Ohio Lake Erie Commission

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Mike DeWine, *Governor* Jon Husted, *Lt. Governor* Joy Mulinex, *Executive Director*

August 20, 2024

Teresa Seidel, Director
U.S. Environmental Protection Agency
Great Lakes National Program Office
77 W. Jackson Boulevard (G-17J)
Chicago, IL 60604-3511

RE: Maumee Area of Concern Restrictions on Navigational Dredging Activities Beneficial Use Impairment Removal Action

Dear Director Seidel,

Through a partnership between the Ohio Lake Erie Commission, Ohio EPA and many local entities, the State of Ohio has worked towards the restoration of the Restrictions on Navigational Dredging Activities Beneficial Use Impairments (BUI) identified for the Maumee Area of Concern (AOC).

Because of improvements over the years in the lower Maumee River, implementation of source control measures, routine federal navigation channel dredging, and results and findings of the Toledo Harbor 2021 sediment data, I submit this BUI removal recommendation for Restrictions on Navigational Dredging Activities in the Maumee AOC. On behalf of Ohio EPA, the local AOC Advisory Committee and the organizations that have helped restore the BUI, I respectfully request your concurrence with the enclosed recommendation to remove the Restrictions on Navigational Dredging Activities BUI in the Maumee AOC.

This will be the fourth BUI removed in the Maumee AOC. The continued progress restoring the AOC and delisting BUIs is a result of the work by local stakeholders and organizations, as well as the state and federal AOC programs. We look forward to working with U.S. EPA and the local AOC Advisory Committee to continue progress in the Maumee Area of Concern.

Sincerely,

Joy Mulinex

Joy Mulinex
Director, Ohio Lake Erie Commission

Enclosure
cc: Mark Johnson, OEPA-DSW
Kris Patterson, OLEC
Leah Medley, USEPA-GLNPO
Cherie Blair, OEPA

Removal Recommendation for the Restrictions on Navigational Dredging Activities Beneficial Use Impairment in the Maumee AOC

Lower Maumee River
Photo credit: Bryce Blair Jr.

August 2024

Environmental Protection Agency

Maumee AOC

Lake Erie Commission

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Purpose

The purpose of this document is to recommend the removal of the *Restrictions on Navigational Dredging Activities* Beneficial Use Impairment (BUI) from the Maumee Area of Concern (AOC). This document includes for background a brief history of the uses, impacts, and cleanup of the Maumee River as it relates to sediment contamination and port operations, as well as information and documentation regarding the sediment quality evaluations and measures the results of the evaluations compared to applicable State of Ohio BUI Restoration Targets.

Background of Maumee AOC

In 1987, the US-Canada Great Lakes Water Quality Agreement amendments formed the Area of Concern (AOC) program. This program, specific to the Great Lakes Region, identified 43 "Areas of Concern" surrounding the Great Lakes that exhibited such degrees of environmental degradation that they posed risks to the overall health of the Lakes, the wildlife that depend on them, and the people that use the resources.

The Maumee AOC is one of those areas of concern. It covers 787 square miles, encompassing the greater-Toledo region and areas around Toledo in Ottawa, Wood, and Fulton counties. In total, 57 communities of all sizes are spread across this area, and roughly 500,000 people call it home. The Maumee AOC, shown in Figure 1, includes approximately 45 miles of Lake Erie shoreline and over 1,900 miles of stream in 11 independent watersheds including all of Swan Creek, Ottawa River (Ten

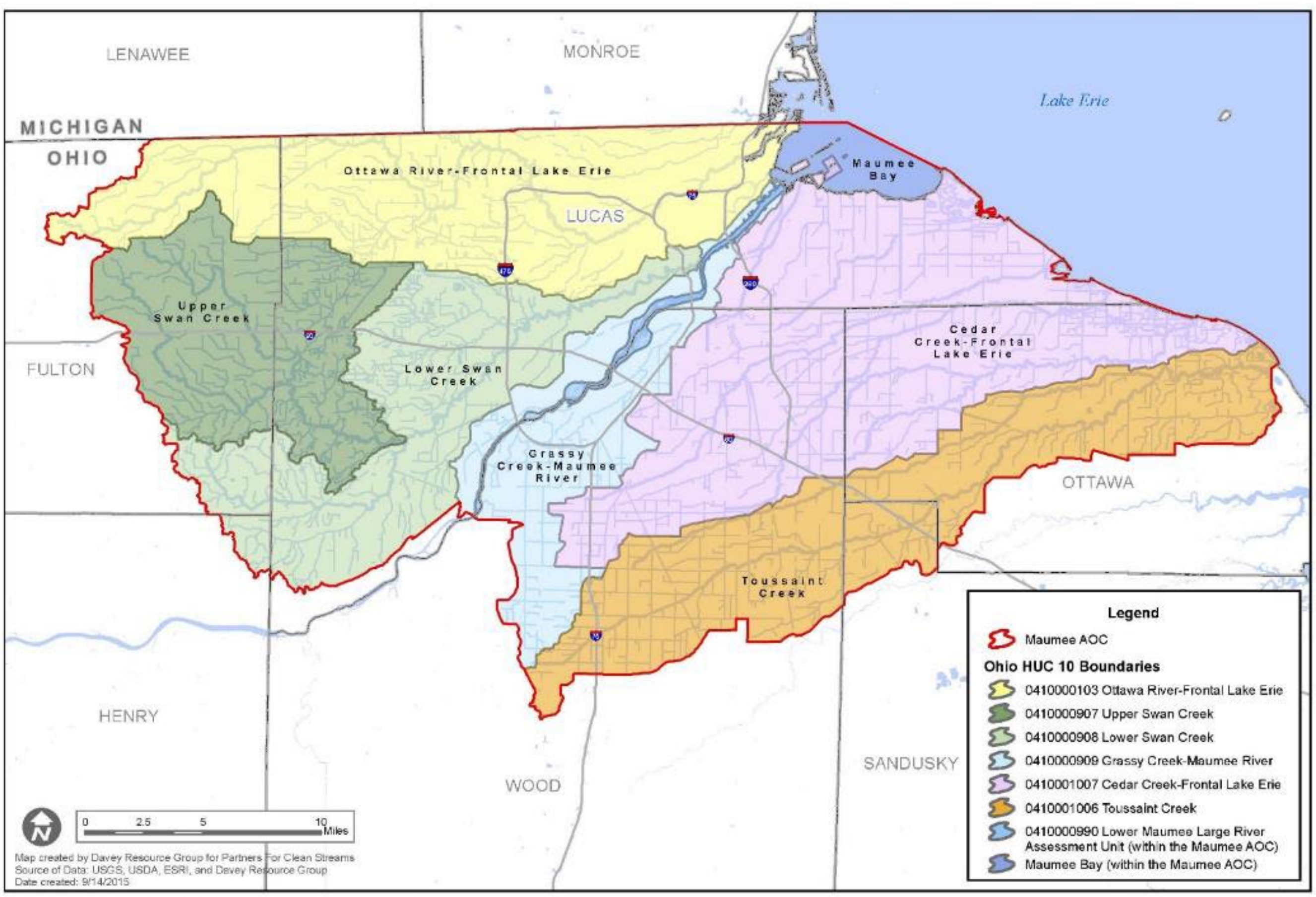

Figure 1. Maumee Area of Concern

Mile Creek), Duck Creek, Otter Creek, Cedar Creek, Grassy Creek, Crane Creek, Turtle Creek, Packer Creek, Toussaint River, the lower 23 miles of the Maumee River and a portion of Maumee Bay. Land use in the AOC is diverse, representing urban and rural developments, agriculture, and pockets of native forests, prairies, and wetlands.

The work of the Maumee AOC and its partners strives to improve water quality of the rivers and streams in the AOC by correcting and removing physical, chemical, and/or biological issues, also known as Beneficial Use Impairments (BUIs). The Maumee AOC had 10 of the 14 BUIs identified as impaired in 1987, these are summarized below: BUI 12 was removed in 2015, BUI 1 was removed in 2022, and BUI 11 was removed in 2023.

Beneficial Use Impairments listed in Maumee AOC

1. **Restrictions on fish and wildlife consumption – Removed in 2022**
3. Degradation of fish and wildlife populations
4. Fish tumors or other deformities
6. Degradation of benthos
7. Restrictions on dredging activities
8. Eutrophication or undesirable algae
10. Beach closings
11. **Degradation of aesthetics – Removed in 2023**
12. **Added cost to agriculture or industry – Removed in 2015**
14. Loss of fish and wildlife habitat

Ohio's BUI Listing Guideline and Restoration Target for *BUI 7: Restrictions on Navigational Dredging Activities*

In 2005, the Ohio Environmental Protection Agency (Ohio EPA) created *Delisting Targets for Ohio Areas of Concern* for each BUI (Ohio EPA, 2005). The state based this guidance upon the U.S. Policy Committee Delisting Principles and Guidelines (USPC, 2001), the International Joint Commission's Delisting Guidelines (1991), and various Ohio water quality standards, guidance, and policies. From 2012 to 2014 Ohio conducted a comprehensive evaluation of its BUI Delisting Targets to ensure they were measurable and achievable for the AOC Program. The outcome of that review was Ohio's 2014 version of the *Delisting Guidance and Restoration Targets for Ohio Areas of Concern.*

Since then, the Ohio Areas of Concern Program has periodically updated this BUI removal guidance document with the most current version being released in December 2023 (Ohio EPA and OLEC, 2023). This document outlines for *BUI 7: Restrictions on Navigational Dredging Activities*, the International Joint Commission (IJC) listing guideline as:

IJC Listing Guideline

An impairment will be listed when contaminants in sediments exceed standards, criteria or guidelines such that there are restrictions on dredging or disposal activities.

Also included in the *Delisting Guidance and Restoration Targets for Ohio Areas of Concern* are Ohio's BUI listing guidelines and restoration targets for BUI removal. The State of Ohio BUI listing guideline for BUI 7 is:

State of Ohio Listing Guideline
This beneficial use shall be listed as impaired if: Contaminants in sediment exceed sediment quality guidelines used by the State such that there are restrictions on navigational dredging or disposal activities.

The current state of Ohio restoration target for BUI 7 is:

State of Ohio Restoration Target
This beneficial use will be considered restored when the following conditions are met: There are no restrictions on navigational dredging or disposal activities due to contaminants in sediment, such that there are suitable options available for reuse or disposal of the material. **Notes** • Navigational dredging refers to dredging of a federally designated ship channel and historically dredged stretches of a river to enable the passage of commercial and/or recreational vessels. Restrictions to disposal activities refer to the prohibition of disposal or reuse of dredged materials due to chemical contamination or biological toxicity of the sediment. • This does not include the maintenance dredging of private marinas, slips, docks, etc. However, if sediment contaminant concentrations in these areas are a source of contamination that precludes attainment of remedial dredging goals of federally designated ship channels and historically dredged stretches of a river, then dredging of private marinas, slips, docks, etc. may be necessary. **Potential Data Sources** • Ohio EPA and U.S. Army Corps of Engineers sediment characterization studies • Other sediment characterization studies

The full text of this BUI Restoration Target is included in Appendix A of this document.

Listing BUI 7 as Impaired in the Maumee AOC

According to the Ohio's BUI restoration target guidance (Ohio EPA and OLEC, 2023), navigational dredging refers to dredging of a federally designated ship channel and historically dredged stretches of a river to enable the passage of commercial and/or recreational vessels. The Maumee AOC includes a portion of the Toledo Harbor federal navigation channel (Figures 6 and 7). This is the only area of the Maumee AOC where this BUI is considered to be applicable and it does not include the maintenance dredging of private marinas, slips, docks, etc. The guidance also states that restrictions to disposal activities refers to the prohibition of disposal or reuse of dredged materials due to chemical contamination or biological toxicity of the sediment.

Figure 2. Sediment plume from Maumee River and Maumee Bay entering Lake Erie. Landsat image from April 11, 2014.

BUI 7: Restrictions on Navigational Dredging Activities was listed as impaired in the *1990 Maumee River Remedial Action Plan Stage 1 Investigation Report – Executive Summary* (Ohio EPA, 1990a) due to "The Lower Maumee River Basin has pollution problems caused by excess sediments, nutrients and toxics entering the system. It has been designated an AOC because of the heavy metals and organic chemical contamination in the sediment. ... Erosion causes problems to navigation on the Maumee River and Bay because of an increase in sediments. The stream segments in the AOC are moderately to heavily polluted, depending on the particular metal and sampling point." The *1990 Maumee River Remedial Action Plan Stage 1 Investigation Report* [Stage 1 Report] (Ohio EPA, 1990b) includes data illustrating the elevated levels of contamination and toxicity in the Toledo Harbor federal navigation channel sediment compared to from various biological studies outlining the negative impacts to the biological community. An example of a sediment plume entering Maumee Bay from the Maumee River is shown in Figure 2. The Maumee River has been used as a shipping hub for more than a century as shown in Figure 3.

Figure 3. Entrance to the Maumee River from Maumee Bay and Lake Erie prior to the creation of the present day docks at the Port of Toledo. Circa early 1900s. Courtesy of https://nmgl.org/entrance-to-the-maumee-river/

The Ohio's BUI restoration target guidance (Ohio EPA and OLEC, 2023) states that *BUI 7: Restrictions on Navigational Dredging Activities* shall be listed as impaired when "contaminants in sediment exceed sediment quality guidelines used by the State such that there are restrictions on navigational dredging or disposal activities". Under this criterion, the BUI has remained impaired until now.

Uses, Impacts, and Cleanup of the Maumee River

Since before the earliest days of European settlement, the Great Lakes and St. Lawrence River have been utilized as a means of transportation. Great Lakes cities were founded as trading posts along a vast marine highway that facilitated commerce in an era pre-dating railroads and highways. This relationship to the water has enabled the region to thrive, and today the Great Lakes-St. Lawrence region is the industrial and agricultural heartland of both the United States and Canada. With the Lower Maumee River being utilized as a port since the mid-1800s, it has a legacy of use, and some abuse, for more than 170 years, as shown in Figures 3 and 4. This section explains some of the key challenges and changes this river has faced.

Figure 4. Colored photograph of Maumee River looking upstream from Cherry St. Bridge (renamed Dr. Martin Luther King Jr Bridge). Circa 1900.
Courtesy of https://nmgl.org/pot-pc-from-cherry-st-bridge/

Port of Toledo and Toledo Harbor

The Port of Toledo is an industrial, commercial, and transportation center for the north central United States. The Port of Toledo handles over 27 different bulk commodities (Figure 5). Historically, three dry bulk commodities have been dominant – receipt of iron ore, shipment of coal, and shipment of grain. Other bulk commodities handled through the port include gravel, sand, salt, limestone, wheat, oats, soybeans, maize, coke, abrasives, pig iron, fertilizer, cement, molasses, benzene, and scrap metal. In addition, several waterfront facilities are equipped to receive and/or ship petroleum products (i.e., oil, asphalt) (USACE, 2023).

Figure 5. The Port of Toledo moves a variety of bulk commodities with new cranes installed in 2020.
Courtesy of Toledo Lucas County Port Authority

The Toledo-Lucas County Port Authority (TLCPA) offers long- and short-term dry storage space, as well as open storage areas, for commodities shipped through the port. The Port of Toledo also holds waterfront plants engaged in making repairs to vessels of wide-ranging sizes. Tug operations for towing, docking, and shifting vessels at the harbor, and for towing services at numerous other Great Lakes ports, are also housed at the port (USACE, 2023).

The Toledo Harbor federal navigation channel, Figure 6, supports the Port of Toledo's 35 piers, wharves, and docks located in Maumee Bay along the southeast side of the Maumee River mouth, and along both banks of the lower seven miles of the river. Many of the piers, wharves and docks are used for multiple purposes (USACE, 2023). In 2022, the Port of Toledo supported nearly 8,000 jobs in

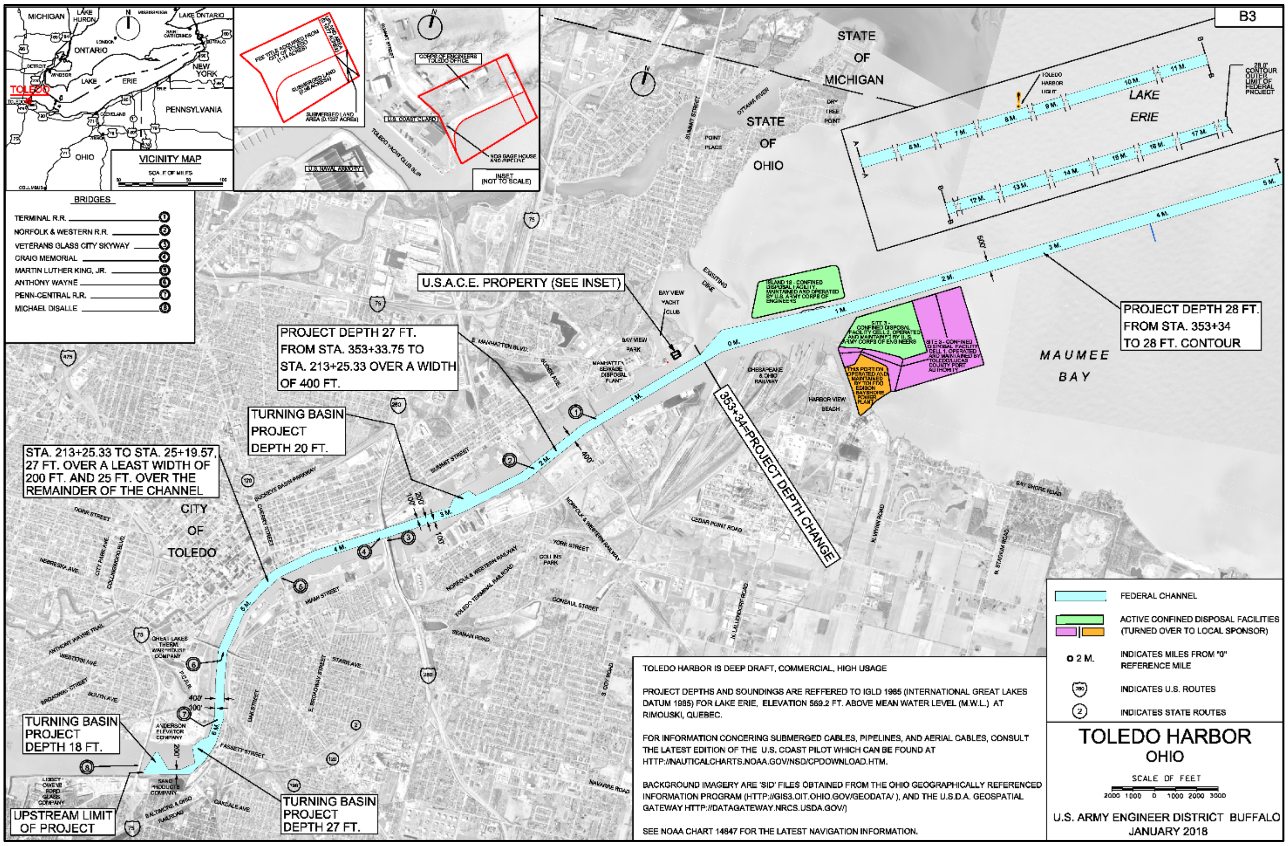

Figure 6. Toledo Harbor federal navigation channel.

the region and generated over $906 million annually in economic activity (TLCPA, 2023). Consistent dredging, along with proper dredge sediment management, is critical to the long-term sustainability of the Port of Toledo's industrial operations and the ecosystem in Toledo Harbor (TLCPA, 2024).

The authorized Toledo Harbor federal navigation channel is designed to accommodate safe deep-draft commercial navigation and is maintained by U.S. Army Corps of Engineers. The Toledo Harbor federal navigation channel generally includes a seven-mile-long River Channel in the lower Maumee River and a Lake Approach Channel extending approximately 18-miles out into the Western Lake Erie Basin (WLEB) as shown in Figure 6 (USACE, 2022). Not all of the Toledo Harbor federal navigation channel is within the

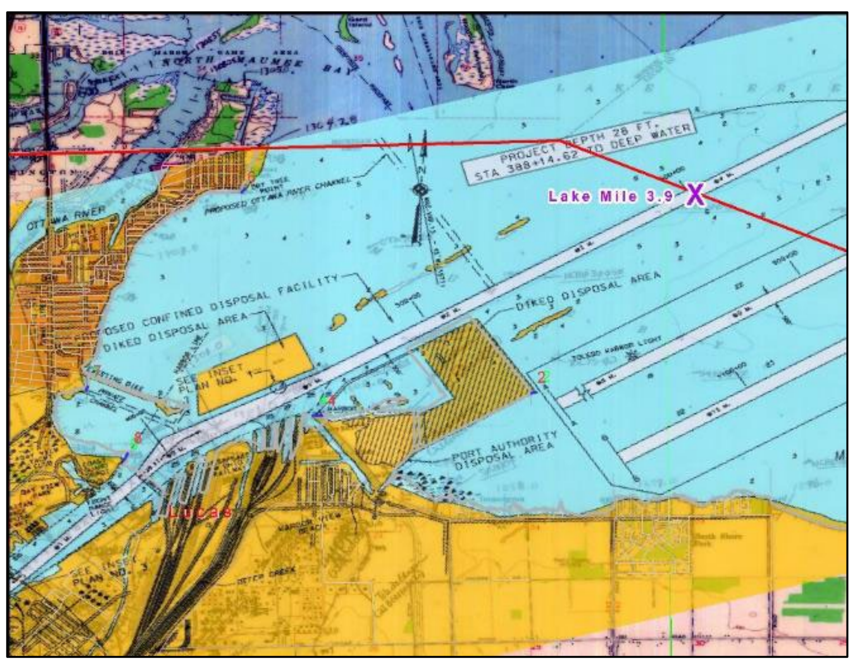

Figure 7. Toledo Harbor federal navigation channel within the Maumee AOC.

Maumee AOC. The Maumee AOC includes the seven-mile-long Maumee River Channel and up to Lake Mile 3.9 in the Lake Approach Channel as shown in Figure 7.

For more than 170 years these shipping uses, along with many other uses seen in Figure 8, such as various coal industries, chemical plants, petroleum production, and wastewater outfalls, contributed to sediment contamination of the lower Maumee River.

Figure 8. The Maumee River from the mouth of Swan Creek to its confluence with Maumee Bay. Circa 1955. Courtesy of https://voicemap.me/tour/toledo-ohio/the-port-of-toledo-from-middlegrounds-metropark-to-cherry-street-and-back/sites/the-mighty-maumee

The predominant source of sediments in the federal navigation channel are erosion in the upstream portions of the Maumee River Basin, and the Western Lake Erie Basin (WLEB), respectively. Like other sediments or soils within an urbanized and developed watershed or water body influenced by anthropogenic activities, these sediments are impacted by low concentrations of metals, nutrients, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, and other constituents reflective of ambient conditions in the 21st Century environment (USACE, 2016; USACE, 2018; USACE, 2022). The results of recent sediment sampling activities are discussed in subsequent sections of this document.

Federal Navigation Channel

A "federal" navigation channel is one that has been authorized by Congress. The Toledo Harbor is one of those authorized federal navigation channels designated by Congress. Funding for maintenance dredging in the federal channel was first initiated in 1856 through the Rivers and Harbors Act, with the federal channel first completed in 1892. Successive acts increased the authorized depth from 15 feet in 1875 to 25 feet below low water datum (LWD) in 1936. Additional sections of the respective river and lake channels were authorized to be deepened to 27 feet and 28 feet in 1960 (OLEC and TLCPA, 2012). The current authorized maintenance for the Maumee River channel is 7 miles long, 400 feet wide and 27 feet deep with the lake approach channel being 18 miles long, 500 feet wide and 28 feet deep in Maumee Bay.

The USACE Buffalo District maintains the federal navigation channel with annual operation and maintenance dredging. USACE dredges approximately 600,000 - 1,000,000 CY of sediment from the Toledo Harbor federal navigation channel annually. That is equivalent to nearly 27,000 dump trucks annually. Toledo Harbor accounts for 25% of all dredged material in the Great Lakes, more than any other single port on the Great Lakes (TLCPA, 2024).

Historically, dredged sediment was placed in a series of Confined Disposal Facilities (CDFs) along the Maumee River and in Maumee Bay. The *Stage 1 Report* states that, "The COE [Corps of Engineers] dredges approximately one million cubic yards of materials from the channel each year. Prior to 1975, those materials were disposed of in confined disposal facilities (CDF) or by open lake disposal. From 1975 to 1985, dredge spoils were placed in the currently active CDF, Facility #3, to protect the environment from contaminated sediments. In 1985, U.S. EPA approved open lake disposal of materials dredged from less polluted areas of the channel if chemical analysis showed that the materials to be disposed of were similar to sediment in certain areas of the Western Basin where disposal had occurred in the past." (Ohio EPA, 1990b). Dredged sediment was placed in the open waters of Lake Erie until Ohio banned open lake placement of Lake Erie dredge from federal navigation channels, effective July 1, 2020, as part of statewide efforts to improve Lake Erie water quality, reduce nutrient load, and minimize sedimentation. To achieve these goals, Ohio is working closely with the USACE and local stakeholders to develop projects to beneficially use dredged sediment as a resource. Dredge sediment beneficial use project include dredge as a farm field soil amendment, marketable soil, and for wetlands and other ecosystem restoration and creation projects. For more information on Ohio's Dredge Material Program, refer to the OLEC website: https://lakeerie.ohio.gov/programs-and-projects/dredge-material-program/dredge-material-program (OLEC, 2024).

Other Impacts and Improvements

In addition to the transportation of goods through the Port of Toledo, there have also been countless industries, power plants, and other dischargers to the Lower Maumee River. By the mid-19th century, Toledo boasted a population of more than 50,000 people, making it one of the largest cities in the state (Metroparks, 2021). This section highlights just a few of the contributors to the contamination that once existed and briefly describes how it has been addressed. This information has been grouped in the two subsections from upstream in the Maumee River federal navigation channel toward Lake Erie.

Maumee River (River Navigation Channel)

This subsection features selected sites from upstream along the Maumee River federal navigation channel toward the mouth/confluence with the Lake Approach Navigation Channel. An overview of these sites can be seen in Figures 9 and 17.

Figure 9. Overview of sites located in the Maumee River Navigation Channel as referenced in this Maumee River subsection. Base image courtesy of Google Earth Pro, image date: 10/21/2022.

Middlegrounds Rail Yard (near River Mile [RM] 5.3)

In 1848, Erie and Kalamazoo Railroad purchased 30 acres of Middlegrounds for $70/acre, and they built railroads, docks, the Island House, station bridges, and roundhouse for servicing locomotives. In 1888, twelve grain elevators stood on Middlegrounds land and had a capacity of 7.2 million bushels with daily receipts and shipments of 1.2 million bushels (Figure 10). Years of industry took its toll on this property, but in 2006, Metroparks Toledo transformed what was essentially a public dumping grounds into the Middlegrounds Metropark by removing 8,000 tons of waste, including, tires, household garbage, and litter (Figure 11). Thousands of tons of dirt and debris were removed, soil was restored, and a creative, eco-friendly process for filtering stormwater runoff from Anthony Wayne Bridge was enacted. Stormwater from the bridge is now collected through pipes and channeled into a series of rock and vegetation filled bio-swales that help to filter the water (Metroparks, 2018).

Figure 10. Railroads and roundhouses under the Anthony Wayne High Level Bridge (circa late 1800s).
Courtesy of https://metroparkstoledo.com/discover/blog/posts/middlegrounds-was-center-of-transportation/

Figure 11. Middlegrounds Metropark shortly after construction in 2006.
Courtesy of https://toledocitypaper.com/health/middlegrounds-kayak-adventure-on-the-maumee/

Water Street Station (near RM 4.5)

The massive brick building with two stacks guarding Promenade Park is known today as the ProMedica Headquarters. Originally called Water Street Station, this facility was built as a coal plant in the late 1800s. The plant was converted to steam in 1929. When the steam plant underwent extensive repair and remodeling in 1975, the area just upstream of the plant was chosen for development as the new Promenade Park. This Park was expanded to include ProMedica Plaza in 2017 and now is a total of 11 acres along the west bank of the Maumee River in downtown Toledo (Long, 2018) (Figures 12-13).

Figure 12. Water St Station steam plant was one of the largest power plants in the Midwest in early 1900s.
Courtesy of https://voicemap.me/tour/toledo-ohio/the-port-of-toledo-from-middlegrounds-metropark-to-cherry-street-and-back/sites/water-street-station

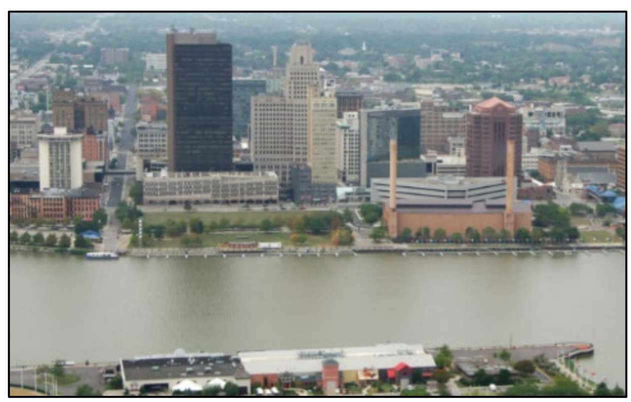

Figure 13. Promenade Park along Maumee River in downtown Toledo. The former steam plant is now used as office space.
Courtesy of https://marinas.com/view/marina/d9cyj6_Promenade_Park_Portside_Docks_Toledo_OH_United_States

Acme Power Plant (near RM 3.7)

This 120-acre property was used for industrial and commercial purposes since the late 1800s. The Acme Power Plant was a coal burning electric power generating facility constructed at this location in 1918 at the site of a former steel mill operation by the Acme Power Company (Long, 2018). In the late 1900s the property housed the Toledo Sports Arena, Brenner Marine, Penn Railroad, George Gradel Company, ACME Edison Fly Ash Ponds and the Paul Lorenzen Property (woodworking and storage). In April 2010, following extensive local, state, and federal investment in the cleanup of this site, Ohio EPA issued a Covenant Not to Sue based upon a determination that the site was suitable for reuse (Ohio EPA, 2010). As a part of redeveloping this property into green space in 2022 and 2023, Metroparks Toledo beneficially used clean Toledo Harbor dredged sediment for revegetation of former industrial areas at Glass City Metropark and associated Riverwalk (Figures 14-15).

Figure 14. Toledo Edison Acme coal power plant along the Maumee River. Circa. 1954.
Courtesy of the Toledo-Lucas County Public Library, obtained from http:///images2.toledolibrary.org/

Figure 15. Glass City Metropark. Phase 1 was completed in 2019. This image shows Phase 2 under construction in 2021.
Courtesy of Google Earth Pro, image date: 2/2/2023.

Koppers/Toledo Coke (near RM 1.8)

The 51-acre site is located along the east side of the Maumee River and was used from 1914 to the mid-1990s primarily for coking operations as shown in Figure 16. The coal tar that was produced was reused in the coking process. In May 1987, Toledo Coke purchased the property (Maumee AOC, 2002). In October 2013, Ohio EPA issued a Covenant Not to Sue to the TLCPA based upon a determination that the site was suitable for commercial or industrial land use. Remedial activities included the excavation and off-property disposal at a licensed facility of over 8,000 CY of contaminated soils. Another 5,500 CY of contaminated soils were consolidated on the property, covered with clean soil, compacted, and a perimeter fence was installed around this soil consolidation area (Ohio EPA, 2013a). This site is now leased to Seneca Petroleum.

Figure 16. Toledo Coke is operations. Date Unknown.
Photo courtesy of Verdantas, Phase 1 Property Assessment. June 1991.

Chevron (near RM 1.6)

The Chevron Toledo Property is located in Toledo and Oregon, Ohio stretching from the east bank of the Maumee River to the west bank of Otter Creek. The northern boundary is Old Millard Ave., and the southern boundary is a rail line. Petroleum refining was conducted by Paragon Oil Refinery and Gulf Refining Company at the approximately 220-acre site from 1888 until 1981. The refinery was closed by Gulf in 1981. In 1984, the facility was dismantled and shortly thereafter, Chevron U.S.A Inc. merged with Gulf. In September 2003, Ohio EPA issued a Covenant Not to Sue based upon a determination that the site was suitable for industrial land use (Ohio EPA, 2013b). The remedial activities generally consisted of long-term institutional and engineering controls located on the Property, which are designed to address residual levels of hazardous substances and petroleum contamination in soil and ground water. The engineering controls consisted of an encapsulation cell for the management of impacted soils, including a shoreline revetment to prevent the erosion of native soils into the Maumee River; a barrier wall to prevent impacted ground water migration into the Maumee River; a ground water management system for the treatment of impacted ground water; redistribution of the treated ground water downgradient of the wall; and relief of ground water mounding upgradient of the wall; and an engineered separation cap for the protection of future industrial workers. The engineering controls for the Former Marketing Area consisted of a soil-bentonite barrier wall designed to provide a low permeability, vertical barrier to eliminate the lateral migration of dense non-aqueous phase liquid (DNAPL) off-site. DNAPL recovery sumps were installed to intercept and collect any DNAPL; and an engineered separation cap was installed to prevent exposure of soils to industrial workers (Ohio EPA, 2013b). The DNAPL sumps were decommissioned as DNAPL was never identified in meaningful quantities and additional engineering improvements were installed to support the current Cleveland-Cliffs' Toledo Direct Reduction Plant that operates on a portion of the site. Ironville Terminal Intermodal Yard operates on another portion of the site.

Figure 17. Overview of the confluence of the Maumee River with Maumee Bay showing the Port of Toledo docks and several of the former and current CDFs. Base image courtesy of Google maps-2024.

Penn 7, Penn 8, and Riverside Park (near RM 1.5, 2.1, and 2.5)

The City of Toledo owns and operated the Penn 7, Penn 8, and Riverside Park properties, which are located north of Interstate 280 along the west bank of the Maumee River. These facilities are approximately 59 acres, 30 acres, and 52 acres, respectively (OLEC and TLCPA, 2012). These sites, along with Grassy Island (information in next subsection), were created as combined disposal facilities (CDFs) to receive dredge material from the Maumee River in the late 1960s to early 1970s (Figure 17). All three Maumee River areas are situated along a section of the river where shorelines are predominantly lined with metal walls and floodplain wetland habitat is almost non-existent.

Penn 7 was identified as a location for a Maumee AOC management action for the benefit of fish and wildlife populations and habitat. Prior to beginning this project, a Feasibility Study was conducted in 2017 that evaluated the potential restoration plans and determined that "evaluation reveals that is not reasonably anticipated that any wetland restoration activities completed on Penn 7 would have a deleterious impact on the surrounding area" (Hull & Associates, 2017). From 2018 to 2021, the Penn 7 property was transformed from an old CDF to a natural urban oasis that provides natural habitat for birds, fish, and many other animals. The site is in the process of being activated as a city park with trails, water access, and educational signage (Figure 18).

Figure 18. Penn 7 after wetland, stream and open-water enhancements were completed in 2022.
Courtesy of Verdantas 2022.

Penn 8 has been kept in a fallow state with some low-quality vegetation (i.e., cottonwoods, scrub grass, phragmites). It has been used by City of Toledo since the early 2000s to store dirt, wood, and other natural materials for later use by the city.

Great Lakes Dredged Material Center for Innovation (f.k.a. Riverside Park [riverfront portion]) site was selected to be transformed from a former CDF to a site that could be used to identify a long-term combination of beneficial uses for Toledo Harbor dredged material. Approximately 40,000 CY of dredged material was stockpiled on site in 2012. In 2015-16 that material was used to construct containment cells to manage and dewater 70,000 CY of hydraulically offloaded dredged material that is being researched and beneficially used to enhance soil quality on agricultural land (Bingham et. al., 2021) and on former brownfields including Glass

Figure 19. Dredged Material Center for Innovation in Fall 2020.
Courtesy of Verdantas November 2020

City Metropark (Figure 14), and to reduce nutrient runoff. The center also is researching the feasibility of dredged materials being used in blended soil products (TLCPA, 2018) (Figure 19).

Maumee Bay (Lake Approach Navigation Channel)

This subsection features selected sites from the confluence of the Maumee River with Maumee Bay toward Lake Erie.

Grassy Island (near Lake Mile [LM] 0.7)

Grassy Island, also called Island 18, was constructed as a CDF in 1962 with an initial capacity of 5 million CY. It was expanded in 1977 by USACE. Grassy Island is approximately 150 acres and was used throughout the 1970s to place material from the federal navigation channel (USACE, 2003). In August 2007, after several decades of not being used, USACE attempted to place material into the site, causing the dike to breach. A temporary repair was immediately completed; however, Grassy Island currently requires a permanent repair to the dike breach before it can accept additional dredged material. Once repaired, the site could accommodate 1.8M CY (OLEC and TLCPA 2012). Grassy Island is exclusively managed and maintained by USACE (Figure 20).

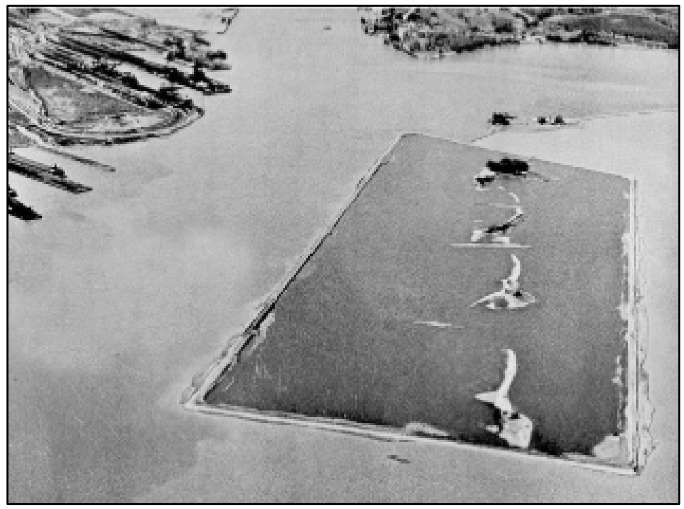

Figure 20. Island 18 CDF shortly after construction in 1962
Courtesy of US Army Corps of Engineers

Otter Creek Contaminated Sediment Remediation (near LM 0.8)

Otter Creek and the surrounding area was historically an industrial area populated by oil refineries, railroad yards, and other industrial use businesses. By the early 1900s there were multiple refineries located in east Toledo. A 1976 study documented conditions in Otter Creek that included oil sheens killing wildlife, oily fires, sludge, and other environmental hazards. Documentation of these conditions were based on reports and letters from local and state organizations and individuals that dated back to the 1940s (Balduf, 1976). In 2021, the lower 1.7 miles of Otter Creek were subject to a Great Lakes Legacy Act (GLLA) sediment remediation project (Figure 21). The project successfully removed approximately 50,400 cubic yards of contaminated sediment via hydraulic dredging from the creek and its confluence within Maumee Bay (U.S. EPA, 2021).

Figure 21. Dredging operations at the confluence of Otter Creek and Maumee Bay in Summer 2021.
Courtesy of US Army Corps of Engineers

Facility 3 *(near Lake Mile [LM] 1.5)*

CDF Facility 3, also called Site 3, was constructed in 1976. An extension was built in 1993 (USACE, 1995). The existing CDF is approximately 495 acres and is composed of different areas based upon ownership and usage as depicted in Figure 22. Facility 3 is owned/operated by the Toledo-Lucas County Port Authority (TLCPA) with the exception of one 155-acre cell that the USACE owns/operates. After decades of a mix of open lake placement and CDF disposal to manage the dredged material, beginning in 2020, all material dredged from the federal navigation channel has been placed in Facility 3 Management Unit 1. Non-federal dredged sediment is typically placed in the areas known as the "wart" and "banana" (Figure 22).

Figure 22. Facility 3 Confined Disposal Facility with management units labeled.

The TLCPA has partnered with the Ohio EPA and the Ohio Department of Natural Resources (ODNR) to reactivate Toledo's dredge placement CDF (Figure 22). Since 2014, in anticipation of Ohio's prohibition on open lake placement of dredge material in 2020, the TLCPA, Ohio EPA, and ODNR began collaborating to modify Facility 3 to accommodate the placement of dredge material from the federal navigation channel and the approaches and berths of Toledo's 13 active marine terminals. Using $4.7 million in Ohio's Healthy Lake Erie Grant Program funding and local funding, approximately 4.1 million CY of dredging disposal capacity was created in Management Unit 1 of Facility 3 between 2018 and 2020. Additional work was completed to build capacity in Management Unit 2 with this funding (Figure 22).

Since July 1, 2020, Toledo Harbor dredged sediment has been hydraulically placed into Management Unit 1 of the upgraded TLCPA maintained portions of Facility 3, shown in Figure 23. In 2022, Ohio EPA awarded an additional $9 million to TLCPA to further expand the capacity of Facility 3, so it can continue to receive all Toledo Harbor dredged material through 2040. The Facility 3 Improvements Project is financed with federal funding through a State and Local Fiscal Recovery Fund Grant made available by the American Rescue Plan Act through a financial assistance grant agreement to TLCPA by Ohio EPA. As part of the Facility 3 Improvements Project, the TLCPA is raising dike berms and constructing areas to excavate and readily dewater dredged sediment for sustainable beneficial uses

Figure 23. Hydraulic placement of dredged sediment into Facility 3 at the mouth of the Maumee River. Courtesy of Verdantas, 2020.

such as marketable soil and farm soil amendment (Brigham, 2021). For more information on the Facility 3 Improvements Project, refer to https://www.toledoport.org/facility-3-improvement-project (TLCPA, 2024).

Measuring Conditions

In order to evaluate the impact that shipping and industry has had upon the sediments in the Lower Maumee River, the USACE routinely samples sediment from within the federal navigation channel in order to make dredged material management decisions. Sediment sampling events usually include portions of the river and/or lake approach navigation channel. Most recently these sampling events occurred in 2010, 2012, 2014, 2015, 2016, 2017, and 2021. USACE also performed dredged sediment evaluations/characterizations in 2016, 2018, and 2022 in order to determine if sediments dredged from Toledo Harbor federal navigation channels meet "contaminant determination" Clean Water Act Section 404(b)(1) Guidelines (40 CFR 230.11[d]) for placement at the authorized open-lake placement site in the WLEB. These sediment characterization efforts within the navigation channel included elutriate analysis with pore water analysis, toxicity, and bioaccumulation tests (biological characterizations), as well as chemical and physical characterizations (USACE, 2016; USACE, 2018; USACE, 2021a; USACE, 2022).

Process and Data for BUI Status Evaluation

In previous versions of the *Delisting Guidance and Restoration Targets for Ohio Areas of Concern*, the Ohio AOC Program relied on suitability of dredged sediments for open lake disposal as the BUI restoration target. The suitability for open lake disposal was selected as a measure of sediment quality since Ohio did not have sediment criteria and open lake disposal was considered the least restrictive form of disposal at the time. Since this target was originally drafted and implemented back in 2005, Ohio has developed alternative options for Lake Erie dredged sediment beneficial use. In 2015, Ohio prohibited the practice of open lake disposal (effective July 1, 2020) with a few limited exceptions (Ohio EPA and OLEC, 2023).

In 2017, Ohio developed beneficial use rules authorizing the upland beneficial use of Lake Erie dredge sediment (Ohio Administrative Code (OAC) Chapter 3745-599, effective March 31, 2019). The rules address individual and general beneficial use permit requirements including the establishment of screening levels, restrictions, or standards (OAC 3745-599-200, -310 and -320). To evaluate this BUI for the Maumee AOC, the Ohio AOC Program will compare dredged sediment data to a number of standards and screening levels, including 1) the residential and/or industrial soil U.S. EPA Regional Screening Levels (RSLs) and 2) information regarding ambient background conditions for the upland beneficial use of dredged sediment. If the material would be found suitable for upland beneficial use of the dredged sediment based on the two above evaluation methods, then the restoration target for this BUI would be met (Ohio EPA and OLEC, 2023).

An alternate evaluation method for achieving the restoration target for this BUI is related to the aquatic beneficial use of dredged sediment such as in-water habitat restoration projects. Placement of material into 'waters of the state' requires a Federal Water Pollution Control Act certification under section 401 from the state of Ohio. To evaluate this BUI for the Maumee AOC, the Ohio AOC

Program will evaluate applicable chemical and biological data in accordance with the 401-certification process, such that the dredged sediments would be suitable for in-water use. If the material would be permittable for aquatic beneficial use for dredge sediment based on the 401-certification process, then the restoration target for this BUI would be met (Ohio EPA and OLEC, 2023).

Review of Previous Sediment Data – USACE, 2016 and 2018

USACE previously completed sediment sampling and testing within the Toledo Harbor federal navigation channels under two separate sediment investigations that were conducted in 2016 and 2018. Sediments within maintained areas of the Toledo Harbor are periodically sampled, tested, and evaluated to determine whether there has been any change with respect to the contaminant determination per Clean Water Act (CWA) Section 404(b)(1) Guidelines (40 CFR 230.11[d]) regarding the open-water placement of dredged sediment. Sediment sampling included locations that are part of the Maumee AOC that are the lower seven miles of the Maumee River and 3.9 miles of the Lake Approach Channel. The results of this sediment sampling and testing are provided in the *Toledo Harbor Dredged Sediment Evaluation -2016* and *Toledo Harbor (Select Channels) Dredged Sediment Evaluation -2018* (USACE, 2016; USACE 2018). The USACE 2016 dredged sediment evaluation stated that "It is inconclusive at this time whether sediments dredged from three discrete sites in the River Channel meet contaminant determination CWA Section 404(b)(1) Guidelines. Sediments in these areas will be subjected to further PAH-related testing and evaluation (USACE, 2016)." The USACE 2018 dredged sediment evaluation concluded that "This evaluation indicates that the discharge of sediments dredged from the Toledo Harbor Lake Approach Channel north flank, Turning Basin near River Mile 3, and River Channel River Mile 1 and 2 reaches at the designated open-water placement area in the WLEB would not result in contaminant-related, unacceptable adverse effects to the aquatic ecosystem. Based on this information, USACE concluded that these dredged sediments meet CWA Section 404(b)(1) Guidelines for open- water placement as presented in 40 CFR 230.11(d) (USACE, 2018).

Recent Sediment Data – USACE, 2021

Recent sediment data collected by USACE in 2021 were used to conduct a risk-based screening for upland beneficial use determination to support removal of the restrictions on navigational dredging BUI (USACE, 2022; Appendix C). USACE collected sediment samples from Toledo Harbor and Lake Erie vicinity as part of its routine O&M dredging activities in October 2021, as described in the Sampling and Analysis Work Plan (FY21) (USACE, 2021b). Toledo Harbor sediment samples from 2021 were collected at the locations shown in Figures 24 and 25, for a total of 21 locations. Each discrete sediment sample was analyzed for PAHs, PCBs (as Aroclor mixtures), pesticides, hydrocarbons (total oil & grease), TOC, metals, and anions (total cyanide, total kjeldahl nitrogen, ammonia nitrogen, total phosphorus). Physical analyses included grain size and hydrometer, Atterberg Limits, water content (percent moisture), Engineering (USCS) Soil Classification, and organic matter. The risk-based screening process and results are described in subsequent sections below and focuses on the Toledo Harbor federal navigation channel within the Maumee AOC that includes the 7-mile-long Maumee River Channel and up to Lake Mile 3.9 in the 18-mile Lake Approach Channel as shown in Figure 7.

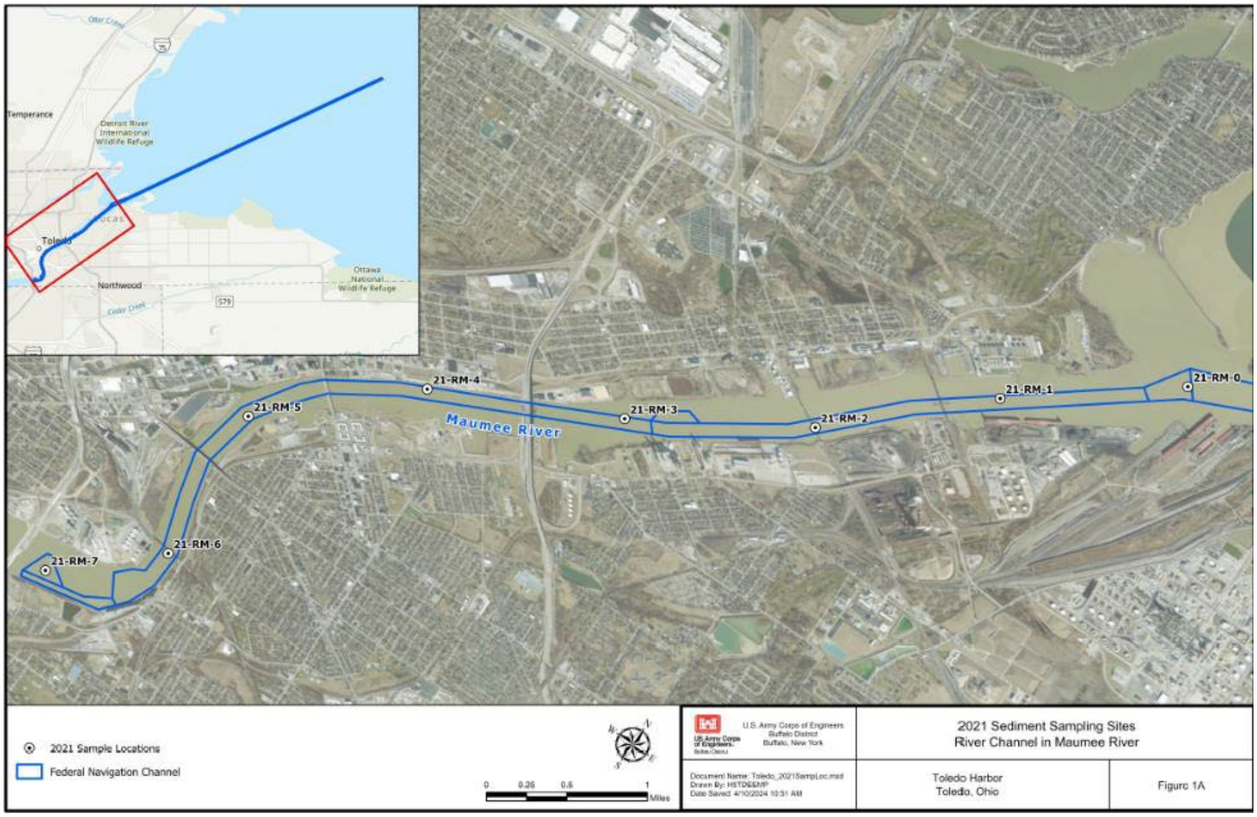

Figure 24. Lower Maumee River Sediment Sampling Locations.

Figure 25. Lake Approach Channel Sediment Sampling Locations

BUI Status Assessment

This section of the Maumee AOC *BUI 7: Restrictions on Navigational Dredging Activities* removal recommendation examined multiple conditions to determine the status of this BUI. Toledo Harbor sediment data collected in 2016, 2018, and 2021 were reviewed. A sediment risk-based screening evaluation for upland beneficial use was completed using the recent USACE 2021 sediment data (USACE, 2022; Appendix C) to demonstrate that *BUI 7: Restrictions on Navigational Dredging Activities* is no longer impaired in the Maumee AOC, and the State of Ohio Restoration Target and rationale provided in Appendix A have been met.

Sediment Risk-Based Screening: Evaluation for Upland Beneficial Use

The State of Ohio BUI Restoration Target and rationale for the Restrictions on Navigational Dredging Activities is provided in Appendix A. It states that this beneficial use can be removed when "There are no restrictions on navigational dredging or disposal activities due to contaminants in sediment, such that there are suitable options available for reuse or disposal of the material." To evaluate this BUI consistent with the target and rationale, Ohio EPA compared the recent USACE 2021 sediment data to a number of standards and screening levels including the residential soil U.S. EPA Regional Screening Levels (RSLs), along with ambient background conditions for the upland beneficial use of dredged sediment. If the dredged sediment is determined to be suitable for upland beneficial using these criteria, then the restoration target for this BUI would be met.

The sediment risk-based screening evaluation for upland beneficial use consisted of comparing the bulk sediment chemistry data summarized in Appendix B (Table 1) from the *USACE Toledo Harbor Dredged Sediment Evaluation - 2022* to U.S. EPA's Regional Screening Levels (RSLs) for residential direct contact with soil and industrial direct contact with soil, updated May 2024, and found at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (U.S.EPA, 2024). The residential soil RSLs are protective of both children and adults for unrestricted, residential land uses. Residential soil RSLs are protective of other land uses, including recreational, commercial, and industrial land uses, because these other land uses generally involve less exposure to soil for shorter periods of time. Ohio's Voluntary Action Program (VAP) residential, commercial, and industrial soil standards were also included for comparison purposes. Under Ohio's VAP, the residential land use is the unrestricted land use category. Ohio also has an additional category of screening values that was derived for recreational receptors. Screening levels for carcinogenic and non-carcinogenic human health effects were used. The initial screening compared maximum constituent concentrations detected and used criteria based on incremental lifetime cancer risks (ILCR) of one in a million (1E-06) and non-cancer health effects with a hazard quotient (HQ) of 0.1 (Appendix B - Table 2).

Further screening was conducted on chemicals that were retained from the initial screening and to conduct a cumulative risk assessment. More refined screening involved using exposure point concentrations calculated as the 95% upper confidence limit on the mean (UCL95), if needed, and using the cumulative ILCR of one in 100,000 (1E-05) and non-cancer hazard quotient of 1.0 (Appendix B - Tables 3-5) (Singh, 2013). UCL95 was calculated using maximum likelihood estimation for normal, lognormal, and gamma distributions, as well as non-parametric techniques. Calculations were done using ProUCL 5.0, which provides a recommended UCL95 to use based on goodness-of-fit tests for each distribution (U.S. EPA, 2013). Risk ratios were then calculated for each parameter by comparing both maximum detection and UCL95 concentrations to relevant cancer or non-cancer risk-based screening levels. Cumulative risk ratios, the summed ratios for individual parameters, were then calculated to address potential cumulative exposures of a single receptor to multiple chemicals. Cumulative risk ratios exceeding unity (1.0) represent unacceptable risk, as determined by U.S. EPA and Ohio VAP screening protocols.

U.S. EPA's RSLs are based on default exposure parameters and factors that represent reasonable maximum exposure conditions for long-term, chronic exposures for residential and industrial soil land use. The residential soil RSLs are the most protective for human health criteria because they account for daily exposures by both children and adults in a residential setting. Residential exposure factors include living at the same residence 350 days per year for 26 years. The industrial screening levels account for exposures to adults throughout an eight-hour workday, 250 days per year for 25 years. An additional category of screening was conducted for the recreational land use by adjusting the number of days, known as exposure frequency, to 90 days per year for recreational child and adult receptors, compared to 350 days per year for residential receptors.

Appendix B includes tables that contain the Toledo Harbor USACE 2022 sediment datasets screened against the upland beneficial use criteria and for potential future aquatic beneficial use projects. Because the Toledo Harbor federal navigation channel within the Maumee AOC includes the 7-mile-long Maumee River Channel and up to Lake Mile 3.9 in the 18-mile Lake Approach Channel as shown in Figure 7, the screening focused on this portion of Toledo Harbor. The sediment risk-based screening consists of a series of seven tables, Tables 1-7 that contain the following information in Appendix B:

1. Table 1: Toledo Harbor and Toledo Harbor Within Maumee AOC Sediment Results, includes a summary of all sediment chemistry results;
2. Table 2: Toledo Harbor Within Maumee AOC Initial Sediment Screening Results, includes initial screen of maximum detected and UCL95 concentrations compared to risk-based screening levels and Ohio background soil and sediment values;
3. Table 3: Residential Land Use – Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations, compared to risk-based screening levels for residential land use and Ohio background values;
4. Table 4: Commercial/Industrial Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results, same as Table 3 except for industrial land use;
5. Table 5: Recreational Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results, same as Table 3 except for recreational land use;
6. Table 6: Ecological Soil - Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations compared to risk-based soil screening levels for ecological receptors and Ohio background values; and
7. Table 7: Ecological Sediment - Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations compared to risk-based sediment screening levels for ecological receptors and Ohio background values. This is representative of aquatic exposure and was provided for potential future aquatic beneficial use projects.

Comparison to Background

Concentrations of metals in the Toledo Harbor sediment were compared to concentrations established for background soils and sediment reference values (SRVs), as shown in Appendix B - Tables 2, 6, and 7. Background metal concentrations were obtained from Ohio EPA VAP for Lucas County – Toledo Area (Ohio EPA, 2015) and Erie County (Ohio EPA, 2019b). The Lucas County – Toledo Area report only includes background metals soil concentrations for seven metals. The Erie County background metals in soil were included in the background comparison because it contains analyses for a larger number of metals, the 21 U.S. EPA Target Analyte List metals, and is located in close proximity to Lucas County also along Lake Erie. In addition, Ohio EPA developed specific sediment reference values (SRVs) available in the Ohio EPA Division of Environmental Response and Revitalization (DERR) *Ecological Risk Assessment Guidance Document* updated in 2018 (Ohio EPA, 2018) and found at: https://www.epa.ohio.gov/portals/30/rules/RR-031.pdf. SRVs were developed from sediment sampling and analyses conducted at Ohio's biological reference sites. These reference sites were the same sites used in the development of biological criteria in Ohio and represent background sediment concentrations. Concentrations of metals detected below their respective background soils concentrations and/or SRVs (Appendix B - Table 2) were considered to be representative of background conditions and not contributors to the ILCR or non-carcinogenic health hazards. As a result, their individual risk ratios were removed when calculating cumulative risk ratios because metal concentrations below background levels do not contribute to additional risk associated with upland placement of dredged sediment.

Comparison to Ecological Soil and Sediment Screening Levels

An ecological soil screening level evaluation of Toledo Harbor sediment data was conducted to assess the protectiveness of upland use for areas with sufficient ecological habitat and resources (Appendix B - Table 6). U.S. EPA Soil Screening Levels ("Eco-SSLs") are concentrations of chemicals in soil that are protective of ecological receptors that commonly come into contact with and/or consume biota that live in or on soil. Eco-SSLs have been derived for four groups of ecological receptors: plants, soil invertebrates, birds, and mammals. Ohio EPA's 2018 ecological risk assessment guidance outlines a soil screening hierarchy using the Eco-SSLs and Oak Ridge National Laboratory preliminary remediation goals for ecological endpoints (Efroymson et al., 1997). Eco-SSLs, last updated in February of 2018, have been developed for sixteen metals, PAHs, PCBs, and some pesticides. Appendix B -Table 6 summarizes the maximum detected and UCL95 concentrations that were screened against available receptors for a particular chemical in soil.

An ecological sediment screening level evaluation was conducted to assess the protectiveness of aquatic beneficial uses of sediment (e.g., habitat restoration, wetland creation). Appendix B - Table 7 summarizes the maximum detected and UCL95 sediment concentrations that were screened against available sediment quality guidelines and the SRVs. The sediment quality guidelines are from MacDonald et. al (2000). Threshold Effects Concentrations (TECs) are concentrations below which harmful effects are unlikely to occur and Probable Effects Concentrations (PECs) are concentrations above which harmful effects are likely to be observed.

Sediment Evaluation: Results for Upland Beneficial Use

The Toledo Harbor USACE sediment data within the Maumee AOC evaluated consisted of 12 surficial sediment sample locations located within the federal navigation channel, including sediment results to Lake Mile 4. Appendix B - Table 1 includes a comparison of the maximum concentrations detected in all of Toledo Harbor (includes Lake Mile 5 to Lake Mile 13 sediment results), compared to the Toledo Harbor within the Maumee AOC sediment results. All data for sediment located laterally outside of the federal navigation channels was excluded, including the lake placement site samples, lake reference site samples, and nearshore samples taken for characterizing potential aquatic beneficial use sites. The remaining detailed risk-based screening focused on Toledo Harbor within the Maumee AOC. In general, the concentrations of metals detected are representative of naturally occurring background levels in soil and sediment. For example, arsenic tends to be a risk-driver due to the low residential risk-based screening levels. The maximum concentration of arsenic detected was 12 mg/kg, with a 95% upper confidence limit on the mean (UCL95) of 11 mg/kg, which is representative of soil and sediment background levels. There was only one low level detection of total PCBs of 0.038 mg/kg, below the screening levels. Similarly, PAHs were detected at low levels, below the screening levels. Pesticides were not detected. Based on the risk-based screening evaluation of residential use for the Toledo Harbor sediment data within the Maumee AOC, it was determined that (Appendix B - Tables 2 and 3):

- Metals concentrations were below U.S. EPA's residential soil RSLs at 1E-06 ILCR or HI 1.0 or are similar to ambient background soil and sediment concentrations;
- PAH concentrations were less than the detection limits or less than the residential soil RSLs, at the 1E-06 ILCR or noncancer hazard quotient of 0.1. Carcinogenic PAHs were less than the cumulative ILCR of 1E-05 for residential soil RSLs;
- PCB concentrations were less than the detection limits or less than the residential RSL at the 1E-06 ILCR; and
- Toledo Harbor sediment concentrations are below Ohio VAP residential soil standards or are similar to ambient background soil and sediment concentrations.

The sediment results from Toledo Harbor within the Maumee AOC are below U.S. EPA's residential soil RSLs and/or ambient soil and sediment background levels. The residential RSLs are the most protective human health criteria because they account for daily exposures by both children and adults in a residential setting. The industrial soil RSLs and a recreational exposure scenario were also evaluated, and all risks were below the risk goals of ILCR of 1E-06 and HI of 0.1 (Appendix B - Tables 4 and 5, respectively). Toledo Harbor sediment within the Maumee AOC has been determined to be suitable for residential upland beneficial use, as well as industrial and recreational use, and the restoration target for this BUI has been met.

Appendix B - Tables 6 and 7 compare the Toledo Harbor USACE sediment data to ecological soil and sediment screening values, respectively. Because some of the Eco-SSLs are low, comparison to ambient background levels is an important component and was conducted in the ecological soil and sediment risk-based screening. Overall, concentrations are below ecological screening levels or are similar to ambient background soil and sediment concentrations. For instance, although chromium and vanadium sediment concentrations exceed some of the Eco-SSLs, chromium sediment concentrations are below the Ohio EPA SRV and the vanadium UCL95 is 41 mg/kg, which is similar to the SRV of 40 mg/kg. The industrial soil RSLs and a recreational exposure scenario were also evaluated, and all risks were below the ILCR of 1E-06 and HI of 0.1 (Appendix B - Tables 4 and 5, respectively).

Sediment Evaluation: Aquatic Beneficial Use

An alternate evaluation method for achieving the restoration target for this BUI is related to the *aquatic* beneficial use of dredged sediment, such as in-water habitat restoration projects. Placement of material into 'waters of the state' requires a Federal Water Pollution Control Act certification under section 401 from the state of Ohio. To evaluate this BUI, Ohio will evaluate applicable chemical and biological data in accordance with the 401-certification process, such that the dredged sediments would be suitable for in-water use. If the material would be permittable for *aquatic* beneficial use for dredged sediment based on the 401-certification process, then the restoration target for this BUI has been met.

USACE concluded in its Toledo Harbor Dredged Sediment Evaluation (USACE, 2022) that the open-water placement of sediment dredged from the federal navigation channels of Toledo Harbor at the existing, authorized open-water placement area is not expected to cause unacceptable, adverse, contaminant-related impacts. The USACE 2022 dredged sediment evaluation would support ecosystem restoration projects. The results of the soil and sediment risk-based screening for ecological receptors summarized in Appendix B - Tables 6 and 7 demonstrate that the Toledo Harbor dredge sediment within the Maumee AOC may be permittable for aquatic beneficial use projects based on the 401-certification process.

Conclusions

All dredged sediment from the Toledo Harbor federal navigation channel within the Maumee AOC are suitable to be beneficially used upland based on the evaluation of the sediment data to the U.S. EPA residential soil regional screening levels, information regarding ambient background conditions, and ecological screening levels. Dredged sediment may be able to be used for aquatic beneficial uses such as in-water habitat restoration projects in accordance with the 401 water quality certification process.

Figure 26. Glass City Metropark after placement of beneficial use of dredged material. 2023. Courtesy of: Vanessa Steigerwald Dick.

A public comment period of 14-days was issued by Ohio Lake Erie Commission and Ohio EPA from July 26 through August 9, 2024. The opportunity for public comment was shared through an Ohio EPA/Ohio Lake Erie Commission press release with information provided on Ohio Lake Erie Commission, Ohio EPA and the

Maumee AOC websites. The information was subsequently shared via Ohio Lake Erie Commission and Maumee AOC social media. No public comments were received. The Maumee AOC Advisory Committee issued a letter of support for this BUI removal (Appendix D).

Removal Statement

Ohio EPA, Ohio Lake Erie Commission, and the Maumee AOC Advisory Committee recommend the removal of BUI 7: *Restrictions on Navigational Dredging Activities* from the Maumee AOC. This recommendation to remove BUI 7: *Restrictions on Navigational Dredging Activities* is made in accordance with the process and criteria set forth in the *Delisting Guidance and Restoration Targets for Ohio Areas of Concern* (Ohio EPA and OLEC, 2023).

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Appendix A: Restoration Target for BUI 7: Restrictions of Navigational Dredging Activities (Ohio EPA and OLEC, 2023)

IJC Listing Guideline

An impairment will be listed when contaminants in sediments exceed standards, criteria or guidelines such that there are restrictions on dredging or disposal activities.

State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

Contaminants in sediment exceed sediment quality guidelines used by the State such that there are restrictions on navigational dredging or disposal activities.

State of Ohio Restoration Target

There are no restrictions on navigational dredging or disposal activities due to contaminants in sediment, such that there are suitable options available for reuse or disposal of the material.

Notes

- Navigational dredging refers to dredging of a federally designated ship channel and historically dredged stretches of a river to enable the passage of commercial and/or recreational vessels. Restrictions to disposal activities refer to the prohibition of disposal or re-use of dredged materials due to chemical contamination or biological toxicity of the sediment.
- This does not include the maintenance dredging of private marinas, slips, docks, etc. However, if sediment contaminant concentrations in these areas are a source of contamination that precludes attainment of remedial dredging goals of federally designated ship channels and historically dredged stretches of a river, then dredging of private marinas, slips, docks, etc. may be necessary.

Potential Data Sources

- Ohio EPA and U.S. Army Corps of Engineers sediment characterization studies
- Other sediment characterization studies

Rationale

This BUI specifically addresses areas within the boundaries of AOCs that are historically dredged to maintain navigable depths for commercial and/or recreational vessels. While this beneficial use addresses restrictions on dredging or disposal activities:

1) Precautionary seasonal restrictions on dredging to prevent real or anticipated impacts to spawning fish, avian or macroinvertebrate species is not considered to be a cause for impairment;
2) Local restrictions due to local detrimental effects of the dredging operation (increased turbidity, noise, channel restrictions, etc.) are not considered to be a cause for impairment for this BUI; and

3) If sediment reuse or disposal is restricted solely due to volume, this beneficial use would not be considered to be impaired.

In previous versions of this Guidance, Ohio relied on suitability of dredged sediments for open lake disposal as the BUI restoration target. The suitability for open lake disposal was selected as a measure of sediment quality since Ohio did not have sediment criteria and open lake disposal was considered the least restricted form of disposal at the time. Since this target was originally drafted and implemented back in 2005, Ohio has developed alternative options for Lake Erie dredged sediment beneficial use. In 2015, Ohio prohibited the practice of open lake disposal (effective July 1, 2020) with a few limited exceptions.

In 2017, Ohio developed beneficial use rules authorizing the upland beneficial use of Lake Erie dredge sediment (Ohio Administrative Code (OAC) Chapter 3745-599, effective March 31, 2019). The rules address individual and general beneficial use permit requirements including the establishment of screening levels, restrictions, or standards (OAC 3745-599-200, -310 and -320). To evaluate this BUI, Ohio will compare dredged sediment data to a number of standards and screening levels, including 1) the residential and/or industrial soil U.S. EPA Regional Screening Levels (RSLs) and 2) information regarding ambient background conditions for the upland beneficial use of dredged sediment. If the material would be found suitable for upland beneficial use of the dredged sediment based on the two above evaluation methods, then the restoration target for this BUI will be met.

An alternate evaluation method for achieving the restoration target for this BUI is related to the aquatic beneficial use of dredged sediment such as in-water habitat restoration projects. Placement of material into 'waters of the state' requires a Federal Water Pollution Control Act certification under section 401 from the state of Ohio. To evaluate this BUI, Ohio will evaluate applicable chemical and biological data in accordance with the 401-certification process, such that the dredged sediments would be suitable for in-water use. If the material would be permittable for aquatic beneficial use for dredge sediment based on the 401-certification process, then the restoration target for this BUI has been met.

Additional conditions that may be considered in determining the status of this BUI include:

- Effectiveness & extent of improvements from remedial activities that have been completed and/or,
- Ecological screening levels and any associated restrictions and/or,
- Associated dredge material management plans and navigation dredging permitting that will continue to monitor navigational dredging activities, if applicable.

References for Appendix A

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Appendix B: Tables for Toledo Harbor Within Maumee AOC Sediment Risk-Based Screening for Upland Beneficial Use

Appendix B includes tables that contain the Toledo Harbor USACE 2022 sediment datasets screened against the upland beneficial use criteria and for potential future aquatic beneficial use projects. Because the Toledo Harbor federal navigation channel within the Maumee AOC includes the seven-mile-long Maumee River Channel and only up to Lake Mile 3.9, the screening focused on this portion of Toledo Harbor.

Toledo Harbor USACE 2022 sediment sampling results were screened against upland beneficial use criteria. The sediment risk-based screening evaluation consisted of comparing the bulk sediment chemistry data to U.S. EPA's Regional Screening Levels (RSLs) for residential direct contact with soil and industrial direct contact with soil, updated November 2023, found at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables Ohio's Voluntary Action Program (VAP) residential, commercial, and industrial soil standards were also included for comparison purposes. Screening levels for carcinogenic and non-carcinogenic human health effects were used. The initial screening compared maximum constituent concentrations detected and used criteria based on incremental lifetime cancer risks (ILCR) of one in a million (1E-06) and non-cancer health effects with a hazard quotient (HQ) of 0.1. Further screening was conducted on chemicals that were retained from the initial screening. More refined screening involved using exposure point concentrations calculated as the 95% upper confidence limit on the mean (UCL95) and using the cumulative ILCR of one in 100,000 (1E-05) and non-cancer hazard quotient of 1.0.

The sediment risk-based screening consists of a series of seven tables that contain the following information in Appendix B:

1. Table 1: Toledo Harbor and Toledo Harbor Within Maumee AOC Sediment Results, includes a summary of all sediment chemistry results;
2. Table 2: Toledo Harbor Within Maumee AOC Initial Sediment Screening Results, includes initial screen of maximum detected and UCL95 concentrations compared to risk-based screening levels and Ohio background soil and sediment values;
3. Table 3: Residential Land Use – Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations, compared to risk-based screening levels for residential land use and Ohio background values;
4. Table 4: Commercial/Industrial Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results, same as Table 3 except for industrial land use;
5. Table 5: Recreational Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results, same as Table 3 except for recreational land use;
6. Table 6: Ecological Soil - Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations compared to risk-based soil screening levels for ecological receptors and Ohio background values; and
7. Table 7: Ecological Sediment - Toledo Harbor Within Maumee AOC Sediment Screening Results, includes screening of maximum detected and UCL95 concentrations compared to risk-based sediment screening levels for ecological receptors and Ohio background values. This is representative of aquatic exposure and was provided for potential future aquatic beneficial use projects.

Table 1. Toledo Harbor and Toledo Harbor Within Maumee AOC Sediment Results Summary

All units are mg/kg (ppm)				Toledo Harbor			Toledo Harbor Within Maumee AOC		
Parameter	CAS Number	Toledo Harbor Number of Samples	Maumee AOC Number of Samples	Minimum Detection	Maximum Detection	Maximum Location ID	Minimum Detection	Maximum Detection	Maximim Location ID
METALS									
ALUMINUM	7429-90-5	21	12	1650	29000	21-MRC-2	13900	29000	21-MRC-2
ANTIMONY	7440-36-0	21	12	5.5	5.5	21-LM-13	-	-	-
ARSENIC	7440-38-2	21	12	7	12.1	21-MRC-3	8.7	12.1	21-MRC-3
BARIUM	7440-39-3	21	12	15.9	181	21-MRC-2	113	181	21-MRC-2
BERYLLIUM	7440-41-7	21	12	0.7	1.3	21-MRC-2	0.7	1.3	21-MRC-2
CADMIUM	7440-43-9	21	12	0.59	1.8	21-MRC-6	0.59	1.8	21-MRC-6
CALCIUM	7440-70-2	21	12	23200	104000	21-LM-13	23200	37200	21-MRC-7
CHROMIUM, TOTAL	7440-47-3	21	12	3.6	40.9	21-LMR-2	22.6	40.9	21-MRC-4
COBALT	7440-48-4	21	12	2.3	15.1	21-LM-4	8.6	15.1	21-LM-4
COPPER	7440-50-8	21	12	28.1	46.2	21-LM-5	28.1	44.1	21-MRC-2
IRON	7439-89-6	21	12	7630	37200	21-MRC-2	24400	37200	21-MRC-2
LEAD	7439-92-1	21	12	6.6	35.8	21-LM-11	15.3	23.4	21-MRC-2
MAGNESIUM	7439-95-4	21	12	7130	12800	21-LM-8	7130	11100	21-LM-2
MANGANESE	7439-96-5	21	12	271	800	21-MRC-4	372	800	21-MRC-4
MERCURY	7439-97-6	21	12	0.19	0.27	21-LM-11	-	-	-
NICKEL	7440-02-0	21	12	5.2	42.8	21-MRC-2	27.1	42.8	21-MRC-2
POTASSIUM	7440-09-7	21	12	214	4660	21-MRC-0	2390	4660	21-MRC-0
SELENIUM	7782-49-2	21	12	-	-	-	-	-	-
SILVER	7440-22-4	21	12	0.53	1.3	21-MRC-6	0.53	1.3	21-MRC-6
SODIUM	7440-23-5	21	12	125	1720	21-MRC-0	125	1720	21-MRC-0
THALLIUM	7440-28-0	21	12	-	-	-	-	-	-
VANADIUM	7440-62-2	21	12	5.4	54.8	21-MRC-2	26.6	54.8	21-MRC-2
ZINC	7440-66-6	21	12	17.9	169	21-MRC-2	104	169	21-MRC-2
POLYNUCLEAR AROMATIC HYDROCARBONS									
ACENAPHTHENE	83-32-9	21	12	0.0011	0.0305	21-MRC-2	0.0011	0.0305	21-MRC-2
ACENAPHTHYLENE	208-96-8	21	12	0.0012	0.0099	21-LM-12	0.0012	0.0093	21-MRC-2
ANTHRACENE	120-12-7	21	12	0.0034	0.0344	21-MRC-2	0.0034	0.0344	21-MRC-2
BENZO(A)ANTHRACENE	56-55-3	21	12	0.0123	0.0766	21-MRC-2	0.0123	0.0766	21-MRC-2
BENZO(A)PYRENE	50-32-8	21	12	0.017	0.0756	21-MRC-2	0.017	0.0756	21-MRC-2
BENZO(B)FLUORANTHENE	205-99-2	21	12	0.0155	0.102	21-MRC-2	0.0155	0.102	21-MRC-2
BENZO(G,H,I)PERYLENE	191-24-2	21	12	0.0138	0.0603	21-LM-12	0.0138	0.0538	21-MRC-2
BENZO(K)FLUORANTHENE	207-08-9	21	12	0.0153	0.0843	21-MRC-2	0.0153	0.0843	21-MRC-2
CHRYSENE	218-01-9	21	12	0.0176	0.132	21-MRC-2	0.0176	0.132	21-MRC-2
DIBENZ(A,H)ANTHRACENE	53-70-3	21	12	0.0038	0.0814	21-LM-12	0.0038	0.0139	21-MRC-2
FLUORANTHENE	206-44-0	21	12	0.0271	0.367	21-MRC-2	0.0271	0.367	21-MRC-2
FLUORENE	86-73-7	21	12	0.00099	0.0504	21-MRC-2	0.0025	0.0504	21-MRC-2
INDENO(1,2,3-C,D)PYRENE	193-39-5	21	12	0.0143	0.0657	21-LM-12	0.0143	0.0568	21-MRC-2
NAPHTHALENE	91-20-3	21	12	0.0142	0.05	21-LM-11	0.0142	0.0377	21-MRC-2
PHENANTHRENE	85-01-8	21	12	0.0119	0.202	21-MRC-2	0.0119	0.202	21-MRC-2
PYRENE	129-00-0	21	12	0.0236	0.26	21-MRC-2	0.0236	0.26	21-MRC-2

All units are mg/kg (ppm)				Toledo Harbor			Toledo Harbor Within Maumee AOC		
Parameter	CAS Number	Toledo Harbor Number of Samples	Maumee AOC Number of Samples	Minimum Detection	Maximum Detection	Maximum Location ID	Minimum Detection	Maximum Detection	Maximim Location ID
POLYCHLORINATED BIPHENYLS									
PCB, TOTAL	1336-36-3	21	12	0.021	0.083	21-LM-11	0.021	0.038	21-MRC-1
PCB-1016 (AROCLOR 1016)	12674-11-2	21	12	-	-	-	-	-	-
PCB-1221 (AROCLOR 1221)	11104-28-2	21	12	-	-	-	-	-	-
PCB-1232 (AROCLOR 1232)	11141-16-5	21	12	-	-	-	-	-	-
PCB-1242 (AROCLOR 1242)	53469-21-9	21	12	-	-	-	-	-	-
PCB-1248 (AROCLOR 1248)	12672-29-6	21	12	0.03	0.03	21-LM-11	-	-	-
PCB-1254 (AROCLOR 1254)	11097-69-1	21	12	0.036	0.036	21-LM-11	-	-	-
PCB-1260 (AROCLOR 1260)	11096-82-5	21	12	-	-	-	-	-	-
PCB-1262 (AROCLOR 1262)	37324-23-5	21	12	-	-	-	-	-	-
PCB-1268 (AROCLOR 1268)	11100-14-4	21	12	-	-	-	-	-	-
PESTICIDES									
ALDRIN	309-00-2	21	12	-	-	-	-	-	-
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	21	12	-	-	-	-	-	-
ALPHA ENDOSULFAN	959-98-8	21	12	-	-	-	-	-	-
ALPHA-CHLORDANE	5103-71-9	21	12	-	-	-	-	-	-
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	21	12	-	-	-	-	-	-
BETA ENDOSULFAN	33213-65-9	21	12	-	-	-	-	-	-
BETA-CHLORDANE	5103-74-2	21	12	-	-	-	-	-	-
CHLORDANE	57-74-9	21	12	-	-	-	-	-	-
DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHANE)	72-54-8	21	12	-	-	-	-	-	-
DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHENE)	72-55-9	21	12	-	-	-	-	-	-
DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLOROETHANE)	50-29-3	21	12	-	-	-	-	-	-
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	21	12	-	-	-	-	-	-
DIELDRIN	60-57-1	21	12	-	-	-	-	-	-
ENDOSULFAN SULFATE	1031-07-8	21	12	-	-	-	-	-	-
ENDRIN	72-20-8	21	12	-	-	-	-	-	-
ENDRIN ALDEHYDE	7421-93-4	21	12	-	-	-	-	-	-
ENDRIN KETONE	53494-70-5	21	12	-	-	-	-	-	-
GAMMA BHC (LINDANE)	58-89-9	21	12	-	-	-	-	-	-
HEPTACHLOR	76-44-8	21	12	-	-	-	-	-	-
HEPTACHLOR EPOXIDE	1024-57-3	21	12	-	-	-	-	-	-
METHOXYCHLOR	72-43-5	21	12	-	-	-	-	-	-
TOXAPHENE	8001-35-2	21	12	-	-	-	-	-	-
INORGANICS									
CYANIDE	57-12-5	21	12	-	-	-	-	-	-
NITROGEN, AMMONIA	7664-41-7	21	12	30.1	447	21-LM-3	30.1	447	21-LM-3
NITROGEN, TOTAL KJELDAHL (TKN)	7727-37-9	21	12	465	3310	21-MRC-1	1790	3310	21-MRC-1
PHOSPHORUS, TOTAL (AS P)	7723-14-0	21	12	75.7	1580	21-LM-12	132	1230	21-MRC-7

Table 2. Toledo Harbor Within Maumee AOC Initial Sediment Screening Results

All units are mg/kg (ppm)			Range of Detections				Risk-based soil screening levels			Ohio Background Values			Initial Screening Results						
Parameter	CAS Number	Number of Samples	Minimum Detection	Maximum Detection	UCL95 on the mean	Maximum Location	USEPA residential soil screening level (1E-06 or HQ 0.1)	Ohio VAP residential generic soil standard (1E-05 or HQ 1)	Biosolids Limits 40 CFR503.13 Table 3	Lucas County soil background (Ohio EPA 2014)	Erie County soil background (Ohio EPA 2019)	Huron/Erie Lake Plain Sediment Reference Value (Ohio EPA 2018)	Max exceeds USEPA residential RSL?	Max exceeds VAP residential GNS?	Max exceeds Biosolids limit?	Max exceeds soil background?	UCL95 of the Mean exceeds soil background?	Max exceeds sediment reference value?	UCL95 of the Mean exceeds sediment reference value?
METALS																			
ALUMINUM	7429-90-5	12	13900	29000	22029	21-MRC-2	7700.00				11300	42000	YES	no GNS	no Biosolids limit	YES	YES	no	no
ANTIMONY	7440-36-0	12	-	-	-	-	31.00	63				0.84	no detects	no detects	no Biosolids limit	no background	no background	no detects	no detects
ARSENIC	7440-38-2	12	8.7	12.1	11.03	21-MRC-3	0.68	14	41	9.7	16.7	11	YES	no	no	no	no	YES	no
BARIUM	7440-39-3	12	113	181	151.9	21-MRC-2	1500.00	30000		90.1	111	210	no	no	no Biosolids limit	YES	YES	no	no
BERYLLIUM	7440-41-7	12	0.7	1.3	1.16	21-MRC-2	16.00	310			0.85	0.8	no	no	no Biosolids limit	YES	no background	YES	YES
CADMIUM	7440-43-9	12	0.59	1.8	1.23	21-MRC-6	7.10	140	39			0.96	no	no	no	no background	no background	YES	YES
CALCIUM	7440-70-2	12	23200	37200	32630	21-MRC-7					6770	110000	no RSL	no GNS	no Biosolids limit	YES	YES	no	no
CHROMIUM, TOTAL	7440-47-3	12	22.6	40.9	33.01	21-MRC-4	12000.00	230000		23.2	17.6	51	no	no	no Biosolids limit	YES	YES	no	no
COBALT	7440-48-4	12	8.6	15.1	12.25	21-LM-4	2.30	47			13.23	12	YES	no	no Biosolids limit	YES	no	YES	no
COPPER	7440-50-8	12	28.1	44.1	38.86	21-MRC-2	310.00	6300	1500		42	42	no	no	no	YES	YES	YES	no
IRON	7439-89-6	12	24400	37200	32589	21-MRC-2	5500.00				27567	44000	YES	no GNS	no Biosolids limit	YES	no	no	no
LEAD	7439-92-1	12	15.3	23.4	21.75	21-MRC-2	400.00	400	300	17	29.6	47	no	no	no	NO	no	no	no
MAGNESIUM	7439-95-4	12	7130	11100	9940	21-LM-2					4090	29000	no RSL	no GNS	no Biosolids limit	YES	YES	no	no
MANGANESE	7439-96-5	12	372	800	704.9	21-MRC-4	180.00	3600			1164	1000	YES	no	no Biosolids limit	no	no	no	no
MERCURY	7439-97-6	12	-	-	-	-	1.10	3.1		0.045	0.071	0.12	no detects	no detects	no Biosolids limit	no detects	no detects	no detects	no detects
NICKEL	7440-02-0	12	27.1	42.8	37.07	21-MRC-2	150.00	3100	420	28.5	22.5	36	no	no	no	YES	YES	YES	YES
POTASSIUM	7440-09-7	12	2390	4660	4188	21-MRC-0				679	1248	12000	no RSL	no GNS	no Biosolids limit	YES	YES	no	no
SELENIUM	7782-49-2	12	-	-	-	-	39.00	780	100		1.1	1.4	no detects	no detects	no detects	no detects	no background	no SRV	no detects
SILVER	7440-22-4	12	0.53	1.3	1.3	21-MRC-6	39.00	780				0.43	no	no	no Biosolids limit	no background	no background	YES	YES
SODIUM	7440-23-5	12	125	1720	885.6	21-MRC-0					110		no RSL	no GNS	no Biosolids limit	YES	YES	no SRV	no SRV
THALLIUM	7440-28-0	12	-	-	-	-	0.08			0.44	0.6	4.7	no detects	no GNS	no Biosolids limit	no detects	no detects	no detects	no detects
VANADIUM	7440-62-2	12	26.6	54.8	41.39	21-MRC-2	39.00	620			22.7	40	YES	no	no Biosolids limit	YES	no background	YES	YES
ZINC	7440-66-6	12	104	169	146	21-MRC-2	2300.00	47000	2800		71.1	190	no	no	no	YES	no background	no	no
POLYNUCLEAR AROMATIC HYDROCARBONS																			
ACENAPHTHENE	83-32-9	12	0.0011	0.0305		21-MRC-2	360.00	7200					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
ACENAPHTHYLENE	208-96-8	12	0.0012	0.0093		21-MRC-2							no RSL	no GNS	no Biosolids limit	no background	no background	no SRV	no SRV
ANTHRACENE	120-12-7	12	0.0034	0.0344		21-MRC-2	1800.00	36000					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
BENZO(A)ANTHRACENE	56-55-3	12	0.0123	0.0766		21-MRC-2	1.10	23					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
BENZO(A)PYRENE	50-32-8	12	0.017	0.0756		21-MRC-2	0.11	2.3					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
BENZO(B)FLUORANTHENE	205-99-2	12	0.0155	0.102		21-MRC-2	1.10	23					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0138	0.0538		21-MRC-2							no RSL	no GNS	no Biosolids limit	no background	no background	no SRV	no SRV
BENZO(K)FLUORANTHENE	207-08-9	12	0.0153	0.0843		21-MRC-2	11.00	230					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
CHRYSENE	218-01-9	12	0.0176	0.132		21-MRC-2	110.00	2300					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0038	0.0139		21-MRC-2	0.11	2.3					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
FLUORANTHENE	206-44-0	12	0.0271	0.367		21-MRC-2	240.00	4800					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
FLUORENE	86-73-7	12	0.0025	0.0504		21-MRC-2	240.00	4800					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0143	0.0568		21-MRC-2	1.10	23					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
NAPHTHALENE	91-20-3	12	0.0142	0.0377		21-MRC-2	2.00	96					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
PHENANTHRENE	85-01-8	12	0.0119	0.202		21-MRC-2							no RSL	no GNS	no Biosolids limit	no background	no background	no SRV	no SRV
PYRENE	129-00-0	12	0.0236	0.26		21-MRC-2	180.00	3600					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
POLYCHLORINATED BIPHENYLS																			
PCB, TOTAL	1336-36-3	12	0.021	0.038		21-MRC-1	0.23	5					no	no	no Biosolids limit	no background	no background	no SRV	no SRV
PCB-1016 (AROCLOR 1016)	12674-11-2	12	-	-		-	0.41	8.2					no detects	no detects	no detects	no detects	no detects	no detects	no detects
PCB-1221 (AROCLOR 1221)	11104-28-2	12	-	-		-	0.20	3.9					no detects	no detects	no detects	no detects	no detects	no detects	no detects
PCB-1232 (AROCLOR 1232)	11141-16-5	12	-	-		-	0.17	3.4					no detects	no detects	no detects	no detects	no detects	no detects	no detects
PCB-1242 (AROCLOR 1242)	53469-21-9	12	-	-		-	0.23	4.6					no detects	no detects	no detects	no detects	no detects	no detects	no detects
PCB-1248 (AROCLOR 1248)	12672-29-6	12	-	-		-	0.23	4.5					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
PCB-1254 (AROCLOR 1254)	11097-69-1	12	-	-		-	0.12	2.3					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
PCB-1260 (AROCLOR 1260)	11096-82-5	12	-	-		-	0.24	4.8					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
PCB-1262 (AROCLOR 1262)	37324-23-5	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
PCB-1268 (AROCLOR 1268)	11100-14-4	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
PESTICIDES																			
ALDRIN	309-00-2	12	-	-		-	0.04	0.62					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	12	-	-		-	0.09	1.7					no detects	no detects	no detects	no detects	no detects	no detects	no detects
ALPHA ENDOSULFAN	959-98-8	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
ALPHA-CHLORDANE	5103-71-9	12	-	-		-	3.60						no detects	no detects	no detects	no detects	no detects	no detects	no detects
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	12	-	-		-	0.30	6					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
BETA ENDOSULFAN	33213-65-9	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
BETA-CHLORDANE	5103-74-2	12	-	-		-	3.60	32					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
CHLORDANE	57-74-9	12	-	-		-	1.70	34					no detects	no detects	no detects	no detects	no detects	no detects	no detects
DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHANE)	72-54-8	12	-	-		-	0.19	45					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHENE)	72-55-9	12	-	-		-	2.00	31					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLOROETHANE)	50-29-3	12	-	-		-	1.90	38					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV

All units are mg/kg (ppm)			Range of Detections				Risk-based soil screening levels			Ohio Background Values			Initial Screening Results						
Parameter	CAS Number	Number of Samples	Minimum Detection	Maximum Detection	UCL95 on the mean	Maximum Location	USEPA residential soil screening level (1E-06 or HQ 0.1)	Ohio VAP residential generic soil standard (1E-05 or HQ 1)	Biosolids Limits 40 CFR503.13 Table 3	Lucas County soil background (Ohio EPA 2014)	Erie County soil background (Ohio EPA 2019)	Huron/Erie Lake Plain Sediment Reference Value (Ohio EPA 2018)	Max exceeds USEPA residential RSL?	Max exceeds VAP residential GNS?	Max exceeds Biosolids limit?	Max exceeds soil background?	UCL95 of the Mean exceeds soil background?	Max exceeds sediment reference value?	UCL95 of the Mean exceeds sediment reference value?
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
DIELDRIN	60-57-1	12	-	-		-	0.03	0.68					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
ENDOSULFAN SULFATE	1031-07-8	12	-	-		-	38.00						no detects	no detects	no detects	no detects	no detects	no detects	no detects
ENDRIN	72-20-8	12	-	-		-	1.90	38					no detects	no detects	no detects	no detects	no detects	no detects	no detects
ENDRIN ALDEHYDE	7421-93-4	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
ENDRIN KETONE	53494-70-5	12	-	-		-							no detects	no detects	no detects	no detects	no detects	no detects	no detects
GAMMA BHC (LINDANE)	58-89-9	12	-	-		-	0.57	11					no detects	no detects	no detects	no detects	no detects	no detects	no detects
HEPTACHLOR	76-44-8	12	-	-		-	0.13	2.2					no detects	no detects	no detects	no detects	no detects	no detects	no detects
HEPTACHLOR EPOXIDE	1024-57-3	12	-	-		-	0.07	1.1					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
METHOXYCHLOR	72-43-5	12	-	-		-	32.00	630					no detects	no detects	no detects	no detects	no detects	no detects	no detects
TOXAPHENE	8001-35-2	12	-	-		-	0.49	9.9					no detects	no detects	no detects	no detects	no detects	no detects	no detects
INORGANICS																			
CYANIDE	57-12-5	12	-	-		-	2.30	51					no detects	no detects	no Biosolids limit	no background	no background	no SRV	no SRV
NITROGEN, AMMONIA	7664-41-7	12	30.1	447		21-LM-3									no Biosolids limit	no background	no background	no SRV	no SRV
NITROGEN, TOTAL KJELDAHL (TKN)	7727-37-9	12	1790	3310		21-MRC-1									no Biosolids limit	no background	no background	no SRV	no SRV
PHOSPHORUS, TOTAL (AS P)	7723-14-0	12	132	1230		21-MRC-7									no Biosolids limit	no background	no background	no SRV	no SRV

Table 3. Residential Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results

All units are mg/kg (ppm)			Exposure Point Concentration Estimate		USEPA Residential RSL					
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL$_{95}$ on the mean	Cancer risk screening level (1E-05)	Cancer risk ratio for maximum detection	Cancer risk ratio for UCL$_{95}$ concentration	Non-Cancer hazard index screening level (HQ =1)	Hazard Index ratio for maximum detection	Hazard Index ratio for UCL$_{95}$ concentration
METALS										
ALUMINUM	7429-90-5	12	29000	22029				77000	0.38	0.29
ARSENIC	7440-38-2	12	12.1	11.03	6.8	1.78	1.62	35	0.35	0.32
BARIUM	7440-39-3	12	181	151.9				15000	0.01	0.01
BERYLLIUM	7440-41-7	12	1.3	1.16	16000	0.00	0.00	160	0.01	0.01
CADMIUM	7440-43-9	12	1.8	1.23	21000	0.00	0.00	71	0.03	0.02
CALCIUM	7440-70-2	12	37200	32630						
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01				120000	0.00	0.00
COBALT	7440-48-4	12	15.1	12.25	4200	0.00	0.00	23	0.66	0.53
COPPER	7440-50-8	12	44.1	38.86				3100	0.01	0.01
IRON	7439-89-6	12	37200	32589				55000	0.68	0.59
LEAD	7439-92-1	12	23.4	21.75				200	0.12	0.06
MAGNESIUM	7439-95-4	12	11100	9940						
MANGANESE	7439-96-5	12	800	704.9				1800	0.44	0.39
MERCURY	7439-97-6	12	-	-				11	0.00	0.00
NICKEL	7440-02-0	12	42.8	37.07	150000	0.00	0.00	1500	0.03	0.02
POTASSIUM	7440-09-7	12	4660	4188						
SELENIUM	7782-49-2	12	-	-				390	0.00	0.00
SILVER	7440-22-4	12	1.3	1.3				390	0.00	0.00
SODIUM	7440-23-5	12	1720	885.6						
THALLIUM	7440-28-0	12	-	-				0.78	0.00	0.00
VANADIUM	7440-62-2	12	54.8	41.39				390	0.14	0.11
ZINC	7440-66-6	12	169	146				23000	0.01	0.01
POLYNUCLEAR AROMATIC HYDROCARBONS										
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				3600	0.00	0.00
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093						
ANTHRACENE	120-12-7	12	0.0344	0.0344				18000	0.00	0.00
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	11	0.01	0.01			
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	1.1	0.07	0.07	18	0.00	0.00
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	11	0.01	0.01			
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538						
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	110	0.00	0.00			
CHRYSENE	218-01-9	12	0.132	0.132	1100	0.00	0.00			
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	1.1	0.01	0.01			
FLUORANTHENE	206-44-0	12	0.367	0.367				2400	0.00	0.00
FLUORENE	86-73-7	12	0.0504	0.0504				2400	0.00	0.00
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	11	0.01	0.01			
NAPHTHALENE	91-20-3	12	0.0377	0.0377	20	0.00	0.00	130	0.00	0.00
PHENANTHRENE	85-01-8	12	0.202	0.202						
PYRENE	129-00-0	12	0.26	0.26				1800	0.00	0.00
POLYCHLORINATED BIPHENYLS										
PCB, TOTAL	1336-36-3	12	0.038	0.038	2.3	0.02	0.02			
PESTICIDES		12	-	-						
INORGANICS										
CYANIDE	57-12-5	12	-	-				23		
CUMULATIVE RISK RATIOS WIHTOUT ARSENIC						0.13	0.13		2.52	2.05
CUMULATIVE RISK RATIOS WITHOUT METALS BELOW BACKGROUND LEVELS(GREEN SHADED)						0.13	0.13		0.24	0.19

[1] screening levels for trivalent

All units are mg/kg (ppm)			Exposure Point Concentration Estimate		Ohio VAP Residential GNS						Carcinogenic PAHs	
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL$_{95}$ on the mean	Cancer risk generic numeric standard (1E-05)	Cancer risk ratio for maximum detection	Cancer risk ratio for UCL$_{95}$ concentration	Non-Cancer hazard index generic numeric standard (HQ =1)	Hazard Index ratio for maximum detection	Hazard Index ratio for UCL$_{95}$ concentration	Relative Potency Factor	Benzo(a)pyrene-equivalent
METALS												
ALUMINUM	7429-90-5	12	29000	22029								
ARSENIC	7440-38-2	12	12.1	11.03	14	0.86	0.79	70	0.17	0.16		
BARIUM	7440-39-3	12	181	151.9				30000	0.01	0.01		
BERYLLIUM	7440-41-7	12	1.3	1.16	22000	0.00	0.00	310	0.00	0.00		
CADMIUM	7440-43-9	12	1.8	1.23	30000	0.00	0.00	140	0.01	0.01		
CALCIUM	7440-70-2	12	37200	32630								
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01				230000	0.00	0.00		
COBALT	7440-48-4	12	15.1	12.25	5900	0.00	0.00	47	0.32	0.26		
COPPER	7440-50-8	12	44.1	38.86				6300	0.01	0.01		
IRON	7439-89-6	12	37200	32589								
LEAD	7439-92-1	12	23.4	21.75				200	0.12	0.11		
MAGNESIUM	7439-95-4	12	11100	9940								
MANGANESE	7439-96-5	12	800	704.9				3600	0.22	0.20		
MERCURY	7439-97-6	12	-	-				9.9	0.00	0.00		
NICKEL	7440-02-0	12	42.8	37.07	210000	0.00	0.00	3100	0.01	0.01		
POTASSIUM	7440-09-7	12	4660	4188								
SELENIUM	7782-49-2	12	-	-				780	0.00	0.00		
SILVER	7440-22-4	12	1.3	1.3				780	0.00	0.00		
SODIUM	7440-23-5	12	1720	885.6								
THALLIUM	7440-28-0	12	-	-								
VANADIUM	7440-62-2	12	54.8	41.39				620	0.09	0.07		
ZINC	7440-66-6	12	169	146				47000	0.00	0.00		
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				7200	0.00	0.00		
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093								
ANTHRACENE	120-12-7	12	0.0344	0.0344				36000	0.00	0.00		
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	23	0.00	0.00				0.10	0.008
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	2.3	0.03	0.03	36	0.00	0.00	1.00	0.076
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	23	0.00	0.00				0.10	0.001
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538								
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	230	0.00	0.00				0.01	0.001
CHRYSENE	218-01-9	12	0.132	0.132	2300	0.00	0.00				0.001	0.000
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	2.3	0.01	0.01				1.00	0.014
FLUORANTHENE	206-44-0	12	0.367	0.367				4800	0.00	0.00		
FLUORENE	86-73-7	12	0.0504	0.0504				4800	0.00	0.00		
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	23	0.00	0.00				0.10	0.006
NAPHTHALENE	91-20-3	12	0.0377	0.0377	96	0.00	0.00	320	0.00	0.00	N/A	
PHENANTHRENE	85-01-8	12	0.202	0.202								
PYRENE	129-00-0	12	0.26	0.26				3600	0.00	0.00	SUM PAHs	0.105
POLYCHLORINATED BIPHENYLS												
PCB, TOTAL	1336-36-3	12	0.038	0.038	5	0.01	0.01					
PESTICIDES		12	-	-								
INORGANICS												
CYANIDE	57-12-5	12	-	-				51				
CUMULATIVE RISK RATIOS WIHTOUT ARSENIC						0.05	0.05		0.79	0.61		
CUMULATIVE RISK RATIOS WITHOUT METALS BELOW BACKGROUND LEVELS(GREEN SHADED)						0.05	0.05		0.13	0.04		

[1] screening levels for trivalent

Table 4. Commercial/Industrial Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results

All units are mg/kg (ppm)			Exposure Point Concentration Estimate		USEPA Industrial RSL					
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL_{95} on the mean	Cancer risk screening level (1E-05)	Cancer risk ratio for maximum detection	Cancer risk ratio for UCL_{95} concentration	Non-Cancer hazard index screening level (HQ =1)	Hazard Index ratio for maximum detection	Hazard Index ratio for UCL_{95} concentration
METALS										
ALUMINUM	7429-90-5	12	29000	22029				1100000	0.03	0.02
ARSENIC	7440-38-2	12	12.1	11.03	30	0.40	0.37	480	0.03	0.02
BARIUM	7440-39-3	12	181	151.9				220000	0.00	0.00
BERYLLIUM	7440-41-7	12	1.3	1.16	69000	0.00	0.00	2300	0.00	0.00
CADMIUM	7440-43-9	12	1.8	1.23	93000	0.00	0.00	980	0.00	0.00
CALCIUM	7440-70-2	12	37200	32630						
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01				1800000	0.00	0.00
COBALT	7440-48-4	12	15.1	12.25	19000	0.00	0.00	350	0.04	0.04
COPPER	7440-50-8	12	44.1	38.86				47000	0.00	0.00
IRON	7439-89-6	12	37200	32589				820000	0.05	0.04
LEAD	7439-92-1	12	23.4	21.75				800	0.03	0.03
MAGNESIUM	7439-95-4	12	11100	9940						
MANGANESE	7439-96-5	12	800	704.9				26000	0.03	0.03
MERCURY	7439-97-6	12	-	-				46	0.00	0.00
NICKEL	7440-02-0	12	42.8	37.07	640000	0.00	0.00	22000	0.00	0.00
POTASSIUM	7440-09-7	12	4660	4188						
SELENIUM	7782-49-2	12	-	-				5800	0.00	0.00
SILVER	7440-22-4	12	1.3	1.3				5800	0.00	0.00
SODIUM	7440-23-5	12	1720	885.6						
THALLIUM	7440-28-0	12	-	-				12	0.00	0.00
VANADIUM	7440-62-2	12	54.8	41.39				5800	0.01	0.01
ZINC	7440-66-6	12	169	146				350000	0.00	0.00
POLYNUCLEAR AROMATIC HYDROCARBONS										
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				45000	0.00	0.00
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093						
ANTHRACENE	120-12-7	12	0.0344	0.0344				230000	0.00	0.00
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	210	0.00	0.00			
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	21	0.00	0.00	220	0.00	0.00
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	210	0.00	0.00			
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538						
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	2100	0.00	0.00			
CHRYSENE	218-01-9	12	0.132	0.132	21000	0.00	0.00			
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	21	0.00	0.00			
FLUORANTHENE	206-44-0	12	0.367	0.367				30000	0.00	0.00
FLUORENE	86-73-7	12	0.0504	0.0504				30000	0.00	0.00
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	210	0.00	0.00			
NAPHTHALENE	91-20-3	12	0.0377	0.0377	86	0.00	0.00	590	0.00	0.00
PHENANTHRENE	85-01-8	12	0.202	0.202						
PYRENE	129-00-0	12	0.26	0.26				23000	0.00	0.00
POLYCHLORINATED BIPHENYLS										
PCB, TOTAL	1336-36-3	12	0.038	0.038	9.4	0.00	0.00			
PESTICIDES										
INORGANICS										
CYANIDE	57-12-5	12	-					150		
CUMULATIVE RISK RATIOS						0.40	0.37		0.22	0.19
CUMULATIVE RISK RATIOS WITHOUT ARSENIC						0.00	0.00		0.19	0.17

[1] screening levels for trivalent

All units are mg/kg (ppm)			Exposure Point Concentration Estimate		Ohio VAP Commercial/Industrial GNS					
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL_{95} on the mean	Cancer risk generic numeric standard (1E-05)	Cancer risk ratio for maximum detection	Cancer risk ratio for UCL_{95} concentration	Non-Cancer hazard index generic numeric standard (HQ =1)	Hazard Index ratio for maximum detection	Hazard Index ratio for UCL_{95} concentration
METALS										
ALUMINUM	7429-90-5	12	29000	22029						
ARSENIC	7440-38-2	12	12.1	11.03	100	0.12	0.11	1600	0.01	0.01
BARIUM	7440-39-3	12	181	151.9				760000	0.00	0.00
BERYLLIUM	7440-41-7	12	1.3	1.16	97000	0.00	0.00	8800	0.00	0.00
CADMIUM	7440-43-9	12	1.8	1.23	130000	0.00	0.00	3300	0.00	0.00
CALCIUM	7440-70-2	12	37200	32630						
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01				1000000	0.00	0.00
COBALT	7440-48-4	12	15.1	12.25	26000	0.00	0.00	1400	0.01	0.01
COPPER	7440-50-8	12	44.1	38.86				190000	0.00	0.00
IRON	7439-89-6	12	37200	32589						
LEAD	7439-92-1	12	23.4	21.75				800	0.03	0.03
MAGNESIUM	7439-95-4	12	11100	9940						
MANGANESE	7439-96-5	12	800	704.9				88000	0.01	0.01
MERCURY	7439-97-6	12	-	-				92	0.00	0.00
NICKEL	7440-02-0	12	42.8	37.07	900000	0.00	0.00	83000	0.00	0.00
POTASSIUM	7440-09-7	12	4660	4188						
SELENIUM	7782-49-2	12	-	-				23000	0.00	0.00
SILVER	7440-22-4	12	1.3	1.3				23000	0.00	0.00
SODIUM	7440-23-5	12	1720	885.6						
THALLIUM	7440-28-0	12	-	-						
VANADIUM	7440-62-2	12	54.8	41.39				23000	0.00	0.00
ZINC	7440-66-6	12	169	146				1000000	0.00	0.00
POLYNUCLEAR AROMATIC HYDROCARBONS										
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				1000000	0.00	0.00
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093						
ANTHRACENE	120-12-7	12	0.0344	0.0344				670000	0.00	0.00
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	610	0.00	0.00			
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	62	0.00	0.00	640	0.00	0.00
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	620	0.00	0.00			
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538						
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	6200	0.00	0.00			
CHRYSENE	218-01-9	12	0.132	0.132	62000	0.00	0.00			
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	62	0.00	0.00			
FLUORANTHENE	206-44-0	12	0.367	0.367				89000	0.00	0.00
FLUORENE	86-73-7	12	0.0504	0.0504				89000	0.00	0.00
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	620	0.00	0.00			
NAPHTHALENE	91-20-3	12	0.0377	0.0377	420	0.00	0.00	1500	0.00	0.00
PHENANTHRENE	85-01-8	12	0.202	0.202						
PYRENE	129-00-0	12	0.26	0.26				67000	0.00	0.00
POLYCHLORINATED BIPHENYLS										
PCB, TOTAL	1336-36-3	12	0.038	0.038	30	0.00	0.00			
PESTICIDES										
INORGANICS										
CYANIDE	57-12-5	12	-					400		
CUMULATIVE RISK RATIOS						0.12	0.11		0.06	0.06
CUMULATIVE RISK RATIOS WITHOUT ARSENIC						0.00	0.00		0.05	0.05

[1] screening levels for trivalent

Table 5. Recreational Land Use - Toledo Harbor Within Maumee AOC Sediment Screening Results

All units are mg/kg (ppm)			Exposure Point Concentration Estimate		USEPA Recreational RSL					
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL_{95} on the mean	Cancer risk screening level (1E-05)	Cancer risk ratio for maximum detection	Cancer risk ratio for UCL_{95} concentration	Non-Cancer hazard index screening level (HQ =1)	Hazard Index ratio for maximum detection	Hazard Index ratio for UCL_{95} concentration
METALS										
ALUMINUM	7429-90-5	12	29000	22029				300000	0.00	0.00
ARSENIC	7440-38-2	12	12.1	11.03	26	0.46	0.42	140	0.09	0.08
BARIUM	7440-39-3	12	181	151.9				58000	0.00	0.00
BERYLLIUM	7440-41-7	12	1.3	1.16	62000	0.00	0.00	620	0.0021	0.0019
CADMIUM	7440-43-9	12	1.8	1.23	82000	0.00	0.00	280	0.0064	0.0044
CALCIUM	7440-70-2	12	37200	32630						0.00
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01				470000	0.00	0.00
COBALT	7440-48-4	12	15.1	12.25	16000	0.00	0.00	89	0.17	0.14
COPPER	7440-50-8	12	44.1	38.86				12000	0.0037	0.0032
IRON	7439-89-6	12	37200	32589				210000	0.18	0.16
LEAD	7439-92-1	12	23.4	21.75				200	0.12	0.11
MAGNESIUM	7439-95-4	12	11100	9940						
MANGANESE	7439-96-5	12	800	704.9				7000	0.11	0.10
MERCURY	7439-97-6	12	-	-				43	0.00	0.00
NICKEL	7440-02-0	12	42.8	37.07	580000	0.00	0.00	5800	0.01	0.01
POTASSIUM	7440-09-7	12	4660	4188						
SELENIUM	7782-49-2	12	-	-				1500	0.00	0.00
SILVER	7440-22-4	12	1.3	1.3				1500	0.00	0.00
SODIUM	7440-23-5	12	1720	885.6						
THALLIUM	7440-28-0	12	-	-				3.03	0.00	0.00
VANADIUM	7440-62-2	12	54.8	41.39				1500	0.036	0.028
ZINC	7440-66-6	12	169	146				89000	0.0019	0.0016
POLYNUCLEAR AROMATIC HYDROCARBONS										
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				14000	0.00	0.00
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093						
ANTHRACENE	120-12-7	12	0.0344	0.0344				70000	0.00	0.00
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	42.78	0.00	0.00			
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	4.28	0.018	0.018	70	0.00	0.00
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	42.78	0.00	0.00			
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538						
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	427.78	0.00	0.00			
CHRYSENE	218-01-9	12	0.132	0.132	4277.78	0.00	0.00			
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	4.28	0.003	0.003			
FLUORANTHENE	206-44-0	12	0.367	0.367				9333	0.00	0.00
FLUORENE	86-73-7	12	0.0504	0.0504				9333	0.00	0.00
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	42.78	0.00	0.00			
NAPHTHALENE	91-20-3	12	0.0377	0.0377	77.78	0.00	0.00	506	0.00	0.00
PHENANTHRENE	85-01-8	12	0.202	0.202						
PYRENE	129-00-0	12	0.26	0.26				7000	0.00	0.00
POLYCHLORINATED BIPHENYLS										
PCB, TOTAL	1336-36-3	12	0.038	0.038	8.94	0.0042	0.0042			
PESTICIDES										
INORGANICS										
CYANIDE	57-12-5	12	-	-				89.44		
CUMULATIVE RISK RATIOS WITHOUT ARSENIC						0.02	0.02		0.64	0.56

[1] screening levels for trivalent chromium were used

Table 6. Ecological Soil - Toledo Harbor Within Maumee AOC Sediment Screening Results

All units are mg/kg (ppm)					Risk-based screening levels (OEPA 2008, 2018)			Ohio Background Values		Initial Screening Results		
					Tier I	Tier II	Tier III					
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL95 on the Mean	Eco-SSLs (USEPA 2003a; updated 2018)	Oak Ridge Ecological Endpoints (Efroymson et al. 1997)	Region 5 Ecological Screening Levels (USEPA 2003b)	Lucas County soil background (Ohio EPA, 2015)	Erie County soil background (Ohio EPA, 2019)	Max exceeds highest tier screening level available?	Max exceeds soil background?	UCL95 on the Mean exceeds soil background?
METALS												
ALUMINUM	7429-90-5	12	29000	22029					11300		YES	YES
ARSENIC	7440-38-2	12	12.1	11.03	18	9.9	5.7	9.7	16.7	no	no	no
BARIUM	7440-39-3	12	181	151.9	330	283	1.04	90.1	111	no	YES	YES
BERYLLIUM	7440-41-7	12	1.3	1.16	21	10	1.06		0.85	no	YES	YES
CADMIUM	7440-43-9	12	1.8	1.23	0.36	4	0.00222			no	no background	no background
CALCIUM	7440-70-2	12	37200	32630					6770		YES	YES
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01	26	0.4	0.4	23.2	17.6	YES	YES	YES
COBALT	7440-48-4	12	15.1	12.25	13	20	0.14		13.23	no	YES	no
COPPER	7440-50-8	12	44.1	38.86	28	60	5.4		42	no	YES	no
IRON	7439-89-6	12	37200	32589					27567		YES	no
LEAD	7439-92-1	12	23.4	21.75	11	40.5	0.0537	17	29.6	YES	no	no
MAGNESIUM	7439-95-4	12	11100	9940					4090		YES	YES
MANGANESE	7439-96-5	12	800	704.9	220				1164	no	no	no
MERCURY	7439-97-6	12	-	-		0.00051	0.1	0.045	0.071	no	no	no
NICKEL	7440-02-0	12	42.8	37.07	38	30	13.6	28.5	22.5	no	YES	YES
POTASSIUM	7440-09-7	12	4660	4188				679	1248		YES	YES
SELENIUM	7782-49-2	12	-	-	0.52	0.21	0.0276		1.1	no	no	no
SILVER	7440-22-4	12	1.3	1.3	4.2	2	0.109			no	no background	no background
SODIUM	7440-23-5	12	1720	885.6					110		YES	YES
THALLIUM	7440-28-0	12	-	-		1	0.0569	0.44	0.6	no	no	no
VANADIUM	7440-62-2	12	54.8	41.39	7.8	2	1.59		22.7	YES	YES	YES
ZINC	7440-66-6	12	169	146	46	8.5	6.62		71.1	YES	YES	no
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	83-32-9	12	0.0305	0.0305	29	20	682			no	no background	no background
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093	29		682			no	no background	no background
ANTHRACENE	120-12-7	12	0.0344	0.0344	29		1480			no	no background	no background
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766	1.1		5.21			no	no background	no background
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756	1.1		1.52			no	no background	no background
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102	1.1		59.8			no	no background	no background
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538	1.1		119			no	no background	no background
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843	1.1		148			no	no background	no background
CHRYSENE	218-01-9	12	0.132	0.132	1.1		4.73			no	no background	no background
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139	1.1		18.4			no	no background	no background
FLUORANTHENE	206-44-0	12	0.367	0.367	1.1		122			no	no background	no background
FLUORENE	86-73-7	12	0.0504	0.0504	29		122			no	no background	no background
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568	1.1		109			no	no background	no background
NAPHTHALENE	91-20-3	12	0.0377	0.0377	29		0.0994			no	no background	no background
PHENANTHRENE	85-01-8	12	0.202	0.202	29		45.7			no	no background	no background
PYRENE	129-00-0	12	0.26	0.26	1.1		78.5			no	no background	no background
POLYCHLORINATED BIPHENYLS												
PCB, TOTAL	1336-36-3	12	0.038	0.0328		0.371	0.000332			no	no background	no background
PESTICIDES												
INORGANICS												
CYANIDE	57-12-5	12	-	-			1.33			no	not detected	not detected
NITROGEN, AMMONIA	7664-41-7	12	447								no background	no background
NITROGEN, TOTAL KJELDAHL (TKN)	7727-37-9	12	3310								no background	no background
PHOSPHORUS, TOTAL (AS P)	7723-14-0	12	1230								no background	no background

[1] screening levels for trivalent chromium were used

Table 7. Ecological Sediment - Toledo Harbor Within Maumee AOC Sediment Screening Results

All units are mg/kg (ppm)					Sediment Background	Sediment Quality Guidelines, MacDonald et al. (2000)		Initial Screening Results		
Parameter	CAS Number	Number of Samples	Maximum Detection	UCL95 on the Mean	Huron/Erie Lake Plain Sediment Reference Value (Ohio EPA 2018)	Threshold Effects Concentrations	Probable Effects Concentrations	UCL95 on the Mean exceeds sediment background?	Max exceeds TEC?	Max exceeds PEC?
METALS										
ALUMINUM	7429-90-5	12	29000	22029	42000			no	no TEC	no PEC
ARSENIC	7440-38-2	12	12.1	11.03	11	9.79	33	no	YES	no
BARIUM	7440-39-3	12	181	151.9	210			no	no TEC	no PEC
BERYLLIUM	7440-41-7	12	1.3	1.16	0.8			YES	no TEC	no PEC
CADMIUM	7440-43-9	12	1.8	1.23	0.96	0.99	4.98	YES	YES	no
CALCIUM	7440-70-2	12	37200	32630	110000			no	no TEC	no PEC
CHROMIUM, TOTAL [1]	7440-47-3	12	40.9	33.01	51	43.4	111	no	no	no
COBALT	7440-48-4	12	15.1	12.25	12			no	no TEC	no PEC
COPPER	7440-50-8	12	44.1	38.86	42	31.6	149	no	YES	no
IRON	7439-89-6	12	37200	32589	44000			no	no TEC	no PEC
LEAD	7439-92-1	12	23.4	21.75	47	35.8	128	no	no	no
MAGNESIUM	7439-95-4	12	11100	9940	29000			no	no TEC	no PEC
MANGANESE	7439-96-5	12	800	704.9	1000			no	no TEC	no PEC
MERCURY	7439-97-6	12	-	-	0.12	0.18	1.06	no	no	no
NICKEL	7440-02-0	12	42.8	37.07	36	22.7	48.6	YES	YES	no
POTASSIUM	7440-09-7	12	4660	4188	12000			no	no TEC	no PEC
SELENIUM	7782-49-2	12	-	-	1.4			no	no TEC	no PEC
SILVER	7440-22-4	12	1.3	1.3	0.43			YES	no TEC	no PEC
SODIUM	7440-23-5	12	1720	885.6				no background	no TEC	no PEC
THALLIUM	7440-28-0	12	-	-	4.7			no	no TEC	no PEC
VANADIUM	7440-62-2	12	54.8	41.39	40			YES	no TEC	no PEC
ZINC	7440-66-6	12	169	146	190	121	459	no	YES	no
POLYNUCLEAR AROMATIC HYDROCARBONS										
ACENAPHTHENE	83-32-9	12	0.0305	0.0305				no background	no TEC	no PEC
ACENAPHTHYLENE	208-96-8	12	0.0093	0.0093				no background	no TEC	no PEC
ANTHRACENE	120-12-7	12	0.0344	0.0344		0.0572	0.845	no background	no	no
BENZO(A)ANTHRACENE	56-55-3	12	0.0766	0.0766		0.108	1.05	no background	no	no
BENZO(A)PYRENE	50-32-8	12	0.0756	0.0756		0.15	1.45	no background	no	no
BENZO(B)FLUORANTHENE	205-99-2	12	0.102	0.102				no background	no TEC	no PEC
BENZO(G,H,I)PERYLENE	191-24-2	12	0.0538	0.0538				no background	no TEC	no PEC
BENZO(K)FLUORANTHENE	207-08-9	12	0.0843	0.0843				no background	no TEC	no PEC
CHRYSENE	218-01-9	12	0.132	0.132		0.166	1.29	no background	no	no
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0.0139	0.0139		0.033		no background	no	no PEC
FLUORANTHENE	206-44-0	12	0.367	0.367		0.423	2.23	no background	no	no
FLUORENE	86-73-7	12	0.0504	0.0504		0.0774	0.536	no background	no	no
INDENO(1,2,3-C,D)PYRENE	193-39-5	12	0.0568	0.0568				no background	no TEC	no PEC
NAPHTHALENE	91-20-3	12	0.0377	0.0377		0.176	0.561	no background	no	no
PHENANTHRENE	85-01-8	12	0.202	0.202		0.204	1.17	no background	no	no
PYRENE	129-00-0	12	0.26	0.26		0.195	1.52	no background	no	no
POLYCHLORINATED BIPHENYLS										
PCB, TOTAL	1336-36-3	12	0.038	0.038	0.038	0.0598	0.676	no	no	no
PESTICIDES								no detects	no detects	no detects
INORGANICS										
CYANIDE	57-12-5	12		-				no detects	no TEC	no PEC
NITROGEN, AMMONIA	7664-41-7	12		447				no background	no TEC	no PEC
NITROGEN, TOTAL KJELDAHL (TKN)	7727-37-9	12		3310				no background	no TEC	no PEC
PHOSPHORUS, TOTAL (AS P)	7723-14-0	12		1230				no background	no TEC	no PEC

[1] screening levels for trivalent chromium were used

Appendix C: USACE Toledo Harbor Dredged Sediment Evaluation – 2022

US Army Corps of Engineers®
Buffalo District

Toledo Harbor Dredged Sediment Evaluation—2022

EVALUATION OF TOLEDO HARBOR FEDERAL NAVIGATION CHANNEL DREDGED SEDIMENTS WITH RESPECT TO SUITABILITY FOR OPEN-WATER PLACEMENT

EXECUTIVE SUMMARY

Federal navigation channels in Toledo Harbor generally consist of a seven mile-long River Channel in the lower Maumee River and a Lake Approach Channel extending approximately 18 miles out into the Western Lake Erie Basin (WLEB), and include three Turning Basins. The predominant source of sediments in the River Channel and Lake Approach Channel areas are erosion in the upstream portions of the Maumee River Basin, and the Western Lake Erie Basin (WLEB), respectively. Like other sediments or soils within an urbanized and developed watershed or water body influenced by anthropogenic activities, these channel sediments are impacted by low concentrations of metals, nutrients, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and many other constituents reflective of ambient conditions in the 21st Century environment. These channel sediments were evaluated to determine their suitability for placement at a designated open-water site in the WLEB.

In 2021, a series of discrete sediment samples collected from Toledo Harbor federal navigation channels were subjected to a suite of bulk physical and chemical tests. In addition, discrete sediment samples collected in the WLEB from open-water placement and reference sites were sampled and subjected to the same testing. Previous testing, including biological effects-based testing, has shown that sediments dredged from these channels met "contaminant determination" Clean Water Act (CWA) Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for discharge at the open-water placement site. The new data generated in 2021, in tandem with previous data and evaluations completed in 2016 and 2018, and other relevant information, were evaluated to determine whether this conclusion should be changed.

To evaluate the contaminant-related impacts of these sediments when placed in the open-water, relevant pathways were examined to evaluate fate, exposure and risks. Primary contaminant exposure pathways in the water column include uptake by plankton and fish as contaminants are released from the dredged sediments during discharge, and the associated toxicity effects. With respect to contaminant-related impacts after the dredged sediments are placed on the lake bottom, the primary exposure pathway is uptake by benthic organisms and the associated toxicity effects, which may involve bioaccumulation of bioaccumulative contaminants in receptors.

Previous evaluations initially identified polycyclic aromatic hydrocarbons (PAHs) as a preliminary contaminant of concern (COC) in some River Channel sediments. Further evaluation involving standard laboratory toxicity bioassay and porewater testing on the sediments, and modeling, eliminated PAHs as a preliminary COC. Previous evaluations found that ammonia concentrations in channel sediments was often higher in comparison to the open-lake placement and reference sites. Ammonia is a naturally occurring constituent of sediment porewater and, due to its labile and ephemeral nature, is generally not considered a COC in the management of dredged sediments. Further evaluation involving elutriate and water column toxicity testing, and modeling showed that ammonia released during dredged sediment placement would rapidly mix in the water column and dilute to levels protective of aquatic life. Previous elutriate data and modeling indicated that the discharge of the dredged sediments at the designated open-lake placement site would be protective of aquatic life, and comply with applicable state water quality standards (WQSs) after consideration of dilution and dispersion. Finally, comprehensive review of the 2021 bulk sediment data on Toledo Harbor federal navigation channel sediments, as contained in this evaluation, did not identify any preliminary COCs.

A comprehensive large-scale investigation employing field monitoring and laboratory testing was accomplished in 2014 to evaluate whether phosphorus in Toledo Harbor dredged sediments had the potential to influence Lake Erie harmful algal blooms (HABs) as a result of open-water placement. The investigation concluded that the open-water placement of Toledo Harbor dredged sediment did not represent a net source of bioavailable phosphorus contributing to HABs.

Based on evaluation of the 2021 data along with the previous 2016 and 2018 evaluations, and other information, it is concluded that the discharge of all sediments dredged from Toledo Harbor federal navigation channels at the designated open-lake placement site in the western Lake Eire basin (WLEB) would not result in contaminant-related, unacceptable adverse effects to the aquatic ecosystem. Based on this information, it has been concluded that these dredged sediments meet CWA Section 404(b)(1) Guidelines for open-water placement as presented at 40 CFR 230.11(d).

1.0 INTRODUCTION AND BACKGROUND

1.1 Toledo Harbor federal navigation project. Toledo Harbor is centered in Toledo, Lucas County, Ohio on the western end of Lake Erie at the mouth of the Maumee River. Figure 1 is a map of the existing Toledo Harbor federal navigation project. The harbor is designed to accommodate deep-draft commercial navigation and is maintained by U.S. Army Corps of Engineers (USACE). The following is a description of the authorized federal navigation channel locations and dimensions:

- Lake Approach Channel: This approximately 18-mile long channel in the WLEB has a depth of -28 feet low water datum (LWD)[1] and width of 500 feet from the mouth of the Maumee River (Mile 0), through Maumee Bay to deep water in the lake (Lake Mile [LM] 18).
- Maumee River Channel: This approximately 7-mile long channel in the Maumee River has a depth of -27 feet LWD and width of 400 feet from Mile 0 to River Mile (RM) – 3; thence a width of 400 feet from RM-3 to RM-6.5 with depths of -27 feet LWD over a least width of 200 feet, and -25 feet LWD over the remainder of the 400-foot width; thence a width of 200 feet and depth of -25 feet LWD to the upper limit of the federal navigation project at RM-7.
- Lower Turning Basin: This basin is located adjacent to the Maumee River Channel at RM-2.7. It is trapezoidal in shape with a width of 750 feet and approximate lengths of 800 and 1,200 feet, with a depth of -20 feet LWD.
- Middle Turning Basin: This basin is located adjacent to the Maumee River Channel at RM-6.5. It is semicircular in shape with a radius of 730 feet and depth of -27 feet LWD.
- Upper Turning Basin: This basin is located at the upper limit of the Maumee River Channel at RM-7. It is triangular in shape with sides of about 1,100 feet and depth of -18 feet LWD.

The Toledo Harbor federal navigation project supports the Port of Toledo, which offers 35 piers, wharves and docks located in Maumee Bay along the southeast side of the Maumee River mouth, and along both banks of the lower seven miles of the river. Many of the piers, wharves and docks are used for multiple purposes. The port characteristically handles over 27 different bulk commodities. Historically, three dry bulk commodities have been dominant – Receipt of iron ore, shipment of coal and shipment of grain. Other bulk commodities handled through the port include gravel, sand, salt, limestone, wheat, oats, soybeans, maize, coke, abrasives, pig iron, fertilizer, cement, molasses, benzene and scrap metal. In addition, several waterfront facilities are equipped to receive and/or ship petroleum products (e.g., oil, asphalt). The Toledo-Lucas County Port Authority offers long- and short-term dry storage space, as well as open storage areas, for commodities shipped through the port. The Port of Toledo also holds waterfront plants engaged in making repairs to vessels of wide-ranging sizes. Tug operations for towing, docking and shifting vessels at the harbor, and for towing services at numerous other Great Lakes ports, are also housed at the port.

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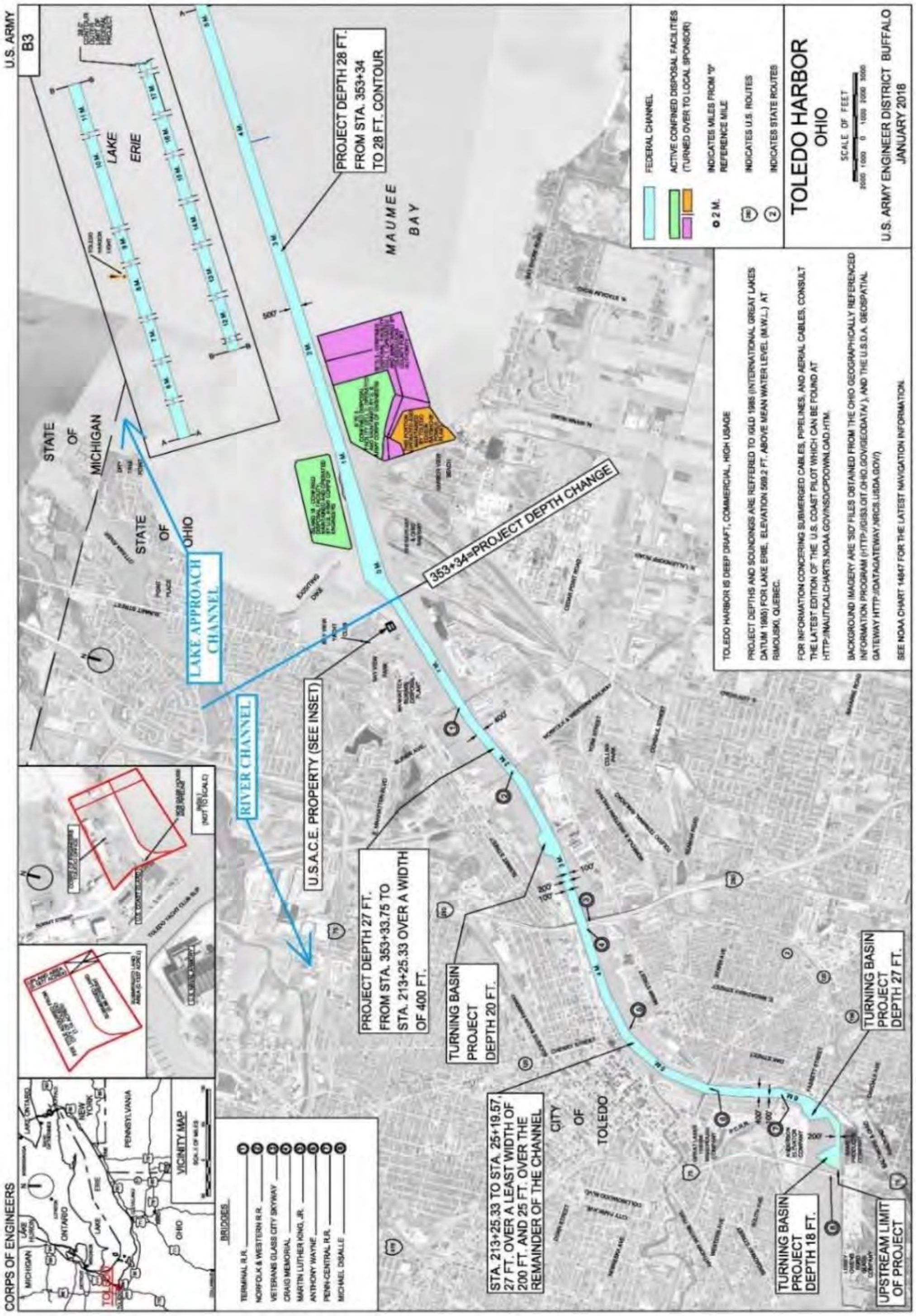
[1] Low Water Datum for Lake Erie is elevation 569.2 feet above mean water level at Rimouski, Quebec, Canada; International Great Lakes Datum (IGLD), 1985.

FIGURE 1. Toledo Harbor federal navigation project.



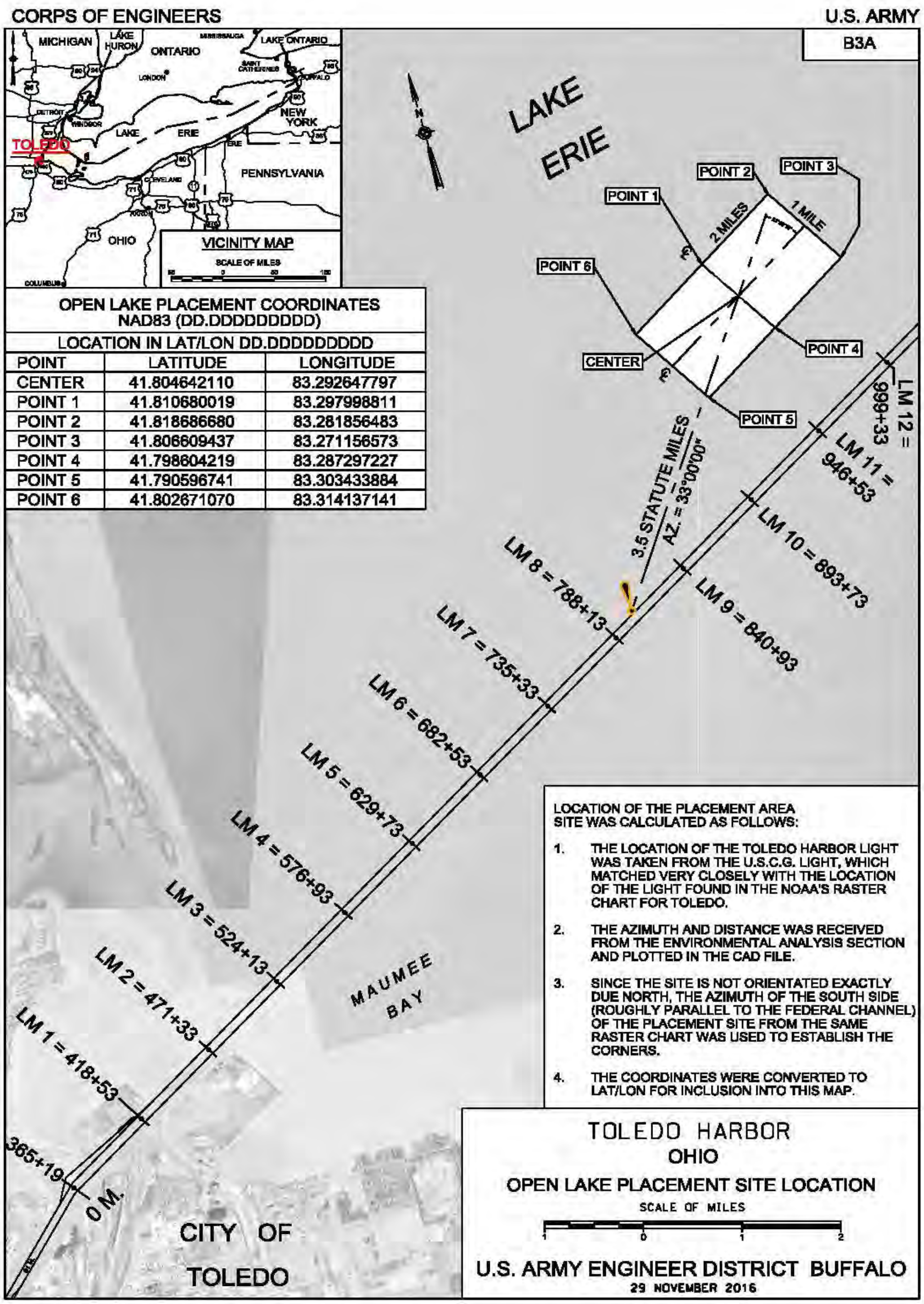
The Toledo Harbor federal navigation project is located within the designated 775 square mile Maumee Great Lakes Area of Concern (AOC) (USEPA 2022). A major ecological concern within this AOC is agricultural runoff of phosphorus, which leads to cultural eutrophication in Lake Erie. Contaminants of concern (COCs) may include polychlorinated biphenyls (PCBs), heavy metals, phthalates and polycyclic aromatic hydrocarbons (PAHs). "Restrictions on Dredging Activities" is among the AOC's various Beneficial Use Impairments.

1.2 Toledo Harbor Maintenance dredging. As sediments deposit through sedimentation and accumulate as shoals in Toledo Harbor federal navigation channels, they obstruct deep-draft commercial navigation, thus requiring periodic maintenance dredging. Land use around the harbor consists of mixed urban uses, including industrial, commercial and some recreational areas, with rural agricultural areas immediately to the south. Sediment deposited within the harbor's federal navigation channels originates mainly from the runoff of surficial fine-grained soils within the agricultural upper watershed of the Maumee River, as well as from re-suspension of lake sediments in Maumee Bay and WLEB in the harbor's approach. Generally, USACE dredges between 600,000 and 1,000,000 cubic yards of sediments are dredged from Toledo Harbor federal navigation channels annually. The average annual target is to dredge 800,000 cubic yards each year. USACE contracts with a private entity to perform this maintenance dredging. Typically, the dredging is completed by mechanical means using a clamshell bucket, with placement of the dredged sediment in a scow. The scow is then transported to the placement site for management of the dredged sediment.

The quality of sediments dredged from Toledo Harbor federal navigation channels is evaluated and determined through "contaminant determination" Clean Water Act (CWA) Section 404(b)(1) Guidelines (40 CFR 230.11[d]) (U.S. Environmental Protection Agency [USEPA] 1980). This determination is made using joint formal USEPA/USACE guidance for the testing and evaluation of dredged sediment as prescribed in the Great Lakes Dredged Material Testing and Evaluation Manual (Great Lakes Testing Manual [GLTM]) (USEPA/USACE 1998a) and Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual [ITM]) (USEPA/USACE 1998b). The most recent CWA Section 404(b)(1) Evaluation (USACE 2020) concluded that all sediments dredged from Toledo Harbor federal navigation channels met the Section 404(b)(1) Guidelines for placement at the authorized two square mile open-lake placement area in the WLEB (Figure 2).

The objective of this evaluation is to evaluate 2021 test data and other relevant information to reach a CWA Section 404(b)(1) Guideline "contaminant determination" regarding the open-water placement of sediments dredged from Toledo Harbor federal navigation channels. This evaluation was conducted in accordance with formal federal guidance prescribed in USEPA/USACE (1998a,b).

FIGURE 2. Authorized Lake Erie open-lake placement site for Toledo Harbor dredged sediment.



2.0 SEDIMENT SAMPLING AND TESTING

This evaluation emphasizes 2021 analyses performed on sediment samples collected from Toledo Harbor federal navigation channels and other open-water sites in the WLEB. It addresses the potential discharge of sediments dredged from these channels at the existing open-lake placement site in the WLEB. This evaluation also considers evaluations from 2016 (USACE 2016) and 2018 (USACE 2018), as well as other relevant sediment data and information. For the purposes of this evaluation, Toledo Harbor channels are designated as the Lake Approach Channel (including the "north flank") in the WLEB, and River Channels (including lower Turning Basin) in the lower Maumee River.

2.1 2021 investigation. The objective of this effort was to generated data to evaluate whether sediments dredged for the maintenance of Toledo harbor federal navigation channels meet "contaminant determination" CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for placement at the existing open-lake placement site.

2.1.1 Sampling—Discrete surface grab sediment samples were collected across the federal navigation channels. A total of eight were collected from the River Channel in the Maumee River (21-MRC-0 through 21-MRC-7) (Figure A1) and a total of 13 were collected from the Lake approach Channel in the WLEB (21-LM-1 through 21-LM-13) (Figure A2). Generally, discrete sites were staged every one mile. In the lake, sediment grab samples were collected from four discrete sites at both the open-lake placement site (21-TD-1 through 21-TD-4) and open-lake reference site (21-TR-1 through 21-TR-4) (Figure A3).

2.1.2 Analyses—Bulk sediment and elutriate data for this investigation were generated under contract (ALS 2021).

a. Bulk sediment. All discrete sediment samples from the harbor and lake were analyzed for bulk grain size (grain size and hydrometer, Unified Soil Classification System (USCS) soil classification, Atterberg Limits, percent moisture and organic matter), metals (23 target analytes list [TAL, including mercury]), total cyanide, nitrogen-ammonia, nitrite/nitrate, total Kjeldahl nitrogen (TKN), total phosphorus (TP), total oil&grease, TOC, $PAHs_{16}$ (16 USEPA priority pollutants [Office of the Federal Registration 1982]), $PCBs_{Aroclors}$ (Aroclor mixtures) and pesticides.

b. Sediment elutriate testing. The standard elutriate test (SET) was performed on composite harbor channel sediment samples: Maumee River (21-MAC), and Lake Approach Channel (21-LAC-1 [discrete samples 21-LM-1 to 5] and 21-LAC-2 [discrete samples 21-LM-6 to 13]). The SET is a laboratory simulation to predict the potential release of contaminants from dredged sediments to the water column during open-water placement of dredged sediments. Generally, elutriate preparations and lake water samples were analyzed for the same chemical parameters as the bulk sediment samples.

3.0 DREDGED SEDIMENT EVALUATION

3.1 General description

This evaluation addresses sediments dredged from the Toledo Harbor federal navigation channels and their placement at the existing open-lake placement site in the WLEB. It references or integrates information from the previous dredged sediment evaluations (USACE 2016, 2018) and other relevant information as appropriate.

The initial step toward evaluating the toxicological effects of placing any dredged sediments in the open-water is to compare bulk contaminant concentrations in the sediment samples to those from the open-lake placement site(s). If any channel sediment contaminant concentration substantially exceeds open-lake placement site sediment concentrations such that they would present a potential toxicological risk, it is identified as a preliminary contaminant of concern (COC) or COC, and then subjected to further testing and/or evaluation. Further testing/evaluation typically includes modeling, or toxicity or bioaccumulation testing (bioassays). With respect to applicable state water quality standards (WQSs), sediment elutriate data are used to assess compliance after consideration of dilution and dispersion. Water column toxicity test data are also utilized to evaluate water quality-related effects and compliance.

3.2 Site conceptual model

The site conceptual model for this activity focuses on potential contaminant-related adverse impacts to the aquatic ecosystem that would occur as a result of the discharge of the dredged sediment at the open-lake placement site in the WLEB. This is a designated two square mile area with water depths of between 17 and 22 feet. Aquatic habitat at this location consists primarily of warm water habitat, with mud-bottom (mainly silt/clay) benthic substrate and overlying water column. Bottom sediments at this site are colonized by a community of benthic invertebrates that are relatively low in species diversity and dominated by oligochaetes and chironomids. The water column at this site is used by most fish, nekton and plankton on a transient basis as required for foraging and migration. Aquatic birds use the water surface and water column on a transient basis for resting and foraging.

Under this dredged sediment management alternative, sediments from Toledo Harbor would typically be mechanically dredged from the channel using a clamshell bucket, then placed in a scow for transport to the open-lake placement site for discharge. The dredged sediment is composed mainly of silts, clays, sands and water with residual bulk concentrations of contaminants and organic matter. During discharge, dredged sediment is released from the scow and descends through the water column until it hits the bottom substrate, then collapses and spreads out before coming to rest on the lake bottom. Contaminant-related impacts can occur in both the water column and benthic environs, and are assessed mainly through toxicity and bioaccumulation endpoints relative to biological receptors. Typical exposure pathways between the dredged sediment and receptors would include uptake through absorption (bioconcentration) and absorption/ingestion (bioaccumulation), and trophic transfer through bioaccumulation. With respect to contaminant-related impacts in the water column, effects require exposure to biota and include the release of dissolved contaminants from the dredged sediments and turbidity, both of which are short-term events. These effects are evaluated via comparison of elutriate contaminant concentrations, after modeling the effects of dilution and dispersion in the water column, with applicable WQSs that are protective of aquatic life and toxicity criteria developed by elutriate bioassays using a minnow and water flea as representative test species. With respect to contaminant-related benthic impacts associated with the placed dredged sediments, effects require exposure to biota and include toxicity and bioaccumulation. These effects are evaluated through bulk sediment chemistry, solid phase bioassays using an amphipod and midge as representative test species, bioaccumulation experiments using an aquatic worm, and modeling. Regarding dredged sediment movement on the lake bottom, the placed sediment would behave in a manner similar to the adjacent and surrounding lake bottom sediments, whereby a thin layer of the actively bioturbated zone could resuspend and migrate from the site under severe storm conditions. Resuspended dredged sediments under these conditions would constitute a very small fraction of the regional suspended sediment load during the storm event. Any resuspended dredged sediments would mix thoroughly with the load and be indistinguishable from the regional load. The depths of the open-lake placement site would serve to allay the potential for sediment erosion, resuspension and movement.

3.3 Summary of previous evaluations

The primary previous Toledo Harbor federal navigation channel sediment evaluations considered in this evaluation are USACE (2016) and USACE (2018). Across both evaluations, channel sediments were generally found to be predominantly fine-grain in nature, comprised of mostly silts and clays, with some sands and gravels.

3.3.1 2016 evaluation—USACE (2016) documents the results of the testing and evaluation of Toledo Harbor federal navigation channel sediment samples collected in 2012 and 2015.

The 2012 investigation evaluated PAH contamination and the associated toxicity of River Channel sediments in relation to open-lake placement and reference site sediments, involving testing for bulk particle size, TOC content and PAH_{16} concentration. In addition, standard toxicity testing included the following: (1) 10-day solid phase (whole sediment) *Hyalella azteca* (amphipod) bioassay using survival as the biological measurement endpoint; (2) 10-day solid phase *Chironomus dilutus* (midge fly) bioassay using survival and growth as the biological measurement endpoints; (3) 96-hour water column (elutriate) *Pimephales promelas* (fathead minnow) bioassay using survival as the biological measurement endpoint; and (4) 48-hour water column *Ceriodaphnia dubia* (water flea) bioassay using survival as the biological measurement endpoint (USEPA/USACE 1998a,b).

The 2015 investigation was very similar to the effort accomplished in 2021 (Section 2.1) but also included application of a SET to the channel sediments for a similar array of sediment contaminants. USACE (2016) concluded that sediments dredged from all Toledo Harbor federal navigation channels (Lake Approach and River Channels), except for those in most of the River Mile (RM) 1 and 2 reaches of lower River Channel, met the "contaminant determination" CWA Section 404(b)(1) Guidelines for discharge at the designated open-lake placement site in the WLEB. Due to higher total PAH concentrations, it was inconclusive whether sediments dredged from a RM-1 reach (between Stations 315+00 and 286+00) and RM-2 reach (between Stations 271+00 and 245+00) met these guidelines. A brief technical summary of the results of these investigations is as follows:

a. Preliminary COCs. Concentrations of total PAH_{16} in sediments sampled (including a composite sample) at some lower River Channel sites were gauged to be of potential toxicological concern due to bulk concentration (26.8, 37.1 and 48.9 mg/kg). Therefore, total PAHs at these sites were identified as a preliminary COC and referred for further evaluation. All other concentrations of total PAH_{16} measured in the channel sediments across the combined 2012 and 2015 sampling events (range 0.01 to 10.3 mg/kg) were not of toxicological significance.

b. Solid phase bioassays. The 2012 bioassays demonstrated that the River Channel sediments (dredged material management unit [DMMU] composite samples] did not exhibit any toxicity (*H. azteca* mean survival range 88±8 to 100%; *C. dilutus* mean survival range 94±13 to 100%; *C. dilutus* mean growth range 1.48±0.22 to 2.20±0.10 mg dry weight) when compared to those at the open-lake placement or reference sites, or standard criteria (minimum *C. dilutus* mean growth of 0.6 mg [USEPA/USACE 1998b]). This bioassay dataset generated an unbounded no observed effect concentration (NOEC) of 48.9 mg/kg (2,520 mg/kg-TOC) for total PAH_{16} (USACE 2016) based on the summary information in Table 1.

TABLE 1

Standard bioassay	Biological measurement endpoint (±standard deviation [SD])	Sediment sample		
		Toledo Harbor, 12-RM-1	Open-lake reference site	Control
H. azteca	Mean survival (%)	**94±9** [1]	98±5	98±5
C. dilutus	Mean survival (%)	**98±5** [1]	98±5	100
C. dilutus	Mean dry weight (mg)	**1.48±0.22** [2]	1.80±0.14	1.83±0.31

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[1] Not statistically different than data on open-lake reference site sediments.
[2] Greater than or equal to criterion of 0.6 mg (USEPA/USACE 1998b).

c. Water column bioassays. The 2012 bioassays demonstrated that the River Channel sediment elutriates were not toxic to *P. promelas* or *C. dubia* after ammonia released from the dredged sediment is diluted in the water column. Evidence suggested that the un-ionized fraction of ammonia in undiluted (100%) elutriate was a contributor and likely the cause of the observed mortality to both test species (e.g., comparison to various toxicity reference values

[TRVs]). The mean survival of *P. promelas* exposed to the 100% elutriates ranged from 0 to 74±17%, all of which were statistically lower than mean survival for site water. Mean *P. promelas* survivals generated from a follow-up full dilution series (i.e., 100, 50, 25, 12.5 and 6.25%) of exposures were high (≥92%) at a minimum elutriate dilution of 50%.
With respect to *C. dubia*, the mean survival exposed to 100% elutriates ranged from 8±11 to 96±9%, less than a half of which were statistically lower than the site water results. Subsequent dilution series of exposures showed elutriate dilutions of 50% or greater to not be toxic to *C. dubia* (mean survival ≥92%).

d. Compliance with applicable WQSs. Nitrogen-ammonia was the only parameter of concern in the elutriate and with respect to numeric Ohio WQSs (Ohio Environmental Protection Agency [OEPA] 2021). SET data and modeling indicated that the discharge of all sediments dredged from Toledo Harbor federal navigation channel sediments at the designated open-lake placement site would comply with applicable state WQSs after consideration of dilution and dispersion.

e. Remaining COCs. Pending further evaluation, total PAHs were again identified as a preliminary sediment COC at three discrete lower River Channel sites due to higher bulk concentrations measured in 2015.

3.3.2 2018 evaluation—In follow-up to the USACE (2016) evaluation, USACE (2018) documents the results of the testing and evaluation of Toledo Harbor federal navigation channel sediments involving two separate investigations in 2016 and 2017.

The 2016 investigation was directed at two infrequently maintained areas of the harbor, including the north side of the Lake Approach Channel near the river mouth (north flank) and upstream River Channel Turning Basin near River Mile 3 (lower Turning Basin) in 2016. Sediment samples from the channels and open-lake placement and reference sites were analyzed for a similar array of bulk parameters as conducted in 2021 (Section 2.1) and also included application of a SET. In addition, elutriate from the channel sediment samples were subjected to standard toxicity tests including the 96-hour water column *P. promelas* bioassay for survival, and 48-hour water column *C. dubia* bioassay for survival (USEPA/USACE 1998a,b).

The 2017 investigation focused on sediments in the lower River Channel within the general RM 1 to 2 reach between Stations 315+00 and 286+00, and 271+00 and 245+00, and subjected the sediment samples to further PAH-related testing and evaluation to make a contaminant determination for open-water placement. Testing on the channel and open-lake placement and reference site samples included bulk particle size, TOC content and 34 PAH compounds (18 non-alkylated parent compounds and 16 groups of generic alkylated forms [34 PAHs]) ($PAHs_{34}$). In addition, $PAHs_{34}$ were analyzed in sediment porewater (ASTM D7363-13a; ASTM International 2010), and sediment samples were subjected to the standard 10-day *H. azteca* bioassay for survival and *C. dilutus* bioassay for survival and growth. USACE (2018) concluded that sediments dredged from these channels, as tested and evaluated in both investigations, met the "contaminant determination" CWA Section 404(b)(1) Guidelines for discharge at the designated open-lake placement site in the WLEB. A brief technical summary of the results of these investigations is as follows:

a. Preliminary COCs. PAHs were identified as a preliminary COC in a lower River Channel sediment sample collected in 2017 within the general RM 1 to 2 reach where a total $PAHs_{16}$ concentration of 46.1 mg/kg was observed. The PAH contamination at this site was subjected to further evaluation. With this one exception, concentrations of total PAH_{16} in the River Channel sediments samples ranged from 0.9 to 9.2 mg/kg and were not of toxicological concern. No preliminary COCs were identified in the north flank or lower Turning Basin sediment samples.

b. Bulk sediment concentration and bioavailability of PAHs. Total PAH_{16} concentrations in River Channel sediment samples ranged from 0.9 to 46.1 mg/kg. Sediment porewater data demonstrated a low bioavailability of PAH compounds in the lower River Channel sediments. The PAH_{34} sediment porewater data were used to compute total toxic units for total PAHs ($\sum IWTU_{FCV}$ or "PAH TUs") specific to *H. azteca,* a sensitive freshwater benthic species used for dredged sediment toxicity testing (USEPA 2003). PAH TUs across the lower River Channel sediment samples ranged from 0 to 0.60 and were <1.0, indicating that the PAH concentrations exhibited a low bioavailability and were protective of *H. azteca*. The 0.60 TU corresponded with the highest bulk sediment concentration of 46.1 mg/kg for PAH_{16} (72 mg/kg for PAH_{34}), and would likely result in a mean *H. azteca* survival of ≥85% using data from USEPA (2003) and Hawthorne *et al.* (2007) (USACE 2016). This result is consistent with the high survival of *H. azteca* (mean 94±9%) linked to a total PAH_{16} concentration of 48.9 mg/kg (2,520 mg/kg-TOC) as observed in bioassays on sediments sampled from an adjacent downstream area in the lower River Channel (see Table 1) (USACE 2016).

c. Solid phase bioassays. The 2017 bioassays were limited to lower River Channel sediments from only one of the DMMU composite samples because it possessed higher concentrations of PAHs at its contributing discrete sites (e.g., up to 46.1 mg/kg PAH_{16}) and produced the highest TU (0.4) of the two. The bioassay results showed no toxicity to *H. azteca* (mean survival 94±9%) or *C. dilutus* (mean survival 98±5%; mean growth 2.65±0.22 mg dry weight) when compared to those at the open-lake placement site (*H. azteca* mean survival 98±5%; *C. dilutus* mean survival 98±5%) or open-lake reference site (*H. azteca* mean survival 96±6%; *C. dilutus* mean survival 96±9%), or standard criteria (minimum *C. dilutus* mean growth of 0.6 mg [USEPA/USACE 1998b]). This information, in tandem with the porewater data and TU results in paragraph 3.3.2(c), served to eliminate PAHs as a preliminary COC in the lower River Channel sediments.

d. Water column bioassays. Ammonia was an initial toxicity issue with the 2016 bioassays. Exposure of *P. promelas* to the 100% lower Turning Basin sediment elutriates resulted in complete mortality. Exposure to the 50% elutriate in a full dilution series run yielded statistically lower survival (58±13%) relative to site water, resulting in a calculated LC_{50} of 49%. Evidence indicated that the un-ionized fraction of ammonia in the elutriates was a contributor and likely the cause of the observed mortality to *P. promelas* (e.g., comparison to various TRVs; a strong correlation was observed between mean *P. promelas* survival and average un-ionized ammonia concentrations across the elutriate dilution series [$R = 0.95$; $P < 0.001$] [U.S. Army Engineer Research and Development Center (USAERDC) 2018]).

With respect to *C. dubia*, the mean survival exposed to 100% elutriates ranged from 20±24 to 84±22%, with the lower value being statistically lower compared to the site water results. The bioassay run across the full dilution series showed no statistically significant difference from any of the other dilutions (i.e., for the 50% or less elutriates, mean survivals ranged from 96±9 to 100%), and a calculated LC_{50} of 77% was derived. Evidence suggested that un-ionized fraction of ammonia in the elutriates was a contributor and likely the cause of the observed mortality to *C. dubia* (e.g., comparison to various TRVs).

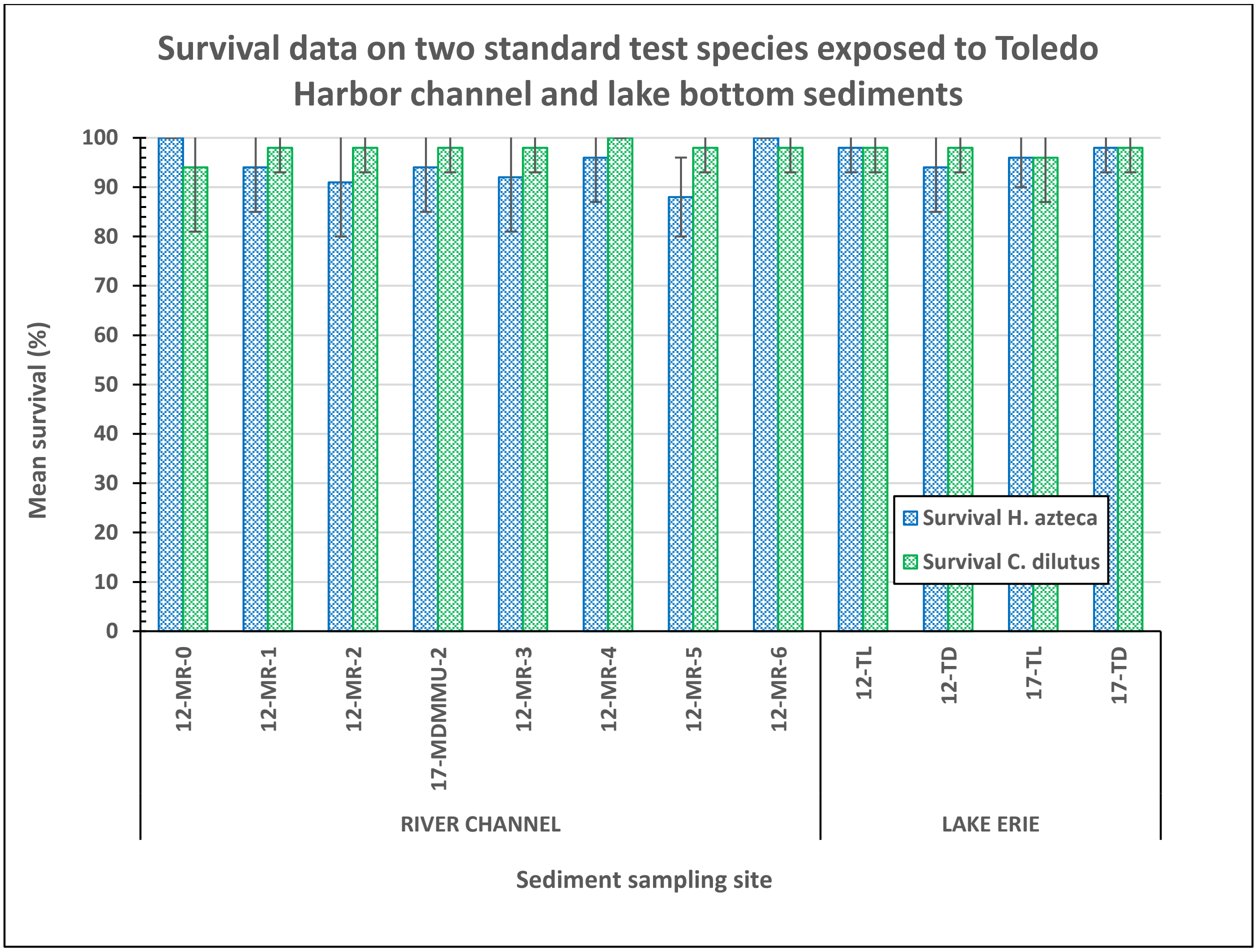
P. promelas and *C. dubia* toxicity reduction evaluation (TRE) elutriate bioassays were performed to develop additional lines of evidence as to whether the elevated ammonia concentrations were the sole driver of the observed toxicity (USAERDC 2018). Elutriate water manipulations included zeolite- and pH 6.5-adjusted treatment of the 100% elutriate. The TRE results, coupled with a review of the sediment elutriate chemistry, provided strong lines of evidence suggesting that all of the toxicity observed for the elutriates for both test species was caused by ammonia.

e. <u>Compliance with applicable WQSs</u>. Nitrogen-ammonia was the only parameter of concern in the elutriate and with respect to numeric Ohio WQSs (OEPA 2021). SET data and modeling indicated that the discharge of all sediments dredged from Toledo Harbor federal navigation channel sediments at the designated open-lake placement site would comply with applicable state WQSs after consideration of dilution and dispersion.

f. <u>Remaining COCs</u>. No preliminary COCs remained in the lower River Channel, north flank or lower Turning Basin sediments of Toledo Harbor.

In summary, these two evaluations culminated in the conclusion that sediments dredged from Toledo Harbor federal navigation channels are not expected to pose any toxicological concern with respect to open-water placement. To this point, the combined solid phase toxicity test data (survival endpoint) from the investigations in 2012 (USACE 2016) and 2017 (USACE 2018) are illustrated in Figure 1. Therefore, it was determined that sediments dredged from all Toledo Harbor channels met the "contaminant determination" CWA Section 404(b)(1) Guidelines for discharge at the designated open-lake placement site in the WLEB.

FIGURE 1



3.4 2021 investigation

3.4.1 Bulk sediment analyses

a. <u>Particle size distribution</u>. Table A1 summarizes the results of these analyses. With one exception, particle size data across the Lake Approach Channel samples show the sediments to be primarily fine-grain being comprised of between 85.5% (21-LM-3) and 92.3% (21-LM-5) silts and clays, with the remainder sands. Sample 21-LM-13 was comprised mainly of sands and gravels (96%). River Channel samples show the sediments to be primarily fine-grain but with a greater fraction of sands, being comprised of between 60.8% (21-MRC-6) and 92% (21-MRC-0) silts and clays, with the remainder sands. Lake bottom samples show sediments at the open-lake placement site to be composed predominantly of silts and clays (69 to 90%), with the remainder sands. At the open-lake reference site, two of the samples showed the sediments to be mostly silts and clays (89 to 91%) with the remainder sands and gravels; the other two samples (21-TL-3 and 4) showed the sediments to be predominantly coarse-grain, being 64 to

66% sands and gravels with the remainder silts and clays. These samples were substantially more coarse-grain in comparison to past sampling events at this site.

b. <u>Inorganic chemistry</u>.

(1) *Miscellaneous*—Table A2 summarizes the results of these analyses. TOC content ranged from 24,100 to 57,700 mg/kg in the Lake Approach and River Channel sediment samples. In the lake bottom sediment samples, TOC content ranged from 11,000 to 27,000 mg/kg at the open-lake placement site and from 23,600 to 31,800 kg/kg at the open-lake reference site. The TP data on sample 21-LM-11 in the Lake Approach Channel were rejected (i.e., qualified with an "R") due to matrix spike recoveries of below 10%. With such poor recovery, it cannot be definitively concluded that the analyses accurately measured the concentration of TP in the sample. Except for nitrogen-ammonia and TP, most bulk concentrations of these miscellaneous inorganics in the Lake Approach and River Channel sediment samples were similar to those across the lake sites.

Nitrogen-ammonia concentrations in the channel sediment samples ranged from non-detectable (<6 mg/kg) to 447 mg/kg, and was variable (average 212±127 mg/kg). Many of these were greater than those measured in the samples from the open-lake placement and reference sites (range non-detectable [10 mg/kg] to 95.4 mg/kg). Ammonia contamination associated with the channel sediments is further addressed in paragraph 3.4.3(a). TP concentrations in the channel sediment samples ranged from 75.7 (21-LM-8) to 1,580 mg/kg (21-LM-12), and were highly variable (average 472±469 mg/kg). Many of these were greater than those measured in the samples from the open-lake placement and reference sites (range 58.1 to 96.2 mg/kg). In 2015, TP concentrations in the channel sediments, ranging from 60 to 920 mg/kg (average 325±144 mg/kg), were more comparable to those at the open-lake placement and reference sites (180 to 370 mg/kg) (USACE 2016). TP in the channel sediments is further addressed in paragraph 3.4.2(b).

(2) *Metals*—The results of these analyses are summarized in Table A3. The bulk concentrations of most metals in the Lake Approach and River Channel sediment samples were similar to those across the open-lake placement and reference sites. Relative to the Lake Approach Channel sediment samples, sample 21-LM-12 initially showed various metal concentrations that were unusually elevated. Most of the metal concentrations in this sample were anomalous based on previous analyses of harbor channel sediments (e.g., USACE 2016, 2018), and the concurrent results for sediment samples upstream (21-LM-11) and downstream (21-LM-13) of the site. Further review of information on sample 21-LM-12 suggested that carryover contamination may have biased metal concentrations high given that it was analyzed immediately following a matrix spike/matrix spike duplicate (MS/MSD) analysis. Based on this collective information, the bulk sediment metals data on this sample were considered to be unreliable, and were therefore rejected. The sediments at this site in the Lake Approach Channel are dredged very infrequently, on the order of every 40 years (e.g., the last two maintenance dredging events in this area of the channel were in 1981 and 2018). Metal contamination in sediment sample(s) from this site will be re-examined in future sampling,

testing and evaluation efforts planned to be accomplished in 2026 or 2027.

Concentrations of barium in the Maumee River and Lake Approach Channel sediment samples (range 15.9 to 181 mg/kg) were higher at various sites relative to those measured across the open-lake placement and reference sites (range 58.1 to 108 mg/kg). However, they were generally comparable to those measured in lake site sediment samples in both 2015 (USACE 2016) and 2017 (USACE 2018) (range 68 to 140 mg/kg), and fell below the sediment reference value (SRV) of 210 mg/kg for the Huron/Erie Lake Plain (OEPA 2018).

c. Organic chemistry.

(1) *PAHs*—Table A4 summarizes the results of these analyses. Total PAH_{16} concentrations in the Lake Approach and River Channel sediment samples ranged from non-detectable (21-LM-7) (<0.05 mg/kg per compound) to 1.59 mg/kg (21-MRC-2), and were comparable to those measured at the open-lake placement site (range 0.72 to 1.41 mg/kg) and open-lake reference site (<0.04 mg/kg per compound, to 0.04 mg/kg). Total PAH_{16} concentrations in the channel sediments were low and well below a site-specific Toledo Harbor unbounded NOEC of 48.9 mg/kg (USACE 2016). The concentrations measured across harbor channel and lake sediment samples in 2021 were lower than observed in USACE (2016) (see paragraph 3.3.1[a]) and USACE (2018) (see paragraph 3.3.2[a]).

(2) *PCBs*—The results of these analyses are summarized in Table A5. Total PCB concentrations in the Lake Approach and River Channel sediment samples ranged from non-detectable (several sites; <0.02 to <0.03 mg/kg) to 0.08 mg/kg (21-LM-11). These were comparable to those at the open-lake placement and reference sites, which ranged from 0.04 to 0.07 mg/kg and non-detectable (<0.02 mg/kg) to 0.11 mg/kg at the open-lake placement and reference sites, respectively. The PCB data were rejected on sample 21-MR-7 in the River Channel because the two surrogates used in the analysis were recovered below 10%. With such low recovery, it is difficult to establish that PCB concentrations in the sample were accurately quantified as non-detectable. However, based on the most recent past data, low concentrations of total PCBs are expected in sediments in this area of Toledo Harbor (e.g., <0.005 mg/kg; USACE 2016).

(3) *Pesticides*—Table A6 summarizes the results of these analyses. The data show non-detectable concentrations of pesticides in sediment samples across the Lake Approach and River Channel, as well open-lake placement and reference sites (<0.58 to <161 μg/kg). Like total PCBs, the pesticides data on sample 21-MR-7 in the River Channel were rejected because the two surrogates used in the analysis were recovered below 10%. With such low recovery, it is difficult to establish that pesticide concentrations in this sample were accurately quantified as non-detectable. In addition, the delta-BHC, 4,4′-DDT and methoxychlor data on sample 21-LM-1 in the Lake Approach Channel were rejected due to matrix spike recoveries below 10%. With such poor recovery, it cannot be definitively concluded that the analyses accurately measured these analytes. Nevertheless, based on the most recent past data, low concentrations of pesticides are expected in sediments in this area of Toledo Harbor (e.g., <2.5 to <43 μg/kg;

USACE 2016).

3.4.2 Sediment elutriate analysis

SET data on the composite samples of the federal navigation channel sediments were found to be unreliable. This is because the SET was not performed according to standard procedures (e.g., USEPA/USACE 1998a). The main issue was the supernatant was not centrifuged for analytical testing. Rather, the supernatant was allowed to settle for 24 hours after which the separated top layer of water was vacuumed off for analytical testing. This resulted in a high amount of particulates being retained in the elutriate.

Recent evaluations on channel sediments (USACE 2016, 2018) did not identify any water column COCs that could not be eliminated, and there is no reason to believe that has changed. Therefore, elutriate data from these investigations was relied upon for the purposes of this evaluation. An evaluation specific to nitrogen-ammonia contamination associated with the channel sediments is contained in paragraph 3.4.3(a). Data and information from USACE (2016, 2018) indicate that open-water placement of sediment dredged from the channels would comply with applicable Ohio WQSs.

3.4.3 Further evaluation

a. Nitrogen-ammonia. Compared to the 2021 nitrogen-ammonia data (paragraph 3.4.1[b]; Table A2), 2016 data on Toledo federal navigation channel sediment samples showed concentrations of 690 to 870 mg/kg (average 766±57.4 mg/kg) (USACE 2018) that were, on average, more than three times greater. Sediment standard elutriate test (SET) data and water column toxicity test (i.e., 96-hour survival of *Pimephales promelas* and 48-hour survival of *Ceriodaphnia dubia*) data from the 2016 dataset (USACE 2018) were conservatively used to predict and evaluate releases from the channel sediments. The SET showed elutriate concentrations of ammonia-nitrogen to be as high as 17 mg/L which exceeded a water quality criterion of 4.5 mg/L (outside mixing zone maximum [OMZM] water quality criterion for the protection of aquatic life at a pH of 8.1 and temperature of 25°C [OEPA 2021]). Therefore, consideration of mixing in the water column would be required to evaluate compliance with the applicable WQS.

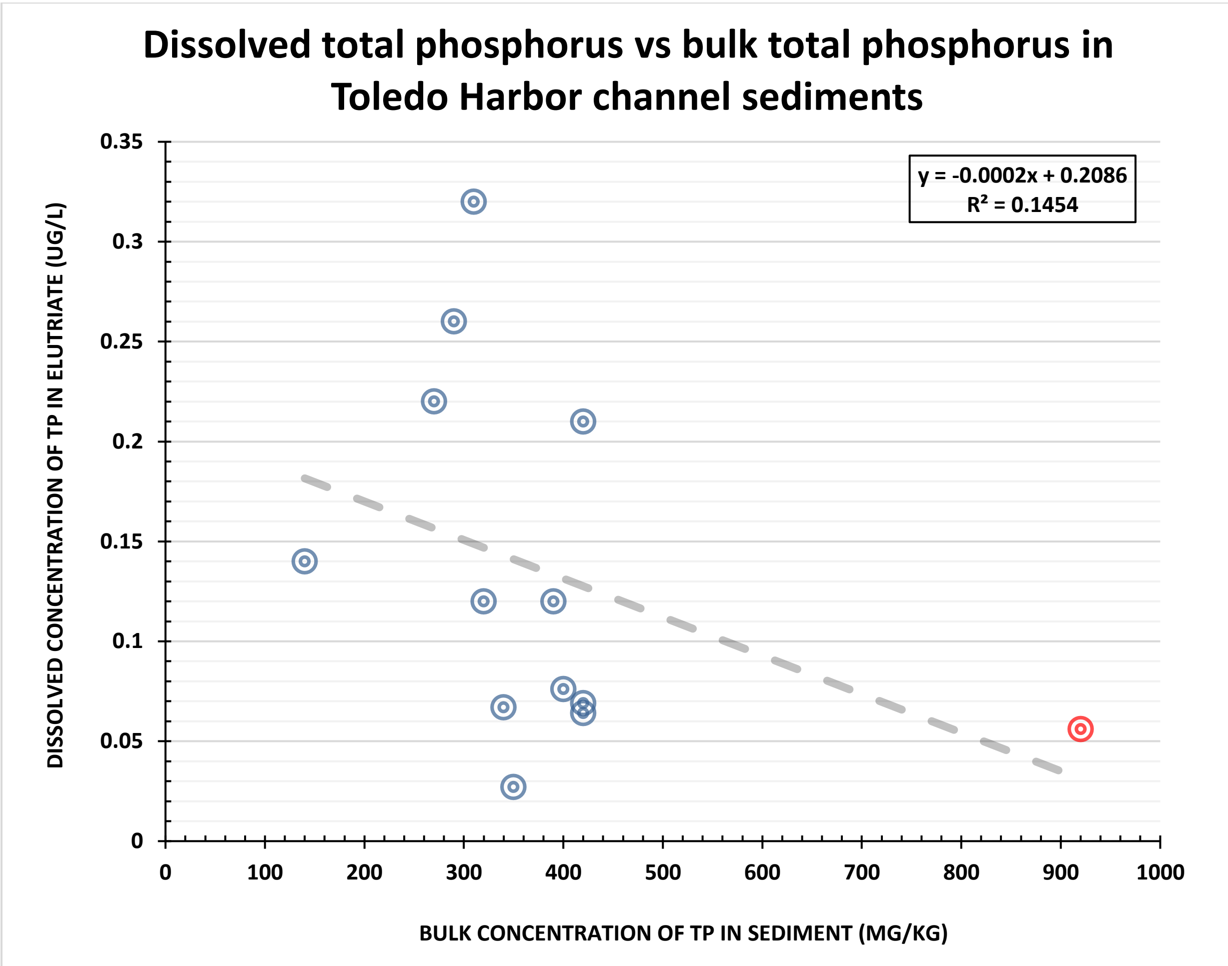
Ammonia is a naturally occurring constituent of sediment pore water and, due to its labile and ephemeral nature, is generally not considered a COC in the management of dredged sediments. However, sediment elutriate concentrations were greater than levels protective of water column organisms, prior to consideration of dilution and dispersion in the water column during dredged sediment placement. Since ammonia was identified as a cause of the elutriate toxicity associated with Toledo Harbor federal navigation channel sediments (USACE 2018), an application factor of 0.1 was applied to the lethal concentration to 50% of the test organisms (LC_{50}) data to compute limited permissible concentrations (LPCs) (as opposed to using an application factor of 0.01 if the toxicity were a result of toxicants other than ammonia). An application factor of 0.1 is appropriate for protection of *P. promelas* (Kennedy *et al.* 2015). The resulting minimum LPC would be 4.9%, requiring a dilution factor of about 19.

To evaluate mixing within the water column, the Short-Term FATE (STFATE) of dredged sediment in open-water model was used (USEPA/USACE 1998a,b). This model considers mixing due to the dynamics of the dredged sediment discharge (convective descent and dynamic collapse) followed by transport and spreading of the discharge due to ambient currents and turbulence within the water column (passive transport-dilution). The parameter requiring the greatest amount of dilution is the elutriate toxicity test LPC of 4.9%. Based on a scow discharge of 1,500 cubic yards of sediment, assumed to be volumetrically 80% water, 2% sand, 8% silt and 10% clay, and a water column depth of 20 feet with an average water current velocity of 0.164 feet/s (0.05 m/s), the elutriate LPC of 4.9% would be met within 700 feet and 60 minutes from the point of discharge, well within the boundaries of the open-lake placement site. The ammonia water quality criteria of 4.5 mg/L would be met within 300 feet and 20 minutes of the discharge based on the maximum elutriate concentration of 17 mg/L and background water column concentration of 0.051 mg/L (USACE 2018).

In summary, water quality modeling indicated that nitrogen-ammonia released during dredged sediment placement would rapidly dilute in the water column to levels protective of aquatic life.

b. TP. As indicated in paragraph 3.4.1(b) and contained in Table A2, a number of bulk concentrations of TP in the channel sediment samples substantially exceeded those at the open-lake placement and reference sites. It is integral to note, however, that bulk concentrations of TP are typically not reflective of dissolved reactive phosphorus (DRP) in sediment, and that TP measured in sediment samples is on the order of >99% particulate phosphorus (PP). DRP (consisting primarily of orthophosphate) is considered to be 100% bioavailable to support algal growth and therefore is the most important form of phosphorus to influence eutrophication, including harmful algal blooms (HABs). Sediment-associated TP data (USACE 2016) help explain that bulk concentrations of TP are not indicative of the readily soluble and bioavailable forms of phosphorus as estimated through elutriate testing. The scatter plot of 2015 data from USACE (2016) in Figure 2 fails to illustrate any significant relationship between bulk sediment TP and dissolved TP concentrations in associated elutriate. This is because the TP measured in the sediments is almost exclusively particulate in nature and not released to the water column during open-water placement activities or from in-place lake bottom sediments. Note that despite the highest bulk concentration of TP (920 mg/kg) observed among the sediment samples, the same sample yielded a release of dissolved TP (0.056 mg/L) (shown by the red point in Figure 1) that was among the lowest of all the other low releases. These data are consistent with the findings of Jones and Lee (1980) in their assessment of the release of available forms of nutrients across more than 20 waterway sediments. Jones and Lee (1980) also noted that the open-water release of dissolved nutrients from dredged sediment predicted in their study would be expected to overestimate that which is actually released through scow-based open-water placement of mechanically-dredged sediment. This is due to the elutriate test

FIGURE 2



methodology being predicated on hydraulic dredging and disposal (e.g., mixing and sediment-to-water ratio), indicating that the release of dissolved TP through the open-water placement of mechanically-dredged Toledo Harbor sediments via scow would be expected to be less than that the predicted through the elutriate test data included in Figure 2.

In 2014, water quality monitoring was performed immediately after open-water placement of Toledo Harbor dredged sediment in a comprehensive, large-scale investigation to evaluate whether the activity posed any potential to trigger or exacerbate HABs in the WLEB (Ecology and Environment [E&E]/LimnoTech 2014). The field monitoring of open-water placement of dredged sediment and study of placed sediment showed very little release of dissolved TP, including DRP, with PP rapidly depositing along with the suspended solids (i.e., mostly clay and silt particles) to which it is adsorbed to in the lake sediment bed. The released concentrations of DRP in the water column rapidly decreased to background concentrations within minutes and provided no net change to water column TP or DRP concentrations in the vicinity of the placement site. Extensive sediment phosphorus release experiments conducted by an independent laboratory using state-of-the-science core tube incubation techniques showed no difference among the reference and placement sites. The investigation team concluded that open-water placement of Toledo Harbor dredged sediment was not a net source of bioavailable phosphorus contributing to HABs. In addition, simply moving sediments from one location to another did not raise TP/DRP in either the water column or in sediment release experiments relative to reference sites. The background rates of DRP release were later validated by Matisoff *et al.* (2016) using similar methods at nearby sites. In addition, Matisoff *et al.* (2016) found no statistically significant correlation between overall SRP flux and TP concentrations in sediment ($R = -0.008$, $P = 0.976$). These findings and data suggest no connection between the placement of Toledo Harbor dredged sediment in the WLEB and HABs. To this point, all forecasting models used to predict the size of a HAB in the WLEB (e.g., National Oceanic and Atmospheric Administration [NOAA 2019]) do not include dredged material placement activities within the basin as a predictive variable. Across all models, the number one predictor variable is the measurement of TP in the Maumee River at the U.S. Geological Survey (USGS) gauge in Waterville, Ohio, located upstream the Toledo Harbor federal navigation project.

In summary, it is unlikely that TP in Toledo Harbor channel sediments represents any biologically meaningful source of TP, including DRP, with respect to eutrophication. The relevant scientific literature and site-specific data directly challenge suggestions that open-lake placement of Toledo Harbor dredged sediment comprises a significant source of TP or DRP contributing to HABs in the WLEB (e.g., "Group protests open-water sediment dumping in Lake Erie" 2010; "Report offers solutions to Lake Erie algae bloom" 2014; "To reduce algae in Lake Erie, ban open-lake dumping" 2015; Great Lakes Commission 2015; Watson *et al.* 2016).

3.4.4 COCs—Evaluation of the 2021 dataset, and other relevant information, show no COCs to be associated with Toledo Harbor federal navigation channel sediments.

4.0 CONCLUSION

Bulk sediment chemistry data (ALS 2021), in tandem with previous evaluations containing sediment toxicity, elutriate and water column toxicity data (USACE 2016, 2018), were evaluated to determine if sediments dredged from Toledo Harbor federal navigation channels meet "contaminant determination" CWA Section 404(b)(1) Guidelines (40 CFR 230.11[d]) for placement at the authorized open-lake placement site in the WLEB. All sediments dredged from the River and Lake Approach Channels meet these guidelines. This conclusion is consistent with the existing CWA Section 404(b)(1) Evaluation addressing the open-water placement of sediments dredged from Toledo Harbor federal navigation channels (USACE 2020). This evaluation shows that open-water placement of Toledo Harbor dredged sediments would meet applicable state WQSs.

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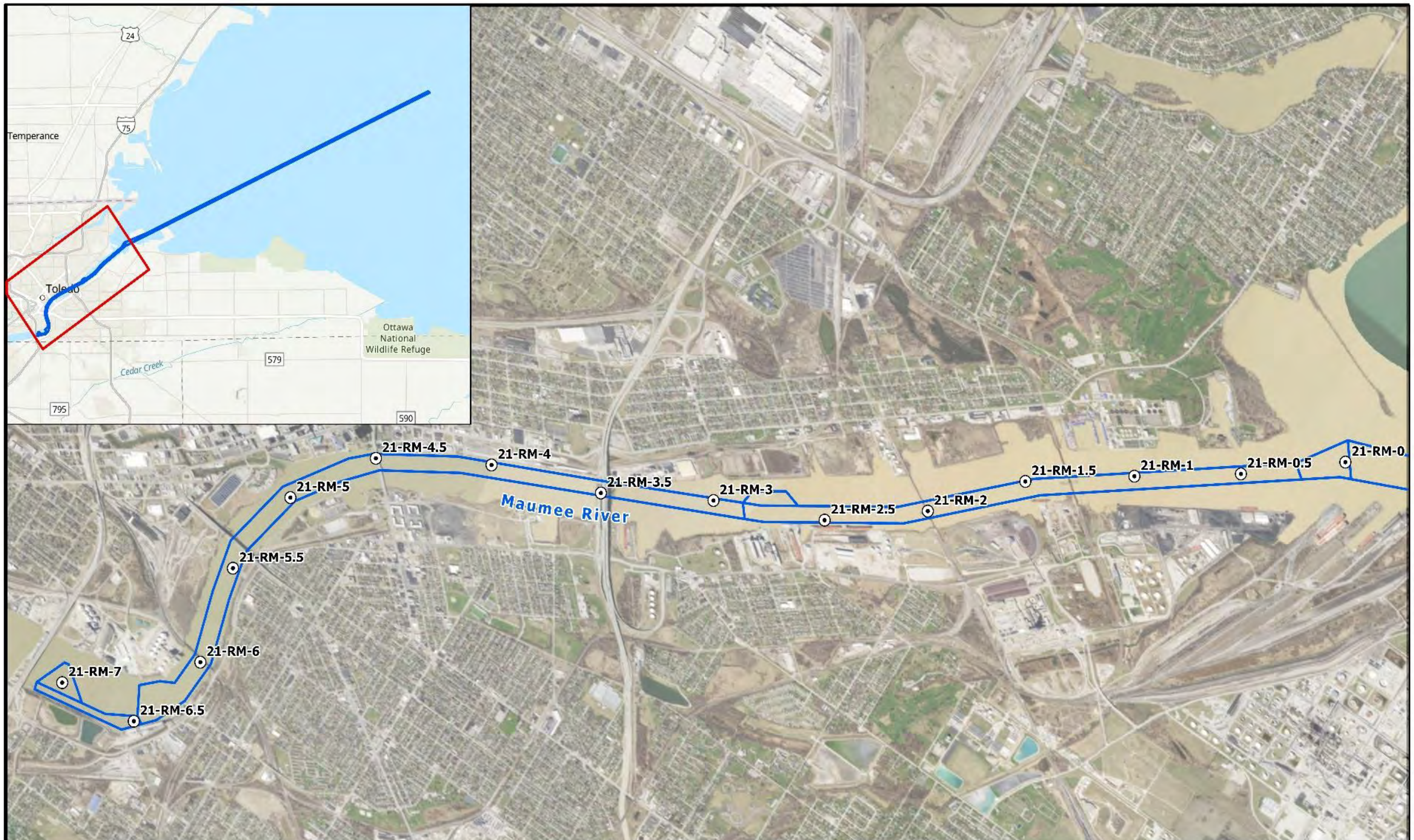
ATTACHMENTS



⊙ 2021 Sample Locations

Federal Navigation Channel

0 0.25 0.5 1 Miles

U.S. Army Corps of Engineers
Buffalo District
Buffalo, New York

2021 Sediment Sampling Sites
River Channel in Maumee River

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Toledo Harbor
Toledo, Ohio

Figure 1A


2021 Sediment Sampling Sites
Lake Approach Channel in Maumee Bay &
Western Lake Erie Basin
Toledo Harbor
Toledo, Ohio
Figure 2A
U.S. Army Corps of Engineers
Buffalo District
Buffalo, New York
Document Name: Toledo_2021SampLoc.mxd
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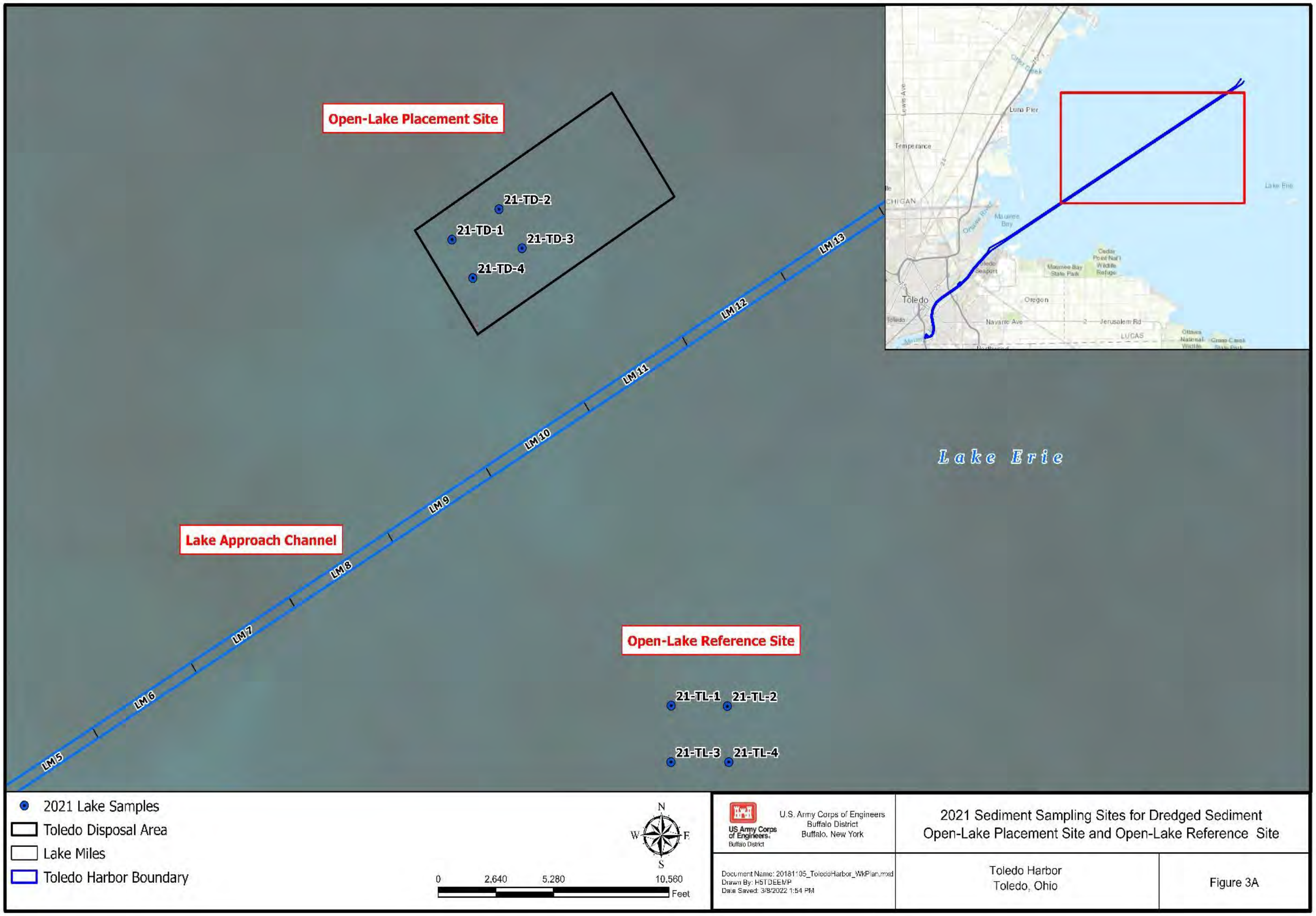
2021 Sample Locations
Federal Navigation Channel
0
0.5
1
2
Miles
N
S
E
W
Lake Erie
21-LM-1
21-LM-2
21-LM-3
21-LM-4
21-LM-5
21-LM-6
21-LM-7
21-LM-8
21-LM-9
21-LM-10
21-LM-11
21-LM-12
21-LM-13
Toledo
Ottawa National Wildlife Refuge
579



Open-Lake Placement Site
21-TD-1
21-TD-2
21-TD-3
21-TD-4
Lake Approach Channel
LM 5
LM 6
LM 7
LM 8
LM 9
LM 10
LM 11
LM 12
LM 13
Open-Lake Reference Site
21-TL-1
21-TL-2
21-TL-3
21-TL-4
Lake Erie
Toledo
Oregon
Luna Pier
Temperance
Lewis Ave
Navarre Ave
Jerusalem Rd
LUCAS
Maumee Bay State Park
2021 Lake Samples
Toledo Disposal Area
Lake Miles
Toledo Harbor Boundary
N
S
W
E
0
2,640
5,280
10,560
Feet
U.S. Army Corps of Engineers
Buffalo District
Buffalo, New York
US Army Corps of Engineers
Buffalo District
Document Name: 20181105_ToledoHarbor_WkPlan.mxd
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2021 Sediment Sampling Sites for Dredged Sediment
Open-Lake Placement Site and Open-Lake Reference Site
Toledo Harbor
Toledo, Ohio
Figure 3A

TABLE A1. Bulk particle size distribution data on Toledo Harbor federal navigation channel and Lake Erie site sediments (ALS 2021).

PARTICLE SIZE (%)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
COARSE GRAVEL	0	1	0	0	0	0	0	2
FINE GRAVEL	0	0	14	8	0	0	0	2
COARSE SAND	0	1	25	19	1	1	1	1
MEDIUM SAND	1	3	15	20	1	1	1	1
FINE SAND	8	6	10	19	9	8	11	25
COARSE-GRAIN	9	11	64	66	11	10	13	31
SILT	26	38	24	25	25	25	23	23
CLAY	65	51	12	9	64	65	64	46
FINE-GRAIN	91	89	36	34	89	90	87	69

PARTICLE SIZE (%)	HARBOR																				
	LAKE APPROACH CHANNEL													RIVER CHANNEL							
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
FINE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0
COARSE SAND	0	0	0.1	0	0	0	0	0	1	0	0	0	16	0	0	0	0	0	0	0.2	0
MEDIUM SAND	1.4	1.5	9.9	0.6	0.9	1	1	1	1	2	2	3	48	1.4	0.8	4.3	3.4	4.9	4.3	3.4	2.9
FINE SAND	10.1	7.1	4.4	8.3	6.8	10	9	9	10	7	7	8	16	6.6	6.9	7.2	8.6	23.3	25.2	35.6	24.3
COARSE-GRAIN	11.5	8.6	14.4	8.9	7.7	11	10	10	12	9	9	11	96	8	7.7	11.5	12	28.2	29.5	39.2	27.2
SILT	23.7	26.6	20.8	26.3	27.5	24	25	25	23	26	26	24	4	27.2	27	23.7	23.2	34.3	35.9	45.9	37
CLAY	64.8	64.8	64.7	64.8	64.8	65	65	65	65	65	65	65	0	64.8	64.8	64.8	64.8	37.5	34.6	14.9	35.8
FINE-GRAIN	88.5	91.4	85.5	91.1	92.3	89	90	90	88	91	91	89	4	92	91.8	88.5	88	71.8	70.5	60.8	72.8

TABLE A2. Bulk inorganic data on Toledo Harbor federal navigation channel and Lake Erie site sediments (ALS 2021).

INORGANIC PARAMETER (mg/kg)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
CYANIDE	U [1] 0.35	U 0.31	U 0.33	U 0.27	U 0.47	U 0.49	U 0.27	U 0.25
NITROGEN, AMMONIA	U 10	U 10	35.3	14.3 J [2]	95.4	67.7	59.9	86.3
NITROGEN, TOTAL KJELDAHL	2080	2250	1520	1110 J	1980	2120	2040	1800
PHOSPHORUS, TOTAL	72.5	80.6	60.9	58.1	N [3]	96.2	93.9	87.8
TOTAL OIL & GREASE	U 200	U 200	U 200	U 200	293	60	U 200	U 200
TOTAL ORGANIC CARBON	26300 J	25300 J	31800 J	23600 J	23600 J	26600 J	23600 J	26300 J

INORGANIC PARAMETER (mg/kg)	HARBOR																				
	LAKE APPROACH CHANNEL													RIVER CHANNEL							
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
CYANIDE	U 0.44	U 0.66	U 0.56	U 0.44	U 0.55	U 0.69	U 0.78	U 0.58	U 0.73	U 0.64	U 0.83	U 0.73	U 0.29	U 0.92	U 0.58	U 0.68	U 0.59	U 0.49	U 0.81	U 0.38	U 0.46
NITROGEN, AMMONIA	339	238	447	282 J	234 J	47.1	23.3 J	30.1	128	82.9	55.3	113	U 6	393	326	234	289	294	196	161	319
NITROGEN, TOTAL KJELDAHL	1980	2590	2570	2370	2450	2200	2390	2710	2670	2270	2070	2460	465 J	3140	3310	2980	2810	2980	2810	1790	2970
PHOSPHORUS, TOTAL	897 J	879 J	931 J	1050 J	361 J	75.7	96.3	79.6	92.9	92.3	R [4] 82	1580 J	320	178	167	146	154	157	132	812 J	1230 J
TOTAL OIL & GREASE	U 200	U 300	U 300	U 200	649 J	U 300	U 300	U 300	U 300	89	U 300	U 300	U 100	U 300	489 J	U 300	U 300	U 300	U 300	418 J	U 200
TOTAL ORGANIC CARBON	28700 J	29000 J	57700 J	31000 J	30600 J	26800 J	29000 J	27600 J	32600 J	28700 J	26200 J	27700 J	24300 J	37200 J	27100 J	27300 J	27500 J	27900 J	37400 J	24100 J	26000 J

[1] Not detected at or above the specified detection limit.

[2] Estimated value.

[3] No data.

[4] Data rejected due to major QC issues.

TABLE A3. Bulk metal data on Tolelo Harbor federal navigation channel and Lake Erie sediments (ALS 2021).

METAL (mg/kg)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
ALUMINUM	9570	13200	10100	8630	13900	15700	14200	12800
ANTIMONY	U [1] 7.1	U 8.2	U 6.8	U 6.3	U 6.1	U 6.7	U 6	U 5.4
ARSENIC	U 7.1	U 8.2	U 6.8	6.6 J [2]	10 J	10.6 J	6.5 J	7.8 J
BARIUM	69.1	93.1	71.6	58.1	97.5	108	95.1	86.4
BERYLLIUM	U 3.6	U 4.1	U 3.4	U 3.1	U 3	U 3.4	U 3	U 2.7
CADMIUM	U 1.8	U 2.1	U 1.7	U 1.6	U 1.5	U 1.7	U 1.5	U 1.3
CALCIUM	25100	22500	55700	40300	32700	36600	30900	40700
CHROMIUM, TOTAL	29.1	47.9	23.1	23.1	27.8	27.5	31.1	27.3
COBALT	6.9 J	9.9 J	7 J	6.3 J	9.4	10 J	9.9	8.6
COPPER	29.3	46.3	26.9	18.1 J	33.6	29.5	36.6	32.1
IRON	20100	27100	19300	18600	24800	25900	25400	23200
LEAD	26.6	45.8	18.8 J	18.9	20.8	19.1 J	25.3	22.7
MAGNESIUM	10300	12100	8140	6800	10800	12100	11900	12100
MANGANESE	410	506	320	300	564	509	526	503
MERCURY	0.24 J	0.37 J	U 0.14	0.14 J	0.12 J	U 0.13	0.16 J	U 0.1
NICKEL	28	43.5	23.2	23.3	31.2	31.6	34.3	29.4
POTASSIUM	1400	2060	1820	1570	2110	2720	2150	2000
SELENIUM	U 17.7	U 20.5	U 17	U 15.6	U 15.2	U 16.7	U 15	U 13.4
SILVER	U 1.8	U 2.1	U 1.7	U 1.6	U 1.5	U 1.7	U 1.5	U 1.3
SODIUM	U 177	U 205	254 J	U 156	U 152	U 167	U 150	U 134
THALLIUM	U 10.7	U 12.4	U 10.2	U 9.4	U 9.1	U 10.1	U 9	U 8.1
VANADIUM	20.6	27.2	21.4	22.9	27.9	31.9	29	27.5
ZINC	107	167	94.6	88.2	115	117	130	113

METAL (mg/kg)	HARBOR																				
	LAKE APPROACH CHANNEL													RIVER CHANNEL							
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
ALUMINUM	22200	21700	15600	15200	21400	18900	16500	16800	17800	17000	13400	R [3] 15700	1650	23200	20800	29000	19900	22400	16800	13900	16800
ANTIMONY	U 1.6	U 1.6	U 1.6	U 6.2	U 8.3	U 7.7	U 8	U 8.1	U 8.5	U 9	U 9	R 12.4 J	5.5 J	U 1.9	U 1.6	U 1.6	U 2	U 1.6	U 2	1.3 J	U 1.6
ARSENIC	11.2	11.1	9	9.7 J	10.8 J	9.3 J	9.3 J	9 J	9.3 J	U 9	U 9	R 17.5 J	7 J	9.6	10.5	11.3	12.1	11.7	10.9	9.7	8.7
BARIUM	155	149	115	119	148	119	109	122	129	116	96.8	R 140	15.9	150	151	181	154	156	129	113	115
BERYLLIUM	1.1 J	1.1 J	U 0.79	U 3.1	U 4.1	U 3.9	U 4	U 4	U 4.3	U 4.5	U 4.5	R 8.6 J	U 2	1 J	0.98 J	1.3 J	U 1	1 J	U 1	0.7 J	U 0.81
CADMIUM	0.75 J	1 J	0.59 J	2.1 J	U 2.1	U 1.9	U 2	U 2	U 2.1	U 2.2	U 2.2	R 9.1	U 1	0.72 J	0.86 J	0.85 J	0.9 J	0.83 J	0.88 J	1.8	0.63 J
CALCIUM	25500	37200	23800	35300	35900	32000	33100	36700	33700	30100	27300	R 27300	104000	23800	29200	29000	36000	26400	36200	32500	23200
CHROMIUM, TOTAL	33.3	34.3	23.3	26.4	33.4	30.6	29.5	32.2	35.8	37.4	39	R 45.6	3.6 J	32.9	33.7	40.9	31.2	32.2	26.8	22.6	24.4
COBALT	12	12	8.6	15.1	12.4	10 J	9.9 J	10.8 J	11.5 J	10.8 J	10.9 J	R 48.6	2.3 J	11.1	11.8	13.4	11.5	11.2	10	10.2	8.7
COPPER	36.8	41.4	28.1	33.5	46.2	34.8	32	33.9	37.8	37.4	45.1	R 73.8	U 4	36.4	43.3	44.1	39.1	37.3	34.5	28.4	29
IRON	34800	32700	25300	26100	33900	28300	28000	29700	31600	30800	27500	R 28200	7630	31300	32500	37200	32800	33600	28900	22500	24400
LEAD	20.1	23.1	15.3	21.4	21.2 J	17.9 J	21.8 J	22.3 J	29.9	27.8	35.8	R 42.7	6.6 J	19.5	23.2	23.4	21.6	20.6	21.6	18.8	15.3
MAGNESIUM	9570	11100	7130	10200	11600	11100	11800	12800	12100	11900	11900	R 11900	15800	8630	9970	10400	9690	9320	9500	8850	8420
MANGANESE	659	644	576	510	599	607	587	590	604	700	616	R 840	271	700	500	641	930	800	721	372	412
MERCURY	U 0.15	U 0.16	U 0.16	U 0.12	U 0.14	U 0.17	U 0.18	U 0.15	U 0.19	0.19 J	0.27 J	R 0.28 J	U 0.075	U 0.19	U 0.16	U 0.16	U 0.19	U 0.16	U 0.17	U 0.11	U 0.16
NICKEL	38.1	38.3	27.1	36.4	39.6	34	33.4	36.3	39.7	38.8	39.8	R 75.6	5.2 J	35.3	38.2	42.8	36	34.9	31	28.2	27.7
POTASSIUM	3800	4020	2690	2690	3560	3460	2920	2950	2920	2850	2210	R 3580	214 J	4660	3790	5700	3790	4240	3420	2390	3030
SELENIUM	U 4	U 3.9	U 3.9	U 15.6	U 20.6	U 19.3	U 20	U 20.1	U 21.2	U 22.4	U 22.3	R 35.7 J	U 10	U 4.8	U 4	U 4	U 5	U 4.1	U 5.1	U 2.5	U 4
SILVER	U 0.4	0.53 J	U 0.39	U 1.6	U 2.1	U 1.9	U 2	U 2	U 2.1	U 2.2	U 2.2	R 6.9 J	UJ [4] 1	U 0.48	U 0.4	U 0.4	U 0.5	U 0.41	U 0.51	1.3	U 0.4
SODIUM	172	198	126	363 J	U 206	254 J	U 200	U 201	U 212	U 224	U 223	R 894	U 99.7	1720	197	282	206	209	193	125	136
THALLIUM	U 2.4	U 2.3	U 2.4	U 9.4	U 12.4	U 11.6	U 12.1	U 12.1	U 12.8	U 13.5	U 13.5	R U 15.9	U 6	U 2.9	U 2.4	U 2.4	U 3	U 2.5	U 3	U 1.5	U 2.4
VANADIUM	40	41.2	29.1	30.4	40	38.8	34.5	36.1	36.7	35.4	27.5	R 41.6	5.4 J	43.7	39.4	54.8	38.2	41.3	31.7	26.6	30.9
ZINC	142	151	104	118	148	124	121	136	150	148	154	R 161	17.9	136	160	169	143	143	131	124	107

[1] Not detected at or above the specified detection limit.

[2] Estimated value.

[3] Rejected by end user; suspected carryover contamination in sample matrix from immediately prior spike/matrix spike duplicate (MS/MSD) analysis may have biased metal concentrations.

[4] Not detected at or above the specified detection limit; potentially biased low due to QC/QA results having low recoveries below lab

TABLE A4. Bulk PAH data on Toledo Harbor federal navigation channel and Lake Erie site sediments (ALS 2021).

PAH COMPOUND (µg/kg)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
ACENAPHTHENE	U [1] 39.3	U 41	U 37.7	U 35.1	7.8	8.5	4.5 J [2]	11
ACENAPHTHYLENE	U 39.3	U 41	U 37.7	U 35.1	13.1	12.1	10.2	12.8
ANTHRACENE	U 39.3	U 41	U 37.7	U 35.1	23.4	23.4	14.6	34.5
BENZO(A)ANTHRACENE	U 39.3	U 41	U 37.7	UJ [3] 35.1	86.6	88.1	53.4	107
BENZO(A)PYRENE	U 39.3	U 41	U 37.7	U 35.1	111	115	68.9	123
BENZO(B)FLUORANTHENE	U 39.3	U 41	U 37.7	UJ 35.1	106	119	61	116
BENZO(G,H,I)PERYLENE	U 39.3	U 41	U 37.7	UJ 35.1	58.2	64.2	41.7	58.3
BENZO(K)FLUORANTHENE	U 39.3	U 41	U 37.7	UJ 35.1	98.5	101	58.2	113
CHRYSENE	U 39.3	U 41	U 37.7	UJ 35.1	129	130	72.8	145
DIBENZ(A,H)ANTHRACENE	U 39.3	U 41	U 37.7	U 35.1	19.8	20.1	13.8	21.9
FLUORANTHENE	U 39.3	U 41	U 37.7	U 35.1	185	199	100	222
FLUORENE	U 39.3	U 41	U 37.7	U 35.1	20.4	20.5	11.1	24.7
INDENO(1,2,3-C,D)PYRENE	U 39.3	U 41	U 37.7	UJ 35.1	65.7	74.5	46.3	69.1
NAPHTHALENE	U 39.3	U 41	U 37.7	U 35.1	25.9	24.7	24	33.7
PHENANTHRENE	U 39.3	U 41	U 37.7	U 35.1	78.9	82.9	46.2	121
PYRENE	U 39.3	U 41	37.8 J	U 35.1	175	176	97.6	194
TOTAL PAHs	0	0	37.8	0	1204	1259	720	1407
TOC (mg/kg)	23600	26600	23600	26300	26300	25300	31800	23600
TOC-NORMALIZED TOTAL PAHs (mg/kg-TOC)	ND [4]	ND	1.6	0	45.8	49.8	22.6	59.6

PAH COMPOUND (µg/kg)	HARBOR												
	LAKE APPROACH CHANNEL												
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13
ACENAPHTHENE	1.8 J	UJ 1.1	1.9 J	2 J	2.6 J	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	4 J	U 0.48
ACENAPHTHYLENE	2.4 J	UJ 1.2	3.9 J	4.3 J	5.6 J	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	9.9 J	U 0.53
ANTHRACENE	4.8 J	5.4 J	5.2 J	6.1 J	10.4	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	14.4	U 0.58
BENZO(A)ANTHRACENE	20.7	12.3 J	22 J	30.7	41.4	U 47	U 46.1	U 42.2	U 51	U 50.4	48.3 J	59.7	U 0.83
BENZO(A)PYRENE	31.4	17 J	33.1 J	44.4	59.3	57.5 J	U 46.1	44.7 J	U 51	U 50.4	46.9 J	87.2	U 0.9
BENZO(B)FLUORANTHENE	32.5	15.5 J	30.9 J	42.2	62.6	U 47	U 46.1	U 42.2	U 51	50.6 J	U 45.5	87.2	U 0.82
BENZO(G,H,I)PERYLENE	26.3	13.8 J	27.7 J	35.3	48.9	U 47	U 46.1	U 42.2	U 51	U 50.4	52 J	60.3	U 1.8
BENZO(K)FLUORANTHENE	28.4	15.3 J	29.1 J	38.4	55.1	U 47	U 46.1	44.8 J	U 51	U 50.4	61.2 J	77.7	U 0.7
CHRYSENE	34	17.6 J	32.1 J	45.6	69.8	U 47	U 46.1	U 42.2	U 51	U 50.4	52 J	92	3.2 J
DIBENZ(A,H)ANTHRACENE	6.8 J	3.8 J	9.2 J	8.1	12.4	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	18.4	U 1.2
FLUORANTHENE	56.2	27.1 J	47.5 J	67.4	101	92.7 J	U 46.1	66.8 J	U 51	67.5 J	90.7 J	125	3.6 J
FLUORENE	4.4 J	2.5 J	3.9 J	4.7 J	7.3 J	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	12.2	0.99 J
INDENO(1,2,3-C,D)PYRENE	27.3	14.3 J	29 J	36.8	50.5	U 47	U 46.1	U 42.2	U 51	U 50.4	U 45.5	65.7	U 1.9
NAPHTHALENE	16.1	14.2 J	21.3 J	18.2	40.4	U 47	U 46.1	U 42.2	U 51	U 50.4	50 J	37	9.5
PHENANTHRENE	23.2	11.9 J	20 J	25.9	40.7	U 47	U 46.1	U 42.2	U 51	U 50.4	50.2 J	48.4	4.4
PYRENE	47.8	23.6 J	41.6 J	58.8	87.7	63.2 J	U 46.1	49.7 J	U 51	70.5 J	76.8 J	116	4.3
TOTAL PAHs	364	194	358	469	696	213	0	206	0	189	528	915	26.0
TOC (mg/kg)	28700	29000	57700	31000	30600	26800	29000	27600	32600	28700	26200	27700	24300
TOC-NORMALIZED TOTAL PAHs (mg/kg-TOC)	12.7	6.7	6.2	15.1	22.7	8.0	ND	7.5	ND	6.6	20.2	33.0	1.1

PAH COMPOUND (µg/kg)	HARBOR							
	RIVER CHANNEL							
	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
ACENAPHTHENE	UJ 1.2	1.8 J	30.5 J	1.9 J	2.1 J	UJ 1	8	U 0.97
ACENAPHTHYLENE	2.6 J	5.4 J	9.3 J	3.2 J	5 J	2.3 J	3.5 J	U 1.1
ANTHRACENE	4.6 J	5.9 J	34.4 J	4.1 J	7.1 J	3.7 J	11.3	3.4 J
BENZO(A)ANTHRACENE	20.1 J	24 J	76.6 J	17 J	34.4 J	14.9 J	20.6	15.2
BENZO(A)PYRENE	29.6 J	37.4 J	75.6 J	25.5 J	51.6 J	22.1 J	24.3	22.5
BENZO(B)FLUORANTHENE	26.9 J	32.5 J	102 J	24.9 J	50.9 J	23.2 J	28.4	22.6
BENZO(G,H,I)PERYLENE	25.2 J	29.1 J	53.8 J	19.6 J	41 J	17.3 J	16.6	15.7
BENZO(K)FLUORANTHENE	25.2 J	29.4 J	84.3 J	22.8 J	48.1 J	21.7 J	25.3	20.6
CHRYSENE	30.3 J	33.7 J	132 J	26.6 J	53.3 J	24.2 J	39.7	23.7
DIBENZ(A,H)ANTHRACENE	7.5 J	8.8 J	13.9 J	4.9 J	10.5 J	4.3 J	4.4 J	3.9 J
FLUORANTHENE	46 J	47.4 J	367 J	39.7 J	88.8 J	41 J	82.8	41.5
FLUORENE	3.2 J	4.2 J	50.4 J	3.5 J	3.8 J	2.9 J	13.5	2.4 J
INDENO(1,2,3-C,D)PYRENE	24.2 J	30.2 J	56.8 J	20.8 J	45.4 J	19 J	18.2	17.3
NAPHTHALENE	19.2 J	15.2 J	37.7 J	21.3 J	14.6 J	16.9 J	13.9 J	14.2 J
PHENANTHRENE	19.1 J	18 J	202 J	14.9 J	30.4 J	16 J	51.4	16.6
PYRENE	40.6 J	42.6 J	260 J	33.8 J	74.7 J	33.9 J	67.1	36.5
TOTAL PAHs	324	366	1586	285	562	263	425	256
TOC (mg/kg)	37200	27100	27300	27500	27900	37400	24100	26000
TOC-NORMALIZED TOTAL PAHs (mg/kg-TOC)	8.7	13.5	58.1	10.3	20.1	7.0	17.6	9.9

[1] Not detected at or above the specified detection limit.

[2] Estimated value.

[3] Not detected at or above the specified detection limit; potentially biased low due to QC/QA results having low recoveries below lab criteria.

[4] Not determined due to non-detectable levels of PAH compounds.

TABLE A5. Bulk PCB data on Toledo Harbor federal navigation channel and Lake Erie site sediments (ALS 2021).

PCB MIXTURE (mg/kg)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
AROCLOR 1016	U [1] 0.023	UJ [2] 0.023	U 0.022	U 0.02	U 0.019	U 0.02	U 0.019	U 0.018
AROCLOR 1221	U 0.023	UJ 0.023	U 0.022	U 0.02	U 0.019	U 0.02	U 0.019	U 0.018
AROCLOR 1232	U 0.023	UJ 0.023	U 0.022	U 0.02	U 0.019	U 0.02	U 0.019	U 0.018
AROCLOR 1242	U 0.023	UJ 0.023	U 0.022	U 0.02	U 0.019	U 0.02	U 0.019	U 0.018
AROCLOR 1248	0.046 J	UJ 0.023	0.024 J	U 0.02	0.024 J	U 0.02	0.022 J	0.031 J
AROCLOR 1254	0.046 J	UJ 0.023	0.028 J	0.024 J	0.023 J	U 0.02	U 0.019	0.027 J
AROCLOR 1260	U 0.023	UJ 0.023	U 0.022	U 0.02	U 0.019	U 0.02	U 0.019	U 0.018
TOTAL PCBs (mg/kg)	0.11	UJ 0.023	0.066 J	0.054 J	0.057 J	0.038 J	0.049 J	0.07
TOC (mg/kg)	23600	26600	23600	26300	26300	25300	31800	23600
TOC-NORMALIZED TOTAL PCBs (µg/kg-TOC)	4661	ND [3]	2797	2053	2167	1502	1541	2966

PCB MIXTURE (mg/kg)	HARBOR																			
	LAKE APPROACH CHANNEL													RIVER CHANNEL							
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
AROCLOR 1016	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	U 0.026	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R [4] 0.023
AROCLOR 1221	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	U 0.026	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
AROCLOR 1232	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	U 0.026	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
AROCLOR 1242	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	U 0.026	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
AROCLOR 1248	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	0.03 J	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
AROCLOR 1254	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	0.036 J	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
AROCLOR 1260	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	U 0.028	U 0.027	U 0.026	U 0.029	U 0.03	U 0.026	U 0.032	U 0.012	U 0.031	U 0.026	U 0.026	U 0.028	U 0.025	U 0.026	UJ 0.018	R 0.023
TOTAL PCBs (mg/kg)	U 0.022	U 0.028	U 0.025	U 0.021	U 0.025	0.029 J	U 0.027	0.051 J	0.044 J	0.071 J	0.083 J	0.078 J	0.012 J	U 0.031	0.038 J	0.031 J	0.035 J	0.033 J	U 0.026	0.021 J	R 0.023
TOC (mg/kg)	28700	29000	57700	31000	30600	26800	29000	27600	32600	28700	26200	27700	24300	37200	27100	27300	27500	27900	37400	24100	26000
TOC-NORMALIZED TOTAL PCBs (µg/kg-TOC)	ND	ND	ND	ND	ND	1082	ND	1848	1350	2474	3168	2816	494	ND	1402	1136	1273	1183	ND	871	ND

[1] Not detected at or above the specified detection limit.
[2] Not detected at or above the specified detection limit; potentially biased low due to QC/QA results having low recoveries below lab criteria.
[3] Not determined due to non-detectable of levels PCBs or rejected data.
[4] Data rejected due to major QC issues.

TABLE A6. Bulk pesticide data on Toledo Harbor federal navigation channel and Lake Erie site sediments (ALS 2021).

PESTICIDE (µg/kg)	LAKE ERIE							
	REFERENCE SITE				PLACEMENT SITE			
	21-TL-1	21-TL-2	21-TL-3	21-TL-4	21-TD-1	21-TD-2	21-TD-3	21-TD-4
ALDRIN	U [1] 6.3	UJ [2] 1.3	U 6	U 5.5	U 5.4	U 5.5	U 5.2	U 4.8
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
ALPHA-CHLORDANE	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
ALPHA ENDOSULFAN	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
BETA-CHLORDANE	U 3.3	UJ 0.68	U 3.2	U 2.9	U 2.8	U 2.9	U 2.8	U 2.5
BETA ENDOSULFAN	U 31.5	UJ 1.6	U 7.5	U 27.8	U 26.9	U 27.4	U 26.3	U 24.2
DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHANE)	U 12.3	UJ 0.63	U 2.9	U 10.9	U 10.5	U 10.7	U 10.3	U 9.5
DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHENE)	U 5.1	UJ 1.1	U 4.9	U 4.5	U 4.4	U 4.5	U 4.3	U 3.9
DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLOROETHANE)	U 86.8	UJ 0.89	UJ 82.7	UJ 76.5	UJ 74.1	UJ 75.4	UJ 72.4	UJ 66.6
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
DIELDRIN	U 4.3	UJ 0.89	U 4.1	U 3.8	U 3.7	U 3.8	U 3.6	U 3.3
ENDOSULFAN SULFATE	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
ENDRIN	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
ENDRIN ALDEHYDE	U 4.1	UJ 0.84	U 3.9	U 3.6	U 3.5	U 3.6	U 3.4	U 3.2
ENDRIN KETONE	U 21	UJ 1.1	U 20	U 18.5	U 17.9	U 18.2	U 17.5	U 16.1
GAMMA BHC (LINDANE)	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
HEPTACHLOR	U 11.4	UJ 0.58	U 10.9	U 10.1	U 9.7	U 9.9	U 9.5	U 8.8
HEPTACHLOR EPOXIDE	U 2.9	UJ 0.58	U 2.7	U 2.5	U 2.4	U 2.5	U 2.4	U 2.2
METHOXYCHLOR	U 100	UJ 1	U 95.7	UJ 88.6	UJ 85.8	UJ 87.3	UJ 83.9	UJ 77.1
TOXAPHENE	U 114	UJ 23.4	U 109	U 101	U 97.5	U 99.2	U 95.3	U 87.6

PESTICIDE (µg/kg)	HARBOR																				
	LAKE APPROACH CHANNEL													RIVER CHANNEL							
	21-LM-1	21-LM-2	21-LM-3	21-LM-4	21-LM-5	21-LM-6	21-LM-7	21-LM-8	21-LM-9	21-LM-10	21-LM-11	21-LM-12	21-LM-13	21-MRC-0	21-MRC-1	21-MRC-2	21-MRC-3	21-MRC-4	21-MRC-5	21-MRC-6	21-MRC-7
ALDRIN	U 6.2	U 7.7	U 6.9	U 5.8	U 6.7	U 7.6	U 7.4	U 7.2	U 8.1	U 8.2	U 7.1	U 8.9	U 0.64	U 8.5	U 7.2	U 7.1	U 7.6	U 6.9	U 7.2	UJ 5	R [3] 6.4
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
ALPHA-CHLORDANE	UJ 11.2	U 14	U 12.5	U 10.5	U 12.3	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 15.5	U 13.1	U 13	U 13.9	U 12.6	U 13.1	UJ 9.1	R 2.9
ALPHA ENDOSULFAN	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	U 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
BETA-CHLORDANE	UJ 3.3	U 4.1	U 3.6	U 3	U 3.6	U 4	U 3.9	U 3.8	U 4.3	U 4.3	U 3.8	U 4.7	U 0.34	U 4.5	U 3.8	U 3.8	U 4	U 3.7	U 3.8	UJ 2.6	R 3.4
BETA ENDOSULFAN	UJ 7.7	U 9.6	U 8.6	U 7.2	U 8.5	U 38.2	U 37.2	U 36.1	U 40.6	U 41.2	U 35.8	U 44.5	U 0.8	U 10.7	U 9	U 8.9	U 9.6	U 8.7	U 9	UJ 6.3	R 8
DDD (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHANE)	UJ 12.1	U 15.1	U 13.5	U 11.3	U 13.3	U 14.9	U 14.5	U 14.1	U 15.9	U 16.1	U 14	U 17.4	0.55 J	U 16.7	U 14.1	U 14	U 15	U 13.6	U 14.1	UJ 9.8	R 12.5
DDE (1,1-BIS(CHLOROPHENYL)-2,2-DICHLOROETHENE)	UJ 5.1	U 6.3	U 22.5	U 18.9	U 22.1	U 6.2	U 6.1	U 5.9	U 6.6	U 6.7	U 5.8	U 7.3	U 0.52	U 27.9	U 23.5	U 23.3	U 25	U 22.7	U 23.5	UJ 16.3	R 5.2
DDT (1,1-BIS(CHLOROPHENYL)-2,2,2-TRICHLOROETHANE)	R 85.3	U 106	U 95.1	U 79.7	U 93.3	U 105	U 102	U 99.4	U 112	U 113	UJ 98.6	UJ 123	U 0.44	U 118	U 99.3	U 98.5	U 106	UJ 95.7	UJ 99.3	UJ 69	R 17.6
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	R 11.2	U 14	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
DIELDRIN	UJ 4.3	U 5.3	U 4.8	U 4	U 4.7	U 5.3	U 5.1	U 5	U 5.6	U 5.7	U 4.9	U 6.1	U 0.44	U 5.9	U 5	U 4.9	U 5.3	U 4.8	U 5	UJ 3.5	R 4.4
ENDOSULFAN SULFATE	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
ENDRIN	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
ENDRIN ALDEHYDE	UJ 4	U 5	U 4.5	U 3.8	U 4.4	U 5	U 4.8	U 4.7	U 5.3	U 5.4	U 4.7	U 5.8	U 0.42	U 5.6	U 4.7	U 4.7	U 5	U 4.5	U 4.7	UJ 3.3	R 4.2
ENDRIN KETONE	UJ 20.7	U 25.7	U 5.8	U 4.8	U 5.6	U 25.4	U 24.8	U 24.1	U 27.1	U 27.4	U 23.9	U 29.7	U 0.53	U 7.1	U 6	U 6	U 6.4	U 5.8	U 6	UJ 4.2	R 5.3
GAMMA BHC (LINDANE)	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
HEPTACHLOR	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 13.8	U 13.5	U 13.1	U 14.7	U 14.9	U 13	U 16.1	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
HEPTACHLOR EPOXIDE	UJ 2.8	U 3.5	U 3.1	U 2.6	U 3.1	U 3.5	U 3.4	U 3.3	U 3.7	U 3.7	U 3.2	U 4	U 0.29	U 3.9	U 3.3	U 3.2	U 3.5	U 3.1	U 3.3	UJ 2.3	R 2.9
METHOXYCHLOR	R 98.8	U 123	U 110	U 92.2	U 108	U 122	U 119	U 115	U 129	U 131	UJ 114	UJ 142	U 0.51	U 136	U 115	U 114	U 122	U 111	U 115	UJ 79.9	R 20.4
TOXAPHENE	U 112	U 140	U 125	U 105	U 123	U 138	U 135	U 131	U 147	U 149	U 130	U 161	U 11.6	U 155	U 131	U 130	U 139	U 126	U 131	UJ 90.8	R 116

[1] Not detected at or above the specified detection limit.

[2] Not detected at or above the specified detection limit; potentially biased low due to QC/QA results having low recoveries below lab criteria.

[3] Data rejected due to major QC issues.

Appendix D: Maumee AOC Advisory Committee Letter of Support

MAAC
Maumee AOC Advisory Committee

August 15, 2024

Anne M. Vogel, Director
Ohio EPA – Director's Office
P. O. Box 1049
Columbus OH 43216-1049

Joy Mulinex, Executive Director
Ohio Lake Erie Commission
P.O. Box 1049
Columbus OH 43126-1049

RE: Support to Request to GLNPO for Removal of Beneficial Use Impairment for Restrictions on Navigational Dredging Activities

Dear Directors Vogel and Mulinex,

The Maumee Area of Concern (AOC) Advisory Committee (MAAC) reviewed the removal recommendation document for the beneficial use impairment (BUI) for Restrictions on Navigational Dredging Activities (BUI 7). The MAAC supports the Ohio AOC Program's BUI 7 removal recommendation documentation submittal to the U.S. EPA Great Lakes National Program Office (GLNPO) requesting their approval consideration.

Upon removal of this BUI, four of the original ten BUIs would be removed from the Maumee AOC. If approved, the following impairments would remain:

- BUI #3: Degradation of Fish & Wildlife Populations
- BUI #4: Fish Tumors or Other Deformities
- BUI #6: Degradation of Benthos
- BUI #8: Eutrophication or Undesirable Algae
- BUI #10: Beach Closings (Recreational Contact)
- BUI #14: Loss of Fish & Wildlife Habitat

The MAAC looks forward to continuing to work in coordination with the Ohio AOC Program and GLNPO to complete the work necessary to remove remaining BUIs.

Sincerely,

Digitally signed by Michael Pniewski, P.E., P.S.
DN: cn=Michael Pniewski, P.E., P.S., o=Lucas County Engineer's Office, ou=Lucas County Engineer, email=mpniewski@co.lucas.oh.us, c=US
Date: 2024.08.15 15:08:30 -04'00'

Mike Pniewski, Chair
Maumee AOC Advisory Committee

cc: Kris Patterson, OLEC and Cherie Blair, Ohio EPA

Ohio Environmental Protection Agency

PO Box 203 Perrysburg, Ohio 43552
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Partners for Clean Streams