

Appendix Q1

Water Quality Modeling Results

Linear Regression Summary

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
DO	EPC 105	Bottom	139	0.021	<0.001	0.075	0.30	1
DO	EPC 1512	Bottom	55	0.014	ns	-0.043	0.41	0
DO	EPC 1514	Bottom	55	ns	ns	-0.017	0.00	0
DO	EPC 1515	Bottom	51	ns	ns	0.002	0.00	0
DO	EPC 152	Bottom	120	<0.001	0.04	0.021	0.33	1
DO	EPC 2 CR	Bottom	2006	<0.001	<0.001	0.026	0.44	1
DO	EPC 270	Bottom	12	ns	ns	0.041	0.02	0
DO	SWFWMD LHR01_800043_RKm_16	Bottom	5	ns	ns	0.016	0.01	0
DO	SWFWMD LHR02_800044_RKm_15.7	Bottom	47	ns	0.042	0.090	0.09	1
DO	SWFWMD LHR03_19208_RKm_15.4	Bottom	62	<0.001	<0.001	0.153	0.60	1
DO	SWFWMD LHR04_800045_RKm_15.1	Bottom	61	0.002	<0.001	0.171	0.51	1
DO	SWFWMD LHR05_800046_RKm_14.8	Bottom	70	<0.001	<0.001	0.167	0.57	1
DO	SWFWMD LHR06_800047_RKm_14.5	Bottom	69	<0.001	<0.001	0.155	0.52	1
DO	SWFWMD LHR07_800048_RKm_14.3	Bottom	70	<0.001	ns	0.084	0.37	0
DO	SWFWMD LHR08_800049_RKm_13.9	Bottom	69	0.025	ns	0.063	0.27	0
DO	SWFWMD LHR09_19209_RKm_13.6	Bottom	65	ns	ns	0.043	0.02	0
DO	SWFWMD LHR10_800050_RKm_13.3	Bottom	70	<0.001	ns	0.026	0.52	0
DO	SWFWMD LHR11_800052_RKm_13	Bottom	70	0.002	ns	-0.003	0.35	0
DO	SWFWMD LHR12_800053_RKm_12.7	Bottom	69	<0.001	ns	0.006	0.42	0
DO	SWFWMD LHR13_19235_RKm_12.3	Bottom	65	<0.001	ns	-0.006	0.53	0
DO	SWFWMD LHR14_800054_RKm_11.8	Bottom	66	<0.001	ns	0.014	0.44	0
DO	SWFWMD LHR15_800055_RKm_11.3	Bottom	64	<0.001	ns	0.026	0.42	0
DO	SWFWMD LHR16_19237_RKm_10.8	Bottom	61	<0.001	ns	-0.003	0.52	0
DO	USGS 02304515 Hannah's Whirl	Bottom	70	0.016	0.045	0.152	0.18	1
DO	USGS 02304517 BL Hannah's Whirl	Bottom	699	<0.001	<0.001	-0.053	0.34	-1

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
DO	EPC 105	Midwater	140	<0.001	<0.001	0.066	0.36	1
DO	EPC 1512	Midwater	55	0.012	ns	0.038	0.37	0
DO	EPC 1514	Midwater	55	0.001	ns	0.091	0.44	0
DO	EPC 1515	Midwater	51	0.005	ns	0.127	0.42	0
DO	EPC 152	Midwater	121	0.005	ns	0.023	0.23	0
DO	EPC 174	Midwater	72	ns	ns	-0.006	0.00	0
DO	EPC 270	Midwater	14	0.01	ns	0.144	0.78	0
DO	SWFWMD LHR02_800044_RKm_15.7	Midwater	24	ns	ns	0.076	0.10	0
DO	SWFWMD LHR03_19208_RKm_15.4	Midwater	58	0.001	<0.001	0.110	0.51	1
DO	SWFWMD LHR04_800045_RKm_15.1	Midwater	24	ns	ns	0.098	0.13	0
DO	SWFWMD LHR05_800046_RKm_14.8	Midwater	56	<0.001	<0.001	0.157	0.58	1
DO	SWFWMD LHR06_800047_RKm_14.5	Midwater	53	0.003	<0.001	0.173	0.52	1
DO	SWFWMD LHR07_800048_RKm_14.3	Midwater	64	<0.001	<0.001	0.177	0.56	1
DO	SWFWMD LHR08_800049_RKm_13.9	Midwater	68	<0.001	<0.001	0.115	0.44	1
DO	SWFWMD LHR09_19209_RKm_13.6	Midwater	62	ns	0.002	0.122	0.15	1
DO	SWFWMD LHR10_800050_RKm_13.3	Midwater	58	0.007	0.028	0.066	0.39	1
DO	SWFWMD LHR11_800052_RKm_13	Midwater	67	0.001	ns	0.046	0.37	0
DO	SWFWMD LHR12_800053_RKm_12.7	Midwater	62	0.007	ns	0.022	0.34	0
DO	SWFWMD LHR13_19235_RKm_12.3	Midwater	64	<0.001	ns	0.020	0.39	0
DO	SWFWMD LHR14_800054_RKm_11.8	Midwater	64	0.001	ns	0.038	0.39	0
DO	SWFWMD LHR15_800055_RKm_11.3	Midwater	53	ns	ns	-0.020	0.01	0
DO	SWFWMD LHR16_19237_RKm_10.8	Midwater	61	<0.001	ns	0.020	0.43	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
DO	EPC 105	Surface	139	0.004	0.001	0.036	0.24	1
DO	EPC 1512	Surface	55	ns	ns	-0.004	0.00	0
DO	EPC 1514	Surface	55	<0.001	0.004	0.120	0.53	1
DO	EPC 1515	Surface	51	<0.001	0.005	0.158	0.50	1
DO	EPC 152	Surface	122	ns	0.048	0.028	0.03	1
DO	EPC 2 CR	Surface	1917	<0.001	ns	0.002	0.37	0
DO	EPC 270	Surface	12	ns	ns	-0.131	0.05	0
DO	FDEP SBIO TP482HILLS_HD	Surface	1	ns	ns	0.000	0.00	.
DO	SWFWMD LHR01_800043_RKm_16	Surface	28	ns	0.036	0.104	0.16	1
DO	SWFWMD LHR02_800044_RKm_15.7	Surface	66	ns	ns	0.073	0.04	0
DO	SWFWMD LHR03_19208_RKm_15.4	Surface	62	0.009	ns	0.034	0.34	0
DO	SWFWMD LHR04_800045_RKm_15.1	Surface	68	<0.001	<0.001	0.102	0.46	1
DO	SWFWMD LHR05_800046_RKm_14.8	Surface	70	0.003	<0.001	0.118	0.42	1
DO	SWFWMD LHR06_800047_RKm_14.5	Surface	71	<0.001	<0.001	0.144	0.48	1
DO	SWFWMD LHR07_800048_RKm_14.3	Surface	70	<0.001	<0.001	0.144	0.57	1
DO	SWFWMD LHR08_800049_RKm_13.9	Surface	70	<0.001	<0.001	0.097	0.44	1
DO	SWFWMD LHR09_19209_RKm_13.6	Surface	66	0.001	0.023	0.070	0.40	1
DO	SWFWMD LHR10_800050_RKm_13.3	Surface	70	ns	ns	0.028	0.01	0
DO	SWFWMD LHR11_800052_RKm_13	Surface	70	ns	ns	0.003	0.00	0
DO	SWFWMD LHR12_800053_RKm_12.7	Surface	70	ns	ns	-0.019	0.00	0
DO	SWFWMD LHR13_19235_RKm_12.3	Surface	65	ns	ns	-0.013	0.00	0
DO	SWFWMD LHR14_800054_RKm_11.8	Surface	66	ns	ns	-0.036	0.02	0
DO	SWFWMD LHR15_800055_RKm_11.3	Surface	66	ns	ns	-0.059	0.05	0
DO	SWFWMD LHR16_19237_RKm_10.8	Surface	61	ns	ns	-0.051	0.03	0
DO	SWFWMD WMD_19206	Surface	446	<0.001	ns	-0.012	0.48	0
DO	USGS 02304515 Hannah's Whirl	Surface	108	0.001	ns	-0.007	0.18	0
DO	USGS 02304517 BL Hannah's Whirl	Surface	710	<0.001	<0.001	-0.042	0.31	-1

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
SALIN	EPC 105	Bottom	144	0.007	<0.001	-0.207	0.47	-1
SALIN	EPC 1512	Bottom	60	ns	ns	-0.202	0.05	0
SALIN	EPC 1514	Bottom	60	ns	ns	-0.223	0.05	0
SALIN	EPC 1515	Bottom	54	<0.001	ns	-0.133	0.48	0
SALIN	EPC 152	Bottom	131	ns	ns	-0.074	0.03	0
SALIN	EPC 2 CR	Bottom	2006	<0.001	<0.001	-0.142	0.23	-1
SALIN	EPC 270	Bottom	12	ns	ns	-0.381	0.05	0
SALIN	SWFWMD LHR01_800043_RKm_16	Bottom	5	ns	ns	-0.156	0.75	0
SALIN	SWFWMD LHR02_800044_RKm_15.7	Bottom	47	0.011	0.046	-0.050	0.46	-1
SALIN	SWFWMD LHR03_19208_RKm_15.4	Bottom	62	0.002	0.001	-0.084	0.45	-1
SALIN	SWFWMD LHR04_800045_RKm_15.1	Bottom	60	0.002	<0.001	-0.109	0.49	-1
SALIN	SWFWMD LHR05_800046_RKm_14.8	Bottom	69	<0.001	<0.001	-0.135	0.56	-1
SALIN	SWFWMD LHR06_800047_RKm_14.5	Bottom	69	<0.001	<0.001	-0.144	0.56	-1
SALIN	SWFWMD LHR07_800048_RKm_14.3	Bottom	70	0.004	0.005	-0.228	0.36	-1
SALIN	SWFWMD LHR08_800049_RKm_13.9	Bottom	70	0.022	0.004	-0.238	0.32	-1
SALIN	SWFWMD LHR09_19209_RKm_13.6	Bottom	65	ns	0.002	-0.284	0.14	-1
SALIN	SWFWMD LHR10_800050_RKm_13.3	Bottom	70	ns	ns	-0.134	0.03	0
SALIN	SWFWMD LHR11_800052_RKm_13	Bottom	70	0.047	ns	-0.156	0.27	0
SALIN	SWFWMD LHR12_800053_RKm_12.7	Bottom	68	0.049	ns	-0.151	0.26	0
SALIN	SWFWMD LHR13_19235_RKm_12.3	Bottom	65	ns	ns	-0.114	0.03	0
SALIN	SWFWMD LHR14_800054_RKm_11.8	Bottom	66	ns	ns	-0.118	0.03	0
SALIN	SWFWMD LHR15_800055_RKm_11.3	Bottom	63	ns	ns	-0.170	0.06	0
SALIN	SWFWMD LHR16_19237_RKm_10.8	Bottom	61	ns	ns	-0.053	0.01	0
SALIN	TBW Sligh	Bottom	2997	<0.001	<0.001	-0.119	0.18	-1
SALIN	USGS 02304510 Rowlett	Bottom	4416	<0.001	<0.001	-0.196	0.44	-1
SALIN	USGS 02304515 Hannah's Whirl	Bottom	108	<0.001	ns	0.174	0.23	0
SALIN	USGS 02304517 BL Hannah's Whirl	Bottom	710	<0.001	ns	-0.004	0.60	0
SALIN	USGS 023060013 I-275	Bottom	2121	<0.001	<0.001	-0.202	0.33	-1

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
SALIN	EPC 105	Midwater	145	0.038	<0.001	-0.205	0.46	-1
SALIN	EPC 1512	Midwater	60	ns	ns	-0.084	0.01	0
SALIN	EPC 1514	Midwater	60	0.02	ns	0.009	0.31	0
SALIN	EPC 1515	Midwater	55	0.049	ns	0.031	0.30	0
SALIN	EPC 152	Midwater	131	0.008	0.002	-0.131	0.23	-1
SALIN	EPC 174	Midwater	75	ns	ns	0.012	0.01	0
SALIN	EPC 270	Midwater	14	ns	ns	-0.298	0.14	0
SALIN	SWFWMD LHR02_800044_RKm_15.7	Midwater	24	ns	ns	-0.064	0.12	0
SALIN	SWFWMD LHR03_19208_RKm_15.4	Midwater	58	0.01	0.005	-0.064	0.42	-1
SALIN	SWFWMD LHR04_800045_RKm_15.1	Midwater	24	0.009	ns	-0.053	0.72	0
SALIN	SWFWMD LHR05_800046_RKm_14.8	Midwater	56	0.008	<0.001	-0.100	0.48	-1
SALIN	SWFWMD LHR06_800047_RKm_14.5	Midwater	52	0.046	0.002	-0.109	0.44	-1
SALIN	SWFWMD LHR07_800048_RKm_14.3	Midwater	64	<0.001	<0.001	-0.196	0.48	-1
SALIN	SWFWMD LHR08_800049_RKm_13.9	Midwater	68	0.004	0.003	-0.178	0.38	-1
SALIN	SWFWMD LHR09_19209_RKm_13.6	Midwater	62	ns	0.002	-0.276	0.14	-1
SALIN	SWFWMD LHR10_800050_RKm_13.3	Midwater	58	ns	0.017	-0.154	0.10	-1
SALIN	SWFWMD LHR11_800052_RKm_13	Midwater	67	ns	ns	-0.144	0.05	0
SALIN	SWFWMD LHR12_800053_RKm_12.7	Midwater	62	ns	ns	-0.100	0.03	0
SALIN	SWFWMD LHR13_19235_RKm_12.3	Midwater	64	ns	ns	-0.151	0.05	0
SALIN	SWFWMD LHR14_800054_RKm_11.8	Midwater	64	ns	0.007	-0.200	0.11	-1
SALIN	SWFWMD LHR15_800055_RKm_11.3	Midwater	53	ns	ns	-0.070	0.01	0
SALIN	SWFWMD LHR16_19237_RKm_10.8	Midwater	61	ns	ns	-0.139	0.05	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
SALIN	EPC 105	Surface	144	ns	<0.001	-0.183	0.38	-1
SALIN	EPC 1512	Surface	59	ns	0.006	-0.124	0.13	-1
SALIN	EPC 1514	Surface	59	0.002	0.036	-0.069	0.49	-1
SALIN	EPC 1515	Surface	53	0.011	ns	-0.041	0.42	0
SALIN	EPC 152	Surface	131	0.012	<0.001	-0.133	0.30	-1
SALIN	EPC 2 CR	Surface	1916	<0.001	<0.001	-0.119	0.31	-1
SALIN	EPC 270	Surface	12	ns	ns	-0.054	0.04	0
SALIN	FDEP SBIO TP482HILLS_SCI	Surface	2	ns	ns	0.000	0.00	.
SALIN	SWFWMD LHR01_800043_RKm_16	Surface	28	ns	ns	-0.008	0.01	0
SALIN	SWFWMD LHR02_800044_RKm_15.7	Surface	65	<0.001	ns	0.011	0.41	0
SALIN	SWFWMD LHR03_19208_RKm_15.4	Surface	62	0.006	ns	-0.017	0.36	0
SALIN	SWFWMD LHR04_800045_RKm_15.1	Surface	68	<0.001	0.003	-0.058	0.44	-1
SALIN	SWFWMD LHR05_800046_RKm_14.8	Surface	70	<0.001	ns	-0.046	0.43	0
SALIN	SWFWMD LHR06_800047_RKm_14.5	Surface	71	0.004	<0.001	-0.092	0.43	-1
SALIN	SWFWMD LHR07_800048_RKm_14.3	Surface	70	0.003	<0.001	-0.098	0.43	-1
SALIN	SWFWMD LHR08_800049_RKm_13.9	Surface	70	0.014	<0.001	-0.107	0.40	-1
SALIN	SWFWMD LHR09_19209_RKm_13.6	Surface	66	ns	0.004	-0.095	0.12	-1
SALIN	SWFWMD LHR10_800050_RKm_13.3	Surface	70	ns	0.008	-0.078	0.10	-1
SALIN	SWFWMD LHR11_800052_RKm_13	Surface	70	ns	0.024	-0.068	0.07	-1
SALIN	SWFWMD LHR12_800053_RKm_12.7	Surface	70	ns	ns	-0.029	0.02	0
SALIN	SWFWMD LHR13_19235_RKm_12.3	Surface	65	0.043	ns	-0.050	0.29	0
SALIN	SWFWMD LHR14_800054_RKm_11.8	Surface	66	ns	ns	-0.038	0.02	0
SALIN	SWFWMD LHR15_800055_RKm_11.3	Surface	65	ns	ns	-0.052	0.04	0
SALIN	SWFWMD LHR16_19237_RKm_10.8	Surface	61	ns	ns	-0.053	0.04	0
SALIN	SWFWMD WMD_19206	Surface	446	<0.001	ns	-0.002	0.67	0
SALIN	TBW Sligh	Surface	2887	<0.001	<0.001	-0.089	0.17	-1
SALIN	USGS 02304510 Rowlett	Surface	4476	<0.001	<0.001	-0.194	0.42	-1
SALIN	USGS 02304515 Hannah's Whirl	Surface	108	0.013	ns	-0.031	0.18	0
SALIN	USGS 02304517 BL Hannah's Whirl	Surface	710	<0.001	0.006	-0.031	0.55	-1
SALIN	USGS 023060013 I-275	Surface	2126	<0.001	<0.001	-0.113	0.18	-1

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
TEMP	EPC 105	Bottom	147	<0.001	ns	-0.012	0.73	0
TEMP	EPC 1512	Bottom	60	<0.001	ns	0.054	0.90	0
TEMP	EPC 1514	Bottom	60	<0.001	ns	0.036	0.87	0
TEMP	EPC 1515	Bottom	54	<0.001	ns	0.045	0.85	0
TEMP	EPC 152	Bottom	131	<0.001	ns	0.006	0.87	0
TEMP	EPC 2 CR	Bottom	2006	<0.001	ns	0.005	0.82	0
TEMP	EPC 270	Bottom	12	0.003	ns	0.098	0.91	0
TEMP	SWFWMD LHR01_800043_RKm_16	Bottom	5	ns	ns	0.039	0.06	0
TEMP	SWFWMD LHR02_800044_RKm_15.7	Bottom	47	<0.001	ns	-0.029	0.71	0
TEMP	SWFWMD LHR03_19208_RKm_15.4	Bottom	62	<0.001	ns	-0.047	0.73	0
TEMP	SWFWMD LHR04_800045_RKm_15.1	Bottom	60	<0.001	ns	-0.032	0.87	0
TEMP	SWFWMD LHR05_800046_RKm_14.8	Bottom	70	<0.001	ns	-0.029	0.73	0
TEMP	SWFWMD LHR06_800047_RKm_14.5	Bottom	69	<0.001	ns	-0.026	0.74	0
TEMP	SWFWMD LHR07_800048_RKm_14.3	Bottom	70	<0.001	ns	-0.036	0.76	0
TEMP	SWFWMD LHR08_800049_RKm_13.9	Bottom	70	<0.001	ns	-0.026	0.76	0
TEMP	SWFWMD LHR09_19209_RKm_13.6	Bottom	65	<0.001	ns	-0.029	0.83	0
TEMP	SWFWMD LHR10_800050_RKm_13.3	Bottom	70	<0.001	ns	-0.021	0.79	0
TEMP	SWFWMD LHR11_800052_RKm_13	Bottom	70	<0.001	ns	-0.002	0.79	0
TEMP	SWFWMD LHR12_800053_RKm_12.7	Bottom	69	<0.001	ns	-0.002	0.77	0
TEMP	SWFWMD LHR13_19235_RKm_12.3	Bottom	65	<0.001	ns	-0.014	0.86	0
TEMP	SWFWMD LHR14_800054_RKm_11.8	Bottom	66	<0.001	ns	-0.004	0.81	0
TEMP	SWFWMD LHR15_800055_RKm_11.3	Bottom	64	<0.001	ns	-0.018	0.79	0
TEMP	SWFWMD LHR16_19237_RKm_10.8	Bottom	61	<0.001	ns	-0.018	0.87	0
TEMP	TBW Sligh	Bottom	2997	<0.001	<0.001	0.027	0.85	1
TEMP	USGS 02304510 Rowlett	Bottom	4535	<0.001	<0.001	0.023	0.72	1
TEMP	USGS 02304515 Hannah's Whirl	Bottom	108	<0.001	<0.001	0.082	0.65	1
TEMP	USGS 02304517 BL Hannah's Whirl	Bottom	710	<0.001	0.024	-0.021	0.77	-1
TEMP	USGS 023060013 I-275	Bottom	2379	<0.001	0.017	0.005	0.81	1

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
TEMP	EPC 105	Midwater	148	<0.001	ns	-0.006	0.74	0
TEMP	EPC 1512	Midwater	60	<0.001	ns	0.036	0.87	0
TEMP	EPC 1514	Midwater	60	<0.001	ns	0.076	0.83	0
TEMP	EPC 1515	Midwater	55	<0.001	ns	0.097	0.80	0
TEMP	EPC 152	Midwater	131	<0.001	ns	-0.006	0.85	0
TEMP	EPC 174	Midwater	77	<0.001	0.003	0.030	0.65	1
TEMP	EPC 270	Midwater	14	<0.001	ns	-0.249	0.92	0
TEMP	SWFWMD LHR02_800044_RKm_15.7	Midwater	24	0.006	ns	-0.032	0.69	0
TEMP	SWFWMD LHR03_19208_RKm_15.4	Midwater	57	<0.001	ns	-0.039	0.71	0
TEMP	SWFWMD LHR04_800045_RKm_15.1	Midwater	24	<0.001	ns	-0.027	0.85	0
TEMP	SWFWMD LHR05_800046_RKm_14.8	Midwater	56	<0.001	ns	-0.010	0.82	0
TEMP	SWFWMD LHR06_800047_RKm_14.5	Midwater	53	<0.001	ns	-0.001	0.82	0
TEMP	SWFWMD LHR07_800048_RKm_14.3	Midwater	64	<0.001	ns	-0.009	0.73	0
TEMP	SWFWMD LHR08_800049_RKm_13.9	Midwater	68	<0.001	ns	-0.023	0.76	0
TEMP	SWFWMD LHR09_19209_RKm_13.6	Midwater	62	<0.001	ns	-0.049	0.82	0
TEMP	SWFWMD LHR10_800050_RKm_13.3	Midwater	58	<0.001	ns	-0.023	0.74	0
TEMP	SWFWMD LHR11_800052_RKm_13	Midwater	67	<0.001	ns	-0.019	0.79	0
TEMP	SWFWMD LHR12_800053_RKm_12.7	Midwater	62	<0.001	ns	-0.025	0.78	0
TEMP	SWFWMD LHR13_19235_RKm_12.3	Midwater	64	<0.001	ns	-0.035	0.85	0
TEMP	SWFWMD LHR14_800054_RKm_11.8	Midwater	64	<0.001	ns	-0.029	0.81	0
TEMP	SWFWMD LHR15_800055_RKm_11.3	Midwater	53	<0.001	ns	-0.072	0.80	0
TEMP	SWFWMD LHR16_19237_RKm_10.8	Midwater	61	<0.001	ns	-0.028	0.86	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
TEMP	EPC 105	Surface	147	<0.001	ns	-0.003	0.73	0
TEMP	EPC 1512	Surface	60	<0.001	ns	0.003	0.84	0
TEMP	EPC 1514	Surface	60	<0.001	ns	0.067	0.81	0
TEMP	EPC 1515	Surface	54	<0.001	ns	0.085	0.78	0
TEMP	EPC 152	Surface	131	<0.001	ns	0.003	0.79	0
TEMP	EPC 2 CR	Surface	1917	<0.001	0.018	0.011	0.80	1
TEMP	EPC 270	Surface	12	0.002	0.026	-0.347	0.93	-1
TEMP	FDEP SBIO TP482HILLS_HD	Surface	1	ns	ns	0.000	0.00	.
TEMP	SWFWMD LHR01_800043_RKm_16	Surface	28	0.006	ns	0.003	0.65	0
TEMP	SWFWMD LHR02_800044_RKm_15.7	Surface	66	<0.001	ns	0.010	0.67	0
TEMP	SWFWMD LHR03_19208_RKm_15.4	Surface	62	<0.001	ns	-0.027	0.71	0
TEMP	SWFWMD LHR04_800045_RKm_15.1	Surface	67	<0.001	ns	-0.019	0.77	0
TEMP	SWFWMD LHR05_800046_RKm_14.8	Surface	70	<0.001	ns	-0.018	0.74	0
TEMP	SWFWMD LHR06_800047_RKm_14.5	Surface	71	<0.001	ns	-0.022	0.75	0
TEMP	SWFWMD LHR07_800048_RKm_14.3	Surface	70	<0.001	ns	-0.013	0.74	0
TEMP	SWFWMD LHR08_800049_RKm_13.9	Surface	70	<0.001	ns	-0.027	0.75	0
TEMP	SWFWMD LHR09_19209_RKm_13.6	Surface	66	<0.001	ns	-0.036	0.79	0
TEMP	SWFWMD LHR10_800050_RKm_13.3	Surface	70	<0.001	ns	-0.023	0.75	0
TEMP	SWFWMD LHR11_800052_RKm_13	Surface	70	<0.001	ns	-0.024	0.74	0
TEMP	SWFWMD LHR12_800053_RKm_12.7	Surface	70	<0.001	ns	-0.023	0.70	0
TEMP	SWFWMD LHR13_19235_RKm_12.3	Surface	65	<0.001	ns	-0.039	0.78	0
TEMP	SWFWMD LHR14_800054_RKm_11.8	Surface	66	<0.001	ns	-0.045	0.75	0
TEMP	SWFWMD LHR15_800055_RKm_11.3	Surface	66	<0.001	ns	-0.050	0.74	0
TEMP	SWFWMD LHR16_19237_RKm_10.8	Surface	61	<0.001	0.006	-0.094	0.76	-1
TEMP	SWFWMD WMD_19206	Surface	446	<0.001	0.045	0.029	0.66	1
TEMP	TBW Sligh	Surface	2891	<0.001	<0.001	0.024	0.81	1
TEMP	USGS 02304510 Rowlett	Surface	4468	<0.001	<0.001	0.027	0.71	1
TEMP	USGS 02304515 Hannah's Whirl	Surface	536	<0.001	<0.001	-0.061	0.81	-1
TEMP	USGS 02304517 BL Hannah's Whirl	Surface	710	<0.001	0.006	-0.027	0.75	-1
TEMP	USGS 023060013 I-275	Surface	2378	<0.001	ns	0.002	0.80	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
PH	EPC 105	Bottom	142	0.002	<0.001	0.010	0.40	1
PH	EPC 1512	Bottom	55	0.027	ns	0.001	0.34	0
PH	EPC 1514	Bottom	54	ns	ns	0.002	0.00	0
PH	EPC 1515	Bottom	49	0.029	ns	0.007	0.36	0
PH	EPC 152	Bottom	126	<0.001	0.009	0.003	0.32	1
PH	EPC 270	Bottom	11	0.038	ns	0.028	0.89	0
PH	SWFWMD LHR02_800044_RKm_15.7	Bottom	46	ns	ns	0.002	0.00	0
PH	SWFWMD LHR03_19208_RKm_15.4	Bottom	62	0.021	0.006	0.009	0.35	1
PH	SWFWMD LHR04_800045_RKm_15.1	Bottom	60	ns	0.006	0.009	0.12	1
PH	SWFWMD LHR05_800046_RKm_14.8	Bottom	69	0.012	<0.001	0.012	0.37	1
PH	SWFWMD LHR06_800047_RKm_14.5	Bottom	68	<0.001	<0.001	0.013	0.46	1
PH	SWFWMD LHR07_800048_RKm_14.3	Bottom	69	0.018	0.034	0.008	0.30	1
PH	SWFWMD LHR08_800049_RKm_13.9	Bottom	69	0.002	0.034	0.007	0.36	1
PH	SWFWMD LHR09_19209_RKm_13.6	Bottom	65	ns	ns	0.004	0.02	0
PH	SWFWMD LHR10_800050_RKm_13.3	Bottom	69	<0.001	ns	0.002	0.45	0
PH	SWFWMD LHR11_800052_RKm_13	Bottom	69	0.005	ns	-0.001	0.32	0
PH	SWFWMD LHR12_800053_RKm_12.7	Bottom	68	0.001	ns	0.000	0.37	0
PH	SWFWMD LHR13_19235_RKm_12.3	Bottom	65	<0.001	ns	-0.000	0.47	0
PH	SWFWMD LHR14_800054_RKm_11.8	Bottom	65	<0.001	ns	0.000	0.45	0
PH	SWFWMD LHR15_800055_RKm_11.3	Bottom	63	<0.001	ns	0.002	0.44	0
PH	SWFWMD LHR16_19237_RKm_10.8	Bottom	61	<0.001	ns	-0.000	0.49	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
PH	EPC 105	Midwater	143	0.001	<0.001	0.009	0.37	1
PH	EPC 1512	Midwater	57	0.046	ns	0.003	0.30	0
PH	EPC 1514	Midwater	57	<0.001	ns	0.003	0.44	0
PH	EPC 1515	Midwater	52	0.012	ns	0.003	0.38	0
PH	EPC 152	Midwater	126	0.002	0.006	0.004	0.27	1
PH	EPC 174	Midwater	72	ns	ns	-0.004	0.02	0
PH	EPC 270	Midwater	13	0.028	ns	0.043	0.77	0
PH	SWFWMD LHR02_800044_RKm_15.7	Midwater	23	ns	ns	0.001	0.00	0
PH	SWFWMD LHR03_19208_RKm_15.4	Midwater	57	ns	ns	0.005	0.06	0
PH	SWFWMD LHR04_800045_RKm_15.1	Midwater	24	ns	ns	0.002	0.01	0
PH	SWFWMD LHR05_800046_RKm_14.8	Midwater	55	ns	0.011	0.009	0.12	1
PH	SWFWMD LHR06_800047_RKm_14.5	Midwater	52	ns	0.006	0.010	0.14	1
PH	SWFWMD LHR07_800048_RKm_14.3	Midwater	63	0.021	<0.001	0.013	0.41	1
PH	SWFWMD LHR08_800049_RKm_13.9	Midwater	67	<0.001	0.004	0.008	0.42	1
PH	SWFWMD LHR09_19209_RKm_13.6	Midwater	62	0.036	0.019	0.008	0.33	1
PH	SWFWMD LHR10_800050_RKm_13.3	Midwater	57	ns	ns	0.005	0.06	0
PH	SWFWMD LHR11_800052_RKm_13	Midwater	66	<0.001	ns	0.004	0.42	0
PH	SWFWMD LHR12_800053_RKm_12.7	Midwater	61	0.009	ns	0.001	0.34	0
PH	SWFWMD LHR13_19235_RKm_12.3	Midwater	64	<0.001	ns	0.000	0.47	0
PH	SWFWMD LHR14_800054_RKm_11.8	Midwater	63	<0.001	ns	0.003	0.50	0
PH	SWFWMD LHR15_800055_RKm_11.3	Midwater	52	ns	ns	-0.002	0.00	0
PH	SWFWMD LHR16_19237_RKm_10.8	Midwater	61	<0.001	ns	-0.001	0.42	0

Linear Regression Summary for Target Zone

Constituent	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	Slope Direction
PH	EPC 105	Surface	142	0.005	<0.001	0.006	0.25	1
PH	EPC 1512	Surface	57	ns	ns	-0.001	0.00	0
PH	EPC 1514	Surface	57	0.025	ns	0.006	0.32	0
PH	EPC 1515	Surface	51	0.017	ns	0.008	0.37	0
PH	EPC 152	Surface	126	0.038	<0.001	0.007	0.29	1
PH	EPC 270	Surface	11	ns	ns	0.014	0.05	0
PH	SWFWMD LHR01_800043_RKm_16	Surface	27	ns	ns	0.002	0.01	0
PH	SWFWMD LHR02_800044_RKm_15.7	Surface	65	ns	ns	-0.000	0.00	0
PH	SWFWMD LHR03_19208_RKm_15.4	Surface	62	ns	ns	-0.003	0.01	0
PH	SWFWMD LHR04_800045_RKm_15.1	Surface	67	ns	ns	0.005	0.04	0
PH	SWFWMD LHR05_800046_RKm_14.8	Surface	69	ns	0.032	0.006	0.07	1
PH	SWFWMD LHR06_800047_RKm_14.5	Surface	70	ns	0.011	0.008	0.09	1
PH	SWFWMD LHR07_800048_RKm_14.3	Surface	69	0.046	<0.001	0.011	0.33	1
PH	SWFWMD LHR08_800049_RKm_13.9	Surface	69	0.024	0.002	0.009	0.32	1
PH	SWFWMD LHR09_19209_RKm_13.6	Surface	66	0.021	0.026	0.007	0.31	1
PH	SWFWMD LHR10_800050_RKm_13.3	Surface	69	ns	ns	0.005	0.03	0
PH	SWFWMD LHR11_800052_RKm_13	Surface	69	ns	ns	0.003	0.02	0
PH	SWFWMD LHR12_800053_RKm_12.7	Surface	69	ns	ns	0.001	0.00	0
PH	SWFWMD LHR13_19235_RKm_12.3	Surface	65	ns	ns	0.002	0.00	0
PH	SWFWMD LHR14_800054_RKm_11.8	Surface	65	ns	ns	-0.000	0.00	0
PH	SWFWMD LHR15_800055_RKm_11.3	Surface	65	ns	ns	-0.002	0.01	0
PH	SWFWMD LHR16_19237_RKm_10.8	Surface	61	ns	ns	-0.002	0.01	0
PH	SWFWMD WMD_19206	Surface	446	<0.001	ns	0.001	0.34	0

Appendix Q2

Water Quality Modeling Results

Logistic Regression Summary

Logistic Regression Summary Tables

Constituent	Source	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	ROC	Slope Direction
DO	EPC	105	Bottom	139	ns	0.001	-0.084	0.15	69.38	-1
DO	EPC	152	Bottom	Convergence issues – no model fit						
DO	EPC	EPC 2 CR	Bottom	2006	<0.001	<0.001	-0.040	0.49	86.14	-1
DO	USGS	USGS 02304517 BL Hannah's Whirl	Bottom	699	<0.001	<0.001	0.087	0.38	83.14	1

Con stituent	Source	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	ROC	Slope Direction
DO	EPC	152	Surface	122	ns	ns	-0.028	0.02	57.43	0
DO	EPC	EPC 2 CR	Surface	1917	<0.001	<0.001	0.046	0.49	90.49	1
DO	SWFWMD	WMD_19206	Surface	446	<0.001	0.007	0.088	0.48	85.46	1
DO	USGS	USGS 02304515 Hannah's Whirl	Surface	108	ns	ns	0.010	0.00	45.87	0

Logistic Regression Summary Tables

Constituent	Source	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	ROC	Slope Direction
SALIN	EPC	105	Bottom	144	ns	<0.001	-0.234	0.57	89.90	-1
SALIN	EPC	152	Bottom	Convergence issues – no model fit						
SALIN	EPC	EPC 2 CR	Bottom	2006	<0.001	<0.001	-0.113	0.28	76.79	-1
SALIN	TBW	Sligh	Bottom	2997	0.001	ns	-0.045	0.19	90.09	0
SALIN	USGS	USGS 02304510 Rowlett	Bottom	4416	<0.001	<0.001	-0.220	0.58	91.08	-1
SALIN	USGS	USGS 02304515 Hannah's Whirl	Bottom	Convergence Issues – no model fit						
SALIN	USGS	USGS 02304517 BL Hannah's Whirl	Bottom	710	<0.001	ns	0.030	0.43	84.58	0
SALIN	USGS	USGS 023060013 I-275	Bottom	2121	<0.001	<0.001	-0.072	0.26	83.47	-1

Constituent	Source	Station	Level	N	Month p Value	Flow p Value	Flow Slope	R square	ROC	Slope Direction
SALIN	EPC	105	Surface	144	ns	ns	-7.619	0.80	93.97	0
SALIN	EPC	152	Surface	Convergence issues – no model fit						
SALIN	EPC	EPC 2 CR	Surface	1916	<0.001	<0.001	-0.166	0.29	77.82	-1
SALIN	SWFWMD	WMD_19206	Surface	446	<0.001	ns	-0.041	0.58	86.95	0
SALIN	TBW	Sligh	Surface	2887	<0.001	<0.001	-0.060	0.17	72.64	-1
SALIN	USGS	USGS 02304510 Rowlett	Surface	4476	<0.001	<0.001	-0.304	0.66	94.31	-1
SALIN	USGS	USGS 02304515 Hannah's Whirl	Surface	Convergence issues – no model fit						
SALIN	USGS	USGS 02304517 BL Hannah's Whirl	Surface	710	<0.001	ns	-0.013	0.66	94.99	0
SALIN	USGS	USGS 023060013 I-275	Surface	2126	<0.001	<0.001	-0.069	0.27	79.85	-1

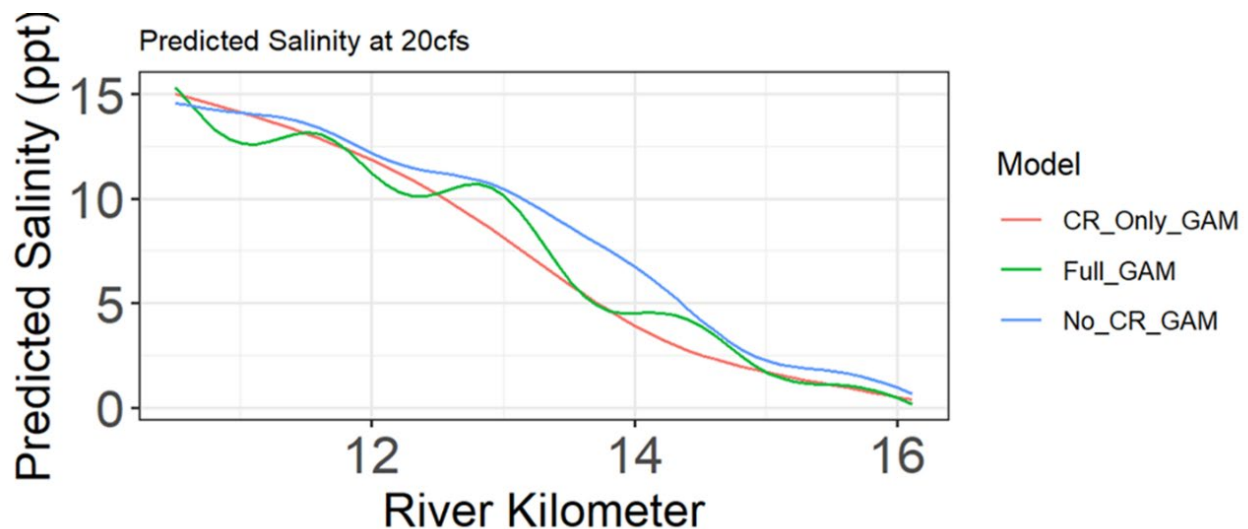
Appendix Q3

Water Quality Modeling Results

GAM Model Subsets

Appendix P3- GAM Model Subsets

One of the most challenging aspects of GAM modeling is the control over the smoothing functions. The default method in the R mgcv package is generalized cross validation which was used for all modeling in this report since its objective is to maximize accuracy of predictions for out of sample data. The final GAM model for bottom salinity (model3) was used to compare the effects of estimating the salinity response using the full dataset as provided in the main document (“Full GAM”), and models where either the continuous recorder data were dropped from analysis (“No CR GAM”), or only CR data were used (CR Only GAM). The resulting curves for these three models using a 14 day lag average flow of 20cfs in the month of June is provided below. It appears that the CR data may be pulling prediction lines down relative to the ambient grab sample data at the CR locations causing the sinusoidal aspects of the prediction curve for the Full GAM. Utilizing all data was a prime objective of this report and dropping the CR data resulted in predicted salinities that were substantially higher between Rkm 12 and 15 with a much lower R square (Fit statistics for all three models below). Mixing daily average data and instantaneous grab sample measurements is likely including some uncertainty into the model predictions; however, the goal of this modeling was to compare the Existing and NoMFL scenarios and inference of that comparison should not be affected.



Model fit statistics for the three models:

No CR GAM:

R-sq.(adj) = 0.568 Deviance explained = 57.3%
GCV = 18.52 Scale est. = 18.297 n = 2667

Full GAM

R-sq.(adj) = 0.725 Deviance explained = 72.5%
GCV = 11.598 Scale est. = 11.572 n = 15025

CR Only GAM

R-sq.(adj) = 0.762 Deviance explained = 76.3%
GCV = 9.9296 Scale est. = 9.9073 n = 12358

Appendix Q4

Water Quality Modeling Results

GAM Model Chapter 6 Detailed Results

Surface Salinity

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.84188	78163.16	10.84188	78245.61
g3	10.68179	77948.57	10.68179	78029.80
g5	10.56357	77775.98	10.56357	77856.31
g7	10.64560	77614.42	10.64560	77695.37
g14	10.66837	77357.81	10.66837	77438.94
g21	10.91380	77496.20	10.91380	77579.20
g28	10.95555	77613.73	10.95555	77697.05

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	26.59176	69853.51	26.59176	70055.73
gam_model2	33.95377	69734.84	33.95377	69993.05
gam_model3	34.70458	68111.03	34.70458	68374.94
gam_model4	26.39885	68756.43	26.39885	68957.18
gam_model5	39.35065	67892.89	39.35065	68192.14

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(lag_14_avg) + s(Rkm) + te(lag_14_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.42323	0.13288	3.185	0.00145	**
factor(Month)2	-0.10002	0.09680	-1.033	0.30150	
factor(Month)3	-0.17803	0.08545	-2.083	0.03723	*
factor(Month)4	0.01158	0.08501	0.136	0.89169	
factor(Month)5	0.45401	0.07888	5.756	8.80e-09	***
factor(Month)6	-0.64397	0.08537	-7.544	4.84e-14	***

```

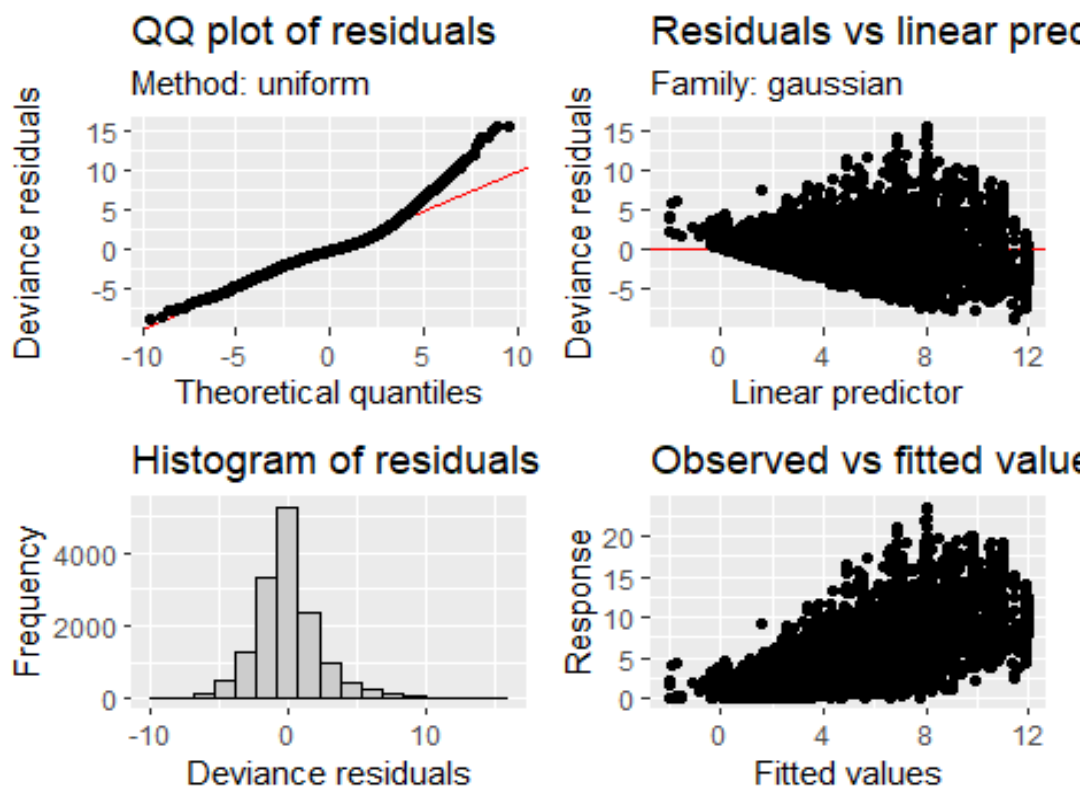
factor(Month)7  -1.39156    0.11103 -12.533 < 2e-16 ***
factor(Month)8  -3.55655    0.19008 -18.711 < 2e-16 ***
factor(Month)9  -0.89268    0.20098  -4.442 8.99e-06 ***
factor(Month)10  0.89556    0.11477   7.803 6.45e-15 ***
factor(Month)11  1.41486    0.09893  14.302 < 2e-16 ***
factor(Month)12  0.39618    0.08594   4.610 4.06e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df      F p-value
s(lag_14_avg)  8.939  8.999  21.9 <2e-16 ***
s(Rkm)         8.747  8.965 1729.7 <2e-16 ***
te(lag_14_avg):Rkm 4.973  4.973 286.3 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

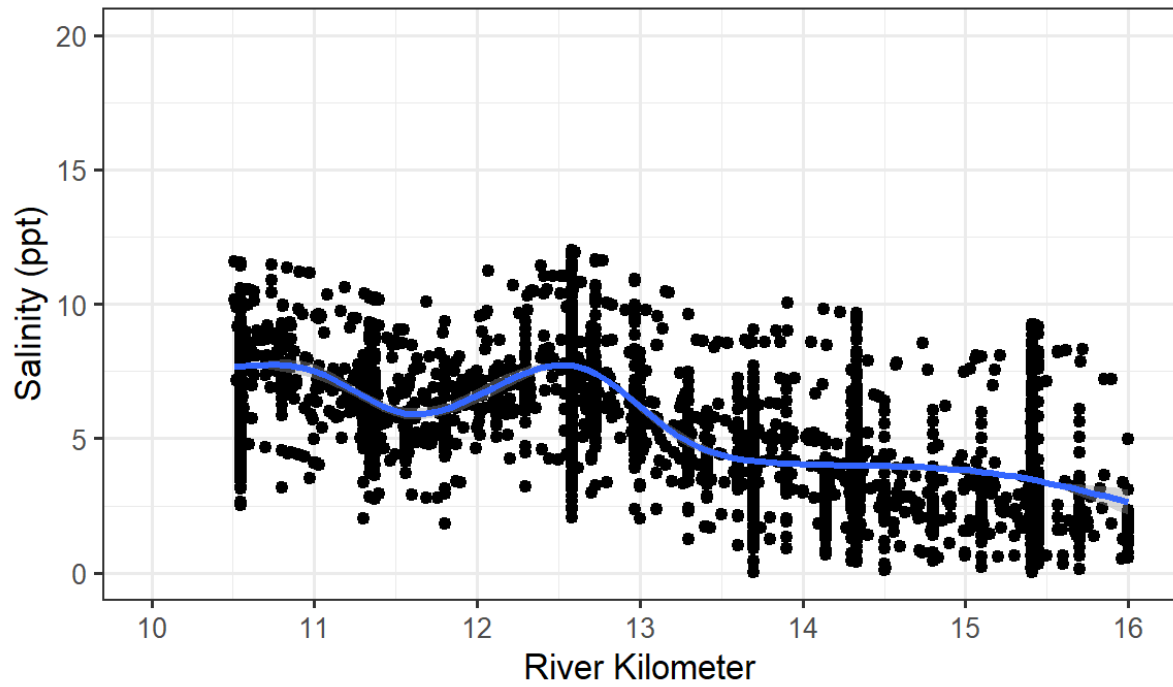
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R-sq.(adj) =  0.556   Deviance explained = 55.7%
GCV =  5.775   Scale est. = 5.7619    n = 14834

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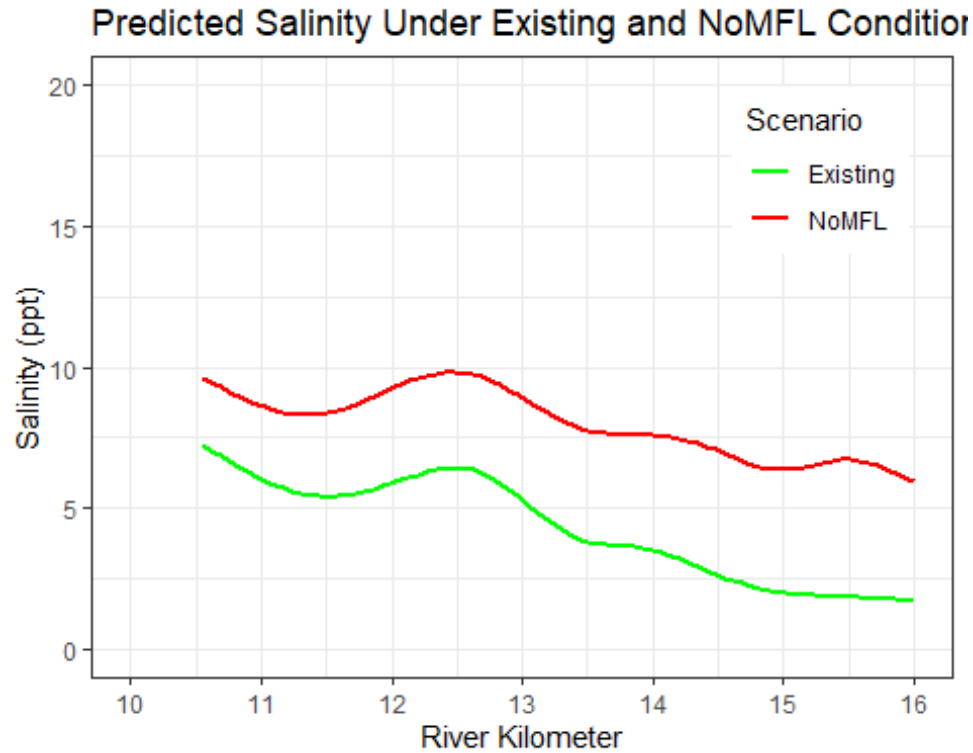
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Bottom Salinity

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.798387	97912.64	10.798387	97994.84
g3	9.611105	97869.41	9.611105	97942.57
g5	10.218405	97817.60	10.218405	97895.38
g7	10.170574	97784.61	10.170574	97862.02
g14	8.133024	97692.98	8.133024	97754.89
g21	9.881501	97641.83	9.881501	97717.04
g28	10.406312	97628.68	10.406312	97707.89

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model11	26.80229	80134.13	26.80229	80338.15
gam_model12	34.65679	79968.85	34.65679	80232.65
gam_model13	34.17188	78447.70	34.17188	78707.81
gam_model14	26.84899	78981.02	26.84899	79185.39
gam_model15	39.62099	78493.96	39.62099	78795.54

Summary model results for GAM Model3

Family: gaussian
Link function: identity

Formula:
Result ~ s(lag_28_avg) + s(Rkm) + te(lag_28_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	1.814116	0.204339	8.878	< 2e-16	***
factor(Month)2	-0.398223	0.133142	-2.991	0.00279	**
factor(Month)3	-1.106846	0.119393	-9.271	< 2e-16	***
factor(Month)4	-0.940420	0.117993	-7.970	1.70e-15	***
factor(Month)5	-0.001223	0.109791	-0.011	0.99111	
factor(Month)6	-1.575575	0.118407	-13.306	< 2e-16	***
factor(Month)7	-2.603383	0.153216	-16.992	< 2e-16	***
factor(Month)8	-4.616903	0.239084	-19.311	< 2e-16	***
factor(Month)9	0.721340	0.283708	2.543	0.01101	*
factor(Month)10	2.272801	0.159955	14.209	< 2e-16	***
factor(Month)11	2.512181	0.136059	18.464	< 2e-16	***
factor(Month)12	0.806257	0.119282	6.759	1.44e-11	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	F	p-value	
s(lag_28_avg)	8.380	8.840	15.34	<2e-16	***
s(Rkm)	8.931	8.981	5165.16	<2e-16	***
te(lag_28_avg):Rkm	4.816	4.938	265.68	<2e-16	***

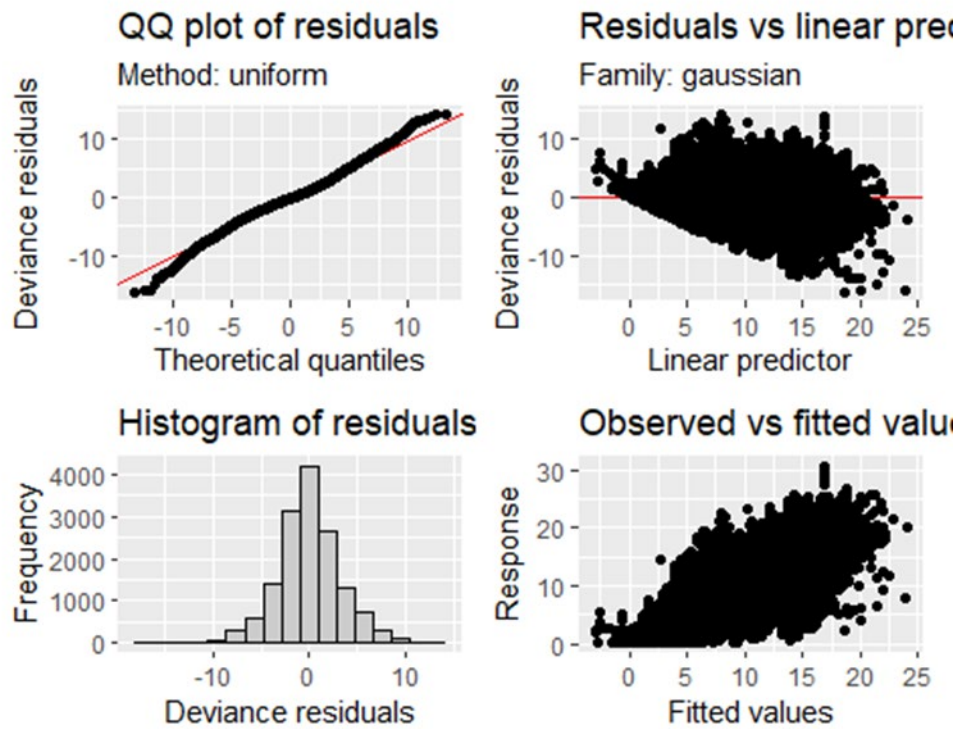
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Rank: 34/35

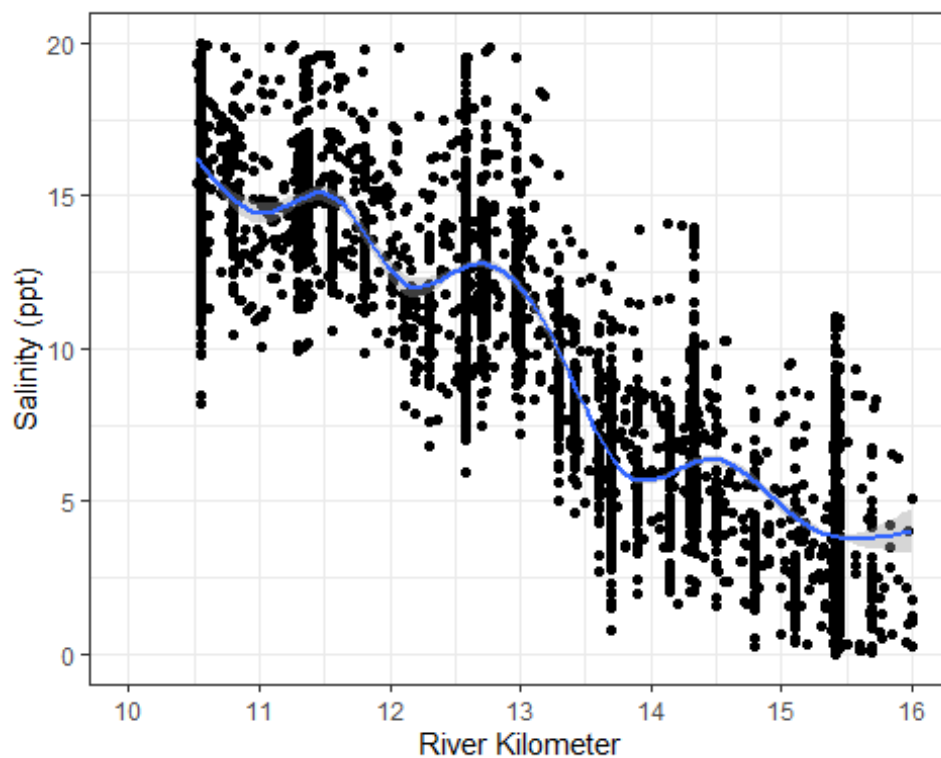
R-sq.(adj) = 0.735 Deviance explained = 73.6%

GCV = 11.17 Scale est. = 11.145 n = 14939

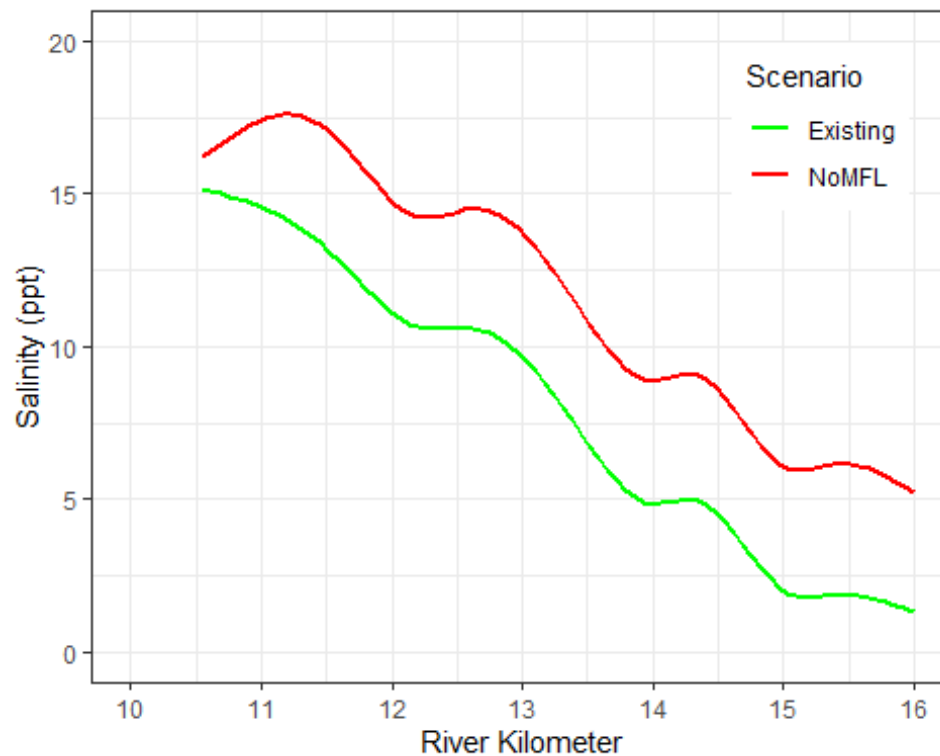
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Surface DO

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.640298	22608.61	10.640298	22678.63
g3	7.618215	22601.60	7.618215	22651.73
g5	9.294218	22596.86	9.294218	22658.02
g7	9.551779	22582.14	9.551779	22644.99
g14	10.099743	22526.26	10.099743	22592.72
g21	9.094643	22478.78	9.094643	22538.62
g28	9.868707	22458.92	9.868707	22523.86

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	26.62945	20404.03	26.62945	20579.25
gam_model2	31.36995	20375.48	31.36995	20581.89
gam_model3	34.70405	20326.33	34.70405	20554.69
gam_model4	26.91187	21173.77	26.91187	21350.85
gam_model5	40.81681	20285.63	40.81681	20554.20

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(lag_28_avg) + s(Rkm) + te(lag_28_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-0.43160	0.05766	-7.485	8.31e-14	***
factor(Month)2	-0.16620	0.10925	-1.521	0.128	
factor(Month)3	-0.81923	0.10027	-8.170	3.81e-16	***
factor(Month)4	-1.17041	0.09928	-11.789	< 2e-16	***
factor(Month)5	-1.76730	0.09027	-19.579	< 2e-16	***
factor(Month)6	-2.37672	0.09805	-24.240	< 2e-16	***
factor(Month)7	-2.82146	0.12716	-22.188	< 2e-16	***
factor(Month)8	-3.02016	0.19848	-15.217	< 2e-16	***
factor(Month)9	-3.05030	0.28645	-10.649	< 2e-16	***
factor(Month)10	-1.95859	0.13147	-14.897	< 2e-16	***
factor(Month)11	-1.49500	0.11652	-12.830	< 2e-16	***
factor(Month)12	-0.53317	0.10128	-5.264	1.46e-07	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	F	p-value	
s(lag_28_avg)	8.878	8.993	5.625	<2e-16	***
s(Rkm)	8.819	8.983	107.516	<2e-16	***
te(lag_28_avg):Rkm	4.973	4.973	1253.985	<2e-16	***

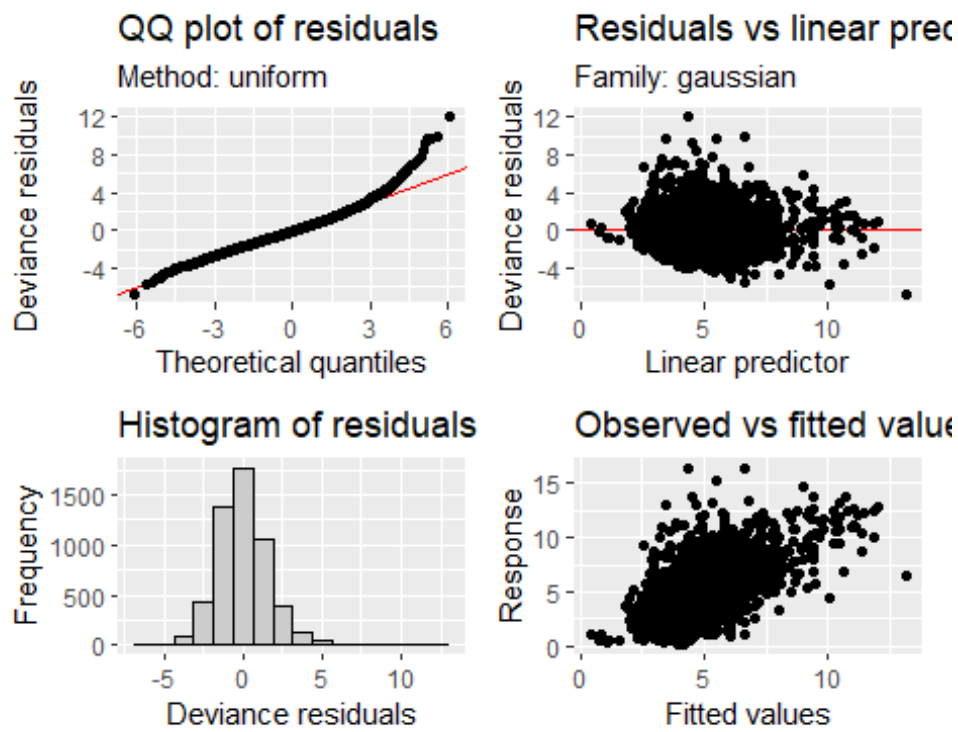
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 34/35

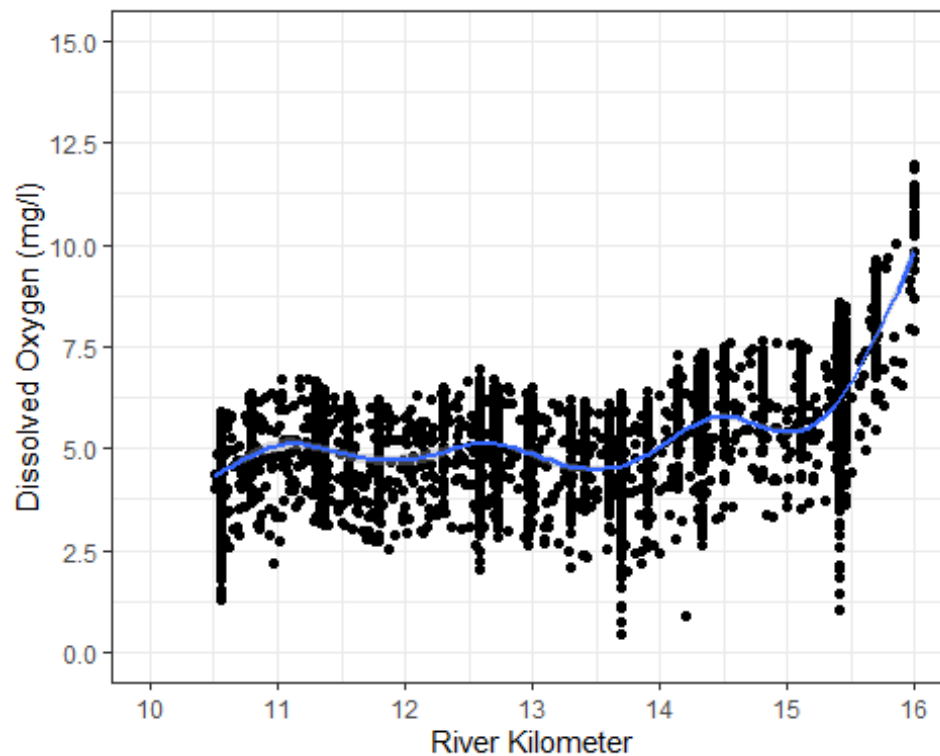
R-sq.(adj) = 0.37 Deviance explained = 37.4%

GCV = 2.6635 Scale est. = 2.6467 n = 5324

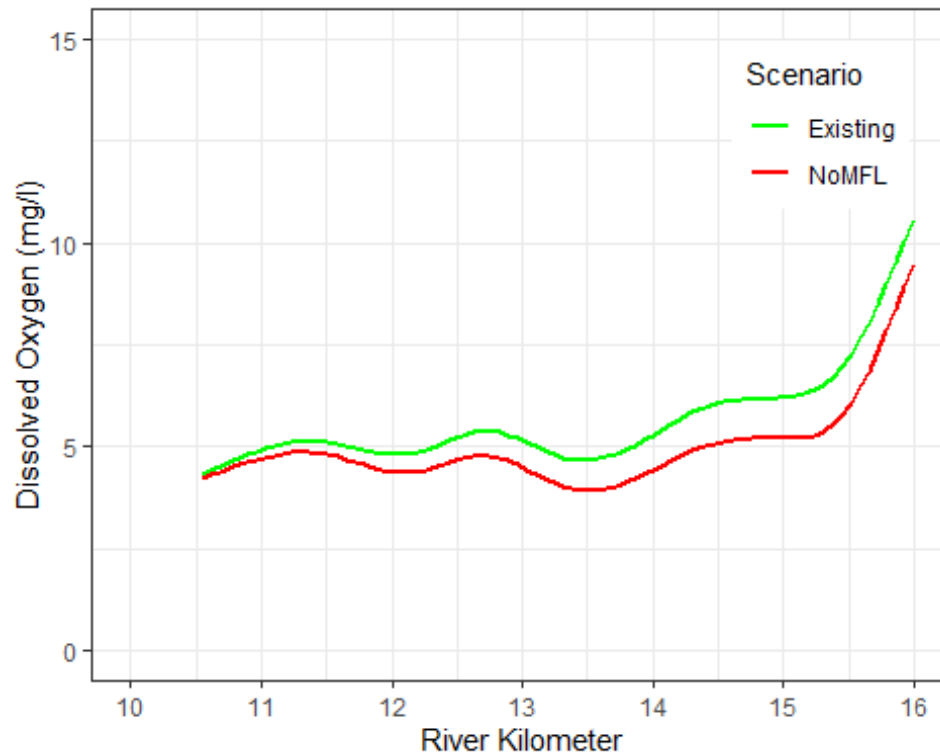
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Bottom DO

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	5.797810	23522.20	5.797810	23560.36
g3	3.000000	23497.87	3.000000	23517.61
g5	7.356318	23502.41	7.356318	23550.82
g7	9.126307	23495.16	9.126307	23555.22
g14	7.698368	23482.26	7.698368	23532.92
g21	9.644957	23445.78	9.644957	23509.26
g28	10.079380	23411.65	10.079380	23477.98

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	26.73428	20771.02	26.73428	20946.95
gam_model2	29.90026	20768.24	29.90026	20965.02

```
gam_model3 34.85831 20703.79 34.85831 20933.18
gam_model4 26.91787 21253.05 26.91787 21430.19
gam_model5 39.04914 20663.57 39.04914 20920.55
```

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(lag_28_avg) + s(Rkm) + te(lag_28_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-0.531981	0.062298	-8.539	< 2e-16	***
factor(Month)2	-0.002454	0.111257	-0.022	0.982	
factor(Month)3	-0.523883	0.102822	-5.095	3.61e-07	***
factor(Month)4	-1.182566	0.102112	-11.581	< 2e-16	***
factor(Month)5	-2.095993	0.093024	-22.532	< 2e-16	***
factor(Month)6	-2.357546	0.100974	-23.348	< 2e-16	***
factor(Month)7	-2.143454	0.132236	-16.209	< 2e-16	***
factor(Month)8	-2.322836	0.202981	-11.444	< 2e-16	***
factor(Month)9	-3.087691	0.300989	-10.258	< 2e-16	***
factor(Month)10	-2.618988	0.134375	-19.490	< 2e-16	***
factor(Month)11	-2.051932	0.120285	-17.059	< 2e-16	***
factor(Month)12	-0.796959	0.103902	-7.670	2.03e-14	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	F	p-value	
s(lag_28_avg)	8.925	8.997	5.837	<2e-16	***
s(Rkm)	8.926	8.991	117.340	<2e-16	***
te(lag_28_avg):Rkm	4.973	4.973	631.083	<2e-16	***

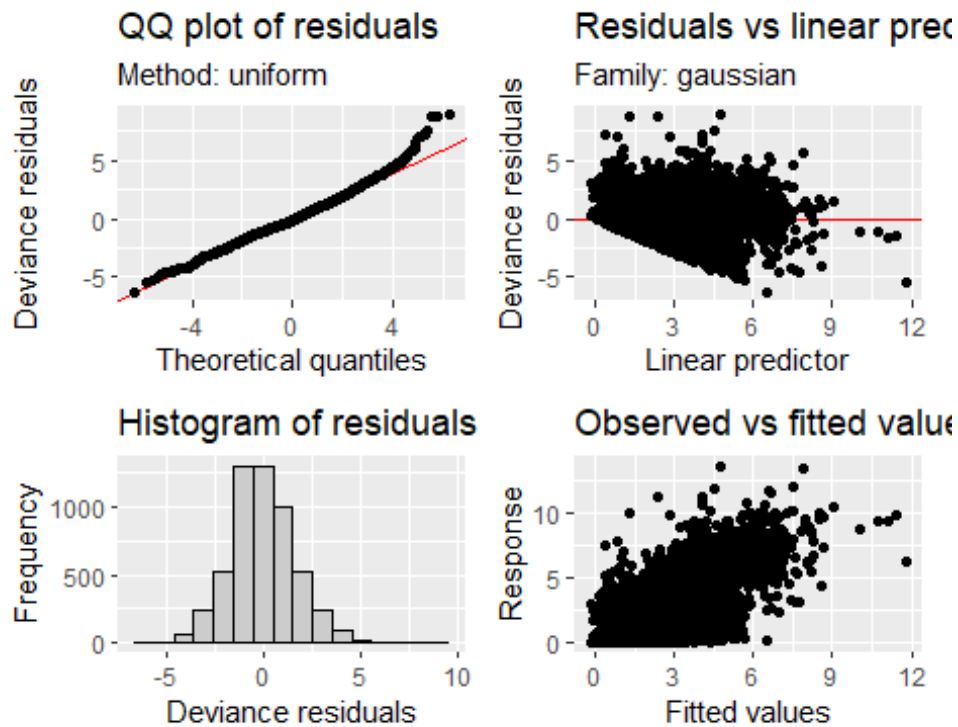
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 34/35

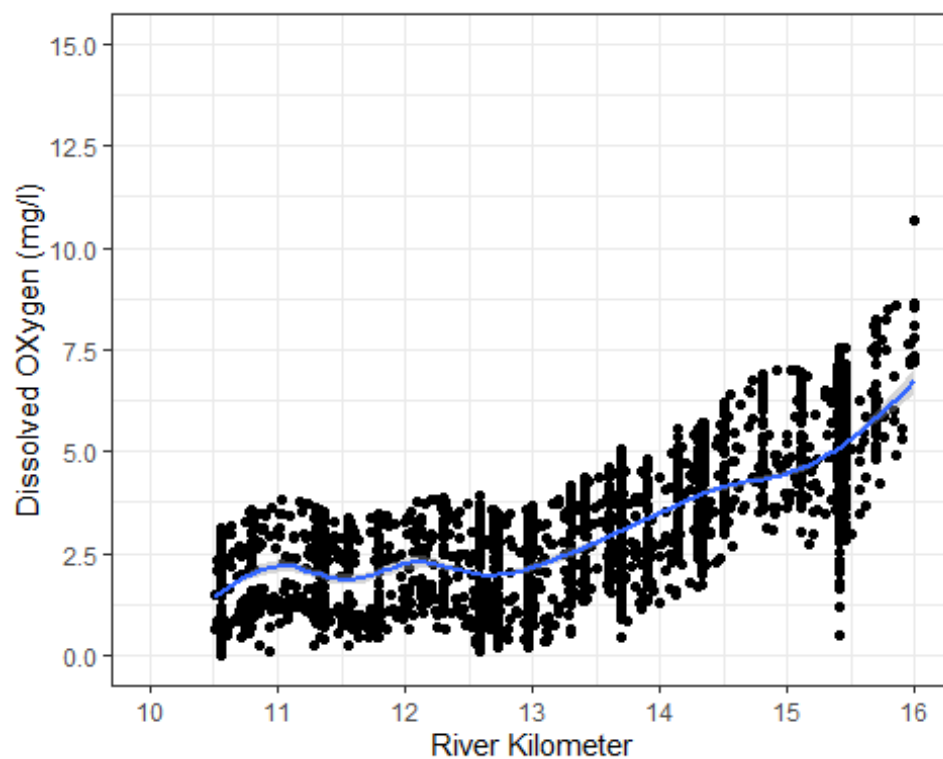
R-sq.(adj) = 0.422 Deviance explained = 42.6%

GCV = 2.8488 Scale est. = 2.8307 n = 5329

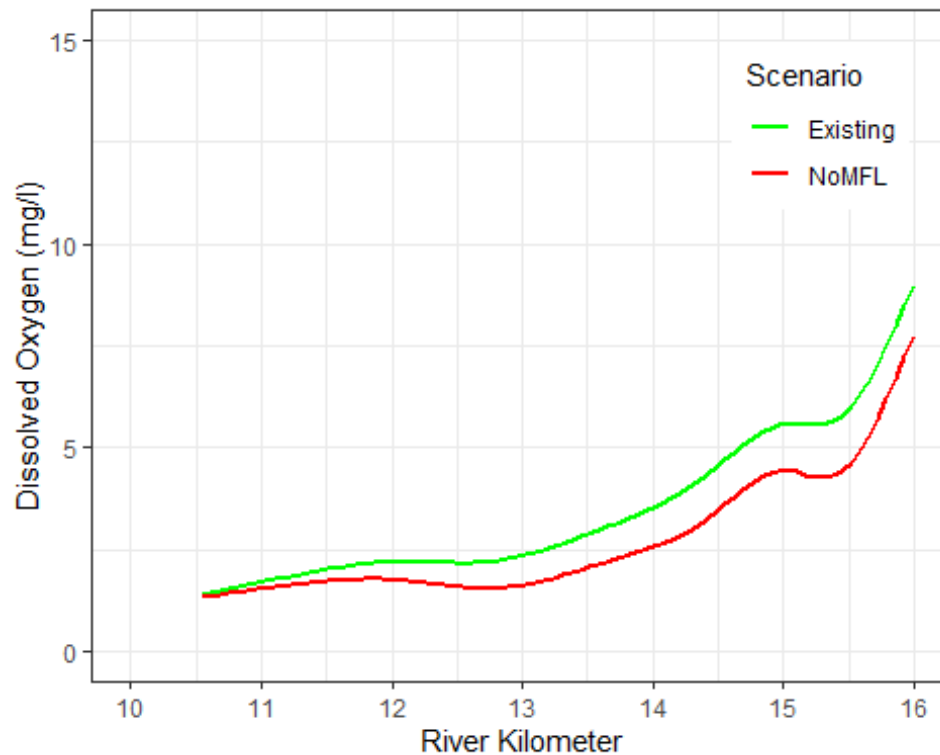
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Surface Temp

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.621686	79634.90	10.621686	79716.15
g3	10.590834	79647.25	10.590834	79728.27
g5	10.588730	79660.42	10.588730	79741.42
g7	10.788518	79662.34	10.788518	79744.87
g14	10.935714	79766.63	10.935714	79850.29
g21	10.822007	79816.54	10.822007	79899.33
g28	8.173211	79843.74	8.173211	79906.27

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model11	26.11445	58620.27	26.11445	58820.04
gam_model12	32.43020	58454.76	32.43020	58702.84
gam_model13	32.43020	58454.76	32.43020	58702.84
gam_model14	25.11582	58692.27	25.11582	58884.40
gam_model15	40.28877	58342.53	40.28877	58650.73

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

Family: gaussian
Link function: identity

Formula:

Result ~ s(LHR_Totflow) + s(Rkm) + te(LHR_Totflow, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.81497	0.07928	10.28	<2e-16 ***
factor(Month)2	1.32275	0.06157	21.48	<2e-16 ***
factor(Month)3	3.04559	0.05542	54.96	<2e-16 ***
factor(Month)4	4.72029	0.05507	85.71	<2e-16 ***
factor(Month)5	6.37710	0.05126	124.40	<2e-16 ***
factor(Month)6	7.80832	0.05536	141.05	<2e-16 ***
factor(Month)7	8.36869	0.07153	117.00	<2e-16 ***
factor(Month)8	8.91709	0.12387	71.99	<2e-16 ***
factor(Month)9	7.82200	0.12722	61.48	<2e-16 ***
factor(Month)10	5.52553	0.07450	74.17	<2e-16 ***
factor(Month)11	2.88649	0.06412	45.01	<2e-16 ***
factor(Month)12	1.09764	0.05511	19.92	<2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	F	p-value
s(LHR_Totflow)	8.318	8.812	21.43	<2e-16 ***
s(Rkm)	8.474	8.903	4361.92	<2e-16 ***
te(LHR_Totflow):Rkm	3.593	4.043	12010.88	<2e-16 ***

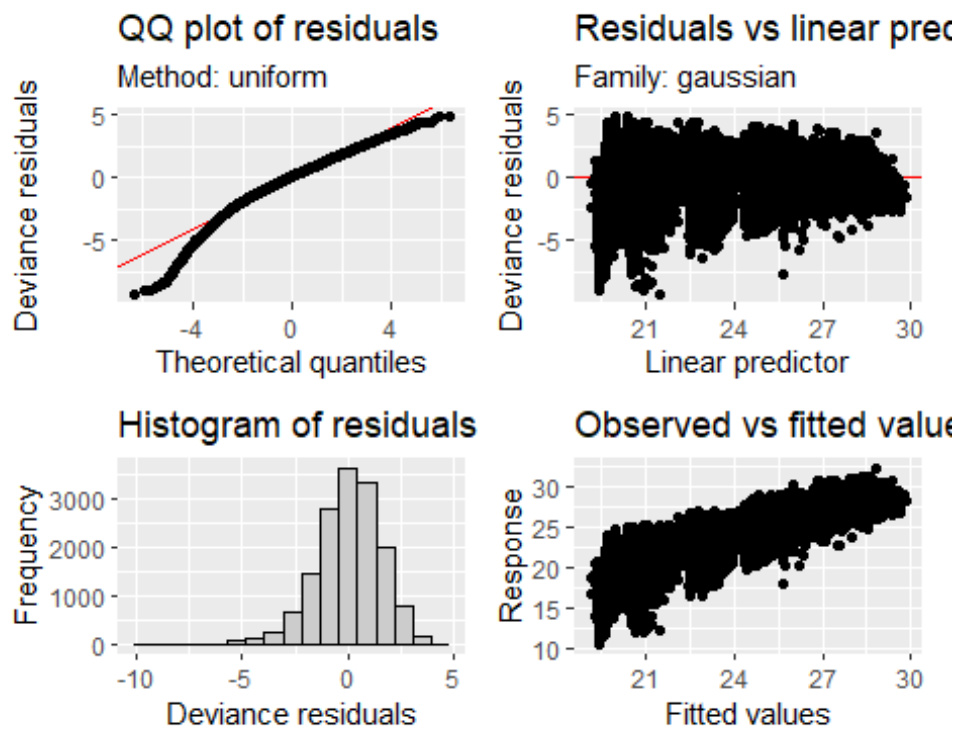
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 34/35

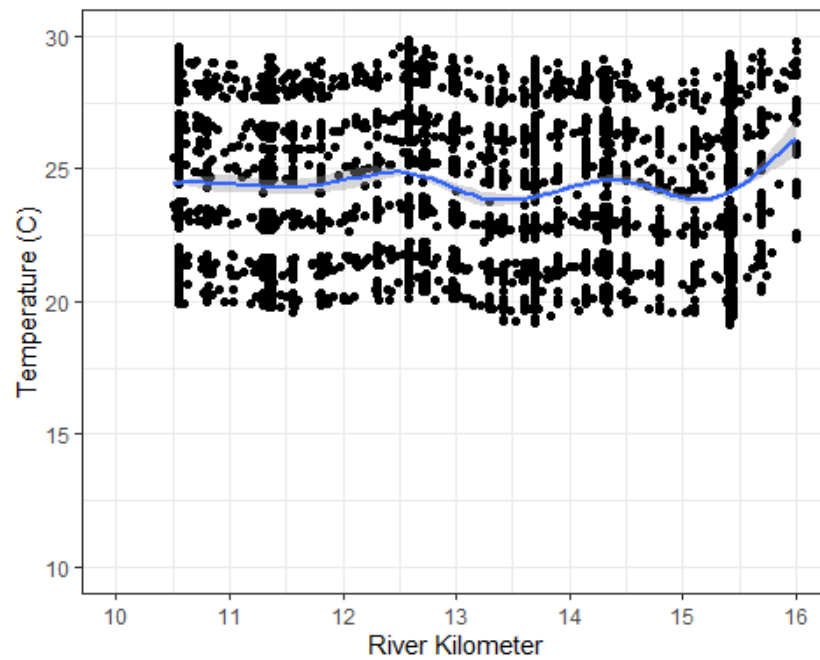
R-sq.(adj) = 0.752 Deviance explained = 75.3%

GCV = 2.5317 Scale est. = 2.5266 n = 15518

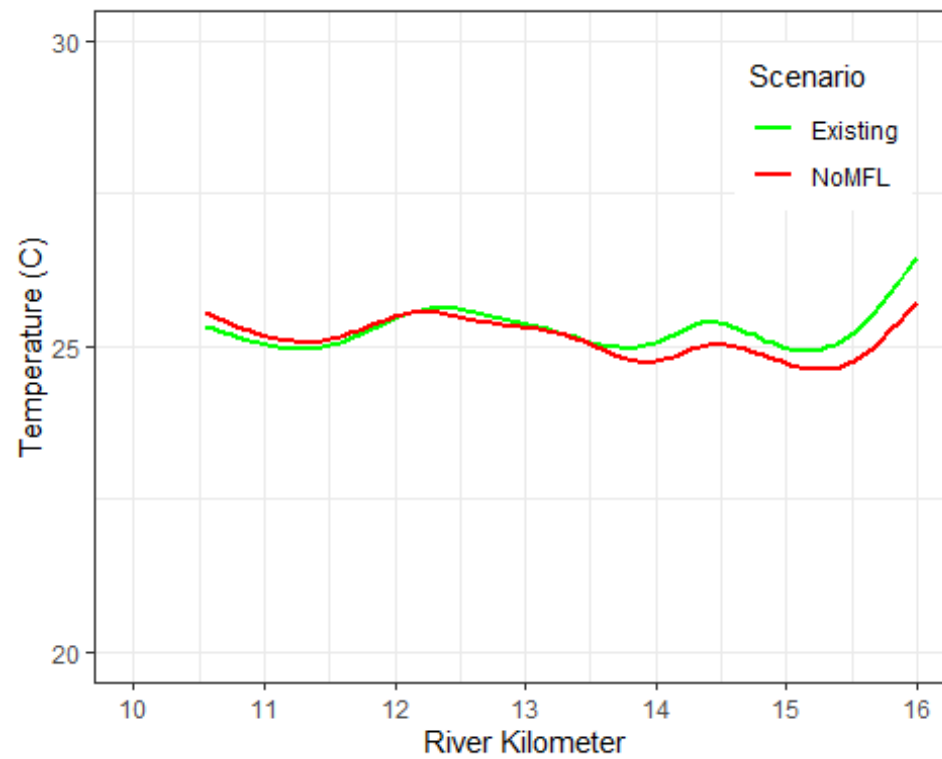
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Bottom Temperature

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.675448	79115.22	10.675448	79196.74
g3	10.499964	79132.93	10.499964	79213.12
g5	10.520959	79126.89	10.520959	79207.24
g7	10.800703	79128.07	10.800703	79210.55
g14	10.935036	79243.26	10.935036	79326.77
g21	10.557350	79303.43	10.557350	79384.05
g28	8.604678	79278.64	8.604678	79344.36

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	26.17650	56508.98	26.17650	56708.89
gam_model2	33.04548	56362.37	33.04548	56614.74
gam_model3	33.04548	56362.37	33.04548	56614.74
gam_model4	26.14730	56604.35	26.14730	56804.04
gam_model5	40.86263	56294.03	40.86263	56606.10

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(LHR_Totflow) + s(Rkm) + te(LHR_Totflow, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	1.13977	0.08990	12.68	<2e-16	***
factor(Month)2	1.26741	0.05934	21.36	<2e-16	***
factor(Month)3	3.21198	0.05369	59.83	<2e-16	***
factor(Month)4	4.86375	0.05339	91.09	<2e-16	***
factor(Month)5	6.59240	0.04962	132.87	<2e-16	***
factor(Month)6	8.02251	0.05346	150.07	<2e-16	***
factor(Month)7	8.66888	0.06883	125.95	<2e-16	***
factor(Month)8	9.37931	0.10566	88.77	<2e-16	***
factor(Month)9	8.39914	0.12310	68.23	<2e-16	***

```

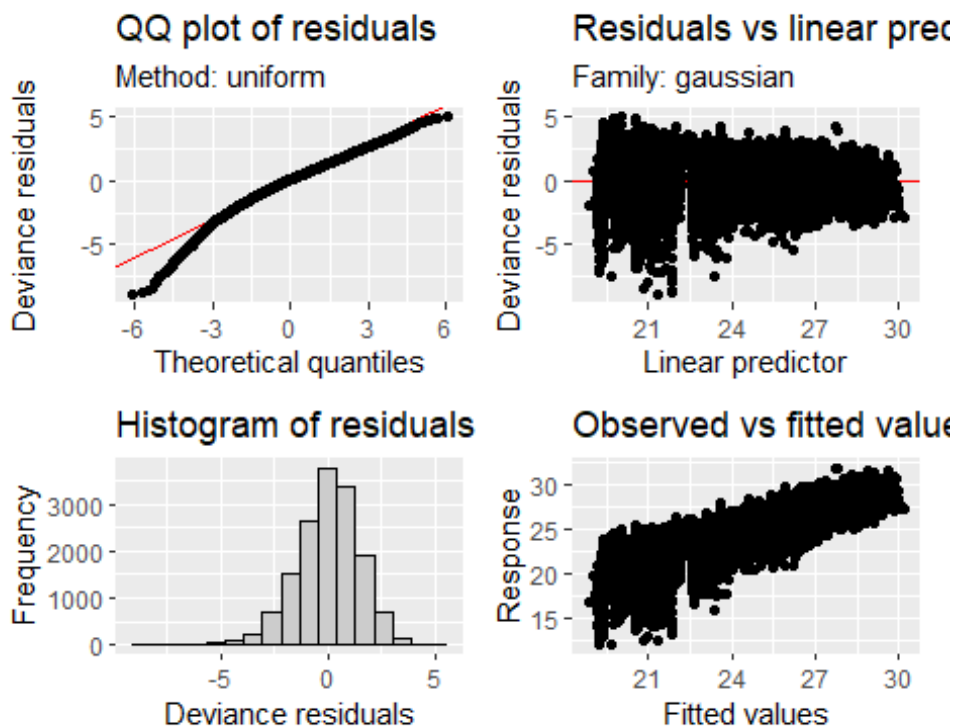
factor(Month)10  6.29719    0.06996    90.01    <2e-16 ***
factor(Month)11  3.32119    0.06120    54.26    <2e-16 ***
factor(Month)12  1.34944    0.05292    25.50    <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df      F p-value
s(LHR_Totflow)    8.296  8.801   17.17 <2e-16 ***
s(Rkm)            8.797  8.971 5205.37 <2e-16 ***
te(LHR_Totflow):Rkm 3.907  4.331 8758.19 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

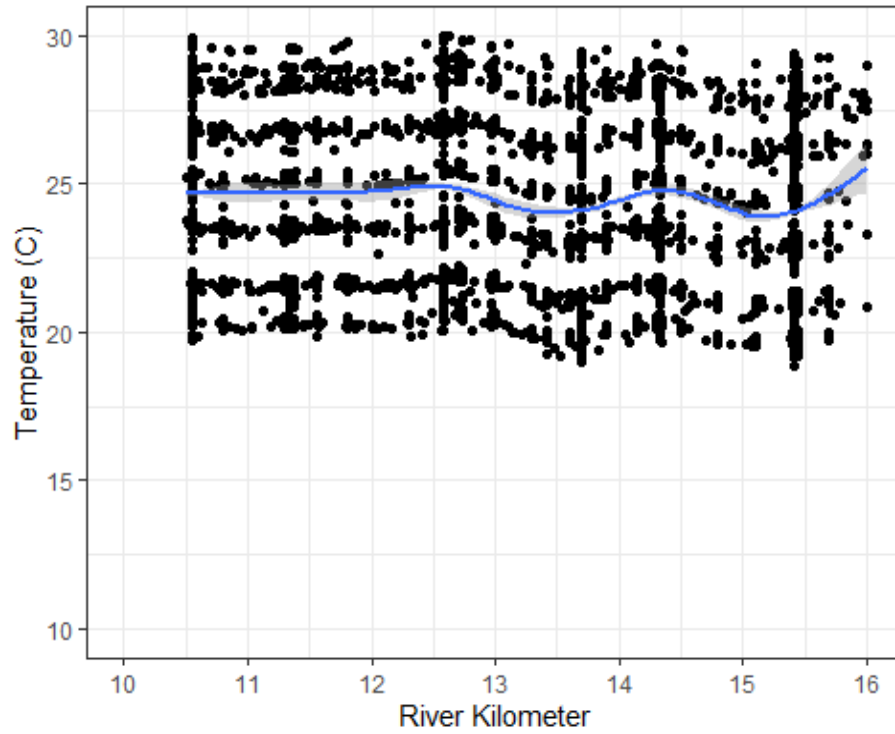
Rank: 34/35
R-sq.(adj) =  0.78  Deviance explained =  78%
GCV = 2.3176  Scale est. = 2.3127    n = 15322

```

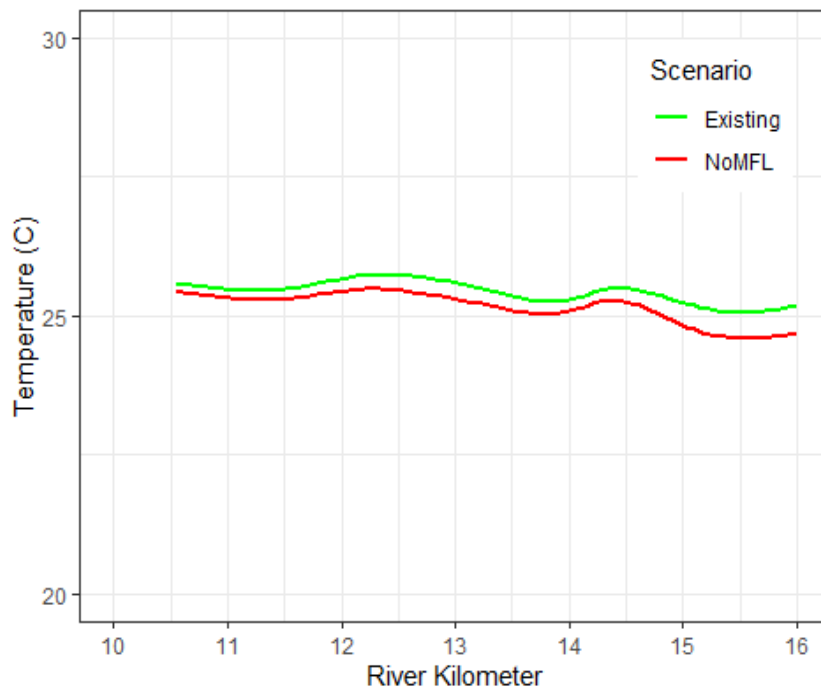
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Surface PH

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.632740	-841.5587	10.632740	-779.5780
g3	10.425256	-840.0766	10.425256	-779.3054
g5	10.380988	-839.2962	10.380988	-778.7830
g7	7.595156	-824.6016	7.595156	-780.3276
g14	9.275640	-855.9060	9.275640	-801.8361
g21	9.171529	-884.0116	9.171529	-830.5486
g28	9.573334	-891.5459	9.573334	-835.7408

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	25.46081	-1168.369	25.46081	-1019.9517
gam_model2	29.39518	-1178.341	29.39518	-1006.9897
gam_model3	33.30513	-1197.923	33.30513	-1003.7792
gam_model4	26.70569	-1108.873	26.70569	-953.1992
gam_model5	35.27526	-1220.886	35.27526	-1015.2585

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(lag_28_avg) + s(Rkm) + te(lag_28_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.28291	0.01214	23.308	< 2e-16	***
factor(Month)2	0.03529	0.01744	2.023	0.043158	*
factor(Month)3	-0.03815	0.01704	-2.239	0.025254	*
factor(Month)4	-0.04458	0.01700	-2.623	0.008777	**
factor(Month)5	-0.05829	0.01523	-3.826	0.000133	***
factor(Month)6	-0.05174	0.01707	-3.030	0.002467	**
factor(Month)7	-0.12503	0.02259	-5.535	3.43e-08	***
factor(Month)8	-0.09343	0.03476	-2.688	0.007239	**
factor(Month)9	-0.22778	0.04967	-4.586	4.74e-06	***

```

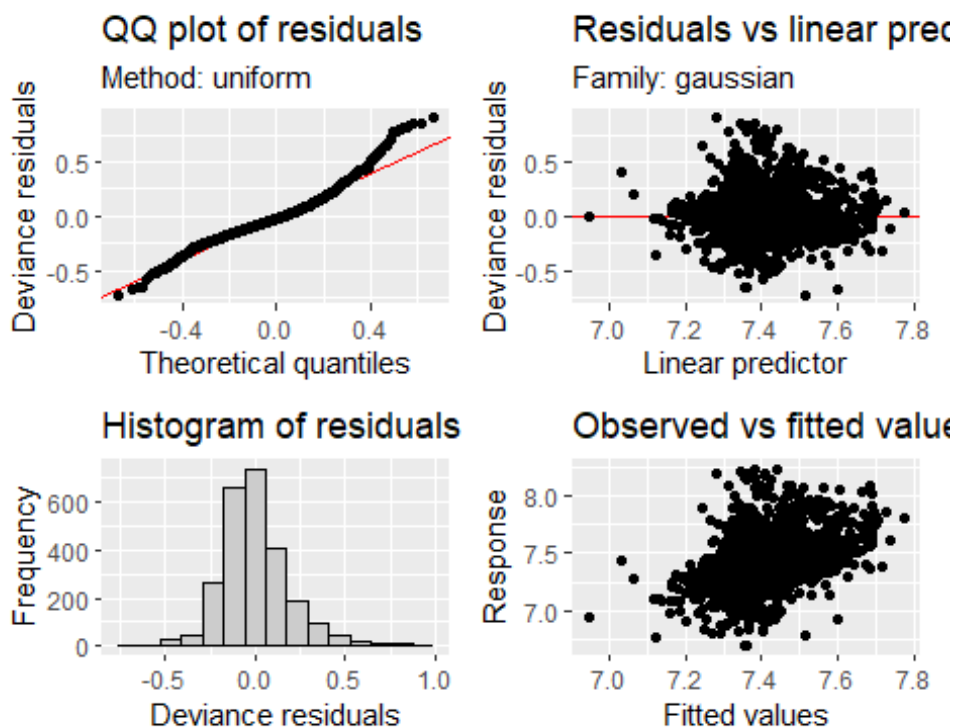
factor(Month)10 -0.10368    0.02252  -4.604 4.36e-06 ***
factor(Month)11 -0.06692    0.01923  -3.480 0.000509 ***
factor(Month)12 -0.01377    0.01756  -0.784 0.433106
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df      F  p-value
s(lag_28_avg)  8.614  8.940    3.68 0.000275 ***
s(Rkm)         7.677  8.542 4527.16 < 2e-16 ***
te(lag_28_avg):Rkm 4.972  4.972 46484.88 < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

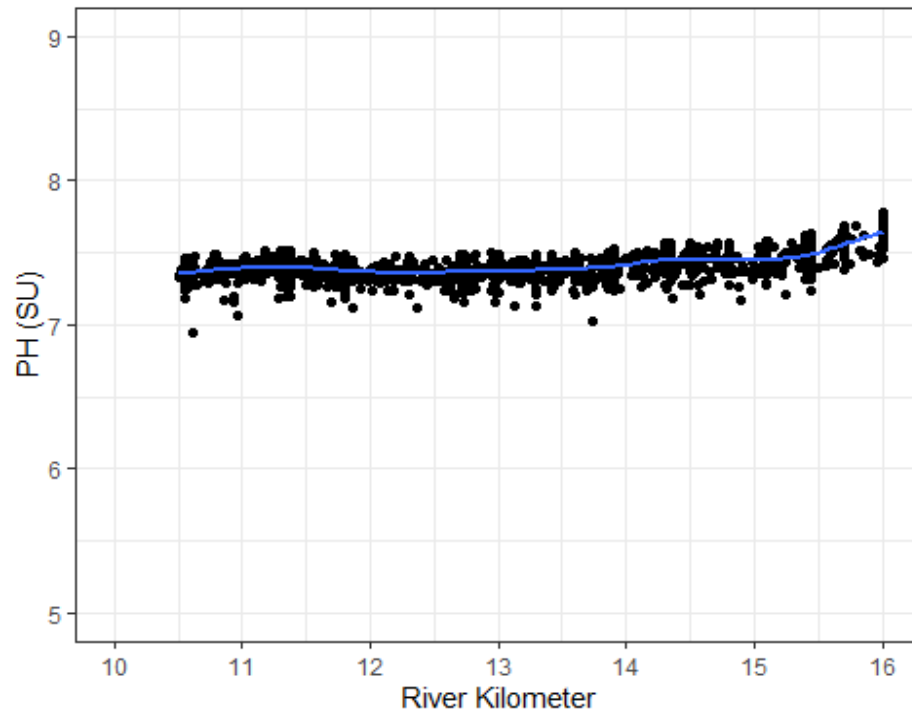
Rank: 34/35
R-sq.(adj) = 0.168  Deviance explained = 17.8%
GCV = 0.036327  Scale est. = 0.03586  n = 2513

```

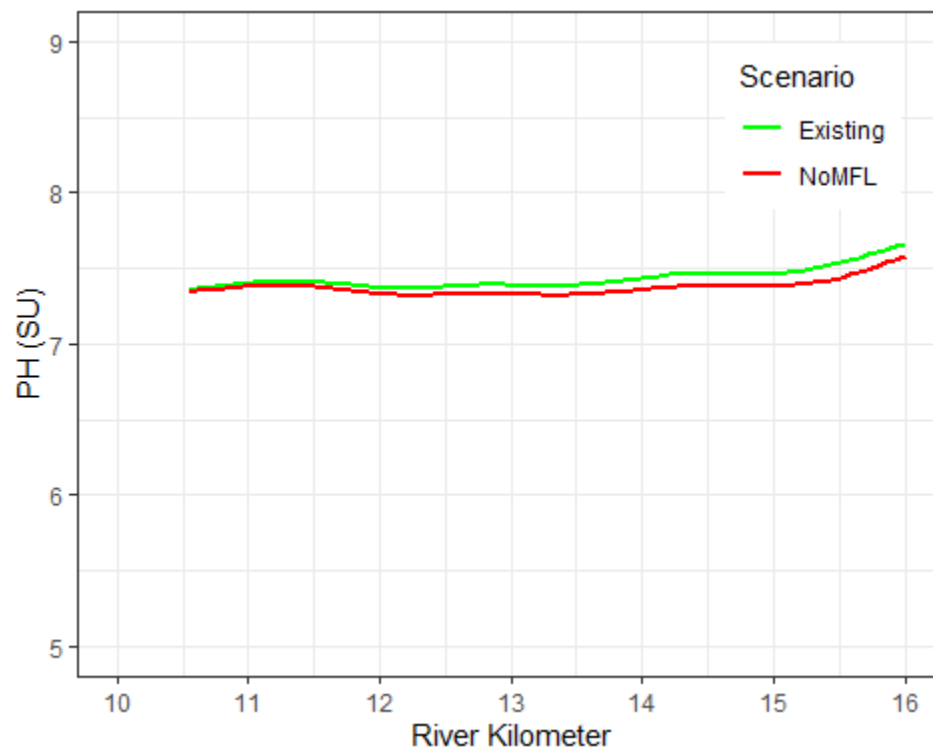
Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario



Bottom PH

Univariate GAMs with lag average flow designated by number after the “g” (e.g. “g3” is the 3 day lag average flow)

	df	AIC	df	BIC
g0	10.302783	-349.0321	10.302783	-289.0861
g3	10.249110	-350.4865	10.249110	-290.8528
g5	10.085061	-353.1513	10.085061	-294.4721
g7	9.677794	-364.8830	9.677794	-308.5734
g14	9.107318	-364.9976	9.107318	-312.0073
g21	6.973477	-383.6362	6.973477	-343.0615
g28	8.464032	-403.7352	8.464032	-354.4878

AIC and BIC for 5 GAM model options

	df	AIC	df	BIC
gam_model1	26.31951	-1046.1501	26.31951	-893.0118
gam_model2	29.43234	-1052.8490	29.43234	-881.5990
gam_model3	34.06766	-1078.5433	34.06766	-880.3230
gam_model4	26.90026	-835.5136	26.90026	-678.9963
gam_model5	39.82336	-1122.9934	39.82336	-891.2840

Summary model results for GAM Model3

Family: gaussian

Link function: identity

Formula:

Result ~ s(lag_28_avg) + s(Rkm) + te(lag_28_avg, by = Rkm) +
factor(Month)

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.264525	0.011542	22.919	< 2e-16	***
factor(Month)2	0.029788	0.017702	1.683	0.09254	.
factor(Month)3	-0.041268	0.017393	-2.373	0.01773	*
factor(Month)4	-0.095765	0.017388	-5.508	4.02e-08	***
factor(Month)5	-0.119824	0.015565	-7.698	1.98e-14	***
factor(Month)6	-0.117145	0.017315	-6.766	1.65e-11	***
factor(Month)7	-0.129442	0.022917	-5.648	1.81e-08	***
factor(Month)8	-0.146862	0.035446	-4.143	3.54e-05	***

```

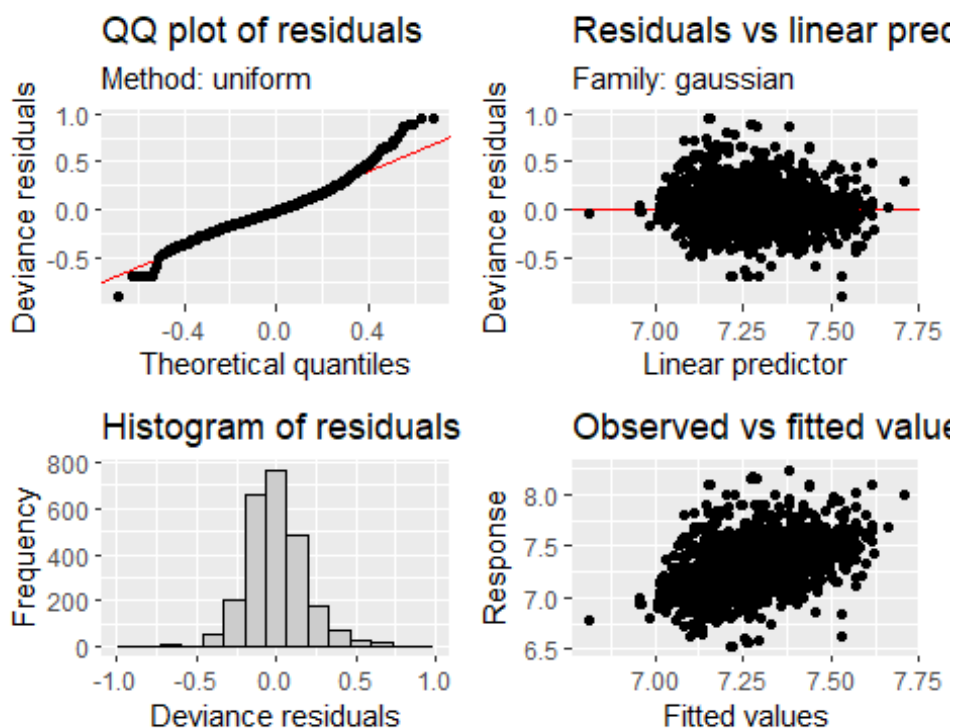
factor(Month)9  -0.149967  0.049971  -3.001  0.00272 **
factor(Month)10 -0.135574  0.022824  -5.940  3.26e-09 ***
factor(Month)11 -0.083049  0.019868  -4.180  3.02e-05 ***
factor(Month)12 -0.004203  0.017863  -0.235  0.81399
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df      F  p-value
s(lag_28_avg)  8.853  8.990    4.289 1.66e-05 ***
s(Rkm)         8.203  8.816  3991.901 < 2e-16 ***
te(lag_28_avg):Rkm 4.970  4.972 37942.296 < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

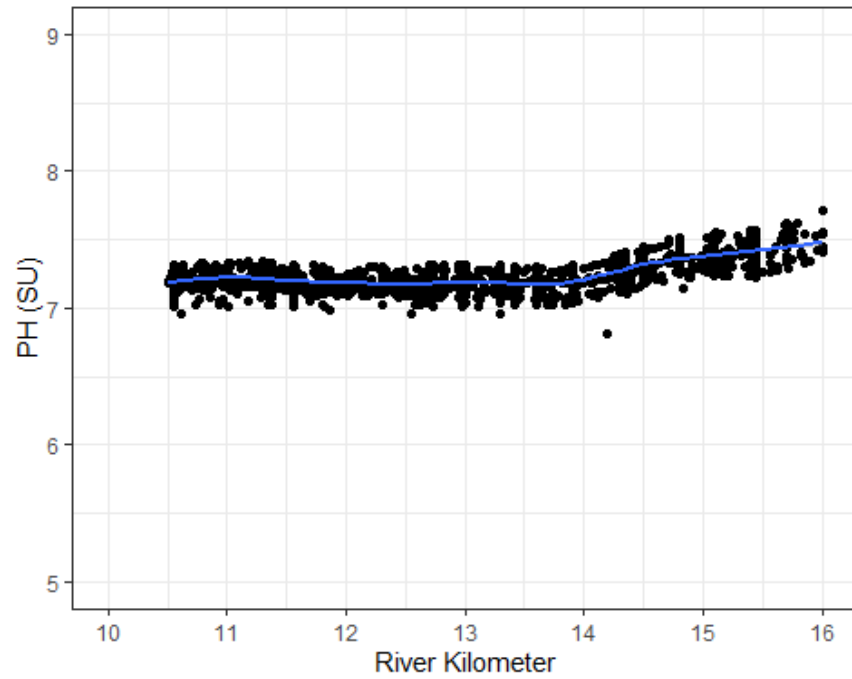
Rank: 34/35
R-sq.(adj) = 0.267  Deviance explained = 27.6%
GCV = 0.037917  Scale est. = 0.037413  n = 2486

```

Model Fit Plot



Smoothed average model prediction as a function of river kilometer



Smoothed average model prediction for the existing an NoMFL scenario

