

United States
Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

**Total Maximum Daily Load (TMDL)
For
Poly-Chlorinated Biphenyl (PCBs)
In Garrison Slough, Alaska**

In compliance with the provisions of the Clean Water Act, 33 U.S.C. § 1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the Environmental Protection Agency is hereby establishing a Total Maximum Daily Load (TMDL) that involves removing contaminated sediments from Garrison Slough to restore its beneficial uses. Subsequent actions must be consistent with this TMDL.

This TMDL shall become effective immediately.

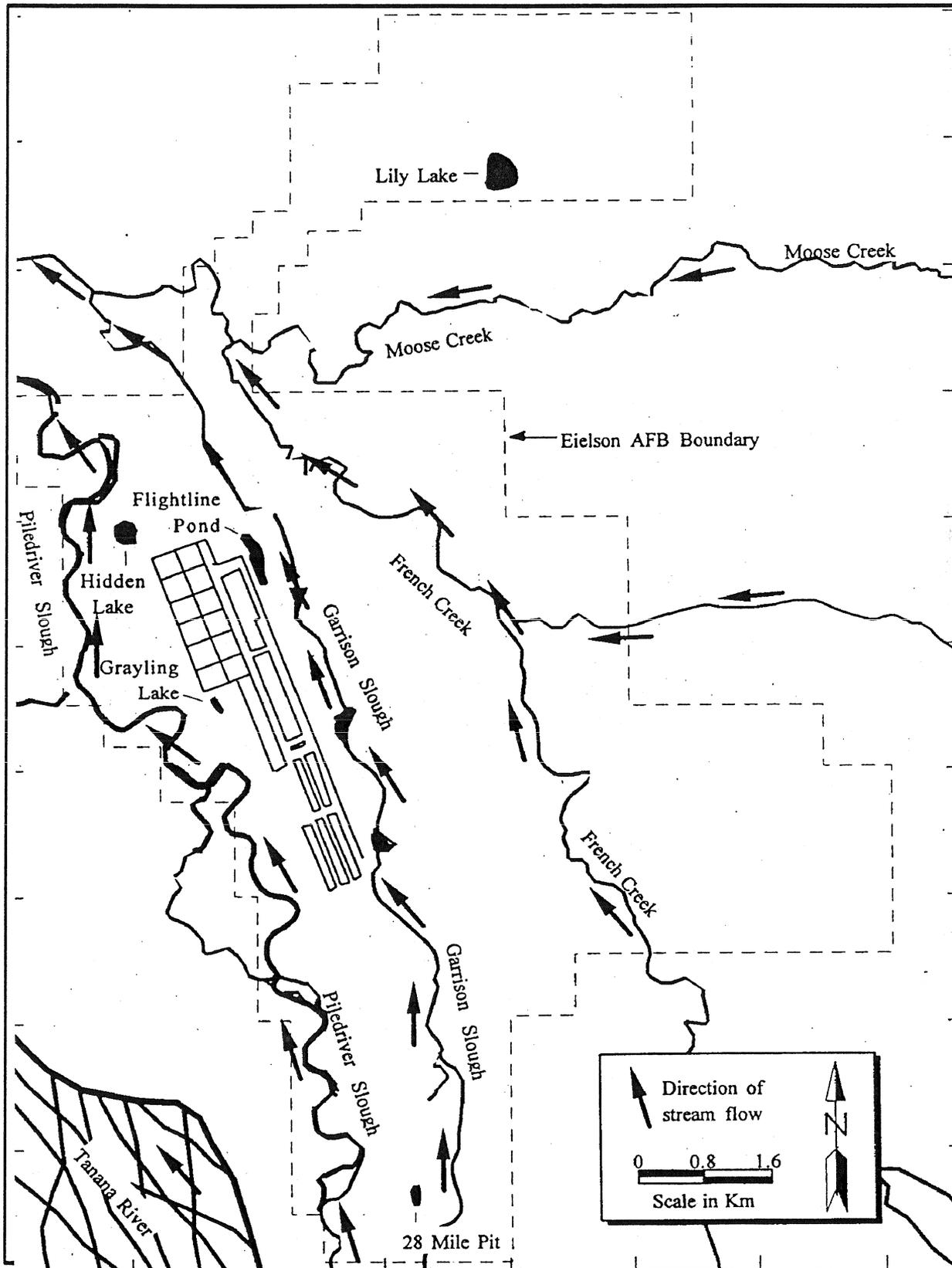
Signed this 27th day of September, 1996.



Philip G. Millam
Director
Office of Water



Figure 1



snails, are present in most streams and lakes on the base. These organisms are the primary food source for fish.

1d. SOIL TYPE ON EAFB

The base is located in the Tanana River Valley. Most of the base has been constructed on sand gravel fill. The topography in the developed portion of the base is generally flat and featureless with elevation averaging about 168 m (550 ft.) above sea level. Two-thirds of the base (mostly the undeveloped areas) is underlain by soils containing discontinuous permafrost. Half the potential agricultural soil is currently being used for recreation facilities, ammunition storage areas, Arctic Survival Training School, and other Air Force operations.

1e. GROUNDWATER:

The developed portion of the base is underlain by a shallow, unconfined aquifer comprising up to 91 m (300 ft) of alluvial sands and gravel with minor clay and silt overlying crystalline bedrock. Groundwater is the only source of potable water at the base and in the communities near the base. Potable water in the main base system is treated to remove iron and sulfate. Groundwater is the principle source for various other industrial, domestic, agricultural, and fire fighting purposes.

1f. LAND USE:

Current and future land use for water bodies on EAFB is recreation.

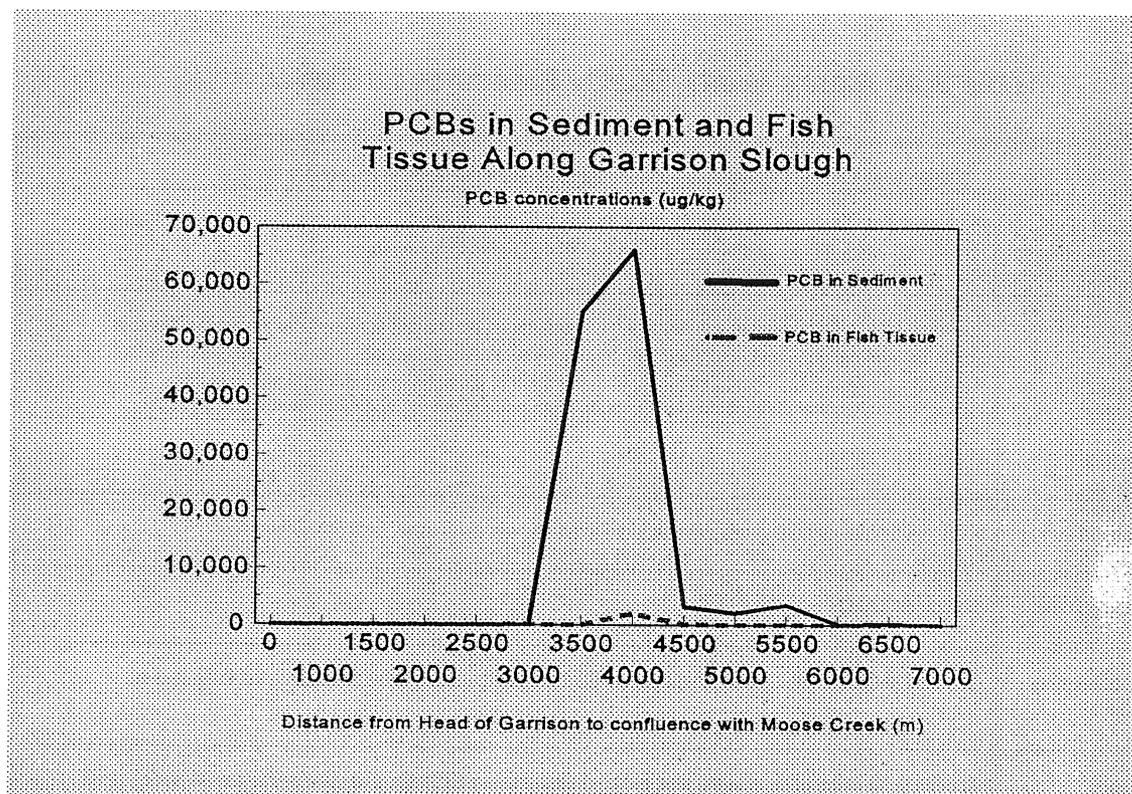
1e. IMPAIRED WATERBODY LISTING / TMDL DEVELOPMENT:

The CWA § 303(d)(1)(A) requires states to submit to the EPA, every two years, a list of waters which exceed water quality standards after the implementation of technology-based or water quality-based controls. Garrison Slough is on DEC's 1994/1996 303(d) list. The pollutant parameter of concern is PCBs.

A TMDL is a planning and management mechanism to restore water quality. The primary goal of a TMDL is to restore and maintain the designated beneficial uses of an impaired water body. TMDL is based on the relationship between pollutant sources and instream water quality conditions.

The TMDL establishes the allowable loading for a water body and thereby provides a basis for water quality-based controls.

For Garrison Slough, a phased TMDL has been determined appropriate. A phased TMDL is used when existing data are not adequate to determine needed pollutant load reductions from pollutant sources being addressed, or to determine the controls necessary to address impairments. In a phased TMDL, controls are instituted and monitored to determine whether the controls are making adequate progress toward the attainment of water quality standards. If monitoring shows water quality improvements are not being made within a reasonable time frame, the controls will be



Based on data presented in the Baseline Risk Assessment for Garrison Slough, it appears that a complete exposure pathway exists from the sediment to fish in lower Garrison Slough, and that the high concentrations in fish tissues are a direct result of exposure to the contaminated sediments. The uptake of PCBs by fish may occur through incidental ingestion of contaminated sediment while feeding, and ingestion of contaminated water and prey. Fish that remain in lower Garrison Slough are likely to continue to bioaccumulate PCBs without the controls of the TMDL.

2b. WATER QUALITY STANDARD OF CONCERN FOR GARRISON SLOUGH:

Once a State designates uses, it establishes water quality criteria to protect those uses. Together, the criteria and designated uses constitute the State's water quality standards.

Garrison Slough has been placed on the State of Alaska's 1996 Section 303(d) list for exceeding the narrative water quality standard for toxics found in sediments and the water quality standard for residues found in fish tissue (Table 2(a), Table 2(b)).

Table 2(b): Alaska Water Quality Standards for Residues

<u>Residues</u> Floating Scum, Debris, Sludge, Deposits, Foam, Scum, or Other Residues	
(A) Water Supply (I) drinking, culinary and food processing	May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substance, cause a film, sheen, or discoloration on the surface of the water or adjoining shoreline, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines
(A) Water Supply (iv) Industrial	May not, alone or in combination with other substances or waste, make the water unfit or unsafe for the use.
(B) Water Recreation (I) contact recreation	Same as (A)(I)
(B) Water Recreation (ii) secondary recreation	Same as (A)(i)
(C) Growth and Propagation of Fish, Shellfish, other Aquatic Life, and Wildlife	May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substance, cause a film, sheen, or discoloration on the surface of the water or adjoining shoreline, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.

Human Health Risk Level:

For the purpose of this TMDL, EPA has elected to apply a 10⁻⁵ risk level for consistency with current state and federal regulations. The State of Alaska requested the application of this risk level under the National Toxics Rule (Dec 1992), and the State has selected this level for future water quality standards adoptions (Alaska Water Quality Standards, Jan 1995).

2c. PARAMETER OF CONCERN:

PCB is the parameter of concern addressed in this TMDL. Studies have shown that PCB absorption to sediments is the major nondestructive process affecting PCBs after introduction to the aquatic environment. The combination of the low water solubility and the high octanol-water partition coefficient indicates that PCBs will have a high affinity for suspended solids, especially those in organic carbon. When contamination becomes sufficiently high, sediments may serve as a reservoir for re-resolution of polychlorinated biphenyls (Veith and Comstock 1975). This fact has important ramifications for areas where PCBs are spilled; even after the initial degradation in water quality, release of PCBs from sediments can cause long term pollution.

analyses were performed; however, only total values were used in the risk assessments.

4b. VOLATILE ORGANIC COMPOUNDS (VOCs) AND PESTICIDE SAMPLES:

VOCs were collected in surface water in 1993 and 1994. The 1993 data were preferred because they had lower contract required quantitation limits (CRQLs). The 1994 data were only used where an analyte was detected at a higher concentration, as was true with trichloroethylene at two locations.

Pesticides and PCBs were also sampled in 1993 and 1994. Similar to the sediment data, the 1993 samples were preferred because of lower CRQLs.

4c. FISH TISSUE SAMPLES:

Fish tissue data were collected in 1993 and 1994 (Table 5). Only a limited sampling of data was collected in 1993 as part of the sitewide biological risk assessment, because detecting contaminants in fish tissue was not expected. Six samples were acquired and analyzed for poly-aromatic hydrocarbons (PAHs), pesticides, and PCBs.

Table 5

1993 Fish Tissue Samples			
Sample Location	Detections		
	PAHs	Pesticides	PCBs
Lower French Creek	X	X	X
Upper Garrison Slough	X	X	X
Middle Garrison Slough	X	X	X
Lower Garrison Slough	X	X	X
Flightline Pond	X		

The calculated potential risk to human health was great enough that an extensive sampling event was conducted in 1994. Fifty-six samples, including duplicates and splits, were acquired at 14 sites. Arctic grayling were collected at all sites except Hidden Lake and 28 Mile Pit (Upper Garrison Slough).

The purpose of the 1994 effort was to determine the extent of fish contamination onsite, to evaluate whether the contaminated fish were symptomatic of a sub-regional contamination problem, to determine background contamination levels for fish from undeveloped watersheds, and to determine if the contamination was in edible fish tissue.

5b. Selection of Loading Capacity

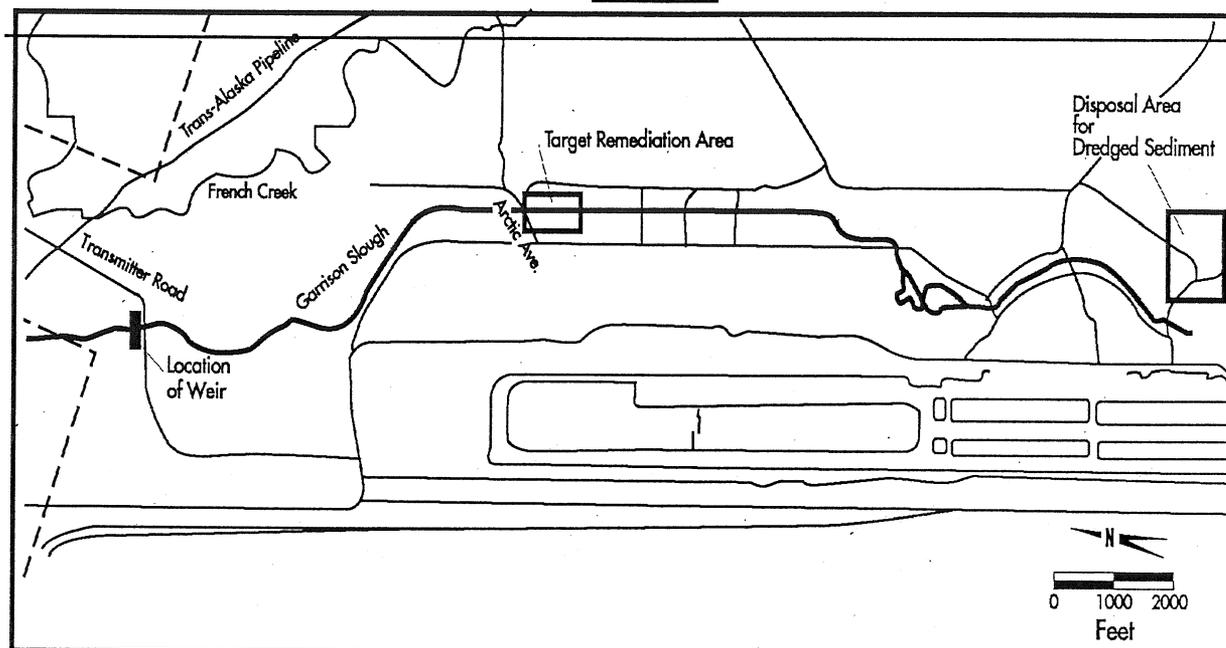
When assessing the capacity of a flowing waterbody to assimilate pollutant inputs, water quality agencies can perform a straightforward calculation using the critical design flow for the waterbody and the water quality criteria values for the pollutant of concern. In these cases, loading capacities are expressed as chemical mass per time (such as pounds per day). The Garrison Slough problem, stemming from sediment contamination and not water column contamination, is not amenable to this traditional loading capacity approach. Nevertheless, the goal to achieve and maintain water quality standards can be quantified in terms of a "Load Reduction (LR)." This LR is achieved through the physical removal of contaminated sediments, based on the assumption that the reductions in sediment PCB concentrations will result in reductions in fish tissue PCB concentrations.

As discussed earlier, the ultimate goal of this phased TMDL is to achieve the 10^{-5} risk level to protect human health in and around Garrison Slough. EPA has determined that removing 870 yd³ (or 80%) of contaminated sediments, in combination with institutional controls, will reduce risks to the 10^{-5} level and therefore meet water quality standards.

5c. Prescriptions:

In developing prescriptions for Garrison Slough, the ADEC, USAF, and EPA evaluated a number of alternatives. For sediments and fish, the clean-up objectives are three fold. The first objective, is to reduce the PCB levels in sediments so that concentrations in fish tissue will be reduced to acceptable risk levels. The second objective, is to prevent people from eating PCB contaminated fish until PCB tissue concentrations are lowered to acceptable risk levels. The third objective is to restore and protect the water quality standards for Garrison Slough.

In determining what prescriptions would be feasible for Garrison Slough, five alternatives were evaluated. (Table 6.)

Figure 5**Final Selected Prescriptions:**

The selected prescriptions as described in the ROD for the site, are a combination of Alternative 2 and Alternative 4. Based on the administrative record for the ROD, EPA has determined that this action will result in a 10^{-5} risk level to humans and therefore meet water quality standards. The following activities will take place on Garrison Slough.

- ▶ Fishing advisories posted along the slough.
- ▶ Installation of a weir near the downstream edge of EAFB to prevent fish movement during dredging (Figure 5).
- ▶ Mechanical dredging of PCB contaminated sediments, which is expected to result in removal of 80% of PCB volume.
- ▶ On-site disposal of PCB contaminated sediments at inactive base landfill.
- ▶ Long-term monitoring of surface water, sediment, and fish.