

SITE NUMBER—07144100

SITE NAME—Little Ark near Sedgwick

DATE CREATED—4/10/2013

MODEL DEVELOPMENT DATA PERIOD—7/27/2004 – 09/22/2011

MODEL-CALIBRATION DATA SET—All data were collected using USGS protocols and are stored in NWIS database. The regression model is based on 65 concurrent measurements of total phosphorus (*TP*) and turbidity (*Turb*) samples collected from 07-27-2004 through 09-22-2011. Samples were collected throughout the range of continuously observed hydrologic condition. Summary statistics and complete model-calibration data set are provided. No total phosphorus values were deemed outliers.

MODEL DEVELOPMENT— Regression analysis was done using S-PLUS, R, and a spreadsheet macro which examined turbidity as an explanatory variable for estimating total phosphorus. Different combinations of untransformed and log₁₀-transformed data were evaluated. Turbidity was selected as the best model on the basis of residual plots, *MSPE*, adjusted *R*², PRESS and Mallow's *C*_{*p*}. Model spreadsheet is archived and can be found at <http://nrtwq.usgs.gov/ks> for review, and contains all relevant sample data and more in-depth statistical information.

MODEL SUMMARY—Summary of final regression analysis for total phosphorus at site number 07144100.

Turbidity-based model:

$$\log_{10}(TP) = 0.0012 \times \log_{10}(Turb) + 0.5357,$$

where

TP = total phosphorus, in mg/L as P; and

Turb = turbidity, in FNU.

The use of turbidity as an explanatory variable makes sense both physically and statistically. It makes physical sense because nutrients, such as total phosphorus, tend to adhere to particles associated with turbidity. Therefore, total phosphorus is mobilized by the same hydrologic forces that mobilize sediment particles associated with turbidity. Also, total phosphorus is a nutrient that affects organisms in water that reduce penetration of light. This results in a clear correlation between total phosphorus and turbidity. Turbidity makes statistical sense as an explanatory variable because it resulted in a model with low Mallow's *C*_{*p*} and PRESS values, and high adjusted *R*² values.

TOTAL PHOSPHORUS RECORD— The record is computed using the regression model in the NRTWQ website. Data are computed at hourly intervals. The record is complete for the year except as noted. A more in-depth description of the water quality record can be found at –

<http://nrtwq.usgs.gov/ks>

REMARKS—

- Site location, equipment, and other gage information can be found in SIMS.

Computed: Aaron King

Reviewed: Patrick Rasmussen

Model Form

TP = 0.0012 * Turb + 0.5357

Explanatory variable summary statistics

	Turb
Minimum	3.30
1st Quartile	23.0
Median	140
Mean	186
3rd Quartile	240
Maximum	1060

Notes:

Dependent variable summary statistics

	TP
Minimum	0.300
1st Quartile	0.540
Median	0.720
Mean	0.763
3rd Quartile	0.880
Maximum	2.11

Notes:

Model Calibration

Basic Data

Number of Measurements:	65
Standard Error:	0.1516
MSPE (Upper)	+ 19.87
MSPE (Lower)	-19.87
R ²	0.78
Adj R ²	0.78

Explanatory Variables

Variable	Value	Standard Error
Intercept	0.535	0.0242
Turb	0.00123	0.0000822

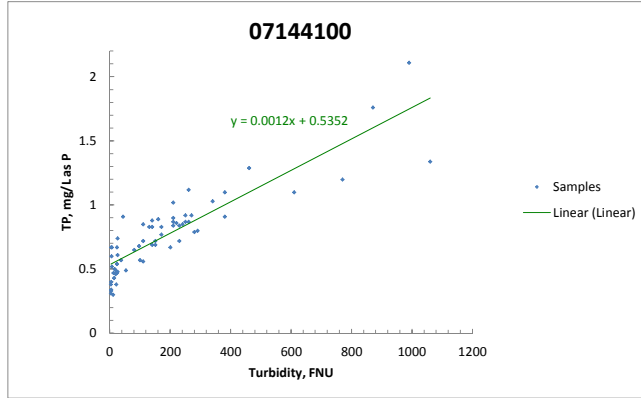
Notes:

Covariance Matrix

	Intercept	Turb
Intercept	1	-0.63
Turb	-0.63	1

Test Criteria

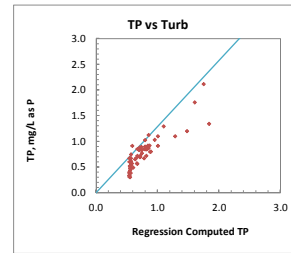
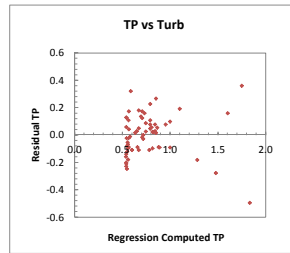
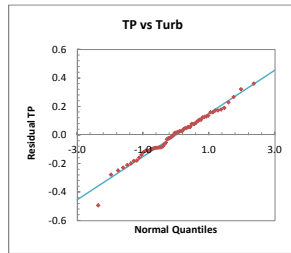
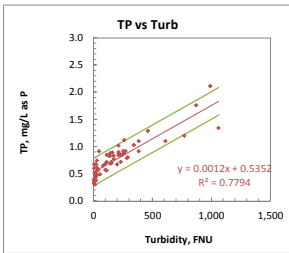
Leverage	Cook's D	DFITS
0.0923	0.797	0.351



Observations exceeding at least one test criterion

Observation	Observed TP	Predicted TP	Residuals	Standardized Residuals	Studentized Residuals	Leverage	Cook's D	DFITS
5	1.34	1.83	-0.495	-3.74	-4.21	0.240	2.22	-2.37
27	1.76	1.60	0.158	1.13	1.14	0.153	0.116	0.483
30	1.20	1.48	-0.279	-1.96	-2.01	0.116	0.251	-0.726
44	2.11	1.75	0.361	2.67	2.82	0.206	0.924	1.43

Notes:



Date	Turbidity	Streamflow	Regression			90% P.I.	
	FNU	ft ³ /sec	TP, mg/L as P	Computed TP	Residual TP	Lower	Upper
7/27/2004	200	5855	0.670	0.780	-0.110	0.53	1.03
1/27/2005	81.0	172	0.650	0.635	0.015	0.38	0.89
3/23/2005	260	5855	0.870	0.854	0.016	0.60	1.11
5/10/2005	170	203	0.770	0.744	0.026	0.49	1.00
5/27/2005	1060	743	1.34	1.84	-0.495	1.58	2.09
6/6/2005	290	1957	0.800	0.891	-0.091	0.64	1.14
6/9/2005	380	11797	0.910	1.00	-0.091	0.75	1.25
8/31/2005	96.0	112	0.680	0.653	0.027	0.40	0.91
1/10/2007	6.90	13.8	0.670	0.544	0.126	0.29	0.80
3/12/2007	23.0	19.1	0.670	0.563	0.107	0.31	0.82
3/21/2007	26.0	51.0	0.740	0.567	0.173	0.31	0.82
3/27/2007	250	164	0.870	0.842	0.028	0.59	1.09
4/2/2007	380	2886	1.10	1.00	0.099	0.75	1.25
7/11/2007	210	1927	1.02	0.793	0.227	0.54	1.05
8/16/2007	26.0	59.3	0.610	0.567	0.043	0.31	0.82
9/6/2007	23.0	25.5	0.470	0.563	-0.093	0.31	0.82
11/26/2007	4.40	28.9	0.670	0.541	0.129	0.29	0.79
12/6/2007	5.00	29.5	0.600	0.541	0.059	0.29	0.79
12/13/2007	260	2740	1.12	0.854	0.266	0.60	1.11
3/6/2008	610	979	1.10	1.28	-0.183	1.03	1.54
4/14/2008	230	484	0.720	0.817	-0.097	0.56	1.07
5/29/2008	230	2895	0.840	0.817	0.023	0.56	1.07
6/30/2008	210	877	0.900	0.793	0.107	0.54	1.05
9/16/2008	170	1716	0.830	0.744	0.086	0.49	1.00
4/6/2009	53.0	187	0.490	0.600	-0.110	0.35	0.85
4/28/2009	280	9190	0.790	0.879	-0.088	0.63	1.13
6/16/2009	870	661	1.76	1.60	0.158	1.35	1.86
7/30/2009	210	523	0.840	0.793	0.047	0.54	1.05
9/9/2009	210	3141	0.870	0.793	0.077	0.54	1.05
9/24/2009	770	333	1.20	1.48	-0.279	1.23	1.73
11/3/2009	140	328	0.690	0.707	-0.017	0.45	0.96
11/19/2009	6.90	65.0	0.520	0.544	-0.024	0.29	0.80
12/1/2009	4.40	54.7	0.400	0.541	-0.141	0.29	0.79
12/17/2009	3.40	58.7	0.310	0.539	-0.229	0.29	0.79
1/6/2010	3.30	94.5	0.380	0.539	-0.159	0.29	0.79
1/19/2010	4.50	79.7	0.340	0.541	-0.201	0.29	0.79
2/4/2010	4.40	63.9	0.330	0.541	-0.211	0.29	0.79

2/23/2010	11.0	69.3	0.300	0.549	-0.249	-1.75	0.30	0.80
3/10/2010	150	547	0.690	0.719	-0.029	-0.272	0.47	0.97
3/11/2010	100	11111	0.570	0.658	-0.088	-0.479	0.40	0.91
4/14/2010	12.0	52.7	0.470	0.550	-0.080	-0.394	0.30	0.80
4/23/2010	110	228	0.720	0.670	0.050	0.313	0.42	0.92
5/13/2010	460	544	1.29	1.10	0.191	1.47	0.85	1.35
6/9/2010	990	2448	2.11	1.75	0.361	2.36	1.50	2.00
6/10/2010	160	3345	0.890	0.731	0.159	1.12	0.48	0.98
6/13/2010	340	7905	1.03	0.952	0.078	0.523	0.70	1.21
6/14/2010	150	15162	0.720	0.719	0.001	-0.077	0.47	0.97
6/15/2010	250	6480	0.920	0.842	0.078	0.567	0.59	1.09
6/16/2010	220	4806	0.860	0.805	0.055	0.394	0.55	1.06
7/6/2010	140	13387	0.880	0.707	0.173	1.28	0.45	0.96
8/19/2010	37.0	60.8	0.570	0.581	-0.011	-0.116	0.33	0.83
8/25/2010	240	770	0.850	0.830	0.021	0.038	0.58	1.08
11/16/2010	140	262	0.830	0.707	0.123	0.811	0.45	0.96
1/19/2011	21.0	83.3	0.380	0.561	-0.181	-1.19	0.31	0.81
3/7/2011	14.0	50.8	0.430	0.552	-0.122	-0.984	0.30	0.81
3/16/2011	19.0	48.0	0.460	0.559	-0.099	-0.759	0.31	0.81
4/6/2011	16.0	37.6	0.500	0.555	-0.055	-0.313	0.30	0.81
4/18/2011	19.0	32.8	0.490	0.559	-0.069	-0.353	0.31	0.81
5/2/2011	25.0	28.8	0.480	0.566	-0.086	-0.436	0.31	0.82
5/16/2011	23.0	26.8	0.540	0.563	-0.023	-0.193	0.31	0.82
6/7/2011	44.0	21.9	0.910	0.589	0.321	1.97	0.34	0.84
6/21/2011	110	110	0.850	0.670	0.180	1.37	0.42	0.92
6/22/2011	130	46.2	0.830	0.695	0.135	0.984	0.44	0.95
8/15/2011	270	25.5	0.920	0.866	0.054	0.353	0.61	1.12
9/22/2011	110	42.9	0.560	0.670	-0.110	-0.811	0.42	0.92