# Alaska Department of Environmental Conservation
# Draft Waterbody Determination Paper
# Lake Lucile, Wasilla, Alaska
# Toxic and Other Deleterious Substances Determination

## Recommendation

**Waterbody:** Lake Lucile (also spelled Lucille)

**Category Recommendation:** 4a

**Water Quality Standard Affected:** Toxic and other deleterious organic and inorganic Substances

**Designated Uses Affected:** Aquaculture; Growth and propagation of fish, shellfish, other aquatic life, and wildlife

**Pollutant:** Polycyclic aromatic hydrocarbons (PAH)

## Executive Summary

This document describes the data analysis and conclusions reached in evaluating PAH in Lake Lucile bottom sediments for the 2020 Integrated Report (IR). Lake Lucile, located in Wasilla (Figure 1), is recommended for placing in Category 4(a), with a Total Maximum Daily Load (TMDL) already approved, for PAH in lakebed sediments. Based on sediment data collected in 2011-2013, Lake Lucile was listed as Category 5 for lakebed sediment lead and zinc impairment in the 2014/16 Integrated Report. During TMDL development in 2020, a re-evaluation of the PAH data results indicated impairment and PAH loading allocations were included in the TMDL analysis. The TMDL was approved by the Environmental Protection Agency in May 2020[1].

This determination paper updates the administrative record to include PAH as a pollutant causing impairment (Category 4a). This administrative action does not require amending the currently approved TMDL.

*Table 1. Basic Waterbody Information*

| | |
|---|---|
| **Assessment Unit ID** | AK-2040105_036_001 |
| **Assessment Unit Name** | Lake Lucile (also spelled Lucille) |
| **Location description** | City of Wasilla; HUC 19020505 |
| **Water Type** | Lake |
| **Water Size (units)** | 377 acres |

[1] ADEC (Alaska Department of Environmental Conservation). 2020. Total Maximum Daily Load (TMDL) for Lead, Zinc and Polycyclic Armomatic Hydrocarbon in Lakebed Sediments for Lake Lucile in Wasilla, AK.

| | |
|---|---|
| **Area of impairment** | 5.6 acres total |
| **Time of impairment** | year-round but primarily open water months |

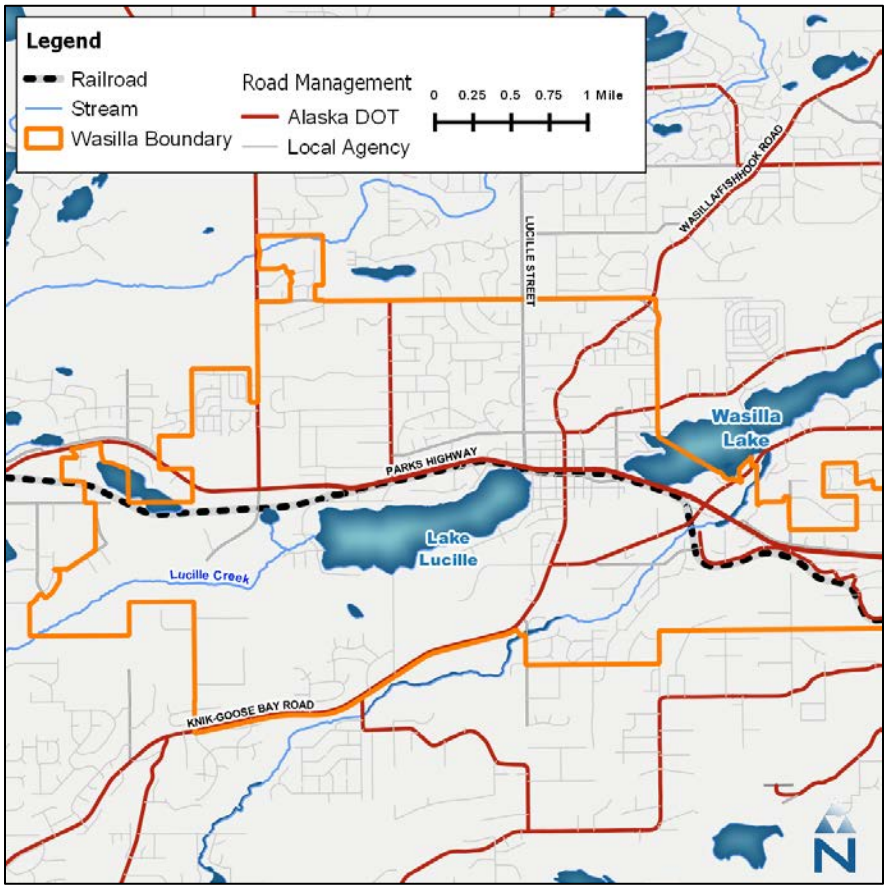


*Figure 1. Location of Lake Lucile in Wasilla, Alaska*

## Pollutant Status

*Table 2. Alaska's Water Quality Standards at 18 AAC 70 (11) toxic and other deleterious organic and inorganic substances, for fresh water uses[2].*

| Designated Use | Water Quality Criteria | Status |
|---|---|---|
| (A) Water Supply<br>(i) drinking, culinary, and food processing | The concentration of substances in water may not exceed the numeric criteria for drinking water and human health for consumption of water and aquatic organisms shown in the Alaska Water Quality Criteria Manual. Substances may not be introduced at concentrations that cause, or can reasonably be | Supporting |

[2] Alaska Department of Environmental Conservation. 2020. 18 AAC 70.010 Water Quality Standards. Amended as of March 5, 2020.

| | | |
|---|---|---|
| | expected to cause, either singly or in combination, odor, taste, or other adverse effects on the use. | |
| (A) Water Supply<br>(ii) Agriculture, including irrigation and stock watering | The concentration of substances in water may not exceed the numeric criteria for drinking and stockwater and irrigation water shown in the Alaska Water Quality Criteria Manual. Substances may not be introduced at concentrations that cause, or can reasonably be expected to cause, either singly or in combination, odor, taste, or other adverse effects on the use. | Supporting |
| Water Supply<br>(iii) aquaculture | Same as 11(C) | Not Supporting |
| Water Supply<br>(iv) industrial | Concentrations of substances that pose hazards to worker contact may not be present. | Supporting |
| (B)Water Recreation<br>(i) contact recreation | The concentration of substances in water may not exceed the numeric criteria for drinking water shown in the Alaska Water Quality Criteria Manual. Substances may not be introduced at concentrations that cause, or can reasonably be expected to cause, either singly or in combination, odor, taste, or other adverse effects on the use. | Supporting |
| (B) Water Recreation<br>(ii) Secondary recreation | Concentrations of substances that pose hazards to incidental human contact may not be present. | Supporting |
| (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife | The concentration of substances in water may not exceed the numeric criteria for aquatic life for fresh water and human health for consumption of aquatic organisms only shown in the Alaska Water Quality Criteria Manual, or any chronic and acute criteria established in this chapter, for a toxic pollutant of concern to protect sensitive and biologically important life stages of resident species of this state. There may be no concentrations of toxic substances in water or in shoreline or bottom sediments, that, singly or in combination, cause, or reasonably can be expected to cause, adverse effects on aquatic life or produce undesirable or nuisance aquatic life, except as authorized by this chapter. Substances may not be present in concentrations that individually or in combination impart undesirable odor or taste to fish or other aquatic organisms, as determined by either bioassay or organoleptic tests. | Not Supporting |

# Impairment Evaluation

## Data Sources

DEC conducted a stormwater pollutant study on area lakes including Lake Lucile in 1989-1990. There is also a 2002 approved TMDL for low dissolved oxygen impairment in Lake Lucile. Development of the TMDL and this determination relies heavily on two studies (Davis et al., 2013a[3], 2013b[4]) conducted for DEC by the Aquatic Restoration and Research Institute (ARRI) for information on the magnitude and extent of metal and PAH contamination in Lake Lucile lakebed sediment. The reports include wet weather lakebed sediment sample concentrations collected near the stormwater discharge point from the east outfall in 2011–2012 and dry weather lakebed sediment samples collected near the east and west outfalls in 2013 .

## Data used in impairment determination

The State of Alaska has not adopted freshwater numeric sediment criteria in the state Water Quality Standards (18 AAC 70), however, the state has adopted narrative criteria for toxic and other deleterious organic and inorganic substances as shown in Table 2. To implement narrative criteria for toxic substances in fresh and marine sediments, DEC currently uses the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRT) as sediment quality guidelines for protection of aquatic life.

SQuiRT sediment quality guidelines are scientific tools that synthesize information regarding the relationships between the sediment concentrations of chemicals and any adverse biological effects resulting from exposure to these chemicals. SQuiRT values were developed to support the evaluation of potential risks from contaminated water, sediments, or soil and represent statistical relationships between sediment chemical concentrations and adverse biological effects resulting from exposure. SQuiRT tables present a range of risk tolerance levels for inorganic and organic substances in sediment, soil, and water (in freshwater and marine environments). The DEC Contaminated Sites Program issued *Sediment Quality Guidelines* (ADEC, 2013), which recommend the use of Threshhold Effect Levels and Probable Effect Levels (TELs and PELs) from the most current SQuiRT tables. The TEL represents the concentration below which adverse biological effects are expected to occur rarely, and the PEL defines the level above which adverse effects are expected to occur frequently. The PAH TEL value is 264.1 µg/kg. PAH has no PEL value listed in SQuiRT tables.

[3] Davis, J. C, Davis, G., and Jensen, L. 2013a. Matanuska-Susitna Stormwater Assessment: 2011-2012. Prepared by the Aquatic Restoration and Research Institute.

[4] Davis, J. C., Davis, A., and Burns, R. 2013b. Lake Lucile Sediment Quality Sampling: Spatial Extent of Impaired Sediment due to Outfall Stormwater Inputs. Final Report for ADEC. Prepared by the Aquatic Restoration and Research Institute.

## Data Evaluation

Data met minimum requirements as outlined in Alaska CALM.

# Results

## Dry Weather Sampling – East and West Outfalls

During dry weather sampling (June 2013) at both the east and west outfalls, PAH concentrations above the TEL value of 264.1 µg/kg were observed at three sites (Figure 2, sites 6, 27, and 33). All other samples collected were below the analytical detection limit as shown in Figure 2. Site 6 exhibited the highest PAH sample concentration, 1,125.5 µg/kg, which is considerably above the PAH TEL value. The reference site sample was below the detection limit. Appendix A shows all of the data results.

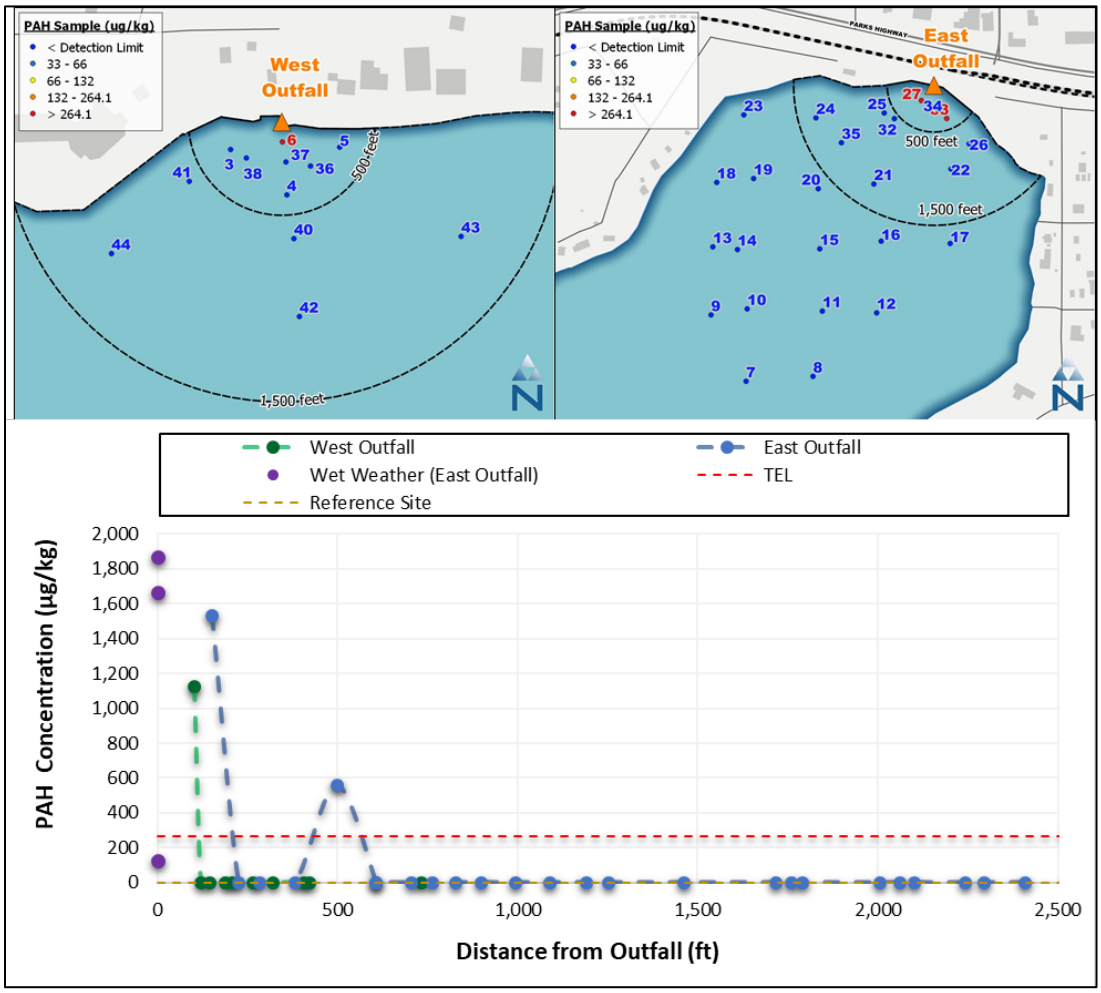


*Figure 2. Locations and concentrations at PAH sediment sites 2011–2013 (Davis et al., 2013b)*

## Wet Weather Sampling – East Outfall

Figure 3 presents the results of the wet weather monitoring at the east outfall for PAH compared to the TEL value. During wet weather monitoring, two of the three samples exceeded the TEL

value. There is no PEL for PAH. Based on the magnitude of the exceedances (six times the TEL value), DEC has determined that Lake Lucile is impaired for PAH in the lakebed sediments.

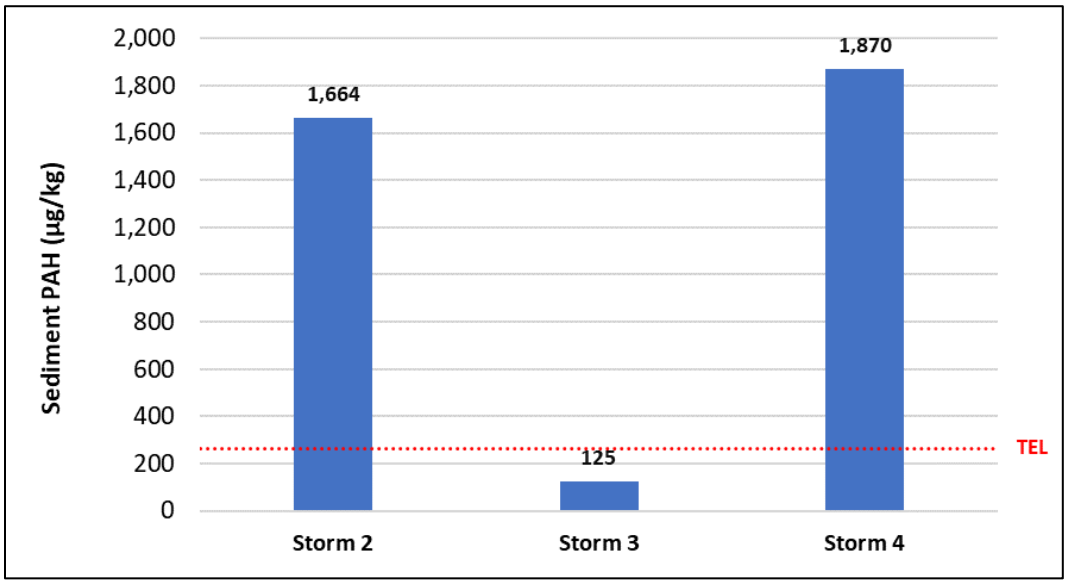


*Figure 3. Wet weather PAH sediment sampling at the east outfall 2011–2012 (Davis et al., 2013a)*

## Pollutant Sources

Pollutant sources include street, highway and parking lot runoff entering the piped stormwater system and discharging to Lake Lucile. Figure 4 show the drainage area that flows to the east (red) and west (green) outfall points to Lake Lucile.

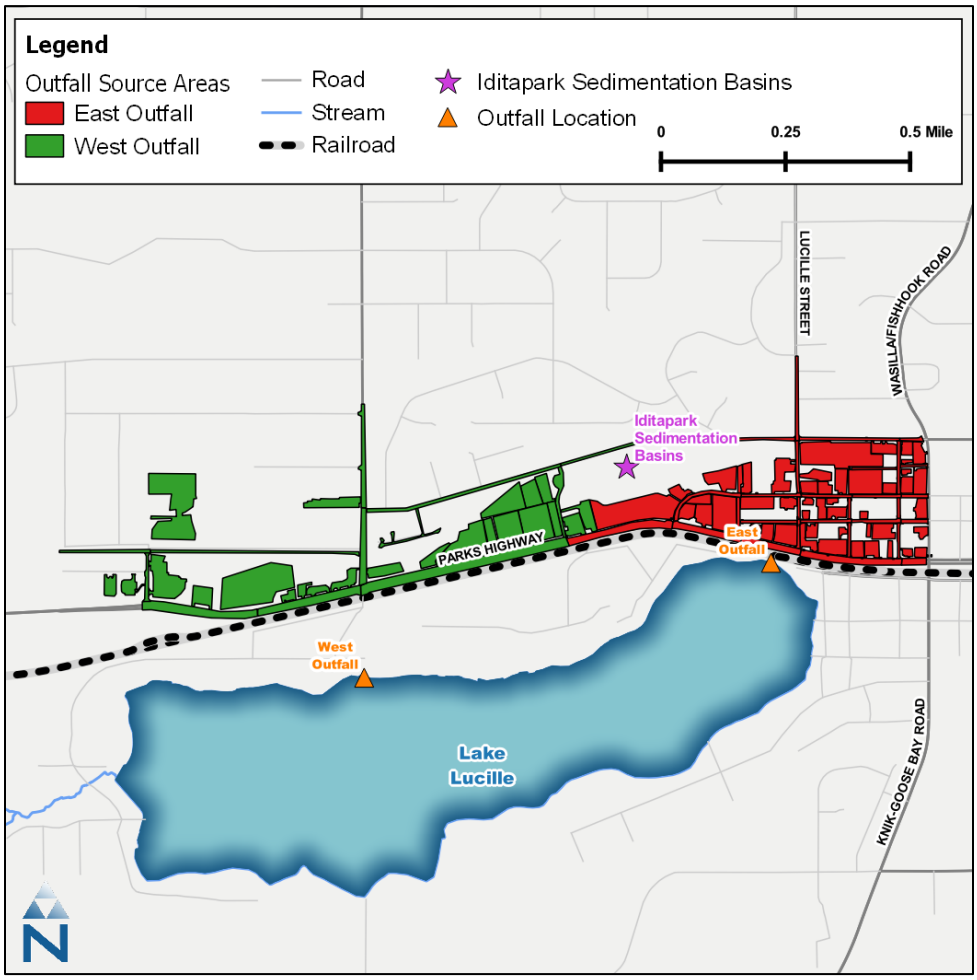


*Figure 4. Land areas draining to the east and west Lake Lucile outfalls (ARRI, 2019).*

## Conclusion

Lake Lucile is recommended for placing in Category 4(a), with a TMDL already approved, for PAH in lakebed sediments. This administrative action does not require amending the currently approved TMDL.

The impaired areas of the lake are approximately 4.5 acres in the northeast area surrounding the east stormwater outfall and approximately 1.1 acres in the northwest area surrounding the west stormwater outfall.

## TMDL Priority Ranking and Schedule

*Table 3. TMDL cycle and ranking*

| **TMDL Cycle** | | **2020** |
|---|---|---|
| Ranking | | Completed. EPA approved May 2020 |

# Appendices A: Sediment PAH Sampling Results

*Table A1. Results of Lake Lucile 2013 dry weather sediment sampling (east and west outfalls) and 2011-2012 wet weather sediment sampling (east outfall).*

| Site ID | Location | PAH µg/kg |
|---|---|---|
| 2013 Dry Weather Sediment Sampling (Davis et. al., 2013b) | | |
| 1 | Reference Site | < DL |
| 3 | West Outfall | < DL |
| 4 | West Outfall | < DL |
| 5 | West Outfall | < DL |
| 6 | West Outfall | **1,125.5** |
| 36 | West Outfall | < DL |
| 37 | West Outfall | < DL |
| 37 X | West Outfall | < DL |
| 38 | West Outfall | < DL |
| 39 | West Outfall | < DL |
| 39 X | West Outfall | < DL |
| 40 | West Outfall | < DL |
| 41 | West Outfall | < DL |
| 42 | West Outfall | — |
| 43 | West Outfall | — |
| 44 | West Outfall | — |
| 36 | West Outfall | < DL |
| 7 | East Outfall | < DL |
| 8 | East Outfall | < DL |
| 9 | East Outfall | < DL |
| 10 | East Outfall | < DL |
| 11 | East Outfall | < DL |
| 12 | East Outfall | < DL |
| 13 | East Outfall | < DL |
| 13 X | East Outfall | *302 (sample error)* |
| 13 b | East Outfall | < DL |
| 14 | East Outfall | < DL |
| 15 | East Outfall | < DL |

| | | |
|---|---|---|
| 16 | East Outfall | < DL |
| 17 | East Outfall | < DL |
| 18 | East Outfall | < DL |
| 19 | East Outfall | < DL |
| 20 | East Outfall | < DL |
| 21 | East Outfall | < DL |
| 22 | East Outfall | < DL |
| 23 | East Outfall | < DL |
| 24 | East Outfall | < DL |
| 24 X | East Outfall | < DL |
| 25 | East Outfall | < DL |
| 26 | East Outfall | < DL |
| 27 | East Outfall | **1,530** |
| 32 | East Outfall | < DL |
| 33 | East Outfall | **559.4** |
| 34 | East Outfall | < DL |
| 35 | East Outfall | < DL |
| 2011–2012 Wet Weather Sediment Sampling (Davis et al., 2013a) | | |
| OF1-Storm 2 | East Outfall | **1,664** |
| OF1-Storm 3 | East Outfall | 125 |
| OF1 Storm 4 | East Outfall | **1,870** |

DL is detection limit. Site 1 is the reference location on the south shore. Results in exceedance of TEL values are bolded. Results in exceedance of PEL values are bolded and asterisked (*). In site name, "X" indicates replicate measures. At Site 13X, initial sampling occurred on June 4, 2013, and only PAH was resampled (13 b) on June 21, 2013 (Davis et al., 2013b). The original anomalous PAH result at 13X was not used in subsequent data analysis.