• Soil & Wetland Studies
• Ecology • Application Reviews
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• Environmental Planning & Management
• Ecological Restoration & Habitat Mitigation
• Expert Testimony • Permitting

VIA HAND DELIVERY

February 18, 2020

Town of South Windsor
Inland Wetlands and Agency /
Conservation Commission
1540 Sullivan Avenue
South Windsor, CT 06074

ATTN: Ms. Barbara Kelly, Chairperson

RE: WETLANDS ASSESSMENT: *Summary of Findings*
Proposed Industrial/Business Development
360 Burnham Street, South Windsor, CT
REMA Job # 18-2142-SWN107

Dear Ms. Kelly and Commission members:

At the request of the applicant, 360 Burnham Street, LLC, REMA ECOLOGICAL SERVICES, LLC (REMA), has prepared this *Wetlands Assessment: Summary of Findings* to be submitted as part of an application before the Town of South Windsor's Inland Wetlands Agency (a.k.a. Conservation Commission).

1.0 Introduction & Overview

The applicant is proposing to construct an industrial project, consisting of three buildings, associated parking, and other infrastructure improvements, including a stormwater management system, on the southernmost portion of a +/- 6.61-acre parcel, located to the north of Burnham Street, in the town of South Windsor, CT. The development would occupy approximately 1.58 acres of the overall property's uplands, leaving the bulk of the

site, which includes forested uplands and wetlands, untouched (see Figure 1, attached). The proposed development will be serviced by public sewer and water.

Under existing conditions, the development site consists of nearly level, second growth woods, in part with a cleared understory, especially close to the street. The balance of the overall property, which is also quite level, is densely wooded, and has been wooded back to the 1930s, based the 1934 aerial photograph. Within the development site the ruins of an old residence is visible. This residence can be seen on the 1948 Town aerial photograph (see Figure 2, attached). Approximately 2.72 acres of wetlands have been delineated within the overall property (i.e., 41.05% of total acreage).

The site's regulated wetlands and watercourses were delineated in the field by REMA soil/wetland scientists in December of 2019 for someone other than the applicant. Re-checking of the wetland boundary took in October of 2019, and the wetland boundary was surveyed and accurately appears on the submitted site plan. The observed soil types are predominately undisturbed types and are derived from glaciofluvial (i.e., stratified drift; outwash) deposits (see *On-Site Soil Investigation & Wetland Delineation Report,* dated November 4th, 2019, attached).

The wetlands within the overall property, which are measured at 2.72 acres, extend to the north, east and northeast. It is estimated that the entire contiguous forested wetland approaches 14 acres, and appears to drain both to the southwest and to the east. A topographic "saddle" occurs within the wetland on the subject site immediately to the northwest of the northern portion of the proposed development area.

The overall wetland is *seasonally flooded* and *seasonally saturated.* The wetland's hydrogeomorphic classification is predominately: *groundwater depression*, and to a lesser extent a *groundwater slope* (see appended definitions).

It is expected that the overall wetland offers embedded vernal pool habitats for the breeding of obligate amphibians such as mole salamanders, but predominately wood frog. A small seasonally flooded area occurs in part within the subject site, extending over the eastern property boundary. While this may attract obligate amphibians, in all likelihood another larger and sufficiently deep area occurs off-site to the east. It is within this area that REMA observed juvenile wood frogs in September 2018, while delineating wetland boundaries on the adjacent property (i.e., 396 Burnham Street).

The overall forested wetland, including the portions on the subject property, is dominated by red maple and yellow birch in the overstory. Other observed tree species include swamp white oak, tupelo, beech, witch-hazel, and pin oak. The understory includes such species as highbush blueberry, spicebush, sweet pepperbush, winterberry, multiflora rose, Morrow's honeysuckle, Japanese barberry, and northern arrowwood. Observed herbaceous species observed in the fall, included sedges, such as tussock sedge, royal, New York, and cinnamon ferns, wood ferns, skunk cabbage, violets, goldenrods, stout wood reedgrass, and poison ivy. Lianas included green briar, and Asiatic bittersweet. In general, most of the wetlands on the subject property had a low density of invasive plants. A small patch of Japanese knotweed was observed on uplands at the eastern edge of the development envelope. It is expected that this patch will be removed during construction.

According to the submitted plans there would be no *direct* wetland impact from the proposed activities. Approximately 31,800 square feet (i.e., 0.73 acres) of activity is proposed within the Upland Review Area to the delineated wetlands.

This report is a *Summary of Findings* that provides a "description of the ecological communities and functions of the wetlands and the effects of the proposed activity" pursuant to the Connecticut Inland Wetlands and Watercourses Act (Section 22a-36 through 22a-45 of the Connecticut General Statutes), and the Town's Inland Wetland & Watercourses Regulations.

Appended to this report are several figures, including a historic aerial photograph, depicting the site (i.e., Figures 1 and 2), and annotated photographs (i.e., Photos 1 through 16). We note that REMA reviewed a variety of secondary source data, including archival aerial photographs including for flight years 1934, 1951, 1965, 1985, 2004, and 2016, USGS topographic maps, the Soil Survey State of Connecticut (USDA-NRCS), and CT DEEP GIS-based resource maps (e.g. surficial and bedrock geology, etc.).

Based on the review of the site, the site plans, and above-referenced documents, it is our professional opinion that the proposed regulated activities will *not* have a significant adverse impact on the overall wetland associated with the subject site, both on-site and off-site, in the short-term or long-term.

2.0 Wetland Functions & Values

Wetland/watercourse functions and **values**[1] were assessed informally, using the rationales of a standardized evaluation methods (e.g., US Army Corps of Engineers' *Descriptive Approach* (1995)), and best professional judgment. Wetland and upland baseline data provide the basis for the assessment. Table 1 (below) shows the results of the assessment.

The assessment considers the overall Wetland A, which is estimated at almost 14 acres, of which only 2.72 acres occur within the overall property. The wetlands adjacent to proposed development do not contribute as high to the overall functions and values, in part because of their transitional nature, such as is the case at the wetland "finger" (i.e., Wetland Flags B-8 to B-17), and in part because they are adjacent to areas that are already disturbed and/or cleared.

Table 1: Summary of Wetland/Watercourse Functions-Values Assessment

Function/Value	Wetland B *(on-site/off-site)*
Groundwater Recharge/discharge	Y
Floodflow alteration	Y
Sediment/Shoreline Stabilization	N/A
Sediment/toxicant/pathogen retention	**P**
Nutrient Removal/Transformation	**P**
Production Export	Y
Aquatic Habitat	N
Wildlife Habitat	**P**
Endangered Species Habitat	N
Visual Quality/aesthetics	Y
Educational/Scientific Value	Y
Recreation (passive/active)	N
Uniqueness/heritage	N

Notes: P = Primary function; Y = function present; N = function not appreciably present or absent

While the overall wetland is sizeable, and may contain some embedded vernal pool habitats which attract wood frogs, there is a lack of open water or a perennial stream, and only one wetland cover type, that is, a red maple swamp. Nevertheless, wildlife habitat is still a

[1] Functions are those provided by a given wetland/watercourse that are intrinsic to the resource. That is, they would present regardless of society (e.g wildlife habitat, nutrient removal/transformation). Values are those services that society benefits from (e.g., floodflow alteration, recreation, educational/scientific value. Some "functions" also benefit society, such as sediment/toxicant/pathogen retention.

principal function. Other principal functions/values include sediment/toxicant/pathogen retention, and nutrient removal transformation. These latter functions/values are primarily due to the older industrial developments that occur to the east of the subject site.

3.0 Overview of Potential Wetland/Watercourse Impacts

3.1 Direct Wetland/Watercourse Impacts

There are *zero* direct impacts to wetlands at the subject site.

3.2 Indirect Wetland/Watercourse Impacts

Indirect or secondary impacts to a wetland or watercourse may occur as a result of activities outside of wetlands or watercourses. Such impacts may be *short-term* or *long-term*, and are typically associated with erosion and sedimentation, mostly during the construction period, the removal or disturbance of vegetation in upland areas but adjacent to wetlands or watercourses, the alteration of wetland hydrology or the flow regime of a watercourse, and the discharge of degraded surface water or groundwater, which may adversely impact the water quality of the regulated resources.

The potential for any of these indirect impacts to occur at the site as a result of the proposal depends on the regulated resources themselves, their environmental sensitivity, and their ecological and physical characteristics. These potential impacts are discussed below.

3.2.1 Erosion and Sedimentation

The potential for soil erosion and subsequent deposition in wetlands or watercourses exists at every construction site that involves soil disturbance. At this site the risk or the potential for adverse impacts from erosion and sedimentation is considered to *be low-moderate*. The primary reasons for this assessment are as follows: (1) appropriate erosion and sedimentation controls have been proposed, (2) the dominant soils in the areas to be graded and/or exposed have *moderate* erodibility (i.e., K-factor is 0.32 for Ninigret soil series); and (3) slopes are generally gentle to nearly flat throughout most of the site subject to earthwork. Diligent monitoring and maintenance of erosion and sedimentation controls is necessary to ensure that the regulated resources are protected during the construction phase.

We should mention that although the edge of earthwork is at the edge of the delineated wetlands, the plans show that a 3-foot high earthen berm would be constructed along the

perimeter of the development envelope, where it falls adjacent to the wetland boundary. This will be accomplished during the initial phase of construction, right after tree removal and grubbing, thus protecting the wetlands as the construction of the paved areas, and buildings takes place. In conjunction with the aforementioned berm the stormwater basins proposed along the perimeter of the site will be constructed, to act as temporary sediment basins.

3.2.2 Removal of Native Vegetation and Habitat Loss

Habitat loss associated with land clearing is an unavoidable consequence of land development, which has the potential of impacting wetlands and watercourses. At the subject site, development is proposed up to the wetland boundary, thus removing woody vegetation. However, for the most part the proposed stormwater basins, to be located along the perimeter of the site, will provide some separation between the buildings and the impervious surfaces from the wetlands. While the vegetation at the new forest edge will experience more growth due to more sunlight exposure, it may be prudent to plant clonal shrubs at the edge of the wetland both to ensure that the wetlands are screened, but also to discourage proliferation of invasive species into the wetland, particularly in those areas with marginal wetland hydrology (i.e., seasonally saturated). Such species could include sweet pepperbush and nannyberry.

3.2.3 Potential Impacts to Wetland Hydrology and Stream Flow

The hydrologic regime of the site's wetland is dependent somewhat on surface flows, but mostly by the local groundwater regime. The proposal is capturing and conveying most all stormwater runoff to retention/infiltration basins located at the edge of the wetlands. This will ensure that the hydrologic regimes of the adjacent wetlands shall not be altered.

3.2.4 Potential Water Quality Impacts

Stormwater runoff from impervious surfaces of industrial sites has the potential of degrading the water quality (i.e. surface and groundwater) of regulated resources. Generation of potential pollutants on impervious surfaces typically results from vehicular traffic over them. The more the "axle-miles" or the movements of vehicles over impervious surfaces, the higher is the potential loading of runoff constituents, including sediment, nutrients, heavy metals, and the like.

For the site, a minimal amount of parking spaces are proposed to serve the industrial buildings, and vehicular traffic is likely to be limited based on the proposed use. Therefore, the potential for the generation of significant runoff constituents is moderated, and this site is not considered a "hot spot" or a significant generator of runoff constituents, as would be a convenience store or other commercial establishments. The proposed stormwater management design promotes sheet flow off of the driveway and parking areas, or through leak offs, directly into retention/infiltration basins that have been sized for the water quality volume (WQV). The WQV will be retained in the basins and overflow to the wetlands would only take place during larger storm events, and not during the more frequent "first flush" rainstorms which generate the bulk of potential pollutants. Therefore, the proposed stormwater management system will provide more than adequate attenuation of runoff and not result in an adverse impact to the receiving waters.

5.0 Conclusion

It is our professional opinion that the proposal represents the feasible and prudent alternative in regards to direct and indirect, short-term and long-term impacts to wetlands and watercourses. No significant and adverse impacts to the site's wetlands are expected, based on the reviewed plans. The wetlands associated with the site will continue to provide functions and values post-construction at similar levels as are provided under existing conditions.

Please call us if you have any questions on the above.

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

George T. Logan

George T. Logan, MS, PWS, CSE
Certified Professional Wetland Scientist
Registered Soil Scientist / Certified Senior Ecologist

Attachments: Figures (1-2)
Annotated Photographs (1-16)
On-Site Soil Investigation & Wetland Delineation Report
Wetland Classification & Characterization Definitions

FIGURE 1:

360 Burnham Street, South Windsor, CT
(as seen on a July 2019 aerial photo)

Town of South Windsor

Geographic Information System (GIS)

Date Printed: 2/11/2020

FIGURE 2: Development Site as seen on a 1948 Town aerial photograph; 360 Burnham Street, South Windsor, CT

Proposed Commercial Development, 360 Burnham Street, South Windsor, CT
Photos taken on December 9th & 27th, 2018, and on January 28th, 2020
by REMA Ecological Services, LLC

Photo 1: Wetland 1A; only a small portion is within site; facing southerly.

Photo 2: Wetland 1A; seasonally flooded small pool, not likely a vernal pool habitat; facing southerly.

Proposed Commercial Development, 360 Burnham Street, South Windsor, CT
Photos taken on December 9th & 27th, 2018, and on January 28th, 2020
by REMA Ecological Services, LLC

Photo 3: Wetland B; northerly of Building 'C'; facing northerly.

Photo 4: Wetland B; westerly of Building 'C'; facing northeasterly.

Proposed Commercial Development, 360 Burnham Street, South Windsor, CT
Photos taken on December 9th & 27th, 2018, and on January 28th, 2020
by REMA Ecological Services, LLC

Photo 5: Wetland B "finger" situated between the two westerly stormwater basins; seasonally saturated; facing southerly

Photo 6: Wetland B; westerly of two westerly proposed stormwater basins; facing northwesterly.

Proposed Commercial Development, 360 Burnham Street, South Windsor, CT
Photos taken on December 9th & 27th, 2018, and on January 28th, 2020
by REMA Ecological Services, LLC

Photo 7: Wetland 1A (seasonally flooded pool); facing southerly.

Photo 8: Wetland B along southerly boundary of overall property; facing westerly.

Proposed Commercial Development, 360 Burnham Street, South Windsor, CT
Photos taken on December 9th & 27th, 2018, and on January 28th, 2020
by REMA Ecological Services, LLC

Photo 9: Outlet of Wetland B, just past southern property boundary; facing southwesterly.

Photo 10: Off-site potential vernal pool, located easterly of Wetland 1A (seasonally flooded pool); facing easterly.

Photo 11: Close-up of potential vernal pool habitat seen in Photo 10; facing northeasterly.

Photo 12: Development area (uplands) - central; facing southerly.

Photo 13: Development Area (upland) – northern portion; facing southerly.

Photo 14: Development area (upland; north-central); note Japanese knotweed; facing westerly.

REPORT DATE: November 4, 2019

REMA ECOLOGICAL SERVICES, LLC
164 East Center Street, Suite 8
Manchester, CT 06040
860.649.REMA (7362)

ON-SITE SOIL INVESTIGATION & WETLAND DELINEATION REPORT

PROJECT NAME & SITE LOCATION:
(+/- 6.3 acres)
360 Burnham Street
South Windsor, CT

REMA Job No.: 18-2142-SWN107
Field Investigation Date(s): 12/9 & 12/27/18, 9/27/19
Field Investigation Method(s):
- ☒ Spade and Auger
- ☐ Backhoe Test Pits
- ☐ Other:

REPORT PREPARED FOR:
Three C's, LLC
Attn.: Mr. Dave Simler, LS

Field Conditions:
Weather: Partly sunny to sunny, 40s/70s
Soil Moisture: moderate to moderate-high
Snow Depth: N/A
Frost Depth: N/A

Purpose of Investigation:
- ☒ Wetland Delineation/Flagging in Field
- ☐ Wetland Mapping on Sketch Plan or Topographic Plan
- ☐ High Intensity Soil Mapping by Soil Scientist
- ☒ Medium Intensity Soil Mapping from *The Soil Survey of Connecticut* Maps (USDA-NRCS)
- ☐ Other:

Base Map Source: CT Web Soil Survey (USDA-NRCS) (attached); Figure A (attached)

Wetland Boundary Marker Series: RES-1A-1 to RES-1A-4 (open line); RES-1A-15 to RES-1A-20 (open line); RES-B-1 to RES-B-27 (open line); RES-1B-1 to RES-1B-23 (open line); and RES-2B-1 to RES-2B-8 (closed loop; upland island within wetland)

General Site Description/Comments: The "the study area", or "site", is +/-6.3 acres of land located on the north side of Burnham Street, in South Windsor, CT. Landuses surrounding the site includes moderate-density residential, as well as industrial development. The site is undeveloped and forested, but foundations of long-abandoned structures are evident in the southeastern section of the site. The soils observed at the site are derived from glaciofluvial deposits (i.e., stratified sand, and gravel). The upland-type soils within the study area are predominately the moderately well drained Ninigret (701) fine sandy loam, while the wetland-type soils observed onsite are predominately the poorly drained Walpole (13) sandy loam. Within the delineated wetland there are inclusions of somewhat poorly drained to moderately well drained soils, but to the extent that these areas support wetland vegetation they may be regulated under the "watercourse" definition of the State Statutes. However, one "upland" island was delineated (i.e., 2A-series). The regulated on-site resource is a deciduous forested swamp, that is seasonally flooded to seasonally saturated. Dominant overstory vegetation associated with the delineated wetlands includes red maple, pin oak, swamp white oak, and green ash. Understory vegetation includes winterberry, sweet pepperbush, highbush blueberry, multiflora rose, spicebush, rough-stem goldenrod, stout wood reedgrass, sedges, skunk cabbage, cinnamon, sensitive, New York fern, and royal ferns, and others. Lianas observed include poison ivy, and fox grape.

DATE: 11/4/19

ON-SITE SOIL INVESTIGATION & WETLAND DELINEATION REPORT *(CONTINUED)*

PROJECT NAME & SITE LOCATION: (+/- 6.3 acres)
360 Burnham Street, South Windsor, CT

SOIL MAP UNITS

Upland Soils

Ninigret fine sandy loam (701). This series consists of very deep moderately well drained soils formed in a coarse-loamy mantle underlain by sandy water deposited glacial outwash materials. They are nearly level to gently sloping soils on glaciofluvial landforms, typically in slight depressions and broad drainage ways. The soils formed in loamy over stratified sandy and gravelly outwash derived from a variety of acid rocks. Typically, these soils have a very dark grayish brown fine sandy loam surface layer 8 inches thick. The subsoil from 8 to 26 inches is yellowish brown fine sandy loam with mottles below 16 inches. The substratum from 26 to 60 inches is mottled, pale brown, loose, stratified loamy sand.

Wetland Soils

Walpole sandy loam (13). This series consists of deep, poorly drained soils formed in sandy water deposited glacial outwash materials. They are nearly level to gently sloping soils on glaciofluvial landforms, typically in shallow drainage ways and low-lying positions on stream terraces and outwash plains. The soils formed in loamy over stratified sandy and gravelly outwash derived from a variety of acid rocks. Typically, these soils have a very dark brown sandy loam surface layer 6 inches thick. The subsoil from 6 to 23 inches is mottled, grayish brown sandy loam. The substratum from 23 to 60 inches is mottled, light brownish gray, gravelly loamy sand and gravelly sand.

DATE: 11/4/19

ON-SITE SOIL INVESTIGATION & WETLAND DELINEATION REPORT *(CONTINUED)*

PROJECT NAME & SITE LOCATION: (+/- 6.3 acres)
360 Burnham Street, South Windsor, CT

SOIL MAP UNITS

See previous page

Any accompanying soil logs and soil maps, and the on-site soil investigation narrative are in accordance with the taxonomic classification of the National Cooperative Soil Survey of the USDA Natural Resource Conservation Service, and with the Connecticut Soil Legend (DEP Bulletin No.5, 1983), as amended by USDA-NRCS. Jurisdictional wetland boundaries were delineated pursuant to the Connecticut General Statutes (CGS Sections 22a-36 to 22a-45), as amended. The site investigation was conducted and/or reviewed by the undersigned Registered Soil Scientist(s) [registered with the Society of Soil Scientists of Southern New England (SSSSNE) in accordance with the standards of the Federal Office of Personnel Management].

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

George T. Logan

George T. Logan, MS, PWS, CSE
Registered Soil Scientist
Field Investigator/Senior Reviewer

Town of South Windsor

Geographic Information System (GIS)

Date Printed: 12/6/2018

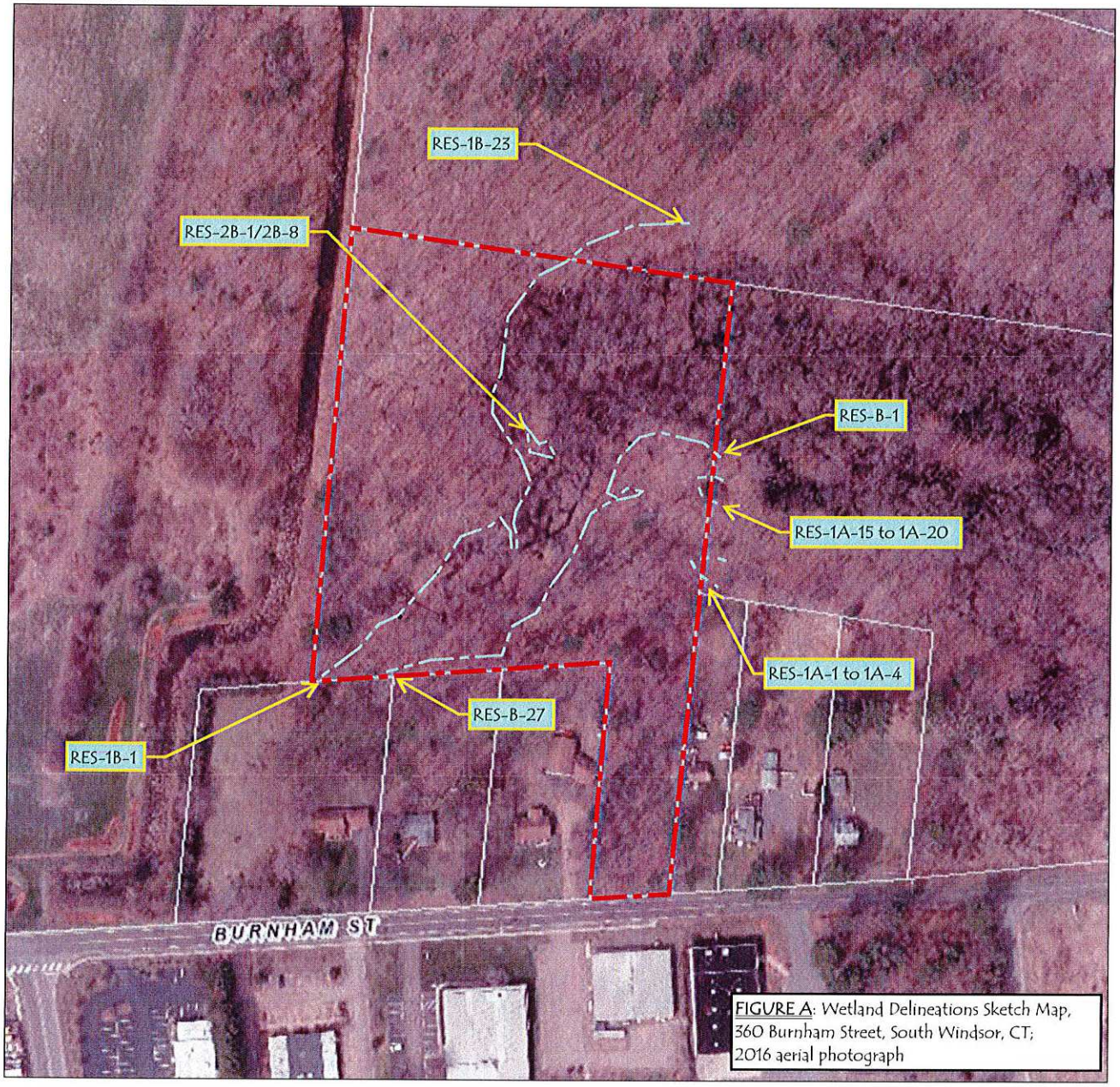

FIGURE A: Wetland Delineations Sketch Map, 360 Burnham Street, South Windsor, CT; 2016 aerial photograph

MAP DISCLAIMER - NOTICE OF LIABILITY

This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of South Windsor and its mapping contractors assume no legal responsibility for the information contained herein.

Approximate Scale: 1 inch = 200 feet

0 200 Feet

N W E S

Soil Map—State of Connecticut
(360 Burham Street, South Windsor, CT)

Map Scale: 1:3,110 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 18, Dec 6, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 27, 2016—Oct 30, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13	Walpole sandy loam, 0 to 3 percent slopes	10.3	25.0%
306	Udorthents-Urban land complex	4.9	12.0%
701A	Ninigret fine sandy loam, 0 to 3 percent slopes	25.9	63.0%
Totals for Area of Interest		**41.1**	**100.0%**

WETLANDS: *The Physical Environment*

WETLAND HYDROGEOMORPHIC CLASSIFICATION

Surface-Water Depression Wetlands: In these wetlands, precipitation and overland flow (surface runoff) collect in a depression where there is little or no groundwater discharge. Water leaves the wetland principally by evaporotranspiration and infiltration (groundwater recharge). The wetland hydrologic system lies above the local or regional groundwater system and is isolated from it by an unsaturated zone; thus, it is said to be "perched." In the glaciated Northeast, surface-water depression wetlands are most likely to form over bedrock or till deposits in topographically elevated areas of landscape; however, they may develop in lowland kettles or ice-block basins that formed in glaciolacustrine or fine-textured glaciofluvial deposits.

Surface-Water Slope Wetlands: These wetlands are located along the edge of stream or lake or on the sloping surface of a floodplain. They may occur on till or stratified drift but are commonly found on alluvium. While precipitation and overland flow also feed these wetlands, the principal source of water is the overflow of the adjacent water body. The sloping surface of the wetland permits water to drain readily back to the lake or river as its stage falls. As was the case with the previous class, the wetland surface usually lies well above the local water table, so groundwater discharge to the wetland is negligible or nonexistent. Groundwater recharge from the wetland is possible, depending on the permeability of underlying surficial deposits.

Groundwater Depression Wetlands: These wetlands occur where a basin intercepts the local groundwater table, so that groundwater discharge as well as precipitation and overland flow feed the wetland. Classic groundwater depression wetlands have no surface drainage leaving the site; however, occasional streamflow out may occur form basin overflow. Groundwater inflow may be continuous or seasonal, depending upon the depth of the basin and the degree of fluctuation of the local water table. During periods when the wetland water level is higher than the local groundwater table (e.g., after major precipitation events in dry season), groundwater recharge may occur. Groundwater may enter the wetland basin from all directions, or it may discharge in one area and recharge in another. In the glaciated Northeast, groundwater depression wetlands are most likely to occur in stratified drift, particularly in coarse-textured glaciofluvial deposits where relatively rapid movement between groundwater and surface water can occur.

Groundwater Slope Wetlands: These wetlands occur where groundwater discharges as springs or seeps at the land surface and drains away as streamflow. Most commonly, these wetlands occur on hillsides over till deposits or at the base of hills where stratified drift and till come into contact. Headwater wetlands are typically groundwater slope wetlands. The local water table slopes toward the wetland surface. Where groundwater flow is continuous, the soil remains saturated. At many sites, however, groundwater inputs cease during late summer or early fall as evaporotranspiration depletes soil moisture in the root zone, in which case the soil is only seasonally saturated. Permanent ponding of water is prevented by the sloping land surface, but water may collect temporarily in isolated depressions. Precipitation and overland flow provide additional water to the wetland on an intermittent basis. Groundwater recharge may occur in the wetland after such events, but amounts are likely to be negligible, especially where wetland soils have formed over dense lodgment till deposits. Where such deposits are present, groundwater slope wetlands may be fed primarily by shallow groundwater systems perched above the regional system.

Reference:

Golet, C.G., A.J.K. Calhoun, W.R. DeRagon, D.J. Lowry, and A.J. Gold. 1993. Ecology of Red Maple Swamps in the Glaciated Northeast: A Community Profile. USFWS. Biological Report No. 12

WETLANDS: *The Physical Environment*

SOIL DRAINAGE CLASSES

Excessively drained: Brightly colored; usually coarse-textured; rapid permeability; very low water-holding capacity; subsoil free of mottles

Somewhat excessively drained: Brightly colored; rather sandy; rapid permeability; low water-holding capacity; subsoil free of mottles

Well drained: Color usually bright yellow, red, or brown; drain excess water readily, but contain sufficient fine material to provide adequate moisture for plant growth; subsoil is free of mottles to a depth of at least 36 inches.

Moderately well drained: Generally any texture, but internal drainage is restricted to some degree; mottles common in the lower part of the subsoil, generally at a depth of 18 to 36 inches; may remain wet and cold later in spring; generally suited for agricultural use.

Somewhat poorly drained: Remain wet for long periods of time due to slow removal of water; generally have a slowly permeable layer within the profile or a high water table; mottles common in the subsoil at a depth of 8 to 18 inches.

Poorly drained: Dark, thick surface horizons commonly; gray colors usually dominate subsoil; water table at or near the surface during a considerable part of the year; mottles frequently found within 8 inches of the soil surface.

Very poorly drained: Generally thick black surface horizons and gray subsoil; saturated by high water table most of the year; usually occur in level or depressed sites and are frequently ponded with water.

Reference:

Wright, W. R., and E. H. Sautter. 1979. Soils of Rhode Island landscapes. R.I. Agric Exp. Station Bull. 429. 42 pp.

WETLANDS: *The Plant Community*

WETLAND CLASSES AND SUBCLASSES IN THE GLACIATED NORTHEAST

WETLAND CLASS	WETLAND SUBCLASS
Open Water	(OW-1) Vegetated (OW-2) Floating-leaved (OW-3) Non-vegetated
Deep Marsh	(DM-1) Dead Woody (DM-2) Shrub (DM-3) Sub-shrub (DM-4) Robust (DM-5) Narrow-leaved (DM-6) Broad-leaved
Shallow Marsh	(SM-1) Robust (SM-2) Narrow-leaved (SM-3) Broad-leaved
Meadow	(M-1) Ungrazed (M-2) Grazed
Shrub Swamp	(SS-1) Sapling (SS-2) Bushy (SS-3) Compact (SS-4) Aquatic
Wooded Swamp	(WS-1) Deciduous (WS-2) Evergreen
Bog	(BG-1A) Compact Shrub (BG-1B) Bushy Shrub (BG-2) Wooded (BG-3) Emergent

Note: Subclass (OW-2) has replaced (SM-4)
Seasonally Flooded Class (SF-1 & SF-2) has been removed

Reference:

Golet, F.C., and J.S. Larson. 1974. Classification of freshwater wetlands in the glaciated Northeast. USFWS Resour. Publ. 116. 56 pp.

WETLANDS: *The Physical Environment*

COMMON WATER REGIMES OF NORTHEASTERN WETLANDS

Seasonally flooded: Surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

Temporarily flooded: Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season.

Seasonally saturated: The soil is saturated to the surface, especially early in the growing season, but unsaturated conditions prevail by the end of the season in most years. Surface water is absent except for groundwater seepage and overland flow.

Semi-permanently flooded: Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Permanently flooded: Water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes.

Saturated: The substratum is saturated to the surface for extended periods during the growing season, but surface water is seldom present. This water regime applies to permanently saturated, non-flooded wetlands such as bogs.

References:

Golet, F. C., A. J. K. Calhoun, W. R. DeRagon, D. J. Lowry and A. J. Gold. 1993. Ecology of Red Maple Swamps in the Glaciated Northeast: A Community Profile. U. S. Dep. Int. Fish Wild. Serv. Biol. Rep. 12, 152 pp.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Fish Wild. Serv. Biol. Serv. Program FWS-OBS 79/31. 103 pp.