

**Assessment of Ecoregional Dissolved Oxygen Regimes
Data Report for 2007 Study Season**

SECTION 3

MATERIAL AND METHODS

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3.1. Data Collection Activities

Quality assurance documents prepared by MEC to support AERDOR field investigation efforts included an approved general Quality Assurance Project Plan (QAPP) and Sampling Analysis Plan (SAP) that were approved by both EPA Region 7 and MDNR. The SAP specified monitoring locations for the 2007 season (Table 4). The SAP and project QAPP serve as primary references for sampling activities and are available from ERC by request.

TABLE 4. Description of Monitoring Locations for AERDOR 2007 Study Season.

Site (ID)	Site Description (narrative)	Stream (name)	Easting (m)	Northing (m)	County (name)	WBID (#)
EFCR1	West of Vassmer Road	East Fork Crooked River	0423146	4355280	Ray	0372
EFCR2	128th Street	East Fork Crooked River	0423287	4353126	Ray	0372
HC1	Wanamaker Rd. Crossing	Heaths Creek	0484199	4306864	Pettis	0848
HC2	Major Rd. Crossing	Heaths Creek	0486449	4307033	Pettis	0848
HC3	Walk Rd. Crossing	Heaths Creek	0488470	4308749	Pettis	0848
HC4	Hwy BB Crossing	Greer Branch	0483362	4305680	Pettis	0850
HC5	Anderson Rd. Crossing	Long Grove Branch	0486278	4305837	Pettis	3531
HC6	Rains/Reines Rd. Crossing	Pointer Branch	0490845	4308710	Pettis	3486
HC7	Millers Chapel Rd. Crossing	Marlin Branch	0491555	4305177	Pettis	0852
LDC1	Bushwacker Conservation Area approximately 0.20 miles Northwest from the east most parking lot off Cty. Rd. 718	Little Drywood Creek	0377693	4168144	Vernon	1326
LDC2	Bushwacker Conservation Area approximately 0.20 miles Southwest from parking lot off Cty. Rd. 711	Little Drywood Creek	0377004	4169298	Vernon	1326
LDC3	Route N Crossing	Little Drywood Creek	0377053	4173201	Vernon	1326
LDC4	Route F Crossing	Little Drywood Creek	0376797	4179792	Vernon	1325
LDC5	Cty. Rd. 530 Crossing	Little Drywood Creek	0377040	4181802	Vernon	1325
LDC6	Cty. Rd. 575 Crossing	Pleasant Creek	0378355	4174095	Vernon	1327
LDC7	Cty. Rd. 578 Crossing	Pleasant Creek	0379815	4173862	Vernon	1327

Continuous and discrete water quality data were collected from AERDOR streams and classified tributaries. Continuous data were collected at stationary, roving, and extended deployment monitoring locations on the reference streams (Table 5). Continuous monitoring equipment was installed at stationary sites (EFCR1, EFCR2, HC1, HC2, HC3, LDC1, LDC2) in mid-July and remained until the beginning of September. Discrete water quality data were also collected at the stationary sites (Table 5).

Sites LDC3, LDC4, and LDC5 were roving sites. At these sites, data were collected for a two-week period at each site before monitoring equipment was moved to the next

downstream site. In order to assess the potential seasonal recovery patterns of DO, two stationary sites (EFCR2, HC2) served as extended deployment sites. Continuous stream data were collected at the extended deployment sites until mid-November (Table 5). Discrete water quality information was collected in 7 tributaries (sites HC4, HC5, HC6, HC7, LDC6, and LDC7) between mid-July and the beginning of September (Table 5).

TABLE 5. Continuous and Discrete Parameters Collected in AERDOR Study Streams During 2007

Station Type	Monitoring Sites	Continuous Data	Discrete Data
Stationary*	EFCR1, EFCR2, HC1, HC2, HC3, LDC1, LDC2	DO, DO %, Temp., SC, Level, Light, Baro.	TP, TN, NO2+NO3, NH3N, Chl a, TSS, VSS, CBODU, pH, Hydrogeometry, Channel Characteristics
Roving	LDC3, LDC4, LDC5	DO, DO %, Temp., SC	Hydrogeometry, Channel Characteristics
Extended Deployment	HC2, EFCR2	DO, DO %, Temp., SC, Level, Light, Baro	None During Extended Deployment
Tributaries	HC4, HC5, HC6, HC7, LDC6, LDC7	None	DO, DO %, Temp., SC, pH

DO – Dissolved Oxygen, mg/L
DO % - Dissolved Oxygen, % Sat.
Temp. – Water Temperature, °C
SC – Specific Conductance, uS/cm
Level – Water Level, cm/WC
Baro. – Barometric Pressure, mm/Hg
TP – Total Phosphorus, mg/L
TN – Total Nitrogen, mg/L
NO2+NO3 – Nitrite+Nitrate as N, mg/L

NH3N, Tot. Ammonia as N, mg/L
Chl a – Suspended and Benthic Chlorophyll a, ug/L, mg/m²
TSS – Total Suspended Solids, mg/L
VSS – Volatile Suspended Solides, mg/L
CBODU – Ultimate Carbonaceous Oxygen Demand, mg/L
pH – Potential Hydrogen, SU
Hydrogeometry – Channel Width and Depth, feet
Channel Characteristics- Mesotype, Shading, Substrate Composition, Periphyton Coverage, SOD Coverage

Notes:
*Level, light, barometric pressure, and discrete water quality data only collected at sites HC2, EFCR2, and LDC2. Hydrogeometry and channel characteristics collected at all stationary sites.

3.2. Data Analysis Techniques

Data were summarized on a parameter-by-parameter basis and relationships were evaluated. When used, statistical analysis techniques were chosen based on the statistical and distributional properties of the data. Correlation and regression techniques were used assess the relationships between DO and the variables outlined in Table 6.

TABLE 6. Variables Included in Dissolved Oxygen Correlation and Regression Analyses.

Category	Variables
Chemical Characteristics	Nutrients, Chlorophyll a
Physical Characteristics	Stream Level/Depth, Discharge, Water Temp.
Environmental Characteristics	Light Intensity, Land Use, Watershed Area

Major sources and sinks of DO were identified through a desktop application of simplified routines included in the QUAL2K water quality model (Chapra *et al.* 2005). Least-squares optimization was used to calibrate the model for DO production and consumption at sites LDC2, EFCR2, and HC2. Observed photosynthesis and respiration rates obtained from stream metabolism calculations were used as calibration targets. Model predictions of photosynthesis and respiration were derived from observed chemistry and chlorophyll-a data. Kinetic and mass-transfer processes in the model were forced within the boundary of reasonable literature values. A conceptual outline of the model is included as Figure 5.

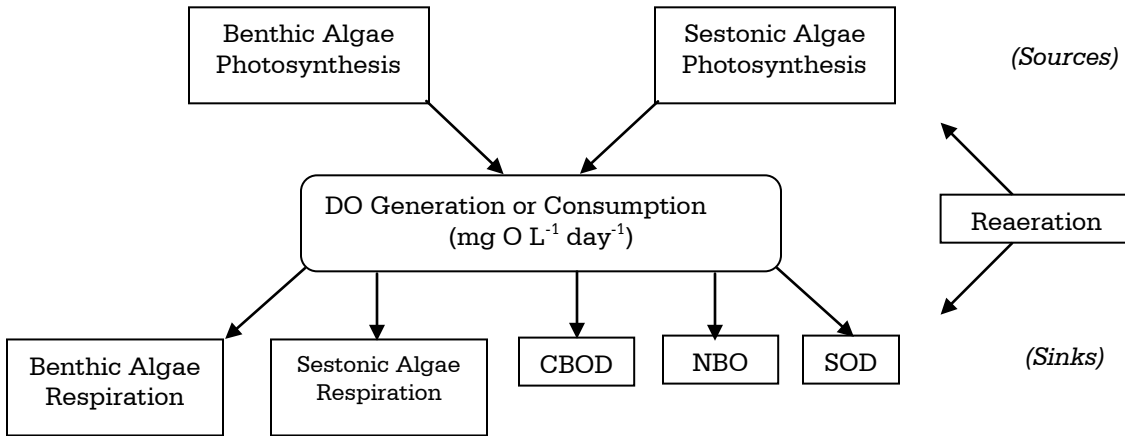


FIGURE 5. Conceptual Model of Dissolved Oxygen Sources and Sinks in AERDOR Study Streams.

In the model, CBOD, NBOD, SOD, and respiration from benthic and sestonic algae were included as DO sinks (Figure 5). Photosynthesis from benthic and sestonic algae was a DO source. Reaeration was modeled as a 'sink' during periods of supersaturation and a 'source' when the water column was undersaturated.

Parameter summaries, modeling results and statistical analyses were compared to 2006 AERDOR results (MEC 2007) in order to evaluate seasonal differences, ecoregional patterns, and overall trends.