Development of Water Quality Standards for Willard Spur

Summary of Science Panel Presentations

Compiled from all Investigator’s Presentations 1/28/13

January 29, 2013

Willard Spur Science Panel
Meeting Objective

• Science Panel focused upon:
  1. Have we answered the questions we posed?
  2. Do we have an adequate understanding of the system to make a recommendation?
  3. What do we need to do to make a recommendation?
Monday’s Agenda

• Heard updates on:
  1. Hydrology & Nutrient loading (CH2M HILL)
  2. Water chemistry (Jeff Ostermiller, Toby Hooker, Mike Shupryt)
  3. Macroinvertebrates (Dr. Larry Gray)
  4. Nutrient cycling Study (Dr. William Johnson, Dr. Heidi Hoven, Dr. Ramesh Goel, Dr. David Richards, Dr. Sam Rushforth, Sarah Jane Rushforth, Joel Pierson, Ramin Nasrabadi, Mitch Hogsett, Sarah Kissell)
Tuesday’s Agenda

• Focused upon:
  1. Defining objectives and framework for nutrient cycling study
  2. Reviewing and narrowing down the “wish list”
Hydrology

• What are the hydrologic characteristics of Willard Spur?
  – Inflows & Outflows
    • *Outflows measured twice – reflected inflows very well*
    • *Outflows governed by inflows, “natural weir”, and GSL water level*
    • *“Natural weir” appears to be at 4201.8ft*
  – Water levels
• Does the Plant flow reach WS?
Very Wet Year
2012 Inflow Summary

Very Dry Year

Outflow measurement: 65 cfs on 5/17/2012
2012 Willard Spur Water Levels

USGS site not connected to Willard Spur from approx. 7/19 to 10/30

WS2 transducer is 0.54 ft above bottom, water depth on 8/23

WS6 considered to be best reflection of water level at lowest levels

Willard Spur still flowing into Bear River Bay on May 17 but not on May 23

WS2 Bottom Elevation - 4200.34ft  WS12 Bottom Elevation - 4200.19ft  WS6 Bottom Elevation - 4200.13ft

WS12 transducer is 0.39ft above bottom, water depth on 5/17 measured as 0.23 ft
When does the Plant’s flow reach Willard Spur?
Nutrient Loading

• What are the sources of nutrients entering Willard Spur and what is the relative significance of these sources?
  – Note: these pie and bar charts all assume that the full nutrient load from the Plant reaches the open water of Willard Spur. There is indication that there is uptake in the ditch/wetlands upstream of the open water as well as the effluent possibly evaporating prior to reaching Willard Spur. Thus, these comparisons of load contribution should be considered to be conservative and likely over-estimate the contribution of the Plant at this point. Work in 2013 will verify the nutrient uptake and evaporation questions and allow refinement of loads.
Total Nitrogen Loading - 2012

- April 2012
- May 2012
- June 2012
- July 2012
- August 2012
- September 2012
- October 2012
- November 2012
Nutrient Loading

- What are the nutrient loads in the effluent with and without nutrient removal process at the Plant?
Nutrient Loading

• Does the Plant’s load have an impact on Willard Spur?
• On an annual basis it does not appear to have a significant impact.
• It may have an impact if:
  – Full load reaches open water during critical months during critical hydrologic years
Water Chemistry

- We saw higher salinity and water temperature in 2012 vs 2011
- We saw the organic nutrient pool in Willard Spur increase during the year in 2012
- We saw inorganic nutrients only significant near inflow sites; but dissipated quickly
  - Nutrients appear to be assimilated quickly
3. Water Column Dissolved Nutrient Pools

- Inorganic N and P pools are generally low
  - Except for sites near inflows

- Given the seasonal increases in TN and TP, this suggests that:
  - Inorganic nutrient cycling is tight (i.e., available nutrients are rapidly taken up)
  - Nutrient fluxes from inflows are rapidly assimilated within the Open Water sites
Pelagic Nutrient Limitation

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Biological Response

• We saw a much higher biological response in 2012
• Higher increase in chl-a
• Decline in SAV was sooner and coincided with the chl-a and organic nutrients
• Indicates that internal nutrient cycling is very important
Does the plant represent a threat to the Spur?

Probably not, at least immediately…
- Any effects—positive or negative—are small and local
  - Importance of local cycling vs. all external inputs
  - Size of discharge small relative to other sources
- Ecological resilience
- Any deleterious effects are likely to be local
  - i.e., rapid uptake of nutrients
- Yearly flushing flows probably decreases accumulation through time
- N-limitation thresholds suggest that were at ~50% assimilative capacity
  - but more work needed
Macroinvertebrates

- Patterns we saw in 2012 reflect other observations in Willard Spur
- Reflect decline of SAV very well
% PMI (open-water sites): 2011 & 2012

Willard Spur: % PMI (open-water sites)

0 10 20 30 40 50 60
2012 2011
Relative abundance of Cladocera
Fish, Birds & Vegetation

• Draft reports are complete and being reviewed by Science Panel
• Fish studies/review complete
• Still finishing review of historical bird survey data
• Vegetation work is largely complete
Nutrient Cycling Study

• We were able to discern the effect of nutrient amendments within the test plots
• We saw that nutrients in water column are rapidly “consumed”
• We see that SAV derive much of their nutrients from the sediment
• We saw many of the same patterns we saw throughout Willard Spur
Nutrient Cycling Study

- We saw that a critical period of response is April-May during a dry year
- We identified a number of key indicators in SAV that we want to follow in 2013
How it fits together

• Best means of explaining all of the patterns is to see it

• Bottom line – observations fit together remarkably well

• Note that vertical scale on following slide is only relevant within the particular level you are looking at. Purpose of slide is to show how the system’s responses are interrelated
Chl-a, TDS, TSS, POP, NH4 all increase.

TN and TP water column nutrient pool generally increases.

No Outflow – “stagnant” conditions.

Plant flow likely didn’t reach Open Water.

Inflow

Total Cover

SAV Condition

Epiphytes

Peak Algal Mat

Chironomid Peak

Phytoplankton

Snails

Moina

S&S

% PMI

Macroinvertebrate total count

2012

2012