Impact to Planning Targets and 2017 Progress Due to Phase 6 Updates

Water Quality GIT

June 18, 2018

CBPO Staff

Purpose of Today's WQGIT Call

- **Decision Requested**: Correction to Legume Fixation
- **Decision Requested**: Inclusion of federal BMPs and corrections to stormwater implementation levels in E3 scenarios
- **Information-only (already at PSC level)**: Incorporation of tax ditches – MD and DE analysis
- The PSC is scheduled to make a decision on the final Phase III planning targets during their July 9th meeting. Meeting materials will be distributed this week. Therefore, we need decisions on these issues today.

Changes to Legume Fixation

- Legume fixation is related to 1.5 X Crop Removal.
- In December version, Crop Removal was multiplied by 1.5 twice.
- This fix removes the duplicate multiplication.
- Once removed, the fix also requires a new “baseline” be calculated. This baseline requires small changes to delivery factors and average loads resulting in changes to both delivered nitrogen and phosphorus.

Comparison of 2017 Progress Legume Fixation to Intended Values

Crop	INTENDED AVG Lb N Fixation/ Acre	ACTUAL AVG Lbs N Fixation/ Acre	Ratio of ACTUAL to INTENDED
Alfalfa Hay Harvested Area	233	349	1.5
Soybeans for beans Harvested Area	164	245	1.5
Pasture	23	35	1.5

Other Minor Corrections

- Changes to streambank load is based on changes to upstream loads. A minor correction in the upstream point source file was included
- The approved lat-long changes and fixation changes are included in the calibration run that sets the river-to-bay factors resulting in slight changes.

Impact

- It is easily demonstrated that the model is still calibrated.
- Estimated N runoff from *additional* yields or acres of leguminous crops (majority of which comes from soybeans and hay) is reduced.
- Estimated N runoff from *Reduced* yields or acres of leguminous crops (majority of which comes from soybeans and hay) is increased.
- All jurisdictions are slightly closer to planning targets except DC, which is unchanged

Changes in Loads due to fixation and updated base run

Nitrogen Planning Target			
State	December	Fixation Baseline	Difference
DC	2.43	2.43	0.00
DE	4.59	4.52	-0.07
MD	45.30	45.14	-0.16
NY	11.59	11.61	0.01
PA	73.18	73.31	0.13
VA	55.82	55.77	-0.05
WV	8.24	8.26	0.02
Total	201.14	201.03	-0.12
2017 Progress			
State	December	Fixation Baseline	Difference
DC	1.56	1.56	0.00
DE	6.94	6.85	-0.09
MD	54.85	54.03	-0.82
NY	14.35	14.32	-0.03
PA	108.54	107.31	-1.22
VA	58.65	58.16	-0.50
WV	7.80	7.77	-0.03
Total	252.68	249.99	-2.69

Phosphorus Planning Target			
State	December	Fixation Baseline	Difference
DC	0.130	0.130	0.000
DE	0.120	0.118	-0.002
MD	3.604	3.611	0.007
NY	0.606	0.611	0.006
PA	3.073	3.061	-0.013
VA	6.186	6.216	0.031
WV	0.456	0.438	-0.018
Total	14.173	14.184	0.011
2017 Progress			
State	December	Fixation Baseline	Difference
DC	0.076	0.076	0.000
DE	0.127	0.126	-0.001
MD	3.645	3.625	-0.020
NY	0.638	0.632	-0.005
PA	3.864	3.801	-0.063
VA	6.264	6.226	-0.038
WV	0.455	0.429	-0.025
Total	15.067	14.915	-0.153

E3 Stormwater BMPs (and Federal BMPs)

- Original E3 left out stormwater BMPs on federal lands. Update fixes this.
- Original E3 stormwater implementation levels fell well short of intended implementation levels for some jurisdictions due to an inside/outside watershed mistake. Update fixes this.
  - Close in MD and DC
  - Way off in NY and DE
  - Somewhat off in all other states

Impact

- All areas have reduced E3 loads
- Areas where original E3 implementation fell short of intended have more change in E3 loads
- E3 intent was 80% implementation

Percent Implementation of Stormwater Practices in Original E3

State	Percent of Implementation
DC	76.4
DE	18.5
MD	78.1
NY	30.6
PA	58.1
VA	70.8
WV	67.9

Changes in Loads due to Stormwater and Federal BMPs

Nitrogen Planning Target			
State	Fixation Baseline	SW/Fed	Difference
DC	2.43	2.42	0.00
DE	4.52	4.51	-0.01
MD	45.14	45.79	0.65
NY	11.61	11.33	-0.28
PA	73.31	73.20	-0.11
VA	55.77	55.75	-0.01
WV	8.26	8.14	-0.12
Total	201.03	201.15	0.12
2017 Progress			
State	Fixation Baseline	SW/Fed	Difference
DC	1.56	1.56	0.00
DE	6.85	6.85	0.00
MD	54.03	54.03	0.00
NY	14.32	14.32	0.00
PA	107.31	107.31	0.00
VA	58.16	58.16	0.00
WV	7.77	7.77	0.00
Total	249.99	249.99	0.00

Phosphorus Planning Target			
State	Fixation Baseline	SW/Fed	Difference
DC	0.130	0.130	0.000
DE	0.118	0.109	-0.008
MD	3.611	3.679	0.069
NY	0.611	0.588	-0.023
PA	3.061	3.046	-0.015
VA	6.216	6.191	-0.025
WV	0.438	0.429	-0.009
Total	14.184	14.173	-0.011
2017 Progress			
State	Fixation Baseline	SW/Fed	Difference
DC	0.076	0.076	0.000
DE	0.126	0.126	0.000
MD	3.625	3.625	0.000
NY	0.632	0.632	0.000
PA	3.801	3.801	0.000
VA	6.226	6.226	0.000
WV	0.429	0.429	0.000
Total	14.915	14.915	0.000

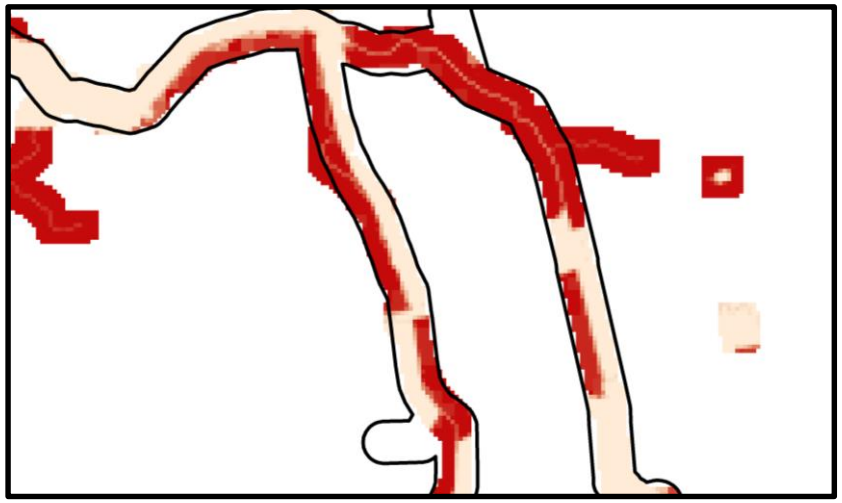
Tax Ditches in E3

- June 1 co-regulators meeting decision:
  - DE and MD may change buffers around tax ditches in the E3 scenario.
- Specifically, they requested:
  - All forest buffers within 30 meters of any CBPO mapped streams that are also mapped as tax ditches by the two states be removed.
  - All crop area within 10 feet of a tax ditch should be submitted as grass buffers.

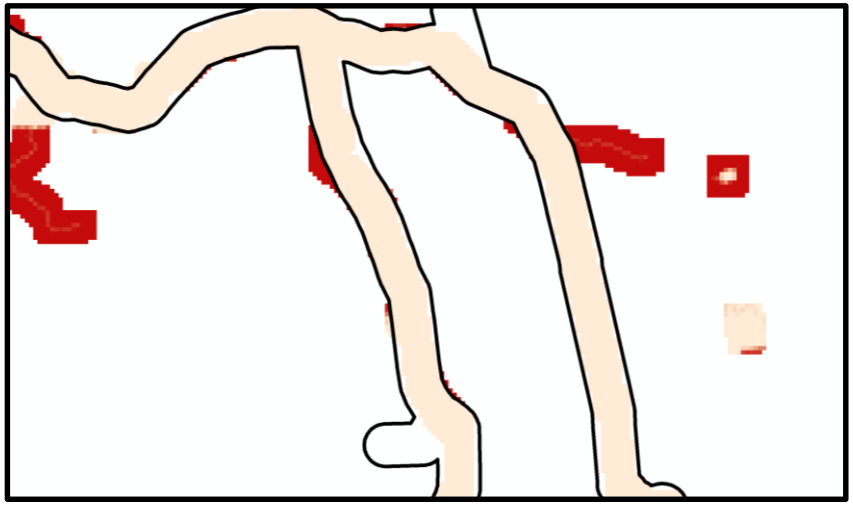
Tax Ditch Bufferable Area Method

Crop within 30M

Outline of Ditch Buffer (30M)



New Crop within 30M



0% Probability of Crop

100% Probability of Crop

Impact

- This is an E3 scenario correction
- DE and MD have higher E3 nitrogen loads leading to higher (less stringent) planning targets
- Other states make up the difference

Changes in Loads due to Incorporation of Tax Ditches

Nitrogen Planning Target			
State	SW/Fed	Ditches	Difference
DC	2.42	2.42	0.00
DE	4.51	4.61	0.09
MD	45.79	45.82	0.03
NY	11.33	11.32	-0.01
PA	73.20	73.14	-0.06
VA	55.75	55.73	-0.02
WV	8.14	8.14	0.00
Total	201.15	201.18	0.04
2017 Progress			
State	SW/Fed	Ditches	Difference
DC	1.56	1.56	0.00
DE	6.85	6.85	0.00
MD	54.03	54.03	0.00
NY	14.32	14.32	0.00
PA	107.31	107.31	0.00
VA	58.16	58.16	0.00
WV	7.77	7.77	0.00
Total	249.99	249.99	0.00

Phosphorus Planning Target			
State	SW/Fed	Ditches	Difference
DC	0.130	0.130	0.000
DE	0.109	0.110	0.001
MD	3.679	3.680	0.001
NY	0.588	0.588	0.000
PA	3.046	3.045	-0.001
VA	6.191	6.190	-0.001
WV	0.429	0.429	0.000
Total	14.173	14.172	-0.001
2017 Progress			
State	SW/Fed	Ditches	Difference
DC	0.076	0.076	0.000
DE	0.126	0.126	0.000
MD	3.625	3.625	0.000
NY	0.632	0.632	0.000
PA	3.801	3.801	0.000
VA	6.226	6.226	0.000
WV	0.429	0.429	0.000
Total	14.915	14.915	0.000

Nitrogen Summary

Nitrogen Planning Target						
State	December	Fixation Baseline	SW/Fed	Ditches	Difference	Additional Reduction
DC	2.43	2.43	2.42	2.42	0.00	0.00
DE	4.59	4.52	4.51	4.61	0.02	-0.11
MD	45.30	45.14	45.79	45.82	0.52	-1.34
NY	11.59	11.61	11.33	11.32	-0.27	0.24
PA	73.18	73.31	73.20	73.14	-0.04	-1.19
VA	55.82	55.77	55.75	55.73	-0.09	-0.41
WV	8.24	8.26	8.14	8.14	-0.10	0.07
Total	201.14	201.03	201.15	201.18	0.04	-2.73
2017 Progress						
State	December	Fixation Baseline	SW/Fed	Ditches	Difference	
DC	1.56	1.56	1.56	1.56	0.00	
DE	6.94	6.85	6.85	6.85	-0.09	
MD	54.85	54.03	54.03	54.03	-0.82	
NY	14.35	14.32	14.32	14.32	-0.03	
PA	108.54	107.31	107.31	107.31	-1.22	
VA	58.65	58.16	58.16	58.16	-0.50	
WV	7.80	7.77	7.77	7.77	-0.03	
Total	252.68	249.99	249.99	249.99	-2.69	

Additional reduction equals change in level of effort from 2017 to new draft planning target. Negative = less level of effort; positive = more

Phosphorus Summary

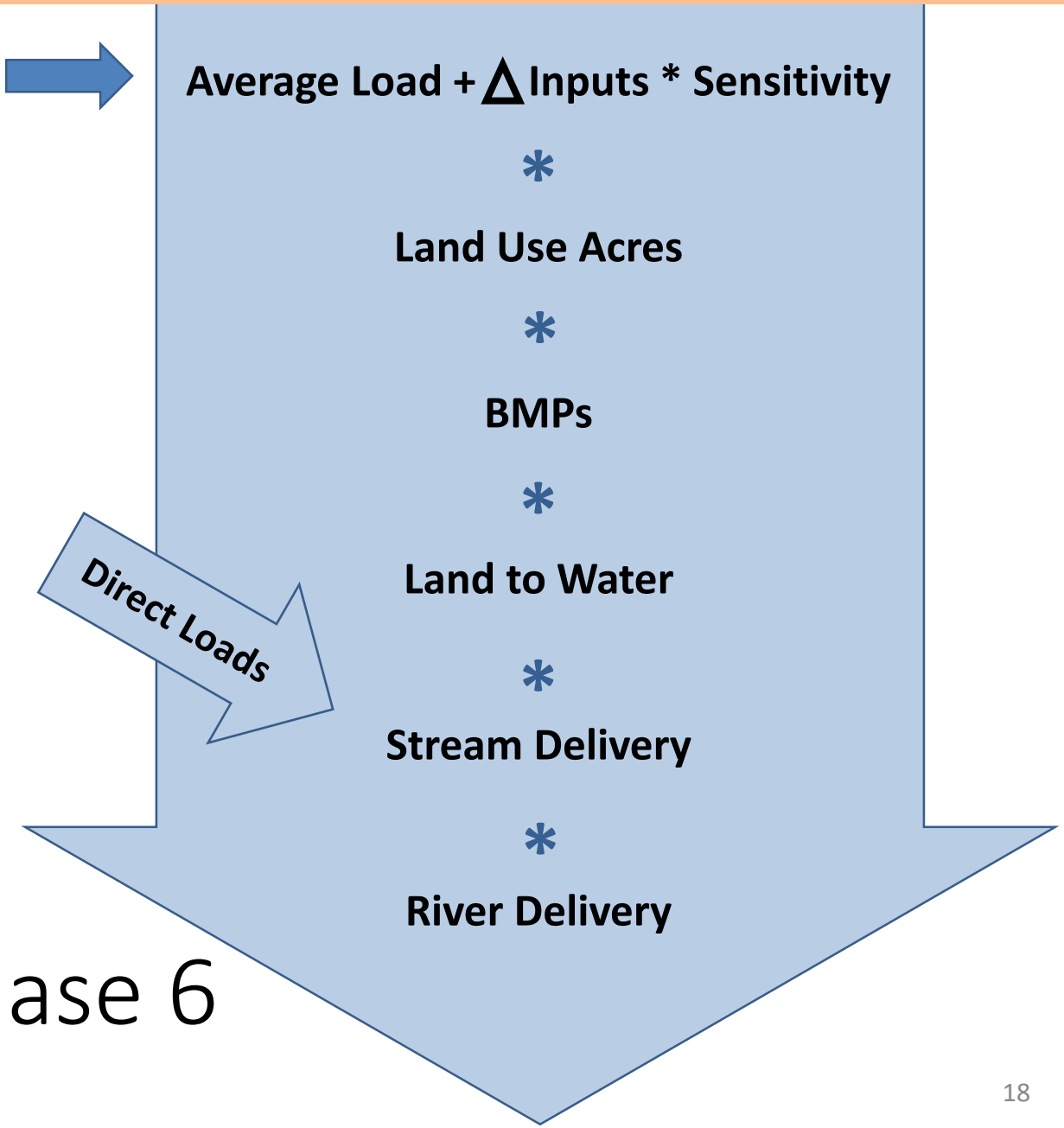
Phosphorus Planning Target						
State	December	Fixation Baseline	SW/Fed	Ditches	Difference	Additional Reduction
DC	0.130	0.130	0.130	0.130	0.000	0.00
DE	0.120	0.118	0.109	0.110	-0.009	0.01
MD	3.604	3.611	3.679	3.680	0.076	-0.10
NY	0.606	0.611	0.588	0.588	-0.018	0.01
PA	3.073	3.061	3.046	3.045	-0.028	-0.03
VA	6.186	6.216	6.191	6.190	0.004	-0.04
WV	0.456	0.438	0.429	0.429	-0.026	0.00
Total	14.173	14.184	14.173	14.172	-0.001	-0.15
2017 Progress						
State	December	Fixation Baseline	SW/Fed	Ditches	Difference	
DC	0.076	0.076	0.076	0.076	0.000	
DE	0.127	0.126	0.126	0.126	-0.001	
MD	3.645	3.625	3.625	3.625	-0.020	
NY	0.638	0.632	0.632	0.632	-0.005	
PA	3.864	3.801	3.801	3.801	-0.063	
VA	6.264	6.226	6.226	6.226	-0.038	
WV	0.455	0.429	0.429	0.429	-0.025	
Total	15.067	14.915	14.915	14.915	-0.153	

Additional reduction equals change in level of effort from 2017 to new draft planning target. Negative = less level of effort; positive = more

Detailed Explanations of the legume fixation issue

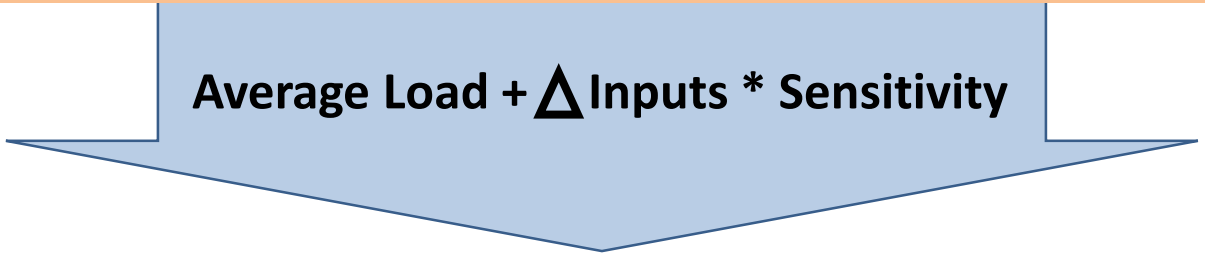
Phase 6 Model Structure

Change in fixation affects the top line



Phase 6

Phase 6 Model Structure



Average Loads are determined by monitoring data, multiple model averaging, and literature reviews

The local **deviation** from the average load is determined by the local **deviation** in inputs

Phase 6 Model Structure

Average Load + ΔInputs * Sensitivity

Simple Example:

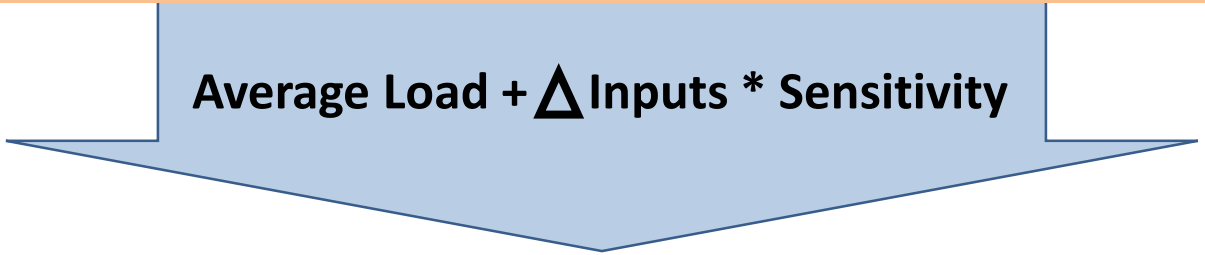
Soy was about 200 lbs/acre/year every where

Segment	Old Fixation	Input Deviation	Load Deviation	New Fixation	Input Deviation	Load Deviation	Difference
A	210	10	1.4	140	7	1.0	0.5
B	200	0	0.0	133	0	0.0	0.0
C	190	-10	-1.4	127	-7	-1.0	-0.5
Average	200			200			

No change in overall load

Deviations from the mean are made smaller

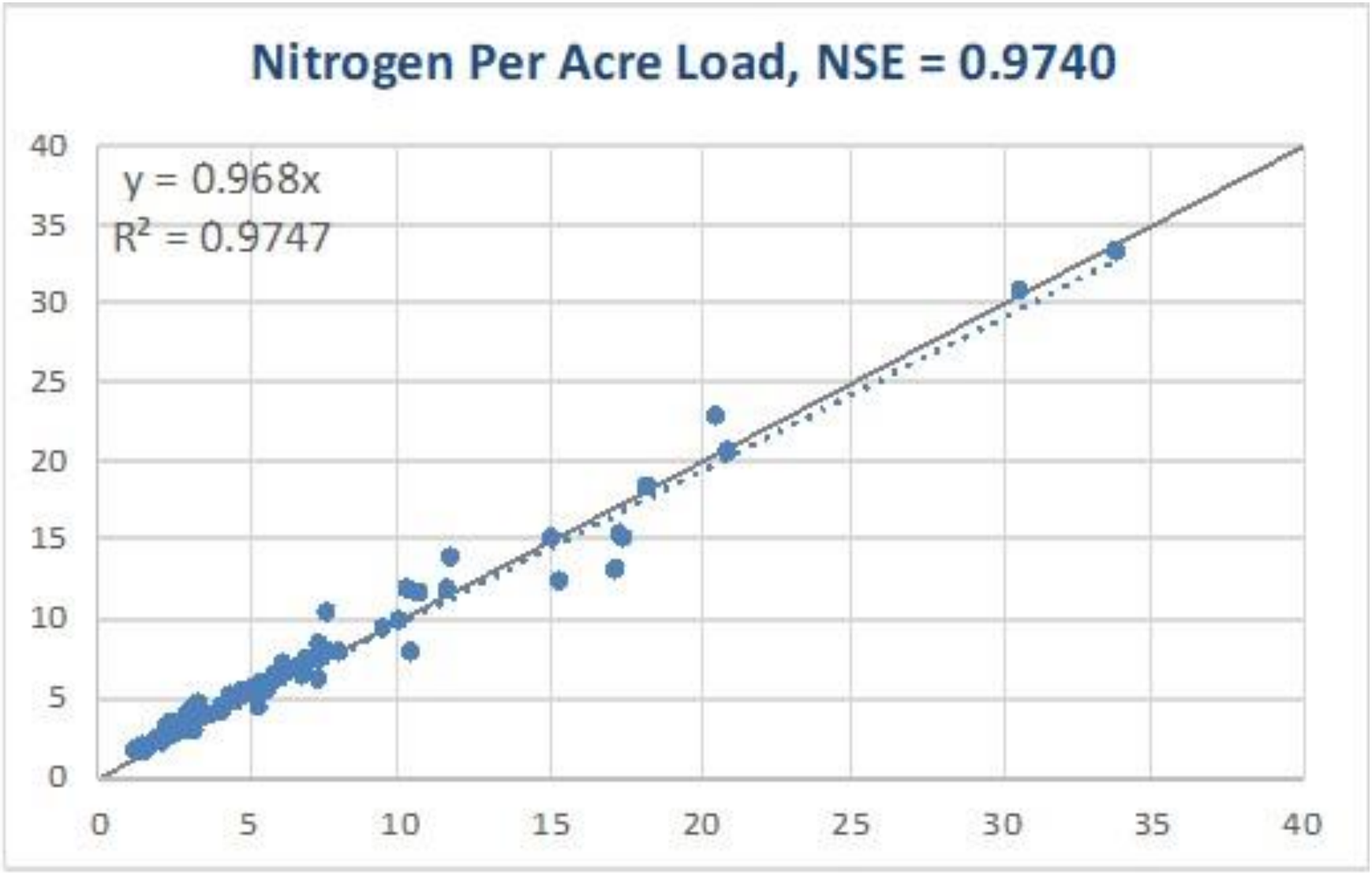
Phase 6 Model Structure



Small differences in each land river segment in each scenario

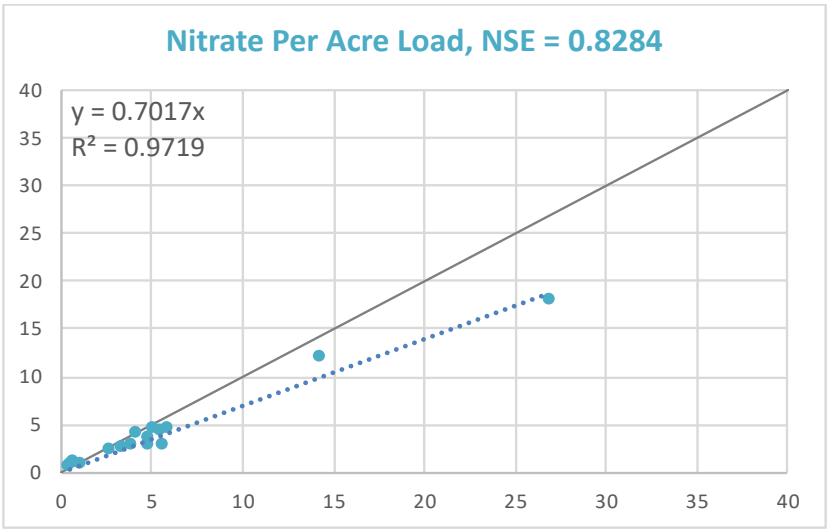
Calibration is affected, so need to make sure model is still calibrated.

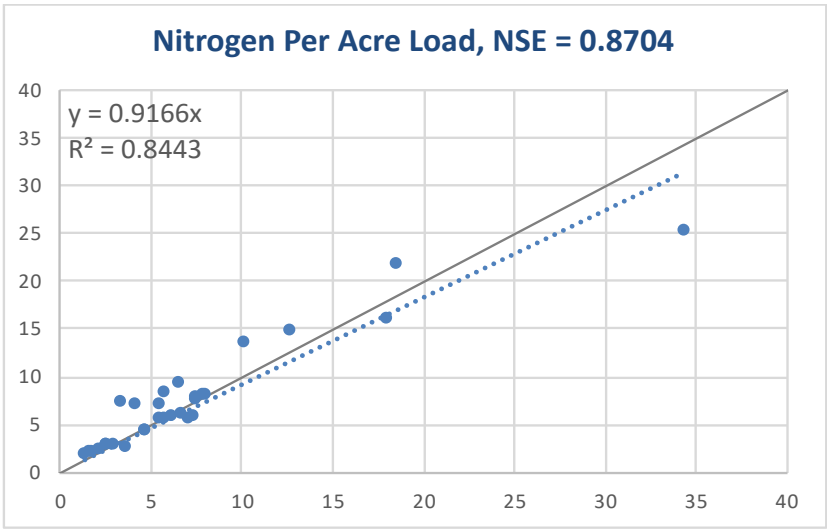
Phase 6 – geographic efficiencies
How well do we predict differences in load per acre?

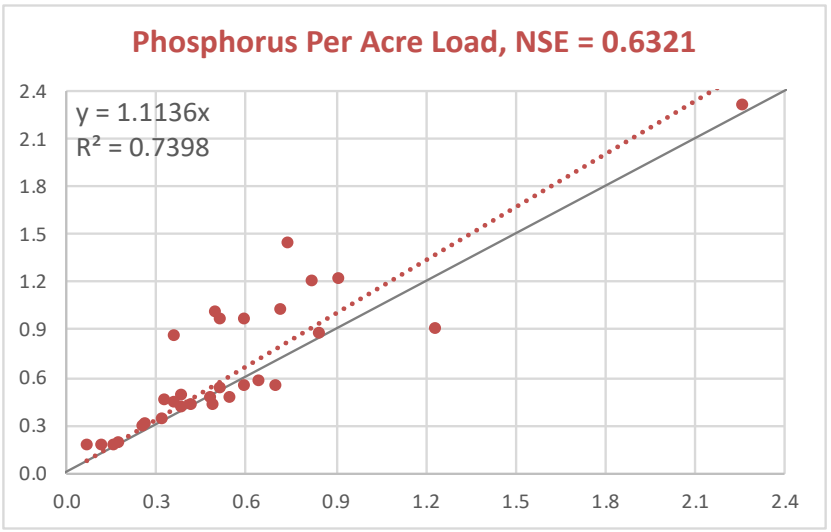


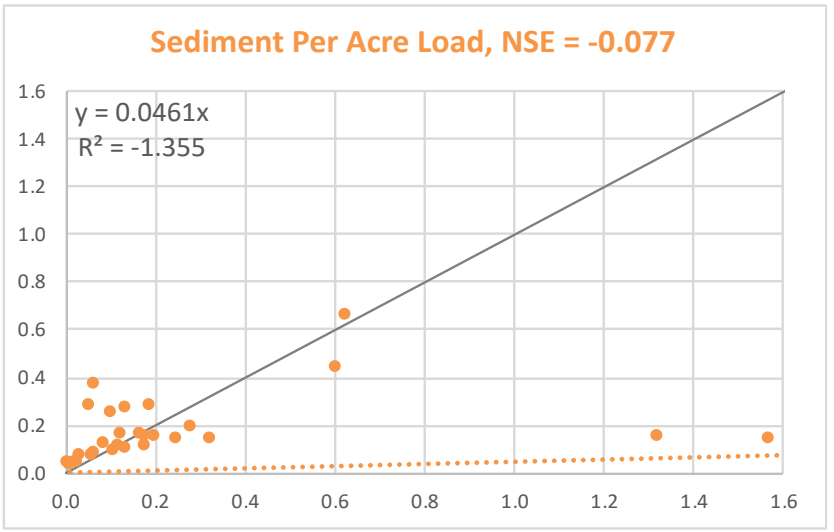
Higher NSE indicates better model performance.

Phase 5 – geographic efficiencies





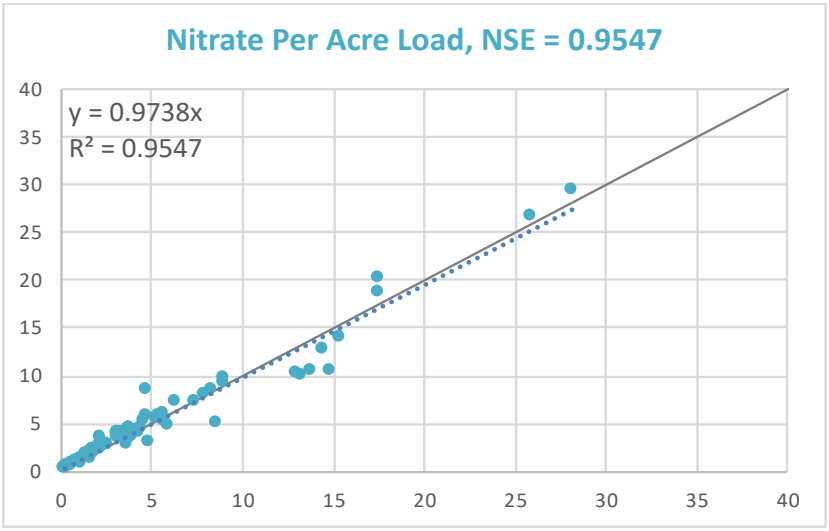


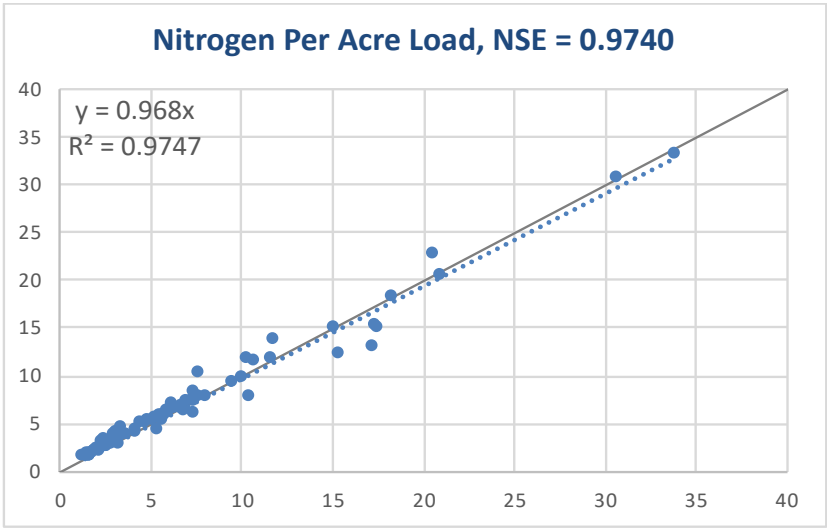


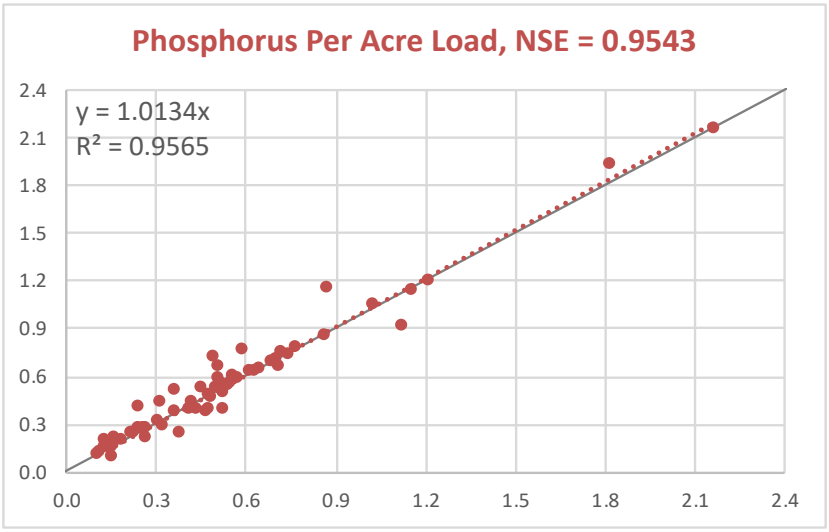
Simulated Per Acre Load

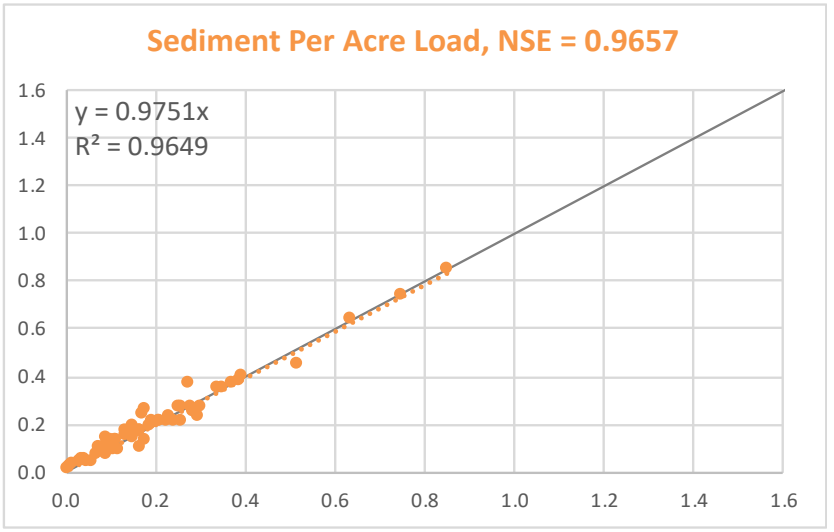
WRTDS Per Acre Load

Phase 6 – geographic efficiencies – December 2017





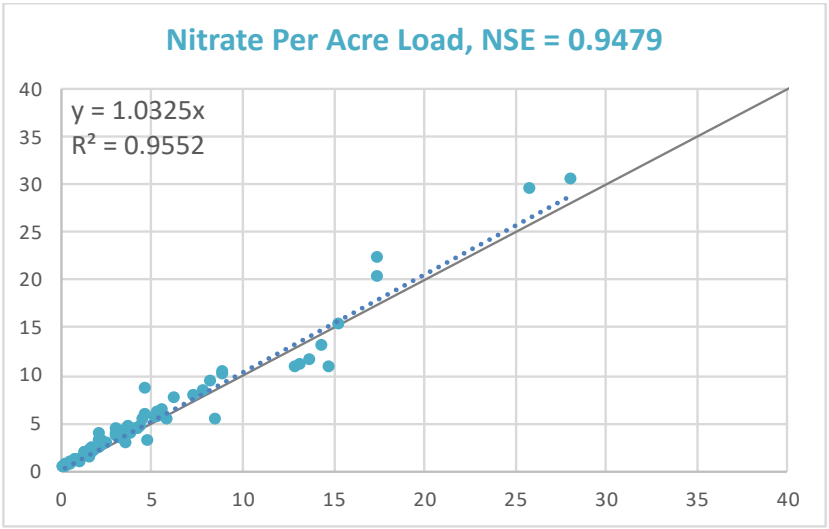


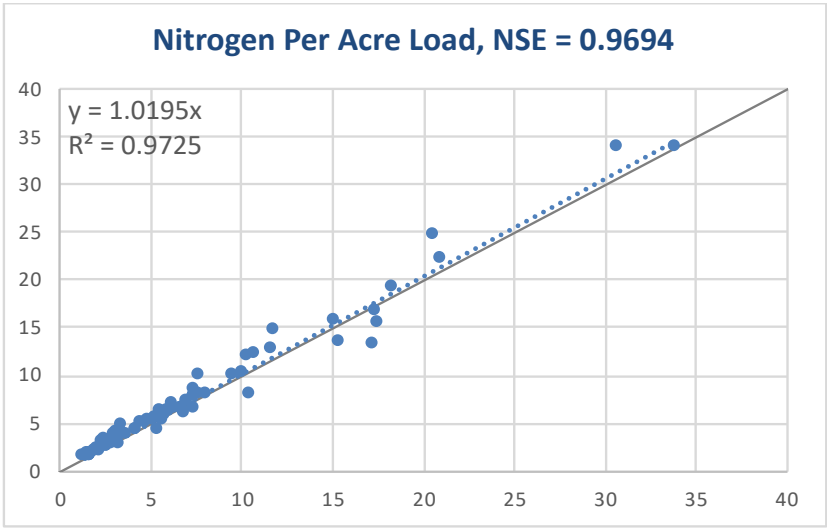


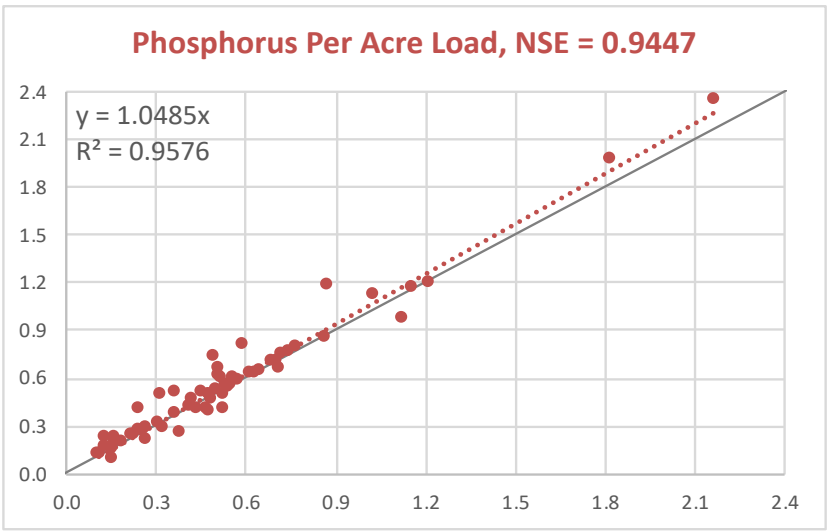
Simulated Per Acre Load

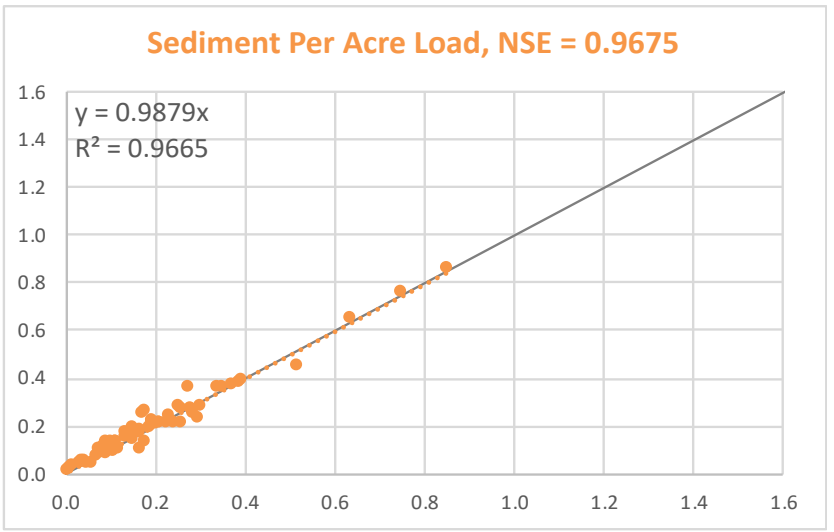
WRTDS Per Acre Load

May 2018 – Lat-Long fix





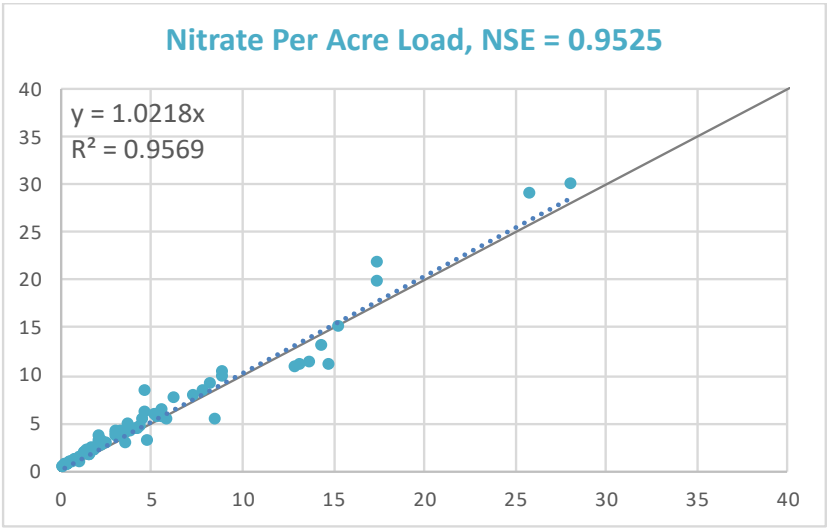


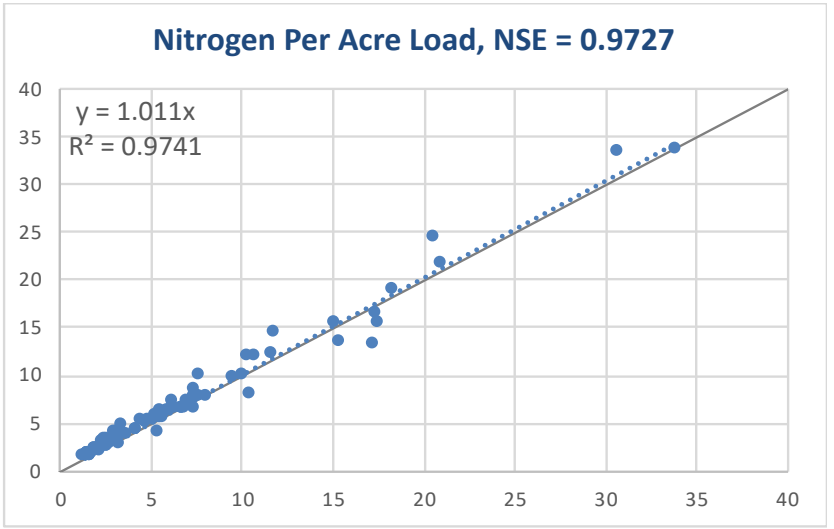


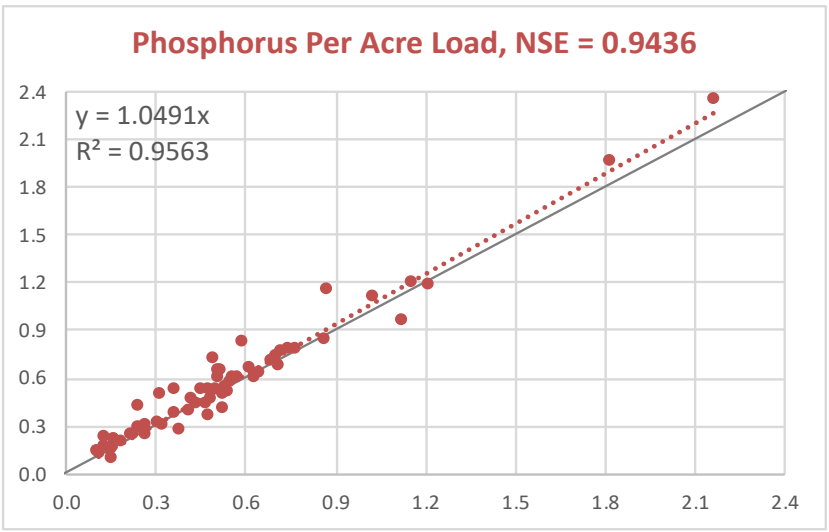
Simulated Per Acre Load

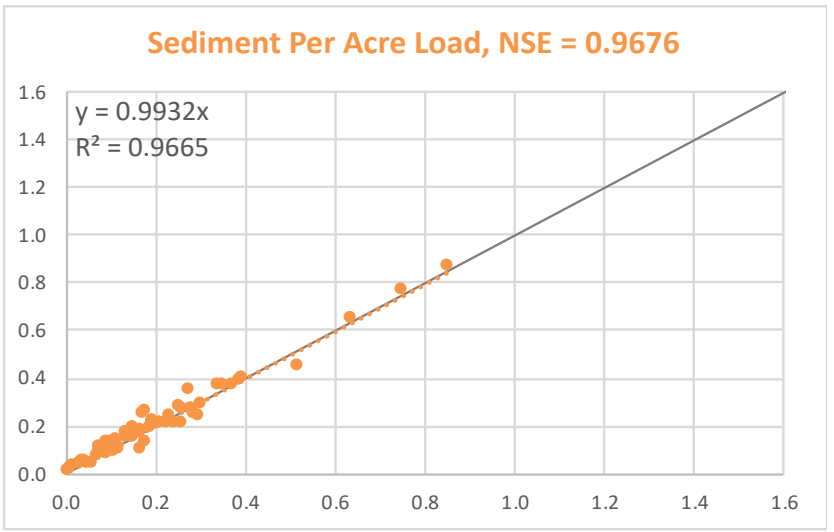
WRTDS Per Acre Load

June 2018 Fixation change



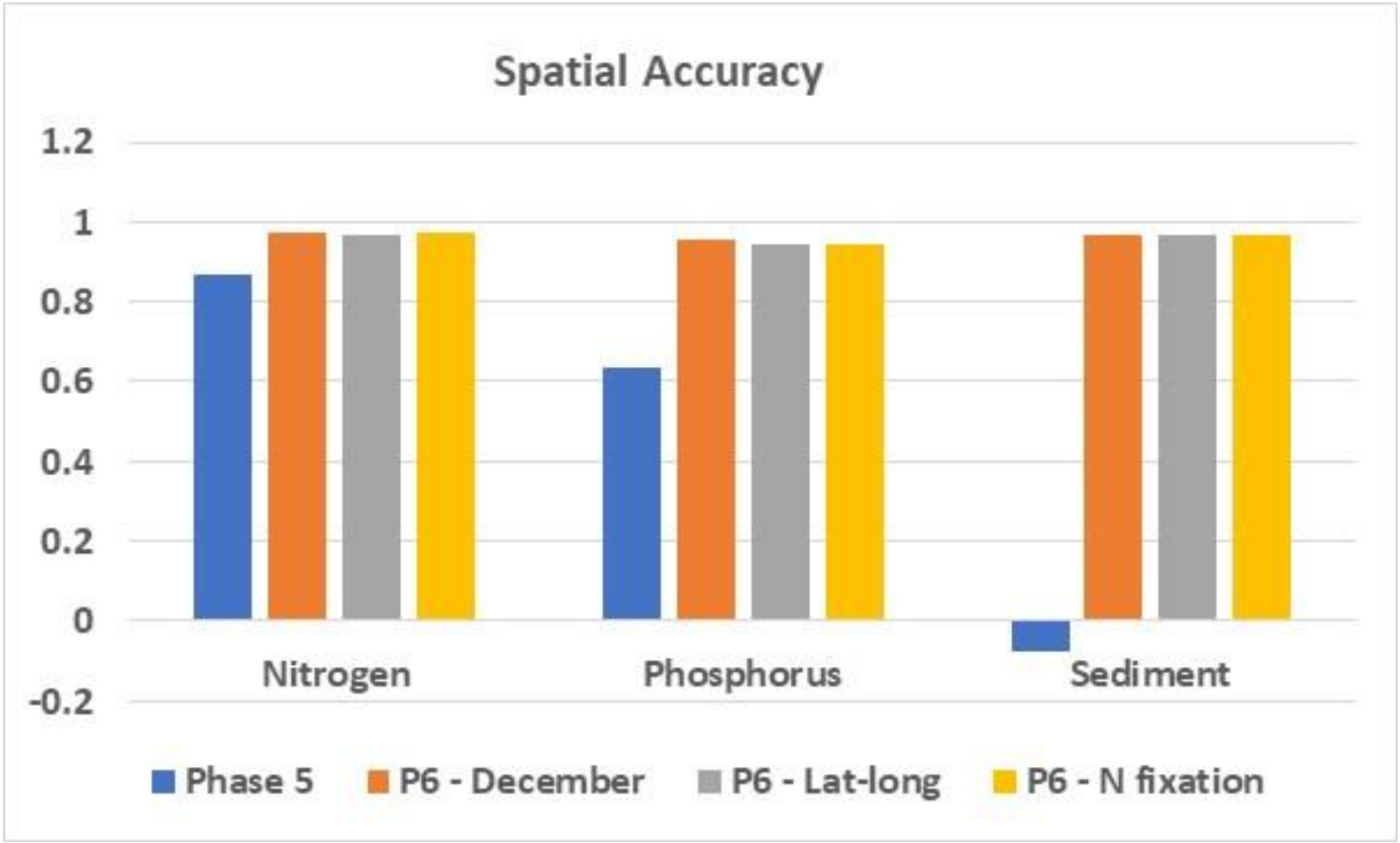






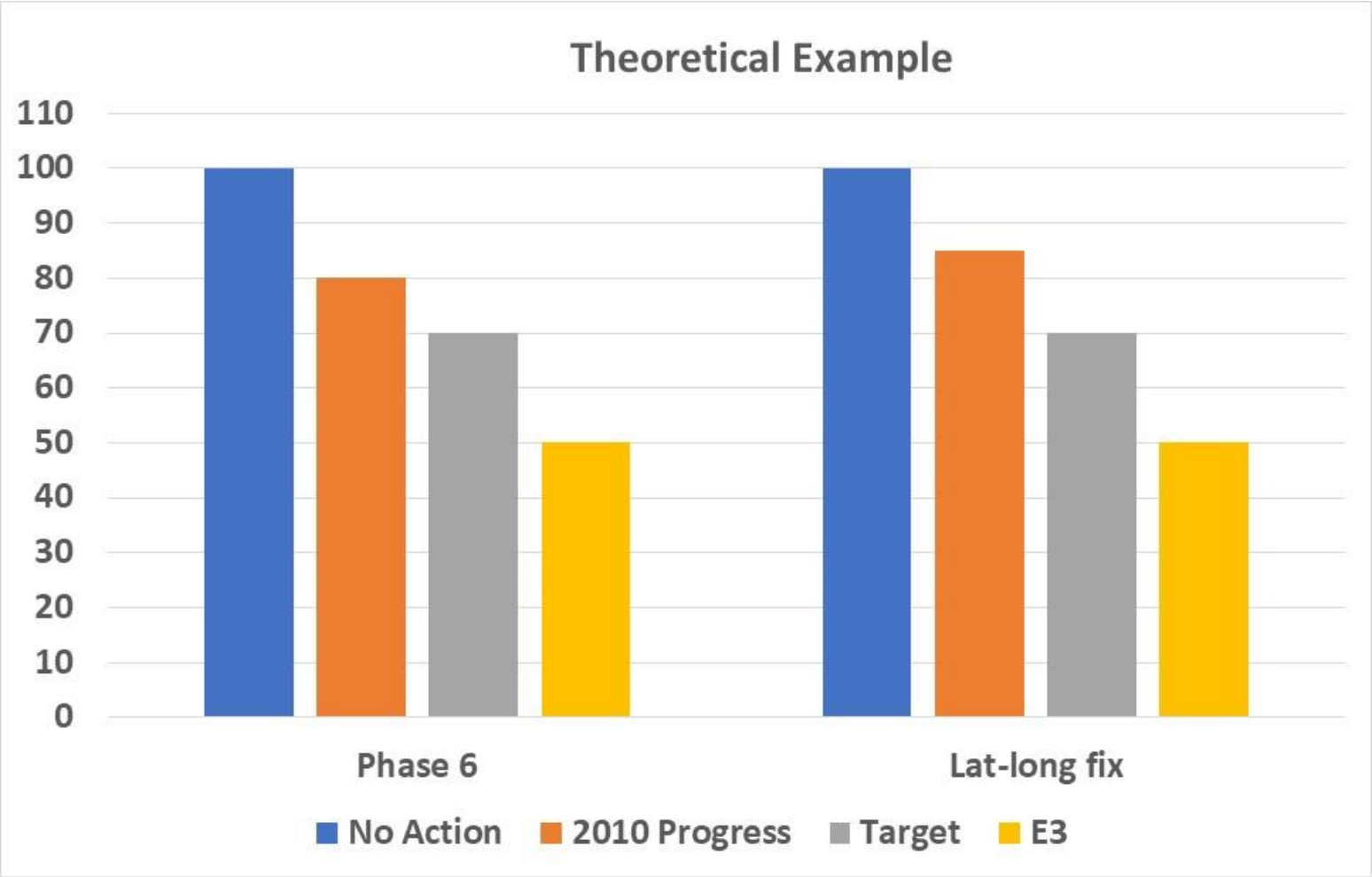
Simulated Per Acre Load

WRTDS Per Acre Load



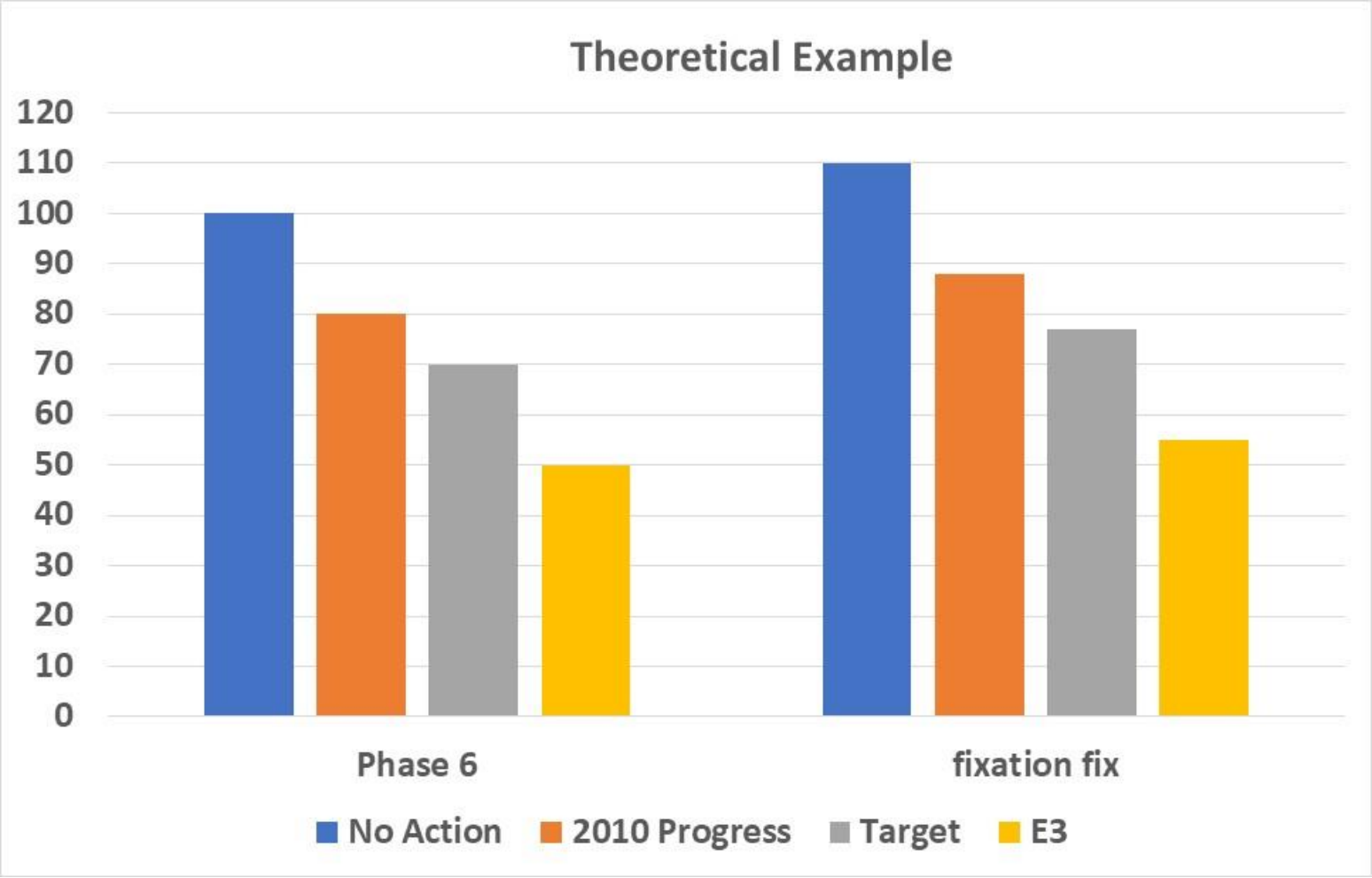
The Spatial Accuracy of the P6 watershed model is still very good
No recalibration is required

The Fixation Issue is Different from the Lat-Long Issue



The lat-long issue did not change No Action, E3, or the Target.
It did change the progress run if reported in lat-long

The Fixation Issue is Different from the Lat-Long Issue



The Fixation issue changes all scenarios in roughly the same way.
It would need to be applied to the planning targets as well as the progress runs