Development of Water Quality Standards for Willard Spur

Steering Committee Meeting

July 10, 2014

Photo:Josh Noble

Agenda

1. **Overview of the July 9 Science Panel meeting**
2. **Discussion of regulatory options**
   – Attributes discussed
3. **Schedule Overview**

Development of Water Quality Standards for Willard Spur

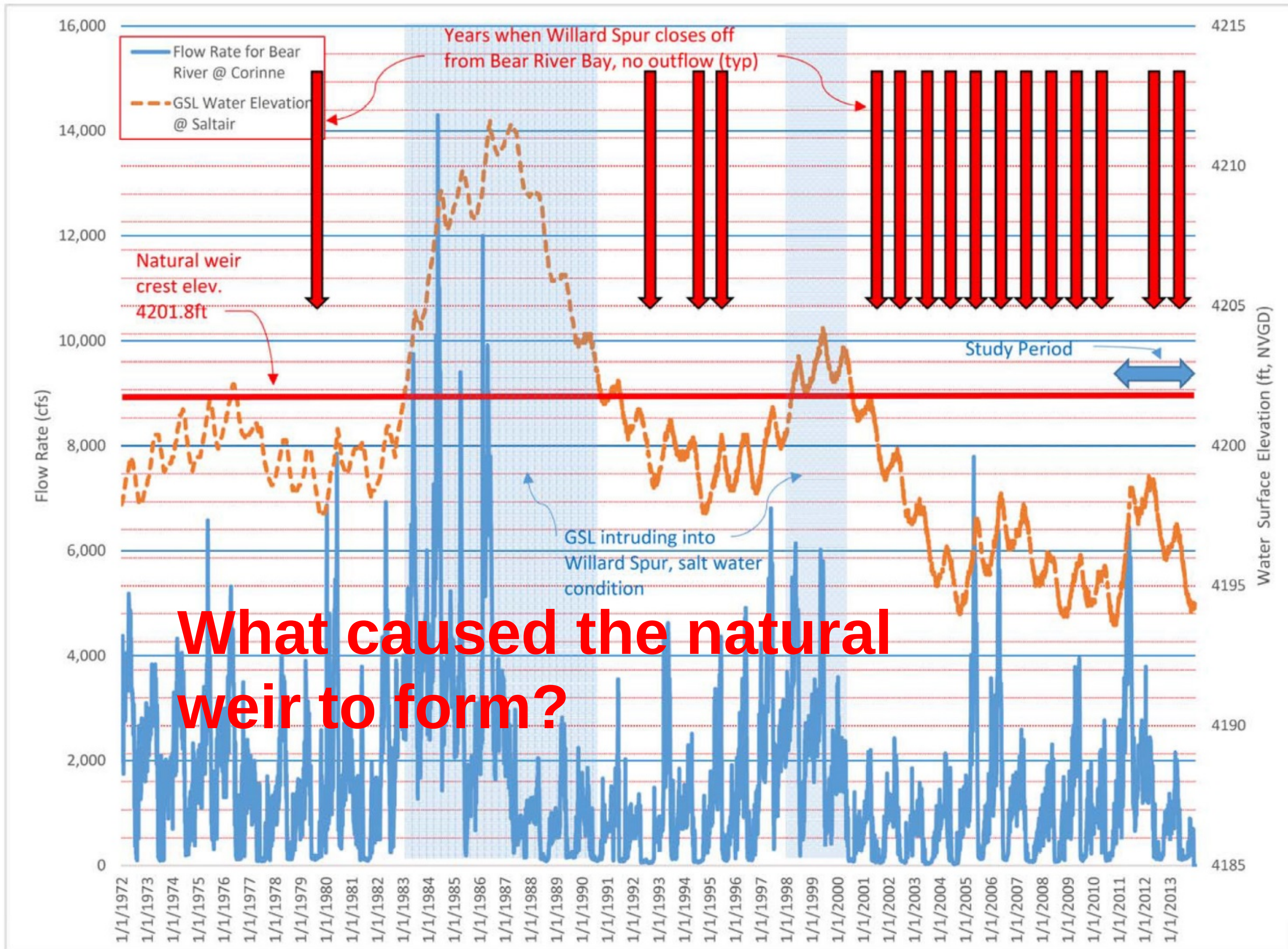
What are the Impacts from the Plant?

Key Observations - Uses

- **What are the key beneficial uses we observed in Willard Spur?**
  - Primary and secondary recreation
  - Waterfowl & Shorebirds
  - Warm-water fishery
  - Other water-oriented wildlife
  - Necessary food chain for fish and wildlife
    - *Fresh water invertebrates*
    - *Algae, emergent and submerged vegetation*

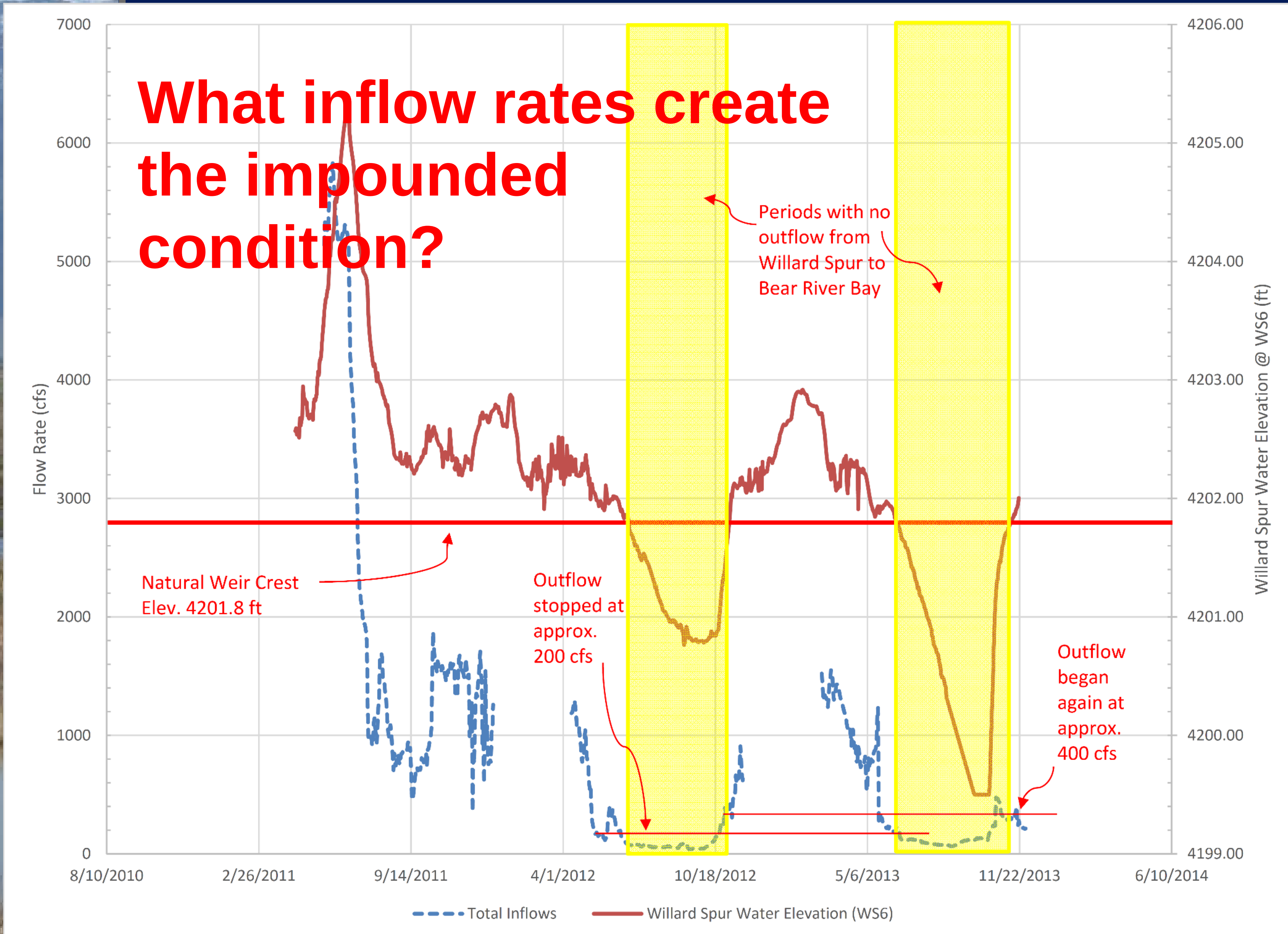
Key Observations - Hydrology

- **Very dependent upon dynamic inflows**
  - Dominated by Bear River flows, spring runoff
  - Water levels and conditions depend upon it
- **Typically two flow regimes per year**
  - Flowing and impounded, controlled by natural weir
  - "Flushing" flows from October-May seem to reset clock

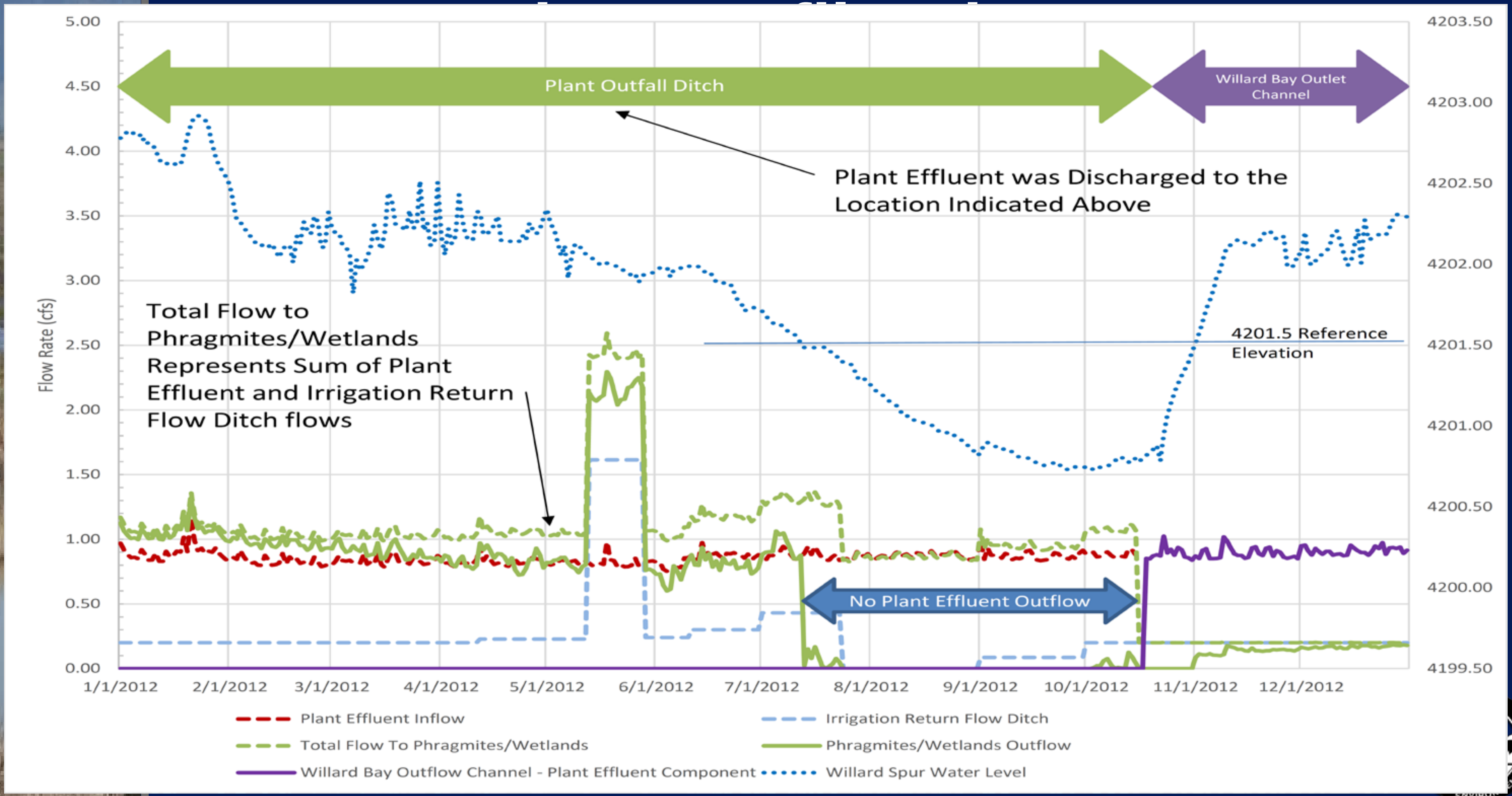


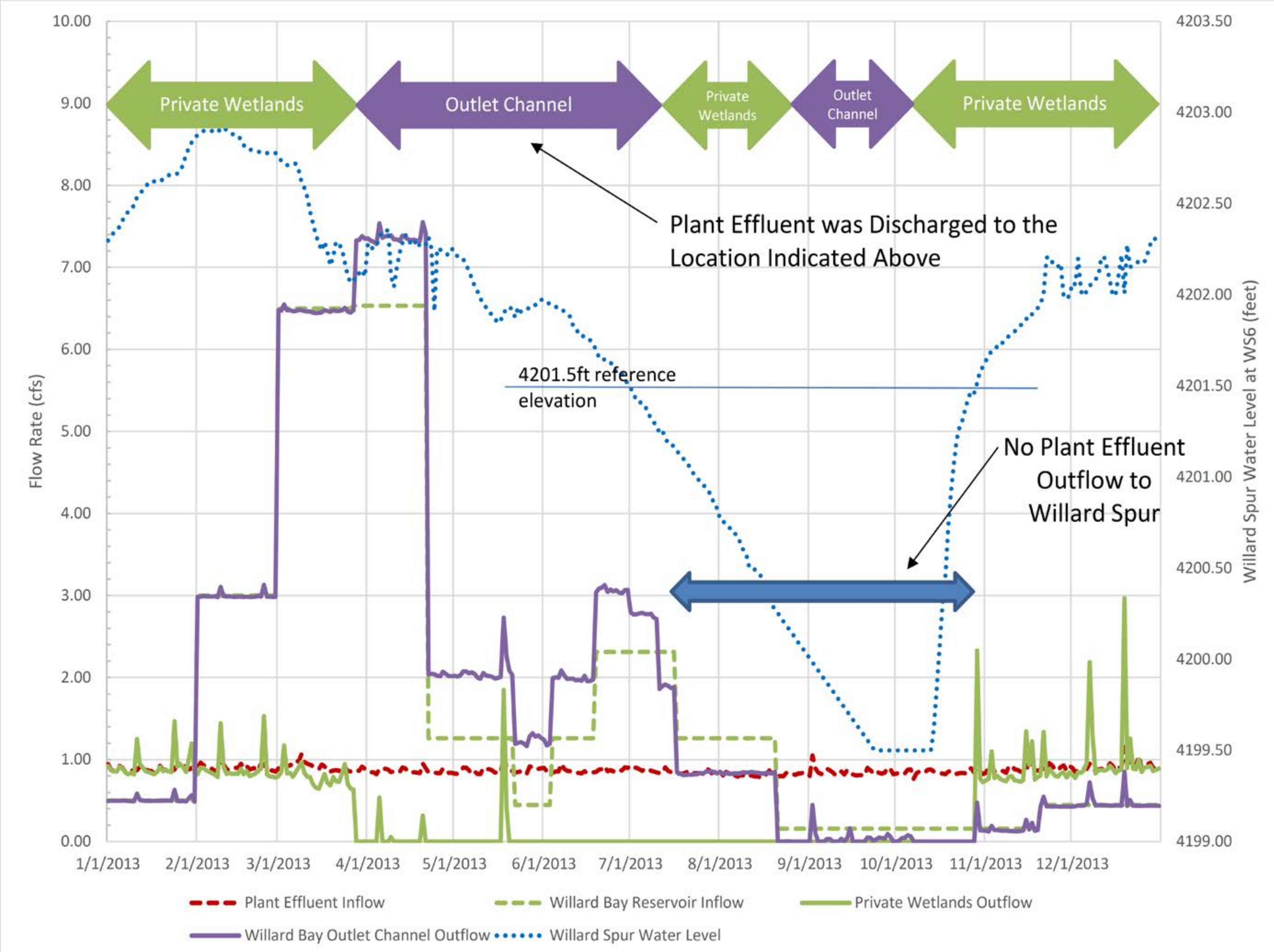
What caused the natural weir to form?

What inflow rates create the impounded condition?



Infiltration appears to be a significant factor in why the effluent didn't reach the open water





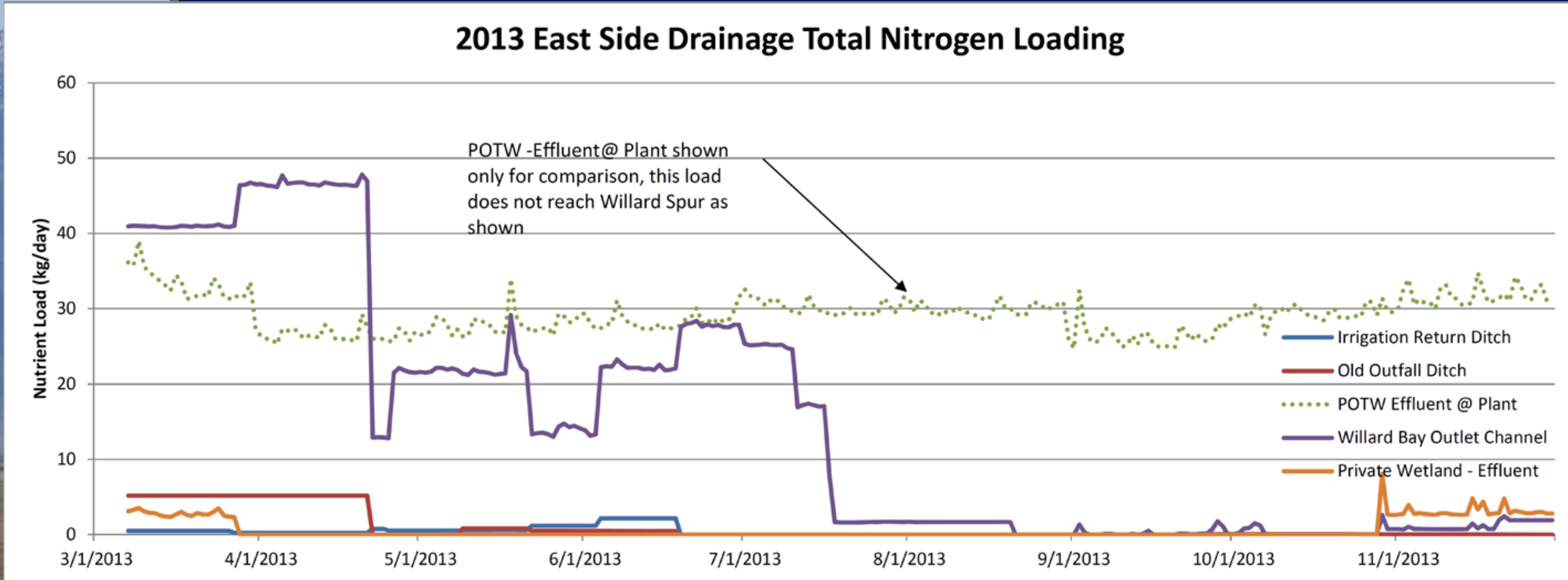
Private Wetlands
Outlet Channel
Private Wetlands
Outlet Channel
Private Wetlands
Plant Effluent was Discharged to the Location Indicated Above
4201.5ft reference elevation
No Plant Effluent Outflow to Willard Spur
Flow Rate (cfs)
Willard Spur Water Level at WS6 (feet)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
4203.50
4203.00
4202.50
4202.00
4201.50
4201.00
4200.50
4200.00
4199.50
4199.00
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
10/1/2013
11/1/2013
12/1/2013
Plant Effluent Inflow
Willard Bay Reservoir Inflow
Private Wetlands Outflow
Willard Bay Outlet Channel Outflow
Willard Spur Water Level

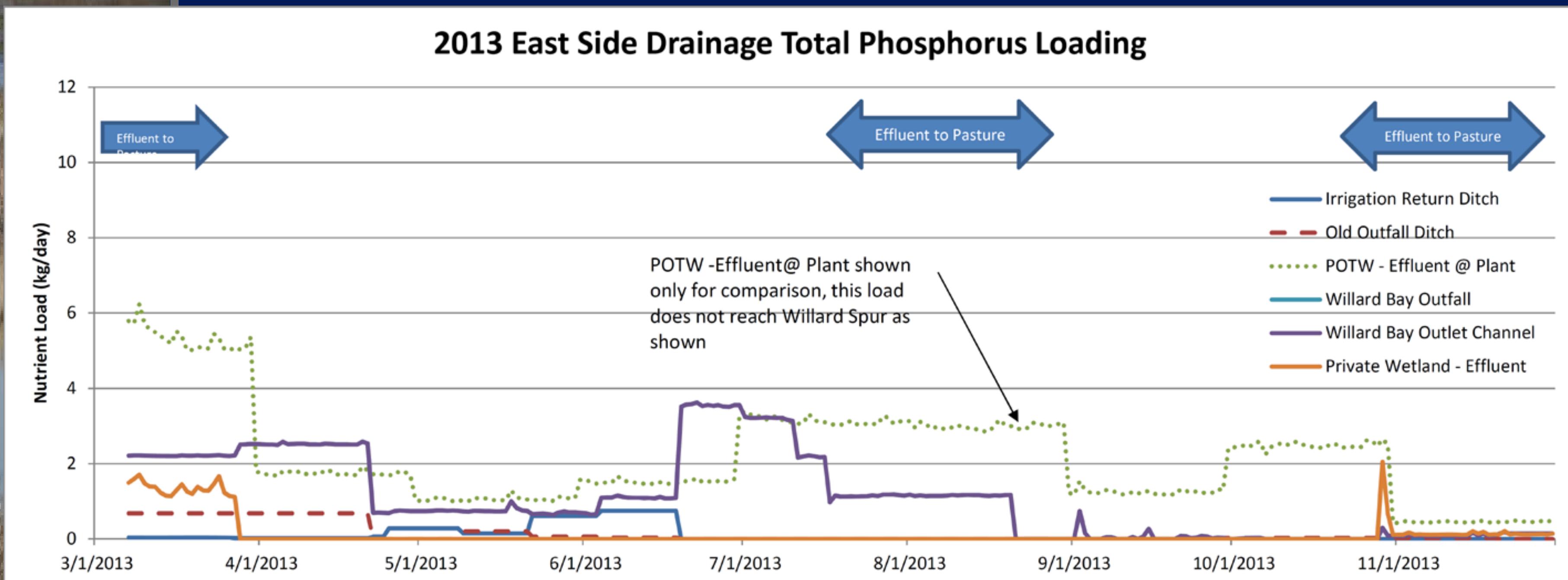
Key Observations - Hydrology

- **Will not be able to “close” the water balance**
  - Outflow rating curve only good up to about 1500 cfs
  - Infiltration losses

Key Observations – Nutrient Loads

- **BRMBR was primary source of nutrient inputs, followed by HCWMA**
  - Together represent 90-100% of nutrient input
- **Plant was typically <3% of the nutrient input**
  - Pasture exhibited significant assimilation/loss of water and nutrients


2013 East Side Drainage Total Nitrogen Loading
Nutrient Load (kg/day)
60
50
40
30
20
10
0
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
10/1/2013
11/1/2013
POTW -Effluent@ Plant shown only for comparison, this load does not reach Willard Spur as shown
Irrigation Return Ditch
Old Outfall Ditch
POTW Effluent @ Plant
Willard Bay Outlet Channel
Private Wetland - Effluent


2013 East Side Drainage Total Phosphorus Loading
Nutrient Load (kg/day)
12
10
8
6
4
2
0
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
10/1/2013
11/1/2013
Effluent to
Effluent to Pasture
Effluent to Pasture
POTW -Effluent@ Plant shown only for comparison, this load does not reach Willard Spur as shown
Irrigation Return Ditch
Old Outfall Ditch
POTW - Effluent @ Plant
Willard Bay Outfall
Willard Bay Outlet Channel
Private Wetland - Effluent

2011	Monthly % Contribution of TP				Monthly % Contribution of TN			
	BRMBR	POTW Effluent	WB Outfall	HCWMA	BRMBR	POTW Effluent	WB Outfall	HCWMA
May	89%	0%	8%	2%	84%	0%	13%	2%
June	86%	0%	10%	5%	83%	0%	12%	5%
July	91%	1%	1%	7%	85%	1%	1%	12%
August	84%	3%	0%	14%	78%	2%	0%	20%
Septemb er	78%	4%	0%	18%	59%	3%	0%	38%
October	89%	2%	0%	10%	83%	1%	0%	16%

2013	Monthly % Contribution of TP						Monthly % Contribution of TN					
	BRMBR	Irr Ret Ditch	Old Outfall Ditch	Private Wetland	WB Outfall	HCWMA	BRMBR	Irr Ret Ditch	Old Outfall Ditch	Private Wetland	WB Outfall	HCWMA
March	95%	0%	0%	0%	0%	4%	95%	0%	0%	0%	1%	4%
April	95%	0%	0%	0%	1%	4%	95%	0%	1%	0%	1%	4%
May	94%	0%	0%	0%	0%	5%	86%	0%	3%	0%	2%	12%
June	83%	1%	0%	0%	4%	13%	69%	0%	7%	0%	5%	25%
July	78%	0%	0%	0%	6%	16%	63%	0%	0%	0%	4%	34%
August	82%	0%	0%	0%	3%	15%	72%	0%	0%	0%	0%	28%
Septemb er	86%	0%	0%	0%	0%	14%	81%	0%	0%	0%	0%	19%
October	96%	0%	0%	0%	0%	4%	87%	0%	0%	0%	0%	13%
Novembe r	97%	0%	0%	0%	0%	3%	92%	0%	0%	1%	0%	8%

Key Observations – Nutrient Response

- SAV begin to grow in April, water is usually cold and turbid, significant inflows to Willard Spur
- As water warms up in May, SAV grow vigorously in deeper water and assimilate/store nutrients, algal mats are observed in shallow shoreline areas, water begins to clear, algae/BDS begins to flourish on the SAV and assimilate/store nutrients, inflows begin to decline to the point where Willard Spur becomes an impoundment, water chemistry begins to change
- Water continues to warm in June, water chemistry evolves, macroinvertebrates begin to increase, algae/BDS continue to increase on the SAV perhaps interfering with the SAV, SAV begin to senesce and release nutrients back into the water

Key Observations – Nutrient Response

- SAV crash in July, begin to decompose, algae/BDS decline (due to lack of substrate?), macroinvertebrate/zooplankton species change to decomposers, nutrients from plants released back into the water column. See ammonioa, TP and TN increase in water, phytoplankton take over to consume nutrients, sediment becomes more significant uptake mechanism
- Some SAV seem to return in late August/September
- Inflows ramp up again in October, flushing any water in Willard Spur into Bear River Bay, perhaps also flushing any organic material and nutrients that remain out to Bear River Bay. Flushing flows continue through April-May of the following year. Reset the clock.

Key Observations – Nutrient Response

- **Are nutrients a primary factor in the conditions we observe?**
  - They are a factor but not the primary factor
    - *SAV assimilate incoming nutrients, nutrients are released when they senesce, part of the succession of processes that occurs*
  - Water chemistry (pH, alkalinity, bicarbonates) that results from impounded condition appears to be a factor that results in SAV starting to senesce

Key Observations – Nutrient Response

- **What can we say about Willard Spur's condition? Is it supporting its uses?**
  - Appears to be in good condition and supporting its beneficial uses
  - Concerned about condition during impounded period but don't have data to definitively say
    - *We see the system evolving in response to the impounded condition, what is unique is that Willard Spur is resilient, ie, it bounces back each year*
    - *We cant say what might happen if we added more nutrients during this period, we know that HCWMA does add nutrients but cant isolate its contribution*

Key Observations – Nutrient Response

- **Are the conditions observed during the impounded condition satisfactory?**
  - They are a factor but not the primary factor
- **Did the Plant have a role in what we observed in the impoundment?**
  - No, their effluent did not reach the impounded water during dry years, impact is likely localized

Impacts from the Plant

- **How much of its load reaches Willard Spur when Willard Spur levels are high?**
  - Most of the load reaches the open water
    - *Correlated to high inflows, high nutrient input from other sources, thriving SAV*
    - *High level of dilution, export and nutrient assimilation*
    - *Low risk of impact throughout, perhaps some localized/minimal impact*

Impacts from the Plant

- **How much of its load reaches Willard Spur when water levels are low?**
  - Significant evaporation/infiltration, very little if any effluent reaches open water
    - *Correlated to low/no inflows to Willard Spur, impounded condition*
    - *Significant internal cycling in the impoundment, perhaps more sensitive to new inputs*
    - *But effluent currently doesn’t reach it*

Impacts from the Plant

- **What happens if Plant flows increase and loads reach impoundment?**
  - We cannot say with current data; have to begin to weigh the cost of nutrient load vs benefit of water in the impoundment
  - Impoundment currently receives flows from BRMBR and HCWMA
  - Annual “flushing” flows are critical to allowing the system to reset each year

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Impacts from the Plant

- **Localized impacts**
  - Reduced soil salinity – *phragmites*?
  - If discharged to channel, enough flow to push load to open water?
  - Algae/chl-a in outlet channel?

- **Any other impacts?**

Impacts from the Plant

- **Risks from the Plant appear to currently be low**
- **Risk could be further reduced if:**
  - Effluent is discharged to location where assimilation, evaporation, infiltration can be maximized
  - Flows reaching Willard Spur minimized
  - Flows released in pulses rather than continuous
  - Nutrient removal at Plant continued
  - *Phragmites* control
- **Assumes nutrient concentrations/loads don't increase**

Development of Water Quality Standards for Willard Spur

How do we Protect Willard Spur?

How do we protect Willard Spur?

- **Regulatory tools - Jeff O to discuss**
- **Manage the potential risks**
  - Is Willard Spur changing?
  - Are inflow patterns changing?
  - Are nutrient loads from all sources changing?
  - Are Plant nutrient loads changing?

Long term Monitoring Strategy

- **What are the key objectives for monitoring?**
  - Assess its condition
  - Look for changes that might signal condition is getting worse
- **What will UDWQ be monitoring?**
  - Will focus upon indicators linked to attributes of value and poor condition
  - To be completed in coming months

BRMBR Habitat/Water Management Plan

- How might Bear River TMDL affect WQ?
- How might Bear River Project affect flows?
- Can BRMBR management actions improve the WQ and volume/timing of water entering Willard Spur?
- Can/should BRMBR manage Willard Spur water levels and period of flowing regime?

- *Should the same be done for HCWMA?*


BRMBR
3A
3B
3C
3D
3E
3F
3G
3H
3I
3J
3K
4A
4B
4C
5A
5B
5C
6
7
8
Bear River
Canal
O-Line Canal
4's Drain Canal
Whistler Canal
5's Drain Canal
Reeder Canal
Bird Refuge Boundary
BRR-1
BRR-2
BRR-3
BRR-4
BRR-5
BRR-6
BRR-7
BRR-8
BRR-9
BRR-10
BRR-11
WILLARD SPUR STUDY AREA
WILLARD BAY RESERVOIR
Perry
Willard
LEGEND
Willard Spur Study Area
BRMBR Boundary
Unit Boundaries
Canal
D-Line Dike
Flow Measurement Site
N

Reducing Risks from the Plant

- **Nutrient load control**
  - Should P removal be continued?
    - *What are the costs vs the benefits*
  - Can pasture be utilized to reduce the volume of water and nutrient load?
  - Does the water present other risks?

Reducing Risks from the Plant

- **Continue practice of discharging to the pasture on private property?**
- **If so, need to modify UPDES to add the new outfall location**
  - Pasture is jurisdictional wetland, same waterbody as Willard Spur
  - Include additional provisions

Reducing Risks from the Plant

- **UPDES permit modifications**
  - Add outfall location for pasture
  - Water management plan specifying what, when, and how effluent will be controlled
  - Agreement with property owner
  - Additional sampling of effluent that leaves property (west end)
- **Any risks that should be addressed?**
  - Phragmites control?

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Other ideas

- **Repurpose the State Park Lagoons**
  - Not feasible
- **Constructed Treatment Wetlands**
  - Plant is likely surrounded by jurisdictional wetlands that cant be used for NTS
- **Anything else?**

Path Toward Completion - 2014