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Year 5 Massachusetts Small Municipal Separate Storm System Permit – Nitrogen Source Identification Report

Submitted to the Town of Oxford
June 30th, 2022 – Updated June 30, 2023
Nitsch #14845

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1 Introduction

1.1 Nutrients and Water Pollution

Water quality in the nation’s rivers, streams, ponds, and lakes is threatened by excess nutrients entering these water bodies via stormwater runoff. As development of paved surfaces like roads, roofs, and parking lots increases, so does the amount of stormwater runoff entering the stormwater management drainage system and eventually discharging to waterways or water bodies. Nutrients, including nitrogen, are carried to waterbodies in the form of organic debris, animal and pet waste, lawn or agricultural fertilizers, malfunctioning sewers and septic systems, along with plenty of other sources.

Excess nitrogen, along with other pollutants such as phosphorus and bacteria, are threatening the ecosystems of these waterways. Excess plant and algae growth lead to toxic environments for both humans and aquatic wildlife which impedes recreational uses in lakes, streams and rivers. Nitrogen becomes a primary concern in areas where freshwater rivers flow into saltwater estuaries and bays.

1.2 Regulatory Context

Under the federal and state Clean Water Acts, the Massachusetts Department of Environmental Protection (MassDEP) is charged with establishing water quality standards and determining whether waterways meet these designated standards. MassDEP published the Massachusetts 2018/2020 list - "Final 2018/2020 Integrated List of Waters” also referred to at the 303d Impaired Waters List, identifying waters that do not meet standards. These waterways are referred to as being “impaired” or “water quality limited” based on one or more causes which may include nitrogen, phosphorous, “nutrient/eutrophication biological indicators” or in some cases turbidity or transparency. MassDEP is also charged with preparing waterbody-specific cleanup plans for nutrient pollution known as Total Maximum Daily Loads or TMDLs, though these are yet to be prepared for many impaired waterways.

The Town of Oxford (“the Town”) is subject to the requirements of the US Environmental Protection Agency’s (EPA’s) 2016 Massachusetts Small MS4 General Permit (the Permit). One of the requirements of the Permit is that Massachusetts communities located within the Long Island Sound watershed, which has an approved TMDL for Total Nitrogen, shall prepare a Nitrogen Source Identification Report as detailed in Appendix F of the Permit. The Town of Oxford is within the French River Watershed which joins the Thames River and drains to the Long Island Sound. There are two listings in the Town of Oxford for rivers as impaired in Category 5 of MassDEPs 2018 303d list. Table 1 shows the listing of these waters. Figure 1 is a map of the impaired waters in Oxford.

Table 1. Impaired Receiving Waters, Category 5 – Requiring a TMDL

Water Body	Segment ID	Description	Size	Units	Impairment
Wellington Brook	MA42-11	Headwaters south of Cedar Street, Auburn to mouth at confluence with French River, Oxford.	3.4	Miles	Escherichia Coli (E. Coli)
French River	MA42-03	Headwaters, outlet Greenville Pond, Leicester to the outlet of Thayers Pond, Oxford (excluding approximately 0.6 miles through Rochdale Pond segment MA42048) (through former pond segments Texas Pond MA42058 and Thayers Pond MA42059).	3.8	Mile	Mercury in Fish Tissue

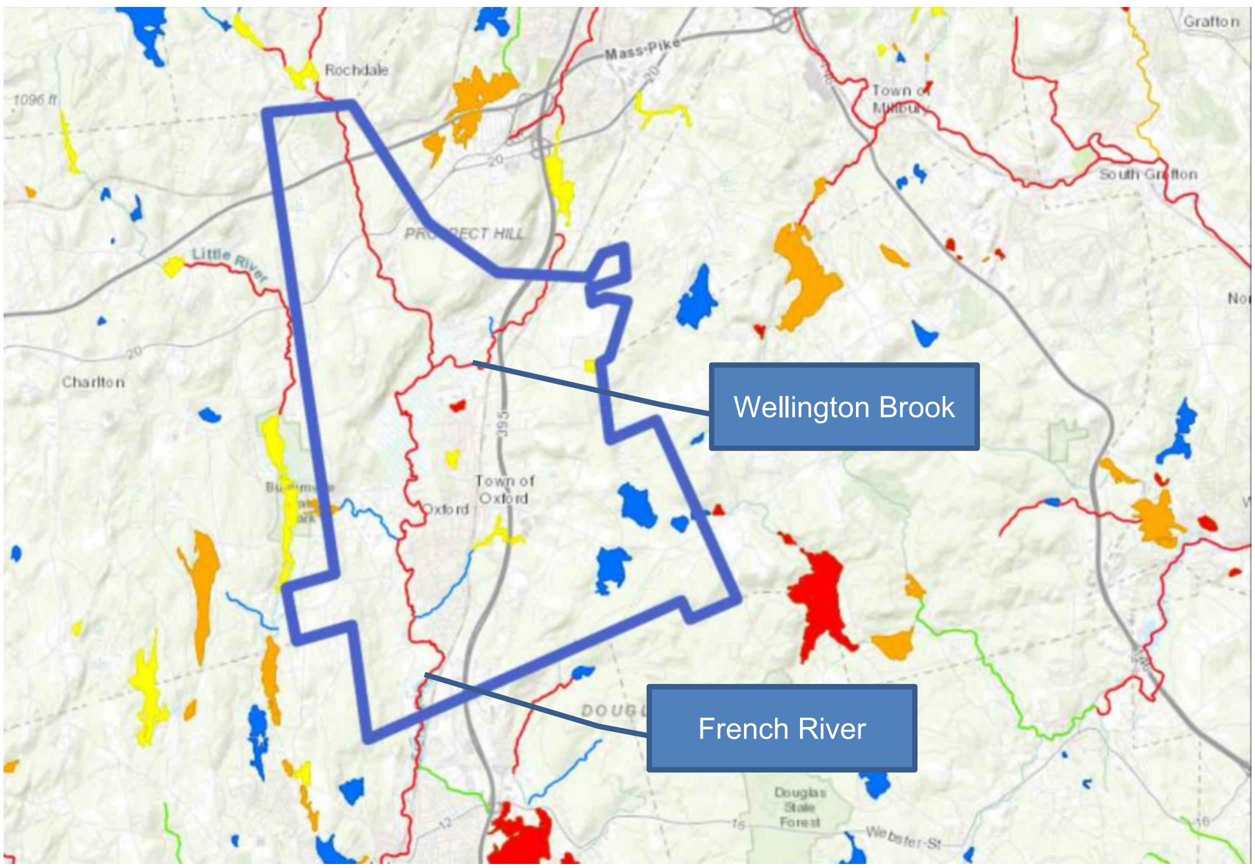


Figure 1. Map of Town of Oxford Category 5 Impaired Waters - Waters requiring a TMDL (Source: MassGIS)

The Nitrogen Source Identification Report must be submitted with the permit year 4 annual report (year ending June 30, 2022, and report due late September 2022). Appendix F of the EPA 2016 MS4 Permit describes the following requirements for the Nitrogen Source Identification Report:

1. Calculation of total urbanized area within the permittee's jurisdiction that is within the Connecticut River Watershed, the Housatonic River Watershed, or **the Thames River Watershed**, incorporating updated

mapping of the MS4 and catchment delineations produced pursuant to part 2.3.4.6;

2. All screening and monitoring results pursuant to part 2.3.4.7.b., targeting the receiving water segment(s);

3. Impervious area and DCIA for the target catchment;

4. Identification, delineation and prioritization of potential catchments with high nitrogen loading;

5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment.

2 Data Sources and Analytical Methods

Several existing data sets were used to complete this work. Table 2 below list the utilized data sets and their references.

Table 2. Data Sources

Existing Data Set	Origin	Date Published/ Updated	Link
2016 Land Cover/Land Use	MassGIS	May 2019	https://docs.digital.mass.gov/dataset/massgis-data-2016-land-coverland-use
Soil Survey Geographic (SSURGO) Database for Worcester County, Massachusetts	USDA	June 2020	Downloaded through Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm). Hydrologic soil groups extracted using Soil Data Viewer Version 6.1 (https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053619)
Town of Oxford Catchments	Town of Oxford GIS files	Received 2/10/2022	Email from Judy Lochner jlochner@oxfordma.us

Impervious area is the portion of the Town that is paved, covered by buildings, or otherwise rendered unable to absorb water naturally due to development. Impervious area for the Town was calculated using the MassGIS 2016 Land Cover/Land Use data layer which was published in 2019. This data layer maps impervious and pervious land cover by land use type based on aerial photography and other data sources. This was overlaid with the Town's data layer for outfall catchment areas (the area draining to each Town-owned stormwater discharge point) to estimate total areas and total impervious area discharging to or upstream of nutrient-impaired waterways, as well as to estimate impervious area for each stormwater outfall catchment.

Directly connected impervious area (DCIA), also referred to as "effective impervious cover," is the amount of impervious area that is directly connected to the storm drain system. Most land in the Town was developed before the creation of modern requirements to capture, clean, slow, and recharge stormwater runoff using Stormwater Control Measures (SCMs). However, many new development and redevelopment projects constructed in recent years have required the installation or upgrade of SCMs, such that today some properties have no SCMs, some have SCMs that meet some modern standards, and some have SCMs that are fully compliant with modern standards.

Because site-specific information about the existence of specific SCMs is not available at the parcel level, an estimate of DCIA or effective impervious cover is used to approximate the average level of SCMs installed across the watershed. DCIA was estimated based on land use categories following EPA guidance.

To estimate the pollutant loads for nitrogen in each catchment, estimated pollutant loading rates for different combinations of land use type, land cover type, and soil type were applied in accordance with guidance in the EPA 2016 MS4 Permit. The individual loading rates for these unique subsections were summed based on catchment, which produced an overall estimated catchment pollutant loading rate.

For a more detailed description of the analytical methods used for this project, refer to the Calculation & GIS Methods document in Appendix A.

3 MS4 Total Urbanized Regulated Area

The total area of the Town of Oxford is approximately 17,600 acres, with approximately 9,370 acres located in the urbanized/MS4-regulated area. All of the MS4 regulated acreage is within the Thames River Watershed. The Town's urbanized/MS4-regulated area included in Year 4's Nitrogen Source Analysis includes 218 outfall catchment areas totaling 3,422 acres. Therefore, the only areas included in this analysis are areas within an outfall catchment that are also within the urbanized/MS4-regulated area.

Figure 2 shows the Town of Oxford's catchment areas with the urbanized areas overlaid in red hatch.

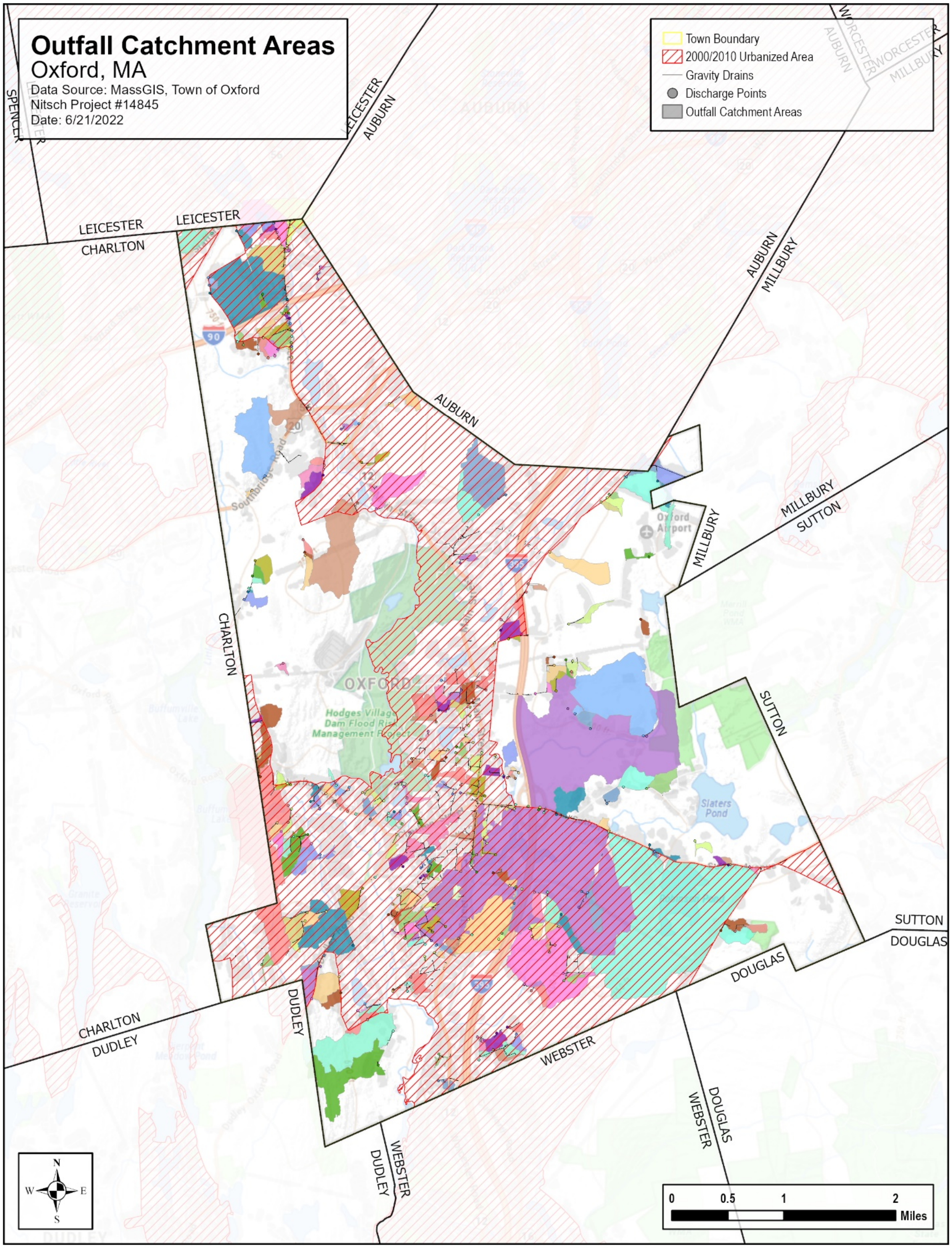


Figure 2. Stormwater Catchment Areas for the Town of Oxford

4 Impervious Area and Directly Connected Impervious Area (DCIA)

Table 3 below summarizes the total impervious area (IA) and estimated Directly Connected Impervious Area (DCIA) within the Town of Oxford's outfall catchment areas in the MS4-regulated area.

Table 3. Summary of Impervious Area and DCIA within Oxford's MS4-regulated Area Catchments

Total within MS4 Area for Oxford	Acres
Impervious Area	336.01
Estimated DCIA	87.15

Table 4 below shows information for the 10 catchments within the MS4-regulated area with the most impervious area. The catchments are labeled using the Town's identifier for the outfall to which they drain. The table is sorted in descending order of total impervious area. A full list of impervious area and estimates of DCIA for all storm drain outfall catchments in the Town of Oxford is attached as Appendix B.

Table 4. Total Impervious Area and DCIA for the Ten Most Impervious Catchments

Catchment Identifier	Impervious Area (Acres)	Percent Impervious	DCIA (Acres)	Percent DCIA
OF-108	65.44	8.48%	8.70	1.13%
OF-270	18.32	11.40%	4.85	3.02%
OF-192	16.91	2.33%	4.06	0.56%
OF-98	10.85	23.61%	3.25	7.07%
OF-141	10.71	7.64%	1.15	0.82%
OF-166	8.54	8.55%	1.18	1.18%
OF-173	7.55	4.27%	0.72	0.40%
OF-158	7.07	52.91%	1.88	14.04%
OF-134	6.90	46.52%	2.24	15.14%
OF-142	6.14	48.47%	2.39	18.85%

5 Identification, Delineations, and Prioritization of Potential Catchments with High Nitrogen Loading

5.1 Estimated Nitrogen Loading

Using methods described in Appendix A, estimates of nitrogen loading potential were created for each of the Town's storm drain outfall catchments. Figure 3 shows the estimated nitrogen loading of each catchment within the Town of Oxford's MS4 area.

Table 5 shows the five catchments with the highest estimated nitrogen loading in the entire urbanized/MS4-regulated area. A complete table showing calculated nitrogen loading estimates for all catchments analyzed for the Town of Oxford is attached in Appendix B.

Table 5. Estimated Nitrogen Loading for Five Highest-Load Catchments in MS4 Area

Catchment Identifier	Estimated N Load (lbs/year)
OF-108	2,019.94
OF-192	1,376.65
OF-270	617.62
OF-173	476.00
OF-141	371.96
Top 5 as a % of Total Town Load	50.11%

Note these are estimated loadings based on land cover, land use, and soil type. For this analysis, estimated DCIA (e.g. typical level of SCMs in Town) was not used in estimating Nitrogen loading. Further analysis using another calculation method could be employed in future permit years. Actual loading may vary considerably from site to site depending on what SCMs are present. Regional studies such as the Charles River Phosphorous TMDL have indicated that the default DCIA assumptions used by EPA are somewhat optimistic, such that actual loading rates may be higher. However, these estimates provide a valuable guide to help identify those areas of the Town that should be the highest priorities for interventions to begin reducing pollutant loading.

5.2 Outfall Screening Monitoring Results

The Town of Oxford has visibly screened each outfall from August 2019 to June 2022. Detailed outfall screening data is found in Appendix C. As of June 2023, outfall sampling results are not available. Once they become available, they will be included in this section and the findings shall be incorporated into any updates to the highest priority catchments with respect to nitrogen loading.

5.3 Catchment Prioritization

The results of the nitrogen loading calculations (Table 5), along with other pertinent data, were utilized in the Municipal Property Retrofit analysis to prioritize locations for future stormwater treatment. Refer to the *Year 4 Massachusetts Small Municipal Separate Storm System Permit – Municipal Property Retrofits Report* for additional information on the prioritization methodology and results.

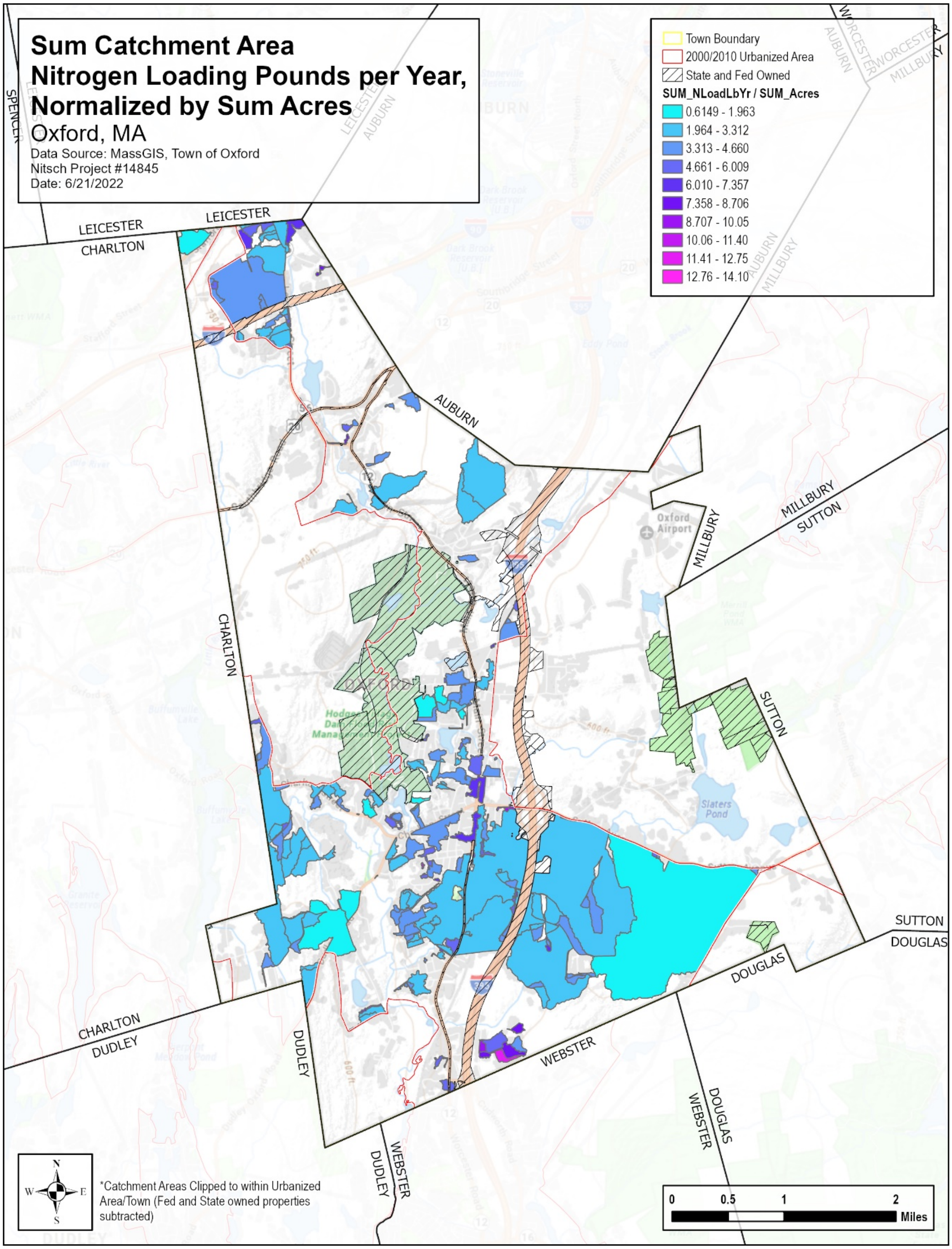


Figure 3. Estimated Nitrogen Loading per Catchment Area in Oxford

6 Potential Stormwater BMP Opportunities

6.1 BMP Suitability Assessment

A high-level stormwater BMP suitability assessment was conducted on all town-owned parcels to determine what structural BMPs could be implemented to mitigate both nitrogen and phosphorus within the Town of Oxford. The detailed methodology and GIS data used in this assessment can be found in Appendix D. Sites were initially categorized into three groups:

- Sites unsuitable for BMP implementation
- Sites suitable for “Type 1” BMP implementation (infiltrative BMPs such as infiltration trenches or infiltrative bioretention)
- Sites suitable for “Type 2” BMP implementation (non-infiltrative BMPs)

The analysis produced a total of 96 potential BMP sites on 60 town-owned parcels. The following criteria were used to determine the suitability of a site for BMP implementation:

1) Topography/Slope - Sites with a slope of greater than 5% were considered unsuitable for implementation of a BMP for this initial analysis.
2) Soil type – Sites with a majority of soil classified as Hydrologic Soil Group (HSG) A, B, or C were considered suitable for an infiltrative BMP (Type 1) whereas sites with majority soils classified as HSG D, A/D, B/D, C/D, or unknown were considered suitable for non-infiltrative BMPs (Type 2).
3) Depth to groundwater – Sites where groundwater was greater than 4 feet were considered suitable for infiltrative BMPs (Type 1); sites where the depth to groundwater was known to be less than 4 feet were considered suitable for non-infiltrative BMPs (Type 2); in cases where the depth to groundwater was unknown, these sites were analyzed as non-infiltrative BMPs (Type 2).
4) Proximity to buildings – Building footprints were mapped in GIS and were not considered as sites for implementation of BMPs; sites within 10 feet of a MassGIS inventoried building were also not considered as sites for implementation of BMPs.
5) Adjacent to MassDOT roads – Sites within 100 feet of a MassDOT road were considered as sites for implementation of BMPs as they will readily allow for construction and maintenance access.
6) Proximity to wetland resource areas – Sites within 25 feet of MassDEP wetlands were not considered as sites for implementation of BMPs.
7) Watersheds that did not contain impervious area were considered unsuitable for BMP implementation.

The annual Total Phosphorus (TP) and Total Nitrogen (TN) reduction for each potential BMP was calculated using the performance curves for each of the BMP types found in Attachment 3 to Appendix F of the MS4 Permit. The final set of BMP sites were then reviewed for potential implementation of structural nitrogen controls as well as for use in phosphorus reduction as explained in more detail in the Town of Oxford’s Lake Phosphorus Control Plan.

6.2 High Priority Parcels Based on Nitrogen Loading

The Town of Oxford developed a priority ranking of areas and infrastructure within the municipality for potential implementation of structural BMPs.

A total of 60 town-owned parcels containing 96 potential BMP locations which were ranked based on potential implementation of structural BMPs to reduce Nitrogen load. Table 6 below shows BMP locations with ranked “high” and “medium”.

Table 6. High & Medium Priority BMP Locations for Nitrogen Removal

Ranking for NSID Report	LOC_ID_BMP Locations	Site Address	Land Use	Cumulative Nitrogen Load Reduction (lbs/yr)
HIGH	F_548642_2887754_02	0 LEICESTER ST	multi-family residential	5.745
HIGH	F_553938_2870622_11	0 CHURCH ST		6.922
HIGH	F_554781_2871780_20	0 FOREST ST	near McKinstry Pond	0.181
HIGH	F_556201_2871585_06	0 FOREST ST	single family residential	0.142
HIGH	F_555871_2867501_02	34 CHARLTON ST	DPW Garage	216.800
HIGH	F_556403_2869246_09	0 MAPLE RD	Oxford Community Center, basketball, field, playground	152.873
HIGH	F_556895_2868222_02	5 SIGOURNEY ST	Town Hall Parking	3.304
HIGH	F_556901_2867471_01	3 BARTON ST	mixed use	2.049
HIGH	F_557059_2868110_01	325 MAIN ST	Town Hall	4.890
HIGH	F_557101_2868431_02	339 MAIN ST	Library	3.002
HIGH	F_557338_2873475_01	450 MAIN ST	DPW Headquarters	3.112
HIGH	F_557458_2869400_07	350 MAIN ST	Joslin Park	2.956
HIGH	F_557509_2869588_01	352 MAIN ST	Joslin Park	0.525
HIGH	F_549728_2886376_02	0 SOUTHBRIDGE RD	commercial	1.030
HIGH	F_556403_2869246_07	0 MAPLE RD	Oxford Community Center	0.106
HIGH	F_556403_2869246_08	0 MAPLE RD	Oxford Community Center	0.669
HIGH	F_556403_2869246_10	0 MAPLE RD	Oxford Community Center	2.767
HIGH	F_556403_2869246_11	0 MAPLE RD	Oxford Community Center	0.054
HIGH	F_556989_2873986_01	4 EDDY ST	vacant lot	15.453
HIGH	F_556989_2873986_02	4 EDDY ST	vacant lot	20.762
HIGH	F_558185_2857434_06	0 INDUSTRIAL PARK EAST RD		203.749
MEDIUM	F_555478_2875043_12	100 CARBUNCLE DR	Oxford High School	36.409
MEDIUM	F_555896_2864398_09	9 CLOVER ST	Alfred E. Chaffee School	35.723
MEDIUM	F_556065_2880446_08	25 DEPOT RD	Clara Barton School	28.888
MEDIUM	F_556358_2861578_03	0 MAIN ST		17.058
MEDIUM	F_558185_2857434_09	0 INDUSTRIAL PARK EAST RD		66.031

The following criteria was used to determine ranking of potential BMP sites for nitrogen controls:

1) Nitrogen loading (lb/year) - Available screening and monitoring results to date did not include nitrogen loads and were not used during this initial analysis but will be incorporated into priority rankings in future years; as a part of this analysis, nitrogen loads were calculated for each individual potential BMP's watershed; sites were ranked higher in priority based on higher loading.
2) Total Nitrogen (TN) removed – Sites achieving higher nitrogen removal were ranked a higher priority.
3) Location within Urbanized Area (MS4-regulated area) – Sites located outside the Urbanized Area were not considered for BMP implementation.
4) Location within a Phosphorus Impaired Lake or Pond Watershed - Sites located within an impaired pond watershed ranked higher in priority. Impaired lakes and ponds include: Buffumville Lake, Lowes Pond, McKinstry Pond, Robinson Pond, and Texas Pond.
5) Proximity to outfalls – using the existing MS4 mapping, sites located closer to the downstream end of large drainage areas gave sites higher priority over areas located at the top of a watershed.
6) Opportunities for public use and education – Sites located near elementary, middle, and high schools, as well as sites often visited by the public, such as town hall and parks, were prioritized over sites that would see less interaction from town residents and visitors.
7) Capital Plans & Pavement Management Plan – The Town of Oxford routinely updates their planning efforts to anticipate funding needs for upcoming fiscal years. As part of the LPCP assessment, these plans were reviewed to understand upcoming planned projects and how they could incorporate stormwater BMPs and improve water quality. Refer to the Lake Phosphorus Control Plan for further information about potential stormwater BMP integration into upcoming municipal roadway projects.
8) Discharges to water quality limited waters, first or second order streams, public swimming beaches, drinking water supply sources, etc. – Sites located near any of these water bodies were given priority because of additional public health benefits improved water quality can provide.

Results of the analysis for BMP suitability can be found in Appendix E. A full list of sites ranked for nitrogen controls can be found in Appendix F which includes maps of all sites.

7 Planned Structural Controls Implementation Schedule

The Town of Oxford has prepared an implementation schedule for the structural controls proposed to improve nitrogen and phosphorus reduction. This schedule is included as Appendix G. Additional details are available from the DPW office or the Town's Conservation Commission. This implementation schedule was driven by the required phosphorus load reductions and associated prioritization outlined in the Lake Phosphorus Control Plan but will achieve significant nitrogen reductions as detailed in Section 6.2.

The Town of Oxford is also installing a demonstration project in the Lowes Pond watershed as part of the requirements of the Lake Phosphorus Control Plan. The project is described in Appendix H.

Appendix A – Calculation & GIS Methods

Year 4 Oxford MS4 Permit Analysis

This document serves as Appendix A to the Town of Oxford's Year 4 Nutrient Source Identification Report and Phosphorus Control Plan updates as required by the 2016 MA Small MS4 Permit. This document outlines the methodology utilized for the nutrient analysis in both documents, which were performed using ArcGIS Pro 2.8.0.

1. Data Sources

- Pond Watersheds - StreamStats (usgs.gov)
- 2000 Urbanized Areas - Layer: Urbanized Areas (ID: 4) (census.gov)
- 2010 Urbanized Areas - Layer: Urbanized Areas (ID: 1) (census.gov)
- 2016 Land Cover Land Use (four blocks) - MassGIS Data: 2016 Land Cover/Land Use | Mass.gov
- Hydrologic Soil Groups - MassGIS Data: Soils SSURGO-Certified NRCS | Mass.gov
- Tax Parcels from Oxford, MA - Judy Lochner jlochner@oxfordma.us
- Oxford MA MS4 year 3 drainage catchment area – Town of Oxford (received 2/10/2022)
- Municipal Boundaries - MassGIS Data: Municipalities | Mass.gov
- MassDEP Wellhead Protection Areas (Zone II, Zone I, IWPA) - MassGIS Data: MassDEP Wellhead Protection Areas (Zone II, Zone I, IWPA) | Mass.gov
- Surface Water Supply Protection Areas (ZONE A, B, C) - MassGIS Data: Surface Water Supply Protection Areas (ZONE A, B, C) | Mass.gov
- NHESP Certified Vernal Pools - MassGIS Data: NHESP Certified Vernal Pools | Mass.gov
- BioMap2 - MassGIS: BioMap2 | Mass.gov
- Building Structures (2-D) - MassGIS Data: Building Structures (2-D) | Mass.gov
- MassDEP Wetlands (2005) - MassGIS Data: MassDEP Wetlands (2005) | Mass.gov
- 2020 Environmental Justice Populations - MassGIS Data: 2020 Environmental Justice Populations | Mass.gov
- Public Water Supplies - MassGIS Data: Public Water Supplies | Mass.gov
- Lidar DEM and Shaded Relief - MassGIS Data: Lidar DEM and Shaded Relief | Mass.gov

2. Creation of Base Shapefiles for Phosphorus and Nitrogen Calculations

To define the area of analysis for Phosphorus and Nitrogen calculations, pond watersheds, urbanized area, land cover land use, NRCS soils, and MassDOT road inventory datasets where clipped within the Oxford, MA municipal boundary. The MassDOT road inventory was used to find State and Federal roads which, when overlayed on the Oxford tax parcel dataset, distinguished right-of-way parcels under State and Federal jurisdiction and therefore not included in the Phosphorus and Nitrogen calculation area.

Similarly, Federal and State-owned tax parcels were identified from the attributes of the Oxford tax parcel dataset and removed from the Phosphorus and Nitrogen calculation area. Finally, the urbanized area dataset was used as the boundary of the area considered for Phosphorus and Nitrogen calculations.

To create the base shapefiles for phosphorus and nitrogen loading calculations, 2016 Land Use/Land Cover data from MassGIS was combined with NRCS SSURGO-Certified Soils data. The union of the two datasets created small "records" that were referenced in calculations to find specific Nitrogen or Phosphorus Loads. Each record in the shapefile represents an area with a specific land cover, land use, and soil type.

3. Phosphorus Load Calculations

Annual Phosphorus Load for each record was determined using methodology found in Attachment 1 to Appendix F of the 2016 MS4 Permit. Phosphorus Loading Export rates (PLERs) were determined using crosswalk in the document entitled "2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts Land Use/Land Cover GIS Dataset" published by MassDEP and EPA Region 1.

Watershed areas of the Oxford's lakes and ponds identified in the MS4 Permit were created with USGS's Stream Stats program, using a single pour point at the lowest end of each pond. The pond watersheds dataset was used as the clip feature in a "Clip" function targeted at the land cover/land use/NRCS soils dataset described in the last section. The resulting shapefile limits the information contained in the broader town-wide Phosphorus load to only what occurs in each of Oxford's pond watersheds of concern, allowing further pond-specific analysis of Phosphorus loading.

In the shapefiles produced, a field entitled "Acres" was added to the attribute table. The "Calculate Geometry" function was used, in acre area (geodesic), to populate the field with individual land cover/land use/NRCS soil record areas. This field allowed for the calculation of each record's phosphorus load in pounds per year when multiplied by the "PLER" field.

In the shapefiles, a field entitled "PLER" was added to the attribute table. For the "PLER" field, a "Field Calculator" function was used to provide a Phosphorus Loading Export Rate (PLER) for each record. PLER is measured in pounds phosphorus per acre per year. PLER was determined using the MassDEP and EPA Region 1 developed crosswalk between the 2016 land use land cover dataset and the EPA Region 1 Pollutant Load Export Rates developed as part of the 2016 MS4 permit. The Table below was prepared by MassDEP and EPA Region 1 to ensure consistency of PLER across records. Using the table, a python script was created for the field calculator.

LAND USE CLASSES	IMPERVIOUS	DEVELOPED SPACE OPEN	CULTIVATED	PASTURE/ HAY	GRASSLAND	DECIDUOUS	EVERGREEN	SHRUB/ SCRUB	FORESTED PALUSTRINE	SHRUB/SCRUB PALUSTRINE	EMERGENT PALUSTRINE	FORESTED ESTUARINE	SHRUB/SCRUB ESTUARINE	EMERGENT ESTUARINE	SHORED UNCONSOLIDATE	BARE	WATER	BED AQUATIC PALUSTRINE	BED AQUATIC ESTUARINE
	LAND COVER CLASSES																		
UNKNOWN	1.52	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
OPEN LAND	1.52	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
COMMERCIAL	1.78	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
INDUSTRIAL	1.78	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
FOREST	1.52	0.13	0.13	0.45	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
AGRICULTURAL	1.52	0.45	0.45	0.45	0.45	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
RECREATIONAL	1.52	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
TAX EXEMPT	1.78	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
MIXED-PRIMARILY RESIDENTIAL	2.32	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
SINGLE FAMILY RESIDENTIAL	1.96	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
MULTI-FAMILY RESIDENTIAL	2.32	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
OTHER RESIDENTIAL	1.96	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
MIXED OTHER	1.78	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
MIXED COMMMERCIAL	1.78	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
RIGHT OF WAY	1.95	0.03 - 0.37 *by HSG	0.45	0.45	0.03 - 0.37 *by HSG	0.13	0.13	0.13	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	0.03 - 0.37 *by HSG	Water	Water	Water
WATER	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water

Figure 1. Crosswalk of 2016 Land Use and Land Cover categories and PLERs in lbs/acre/year from MassDEP & EPA Region 1 (Note: Hydrologic Soil Group (HSG) A and A/D have a PLER of 0.03, HSG B and B/D have a PLER of 0.12, HSG C and C/D and Unknown have a PLER of 0.21, and HSG D has a PLER of 0.37)

In the shapefiles, a field entitled "PLoadLbYr" was added to the attribute table. For the "PLoadLbYr" field, a "Field Calculator" function was used to provide a Phosphorus Loading Pounds Per Year for each record. By multiplying the record's acre area (from the "Acre" field) by the record's PLER (from the "PLER" field) the record's pounds phosphorus per year was calculated. Using the "Dissolve" function, all records were dissolved together by pond watershed name, with a "SUM" field statistics option selected for the "PLoadLbYr" field. The resulting shapefiles contained a simple table of the pond watershed name and the Phosphorus Loading Pounds per Year associated with the land it encompassed. Further details and the exact steps in this workflow can be found in the "Nitrogen & Phosphorus Loading Calculation Workflow" section of this document.

4. Nitrogen Load Calculations

Annual Nitrogen Load for each record was determined using methodology described in a document entitled "Nutrient Source Identification Report Addendum: Methods" dated June 10, 2021 and prepared by Neponset River Watershed Association. For the Nitrogen loading analysis, a "Loading Export Rate" field was created, along with a field containing the area of a record and final "Loading Pound Per Year" amount.

Nitrogen loads were calculated for each record in the "Oxford MA MS4 year 3 drainage catchment area" model. The catchment area dataset was used as the clip feature in a "Clip" function targeted at the land cover/land use/NRCS soils dataset described in the last section. The resulting shapefile limits the information contained in the larger town-wide Nitrogen load calculation to only what occurs in each drainage catchment area, allowing catchment-specific analysis of Nitrogen loading.

In the shapefiles produced, a field entitled "Acres" was added to the attribute table. The "Calculate Geometry" function was used, in acre area (geodesic), to populate the field with individual land cover/land use/NRCS soil record areas. This field would allow for the calculation of each records nitrogen loading pounds per year when multiplied by the field described below.

In the shapefiles, a field entitled “NLER” was added to the attribute table. For the “NLER” field, a “Field Calculator” function was used to provide a Nitrogen Loading Export Rate (NLER) for each record. NLER is measured in pounds nitrogen per acre per year. NLER was determined using the Nitrogen Source Categories and nitrogen load export rates shown in Table 1 of Attachment 1 to Appendix H of the 2016 Massachusetts Small MS4 General Permit. Using the table as reference, a python script was created for the field calculator that assigns a nitrogen loading category to each record and matches it to its corresponding NLER. The Table below was prepared by the Neponset River Watershed Association to demonstrate Land Cover’s link to Nitrogen Source Categories.

Table 1. Nitrogen Loading Export Rates

Land Cover	Soil Type	Nitrogen Source Category
Impervious	All	All Impervious Cover
Water	All	None, rate was set to 0 for records that represented surface water.
Non-Impervious, Non-Water	A	Developed Land Pervious (DevPERV)-HSG A
Non-Impervious, Non-Water	B	Developed Land Pervious (DevPERV)-HSG B
Non-Impervious, Non-Water	C	Developed Land Pervious (DevPERV)-HSG C
Non-Impervious, Non-Water	D	Developed Land Pervious (DevPERV)-HSG D
Non-Impervious, Non-Water	A/D	Developed Land Pervious (DevPERV)-HSG A
Non-Impervious, Non-Water	B/D	Developed Land Pervious (DevPERV)-HSG B
Non-Impervious, Non-Water	C/D	Developed Land Pervious (DevPERV)-HSG C/D

In the shapefiles, a field entitled “NLoadLbYr” was added to the attribute table. For the “NLoadLbYr” field, a “Field Calculator” function was used to provide a Nitrogen Loading Pounds Per Year for each record. By multiplying the record’s acre area, from the “Acre” field, by the record’s NLER, from the “NLER” field, the record’s pounds nitrogen per year was calculated. Using the “Dissolve” function, all records were dissolved together by catchment ID, with a “SUM” field statistics option selected for the “NLoadLbYr” field. The resulting shapefiles contained a simple table of the catchment ID and the Nitrogen Loading Pounds per Year associated with the land it encompassed. Further details and the exact steps in this workflow can be found in the “Nitrogen & Phosphorus Loading Calculation Workflow” section (Section 7) of this document.

5. Impervious Calculation for Catchment Areas

Impervious area within each catchment area was calculated using the land cover, land use, soil type records shapefile described in the Creation of Base Shapefiles for Phosphorus and Nitrogen Calculations section. Note that records outside the Urbanized Area and parcels identified as Federal or State-owned land were not included in the calculations.

The ‘Oxford MA MS4 year 3 drainage catchment area” shapefile contains polygons of areas within each catchment with like land cover, land use, and soil type. To begin, the “Oxford MA MS4 year 3 drainage catchment area" was queried so that only polygons with an entry of “Impervious” for the “CoverName” field were shown. Then, the Calculate Geometry tool was used on those queried records to display the area of each impervious polygon in acres. These results were eventually summed for overall catchment totals of impervious area.

To further illustrate impervious cover statistics and for use in Directly Connected Impervious Area (DCIA) calculation, the impervious cover in each polygon was also calculated as a percentage of each catchment. For this measurement, the Field Calculator tool was used on the “ImpPercent” field to divide the impervious area of each polygon (“ImpAreaAcre”) by the total catchment size (“CatchAreaAcre”, created when preparing the catchment shapefile). This figure was then multiplied by 100 to obtain a percent.

6. DCIA Calculation

Directly Connected Impervious Area (DCIA) estimates were based on the Sutherland equations within the EPA guidance document entitled “Estimating Change in Impervious Area (IA) and Directly Connected Impervious Areas (DCIA) for Massachusetts Small MS4 Permit” (Revised April 2014). Table 2 below shows the relation between various land uses in the watershed, the chosen “connectedness” category, and the associated Sutherland equation used in the DCIA estimate. Note that these estimates only occurred on polygons that contained an “Impervious” entry in the CoverName field, as DCIA only exists where impervious area exists.

Table 2. DCIA Calculations per land use

USEGENNAME	"Connectedness" Category	Sutherland Equation
Agriculture	Mostly Disconnected	$DCIA=0.01(IA)^{2}$
Commercial	Average	$DCIA=0.1(IA)^{1.5}$
Forest	Mostly Disconnected	$DCIA=0.01(IA)^{2}$
Industrial	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, other	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, primarily commercial	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, primarily residential	Average	$DCIA=0.1(IA)^{1.5}$
Open land	Average	$DCIA=0.1(IA)^{1.5}$
Recreation	Average	$DCIA=0.1(IA)^{1.5}$
Residential - multi-family	Highly Connected	$DCIA=0.4(IA)^{1.2}$
Residential - other	Average	$DCIA=0.1(IA)^{1.5}$
Residential - single family	Average	$DCIA=0.1(IA)^{1.5}$
Right-of-way	Average	$DCIA=0.1(IA)^{1.5}$
Tax exempt	Average	$DCIA=0.1(IA)^{1.5}$
Unknown	Average	$DCIA=0.1(IA)^{1.5}$
Water	Average	$DCIA=0.1(IA)^{1.5}$

In the “Oxford MA MS4 year 3 drainage catchment area” shapefile, a field entitled “TotalArea” was added to the attribute table. For the “TotalArea” field, a “Calculate Geometry” function was used, in acre area (geodesic), to populate the field with acre areas of the entire associated catchment area. A “Union” function was run between the catchment area shapefile and the land cover, land use, soil type records shapefile described in the Creation of Base Shapefiles for Phosphorus and Nitrogen Calculations section. The unioned dataset was queried so that no polygons with an entry of “<Null>” for the “Catchment ID” field were shown. Only records within the catchment boundaries were displayed.

In these equations, the percentage of impervious cover for a given area is used to determine the percentage of DCIA in the same area. Thus, DCIA percent was calculated in the “DCIAPercent” field using Field Calculator. In this calculation, the impervious percentage represented by the polygon ("ImpPercent") was raised to the power shown in the appropriate equation (already entered in the "DCIA_E" field when preparing the base shapefile) and multiplied by the factor shown (already entered in the "DCIA_M" field when preparing the base shapefile).

The Field Calculator equation was: "DCIAPercent" = ("ImpPercent" ^ "DCIA_E") * "DCIA_M".

These results were eventually summed for overall catchment totals of impervious area. Finally, the estimated acreage of DCIA for each polygon was calculated in the "DCIAAcre" field using Field Calculator. In this calculation, "DCIAPercent" was divided by 100 and multiplied by the overall catchment size ("CatchAreaAcr" or "CatchAreaA").

7. Nitrogen & Phosphorus Loading Calculation Workflow

1. Download Data:
   - Pond Watersheds (from points which are included in download folders)- StreamStats (usgs.gov)
   - 2000 Urbanized Areas - Layer: Urbanized Areas (ID: 4) (census.gov)
   - 2010 Urbanized Areas - Layer: Urbanized Areas (ID: 1) (census.gov)
   - 2016 Land Cover Land Use (four blocks) - MassGIS Data: 2016 Land Cover/Land Use | Mass.gov
   - Hydrologic Soil Groups - MassGIS Data: Soils SSURGO-Certified NRCS | Mass.gov
   - Utilities from PeopleGIS - www.mapsonline.net/oxfordma/dpw.php
     . Open Drains
     i. Manholes
     ii. Inlets
     iii. Gravity Drains
     iv. Discharge Points
     v. Crossings
     vi. Crossing End Points
   - Tax Parcels from Oxford, MA - Judy Lochner <jlochner@oxfordma.us>
   - MassDOT Road Inventory - Road Inventory 2020 | MassDOT Open Data Portal (arcgis.com)
   - Municipal Boundaries - MassGIS Data: Municipalities | Mass.gov
   - Outfall Catchments (all pipes) - Judy Lochner <jlochner@oxfordma.us>

2. GIS Analysis:
   a. To get Oxford boundary, in (1.i.) properties DEF QUERY Town="Oxford"
   b. BATCH PAIRWISE CLIP (2.b.) areas from
      i. (1.a.)
      ii. (1.b.)
      iii. (1.c.)
      iv. (1.d.)
      v. (1.e.)
      vi. (1.h.)
   c. To get road areas belonging to State and Federal Organizations
      i. In (1.h.) properties DEF QUERY "Jurisdictn" does not include the value(s) "0","2","H" AND "Jurisdictn" is not null
      ii. Overlay (2.c.i.) over (1.g.)
      iii. CREATE SHAPEFILE to hold state/fed road polygons
      iv. CREATE FEATURES to trace (1.g.) parcel boundaries containing (2.c.i.)
   d. To get Federal Owned Parcels:
      i. In (1.g.) properties DEF QUERY "OWNER1" contains the text "UNITED STATES OF AMERICA" OR "LOC_ID" is equal to "F_551778_2870612"
   e. To get State Owned Parcels:

i. In (1.g.) properties DEF QUERY "OWNER1" contains the text "COMMONWEALTH OF MASS"

f. To get total urbanized area, UNION (2.b.ii.) and (2.b.iii.)
g. To get single pond watersheds shapefile, UNION (2.b.i.)
h. To get 2016 land cover land use within Oxford, UNION (2.b.iv)
i. To get land use/land cover/hydr soil groups, outfall catchments, and pond watersheds within urbanized area
    i. UNION (2.h.) and (2.b.v)
    ii. BATCH PAIRWISE ERASE (2.c.), (2.d.), and (2.e.) from
        1. (2.j.i.)
        2. (1.j.)
        3. (2.g.)
    iii. BATCH CLIP (2.f.) from
        1. (2.i.ii.1.)
        2. (2.i.ii.2.)
        3. (2.i.ii.3.)
j. **<u>To get Nitrogen Load Export Rate per Outfall Catchment Area</u>**
    i. To get outfall catchment acre area attribute in (2.i.iii.2.) table
        1. ADD A NEW FIELD "TotalAcres" [double]
        2. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]
    ii. UNION (2.i.iii.1.) and (2.j.i.)
    iii. To get acre area attribute in (2.j.ii.) table
        1. ADD A NEW FIELD "Acres" [double]
        2. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]
    iv. To get impervious acre area in (2.j.iii.) table
        1. ADD A NEW FIELD called "ImpervAcres" [double]
        2. CALCULATE FIELD "ImpervAcres" = 0
        3. SELECT BY ATTRIBUTES Where "COVERNAME" is equal to "Impervious"
        4. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]
    v. To get an estimate of percent of catchment area's directly connected impervious area represented by a record in (2.j.iv.) table
        1. ADD A NEW FIELD called "DCIAPercent" [double]
        2. CALCULATE FIELD "DCIAPercent" = DCIAPercent.CAL
    vi. To get an estimate the area of directly connected impervious area associated with a record in (2.j.v.) table
        1. ADD A NEW FIELD called "DCIAAcres" [double]
        2. CALCULATE FIELD "DCIAAcres" = ("DCIAPercent"/100) * "TotalAcres"
    vii. To get the numerical nitrogen loading rate assigned to a record. The value originates from Table 1 in Attachment 1 of Appendix H of the 2016 Massachusetts Small MS4 General Permit. A/D Hydrologic Soil Group was given a value of (A value * D value)/2. B/D Hydrologic Soil Group was given a value of (B value * D value)/2. Water was given no value.
        1. ADD A NEW FIELD called "NLER" [double]
        2. CALCULATE FIELD "NLER" = 2016 Land Cover Land Use TO NLER.CAL
    viii. To get the estimated nitrogen load from a record in (2.j.vii.) table
        1. ADD A NEW FIELD called "NLoadLbYr" [double]
        2. CALCULATE FIELD "NLoadLbYr" = "NLER" * "Acres"
    ix. To get Nitrogen Load Export Rate per Outfall Catchment Area table
        1. PAIRWISE DISSOLVE (2.j.viii.) Dissolve_Field = "Outfall_ID" and Statistics Fields = ["Acres" : SUM], ["ImpervAcres" : SUM], ["DCIAAcres" : SUM], ["NLoadLbYr" : SUM]

k. <u>To get Phosphorus Load Export Rate per Pond Watershed Area</u>

i. To get pond watershed acre area attribute in (2.i.iii.3.) table
   1. ADD A NEW FIELD "TotalAcres" [double]
   2. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]

ii. UNION (2.i.iii.1.) and (2.k.i.)

iii. To get acre area attribute in (2.k.ii.) table
   1. ADD A NEW FIELD "Acres" [double]
   2. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]

iv. To get impervious acre area in (2.k.iii.) table
   1. ADD A NEW FIELD called "ImpervAcres" [double]
   2. CALCULATE FIELD "ImpervAcres" = 0
   3. SELECT BY ATTRIBUTES Where "COVERNAME" is equal to "Impervious"
   4. CALCULATE GEOMETRY [Area (geodesic), Acres, NAD83 MA Mainland Feet]

v. To get an estimate of percent of watershed's directly connected impervious area represented by a record in (2.k.iv.) table
   1. ADD A NEW FIELD called "DCIAPercent" [double]
   2. CALCULATE FIELD "DCIAPercent" = DCIAPercent.CAL

vi. To get an estimate the area of directly connected impervious area associated with a record in (2.k.v.) table
   1. ADD A NEW FIELD called "DCIAAcres" [double]
   2. CALCULATE FIELD "DCIAAcres" = ("DCIAPercent"/100) * "TotalAcres"

vii. To get the numerical phosphorus loading rate assigned to a record. The value originates from MassGIS's "2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts Land Use/Land Cover GIS Dataset" (download (mass.gov))
   1. ADD A NEW FIELD called "PLER" [double]
   2. CALCULATE FIELD "PLER" = 2016 Land Cover Land Use TO PLER.CAL

viii. To get the estimated phosphorus load from a record in (2.k.vii.) table
   1. ADD A NEW FIELD called "PLoadLbYr" [double]
   2. CALCULATE FIELD "PLoadLbYr" = "PLER" * "Acres"

ix. To get Phosphorus Load Export Rate per Pond Watershed Area table
   1. PAIRWISE DISSOLVE (2.j.viii.) Dissolve_Field = "Outfall_ID" and Statistics Fields = ["Acres" : SUM], ["ImpervAcres" : SUM], ["DCIAAcres" : SUM], ["PLoadLbYr" : SUM]

Appendix B – Outfall Catchment Calculations for Impervious Area, DCIA, & Nitrogen Load

OBJECTID_1	Outfall_ID	SUM_Acres	SUM_ImpervAcres	SUM_DCIAAcre	SUM_NLoadLbYr	Percent Impervous	Percent DCIA
10	OF-108	771.82	65.44	8.70	2019.94	8.48	1.13
93	OF-192	726.48	16.91	4.06	1376.65	2.33	0.56
140	OF-270	160.68	18.32	4.85	617.62	11.40	3.02
76	OF-173	176.95	7.55	0.72	476.00	4.27	0.40
44	OF-141	140.21	10.71	1.15	371.96	7.64	0.82
151	OF-281	94.50	3.76	0.20	269.33		
68	OF-166	99.83	8.54	1.18	231.52	8.55	1.18
40	OF-138	92.91	6.05	0.69	181.11		
217	OF-98	45.96	10.85	3.25	163.56	23.61	7.07
172	OF-44	50.17	1.78	0.39	122.79		
147	OF-278	37.63	1.68	0.25	114.09		
61	OF-158	13.37	7.07	1.88	111.14	52.91	14.04
37	OF-134	14.83	6.90	2.24	99.67	46.52	15.14
150	OF-280	32.69	1.19	0.16	93.05		
45	OF-142	12.67	6.14	2.39	88.58	48.47	18.85
67	OF-164	7.26	5.74	2.95	84.44		
134	OF-264	20.34	1.70	0.31	75.64		
6	OF-104	18.72	5.02	1.85	74.96		
148	OF-279	11.76	3.80	1.58	72.19		
212	OF-93	27.39	3.07	0.63	71.90		
85	OF-183	14.40	3.00	0.66	70.67		
94	OF-193	20.12	0.58	0.05	67.30		
83	OF-181	17.30	1.64	0.25	64.13		
1	OF-1	14.31	3.32	1.45	59.13		
208	OF-9	13.99	3.71	1.02	57.19		
121	OF-249	14.47	1.81	0.25	56.18		
193	OF-73	8.43	2.81	0.97	55.10		
38	OF-135	10.70	3.73	1.35	54.67		
194	OF-74	9.81	2.55	1.41	53.99		
41	OF-139	24.99	1.83	0.25	53.57		
82	OF-180	15.91	0.83	0.11	52.59		
47	OF-144	22.00	1.95	0.42	51.58		
154	OF-286	12.20	3.40	1.29	50.53		
206	OF-88	15.16	1.64	0.28	48.66		
55	OF-152	15.44	2.69	0.79	46.84		
135	OF-265	11.82	1.00	0.18	43.13		
192	OF-72	26.84	0.80	0.10	42.70		
53	OF-150	20.26	1.42	0.27	42.65		
58	OF-155	22.35	1.96	0.37	39.19		
66	OF-162	4.27	2.32	1.26	35.92		
24	OF-121	7.01	2.36	0.93	34.73		
201	OF-82	12.76	1.48	0.36	34.39		
177	OF-57	13.23	1.24	0.21	33.99		
86	OF-184	12.34	0.36	0.04	33.89		
153	OF-285	8.65	1.71	0.86	32.47		
65	OF-161	3.39	1.99	0.77	31.90		
117	OF-240	11.08	1.91	0.44	31.58		
19	OF-117	5.84	1.97	0.67	30.74		
13	OF-110	6.97	2.07	0.80	30.59		
216	OF-97	9.36	1.91	0.61	29.17		
11	OF-109	7.85	1.93	0.68	28.99		
3	OF-100	8.68	1.83	0.59	27.85		
84	OF-182	6.25	1.54	0.46	27.77		
17	OF-115	7.05	1.22	0.25	27.31		
49	OF-146	6.19	0.90	0.24	26.94		
114	OF-229	7.22	1.73	0.59	26.01		
32	OF-13	5.91	1.43	0.44	25.35		
146	OF-277	6.71	1.43	0.35	25.25		
139	OF-27	4.50	1.69	0.74	24.66		
30	OF-128	5.00	1.53	0.39	24.28		
4	OF-101	7.43	1.58	0.52	24.07		
2	OF-10	6.76	1.21	0.33	23.72		
137	OF-267	2.98	1.56	0.79	23.71		
92	OF-191	5.46	0.99	0.23	23.55		
101	OF-202	5.18	1.58	0.60	23.32		
12	OF-11	18.41	0.71	0.08	23.22		
132	OF-261	5.16	1.33	0.40	22.59		
189	OF-69	7.17	1.07	0.31	22.43		
46	OF-143	10.41	0.73	0.13	21.88		
215	OF-96	4.49	1.21	0.34	20.76		
209	OF-90	6.61	0.99	0.29	20.73		
81	OF-18	5.87	1.26	0.37	20.57		
136	OF-266	5.84	0.65	0.13	20.21		
109	OF-212	2.15	1.30	0.65	19.30		
89	OF-189	5.69	0.48	0.10	19.23		
48	OF-145	4.40	1.05	0.38	18.85		
188	OF-68	4.20	1.02	0.72	18.18		
131	OF-260	5.96	0.67	0.13	18.13		
62	OF-159	5.10	0.49	0.10	18.00		
213	OF-94	6.91	0.74	0.17	17.86		

	Acres
Sum Acres Analyzed	3,421.93
Sum Impervious Acres	336.01
Sum DCIA	87.15

	lb per yr
SUM N-load	9,703.81
Total top 5 N-load	4,862.17

top 5 as % of total load	50.11

KEY
Top 10 by Impervious Area
Top 5 by N-load (lb/yr)

42	OF-14	6.09	0.92	0.19	17.78		
100	OF-201	3.18	1.19	0.52	17.43		
28	OF-126	2.98	1.08	0.41	16.98		
15	OF-112	5.23	1.10	0.36	16.69		
158	OF-29	5.29	1.07	0.34	16.35		
39	OF-137	7.33	0.54	0.08	16.18		
22	OF-12	8.23	0.68	0.11	16.03		
211	OF-92	4.62	0.80	0.23	15.90		
77	OF-174	8.01	0.41	0.05	15.88		
79	OF-176	3.90	0.80	0.28	15.02		
155	OF-287	6.29	0.57	0.11	14.96		
73	OF-170	2.87	0.79	0.29	14.87		
59	OF-156	5.63	0.95	0.28	14.84		
171	OF-43	2.62	0.90	0.38	14.81		
96	OF-195	3.25	0.45	0.12	14.69		
34	OF-131	5.53	0.80	0.19	14.63		
214	OF-95	5.24	0.89	0.29	14.46		
205	OF-87	1.91	0.82	0.41	14.18		
69	OF-167	4.78	0.14	0.02	14.07		
145	OF-276	5.86	0.82	0.21	13.94		
199	OF-8	5.24	0.71	0.13	13.86		
191	OF-70	3.32	0.70	0.17	13.59		
175	OF-55	1.74	0.85	0.39	13.58		
167	OF-4	5.78	0.79	0.20	13.57		
178	OF-59	6.25	0.47	0.15	13.52		
5	OF-102	3.18	0.91	0.34	13.46		
162	OF-33	2.25	0.62	0.19	13.30		
163	OF-35	2.74	0.82	0.35	12.51		
97	OF-196	3.34	0.50	0.08	12.47		
218	OF-99	3.54	0.82	0.28	12.42		
78	OF-175	5.10	0.56	0.10	12.31		
165	OF-37	5.42	0.73	0.19	11.88		
7	OF-105	3.92	0.76	0.25	11.67		
182	OF-62	2.45	0.49	0.34	11.67		
88	OF-188	1.83	0.61	0.30	11.56		
161	OF-32	3.32	0.76	0.25	11.42		
169	OF-41	8.02	0.64	0.14	11.24		
31	OF-129	1.04	0.73	0.44	11.01		
43	OF-140	4.18	0.49	0.11	10.75		
207	OF-89	1.89	0.65	0.30	10.62		
75	OF-172	3.04	0.20	0.04	10.55		
210	OF-91	2.75	0.54	0.19	10.41		
8	OF-106	3.65	0.64	0.22	10.07		
197	OF-77	3.54	0.11	0.01	9.79		
195	OF-75	3.13	0.17	0.05	9.57		
63	OF-16	2.88	0.45	0.13	9.15		
29	OF-127	2.12	0.61	0.24	9.10		
196	OF-76	3.55	0.05	0.00	9.07		
204	OF-85	1.81	0.53	0.28	9.00		
104	OF-205	0.91	0.56	0.44	8.33		
90	OF-19	2.20	0.55	0.21	8.20		
106	OF-209	1.82	0.28	0.08	8.20		
123	OF-251	1.69	0.28	0.09	8.18		
198	OF-78	0.90	0.55	0.38	8.15		
91	OF-190	2.59	0.17	0.03	8.14		
99	OF-2	1.83	0.53	0.20	7.82		
70	OF-168	1.73	0.33	0.11	7.75		
157	OF-289	2.98	0.49	0.14	7.70		
200	OF-81	1.51	0.46	0.23	7.69		
72	OF-17	1.66	0.42	0.18	7.37		
51	OF-149	3.55	0.23	0.04	7.23		
180	OF-60	2.43	0.12	0.02	7.06		
113	OF-227	1.30	0.31	0.11	6.77		
57	OF-154	0.82	0.45	0.27	6.52		
14	OF-111	1.45	0.43	0.18	6.36		
103	OF-204	0.51	0.44	0.30	6.26		
181	OF-61	1.49	0.23	0.06	6.20		
21	OF-119	1.08	0.25	0.12	6.00		
20	OF-118	0.57	0.37	0.30	5.88		
166	OF-38	1.26	0.23	0.07	5.76		
184	OF-64	1.25	0.33	0.12	5.71		
183	OF-63	1.43	0.19	0.05	5.63		
71	OF-169	1.50	0.22	0.08	5.50		
33	OF-130	0.65	0.31	0.20	5.45		
60	OF-157	0.75	0.35	0.16	5.06		
170	OF-42	1.34	0.28	0.07	4.97		
25	OF-122	2.02	0.30	0.09	4.76		
115	OF-23	3.92	0.00	0.00	4.70		
54	OF-151	0.80	0.29	0.15	4.68		
74	OF-171	0.75	0.29	0.15	4.59		
179	OF-6	2.60	0.27	0.06	4.50		

138	OF-269	1.70	0.19	0.05	4.43		
118	OF-242	0.61	0.29	0.16	4.22		
16	OF-113	0.68	0.29	0.11	4.16		
159	OF-3	0.84	0.28	0.13	4.15		
87	OF-187	0.85	0.16	0.05	3.87		
9	OF-107	0.56	0.27	0.13	3.85		
142	OF-272	0.91	0.20	0.07	3.68		
160	OF-31	0.60	0.25	0.12	3.65		
122	OF-250	0.90	0.09	0.03	3.49		
129	OF-258	0.42	0.15	0.07	2.95		
156	OF-288	1.07	0.17	0.06	2.93		
144	OF-274	0.52	0.18	0.08	2.77		
143	OF-273	0.48	0.18	0.10	2.67		
130	OF-259	0.78	0.02	0.00	2.60		
52	OF-15	0.47	0.16	0.07	2.36		
173	OF-5	0.49	0.16	0.07	2.30		
149	OF-28	0.42	0.16	0.07	2.27		
56	OF-153	0.52	0.15	0.06	2.26		
27	OF-124	0.42	0.13	0.06	1.97		
105	OF-207	0.44	0.06	0.01	1.79		
35	OF-132	0.16	0.12	0.07	1.75		
133	OF-263	0.65	0.08	0.02	1.66		
23	OF-120	0.23	0.07	0.04	1.45		
120	OF-248	0.18	0.06	0.03	1.22		
168	OF-40	0.11	0.09	0.07	1.22		
112	OF-226	0.14	0.08	0.05	1.18		
116	OF-233	0.25	0.07	0.03	1.10		
50	OF-147	0.10	0.08	0.07	1.10		
110	OF-216	0.07	0.07	0.06	1.06		
119	OF-243	0.06	0.06	0.05	0.79		
187	OF-67	0.06	0.06	0.05	0.78		
202	OF-83	0.12	0.05	0.03	0.73		
107	OF-21	0.55	0.00	0.00	0.71		
95	OF-194	0.14	0.02	0.01	0.65		
64	OF-160	0.06	0.04	0.04	0.65		
203	OF-84	0.13	0.04	0.02	0.65		
26	OF-123	0.19	0.04	0.02	0.61		
185	OF-65	0.04	0.04	0.04	0.58		
36	OF-133	0.04	0.04	0.04	0.57		
164	OF-36	0.12	0.04	0.01	0.53		
152	OF-284	0.14	0.03	0.01	0.46		
186	OF-66	0.03	0.03	0.03	0.41		
190	OF-7	0.03	0.02	0.02	0.32		
126	OF-254	0.01	0.01	0.01	0.19		
128	OF-257	0.01	0.01	0.01	0.18		
127	OF-256	0.01	0.01	0.01	0.18		
111	OF-22	0.26	0.00	0.00	0.16		
98	OF-198	0.01	0.01	0.01	0.15		
102	OF-203	0.02	0.01	0.01	0.14		
108	OF-211	0.01	0.00	0.00	0.07		
141	OF-271	0.02	0.00	0.00	0.03		
18	OF-116	0.00	0.00	0.00	0.03		
80	OF-177	0.00	0.00	0.00	0.02		
124	OF-252	0.00	0.00	0.00	0.02		
125	OF-253	0.00	0.00	0.00	0.01		
174	OF-54	0.00	0.00	0.00	0.01		
176	OF-56	0.00	0.00	0.00	0.00		

Appendix C – Outfall Screening Data

facilityid	insp_id	category	insp_date	insp_by	comments	flow_desc	submerged	ht_abv_out	dp_observ	color	color_sev	floatables	float_sev	odor	oder_sev	turbidity	dns_observ	color_dns	oth_observ	ammon_kit	ammon_res	spec_cond	salinity	chlor_kit	fc_result	tc_result	cc_result	deter_surf	ph_kit	ph_result	airtemp	watertemp	do_result	comm_fld_s	amon_lab	ecoli_lab	fcoli_lab	detsur_lab	phos_lab
OF-13	DISIN-1	Dry	2019-08-07	DL		None	No																0				0												
OF-14	DISIN-2	Dry	2019-08-07	DL	Incorrect key for lock																		0				0												
OF-273	DISIN-6	Dry	2019-08-12	DL	Logs, rocks, lawn trimmings	None													Following the path of erosion this is the most likely place for the pip				0				0												
OF-274	DISIN-5	Dry	2019-08-12	DL															Full of dirt				0				0												
OF-275	DISIN-4	Dry	2019-08-12	DL		None	No																0				0												
OF-277	DISIN-9	Dry	2019-08-12	DL	Severely overgrown, could not view.	None													Needs to be trimmed can't access gated area				0				0												
OF-288	DISIN-3	Dry	2019-08-12	DL	Overgrown	None	No												Lawn clippings				0				0												
OF-3	DISIN-8	Dry	2019-08-12	DL		None	No																0				0												
OF-4	DISIN-7	Dry	2019-08-12	DL		None	No																0				0												
OF-135	DISIN-10	Dry	2019-08-13	DL		None	No																0				0												
OF-18	DISIN-19	Dry	2019-08-13	DL	In need of maintenance overgrown																		0				0												
OF-20	DISIN-17	Dry	2019-08-13	DL	Pipe is hidden under rocks that do not disrupt drainage	None	No																0				0												
OF-21	DISIN-18	Dry	2019-08-13	DL	Excessive amount of Japanese knotweed make outfall in accessible																		0				0												
OF-22	DISIN-16	Dry	2019-08-13	DL	Directly across from drain, excellent condition	None	No																0				0												
OF-23	DISIN-15	Dry	2019-08-13	DL		None	No												Directly across from basin				0				0												
OF-24	DISIN-14	Dry	2019-08-13	DL	Perfect condition	None	No																0				0												
OF-25	DISIN-13	Dry	2019-08-13	DL	Some sediment and mud buildup in opening																		0				0												
OF-26	DISIN-11	Dry	2019-08-13	DL	Good amount of sediment in pipe	None	No										Algea						0				0												
OF-86	DISIN-12	Dry	2019-08-13	DL		None	No												Very high on the rock face				0				0												
OF-100	DISIN-32	Dry	2019-08-30	DL		None	No																0				0												
OF-102	DISIN-25	Dry	2019-08-30	DL	In fenced in backyard	None	No																0				0												
OF-103	DISIN-24	Dry	2019-08-30	DL	Unable to locate																		0				0												
OF-104	DISIN-29	Dry	2019-08-30	DL	Very well maintained	None	No																0				0												
OF-106	DISIN-28	Dry	2019-08-30	DL	Safe to assume during heavy rain this outfall has quite heavy flow due to the obvious path the water takes towards river	None	No																0				0												
OF-107	DISIN-27	Dry	2019-08-30	DL	A lot of erosion	None	No																0				0												
OF-108	DISIN-26	Dry	2019-08-30	DL		None	No																0				0												
OF-110	DISIN-31	Dry	2019-08-30	DL		None	No																0				0												
OF-111	DISIN-30	Dry	2019-08-30	DL	Lots of sediment in front of drain. Lady who's house it's abuts is very	None	No										Excessive Sediment						0				0												
OF-114	DISIN-20	Dry	2019-08-30	DL	Overgrown	None	No																0				0												
OF-115	DISIN-21	Dry	2019-08-30	DL	Gate broken open, excessive vegetation	None	No																0				0												
OF-116	DISIN-23	Dry	2019-08-30	DL	All pitfalls dump in fenced in area with forced open gate	None	No																0				0												
OF-117	DISIN-22	Dry	2019-08-30	DL	Excessive vegetation same broken fenced in area																		0				0												
OF-124	DISIN-40	Dry	2019-08-30	DL	Brush and tree limbs make it inaccessible, very steep incline																		0				0												
OF-125	DISIN-41	Dry	2019-08-30	DL		None	No																0				0												
OF-129	DISIN-33	Dry	2019-08-30	DL	Trickle from pipe; pond level high	Trickling	No																0				0												
OF-130	DISIN-34	Dry	2019-08-30	DL		None	No																0				0												
OF-138	DISIN-35	Dry	2019-08-30	DL	Lots of rose bushes	None	No																0				0												
OF-140	DISIN-42	Dry	2019-08-30	DL	On the opposite side of the road as shown in map	None	No																0				0												
OF-155	DISIN-36	Dry	2019-08-30	DL		None	No																0				0												
OF-156	DISIN-37	Dry	2019-08-30	DL		None	No										Excessive Sediment						0				0												
OF-157	DISIN-39	Dry	2019-08-30	DL		Trickling	No																0				0												
OF-285	DISIN-44	Dry	2019-08-30	DL	Difficult to see due to excessive vegetation looks poorly maintained	None	No																0				0												
OF-35	DISIN-48	Dry	2019-08-30	DL	Water is rust colored	Moderate	Yes	2		Tea													0				0												
OF-36	DISIN-47	Dry	2019-08-30	DL	Couldn't locate believed to be in yard clippings pile																		0				0												
OF-37	DISIN-46	Dry	2019-08-30	DL	In front yard	None	No																0				0												
OF-91	DISIN-45	Dry	2019-08-30	DL	Much more towards street then shown	None	No																0				0												
OF-93	DISIN-43	Dry	2019-08-30	DL	Could not locate excessive vegetation																		0				0												
OF-98	DISIN-38	Dry	2019-08-30	DL	Very large	None	No																0				0												
OF-132	DISIN-52	Dry	2019-10-02	DL	A lot of dirt in mouth of pipe	None	No										Excessive Sediment						0				0												
OF-132	DISIN-53	Dry	2019-10-02	DL	Not sure which pipe so I pictured both	None	No																0				0												
OF-133	DISIN-54	Dry	2019-10-02	DL	Pipe broken	Trickling	No																0				0												
OF-139	DISIN-62	Dry	2019-10-02	DL	Couldn't locate either																		0				0												
OF-141	DISIN-66	Dry	2019-10-02	DL	Easily accessible well kept	None	No																0				0												
OF-143	DISIN-59	Dry	2019-10-02	DL	Very good condition	None	No																0				0												
OF-144	DISIN-61	Dry	2019-10-02	DL	About 50ft down driveway to left	None	No										Excessive Sediment						0				0												
OF-145	DISIN-60	Dry	2019-10-02	DL	Beyond the backyard of house	None	No																0				0												
OF-149	DISIN-55	Dry	2019-10-02	DL	Pipe rusted on end	None	No																0				0												
OF-150	DISIN-56	Dry	2019-10-02	DL	Unaccessible																		0				0												
OF-152	DISIN-49	Dry	2019-10-02	DL	not accessible from road but easily accessible if you go through the yard next to it	None	No																0				0												
OF-153	DISIN-51	Dry	2019-10-02	DL	Lots of leaves	None	No										Excessive Sediment						0				0												
OF-154	DISIN-50	Dry	2019-10-02	DL	Logs cinderblocks and dented pipe	None	No																0				0												
OF-199	DISIN-58	Dry	2019-10-02	DL	Rotted	None	No																0				0												
OF-200	DISIN-57	Dry	2019-10-02	DL	Nice	None	No																0				0												
OF-264	DISIN-67	Dry	2019-10-02	DL	On the right side of the road	None	No																0				0												
OF-266	DISIN-74	Dry	2019-10-02	DL	Right behind cream colored house	None	No																0				0												
OF-34	DISIN-69	Dry	2019-10-02	DL	Directly across from basin	None	No																0				0												
OF-38	DISIN-68	Dry	2019-10-02	DL	Big extension on outlet	None	No																0				0												
OF-45	DISIN-70	Dry	2019-10-02	DL	Rocks are very slick	None	No																0				0												
OF-46	DISIN-71	Dry	2019-10-02	DL	Bricks near opening	None	No																0				0												
OF-48	DISIN-72	Dry	2019-10-02	DL		None	No																0				0												
OF-54	DISIN-73	Dry	2019-10-02	DL	All In gated in yard																		0				0												
OF-89	DISIN-63	Dry	2019-10-02	DL	No visible pipe looks like just an opening	None	No																0				0												
OF-90	DISIN-64	Dry	2019-10-02	DL	Alot of leaves	None	No																0				0												
OF-92	DISIN-65	Dry	2019-10-02	DL	Dense vegetation																		0				0												
OF-169	DISIN-103	Dry	2019-10-15	DL		None	No																0				0												
OF-176	DISIN-102	Dry	2019-10-15	DL	Covered almost completely	None	No																0				0												
OF-177	DISIN-101	Dry	2019-10-15	DL	Almost completely covered	None	No																0				0												
OF-181	DISIN-100	Dry	2019-10-15	DL		None	No																0				0												
OF-192	DISIN-93	Dry	2019-10-15	DL	Light trickle	Trickling	No																0				0												
OF-194	DISIN-98	Dry	2019-10-15	DL		None	No																0				0												
OF-195	DISIN-99	Dry	2019-10-15	DL		None	No																0				0												
OF-198	DISIN-97	Dry	2019-10-15	DL	Full of mud	None	No										Excessive Sediment						0				0												
OF-206	DISIN-94	Dry	2019-10-15	DL		None	No																0				0												
OF-209	DISIN-96	Dry	2019-10-15	DL	Road has significant cracks where pipe runs underneath	None	No																0				0												
OF-211	DISIN-95	Dry	2019-10-15	DL		None	No																0				0												
OF-212	DISIN-92	Dry	2019-10-15	DL	Blocked with a rock	None	No																0				0												
OF-269	DISIN-84	Dry	2019-10-15	DL	Down stream has a lot of trash	None	No																0				0												
OF-270	DISIN-85	Dry	2019-10-15	DL	Not even trickling just wet	None	No																0				0												
OF-42	DISIN-87	Dry	2019-10-15	DL		None	No																0				0												
OF-49	DISIN-88	Dry	2019-10-15	DL		None	No																0				0												
OF-50	DISIN-89	Dry	2019-10-15	DL	Tampered with	None	No																0				0												
OF-51	DISIN-90	Dry	2019-10-15	DL	Down the driveway about 75 feet and to left	None	No																0				0												
OF-52	DISIN-91	Dry	2019-10-15	DL	Pipe under rock	None	No																0				0												
OF-69	DISIN-82	Dry	2019-10-15	DL		None	No																0				0												
OF-78	DISIN-75	Dry	2019-10-15	DL		None	No																0				0												
OF-79	DISIN-77	Dry	2019-10-15	DL	Next to 80	None	No																0				0												
OF-80	DISIN-76	Dry	2019-10-15	DL	It's had like a rubber liner inside	None	No																0				0												
OF-81	DISIN-78	Dry	2019-10-15	DL	Looks to be in need of repair	None	No																0				0												
OF-82	DISIN-79	Dry	2019-10-15	DL		None	No																0				0												
OF-83	DISIN-80	Dry	2019-10-15	DL	Down steep embankment	None	No																0				0												
OF-84	DISIN-81	Dry	2019-10-15	DL	Might need repair	None	No																0				0												
OF-85	DISIN-83	Dry	2019-10-15	DL		None	No																0				0												
OF-88	DISIN-86	Dry	2019-10-15	DL		None	No																0				0												
OF-158	DISIN-124	Dry	2021-01-19	DL		None	No																0				0												
OF-159	DISIN-136	Dry	2021-01-19	DL	Bunch of leaves in the areA but not stopping the flow	None	No																0				0												
OF-160	DISIN-127	Dry	2021-01-19	DL	Hard to access due to thorn bushes	Moderate	No		Color (Water)	Orange							Color (Water)	Orange					0				0												
OF-161	DISIN-125	Dry	2021-01-19	DL	To get to the outfall you need to walk about 100ft until you reach the shipping containers which they are behind	Trickling	No		Excessive Sediment								Excessive Sediment		A lot of sediment in the outlets				0				0												
OF-162	DISIN-128	Dry	2021-01-19	DL	Cut up telephone poles and a small tree in the mouth of the outlet	None	No																0				0												
OF-165	DISIN-123	Dry	2021-01-19	DL	Looks to be in very good condition	Moderate	No																0				0												
OF-166	DISIN-122	Dry	2021-01-19	DL	Down the embankment, couldn't get super close to it	Moderate	No																0				0												
OF-167	DISIN-114	Dry	2021-01-19	DL	Slow trickle out of the pipe, looks like the overall flow has been good	None	No																0				0												
OF-169	DISIN-109	Dry	2021-01-19	DL	Completely covered in leaves and some small logs	None	No																0				0												
OF-170	DISIN-108	Dry	2021-01-19	DL	Pipe as about half full of leaves. Looks like it had decent flow	None	No																0				0												
OF-171	DISIN-106	Dry	2021-01-19	DL	Outfall is completely covered in debris and dead plants. Looks like someone's dumped there lawn clippings there for some time,	None	No		Excessive Vegetation														0				0												
OF-172	DISIN-111	Dry	2021-01-19	DL	No flow but in good condition	None	No																0				0												
OF-173	DISIN-110	Dry	2021-01-19	DL	Solid flow, waters crystal clear	Moderate			Color (Water)														0				0												
OF-174	DISIN-112	Dry	2021-01-19	DL	A good ways into the yard. Walking along the property edge until nearly in the back yard and its on the other side of the small dirt mound.	Trickling	No																0				0												
OF-175	DISIN-104	Dry	2021-01-19	DL	Surrounded by dead knotweed very easy to access, down the path and to the right	Trickling	No																0				0												
OF-176	DISIN-105	Dry	2021-01-19	DL	In between the driveways, concrete pipe	None	No																0				0												
OF-177	DISIN-107	Dry	2021-01-19	DL	Pipe is about half full with sediment, surrounded by thorn bushes	None	No		Excessive Sediment|Excessive Vegetation														0				0												
OF-183	DISIN-126	Dry	2021-01-19	DL	Couldn't quite reach due to an excessive amount of thorns	Trickling	No																0				0												
OF-186	DISIN-113	Dry	2021-01-19	DL	Not the easiest to access		No																0				0												
OF-188	DISIN-117	Dry	2021-01-19	DL	Walk through the yard and behind the small decorative trees. A pipe from the house number 10 dumps into the same run off	None	No																0				0												
OF-189	DISIN-118	Dry	2021-01-19	DL	Storm drain and outfall I need of repair, traffic cone placed over top	None	No																0				0												
OF-189	DISIN-119	Dry	2021-01-19	DL	Also in need of repair. Over all rough shape																		0				0												
OF-190	DISIN-120	Dry	2021-01-19	DL	In need of repair																		0				0												
OF-191	DISIN-116	Dry	2021-01-19	DL	It looks like a pipe not installed by us. The gravel road looks relatively new	None	No																0				0												
OF-196	DISIN-115	Dry	2021-01-19	DL	Following the driveway all the way leads to a small path to access the outfall	Moderate	No		Algae|Color (Water)	Light Green							Algae		A lot of moss on the rocks giving water a greenish color				0				0												
OF-226	DISIN-121	Dry	2021-01-19	DL	Someone dumped bushes where the pipe should be	None	No																0				0												
OF-59	DISIN-132	Dry	2021-01-19	DL	Full of sediment and looks partly crushed.	Trickling	No																0				0												

OF-60	DISIN-134	Dry	2021-01-19	DL	If you walk through the field to the tree grouping it's up high and trickling into the basin	Trickling	No						0	0			
OF-61	DISIN-135	Dry	2021-01-19	DL	Seems to be slightly covered with rocks but is still flowing	Trickling	Yes						0	0			
OF-62	DISIN-137	Dry	2021-01-19	DL	Down the embankment, proceeded with caution lots of loose rocks	None	No						0	0			
OF-63	DISIN-138	Dry	2021-01-19	DL	Good shape	None	No						0	0			
OF-64	DISIN-129	Dry	2021-01-19	DL	I believe the outfall is in this pile of leaves and wood								0	0			
OF-65	DISIN-130	Dry	2021-01-19	DL	If you follow the white pipe at the street it follows perfectly at a 45 degree angle	Trickling	No						0	0			
OF-66	DISIN-131	Dry	2021-01-19	DL	The concrete pipe is covered in large rocks; water is able to flow out but it is about at half capacity	None	No						0	0			
OF-67	DISIN-133	Dry	2021-01-19	DL	Lots of leaves and setiment	Trickling	Yes	4	Excessive Sediment	Excessive Sediment			0	0			
OF-81	DISIN-139	Dry	2021-06-15	DL	Pipe is broken and wall is following over	None	No			Excessive Sediment			0	0			
OF-82	DISIN-140	Dry	2021-06-15	DL	Outlet is good shape alot of leaves	N/A	No		Excessive Sediment	Excessive Sediment			0	0			
OF-10	DISIN-152	Dry	2021-06-16	RY		None					Fair condition		0	0			
OF-11	DISIN-151	Dry	2021-06-16	RY		None					Good condition		0	0			
OF-19	DISIN-142	Dry	2021-06-16	DL | RY	In excellent shape	None	No						0	0			
OF-28	DISIN-148	Dry	2021-06-16	RY	1/4 of pipe closed, needs clean up.	None					Erosion at structure. Pipe needs to be cleaned out.		0	0			
OF-30	DISIN-146	Dry	2021-06-16	RY	Good shape.	None	No						0	0			
OF-31	DISIN-147	Dry	2021-06-16	RY		None					Erosion		0	0			
OF-32	DISIN-194	Dry	2021-06-16	RY		None							0	0			
OF-33	DISIN-149	Dry	2021-06-16	RY	Good condition	None							0	0			
OF-39	DISIN-150	Dry	2021-06-16	RY		None					Leaves need to be removed		0	0			
OF-15	DISIN-157	Dry	2021-06-17	RY		None					Good		0	0			
OF-2	DISIN-156	Dry	2021-06-17	RY		None					Good		0	0			
OF-5	DISIN-160	Dry	2021-06-17	RY		None					Good		0	0			
OF-57	DISIN-159	Dry	2021-06-17	RY		Trickling					Good		0	0			
OF-6	DISIN-153	Dry	2021-06-17	RY		None					Good condition		0	0			
OF-68	DISIN-161	Dry	2021-06-17	RY		None					Good		0	0			
OF-7	DISIN-154	Dry	2021-06-17	RY		None					Good condition		0	0			
OF-8	DISIN-155	Dry	2021-06-17	RY		None				Excessive Vegetation	Debris		0	0			
OF-9	DISIN-158	Dry	2021-06-17	RY		Trickling					Good		0	0			
OF-109	DISIN-167	Dry	2021-06-21	RY		None					Good		0	0			
OF-112	DISIN-166	Dry	2021-06-21	RY		None					Good		0	0			
OF-118	DISIN-168	Dry	2021-06-21	RY		None					Good		0	0			
OF-70	DISIN-165	Dry	2021-06-21	RY	Corner of Hartwell St.	Moderate					Good		0	0			
OF-72	DISIN-162	Dry	2021-06-21	RY		None					Good		0	0			
OF-73	DISIN-163	Dry	2021-06-21	RY		None					Good		0	0			
OF-101	DISIN-169	Dry	2021-06-22	RY		None					Good		0	0			
OF-184	DISIN-183	Dry	2021-06-22	RY		None					Good		0	0			
OF-185	DISIN-184	Dry	2021-06-22	RY		None					Good		0	0			
OF-240	DISIN-182	Dry	2021-06-22	RY		None					Good		0	0			
OF-242	DISIN-181	Dry	2021-06-22	RY		None					Good		0	0			
OF-243	DISIN-177	Dry	2021-06-22	RY		None					Good		0	0			
OF-249	DISIN-180	Dry	2021-06-22	RY		None					Good		0	0			
OF-251	DISIN-179	Dry	2021-06-22	RY		Moderate					Good		0	0			
OF-255	DISIN-178	Dry	2021-06-22	RY		Trickling					Good		0	0			
OF-278	DISIN-172	Dry	2021-06-22	RY		None							0	0			
OF-74	DISIN-173	Dry	2021-06-22	RY		None					Good		0	0			
OF-97	DISIN-171	Dry	2021-06-22	RY		None							0	0			
OF-163	DISIN-190	Dry	2021-06-24	RY		None					Good		0	0			
OF-164	DISIN-191	Dry	2021-06-24	RY		None					Good		0	0			
OF-168	DISIN-187	Dry	2021-06-24	RY		None					Good		0	0			
OF-182	DISIN-192	Dry	2021-06-24	RY		None					Good		0	0			
OF-187	DISIN-188	Dry	2021-06-24	RY		None					Good		0	0			
OF-193	DISIN-189	Dry	2021-06-24	RY		None					Good		0	0			
OF-279	DISIN-193	Dry	2021-06-24	RY		None					Good		0	0			
OF-105	DISIN-170	Dry	2021-09-22	RY		None			Excessive Sediment		Did not see the pipe - lots of rocks		0	0			
OF-178	DISIN-185	Dry	2021-09-22	RY		None					Fair		0	0			
OF-179	DISIN-186	Dry	2021-09-22	RY		None							0	0			
OF-259	DISIN-176	Dry	2021-09-22	RY		Trickling					Good		0	0			
OF-75	DISIN-174	Dry	2021-09-22	RY		None					Good		0	0			
OF-76	DISIN-175	Dry	2021-09-22	RY		None					Could not find pipe.		0	0			
OF-1	DISIN-205	Dry	2022-06-16	PG		None	No		Excessive Sediment				0	0			
OF-131	DISIN-198	Dry	2022-06-16	PG		None	No			Excessive Vegetation			0	0			
OF-147	DISIN-196	Dry	2022-06-16	PG		None	No				Picture not taken due to vegetation		0	0			
OF-148	DISIN-195	Dry	2022-06-16	PG		None	No						0	0			
OF-151	DISIN-224	Dry	2022-06-16	PG		None	No						0	0			
OF-17	DISIN-204	Dry	2022-06-16	PG	Could not get to pipe.								0	0			
OF-252	DISIN-222	Dry	2022-06-16	PG		None	No						0	0			
OF-253	DISIN-220	Dry	2022-06-16	PG		None	No						0	0			
OF-255	DISIN-221	Dry	2022-06-16	PG	Delete outfall.								0	0			
OF-256	DISIN-223	Dry	2022-06-16	PG		None	No						0	0			
OF-261	DISIN-217	Dry	2022-06-16	PG	Behind fence and no one answered. Could not get to.								0	0			
OF-265	DISIN-216	Dry	2022-06-16	PG		None	Yes	5					0	0			
OF-267	DISIN-215	Dry	2022-06-16	PG		None	No						0	0			
OF-268	DISIN-214	Dry	2022-06-16	PG		None	No						0	0			
OF-271	DISIN-211	Dry	2022-06-16	PG	No outfall exists. No catch basin outlet.								0	0			
OF-272	DISIN-212	Dry	2022-06-16	PG		None	No						0	0			
OF-276	DISIN-206	Dry	2022-06-16	PG		None	No		Scouring Below Inlet				0	0			
OF-280	DISIN-218	Dry	2022-06-16	PG		None	No						0	0			
OF-281	DISIN-219	Dry	2022-06-16	PG		None	No		Scouring Below Inlet				0	0			
OF-29	DISIN-203	Dry	2022-06-16	PG		None	No						0	0			
OF-291	DISIN-199	Dry	2022-06-16	PG		None	Yes			Excessive Sediment	Water is stagnant in front of pipe.		0	0			
OF-40	DISIN-202	Dry	2022-06-16	PG		None	No		Excessive Sediment	Excessive Sediment			0	0			
OF-44	DISIN-213	Dry	2022-06-16	PG	Cannot find outfall.								0	0			
OF-55	DISIN-208	Dry	2022-06-16	PG		None	Yes	2	Excessive Vegetation				0	0			
OF-56	DISIN-207	Dry	2022-06-16	PG		None	No						0	0			
OF-71	DISIN-209	Dry	2022-06-16	PG		None	No						0	0			
OF-77	DISIN-197	Dry	2022-06-16	PG		None	No		Scouring Below Inlet	Scouring Below Outlet			0	0			
OF-87	DISIN-210	Dry	2022-06-16	PG	Gate was blocked by firewood and could not see past vegetation.								0	0			
OF-94	DISIN-200	Dry	2022-06-16	PG		None	No		Excessive Sediment				0	0			
OF-95	DISIN-201	Dry	2022-06-16	PG		None	Yes	4					0	0			
OF-113	DISIN-232	Dry	2022-06-17	PG	Too overgrown to find.								0	0			
OF-115	DISIN-233	Dry	2022-06-17	PG		None	No						0	0			
OF-119	DISIN-230	Dry	2022-06-17	PG		None	No		Excessive Sediment				0	0			
OF-12	DISIN-239	Dry	2022-06-17	PG	Could not find outfall.								0	0			
OF-120	DISIN-231	Dry	2022-06-17	PG	Too overgrown to find.								0	0			
OF-122	DISIN-225	Dry	2022-06-17	PG		None	No		Excessive Sediment				0	0			
OF-123	DISIN-226	Dry	2022-06-17	PG		None	No		Excessive Sediment				0	0			
OF-126	DISIN-228	Dry	2022-06-17	PG		None	No		Scouring Below Inlet	Excessive Sediment			0	0			
OF-134	DISIN-234	Dry	2022-06-17	PG			Yes	6	Scouring Below Inlet	Scouring Below Outlet			0	0			
OF-180	DISIN-229	Dry	2022-06-17	PG		None	No		Excessive Sediment				0	0			
OF-207	DISIN-241	Dry	2022-06-17	PG	Outfall deleted.								0	0			
OF-213	DISIN-242	Dry	2022-06-17	PG		None	No						0	0			
OF-227	DISIN-240	Dry	2022-06-17	PG	Outfall deleted.								0	0			
OF-228	DISIN-236	Dry	2022-06-17	PG		None	No						0	0			
OF-229	DISIN-235	Dry	2022-06-17	PG		None	No						0	0			
OF-263	DISIN-237	Dry	2022-06-17	PG		None	No						0	0			
OF-283	DISIN-238	Dry	2022-06-17	PG			Yes	6	Algae	Algae			0	0			
OF-290	DISIN-227	Dry	2022-06-17	PG	No outlet pipe from CB.								0	0			
OF-121	DISIN-256	Dry	2022-06-29	PG	Could not find.								0	0			
OF-127	DISIN-248		2022-06-29	PG	Too overgrown								0	0			
OF-142	DISIN-257	Dry	2022-06-29	PG	Could not locate								0	0			
OF-146	DISIN-247	Dry	2022-06-29	PG	Too overgrown to find								0	0			
OF-16	DISIN-249	Dry	2022-06-29	PG	No one home can't get back there.								0	0			
OF-173	DISIN-264	Dry	2022-06-29	PG		None	No						0	0			
OF-201	DISIN-243	Dry	2022-06-29	PG		N/A	Yes	8	Excessive Sediment				0	0			
OF-202	DISIN-261	Dry	2022-06-29	PG	No answer at door.								0	0			
OF-208	DISIN-245	Dry	2022-06-29	PG		None	No						0	0			
OF-210	DISIN-244	Dry	2022-06-29	PG		None	No		Excessive Vegetation		Overgrown		0	0			
OF-233	DISIN-250	Dry	2022-06-29	PG	No answer at door. In backyard.								0	0			
OF-250	DISIN-262	Dry	2022-06-29	PG	Could not find.								0	0			
OF-260	DISIN-251	Dry	2022-06-29	PG	No answer at door.								0	0			
OF-27	DISIN-253		2022-06-29	PG	No answer at door								0	0			
OF-284	DISIN-258	Dry	2022-06-29	PG	No answer at door								0	0			
OF-286	DISIN-260	Dry	2022-06-29	PG	No answer at door								0	0			
OF-287	DISIN-259	Dry	2022-06-29	PG	No answer at door								0	0			
OF-289	DISIN-255	Dry	2022-06-29	PG	Could not find								0	0			
OF-41	DISIN-246		2022-06-29	PG	Could not find								0	0			
OF-70	DISIN-263	Dry	2022-06-29	PG		Trickling	No					327	0.18242039657999998	0	5.81	73	66
OF-96	DISIN-252	Dry	2022-06-29	PG	No answer								0	0			
OF-99	DISIN-254	Dry	2022-06-29	PG	Not an outfall								0	0			
OF-162	DISIN-270	Dry	2022-06-30	PG									0	0			
OF-165	DISIN-268	Dry	2022-06-30	PG	This is a culvert, not an outfall.								0	0			
OF-166	DISIN-267	Dry	2022-06-30	PG	Severely overgrown. Cannot access.								0	0			
OF-196	DISIN-266	Dry	2022-06-30	PG	No answer at door.								0	0			
OF-254	DISIN-265	Dry	2022-06-30	PG		None	No						0	0			
OF-293	DISIN-269	Dry	2022-06-30	PG		None	No						0	0			
OF-9	DISIN-271	Dry	2022-06-30	PG		Moderate	No					445	0.2483540105	0	5.54	75	64

Appendix D – BMP Assessment Methodology

BMP Site Assessment

1.1 Methodology

In the fifth year of the Oxford MS4 report, Nitsch Engineering conducted a comprehensive evaluation of subdivisions of town-owned parcels to identify and prioritize potential stormwater BMP locations. Unlike previous years, this year's methodology did not involve a scoring system. Instead, the focus was on a detailed analysis of various criteria that could influence the success and efficiency of a BMP on a town-owned parcel.

Each town-owned parcel was evaluated based on several criteria, some of which were used for informational purposes only. These criteria played a significant role in decision-making processes related to BMP selection and design.

The phosphorus or nitrogen loading rates were calculated for individual BMP watersheds, instead of those of the encompassing town-owned parcel. The watershed was determined using the ArcGIS Pro "watershed" function, with a MassGIS Lidar DEM serving as a base for flow direction. Each BMP area was determined through a process of subdividing town-owned parcels by hydrologic soil group, depth to groundwater, and surface slope.

For local decision-making, the considerations in this analysis can be further supplemented and fine-tuned based on local priorities. For some areas, localized access and education could be an important additional consideration.

The stormwater retrofit prioritization will continue to be updated in future Permit years to adapt to local efforts in pursuit of the MS4 permit. This year's methodology builds upon the previous years' work, incorporating lessons learned and refining the process for identifying and prioritizing potential BMP areas.

1.2 Data Sources

- Pond Watersheds - StreamStats (usgs.gov)
- 2016 Land Cover Land Use (four blocks) - MassGIS Data: 2016 Land Cover/Land Use |
- Mass.gov
- Building Footprints - MassGIS Data: Building Structures (2-D) | Mass.gov
- Train Lines - MassGIS Data: Trains | Mass.gov
- Wetlands - MassGIS Data: MassDEP Wetlands (2005) | Mass.gov
- Hydrologic Soil Groups - MassGIS Data: Soils SSURGO-Certified NRCS | Mass.gov
- Tax Parcels from Oxford, MA - Judy Lochner jlochner@oxfordma.us
- LiDAR DEM - 2015 USGS Lidar: Maine & Massachusetts QL1 & QL2, 2013 - 2014 USGS Lidar: Post-Sandy (MA, NH, RI), and 2010 FEMA Lidar: MA & RI

<table>
<tr><th><u>ATTRIBUTE TYPE</u></th><th><u>DESCRIPTION</u></th><th><u>CODE (IF APPLICABLE)</u></th></tr>
<tr><td>LOC_ID_BMPLocations</td><td>This attribute is a unique identifier for each BMP location. It was created after identifying the best BMP areas within each town owned parcel, then dissolving together any identical BMP types that touched boundaries. within the parcel. The unique identifier is made up of the parcel's LOC_ID with "_**" count number after it. Besides LOC_ID and BMP, all attributes are uniquely calculated for each LOC_ID_BMPLocations.</td><td><pre>
Calculates a sequential number
More calculator examples at
esriurl.com/CalculatorExamples
rec=0
def SequentialNumber():
   global rec
   pStart = 1
   pInterval = 1
   if (rec == 0):
      rec = pStart
   else:
      rec = rec + pInterval
   return rec

uniqueList = []
def isDuplicate(inValue):
   if inValue in uniqueList:
      iteration = SequentialNumber()
      if iteration > 9:
         return inValue + "_" + str(iteration)
      else:
         return inValue + "_0" + str(iteration)
   else:
      global rec
      rec=0
      iteration = SequentialNumber()
      uniqueList.append(inValue)
      return inValue + "_0" + str(iteration)
</pre></td></tr>
<tr><td>LOC_ID</td><td>This attribute is the unique identified for each town owned parcel that the potential BMP areas are within. It was created by MassGIS.</td><td></td></tr>
<tr><td>BMP</td><td>This attribute is the best fitting BMP type for the area. It was calculated by first erasing any areas within town owned parcels that were overlapped by a building, within 25ft of a train line, or within 25ft of a Wetland or stream. These three variables would make a BMP overly difficult to construct. Next, town owned parcels were subdivided by hydrologic soil group (HSG), 100sqrft slope area, and depth to groundwater area. Type 1 BMPs fit best where HSG is A, B, or C, slope is <5%, and depth to groundwater is >= 4 ft. Type 2 BMPs fit best where HSG is unknown, A/D, B/D, C/D, or D, slope is <5%, and depth to groundwater is <4ft or unknown. Any areas with slopes >5% in an averaged 100sqrft area where not given a potential BMP category as it would be overly expensive to grade the slope to a manageable %.</td><td></td></tr>
<tr><td>BMP Area - Square Ft</td><td>This attribute is the square foot area of the unique potential BMP area within the town owned parcel.</td><td></td></tr>
<tr><td>BMP Volume - Cubic Ft</td><td>This attribute is the cubic foot volume of the unique potential BMP area within the town owned parcel. All BMP's were assumed to have a 2ft depth.</td><td></td></tr>
<tr><td>Hydrologic Soil Group With Largest Area in BMP</td><td>This attribute is the hydrologic soil group with the largest area within each potential BMP area. Some potential BMP areas contained more than one hydrologic soil group within them. Later calculations rely on this attribute to determine which subtype of BMP Type 1 is most appropriate at the potential BMP area.</td><td></td></tr>
</table>

Watershed Area - Acres	This attribute is the area in acres of each potential BMP area's watershed. ArcGIS Pro's watershed tool was used in association with an elevation DEM made by combining 2015 USGS Lidar: Maine & Massachusetts QL1 & QL2, 2013 - 2014 USGS Lidar: Post-Sandy (MA, NH, RI), and 2010 FEMA Lidar: MA & RI. Each potential BMP area watershed was calculated iteratively.	
Watershed Impervious Area - Acres	This attribute is the area in acres of pervious land cover within each potential BMP area's watershed. It was calculated by subdividing the watershed by the MassGIS 2016 Land Cover Land Use dataset, selecting all areas with an Impervious land cover identifier, and adding together their individual acre area values.	
Watershed Pervious Area - Acres	This attribute is the area in acres of pervious land cover within each potential BMP area's watershed. It was calculated by subdividing the watershed by the MassGIS 2016 Land Cover Land Use dataset, selecting all areas without an Impervious land cover identifier, and adding together their individual acre area values.	
Unknown Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of unknown hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an Unknown HSG identifier, then adding together their individual acre area values.	
A Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of A hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an A HSG identifier, then adding together their individual acre area values.	
A/D Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of A/D hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an A/D HSG identifier, then adding together their individual acre area values.	
B Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of B hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an B HSG identifier, then adding together their individual acre area values.	

B/D Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of B/D hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an B/D HSG identifier, then adding together their individual acre area values.	
C Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of C hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an C HSG identifier, then adding together their individual acre area values.	
C/D Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of C/D hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an C/D HSG identifier, then adding together their individual acre area values.	
D Type Hydrologic Soil Group Pervious Area (Watershed) - Acres	This attribute is the area in acres of D hydrologic soil groups (HSG) within the pervious area of the potential BMP's watershed. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier and an D HSG identifier, then adding together their subdivision acre area values.	

2 Inch Rainfall Watershed Pervious Volume Runoff - Cubic Ft	This attribute is the volume in cubic ft of runoff from the pervious area of the potential BMP's watershed during a 2 inch rainfall event. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier, then depending on each subdivisions hydrologic soil group their area was multiplied by the associated runoff depth index (see below). Soil Group : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D'] 2.0in rainfall : [0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08] Subdivision calculations finally added together for the final runoff volume.	def Runoff(UNKNWN, A, A_D, B, B_D, C, C_D, D): #for each rainfall option change the below rainfall depth RainfallDepth = **FILL DEPENDING ON RAINFALL EVENT, EX. 0.6** HSG_Runoff = {'Soil Group' : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D'], 0.1 : [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0], 0.2 : [0.01, 0.0, 0.02, 0.0, 0.02, 0.01, 0.02, 0.02], 0.4 : [0.03, 0.0, 0.06, 0.0, 0.06, 0.03, 0.05, 0.06], 0.5 : [0.05, 0.0, 0.09, 0.01, 0.09, 0.05, 0.07, 0.09], 0.6 : [0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11], 0.8 : [0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16], 1.0 : [0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21], 1.2 : [0.14, 0.04, 0.39, 0.05, 0.39, 0.14, 0.27, 0.39], 1.5 : [0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72], 2.0 : [0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08]} RUNOFF_UNKNWN = 0 RUNOFF_A = 0 RUNOFF_A_D = 0 RUNOFF_B = 0 RUNOFF_B_D = 0 RUNOFF_C = 0 RUNOFF_C_D = 0 RUNOFF_D = 0 if UNKNWN != None and UNKNWN > 0: DepthIndex = HSG_Runoff['Soil Group'].index("Unknown") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_UNKNWN = (HSG_RainfallDepth/12) * (UNKNWN*43560) if A != None and A > 0: DepthIndex = HSG_Runoff['Soil Group'].index("A") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_A = (HSG_RainfallDepth/12) * (A*43560) if A_D != None and A_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("A/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_A_D = (HSG_RainfallDepth/12) * (A_D*43560) if B != None and B > 0: DepthIndex = HSG_Runoff['Soil Group'].index("B") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_B = (HSG_RainfallDepth/12) * (B*43560) if B_D != None and B_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("B/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_B_D = (HSG_RainfallDepth/12) * (B_D*43560) if C != None and C > 0: DepthIndex = HSG_Runoff['Soil Group'].index("C") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_C = (HSG_RainfallDepth/12) * (C*43560) if C_D != None and C_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("C/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_C_D = (HSG_RainfallDepth/12) * (C_D*43560) if D != None and D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_D = (HSG_RainfallDepth/12) * (D*43560) RUNOFF_TOTAL = RUNOFF_UNKNWN + RUNOFF_A + RUNOFF_A_D + RUNOFF_B + RUNOFF_B_D + RUNOFF_C + RUNOFF_C_D + RUNOFF_D return RUNOFF_TOTAL

1.5 Inch Rainfall Watershed Pervious Area Runoff - Cubic Ft

This attribute is the volume in cubic ft of runoff from the pervious area of the potential BMP's watershed during a 1.5 inch rainfall event. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier, then depending on each subdivisions hydrologic soil group their area was multiplied by the associated runoff depth index (see below).

Soil Group : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D']
1.5in rainfall : [0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72]

Subdivision calculations finally added together for the final runoff volume.

```
def Runoff(UNKNWN, A, A_D, B, B_D, C, C_D, D):
    #for each rainfall option change the below rainfall depth
    RainfallDepth = **FILL DEPENDING ON RAINFALL EVENT, EX. 0.6**
    HSG_Runoff = {'Soil Group' : [ 'Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D' ],
              0.1 : [ 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0 ],
              0.2 : [ 0.01, 0.0, 0.02, 0.0, 0.02, 0.01, 0.02, 0.02 ],
              0.4 : [ 0.03, 0.0, 0.06, 0.0, 0.06, 0.03, 0.05, 0.06 ],
              0.5 : [ 0.05, 0.0, 0.09, 0.01, 0.09, 0.05, 0.07, 0.09 ],
              0.6 : [ 0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11 ],
              0.8 : [ 0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16 ],
              1.0 : [ 0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21 ],
              1.2 : [ 0.14, 0.04, 0.39, 0.05, 0.39, 0.14, 0.27, 0.39 ],
              1.5 : [ 0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72 ],
              2.0 : [ 0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08 ]}

    RUNOFF_UNKNWN = 0
    RUNOFF_A = 0
    RUNOFF_A_D = 0
    RUNOFF_B = 0
    RUNOFF_B_D = 0
    RUNOFF_C = 0
    RUNOFF_C_D = 0
    RUNOFF_D = 0

    if UNKNWN != None and UNKNWN > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("Unknown")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_UNKNWN = (HSG_RainfallDepth/12) * (UNKNWN*43560)
    if A != None and A > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("A")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_A = (HSG_RainfallDepth/12) * (A*43560)
    if A_D != None and A_D > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("A/D")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_A_D = (HSG_RainfallDepth/12) * (A_D*43560)
    if B != None and B > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("B")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_B = (HSG_RainfallDepth/12) * (B*43560)
    if B_D != None and B_D > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("B/D")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_B_D = (HSG_RainfallDepth/12) * (B_D*43560)
    if C != None and C > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("C")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_C = (HSG_RainfallDepth/12) * (C*43560)
    if C_D != None and C_D > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("C/D")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_C_D = (HSG_RainfallDepth/12) * (C_D*43560)
    if D != None and D > 0:
        DepthIndex = HSG_Runoff['Soil Group'].index("D")
        HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
        RUNOFF_D = (HSG_RainfallDepth/12) * (D*43560)

    RUNOFF_TOTAL = RUNOFF_UNKNWN + RUNOFF_A + RUNOFF_A_D + RUNOFF_B + RUNOFF_B_D + RUNOFF_C + RUNOFF_C_D + RUNOFF_D
    return RUNOFF_TOTAL
```

1 Inch Rainfall Watershed Pervious Area Runoff - Cubic Ft

This attribute is the volume in cubic ft of runoff from the pervious area of the potential BMP's watershed during a 1 inch rainfall event. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier, then depending on each subdivisions hydrologic soil group their area was multiplied by the associated runoff depth index (see below).

Soil Group : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D']
1.0in rainfall : [0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21]

Subdivision calculations finally added together for the final runoff volume.

```
def Runoff(UNKNWN, A, A_D, B, B_D, C, C_D, D):
   #for each rainfall option change the below rainfall depth
   RainfallDepth = **FILL DEPENDING ON RAINFALL EVENT, EX. 0.6**
   HSG_Runoff = {'Soil Group' : [ 'Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D' ],
              0.1 : [ 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0 ],
              0.2 : [ 0.01, 0.0, 0.02, 0.0, 0.02, 0.01, 0.02, 0.02 ],
              0.4 : [ 0.03, 0.0, 0.06, 0.0, 0.06, 0.03, 0.05, 0.06 ],
              0.5 : [ 0.05, 0.0, 0.09, 0.01, 0.09, 0.05, 0.07, 0.09 ],
              0.6 : [ 0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11 ],
              0.8 : [ 0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16 ],
              1.0 : [ 0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21 ],
              1.2 : [ 0.14, 0.04, 0.39, 0.05, 0.39, 0.14, 0.27, 0.39 ],
              1.5 : [ 0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72 ],
              2.0 : [ 0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08 ]}

   RUNOFF_UNKNWN = 0
   RUNOFF_A = 0
   RUNOFF_A_D = 0
   RUNOFF_B = 0
   RUNOFF_B_D = 0
   RUNOFF_C = 0
   RUNOFF_C_D = 0
   RUNOFF_D = 0

   if UNKNWN != None and UNKNWN > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("Unknown")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_UNKNWN = (HSG_RainfallDepth/12) * (UNKNWN*43560)
   if A != None and A > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("A")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_A = (HSG_RainfallDepth/12) * (A*43560)
   if A_D != None and A_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("A/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_A_D = (HSG_RainfallDepth/12) * (A_D*43560)
   if B != None and B > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("B")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_B = (HSG_RainfallDepth/12) * (B*43560)
   if B_D != None and B_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("B/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_B_D = (HSG_RainfallDepth/12) * (B_D*43560)
   if C != None and C > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("C")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_C = (HSG_RainfallDepth/12) * (C*43560)
   if C_D != None and C_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("C/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_C_D = (HSG_RainfallDepth/12) * (C_D*43560)
   if D != None and D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_D = (HSG_RainfallDepth/12) * (D*43560)

   RUNOFF_TOTAL = RUNOFF_UNKNWN + RUNOFF_A + RUNOFF_A_D + RUNOFF_B + RUNOFF_B_D + RUNOFF_C + RUNOFF_C_D + RUNOFF_D
   return RUNOFF_TOTAL
```

0.8 Inch Rainfall Watershed Pervious Area Runoff - Cubic Ft

This attribute is the volume in cubic ft of runoff from the pervious area of the potential BMP's watershed during a 0.8 inch rainfall event. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier, then depending on each subdivisions hydrologic soil group their area was multiplied by the associated runoff depth index (see below).

Soil Group : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D']
0.8in rainfall : [0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16]

Subdivision calculations finally added together for the final runoff volume.

```
def Runoff(UNKNWN, A, A_D, B, B_D, C, C_D, D):
   #for each rainfall option change the below rainfall depth
   RainfallDepth = **FILL DEPENDING ON RAINFALL EVENT, EX. 0.6**
   HSG_Runoff = {'Soil Group' : [ 'Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D' ],
              0.1 : [ 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0 ],
              0.2 : [ 0.01, 0.0, 0.02, 0.0, 0.02, 0.01, 0.02, 0.02 ],
              0.4 : [ 0.03, 0.0, 0.06, 0.0, 0.06, 0.03, 0.05, 0.06 ],
              0.5 : [ 0.05, 0.0, 0.09, 0.01, 0.09, 0.05, 0.07, 0.09 ],
              0.6 : [ 0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11 ],
              0.8 : [ 0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16 ],
              1.0 : [ 0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21 ],
              1.2 : [ 0.14, 0.04, 0.39, 0.05, 0.39, 0.14, 0.27, 0.39 ],
              1.5 : [ 0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72 ],
              2.0 : [ 0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08 ]}

   RUNOFF_UNKNWN = 0
   RUNOFF_A = 0
   RUNOFF_A_D = 0
   RUNOFF_B = 0
   RUNOFF_B_D = 0
   RUNOFF_C = 0
   RUNOFF_C_D = 0
   RUNOFF_D = 0

   if UNKNWN != None and UNKNWN > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("Unknown")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_UNKNWN = (HSG_RainfallDepth/12) * (UNKNWN*43560)
   if A != None and A > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("A")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_A = (HSG_RainfallDepth/12) * (A*43560)
   if A_D != None and A_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("A/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_A_D = (HSG_RainfallDepth/12) * (A_D*43560)
   if B != None and B > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("B")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_B = (HSG_RainfallDepth/12) * (B*43560)
   if B_D != None and B_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("B/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_B_D = (HSG_RainfallDepth/12) * (B_D*43560)
   if C != None and C > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("C")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_C = (HSG_RainfallDepth/12) * (C*43560)
   if C_D != None and C_D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("C/D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_C_D = (HSG_RainfallDepth/12) * (C_D*43560)
   if D != None and D > 0:
      DepthIndex = HSG_Runoff['Soil Group'].index("D")
      HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex]
      RUNOFF_D = (HSG_RainfallDepth/12) * (D*43560)

   RUNOFF_TOTAL = RUNOFF_UNKNWN + RUNOFF_A + RUNOFF_A_D + RUNOFF_B + RUNOFF_B_D + RUNOFF_C + RUNOFF_C_D + RUNOFF_D
   return RUNOFF_TOTAL
```

0.6 Inch Rainfall Watershed Pervious Area Runoff - Cubic Ft	This attribute is the volume in cubic ft of runoff from the pervious area of the potential BMP's watershed during a 0.6 inch rainfall event. It was calculated by subdividing the watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, selecting all areas without an Impervious land cover identifier, then depending on each subdivisions hydrologic soil group their area was multiplied by the associated runoff depth index (see below). Soil Group : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D'] 0.6in rainfall : [0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11] Subdivision calculations finally added together for the final runoff volume.	def Runoff(UNKNWN, A, A_D, B, B_D, C, C_D, D): #for each rainfall option change the below rainfall depth RainfallDepth = **FILL DEPENDING ON RAINFALL EVENT, EX. 0.6** HSG_Runoff = {'Soil Group' : ['Unknown', 'A', 'A/D', 'B', 'B/D' ,'C' ,'C/D' ,'D'], 0.1 : [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0], 0.2 : [0.01, 0.0, 0.02, 0.0, 0.02, 0.01, 0.02, 0.02], 0.4 : [0.03, 0.0, 0.06, 0.0, 0.06, 0.03, 0.05, 0.06], 0.5 : [0.05, 0.0, 0.09, 0.01, 0.09, 0.05, 0.07, 0.09], 0.6 : [0.06, 0.01, 0.11, 0.02, 0.11, 0.06, 0.09, 0.11], 0.8 : [0.09, 0.02, 0.16, 0.03, 0.16, 0.09, 0.13, 0.16], 1.0 : [0.12, 0.03, 0.21, 0.04, 0.21, 0.12, 0.17, 0.21], 1.2 : [0.14, 0.04, 0.39, 0.05, 0.39, 0.14, 0.27, 0.39], 1.5 : [0.39, 0.08, 0.72, 0.11, 0.72, 0.39, 0.55, 0.72], 2.0 : [0.69, 0.14, 1.08, 0.22, 1.08, 0.69, 0.89, 1.08]} RUNOFF_UNKNWN = 0 RUNOFF_A = 0 RUNOFF_A_D = 0 RUNOFF_B = 0 RUNOFF_B_D = 0 RUNOFF_C = 0 RUNOFF_C_D = 0 RUNOFF_D = 0 if UNKNWN != None and UNKNWN > 0: DepthIndex = HSG_Runoff['Soil Group'].index("Unknown") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_UNKNWN = (HSG_RainfallDepth/12) * (UNKNWN*43560) if A != None and A > 0: DepthIndex = HSG_Runoff['Soil Group'].index("A") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_A = (HSG_RainfallDepth/12) * (A*43560) if A_D != None and A_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("A/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_A_D = (HSG_RainfallDepth/12) * (A_D*43560) if B != None and B > 0: DepthIndex = HSG_Runoff['Soil Group'].index("B") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_B = (HSG_RainfallDepth/12) * (B*43560) if B_D != None and B_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("B/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_B_D = (HSG_RainfallDepth/12) * (B_D*43560) if C != None and C > 0: DepthIndex = HSG_Runoff['Soil Group'].index("C") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_C = (HSG_RainfallDepth/12) * (C*43560) if C_D != None and C_D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("C/D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_C_D = (HSG_RainfallDepth/12) * (C_D*43560) if D != None and D > 0: DepthIndex = HSG_Runoff['Soil Group'].index("D") HSG_RainfallDepth = HSG_Runoff[RainfallDepth][DepthIndex] RUNOFF_D = (HSG_RainfallDepth/12) * (D*43560) RUNOFF_TOTAL = RUNOFF_UNKNWN + RUNOFF_A + RUNOFF_A_D + RUNOFF_B + RUNOFF_B_D + RUNOFF_C + RUNOFF_C_D + RUNOFF_D return RUNOFF_TOTAL

BMP Capacity For Impervious Area Runoff During Largest Rainfall Allowable - Cubic Ft	This attribute is the potential BMP's capacity for impervious area runoff volume in cubic ft during the largest rainfall event it could contain. It uses the previously calculated Rainfall Watershed Pervious Area Runoff attributes (ex. 2.0 Inch Rainfall Watershed Pervious Area Runoff) to determine how much BMP volume is available to treat its watershed's impervious area runoff after all its watershed's pervious area runoff has been accounted for. An important factors in the calculation was whether the potential BMP's watershed contained any impervious area at all. By referencing the Watershed Impervious Area - Acres attribute, any BMP watersheds without impervious area were discounted from the calculation, as even with capacity there would be no impervious area for the BMP to treat. After calculation, the attribute contains three values: - The largest rainfall event in which the BMP can treat all watershed runoff from pervious areas while retaining capacity for watershed runoff from impervious areas. - The volume from the watershed's impervious area runoff that the BMP could treat during the above rainfall event. - The depth of water within the BMP's volume made up by the watershed's impervious area runoff during the above rainfall event. **Note: If the BMP's capacity could treat only less than 0.6in rainfall events runoff, it is flagged as such. Such a small capacity means the BMP would not be worth the effort of construction.	def BMP_IA_VolumeFt_Capacity(BMP_Vol, IA_Area, PA_Vol_2inRF, PA_Vol_1pt5inRF, PA_Vol_1inRF, PA_Vol_pt8inRF, PA_Vol_pt6inRF): PA_Runoff_Volumes = { "2 Inches Rainfall":PA_Vol_2inRF, "1.5 Inches Rainfall":PA_Vol_1pt5inRF, "1 Inch Rainfall":PA_Vol_1inRF, "0.8 Inches Rainfall":PA_Vol_pt8inRF, "0.6 Inches Rainfall":PA_Vol_pt6inRF} for key, value in PA_Runoff_Volumes.items(): IA_Volume = BMP_Vol - value RF_Depth = float(key.split(" ")[0]) if IA_Area == 0 or IA_Area is None: return "No impervious area in watershed" BMP_IA_Runoff_Capacity = (IA_Volume/IA_Area)*(12/43560) if IA_Volume > 0 and IA_Area != 0: return key + ": " + str(IA_Volume) + " ft3, " + str(BMP_IA_Runoff_Capacity) + " inch IA runoff capacity" else: IA_Volume = 0 return "Rainfall capacity less than 0.6in"

Watershed Phosphorus Load - Lb/Yr	This attribute is the potential BMP watershed's phosphorus load in pounds per year. It was calculated by subdividing the BMP's watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, then assigning a PLER for each subdivision, referencing the EPA MS4 appendix, based on land cover, land use, and hydrologic soil group identifiers. Finally, the subdivisions are multiplied by their acre areas and then added together by BMP watershed. The result is a total yearly phosphorus load for the watershed.	(see code below)

```
def PLER(HydSoils, LU_Code, LC_Code):
  WaterLC = [23,22,21]
  WaterLU = [88]
  Imperv_LU_01 = [10,12]
  Imperv_LU_02 = [3,4,9,20,30]
  Imperv_LU_03 = [55]
  Imperv_LU_04 = [6]
  Imperv_LU_05 = [7]
  Imperv_LU_06 = [0,2,8]
  Imperv_LU_07 = [13,11]
  Perv_LC_01 = [9,10,12]
  Perv_LU6LC_01 = [5,6,8,13,14,15,16,17,18]
  Perv_LC_02 = [6,7]
  Perv_LU7LC_01 = [5,8]
  Perv_LC_03 = [5,8,13,14,15,16,17,18,19,20]
  HydrSoils_01 = ["A"]
  HydrSoils_02 = ["B", "B/D"]
  HydrSoils_03 = ["C", "C/D"]
  HydrSoils_04 = ["D"]
  if LC_Code in WaterLC or LU_Code in WaterLU:
    return 0
  elif LC_Code is 2:
    if LU_Code in Imperv_LU_01:
      return 2.32
    elif LU_Code in Imperv_LU_02:
      return 1.78
    elif LU_Code in Imperv_LU_03:
      return 1.95
    elif LU_Code in Imperv_LU_04:
      return 1.52
    elif LU_Code in Imperv_LU_05:
      return 1.52
    elif LU_Code in Imperv_LU_06:
      return 1.52
    elif LU_Code in Imperv_LU_07:
      return 1.96
    else:
      return 100
  elif LC_Code in Perv_LC_01:
    return 0.13
  elif LU_Code is 6 and LC_Code in Perv_LU6LC_01:
    return 0.13
  elif LC_Code in Perv_LC_02:
    return 0.45
  elif LU_Code is 7 and LC_Code in Perv_LU7LC_01:
    return 0.45
  elif LC_Code in Perv_LC_03:
    if HydSoils in HydrSoils_01:
      return 0.03
    elif HydSoils in HydrSoils_02:
      return 0.12
    elif HydSoils in HydrSoils_03:
      return 0.21
    elif HydSoils in HydrSoils_04:
      return 0.37
    else:
      return 0.21
  elif LC_Code is 21 or LU_Code is 88:
    return 0
  else:
    return 102
```

BMP Phosphorus Load Reduction Ability During Largest Rainfall Allowable - %	This attribute is the percent of phosphorus load that the potential BMP could reduce during the largest rainfall event in which the BMP can treat all watershed runoff from pervious areas while retaining capacity for watershed runoff from impervious areas. For BMP Type 1, percent reduction potential is dependent on the subtype of BMP at the location. The Hydrologic Soil Group With Largest Area in BMP attribute was used to determine the likely infiltration rate of the soil beneath the BMP, and from that a Type 1 subtype could be identified. BMP Type 1 areas with a majority hydrologic soil group (HSG) A were assumed to have a 2.41 surface infiltration rate. BMP Type 1 areas with a majority hydrologic soil group (HSG) B were assumed to have a 0.52 surface infiltration rate. BMP Type 1 areas with a majority hydrologic soil group (HSG) C were assumed to have a 0.17 surface infiltration rate. For BMP Type 2, there were no subtypes. The percent reduction is entirely dependent on the BMP Capacity For Impervious Area Runoff During Largest Rainfall Allowable attribute. Using the BMP Capacity For Impervious Area Runoff During Largest Rainfall Allowable attribute in association with the BMP's type, and referencing the EPA MS4 appendix, the percent that the BMP is able to reduce phosphorus load was determined. In general, the larger the rainfall event (ex. 2in) capacity the larger the percent reduction.	def CumulativePhosLoadReduction(BMP_Capacity, PLoad, BMP,HSG): BMP_Capacity_Choice = BMP_Capacity.split(" ")[0] PLoadReduction = 0 if BMP == "Type 2": Biofiltration_Phos_Performance_Table = { "0.6": .44, "0.8": .48, "1": .53, "1.5": .58, "2": .63} for key, value in Biofiltration_Phos_Performance_Table.items(): if key == BMP_Capacity_Choice: PLoadReduction = str(round(value * 100,1))+"%" return PLoadReduction elif BMP == "Type 1": SurfaceInfil_pt17_Phos_Performance_Table = { "0.6": .82, "0.8": .88, "1": .92, "1.5": .97, "2": .99} SurfaceInfil_pt52_Phos_Performance_Table = { "0.6": .87, "0.8": .92, "1": .95, "1.5": .98, "2": .99} SurfaceInfil_2pt41_Phos_Performance_Table = { "0.6": .94, "0.8": .97, "1": .98, "1.5": 1.0, "2": 1.0} if HSG == "A": for key, value in SurfaceInfil_2pt41_Phos_Performance_Table.items(): if key == BMP_Capacity_Choice: PLoadReduction = str(round(value * 100,1))+"%" return PLoadReduction if HSG == "B": for key, value in SurfaceInfil_pt52_Phos_Performance_Table.items(): if key == BMP_Capacity_Choice: PLoadReduction = str(round(value * 100,1))+"%" return PLoadReduction if HSG == "C": for key, value in SurfaceInfil_pt17_Phos_Performance_Table.items(): if key == BMP_Capacity_Choice: PLoadReduction = str(round(value * 100,1))+"%" return PLoadReduction else: return None
BMP Cumulative Phosphorus Load Reduction - Lb/Yr	This attribute is the potential BMP's cumulative phosphorus load reduction amount in pounds per year. It was calculated by multiplying the BMP Phosphorus Load Reduction Ability During Largest Rainfall Allowable attribute by the Watershed Phosphorus Load attribute. By identifying the load reduction that the BMP's construction could provide, it is possible to do a planning level cost analysis to determine which BMP areas would provide the most benefit to phosphorus load reduction within MS4 pond watersheds. **Note: The calculation assumes that a BMP would be constructed that covers the entire original area. If not the case, the BMP would need to have a depth larger than 2ft to make up for the volume decreased by a smaller than calculated surface area. Runoff would additionally need to be routed to the BMPs location, as the watershed calculated is for the entire original BMP area.	

Watershed Nitrogen Load - Lb/Yr	This attribute is the potential BMP watershed's nitrogen load in pounds per year. It was calculated by subdividing the BMP's watershed by MassGIS's 2016 Land Cover Land Use and SSURGO Soils dataset, then assigning a NLER for each subdivision, referencing the EPA MS4 appendix, based on land cover, land use, and hydrologic soil group identifiers. Finally, the subdivisions are multiplied by their acre areas and then added together by BMP watershed. The result is a total yearly nitrogen load for the watershed.	def NLER(LC_Code,LU_Code,HydrSoil): Impervious = [2] WaterLC = [23,22,21] WaterLU = [88] HydrSoils_01 = ["A", "A/D"] HydrSoils_02 = ["B", "B/D"] HydrSoils_03 = ["C"] HydrSoils_06 = ["C/D"] HydrSoils_04 = ["D"] HydrSoils_05 = [""," ",None] if LC_Code in WaterLC or LU_Code in WaterLU: return 0 elif LC_Code in Impervious: return 14.1 else: if HydrSoil in HydrSoils_05: return 3.0 elif HydrSoil in HydrSoils_01: return 0.3 elif HydrSoil in HydrSoils_02: return 1.2 elif HydrSoil in HydrSoils_03: return 2.4 elif HydrSoil in HydrSoils_06: return 3.0 elif HydrSoil in HydrSoils_04: return 3.7 else: return 102
BMP Nitrogen Load Reduction Ability During Largest Rainfall Allowable - %	This attribute is the percent of nitrogen load that the potential BMP could reduce during the largest rainfall event in which the BMP can treat all watershed runoff from pervious areas while retaining capacity for watershed runoff from impervious areas. For BMP Type 1, percent reduction potential is dependent on the subtype of BMP at the location. The Hydrologic Soil Group With Largest Area in BMP attribute was used to determine the likely infiltration rate of the soil beneath the BMP, and from that a Type 1 subtype could be identified. BMP Type 1 areas with a majority hydrologic soil group (HSG) A were assumed to have a 2.41 surface infiltration rate. BMP Type 1 areas with a majority hydrologic soil group (HSG) B were assumed to have a 0.52 surface infiltration rate. BMP Type 1 areas with a majority hydrologic soil group (HSG) C were assumed to have a 0.17 surface infiltration rate. For BMP Type 2, there were no subtypes. The percent reduction is entirely dependent on the BMP Capacity For Impervious Area Runoff During Largest Rainfall Allowable attribute. Using the BMP Capacity For Impervious Area Runoff During Largest Rainfall Allowable attribute in association with the BMP's type, and referencing the EPA MS4 appendix, the percent that the BMP is able to reduce nitrogen load was determined. In general, the larger the rainfall event (ex. 2in) capacity the larger the percent reduction.	def CumulativeNitLoadReduction(BMP_Capacity, NLoad, BMP,HSG): BMP_Capacity_Choice = BMP_Capacity.split(" ")[0] NLoadReduction = 0 if BMP == "Type 2": Biofiltration_Nit_Performance_Table = { "0.6": .28, "0.8": .31, "1": .32, "1.5": .37, "2": .40} for key, value in Biofiltration_Nit_Performance_Table.items(): if key == BMP_Capacity_Choice: NLoadReduction = str(round(value * 100,1))+"%" return NLoadReduction elif BMP == "Type 1": SurfaceInfil_pt17_Nit_Performance_Table = { "0.6": .92, "0.8": .96, "1": .98, "1.5": .99, "2": 1.0} SurfaceInfil_pt52_Nit_Performance_Table = { "0.6": .94, "0.8": .98, "1": .99, "1.5": 1.0, "2": 1.0} SurfaceInfil_2pt41_Nit_Performance_Table = { "0.6": .98, "0.8": .99, "1": 1.0, "1.5": 1.0, "2": 1.0} if HSG == "A": for key, value in SurfaceInfil_2pt41_Nit_Performance_Table.items(): if key == BMP_Capacity_Choice: NLoadReduction = str(round(value * 100,1))+"%" return NLoadReduction if HSG == "B": for key, value in SurfaceInfil_pt52_Nit_Performance_Table.items(): if key == BMP_Capacity_Choice: NLoadReduction = str(round(value * 100,1))+"%" return NLoadReduction if HSG == "C" or HSG == "C/D": for key, value in SurfaceInfil_pt17_Nit_Performance_Table.items(): if key == BMP_Capacity_Choice: NLoadReduction = str(round(value * 100,1))+"%" return NLoadReduction else: return None

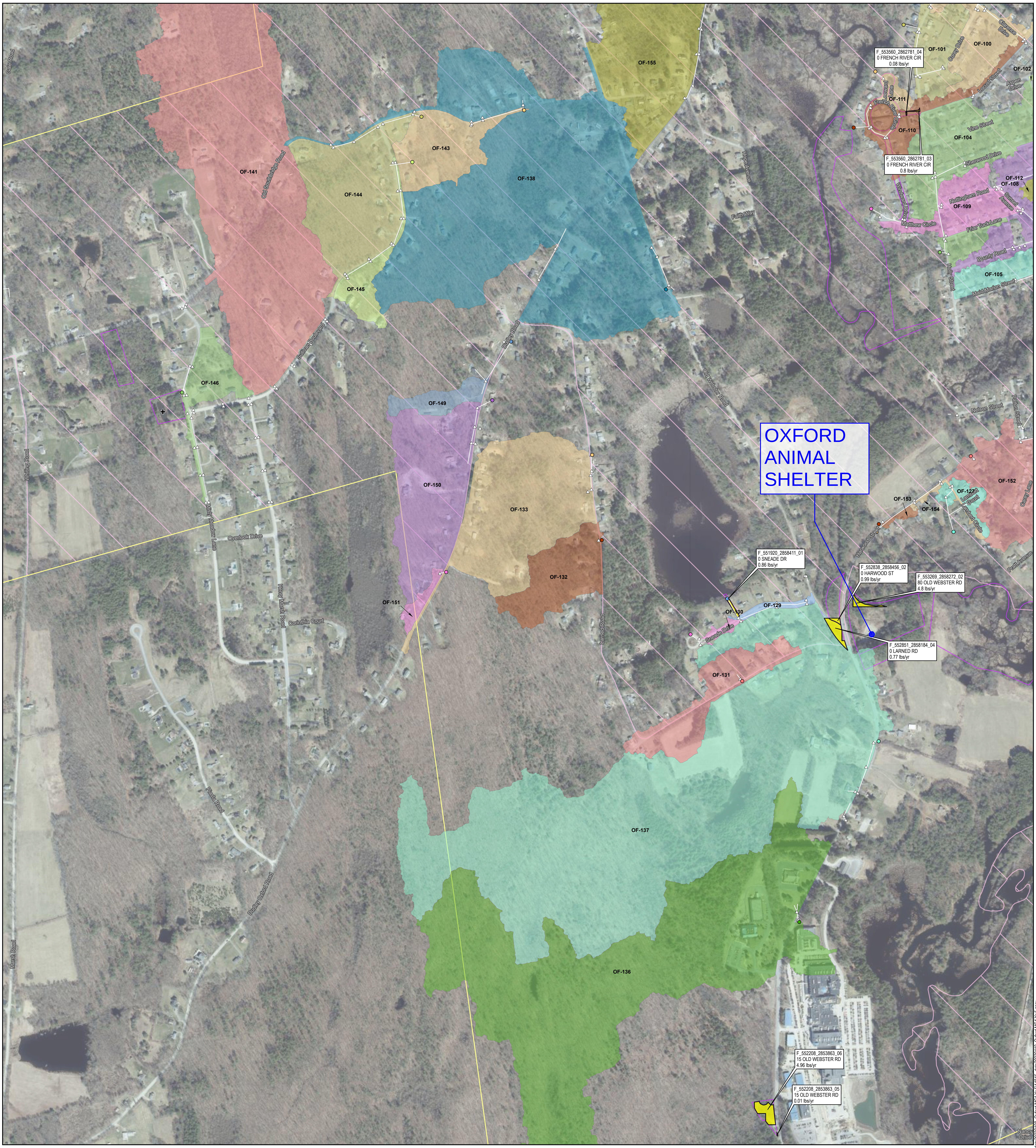
BMP Cumulative Nitrogen Load Reduction - Lb/Yr	This attribute is the potential BMP's cumulative nitrogen load reduction amount in pounds per year. It was calculated by multiplying the BMP Nitrogen Load Reduction Ability During Largest Rainfall Allowable attribute by the Watershed Nitrogen Load attribute. By identifying the load reduction that the BMP's construction could provide, it is possible to do a planning level cost analysis to determine which BMP areas would provide the most benefit to nitrogen load reduction within Oxford, MA. **Note: The calculation assumes that a BMP would be constructed that covers the entire original area. If not the case, the BMP would need to have a depth larger than 2ft to make up for the volume decreased by a smaller than calculated surface area. Runoff would additionally need to be routed to the BMPs location, as the watershed calculated is for the entire original BMP area.	
MS4 Pond Watershed Intersecting BMP	This attribute is what MS4 pond watershed intersects the BMP. MS4 phosphorus reduction requirements are pond watershed specific. For planning purposes, it is important to determine which pond watersheds contain which potential BMP areas. That way construction can be prioritized where high phosphorus reduction BMPs overlap pond watersheds with the highest phosphorus reduction requirements.	
Drainage Outfall Catchment Area Intersecting Watershed	This attribute is what Oxford drainage outfall catchment area intersects the BMP. MS4 nitrogen reduction requirements are undefined but lean on the town's drainage outfall catchment area nitrogen loads to help determine if nitrogen is at an adequate level. By identifying which, if any, outfall catchment areas intersect with the potential BMP's watershed, it is easier to prioritize where BMPs should be constructed for their nitrogen reduction ability.	
Watershed Intersects Drainage Network Flag	This attribute is a flag identifying potential BMPs whose watersheds intersect the Oxford drainage network. The importance of this flag is to associate relevant potential BMP areas with the ability to connect their watershed into the Oxford drainage network and increase its catchment area, therein increasing the BMP's phosphorus and nitrogen load reduction amount.	
Watershed Intersects MassDOT Road Flag	This attribute is a flag identifying potential BMPs whose watersheds intersect MassDOT inventoried roads. The importance of this flag is to associate relevant potential BMP areas with the ability to connect their watershed to road drainage systems that may have been missed by the ArcGIS Pro Watershed tool. Such a connection could either increase the amount of reduceable phosphorus and nitrogen load that reaches the BMP.	
BMP Intersects Urbanized Area Flag	This attribute is a flag identifying potential BMPs that intersect Urbanized Area. The importance of this flag is to provide context for changes in advised BMP construction locations if Oxford commits to only managing nitrogen reduction within the Urbanized Area.	

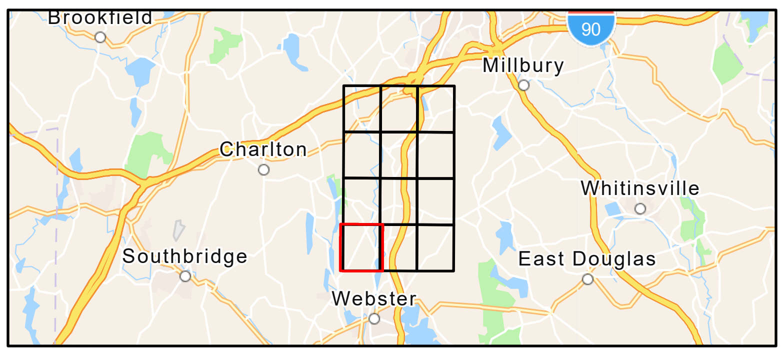
Appendix E – BMP Assessment Results

OBJECTID	LOC_ID	RANKING FOR LPCP	RANKING FOR NSID	LOC_ID_BMPLocations	SITE_ADDR	LAND USE/NAME	URBANIZED AREA	WithinWatershed	BMP	HSG	BMP_AreaFt
1	F_546353_2893567	LOW	LOW	F_546353_2893567_02	0 MERRIAM DIST	GORE CEMETERY	YES	Texas Pond	Type 2	C/D	33.04189462
2	F_546353_2893567	LOW	LOW	F_546353_2893567_03	0 MERRIAM DIST	GORE CEMETERY	YES	Texas Pond	Type 2	C/D	7030.639404
3	F_546353_2893567	LOW	LOW	F_546353_2893567_04	0 MERRIAM DIST	GORE CEMETERY	YES	Texas Pond	Type 2	C/D	9285.917937
4	F_546452_2860635	LOW		F_546452_2860635_02	75 OLD SOUTHBRIDGE RD	[not mapped, not enough IA]	YES	NO	Type 2	D	1232.555495
5	F_548642_2887754	HIGH	HIGH	F_548642_2887754_02	0 LEICESTER ST	multi-family residential	YES	Texas Pond	Type 2	B	22050.99176
6	F_549675_2883997	LOW	LOW	F_549675_2883997_03	0 PIONEER DR		NO	NO	Type 2	B	2687.789515
7	F_549675_2883997	LOW	LOW	F_549675_2883997_04	0 PIONEER DR		NO	NO	Type 2	B	820.7878082
8	F_549728_2886376	MEDIUM	HIGH	F_549728_2886376_02	0 SOUTHBRIDGE RD	commercial	YES	Texas Pond	Type 2	B	4113.479289
9	F_551517_2884993	LOW		F_551517_2884993_02	0 PROSPECT ST	[triangle lot]	YES	NO	Type 2	A	3637.418677
10	F_551920_2858411	LOW		F_551920_2858411_01	0 SNEADE DR	easement?	YES	NO	Type 2		4110.620244
11	F_552208_2853863	LOW	LOW	F_552208_2853863_05	15 OLD WEBSTER RD		NO	NO	Type 2	B	90.44110833
12	F_552208_2853863	LOW	LOW	F_552208_2853863_06	15 OLD WEBSTER RD		NO	NO	Type 2	B	22724.71144
13	F_552508_2883166	LOW		F_552508_2883166_04	656 MAIN ST	N. FIRE STATION, BALL FIELD, DOG PARK	YES	NO	Type 2	A	102237.237
14	F_552508_2883166	LOW		F_552508_2883166_05	656 MAIN ST	N. FIRE STATION, BALL FIELD, DOG PARK	YES	NO	Type 2	B	5861.808256
15	F_552838_2858456	LOW		F_552838_2858456_02	0 HARWOOD ST	wedge lot	YES	NO	Type 2	A	2967.704196
16	F_552851_2858184	LOW		F_552851_2858184_04	0 LARNED RD	[triangle lot]	YES	NO	Type 2	A	18106.38883
17	F_553269_2858272	LOW	LOW	F_553269_2858272_02	80 OLD WEBSTER RD	just outside UA	NO	NO	Type 2	A	8436.86156
18	F_553560_2862781	LOW		F_553560_2862781_03	0 FRENCH RIVER CIR		YES	NO	Type 2	A	892.5992678
19	F_553560_2862781	LOW		F_553560_2862781_04	0 FRENCH RIVER CIR		YES	NO	Type 2	A	281.0860133
20	F_553906_2874229	LOW		F_553906_2874229_10	0 ROCKY HILL RD	stockpiles, yw collection	YES	NO	Type 2	A	321982.9559
21	F_553938_2870622	HIGH		F_553938_2870622_11	0 CHURCH ST		YES	McKinstry Pond-adjacent	Type 2	A	13601.34754
22	F_554692_2875377	LOW		F_554692_2875377_09	495 MAIN ST	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	8897.220277
23	F_554692_2875377	LOW		F_554692_2875377_11	495 MAIN ST	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	27675.68415
24	F_554781_2871780	HIGH	HIGH	F_554781_2871780_20	0 FOREST ST	near McKinstry Pond	YES	McKinstry Pond	Type 2	A	42.66218353
25	F_554880_2876071	LOW		F_554880_2876071_03	0 MAIN ST	adj to north cemetery	YES	NO	Type 2	A	7447.455651
26	F_554880_2876071	LOW		F_554880_2876071_04	0 MAIN ST	adj to north cemetery	YES	NO	Type 2	A	23571.22584
28	F_554880_2876071	LOW		F_554880_2876071_07	0 MAIN ST	adj to north cemetery	YES	NO	Type 2	A	4195.563348
27	F_554880_2876071	LOW		F_554880_2876071_05	0 MAIN ST	adj to north cemetery	YES	NO	Type 2	A	23.23783249
30	F_555002_2866202	LOW		F_555002_2866202_04	36 QUOBAUG AVE	residential	YES	NO	Type 2	A	1554.227629
29	F_555002_2866202	LOW		F_555002_2866202_03	36 QUOBAUG AVE	residential	YES	NO	Type 2	A	872.5357747
33	F_555058_2861222	LOW		F_555058_2861222_09	0 SUNSET AVE		YES	NO	Type 2	B/D	2025.107198
31	F_555058_2861222	LOW		F_555058_2861222_07	0 SUNSET AVE		YES	NO	Type 2	B/D	1765.684688
32	F_555058_2861222	LOW		F_555058_2861222_08	0 SUNSET AVE		YES	NO	Type 2	B/D	2431.839732
34	F_555399_2861526	LOW		F_555399_2861526_11	0 SUNSET AVE		YES	NO	Type 2	B/D	689.5965828
35	F_555399_2861526	LOW		F_555399_2861526_12	0 SUNSET AVE		YES	NO	Type 2	B/D	1128.525061
36	F_555399_2861526	LOW		F_555399_2861526_14	0 SUNSET AVE		YES	NO	Type 2	B/D	48.02497927
39	F_555478_2875043	LOW	MEDIUM	F_555478_2875043_12	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	471978.2609
37	F_555478_2875043	LOW		F_555478_2875043_09	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	14034.31106
38	F_555478_2875043	LOW		F_555478_2875043_10	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	2010.029085
40	F_555478_2875043	LOW		F_555478_2875043_14	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	NO	Type 2	A	2395.84731
41	F_555650_2856051	LOW		F_555650_2856051_04	37 MAIN ST		YES	NO	Type 2	A	45618.29357
43	F_555694_2867399	LOW		F_555694_2867399_03	38 CHARLTON ST	DPW GARAGE	YES	NO	Type 2	B	896.4488516
42	F_555694_2867399	LOW		F_555694_2867399_02	38 CHARLTON ST	DPW GARAGE	YES	NO	Type 2	A	23259.88481
44	F_555729_2875887	LOW	LOW	F_555729_2875887_09	505 MAIN ST	North Cemetery	YES	NO	Type 2	A	877006.8591
45	F_555740_2876253	LOW	LOW	F_555740_2876253_02	0 MAIN ST	North Cemetery	YES	NO	Type 2	A	1629.679898
46	F_555750_2863438	LOW		F_555750_2863438_07	27 LOCUST ST	RUEL FIELDS	YES	NO	Type 2	A	703701.4812
47	F_555750_2863438	LOW		F_555750_2863438_09	27 LOCUST ST	RUEL FIELDS	YES	NO	Type 2	A	595.6026934
48	F_555786_2855189	LOW		F_555786_2855189_02	23 MAIN ST	[triangle lot]	YES	NO	Type 2	A	3969.375525
49	F_555871_2867501	LOW	HIGH	F_555871_2867501_02	34 CHARLTON ST	DPW GARAGE	YES	NO	Type 2	A	41965.51486
52	F_555896_2864398	LOW	MEDIUM	F_555896_2864398_09	9 CLOVER ST	Alfred E. Chaffee School	YES	NO	Type 2	A	296455.5002
50	F_555896_2864398	LOW		F_555896_2864398_07	9 CLOVER ST	Alfred E. Chaffee School	YES	NO	Type 2	A	431.4640991
53	F_555896_2864398	LOW		F_555896_2864398_10	9 CLOVER ST	Alfred E. Chaffee School	YES	NO	Type 2	A	445.95363
51	F_555896_2864398	LOW		F_555896_2864398_08	9 CLOVER ST	Alfred E. Chaffee School	YES	NO	Type 2	A	611.3962309
54	F_555896_2864398	LOW		F_555896_2864398_12	9 CLOVER ST	Alfred E. Chaffee School	YES	NO	Type 2	A	241.0526186
55	F_556065_2880446	LOW	MEDIUM	F_556065_2880446_08	25 DEPOT RD	Clara Barton School	YES	NO	Type 2	A	33516.86188
58	F_556065_2880446	LOW		F_556065_2880446_11	25 DEPOT RD	Clara Barton School	YES	NO	Type 2	A	106600.7473
57	F_556065_2880446	LOW		F_556065_2880446_10	25 DEPOT RD	Clara Barton School	YES	NO	Type 2	A	10048.33857
56	F_556065_2880446	LOW		F_556065_2880446_09	25 DEPOT RD	Clara Barton School	YES	NO	Type 2	A	478.1540089
59	F_556091_2874903	LOW		F_556091_2874903_02	CARBUNCLE DR	TOWN BEACH	YES	NO	Type 2	A	2453.899871
60	F_556201_2871585	HIGH	HIGH	F_556201_2871585_06	0 FOREST ST	single family residential	YES	McKinstry Pond	Type 2	B/D	370.9636235
61	F_556201_2871585	LOW		F_556201_2871585_07	0 FOREST ST	single family residential	YES	McKinstry Pond	Type 2	B/D	76.2603372
62	F_556208_2878888	LOW		F_556208_2878888_02	579A MAIN ST		YES	NO	Type 2	A	300.8025622
63	F_556358_2861578	LOW	MEDIUM	F_556358_2861578_03	0 MAIN ST		YES	NO	Type 2	A	5447.087504
66	F_556403_2869246	HIGH - Year 8	HIGH	F_556403_2869246_09	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Lowes Pond - adjacent	Type 2	A	276867.807
67	F_556403_2869246	MEDIUM		F_556403_2869246_10	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Lowes Pond - adjacent	Type 2	A	14425.80446
65	F_556403_2869246	MEDIUM	HIGH	F_556403_2869246_08	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Lowes Pond - adjacent	Type 2	A	795.6656159
64	F_556403_2869246	MEDIUM	HIGH	F_556403_2869246_07	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Lowes Pond - adjacent	Type 2	A	451.1838376
68	F_556403_2869246	MEDIUM	HIGH	F_556403_2869246_11	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Lowes Pond - adjacent	Type 2	A	1090.430879
70	F_556452_2875677	LOW		F_556452_2875677_03	503 MAIN ST	POLICE DEPARTMENT	YES	NO	Type 2	A	12722.20813
69	F_556452_2875677	LOW		F_556452_2875677_02	503 MAIN ST	POLICE DEPARTMENT	YES	NO	Type 2	A	897.3545294
71	F_556456_2863446	LOW		F_556456_2863446_03	181 MAIN ST	FIRE-EMS HQ	YES	NO	Type 2	A	9375.477349
72	F_556456_2863446	LOW		F_556456_2863446_04	181 MAIN ST	FIRE-EMS HQ	YES	NO	Type 2	A	1022.612599
73	F_556526_2876215	LOW		F_556526_2876215_03	66 PLANTATION RD	east of north cemetery	YES	NO	Type 2	A	44713.2789
74	F_556637_2880397	LOW		F_556637_2880397_01	0 OLD WORCESTER RD	triangle lot near school	YES	NO	Type 2	A	11507.89175
75	F_556732_2869373	LOW	LOW	F_556732_2869373_02	0 CHURCH ST	SOUTH CEMETERY	YES	NO	Type 2	A	152485.5459
76	F_556895_2868222	HIGH - Year 8	HIGH	F_556895_2868222_02	5 SIGOURNEY ST	TOWN HALL PARKING	YES	Lowes Pond - adjacent	Type 2	A	27656.42779
77	F_556896_2868055	LOW		F_556896_2868055_01	323 MAIN ST	SENIOR CENTER	YES	NO	Type 2	A	11175.08215
78	F_556901_2867471	HIGH	HIGH	F_556901_2867471_01	3 BARTON ST	mixed use	YES	Lowes Pond - adjacent	Type 2	A	8096.196259
80	F_556989_2873986	MEDIUM	HIGH	F_556989_2873986_02	4 EDDY ST	vacant lot	YES	Lowes Pond - adjacent	Type 2	A	3562.942085
79	F_556989_2873986	MEDIUM	HIGH	F_556989_2873986_01	4 EDDY ST	vacant lot	YES	Lowes Pond - adjacent	Type 2	A	69026.69235
81	F_557059_2868110	HIGH	HIGH	F_557059_2868110_01	325 MAIN ST	TOWN HALL	YES	Lowes Pond	Type 2	A	31943.56807
82	F_557101_2868431	HIGH	HIGH	F_557101_2868431_02	339 MAIN ST	LIBRARY	YES	Lowes Pond	Type 2	A	26753.63877
83	F_557338_2873475	HIGH	HIGH	F_557338_2873475_01	450 MAIN ST	DPW HEADQUARTERS	YES	Lowes Pond	Type 2	A	33643.04139
84	F_557458_2869400	HIGH	HIGH	F_557458_2869400_07	350 MAIN ST	JOSLIN PARK	YES	Lowes Pond	Type 2	A	27288.78781
85	F_557509_2869588	HIGH	HIGH	F_557509_2869588_01	352 MAIN ST	JOSLIN PARK	YES	Lowes Pond	Type 2	A	22722.11413
86	F_557838_2856679	LOW		F_557838_2856679_05	53 INDUSTRIAL PARK EAST RD		YES	NO	Type 2	C/D	4799.829516
87	F_558185_2857434	LOW	HIGH	F_558185_2857434_06	0 INDUSTRIAL PARK EAST RD		YES	NO	Type 1	C	6083.583765
88	F_558185_2857434	LOW	MEDIUM	F_558185_2857434_09	0 INDUSTRIAL PARK EAST RD		YES	NO	Type 1	C	14977.62838
89	F_558395_2876151	LOW		F_558395_2876151_02	0 MILLBURY RD		YES	NO	Type 2	A	9107.974924
90	F_558789_2862247	LOW		F_558789_2862247_03	26 WESTVIEW DR		YES	NO	Type 1	C	885.0581216
91	F_559279_2869453	LOW	LOW	F_559279_2869453_02	10 SIBLEY CIR	residential lot	NO	Lowes Pond	Type 2	B/D	1565.853389
92	F_559665_2873361	LOW	LOW	F_559665_2873361_02	61 DANA RD	adj to I-395	NO	Lowes Pond	Type 2	C/D	27218.7955
93	F_560867_2873230	LOW	LOW	F_560867_2873230_01	0 DANA DR		NO	Lowes Pond	Type 2	C/D	8583.812699
94	F_565783_2881200	LOW	LOW	F_565783_2881200_05	0 FEDERAL HILL RD		NO	NO	Type 1	C	157023.416
95	F_566145_2881669	LOW	LOW	F_566145_2881669_02	0 FEDERAL HILL RD		NO	NO	Type 1	C	162959.4295
96	F_567246_2881296	LOW	LOW	F_567246_2881296_06	0 FEDERAL HILL RD		NO	NO	Type 1	C	272481.5658

*96 potential BMP sites on 60 town-owned parcels

Appendix F – Nitrogen Control BMP Sites & Maps





Town Owned Parcels	Utilities	Discharge Points	21.000001 - 72.000000
Urbanized Area	swGravityDrains	Cumulative Nitrogen Load Reduction	72.000001 - 217.000000
Town Boundary	swOpenDrains	0.007785 - 21.000000	
	swInlets		
	Detention/Fire		

Scale: 1"=750'

0 375 750 1,500 Feet

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Cumulative Nitrogen Load Reduction

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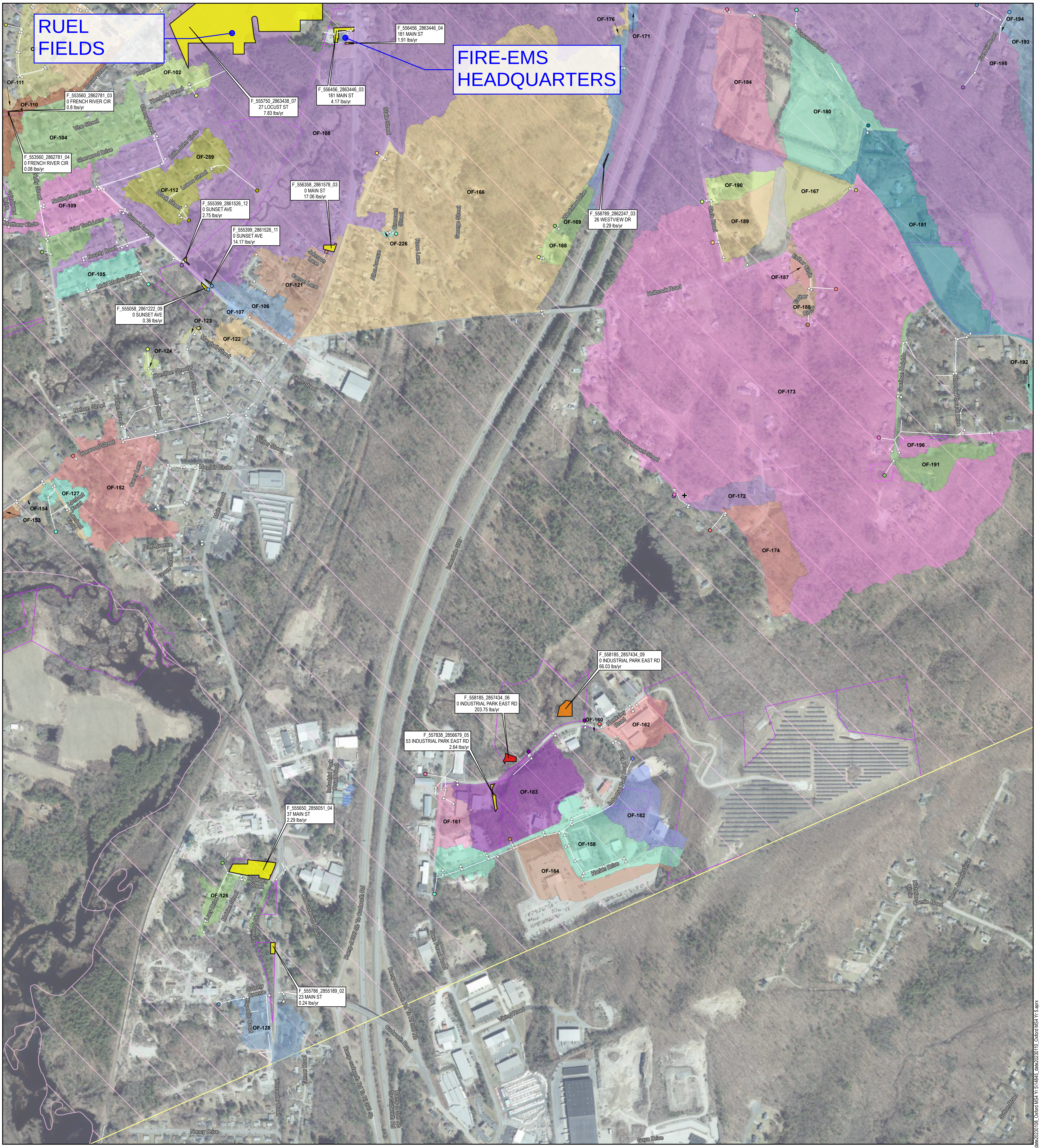
Oxford, MA

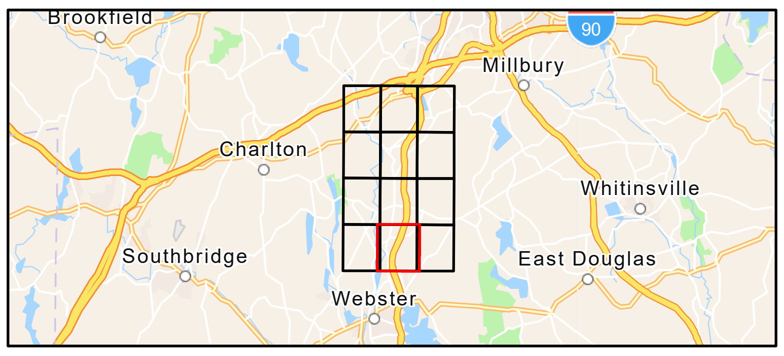
MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swOpenDrains
swInlets
Detention/Fire

Discharge Points
Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

N
W E
S

Scale: 1"=750'
0 375 750 1,500 Feet

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Cumulative Nitrogen Load Reduction

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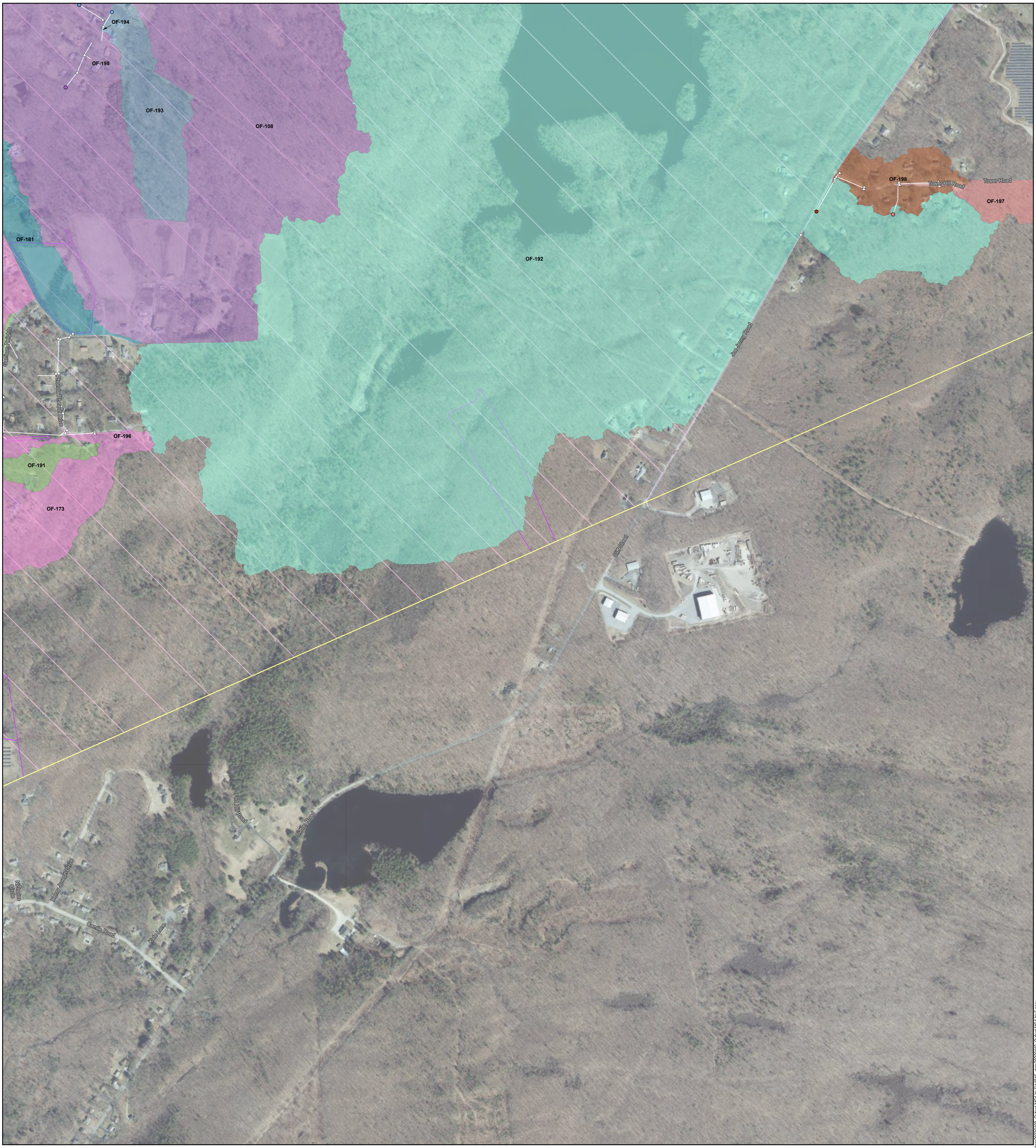
Oxford, MA

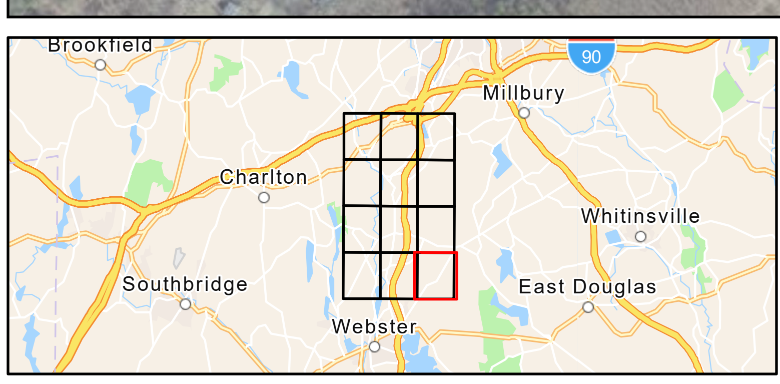
MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swInlets
Discharge Points

Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

N
W E
S

Scale: 1"=750'
0 375 750 1,500 Feet

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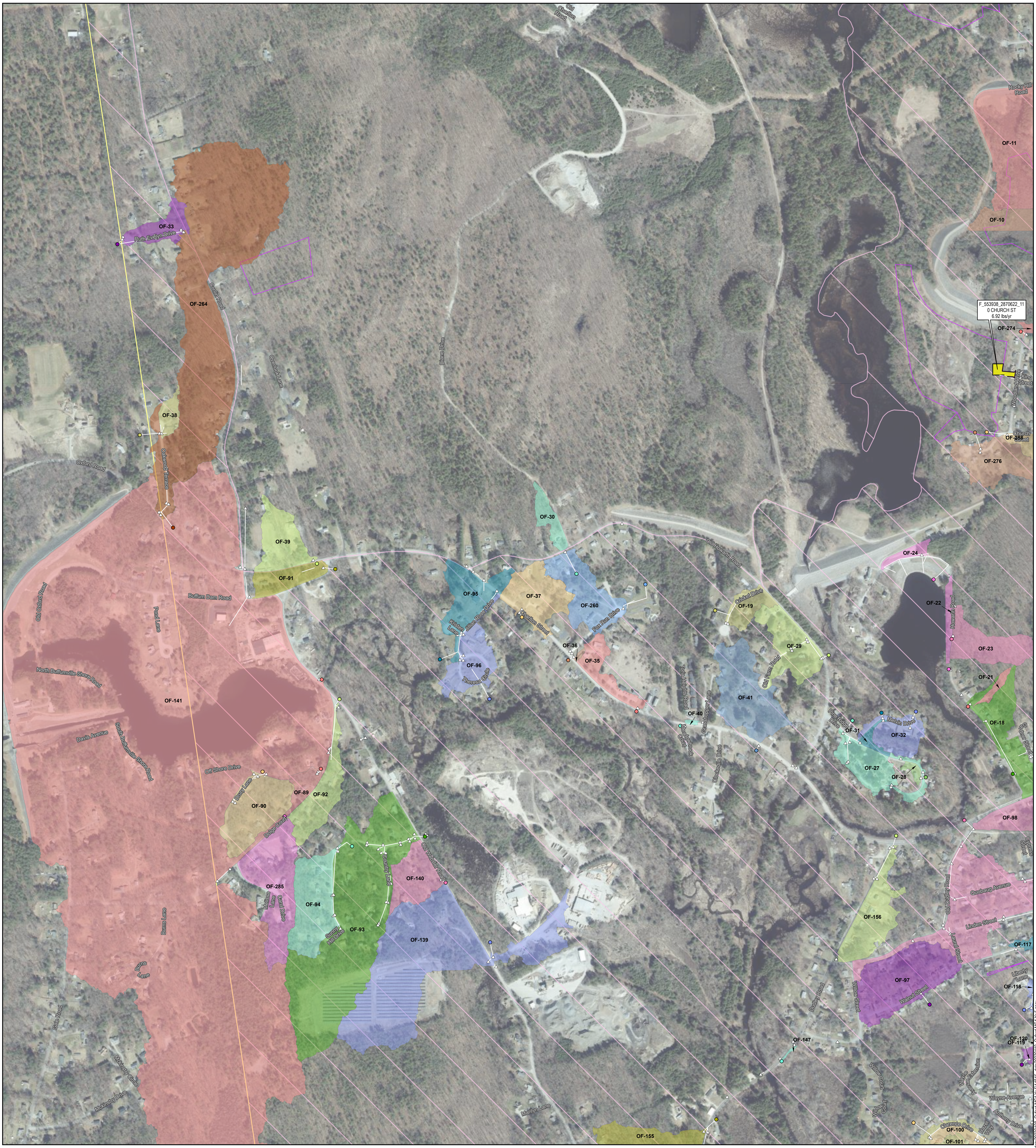
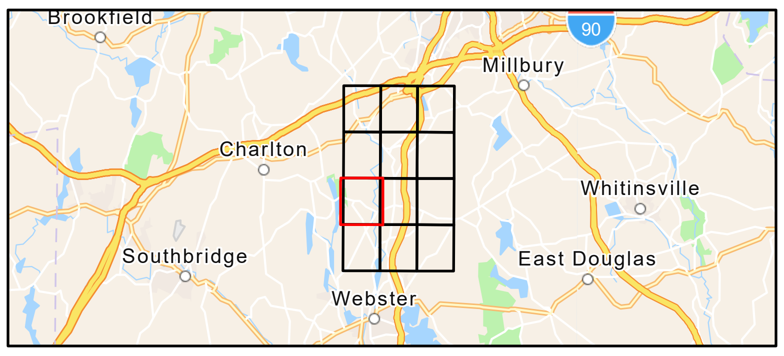
Cumulative Nitrogen Load Reduction
Page 3 of 12
Oxford, MA
MS4 Year 5
Data Source: MassGIS
Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels

Urbanized Area

Town Boundary

Utilities

swGravityDrains

swOpenDrains

swInlets

Detention

Discharge Points

Cumulative Nitrogen Load Reduction

0.007785 - 21.000000

21.000001 - 72.000000

72.000001 - 217.000000

N
W E
S

Scale: 1"=750'

0 375 750 1,500 Feet

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Cumulative Nitrogen Load Reduction

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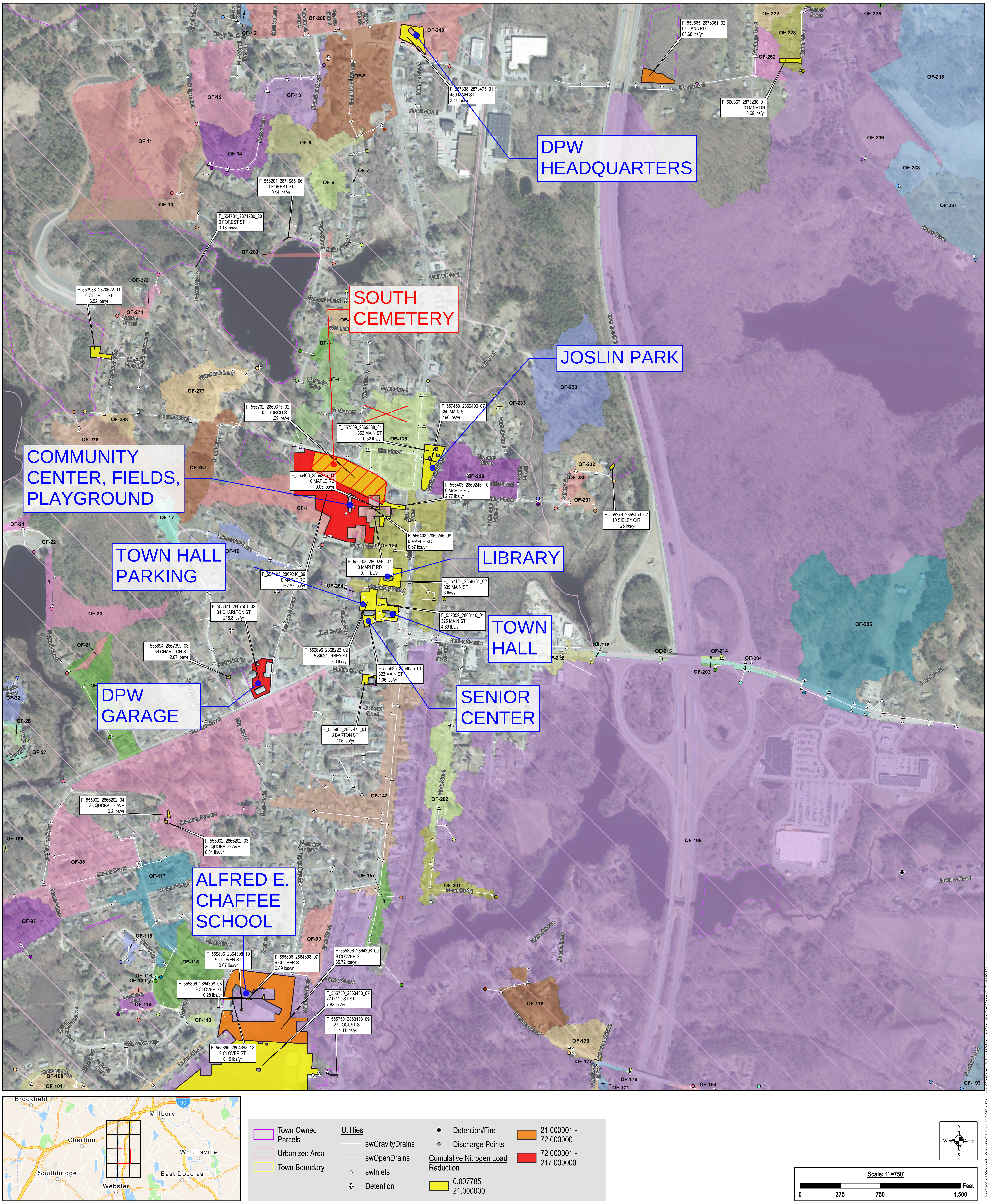
Oxford, MA

MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

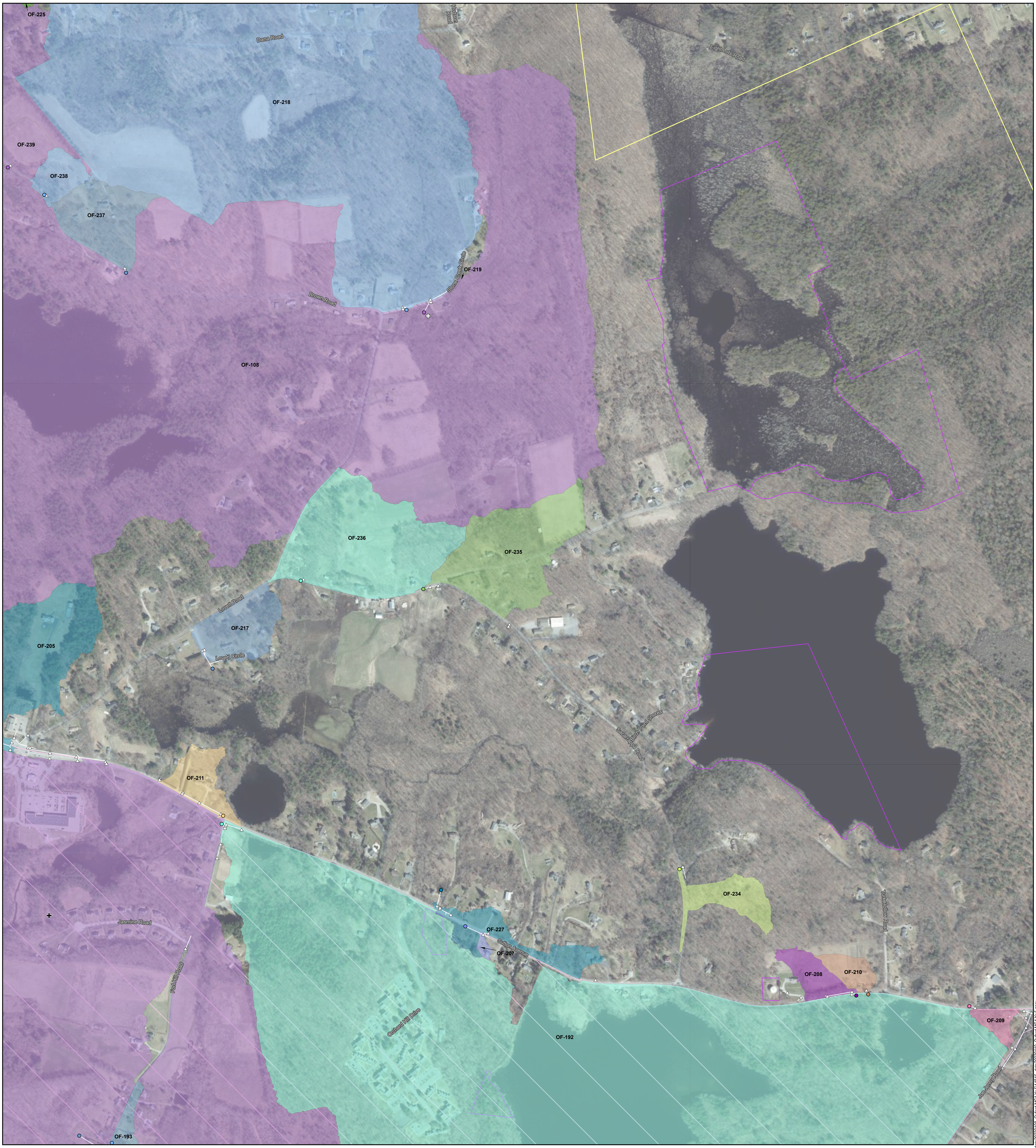
Nitsch Engineering

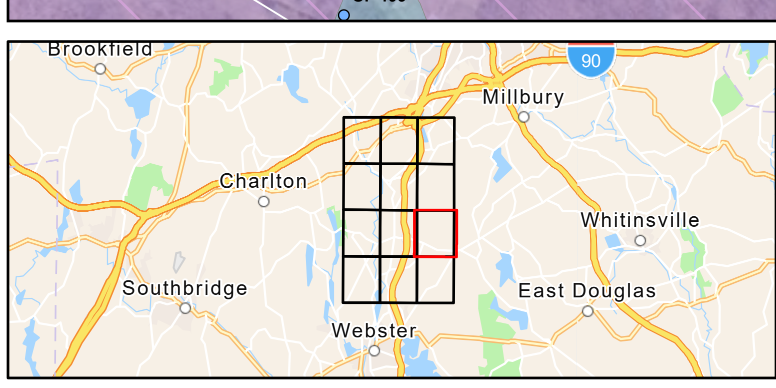


Cumulative Nitrogen Load Reduction
Page 5 of 12
Oxford, MA
MS4 Year 5
Data Source: MassGIS
Nitsch Project #14845

6/25/2023

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swInlets
Detention
Detention/Fire

Discharge Points

Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

N W E S

Scale: 1"=750'

0 375 750 1,500 Feet

6/25/2023

Cumulative Nitrogen Load Reduction

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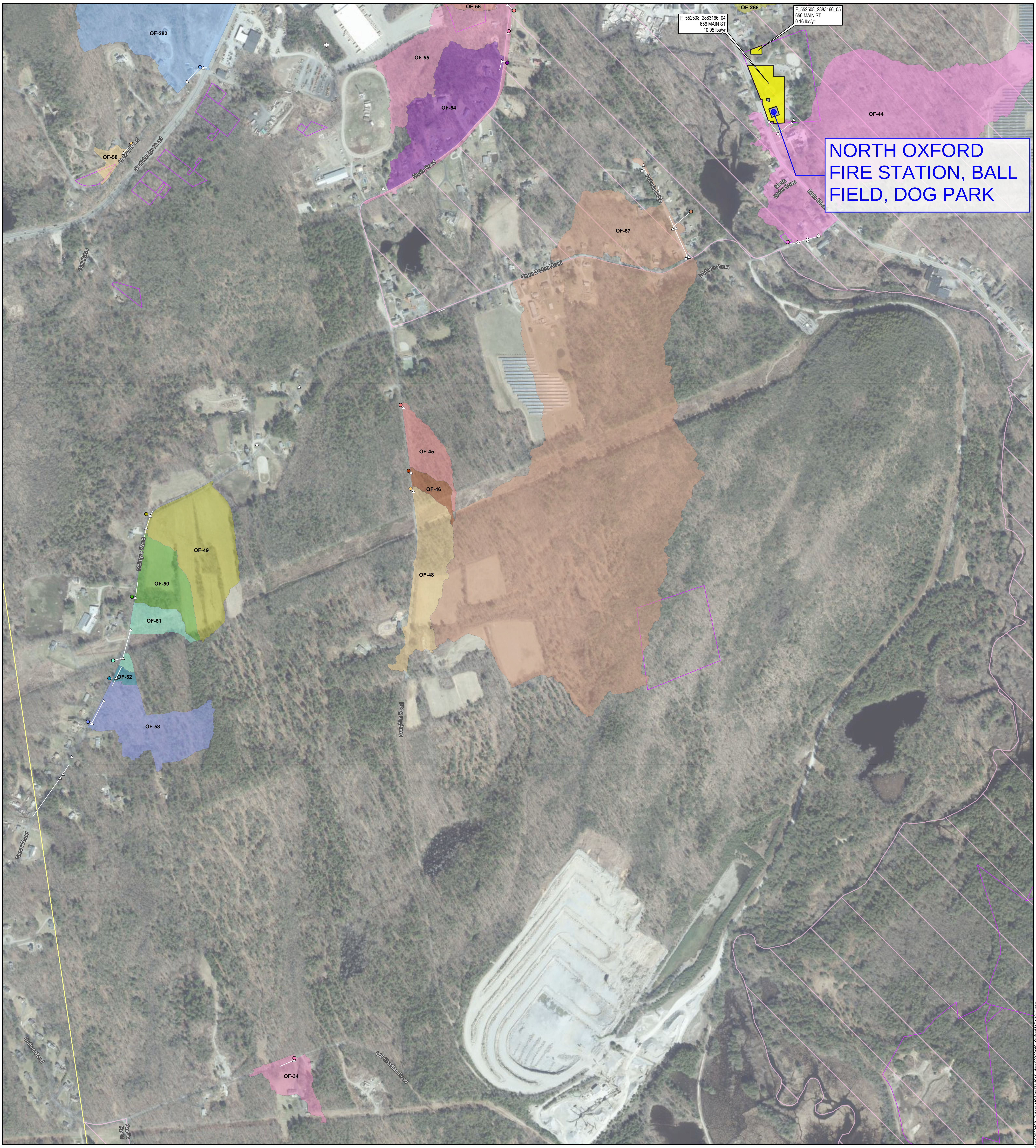
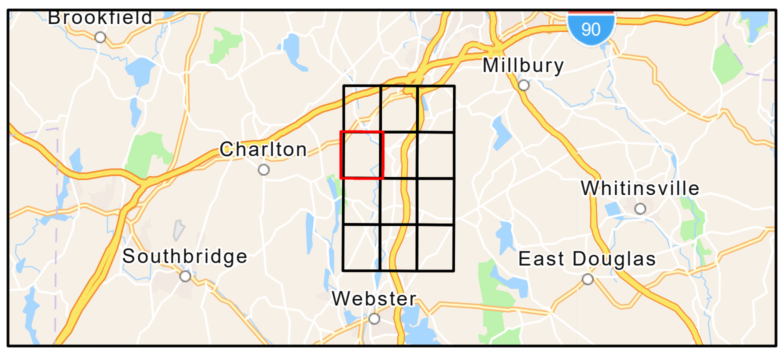
Oxford, MA

MS4 Year 5

Data Source: MassGIS
Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swOpenDrains
swInlets
Detention

Discharge Points
Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

Scale: 1"=750'
Feet
0 375 750 1,500

6/25/2023

Cumulative Nitrogen Load Reduction

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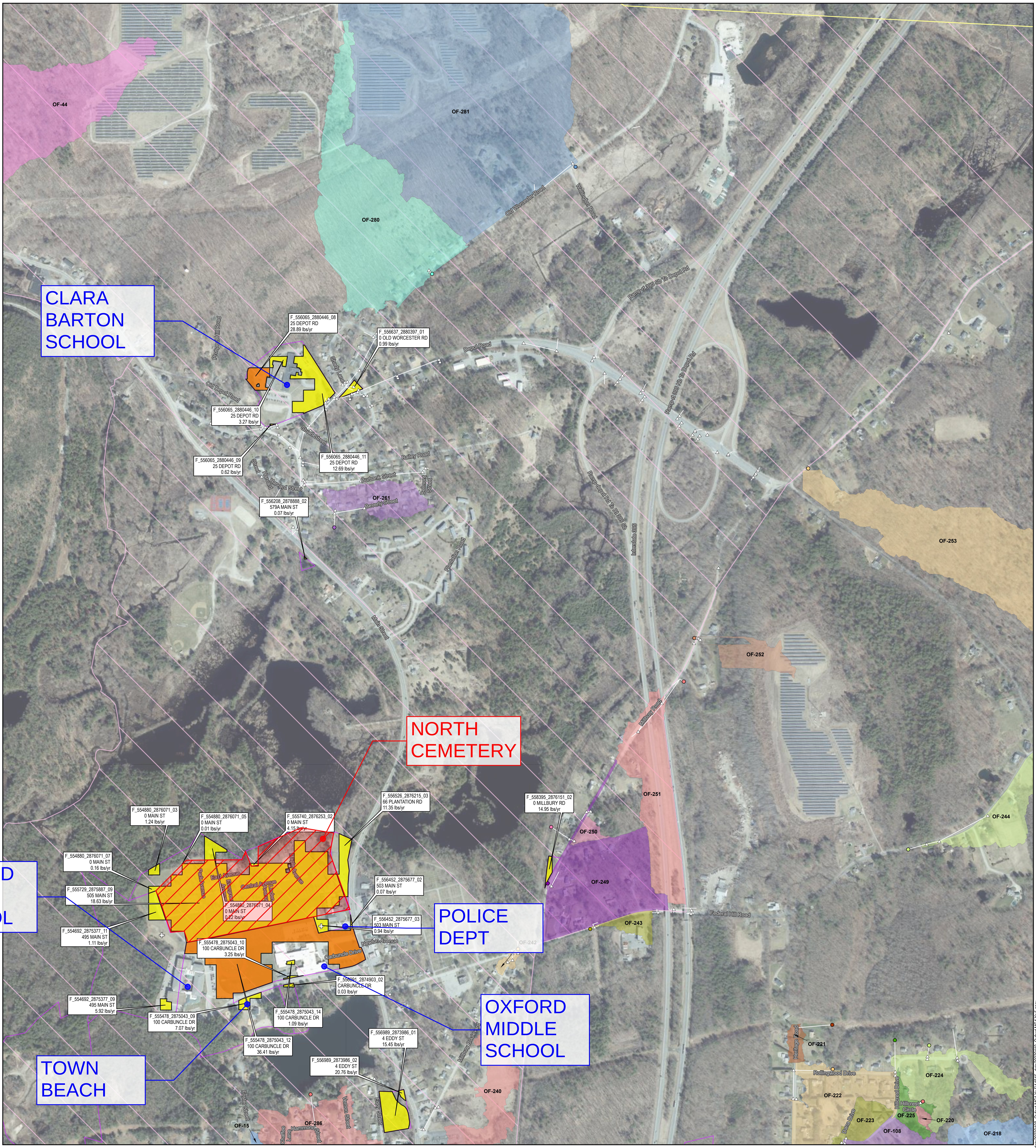
Oxford, MA

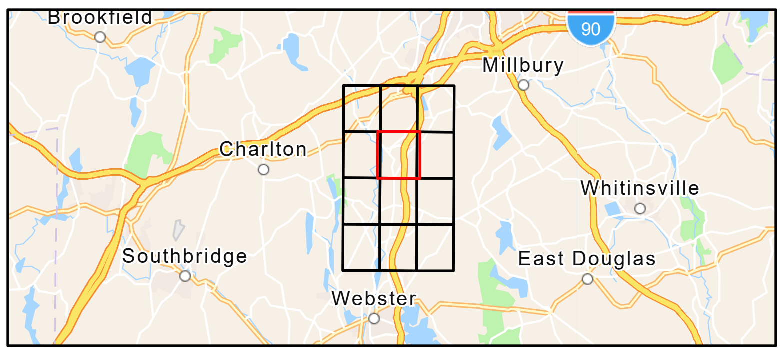
MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swOpenDrains
swInlets
Detention

Discharge Points

Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

Scale: 1"=750'
0 375 750 1,500 Feet

Cumulative Nitrogen Load Reduction
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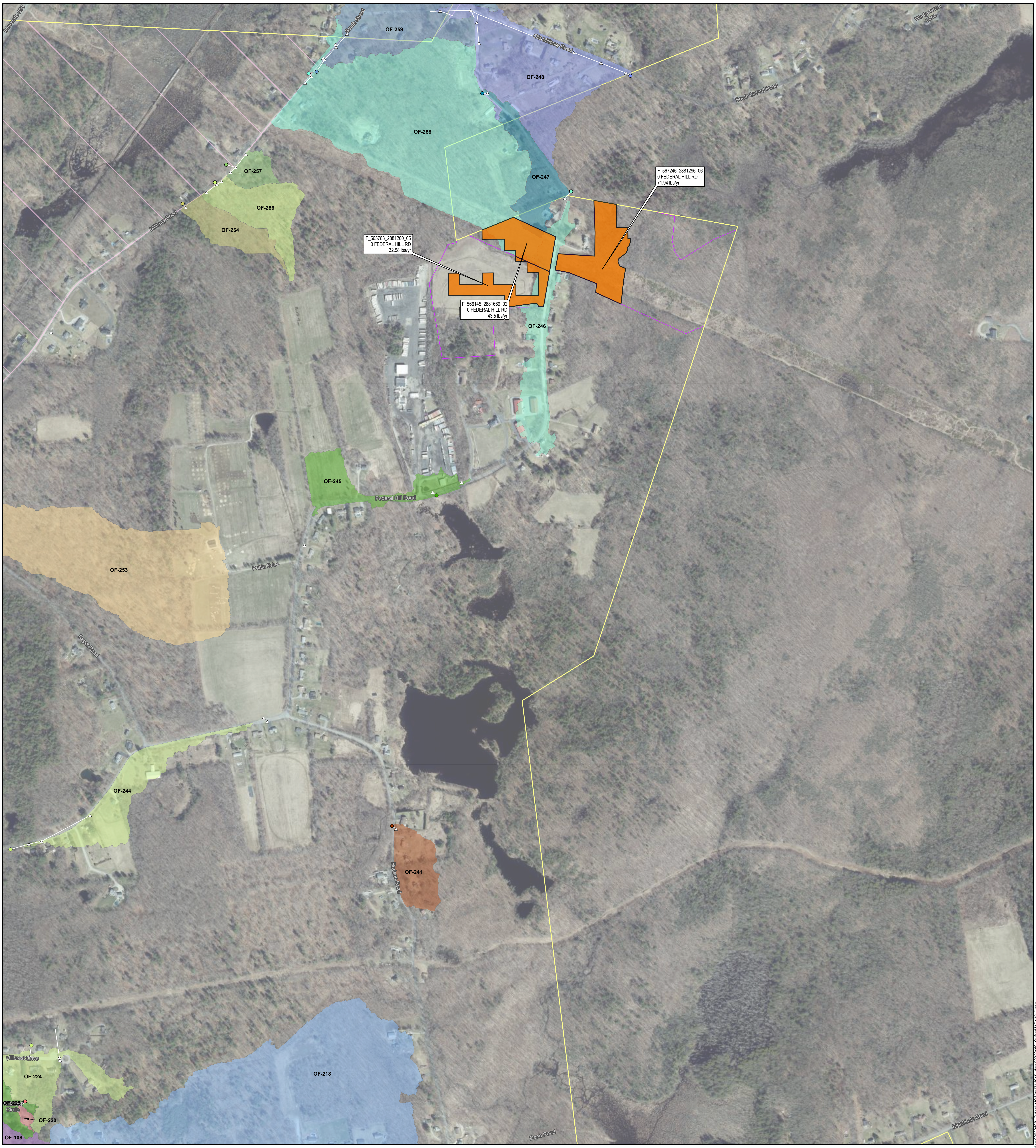
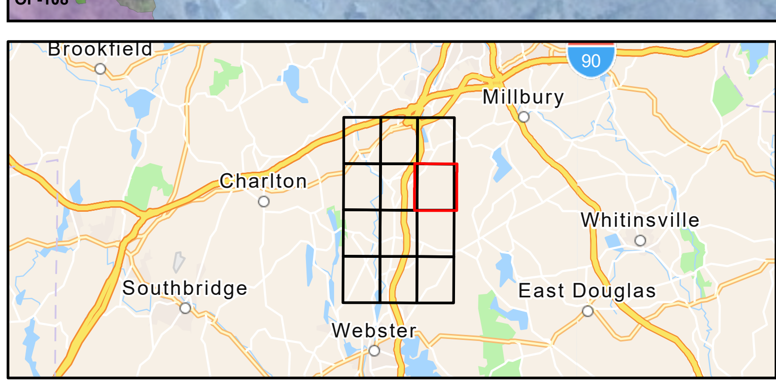
Oxford, MA
MS4 Year 5
Data Source: MassGIS
Nitsch Project #14845

6/25/2023

Nitsch Engineering





Town Owned Parcels	
Urbanized Area	
Town Boundary	
Utilities	
swGravityDrains	
swInlets	
Discharge Points	
Cumulative Nitrogen Load Reduction	
0.007785 - 21.000000	
21.000001 - 72.000000	
72.000001 - 217.000000	

N W E S

Scale: 1"=750'

0 375 750 1,500 Feet

6/25/2023

Cumulative Nitrogen Load Reduction

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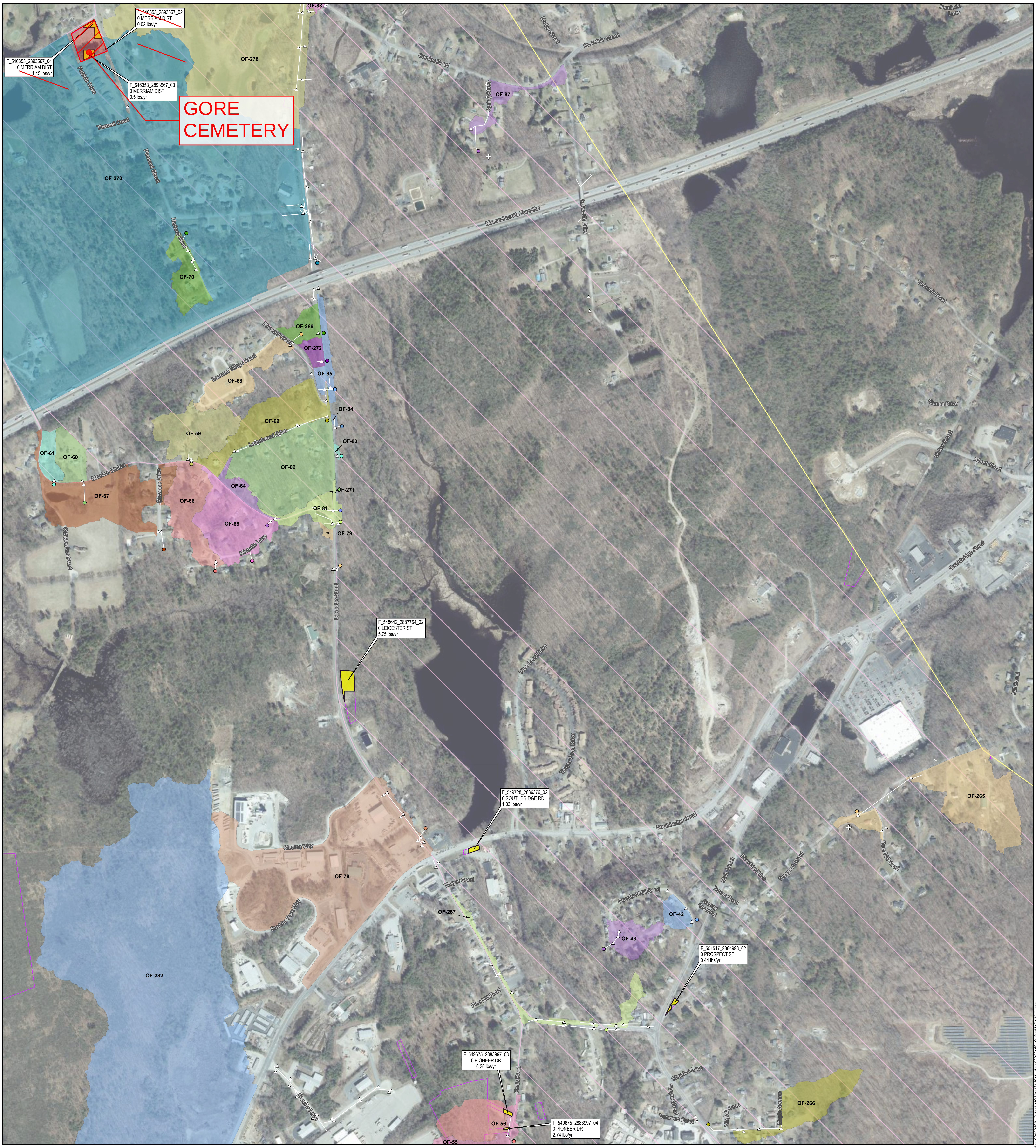
Oxford, MA

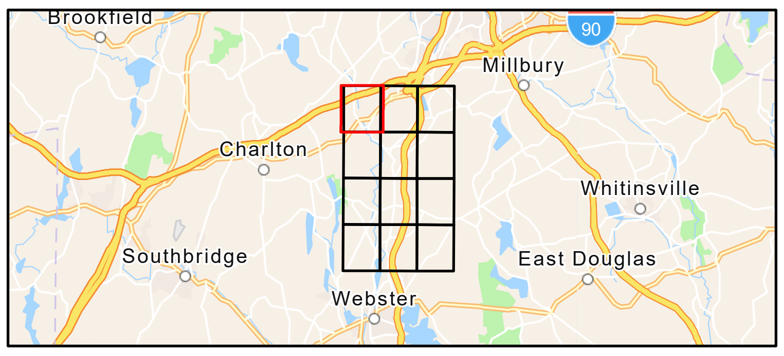
MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

Nitsch Engineering





Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swOpenDrains
swInlets
Detention

Discharge Points

Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

N W E S

Scale: 1"=750'
0 375 750 1,500 Feet

6/25/2023

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Cumulative Nitrogen Load Reduction

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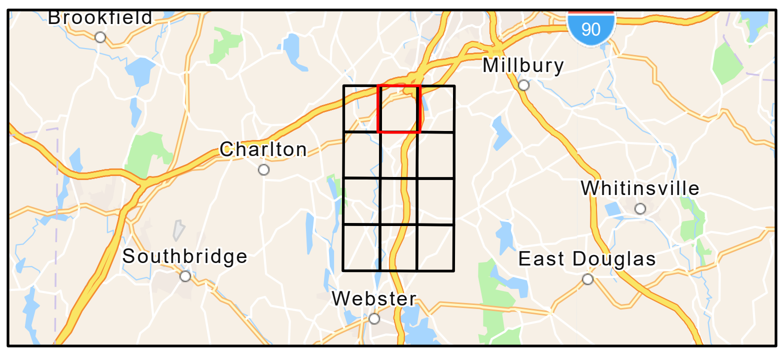
Oxford, MA
MS4 Year 5
Data Source: MassGIS
Nitsch Project #14845

Nitsch Engineering



Town Owned Parcels
Urbanized Area
Town Boundary

Utilities
swGravityDrains
swOpenDrains
swInlets

Discharge Points

Cumulative Nitrogen Load Reduction
0.007785 - 21.000000
21.000001 - 72.000000
72.000001 - 217.000000

N W E S

Scale: 1"=750'
0 375 750 1,500 Feet

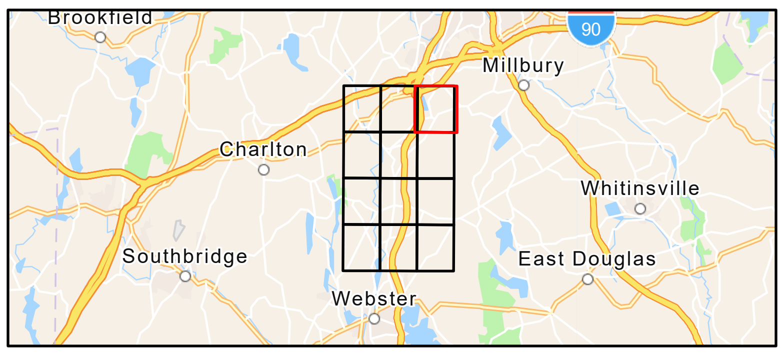
Path: P:\10000-14999\14845 Oxford MS4\Planning\GIS\14845_date20230108_Oxford MS4 Yr 5\14845_date20230110_Oxford MS4 Yr 5.aprx

Cumulative Nitrogen Load Reduction

Oxford, MA
MS4 Year 5
Data Source: MassGIS
Nitsch Project #14845

6/25/2023

Nitsch Engineering



Urbanized Area
Town Boundary
Utilities
swGravityDrains
swInlets
Discharge Points

Cumulative Nitrogen Load Reduction
- 0.007785 - 21.000000
- 21.000001 - 72.000000
- 72.000001 - 217.000000

N W E S

Scale: 1"=750'

0 375 750 1,500 Feet

6/25/2023

Cumulative Nitrogen Load Reduction

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Oxford, MA

MS4 Year 5

Data Source: MassGIS

Nitsch Project #14845

Nitsch Engineering

Path: P:\10000-14999\14845 Oxford MS4\Planning\GIS\14845_date20230108_Oxford MS4 Yr 5\14845_date20230108_Oxford MS4 Yr 5.aprx

OBJECTID	LOC_ID	RANKING FOR NSID	LOC_ID_BMPLocations	SITE_ADDR	LAND USE/NAME	URBANIZED AREA	BMP	HSG	BMP_AreaFt	BMP_VolumeFt	BMP_Watershed_Acres	BMP_Watershed_IA_Acres	BMP_Watershed_PA_Acres	NLoadLbYr	NitLoadReductionPercent	CumulativeNitLoadReduction	IntersectsRoad	ContainsDrainageNetwork	OutfallCatchmentIntersectingBMP	BMP_IA_VolumeFt_Capacity
1	F_546353_2893567	LOW	F_546353_2893567_02	0 MERRIAM DIST	GORE CEMETERY	YES	Type 2	C/D	33.04189462	66.08378924	0.012097057	0.001271749	0.010825309	0.050407582	40.0%	0.020				2 Inches Rainfall: 31.110464261516306 ft3, 6.7390484346126245 inch IA runoff capacity
2	F_546353_2893567	LOW	F_546353_2893567_03	0 MERRIAM DIST	GORE CEMETERY	YES	Type 2	C/D	7030.639404	14061.27881	0.389540803	0.008430167	0.381110636	1.26219726	40.0%	0.505			OF-270	2 Inches Rainfall: 12830.024675228291 ft3, 419.2612278329732 inch IA runoff capacity
3	F_546353_2893567	LOW	F_546353_2893567_04	0 MERRIAM DIST	GORE CEMETERY	YES	Type 2	C/D	9285.917937	18571.83587	0.78269114	0.114542228	0.668148912	3.619492153	40.0%	1.448	Watershed Intersects Roads		OF-270	2 Inches Rainfall: 16413.24718366427 ft3, 39.47501086752248 inch IA runoff capacity
4	F_546452_2860635		F_546452_2860635_02	75 OLD SOUTHBRIDGE RD	[not mapped, not enough IA]	YES	Type 2	D	1232.555495	2465.11099	11.25845019	0.646773726	10.61167646	38.81400673			Watershed Intersects Roads	Watershed Contains Drain Lines	OF-146	Rainfall capacity less than 0.6in
5	F_548642_2887754	HIGH	F_548642_2887754_02	0 LEICESTER ST	multi-family residential	YES	Type 2	B	22050.99176	44101.98352	7.760156871	0.391506329	7.368650542	14.36261989	40.0%	5.745	Watershed Intersects Roads			2 Inches Rainfall: 38217.37919314838 ft3, 26.891528551193552 inch IA runoff capacity
6	F_549675_2883997	LOW	F_549675_2883997_03	0 PIONEER DR		NO	Type 2	B	2687.789515	5375.579031	0.476071649	0.000257189	0.47581446	0.697806878	40.0%	0.279			OF-55	2 Inches Rainfall: 4820.42950340921 ft3, 5163.296767089322 inch IA runoff capacity
7	F_549675_2883997	LOW	F_549675_2883997_04	0 PIONEER DR		NO	Type 2	B	820.7878082	1641.575616	3.486584136	0.119346083	3.367238052	9.138230955	32.0%	2.741		Watershed Contains Drain Lines	OF-55	1 Inch Rainfall: 292.09380790837986 ft3, 0.6742291969704219 inch IA runoff capacity
8	F_549728_2886376	HIGH	F_549728_2886376_02	0 SOUTHBRIDGE RD	commercial	YES	Type 2	B	4113.479289	8226.958577	0.27860472	0.173775909	0.104828811	2.576034892	40.0%	1.030	Watershed Intersects Roads			2 Inches Rainfall: 8143.242288617702 ft3, 12.909254485171852 inch IA runoff capacity
9	F_551517_2884993		F_551517_2884993_02	0 PROSPECT ST	[triangle lot]	YES	Type 2	A	3637.418677	7274.837354	0.161677271	0.076029693	0.085647578	1.09771295	40.0%	0.439	Watershed Intersects Roads			2 Inches Rainfall: 7231.311255211504 ft3, 26.201562533009408 inch IA runoff capacity
10	F_551920_2858411		F_551920_2858411_01	0 SNEADE DR	easement?	YES	Type 2		4110.620244	8221.240489	0.385739276	0.089561924	0.296177352	2.151355186	40.0%	0.861	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-129	2 Inches Rainfall: 1910.2638595354392 ft3, 5.875750128712548 inch IA runoff capacity
11	F_552208_2853863	LOW	F_552208_2853863_05	15 OLD WEBSTER RD		NO	Type 2	B	90.44110833	180.8822167	0.002019674	0.001549935	0.000469739	0.022417774	40.0%	0.009				2 Inches Rainfall: 180.50708318868928 ft3, 32.08293222083444 inch IA runoff capacity
12	F_552208_2853863	LOW	F_552208_2853863_06	15 OLD WEBSTER RD		NO	Type 2	B	22724.71144	45449.42288	10.15502774	0.01599113	10.13903661	12.39231887	40.0%	4.957				2 Inches Rainfall: 37084.15782279034 ft3, 638.8554982835233 inch IA runoff capacity
13	F_552508_2883166		F_552508_2883166_04	656 MAIN ST	N. FIRE STATION, BALL FIELD, DOG PARK	YES	Type 2	A	102237.237	204474.474	4.838993934	1.739377472	3.099616462	27.3706374	40.0%	10.948	Watershed Intersects Roads		OF-44	2 Inches Rainfall: 202281.1712420745 ft3, 32.0372325503821 inch IA runoff capacity
14	F_552508_2883166		F_552508_2883166_05	656 MAIN ST	N. FIRE STATION, BALL FIELD, DOG PARK	YES	Type 2	B	5861.808256	11723.61651	0.255172879	0.007924619	0.24724826	0.406851105	40.0%	0.163				2 Inches Rainfall: 11526.67513425707 ft3, 400.6997179895369 inch IA runoff capacity
15	F_552838_2858456		F_552838_2858456_02	0 HARWOOD ST	wedge lot	YES	Type 2	A	2967.704196	5935.408393	0.332039435	0.172136283	0.159903152	2.475092539	40.0%	0.990	Watershed Intersects Roads		OF-137	2 Inches Rainfall: 5854.145611082684 ft3, 9.368810917472176 inch IA runoff capacity
16	F_552851_2858184		F_552851_2858184_04	0 LARNED RD	[triangle lot]	YES	Type 2	A	18106.38883	36212.77766	0.560042388	0.127042815	0.432999573	1.921203569	40.0%	0.768	Watershed Intersects Roads		OF-137	2 Inches Rainfall: 35992.727280381456 ft3, 78.047324750369 inch IA runoff capacity
17	F_553269_2858272	LOW	F_553269_2858272_02	80 OLD WEBSTER RD	just outside UA	NO	Type 2	A	8436.86156	16873.72312	3.815298427	0.785344488	3.029953938	11.99382196	40.0%	4.798	Watershed Intersects Roads		OF-137	2 Inches Rainfall: 15245.47403725382 ft3, 5.347787077961251 inch IA runoff capacity
18	F_553560_2862781		F_553560_2862781_03	0 FRENCH RIVER CIR		YES	Type 2	A	892.5992678	1785.198536	0.364063267	0.136776062	0.227287205	1.996728642	40.0%	0.799	Watershed Intersects Roads		OF-101	2 Inches Rainfall: 1669.6911780480589 ft3, 3.362942413714262 inch IA runoff capacity
19	F_553560_2862781		F_553560_2862781_04	0 FRENCH RIVER CIR		YES	Type 2	A	281.0860133	562.1720267	0.033904165	0.013515487	0.020388679	0.196684967	40.0%	0.079	Watershed Intersects Roads		OF-110	2 Inches Rainfall: 551.8105001679326 ft3, 11.247387137614409 inch IA runoff capacity
20	F_553906_2874229		F_553906_2874229_10	0 ROCKY HILL RD	stockpiles, yw collection	YES	Type 2	A	321982.9559	643965.9118	18379.67989	1109.881016	17269.79887	49073.97492			Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	Rainfall capacity less than 0.6in
21	F_553938_2870622		F_553938_2870622_11	0 CHURCH ST		YES	Type 2	A	13601.34754	27202.69508	5.139417663	1.055675336	4.083742327	17.30501815	40.0%	6.922	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-277	2 Inches Rainfall: 24538.6173715536 ft3, 6.403436225764657 inch IA runoff capacity
22	F_554692_2875377		F_554692_2875377_09	495 MAIN ST	OXFORD HIGH SCHOOL	YES	Type 2	A	8897.220277	17794.44055	1.393716961	1.042959226	0.350757735	14.81095241	40.0%	5.924				2 Inches Rainfall: 17616.185472780955 ft3, 4.653052136091818 inch IA runoff capacity
23	F_554692_2875377		F_554692_2875377_11	495 MAIN ST	OXFORD HIGH SCHOOL	YES	Type 2	A	27675.68415	55351.36829	1.351554727	0.170910166	1.180644561	2.764026709	40.0%	1.106	Watershed Intersects Roads			2 Inches Rainfall: 54751.36472425353 ft3, 88.25116105863866 inch IA runoff capacity
24	F_554781_2871780	HIGH	F_554781_2871780_20	0 FOREST ST	near McKinstry Pond	YES	Type 2	A	42.66218353	85.32436706	0.170734781	0.035336422	0.135398359	0.602877132	32.0%	0.181	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-10	1 Inch Rainfall: 24.105267877696292 ft3, 0.1879242234636952 inch IA runoff capacity
25	F_554880_2876071		F_554880_2876071_03	0 MAIN ST	adj to north cemetery	YES	Type 2	A	7447.455651	14894.9113	1.653362307	0.188207496	1.465154811	3.093272139	40.0%	1.237	Watershed Intersects Roads			2 Inches Rainfall: 14150.31962621426 ft3, 20.712031967438417 inch IA runoff capacity
26	F_554880_2876071		F_554880_2876071_04	0 MAIN ST	adj to north cemetery	YES	Type 2	A	23571.22584	47142.45168	1.100472181	0.015156848	1.085315333	0.53930616	40.0%	0.216	Watershed Intersects Roads			2 Inches Rainfall: 46590.89443170333 ft3, 846.8091073122876 inch IA runoff capacity
27	F_554880_2876071		F_554880_2876071_05	0 MAIN ST	adj to north cemetery	YES	Type 2	A	23.23783249	46.47566497	0.01424485	0.001130541	0.013114309	0.01987492	40.0%	0.008	Watershed Intersects Roads			2 Inches Rainfall: 39.81097319164512 ft3, 9.700851663443817 inch IA runoff capacity
28	F_554880_2876071		F_554880_2876071_07	0 MAIN ST	adj to north cemetery	YES	Type 2	A	4195.563348	8391.126696	0.352499935	0.020980008	0.331519927	0.395274087	40.0%	0.158	Watershed Intersects Roads			2 Inches Rainfall: 8222.648269333939 ft3, 107.96909110034407 inch IA runoff capacity
29	F_555002_2866202		F_555002_2866202_03	36 QUOBAUG AVE	residential	YES	Type 2	A	872.5357747	1745.071549	0.045595901	0.000419038	0.045176862	0.019461497	40.0%	0.008			OF-98	2 Inches Rainfall: 1722.1126678934993 ft3, 1132.1431690625132 inch IA runoff capacity
30	F_555002_2866202		F_555002_2866202_04	36 QUOBAUG AVE	residential	YES	Type 2	A	1554.227629	3108.455258	0.051782616	0.034467348	0.017315267	0.49118419	40.0%	0.196			OF-98	2 Inches Rainfall: 3099.6556392028638 ft3, 24.774160751738936 inch IA runoff capacity
31	F_555058_2861222		F_555058_2861222_07	0 SUNSET AVE		YES	Type 2	B/D	1765.684688	3531.369377	5205.416022	322.6146667	4882.801355	14142.07167			Watershed Intersects Roads	Watershed Contains Drain Lines	OF-1	Rainfall capacity less than 0.6in
32	F_555058_2861222		F_555058_2861222_08	0 SUNSET AVE		YES	Type 2	B/D	2431.839732	4863.679463	146.5932836	16.81833983	129.7749437	376.6330269			Watershed Intersects Roads	Watershed Contains Drain Lines	OF-106	Rainfall capacity less than 0.6in
33	F_555058_2861222		F_555058_2861222_09	0 SUNSET AVE		YES	Type 2	B/D	2025.107198	4050.214395	0.100400701	0.060168209	0.040232491	0.896454767	40.0%	0.359	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-107	2 Inches Rainfall: 3893.229945718373 ft3, 17.82527926049243 inch IA runoff capacity
34	F_555399_2861526		F_555399_2861526_11	0 SUNSET AVE		YES	Type 2	B/D	689.5965828	1379.193166	10.43520312	3.185559267	7.249643855	47.2362046	32.0%	14.171	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-106	1 Inch Rainfall: 484.49083360842815 ft3, 0.041897995931290385 inch IA runoff capacity
35	F_555399_2861526		F_555399_2861526_12	0 SUNSET AVE		YES	Type 2	B/D	1128.525061	2257.050122	5.733887537	0.265295113	5.468592423	9.176238693	28.0%	2.753	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	0.6 Inches Rainfall: 594.46882506316 ft3, 0.6172956388276504 inch IA runoff capacity
36	F_555399_2861526		F_555399_2861526_14	0 SUNSET AVE		YES	Type 2	B/D	48.02497927	96.04995855	0.419630757	0.020254605	0.399376152	0.706071206			Watershed Intersects Roads		OF-108	Rainfall capacity less than 0.6in
37	F_555478_2875043		F_555478_2875043_09	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	Type 2	A	14034.31106	28068.62213	3.758609529	1.198574349	2.56003518	17.66790887	40.0%	7.067	Watershed Intersects Roads			2 Inches Rainfall: 26767.612250856488 ft3, 6.152307426047349 inch IA runoff capacity
38	F_555478_2875043		F_555478_2875043_10	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	Type 2	A	2010.029085	4020.058169	0.916848008	0.569666461	0.347181547	8.136451563	40.0%	3.255	Watershed Intersects Roads			2 Inches Rainfall: 3843.620507074966 ft3, 1.8587168056088157 inch IA runoff capacity
39	F_555478_2875043	MEDIUM	F_555478_2875043_12	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	Type 2	A	471978.2609	943956.5217	24.66494252	6.059551712	18.60539081	91.02129638	40.0%	36.409	Watershed Intersects Roads			2 Inches Rainfall: 934501.2621365763 ft3, 42.48472106193287 inch IA runoff capacity
40	F_555478_2875043		F_555478_2875043_14	100 CARBUNCLE DR	OXFORD HIGH SCHOOL	YES	Type 2	A	2395.84731	4791.69462	0.26448865	0.191222741	0.073265909	2.718220419	40.0%	1.087				2 Inches Rainfall: 4754.460885314016 ft3, 6.849440777796161 inch IA runoff capacity
41	F_555650_2856051		F_555650_2856051_04	37 MAIN ST		YES	Type 2	A	45618.29357	91236.58714	2.020795034	0.371476452	1.649318582	5.732613553	40.0%	2.293	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-126	2 Inches Rainfall: 90398.40343293663 ft3, 67.03827735266384 inch IA runoff capacity
42	F_555694_2867399		F_555694_2867399_02	38 CHARLTON ST	DPW GARAGE	YES	Type 2	A	23259.88481	46519.76962	252.2194075	40.00840093	212.2110065	724.0129034			Watershed Intersects Roads	Watershed Contains Drain Lines	OF-1	Rainfall capacity less than 0.6in
43	F_555694_2867399		F_555694_2867399_03	38 CHARLTON ST	DPW GARAGE	YES	Type 2	B	896.4488516	1792.897703	0.914976733	0.315744911	0.599231822	5.166566538	40.0%	2.067	Watershed Intersects Roads	Watershed Contains Drain Lines		2 Inches Rainfall: 1315.8079760021892 ft3, 1.1480202005584517 inch IA runoff capacity
44	F_555729_2875887	LOW	F_555729_2875887_09	505 MAIN ST	North Cemetery	YES	Type 2	A	877006.8591	1754013.718	20.79358113	2.923436849	17.87014428	46.58150285	40.0%	18.633	Watershed Intersects Roads			2 Inches Rainfall: 1744932.1108707953 ft3, 164.42891569774136 inch IA runoff capacity
45	F_555740_2876253	LOW	F_555740_2876253_02	0 MAIN ST	North Cemetery	YES	Type 2	A	1629.679898	3259.359795	3.195860264	0.68146263	2.514397634	10.36294237	40.0%	4.145	Watershed Intersects Roads			2 Inches Rainfall: 1981.5429177380402 ft3, 0.8010411248000484 inch IA runoff capacity
46	F_555750_2863438		F_555750_2863438_07	27 LOCUST ST	RUEL FIELDS	YES	Type 2	A	703701.4812	1407402.962	19.13627126	1.002945022	18.13332624	19.58152269	40.0%	7.833	Watershed Intersects Roads		OF-102	2 Inches Rainfall: 1398187.6061037462 ft3, 384.04462904822947 inch IA runoff capacity
47	F_555750_2863438		F_555750_2863438_09	27 LOCUST ST	RUEL FIELDS	YES	Type 2	A	595.6026934	1191.205387	1.661782884	0.164963793	1.496819091	2.775035207	40.0%	1.110	Watershed Intersects Roads		OF-108	2 Inches Rainfall: 430.52192445419803 ft3, 0.7189521959144856 inch IA runoff capacity
48	F_555786_2855189		F_555786_2855189_02	23 MAIN ST	[triangle lot]	YES	Type 2	A	3969.375525	7938.751051	0.206842646	0.03893083	0.167911815	0.599298253	40.0%	0.240	Watershed Intersects Roads			2 Inches Rainfall: 7853.418266261711 ft3, 55.57230829241909 inch IA runoff capacity
49	F_555871_2867501	HIGH	F_555871_2867501_02	34 CHARLTON ST	DPW GARAGE	YES	Type 2	A	41965.51486	83931.02972	250.8713034	39.94893644	210.922367	722.6682378	28.0%	216.800	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-1	0.6 Inches Rainfall: 22839.223165530697 ft3, 0.15749598301276513 inch IA runoff capacity
50	F_555896_2864398		F_555896_2864398_07	9 CLOVER ST	Alfred E. Chaffee School	YES	Type 2	A	431.4640991	862.9281982	0.170038819	0.15829783	0.01174099	2.235521693	40.0%	0.894			OF-108	2 Inches Rainfall: 856.9614272185709 ft3, 1.4913503798520265 inch IA runoff capacity
51	F_555896_2864398		F_555896_2864398_08	9 CLOVER ST	Alfred E. Chaffee School	YES	Type 2	A	611.3962309	1222.792462	0.061152253	0.048751137	0.012401117	0.691111364	40.0%	0.276			OF-108	2 Inches Rainfall: 1216.4902144431692 ft3, 6.87412218362961 inch IA runoff capacity
52	F_555896_2864398	MEDIUM	F_555896_2864398_09	9 CLOVER ST	Alfred E. Chaffee School	YES	Type 2	A	296455.5002	592911.0005	17.25175438	6.09646825	11.15528613	89.30678817	40.0%	35.723	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	2 Inches Rainfall: 587241.8840541858 ft3, 26.535793686692802 inch IA runoff capacity
53	F_555896_2864398		F_555896_2864398_10	9 CLOVER ST	Alfred E. Chaffee School	YES	Type 2	A	445.95363	891.9072599	0.123079269	0.118994705	0.004084564	1.679050715	40.0%	0.672			OF-108	2 Inches Rainfall: 889.8314846639457 ft3, 2.060029810160392 inch IA runoff capacity
54	F_555896_2864398		F_555896_2864398_12	9 CLOVER ST	Alfred E. Chaffee School	YES	Type 2	A	241.0526186	482.1052372	0.034059556	0.033654578	0.000404978	0.474651037	40.0%	0.190			OF-108	2 Inches Rainfall: 481.8994272480416 ft3, 3.9446242659760085 inch IA runoff capacity
55	F_556065_2880446	MEDIUM	F_556065_2880446_08	25 DEPOT RD	Clara Barton School	YES	Type 2	A	33516.86188	67033.72375	26.62411319	0.890335899	25.7337773	72.21876023	40.0%	28.888	Watershed Intersects Roads		OF-280	2 Inches Rainfall: 4509.429354485095 ft3, 1.3952790642406885 inch IA runoff capacity
56	F_556065_2880446		F_556065_2880446_09	25 DEPOT RD	Clara Barton School	YES	Type 2	A	478.1540089	956.3080178	0.333949207	0.104736806	0.229212401	1.545552685	40.0%	0.618				2 Inches Rainfall: 839.82227559112 ft3, 2.2089273824531133 inch IA runoff capacity
57	F_556065_2880446		F_556065_2880446_10	25 DEPOT RD	Clara Barton School	YES	Type 2	A	10048.33857	20096.67714	2.703136775	0.192210165	2.51092661	8.185705353	40.0%	3.274				2 Inches Rainfall: 14331.100351995228 ft3, 20.53981651964747 inch IA runoff capacity
58	F_556065_2880446		F_556065_2880446_11	25 DEPOT RD	Clara Barton School	YES	Type 2	A	106600.7473	213201.4946	8.126089098	1.913739528	6.212349569	31.72462528	40.0%	12.690	Watershed Intersects Roads	Watershed Contains Drain Lines		2 Inches Rainfall: 207308.99002238124 ft3, 29.84205204521866 inch IA runoff capacity
59	F_556091_2874903		F_556091_2874903_02	CARBUNCLE DR	TOWN BEACH	YES	Type 2	A	2453.899871	4907.799742	0.090484919	0.002631121	0.087853798	0.063454951	40.0%	0.025				2 Inches Rainfall: 4863.152442108768 ft3, 509.1788755477015 inch IA runoff capacity
60	F_556201_2871585	HIGH	F_556201_2871585_06	0 FOREST ST	single family residential	YES	Type 2	B/D	370.9636235	741.927247	0.130224038	0.020023148	0.11020089	0.354053725	40.0%	0.142				2 Inches Rainfall: 539.323376683693 ft3, 7.420108765775673 inch IA runoff capacity
61	F_556201_2871585		F_556201_2871585_07	0 FOREST ST	single family residential	YES	Type 2	B/D	76.2603372	152.5206744	0.189277337	0.009140641	0.180136697	0.318629704						Rainfall capacity less than 0.6in
62	F_556208_2878888		F_556208_2878888_02	579A MAIN ST		YES	Type 2	A	300.8025622	601.6051245	0.057210959	0.011275609	0.04593535	0.172766687	40.0%	0.069	Watershed Intersects Roads			2 Inches Rainfall: 578.2607794354526 ft3, 14.127883927583722 inch IA runoff capacity
63	F_556358_2861578	MEDIUM	F_556358_2861578_03	0 MAIN ST		YES	Type 2	A	5447.087504	10894.17501	8.343471582	2.908868661	5.43460292	42.645429	40.0%	17.058	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	2 Inches Rainfall: 8132.30980435189 ft3, 0.7701639338802607 inch IA runoff capacity
64	F_556403_2869246	HIGH	F_556403_2869246_07	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Type 2	A	451.1838376	902.3676751	0.019344527	0.018699859	0.000644668	0.263861408	40.0%	0.106			OF-1	2 Inches Rainfall: 902.0400549049897 ft3, 13.288650298898444 inch IA runoff capacity
65	F_556403_2869246	HIGH	F_556403_2869246_08	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Type 2	A	795.6656159	1591.331232	0.264114104	0.115424073	0.148690031	1.672086441	40.0%	0.669	Watershed Intersects Roads		OF-1	2 Inches Rainfall: 1515.7669579661108 ft3, 3.6176738848550816 inch IA runoff capacity
66	F_556403_2869246	HIGH	F_556403_2869246_09	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Type 2	A	276867.807	553735.614	169.18502	19.1329948	150.0520252	382.1822858	37.0%	152.873	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-1	1.5 Inches Rainfall: 186330.44542013202 ft3, 2.6828367306572067 inch IA runoff capacity
67	F_556403_2869246		F_556403_2869246_10	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Type 2	A	14425.80446	28851.60893	1.05929632	0.478247861	0.581048459	6.917609376	40.0%	2.767	Watershed Intersects Roads		OF-1	2 Inches Rainfall: 28556.320102830778 ft3, 16.449116646034 inch IA runoff capacity
68	F_556403_2869246	HIGH	F_556403_2869246_11	0 MAPLE RD	Oxford Community Center, basketball, fi	YES	Type 2	A	1090.430879	2180.861758	0.048232018	0.008780046	0.039451972	0.13563424	40.0%	0.054			OF-1	2 Inches Rainfall: 2160.812265968287 ft3, 67.79749093543013 inch IA runoff capacity
69	F_556452_2875677		F_556452_2875677_02	503 MAIN ST	POLICE DEPARTMENT	YES	Type 2	A	897.3545294	1794.709059	0.038409051	0.011049192	0.027359859	0.16400157	40.0%	0.066				2 Inches Rainfall: 1780.8047783630677 ft3, 44.39960967207568 inch IA runoff capacity
70	F_556452_2875677		F_556452_2875677_03	503 MAIN ST	POLICE DEPARTMENT	YES	Type 2	A	12722.20813	25444.41627	1.212587731	0.143256234	1.069331497	2.340712346	40.0%	0.936				2 Inches Rainfall: 24900.9819984836 ft3, 47.884650264783645 inch IA runoff capacity
71	F_556456_2863446		F_556456_2863446_03	181 MAIN ST	FIRE-EMS HQ	YES	Type 2	A	9375.477349	18750.9547	5.553437274	0.634706855	4.918730419	10.42498578	40.0%	4.170	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	2 Inches Rainfall: 16251.255899692149 ft3, 7.053539697918092 inch IA runoff capacity
72	F_556456_2863446		F_556456_2863446_04	181 MAIN ST	FIRE-EMS HQ	YES	Type 2	A	1022.612599	2045.225199	0.633765493	0.333061526	0.300703968	4.786378701	40.0%	1.915		Watershed Contains Drain Lines	OF-108	2 Inches Rainfall: 1892.407442568059 ft3, 1.5652494337313965 inch IA runoff capacity
73	F_556526_2876215		F_556526_2876215_03	66 PLANTATION RD	east of north cemetery	YES	Type 2	A	44713.2789	89426.5578	4.844044896	1.950470155	2.893574741	28.3697016	40.0%	11.348	Watershed Intersects Roads			2 Inches Rainfall: 87956.04311675215 ft3, 12.422807316526423 inch IA runoff capacity
74	F_556637_2880397		F_556637_2880397_01	0 OLD WORCESTER RD	triangle lot near school	YES	Type 2	A	11507.89175	23015.78349	0.385737798	0.170713453	0.215024346	2.471566985	40.0%	0.989	Watershed Intersects Roads	Watershed Contains Drain Lines		2 Inches Rainfall: 22906.508120052134 ft3, 36.96447304206809 inch IA runoff capacity
75	F_556732_2869373	LOW	F_556732_2869373_02	0 CHURCH ST	SOUTH CEMETERY	YES	Type 2	A	152485.5459	304971.0919	8.823250797	1.926380414	6.896870382	29.23371233	40.0%	11.693	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-1	2 Inches Rainfall: 301455.9136178063 ft3, 43.10971270592549 inch IA runoff capacity
76	F_556895_2868222	HIGH	F_556895_2868222_02	5 SIGOURNEY ST	TOWN HALL PARKING	YES	Type 2	A	27656.42779	55312.85559	0.75216582	0.582144939	0.170020881	8.2592499	40.0%	3.304			OF-134	2 Inches Rainfall: 55226.45097395489 ft3, 26.13421044863503 inch IA runoff capacity
77	F_556896_2868055		F_556896_2868055_01	323 MAIN ST	SENIOR CENTER	YES	Type 2	A	11175.08215	22350.16431	0.417618201	0.182860364	0.234757837	2.648758483	40.0%	1.060		Watershed Contains Drain Lines		2 Inches Rainfall: 22230.86037693861 ft3, 33.491150446539955 inch IA runoff capacity
78	F_556901_2867471	HIGH	F_556901_2867471_01	3 BARTON ST	mixed use	YES	Type 2	A	8096.196259	16192.39252	0.52520597	0.359796347	0.165409623	5.122751374	40.0%	2.049	Watershed Intersects Roads	Watershed Contains Drain Lines		2 Inches Rainfall: 16108.331347589321 ft3, 12.333523913760974 inch IA runoff capacity
79	F_556989_2873986	HIGH	F_556989_2873986_01	4 EDDY ST	vacant lot	YES	Type 2	A	69026.69235	138053.3847	7.603556909	2.634198699	4.96935821	38.63300912	40.0%	15.453	Watershed Intersects Roads		OF-240	2 Inches Rainfall: 135527.9568489737 ft3, 14.17338992619685 inch IA runoff capacity
80	F_556989_2873986	HIGH	F_556989_2873986_02	4 EDDY ST	vacant lot	YES	Type 2	A	3562.942085	7125.884169	13.96675068	3.457673703	10.50907697	51.9059223	40.0%	20.762	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-240	2 Inches Rainfall: 1785.17125089598 ft3, 0.14222935881090476 inch IA runoff capacity
81	F_557059_2868110	HIGH	F_557059_2868110_01	325 MAIN ST	TOWN HALL	YES	Type 2	A	31943.56807	63887.13613	1.079507459	0.862448354	0.217059105	12.22563953	40.0%	4.890	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-134	2 Inches Rainfall: 63776.82669468827 ft3, 20.37150822485846 inch IA runoff capacity
82	F_557101_2868431	HIGH	F_557101_2868431_02	339 MAIN ST	LIBRARY	YES	Type 2	A	26753.63877	53507.27755	1.026084143	0.521512103	0.50457204	7.504692257	40.0%	3.002	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-134	2 Inches Rainfall: 53250.85403705641 ft3, 28.129082123170797 inch IA runoff capacity
83	F_557338_2873475	HIGH	F_557338_2873475_01	450 MAIN ST	DPW HEADQUARTERS	YES	Type 2	A	33643.04139	67286.08277	1.33683488	0.534626353	0.802208527	7.778894135	40.0%	3.112			OF-240	2 Inches Rainfall: 66878.40039884693 ft3, 34.46108045249778 inch IA runoff capacity
84	F_557458_2869400	HIGH	F_557458_2869400_07	350 MAIN ST	JOSLIN PARK	YES	Type 2	A	27288.78781	54577.57563	1.590329225	0.500863286	1.08946594	7.389012111	40.0%	2.956	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-135	2 Inches Rainfall: 54023.909036992205 ft3, 29.7139359033928 inch IA runoff capacity
85	F_557509_2869588	HIGH	F_557509_2869588_01	352 MAIN ST	JOSLIN PARK	YES	Type 2	A	22722.11413	45444.22826	0.620024937	0.081580179	0.538444758	1.311813957	40.0%	0.525			OF-135	2 Inches Rainfall: 45170.59063015045 ft3, 152.53323742834155 inch IA runoff capacity
86	F_557838_2856679		F_557838_2856679_05	53 INDUSTRIAL PARK EAST RD		YES	Type 2	C/D	4799.829516	9599.659032	0.679842283	0.41016033	0.269681953	6.592002606	40.0%	2.637			OF-183	2 Inches Rainfall: 8728.765274052797 ft3, 5.862630675050438 inch IA runoff capacity
87	F_558185_2857434	HIGH	F_558185_2857434_06	0 INDUSTRIAL PARK EAST RD		YES	Type 1	C	6083.583765	12167.16753	27.50674352	12.15010765	15.35663587	203.7490566	98.0%	203.749	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-158	1 Inch Rainfall: 6377.992393611409 ft3, 0.1446096404217336 inch IA runoff capacity
88	F_558185_2857434	MEDIUM	F_558185_2857434_09	0 INDUSTRIAL PARK EAST RD		YES	Type 1	C	14977.62838	29955.25676	12.22191936	3.536607113	8.68531225	66.03063107	100.0%	66.031	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-158	2 Inches Rainfall: 14952.6346053842 ft3, 1.16472736580222 inch IA runoff capacity
89	F_558395_2876151		F_558395_2876151_02	0 MILLBURY RD		YES	Type 2	A	9107.974924	18215.94985	10.57390772	0.835316108	9.738591616	37.37104039	37.0%	14.948	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-249	1.5 Inches Rainfall: 1641.5078725961976 ft3, 0.5413591589822329 inch IA runoff capacity
90	F_558789_2862247		F_558789_2862247_03	26 WESTVIEW DR		YES	Type 1	C	885.0581216	1770.116243	0.119488708	0.000304136	0.119184572	0.287261951	100.0%	0.287			OF-108	2 Inches Rainfall: 1475.958487789374 ft3, 1336.9003751079256 inch IA runoff capacity
91	F_559279_2869453	LOW	F_559279_2869453_02	10 SIBLEY CIR	residential lot	NO	Type 2	B/D	1565.853389	3131.706778	1.796577129	0.079555087	1.717022042	3.18838655	40.0%	1.275	Watershed Intersects Roads		OF-108	2 Inches Rainfall: 267.37830620567 ft3, 0.9258733573341288 inch IA runoff capacity
92	F_559665_2873361	LOW	F_559665_2873361_02	61 DANA RD	adj to I-395	NO	Type 2	C/D	27218.7955	54437.591	64.01651874	4.101637417	59.91488133	212.2580228	32.0%	63.677	Watershed Intersects Roads	Watershed Contains Drain Lines	OF-108	1 Inch Rainfall: 25168.838220259004 ft3, 1.6904381208283865 inch IA runoff capacity
93	F_560867_2873230	LOW	F_560867_2873230_01	0 DANA DR		NO	Type 2	C/D	8583.812699	17167.6254	0.509735727	0.01712059	0.492615138	1.737370883	40.0%	0.695		Watershed Contains Drain Lines	OF-108	2 Inches Rainfall: 15558.275216894579 ft3, 250.34337487501404 inch IA runoff capacity
94	F_565783_2881200	LOW	F_565783_2881200_05	0 FEDERAL HILL RD		NO	Type 1	C	157023.416	314046.832	9.942482338	0.665816028	9.27666631	32.58058357	100.0%	32.581	Watershed Intersects Roads		OF-246	2 Inches Rainfall: 289687.9860157655 ft3, 119.85871401380616 inch IA runoff capacity
95	F_566145_2881669	LOW	F_566145_2881669_02	0 FEDERAL HILL RD		NO	Type 1	C	162959.4295	325918.8589	13.4280855	0.884116793	12.54396871	43.5001501	100.0%	43.500	Watershed Intersects Roads		OF-246	2 Inches Rainfall: 293376.4005989771 ft3, 91.4131998205666 inch IA runoff capacity
96	F_567246_2881296	LOW	F_567246_2881296_06	0 FEDERAL HILL RD		NO	Type 1	C	272481.5658	544963.1316	22.41887416	1.17483976	21.2440344	71.9404162	100.0%	71.940	Watershed Intersects Roads		OF-246	2 Inches Rainfall: 486441.9121064216 ft3, 114.06324581976202 inch IA runoff capacity

*96 potential BMP sites on 60 town-owned parcels

Appendix G – Implementation Schedule

LPCP Implementation Schedule - BUFFUMVILLE LAKE

Milestone	Phosphorus Reduction Goal (lb/yr)	Structural BMP Credits for town-owned properties (lb/yr)	Non-Structural BMP Credits (lb/yr)	Structural BMPs adjacent to Roadways Credits (lb/yr)	Total BMP Credits (lb/year)	Percent of Milestone Goal	Note: percent of roads treated
Year 8 (2026)	3.71	0	1.76	1.95	**3.71**	100%	15%
Year 10 (2028)	7.41	0	1.76	5.72	**7.48**	101%	44%
Year 13 (2031)	12.97	0	1.76	11.32	**13.08**	101%	87%
Year 15 (2033)	18.53	0	1.76	13.01	**14.77**	80%	100%

*Town will not reach Year 15 milestone for Buffumville without additional interventions or more detailed analysis before year 15

*options not considered in these calculations include: instllation/certification of privately-owned/maintained BMPs, increasing non-structural BMP credits by street sweeping more frequently or using more effective equipment

LPCP Implementation Schedule - LOWES POND

Milestone	Phosphorus Reduction Goal (lb/yr)	Structural BMP Credits for town-owned properties (lb/yr)	Non-Structural BMP Credits (lb/yr)	Structural BMPs adjacent to Roadways Credits (lb/yr)	Total BMP Credits (lb/year)	Percent of Milestone Goal	Note: percent of roads treated
Year 8 (2026)	54.47	29.75	24.72	0.00	**54.47**	100%	0%
Year 10 (2028)	108.93	42.99	24.72	41.22	**108.93**	100%	57%
Year 13 (2031)	190.63	42.99	24.72	72.04	**139.75**	73%	100%
Year 15 (2033)	272.33	42.99	24.72	72.04	**139.75**	51%	100%

LPCP Implementation Schedule - MCKINSTRY POND

Milestone	Phosphorus Reduction Goal (lb/yr)	Structural BMP Credits for town-owned properties (lb/yr)	Non-Structural BMP Credits (lb/yr)	Structural BMPs adjacent to Roadways Credits (lb/yr)	Total BMP Credits (lb/year)	Percent of Milestone Goal	Note: percent of roads treated
Year 8 (2026)	6.60	1.54	2.46	2.60	**6.6**	100%	36%
Year 10 (2028)	13.21	1.54	2.46	7.20	**11.2**	85%	100%
Year 13 (2031)	23.11	1.54	2.46	7.20	**11.2**	48%	100%
Year 15 (2033)	33.02	1.54	2.46	7.20	**11.2**	34%	100%

LPCP Implementation Schedule - ROBINSON POND

Milestone	Phosphorus Reduction Goal (lb/yr)	Structural BMP Credits for town-owned properties (lb/yr)	Non-Structural BMP Credits (lb/yr)	Structural BMPs adjacent to Roadways Credits (lb/yr)	Total BMP Credits (lb/year)	Percent of Milestone Goal	Note: percent of roads treated
Year 8 (2026)	1.19	0	1.11	0.12	**1.23**	103%	2%
Year 10 (2028)	2.38	0	1.11	1.30	**2.41**	101%	22%
Year 13 (2031)	4.17	0	1.11	3.08	**4.19**	100%	52%
Year 15 (2033)	5.96	0	1.11	4.85	**5.96**	100%	82%

LPCP Implementation Schedule - TEXAS POND

Milestone	Phosphorus Reduction Goal (lb/yr)	Structural BMP Credits for town-owned properties (lb/yr)	Non-Structural BMP Credits (lb/yr)	Structural BMPs adjacent to Roadways Credits (lb/yr)	Total BMP Credits (lb/year)	Percent of Milestone Goal	Note: percent of roads treated
Year 8 (2026)	11.48	1.03	10.91	0.00	**11.94**	104%	0%
Year 10 (2028)	22.96	1.22	10.91	10.83	**22.96**	100%	40%
Year 13 (2031)	40.18	1.22	10.91	27.49	**39.62**	99%	100%
Year 15 (2033)	57.40	1.22	10.91	27.49	**39.62**	69%	100%

Appendix H – Pilot Demonstration Project

Oxford Pilot Project Summary – Sigourney/Fremont Street and Town Hall Complex

Sigourney Street and Fremont Street are located within the Town Center of Oxford, Massachusetts. Sigourney Street connects Fremont Street to Main Street and provides vehicular access to the Oxford Free Public Library and the Oxford Town Hall complex.

Nitsch Engineering worked with the Town of Oxford to update their MassDOT Tier 2 Complete Streets Prioritization Plan. This included working closely with the Town's Department of Public Works to develop goals for analyzing and improving the Town's existing Complete Street network. Nitsch reviewed existing planning studies, master plans, and projects to determine a list of potential projects, as well as a gap analysis of the Town's pedestrian network to identify potential projects.

After developing a preliminary project list, Nitsch conducted a binary ranking of all the potential projects. Each project was ranked on 10 factors that varied from distances from schools, network gaps, safety, cost, permitting, and public support.

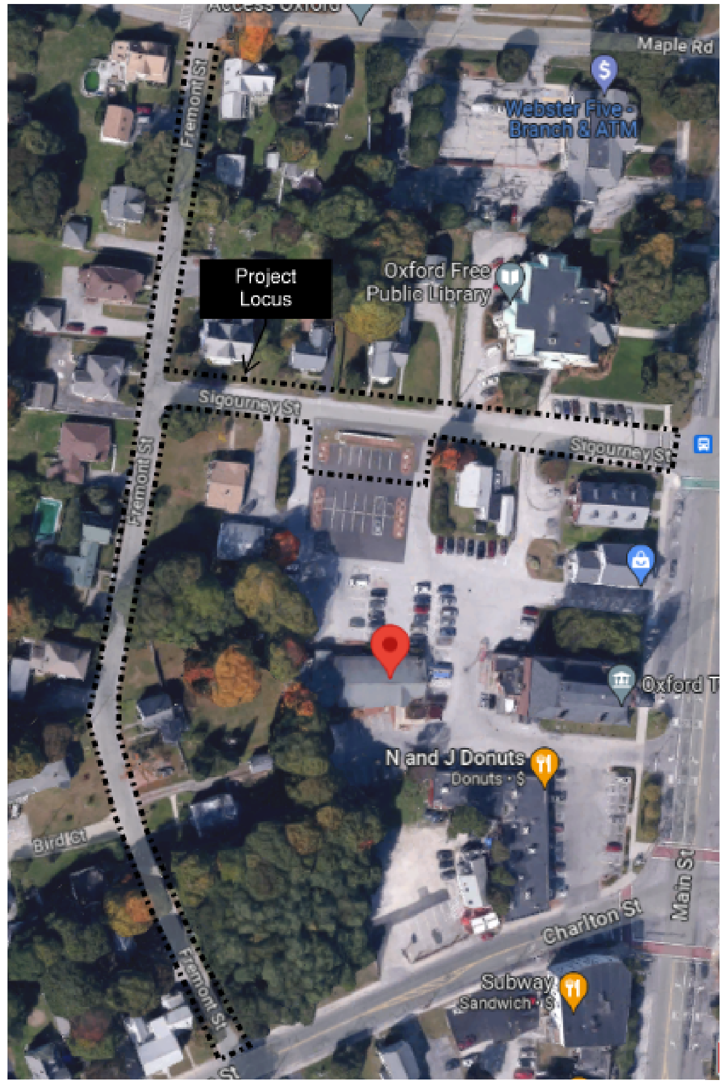


Figure 1. Project Locus

The top ranked project from the Complete Streets Prioritization Plan was Sigourney and Fremont Street (subsequently referred to as the Project). The Project was prioritized because the reconstruction of the roadways and addition of sidewalks provides a direct connection from residential properties to the Oxford Public Library and connects to the existing sidewalks on Main Street. This Project would help complete the sidewalk network directly within the Town Center area, increasing pedestrian accessibility to key destinations such as the Community Center and Town Hall. The Project is located within a quarter mile of the Oxford Community Center and within a mile of the A.M. Chaffee Elementary School.

Additionally, the existing roadways are very flat and experience drainage issues following rainfall events (Figures 2 and 3). The Project provides an opportunity to improve positive drainage to reduce ponding, as well as providing stormwater retrofit best management practices (BMPs) to reduce pollutant discharges to the Town's stormwater system.

Figures 2 and 3. Sigourney Street, left, and Fremont Street, right, in the preconstruction condition

The Project is located within a portion of Oxford that is prioritized for stormwater retrofits due to its urbanized location within both nitrogen and phosphorus impairment watershed. Most of the Project discharges towards the municipal stormwater system located in Main Street, which discharges towards Lowes Pond (Figure 4). Lowes Pond was categorized as “4A” in the Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle and a TMDL is completed/determined. Nutrient/Eutrophication Biologic Indicators are noted as an impairment. A survey from the mid-1990s also indicated that 75% to 100% of the Pond was covered with aquatic plants.

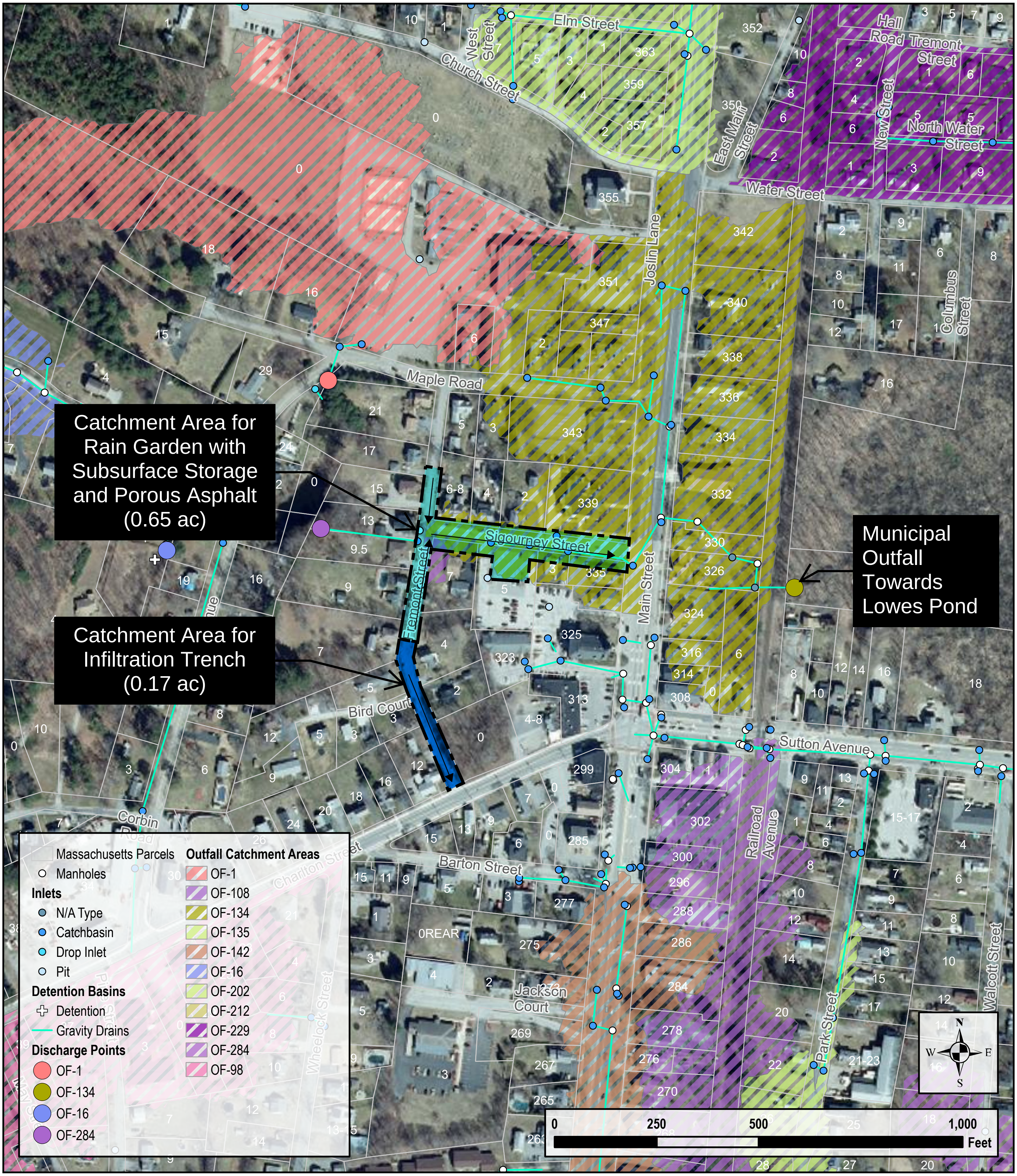
To meet the Project’s stormwater water quality goals, several stormwater BMP retrofits were incorporated into the Project. These included: (1) a subsurface infiltration trench located at the southern end of Fremont Street, (2) a bioretention basin with enhanced subsurface storage at the entrance to the Town Hall Complex on Sigourney Street, and (3) porous asphalt sidewalks on Sigourney Street. The bioretention basin is an expansion of an existing rain garden to provide additional capacity both above and below grade (Figure 5).

The BMPs were designed to maximize treatment and storage and provide infiltration of up to the 25-year storm event. The BMPs were designed to accommodate greater than 2.0 inches BMP capacity and provide infiltration, therefore the estimated pollutant removal was determined based on the Subsurface Infiltration Trench (IR = 2.41 in./hr) BMP Performance Table from Appendix H Attachment 3 of the MA MS4 Permit. **This chart indicates both phosphorus and nitrogen load reductions of 100%, which equates to 1.45 lb/year and 10.46 lb/year, respectively.**

The Project issued 100% Construction Documents in March 2023 and is anticipated to be constructed in summer 2023. The Plans are attached for reference.

Figure 4. Catchment Areas with New Stormwater BMP for the Project

Figure 5. Town Hall Complex – Bioretention Basin with Enhanced Storage Stormwater Retrofit



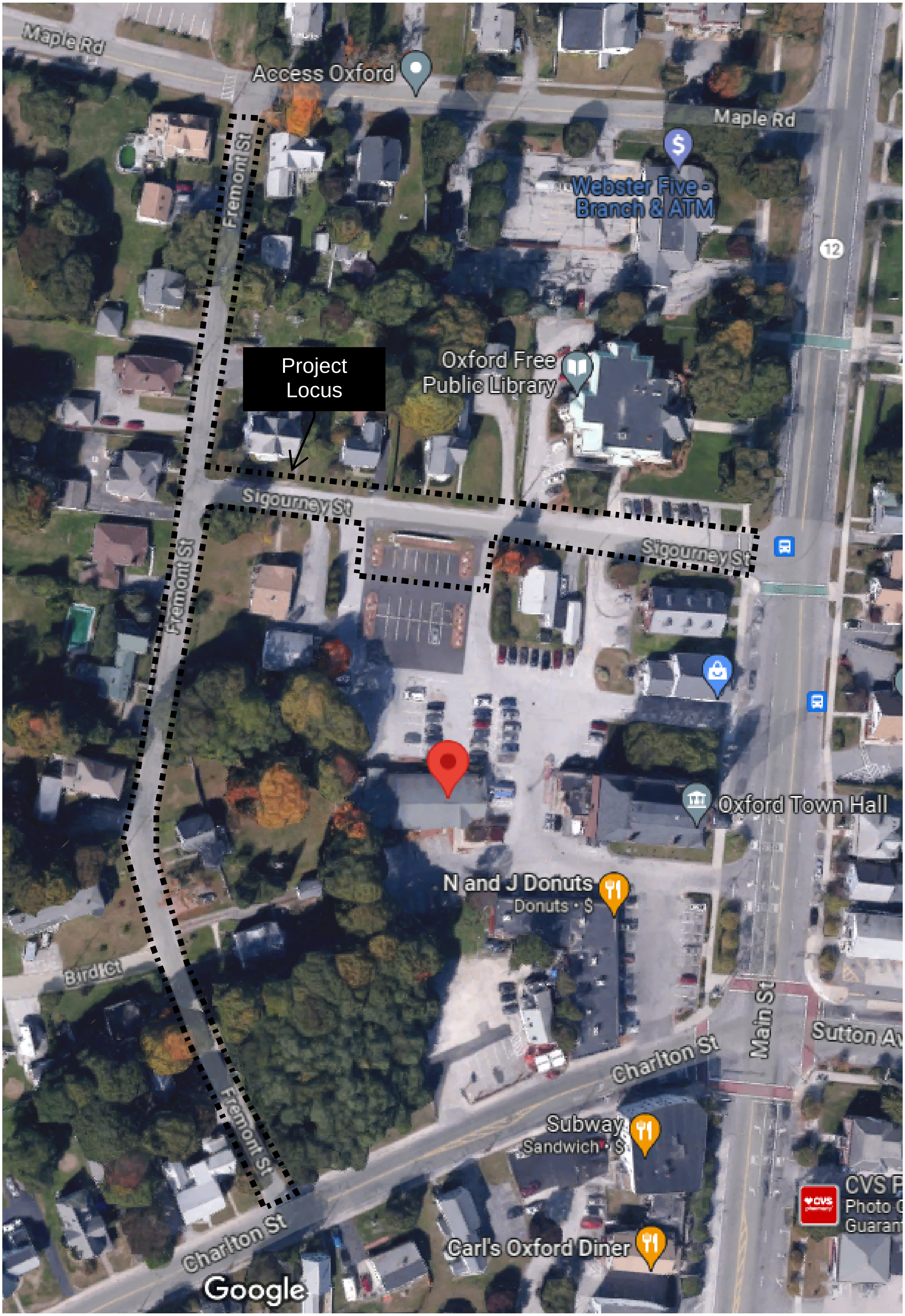
Drainage Network

Oxford, MA

7/28/2022

Data Source: MassGIS, Oxford MA

Nitsch Engineering



Maple Rd
Access Oxford
Maple Rd
Webster Five - Branch & ATM
12
Fremont St
Project Locus
Oxford Free Public Library
Sigourney St
Sigourney St
Fremont St
Oxford Town Hall
N and J Donuts
Donuts · $
Bird Ct
Main St
Sutton Av
Charlton St
Fremont St
Subway
Sandwich · $
CVS
Carl's Oxford Diner
Charlton St
Google

TOWN OF OXFORD
DEPARTMENT OF PUBLIC WORKS

PLAN OF

SIGOURNEY STREET AND FREMONT STREET SIDEWALK CONSTRUCTION

IN THE TOWN OF

OXFORD

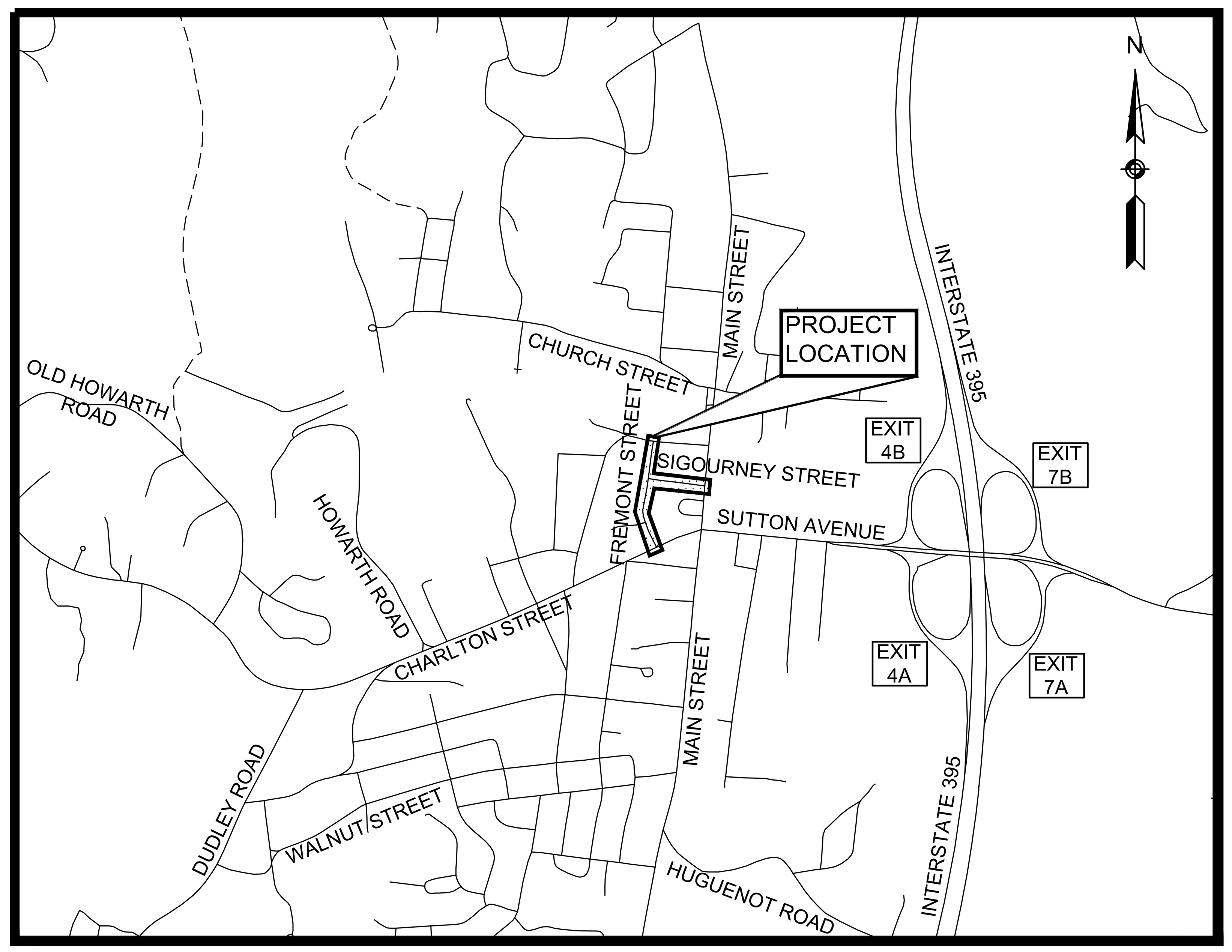
WORCESTER COUNTY

PROJECT NO.

H-23-08

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

INDEX



0 1,000 2,000 3,000 4,000

SCALE: 1" = 1,000'

DESIGN DESIGNATION (MAIN STREET)

DESIGN SPEED	20 MPH
FUNCTIONAL CLASSIFICATION	LOCAL

DATE	DESCRIPTION	REV #

NITSCH PROJECT # 14521.3

COMMONWEALTH OF MASSACHUSETTS
MATTHEW J. SOLTYS
CIVIL
No. 53326
REGISTERED PROFESSIONAL ENGINEER
03/15/2023

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T: (508) 365-1034
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► Land Surveying
► Transportation Engineering
► Structural Engineering
► Green Infrastructure
► Planning
► GIS

Oxford MS4 Pilot Project Plans - Select Stormwater Plans Provided

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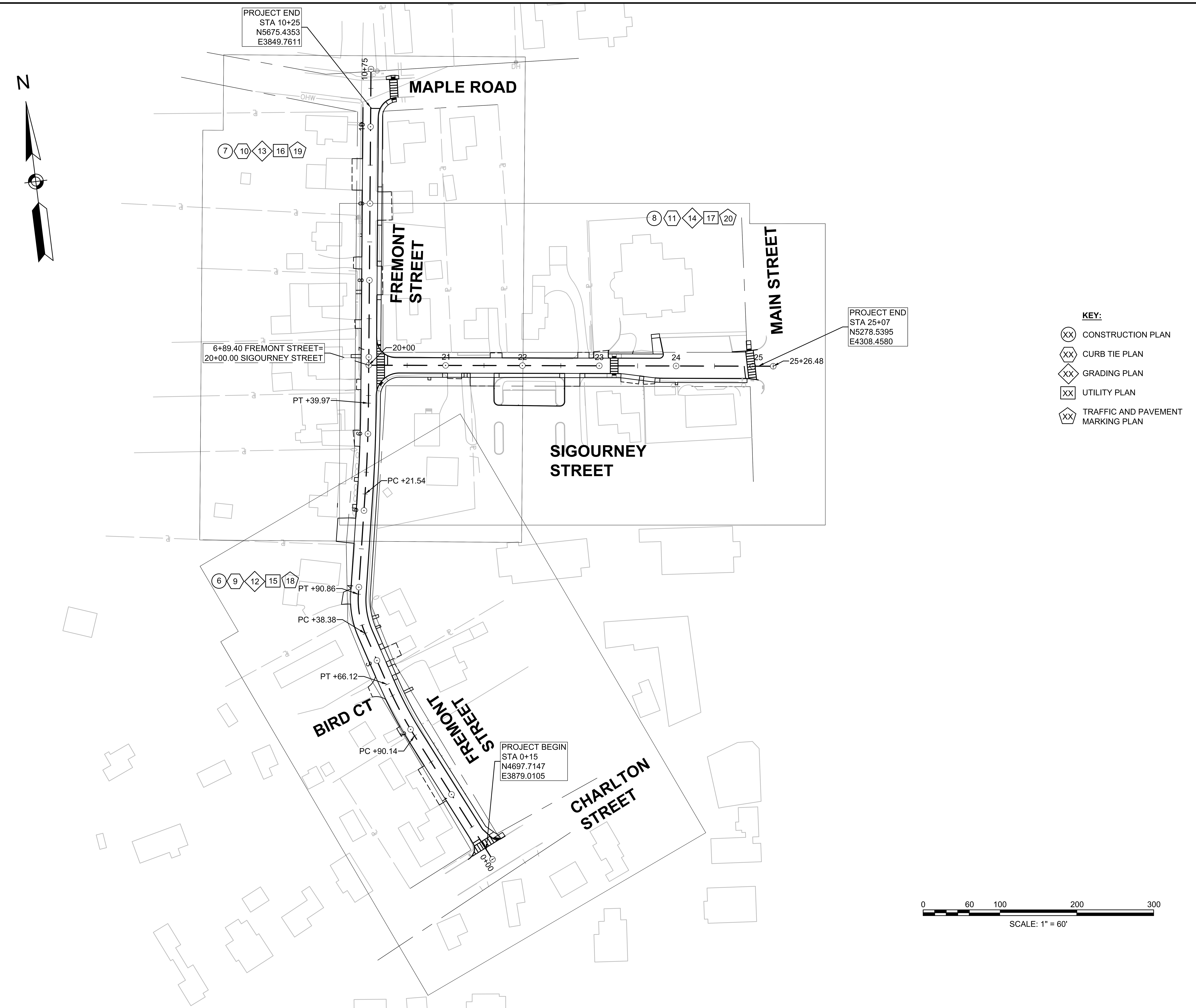
OXFORD
SIGOURNEY STREET AND FREMONT STREET
SIDEWALK CONSTRUCTION
SHEET 3 OF 28
KEY PLAN



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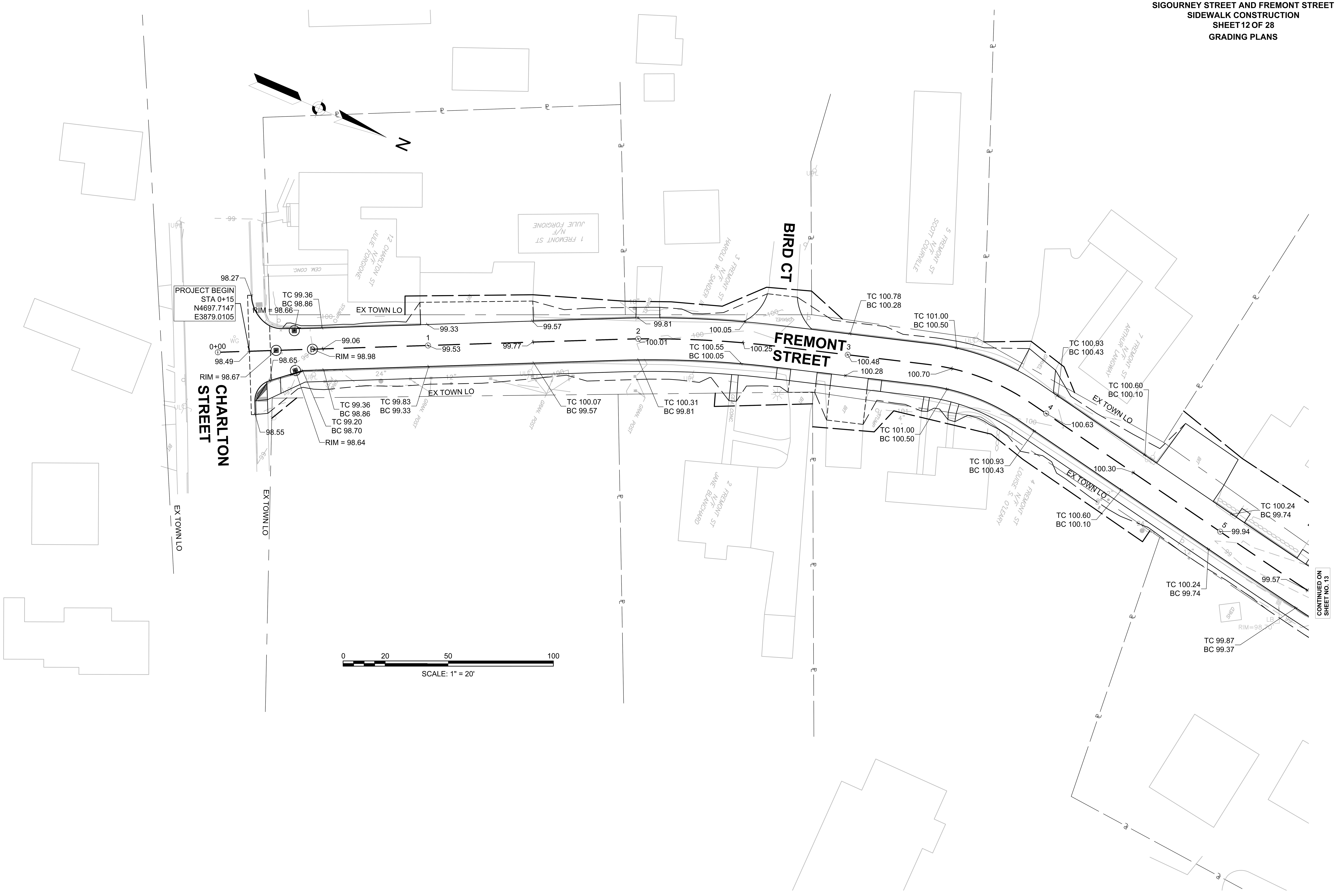
OXFORD
SIGOURNEY STREET AND FREMONT STREET
SIDEWALK CONSTRUCTION
SHEET 12 OF 28
GRADING PLANS



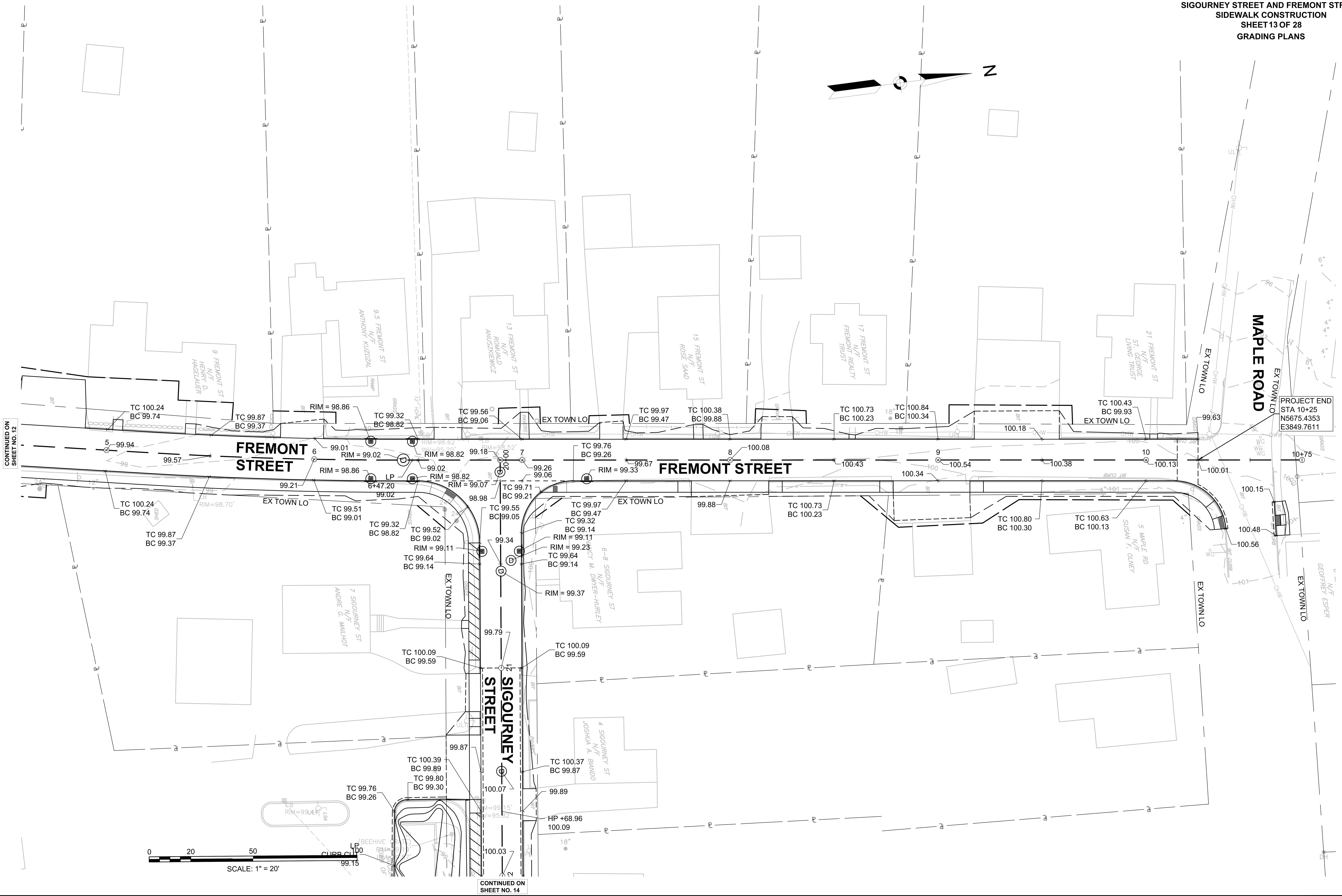
CONTINUED ON SHEET NO. 13

14521.3_HD_GRADING.DWG Plotted on 14-Mar-2023 3:27 PM

OXFORD
SIGOURNEY STREET AND FREMONT STREET
SIDEWALK CONSTRUCTION

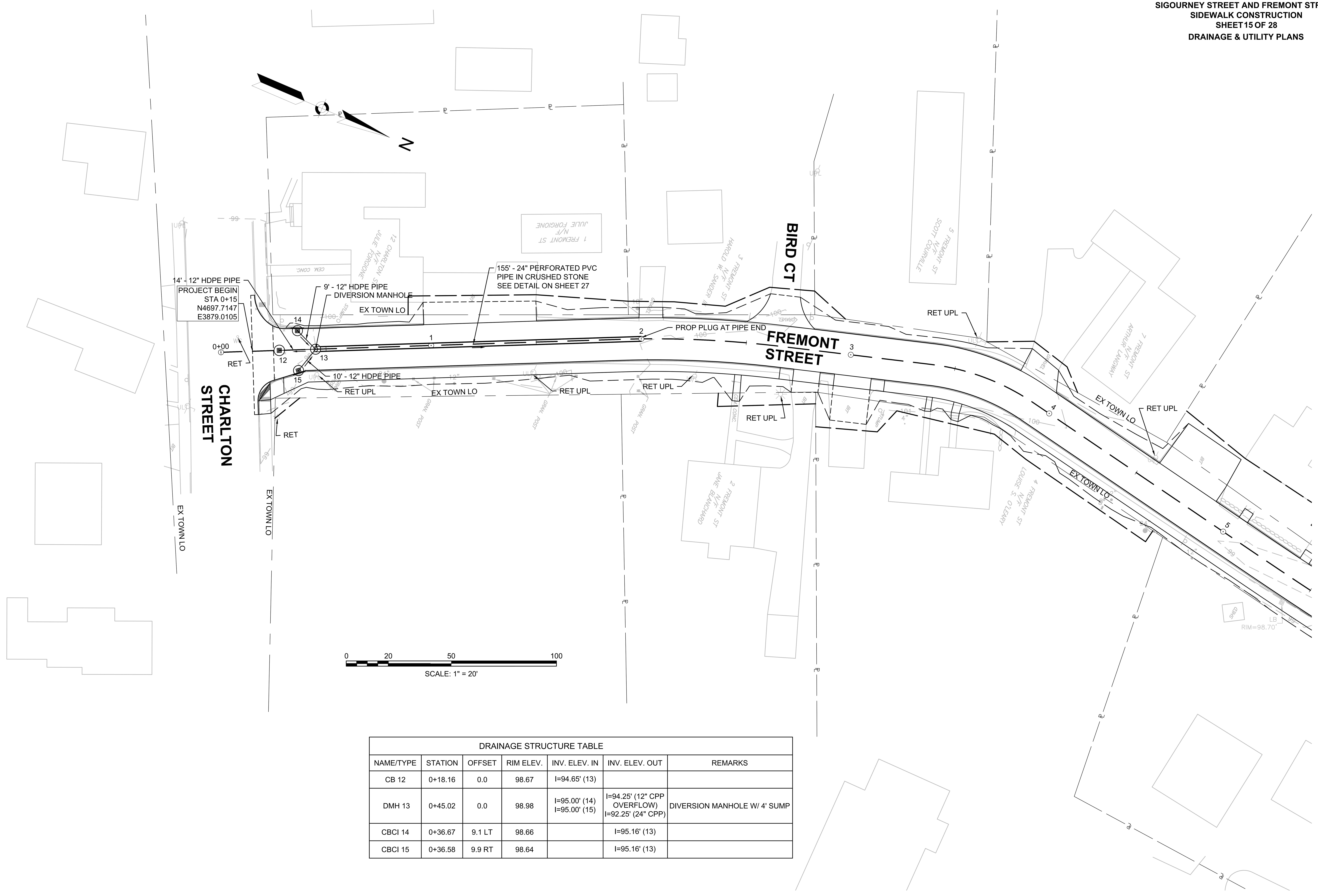
GRADING PLANS

Plotted on 14-Mar-2023 3:27 PM
14521.3_HD_GRADING.DWG



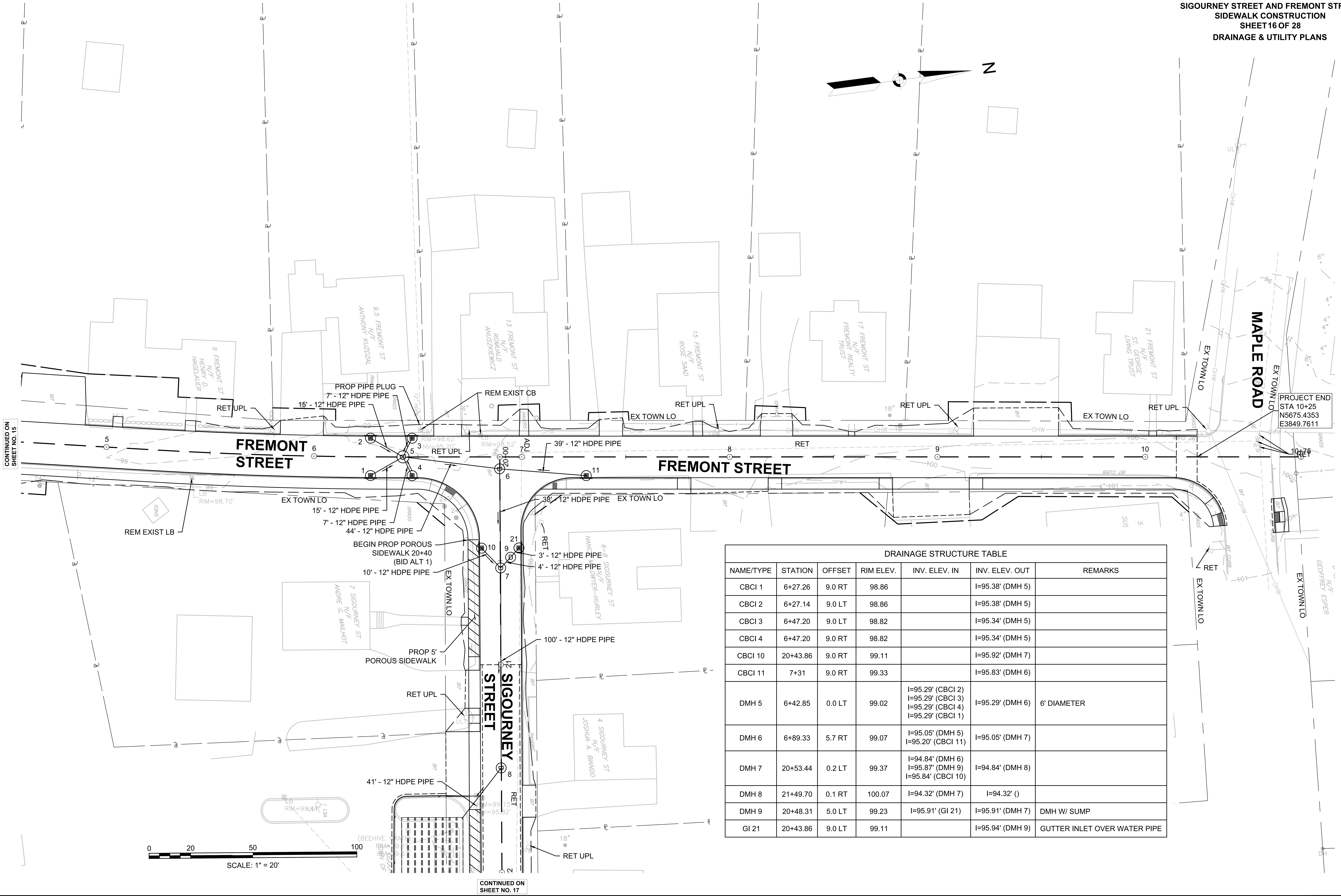
OXFORD
SIGOURNEY STREET AND FREMONT STREET
SIDEWALK CONSTRUCTION
SHEET 14 OF 28
GRADING PLANS

Plotted on 14-Mar-2023 3:28 PM
14521.3_HD_GRADING.DWG



DRAINAGE STRUCTURE TABLE						
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT	REMARKS
CB 12	0+18.16	0.0	98.67	I=94.65' (13)		
DMH 13	0+45.02	0.0	98.98	I=95.00' (14) I=95.00' (15)	I=94.25' (12" CPP OVERFLOW) I=92.25' (24" CPP)	DIVERSION MANHOLE W/ 4' SUMP
CBCI 14	0+36.67	9.1 LT	98.66		I=95.16' (13)	
CBCI 15	0+36.58	9.9 RT	98.64		I=95.16' (13)	

14521.3_HD_DRAINAGE & UTILITY.DWG Plotted on 15-Mar-2023 3:14 PM



CONTINUED ON SHEET NO. 15

CONTINUED ON SHEET NO. 17

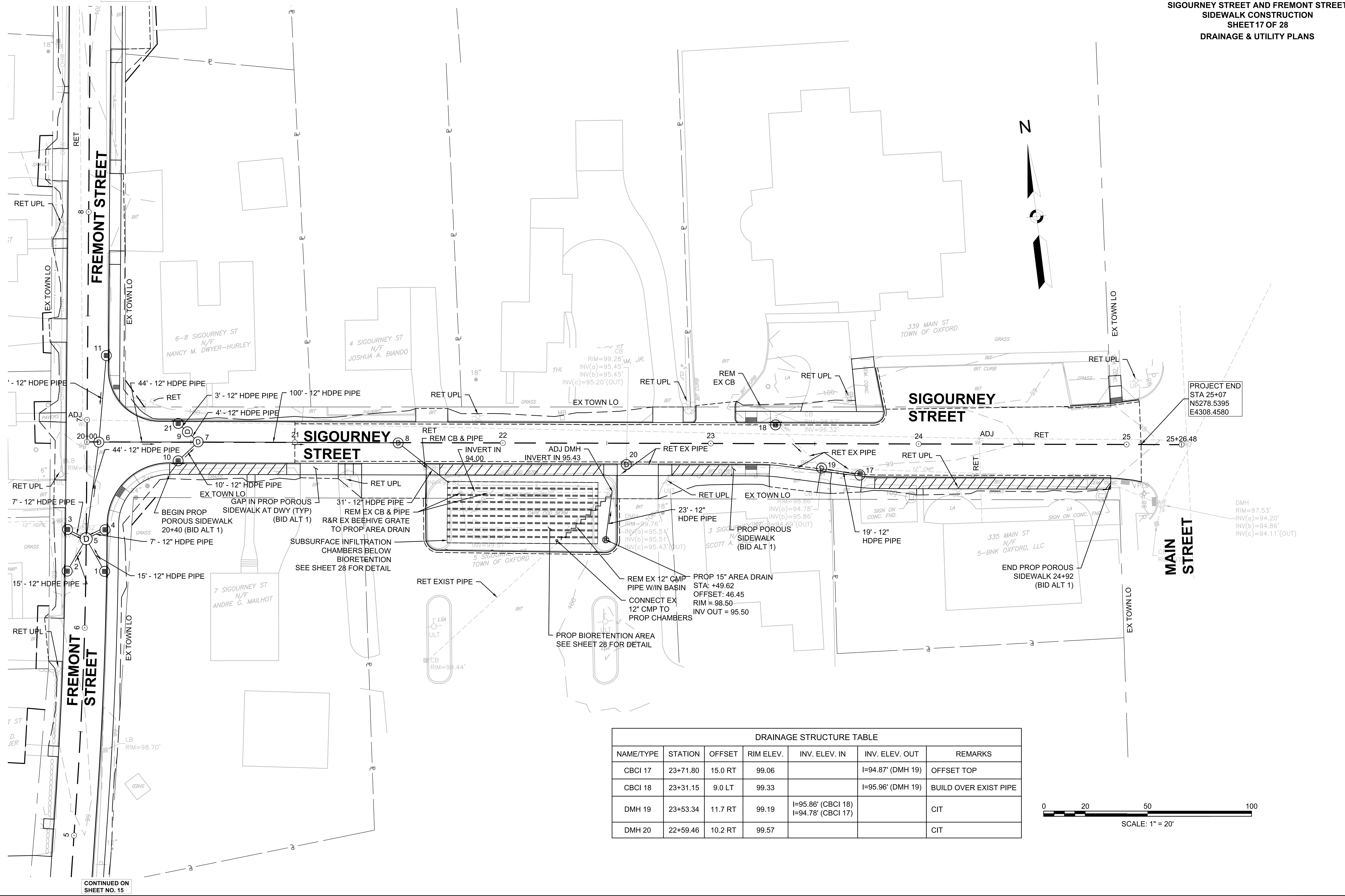
DRAINAGE STRUCTURE TABLE

NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT	REMARKS
CBCI 1	6+27.26	9.0 RT	98.86		I=95.38' (DMH 5)	
CBCI 2	6+27.14	9.0 LT	98.86		I=95.38' (DMH 5)	
CBCI 3	6+47.20	9.0 LT	98.82		I=95.34' (DMH 5)	
CBCI 4	6+47.20	9.0 RT	98.82		I=95.34' (DMH 5)	
CBCI 10	20+43.86	9.0 RT	99.11		I=95.92' (DMH 7)	
CBCI 11	7+31	9.0 RT	99.33		I=95.83' (DMH 6)	
DMH 5	6+42.85	0.0 LT	99.02	I=95.29' (CBCI 2) I=95.29' (CBCI 3) I=95.29' (CBCI 4) I=95.29' (CBCI 1)	I=95.29' (DMH 6)	6' DIAMETER
DMH 6	6+89.33	5.7 RT	99.07	I=95.05' (DMH 5) I=95.20' (CBCI 11)	I=95.05' (DMH 7)	
DMH 7	20+53.44	0.2 LT	99.37	I=94.84' (DMH 6) I=95.87' (DMH 9) I=95.84' (CBCI 10)	I=94.84' (DMH 8)	
DMH 8	21+49.70	0.1 RT	100.07	I=94.32' (DMH 7)	I=94.32' ()	
DMH 9	20+48.31	5.0 LT	99.23	I=95.91' (GI 21)	I=95.91' (DMH 7)	DMH W/ SUMP
GI 21	20+43.86	9.0 LT	99.11		I=95.94' (DMH 9)	GUTTER INLET OVER WATER PIPE

14521.3_HD_DRAINAGE & UTILITY.DWG Plotted on 15-Mar-2023 3:14 PM

OXFORD
SIGOURNEY STREET AND FREMONT STREET
SIDEWALK CONSTRUCTION
SHEET 17 OF 28
DRAINAGE & UTILITY PLANS

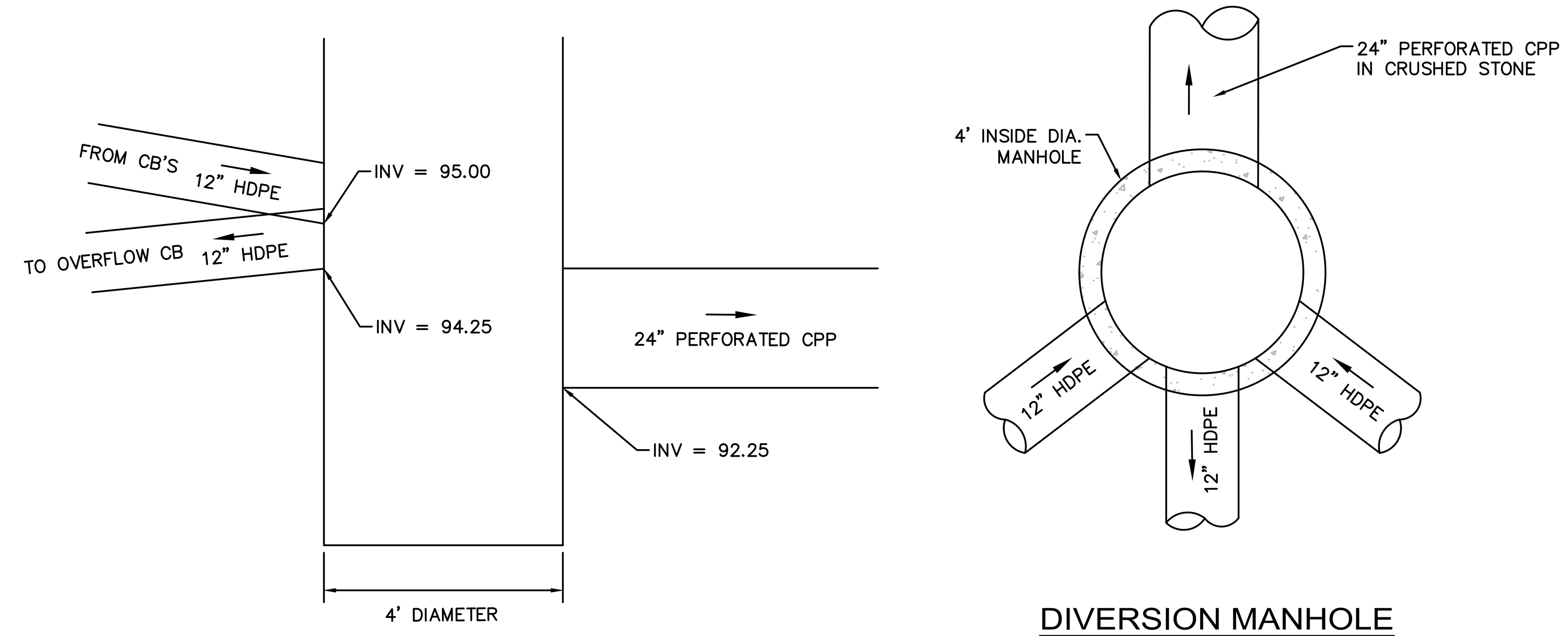
CONTINUED ON SHEET NO. 16



DRAINAGE STRUCTURE TABLE

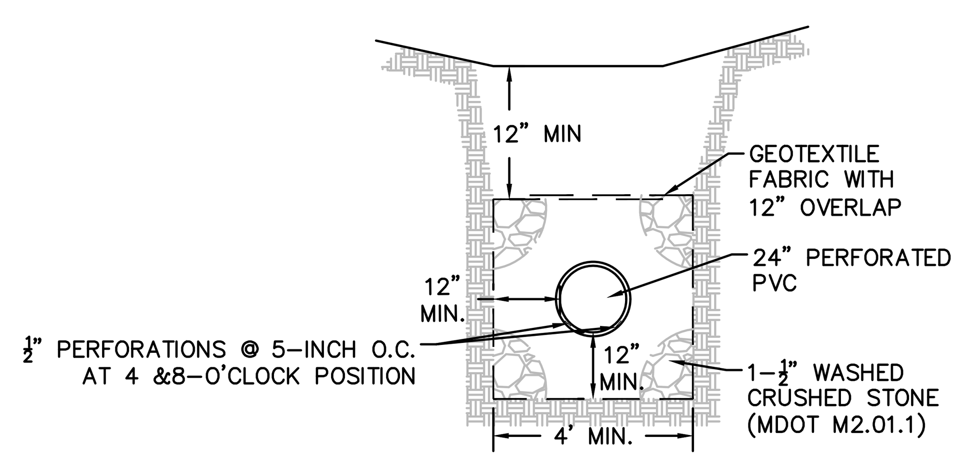
NAME/TYPE	STATION	OFFSET	RIM ELEV.	INV. ELEV. IN	INV. ELEV. OUT	REMARKS
CBCI 17	23+71.80	15.0 RT	99.06		I=94.87' (DMH 19)	OFFSET TOP
CBCI 18	23+31.15	9.0 LT	99.33		I=95.96' (DMH 19)	BUILD OVER EXIST PIPE
DMH 19	23+53.34	11.7 RT	99.19	I=95.86' (CBCI 18) I=94.78' (CBCI 17)		CIT
DMH 20	22+59.46	10.2 RT	99.57			CIT

CONTINUED ON SHEET NO. 15



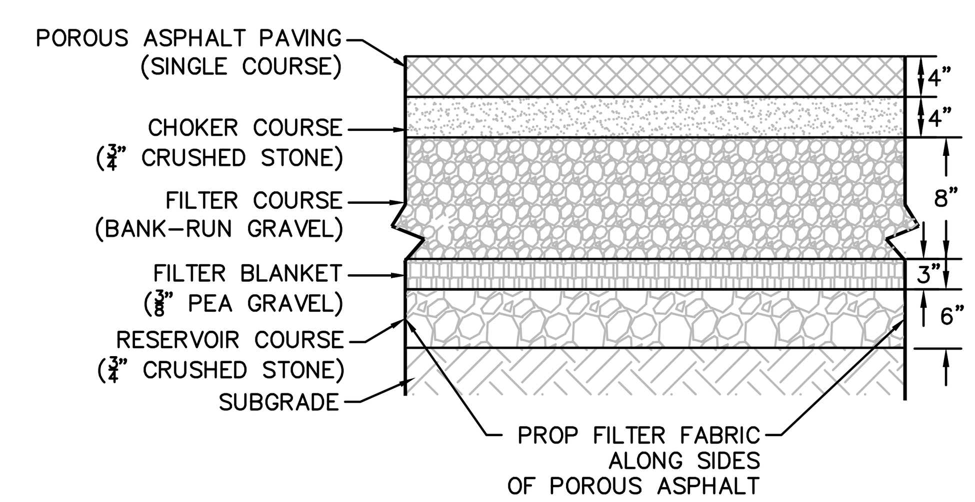
DIVERSION MANHOLE

NOT TO SCALE



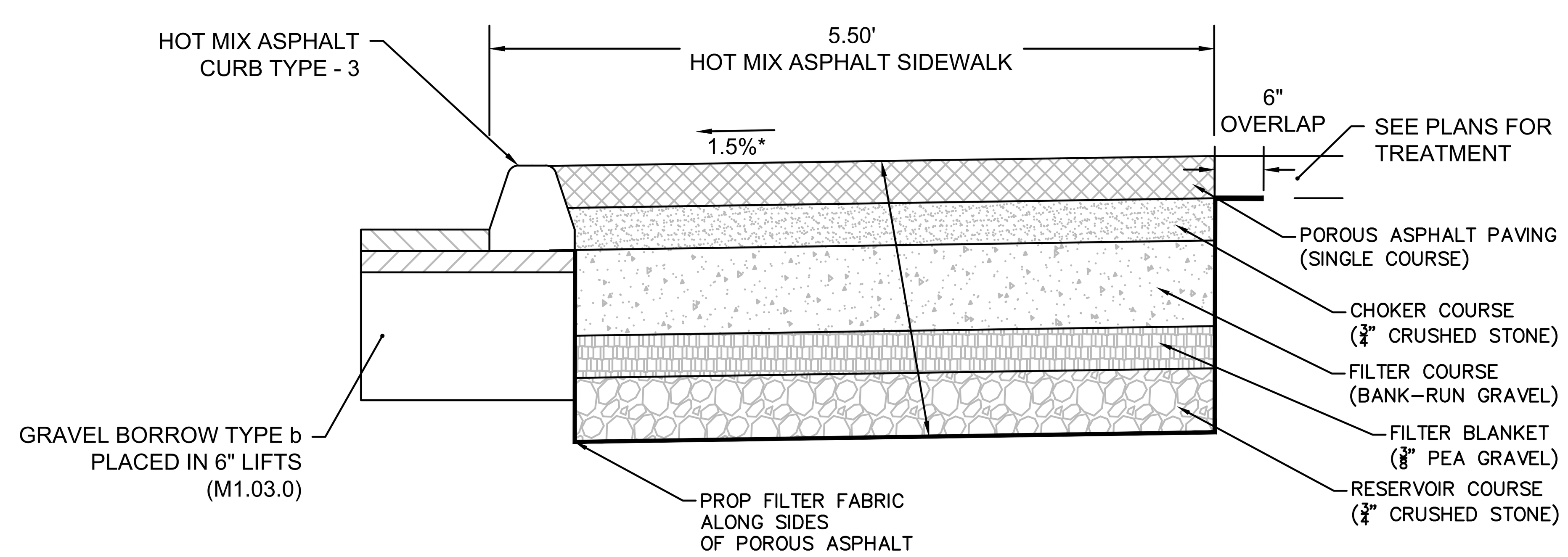
24" PERFORATED CPP IN CRUSHED STONE

NOT TO SCALE



TYPICAL POROUS ASPHALT SECTION DETAIL

NOT TO SCALE

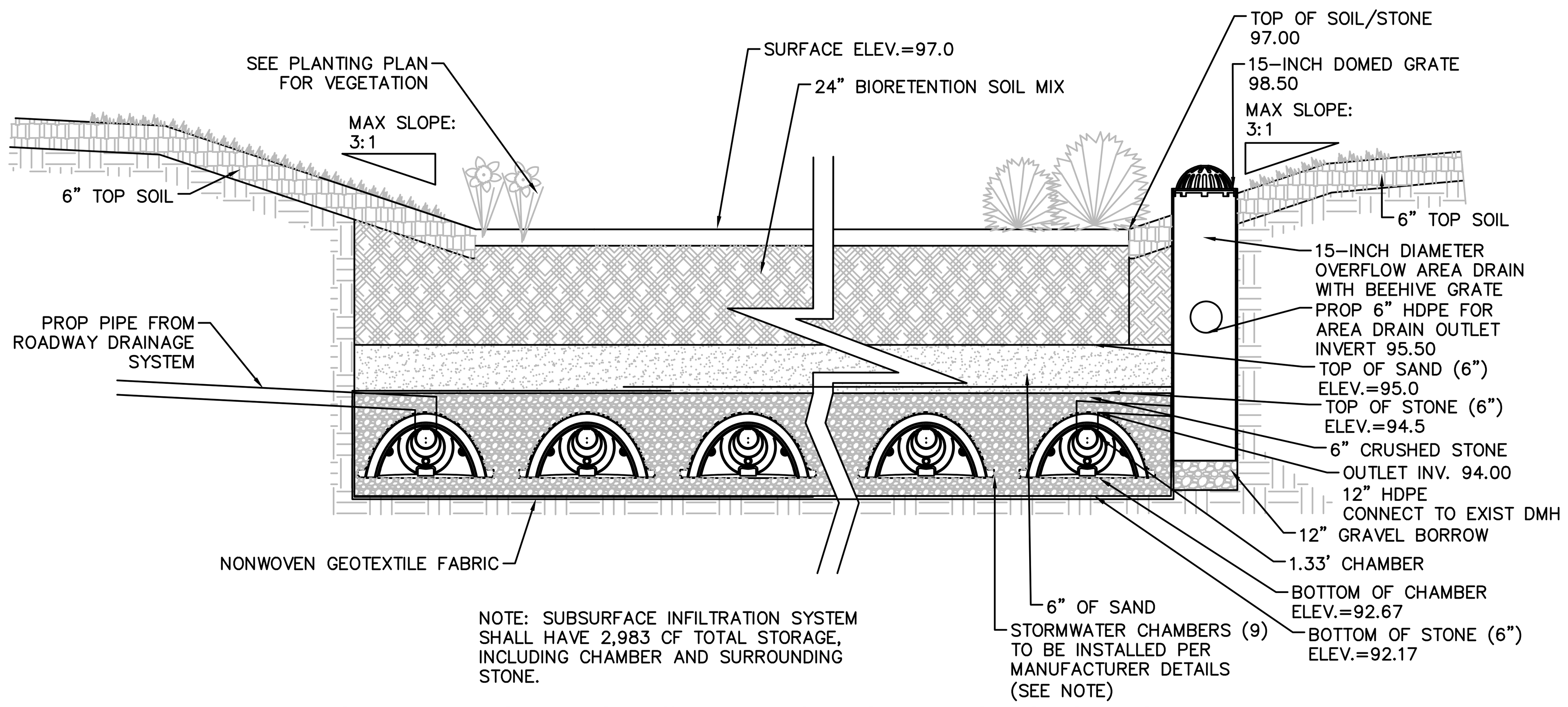


*= TOLERANCE FOR CONSTRUCTION ±0.5%

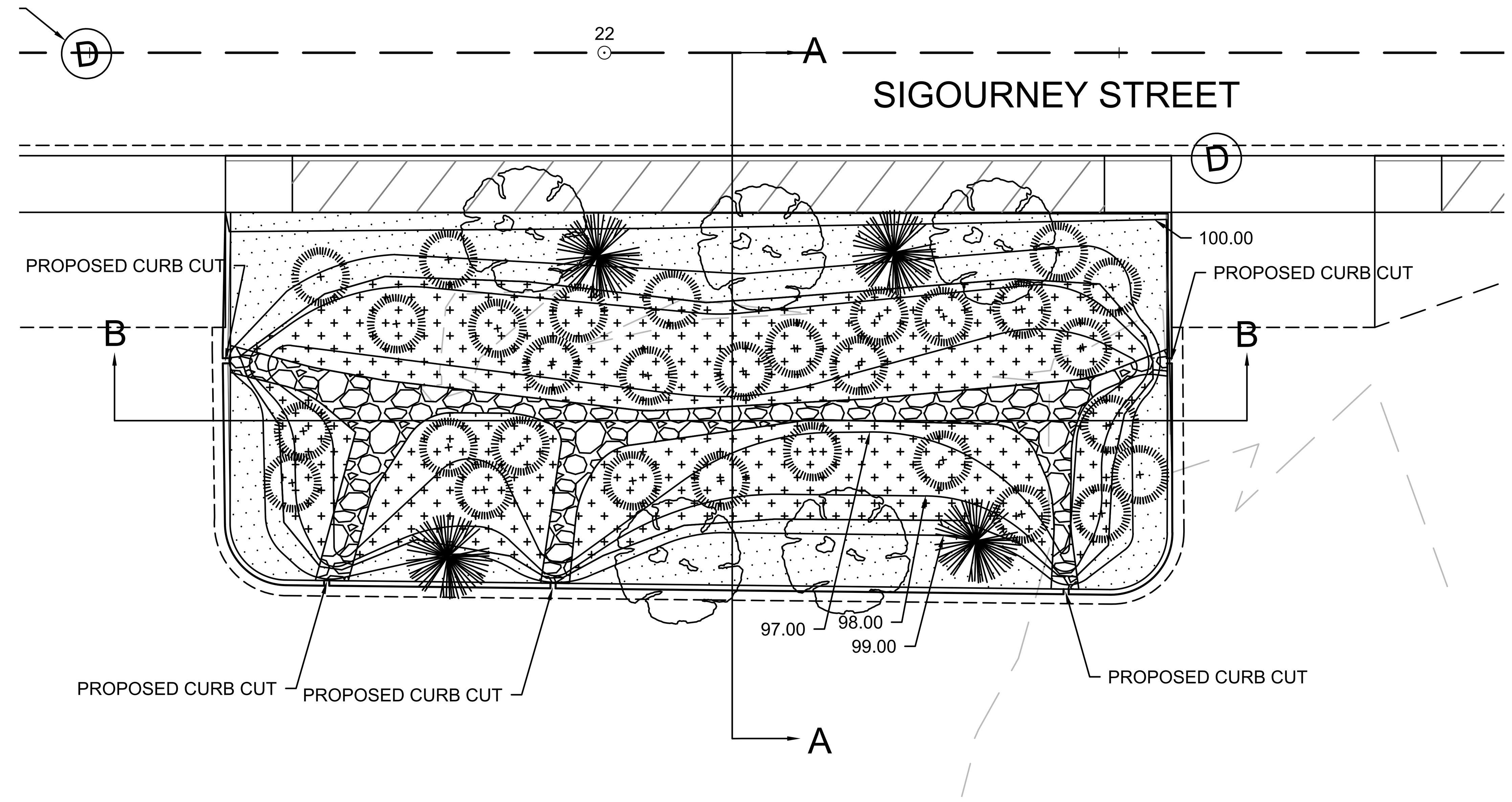
POROUS ASPHALT SECTION DETAIL AT SIDEWALK

NOTES:

1. EXCAVATION, POROUS MEDIA, GRADING, FILTER FABRIC, AND BACKFILL MATERIALS, FOR POROUS HOT MIX ASPHALT SHALL BE INCLUDED UNDER THE CONTRACT UNIT PRICE FOR ITEM 702.5 - POROUS ASPHALT SIDEWALK.
2. HMA CURB INSTALLATION SHALL BE MEASURED AND PAID FOR UNDER ITEM 570.3, HOT MIX ASPHALT CURB - TYPE 3.
3. GRAVEL BORROW UNDER THE CURB AND ROADWAY SHALL BE MEASURED AND PAID FOR UNDER ITEM 151, GRAVEL BORROW.
4. POROUS ASPHALT SHALL NOT BE USED IN VEHICULAR AREAS.
5. THE FULL PERMEABILITY OF THE PAVEMENT SURFACE SHALL BE TESTED BY APPLICATION OF CLEAN WATER AT THE RATE OF AT LEAST 5 GALLONS PER MINUTE (GPM) OVER THE SURFACE, USING A HOSE OR OTHER DISTRIBUTION DEVICE.



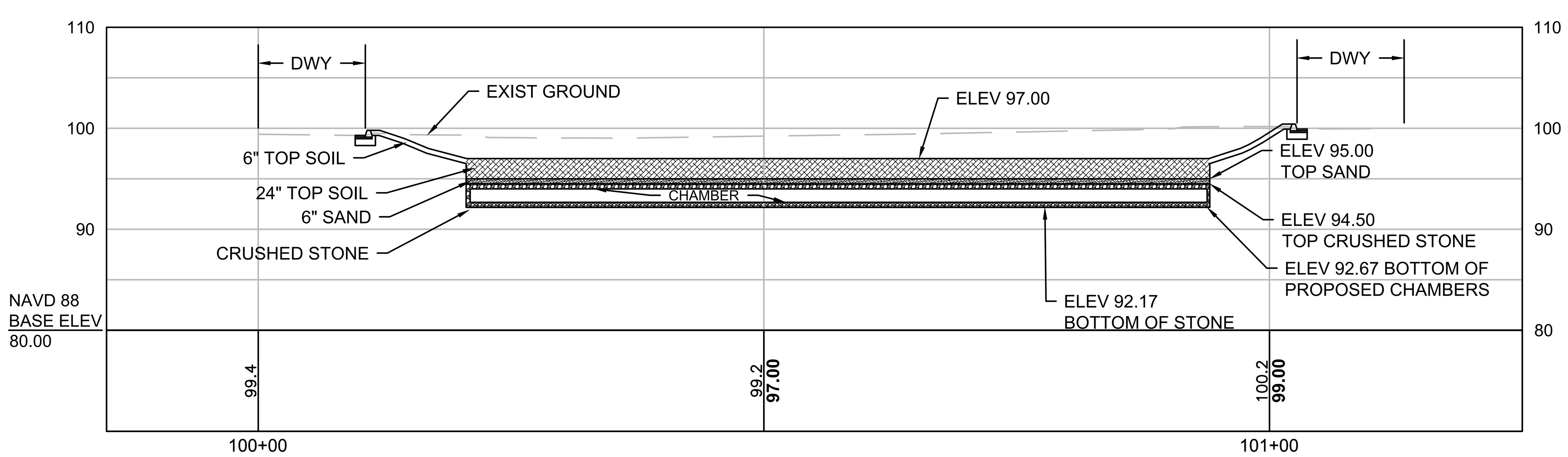
BIORETENTION BASIN #1 WITH SUBSURFACE STORAGE
NOT TO SCALE



BIORETENTION PLAN VIEW
SCALE: 1" = 10'

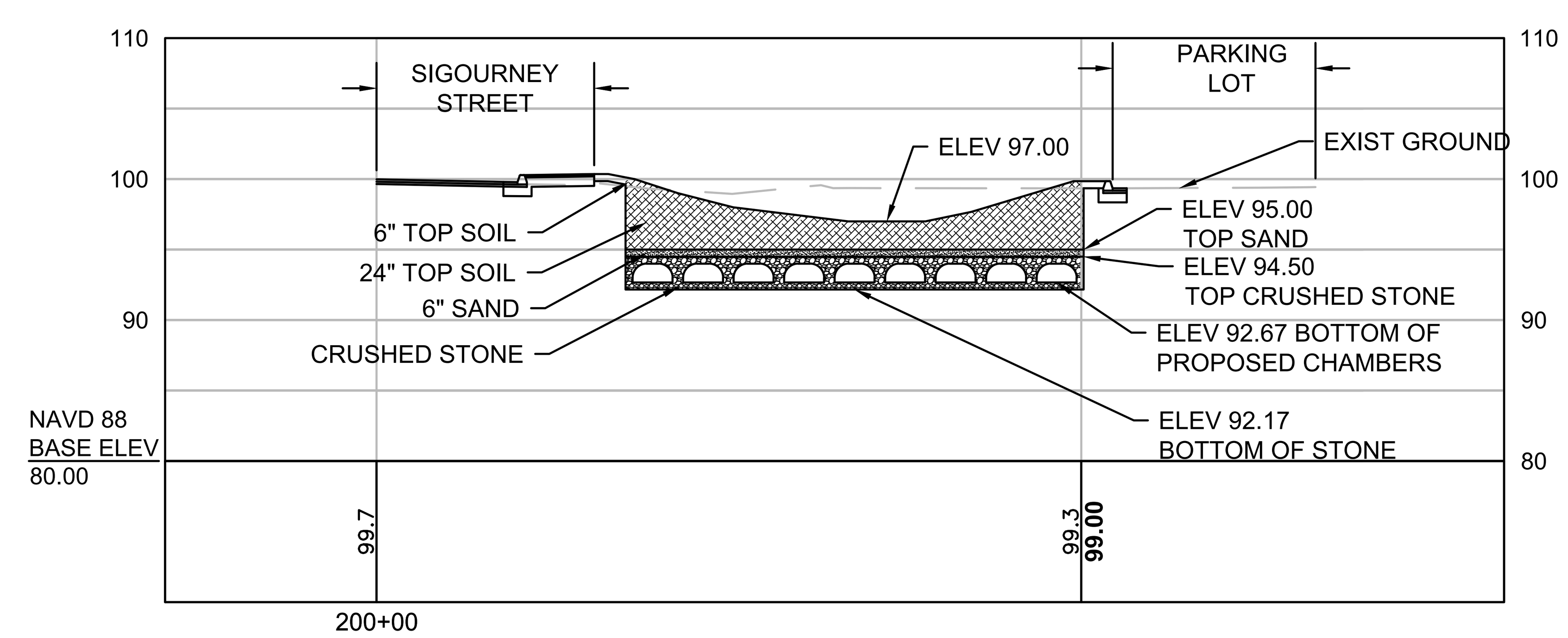
PLANTING SCHEDULE			
	SYMBOL	SPECIES	QUANTITY
SMALL DECIDUOUS TREES		BETULA NIGRA, CORNUS FLORIDA, PRUNUS VIRGINIANA	5
SMALL CONIFEROUS TREES		JUNIPERUS VIRGINIANA	4
SHRUBS		VIBURNUM DENTATUM, VACCINUM CORYMBOSUM, CORNUS AMOMUM, SAMBUCUS CANADENSIS	30
SEEDMIX A		SHORT ROADSIDE POLLINATOR MEADOW MIX * MODIFY TO ALL MA NATIVE SPECIES	1200 SF (ABOVE EL. 98.25)
SEEDMIX B		ROADSIDE RIVERBANK MIX	3100 SF (BELOW EL. 98.25)
MODIFIED ROCKFILL		8" ANGLED STONE	400 SF

BIORETENTION A-A



BIORTENTION SECTION VIEW A-A
(WEST TO EAST)
SCALE: 1" = 10'

BIORETENTION B-B



BIORETENTION SECTION VIEW B-B
(NORTH TO SOUTH)
SCALE: 1" = 10'