

## DOUBLE BAYOU WPP: INITIAL SAMPLING – DISSOLVED OXYGEN AND NUTRIENTS



Double Bayou Watershed Partnership Stakeholder Meeting  
November 18, 2014  
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## AQUATIC CYCLE: DISSOLVED OXYGEN AND NUTRIENTS

- Nutrient Inputs (nitrogen and phosphorus)
- Bacteria and plants (i.e. phytoplankton) consume the nutrients
- Chlorophyll-a can be an indicator of how much photosynthesis is going on in a system
- Excess nutrients can increase both bacteria growth and plant growth (which leads to increased chlorophyll-a and decreased DO)

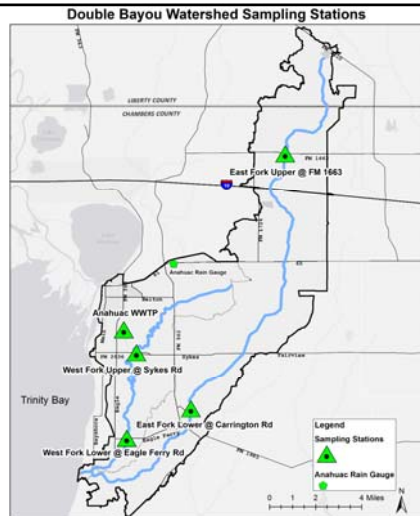


Image from Eutrophication: NPEC/CEARAC

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## SAMPLING STATIONS

- Five Stations
  - Two on each Fork, one at Anahuac Waste Water Treatment Plant
- Sampling results: October 2013 – August 2014
- Initial Sampling results include 17 routine events and 4 targeted rain events at each station (sampling @ twice a month)



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## DISSOLVED OXYGEN

- Designated Use: Aquatic Life
- Low Dissolved Oxygen levels can indicate an excessive demand on the oxygen in the system.



- < 0.5 mg/L **Anoxic** – Oxygen dependent animals die
- < 3 mg/L **Hypoxic** - Most aquatic organisms cannot survive
- 4-5 mg/L Aquatic organisms become stressed
- > 6 mg/L Optimal for many aquatic organisms



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## DISSOLVED OXYGEN

- Time dependent
  - Plants don't produce oxygen during the night - but oxygen is still being used then for respiration, so dissolved oxygen (DO) concentrations will be the lowest in a water body in the morning.
- Temperature dependent
  - The colder the water, the greater capacity it has to hold oxygen.



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## DISSOLVED OXYGEN

- Salinity dependent
  - As salinity in water increases, its ability to hold DO decreases.
  - But DO decreases more as temperature goes up regardless of salinity.
- Event dependent
  - DO can go up right after a rainfall because fresh rain water, which is high in DO, is flushed into the system.
  - After a lag period, the DO may go down because of increased bacteria in the runoff leading to increased decomposition.



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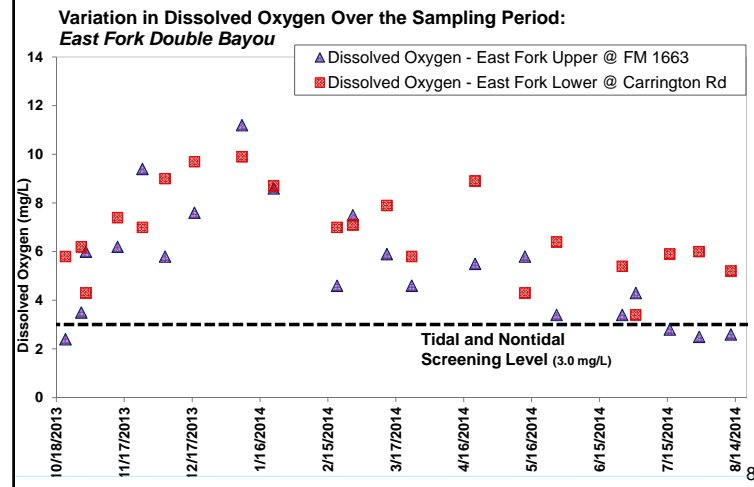
## DISSOLVED OXYGEN

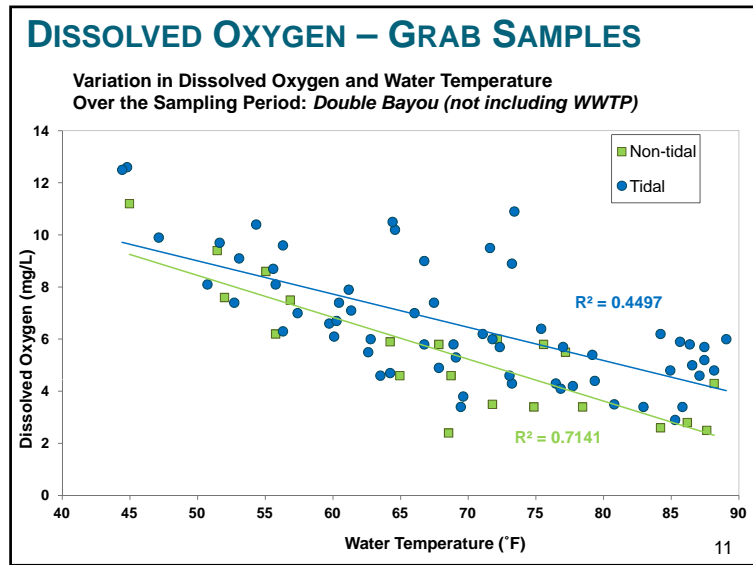
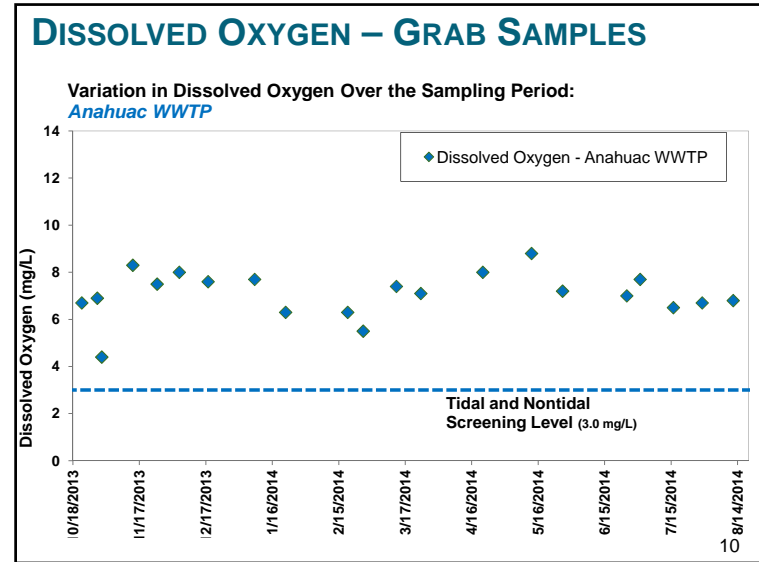
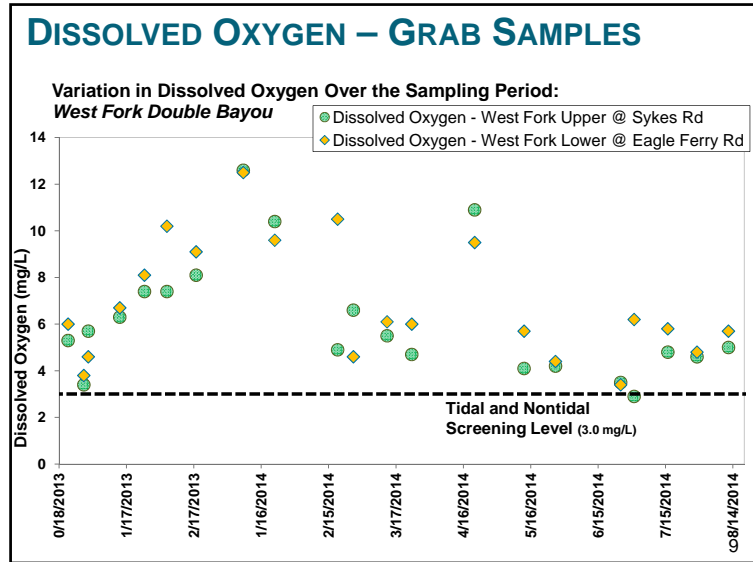
- Two Methods of Sampling
  - “Grab” sampling (includes routine and targeted rain event)
    - Only get one sample a day (typically 9 am -5 pm)
    - Shows greater range over a longer time period
  - 24-hour sampling
    - For a period of 24 hours (or more), takes one sample every 15 minutes
    - Captures the highest highs and lowest lows of the day – really shows entire range of DO
    - Limited to that one day (less long-term range)
- If available, TCEQ uses 24-hour data for criteria assessment. If no/limited 24-hour data are available, TCEQ will use Grab samples with screening parameters for assessment.



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## DISSOLVED OXYGEN – GRAB SAMPLES



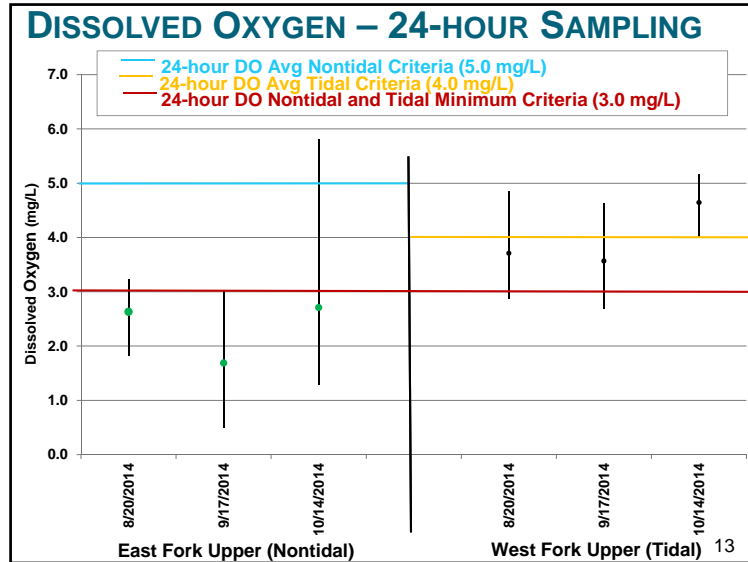


### DISSOLVED OXYGEN – GRAB SAMPLES

- Seasonal Table (does not include WWTP)
  - Highest % below Screening Levels in Summer

Dissolved Oxygen	Number of Routine Samples	Routine Samples Below Screening Level	Percent Below Screening Level (Routine)	Number of Targeted Rain Event Samples	Targeted Rain Event Samples Below Screening Level	Percent Below Screening Level (Targeted)
Fall Total (Sept. - Nov.)	16	1	6%	4	0	0%
Winter Total (Dec. - Feb.)	20	0	0%	4	0	0%
Spring Total (Mar. - May)	12	0	0%	9	0	0%
Summer Total (June - Aug.)	20	4	20%	0	0	0%

DOUBLE BAYOU WATERSHED PARTNERSHIP



### DISSOLVED OXYGEN

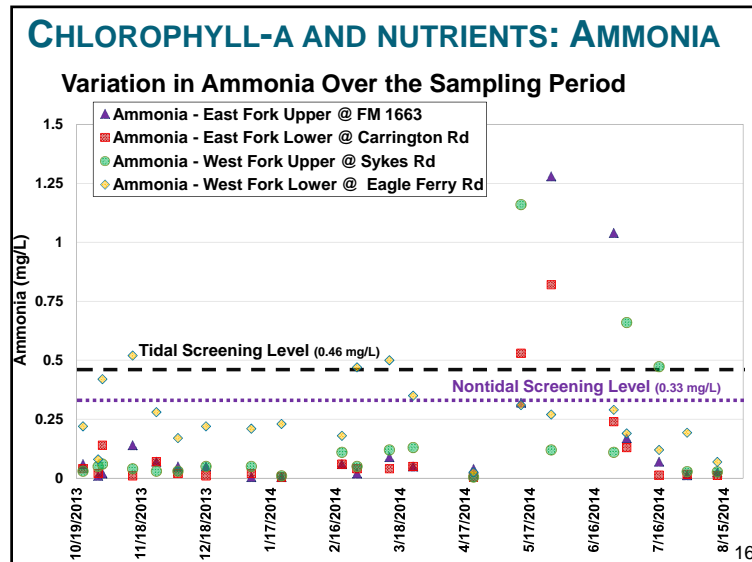
- 24-hour samples (East and West Forks Upper) suggest fluctuations throughout the day problematic for aquatic life
  - 5 out of 6 sampling periods had minimums below criteria
  - 5 out of 6 sampling periods had averages below criteria
- Grab samples (except WWTP)
  - Seasonal patterns show higher percent below screening level in Summer
  - East Fork Upper shows samples below screening levels in July – Oct timeframe
  - Note that the 24-hour sample events occurred in August-October timeframe
- BMPs
  - All grab samples suggest similar patterns at all stations

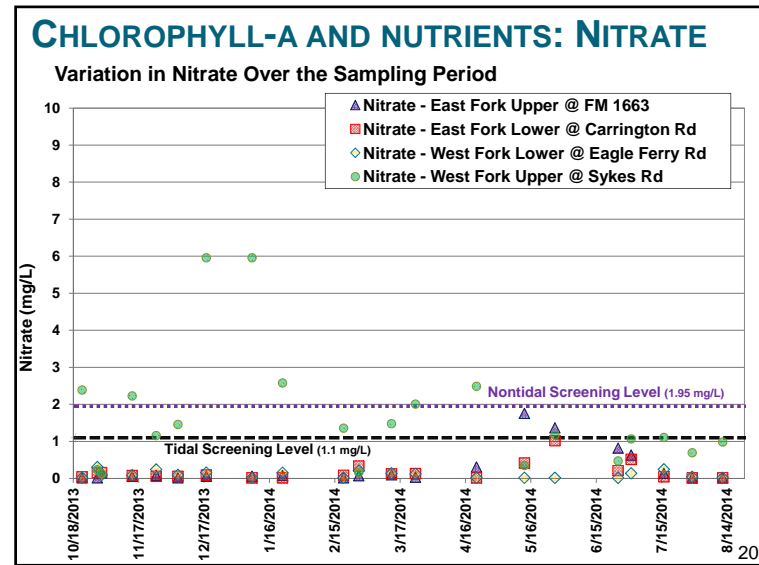
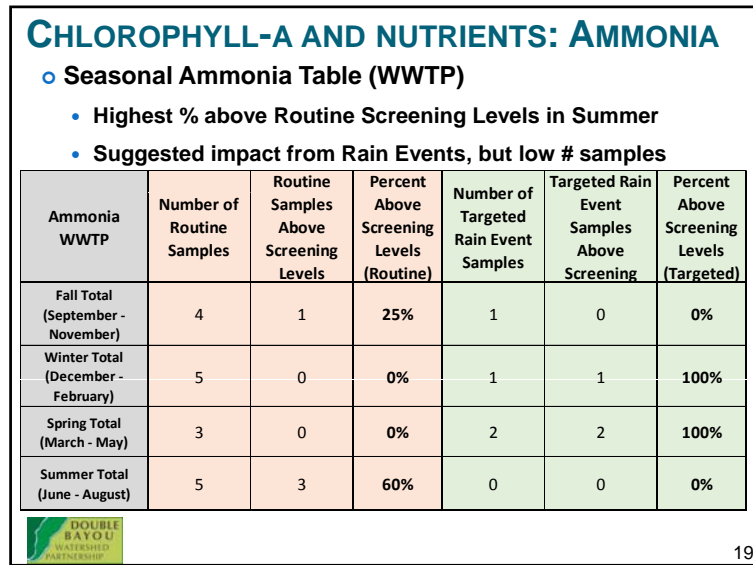
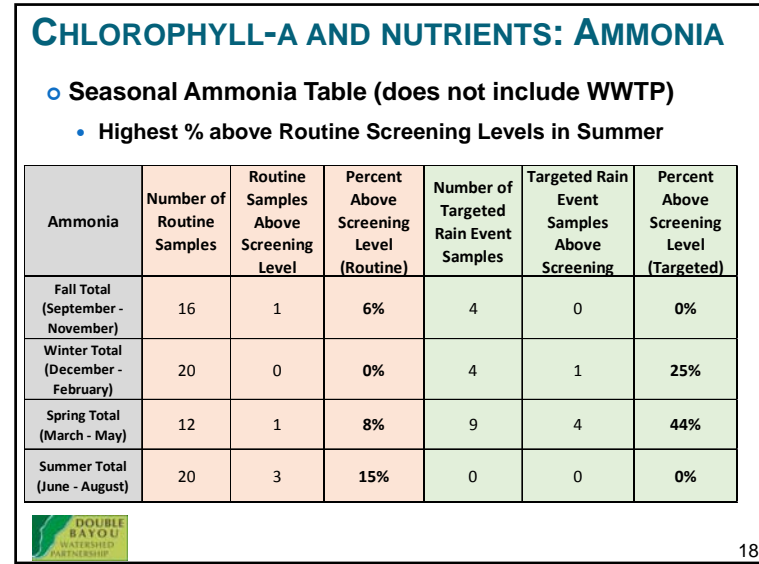
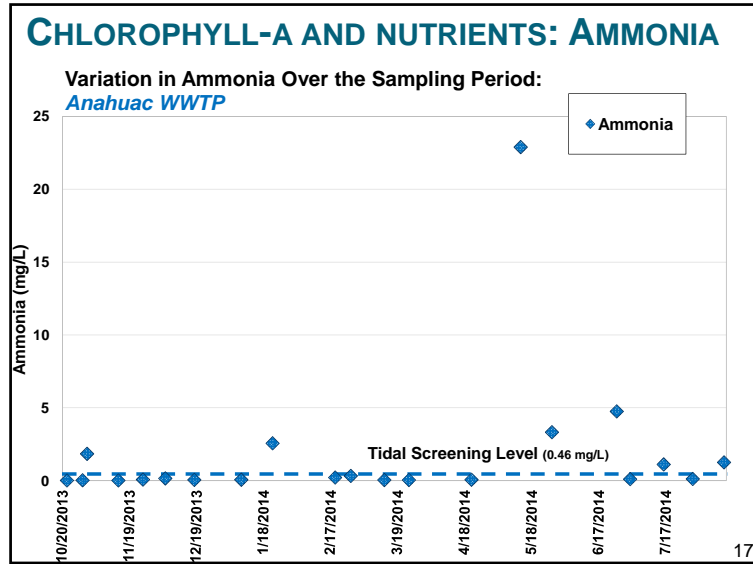
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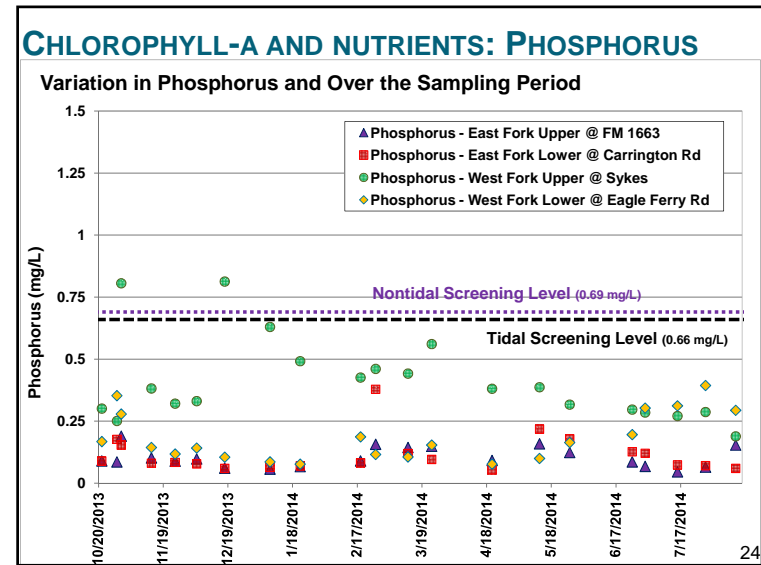
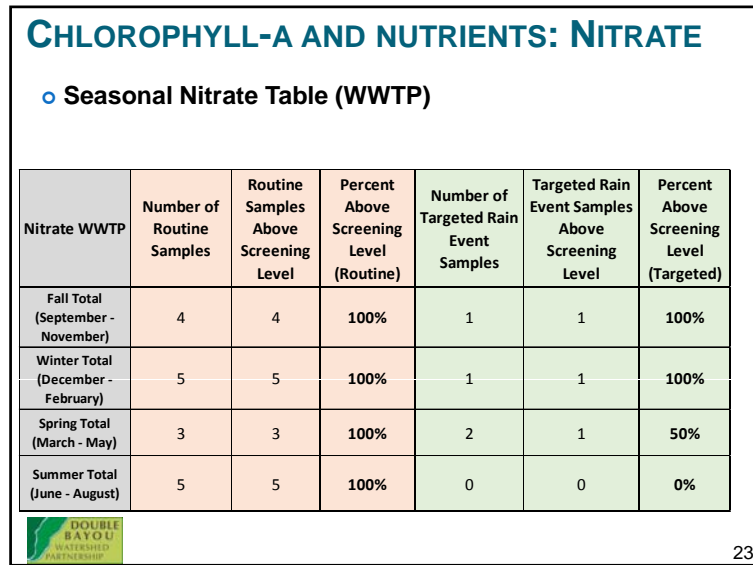
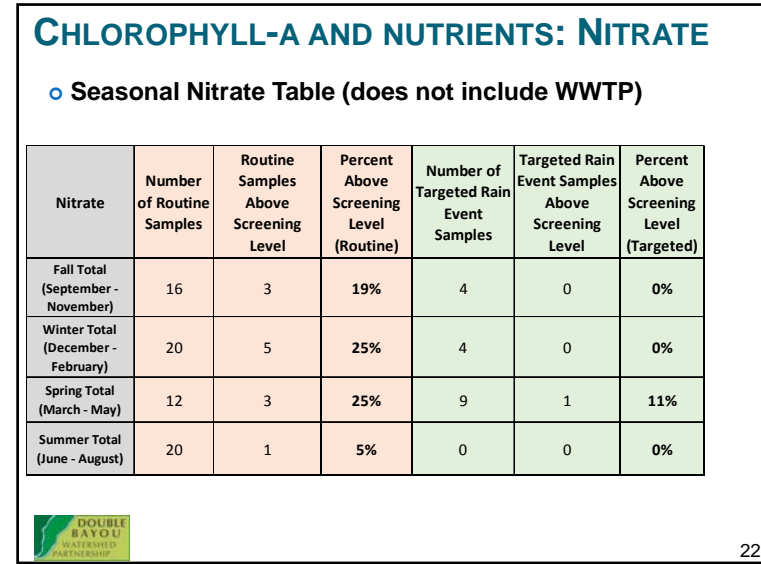
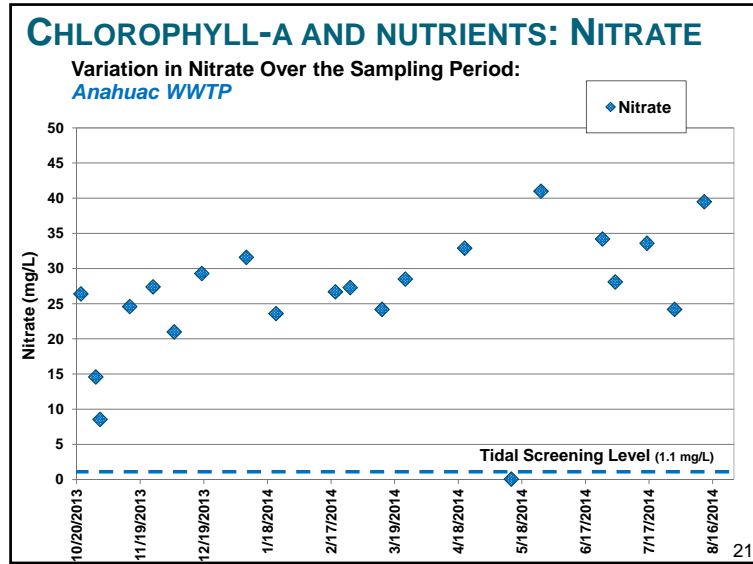
### CHLOROPHYLL-A & NUTRIENTS

- Indicator of phytoplankton abundance and biomass in coastal and estuarine waters
- Chlorophyll-a is a green pigment found in plants that absorbs sunlight and converts it to sugar during photosynthesis using nutrients such as phosphorus and nitrogen
- High levels often indicate poor water quality and low levels often suggest good conditions BUT it is the overall cycle that is important
  - Temporal and spatial variation
  - Long-term persistence of elevated levels that can be problematic
- Grab samples (results include both routine and targeted rain event)

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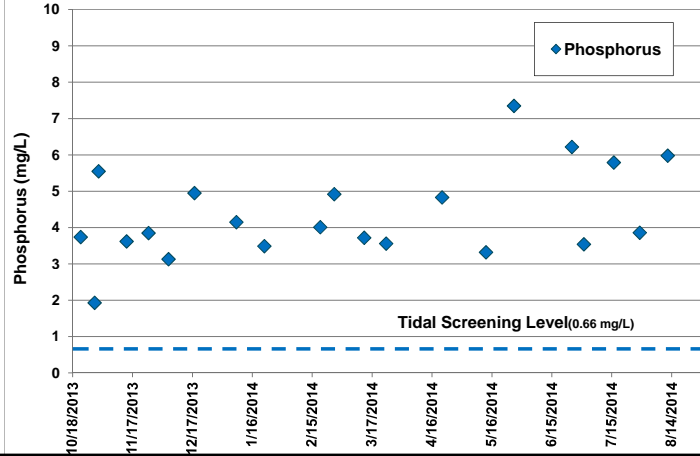






### CHLOROPHYLL-A AND NUTRIENTS: PHOSPHORUS

Variation in Phosphorus Over the Sampling Period:  
Anahuac WWTP



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### CHLOROPHYLL-A AND NUTRIENTS: PHOSPHORUS

Seasonal Phosphorus Table (does not include WWTP)

- Less of a temporal pattern

Phosphorus	Number of Routine Samples	Routine Samples Above Screening Level	Percent Above Screening Level (Routine)	Number of Targeted Rain Event Samples	Targeted Rain Event Samples Above Screening Level	Percent Above Screening Level (Targeted)
Fall Total (September - November)	16	0	0%	4	1	25%
Winter Total (December - February)	20	1	5%	4	0	0%
Spring Total (March - May)	12	0	0%	9	0	0%
Summer Total (June - August)	20	0	0%	0	0	0%



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### CHLOROPHYLL-A AND NUTRIENTS: PHOSPHORUS

Seasonal Phosphorus Table (WWTP)

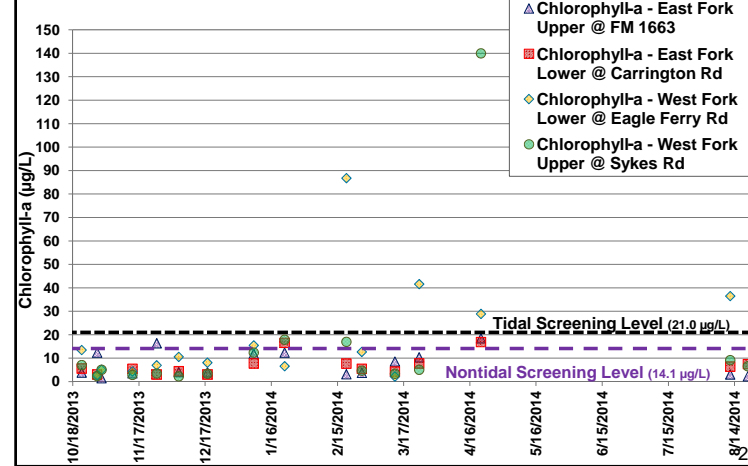
Phosphorus WWTP	Number of Routine Samples	Routine Samples Above Screening Level	Percent Above Screening Level (Routine)	Number of Targeted Rain Event Samples	Targeted Rain Event Samples Above Screening Level	Percent Above Screening Level (Targeted)
Fall Total (September - November)	4	4	100%	1	1	100%
Winter Total (December - February)	5	5	100%	1	1	100%
Spring Total (March - May)	3	3	100%	2	2	100%
Summer Total (June - August)	5	5	100%	0	0	0%



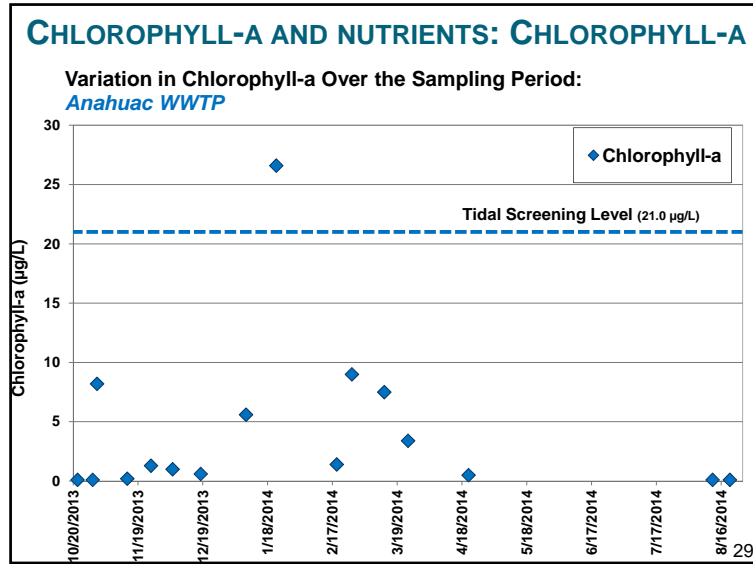
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### CHLOROPHYLL-A AND NUTRIENTS: CHLOROPHYLL-A

Variation in Chlorophyll-a Over the Sampling Period



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### CHLOROPHYLL-A AND NUTRIENTS: CHLOROPHYLL-A

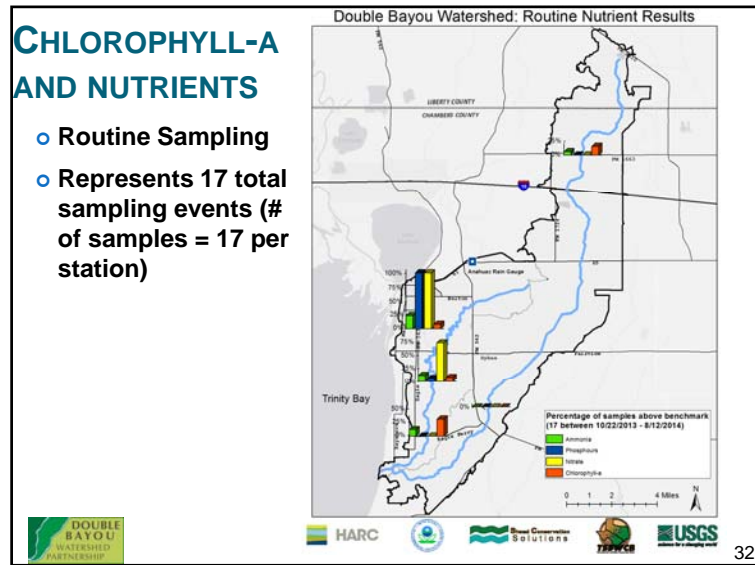
- Seasonal Chlorophyll-a Table (does not include WWTP)

Chlorophyll-a	Number of Routine Samples	Routine Samples Above Above Screening Level	Percent Above Screening Level (Routine)	Number of Targeted Rain Event Samples	Targeted Rain Event Samples Above Screening Level	Percent Above Screening Level (Targeted)
Fall Total (September - November)	16	1	6%	4	0	0%
Winter Total (December - February)	20	1	5%	4	0	0%
Spring Total (March - May)	12	4	33%	0	0	0%
Summer Total (June - August)	4	1	25%	0	0	0%

### CHLOROPHYLL-A AND NUTRIENTS: CHLOROPHYLL-A

- Seasonal Chlorophyll-a Table (WWTP)

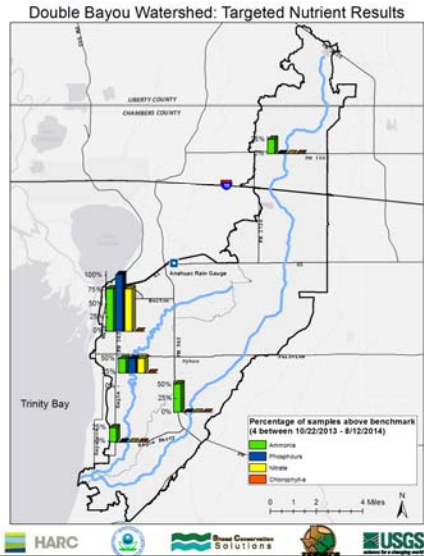
Chlorophyll-a WWTP	Number of Routine Samples	Routine Samples Above Above Screening Level	Percent Above Screening Level (Routine)	Number of Targeted Rain Event Samples	Targeted Rain Event Samples Above Screening Level	Percent Above Screening Level (Targeted)
Fall Total (September - November)	4	0	0%	1	0	0%
Winter Total (December - February)	5	1	20%	1	0	0%
Spring Total (March - May)	3	0	0%	0	0	0%
Summer Total (June - August)	1	0	0%	0	0	0%





## CHLOROPHYLL-A AND NUTRIENTS

- Targeted Rain Event Sampling
- Represents 4 total sampling events (# of samples = 4 per station)



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## CHLOROPHYLL- A AND NUTRIENTS

- Seasonal (not WWTP)
  - Higher percentage of samples above screening level:
    - Ammonia in the Summer
    - Nitrate in the Fall, Winter and Spring (West Fork Upper heavily influences this result)
    - Chlorophyll-a in Spring and Summer
- By Station
  - Overall exceedances low by station except
    - Nitrate at West Fork Upper
    - Chlorophyll a at West Fork Lower (but low number of samples)
    - Phosphorus, Nitrate and Ammonia at WWTP
- For BMP Consideration
  - Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas

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## QUESTIONS




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## BACKUP SLIDES

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Anahuac Rain Gauge (10/1/2013 - 9/10/2014)				
	Fall (September - November)	Winter (December - February)	Spring (March - May)	Summer (June - August)
Anahuac Rain Gauge Days with Rain	12	26	19	16
Anahuac Rain Gauge Days without Rain	52	62	72	74
Total Days	64	88	91	90
Percent of Days with Rain	19%	30%	21%	18%

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