Alaska's 2014/2016 Integrated Report
Category 4b Demonstration for Petroleum Hydrocarbons, Oils, and Grease
Little Susitna River, Alaska

1. Identification of segment and statement of problem causing the impairment

A. Segment description

The Little Susitna River is located within south-central Alaska and flows from the Talkeetna Mountains adjacent to the communities of Wasilla and Houston. The river travels over 113 miles from the Mint Glacier to Cook Inlet. (Figure 1).

River miles (RM) considered impaired are from RM 17.5 (7.5 miles downstream of the Little Susitna River Public Use Facility (PUF) boat launch) to RM 26 (approximately 0.7 miles upstream of the PUF). The Alaska identifier number for this segment is 20505-004 as transmitted to the Environmental Protection Agency's Assessment Database. Table 1 shows Global Positioning System (GPS) segment identifiers.

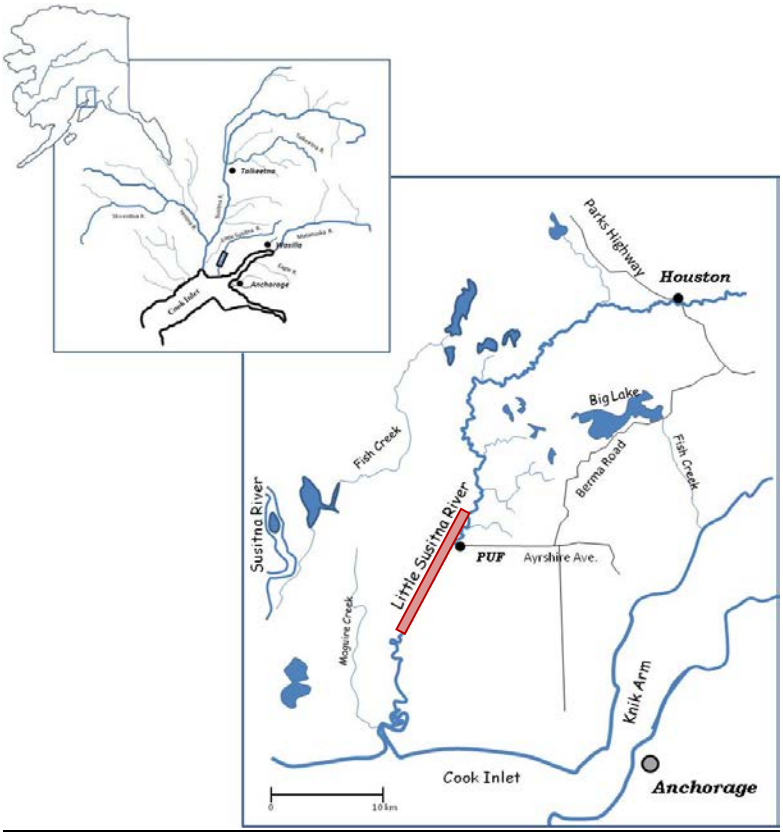

Figure 1. Location of the Little Susitna River Public Use Facility (PUF) boat launch within South-central Alaska and approximate primary sampling reach (red rectangle).

Table 1. GPS coordinates for the 8.5 mile segment of the lower Little Susitna River affected by persistent TAH pollution.

Extent of TAH Pollution by River Mile	Latitude North	Longitude West
River mile 17.5	61.39668	-150.22345
River mile 26	61.44238	-150.16205

B. Impairment and pollutant causing impairment

Water Quality Standard not being met: Title 18, Chapter 70 of the Alaska Administrative Code (AAC) Section 70.020(5) Petroleum Hydrocarbons, Oils and Grease for Fresh Water Uses (Table 2).

Designated Use not being attained: Water Supply, Aquaculture; Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.

Pollutant Parameter: Total aromatic hydrocarbons (TAH)

Table 2. Alaska's Water Quality Standards for Petroleum Hydrocarbons, Oils and Grease for Fresh Water Uses.

Designated Use	Water Quality Criteria
(A) Water Supply (i) Drinking, Culinary, and Food Processing	May not cause a visible sheen upon the surface of the water. May not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.
(ii)Agriculture, including irrigation and stock watering	May not cause a visible sheen upon the surface of the water.
(iii) Aquaculture	Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/L (see note 7). Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/L. There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration.
(iv) Industrial	May not make the water unfit or unsafe for the use.
(B) Recreation (i) Contact	May not cause a film, sheen, or discoloration on the surface or floor of the waterbody or adjoining shorelines. Surface waters must be virtually free from floating oils.
Recreation (ii) Secondary	Same as (5)(B)(i).
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Same as (5)(A)(iii).

Note 7. Samples to determine concentrations of total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) must be collected in marine and fresh waters below the surface and away from any observable sheen; concentrations of TAqH must be determined and summed using a combination of: (A) EPA Method 602 (plus xylenes) or EPA Method 624 to quantify monoaromatic hydrocarbons and to measure TAH; and (B) EPA Method 610 or EPA Method 625 to quantify polynuclear aromatic hydrocarbons listed in EPA Method 610; use of an alternative method requires department approval.

TAH concentrations greater than 10 µg/L were recorded at sites located from RM 17.5 (7.5 miles downstream of the PUF boat launch) to RM 26 (approximately 0.7 miles upstream of the PUF). See Figure 2 and Appendix A. Generally, TAH concentrations did not decline longitudinally along the river corridor with flushing. Instead, TAH concentrations tend to increase downstream of the PUF boat launch. Figure 3 illustrates the river corridor trend in TAH concentrations. The 2007-2014 studies indicate that the highest TAH concentrations are typically found immediately downstream of the PUF boat launch (labeled as LS 0 PUF) and at 4 km downstream (labeled as LS 4 km dn in Figure 2) of the PUF boat launch.

Figure 2. Aerial photograph of the lower Little Susitna River showing sampling locations and area of threatened water quality (red line).

C. Sources of pollutant causing impairment

Concentrated motorized boat use on the lower Little Susitna River during the king and silver salmon fisheries is causing elevated levels of Total Aromatic Hydrocarbons (TAH). The Alaska Department of Environmental Conservation (DEC) conducted Little Susitna River water quality studies in 2007 continuing through 2011. Additional studies were conducted in 2012 and 2014.

Information on motorized boat activity and flow was collected concurrent with TAH sampling from 2007-2014 except for 2012 due to equipment failure. A comprehensive description of the sampling and results can be found in the *Water Quality in the Lower Little Susitna River: Cumulative Final Water Quality Report 2007-2012* (Davis and Davis, 2013) and the *Lower Little Susitna River Water Quality Assessment: May, June and August 2014* (Burns et al. 2015).

The source of TAH pollution has been correlated to motorized boats. Motorized boat use increases during sport fisheries. Concentrations of TAH increased with increased boat use during sampling periods. Figure 3 provides a snapshot of this finding from August 2010. Regression relationships between flow-corrected TAH concentrations and motorized boat use were significant.

The source of the petroleum hydrocarbons in the Little Susitna River is from motorized boats. Other potential sources for petroleum hydrocarbons, such as contaminated sites, spills and seeps were investigated and none were found.

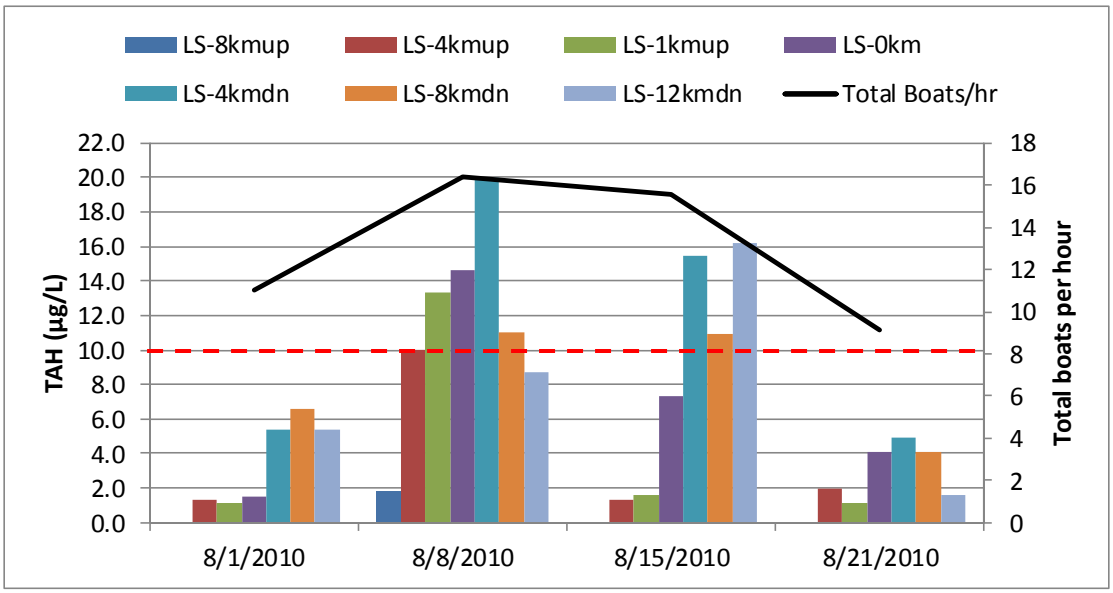

Figure 3. August 2010 TAH sample results at multiple sample locations upstream (kmup) and downstream (kmdn) of the PUF boat launch (LS-0km). The downstream TAH concentration increase trend was documented throughout the multi-year study. The black line indicates total boats per hour counted at the PUF boat launch. Dashed red line denotes WQC of 10 µg/L.

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

A. Water quality target

The *Listing Methodology for Determining Water Quality Impairments from Petroleum Hydrocarbons, Oils and Grease. Final Guidance* (DEC 2015) uses a 4-day averaging period for determining compliance with

state water quality criteria. The 4-day average TAH concentration must be less than 10 µg/L. This is the water quality target for the lower Little Susitna River.

B. Point and nonpoint source loadings that when implemented will achieve WQS

There are no point sources of TAH impacting the river (see Section 1.C).

The source of TAH pollution has been strongly correlated to motorized boats. Concentrations of TAH increased with motorized boat use during sampling periods. Regression relationships between flow-corrected TAH concentrations and motorized boat use were significant.

The changes of flow-corrected TAH as a function of motorized boat counts by motor type were modeled using second-order Akaike's information criterion (AIC) for small samples (Burnham and Anderson 2002). Based on AIC modeling beta values, or slopes, of 8.9 and 6.2 for carbureted 2-stroke and 4-stroke motors respectively, 2-stroke motors discharged approximately 1.3 times more gasoline than 4-stroke motors (Davis and Davis, 2011).

Considering all sample dates from fall 2008 through spring 2010, the total number of boats operating at the Little Susitna River PUF boat launch during TAH sampling ranged from 3.3 per hour to 23.6 per hour with an average of 11.4 boats per hour. Peak boat use occurred in early June and early August. The portion of boats using 2-stroke motors averaged 40 percent and ranged from 10 percent to 60 percent of the total boats counted during sample dates. Average horsepower was 65 but ranged from 25 to 225. Modeling TAH contributions coming from only carbureted 2-stroke motors proved challenging due to all of the variability.

Because carbureted 2-stroke motors do not completely burn fuel, instead releasing 20 to 30 percent into the air and water as unburned gasoline, DEC is confident that reducing the portion of boats using carbureted 2-stroke motors will improve water quality as supported by the AIC modeling and by the fact that the portion of boats using carbureted 2-stroke motors averaged 40% of the total boats.

C. Description of controls to achieve WQS

The *Water Quality in the Lower Little Susitna River: Cumulative Final Water Quality Report 2007-2012* (Davis and Davis, 2013) report was brought to the attention of the Alaska Board of Fisheries during the Upper Cook Inlet Finfish meeting on January 31- February 13, 2014. The Board approved a proposal to restrict sport fishing from motorized boats, unless the motor is a 4-stroke or direct fuel injection 2-stroke motor, with an implementation start date of January 1, 2017. This action was adopted in regulation at 5 AAC 60.122(a)(9)(L).

A violation of this regulation is a bailable offense with a fine of $100, plus $150 per king salmon and $20 per other fish illegally taken. Citations will be issued by Alaska Department of Natural Resources (DNR) State Park Rangers, Department of Public Safety Wildlife Troopers and by Department of Fish and Game (DFG) staff.

The Little Susitna River PUF has a restricted access point with a staffed entrance booth. This design will assist in regulating boat motor types being launched on the river. Signage is placed at the boat launch reminding boaters of the regulation and citation penalty.

D. Description of requirements for implementing controls

Boat motor restrictions for the Little Susitna River have been adopted into state regulation at 5 AAC 60.122(a)(9)(L) and will be implemented by the DFG.

3. Projection of the time when WQS will be met

Action by the Alaska Board of Fisheries (effective January 2017) to restrict fishing from carbureted 2-stroke motors on the Little Susitna River is expected to reduce petroleum pollution sources and allow the waterbody to recover. Water quality improvements will be immediately realized when boats begin accessing the river for the king salmon sport fishery in May 2017 and especially during the month of August in the more popular (i.e. more boats) silver salmon fishery.

DEC is confident that the new motor restriction will reduce TAH loading and the Little Susitna River will meet WQS. Based on project studies, carbureted 2-stroke motors discharged approximately 1.3 times more gasoline than 4-stroke motors. Removing these motors from the river will reduce TAH concentrations.

4. Schedule for implementing pollution controls

The Little Susitna River DFG regulation restricting sport fishing from a motorized boat, unless the motor is a 4-stroke or direct fuel injection 2-stroke motor became effective on January 1, 2017.

5. Monitoring plan to track effectiveness of pollution controls

Effectiveness monitoring will take place in the following ways:

1. Through tracking the number of boats and type of boat motors passing through the gated entrance booth at the Little Susitna Public Use Facility,
2. By the number of citations issued during each sport fishery, and
3. Through DEC approved water quality sampling anticipated for the summer of 2019.

6. Commitment to revise pollution controls, as necessary

The Alaska Board of Fisheries has the authority to revise controls as related to the sport fishery on the Little Susitna River. DEC will coordinate information sharing between the state agencies to determine if boats accessing the Little Susitna River are complying with the motor restriction and if the water quality meets WQS.

If monitoring conducted after implementing the new regulations shows the actions taken to-date are insufficient to attain WQS, DEC will consider additional measures to reduce the hydrocarbon

input to the river. Any new actions taken would include additional monitoring to show water quality standards are being met.

References

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Appendix A

Summary table of TAH concentrations 2007-2014. Shaded boxes denote 2, 3, or 4-day sampling periods.

Date	Number TAH Samples per Day within Target Area	Daily Average TAH µg/L*	4-Day Average TAH µg/L (number of days sampled)
7/29/2007	2	3.85	3.85 (1)
8/5/2007	2	0.00	0.00 (1)
8/12/2007	2	0.00	0.00 (1)
8/19/2007	2	8.44	8.44 (1)
8/26/2007	1	0.00	0.00 (1)
9/2/2007	2	0.00	0.00 (1)
9/9/2007	2	0.00	0.00 (1)
9/16/2007	2	0.00	0.00 (1)
5/10/2008	2	0.00	0.00 (1)
5/18/2008	2	0.00	0.00 (1)
5/24/2008	2	3.25	3.25 (1)
6/1/2008	2	28.10	28.10 (1)
6/8/2008	2	55.95	55.95 (1)
6/15/2008	2	16.20	16.20 (1)
6/21/2008	2	4.55	4.55 (1)
6/29/2008	2	12.05	12.05 (1)
7/27/2008	6	2.57	2.57 (1)
8/2/2008	6	17.92	17.92 (1)
8/10/2008	6	24.93	24.93 (1)
8/13/2008	6	9.00	9.00 (1)
8/17/2008	6	13.95	13.95 (1)
8/24/2008	6	8.22	8.22 (1)
8/30/2008	6	0.00	0.00 (1)
9/6/2008	6	0.48	0.48 (1)
5/17/2009	6	0.17	0.17 (1)
5/24/2009	6	6.55	6.55 (1)
5/31/2009	6	1.45	1.45 (1)
6/7/2009	6	8.53	8.53 (1)
6/14/2009	6	4.30	4.30 (1)
6/21/2009	6	2.72	2.72 (1)
6/28/2009	6	3.98	3.98 (1)
7/19/2009	6	5.68	5.68 (1)

7/26/2009	6	7.22	7.22 (1)
8/2/2009	6	3.28	3.28 (1)
8/8/2009	6	13.72	9.01 (3)
8/9/2009	12	8.28	
8/10/2009	4	4.18	
8/16/2009	6	4.97	4.97 (1)
8/23/2009	6	2.27	2.27 (1)
8/30/2009	6	2.92	2.92 (1)
9/5/2009	3	2.13	2.13 (1)
5/15/2010	5	3.30	3.30 (1)
5/23/2010	5	4.74	4.74 (1)
5/30/2010	5	3.72	3.72 (1)
6/6/2010	5	6.60	6.60 (1)
6/13/2010	5	12.12	12.12 (1)
6/19/2010	6	4.22	4.28 (2)
6/20/2010	11	4.31	
6/27/2010	3	2.70	2.70 (1)
8/1/2010	5	4.02	4.02 (1)
8/7/2010	6	9.13	11.18 (3)
8/8/2010	10	12.08	
8/9/2010	3	12.29	
8/15/2010	5	10.30	10.30 (1)
8/21/2010	5	3.17	3.17 (1)
6/4/2011	4	4.86	4.86 (1)
6/11/2011	4	12.89	10.20 (2)
6/12/2011	4	7.51	
8/2/2012	2	1.59	1.59 (1)
8/3/2012	12	2.04	1.78 (4)
8/4/2012	12	1.88	
8/5/2012	12	2.31	
8/6/2012	12	0.88	
5/24/2014	14	1.89	1.86 (4)
5/25/2014	14	2.61	
5/26/2014	14	1.54	
5/27/2014	14	1.40	
5/30/2014	14	1.50	1.61 (4)
5/31/2014	14	2.05	
6/1/2014	14	1.30	
6/2/2014	14	1.61	
6/6/2014	14	1.31	1.45 (4)

6/7/2014	14	1.80	
6/8/2014	14	1.36	
6/9/2014	14	1.35	
8/1/2014	14	4.95	6.49 (4)
8/2/2014	14	8.45	
8/3/2014	14	9.22	
8/4/2014	14	3.35	
8/6/2014	14	6.55	6.78 (4)
8/7/2014	14	2.44	7.83 (4)
8/8/2014	14	8.66	
8/9/2014	14	9.46	
8/10/2014	14	10.78	
8/14/2014	14	7.03	6.27 (4)
8/15/2014	14	6.69	
8/16/2014	14	5.51	
8/17/2014	14	5.87	
8/18/2014	14	4.07	5.53 (4)
8/21/2014	14	4.79	5.48 (4)
8/22/2014	14	1.96	
8/23/2014	14	8.86	
8/24/2014	14	6.31	
8/25/2014	14	4.97	5.53 (4)

*From 2007-2012 sample results below the method detection limit (DL) (also called non-detect) used a zero value. In 2014 a value of 0.5 x DL was used in the analysis.