Phase 7 Watershed Model Plans

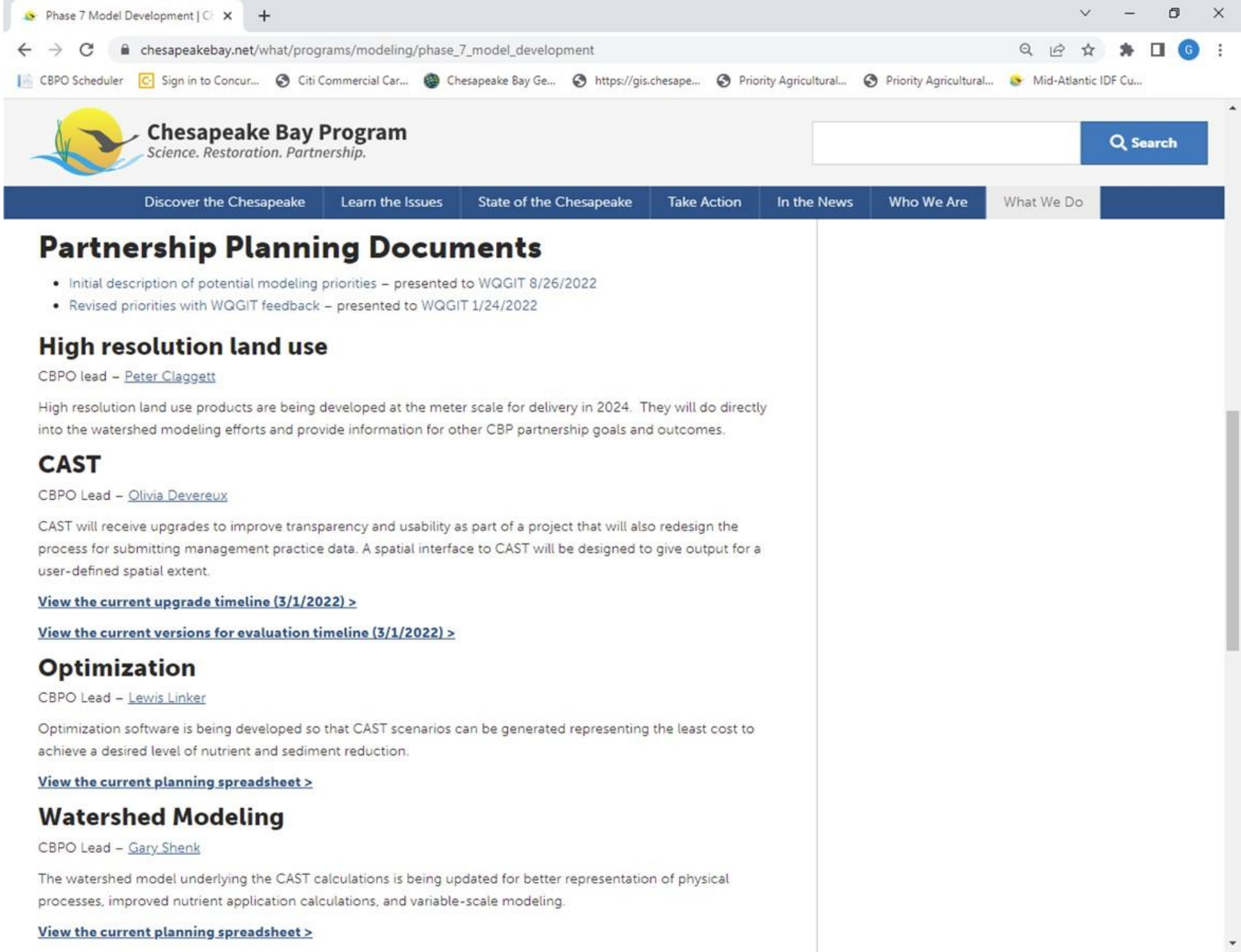
Gary Shenk – CBPO

WGIT

04/25/2022

Web page

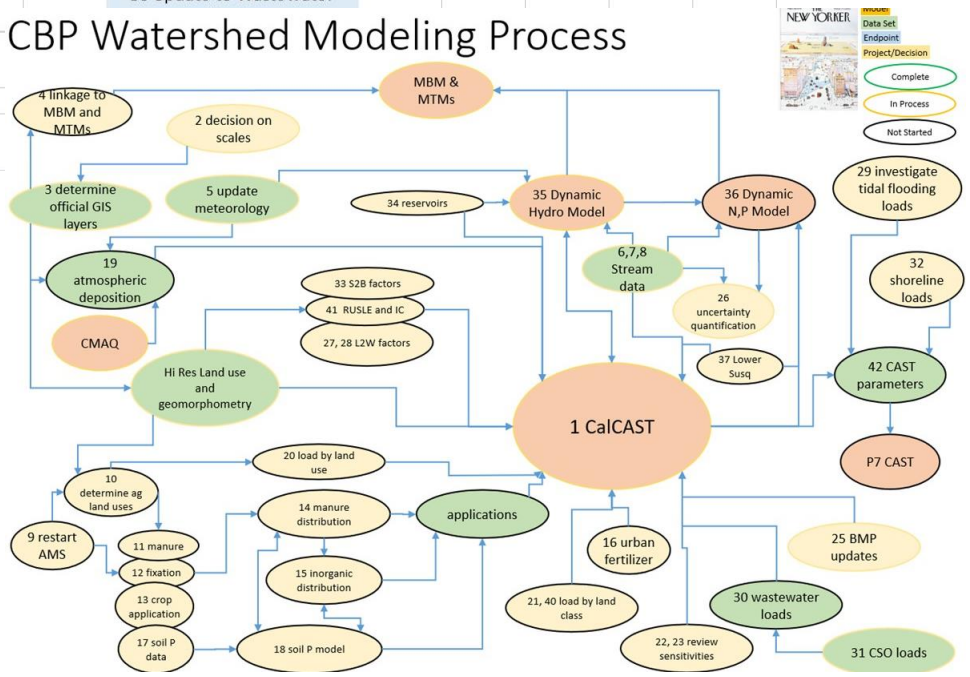
- Current plan under “Watershed Modeling”



Watershed Model Planning Documents

	2022 1	2022 2	2022 3	2022 4	2023 1	2023 2	2023 3	2023 4	2024 1	2024 2	2024 3	2024 4	2025 1	2025 2	2025 3	2025 4
Phase 7 Activity	Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models		
General	1 Develop CalCAST using P6 data								1 Use CalCAST as primary calibration tool							
	3 Determine official CBPO GIS layers 5 system of annual meteorology updates															
	25 BMP updates															
			35 Dynamic model for hydrology, sediment, and temperature													
						29 Investigate tidal flooding loads										
									30 Update to Wastewater							
			31 Update to CSOs													
Variable Scale Modeling																

Item	Category	What: short description	Why: who asked for it or why is it necessary	Who in C elsewhen the work		development time	
1	General	Develop CalCAST. CalCAST will be a tool for comparing estimated load to monitored loads given a set of inputs and parameters. It will be used in the calibration	CalCAST allows the CBP to test various data sets and strategies to see which match monitoring data best. Primary suggestion of STAC Phase 6 STAC review and Future of Modeling workshop. Allows efficient incoporation of all other development priorities	Bertani; Bhatt; Shenk	MWG	First priority. The rest of development depends on CalCAST. Need decisions on scale. 2022	A model of loads at a point is developed in Section 12 of the documentation. It will be implemented for speed of calculation with the potential to wrap parameter estimation techiques around it
2	variable scale modeling	Discuss scale and reach decision	Development of various Phase 7 tasks will benefit from knowledge of the output scale	Shenk	WQGIT, MWG	2022-2025	Presentation to WQGIT and MWG on various aspects, discussed in section 2
3	General	determine official versions of GIS layers: NHD, county, shoreline, Lrseg	Counties have updated boundaries. NHD necessary to use many important data sets, shoreline determines watershed/estuarine parameters. Lrseg may change for NHD boundaries	McDonald, Fitch, Ahmed, Bhatt	MWG	early 2022	CBPO discussions, with results to be written into section 2
4	Main bay and tributary models	physical and chemical linkage with estuarine model	Needed to run estuarine models	Bhatt	MWG	late 2022. Need to determine form of dynamic model first for the variable description.	Indentify set of terminal segments. Identify estuarine cell for each terminal segment. Compare old ICM variables with new ICM variables. Do new WSM variables match up?

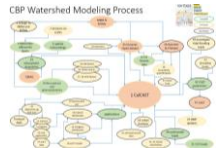


Watershed Model Planning Documents

Gantt Chart

	2022 1	2022 2	2022 3	2022 4	2023 1	2023 2	2023 3	2023 4	2024 1	2024 2	2024 3	2024 4	2025 1	2025 2	2025 3	2025 4
Phase 7 Activity	Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models		
General	1 Develop CalCAST using P6 data								1 Use CalCAST as primary calibration tool							
	3 Determine official CBPO GIS layers															
	5 system of annual meteorology updates															
	25 BMP updates															
			35 Dynamic model for hydrology, sediment, and temperature													
						29 Investigate tidal flooding loads										
									30 Update to Wastewater Loads							
															42 CalCAST transfer to CAST	
			31 Update to CSOs													
Variable Scale Modeling													2 Partnership decision on Scales			

Format will vary by Track

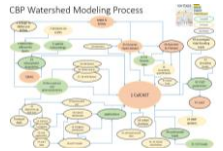


Watershed Model Planning Documents

Task List

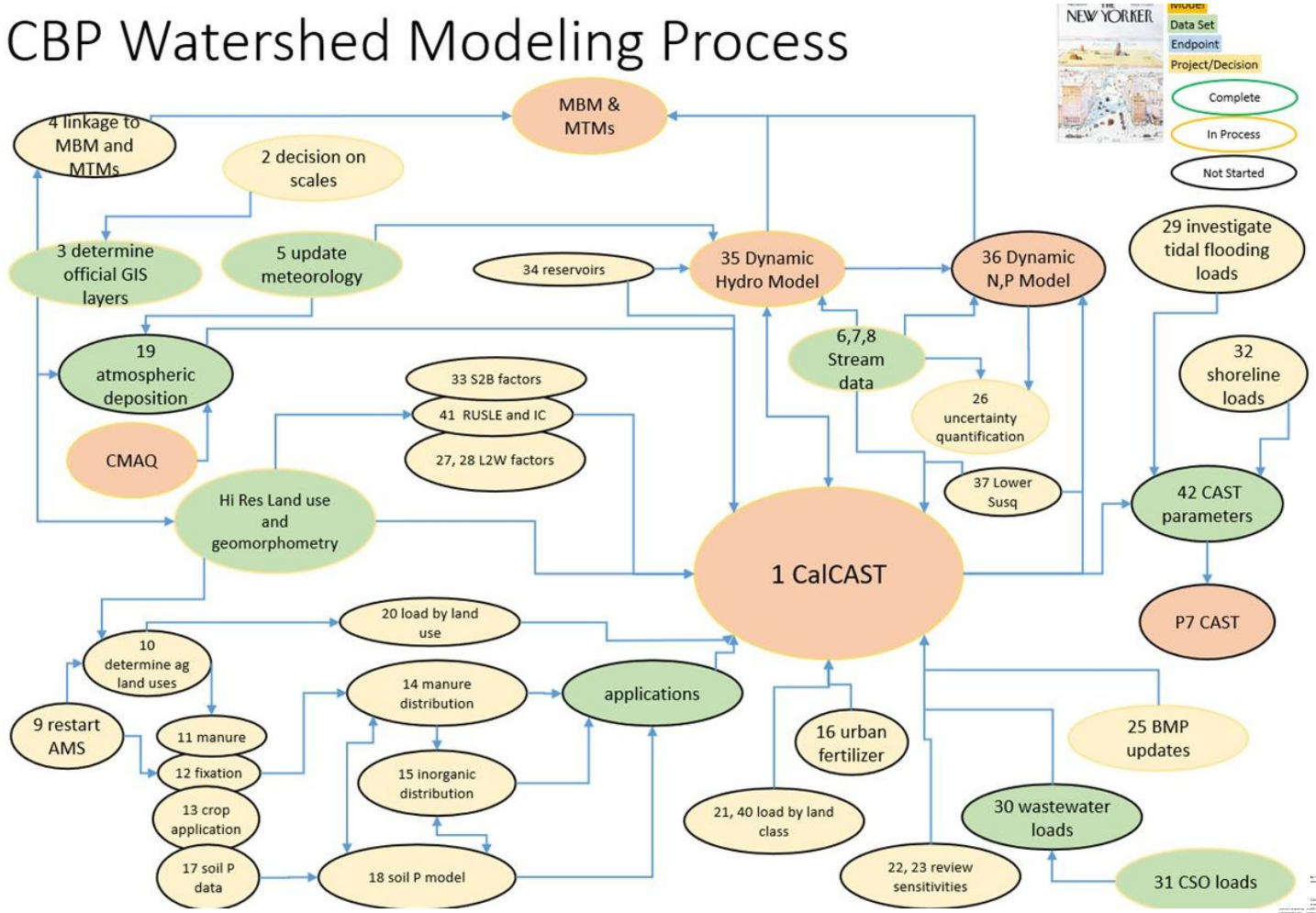
Item	Category	**What**: short description	**Why**: who asked for it or why is it necessary	**Who** in CBPO or elsewhere will do the work	**Where** in the CBP organizational chart do the decisions lie	**When** does this need to be done, including general dependencies and development time	**How**: A very short description with a link to the longer documentation
1	General	Develop CalCAST. CalCAST will be a tool for comparing estimated load to monitored loads given a set of inputs and parameters. It will be used in the calibration	CalCAST allows the CBP to test various data sets and strategies to see which match monitoring data best. Primary suggestion of STAC Phase 6 STAC review and Future of Modeling workshop. Allows efficient incoporation of all other development priorities	Bertani; Bhatt; Shenk	MWG	First priority. The rest of development depends on CalCAST. Need decisions on scale. 2022	A model of loads at a point is developed in Section 12 of the documentation. It will be implemented for speed of calculation with the potential to wrap parameter estimation techiques around it
2	variable scale modeling	Discuss scale and reach decision	Development of various Phase 7 tasks will benefit from knowledge of the output scale	Shenk	WQGIT, MWG	2022-2025	Presentation to WQGIT and MWG on various aspects, discussed in section 2
3	General	determine official versions of GIS layers: NHD, county, shoreline, Lrseg	Counties have updated boundaries. NHD necessary to use many important data sets, shoreline determines watershed/estuarine parameters. Lrseg may change for NHD boundaries	McDonald, Fitch, Ahmed, Bhatt	MWG	early 2022	CBPO discussions, with results to be written into section 2
4	Main bay and tributary models	physical and chemical linkage with estuarine model	Needed to run estuarine models	Bhatt	MWG	late 2022. Need to determine form of dynamic model first for the variable description.	Indentify set of terminal segments. Identify estuarine cell for each terminal segment. Compare old ICM variables with new ICM variables. Do new WSM variables match up?

Format will vary by Track



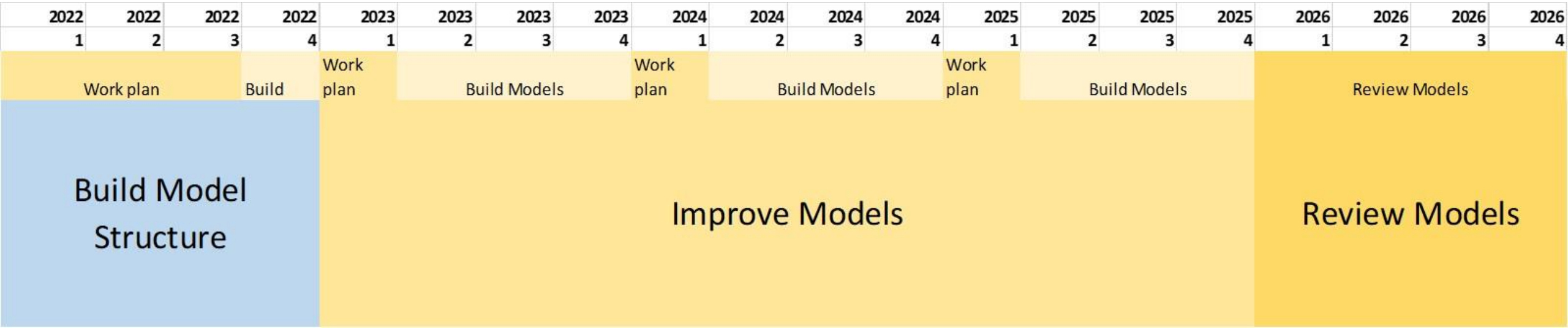
Watershed Model Planning Documents

Flow Chart



Format will vary by Track

Watershed Model Plan – Big Picture

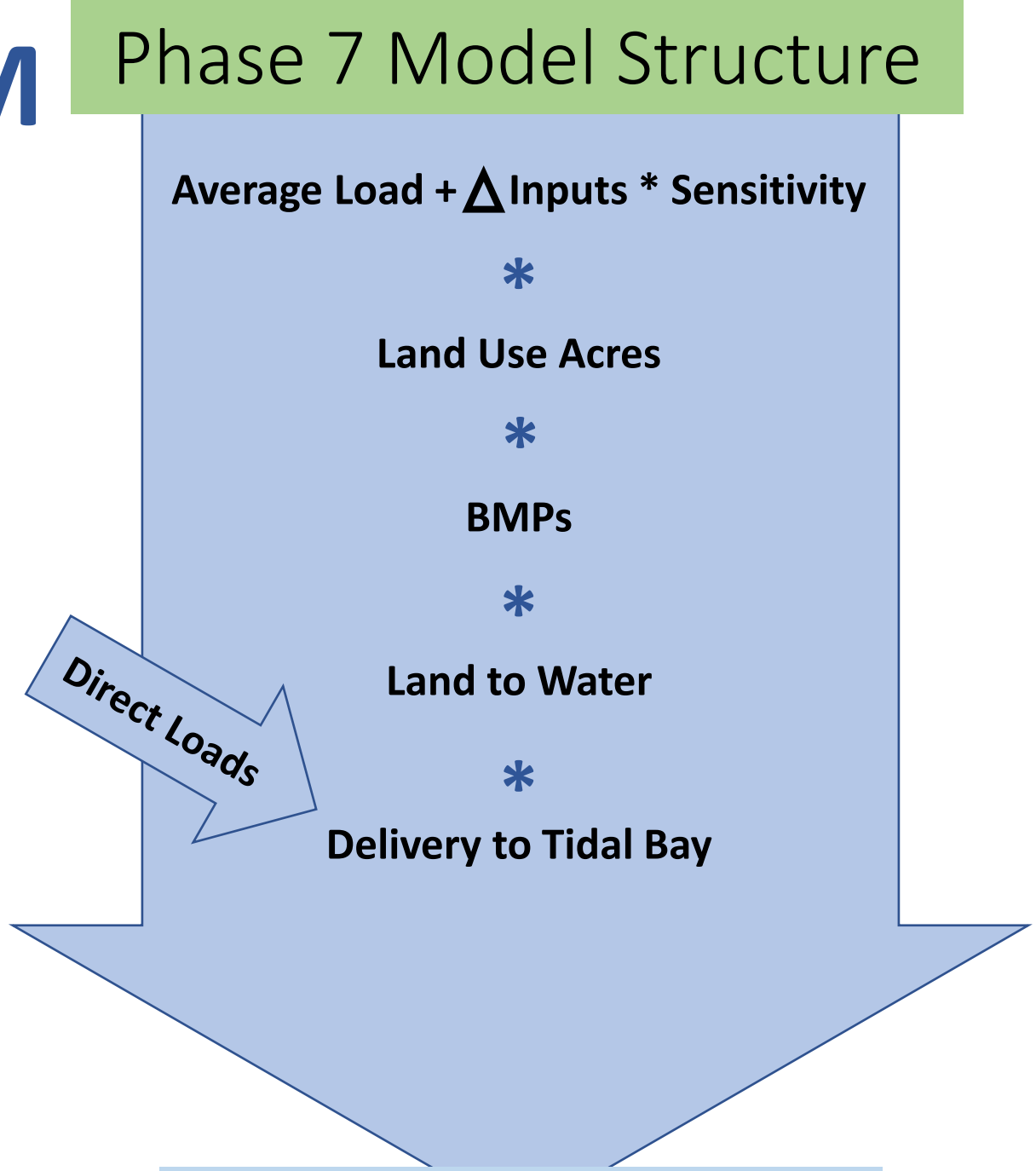


Cast/CalCast/DM

Phase 7

Cast

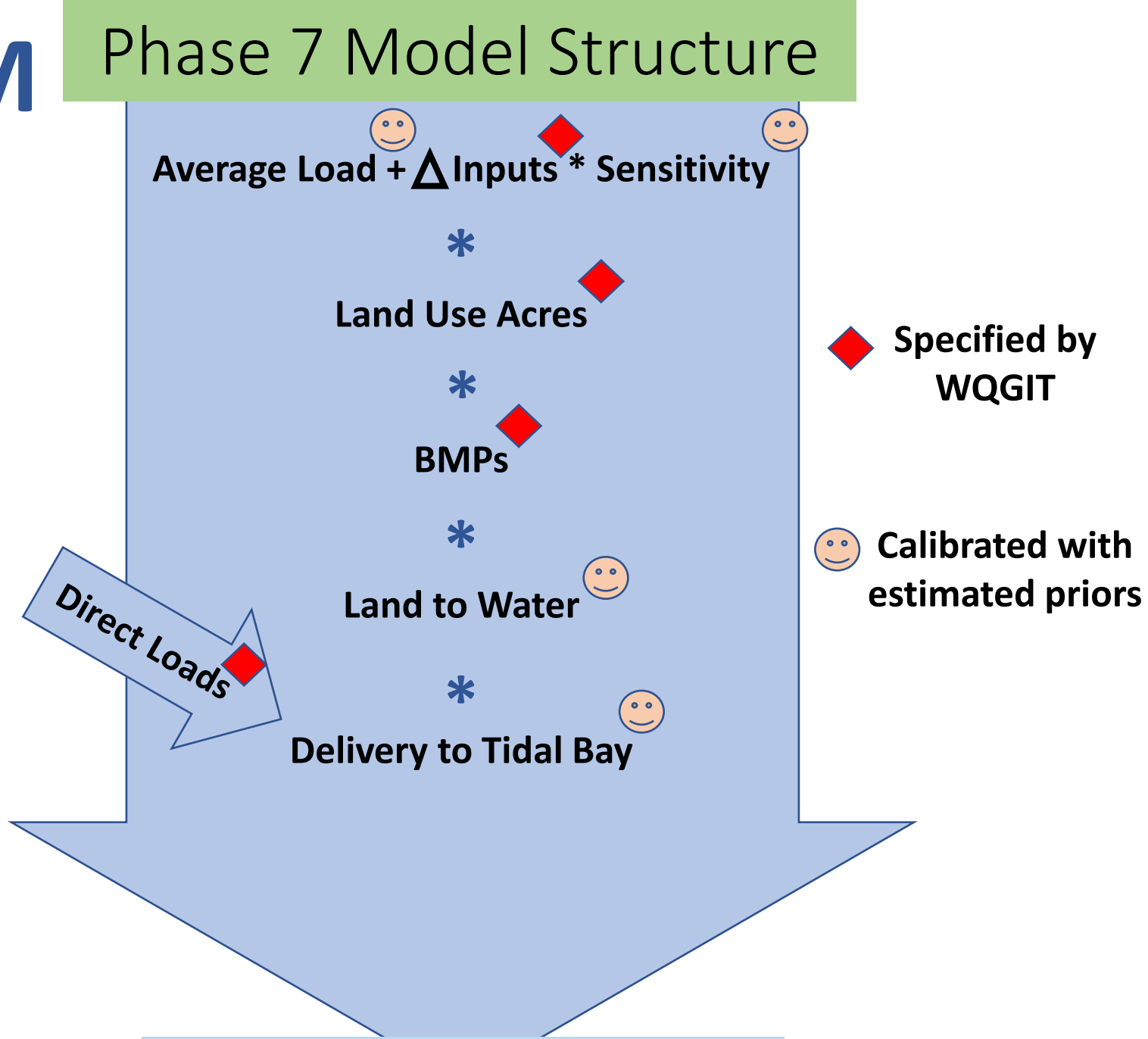
Deterministic Scenario Tool:
1 set of loads for 1 set of inputs



Cast/CalCast/DM

Phase 7
CalCast

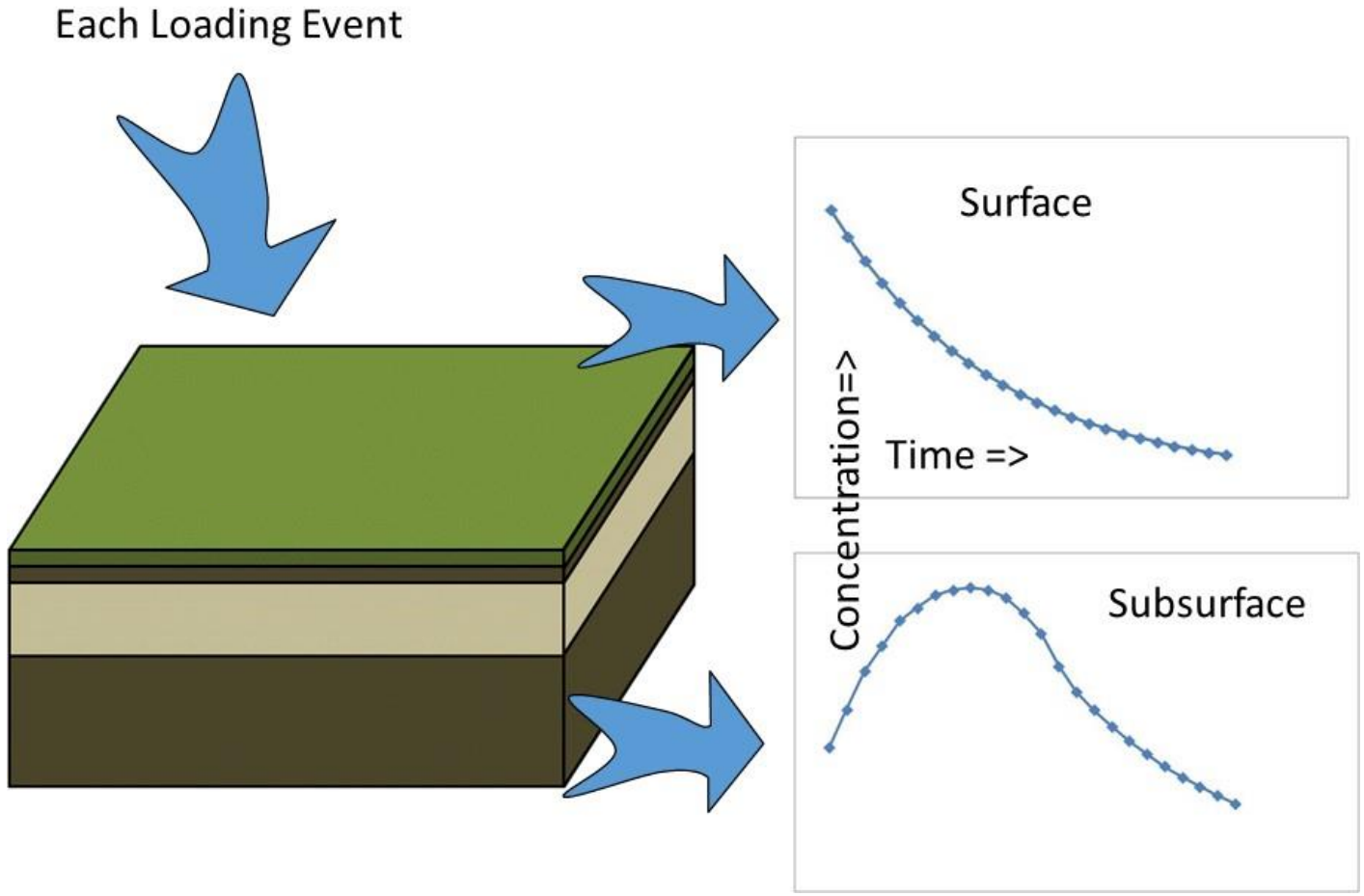
Tool for finding parameters that best match observations



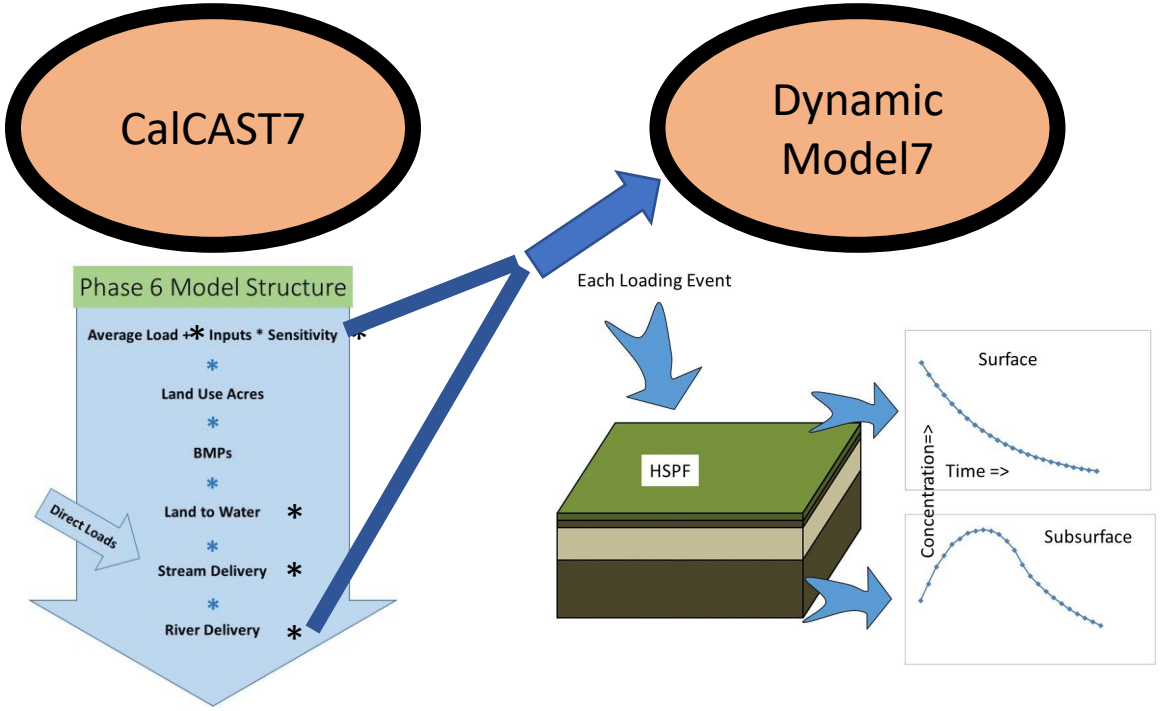
Cast/CalCast/DM

Phase 7
Dynamic Model

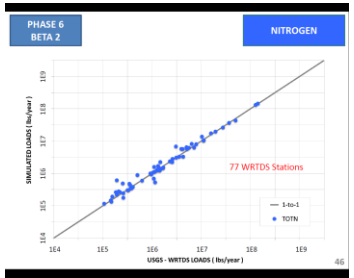
Takes output of CAST/CalCAST and breaks it into hourly values



CBP **Phase 7** Model – Calibration Mode

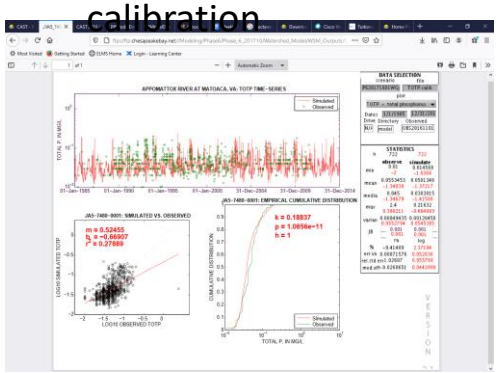


Calibration of meta-parameters to spatial loads



Potential feedback

Temporal calibration



CBP **Phase 7** Model – Calibration Mode

CAST7

Phase 6 Model Structure

Average Load + Inputs * Sensitivity

Land Use Acres

BMPs

Land to Water

Direct Loads

Stream Delivery

River Delivery

CAST determines CBP official scenario loads

CalCAST7

Phase 6 Model Structure

Average Load + Inputs * Sensitivity

Land Use Acres

BMPs

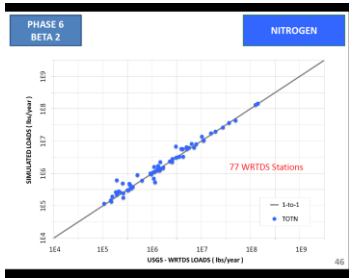
Land to Water

Direct Loads

Stream Delivery

River Delivery

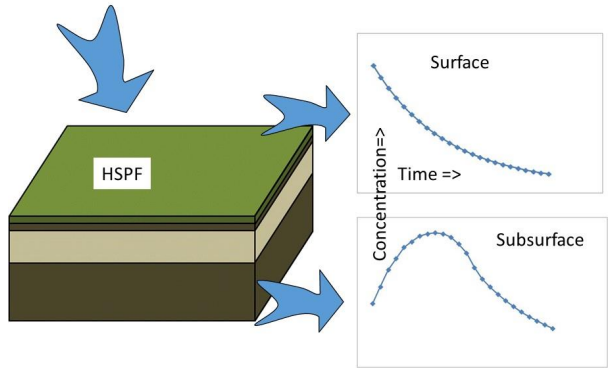
Calibration of meta-parameters to spatial loads



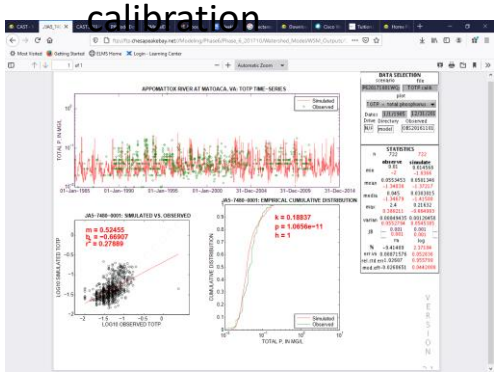
Potential feedback

Dynamic Model7

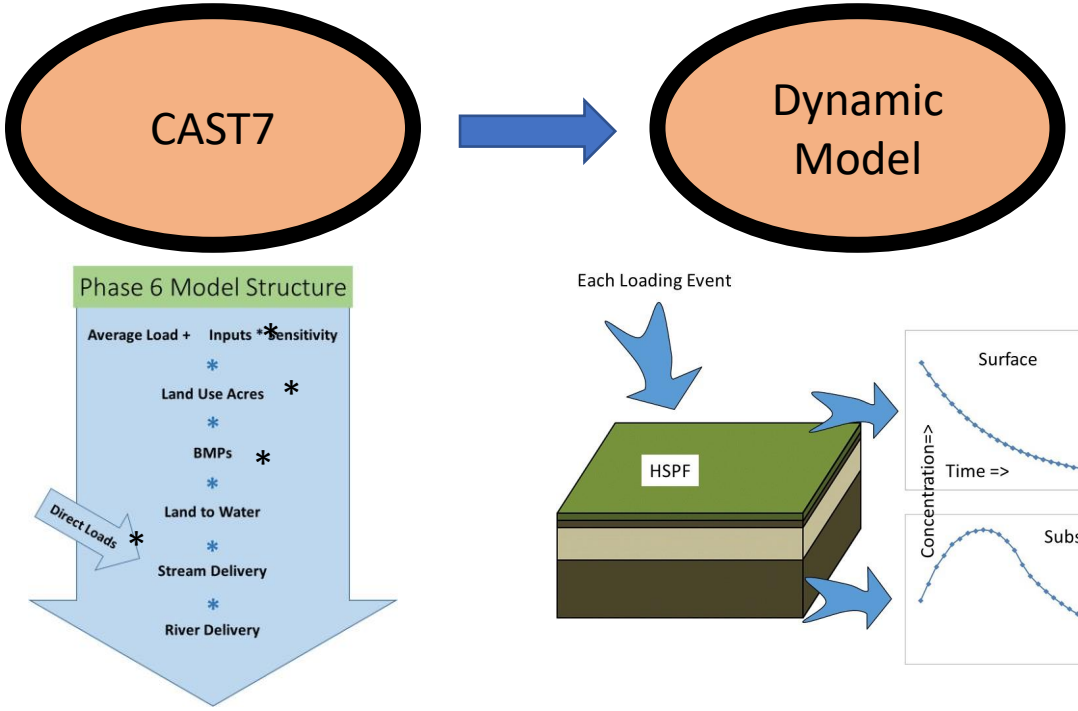
Each Loading Event



Temporal calibration



CBP **Phase 7** Model – Scenario Mode



CAST determines CBP official scenario loads

CAST loads are temporally disaggregated for estuarine model

Watershed Model Plan – Year 1 - slightly more detail

	2022	2022	2022	2022
	1	2	3	4
Phase 7 Activity	Work plan			Build
General	1 Develop CalCAST using P6 data			
	3 Determine official CBPO GIS layers			
	5 system of annual meteorology updates			
		35 Dynamic model for hydrology, sediment, and temperature		
		36 Dynamic model for nutrients		
Physical Process Simulation	6 Streamflow data			
	7 stream conc data			
		8 Stream load data		
Uncertainty Quantification	26 Methods			

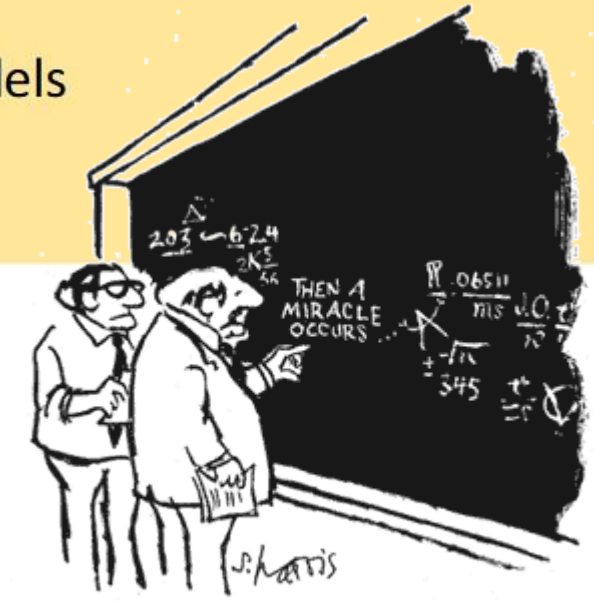
Watershed Model Plan – Big Picture

2022	2022	2022	2022	2023	2023	2023	2023	2024	2024	2024	2024	2025	2025	2025	2025	2026	2026	2026	2026
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Work plan			Build	Work plan	Build Models			Work plan	Build Models			Work plan	Build Models			Review Models			

Build Model Structure

Improve Models

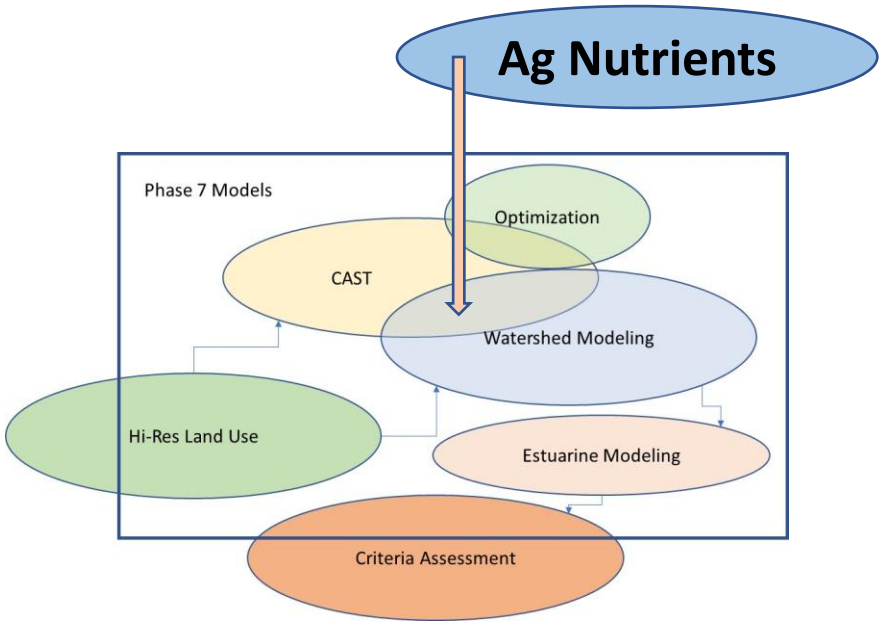
Review Models



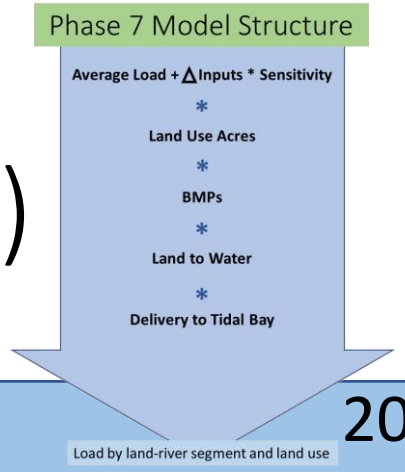
"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Ag Nutrient Applications (2022-2025)

- 9 Bring back Ag Modeling Subcommittee
- 10 Consider revising the types of ag land uses simulated in the model
- 11 Manure nutrient generation
- 12 Fixation
- 13 Crop application goals
- 14 Manure distribution on Crops
- 15 Inorganic applications
- 17 soil P data
- 18 soil P model
- *Other duties as assigned*



Physical Processes (2022-2025)



• 20	Review relative loading rates by land use	2022-2023
• 21	Review relative loading rates by land class	2023-2025
• 22	Review of sensitivities to inputs	2023-2025
• 27	Investigate land to water factors (geomorph data)	2023-2025
• 28	Incorporate local data in land to water factors	2023-2025
• 33	Stream to Bay factors (geomorph data)	2024-2025
• 34	Reservoir consideration	2023-2025
• 37	Lower Susquehanna Simulation	2023-2025
• 32	Tidal Shoreline loads	2022-2023
• 40	Add solar fields as land use in developed land class	2024-2025
• 41	recalculate EOS sediment	2024-2025

General Updates

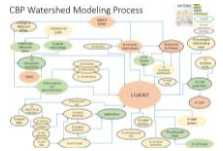
• 2	Determine Scale of CAST	2022-2025
• 16	Urban Fertilizer applications	2022-2025
• 19	New atmospheric deposition data	2023-2025
• 24	Convert fine-scale land use to CAST land use	2024
• 25	BMP updates	ongoing
• 29	Investigate tidal flooding loads	any time 2023-2025
• 30	Update to Wastewater Loads	any time 2023-2025
• 31	Update to CSOs	any time 2023-2025
• 42	transfer CalCAST values to CAST	end of 2025
• 43	Point source location checks	any time 2023-2025

Watershed Model Planning Documents

Task List

Item	Category	**What**: short description	**Why**: who asked for it or why is it necessary	**Who** in CBPO or elsewhere will do the work	**Where** in the CBP organizational chart do the decisions lie	**When** does this need to be done, including general dependencies and development time	**How**: A very short description with a link to the longer documentation
1	General	Develop CalCAST. CalCAST will be a tool for comparing estimated load to monitored loads given a set of inputs and parameters. It will be used in the calibration	CalCAST allows the CBP to test various data sets and strategies to see which match monitoring data best. Primary suggestion of STAC Phase 6 STAC review and Future of Modeling workshop. Allows efficient incoporation of all other development priorities	Bertani; Bhatt; Shenk	MWG	First priority. The rest of development depends on CalCAST. Need decisions on scale. 2022	A model of loads at a point is developed in Section 12 of the documentation. It will be implemented for speed of calculation with the potential to wrap parameter estimation techiques around it
2	variable scale modeling	Discuss scale and reach decision	Development of various Phase 7 tasks will benefit from knowledge of the output scale	Shenk	WQGIT, MWG	2022-2025	Presentation to WQGIT and MWG on various aspects, discussed in section 2
3	General	determine official versions of GIS layers: NHD, county, shoreline, Lrseg	Counties have updated boundaries. NHD necessary to use many important data sets, shoreline determines watershed/estuarine parameters. Lrseg may change for NHD boundaries	McDonald, Fitch, Ahmed, Bhatt	MWG	early 2022	CBPO discussions, with results to be written into section 2
4	Main bay and tributary models	physical and chemical linkage with estuarine model	Needed to run estuarine models	Bhatt	MWG	late 2022. Need to determine form of dynamic model first for the variable description.	Indentify set of terminal segments. Identify estuarine cell for each terminal segment. Compare old ICM variables with new ICM variables. Do new WSM variables match up?

Format will vary by Track

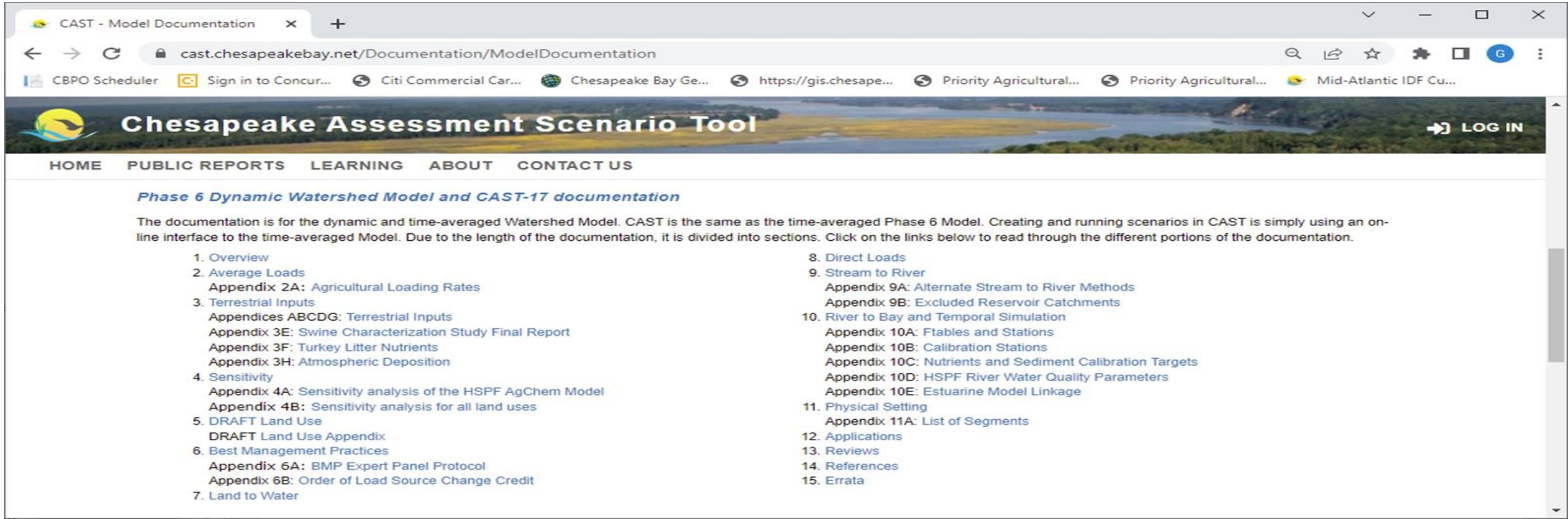


Watershed Model Plan – sample task

Item	4
Category	Main bay and tributary models
What: short description	physical and chemical linkage with estuarine model
Why: who asked for it or why is it necessary	Needed to run estuarine models
Who in CBPO or elsewhere will do the work	Bhatt
Where in the CBP organizational chart do the decisions lie	MWG
When does this need to be done, including general dependencies and development time	late 2022. Need to determine form of dynamic model first for the variable description.
How: A very short description with a link to the longer documentation	Section 2 of P7 documentation. Indentify set of terminal segments. Identify estuarine cell for each terminal segment. Compare old ICM variables with new ICM variables. Do new WSM variables match up?

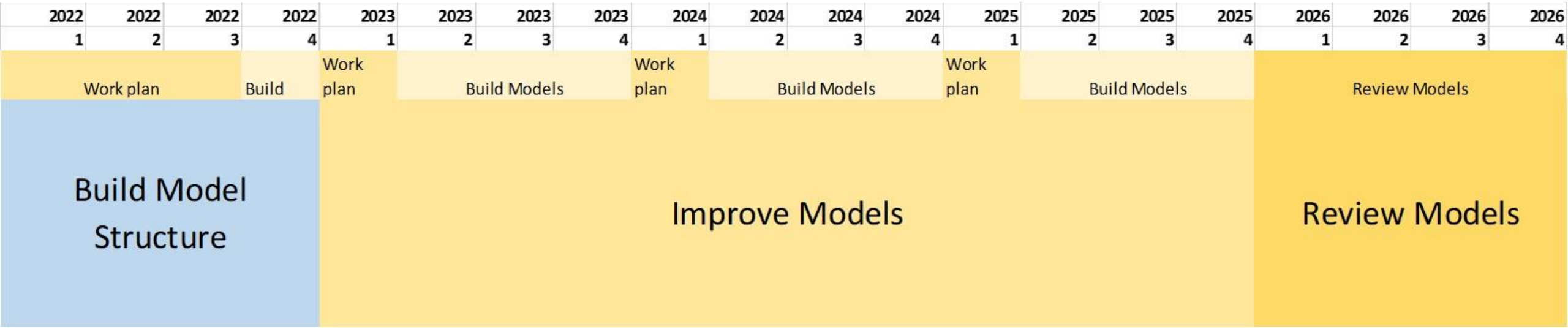
Full Details in Draft Documentation

- P6 documentation being updated to P7
- Expect rolling releases as we complete sections



Summary and next steps

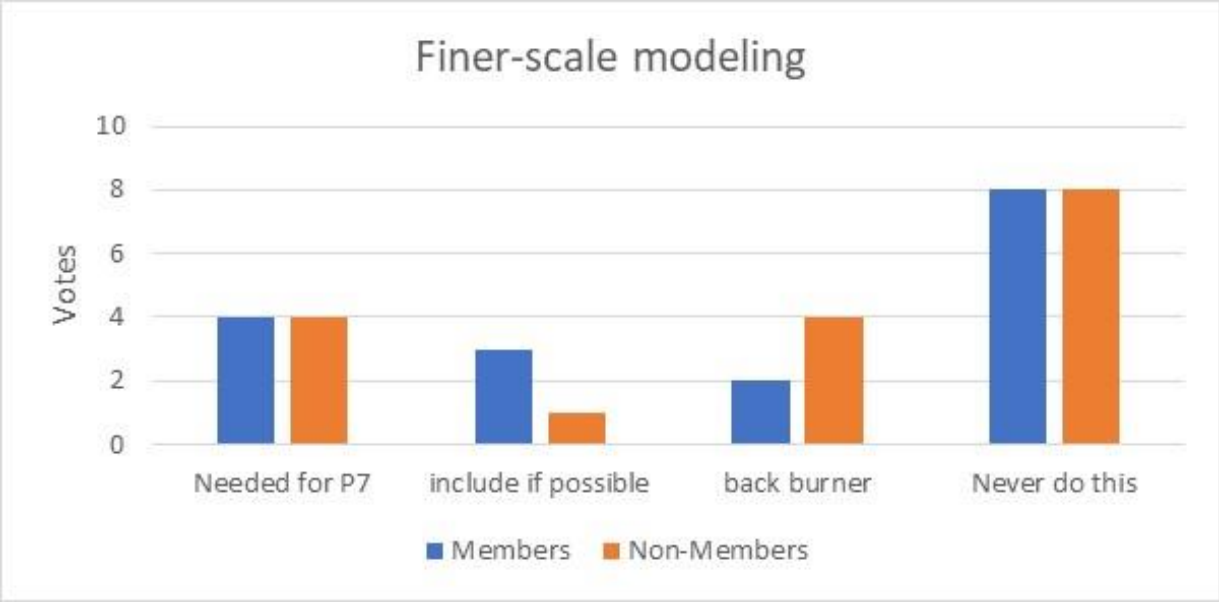
- Expect updates on development of the structure this year
- Expect improvements in inputs and calibration through 2025
- Expect documentation as tasks are complete



- Extra slides for scale discussion if needed

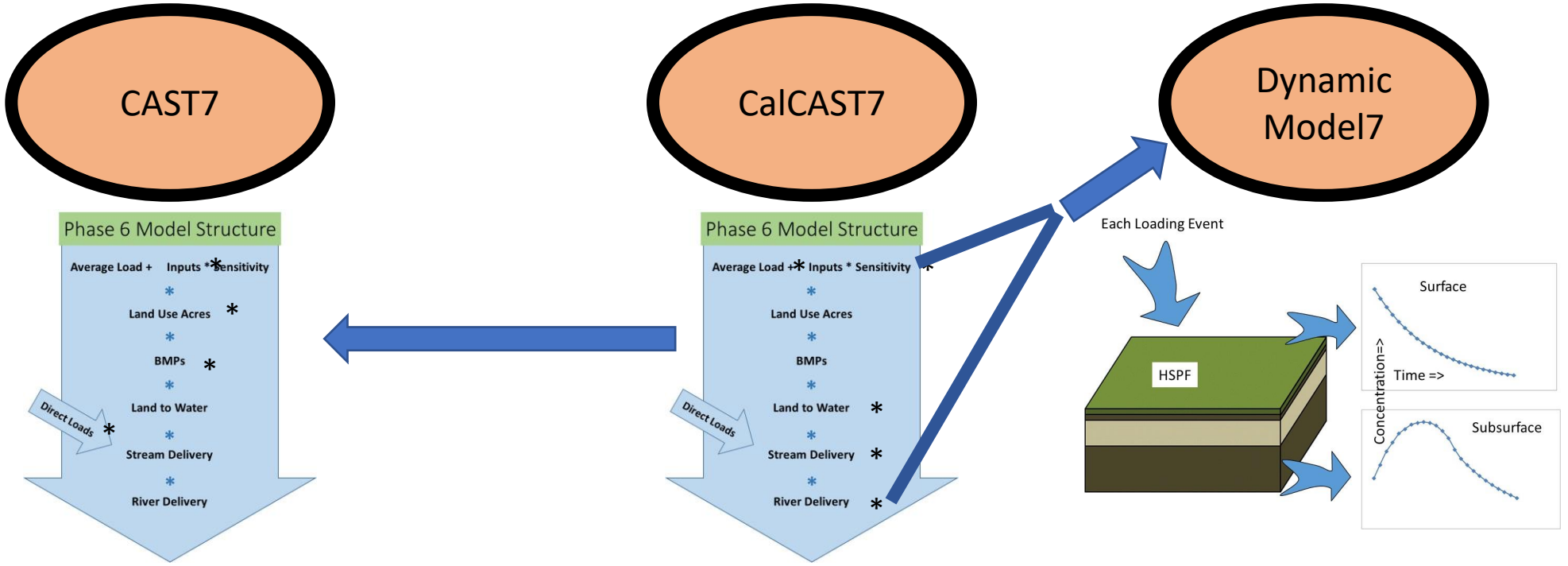
Phase 7 CAST will be built at the scale that the partnership wants

- The modeling team proposed a scale that was met with mixed reviews
- The modeling team is revising the proposal based on the feedback



- Few comments
- Half of comments favored use for targeting
- Half opposed
  - Resources better used elsewhere
  - Greater uncertainty at finer scales

Scale



Whatever scale is needed for management

NHD scale to capture local monitoring

NHD scale to load the estuarine models

The Watershed Model does not have to be one-size-fits-all

- The current Phase 6 CAST scale is land-river segment for nonpoint source and NHD for point source
- Development and calibration can happen at the NHD scale
- CAST scenarios can be run at an aggregated scale
- CAST scenario results can be downscaled for the estuarine models
- Unofficial CAST scenarios could potentially be run at a finer scale

- The partnership decides the CAST scale…and you don’t have to decide now.
  - Development and calibration happen now
  - CAST gets built in 2025 for 2026