P Loss in Ag and Natural
Section 4.5.1

L2W & S2R
Section 4.7.5

BMP effectiveness
Section 4.6

Loads from Flooding
Section 5.1.5

Climate Change Topics

Gary Shenk – CBPO

10/8/19

Presentation to Modeling Workgroup

Phosphorus Loss Sensitivity to Climate Change in Agricultural and Natural Land

- No new analysis
- Using sensitivities that are already part of the phase 6 model
- Natural land and pasture land have increasing loads due to increased stormwater runoff and increased sediment washoff
- Soil P loss is accelerated under conditions of increased stormwater runoff and increased sediment washoff, leading to a decreased sensitivity to these factors.

P Loss in Ag and Natural
Section 4.5.1

Sensitivities already part of the Phase 6 Model

Land use Category	Flow Sensitivity Range	Sediment Sensitivity Range
Natural	0.007, 0.019, 0.042	0.012, 0.031, 0.067
Pasture	0.080	0.126
Cropland	0.041	0.121

- Flow sensitivity is pounds P per inch of stormwater
- Sediment sensitivity is pounds P per ton of sediment

Sensitivity of soil P to flow and sediment

APLE emulator model

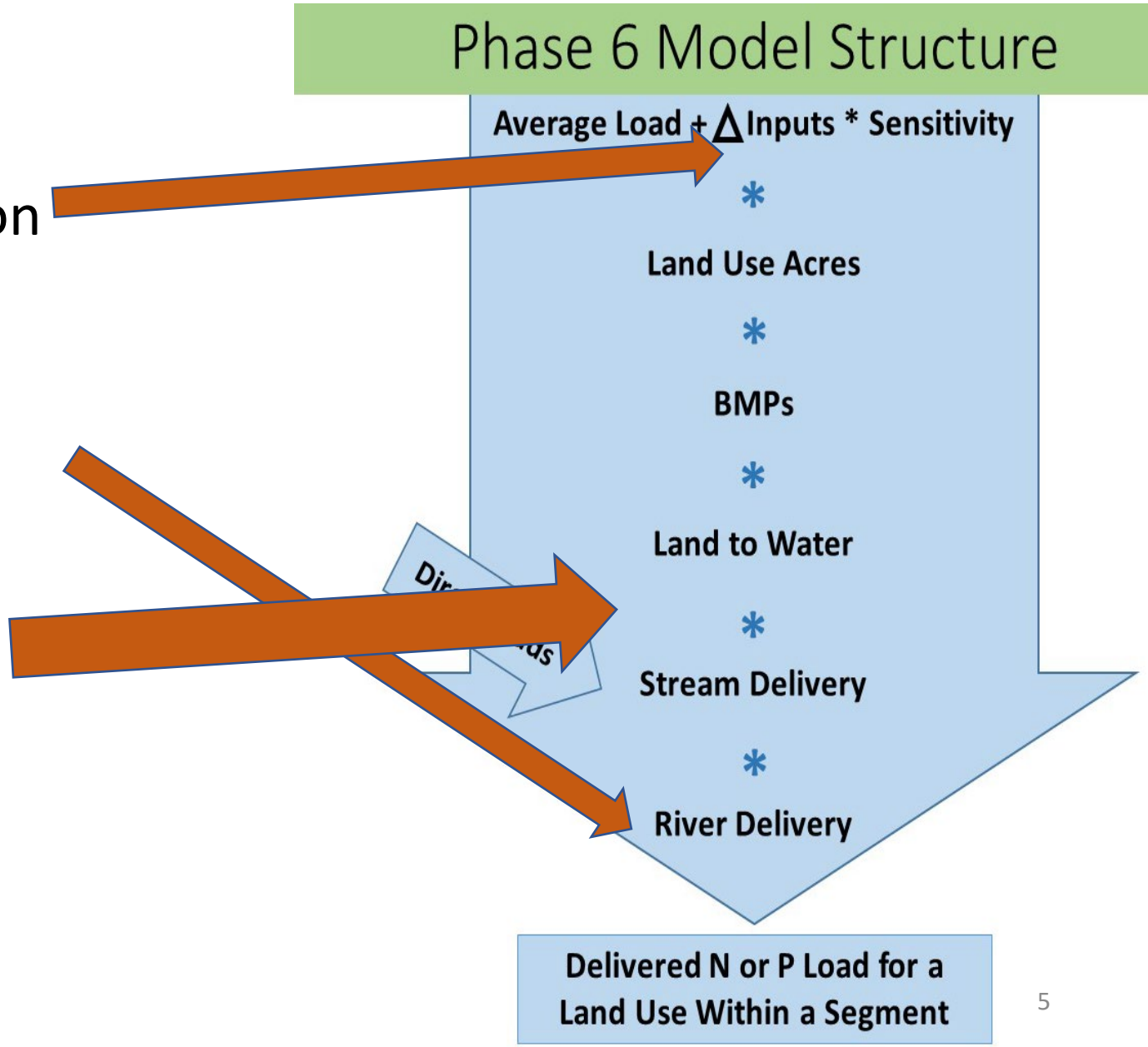
$$M_{i+1} = M_i + \left(\sum_{n=1}^{Nfactors} (Factor * Coefficient) \right) * (1 - 0.95 * \log_{75} i)$$

- Predicts change in soil P for a given management scenario
- Runs 25 iterations
- Reduces soil sensitivity by 20%
- Reduces runoff sensitivity by 12%

Factor	unit	Coefficient
Solid Manure	pound/acre/year TP	0.151
Liquid Manure	pound/acre/year TP	0.154
Fertilizer	pound/acre/year TP	0.0559
Biosolids	pound/acre/year TP	0.00463
Uptake	pound/acre/year TP	-0.159
Sediment Loss	ton/acre/year	-0.208
Stormflow	inches/year	-0.0355
Percent Incorporation	percent	0.0479
Percent Mixing	percent	-0.0508
Depth of Incorporation	inches	0.183
Precipitation	inches/year	-0.00152
Clay percent	percent	Clay > 15: 0.160 Else: 0.000
Organic Matter	percent	Clay >15: -0.549 Else: 0.000
Local Adjustment	ppm Mechlich 3	Varies

Delivery Effects

- Most of the work has been on inputs and sensitivities
- Rivers are directly simulated
- How to consider effects on delivery?



Delivery Effects - Nitrogen

Land use category	Land to water	Stream delivery	River delivery
Agricultural	Captured in literature review and analysis		Simulated in HSPF
Developed	Captured in literature review and analysis		Simulated in HSPF
Natural	Captured in literature review and analysis		Simulated in HSPF

- Section 4.4 deals with a literature review and an analysis of in-stream data.
- Nitrogen analysis performed at the watershed scale, so it incorporates the land to water and stream delivery effects
- Additional temperature and stream velocity considerations are modeled in the HSPF river simulation

L2W & S2R
Section 4.7.5

Delivery Effects – Phosphorus

Land use category	Land to water	Stream delivery	River delivery
Agricultural	Already represented in sensitivities	Not adjusted for climate	Simulated in HSPF
Developed	Added based on literature and analysis	Not adjusted for climate	Simulated in HSPF
Natural	Already represented in sensitivities	Not adjusted for climate	Simulated in HSPF

- Spatial variability of phosphorus delivery is based on stormwater runoff, sediment washoff, and soil P levels. These three factors are already considered in the climate change modeling
- Additional temperature and stream velocity considerations are modeled in the HSPF river simulation
- Stream delivery is not changed due to lack of information

L2W & S2R
Section 4.7.5

Delivery Effects

Land use category	Land to water	Stream delivery	River delivery
Agricultural	Captured in literature review and analysis		Simulated in HSPF
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Land use category	Land to water	Stream delivery	River delivery
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BMP performance

- Some literature evidence of modeled decreasing BMP performance under climate change
- Discussed at the Principals' Staff Committee and Management Board
  - Begun prototype program on BMP responsiveness to climate change
- WQGIT, CRWG are aware of the issues
- *The CBP partnership has determined that there is not sufficient information available to model the effect of climate change at this time*.

Loads from tidal flooding

Loads from tidal flooding

- Brought to our attention by recent news reports based on research by Margie Mulholland

- Insufficient data
- Added to the documentation so that it could be considered next time

Loads from Flooding Section 5.1.5

BMP effectiveness Section 4.6

L2W & S2R Section 4.7.5

P Loss in Ag and Natural Section 4.5.1

Request approval of documentation

- Section 4.5.1
  - Use existing simulation for P loss in agricultural and natural settings
- Section 4.7.5
  - Climate effect on land to water, stream to river, and river to bay factors adequately modeled except stream to river phosphorus, which is ignored
- Section 4.6
  - BMP effectiveness will likely decrease with climate change, but not enough evidence to for values to use in modeling
- Section 5.1.5
  - Acknowledge tidal flooding as a possible source