Development of Water Quality Standards for Willard Spur

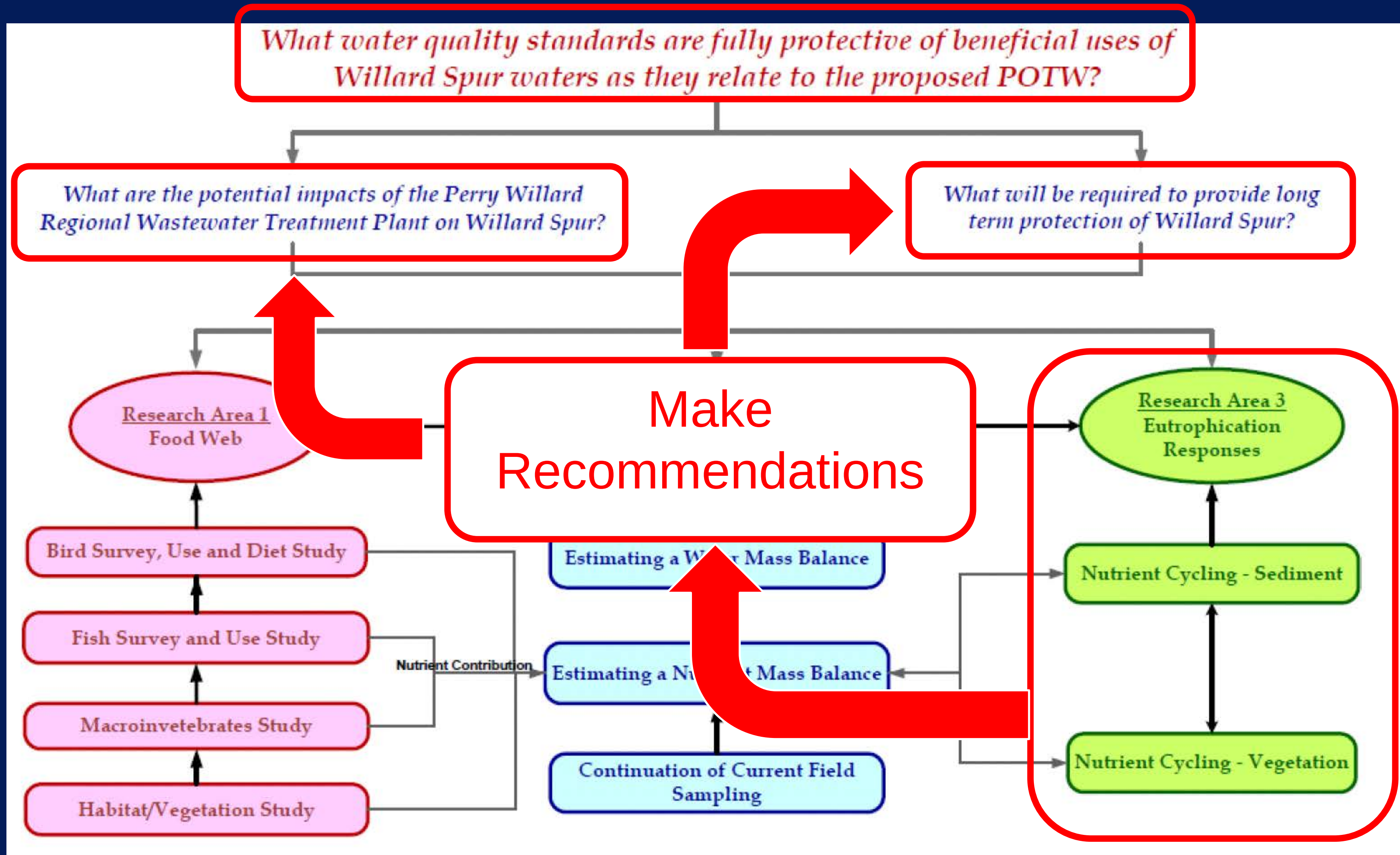
Willard Spur Steering Committee

January 30, 2014

Today's Agenda

1. Overview of program objectives
2. Summary of Science Panel meetings
3. Management alternatives
4. Path forward

Willard Spur Research Plan

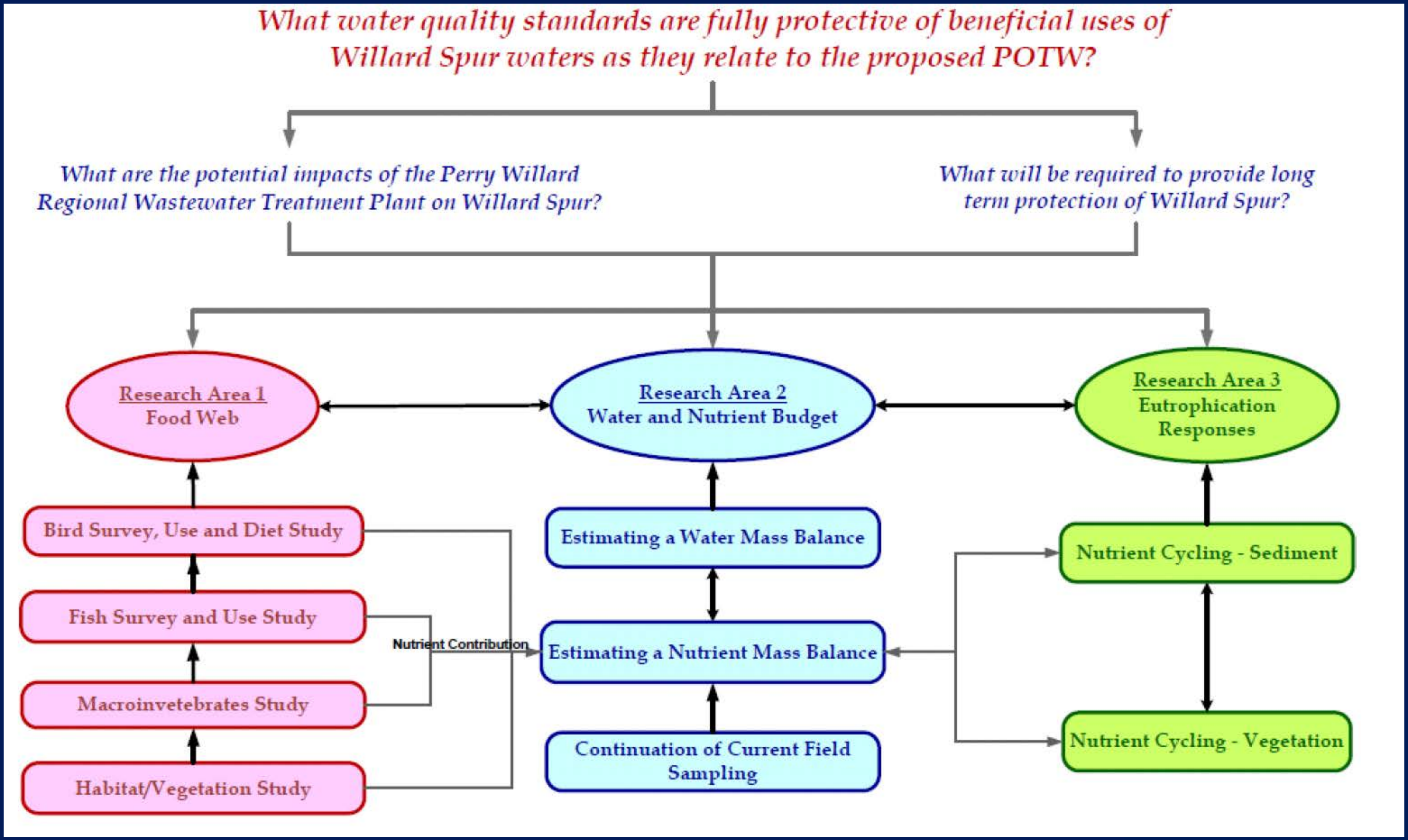


Looking at historic and current changes due to nutrients

Looking at potential future changes due to nutrients

See Linkages Handout

Willard Spur Research Plan



Looking at historic and current changes due to nutrients

Looking at potential future changes due to nutrients

Science Panel Meetings
January 29-30, 2014

Yesterday's Objectives

- **Understand the significance of nutrient cycling processes in Willard Spur:**
  1. How do we define the nutrient cycle?
  2. What factors most influence nutrient cycling and uptake?
  3. How do we define a "natural" response in Willard Spur?
  4. Will added nutrients change this?

Yesterday’s Objectives

- **Understand the significance of nutrient cycling processes in Willard Spur**
- **Assuming we do not understand all of the details, what are the significant drivers and risks to Willard Spur from nutrients?**

What impact does the Plant have?

Today's Objectives

- Discuss potential impacts from the Plant
- Identify potential recommendations for protecting Willard Spur

Agree on our path forward

UofU Nutrient Cycling Study

- **General Observed Cycle for Dry Years**
  - April – SAV starting
  - May – SAV dominate
  - May-June – Algae/BDS begin to grow
  - June-July – SAV senesce
  - July – Sept - phytoplankton

SAV uptake

SAV release

Water phases coincide with nutrient cycle

See UofU presentations, January 29, 2014

UofU Nutrient Cycling Study

- **Key treatment effects observed in**
  - % forageable SAV
  - Branch density
  - % cover algae on SAV
- **Key factors for changes**
  - Spring inflows set the clock
  - Available nutrients, turbidity, dissolved organic material
  - pH/HCO3 – may be stressing SAV
  - Impounded/stagnant conditions

Nutrient Cycling Study

- **Tissues indicate N-limitation in SAV and co-limitation in algae**
- **Negative effects observed with treatments**
  - Premature SAV die-off
    - *Alkalinity? Reduction in available nutrients? Algae/BDS?*
  - Algae and BDS on SAV
    - *Available nutrients? Lack of top-down control?*

Nutrient Cycling Study

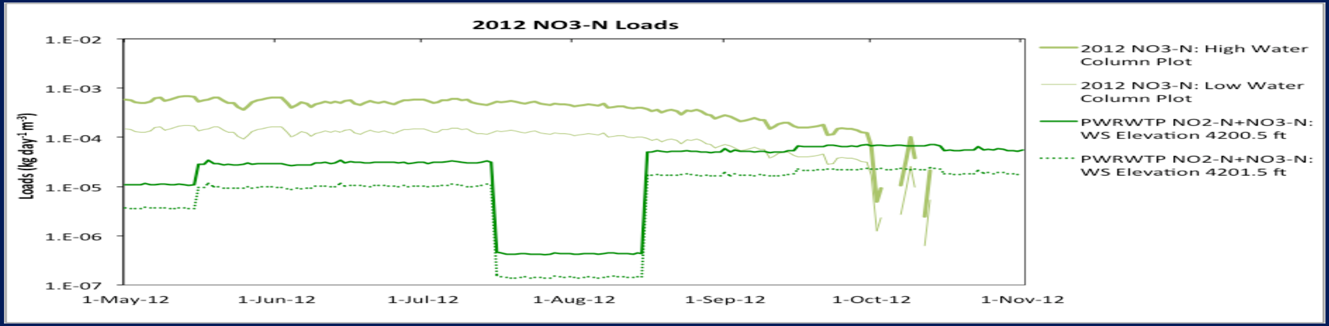
- **Identified 5 possible bioindicators from data**
  - Branch density
  - % total SAV
  - % BDS on SAV
  - % algae on SAV
  - DWQ condition index

Key thresholds focused on:

- Alkalinity
- TDS
- TP
- TN

UofU Uptake Studies

- **Joel Pierson completed experiments to relate test plot "loads" to Plant loads**
- **Confirmed methods and that target levels were appropriate**
  - Higher than potential loads to Willard Spur



UofU Uptake Studies

- Analysis of data/experimentation is ongoing
- Targeting only water column and sediment uptake
- Discovered a release of ammonia at night
- Is biota taking up nutrients than denitrification?

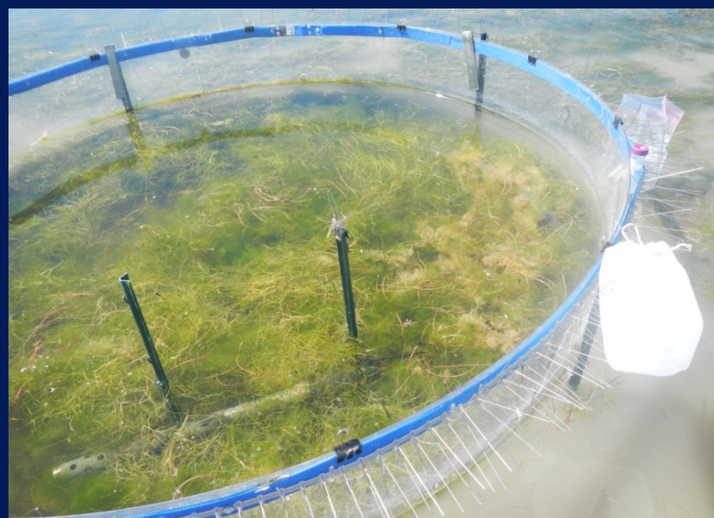
DWQ Uptake Studies

- Monitoring data show that nutrients are rapidly assimilated
- Experiments confirm most likely N-limited
- Using metabolism to estimate primary production/respiration and link uptake rates to the ecosystem
- More to come….

See DWQ presentation, January 29, 2014

DWQ Uptake Studies

- **Completed experiments in June, August, & September**



Determine
Uptake Rates

Uptake Studies

- **June findings**
  - Uptake with SAV was generally 3X faster than without SAV
  - Uptake of NO3 was 5 X faster than for PO4

Significant assimilative capacity when SAV dominate

Uptake Studies

- **August findings – day time**
  - NO3 Uptake rate “with SAV” was similar to June, but “no SAV” similar to “with SAV”
  - NO3 uptake rates similar to PO4
- **August findings – night time**
  - NO3 uptake rates much higher during night for no SAV, SAV rates were comparable to day time
  - PO4 uptake rates comparable to day time

DWQ Uptake Studies

- NO3 uptake rates with SAV were faster in June than August
- PO4 uptake was faster in August vs June
- PO4 rates didn't change much with SAV

August mesocosms

DWQ Uptake Studies

- **External loading is highest in the spring**
  - But export and uptake are highest, thus
  - Assimilative capacity is highest in spring
- **Summertime internal cycling is critical to understanding changes**
- **Risk in Willard Spur is highest when water is impounded & internal cycling is highest**

Discussion points

- **Extremely dynamic conditions - unique**
  - Hydrology establishes framework
  - Significant/important link to upstream watershed
- **Nutrients do not appear to be accumulating in this system**
  - Export via winter/spring flushing flows
  - Oxidation due to drying of sediments

Discussion points

- **Resilient ecosystem**
  - “Rebounds” from extreme events
  - Diversity of habitat, plants, processes, and dynamics are unique and critical to Willard Spur
  - Located downstream of an important wetland area with source populations that likely contributes to resiliency
  - “Stabilization” of extremes may reduce diversity/complexity that supports resiliency

Discussion Points

- **Nutrient responses are unique in Willard Spur**
  - Constrained by hydrologic conditions/extremes
  - Key factors linked to impounded condition
    - *Conductance/temperature*
    - *Longer low-DO*
    - *Higher ammonia levels*
    - *Higher pH/HCO3*
    - *Reduction in external nutrient load followed by increase in internal nutrient cycling*

Discussion points

- **Willard Spur shows signs of nutrient limitation**
  - Lack of nutrient accumulation in sediments
  - Size of diatoms
  - Response of SAV

Flow through/flushing flows is a key to resetting the clock every year by preventing accumulation of nutrients

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Does the plant represent a risk to the Spur?

Probably not…

- Effluent doesn't appear to reach open water during critical periods in Willard Spur
- Substantial uptake of nutrients between Plant and confluence with Willard Spur – load is reduced
- Any effects—positive or negative—are small and local
  - Importance of local cycling vs. <u>all</u> external inputs
  - Size of discharge small relative to other sources
- Any deleterious effects are <u>likely to be local</u>
  - i.e., rapid uptake of nutrients
- Benefit of water could outweigh nutrient impacts if water is lacking in Willard Spur

Recommendations

Goal: Provide long term protection of Willard Spur

- **Water quality standards**
- **Identify possible risks**
- **Is there a connection to the Plant?**
  - Can we minimize potential risks?

Worked to identify alternatives to consider – not the definitive list or are they requirements

Water Quality Standards

1. **Numeric criteria were considered**
   - Extremely difficult to establish and link to adverse impacts – dynamic system
   - Creates regulatory challenges that defeat goal of protecting conditions – not the best approach   Not to be carried forward
2. **Reclassify beneficial use to match BRMBR**
   - Define boundary of Willard Spur
   - Address DO, pH, and ammonia exceedences

Water Quality Standards

3. **Develop narrative bio-criteria**
   - Developed for Willard Spur and/or ponded wetlands
   - Define conditions to avoid
   - Linked to monitoring and bio-indicators identified in studies

Conditions to Avoid

- ***Excessive increase in sediment quantity or decreased quality,***
- ***A decrease in the abundance, diversity or condition of submerged aquatic vegetation (SAV),***
- ***Unusually long periods of hydrologic isolation from Bear River Bay,***
- ***Excessive algal surface mats,***
- ***Toxic algae blooms, or***
- ***An increased abundance of invasive species***

Other Options Considered

- **Long term monitoring strategy**
  - Need to determine frequency, timing, and correct parameters
  - Link to standards
- **BRMBR Habitat/Water Management Plan**
  - Inclusion of Willard Spur in the HMP
  - Improvements required to provide flexibility to deliver water to Willard Spur?

If the Plant does have an impact, what options could be considered?

- **What goals would any recommendations to minimize impacts from the Plant need to achieve?**
  - Reduce the nutrient concentration and load
  - Reduce the quantity of water and load
  - Minimize incidence of discharge
  - If discharge, maximize the peak of discharge to minimize period of discharge

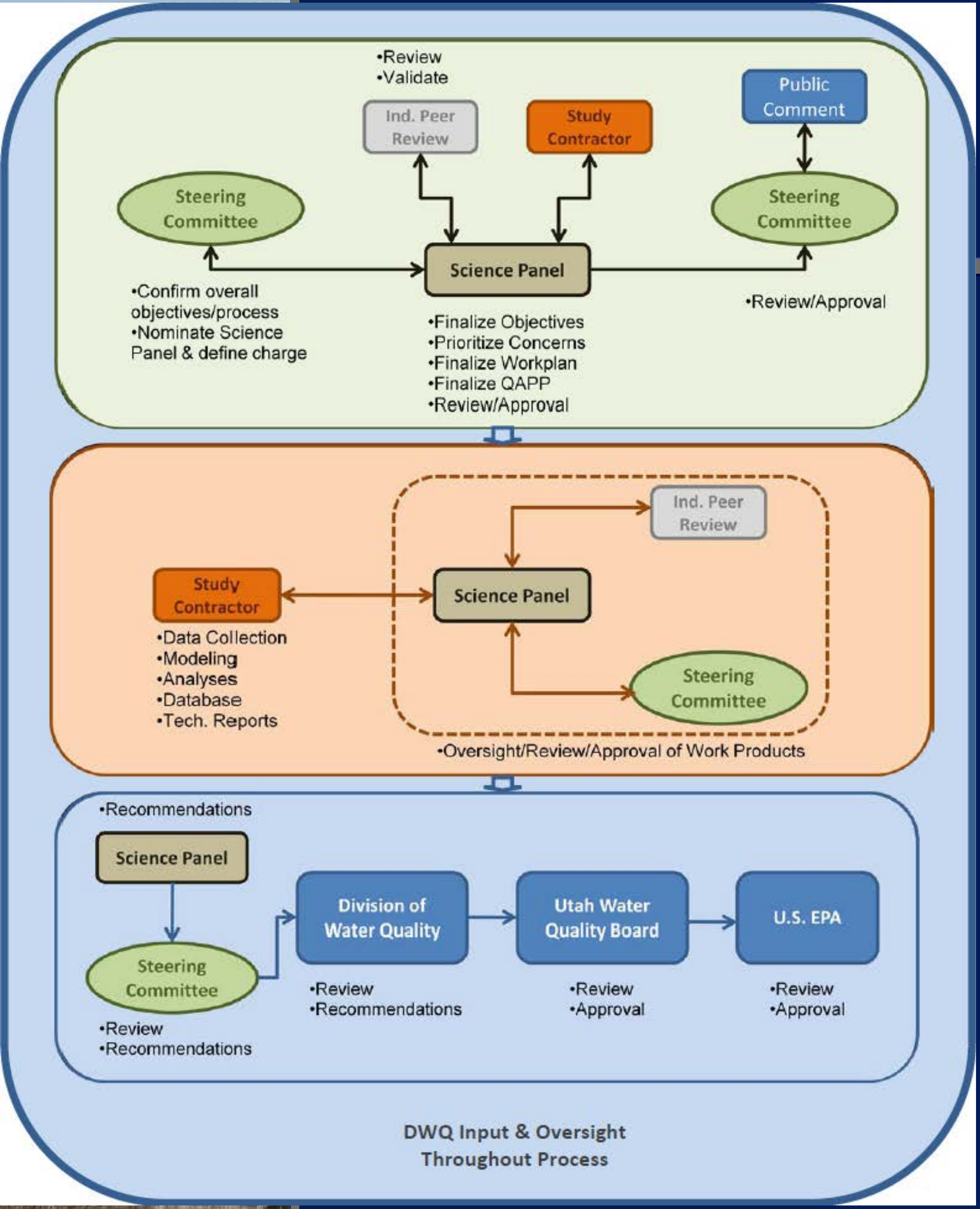
Options to Consider for the Plant

- **Modify UPDES permit to define discharge locations**
- **Maintain chemical phosphorus removal**
- **Discharge to private property/pasture**
  - Formalize agreement with landowner
  - Land application requirements/permits
  - Water management plan

Options to Consider for the Plant

- **Re-purpose State Park Lagoons**
  - Connect State Park to the Plant
  - Storage/evaporation of effluent
  - Nutrient reduction
  - Will require a management plan
- **Constructed Treatment Wetland**
- **Phragmites control plan**

Path to Completion



2011

Plan Formulation

2012-2013

Research & Evaluation

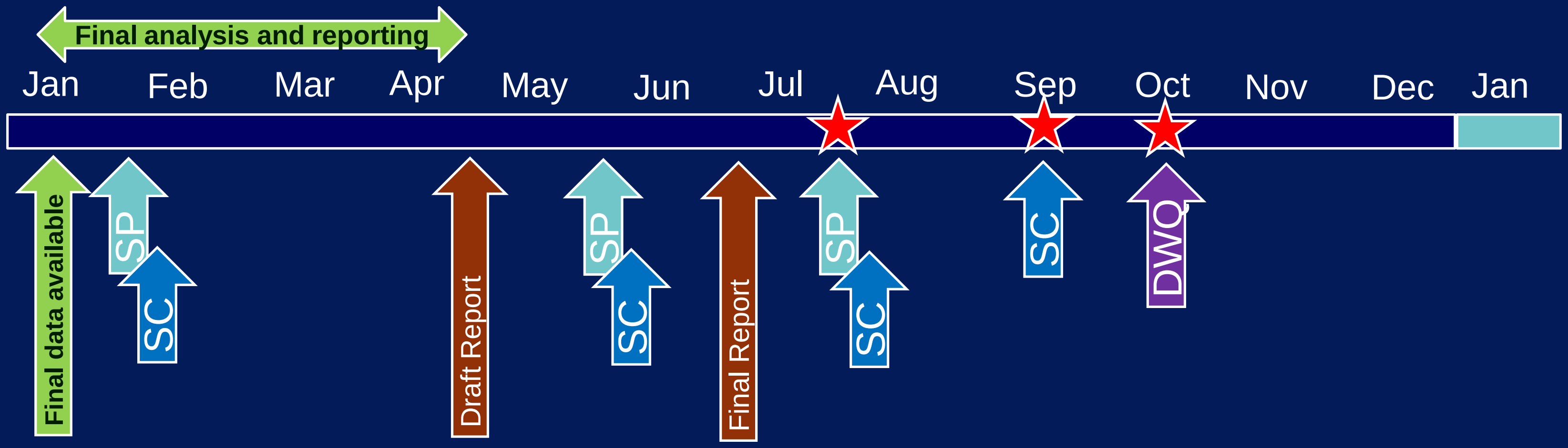
2014

Reporting & Recommendations

Schedule of Deliverables

Description	Data	Draft	Final
Database			
2011-2013 Database		28-Feb-14	30-Jun-14
2013 Research Plan			
Plant Impacts	31-Jan-14	30-Mar-14	30-Jun-14
Nutrient Cycling Study	30-Sep-13	15-Jan-14	28-Feb-14
Uptake Studies	30-Jan-14	28-Feb-14	30-Mar-14
Final Reporting			
Food Web		30-Apr-14	30-Jun-14
2011-2013 Hydrology	31-Jan-14	30-Mar-14	30-Jun-14
2011-2013 Nutrient Loading	31-Jan-14	30-Mar-14	30-Jun-14
Open Water Characteristics	31-Jan-14	30-Apr-14	30-Jun-14
Nutrient Cycling Study		30-Apr-14	30-Jun-14
WWTP Impacts		30-Apr-14	30-Jun-14
Management Alternatives/Rec		30-May-14	30-Sept-14
Final report summary		30-Aug-14	30-Oct-14

Path Toward Completion - 2014



SP — Science Panel meeting

SC — Steering Committee Meeting

★ — Final Recommendation

Next Meeting

- **June 4 or 5, 2014**
  - One day meeting for Science Panel
  - Afternoon Steering Committee meeting
- **Outcomes**
  - Comments on draft reports
  - Discuss recommendations