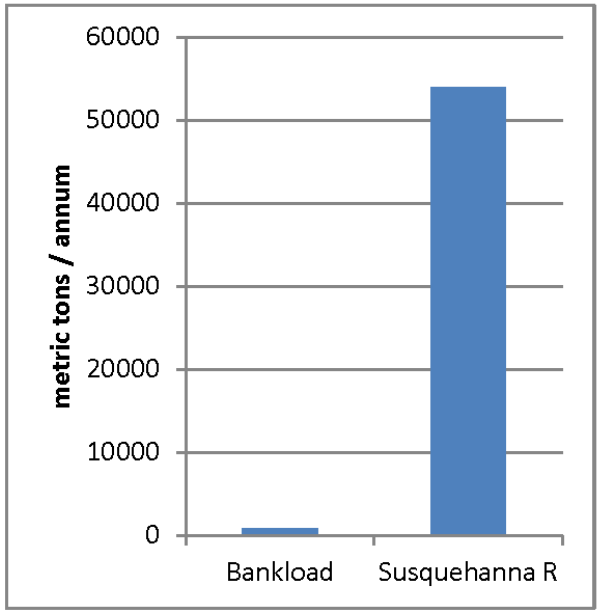
Secondary Sources

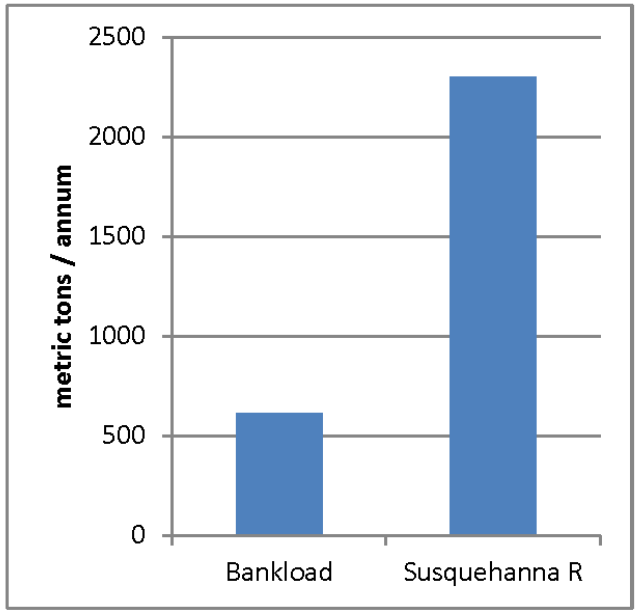
- We're finding ourselves dealing with nutrient sources outside our conventional point and nonpoint-source loads.
  - Bottom scour from Conowingo Reservoir.
  - Nitrogen and phosphorus associated with bank erosion.
  - Carbon, nitrogen, and phosphorus associated with marsh erosion. Likely to gain in importance when we deal with projections of sea-level rise.
- Our immediate concern is to incorporate bank nutrient loads into the TMDL as per request from WQGIT.

Bank Nutrient Loads

Nitrogen



Phosphorus

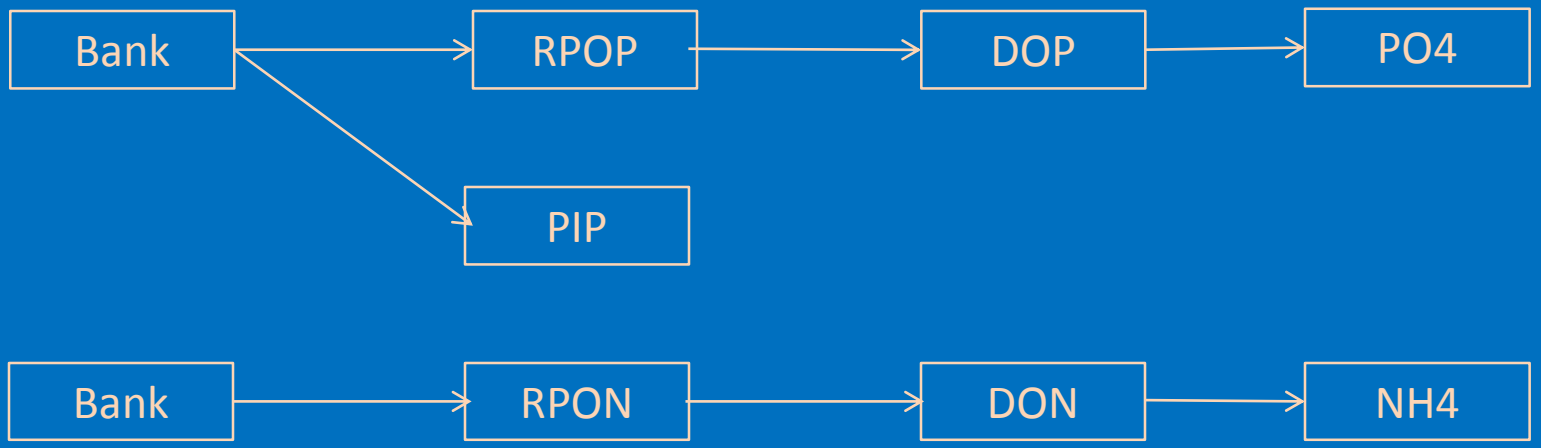


Bankloads calculated based on values provided by WQGIT: 0.29 mg N/g sed, 0.205 mg P/g sed.

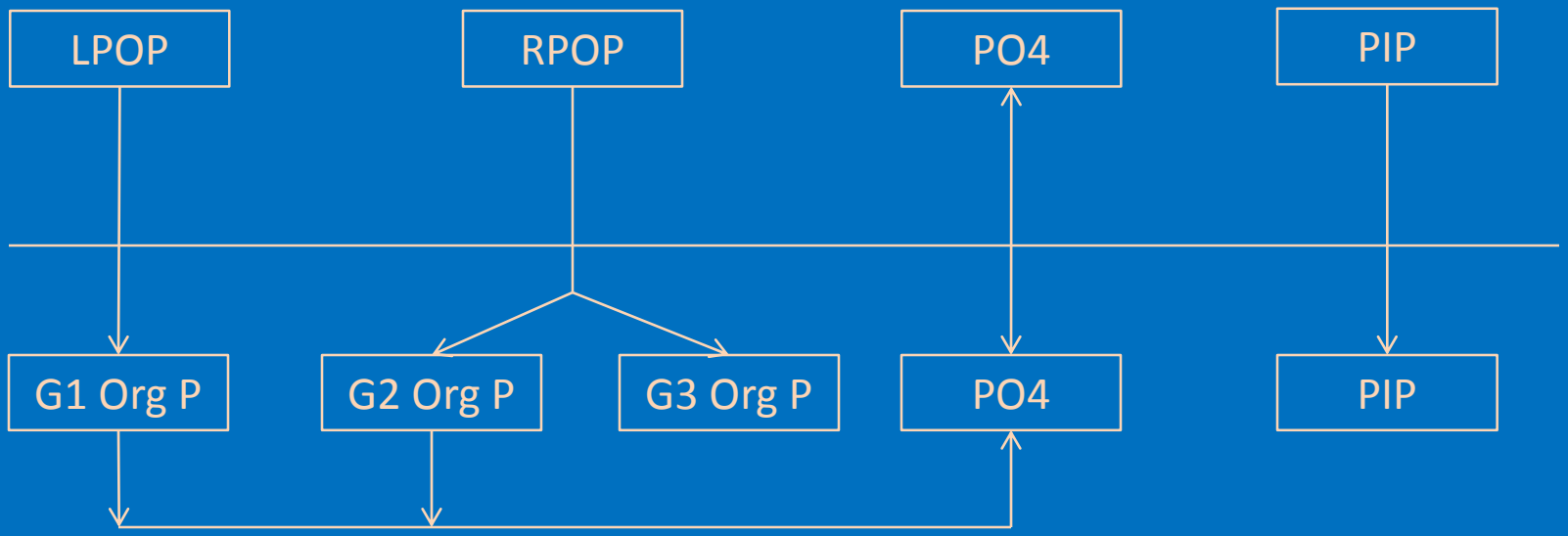
Model Particulate P Variables in Water Column

- Labile Particulate Organic Phosphorus – Decay rate 0.12 / day.
- Refractory Particulate Organic Phosphorus – Decay rate 0.005 / day.
- Particulate Phosphate – Partitioned between dissolved and particulate phases. Loosely bound.
- Particulate Inorganic Phosphorus – Originates in the watershed. Tightly bound. Inert in water column.

Routing Bankloads to Water Column

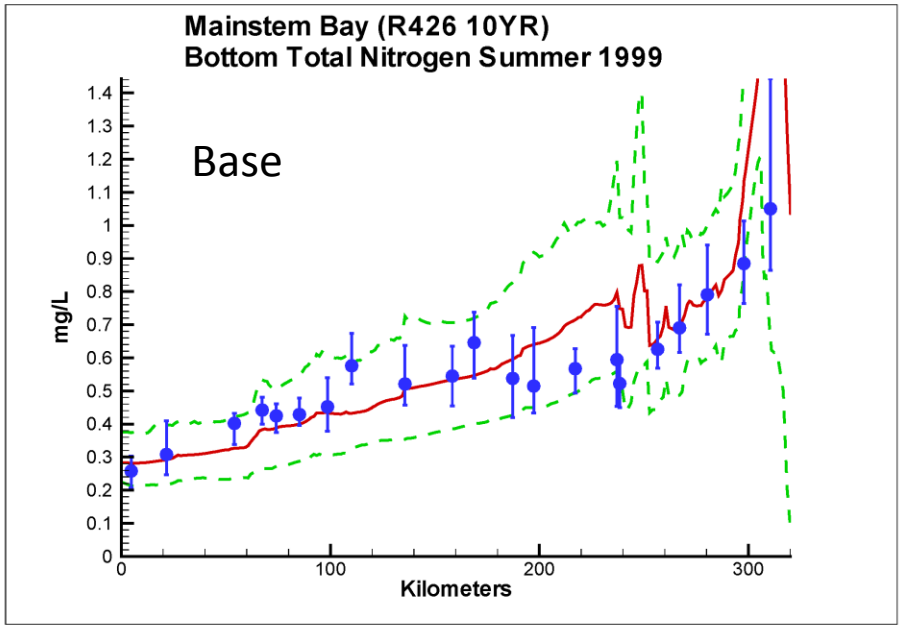


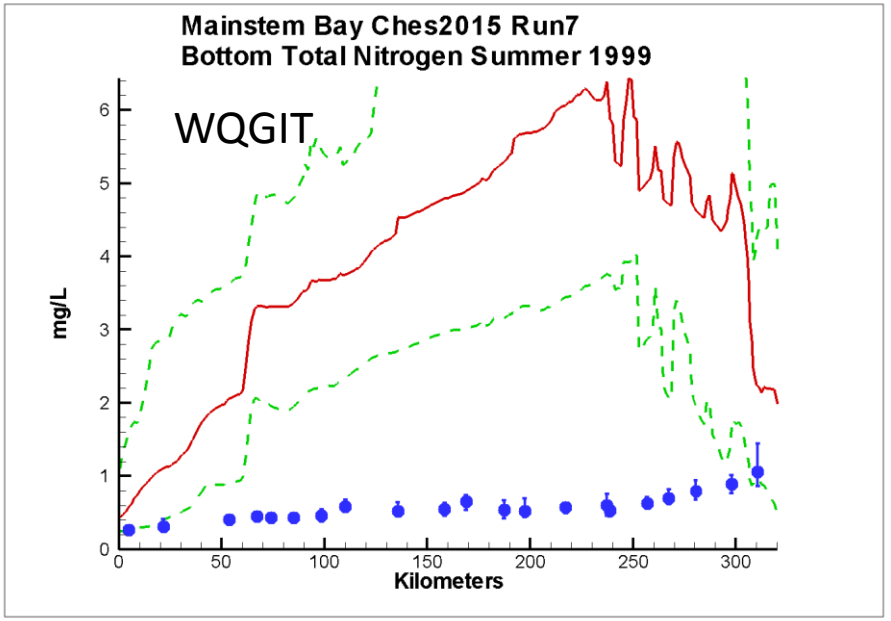
Routing Water Column P to Sediments

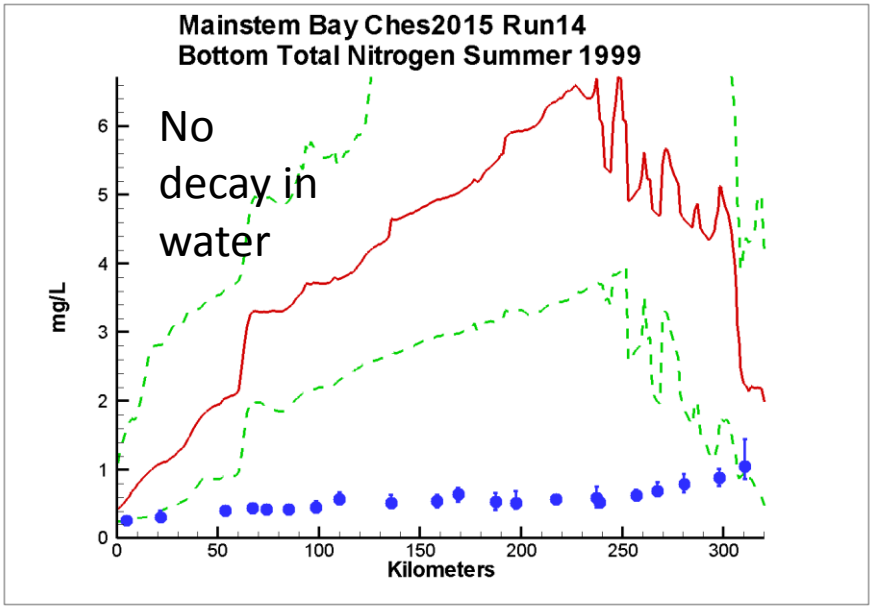


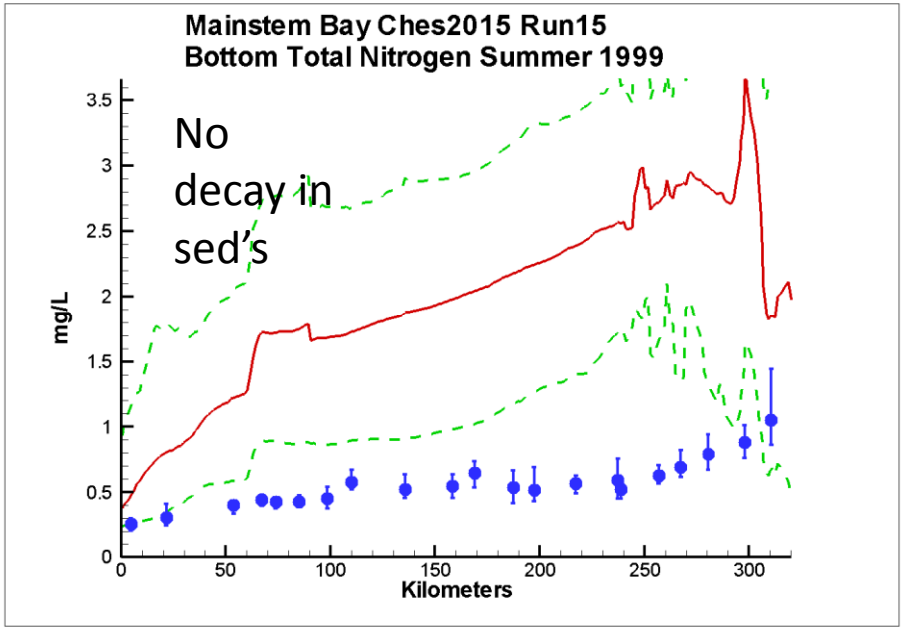
Sensitivity Runs

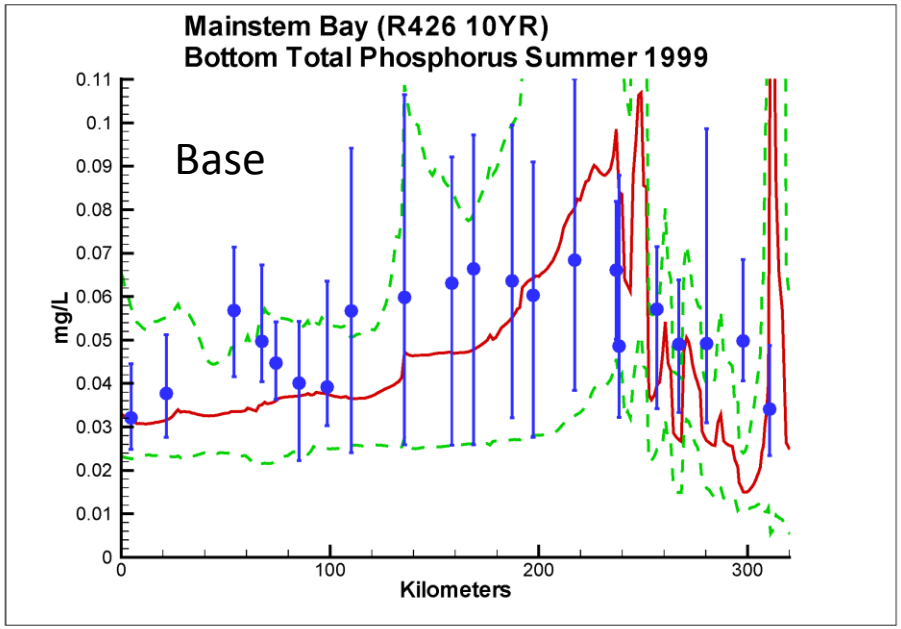
- Our base calibration of 1991 - 2000.
- Calibration plus nutrient bankloads.
- No decay of RPON, RPOP in water column.
- No decay of G2 nitrogen, phosphorus in bottom sediments.

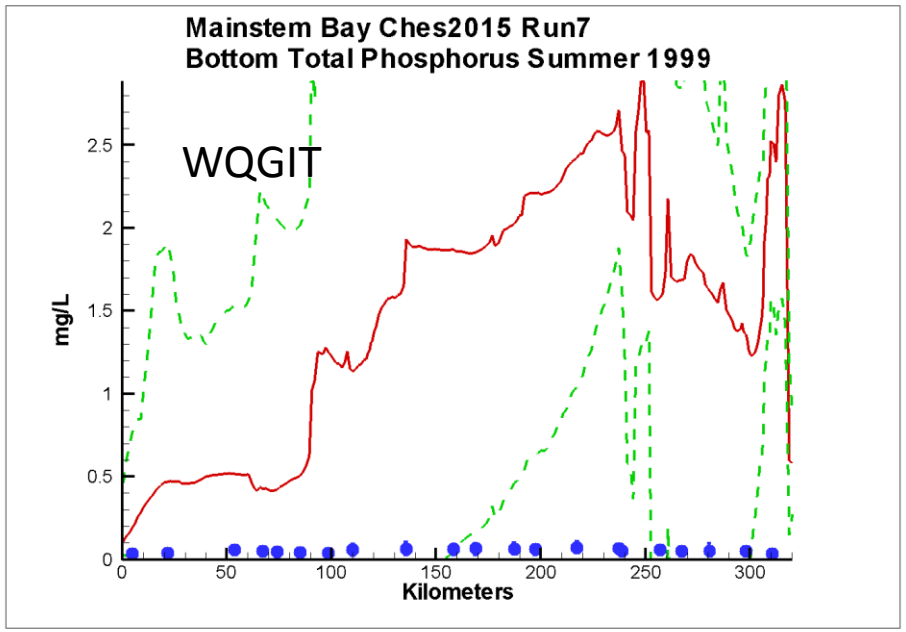

Mainstem Bay (R426 10YR)
Bottom Total Nitrogen Summer 1999
Base
mg/L
Kilometers

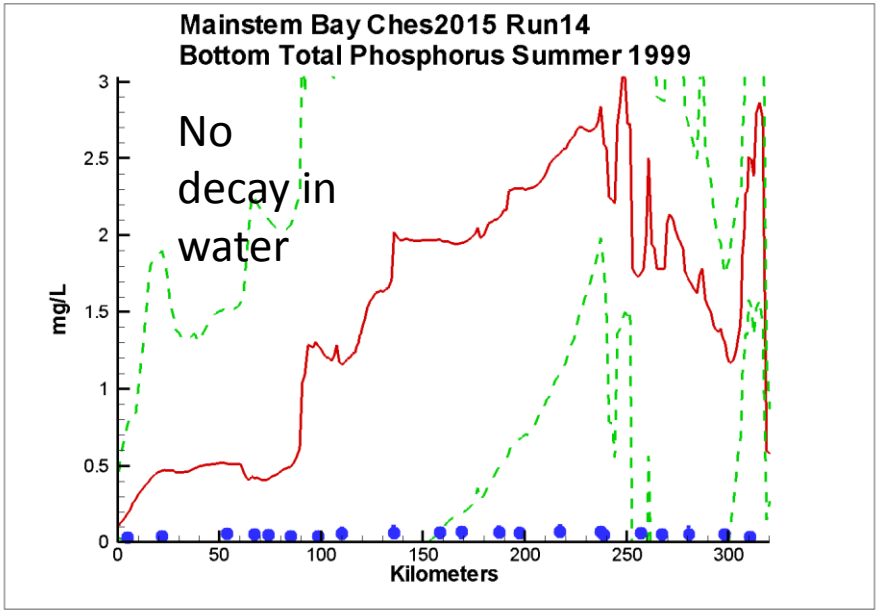

Mainstem Bay Ches2015 Run7
Bottom Total Nitrogen Summer 1999
WQGIT
mg/L
Kilometers

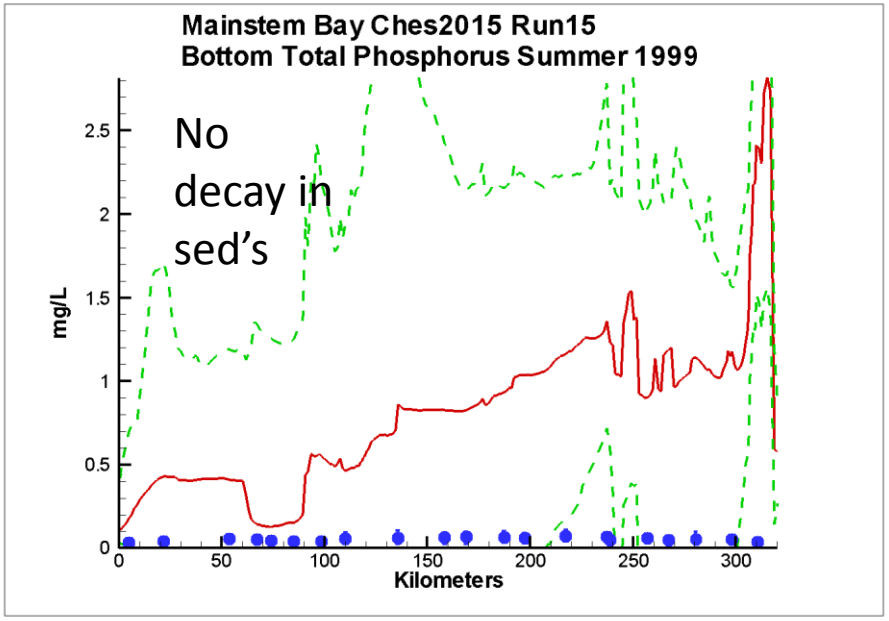

Mainstem Bay Ches2015 Run14
Bottom Total Nitrogen Summer 1999
No
decay in
water
mg/L
Kilometers

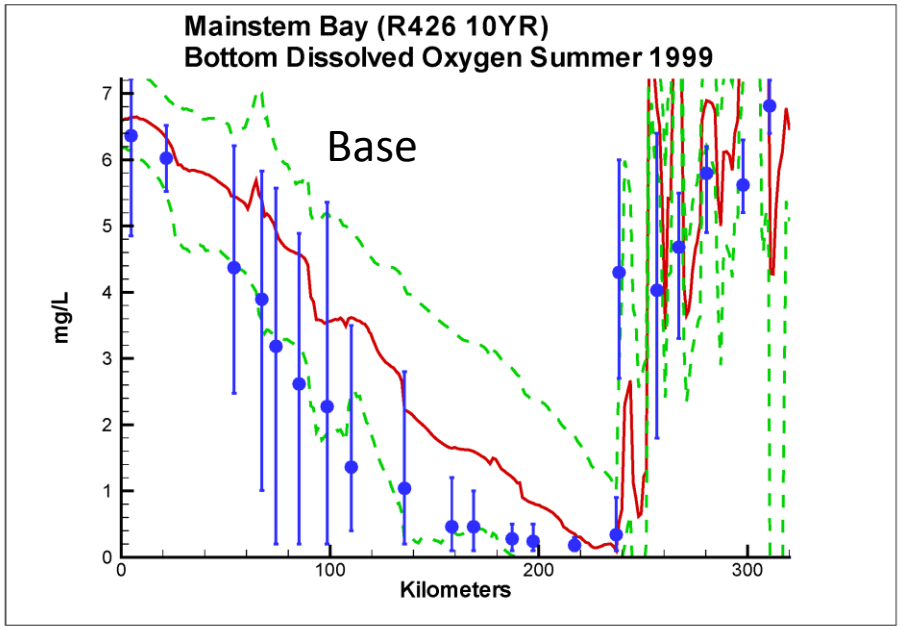

Mainstem Bay Ches2015 Run15
Bottom Total Nitrogen Summer 1999
No
decay in
sed's
mg/L
Kilometers

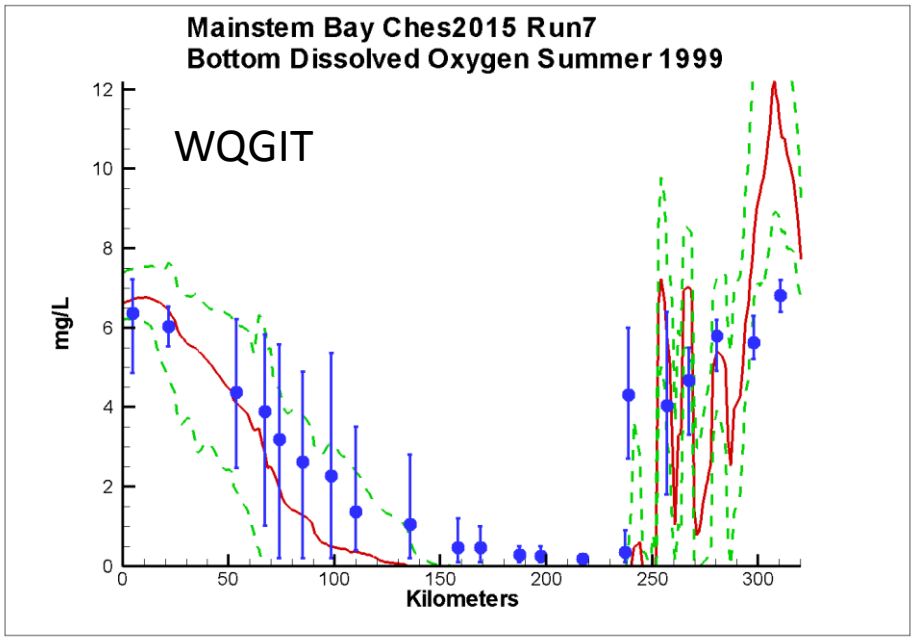

Mainstem Bay (R426 10YR)
Bottom Total Phosphorus Summer 1999
Base
mg/L
Kilometers

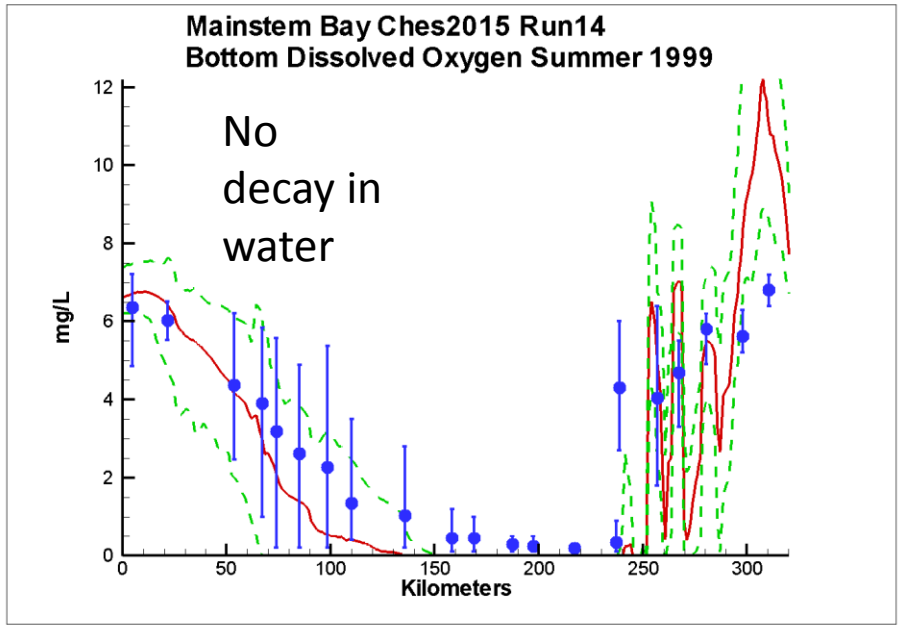

Mainstem Bay Ches2015 Run7
Bottom Total Phosphorus Summer 1999
WQGIT
mg/L
Kilometers

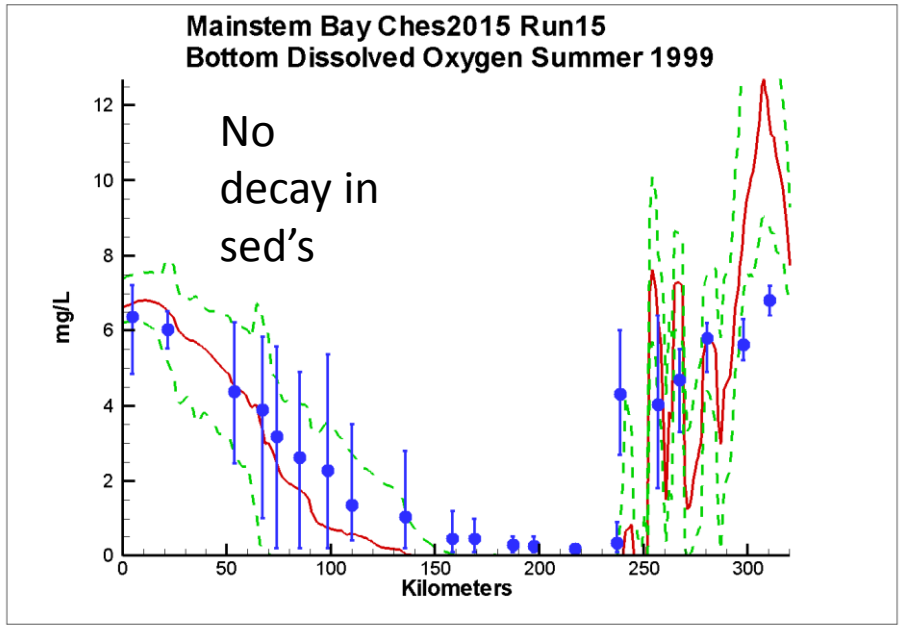

Mainstem Bay Ches2015 Run14
Bottom Total Phosphorus Summer 1999
No decay in water
mg/L
Kilometers

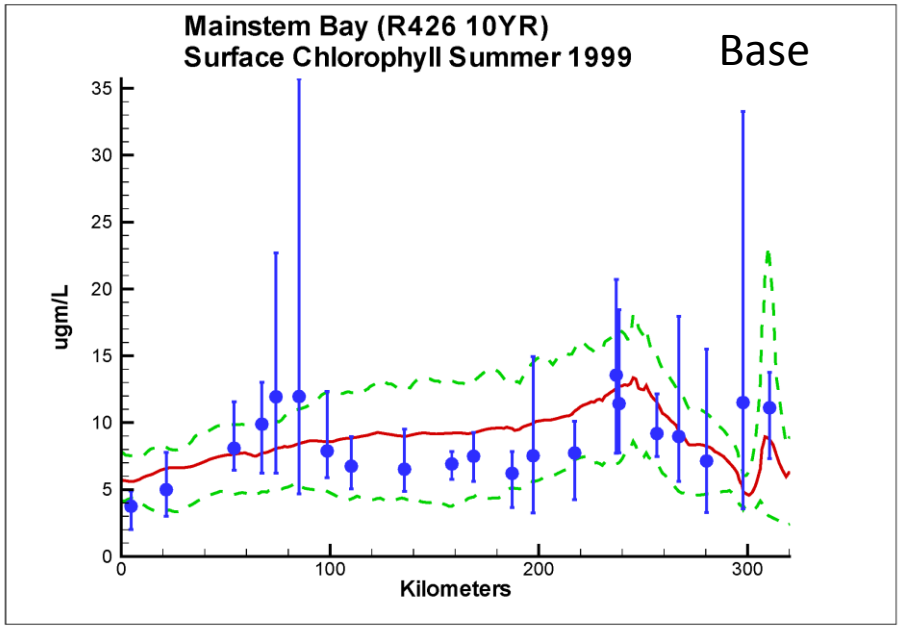

Mainstem Bay Ches2015 Run15
Bottom Total Phosphorus Summer 1999
No decay in sed's
mg/L
Kilometers

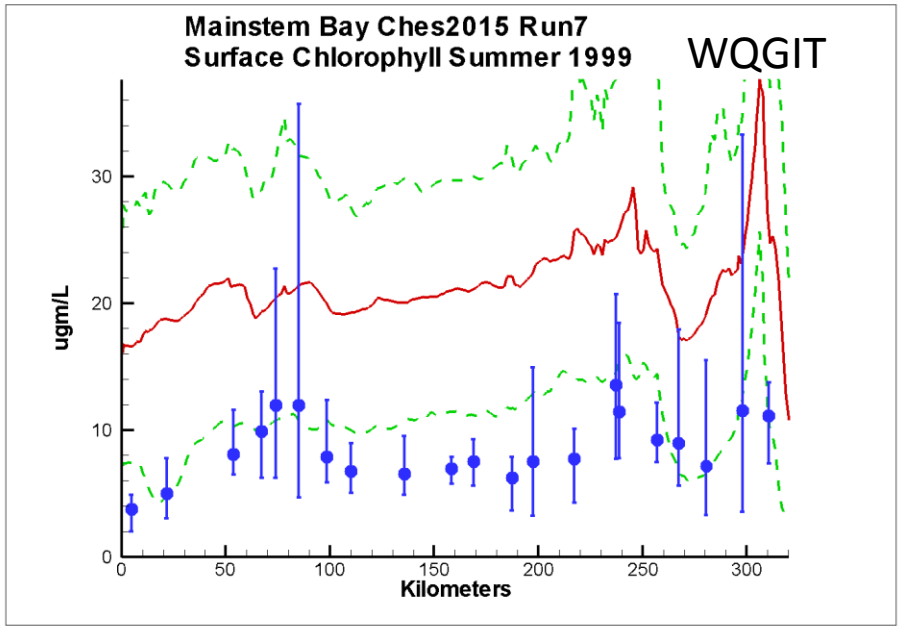

Mainstem Bay (R426 10YR)
Bottom Dissolved Oxygen Summer 1999
Base
mg/L
Kilometers

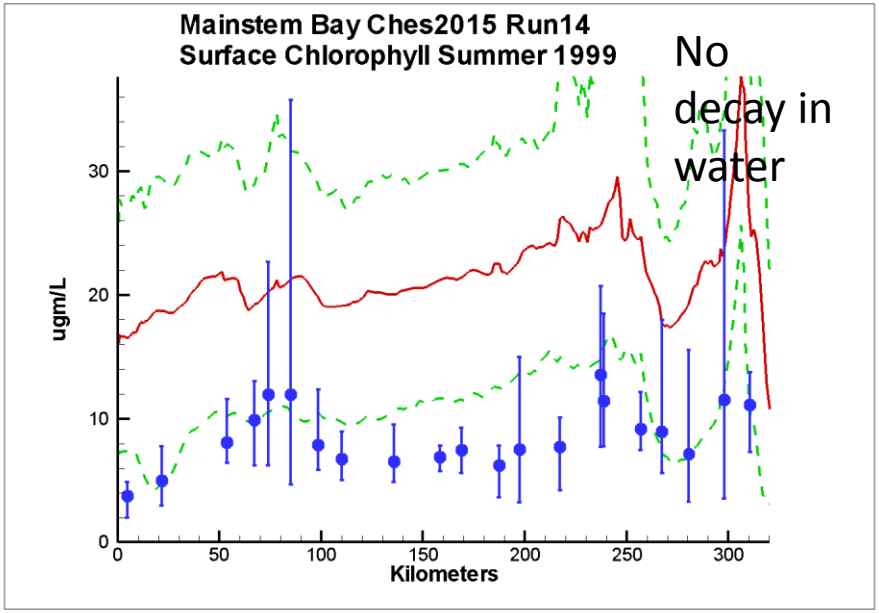

Mainstem Bay Ches2015 Run7
Bottom Dissolved Oxygen Summer 1999
WQGIT
mg/L
Kilometers

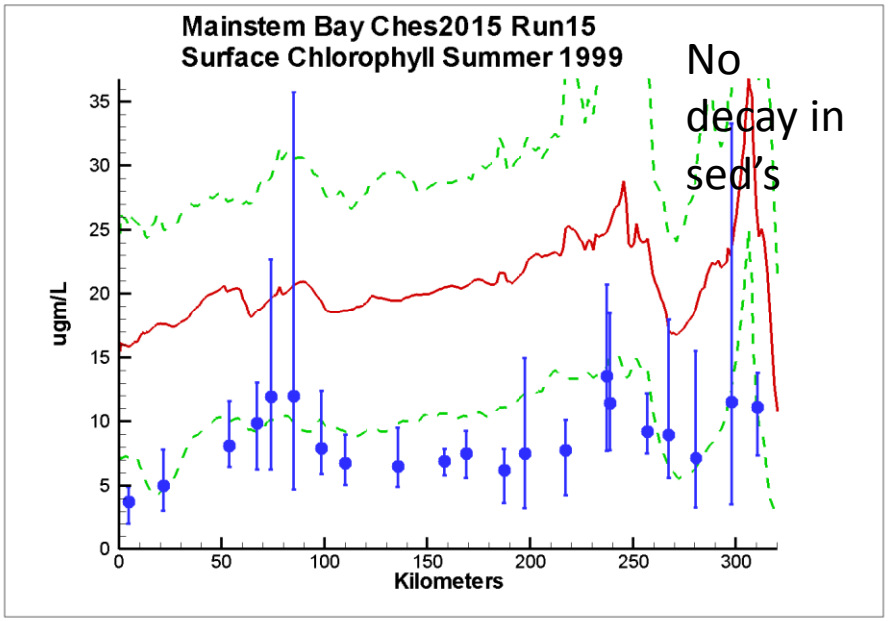

Mainstem Bay Ches2015 Run14
Bottom Dissolved Oxygen Summer 1999
No
decay in
water
mg/L
Kilometers

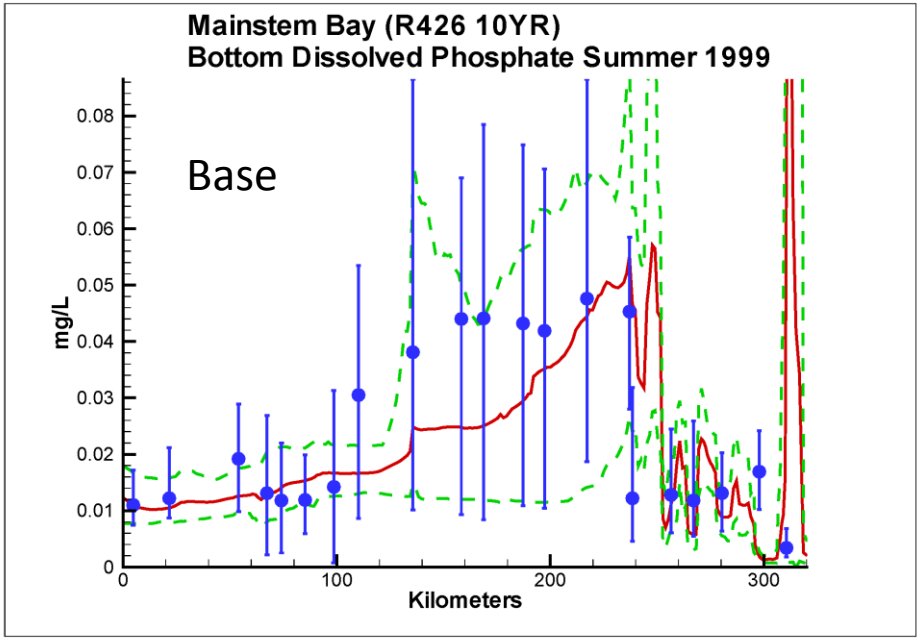

Mainstem Bay Ches2015 Run15
Bottom Dissolved Oxygen Summer 1999
No
decay in
sed's
mg/L
Kilometers

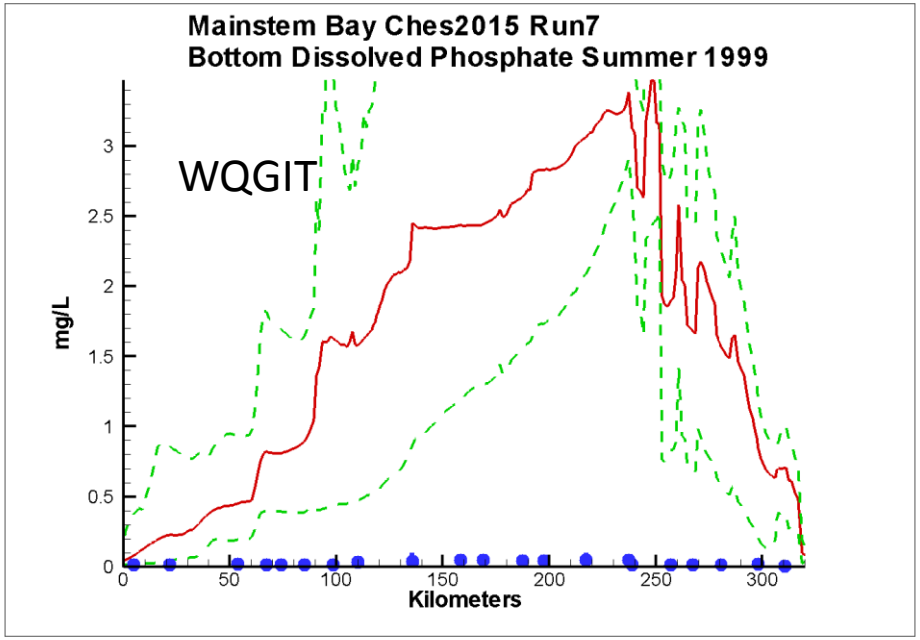

Mainstem Bay (R426 10YR)
Surface Chlorophyll Summer 1999
Base
ugm/L
Kilometers

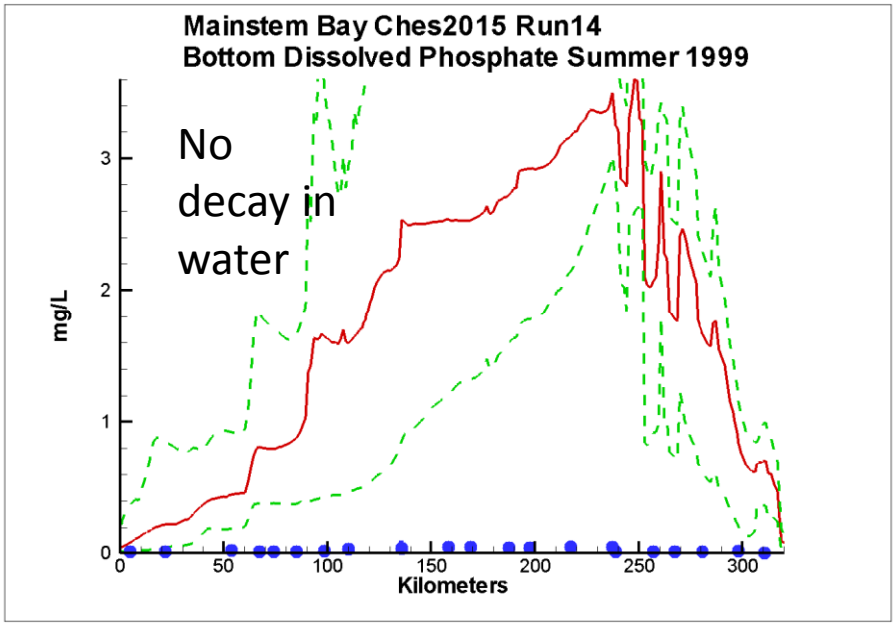

Mainstem Bay Ches2015 Run7
Surface Chlorophyll Summer 1999
WQGIT
ugm/L
Kilometers

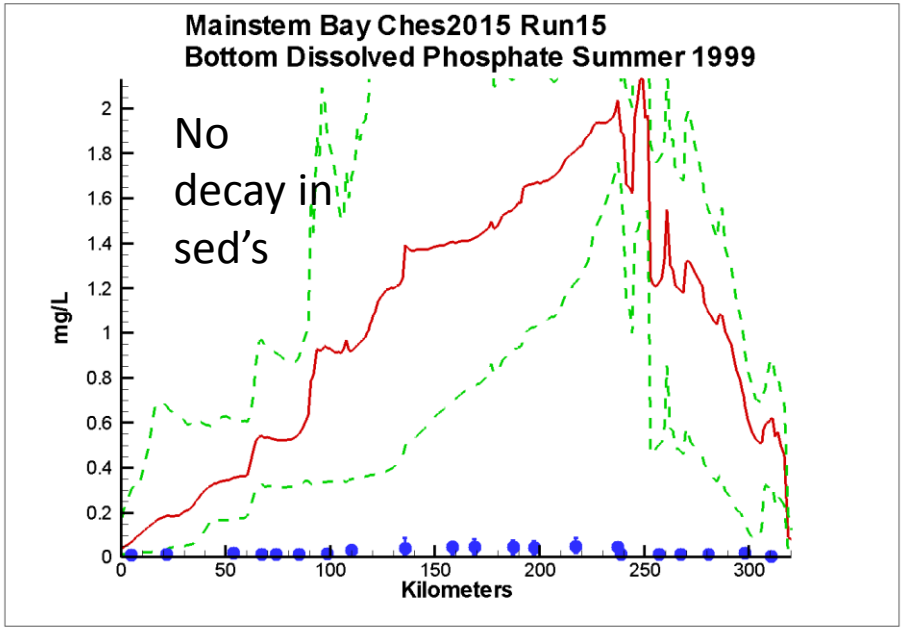

Mainstem Bay Ches2015 Run14
Surface Chlorophyll Summer 1999
No decay in water
ugm/L
Kilometers

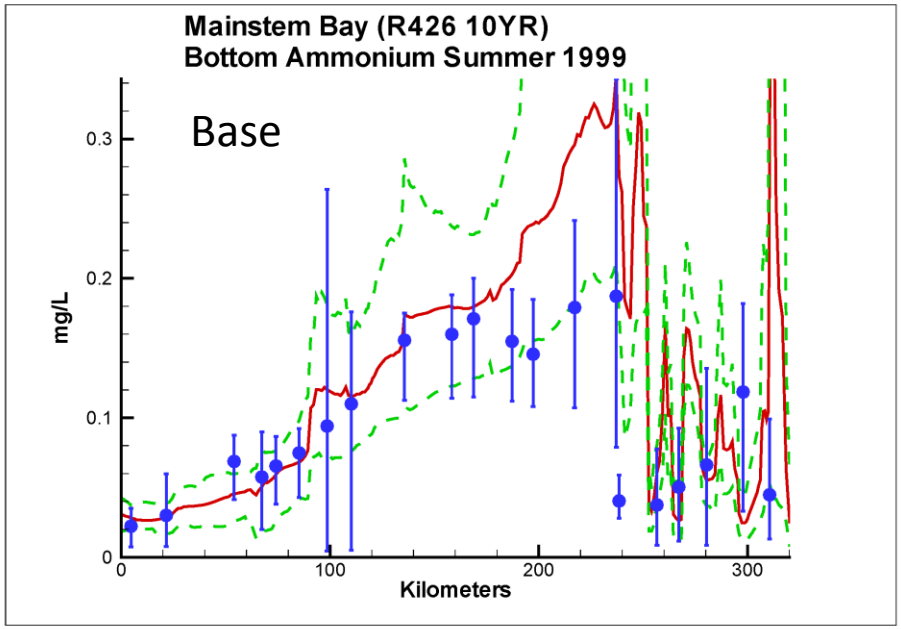

Mainstem Bay Ches2015 Run15
Surface Chlorophyll Summer 1999
No decay in sed's
ugm/L
Kilometers

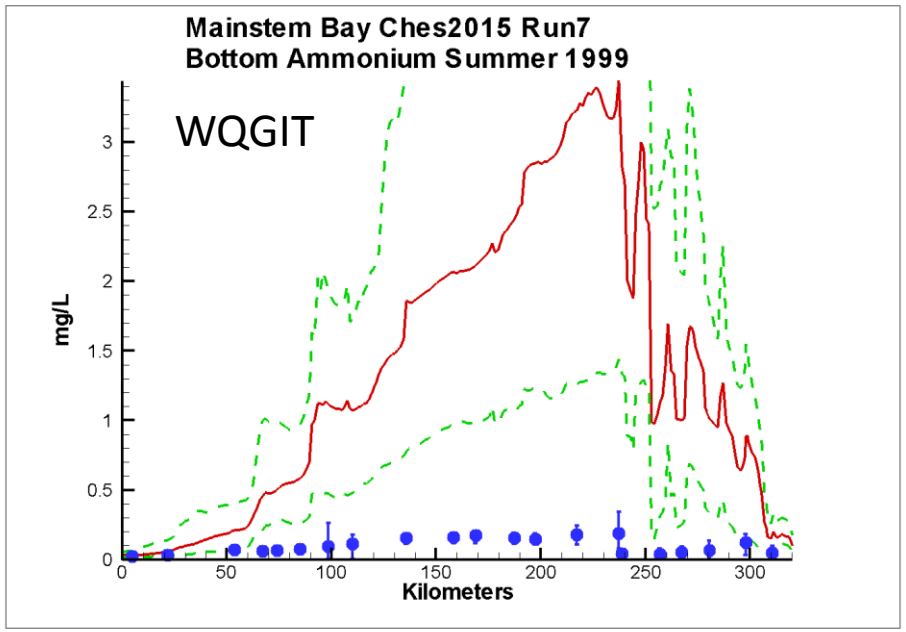

Mainstem Bay (R426 10YR)
Bottom Dissolved Phosphate Summer 1999
Base
mg/L
Kilometers

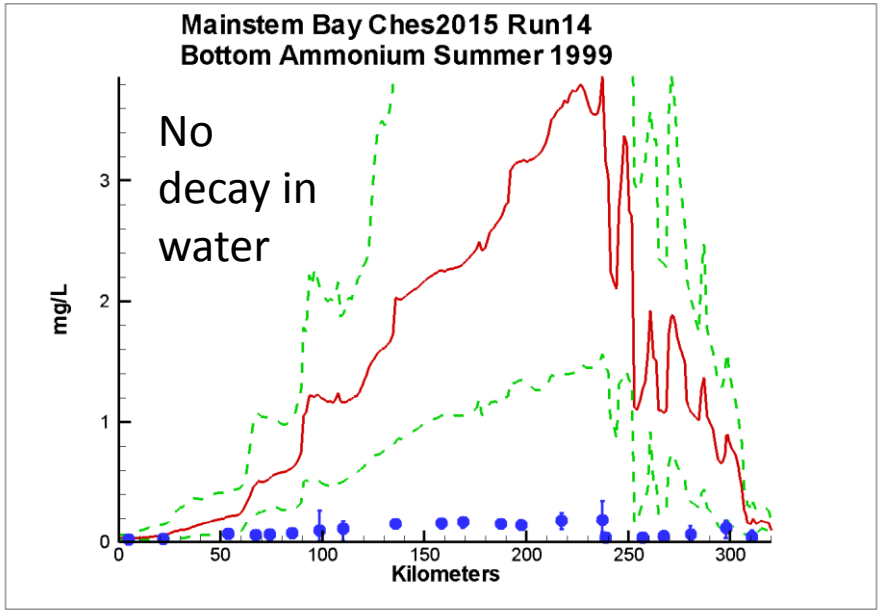

Mainstem Bay Ches2015 Run7
Bottom Dissolved Phosphate Summer 1999
WQGIT
mg/L
Kilometers

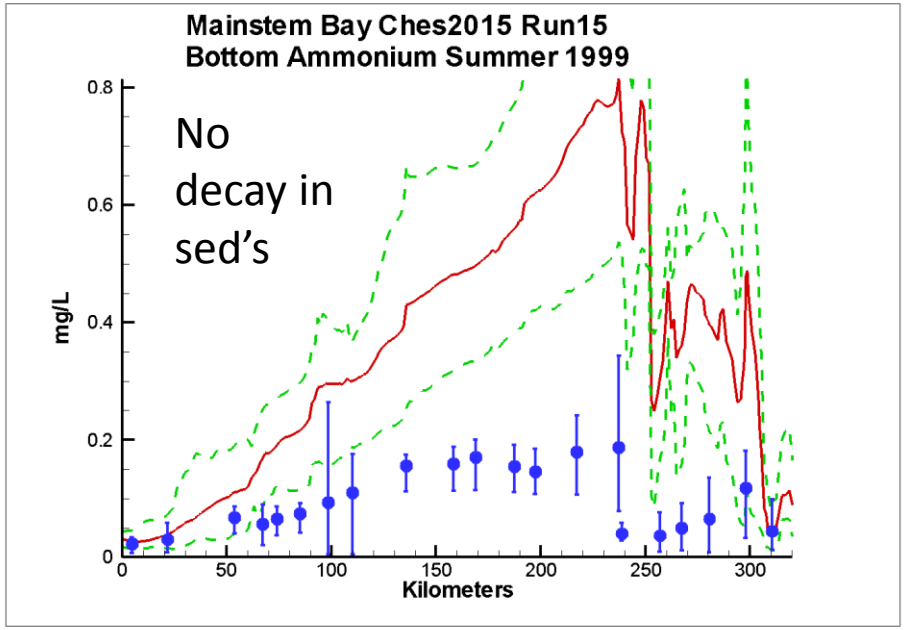

Mainstem Bay Ches2015 Run14
Bottom Dissolved Phosphate Summer 1999
No decay in water
mg/L
Kilometers

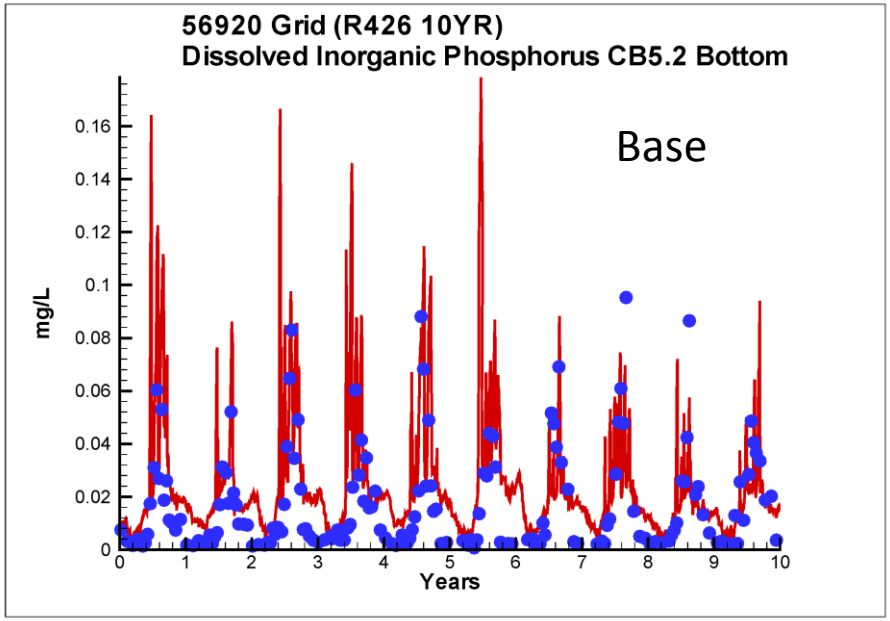

Mainstem Bay Ches2015 Run15
Bottom Dissolved Phosphate Summer 1999
No decay in sed's
mg/L
Kilometers

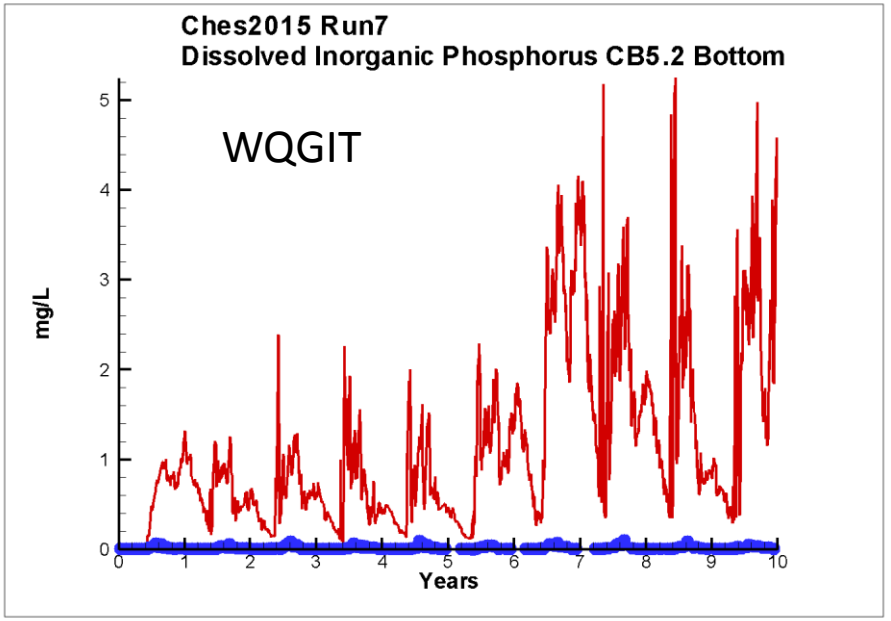

Mainstem Bay (R426 10YR)
Bottom Ammonium Summer 1999
Base
mg/L
Kilometers

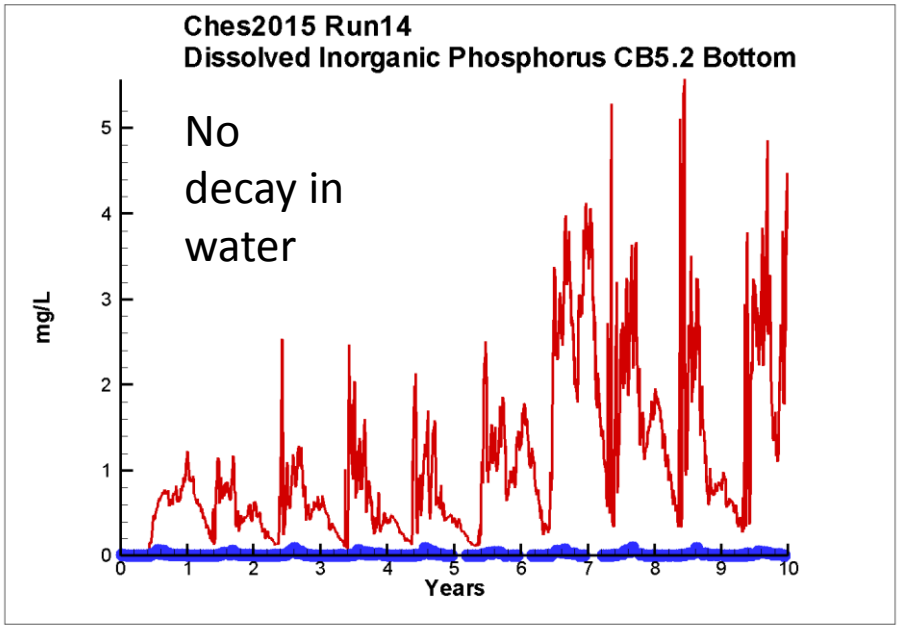

Mainstem Bay Ches2015 Run7
Bottom Ammonium Summer 1999
WQGIT
mg/L
Kilometers

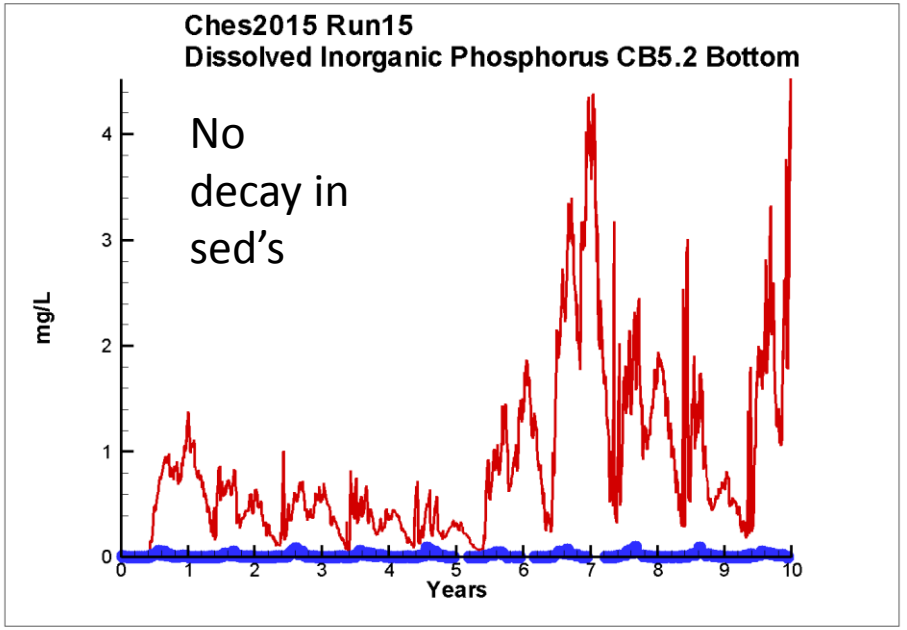

Mainstem Bay Ches2015 Run14
Bottom Ammonium Summer 1999
No decay in water
mg/L
Kilometers

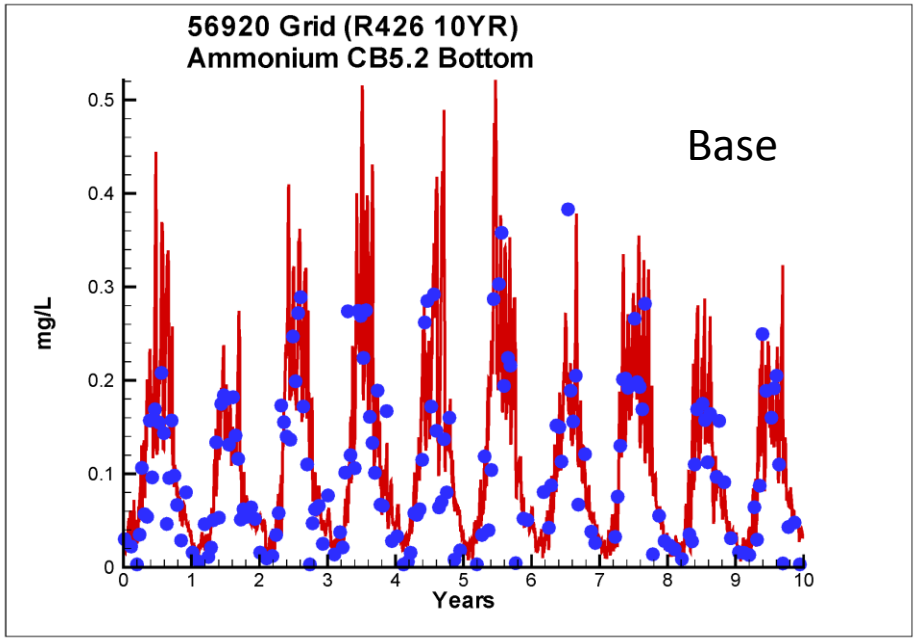

Mainstem Bay Ches2015 Run15
Bottom Ammonium Summer 1999
No decay in sed's
mg/L
Kilometers

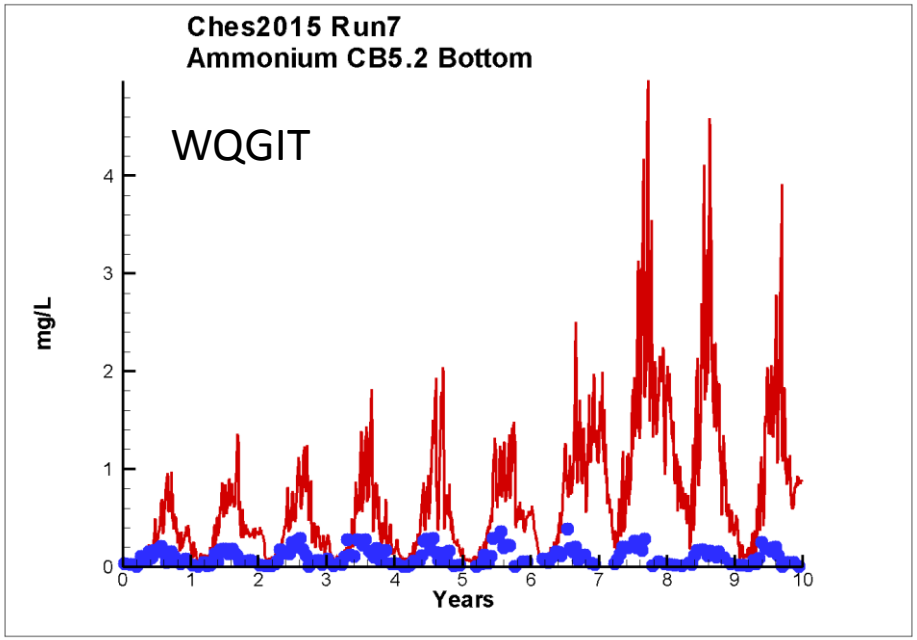

56920 Grid (R426 10YR)
Dissolved Inorganic Phosphorus CB5.2 Bottom
Base
mg/L
Years

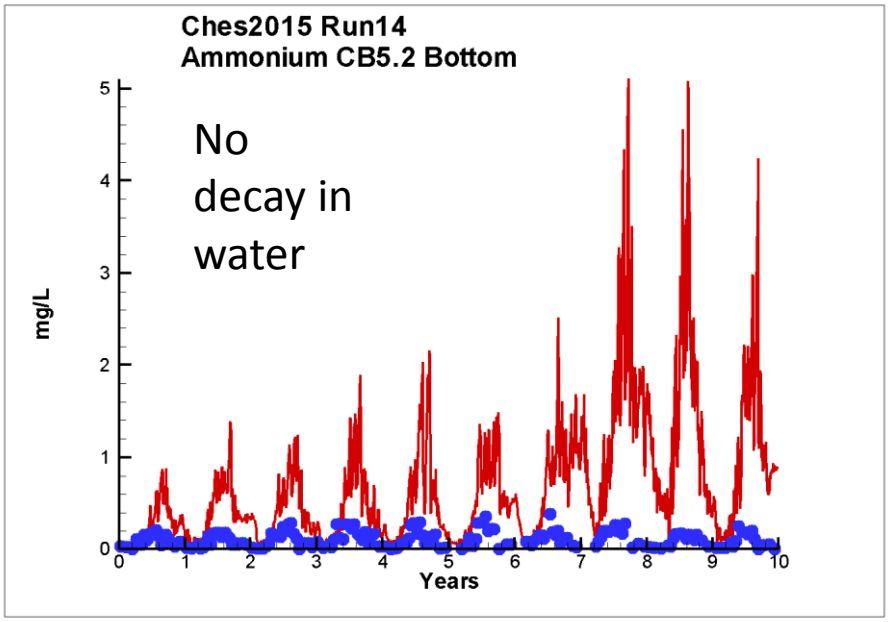

Ches2015 Run7
Dissolved Inorganic Phosphorus CB5.2 Bottom
WQGIT
mg/L
Years

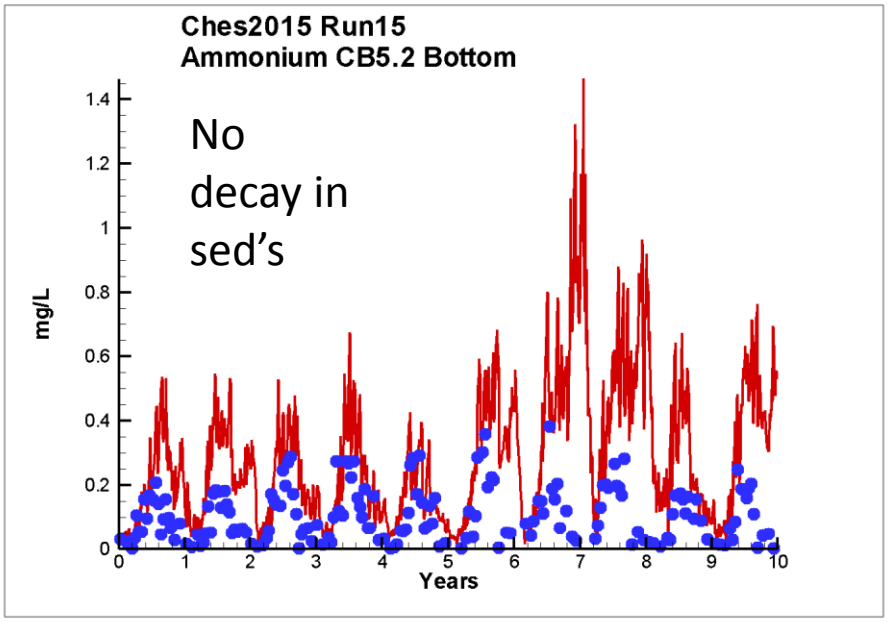

Ches2015 Run14
Dissolved Inorganic Phosphorus CB5.2 Bottom
No
decay in
water
mg/L
Years


Ches2015 Run15
Dissolved Inorganic Phosphorus CB5.2 Bottom
No
decay in
sed's
mg/L
Years

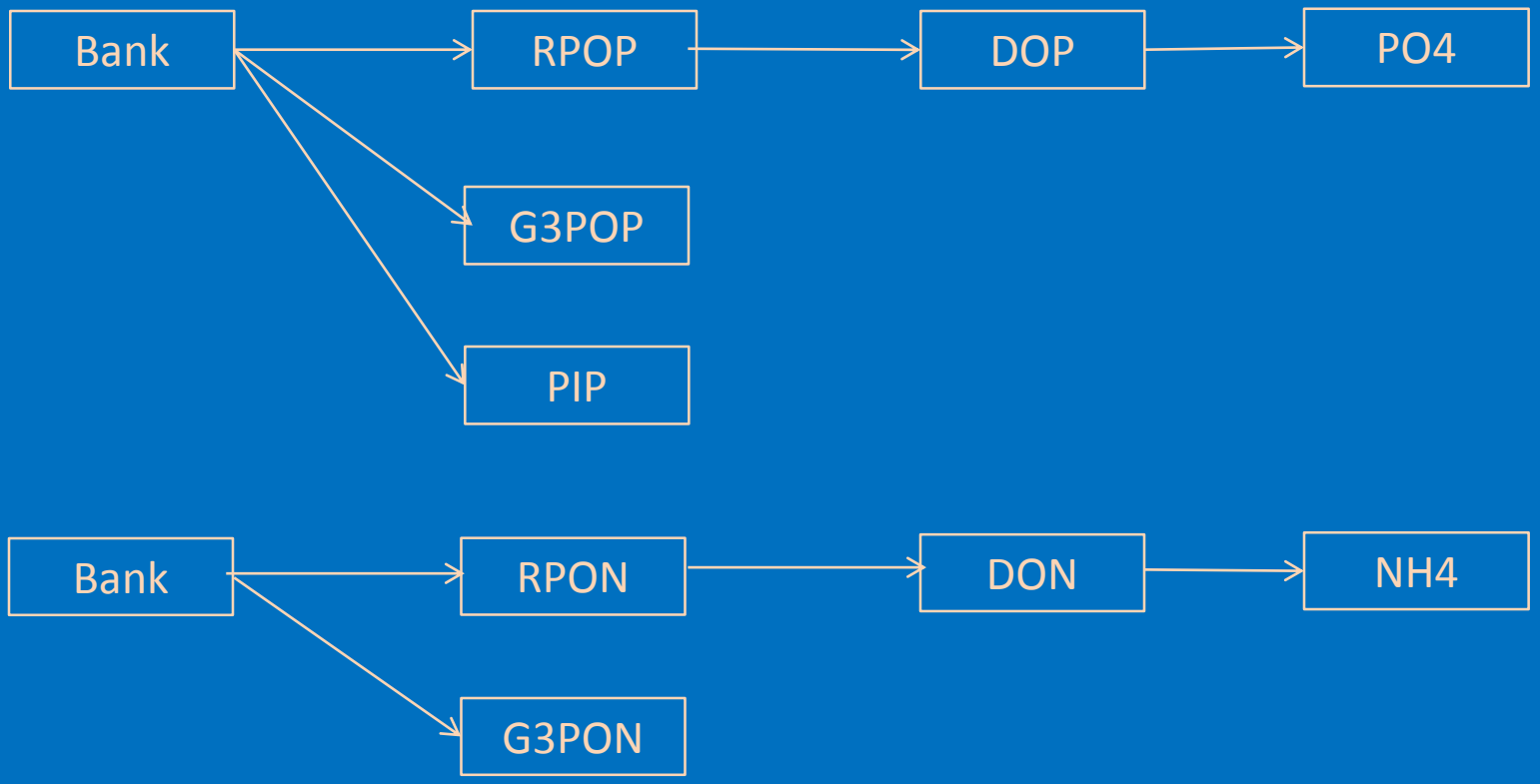

56920 Grid (R426 10YR)
Ammonium CB5.2 Bottom
Base
mg/L
Years


Ches2015 Run7
Ammonium CB5.2 Bottom
WQGIT
mg/L
Years

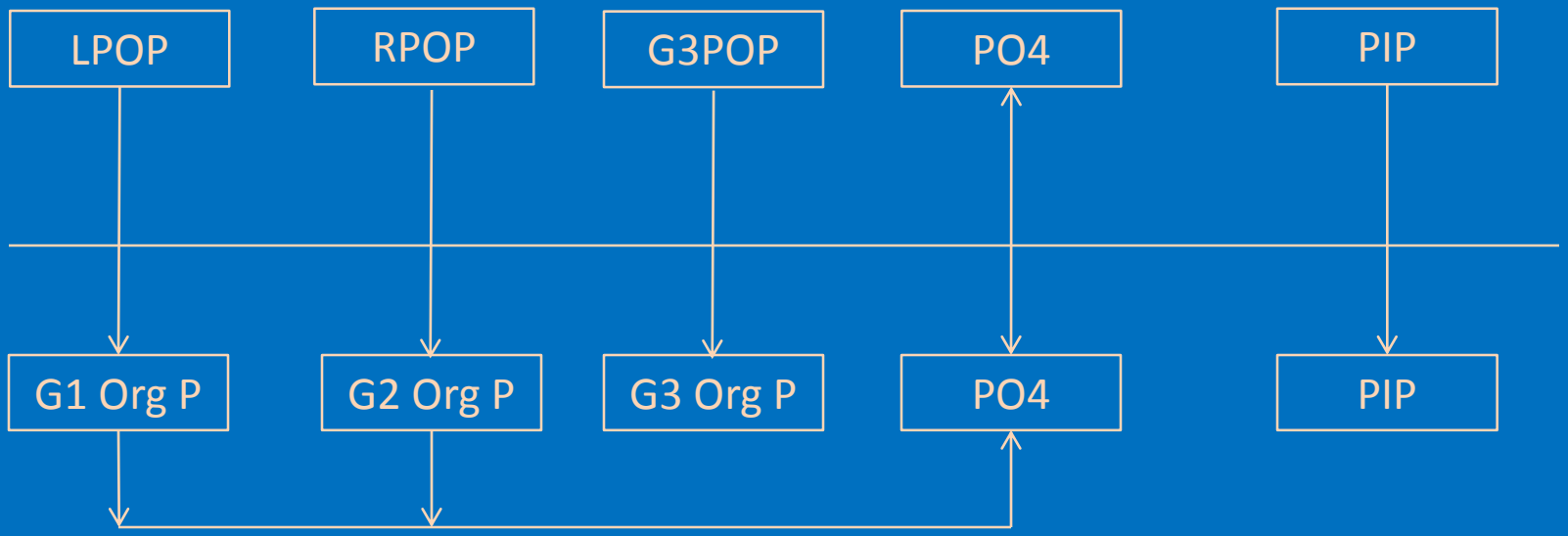

Ches2015 Run14
Ammonium CB5.2 Bottom
No
decay in
water
mg/L
Years


Ches2015 Run15
Ammonium CB5.2 Bottom
No
decay in
sed's
mg/L
Years

Revised Routing of Bankloads to Water Column



Revised Routing of Water Column P to Sediments



Discussion

- We seem to have reached a limit on reactive P loading to the system. We have been using “fixes” like PIP to limit the amount of reactive P. If we introduce more reactive P (e.g. bank loads) we are going to have to reduce the reactivity of P from somewhere else. Watershed? Algal mortality? This means model recalibration.
- The phosphorus model is a vast simplification of the processes in the Bay. It’s unclear what advances we can make in this phase of the modeling effort.
- We lack the necessary data to accurately partition P loads into appropriate categories.

Discussion

- The magnitude of bank P loads is significant relative to TMDL loads. They also occur distant from conventional loads in tributaries and point sources.
- We could make the bankloads 100% inert. Make them all an inert PIP form, for example. This P would float around and do nothing. But managers might wind up giving credits for reducing inert P loads.
- There are multiple reasons for installing G3 organic matter into the water column. Resuspension in the present model is a real problem. Let's do it right.