



Libby VARQ Flood Control Impacts on Kootenay River Dikes

Hamish Weatherly, Hydrologist



CRESTON VALLEY, BRITISH COLUMBIA

Creston Valley Dikes

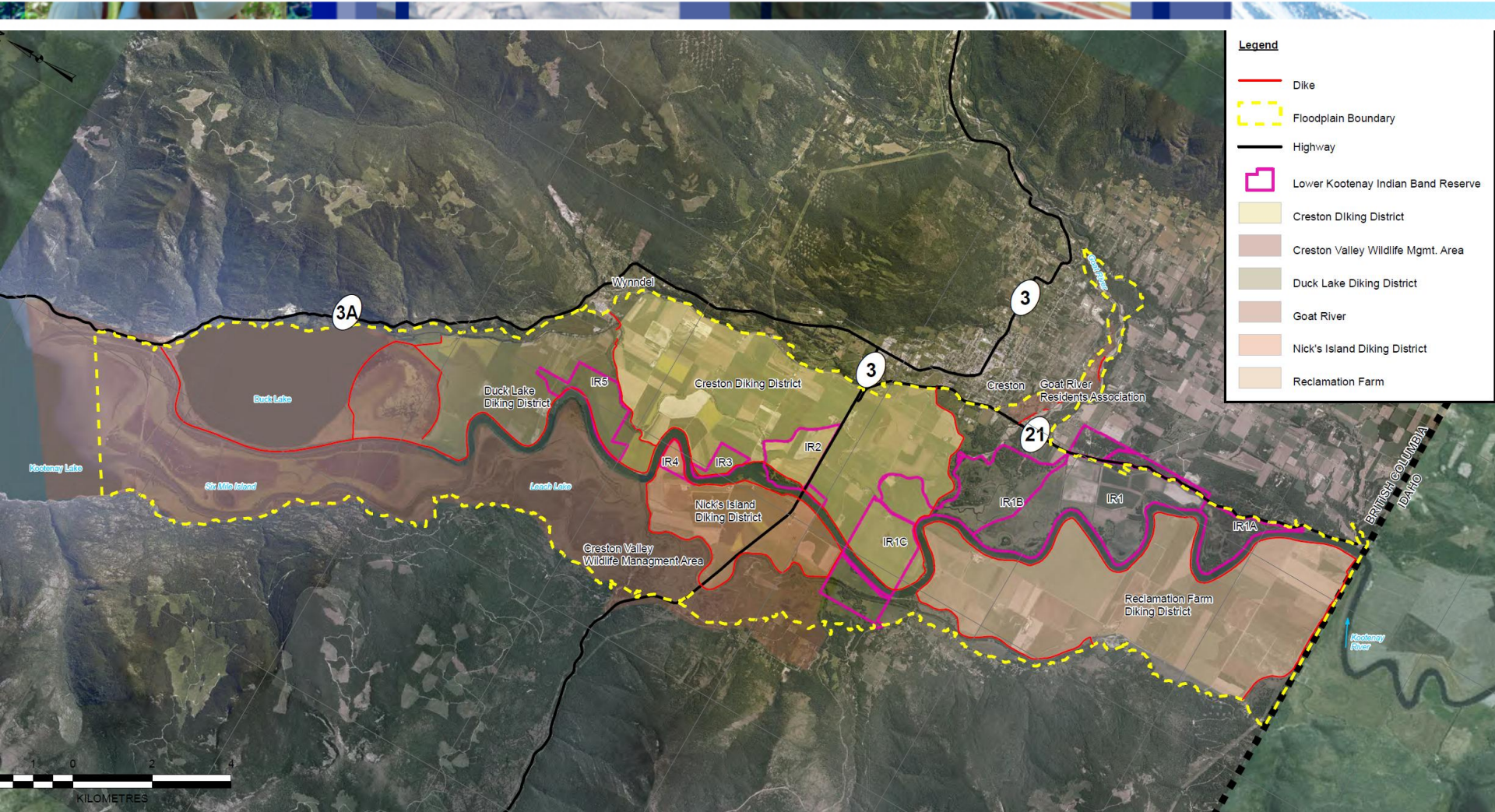




PLATE 16. KATSENAI VALLEY LOOKING
NORTH FROM HANSEN'S DOG SHOWING
TRACES OF CULTIVATION AS A RESULT OF
RECLAMATION.



Image USDA Farm Service Agency
Image © 2009 TerraMetrics

Image © 2009 Province of British Columbia

11 U 533809.67 m E 5432073.86 m N elev 539 m

©2009 Google

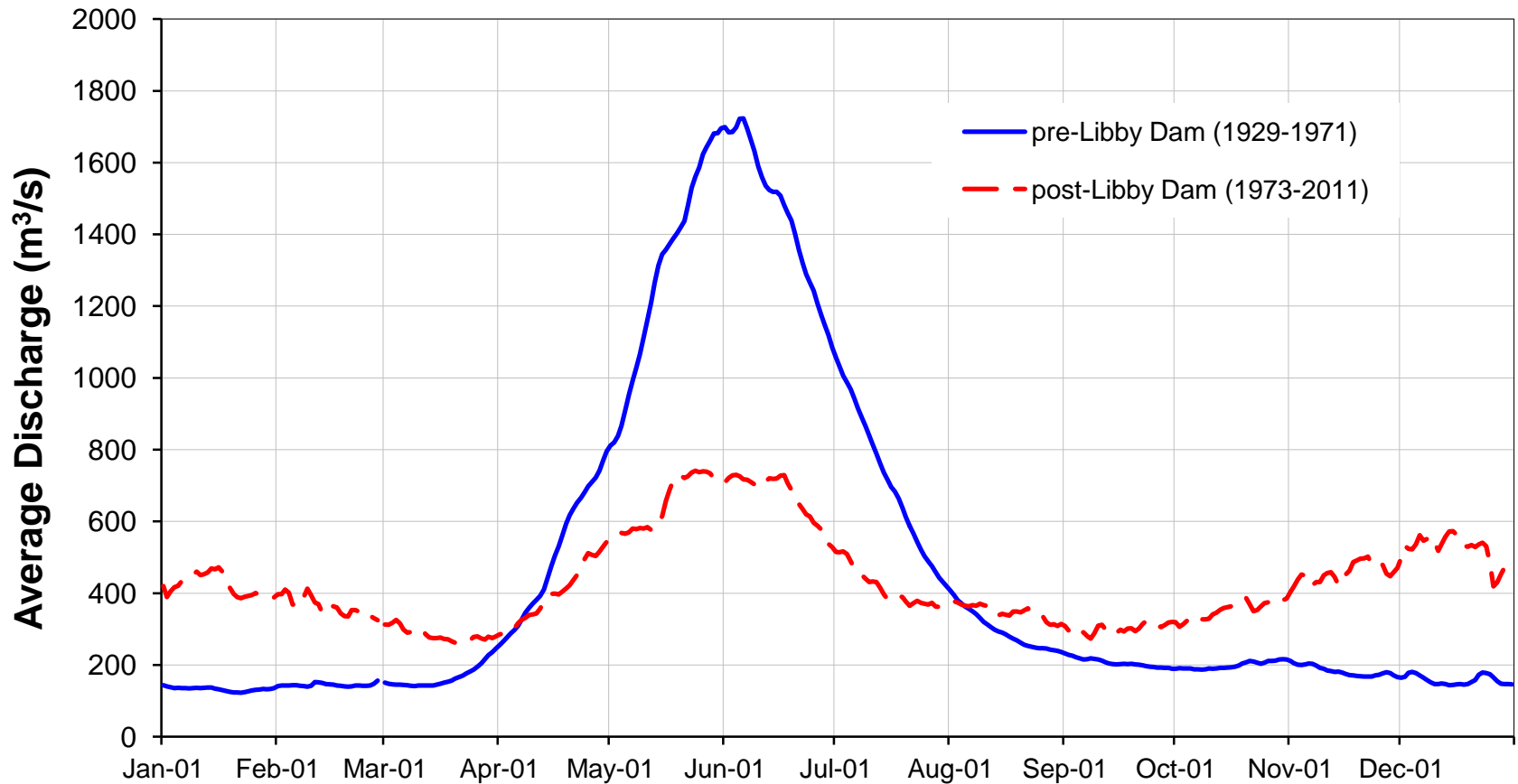
Eye alt 3.13 km

Imagery Dates: 2004 - 2005

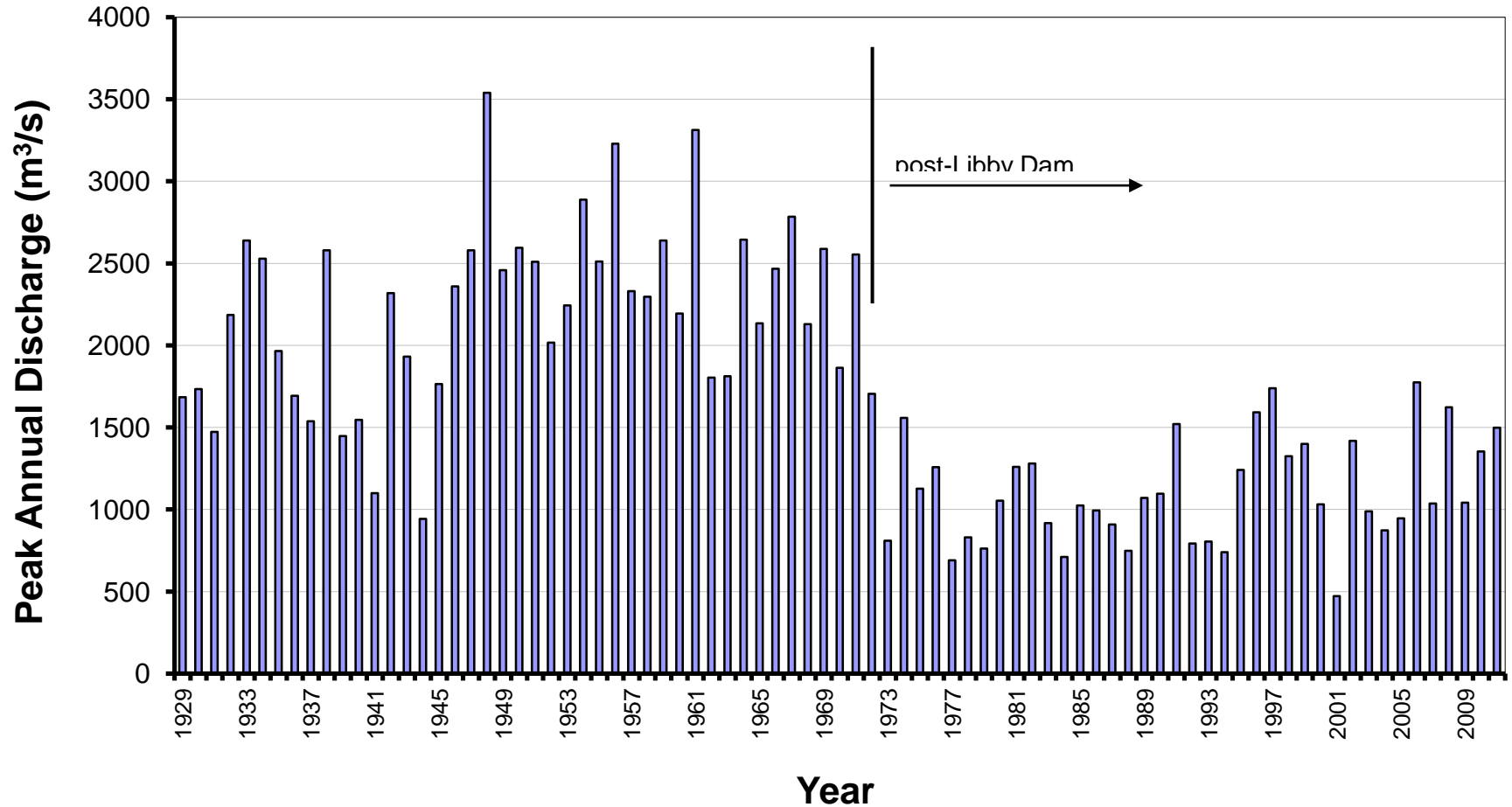
Dam Construction

- Increased control of flooding on the Kootenay River and Kootenay Lake was achieved through the construction of three dams
 - Corra Linn Dam (at Nelson) – 1932
 - Duncan Dam – 1967
 - Libby Dam – 1973
- Libby Dam has had a major impact on Kootenay River and Kootenay Lake water levels
 - it regulates 70% of the flow at the US-Canada border

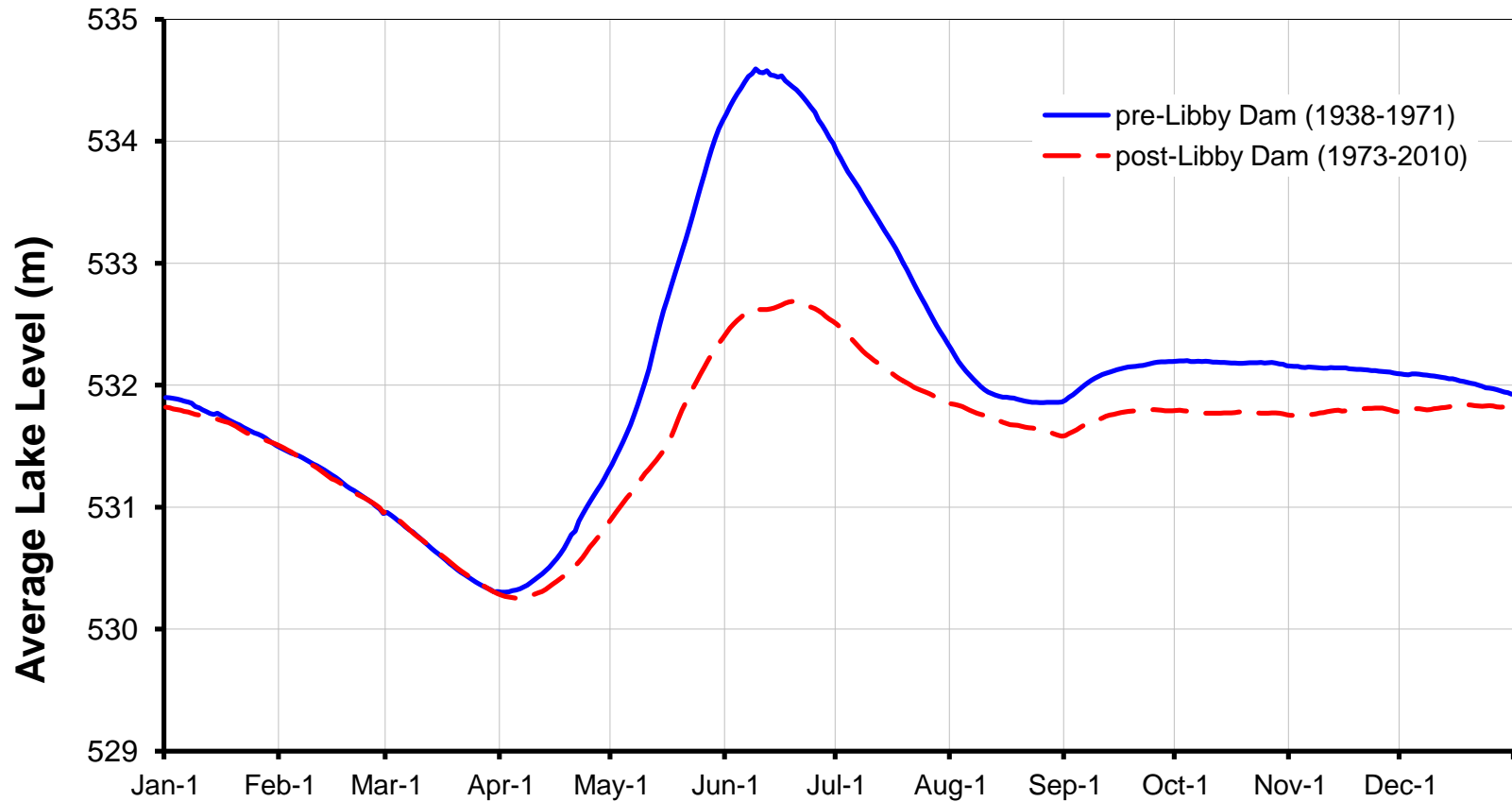
Porthill, Idaho



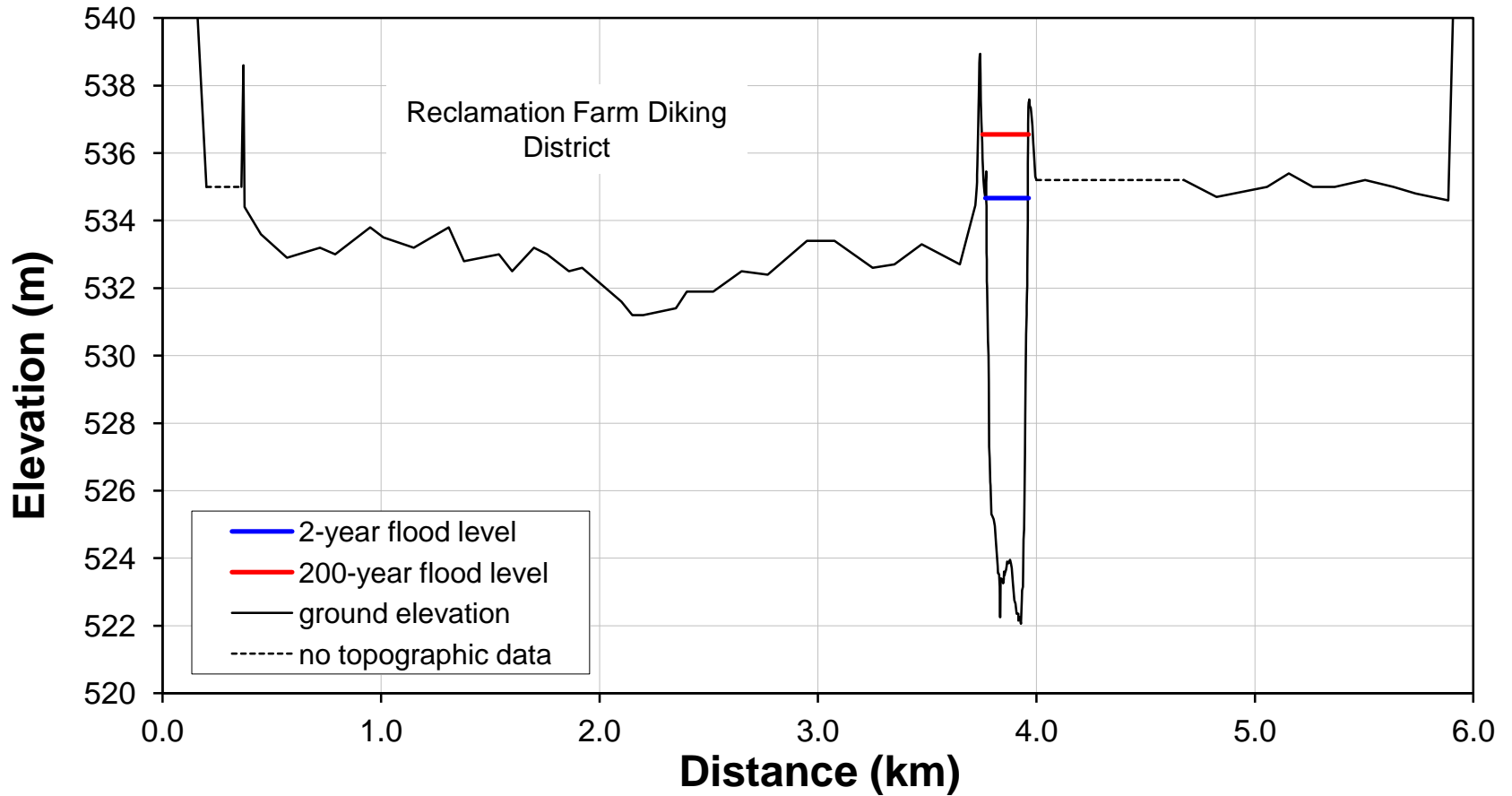
Kootenay River Peak Flows



Kootenay Lake



Kootenay River



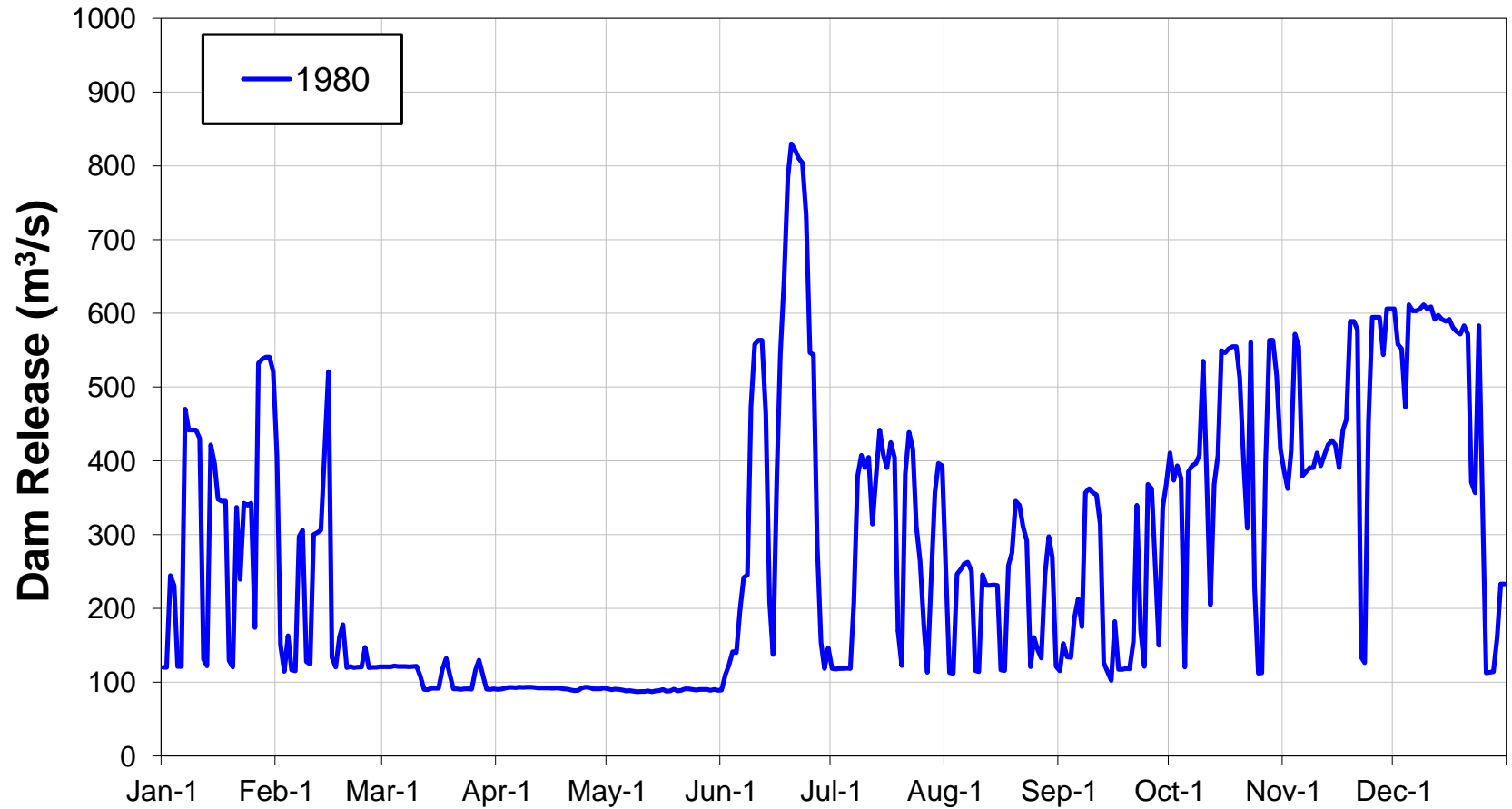
Libby Dam Operation

- 1973 to 1992
 - Standard Flood Control regime with operation of the dam driven almost exclusively by flood control and power
- 1993 to 2002
 - Standard FC continues and flood control remains a top priority. However, operations for downstream fisheries has a higher priority than power operations. Ramping rate restrictions were also adopted in the late 1990's.
- 2003 – present
 - Variable Flood Control is adopted. With this regime there are higher flood control curves for most water conditions, although flood control remains a top priority.

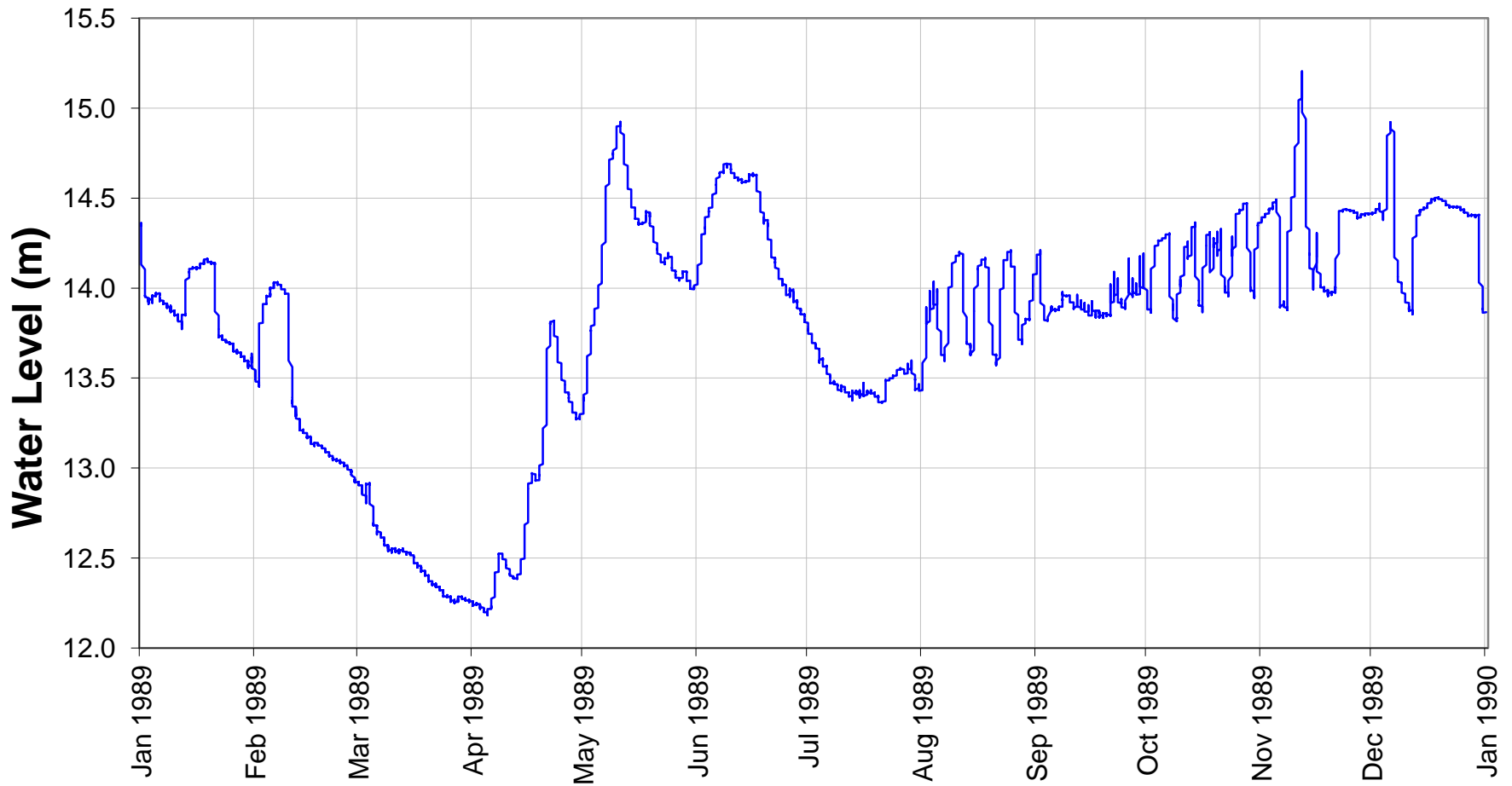
Load Following

- Prior to the late 1990's, Libby Dam was operated with the practice of load following
 - Refers to fluctuations in dam releases that correspond to changes in power demand
 - Load following was typically employed during the late fall and winter

Load Following



Load Following - 1980



- nhc was retained by Kootenay Diking Districts to investigate bank erosion

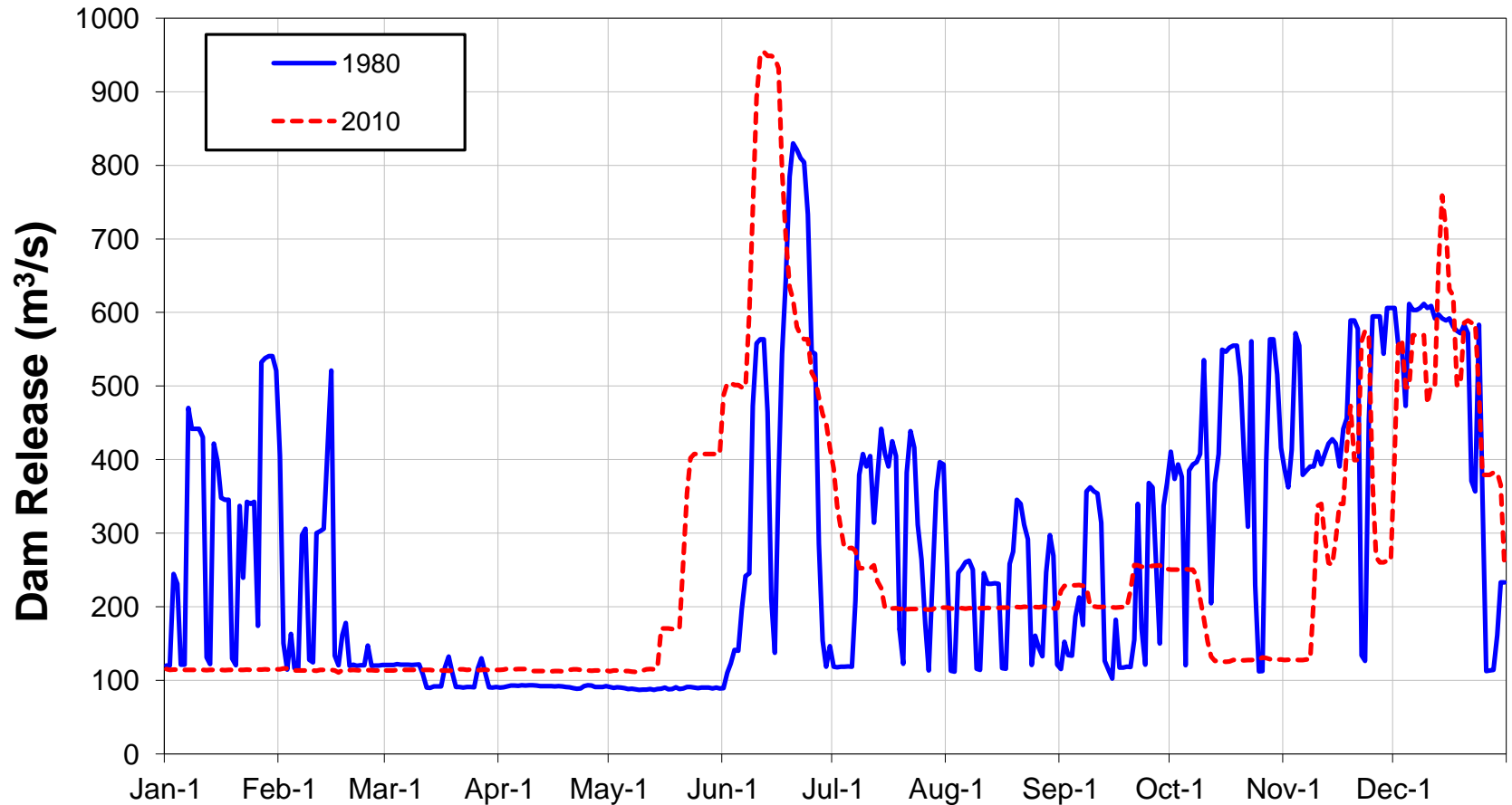
“It is considered probable that the development of this notch is more pronounced now that the river level is controlled by Libby Dam in comparison to pre-Libby Dam, when the river level fluctuated over a wider range and the short duration releases from Libby Dam did not occur. The more limited range of water levels, greater fluctuations in flows during the winter season, and more frequent cycles of wetting and drying appears to induce a weakening of the banks resulting in toppling of soil wedges.”

Dike Erosion

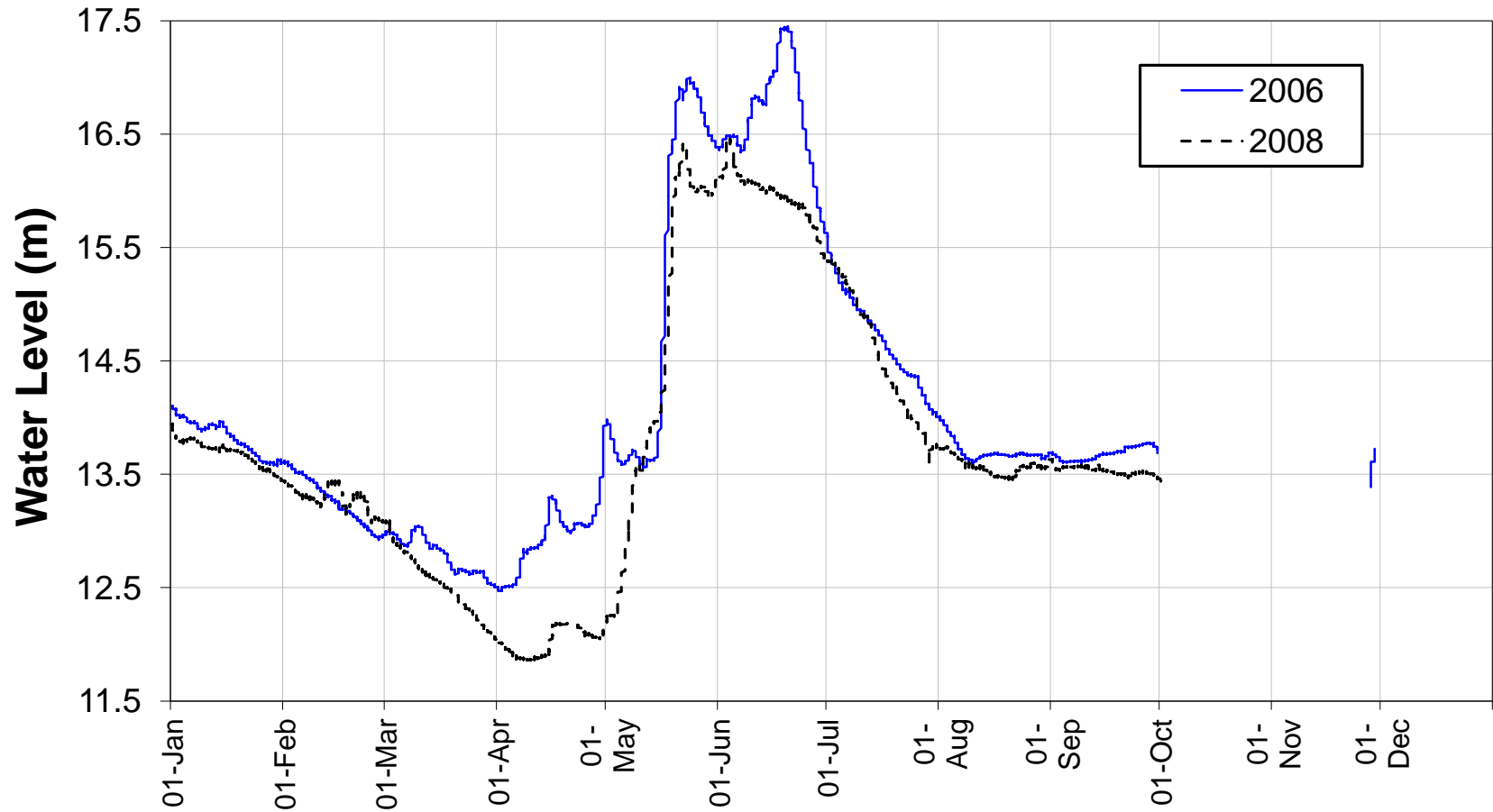
- The US Army Corps of Engineers (2006) have also concluded that past practices of load following contributed to the erosion of the toe slope of much of the levee system in the Kootenai Valley
- Lack of riparian vegetation is also likely a factor
- Maximum ramping rates were therefore prescribed in the late 1990s
 - implemented not only for fisheries but also to help minimize dike/levee erosion along the river



Prescribed Ramping Rates



Load Following



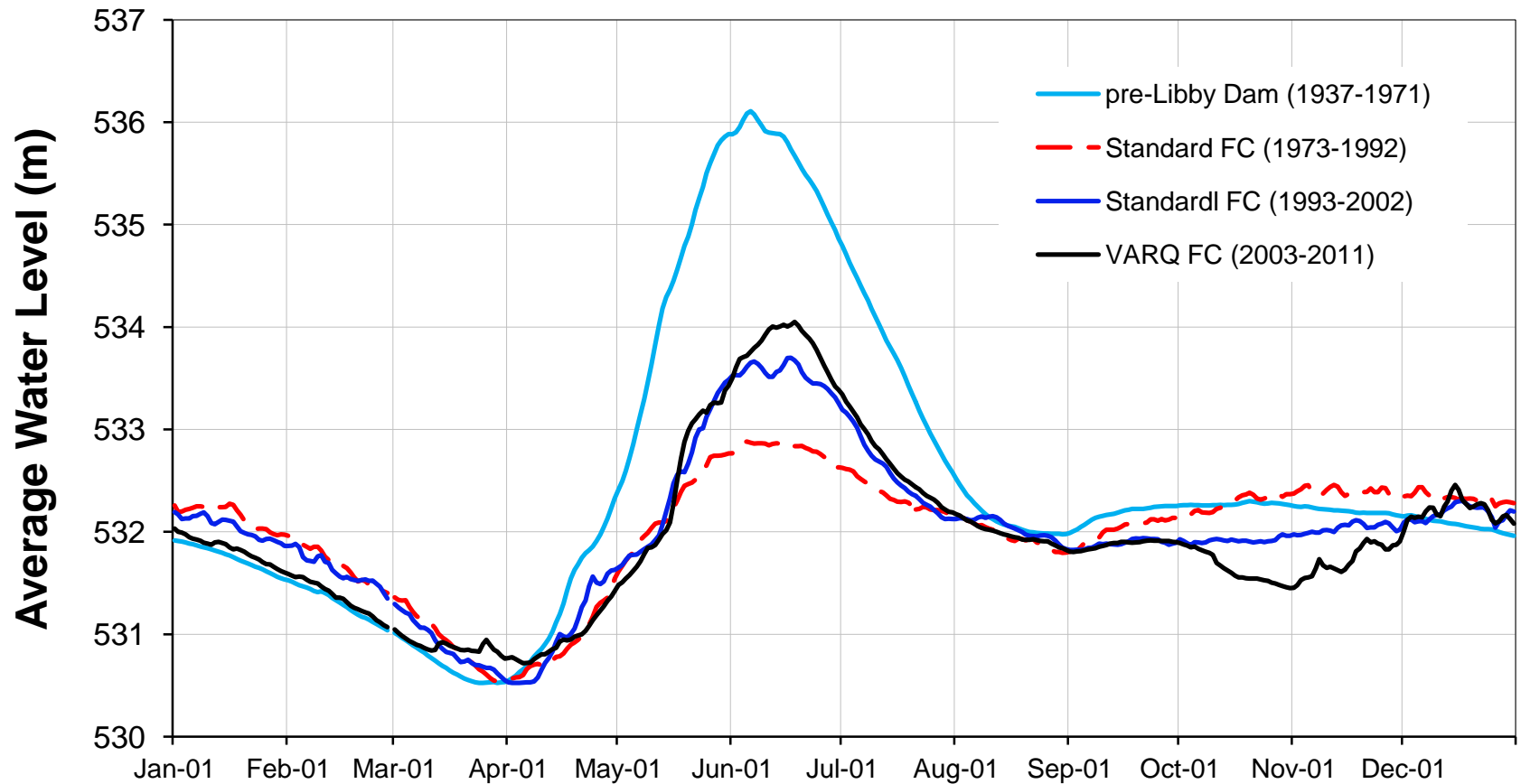
Standard vs VARQ FC

- In December 2000, the USFWS and the National Marine Fisheries Service (NMFS) each issued a Biological Opinion outlining measures to protect endangered species including sturgeon, bull trout, salmon and steelhead
- Recommended measures included VARQ FC
- Intent of VARQ FC is to provide additional flows for downstream fish while continuing to provide adequate downstream flood protection

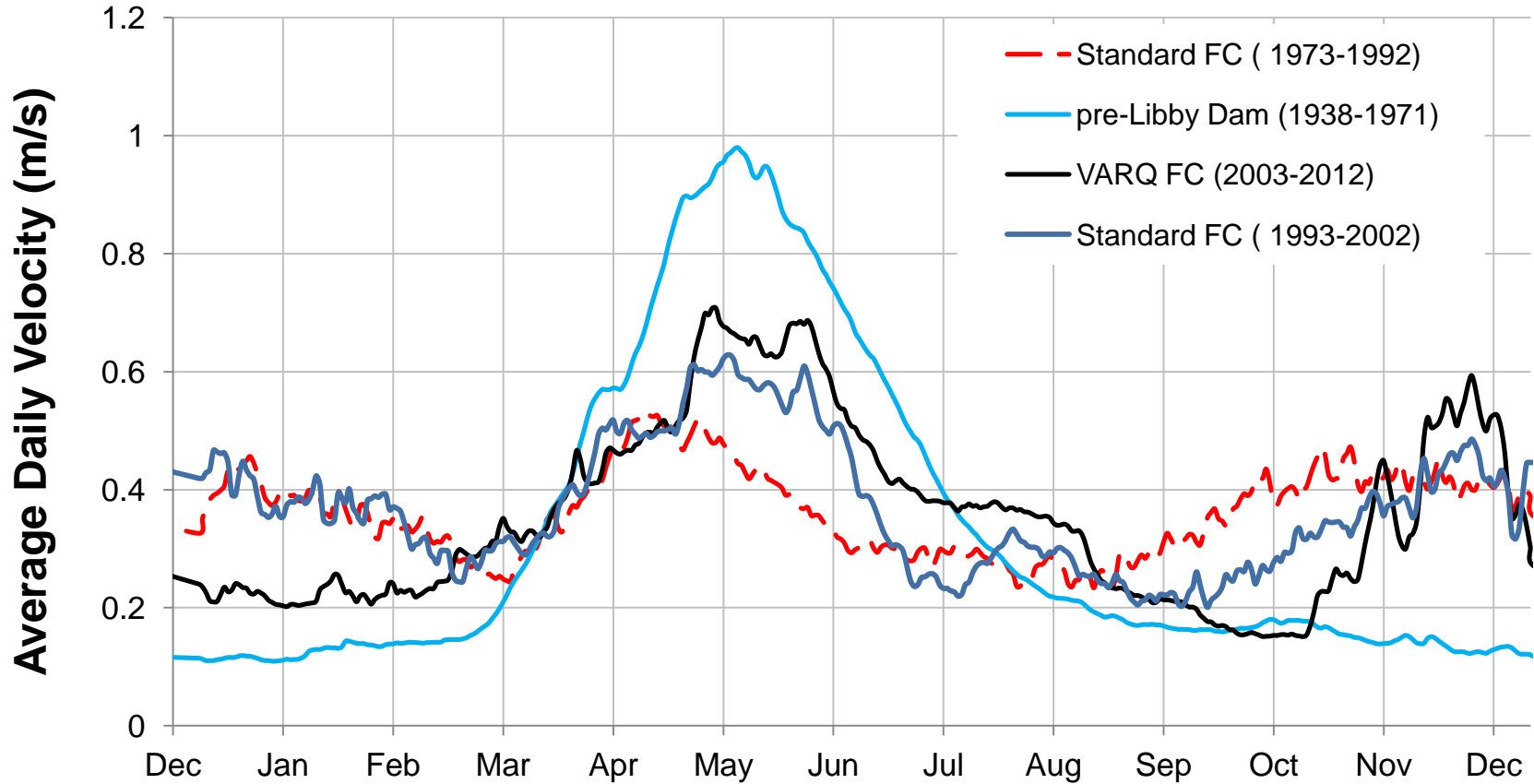
Standard vs VARQ FC

- Dam began discharging less water during the fall/winter period and more water during the spring/summer to benefit downstream fish.
- Standard and VARQ FC have the same storage space for flood control when the water supply forecast is 120% of normal
- In practice, there is only a difference in the two methods when the inflow forecast is between 80% and 120% of normal

Standard vs VARQ FC



Standard vs VARQ FC



Conclusion

- Implementation of VARQ FC has not had a significant impact on diking infrastructure adjacent to the Kootenay River
- The past practice of load following did have a significant negative impact on diking infrastructure
- High flows in 2011 and 2012 may be contributing to perception of impacts
 - highest lake level on Kootenay Lake in 2012 in 38 years
 - also record June and July rainfall

BGC