Preliminary Modeling Results for Brady Creek Watershed Protection Plan

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Why Use Modeling?

Models provide a viable approach for estimating loads, providing source load estimates, and evaluating various management alternatives.

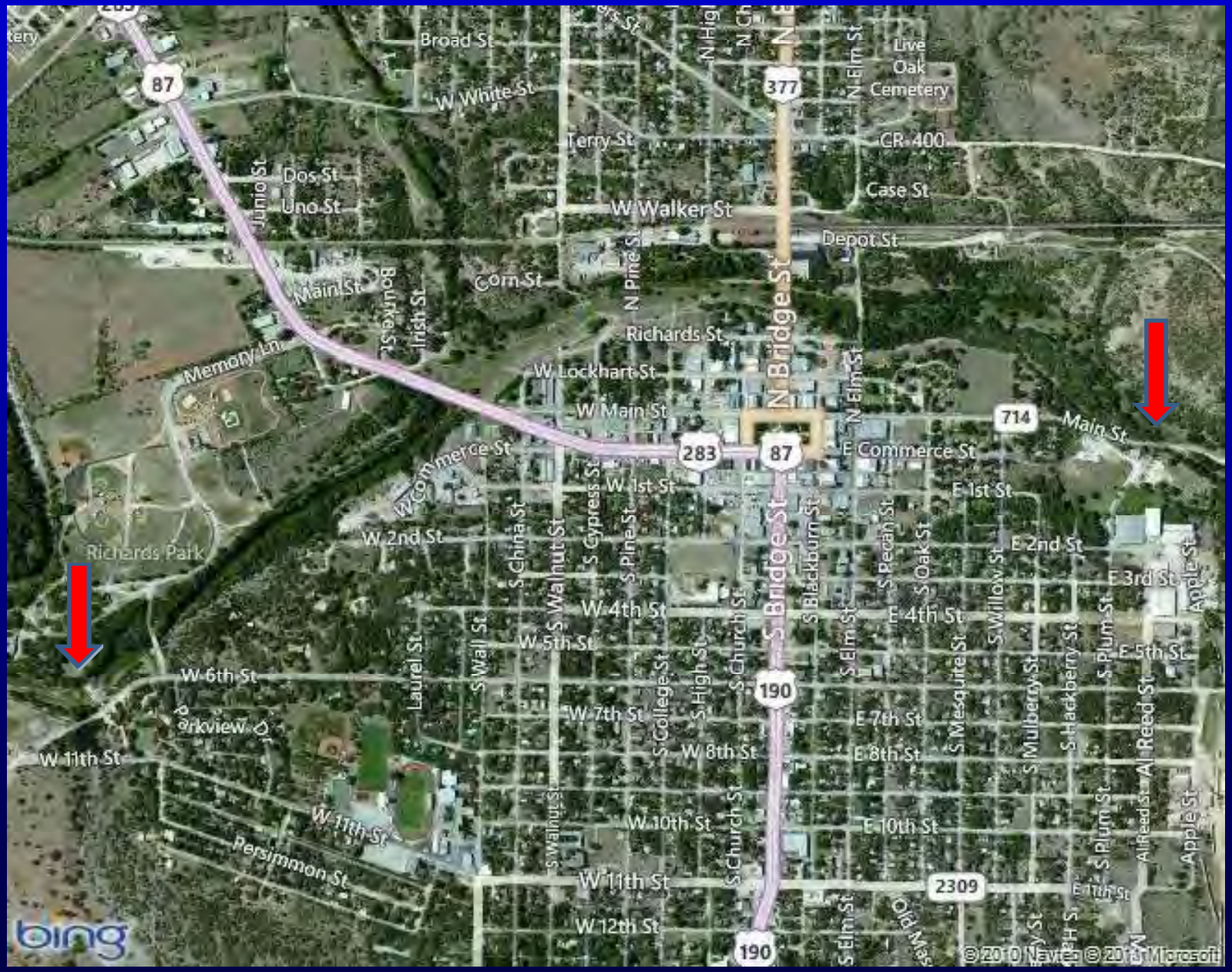
Documentation of Impairment: State of Texas 2010 Integrated Report

Brady Creek (Segment 1416A) from San Saba River upstream to Brady Lake dam.

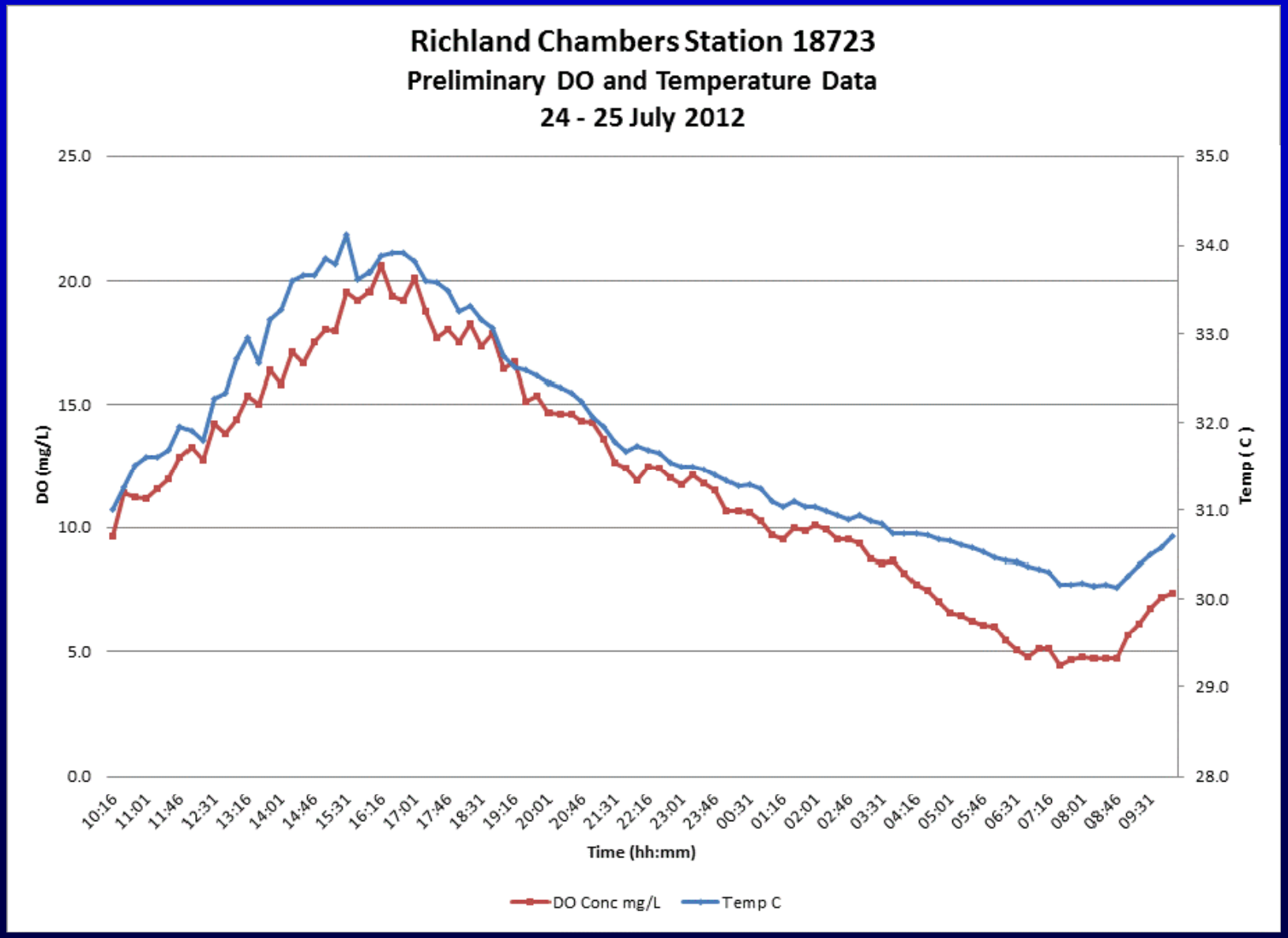
- Depressed dissolved oxygen from RR 714 in City of Brady to Brady Lake dam

  (focused area within City of Brady)

Brady Creek: Area of Focus



Example of Large 24-Hour Dissolved Oxygen Fluctuations



TCEQ 2010 Assessment Data (24-hr DO)

Sampling Dates	24-Hour Minimum DO (mg/L)	24-Hour Average DO (mg/L)
4-5 Aug. 2002	2.7	3.9
4-5 Mar. 2005	2.4	4.1
22-23 Aug. 2005	0.2	1.1
12-13 Sep. 2005	1.5	3.2
20-21 Mar. 2006	7.5	9.7
18-19 Sep. 2006	0.7	3.2
19-20 Mar. 2007	4.3	6.8

24-Hour DO Assessment Criteria

- Average - greater than or equal to 4.0 mg/L
- Minimum – greater than or equal to 3.0 mg/L

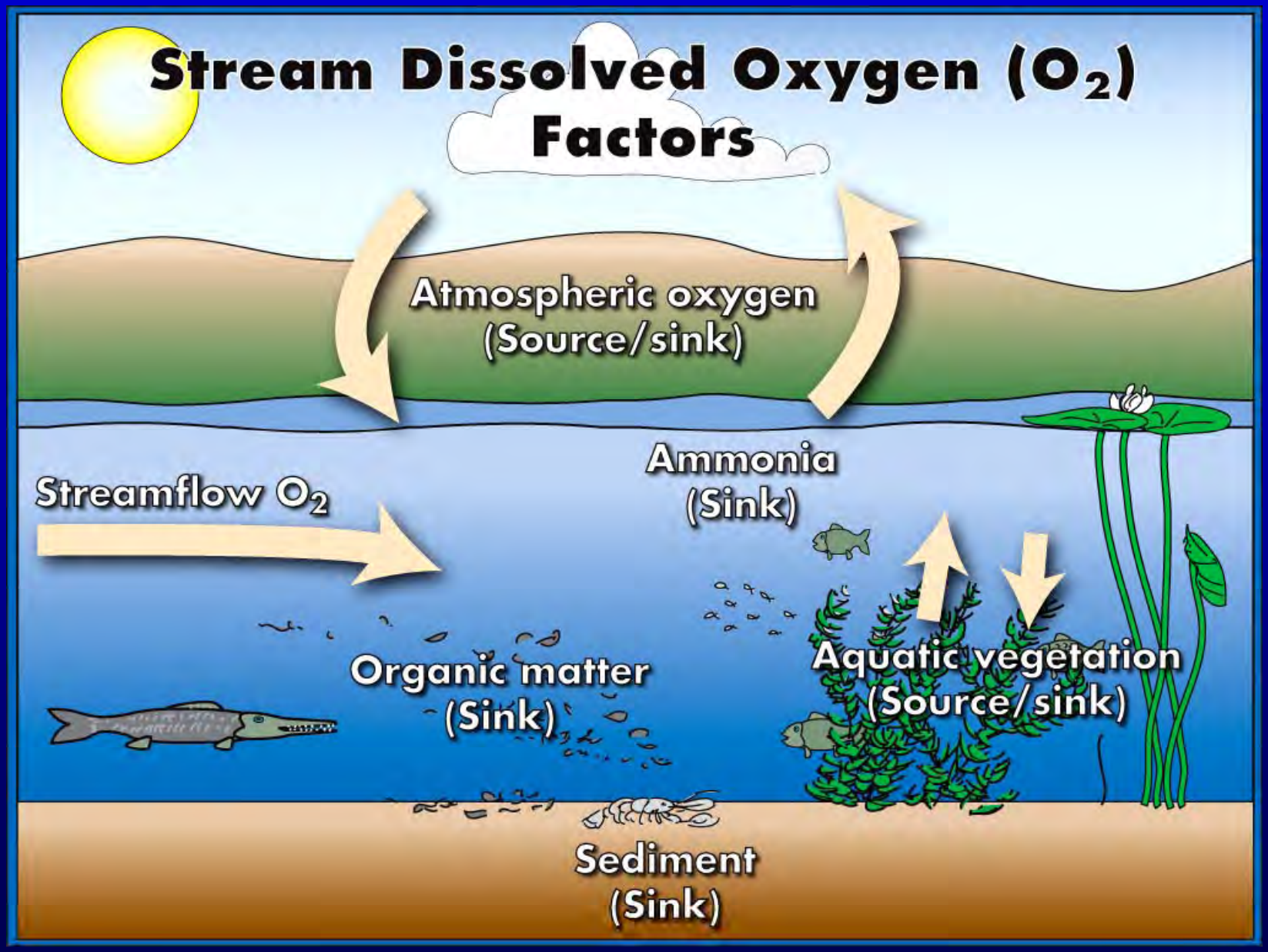
Dual-Modeling Approach to Investigate Low Dissolved Oxygen in Urban Portion of Brady Creek

- SWMM – Storm Water Management Model
  - Evaluate loadings of urban storm water pollution
  - Evaluate reductions from BMPs
- QUAL2K – Stream Dissolved Oxygen model
  - Evaluate improvements from reduced urban loadings
  - Evaluate impacts of increased streamflow

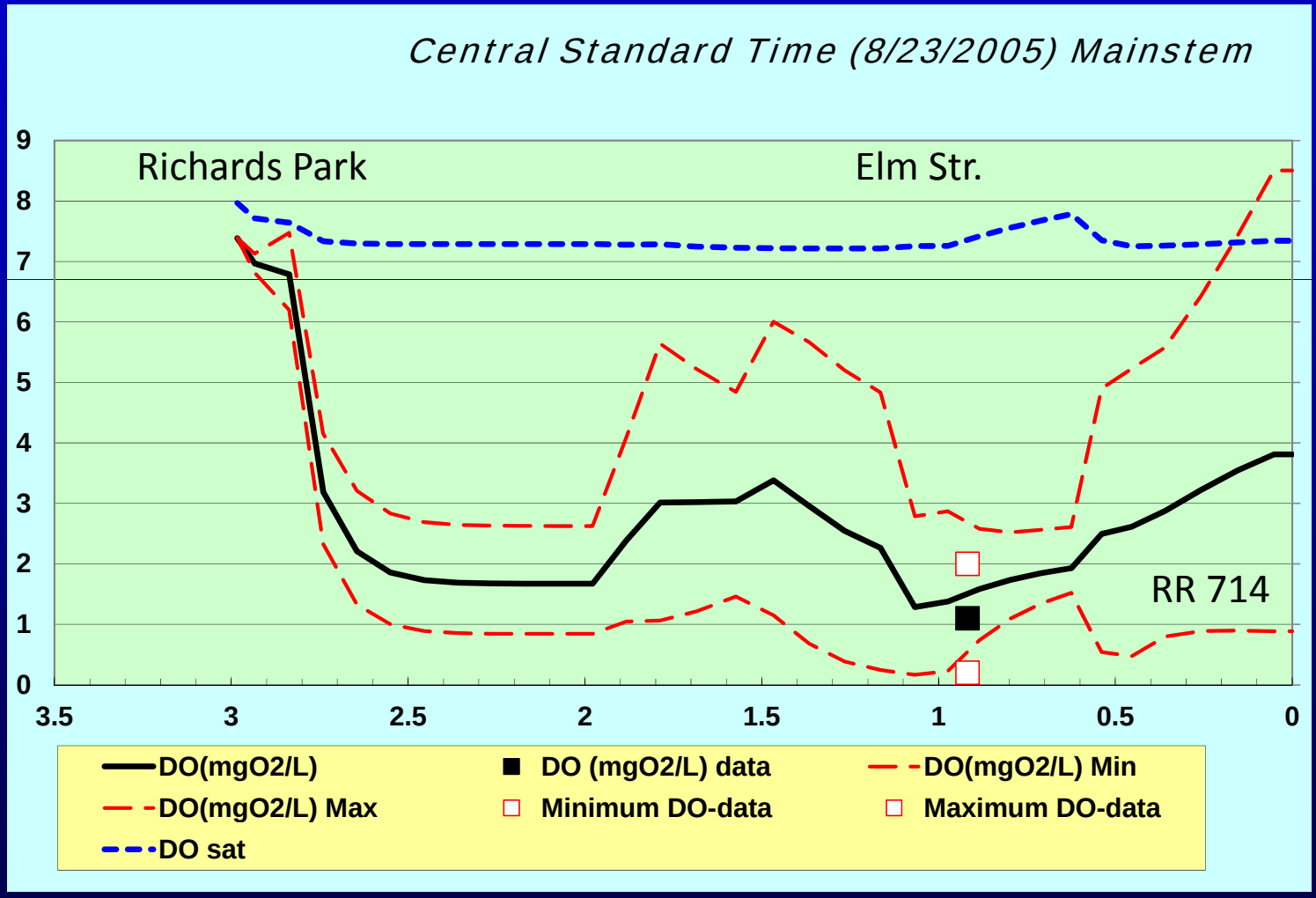
Tool to Address Dissolved Oxygen – QUAL2K

- QUAL2K is a stream water quality model. It is one-dimensional* and operates under steady-state flow.
- All water quality variables are simulated on a diurnal (24-hour) time scale, including dissolved oxygen.

  * One-dimensional means the model divides the Brady Creek into computation elements along the creek's length.


Stream Dissolved Oxygen (O_2) Factors
Atmospheric oxygen (Source/sink)
Streamflow O_2
Ammonia (Sink)
Organic matter (Sink)
Aquatic vegetation (Source/sink)
Sediment (Sink)

Urban Brady Creek – Dissolved Oxygen (DO) Results for Model Calibration



Brady Creek Pools in Urban Area

QUAL2K Evaluations of BMPs for Improvements in Dissolved Oxygen

- Created 24 individual scenarios; 1 for each month in 2005 - 2006
- Evaluated Baseline (Existing) conditions
- Evaluated various BMPs
  - Reductions in sediment demand due to urban stormwater BMPs
  - Pump wastewater treatment plant effluent to headwaters for months of March - October
  - Pump effluent to Richards Park “eastside” pool & discharge through diffuser for months of March - October
  - Combination of effluent pumping & sediment-demand reductions

Updated BMP Analysis
Percent of Time Simulated DO ≥ Criterion
(**Goal** – 90% Attainment of DO Criteria)

Condition	Pier near Elm Street		Entire Reach (Richards Park to RR 714)	
	24-hr Min. DO	24-hr Avg. DO	24-hr Min. DO	24-hr Avg. DO
Baseline	47%	48%	47%	48%
A) 25% Reduction in Sediment Exchange Rates	53%	54%	53%	53%
B) 50% Reduction in Sediment Exchange Rates	73%	77%	70%	75%
C) Effluent Pumped to Headwaters (Mar.-Oct.)	64%	68%	47%	45%
D) Effluent Pumped to "East" Pool; Diffuser (Mar.-Oct.)	69%	75%	62%	54%

Updated BMP Analysis
Percent of Time Simulated DO ≥ Criterion
(**Goal** – 90% Attainment of DO Criteria)

Condition	Pier near Elm Street		Entire Reach (Richards Park to RR 714)	
	24-hr Min. DO	24-hr Avg. DO	24-hr Min. DO	24-hr Avg. DO
Baseline	47%	48%	47%	48%
E) Combine B & C Conditions (No Diffuser & 50% Sediment Reduction)*	100%	100%	94%	89%
F) Combine A & D Conditions (Diffuser & 25% Sediment Reduction)*	76%	100%	75%	72%
G) Combine B & D Conditions (Diffuser & 50% Sediment Reduction)*	100%	100%	100%	100%

* Effluent pumped for months of March – October.

Thank You

Questions?