# Stormwater Master Plan for the Town of Wilmington, Vermont

## FINAL REPORT

## April 30, 2025

**Eroded Ditch at Project WIL-30**

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# 1.0 Introduction

In 2022, Fitzgerald Environmental Associates (FEA) was contracted by the Vermont Department of Environmental Conservation (VTDEC) to develop a Stormwater Master Plan (SWMP) for the Town of Wilmington. This final SWMP report for the Town of Wilmington represents significant efforts and collaborations over the last year between the Town, FEA, VTANR, and other partners, including private landowners and business owners, interested in mitigating stormwater and improving water quality.

## 1.1 Stormwater Master Planning

Stormwater runoff is caused by precipitation, both in the form of rain or melting snow/ice, that is not infiltrated into the ground, absorbed by wetlands, or otherwise intercepted by plants. Human alteration of our landscapes in the form of impervious surfaces (i.e., pavement, rooftops) and compaction of soils disrupts natural hydrology and causes increased stormwater runoff. Increased stormwater runoff leads to higher magnitude flood flows and greater erosive power in stream channels, increased delivery of sediment, nutrients, and other pollutants to waterways, and increased flooding conflicts with improved properties downstream. Increased stormwater runoff is directly linked to the quality of water in our streams, rivers, ponds, and lakes that we depend on for drinking water, healthy fisheries, and recreation.

Stormwater master plans can prevent problems from happening either by mitigating impacts before they create problems or by avoiding the creation of problems; in other words, prevention is cheaper than restoration. If we are to avoid the high cost of restoring degraded surface waters, we must better manage stormwater runoff before waters become impaired. Plans are developed with public involvement and comment and should be as comprehensive as possible in listing all known problems. Plans are based on a prioritized list of projects or a strategic approach and are therefore more likely to succeed than a reactionary approach that addresses problems as they arise. Historically almost all Vermont municipalities have responded to stormwater runoff or drainage problems the latter way, and frequently during an emergency or after a structural failure has occurred. Stormwater management plans contain important information about preserving natural features and functions of a watershed and provide a list of evaluated alternatives such as using traditional pipe (gray) infrastructure versus green stormwater infrastructure.

### 1.2 Project Goals and Objectives

The primary goals of this planning effort are to better manage stormwater runoff to reduce sediment and nutrient pollution into the North Branch of the Deerfield River, improve flood resiliency, and to reduce the Town's maintenance requirements in areas with chronic stormwater and drainage issues.

- Identify opportunities to incorporate stormwater treatment and/or outfall stabilization at the outfalls of existing closed stormwater conveyance systems.
- Identify opportunities to incorporate green stormwater infrastructure within the Village of Wilmington and other developed areas.
- Identify opportunities to improve stormwater management in areas with active erosion and/or poor conveyances.

Project prioritization followed the Unified Scoring Metrics developed by VTDEC (2023) and Non-Unified Scoring Metrics (**Section 4.3**). Conceptual design plans (30% design) were prepared for 5 high-priority projects. Phosphorus loading and removal estimates were provided for each project to assist the Town with prioritization for meeting water quality goals.

## 2.0 Study Area Description

Wilmington is a 41.3 square mile town located in Windham County in Southern Vermont (**Figure 1**). As of the 2020 census, Wilmington has a total population of 2,255 people (U.S. Census Bureau, 2020). The Town's area is primarily forested and is 9.6% developed (**Table 1**). The Hermitage Club, a private ski area, is located within the Town and constitutes a large, developed area. Wilmington is bordered by 7 Vermont towns (Dover, Marlboro, Halifax, Whitingham, Readsboro, Searsburg, and Somerset). Most of the roads in Wilmington are municipal and private, with 11.8% of the Town's road length on Vermont State Highways (**Table 2**). The Town of Wilmington lies within the Upper Deerfield River watershed. Soil hydrogroup coverage within the Town is shown in **Table 3**.

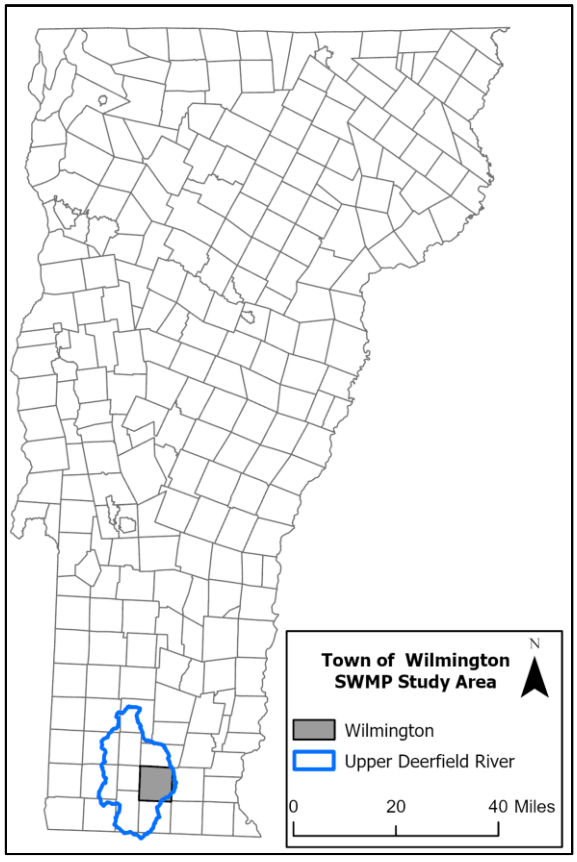


**Figure 1:** Town of Wilmington and Associated Watershed Location Map

**Table 1:** Land cover in Wilmington (Dewitz and U.S Geological Survey 2021)

| Landcover/Landuse Type | % of Town |
|---|---|
| Agriculture | 6.4 |
| Barren | 0.1 |
| Developed | 9.6 |
| Forest | 75.8 |
| Grassland/Herbaceous | 0.3 |
| Open Water | 4.4 |
| Shrub/Scrub | 0.8 |
| Wetland | 2.6 |

**Table 2:** Road length by AOT Class in Wilmington (Enhanced 911 Board, 2022)

| AOT Class | Description | Length (miles) | % of Town Road Length (excluding discontinued) |
|---|---|---|---|
| 1 | Class 1 Town Highway | - | - |
| 2 | Class 2 Town Highway | 13.1 | 10.7 |
| 3 | Class 3 Town Highway | 54.5 | 44.5 |
| 4 | Class 4 Town Highway | 7.08 | 5.8 |
| 5 | State Forest Highway | 1.03 | 0.8 |
| 6 | National Forest Highway | - | - |
| 7 | Legal Trail | - | - |
| 8 & 9 | Private Road | 32.2 | 26.3 |
| 30 | Vermont State Highway | 14.4 | 11.8 |
| 40 | US Highway | - | - |
| Other | - | 0.23 | 0.2 |
| 96 | Discontinued Road | 0.55 | - |

**Table 3:** Summary of town-wide soil drainage (VCGI, 2022).

| Soil Hydrogroup | Area (acres) | Area (%) |
|---|---|---|
| A | 565 | 2.1 |
| B | 8,782 | 32.3 |
| C | 7,738 | 28.5 |
| D | 8,787 | 32.3 |
| water | 1,301 | 4.8 |

## 3.0 Stormwater Management Planning Library

### 3.1 Mapping Data

VTDEC Municipal Roads Program

A Road Erosion Inventory (REI) for the Town of Wilmington was conducted by the Windham Regional Commission (WRC) in 2018. The REI was developed for municipalities to fulfill requirements of the VTDEC Municipal Roads General Permit (MRGP). In this inventory, roads are divided into 100-meter (328 ft) segments with unique identification numbers. The segments deemed hydrologically connected to surface waters are assessed in the field and given a road erosion score. This score is determined from characteristics of the roadway and of the stormwater drainage features associated with it (crown, berm, ditch, conveyance stability, culverts, etc). Each segment is classified as "Fully Meets", "Partially Meets", or "Does Not Meet", to reflect the current level of conformance with the MRGP standards. Of the 577 hydrologically connected segments inventoried in Wilmington, 76 (13.2%) did not meet MRGP standards and 157 (27.2%) partially met MRGP standards (link). Roads in the Town with segments that did not meet or partially met MRGP standards included Boyd Hill Road, Shearer Hill Road, and Higley Hill Road, among others. The MRGP specifies a timeline for bringing all road segments up to standards. High priority segments identified in the REI are potentially important opportunities to reduce erosion and sediment loading to receiving waters.

Light Detection and Ranging (LiDAR)

LiDAR returns for Wilmington were collected in a series of flights conducted during 2015 as part of the VT LiDAR Initiative. The data meet the National Digital Elevation Program Quality Level 2 specifications for accuracy satisfactory for generation of a 0.7-meter Digital Elevation Model (DEM) and 1-foot contours. Derivations of LiDAR data, such as Digital Elevation Models (DEMs), terrain models, and contours are useful tools for stormwater feature identification and site design. The 0.7-meter DEM can assist in culvert watershed delineation and the design of stormwater management projects. Terrain models can assist in remote identification of erosion features, such as stormwater gullies.

Municipal Bridge and Culvert Data

Culvert and bridge data collected by the WRC for Town roads in Wilmington are available online (https://vtculverts.org/). The dataset includes the structure dimensions and overall conditions but does not include the presence/absence of erosion. While most culverts were rated as good or excellent, a few were rated as poor (5%) or fair (9%). We will review the culvert data to refine the selection of non-stream culverts we focus on during field surveys.

Town of Wilmington Stormwater Infrastructure Mapping Project

This dataset was produced by the Vermont Agency of Natural Resources (VTANR) in 2019. The Stormwater Mapping Project documents the connectivity of stormwater infrastructure on private and public land within the Town of Wilmington. The data show the paths of stormwater from different areas of impervious surface (**Figures 2 and 3**). The associated report identifies four high priority sites for

improvement, and points to one site of moderate priority. Seven potential retrofit projects were identified in this study.

Natural Resources Conservation Service (NRCS) Soils Survey

The NRCS soils survey dataset is valuable for stormwater master planning (websoilsurvey.sc.egov.usda.gov). As part of our initial scoping, we will screen problem areas based on the NRCS hydrologic soil groupings (HSG). The HSGs indicate the infiltration potential of the native soil type, which is useful for identifying areas of excessive runoff potential (e.g., HSG D-type) or good infiltration (e.g., HSG A-type) where stormwater infiltration practices should be explored.

Flood Hazard Mapping

The FEMA DFIRM flood hazard dataset categorizes areas based on flooding potential. This dataset can inform planning on where high flow volumes will occur during major storm events. This dataset can also be used to inform BMP designs and location. BMPs proposed for locations upgradient of areas that are at high risk of flooding may have the potential to reduce downstream flooding and erosion issues. Prioritization of sites will be informed by flood hazard potentials to mitigate flood damage within the Village center.

River Corridor Mapping

River corridor maps were produced by the Vermont Agency of Natural Resources. These data display both the river channel and the active corridor through which a river can be expected to meander over time. This mapping can inform stormwater mitigation efforts by indicating where rivers and streams might flow during flood events. This dataset also identifies areas where the river channel has been altered or confined. These problem areas are often prone to erosion and flooding.

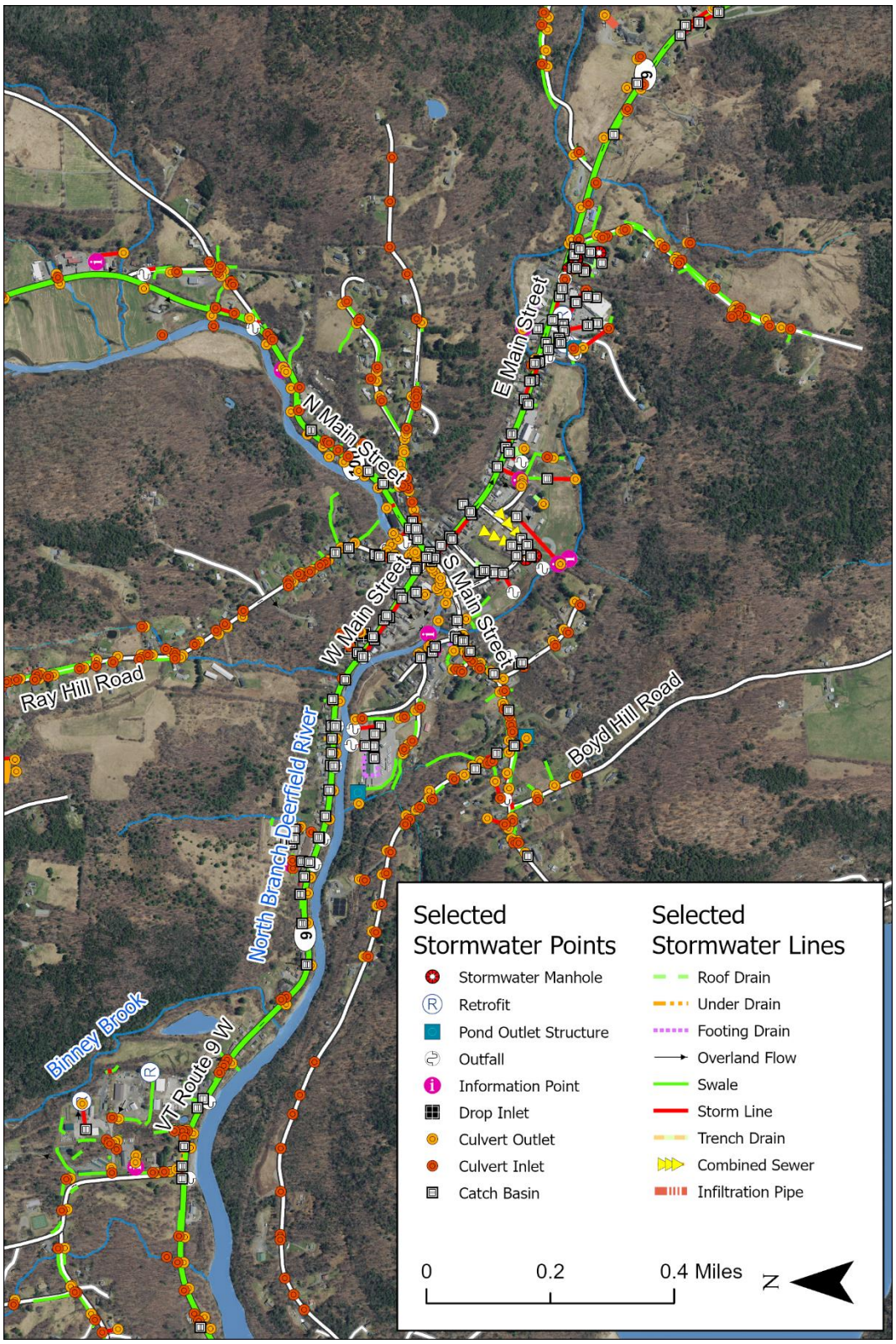


**Figure 2:** Wilmington Stormwater Infrastructure Map

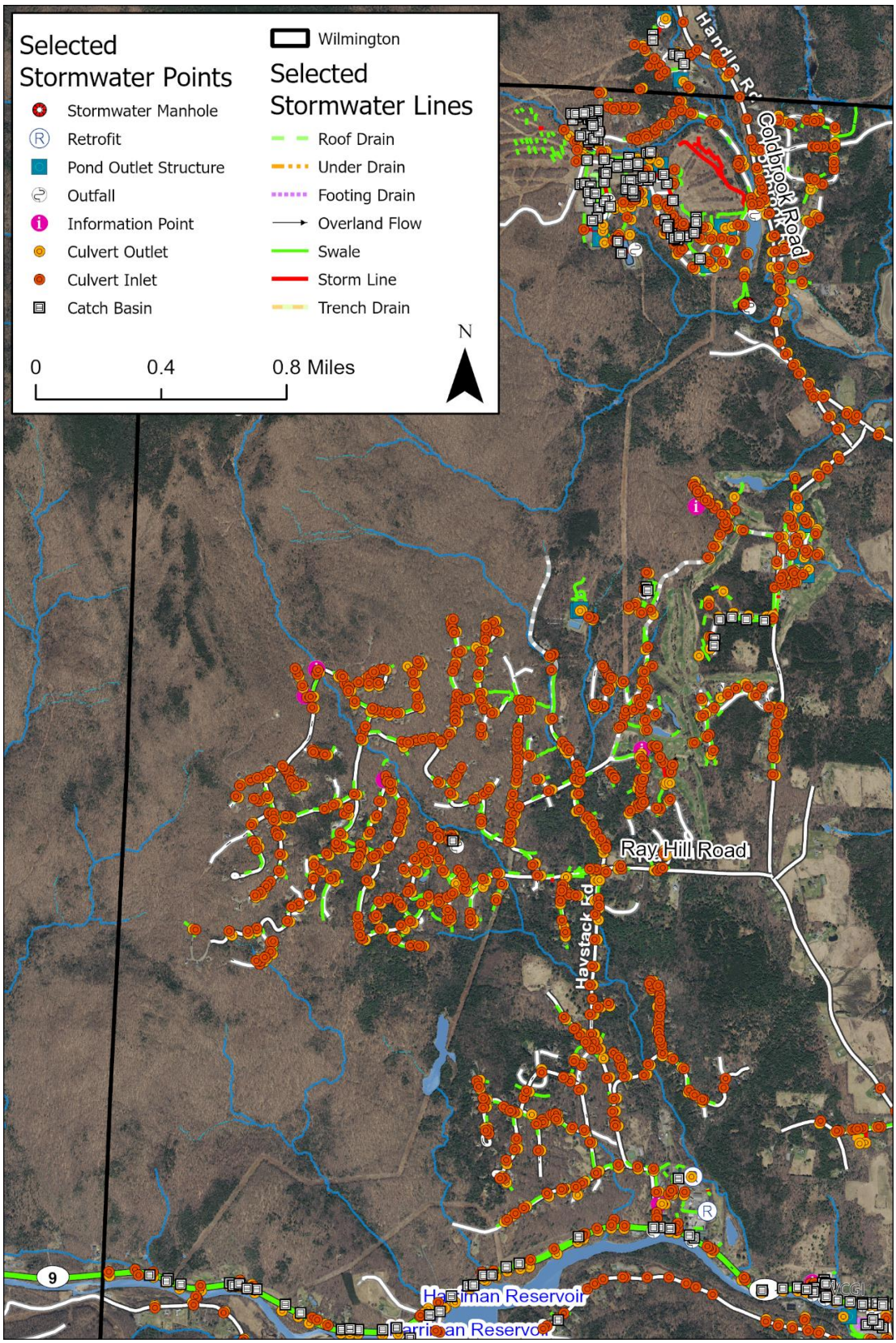


**Figure 3:** The Hermitage Club Stormwater Infrastructure Map

## 3.2 Watershed Planning

Basin 12 Tactical Basin Plan

The Basin 12 Tactical Basin Plan was prepared by the Vermont Agency of Natural Resources in 2020. Basin 12 includes the Deerfield River, a short reach of the Connecticut River, and related tributaries. This Basin plan catalogs current surface water quality conditions, stressors, and recommended actions for water quality restoration. Roughly 82% of the basin is forested with 5% agriculture and 5 % developed.

Within Basin 12, Wilmington is located within the Deerfield River watershed, which drains 318 square miles. Near Wilmington, the Deerfield River is threatened by physical alteration, sedimentation, temperature stress, acid deposition, stormwater, nutrients, and *E. coli*. Harriman Reservoir, a portion of which is located in Wilmington, is threatened by mercury pollution and degraded lake and shore habitat. The Tactical Basin Plan draws focus to several potential projects for the Deerfield River. Those of particular relevance to Wilmington include developing and implementing stormwater control projects, working with the town of Wilmington to address high *E. coli* levels in the North Branch of the Deerfield River, and supporting smart growth development to slow forest fragmentation.

Basins 1 and 12 IDDE Report

The Illicit Discharge Detection and Elimination (IDDE) report for Basins 1 and 12 was produced by Stone Environmental for VTDEC in 2020. Researchers collected water samples at outfalls and junctions in stormwater systems and tested them for chemical and biological pollutants. Surveys in 2019 identified two locations in Wilmington with suspected illicit discharges. Any sites where stormwater and wastewater may be comingling are high priorities for the SWMP.

Deerfield River Water Quality and Aquatic Habitat Assessment Report

This report on water quality in the Deerfield River watershed was produced in 2012 by VTANR and VTDEC/ The study included monitoring for biological contaminants and E. coli as well as physical condition monitoring. Between 2006 and 2019, there were eight exceedances of the state E. coli standard at the upstream station on the North Branch of the Deerfield and nine exceedances at the downstream station. The study found that construction activity at Mount Snow Ski resort, just north of Wilmington, contributes to a reduction in density of the macroinvertebrate community.

North Branch of the Deerfield River Corridor Management Plan

This River Corridor Management Plan was developed by Bear Creek Environmental for the Windham Regional Commission in 2013. The River Corridor Management Plan uses data collected during the 2005 Phase 2 Stream Geomorphic Assessment (SGA) to generate a list of potential restoration projects. The Phase 2 SGA was conducted on select reaches of the North Branch of the Deerfield River. Major problems in these reaches include human-caused channel and valley constriction. Channel straightening and stream bank armoring have all brought the North Branch Deerfield River channel away from its natural geomorphology and caused increased risk of damage and erosion during high flow events. Some other general information about each reach is summarized in **Table 3**. The locations of these reaches are shown

in **Figure 4**. Potential projects identified in these reaches include removing old abutments, streamside plantings to restore the riparian buffer, and protecting the river corridor through easement.

**Table 3:** Summary of Phase 2 Reaches in Wilmington

| Stream | Reach | Existing Stream Type | Habitat Condition | Geomorphic Condition |
|---|---|---|---|---|
| North Branch Deerfield River | T2.01 | - | - | - |
| | T2.02 | F | Fair | Fair |
| | T2.03A | F | Fair | Fair |
| | T2.03B | C | Fair | Fair |
| | T2.04A | | Poor | Fair |
| | T2.04B | B | Poor | Fair |
| | T2.05 | C | Fair | Fair |
| | T2.06 | C | Fair | Fair |
| | T2.07 | F | Fair | Fair |
| | T2.08A | C | Fair | Fair |
| | T2.08B | F | Fair | Fair |

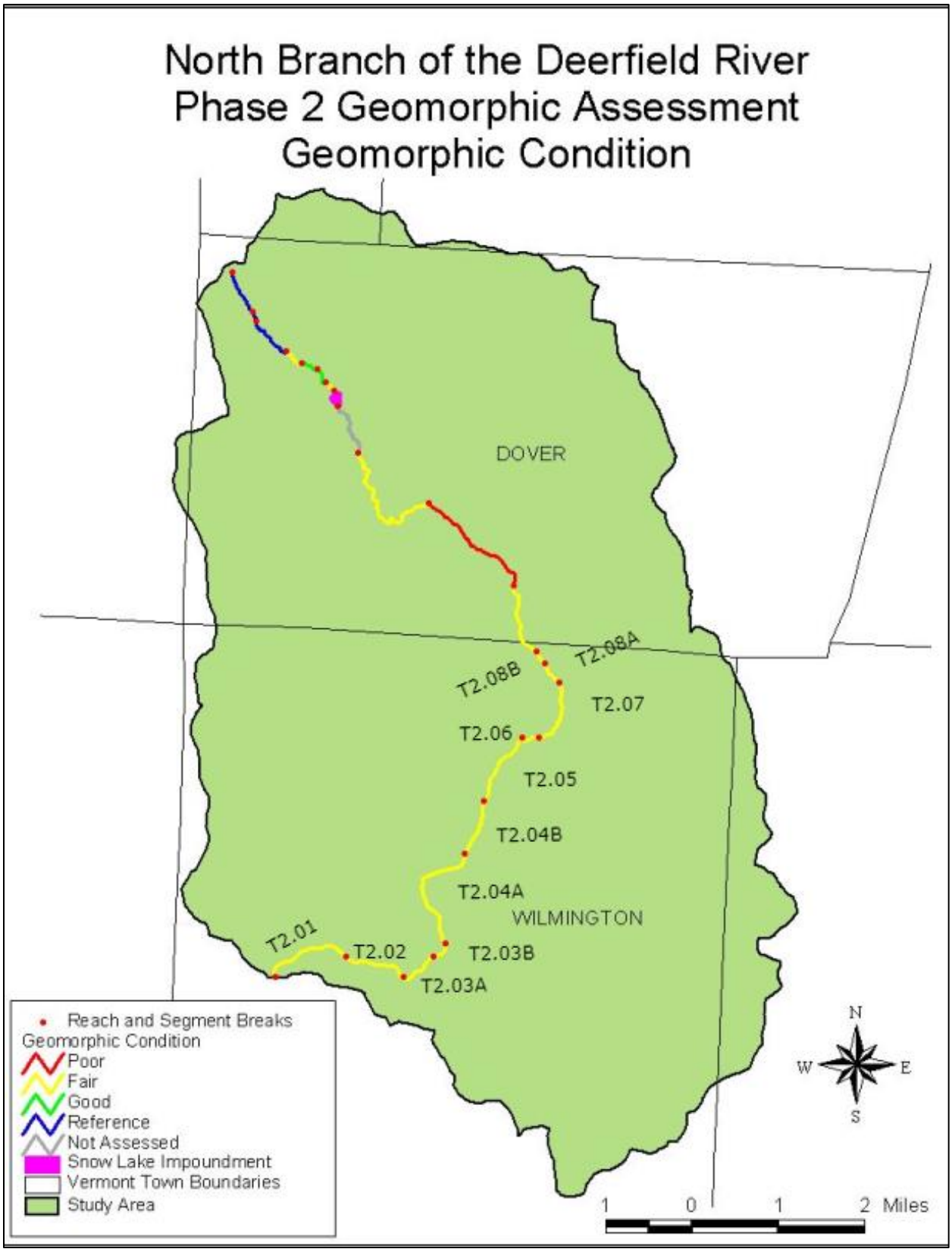


**Figure 4:** Map of Phase 2 Reaches in Wilmington (Bear Creek Environmental 2006)

## 3.3 Town Planning and Permitting

Wilmington Town Plan

The Wilmington Town Plan was adopted by the Town in October 2018 and was developed by the Wilmington Planning Commission. Goals of the town plan include, "making Wilmington a flood resilient community", to "protect and preserve the important natural resources and features important to the town", and to "manage rivers, streams, and waters in conformity with state and federal guidelines". Proposed actions for achieving the above goals include installing 100 year flood culverts, moving key public services outside of flood hazard areas, and requiring buffer strips on all riparian areas and river/stream corridors. FEMA flood hazard mapping will be used to inform project selection to address flood risk and minimize damage.

Town of Wilmington Single Jurisdiction Hazard Mitigation Plan

This document was prepared by the Windham Regional Commission for the Town of Wilmington and adopted in 2014. The purpose of this plan is to identify natural hazards that are more likely to occur, assess their impacts on the community, and generate a list of strategies and actions to reduce the impacts. Of the hazards assessed, flooding was found to be the hazard that Wilmington is most susceptible to. High priority actions and mitigation strategies associated with flooding include replacing undersized culverts, buyouts of select flood-prone properties, and bridge maintenance.

Town of Wilmington Zoning Ordinance and Development Guidelines

This document was completed and implemented by the Town of Wilmington in 2022. It contains provisions to promote the development of the Town in a way that minimizes potential damages from future flood events and minimize water quality impacts. It limits development in river corridors, and wetlands. These guidelines will inform site selection for the SWMP. Development of BMPs in safer areas will be prioritized over those in flood-prone areas.

## 3.4 Data Gaps

The data sources and information describing stormwater and watershed management in the Town of Wilmington are thorough and primarily up to date. Since the stormwater infrastructure mapping was completed in 2019, there may have been important updates to the drainage systems in recent years. If we identify discrepancies in the drainage mapping over the course of our field work, we will summarize these changes in GIS files and bring them to the attention of VTDEC and the Town.

## 4.0 Stormwater Problem Areas

One of the primary objectives of the SWMP is to "develop a comprehensive list of stormwater problems" within the Town of Wilmington. FEA staff made several field visits to the project area and hosted meetings with the Town to identify existing problem areas, evaluate and prioritize sites, and recommend potential solutions.

### 4.1 Identification of Problem Areas

The initial round of problem area identification began with the identification of stormwater related projects using a desktop exercise scanning the watershed with aerial imagery, NRCS soils data, Town stormwater infrastructure mapping, contour data, and road erosion inventory results in GIS. Potential project areas were identified and mapped for review during site visits. A total of 33 stormwater problem areas were identified and assessed in the field (see map in Appendix A and table in Appendix B). We grouped the problem areas into five project categories described below.

- **Green Stormwater Infrastructure (GSI) Installation/Retrofit (20) –** Opportunity to reduce sediment and nutrient loads through the installation of a new stormwater best management practice (BMP). Also includes sites where nutrient and sediment reductions could be improved through the retrofit of existing stormwater BMPs .
- **Road Erosion Mitigation (5) –** Areas of high sediment and nutrient loading due to road, embankment, and ditch erosion.
- **Culvert Replacement (3) –** Problem areas where undersized culverts are exacerbating erosion issues.
- **Gully Stabilization (3) –** Areas of severe erosion from concentrated stormwater runoff.
- **Swirl Separator (1) –** Opportunity to treat stormwater flowing through traditional piped stormwater infrastructure using a swirl separator.
- **Stream Restoration (1) –** Problem areas where stream bank or bed erosion is a significant nutrient and sediment source.

## 4.2 Evaluation and Prioritization of Problem Areas

The 20 GSI projects and single swirl separator project described in the master project table (Appendix B) were prioritized based on the potential for each project to improve water quality, reduce environmental impact, project feasibility, and co-benefits. Estimated project cost and the phosphorus removal efficiency ($/lb of P) were included. We followed the Unified Scoring Prioritization for Stormwater Master Plans document developed by VTDEC (2023). This method includes a total of 19 criteria divided into 3 categories. The final score is expressed as a percent of the total score, with slightly different criteria applied to road drainage projects. Total scores were out of a maximum of 50 points. The project scores ranged from a low score of 11 to 36 points. Additional information about the unified prioritization methods can be found in **Table 5** and **Section 4.3**.

The remaining 13 projects were prioritized using Non-Unified Scoring Prioritization methods. These projects were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30 and the individual site scores ranged from 13 to 21. Additional information about the non-unified prioritization methods can be found in **Section 4.4**.

GIS-Based Site Screening

Using the field data points collected with sub-meter GPS during our watershed tours, we evaluated key characteristics for each site indicating the potential for increased stormwater runoff and pollutant loading, among several other factors described below. These GIS-based observations, along with field-based observations of site characteristics, are summarized in the project prioritization table (Appendix B).

The following geospatial data were reviewed and evaluated as part of the GIS-based screening:

- **Subwatershed Mapping –** The contributing drainage area to each problem area was mapped based on field observations and 1-foot contours derived from the 0.7-meter 2015 LiDAR elevation surface.
- **Aerial Photography** – We used the 0.6 m imagery collected in 2022 to review the site land cover characteristics (i.e., forest, grass, impervious).
- **Impervious Surfaces Data** – We used the 2016 statewide high-resolution impervious surfaces data layer developed by the UVM Spatial Analysis Lab.
- **Stormwater Infrastructure** – We used the Stormwater Infrastructure Mapping Project data collected in 2019 with detailed mapping of stormwater infrastructure throughout the Town.
- **NRCS Soils** – We used the VT Soils data to evaluate the inherent runoff and erosion potential of native soil types (i.e., hydrologic soil group, erodible land class). For project sites with potential for green stormwater infrastructure (GSI), we assessed the general runoff characteristics of the drainage area based on hydrologic soil group (HSG).
- **Parcel Data** – We used the parcel data available through VCGI to scope the limits of potential projects based on approximate parcel boundaries and road right-of-way.
- **VTDEC Hydrologically Collected Road Segment Data –** We used a statewide inventory of road erosion risk and hydrologic connectivity of road segments to prioritize areas of potential sediment loading to visit for field surveys.

**Table 5:** Unified scoring prioritization for stormwater master plans, developed by VTANR (VTDEC, 2023).

| Criteria | Proposed Weight | Max points |
|---|---|---|
| **Water Quality/Environmental impact** | | |
| Sediment reduction (using STP calculator for sediment) (not yet developed) | 0-4 (natural groupings within the range of sediment reductions for proposed projects for a specific plan. 0=very low reduction, 4= very high sediment reduction) | 4 |
| Phosphorus/nutrient reduction (using STP Calculator) | 0-4 (natural groupings within the range of phosphorus reductions for proposed projects for a specific plan. 0=very low p reduction, 4= very high P reduction) | 4 |
| Impervious area managed | 1-4 (natural groupings within the range of impervious surface managed for proposed projects for a specific plan. More impervious treated gets more points) | 4 |
| Percent of Water Quality & Channel Protection Volume treated* | 0-3 (0= no WQ treated, 1= ½ WQV treated, 2=meeting WQV, 3=meets WQV and CPV). Do not apply to road projects. | 3 |
| Percent of Recharge criteria met * | 0-3 (0 = no infiltration, 1 =infiltrates less than recharge volume, 2= meets full recharge, 3= exceeds recharge 1.5 times or more) Do not apply to road projects. | 3 |
| Streambank or other gully erosion mitigation | 0-2 (calculate volume= Length x avg. width x avg. depth, use natural groupings to divide volume into 3 categories) | 2 |
| Green infrastructure opportunity | 0-1 (0=no, 1=yes) | 1 |
| * WQV, CPV and Recharge criteria as outlined in 2017 Vermont Stormwater Management Manual | | |
| **Total Water Quality Score (out of 21, or 15 if road project)** | | |
| **Feasibility Criteria** | | |
| Public land or Private Landowner support | 0-3 (3=public land, 2=willing private land owner, 0=unwilling or unknown willingness of private landowner) | 3 |
| Project and Permitting complexity (number of permits required) | 0-2 (2= simple permitting, 0= complex permitting-potential denial) | 2 |
| Infrastructure conflicts | 1 (Y= 0, N=1) | 1 |
| Total Estimated Project Cost) | Enter engineering estimate+ construction estimate (no points) | |
| Project efficiency ($/lbs. of P removed) | 1-12 (Use natural grouping of $/lbs. removed) | 12 |
| Ease of O&M and ease of access for O&M | 0-2 (based on municipal input on what is easiest to maintain, 0=high maintenance, 2=easy maintenance) | 2 |
| **Total Feasibility Score (out of 20)** | | |
| **Other considerations/Co-benefits** (0=doesn't address concern, 1=addresses concern) | | |
| Educational benefits and or Recreational benefits | 1 | 1 |
| Natural habitat creation/protection | 1 | 1 |
| Infrastructure improvement (culvert replacement) | 1 | 1 |
| Outfall erosion control | 1 | 1 |
| Connected to receiving water | 3=all runoff infiltrates on site, 2= runoff receives some treatment before reaching receiving water. 1=runoff drains via infrastructure directly to receiving water with no erosion or additional pollutant loading, 0 =runoff drains directly to receiving water | 3 |
| Flood mitigation (known problem) | 1 | 1 |
| Existing local concerns | 1 | 1 |
| **Total Co-benefits Score (out of 9)** | | |
| **Overall Score (out of 50 or 44)** | | |

### 4.3 Unified Matrix Evaluation and Prioritization of Problem Areas

The 20 GSI projects and single swirl separator project are described in the Unified Prioritization Project Table (Appendix B). These projects were prioritized based on the potential for each project to improve water quality, reduce environmental impact, project feasibility, and co-benefits. Estimated project cost and the phosphorus removal efficiency ($/lb of P) were included. We followed the Unified Scoring Prioritization for Stormwater Master Plans document developed by VTDEC (2023). This method includes a total of 19 criteria divided into 3 categories. Total scores were out of a maximum of 50 points.

**It is important to note that the phosphorus loading estimates for the unified scoring system have only been developed for the Lake Champlain Basin.** VTANR has not yet released a timeline for developing nutrient loading calculations for the Connecticut River basin. Phosphorus loading rates are highly variable between lake segments. We selected the loading rates for the "Winooski River" lake segment, as these rates are roughly in the median range for phosphorus loading from pervious and impervious surfaces.

We anticipate that stormwater management efforts in the Connecticut River basin will consider nitrogen removal to be as important as phosphorus. VTANR has not yet developed guidance for calculating nitrogen loading rates or nitrogen removal efficiencies for stormwater treatment practices. We are evaluating options for estimating these loads and removal rates for our high priority projects that are selected for concept design development. Most stormwater treatment practices have similar removal efficiencies for nitrogen and phosphorus, therefore the information used for project prioritization should remain applicable if the focus of stormwater treatment shifts towards nitrogen in the Connecticut River Basin.

<u>BMP Unit Costs and Adjustment Factors</u>

BMP unit costs (2016 $) and adjustment factors were derived from stormwater master plans completed by Watershed Consulting Associates (2018). These numbers were primarily based on research completed by the Charles River Watershed Association and the Center for Watershed Protection (EPA, 2016), as well as updates based on actual construction costs in Vermont (**Table 6**). The unit cost estimates include an 24.75% total inflation adjustment for 2016 to 2023 based on the Consumer Price Indicator Inflation Calculator. Unit construction costs for road drainage projects were based on the estimates provided in the Road Erosion Site Prioritization and Remediation Project Summary (FEA and MMI, 2017). Additional multipliers for site type (**Table 7**) and level of permitting and engineering required (**Table 8**) are also shown below.

**Table 6:** BMP Unit Costs ($)

| BMP Type | Cost/ft$^3$ Treatment Volume |
|---|---|
| Constructed Wetland | $11.26 |
| Dry Pond | $5.77 |
| Grass Conveyance Swale | $5.13 |
| Rain Garden (no underdrain) | $19.83 |
| Rain Garden (with underdrain) | $19.83 |
| Subsurface Infiltration | $8.02 |
| Surface Infiltration | $8.00 |
| Wet Pond | $8.72 |
| Swirl Separator (small) | Lump Sum: $20,000 |
| Swirl Separator (medium) | Lump Sum: $40,000 |
| Swirl Separator (large) | Lump Sum: $60,000 |

**Table 7:** Site Type Cost Adjustment

| Site Type | Cost Multiplier |
|---|---|
| Existing BMP retrofit | 0.25 |
| Complicated retrofit | 0.75 |
| New BMP in undeveloped area | 1.00 |
| New BMP in partially developed area | 1.50 |
| New BMP in developed area | 2.00 |

**Table 8:** Permitting and Engineer (P&E) Cost Adjustment

| Level of P&E Required | Cost Multiplier |
|---|---|
| None | 1.00 |
| Low | 1.20 |
| Moderate | 1.25 |
| High | 1.35 |

### 4.3 Non-Unified Evaluation and Prioritization of Problem Areas

Areas identified during field tours of the study area where the primary project recommendation was not stormwater treatment infrastructure were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30 and the individual site scores ranged from 13 to 21. Each category is described below and includes a description of the scoring for each criterion. Final evaluation criteria summarized in the Non-Unified Prioritization Project Table (Appendix B) are described below:

- **Water Quality Benefits (15 points total)**
  - **Nutrient Reduction Effectiveness (4 points)** – Degree of nutrient removal potential with project implementation, this accounts for both the existing nutrient loads and the removal efficiency and capacity of the proposed treatment. Nutrient loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.
    - 0 points – No nutrient source and/or no increased treatment
    - 1 point – Minor nutrient source and/or minor increase in treatment
    - 2 points – Moderate nutrient source with some increase in treatment
    - 3 points – Moderate nutrient source with significant increase in treatment
    - 4 points – Major nutrient source with significant increase in treatment
  - **Sediment Reduction Effectiveness (4 points)** – Degree of sediment removal potential with project implementation, this accounts for both the existing sediment loads and the removal efficiency and capacity of the proposed treatment. Sediment loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.
    - 0 points – No sediment source and/or no increased treatment
    - 1 point – Minor sediment source and/or minor increase in treatment
    - 2 points – Moderate sediment source with some increase in treatment
    - 3 points – Moderate sediment source with significant increase in treatment
    - 4 points – Major sediment source with significant increase in treatment
  - **Drainage Area (1 point)** – Approximate drainage area to site is greater than 2 acres
  - **Impervious Drainage (3 points)**– Approximate area of impervious surfaces draining to the site.
    - 0 points – Area of impervious surfaces is less than 0.25 acres
    - 1 point – Area of impervious surfaces is 0.25-0.5 acres
    - 2 points – Area of impervious surfaces is 0.5-1.0 acres
    - 3 points – Area of impervious surfaces is >1.0 acres
  - **Connectivity to Surface Waters (3 points)**
    - 0 points – All stormwater infiltrates on site
    - 1 point – Stormwater receives some treatment before reaching receiving waters

    - 2 points – Stormwater drains into drainage infrastructure that directly outlets to receiving waters (assumes no erosion or additional pollutant loading to discharge point)
    - 3 points – Stormwater drains directly into receiving waters (typically stormwater draining directly into a large wetland is assigned 2 points)
- **Landowner Support (2 points)**
    - 0 points – Project is located on private property, no contact with landowner
    - 1 point – Project is on Town or State property with no contact
    - 2 points – Project has been discussed and is supported by landowner
- **Operation and Maintenance Requirements (2 points)**
    - 0 points – Project will require significant increased maintenance effort
    - 1 point – Project will require some increased maintenance effort
    - 2 points – Project will require no additional maintenance effort
- **Cost and Constructability (6 points) –** This score is based on the overall project cost (low score for high cost) and accounts for additional design, permitting requirements, and implementation considerations, such as site constraints and utilities, prior to project implementation.

- **Additional Benefits (5 points total) –** Description of other project benefits, total score is roughly a count of the number of additional benefits. Additional benefits considered in the prioritization are as follows:
    - **(1) Chronic Problem Area** – The site requires frequent maintenance and/or is an ongoing problem affecting water quality
    - **(2) Seasonal Flooding** – The site is affected by or contributes to seasonal flooding
    - **(3) Educational** – The site provides an opportunity to educate the public about stormwater treatment practices
    - **(4) High Visibility** – The site is highly visible and will benefit from aesthetically designed treatment practices
    - **(5) Infrastructure Conflicts** – The stormwater problem area is increasing erosion or inundation vulnerability of adjacent infrastructure (i.e. roads, buildings, etc.)
    - **(6) Drains to Connected Stormwater Infrastructure** – The site drains into a larger stormwater conveyance system that is less likely to receive downstream treatment
    - **(7) Reduces Thermal Pollution** – Project implementation will reduce the risk of thermal loading from runoff to receiving surface waters
    - **(8) Improves BMP Performance** – Project implementation will improve the performance of existing stormwater treatment practices that receive runoff from the site
    - **(9) Peak Flow Reduction** – Project implementation will significantly reduce stormwater peak flows leaving the site
    - **(10) Enhances Lakeshore Natural Communities** – Project implementation will promote a native vegetated lakeshore buffer and/or provide wildlife habitat along the lakeshore

### 4.4 Conceptual Designs

FEA hosted a meeting with the Town and VTDEC in April 2024 to discuss project prioritization and selection of 5 projects for conceptual design development. Five (5) projects were selected at this meeting for concept designs. FEA and SLR developed 30% conceptual designs and preliminary cost estimates for these 5 projects. Concept designs include:

- A site plan with contours, existing stormwater infrastructure, and proposed design elements
- Where relevant, hydrologic and hydraulic modeling data of the contributing drainage area and proposed BMP sizing and design specifications
- Typical details for proposed practices
- A preliminary cost opinion

The projects selected for 30% conceptual design were:

1. **Project WIL-01 – East Main Street: Mount Snow Shopping Center (10%)**

   **Problems Identified:** An existing stormwater treatment system (Permit 3223-9050) is filled in and has areas of gully erosion between the outlet and Beaver Brook.

   **Proposed Best Management Practice(s):** Clean out the existing basin and adjust grading to provide adequate pre-treatment with a sediment forebay. The outlet structure can be modified to provide additional extended detention treatment volume. Stabilize erosion along the outlet swale leading to Beaver Brook.

   **Estimated Cost Effectiveness:** $20,000-30,000/kg P/year

2. **Project WIL-06/WIL-27/WIL-28 – Wilmington Town Garage (30%)**

   **Problems Identified:** A large gravel parking lot and sand/gravel storage area drains downhill to the river. Additionally, half of a large roof and a portion of the parking lot drain to an existing 10x20x2 wet pond with overflow to a floodplain and stream.

   **Proposed Best Management Practice(s):** Increase the size and volume of the existing pond and provide a sediment forebay for pre-treatment. Install sediment basins in two locations receiving concentrated runoff from the large gravel parking and staging area.

   **Estimated Cost Effectiveness:** $15,000-20,000/kg P/year

3. **Project WIL-16 – Beaver Street (30%)**

   **Problems Identified:** A high volume of runoff is generated in the wide expanse of paving in the road and driveways/parking areas associated with the school and fire department. The new lawn area in front of the fire department receives sheet flow. Soil erosion is present.

   **Proposed Best Management Practice(s):** Direct runoff into a new sediment forebay and infiltration basin. The existing catch basin can be used for overflow from the infiltration basin.

   **Estimated Cost Effectiveness:** $20,000-30,000/kg P/year

4. **Project WIL-30/WIL-32 – Pond Loop Common Land (30%)**

   **Problems Identified:** Runoff from the road and tennis courts flows through eroding ditches discharging to the the forested area down a steep slope with a large gully.

   **Proposed Best Management Practice(s):** Stabilize the eroding ditches and the gully. There is room on common land at the top of the gully to install a large sediment trap (Project WIL-30). Additional water quality treatment could be provided by diverting a portion of the WQv from this basin into the existing pond (WIL-32).

   **Estimated Cost Effectiveness:** $15,000-25,000/kg P/year

5. **Project WIL-31 – Lake Raponda Boat Launch (30%)**

   **Problems Identified:** Sediment loading from Old Stage Road and Raponda Road is entering the cross-culvert and discharging directly to the stream below the dam.

   **Proposed Best Management Practice(s):** Deepen the road ditch to install a sediment trap at the culvert inlet.

   **Estimated Cost Effectiveness:** $10,000-15,000/kg P/year

## 5.0 Next Steps

This stormwater master plan represents an extensive effort to identify, describe, and evaluate stormwater issues affecting water quality and localized flooding in the Town of Wilmington. For each project recommendation, we provided a preliminary cost estimate and nutrient/sediment treatment estimates to Town representatives to assist with planning and prioritizing project implementation. The problem area descriptions for Town roads (e.g., roadside ditches) will aid the Town Highway Department in proactively stabilizing and maintaining these features to avoid future stormwater problems, and to come into compliance with the VTANR Municipal Roads General Permit.

We recommend that the Town work with VTDEC to secure funding for the high priority projects described in Appendices B and C. Landowner outreach should be completed for all projects that are not on Town land or right-of-way. The BMP installation/retrofit opportunities identified in the Unified Prioritization Matrix represent a potential phosphorus load reduction of approximately 47 lb/year. Based on our review and preliminary designs and our experience with previous SWMP efforts, we feel that the projects listed in Appendix C should be considered for further development and implementation.

## 6.0 References

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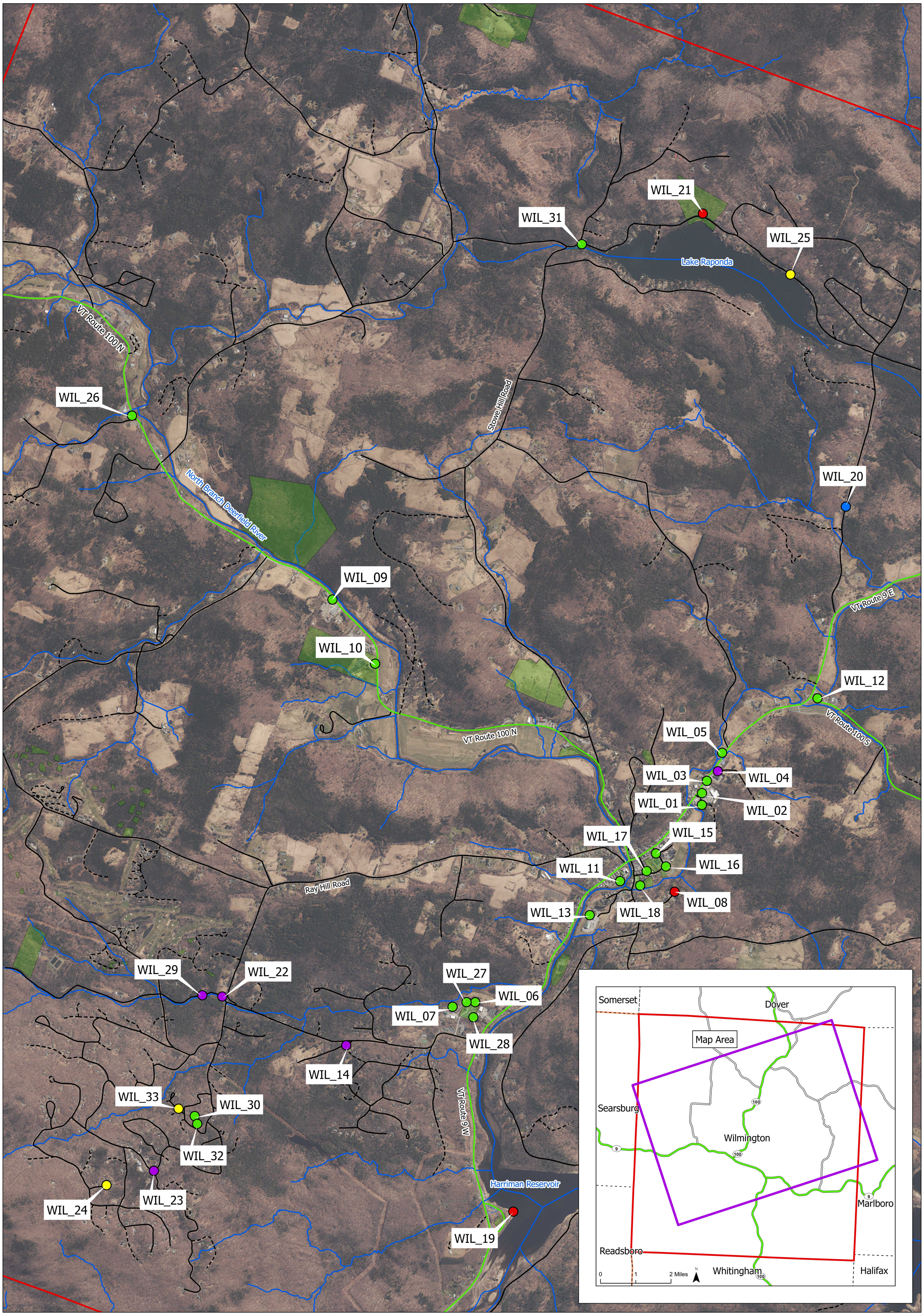
Windham Regional Commission, December, 2013. Single Jurisdiction Hazard Mitigation Plan: Town of Wilmington, Vermont.

# APPENDIX A

**Pro**ject Location Map
**(**24**”x3**6**”)**

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# Town of Wilmington

Stormwater Master Plan Study Area
Project Location Map

Notes:
-Project locations and recommendations are based on field assessments conducted on 12/8/22 and 5/15/23

JWC
DRAWN

JHB
CHECKED

March 13, 2024
DATE

Proposed Project Type
- Stormwater BMP New/Retrofit
- Road Erosion Mitigation
- Gully Stabilization
- Culvert Replacement
- Stream Restoration

Roads
- Town Road
- State Highway
- Private Road

Surface Waters
- Wilmington
- Village Center
- Town Boundaries
- Municipal Parcels

N
0 1,000 2,000 US Feet
1 inch = 1,000 feet

# **A**ppendix **B**

## Project Prioritization Summary Tables
## Unified and Non-Unified
## (11”x17”& 8.5”x 11”)

**Stormwater Master Plan - Town of Wilmington**

**Unified Prioritization Project Table**

**March 28, 2025**

| Project ID | Project Type | Location | Description | Preliminary Recommendations | Total Acreage | Impervious Acreage | % Impervious | P Load (lb/yr) | WQv (cf) | BMP Type | BMP Volume (cf) | BMP P Reduction (lb/yr) | Erosion P Reduction (lb/yr) | Total P Reduction (lb/yr) | Gully Mitigation | Landowner | Project/ Permitting Complexity | Infrastructure Conflicts | Total Cost | Project Efficiency $/lb | Ease of O&M | Co-Benefits Sum | Total Score | Possible | Final Score % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WIL_07** | GSI | Haystack Road - AOT garage | The parking area drains to a small gully. A wetland currently treats runoff, but there is no storage capacity. | Stabilize the existing erosion. Add a pretreatment feature above the erosion. Add a berm downhill to pond water in the existing wetland area for treatment before it enters the river. | 0.86 | 0.85 | 99% | 2.09 | 2,940 | Wet pond/Created Wetland | 1,800 | 0.902 | 3.70 | 4.60 | 2 | 3 | 2 | 1 | $ 31,800 | $ 6,910 | 1 | 2 | 36 | 50 | 72% |
| **WIL_06** | GSI | Haystack Road - Wilmington Town garage SE Corner of Parking Area | A large gravel parking lot and sand/gravel storage area drains downhill to the river. | There is space in the low area for a sediment trap with some tree clearing. There will be a heavy sediment load here with gravel, silt and heavy soils. | 1.01 | 1.00 | 99% | 2.46 | 3,465 | Extended Dry Detention Pond | 1,800 | 0.198 | 3.00 | 3.20 | 2 | 3 | 2 | 1 | $ 23,700 | $ 7,418 | 2 | 2 | 34 | 50 | 68% |
| **WIL_09** | GSI | VT Route 100N - W W Building Supply | The inlet of a culvert under Route 100N is eroding. The culvert drains a large gravel parking lot and buildings. | Use the open green space to pool and infiltrate the stormwater before it enters the culvert and river | 1.98 | 1.64 | 83% | 4.20 | 5,731 | Infiltration Basin | 5,730 | 4.026 | 0.56 | 4.58 | 0 | 0 | 1 | 1 | $ 92,900 | $ 20,279 | 2 | 3 | 30 | 50 | 60% |
| **WIL_10** | GSI | VT Route 100N - Twin Valley Elementary School | The school parking lot and building drain to a green space along the road. | Raise the catch basin inlet to pool runoff in the green space. The feature could be installed in the space to the west between the road and athletic field depending on sizing and soils. | 0.95 | 0.75 | 80% | 1.94 | 2,636 | Infiltration Basin | 2,640 | 1.848 | 0.00 | 1.85 | 0 | 3 | 2 | 1 | $ 42,800 | $ 23,160 | 2 | 2 | 30 | 50 | 60% |
| **WIL_16** | GSI | Beaver Street - School/firehouse bottom of hill | A high volume of runoff is generated in the wide expanse of paving in the road and driveways/parking areas associated with school and fire dept. The new lawn area in front of fire house receives sheet flow. Eroding soil is present. | Install a bioretention or another infiltration/temporary storage feature in the lawn area. | 1.56 | 1.35 | 86% | 3.43 | 4,677 | Infiltration Basin | 2,680 | 3.146 | 0.15 | 3.29 | 0 | 3 | 2 | 0 | $ 57,900 | $ 17,577 | 2 | 2 | 30 | 50 | 60% |
| **WIL_32** | GSI | Pond Loop - Common land SW of the pond | There is significant sediment scour and movement into the woods. All stormwater currently bypasses the pond. There is available community land to use for a sediment trapping practice. | Construct a small forebay and divert stormwater runoff from the ditches through that and into the existing pond. Retrofit the pond outlet to provide additional detention. There is also space for sediment traps if there is not desire to use the existing pond. | 8.07 | 0.57 | 7% | 5.21 | 3,339 | Wet pond/Created wetland | 4,000 | 2.288 | 2.04 | 4.32 | 2 | 0 | 0 | 1 | $ 41,800 | $ 9,669 | 1 | 4 | 30 | 50 | 60% |
| **WIL_01** | GSI | East Main Street - Existing stormwater treatment feature behind Mobil station | The existing feature has a small storage capacity and a gully has formed at the outlet. Appears to be the treatment feature listed in 3223-9050. | Add risers to the outlet pipes to raise the water level and clean out basin to create storage for stormwater. Stabilize the outfall with stone to prevent further erosion. | 1.74 | 1.52 | 87% | 3.85 | 5,294 | Wet pond/Created Wetland | 3,900 | 0.726 | 1.85 | 2.58 | 1 | 0 | 1 | 0 | $ 13,100 | $ 5,085 | 1 | 2 | 28 | 50 | 56% |
| **WIL_03** | GSI | East Main Street - Between Walgreens and auto shop | A swale meets the closed-system stormwater infrastructure, undermining the roadway. Erosion is developing in the swale. | Stabilize the road embankment and swale. Retrofit the swale to infiltrate if the soils are appropriate. | 0.54 | 0.27 | 50% | 0.79 | 987 | Dry Swale (w/ underdrain) | 600 | 0.33 | 1.11 | 1.44 | 1 | 3 | 2 | 0 | $ 9,600 | $ 6,667 | 2 | 2 | 27 | 50 | 54% |
| **WIL_26** | GSI | VT Route 100N - Creemee Stand next to stream | The gravel parking lot drains directly to the stream. Erosion is evident. | Install a roadside swale to filter and infiltrate runoff as it drains to the stream. The practice needs pretreatment to manage sediment. | 1.33 | 0.58 | 43% | 1.80 | 2,123 | Dry swale (infiltrating) | 2,120 | 1.694 | 0.37 | 2.06 | 0 | 0 | 2 | 1 | $ 24,600 | $ 11,919 | 2 | 2 | 27 | 50 | 54% |
| **WIL_11** | GSI | West Main Street - Commercial Gravel Parking Lot | The large gravel parking lot is right next to the river with a berm separating it from the channel. Small gullies are forming at multiple breaks in the berm. | Stabilize the gaps in the berm with stone-lined spillways and install infiltrating swales along the length of the berm. The swales should direct water through the breaks in the berm as sheet flow. | 2.94 | 1.87 | 64% | 5.15 | 6,654 | Dry Swale (infiltrating) | 2,000 | 3.85 | 1.11 | 4.96 | 1 | 0 | 0 | 0 | $ 37,700 | $ 7,601 | 2 | 1 | 26 | 50 | 52% |
| **WIL_31** | GSI | Lake Raponda Road - Boat Launch | The large sediment load from Old Stage Road is filling up the cross culvert inlet. | A sediment trap could be installed at the inlet to reduce the sediment load to the culvert and the lake. | 1.96 | 0.09 | 5% | 1.17 | 664 | Extended Dry Detention Pond | 550 | 0.088 | 1.00 | 1.09 | 1 | 3 | 2 | 1 | $ 7,800 | $ 7,176 | 2 | 1 | 26 | 50 | 52% |
| **WIL_18** | GSI | South Main Street - Park and Ride | The park and ride lot and adjacent lawn is sloped and eroding the channel at the playground and walkway intersection. | Install a swale that stabilizes the water path down the hill. | 0.40 | 0.28 | 70% | 0.73 | 970 | Dry swale (infiltrating) | 655 | 0.704 | 0.30 | 1.00 | 0 | 3 | 0 | 1 | $ 10,000 | $ 10,000 | 2 | 3 | 25 | 50 | 50% |
| **WIL_12** | GSI | Junction of VT Route 100S and Route 9 | A building and paved parking lot drain to an unused green space and into the stormwater infrastructure. | Use the green space for an infiltration basin before runoff enters the catch basin. | 0.65 | 0.50 | 77% | 1.30 | 1,743 | Infiltration Basin | 1,740 | 1.276 | 0.00 | 1.28 | 0 | 0 | 2 | 1 | $ 25,100 | $ 19,671 | 2 | 1 | 24 | 50 | 48% |
| **WIL_30** | GSI | Pond Loop - Common land between tennis court and pond | Multiple eroding ditches for road drainage and tennis court combine and discharge into the woods. There is a large sediment load, but plenty of woods to dissipate it. | Stabilize eroding ditches and install a sediment trap or a wet pond depending on space availability. | 0.55 | 0.17 | 30% | 0.62 | 643 | Extended Dry Detention Pond | 640 | 0.066 | 1.85 | 1.92 | 1 | 0 | 0 | 1 | $ 24,400 | $ 12,735 | 2 | 3 | 24 | 50 | 48% |
| **WIL_05** | GSI | VT Route 100 - Wahoo's Eatery | The untreated gravel parking area drains directly into the river. | Regrade the parking lot to slope away from the river. Install a swale between the lot and the road to infiltrate runoff before it reaches the river. The north side of the parking lot is too close to river to install a practice. | 0.84 | 0.55 | 65% | 1.50 | 1,941 | Dry Swale (infiltrating) | 1,940 | 1.43 | 0.07 | 1.50 | 0 | 0 | 0 | 1 | $ 30,200 | $ 20,080 | 2 | 1 | 22 | 50 | 44% |
| **WIL_13** | GSI | Mill Street - Southeast VT transit | Stormwater infrastructure drains directly into the river from a very large paved parking area and building. | Divert the existing underground stormwater infrastructure from the roof and parking lot into a surface or subsurface infiltration practice in the green space. There is a large area for a feature. The depth of the existing pipes will determine whether a subsurface practice is necessary. | 1.80 | 1.38 | 77% | 3.61 | 4,843 | Infiltration Chambers | 4,840 | 3.102 | 0.00 | 3.10 | 0 | 0 | 0 | 1 | $ 124,700 | $ 40,200 | 0 | 1 | 21 | 50 | 42% |
| **WIL_02** | GSI | East Main Street - Green space in front of Shaws | There is a large unused green space at the bottom of the sloped Shaws parking lot. | Divert Stormwater Infrastructure into a surface or subsurface infiltration practice in the green space. | 3.11 | 2.20 | 71% | 5.87 | 7,762 | Gravel Wetland | 7,760 | 3.432 | 0.00 | 3.43 | 0 | 0 | 2 | 0 | $ 235,900 | $ 68,735 | 0 | 2 | 19 | 50 | 38% |
| **WIL_15** | GSI | Across Beaver St from the highschool. Little garage with dumpster | Sheet flow off of Beaver street and school street hill goes into this property with a gravel parking lot, moving sediment. The property is up gradient of town-owned property (fire station). | Install a swale to redirect road runoff from parking lot (even contouring the asphalt roadway with gentle curb) to reduce surface flow over erodable surface. | 0.32 | 0.27 | 84% | 0.68 | 940 | Dry Swale (infiltrating) | 238 | 0.484 | 0.11 | 0.60 | 0 | 0 | 2 | 0 | $ 6,800 | $ 11,429 | 2 | 1 | 18 | 50 | 36% |
| **WIL_27** | GSI | Haystack Road - Wilmington Town Garage NE Corner of Parking Area | Half of the large roof and a portion of the parking lot drain via sheet flow to a 10x20x2 wet pond with overflow to a floodplain and stream. There are no obvious erosion issues but lots of water. The wellhead is even with the northeast corner of the building. | Increase the size and storage capacity of the existing pond. Install a pretreatment feature to address sediment. Stabilize the outfall. | 0.62 | 0.43 | 70% | 1.14 | 1,511 | Wet pond/Created wetland | 880 | 0.154 | 0.00 | 0.15 | 0 | 3 | 2 | 1 | $ 24,400 | $ 158,442 | 1 | 1 | 13 | 50 | 26% |
| **WIL_28** | GSI | Haystack Road - Wilmington Town Garage SW Corner of Parking area | A large area drains to the edge of the property and into the hiking trail. The area is fully built out to the property line. | Install a sediment trap in the corner of the property where space allows. | 0.43 | 0.42 | 98% | 1.03 | 1,457 | Extended Dry Detention Pond | 660 | 0.088 | 0.07 | 0.16 | 0 | 3 | 2 | 1 | $ 11,900 | $ 73,457 | 2 | 1 | 13 | 50 | 26% |
| **WIL_17** | Swirl Separator | Church Street - Old Firehouse catchbasin | Gravel parking lots are eroding into a catch basin at the road edge. | Install a swirl separator or raise the catch basin inlet to pool and treat water. | 1.69 | 1.11 | 66% | 3.01 | 3,925 | Swirl Separator | 1 | 0.308 | 0.00 | 0.31 | 0 | 3 | 1 | 0 | $ 100,000 | $ 324,675 | 2 | 0 | 11 | 50 | 22% |

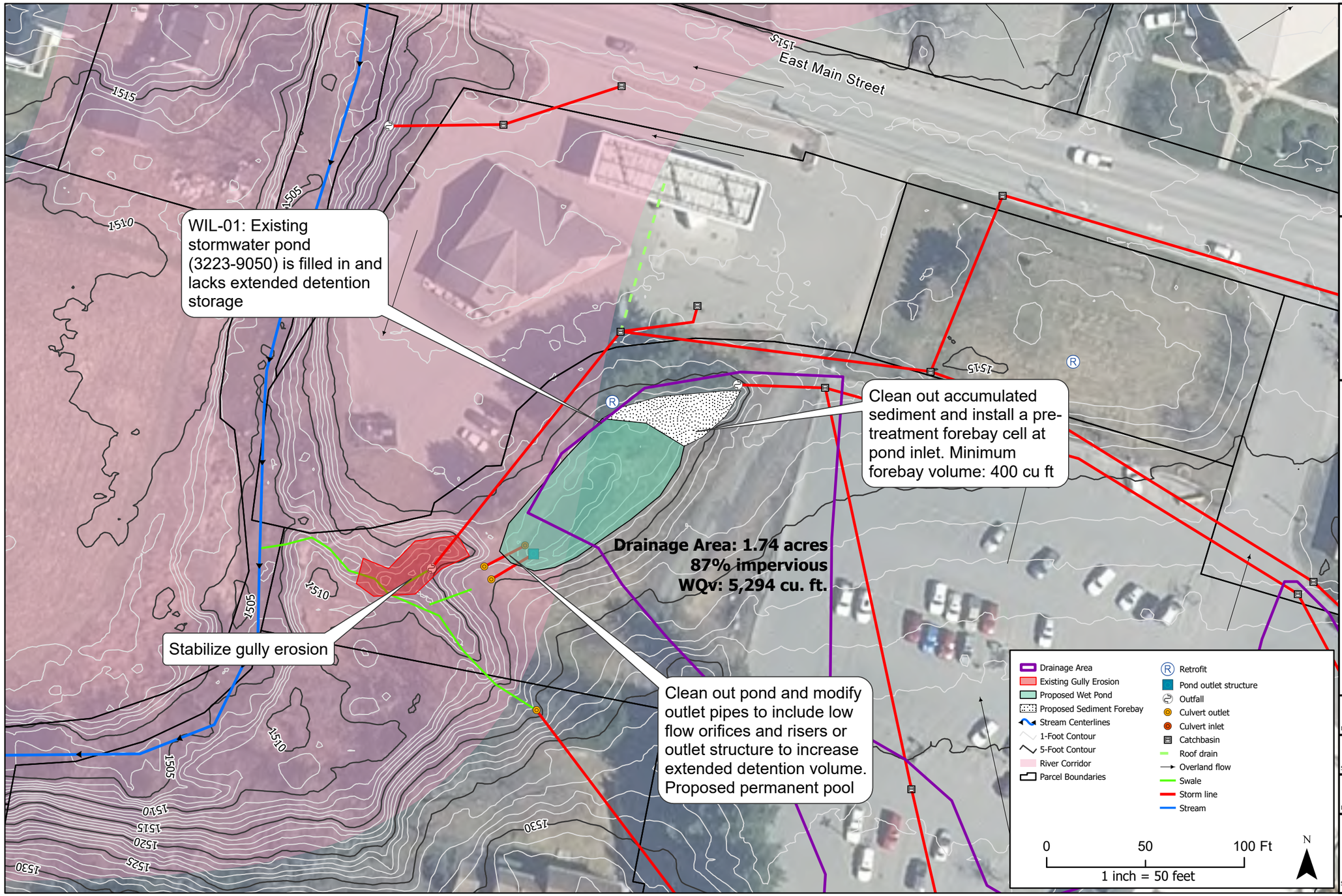
**Stormwater Master Plan - Town of Wilmington**
**Non-Unified Prioritization Project Table**
**March 28, 2025**

| Additional Benefits Codes | CPA | SF | E | IC | SW | BMP | HV | TH | PF | L |
|---|---|---|---|---|---|---|---|---|---|---|
| | Chronic Problem Area | Seasonal Flooding | Educational | Infrastructure Conflicts | Drains to Connected Stormwater Infrastructure | Improves Exisiting BMP Performance | High Visibility | Reduces Thermal Pollution | Peak Flow Reduction | Enhance Lakeshore Natural Communities |

| | | | | | | Water Quality Benefits | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project ID | Project Type | Location | Description | Preliminary Recommendations | Nutrient Reduction | Sediment Reduction | Drainage Area | Impervious Drainage | Connectivity to Surface Waters | Landowner Support | O&M Requirements | Cost and Constructability | Additional Benefits | Additional Benefits Score | Total Score |
| | | | | | 4 | 4 | 1 | 3 | 3 | 2 | 2 | 6 | | 5 | 30 |
| **WIL_19** | Gully | Oxbow Loop - Parking Lot | The gravel lot right next to the reservoir is unstable and draining to an eroding gully and directly to the water. There is significant sediment transport. There are signs that the gully is also used for water access by people, making erosion worse. An additional gully is forming on the drive towards the lake in the direction of the boat dealership. | Stabilize the gully and regrade the parking lot and install ditches/swales to slow and direct stormwater to a safe outfall. Consider creating a formal water access to avoid continued damage to the slope. | 4 | 4 | 0 | 1 | 3 | 0 | 0 | 5 | CPA, E, HV, L | 4 | **21** |
| **WIL_04** | Road Erosion | Country Club Road | The roadside ditch is heavily eroding in a steep section of the road. Mobilized sediment is directed into the closed stormwater infrastructure. | Stabilize the ditch with stone and checkdams where appropriate. Fix the road crown and stabilize the inlet that accepts runoff from the ditch. | 3 | 3 | 0 | 0 | 3 | 1 | 1 | 6 | CPA, IC, SW | 3 | **20** |
| **WIL_20** | Stream | Ballou Hill Road - Ditch/Culvert Crossing | There are issues with the eroding ditch and stream culvert crossing. Erosion is evident at the downstream side of the culvert and ditch erosion locally. | Stabilize the stream and/or complete a culvert replacement/assessment. | 3 | 3 | 1 | 2 | 3 | 1 | 2 | 4 | IC | 1 | **20** |
| **WIL_25** | Culvert | Lake Raponda Road | The culvert is failing under the road. The outfall to the lake is perched and eroding. | Install a catch basin and replace the culvert. | 4 | 4 | 1 | 0 | 3 | 0 | 1 | 2 | CPA, IC, L | 3 | **18** |
| **WIL_14** | Road Erosion | Intersection of Beebe Road and West Road | Steep gravel roads are eroding in the ROWs and in the ditches. | Stabilize the ditches with stone and re-grade/crown the roads. | 3 | 3 | 0 | 1 | 1 | 0 | 2 | 6 | CPA | 1 | **17** |
| **WIL_08** | Gully | Whitney Lane | A gully is forming down to the river from the outlet of a road culvert. The culvert is in good shape. | Stabilize the gully with stone. Install checkdams where necessary for the steep slope. | 4 | 4 | 1 | 0 | 1 | 0 | 2 | 3 | CPA | 1 | **16** |
| **WIL_21** | Gully | Lake Raponda Road - Green Mountain Beach Parking Area | The gravel parking lot and access drive are eroding. The existing water bar is filled in with sediment. | Regrade gravel areas and reestablish the water bar at the top of the driveway. | 2 | 2 | 1 | 0 | 2 | 1 | 1 | 6 | E | 1 | **16** |
| **WIL_29** | Road Erosion | Near 287 Haystack Road | Large sediment deposits are forming along the side of the road to cross culverts directly into stream. | Install sediment traps in the problem areas where space allows. | 1 | 1 | 1 | 2 | 3 | 1 | 0 | 6 | CPA | 1 | **16** |
| **WIL_22** | Road Erosion | Haystack Road - Rose Brook Erosion | The bank is eroding between the road and the brook. | Stabilize the bank with stone or bioengineering. | 1 | 1 | 1 | 0 | 3 | 1 | 2 | 5 | CPA | 1 | **15** |
| **WIL_23** | Road Erosion | Instersection of Spruce Grove Road and Chimney Hill Road | Water washes out the road at the corner because runoff is not entering the ditches. The culvert is full of sediment at the corner of the paved and gravel road. | Increase the size of the culvert(s) and repair the road surface. Install a cross culvert at the clubhouse to take pressure off the main culvert at the road intersection. | 3 | 3 | 2 | 1 | 2 | 1 | 0 | 2 | CPA | 1 | **15** |
| **WIL_33** | Culvert | Instersection of Bullet Hole Road and Mallard Court | Stormwater is not being addressed in eroding ditches. | Stabilize the ditches and install sediment traps and stabilized turnouts. | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 6 | CPA, IC | 2 | **15** |
| **WIL_24** | Culvert | Splatter Foot Road | Water comes through several driveway culverts and overflows from the ditch to run across the surface and erode driveway entrances. | Stabilize the ditch and increase the sizes of the culverts. | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 4 | IC | 1 | **13** |

# APPENDIX C

Conceptual Designs
**(11”x**17**”)**

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Notes:
- Conceptual design based on FEA field visit in 2024

Project WIL-01 Conceptual Design
Stormwater Master Plan

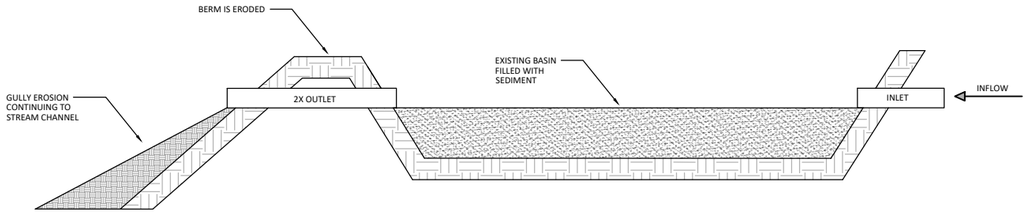
East Main Street
Wilmington, VT

| MAP BY | CHECKED |
|---|---|
| JWC | JHB |

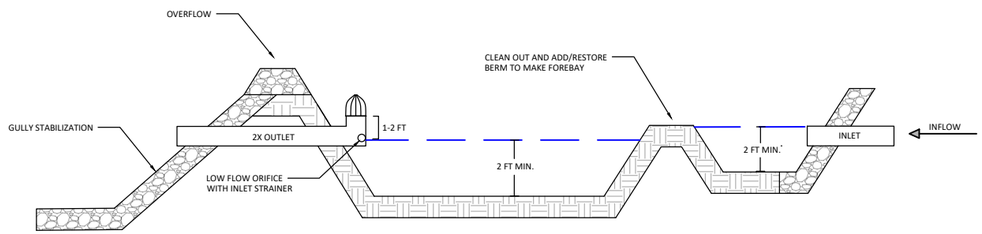
SCALE: 1 inch = 50 feet

DATE: April 7, 2025

SHEET NO.: SHEET 1




PROFILE: EXISTING N.T.S

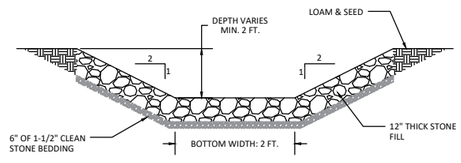



PROFILE: PROPOSED N.T.S

## Preliminary Cost Opinion

Project WIL-01

| Item | Quantity | Unit | Unit Price | Cost |
|---|---|---|---|---|
| Mobilization/Demobilization | 1 | LS | $ 3,000 | $ 3,000 |
| Common Excavation | 120 | CY | $ 25 | $ 3,000 |
| Hauling | 120 | CY | $ 20 | $ 2,400 |
| Topsoil | 10 | CY | $ 50 | $ 500 |
| Type II Stone Fill | 40 | CY | $ 80 | $ 3,200 |
| Outlet Structure Retrofits | 1 | LS | $ 2,000 | $ 2,000 |
| Misc. Erosion Control and Site Restoration | 1 | LS | $ 2,000 | $ 2,000 |
| Laborer | 40 | HR | $ 50 | $ 2,000 |
| Final Design & Permitting | 1 | LS | $ 10,000 | $ 10,000 |
| Construction Oversight | 1 | LS | $ 3,000 | $ 3,000 |
| | | | Subtotal | $ 31,100 |
| | | | Contingency (20%) | $ 6,220 |
| | | | **Total** | **$ 37,320** |




- SLOPES 5% TO 10% USE 6-8 INCH MINUS STONE FILL
- SLOPES MORE THAN 10% USE 12 INCH MINUS STONE FILL

STONE LINED DITCH GULLY STABILIZATION N.T.S

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Notes:

**Project WIL-01 Conceptual Design**
Stormwater Master Plan
East Main Street - Existing Stormwater Treatment
Feature Behind Mobil Station
Wilmington, VT
NOT FOR CONSTRUCTION

| DRAWN | CHECKED |
|---|---|
| ORD | JHB |

SCALE: N.T.S.

DATE: 2025-03-03

SHEET NO.: Sheet 2

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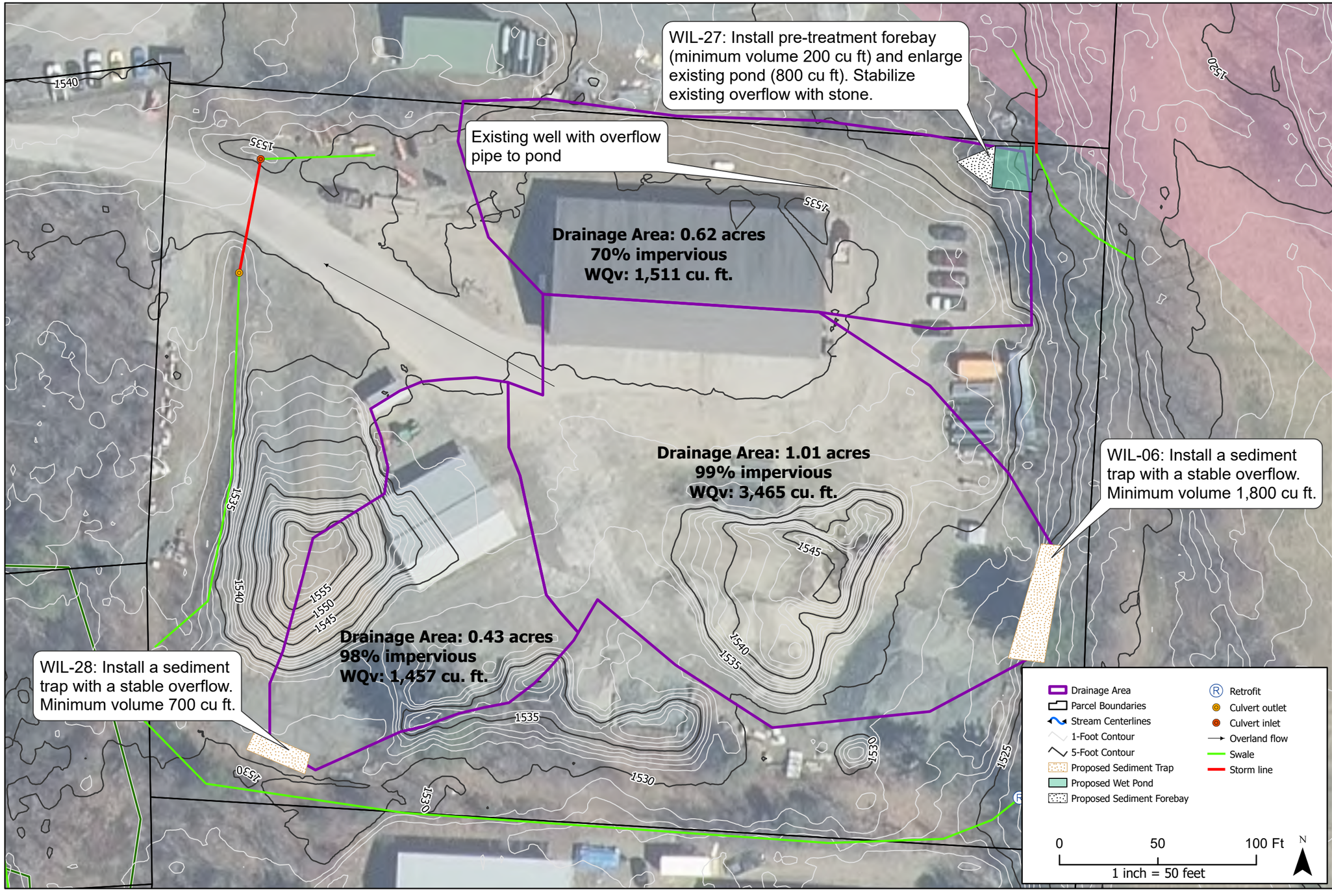


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Notes:
- Conceptual design based on FEA field visit in 2024

Project WIL-06/27/28
Conceptual Design
Stormwater Master Plan

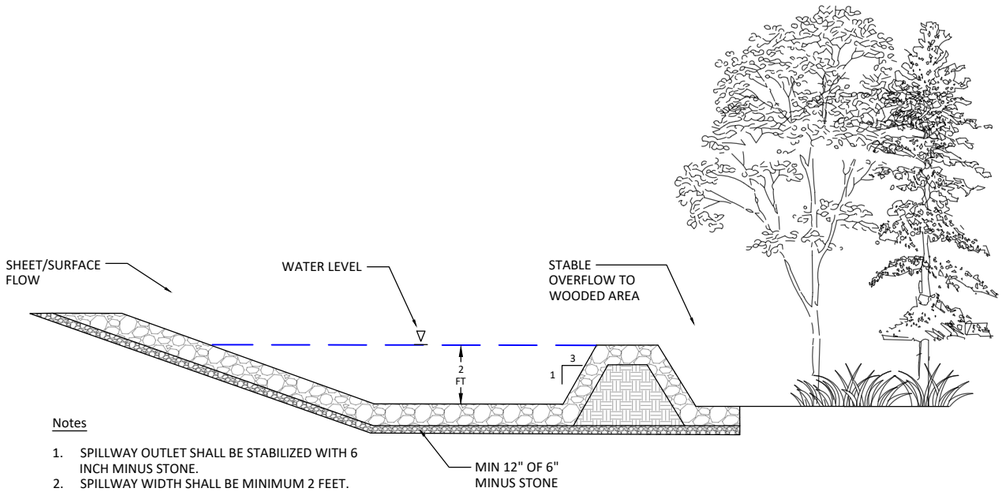
Wilmington Town Garage
Wilmington, VT

| MAP BY | CHECKED |
|---|---|
| JWC | JHB |

SCALE: 1 inch = 50 feet

DATE: May 5, 2025

SHEET NO.: SHEET 1




Notes

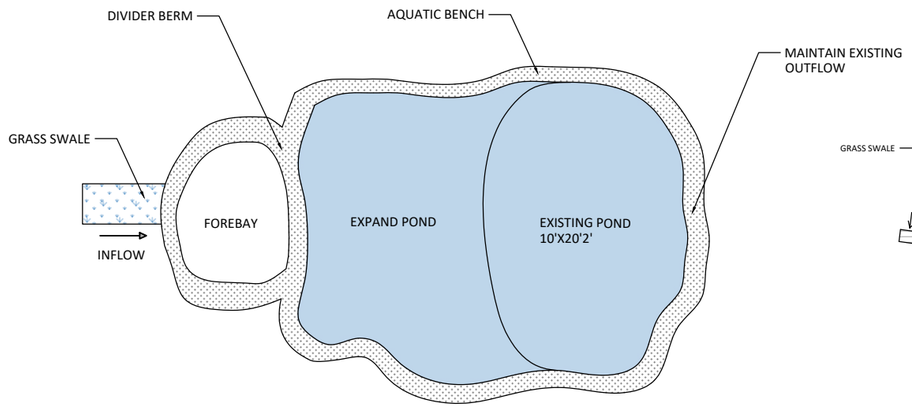
1. SPILLWAY OUTLET SHALL BE STABILIZED WITH 6 INCH MINUS STONE.
2. SPILLWAY WIDTH SHALL BE MINIMUM 2 FEET.

PROFILE: SEDIMENT TRAP WITH STONE OVERFLOW N.T.S

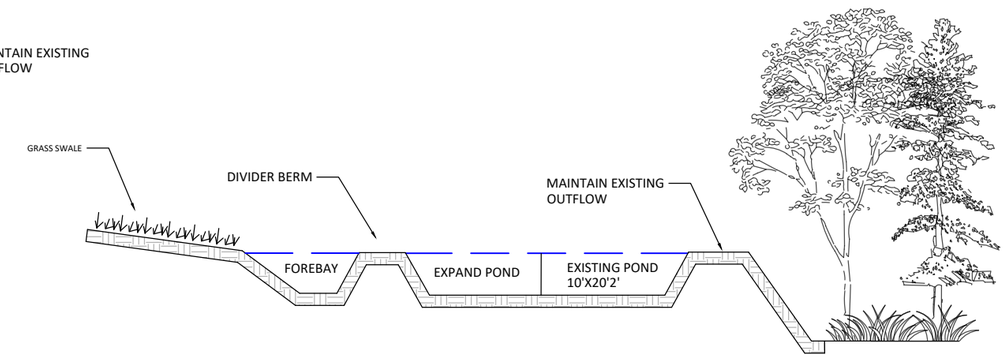
## Preliminary Cost Opinion

Projects WIL-06, WIL-27, WIL-28

| Item | Quantity | Unit | Unit Price | Cost |
|---|---|---|---|---|
| Mobilization/Demobilization | 1 | LS | $ 1,500 | $ 1,500 |
| Common Excavation | 120 | CY | $ 25 | $ 3,000 |
| Hauling | 120 | CY | $ 20 | $ 2,400 |
| 6" Minus Stone | 20 | CY | $ 80 | $ 1,600 |
| Misc. Erosion Control and Site Restoration | 1 | LS | $ 2,000 | $ 2,000 |
| Laborer | 30 | HR | $ 50 | $ 1,500 |
| Final Design & Permitting | 1 | LS | $ 10,000 | $ 10,000 |
| Construction Oversight | 1 | LS | $ 3,000 | $ 3,000 |
| | | | Subtotal | $ 25,000 |
| | | | Contingency (20%) | $ 5,000 |
| | | | **Total** | **$ 30,000** |




PRE TREATMENT FOREBAY TO POND N.T.S




PROFILE: PRE TREATMENT FOREBAY TO POND N.T.S

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Notes:

**Project WIL-06/ WIL-27/ WIL-28**
**Conceptual Design**
Stormwater Master Plan
Haystack Road - Wilmington Town Garage
Wilmington, VT
NOT FOR CONSTRUCTION

| ORD | JHB |
|---|---|
| DRAWN | CHECKED |

N.T.S.
SCALE

2025-03-03
DATE

Sheet 2
SHEET NO.

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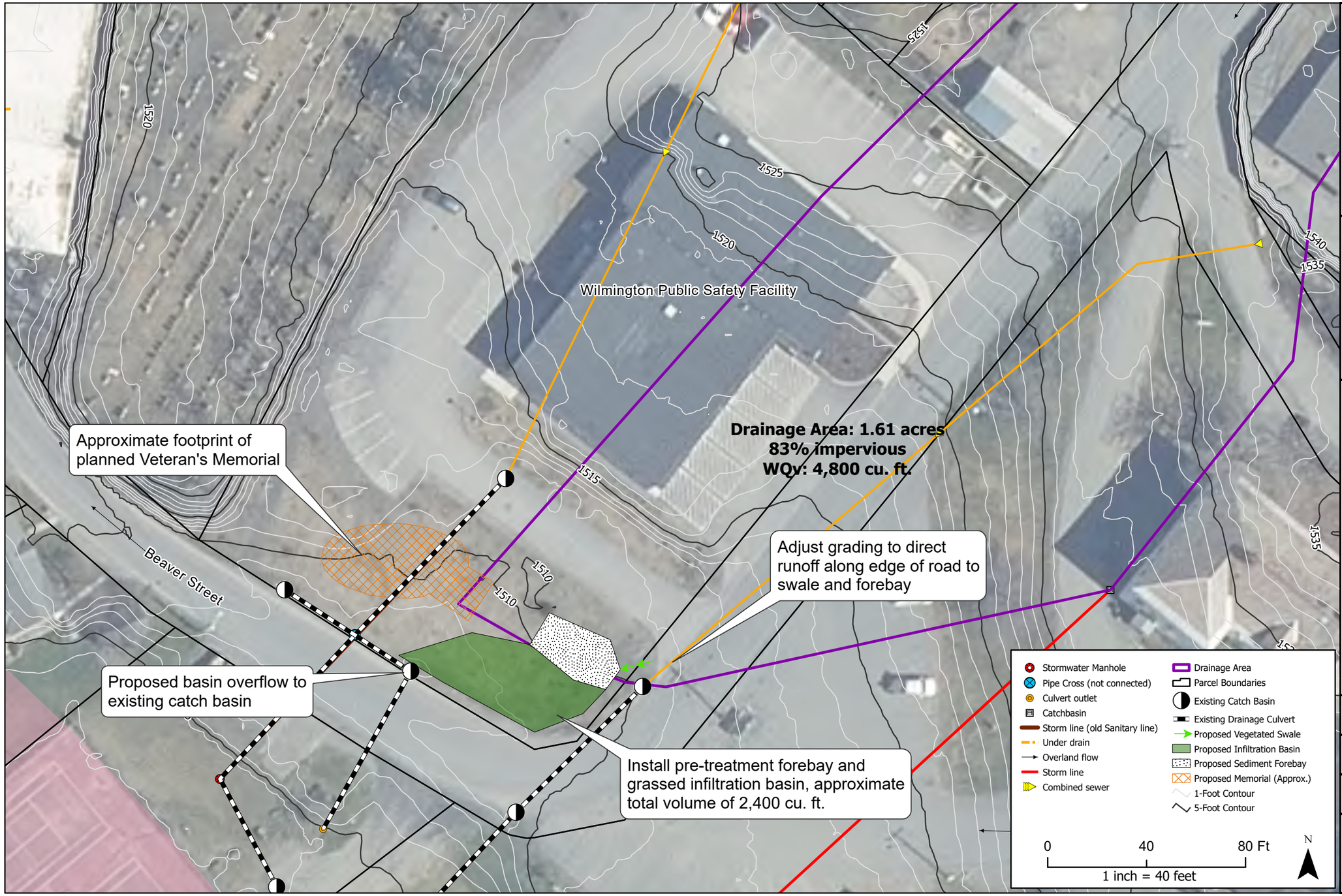


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Notes:
- Conceptual design based on FEA field visit in 2024

Project WIL-16 Conceptual Design
Stormwater Master Plan

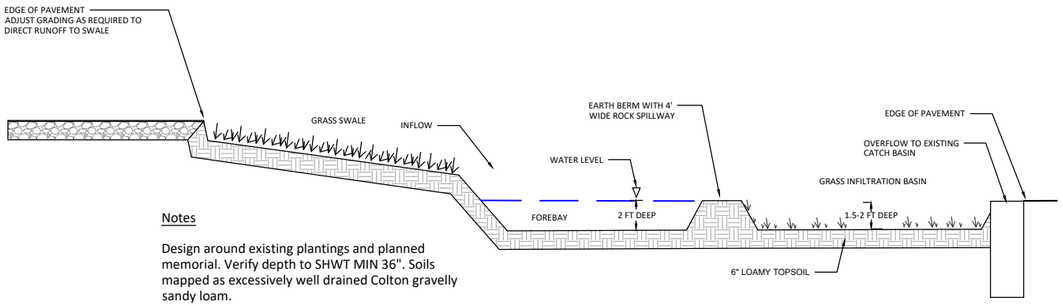
Beaver Street
Wilmington, VT

| MAP BY | CHECKED |
|---|---|
| JWC | JHB |

SCALE: 1 inch = 40 feet

DATE: May 5, 2025

SHEET NO.: SHEET 1

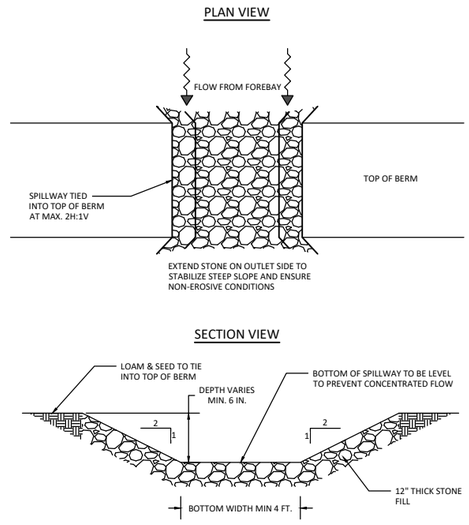



Notes

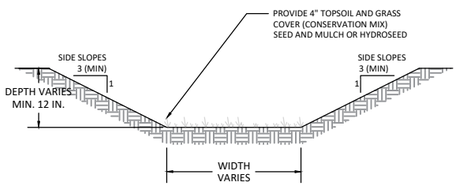
Design around existing plantings and planned memorial. Verify depth to SHWT MIN 36". Soils mapped as excessively well drained Colton gravelly sandy loam.

Verify that underlying soil meets the minimum infiltration rate of 0.2"/hr.

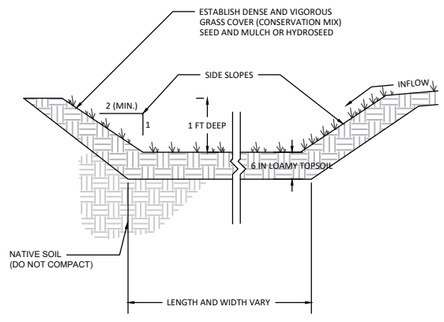
PROFILE: GRASS INFILTRATION BASIN WITH FOREBAY N.T.S




BASIN OUTLET SPILLWAY N.T.S




GRASSED SWALE N.T.S




INFILTRATION BASIN N.T.S

**Preliminary Cost Opinion**

Project WIL-16

| Item | Quantity | Unit | Unit Price | Cost |
|---|---|---|---|---|
| Mobilization/Demobilization | 1 | LS | $ 2,000 | $ 2,000 |
| Common Excavation | 110 | CY | $ 25 | $ 2,750 |
| Hauling | 110 | CY | $ 20 | $ 2,200 |
| 6" Minus Stone | 10 | CY | $ 80 | $ 800 |
| Topsoil | 20 | CY | $ 80 | $ 1,600 |
| Grading | 1 | LS | $ 2,000 | $ 2,000 |
| Misc. Erosion Control and Site Restoration | 1 | LS | $ 4,000 | $ 4,000 |
| Laborer | 30 | HR | $ 50 | $ 1,500 |
| Final Design & Permitting | 1 | LS | $ 15,000 | $ 15,000 |
| Construction Oversight | 1 | LS | $ 3,000 | $ 3,000 |
| | | | Subtotal | $ 34,850 |
| | | | Contingency (20%) | $ 6,970 |
| | | | **Total** | **$ 41,820** |

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Notes:

**Project WIL-16 Conceptual Design**

Stormwater Master Plan

Beaver Street, School/Tirehouse Bottom of the Hill

Wilmington, VT

NOT FOR CONSTRUCTION

| ORD | JHB |
|---|---|
| DRAWN | CHECKED |

N.T.S.
SCALE

2025-03-03
DATE

Sheet 2
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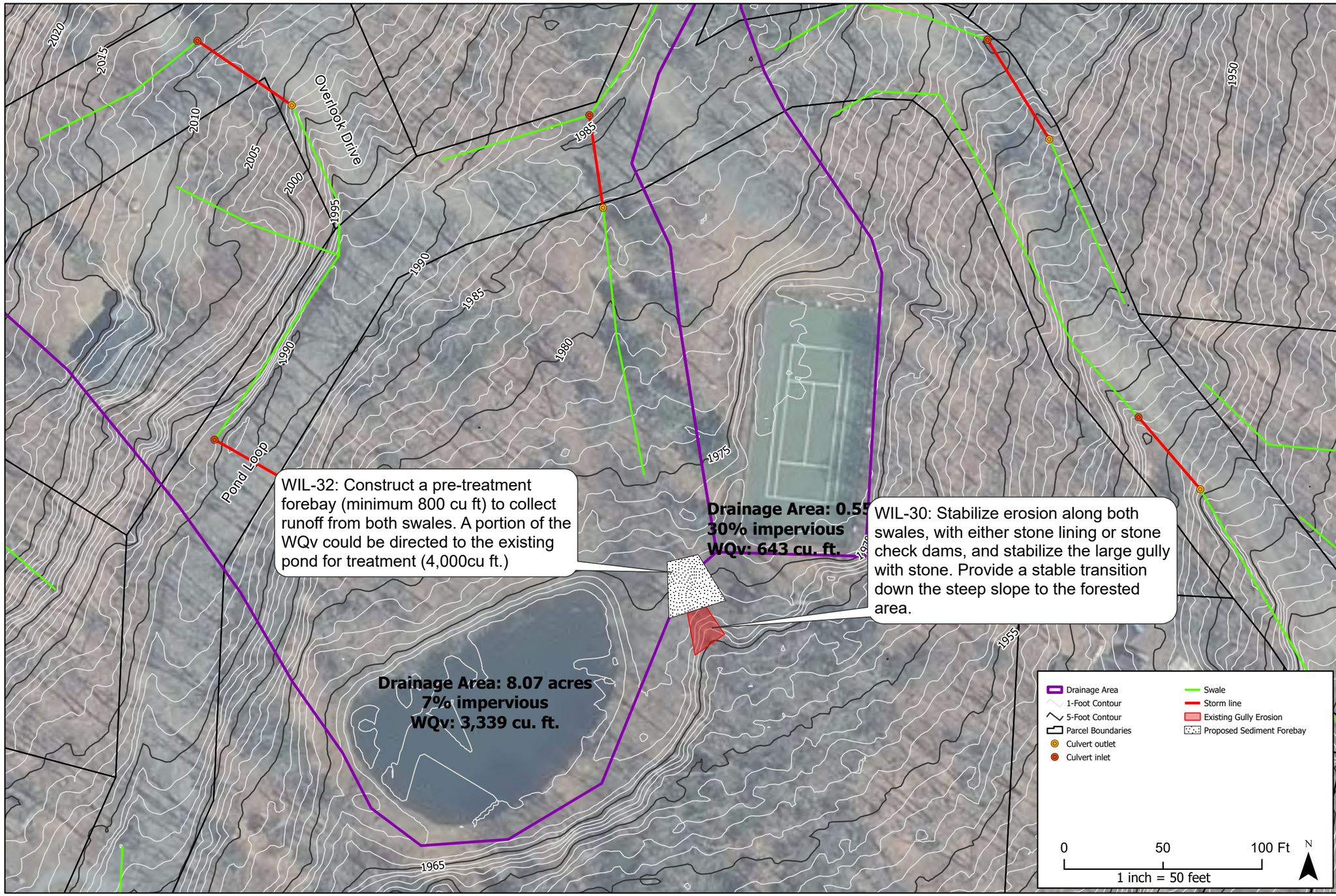


Notes:
- Conceptual design based on FEA field visit in 2024

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Project WIL-30/32 Conceptual Design
Stormwater Master Plan

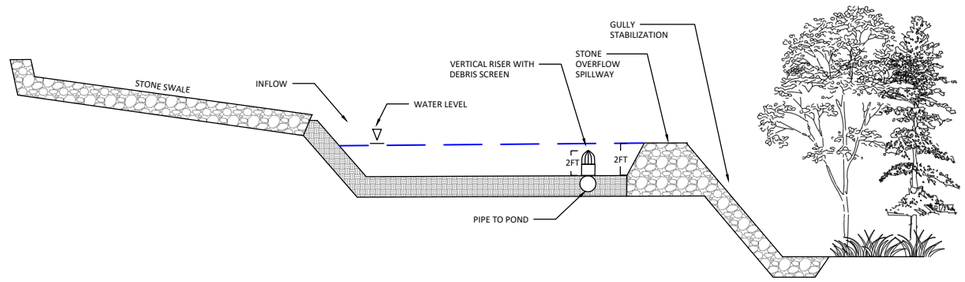
Pond Loop
Wilmington, VT

| MAP BY | CHECKED |
|---|---|
| JWC | JHB |

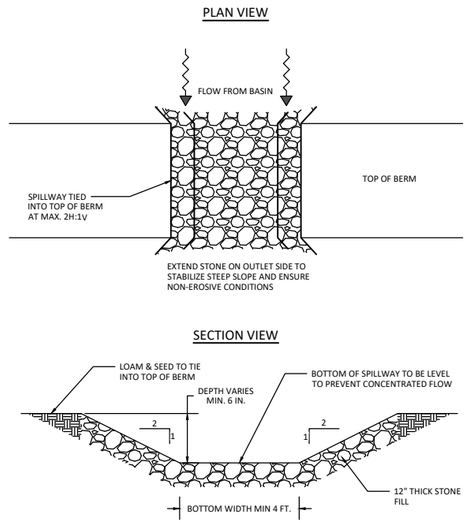
SCALE: 1 inch = 50 feet

DATE: April 7, 2025

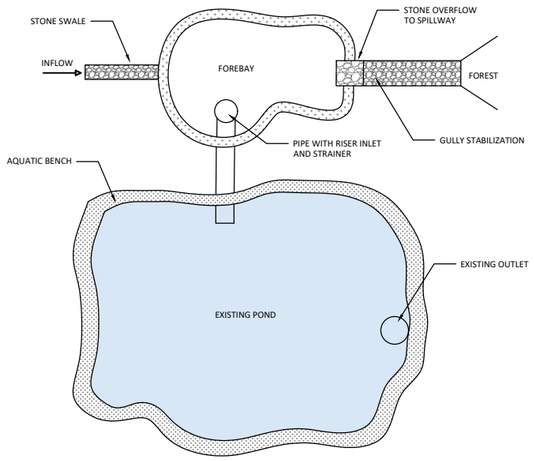
SHEET NO.: SHEET 1



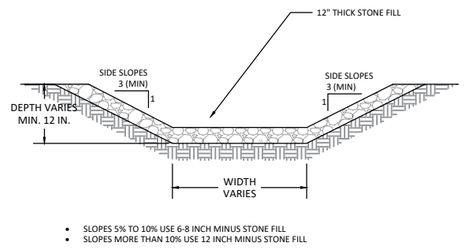

PROFILE: PRE-TREATMENT FOREBAY AND STONE SPILLWAY N.T.S




BASIN OUTLET SPILLWAY N.T.S

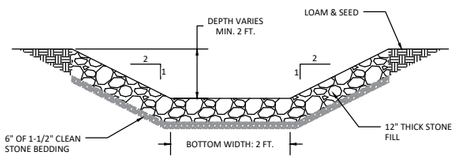



PRE-TREATMENT FOREBAY AND STONE SPILLWAY N.T.S




- SLOPES 5% TO 10% USE 6-8 INCH MINUS STONE FILL
- SLOPES MORE THAN 10% USE 12 INCH MINUS STONE FILL

STONE LINED SWALE




- SLOPES 5% TO 10% USE 6-8 INCH MINUS STONE FILL
- SLOPES MORE THAN 10% USE 12 INCH MINUS STONE FILL

STONE LINED DITCH GULLY STABILIZATION N.T.S

## Preliminary Cost Opinion

Projects WIL-30, WIL-32

| Item | Quantity | Unit | Unit Price | Cost |
|---|---|---|---|---|
| Mobilization/Demobilization | 1 | LS | $ 3,000 | $ 3,000 |
| Common Excavation | 20 | CY | $ 25 | $ 500 |
| Hauling | 20 | CY | $ 20 | $ 400 |
| Topsoil | 5 | CY | $ 50 | $ 250 |
| Stone Line Ditch | 300 | LF | $ 30 | $ 9,000 |
| Type II Stone Fill | 40 | CY | $ 80 | $ 3,200 |
| Outlet Structure | 1 | LS | $ 2,000 | $ 2,000 |
| Misc. Erosion Control and Site Restoration | 1 | LS | $ 2,000 | $ 2,000 |
| Laborer | 40 | HR | $ 50 | $ 2,000 |
| Final Design & Permitting | 1 | LS | $ 10,000 | $ 10,000 |
| Construction Oversight | 1 | LS | $ 3,000 | $ 3,000 |
| | | | Subtotal | $ 35,350 |
| | | | Contingency (20%) | $ 7,070 |
| | | | **Total** | **$ 42,420** |

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Notes:

**Project WIL-30/ WIL-32**
**Conceptual Design**
Stormwater Master Plan
Pond Loop - Common Land
Wilmington, VT
NOT FOR CONSTRUCTION

| DRAWN | CHECKED |
|---|---|
| ORD | JHB |

SCALE: N.T.S.

DATE: 2025-03-03

SHEET NO.: Sheet 2

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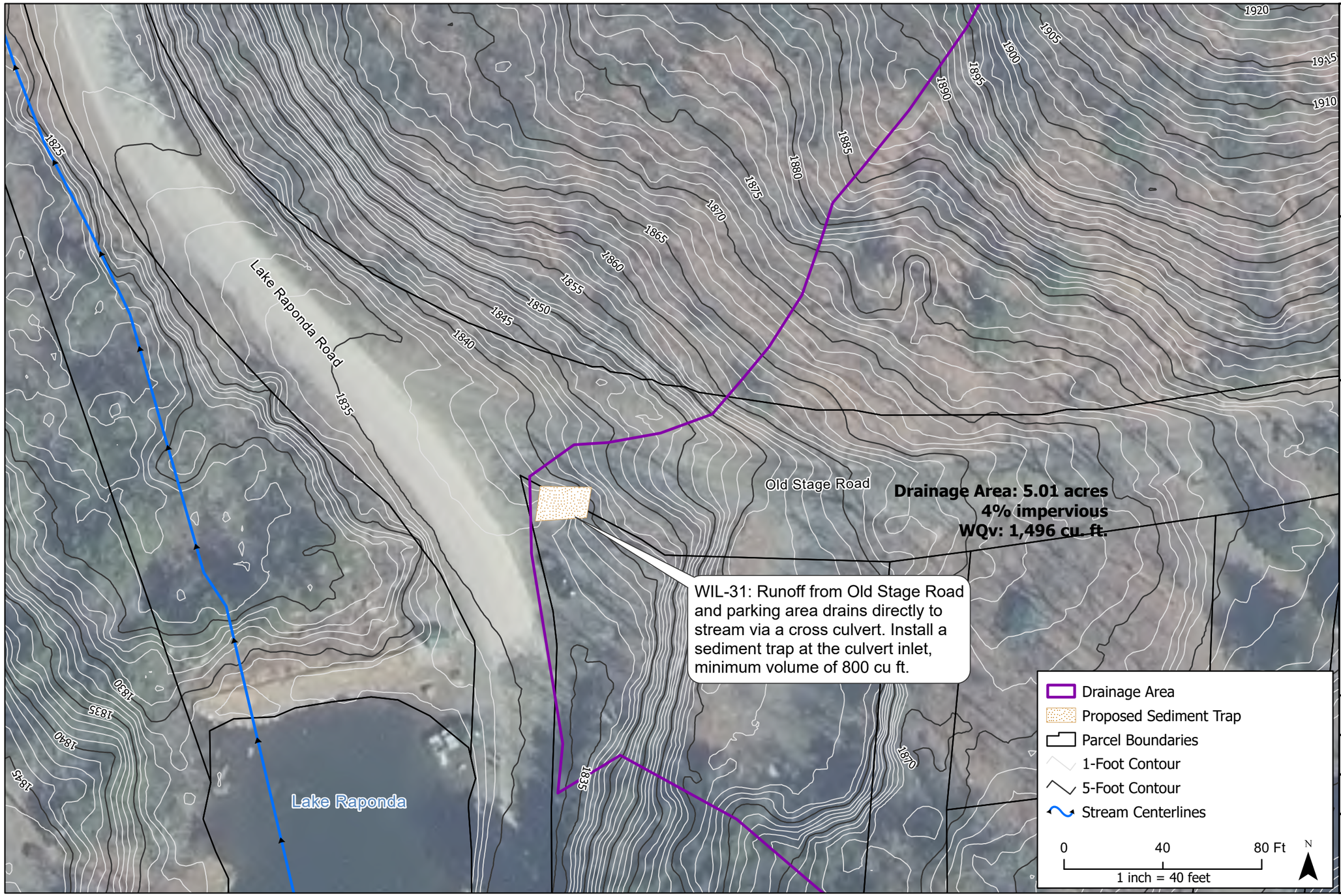


Notes:
- Conceptual design based on FEA field visit in 2024

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Project WIL-31 Conceptual Design
Stormwater Master Plan

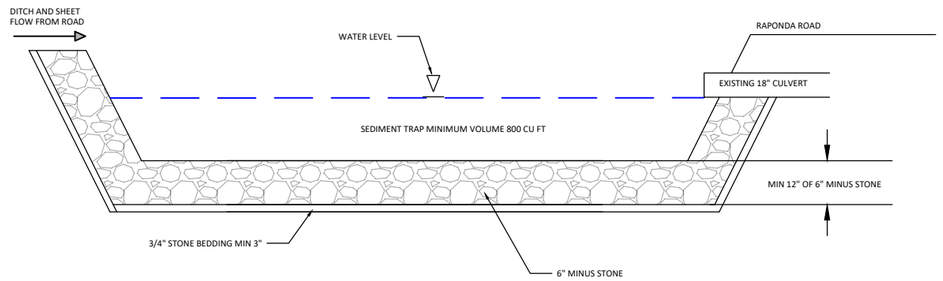
Lake Raponda Road
Wilmington, VT

| MAP BY | CHECKED |
|---|---|
| JWC | JHB |

SCALE: 1 inch = 40 feet

DATE: April 7, 2025

SHEET NO.: SHEET 1




SEDIMENT TRAP AT CULVERT INLET N.T.S


**Preliminary Cost Opinion**

Project WIL-31

| Item | Quantity | Unit | Unit Price | Cost |
|---|---|---|---|---|
| Mobilization/Demobilization | 1 | LS | $ 1,000 | $ 1,000 |
| Common Excavation | 30 | CY | $ 25 | $ 750 |
| Hauling | 30 | CY | $ 20 | $ 600 |
| Misc. Erosion Control and Site Restoration | 1 | LS | $ 500 | $ 500 |
| Laborer | 30 | HR | $ 20 | $ 600 |
| Final Design & Permitting | 1 | LS | $ 3,000 | $ 3,000 |
| Construction Oversight | 1 | LS | $ 1,000 | $ 1,000 |
| | | | Subtotal | $ 7,450 |
| | | | Contingency (20%) | $ 1,490 |
| | | | **Total** | **$ 8,940** |

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Notes:

**Project WIL-31 Conceptual Design**

Stormwater Master Plan

Lake Raponda Road - Boat Launch
Wilmington, VT
NOT FOR CONSTRUCTION

| DRAWN | CHECKED |
|---|---|
| ORD | JHB |

SCALE: N.T.S.

DATE: 2025-03-03

SHEET NO.: Sheet 2

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