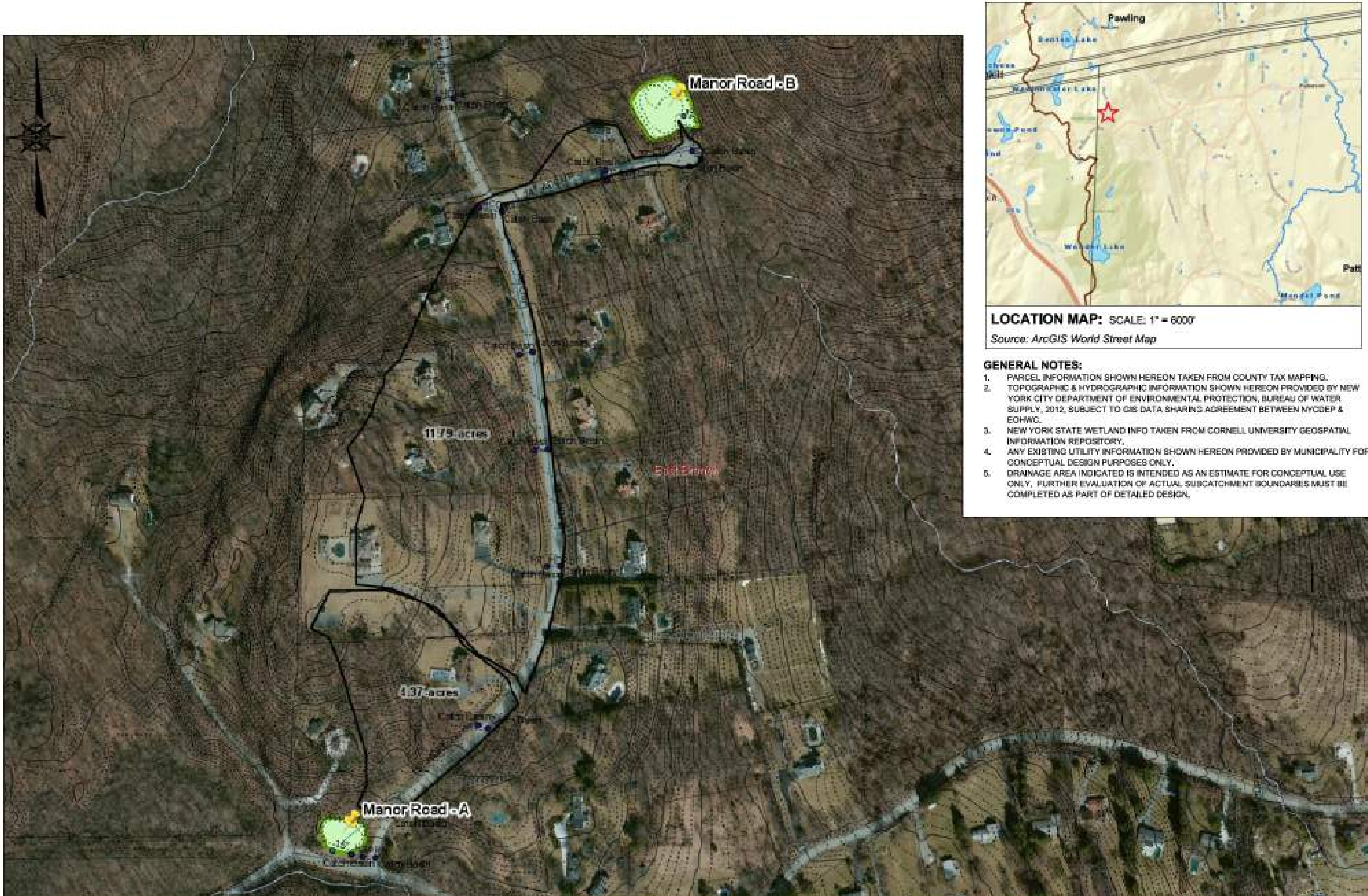
JOB NO:

DATE: 8/12/16

SCALE: 1"=60'

PAT-8B

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	MANORROAD_DRAINAGEAREA_FIGURE_11X17.DWG	

DRAINAGE AREA PLAN
MANOR ROAD

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=250'

PAT-8

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-8 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-8 A: Manor Road

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	4.4	acres	where:	A =	Contributing Area (acres)
I =	1.2	27.27%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.2955		WQv =	Water Quality Volume
WQv (acre-ft) =		**0.130**			
WQv (cu-ft) =		**5663**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2955		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	4.4		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Wet ED Pond	
Removal Efficiency:	*55%*	
P Load ------------------->	**4.90**	lb/yr
	2.22	kg/yr
P Removal ------------------->	**2.70**	lb/yr
	1.22	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**4.4**	Phosphorus Loading (kg/yr)	**2.22**
Water Quality Volume (cf)	**5663**	Phosphorus Reduction (kg/yr)	**1.22**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-8 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-8 B: Manor Road

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	11.8	acres	where:	A =	Contributing Area (acres)
I =	3.6	30.51%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.3246		WQv =	Water Quality Volume
WQv (acre-ft) =		**0.383**			
WQv (cu-ft) =		**16683**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3246		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	11.8		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

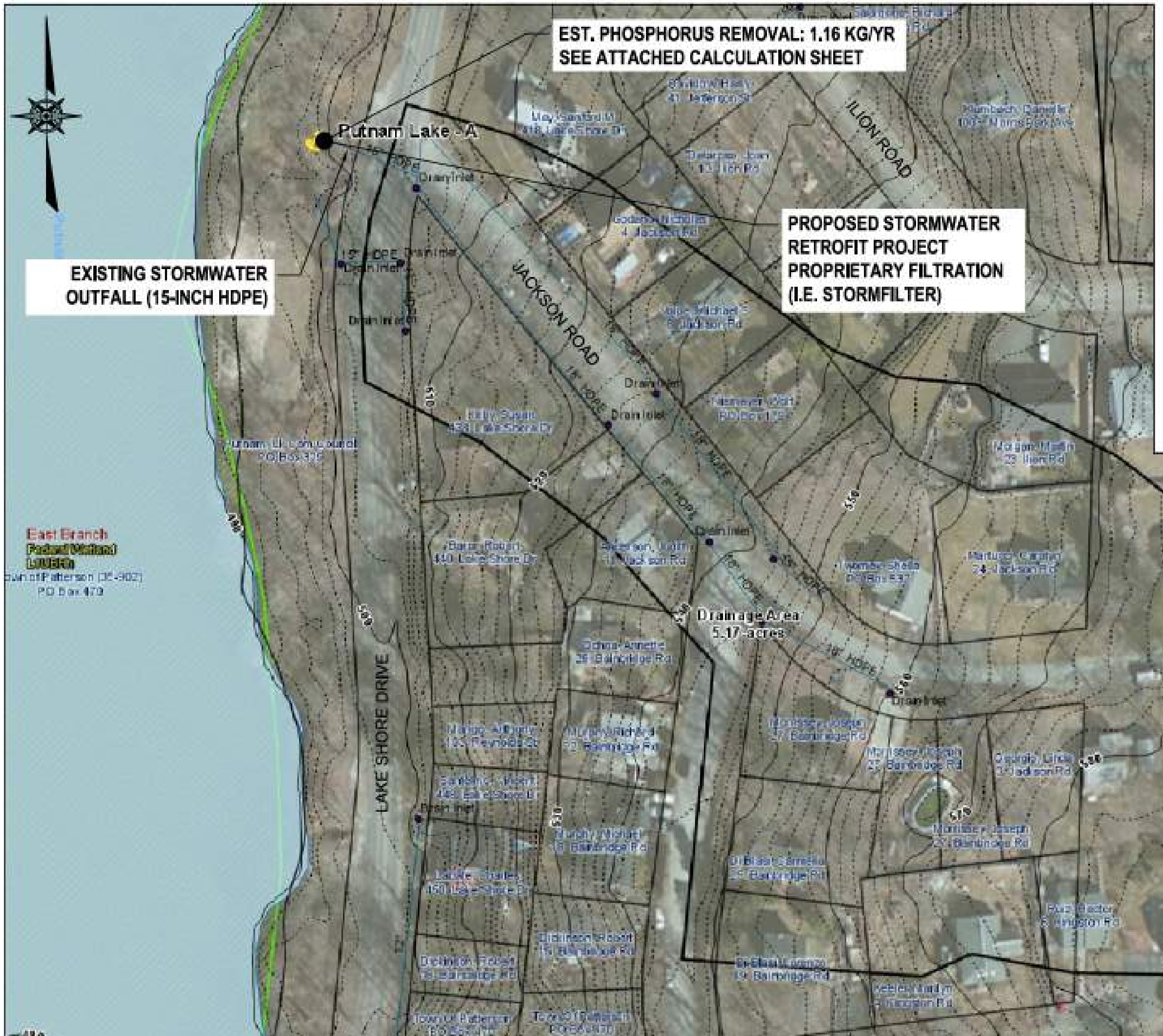
Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**14.44**	lb/yr
	6.55	kg/yr
P Removal ------------------->	**7.94**	lb/yr
	3.60	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**11.8**	Phosphorus Loading (kg/yr)	**6.55**
Water Quality Volume (cf)	**16683**	Phosphorus Reduction (kg/yr)	**3.60**



LOCATION MAP: SCALE: 1" = 2000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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4. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
5. STABILIZATION/ELIMINATION OF EXISTING ERODED CHANNELS BETWEEN OUTFALL DISCHARGE AND LAKE CARMEL SHOULD BE INCORPORATED INTO DETAILED DESIGN OF SRP.

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COMMITMENT & INTEGRITY DRIVE RESULTS

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STORMWATER RETROFIT CONCEPT PLAN

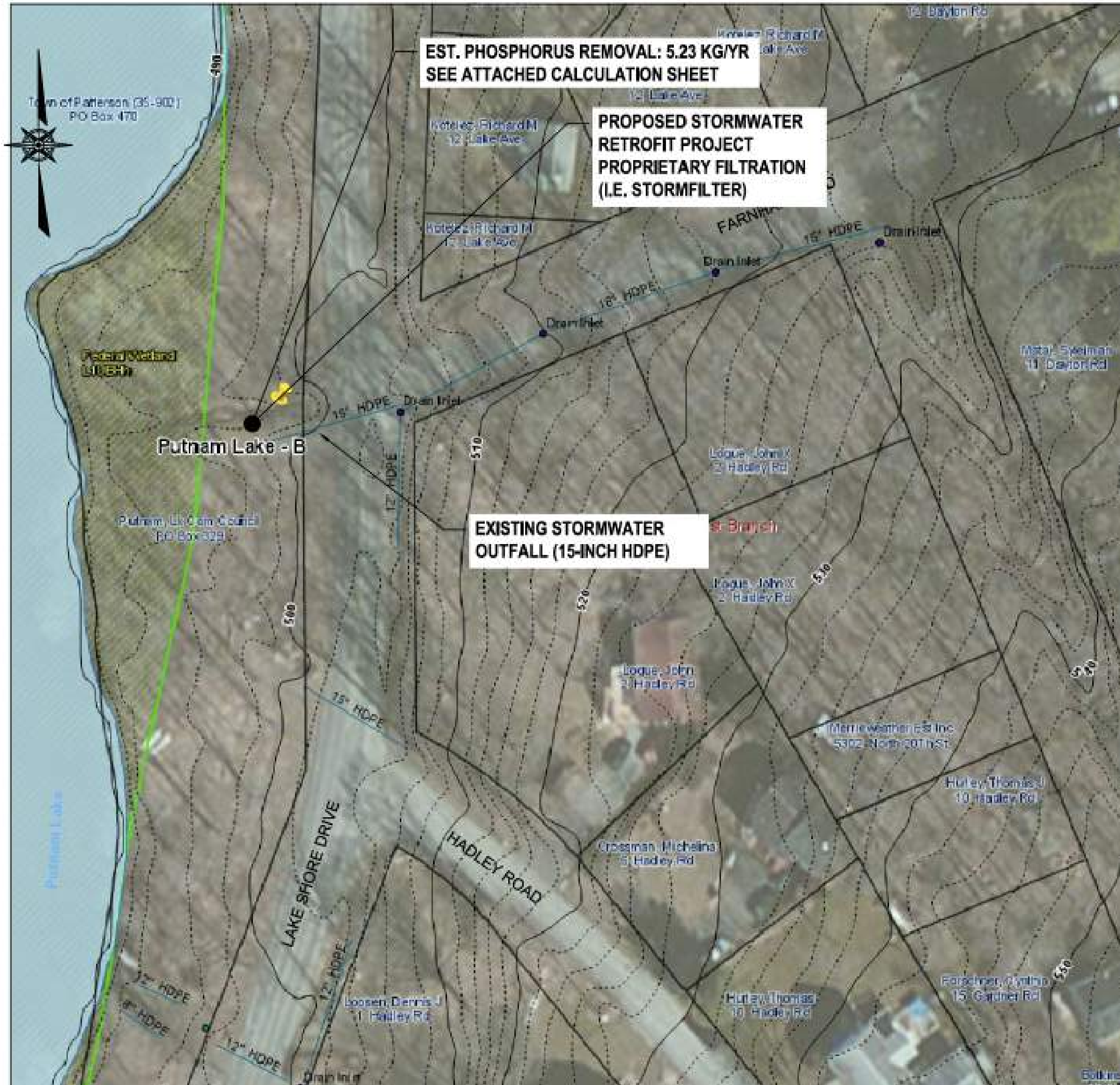
DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	PUTNAMLAKE_A-E_CONCEPTPLAN_FIGURE

PROPRIETARY FILTERING PRACTICE
PUTNAM LAKE - A

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-9A



LOCATION MAP: SCALE: 1" = 2000'

Source: ArcGIS World Street Map

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	FIGURE: PUTNAMLAKE_A-E_CONCEPTPLAN

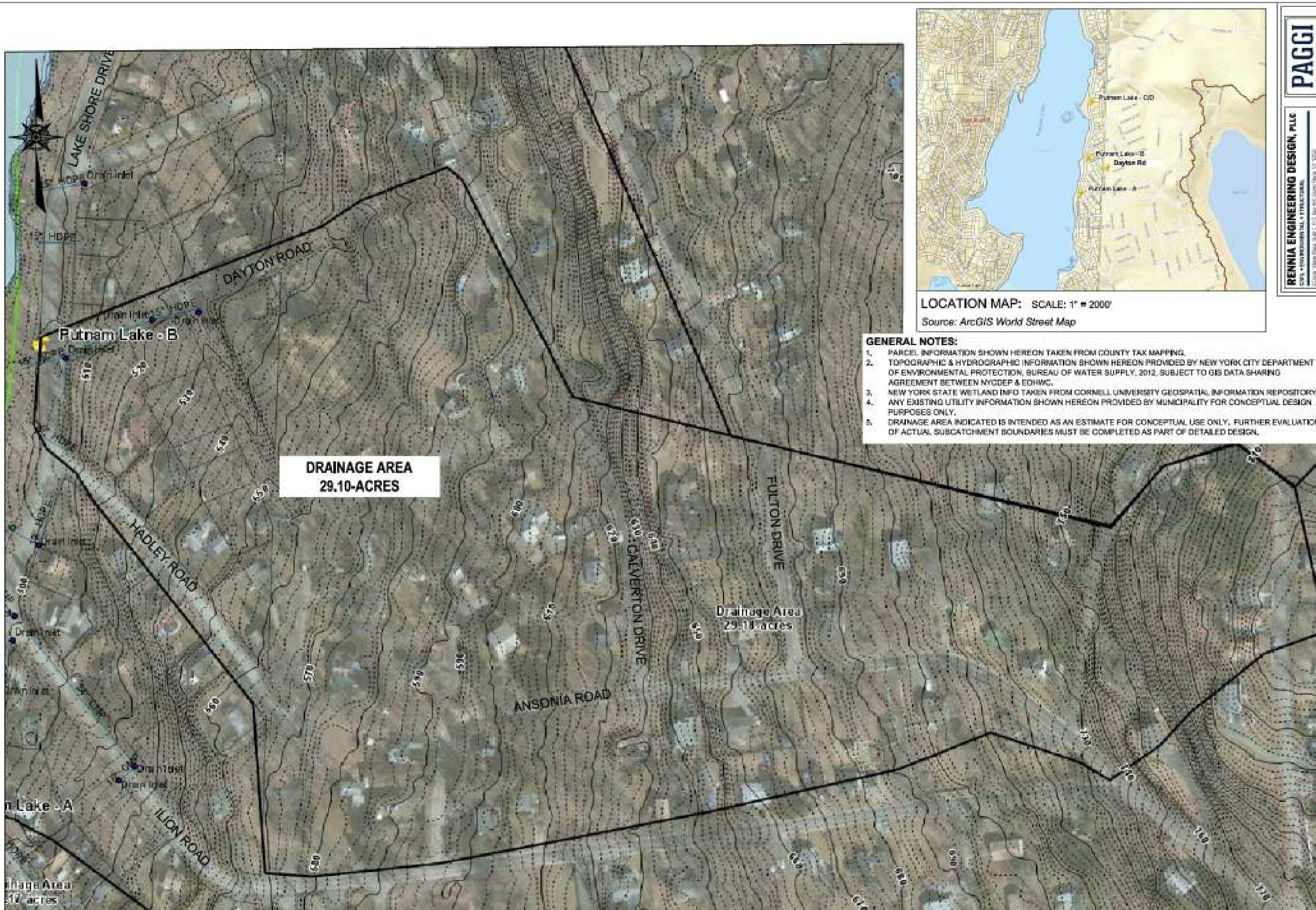
PROPRIETARY FILTERING PRACTICE
PUTNAM LAKE - B

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

PAT-9B

1:1



LOCATION MAP: SCALE: 1" = 2000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	FIGURE:	PUTNAMLAKE_A–B_DRAINAGEAREA

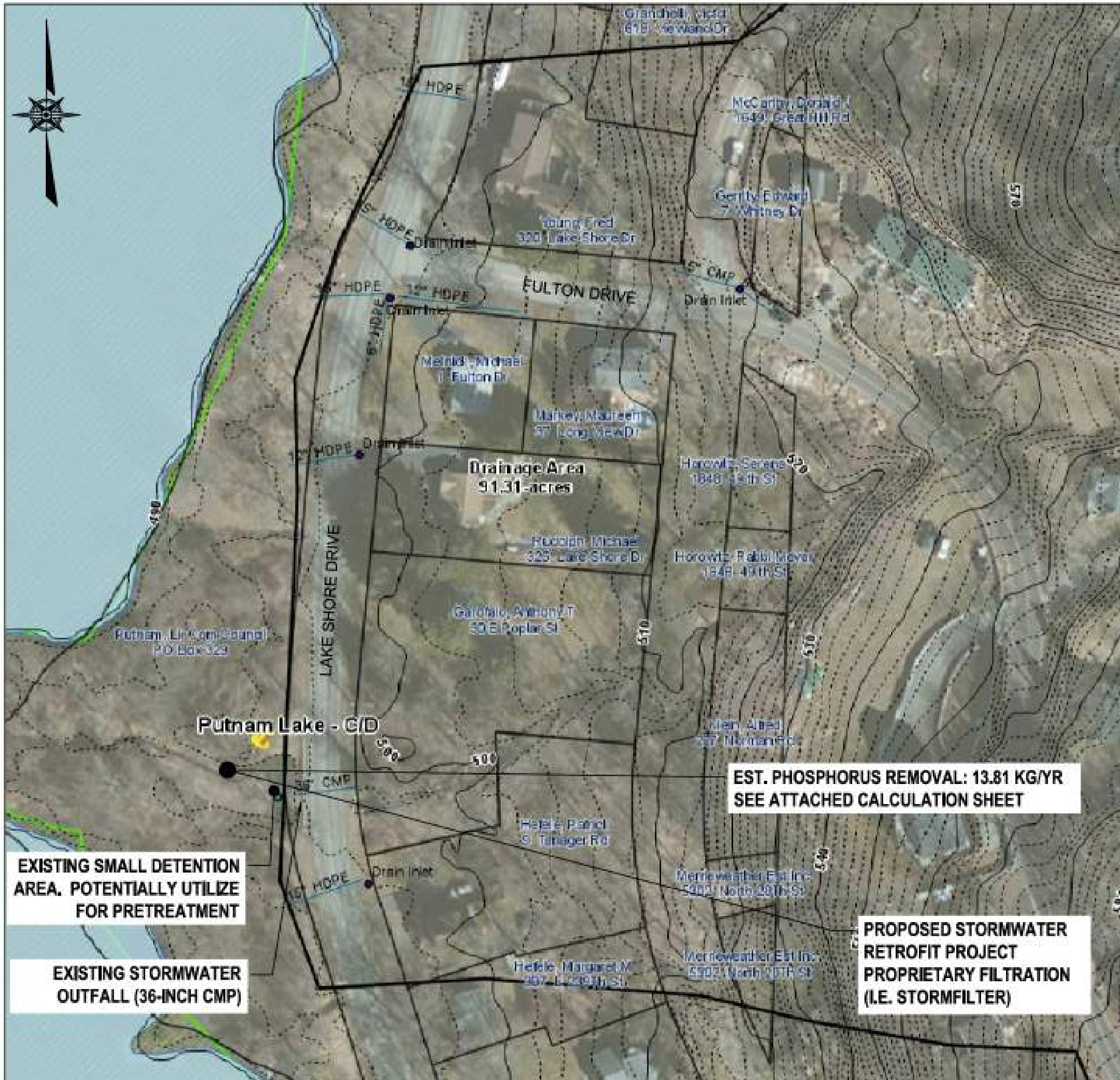
DRAINAGE AREA PLAN
PUTNAM LAKE – B

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

PAT-9B

1:1



LOCATION MAP: SCALE: 1" = 2000'

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3. PROPOSED FILTERING PRACTICE AT END OF PIPE. EXISTING STORMWATER OUTFALL LOCATED IN AREA OF PROPOSED SRP.
4. LARGE ESTIMATED DRAINAGE AREA TO BE VERIFIED. MOST LIKELY WILL SPLIT INTO TWO PROJECTS (C&D) ONCE ACTUAL DRAINAGE AREA IS DETERMINED.
5. WHERE POSSIBLE, CONSIDERATION SHOULD BE GIVEN TO COMBINING MULTIPLE SRP's TO A SINGLE PRACTICE WHERE PROXIMITY OF OUTFALLS, EXISTING DRAINAGE INFRASTRUCTURE AND TOPOGRAPHY ALLOW.
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709 Westchester Avenue, Suite L2
White Plains, New York 10604
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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
PUTNAMLAKE_A-E_CONCEPTPLAN_FIGURE

PROPRIETARY FILTERING PRACTICE
PUTNAM LAKE – C/D

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-9C/9D

1:1

LOCATION MAP; SCALE; 1" = 2000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	FIGURE:	PUTNAMLAKE_A-B_DRAINAGE AREA

DRAINAGE AREA PLAN
PUTNAM LAKE – C/D

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=250'

PAT-9C/9D

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-9 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-9 A: Putnam Lake

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	5.2	acres	where:	A =	Contributing Area (acres)
I =	1.6	30.77%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3269			WQv =	Water Quality Volume
WQv (acre-ft) =	**0.170**				
WQv (cu-ft) =	**7405**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.15	hours	Tc =	Time of Concentration (hours)
CN =	88		CN =	Curve Number
qu =	607.249		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	1.93561	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3269		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	5.2		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**6.41**	lb/yr
	2.91	kg/yr
P Removal ------------------->	**2.56**	lb/yr
	1.16	kg/yr

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**5.2**	Phosphorus Loading (kg/yr)	**2.91**
Water Quality Volume (cf)	**7405**	Phosphorus Reduction (kg/yr)	**1.16**

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-9 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-9 B: Putnam Lake

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	29.2 acres	where:	A =	Contributing Area (acres)
I =	9 30.82%		I =	Impervious Area (acres/%)
P =	1.2 inches		P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3274		WQv =	Water Quality Volume
WQv (acre-ft) =	**0.956**			
WQv (cu-ft) =	**41643**			

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.25 hours	Tc =	Time of Concentration (hours)
CN =	88	CN =	Curve Number
qu =	513.485	qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	9.20421 CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3274		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	29.2		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------->	**36.03**	lb/yr
	16.35	kg/yr
P Removal ------------------->	**14.41**	lb/yr
	6.54	kg/yr
	5.23	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**29.2**	Phosphorus Loading (kg/yr)	**16.35**
Water Quality Volume (cf)	**41643**	Phosphorus Reduction (kg/yr)	**5.23**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-9 C/D
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-9 C/D: Putnam Lake

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	91	acres	where:	A =	Contributing Area (acres)
I =	23	25.27%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.2775			WQv =	Water Quality Volume
WQv (acre-ft) =	**2.525**				
WQv (cu-ft) =	**109989**				

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	1.2	hours	Tc =	Time of Concentration (hours)
CN =	87		CN =	Curve Number
qu =	243.737		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	11.5394	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2775		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	91		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Stormfilter	
Removal Efficiency:	*40%*	
P Load ------------------>	**95.18**	lb/yr
	43.17	kg/yr
P Removal ------------------>	**38.07**	lb/yr
	17.27	kg/yr
	13.81	kg/yr **Assume 80% of WQv treated**

Summary:

Proposed Retrofit Practice	Stormfilter		
Drainage Area (acres)	**91.0**	Phosphorus Loading (kg/yr)	**43.17**
Water Quality Volume (cf)	**109989**	Phosphorus Reduction (kg/yr)	**13.81**

1:1

PROPOSED STORMWATER RETROFIT PROJECT: RETROFIT EXISTING DETENTION POND TO PROVIDE WATER QUALITY TREATMENT (WET EXTENDED DETENTION POND)

EST. PHOSPHORUS REMOVAL: 6.94 KG/YR
SEE ATTACHED CALCULATION SHEET

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
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2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED. DETENTION POND IS WITHIN EXISTING COMMERCIAL PARK AND RECEIVES STORMWATER RUNOFF FROM A PORTION OF THE DEVELOPMENT (SEE DRAINAGE AREA PLAN).
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.

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ROBIN HILL CORPORATE PARK_A-E_CONCEPT PLAN_FIGURE_11X17.DWG

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

RETROFIT EXISTING DETENTION POND
ROBIN HILL CORPORATE PARK – A

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

PAT-10A

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.

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STORMWATER RETROFIT CONCEPT PLAN

RETROFIT EXISTING DETENTION POND
ROBIN HILL CORPORATE PARK – B

TOWN OF PATTERSON

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

PAT-10B

1:1

GENERAL NOTES:

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3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND.

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	ROBINHILLCORPORATEPARK_A-E_CONCEPTPLAN_11X17.DWG

RETROFIT EXISTING DETENTION POND
ROBIN HILL CORPORATE PARK – C

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=40'

PAT-10C

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

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STORMWATER RETROFIT
CONCEPT PLAN

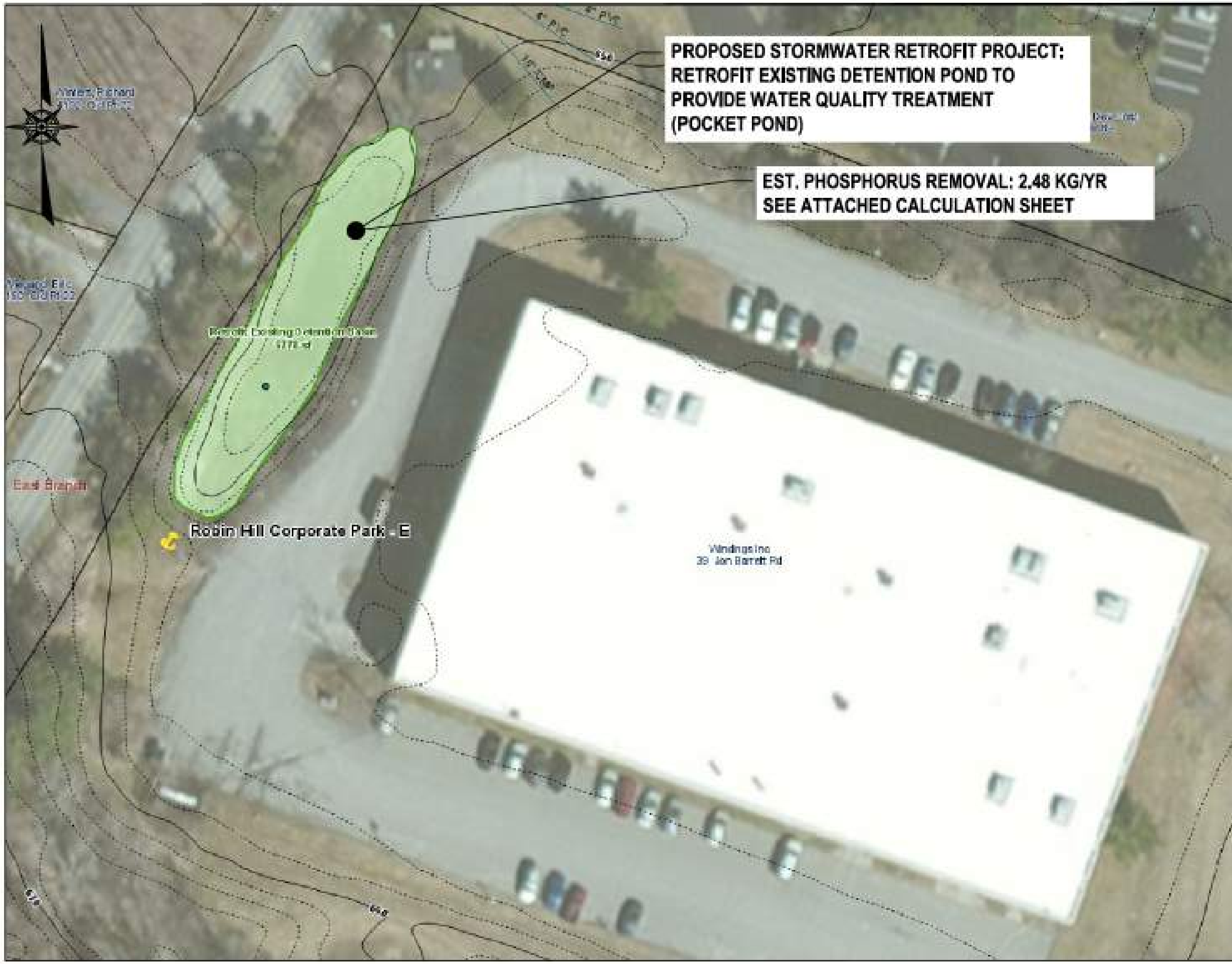
DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	ROBINHILLCORPORATEPARK_A-E_CONCEPT PLAN FIGURE_11X17.DWG

RETROFIT EXISTING DETENTION POND
ROBIN HILL CORPORATE PARK – D

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=40'

PAT-10D



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP
ROBINHILLCORPORATEPARK_A-E_CONCEPTPLAN_FIGURE_11X17.DWG

RETROFIT EXISTING DETENTION POND
ROBIN HILL CORPORATE PARK – E

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=50'

PAT-10E

1:1

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

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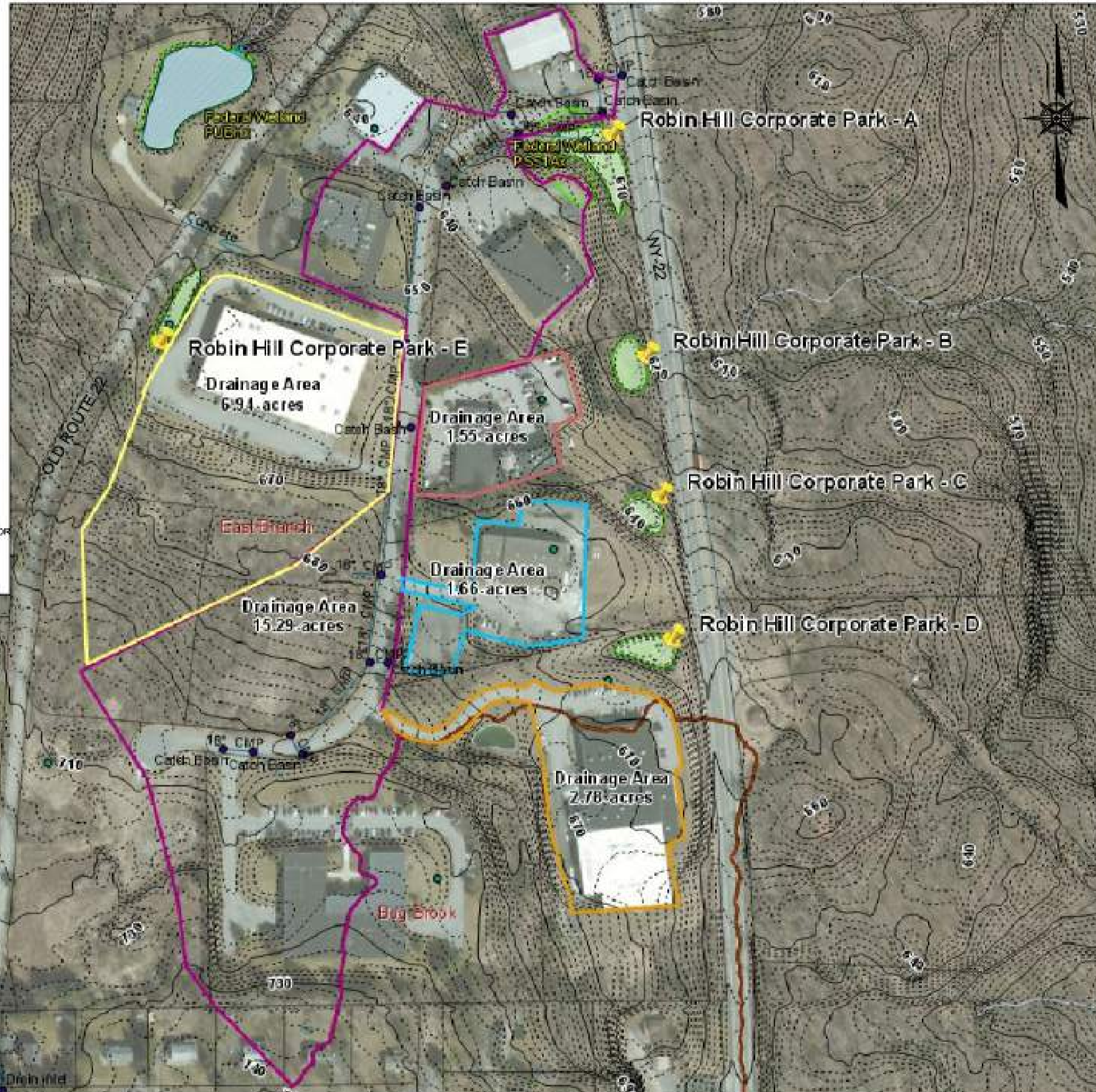

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	ROBIN-HILLCORPORATEPARK_DRAINAGE AREA_FIGURE_PAT#.DWG	

DRAINAGE AREA PLAN
ROBIN HILL CORPORATE PARK A–E

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=220'

PAT-10A-10E

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-10 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-10 A: Robin Hill Corporate Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	15.29	acres	where:	A =	Contributing Area (acres)
I =	6.3	41.20%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=		0.4208		WQv =	Water Quality Volume
Rv (min)** =		0.4208			
WQv (acre-ft) =		**0.643**			
WQv (cu-ft) =		**28029**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.4208		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	15.29		Rv =	Runoff Coefficient
C =	0.47		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0.59
Actively Grazed Pasture	0
Forest	0
Impervious	0.41
Develped Open Space	0
Weighted "C":	*0.47*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**27.83**	lb/yr
	12.62	kg/yr
P Removal ------------------->	**15.31**	lb/yr
	6.94	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**15.3**	Phosphorus Loading (kg/yr)	**12.62**
Water Quality Volume (cf)	**28029**	Phosphorus Reduction (kg/yr)	**6.94**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-10 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-10 B: Robin Hill Corporate Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.6	acres	where:	A =	Contributing Area (acres)
I =	1.6	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.152**				
WQv (cu-ft) =	**6621**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.6		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Pocket Pond**	
Removal Efficiency:	***67%***	
P Load ------------------->	**6.99**	lb/yr
	3.17	kg/yr
P Removal ------------------->	**4.68**	lb/yr
	2.12	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**1.6**	Phosphorus Loading (kg/yr)	**3.17**
Water Quality Volume (cf)	**6621**	Phosphorus Reduction (kg/yr)	**2.12**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-10 C
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-10 C: Robin Hill Corporate Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.7	acres	where:	A =	Contributing Area (acres)
I =	1.7	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.162**				
WQv (cu-ft) =	**7035**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.7		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Pocket Pond	
Removal Efficiency:	*67%*	
P Load ------------------->	**7.42**	lb/yr
	3.37	kg/yr
P Removal ------------------->	**4.97**	lb/yr
	2.26	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**1.7**	Phosphorus Loading (kg/yr)	**3.37**
Water Quality Volume (cf)	**7035**	Phosphorus Reduction (kg/yr)	**2.26**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-10 D
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-10 D: Robin Hill Corporate Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

			where:		
A =	2.8	acres		A =	Contributing Area (acres)
I =	2.8	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.9500			WQv =	Water Quality Volume
Rv (min)** =	0.9500				
WQv (acre-ft) =	**0.266**				
WQv (cu-ft) =	**11587**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

		where:		
P =	45		P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.8		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Pocket Pond**	
Removal Efficiency:	***67%***	
P Load ------------------->	**12.23**	lb/yr
	5.55	kg/yr
P Removal ------------------->	**8.19**	lb/yr
	3.72	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**2.8**	Phosphorus Loading (kg/yr)	**5.55**
Water Quality Volume (cf)	**11587**	Phosphorus Reduction (kg/yr)	**3.72**

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-10 E
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-10 E: Robin Hill Corporate Park

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	6.94	acres	where:	A =	Contributing Area (acres)
I =	2.94	42.36%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.4313			WQv =	Water Quality Volume
Rv (min)** =	0.4313				
WQv (acre-ft) =	**0.299**				
WQv (cu-ft) =	**13038**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.4313		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	6.94		Rv =	Runoff Coefficient
C =	0.30		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0.58
Impervious	0.42
Develped Open Space	0
Weighted "C":	*0.30*

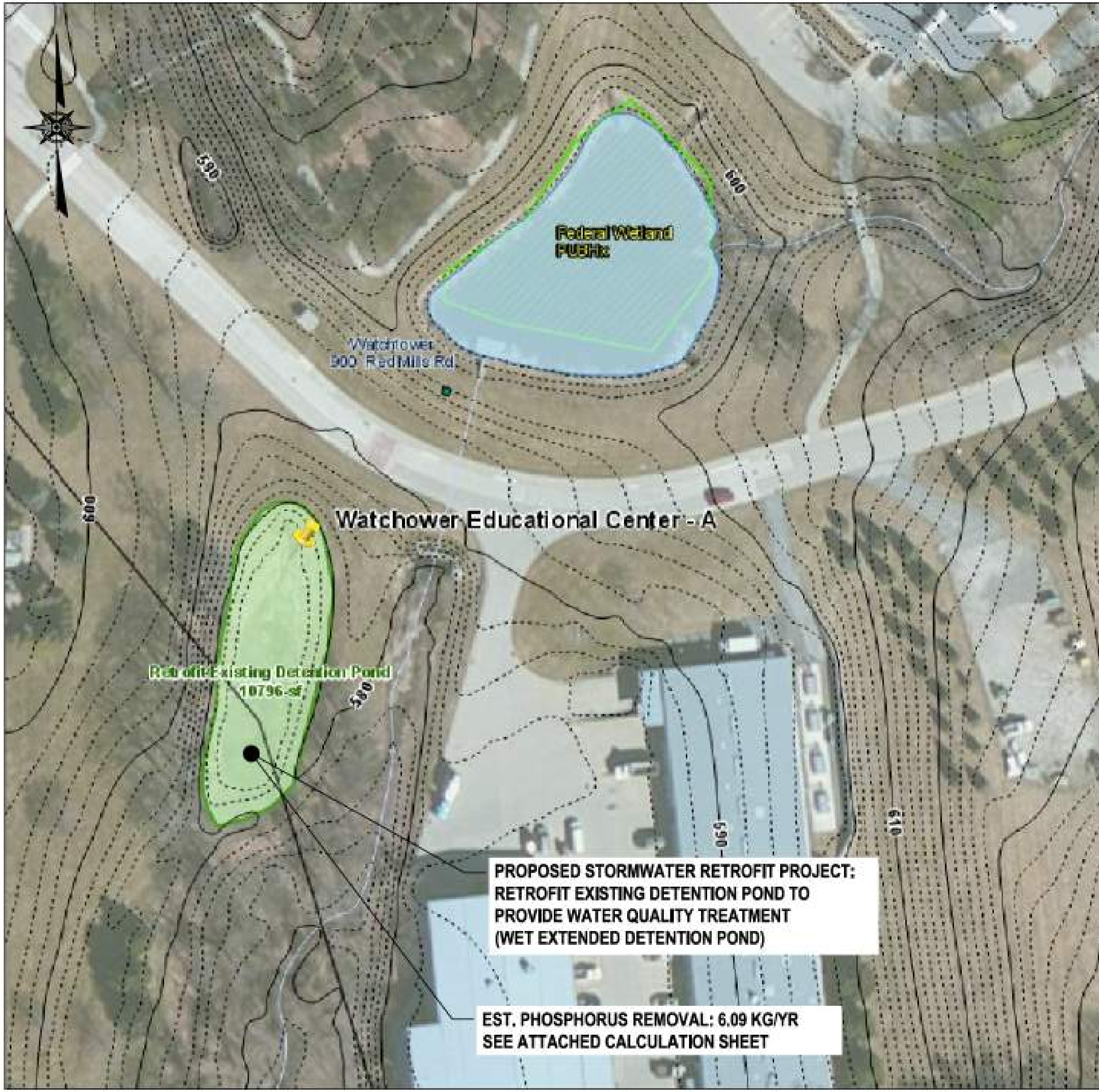
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Pocket Pond	
Removal Efficiency:	*67%*	
P Load ------------------->	**8.17**	lb/yr
	3.71	kg/yr
P Removal ------------------->	**5.48**	lb/yr
	2.48	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**6.9**	Phosphorus Loading (kg/yr)	**3.71**
Water Quality Volume (cf)	**13038**	Phosphorus Reduction (kg/yr)	**2.48**

1: 1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED. DETENTION POND APPEARS TO RECEIVE RUNOFF FROM A PORTION OF THE WATCHTOWER FACILITY. ACTUAL DRAINAGE AREA WILL NEED TO BE VERIFIED.
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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FIGURE_WATCHTOWER_A–B_CONCEPTPLAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL	CHECKED BY: LJP
DRAWN BY: CRP/RGL	WATCHTOWER_A–B_CONCEPTPLAN

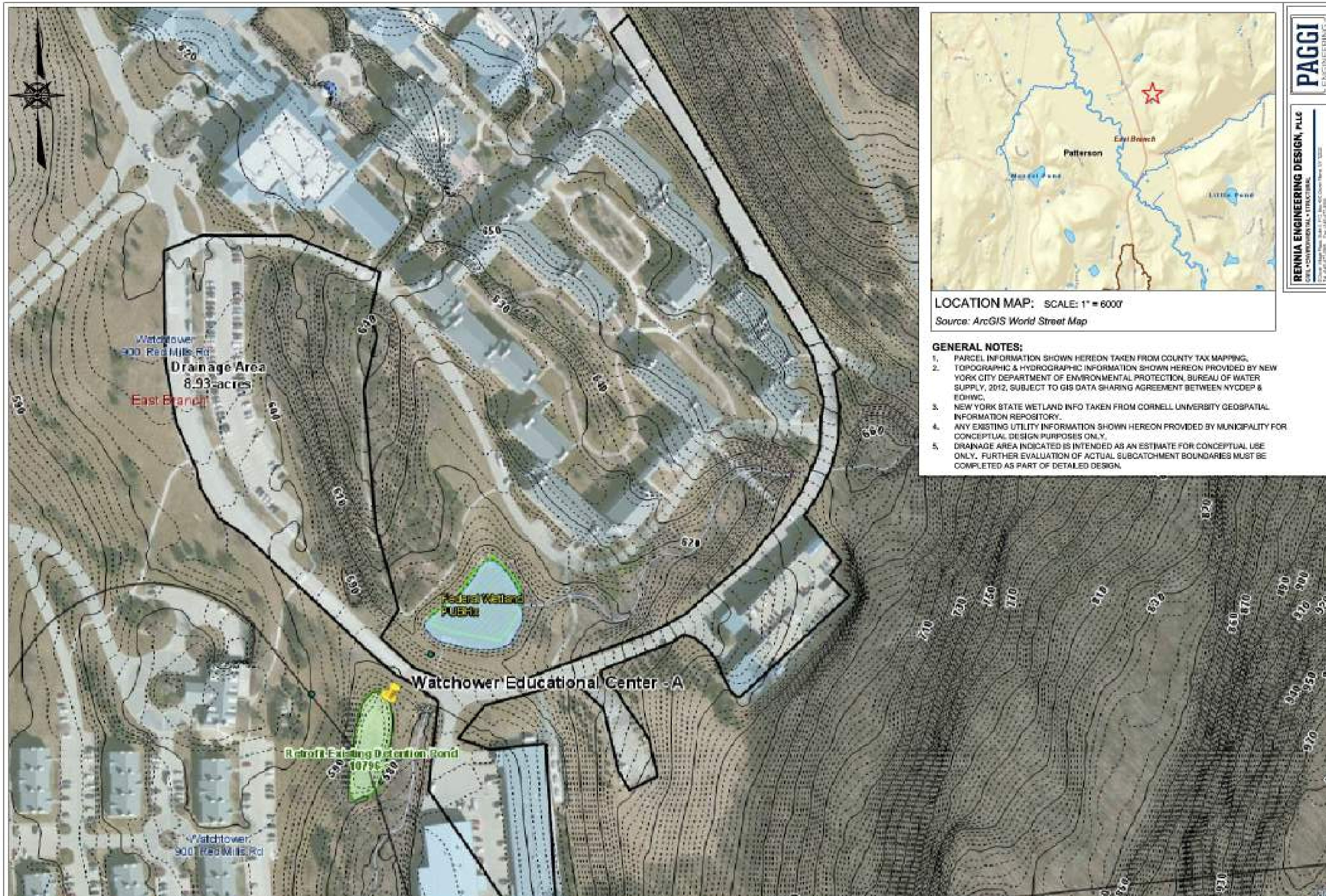
RETROFIT EXISTING DETENTION POND
WATCHTOWER – A

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=60'

PAT-11A

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	WATCHTOWER_A–B_DRAINAGEAREA_FIGURE	

DRAINAGE AREA PLAN
WATCHTOWER – A

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=150'

PAT-11A

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-11 A
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-11 A: Watchtower

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	8.93	acres	where:	A =	Contributing Area (acres)
I =	6.23	69.76%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.6779		WQv =	Water Quality Volume
WQv (acre-ft) =		**0.605**			
WQv (cu-ft) =		**26369**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.6779		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	8.93		Rv =	Runoff Coefficient
C =	0.44		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.7
Develped Open Space	0.3
Weighted "C":	*0.44*

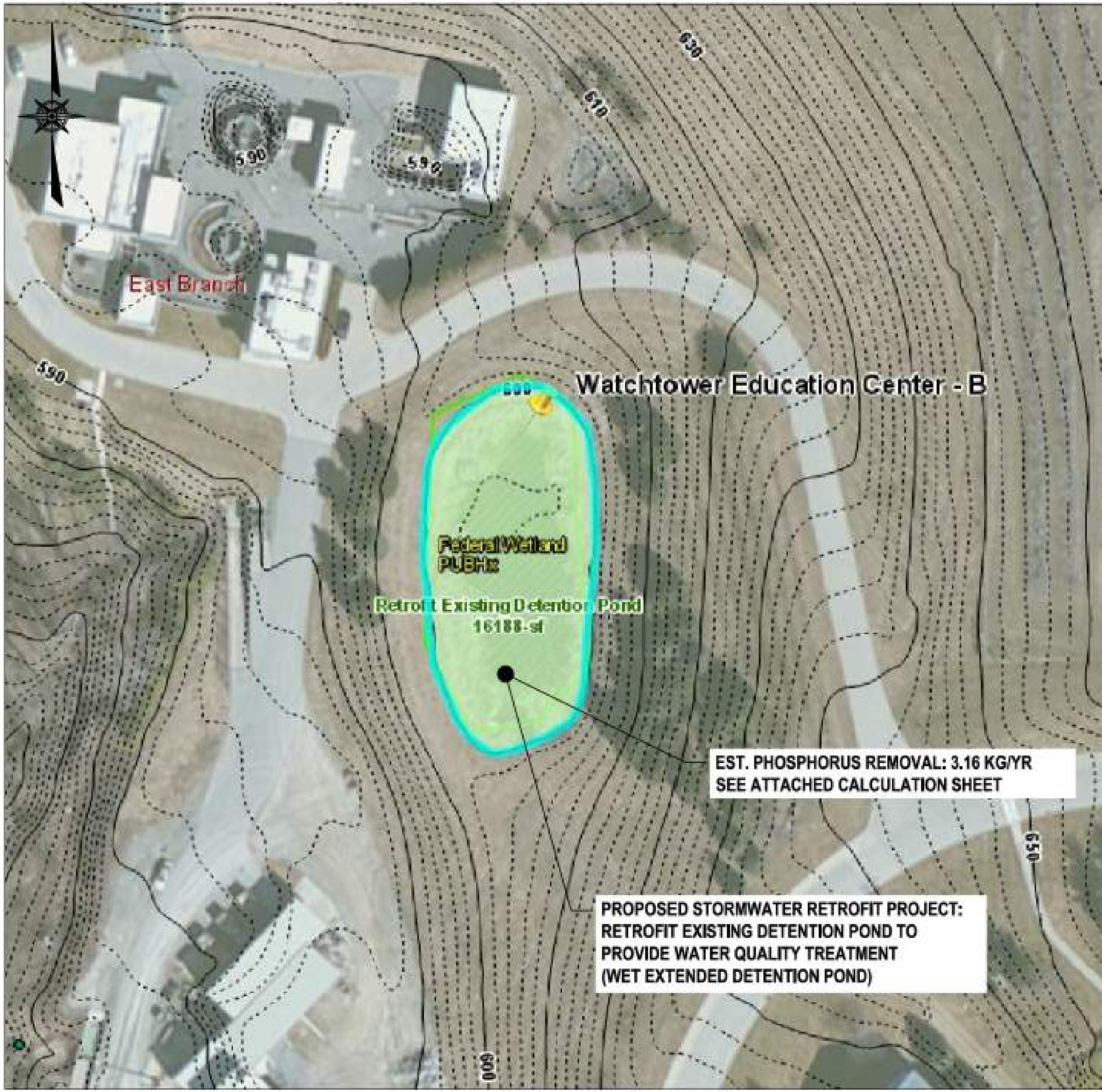
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------->	**24.40**	lb/yr
	11.07	kg/yr
P Removal ------------------->	**13.42**	lb/yr
	6.09	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**8.9**	Phosphorus Loading (kg/yr)	**11.07**
Water Quality Volume (cf)	**26369**	Phosphorus Reduction (kg/yr)	**6.09**

1:1



LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.

SITE SPECIFIC NOTES:

1. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.
2. PROPOSED SRP IS LOCATED ON PRIVATE PROPERTY AND WILL REQUIRE COORDINATION WITH THE PROPERTY OWNER TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED. DETENTION POND APPEARS TO RECEIVE RUNOFF FROM A PORTION OF THE WATCHTOWER FACILITY. ACTUAL DRAINAGE AREA WILL NEED TO BE VERIFIED.
3. OBTAIN AS-BUILT SURVEY INFORMATION OF EXISTING DETENTION POND AND SPECIFY NECESSARY MODIFICATIONS TO CONVERT TO WATER QUALITY POND

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP
FIGURE:	WATCHTOWER_A-B_CONCEPTPLAN

RETROFIT EXISTING DETENTION POND
WATCHTOWER - B

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=60'

PAT-11B

1:1

LOCATION MAP: SCALE: 1" = 6000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY,
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL
DRAWN BY:	CRP/RGL
CHECKED BY:	LJP

WATCHTOWER_A-B_DRAINAGEAREA_FIGURE

DRAINAGE AREA PLAN
WATCHTOWER – B

TOWN OF PATTERSON

JOB NO:	
DATE:	8/12/16
SCALE:	1"=150'

PAT-11B

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-11 B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-11 B: Watchtower

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.9	acres	where:	A =	Contributing Area (acres)
I =	2.9	100.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.9500		WQv =	Water Quality Volume
WQv (acre-ft) =		**0.276**			
WQv (cu-ft) =		**12001**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.9500		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.9		Rv =	Runoff Coefficient
C =	0.50		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	1
Develped Open Space	0
Weighted "C":	*0.50*

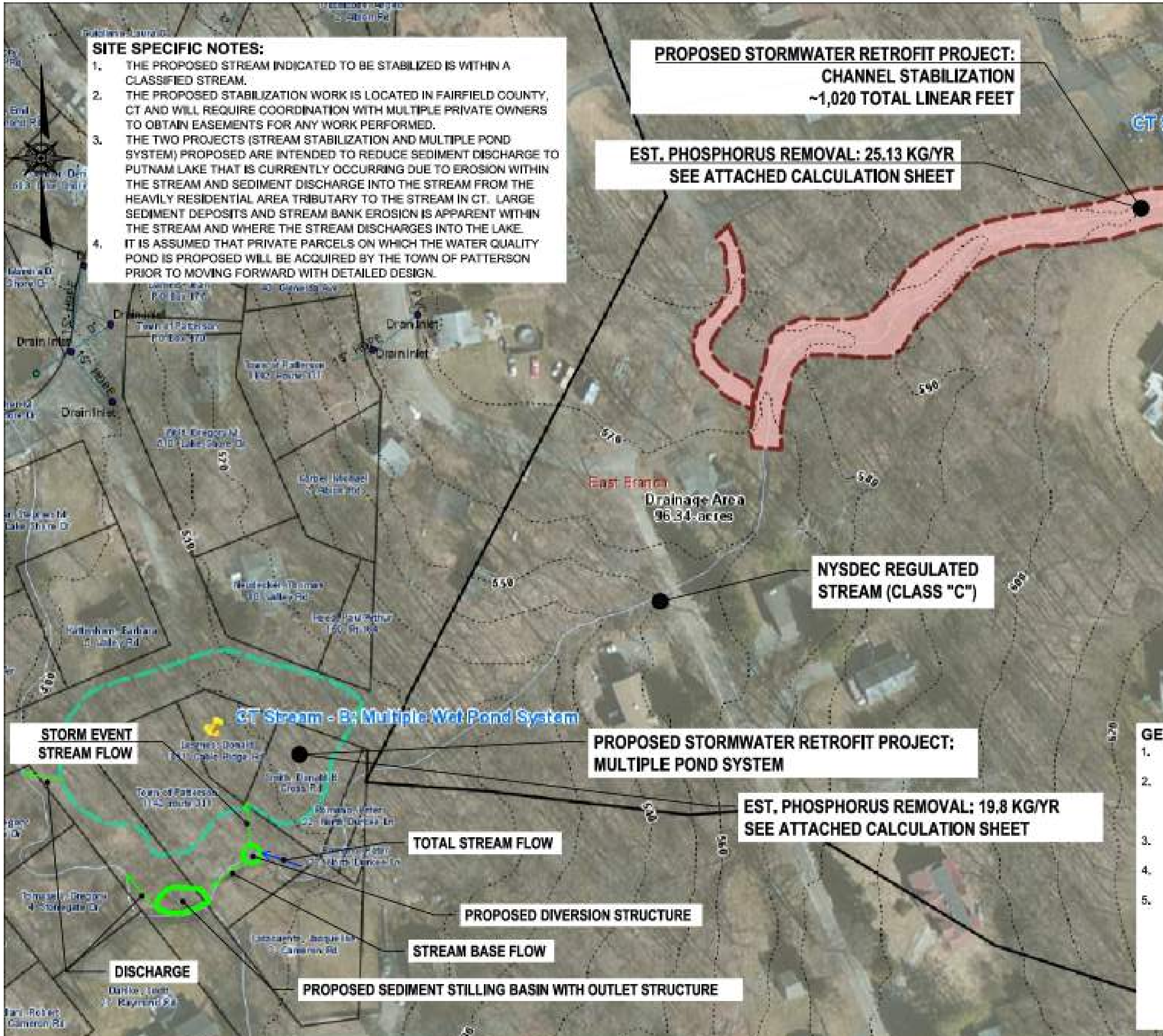
PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Wet ED Pond**	
Removal Efficiency:	***55%***	
P Load ------------------>	**12.66**	lb/yr
	5.74	kg/yr
P Removal ------------------>	**6.97**	lb/yr
	3.16	kg/yr

Summary:

Proposed Retrofit Practice	Wet ED Pond		
Drainage Area (acres)	**2.9**	Phosphorus Loading (kg/yr)	**5.74**
Water Quality Volume (cf)	**12001**	Phosphorus Reduction (kg/yr)	**3.16**

1:1



SITE SPECIFIC NOTES:

1. THE PROPOSED STREAM INDICATED TO BE STABILIZED IS WITHIN A CLASSIFIED STREAM.
2. THE PROPOSED STABILIZATION WORK IS LOCATED IN FAIRFIELD COUNTY, CT AND WILL REQUIRE COORDINATION WITH MULTIPLE PRIVATE OWNERS TO OBTAIN EASEMENTS FOR ANY WORK PERFORMED.
3. THE TWO PROJECTS (STREAM STABILIZATION AND MULTIPLE POND SYSTEM) PROPOSED ARE INTENDED TO REDUCE SEDIMENT DISCHARGE TO PUTNAM LAKE THAT IS CURRENTLY OCCURRING DUE TO EROSION WITHIN THE STREAM AND SEDIMENT DISCHARGE INTO THE STREAM FROM THE HEAVILY RESIDENTIAL AREA TRIBUTARY TO THE STREAM IN CT. LARGE SEDIMENT DEPOSITS AND STREAM BANK EROSION IS APPARENT WITHIN THE STREAM AND WHERE THE STREAM DISCHARGES INTO THE LAKE.
4. IT IS ASSUMED THAT PRIVATE PARCELS ON WHICH THE WATER QUALITY POND IS PROPOSED WILL BE ACQUIRED BY THE TOWN OF PATTERSON PRIOR TO MOVING FORWARD WITH DETAILED DESIGN.

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATIONS WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATIONS SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

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COMMITMENT & INTEGRITY DRIVE RESULTS

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL CHECKED BY: LJP
DRAWN BY: CRP/RGL CT STREAM_A-B_CONCEPTPLAN_FIGURE

STREAM STABILIZATION
CT STREAM STABILIZATION A-B

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=100'

PAT-12A-12B

1:1

LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. DRAINAGE AREA INDICATED IS INTENDED AS AN ESTIMATE FOR CONCEPTUAL USE ONLY. FURTHER EVALUATION OF ACTUAL SUBCATCHMENT BOUNDARIES MUST BE COMPLETED AS PART OF DETAILED DESIGN.

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795 Westchester Avenue, Suite L2
White Plains, New York 10604
866.807.4080 | www.woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY:	CRP/RGL	CHECKED BY:	LJP
DRAWN BY:	CRP/RGL	CT STREAM_A-B_DRAINAGEAREA_FIGURE	

DRAINAGE AREA PLAN
CT STREAM STABILIZATION A-B

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=250'

PAT-12A-12B

Pat-12A: CT Stream Stabilization

Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	7.0	3.5	4.5			
Channel Bottom Width - B (ft)	25.0	8.0	6.0			
Channel Top Width -T (ft)	30.0	12.0	10.0			
Wetted Perimeter Calculation-P (ft)	39.87	16.06	15.85			
Channel Length-L (ft)	570	220	230			
Soil Erosion Depth-D (ft)	0.065	0.065	0.065			
Soil Erosion Volume-V (ft^3)	1,477.0	229.7	236.9			
Weight* (lbs)	140,318.6	21,820.6	22,509.3			
Weight (Kg)	63,648.5	9,897.8	10,210.2			
P Load** (mg/Yr)	19,094,554.5	2,969,344.1	3,063,071.0			
P Load (Kg/Yr)	19.09	2.97	3.06			
					ESTIMATED TOTAL (KG/YR):	25.13

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P= T+ [(8/3)* (y^2/T)]$
Soil Erosion Volume: $V= P*L*D$
BD* = bulk density (typ. 95 lb/CF)
Ptest** = phosphorus level in soil (typ. 300 mg/kg)

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Pat-12B
Prepared for:	East of Hudson Coalition
Prepared by:	CRP
Project County:	Putnam

Pat-12B: CT Stream - B

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	96.4	acres	where:	A =	Contributing Area (acres)
I =	28.5	29.56%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv =		0.3161		WQv =	Water Quality Volume
WQv (acre-ft) =		**3.047**			
WQv (cu-ft) =		**132727**			

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3161		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	96.4		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0
Develped Open Space	0
Weighted "C":	*0.41*

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PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

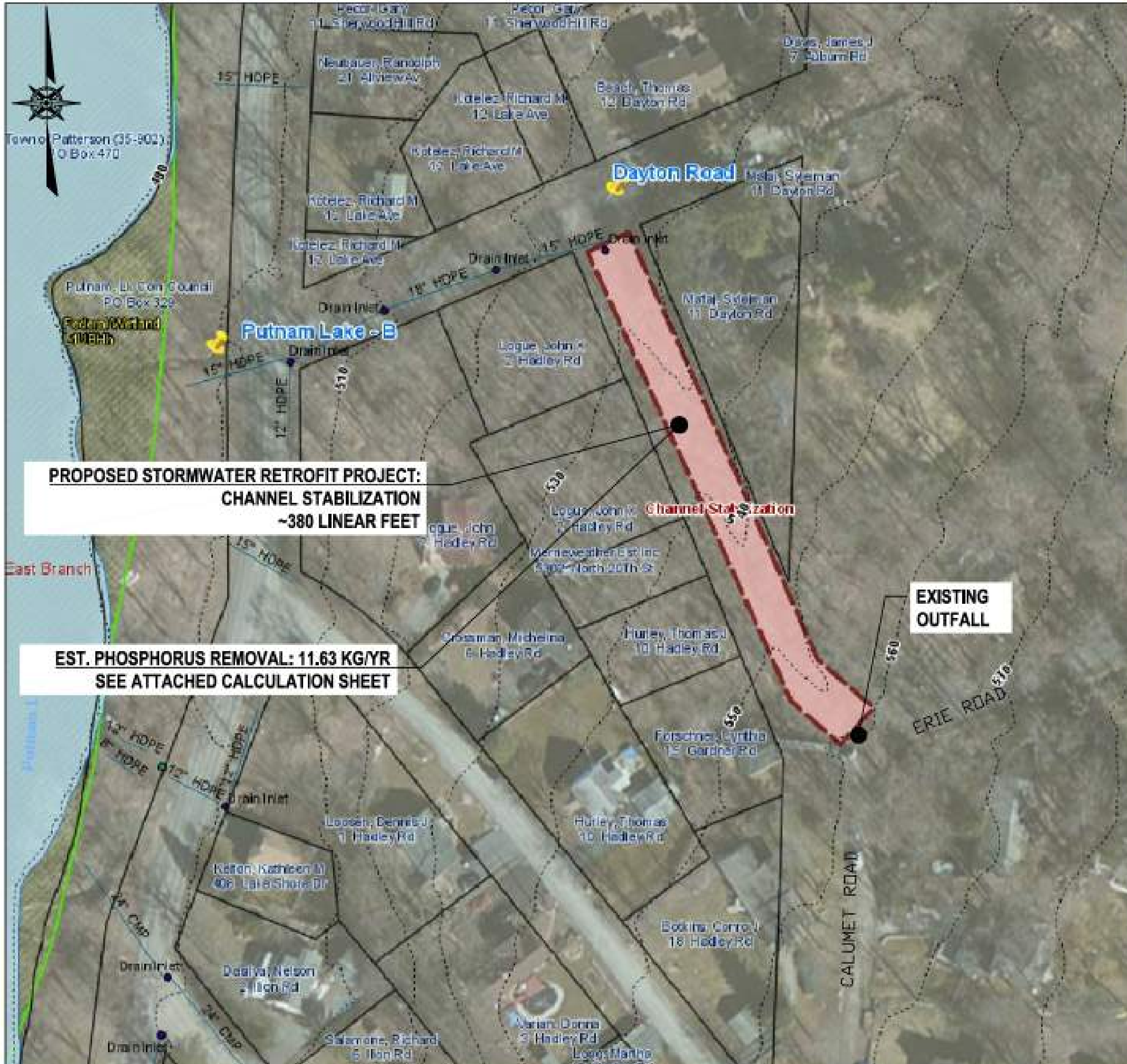
Proposed Retrofit Practice:	Multiple Pond	
Removal Efficiency:	*76%*	
P Load ------------------>	**114.85**	lb/yr
	52.10	kg/yr
P Removal ------------------>	**87.29**	lb/yr
	39.59	kg/yr

19.80 kg/yr **Assume 50% of WQv treated**

Summary:

Proposed Retrofit Practice	Multiple Pond		
Drainage Area (acres)	**96.4**	Phosphorus Loading (kg/yr)	**52.10**
Water Quality Volume (cf)	**132727**	Phosphorus Reduction (kg/yr)	**19.80**

1:1



LOCATION MAP: SCALE: 1" = 4000'

Source: ArcGIS World Street Map

GENERAL NOTES:

1. PARCEL INFORMATION SHOWN HEREON TAKEN FROM COUNTY TAX MAPPING.
2. TOPOGRAPHIC & HYDROGRAPHIC INFORMATION SHOWN HEREON PROVIDED BY NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER SUPPLY, 2012, SUBJECT TO GIS DATA SHARING AGREEMENT BETWEEN NYCDEP & EOHWC.
3. NEW YORK STATE WETLAND INFO TAKEN FROM CORNELL UNIVERSITY GEOSPATIAL INFORMATION REPOSITORY.
4. ANY EXISTING UTILITY INFORMATION SHOWN HEREON PROVIDED BY MUNICIPALITY FOR CONCEPTUAL DESIGN PURPOSES ONLY.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATIONS WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATIONS SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

SITE SPECIFIC NOTES:

1. EXISTING ERODED DRAINAGE CHANNEL IN TOWN RIGHT OF WAY (ROAD NEVER BUILT).
2. STORMWATER OUTFALL AT LOCATION SHOWN ON PLAN.
3. CULVERT PIPE CROSSING ERIE/CALUMET ROAD IS EXPOSED IN ROAD AND APPEARS TO BE DAMAGED. CONSIDERATION TO REPLACEMENT OF CULVERT PIPES SHOULD BE MADE DURING DETAILED DESIGN.

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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: CRP/RGL
DRAWN BY: CRP/RGL
CHECKED BY: LJP

DAYTONROAD_CONCEPTPLAN_FIGURE

CHANNEL STABILIZATION
DAYTON ROAD

TOWN OF PATTERSON

JOB NO:
DATE: 8/12/16
SCALE: 1"=80'

PAT-13

Pat-13: Dayton Road Channel Stabilization						
Channel ID	A	B	C	D	E	F
Channel Depth - y (ft)	5.0	6.0				
Channel Bottom Width - B (ft)	15.0	25.0				
Channel Top Width -T (ft)	20.0	30.0				
Wetted Perimeter Calculation-P (ft)	26.18	41.76				
Channel Length-L (ft)	130	250				
Soil Erosion Depth-D (ft)	0.065	0.065				
Soil Erosion Volume-V (ft^3)	221.2	678.6				
Weight* (lbs)	21,016.3	64,471.7				
Weight (Kg)	9,533.0	29,244.4				
P Load** (mg/Yr)	2,859,893.7	8,773,311.1				
P Load (Kg/Yr)	2.86	8.77				
					ESTIMATED TOTAL (KG/YR):	11.63

Notes:

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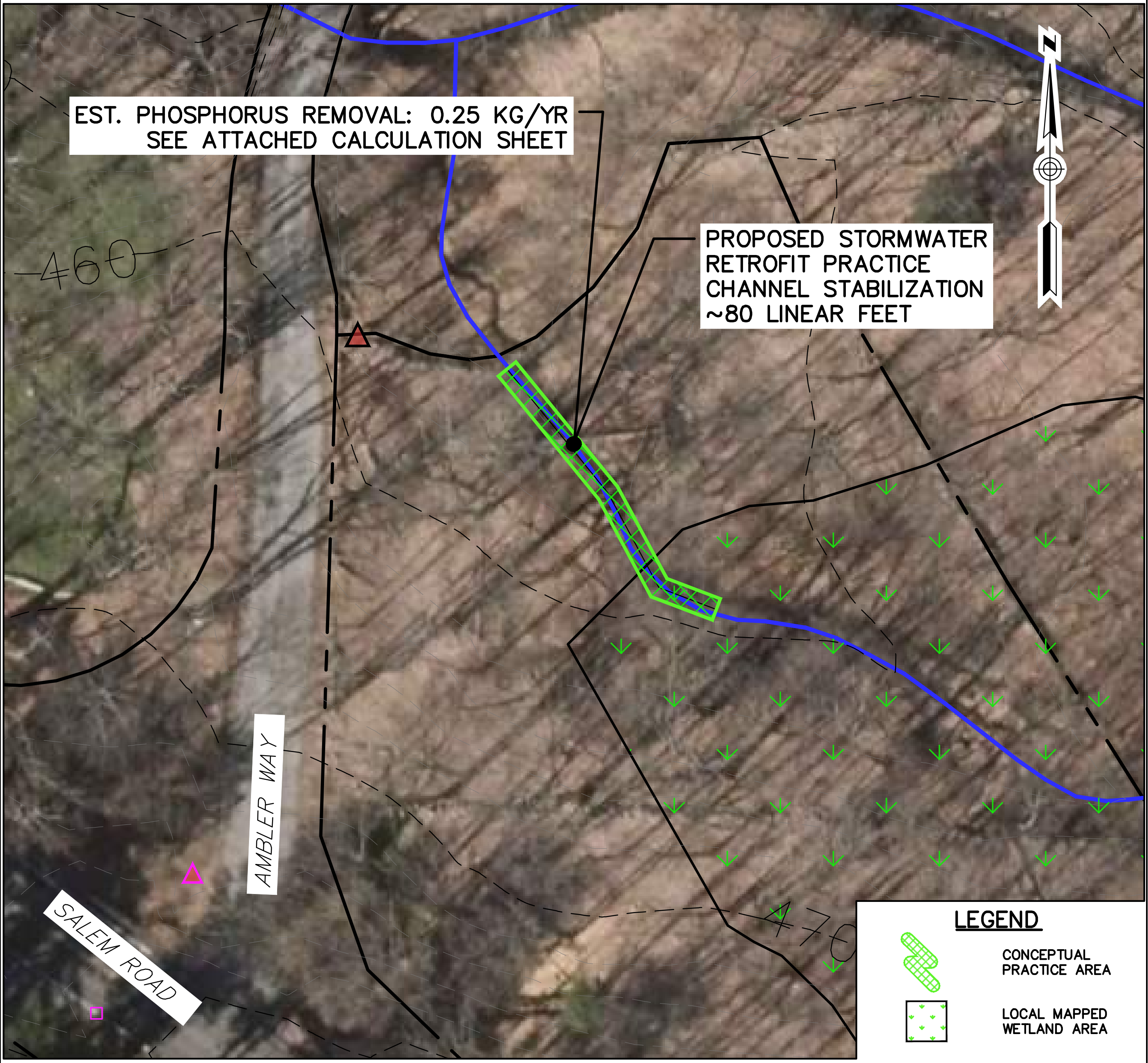
Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P = T + [(8/3)^* (y^2/T)]$

Soil Erosion Volume: $V = P^*L^*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)



LEGEND

- CONCEPTUAL PRACTICE AREA
- LOCAL MAPPED WETLAND AREA
- MAPPED WATERCOURSE
- STORM SEWER DISCHARGE POINT
- STORM SEWER PIPE

GENERAL NOTES

1. SITE ORTHOIMAGERY, TOPOGRAPHY AND PROPERTY DATA OBTAINED FROM WESTCHESTER COUNTY DEPARTMENT OF PLANNING GEOGRAPHIC INFORMATION SYSTEMS INTERACTIVE MAPPER, JULY 2016.
2. STORM SEWER INFRASTRUCTURE REPRESENTED ON MAP AS APPROXIMATE BASED UPON PROVIDED MUNICIPAL GIS DATA.
3. CHANNEL STABILIZATION PROJECTS PROPOSED WITHIN CLASSIFIED STREAMS REQUIRE CASE BY CASE REVIEW AND APPROVAL BY NYSDEC, AS WELL AS APPROVAL OF THE PROPOSED STABILIZATION METHOD.
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20' 0 20' 40'
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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: RPW	CHECKED BY: SL
DRAWN BY: RPW	POUND RIDGE DRAWINGS.DWG

CHANNEL STABILIZATION
AMBLER WAY

TOWN OF POUND RIDGE

JOB NO: 214336
DATE: 08/09/2016
SCALE: AS SHOWN

PR-1

PR-1_Ambler Way_Trapezoidal Channel Stabilization P-Loading Calculation	
Channel ID	**A**
Channel Depth - y (ft)	1.0
Channel Bottom Width - B (ft)	1.5
Channel Top Width -T (ft)	2.5
Wetted Perimeter Calculation-P (ft)	3.74
Channel Length-L (ft)	80
Soil Erosion Depth-D (ft)	0.065
Soil Erosion Volume-V (ft^3)	19.4
Weight* (lbs)	1,845.6
Weight (Kg)	837.2
P Load (mg/Yr)**	251,151.6
P Load (Kg/Yr)	0.25
ESTIMATED TOTAL (KG/YR):	0.25

Notes:

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BD* = bulk density (typ. 95 lb/CF)
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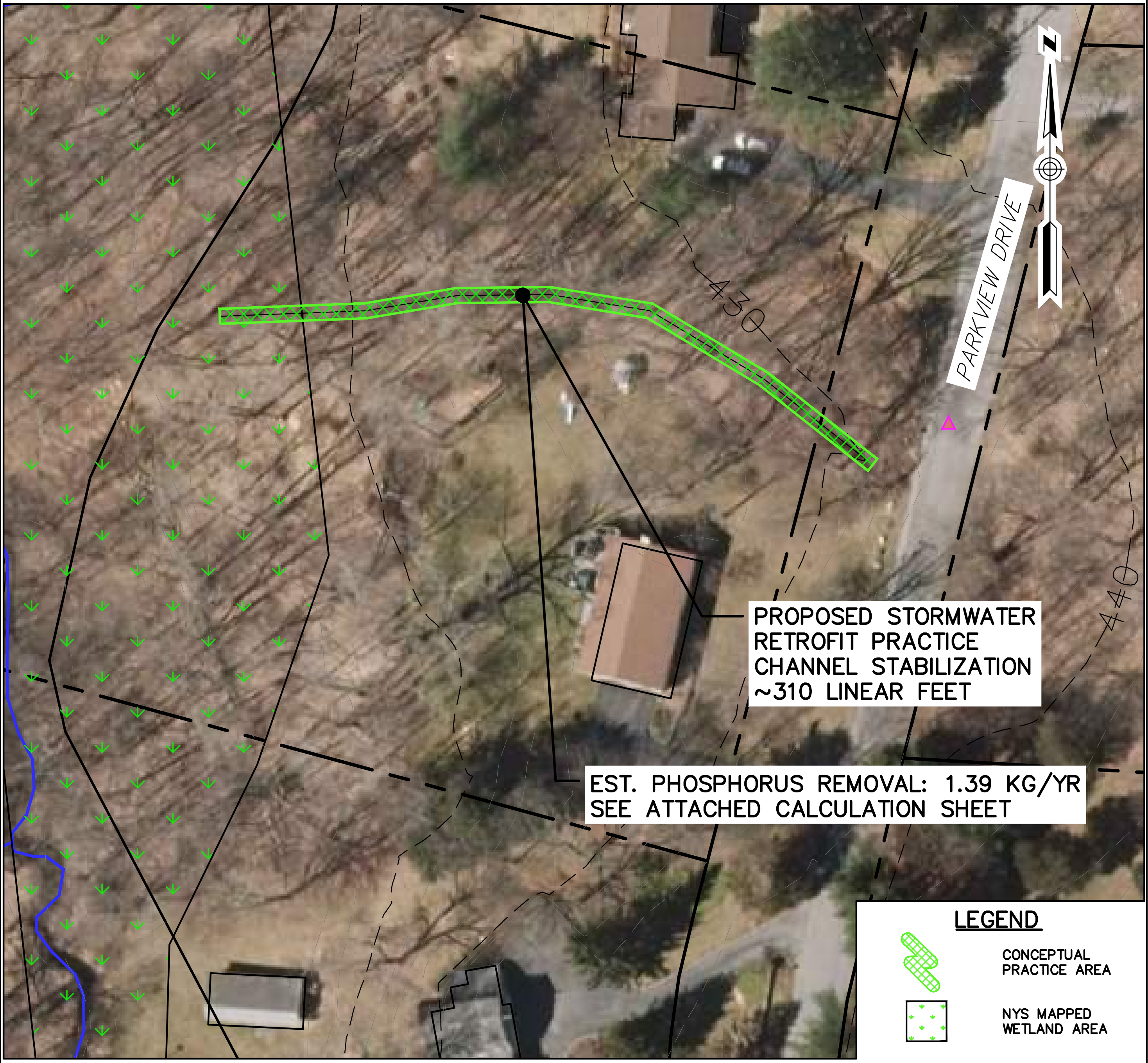

LEGEND

- CONCEPTUAL PRACTICE AREA
- NYS MAPPED WETLAND AREA
- MAPPED WATERCOURSE
- STORM SEWER DISCHARGE POINT
- STORM SEWER PIPE

SITE SPECIFIC NOTES

1. PROJECT COORDINATION WITH PRIVATE PROPERTY OWNER INITIATED BY TOWN OF POUND RIDGE HIGHWAY SUPERINTENDENT

GENERAL NOTES

1. SITE ORTHOIMAGERY, TOPOGRAPHY AND PROPERTY DATA OBTAINED FROM WESTCHESTER COUNTY DEPARTMENT OF PLANNING GEOGRAPHIC INFORMATION SYSTEMS INTERACTIVE MAPPER, JULY 2016.
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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

CHANNEL STABILIZATION
114 PARKVIEW DRIVE

TOWN OF POUND RIDGE

DESIGNED BY: RPW	CHECKED BY: SL
DRAWN BY: RPW	POUND RIDGE DRAWINGS.DWG

JOB NO: 214336
DATE: 08/09/2016
SCALE: AS SHOWN

PR-3

PR-3_Parkview Drive_Trapezoidal Channel Stabilization P-Loading Calculation	
Channel ID	**A**
Channel Depth - y (ft)	1.5
Channel Bottom Width - B (ft)	2.0
Channel Top Width -T (ft)	3.5
Wetted Perimeter Calculation-P (ft)	5.35
Channel Length-L (ft)	310
Soil Erosion Depth-D (ft)	0.065
Soil Erosion Volume-V (ft^3)	107.9
Weight* (lbs)	10,249.1
Weight (Kg)	4,649.0
P Load (mg/Yr)**	1,394,696.1
P Load (Kg/Yr)	1.39
ESTIMATED TOTAL (KG/YR):	1.39

Notes:

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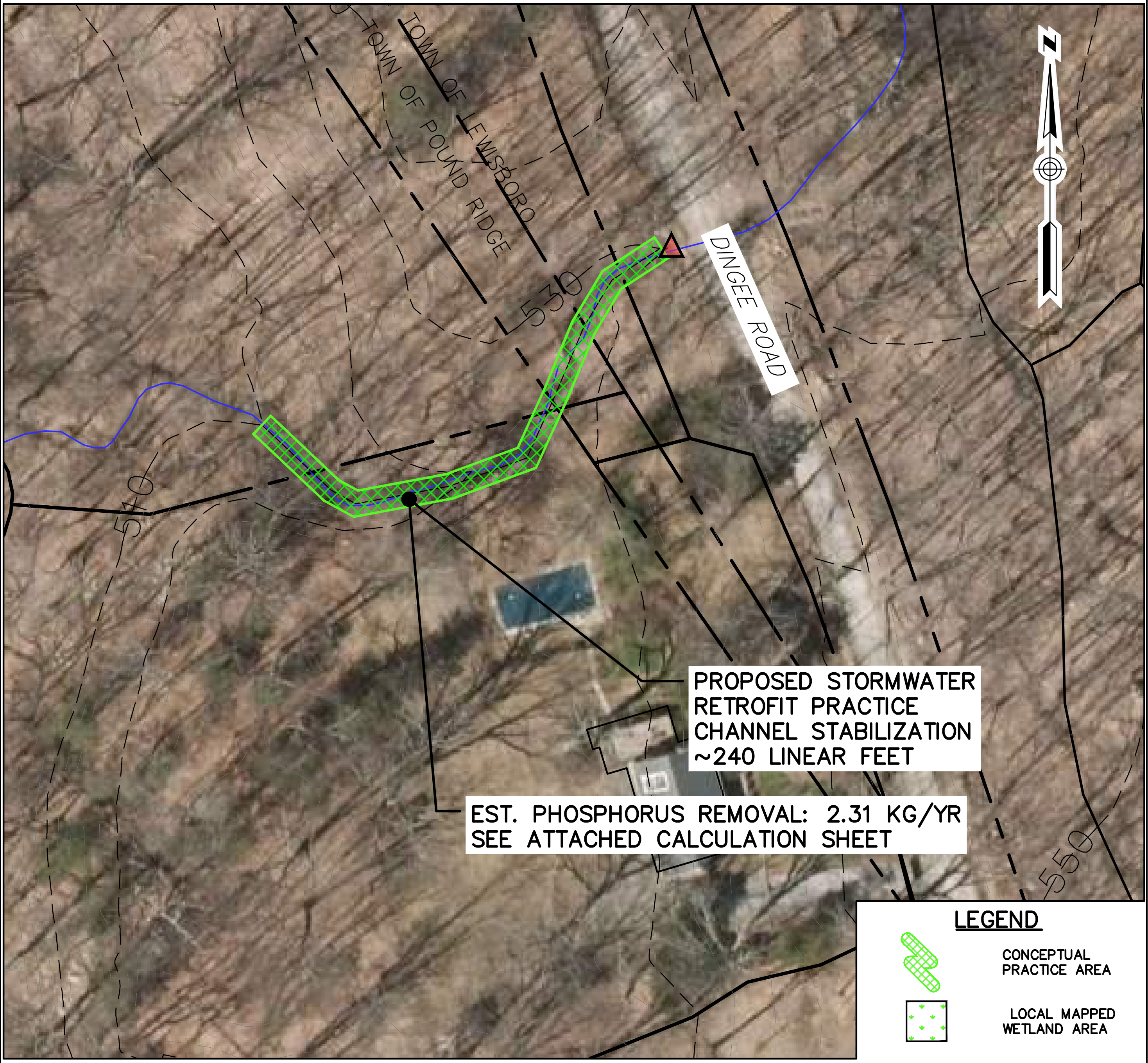

LEGEND

- CONCEPTUAL PRACTICE AREA
- LOCAL MAPPED WETLAND AREA
- MAPPED WATERCOURSE
- STORM SEWER DISCHARGE POINT
- STORM SEWER PIPE

SITE SPECIFIC NOTES

1. PORTION OF CHANNEL IS LOCATED OUTSIDE MUNICIPAL BOUNDARY OF POUND RIDGE. (TOWN OF LEWISBORO)

GENERAL NOTES

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STORMWATER RETROFIT CONCEPT PLAN	CHANNEL STABILIZATION 26 DINGEE ROAD	JOB NO: 214336	
		DATE: 08/05/2016	
		SCALE: AS SHOWN	
DESIGNED BY: RPW	CHECKED BY: SL	TOWN OF POUND RIDGE	PR-4
DRAWN BY: RPW	POUND RIDGE DRAWINGS.DWG		

PR-4_Dingee Road_Trapezoidal Channel Stabilization P-Loading Calculation	
Channel ID	**A**
Channel Depth - y (ft)	2.0
Channel Bottom Width - B (ft)	7.0
Channel Top Width -T (ft)	9.0
Wetted Perimeter Calculation-P (ft)	11.47
Channel Length-L (ft)	240
Soil Erosion Depth-D (ft)	0.065
Soil Erosion Volume-V (ft^3)	179.0
Weight* (lbs)	17,001.7
Weight (Kg)	7,712.0
P Load (mg/Yr)**	2,313,592.1
P Load (Kg/Yr)	2.31
ESTIMATED TOTAL (KG/YR):	2.31

Notes:

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Soil Erosion Volume: $V= P*L*D$
BD* = bulk density (typ. 95 lb/CF)
Ptest** = phosphorus level in soil (typ. 300 mg/kg)

SITE SPECIFIC NOTES

1. APPROXIMATE SUBCATCHMENT AREA ILLUSTRATED BASED UPON FIELD OBSERVATION OF GENERAL DRAINAGE CONDITIONS. TOPOGRAPHIC SURVEY AND DRAINAGE STRUCTURE MAPPING MUST BE EVALUATED DURING DESIGN..

GENERAL NOTES

1. SITE ORTHOIMAGERY DEPICTED BASE UPON GOOGLE EARTH IMAGERY
2. CHANNEL STABILIZATION PROJECTS PROPOSED WITHIN CLASSIFIED STREAMS REQUIRE CASE BY CASE REVIEW AND APPROVAL BY NYSDEC, AS WELL AS APPROVAL OF THE PROPOSED STABILIZATION METHOD.
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LEGEND

CONCEPTUAL PRACTICE AREA

STORM SEWER DISCHARGE POINT

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STORMWATER RETROFIT CONCEPT PLAN		CHANNEL STABILIZATION STAGECOACH ROAD	JOB NO: 214336 DATE: 08/09/2016 SCALE: AS SHOWN
DESIGNED BY: RPW	CHECKED BY: SL	PUTNAM COUNTY	PC-1
DRAWN BY: RPW	PUT CO. DRAWINGS.DWG		

PC-1 - Stagecoach Road Trapezoidal Channel Stabilization P-Loading Calculation	
Channel ID	**A**
Channel Depth - y (ft)	2.5
Channel Bottom Width - B (ft)	3.0
Channel Top Width -T (ft)	5.0
Wetted Perimeter Calculation-P (ft)	8.39
Channel Length-L (ft)	320
Soil Erosion Depth-D (ft)	0.065
Soil Erosion Volume-V (ft^3)	174.4
Weight* (lbs)	16,569.1
Weight (Kg)	7,515.7
P Load (mg/Yr)**	2,254,721.2
P Load (Kg/Yr)	2.25
ESTIMATED TOTAL (KG/YR):	2.25

Notes:

1. Channel dimensions are based upon field measurements taken by the W&C team during field visits for each channel

2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.

3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

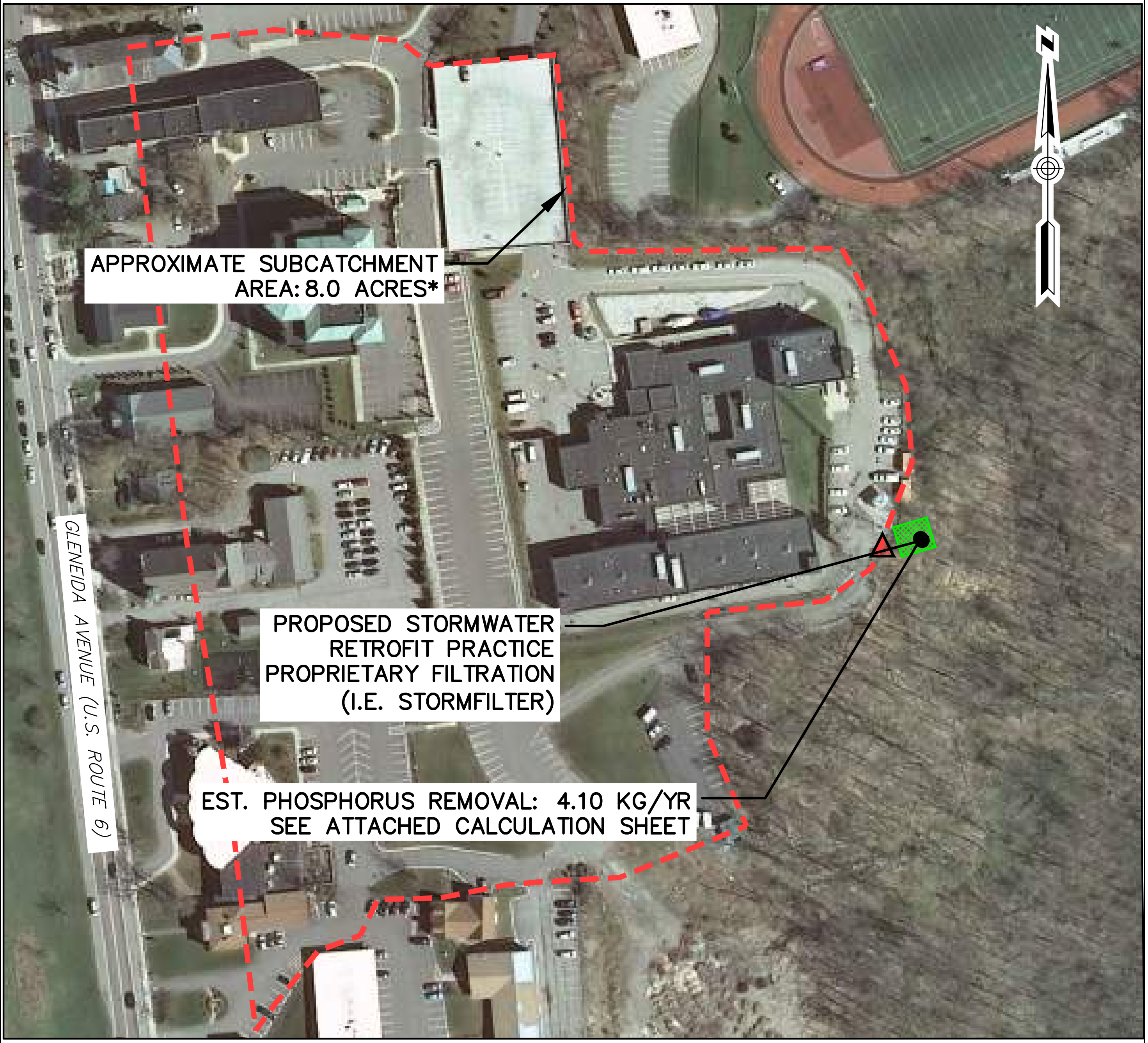
Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P= T+ [(8/3)* (y^2/T)]$

Soil Erosion Volume: $V= P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)



SITE SPECIFIC NOTES

1. APPROXIMATE SUBCATCHMENT AREA ILLUSTRATED BASED UPON FIELD OBSERVATION OF GENERAL DRAINAGE CONDITIONS. TOPOGRAPHIC SURVEY AND DRAINAGE STRUCTURE MAPPING MUST BE EVALUATED DURING DESIGN..

GENERAL NOTES

1. SITE ORTHOIMAGERY, TOPOGRAPHY AND PROPERTY DATA OBTAINED FROM WESTCHESTER COUNTY DEPARTMENT OF PLANNING GEOGRAPHIC INFORMATION SYSTEMS INTERACTIVE MAPPER, JULY 2016.
2. STORM SEWER INFRASTRUCTED REPRESENTED ON MAP AS APPROXIMATE BASED UPON PROVIDED MUNICIPAL GIS DATA.

LEGEND

CONCEPTUAL PRACTICE AREA

STORM SEWER DISCHARGE POINT

APPROX WATERSHED BOUNDARY

NOT FOR CONSTRUCTION

ANY ALTERATION OF PLANS, SPECIFICATIONS, PLATS AND REPORTS BEARING THE SEAL OF A LICENSED PROFESSIONAL ENGINEER OR LICENSED LAND SURVEYOR IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW, EXCEPT AS PROVIDED FOR BY SECTION 7209, SUBSECTION 2.

75' 0 75' 150'
BAR SCALE
1" = 150'
CHECK GRAPHIC SCALE BEFORE USING

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800.807.4080 | www.woodardcurran.com
WOODARD & CURRAN
COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: RPW | CHECKED BY: SL
DRAWN BY: RPW | PUT CO. DRAWINGS.DWG

PROPRIETARY FILTRATION PRACTICE
PUTNAM COUNTY SHERIFF'S FACILITY

PUTNAM COUNTY

JOB NO: 214336
DATE: 08/09/2016
SCALE: AS SHOWN

PC-2

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	PC-2
Prepared for:	EOHC
Prepared by:	RB/SL
Project County:	Putnam

PC-2 - Putnam County Sheriff's Facility

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	8	acres	where:	A =	Contributing Area (acres)
I =	5.6	70.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.6800			WQv =	Water Quality Volume
Rv (min)**** =**	0.6800				
WQv (acre-ft) =	**0.544**				
WQv (cu-ft) =	**23697**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.33	hours	Tc =	Time of Concentration (hours)
CN =	96		CN =	Curve Number
qu =	472.223		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	4.81668	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.6800		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	8		Rv =	Runoff Coefficient
C =	0.45		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

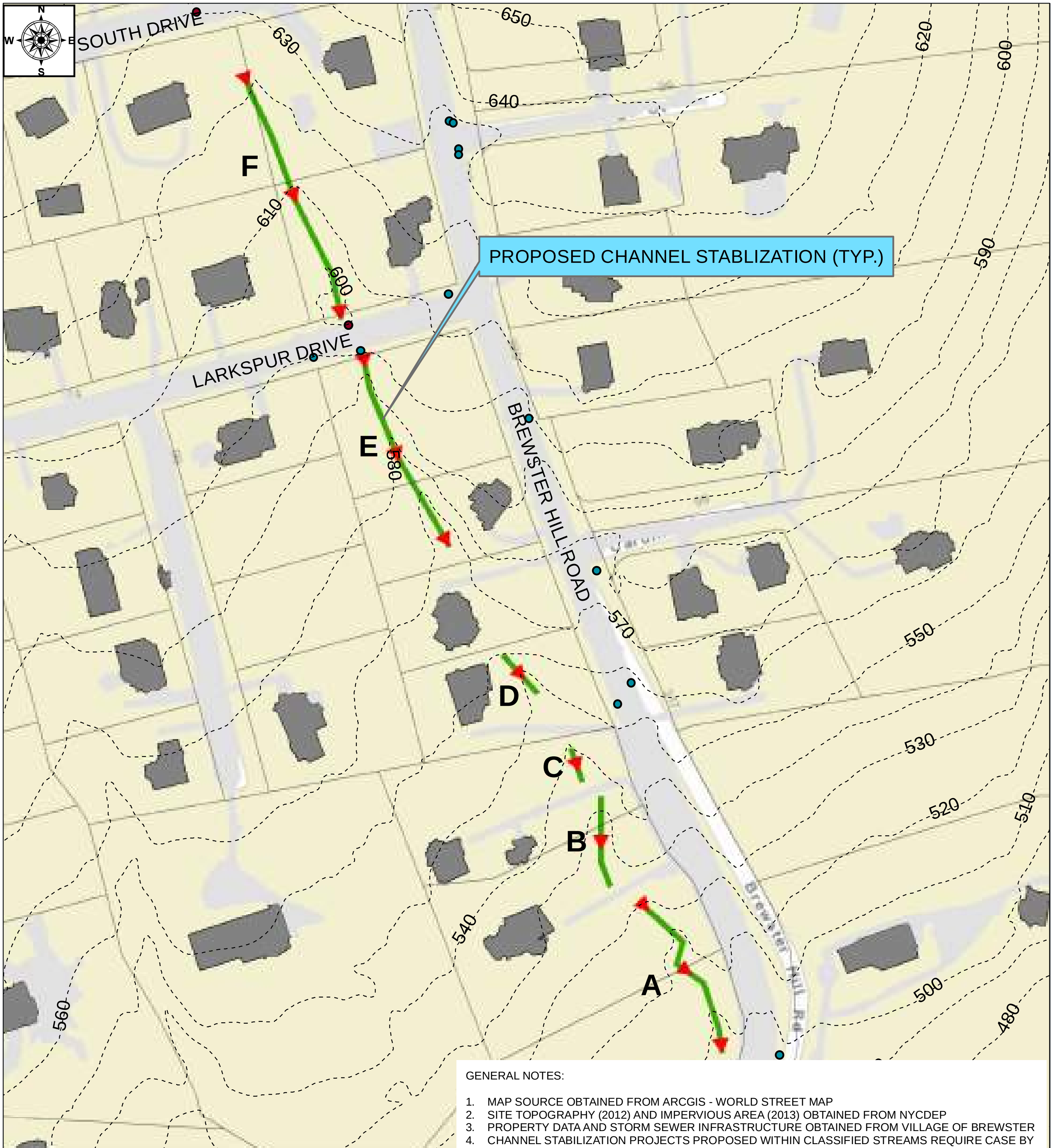
Land Use	**Fraction of Total Area**
Residential	0.0%
Commercial	30.0%
Industrial	0.0%
Actively Grazed Pasture	0.0%
Forest	0.0%
Impervious	70.0%
Develped Open Space	0.0%
Weighted "C":	*0.45*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**StormFilter**	
Removal Efficiency:	***40%***	
P Load -------------------->	**22.61**	lb/yr
	10.25	kg/yr
P Removal -------------------->	**9.04**	lb/yr
	4.10	kg/yr

Summary:

Proposed Retrofit Practice	StormFilter		
Drainage Area (acres)	**8.0**	Phosphorus Loading (kg/yr)	**10.25**
Water Quality Volume (cf)	**23697**	Phosphorus Reduction (kg/yr)	**4.10**



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER
4. CHANNEL STABILIZATION PROJECTS PROPOSED WITHIN CLASSIFIED STREAMS REQUIRE CASE BY CASE REVIEW AND APPROVAL BY NYSDEC, AS WELL AS AN APPROVAL OF THE PROPOSED STABILIZATION METHOD.
5. THE PHOSPHORUS VALUES INCLUDED IN THIS RETROFIT PLAN ARE ESTIMATED VALUES. FINAL SIGNED AND SEALED PHOSPHORUS LOADING CALCULATION WILL NEED TO BE PERFORMED IN ACCORDANCE WITH THE EOHWC DESIGN MANUAL CONSISTENT WITH THE LATEST APPROVED NYSDEC "ALTERNATIVE CHANNEL STABILIZATION FORMULA". THE FINAL CALCULATION SHOULD INCLUDE SURVEYS TO CONFIRM CHANNEL DIMENSIONS, AND A COMPLETE ANALYSIS AND COMPUTATIONS OF ALL INPUT PARAMETERS USED IN THE "ALTERNATIVE CHANNEL STABILIZATION FORMULA", INCLUDING THE BEHI AND NBS INDEXES.

0 75 150 225 300 Feet

Legend

Parcels

Proposed SRP Location

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Tel: (845) 877-0555 Fax: (845) 877-0556

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN	UPPER BREWSTER HILL ROAD	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 150'
DESIGNED BY: RAR DRAWN BY: JBM	CHECKED BY: RAR	
	TOWN OF SOUTHEAST	SE-1A

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF BREWSTER
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0 75 150 225 300 Feet

Legend

Parcels

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

UPPER BREWSTER HILL ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 150'

SE-1A

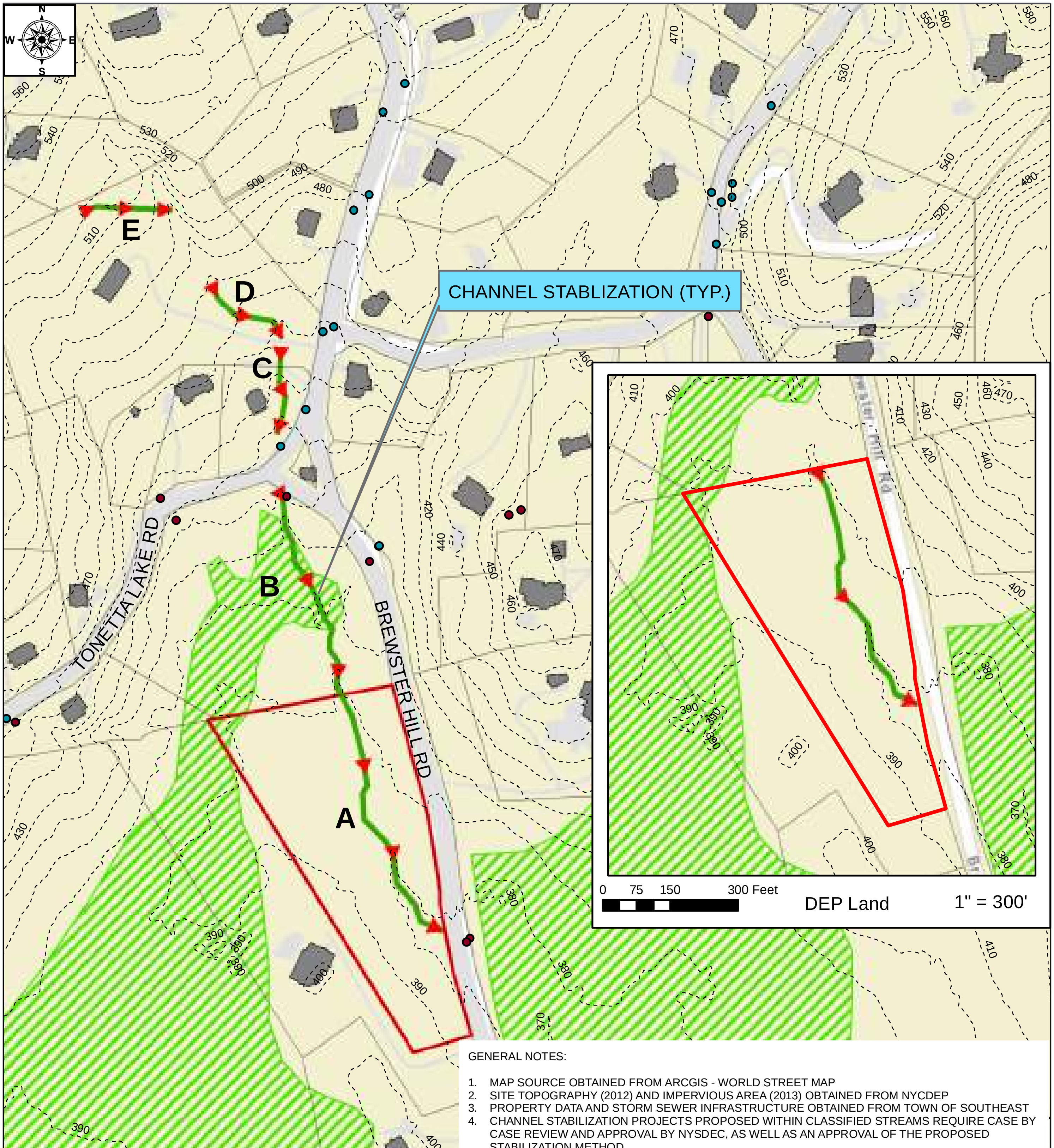
SE-1A - Upper Brewster Hill Road: Trapezoidal Channel Stabilization P-Loading Calculation						
Channel ID	**A (Private)**	**B (Private)**	**C (Private)**	**D (Private)**	**E (Private)**	**F (Private)**
Channel Depth - y (ft)	3.0	3.0	3.0	3.0	2.5	1.5
Channel Bottom Width - B (ft)	2.0	2.0	2.0	2.0	2.0	1.0
Channel Top Width -T (ft)	14.0	14.0	14.0	14.0	12.0	7.0
Wetted Perimeter Calculation-P (ft)	15.42	15.42	15.42	15.42	13.18	7.71
Channel Length-L (ft)	209	100	39	57	236	295
Soil Erosion Depth-D (ft)	0.065	0.065	0.065	0.065	0.065	0.065
Soil Erosion Volume-V (ft^3)	209.4	100.2	39.1	57.1	202.2	147.8
Weight* (lbs)	19,896.0	9,519.6	3,712.7	5,426.2	19,207.7	14,041.5
Weight (Kg)	9,024.8	4,318.1	1,684.1	2,461.3	8,712.6	6,369.2
P Load (mg/Yr)**	2,707,451.8	1,295,431.5	505,218.3	738,396.0	2,613,785.1	1,910,761.5
P Load (Kg/Yr)	2.71	1.30	0.51	0.74	2.61	1.91
					ESTIMATED TOTAL (KG/YR):	**9.77**

Notes:

1. Channel dimensions are based upon field measurements estimated by the W&C team during field visits for each channel
2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.
3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC "Alternative Channel Stabilization Formula". The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the "Alternative Channel Stabilization Formula", including the BEHI and NBS indexes.
4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:
Wetted Perimeter (P) approximately: $P= T+ [(8/3)* (y^2/T)]$
Soil Erosion Volume: $V= P*L*D$
BD* = bulk density (typ. 95 lb/CF)
Ptest** = phosphorus level in soil (typ. 300 mg/kg)

Comments:
Private Property referred by the Town of Southeast.



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST
4. CHANNEL STABILIZATION PROJECTS PROPOSED WITHIN CLASSIFIED STREAMS REQUIRE CASE BY CASE REVIEW AND APPROVAL BY NYSDEC, AS WELL AS AN APPROVAL OF THE PROPOSED STABILIZATION METHOD.
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0 150 300 450 600 Feet

Legend

Parcels

Mapped Wetland Area

Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

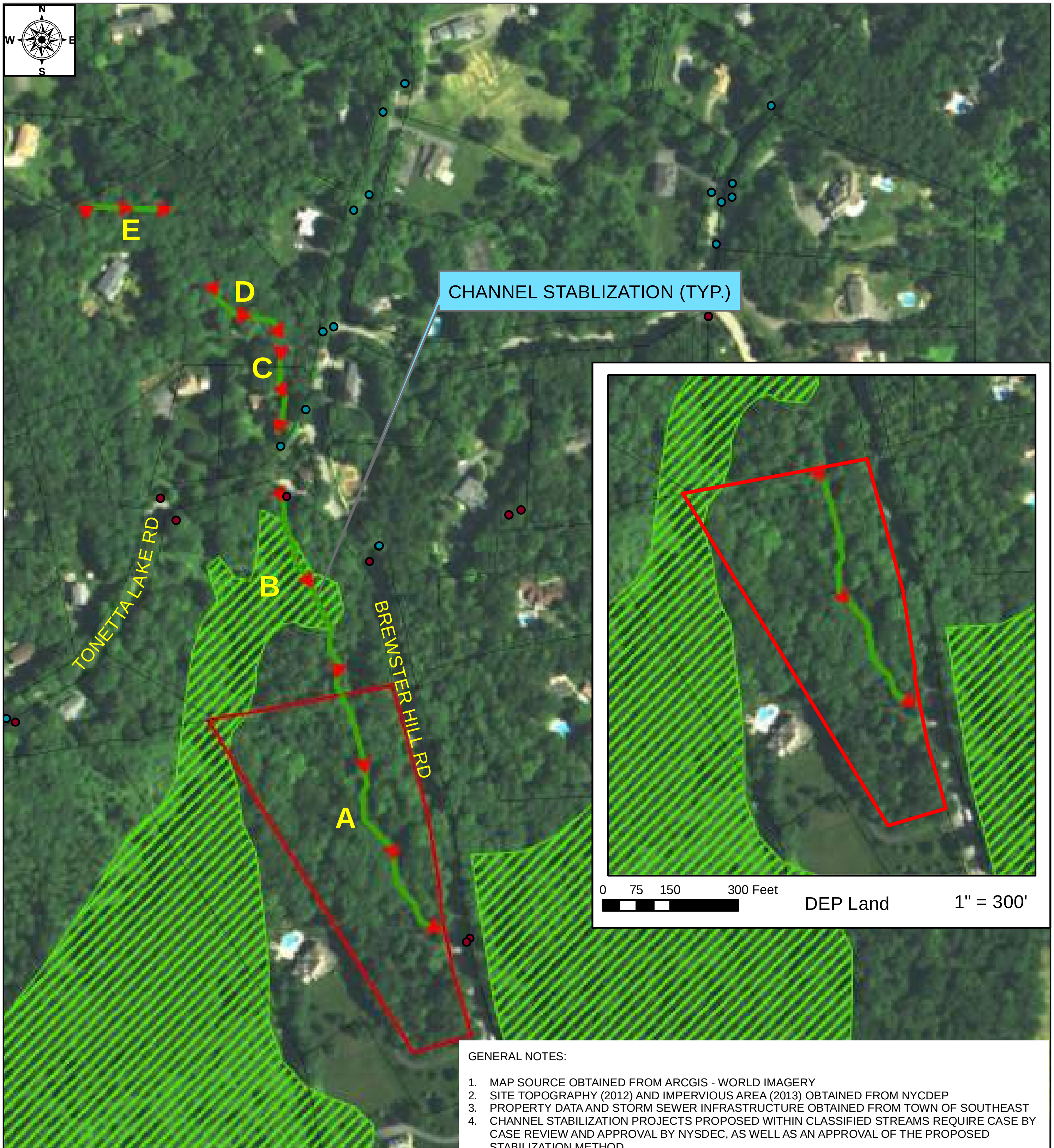
DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

LOWER BREWSTER HILL ROAD

TOWN OF SOUTHEAST

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 300'

SE-1B



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0 150 300 450 600 Feet

Legend

- Parcels
- Mapped Wetland Area
- Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

LOWER BREWSTER HILL ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 300'

SE-1B

SE-1B - Lower Brewster Hill Road: Trapezoidal Channel Stabilization P-Loading Calculation					
Channel ID	**A (NYCDEP)**	**B (Private)**	**C (Private)**	**D (Private)**	**E (Private)**
Channel Depth - y (ft)	3.0	3.0	2.0	2.0	8.0
Channel Bottom Width - B (ft)	3.0	3.0	1.5	1.5	1.0
Channel Top Width -T (ft)	15.0	15.0	9.5	9.5	6.0
Wetted Perimeter Calculation- P (ft)	16.42	16.42	10.44	10.44	17.76
Channel Length-L (ft)	611	496	200	217	202
Soil Erosion Depth-D (ft)	0.065	0.065	0.065	0.065	0.065
Soil Erosion Volume-V (ft^3)	652.0	529.3	135.8	147.3	233.2
Weight* (lbs)	61,937.9	50,280.2	12,898.7	13,995.1	22,156.7
Weight (Kg)	28,095.0	22,807.1	5,850.8	6,348.2	10,050.3
P Load (mg/Yr)**	8,428,506.1	6,842,126.1	1,755,251.8	1,904,448.2	3,015,090.0
P Load (Kg/Yr)	8.43	6.84	1.76	1.90	3.02
				ESTIMATED TOTAL (KG/YR):	**21.95**

Notes:

1. Channel dimensions are based upon field measurements estimated by the W&C team during field visits for each channel
2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.
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Equation and Input Paramaters Basis:

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Soil Erosion Volume: $V= P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

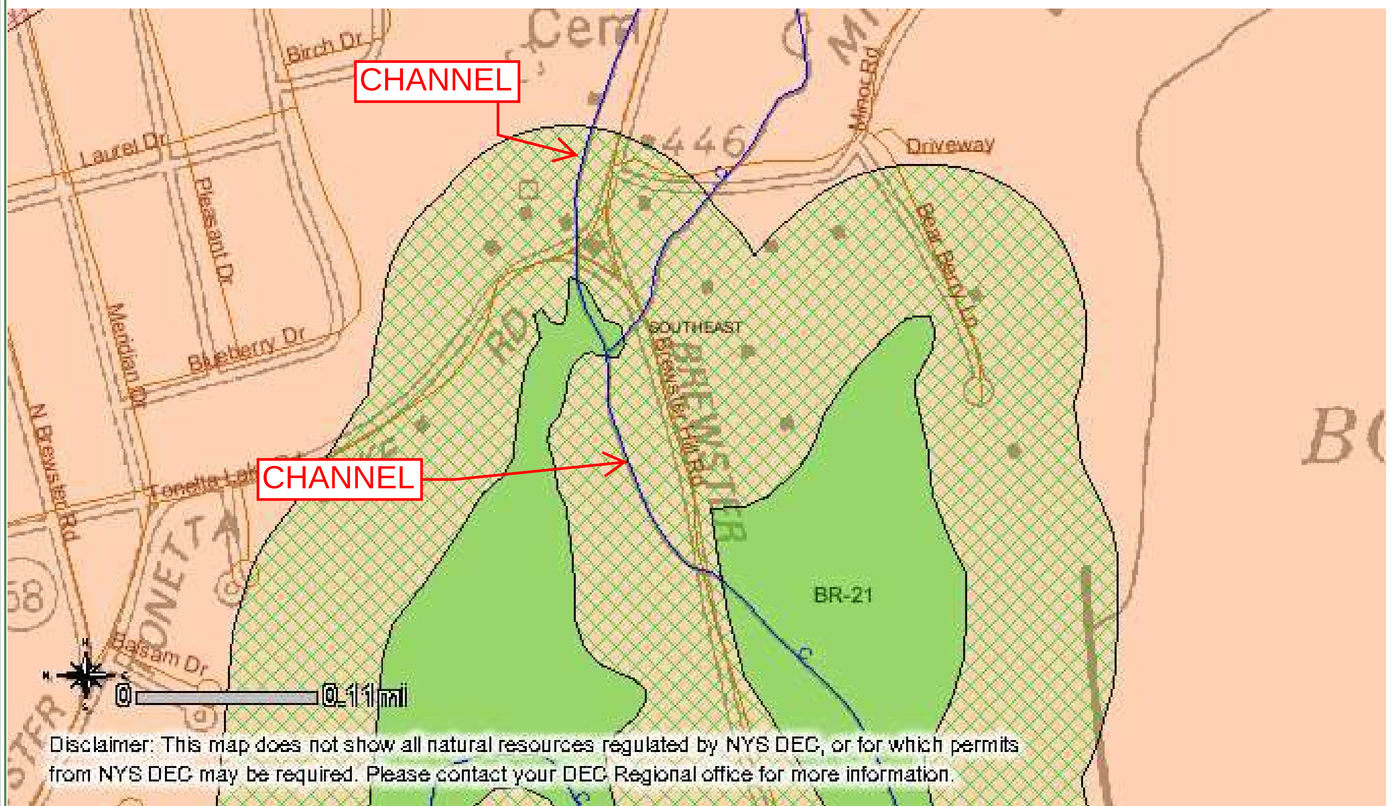
Comments:

Public & Private Property referred by the Town of Southeast.

[print page] [close window]

Please set your printer orientation to "Landscape".

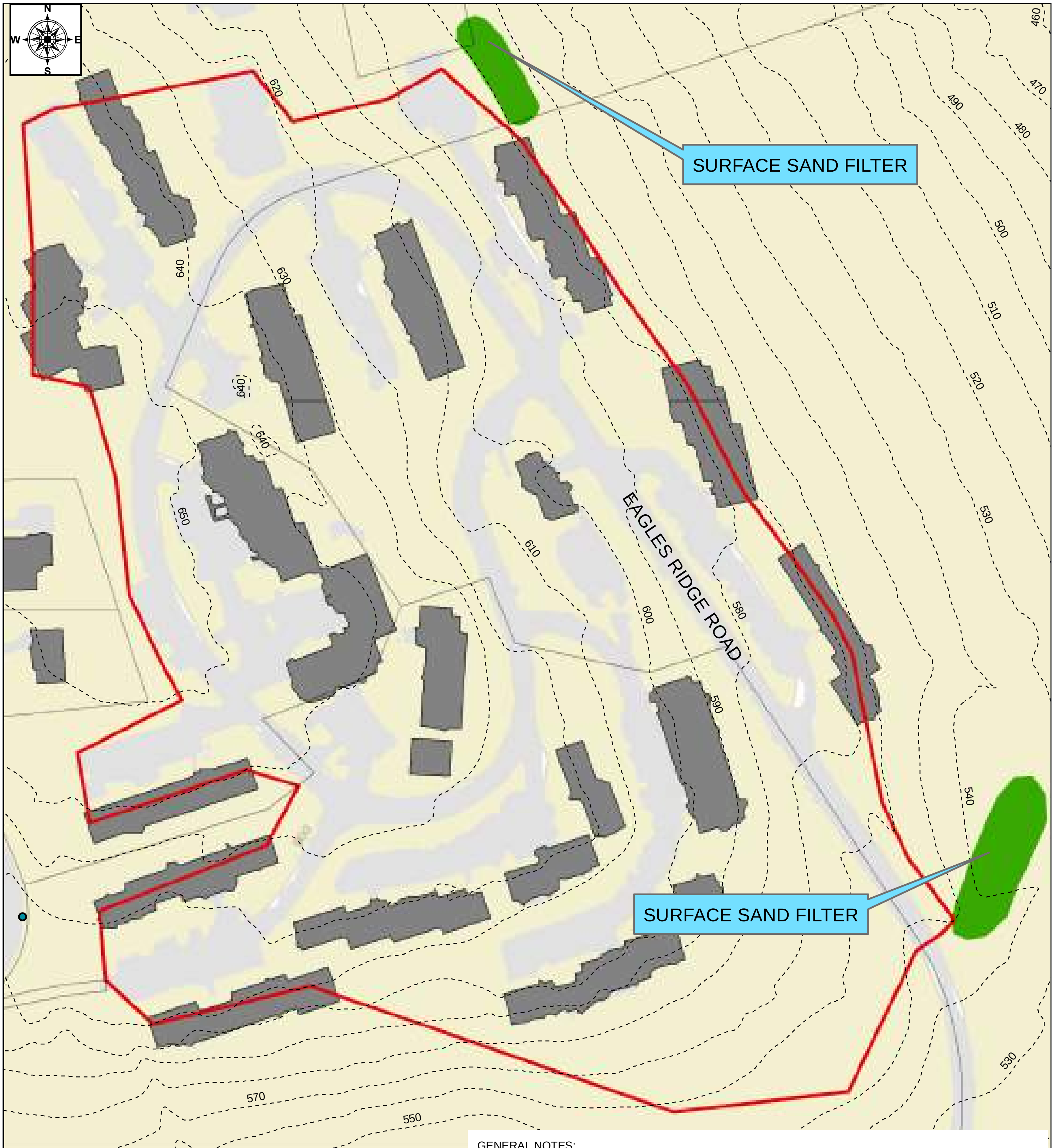
Brewster Hill Road



MinX: 616574, MaxX: 617960, MinY: 4586278, MaxY: 4585597

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 75 150 225 300 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN	EAGLES RIDGE 101–907 EAGLE RIDGE ROAD	JOB NO: 15–031 DATE: 8/11/16 SCALE: 1" = 150'
DESIGNED BY: RAR CHECKED BY: RAR DRAWN BY: JBM	TOWN OF SOUTHEAST	SE-2

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 75 150 225 300 Feet

Legend

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STORMWATER RETROFIT
CONCEPT PLAN

EAGLES RIDGE
101–907 EAGLE RIDGE ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO:	15–031
DATE:	8/11/16
SCALE:	1" = 150'

SE-2

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: SE-2
Prepared for: EOHC
Prepared by: RED
Project County: Putnam

"SE-2: Eagles Ridge"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	17.7085	acres	where:	A =	Contributing Area (acres)
I =	4.94	27.90%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3011			WQv =	Water Quality Volume
Rv (min)**** =**	0.3011				
WQv (acre-ft) =	**0.533**				
WQv (cu-ft) =	**23224**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3011		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	17.7085		Rv =	Runoff Coefficient
C =	0.42		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.67
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0.05
Impervious	0.28
Develped Open Space	0
Weighted "C":	*0.42*

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PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**20.69**	lb/yr
	9.39	kg/yr
P Removal -------------------->	**12.21**	lb/yr
	5.54	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**17.7**	Phosphorus Loading (kg/yr)	**9.39**
Water Quality Volume (cf)	**23224**	Phosphorus Reduction (kg/yr)	**5.54**

ASSUMPTIONS/COMMENTS:

Permission is required from private property owners (assumed to be HOA).
Further investigation should identify location of existing outfalls and potential dry basins.
May be able to retrofit old style detention basins.
Potential to utilize adjacent to Town owned Sewage Treatment Facility property.

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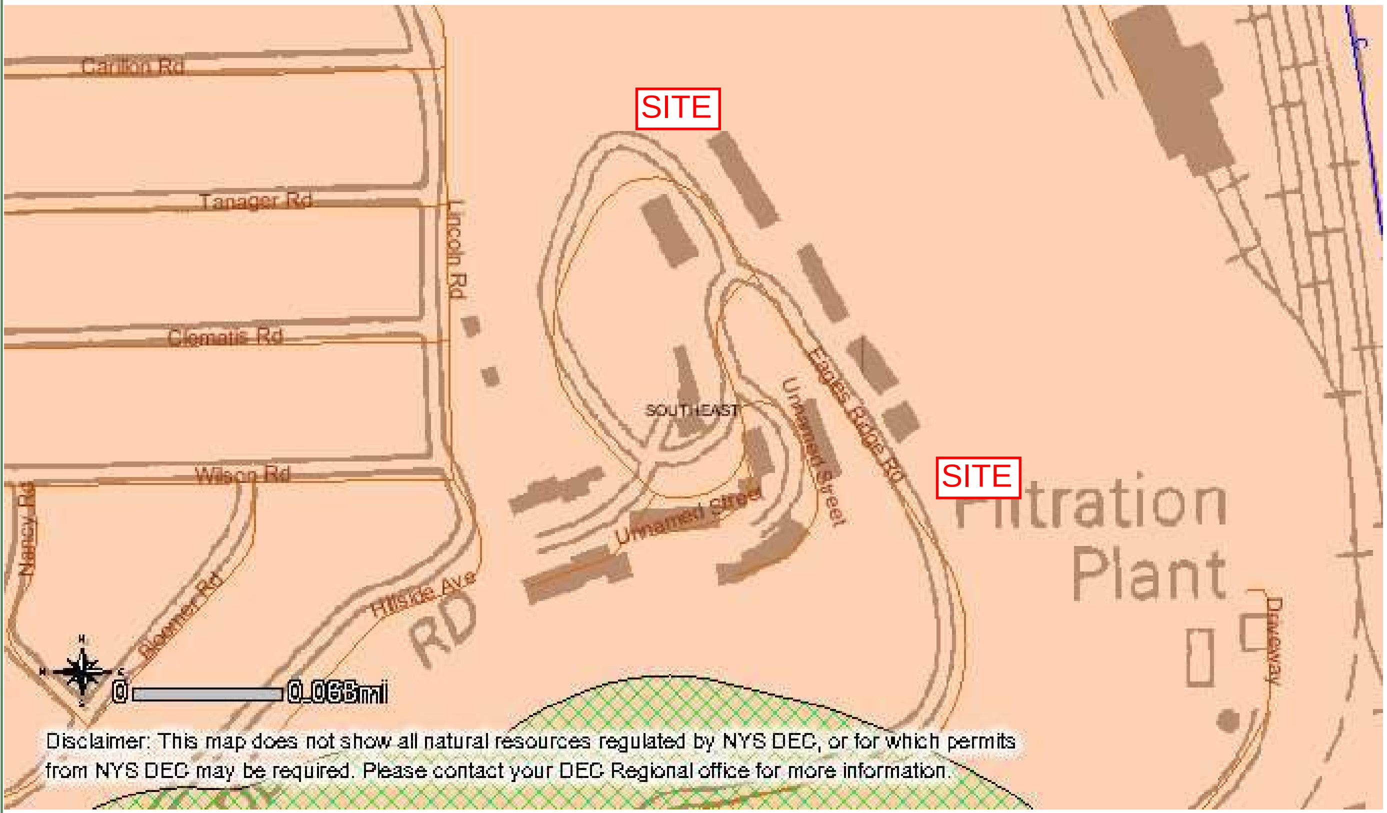
Please set your printer orientation to "Landscape".

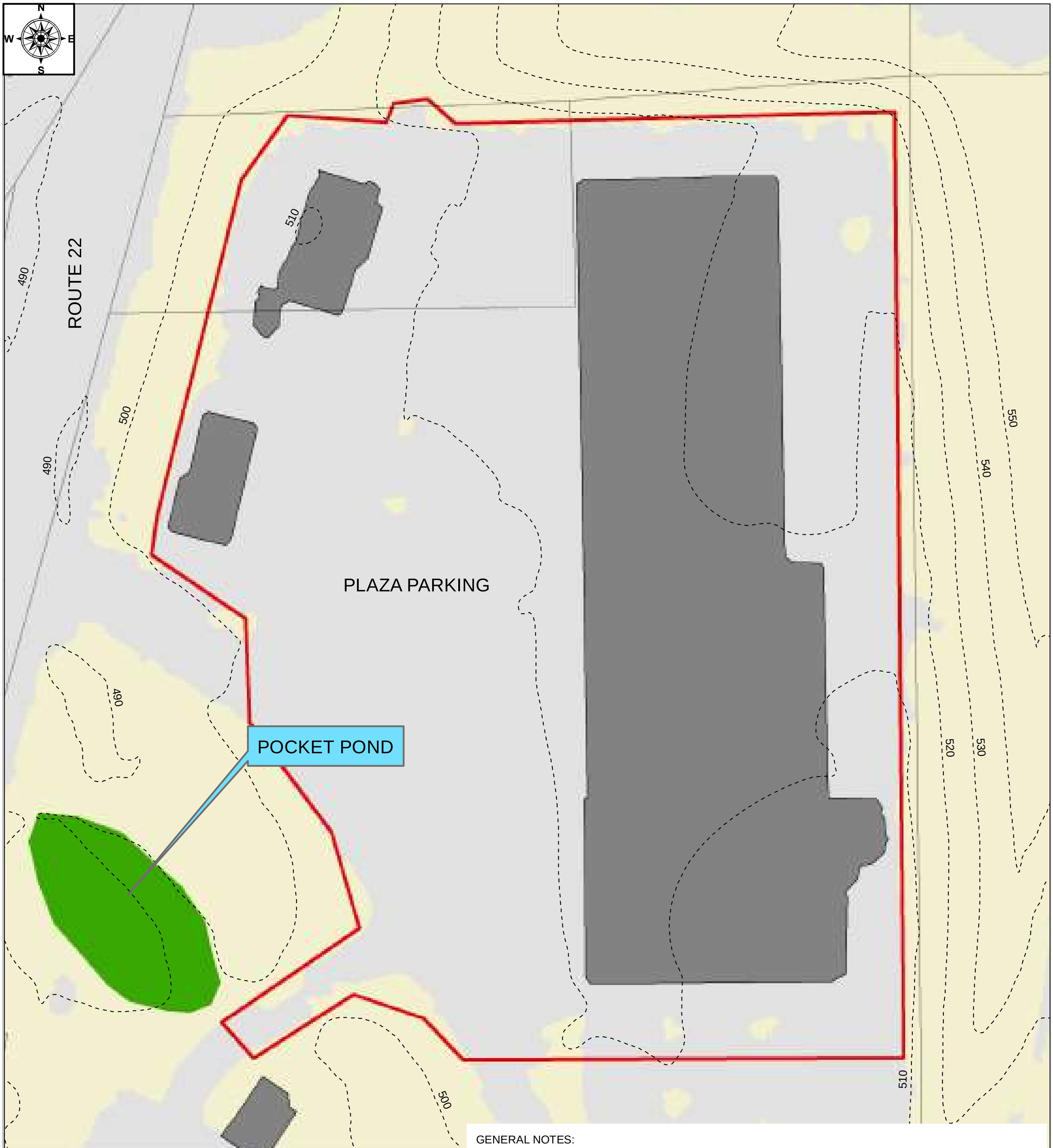
Eagles Ridge Road



MinX: 614356, MaxX: 615277, MinY: 4584824, MaxY: 4584371

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY: SL	CHECKED BY: RAR
DRAWN BY: RED	

GARDEN HOMES BREWSTER
1620 NEW YORK 22

TOWN OF SOUTHEAST

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 100'

SE-3

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200
Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

GARDEN HOMES BREWSTER
1620 NEW YORK 22

TOWN OF SOUTHEAST

DESIGNED BY: SL	CHECKED BY: RAR
DRAWN BY: RED	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-3

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-3
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-3: Garden Homes Brewster"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	7.64172	acres	where:	A =	Contributing Area (acres)
I =	4.85	63.47%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.6212			WQv =	Water Quality Volume
Rv (min)****** =	0.6212				
WQv (acre-ft) =	**0.475**				
WQv (cu-ft) =	**20678**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.6212		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	7.64172		Rv =	Runoff Coefficient
C =	0.44		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.36
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.64
Developed Open Space	0
Weighted "C":	*0.44*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Pocket Pond**	
Removal Efficiency:	***67%***	
P Load -------------------->	**19.31**	lb/yr
	8.76	kg/yr
P Removal -------------------->	**12.94**	lb/yr
	5.87	kg/yr
20% Reduction Due to Site Constraints		
P Removal -------------------->	**10.35**	lb/yr
	4.69	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**7.6**	Phosphorus Loading (kg/yr)	**8.76**
Water Quality Volume (cf)	**20678**	Phosphorus Reduction (kg/yr)	**4.69**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Convert existing retail plaza basin to achieve water quality requirements.
Further study required to determine original practice size and purpose (i.e. conversion of detention facility).

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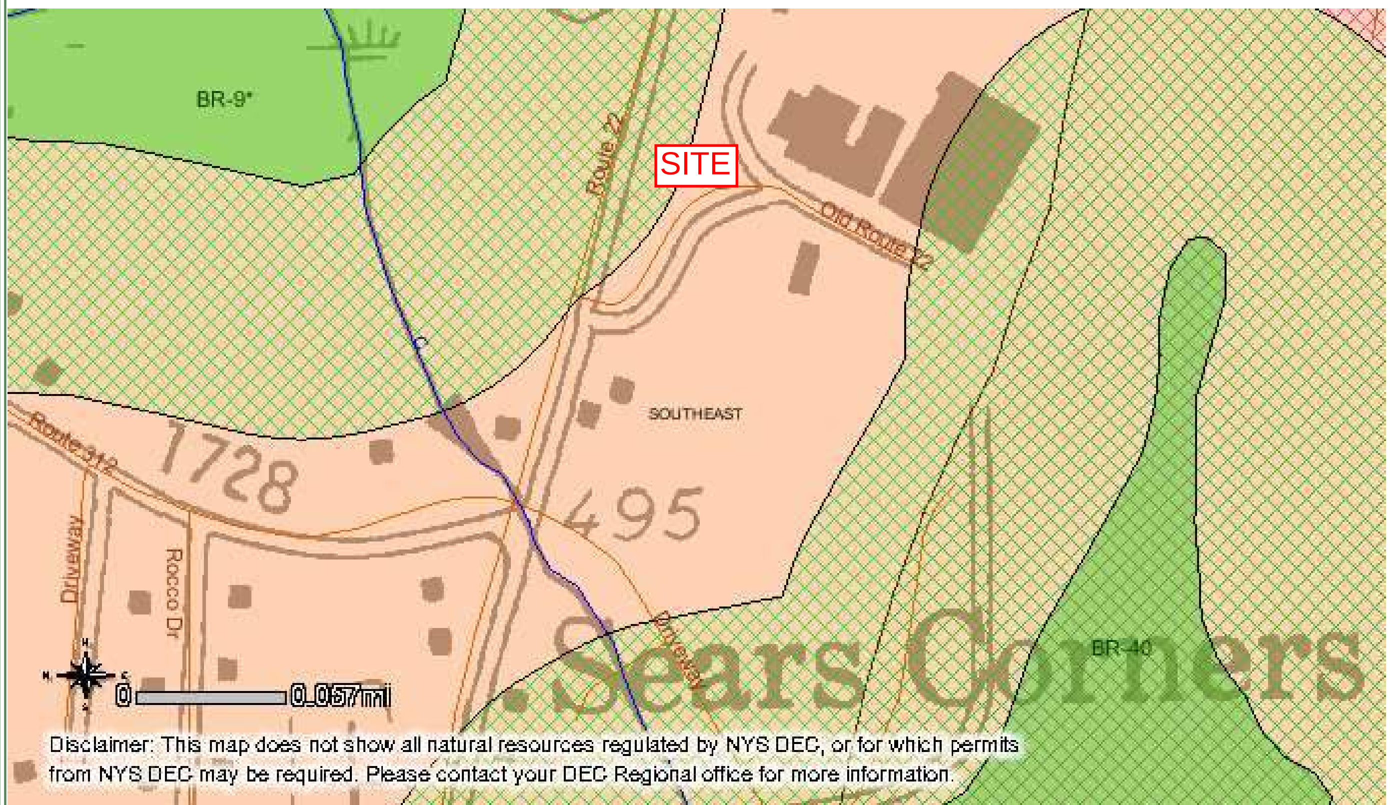
Please set your printer orientation to "Landscape".

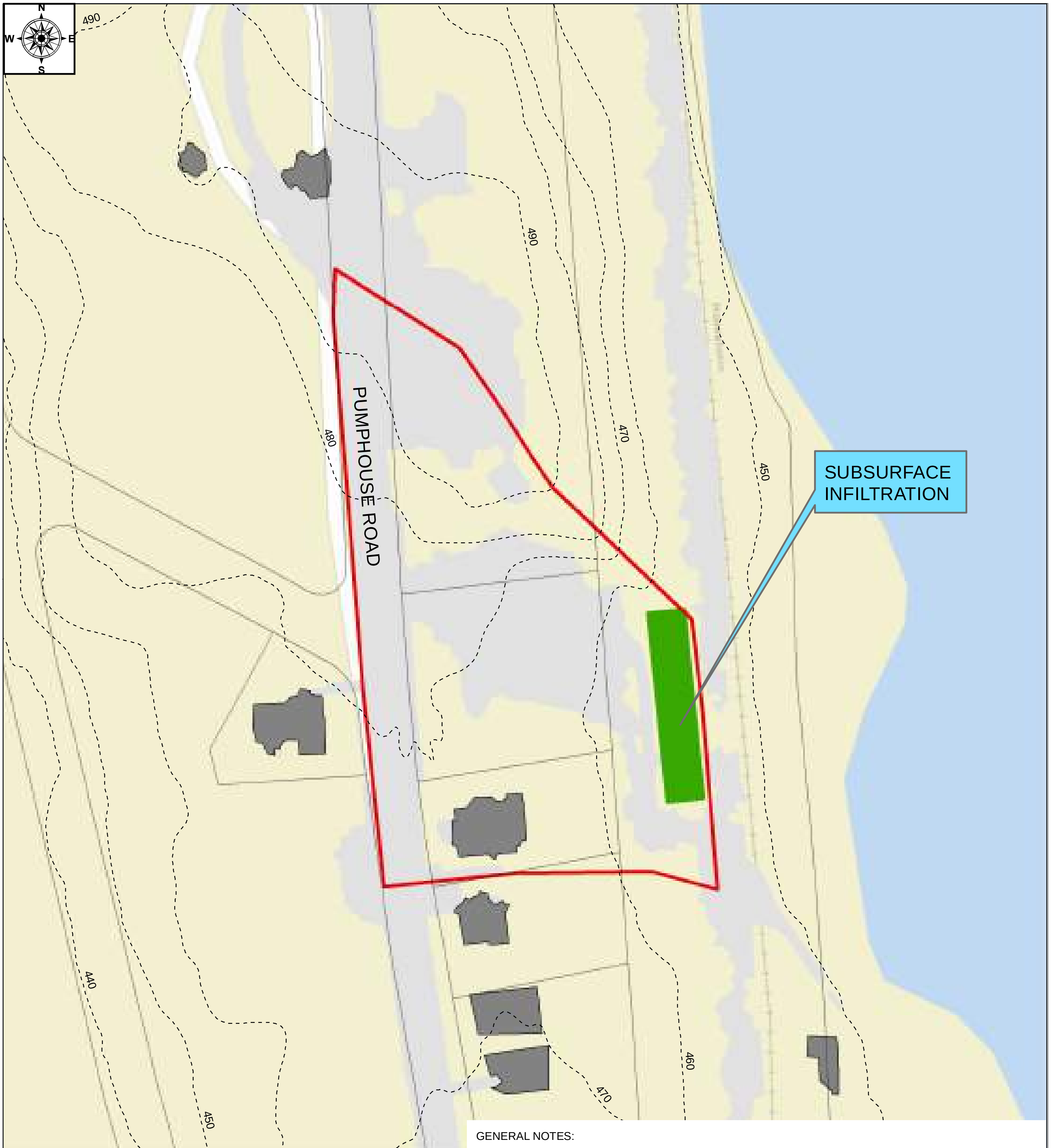
Garden Homes Brewster



MinX: 618575, MaxX: 619404, MinY: 4587568, MaxY: 4587160

Visible Layers

Classified Streams
Classified Ponds
State-Regulated Freshwater Wetlands
Wetland Checkzone
State-Regulated Freshwater Wetlands
Rare Plants and Rare Animals
Significant Natural Communities Buffered
Natural Communities Nearby
Significant Natural Communities
Interstate Highways
Adirondack Park Boundary
Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

LAKE TONETTA
192–198 PUMPHOUSE ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-4

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

LAKE TONETTA
192–198 PUMPHOUSE ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR
DRAWN BY: JBM
CHECKED BY: RAR

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-4

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-4
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-4 Number: Lake Tonetta"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.88084	acres	where:	A =	Contributing Area (acres)
I =	1.08	57.42%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=		0.5668		WQv =	Water Quality Volume
Rv (min)**** =**		0.5668			
WQv (acre-ft) =		**0.107**			
WQv (cu-ft) =		**4644**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5668		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.88084		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.57
Developed Open Space	0.43
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Subsurface Infiltration**	
Removal Efficiency:	***100%***	
P Load -------------------->	**4.04**	lb/yr
	1.83	kg/yr
P Removal -------------------->	**4.04**	lb/yr
	1.83	kg/yr

Summary:

Proposed Retrofit Practice	Subsurface Infiltration		
Drainage Area (acres)	**1.9**	Phosphorus Loading (kg/yr)	**1.83**
Water Quality Volume (cf)	**4644**	Phosphorus Reduction (kg/yr)	**1.83**

ASSUMPTIONS/COMMENTS:

Soil tests required to confirm infiltration pratice.
Install practice on Town owned property.

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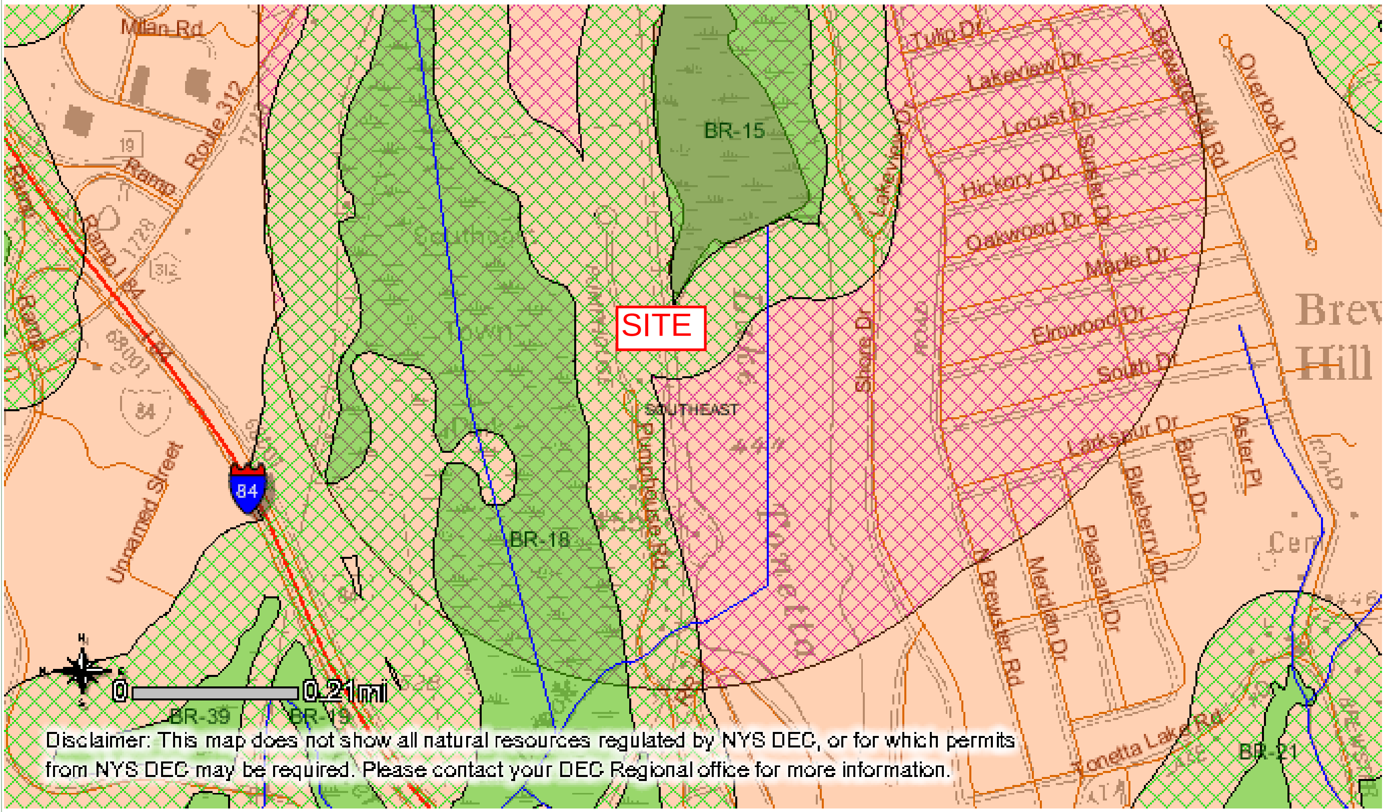
Please set your printer orientation to "Landscape".

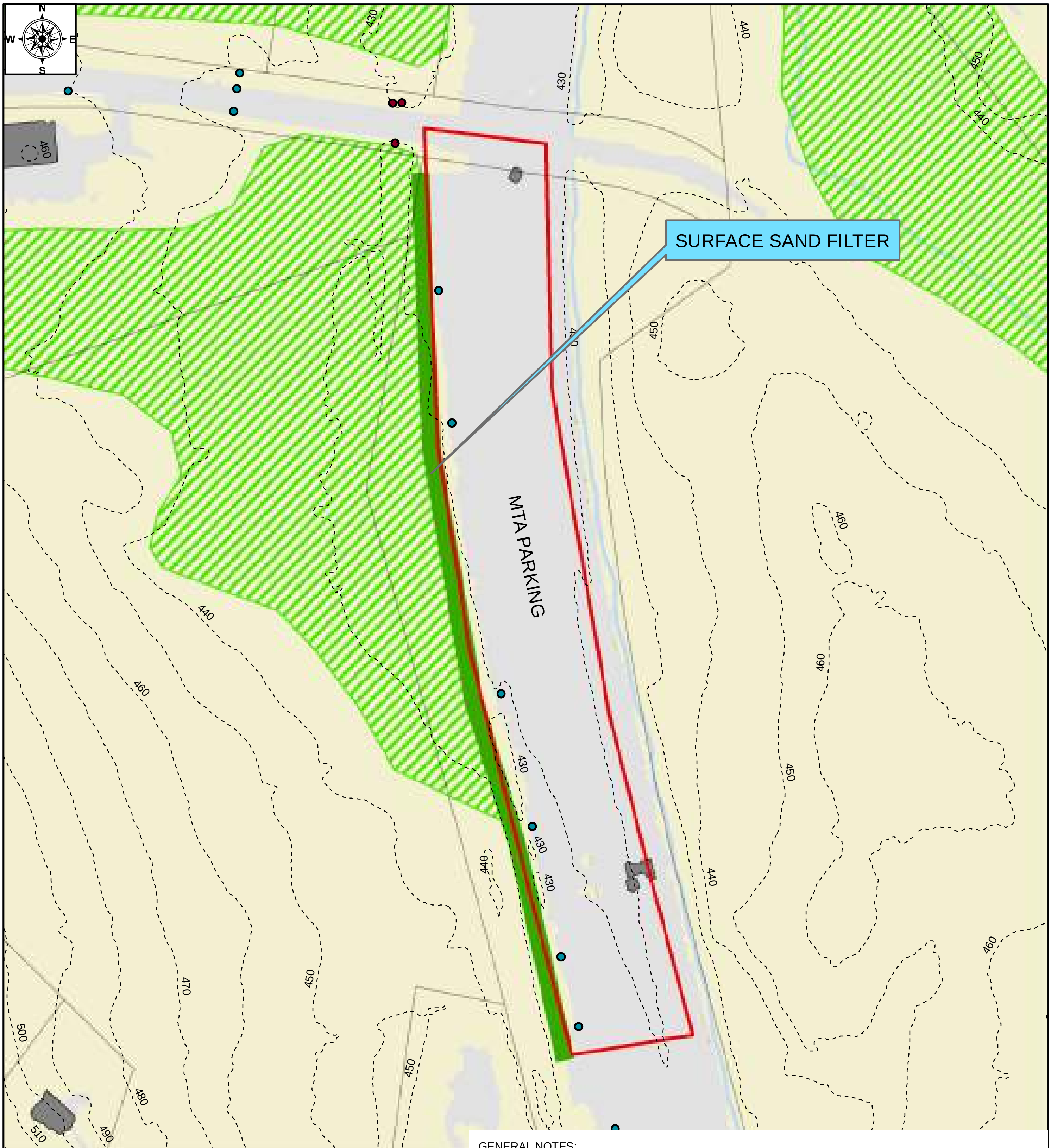
Lake Tonetta



MinX: 614808, MaxX: 617051, MinY: 4587414, MaxY: 4585781

Visible Layers

- Highlighted Feature
- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 100 200 300 400 Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

Mapped Wetland Area

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

MIDTOWN TRACKAGE VENTURES LLC
1 INDEPENDENT WAY

TOWN OF SOUTHEAST

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 200'

SE-5

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 100 200 300 400 Feet

Legend

Parcels	Proposed SRP Location
Drainage Basins	Mapped Wetland Area

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STORMWATER RETROFIT
CONCEPT PLAN

MIDTOWN TRACKAGE VENTURES LLC
1 INDEPENDENT WAY

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR	JOB NO: 15-031	
DRAWN BY: JBM		DATE: 8/11/16	
		SCALE: 1" = 200'	
		SE-5	

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-5
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-5: Midtown Trackage Ventures LLC"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	5.63355	acres	where:	A =	Contributing Area (acres)
I =	5.01	88.93%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.8504			WQv =	Water Quality Volume
Rv (min)**** =**	0.8504				
WQv (acre-ft) =	**0.479**				
WQv (cu-ft) =	**20868**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.8504		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	5.63355		Rv =	Runoff Coefficient
C =	0.48		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.11
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.89
Developed Open Space	0
Weighted "C":	*0.48*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**21.25**	lb/yr
	9.64	kg/yr
P Removal -------------------->	**12.54**	lb/yr
	5.69	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**5.6**	Phosphorus Loading (kg/yr)	**9.64**
Water Quality Volume (cf)	**20868**	Phosphorus Reduction (kg/yr)	**5.69**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Metro North commuter lot for the Southeast Train Station.

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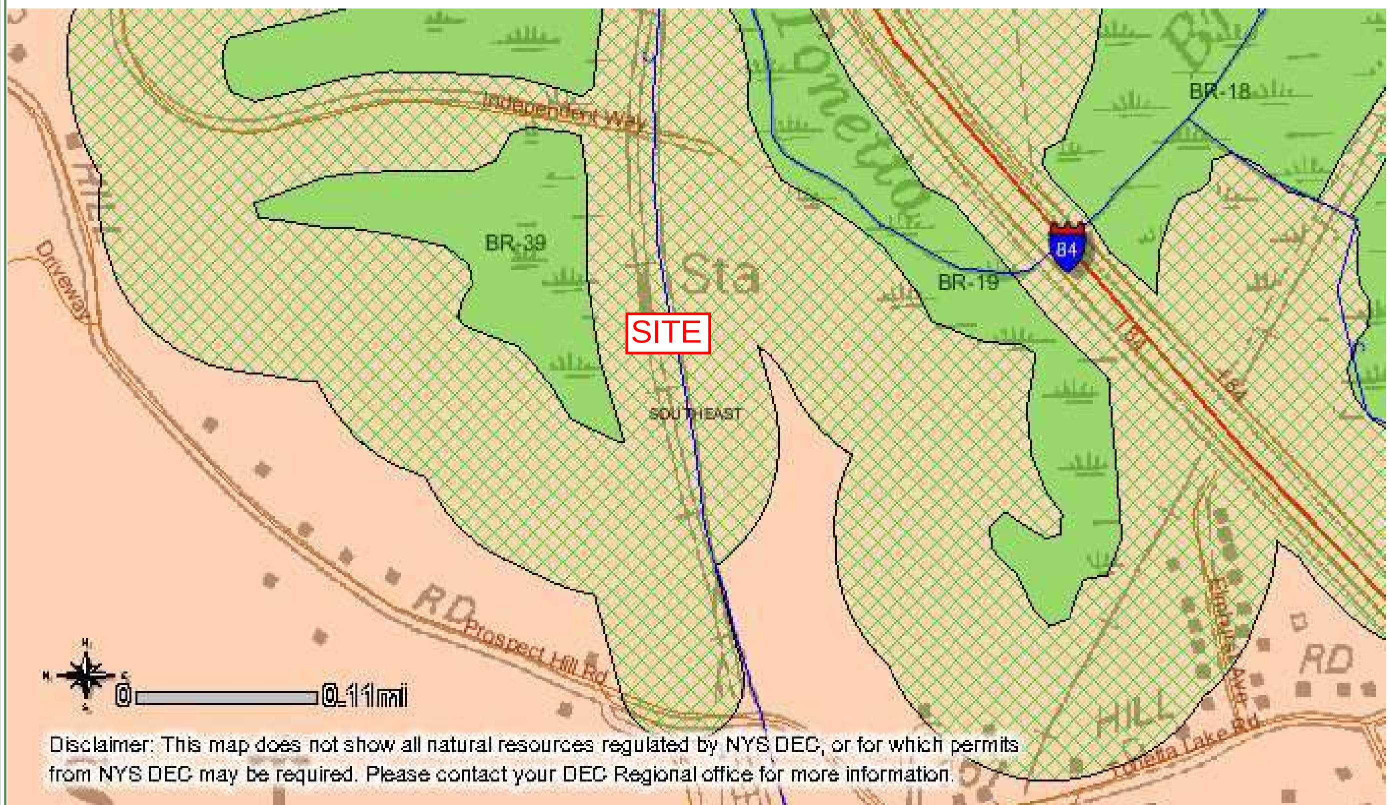
Please set your printer orientation to "Landscape".

Independent Way



MinX: 614422, MaxX: 615777, MinY: 4585870, MaxY: 4585204

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
  - Wetland Checkzone
  - State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
  - Natural Communities Nearby
  - Significant Natural Communities
- Interstate Highways
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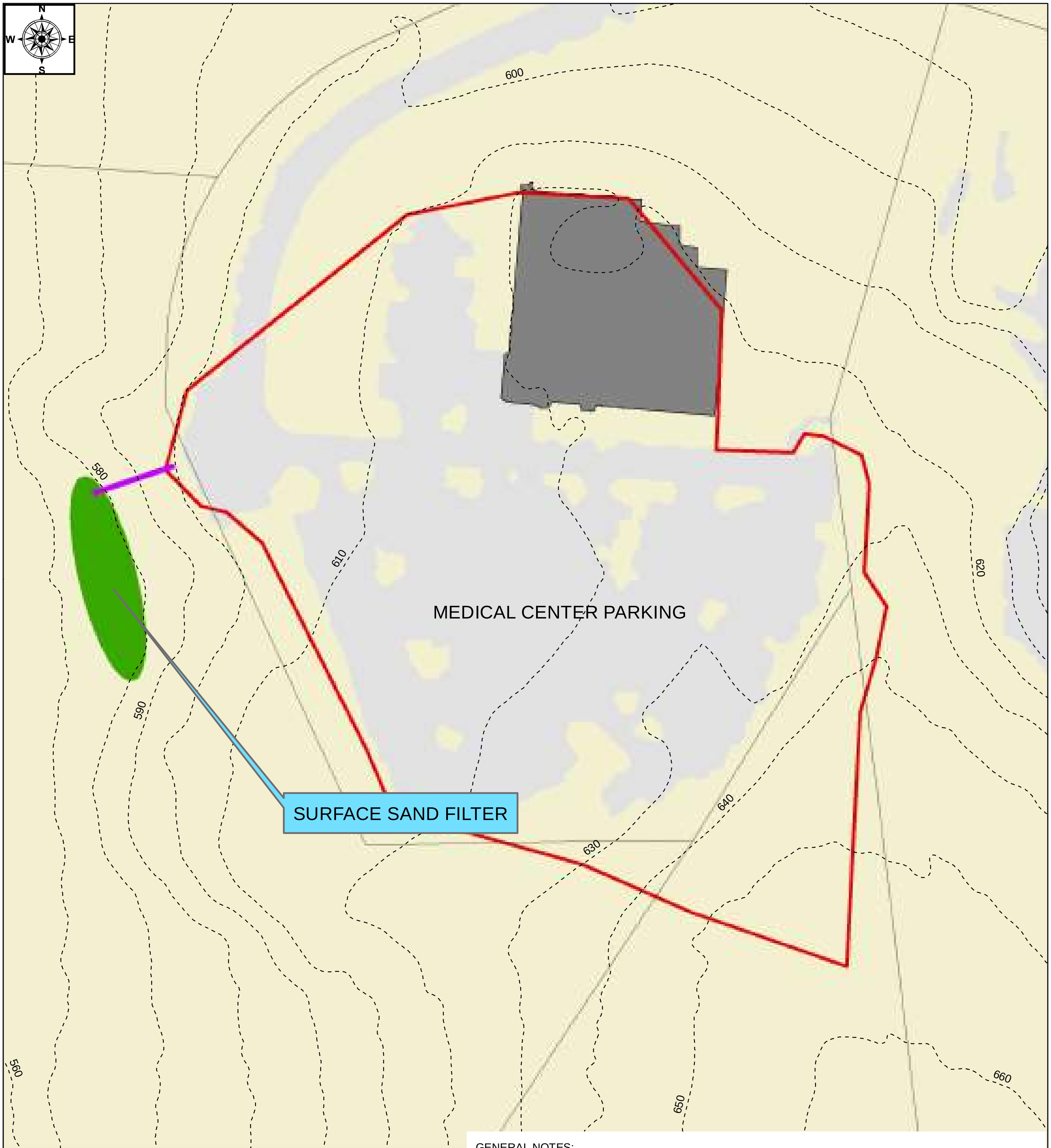
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

Parcels
Drainage Basins
Proposed Pipe
Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

MOUNT KISCO MEDICAL GROUP
185 NY-312

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-6

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

Parcels

Drainage Basins

Proposed Pipe

Proposed SRP Location

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STORMWATER RETROFIT
CONCEPT PLAN

MOUNT KISCO MEDICAL GROUP
185 NY–312

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15–031
DATE: 8/11/16
SCALE: 1" = 100'

SE-6

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-6
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-6: Mount Kisco Medical Group"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	4.35135	acres	where:	A =	Contributing Area (acres)
I =	2.27	52.17%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.5195			WQv =	Water Quality Volume
Rv (min)**** =**	0.5195				
WQv (acre-ft) =	**0.226**				
WQv (cu-ft) =	**9847**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5195		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	4.35135		Rv =	Runoff Coefficient
C =	0.42		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.48
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.52
Developed Open Space	0
Weighted "C":	*0.42*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**8.80**	lb/yr
	3.99	kg/yr
P Removal -------------------->	**5.19**	lb/yr
	2.35	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**4.4**	Phosphorus Loading (kg/yr)	**3.99**
Water Quality Volume (cf)	**9847**	Phosphorus Reduction (kg/yr)	**2.35**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Further soils investigation should identify if infiltration could be a suitable alternative practice.
Potential that owner may look to expand site in the future.

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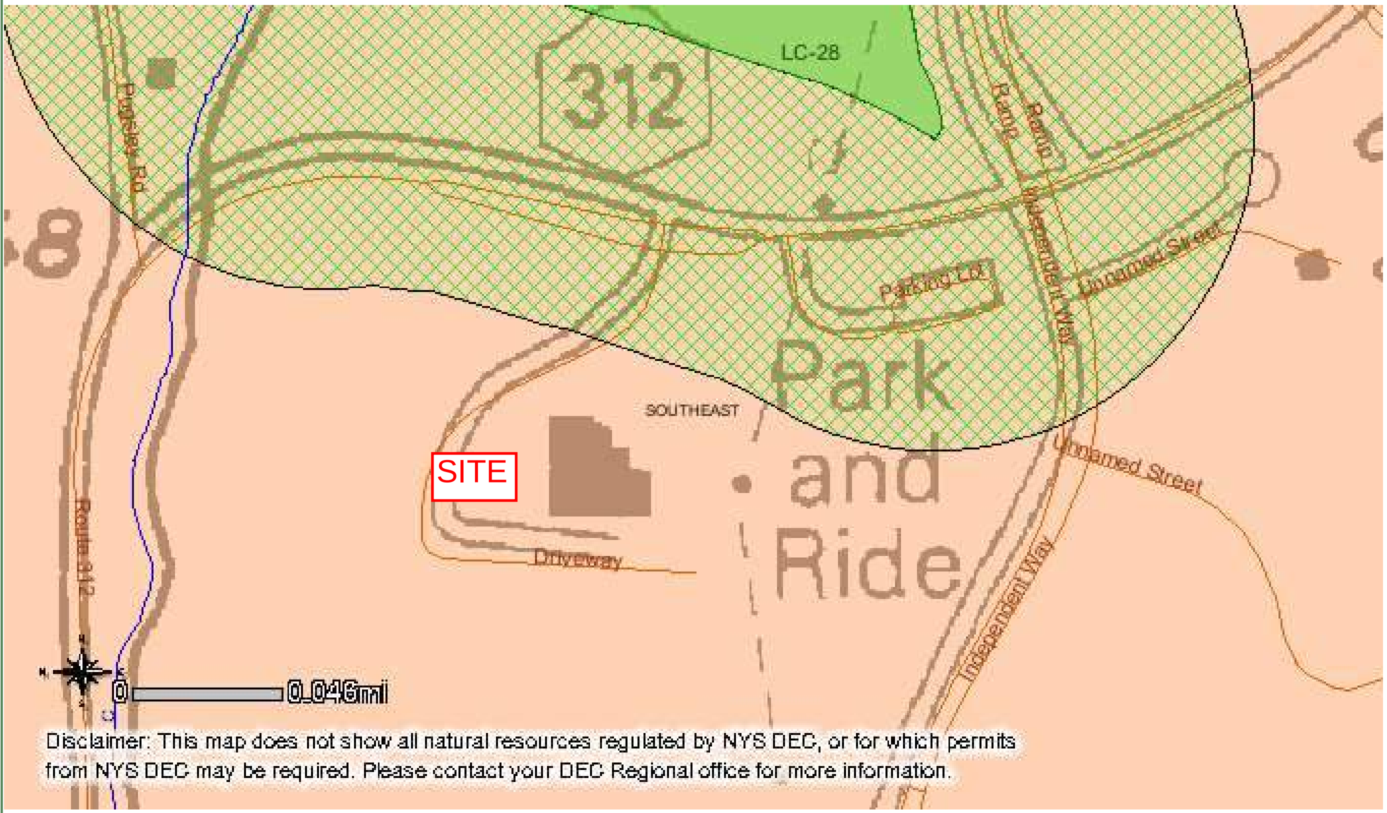
Please set your printer orientation to "Landscape".

Mount Kisco Medical Group



MinX: 614076, MaxX: 614749, MinY: 4586775, MaxY: 4586445

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 75 150 225 300
Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

POWERS PRODUCTS III LLC
2 POWERS LANE

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 150'

SE-7

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 75 150 225 300 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN		POWERS PRODUCTS III LLC 2 POWERS LANE	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 150'
DESIGNED BY: RAR	CHECKED BY: RAR	TOWN OF SOUTHEAST	SE-7
DRAWN BY: JBM			

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	Powers Products III LLC
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-7: Powers Products III LLC"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	11.7481	acres	where:	A =	Contributing Area (acres)
I =	3.74	31.83%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.3365			WQv =	Water Quality Volume
Rv (min)**** =**	0.3365				
WQv (acre-ft) =	**0.395**				
WQv (cu-ft) =	**17221**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.3365		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	11.7481		Rv =	Runoff Coefficient
C =	0.38		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.63
Industrial	0
Actively Grazed Pasture	0
Forest	0.05
Impervious	0.32
Developed Open Space	0
Weighted "C":	*0.38*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**13.87**	lb/yr
	6.29	kg/yr
P Removal -------------------->	**8.19**	lb/yr
	3.71	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**11.7**	Phosphorus Loading (kg/yr)	**6.29**
Water Quality Volume (cf)	**17221**	Phosphorus Reduction (kg/yr)	**3.71**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Soils investigation should be completed to identify if infiltration could be a suitable alternative practice.
Bioretention could also be utilized and would provide a larger phosphorus reduction.

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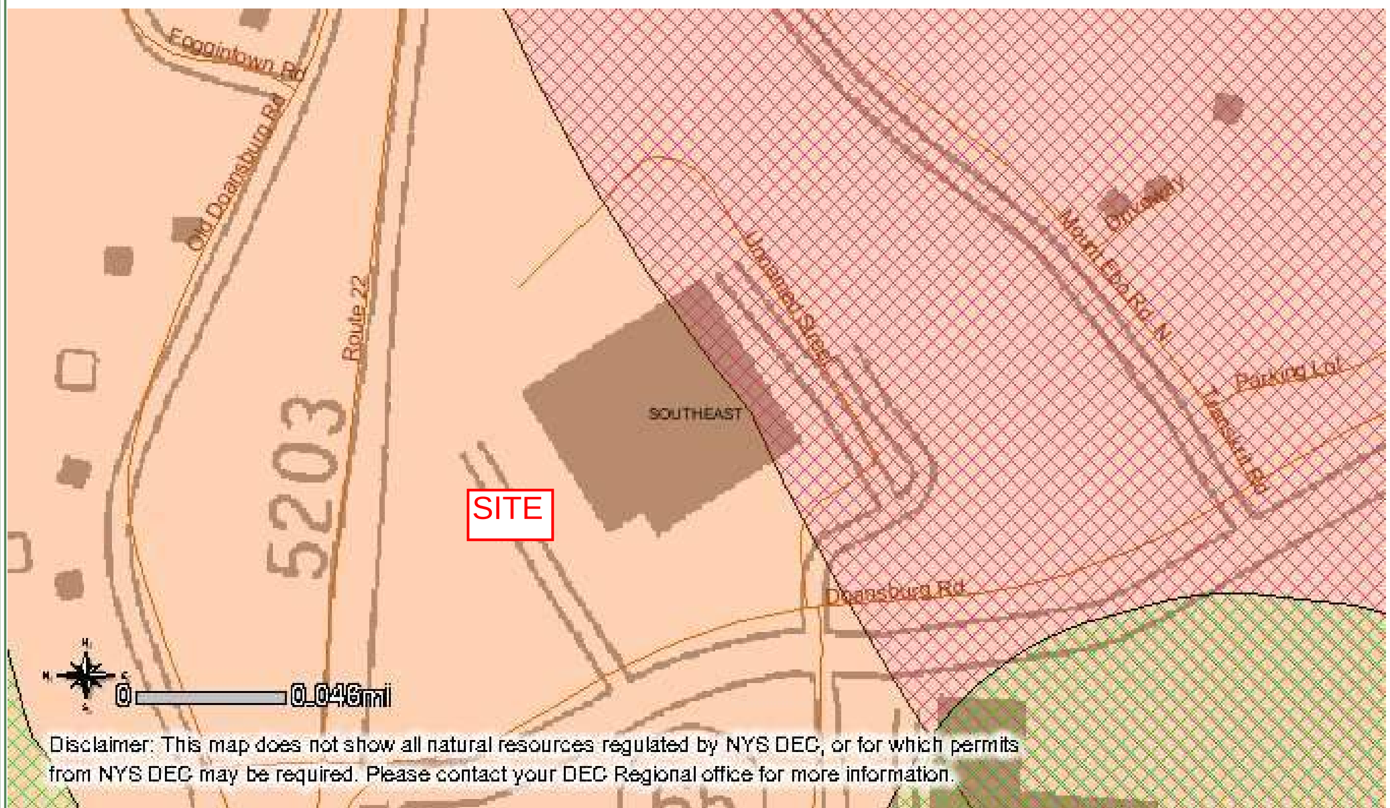
Please set your printer orientation to "Landscape".

Powers Lane



MinX: 618870, MaxX: 619542, MinY: 4588371, MaxY: 4588040

0 100 200 300 400 Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

SCOLPINO PARK
115 DOANSBURG ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 200'

SE-8

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 100 200 300 400 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

SCOLPINO PARK
115 DOANSBURG ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 200'

SE-8

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-8
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-8: Scolpino Park"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.96575	acres	where:	A =	Contributing Area (acres)
I =	1.31	44.17%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.4475			WQv =	Water Quality Volume
Rv (min)**** =**	0.4475				
WQv (acre-ft) =	**0.133**				
WQv (cu-ft) =	**5782**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.4475		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.96575		Rv =	Runoff Coefficient
C =	0.41		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.56
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.44
Developed Open Space	0
Weighted "C":	*0.41*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**5.01**	lb/yr
	2.27	kg/yr
P Removal -------------------->	**2.95**	lb/yr
	1.34	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**3.0**	Phosphorus Loading (kg/yr)	**2.27**
Water Quality Volume (cf)	**5782**	Phosphorus Reduction (kg/yr)	**1.34**

ASSUMPTIONS/COMMENTS:

Install practice on Town owned property.
Soils investigation should be completed to identify if infiltration could be a suitable alternative practice.
Bioretention could also be utilized and would provide a larger phosphorus reduction.
May be potential to treat adjacent ballfield areas.
Adjacent wetland will require a delineation to confirm area available for practice.

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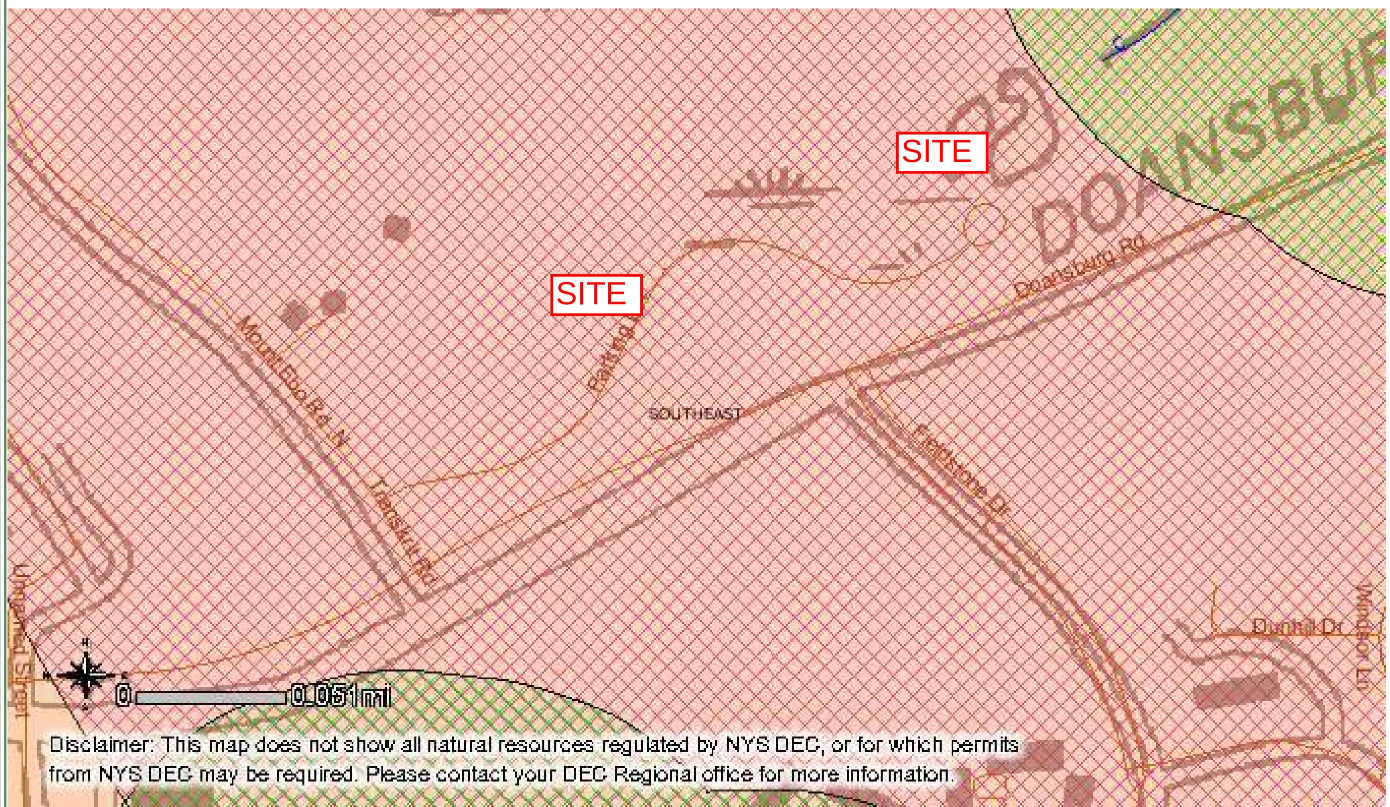
Please set your printer orientation to "Landscape".

Scolpino Park



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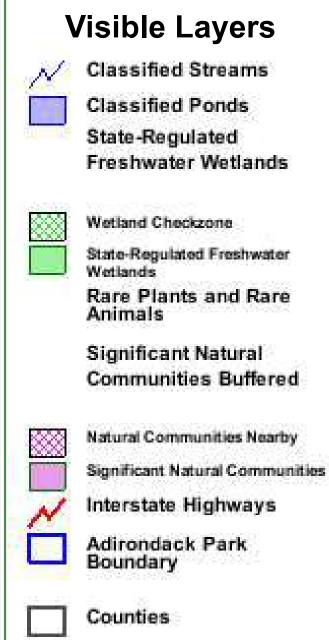

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

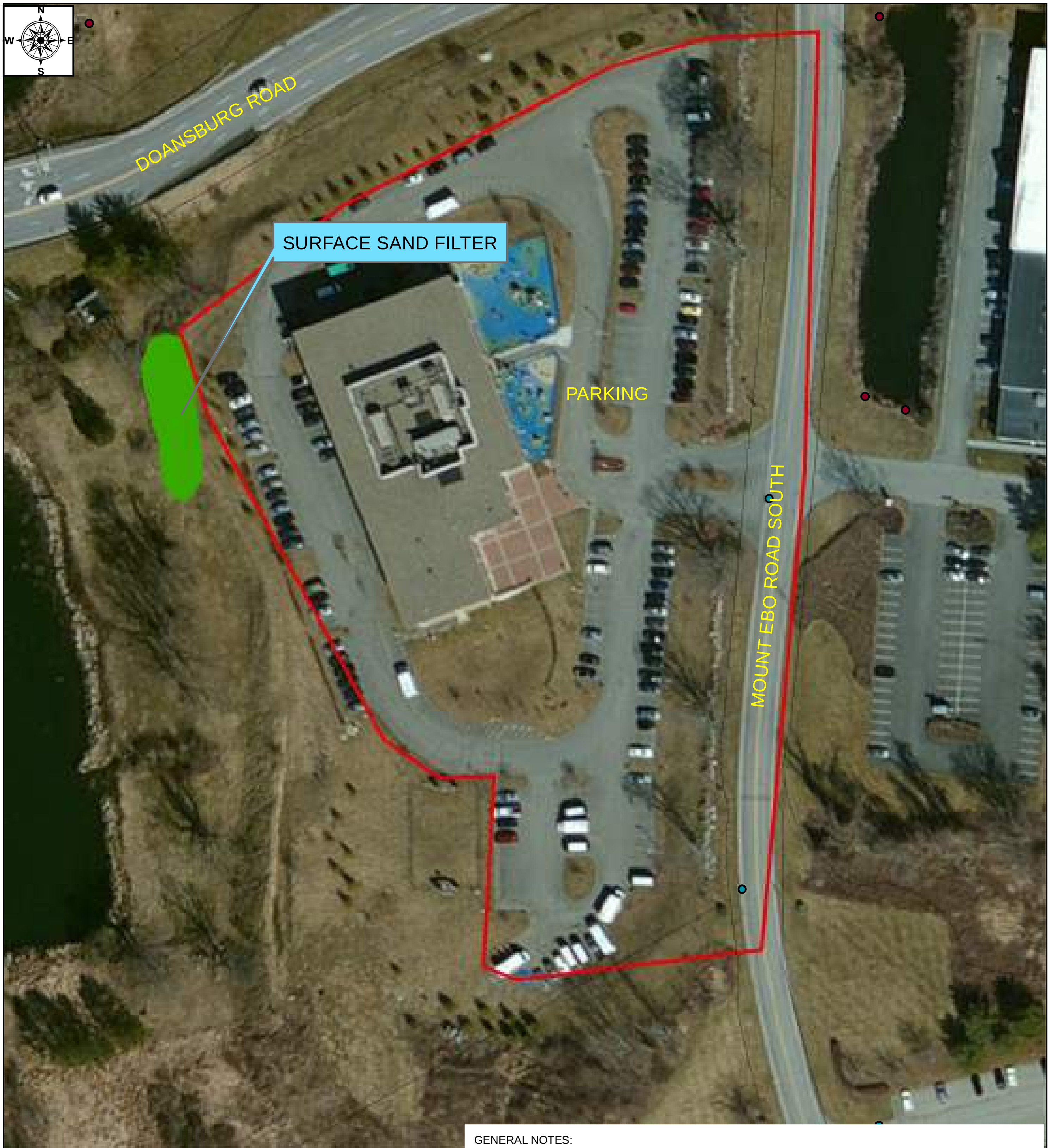
15 MOUNT EBO ROAD SOUTH

TOWN OF SOUTHEAST

DESIGNED BY: RAR | CHECKED BY: RAR
DRAWN BY: JBM

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-9



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN	15 MOUNT EBO ROAD SOUTH	JOB NO: 15-031
		DATE: 8/11/16
		SCALE: 1" = 100'
DESIGNED BY: RAR	CHECKED BY: RAR	
DRAWN BY: JBM	TOWN OF SOUTHEAST	SE-9

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-9
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-9: 15 Mt. Ebo Road South"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	5.0229	acres	where:	A =	Contributing Area (acres)
I =	3.19	63.51%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.6216			WQv =	Water Quality Volume
Rv (min)**** =**	0.6216				
WQv (acre-ft) =	**0.312**				
WQv (cu-ft) =	**13600**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.6216		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	5.0229		Rv =	Runoff Coefficient
C =	0.44		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.37
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.63
Developed Open Space	0
Weighted "C":	*0.44*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**12.65**	lb/yr
	5.74	kg/yr
P Removal -------------------->	**7.46**	lb/yr
	3.39	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**5.0**	Phosphorus Loading (kg/yr)	**5.74**
Water Quality Volume (cf)	**13600**	Phosphorus Reduction (kg/yr)	**3.39**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Bioretention could also be utilized and would provide a larger phosphorus reduction.

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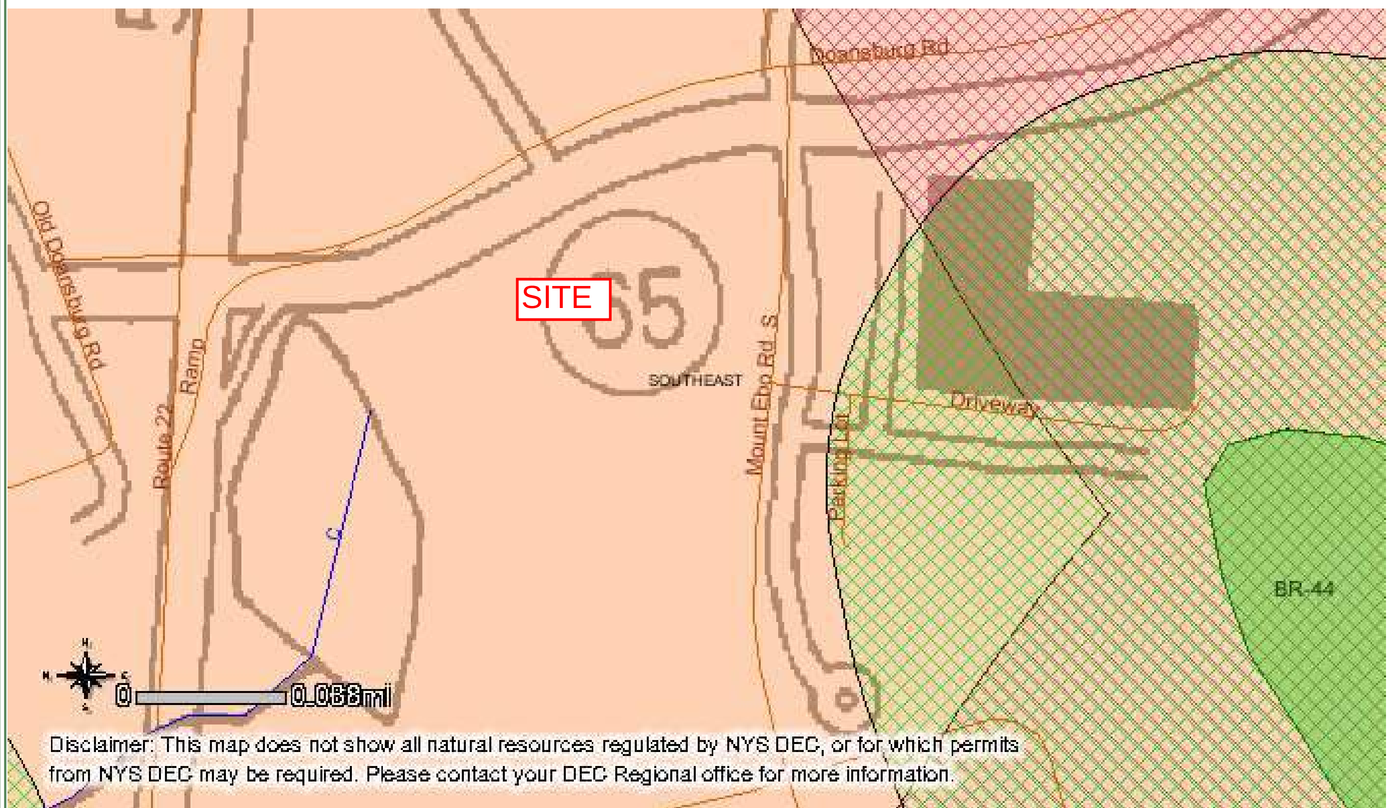
Please set your printer orientation to "Landscape".

Mount Ebo Road



MinX: 618952, MaxX: 619508, MinY: 4588108, MaxY: 4587835

Visible Layers

Classified Streams

Classified Ponds

State-Regulated Freshwater Wetlands

Wetland Checkzone

State-Regulated Freshwater Wetlands

Rare Plants and Rare Animals

Significant Natural Communities Buffered

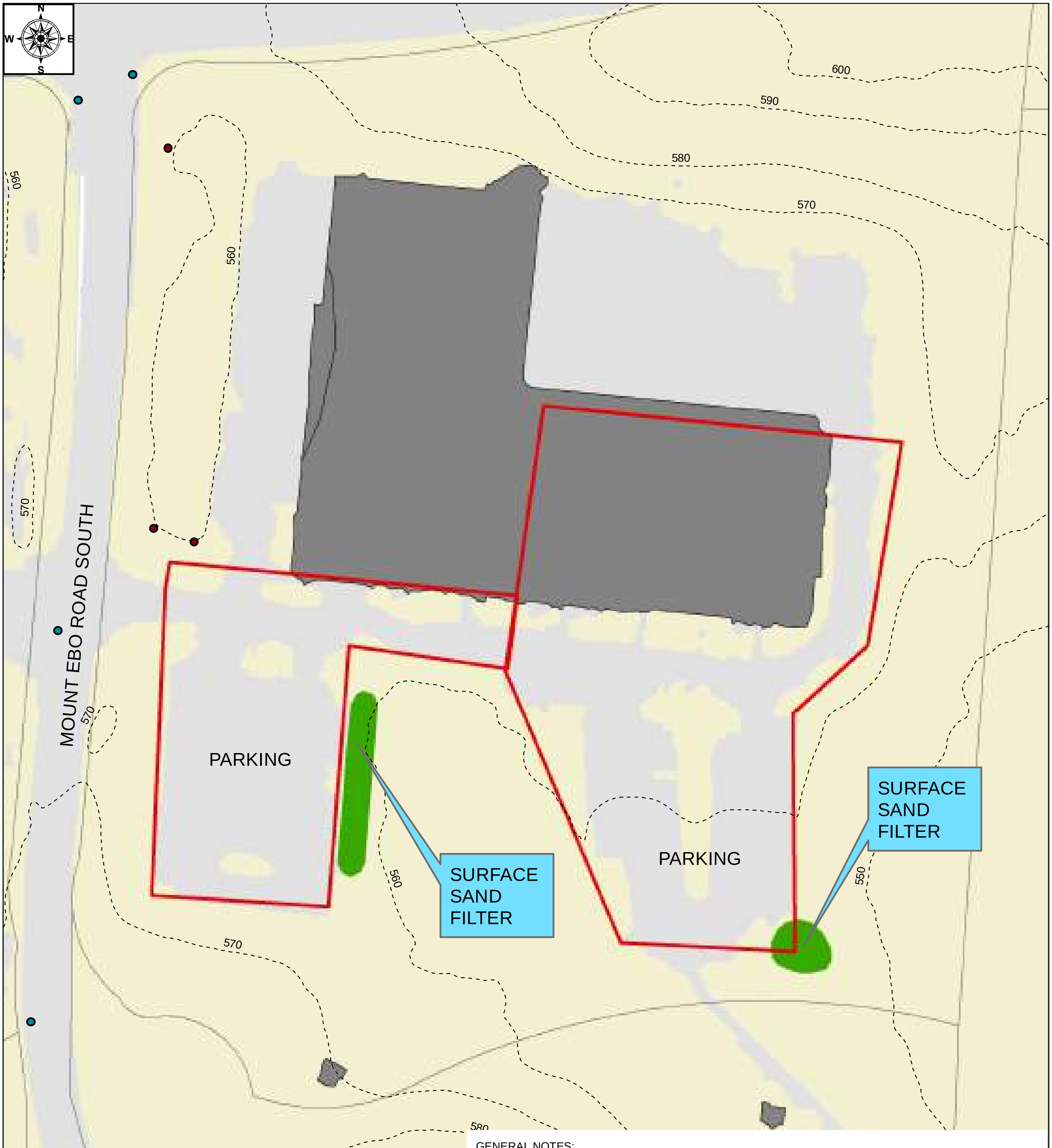
Natural Communities Nearby

Significant Natural Communities

Interstate Highways

Adirondack Park Boundary

Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200 Feet

Legend

- Parcels
- Drainage Basins
- Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN		16 MOUNT EBO ROAD SOUTH	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 100'
DESIGNED BY: RAR	CHECKED BY: RAR	TOWN OF SOUTHEAST	SE-10
DRAWN BY: JBM			

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST

0 50 100 150 200
Feet

Legend

Parcels

Drainage Basins

Proposed SRP Location

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

16 MOUNT EBO ROAD SOUTH

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

SE-10

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	SE-10
Prepared for:	EOHC
Prepared by:	RED
Project County:	Putnam

"SE-10: 16 Mt. Ebo Road South"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	2.81477	acres	where:	A =	Contributing Area (acres)
I =	1.52	54.00%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.5360			WQv =	Water Quality Volume
Rv (min)**** =**	0.5360				
WQv (acre-ft) =	**0.151**				
WQv (cu-ft) =	**6572**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5360		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	2.81477		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.46
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.54
Developed Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load -------------------->	**5.91**	lb/yr
	2.68	kg/yr
P Removal -------------------->	**3.49**	lb/yr
	1.58	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**2.8**	Phosphorus Loading (kg/yr)	**2.68**
Water Quality Volume (cf)	**6572**	Phosphorus Reduction (kg/yr)	**1.58**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Soils investigation should be completed to identify if infiltration could be a suitable alternative practice.
Bioretention could also be utilized and would provide a larger phosphorus reduction.

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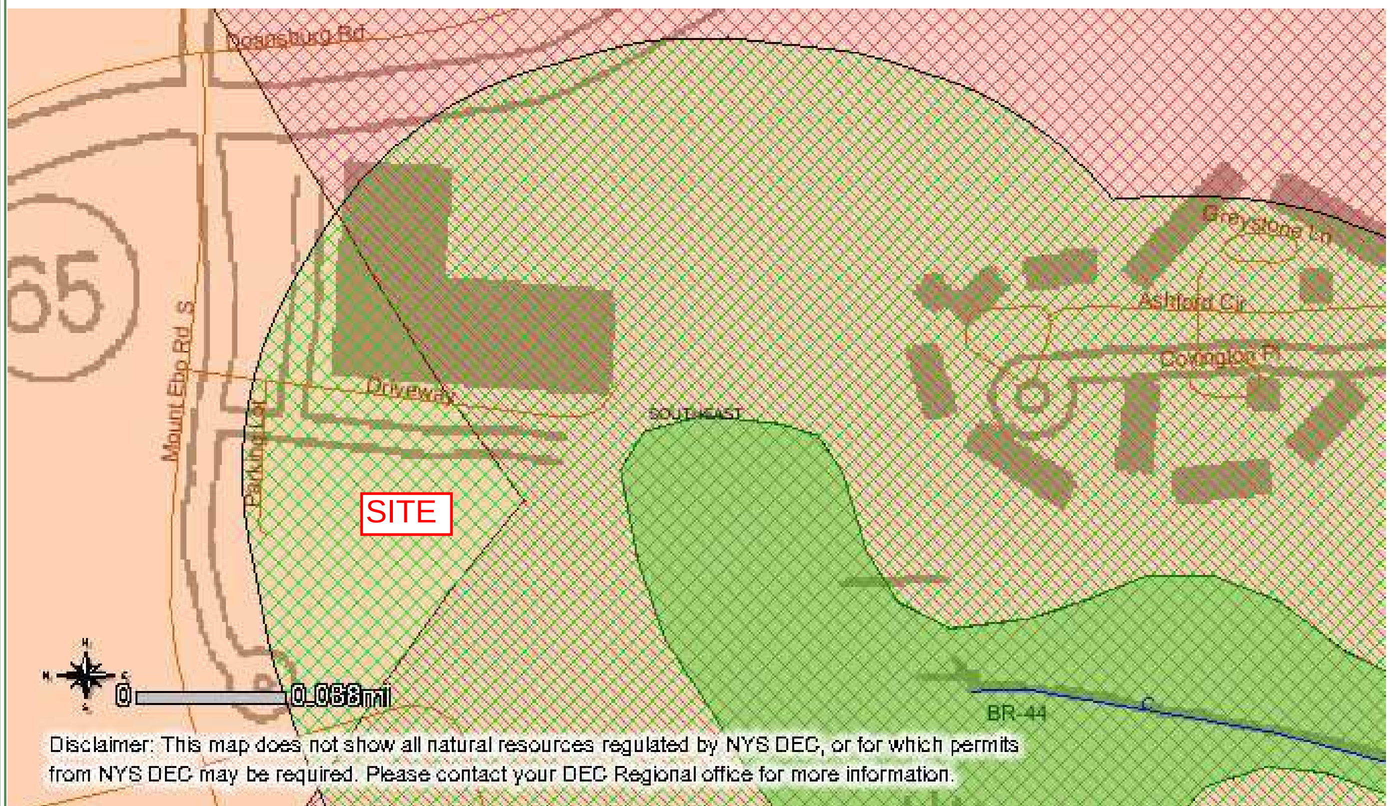
Please set your printer orientation to "Landscape".

Mount Ebo Road



MinX: 619187, MaxX: 619743, MinY: 4588102, MaxY: 4587829

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
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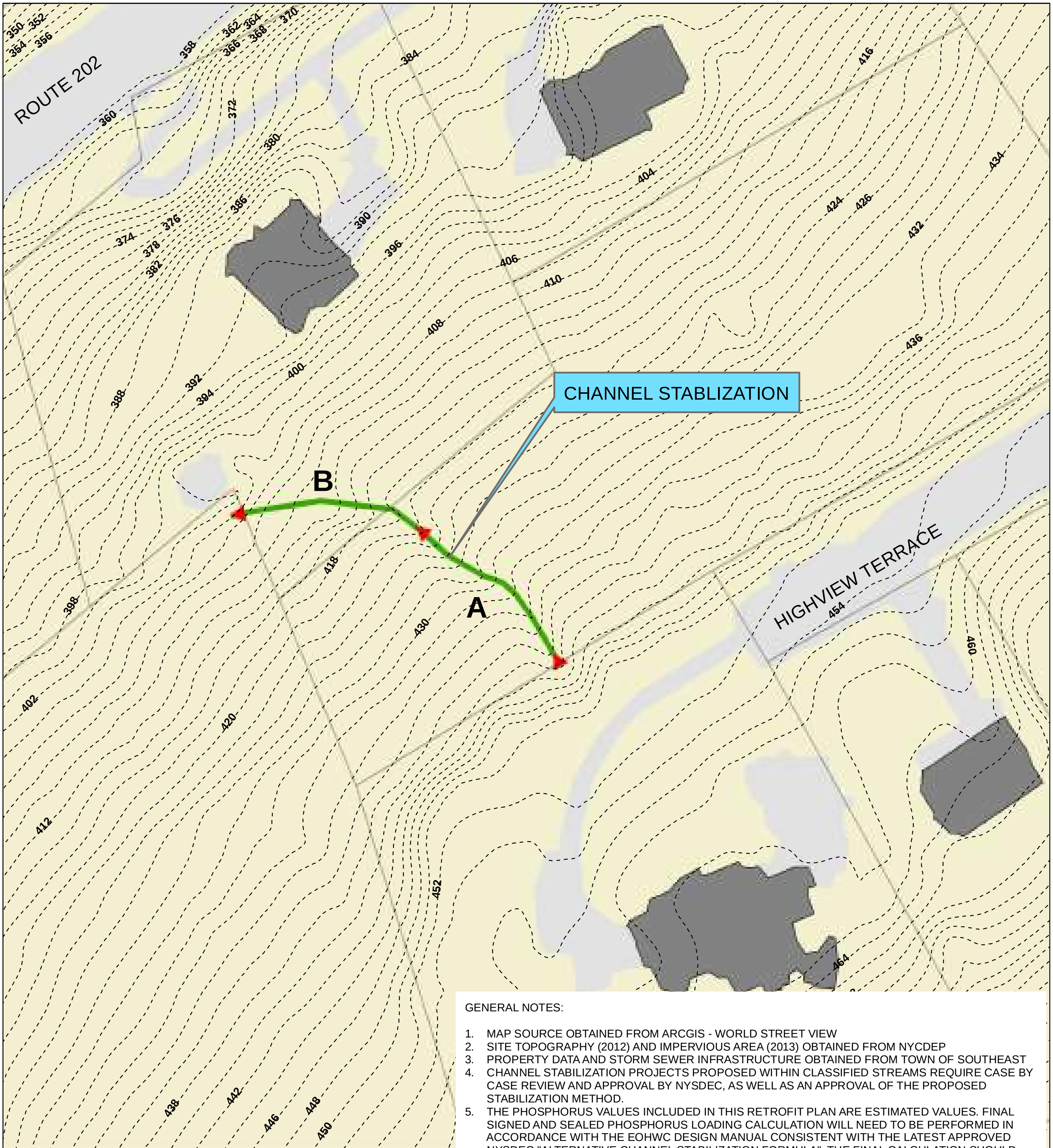

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET VIEW
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF SOUTHEAST
4. CHANNEL STABILIZATION PROJECTS PROPOSED WITHIN CLASSIFIED STREAMS REQUIRE CASE BY CASE REVIEW AND APPROVAL BY NYSDEC, AS WELL AS AN APPROVAL OF THE PROPOSED STABILIZATION METHOD.
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0 30 60 90 120 Feet

Legend

Parcels

Drainage Basins

Channel to be Stabilized

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

HIGHVIEW TERRACE CHANNEL
33 HIGHVIEW TERRACE

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 60'

SE-11

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
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0 30 60 90 120
Feet

Legend

Parcels

Drainage Basins

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STORMWATER RETROFIT
CONCEPT PLAN

DESIGNED BY: RAR | CHECKED BY: RAR
DRAWN BY: JBM

HIGHVIEW TERRACE CHANNEL
33 HIGHVIEW TERRACE

TOWN OF SOUTHEAST

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 60'

SE-11

SE-11 - Highview Terrace: Trapezoidal Channel Stabilization P-Loading Calculation				
Channel ID	A (Putnam County)	B (Private)		
Channel Depth - y (ft)	5.0	4.0		
Channel Bottom Width - B (ft)	1.0	1.0		
Channel Top Width -T (ft)	6.0	5.0		
Wetted Perimeter Calculation-P (ft)	12.18	9.94		
Channel Length-L (ft)	105	80		
Soil Erosion Depth-D (ft)	0.065	0.065		
Soil Erosion Volume-V (ft^3)	83.1	51.7		
Weight* (lbs)	7,897.4	4,912.5		
Weight (Kg)	3,582.3	2,228.3		
P Load** (mg/Yr)	1,074,682.0	668,489.0		
P Load (Kg/Yr)	1.07	0.67		
	ESTIMATED TOTAL (KG/YR):	**1.74**		

Notes:

1. Channel dimensions are based upon field measurements estimated by the W&C team during field visits for each channel
2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.
3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC “Alternative Channel Stabilization Formula”. The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the “Alternative Channel Stabilization Formula”, including the BEHI and NBS indexes.

4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

Wetted Perimeter (P) approximately: $P= T+ [(8/3)* (y^2/T)]$

Soil Erosion Volume: $V= P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest**   = phosphorus level in soil (typ. 300 mg/kg)

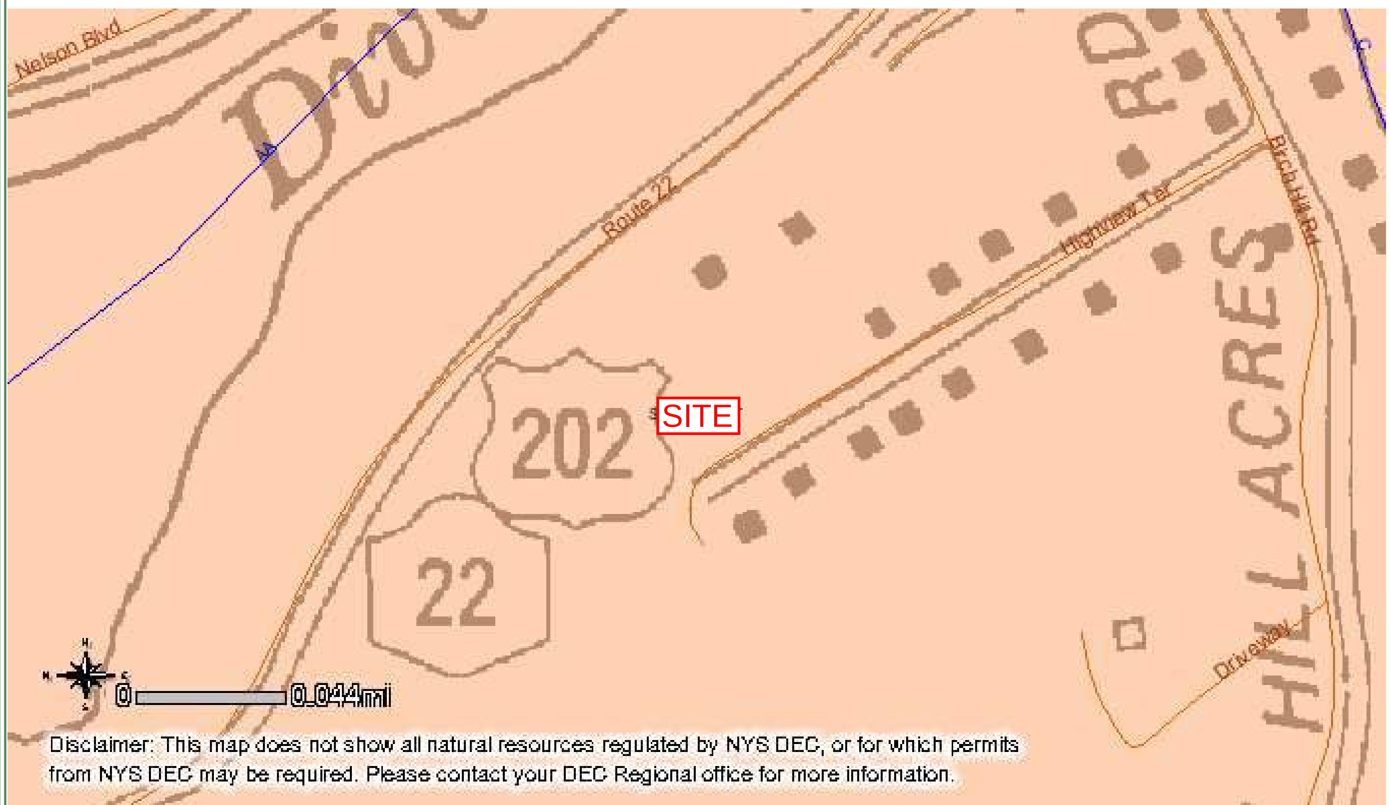
Comments:

Public & Private Property referred by the Town of Southeast.

[print page] [close window]

Please set your printer orientation to "Landscape".

Highview Terrace



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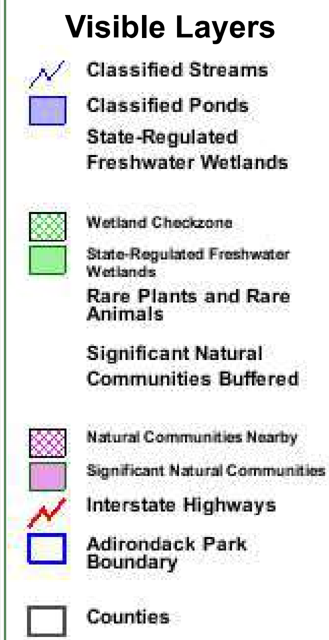

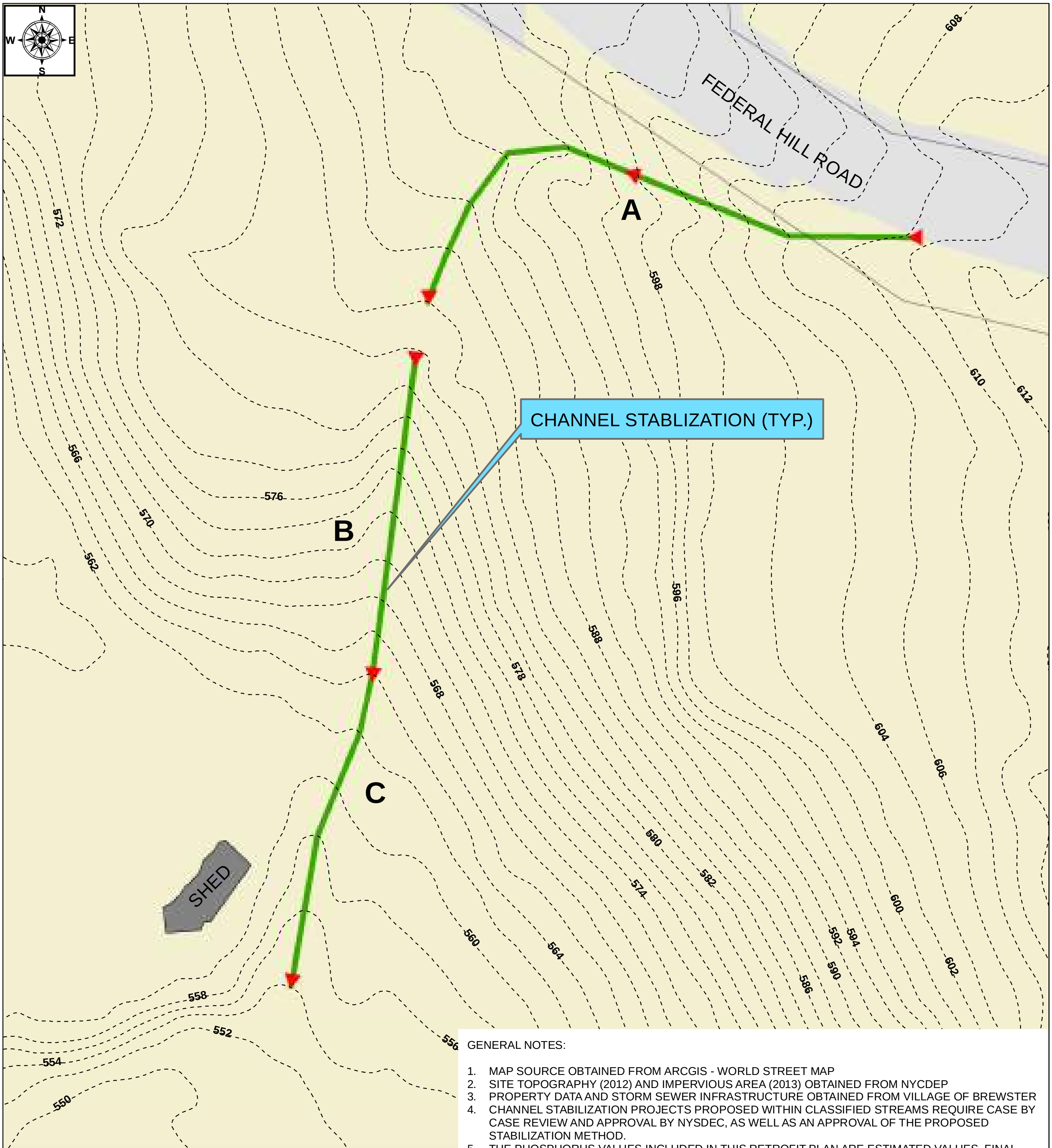

GENERAL NOTES:

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0 25 50 75 100 Feet

Legend

Parcels

Proposed SRP Location

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STORMWATER RETROFIT CONCEPT PLAN

FEDERAL HILL ROAD CHANNEL
118–120 FEDERAL HILL ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15–031
DATE: 8/11/16
SCALE: 1" = 50'

SE-12

GENERAL NOTES:

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Legend

Parcels

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STORMWATER RETROFIT CONCEPT PLAN

FEDERAL HILL ROAD CHANNEL
118-120 FEDERAL HILL ROAD

TOWN OF SOUTHEAST

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 50'

SE-12

SE-12 - Federal Hill Road: Trapezoidal Channel Stabilization P-Loading Calculation				
Channel ID	**A (Private)**	**B (Private)**	**C (Private)**	
Channel Depth - y (ft)	2.0	3.0	3.0	
Channel Bottom Width - B (ft)	1.5	1.0	2.0	
Channel Top Width -T (ft)	3.0	3.0	4.0	
Wetted Perimeter Calculation-P (ft)	5.77	7.32	8.32	
Channel Length-L (ft)	220	142	100	
Soil Erosion Depth-D (ft)	0.065	0.065	0.065	
Soil Erosion Volume-V (ft^3)	82.5	67.6	54.1	
Weight* (lbs)	7,841.3	6,422.5	5,140.4	
Weight (Kg)	3,556.8	2,913.3	2,331.7	
P Load (mg/Yr)**	1,067,039.3	873,978.7	699,507.4	
P Load (Kg/Yr)	1.07	0.87	0.70	
		ESTIMATED TOTAL (KG/YR):	**2.64**	

Notes:

1. Channel dimensions are based upon field measurements estimated by the W&C team during field visits for each channel
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4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Paramaters Basis:

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Soil Erosion Volume: $V = P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

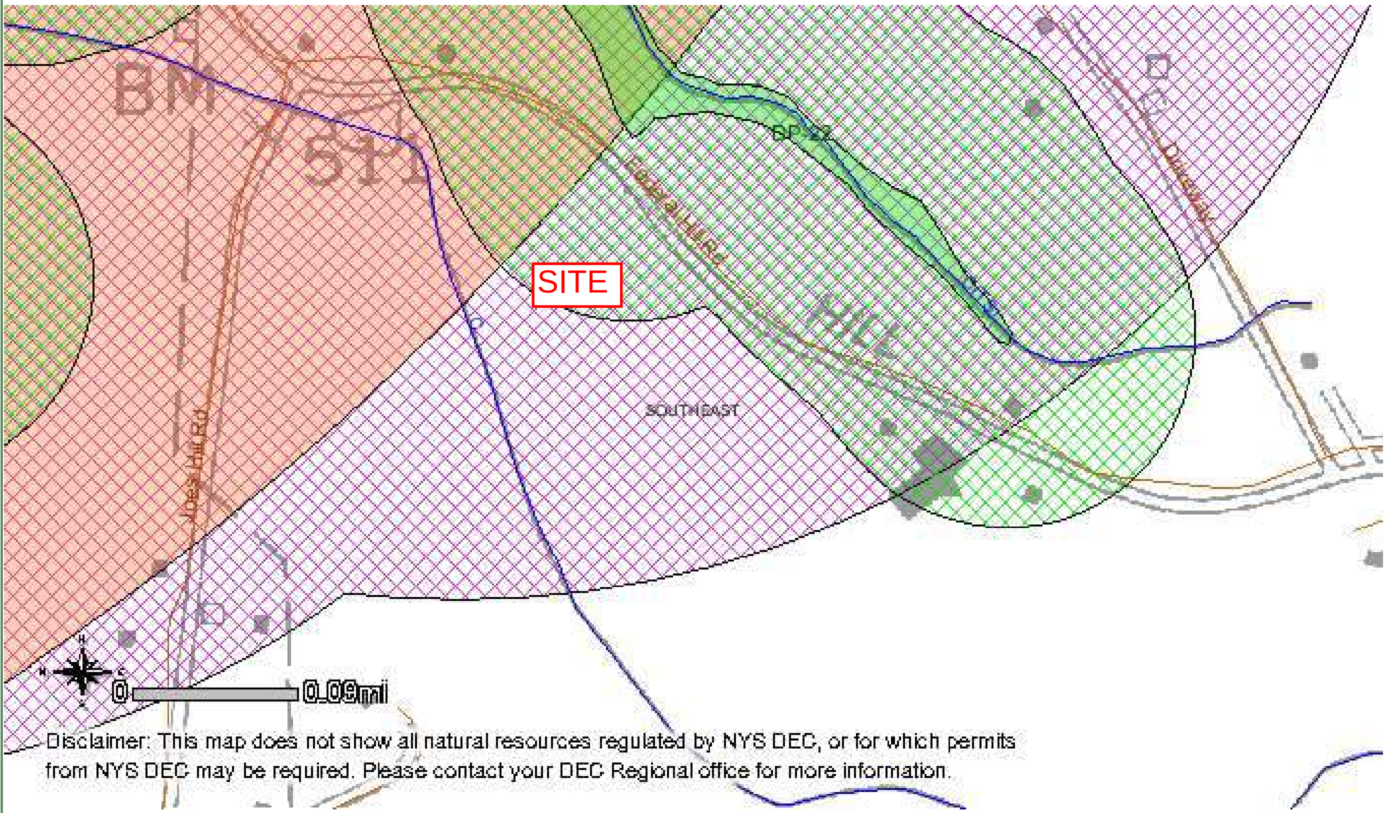
Comments:

Private Property referred by the Town of Southeast (former Melrose School Site).

[print page] [close window]

Please set your printer orientation to "Landscape".

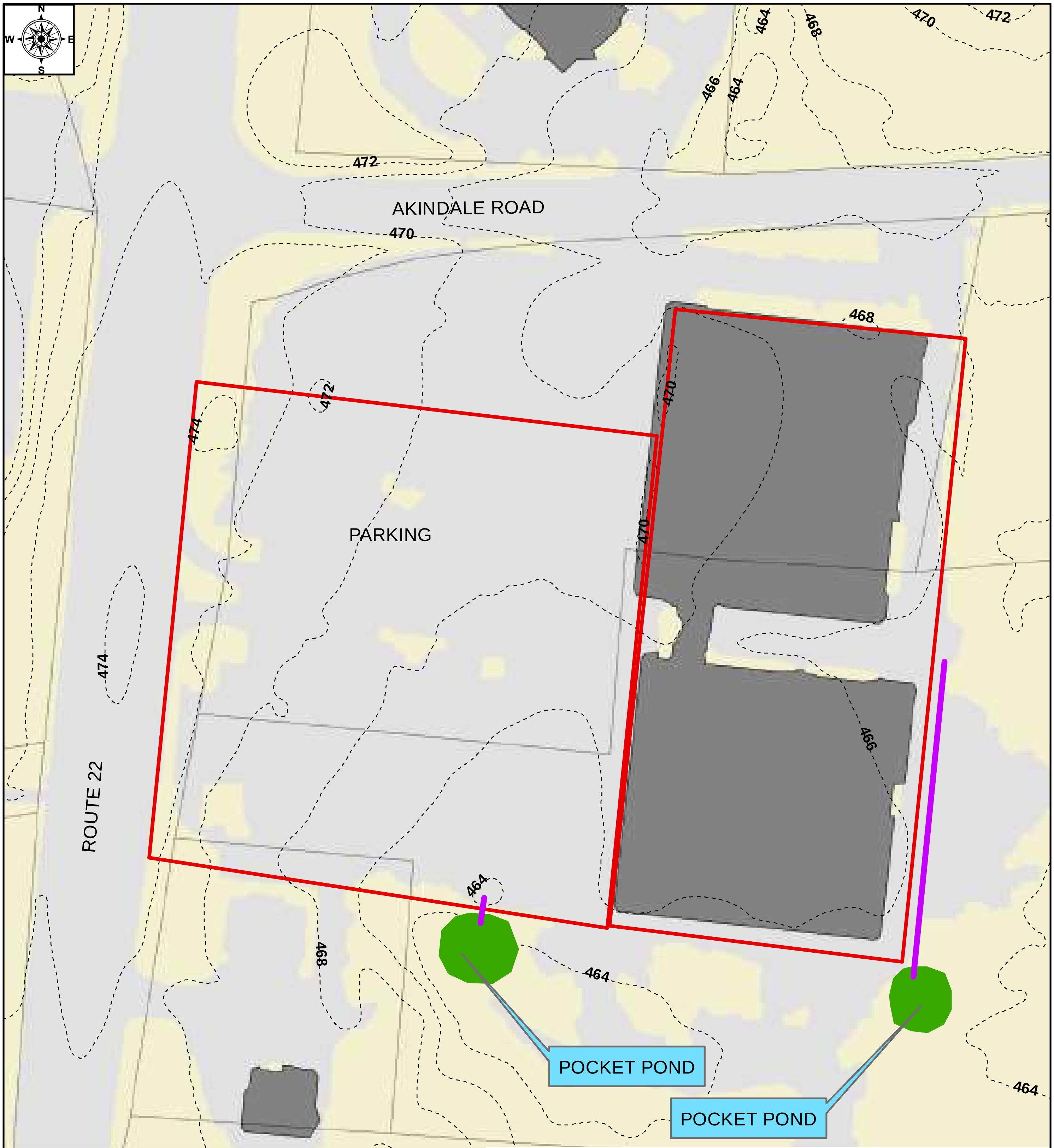
Federal Hill



Disclaimer: This map does not show all natural resources regulated by NYS DEC, or for which permits from NYS DEC may be required. Please contact your DEC Regional office for more information.

MinX: 620422, MaxX: 621567, MinY: 4585171, MaxY: 4584608

Visible Layers



0 50 100 150 200 Feet

Legend

- Proposed Pipe
- Drainage Basins
- Proposed SRP Locations
- Parcels

GENERAL NOTES:

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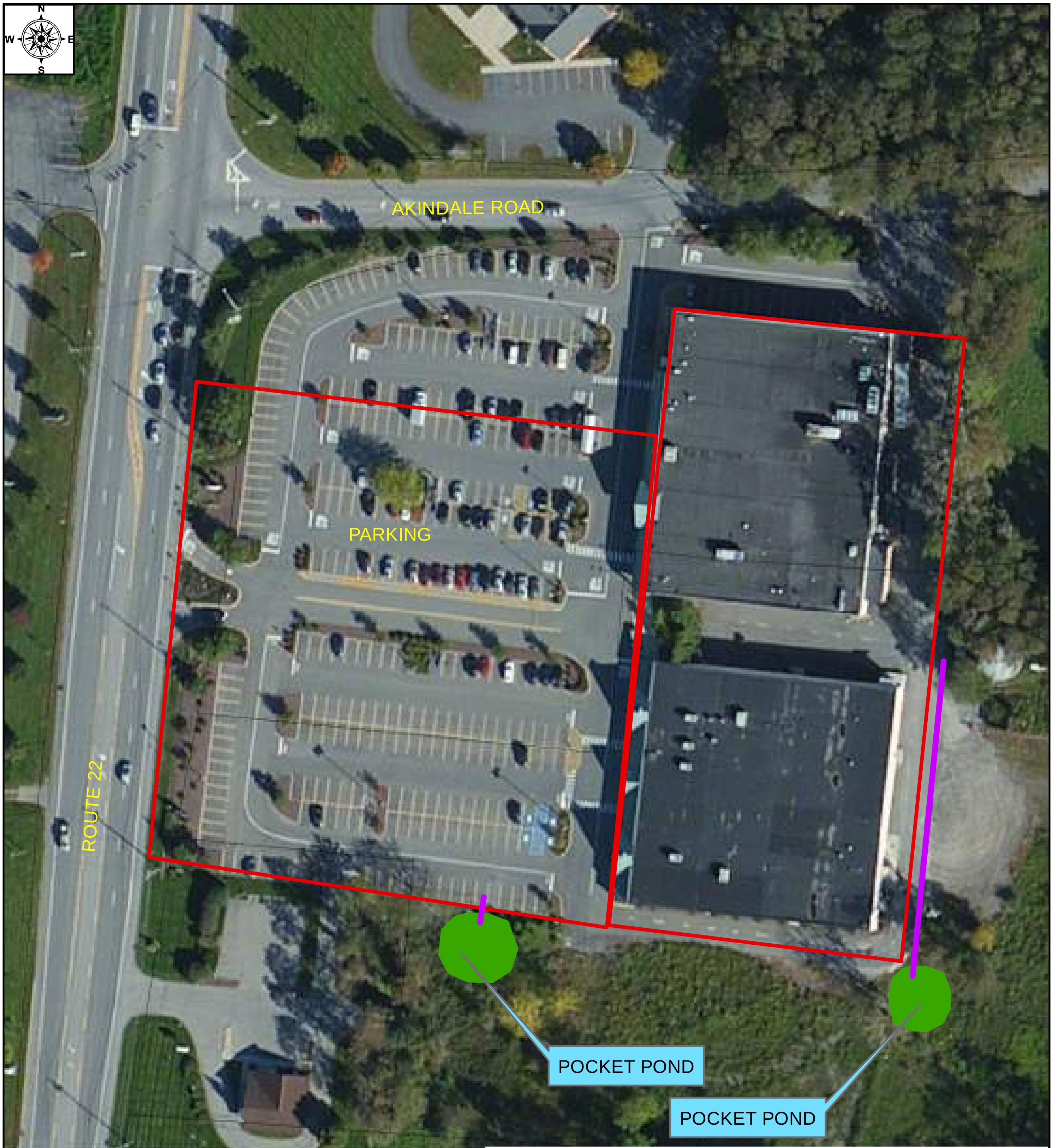
STORMWATER RETROFIT CONCEPT PLAN		158 ROUTE 22 LLC 158 ROUTE 22	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 100'
DESIGNED BY: RAR	CHECKED BY: RAR	TOWN OF PAWLING	PW-1
DRAWN BY: JBM			



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STORMWATER RETROFIT CONCEPT PLAN

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

158 ROUTE 22 LLC
158 ROUTE 22

TOWN OF PAWLING

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 100'

PW-1

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	PW-1
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"PW-1: 158 Route 22 LLC"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	5.09019	acres	where:	A =	Contributing Area (acres)
I =	4.73	92.92%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.8863			WQv =	Water Quality Volume
Rv (min)**** =**	0.8863				
WQv (acre-ft) =	**0.451**				
WQv (cu-ft) =	**19652**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.8863		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	5.09019		Rv =	Runoff Coefficient
C =	0.49		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.07
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.93
Developed Open Space	0
Weighted "C":	*0.49*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	Pocket Pond	
Removal Efficiency:	*67%*	
P Load ------------------->	**20.27**	lb/yr
	9.20	kg/yr
P Removal ------------------->	**13.58**	lb/yr
	6.16	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**5.1**	Phosphorus Loading (kg/yr)	**9.20**
Water Quality Volume (cf)	**19652**	Phosphorus Reduction (kg/yr)	**6.16**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Calculations include total combined area for 2 Pocket Ponds.
Soils investigation should be completed to identify if infiltration could be a suitable alternative practice.
Captures runoff from existing retail center buildings and parking lot.

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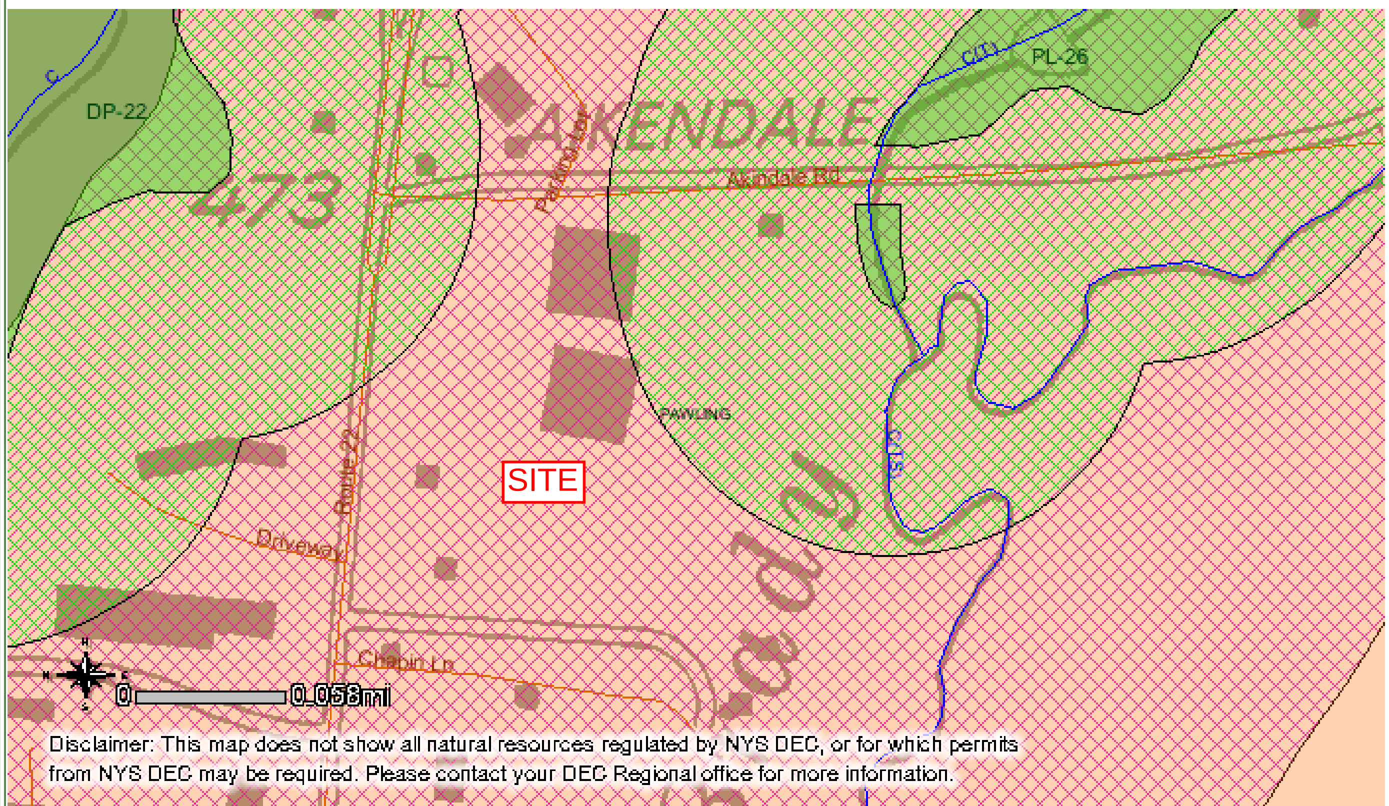
Please set your printer orientation to "Landscape".

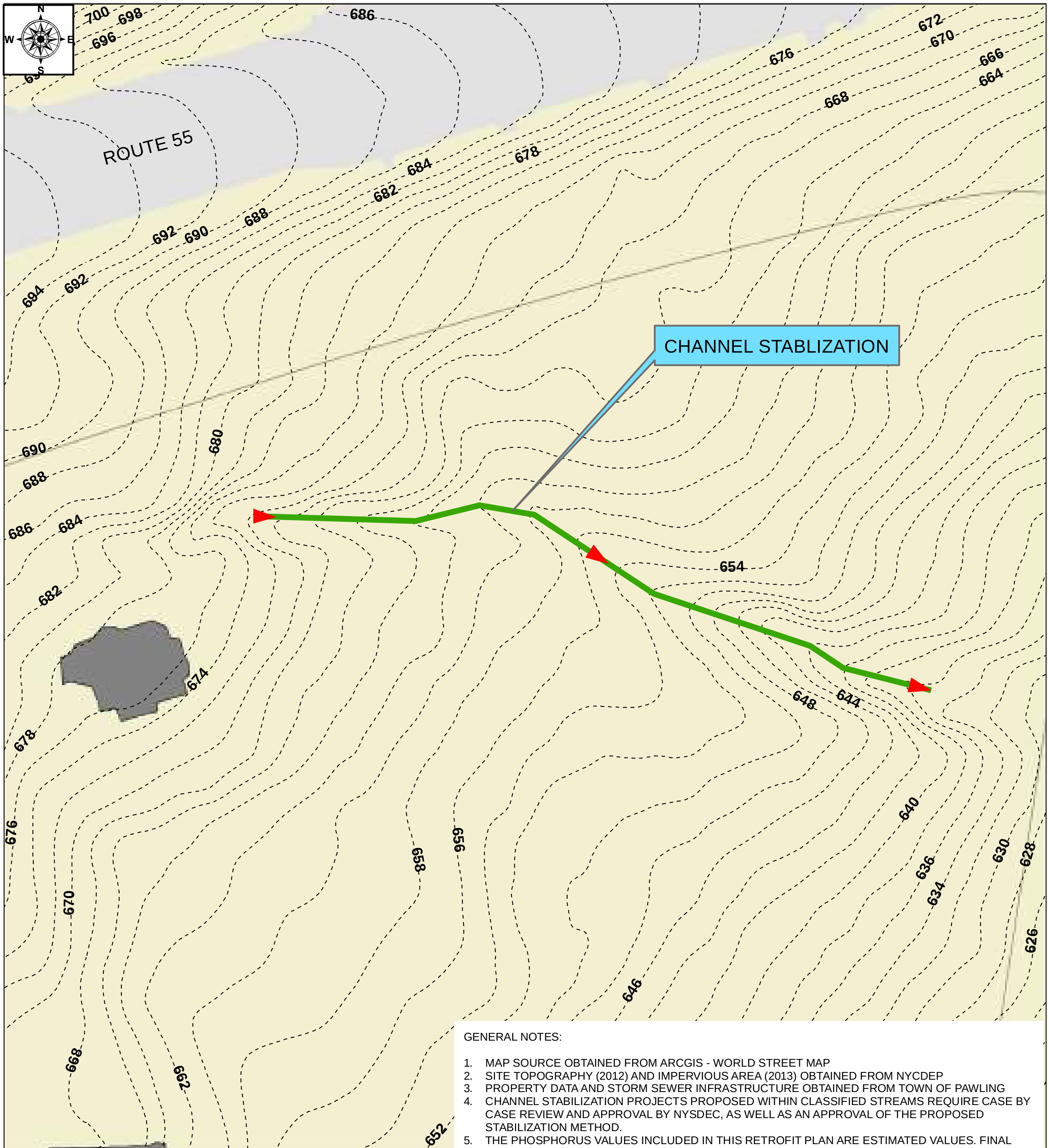
158 Route 22 LLC



MinX: 617831, MaxX: 618677, MinY: 4599463, MaxY: 4599047

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



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0 25 50 75 100 Feet

Legend

Channel to be Stabilized

Parcels

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

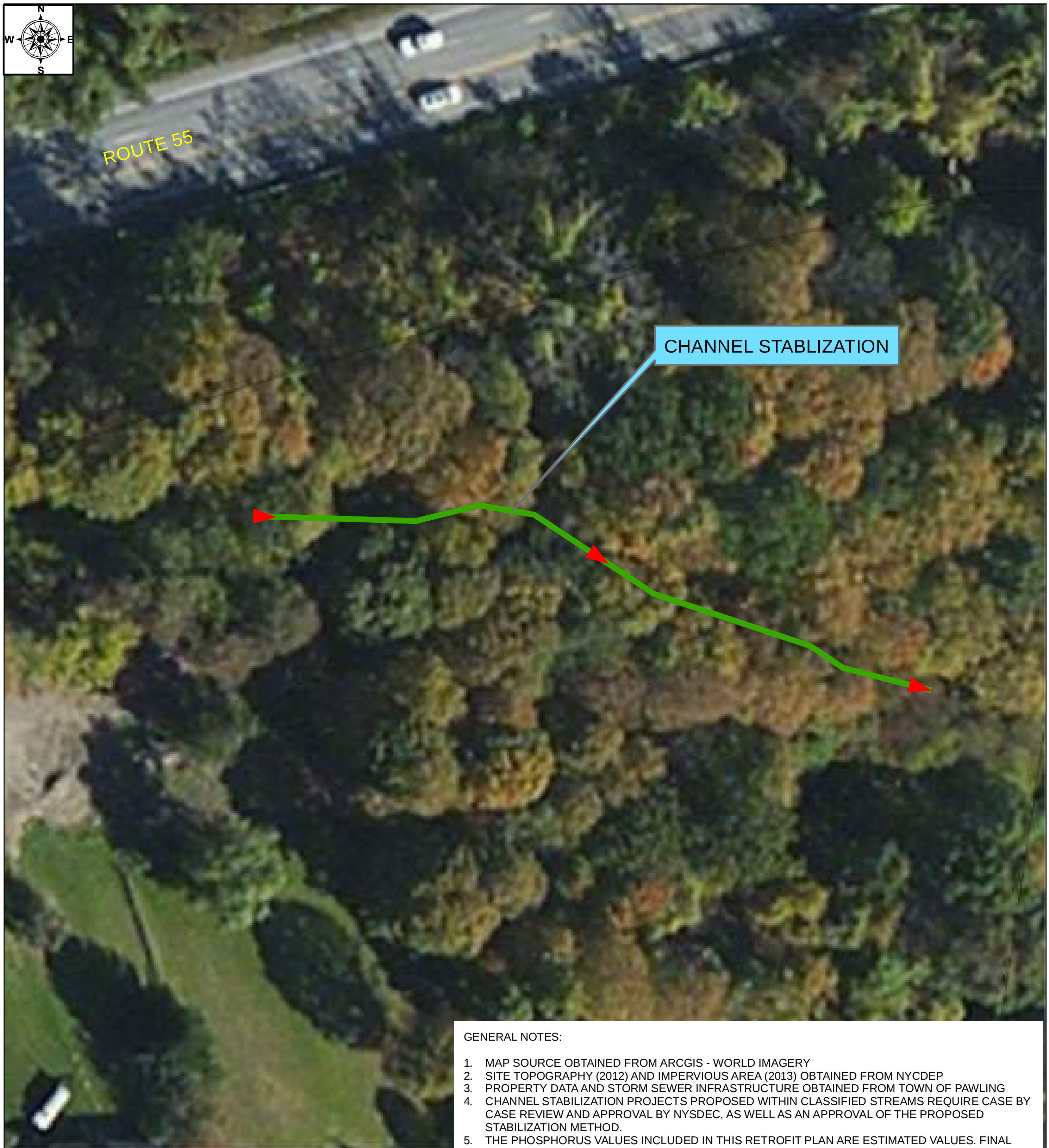
DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

DALEY, JOHN
3874 ROUTE 55

TOWN OF PAWLING

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 50'

PW-2



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STORMWATER RETROFIT CONCEPT PLAN

DALEY, JOHN
3874 ROUTE 55

TOWN OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 50'

PW-2

PW-2 - Daley John: Parabolic Channel Stabilization P-Loading Calculation				
Channel ID	**A (Private)**			
Channel Depth - y (ft)	4.0			
Channel Top Width -T (ft)	8.0			
Wetted Perimeter Calculation- P (ft)	13.32			
Channel Length-L (ft)	268			
Soil Erosion Depth-D (ft)	0.065			
Soil Erosion Volume-V (ft^3)	232.0			
Weight* (lbs)	22,043.3			
Weight (Kg)	9,998.8			
P Load (mg/Yr)**	2,999,647.9			
P Load (Kg/Yr)	3.00			
ESTIMATED TOTAL (KG/YR):	**3.00**			

Notes:

1. Channel dimensions are based upon field measurements estimated by the W&C team during field visits for each channel
2. The soil erosion depth has been assumed to be 0.065, and is a conservative assumption based upon the statistical analysis and results included in the study titled "A Practical Method of Computing Streambank Erosion Rate". This study was the basis of the revised approved channel stabilization methodology/calculations as approved by NYSDEC. The assumed 0.065 value was based specifically on the data presented in Figures 2 and 3 titled "Stream Bank Erodibility", that correspond to Low Bank Erosion Hazard Index and Low Near Bank Stress ratings.
3. The phosphorus values included in this retrofit plan are estimated values. Final signed and sealed phosphorus loading calculations will need to be performed in accordance with the EOHWC Design Manual consistent with the latest approved NYSDEC “Alternative Channel Stabilization Formula”. The final calculations should include surveys to confirm channel dimensions, and a complete analysis and computations of all input parameters used in the “Alternative Channel Stabilization Formula”, including the BEHI and NBS indexes.
4. Channel stabilization projects proposed within classified streams require case by case review and approval by NYSDEC, as well as an approval of the proposed stabilization method.

Equation and Input Parameters Basis:

Wetted Perimeter (P) approximately: $P = T + [(8/3) * (y^2/T)]$

Soil Erosion Volume: $V = P*L*D$

BD* = bulk density (typ. 95 lb/CF)

Ptest** = phosphorus level in soil (typ. 300 mg/kg)

Comments:

Private Residential Property referred by the Town of Pawling.

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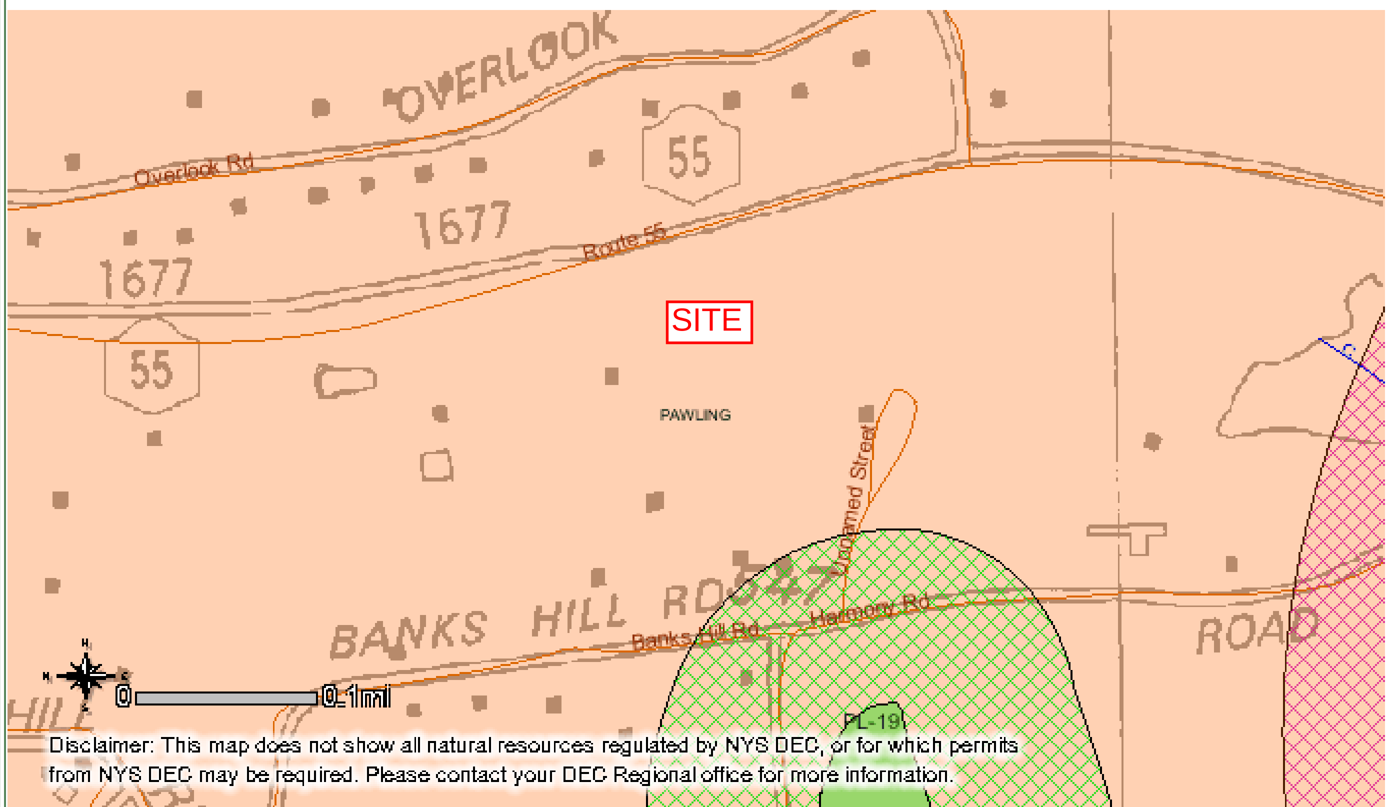
Please set your printer orientation to "Landscape".

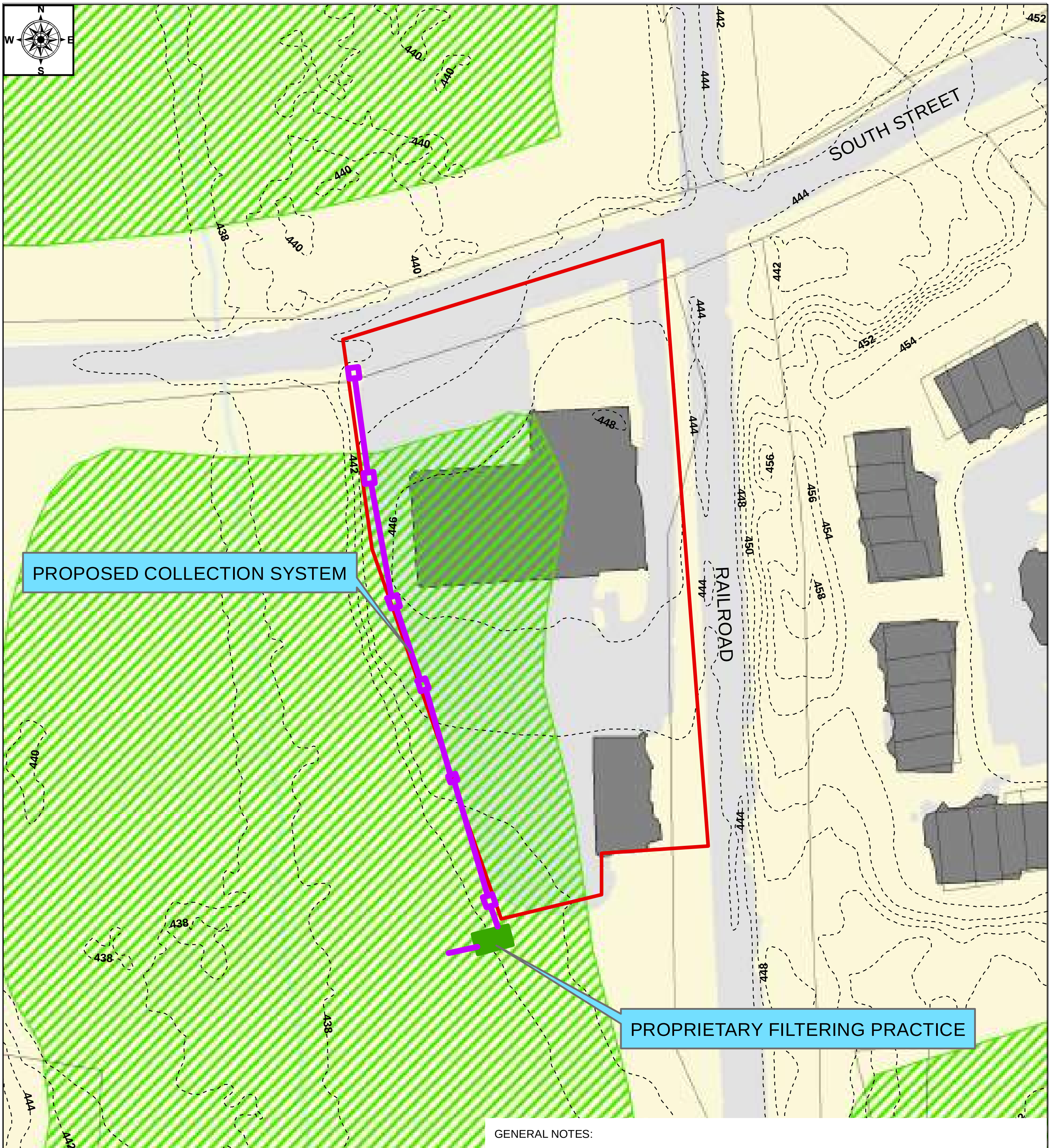
Daley, John



MinX: 614454, MaxX: 615665, MinY: 4601294, MaxY: 4600698

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF PAWLING

0 50 100 150 200 Feet

Legend

- Proposed Pipe
- Proposed SRP Locations
- Drainage Basins
- Parcels
- Mapped Wetland Area

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STORMWATER RETROFIT CONCEPT PLAN

PAWLING FIRE DEPT. INC.
25 SOUTH STREET

TOWN OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 100'

PW-3

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF PAWLING

0 50 100 150 200 Feet

Legend

- Proposed Pipe
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STORMWATER RETROFIT CONCEPT PLAN

PAWLING FIRE DEPT. INC.
25 SOUTH STREET

TOWN OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR	JOB NO: 15-031	
DRAWN BY: JBM		DATE: 8/11/16	
		SCALE: 1" = 100'	

PW-3

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #: PW-3
Prepared for: EOHC
Prepared by: RED
Project County: Dutchess

"PW-3: Pawling Fire House"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

			where:	
A =	14.5792	acres	A =	Contributing Area (acres)
I =	1.81	12.41%	I =	Impervious Area (acres/%)
P =	1.2	inches	P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.1617		WQv =	Water Quality Volume
Rv (min)**** =**	0.2000			
WQv (acre-ft) =	**0.292**			
WQv (cu-ft) =	**12701**			

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:
Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.145	hours	Tc =	Time of Concentration (hours)
CN =	84		CN =	Curve Number
qu =	526.256		qu =	Unit Peak Discharge ($cfs/mi^2/inch$)
Qp =	2.87714	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

		where:	
P =	45	P Load=	Annual load (kg/yr)
Pj =	0.9	P =	Annual Rainfall (inches)
Rv =	0.1617	Pj =	Fraction of rainfall producing Runoff = 0.9
A =	14.5792	Rv =	Runoff Coefficient
C =	0.47	C =	Pollutant Concentration (mg/l)
		A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.16
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.84
Developed Open Space	0
Weighted "C":	*0.47*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION

Proposed Retrofit Practice:	**Proprietary Filtering**	
Removal Efficiency:	***40%***	
P Load -------------------->	**10.28**	lb/yr
	4.66	kg/yr
P Removal -------------------->	**4.11**	lb/yr
	1.87	kg/yr

Summary:

Proposed Retrofit Practice	Proprietary Filtering		
Drainage Area (acres)	**14.6**	Phosphorus Loading (kg/yr)	**4.66**
Water Quality Volume (cf)	**12701**	Phosphorus Reduction (kg/yr)	**1.87**

ASSUMPTIONS/COMMENTS:

Install practice on property owned by Pawling Fire Dept Inc.
Assumes the installation of curb and storm collection pipe along west side of driveway.
Adjacent wetland will require a delineation to confirm area available for practice.
Further soils and topographic investigation should be completed to identify if surface sand filters could be a suitable alternative practice.

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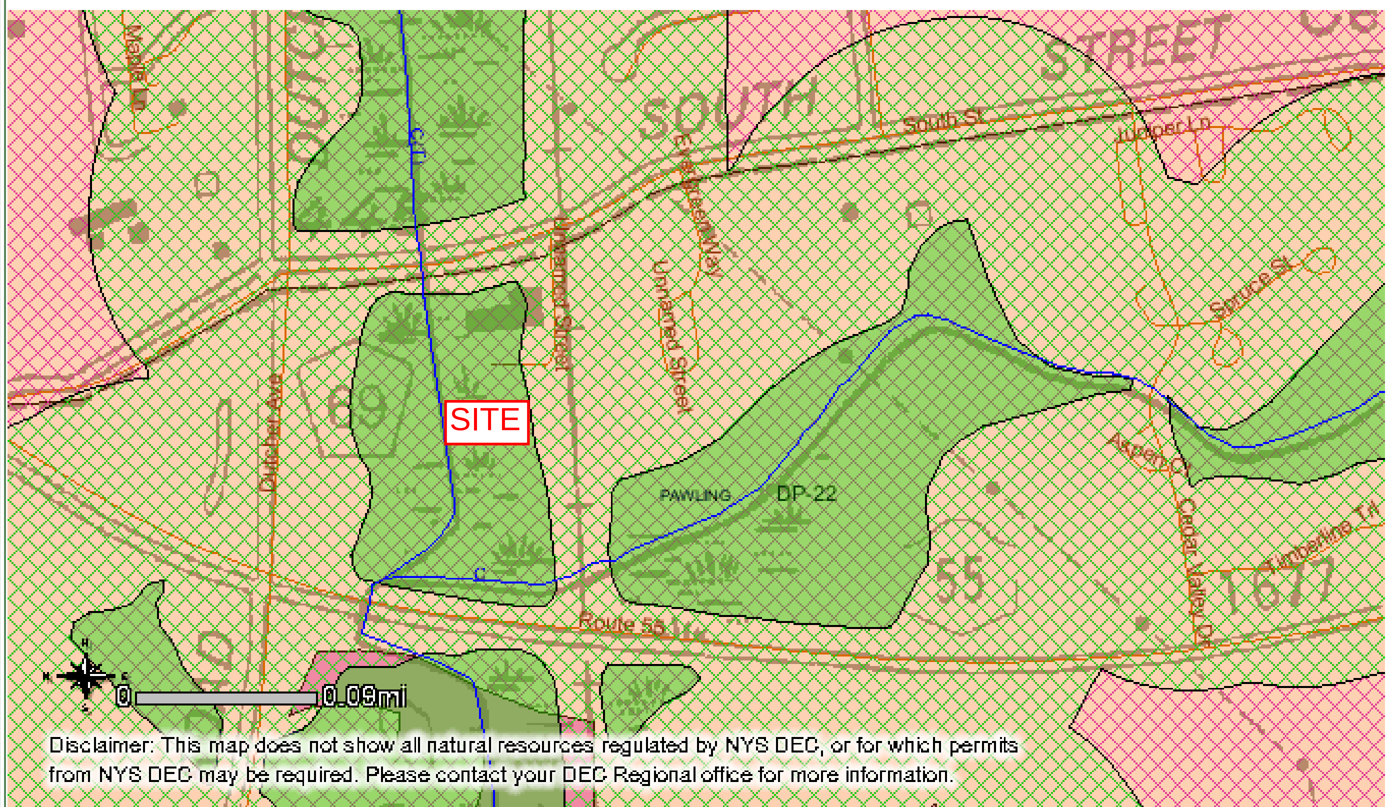
Please set your printer orientation to "Landscape".

Pawling Fire Dept.



MinX: 616169, MaxX: 617201, MinY: 4601195, MaxY: 4600688

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM TOWN OF PAWLING

0 100 200 300 400 Feet

Legend

- Proposed Pipe
- Drainage Basins
- Proposed SRP Locations
- Parcels

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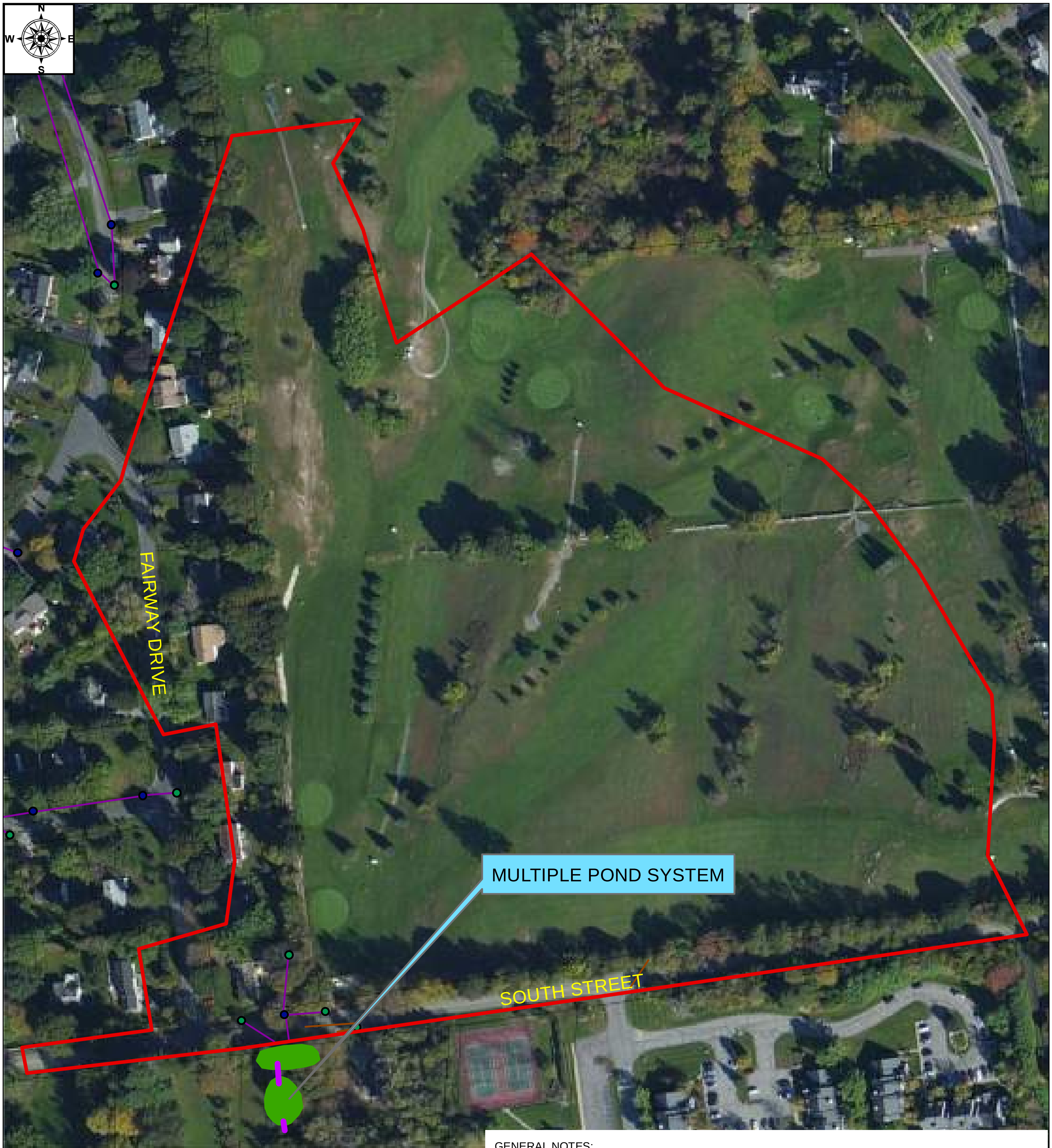
STORMWATER RETROFIT CONCEPT PLAN	SOUTH STREET 29 SOUTH STREET	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 200'
DESIGNED BY: RAR CHECKED BY: RAR DRAWN BY: JBM	TOWN OF PAWLING	PW-4



GENERAL NOTES:

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Legend

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- Parcels

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STORMWATER RETROFIT CONCEPT PLAN	SOUTH STREET 29 SOUTH STREET	JOB NO: 15-031	DATE: 8/11/16
		SCALE: 1" = 200'	
DESIGNED BY: RAR	CHECKED BY: RAR	TOWN OF PAWLING	PW-4
DRAWN BY: JBM			

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	PW-4
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"PW-4: South Street"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	27.3984	acres	where:	A =	Contributing Area (acres)
I =	2.55	9.31%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.1338			WQv =	Water Quality Volume
Rv (min)**** =**	0.2000				
WQv (acre-ft) =	**0.548**				
WQv (cu-ft) =	**23870**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.1338		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	27.3984		Rv =	Runoff Coefficient
C =	0.32		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.1
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.09
Developed Open Space	0.81
Weighted "C":	*0.32*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Multiple Pond**	
Removal Efficiency:	***76%***	
P Load -------------------->	**10.95**	lb/yr
	4.97	kg/yr
P Removal -------------------->	**8.32**	lb/yr
	3.77	kg/yr

Summary:

Proposed Retrofit Practice	Multiple Pond		
Drainage Area (acres)	**27.4**	Phosphorus Loading (kg/yr)	**4.97**
Water Quality Volume (cf)	**23870**	Phosphorus Reduction (kg/yr)	**3.77**

ASSUMPTIONS/COMMENTS:

Install practice on property owned by the Town of Pawling.
Assumes the installation of additional swales or storm collection pipe along South Street.
Landscape screening from adjacent neighbor will be required.

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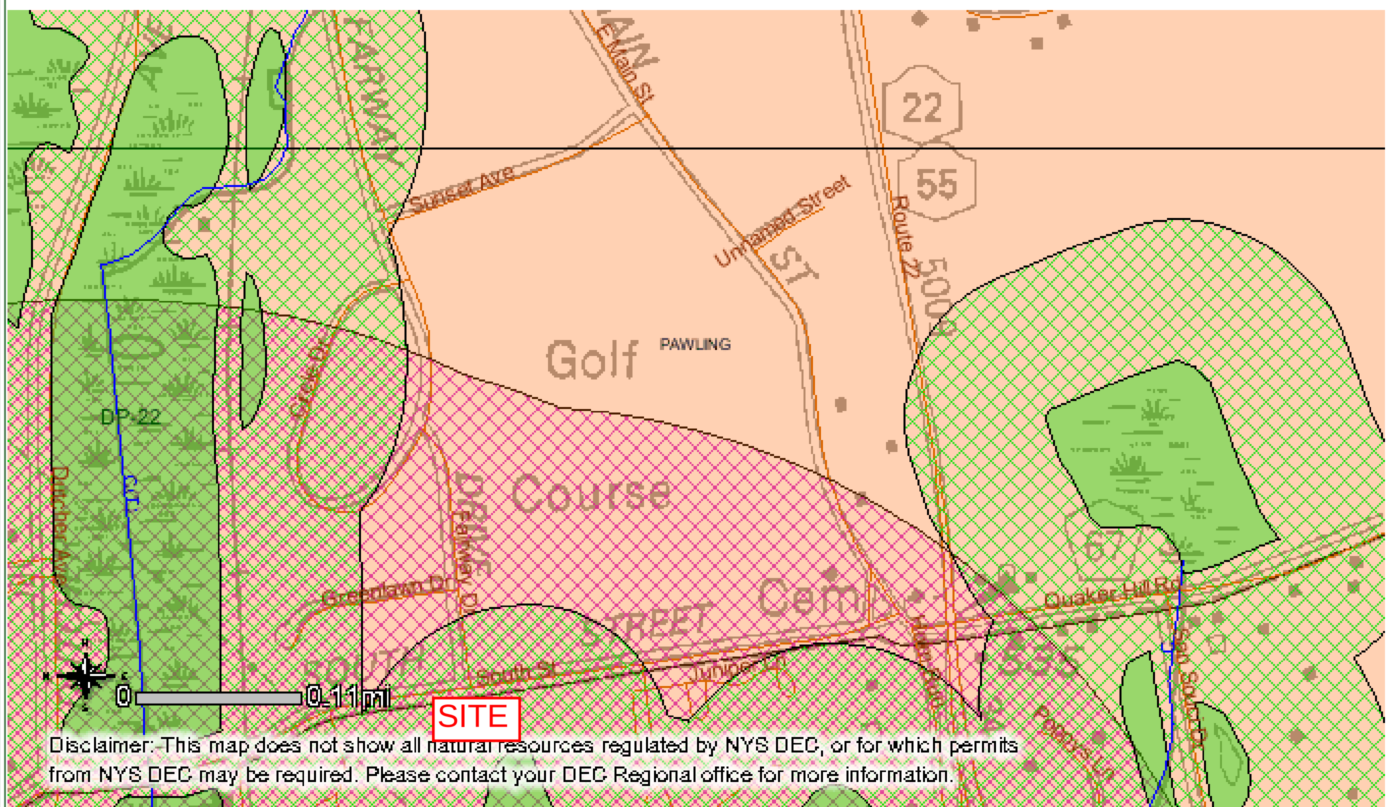
South Street



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Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
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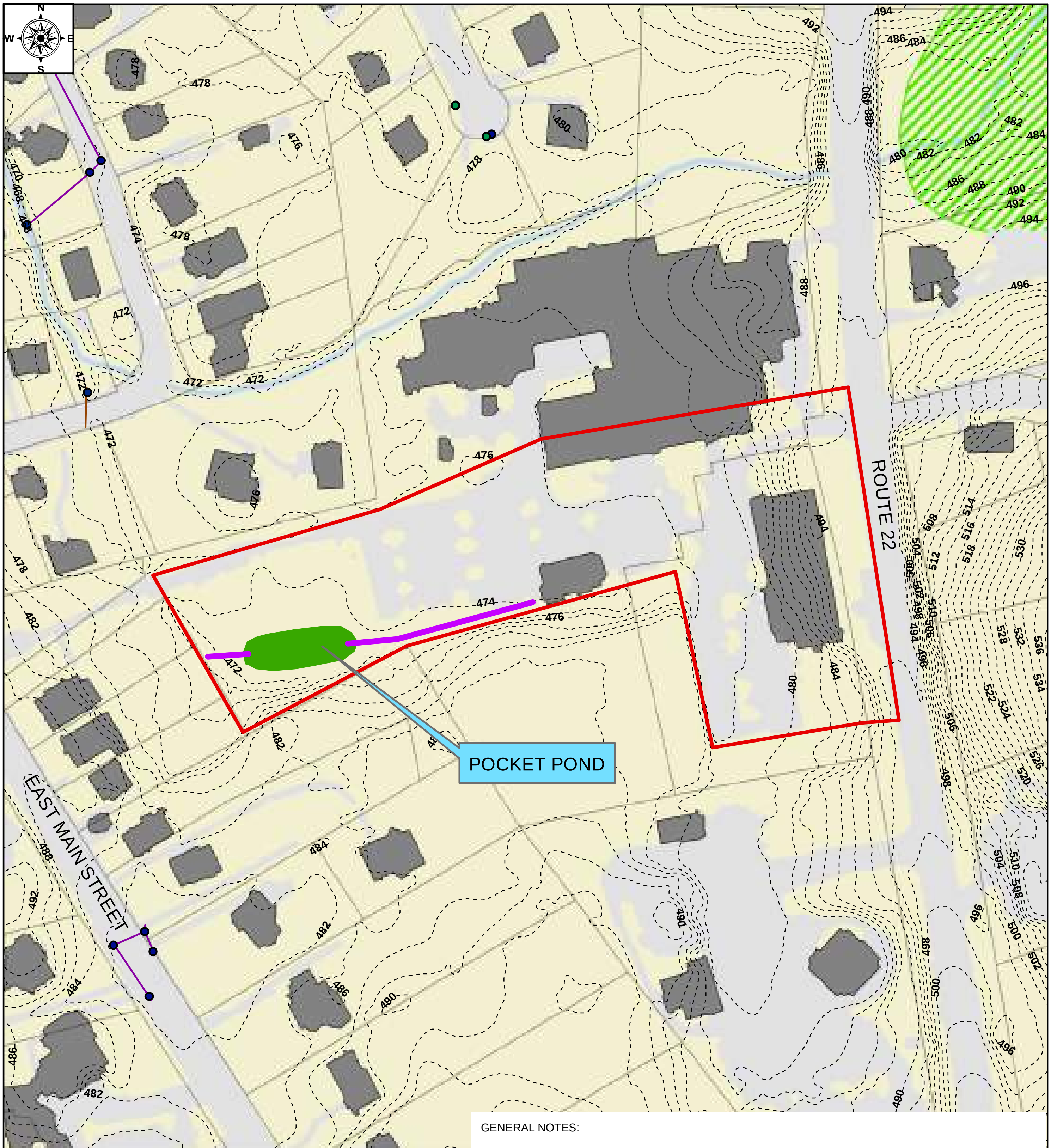
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

Legend

0 75 150 225 300 Feet

- Proposed Pipe
- Drainage Basins
- Proposed SRP Locations
- Parcels
- Mapped Wetland Area

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COMMITMENT & INTEGRITY DRIVE RESULTS

STORMWATER RETROFIT CONCEPT PLAN

MIZZENTOP DAY SCHOOL
70 NY-22

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 150'

VPW-1

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

0 75 150 225 300 Feet

Legend

- Proposed Pipe
- Drainage Basins
- Proposed SRP Locations
- Parcels
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STORMWATER RETROFIT CONCEPT PLAN

MIZZENTOP DAY SCHOOL
70 NY-22

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO:	15-031
DATE:	8/11/16
SCALE:	1" = 150'

VPW-1

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VPW-1
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"VPW-1: Mizzentop Day School"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.99598	acres	where:	A =	Contributing Area (acres)
I =	2.16	54.05%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.5365			WQv =	Water Quality Volume
Rv (min)**** =**	0.5365				
WQv (acre-ft) =	**0.214**				
WQv (cu-ft) =	**9338**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.5365		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.99598		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.46
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.54
Developed Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Pocket Pond**	
Removal Efficiency:	***67%***	
P Load -------------------->	**8.40**	lb/yr
	3.81	kg/yr
P Removal -------------------->	**5.63**	lb/yr
	2.55	kg/yr

Summary:

Proposed Retrofit Practice	Pocket Pond		
Drainage Area (acres)	**4.0**	Phosphorus Loading (kg/yr)	**3.81**
Water Quality Volume (cf)	**9338**	Phosphorus Reduction (kg/yr)	**2.55**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Existing site contains a private school and offices.
Adjacent parcel owned by Inspirational Book Service Inc. appears to be part of the drainage area.

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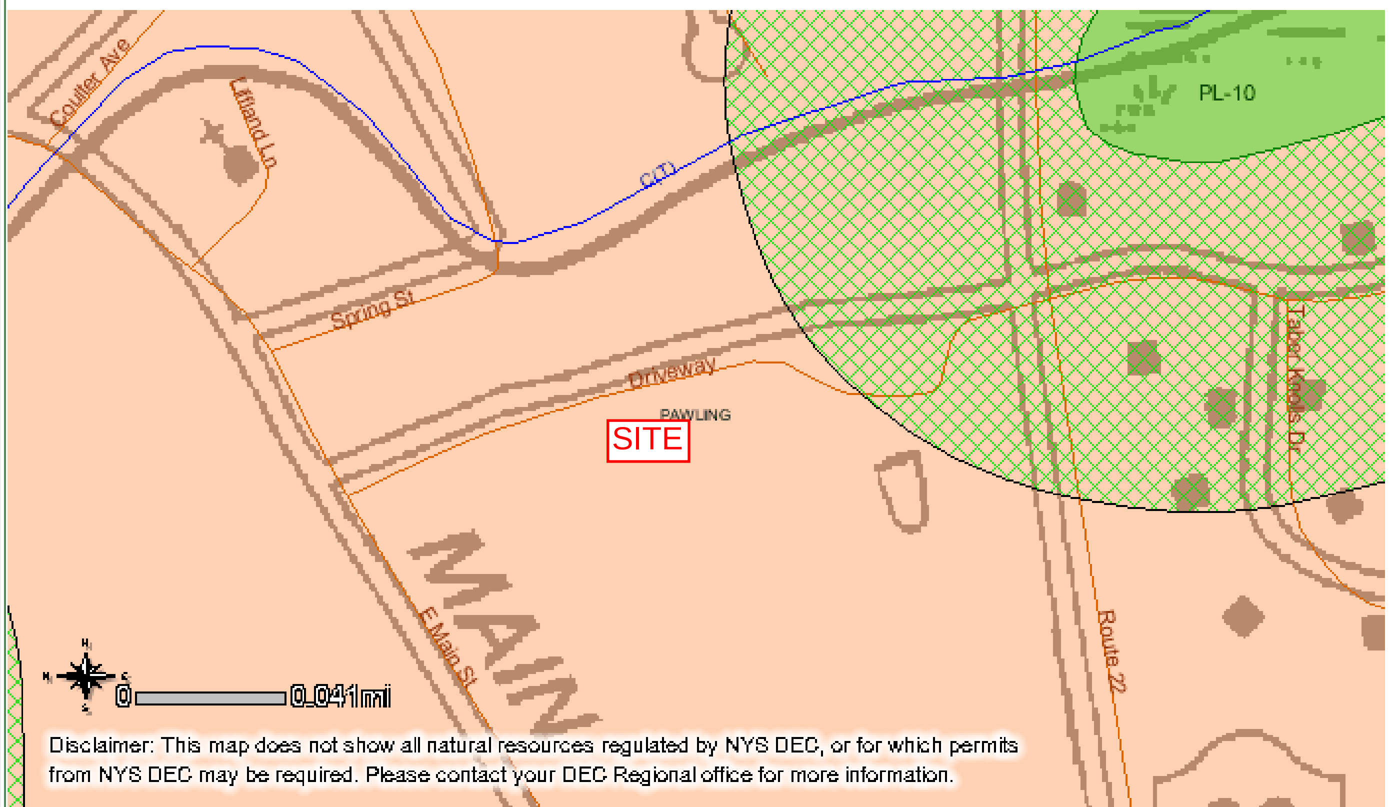
Please set your printer orientation to "Landscape".

Foundation for Christian Living



MinX: 616771, MaxX: 617371, MinY: 4602108, MaxY: 4601813

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
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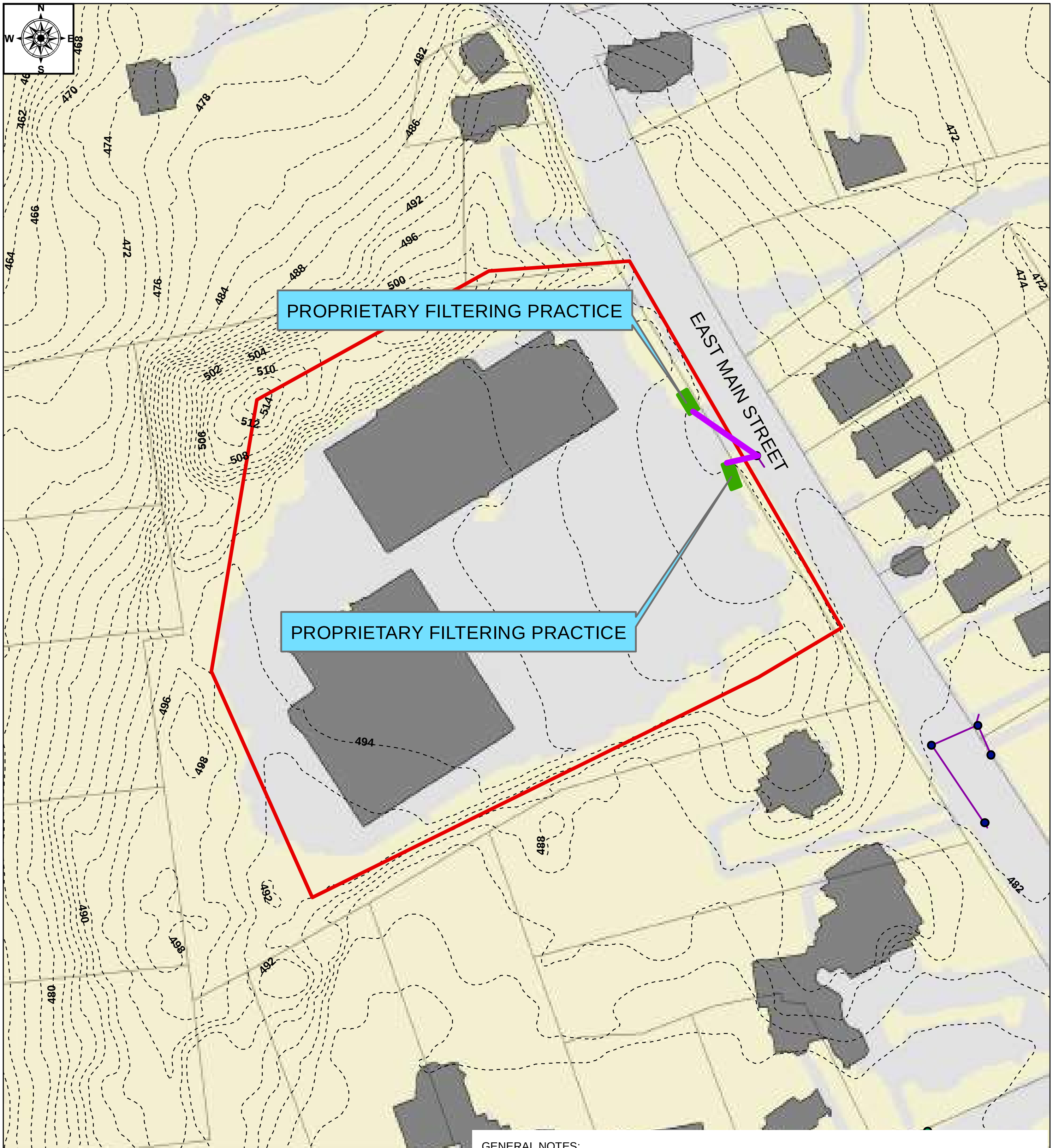

GENERAL NOTES:

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2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

N
W E
S

Legend

- Proposed Pipe
- Proposed SRP Locations
- Drainage Basins
- Parcels

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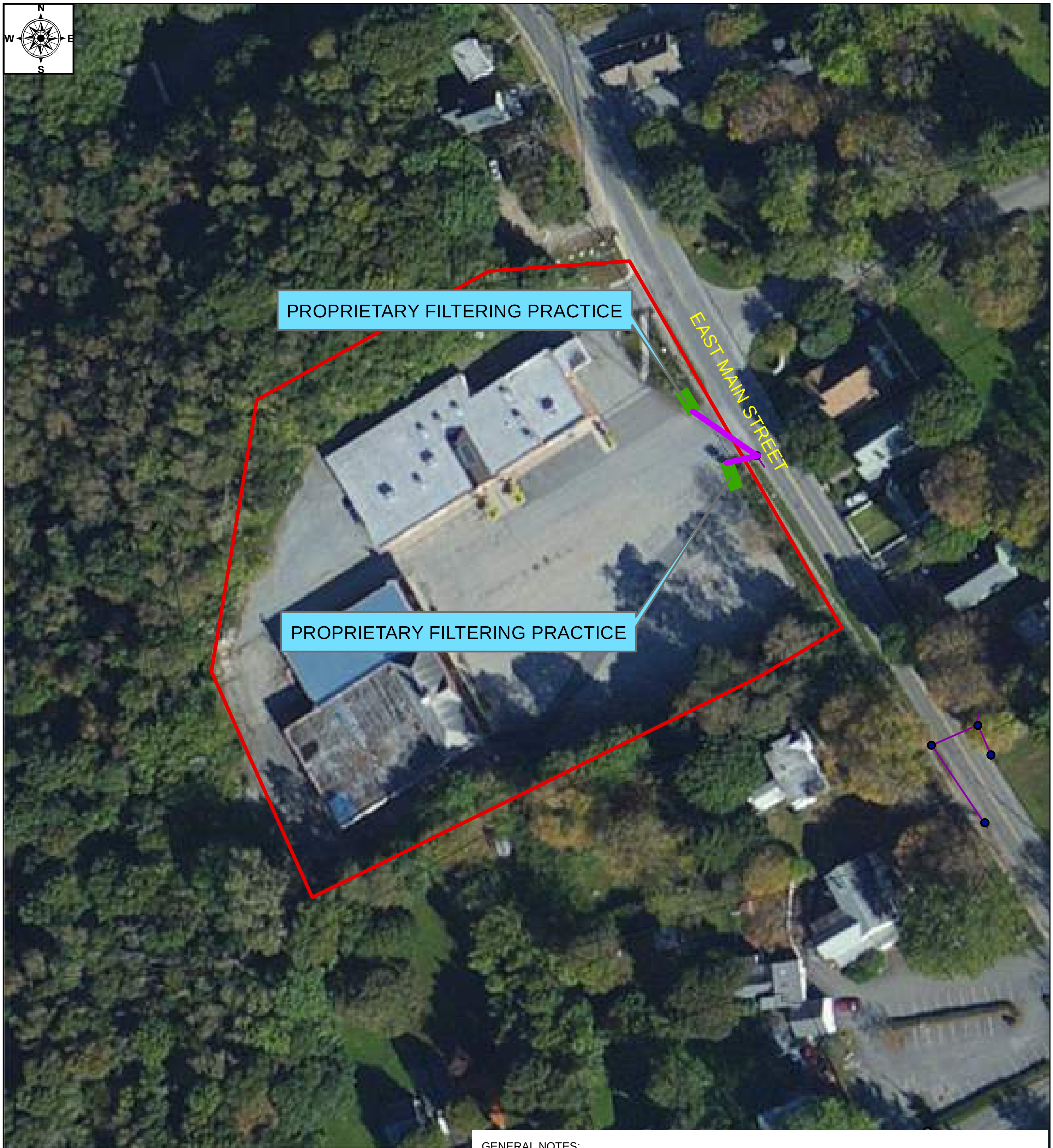
STORMWATER RETROFIT CONCEPT PLAN		LAPPAS INC. 69 EAST MAIN STREET	JOB NO: 15-031 DATE: 8/11/16 SCALE: 1" = 100'
DESIGNED BY: RAR DRAWN BY: JBM	CHECKED BY: RAR	VILLAGE OF PAWLING	VPW-2



GENERAL NOTES:

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2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

N
W E
S

Legend

Proposed Pipe	Proposed SRP Locations
Drainage Basins	Parcels

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STORMWATER RETROFIT CONCEPT PLAN

LAPPAS INC.
69 EAST MAIN STREET

VILLAGE OF PAWLING

JOB NO: 15-031	
DATE: 8/11/16	
SCALE: 1" = 100'	
VPW-2	

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VPW-2
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"VPW-2: Lappas Inc."

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	3.135	acres	where:	A =	Contributing Area (acres)
I =	2.46	78.47%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.7562			WQv =	Water Quality Volume
Rv (min)**** =**	0.7562				
WQv (acre-ft) =	**0.237**				
WQv (cu-ft) =	**10327**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.098	hours	Tc =	Time of Concentration (hours)
CN =	97		CN =	Curve Number
qu =	610.509		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	2.71381	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.7562		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	3.135		Rv =	Runoff Coefficient
C =	0.47		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.21
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.79
Developed Open Space	0
Weighted "C":	*0.47*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Proprietary Filtering**	
Removal Efficiency:	***40%***	
P Load -------------------->	**10.17**	lb/yr
	4.61	kg/yr
P Removal -------------------->	**4.07**	lb/yr
	1.84	kg/yr

Summary:

Proposed Retrofit Practice	Proprietary Filtering		
Drainage Area (acres)	**3.1**	Phosphorus Loading (kg/yr)	**4.61**
Water Quality Volume (cf)	**10327**	Phosphorus Reduction (kg/yr)	**1.84**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.

One retail building is currently not in use.

Captures runoff from existing retail center buildings and parking lot prior to discharge into the Village of Pawling storm drain system.

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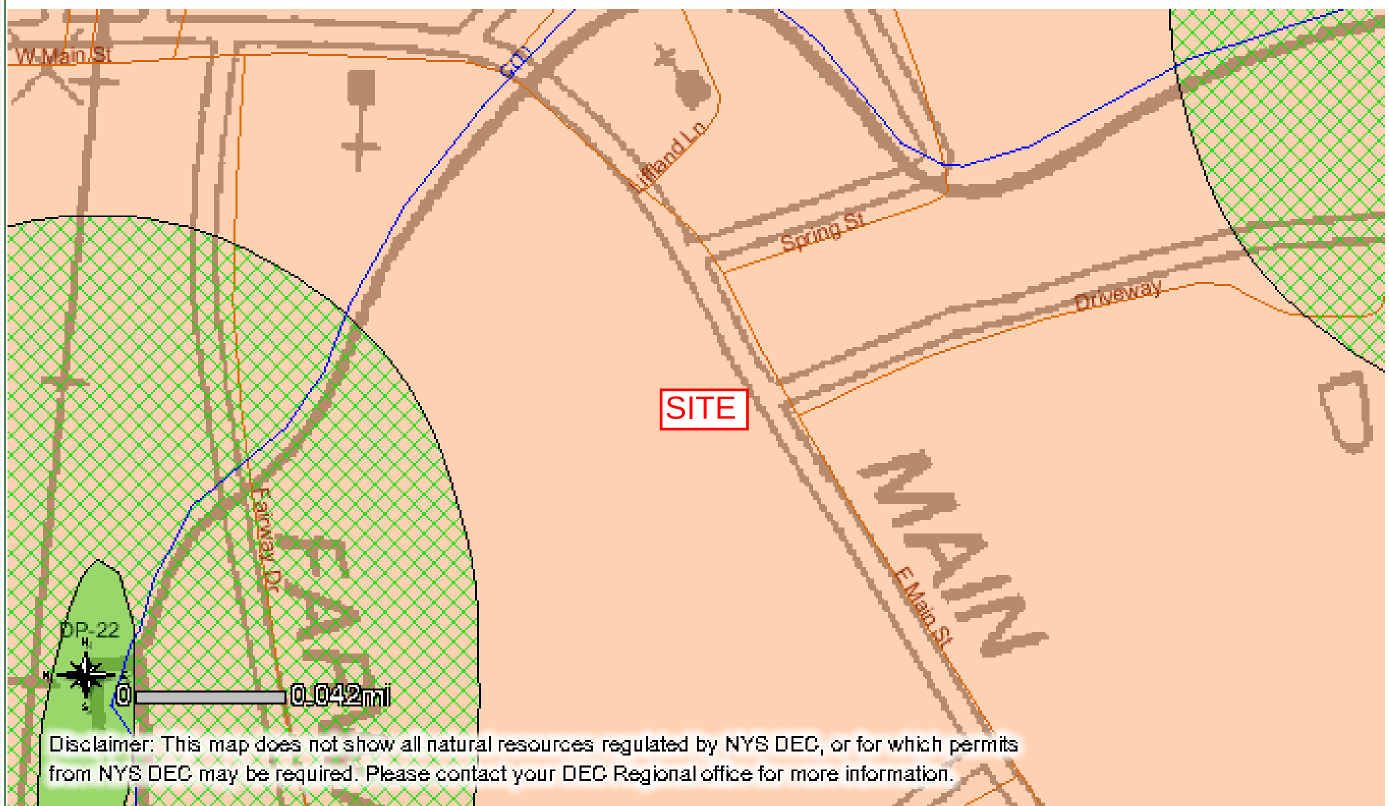
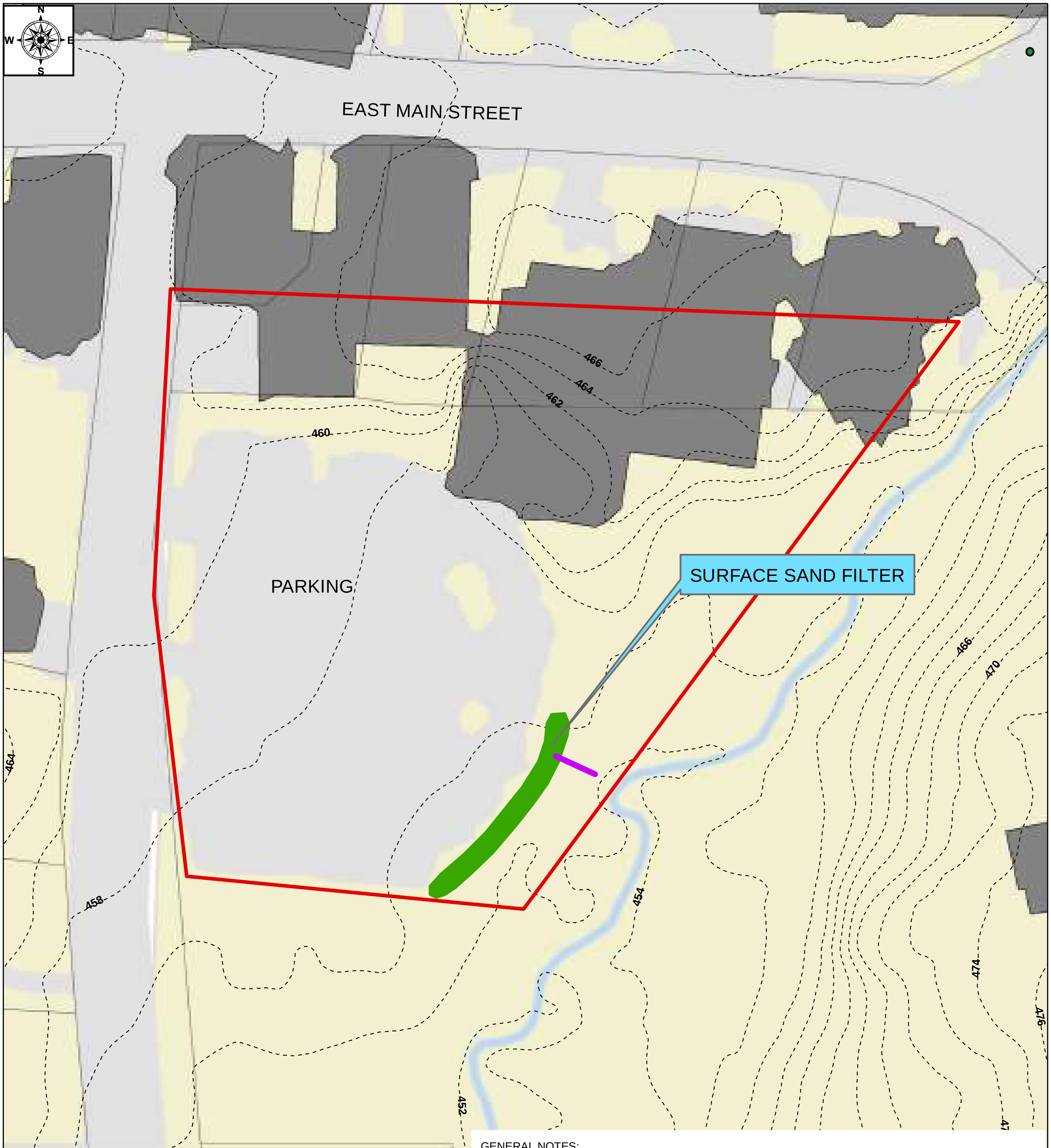
Lappas



MinX: 616569, MaxX: 617178, MinY: 4602076, MaxY: 4601776

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD STREET MAP
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

0 30 60 90 120 Feet

Legend

Proposed Pipe

Proposed SRP Locations

Drainage Basins

Parcels

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STORMWATER RETROFIT CONCEPT PLAN

SAINT JOHN'S CHURCH
39 E MAIN STREET

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 60'

VPW-3

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

0 30 60 90 120 Feet

Legend

Proposed Pipe
Proposed SRP Locations
Drainage Basins
Parcels

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STORMWATER RETROFIT CONCEPT PLAN

SAINT JOHN'S CHURCH
39 E MAIN STREET

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 60'

VPW-3

PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VPW-3
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"VPW-3: Saint Johns Church"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	1.55459	acres	A =	Contributing Area (acres)
I =	1.05	67.54%	I =	Impervious Area (acres/%)
P =	1.2	inches	P =	90th Percentile Rainfall Event Number (in)
			Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.6579		WQv =	Water Quality Volume
Rv (min)**** =**	0.6579			
WQv (acre-ft) =	**0.102**			
WQv (cu-ft) =	**4455**			

where: see right-hand definitions above.

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	P Load=	Annual load (kg/yr)
Pj =	0.9	P =	Annual Rainfall (inches)
Rv =	0.6579	Pj =	Fraction of rainfall producing Runoff = 0.9
A =	1.55459	Rv =	Runoff Coefficient
C =	0.45	C =	Pollutant Concentration (mg/l)
		A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0
Commercial	0.32
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.68
Developed Open Space	0
Weighted "C":	*0.45*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Surface Sand Filter**	
Removal Efficiency:	***59%***	
P Load ------------------->	**4.22**	lb/yr
	1.91	kg/yr
P Removal ------------------->	**2.49**	lb/yr
	1.13	kg/yr

Summary:

Proposed Retrofit Practice	Surface Sand Filter		
Drainage Area (acres)	**1.6**	Phosphorus Loading (kg/yr)	**1.91**
Water Quality Volume (cf)	**4455**	Phosphorus Reduction (kg/yr)	**1.13**

ASSUMPTIONS/COMMENTS:

Permission required from private property owner.
Existing site contains a Church and parking lot.
Adjacent parcels contribute to the drainage area.
Parcel owned by the Catholic Church Association.

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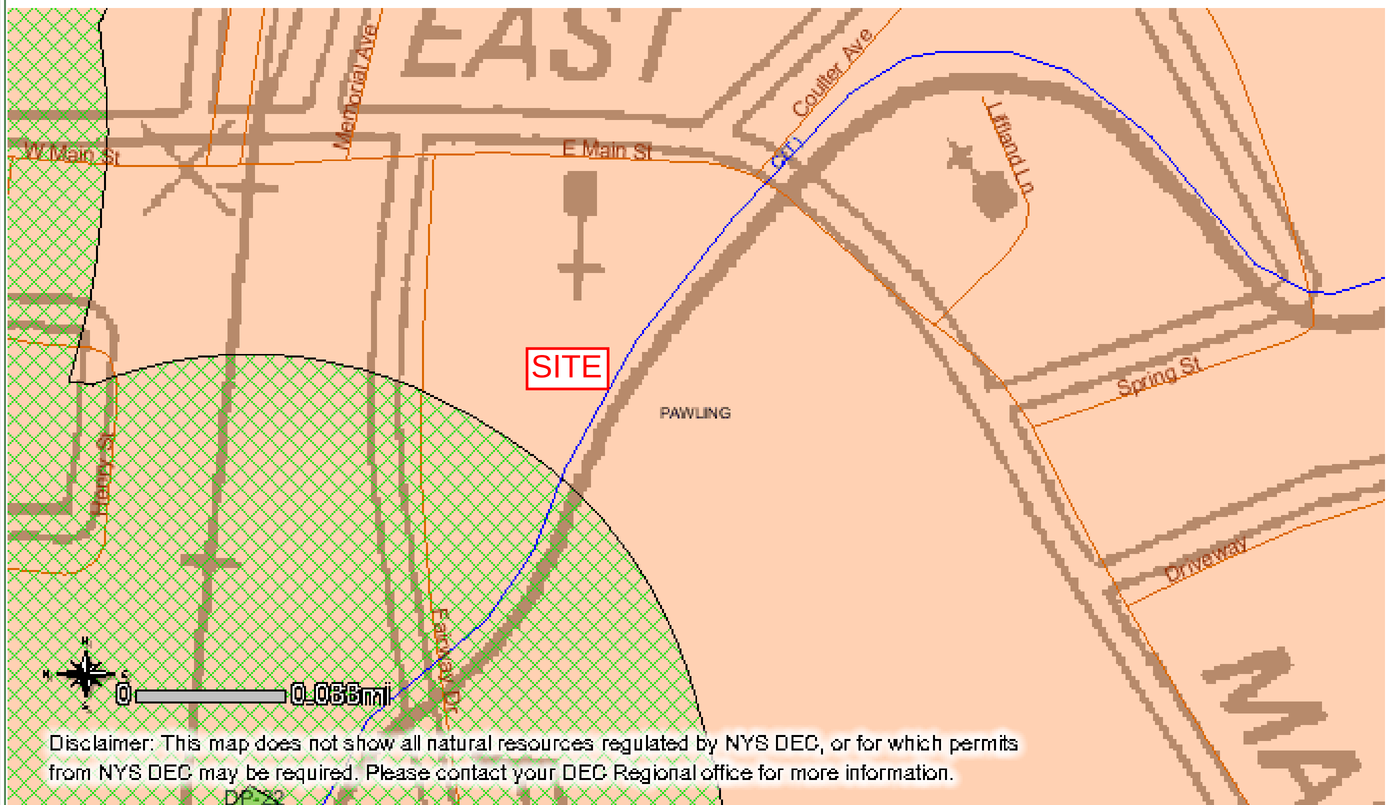
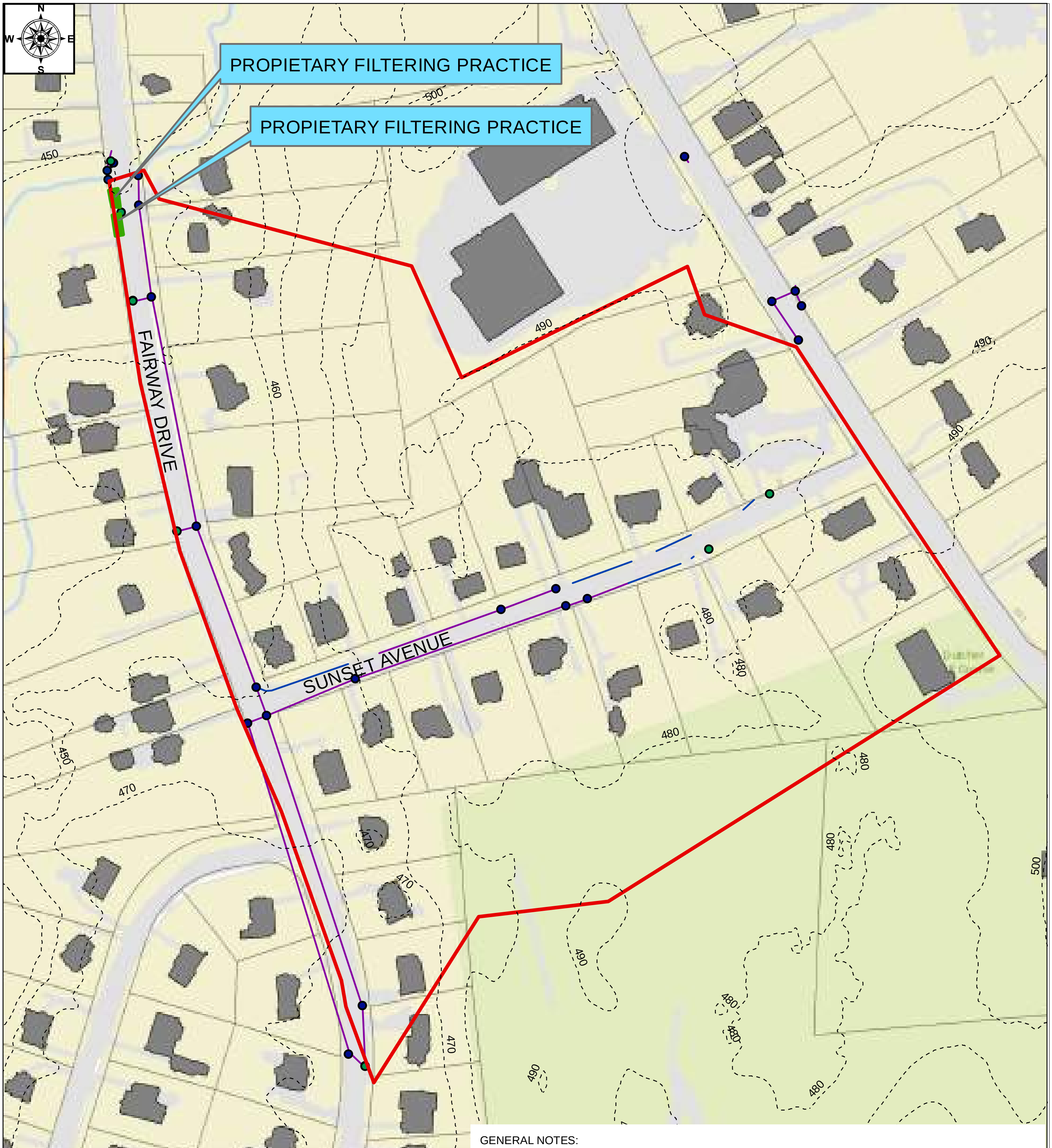
Saint John's Church



MinX: 616523, MaxX: 617010, MinY: 4602113, MaxY: 4601874

Visible Layers

- Classified Streams
- Classified Ponds
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Significant Natural Communities Buffered
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways
- Adirondack Park Boundary
- Counties



GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

0 100 200 300 400 Feet

Legend

Drainage Basins

Proposed SRP Locations

Parcels

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STORMWATER RETROFIT CONCEPT PLAN

FAIRWAY DRIVE
25 FAIRWAY DRIVE

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 200'

VPW-4

GENERAL NOTES:

1. MAP SOURCE OBTAINED FROM ARCGIS - WORLD IMAGERY
2. SITE TOPOGRAPHY (2012) AND IMPERVIOUS AREA (2013) OBTAINED FROM NYCDEP
3. PROPERTY DATA AND STORM SEWER INFRASTRUCTURE OBTAINED FROM VILLAGE OF PAWLING

0 100 200 300 400 Feet

Legend

- Drainage Basins
- Proposed SRP Locations
- Parcels

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STORMWATER RETROFIT CONCEPT PLAN

FAIRWAY DRIVE
25 FAIRWAY DRIVE

VILLAGE OF PAWLING

DESIGNED BY: RAR	CHECKED BY: RAR
DRAWN BY: JBM	

JOB NO: 15-031
DATE: 8/11/16
SCALE: 1" = 200'

VPW-4

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PHOSPHORUS LOADING AND REDUCTION CALCULATION SHEET

Project #:	VPW-4
Prepared for:	EOHC
Prepared by:	RED
Project County:	Dutchess

"VPW-4: Fairway Drive"

WATER QUALITY VOLUME: *WQv(acre-feet) = [(P)(Rv)(A)] /12*

A =	20.9297	acres	where:	A =	Contributing Area (acres)
I =	4.49	21.45%		I =	Impervious Area (acres/%)
P =	1.2	inches		P =	90th Percentile Rainfall Event Number (in)
				Rv =	Runoff Coefficient [0.05 + 0.009(I)]
Rv (calculated)=	0.2431			WQv =	Water Quality Volume
Rv (min)**** =**	0.2431				
WQv (acre-ft) =	**0.509**				
WQv (cu-ft) =	**22161**				

**Minimum Rv = 0.2 when determining WQv. Use calculated Rv when determining phosphorus loading.

WQv PEAK FLOW:

Based upon NYSDEC Stormwater Manual. Appendix B-2

Tc =	0.488	hours	Tc =	Time of Concentration (hours)
CN =	86		CN =	Curve Number
qu =	369.334		qu =	Unit Peak Discharge (cfs/mi^2/inch)
Qp =	3.52309	CFS	Qp =	Peak Discharge (CFS)

PHOSPHORUS LOADING:

Simple Method: *P Load = P x Pj x Rv x C x A x 0.103*

P =	45	where:	P Load=	Annual load (kg/yr)
Pj =	0.9		P =	Annual Rainfall (inches)
Rv =	0.2431		Pj =	Fraction of rainfall producing Runoff = 0.9
A =	20.9297		Rv =	Runoff Coefficient
C =	0.43		C =	Pollutant Concentration (mg/l)
			A =	A = Contributing Area (acres)

Weighted Loading Coefficients

Land Use	**% of Total Area**
Residential	0.79
Commercial	0
Industrial	0
Actively Grazed Pasture	0
Forest	0
Impervious	0.21
Developed Open Space	0
Weighted "C":	*0.43*

PROPOSED RETROFIT PRACTICE AND ANITICIPATED REDUCTION:

Proposed Retrofit Practice:	**Proprietary Filtering**	
Removal Efficiency:	***40%***	
P Load -------------------->	**20.06**	lb/yr
	9.10	kg/yr
P Removal -------------------->	**8.02**	lb/yr
	3.64	kg/yr

Summary:

Proposed Retrofit Practice	Proprietary Filtering		
Drainage Area (acres)	**20.9**	Phosphorus Loading (kg/yr)	**9.10**
Water Quality Volume (cf)	**22161**	Phosphorus Reduction (kg/yr)	**3.64**

ASSUMPTIONS/COMMENTS:

Install practice in concrete vault within the Village of Pawling highway Right of Way
Drainage area consists mainly of a residential neighborhood.

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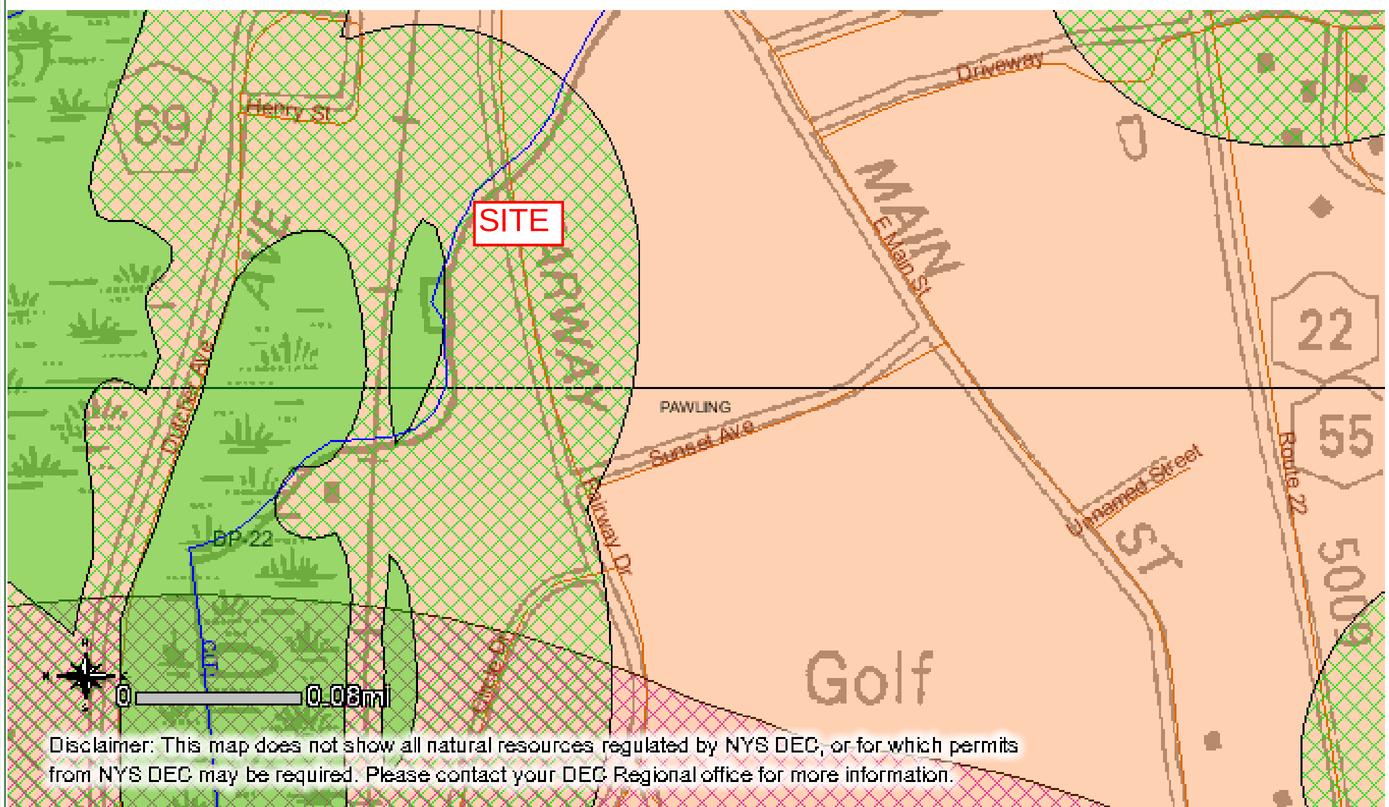
Please set your printer orientation to "Landscape".

Fairway Drive



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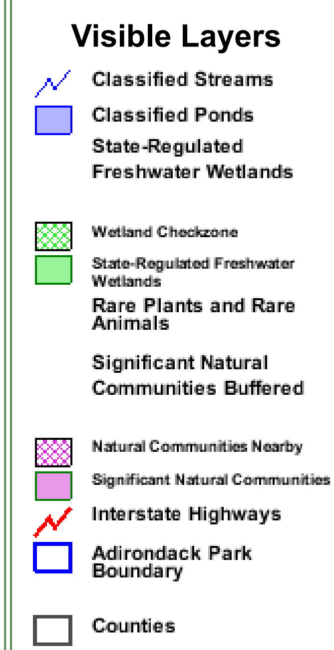

APPENDIX C: STORMBASIN W/ FABPHOS SUBMITTAL & NYSDEC APPROVAL

Steve Lauria

From:	Capowski, Robert M (DEC) <robert.capowski@dec.ny.gov>
Sent:	Tuesday, July 19, 2016 3:41 PM
To:	Steve Lauria
Cc:	Kosinski, Kenneth A (DEC)
Subject:	RE: EOHC Years 6-10 - Request to Review Proposed Proprietary Retrofit Practice

Steve,

This practice is acceptable for use in EOHWC Stormwater Retrofit Program work and will be credited for phosphorus reduction efficiency at 50%. For filtering practices such as this one, BMPs should be sized to meet or exceed the peak runoff rate from the contributing subcatchment for the 90% WQV storm.

Thanks,
Bob Capowski

Robert M. Capowski
Environmental Engineer II, Division of Water

New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12203
P: (518) 402-8112 | F: (518) 402-9029 | robert.capowski@dec.ny.gov

www.dec.ny.gov | |

From: Steve Lauria [mailto:slauria@woodardcurran.com]
Sent: Thursday, July 14, 2016 6:42 PM
To: Capowski, Robert M (DEC) <robert.capowski@dec.ny.gov>
Subject: EOHC Years 6-10 - Request to Review Proposed Proprietary Retrofit Practice

Good evening Bob, as previosuly discussed please find the attached “Request to Review Proposed Proprietary Retrofit Practice” submittal associated with the FABCO StormBasin (with FABPHOS nutrients filtering cartidge) proprietary practice for your review and consideration as an acceptable retrofit practice for use in the East of Hudson Watershed phosphorus reduction program.

Please feel free to call or email me anytime with any questions.   Thank you for your consideration of the attached submittal, and I look forward to hearing from you.

Regards,
Steve

COMMITMENT & INTEGRITY DRIVE RESULTS

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709 Westchester Avenue | Suite L2
White Plains, New York 10604
www.woodardcurran.com

T 800.807.4080
T 914.448.2266
F 914.448.0147

July 14, 2016

Mr. Robert M. Capowski, P.E.
New York State Department of Environmental Conservation (NYSDEC)
New York City Watershed Section
Bureau of Water Resource Management, 4th Floor
625 Broadway
Albany, NY 12233-3505

Re: EOHC Stormwater Retrofit Plan, Years 6-10
Request to Review Proposed Proprietary Retrofit Practice: FABCO StormBasin w/ FABPHOS Nutrients Filtering Cartridge

Dear Mr. Capowski:

On behalf of the East of Hudson Coalition, we are submitting this "Request to Review Proposed Proprietary Retrofit Practice" submittal for the NYSDEC's review and consideration relative to the East of Hudson Watershed (EOHW) phosphorus reduction program. This submittal represents a request for the NYSDEC to review the proposed proprietary retrofit practice consisting of the FABCO StormBasin w/ FABPHOS Nutrients Filtering Cartridge, for use as an acceptable stormwater retrofit practice in the EOHW phosphorus reduction program.

This submittal includes a description and application of the stormwater treatment practice, field test data documenting phosphorus removal efficiencies, and previously issued regulatory determinations by the Pennsylvania Department of Environmental Protection (PADEP) and Maryland Department of the Environment (MDE) stating that the proposed proprietary stormwater treatment practice qualifies as an acceptable water quality filtering practice in retrofitting and redevelopment applications.

PRODUCT DESCRIPTION & APPLICATION

The StormBasin is an injection molded basin that is available in custom sizes and can be installed within new drainage structures or used to retrofit existing drainage structures. The proposed product simply is placed within a drainage structure to treat runoff as it enters the structure. An adjustable flange allows the StormBasin to be supported from the interior frame of the drainage structure top casting without interfering with connected inlet and outlet pipes. The StormBasin relies on removable filtration cartridges installed at the base of the basin tub to filter out targeted nutrient pollutants including phosphorus. Stormwater runoff flows vertically through the nutrient filtration cartridge and discharges into the existing drainage structure. Storage within the basin (above the filter) provides capacity for capture and storage of sediment/trash as the pretreatment mechanism prior to treatment via filtration. Bypass ports are provided at the top of the StormBasin to allow for the bypass of heavy rainfall events beyond the design treatment flowrate of the practice. No structural modifications of an existing drainage structure are required for installation of the product. Please refer to the attached manufacturer literature in Attachment A (*page 4 of 38*) for further description and illustrations of the product.

The intended application for this product under the EOHW phosphorus reduction program would be primarily for retrofitting existing drainage structures located in parking lots and roadways that capture runoff from watershed areas comprised of nearly 100% impervious surfaces. Capturing and treating runoff from nearly 100% impervious surfaces would maximize the proposed phosphorus loading, and therefore also maximize the treatment and cost efficiencies of this practice.

The use of this practice would also significantly streamline the stormwater retrofit implementation process. The design and construction phases can be removed from the traditional retrofit implementation process, since the StormBasin retrofit practice simply requires measuring the dimensions of an existing drainage structure and providing them to the manufacturer for production. In addition, the unit can be installed relatively quickly by the owner as it only involves the removal of the existing drainage structure grate, and placing the proposed product within the basin (along with reinstallation of the existing grate). The manufacturer also offers assistance to the Owner during field measurement of existing drainage structures, and installation of proposed units.

The StormBasin is a relatively low cost retrofit option. Depending on the size of the catch basin, the product cost in the range of $1,000 to $1,500 per unit. Maintenance of the unit is fairly straightforward and can be performed by the owner; maintenance simply consists of the cleanout of sediment and debris from the StormBasin tub as required, and replacement of the filtering catridge approximately every 3 years (~ $200 per filter) as recommended by the manufacturer to ensure filtering performance.

REGULATORY APPROVALS
The StormBasin is recognized by PADEP as a flow based best management practice for water quality treatment under Chapter 6.6 "Runoff Quality/Peak Runoff BMPs" of the *Pennsylvania Stormwater Best Management Practices Manual*, dated December 2006. Based upon correspondence from PADEP staff, the StormBasin product specifically falls under the manual's category of "BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices", and treats phosphorus at a removal rate of 50%. Refer to Attachment B (*page 6 of 38*) which consists of the PADEP correspondence that substantiates this statement, and Attachment C (*page 7 of 38*) for the corresponding excerpt from the Pennsylvania Stormwater Best Management Practices Manual.

In addition to PADEP, the MDE has issued correspondence verifying product classification of the StormBasin for use in retrofitting and redevelopment applications. This verification is can be found in the last paragraph of the MDE letter included in Attachment D (*page 13 of 38*).

FIELD TESTING
Fabco Industries Inc. has provided field testing data to document pollutant removal efficiencies, including phosphorus, associated with installations of the catch basin insert product in various sites throughout Long Island. A field testing program was completed that included the study of phosphorus removal at several retrofitted drainage structures within the region. The completed test program analyzed stormwater concentrations of orthophosphate and total phosphate collected from testing sites under existing untreated conditions compared to post treatment via the StormBasin product utilizing the FABPHOS Nutrients Filtering cartridges.

Based upon the provided testing data, average reduction of Total Phosphorus concentration in stormwater runoff was reported at 66% removal for the overall program. A greater average reduction in stormwater orthophosphate concentrations was reported through the testing program at an average of 79% removal. A summary table of the lab testing results is included in Attachment E (*page 14 of 38*), and the field test program report is included in Attachment F (*page 22 of 38*).

CONCLUSION
Based on the information noted above, the StormBasin product presents a unique opportunity to introduce a low cost stormwater retrofit practice that would effectively remove high concentrations of phosphorus in runoff from impervious areas into the EOHW phosphorus reduction program. Unlike the currently approved stormwater retrofit practices, the StormBasin is a low cost retrofit solution that is relatively easy and quick to implement (does not require traditional design and construction phases) and maintain, and

does not require any ground intrusive or disruptive construction operations. This product not only has the ability to effectively treat phosphorus, but it also provides the host municipalities with a highly flexible retrofit solution that can be implemented in any existing catch basin within the watershed, regardless of property, ownership, or environmental constraints that have ultimately resulted in cancelled and infeasible stormwater retrofit projects in previous years.

We respectfully request that the StormBasin with FABPHOS Nutrients Filtering Cartridge practice be considered as an acceptable stormwater retrofit practice for implementation within the EOHW phosphorus reduction program, based upon a review of the test data and regulatory agency recognition of the practice included in this submittal. Field verified phosphorus removal rates and outside regulatory agency recognition of the product for water quality treatment support proposed removal rates in the range of 50-65% phosphorus removal.

Thank you for your time and attention towards this matter. Please feel free to contact me directly anytime at slauria@woodardcurran.com or 914-355-9882 with any questions or to discuss this submittal in further detail.

Sincerely,

WOODARD & CURRAN ENGINEERING PA PC

Steven Lauria, PE
Associate Principal

Enclosure(s):
Attachment A - FABCO StormBasin filtering catridge product sheets
Attachment B - PADEP correspondence
Attachment C - Pennsylvania Stormwater Best Management Practices Manual excerpt
Attachment D - MDE correspondence
Attachment E - Lab testing summary table
Attachment F - Field testing program report

StormBasin

ATTACHMENT A

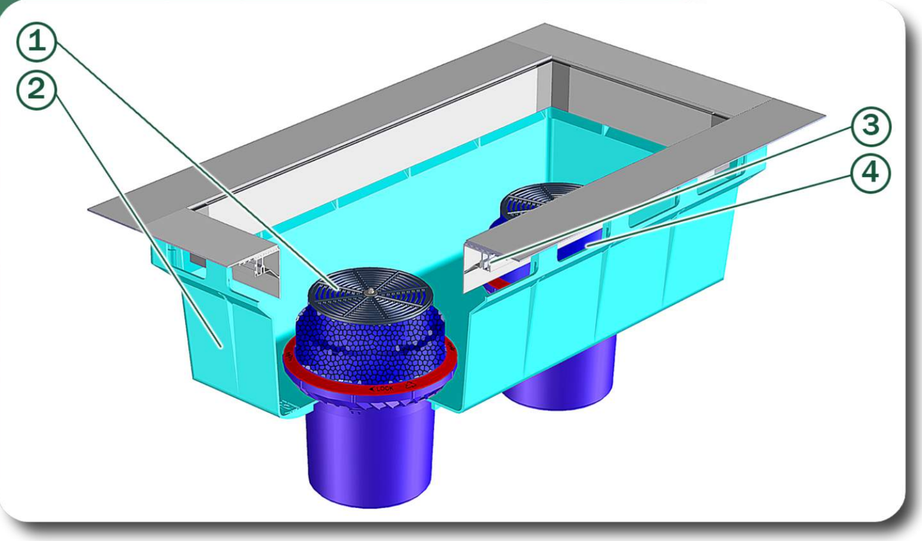
The StormBasin catch basin insert combines a gross pollutant trap with Fabco's proprietary cartridge filtration system for effective capture of both solid and soluble pollutants. Fabco filter cartridges can be customized with specific media that can target fine particulate, hydrocarbons, heavy metals, organics and other pollutants.

Ideally suited for municipal storm drain retrofits, the StormBasin's solid construction and unique design allow for easy installation and maintenance. The StormBasin also features Fabco's patented dovetailed aluminum flange which enables quick sizing adjustments during installation. Fabco filter cartridges feature a twist and lock mechanism that makes replacement fast and simple. Periodic maintenance of the StormBasin is quick and easy - trash and debris can be removed from the unit at the street level with a vactor truck or a vacuum hose attached to a sweeper truck. Extracted waste has minimal water content reducing disposal weight and volume.

Fabco's StormPod offers the same filtration method, but for smaller, round openings.

Features/Benefits

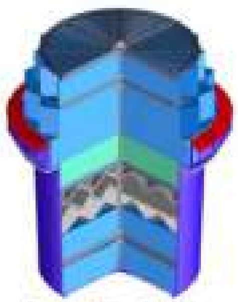
1. Easily replaceable lightweight filter cartridges customized for targeted pollutants
2. Durable, UV safe co-polymer basin with aluminum mounting flange – has a 15 year service life
3. Patented dovetailed flange allows for 5" of length/width adjustment during installation
4. Baffled bypass traps floatables



Application	Regulatory Issue	Target Pollutants
Municipal Storm Drain Retrofits	MS4 Permit	Sediment, Trash, O&G, Nutrients
Fuel/Oil Storage and Handling Facilities	EPA SPCC (Spill Control Rule)	Hydrocarbons, Oily Sediments
Scrap Metal, Solid Waste, Power Plants	Industrial Multi-Sector General Permit	Solids, Hydrocarbons, Metals
Pre-Treatment BMP for New Development	Municipal Stormwater Permit	Sediment, O&G, Nutrients
Retail, Garden Centers	Phosphorus, Nitrogen, Pesticides	Fertilizers, Pesticides

FilterCartridges

Stormwater filtration cartridges for StormBasin & StormPod



Standard Filter Cartridge

Part Number	Effectiveness	Ring color code
9718-1	**Standard Cartridge** Good All-purpose cartridge for common surface runoff that may contain a little bit of everything.	Red
9718-2	**Pathogens Cartridge** 2x's more pathogen treatment Vs. Std Cartridge. Use near sensitive water ways to keep beaches and shell fishing areas open.	Yellow
9718-3	**HV Hydrocarbon Cartridge** 25% more hydrocarbon filter media Vs Std cartridge. Excellent for vehicle or maintenance related applications.	Blue
9718-4	**HV Metals Cartridge** Uses unique FABLITE filter media for HV metals. Suggested for industrial usage where persistent HV metals have been identified in surface runoff	Grey
9718-5	**Standard short Cartridge** Reduced height version of std Cart.	Mint
9718-6	**Nutrients Cartridge** Uses proprietary FABPHOS media for nutrients. Highly effective on the critical dissolved Ortho-Phosphates. Helps reduce algae blooms keeping the water clean and healthy.	Green

ATTACHMENT B

PADEP email

From: Rosenquest, Darl [mailto:drosenques@pa.gov]
Sent: Friday, August 29, 2014 10:54 AM
To: rwoodman@fabcoindustries.com
Cc: Himes, William; Lonergan, Mark; Orr, Jennifer
Subject: PCSM Approval Request

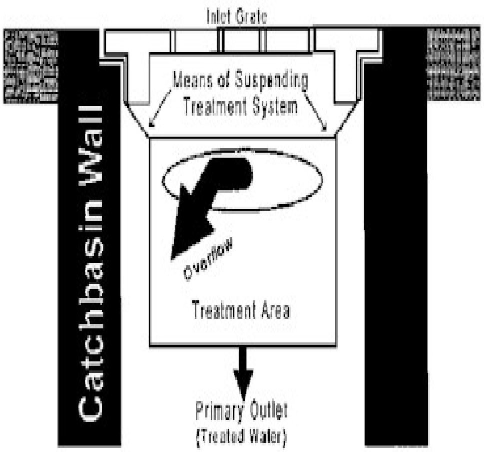
In response to your submittal, please be advised that the Department does not "approve" proprietary products. It will evaluate the information you submitted to determine whether the BMPs meet or exceed the standards of BMPs contained in the Stormwater manual of 2006. That being said, the initial findings are as follows:

StormBasin and StormSafe Vault essentially fall under the category of Water Quality Filters (BMP 6.6.4). Therefore, no further action is necessary.
DownSpout Filter may have potential for PCSM use, but more information (proper sizing, installation, limitations, etc.) is needed.
Connector Pipe Screen is essentially a trash guard for cross pipes. No further action is necessary.
Trench Drain Filter – It is unclear what the purpose, use, and limitations of this device are. Please provide additional information.

Should a suitable generic design be provided for downspout filters, this BMP will be added to the Department's list of PCSM BMPs. If a purpose and design for the trench drain filter be provided, it too will be added to the list.

Darl Rosenquest, PE, PG | Senior Civil Engineer
DEP - Waterways Engineering & Wetlands
25 Technology Drive
California Technology Park
Coal Center, PA 15423
724-769-1068
drosenques@pa.gov

BMP 6.6.4: Water Quality Filters & Hydrodynamic Devices



A broad spectrum of BMPs have been designed to remove non point source pollutants from runoff as a part of the runoff conveyance system. These structural BMPs vary in size and function, but all utilize some form of settling and filtration to remove particulate pollutants from stormwater runoff, a difficult task given the concentrations and flow rates experienced. Regular maintenance is critical for this BMP. Many water quality filters, catch basin inserts and hydrodynamic devices are commercially available. They are generally configured to remove particulate contaminants, including coarse sediment, oil and grease, litter, and debris.

s

- Choose a device that (collectively) has the hydraulic capacity to treat the design storm
- Evaluation of the device chosen should be balanced with cost
- Hydraulic capacity controls effectiveness
- Most useful in small drainage areas (< 1 Acre)
- Ideal in combination with other BMPs
- Regular maintenance is necessary

Stormwater Functions

Volume Reduction: None
Recharge: None
Peak Rate Control: None
Water Quality: Medium

Water Quality Functions

TSS: 60%
TP: 50%
NO3: 20%

Other Considerations

- See Manufacturers specifications for estimated pollutant removal efficiencies.

Description

Water Quality Inlets are stormwater inlets that have been fitted with a proprietary product (or the proprietary product replaces the catch basin itself). They are designed to reduce large sediment, suspended solids, oil and grease, and other pollutants, especially pollutants conveyed with sediment transport. They can provide "hotspot" control and reduce sediments loads to infiltration devices. They are commonly used as pretreatment for other BMPs. The manufacturer usually provides the mechanical design, construction, and installation instructions. Selection of the most appropriate device and development of a maintenance plan should be carefully considered by the Designer.

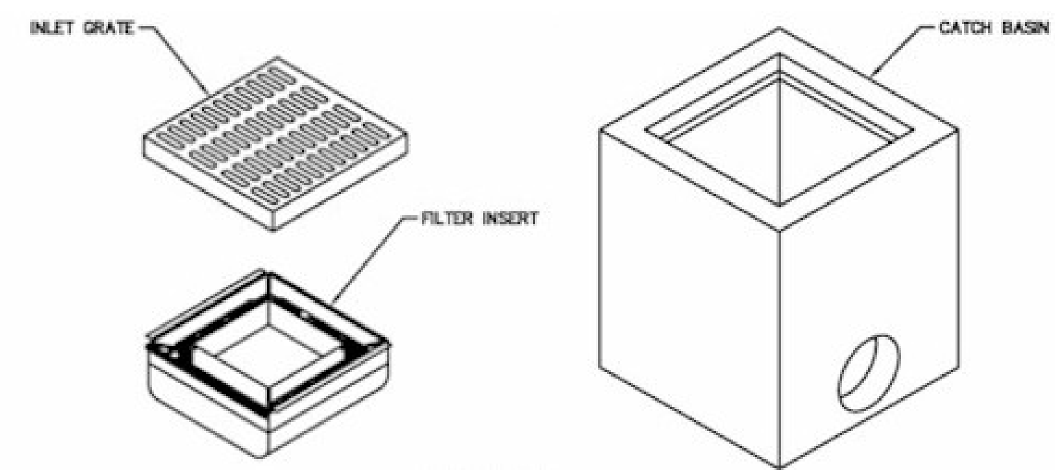
The size of a water quality inlet limits the detention time and the hydraulic capacity influences the effectiveness of the water quality insert. Most products are designed for an overflow in large storm events, which is necessary hydraulically and still allows for a "first flush" treatment.

Regular maintenance according to application and manufacturer's recommendations is essential for continued performance.

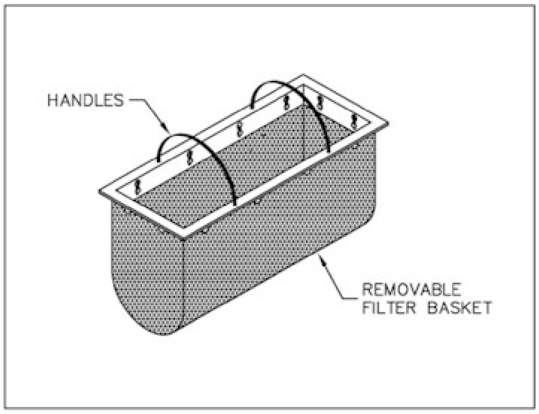
Variations

Tray types

Allows flow to pass through filter media that is contained in a tray located around the perimeter of the inlet. Runoff enters the tray and leaves via weir flow under design conditions. High flows pass over the tray and into the inlet unimpeded.

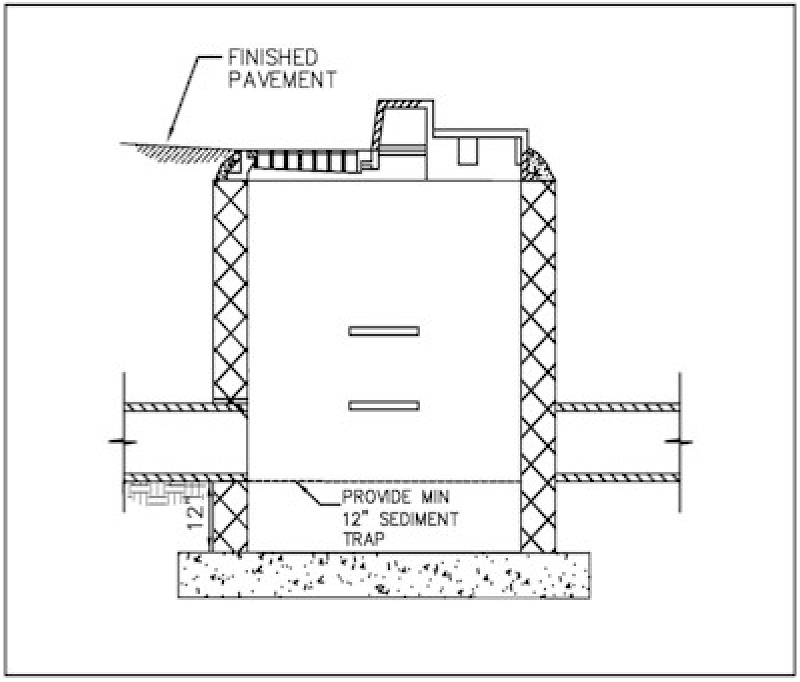


Bag types
Insert is made of fabric and is placed in the drain inlet around the perimeter of the grate. Runoff passes through the bag before discharging into the drain outlet pipe. Overflow holes are usually provided to pass larger flows without causing a backwater at the grate. Certain manufactured products include polymers intended to increase pollutant removal effectiveness.

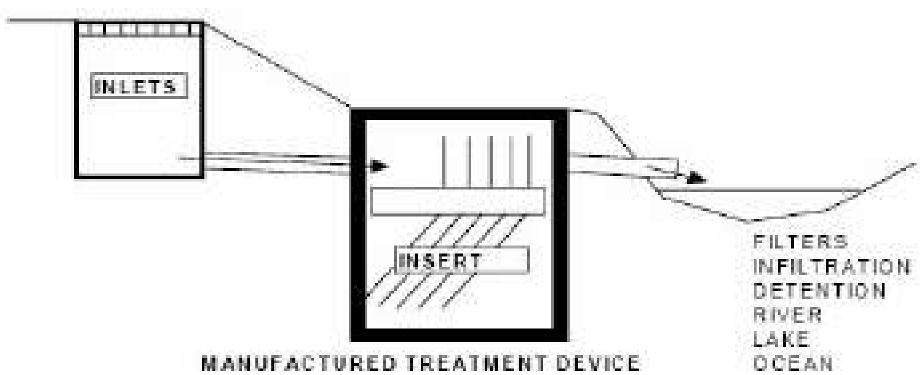


Basket types
The insert consists of “basket type” insert that sets into the inlet and has a handle to remove basket for maintenance. Small orifices allow small storm events to weep through, while larger storms overflow the basket. Primarily useful for debris and larger sediment, and requires consistent and frequent maintenance.

Simple, "sumps" in inlets
Space created in inlets below the invert of the pipes for sediment and debris to deposit, usually leaving 6-inches to 12-inches at the bottom of an inlet. Small weep holes should be drilled into the bottom of the inlet to prevent standing water for long periods of time. Regular maintenance is required.



Description - Hydrodynamic Devices
Hydrodynamic Devices are not truly inserts, but separate flow through devices designed to serve in concert with inlets and storm sewer. A variety of products are available from different manufacturers. The primary purpose is to use various methods to remove sediments and pollutants. These methods include baffle plate design, vortex design, tube settler design, inclined plate settler design
or a combination of these. Ideally, the flow through device should remove litter, oil, sediment, heavy metals, dissolved solids and nutrients. Removal ability varies as a result of loading rate and design. Clays and fine silts do not easily settle out unless they are coagulated with some kind of chemical addition or polymer. These devices work most effectively in combination with other BMPs, either as a pre-treatment or as a final treatment at the end of a pipe.



Applications

Any existing or proposed inlet where the contributing runoff may contain significant levels of sediment and debris, for example: parking lots, gas stations, golf courses, streets, driveways, industrial or commercial facilities, and municipal corporation yards. Commonly used as pretreatment before other stormwater BMPs.

Design Considerations

1. Match site considerations with manufacturer's guidelines/specifications (i.e. land use will determine specific pollutants to be removed from runoff).

2. Prevent re-suspension of particles by using small drainage areas and good maintenance.

3. Retrofits should be designed to fit existing inlets.

4. Placement should be accessible to maintenance.

5. If used as part of Erosion & Sedimentation Control during construction, insert should be reconfigured (if necessary) per manufacture's guidelines.

6. Overflow should be designed so that storms in excess of the device's hydraulic capacity bypass the treatment and is treated by another quality BMP.

Detailed Stormwater Functions

Volume Reduction Calculations
N/A

Peak Rate Mitigation Calculations
N/A

Water Quality Improvement
See manufacturers specifications and tests.

Construction Sequence

1. Stabilize all contributing areas before installing and connecting pipes to these inlets.

2. Follow manufacturer's guidelines for installation. Do not use water quality inserts during construction unless product is designed primarily for sediment removal. (Some products have adsorption components that should be installed post-construction.)

Maintenance Issues

Follow the manufacturer's guidelines for maintenance, also taking into account expected pollutant load and site conditions. Inlets should be inspected weekly during construction. Post-construction, they should be emptied when over half full of sediment (and trash) and cleaned at least twice a year. They should also be inspected after runoff events. Maintenance is crucial to the effectiveness of this BMP. The more frequent a water quality insert is cleaned, the more effective it will be. One study (Pitt, 1985) found that WQI's can store sediment up to 60% of its sump volume, and after that, the inflow resuspends the sediments into the stormwater. Some sites have found keeping a log of sediment amount date removed helpful in planning a maintenance schedule. Environmental Technology Verification (ETV) Program and the Technology Acceptance and Reciprocity Partnership (TARP) may be available to assist with the development of a monitoring plan. These programs are detailed in Section 6.3.

Disposal of removed material will depend on the nature of the drainage area and the intent and function of the water quality insert. Material removed from water quality inserts that serve "Hot Spots" such as fueling stations or that receive a large amount of debris should be handling according to DEP regulations for that type of solid waste, such as a landfill that is approved by DEP to accept solid waste. Water quality inserts that primarily catch sediment and detritus from areas such as lawns may reuse the waste on site.

Vactor trucks may be an efficient cleaning mechanism.

Winter Concerns: There is limited data studying cold weather effects on water quality insert effectiveness. Freezing may result in more runoff bypassing the treatment system. Salt stratification may also reduce detention time. Colder temperatures reduce the settling velocity of particles, which can result in fewer particles being "trapped". Salt and sand are significantly increased in the winter, and may warrant more frequent maintenance. Sometimes freezing makes accessing devices for maintenance difficult

Cost Issues

Check with manufacturers for current prices.

Specifications

Follow manufacturer's instructions and specific specifications.

References

Brzozowski, C., 2003. "Inlet Protection – Strategies for Preserving Water Quality," Stormwater magazine.

Lee, F. "The Right BMPs? Another Look at Water Quality." Stormwater magazine.

New Hampshire Watershed Management Bureau, Watershed Assistance Section, 2002. "Innovative Stormwater Treatment Technologies BMP Manual."

Pitt, R. *Characterizing and Controling Urban Runoff through Street and Sewerage Cleaning.* US EPA, June 1985.

ATTACHMENT D

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

February 13, 2012

Mr. Francis Tighe, Division Manager
Eastern Region
Fabco Industries, Incorporated
120 Exchange Street, Suite 300
Portland, Maine 04101

Dear Mr. Tighe:

Thank you for your recent email to the Maryland Department of the Environment (MDE), Water Management Administration (WMA) regarding the StormSack, StormBasin and StormSafe Helix products from Fabco Filter Technologies. WMA has evaluated the product descriptions and supporting information with respect to potential treatment applications in Maryland. We offer the following:

In Maryland, environmental site design (ESD) must be used to the maximum extent practicable (MEP) to reduce runoff and mimic natural hydrologic conditions. The use of ESD planning techniques and treatment practices must be exhausted before any approved structural practices may be used. The Fabco products listed above currently do not meet the specifications found in the **2000 Maryland Stormwater Design Manual** for ESD or structural practices for new development applications. However, WMA believes that circumstances exist, such as pretreatment, retrofitting, or redevelopment where these practices may be appropriate for water quality treatment.

With respect to the information submitted to support performance claims, please find attached a copy of the fact sheet "Maryland's Stormwater Management Program and Proprietary Practices" that provides additional information on our policies for the review of proprietary practices, including performance monitoring requirements. Monitoring information demonstrating compliance with the general performance criteria must be submitted. MDE recommends that this information conforms to the Technology Acceptance Reciprocity Partnership (TARP) protocol to ensure interstate reciprocity of the data.

WMA has no objections to the use of these Fabco products for redevelopment, pretreatment, and retrofitting provided they are accepted locally. However, local jurisdictions may request that a letter from MDE/WMA be provided verifying product classification. Please consider this that letter. Thank you again for your interest. If you have any additional questions, please contact me at 410-537-3550 or scomstock@mde.state.md.us.

Sincerely,

Stewart R. Comstock, P.E.
Regulatory & Compliance Engineer
Sediment, Stormwater & Dam Safety Program

ATTACHMENT E

2007: Testing with Nutrients cartridge FPAM at Country Lake Court, Centerport, NY

Cartridge type: FPAM											
Untreated	ID	Report Date						**Treated**	ID		
Huntington Town, Country Lake Court	0367 (IN)	11/16/07	**Value**	Sampled	Water LRL	Method		Huntington Town, Country Lake Court	0368 (OUT)	**Value**	% Change
Tot. Kjeldahl N.	mg/L		**3.80**	11/12/07	0.2	SM4500NorgB		Tot. Kjeldahl N.	mg/L	**2.40**	36.84%
Nitrate as N	mg/L		**1.40**	11/7/07	0.5	EPA353.2		Nitrate as N	mg/L	**0.49**	65.00%
Nitrogen, total as N	mg/L		**5.20**	11/12/07	0.2	EPA351,353		Nitrogen, total as N	mg/L	**2.90**	44.23%
Ortho Phosphate as P	mg/L		**0.58**	11/7/07	0.1	EPA365.3		Ortho Phosphate as P	mg/L	**0.17**	70.69%
Tot. Phosphate as P	mg/L		**0.57**	11/14/07	0.02	EPA365.3		Tot. Phosphate as P	mg/L	**0.34**	40.35%
Cartridge type: FPAM											
Untreated	ID	Report Date						**Treated**	ID		
Huntington Town, Country Lake Court	0365 (IN)	11/9/07	**Value**	Sampled	Water LRL	Method		Huntington Town, Country Lake Court	0366 (OUT)	**Value**	% Change
Tot. Kjeldahl N.	mg/L		**0.80**	11/1/07	0.2	SM4500NorgB		Tot. Kjeldahl N.	mg/L	**0.60**	25.00%
Nitrate as N	mg/L		**0.49**	10/30/07	0.5	EPA353.2		Nitrate as N	mg/L	**0.49**	0.00%
Nitrogen, total as N	mg/L		**0.80**	11/1/07	0.2	EPA351,353		Nitrogen, total as N	mg/L	**0.60**	25.00%
Ortho Phosphate as P	mg/L		**0.49**	10/31/07	0.1	EPA365.3		Ortho Phosphate as P	mg/L	**0.09**	81.63%
Tot. Phosphate as P	mg/L		**0.33**	11/2/07	0.02	EPA365.3		Tot. Phosphate as P	mg/L	**0.09**	72.73%
Cartridge type: FPAM											
Untreated	ID	Report Date						**Treated**	ID		
Huntington Town, Country Lake Court	112101 (IN)	12/4/07	**Value**	Sampled	Water LRL	Method		Huntington Town, Country Lake Court	112102 (OUT)	**Value**	% Change
Tot. Kjeldahl N.	mg/L		**3.00**	11/27/07	0.2	SM4500NORGB		Tot. Kjeldahl N.	mg/L	**1.00**	66.67%
Nitrate as N	mg/L		**1.00**	11/27/07	0.5	EPA353.2		Nitrate as N	mg/L	**0.50**	50.00%
Nitrogen, total as N	mg/L		**4.00**	11/27/07	0.2	EPA351,353		Nitrogen, total as N	mg/L	**1.50**	62.50%
Ortho Phosphate as P	mg/L		**1.90**	11/21/07	0.1	EPA365.3		Ortho Phosphate as P	mg/L	**0.26**	86.32%
Tot. Phosphate as P	mg/L		**2.10**	11/30/07	0.1	EPA365.3		Tot. Phosphate as P	mg/L	**0.30**	85.71%

Avg						
Tot. Kjeldahl N.	mg/l	**2.53**	Tot. Kjeldahl N.	mg/L	**1.33**	
Nitrate as N		**0.96**	Nitrate as N	mg/L	**0.49**	
Nitrogen, total as N		**3.33**	Nitrogen, total as N	mg/L	**1.67**	
Ortho Phosphate as P		**0.99**	Ortho Phosphate as P	mg/L	**0.17**	
Tot. Phosphate as P		**1.00**	Tot. Phosphate as P	mg/L	**0.24**	
			Avg			
			Tot. Kjeldahl N.			42.84%
			Nitrate as N			38.33%
			Nitrogen, total as N			43.91%
			Ortho Phosphate as P			79.55%
			Tot. Phosphate as P			66.26%

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777 • FAX (631) 422-5770

Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.274758.01 11/09/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:10/30/07 RECEIVED:10/30/07
TIME COL'D:1530
MATRIX:Water SAMPLE: 0365 (IN)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	0.8		11/01/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		10/30/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	0.8		11/01/07	0.2	SM4500NH3C
ortho Phosphate as P	mg/L	< 0.5	*	10/31/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.33		11/02/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS: *elevated lab reporting limit due to interferenc in sample.

DIRECTOR ____________

rn = 33081 NYSDOH ID # 10320

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Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.274758.02 11/09/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317
ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:10/30/07 RECEIVED:10/30/07
TIME COL'D:1530
MATRIX:Water SAMPLE: 0366 (OUT)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	0.6		11/01/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		10/30/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	0.6		11/01/07	0.2	SM4500NH3C
ortho Phosphate as P	mg/L	< 0.1		10/31/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	< 0.1		11/02/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 33082 NYSDOH ID # 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777• FAX (631) 422-5770

Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.274866.01 11/16/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:11/07/07 RECEIVED:11/07/07
TIME COL'D:1300
MATRIX:Water SAMPLE: 0367 (IN)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	3.8		11/12/07	0.2	SM4500NorgB
Nitrate as N	mg/L	1.4		11/07/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	5.2		11/12/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.58		11/07/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	0.57		11/14/07	0.02	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 33860 NYSDOH ID # 10320

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777• FAX (631) 422-5770

Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.274866.02 11/16/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:11/07/07 RECEIVED:11/07/07
TIME COL'D:1300
MATRIX:Water SAMPLE: 0368 (OUT)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	2.4		11/12/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		11/07/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	2.9		11/12/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.17		11/07/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.34		11/14/07	0.02	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 33861 NYSDOH ID # 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

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Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.275079.01 12/04/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Country Lake Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:11/20/07 RECEIVED:11/21/07
TIME COL'D:1330
MATRIX:Water SAMPLE: 112101

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	3.0		11/27/07	0.2	SM4500NORGB
Nitrate as N	mg/L	1		11/27/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	4.0		11/27/07	0.2	EPA351.353
ortho Phosphate as P	mg/L	1.9		11/21/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	2.1		11/30/07	0.1	EPA365.3

CC:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 35210 NYSDOH ID # 10320

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING
377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777• FAX (631) 422-5770
Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO.275079.02 12/04/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317
ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Country Lake Court
SOURCE OF SAMPLE:
COLLECTED BY: Client DATE COL'D:11/20/07 RECEIVED:11/21/07
TIME COL'D:1330
MATRIX:Water SAMPLE: 112102

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	1		11/27/07	0.2	SM4500NORGB
Nitrate as N	mg/L	0.5		11/27/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	1.5		11/27/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.26		11/21/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.3		11/30/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 35211 NYSDOH ID # 10320 Page 1 of 1

ATTACHMENT F

FABCO INDUSTRIES, INC
STORMWATER NUTRIENTS: P & N
TEST PROGRAM

Prepared by:

Fabco Industries
66 Central Ave
Farmingdale, NY 11735
Tel: 631 393 6024

Len Emma
John Markee
John Peters

Executive Summary

Under a contract between a local municipality and Fabco Industries, Inc, Bohemia, NY, from October 2006 to December 2007 a series of field tests were conducted on the Fabco StormBasin and StormPod catch basin inserts to evaluate their effectiveness in reducing phosphorus and nitrogen compounds in stormwater runoff. The testing took place at 3 different sites and involved 5 different filter cartridge configurations.

The testing protocol called for testing under realistic field conditions; all test units were installed into existing roadside storm drains, only minimal maintenance was performed during a test sequence and the same filtering cartridge was used from start to finish better simulating expected results. All samples of treated and untreated stormwater were collected during the first 15 minutes – "first flush" of a rain event. Many published studies (example: First Flush Phenomenon, CalTrans, Aug 2005) have concluded that first flush runoff water contains the highest expected concentrations of pollutants during a storm event.

The data presented in the report confirms that the Fabco StormBasin and StormPod units were highly effective in reducing both phosphorus and nitrogen compounds. Specifically:

- Total phosphates were reduced an average 66% - exceeding the 40% required by many states including: New York, Maryland, Virginia and New Jersey.
- Total nitrogen compounds were reduced an average 44%

Additionally, although not required by the study, the report contains information on the type and quantity of solid debris; sediments, trash, leaves, sticks and other material that were collected in the units between tests. Using a separate laboratory analysis on this type

of debris, the report concludes significant concentrations of nutrients maybe stored in this captured material that is not included in the reported reductions.

FABCO INDUSTRIES, INC
STORMWATER NUTRIENTS: P & N
TEST PROGRAM

Introduction:

At the request of a local municipality, a stormwater monitoring program was initiated by Fabco Industries, Bohemia NY, to investigate the efficacy of using the Fabco StormBasin to reduce the levels of nitrogen and phosphate nutrients in stormwater runoff. These chemical species, which typically result from agricultural/landscaping activities, can give rise to eutrophication and subsequent growth of aquatic plant life in receiving waters. This growth tends to deplete vital dissolved oxygen reserves and can result in fish kills.

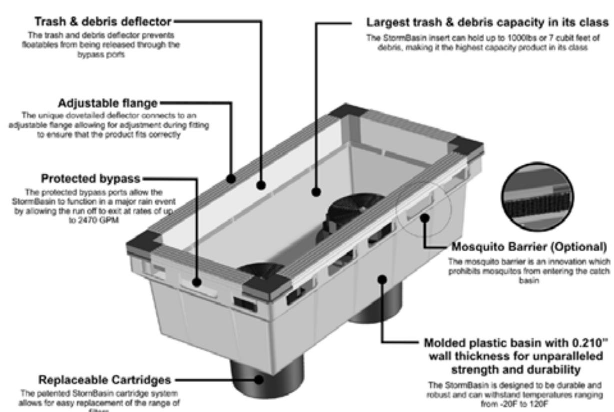
Although both nutrient types are important to plant growth many state stormwater programs require stormwater Best Management Practices (BMPs) to reduce only phosphate levels by a specific amount. For example New York State requires a 40% reduction of Total Phosphates. Specific reductions also come into play within the EPA's TMDL program (Total Maximum Daily Load).

Background:

The Fabco Industries StormBasin is a water treatment system that installs below the iron grate of an existing roadside or parking lot stormwater sewer drain. The StormBasin can be installed into most existing storm water drains without construction or other modifications. In this position the StormBasin intercepts and treats pollutants suspended and/or contained in surface water runoff including: sediments, trash and debris, oils, grease and other toxic hydrocarbon-based chemicals as well as potentially harmful bacteria.

The Technology:

The Fabco StormBasin system consists of a large, injection-molded basin for the collection of raw water, sediments and debris and one or more filtering cartridges located at the bottom of the tub, which treat and discharge the clean water into the storm water system. (Appendix A: StormBasin brochure)



The StormBasin cartridges are selected based on actual pollutant loads expected and are user replaceable.

Currently there are five standard cartridge configurations to choose from: General purpose, Heavy-hydrocarbons (oils & grease), Bacteria, Metals, and Nutrients. Each cartridge type applies one or more filtering technologies in varying degrees to treat specific pollutants. (Appendix B: Filter cartridge brochure)

At the start of the project, Fabco's original nutrient cartridge, although effective on both nitrogen and phosphorous compounds, would not consistently meet the 40%

phosphorous reduction required by many states, including New York. To improve performance on these nutrient compounds Fabco evaluated the use of ten different commercially available filter media in various combinations. Using a series of preliminary, bench scale experiments five were selected for testing within this program.

The media used in this study are identified as:

CHZ – A granular, highly active zeolite mineral which has proven abilities as an ion exchange media.

IC – A fine granular, iron based material specifically produced for efficient removal of phosphates, arsenic and silicates from fresh and salt water. Developed in Germany for treating main water supplies

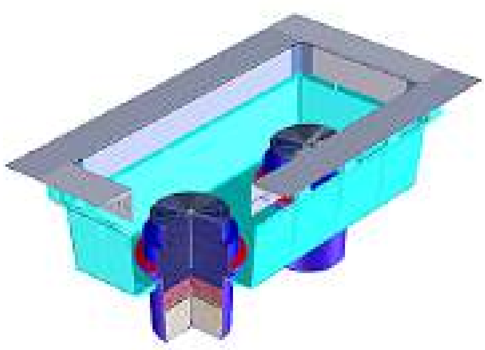
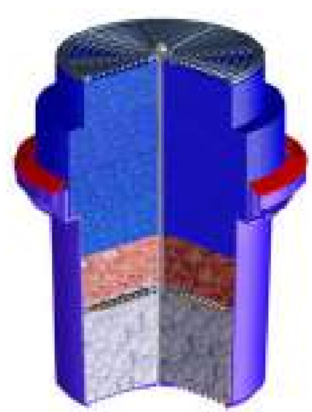
NP – A filter material that has found wide acceptance in large scale commercial aquariums over the past 20 years. NP is effective on ammonia, heavy metals, phosphates and toxic organics.

FP – Fabco's proprietary FabPhos product that combines the effectiveness and many of the properties of the "IC" and "NP" products.

FPAM – Fabco's antimicrobial treatment applied to FabPhos filter media. The antimicrobial surface reduces bacterial build up and slimes.

Using these materials Fabco assembled and tested 4 types of cartridges, which were designated

1. ICCHZ = Combination of layers of IC and CHZ
2. NP = Nutrient Pad material used as sole media type
3. FPCHZ = Combination of layers of FabPhos and CHZ
4. FPAM = Single layer of unique FabPhos material with an additional antimicrobial treatment.

Fabco StormBasin sectional view.	Fabco filtering cartridge. Volume above red ring is considered a "Pre-Filter"
	

Locations:

The sites selected for StormBasin installation were chosen from a list of approximately 15 locations provided by the municipality.

Under the terms of the contract Fabco Industries provided and installed 10 StormBasin units during the spring of 2005 in preparation for the testing. Fabco selected 3 sites for nutrients testing:

Site descriptions:

Site1 community Beach: Base line Nutrient values

The test drain was located in the Northeast corner of the beach parking field and serviced approximately 5900 square feet of black top paving. The parking field was slightly sloped towards the drain causing considerable accumulations of sediments, trash and debris to flow towards the drain. Most importantly for the bacteria study, the parking lot attracts numerous seagulls that leave behind unmistakable evidence of their visits.

Each sewer drain selected at this site had a 24”x48” grate and featured a rear open box inset into the concrete curb. Depth of the vault below the grate was approximately 40”.

Fabco Industries installed a 22”x 44” StormBasins (p/n 9731- 1E) which was configured for the rear open curb box. This configuration features a formed rubber flap that extends from the back edge of the tub into the rear open box. This flap enhances the unit’s ability to capture the very low flows that are generated during the first flush period of a storm. The StormBasin selected featured two (2) Bacteria filtering cartridges p/n 9718-2 (Yellow ring).

As the waterway adjacent to the beach is federally classified as an impacted waterway (303d) due to pathogens/bacteria pollution this was considered an ideal site for Fabco’s bacteria study. The final bacteria report provided by Fabco Industries was completed in December 2006 and is available on the Fabco Industries website (www.fabco-industries.com).

During the bacteria testing phase Fabco engineers had two sets of water samples analyzed for nutrients. It is important to remember that the cartridges used at the beach were optimized for bacteria treatment and as such had no nutrient treatment media in the filter cartridge. The purpose of this sampling was to identify and measure the baseline nutrient values at that site. With virtually no surrounding lawns or landscaped yards in the vicinity, low nutrient levels were expected

Site 2 community beach:

The drains at this site were located at the bottom of a steeply sloped driveway entering a popular beach front park. The driveway is narrow, heavily shaded, and does not attract any seagulls. Runoff entering the drains flows very quickly and contains considerable sediment loads. The drains empty directly into the harbor located approximately 400 feet away.

The two (2) storm drains selected had the same configuration and size as the drains at Site 1. However the two grates were situated next to each other and shared a common underground vault.

Fabco Industries installed two (2) 22"x 44" StormBasins (p/n 9731-1E) which were configured similarly to the units at Site 1 except for the cartridges.

As this site was similar to many other sites located along the north shore of Long Island New York it was considered a good site for nutrient testing.

Site 3: Residential neighborhood adjacent to waterway

A relatively short dead-end road was selected for the test as it had four well-landscaped properties running parallel to the road surface and the installed storm drains empty into a nearby pond located at the end of the road. Based on direct observations, it is suspected that the vegetation on these properties receives a considerable amount of fertilizer. Inasmuch as the storm drains on this road are routed to an estuarial body of water that ultimately drains to Long Island Sound, the impacts associated with the discharge of nutrients in stormwater are potentially significant.

The drain selected for testing was a 24" round grated inlet very similar to the ones you would see in commercial parking lots. This drain had sufficient depth for the unit and the testing apparatus.

Fabco installed a Round StormPod unit, p/n 9734-1A, which would accept a single Nutrients cartridge.

Methods

The sampling protocol called for the simultaneous collection of both an untreated and treated sample during a rain event. The samples collected were then transported to an independent laboratory[1] for analysis of the following analytes:

3 nitrogen compounds

- Total Kjeldahl or organic nitrogen: animal or human waste, decaying organic matter
- Nitrates (NO_3): inorganic nitrogen from two (2) sources breakdown of nitrites (NO_2) by nitrifying bacteria and chemical fertilizers
- Total Nitrogen: representing the sum of inorganic and organic nitrogen

Two types of phosphates

- Total phosphates: Combined organic and inorganic phosphates
- Ortho-phosphates: inorganic, soluble phosphates

Explanation of phosphate analytes:

Phosphorous is usually present in water in the form of phosphates. Phosphates can be organic or inorganic. Organic phosphate is phosphate that is bound to plant tissue, waste solids or other organic material. Inorganic phosphate is not bound to organic material. It can exist as free ions available for immediate plant uptake or attached to sediments. However, plants can only use inorganic free ions also called Ortho-phosphates directly. Organic phosphates must be decomposed into inorganic phosphate before plants can use it for growth.

The monitoring would take place over an indefinite time period with little or no maintenance being performed on the unit during the monitoring period. All samples represent a first flush capture.

Automatic sampling at sites 1 & 2

Water samples at sites 1 and 2 were collected automatically using a battery powered, Global Water, Model SS201 Storm water sampler (Appendix C).

The Global unit features a large, watertight plastic case and dual individually controlled peristaltic sampling pumps with 2 sample bottles. For this test, the standard 1-gallon sampling bottles were replaced with smaller 1 liter bottles.

To collect the effluent samples special collection "pails" or "buckets" were designed to attach and seal directly to the bottom of the standard Fabco Cartridge body.

[1] Ecotest Laboratories, Inc, 377 Sheffield Ave, N. Babylon, NY 11703, Tel: 631/422-5777

In the pictures on the right, the standard cartridge body is dark blue. The collection pail area is a light green color and is sealed to the cartridge body with a sealing adhesive.

Collection pail features:

Each collection pail was constructed with the following features:

1) A vertical over-flow pipe – To maintain approximately 2 liters of water in the pail while allowing excess water to escape.
2) A quick connect coupling – Connects pail to the supply line of the peristaltic pump and sample bottle.
3) A sensor switch - Activates pumps when the minimum level of water has accumulated in the pail.

Two collection pails were fabricated. The first was attached to the standard Fabco filtering cartridge under test. The second was attached to an empty cartridge body. These two filters were then installed into the bottom of the StormBasin unit with the supply lines routed to the Global Sampler.

Sample collection:

During a storm event surface water enters the StormBasin, flows into and through the cartridges and collects in the pails. When approximately two liters of water has collected, the sensor switch activates the pumps and two **First Flush** water samples are collected. The cartridge with the media left in place would supply a sample of treated water. The empty cartridge would collect a sample of untreated raw water.

Semi-Automatic Testing /Sampling at Site 3

The sampling program was set-up to simultaneously collect both the untreated and treated streams of stormwater flowing through the unit. The equipment used was the NALGENE (I-CHEM) Storm Water Sampler (Appendix D). The use of this device permits the remote collection of a sample from the first flush of a qualifying event.

The Nalgene sampler assembly consists of a round black mounting tube and a translucent one liter, plastic sampling bottle that is inserted down into the mounting tube.

Two samplers were used per unit; one was attached to the plastic collection tub and a second was attached to the bottom of the cartridge.

Prior to attaching the mounting tubes, a small hole (3"dia) was drilled in the bottom of the StormPod tub to allow water to pass out and into the sample bottle. This sampler would collect raw untreated water entering the StormPod

To prepare the cartridge a piece of round plastic material with a four inch diameter hole in the center was glued to the bottom of the filter cartridge. This flat plastic washer-like device insured that water leaving the cartridge would be directed out of a central hole into the mounting tube and to the sample bottles.

The black Nalgene tubes were mounted vertically (extending downwards) from the bottom of the StormPod basin and filter cartridge using clevis pins so that they could be removed when required.

After completing these preparatory steps the white sample bottles were then inserted into the mounting tubes and the assembly was fixed, using the clevis pins, to the StormPod basin and cartridge body. In this configuration the bottle under the Basin would collect the sample of untreated water whereas the bottle under the cartridge would catch a sample of treated water.

Sediment Analysis:

As part of the contract, Fabco provided maintenance between testing cycles on the StormBasins to remove collected sediments and debris.

Numerous studies including the National Urban Runoff Program (NURP), which was used as the basis for the NPDES amendments to the Clean Water Act, sight the variety of pollutants, including nutrients that are attached to sediments in runoff.

As part of this study Fabco will include data from one of the maintenance visits.

Additionally, although we did not request a lab analysis of this particular collected waste, we will provide an analysis of a similar waste collected at a Fabco StormBasin site located along the water in Bayville, NY (Appendix E)

Field testing

Testing/sample collections took place during 5 time periods spanning 2006 and 2007.

Table 1: Stormwater sampling

Test	Site	Cartridge	Start Date	End Date	# Samples
1	Site 1 (2006)	Bacteria	10/2/06	10/17/06	2
2	Site 3 – Test 1 (2006)	ICCHZ	9/18/06	10/20/06	3
3	Site 3 – Test 2 (2006)	NP	11/16/06	12/19/06	2
4	Site 2 (2007)	FPCHZ	7/06/07	8/02/07	3
5	Site 3 (2007)	FP-AM	11/01/07	11/27/07	3

This section provides a brief discussion of the testing that took place during each of the 5 tests. For a quick overview, see individual appendices for each location/Test.

1. **Site 1:**

Testing was performed at this site in October of 2006. As expected the bacteria cartridges installed in the unit during the test were ineffective on these chemicals. Again the purpose of the test was to obtain a baseline for the runoff concentrations at the site.

Analysis of the raw samples verified that the runoff contained both Phosphorous and Nitrogen compounds in excess of the National median concentrations. The site recorded the highest levels of organic nitrogen (Kjeldahl) in the test. This is probably attributable to the large number of mostly seagulls that inhabit the site. (See appendix F for data)

2. **Site 3 (2006): Test 1**

Testing was performed during October of 2006. Analysis of the raw samples verified that the runoff contained both Phosphorous and Nitrogen compounds in excess of the National median concentrations.

The cartridge being used for test 1 was a combination of a commercially available Iron rich compound (IC) normally used for Phosphorous control and a zeolite compound (CHZ), which had shown an affinity for nitrogen compounds during in-house testing. Both filtering compounds were granular particles. (Cartridge designated ICCHZ)

Analysis of the results shows good performance on both phosphorus compounds with Total phosphorous being reduced an average 63% and Ortho phosphates being reduced by 69%.

Performance on nitrogen compounds was lower than expected due to poor results obtained in sample set #2.

Sample set 2			Untreated	Treated	% Change
Tot. Kjeldahl N.	mg/L		11.00	19.0	-72.73
Nitrate as N	mg/L		0.49	0.49	0.00
Nitrogen, total as N	mg/L		11.00	19.0	-72.73

Based on an analysis of the filtering cartridge, the poor results were probably related to the CHZ compound.

If we disregard this data point, nitrogen compounds were reduced by the ICCHZ cartridge as follows:

Tot. Kjeldahl reduced an average 36.63%
Nitrate reduced an average 29.2%
Nitrogen reduced an average 38%

Review of test 2:

The IC compound applied in the cartridge consistently reduced phosphorus compounds by greater than 40%. This supports traditional claims regarding the use of Fe compounds in waste water applications and large aquariums.

Results on the nitrogen compounds although encouraging were erratic. Additional testing on the CHZ filter compound is required to confirm effectiveness. (Appendix G for data)

3. **Site 3 (2006): Test 2**

The second set of tests performed at Site 3 was completed in November-December of 2006. For this test a commercially available filter pad called a Nutrient Pad (NP) was tested in the Fabco filter. The NP pad is a woven, mat-type product made up of bonded thin filaments that have been treated with a proprietary technology. (Cartridge designated NP)

This filter media performed very well in the first sampling for all compounds

First sampling	0330 (OUT)	Value	% reduction
Tot. Kjeldahl N.	mg/L	3.00	25.00%
Nitrate as N	mg/L	0.49	59.17%
Nitrogen, total as N	mg/L	3.00	42.31%
Ortho Phosphate as P	mg/L	0.02	96.36%
Tot. Phosphate as P	mg/L	0.15	72.73%

However, there was a decrease in performance during the second sampling set

Second sampling	0338 (OUT)	Value	% reduction
Tot. Kjeldahl N.	mg/L	9.20	8.00%
Nitrate as N	mg/L	2.00	4.76%
Nitrogen, total as N	mg/L	11.00	8.33%
Ortho Phosphate as P	mg/L	0.35	18.60%
Tot. Phosphate as P	mg/L	0.45	50.00%

Review of test 3:

Testing with the Nutrient pad verified that a product of this type has the potential to treat both phosphates and nitrogen compounds. It would be ideal if it could be improved or enhanced to offer more treatment ability/capacity. For the two tests reductions were: Tot Phosphate 61%; Ortho Phosphates 57%; Tot Kjeldahl 16%; Nitrate 31%; Nitrogen 25%. (Appendix G for data)

4. **Site 2 (2007):**

Testing on nutrients commenced in July of 2007. The cartridge under test contained the new Fabco enhanced Nutrient Pad, FabPhos (FP) that had been under development.

.since 2006. A secondary layer of the CHZ zeolite filter media was also added to the cartridge to aid in Nitrogen compound treatment. (Cartridge designated FPCHZ)

Testing verified good reductions on phosphorous with Total phosphorous (TP) being reduced an average 62% and Ortho-phosphates reduced 40%. Performance on Orthophosphate was a little less than the previous tests using the IC compound but over all effectiveness was good.

The reductions for nitrogen compounds although better than the first test with the CHZ granular media again were less than expected.

One aspect that affected the nitrogen results was the very rural, heavily wooded nature of the site. Unlike Site 3, Site 2 has virtually no landscaped lawns or properties on its perimeter. As a result, soluble nitrates, commonly found in commercial fertilizers were undetectable in 3 out of 4 samples resulting in zero percent reductions being included in the average.

Reductions on Total Kjeldahl and Total nitrogen were an unexceptional 16.7% and 2.5% respectively. Data for Nitrates was inconclusive.

Review of Test 4:

The 3rd set of samples with an iron enriched filter media demonstrated that this media is capable of effectively reducing Phosphate levels by greater than 40%. The FabPhos has more capacity than the NP and performed as well as the IC media. Therefore, additional testing by Fabco would be focused on the optimization of the FabPhos media.

For Nitrogen compounds, testing of the CHZ zeolite media had demonstrated that effectiveness could vary greatly from sample set to sample set. One theory from a micro-biologist suggested that natural bacteria captured in the granular media bed would continue to thrive inside the cartridge, using entrapped organic material for food. This continued growth between rain events would result in an increase of nitrate and Total nitrogen levels stored within the media. As a result first flush samples of the treated effluent could have nitrogen concentrations significantly higher than the raw untreated samples.

To test this theory additional field trials outside the scope of this report, using a cartridge of mainly CHZ zeolite, were completed. In these tests, a new cartridge performed well but subsequent testing over a twenty day period, showed as predicted, substantial increases in both Nitrates and Total Nitrogen. The collected data supports the theory that using granular zeolite media may actually promote the growth of bacteria. As a result CHZ was removed from further testing. (Appendix H for data)

5. Site 2 (2007):

Final testing at this site took place in November 2007. In this test we returned to the concept of a single media technology to isolate effectiveness. Based on the previous results the cartridge consisted of the standard antimicrobial treated pre-filter and FabPhos filter media only.

Previous data collected in the first four tests, confirmed the ability of the iron rich FabPhos material to reduce Total Phosphates and Ortho Phosphates by greater than 40%. Its ability on nitrogen compounds was so far untested.

Earlier in these trials the original Nutrient pad had shown some ability to reduce both nitrogen and phosphate concentrations. As a related product with many of the same properties as the NP media, this testing implied the FabPhos material by itself may be effective on Nitrogen compounds.

To reduce the possibility of bacterial action within the cartridge, the FabPhos material was also treated with our proprietary antimicrobial solution.

Review of test 5:

Table 2: Tests results at Site 3 - 2007

Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	3.80	2.40	36.84%
Nitrate as N	mg/L	1.40	0.49	65.00%
Nitrogen, total as N	mg/L	5.20	2.90	44.23%
Ortho Phosphate as P	mg/L	0.58	0.17	70.69%
Tot. Phosphate as P	mg/L	0.57	0.34	40.35%
Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	0.80	0.60	25.00%
Nitrate as N	mg/L	0.49	0.49	0.00%
Nitrogen, total as N	mg/L	0.80	0.60	25.00%
Ortho Phosphate as P	mg/L	0.49	0.09	81.63%
Tot. Phosphate as P	mg/L	0.33	0.09	72.73%
Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	3.00	1.00	66.67%
Nitrate as N	mg/L	1.00	0.50	50.00%
Nitrogen, total as N	mg/L	4.00	1.50	62.50%
Ortho Phosphate as P	mg/L	1.90	0.26	86.32%
Tot. Phosphate as P	mg/L	2.10	0.30	85.71%

In average the data shows excellent reductions for each of the 4 chemicals

Tot. Kjeldahl N.	Reduced	42.84%
Nitrate as N	Reduced	38.33%
Nitrogen, total as N	Reduced	43.91%
Ortho Phosphate as P	Reduced	79.55%
Tot. Phosphate as P	Reduced	66.26%

These tests demonstrate that the FabPhos material far exceeded the 40% TP reduction required by New York State. And, more importantly the soluble phosphate, which is directly available for plant growth, is reduced by nearly 80%.

Nitrogen levels of all types were also reduced an average of nearly 40%. This data confirms the initial test data obtained in 2006 at Site 3, where the nutrient pad by itself, was very effective on Nitrogen compounds.

Starting with the technology of the Nutrients pad, the iron infused FabPhos offers better performance on phosphates while still treating nitrogen compounds effectively.

The antimicrobial treatment will continue to maintain effectiveness of the filter media by reducing the growth of bacteria and slimes within the cartridge, improving the longevity and service cycle. (Appendix I) (Appendix J summary of all results)

Conclusion

Under the terms of the contract a total of ten (10) StormBasin or StormPod units were installed at designated locations within the town. Fabco Industries was contracted to install, maintain/service and provide testing at three sites. Testing was broken up into two phases: 1) Effectiveness on pathogens/bacteria and 2) treatment of nutrients: phosphorous and nitrogen.

In the first half of the testing program "Beach/Harbor stormwater test program" StormBasin effectiveness was measured using 3 common bacteria indicator organism: E.coli, Fecal Coliform and Enterococcus. This study completed in 2006 is available on the Fabco website www.fabco-industries.com. This report focuses on Test Phase 2: Nutrient treatment and reductions.

Testing for effectiveness on nutrients:

3 sites in the Town were designated for evaluation:

Site 1: a popular and busy town beach
Site 2: another popular beach with different terrain and environmental conditions than Site 1
Site 3: a small, affluent community with highly landscaped and maintained yards located near a sensitive waterway.

Testing process: 5 independent tests were run at the 3 sites; each test lasted about one (1) month in duration

Site 1 – Base line nutrient levels only
Site 2 – filtering effectiveness using 1 filter configuration
Site 3: 3 tests – evaluating filtering effectiveness with 3 types of filter media

A total of 13 sets of influent and effluent samples were collected and analyzed by:

Ecotest Laboratories, Inc.
377 Sheffield Ave
North Babylon, NY 11703
Tel: 631/422-5777

Baseline concentrations at each site:

Analysis of untreated raw samples from all three sites confirmed that nutrient values in nearly every case, exceeded the National Median Concentrations as indicated in Chapter 2, pg 2-3 in the New York State Stormwater design manual.

Table 3: Nutrient concentrations at test sites (Appendix K baseline values)

	mg/l	Nat'l Median	Site 1	% > median	Site 3	% > median	Site 2	% > median
Tot. Kjeldahl N.		1.47	**7.40**	**403%**	5.73	290%	4.60	212.93%
Nitrate as N		0.53	**1.15**	**117%**	1.06	100%	0.50	-5.66%
Nitrogen, total as N		2.00	8.55	328%	6.67	233%	4.60	130.00%
Ortho Phosphate as P		0.10	0.03	-75%	**0.94**	**836%**	0.50	400.00%
Tot. Phosphate as P		0.26	0.16	-40%	**1.22**	**369%**	0.78	200.00%

(Appendix L National Median Concentrations, NYS Stormwater Manual)

StormBasin and StormPod effectiveness

Based on the raw nutrient analysis, the majority of the sampling was performed at Site 3. This site provided the second highest nitrogen levels and the highest measured phosphorous concentrations in the study.

All samples were first flush samples which typically contain the highest levels of contamination during a single storm event.

3 tests were run at the Site 3 location. A total of 3 cartridge types were evaluated.

The final cartridge featured Fabco's new proprietary filtering media FabPhos-AM. In November 2007, the StormPod unit installed on the site reduced Total nitrogen compounds by over 40% and Total Phosphorous compounds by over 66%

Table 4 Final results:

Average of 3 events	Units	**Unfiltered**	**Filtered**	**% Reduction**	**Nat'l Median**
Tot. Kjeldahl N.	mg/l	**2.53**	**1.33**	42.84%	1.47
Nitrate as N		**0.96**	**0.49**	38.33%	0.53
Nitrogen, total as N		**3.33**	**1.67**	43.91%	2.00
Ortho Phosphate as P		**0.99**	**0.17**	79.55%	0.10
Tot. Phosphate as P		**1.00**	**0.24**	66.26%	0.26

The results show that the Fabco Industries StormBasin and FabPhos-AM reduced nutrients in stormwater flowing from fertilized, landscaped properties down below the median national average. **The 66% reduction in Total Phosphorous comfortably exceeds typical State requirements of 40%.**

It is important to realize that these reductions do not include the nutrients attached to sediments and bound to organic matter that are captured and stored in the StormBasin/StormPod collection tub. Maintenance records show over 750 pound of trash, debris and sediments being removed from the site 1 unit annually. With Site 2 contributing over 1100lbs. 100 similar installed units would collect between 37.5 and 55 tons of sediments annually.

Nutrient contributions from Sediments and Organic matter:

A coarse analysis of the debris captured at Site 3 showed approximately 150 pounds of trash and debris along with 950 pounds of sediments.

The trash component contained mostly leaves, twigs and grass. In his Nov 2007 article (Stormwater, Nov/Dec 2007, Vol. 8, No. 8, Stormwater pollution: Getting at the Source) L.A Baker estimates a single Maple leaf would contribute 0.3 kilograms of phosphorous per year and that a tree lined road could have greater input than lawns. Capturing and retaining this organic material relatively dry in the StormBasin will significantly reduce the availability of these stored nutrients to the environment. To further aid effectiveness, maintenance activities should be coordinated to clean out the units in the fall months.

Due to the quantity of sediment collected Fabco investigated the size distribution and chemical composition of the load both of which are reported.

Sediment reductions are mandated by most states including New York and for good reason. Many studies have identified nearly every type of pollutant attached to the particles including nutrients.

In our study, Fabco Industries evaluated typical sediments collected in StormBasins located in two Long Island communities

Table 5: Analysis of sediments collected in Fabco StormBasins

Time period 3-4 mo	Location 1	Location 2
Sediments	120.65 Kg	70.3 Kg
Tot. Kjeldahl	590 mg/Kg	780 mg/Kg
Nitrate	8.2 mg/Kg	< 1.0 mg/Kg
Nitrogen	600 mg/Kg	780 mg/Kg
Tot Phosphate	200 mg/Kg	180 mg/Kg

Using the total weights and concentrations indicated in the chart above, the total amounts of nitrogen and phosphorous retained in the captured sediment is shown below.

Location	Total Nitrogen/Total Phoshorous	Yearly (3 cleanout)
1	2.55 / 0.85oz	7.65 / 2.55oz
2	1.93 / 0.45oz	5.79 / 1.35oz

Using the average of these two sites (6.72 TN / 1.95 TP) if we had 100 units the amount of nutrients stored in the captured sediments (yearly) would be equal to 42 pounds of nitrogen and 12 pounds of phosphorous. The State Environmental Resource center (www.serconline.org) suggests that one pound of phosphorous can result in the growth of 350-700 pounds of green algae. 12 pounds would grow 2 ½ to 4 ½ tons of algae.

Again, the nutrient reductions reported earlier reflect reductions in the water samples only and do not include these substantial amounts collected in the debris and in this sediment load.

Recommendations:

As part of a series of simple Best Management Practices the StormBasin can assist the stormwater manager in complying with State and Federal water quality goals in terms of nutrient reductions.

1) StormBasins can be installed quickly at impacted sites using existing drains without additional construction costs. (As an added benefit, pre-installation site surveys can be used to inspect for illicit dumping activities which is also a suggested Stormwater BMP).

2) The StormBasin can help meet State Stormwater and Federal TMDL regulations by reducing nutrients using three methods:

    a. Capturing sediments which can contain many pollutants including nutrients.

    b. Treating the important soluble nutrient compounds including the Ortho-phosphates, which are immediately available to plant growth and have potentially the biggest impact on waterways.

c. Retaining organic debris, keeping it dry and available for easy cleanout before decomposition, and subsequent release of stored nutrients

3) The StormBasin will improve existing street sweeping and spill prevention programs by treating the soluble pollutants and capturing sediments and debris that collect or are deposited between scheduled sweeping.

   The sweeping program would also keep the StormBasin cleaner, maintaining effectiveness and reducing the maintenance frequency. And in terms of servicing, many new sweepers are equipped with catch basin cleaning attachments that can quickly service the units. This eliminates additional staffing and equipment.

   Used as a total solution, spill prevention, sweeping and StormBasin inserts, would keep the paved areas cleaner, minimize the pollutants loads available to first flush action, and reduce the pollutants entering waterways either through the drains or directly from sheet flow off surrounding surfaces.

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