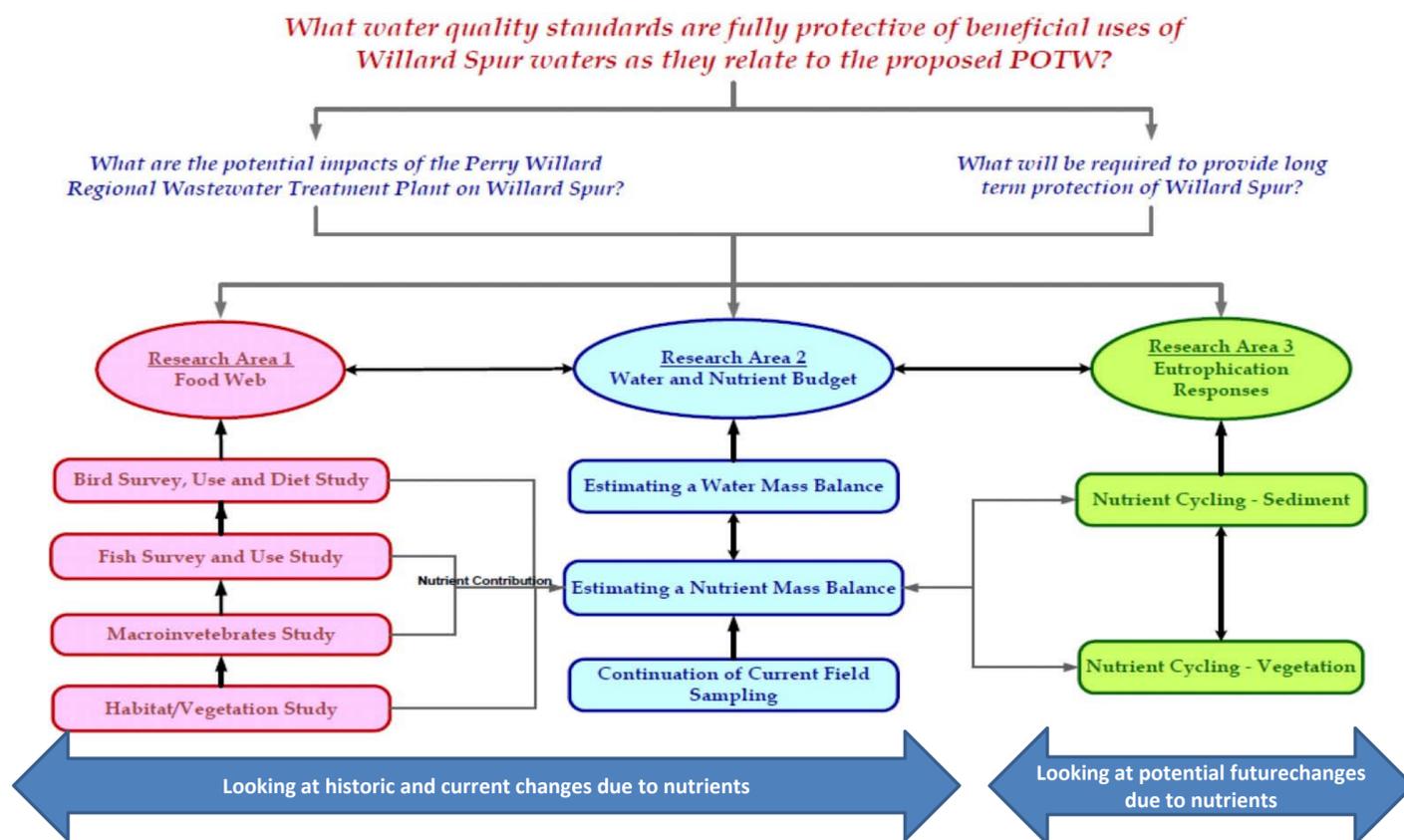


# Linking Objectives & Questions to Answers & Solutions

## Development of Water Quality Standards for Willard Spur



| Study Question  | Research Area that will address question | Specific Study/Task to address question  | Possible Management Solutions   |
|---|--|--|---|
| <b>1. What are the potential impacts of the Plant on Willard Spur?</b>  |  |  |   |
| 1.1 What characteristics of the effluent are of concern?  |  |  |   |
| 1.1.1 Is alteration of site hydrology a concern?  | 2  | Hydrology monitoring   |   |
| 1.1.2 Are the chemical constituents of concern?   | 2  | 2011 and 2012 Sampling Plan  | Maintain Discharge Monitoring Reporting   |
| 1.2 What are the nutrient loads in the effluent with and without nutrient removal?  | 2  | 2011 and 2012 Sampling Plan, Nutrient Budget   | Maintain Discharge Monitoring Reporting   |
| 1.3 What are the sources of nutrients entering Willard Spur and what is the relative significance of these sources?   | 2  | 2011 and 2012 Sampling Plan, Nutrient Budget   |   |
| 1.4 How much of that load will reach Willard Spur accounting for nutrient assimilation by the wetland channel?  | 2  | Nutrient Uptake Capacity Analysis - Special Study  |   |
| 1.5 How will the wetland channel respond to the effluent's nutrient load?   | 2  | 2011 and 2012 Sampling Plan  |   |
| 1.5.1 How will it respond in the long term?   | 2  | Sampling Study, Nutrient assimilation of Harold Crane WMA  | Long term monitoring plan with assessment framework   |
| 1.6 Under what conditions does the effluent reach and not reach Willard Spur?   | 2  | Hydrology study  |   |
| 1.7 Of the nutrients that reach Willard Spur, how might they change the ecosystem?  | 2<br>3<br>1                              | Site-wide Intensive Sampling Study<br>Nutrient cycling study<br>Vegetation/habitat mapping & lit review, Avian use lit review, Fish use lit review, Macroinvertebrate evaluation & lit review  |   |
| 1.7.1 Do these changes have a deleterious effect on Willard Spur?   | 3  | Nutrient cycling study   | Change UPDES permit conditions, permanent nutrient removal  |
| <b>2. What will be required to provide long term protection of Willard Spur?</b>  |  |  |   |
| 2.1 What are the beneficial uses of Willard Spur?   | 2  | 2011 and 2012 Sampling Plan  | Change beneficial use designation   |
| 2.2 What is the present condition of Willard Spur?  | 2  | 2011 and 2012 Sampling Plan  |   |
| 2.2.1 What are the hydraulic/hydrologic characteristics of Willard Spur?  | 2  | 2011 and 2012 Sampling Plan, Hydrologic monitoring   |   |
| 2.2.2 What are the sources of contaminants entering Willard Spur and what is the relative significance of these sources?  | 2  | 2011 and 2012 Sampling Plan, Nutrient Budget   |   |
| 2.2.3 What are the relative concentrations of potential contaminants in water, sediment, macroinvertebrates, and fish in Willard Spur?  | 2  | 2011 and 2012 Sampling Plan  |   |
| 2.2.4 What are the current vegetation, macroinvertebrate, and phytoplankton compositions in Willard Spur?   | 1<br>2                                   | Vegetation/habitat mapping & lit review, Macroinvertebrate evaluation & lit review<br>2011 and 2012 Sampling Plan  |   |
| 2.2.5 What are the current bird and fish compositions in Willard Spur?  | 1<br>2<br>external                       | Avian use lit review, Fish use lit review<br>2011 and 2012 Sampling Plan<br>DWR bird surveys   | Address the petitioners request to reclassify Willard Spur as Category 1 Waters<br>Assessment of beneficial use support |
| 2.3 What are "natural" responses vs. responses to the Plant?  |  |  |   |
| 2.3.1 How has Willard Spur changed over time to what we see today? What factors may have caused that change? How could nutrients affect change?                                   |  |  |   |
| 2.3.1.1 How have hydrologic conditions changed?   | 2  | Hydrology monitoring   |   |
| 2.3.1.2 How have vegetation/habitat changed?  | 1  | Vegetation/habitat study mapping & lit review  |   |
| 2.3.1.3 How has bird use changed?   | 1  | Avian use lit review   |   |
| 2.3.1.4 How has fish use changed?   | 1  | 2011 Waterfowl diet study  |   |
| 2.3.1.5 How has macroinvertebrate (lower food chain) use changed?   | 1  | Fish use lit review  |   |
| 2.3.1.5.1 What is influencing lower numbers of 2011 macroinvertebrates? Pattern doesn't match other GSL wetlands.   | 2  | Macroinvertebrate evaluation & lit review  |   |
| 2.3.1.5.2 Where do macroinvertebrates get their food? Is food source impacted by nutrients?   | 2<br>3                                   | Macroinvertebrate life history analysis<br>Macroinvertebrate stable isotope analysis   |   |
| 2.3.2 How does the Willard Spur ecosystem respond to conditions in 2011 vs 2012 - a wet year representing optimal conditions vs dry/normal year representing critical conditions? | 2<br>1<br>external<br>external           | 2011 and 2012 Sampling Plan, Sonde deployment, Site-wide intensive sampling study<br>Vegetation/habitat mapping & lit review, Avian use lit review, Fish use lit review, Macroinvertebrate evaluation & lit review<br>Dr. Kettenring study of GSL invasive species<br>DWR bird surveys | Long term monitoring plan with assessment framework   |
| 2.4 How is Willard Spur cycling nutrients? How does it respond to nutrients?  | 3  | Nutrient cycling study   |   |
| 2.5 What factors influence how Willard Spur is responding to nutrients?   | 3<br>2                                   | Nutrient cycling study<br>2011 and 2012 Sampling Plan  |   |
| 2.6 How might Willard Spur respond to increased nutrients? In short term? In long term?   | 3  | Nutrient cycling study   | Triggers for use in long term monitoring, Numeric indicators with narrative criteria, Site-specific numeric criteria    |