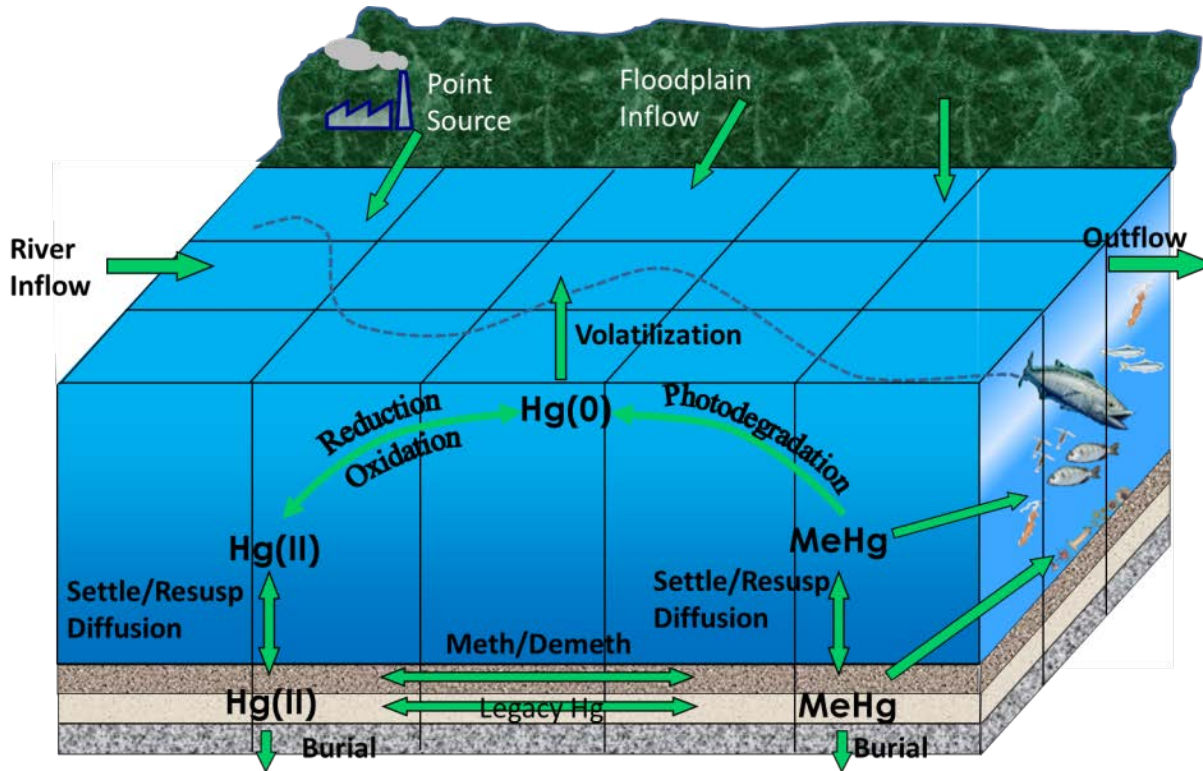


Mechanistic Mercury Modeling in the South River



Reed Harris and David Hutchinson
RHE Ltd.

October 21, 2015

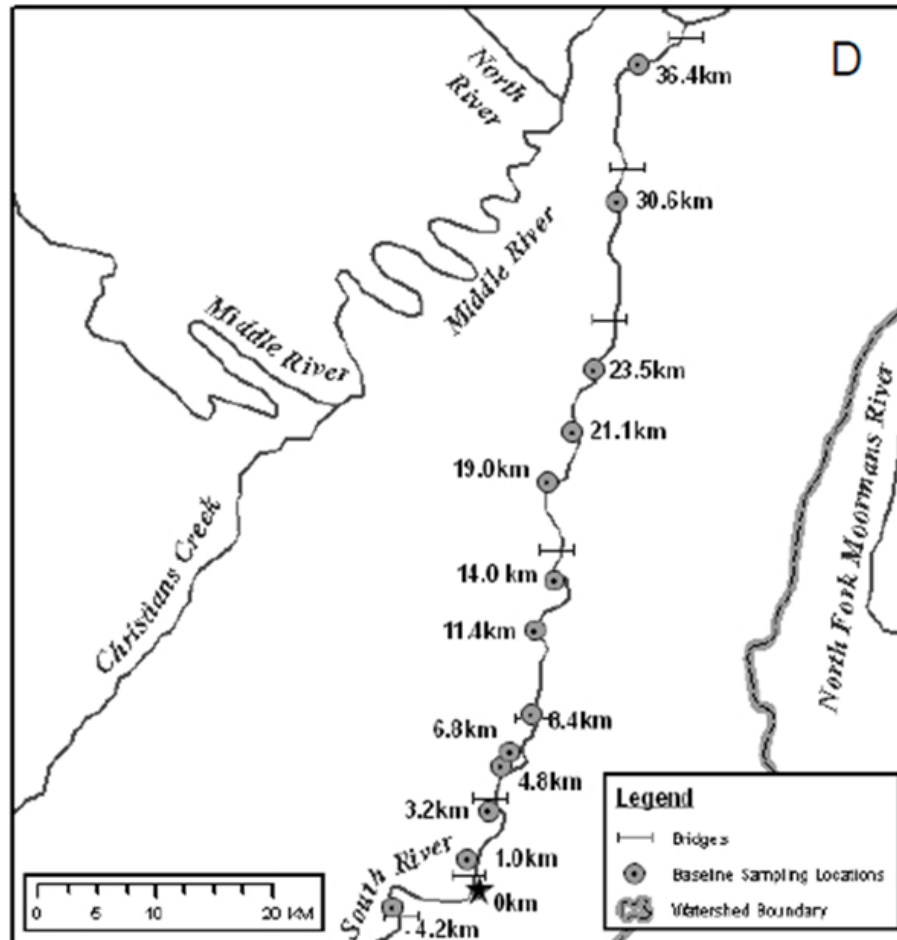
Objectives

- Help predict benefits of bank stabilization.
- Help interpret monitoring data.
- Integrate multi-disciplinary studies.
- Help address uncertainty
- Provide another line of support for decisions (EAM).

Key question to help address with a model:

What will happen to fish mercury levels after bank stabilization?

- Magnitude
- Timing
- Effects at different locations



Observed Hg concentrations along the South River (Source: VDEQ, 2008)

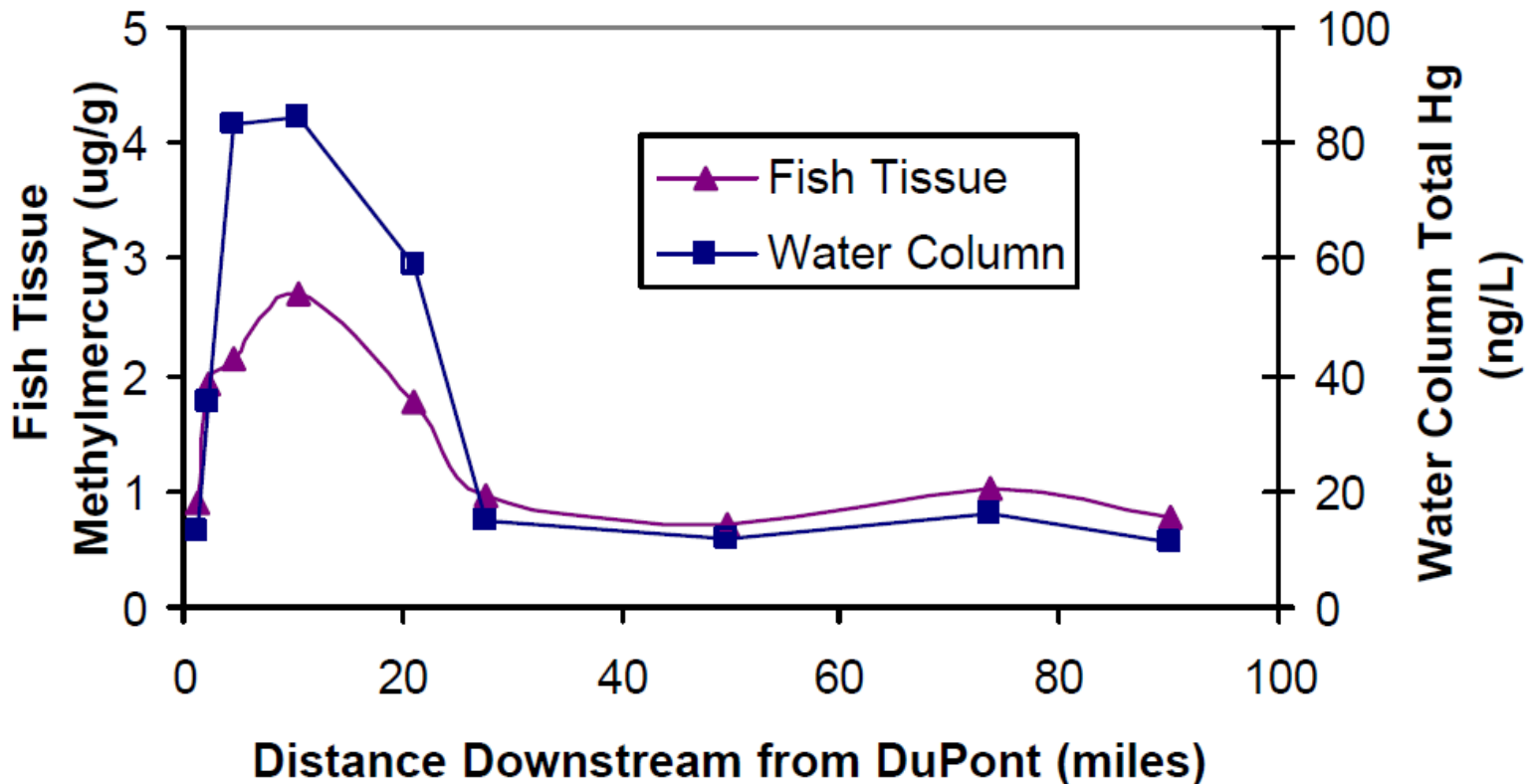
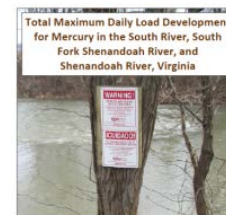


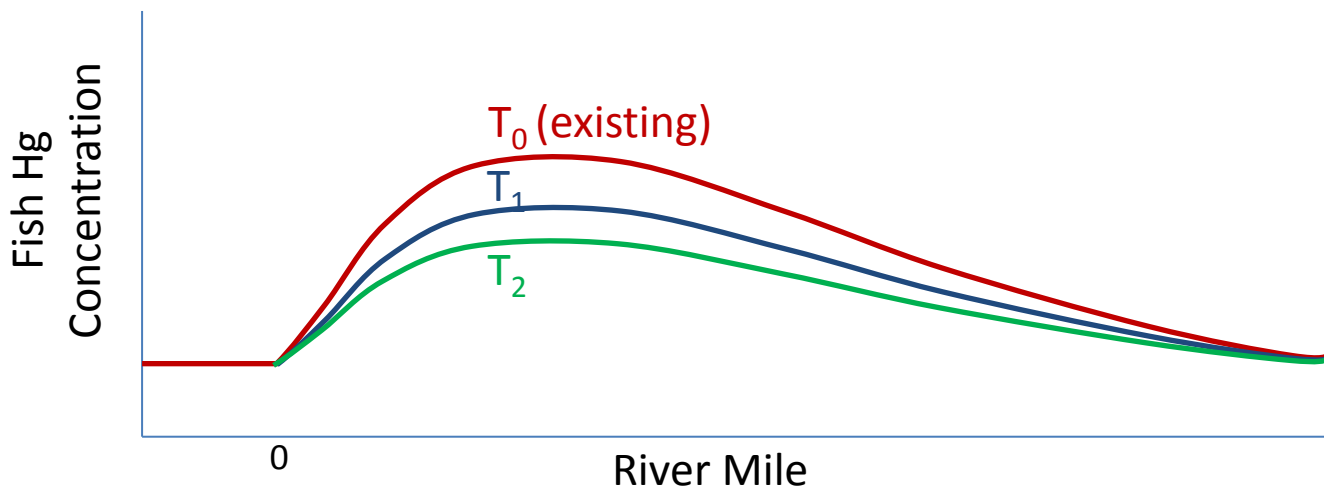
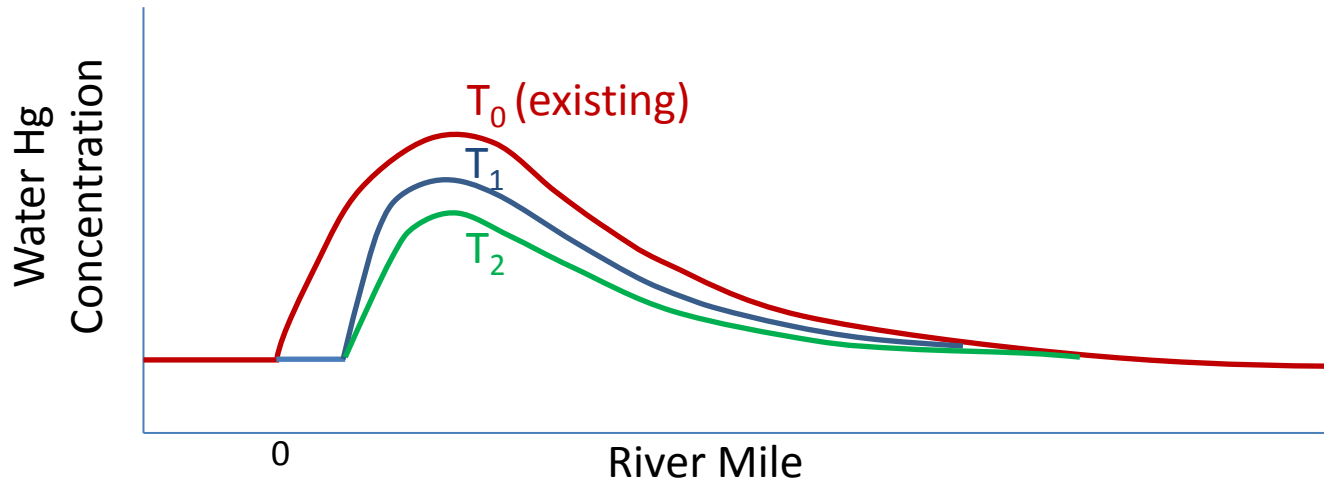
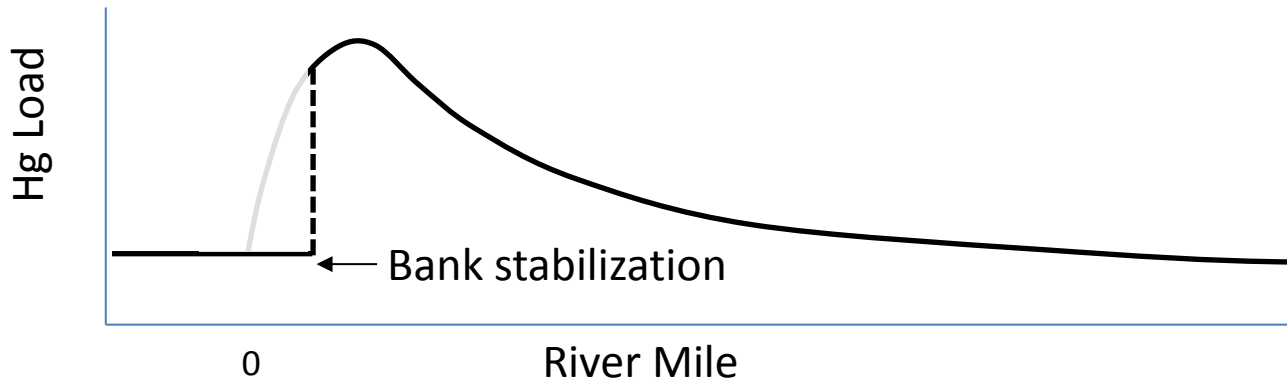
Figure 2-8. Size-normalized Fish Tissue Methylmercury and Water Column Mercury in the South River and South Fork Shenandoah River Downstream from DuPont in Waynesboro, VA.



Prepared by
Virginia Department of Environmental Quality

December 2008





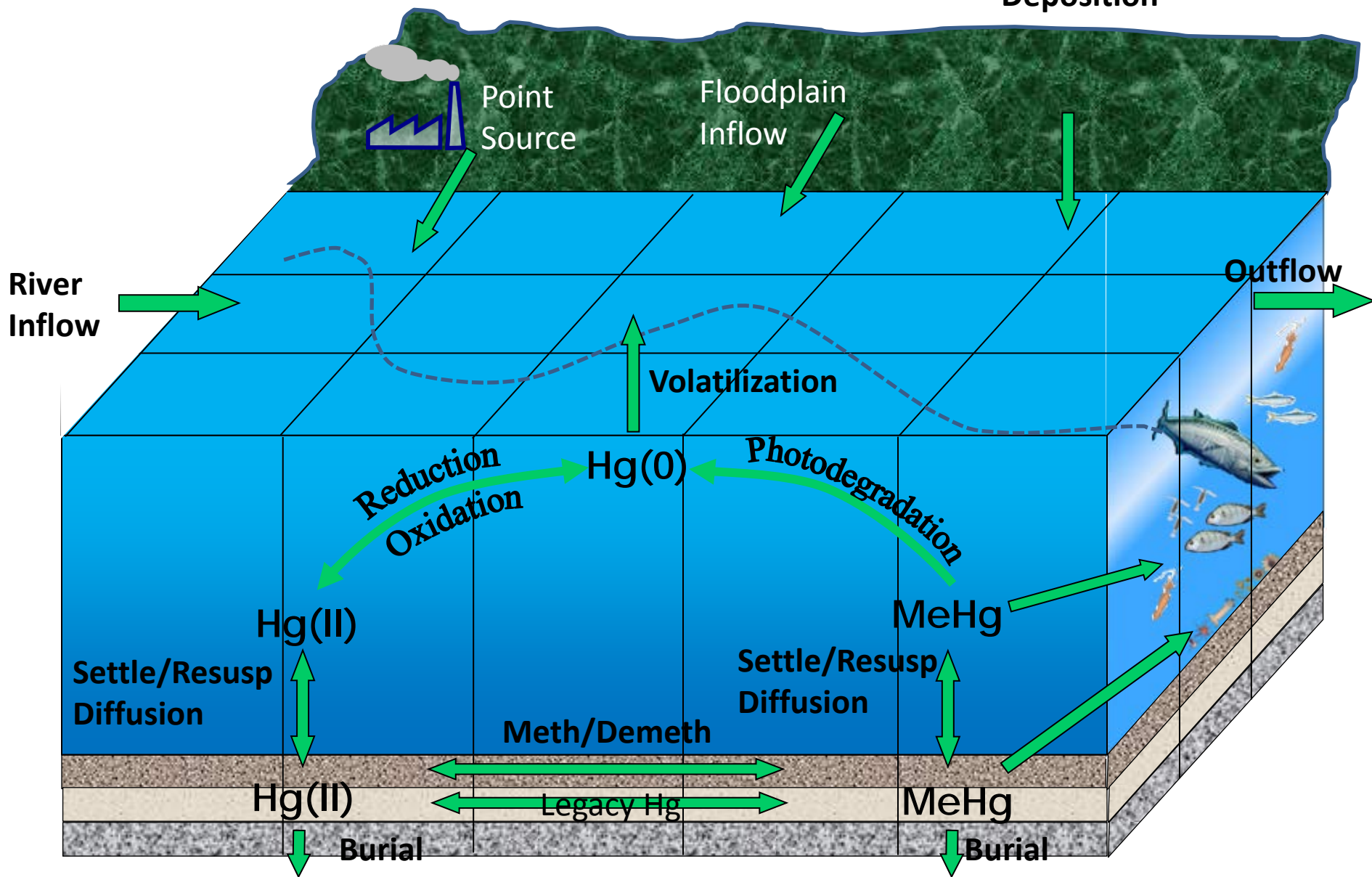
**Predict response
as a function of
location and time**



D-MCM setup for South River

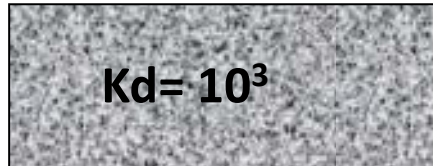


Atmospheric
Deposition



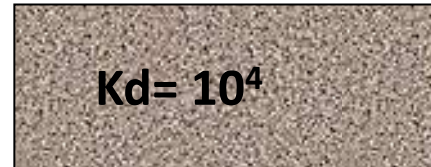
Four types of particulate matter in D-MCM

Coarse Inorganic



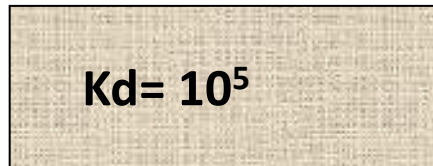
Does not
decompose

Fine Inorganic



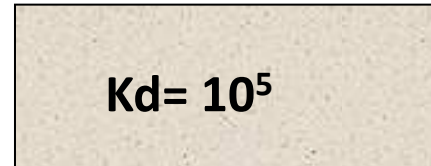
Does not
decompose

Labile Organic



Decomposes
quickly

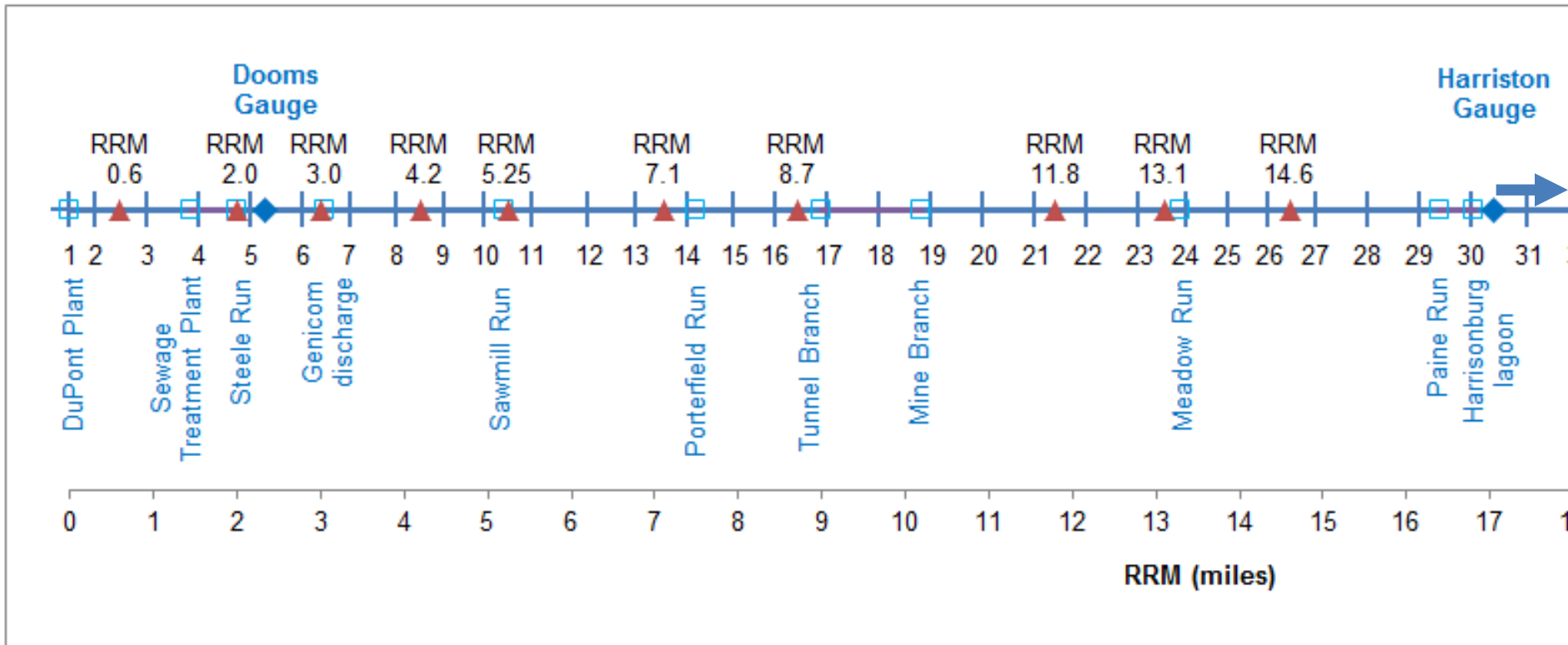
Refractory Organic



Decomposes very
slowly

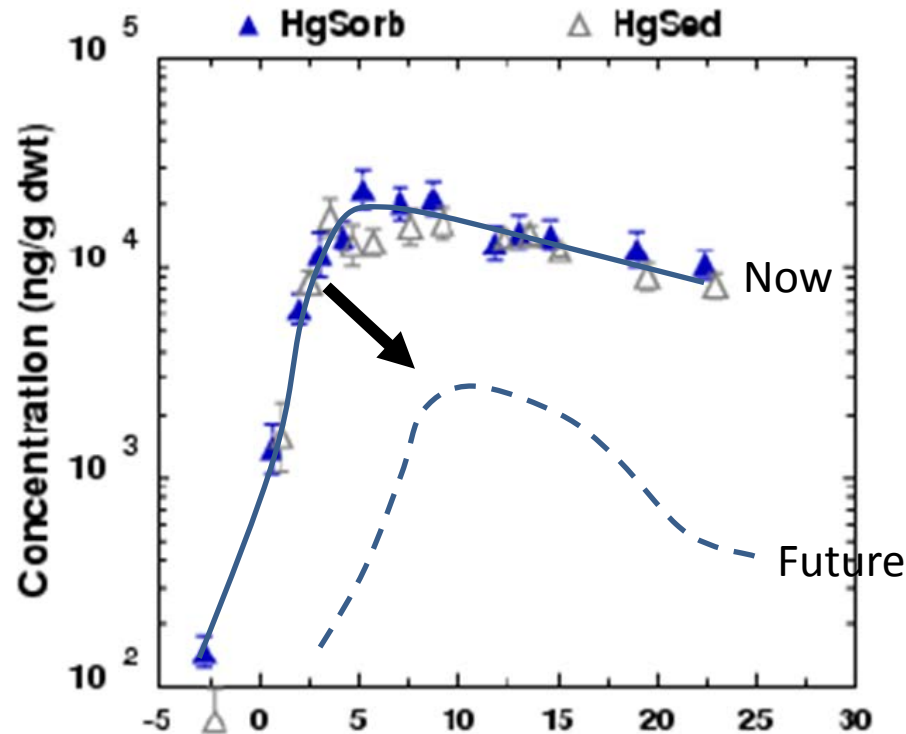
Model Grid

- 47 cells, each roughly 1 km long
- Simulation spans RRM 0 to ~RRM 27
- Tributary inputs increase flow along river

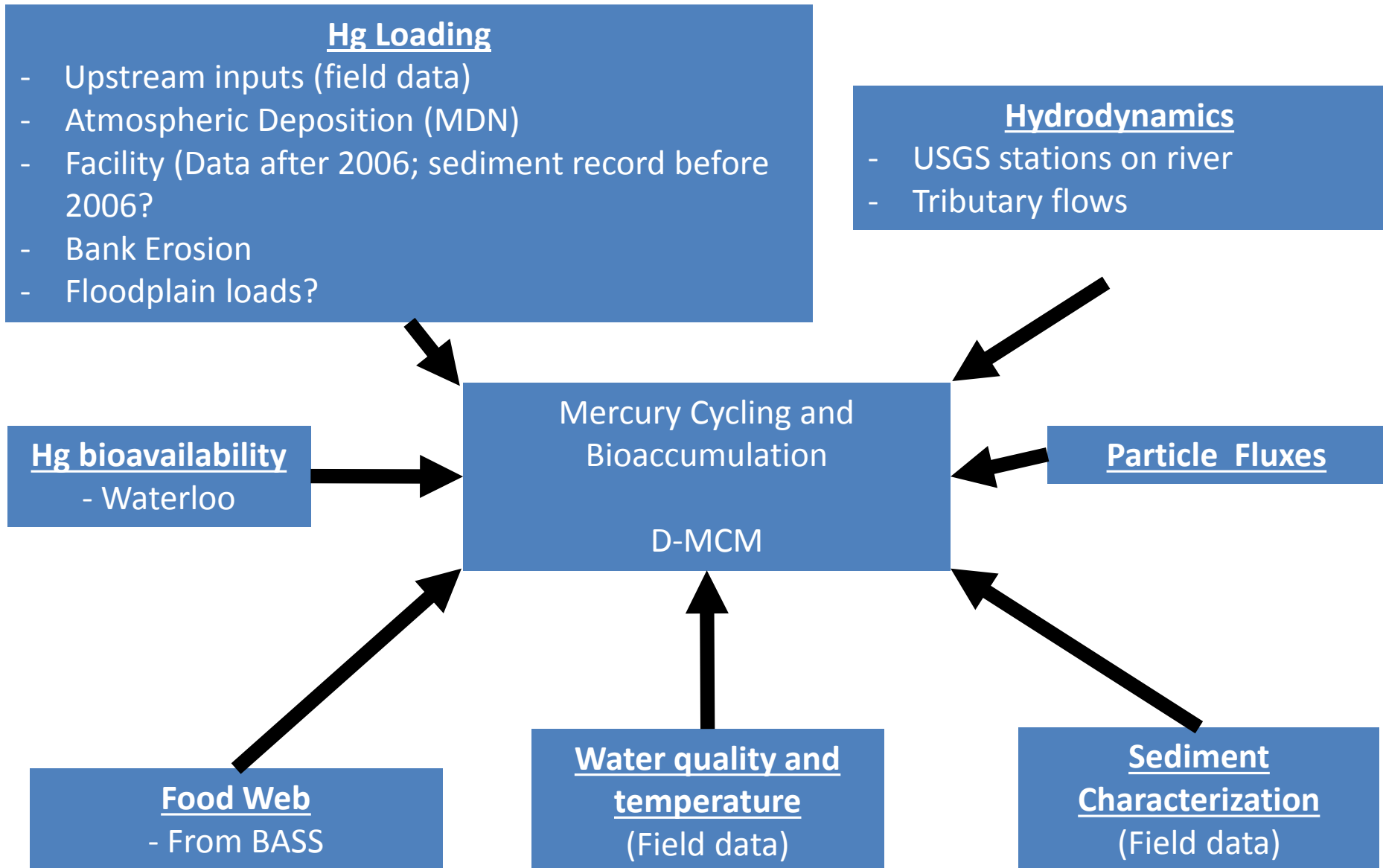


~ 1 km segments designed to accommodate rate of change of conditions.

... Now and in the future.



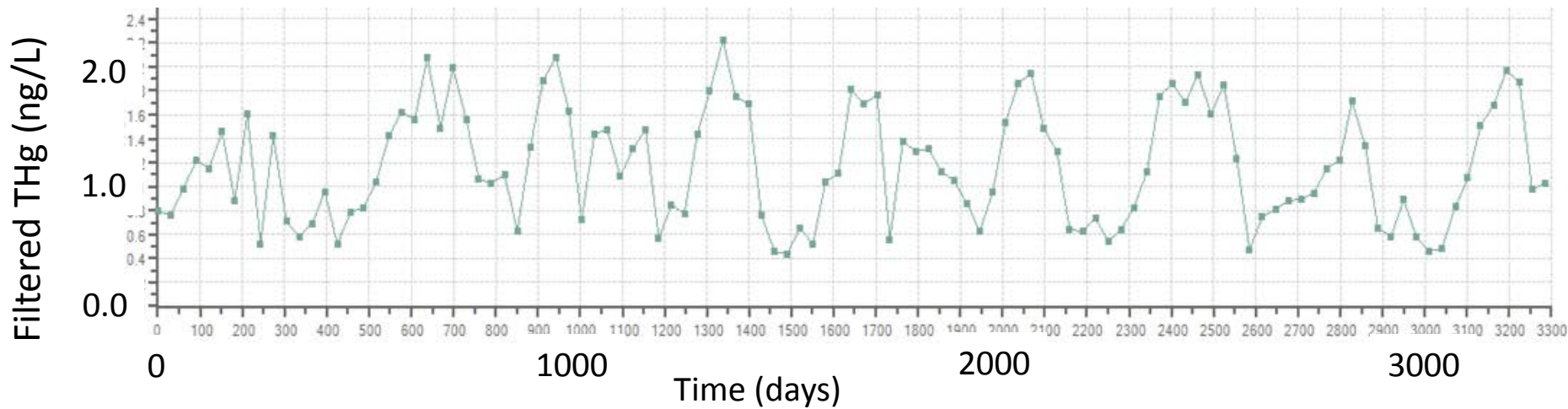
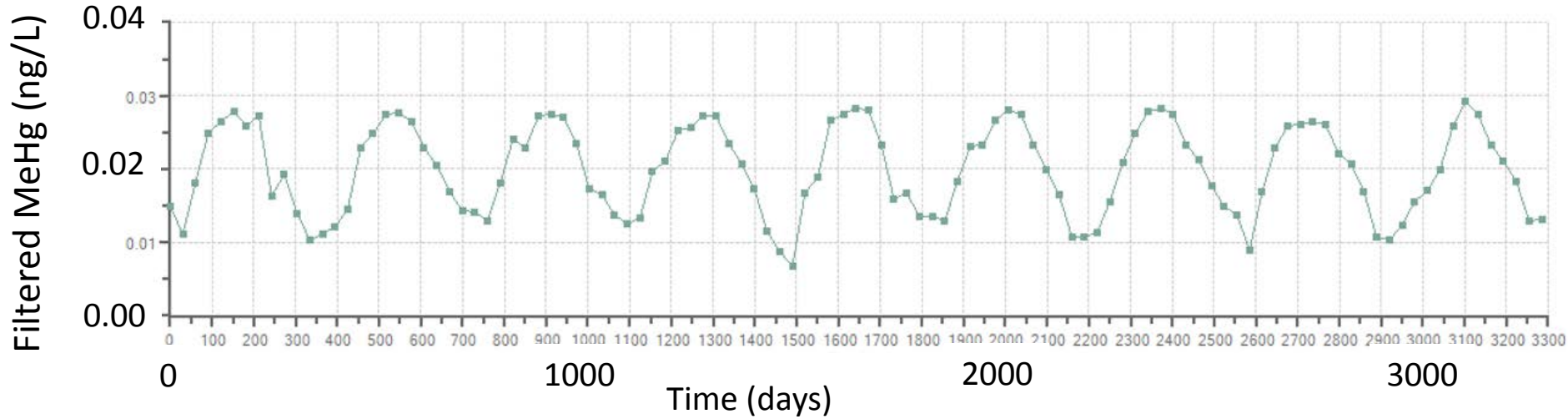
Building Blocks for Mercury Simulations (2006-2014)



Status

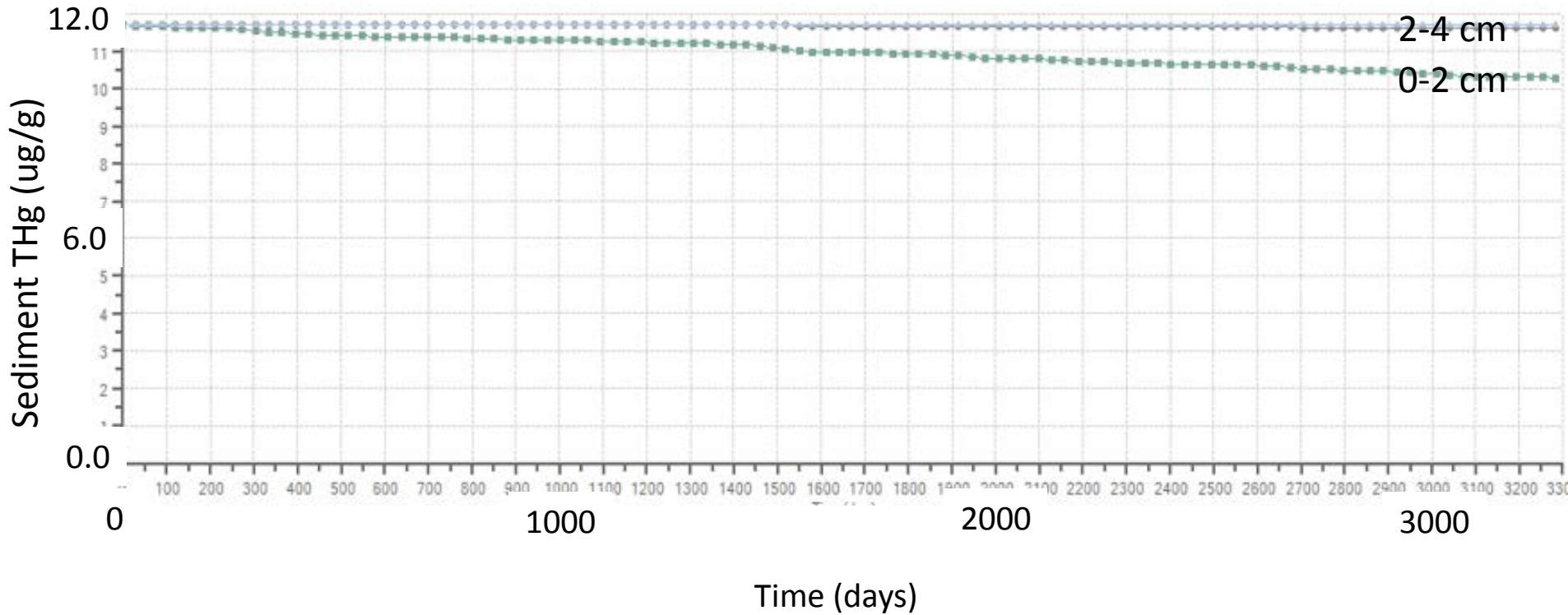
- Model is running for water and sediments for RRM 0-19.
- Adding cells to RRM 27.
- Adding food web.
- Still entering site specific conditions so results are not yet realistic
- Full simulations in November.

Some initial model outputs (Cell 10, 2006-2014)



Not yet realistic – some inputs not site specific..

Some initial model outputs (Cell 10, 2006-2014)

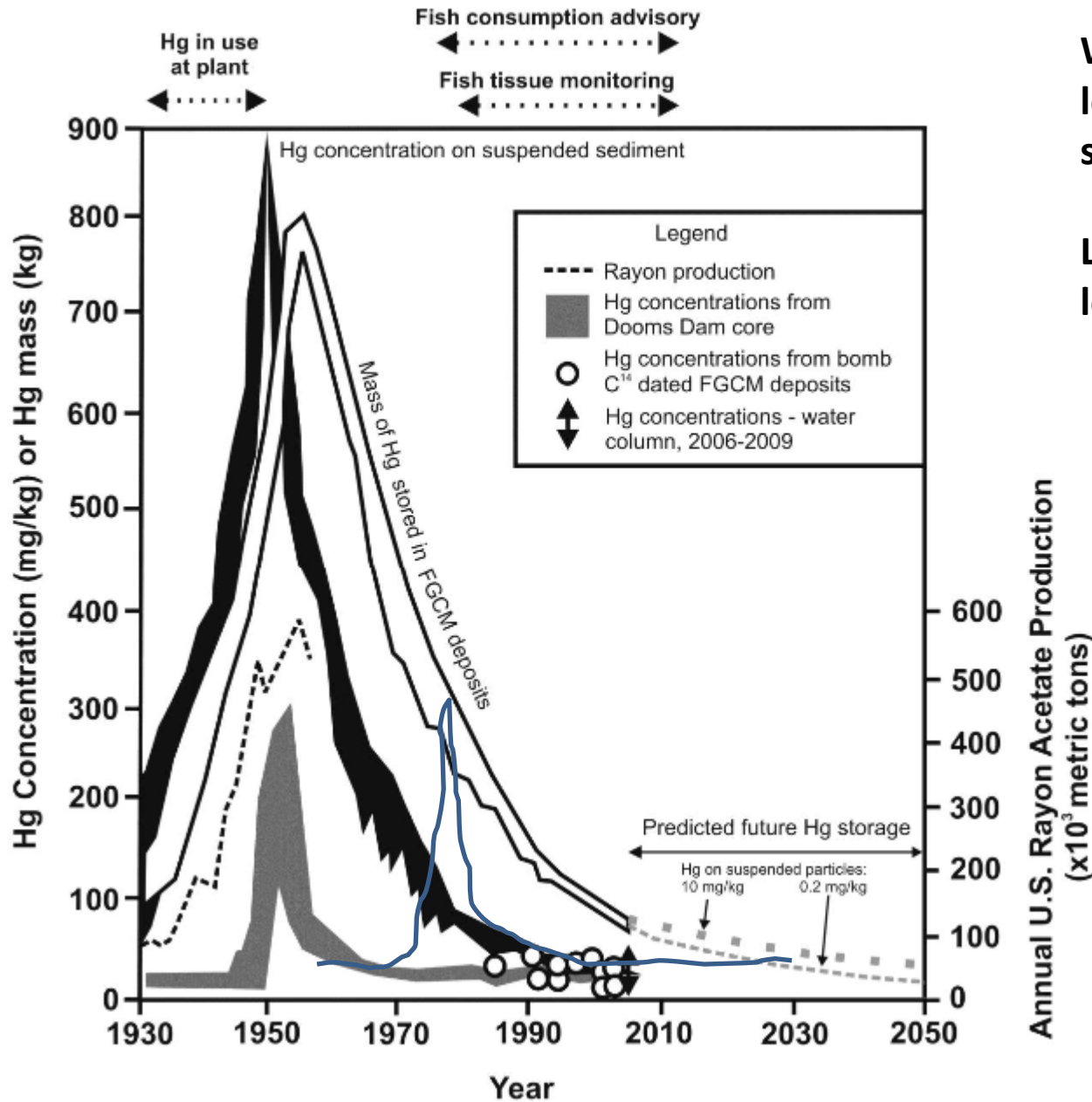


Not yet realistic – some inputs not site specific..

Issues to sort out..

- **Hydrology:**
 - Surface water vs groundwater inputs
 - Bank leaching
- **Particles:** Estimating particle fluxes (resuspension, settling, permanent burial, downstream export)
- **Model setup:** Where is dividing line between sediments and banks
- **Duration of simulation:** Could we do a long term simulation the spans the period of Hg releases?

Preliminary reconstruction of the history of Hg contamination in the South River (from Skalak and Pizzuto, i



Would be valuable to do long term historical simulation.

Lacking information on loading rates over time



Questions?