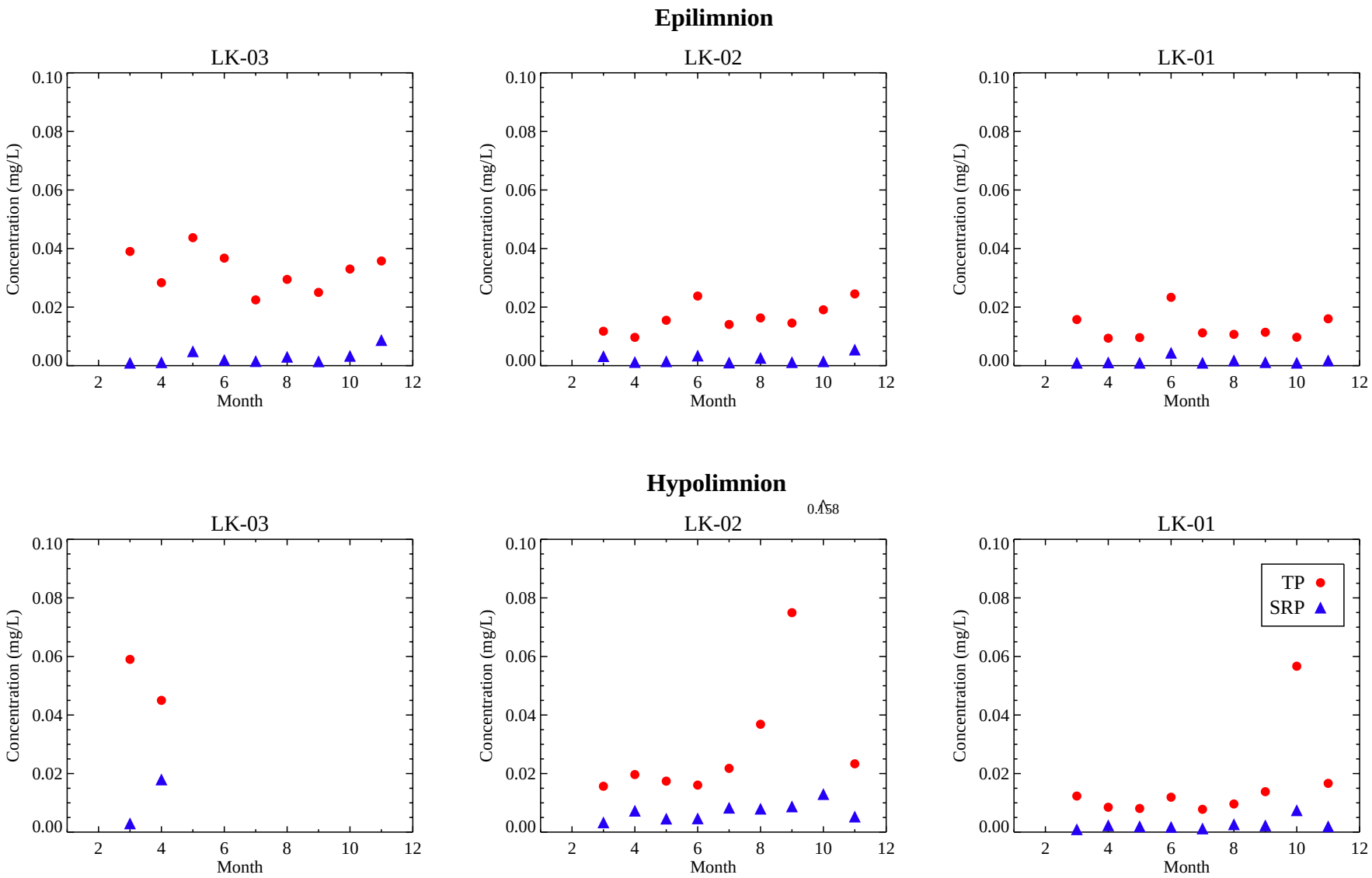


**Figure 2-35. Monthly-averaged total phosphorus and SRP at three stations on Lake Tenkiller.**

*Epilimnion is <10 m depth, and hypolimnion is >=10 m depth. Data source: Plaintiff data collected 2005-2008. Includes only method SM18-4500PF. Non-detects included at detection limit.*

PAL - D:\OICiln\Analyses\IDL_decks\tp_srp_monthlyavg_PAL.pro
Thu Jan 22 14:29:32 2009

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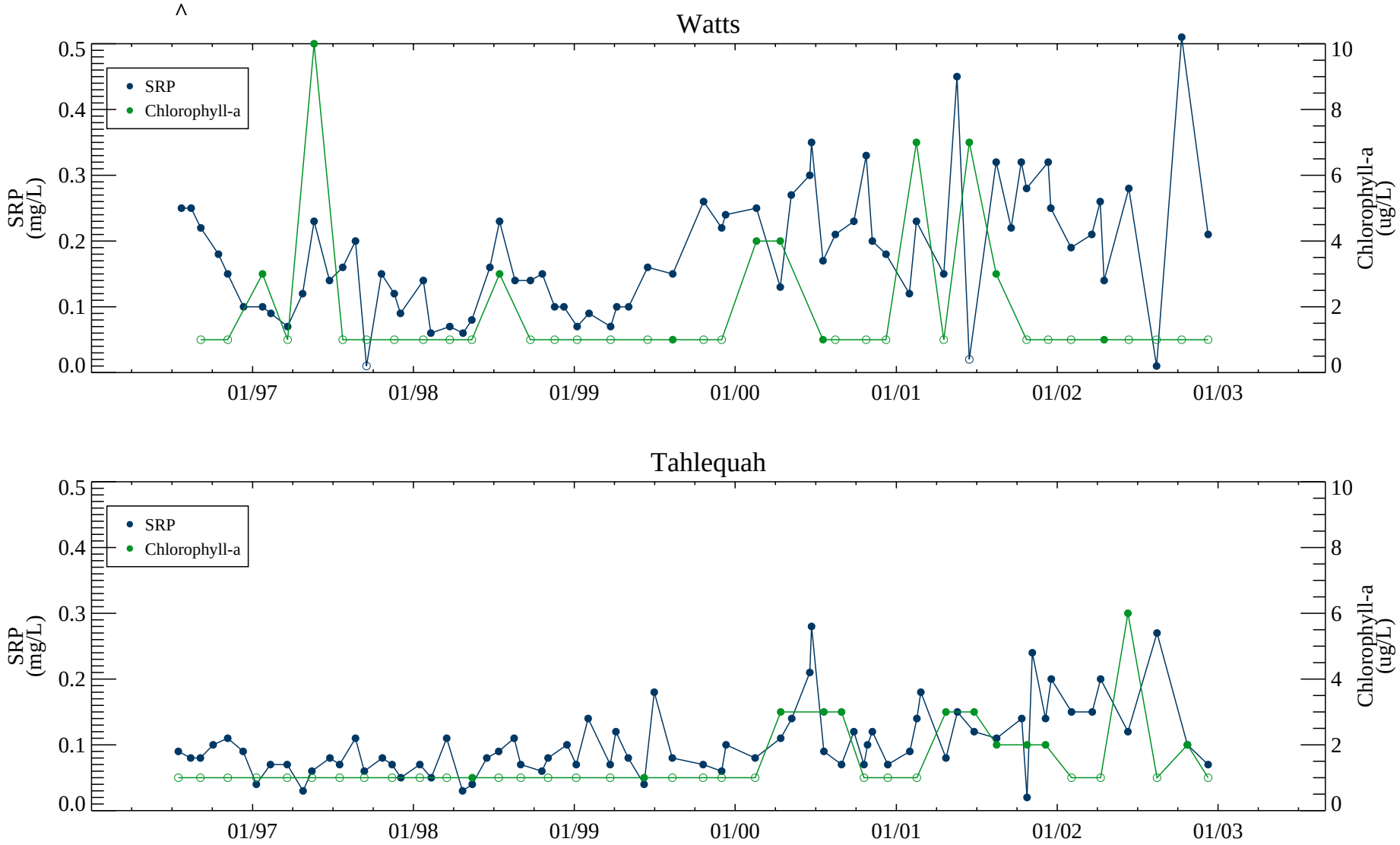



**Figure 3-1. SRP and chlorophyll-a concentrations versus time at Watts and Tahlequah.**

*Watts data from USGS station 07195500. Tahlequah data from USGS station 07196500.*
*Chlorophyll-a data from USGS parameter 32211 (chlorophyll-a, phytoplankton, spectrophotometric acid method).*
*Non-detects included at detection limit and indicated by open symbols.*

PAL - D:\OICiln\Analyses\IDL_decks\chlor_tp_temporal_wattstahlequah.pro
Thu Jan 22 14:43:29 2009

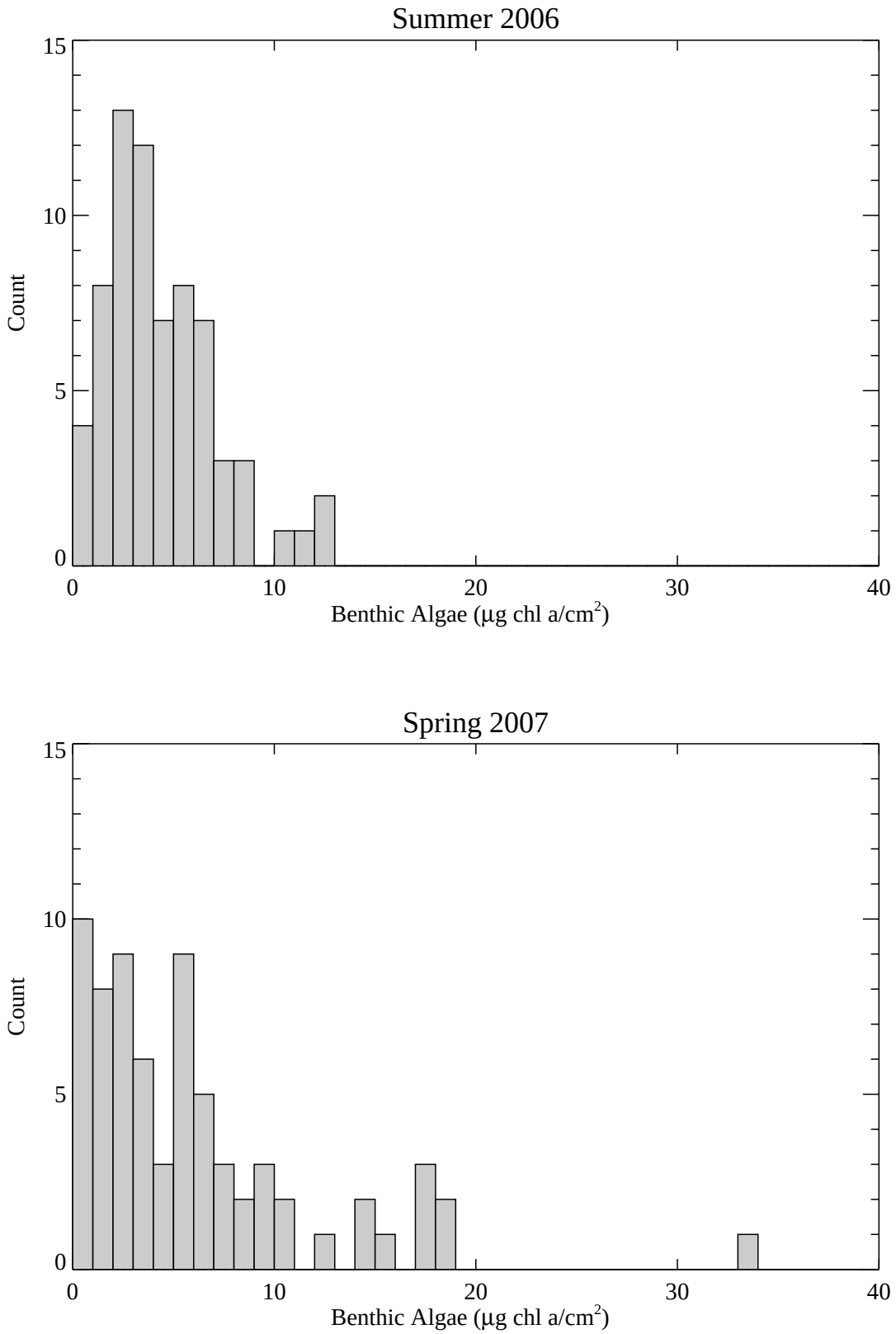
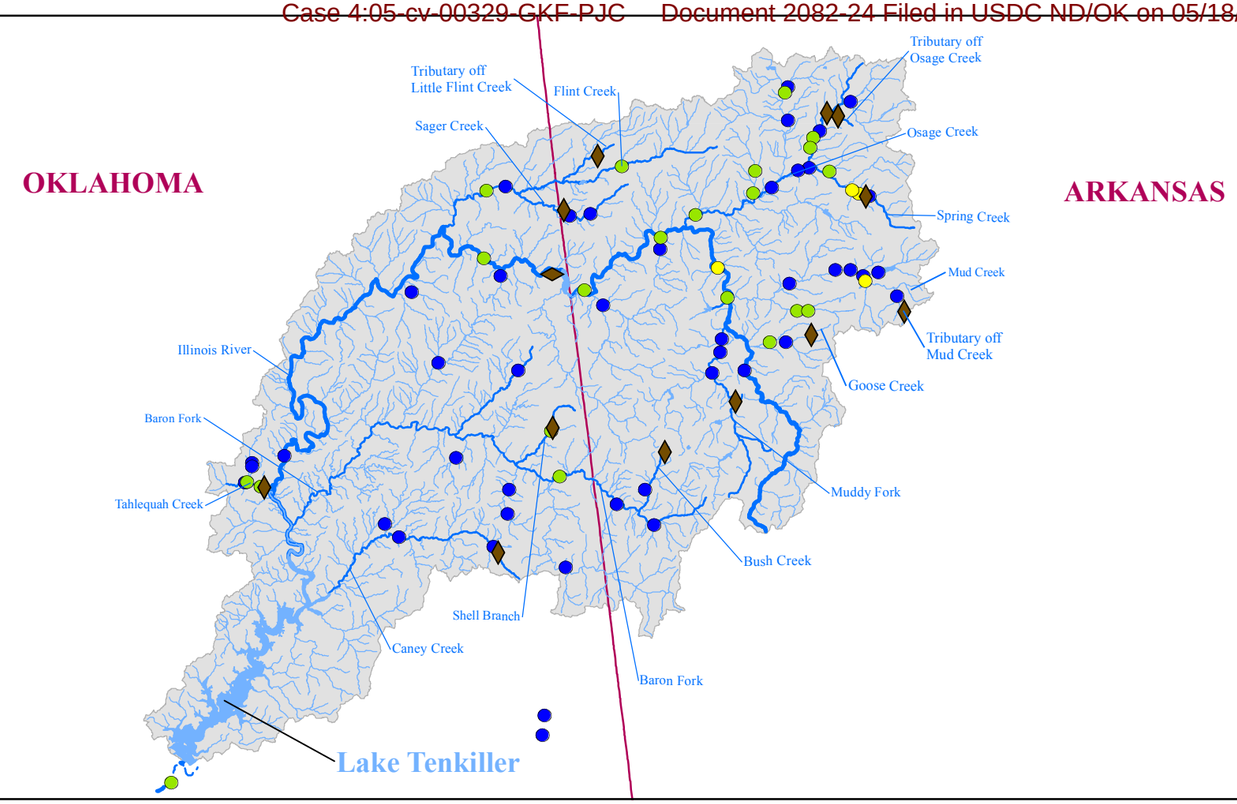


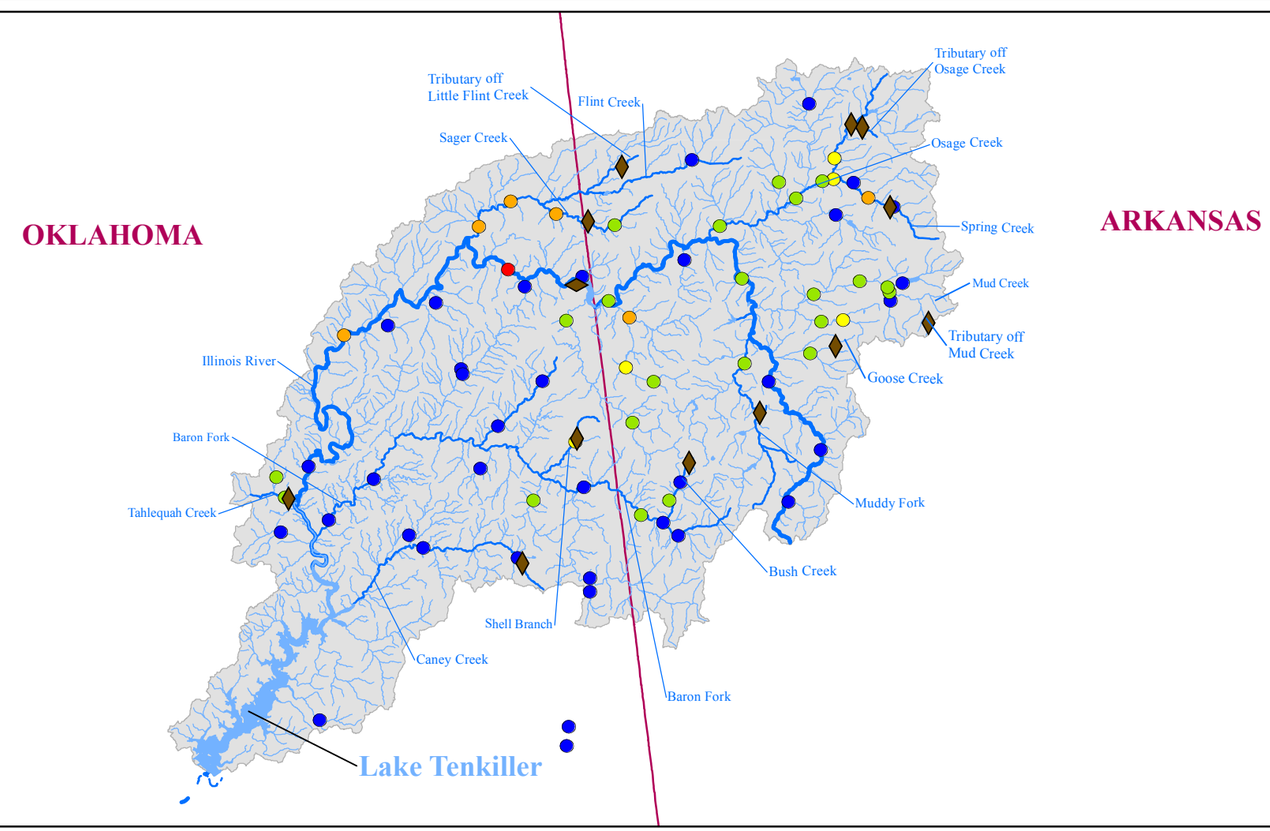

**Figure 3-2. Count of benthic algae algal biomass at stations sampled in Summer 2006 and Spring 2007.**

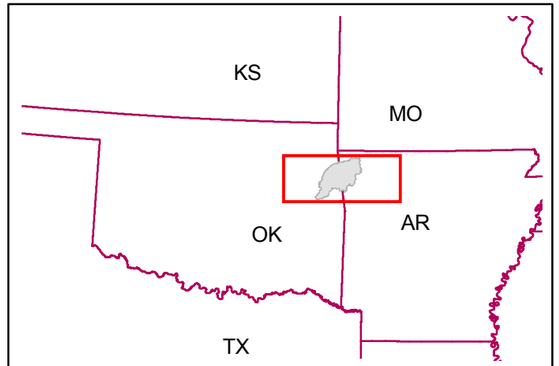
*Data has been confirmed with reasonable confidence by GEI Consultants during data discovery; data based on samples collected by Stevenson.*

## Summer 2006




## Spring 2007




**Locator Map**

## Legend

**Outfall Locations***

- NPDES Discharge
- Land Application Only

**Algal Biomass**
**(ug chl-a/cm2)**

- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- > 20
- Major Tributaries
- Illinois River Watershed

*Jarman, 2008.
*Data source: Figure 2.2.1, Stevenson.*

**Figure 3-3.**
**Benthic algae biomass at stations sampled in Summer 2006 and Spring 2007.**

OICiln:114

January 2009

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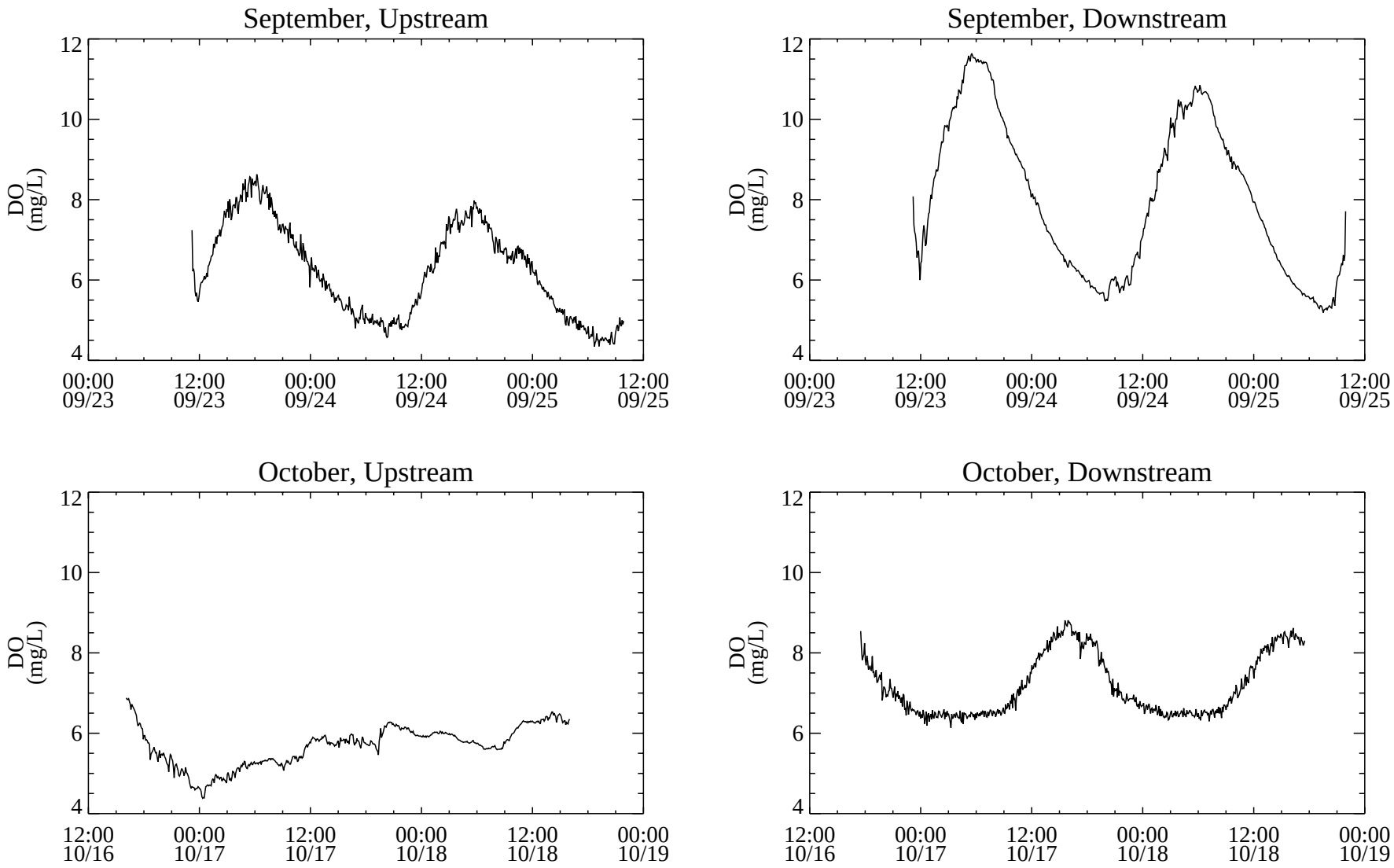


**Figure 3-4a. Dissolved oxygen, Prairie Grove WWTP. River slope = 1 ft / 1000 ft.**

*Data collected in 2003 by U.S. EPA Region 6 water quality and biological assessment of Illinois River and King River basins. Upstream measurements taken ~4800 ft upstream of outfall. Downstream measurements taken ~9300 ft downstream of outfall.*

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Thu Jan 22 14:52:49 2009

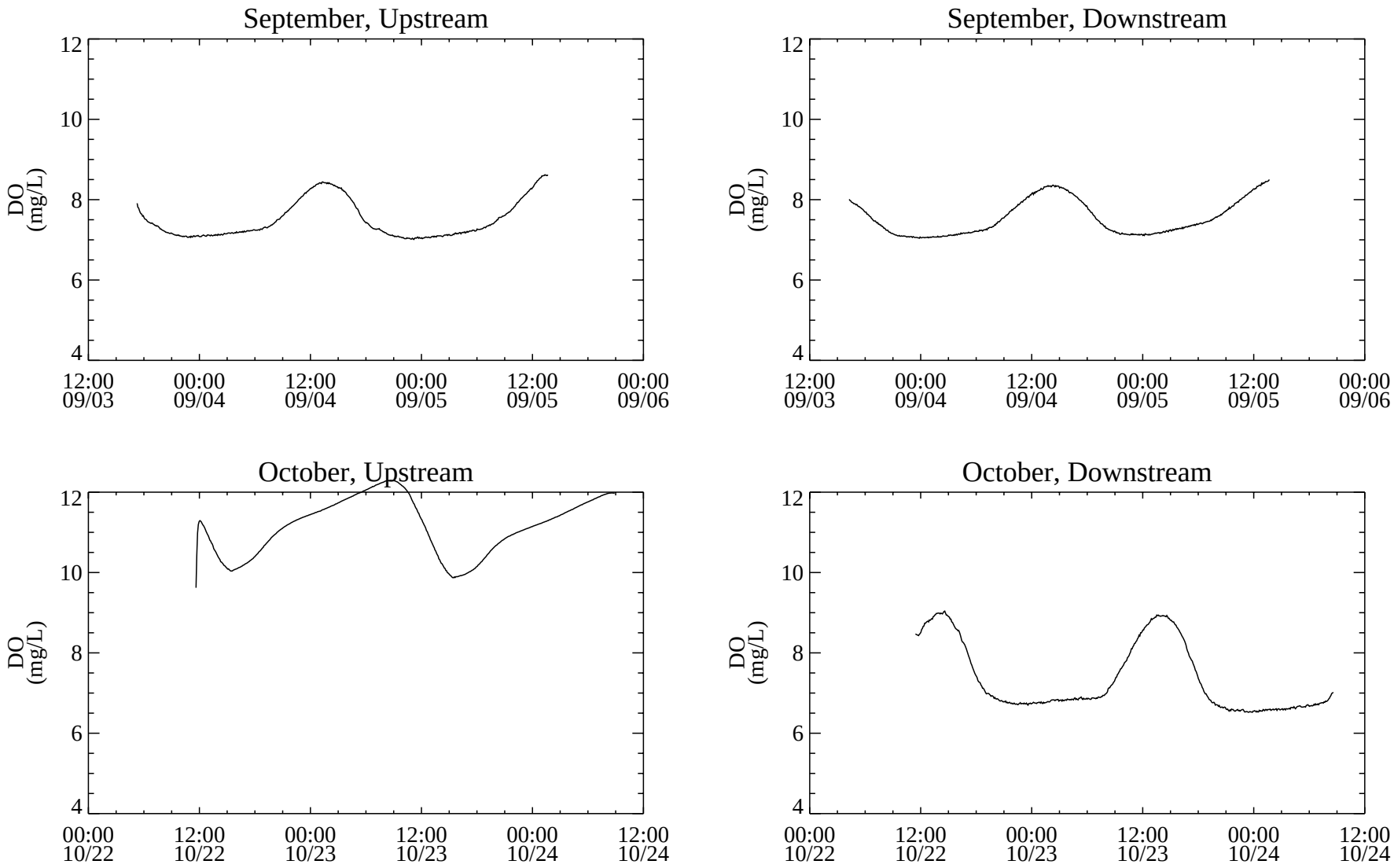


**Figure 3-4b. Dissolved oxygen, Rogers WWTP. River slope = 2 ft / 1000 ft.**

*Data collected in 2003 by U.S. EPA Region 6 water quality and biological assessment of Illinois River and King River basins. Upstream measurements taken ~850 ft upstream of outfall. Downstream measurements taken ~2500 ft downstream of outfall.*

PAL - D:\OICiln\Analyses\IDL_decks\wwtpdoplot_station.pro
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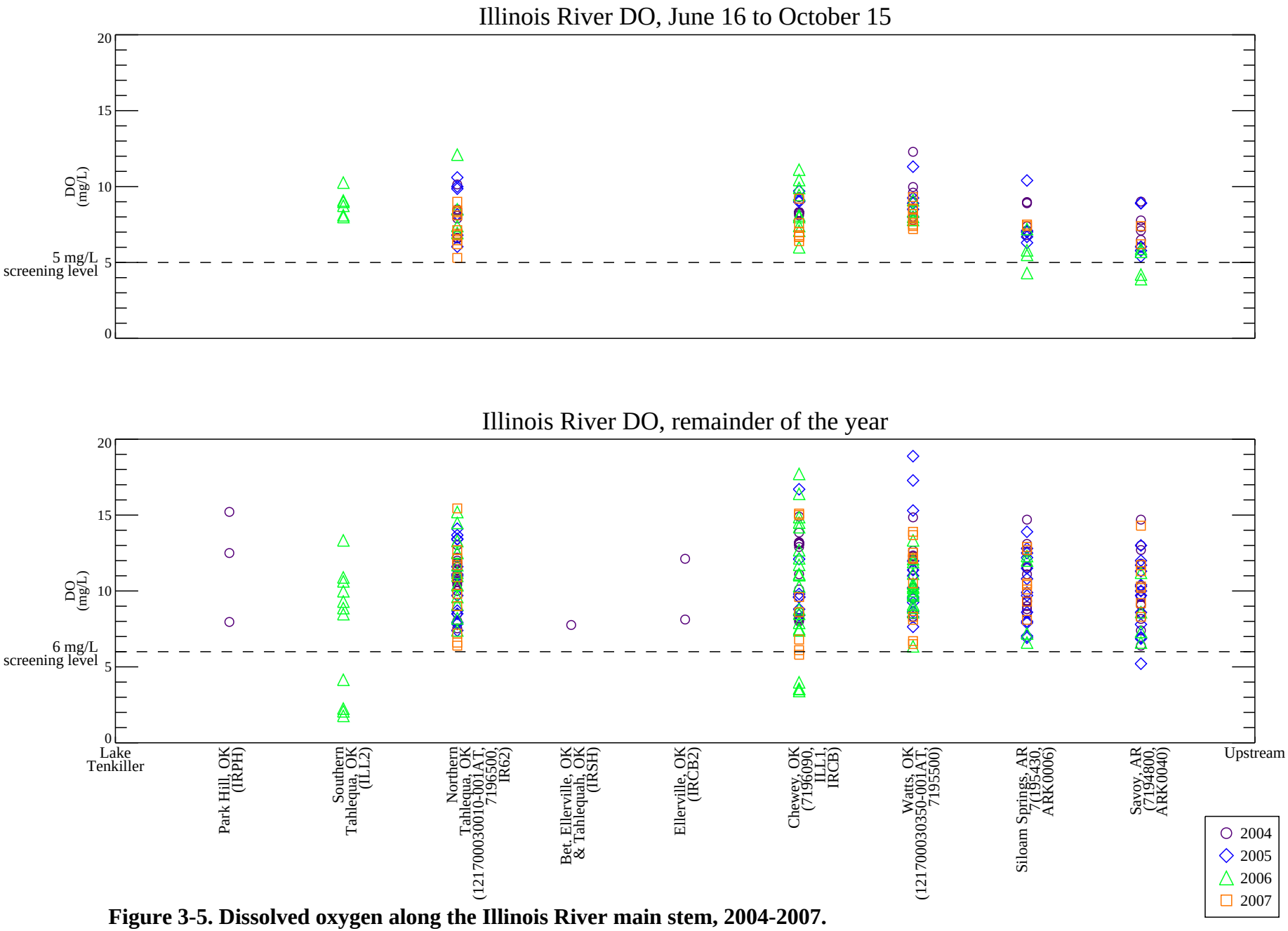
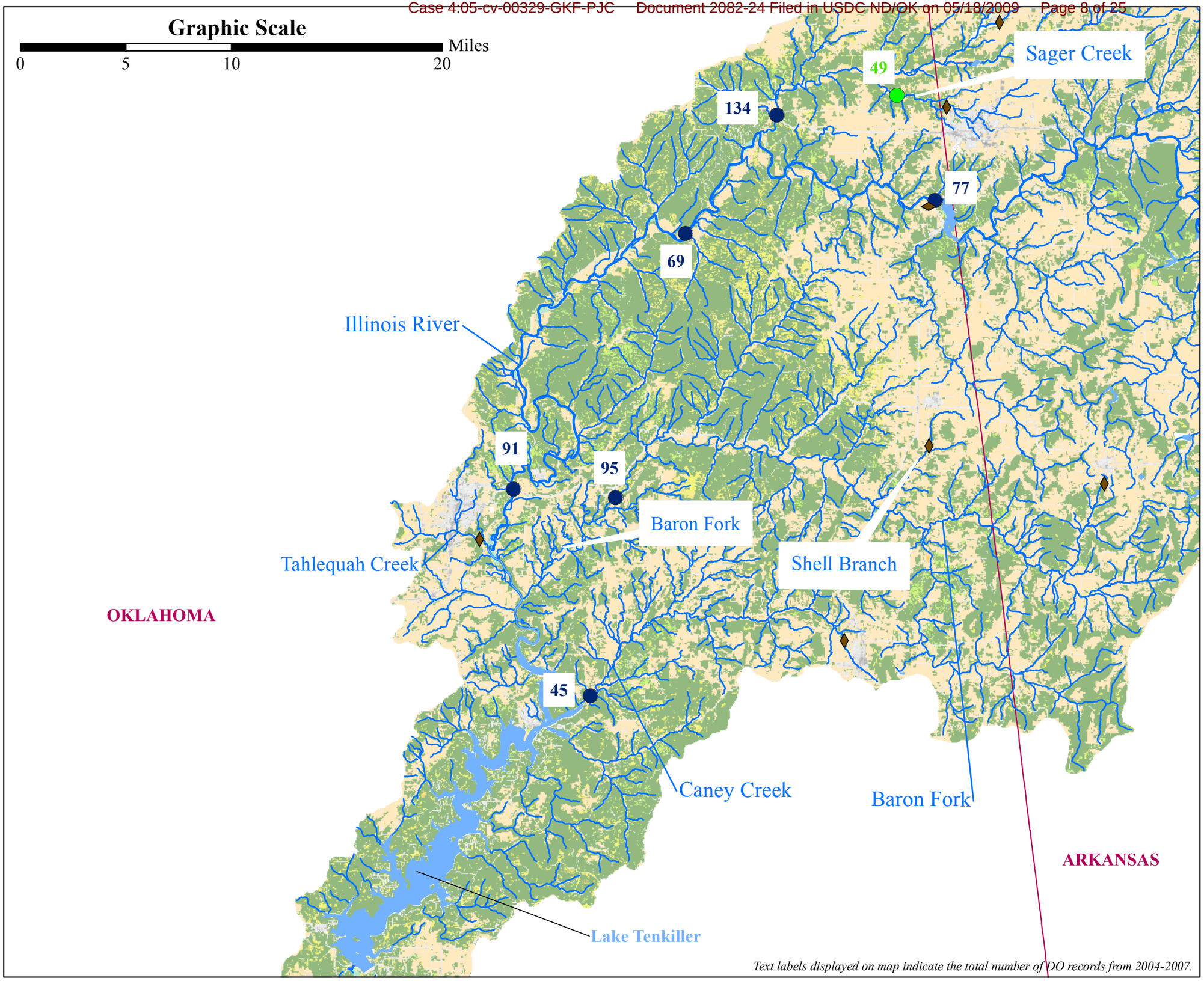


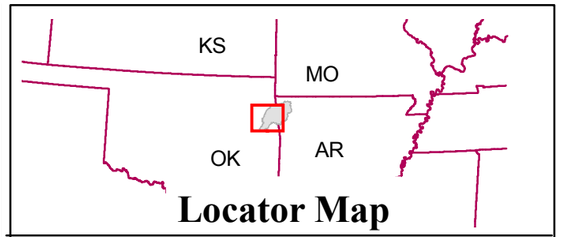

**Figure 3-5. Dissolved oxygen along the Illinois River main stem, 2004-2007.**

**Data sources: Arkansas Dept. of Environmental Quality, Cherokee Nation (Oklahoma), Oklahoma Dept. of Environmental Quality, OWRB, USGS**

SJRH - D:\OICiln\DO_New\IllinoisR_DO_spat.pro
Wed Jan 21 15:53:16 2009




*Text labels displayed on map indicate the total number of DO records from 2004-2007.*




## Legend

**Outfall Locations**

- NPDES Discharge
- Land Application Only

**Dissolved oxygen***

- 0 years with > 10% below screening level
- 1 year with > 10% below screening level
- 2 years with > 10% below screening level
- 3 years with > 10% below screening level
- 4 years with > 10% below screening level
- Lakes
- Major Tributaries and Tributaries with Outfall Locations

**Landuse**

- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

**These values represent the number of years that a given station exceeded the standard and for rivers and streams only.*

*Notes:*

*1) This analysis is based on habitat specific DO screening levels:*

*a) For warm water habitat 4.0 mg/L between June 16 and October 15 and 5.0 mg/L for the rest of the year.*

*b) For cold water habitat 5.0 mg/L between June 16 and October 15 and 6.0 mg/L for the rest of the year.*

*2) Data sources: ADEQ, OWRB, USGS, Storet, Storet-Modern and Plaintiffs' data collected 2005 - 2007.*

*3) To assure sufficient data for determining frequency of exceedance, all sampling stations which meet the following criteria are shown:*

*- 8 or more DO records per year in at least 2 years from 2004-2007*

*- 1 or more DO records per quarter (3-month period) for at least 3 quarters each year.*

*4) Outfall locations are from Jarman, 2008.*

*5) Landuse data source: NLCD 2001.*

# Figure 3-6. Dissolved oxygen exceedances in rivers and streams for the Illinois River Watershed, 2004-2007.

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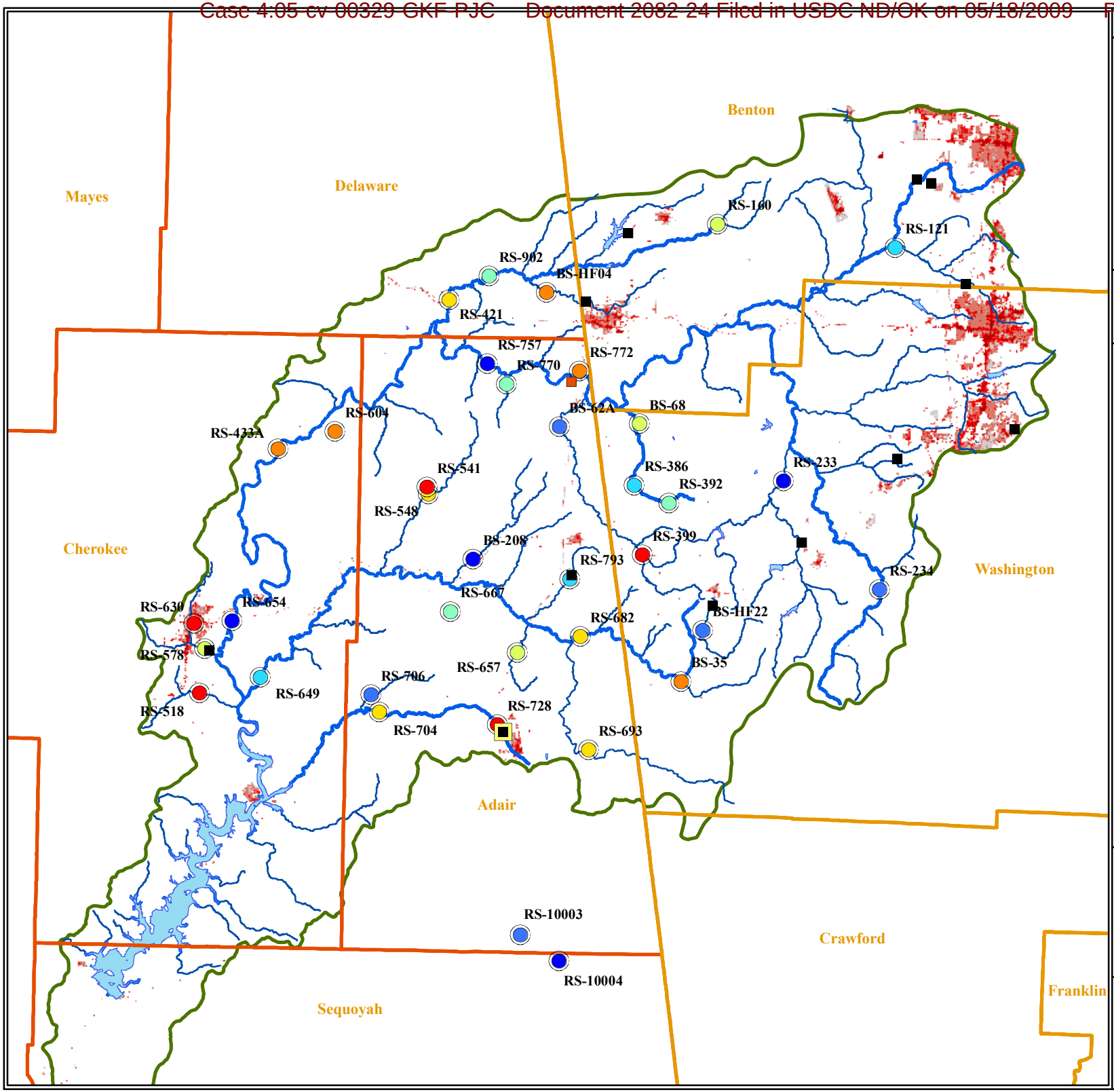
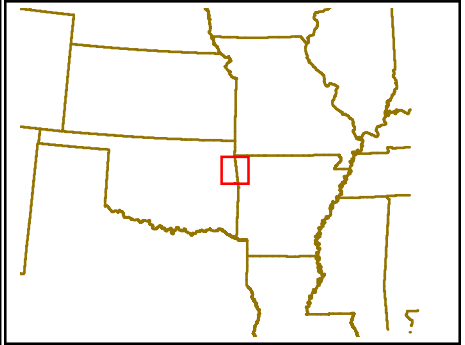



## LOCATOR



## SCALE

0 2.5 5 7.5 10 Miles

## LEGEND

Shannon-Weiner Diversity Index*

- 1.01 - 1.12
- 1.12 - 1.52
- 1.52 - 1.62
- 1.62 - 1.69
- 1.69 - 1.74
- 1.74 - 1.95
- 1.95 - 2.11
- 2.11 - 2.58

WWTP Locations

- NPDES Discharge
- Land Application
- Waterbodies
- Major streams
- Smaller streams
- Watershed

Counties

- Arkansas
- Oklahoma

NLCD Landcover

- urban, vacant
- urban, low
- urban, medium
- urban, high

*Approximate WWTP Location*

** Includes 2007 Plaintiff's data only.*

**Figure 3-7. Illinois River fish: Shannon-Weiner diversity index values.**

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OICiln:115 January 2009

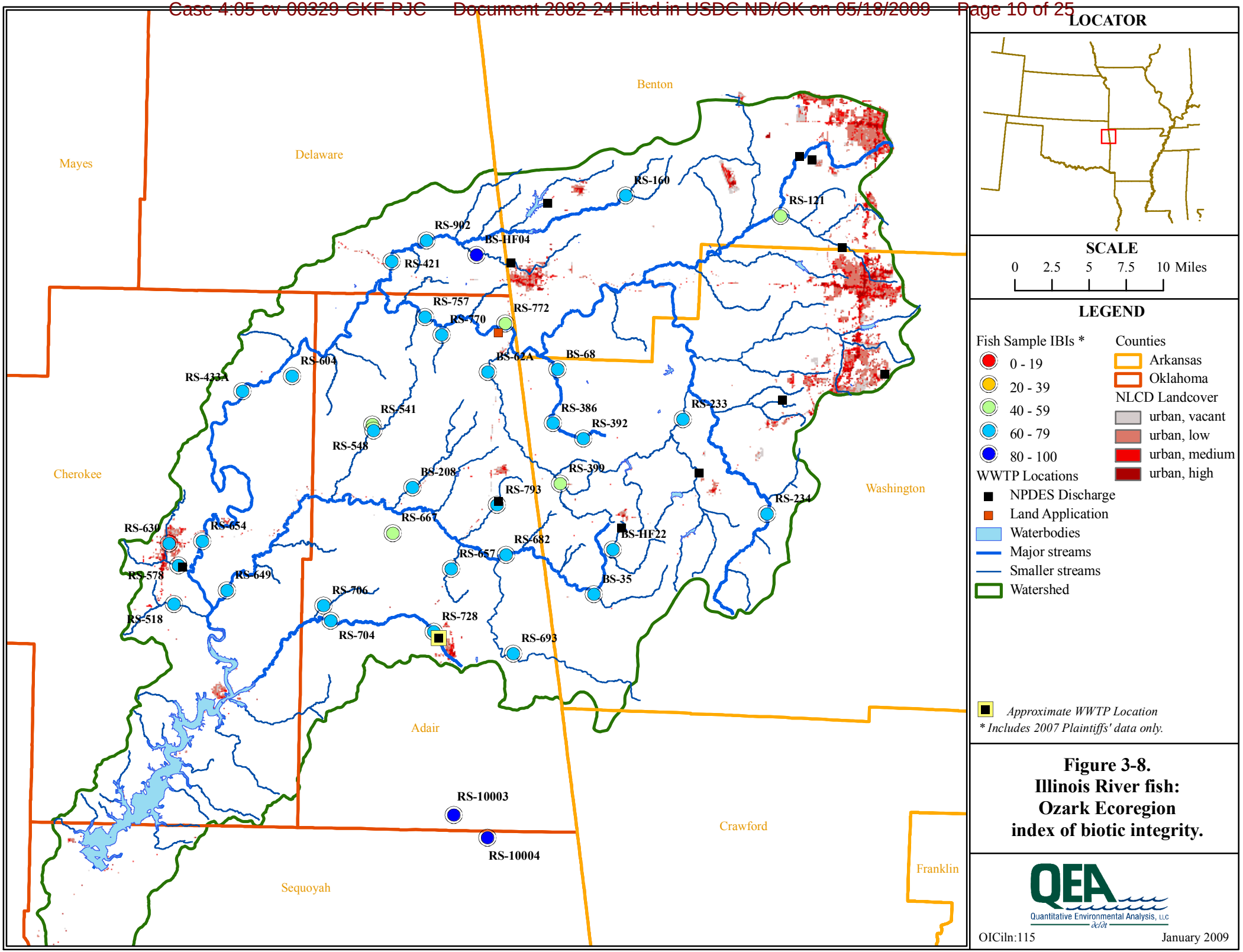


**Figure 3-8.**
**Illinois River fish:**
**Ozark Ecoregion**
**index of biotic integrity.**

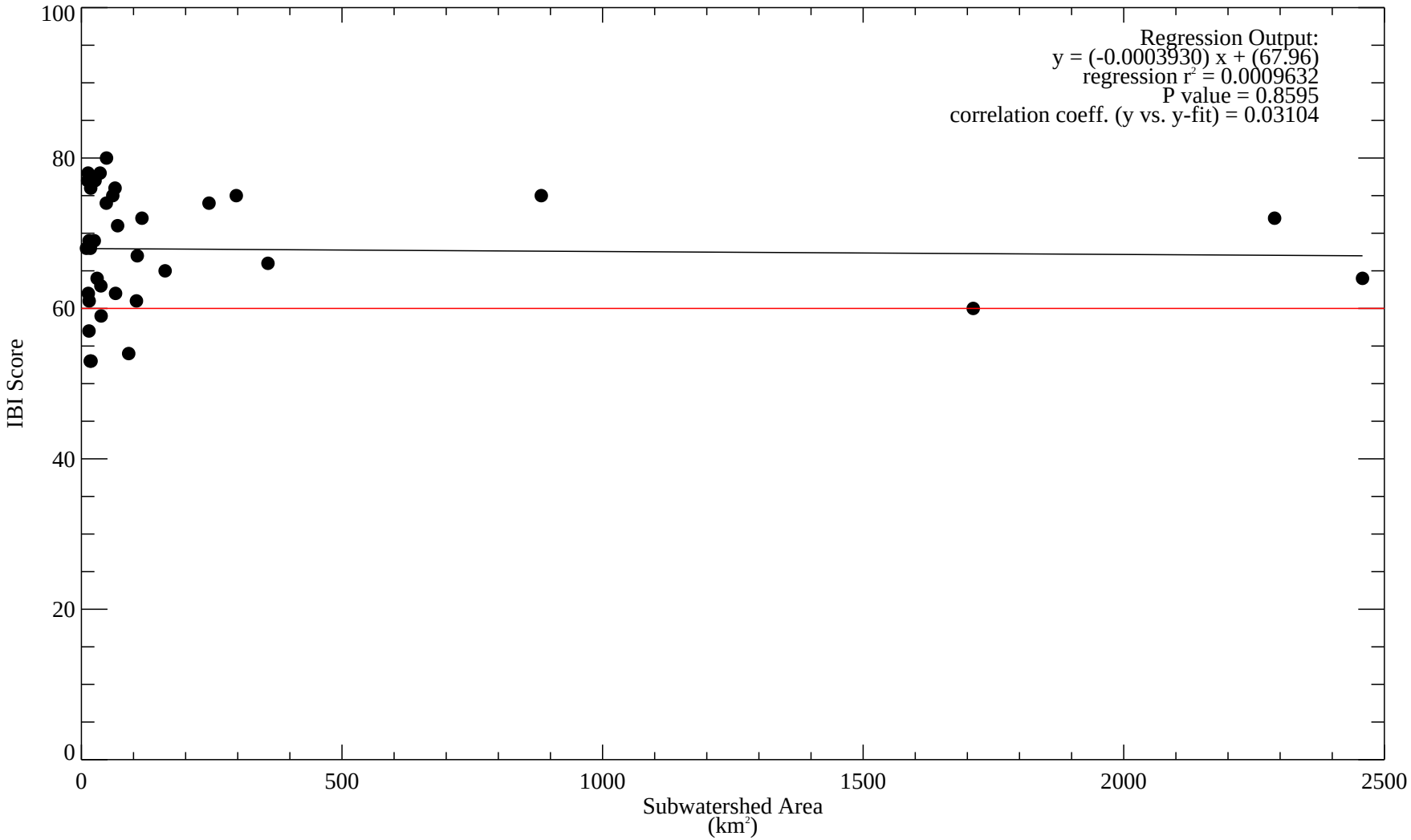


**Figure 3-9. IBI score vs. sub-watershed area: 2007 Plaintiffs' data only.**

*Note: Subwatershed areas based on manual subdivision of NHD subwatersheds.*
*The horizontal red line denotes the minimum IBI score (60) for sites considered in good condition.*

*NDK - Z:\OICiln\Analysis\Fisheries\illinoisriver_ibi_plots.pro*
*Fri Jan 16 13:41:02 2009*

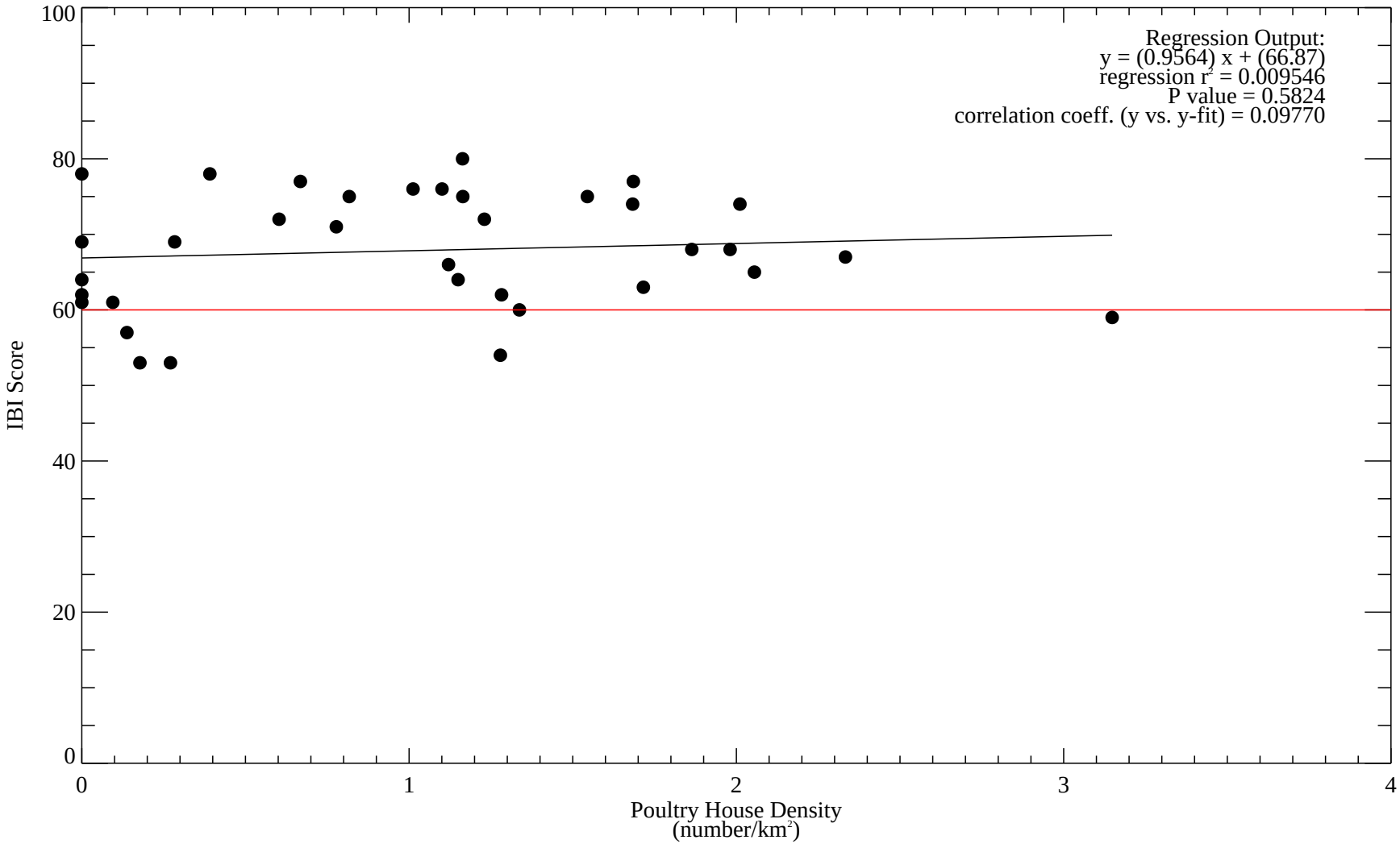


**Figure 3-10. IBI score vs. poultry house density in the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Poultry house density was determined using Prof. Fisher's data coverage.*
*The horizontal red line denotes the minimum IBI score (60) for sites considered in good condition.*

*NDK - Z:\OICiln\Analysis\Fisheries\illinoisriver_ibi_plots.pro*
*Fri Jan 16 13:41:02 2009*

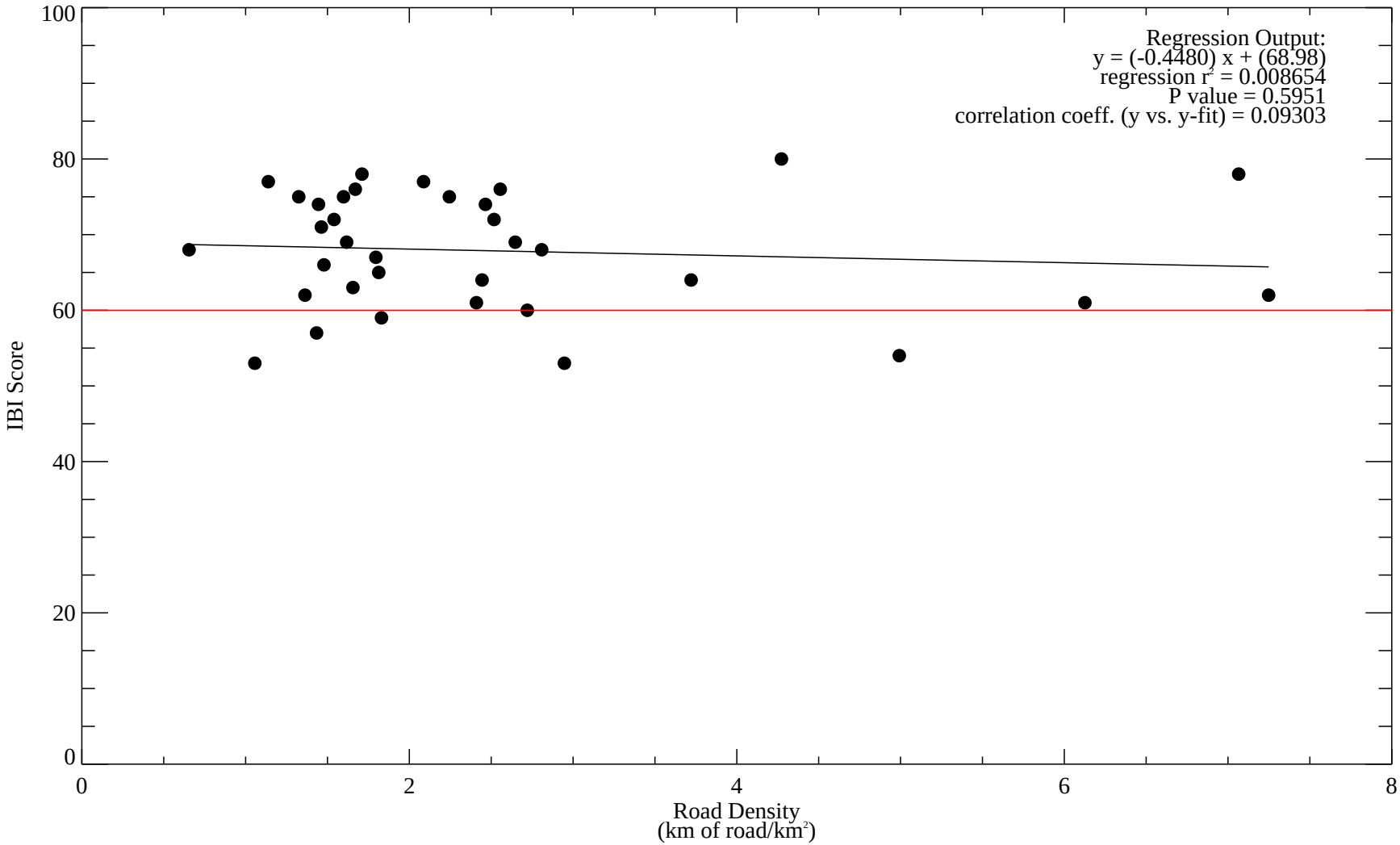


**Figure 3-11. IBI score vs. road density in the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Road density determined using the U.S. Census Bureau's 2007 road coverage.*
*The horizontal red line denotes the minimum IBI score (60) for sites considered in good condition.*

*NDK - Z:\OICiln\Analysis\Fisheries\illinoisriver_ibi_plots.pro*
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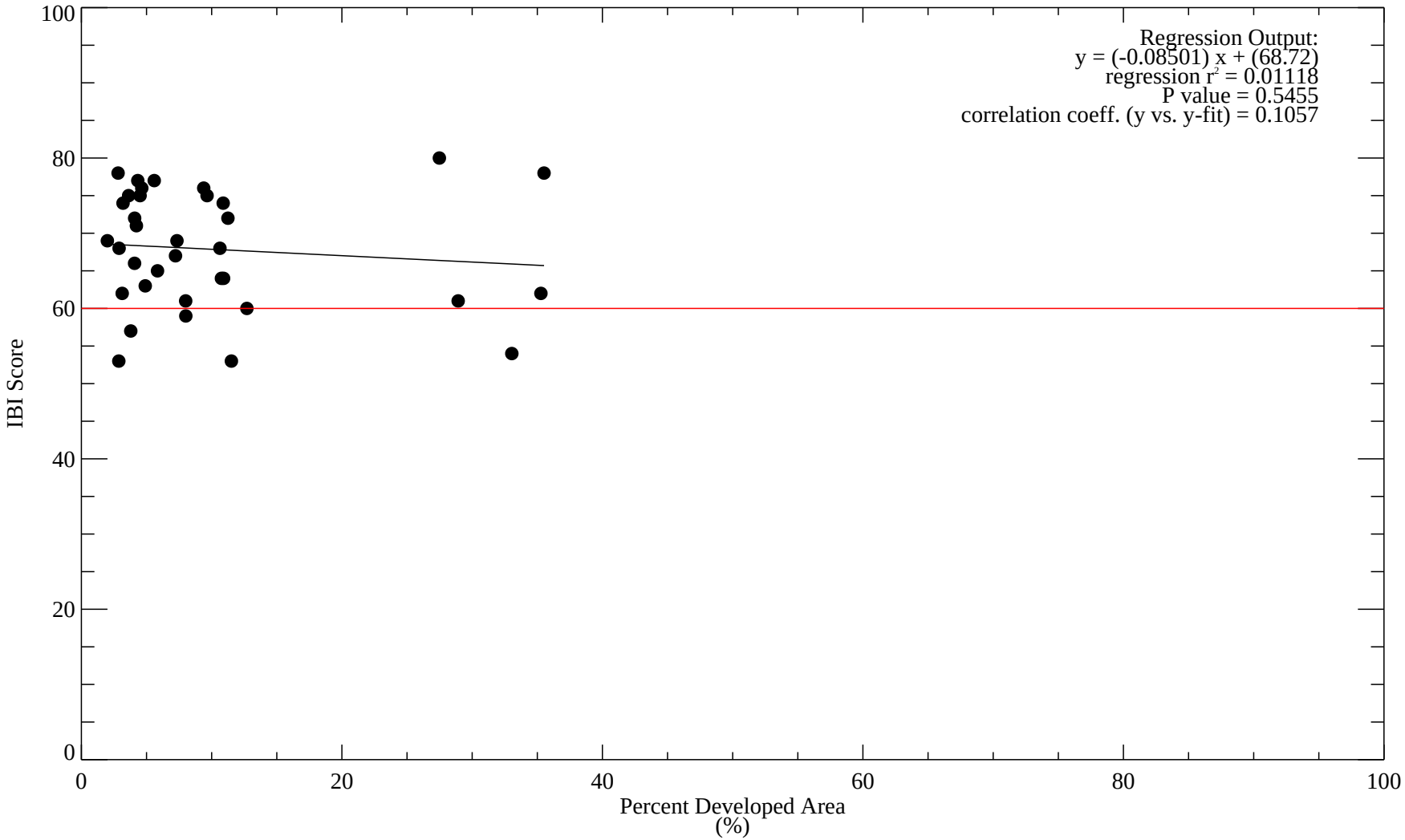


**Figure 3-12. IBI score vs. percent developed area of the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Includes roads and low, mid, and high density urban land-use classifications from the NLCD (2001). The horizontal red line denotes the minimum IBI score (60) for sites considered in good condition.*

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*Fri Jan 16 13:41:02 2009*

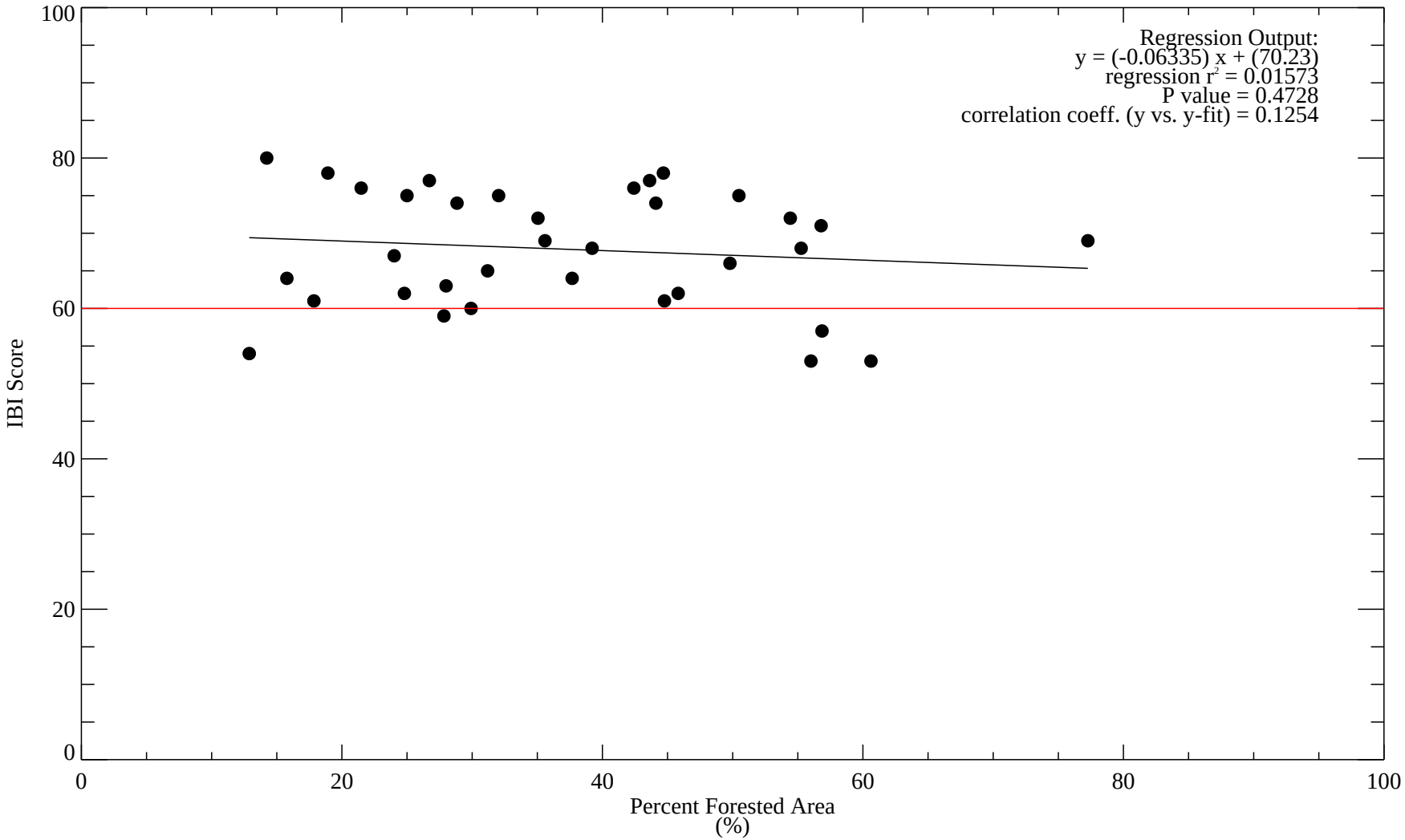


**Figure 3-13. IBI score vs. percent forested area of the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Forested area was determined from the 2001 NLCD land use data.*
*The horizontal red line denotes the minimum IBI score (60) for sites considered in good condition.*

*NDK - Z:\OICiln\Analysis\Fisheries\illinoisriver_ibi_plots.pro*
*Fri Jan 16 13:41:02 2009*

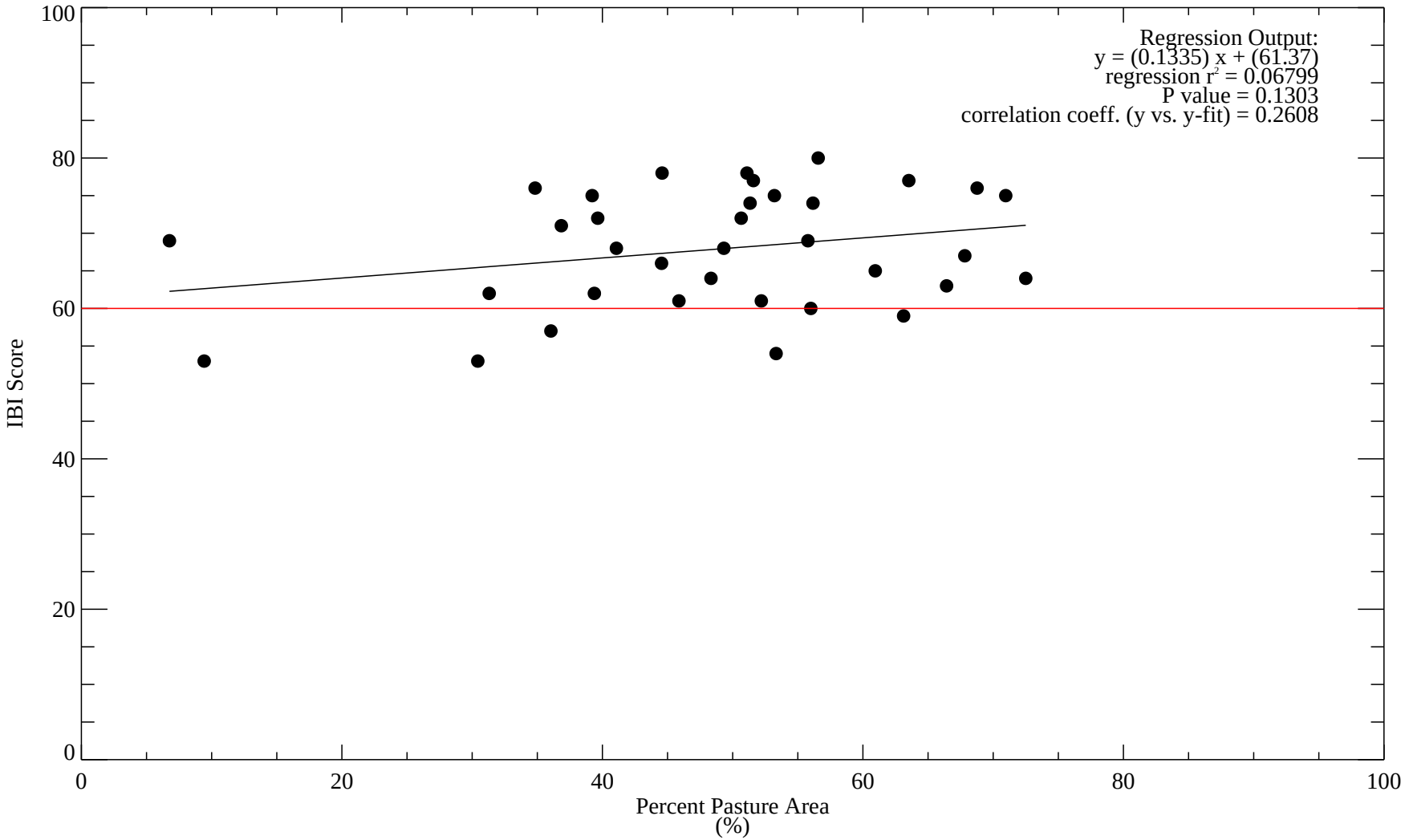


**Figure 3-14. IBI score vs. percent pasture area of the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Pasture area was determined from the 2001 NLCD land use data.*
*The horizontal red line denotes the minimum IBI score (60) for sites in good condition.*

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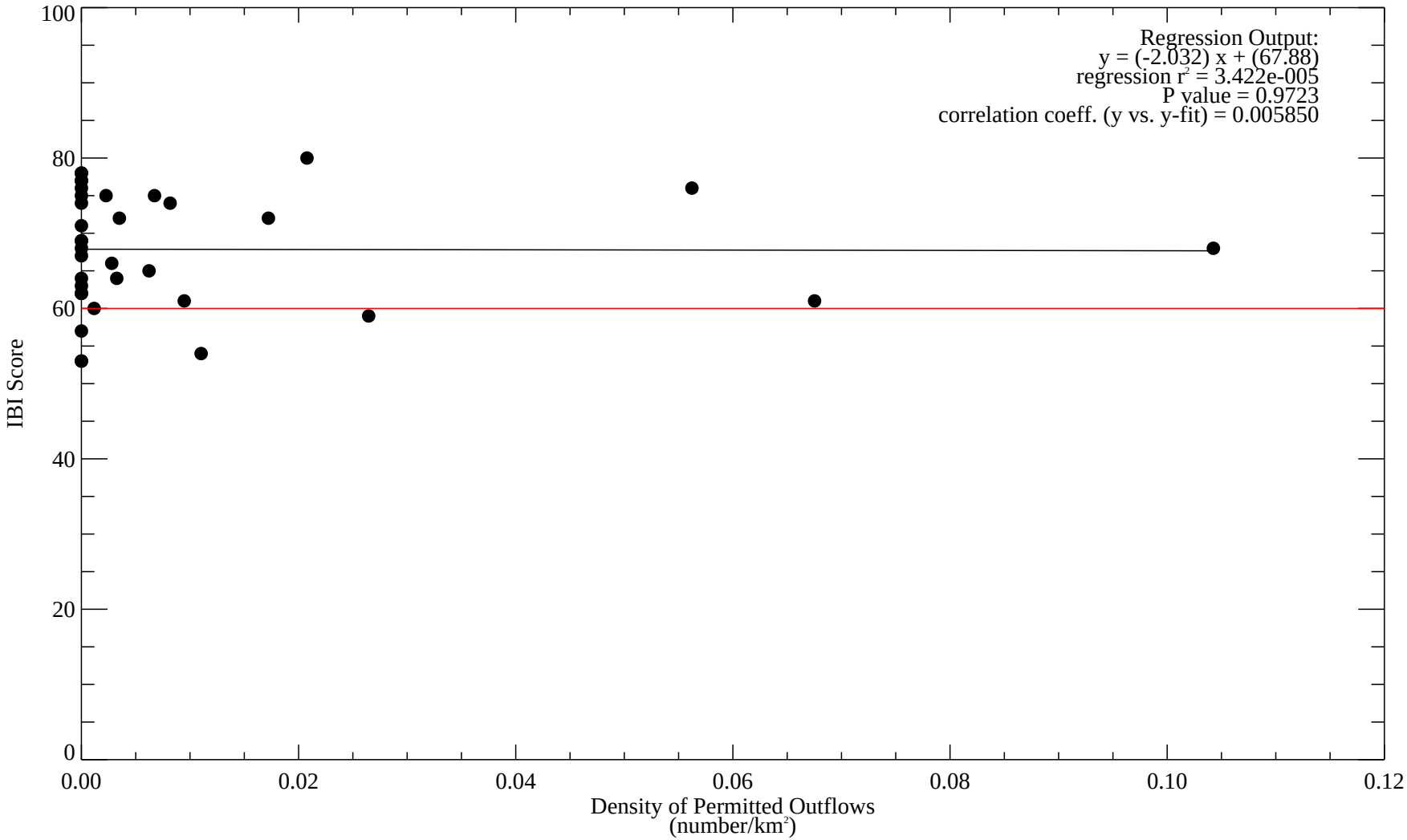


**Figure 3-15. IBI score vs. the density of permitted outflows in the sub-watershed: 2007 Plaintiffs' data only.**

*Note: Waste-water treatment plants with current discharge data in EPA's PCS system are included.*
*The horizontal red line denotes the minimum IBI score (60) for sites in good condition.*

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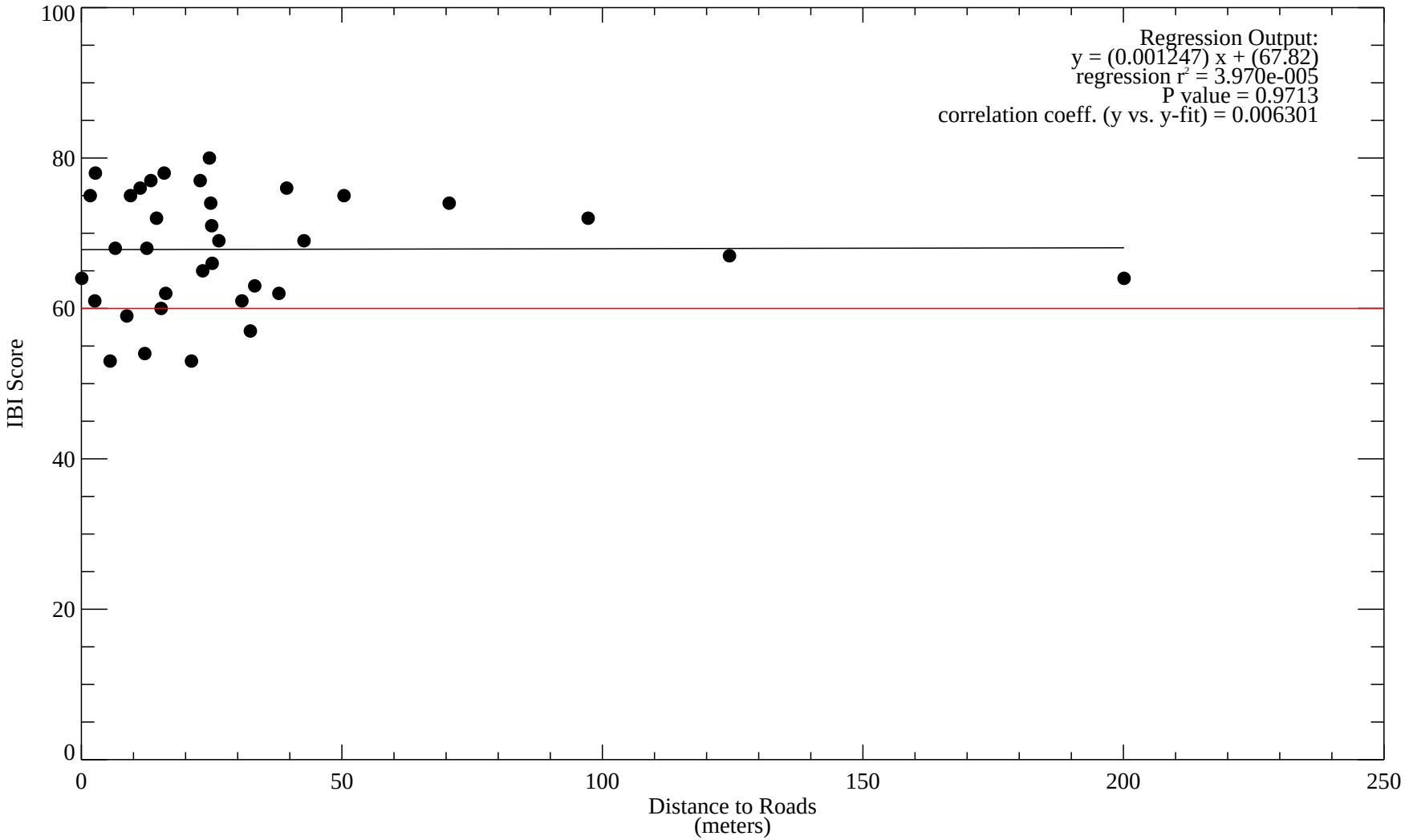


**Figure 3-16. IBI score vs. distance to the nearest road: 2007 Plaintiffs' data only.**

*Note: Road proximity determined using the U.S. Census Bureau's 2007 road coverage. The horizontal red line denotes the minimum IBI score (60) for sites in good condition.*

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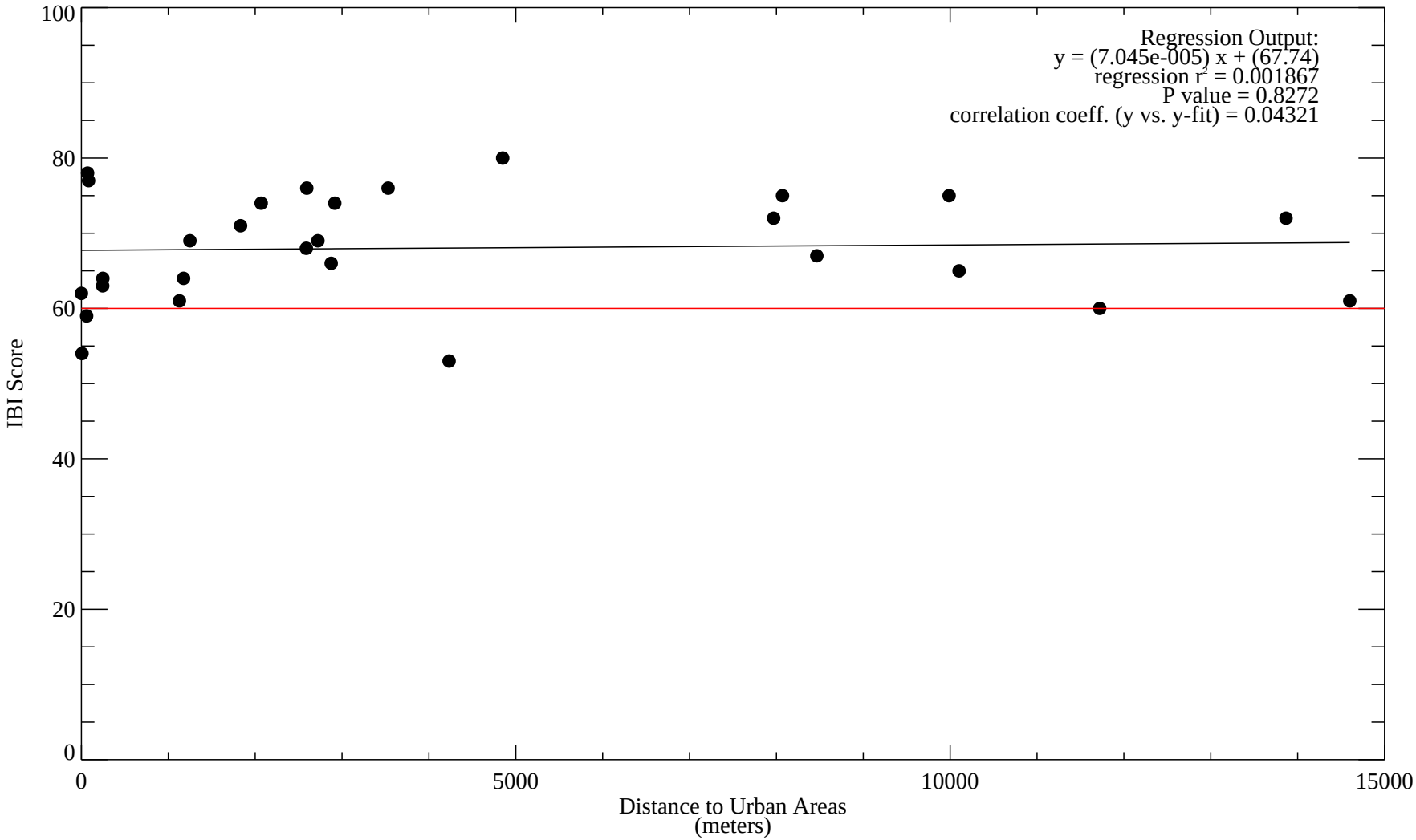


**Figure 3-17. IBI score vs. distance to the nearest urban land-use classification: 2007 Plaintiffs' data only.**

*Note: Urban land-use includes low, mid, and high density urban land-use classifications from the NLCD (2001). The horizontal red line denotes the minimum IBI score (60) for sites in good condition.*

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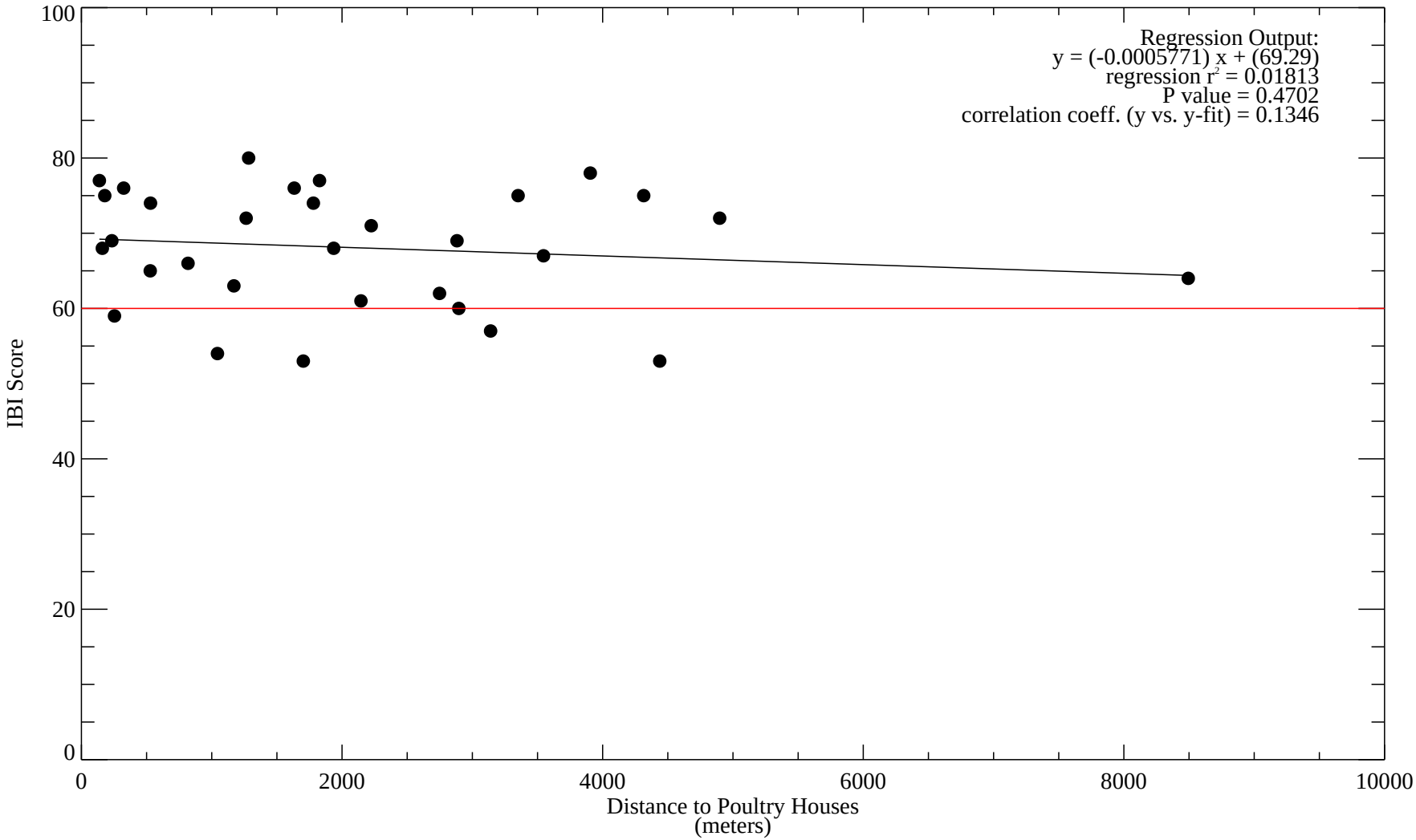


**Figure 3-18. IBI score vs. distance to the nearest poultry house: 2007 Plaintiffs' data only.**

*Note: Poultry house proximity was determined using Prof. Fisher's data coverage.*
*The horizontal red line denotes the minimum IBI score (60) for sites in good condition.*

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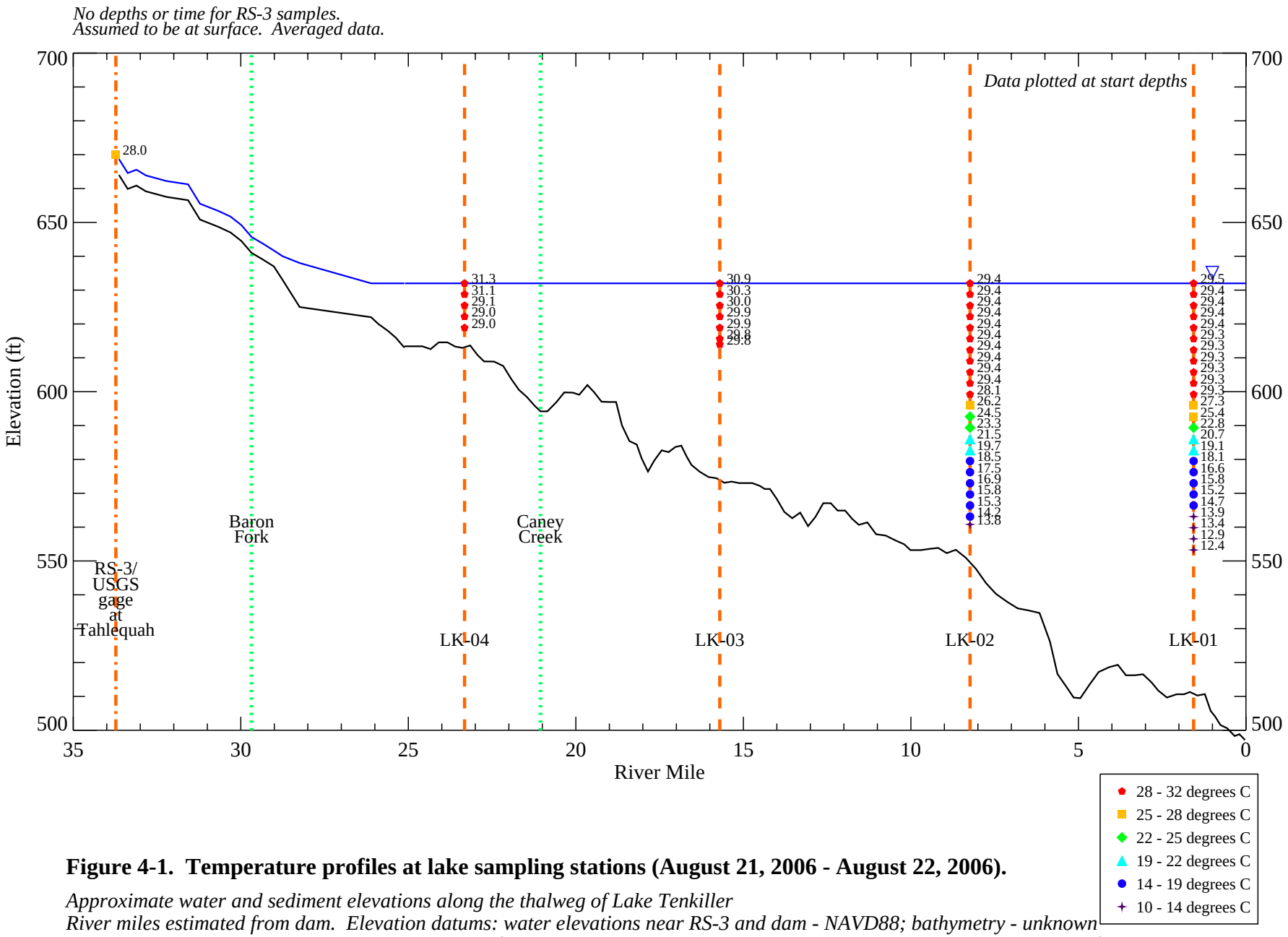


**Figure 4-1. Temperature profiles at lake sampling stations (August 21, 2006 - August 22, 2006).**

*Approximate water and sediment elevations along the thalweg of Lake Tenkiller*
*River miles estimated from dam. Elevation datums: water elevations near RS-3 and dam - NAVD88; bathymetry - unknown*
*Data sources: gage height corresponding to 1300 cfs at Tahlequah (near RS-3) - USGS; normal pool height - Army Corp of Engineers*
*Plaintiff's Database 2005-2007; data elevations estimated from normal pool elevation*

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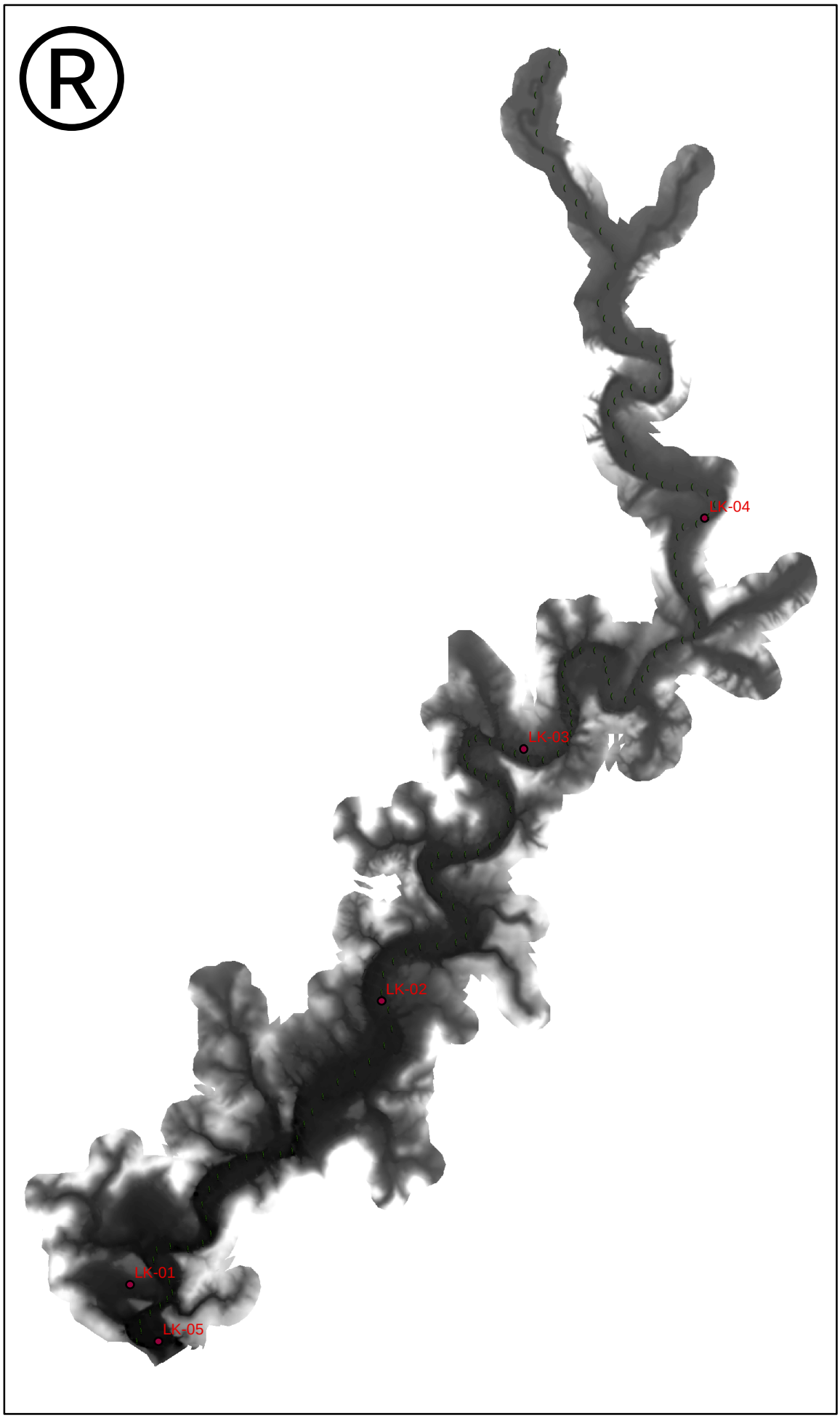

0 0.5 1 2 Miles

## Legend

Thalweg

Sampling Locations

Elevation (m)

High : 314

Low : 140

Illinois River Project

**Figure 4-2.**

**Lake Tenkiller sampling locations and bathymetry.**

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OICiln:114 January 2009

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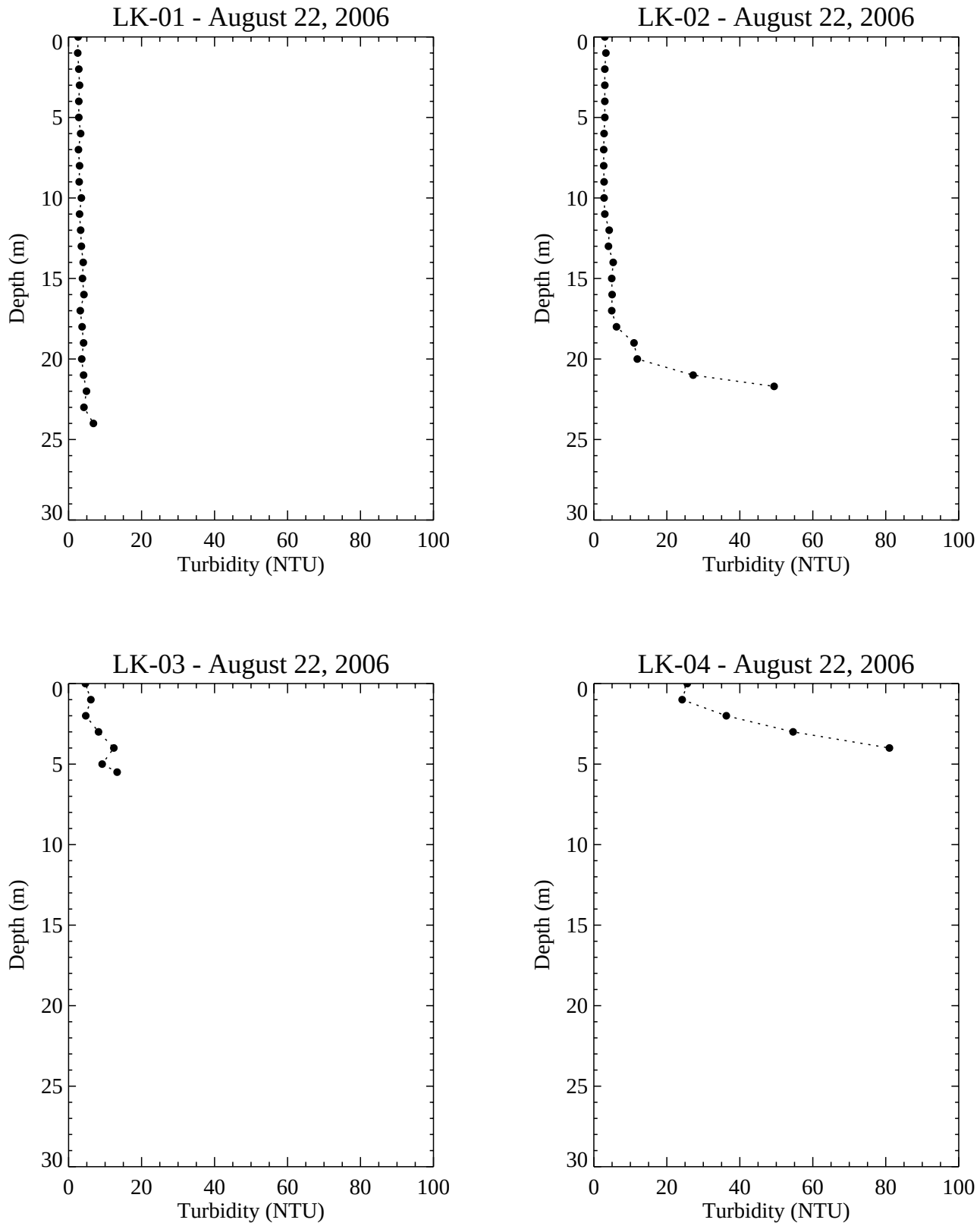


**Figure 4-3. Vertical depth profiles of turbidity on August 22, 2006.**

*Data source: Plaintiff data collected 2005 - 2008.*

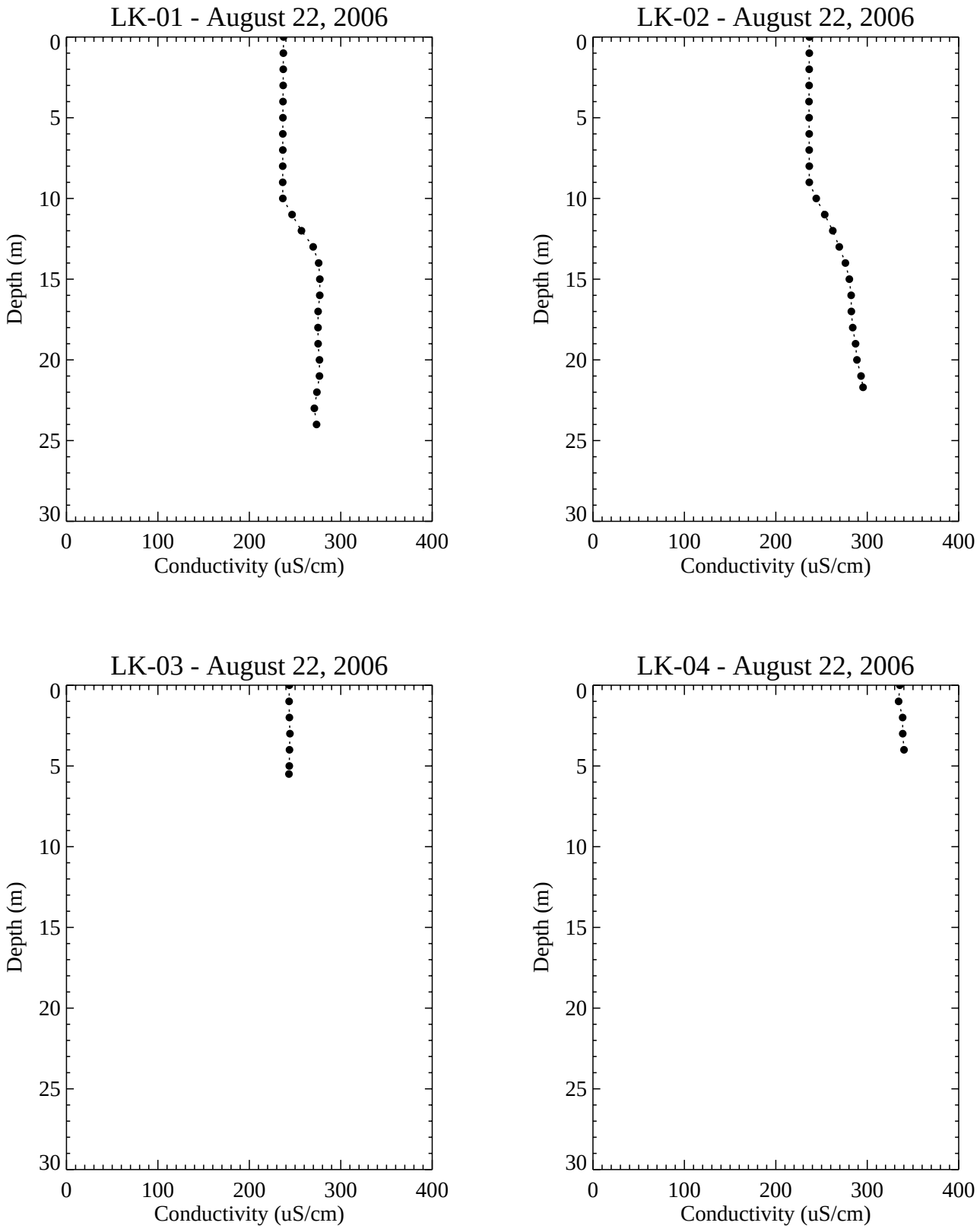


**Figure 4-4. Vertical depth profiles of conductivity on August 22, 2006.**

*Data source: Plaintiff data collected 2005 - 2008.*

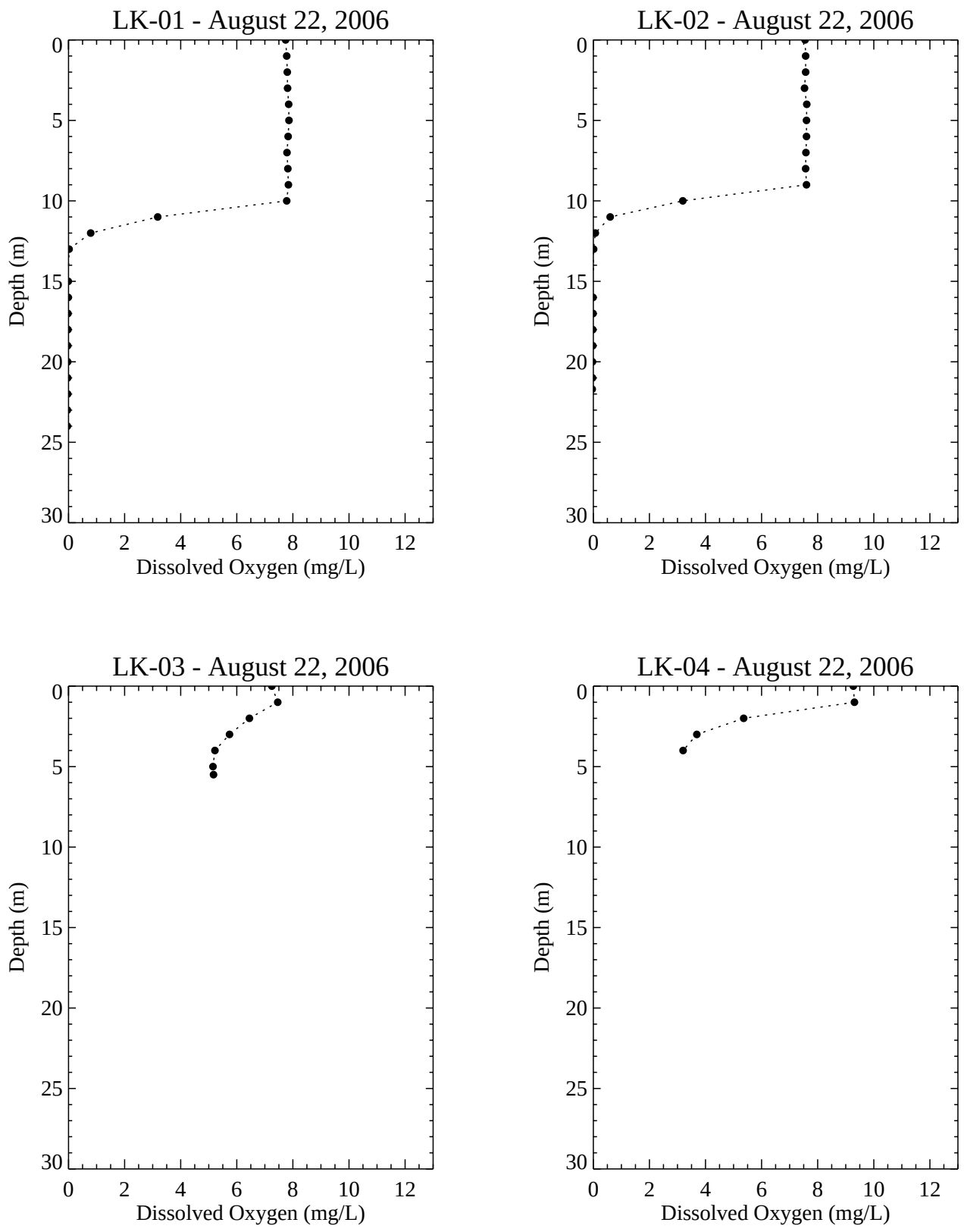


**Figure 4-5. Vertical depth profiles of dissolved oxygen on August 22, 2006.**

*Data source: Plaintiff data collected 2005 - 2008.*