

Category 4B Demonstrations

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Ohio EPA uses the 4B alternative in conjunction with total maximum daily loads (TMDLs) to efficiently address water quality impairments. Because Ohio EPA typically completes TMDLs on a watershed basis, it makes sense to include discussion of 4B demonstrations in TMDL reports as approval of a TMDL is sought, then to report on progress in integrated reports. As new 4B demonstrations accumulate, they will be collected into future integrated reports. Progress on individual 4B projects will be reported in subsequent integrated reports until the impairment is resolved or until a decision is made that the 4B will not be sufficient to address the impairment and a TMDL is scheduled.

K1. Category 4B Demonstrations Contained in Approved Ohio TMDLs to Date

This section presents the 4B discussions as they appeared in the respective TMDL reports, with updates on status. Text that is not original to this report appears with a border to the left; plans and dates are not changed from the original, so some text may appear to be outdated. The table below shows the locations of the original 4B demonstrations as included with TMDL reports and where updates are included in this report.

Name of Watershed	WAU	Location of 4B in TMDL Report	Date of TMDL Approval	4B Status
Big Run-WhiteOak Creek	OH050902011003	Appendix H	2/25/2010	Closed
Lesley Run-Twin Creek	OH050800020205	Appendix B	3/4/2010	On-going
Sycamore Creek	OH050600011704	Appendix B	5/4/2010	Closed
Brandywine Creek - Great Miami River	OH050800010306	Appendix E	3/26/2012	On-going

Projects included in the 2012 Integrated Report

After completion of the *2010 Integrated Report* and before completion of the *2014 Integrated Report*, Ohio submitted three 4B alternatives as part of approved TMDLs: Town Run (White Oak Creek Watershed TMDL Report); Twin Creek (Twin Creek Watershed TMDL Report); and Sycamore Creek (Walnut Creek Watershed TMDL Report). Together with TMDLs approved for other impairments to the aquatic life use, the 4B work should bring the streams into attainment with water quality standards.

Town Run (Big Run - White Oak Creek Watershed)

Impairment of biological water quality standards and high ammonia concentrations have been measured in Town Run, a tributary to White Oak Creek at river mile (RM) 6.95. Town Run is a high gradient bedrock substrate headwater stream that is fed by ground water. The City of Georgetown WWTP discharges to Town Run at RM 0.80. The biological impairment and high ammonia concentrations are resulting from the Georgetown WWTP effluent discharge. Ohio EPA proposes that this impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below. Additional information is available in the main text of the TMDL and in the biological and water quality study publication.

Ohio EPA is addressing the phosphorus and nitrate-nitrite impairments via a TMDL analysis expected to be completed in 2009.

Identification of segment and statement of problem causing the impairment

Ohio EPA measured the water quality in the White Oak Creek watershed in 2006, collecting biological, chemical and physical data. The following paragraph from Ohio EPA's water quality report summarizes the problems observed in Town Run:

“Biological sampling in Town Run (RM 0.9 in 2008) found a marginally good community of macroinvertebrates and a reproducing population of the cold water indicator two-lined salamander upstream from the Georgetown WWTP discharge (RM 0.80). Downstream from the WWTP discharge (RM 0.7 in 2008) the macroinvertebrate community was very poor and there was no observed reproduction of the two-lined salamander. High concentrations of Ammonia-N (median of 3.24 mg/L), Phosphorus-T (median of 3.04 mg/L), and Nitrate-Nitrite-N (median of 6.39 mg/L) were recorded downstream from the WWTP discharge in 2006.” (epa.ohio.gov/portals/35/documents/WhiteOakCreekTSD2006.pdf, p. 9)

During Ohio EPA’s water quality survey of the White Oak Creek watershed in 2006, five sets of chemical samples were collected at sites upstream and downstream of the Georgetown WWTP. Upstream of the WWTP, the median value for ammonia was 0.05 mg/L. Downstream of the WWTP, the ammonia value was 3.24 mg/L. The median ammonia value of the Georgetown WWTP effluent was 4.07 mg/L.

Biological impact was significant, resulting in a listing on the 303(d) list. Upstream of the WWTP, Town Run is fully attaining the Aquatic Life Use, but downstream of the WWTP the use is not attained.

Description of pollution controls and how they will achieve water quality standards

Town Run is effluent-dominated downstream from the Georgetown WWTP. The drainage area upstream of the WWTP discharge is only 1.3 square miles.

The median flow of the Georgetown WWTP from 2002-2006 was 0.47 million gallons per day (MGD) with 23.8 percent (420/1764) of the flow dates being over the facility’s design capacity of 0.80 MGD.

The critical period for ammonia in such an effluent-dominated stream is late summer when ambient temperatures are highest and stream flows are lowest. Calculating a load to meet water quality standards during the summer is protective of other time periods. A winter load is calculated to meet the needs of Ohio EPA’s permitting program.

By reducing the effluent concentration of ammonia from Georgetown, water quality standards for ammonia and the Aquatic Life Use in Town Run are expected to be met.

The nonpoint source load is zero because of the limited drainage area above the WWTP’s discharge point. At the critical condition, no upstream flow would be expected.

Loadings for point sources can be calculated using a mass-balance equation. In this case, since upstream flow equals zero, the allocation for the Georgetown WWTP is equal to the water quality standards (WQS). The ammonia WQS for exceptional warmwater habitat (EWH)/coldwater habitat (CWH) is 0.6 mg/L during summer and 1.93 mg/L during winter.

Thus, the load allocated to the Georgetown WWTP = (WQS) x (Effluent flow) x (conversion factor):

$$\text{Summer: } 0.6 \text{ mg/L} \times 0.8 \text{ MGD} \times (\text{factor}) = 1.82 \text{ kg/day}$$

$$\text{Winter: } 1.93 \text{ mg/L} \times 0.8 \text{ MGD} \times (\text{factor}) = 5.85 \text{ kg/day}$$

An estimate or projection of the time when WQS will be met

After the Georgetown WWTP meets the new ammonia permit limit (by November 2014), the ammonia limit should be met. The water body is expected to respond to the load reduction, but recovery will not be instantaneous. Ohio EPA will monitor the stream for recovery.

Schedule for implementing pollution controls

The Georgetown NPDES permit expires on February 28, 2010. Prior to that date, Ohio EPA will issue a new permit with a 30-day average limit on effluent ammonia of 0.6 mg/L (summer) and 1.93 mg/L (winter).

Officials at the Georgetown WWTP have contracted with an engineering firm and they have produced a plan to upgrade the WWTP to achieve compliance with the new ammonia limits. The WWTP upgrade will be completed by November 2014.

Ohio EPA will monitor Georgetown's progress toward meeting the permit limits by following up on the construction activity and reviewing monthly effluent reports.

Monitoring plan to track effectiveness of pollution controls

As a part of its NPDES permit, the Georgetown WWTP measures and reports ammonia concentrations in its effluent and in Town Run upstream and downstream of its discharge point. The sampling will be conducted twice per week and reported monthly. The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Ohio EPA staff will also conduct facility inspections approximately annually.

After the Georgetown ammonia reductions have been in place for at least one year, Ohio EPA will revisit the area to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Georgetown.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

First Report on Town Run 4B Demonstration (2012 Integrated Report)

A permit was issued to the Georgetown WWTP effective on September 1, 2010. Final effluent limitations for ammonia are 0.60 mg/L (summer monthly average) and 1.76 mg/L (winter monthly average). Those limits must be met beginning on September 1, 2014.

Second Report on Town Run 4B Demonstration (2014 Integrated Report)

The Georgetown WWTP is under construction in fall 2013 to make improvements to meet the new nitrogen-ammonia and total phosphorus limits. The upgrade is scheduled to be completed by September 1, 2014, but upgrades are currently ahead of schedule. Follow-up sampling will take place in 2015 or 2016, so results will likely be available for the 2018 Integrated Report.

Third Report on Town Run 4B Demonstration (2016 Integrated Report)

The Georgetown WWTP did not complete its scheduled upgrades by September 1, 2014, due to contractor issues. The WWTP upgrades were completed on July 1, 2015, and all treatment improvements should help meet the nitrogen-ammonia and total phosphorus limits. Follow up sampling will take place in 2016.

Fourth Report on Town Run 4B Demonstration (2018 Integrated Report)

The Georgetown WWTP experienced some violations of the phosphorus and ammonia limits of their permit during 2015-2016. These violations occurred because of either high flows; high influent concentrations of phosphorus due to sludge dewatering; and/or learning curve on the adjustment of the ferric chloride feed to these factors. The below table details the violations for phosphorous and ammonia that have occurred since the NPDES permit effective date of November 1, 2015. The facility has been in compliance with the permit limits from September 2016 to September 2017. Ohio EPA conducted follow up sampling in Town Run in 2016. The results indicate the stream is still impaired and are being evaluated for further restoration actions.

Violations for phosphorus and ammonia since 11/1/2015 (effective date)

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
Jul 2015	Phosphorus, Total (P)	30D Qty	4.2 kg/day	4.25711 kg/day	7/1/2015
Jul 2015	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.67065 kg/day	7/22/2015
Aug 2015	Nitrogen, Ammonia (NH3)	7D Conc	0.90 mg/L	0.94333 mg/L	8/15/2015
Sep 2015	Phosphorus, Total (P)	30D Conc	1.0 mg/L	1.0475 mg/L	9/1/2015
Sep 2015	Phosphorus, Total (P)	7D Conc	1.5 mg/L	1.8 mg/L	9/22/2015
Dec 2015	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.7105 kg/day	12/1/2015
Jul 2016	Nitrogen, Ammonia (NH3)	7D Qty	3.8 kg/day	4.4491 kg/day	7/22/2016
Jul 2016	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.41985 kg/day	7/22/2016
Aug 2016	Phosphorus, Total (P)	7D Qty	6.3 kg/day	7.42163 kg/day	8/15/2016

Fifth Report on Town Run 4B Demonstration (2020 Integrated Report)

The Georgetown WWTP is still experiencing some periodic violations of the phosphorus and ammonia limits of their permit during 2018-2019. Some violations were due to an extended cold spell and extreme cold limiting the effectiveness of nitrifying bacteria. Others were due to heavy rains causing high flows. The results of the 2016 survey indicate that the stream is no longer impaired by ammonia. At this time the 4B demonstration for ammonia can be closed out.

Violations for phosphorus and ammonia October 2017- May 2019

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
January 2018	Nitrogen, Ammonia (NH3)	7D Conc	2.64 mg/L	2.74667	1/8/2018
January 2018	Nitrogen, Ammonia (NH3)	30D Conc	1.76 mg/L	1.90917	1/1/2018
February 2018	Nitrogen, Ammonia (NH3)	7D Qty	11.0 kg/day	13.5025	2/8/2018
February 2018	Nitrogen, Ammonia (NH3)	7D Qty	11.0kg/day	13.4247	2/15/2018
February 2018	Nitrogen, Ammonia (NH3)	30D Qty	7.4 kg/day	10.0353	2/1/2018
November 2018	Phosphorus, Total (P)	7D Qty	6.3 kg/day	7.10785	11/1/2018
May 2019	Phosphorus, Total (P)	30D Conc	1.0 mg/L	1.0075	5/1/2019

Lesley Run - Twin Creek

The main stem of Twin Creek (in assessment unit 05080002 030) was identified as impaired by total phosphorus during the field sampling in 2005; organic enrichment was later added to the list of causes upon further investigation in the summer of 2009. Upstream of the WWTP in the City of Lewisburg, the stream was in attainment of its aquatic life use. Downstream of the treatment plant, the aquatic life in the stream was partially supporting the use. The City of Lewisburg WWTP discharges to Twin Creek at river mile (RM) 35.2. No impairment to Twin Creek upstream of Lewisburg or downstream at RM 33.6 was found. The biological impairment (between the WWTP and RM 33.6) is resulting from the Lewisburg WWTP effluent discharge. Ohio EPA proposes that this impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below. Additional information is available in the main text of the TMDL and in the forthcoming biological and water quality study publication.

Identification of segment and statement of problem causing the impairment

An Invertebrate Community Index (ICI) of 38 was garnered at RM 34.9, which was below the Exceptional Warmwater Habitat (EWH) criterion. In 2005, excessive phosphorus due to either the Lewisburg WWTP, herbicide runoff from an upstream municipal park, or contaminated storm water was considered potential contributors to this impairment. However, new information obtained during an inspection of the Lewisburg WWTP in September 2009 revealed that biological solids were being discharged directly into Twin Creek from the wastewater plant. Gray and brown sewage sludge was observed in Twin Creek from Lewisburg's outfall downstream to at least the Salem Road Bridge, with thick algal mats coating the

heaviest deposits. Black anoxic muck was also observed under many of the substrates. Because of these new findings, it is apparent that nutrient enrichment was a secondary cause of impairment to Twin Creek at RM 34.9. Organic enrichment attributable to improper solids management at the Lewisburg WWTP is now considered the primary cause of impairment to the macroinvertebrate community at RM 34.9.

Further information regarding the 2005 findings is available in the Biological and Water Quality Study of Twin Creek and Select Tributaries 2005, available on Ohio EPA web site

(epa.ohio.gov/portals/35/documents/TwinCreek2007TSD.pdf). This report will be amended to reflect the 2009 observations.

Ohio EPA included nutrient enrichment for this assessment unit in the *2008 Integrated Report* (303(d) list), available at (epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx). The *2010 Integrated Report* will add organic enrichment as an impairment cause for this assessment unit.

The primary issue with the Lewisburg WWTP is that biological solids or sludge is making its way into the stream resulting in the stream conditions described above. Sludge in the creek will contribute nutrients (phosphorus) and bacteria as well as smothering the substrate. Biological solids are largely made up of sewage treatment micro-organisms, living and dead. Micro-organisms contain phosphorus compounds (e.g., nucleic acids, ADP, ATP). Biosolids from WWTPs are frequently used as an agricultural soil amendment with some fertilizer value. Lewisburg's 2008 annual sewage sludge report included the following analyses results (on a dry weight basis): TKN = 35,000 mg/kg; NH₃-N = 8590 mg/kg; and phosphorus = 15,900 mg/kg.

This information demonstrates there is a nutrient content to Lewisburg's sludge.

In September 2009 there appeared to be both structural and operational problems. Clarified water was overflowing only portions of the clarifier weirs; this may have been caused by the weirs not being level and sections of the weir being clogged with algae. The net result was that the clarifiers were being short circuited. Compounding the problem was the fact that Lewisburg was not wasting sufficient amounts of sludge from the clarifiers to the sludge digesters. This resulted in old sludge denitrifying and floating to the surface of the clarifiers, which was then discharged to Twin Creek. Plant operating logs also documented difficulty in balancing flow between the two clarifiers during rain, which compromised clarifier performance still further. The appearance of the aeration tanks indicated that the mixed liquor suspended solids were being maintained at higher levels than necessary and that the biological solids in the tank were old.

Description of pollution controls and how they will achieve water quality standards

The Village of Lewisburg operates a sewer collection system and a wastewater treatment facility that handles domestic and industrial sewage for a population of about 1,800. The Lewisburg WWTP holds a NPDES permit (1PB00019*HD).

Lewisburg has been reporting substantial compliance with its NPDES effluent limits over the life of the current permit. Ohio EPA now believes that compositing effluent samples using multiple grab samples (as allowed by the NPDES permit) did not provide a true reflection of effluent quality. Recent inspections have also revealed quality control issues with the sampling and analyses, casting doubt on the reported effluent data.

Lewisburg has been required in inspection reports and Notices of Violation to take actions to eliminate the problems resulting in discharge of solids to Twin Creek. The Village has since utilized the assistance of Ohio EPA's Compliance Assistance Unit and has engaged an engineering firm that is reviewing plant operations.

Lewisburg began implementing changes recommended by Ohio EPA's Compliance Assistance Unit in November 2009.

Ohio EPA anticipates that the operational problems contributing to the discharge of solids can be resolved well before the NPDES permit is renewed in April 2010. Ohio EPA NPDES permits staff from the Southwest District office will closely monitor operational changes.

The draft renewal of the Lewisburg WWTP NPDES permit, (scheduled for issuance April 1, 2010) contains additional requirements that will address the impairment in Twin Creek downstream of the WWTP discharge. Ohio EPA intends to revisit the Twin Creek sampling sites in Lewisburg in September 2011. If the operational improvements have been properly implemented and yet the ICI at RM 34.9 cannot be demonstrated to comply with EWH criteria due to organic enrichment from the WWTP, Lewisburg will be required by a modification to its NPDES permit to comply with a schedule that leads to compliance with an initial total phosphorus limit of 1.0 mg/L by April 2015.

A complicating factor is that Preble County, at the request of the Village of Lewisburg, cleared bank vegetation and removed gravel bars and woody debris from the creek in the vicinity of RM 34.9 during the summer of 2009. This work was done to protect the Knapke Lane bridge pier and reduce bank erosion. It is unlikely that the target ICI score can be attained at that location unless the creek habitat is restored.

A loading analysis to address the organic enrichment impairment is not necessary given the scope of the operational problems at the Lewisburg WWTP and the ability of the facility to correct the problem.

Although it is difficult to predict how much of the secondary nutrient enrichment problem is associated with the operational problems, a simple analysis of chemical data provides guidance on point source loading.

The 2005 data collected in Twin Creek by Ohio EPA show a significant change in total phosphorus concentration at the WWTP's entry into the stream. The median in-stream concentration of total phosphorus upstream of Lewisburg's outfall was 0.038 mg/L. The median in-stream concentration downstream of Lewisburg was 0.239 mg/L. The exceptional warmwater habitat (EWH) in-stream target from *Association Between Nutrients, Habitat, and the Aquatic Biota of Ohio Rivers and Streams* is 0.08 mg/L (epa.ohio.gov/portals/35/documents/assoc_load.pdf).

A simple loading analysis using the five sets of samples collected in 2005 yields the following total phosphorus loads:

Stream capacity (based on 0.08 mg/L target) = 1.303 kg/d Margin of safety (5 percent) = 0.065 kg/d

Load allocation (from nonpoint sources) = 0.856 kg/d Wasteload allocation (Lewisburg WWTP) = 0.382 kg/d

A wasteload allocation of 0.382 kg/d equates to an effluent concentration of 0.39 mg/L total phosphorus at the WWTP's design flow. The 95th percentile of effluent total phosphorus reported by Lewisburg over the current permit is 3.69 mg/L, although there is uncertainty because of concerns with laboratory practices.

Ohio EPA intends to apply an initial phosphorus limit of 1.0 mg/L that would be triggered if fixing the WWTP's operational problems fails to result in attainment of WQS. While the loading analysis results indicate that this limit will not meet the phosphorus target concentration, it does represent a significant (approximately 72 percent) reduction in phosphorus load from the Lewisburg WWTP. This limit should provide enough in-stream nutrient reduction to improve aquatic life while imposing achievable NPDES

limits. Any further reduction in effluent limits should be evaluated after this limit is being attained and an evaluation of the biological condition of the stream has been completed.

An estimate or projection of the time when WQS will be met

The next NPDES permit for Lewisburg's WWTP will be issued in 2010. Ohio EPA anticipates that Lewisburg will be able to eliminate the discharge of biosolids to the creek before the permit is renewed. This will significantly reduce the solids and nutrient load to the creek. Ohio EPA expects that the stream will respond to improved operation within two years of making the changes.

Ohio EPA proposes to measure the ICI at RM 34.9 by September 2011. If the ICI does not comply with EWH criterion due to organic enrichment at that time Lewisburg will be given three years to come into compliance with a permit limit for TP of 1.0 mg/L (that is, by April 2015).

Schedule for implementing pollution controls

Any compliance schedule placed in the NPDES permit will allow three years (2012-2015) to implement new controls to reduce TP in effluent if the ICI score is not in attainment by September 2011. It is expected that operational improvements to reduce organic enrichment and, if needed, effluent controls to reduce TP, will sufficiently improve water quality within five years such that the macroinvertebrate community will be able to recover to full attainment.

Monitoring plan to track effectiveness of pollution controls

The City of Lewisburg WWTP is required to submit monthly Discharge Monitoring Reports for effluent quality from the WWTP and upstream and downstream of its discharge point.

The renewed permit will require 24-hour flow composited effluent sampling at Lewisburg, which will provide a much-improved picture of effluent quality. The operations assistance provided by Ohio EPA to the WWTP will include attention to quality control issues so that concerns with past facility monitoring will be resolved.

Following Ohio EPA's Permit Guidance, at upstream and downstream stations, pH, dissolved oxygen and temperature will be monitored once per month year-round. Total phosphorus, bacteria and ammonia-nitrogen will be added to both upstream and downstream stations at a frequency of once per month during the summer season.

The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Ohio EPA staff will also conduct unannounced facility inspections at least twice annually until all identified operational and process changes have been completed.

After the Lewisburg operational improvements have been in place for at least one year, Ohio EPA will return to monitor Twin Creek at RM 34.9 by September 2011 to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. If sufficient progress is not being made, Ohio EPA will evaluate the options available under NPDES authority, including additional operations assistance and enforcement.

Ohio EPA will report progress in its integrated report until the impairment has been eliminated.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Lewisburg.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

First Report on Twin Creek 4B Demonstration (2012 Integrated Report)

Addressing organic solids issues at the Lewisburg WWTP has proven more difficult than originally anticipated. Ohio EPA is continuing to work with the WWTP to address compliance issues.

Second Report on Twin Creek 4B Demonstration (2014 Integrated Report)

A permit to install for WWTP improvements was approved on July 10, 2013. The approved upgrades include a fine spiral screen and continuously backwashed tertiary filters. The Village has been awarded Ohio Public Works Commission funding for completion of the project. The expected date of completion of construction is July 2014. The improvements are expected to reduce the solids being discharged from the treatment plant and therefore the associated organic enrichment, which is expected in turn to result in attainment of the designated aquatic life use.

Third Report on Twin Creek 4B Demonstration (2016 Integrated Report)

The following upgrades have been completed and are on-line:

- A new fine spiral screen;
- Upgrade of the existing circular aeration tanks to a zoned system to support biological nutrient removal (BNR) processes;
- All new mechanical equipment installed in the existing clarifiers;
- Addition of tertiary moving bed sand filters;
- Ultraviolet (UV) disinfection upgrade;
- New generator;
- Sludge pumping upgrades for both the return activated sludge (RAS) and waste activated sludge (WAS); and
- Sludge storage improvements.

Operators are trying to optimize the WWTP operations with small changes such as fine bubble diffusers in the sludge holding tank. There have been challenges trying to meet the 1 mg/L total phosphorus limit. Ohio EPA's Compliance Assistance Unit (CAU) has assisted with the operations at the plant. Other TMDL requirements were incorporated into the facility's NPDES permit when the permit was modified in April 2015.

Fourth Report on Twin Creek 4B Demonstration (2018 Integrated Report)

During the timeframe of January 1, 2016, through September 19, 2017, Lewisburg WWTP has been operating at an average of 106.7 percent of the designed flow rate. The average Phosphorus, Total (P) for 2016 was 1.26 mg/L and the average for 2017 (to date 9/19/17) is 1.12 mg/L. Improvements have been made, but the Lewisburg WWTP is still inconsistent in compliance for Phosphorus, Total (P).

Through the NPDES permit, Ohio EPA has given the Village of Lewisburg until March 1, 2020, to complete further necessary improvements for complying with the total phosphorus limit. Ohio EPA follow-up monitoring in Twin Creek should not proceed until construction of the additional improvements have been completed.

Fifth Report on Twin Creek 4B Demonstration (2020 Integrated Report)

Lewisburg WWTP performed a pilot study in 2017 to determine if chemical or biological phosphorus removal would be more effective at the plant. Results showed chemical removal was most effective, and in August 2018 a permit to install was approved to add a chemical feed system at Lewisburg WWTP to meet permit limits for phosphorus. The Lewisburg WWTP NPDES permit is up for renewal in 2020. No phosphorus violations were reported from October 2017 to May 2019.

Sycamore Creek (Walnut Creek Watershed)

Problem causing the impairment.

Ohio EPA measured the water quality in the Walnut Creek watershed in 2005, collecting biological, chemical and physical data. Impairment of biological water quality standards (OAC 3745-1-07) was measured at six sites on Sycamore Creek, a tributary to Walnut Creek.

Three sites in Sycamore Creek met the biological criteria and three did not. The most upstream site (river mile (RM) 12.2) was impaired due to organic enrichment (probably due to septic systems), and then two sites (RMs 9.6 and 4.7) met the criteria. The next two sites (RM 4.18 (Hill Road) and 2.6 (Busey Road) partially met the criteria. The stream recovered to fully meet the criteria at the most downstream site (RM 0.2).

The City of Pickerington WWTP discharges to Sycamore Creek at RM 4.35. No impairment to Sycamore Creek immediately upstream of Pickerington or downstream of RM 2.6 was measured. The biological impairment is resulting from the Pickerington WWTP effluent discharge.

The site at RM 4.18 only partially met the WWH biological criteria. The fish community was in very good condition while qualitative invertebrate sampling revealed a low-to-fair community. This is likely caused by the proximity of the Pickerington WWTP to this sampling station and documented chronic toxicity of effluent to *Ceriodaphnia* (Ohio EPA, 2006, Bioassay Report 06-3447-C). Both fish and invertebrate communities improved at Sycamore Creek sites downstream of RM 4.18.

The chemical water quality criterion for total dissolved solids (1500 mg/L) was exceeded in Sycamore Creek downstream of the Pickerington WWTP (2110, 1950, 1710 mg/L).

Link between the source of the problem and the specific listed impairments

High total dissolved solids (TDS) concentrations result from the Pickerington WWTP discharge. The WWTP accepts a waste stream from the Pickerington water treatment facility which uses a Zeolite process to treat drinking water. This process creates a wastewater high in dissolved solids which the WWTP does not effectively treat. This high dissolved solids waste gets passed through the WWTP and into Sycamore Creek.

Bioassay testing results on the Pickerington effluent and mixing zone have confirmed TDS-related impairment to the invertebrate community as well by demonstrating negative effects (immotility, death) to *Ceriodaphnia*. Mayfly populations found downstream of the WWTP are impaired revealing only 2 mayfly taxa (compared with 8 found upstream of the discharge point) plus a variety of TDS tolerant and facultative invertebrates as well. The two sites upstream and the site at the mouth were in full attainment of WWH biological standards with moderately good (qualitative assessments at RM 9.6 and 4.7) to exceptional (ICI=50 at RM 0.2) communities of invertebrates.

Low fish MIWB scores found at RM 2.6 provide further evidence of a problem with excessive TDS in-stream contributing to reduced numbers of fish.

Further information regarding the 2005 findings is available in the Biological and Water Quality Study of Walnut Creek and Select Tributaries 2005, available on Ohio EPA web site (epa.ohio.gov/portals/35/documents/WalnutCreek2005TSD.pdf).

Ohio EPA included total dissolved solids for this assessment unit in the 2008 Integrated Report (303(d) list), available at (epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx).

Description of pollution controls and how they will achieve water quality standards

The City of Pickerington operates a sewer collection system and a wastewater treatment facility and is regulated under a NPDES permit (4PB00017*LD).

The existing Pickerington wastewater plant has an average daily design flow of 1.6 MGD. Pickerington is expanding its wastewater plant to an average design flow of 3.2 MGD to accommodate new development within its service area. Along with other improvements, for solids handling the City will construct two new aerobic digesters and new sludge drying beds for storage.

The permit requires the development of a method to control discharges of elevated dissolved solids. Both interim and final effluent concentrations of dissolved solids are present in the permit (calculated by wasteload allocation) which should serve to ameliorate the violations of the WQS in Sycamore Creek (see the NPDES permit fact sheet for the Pickerington WWTP:

wwwapp.epa.ohio.gov/dsw/permits/permit_list.php).

Point and nonpoint source loadings that will achieve water quality standards.

The allowable loading is based on the beneficial uses assigned to the receiving waterbody in OAC 3745-1. Dischargers are allocated pollutant loadings/concentrations based on the Ohio Water Quality Standards (OAC 3745-1). TDS was allocated using the mass-balance method, using the following general equation:

Discharger WLA = [(downstream flow x WQS) - (upstream flow x background concentration)] / discharge flow.

See the permit fact sheet (wwwapp.epa.ohio.gov/dsw/permits/permit_list.php) for details.

The continuous discharge from the WWTP into Sycamore Creek at low stream flows during the summer represent the critical condition for the aquatic ecosystem. The WLA calculation accounts for the nonpoint source load in the equation. See the permit fact sheet

(wwwapp.epa.ohio.gov/dsw/permits/permit_list.php) for details.

All loads in kg/d	Existing WWTP Flow	Expanded WWTP Flow
TMDL	11,022	20,433
LA	666	666
WLA	10,356	19,767

An estimate or projection of the time when WQS will be met

The NPDES permit requires the City of Pickerington to meet the final effluent limitations in the permit within 25 months of the effective date of the permit (in 2010). WQS should be met soon after as macroinvertebrates can recover quickly (6 months to a year) once the stressor is removed.

Schedule for implementing pollution controls

Reference the NPDES permit fact sheet for scheduling information

(wwwapp.epa.ohio.gov/dsw/permits/permit_list.php).

Monitoring plan to track effectiveness of pollution controls

The City of Pickerington WWTP is required to submit monthly Discharge Monitoring Reports for effluent quality from the WWTP and upstream and downstream of its discharge point.

The permit requires 24-hour composite sampling for TDS of the WWTP effluent, to be completed three times per week year-round. In addition, the WWTP will collect an ambient grab sample for TDS at sites both upstream and downstream of the discharge into Sycamore Creek; they will use a laboratory of their choice.

The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Central District Office. Ohio EPA staff will also conduct unannounced facility inspections until all identified operational and process changes have been completed.

Water chemistry and macroinvertebrate community health will be monitored following the construction and new plant start up. After the Pickerington WWTP improvements have been in place for at least one year, Ohio EPA will return to monitor Sycamore Creek to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. If sufficient progress is not being made, Ohio EPA will evaluate the options available under NPDES authority, including operations assistance and enforcement.

Ohio EPA will report progress in its integrated report until the impairment has been eliminated.

Future monitoring

City of Pickerington (far field monitoring for TDS in the NPDES permit, analysis by a laboratory of their choice) and Ohio EPA DSW, CDO WQ (chemistry, with analysis by Ohio EPA DES) and EAS (macroinvertebrates).

Cost estimates

Five work days for two people to sample chemistry, 1 work day for two people to do qualitative macroinvertebrate monitoring, and the associated standard lab costs for TDS samples.

Analysis of the results and annual reporting

Ohio EPA, CDO, DSW WQ staff will examine both data from Ohio EPA sampling and that generated by Pickerington. EAS macroinvertebrate staff will analyze their own data. Ohio EPA CDO staff will complete the reporting necessary for this 4B demonstration.

Revising the implementation strategy and corresponding pollution controls

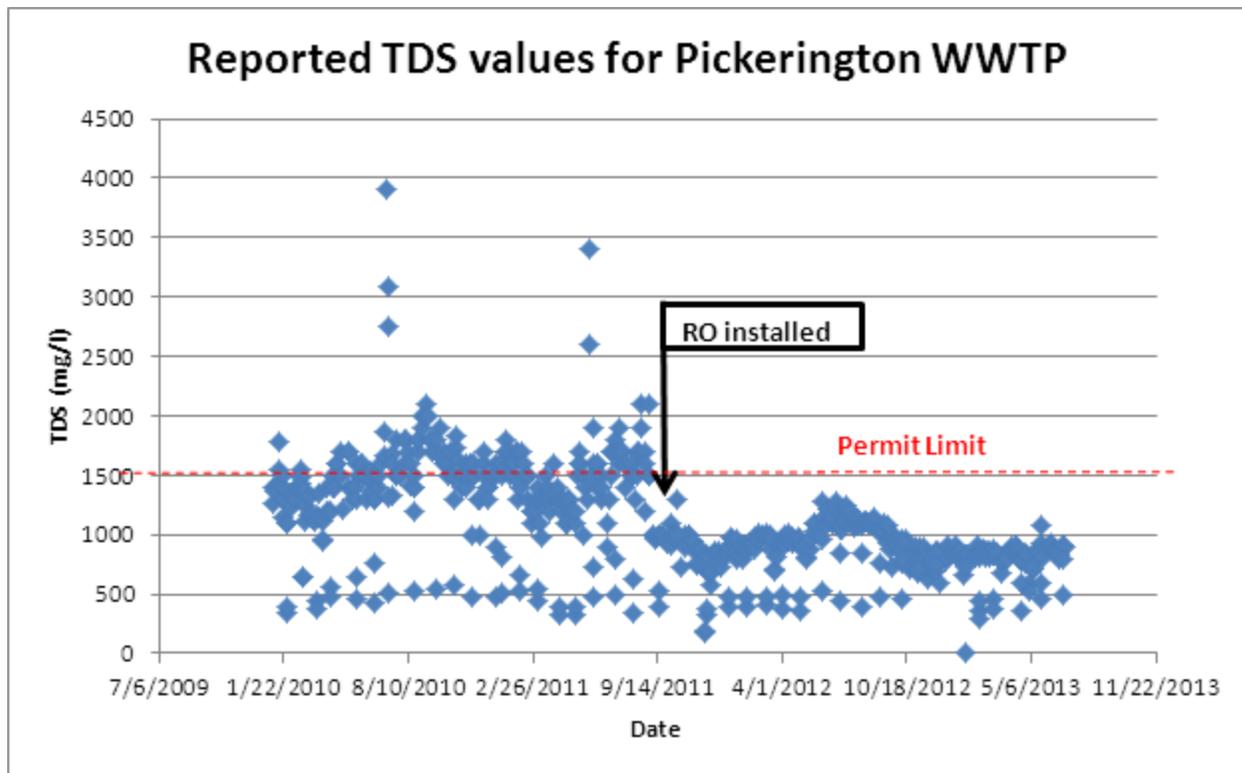
The CDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Pickerington.

First Report on Sycamore Creek 4B Demonstration (2012 Integrated Report)

The City of Pickerington replaced their ion exchange water treatment plant with a reverse osmosis water treatment plant in order to address the NPDES TDS effluent limit violations at their WWTP. Very soon after the new plant began operating, Pickerington returned to compliance with the NPDES permit conditions implementing the water quality criterion for TDS. Ohio EPA expects this to eliminate any impairment in Sycamore Creek.

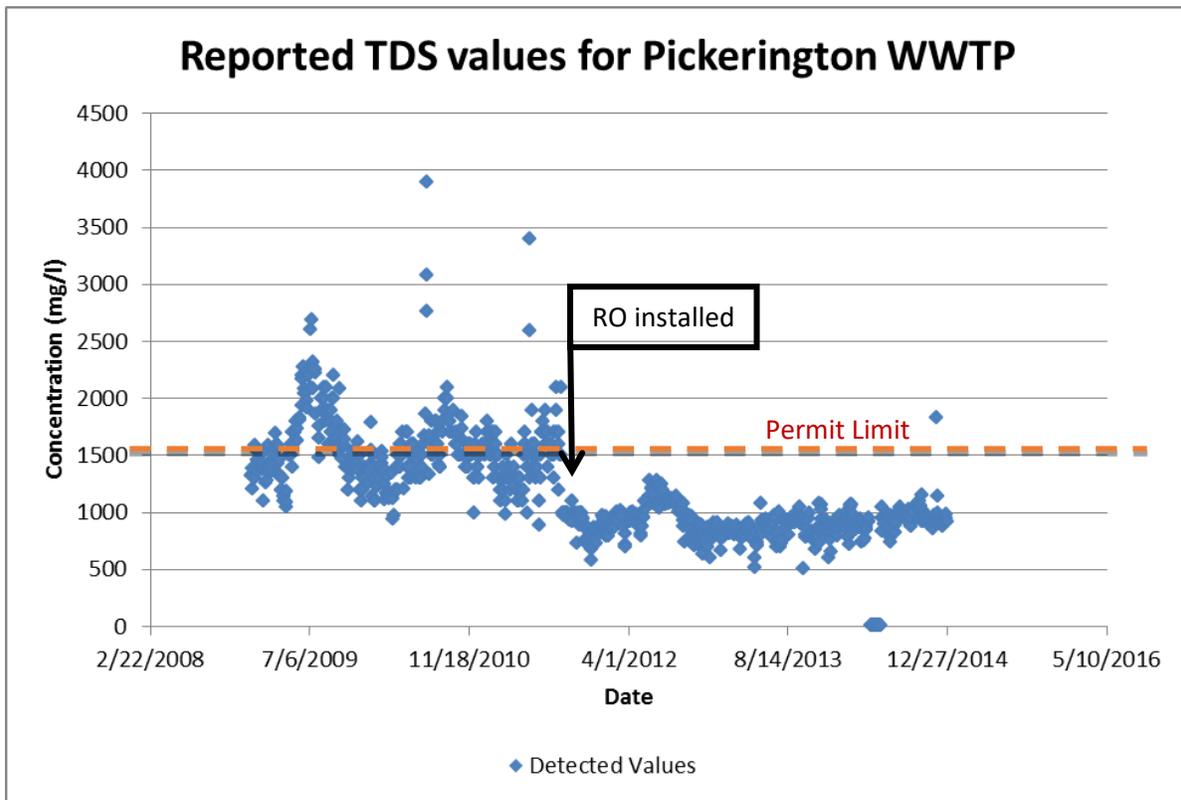
Second Report on Sycamore Creek 4B Demonstration (2014 Integrated Report)

Sycamore Creek has not been reevaluated for aquatic life use support since the *2012 Integrated Report*. However, the facility has not reported any TDS violations since the reverse osmosis system was put in place (see figure below).



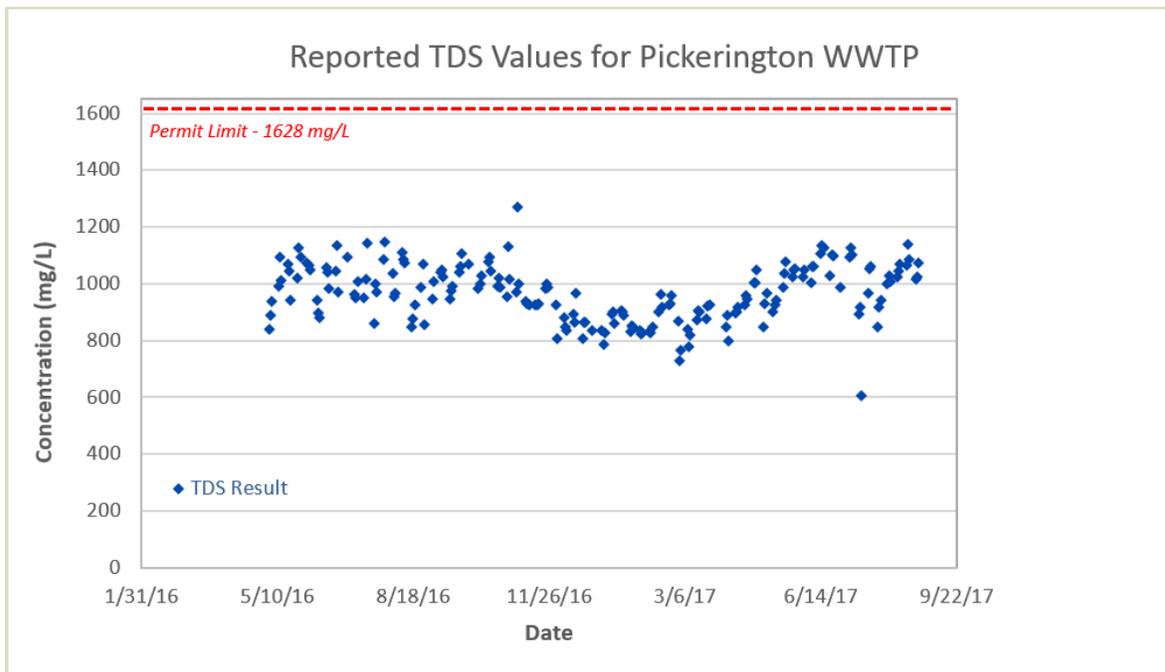
Third Report on Sycamore Creek 4B Demonstration (2016 Integrated Report)

Sycamore Creek has not been reevaluated for aquatic life use support since the *2012 Integrated Report*. However, the facility has not reported any TDS violations since the reverse osmosis (RO) system was put in place (see figure below). Pickerington's permit limit for TDS is 1,628 mg/L. On November 24, 2014, an exceedance of the permit limit for TDS was detected; however, the limit is based on a monthly average, which for November was approximately 1022 mg/L, well below the established limit. Therefore, compliance with the permit was maintained.



Fourth Report on Sycamore Creek 4B Demonstration (2018 Integrated Report)

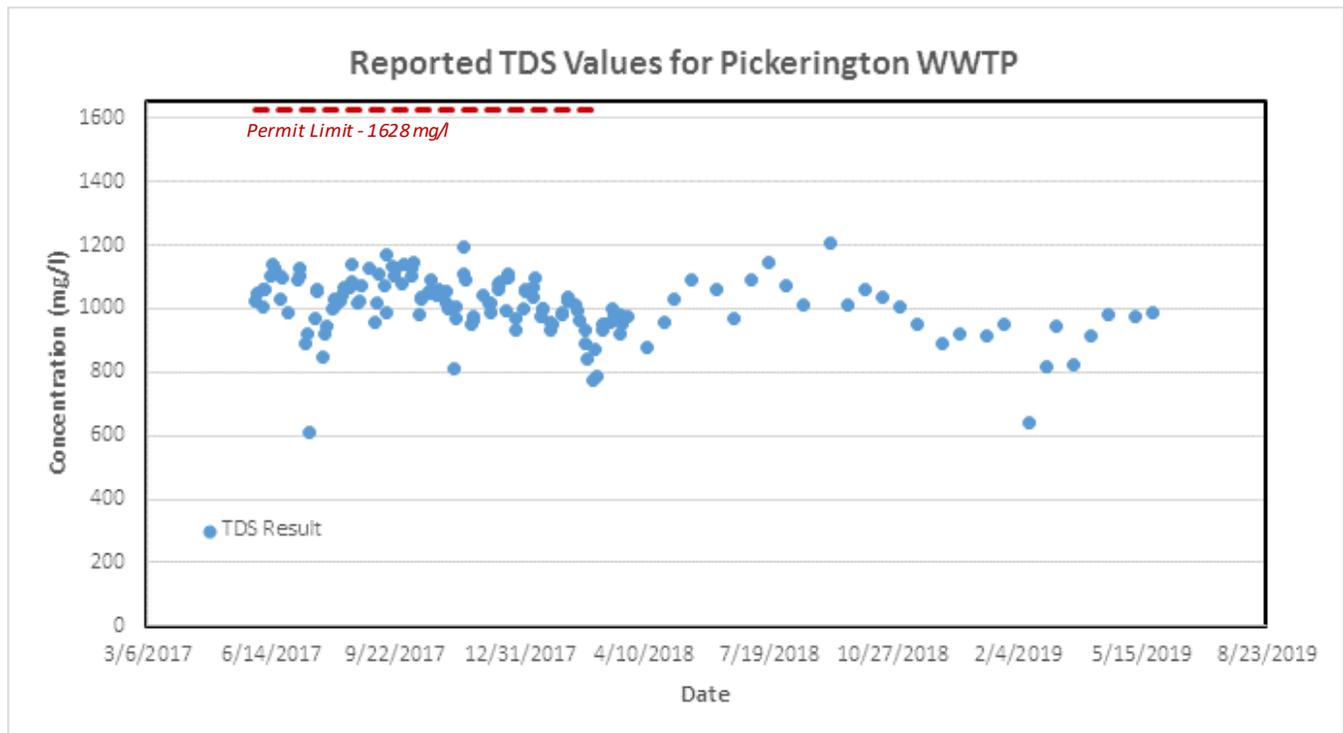
Since the Third Report on Sycamore Creek 4B Demonstration (2016 Integrated Report), there has been no exceedances of the Pickerington WWTP NPDES permit limit for total dissolved solids (TDS). Pickerington's permit limit for TDS is 1,628 mg/L. The mean concentration for TDS from May 2016 to September 2017 is 968 mg/L. Compliance with the permit is being maintained. Follow up monitoring by Ohio EPA is anticipated for the 2019 field season.



Fifth Report on Sycamore Creek 4B Demonstration (2020 Integrated Report)

Since the fourth report on Sycamore Creek 4B demonstration (2018 Integrated Report) there have been no exceedance of the Pickerington WWTP NPDES permit limit for TDS for the permit that expired in March 2017. The permit renewal effective in April 2018 contained monitor only conditions for TDS. The mean concentration for TDS from June 2016 to May 2019 is 1009 mg/l. TDS concentrations continue to be maintained at levels necessary to protect water quality for that parameter.

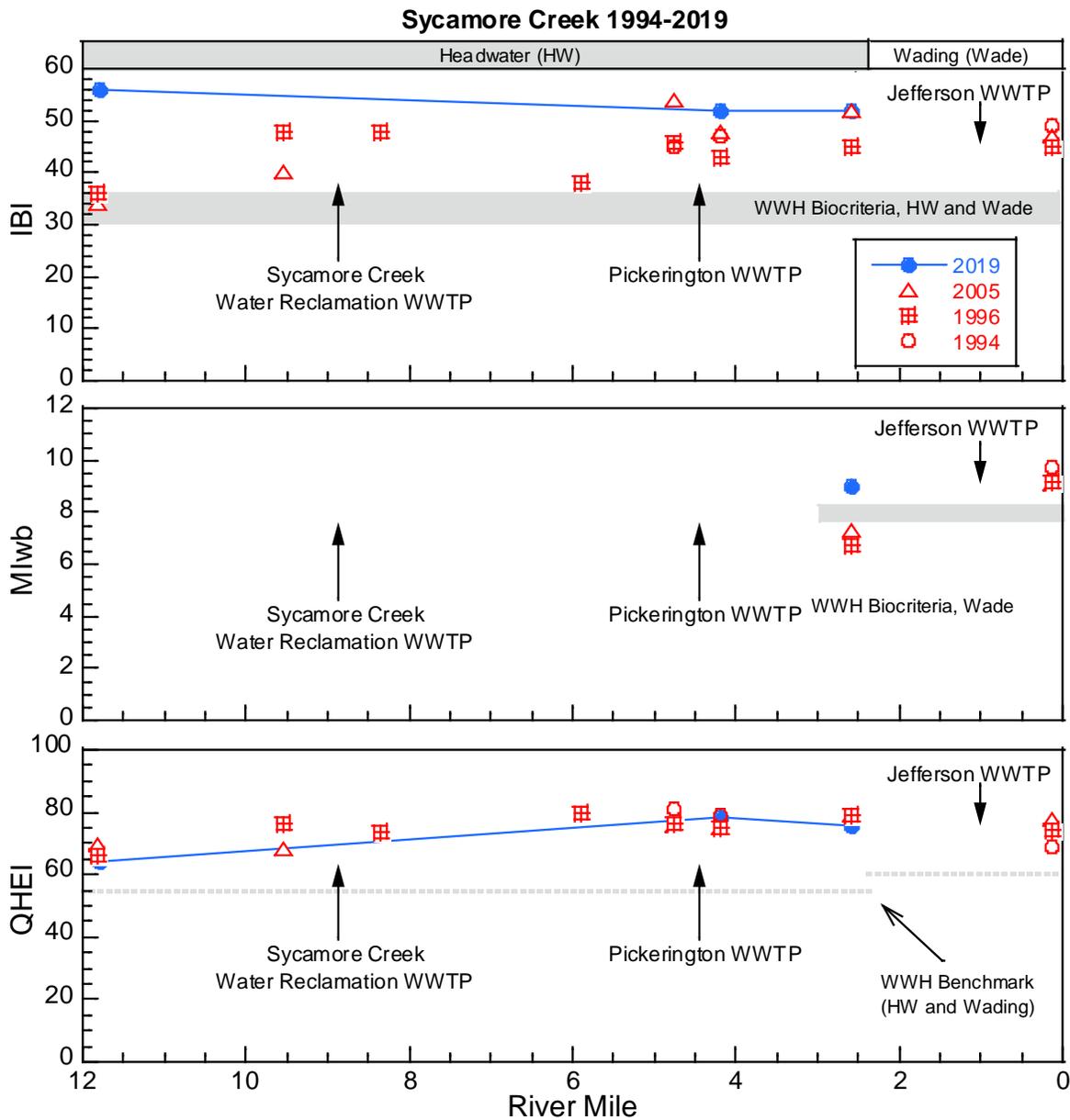
In the summer of 2019, Ohio EPA staff conducted a water quality study of Sycamore Creek to update the 4B characterization and aquatic life use attainment status. Additional details on the 2019 Sycamore Creek study may be found at epa.ohio.gov/Portals/35/lakeerie/Sycamore_Ck_QAPP_Final.pdf. The results of the study indicate that Sycamore Creek is now in full attainment as demonstrated in the following table. This closes out the 4B demonstration for TDS.



Aquatic Life Use Attainment, Sycamore Creek, 1996-2019

Station	Station Name	HUC12	RM	DA	Attain	IBI	MIWB	ICI	QHEI
Sycamore Creek 2019 (02-085-000)									
Eastern Corn Belt Plain Ecoregion (ECBP)									
V08W64	AT ST. RT. 204	05060001 17 04	11.81	4.7	Full	56	NA	G	64.3
V08S29	DST. PICKERINGTON WWTP @ HILL RD. (LOWER)	05060001 17 04	4.18	19.4	Full	52	NA	G	78.5
V08S28	DST. PICKERINGTON @ BUSEY RD.	05060001 17 04	2.60	20.5	Full	52	9.0	48	75.5
2005									
V08W64	AT ST. RT. 204	05060001 17 04	11.81	4.7	Non	34*	NA	F*	69.5
V08S41	NE OF PICKERINGTON @ REFUGEE RD.	05060001 17 04	9.55	8.7	Full	40	NA	MG	68.5
V08S30	UPST. PICKERINGTON WWTP @ HILL RD. (UPPER)	05060001 17 04	4.75	17.3	Full	54	NA	MG	76.0
V08S29	DST. PICKERINGTON WWTP @ HILL RD. (LOWER)	05060001 17 04	4.18	19.4	Partial	48	NA	LF*	75.0
V08S28	DST. PICKERINGTON @ BUSEY RD.	05060001 17 04	2.60	20.5	Partial	52	7.3*	36	79.0
V08S39	NEAR MOUTH @ BENADUM RD.	05060001 17 04	0.13	23.5	Full	47	9.1	50	77.5
1996									
V08W64	AT ST. RT. 204	05060001 17 06	11.8	4.7	Full	36ns	NA	MGns	66.5
V08S41	NE OF PICKERINGTON @ REFUGEE RD.	05060001 17 07	9.55	8.7	Full	48	NA	G	76.5
V08W63	AT STEMEN RD.	05060001 17 08	8.36	9.7	Full	48	NA	VG	73.5
200209	AT PICKERINGTON, DST SR 256	05060001 12 06	5.9	14.8	Full	38ns	NA	VG	79.5
V08S30	UPST. PICKERINGTON WWTP @ HILL RD. (UPPER)	05060001 17 10	4.75	17.3	Full	46	NA	44	76.5
V08S29	DST. PICKERINGTON WWTP @ HILL RD. (LOWER)	05060001 17 11	4.18	19.4	Full	43	NA	36	75.0
V08S28	DST. PICKERINGTON @ BUSEY RD.	05060001 17 12	2.6	20.5	Partial	45	6.7*	42	79.0
V08S39	NEAR MOUTH @ BENADUM RD.	05060001 17 13	0.13	23.5	Full	45	9.2	40	74.5
<p>ns - Nonsignificant departure from prescribed biocriterion (≤ 4 IBI or ICI units or ≤ 0.5 MIwb units)</p> <p>* - Significant departure from prescribed biocriterion (> 4 IBI or ICI units or > 0.5 MIwb units)</p> <p>ICI narrative equivalents: E - exceptional, VG - very good, G - good, MG - marginally good, F - fair (low and high), Poor - P, and VP - very poor.</p>									

Ecoregion Biocriteria: Eastern Corn Belt Plain (ECBP)			
Index - Site Type	EWB	WWB	MWB
IBI - Headwater/Wading	50	40	24
MIwb - Wading	9.4	8.3	6.2
ICI	46	36	22



Projects included in the 2014 Integrated Report

After completion of the *2012 Integrated Report* and before completion of the *2016 Integrated Report*, Ohio submitted one 4B alternative as part of an approved TMDL: Great Miami River (upper) watershed TMDL Report. Together with TMDLs approved for other impairments to the aquatic life use, the 4B work should bring the river into attainment with water quality standards.

Brandywine Creek - Great Miami River (Great Miami River (upper) Watershed)

Ohio EPA is clarifying in the 2020 IR that this 4B demonstration applies to impairments in WAU OH050800010306 Brandywine Creek - Great Miami River.

During the 2008 field survey, Ohio EPA identified that the Great Miami River at river mile 158.15 was partially supporting its warmwater habitat aquatic life use. Identified causes of impairment included habitat alteration, siltation, flow alteration, and organic enrichment/dissolved oxygen (DO). Ohio EPA

proposes that the organic enrichment/DO cause of impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below.

Additional information is available in the main text of the TMDL report and in the biological and water quality study publication (epa.ohio.gov/portals/35/documents/Upper_GMR_TSD_2008.pdf).

Identification of segment and statement of problem causing the impairment

The Great Miami River upstream of the WWTP is in partial attainment of its aquatic life use because of habitat alteration, siltation, flow alteration, and organic enrichment/DO. Organic enrichment/DO is partially attributed to an upstream WWTP at RM 158.15 – Indian Lake/Logan County (OH0036641).

Other sources include Indian Lake overflow of warm water in summer months and sediment from Cherokee Mans Run. Downstream of the WWTP, the river is sluggish from the effects of the low head dam impoundment in Quincy. This sluggish water is not allowing effective re-aeration of river water, which exacerbates the DO stresses caused by nutrient enrichment and sewage solids from the Logan County Indian Lake WWTP. The result is partial attainment downstream at Notestine Road (RM 153.45). Proper treatment of wastewater will help to alleviate the impacts to this stressed section of the Great Miami River.

The Logan County Indian Lake Sanitary Sewer District has an Infiltration/Inflow (I/I) problem in the collection system. Hydraulic surges during storm events overwhelm the collection and treatment systems causing a secondary treatment bypass. The result is the discharge of undertreated sewage with ammonia and solids entering the Great Miami River at RM 158.15, contributing to partial attainment due to low macroinvertebrate performance at Notestine Road (RM 153.45).

Description of pollution controls and how they will achieve water quality standards

On March 6, 2009 the Logan County Board of Commissioners was issued a NPDES permit number 1PK00002*KD for the discharge of treated wastewater to the Great Miami River. This permit includes a compliance schedule for the elimination of a secondary treatment system bypass. This bypass allows for the discharge of primary treated wastewater to go directly to the Great Miami River. The bypass contributes to additional organic and nutrient loadings to the river. The permit compliance schedule address both phase 1 and phase 2 projects designed to eliminate secondary treatment system bypasses at the plant. The phase 1 projects also will address several collection system overflows. The schedule requires completion of phase 1 projects by no later than July 1, 2011. The phase 2 projects are scheduled for completion by no later than July 1, 2016. On June 26, 2007 Permit to Install (PTI) 597728 was issued to the Logan County Water Pollution Control District. This PTI includes the following upgrades: a new 24" force main and lift station in the slough area; new influent fine screens; a new equalization tank (1.55 million gallons); conversion of existing primary clarifiers to equalization (0.5 million gallons); a new UV disinfection system; conversion of the anaerobic digesters to aerobic digester; and the addition of a new belt press and septage receiving station. The majority of the phase 1 projects were completed in early 2010. With the completion of this work the number of bypasses and collection system overflows has been reduced significantly. This will result in a reduction of loadings to the Great Miami River. With the completion of the phase 2 upgrades, all discharges from the plant will need to meet the water quality standards. This should eliminate any water quality impacts downstream resulting from treatment plant discharges.

Aquatic life use was assessed during the summer of 2008 while the WWTP facility was undergoing construction improvements (entitled Phase I). To address one of the causes of impairment, discharge monitoring report (DMR) data and a violations history from this facility were explored for any recognizable

changes in performance before and after completion of Phase I. Other causes and sources of impairment (i.e., siltation, habitat alteration) are addressed in the TMDL project report under loading development.

Phase I construction was completed in late December 2009. The quantitative analysis contained herein contrasts the Indian Lake WWTP performance prior to (January 2005 to December 2009) and following (January 2010 to May 2011) completion of Phase I construction. To summarize, the comparison shows the following changes:

- Reduction in nutrient concentrations for final outfall (station 001) based on review of total phosphorus, ammonia, and nitrite/nitrate effluent data;
- Increase in influent (station 601) concentration of carbonaceous BOD (CBOD) and total suspended solids (TSS);
- Decrease in TSS spikes from final outfall (station 001);
- Reduction in number of bypass occurrences around secondary treatment (station 602); and
- Reduction in number of limit violations (TSS, ammonia, and pH) for final outfall (station 001).

While the improvements in effluent quality and WWTP operations are clearly manifest in 2010, they are somewhat confounded in 2011 due to anomalous meteorological and hydrological conditions within February through May. The upper GMR basin received considerable rainfall and experienced correspondingly high stream flow during late winter to mid spring 2011. Figure E-1 shows a frequency distribution of flow magnitude by percent exceedance for the GMR at Sidney OH for a record of over 25 years of daily flow. This gage is located 28 miles (river miles) downstream of the WWTP outfall. Flows during this period were consistently in the high percentile of non-exceedance. Flow produced from these rain events were exceeded 15 percent or lower over time (or *not* exceeded 85 percent or higher over time). Hence, some of unexpected results (discussed below by topic) following completion of Phase I construction can be explained by these anomalous high flows experienced within the WWTP collection area.

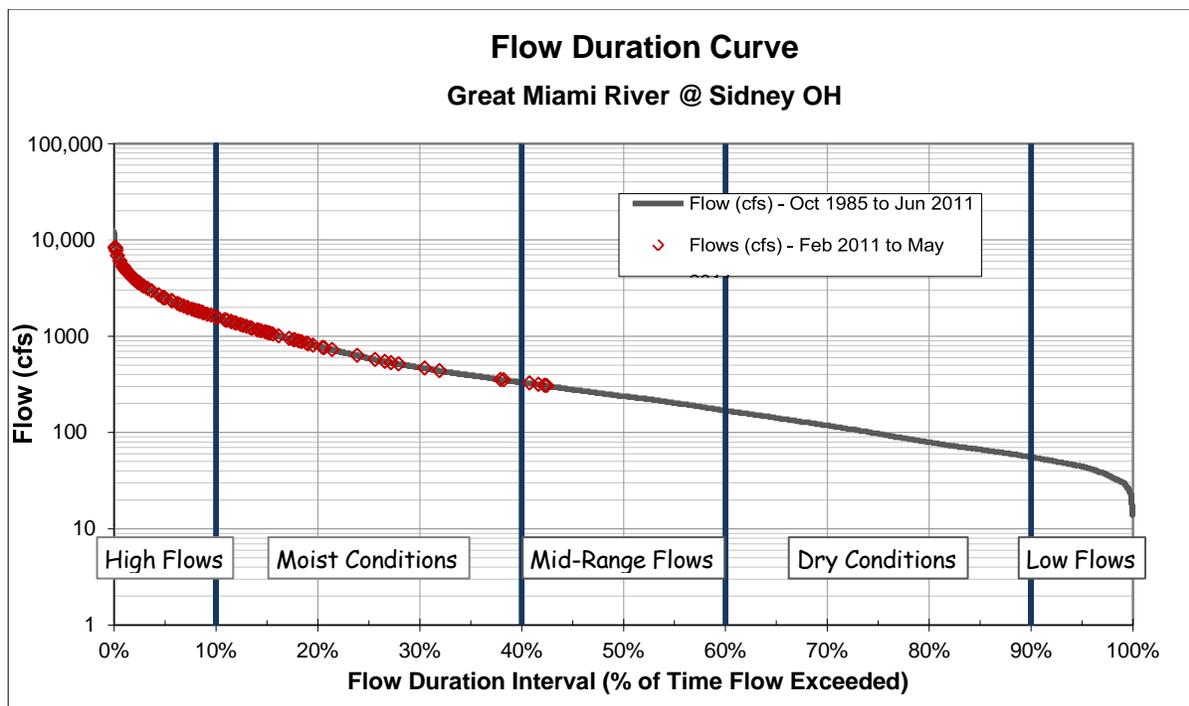


Figure E-1 Flow duration curve for data collected at USGS automatic gauge 03261500 (Great Miami River at Sidney OH) for the period October 1985 through June 2011. Flows during 2011 that occurred between February 16 and May 31 are highlighted in red. All values reported as average daily flow in cubic feet per second (cfs).

Nutrient Loading (Station 001)

When examining loadings for total phosphorus and ammonia from the final outfall, there is a progressive decline from 2005 to 2010 for both summer season (Figure E-2) and annual (Figure E-3) compilations. However, mean daily loadings increased in 2011 (annual compilation) for total phosphorus but not for ammonia (Figure E-3). For nitrite and nitrate effluent loadings, there was no consistent decline in magnitude; though for the 2009 and 2010 summer season, magnitudes were considerably lower than in the previous four years (2005-2008) (Figure E-2). This decline was also apparent for annual nitrite and nitrate loadings – 2009 to 2011 was noticeably lower than in the 2005- 2008 period (Figure E-3).

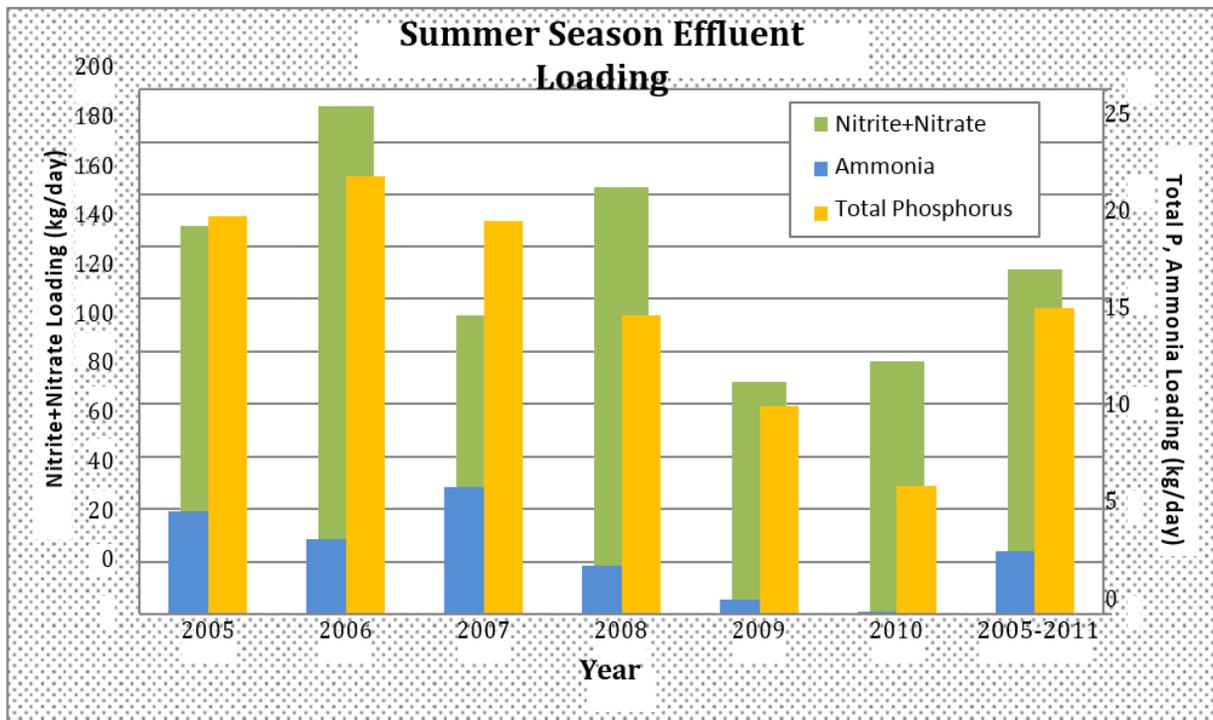


Figure E-2 — Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for summer season (June to September) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven-year summer season mean loading is also shown.

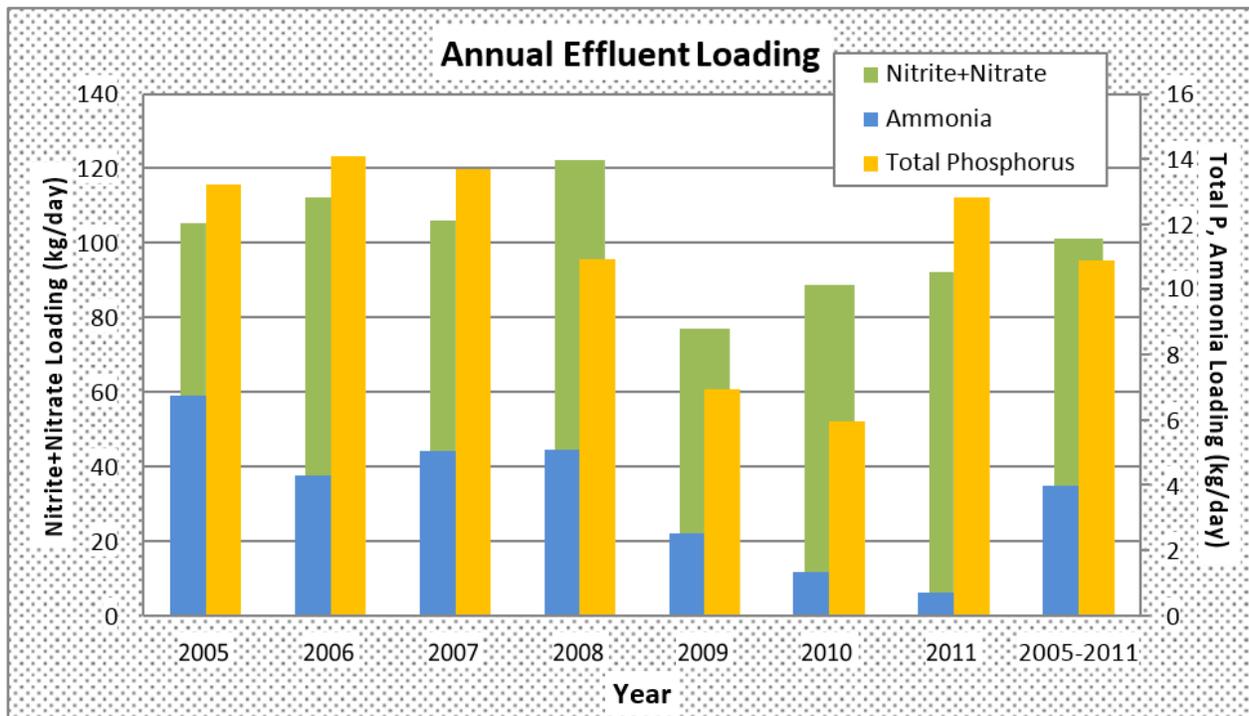


Figure E-3 — Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for annual (January to December) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven-year annual mean loading is also shown.

Influent Concentration (Station 601)

Concentrations of 5-day carbonaceous BOD (CBOD5) and total suspended solids (TSS) were examined for the influent station (station 601) to Indian Lake WWTP. Figure E-4 (summer) and Figure E-5 (annual) are included to show mean concentrations by year and overall for both CBOD5 and TSS. The overall (2005-2011) mean concentration is shown as a seven-year “normal”. Concentrations of influent TSS increased markedly in 2009, and subsequently in 2010 and 2011, to reflect improved changes in septage receiving (from HSTS). A reconfigured influent screening system changed the location of influent monitoring to now measure 100 percent of incoming septage.

The increased concentration seen in 2010 (summer and annual) and 2011 (annual only) compared to the 2005-2008 period can further be explained by completion of Phase I improvements on the wastewater *collection system*. The resultant increase in concentration for both of these parameters suggests improved capture of waste from the collection system – there is less dilution flow from I/I problems and reduced storm water overflow from a slough area into the wastewater stream.

The increasing multi-year trend in influent concentration for both TSS and CBOD5 are further supported by Figure E-6 and Figure E-7, respectively, which show a time series with a 60-day running average and a large gain in the spring of 2009.

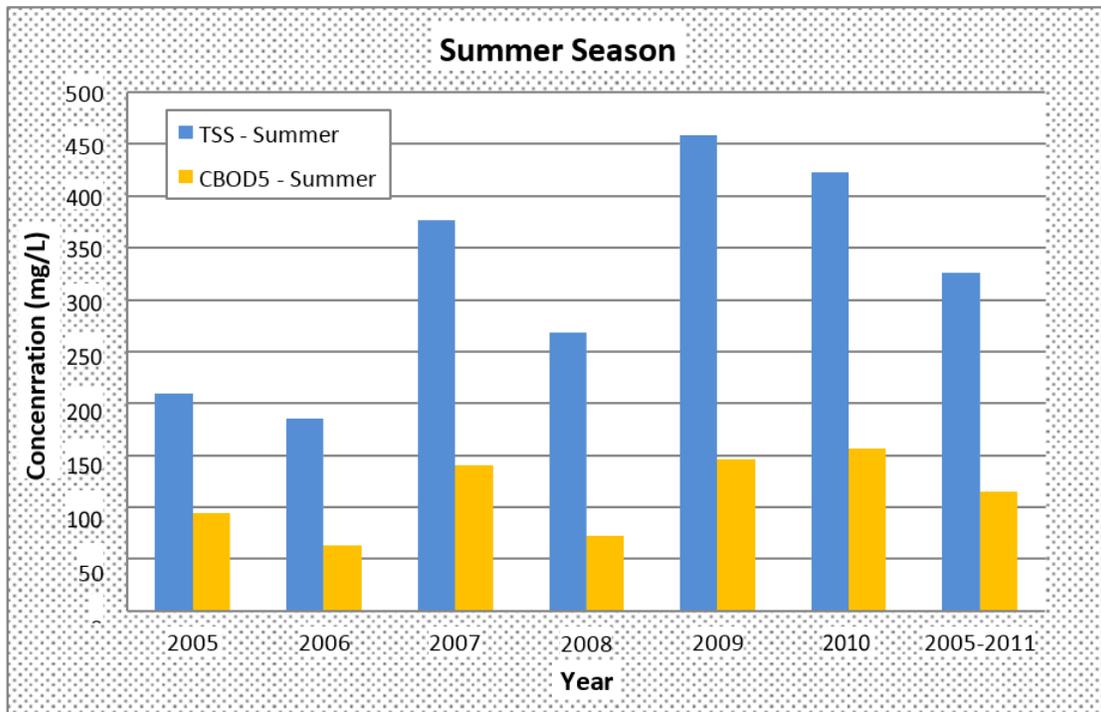


Figure E-4 — Mean concentration (in mg/L) of CBOD 5-day and TSS by year for summer season (June to September) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year summer season mean concentration is also shown.

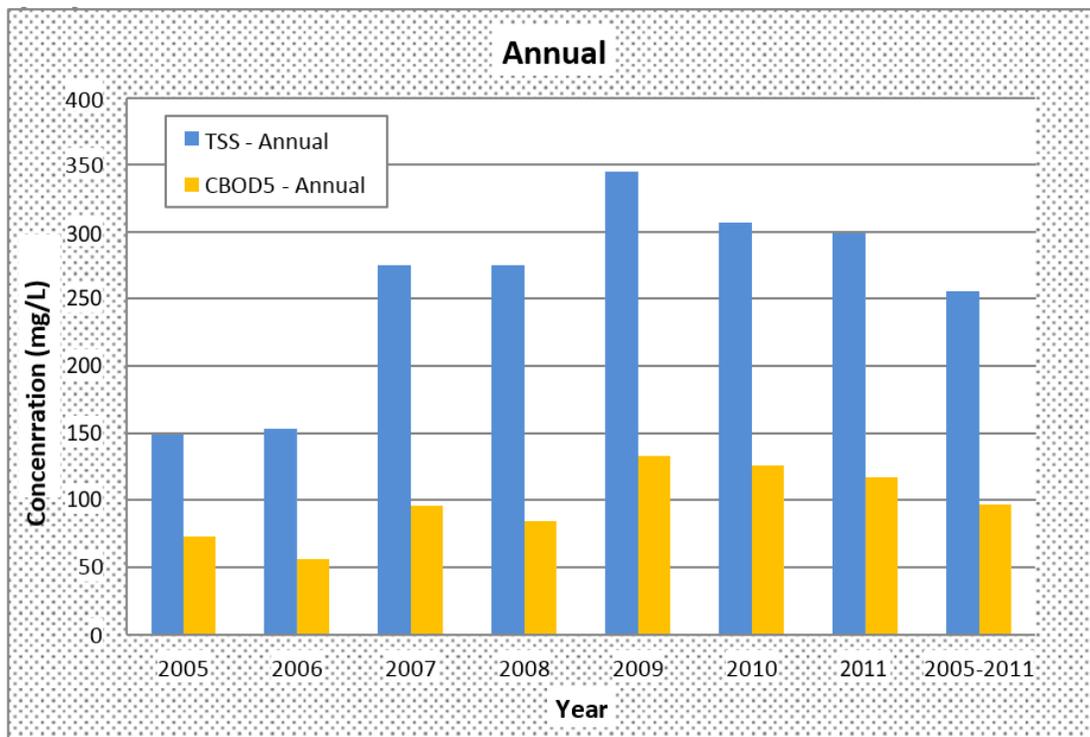


Figure E-5 — Mean concentration (in mg/L) of CBOD 5-day and TSS by year for annual (January to December) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year annual mean concentration is also shown.

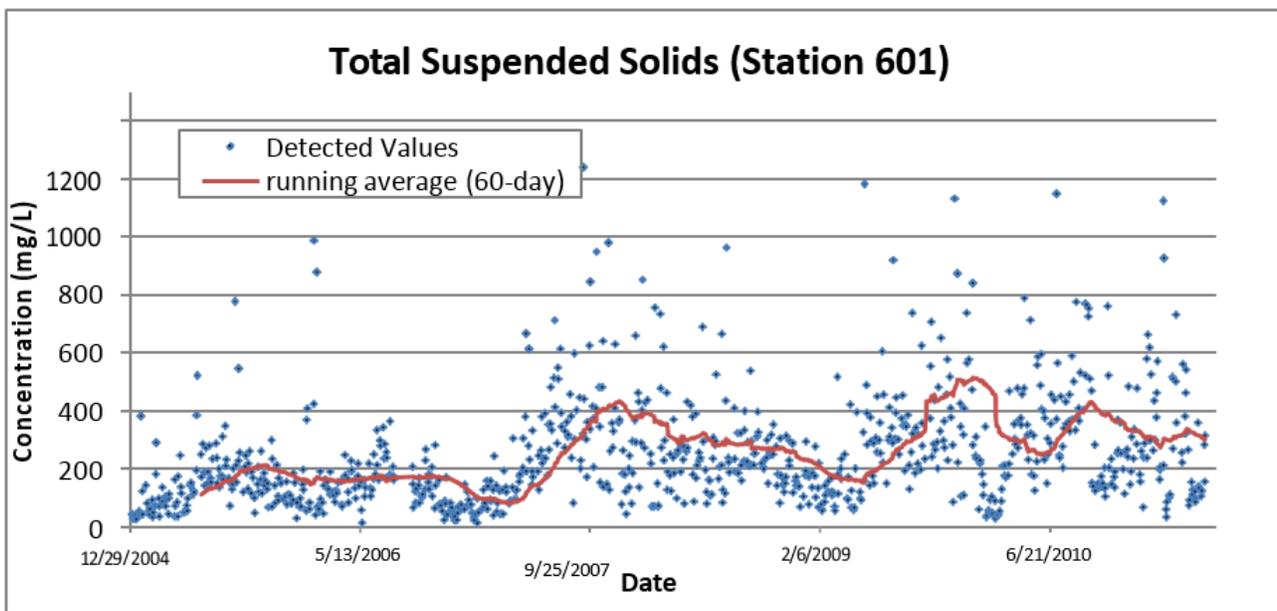


Figure E-6 — Time series of TSS from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60-day running average was also computed and overlaid (solid red line) on the individual observations.

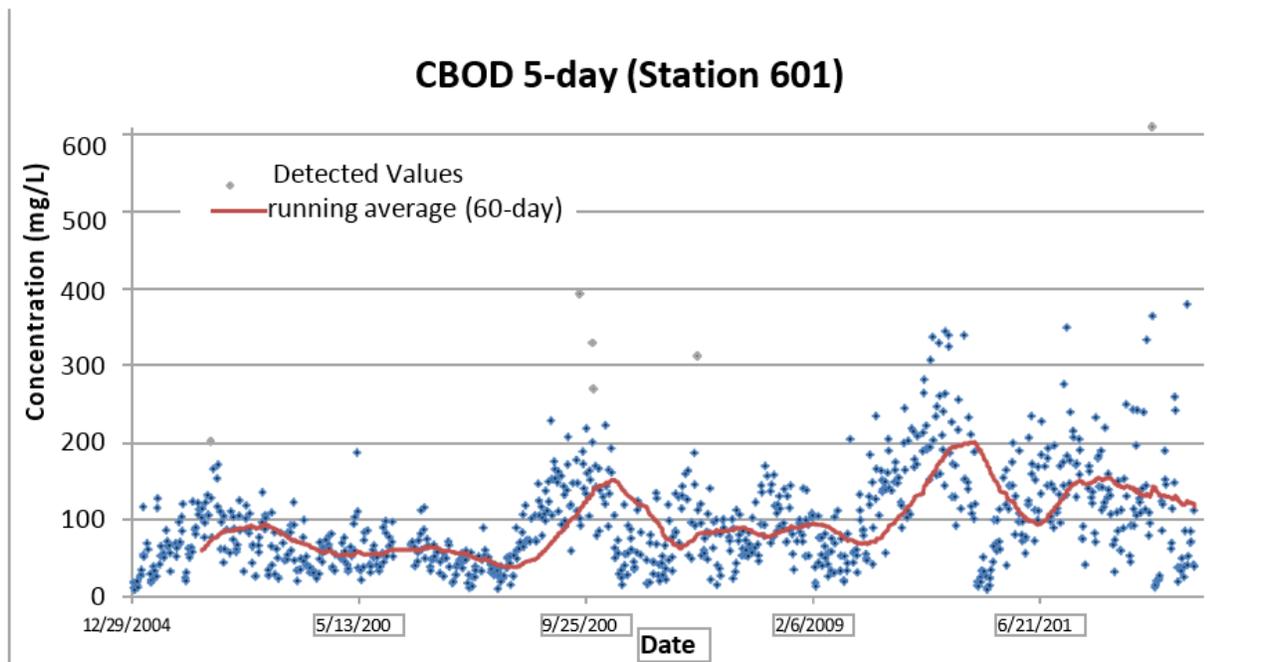


Figure E-7 — Time series of CBOD5 from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60-day running average was also computed and overlaid (solid red line) on the individual observations.

Total Suspended Solids – Peak Events (Station 001)

A peak event is a high loading event and is defined here as a daily TSS load that exceeds 500 kg/day. The TSS permit limit for station 001 for this facility is 522 kg/day (weekly or average criterion). There were 34 of these events between 2005 and 2009 (Figure E-8). Performance following Phase I completion showed no high loading events for all 2010, and for those that occurred in 2011 – 6 of 7 events occurred in early March 2011.

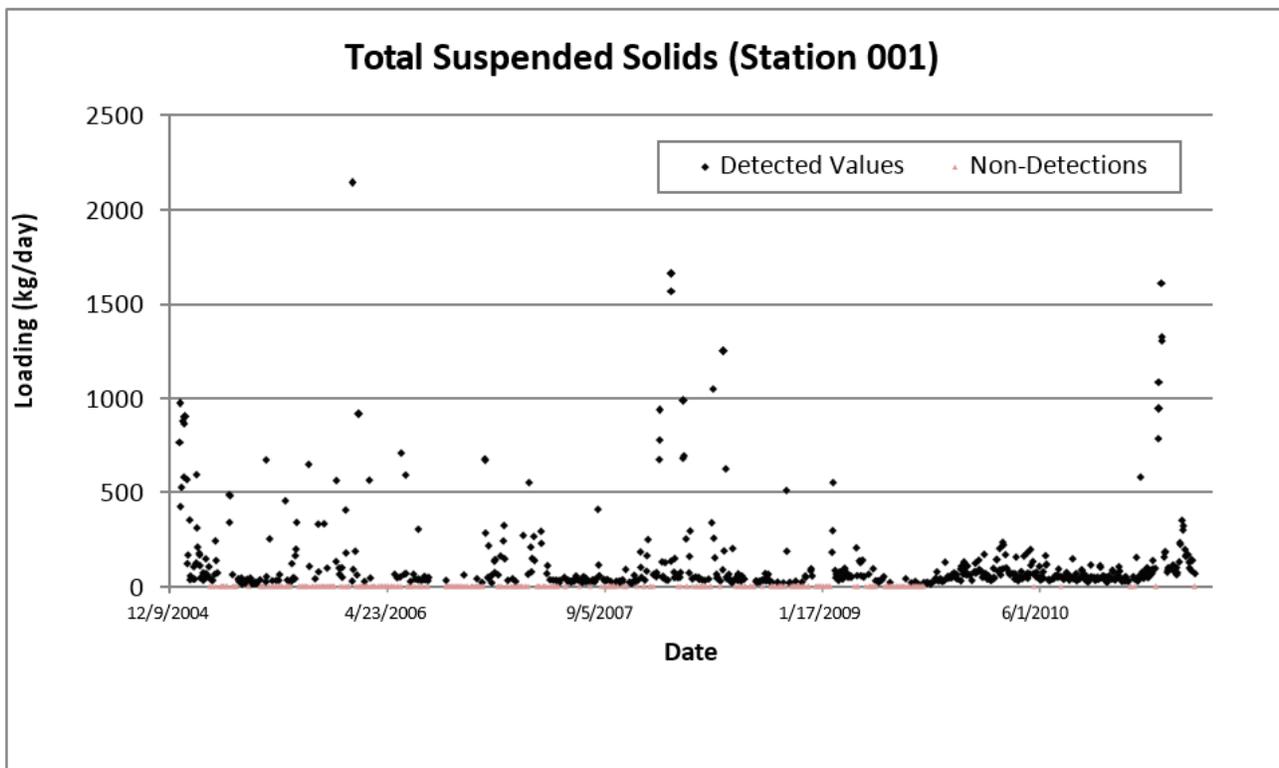


Figure E-8 — Time series of daily total suspended solid loads (kg/day) for Indian Lake WWTP for station 001 for the period January 2005 to May 2011.

Bypass Occurrence (Station 602)

Indian Lake WWTP bypass information such as number of occurrences per year and total and average volume of flow per year was examined and showed a marked decrease once Phase I was completed (Table E-1). A bypass event avoids secondary wastewater treatment and poses potentially significant harm to the receiving water. However, once into 2011 the number of bypass occurrences increased to 11 but all 11 events occurred after 2/17/2011 when the GMR basin, and corresponding WWTP collection area, experienced high percentile flood flows (Figure E-1). DMR data was only available to 5/27/2011 which is still within this identified high flow period. The sharp increase in 2011 also reflects the treatment plant's elimination of several bypasses *within the collection system*. Thus, all the flow that enters the system now makes it completely to the plant. The new expanded equalization system at the WWTP, as part of Phase I construction, will help capture more material before it is bypassed *at the plant*.

Table E-1 Summary of bypass information for Indian Lake WWTP (station 602) for the period 8/1/2006 to 5/26/2011.

Year	Number of Occurrences	Total Volume (MG)	Avg Volume per Occurrence (MG)
2006	9	22.4	2.49
2007	20	72.8	3.64
2008	22	84.8	3.85
2009	22	29.7	1.35
2010	6	12.1	2.02
2011 (5 months)	11	179.6	16.3

Limit Violations (Station 001)

A review of violations of permit limits for Indian Lake WWTP was made and is summarized in Table E-2 below. Both concentration and loading limit violations were considered and for both average (monthly) and maximum (weekly) statistical periods. While found in the review, violations for total chlorine residual were omitted because of insignificance to the impairment cause (DO/organic enrichment).

Since completion of Phase I, there was a considerable reduction in number of violations (Table E-2). The four TSS violation events that occurred after Phase I completion all occurred in early March 2011.

Table E-2 — Summary of limit violations for Indian Lake WWTP (station 001) for the period January 2005 to May 2011. Violations for total chlorine residual are omitted.

Parameter (code)	Number of Limit Violations	
	2005 - 2009	2010 - May 2011
TSS (00530)	8	4
pH (61942)	1	0
ammonia (00610)	7	0

Conclusion

The partial impairment of aquatic-life use that exists at RM 153.45 (Notestine Rd) of the GMR (12-digit HUC 05080001-03-02) is caused by multiple stressors and sources. While the predominant stresses are habitat alteration and siltation – a low gradient river system choked by sediment, a secondary stress is organic enrichment and low DO produced by an upstream POTW. The Agency aquatic-life use assessment was conducted and completed in 2008 but the POTW was in the midst of constructing improvements to minimize their bypass (of secondary treatment) occurrence and volume. The first phase (Phase I) of construction was completed in late December 2009. The above analysis described effluent quality and behavior by comparing results prior to and following this completion date. Though WWTP performance was confounded by high flows in early 2011 (February through May), 2010 performance was considerably better than that observed in the prior four years (2005-2008). Phase II construction will begin soon and address treatment levels needed to meet permit and water quality standards. The goal is that completion of Phase I and Phase II construction will, with high likelihood, remove the stressor of impairment associated with organic enrichment and low dissolved oxygen.

An estimate or projection of the time when WQS will be met

The June 2011 NPDES permit Part I, C-Schedule of Compliance paragraph f, gives April 1, 2017 as the date the Indian Lake Water Pollution Control Facility wastewater works will attain final compliance. Re-evaluation of biological water quality standards shall begin no earlier than the field season of 2018.

Schedule for implementing pollution controls

On July 13, 2011, the Logan County Board of Commissioners were issued NPDES number 1PK00002*LD. This permit contains a compliance schedule for completion of phase 2 projects that will address secondary treatment system bypassing at the plant. The permit schedule includes the following compliance dates:

- Submit an approvable "No Feasible Alternatives Analysis by no later than October 1, 2012.
- Submit a general plan for upgrades design to eliminate the secondary bypass by no later than April 1, 2013.
- Submit a Permit to Install for treatment system upgrades by no later than April 1, 2014.
- Complete treatment system upgrades by no later than July 1, 2016.
- Attain final compliance with NPDES permit limits and conditions by no later than April 1, 2017.

With the completion of the phase 2 projects, the Logan County Water Pollution Control District Indian Lake plant should be in compliance with their NPDES permit conditions, thus eliminating any effluent- derived water quality impacts downstream.

Monitoring plan to track effectiveness of pollution controls

As part of their NPDES permit, Indian Lake Water Pollution Control Facility wastewater works measures and reports plant bypasses at station 602 monthly. In addition, outfall 001 will report TSS, cBOD₅, phosphorus, ammonia and nitrate/nitrite discharges to the Great Miami River monthly. Sampling is done three times a week for TSS, CBOD₅, and NH₃. Phosphorus and NO₂/NO₃ will be sampled once a week. SSO discharges will be reported within 24 hours of the occurrence. The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Inspection of the facility will be done every two years starting in 2012.

No earlier than the field season of 2018, Ohio EPA will sample the impaired section of Great Miami River (RM 153.45, Notestine Rd.) for chemistry, fish and macroinvertebrates. The chemistry will be sampled at one location and five sampling events will be completed. The fish will be sampled at one location with two passes each. The macroinvertebrates will be evaluated on one sampling event. This work will follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. The sampling will take place during the summer/fall sampling season with analysis by Ohio EPA's laboratory and reporting to Southwest District Office.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Indian Lake.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

First Report on Great Miami River 4B Demonstration (2014 Integrated Report)

The facility completed a Phase One study / upgrade (\$ 10,000,000) in 2011. Phase One projects included new influent screens, two MGD in equalization, a new express force main and lift station, and upgrades to the solids handling systems (belt press and septage receiving). The sewer district reported seven SSOs and several secondary bypasses in 2013.

In addition, the sewer district has hired two consultants to work on aspects of the project. The district has begun a Capacity Management Operations and Maintenance program to oversee the collection system. New sewer use regulations have been implemented. In 2012 the district installed rain gauges and 18 flow meters. A model of the sewer is being developed. As part of the phase 2 work, the district is looking at treatment plant alternatives, maximizing existing treatment systems, and high rate treatment. The district is on schedule to meet the next deadline.

Second Report on Great Miami River 4B Demonstration (2016 Integrated Report)

The Indian Lake Water Pollution Control District operates a 4.6 MGD WWTP that discharges directly to the Great Miami River. The plant serves the surrounding lake community as well as the communities of Lakeview, Russells Point, Belle Center and Huntsville. Excessive I/I into the collection system has contributed to collection system bypasses and blending at the plant (blended flows are screened and disinfected before recombining with the final effluent).

In response the district performed a No Feasible Alternatives Analysis (2006) of both the collection and treatment systems. An adaptive management approach was selected. A two-phase schedule was developed. Phase I work was completed in 2010. This phase included upgrades to the influent pump station; construction of new equalization basins (1.5 million gallons); installation of UV disinfection; updates to the bio solids dewatering equipment; and construction of a new pump station and force main was added to the Slough area.

As part of the Phase II work, the district is working on expansion of peak secondary and disinfection treatment capacities (peak 6.0 MGD plus). A PTI application for UV system upgrades was submitted in September 2014. The district is upgrading the final clarifier weirs, baffles and mechanisms to allow for treatment of peak flows. With the completion of this work the amount of flow that receives complete secondary treatment will be significantly increased.

The schedule for implementation of the No Feasible Alternatives Analysis Phase II projects has been inserted in the district's NPDES permit. As part of an adaptive approach the district is evaluating the effectiveness of infiltration removal versus additional treatment. The district believes if I/I into the system can be reduced by 30 percent, elimination of all wet weather overflows and bypasses will occur. The NPDES permit schedule includes the following dates:

- Study (model) and complete enough I/I projects to get to a 10 percent I/I reduction. (September 1, 2021)
- Study (model) and complete enough I/I projects to get to a 20 percent I/I reduction. (September 1, 2027)
- Study (model) and complete enough I/I projects to get to a 30 percent I/I reduction. (September 1, 2032)

With the completion of the various projects the impacts to the receiving stream should be diminished. Through the adaptive approach the district will be able to evaluate and prioritize projects that will provide the biggest improvements in the shortest time.

Third Report on Great Miami River 4B Demonstration (2018 Integrated Report)

On Sept. 1, 2016, construction was completed on the WWTP upgrade that included: new aeration blowers; final clarifier drives, launders, collectors and weirs; UV disinfection up to 6 MGD; and influent monitoring. This upgrade was part of the Logan County's Phase II work. Since construction was completed, the Logan County Commissioners have reported ten dissolved oxygen violations. They attributed these violations to short-term operational/equipment issues rather than infrastructure deficiencies.

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
November 2016	Dissolved Oxygen	1D Conc	5.0	3.4	11/10/2016
November 2016	Dissolved Oxygen	1D Conc	5.0	4.9	11/28/2016
April 2017	Dissolved Oxygen	1D Conc	5.0	4.5	4/12/2017
May 2017	Dissolved Oxygen	1D Conc	5.0	4.6	5/22/2017
July 2017	Dissolved Oxygen	1D Conc	5.0	4.5	7/5/2017
July 2017	Dissolved Oxygen	1D Conc	5.0	4.3	7/10/2017
July 2017	pH, Minimum	1D Conc	6.5	6.19	7/6/2017
July 2017	E. coli	7D Conc	284	840.046	7/8/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.7	8/2/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	3.7	8/3/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.7	8/16/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.9	8/23/2017

In accordance with the NPDES permit compliance schedule, the county is still on track for eliminating wet weather overflows and bypasses through an adaptive, inflow and infiltration reduction approach.

Fourth Report on Great Miami River 4B Demonstration (2020 Integrated Report)

The Indian Lake Water Pollution Control District has continued to work on limiting wet weather overflows and bypasses. In 2018, the District worked on I/I issues, sealing manholes and conducting enforcement actions which included termination of service if abatement wasn't performed. Approximately 18 portable sewer flow meters and 6 rain gauges have been deployed through the district to help contractors develop hydraulic models so areas can be identified to devote I/I reduction resources. The District has also started evaluating flows from satellite collection systems which are believed to have I/I issues. No dissolved oxygen violations have been reported since November 2017.

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
September 2017	Dissolved Oxygen	1D Conc	5.0	4.8	9/5/2017
September 2017	Dissolved Oxygen	1D Conc	5.0	4.4	9/21/2017
October 2017	Dissolved Oxygen	1D Conc	5.0	4.4	10/27/2017
October 2017	pH, Minimum	1D Conc	6.5	6.49	10/12/2017
November 2017	Dissolved Oxygen	1D Conc	5.0	4.6	11/29/2017
June 2018	E. coli	7D Conc	284	1507.53	6/22/2018
March 2019	Total Suspended Solids	7D Qty	783	852.639	3/8/2019