Project Background

Local communities and the Ohio Department of Transportation (ODOT) are required by the Ohio Environmental Protection Agency’s (Ohio EPA) statewide Construction General Permit for Storm Water Discharges OHC000004 (CGP) to select, design, construct, operate and maintain post-construction storm water best management practices (BMPs) for new and redevelopment roadway projects statewide. A challenge facing many Ohio municipal, county and state highway engineers is the lack of sufficient Ohio-specific guidance on post-construction storm water BMPs for linear roadway projects that considers the constraints faced by local jurisdictions, urbanized areas and rural areas. The Ohio Department of Natural Resources (Ohio DNR) Rainwater and Land Development Manual, which the Ohio EPA CGP references, includes design guidance for post-construction water quality controls but does not provide guidance focused specifically toward linear roadway applications.

ODOT’s Location and Design (L&D) Manual, Volume 2 serves as the primary in-state guidance for selecting and designing post-construction BMPs that are specific to roadway applications. The need for state-specific BMP guidance for linear roadway projects, particularly for rural and urban roadways that can be easily accessed by local transportation officials, was the driving force behind this research project.

Study Objectives

The primary technical objectives of this research were to:

1. Identify and screen literature highly applicable to research products, both national and Ohio-specific sources
2. Gather information from Ohio roadway BMP stakeholders and apply to research products
3. Develop and provide a BMP selection tool for Locals
4. Develop and provide five BMP case studies as reference documents

Description of Work

The GS&P Team conducted a literature review to identify relevant and current research and guidance on storm water BMPs applicable to local Ohio roadways. Interviews were also conducted with representatives from Ohio Locals and other Ohio storm water BMP stakeholders to gather feedback on Ohio-specific issues and identify potential BMP case studies.

The key findings on BMP design characteristics, functions, and limitations from the literature review and interviews were used to help develop the BMP selection tool and shape the tool’s screening process. The resulting BMP selection tool is a multi-step spreadsheet screening tool, designed to assist the user with identifying potentially applicable BMPs based on user-defined site and project characteristics. Figure 1 shows a screen shot of the BMP selection tool main menu. The tool also includes supplemental information from the research, including cost and maintenance data.

![BMP Selection Tool Screenshot]

**Figure 1. List from the Main Menu in the BMP Selection Tool**

Through interviews and other correspondence, the GS&P Team gathered data from stakeholders to develop five BMP case studies. Each case study provides information specific to the particular BMP to help identify some of the key factors to consider during BMP selection. With input from the ORIL Technical Advisory Committee, the following representative array of typical local roadway BMPs was selected:

- Bioretention with underdrain
- Manufactured device (also known as hydrodynamic separator)
- Permeable pavement with extended underground detention
- Vegetated biofilter/swale
• Constructed wetland (also known as extended detention wetland)

Research Findings & Conclusions

Generally, the selection and design of post-construction BMPs for local roadway projects in Ohio has several opportunities for improvement. The research products are intended to provide a path forward to address these as summarized by the following:

• Locals and project designers must understand the regulatory requirements for storm water treatment. The BMP selection tool provides assistance with identifying the applicable regulatory requirements.
• Locals would benefit from additional guidance materials to support decision-making in BMP selection and design. Along with the BMP case studies and list of references, the BMP selection tool provides information to help Locals understand BMP characteristics, especially regarding footprint requirements, on-going maintenance, aesthetics, safety considerations, and other potential impacts to the construction project.
• Post-construction BMPs should be considered early in the project design. The BMP selection tool should be implemented prior to beginning Stage 1 design.
• Storm water BMPs occupy space, typically in the right-of-way, and space on local roadway projects is often limited. When BMP planning is incorporated late in the project, BMP options become more limited and additional costs may be incurred.
• The BMP tool provides a common methodology for BMP selection and documentation which may streamline the process. The BMP tool questions also prompt Locals to identify data needs for BMP selection.
• Storm water BMPs must be evaluated on a case-by-case basis. Each project site has unique conditions which can be addressed by different BMPs depending on their characteristics. The BMP selection tool provides a list of potentially applicable BMPs based on the user inputs. Locals and designers must evaluate the BMPs for practicability and appropriateness.
• All BMPs require regular maintenance to function appropriately, and proper maintenance is a condition of the Ohio EPA CGP and local MS4 permits. The research products provide general guidance for comparative purposes and references to find more detailed information associated with post-construction BMP maintenance.

Recommendations for Implementation of Research Findings

To best implement the results of this research project, the GS&P Team recommends the following:

• Utilize the BMP selection tool prior to stage 1 design development, possibly even prior to release of the project request for proposal. Use of the BMP tool will help provide Locals needed information for selecting BMPs.
• Refer to the BMP Case Studies for additional Ohio-specific project information, such as lessons learned, location, photographs, example design drawings, and other considerations for the five different BMPs covered in the case studies.
• Use the reference sources included in the research to find additional information on design, construction costs, operations and maintenance, safety, and pollutant removal performance.

Furthermore, some outstanding questions remain which may affect the successful implementation of the research. The following questions are related to the future use and ownership of the BMP tool:

• How will the BMP tool be made available to Locals? Is there a relevant ODOT website where it could be hosted?
• Who will be the document “owner” to maintain the document if updates are needed?
• How frequently will the document be reviewed and updated to incorporate regulatory changes as well as updates to current BMP information?
• The spreadsheet is currently password protected to prevent accidental editing. Will the unprotected spreadsheet be made available to Locals? Will it be available to the general public?
• Will ODOT provide any training or guidance to Locals on using the BMP tool?

Finally, additional research opportunities were identified as a follow up to this project.
• The BMP selection tool is broadly applicable to statewide requirements. An opportunity exists to customize the tool for specific agencies, including ODOT, agencies with a local design standards manual, and agencies within a watershed with a Total Maximum Daily Load (TMDL). ODOT may benefit from a modified version of the BMP tool which incorporated Interstate, State and US route projects. This version of the tool could expedite BMP assessment and selection for ODOT designers, and add continuity in BMP selection and design process statewide.

• In order to offer more BMP options to Locals and other roadway owners, ODOT may want to update the ODOT L&D Manual to add appropriate BMPs included in the BMP tool (e.g., permeable pavement and shoulder media filter drains). It is understood that ODOT would need to allow for Ohio EPA review and comment on revisions to the ODOT L&D Manual since it is referenced in the Ohio EPA CGP.

• BMP construction costs ranges were provided in the BMP tool, but more detailed, Ohio-specific cost analysis would help Locals better understand the tradeoffs between BMP options.

• Similarly, comparative costs for BMP operations and maintenance were provided in the BMP tool, but more detailed information would be helpful in BMP selection.

Locals who utilize the research products can expect several benefits as described throughout the final report and summarized below:

• Develop a better understanding of local roadway BMP options.
• Have tools available to compare different BMP options depending on project-specific data and Local’s preferences and priorities.
• Create better documentation and quality assurance in the BMP identification and selection process.
• Reduce the risk of unnecessary costs through early planning of BMPs and coordination with overall project design.
• Increase the potential for BMP success by better understanding long term operations and maintenance needs, safety considerations, and aesthetics of potential BMPs.