Appendix

E

CATEGORY 4B DEMONSTRATION:

INDIAN LAKE WASTEWATER TREATMENT PLANT

GREAT MIAMI RIVER (UPPER) WATERSHED

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 (http://www.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 dissolved oxygen (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 and 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 158.14, 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 National Pollutant Discharge Elimination System (NPDES) permit number 1PK00002*KD for the discharge of treated waste water 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 waste water 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 competed 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:

1) Reduction in nutrient concentrations for final outfall (station 001) based on review of total phosphorus, ammonia, and nitrite/nitrate effluent data;
2) Increase in influent (station 601) concentration of carbonaceous BOD (CBOD) and total suspended solids (TSS);
3) Decrease in TSS spikes from final outfall (station 001);
4) Reduction in number of bypass occurrences around secondary treatment (station 602); and
5) 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.

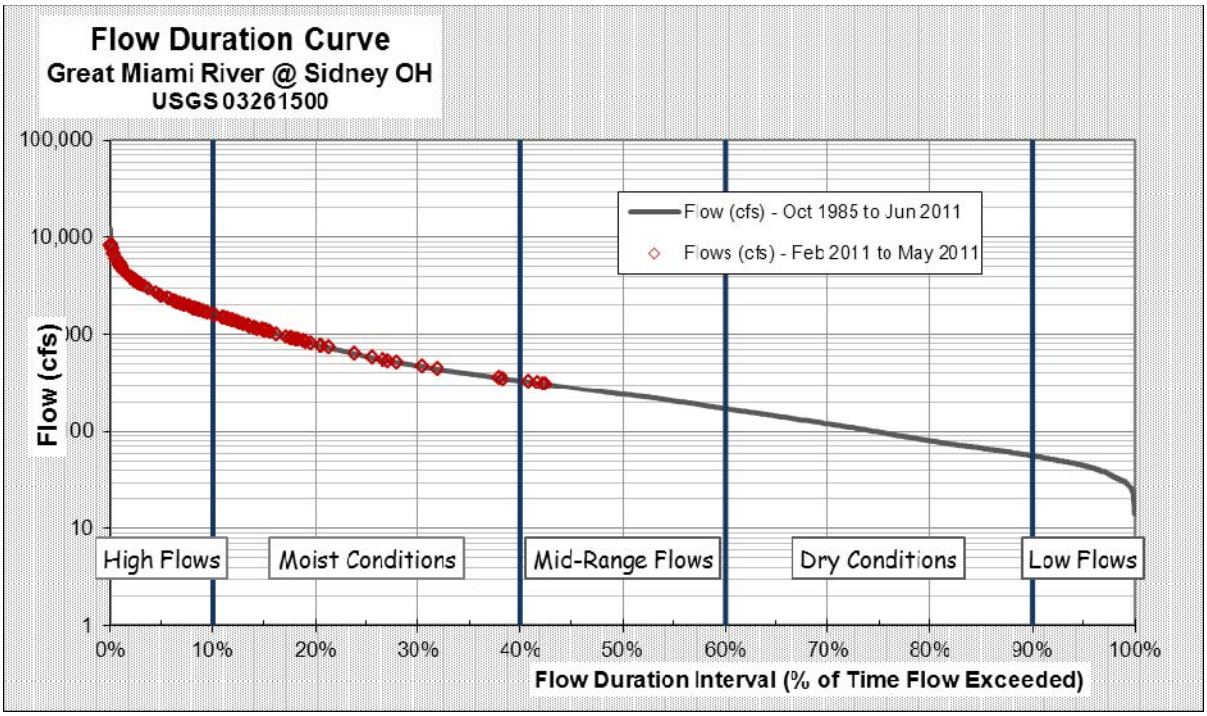

Figure E-1. Flow duration curve for data collected at USGS automatic gauge 03261500 (Great Miami River at Sidney OH) for the period October 1985 through June 2011. Flows during 2011 that occurred between February 16 and May 31 are highlighted in red. All values reported as average daily flow in cubic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

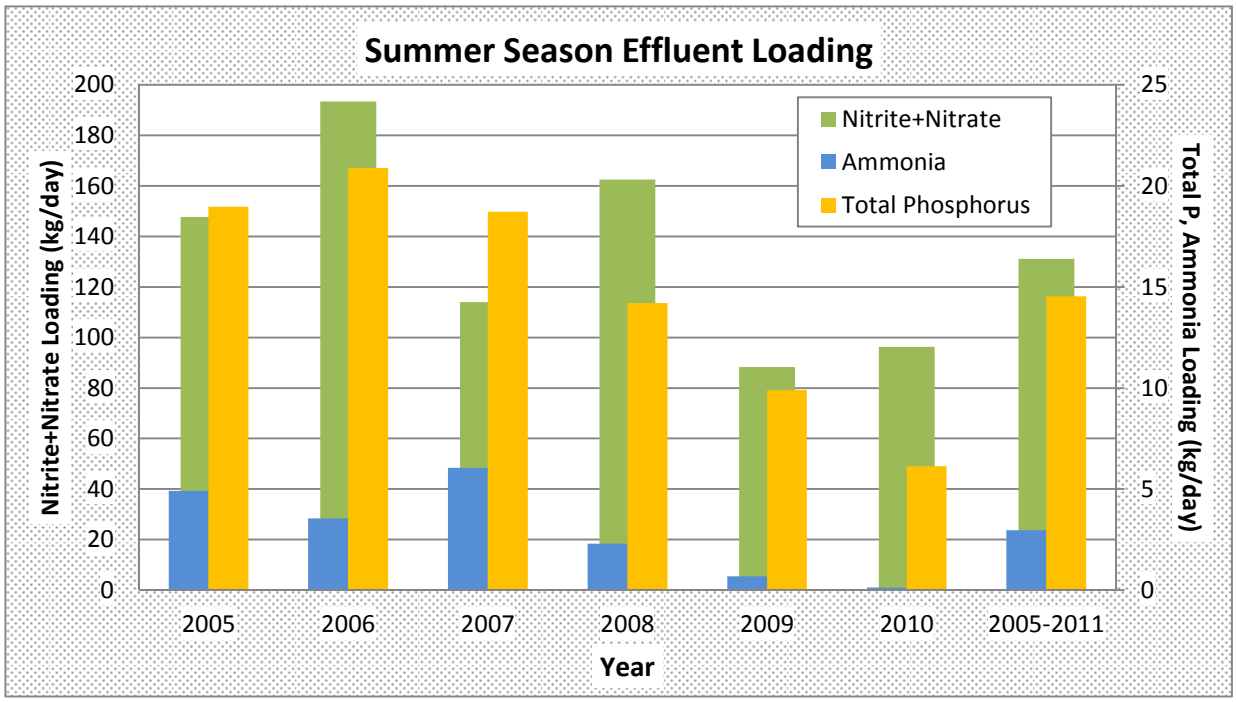

Figure E-2. Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for summer season (June to September) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven-year summer season mean loading is also shown.

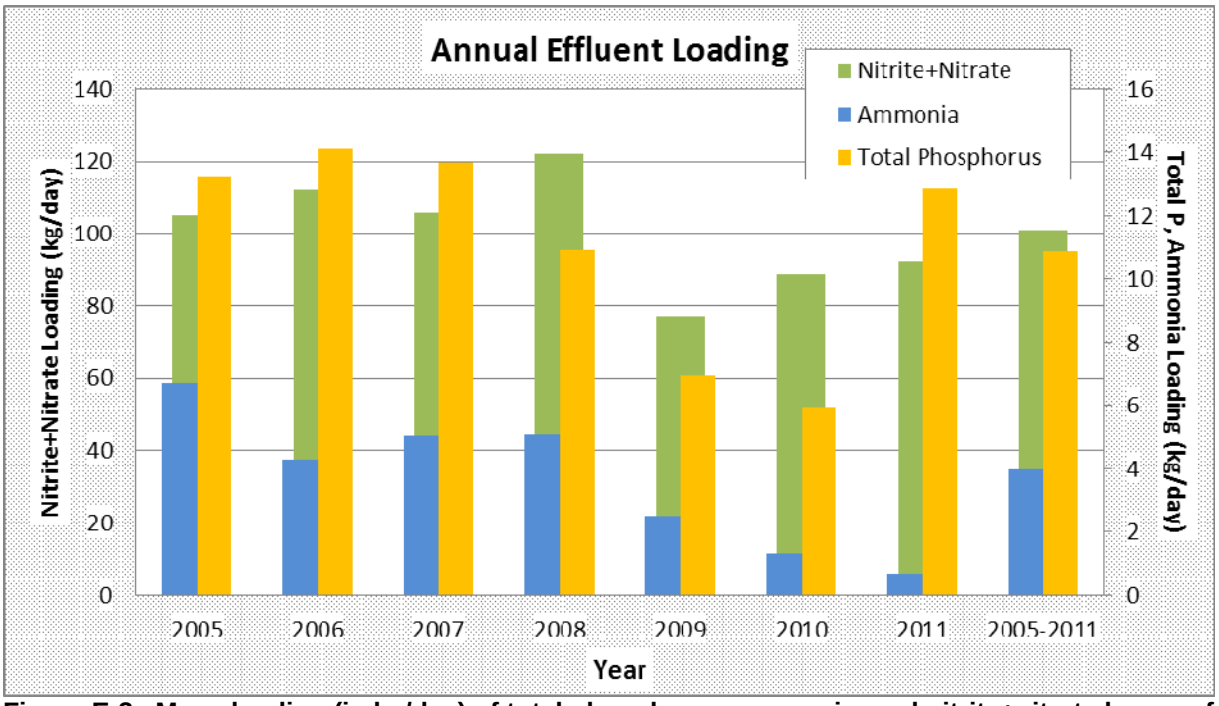

Figure E-3. Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for annual (January to December) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven-year annual mean loading is also shown.

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. Figures E-4 (summer) and 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 of 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 infiltration and inflow 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 Figures E-6 and E-7, respectively, which show a time series with a 60-day running average and a large gain in the spring of 2009.

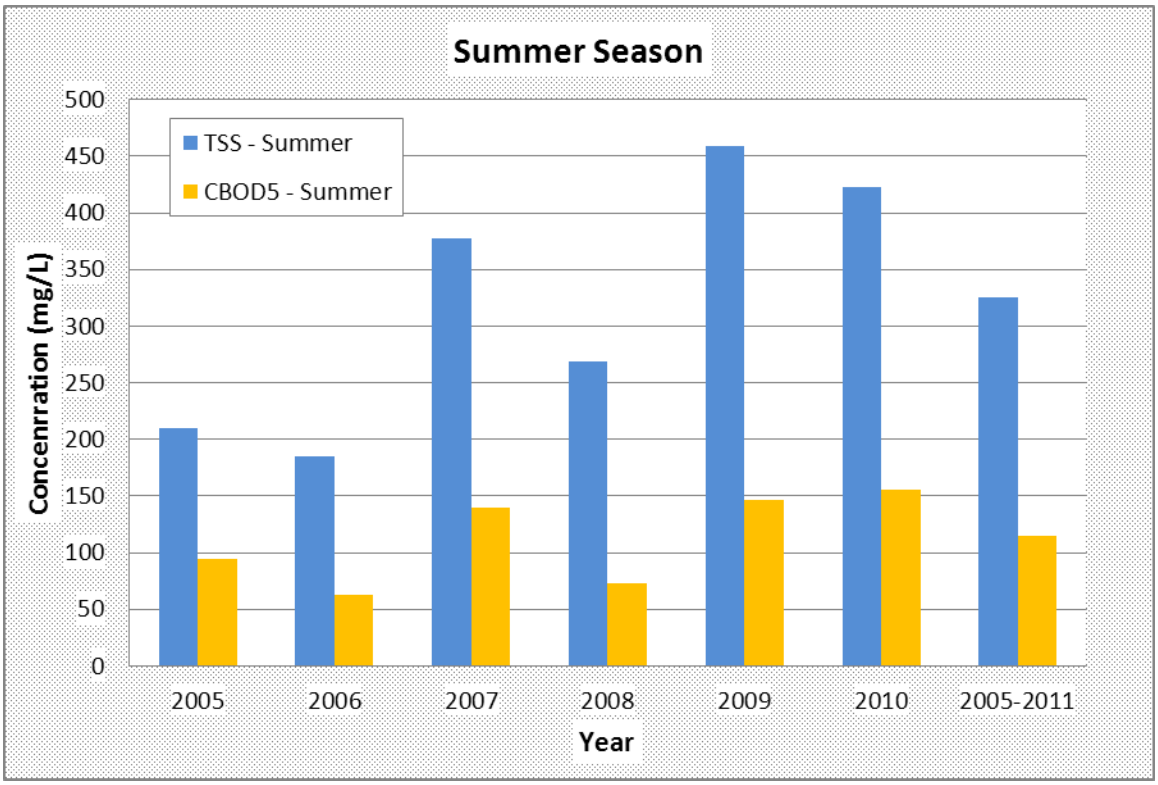

Figure E-4. Mean concentration (in mg/L) of CBOD 5-day and TSS by year for summer season (June to September) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year summer season mean concentration is also shown.

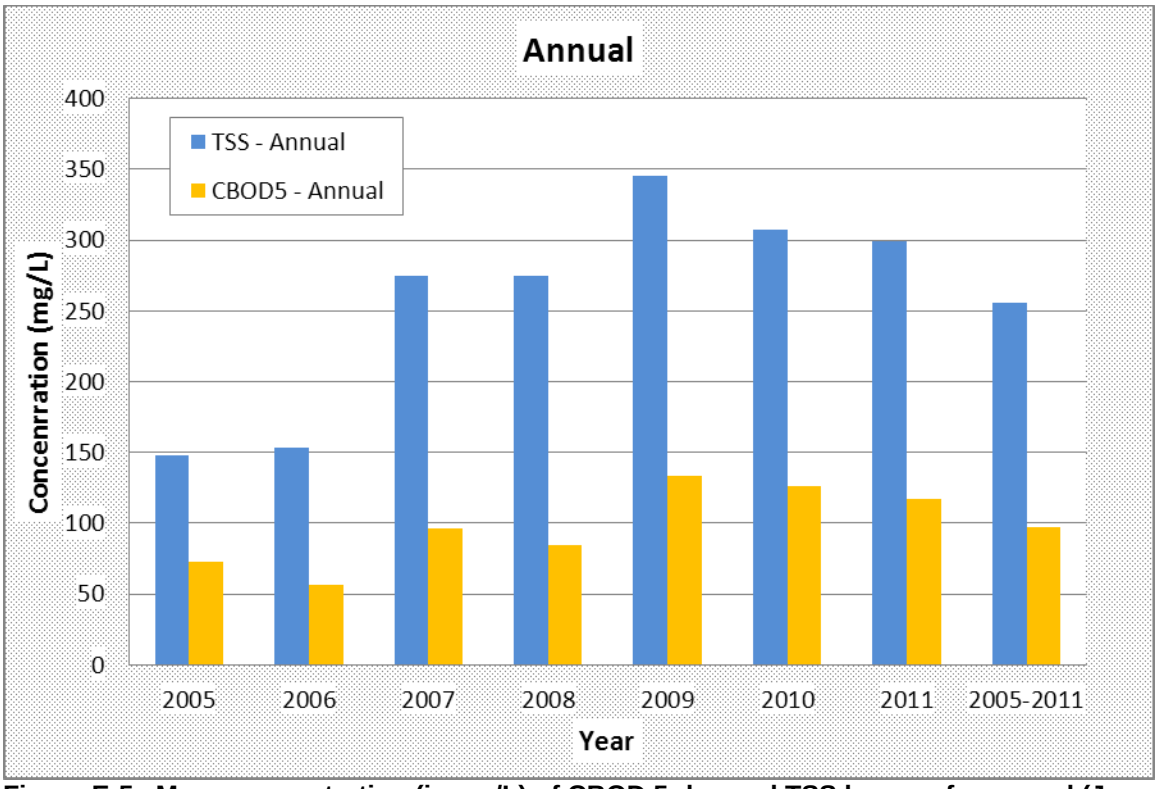

Figure E-5. Mean concentration (in mg/L) of CBOD 5-day and TSS by year for annual (January to December) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year annual mean concentration is also shown.

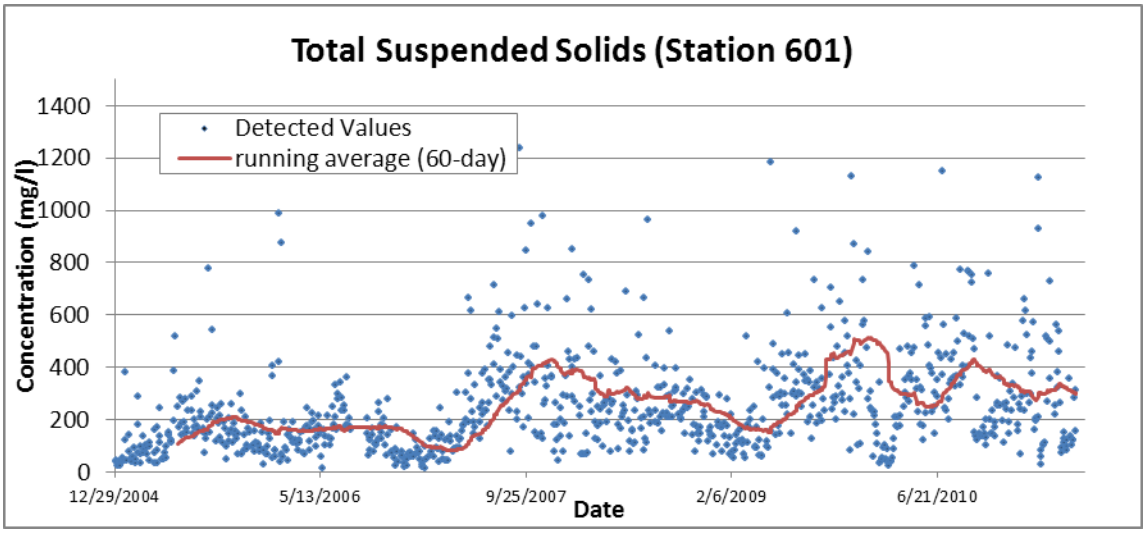

Figure E-6. Time series of TSS from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60-day running average was also computed and overlaid (solid red line) on the individual observations.

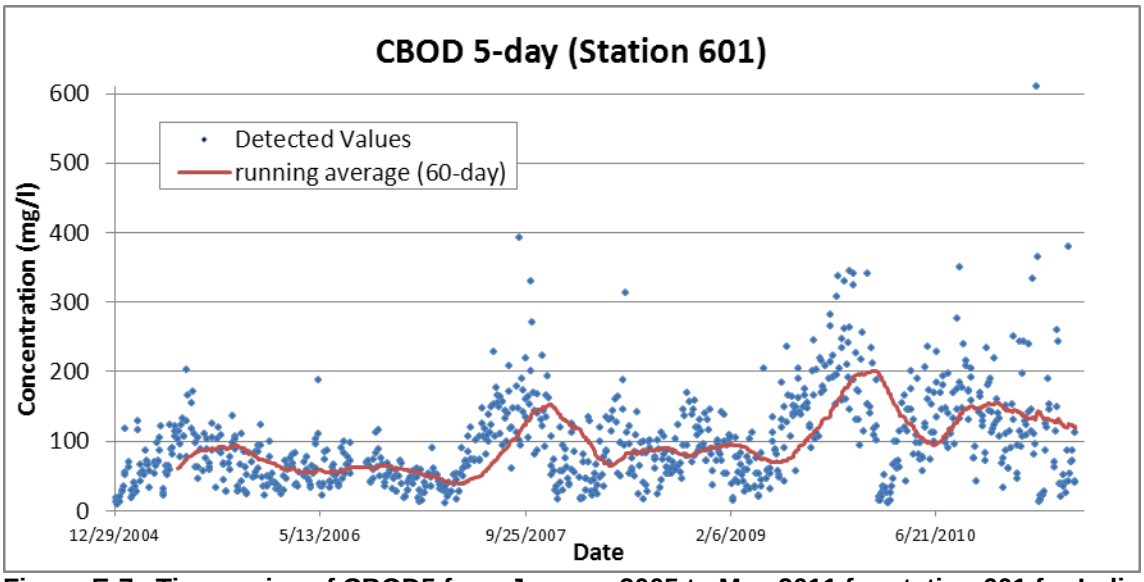

Figure E-7. Time series of CBOD5 from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60-day running average was also computed and overlaid (solid red line) on the individual observations.

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.

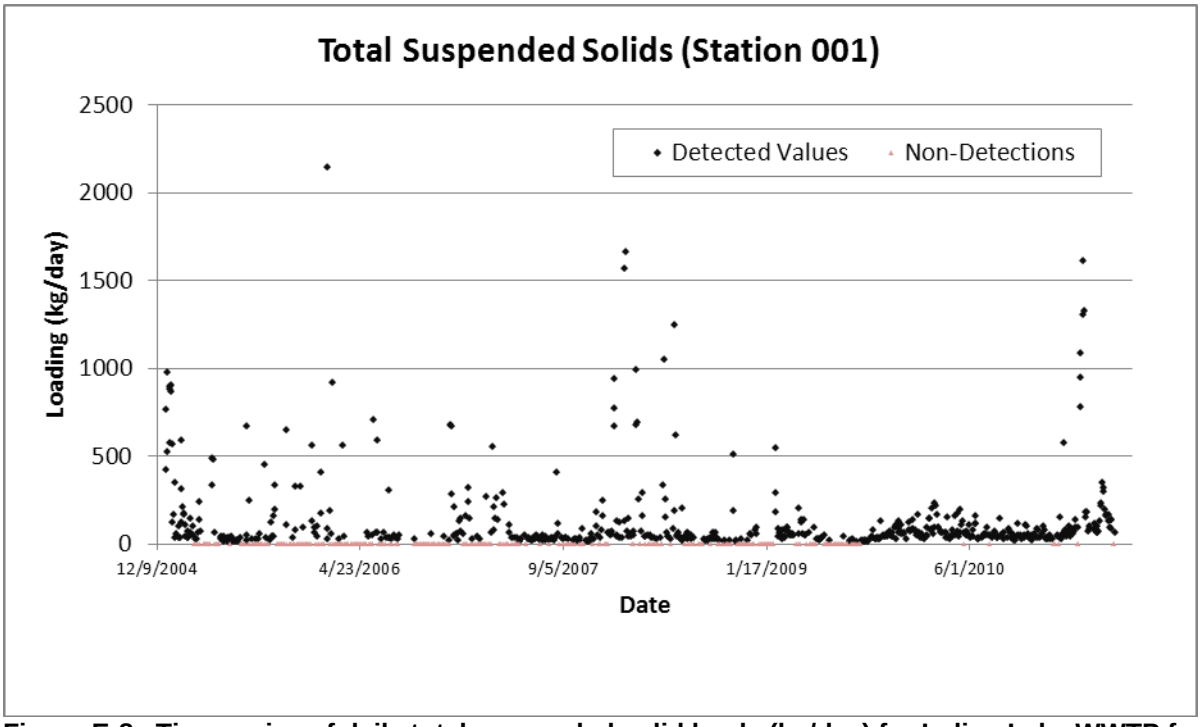

Figure E-8. Time series of daily total suspended solid loads (kg/day) for Indian Lake WWTP for station 001 for the period January 2005 to May 2011.

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 of 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.

	Number of Limit Violations	
Parameter (code)	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 National Pollutant Discharge Elimination System (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:

1. Submit an approvable “No Feasible Alternatives Analysis by no later than October 1, 2012.
2. Submit a general plan for upgrades design to eliminate the secondary bypass by no later than April 1, 2013.
3. Submit a Permit to Install for treatment system upgrades by no later than April 1, 2014.
4. Complete treatment system upgrades by no later than July 1, 2016.
5. 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 on a monthly basis. In addition, outfall 001 will report TSS, $cBOD_5$, phosphorus, ammonia and nitrate/nitrite discharges to the Great Miami River on a monthly basis. Sampling is done three times a week for TSS, $cBOD_5$, and NH_3. Phosphorus and NO_2/NO_3 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.