Year 7 Massachusetts Small Municipal Separate Storm Sewer System (MS4) Permit – Conceptual Best Management Practice (BMP) Designs for the McKinstry Watershed

Submitted to the Town of Oxford
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Nitsch #14845

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1 Introduction

The 2016 National Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) in Massachusetts (MS4 Permit or the Permit) took effect on July 1, 2018. The Permit was subsequently modified on December 7, 2020. The MS4 Permit conditions the operation, regulation, and management of MS4s in subject Massachusetts municipalities. Terms and conditions include requirements across six Minimum Control Measures (also referred to as Maximum Extent Practicable or MEP provisions), and water quality-based effluent limitations (WQBELs), including requirements for waterbodies with approved Total Maximum Daily Loads (TMDLs) and other water-quality-limited waters. Communities that discharge stormwater runoff from an MS4 system to a waterbody with a TMDL are obligated to address phosphorus impairments through the development and implementation of a Lake Phosphorus Control Plan (LPCP) as described in Appendix F of the Permit. The Town of Oxford, Massachusetts ("the Town") has developed an LPCP which is further described in Section 2 of this report.

One Milestone outlined in Appendix F of the Permit is to reduce phosphorus loading to McKinstry Pond by 20%. This translates to a reduction of approximately 1.05 pounds per year of phosphorus by the end of Permit Year 8 (June 30, 2026). Based on estimates related to the current non-structural Best Management Practices (BMPs) implemented within this watershed, the Town may take credit for 0.39 pounds per year of phosphorus removed. This leaves a required 0.66 pounds per year of phosphorus to be removed by structural BMPs. This report describes the potentials locations and conceptual designs of structural BMPs adjacent to roadways within the McKinstry Pond watershed which, when implemented, would allow the Town to achieve the Milestone Goals for Year 8. This report builds upon an analysis of potential locations for structural BMPs on Town-owned properties, which was conducted in Permit Year 6. Refer to the LPCP for additional information regarding the previous analysis.

Nitsch Engineering (Nitsch) worked closely with the Town to identify priority catchment areas and sites for the installation of BMPs to achieve water quality goals. Included in this report is a summary of the analysis methodology, descriptions of existing conditions for two catchment areas within the McKinstry Pond watershed, and an explanation of BMP selection and sizing criteria. Finally, this report includes eight conceptual design plans and details for BMPs within the two subwatersheds. Each concept was designed to meet or exceed the phosphorus load reduction goal for Year 8. An order-of-magnitude cost estimate is included for each concept. This report provides the Town of Oxford with potential retrofit options of BMPs for future consideration.

2 Lake Phosphorus Control Plan Overview

As an MS4 Permittee, the Town of Oxford ("the Town") has developed a Lake Phosphorus Control Plan (LPCP) which must be fully implemented within 15 years of the MS4 Permit effective date (i.e. by June 30, 2033). Appendix F of the MS4 Permit describes specific requirements of the LPCP, implementation of which is anticipated to achieve the TMDL-established targeted phosphorus reductions. LPCP implementation includes structural and non-structural best management practices (BMPs) executed through programs, projects, and policies. The targeted phosphorus reductions are divided into interim mandatory milestones, culminating in the achievement of allowable TMDL phosphorus loads for each municipality at the end of the 15-year schedule.

The Town of Oxford's LPCP includes phosphorus load calculations and reduction requirements for each of the five lakes and ponds into which The Town's MS4 system discharges. The LPCP describes non-structural BMP practices (including street sweeping, catch basin cleaning, and leaf litter programs) and associated phosphorus reductions applied to each lake/pond. The LPCP also outlines a structural BMP suitability assessment to determine locations for potential BMPs on Town-owned properties within the five lake/pond watersheds.

Table 1.General LPCP Implementation Timeline for Lake and Pond Communities

Timeframe	Deadline (End of Fiscal Year)	Phosphorus Reduction Requirement (% of Total)
0-8 years	2026	20%
5-10 years	2028	40%
10-13 years	2031	70%
13-15 years	2033	100%

Based on the options for phosphorus reduction, Nitsch, in partnership with the Town, created an Implementation Schedule for each of the five lakes and ponds. Four of the five lakes/ponds will achieve the Milestone Goal for Year 8 (2026) using either structural BMPs already installed, non-structural BMP credits, or a combination of existing structural BMPs and non-structural BMP credits. The McKinstry Pond watershed will require implementation of structural BMPs adjacent to roadways to meet its phosphorus reduction requirement. The phosphorus reduction requirement of 20% of total phosphors equates to at least 0.66 pounds per year of phosphorus, as shown in

Table 2.

Table 2. LPCP Implementation Schedule for McKinstry Pond

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	LF of Road Needing Treatment	Acres of Road Needing Treatment	Total "Right of Way" Impervious Acres in Watershed
Year 8 (2026)	1.05	0	0.39	0.66	**1.05**	100%	930	0.64	1.45
Year 10 (2028)	2.10	0	0.39	1.71	**2.10**	100%	2,400	1.65	1.45
Year 13 (2031)	3.67	0	0.39	3.28	**3.67**	100%	4,610	3.17	1.45
Year 15 (2033)	5.24	0	0.39	4.85	**5.24**	100%	6,810	4.69	1.45

3 Conceptual BMP Design Methodology

To understand the opportunities and constraints related to implementation of structural BMPs in town-owned rights of way within the McKinstry watershed, Nitsch performed the following:

- Prioritized outfall catchment areas within the watershed based on existing phosphorus load;
- Analyzed existing conditions within priority outfall catchment areas;
- Delineated and refined catch basin drainage areas within priority outfall catchment areas;
- Determined standard details and dimensions for various BMPs;
- Evaluated design storage volume and phosphorus removal potential of each standard BMP.
- Developed conceptual designs using the standard BMPs to achieve the Year 8 phosphorus removal goal outlined in the LPCP.

3.1 Catch Basin Drainage Area Prioritization

Nitsch used the GIS data and calculations described in the Town's LPCP to identify and prioritize outfall catchment areas for structural BMP implementation. Outfalls within the McKinstry Pond watershed were evaluated based on the following criteria:

- Location within McKinstry watershed and proximity to drainage infrastructure connecting to an outfall within that watershed;
- Total phosphorus loading of the outfall catchment area calculated in the LPCP;
- Presence of town-owned rights of way with existing drainage infrastructure;
- Potential for infiltration, determined by Hydrologic Soil Group (HSG); and
- Feedback from the Town regarding existing pavement conditions and planned improvement projects.

Based on these initial criteria, two outfall catchment areas were chosen for further analysis: the catchment area draining to Outfall OF-14 (located on Manor Lane) and the catchment area draining Outfall OF-277 (located on Spicebush Lane).

The Town indicated that the pavement on Manor Lane is in poor condition and advised Nitsch to prioritize the catchment area draining to Outfall OF-14 for BMP implementation to meet the Year 8 goal, allowing the Town to construct BMP retrofits in tandem with a mill and overlay project.

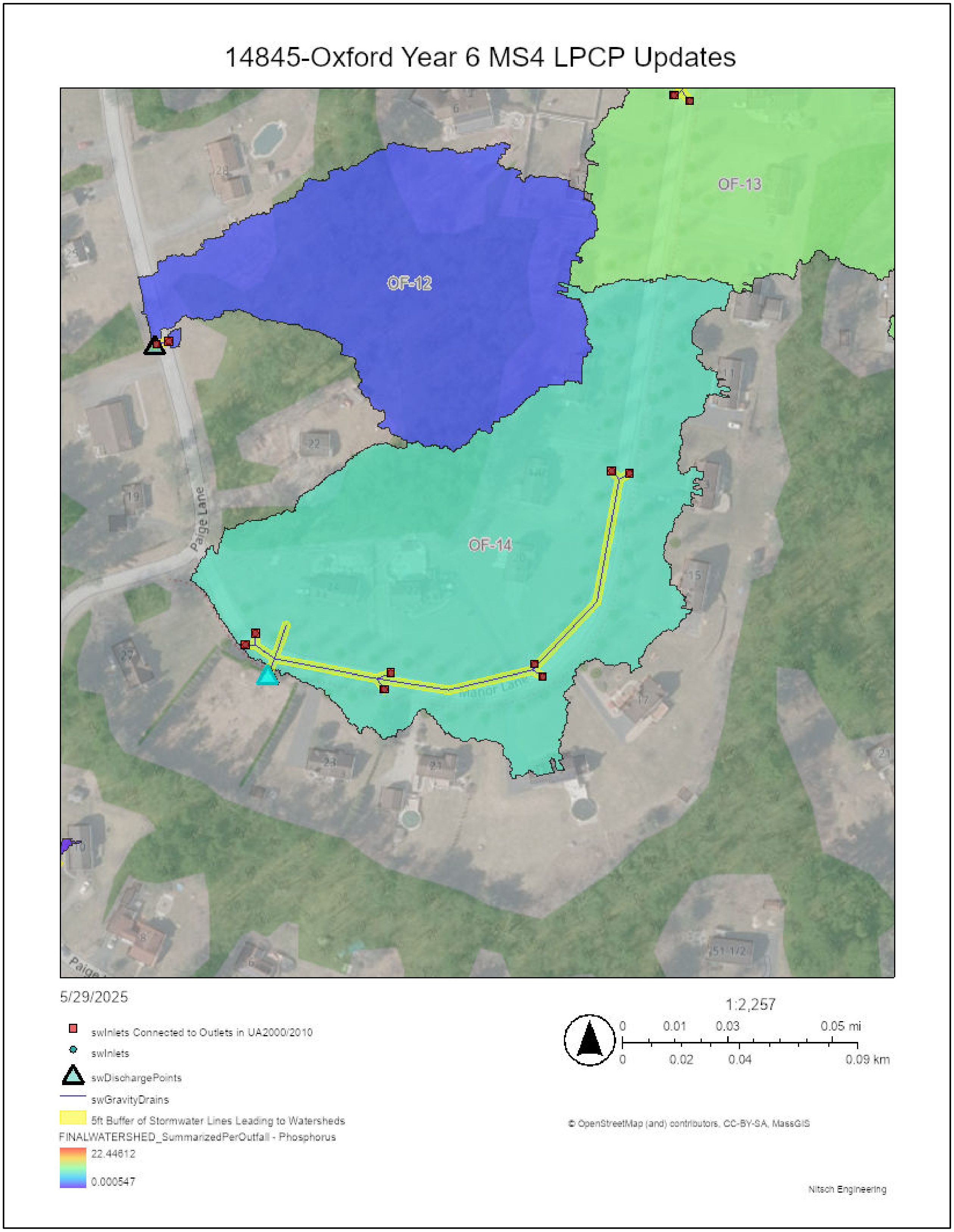

Figure 1. Outfall 14 on Manor Lane in Oxford, MA

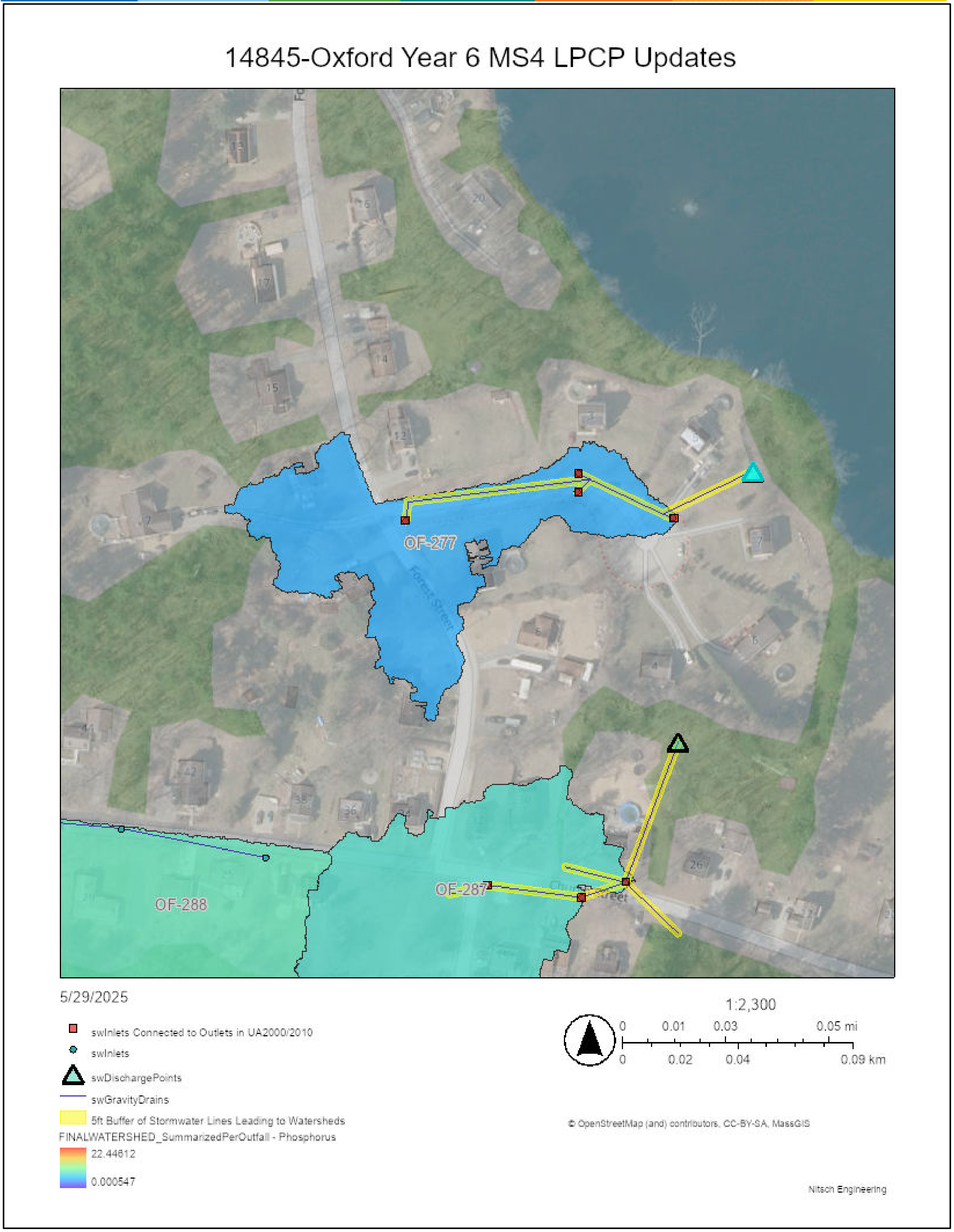

Figure 2. Outfall 277 on Spicebush Lane in Oxford, MA

3.2 Existing Conditions Analysis

Existing conditions for each of the prioritized outfall catchment areas were documented and evaluated for potential retrofit BMPs.

3.2.1 Manor Lane (Catchment Area Draining to OF-14)

The existing drainage area to each catch basin located on Manor Lane was delineated using GIS Lidar data during the development of the LPCP. Nitsch conducted a site visit on April 10, 2025, to evaluate and confirm these initial delineations and document evidence of subsurface utilities. Based on these observations, the drainage areas for four of the eight catch basins were refined to reflect existing conditions, and phosphorus load calculations were adjusted using aerial imagery and 2016 Land Cover/Land Use GIS data.

Nitsch found that the total phosphorus loading for the catchment area draining to Outfall OF-14 did not substantially differ from the phosphorus loading calculated during the development of the LPCP. However, the refined delineations to each catch basins provided more accurate sizing information for potential BMPs.

Nitsch conducted an additional site visit on April 24, 2025, to evaluate the condition of each catch basin and measure sump depth for compliance with the Massachusetts Department of Environmental Protection's (MassDEP's) standards for infiltration pre-treatment. Catch basins for pretreatment are required to have a deep sump (minimum four feet) and a hood on the outlet pipe. All eight catch basins were found to have sumps greater than or equal to four feet and six catch basins have hoods. All completed catch basin inspection forms are attached in Appendix A – Catch Basin Inspection Forms. One catch basin (swIN-125) was found to have a broken frame. Nitsch recommends the Town consider repairing or replacing the frame during any future work in Manor Lane.

3.2.2 Spicebush Lane (Catchment Area Draining to OF-277)

The existing drainage area to each catch basin located on Spicebush Lane was delineated using GIS Lidar data during the development of the LPCP. Nitsch conducted a site visit on May 13, 2025, to evaluate and confirm these initial delineations and document evidence of subsurface utilities. Based on these observations, the drainage areas to all four catch basins were refined to reflect existing condition, and phosphorus load calculations were adjusted using aerial imagery and 2016 Land Cover/Land Use GIS data. One drainage area (swIN-44) significantly increased due to onsite observations.

Nitsch found that the total phosphorus loading for the catchment area draining to Outfall OF-277 did not substantially differ from the phosphorus loading calculated during the development of the LPCP. However, the refined delineations to each catch basin provided more accurate sizing information for potential BMPs.

During the site visit on May 13, 2025, Nitsch evaluated the condition of each catch basin and measured sump depth for compliance with MassDEP's standards for infiltration pre-treatment. Catch basins for pretreatment are required to have a deep sump (minimum four feet) and a hood on the outlet pipe. All four catch basins were found to have sumps greater than or equal to four feet and all have hoods. All completed catch basin inspection forms and photographs are attached in Appendix A – Catch Basin Inspection Forms. Nitsch did not observe any catch basins in need of repair, however all four catch basins were found to have sediment buildup depths greater than 50% of the sump depth. Nitsch recommends cleaning these catch basins as soon as possible: swIN-42, sw-IN-43, sw-IN-44, and sw-IN-45.

Nitsch received a topographic plan dated February 18, 2002, from the Town on April 8, 2025, for Spicebush Lane. The plan confirmed the location of drainage infrastructure within the right of way but did not provide information on the potential presence of other subsurface utilities.

3.3 Structural BMP Location Prioritization

Nitsch evaluated a total of twelve catch basins in the two priority outfall catchment areas (catchment areas draining to Outfalls OF-14 and OF-277). The eight catch basins in Manor Lane and their associated drainage areas (see Figure 3) were evaluated for potential BMP retrofits using the following parameters:

- Calculated Phosphorus load (pounds per year) – Phosphorus loads were calculated for each individual catch basin's drainage area; sites were ranked higher in priority based on higher phosphorus loading.
- Hydrologic Soil Group (HSG) – Using available USGS GIS data, sites were ranked higher in priority based on potential for infiltration.
- Evidence of subsurface utilities – Based on site observations (i.e. existing manhole covers and hydrants) and available record information, catch basins that may have conflicts with potential subsurface utilities ranked lower in priority.
- Size, health and location of existing trees and root zones – Based on site observations, catch basins adjacent to mature and healthy trees ranked lower in priority to minimize potential disturbances.
- Proximity to wetlands (depth to water table) – Sites located furthest from wetlands were prioritized, as proximity to wetlands may indicate higher groundwater levels and limit the constructability of a BMP. Data was acquired from MassDEP and NCRS Web Soil Survey.

Due to the Town's preference for constructing retrofits within Manor Lane to meet Year 8 goals,, catch basins within Spicebush Lane were not ranked using the same methodology.

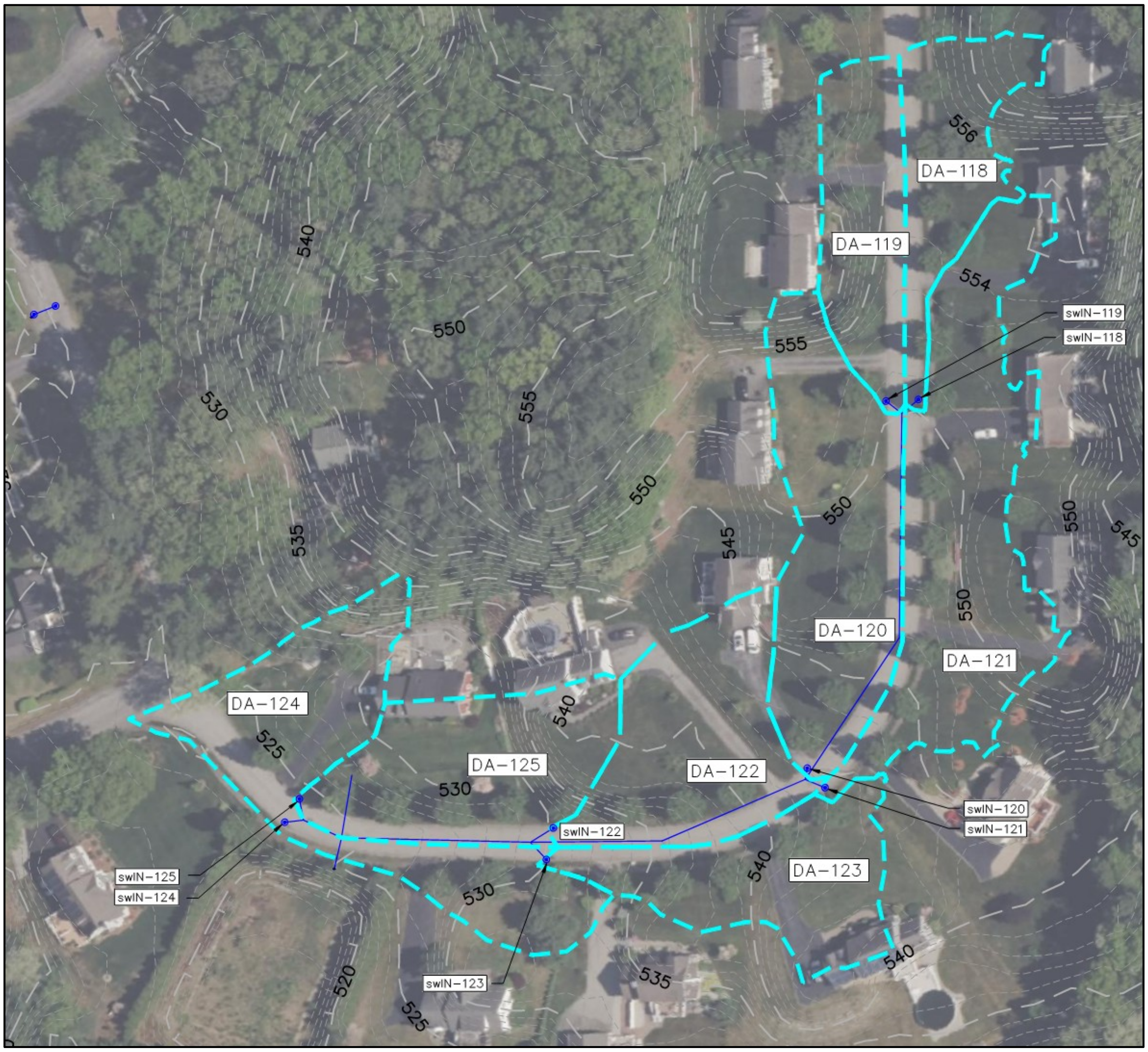

Figure 3. Catch Basins in Manor Lane.

Ultimately, catch basins swIN-124, swIN-122, and swIN-121 in Manor Lane were ranked the highest for potential BMP retrofits. See Table 4 for summary of prioritization criteria for each catch basin.

Table 3. Summary of Catch Basin Prioritization

Catch Basin ID	Parameters					Total Score
	Phosphorus Load[1] (1-5)	Hydrologic Soil Groups[2] (1-5)	Proximity to Observed Utilities[3] (0-1)	Proximity to Mature Trees[4] (0-2)	Proximity to Wetlands[5] (0-2)	
swIN-124	5	5	0	2	1	**13**
swIN-122	4	3	1	2	1	**11**
swIN-121	5	1	1	1	2	**10**
swIN-125	2	1	1	2	2	**10**
swIN-120	1	5	1	2	1	**7**
swIN-123	2	3	1	1	1	**8**
swIN-119	2	1	1	1	2	**7**
swIN-118	2	1	0	0	2	**5**

[1]Catch basins within the first quartile (i.e. highest) of phosphorus loading scored 5 points, second quartile scored 3 points, third quartile scored 2 points, and fourth quartile scored 1 point.

[2]Catch basins located in HSG A scored 5 points, HSG A/B scored 3 points, and HSG B scored 1 point. NRCS WSS data was used to evaluate HSG conditions.

[3]Catch basins where surface utilities were observed (i.e. hydrants or valve box covers) scored 0 points, if no utilities were observed 1 point was scored.

[4]Catch basins located less than 10 feet from a mature tree scored 0 points, catch basins located between 10-20 feet from a mature tree scored 1 point, and catch basins located greater than 20 feet from a mature tree scored 2 points.

[5]Catch basins located 500 feet or more from a wetland scored 2 points, catch basins located less than 500 feet from a wetland scored 1 point.

3.4 BMP Type Prioritization & Selection

Attachment 3 to Appendix F of the MS4 Permit provides methodology for calculating Phosphorus load reductions for structural and semi-structural BMPs for use in meeting goals outlined in the LPCP. Examples of structural BMPs include infiltration trenches, surface infiltration practices such as rain gardens and bioretention basins, gravel wetlands, porous pavement systems, and wet or dry ponds, among others. Examples of semi-structural BMPs include impervious disconnection and soil amendments, among others.

Nitsch reviewed each BMP type to evaluate applicability to the Town of Oxford’s LPCP and implementation along town-owned rights of way. During a project meeting on February 22, 2025, the Town expressed its preference for low-maintenance, subsurface BMPs (such as dry wells) for phosphorus removal credit. Leaching basins (also referred to as dry wells) were recently installed along Church Street as part of a roadway improvement project. The Town also expressed interest in incorporating tree plantings, especially in residential areas. Nitsch evaluated the phosphorus load reduction of tree pits and/or tree trenches and determined that the majority of load reduction would need to be met using infiltration practices. Nitsch recommended the Town consider trees in the residential right of way as a co-benefit to structural BMPs designed for infiltration.

Nitsch then focused the analysis on infiltration trenches and leaching basins with pre-treatment provided by deep sump catch basins. These calculations showed that installing two to three leaching basins within the McKinstry Pond watershed would achieve the phosphorus removal goal for Year 8, depending on site-specific soil conditions in the catch basin drainage areas.

Infiltration Trenches

Infiltration trenches are shallow excavations filled with crushed stone material, which provide temporary storage of runoff utilizing the void spaces within the material. Runoff gradually exfiltrates through the bottom and/or sides of the trench into the subsoil and eventually into the water table. Typically, these systems are constructed by excavating a trench, lining the sides with non-woven geotextile, and filling the trench in layers with clean washed aggregate around a perforated pipe(s). The trench is then topped with processed gravel until final grade is met.

Per the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook, infiltration trenches are well suited for potential retrofits in local roads and small residential developments due to their ability to provide a high degree of pollutant removal. Additionally, trenches are suitable where space is limited due to their thin profile.

Infiltration trenches may be prone to clogging if they are not properly maintained; therefore, Nitsch recommends that maintenance is performed on a regular schedule. Guidance from the MassDEP Stormwater Handbook recommends that infiltration trenches are inspected and cleaned every six months and after every two-year storm event. Inlet and outlet pipes should be inspected for any accumulated sediment or debris and removed if observed. If ponding remains for more than 24 hours following a rain event, the infiltration trench is likely clogged, and the gravel may need to be replaced. The incorporation of pretreatment, such as a deep sump catch basin, will significantly reduce maintenance requirements for the trench, and removing accumulated sediment from the catch basin is less difficult and costly than repairing an infiltration trench.

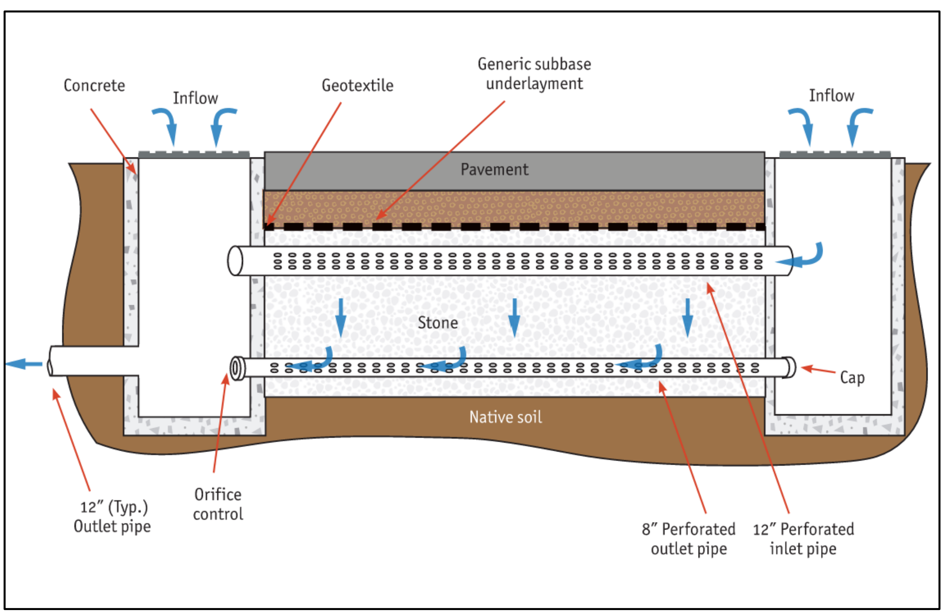

Figure 4. Infiltration Trench (Source: University of New Hampshire Stormwater Center, www.unh.edu/unhsc)

Infiltration trench standard details related to the conceptual designs presented in this report are included in Appendix B – Standard Details and were developed using Massachusetts Department of Transportation (MassDOT) standard details and resources from the University of New Hampshire (UNH) Stormwater Center.

Given the Town's preference to improve stormwater quality while minimizing costs and maintenance considerations, Nitsch also provided conceptual designs and calculations for leaching basins, which have a smaller footprint and can be provided by local pre-cast concrete manufacturers.

Leaching Basins

Leaching basins are typically placed in an excavation lined with geotextile fabric and the basin is placed on top of well-draining crushed stone. Once the basin is placed, the excavation is backfilled with additional well-draining crushed stone. Both the base and the sides of the basin are perforated, allowing runoff to gradually infiltrate into surrounding soil and eventually into the water table. Similar to the construction of an infiltration trench, pretreatment should be provided. A leaching basin is typically preceded by a deep sump catch basin that provides the minimum level of pretreatment for infiltration systems.

To prevent potential clogging, MassDEP recommends that leaching basins are inspected regularly, on an annual or bi-annual basis. Within the first few months following construction, MassDEP also recommends leaching basins are inspected after every two-year storm event to ensure proper stabilization and function. Any accumulated sediment or debris should be removed following inspection.

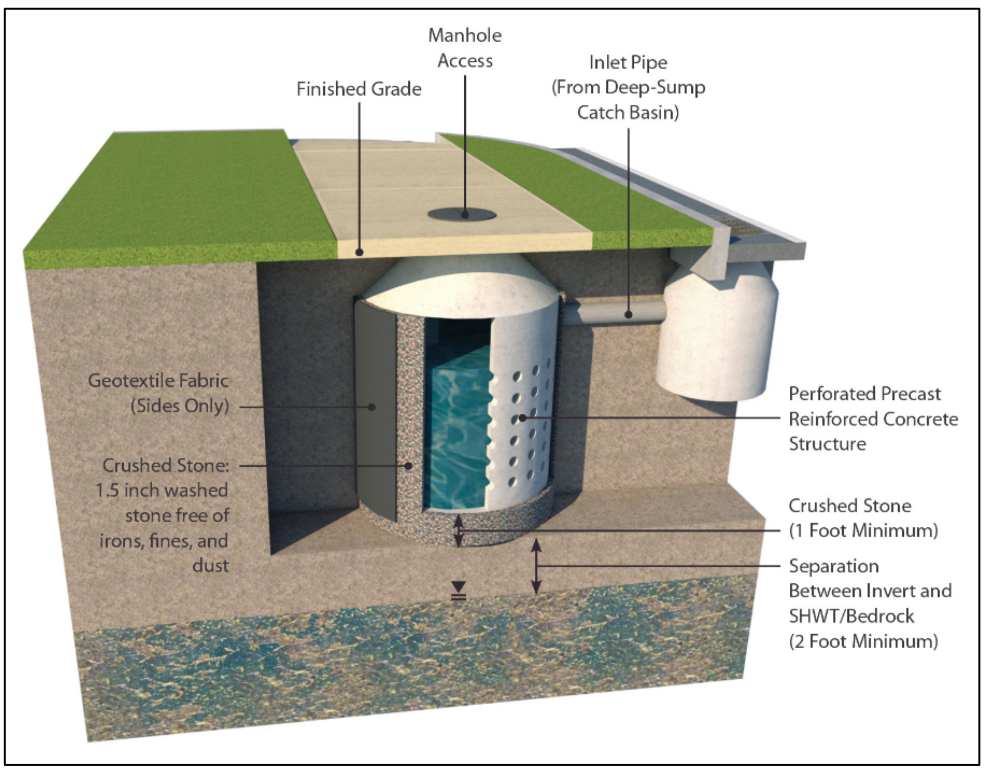

Figure 5. Leaching Basin (Source: MassDOT Stormwater Design Guide, 2023)

Leaching basin (dry well) standard details related to the conceptual designs presented in this report are included in Appendix B – Standard Details and were developed using Massachusetts Department of Transportation (MassDOT) standard details and resources from the University of New Hampshire (UNH) Stormwater Center.

3.5 Structural BMP Sizing

Several parameters were unknown in the conceptual phase, such as soil conditions, infiltration rates, and location of subsurface utilities. Due to these unknown conditions, Nitsch developed standard details and dimensions for large, medium, and small footprint infiltration trenches, as well as a leaching basin, to provide the Town with flexibility once additional information is gathered and existing conditions are confirmed. During a project meeting, the Town expressed a preference for more compact installations as opposed to longer, narrower infiltration trenches, therefore, Nitsch recommends prioritizing leaching basin designs.

Standard BMP dimensions were developed using the average drainage area to catch basins in the two priority outfall catchment areas. Using these standard BMP dimensions, Nitsch calculated the design storage volumes in conformance with Attachment 3 to Appendix F of the MS4 Permit. The design storage volume was then used to determine the treatment depth provided by each standard BMP and potential phosphorus removal rates, depending on soil infiltration rates.

Table 4. BMP Volume Summary

BMP Name	Dimensions			Total Design Storage Volume (Cubic Feet)	Treatment Depth Provided* (Inches)
	Width (Feet)	Length (Feet)	Depth (Feet)		
Infiltration trench, large footprint	8	40	5	776	1.55
Infiltration trench, moderate footprint	6	36	5	568	1.14
Infiltration trench, small footprint	4	24	4	191	0.38
Leaching basin	Diameter = 6 Feet		6	376	0.83

*Note: Treatment depth based on average drainage area of 6,000 square feet.

Nitsch determined that the treatment depth associated with a small footprint infiltration trench would not result in an optimal phosphorus load reduction due to its limited capacity and the relative size of drainage areas in the two outfall catchment areas assessed. Leaching basins were determined to be the preferred alternative to small infiltration trenches, should existing conditions allow for the necessary space/volume required by a 6-foot diameter leaching basin.

4 Phosphorus Removal Calculations & Conceptual Designs

4.1 Phosphorus Removal Calculations

For each catch basin on Manor Lane and Spicebush Lane, Nitsch identified the contributing impervious drainage area (IA) and pervious drainage area (PA) using aerial imagery and the 2016 Land Use/Land Cover GIS dataset. Then, Nitsch applied the infiltration trench performance curves provided in Attachment 3 to Appendix F to determine a feasible runoff depth from impervious areas and the corresponding phosphorus removal rate (see Figure 6). Table 3-4 in Attachment 3 to Appendix F was also used to determine the runoff depth for pervious areas, based on appropriate rainfall depths and Hydrologic Soil Groups (HSGs). The required BMP volume for each catch basin drainage area was calculated by multiplying the IA and PA by their respective runoff depths and summing these values. Based on the required BMP volume for each drainage area, a standard BMP was selected.

Nitsch then estimated the baseline phosphorus load for each catch basin drainage area by multiplying the identified land cover areas by their respective Phosphorus Load Export Rate (PLER), utilizing the crosswalk of the 2016 Land Use/Land Cover categories and PLERs from MassDEP and EPA Region 1. The total phosphorus reduction achieved by BMPs was calculated by multiplying the baseline phosphorus load by the phosphorus load reduction value obtained from the relevant BMP performance curve.

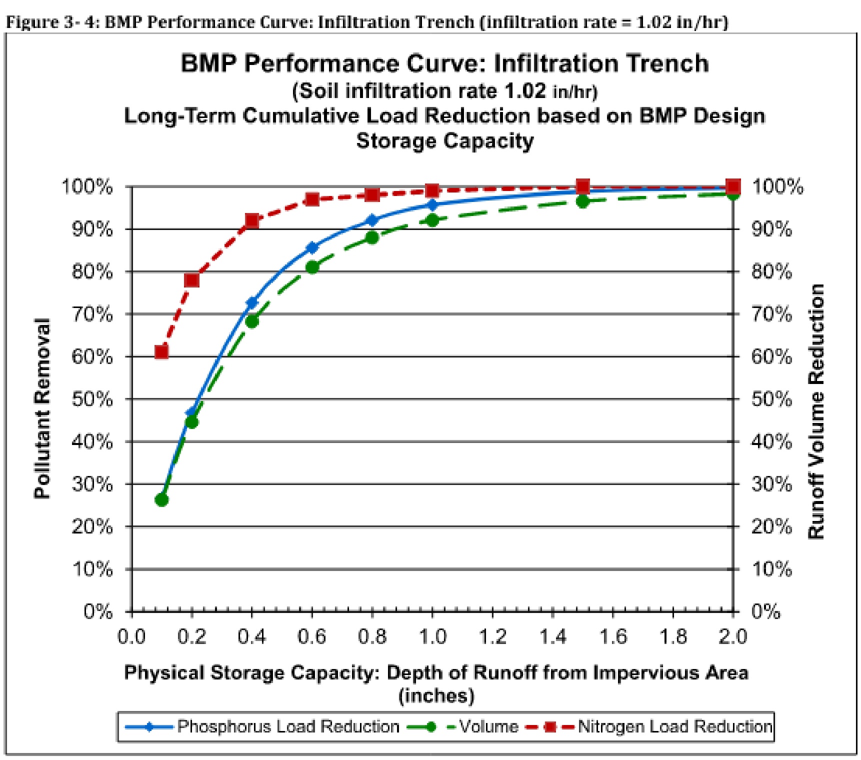

Figure 6. Sample Performance Curve from Attachment 3 to Appendix F of MA MS4 General Permit

Nitsch then repeated pollutant removal calculations for various infiltration rates to verify that the number of infiltration trenches and/or leaching basins would meet or exceed phosphorus load reduction needed to meet the Year 8 goal.

4.2 Conceptual Design Development

Nitsch developed eight conceptual designs based on different combinations of BMPs and catch basin drainage areas treated.

Each conceptual option was designed to meet or exceed the Year 8 phosphorus load reduction goal and is described in more detail in the following sections. The concepts were developed to include the highest priority catchment areas and to include additional catchment areas as needed to meet the phosphorus reduction goals. Because the onsite soil conditions aren't known, the concepts were developed with a range of phosphorus load reduction. Conceptual plans and sizing calculations are included in Appendix C – Conceptual Plans and Appendix D – BMP Sizing and Phosphorus Reduction Calculations.

Table 5. Summary of Conceptual Designs

Catchment Area	Concept	Number of BMP Installations	BMP Type & Size	Catch Basins Proposed for Retrofit	Total Phosphorus Load Reduction (Pounds per year)	Percent Phosphorus Load Reduction in Catchment Area (%)
Manor Lane (OF-14)	A	2	Infiltration Trench, large footprint	swIN-124, swIN-121	0.78	34%
	B	2	Infiltration Trench, medium footprint	swIN-124, swIN-121	0.67	29%
	C	3	Leaching Basin	swIN-124, swIN-122, swIN-120	0.80-0.88*	35-38%*
	D	8	Leaching Basin	swIN-124, swIN-122, swIN-121, swIN-120, swIN-125, swIN-123, swIN-123, swIN-119, swIN-118	1.90	82%
Spicebush Lane (OF-277)	E	4	Leaching Basin	swIN-42, swIN-43, swIN-44, swIN-45	0.94	84%
	F	4	Infiltration Trench, large footprint (2) and medium footprint (2)	swIN-42, swIN-43, swIN-44, swIN-45	1.05	94%

*Phosphorus load reduction was calculated for a range of HSG conditions for this BMP conceptual design.

4.3 Manor Lane

Conceptual designs on Manor Lane were prioritized over Spicebush Lane or other areas within the McKinstry Pond Watershed due to the existing pavement condition (poor) and the Town's preference to capitalize on joint mobilization for both the BMP retrofit installation and a planned mill and overlay project.

Because the existing conditions (soil types, infiltration rates, and existing utilities) surrounding each catch basin are unknown, Nitsch developed concepts that utilize large footprint infiltration trenches, medium footprint infiltration trenches, and leaching basins. Providing concepts with these three options will allow for flexibility when the BMPs are designed and constructed. Concepts A and B meet the phosphorus load reduction target for Year 8 using infiltration trenches, while concept C achieves it using leaching basins. Calculations for concept C were repeated for multiple HSG conditions and are included in Appendix C – Conceptual Plans and Appendix D – BMP Sizing and Phosphorus Reduction Calculations.

Concept D is considered the "above-and-beyond" approach that would surpass the load reduction targets set for both Year 8 and Year 10. The target for Year 10 is to achieve a reduction in phosphorus by 1.71 pounds per year. By implementing a leaching basin downstream of all existing catch basins on Manor Lane, Nitsch estimates that the Town could reduce phosphorus loading by 1.80 pounds per year, exceeding the Year 10 goal.

4.4 Spicebush Lane

According to the Town's pavement management plan, the pavement on Spicebush Lane is currently in good condition. As a result, the Town did not prioritize the construction of BMP retrofit installations in this right of way for Year 8. However, to provide potential BMP retrofits beyond Year 8, Nitsch prepared two conceptual designs based on the conditions on Spicebush Lane.

Nitsch provided conceptual designs utilizing both leaching basins and infiltration trenches. Concept E utilizes leaching basins on each catch basin located on Spicebush Lane; Nitsch estimates that four leaching basins would remove 0.944 pounds per year of phosphorus. Concept F utilizes two large footprint infiltration trenches and two medium footprint infiltration trenches; Nitsch estimates this approach would remove 1.05 pounds of phosphorus per year. Should the Town only meet the Year 8 goal of 0.66 pounds per year with BMP retrofit installations in Manor Lane, Concept F would provide adequate phosphorus removal to meet the Year 10 goal of 1.71 pounds of phosphorus removed.

4.5 Next Steps & Design Recommendations

Limited record plans were available during the conceptual design development, therefore, Nitsch recommends that a survey is conducted to collect additional information on the presence and location of subsurface utilities.

To further refine conceptual designs into construction documents, Nitsch also recommends the Town conduct the following:

- Conduct test pits of each proposed location to confirm location of subsurface utilities and potential conflicts/constraints;
- Conduct soil tests pits and/or infiltration tests at each proposed location to determine depth to groundwater and infiltration rate for existing soils (both of these will have an impact on the results of Phosphorus removal calculations for the required BMP sizing and construction);
    - If selected retrofit sites are determined to have highly infiltrative soils, Nitsch recommends conceptual designs are re-evaluated to incorporate additional pretreatment, in accordance with guidance from the 2008 MassDEP Stormwater Handbook.
- Revise Phosphorus removal calculations for each installed BMP based on volume of BMP; these calculations should be used to update the LPCP for inclusion in Year 8 Annual Report submitted in September 2025.

4.6 Order-of-Magnitude Construction Cost Estimate

Order-of-Magnitude construction cost estimates were developed based on quantity take-offs for each conceptual design and unit costs derived from the MassDOT Construction Project Estimator and recent local construction estimates. These unit costs were adjusted based on professional experience and a 25% contingency was added to each design’s estimate.

The calculation spreadsheets for the Order-of-Magnitude Construction Cost Estimates can be found in Appendix E – Order-of-Magnitude Engineer’s Cost Estimate.

5 Conclusion

Nitsch Engineering developed conceptual designs for Best Management Practices (BMPs) aimed at reducing phosphorus loading into McKinstry Pond as part of the Massachusetts Small Municipal Separate Storm Sewer System (MS4) Permit requirements. This report serves as a comprehensive guide for the Town of Oxford to implement structural BMPs in Town-owned rights of way effectively, ensuring compliance with the MS4 Permit and achieving the necessary phosphorus load reductions to improve the water quality of McKinstry Pond. Each concept was designed to meet or exceed the phosphorus load reduction goal for Year 8. Structural BMPs will need to be implemented by June 30, 2026, to comply with requirements in the Permit and the Town’s Lake Phosphorus Control Plan (LPCP).

Appendix A – Catch Basin Inspection Forms

Appendix B – Standard BMP Details

Appendix C – Conceptual BMP Plans

Appendix D – BMP Sizing and Phosphorus Reduction Calculations

Appendix E – Order-of-Magnitude Engineer's Cost Estimate