NPDES PHASE II MS4 GENERAL PERMIT

WATER QUALITY CHARACTERIZATION REPORT

STORMWATER QUALITY MANAGEMENT PLAN

JANUARY 2023

Prepared for:

City of Carmel
One City Square
Carmel, IN 46032

Permit #: INR040150

Prepared by:

Christopher B. Burke Engineering, LLC
115 W. Washington St., Ste. 1368 S.
Indianapolis, IN 46204

Burke Project No. 19.R050641

WQCR and SWQMP Certification in accordance with 327 IAC 15-4-3(i) and MS4GP 3.3 and 4.9

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Emily Myers 12/19/22

Qualified Professional Signature Date

Emily Myers 12/19/22

Qualified Professional Printed Name Date

12-16-2022

MS4 Operator or Designee Signature (in accordance with 327 IAC 15-4-3(g)) Date

JEREMY KASHMAN, PE 12-16-2022

MS4 Operator or Designee Printed Name Date

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION 1

1.1 CITY OF CARMEL MS4 EXISTING CONDITIONS 2

1.2 MS4 CONVEYANCE SYSTEM 2

CHAPTER 2: WATER QUALITY CHARACTERIZATION REPORT 3

2.1 LAND USE/LAND COVER 3

2.2 MS4 OWNED AND OPERATED STRUCTURAL STORMWATER MANAGEMENT MEASURES 4

2.3 RECEIVING WATERS 4

2.4 SENSITIVE AREAS 6

2.5 REVIEW OF EXISTING WATER QUALITY DATA 9

2.6 POTENTIAL AREAS OF POLLUTION 12

2.7 DATA SUMMARY 14

CHAPTER 3: STORMWATER QUALITY MANAGEMENT PLAN 15

3.1 MS4 BOUNDARIES 15

3.2 MS4 ADMINISTRATION 15

3.3 MCM PROGRAM DESCRIPTIONS 16

REFERENCES 37

LIST OF FIGURES

Figure 1: Location of Carmel, Indiana 1

Figure 2: MS4 Boundary Map, City of Carmel 2

LIST OF TABLES

Table 1: City of Carmel Land Cover 3

Table 2: City of Carmel Receiving Waters 4

Table 3: City of Carmel Watersheds 5

Table 4: City of Carmel 303(d) Impaired Waters 5

Table 5: City of Carmel TMDLs 6

Table 6: City of Carmel Highly Erodible Soils 8

Table 7: LARE Projects Relevant to City of Carmel MS4 11

Table 8: Discharge Screening Factors for IDDE Desktop Assessment 13
Table 9: MS4 Boundaries 15
Table 10: Public Education, Outreach, Participation and Involvement BMPs 17
Table 11: IDDE BMPs 23
Table 12: Construction and Post-Construction BMPs 27
Table 13: Pollution Prevention and Good Housekeeping BMPs 33

LIST OF EXHIBITS

Exhibit 1: MS4 Boundary
Exhibit 2: Water Quality
Exhibit 3: Land Cover
Exhibit 4: Highly Erodible Land

APPENDICES

APPENDIX 1: MS4 Owned/Operated Structural BMP Inventory
APPENDIX 2: Programmatic Indicators
APPENDIX 3: Acronyms
APPENDIX 4: Exhibits

CHAPTER 1: INTRODUCTION

As part of the 1987 amendments to the federal Clean Water Act (CWA), the United States Congress added Chapter 402(p) to the CWA to address the water quality impacts of stormwater discharges from industrial facilities and large to medium municipal separate storm sewers systems (MS4s). Large to medium MS4s were defined as communities serving populations of 100,000 or more and are regulated by the Environmental Protection Agency (EPA) under the National Pollutant Discharge Elimination System's (NPDES) Storm Water Phase I Program.

In addition to these amendments, Congress directed the EPA to issue further regulations to identify and regulate additional stormwater discharges that were considered to be contributing to national water quality impairments. In 1999, the EPA issued regulations that expanded the existing NPDES Storm Water Program to include discharges from small MS4s in "urbanized areas" serving populations of less than 100,000 and stormwater discharges from construction activities that disturb more than one acre of land. These regulations are referred to as the NPDES Phase II Storm Water Program.

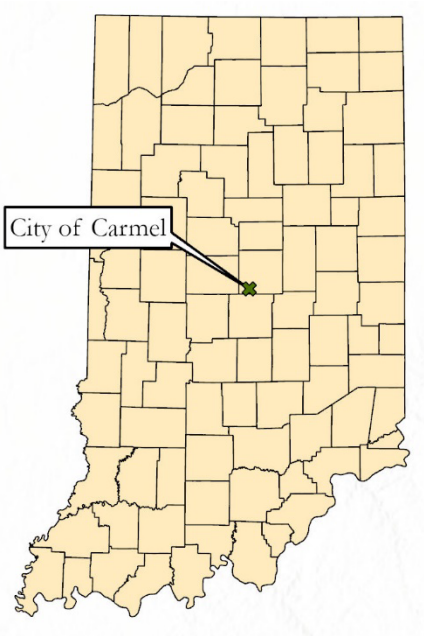


Figure 1: Location of Carmel, Indiana

The City of Carmel (**Figure 1**), located in Hamilton County, has met these criteria and consequently has been designated as an MS4 entity.

In the State of Indiana, the Indiana Department of Environmental Management (IDEM) is responsible for the development and oversight of the NPDES Phase II Program. IDEM initiated adoption of the Phase II Rules that were ultimately codified as 327 IAC 15-13 (Rule 13) and became effective on August 6, 2003.

In December 2021, IDEM formally replaced Rule 13 with a new MS4 General Permit (MS4GP). Since the permits have not been updated since 2003, several new or revised provisions have been incorporated that would impact how regulated Indiana MS4 entities such as counties, cities, and towns incorporate these new changes into their existing programs. The MS4GP provides permit coverage for Phase II entities, and the requirements and conditions of the MS4GP apply to all Phase II MS4s upon submittal of a Notice of Intent (NOI).

Under Rule 13, IDEM issued approximately 185 Phase II MS4 permits in Indiana. On April 13, 2022, IDEM notified another 45 entities that they would be subject to the MS4GP regulations starting on April 13, 2023.

This report has been prepared to meet the requirements of the MS4GP for the development of a Water Quality Characterization Report (WQCR) and a Stormwater Quality Management Plan (SWQMP) for previously regulated and newly designated MS4s. It is also intended to replace older versions of the obsolete Rule 13 required WQCR and SWQMP; also known as Parts A, B, and C.

1.1 CITY OF CARMEL MS4 EXISTING CONDITIONS

The City of Carmel covers approximately 32,050 acres and the MS4 jurisdictional boundary mirrors the city boundaries (as of May 2022), which is identified on **Figure 2**. The city is located in southwestern Hamilton County in Clay Township.

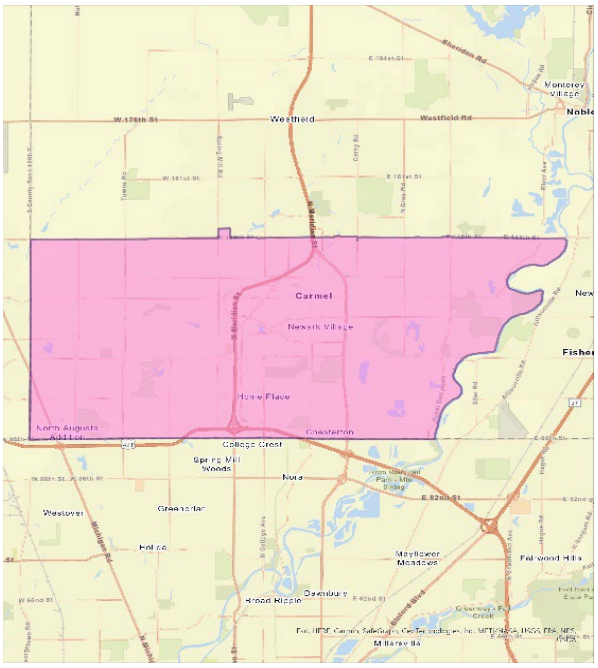


Figure 2: MS4 Boundary Map, City of Carmel

The primary responsibilities for implementing requirements included in the MS4GP are held by the City of Carmel Engineering and Stormwater Management Department. Staff within this department are responsible for the city's Stormwater Management Plan, including compliance, project permitting, and inspections. Activities such as maintenance of the city's storm drains and inlets, trash pick-up, and household hazardous waste collection are the responsibility of the City of Carmel Street Department and Utilities Department.

The City of Carmel has experienced rapid population growth. According to StatsIndiana, the population of Carmel in 2020 was 99,757, an increase of 26.0% since 2010, making it the largest city in Hamilton County by population.

1.2 MS4 CONVEYANCE SYSTEM

The MS4GP authorizes stormwater discharges from designated MS4 entities throughout the State of Indiana. The permit applies to all areas under the ownership, control, or jurisdiction of a designated MS4 entity. "MS4" refers to the permit holder such as the city as well as the separate storm sewer system that the city owns and operates or maintains.

MS4s are defined by the State of Indiana as a conveyance or system of conveyances owned by a state, city, county, town, district, or other public entity having jurisdiction over stormwater, including special districts under state law such as a sewer district, that discharges to waters of the United States and is designed or used for collecting or conveying stormwater. Regulated conveyance systems include roads with public drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels, and conduits. It does not include combined sewer overflows and publicly owned treatment works.

The authorized MS4 entity or city is responsible for the MS4 conveyances that it owns, operates, or maintains within its boundaries.

CHAPTER 2: WATER QUALITY CHARACTERIZATION REPORT

REQUIREMENT MS4GP 3.1(a):
The water quality characterization report (WCQR) shall use the most current data available but may also consider additional data that describes the chemical, biological, and/or physical condition of the receiving waters of the MS4 jurisdictional area.

2.1 LAND USE/LAND COVER

REQUIREMENT MS4GP 3.1(c):
The WCQR must include: (1) An assessment of land use.

Land use and land cover can be an important tool in developing a basic overall assessment of the watershed, MS4 area, and the anticipated water quality within the receiving waters. Derived from the 2019 National Land Cover Dataset (NLCD), **Table 1** indicates the land cover (in acreage) within the jurisdictional area. Additionally, the land cover is graphically represented in **Exhibit 3**.

Table 1: City of Carmel Land Cover

Land Cover	Acres
Cultivated Crops	1,630.7
Developed, Low Intensity	10,136.9
Developed, Open Space	6,879.7
Developed, Medium Intensity	6,925.5
Developed, High Intensity	2,017.7
Barren Land (Rock/Sand/Clay)	24.8
Deciduous Forest	1,526.3
Evergreen Forest	36.6
Mixed Forest	54.6
Grassland/Herbaceous	150.1
Open Water	516.3
Emergent Herbaceous Wetlands	45.6
Woody Wetlands	61.2
Shrub/Scrub	27.8
Pasture/Hay	2,018.4
TOTAL	**32,052.2**

The effects of land use/land cover changes on surface runoff, stream flow, and groundwater recharge are fundamental considerations in stormwater management. Planned expansion of urban areas provides the opportunity to implement policies and best management practices (BMPs) that may significantly reduce or prevent impacts to the environment in terms of groundwater recharge, water pollution and stormwater drainage. Urbanization typically includes additional impervious surfaces and increased runoff which can result in downstream flooding, and detrimental impacts to local waterways. Since each land use/land cover may have a different impact on stormwater runoff, strategic land use planning can help minimize these impacts.

The city's long-term plan includes several areas that will change the land use and land cover of the current MS4 area. For example, the city anticipates suburban residential housing development to continue throughout the MS4, as well as high-density redevelopment in the downtown core. Additional redevelopment is planned along Michigan Road and within the newly annexed Home Place neighborhood.

2.2 MS4 OWNED AND OPERATED STRUCTURAL STORMWATER MANAGEMENT MEASURES

REQUIREMENT MS4GP 3.1(c):
The WQCR must include: (2) An inventory of MS4 owned/operated structural stormwater management measures…including an identification number, geographic coordinate, and structure condition.

According to MS4 staff, there are 80 publicly owned and/or operated structural BMPs within the jurisdictional area. **Appendix 1** lists those BMPs by type and includes an identification number and overall condition based on the last assessment or inspection. These structures, including maintenance dates, findings and methods are managed by the Stormwater Department through the city's asset management database and work orders. The geographic coordinate of each BMP is tracked within the city's database and locations can be made available upon request.

2.3 RECEIVING WATERS

REQUIREMENT MS4GP 3.1(c):
The WCQR must include: (3) Identification of all receiving waters that receive discharges from outfalls within the MS4, including wetlands and lakes. (4) Any 303d listed impaired waters or TMDLs for receiving waters need to be identified.

The city discharges stormwater into the receiving waters listed in **Table 2**. These waterbodies are also identified on **Exhibit 2.**

Table 2: City of Carmel Receiving Waters

Almond Ditch	Hot Lick Creek
Ams Run	Kirkendall Creek
Bear Creek	Lion Creek
Blue Woods Creek	Little Cool Creek
Boone Creek	Little Eagle Creek
Brook Ditch	Long Branch
Carmel Creek	Mitchner Ditch
Cemetery Creek	Ream Creek
Center Creek	Spring Mill Run
Clay Creek	Trail Creek
Cool Creek	Vestal Ditch
Crooked Creek	Well Run
Delaware Creek	White River
Elliot Creek	Will Creek
Henley Creek	Trail Creek
Hiway Run	Williams Creek
Hoover Run	

2.3.1 Watersheds

According to the U.S. Geological Survey (USGS), watersheds are delineated using a nationwide system based on surface hydrologic features. This system divides the country into 21 regions (two-digit), 222 subregions (four-digit), 370 basins (six-digit), 2,270 subbasins (eight-digit), approximately 20,000 watersheds (ten-digit), and 100,000 sub-watersheds (12-digit). A hierarchical hydrologic unit code

(HUC) consisting of two additional digits for each level in the hydrologic unit system is used to identify any hydrologic area.

The MS4 area overlays portions of one eight-digit HUC watershed; the Upper White River Basin (HUC 05120201). The 12-digit HUCs (based on April 2022 MS4 boundaries) along with the acreages in the MS4 are listed in **Table 3.**

Table 3: City of Carmel Watersheds

12-digit HUC	Watershed Name	Watershed Acres Located in MS4 Boundary
051202011003	Carmel Creek-White River	5,758.4
051202011001	Cool Creek	5,941.2
051202011005	Delaware Creek-Crooked Creek	1,686.9
051202011006	Howland Ditch-White River	1,246.6
051202011107	Irishman Run-Eagle Creek	1,652.9
051202011104	Lion Creek-Little Eagle Creek	1,747.6
051202010705	Mallery Granger Ditch-White River	1,139.1
051202011002	Vestal Ditch-White River	3,567.6
051202011004	Williams Creek	9,312.0

2.3.2 Integrated Waters Report

Section 303(d) of the CWA requires states to identify waters that do not currently or are not expected to meet the state's water quality standards through implementation of technology-based standards. Within this section of the CWA, states must also prioritize these waters based on the designated uses of the water and the severity of the pollution. **Table 4** identifies the segments within the jurisdictional area for Carmel that are listed on the Indiana 303(d) list of impaired waters.

Section 305(b) of the CWA requires the state to assess and report on how well the waters of Indiana support the beneficial uses designated in the Water Quality Standards (WQS). Indiana's Integrated Water Monitoring and Assessment Report (IR) is developed every two years to fulfill this requirement and describes the condition of Indiana's lakes and streams, the Lake Michigan shoreline, and ground water. All IDEM water quality data is evaluated and interpreted for each hydrologic unit area (HUA); typically, a 12-digit HUC. Each HUA is given a water quality rating relative to its streams' status in meeting WQS. WQS are set at levels necessary for protecting a waterway's designated use(s), such as swimmable, fishable, or drinkable. Table 5 identifies known impairments for HUAs within the MS4 area.

Table 4: City of Carmel 303(d) Impaired Waters

Segment ID	Waterbody Name	Impairment
INW01A3_T1004	Carmel Creek	Impaired Biotic Communities, *E. coli*, Recreational Use, Aquatic Life
INW01A1_04	Cool Creek	*E. coli*, Recreational Use
INW01A1_T1006	Cool Creek - Unnamed Tributary	*E. coli*, Recreational Use
INW01B4_05	Little Eagle Creek	*E. coli*, Recreational Use
INW01A6_T1003	Ream Creek	PCBs in Fish Tissue, Fish Consumption
INW01A3_01	White River	Nutrients, *E. coli*, PCBs in Fish Tissue, Recreational Use, Aquatic Life, Recreational Use

2.3.3 Total Maximum Daily Loads

The prioritized 303(d) list of impaired waters is used to compile a list of waters for which a Total Maximum Daily Load, or TMDL, must be developed. These TMDL reports identify the causes of the impairments, the amount of pollutant reduction needed, and potential actions to be taken to improve water quality within the watershed. **Table 5** identifies TMDLs relevant to the City of Carmel MS4 jurisdictional boundaries and the pollutant for which it was developed. More information regarding the TMDL program and TMDLs specific to the City of Carmel can be found in Section 2.5.2.

Table 5: City of Carmel TMDLs

Waterbody Name	Pollutant	Link to Report
West Fork White River (Muncie to Hamilton-Marion County Line)	*E. coli*	https://www.in.gov/idem/nps/resources/total-maximum-daily-load-reports/white-river-west-fork-muncie-to-hamilton-marion-county-line/
West Fork White River (Marion Co to Waverly)	*E. coli*	https://www.in.gov/idem/nps/resources/total-maximum-daily-load-reports/white-river-west-fork-marion-county-to-waverly/

2.3.4 Wetlands

The 2021 National Wetlands Inventory (NWI) identifies potential wetland areas by utilizing infrared photography which has not been field verified. Information provided through the NWI should be utilized only as a reference, not as a definitive answer of whether wetlands are present on a particular site. According to the 2022 NWI, there are approximately 1,377.8 acres of potential wetlands within the MS4 area, which are classified as Freshwater Emergent Wetland, Freshwater Forested/Shrub Wetland, Freshwater Pond, Lake, or Riverine.

The MS4GP requires MS4s to establish a construction program that contains, at a minimum, the requirements of the Indiana Construction Stormwater General Permit (CSGP). The CSGP requires all project site owners to develop construction plans that include an existing project site layout describing the location and name of all wetlands, lakes, and water courses on or adjacent to the project site (CSGP 4.1(a)(3)(J)).

2.4 SENSITIVE AREAS

REQUIREMENT MS4GP 3.1(c):
The WQCR must include: (5) Identification of known sensitive areas including, but not limited to public swimming areas, drinking water intakes, habitats associated with threatened or endangered species, and outstanding state and national resource waters.

These areas are designated as sensitive due to their importance to the surrounding environment or economic conditions. Special considerations or restrictions may be imposed to provide an added layer of protection for those areas or land uses designated as sensitive by the MS4 or IDEM.

2.4.1 Public Swimming Areas

There are no known recreational or public swimming areas within the jurisdiction of the MS4. The primary recreational water located within the MS4 area is the White River. This area provides opportunities for boating and canoeing and will be considered a sensitive area, as well as the corresponding 12-digit HUC.

2.4.2 Drinking Water Intakes

According to the Indiana Administrative Code, a public water supply system is a public water supply for the provision to the public of piped water for human consumption, if such a system has at least fifteen (15) service connections, or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days of the year.

IDEM's Drinking Water Branch carries out the requirements of the federal Safe Drinking Water Act (SDWA) which is designed to ensure that Public Water Supplies (PWS) deliver water to Hoosier homes and businesses that is adequate in quantity and is safe to drink. According to the branch, there are 174 drinking water wells in Hamilton County, 66 of which are active. Within the City of Carmel there are two active community wells, two active non-community wells, and one active non-transient non-community well. The two active community wells are Carmel Clay Water, which utilizes purchased surface water, and Carmel Water Department, which utilizes groundwater.

The Indiana Department of Natural Resources' (IDNR) Division of Water conducts resource assessments of ground water aquifers and maintains the records of over 400,000 water wells drilled in Indiana. A 2019 GIS Layer provided by the IDNR showed 2,713 wells within the Carmel MS4 area.

2.4.3 Wellhead Protection

The City of Carmel has an existing Wellhead Protection Zoning Ordinance that prohibits sanitary and storm sewers from being within 200 feet of any of the nine wellheads on the city's east side. The city's Wellhead Protection Program includes a contingency plan that ensures emergency response and spill cleanup activities in response to any spill, leak, or illegal discharge within the city. This program is operated by the Hamilton County Emergency Management Agency with oversight from the Local Emergency Planning Committee (LEPC). The city requires lining for any stormwater facility within the 1-Year Time of Travel.

While Wellhead Protection Areas are sensitive in nature, they are not considered to be sensitive areas in the context of the city's Stormwater Program.

2.4.4 Surface Water Protection

Citizens Energy maintains one surface water intake on the White River in close proximity to the city's MS4 area. The White River North Station, located in the White River – Shoemaker Ditch Watershed, collects its source water from the White River, which is supplemented by Morse Reservoir. In addition to providing the water source for Citizens Energy, White River is a designated stormwater receiving water for the City of Carmel. Therefore, these receiving waters will be considered priorities for the city's Stormwater Program.

2.4.5 Habitat Associated with Threatened or Endangered Species

The IDNR's Division of Nature Preserves maintains the Natural Heritage Data for the State of Indiana. Natural Heritage Data includes general information on endangered, threatened, and rare species for each Indiana county. According to the IDNR, as of February 2022 there are five vascular plants, five birds, one insect, seven mollusks, and two reptiles listed as endangered, threatened, or rare within Hamilton County. Additionally, the IDNR identifies Floodplain Wet-mesic Forest and Upland Mesic Central Till Plain Forest as High-Quality Natural Communities within Hamilton County. However, Natural Heritage Data is only county specific, and therefore, these habitat types may not exist within the MS4 area.

City officials are unaware of any waters within the MS4 area that currently contain threatened, endangered, or rare species or their habitats. If any species listed are identified in the future, the partners will consider those locations to be sensitive areas and will update their stormwater program accordingly.

2.4.6 Limited Use and Outstanding State Resource Waters

The federal CWA requires all states to develop, review, revise, and adopt WQS, which consist of:

- **Designated Uses:** identification of how people, aquatic communities and wildlife use our waters (e.g., public water supply, protection and propagation of fish, shellfish, and wildlife, and recreation).
- **Water Quality Criteria:** numeric or narrative in form and protect the designated uses. Numeric criteria are allowable concentrations of specific pollutants in a water body while narrative criteria are statements of unacceptable conditions in and on the water.
- **Antidegradation Policies:** protection of existing uses and extra protection for high-quality or unique waters.

General antidegradation policies will allow the city to protect existing uses of waterbodies and aid in ensuring these waterbodies will continue to meet WQS. Waters that may be considered for designation as outstanding state resource waters (OSRW) include waterbodies that have unique or special ecological, recreational, or aesthetic significance. According to the Natural Resource Commission's "Outstanding Rivers List for Indiana", there are no outstanding state resources waters within the MS4 boundary.

2.4.7 Other Sensitive Areas

Erodible Soils: The Natural Resource Conservation Service (NRCS) uses the soil erodibility index (EI) to provide a numerical expression of the potential for a soil to erode considering the physical and chemical properties of the soil and the climactic conditions where it is located. As a result, the basis for identifying highly erodible land (HEL) is the EI of the soil map unit.

The EI of a soil is determined by dividing the potential erodibility for each soil by the soil loss tolerance (T) value established for the soil. The T value represents the maximum "tolerable" annual rate of soil erosion that could take place without causing a decline in long-term productivity. **Table 6** documents the HEL and Potentially HEL (PHEL) soils within Hamilton County and therefore potentially throughout the MS4 area. A map showing HEL and PHEL within the MS4 area is included in **Exhibit 4**.

Table 6: City of Carmel Highly Erodible Soils

Map Unit Symbol	Soil Name	HEL Classification
CrA	Crosby	PHEL
FnB2	Fox	PHEL
FxC3	Fox	HEL
HeF	Hennepin	HEL
MmB2, MmC2	Miami	PHEL
MmC2, MmD2, MoC3	Miami	HEL
OcB2	Ockley	PHEL
Pt	Pits	PHEL

Recognizing the potential water quality impacts associated with soil erosion, the MS4 will consider these soils to be sensitive areas and will prioritize new or redevelopment occurring on these sites during

the plan review, inspection, and enforcement process. Current provisions exist in the City of Carmel ordinance include limiting soil erosion into waterways and stormwater infrastructure.

2.5 REVIEW OF EXISTING WATER QUALITY DATA

REQUIREMENT MS4GP 3.1(c):
The WQCR must include: (6) A review and summary of existing and available monitoring data of the MS4 receiving waters, including, as applicable, data that can be correlated from stream reach characterization and evaluation reports (SRCER).

2.5.1 Stream Reach Characterization and Evaluation Report

The stream reach characterization and evaluation report (SRCER) characterizes and evaluates the pollutant sources on receiving waters from a combined sewer system discharge. The SRCER can be utilized to identify ways to beneficially change the storm sewer system within the MS4 and to improve water quality around combined sewer system outfalls. There are no combined sewers within the City of Carmel MS4 boundaries.

The City of Noblesville's SRCER was completed and submitted to IDEM in June 2001. The study characterized the impacts of the city's ten CSOs upon three water bodies: the West Fork White River, Wilson's Ditch and Stony Creek. This study is of relevance to the City of Carmel because it indicates that other sources of pollution are contributing to pollution in the White River as it flows through the City of Carmel. According to the SRCER, over 91% of the City of Noblesville's total CSO discharge volume is discharged to the White River. Conclusions drawn from Noblesville's SRCER provide evidence that significant pollution from a variety of point and non-point sources are entering White River upstream of the City of Carmel's MS4 area. However, this data is over 20 years old and may no longer be fully relevant to the City of Carmel MS4.

2.5.2 Established TMDLs

States are required to develop a priority ranking for waters that do not or are not expected to meet applicable water quality standards taking into account the severity of pollution and the designated uses of the waters. Once this listing and ranking of waters is completed, the states are required to develop TMDLs for these waters in order to achieve compliance with water quality standards. The relevant TMDLs developed to date are described in the following sections. Many of the TMDLs propose similar BMPs to reduce pollutants, especially *E. coli*. These BMPs may include:

- Identification of failing septic systems by local health departments. Requirements for periodic pumping and inspection of septic systems.
- Livestock exclusion from riparian areas.
- Installation of structural urban BMPs.
- Education campaigns designed to address relevant nonpoint source pollutants from the actions of watershed residents.

Regarding the inputs of *E. coli* from MS4 communities and IDEM's MS4GP, the TMDLs anticipate that once MS4 permits have been issued and implemented, they will improve water quality and address storm water impacts in these watersheds.

West Fork White River (Muncie to Hamilton-Marion County Line) *E. coli* TMDL

Finalized in 2004, the TMDL for the West Fork White River Watershed (Muncie to Hamilton-Marion County Line) indicates that "Potential sources of *E. coli* and fecal coliform in the watershed include nonpoint sources from agriculture and pastures, land application of manure and urban and rural run-off, as well as point sources from straight pipe discharges, home sewage treatment system disposal and combined sewer overflow outlets." The West Fork White River from Muncie to the Hamilton-Marion County Line drains approximately 1,100 square miles in central Indiana. TMDLs for the West Fork White River Watershed are established for *E. coli* and will address 12 impairments through storm water controls, point source controls, manure management and habitat improvements.

West Fork White River (Marion Co to Waverly) *E. coli* TMDL

Finalized in 2004, the TMDL for the West Fork White River (Marion Co to Waverly) includes seven impairments. The West Fork White River (Marion County) watershed drains approximately 130 square miles, and only a small area at the northern edge of the watershed exists in the City of Carmel MS4 boundary. The primary cause of impairment in this watershed is *E. coli*. Identified pollution sources in the watershed area include several nonpoint sources, such as agriculture land uses and urban and rural run-off. Pollution sources also include point sources from pipe discharges, single-home sewage treatment system disposal and CSO outlets.

2.5.3 Watershed Management Plans

A watershed management plan (WMP) is a strategy for achieving water quality goals by characterizing the watershed, setting goals and actions steps, and developing an implementation plan to address documented problems. Ultimately, the purpose of the WMP is to guide resource managers, watershed coordinators, policy makers, community organizations, and other relevant stakeholders in restoring and protecting the waterbodies within a given watershed. Information about three of the most recent WMPs relevant to the City of Carmel waters and watersheds can be found in this section.

Williams Creek Watershed Master Plan (2010)

The development of the Williams Creek Watershed Master Plan was administered by the Hamilton County Surveyor's Office in partnership with the City of Carmel. The Watershed Master Plan was developed due to population growth and continued development of the watershed, which is currently on-going. Water resource problems for the developed portions of the watershed are expected to be typical of areas where fields, natural woods, grass fields and wetlands have been converted to impervious surfaces and where highly erodible soils are exposed. Typical, potential problems in these types of areas include increased downstream flooding, loss of riparian habitat, eroded channels, high turbidity, excess sediment loads, and potentially high bacteria concentrations, such as *E. coli*.

Cool Creek WMP (2005)

The 2005 Cool Creek WMP outlined several goal statements that were developed based on concerns and pollutant sources identified during the development of the plan. A thorough evaluation of stormwater management was completed to identify methods of improving the quality of stormwater runoff. The implementation of policies and programs to meet these goal statements improved watershed management in the Cool Creek Watershed. The project also evaluated the general condition of the riparian corridor and streambank erosion problems, reviewed a stream water quality sampling

program and NPDES permit related water quality violations, and assessed best management practices in the watershed.

Eagle Creek WMP (2005)

The 2005 Eagle Creek WMP involved efforts from the Eagle Creek Watershed Task Force and the Central Indiana Water Resources Partnership. The Eagle Creek Watershed is important due to the large public drinking water supply from the Eagle Creek Reservoir. A main goal of this WMP was to increase the science behind watershed management decisions and to incorporate stakeholder views. The main initiatives of the WMP included implementing and demonstrating best management practices, water quality monitoring, watershed education, and public information and outreach. The WMP was revised in 2003 and an Addendum was completed in 2011.

2.5.4 Lake and River Enhancement Projects

The IDNR's Division of Fish and Wildlife aims to enhance aquatic habitat for fish and wildlife and ensure the continued viability of Indiana's publicly accessible lakes and streams through their Lake and River Enhancement Program (LARE). The program aims to accomplish this through measures that reduce non-point sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality standards. The LARE Program provides technical and financial assistance for qualifying projects. **Table 7** includes projects associated with the City of Carmel MS4 receiving waters that have received LARE funding since 2017.

Table 7: LARE Projects Relevant to City of Carmel MS4

Water Body	Grant Type	Project	Year	Grant Award
Morse Reservoir (Hamilton)	LARE Logjam & Sediment Removal	Sediment Removal	FY 2022-23	$100,000
Stony Creek (Hamilton)	LARE Watershed Land Treatment, Biological and Engineering Projects	Stream Design	FY 2022-23	$40,000
	LARE Watershed Land Treatment, Biological and Engineering Projects	Stream stabilization and dam removal feasibility study	FY 2019-20	$40,000
Eller Run (Hamilton)	LARE Watershed Land Treatment, Biological and Engineering Projects	Stream Design-Build	FY 2020-21	$75,000
Hinkle Creek-Morse Reservoir (Hamilton)	LARE Logjam and Sediment Removal	Sediment Removal	FY 2018-19	$75,000
Duck Creek (Hamilton)	LARE Watershed Land Treatment, Biological and Engineering Projects	Streambank Stabilization	FY 2018-19	$50,000

2.6 POTENTIAL AREAS OF POLLUTION

REQUIREMENT MS4GP 3.1(c):
The WQCR must include: (7) Identification of areas that have a reasonable potential for or are actually contributing to stormwater quality problems based on available land use and complaint information and relevant chemical, biological, and physical data.

2.6.1 Complaint Data

When concerns are observed by the city staff, they are equipped to address the issues quickly. Observations of a potential illicit discharge or other stormwater concerns, received by city staff through the Report-A-Polluter phone line, which is advertised on the stormwater web page, are investigated and tracked through photographs and reports. Determined by the nature and severity of the issue, violation notices or fines may be issued. These complaints and observations are currently tracked by location to develop trend data.

2.6.2 Industrial Facilities

The city is aware of 30 facilities within the MS4 boundary which, according to their Standard Identification Classification (SIC) code, should be assessed for their potential to discharge to an MS4 conveyance. While they may also have IDEM Rule 6 permits, it is important for the city to understand the potential impacts to the conveyances and receiving waters. It is important to note that IDEM is currently working on a replacement, master general permit for Rule 6.

2.6.3 Residential Septic Systems

Existing policies dictate all new developments occurring within Carmel are required to connect to the sanitary sewer system if service is readily available. However, when sanitary sewer service is not available, on-site wastewater treatment permits are issued by the Hamilton County Health Department, if site conditions meet all applicable Indiana State Department of Health Standards. Any residential septic system issues that arise are addressed promptly.

2.6.4 Surface Visual Conveyance Inspection Findings

IDEM requires the city to complete visual inspections of catch basins, outfalls, and conveyance systems over the five-year permit term with a minimum of 15% must be completed each year. Areas anticipated to contribute to pollution or decrease system function must be noted and corrected. As of the development of this document, the city is still planning implementation of this inspection program.

2.6.5 IDDE Findings

As complaints are received and/or IDDE screening brings impacts to light, the city will follow through on investigations and mitigation of any problems. It is anticipated that as redevelopment continues within this area, many of the issues will be negated.

A community should understand the extent of water quality problems caused by illicit discharges. The desktop assessment should draw on existing background and anecdotal information to initially characterize illicit discharge potential at the sub-watershed level. Sub-watersheds are then screened

based on their composite score, and are designated as having a low, medium, or high risk. **Table 8** describes discharge factors to screen sub-watersheds based on their illicit discharge potential (IDP).

Table 8: Discharge Screening Factors for IDDE Desktop Assessment

Discharge Screening Factors	Defining and Deriving the Factor
Past Discharge Complaints and Reports	Frequency of past discharge complaints, hotline reports, and spill responses per subwatershed. Any subwatershed with a history of discharge complaints should automatically be designated as having high Illicit Discharge Potential (IDP).
Density of Generating Sites or Industrial NPDES Storm Water Permits	Density of more than 10 generating sites of five industrial NPDES stormwater sites per square mile indicates high IDP. Density determined by screening business or permit databases.
Stormwater Outfall Density	Density of mapped stormwater outfalls in the subwatershed, expressed as the average number per stream or channel mile. A density of more than 20 outfalls per stream mile indicates high IDP.
Age of Subwatershed Development	Defined as the average age of the majority of development in a subwatershed. High IDP is often indicated for developments older than 50 years. Determined from tax maps and parcel data, or from other known information about neighborhoods.
Sewer Conversion	Subwatersheds that had septic systems but have been connected to the sanitary sewer system in the last 30 years have high IDP.
Historic Combined Sewer Systems	Subwatersheds that were once served by combined sewer system but were subsequently separated have a high IDP.
Presence of Older Industrial Operations	Subwatersheds with more than 5% of its area in industrial sites that are more than 40 years old are considered to have high IDP. Determined from historic zoning, tax maps, and "old-timers."
Aging of Failing Sewer Infrastructure	Defined as the age and condition of the subwatershed sewer network. High IDP is indicated when the sewer age exceeds design life of its construction materials (e.g., 50 years) or when clusters of pipe breaks, spills, overflows or are reported by sewer authorities.

2.7 DATA SUMMARY

REQUIREMENT MS4GP 3.1(c):
The WQCR must include: (8) An evaluation of data collected to determine which areas or specific discharge points that may need to be considered for future planning and implementation of new stormwater measures or modification of existing measures. The highest priority should be given to sensitive areas and the prohibition of new or significantly increased MS4 discharges.

Several sensitive areas have been identified for special considerations related to stormwater quality runoff and land cover/land use changes. These areas include drinking water sources, wetlands, habitats of endangered, threatened, or rare species, and recreational waters. These areas, and any identified discharge points near these areas, should be evaluated for the potential addition of structural or non-structural BMPs to maximize the possible protection for the area as well as the receiving waters. Types of BMPs for consideration may include targeted education and awareness programs highlighting the importance of sensitive areas, additional requirements for structural controls on new construction, and/or enhanced post-construction structural BMPs. The structural condition of the current MS4 owned and operated BMPs will guide prioritization of BMP maintenance and repairs over the current MS4GP permit cycle.

As the city plans for future growth and development, land use changes are anticipated within areas of the MS4. Components of the City of Carmel comprehensive plan, including policy, development patterns and a mobility plan are being structured to reflect future goals regarding land use, community growth policies and housing. Several individual development patterns have been identified, one of which is the White River corridor through the City of Carmel, which is planned to include natural trails amid the riparian corridor and low-impact stormwater management practices in parking and servicing areas. Additional development patterns include redevelopment in the Home Place neighborhood and along Michigan Road, high-density redevelopment in downtown Carmel and suburban residential development.

This growth can certainly have impacts on the MS4 program as well as the water quality of receiving waters. Six waterbodies within the City of Carmel are known to have impairments and are 303(d) listed (Carmel Creek, Cool Creek and Unnamed Tributary, Little Eagle Creek, Ream Creek, and White River). Through the implementation of the MS4GP within the city, goals to improve the water quality of impaired waterbodies will be tracked and revised during annual reviews of the program. Outfall mapping and field investigations during dry weather screening will yield any priority areas to be addressed during additional public education and outreach, as well as identify existing BMPs that require repair and/or maintenance. Active construction sites that are greater than five acres and that are near a water resource will have an elevated inspection priority, and post-construction inspections will identify areas needing maintenance or repair which will have a direct positive impact on water quality. The city will continue working to improve water quality in these waterbodies to meet State Water Quality standards through implementation of the MS4GP requirements.

CHAPTER 3: STORMWATER QUALITY MANAGEMENT PLAN

REQUIREMENT MS4GP 4.2:
The SWQMP must be developed, implemented, and maintained to include provisions that will reduce the discharge of pollutants from the MS4 to protect water quality, human health, and the biotic community.

3.1 MS4 BOUNDARIES

The MS4 boundaries are identified on **Exhibit 1** while the specific township, range and section coverage is listed within **Table 9**. Boundaries will be updated as necessary following any future land annexations or acquisitions.

Table 9: MS4 Boundaries

Township	Range	Section
17 N	3 E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
17 N	4 E	3, 4, 5, 6, 7, 8, 9
18 N	3 E	14, 15, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
18 N	4 E	19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35

3.2 MS4 ADMINISTRATION

While the MS4 program oversight will be provided by the Engineering and Stormwater Departments as noted in Section 1.1, other departments, staff members, and partners may be responsible for the implementation of individual minimum control measures (MCMs) and tasks. Responsible parties are included in the MCM tables in the following sections.

The City of Carmel participates in a regional approach to collaborate with other MS4 communities regarding the Public Education, Outreach, Participation and Involvement MCM. The White River Alliance (WRA) has been the umbrella organization for the regional work group and signs an MOU each year with member communities to outline the work plan and deliverables. Annually, the member MS4 communities review the long-term plan and adjust the annual work plan accordingly. Each MS4 community is then responsible for their own local implementation of the resources developed.

3.3 MCM PROGRAM DESCRIPTIONS

REQUIREMENT MS4GP 4.2(a):
The SWQMP must at a minimum include:
(3) Program goals that are established and required by this permit and others identified by the MS4 entity to address local stormwater resource issues within their jurisdiction.
(4) A detailed program description for each minimum control measure (MCM):
(A) A timetable for SWQMP implementation for ach MCM and the WQCR
(B) A summary of measurable goals for ach MCM and a discussion of environmental impact
(C) Individuals that are responsible for implementing each MCM including their contact information

3.3.1 Programmatic Indicators

Programmatic indicators are categories of data collected throughout the annual period by the MS4 entity which are used to measure implementation of each of the MCMs. These indicators pertain to specific environmental gauges that focus on the impacts of stormwater runoff. IDEM utilizes the indicators to determine the degree of success achieved by the stormwater management programs. IDEM requires an annual update for each indicator and if an indicator is not applicable to the MS4 operator, then the operator shall provide rationale for the non-applicability.

Each of the programmatic indicators has been addressed by BMPs within the MS4 entity. For reference, programmatic indicators are listed in **Appendix 2**.

All indicators have been addressed in the tables within following sections detailing BMPs for each MCM. Programmatic indicators are listed in Appendix 1 for reference.

3.3.2 Public Education, Outreach, Participation and Involvement

An MS4 must develop strategies to inform constituents and target groups of the impacts that polluted stormwater runoff can have on water quality and ways they can minimize their impact on stormwater quality.

The city is continuing to develop and implement partnerships with the Hamilton County Soil and Water Conservation District (SWCD) and the Hamilton County Solid Waste Management District (SWMD) to provide public information and outreach services while also playing a major role in the public involvement and participation activities related to the household hazardous waste and recycling efforts.

Table 10 provides a summary of the Public Education, Outreach, Participation and Involvement BMPs to be implemented and identifies the associated measurable goals, timeline, priority areas, and responsible parties.

Table 10: Public Education, Outreach, Participation and Involvement BMPs

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Public Education and Involvement Plan (4.3(a))	• Identify target constituents • Develop a stormwater public education and involvement plan • Develop list of three community wide stormwater issues to assist with education and involvement efforts for construction, residential and commercial/industrial groups • Develop or collaborate with existing efforts to conduct two public events annually • Develop educational materials • Coordinate with local partners to provide annual training to construction site run-off and post-construction target groups (annual contractors' training) • Assist with development and implementation of WRA Strategic Plan to help guide overall efforts	• Plan developed with partner agency and department input by January 2023 • Reviewed annually and revised as needed • Events and activities will be decided in conjunction with development and annual review of the education and involvement plan • Maintain a list of topics covered and constituents reached for each event	• January 2023 (developed) • January 2024 • January 2025 • January 2026	• Carmel MS4 staff
Stormwater Educational Materials (4.3(a)(4)) (4.3(b)) (4.3(d))	• Collaborate to develop, produce, or distribute printed materials related to stormwater issues • Include information related to proper disposal of wastes • Assist with larger efforts such as those similar to MS4 video production, workshops, etc. • Work with other local MS4 entities or the WRA to develop, produce, or distribute printed materials • Localize printed materials as necessary to ensure messages are relevant to the City of Carmel • Provide materials in key city buildings • Include relevant information (conservation tips, recycling days, etc.) in resident utility department newsletter	• Materials and opportunities will be discussed during the development and annual review of the education and involvement plan • Work in cooperation with partners to broaden exposure and present a unified message • Maintain a list of materials developed, distributed, and utilized	• January 2023 (plan) • January 2024 • January 2025 • January 2026	• Carmel MS4 staff

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Web Page (4.3(c))	• Maintain the City of Carmel web page regarding stormwater quality issues, a location to report stormwater quality issues and links to other sites • Include articles developed, brochures, and calendar updates • Include ordinances, applicable fees, and MS4 program information • Provide relevant stormwater updates and postings on web page and/or other partner's social media outlets	• Utilize education and involvement plan to identify messages, issues, and partners • Review web page and update with new information annually • Track total number of hits site receives each year • Document all questions and comments received via the web page as well as the responses to them • Document posts relevant to stormwater issues	• January 2023 • December 2023 • December 2024 • December 2025	• Carmel MS4 staff
Elected Official Update (4.3(e))	• Report stormwater program updates to elected officials or an advisory board	• Updates will be provided by the director of the Stormwater Department during budget hearings • Maintain recorded meeting videos and materials distributed	• June 2023 • June 2024 • June 2025 • June 2026	• Carmel MS4 staff
Household Hazardous Waste (HHW) and Recycling Activities (4.4(b)(4))	• Encourage residents and staff to use existing HHW drop off for proper disposal • Educate Carmel residents about illicit discharges and proper disposal of waste • Encourage Carmel residents to participate in curb-side recycling program • Utilize existing SWMD activities to educate community members on the importance of pollution prevention and recycling programs	• Promote the HHW facilities operated by the SWMD • Document the amount of material collected at the HHW Facility • Document dates, times, and attendance at all presentations to citizen and school groups that incorporate stormwater quality discussions • Document the number of stormwater materials distributed on an annual basis	• On-going	• Carmel MS4 staff • Carmel Utilities • Hamilton County SWMD
Public Reporting Program (4.4(b)(6))	• Utilize hotline and complaint reporting app to field complaints from the public on illegal dumping, illicit discharges, poor erosion control practices, and other activities that negatively impact stormwater quality	• Implement the pollution hotline program • Promote, advertise, and follow-up on complaints and calls received through the program • Include educational material developed • Respond to complaints • Document the number of complaints received and all follow up actions taken on reports	• On-going	• Carmel MS4 staff

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Partnership Activities	• Continue meetings with WRA committee, Carmel Green Initiative, SWCD, and neighboring MS4s and agencies to develop and implement programs and activities throughout the region that are consistent and complimentary in nature • Support SWCD activities to help implement the county-wide "Backyard Conservation" program • Participate actively in planning, coordinating, and participating in the annual White River Clean-up Event	• Provide education and outreach programs for target constituents • Track number of stormwater related articles or materials published • Document dates, times, and attendance at all workshops & trainings focused on stormwater quality related issues • Annually partner with at least one other MS4, watershed group, or volunteer organization	• On-going and annual activities	• Carmel MS4 staff

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party

Annual Report
 	
(4.3(g))
(4.3(h))
	• Assess the program annually
	• Report progress in an annual report to IDEM
		• Assess program in conjunction with gathering data and compilation of the annual report
		• Include:
		  •List of each public participation and outreach event and activity conduction, a description of the activity, an estimate of the number of attendees, and an assessment if the goals and objectives were met
		  •The number and types of construction and/or post-construction stormwater training opportunities what were provided to contractors, developers and builders, property owners (commercial, industrial, residential, homeowner associations, and other targeted entities during the reporting period
		  •Documentation that presentations were made to elected officials or boards
		  •Describe each targeted audience selected and how they were reached during the reporting period and describe behavioral changes observed
		  •A list of all public education materials used during the reporting period
		• Submit annual report
			• February 2023
			• February 2024
			• February 2025
			• February 2026
				• Carmel MS4 staff

3.3.3 Illicit Discharge Detection and Elimination

An MS4 must develop a program which uses education and both structural and non-structural BMPs to detect, address, and eliminate illicit discharges into the MS4 conveyance system. Problem areas must be located via dry weather screening or other means, the source must be determined, illicit connections must be removed or otherwise corrected, and the actions taken must be documented. Through an ordinance or other regulatory mechanism, illicit discharges must be prohibited from entering the MS4 conveyances and appropriate enforcement procedures and actions are required.

The Illicit Discharge Detection and Elimination (IDDE) BMPs outlined in **Table 11** will be implemented by the MS4 staff in order to comply with the minimum requirements of the MCM. The programs are designed to gain a thorough awareness of their separate storm conveyance system and thereby allowing the identification and elimination of illicit discharges entering the system. The program also establishes the legal, technical, and educational means needed to eliminate illicit discharges.

Table 11: IDDE BMPs

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
IDDE Ordinance (4.4(a))	• Review IDDE language contained in the Carmel ordinance documents for needed updates and to ensure compliance with the MS4GP	• Enforce ordinance • Review policies at least once per permit term	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff
IDDE Plan (4.4(b)) (4.4(h))	• Review the IDDE Plan and update as necessary to reflect the proposed actions for illicit discharge detection and elimination in the current permit term • Implement the IDDE plan to detect, address, and eliminate illicit discharges into the MS4 conveyance system • Include SOPs to locate problem areas and to ensure consistent investigations for all illicit discharges • Investigate transient illicit discharges that have been reported to the MS4 Coordinator for additional follow-up • Utilize the Desktop Assessment of Illicit Discharge Potential (Table 9 in WQCR) to better prioritize areas for IDDE screening activities	• Review and revise IDDE plan in first year of permit term • Conduct dry weather screening until 100% screened by end of permit term • Conduct screening of all non-stormwater discharges until discharge is eliminated or determined to be uncontaminated	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff
Stormwater System Mapping (4.4(d)) (4.4(e)) (4.4(f))	• Identify priority areas based on land use, prior history, and frequency of discharges • Enhance existing maps with information collected during dry-weather screening events, maintenance activities, etc. • Add new outfalls and conveyance systems to the map for the appropriate jurisdiction per ordinance as-built requirements or new developments	• Review and update map annually • Identify priority areas within first year of permit term	• January 2023 (identify priority areas) • Review/update annually	• Carmel MS4 staff
IDDE Staff Training (4.4(g))	• Train appropriate staff members on investigation of illicit discharges or illicit connections to the stormwater conveyance system • Provide an internal IDDE manual and field binder to engineering and inspection staff	• Conduct annual refresher training to appropriate departments and staff • Document number of staff, number of events held, and the topics covered in each session • Review and revise manual/field binder	• July 2023 or earlier • Annually	• Carmel MS4 staff • Relevant city employees

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party

Annual Report
 	
(4.4(i))
(4.4(k))
	• Assess the program annually
	• Report progress in an annual report to IDEM
		• Assess program in conjunction with gathering data and compilation of the annual report
		• Include:
		  •IDDE program updates
		  •A summary of any storm sewer system mapping changes to the stormwater outfall and conveyance maps
		  •Number of new MS4 outfalls mapped
		  •Number and location of dry weather outfalls screened for illicit discharges
		  •Number and location of illicit discharges detected
		  •Number and location of illicit discharges eliminated
		  •Number of illicit discharges and/or spills reported to the MS4 entity
		  •Number of enforcement actions taken by the MS4 entity
		• Submit annual report
			• February 2023
			• February 2024
			• February 2025
			• February 2026
				• Carmel MS4 staff

3.3.4 Construction Site Stormwater Run-Off

The MS4GP requires the MS4 Operator to develop and administer an erosion and sediment control program which includes strategies to manage the overall program components, monitor compliance of program requirements, and if necessary, enforce any violations. Requirements also include the development of an ordinance or other regulatory mechanism and establishment of a construction program that controls polluted runoff from construction activities that disturb one or more acres of land in the MS4 area. This construction program must include a permitting process, erosion control plan review process, site inspections, and enforcement. The permitting process must include a requirement for the construction project site owner to submit a copy of the permit application directly to IDEM. MS4 entities must provide an opportunity for local SWCD to provide comments and recommendations to the MS4 operator on individual projects.

The construction program must include requirements for the implementation of appropriate BMPs on construction sites to control sediment, erosion, and other waste. MS4 entities must review and approve construction plans submitted by the construction site operator before construction activity commences. Procedures must be developed for site inspection and enforcement to ensure BMPs are properly installed. The procedures must include a means to identify priority sites for inspection and enforcement, as well as a means to receive and consider public inquiries, concerns, and information submitted regarding local construction activities. A tracking process must be implemented in which submitted public information is documented and then given to the appropriate staff for follow-up. Further MS4 personnel responsible for plan review, inspection, and enforcement of construction activities shall receive annual training.

Table 12 in the next section provides a detailed description of the Construction and Post-Construction Site Stormwater Runoff Control BMPs to be implemented and identifies the measurable goals, progress indicators, timelines, priority areas, and responsible parties. Information such as which structural BMPs are allowed within new or redevelopment, BMP selection criteria, and the associated performance standards may be found in the Stormwater Ordinance and Technical Standards for the City of Carmel. These BMPs have been combined with the Post-Construction Site Stormwater Runoff Control BMPs (MCM #5) for ease of presentation and discussion.

3.3.5 Post-Construction Site Stormwater Run-Off

The MS4GP requires the development of an ordinance or other regulatory mechanism and establishment of a post-construction program that addresses runoff from new development and redevelopment areas that disturb one or more acres of land in the MS4 area. This program must include a permitting process, plan review process, site inspections, and enforcement. MS4 area personnel responsible for plan review, inspection, and enforcement of post-construction BMPs shall receive annual training.

Where appropriate, MS4 entities must use a combination of storage, infiltration, filtering, or vegetative practices to reduce the impact of pollutants in stormwater runoff on receiving waters in areas that are the responsibility of the MS4 entity. A written Operational and Maintenance (O&M) Plan must be developed and implemented for all existing stormwater structural BMPs, which are under the control of the MS4 entity. As new post-construction BMPs are added to areas under the control of the MS4 entity, the O&M Plan must be updated accordingly.

Compliance with this MCM requires MS4s to develop a program for managing Post-Construction Stormwater Runoff Control BMPs that will ensure adequate, long-term stormwater quality benefits in new development and redevelopment activities. Once construction is complete, post-construction practices specified by the MS4 must be implemented to ensure adequate stormwater quality is maintained from the developed site. Table 12 provides a summary of the Construction and Post-Construction Site Stormwater

Runoff Control BMPs to be implemented and identifies the associated measurable goals, programmatic indicators, timeline, priority areas and responsible parties. These BMPs have been combined with the Construction Site Stormwater Runoff Control BMPs (MCM #4) for ease of presentation and discussion.

Table 12: Construction and Post-Construction BMPs

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Stormwater Management Ordinance & Technical Standards (4.5(b)) (4.5(f)) (4.6(b)) (4.6(c))	• Review and revise the active construction and post-construction site ordinance language and stormwater technical standards to ensure compliance with the MS4GP and the CSGP	• Continue to update and enforce the Stormwater Management Ordinance • Review and approve proposed new and redevelopment projects for compliance with the Stormwater Technical Standards • Incorporate post-construction performance standards into the ordinance and/or technical standards • Review at least once per permit term	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff
Plan Review and Permitting Procedures (4.5(c))	• Establish or review plan review and permitting procedures, internal processes, and timetables • Require pre-construction meetings on all new and re-development projects	• Establish or review written procedures for plan review • Develop or review forms, checklists • Review and approve proposed new and redevelopment projects • Review 100% of construction plans and inspect prioritized sites for compliance	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff
Inspection Procedures (4.5(d)) (4.6(e)) (4.6(f))	• Establish or review procedures and processes to inspect sites to ensure measures are installed and maintained • Inspect 100% of all permitted construction sites with greater than one acre of disturbance • Re-inspect and follow-up on prioritized sites having identified problem areas and/or concerns • Complete active construction site and post-construction BMP inspection forms • Require construction performance and maintenance bonds to ensure BMPs are successful and in compliance	• Establish or review written procedures for inspections • Develop or review forms, checklists • Identify priority sites for inspections • Conduct inspections in accordance with procedures • Complete forms for active construction sites and post-construction BMPs inspected • Require bonds for 100% of all active construction sites over ¼ acre and privately owned BMPs	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff
Enforcement Procedures (4.5(e))	• Establish or review procedures and policies to enforce local ordinance	• Establish or review written procedures to address violations, including compliance and escalating enforcement	• January 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Public Reporting Program (4.5(g))	• Utilize hotline and complaint reporting app to field complaints from the public on illegal dumping, illicit discharges, poor erosion control practices, and other activities that negatively impact stormwater quality	• Implement the pollution hotline program • Respond to complaints and inquiries • Document the number of complaints received and all follow up actions taken on reports	• On-going	• Carmel MS4 staff
Staff Training (4.5(j)) (4.6(i))	• Train appropriate staff members on plan review, inspection, compliance, and enforcement	• Conduct annual refresher training to appropriate departments and staff • Provide relevant training to all staff involved in plan review, site inspection, and enforcement requirements for construction and post-construction MCMs • Document number of staff, number of events held, and the topics covered in each session	• Annually	• Carmel MS4 staff
Active Site Inventory (4.5(l))	• Maintain an inventory of all projects subject to the CSGP, the MS4GP, and owned or operated by the MS4 • Track the status of construction projects, erosion and sediment control activities, and post-construction BMPs • Track violations, complaints, and public information requests • Digitize publicly owned structural BMPs • Require BMP owners to submit annual report of BMP maintenance	• Establish or revise tracking procedures • Track active construction and post-construction project sites • Develop and distribute mailer requesting annual maintenance report	• January 2023 (review/update) • On-going	• Carmel MS4 staff
Operation & Maintenance (O&M) Manuals (4.6(d))	• Require O&M manuals to be submitted for all post-construction BMPs identified as part of a project submittal package	• Enforce ordinance requirements for O&M plan submittal and plan contents for new BMPs	• As plans are submitted	• Carmel MS4 staff
CSGP Compliance (4.5(k))	• Ensure MS4 owned/operated projects are compliant with the CSGP	• Submit plans to SWCD • Comply with MS4 Stormwater Ordinance • Develop SOP which includes self-monitoring of projects	• On-going	• Carmel MS4 staff

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party

Annual Report
 	
(4.5(i))
(4.5(m))
(4.6(h))
(4.6(j))
	• Assess the program annually
	• Report progress in an annual report to IDEM
		• Assess program in conjunction with gathering data and compilation of the annual report
		• Include:
		  •The number of construction projects owned and/or operated by the MS4 entity that are active at the time of submittal
		  •The number of construction sites obtaining a MS4 entity-issued stormwater run-off permit or authorization to discharge
		  •The number of construction sites inspection
		  •The number and type of enforcement actions taken
		  •The number of public information requests and/or complaints received
		  •Updates to the post-construction ordinance or regulatory mechanism
		  •Number of sites requiring post-construction controls
		  •Number, type, and location of structural measures installed
		  •Number, type, and location of structural measures modified to function properly to improve water quality benefits
		  •Number, type, and location of structural measures inspection to ensure each meets design requirements and/or are being maintained
		• Submit annual report
			• February 2023
			• February 2024
			• February 2025
			• February 2026
				• Carmel MS4 staff

3.3.6 Municipal Operations Pollution Prevention and Good Housekeeping

The MS4GP requires the development and implementation of a program to prevent or reduce polluted runoff from municipal operations within the MS4 area. The program must include written documentation of maintenance activities, maintenance schedules, and long-term inspection procedures for BMPs to reduce floatables and other pollutants discharged from the separate storm sewers.

Controls must be implemented for reducing or eliminating the discharge of pollutants from operational areas, including roads, parking lots, maintenance and storage yards, and waste transfer stations. Written procedures must be developed and implemented for the proper disposal of waste or materials removed from separate storm sewer systems and operational areas. New flood management projects must be assessed via written documentation for their impacts on water quality and existing flood management projects must be examined for incorporation of additional water quality protection devices or practices. MS4 entity employees must be properly trained on various topics such as herbicide and insecticide application and the function of BMPs. Such training must be documented in writing.

Table 13 provides a summary of the Pollution Prevention and Good Housekeeping BMPs to be implemented and identifies the associated measurable goals, programmatic indicators, environmental benefits, timeline, priority areas and responsible parties associated with each BMP. A detailed description of each BMP is provided below.

Table 13: Pollution Prevention and Good Housekeeping BMPs

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
Stormwater Pollution Prevention Plans (SWPPPs) (4.7(b-f))	• Evaluate listing of properties, lots, storage facilities, etc. owned or operated by the city • Develop additional SWPPPs or SOPs if necessary • Include facility inspection sheets, employee training form, spill documentation • This general BMP covers specific BMPs such as: o Secondary containment o Salt/sand management o Snow disposal areas o Spill prevention and clean up o Fertilizer and pesticide management o Waste disposal o Wash water management	• Utilize SWPPP and sheets to track inspections, training, etc. for each facility • Conduct and document quarterly facility inspections and assessments	• Annually (review and revise) • Quarterly (inspections)	• Carmel MS4 staff • Street Department • Utilities Department • Police/Fire Departments • Golf course staff • Additional relevant city departments
Facility Inspections 4.7(c) 4.7(f)	• Assess existing operations at each MS4 owned and/or operated facility • Conduct quarterly inspections at each facility and update records in SWPPP	• Conduct and document quarterly facility inspections and assessments, at least one of which is conducted by the MS4 coordinator or a designated individual	• Quarterly	• Carmel MS4 staff • Street Department • Utilities Department • Police/Fire Departments • Golf course staff • Additional relevant city departments
Stormwater Infrastructure Maintenance (4.7(g))	• Develop a written O&M plan for MS4 owned and/or operated stormwater infrastructure • Perform a surface visual inspection of all catch basins, outfalls, and conveyance systems • Maintain the MS4 conveyance and associated structures included outfalls, open channels, and ditches	• Implement a storm sewer system maintenance schedule and track activities to document the amount of pollution that has been kept out of local receiving waters as a result of the stormwater program • Complete surface visual inspections of the entire system within the permit cycle with a minimum of 15% completed annually • Document the amount of litter picked up as a result of periodic litter pickup events	• July 2023 (review/update) • Implementation throughout permit term	• Carmel MS4 staff • Street Department

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party
		• Document the amount of materials removed from the storm sewer system and disposal methods • Document all improvements made to roadside shoulders and ditches • Document all improvements made to stormwater outfalls • Document all issues noted during visual inspection		
Third Party Compliance (4.7(j))	• Establish or review procedures to ensure contractors or third-party entities hired by the MS4 entity are required to comply with stormwater good housekeeping	• Establish or review written procedures for compliance and enforcement • Document actions taken	• As needed	• Carmel MS4 staff
Flood Management Projects (4.7(k)) (4.7(l))	• Assess flood management projects for incorporation of water quality devices or practices	• Document that flood control projects are assessed for incorporation of additional water quality devices or practices	• As projects proposed	• Carmel MS4 staff • Engineering Department
Staff Training (4.7(m))	• Train appropriate staff members on new technology, operations, fueling spill prevention and clean-up, other responsibilities that arise during the year, site specific stormwater run-off issues, and permit requirements	• Conduct annual refresher training to appropriate departments and staff • Train all new full-time employees within 60 days of date of employment • Train all new seasonal employees within 30 days of date of employment • Document number of staff, number of events held, and the topics covered in each session	• Annually and as needed with new hires	• Carmel MS4 staff • Street Department • Utilities Department • Police/Fire Departments • Golf course staff • Additional relevant city departments

Best Management Practice (BMP)	BMP Description	Measurable Goals, Tracking and Programmatic Indicators	Timeline	Responsible Party

Annual Report
 	
(4.7(i))
(4.7(n))
	• Assess the program annually
	• Report progress in an annual report to IDEM
		• Assess program in conjunction with gathering data and compilation of the annual report
		• Include:
		  •Number and location of stormwater outfalls and conveyance systems that have been repaired
		  •Estimated amount of material collected from stormwater drainage system cleaning including the disposal methods utilized
		  •Estimated amount of materials collected from street sweeping, if applicable, including the disposal method utilized
		  •Number and location of de-icing salt and sand storage areas and methods used to minimize stormwater exposure
		• Submit annual report
			• February 2023
			• February 2024
			• February 2025
			• February 2026
				• Carmel MS4 staff
				• Street Department

REFERENCES

Carmel Indiana. (2022). Comprehensive Plan Update. *Comprehensive Plan*. Retrieved from https://www.carmel.in.gov/government/departments-services/community-services/comprehensive-plan/comprehensive-plan-update

Clark Dietz, Inc. (2005, December). Cool Creek Watershed Management Plan. *IDEM Section 319 Report*. Retrieved from https://ecm.idem.in.gov/cs/idcplg?IdcService=GET_FILE&dID=83085138&dDocName=83085071&Rendition=web&allowInterrupt=1&noSaveAs=1

Indiana Administrative Code. (n.d.). Section 327 IAC 15-13.

Indiana Department of Environmental Management. (2003, July 7). Rule 13. Storm Water Run-Off Associated with Municipal Separate Storm Sewer System Conveyances. *Indiana Administrative Code*.

Indiana Department of Environmental Management. (2021, December). Municipal Separate Storm Sewer System General Permit.

Indiana Department of Environmental Management. (2022). Eagle Creek WMP 98-002. *Watershed Management Plans*. Retrieved from https://www.in.gov/idem/nps/resources/watershed-management-plans/eagle-creek-wmp-98-002/

Indiana Department of Environmental Management. (2022). Integrated Water Monitoring and Assessment Report. Retrieved from https://www.in.gov/idem/nps/watershed-assessment/water-quality-assessments-and-reporting/integrated-water-monitoring-and-assessment-report/

Indiana Department of Environmental Management. (2022). LARE Project Applications & Funding Approvals. Retrieved from https://www.in.gov/dnr/fish-and-wildlife/wildlife-resources/lake-and-river-enhancement/lare-project-applications-and-funding-approvals/

Indiana Department of Environmental Management. (2022). Section 303(d) List of Impaired Waters. *Indiana's Finalized 303(d) List of Impaired Waters (Category 5) for 2022*. Retrieved from https://www.in.gov/idem/nps/watershed-assessment/water-quality-assessments-and-reporting/section-303d-list-of-impaired-waters/

Indiana Department of Environmental Management. (2022). Summary of Current 319(h) Grant Projects. *Current Section 319/205j Projects*. Retrieved from https://www.in.gov/idem/nps/funding/current-section-319205j-projects/summary-of-current-319h-grant-projects/

Indiana Department of Environmental Management. (n.d.). Rule 6. Storm Water Discharges Exposed to Industrial Activity. *Indiana Administrative Code*.

Indiana Department of Natural Resources. (2022, February 25). Indiana County Endangered, Threatened and Rare Species List County: Hamilton. *Indiana County Endangered, Threatened and Rare Species List*. Retrieved from https://www.in.gov/dnr/nature-preserves/files/np_hamilton.pdf

Indiana Water Monitoring Inventory. (2022). Indiana Water Monitoring Inventory Map. Retrieved from https://inwater.agriculture.purdue.edu/monitoring/

Stats Indiana. (2022). Indiana City/Town Census Counts, 1900 to 2020. Retrieved from http://www.stats.indiana.edu/topic/population.asp

US Fish & Wildlife Service. (2021). Wetlands Mapper. *National Wetlands Inventory*. Retrieved from https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper

USGS. (2021). NLCD 2019 Land Cover (CONUS). *National Land Cover Database*. Retrieved from https://www.mrlc.gov/data/nlcd-2019-land-cover-conus

USGS. (2022). National Hydrography Dataset. Retrieved from https://www.usgs.gov/national-hydrography

APPENDIX 1: MS4 Owned/Operated Structural BMP Inventory

Structural BMP Type	BMP ID	Structural Condition
Water Quality Unit	BMPSTR-1	Satisfactory
Water Quality Unit	BMPSTR-10	Satisfactory
Water Quality Unit	BMPSTR-11	Satisfactory
Water Quality Unit	BMPSTR-12	Satisfactory
Water Quality Unit	BMPSTR-13	Satisfactory
Water Quality Unit	BMPSTR-14	Satisfactory
Water Quality Unit	BMPSTR-15	Satisfactory
Water Quality Unit	BMPSTR-16	Satisfactory
Water Quality Unit	BMPSTR-17	Satisfactory
Water Quality Unit	BMPSTR-18	Satisfactory
Water Quality Unit	BMPSTR-19	Satisfactory
Water Quality Unit	BMPSTR-2	Satisfactory
Water Quality Unit	BMPSTR-20	Satisfactory
Water Quality Unit	BMPSTR-21	Satisfactory
Water Quality Unit	BMPSTR-22	Satisfactory
Water Quality Unit	BMPSTR-23	Satisfactory
Water Quality Unit	BMPSTR-277	Satisfactory
Water Quality Unit	BMPSTR-279	Satisfactory
Water Quality Unit	BMPSTR-280	Satisfactory
Water Quality Unit	BMPSTR-3	Satisfactory
Water Quality Unit	BMPSTR-33	Satisfactory
Water Quality Unit	BMPSTR-34	Satisfactory
Water Quality Unit	BMPSTR-35	Satisfactory
Water Quality Unit	BMPSTR-36	Satisfactory
Water Quality Unit	BMPSTR-37	Satisfactory
Water Quality Unit	BMPSTR-38	Satisfactory
Water Quality Unit	BMPSTR-39	Satisfactory
Water Quality Unit	BMPSTR-4	Satisfactory
Water Quality Unit	BMPSTR-5	Satisfactory
Water Quality Unit	BMPSTR-546	Satisfactory
Water Quality Unit	BMPSTR-547	Satisfactory
Water Quality Unit	BMPSTR-548	Satisfactory
Water Quality Unit	BMPSTR-549	Satisfactory
Water Quality Unit	BMPSTR-550	Satisfactory
Water Quality Unit	BMPSTR-551	Satisfactory
Water Quality Unit	BMPSTR-552	Satisfactory
Water Quality Unit	BMPSTR-553	Satisfactory
Water Quality Unit	BMPSTR-554	Satisfactory
Water Quality Unit	BMPSTR-555	Satisfactory
Water Quality Unit	BMPSTR-556	Satisfactory
Water Quality Unit	BMPSTR-557	Satisfactory
Water Quality Unit	BMPSTR-558	Satisfactory
Water Quality Unit	BMPSTR-559	Satisfactory
Water Quality Unit	BMPSTR-560	Satisfactory
Water Quality Unit	BMPSTR-561	Satisfactory
Water Quality Unit	BMPSTR-562	Satisfactory
Inlet Insert	BMPSTR-563	Satisfactory
Water Quality Unit	BMPSTR-6	Satisfactory
Water Quality Unit	BMPSTR-7	Satisfactory

Structural BMP Type	BMP ID	Structural Condition
Water Quality Unit	BMPSTR-8	Satisfactory
Water Quality Unit	BMPSTR-9	Satisfactory
Native Banks	STMFAC-29	Satisfactory
Dry Basin	STMFAC-508	Satisfactory
Vegetated Swale	STMFAC-509	Satisfactory
Micropool Basin	STMFAC-511	Satisfactory
Vegetated Swale	STMFAC-512	Satisfactory
Vegetated Swale	STMFAC-513	Satisfactory
Vegetated Swale	STMFAC-514	Satisfactory
Pervious Pavers	STMFAC-549	Satisfactory
Pervious Asphalt	STMFAC-550	Satisfactory
Pervious Asphalt	STMFAC-551	Satisfactory
Pervious Asphalt	STMFAC-552	Satisfactory
Pervious Asphalt	STMFAC-553	Satisfactory
Pervious Asphalt	STMFAC-554	Satisfactory
Pervious Asphalt	STMFAC-555	Satisfactory
Pervious Asphalt	STMFAC-556	Satisfactory
Pervious Asphalt	STMFAC-565	Satisfactory
Pervious Pavers	STMFAC-558	Satisfactory
Pervious Pavers	STMFAC-559	Satisfactory
Pervious Pavers	STMFAC-560	Satisfactory
Pervious Pavers	STMFAC-561	Satisfactory
Pervious Pavers	STMFAC-562	Satisfactory
Pervious Pavers	STMFAC-563	Satisfactory
Pervious Pavers	STMFAC-564	Satisfactory
Native Bottom Dry Basin	STMFAC-568	Satisfactory
Native Detention Pond	STMFAC-569	Satisfactory
Rain Garden	STMFAC-570	Satisfactory
Native Bottom Dry Basin	STMFAC-571	Satisfactory
Rain Garden	STMFAC-572	Satisfactory
Rain Garden	STMFAC-573	Satisfactory

APPENDIX 2: Programmatic Indicators

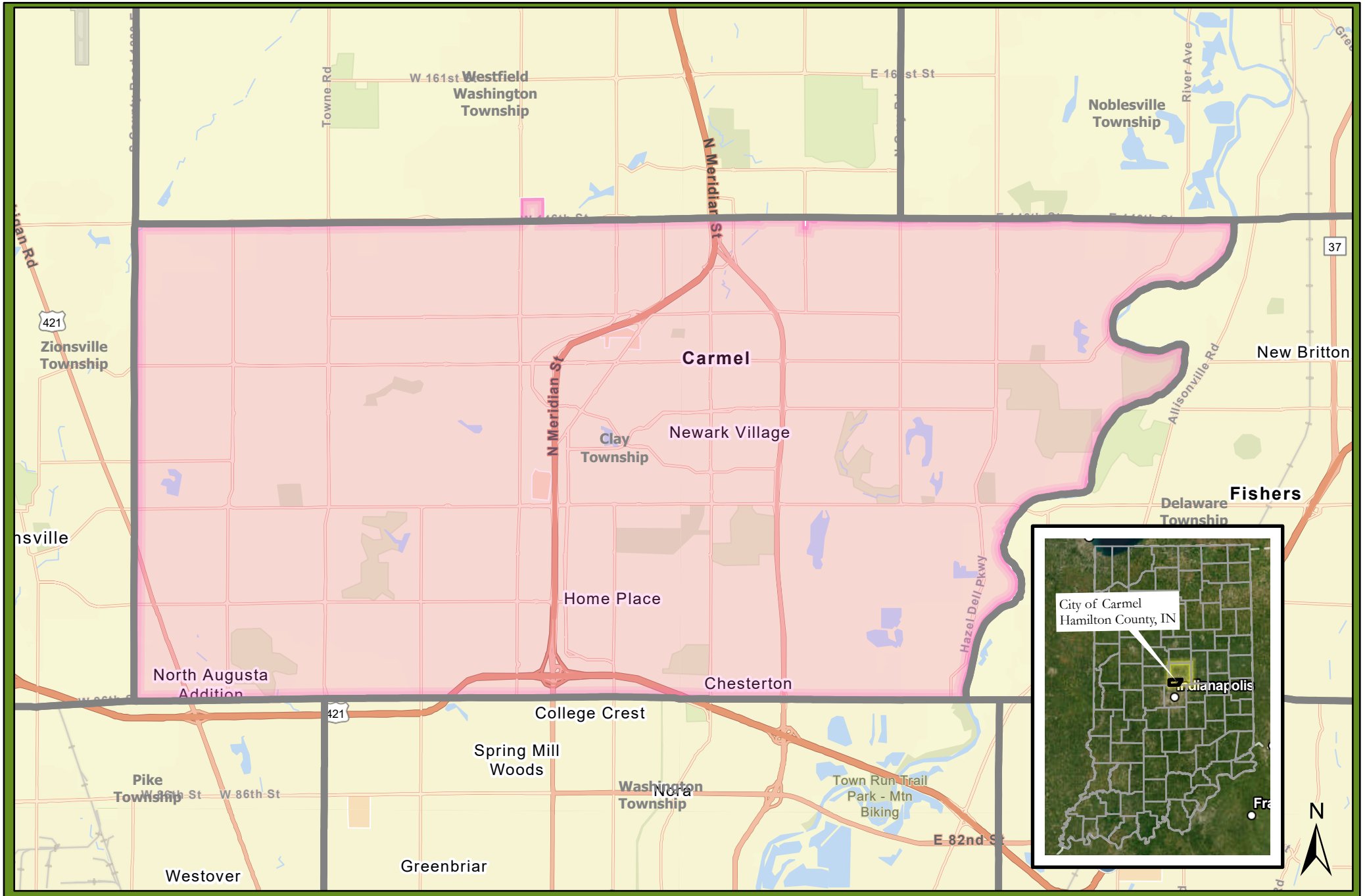
MCM	Programmatic Indicator Permit Citation	Description
Public Education, Outreach, Participation & Involvement	4.3(h)((2)	A list of each public participation and outreach events and activities conducted, a description of the activity, an estimate of the number of attendees, and an assessment if the goals and objectives were met.
	4.3(h)(3)	The number and types of construction and/or post-construction stormwater training opportunities that were provided to contractors, developers and builders, property owners (commercial, industrial, residential, homeowner associations, and other targeted entities during the reporting period.
	4.3(h)(4)	Documentation that presentations were made to elected officials or boards.
	4.3(h)(5)	Describe each targeted audience selected and how they were reached during the reporting period and describe behavioral changes observed.
	4.3(h)(6)	A list of all public education materials used during the reporting period.
Illicit Discharge Detection & Elimination	4.4(k)(2)	IDDE program updates.
	4.4(k)(3)	A summary of any storm sewer system mapping changes to the stormwater outfall and conveyance maps.
	4.4(k)(4)	Number of new MS4 outfalls mapped.
	4.4(k)(5)	Number and location of dry weather outfalls screened for illicit discharges.
	4.4(k)(6)	Number and location of illicit discharges detected.
	4.4(k)(7)	Number and location of illicit discharges eliminated.
	4.4(k)(8)	Number of illicit discharges and/or spills reported to the MS4 entity.
	4.4(k)(9)	Number of enforcement actions taken by the MS4 entity.
Construction Site Stormwater Run-off	4.5(m)(2)	The number of construction projects owned and/or operated by the MS4 entity that are active at the time of submittal.
	4.5(m)(3)	The number of construction sites obtaining a MS4 entity-issued stormwater run-off permit or authorization to discharge.
	4.5(m)(4)	The number of construction sites inspected.
	4.5(m)(5)	The number and type of enforcement actions taken.
	4.5(m)(6)	The number of public information requests and/or complaints received.
Post-Construction Stormwater Run-off	4.6(j)(2)	Updates to the post-construction ordinance or regulatory mechanism.
	4.6(j)(3)	Number of sites requiring post-construction controls.
	4.6(j)(4)	Number, type, and location of structural measures installed.
	4.6(j)(5)	Number, type, and location of structural measures modified to function properly or improve water quality benefits.
	4.6(j)(6)	Number, type, and location of structural measures inspected to ensure each meets design requirements and/or are being maintained.

Municipal Operations Pollution Prevention & Good Housekeeping	4.7(n)(2)	Number and location of stormwater outfalls and conveyance systems that have been repaired.
	4.7(n)(3)	Estimated amount of material collected from stormwater drainage system cleaning including the disposal methods utilized.
	4.7(n)(4)	Estimated amount of material collected from street sweeping, if applicable, including the disposal methods utilized.
	4.7(n)(5)	Number and location of de-icing salt and sand storage areas and methods used to minimize stormwater exposure.

APPENDIX 3: Acronyms

BMP	Best Management Practice
CBBEL	Christopher B. Burke Engineering, LLC
CSGP	Construction Stormwater General Permit
CSO	Combined Sewer Overflow
CWA	Clean Water Act
EI	Erodibility Index
EPA	Environmental Protection Agency
GIS	Geographical Information System
HEL	Highly Erodible Land
HHW	Household Hazardous Waste
HUA	Hydrologic Unit Area
HUC	Hydrologic Unit Code
IAC	Indiana Administrative Code
IBC	Impaired Biotic Communities
IDDE	Illicit Discharge Detection and Elimination
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IDP	Illicit Discharge Potential
IR	Integrated Water Monitoring and Assessment Report
LARE	Lake and River Enhancement Program
LTCP	Long Term Control Plan
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
MS4GP	Municipal Separate Storm Sewer System General Permit
NLCD	National Land Cover Dataset
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
O&M	Operation & Maintenance Manual/Plan
OSRW	Outstanding State Resource Waters
PCB	Polychlorinated biphenyls
PHEL	Potentially Highly Erodible Land
PI	Programmatic Indicators
PWS	Public Water Supplies
SDWA	Safe Drinking Water Act
SIC	Standard Identification Classification
SOP	Standard Operating Procedure
SRCER	Stream Reach Characterization and Evaluation Report
SWCD	Soil and Water Conservation District
SWMD	Solid Waste Management District
SWPPP	Stormwater Pollution Prevention Plan
SWQMP	Stormwater Quality Management Plan
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WHPA	Wellhead Protection Area
WMP	Watershed Management Plan
WQCR	Water Quality Characterization Report
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plant

APPENDIX 4: Exhibits

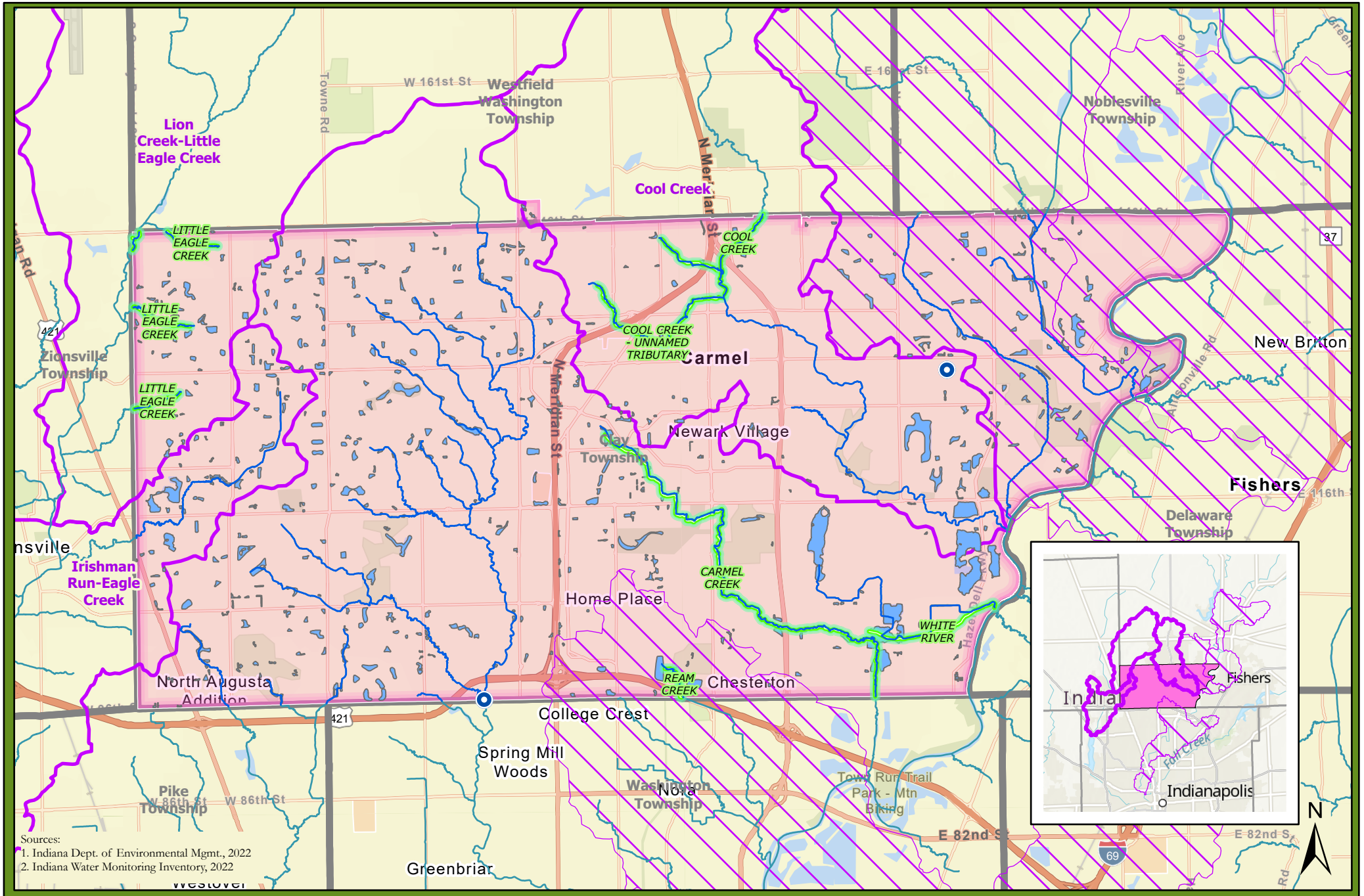


MS4 Boundary

Township Boundary

Christopher B. Burke Engineering LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 www.cbbel-in.com

PROJECT: MS4 Stormwater Quality Management Plan City of Carmel, Indiana		PROJECT NO. 05-0641	APPROX SCALE: 1" = 7,000'
TITLE: MS4 Boundary			DATE: 01/2023
			EXHIBIT: 1

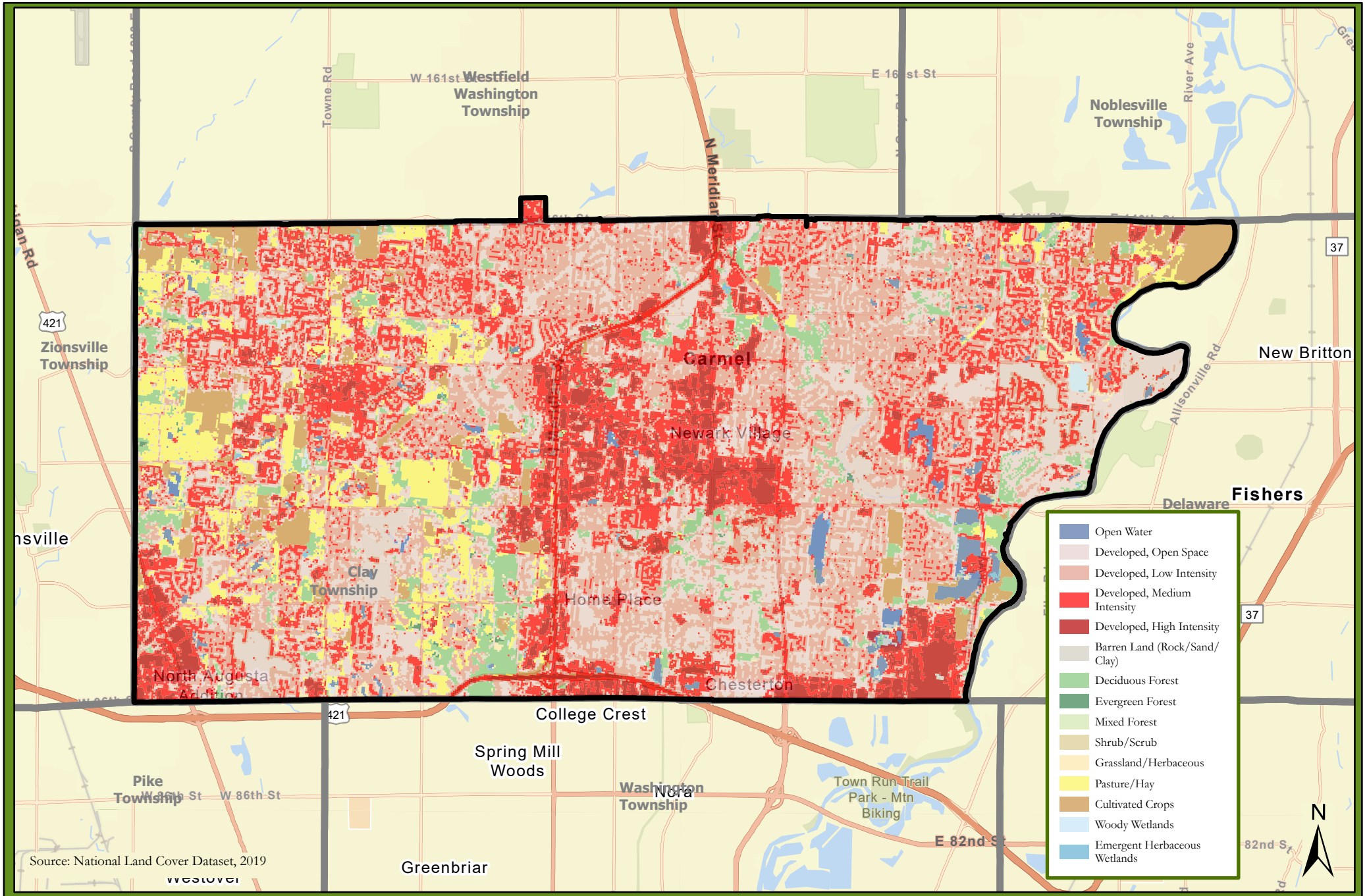


Sources:
1. Indiana Dept. of Environmental Mgmt., 2022
2. Indiana Water Monitoring Inventory, 2022

- Monitoring Sites (IWMI)
- MS4 Receiving Waters
- 303(d) Impaired Waterways
- Total Maximum Daily Load Reports
- Watershed Management Plans
- MS4 Boundary

Christopher B. Burke Engineering LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 www.cbbel-in.com

PROJECT: MS4 Stormwater Quality Management Plan City of Carmel, Indiana		PROJECT NO. 05-0641	APPROX SCALE: 1" = 7,000'
TITLE: Water Quality			DATE: 01/2023
			EXHIBIT: 2



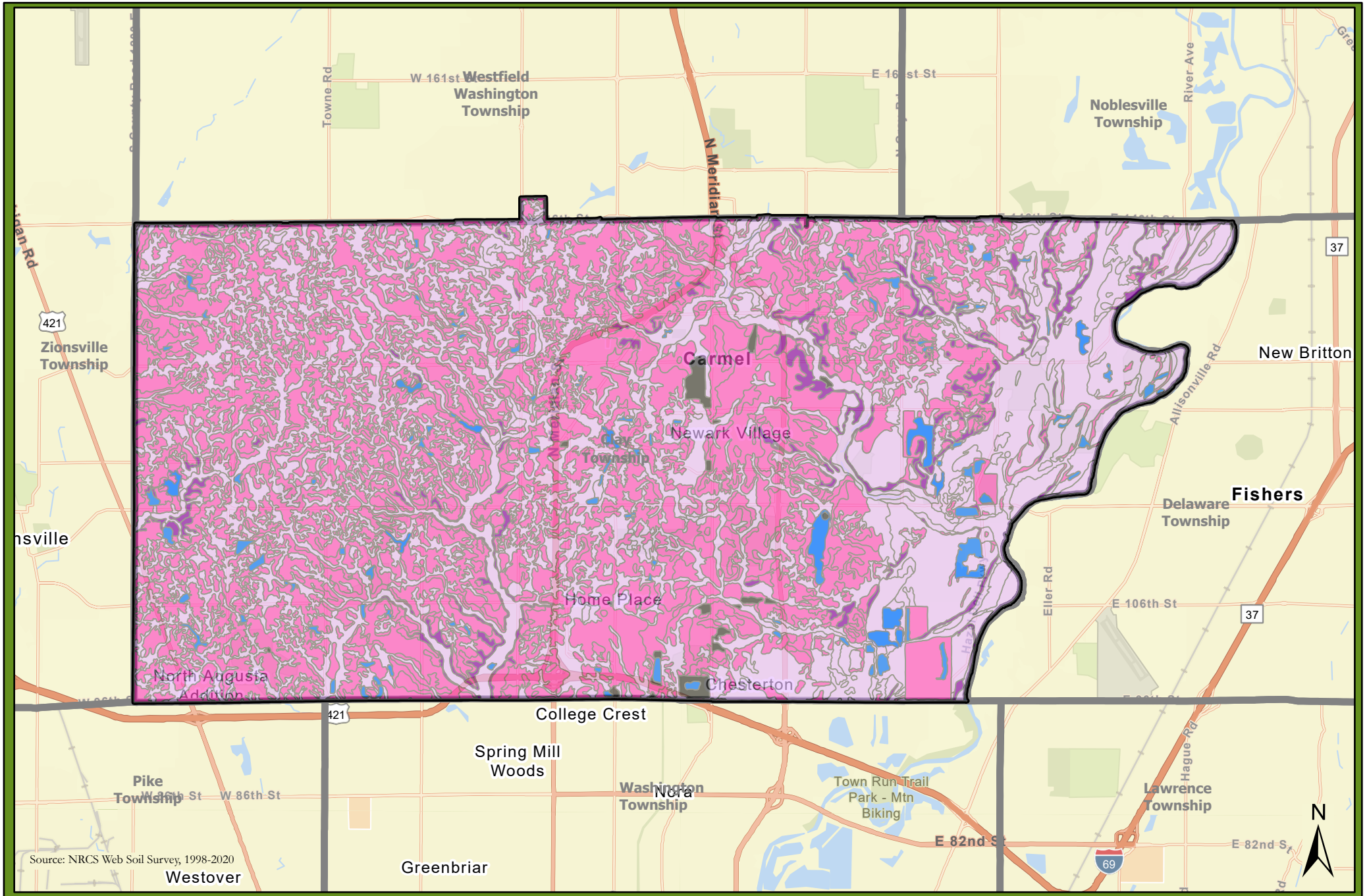
Source: National Land Cover Dataset, 2019

MS4 Boundary

Township Boundary

Christopher B. Burke Engineering LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 www.cbbel-in.com

PROJECT: MS4 Stormwater Quality Management Plan City of Carmel, Indiana		PROJECT NO. 05-0641	APPROX SCALE: 1" = 7,000'
TITLE: Land Cover			DATE: 01/2023
			EXHIBIT: 3



Highly Erodible Land
Potentially Highly Erodible Land
Not Highly Erodible
Orthents
Water
MS4 Boundary

Christopher B. Burke Engineering LLC
PNC Center, Suite 1368 South
115 West Washington Street
Indianapolis, Indiana 46204
(t) 317.266.8000 www.cbbel-in.com

PROJECT: MS4 Stormwater Quality Management Plan City of Carmel, Indiana		PROJECT NO. 05-0641	APPROX SCALE: 1" = 7,000'
TITLE: Highly Erodible Land			DATE: 01/2023
			EXHIBIT: 4