Not Your Father's TCEQ Model

A Year in the Life of a Bay

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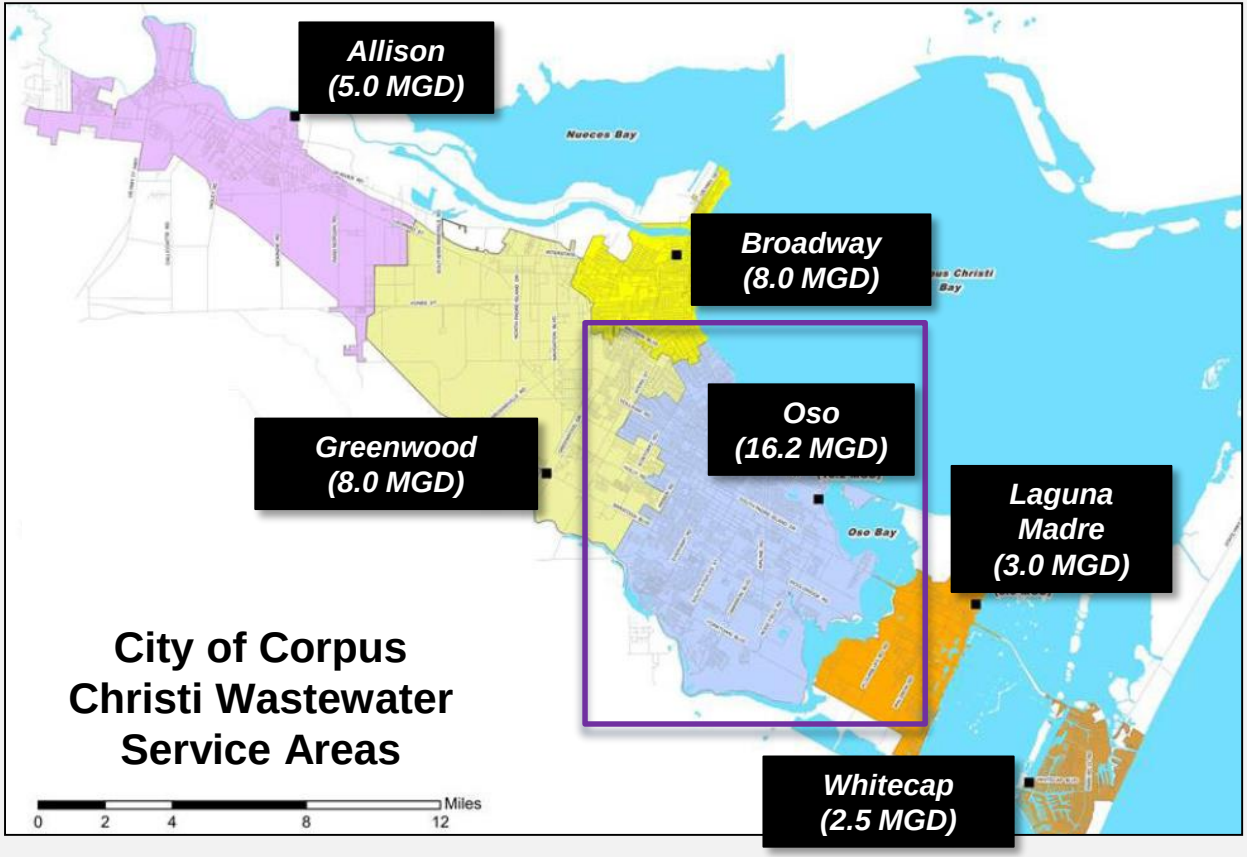
Introduction

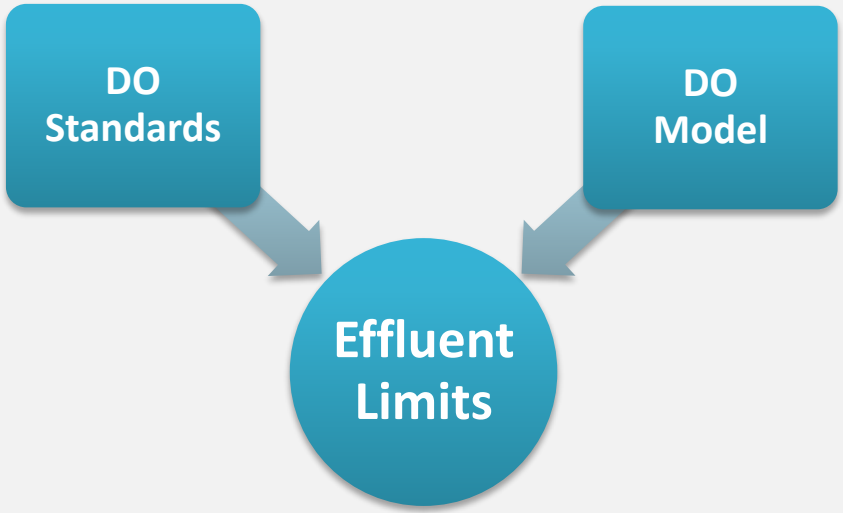


Oso Water Reclamation Plant (WRP)

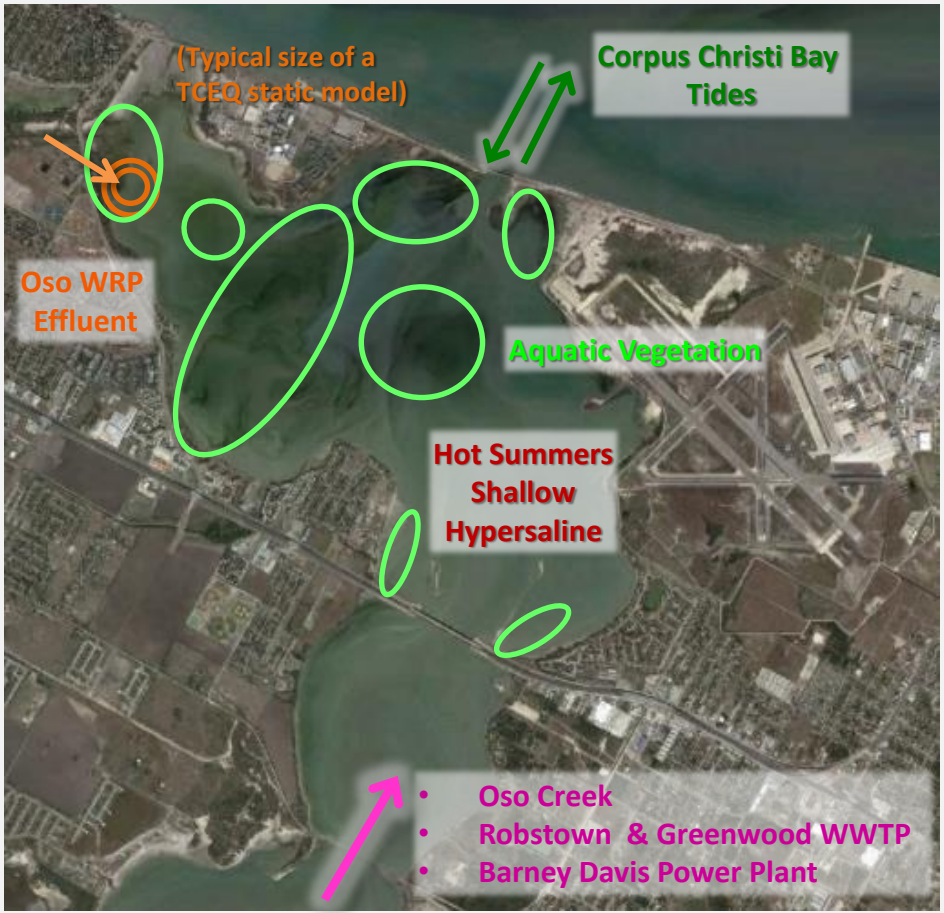
- Began operation in **1943**
- **Largest** wastewater plant in Corpus Christi
- Permitted discharge of **16.2 MGD**
- Average discharge of **~ 12 MGD**

Background: Typical Permitting Process

- Texas Commission on Environmental Quality (**TCEQ**) responsible for **issuing** Texas Pollutant Discharge Elimination System (**TPDES**) **permits**.
- Dissolved Oxygen (DO) Model is used to identify **effluent limits** protective of **DO water quality standard.**
- Typical **static model** represents a single, critical condition.

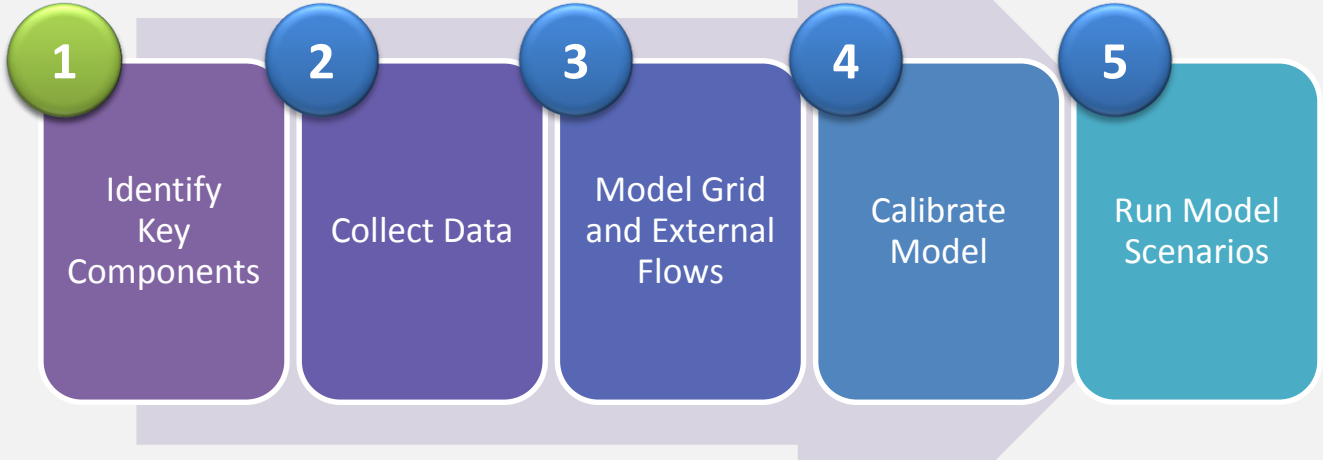


Background: Oso WRP Permit Modeling



- In 2013, Oso WRP **permit** was **up for renewal**.
- TCEQ was concerned that static model would be **too simplistic**, not representative.
- City initiated efforts for a more complex, representative model – a **dynamic model**.

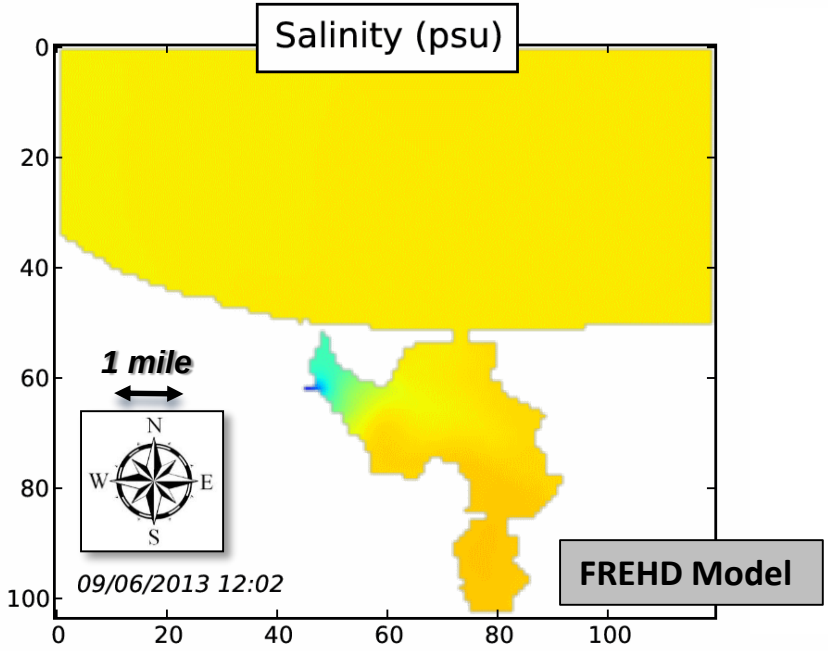
Steps to Develop Dynamic Model



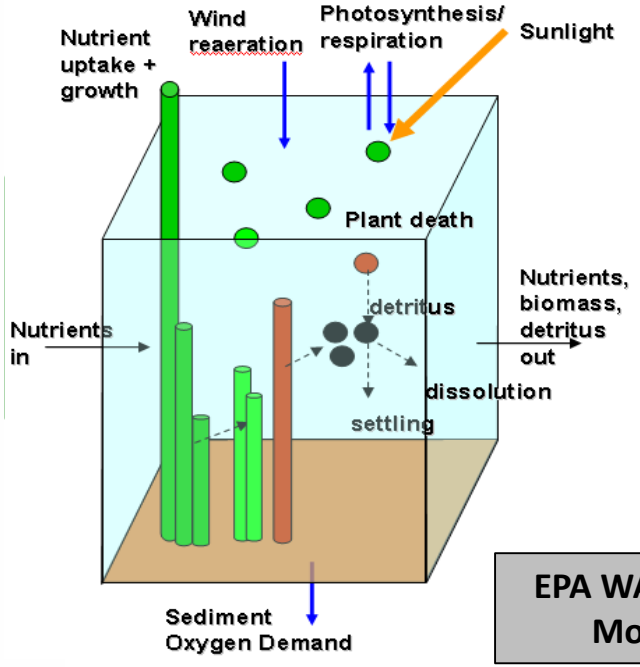
Identify Effluent Limits Protective of DO Standard

Identify Key Components

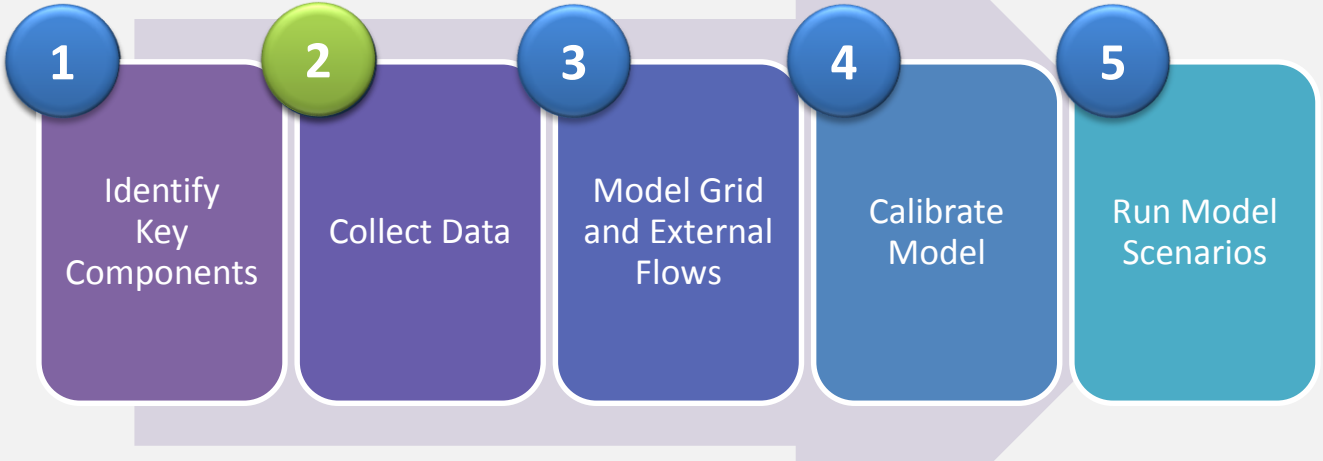
Hydrodynamics



Chemistry and Biology



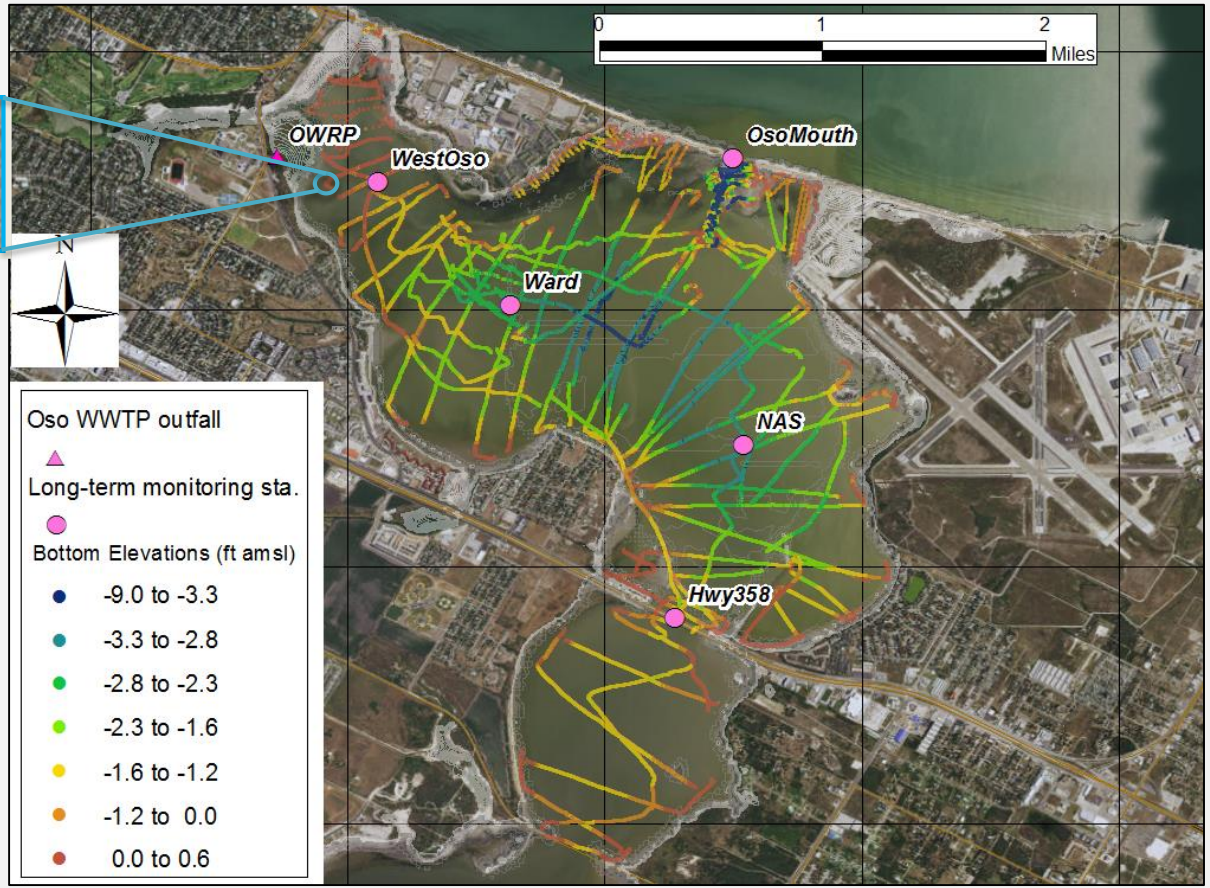
Steps to Develop Dynamic Model



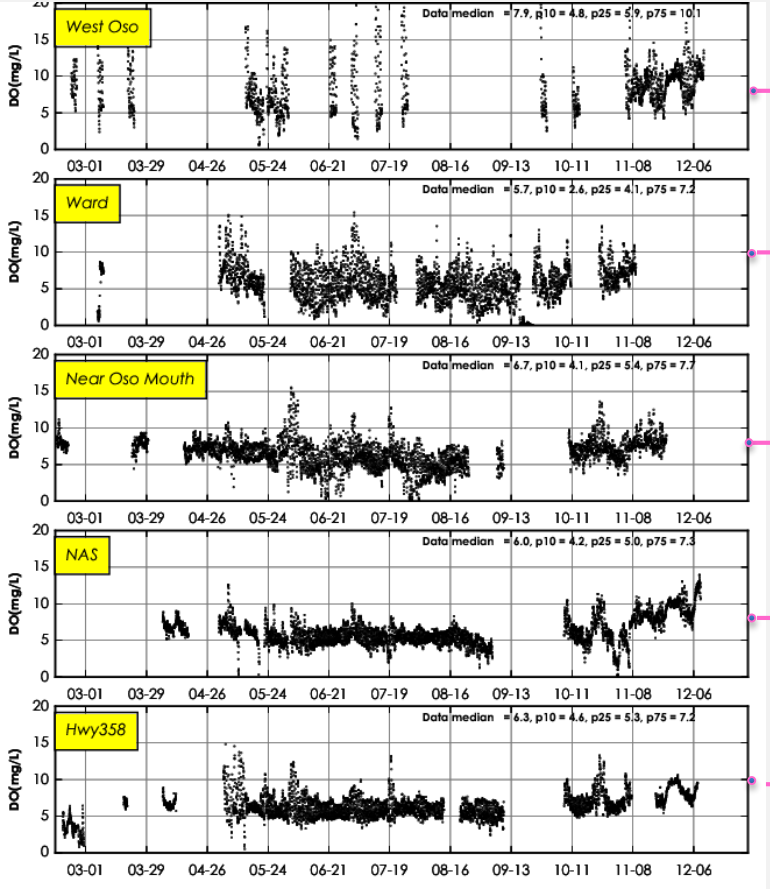
Identify Effluent Limits Protective of DO Standard

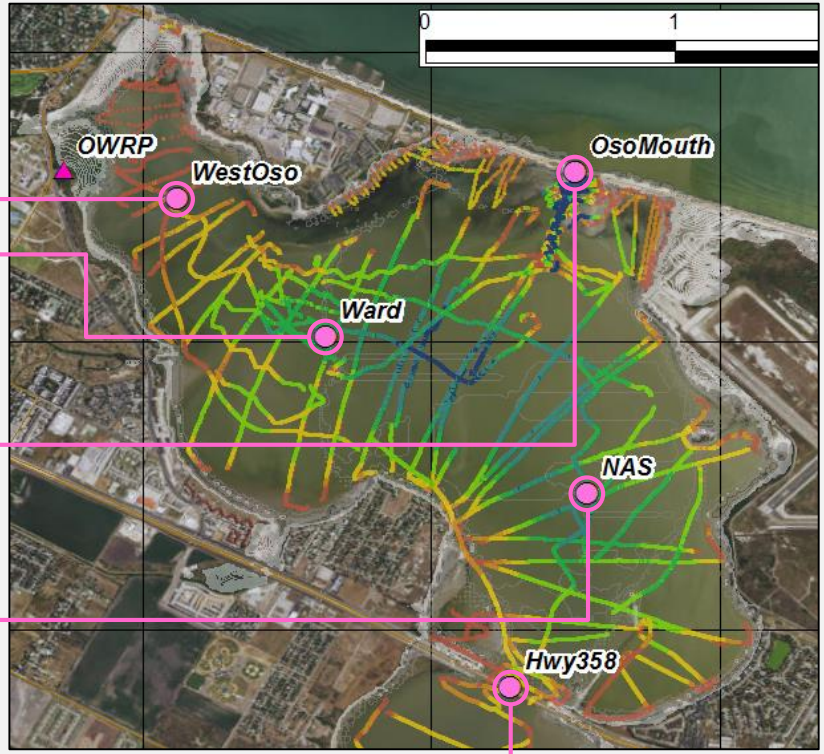
Collect Data: Bathymetry

The shallow Blind Oso



Collect Data: Continuous DO, Temperature and Salinity

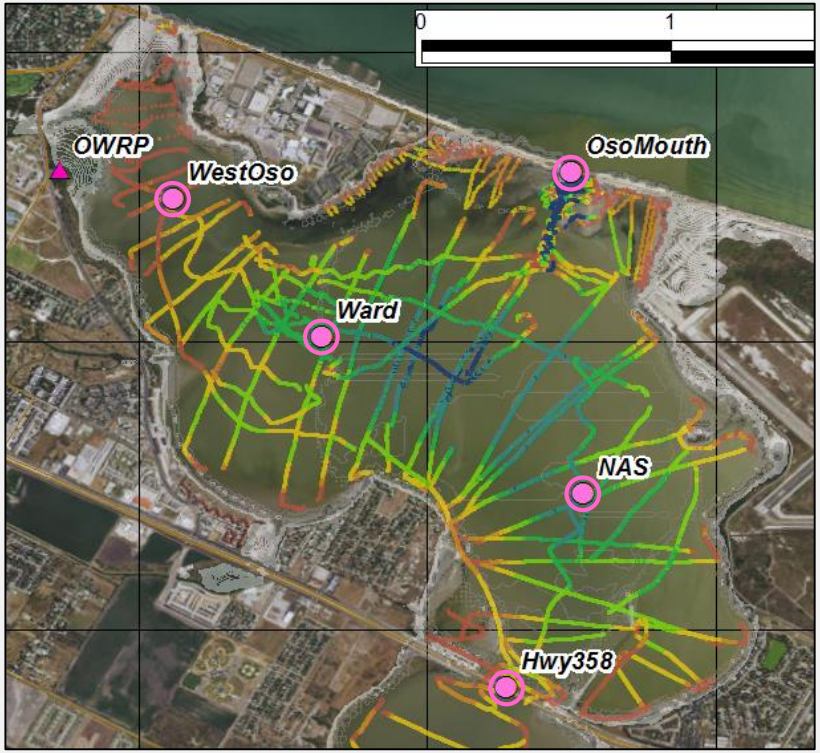




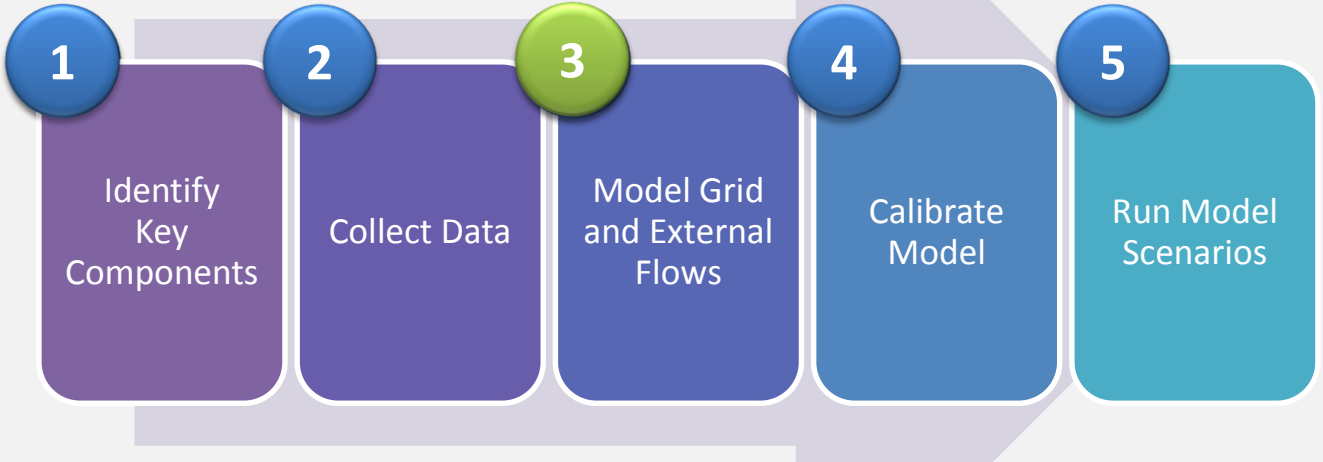
Collect Data: Bi-weekly Nutrients

Bi-weekly sampling of

- Ammonia
- Nitrate
- Orthophosphate
- Chlorophyll-a
- TSS
- etc.

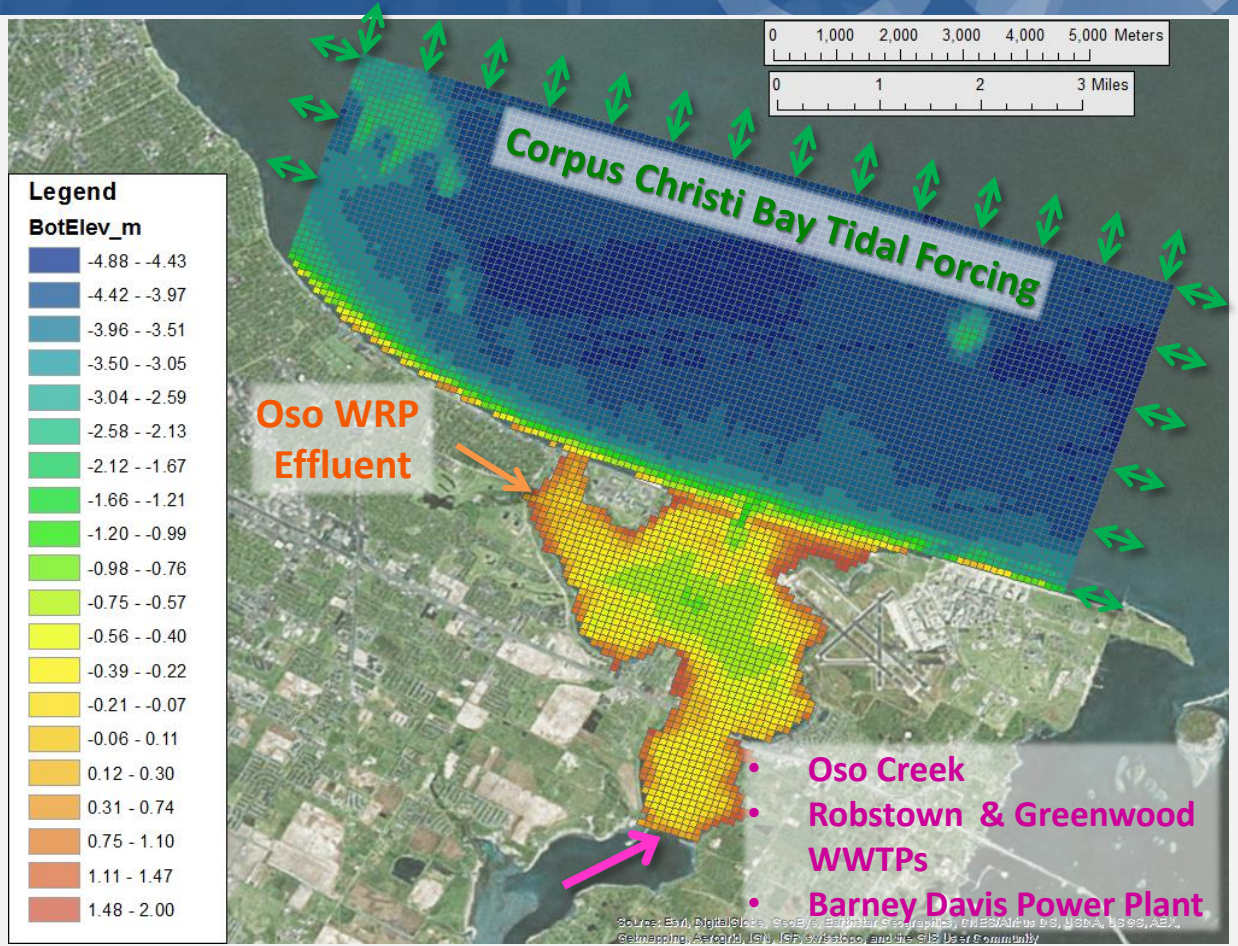


Steps to Develop Dynamic Model



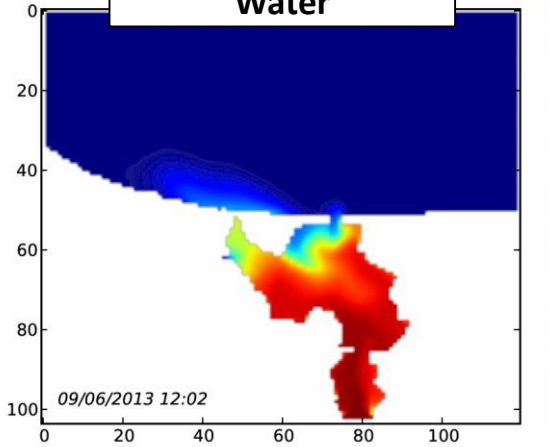
Identify Effluent Limits Protective of DO Standard

Model Grid and External Flows



Model Grid and External Flows: Tracer Simulation

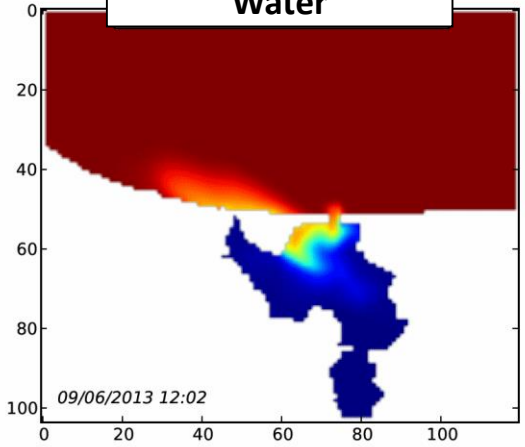
BDPS + Oso Creek Water



RED = 100% BDPS + Oso Creek

BLUE = 0% BDPS + Oso Creek

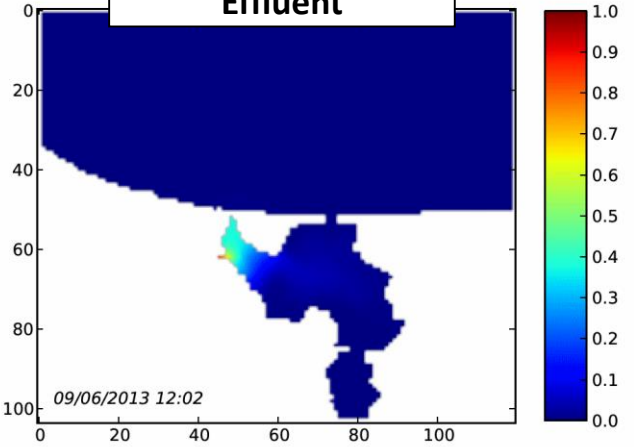
Corpus Christi Bay Water



RED = 100% CC Bay water

BLUE = 0% CC Bay water

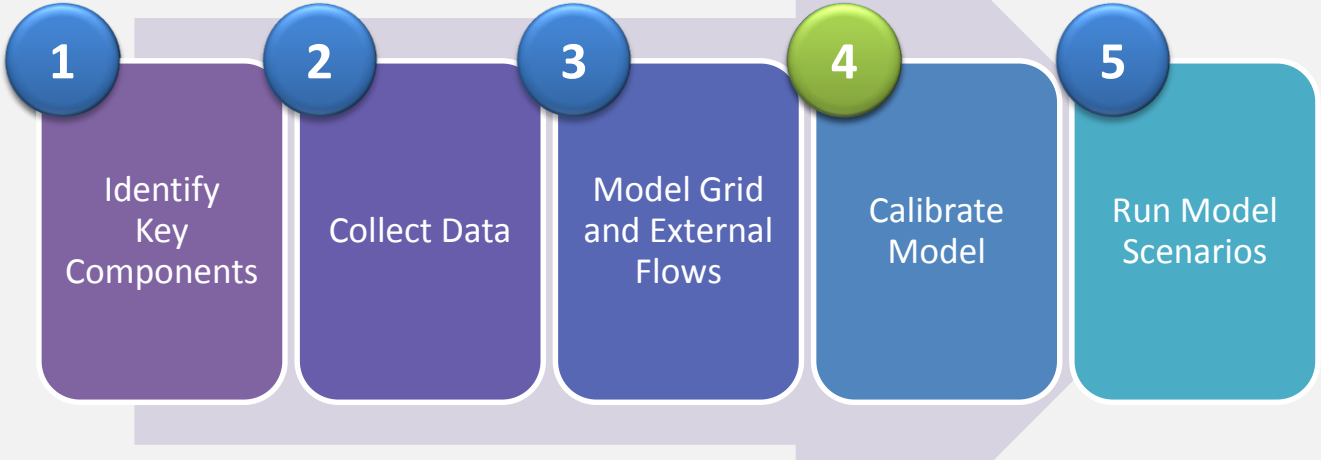
Oso WRP Effluent



RED = 100% OWRP effluent

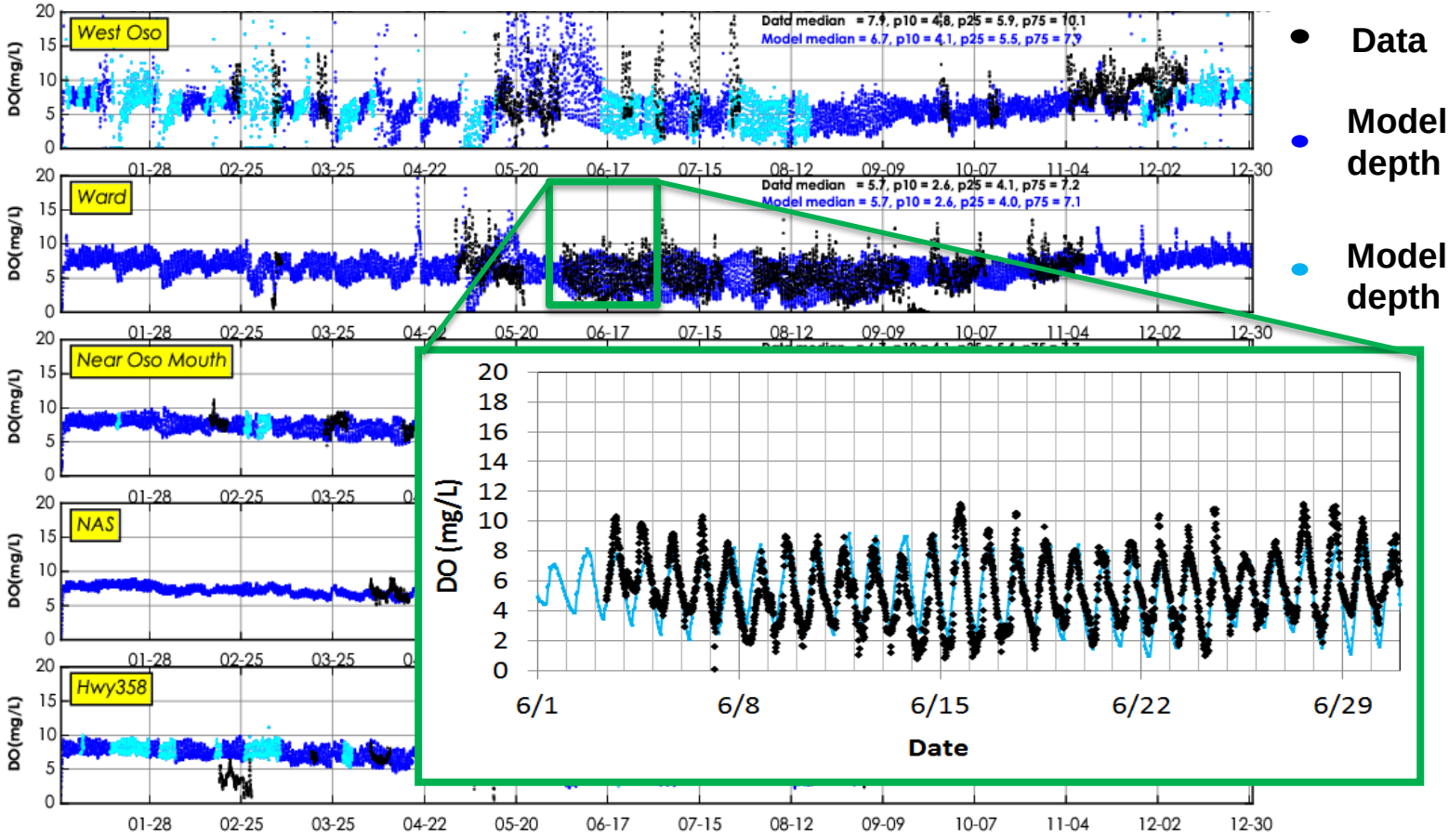
BLUE = 0% OWRP effluent

Steps to Develop Dynamic Model



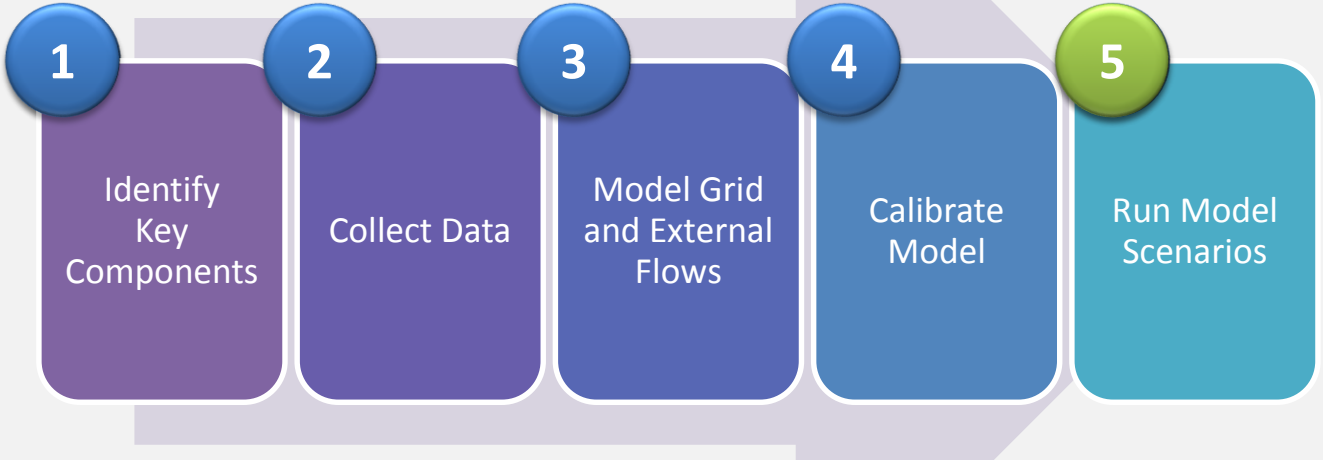
Identify Effluent Limits Protective of DO Standard

Model Calibration



- **Data**
- **Model (daily minimum depth > 0.3 m)**
- **Model (daily minimum depth < 0.3 m)**

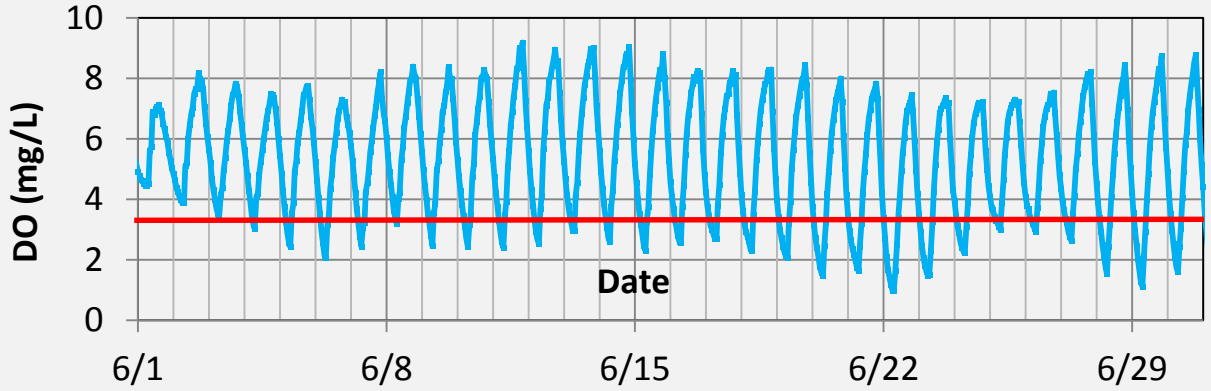
Steps to Develop Dynamic Model



Identify Effluent Limits Protective of DO Standard

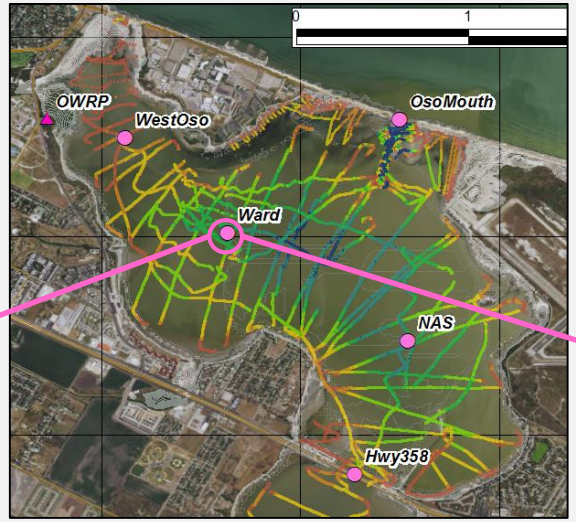
Run Model Scenarios

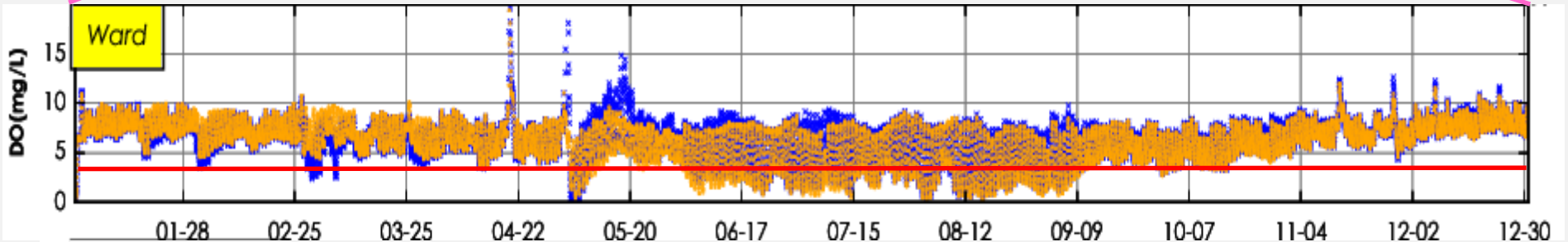
- Ran model scenarios to identify permit limits



- **Oops! No permit limits work.**
  - Most stringent of limits don't work.
  - Not even no-load model meets daily minimum DO standard

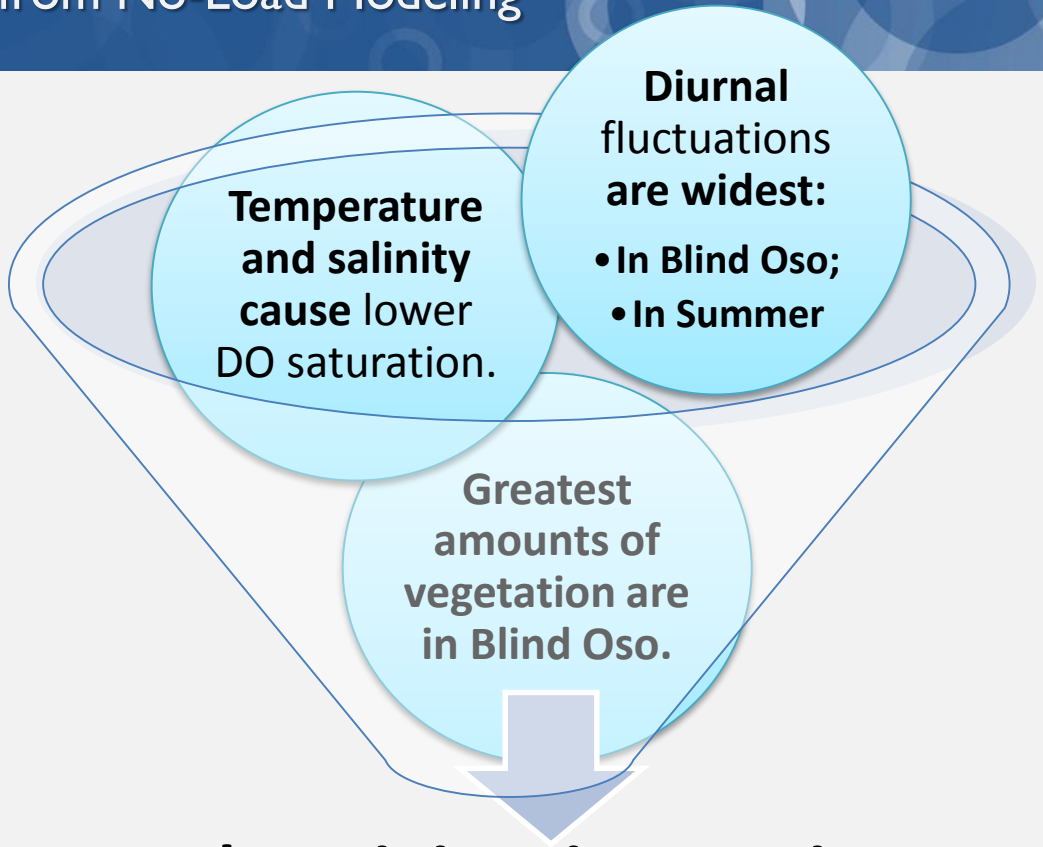
Run Model Scenarios: Comparison with and without discharge





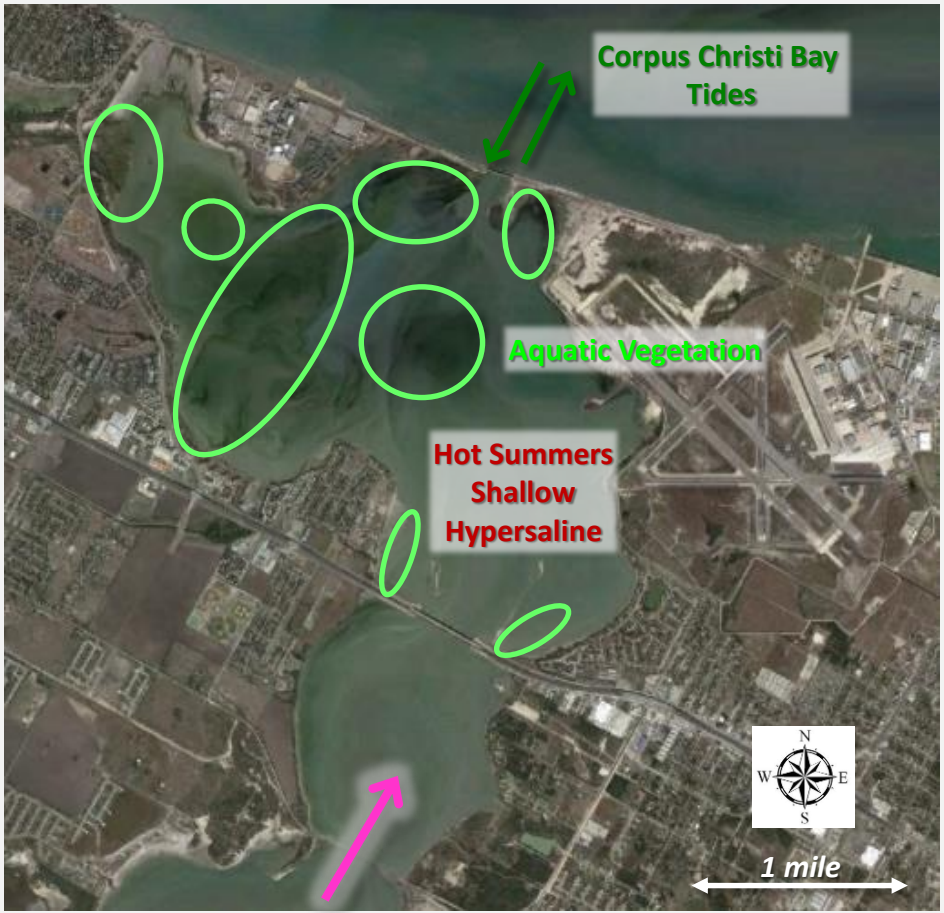
• No-load model • Existing conditions model --- Daily minimum DO standard (3.5 mg/L)

Observations from No-Load Modeling



Driver on the minima is aquatic vegetation, especially in Blind Oso.

Basic Characteristics of Oso Bay



- Semi-tropical climate
- High salinity
- Shallow
  - Large tidal flats, especially in Blind Oso
- Extensive aquatic vegetation
- Large diurnal DO swings

Dissolved Oxygen (DO) Standards in Oso Bay

Segment	DO Standards (mg/L)	
	Daily Average	Daily Minimum
Oso Bay	4.5	3.5

Laguna Madre

- Semi-tropical climate
- High salinity
- Shallow
- Extensive aquatic vegetation
- Minimally impacted by discharge

Laguna Madre was used as reference waterbody for UAA

Use Attainability Analysis Results

Segment	DO Concentrations (mg/L)	
	Daily Average	Daily Minimum
Laguna Madre (Summer)	4.8	1.6
Oso Bay (Summer)	4.2	1.9

TCEQ, 2010, "Development of Revised Dissolved Oxygen Criteria for Oso Bay and Laguna Madre"

Recommendation

- Even under no-load conditions, model showed DO not meeting existing standards in Blind Oso during the summer
- Because of physical differences
  - Split Oso Bay into Blind and Main Oso WQ segments
- Because of seasonal differences
  - Split period of application of standards by season
    - Summer = March to October
    - Winter = October to March

Recommended Dissolved Oxygen (DO) standards

Segment	Summer DO Standards (mg/L)		Winter DO Standards (mg/L)	
	24-hr Average	Daily Minimum	24-hr Average	Daily Minimum
Oso Bay (Existing)	4.5	3.5	4.5	3.5
Blind Oso (Proposed)	**4.0**	**1.5**	4.5	3.5
Main Oso (Proposed)	4.5	3.5	4.5	3.5

Conclusions

- A comprehensive, year-long data set of Oso Bay was collected
- Based on the data, a dynamic DO model was developed to represent the physical, chemical and biological mechanisms in Oso Bay
- Simulation of the no-load scenario has led to the identification of recommended site-specific DO standards

Status

- Recommended DO standards are posted for adoption by **TCEQ in February.**
- **(Stay Tuned!)**

Questions?

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS

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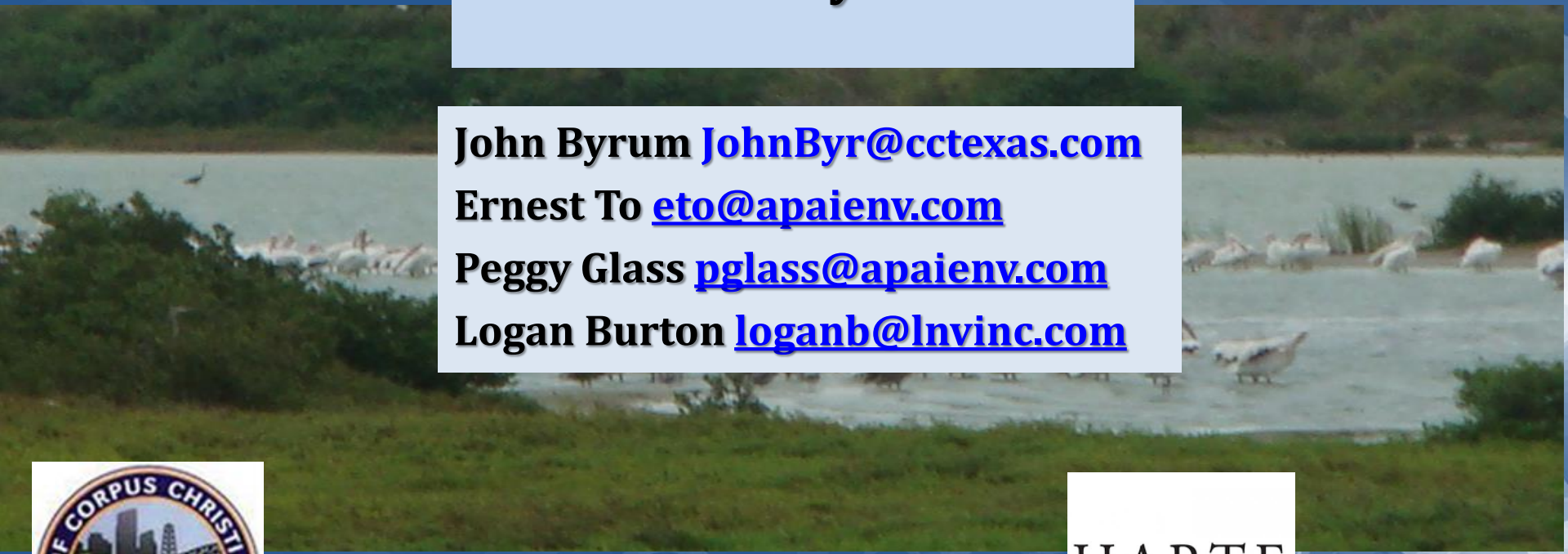
Thank you!



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