TMDL: Des Plaines River/Higgins Creek Watershed, Illinois
Date: AUG 26 2013

DECISION DOCUMENT FOR THE APPROVAL OF THE DES PLAINES RIVER/HIGGINS CREEK WATERSHED, IL, TMDL

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see section 2 below).

The TMDL submittal should include an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

(1) the spatial extent of the watershed in which the impaired waterbody is located;
(2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
(4) present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and

(5) an explanation and analytical basis for expressing the TMDL through *surrogate measures*, if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:
Location Description: The Illinois Environmental Protection Agency (IEPA) developed **24** TMDLs for fecal coliform, chloride, ammonia, total phosphorus (TP) and carbonaceous biochemical oxygen demand (CBOD) substances for eighteen waterbody segments in the Des Plaines River/Higgins Creek (Des Plaines River) watershed in Lake, Cook, and DuPage Counties, Illinois. By implementing measures to reduce pollutant loadings, the TMDLs will address impairments of the Primary Contact Recreation, Aesthetic Quality, and Aquatic Life Uses. Table 1 below identifies the waterbodies addressed by the TMDLs as they appear on the partially approved Illinois 2008 303(d) list.

Table 1. TMDL waterbodies

Waterbody	Segment ID #	Pollutant*	Affected use
Albert Lake	IL_VGG	TP	Aquatic Life, Aesthetic Quality
Beck Lake	IL_RGE	TP	Aesthetic Quality
Big Bear Lake	IL_WGZU	TP	Aquatic Life, Aesthetic Quality
Big Bend Lake	IL_RGL	TP	Aesthetic Quality
Bresen Lake	IL_UGN	TP	Aesthetic Quality
Buffalo Creek Lake	IL_SGC	TP	Aquatic Life, Aesthetic Quality
Countryside Lake	IL_RGQ	TP	Aesthetic Quality
Diamond Lake	IL_RGB	TP	Aesthetic Quality
Forest Lake	IL_RGZG	TP	Aesthetic Quality
Half Day Pit	IL_UGB	TP	Aquatic Life, Aesthetic Quality
Lake Charles	IL_RGZJ	TP	Aesthetic Quality
Little Bear Lake	IL_WGZV	TP	Aesthetic Quality
Pond-A-Rudy	IL_UGP	TP	Aquatic Life, Aesthetic Quality
Salem Reed Lake	IL_WGK	TP	Aesthetic Quality
Sylvan Lake	IL_RGZF	TP, Fecal	Aesthetic Quality
Buffalo Creek	IL_GST	Chloride, Fecal, CBOD, ammonia	Aquatic Life, Recreational
Higgins Creek	IL_GOA-01	Chloride, Fecal	Aquatic Life, Recreational
Higgins Creek	IL_GOA-02	Chloride, Fecal	Aquatic Life, Recreational

* TP = total phosphorus, fecal = fecal coliform

The Des Plaines River watershed is located in northeast Illinois (HUC 0712000405). The Des Plaines River begins in Wisconsin and flows south, eventually merging with the Chicago Ship and Sanitary Canal and flowing into the Illinois River. The TMDLs address several waterbodies: fifteen lakes and two tributaries of the Des Plaines River (Figure 2-2 of the TMDL). The Illinois portion of the Des Plaines watershed covers approximately 223,000 acres. The TMDLs address nine miles of Buffalo Creek and three miles of Higgins Creek, both tributaries to the Des Plaines River. The TMDL report also addresses fifteen lakes in the watershed, ranging in size from 14 acres to 141 acres (Section 2.7 of the TMDL). Several lakes are natural, while several are the result of damming small tributaries in the area or old quarries/borrow pits from nearby road construction. The waterbodies are listed as impaired due to the pollutants listed above. The TMDL does not address any of the impaired mainstem segments of the Des Plaines River.

Distribution of land use: The land use for the Des Plaines River watershed is mainly urban in nature, with approximately 66% urbanized, 17% forested, and 12% agricultural (Section 2.3 of the TMDL). Most of the forested lands are along the mainstem of the Des Plaines River. Table 2 below contains the specific land use data for each of the impaired waterbodies.

Table 2: Land Use Data for the Des Plaines River Watershed

Watershed	Agricultural land	Forested land	Surface water	Urban and built-up land:	Wetland
Entire Des Plaines/Higgins Creek Watershed	11.8%	16.8%	2.7%	66.6%	2.1%
Albert Lake	1.8%	15.6%	1.9%	79.5%	1.2%
Beck Lake	---	56.5%	10.8%	30.7%	2.0%
Big Bear and Little Bear Lake	1.7%	5.9%	3.7%	88.1%	0.7%
Big Bend Lake	---	17.5%	6.2%	74.1%	2.2%
Bresen Lake	19.1%	11.7%	10.4%	52.4%	6.4%
Buffalo Creek	1.7%	19.4%	1.9%	74.1%	3.0%
Buffalo Creek Lake	1.9%	21.9%	2.0%	70.8%	3.3%
Countryside Lake	45.1%	16.2%	10.5%	26.4%	1.7%
Diamond Lake	32.6%	12.7%	8.5%	44.5%	1.7%
Forest Lake	5.3%	8.4%	7.6%	77.5%	1.2%
Half-day Pit	---	17.8%	41.9%	31.9%	8.3%
Higgins Creek	0.1%	7.1%	1.3%	91.0%	0.5%
Lake Charles	2.2%	6.6%	2.2%	88.5%	0.6%
Pond-a-Rudy	11.1%	35.0%	5.7%	38.2%	10.0%
Salem-Reed	11.3%	18.9%	27.6%	35.6%	6.6%
Sylvan Lake	38.0%	15.3%	5.9%	39.2%	1.6%

Population and future growth trends: The population of the watershed is approximately 915,000 people (Section 2.5 of the TMDL). Census data show the population density is highest in the southern portion of the watershed in Chicago, and more sparse in the northern portion of the watershed. IEPA noted that population growth is expected to increase significantly in the northern portions of the watershed (Section 2.6 of the TMDL).

Pollutants of concern: The TMDL submittal states the pollutants addressed in this TMDL for the watershed are fecal coliform, ammonia, chloride, CBOD, and TP (Table 1 above). One segment of Higgins Creek (IL_GOA_02) was identified as impaired due to low dissolved oxygen (DO). IEPA determined that the cause of the low DO is Sediment Oxygen Demand and the lack of re-aeration/low flow, and is not due to a pollutant. Therefore, IEPA did not develop a TMDL addressing low DO for this segment (Section 7.2.5 of the TMDL). All of the lakes have phosphorus TMDLs to either directly address exceedences of the phosphorus water quality standard or to control low dissolved oxygen (DO) levels in the lakes. Both segments of Higgins Creek are impaired due to high levels of fecal coliform and chlorides.

Buffalo Creek is impaired due to high levels of fecal coliform and chlorides, and low DO. To address the DO impairment, IEPA determined that CBOD and ammonia are the two pollutants that need to be controlled to improve the DO levels in the creek (Section 2 of the TMDL).

Organic material such as leaves, bacteria, algae and various sorts of organic debris can enter waterbodies and decay. This is particularly prevalent when flow velocities decrease. These materials can decay in the water, and the decomposition uses oxygen to break down the organic material. CBOD is defined as the carbonaceous portion of the material. The decomposition of nitrogen materials (nitrification) also utilizes oxygen as ammonia is converted to nitrites and then nitrates.

Sources:
Fecal coliform: IEPA identified several non-stormwater point sources which discharge fecal coliform to Buffalo Creek or Higgins Creek (Table 5-6 of the TMDL). Lands regulated under a Municipal Separate Storm Sewer System (MS4) cover 75% of the overall watershed, and were the largest source of fecal coliform for each TMDL (Section 7 of the TMDL). Runoff from urban lands can contain fecal coliform as a result of wildlife and pet wastes washing off during precipitation, as well as illicit connections of septic systems to the MS4 system. Figure 5-14 of the TMDL shows the MS4 entities and the watersheds in which they are located. IEPA noted that no concentrated animal feeding operations (CAFOs) are present in the watershed.

Several potential non-point sources were identified by IEPA. Agricultural lands can contribute bacteria through runoff of soils and other materials. This can be exacerbated by tile drains, which allow faster transmission of pollutant-laden runoff to waterbodies. Animal operations can contribute fecal coliform to the waterbody, via runoff from pastures located near streams.

IEPA noted that aging sewer systems could be contributing fecal coliform to the Higgins Creek and Buffalo Creek watersheds (Section 8.5.2 of the TMDL). Since almost all of the watersheds are served by sanitary sewer collection systems, failing septics are considered unlikely; however, leaks from aging infrastructure are possible.

Chlorides: The source of chlorides in Higgins Creek and Buffalo Creek is run-off due to de-icing activities (Section 7 of the TMDL). Much of the watershed for Higgins Creek and Buffalo Creek are highly urbanized, and large amounts of salt are used to de-ice roads, bridges, and parking lots. IEPA noted that exceedences of the chloride criteria occurred during the months of October to March (Appendix F of the TMDL).

CBOD and Ammonia:
Buffalo Creek was listed as impaired by IEPA due to low DO levels in the creek. Sources identified by IEPA in the TMDL as contributing to the DO impairment include stormwater runoff from the surrounding watershed, and nonpoint source runoff from forests and other non-regulated land uses (Section 8.4.2 of the TMDL).

Buffalo Creek Lake is a man-made impoundment of Buffalo Creek, and is directly upstream of the impaired portion of Buffalo Creek. IEPA noted that the lake is impaired due to low DO as well, and believe that the flow from the lake contributes to the DO impairment in the creek. IEPA believes that the high levels of ammonia and CBOD material in the creek indicate that ammonia and CBOD materials are entering the creek, and when the flow slows down in the reservoir, the ammonia and CBOD substances break down by either conversion of ammonia or the decomposition process.

Total Phosphorus: The sources of phosphorus in the Des Plaines watershed include:

MS4 discharge: Runoff from urbanized land can contain significant amounts of phosphorus. Fertilizers used on lawns and other landscaping can contain phosphorus, which are washed off during precipitation events. Pet waste and waste from other animals (i.e., geese) can also contribute phosphorus via stormwater runoff. Drainage from impervious surfaces can increase the flow rate in the MS4 system and increase streambank erosion. These soils are usually phosphorus-rich, and can contribute to the phosphorus enrichment when they enter the slower waters of a lake.

Agricultural land use practices: A few of the lakes have significant amounts of agricultural lands in the watershed (Section 5.3 of the TMDL). Runoff from agricultural lands may contain significant amounts of phosphorus from fertilizer use or from phosphorus-rich soils washed in to the lakes.

Wildlife/Natural Sources: Deer, geese, ducks, and other animals may contribute phosphorus to the lakes. Several of the lakes are surrounded by forest and parkland, and may receive phosphorus in the form of organic debris such as leaves and other plant material.

Priority Ranking: The Des Plaines River watershed was given a medium priority ranking by IEPA.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this first element.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) - a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:
Designated Use/Standards: Section 4 of the TMDL states that the waterbodies in the Des Plaines River watershed are not meeting the General Use designation. Under the General Use classification, waters are further designated as impaired for Aquatic Life Use, Aesthetic Quality

Use, and Primary Contact Recreational Use. Table 1 above shows the various waterbody segments and the associated impaired uses.

The applicable General Use water quality standards (WQS) for these waterbodies are established in Illinois Administrative Rules Title 35, Environmental Protection; Subtitle C, Water Pollution; Chapter I, Pollution Control Board; Part 302, Water Quality Standards, Subpart B. Table 2 below lists the all the parameters and the applicable citation under the Illinois Code.

Table 2 Numeric Water Quality Standards for the Des Plaines River Watershed

Parameter	units	General Use Water Quality Standard
Chloride	mg/L	500
Dissolved Oxygen	mg/L	March – July 5.0 instantaneous minimum 6.0 as daily mean averaged over 7 days August – February 3.5 instantaneous minimum 4.0 as daily mean averaged over 7 days 5.5 as daily mean averaged over 30 days
Fecal Coliform	cfu/100 mL	200(1), 400(2) May through October
Total Phosphorus	mg/L	0.05(3)

(1) Geometric mean based on a minimum of five samples taken over not more than a 30-day period.
(2) Standard shall not be exceeded by more than 10 percent of the samples collected during any 30-day period.
(3) Standard applies in particular to inland lakes and reservoirs (greater than 20 acres) and in any stream at the point where it enters any such lake or reservoir.

Target: The water quality targets for these TMDLs are the water quality criteria in Table 2 above. The TP criterion does not apply to several of the lakes in the Des Plaines watershed as they are below the minimum lake size (<20 acres). Sampling data showed that these lakes are impaired due to low DO. To address the low DO, IEPA determined that controlling the TP loads into the lakes will result in attaining the DO standard, and therefore calculated TP TMDLs for these lakes (Albert Lake, Half Day Pit, and Pond-A-Rudy).

To address the DO impairment in Buffalo Creek, IEPA determined that CBOD and ammonia were the surrogate pollutants that needed to be reduced in Buffalo Creek. Specific target concentrations were not determined; rather, IEPA used a computer model to determine the maximum loading of CBOD and ammonia that would attain the DO criterion (See Section 3 of this Decision Document).

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this second element.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

TMDLs must take into account *critical conditions* for steam flow, loading, and water quality parameters as part of the analysis of loading capacity. (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and nonpoint source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:
Loading capacity: The loading capacities were calculated for each waterbody, and are found in Section 7 of the TMDL. Tables 3-11 below are a summary of the loading capacities for each of the pollutants for each impaired waterbody in the watershed.

Method for cause and effect relationship:
<u>Fecal coliform (rivers), chlorides:</u> The loading capacities for fecal coliform and chlorides for the impaired river segments in the Des Plaines River watershed were determined by using the load duration curve method (LDC) (Tables 3-8 below; Sections 6.2 and 6.4 of the TMDL). Pollutant concentrations were measured at water quality monitoring stations in the watershed (Appendix B of the TMDL). An explanation is provided below.

1. <u>Flow data</u> - First, continuous flow data are required, and are provided by U.S. Geological Survey (USGS) gages 05528500 located on Buffalo Creek just downstream of the impaired segment, and 05529500 located on McDonald Creek, approximately 5 miles north of Higgins Creek (Figure 2-11 of the TMDL). IEPA used an area-weighted calculation to calculate flows between the McDonald Creek gage and Higgins Creek, as discussed in Section 7.1.2 of the TMDL. The data reflect a range of natural occurrences from extremely high flows to extremely low flows over 55 years.
2. <u>Water Quality data</u> - This dataset is the monitored pollutant data for fecal coliform and chlorides (Section 7 and Appendix B of the TMDL).
3. <u>Load Duration Curves</u> - The plots are derived from the flow data and water quality data described above. Existing monitored water pollutant loads, represented by the points on the plot, are compared to target loads, the water quality standard line (200 cfu/100 mL). If the existing loads are below (less than) the target line, no reduction needs to occur. Conversely, if the existing loads are above (greater than) the target load, a reduction is necessary to reach the target (Appendix F of the TMDL).
4. <u>Analysis</u> - The final step is to link the geographic locations of load reductions needed to the flow conditions under which the exceedences occur. Specific flow regimes contributing to pollutant loads, represented by the graph, are identified to determine under what flow conditions the pollutant exceedences are occurring. The LDCs in the

TMDL show that the exceedences occur under varied flow conditions. By knowing the flow conditions under which exceedences are occurring, IEPA can focus implementation activities on those sources most likely to contribute loads.

The plots show under what flow conditions the water quality exceedences occur. Those exceedences at the right side of the graph occur during low flow conditions; exceedences on the left side of the graphs occur during higher flow events, such as storm runoff. IEPA provided analysis for each LDC, to determine under which flow conditions exceedences (or the most severe exceedences) occurred (Section 7 of the TMDL).

Review of the LDCs for fecal coliform for the two segments of Higgins Creek (IL_GOA-01 and IL_GOA-02) show that exceedences occur generally under all flow conditions, and thus likely from a variety of sources. For Buffalo Creek (IL_GST), exceedences occur generally under all flow conditions, and thus likely from a variety of sources as well.

Review of the LDCs for chlorides for the two segments of Higgins Creek (IL_GOA-01 and IL_GOA-02) show that exceedences occur generally under all flow conditions, while for Buffalo Creek (IL_GST), exceedences occur generally under higher flows conditions. IEPA conducted additional analysis to determine the seasonal changes in chloride loads. Appendix F of the TMDL contains LDCs for October through March. These LDCs show the exceedences occur much more often in the winter higher flow conditions, further evidence of the impact of de-icing activities.

Using the load duration curve approach allows IEPA to determine which implementation practices are most effective for reducing pollutant loads based on flow magnitude. For example, if loads are significant during storm events, implementation efforts can target those best management practices (BMPs) that will most effectively reduce runoff. This allows for a more efficient implementation effort. The load duration curve is a cost-effective TMDL approach, to address the reductions necessary to meet WQS for these pollutants.

Weaknesses of the TMDL analysis are that non-point source (NPS) load allocations were not assigned to specific sources within the watershed, and the identified sources of the pollutants were assumed based on the data collected in the watershed, rather than determined by detailed monitoring and sampling efforts. Moreover, specific source reductions were not quantified. However, EPA believes the strengths of the State's proposed TMDL approach outweigh the weaknesses and that this methodology is appropriate based upon the information available. In the event that the pollutant levels do not meet WQSs in response to implementation efforts described in the TMDL submittal, the TMDL implementation strategy may be amended as new information on the watershed is developed.

<u>Fecal coliform (Sylvan Lake)</u>: The loading capacity for fecal coliform for Sylvan Lake is in Table 9 below. Sylvan Lake was the only lake in the watershed found to be impaired by pathogens. Since the LDC process does not work for lakes, IEPA used the Simple Method and a mass balance process to develop fecal coliform loads for Sylvan Lake (Section 6.2 of the TMDL). The Simple Method estimates loads from runoff in urban areas (Stormwater.net download 6/28/2013). The method utilizes drainage areas, impervious cover, precipitation rates, and runoff rates based upon land use categories. The Simple Method was used to determine the runoff load contributions to the lake. The mass balance was used to determine the loading in the

lake under current conditions. The Simple Method was then adjusted to determine the loading that would achieve the WQS (Section 7.1.4 of the TMDL). Appendix F of the TMDL contains details on the runoff rates and land use areas for Sylvan Lake.

Total phosphorus/DO (Lakes): The loading capacities for total phosphorus for the lakes in the Des Plaines River watershed are in Table 10 below. The loading capacities were determined by IEPA by use of the Lake Load Response Model (LLRM) (Section 6.1 of the TMDL).

The LLRM combines an export coefficient (runoff) model with empirical in-lake response models. Export coefficients for each of the land uses in the watershed for each lake were used to determine phosphorus loading. The loading estimates were adjusted based upon soil type, proximity to the lake, and major Best Management Practices (BMPs) in the watershed. The factors were adjusted to reflect actual sampling data in each watershed. The model also allows direct inputs for atmospheric deposition, septic systems, point sources, waterfowl, and internal loading. Once the watershed loadings were determined, the loads were then processed through several empirical models, and the average TP concentration determined. The models were calibrated to existing lake water quality data where possible. Once calibrated, the loading into the lake was adjusted until the in-lake target of 0.5 mg/L TP standard was met (Sections 6.1 and 7.3 and Appendix H of the TMDL).

For Big Bend Lake (IL_RGL) and Half Day Pit (IL_UGB), the model was revised to account for occasional inflow from the Des Plaines River. Under normal conditions, these lakes flow into the Des Plaines River. However, under high flows, flow can be reversed, and phosphorus-rich water from the Des Plaines River can flow into the two lakes. To account for the flow, IEPA revised the LLRM model to assume 50 % of each of the lakes contained Des Plaines River water during the top 5% of river flows (Sections 7.3.4 and 7.3.10 of the TMDL).

DO (Buffalo Creek): To address the DO impairment in Buffalo Creek, IEPA used the QUAL-2K model to determine the pollutant loadings (Section 6.3 of the TMDL). QUAL-2K determines the effects of various oxygen-demanding substances (phosphorus, CBOD, nitrates, algae, etc.) and determines resulting DO concentration. QUAL-2K is a one-dimensional, steady-state model that accounts for both point and nonpoint source loading. QUAL-2K allows non-uniform reach segmentation, various forms of oxygen-demanding substances, and accounts for anoxia and sediment-water interface reactions.

The QUAL-2K model was developed by IEPA to determine the impacts of CBOD and ammonia on DO levels in the creek. The creek and related tributaries were divided into segments, and the physical characteristics of each segment estimated. Weather data, flow data, and water quality data were used in the model, as well as point source effluent data. The IEPA water quality standard for DO of 5 mg/L was used as the model target (Section 7.2.2 and Appendix G of the TMDL). The 5.0 mg/L target was chosen to meet or exceed the instantaneous DO minimum WQS of 5.0 mg/L (March to July) and 3.5 mg/L (August to February). Review of the model results indicates that the weekly and monthly average WQS for DO would be expected to be met when the instantaneous minimum is met (Figure 5-6, Figure 5-7, and Figure G-2 of the TMDL). The resulting CBOD and ammonia loads are in Table 11 below.

Higgins Creek (IL_GOA-02) is also listed as impaired by IEPA (Section 7.2.5 of the TMDL). QUAL-2K was also used to determine the impacts of CBOD and ammonia reductions on the DO levels in the creek. IEPA determined that reductions in CBOD, ammonia, or phosphorus had little effect on DO levels in the creek. IEPA stated that the model results suggest sediment oxygen demand (SOD) is the major contributor to low DO levels in the creek. SOD is the oxygen demand caused by organic and chemical substances at the sediment-water interface at the bottom of the creek. IEPA believes that the SOD demand as well as a small dam in the segment and related low reaeration of the creek are the source of the low DO levels in Higgins Creek. Based upon the presence of these non-pollutants, IEPA did not develop a TMDL for Higgins Creek (Section 7.2.5 of the TMDL).

Critical condition:
For fecal coliform, a specific flow critical condition was difficult to identify. The load duration curves indicate exceedences are occurring under all flow regimes, and thus differing conditions may contribute to impairment. For water quality, the critical condition was identified as the primary contact recreational season (May through October). The LDC process used by IEPA allows the State to target implementation activities to those flow regimes showing the greatest loading.

For chlorides, the critical condition is winter, when the predominant source is salt used for deicing activities. The implementation activities discussed in the TMDL focus on controlling this source.

For TP, CBOD, and ammonia, the critical condition was identified as the summer low flow conditions. During the summer months, instream flows are lower, water temperatures are higher, and retention time in the lakes is greatest. Under these conditions, the three pollutants are available for uptake by algae and macrophytes, which utilize oxygen when they die and decompose.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this third element.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources.

Comment:
Fecal coliform and chlorides: The LAs for the impaired waterbodies in the Des Plaines River watershed are found in Tables 3-11 below. The LAs are based upon the flow in the river (Section 7.1 of the TMDL). IEPA did not separate out a natural background component.

TP: The LAs for the impaired waterbodies in the Des Plaines River watershed are found in Table 10 below. IEPA did not develop LAs for various land uses. IEPA did determine a natural background concentration for the lakes. This was accomplished by setting the land uses in the LLRM model to forest/wetland, and increasing the attenuation rate by 10%. IEPA noted that for Bresen Lake, Big Bend Lake, and Half Day Pit, the natural background concentration exceeded the WQS, suggesting that the lakes may not be able to attain the WQS. The natural background concentration for Salem Reed Lake is also very close to the WQS.

IEPA also determined an upper bound for TP concentrations by adjusting the LLRM model to convert forest and agricultural lands to low density urban land and reducing attenuation by an additional 10% (Section 7.3 of the TMDL). While no load was determined for the future scenario, the calculation showed the "worst case" scenario that might be expected if development is not better managed.

CBOD and ammonia: The LAs for the impaired waterbodies in the Des Plaines River watershed are found in Table 11 below. IEPA did not separate out a natural background component.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this fourth element.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment:
Fecal coliform: For the fecal coliform TMDLs for Higgins Creek and Buffalo Creek, IEPA identified 4 non-stormwater facilities permitted to discharge under the National Pollutant Discharge Elimination System (NPDES) that discharge into or upstream of the creeks. IEPA also identified several MS4 communities that discharge to the impaired segments (Tables 12-17 below; Section 7.1 of the TMDL).

To calculate the WLAs, IEPA used the fecal coliform standard (200 cfu/100 mL) times the design maximum flow for the high flow range, and the design average flow for the moist, mid-range, dry and low flow regimes (Section 7.1 of the TMDL). For the MS4 allocations, the allocations are based upon the fecal coliform standard (200 cfu/100 mL) and the percentage of land area covered by the MS4 permit.

For the Sylvan Lake fecal coliform TMDL, IEPA identified two MS4 communities in the watershed. The WLAs were calculated based upon the fecal coliform standard (200 cfu/100 mL) and the percentage of land area covered by the MS4 permits (Section 7.1.4 of the TMDL, Table 9 below). IEPA did not identify any CAFOs in the watershed (WLA = 0).

Chlorides: For the chloride TMDLs for Higgins Creek and Buffalo Creek, IEPA determined that the non-stormwater dischargers in the watershed do not discharge chloride in their effluent, and therefore the WLA = 0 for these facilities (Section 7.1.2.4 of the TMDL). As discussed in Section 3 above in this decision document, the exceedences of the chloride standard occurs during the winter months due to de-icing activities. The WLA for the MS4 communities is based upon the water quality standard (500 mg/L) and the percentage of land area covered by the MS4 permit (Table 15-17 below).

The Illinois Tollway Authority is currently pursuing an expansion of the Elgin-O'Hare Expressway. Part of this expansion could occur in the Higgins Creek Watershed (Elgin O'Hare West Bypass Study Tier Two EIS, October, 2012). The WLAs approved as part of this TMDL Decision Document may change based upon the status of the expansion. IEPA is not required to reopen the TMDL as long as the revised individual WLAs do not exceed the sum of the WLA (Considerations for Revising and Withdrawing TMDLs (draft), EPA, May 2012).

CBOD and ammonia: For the CBOD and ammonia TMDLs for Buffalo Creek, IEPA identified two non-stormwater facilities permitted to discharge under the NPDES program that discharge into or upstream of the creek. IEPA also identified several MS4 communities that discharge to the impaired segments (Table 18 below; Section 7.2.2.2 of the TMDL).

To calculate the WLAs, IEPA used the maximum daily permit limit times the design maximum flow for the two facilities. No WLA for ammonia was calculated for the Alden Long Grove Rehab facility (Section 7.2.2.2 of the TMDL). For the MS4 allocations, the allocations are based upon the overall CBOD and ammonia reductions needed to achieve the DO standard (39% for CBOD, 30% for ammonia) applied to the land area for each MS4 permit.

TP: The WLAs for TP are found in Table 19 below. For the TP TMDLs for the lakes in the watershed, IEPA identified only one lake (Buffalo Creek Lake, IL_SGC) where non-stormwater-permitted sources are present. To determine the WLA for the two facilities, IEPA used the permitted effluent limit and average discharge flow in the LLRM model (Section 7.3 of the TMDL). For the MS4 allocations, the allocations are based upon the overall phosphorus reductions needed to achieve the phosphorus standard applied to the land area for each MS4 permit.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this fifth element.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comment:
Fecal coliform and chlorides: For fecal coliform and chlorides, IEPA used an explicit MOS of 10% (Table 3-11 below, Section 7.1.6 of the TMDL) for all waters except Higgins Creek (IL_GOA-01). The margin of safety is appropriate because the use of the LDC provides an accurate account of existing stream conditions (calculated by multiplying daily flows by existing pollutant levels), and an accurate account of the stream's loading capacity (calculated by multiplying daily flows by the appropriate water quality target). In other words, there is a good fit between observed (existing) data and predicted data using the LDC approach, thus providing a relatively accurate determination of the TMDL reductions needed. IEPA accounts for any uncertainty in this method by incorporating the MOS.

IEPA also included additional MOS in the TMDL because no rate of decay was used in calculations or in load duration curves for the fecal coliform. Because bacteria have a limited capability of surviving outside their hosts, a rate of decay would normally be used. Thus, it was determined by IEPA that it is more conservative to use the water quality standard of 200 cfu/100ml fecal coliform, and not to apply a rate of decay which could result in a discharge limit greater than the water quality standard.

As stated in *EPA's Protocol for Developing Pathogen TMDLs* (EPA 841-R-00-002), many different factors affect the survival of pathogens, including the physical condition of the water. These factors include, but are not limited to sunlight, temperature, salinity, and nutrient deficiencies. These factors vary depending on the environmental condition/circumstances of the water, and therefore it would be difficult to assert that the rate of decay caused by any given combination of these environmental variables was sufficient enough to meet the WQS of 200 cfu/100 ml and 400 cfu/100ml. Thus, it is more conservative to apply the State's water quality standard as the margin of safety, because this standard must be met at all times under all environmental conditions.

For Higgins Creek, IEPA did not determine an explicit MOS; the MOS is the implicit MOS as discussed above. The flow in Higgins Creek is almost entirely effluent from the Kirie WWTP. Flow records indicate that over 90% of the stream flow is effluent, and over 99% under dry to low flows. Since the facility is required to disinfect and monitor the discharge, there is less uncertainty associated with the fecal coliform loading to this segment.

Phosphorus: IEPA uses an explicit 10% MOS for phosphorus for the lakes in the Des Plaines River watershed (Table 10 below; Section 7.3.17 of the TMDL). IEPA believes the MOS is sufficient based upon the relatively small watersheds surrounding the lakes, thus limiting the uncertainty in sources, and the LLRM model process, which took the average of 5 separate model formulas to determine the appropriate loading capacity for each lake. This process served to reduce uncertainty as well.

CBOD and ammonia: IEPA used an explicit 10% MOS for CBOD and ammonia for Buffalo Creek (Table 11 below; Section 7.2.8 of the TMDL). A simple calibration of the QUAL2K model was performed, comparing the modeled data to the actual sampling data, and the model was then adjusted to meet the actual data.

EPA finds that the TMDL document submitted by IEPA contains an appropriate MOS satisfying all requirements concerning this sixth element.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Comment:
IEPA properly accounted for seasonality for the fecal coliform and chloride TMDLs by use of the LDC method, which inherently accounts for seasonal variation by using daily flows over a multi-year period (Section 6 of the TMDL). IEPA properly accounted for seasonality in the phosphorus TMDLs by use of monthly average precipitation records over a multi-year period in the LLRM model (Sections 2.6 and 6.1 of the TMDL). The LLRM model used the precipitation data together with the export coefficients to determine the runoff from various land uses. This would include seasonal variations in precipitation. For the DO model, the QUAL-2K model uses temperature and precipitation records to determine DO levels in Buffalo Creek. The model effort focused on the summer DO levels to account for season variations. EPA agrees that this properly accounts for seasonal variations.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this seventh element.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comment:
Point Sources (fecal coliform, phosphorus, CBOD, ammonia): Reasonable assurance that the WLAs will be implemented is provided by 40 CFR 122.44(d)(1)(vii)(B),which requires that NPDES permit effluent limits are consistent with assumptions and requirements of all WLAs in an approved TMDL. IEPA implements its storm water and NPDES permit programs and is responsible for incorporating WLAs into permits. Current NPDES permits will remain in effect until the permits are reissued, provided that IEPA receives the NPDES permit renewal application prior to the expiration date of the existing NPDES permit. Current and future facilities subject to the NPDES MS4 permits would be required to properly select, install, and maintain BMPs required under the permit to reduce pollutant loads from these sources (Section 8 of the TMDL).

Reasonable assurance that WLA will be incorporated into MS4 permits is provided by the current General NPDES MS4 Permit ILR40. Part III- Special Conditions (C) of ILR40 requires the permitted entity to review their storm water management plan and determine whether the discharges within their jurisdiction are meeting the TMDL allocation or approved watershed management plan. If they are not meeting the TMDL allocations, they must modify their storm water management program to implement the TMDL or watershed management plan within eighteen months of notification by IEPA of the TMDL or watershed management approval. The special conditions of the general permit also require the permitted entity to describe and implement a monitoring program to determine if storm water controls are meeting the WLA (General NPDES Permit No. ILR40).

Nonpoint Sources: Nonpoint source loads of pollutants are relatively low in the impaired waterbodies, as much of the land area around the creeks are regulated under MS4 permits. There are few agricultural activities in the Buffalo Creek or Higgins Creek watershed.

In Lake County, the Lake County Stormwater Management Commission (LCSMC) has developed a detailed watershed management plan for the Indian Creek watershed. This plan addresses most of the lake TMDLs, and contains information on the impairment sources in the watershed, storm water BMP inventory programs, funding sources, proposed regulatory actions, and Lake County hydrologic modeling results. This plan has been developed to address not only water quality issues, but water quantity issues in the county. A plan is under development for the Buffalo Creek Watershed.
(http://www.lakecountyil.gov/Stormwater/LakeCountyWatersheds/Pages/WatershedManagementPlans.aspx). The county also holds annual training for de-icing contractors, who upon completion of the training and testing will have their names added to a "preferred provider" list maintained by the county.

Lake County also has regulatory controls for stormwater. The Lake County Watershed Development Ordinance (WDO) provides regulatory controls for county and approved municipalities. The WDO establishes minimum countywide standards for stormwater management, including floodplains, detention, soil erosion/sediment control, water quality treatment, and wetlands. (http://www.lakecountyil.gov/Stormwater/FloodplainStormwaterRegulations/WDOandTRM/Pages/default.aspx)

In Cook County, the county is in the process of developing a Stormwater Ordinance to regulate and control stormwater. The land use surrounding the impaired waters in Cook County is almost exclusively urban, and thus regulated by MS4 permits. In Cook County, the Metropolitan Water Reclamation District (MWRD) is responsible for stormwater control. The MWRD developed the "Detailed Watershed Plan for the Lower Des Plaines River Watershed: Volume 1" which includes Higgins Creek. Although this plan focuses primarily on water quantity rather than water quality, the State believes the Best Management Practices (BMPs) to reduce water quantity will also improve water quality for both fecal coliform and DO substances (Section 8.5 of the TMDL).

To address the chlorides reductions in Higgins Creek, the State and the DuPage River Salt Creek Workgroup (DRSCW) are working with the Illinois Tollway to address impacts from the proposed Elgin-O'Hare West Bypass Project (DRSCW Comments, 2013). This project involves the construction of additional road lanes and interchanges in the Higgins Creek watershed. As part of this project, the Illinois Tollway Authority and the DRSCW are working to reduce chloride use not only on the new tollway itself, but also in surrounding communities (Elgin O'Hare West Bypass Study Tier Two EIS, October, 2012). If an agreement is reached, chloride use could be significantly reduced in several watersheds in the Chicago Area.

EPA finds that this criterion has been adequately addressed.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment:
The TMDL submittal contains a discussion on future monitoring (Section 8.9 of the TMDL). Lake County maintains a Lakes Management Unit that monitors lakes and streams in the watershed. Several lakes in Lake County have designated beaches, which are monitored on a bimonthly basis. Section 8.10 of the TMDL discusses a proposed timeline for integrating various stakeholder activities in the watershed.

EPA finds that this criterion has been adequately addressed.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment:
A summary of potential implementation activities is in Section 8 of the TMDL. The implementation activities are discussed in Section 8 of this Decision Document.

EPA reviews, but does not approve, implementation plans. EPA finds that this criterion has been adequately addressed.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comment:
On May 19, 2009, IEPA held a public meeting to present the Stage 1 preliminary TMDL findings in Des Plaines, Illinois. A second public meeting was held in Des Plaines, Illinois, on August 11, 2010, to discuss the wasteload allocations with the stakeholders. The public comment period for the draft TMDL opened on August 28, 2012, and closed September 27, 2012. A public meeting was held on August 28, 2012, in Des Plaines, Illinois. The public notice for the meeting was made available to the public. Interested individuals and organizations also received copies of the public notice. A copy of the TMDL was made available to the public for comment upon request, as well as at the Des Plaines City Hall, Buffalo Grove City Hall, and the Vernon Hills City Hall. The draft TMDL was also available on IEPA's web page at http://www.epa.state.il.us/water/tmdl. The public meeting started at 2:00 p.m. on August 28, 2012. There were approximately 20 attendees at the meeting and the meeting record remaining open until midnight, September 27, 2012. There were no public comments.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval*. Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment:
On May 30, 2013, EPA received the Des Plaines River Higgins Creek watershed TMDL, and a submittal letter. In the submittal letter, IEPA stated "Please find enclosed Illinois EPA's submittal of the Des Plaines River Higgins Creek Watershed TMDL report for USEPA final approval". The submittal letter included the names and locations of the waterbodies and the pollutants of concern.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this twelfth element.

Conclusion
After a full and complete review, EPA finds that the TMDLs for the Des Plaines River Higgins Creek watershed satisfy all of the elements of approvable TMDLs. This approval is for **24** TMDLs, in 18 waterbody segments.

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.

Table 3 TMDL Summary for fecal coliform for Buffalo Creek (IL_GST) (org/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	1.98E+12	7.93E+11	5.53E+10	1.23E+11	2.06E+10
Reduction	77%	85%	12%	85%	80%
WLA – MS4	2.85E+11	7.74E+10	3.09E+10	0	0
WLA - WWTP	3.56E+08	1.44E+08	1.44E+08	1.44E+08	1.44E+08
LA	9.74E+10	2.65E+10	1.06E+10	1.52E+10	3.35E+09
Reserve Capacity	2.25E+10	6.12E+09	2.45E+09	9.05E+08	2.06E+08
MOS	4.50E+10	1.22E+10	4.89E+09	1.81E+09	4.11E+08
TMDL	**4.50E+11**	**1.22E+11**	**4.89E+10**	**1.81E+10**	**4.11E+09**

Table 4 TMDL Summary for chloride for Buffalo Creek (IL_GST)(lbs/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	190,807	124,227	21,546	11,215	796
Reduction	0	46%	0	11%	0
WLA – MS4	166,286	45,186	18,075	0	0
WLA - WWTP	0	0	0	0	0
LA	56,857	15,450	6,180	8,974	2,037
MOS	24,794	6,737	2,695	997	226
TMDL	**247,936**	**67,374**	**26,950**	**9,971**	**2,264**

Table 5 TMDL Summary for fecal coliform for Higgins Creek (IL_GOA-01) (org/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	9.49E+11	3.89E+11	1.24E+12	1.09E+11	3.05E+11
Reduction	0	0	50%	0	0
WLA – MS4	9.09E+10	2.10E+10	8.93E+09	0	0
WLA - WWTP	8.34E+11	6.06E+11	6.06E+11	6.06E+11	6.06E+11
LA	3.50E+10	8.10E+09	3.44E+09	5.67E+09	2.06E+09
MOS	implicit	implicit	implicit	implicit	implicit
TMDL	**9.60E+11**	**6.35E+11**	**6.19E+11**	**6.12E+11**	**6.08E+11**

Table 6 TMDL Summary for chloride for Higgins Creek (IL_GOA-01) (lbs/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	441,567	591,224	338,885	254,302	409,771
Reduction	0	57%	33%	13%	47%
WLA – MS4	575,438	159,007	140,547	0	0
WLA - WWTP	0	0	0	0	0
LA	258,530	71,438	63,144	199,750	196,515
MOS	92,663	25,605	22,632	22,194	21,835
TMDL	**926,631**	**256,050**	**226,323**	**221,945**	**218,350**

Table 7 TMDL Summary for fecal coliform for Higgins Creek (IL_GOA-02) (org/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	1.90E+12	2.00E+11	1.19E+12	4.60E+10	5.59E+10
Reduction	94%	75%	97%	31%	95%
WLA – MS4	7.41E+10	3.02E+10	2.26E+10	0	0
WLA - WWTP	0	0	0	0	0
LA	2.85E+10	1.16E+10	8.70E+09	2.71E+10	2.48E+10
MOS	1.21E+10	4.92E+09	3.68E+09	3.19E+09	2.92E+09
Reserve Capacity	6.03E+09	2.46E+09	1.84E+09	1.59E+09	1.46E+09
TMDL	**1.21E+11**	**4.92E+10**	**3.68E+10**	**3.19E+10**	**2.92E+10**

Table 8 TMDL Summary for chloride for Higgins Creek (IL_GOA-02) (lbs/day)

	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Current load	112,793	107,977	27,665	76,327	39,380
Reduction	41%	75%	26%	77%	59%
WLA – MS4	41,208	16,903	12,676	0	0
WLA - WWTP	0	0	0	0	0
LA	18,514	7,594	5,695	15,768	14,443
MOS	6,636	2,722	2,041	1,752	1,605
TMDL	**66,358**	**27,220**	**20,413**	**17,520**	**16,048**

Table 9 TMDL summary for Sylvan Lake (IL_RGZF) (MM org/day)

	Fecal Coliform Load
Current Load	2,960,887
Reduction	80%
Hawthorn Woods MS4	100,670
Long Grove MS4	592
Load Allocation	402,088
Reserve Capacity	29,609
MOS	59,218
TMDL	**592,177**

Table 10 TMDL Summary for TP TMDLs for Lakes (lbs/day)

Lake	Current Load	% reduction	WLA	MOS	LA	**TMDL**
Albert Lake	13.07	89	1.32	0.15	0.01	**1.48**
Beck Lake	0.45	10	0.12	0.04	0.25	**0.40**
Big Bear Lake	3.19	33	1.85	0.21	0.07	**2.13**
Big Bend Lake	6.51	74	1.40*	0.17	0.10	**1.66**
Bresen Lake	0.84	59	0.20	0.03	0.11	**0.35**
Buffalo Creek Lake	25.96	65	5.89	0.91	2.26	**9.06**
Countryside Lake	4.17	51	0.44	0.20	1.38	**2.03**
Diamond Lake	1.93	9	0.66	0.18	0.92	**1.75**
Forest Lake	1.52	63	0.34	0.06	0.17	**0.57**
Half Day Pit	11.73	80	0.55**	0.23	1.56	**2.34**
Lake Charles	2.36	13	1.75	.021	0.09	**2.05**
Little Bear Lake	2.23	7	1.81	.021	0.06	**2.08**
Pond-A-Rudy	0.42	67	0.07	0.01	0.05	**0.14**
Salem Reed Lake	0.70	69	0.19	0.02	0.001	**0.22**
Sylvan Lake	0.80	35	0.17	0.05	0.29	**0.51**

* includes 1.376 lb/day from the Des Plaines River
** includes 0.340 lbs/day from the Des Plaines River

Table 11 TMDL Summary for CBOD and NH3 for Buffalo Creek (IL_GST)(lb/day)

	CBOD	NH3
Current Load	158.96	8.92
Reduction	39%	30%
LA	8.59	0.24
MS4	65.04	4.18
WLA	13.7	1.2
MOS	9.70	0.62
TMDL	**97.03**	**6.24**

Table 12 WLAs for fecal coliform for Buffalo Creek (IL_GST) (MM org/day)

	NPDES permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Alden Long Grove Rehab	IL0051934	281	114	114	114	114
Camp Reinberg STP	IL0048542	75	30	30	30	30
Arlington Heights MS4	ILR400282	60,637	16,447	6,574	0	0
Barrington MS4	ILR400285	17,910	4,858	1,941	0	0
Buffalo Grove MS4	ILR400303	34,551	9,372	3,746	0	0
Deer Park MS4	ILR400359	13,551	3,675	1,469	0	0
Inverness MS4	ILR400359	25,321	6,868	2,745	0	0
Kildeer MS4	ILR400215	13,813	3,747	1,498	0	0
Lake Zurich MS4	ILR400370	25,834	7,007	2,801	0	0
Long Grove MS4	ILR400219	46,658	12,656	5,059	0	0
Palatine MS4	ILR400416	48,280	13,096	5,235	0	0

Table 13 WLAs for fecal coliform for Higgins Creek (IL_GOA-01) (MM org/day)

	NPDES Permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Des Plaines MHP	IL0054160	1,340	522	522	522	522
MWRDGC Kirie WRP	IL0047741	832,841	605,702	605	702	605
Arlington Hts MS4	ILR400282	8,172	1,890	803	0	0
Chicago MS4	ILR400173	442	102	43	0	0
Des Plaines MS4	ILR400325	15,160	3,507	1,489	0	0
Elk Grove MS4	ILR400334	32,567	7,534	3,199	0	0
Mt Prospect MS4	ILR400393	9,143	2,115	898	0	0
Rolling Meadows MS4	ILR400435	174	40	17	0	0

Table 14 WLAs for fecal coliform for Higgins Creek (IL_GOA-02) (MM org/day)

	NPDES Permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Arlington Hts MS4	ILR400282	12,530	5,107	3,822	0	0
Des Plaines MS4	ILR400325	1,835	748	560	0	0
Elk Grove MS4	ILR400334	45,540	18,564	13,892	0	0
Mt Prospect MS4	ILR400393	13,989	5,702	4,267	0	0
Rolling Meadows MS4	ILR400435	272	111	83	0	0

Table 15 WLAs for chloride for Buffalo Creek (IL_GST) (lbs/day)

	NPDES Permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Arlington Heights MS4	ILR400282	35,187	9,562	3,825	0	0
Barrington MS4	ILR400285	10,393	2,824	1,130	0	0
Buffalo Grove MS4	ILR400303	20,050	5,448	2,179	0	0
Deer Park MS4	ILR400359	7,864	2,137	855	0	0
Inverness MS4	ILR400359	14,693	3,993	1,597	0	0
Kildeer MS4	ILR400215	8,015	2,178	871	0	0
Lake Zurich MS4	ILR400370	14,991	4,074	1,629	0	0
Long Grove MS4	ILR400219	27,075	7,357	2,943	0	0
Palatine MS4	ILR400416	28,017	7,613	3,045	0	0

Table 16 WLAs for chloride for Higgins Creek (IL_GOA-01) (lbs/day)

	NPDES Permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Arlington Hts MS4	ILR400282	71,402	19,731	17,440	0	0
Chicago MS4	ILR400173	3,866	1,069	944	0	0
Des Plaines MS4	ILR400325	132,461	36,602	32,353	0	0
Elk Grove MS4	ILR400334	284,461	78,633	69,504	0	0
Illinois Tollway MS4	ILR400494	1,727	477	421	0	0
Mt Prospect MS4	ILR400393	79,894	22,077	19,513	0	0
Rolling Meadows MS4	ILR400435	1,502	420	372	0	0

Table 17 WLAs for chloride for Higgins Creek (IL_GOA-02) (lbs/day)

	NPDES Permit #	High Flows (0-10)	Moist Flows (10-40)	Mid-Range Flows (40-60)	Dry Flows (60-90)	Low Flows (90-100)
Arlington Hts MS4	ILR400282	6,950	2,850	2,138	0	0
Des Plaines MS4	ILR400325	1,018	418	313	0	0
Elk Grove MS4	ILR400334	25,207	10,340	7,755	0	0
Illinois Tollway MS4	ILR400494	124	51	38	0	0
Mt Prospect MS4	ILR400393	7,760	3,182	2,387	0	0
Rolling Meadows MS4	ILR400435	150	61.8	45.8	0	0

Table 18 WLAs for CBOD and NH3 for Buffalo Creek (IL_GST)(lb/day)

	NPDES Permit #	CBOD	NH3
Alden Long Grove Rehab	IL0051934	12.0	0
Camp Reinberg	IL0048542	1.7	1.2
Arlington Heights MS4	ILR400282	3.18	0.25
Barrington MS4	ILR400285	0.05	0.004
Buffalo Grove MS4	ILR400303	9.05	0.70
Deer Park MS4	ILR400359	6.67	0.51
Inverness MS4	ILR400359	0.004	0.0003
Kildeer MS4	ILR400215	9.74	0.75
Lake Zurich MS4	ILR400370	5.40	0.42
Long Grove MS4	ILR400219	14.72	1.14
Palatine MS4	ILR400416	7.70	0.59

Table 19 WLAs for TP for Lakes (lbs/day)

Lake	MS4/Facility	NPDES ID #	% Area of Watershed	**WLA (lb/day)**
Albert Lake	Lake Zurich	ILR400370	47	**0.620**
	Long Grove	ILR400219	17	**0.226**
	Kildeer	ILR400215	36	**0.475**
Beck Lake	Glenview	ILR400343	32	**0.117**
Big Bear Lake	Libertyville	ILR400374	14	**0.260**
	Mundelein	ILR400395	54	**1.030**
	Vernon Hills	ILR400252	29	**0.559**
Big Bend Lake	Glenview	ILR400343	8	**0.009**
	Des Plaines	ILR400325	13	**0.015**
Bresen Lake	Hawthorn Woods	ILR400209	64	**0.199**
Buffalo Creek Lake	Alden Long Grove Rehab	IL0051934	Non-MS4	**0.448**
	Camp Reinberg STP	IL0048542	Non-MS4	**0.117**
	Arlington Heights	ILR400282	5	**0.357**
	Barrington	ILR400285	0.1	**0.003**
	Buffalo Grove	ILR400303	1	**0.075**
	Deer Park	ILR400359	10	**0.745**
	Inverness	ILR400359	<0.1	**0.0005**
	Kildeer	ILR400215	14	**1.090**
	Lake Zurich	ILR400370	8	**0.602**
	Long Grove	ILR400219	21	**1.600**
	Palatine	ILR400416	11	**0.864**
Countryside Lake	Hawthorn Woods	ILR400209	14	**0.261**
	Long Grove	ILR400219	<0.1	**0.0005**
	Mundelein	ILR400395	18	**0.183**
Diamond Lake	Mundelein	ILR400395	35	**0.556**
	Long Grove	ILR400219	7	**0.108**
Forest Lake	Hawthorn Woods	ILR400209	37	**0.189**
	Lake Zurich	ILR400370	29	**0.150**
Half Day Pit	Lincolnshire	ILR400375	12	**0.205**
Lake Charles	Libertyville	ILR400374	16	**0.300**
	Mundelein	ILR400395	63	**1.171**
	Vernon Hills	ILR400252	15	**0.282**
Little Bear Lake	Libertyville	ILR400374	12	**0.231**
	Mundelein	ILR400395	49	**0.915**
	Vernon Hills	ILR400252	35	**0.661**
Pond-A-Rudy	Hawthorn Woods	ILR400209	58	**0.072**
Salem Reed Lake	Long Grove	ILR400219	99	**0.193**
Sylvan Lake	Hawthorn Woods	ILR400209	17	**0.172**
	Long Grove	ILR400219	0.1	**0.0004**