9.0 Use Attainability Analysis

Contents:

9.1 Introduction

This document is the Use Attainability Analysis submitted as Section 9 of the Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP). The LTCP was approved, excluding Section 9, by entry of the Consent Decree in December 2006. Three amendments to the Consent Decree have since been approved. The First Amendment to the Consent Decree modified CSO Control Measures 16, 27 and 28 and was approved in 2009. The Second Amendment implemented the "Modified Enhancement Plan" and was approved in 2010. The Third Amendment, approved in 2013, described the transfer of the utility from the City of Indianapolis to the CWA Authority, Inc.

CWA Authority, Inc. (the Authority), operated under the Department of Public Utilities of the City of Indianapolis, doing business as Citizens Energy Group, acquired the Wastewater System on August 26, 2011 from the City of Indianapolis Department of Public Works (the City). The Authority is responsible for the planning, design, construction, operation and maintenance of the Wastewater System as defined in the Asset Purchase Agreement by which the Authority acquired the system serving Indianapolis, Indiana.

In January of 2007 the Indiana Department of Environmental Management (IDEM) provided approval of the CSO LTCP except for this Section 9 of the report. In December of 2007 IDEM provided a letter of review stating that the Use Attainability Analysis (UAA) "provided sufficient information to propose changing the designated recreation use…to the Combined Sewer Overflow (CSO) wet weather limited designated use." The Authority continues to evaluate water quality and support development and implementation of a Use Attainability Analysis ("UAA") for impacted receiving waters.

Following a May 2018 meeting with staff from the Authority, United States Environmental Protection Agency (EPA), and IDEM, the Authority held multiple discussions with IDEM related to the formal submittal, review, and approval of a Use Attainability Analysis (UAA) rulemaking. Discussions culminated in a request for revisions by the Authority to the 2007 UAA submittal, originally submitted by the City of Indianapolis.

This document provides the Authority's update to the 2007 UAA, including the relevant factors provided in 40 CFR 131.10(g), updated to address receiving waters that cannot attain the water quality standards for recreational designated use in part as the result of residual discharges from the Authority's combined sewer system. Generally, ownership of the wastewater system has been changed from "City" to "Authority" throughout the report. Work completed prior to August 26, 2011 is referred to as work completed by the "City," while work completed after August 26, 2011 is referred to as work completed by the "Authority." The City maintains responsibility for the development and implementation of the MS4 stormwater program. Revisions from the original submittal of this document are summarized in Section 9.7 of this report.

9.1.1 Purpose & Objectives

The approved LTCP will achieve an extremely high level of CSO control, resulting in the capture of 95-97 percent of wet-weather sewer flows after full program implementation. This is an extraordinary level of control of urban stormwater throughout the CSO area.

CSOs that remain after full implementation will occur during storms that exceed the LTCP design and performance criteria. These will result in limited periods when CSOs combine with other pollutant sources, as well as conditions such as high stream flow and velocity, to render streams unsuitable for the primary contact recreational designated use. Federal and state laws provide a process for refining designated uses, including those for primary contact recreation in the case of Indianapolis, through a UAA.

This Section 9 describes state and federal requirements associated with a UAA, presents the Authority's UAA, and requests approval of a refinement to the recreational designated use in waterways impacted by CSOs in the Authority's service area.

The UAA is founded on realities of watersheds impacted by the Authority's service area. Consistent with 40 CFR 131.10(g), several factors provide the basis for suspending a designated use.

The effects of urbanization preclude the attainment of the recreational use after large storm events because stormwater runoff volumes generated during large wet weather events result in high flows in the stream networks. These high flows create unsafe conditions that preclude the attainment of the primary contact recreational use. Although urbanization has exacerbated these unsafe conditions in some Indianapolis streams, the higher intermittent wet weather flows generated under natural conditions would also preclude attainment of the recreational use.

Human-caused conditions and the presence of non-CSO sources of bacteria including loadings from upstream sources, wildlife, and domestic animals near and in the urban streams prohibit the attainment of the primary contact recreational water quality standard during any substantial wet weather event.

Hydrologic modifications in the watershed also preclude the attainment of the primary contact recreational use, particularly during and after wet weather events. Dams, diversions, and other similar structures create conditions in the streams and rivers that are unsafe for recreation.

In addition, substantial and widespread social and economic impacts could result from implementation of controls beyond those approved by IDEM and EPA in the Authority's Long Term Control Plan Table 7-5, which includes capturing 95 percent to 97 percent of combined sewer overflows for treatment. The MS4 stormwater management program implemented by the City, and the accompanying improvements in stormwater runoff controls, will further the water quality improvements achieved.

The Authority has gathered extensive information and data to support this UAA. Supporting information is contained in the following documents:

- Stream Reach Characterization and Evaluation Report (SRCER) (March 2000 initial report and 2003 update)
- Total Maximum Daily Load (TMDL) studies of the White River, Fall Creek and Pleasant Run (September 2003)
- Information to Support an Existing Use Determination (April 2005)
- CSO LTCP and subsequent updates
- CSO Operational Plan (CSOOP) (Update 2018)
- Documentation of Water Quality model updates (2013 to 2015)
- Financial Capability Assessment (Updated 2017)

This UAA concludes that the recreational use is not attainable during and for a period of 96 hours following wet weather events that exceed the level of CSO control provided for in the CSO LTCP. The remainder of this document provides the bases for this conclusion.

Finally, the streams within the Authority's CSO area do not meet recreation standards during significant periods of dry weather and, as such, are identified as impaired on IDEM's §303(d) list.

9.1.2 Regulatory Requirements for UAA

Federal regulations specify that a UAA should be "a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in 40 CFR 131.10(g)." 40 CFR 131.10(g) provides that states may establish subcategories of a designated use if the State can demonstrate that attaining the designated use is not feasible because:

1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3) Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be

remedied or would cause more environmental damage to correct than to leave in place; or

4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the use; or

5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

9.1.2.1 EPA Policy and Guidance Documents

EPA's Combined Sewer Overflow (CSO) Control Policy[1] states that one of its key elements is the "development of the long-term plan …[in coordination] with the review and appropriate revision of water quality standards and implementation procedures on CSO-impacted waters to ensure that the long-term controls will be sufficient to meet water quality standards." As part of the analysis, "States should evaluate whether the designated use could be attained if CSO controls were implemented."[2] In 2002, EPA published national guidance on coordinating the development of CSO LTCPs with water quality standards reviews.[3] This document acknowledges the unique relationship between CSOs, designated uses, and water quality standards in CSO-impacted water bodies. The guidance calls for a water quality standards review in conjunction with LTCP development and specifies that appropriate and attainable standards should be established for CSO-impacted waters.

9.1.2.2 State Requirements

Indiana law was developed consistent with EPA's regulation and guidance. During its 2005 session, the Indiana General Assembly approved Senate Enrolled Act (SEA) 620, which was signed into law on April 21, 2005. Among other provisions, SEA 620 (now codified at IC 13-18-3-2.5) provides for:

- A CSO Limited Wet Weather Use subcategory for CSO impacted waters with an approved LTCP; and
- An October 1, 2006, deadline for the Water Pollution Control Board to adopt rules to implement the new subcategory.

Under this statutory provision, the requirements for the CSO Wet Weather Limited Use subcategory depend upon the water quality-based requirements in an approved CSO LTCP. The CSO subcategory and water quality-based requirements may remain in effect for up to 96 hours after the discharge ends. The subcategory is available if: a) IDEM has approved a community's CSO LTCP, b) the LTCP is incorporated into the NPDES permit or an order of the IDEM commissioner, c) a UAA is performed and approved, and d) the approved LTCP is implemented. The UAA conclusions also must be reviewed every five years. Federal requirements under 40 CFR 131.10, 40 CFR 131.20, and 40 CFR 131.21 also must be met.

EPA approved Indiana's CSO Limited Wet Weather Use subcategory on June 8, 2008, indicating that restrictions on CSO discharges, including on the number of overflows, would "ensure that the revised standards reflect the highest level of CSO control that can be feasibly attained, and therefore, reflect the highest attainable recreational use for the water body at issue."

9.2 Current Recreational Standards and Water Quality Conditions

The State of Indiana currently applies the primary contact recreational use designation to all waters in the state. Although it may be appropriate for some waters during certain periods, this designation is not attainable in all waters at all times, especially during and following wet weather events, as Indiana acknowledged when it established the CSO Limited Wet Weather Use subcategory.

To support the primary contact recreational designated use, Indiana adopted the following *E. coli* numeric water quality standards, which apply during the recreational season from April to October:

[1] 59 Federal Register 18,688 (April 19, 1994).
[2] EPA CSO Control Policy at III.B, paragraph 2.
[3] Guidance: Coordinating CSO Long Term Control Planning with Water Quality Standards Reviews (EPA-833-R-01-002, July 2001).

- Geometric mean of 125 colony-forming units per 100 milliliters (cfu/100 mL) based upon five equally spaced samples taken in a one-month period
- Single sample maximum of 235 cfu/100 mL

These water quality criteria are intended to protect full-body immersion bathing, also referred to as swimming. The state currently applies these criteria to all waters, regardless of whether they are actually used for primary contact recreation (e.g. bathing beaches).

Many Indiana water bodies have not and do not currently meet the primary contact recreational use water quality standard and are considered non-attaining. For example, in its 2018 §303(d) List submitted to EPA, IDEM listed more than 24,000 miles (approximately 39 percent) of evaluated stream miles in nonattainment for the primary contact recreational use due to bacteria levels. The White River and all Marion County streams affected by CSOs are included in this list of non-attaining waterways due to *E. coli* and other impairments.

9.3 Determination of Existing Use and Discussion of Highest Attainable Use

9.3.1 Determination of Existing Use

Under federal regulation 40 CFR 131.3(e), a water body's designated use cannot be removed if it is an "existing use," defined as a "use *actually attained* in the water body on or after November 28, 1975" (emphasis added). The City conducted an extensive evaluation to document that recreation is not an existing use during the time when residual CSO events are expected to occur after implementation of the CSO LTCP.

Before removing a designated recreational use, there must be a determination that there are no "existing uses" of affected waterways that would preclude approval of a UAA. After discussions with and review by advisory committee members, the City of Indianapolis submitted data to IDEM in October 2004 to demonstrate that there are no existing full-body or partial-body contact recreational uses, as defined in 40 CFR 131.3(e), within CSO-affected waterways.

The waterways were defined as:

- Fall Creek (Keystone Avenue to White River)
- Eagle Creek, including Big Eagle Creek (Tibbs Avenue to White River) and Little Eagle Creek (Vermont Street to confluence with Eagle Creek)
- Lower Pogues Run Box Culvert (New York Street to White River)
- Pogues Run (Upstream of Box Culvert)
- Pleasant Run (9th Street to White River) and its main tributary, Bean Creek (State Street to Pleasant Run)
- White River (56th Street to State Road 58 near Elnora)

Following discussions in 2005 with IDEM staff, the City revised and resubmitted its final existing use information to the agency on April 5, 2005.[4] This document can be found in **Appendix E** of the November 2017 LTCP Update and is hereby incorporated by reference. In its final submittal, the City requested that IDEM find no existing use during specific storm events that are likely to cause overflows following full implementation of the LTCP. The City's submittal included data and modeling analyses for its typical year level of control, as represented by the 3-month storm event.[5]

The City's demonstration of "no existing use" was based upon a number of factors, including:

- The water quality standards that protect the recreational use have never been "actually attained" during and following CSO and other wet weather discharges as well as for extensive periods during dry weather;

[4] *Information to Support an Existing Use Determination for CSO-Impacted Portions of Marion County Streams,* City of Indianapolis-ICST, April 5, 2005. Existing Use determination stream limits were evaluated in the prior Existing Use Determination and were found to have no primary contact existing use. The 2005 determination is still valid, but is more extensive than needed for this 2019 request for a CSO Wet Weather Limited Use Subcategory.

[5] The 3-month storm event was based on a 24-hour Huff evaluation storm. The 3-month storm is expected to occur four times in a typical year, which is closest to and used as a proxy for the level of control the Authority is required to achieve in comparison to its modeled five-year "typical year.".

- Recreational activities such as swimming and wading are not known to occur during large storm events, such as those exceeding a 1.7-month storm.
- CSO-impacted waterways are especially unsuitable for recreational use during and following large storm events due to high *E. coli* bacteria levels and high stream flows and velocities. For example, the U.S. Geological Survey documented that USGS field personnel should not wade into the streams to obtain samples during or following many storm events. Instead, samples are collected from the safety of bridges above the streams or other methods that do not expose staff to high flows within the streams.
- The City implemented a proactive and effective public outreach program to prevent and control access to waterways during and after wet-weather events.

Based upon this and other information provided, the City of Indianapolis concluded that full-body and partial-body contact recreation was not attained under 40 CFR 131.3(e) during storm events exceeding the 1.7-month storm, including the 3-month storm, which is the storm most closely associated with the Authority's required level of control. On June 27, 2005, IDEM responded with a letter confirming that primary contact recreation was not an existing use for the 3-month storm event. The letter stated:

> "Based on the data provided by Indianapolis, IDEM accepts that primary contact recreation is not an existing use during a 3-month storm event for the portions of the CSO receiving streams the City has identified: Fall Creek, Eagle Creek, Pleasant Run, Pogues Run, and the White River. Since primary contact recreation is not an existing use under 3-month storm event flow conditions, Indianapolis may proceed with a use attainability analysis to determine the attainable recreational use for these waters."

The primary factors and extent of impacted waterways behind this conclusion have not changed since 2005.

This UAA seeks a subcategorization of the designated primary contact recreational use during the limited periods when the waters will be affected by residual CSO discharges due to storm events exceeding the LTCP design criteria. Although the capture of CSO discharges during larger storm events will not provide additional protection for recreational uses, the Authority has committed to protection above 95 percent capture for Fall Creek at the request of U.S. EPA.

9.3.2 Highest Attainable Use

Federal regulations at 40 CFR 131.3(m) require consideration of the *Highest Attainable Use* when states consider a change in designated use. This highest attainable use is one that is closest to the identified designated use(s) and attainable based on the factors identified in a Use Attainability Analysis conducted pursuant to 40 CFR 131.10(g).

As discussed in this UAA, the primary contact recreational use, which represents the Clean Water Act Section 101(a)(2) designated use for the waters in question, is not attained as the result of a combination of influences including CSO discharges. The CSO Wet Weather Limited Use subcategory represents the Highest Attainable Use for these waters during limited periods following certain storm events.

Federal regulations at 40 CFR 131.10(g) provide that where a state adopts revised water quality based upon a UAA to remove a designated use, the state must adopt the highest attainable use as the replacement standard. The highest attainable use would be defined as the aquatic life, wildlife, and/or recreation use that is both closest to the uses specified in the Clean Water Act and attainable, as determined using best available data and information through the UAA. All uses specified in the Act are presumed attainable unless a state demonstrates through a consideration of the six UAA factors specified in 40 CFR 131.10(g) that the uses are not attainable.

Highest attainable use revisions do not allow wholesale elimination of designated uses through the UAA process where partial support of the use could still be attained and maintained. Rather, a partial designated use and the water quality criteria necessary to support that partial use would have to be established in any revised water quality standards. The CSO Wet Weather Limited Use subcategory proposed in the UAA is an appropriate partial designated use based on the applicable federal and state rules[6].

[6] See IC 13-14-9-14; 327 IAC 2-1-3.1.

Section 101(a)(2) of the Clean Water Act[7] establishes the national goal that wherever attainable, water quality will provide for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water.

The language in 40 CFR 131.3(m) demonstrates that permittees should consider subcategories of an attainable use to determine the highest attainable use. Additionally, EPA guidance directs states to establish subcategories of designated uses where primary contact recreation is not feasible at all times. See "Coordinating CSO Long-Term Planning with Water Quality Standards Reviews," EPA-833-R-01-002 (July 31, 2001), at p. 17:

> For water bodies where a state has demonstrated through a UAA that primary contact recreation is not feasible, is not feasible all the time, or poses public safety risks, the state has several options, depending on site-specific circumstances. For example, a state could adopt a CSO subcategory of recreational uses. Since the subcategory lowers the level of protection for the water body, EPA regulations at 40 CFR 131.10(j) require a UAA. Such a subcategory allows for a use less protective than swimming every day during the recreational season when a CSO LTCP that ensures attainment of the use at all times would cause substantial and widespread economic and social impact.

The language from EPA's final rule, "Water Quality Standards Regulatory Revisions," 80 Fed. Reg. 51019 (October 20, 2015) provides additional guidance on how states should articulate HAU through designated use subcategories:

> The preamble to the proposed rule also provided several examples of how states and authorized tribes can articulate the HAU [Highest Attainable Use]. These examples include using an existing designated use framework, adopting a new statewide sub-category of a use, or adopting a new sub-category of a use that uniquely recognizes the limiting condition for a specific water body (e.g., aquatic life limited by naturally high levels of copper).

One example of where a state adopted new statewide sub-categories to protect the highest attainable use was related to a class of waters the state defines as "effluent dependent waters." The state conducted a UAA to justify the removal of the aquatic life use in these waters. It was not feasible for these waters to attain the same aquatic life assemblage expected of waters assigned the statewide aquatic life use. The state identified the highest attainable aquatic life use for these waters and created two new sub-categories (effluent-dependent fisheries and effluent-dependent non-fish bearing waters) with criteria that are sufficiently protective of these uses. These EPA-approved sub-categories reflect the aquatic life use that can be attained in these waters, while still protecting the effluent dependent aquatic life.

Some commenters expressed concern with the difficulty of articulating a specific HAU because doing so may require additional analyses. Where this may be the case, an alternative method of articulating the HAU can be for a state or authorized tribe to designate for a water body a new or already established, broadly defined HAU (e.g., limited aquatic life use) and the criteria associated with the best pollutant/parameter levels attainable based on the information or analysis the state or authorized tribe used to evaluate attainability of the designated use. This is reasonable because the state or authorized tribe is essentially articulating that the HAU reflects whatever use is attained when the most protective, attainable criteria are achieved.

One example where a state used this alternative method involved adoption of a process by which the state can tailor site-specific criteria to protect the highest attainable use as determined by a UAA. EPA approved the state's adoption of a broad "Limited Use" and the subsequent adoption of a provision to allow the development of site-specific criteria for certain pollutants to protect that use. The "Limited Use" shares the same water quality criteria as the state's full designated use for recreation and fish and wildlife protection "except for any site-specific alternative criteria that have been established for

[7] 33 U.S.C. § 1251(a)(2).

the water body." Such site-specific criteria are limited to numeric criteria for nutrients, bacteria, dissolved oxygen, alkalinity, specific conductance, transparency, turbidity, biological integrity, or pH. The state restricts application of the "Limited Use" to waters with human induced physical or habitat conditions that prevent attainment of the full designated use for recreation and fish and wildlife protection, and to either (1) wholly artificial waters, or (2) altered water bodies dredged and filled prior to November 28, 1975. Through this process, the state is able to articulate the HAU by identifying the most protective, attainable criteria that can be achieved.

Where a state or authorized tribe does not already have a statewide use in their regulation that is protective of the HAU, the state or authorized tribe will need to find an approach that meets the requirements of the CWA and § 131.10(g). States and authorized tribes are not limited by the examples described in this section and can choose a different approach that aligns with their specific needs, as long as their preferred approach is protective of the HAU and is consistent with the CWA and § 131.10.[17]

As an example of how a UAA informs the identification of the HAU, consider a state or authorized tribe with a designated aquatic life use and associated dissolved oxygen criterion. The state or authorized tribe determines through a UAA that a particular water body cannot attain its designated aquatic life use due to naturally occurring dissolved oxygen concentrations that prevent attainment of the use (i.e., the use is not attainable pursuant to § 131.10(g)(1)). Such an analysis also shows that the low dissolved oxygen concentrations are not due to anthropogenic sources, but rather due to the bathymetry of the water body. The state or authorized tribe then evaluates what level of aquatic life use is attainable in light of the naturally low dissolved oxygen concentration, as well as any data that were used to evaluate attainability (e.g., biological data). The state or authorized tribe concludes that the naturally low dissolved oxygen concentration precludes attainment of the full aquatic life use, and requires an alternative dissolved oxygen criterion that protects the "highest" but limited aquatic life that is attainable. Once this analysis is complete and fully documented in the UAA, the state or authorized tribe would then designate the HAU and adopt criteria to protect that use.

Here, Indiana has adopted a hybrid approach fully consistent with the EPA guidance summarized above. The state established an alternative method of articulating the highest attainable use, through its CSO Wet Weather Limited Use subcategory.[8] And each application of that subcategory requires a site-specific analysis and a separate rulemaking that establishes the CSO control requirements that will remain applicable during and after wet weather events. EPA approved this subcategory, and, as such, should allow municipalities to invoke this subcategory to establish limits or conditions in their LTCPs that reflect the highest attainable use[9].

EPA approved Indiana's CSO Wet Weather Limited Use subcategory on June 8, 2008. In its approval, EPA explained that any future proposed water quality revision pursuant to the subcategory would need to include appropriate CSO restrictions, including limits on the number of overflows. EPA reasoned that "[s]uch restrictions will be necessary to ensure that the revised standards reflect the highest level of CSO control that can be feasibly attained, and therefore, reflect the highest attainable recreational use for the water body at issue." In other words, EPA explicitly contemplated that this subcategory would be sufficient to define the highest attainable use, as long as the site-specific rulemaking for each water body required the highest level of CSO control that can be feasibly attained. By their approval, EPA and IDEM already have agreed that the LTCP requirements represent the highest level of CSO control that can be feasibly achieved. As a result, the UAA and application of the CSO Wet Weather Limited Use subcategory based on that approved LTCP will ensure that the highest attainable use is achieved.

[8] See 327 IAC 2-1-3.1.
[9] See 327 IAC 2-1-3.1(c)(1) (requiring that the LTCP "specify the water quality-based requirements that will apply to combined sewer overflows . . . if the waterbody or waterbodies receiving the wet weather overflows are redesignated to the CSO Wet Weather Limited Use subcategory").

9.4 The Wet Weather Limited Use Subcategory Is Necessary and Appropriate

Application of the CSO Wet Weather Limited Use subcategory pursuant to both federal regulations and IC 13-18-3-2.5 is both necessary and appropriate for the streams that will receive residual CSO discharges under the Authority's approved LTCP. Further, the CSO Wet Weather Limited Use subcategory reflects the highest attainable use as defined at 40 CFR 131.3(m). Application of the CSO Wet Weather Limited Use subcategory is supported for the Authority's CSO receiving and downstream waters based upon four of the six factors provided in 40 CFR 131.10(g):

- Factor 2: Natural, ephemeral, intermittent, or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.
- Factor 3: Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
- Factor 4: Hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the use.
- Factor 6: Controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.

Each factor and supporting data is discussed in detail below.

9.4.1 Natural or Intermittent High Flow Conditions

Factor 2 under 40 CFR 131.10(g) allows consideration of "natural, ephemeral, intermittent, or low-flow conditions or water levels [that] prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met." In Indianapolis, this factor is met due to the intermittent high flow conditions that accompany large storm events that exceed the LTCP level of control.

Under this factor, in 2005 as part of the original UAA, the City estimated the flow conditions that would have occurred in the streams under natural conditions, prior to the addition of man-made dams, reservoirs and water withdrawals. As noted in Section 2 of the LTCP, natural flows of the White River, Fall Creek, and Eagle Creek are affected by regulation of reservoirs and by water withdrawals for municipal potable water supply by Citizens Energy Group.

For this update, estimates are provided for natural typical year storm event peak flows for White River, Fall Creek, Pleasant Run, Pogues Run, and Eagle Creek. Estimates are based on a loading rate of 12.0 cfs per square mile drainage area, which was determined by reviewing historical USGS data for watersheds for limited urbanization. These estimated natural peak flows are compared in **Table 9-1** to modeled peak instream flows under current, urbanized conditions, drawn from *Water Quality Model Update Phase 1 Memorandum* (CWA Authority, 2013).

Also shown in **Table 9-1** are the flows above which USGS staff is directed not to wade into streams to measure stream discharge. As noted in the approved City of Indianapolis Existing Use submittal, when stream flows are low, trained USGS employees measure stream discharge by wading into the stream. When stream flows are high or potentially dangerous, USGS hydrologists make discharge measurements using acoustic Doppler current meters, a bridge crane or from a tethered boat. The USGS National Field Manual for the Collection of Water Quality Data provides wading safety guidelines for stream sampling. Section 9.4.1 of the manual directs field staff; "Do not attempt to wade a stream for which values of depth multiplied by velocity equal or exceed 10 ft^2/s. For example, a stream only 2 feet deep but with velocities of 5 ft/s or more can be dangerous to wade."

Figures 9-1 through **9-5** show the wading vs. non-wading activity by USGS staff on the relevant streams, the safety criteria for each stream, and the maximum stream flows, depths, and velocities expected for the modeled typical year storm after LTCP implementation. The data are plotted against the safety factor in order to provide a better graphical representation.

In all instances, both the urbanized and natural peak flows in these waterways during the modeled typical year storm event significantly exceed the flows considered safe by USGS staff for wading.

The analysis demonstrates two findings:

1) Natural in-stream peak flows in all waterways during the modeled typical year event (or larger events) are not safe for recreational activities due to high stream velocities; and

2) Urbanization and man-made dams and reservoirs have affected natural flows in the streams, reducing natural peak flows in some waterways and increasing them in others. This finding will be discussed in more detail below in the discussion of human-caused conditions and hydrologic modifications.

Table 9-1 Instream Peak Flow: Comparison of Urbanization to Natural Conditions

Watershed	Total Acreage	Urbanized (Modeled) Instream Peak Flow (cfs)[1]	Estimated Natural Instream Peak Flow (cfs)[2]	Flows Considered Unsafe for Wading by USGS Staff (cfs)[3]	Notes
Fall Creek	193,275	990	3,600	>340	Urbanization has reduced instream peak flow due to Geist Dam.
Pleasant Run	15,165	770	300	>160	Urbanization has increased instream peak flow. Instream velocity under natural conditions may be too high for recreation.
Pogues Run	8,156	205	200	>25	Urbanization has increased instream peak flow.
Eagle Creek	135,231	1,020	2,500	>140	Urbanization reduces instream peak flow due to Eagle Creek Dam.
White River[4,5]	875,321	4,490	16,400	>540	Urbanization reduces instream peak flow in part due to water withdrawal and multiple dams. Natural peak flow is based on the entire White River watershed.
White River[5] (with CSO Tributaries)	1,227,148	5,600	23,000	>540	Urbanization reduces instream peak flow in part due to water withdrawal and multiple dams. Natural peak flow is based on the entire White River watershed.

[1] Instream peak flows are from model simulations presented in *Water Quality Model Update Phase 1 Flow Calibration* (Citizens, 2013). The peak flows presented above correspond to the watershed's downstream location except for the White River without CSO tributaries.

[2] Estimated natural peak flows were calculated by the City based on the return storm most closely associated with the Authority's modeled typical year level of control and a loading rate of 12.0 cfs per square mile drainage area determined by a review of historical USGS data for watersheds with limited urbanization.

[3] Flows considered unsafe for wading by USGS staff were calculated based on actual USGS data for wading and non-contact entry through May 2018.

[4] Modeled instream peak flow for the White River without tributaries is reported from upstream of the confluence with Fall Creek.

[5] For large watersheds such as the White River, the typical year peak streamflow based on the historical flow data record is expected to be produced by a long-duration storm event, and would significantly exceed the streamflow produced by a short duration typical year storm. White River at Petersburg is not presented as gauged flows include the East Fork of the White River.

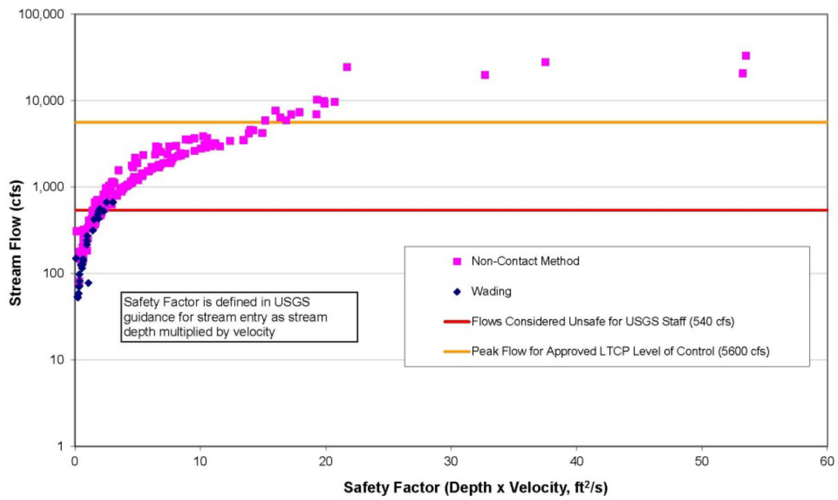

Figure 9-1a: White River USGS Stream Measurement Methods at Varying Streamflows

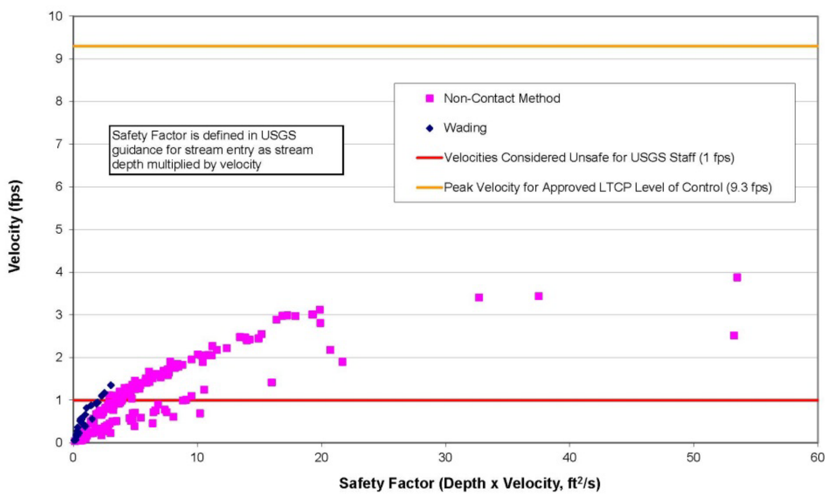

Figure 9-1b: White River USGS Stream Measurement Methods at Varying Velocities

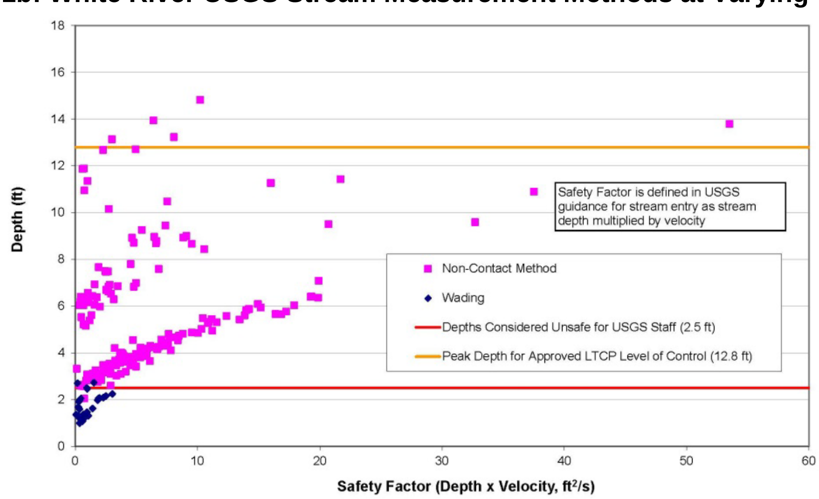

Figure 9-1c: White River USGS Stream Measurement Methods at Varying Depths

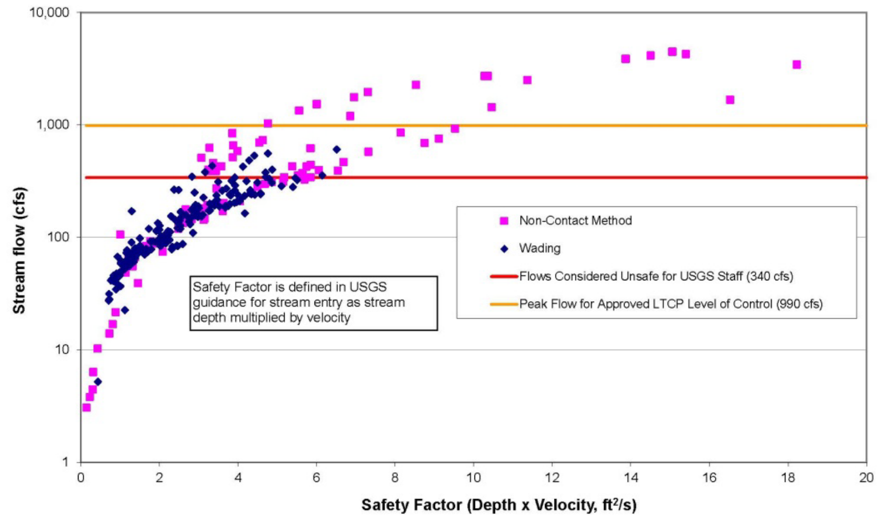

Figure 9-2a: Fall Creek USGS Stream Measurement Methods at Varying Streamflows

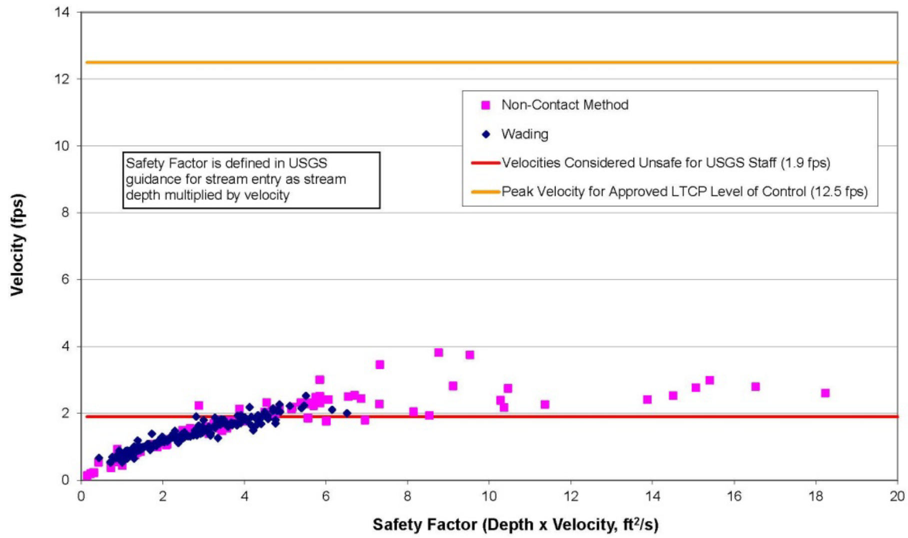

Figure 9-2b: Fall Creek USGS Stream Measurement Methods at Varying Velocities

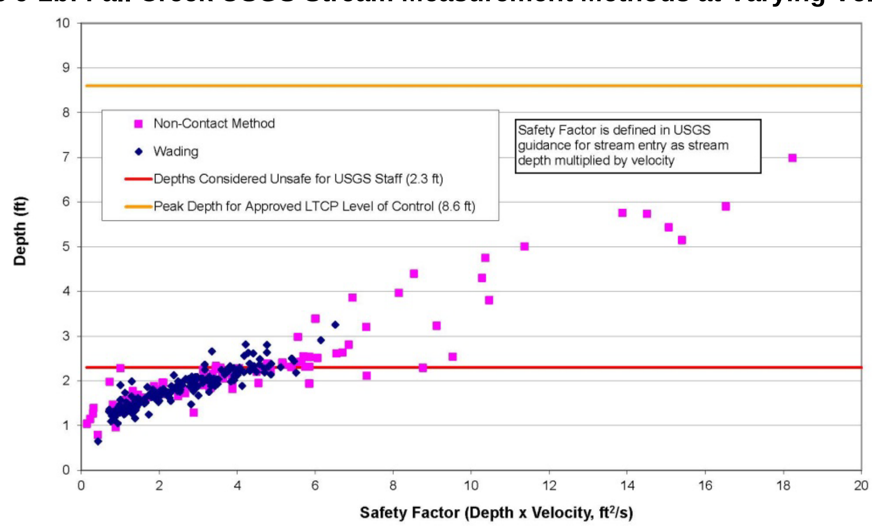

Figure 9-2c: Fall Creek USGS Stream Measurement Methods at Varying Depths

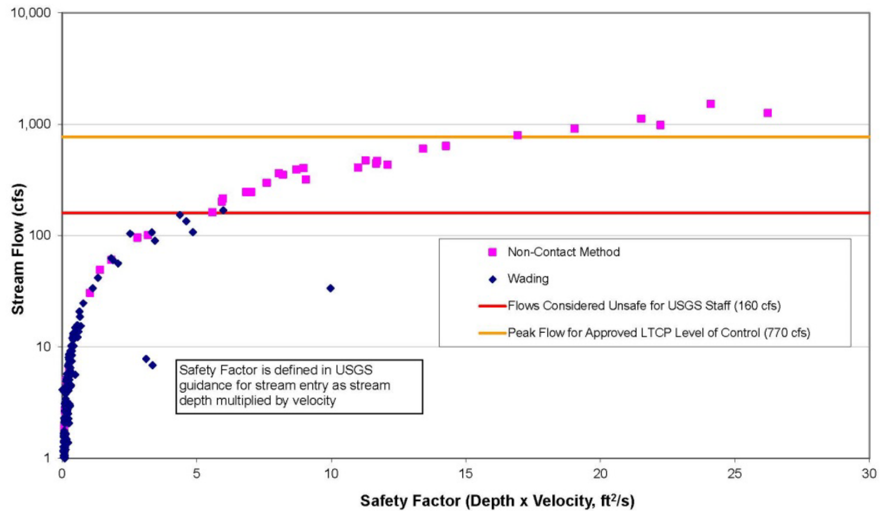

Figure 9-3a: Pleasant Run USGS Stream Measurement Methods at Varying Streamflows

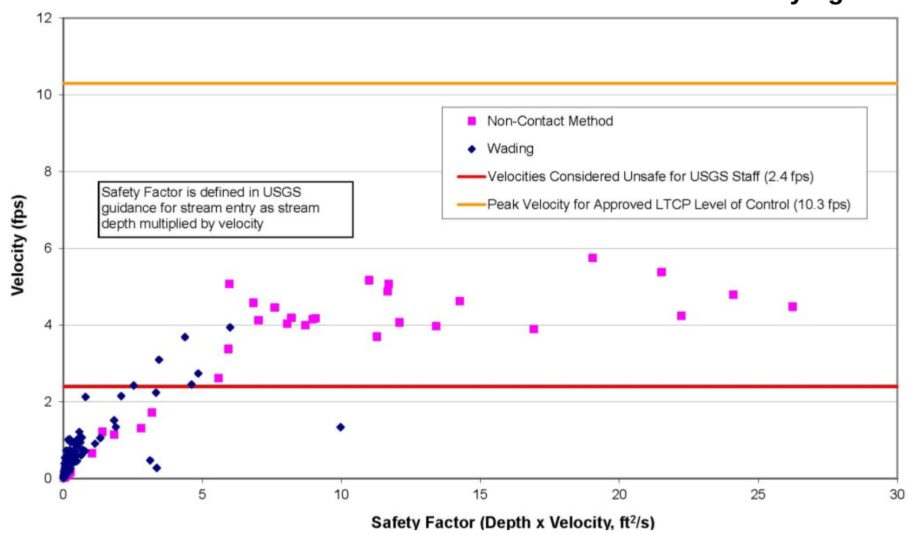

Figure 9-3b: Pleasant Run USGS Stream Measurement Methods at Varying Velocities

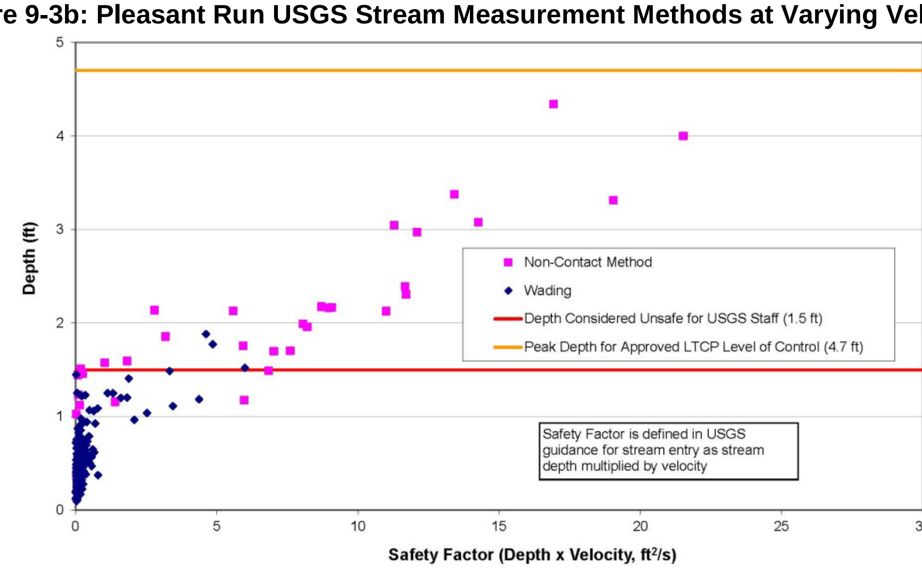

Figure 9-3c: Pleasant Run USGS Stream Measurement Methods at Varying Depths

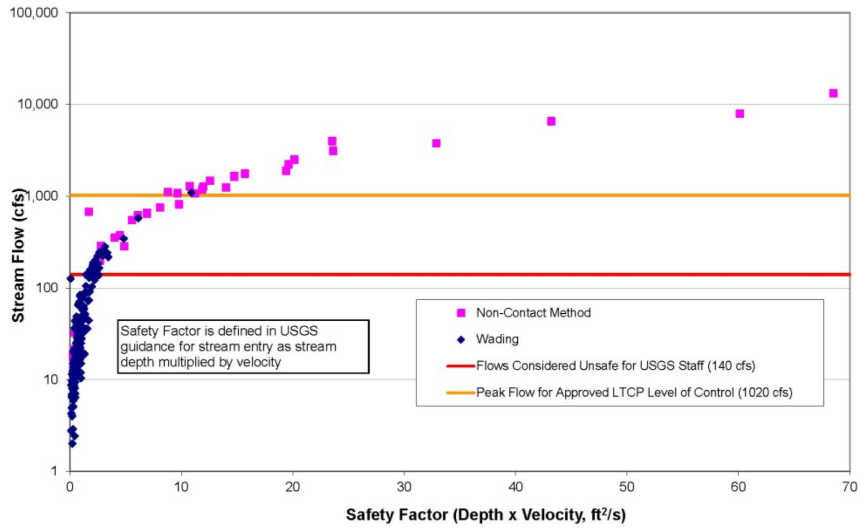

Figure 9-4a: Eagle Creek USGS Stream Measurement Methods at Varying Streamflows

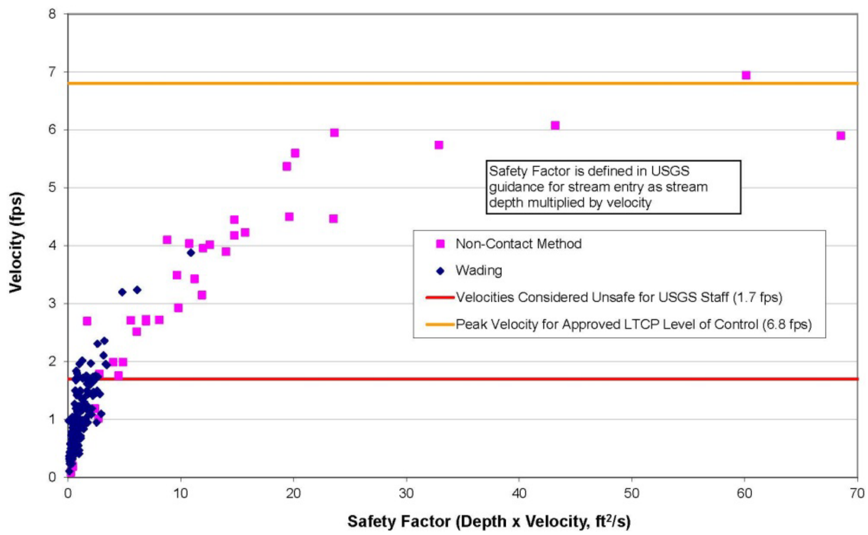

Figure 9-4b: Eagle Creek USGS Stream Measurement Methods at Varying Velocities

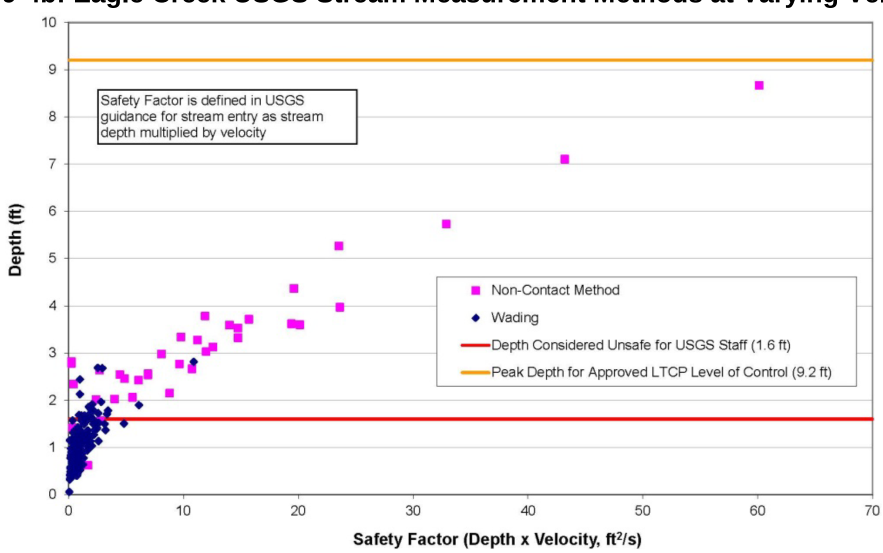

Figure 9-4c: Eagle Creek USGS Stream Measurement Methods at Varying Depths

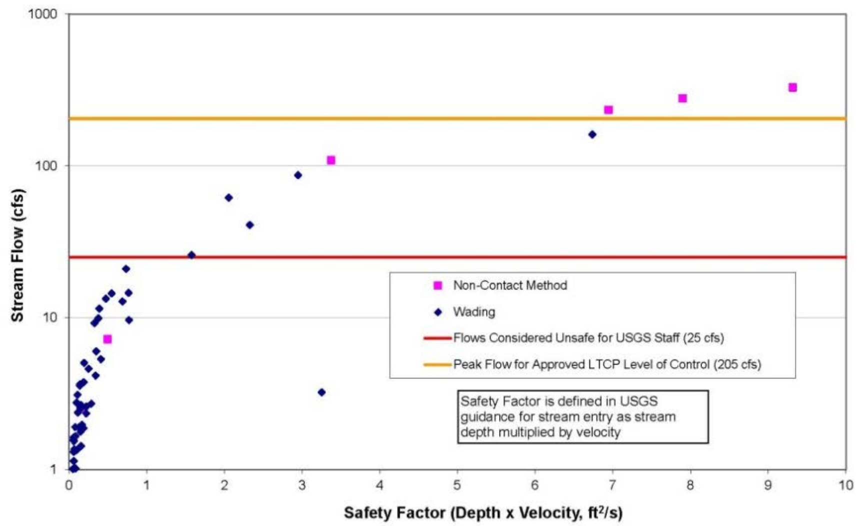

Figure 9-5a: Pogues Run USGS Stream Measurement Methods at Varying Streamflows

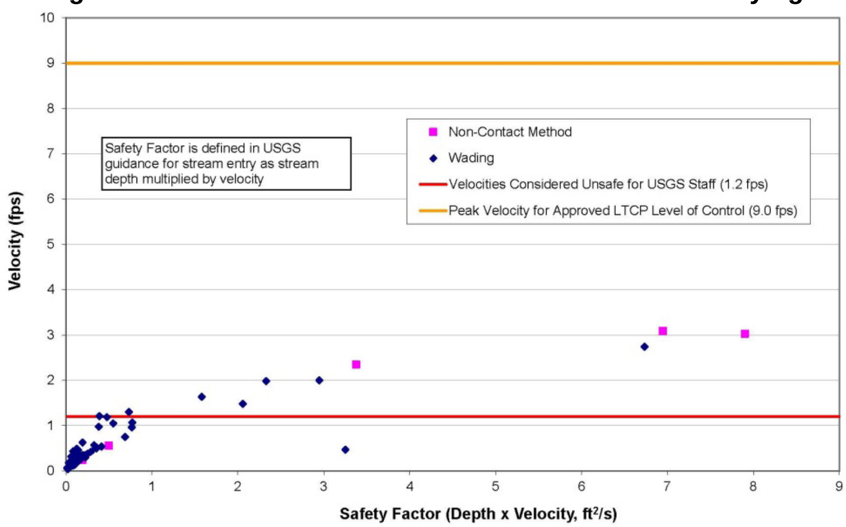

Figure 9-5b: Pogues Run USGS Stream Measurement Methods at Varying Velocities

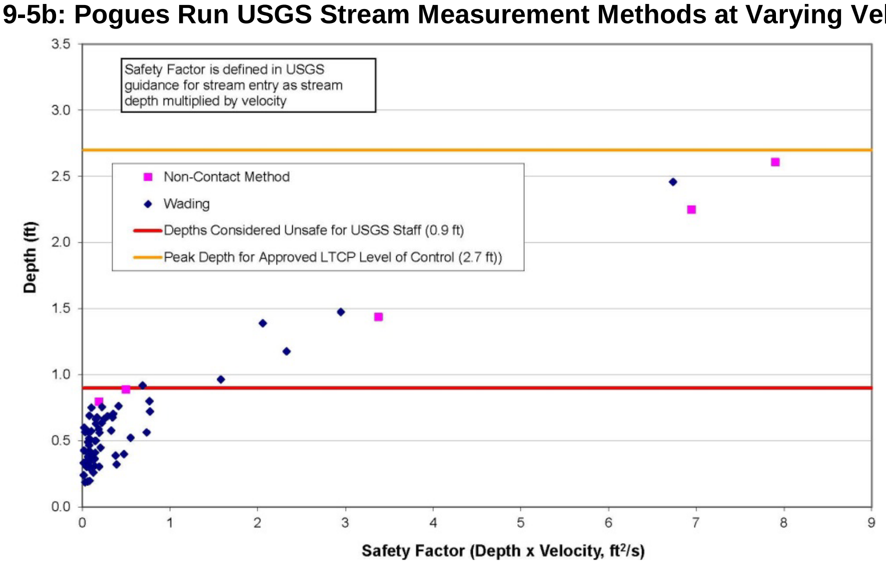

Figure 9-5c: Pogues Run USGS Stream Measurement Methods at Varying Depths

9.4.2 Human-Caused Conditions

In urban waters, there are human-caused conditions and sources of pollution that prevent full attainment of the recreational use during and after wet weather events. Factor 3 under 40 CFR 131.10(g) allows consideration of "human-caused conditions or sources of pollution [that] prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place." This analysis finds that the recreational use cannot be attained during storm events greater than that associated with the Authority's level of control due to the effects of urbanization that cannot be corrected without causing more environmental damage.

These effects include:

1. Increased *E. coli* bacteria pollution
2. Unsafe stream flows after large storms

9.4.2.1 Increased Pollution Caused by Urbanization

Urbanized conditions quickly convey pollutants from the land surface to water courses and through the constructed storm conveyance facilities, thereby delivering substantial bacteria concentrations to urban waters. Bacteria, such as *E. coli*, are used as indicators of waterborne pathogens in water bodies used for recreation.

According to U.S. EPA's 2005 publication, *National Management Measures to Control Nonpoint Source Pollution from Urban Areas*, urban stormwater carries typical concentrations of *E. coli* bacteria at levels of 1,450 most probable number (MPN) per 100 mL. (U.S. EPA, 2005). Work by the City and the Authority to support the CSO LTCP and TMDLs for White River, Pleasant Run, and Fall Creek indicate stormwater discharges in Indianapolis typically have *E. coli* counts of 2,000 to 3,000 cfu/100 ml[10] or higher outside of the CSO area. U.S. EPA notes that, "The bacteria standard is one of the most commonly violated water quality standards in terms of both the number of water bodies and stream miles impaired." The report goes on to state that three major sources of pathogens in urban waters are human waste, pet waste and anthropogenic wildlife, such as raccoons, geese, pigeons, seagulls and rats. (U.S. EPA, 2005)

Bacterial source tracking analysis has been used in some urbanized watersheds to determine the sources of bacterial contamination. TMDLs prepared by Indianapolis for the White River, Fall Creek, and Pleasant Run/Bean Creek concluded that the following non-CSO sources contribute to bacteria contamination:

- Stormwater
- Failing septic systems
- Illicit sanitary connections to storm sewers
- Urbanization
- Domestic animals and wildlife
- Belmont and Southport AWT plant discharges
- Pollutant sources upstream and downstream of Marion County

An example of bacterial source tracking completed in a similar urbanized watershed to Indianapolis, the Four Mile Run watershed in Northern Virginia, concluded that waterfowl contribute 38 percent of bacteria, humans and pets (combined) contribute 26 percent, and raccoons contributed 15 percent. Deer (9 percent) and rats (11 percent) also contributed to bacteria contamination in the watershed, an urbanized area with approximately 40 percent impervious surface. (U.S. EPA, 2002). This example is provided to show the results of non-CSO bacterial source tracking in an urbanized watershed similar to Indianapolis.

The relative loads contributed by each of these sources in Pleasant Run, Fall Creek, and White River are shown in **Table 9-2**. The information in this table was developed during the TMDL analysis for each of these streams. They also show the required reduction in *E. coli* load needed to achieve the TMDL for each stream reach studied. Within and downstream of the CSO area, total bacteria load reductions of 99 percent or greater are required in each of these streams. This level of bacteria control is infeasible, particularly with regard to controlling urban stormwater, as described further below.

[10] MPN (most probable number) and cfu (colony forming units) represent two different laboratory methods for measuring *E. coli* in a water sample. The numbers produced are comparable to each other.

Table 9-2: Pollutant Load Summary and TMDL: April to October Recreation Season

Segment	Point Source - AWT Discharges (cfu)	Point Source - CSO Discharges (cfu)	Point Source - Permitted Stormwater Discharges (cfu)	Point Source - Unpermitted Sanitary Connections (cfu)	**Total Point Source Load (cfu)**	Nonpoint Source - Unpermitted Stormwater Discharges (cfu)	Nonpoint Source - Wildlife (cfu)	Nonpoint Source - Failing Septic Systems (cfu)	**Total Nonpoint Source Load (cfu)**	Upstream Out-of-County Sources (cfu)	**Total Load (cfu)**	TMDL (cfu)	**Required Load Reductions to meet TMDL (%)**
Fall Creek	0	1.50E+14	1.19E+12	1.74E+08	**1.51E+14**	8.97E+11	7.67E+10	4.66E+10	**1.02E+12**	0	**1.52E+14**	7.30E+11	**99.5%**
Pleasant Run	0	5.20E+13	3.34E+11	1.14E+08	**5.23E+13**	0	1.96E+09	9.57E+09	**1.15E+10**	0	**5.23E+13**	4.61E+10	**99.90%**
White River	2.64E+11	5.56E+14	9.40E+12	2.99E+08	**5.65E+14**	1.90E+12	7.56E+11	1.81E+11	**2.84E+12**	1.01E+12	**5.69E+14**	4.87E+12	**99.10%**

Source: Table E.1 of the Fall Creek TMDL Study (IDEM, 2003), Pleasant Run and Bean Creek TMDL Study (IDEM, 2003), and White River TMDL Study (IDEM, 2003).

9.4.2.2 Inability to Remedy Human-Caused *E. coli* Conditions

Treatment options for bacteria in urban stormwater have significant limitations that prevent or create obstacles to their widespread implementation in a fully developed urban community such as Indianapolis, particularly for the large storms that this UAA covers. One possible management method involves building constructed wetlands to capture and treat stormwater runoff prior to discharge to the stream. Such wetlands typically require water to remain for hours or days of treatment (U.S. EPA, 2005). This becomes very difficult to achieve with the amount of stormwater runoff generated by the modeled typical year storm associated with the Authority's required level of control or by larger storms in Indianapolis watersheds. There is not enough available undeveloped land to construct wetlands large enough to capture and treat the typical year or larger storms. More importantly, such wetlands would be unable to achieve the reduction required to meet current standards.

Another possible method for reducing bacteria in stormwater runoff is employing disinfection, typically through the use of ozone or ultraviolet light. According to EPA, the city of Encinitas, California, employed ultraviolet disinfection to treat 85 percent of dry-weather flows in Cottonwood Creek, a significant source of bacterial pollution to an important seaside beach. However, the system does not operate during wet weather due to high flow and high turbidity, which render the UV disinfection ineffective. (U.S. EPA, 2005; Rasmus, 2006) Employing ozone or ultraviolet disinfection during the modeled typical year or larger storms in Indianapolis also would be ineffective due to high flows and high turbidity in both the streams and stormwater outfalls. Facilities using chlorination/dechlorination would be equally problematic due to the retention times required and the lack of available space to build holding tanks. Chlorination also requires remote chemical storage and handling, which presents security concerns in urban neighborhoods. Furthermore, treating bacteria to meet standards still would not allow full attainment of the use, due to high stream flows and velocities that prevent safe recreation. This is demonstrated in Sections 9.4.1, 9.4.2.3, 9.4.2.4 and 9.4.3.

The intractable problem of urban stormwater runoff is reflected in experiences around the country. A review of success stories in managing non-point source pollution published on U.S. EPA's Section 319 website (www.epa.gov/nps) does not include communities that have had success in reducing bacteria in urban stormwater to a point that would meet Indiana's recreational standard of 235 cfu/100 mL. Eight case studies were previously presented that involve reducing non-point source bacteria contamination, including: Edgewood Park Pond in Connecticut, Cane Creek in Tennessee, Afuelo Stream in American Samoa, Middle Fork Holston River in Virginia, Muddy Creek and Lower Dry River in Virginia, Dungeness River Tributary in Washington, Noonsack River in Washington, and North Fork Potomac River in West Virginia.

Seven of those case studies described success in reducing bacteria from agricultural runoff or septic systems, and urban stormwater runoff was not an issue in any of those watersheds. Also, the criteria achieved in three of those studies (Cane Creek, Middle Fork Holston River, and Muddy Creek/Lower Dry River) was 1000 cfu/100 mL – significantly higher than the Indiana standard of 235 cfu/100 mL. The City found no success stories on the U.S. EPA Section 319 website related to controlling wet-weather stormwater runoff to meet bacteria standards in urban streams (U.S. EPA, 2005-2007).

The city of Columbus, Georgia, has installed a stormwater BMP in an existing drainage way to achieve flow attenuation, removal of flushed pollutants by high rate filtration and UV disinfection. However, the UV treatment facility treats only a portion of first-flush wet-weather flows. It does not fully treat peak wet weather flow conditions due to high flows. (Arnett, 2006)

The Authority knows of no community that has successfully controlled urban stormwater to meet a 235 cfu/100 mL *E. coli* bacteria standard during large wet-weather events.

Given these limitations, the City, IDEM and U.S. EPA concluded during the LTCP development that given the financial burden of the CSO LTCP program, the best environmental results would be achieved by capturing CSO, including sanitary and stormwater, through the existing combined sewer system and the proposed storage and conveyance facilities under the DigIndy Project. The City, U.S. EPA and IDEM also concluded that central treatment at the existing advanced wastewater treatment plants was superior to either sewer separation or on-site treatment along the streams. As shown in LTCP Tables 4-18 and 4-19, the approved LTCP achieves greater benefit than sewer separation in reducing *E. coli* bacteria impacts to affected streams. The Authority maintains ownership, management and operation of the wastewater assets, while the City of Indianapolis maintains ownership of the stormwater assets.

The City of Indianapolis manages an NPDES MS4 stormwater program. Although MS4 activities are expected to reduce *E. coli* loading from stormwater to the affected streams, controlling *E. coli* bacteria from stormwater is especially difficult during large storm events for which this UAA request is being made.

With respect to urban stormwater runoff, development of the LTCP included evaluation of a level of control consistent with the limits of “Maximum Extent Practicable” (MEP). MEP controls and associated management actions would not be expected to have significant impact on stormwater *E. coli* concentrations to achieve the attainment of the recreational use during large storm events causing residual CSOs. For Indianapolis, CSO controls were selected on the assumption that MEP stormwater controls are in place in the combined area.

For more information on the City’s stormwater management activities, see LTCP Section 4.3.4 and the *NPDES Stormwater Permit Annual Report* for the City of Indianapolis Department of Public Works.

Implementation by the City of Indianapolis of the MS4 Stormwater Permit will not achieve the reduction in stormwater bacteria required to meet standards. Control of stormwater runoff quality is based on the management of total suspended solids (TSS), with a target TSS removal rate of 80 percent. The requirements apply to all areas of the county except the city limits of Beech Grove, Lawrence, Southport, and Speedway. During the TMDL development in 2003, it was assumed that the City’s MS4 stormwater NPDES Permit program reduces the stormwater *E. coli* bacteria load by approximately 10 percent. This reduction was considered to be an estimate of the program’s effectiveness, rather than an objective.

9.4.2.3 Comparison to EPA Recommended 2012 Recreational Water Quality Criteria for *E. coli*

EPA released revisions to recreational water quality criteria (RWQC) in 2012 following extensive scientific review. The 2012 RWQC retain the use of *E. coli* as the indicator organism and for “Recommendation 1” include the use of a geometric mean criterion (126 cfu/100 ml) and a statistical threshold value (STV). The STV provides that no more than 10 percent of samples taken during a thirty day period exceed the STV criterion (410 cfu/100 ml). The 2012 RWQC recommends to states that the monthly average and STV criteria be used together to determine whether the receiving water meets the designated primary contact recreational use of a particular receiving water.

To understand how the 2012 RWQC might be applied in Indiana, the Authority evaluated *E. coli* impact for CSO contributions following implementation of the LTCP, assuming that other sources of bacteria are controlled to the extent required by the Clean Water Act, including NPDES, TMDL, or other programs addressing non-CSO contributions. For each storm event in the Authority’s typical year period defined in the LTCP, **Table 9-3** shows simulated hours in exceedance of EPA’s 2012 RWQC as a result of CSO contributions alone.

Table 9-3: Simulated Exceedance of EPA 2012 RWQC Based on CSO Contribution Following LTCP Implementation

Simulated CSO Event During Typical Year Period	Simulated Duration above RWQC of 410 cfu/100 mL *E. coli* bacteria (Hours)				
	White River RM 251 to 54	Fall Creek SM 6.1 to 0	Pogues Run SM 5.3 to 0	Pleasant Run SM 7.8 to 0	Eagle Creek SM 4.2 to 0
4/19/1996	0	0	0	2	0
5/15/1996	6	4	10	2	0
5/27/1996	2	0	4	0	2
7/18/1996	30	30	22	4	6
9/16/1996	28	28	24	10	4
9/27/1996	0	0	2	0	0
6/25/1997	6	2	0	0	0
4/30/1998	2	4	0	0	0
6/14/1998	38	26	20	14	4
6/23/1998	10	4	18	4	4
8/7/1998	0	0	0	0	4
8/16/1998	4	4	0	0	0
7/1/1999	10	8	0	0	0
7/20/1999	4	0	2	6	4
5/27/2000	8	2	18	2	4
6/16/2000	2	0	0	0	0
7/4/2000	0	0	6	0	0
8/6/2000	0	0	0	0	0
8/17/2000	0	0	2	0	0
9/4/2000	0	0	0	0	2
10/5/2000	4	0	14	2	0
Maximum Duration (Hours)	**38**	**30**	**24**	**14**	**6**

Source: Citizens Water Quality Model: 1996-2000 Simulation with CSO discharges at LTCP Completion, excluding non-CSO bacteria sources. Simulated events are presented for the April-October recreation season.

Based on the contribution of CSO only, stream reaches are impacted from 6 to 38 hours, with one event causing CSO impact up to 38 hours and the majority events maintaining impacts of less than 30 hours. Consistent with the 2012 RWQC, the Authority achieves compliance with the proposed 10 percent STV. This assumes that "no more than 10 percent of samples taken during a thirty day period" can be equated to 72 hours in a thirty day period.

With non-point source contributions simulated at existing conditions, non-CSO bacteria contributions contribute to exceedance durations in line with the 96 hours stipulated under the Wet Weather Limited Use Subcategory. The effects of non-CSO bacteria are presented in more detail in section 9.6.1.

Additionally, the Authority reviewed simulated CSO loading for each year within the typical year period defined in the LTCP, shown in **Table 9-4**.

Table 9-4: Simulated *E. Coli* Load by Watershed

Year	Simulated *E. coli* Bacteria Load by Watershed (cfu)				
	White River RM 251 to 54	Fall Creek SM 6.1 to 0	Pogues Run SM 5.3 to 0	Pleasant Run SM 7.8 to 0	Eagle Creek SM 4.2 to 0
1996	2.74E+15	3.88E+15	1.96E+15	7.22E+14	2.71E+14
1997	6.76E+13	7.79E+11	0.00E+00	0.00E+00	0.00E+00
1998	2.08E+15	2.44E+15	1.01E+15	5.15E+14	1.26E+14
1999	8.56E+13	6.53E+13	2.78E+12	1.53E+13	1.62E+13
2000	6.14E+13	9.99E+13	9.07E+13	1.64E+13	2.35E+13
Average	1.01E+15	1.30E+15	6.13E+14	2.54E+14	8.73E+13
TMDL	4.87E+12	7.30E+11	N/A	4.61E+10	N/A

Source: Citizens Water Quality Model: 1996-2000 Simulation with CSO discharges at LTCP Completion, excluding non-CSO bacteria sources. Simulated loads are presented for the April-October recreation season.

Source: Total Maximum Daily Load (TMDL) Reports (IDEM, 2004)

9.4.2.4 Unsafe Stream Flows Exacerbated by Urbanization

Typical impacts of increased impervious surface from urban development include both decreased stream base flow and higher peak flows during wet weather. LTCP Section 2 (Baseline Conditions) describes the typical flow regimes found in Indianapolis streams, which display high flows during wet weather and particularly after the large storm events that will cause CSO discharges after implementation of the approved LTCP. **Table 9-1** (see Section 9.4.1) demonstrated that urbanized conditions have increased the estimated natural peak flows on almost all watersheds. Man-made dams on Eagle Creek, Fall Creek, and White River have attenuated the natural peak flows, but peak stream flow rates and velocities remain unsafe for public recreation.

As noted in LTCP Section 2, approximately 85 percent of the 30 river-mile reach of the West Fork White River that flows through Marion County is urbanized. The remaining 15 percent of the river is located downstream of the Belmont Advanced Wastewater Treatment Plant (AWTP) and is bordered by a series of gravel mines, farm fields, parkland, or residential development.

During and after wet weather events, high flow rates and flow velocities in urban streams can render the streams unsafe for recreation. During even relatively small rainfall events, the runoff volumes generated by impervious surface in the separated sewer areas result in large flow volumes and swift currents. As of 2018, the City of Indianapolis measured almost 57,000 acres of impervious surface area which includes an increase of over 2,500 acres from 2005 to 2018.

In addition to the impacts of impervious surface on streamflow during wet weather, natural flows within the watershed and the receiving streams have been altered. Three surface water reservoirs, including one for flood control and two to provide a source of supply for drinking water, represent human-caused conditions that cannot be altered.

The Authority's approved LTCP plan will capture and store more stormwater entering the combined sewer system and convey that combined wastewater to the two advanced wastewater treatment plants. However, in model simulations, results indicate that stream flows would not change significantly for modeled typical year storm associated with the Authority's required level of control even after implementation of the CSO LTCP for White River, Fall Creek, Pleasant Run, and Eagle Creek. Although stream flows would be reduced from current values in Pogues Run, the flows would still be too high to support safe recreation during large storm events following LTCP implementation. In addition, Pogues Run consists of a closed box culvert for much of its reach, from New York Street east of downtown Indianapolis to the confluence with the White River. The information to support this fact is outlined in **Tables 9-5** and **9-6**, which show the combined sewer versus separated sewer areas by watershed (Table 9-3) and the streamflow rates for the modeled typical year storm event associated with the Authority's required level of control.

The flow information contained in **Table 9-6** shows that CSO flow volumes make up only fractions of the total instream flows in all watersheds. Even with CSO volumes removed from the total flow due to the high capture rates of the LTCP, instream flow volumes will still be much too high for safe recreation.

This information can also be quantified by examining the modeled maximum stream flows for the modeled typical year storm for the White River and each of the major tributaries. This analysis indicates that CSO flow reduction has little impact on the instream peak flows, due primarily to peak instream flow rates caused mainly by runoff from the separate sewer areas. This analysis is presented in **Figures 9-6** through **9-10**, along with typical summertime dry-weather stream flows.

For the White River downstream of Marion County, even with the reduction in flow due to CSO capture, the instream flows would remain high, and thus unsafe for recreational uses following the large storm events that can cause residual CSO discharges. This is illustrated in **Figure 9-11**.

Table 9-7 shows the modeled peak flows instream and modeled peak stream velocities and depths during the typical year storm associated with the Authority's required level of control, following LTCP implementation. The peak velocity and depths represent the velocity and depths within the stream cross section that will be likely encountered by persons attempting to recreate. This provides further support for the unsafe nature of the White River and Indianapolis waterways during large storms that will cause overflows after LTCP implementation.

The Indianapolis combined sewer system covers an area greater than 21,000 acres. Therefore, it is possible for rainfall to vary spatially across the watershed as any storm system moves through the area. During this "localized storm" circumstance, intense rainfall may occur for a short duration in a small area in the upper reaches of a tributary watershed, thus activating a localized CSO event but having little impact on instream flows in the White River. Although flows may not reach unsafe levels on the White River, the recreational use still cannot be attained due to the bacterial impacts from non-CSO sources. Therefore, the primary contact recreational use is still prohibited and unattainable, despite the imposition of stormwater MEPs mentioned earlier.

Table 9-5: Summary of Combined and Separate Watershed Acreage

Watershed	Combined Acreage	Separate Acreage	Total Acreage	Percent Combined
Fall Creek	8,817	184,458	193,275	5%
Pleasant Run	3,640	11,525	15,165	24%
Pogues Run	3,978	4,178	8,156	49%
Eagle Creek	842	134,389	135,231	1%
White River	4,350	870,971	875,321	0.5%
White River (with CSO Tributaries)	21,627	1,205,521	1,227,148	2%

Source: CWA Authority GIS CSO Basin and Watershed Coverage.

Table 9-6: Comparison of Modeled CSO Volume and Modeled Instream Flow Volume

Watershed	Modeled CSO Volume (MG)[1]	Modeled Instream Flow Volume (MG)[2]	CSO Percentage of Instream Flow Volume %
Fall Creek	75	453	17%
Pleasant Run	25	133	19%
Pogues Run (Upstream of Box)	2	41	5%
Eagle Creek	2	264	1%
White River (including Tributaries)	188	7230	3%

[1]Source: CSO volumes and instream flows are from model simulations presented in *Water Quality Model Update Phase 1 Flow Calibration* (Citizens, 2013), based on the storm most closely associated with the Authority's modeled typical year level of control.

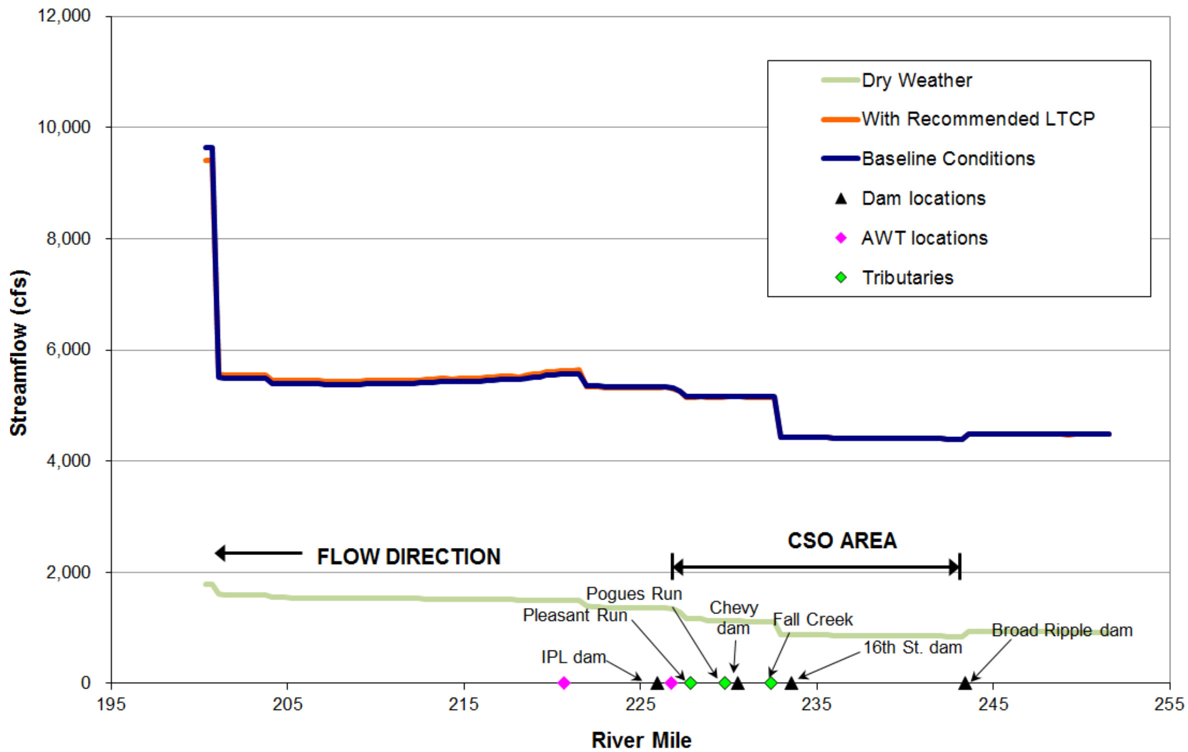

Figure 9-6: Modeled Maximum Streamflow Conditions: White River Upstream of Centerton

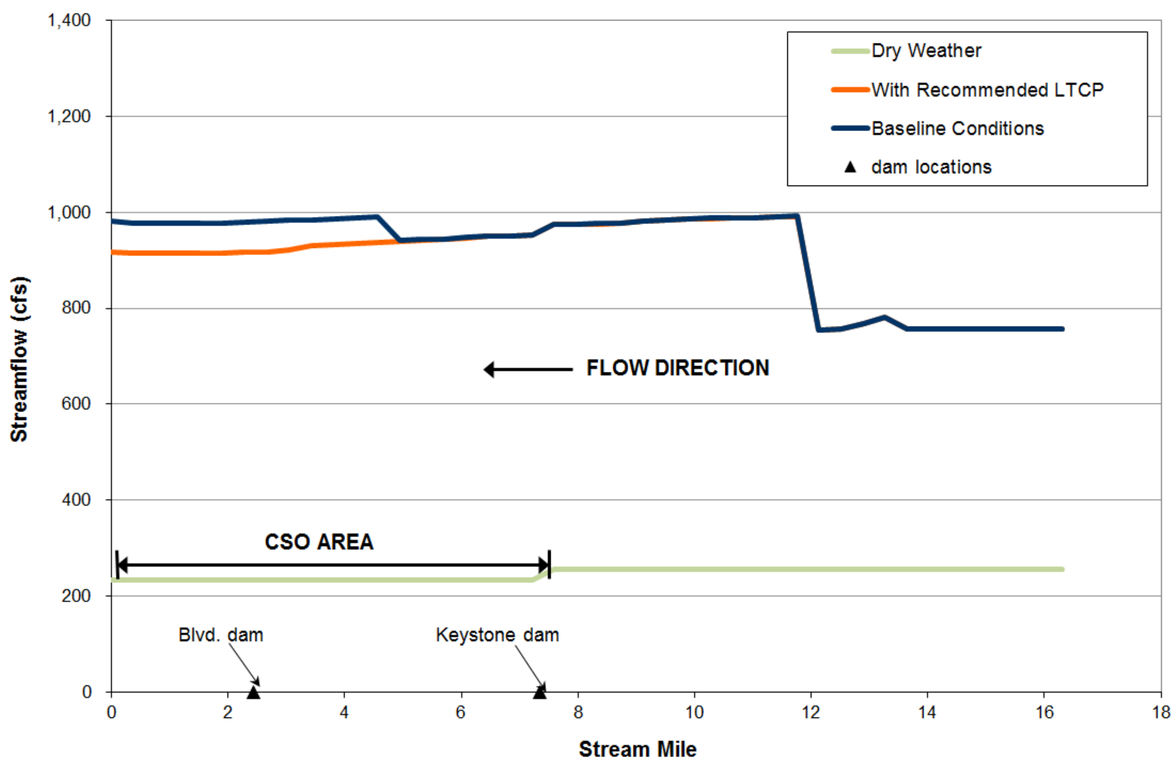

Figure 9-7: Modeled Maximum Streamflow Conditions: Fall Creek

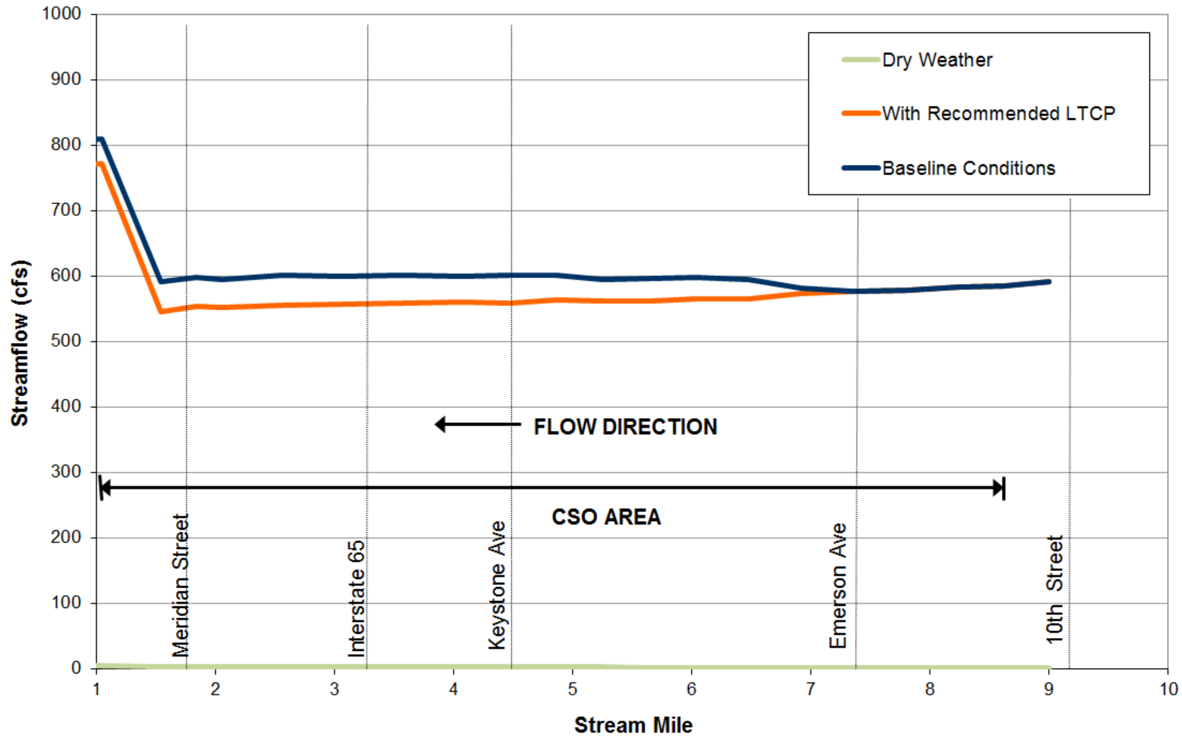

Figure 9-8: Modeled Maximum Streamflow Conditions: Pleasant Run

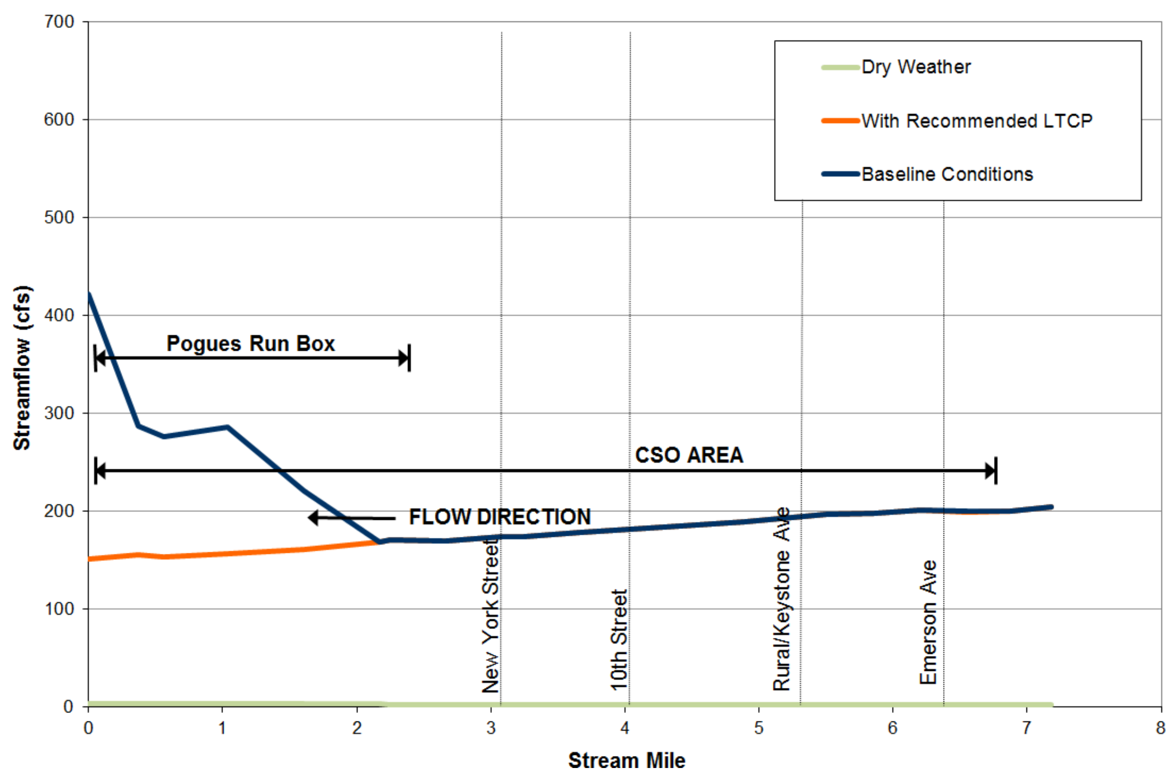

Figure 9-9: Modeled Maximum Streamflow Conditions: Pogues Run

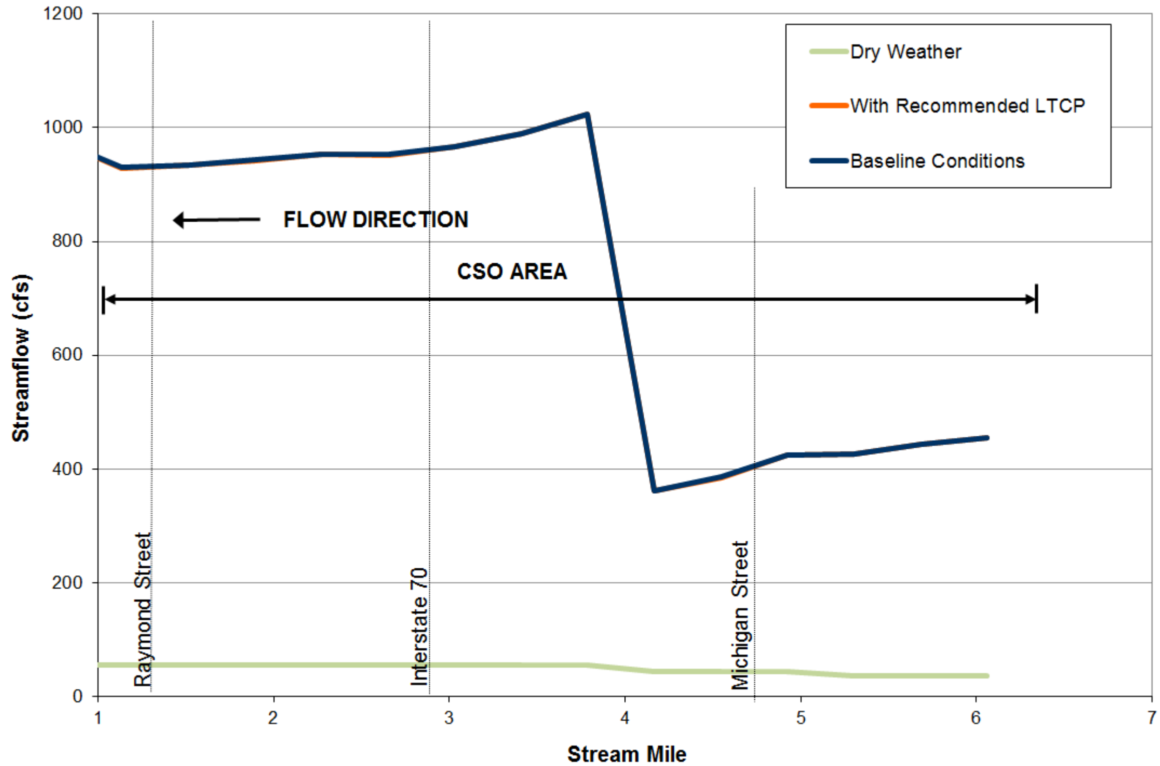

Figure 9-10: Modeled Maximum Streamflow Conditions: Eagle Creek

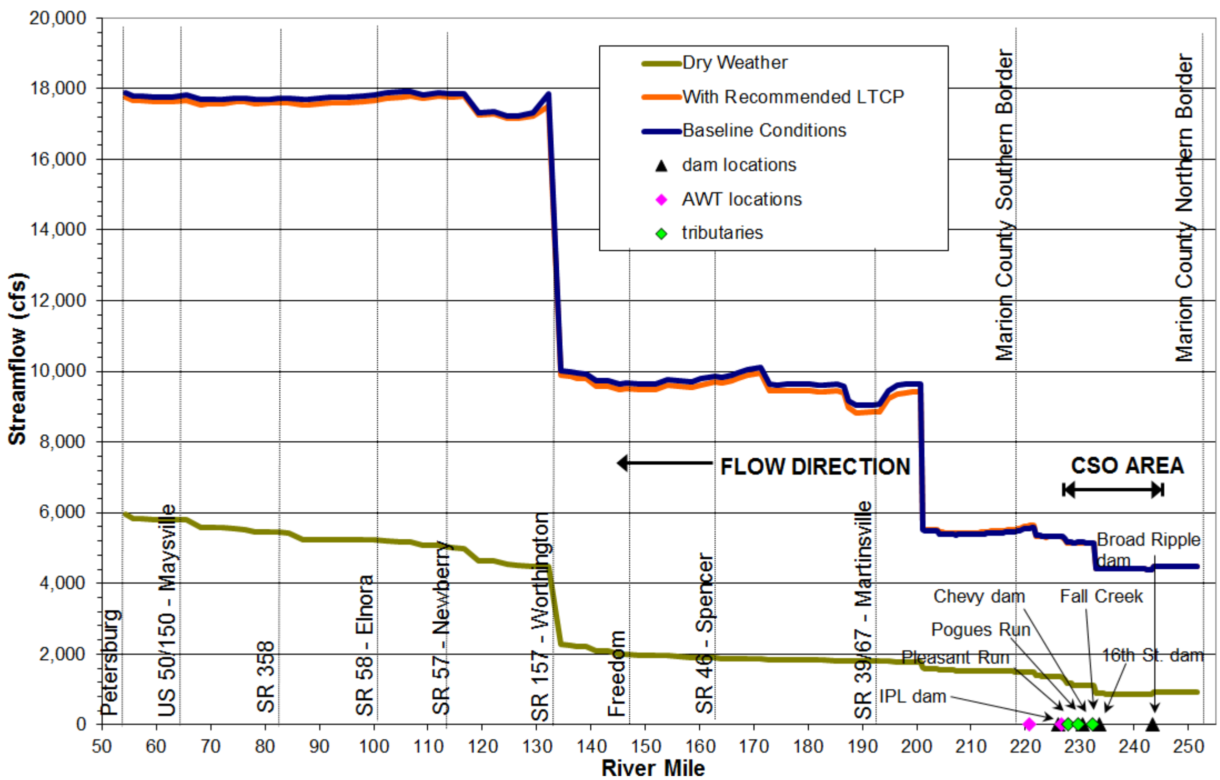

Figure 9-11: Modeled Maximum Streamflow in the White River – Indianapolis to Petersburg

Table 9-7: Modeled Instream Peak Flow, Velocity, and Depth for a Typical Year Storm

Watershed	Flows Considered Unsafe for Wading by USGS Staff (cfs)[1]	Peak (Modeled) Stream Flows after LTCP Implementation (cfs)[2]	Velocities Considered Unsafe for Wading by USGS Staff (fps)[1]	Peak (Modeled) Stream Velocities after LTCP Implementation (fps)[3]	Depths Considered Unsafe for Wading by USGS Staff (ft)[1]	Peak (Modeled) Stream Depths after LTCP Implementation (ft)
Fall Creek	>340	990	>1.9	12.5	>2.3	8.6
Pleasant Run	>160	770	>2.4	10.3	>1.5	4.7
Pogues Run	>25	205	>1.2	9.0	>0.9	2.7
Eagle Creek	>140	1,020	>1.7	6.8	>1.6	9.2
White River[4]	>540	4,490	>1.0	9.3	>2.5	12.8
White River (with CSO Tributaries)	>540	5,600	>1.0	10.5	>2.5	15.3

[1] Flows, velocities, and depths considered unsafe for wading by USGS staff were derived from field measurement data reported by USGS through May 2018 for each watershed's gauging station.

[2] The urbanized instream peak flow, velocity, and depth presented in this column does not include CSO flow. The peak flows are based on the return storm frequency most closely associated with the Authority's modeled typical year level of control.

[3] The peak velocity represents the velocity within the stream cross section that will be likely encountered by persons attempting to recreate. The velocity is calculated as the average velocity over the cross section multiplied by 2.0 based on natural irregular channel velocity profiles presented in Open-Channel Hydraulics (V.T. Chow, 1959). Lower velocities may be found in impoundment areas.

[4] Modeled instream flow, velocity, and depth for the White River without tributaries is reported from upstream of the confluence with Fall Creek.

9.4.2.5 Inability to Remedy Human-Caused High Flow Conditions

The human-caused condition factor also requires the Authority to consider whether those conditions can somehow be remedied without causing more environmental damage than leaving the conditions in place. Because urbanization cannot be reversed, the only feasible remedies to this human-caused condition are management practices to mitigate the effects of urbanization. The City previously analyzed the existing flow conditions within CSO receiving streams to determine whether the recreational use was an existing use. This analysis is documented in *Information to Support an Existing Use Determination*, described earlier in Section 9.3. The City documented that peak stream flows do not support safe primary contact recreational activities.

The City also analyzed the reduction in peak stream flows that might be achieved from the CSO LTCP plan, as shown in Figures 9-6 through 9-11. Observed flow and instream model results provide ample support that full CSO capture consistent with the Authority's modeled typical year level of control or during a larger storm would not reduce streamflow sufficiently to allow recreation because CSO volume is small compared with the overall stream volume during such events. Fall Creek, Eagle Creek, Pleasant Run, and the White River will have similar peak flow conditions. Although Upper Pogues Run will see reductions in flow, the reductions in peak flow are not enough to attain safe primary contact recreational use. Lower Pogues Run is contained in a box culvert under downtown Indianapolis. Access is restricted, and primary contact recreational use is prohibited.

As required by 40 CFR 131.10(g)(3), during LTCP development the City also considered the feasibility of using stormwater runoff reduction practices to remedy high flows caused by urbanization in order to attain the recreational standard to the maximum extent practical. Some of the available best management practices and methods for reducing peak stormwater flows include:

- Stormwater ponds
- Constructed wetlands
- Urban trees
- Green roofs
- Green parking lots
- Rain barrels
- Porous pavement
- Rain gardens

The City considered whether these stormwater controls, in conjunction with the approved LTCP controls, would remedy the human-caused high flow conditions enough to make the recreational use attainable. Theoretically, the use of these practices has the potential to reduce peak stormwater runoff in an urban environment. However, literature suggests that widespread participation and implementation would be required by private property owners to enable significant reductions in stormwater peak volume (Loucks, 2004), which is not practical or feasible as discussed below.

Evaluation of the potential impact of stormwater reduction practices on in-stream peak flows during the modeled typical year storm associated with the Authority's required level of control are shown in **Table 9-8**. The fourth column of the table shows peak stream flows that are expected to result after LTCP implementation, with values corresponding to those shown previously in **Figures 9-6** through **9-11**. These flows exceed the USGS safety threshold. Column five estimates peak stream flows following LTCP implementation plus implementation of stormwater best management practices, implemented to the maximum extent practicable. Even with significant participation by private property owners, these practices show little or no effect on peak stream flows, due to the size of the storm and the amount of rainfall that must be captured in a short period of time. Flows continue to exceed the USGS threshold. Based on this analysis, the implementation of stormwater retention practices would not change the peak stream flows sufficiently to attain the recreational use in the typical year and larger storms that will cause sewer overflows after LTCP implementation.

The City continues to monitor the tangible results of stormwater retention practices in other cities. Some examples of activities to encourage improved stormwater flow management are described below.

New development and significant redevelopment projects in Indianapolis are required to meet post-construction stormwater runoff control requirements addressed in

Chapter 561 (Drainage and Sediment Control) of the Code of the City of Indianapolis and Chapters 104.02 (Stormwater Quality), 600 (Erosion and Sediment Control) and 700 (Stormwater Quality) of the Indianapolis Stormwater Design and Construction Specifications Manual.

Under the City's drainage code, drainage systems for new development must be designed to ensure there will be no increase in peak discharge or runoff rates as a result of the development. (Revised Code, Sec. 461-336). Chapter 700 of the Indianapolis Stormwater Design and Construction Specification Manual specifies the design requirements for stormwater BMPs. Examples of BMPs in the manual include stormwater ponds, stormwater wetlands, bioretention areas, sand filters, water quality swales, biofilters and manufactured BMPs. Each of these BMPs must meet requirements for pollutant removal, in addition to stormwater runoff quantity control requirements described above

To encourage property owners to reduce the quantity of stormwater runoff from their properties, the City offers a stormwater utility credit of 25 percent to more than 50 percent. These quantity reduction credits are offered to nonresidential property owners that maintain stormwater control facilities to restrict stormwater released from their property. A 25 percent credit is available for property owners that restrict stormwater released from their property, but who cannot, or choose not to, provide detailed engineering information on pre-developed and post-developed runoff rates. An additional quantity reduction credit is available to applicants who can demonstrate that their stormwater control facility reduces the post-development peak rate of stormwater runoff for the 100-year design storm below the predevelopment peak runoff rate for the 100-year design storm.

Table 9-8: Analysis of Stormwater Reduction Practices and Ability to Reach Safe Wading Threshold

Watershed	Total Acreage	Flows Considered Unsafe for Wading by USGS Staff (cfs)[1]	Peak (Modeled) Stream Flows after LTCP Implementation (cfs)[2]	Peak (Modeled) Stream Flows after LTCP Implementation plus MEP Stormwater Controls (cfs)[3]
Fall Creek	193,275	>340	990	980
Pleasant Run	15,165	>160	770	760
Pogues Run	8,156	>25	205	205
Eagle Creek	135,231	>140	1,020	1,000
White River[4]	875,321	>540	4,490	4,410
White River (with CSO Tributaries)	1,227,148	>540	5,600	5,500

[1] Flows considered unsafe for wading by USGS staff were derived from field measurement data reported by USGS through May 2018 for each watershed's gauging station.
[2] The urbanized instream peak flow presented in this column does not include CSO flow.
[3] The peak velocity represents the velocity within the stream cross section that will be likely encountered by persons attempting to recreate. The velocity is calculated as the average velocity over the cross section multiplied by 2.0 based on natural irregular channel velocity profiles presented in Open-Channel Hydraulics (V.T. Chow, 1959). Lower velocities may be found in impoundment areas.
[4] Modeled instream flow for the White River without tributaries is reported from upstream of the confluence with Fall Creek.

The Marion County Soil and Water Conservation District also encourages improved stormwater management through a booklet titled “Building with the Land” which includes many ideas for alleviating drainage problems, and by providing technical assistance with drainage problems on private property or coordinating neighborhood led drainage projects. The City continues to encourage voluntary stormwater management practices through stormwater credits, education and other methods. However, the City’s analysis during LTCP development concludes that detaining enough stormwater to attain safe flows is impractical and unachievable for the modeled typical storm associated with the Authority’s required level of control, or for larger storms.

Additionally, Chapter 16, Article 6 of the Code of the Marion County Health and Hospital Corporation, Section 16-602, restricts primary contact recreational use to those waters that attain the standards for *E. coli*.

In conclusion, the recreational use cannot be attained due to the effects of urbanization, specifically increased *E. coli* bacteria pollution and unsafe stream flows and velocities after large storms, and those effects cannot be corrected without causing more environmental damage.

9.4.3 Hydrologic Modifications

The fourth factor in 40 CFR 131.10 (g) allows consideration of “dams, diversions or other types of hydrologic modifications [that] preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use." The urbanization of Marion County and surrounding areas acts as such a hydrologic modification, disrupting the natural flow of stormwater and creating high flow conditions that prevent attainment of the recreational use. This effect was discussed in Section 9.4.1 (Natural or Intermittent High Flow Conditions) and 9.4.2 (Human-Caused Conditions) and also applies to this factor.

According to U.S. EPA, hydromodifications, or hydrologic modifications, are activities that disturb natural flow patterns of surface water and groundwater and have been defined as "...activities which alter the geometry and physical characteristics of streams in such a way that flow patterns change" (USEPA, 2006).

In the early 1900s, Pogues Run was directed into a concrete box culvert that runs underneath downtown Indianapolis from approximately New York Street to the discharge at the White River. A number of factors led the City to this decision, including flooding and public health risks from waterborne and mosquito-borne disease. The present day downtown Indianapolis, constructed above the footprint of this box culvert, represents a hydrologic modification that cannot be undone without significant economic impacts to the community.

There are a total of six dams within the CSO service area of Marion County. Five dams are on the White River and the one dam remains on Fall Creek. This infrastructure is critical to support the water and energy supply to the City of Indianapolis residents and businesses. The Broad Ripple dam and 16th Street dam on the White River and the Keystone dam on Fall Creek were built to supply potable water for the City of Indianapolis, and removal of the dams to restore these waterways to their original condition is not feasible due to the detrimental impact to the city's drinking water. For example, recent failure of the 16th Street dam impacted a water intake at 30th Street on White River, limiting capacity for a newly constructed intake until repairs are complete. Similarly, removal of IPL dam at the Harding Street Station and Perry K dam is infeasible due to the negative impact on the operation of Harding Street Power Plant and Perry K Steam Plant, respectively.

In a publication titled "National Management Measures to Control Nonpoint Source Pollution from Hydromodification," U.S. EPA notes that urbanization is an example of hydromodification because it changes the proportion of pervious and impervious surface within a watershed. As impervious area increases and vegetative cover is lost, the following effects are seen:

- Runoff increases
- Soil percolation decreases
- Evaporation decreases
- Transpiration decreases (USEPA, 2006)

Increased runoff volumes can result in hydraulic changes in downstream areas including bank scouring, channel modifications, and flow alterations (Anderson, 1992; Schueler, 1987).

As shown in **Table 9-1** and in Section 2 of the LTCP, urbanization has led to increased peak stream flows in most Indianapolis waterways when compared to estimated natural conditions before development. For example, the natural peak flow in Pleasant Run for the modeled typical year storm associated with the Authority's required level of control was estimated at 300 cfs. Under urbanized conditions, peak flows are modeled at 770 cfs. Even with increased stormwater capture under the approved LTCP, peak flows are expected to remain above 750 cfs on Pleasant Run (**Figure 9-8**) – far above levels considered safe for recreation.

9.4.3.1 Feasibility of Restoring Water Body to Original Condition

As discussed in Section 9.4.2.5, a number of best management practices may be employed to reduce peak stormwater flows. However, peak flow reductions sufficient to attain the recreational use cannot be achieved, even if private property owners participate to the maximum extent practical. The City continues to encourage these practices through stormwater credits, education and other voluntary methods, and will review the tangible results of other cities' stormwater management programs. In addition, it is not feasible to remove the six dams affecting attainability of the designated recreational use, as discussed above.

9.4.4 Substantial and Widespread Economic and Social Impact

9.4.4.1 EPA Financial Capability Assessment

Section 6 of the CSO LTCP contains the Authority's financial capability assessment for the LTCP. The Authority recognizes high financial burden on ratepayers as a major factor in the implementation of the LTCP. Additional mandated controls to attain water quality standards for bacteria will result in a higher burden on Indianapolis residents, beyond the financial capability of residents.

One key indicator in the financial capability assessment is the cost per household of the selected LTCP controls as a percent of median household income, also known as the Residential Indicator. The Authority's 2017 analysis determined that the Residential Indicator for the Authority's service area was 2.02%, placing the Authority into a High Burden range. Costs included projected 2005-2025 spending for LTCP controls, septic tank elimination and other sanitary capital projects, as well as integrated planning costs for Clean Water Act required expenditures that burden ratepayers, including those pertaining to stormwater, in accordance with EPA's 2012 Integrated Planning Framework and 2014 Financial Capability Assessment Framework (EPA, 2014). Integrated planning costs include those for source water protection activities such as flood control, stream stabilization, and wellhead protection costs. This analysis placed the Authority's service area in the high burden category and Center Township further into the high burden category. **Table 9-9** illustrates residential indicators from the Authority's 2017 Financial Capability Assessment.

Table 9-9: UAA Residential Indicators

Program Costs	Residential Indicator	
	Service Area	Center Township
CSO LTCP Costs (Nov 2017 FCA update)	2.02%	3.07%

In the case of the waters impacted by Indianapolis CSOs, the attainability of the primary contact recreational use is a function of the combined effects of bacteria loadings and high stream flows and velocities. These conditions are caused by both CSOs and other sources of urban stormwater. Consequently, in evaluating the applicability of 131.10(g)(6), it is appropriate to consider both CSO control costs and the projected integrated planning costs of Indianapolis' other stormwater management and control programs, because the primary contact use cannot be attained through CSO controls alone.

This high burden upon the community is based on increasing debt service burden and higher O&M costs associated with the additional capital projects coming on line. When focusing on the population living in poverty, which is over twenty percent of all the Authority's Service Area residents, the Residential Indicator increases to 3.58%. Center Township residents, where much of the CSO area exists, have an adjusted 2017 MHI of $28,312 and the Residential Indicator for those households is 3.07%. Other elements that could potentially increase the burden further include an increase to Residential Share, greater than projected costs for O&M, new additional major capital projects, and higher than anticipated borrowing costs if additional future debt is incurred.

9.4.4.2 IDEM Use Attainability Guidance for Financial Capability

In addition to the Authority's 2017 Financial Capability Assessment, the Authority recognizes widespread economic and social impact following review of financial capability based on IDEM's CSO Long Term Control Plan and Use Attainability Analysis Guidance.

Section XIII of IDEM's December 2001 Nonrule Policy Document for CSO LTCP and UAA Guidance describes evaluation of financial capability, and Section XIV describes UAA factors for providing the basis for suspending a designated use, including Factor 6 for substantial economic impact. IDEM's financial capability analysis guidance includes an initial step to review the Wastewater Cost per Household Indicator (WW_{CPHI}). Based on values used in the Authority's 2017 LTCP update, the WW_{CPHI} is calculated in **Table 9-10** in accordance with IDEM guidance.

Table 9-10: Wastewater Cost per Household

Attribute	Value
CPH[1]	$ 767.03
WW_{CPHI} [2]	1.78%
MHI	$ 43,114

[1]Cost per household is calculated from 2017 FCA Table 6-5 summary and excludes Lines 100a, 101a, 103a, 104a for Integrated Planning costs.
[2]If the WW_{CPHI} percent falls between one and two percent, the impact is labeled "medium burden" per IDEM guidance.

In Center Township, the portion of Indianapolis with the majority of combined sewer outfalls, the 2017 MHI of $28,312 increases the WW_{CPHI} to 2.71% when following the IDEM financial capability guidance for UAAs. If the WW_{CPHI} is two percent or greater, then the socio-economic impact is considered widespread. Based on the WW_{CPHI} calculation, the residents of Center Township within Indianapolis face a widespread social and economic impact.

If the WW_{CPHI} falls between one and two percent, as is the case for Indianapolis, the impact is determined "medium" burden. For the "medium" result, additional consideration of socio-economic factors is necessary to complete the affordability assessment. For a WW_{CPHI} result greater than one percent, the Socio-Economic Indicator Matrix (SEIM) is used to demonstrate the widespread nature of the economic and social impact. The SEIM uses the indicators summarized and scored in **Table 9-11** below.

Table 9-11: Socio-Economic Indicators Matrix (SEIM) for the Authority

Factor	Value	Weak, Mid-Range, or Strong	Score
Median Household Income[1] (MHI) (Percent Above/Below National MHI)	-22.09%	Mid	2
Average Unemployment Rate[2] (Percent Above/Below Natl Average)	-0.5%	Mid	2
Overall Net Debt Per Capita[3]	$ 7,667.48	Weak	3
Bond Rating[4]	A1 (Moody's) AA Stable (S&P)	Strong	1
Property Tax Revenue Collection Rate[5]	99.20%	Strong	1
		SEIM Average	**1.8**

[1] See Table 6-11 of 2017 FCA
[2] See Table 6-10 of 2017 FCA
[3] Based on Table 6-19 of 2017 FCA and a 2017 population of 860,090
[4] See Table 6-8 of 2017 FCA
[5] See Table 6-13 of 2017 FCA

The resulting WW_{CPHI} and SEIM values are used to demonstrate substantial and widespread economic and social impact. Of the six factors listed in IDEM's guidance and 40 CFR 131.10(g) that provide the basis for suspending a designated use, IDEM notes Factor 6 as a mechanism for suspending a recreational designated use: "Controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact."

Based on IDEM's guidance, the Authority demonstrates substantial and widespread economic and social impact based on the first of three tests used by IDEM. The first test of whether substantial and widespread economic and social impact can be demonstrated is the wastewater cost test. The WW_{CPHI} cost and SEIM score are plotted on the Use Attainability Analysis Test chart to find the point where the WW_{CPHI} and the SEIM score meet. If this point is on or above the WW_{CPHI} line, then the NPDES permit holder demonstrates that a substantial and widespread economic and social impact will occur, necessitating a temporary suspension of use.

Following the wastewater cost test guidance, **Figure 9-12** shows the point at which the Authority's WW_{CPHI} and SEIM scores meet above the WW_{CPHI} line, demonstrating that substantial and widespread economic and social impact will occur and therefore a temporary suspension of use is appropriate. This evaluation utilizing IDEM's financial capability guidance clearly demonstrates a high burden, which correlates closely with the Authority's Financial Capability Analysis demonstrating a high burden. Both analyses clearly support the Authority's position to suspend the Wet Weather Limited Use.

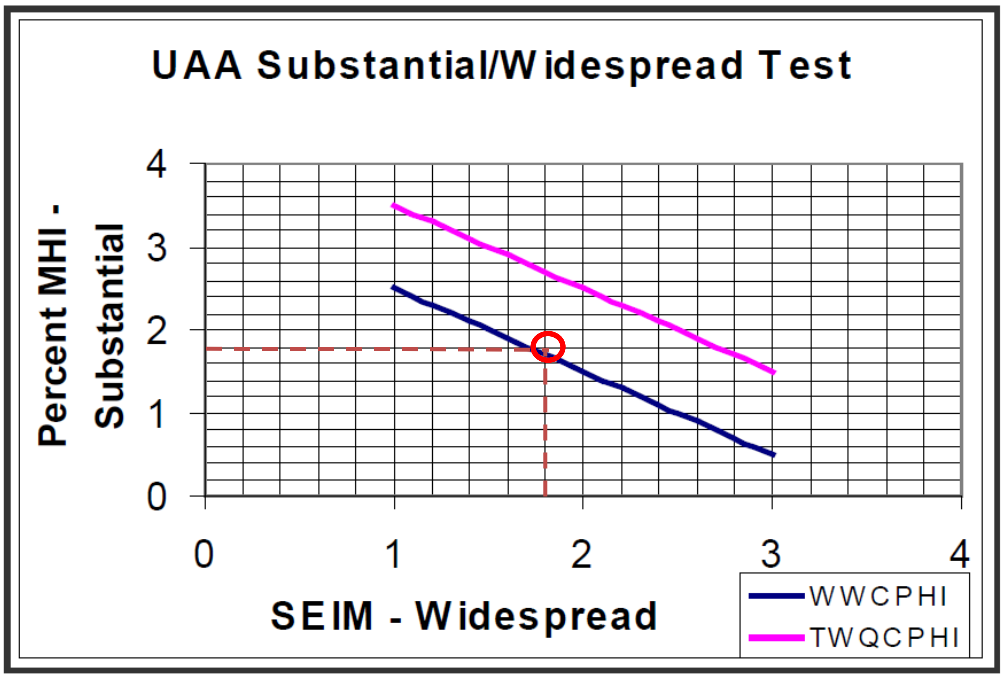

Figure 9-12: Use Attainability Analysis Test for Widespread Economic and Social Impact

9.4.4.3 Economic and Social Feasibility of Restoring Water Bodies to Original Condition

Based upon the Authority's analysis, there is no remedy that will attain the designated use of full-body contact recreation 365 days a year. The sewer separation remedy, estimated at a cost of $8.5 billion in 2017 dollars, would eliminate the CSO contribution to *E.coli* bacteria exceedances but would increase stormwater impacts on affected waterways. Full sewer separation would be economically unfeasible, causing the Authority's wastewater costs to greatly exceed EPA's residential high burden threshold of two percent of median household income. Notably, the selected LTCP will require significant sections of the Authority's ratepayers to exceed EPA's high burden threshold.

Further, the economic health of the community and its citizens contributes to the Authority's ability to generate revenue necessary to fund capital improvement projects and to support the debt service on bonded capital. Additional and excessive financial requirements of the wastewater improvement program due to additional CSO control may impact the Authority's bond ratings. A lower bond rating would increase the cost to debt-fund additional CSO controls with the CSO program. Additionally, there is no assurance that those funds would be available to the Authority, further hindering the Authority's ability to implement a higher level of control.

Also of note are the social effects within the community of CSO controls beyond those contained in the approved LTCP. Urban core areas in the Midwest and nationwide such as Indianapolis and Marion County face economic burden associated with the demographics of the city and current economic trends for core urban areas. Median household income within Center Township and portions of the area are much lower than the state and national average. Up to a three-fold increase in sewer related costs to Indianapolis residents and employers, for full sewer separation or additional CSO control, will exacerbate the current economic difficulties linked to low income and substandard housing. Since implementation of the Consent Decree, the average residential customer bill has increased by approximately 430 percent from $9.59 to $50.89 per month. Coupled with decreasing median household income, unnecessary and substantial sewer related costs will provide an unachievable burden for residents of Indianapolis and a disincentive for current employers and future employers to locate within the area.

Construction required by full sewer separation also would severely disrupt commerce and economic activity within the combined sewer area, including the vibrant downtown and the city's convention business. Total separation of the sewer system would involve major construction along hundreds of miles of urban streets and alleyways over a continual period of many years. Such activity would disrupt large and small local business, public services, emergency services, community programs, schools, and overall quality of life. Construction would require demolition of homes and businesses and the subsequence relocation of residents and businesses, acquiring significant land for easements and rights-of-way and would require an extension of the schedule for the LTCP, possibly by decades or more.

Complete separation of combined sewers would also impact cultural resources in Indianapolis. Based on current analysis, approximately 300 historical sites and more than 6,200 acres of historical land area within the combined sewer area would be impacted by complete sewer separation.

Eliminating the CSO causes of *E. coli* bacteria exceedances would result in substantial and widespread economic and social impacts and would not fully attain the recreational use, further supporting that the Wet Weather Limited Use subcategory reflects the highest attainable use for these waters during certain periods.

9.5 Public Outreach

The City of Indianapolis and IDEM worked together to develop a public outreach program on the benefits of the City's long-term plan and the need for a UAA to ensure continued progress in improving water quality. The Authority and IDEM worked to develop a public outreach update strategy to provide an LTCP progress update, highlight achievements to date, and revisit the need for a UAA to ensure ultimate compliance with water quality. Public outreach has included:

- Coordination with downstream community representatives and other interested parties, including letters of information to Morgan and Owen Counties, along with the City of Indianapolis.
- Coordination with environmental stakeholder groups
- Presentations with Citizens Advisory Groups
- Updated information available on Citizens Energy Group DigIndy Tunnel website

At the time of this submittal, the Authority has met and continues to meet with a number of downstream community representatives and interested parties. These included elected officials, Citizens Energy Group's Wastewater Technical Advisory Group and Stakeholder Alliance, environmental groups, and downstream communities from Owen and Morgan counties. Appendix A includes outreach information provided on Citizens Energy Group's website and to downstream communities.

Meetings and outreach provided information on the affected waterways, the Authority's LTCP and other water quality improvement programs, the stream reaches affected by the UAA and the basis for the UAA's conclusion that the designated use is not attainable during and after large storms. Presentations at the meetings provided background on the issues and answered questions about the Authority's CSO LTCP and the UAA. Additional information can be found in Appendix D of Indianapolis' 2006 CSO Long Term Control Plan. No opposition to the UAA was heard at meetings to date.

9.6 UAA and Wet-Weather Limited Use Subcategory for CSO-Impacted Waterways

The appropriate course for the Authority is the selected LTCP with approval of this UAA. The Wet Weather Limited Use reflects the highest attainable use of the identified streams, based on urban conditions, wet-weather stream flows, economic capability, and other factors.

The information in this Use Attainability Analysis supports approval of the UAA based upon the following factors provided in 40 CFR 131.10(g):

- Factor 2: Natural, ephemeral, intermittent, or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.
- Factor 3: Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
- Factor 4: Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the use.
- Factor 6: Controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.

Based on the approval of this UAA, the Authority is requesting application of the CSO Wet Weather Limited Use subcategory, as provided in IC 13-18-3-2.5, following CSO events that exceed the level of control specified in Section 7 of the approved LTCP.

The CSO Wet Weather Limited Use designation should last no more than four days after a storm event that triggers a discharge, as described in Section 9.6.1, and be applicable to the following waterways[11]:.

- White River, from 56th Street on the Indianapolis north side to Stream Mile 146 near Freedom;
- Fall Creek, from Keystone Avenue to the White River;
- Little Eagle Creek from Michigan Street to the confluence with Big Eagle Creek, and Big Eagle Creek from the confluence with Little Eagle Creek to the White River;
- Pogues Run, from 21st Street to the White River;
- Pleasant Run, from Kitley Avenue to the White River;
- Bean Creek, from Interstate 65 to Pleasant Run.

The Authority used its updated instream water quality model and data analysis to identify the point downstream where Indianapolis CSOs no longer affect the White River's ability to meet the *E. coli* recreational standard of 235 cfu/100 mL. During the instream model's development, the City gathered data downstream of Indianapolis to calibrate the model to downstream river conditions. Subsequently, the Authority performed model updates and conducted a model run to estimate the effects of a 1-year storm on *E. coli* concentrations after full LTCP implementation and excluding natural background and non-point sources. The model uses a 1-year design storm following a period of dry weather as a representation of the greatest downstream impact. This model simulation predicted that, after LTCP implementation, *E. coli* from Indianapolis CSOs would remain above the 235 cfu/100 mL until near Freedom. This analysis is shown in **Figure 9-13.** Model simulations for each tributary show similarly that following LTCP implementation, *E. coli* remains above the 235 cfu/100 mL until confluence with the White River. Analyses are shown in **Figures 9-14 through 9-17**.

[11] *Segments are based on the Authority's updated instream water quality model and will be confirmed with Post Construction modeling to meet the Authority's required performance criteria and level of control approved under the LTCP and Consent Decree.*

The most critical factors influencing the downstream impacts of Indianapolis CSOs are in-stream base flow conditions, antecedent rainfall conditions, size of storm and die-off rate. The model used conservative assumptions regarding in-stream base flow conditions, antecedent rainfall conditions and die-off.

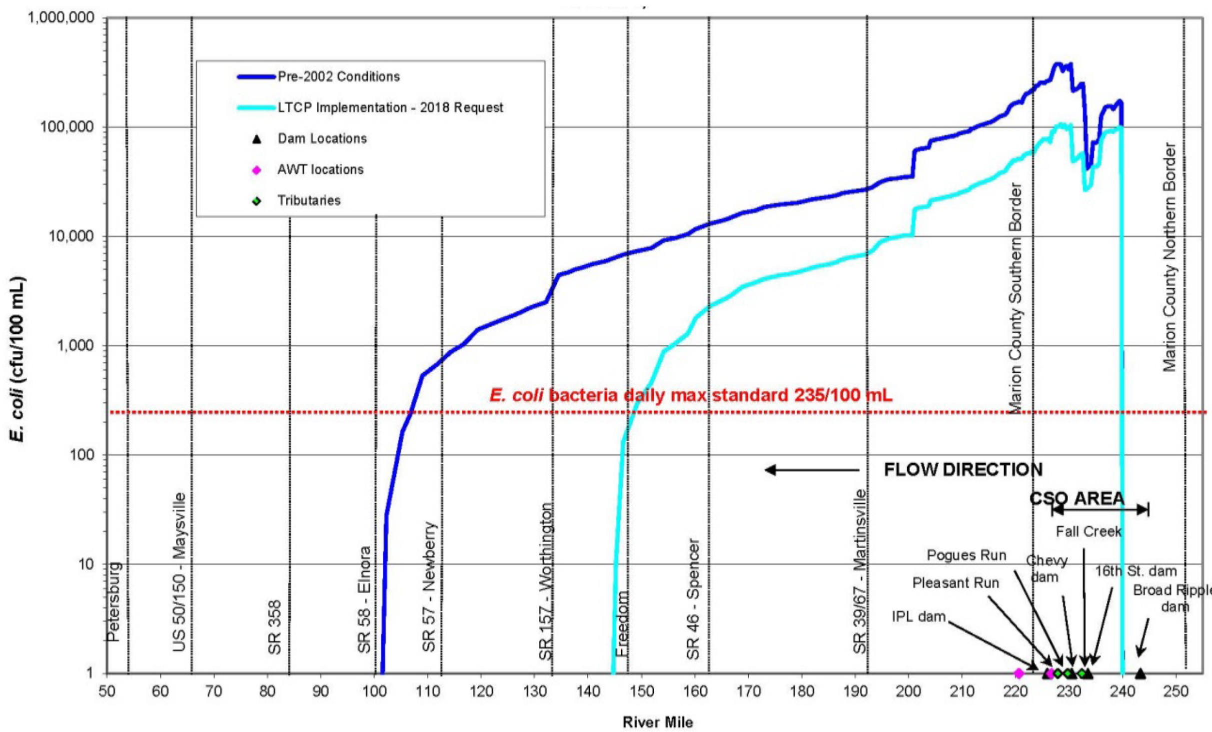

Figure 9-13
Modeled Maximum *E. Coli* Bacteria Concentrations Caused by CSOs in the White River (Excluding Background and Nonpoint Sources)[12]

[12] *Segments are based on the Authority's updated instream water quality mode and will be confirmed with Post Construction modeling to meet the Authority's required performance criteria and level of control approved under the LTCP and Consent Decree.*

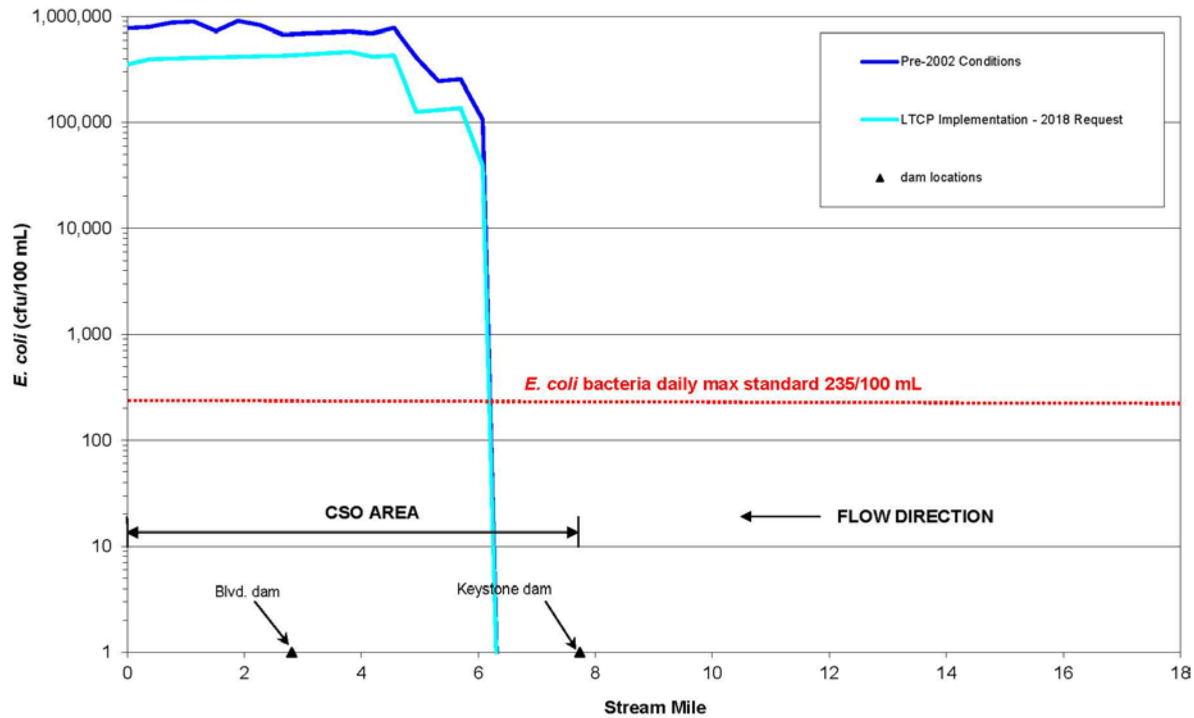

Figure 9-14
Modeled Maximum *E. Coli* Bacteria Concentrations Caused by CSOs in Fall Creek (Excluding Background and Nonpoint Sources)

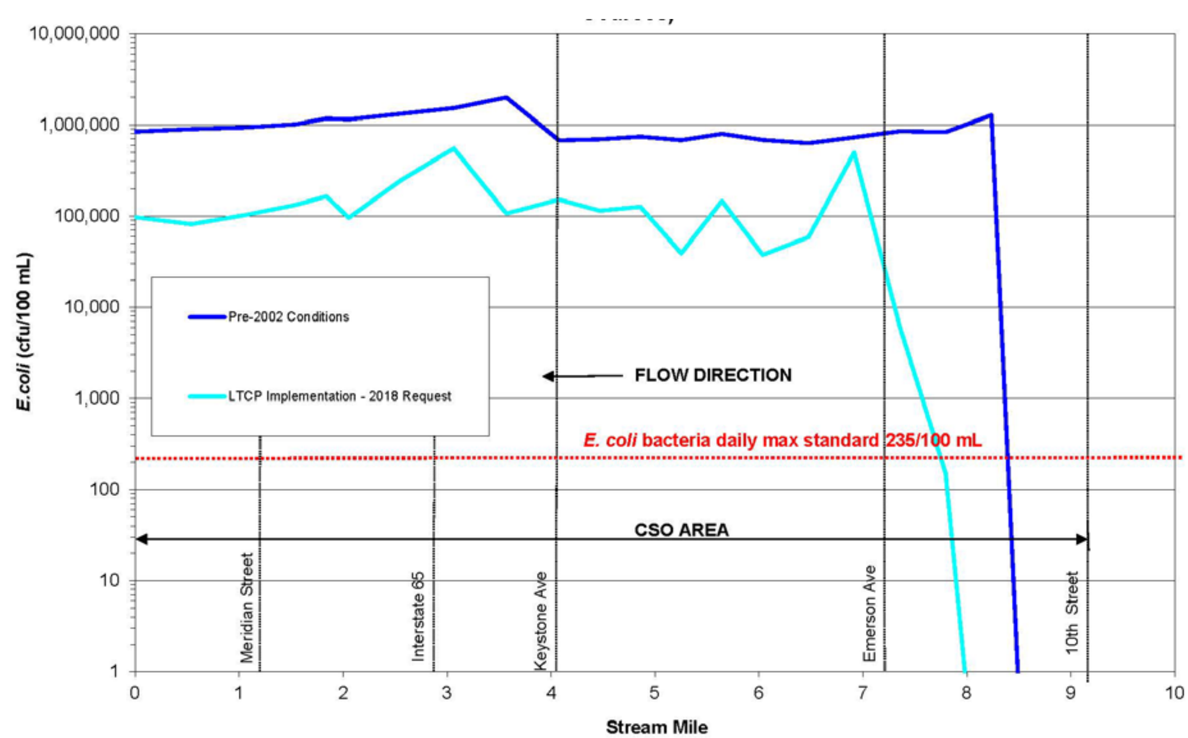

Figure 9-15
Modeled Maximum *E. Coli* Bacteria Concentrations Caused by CSOs in Pleasant Run (Excluding Background and Nonpoint Sources)

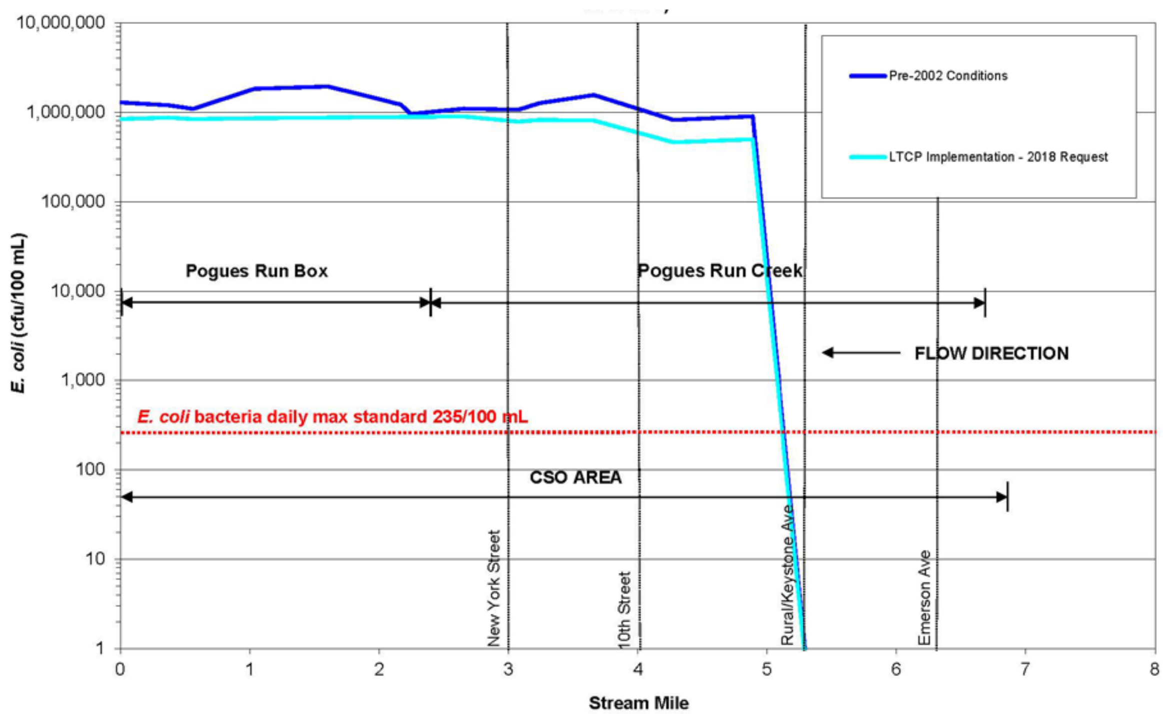

Figure 9-16
Modeled Maximum *E. Coli* Bacteria Concentrations Caused by CSOs in Pogues Run (Excluding Background and Nonpoint Sources)

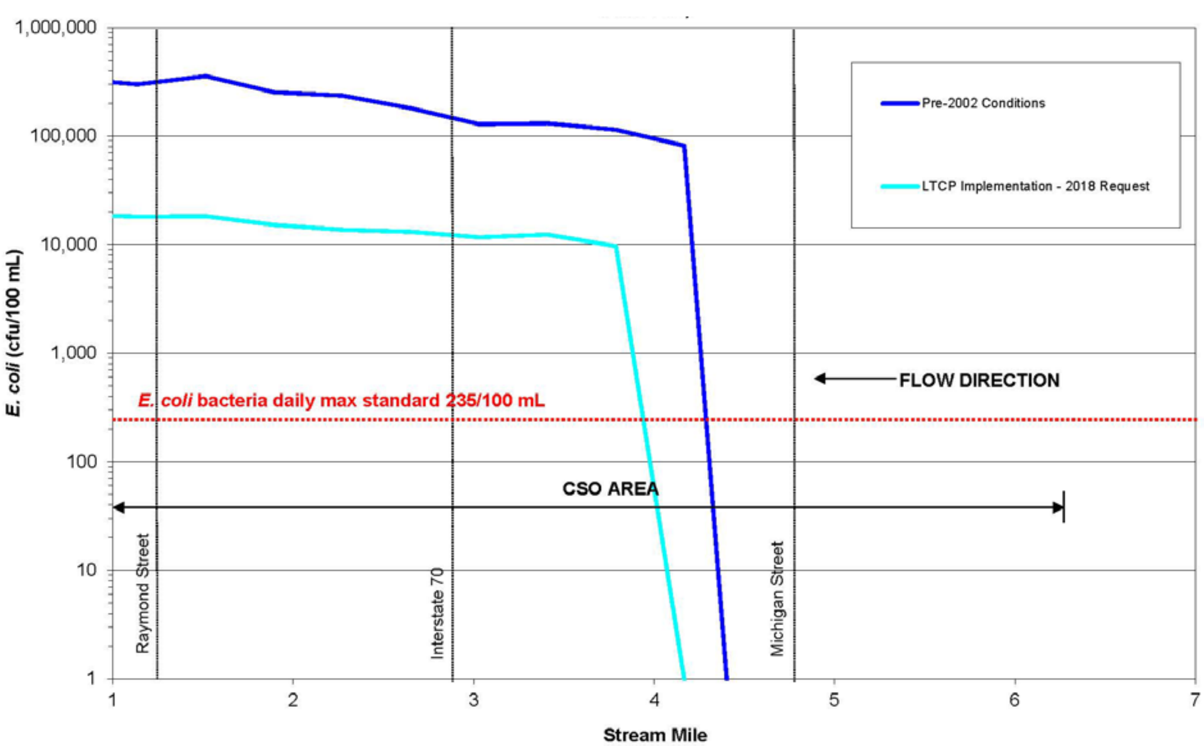

Figure 9-17
Modeled Maximum *E. Coli* Bacteria Concentrations Caused by CSOs in Eagle Creek (Excluding Background and Nonpoint Sources)

IDEM and CWA Authority will need to integrate the approved CSO LTCP with the NPDES permit and the state's water quality standards regulations through the UAA process. Upon approval of this CSO LTCP the following approval language is requested:

> "The water quality-based requirements associated with the CSO Wet Weather Limited Use subcategory for the waterways listed above are determined by implementation of this approved CSO LTCP as provided by IC 13-18-3-2.5. CSO discharges that occur consistent with this approved LTCP comply with the narrative and numeric water quality requirements of the CSO Wet Weather Limited Use subcategory. This is the level of control of CSO discharges that shall be used for any waste load allocation (including through a total maximum daily load) that may be established for the waterways."

A summary of factors supporting the Wet Weather Limited Use subcategory is provided in Section 9.6.1.

9.6.1 Summary of Factors Supporting Wet-Weather Limited Use Subcategory

The primary factors and duration of impact supporting the Wet Weather Limited Use subcategory for each stream segment is summarized in **Table 9-12**.

With respect to Factor 2, *Natural or Intermittent High Flow Conditions*, all stream segments with the exception of Pleasant Run have modeled impacts where a combination of flow, depth and/or velocity render primary contact recreational use unsafe for at least 96 hours.

Factor 3, *Human-Caused Conditions*, indicates that all stream segments have bacterial impacts that extend at least 72 hours, which all segments except Fall Creek experiencing impacts for the 96-hour duration of the Wet Weather Limited Use subcategory.

Data provided in support of Factor 4, *Hydrologic Modifications*, demonstrate that impacts within the watershed, including those resulting from non-point stormwater runoff with the increase in impervious surfaces and other man-made modifications, demonstrate impacts for all stream segments except Pleasant Run that would preclude primary contact recreational use for at least 96 hours.

Data provided in support of Factor 6, *Substantial and Widespread Economic and Social Impact*, demonstrate that impacts of implementing the LTCP place a high burden on ratepayers, with significant burden on populations living below the Federal poverty line and in areas most impacted by CSOs. Eliminating the CSO causes of *E. coli* bacteria exceedances would result in higher burden and in substantial and widespread economic and social impacts but would not fully attain the recreational use. This evaluation supports that the Authority is achieving the maximum level of CSO control and supports a Wet Weather Limited Use subcategory for the total 96 hours.

The Authority requests state and federal approval of the UAA in order to achieve the implementation schedule established in the approved CSO LTCP and Consent Decree. Further, approval of this UAA allows the state to proceed with rulemaking needed for the implementation of the CSO Wet Weather Limited Use subcategory.

Approval of the UAA and designation of specific stream segments under the CSO Wet Weather Limited Use subcategory allows the Authority to proceed with Consent Decree capital investments to achieve Consent Decree performance criteria. Approval of this UAA ensures that investments will result in compliance with water quality standards and alleviate the need for additional significant capital investments following implementation of the CSO LTCP.

This UAA is premised on three technical factors (2, 3, and 4) and the economic factor (6). Although not all stream segments have the same temporal impacts during storm events that result in CSOs, these impacts should not be discarded in favor of the single economic factor as the basis of this UAA. Technical factors and the data generated in this UAA support the 96-hour Wet Weather Limited Use subcategory.

The Wet Weather Limited Use subcategory will ensure protection of public health and safety during periods when primary contact recreational use cannot be attained. Impacted stream segments resulting from conditions unsafe for primary contact access due to stream flows or bacterial impacts from CSOs and impacts from human-caused conditions and hydrologic modifications are beyond the Authority's ability to remedy.

Table 9-12: Summary of UAA Factors Supporting Wet Weather Limited Use

Stream Segment	Factor 2: Natural or Intermittent High Flow Conditions	Factor 3: Human-Caused Conditions	Factor 4: Hydrologic Modifications	Factor 6: Substantial and Widespread Economic and Social Impact
Fall Creek SM 6.1 to 0	96 hours (flow, depth) 36 hours (velocity)	72 hours (bacteria)	96 hours (flow, depth) 36 hours (velocity)	96 hours / Continuous (Substantial and widespread economic and social impact)
Pleasant Run SM 7.8 to 0	48 hours (depth) 24 hours (flow, velocity)	96 hours (bacteria)	48 hours (depth) 24 hours (flow, velocity)	
Pogues Run SM 5.3 to 0	96 hours (depth) 24 hours (flow, velocity)	96 hours (bacteria)	96 hours (depth) 24 hours (flow, velocity)	
Eagle Creek SM 4.2 to 0	96 hours (depth) 48 hours (flow) 24 hours (velocity)	96 hours (bacteria)	96 hours (depth) 48 hours (flow) 24 hours (velocity)	
White River RM 251 to 146	96 hours (flow, depth, velocity)	96 hours (bacteria)	96 hours (flow, depth, velocity)	

9.7 Summary of Revisions

- Section 9.1 Introduction – Updated to provide summary for 2018 update.
- Section 9.2 Current Recreational Standards and Water Quality: Updated text to denote primary versus secondary contract recreational designated use.
- Section 9.2 Current Recreational Standards and Water Quality: Updated reference to IDEM 303(d) list of impaired waters for 2018 integrated report.
- Section 9.3 Determination of Existing Use and Discussion of Highest Attainable Use: Updated reference to the November 2017 LTCP Update
- Section 9.3 Determination of Existing Use and Discussion of Highest Attainable Use: Added Discussion for Highest Attainable Use in Section 9.3.2
- Section 9.4.1 Natural or Intermittent High Flow Conditions: Table 9-1 Updated for instream peak flows
- Section 9.4.1 Natural or Intermittent High Flow Conditions: Figures 9-5 Remove peak flow graphic and added peak flow for Pogues Run
- Section 9.4.1 Natural or Intermittent High Flow Conditions: Figures 9-1 through 9-5 Updated to show flow, velocity, and depth compared to USGS safety factors
- Added Section 9.4.2.3 to include evaluation of CSO contribution to simulated exceedance of RWQC.
- Section 9.4.2.3 Unsafe Stream Flows Exacerbated by Urbanization modified to 9.4.2.4
- Section 9.4.2.4 Unsafe Stream Flows Exacerbated by Urbanization: Updated Table 9-3 for combined and separate acreage reflective of the Authority's hydraulic model expansion and update
- Section 9.4.2.4 Unsafe Stream Flows Exacerbated by Urbanization: Updated Table 9-4 for typical year storm CSO volume and instream flow volume reflective of the Authority's hydraulic model expansion and update
- Section 9.4.2.4 Unsafe Stream Flows Exacerbated by Urbanization: Updated Figures 9-6 through 9-10 for modeled maximum streamflow conditions for each stream segment
- Section 9.4.2.4 Unsafe Stream Flows Exacerbated by Urbanization: Updated Table 9-5 to included modeled peak velocity and depth for a typical year storm following LTCP implementation, in addition to modeled flow
- Section 9.4.2.4 Inability to Remedy Human-Caused High Flow Conditions modified to 9.4.2.5
- Section 9.4.2.5 Inability to Remedy Human-Caused High Flow Conditions: Updated Table 9-6 for peak modeled stream flows following LTCP implementation with and without estimated stormwater controls
- Section 9.4.3 Updated to reflect history and feasibility of removing existing dams
- Section 9.4.4 Substantial and Widespread Economic and Social Impact: Updated to reflect the Authority's 2017 Financial Capability Assessment
- Section 9.4.4 Substantial and Widespread Economic and Social Impact: Updated to show widespread social and economic impacts resulting from evaluation consistent with IDEM's guidance for Use Attainability Analysis financial capability
- Section 9.5 Public Outreach: Updated to reflect current and recent outreach completed by the Authority pertaining to the Use Attainability Analysis
- Section 9.6 UAA and Wet-Weather Limited Use Subcategory for CSO-Impacted Waterways: Updated to include figures for modeled maximum *E. coli* bacteria concentrations caused by CSOs in each tributary of White River
- Section 9.6.1: Added section and added table summarizing factors supporting a wet-weather limited use subcategory for each stream segment

UAA References:

Anderson, S. 1992. Studies begin on Kaneohe Bay's toxin problem. *Makai* 14(2):1,3. University of Hawaii Sea Grant College Program.

Arnett, Clifford J.; Boner, Mark; and Bowman, Jessica; 2006. *Bacteria TMDL Solution to Protect Public Health and Delisting Process in Columbus, Ga*. Paper presented at Water Environment Federation's WEFTEC 2006, 79th Annual Technical Exhibition and Conference, Dallas, Texas.

City of Indianapolis-Department of Public Works, 2006. *NPDES Stormwater Permit Annual Report.*

City of Indianapolis-Indianapolis Clean Stream Team, April 2005. *Information to Support an Existing Use Determination for CSO-Impacted Portions of Marion County Streams*.

IDEM, August 201 8. *Indiana's 2018 Integrated Water Monitoring and Assessment Report, Appendix A, Tables 10 and 11* . IDEM, Office of Water Quality.

IDEM, September 2003a. *Fall Creek TMDL Study*. IDEM, Office of Water Quality, prepared by the City of Indianapolis and CDM.

IDEM, September 2003b. *Pleasant Run and Bean Creek TMDL Study*. IDEM, Office of Water Quality, prepared by the City of Indianapolis and CDM.

IDEM, September 2003c. *White River TMDL Study*. IDEM, Office of Water Quality, prepared by the City of Indianapolis and CDM.

Loucks, Eric D., *Evaluating the Effectiveness of Stormwater Reduction Practices Using Continuous Simulation*. ASCE World Water Congress 2004. http:// www.ascelibrary.org.

Marion County Health and Hospital. *Article 6, Section 16-602*. Gen.Ord. 8-1996(A) Passed 6/19/96 Effective Date 6/19/96.
http://www.hhcorp.org/hhc/images/HHCcode/codechapter16.pdf

Rasmus, James; Fowler, Brad; and Cover, David, 2006, *Meeting New Demands: Treating Urban Runoff*. Water Environment Federation's WEFTEC 2006, 79th Annual Technical Exhibition and Conference, Dallas, Texas.

Revised Code of the Consolidated City and County of Indianapolis/Marion County, Indiana. Codified through Ordinance No. 112, 2006. (Supplement No. 18, Update 1)
http://www.municode.com/resources/gateway.asp?pid=12016&sid=14. Accessed March 2007.

Schueler, T. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices*. Metropolitan Washington Council of Governments, Washington, DC.

Schueler, T. 1995. *Site Planning for Urban Stream Protection*. Metropolitan Washington Council of Governments, Washington, DC. http://www.cwp.org/SPSP/ TOC.htm. Accessed April 2007.

U.S. EPA-Office of Water, 2001. Guidance: Coordinating CSO Long Term Control Planning with Water Quality Standards Reviews. Washington, DC. EPA #833R01002.

U.S. EPA-Office of Water, 2002, *Wastewater Technology Fact Sheet: Bacterial Source Tracking*. Washington, DC EPA 832-F-02-010

U.S. EPA-Office of Water, 2005, *National Management Measures to Control Nonpoint Source Pollution from Urban Areas*, Washington, DC EPA-841-B-05-004

USEPA-Office of Water, 2006. *Management Measures to Control Nonpoint Source Pollution from Hydromodification* (Draft). Washington, DC EPA 841-D06-001

U.S. EPA-Office of Water, 2005-2007, *Section 319 Nonpoint Source Program Success Stories.* http:// www.epa.gov/nps. Accessed April 2007.

USGS National Field Manual for the Collection of Water Quality Data, *Section 9.4.1 Wading*. https://water.usgs.gov/owq/FieldManual/Chap9/chap9.pdf.

Appendix A

04/01/2019

DIG INDY

Cleaner Waters. Better Neighborhoods.

Use Attainability Analysis (UAA)

Why Is a Use Attainability Analysis Important?

A Use Attainability Analysis (UAA) is a critical component of Citizens Energy Group's Consent Decree (CD), for which it assumed responsibility when acquiring the water and wastewater utilities from the City of Indianapolis in 2011. The CD requires the investment of billions of dollars to construct improvements like the DigIndy Tunnel System that will mitigate the impacts of combined sewer systems currently overflowing raw sewage and rainwater into area rivers and streams. A UAA is a component of the CD that ensures investments will result in compliance with water quality standards (WQS) and alleviate the need for additional significant capital investments following the completion of the DigIndy Tunnel System in 2025.

What Is a UAA?

A UAA is a scientific assessment that examines the factors affecting the designated use of a water body and if that use is attainable. Indiana's waterways are designated for full body contact recreation, which is better known as the fishable/swimmable standard.

There are six possible factors defined in the United States Environmental Protection Agency's (U.S. EPA) UAA guidance that can be used to prove the inability to attain the designated use; in Citizens' case, the inability to attain full body contact recreation.

When a UAA is completed and approved, it is used to support a change to the designated use of a water body through the WQS. The WQS are provisions approved by U.S. EPA that describe the desired condition of a water body.

A change in WQS requires that Citizens complete and submit the UAA to the Indiana Department of Environmental Management (IDEM) for review and approval. Following approval of the submittal, IDEM must complete rulemaking, an administrative process, to modify water quality standards.

Citizens' UAA

A UAA was included in Citizens' approved Consent Decree. The CD approval noted that it was IDEM's intent that within a period of 270 days after an approved CD, they would initiate the process to revise WQS or issue a final agency decision that a revision would not be undertaken.

The City of Indianapolis submitted the original UAA documents to IDEM in 2007. The UAA sought suspension of the fishable/swimmable standard on receiving waters (i.e., White River, Eagle Creek, Fall Creek, Pleasant Run Creek and Pogue's Run Creek) during and for up to four days after the end of any remaining combined sewer overflow (CSO) discharges. This submittal was accepted by IDEM in December 2007; it was not accepted by U.S. EPA.

The Indiana Water Pollution Control Board in 2005 adopted a specific designated use to address these circumstances, called the Wet Weather Limited Use Subcategory. This subcategory is intended to support CSO communities that are unable to completely eliminate CSO discharges during rain events due to factors included in UAA guidance from the U.S. EPA and described below. Application of the Wet Weather Limited Use Subcategory would suspend the designated use applicable to Indianapolis waters during wet weather events that would cause CSO discharges exceeding Citizens' CD.

Citizens' UAA utilized the following factors to support modification of a designated use:

- **Factor 2 - Flow Conditions:** CSO-impacted waterways are especially unsuitable for recreational use during and following large storm events (i.e., 3-month storm event) due to high stream flows/velocities.
- **Factor 3 - Human Caused Conditions:** Human-caused conditions, such as those caused by urbanization or sources of pollution, prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
- **Factor 4 - Hydrologic Modification:** On Pogue's Run Creek and Pleasant Run Creek, urbanization has modified the natural hydrology of the streams, increasing peak stream flows to unsafe levels.
- **Factor 6 - Economic and Social Impact:** Attaining a designated use would result in substantial and widespread economic and social impacts affecting the quality of life in our community.

Next Steps

Implementation of the Wet Weather Limited Use requires IDEM to proceed with the administrative rulemaking process. Citizens will update and resubmit the UAA, and request a revision to WQS in the form of a Wet Weather Limited Use designation.

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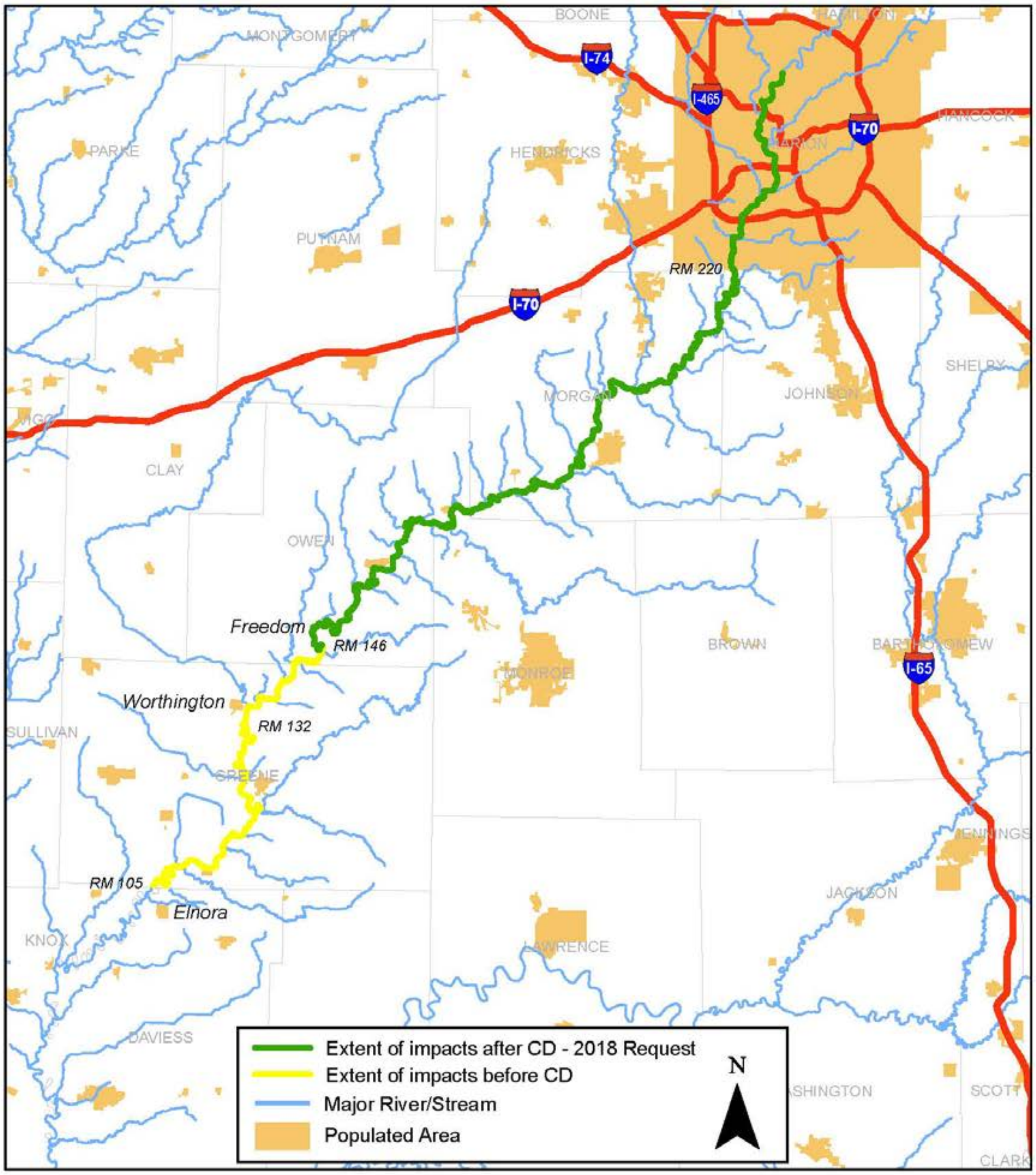

White River Requested CSO Wet Weather Limited Use Designation

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Appendix B

2005 IDEM Approval of Existing Use Determination for CSO-Impacted Portions of Marion County Streams

2008 EPA Approval of CSO Wet Weather Limited Use Subcategory