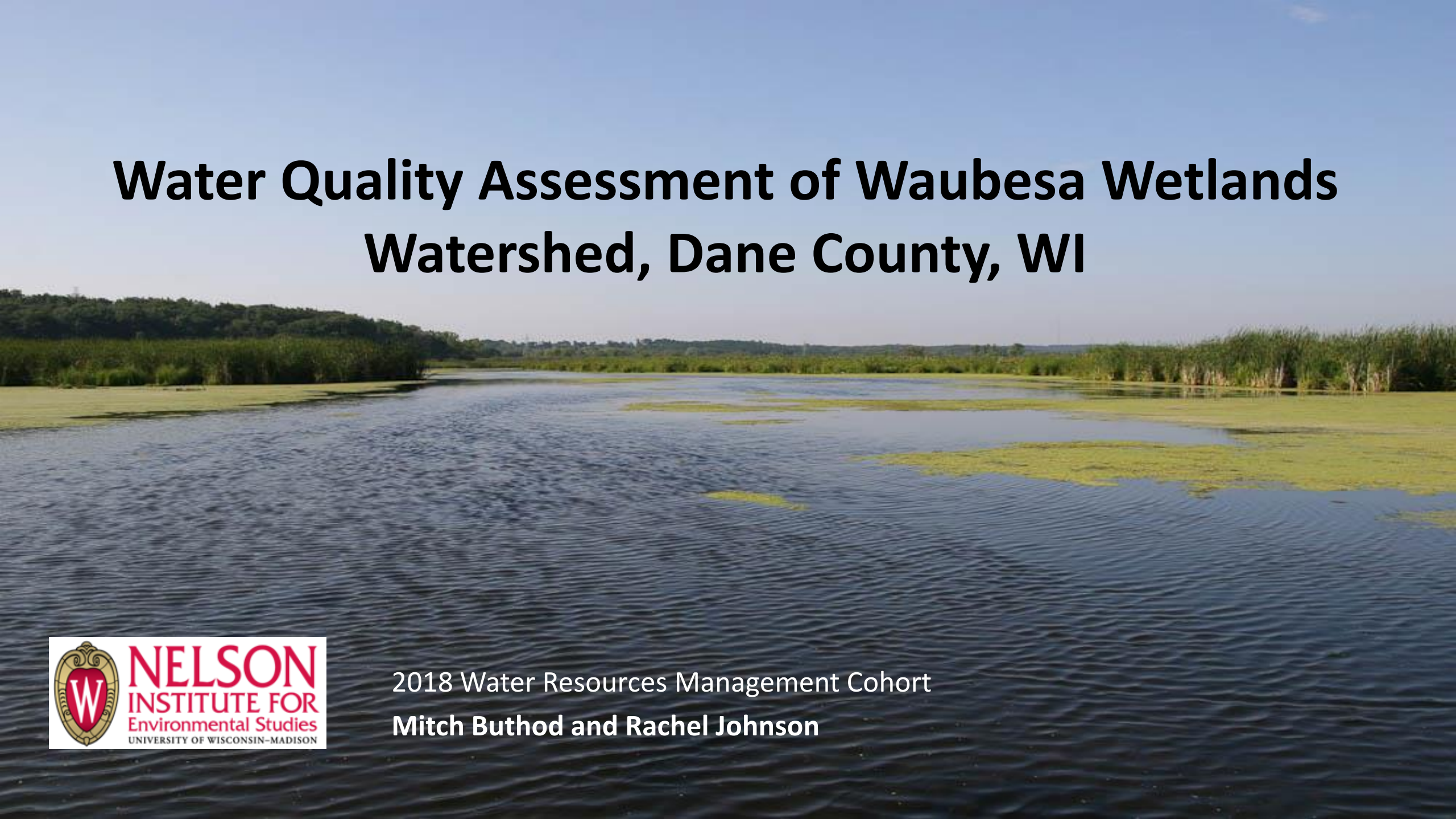
Water Quality Assessment of Waubesa Wetlands Watershed, Dane County, WI



NELSON INSTITUTE FOR Environmental Studies
UNIVERSITY OF WISCONSIN–MADISON

2018 Water Resources Management Cohort

Mitch Buthod and Rachel Johnson

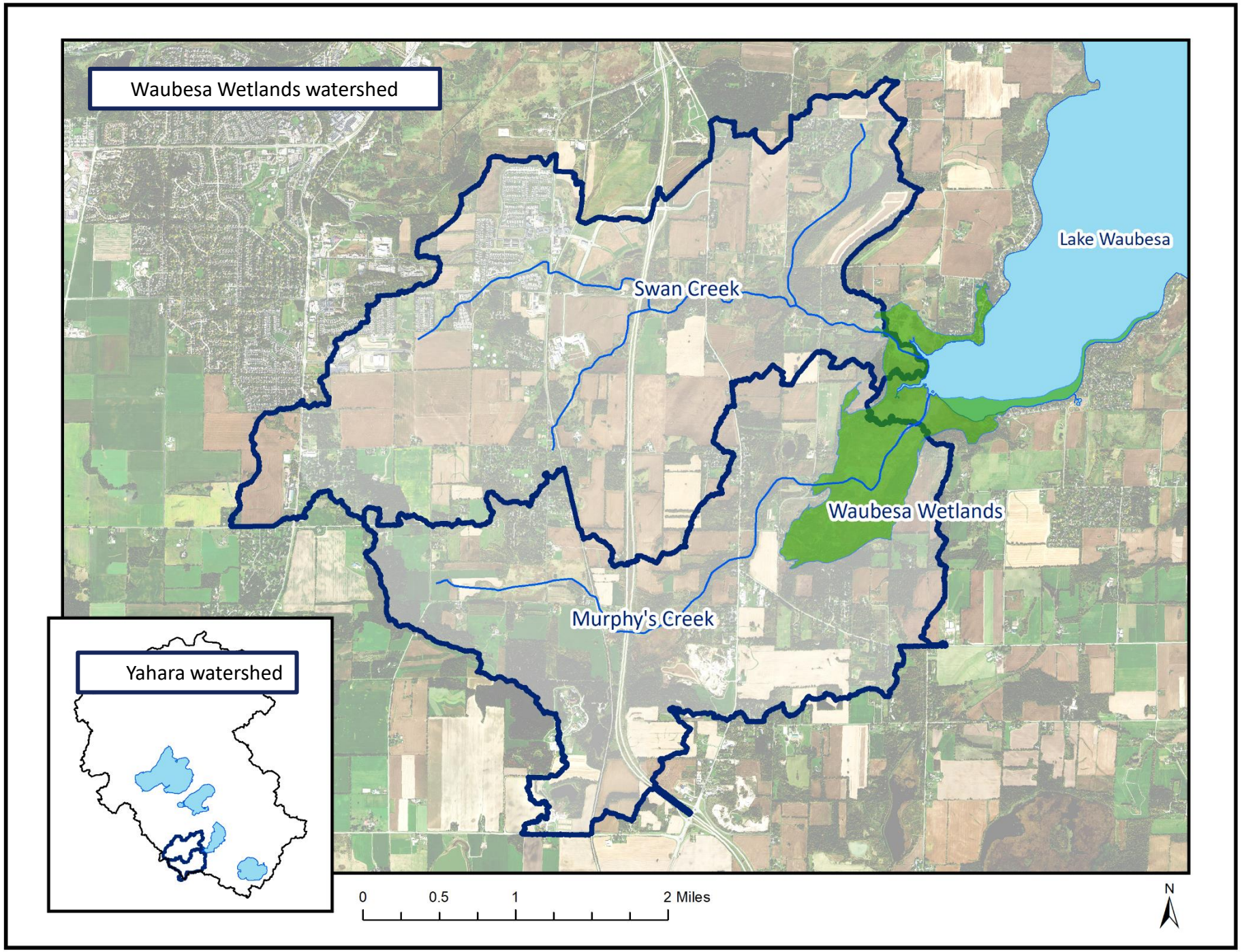
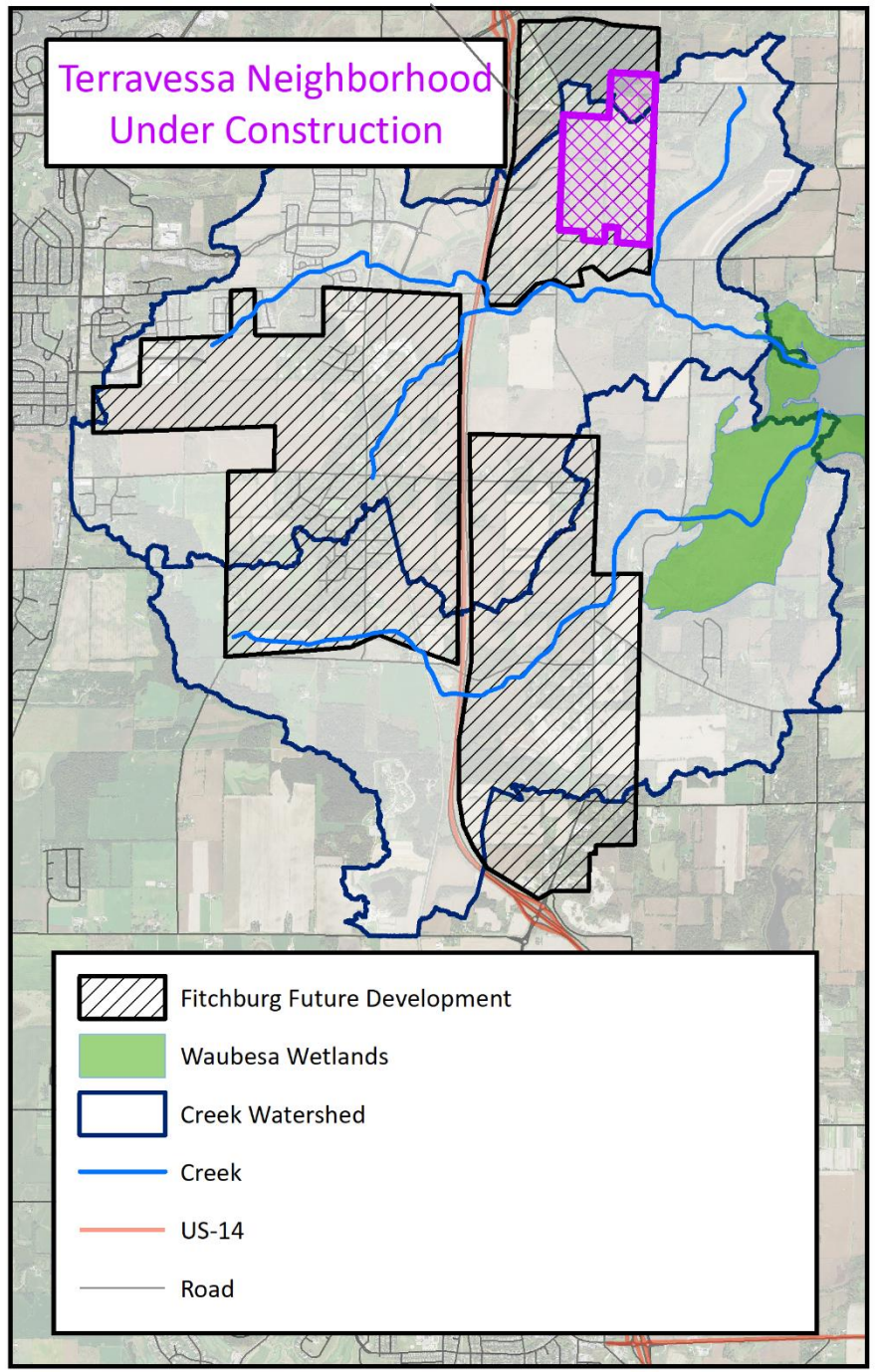

Waubesa Wetlands watershed
Lake Waubesa
Swan Creek
Waubesa Wetlands
Murphy's Creek
Yahara watershed
0
0.5
1
2 Miles
N

Photo by Cal DeWitt

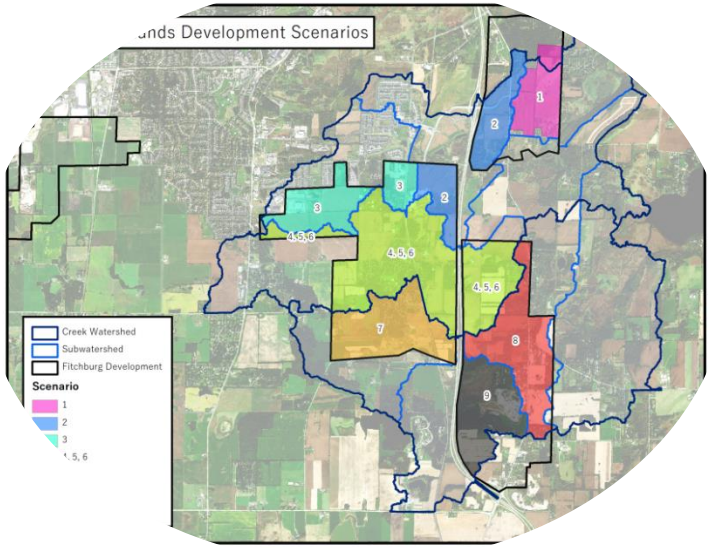

Terravessa Neighborhood
Under Construction
Fitchburg Future Development
Waubesa Wetlands
Creek Watershed
Creek
US-14
Road

Technical Advisory Committee (TAC)

Community Engagement

Water Quality Monitoring

Ecosystem Services Assessment



Modeling

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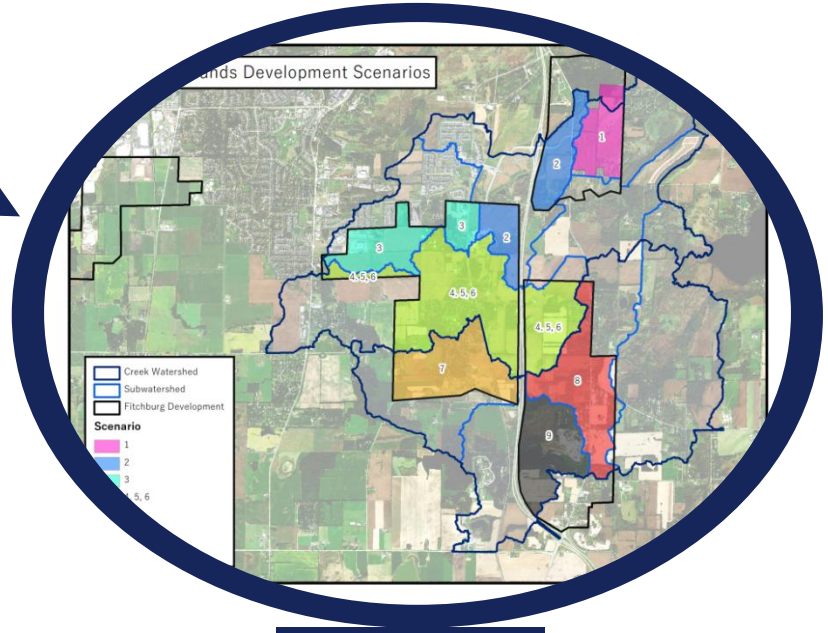

Modeling

Water quality parameters

Field parameters

- Weather conditions
- Air temperature
- Water temperature
- Dissolved oxygen
- Conductivity
- Discharge

Lab parameters, given as concentrations

- Total phosphorus (TP)
- Orthophosphate
- Nitrate and Nitrite (NO2 +NO3)
- Total Kjeldahl Nitrogen (TKN)
- Total Suspended Solids (TSS)
- Chloride

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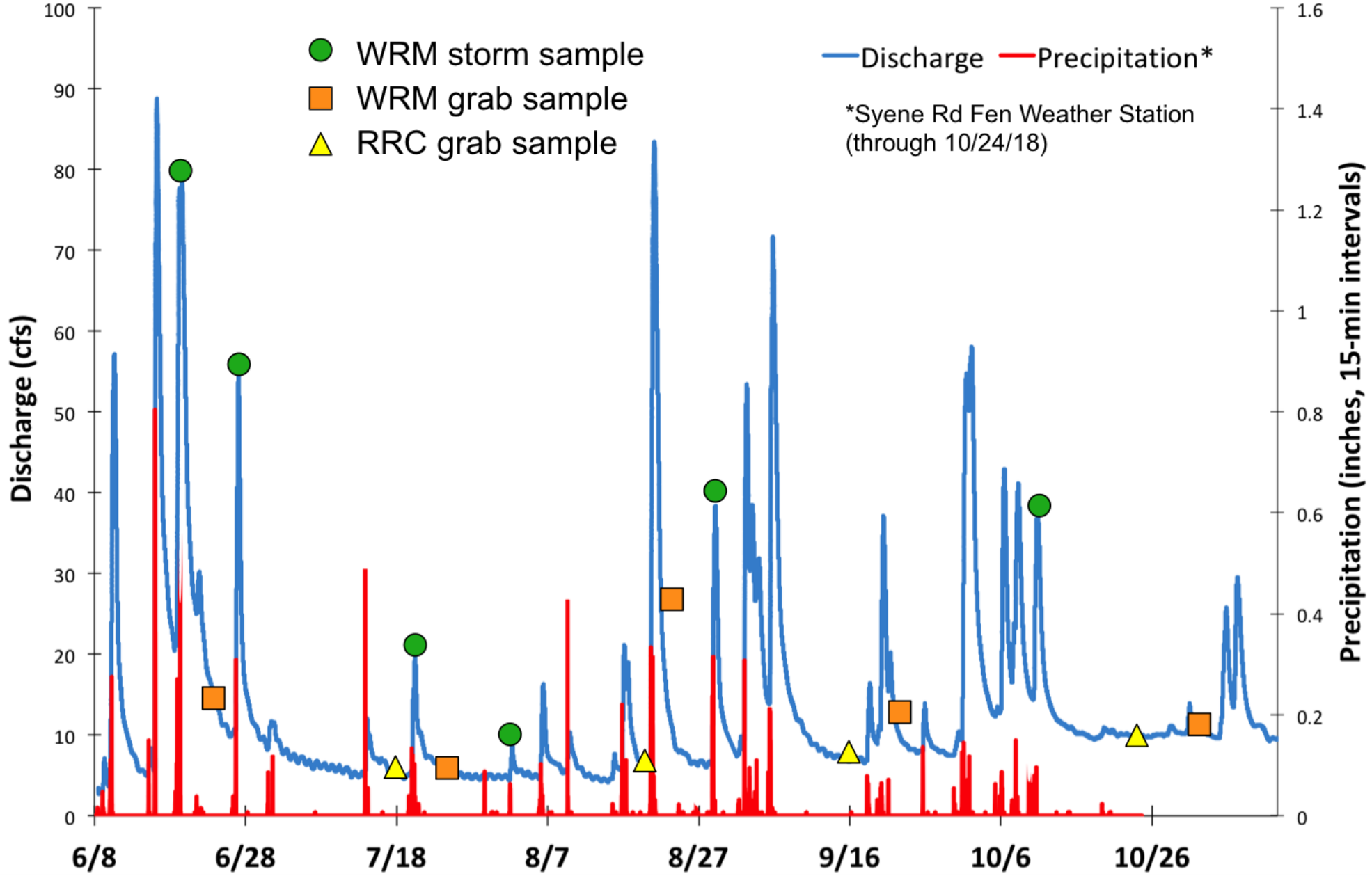
Sample collection

Precipitation and discharge



Comparing nutrient concentrations

1. Discharge

Comparing nutrient concentrations

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2. Location: upstream vs. downstream

Comparing nutrient concentrations

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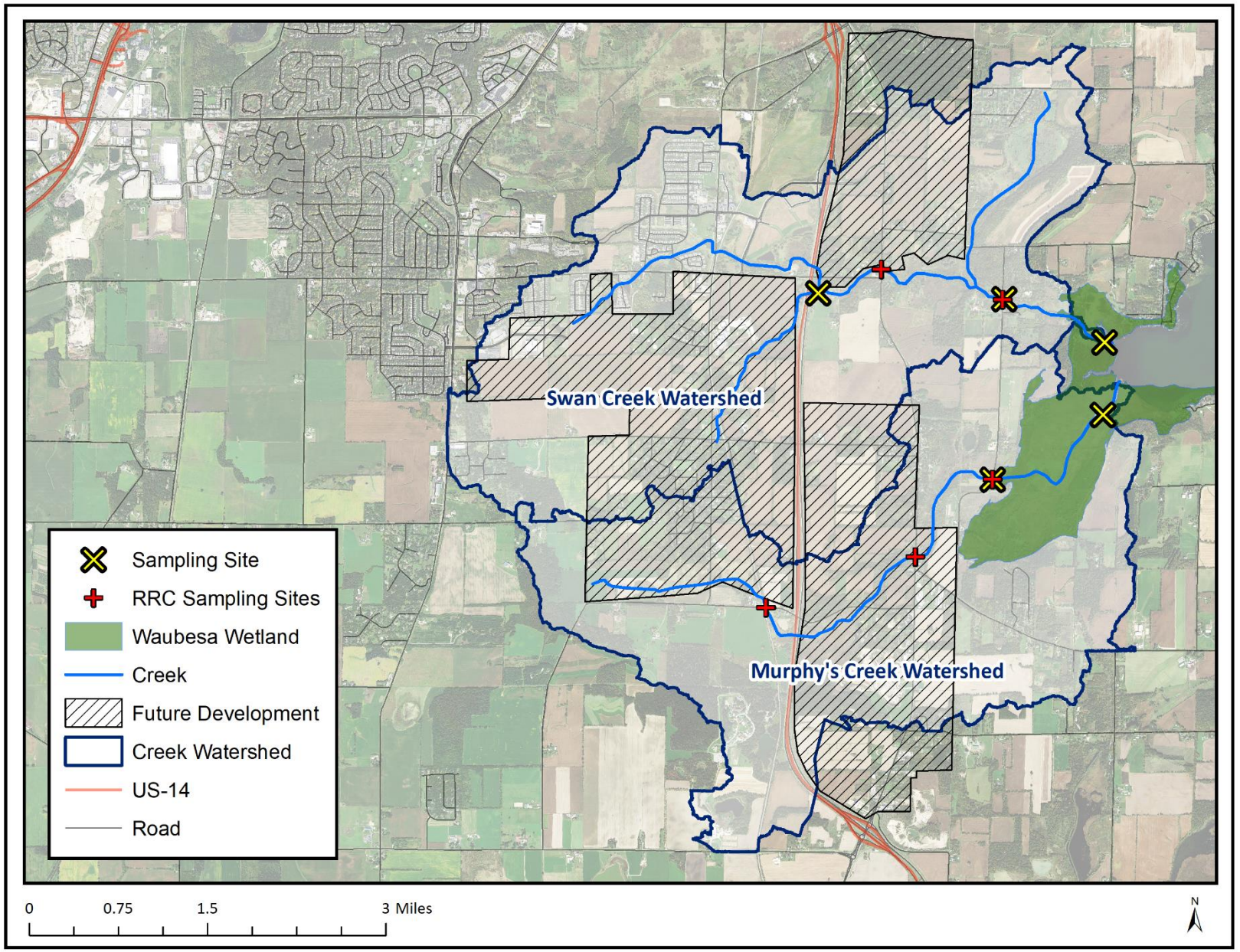
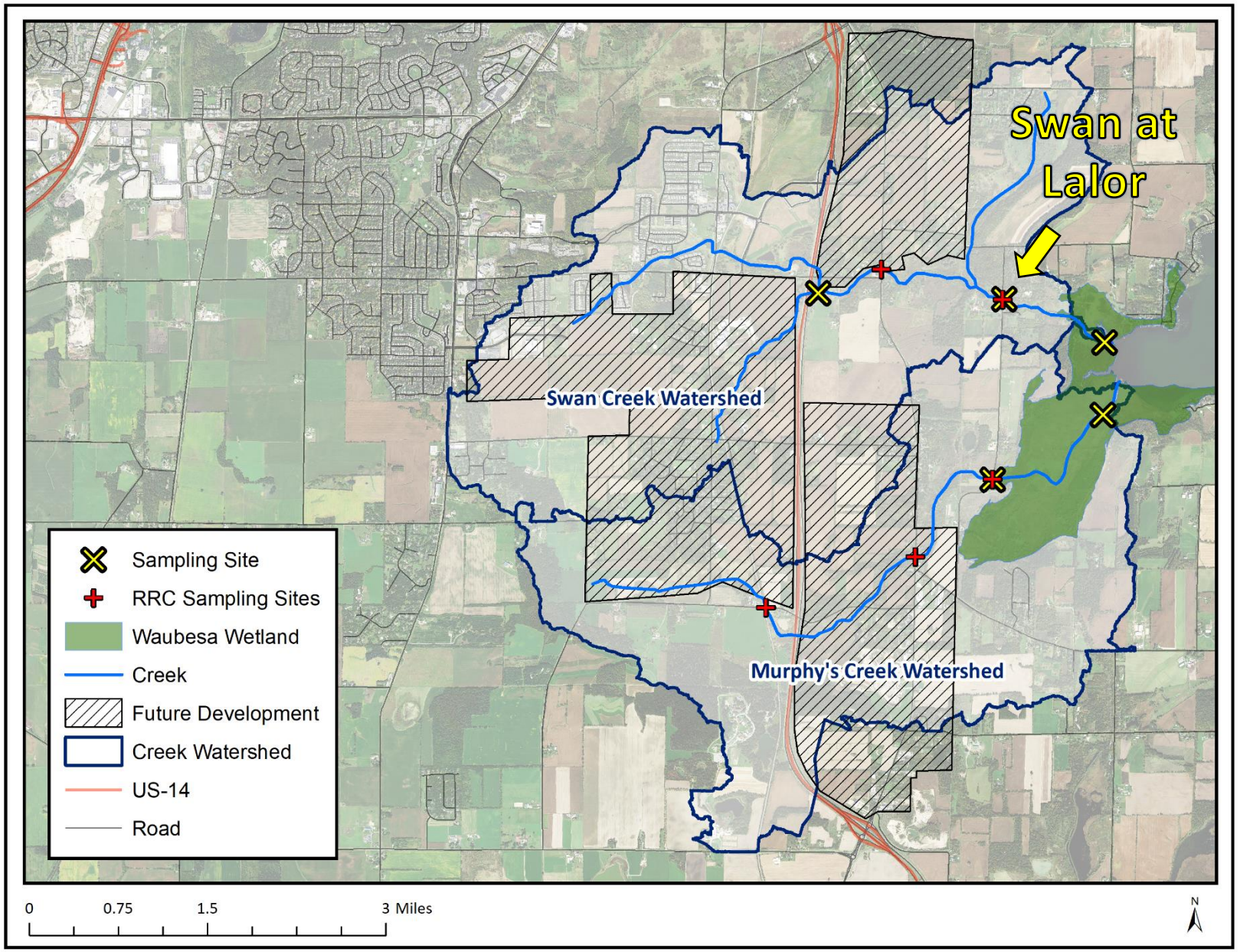
2. Location: upstream vs. downstream
3. Time: 2015 - 2018

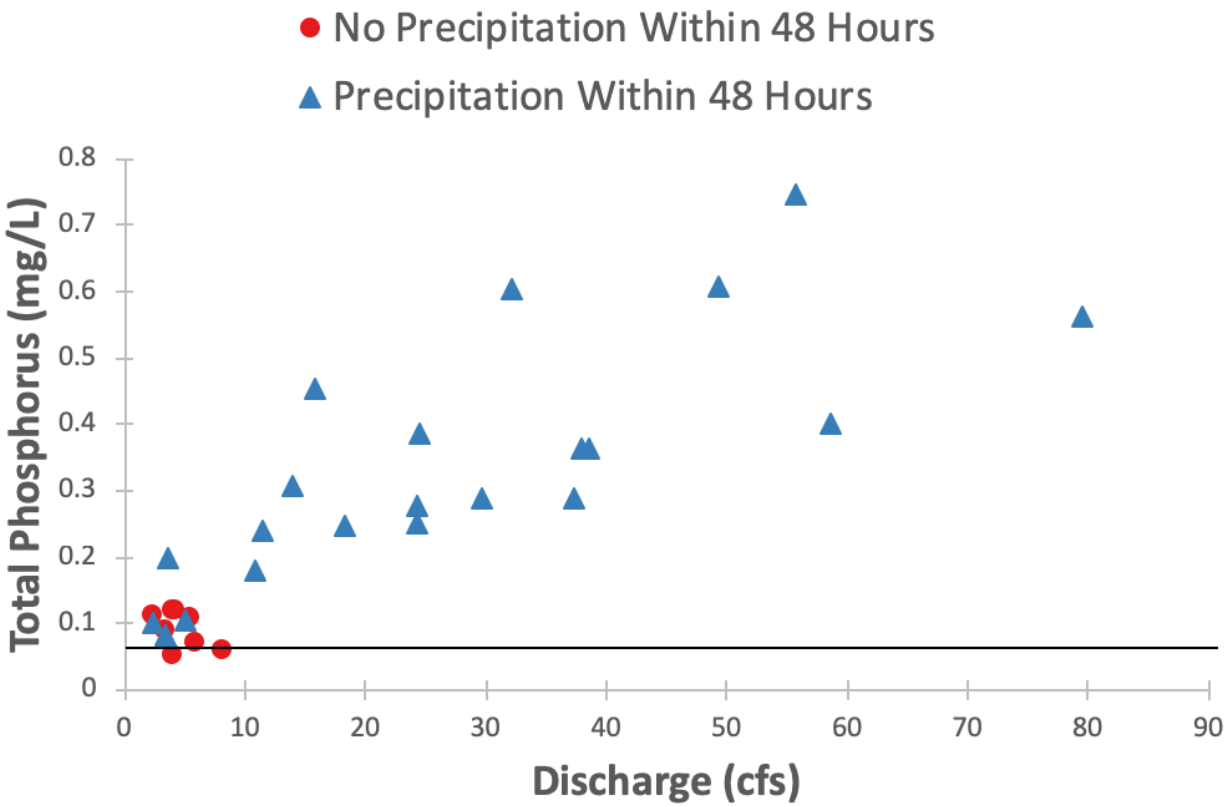
Sampling sites

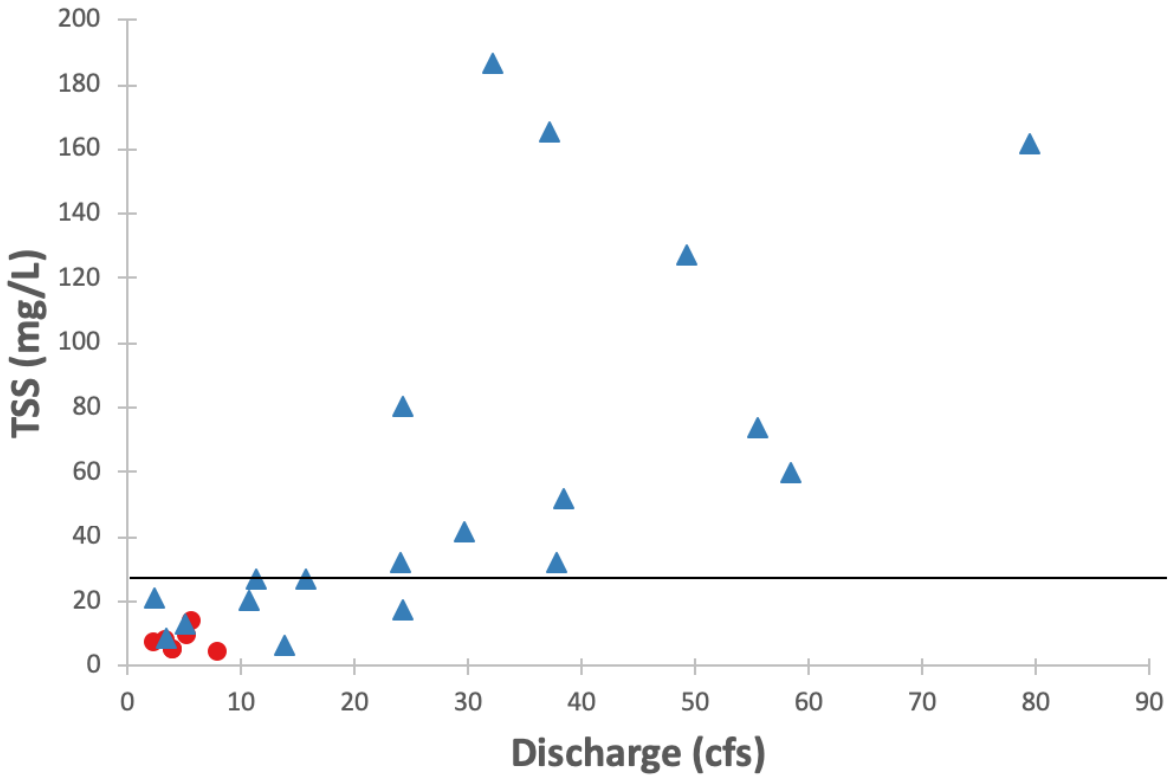


Sampling sites

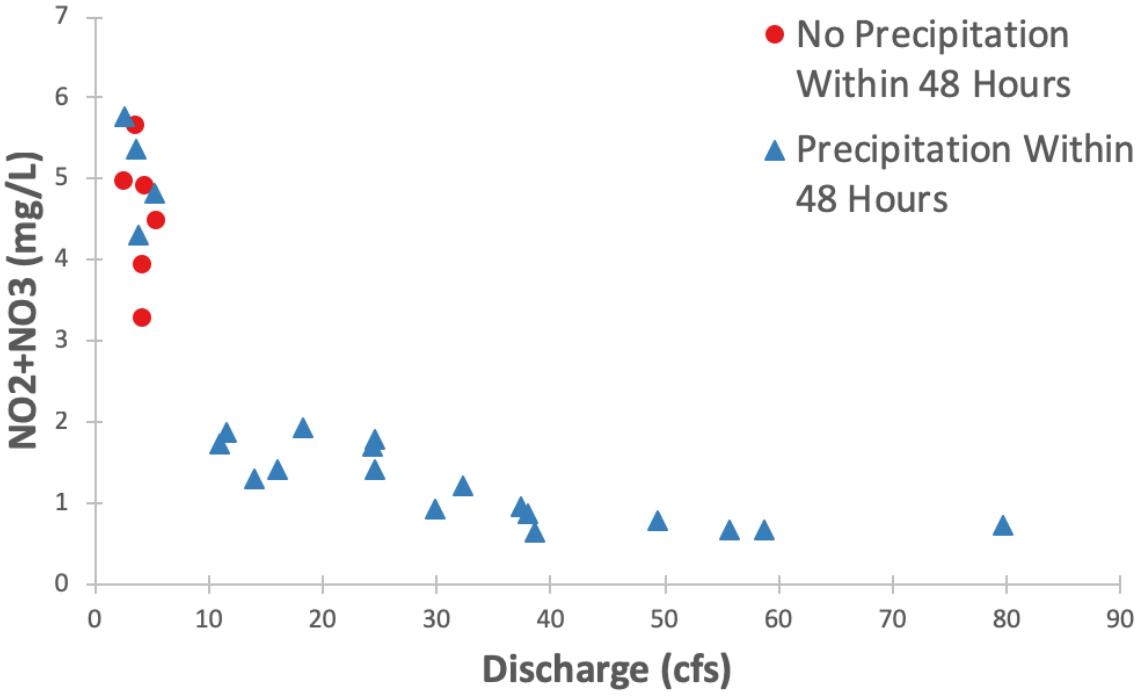


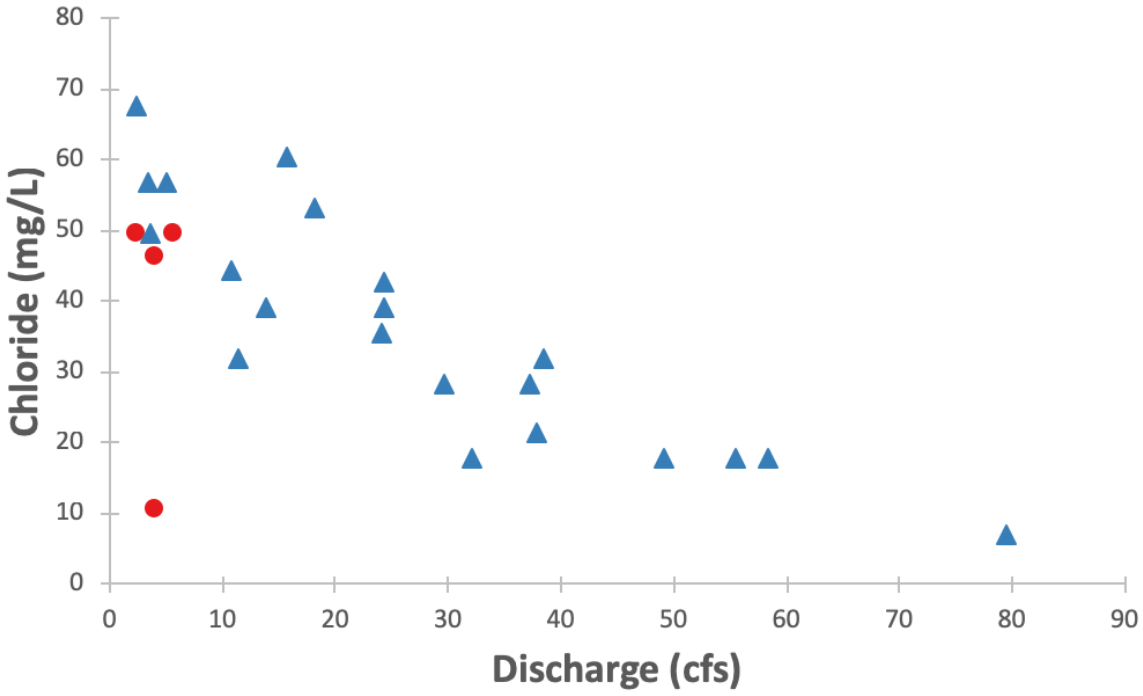
TP and TSS *increase* with increased discharge





NOx and chloride *decrease* with increased discharge



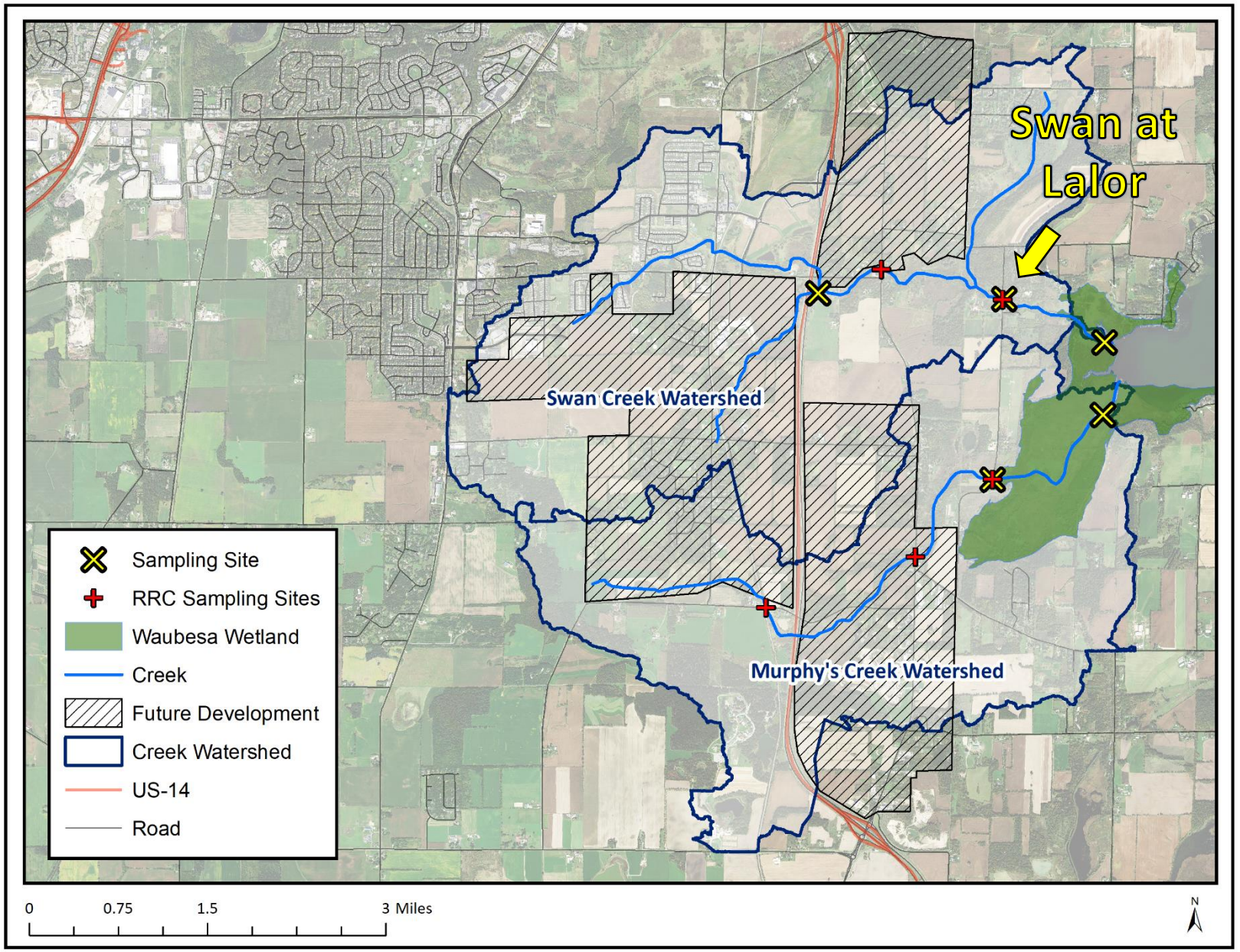


Comparing nutrient concentrations

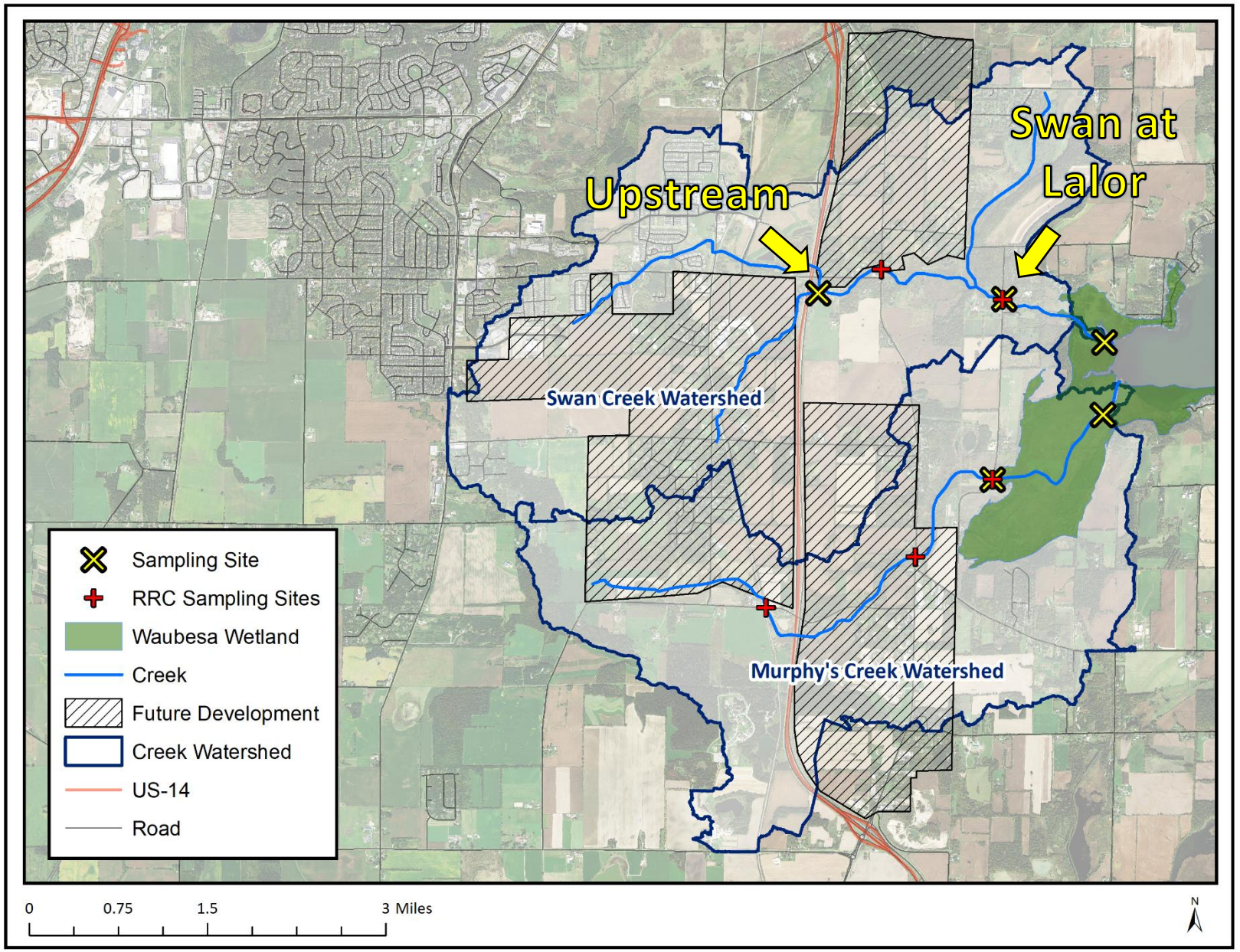
1. Discharge

2. Location: upstream vs. downstream

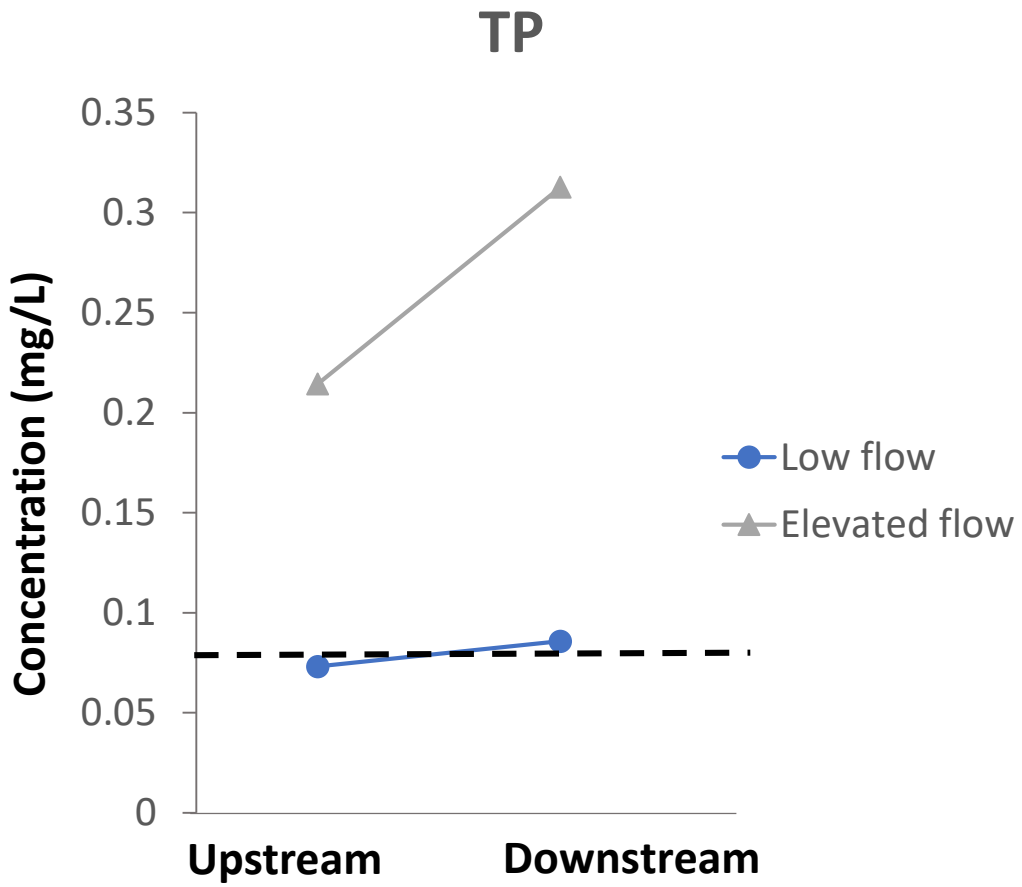
Sampling sites



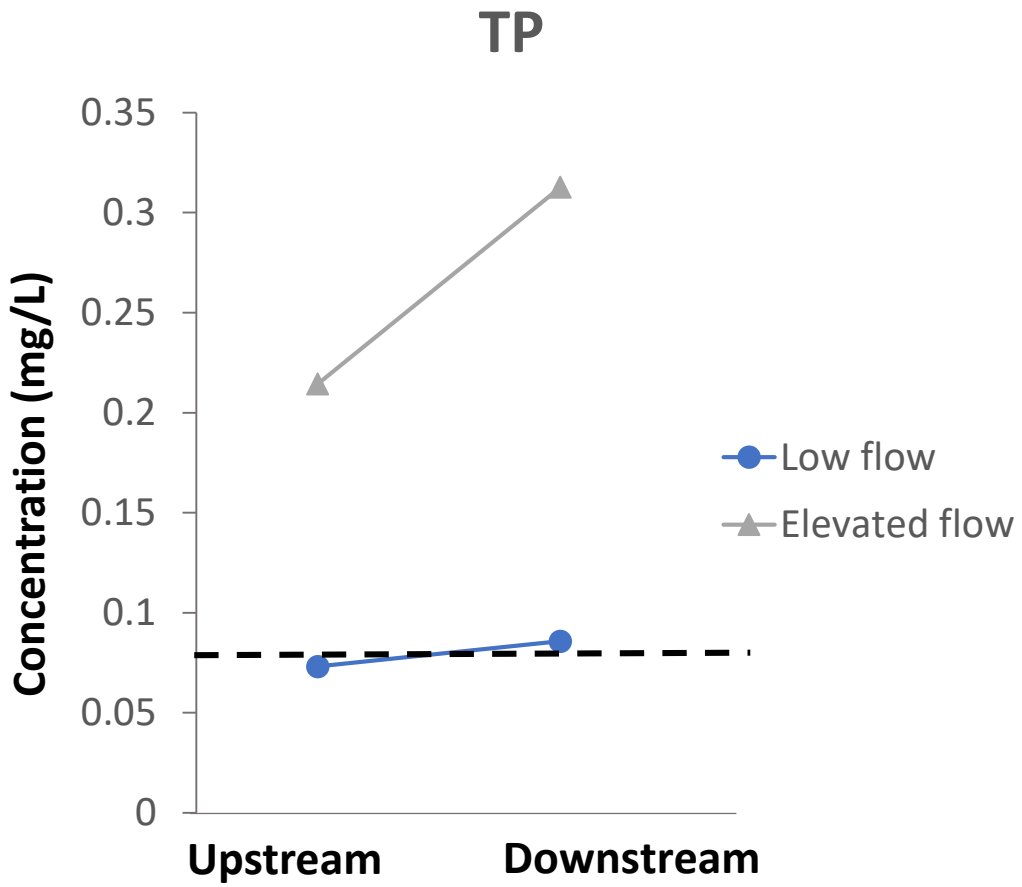
Sampling sites

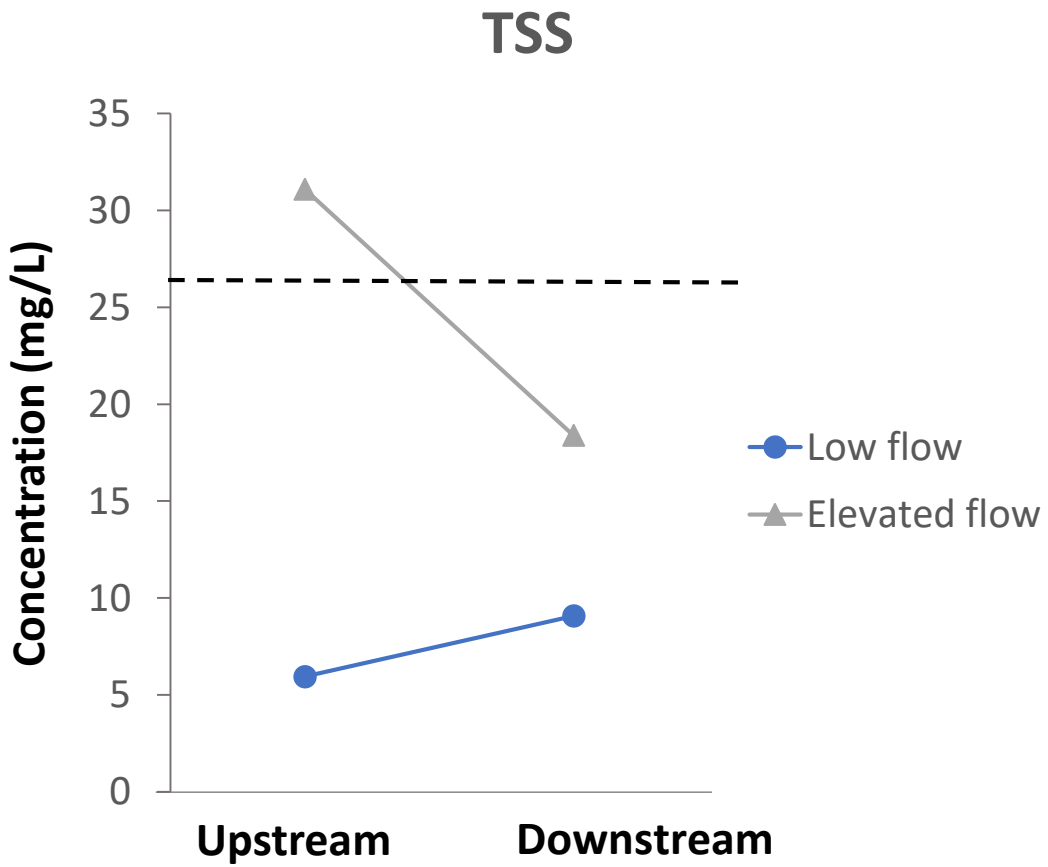


Nutrient concentrations change upstream to downstream



Nutrient concentrations change upstream to downstream





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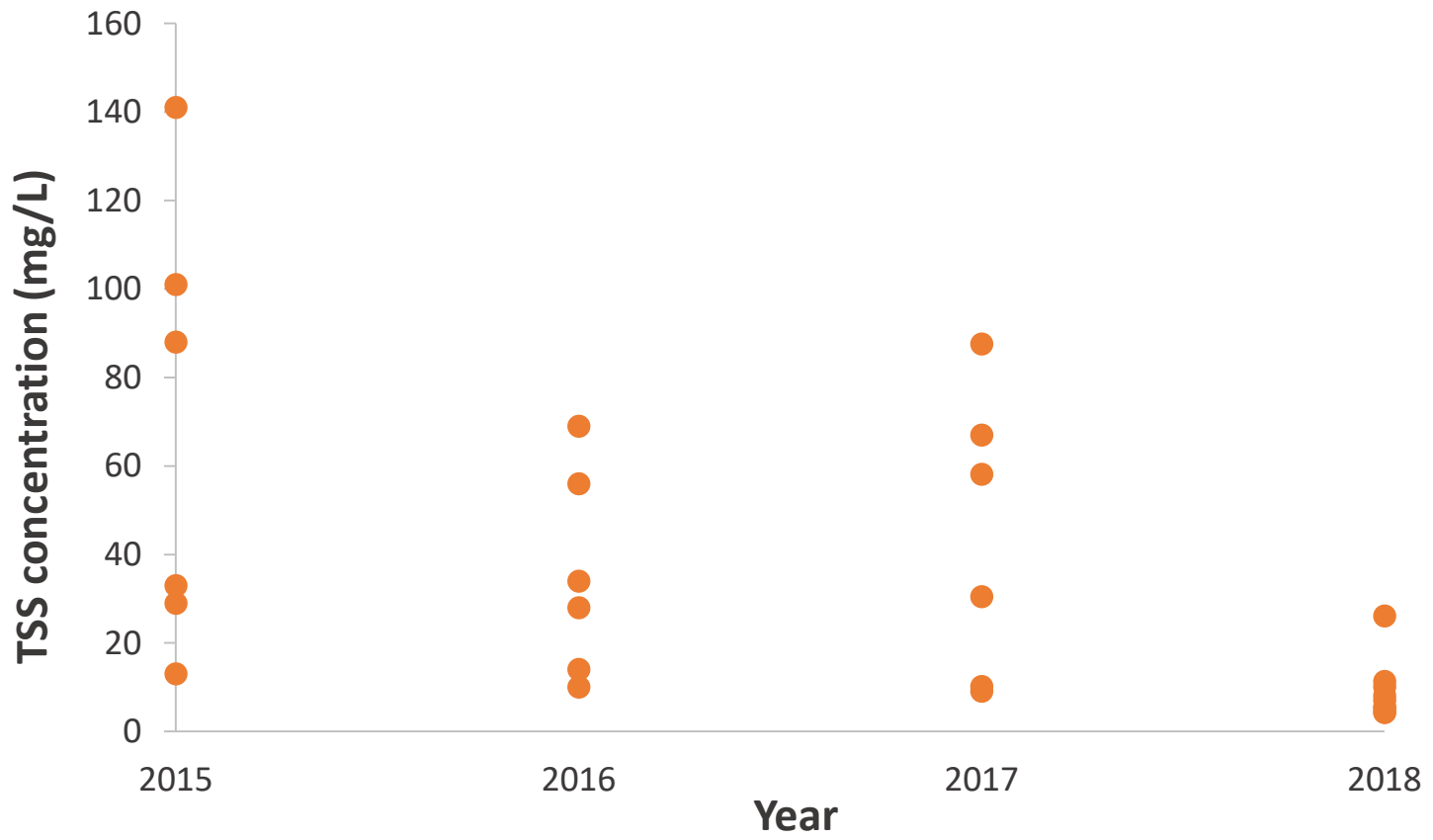
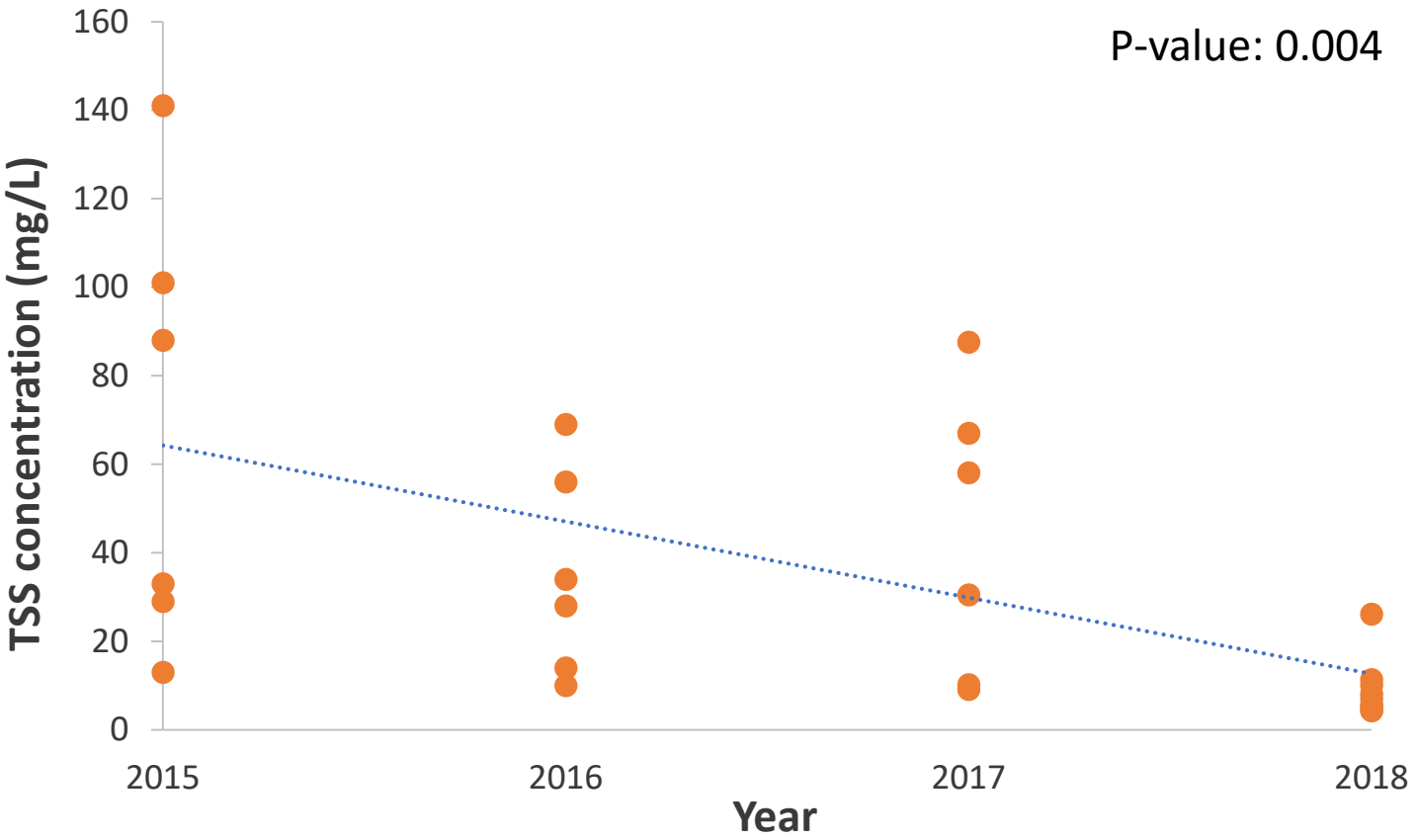
TSS concentrations 2015 - 2018



TSS concentrations 2015 - 2018



TP, TSS, and NOx decreased from 2015 - 2018

SWAN	P-VALUE	TREND
TP	**< 0.05**	↘
Ortho-P	NS	--
TSS	**< 0.05**	↘
$NO_2 + NO_3$	**< 0.05**	↘
TKN	NS	--

MURPHY	P-VALUE	TREND
TP	NS	--
Ortho-P	NS	--
TSS	NS	--
$NO_2 + NO_3$	**< 0.05**	↘
TKN	NS	--

Community Engagement

Water Quality Monitoring

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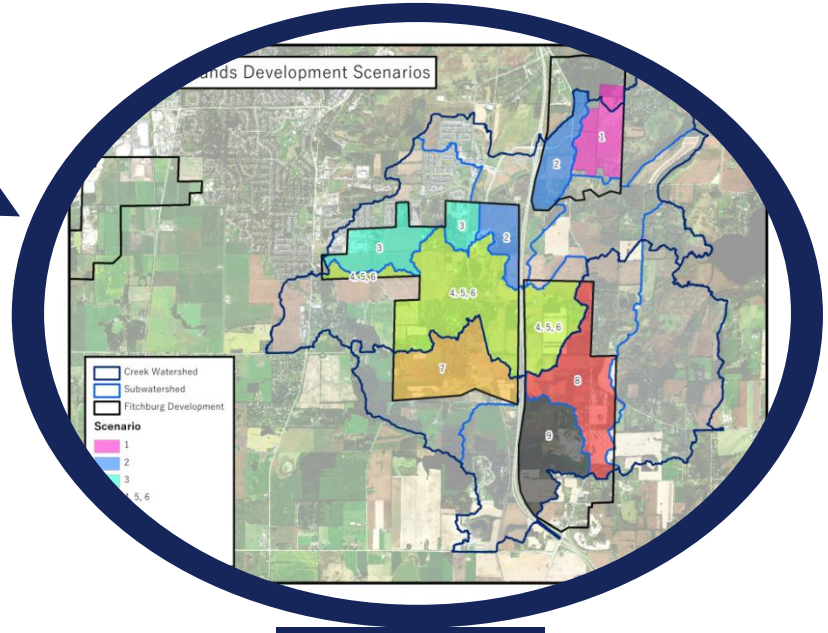

Modeling

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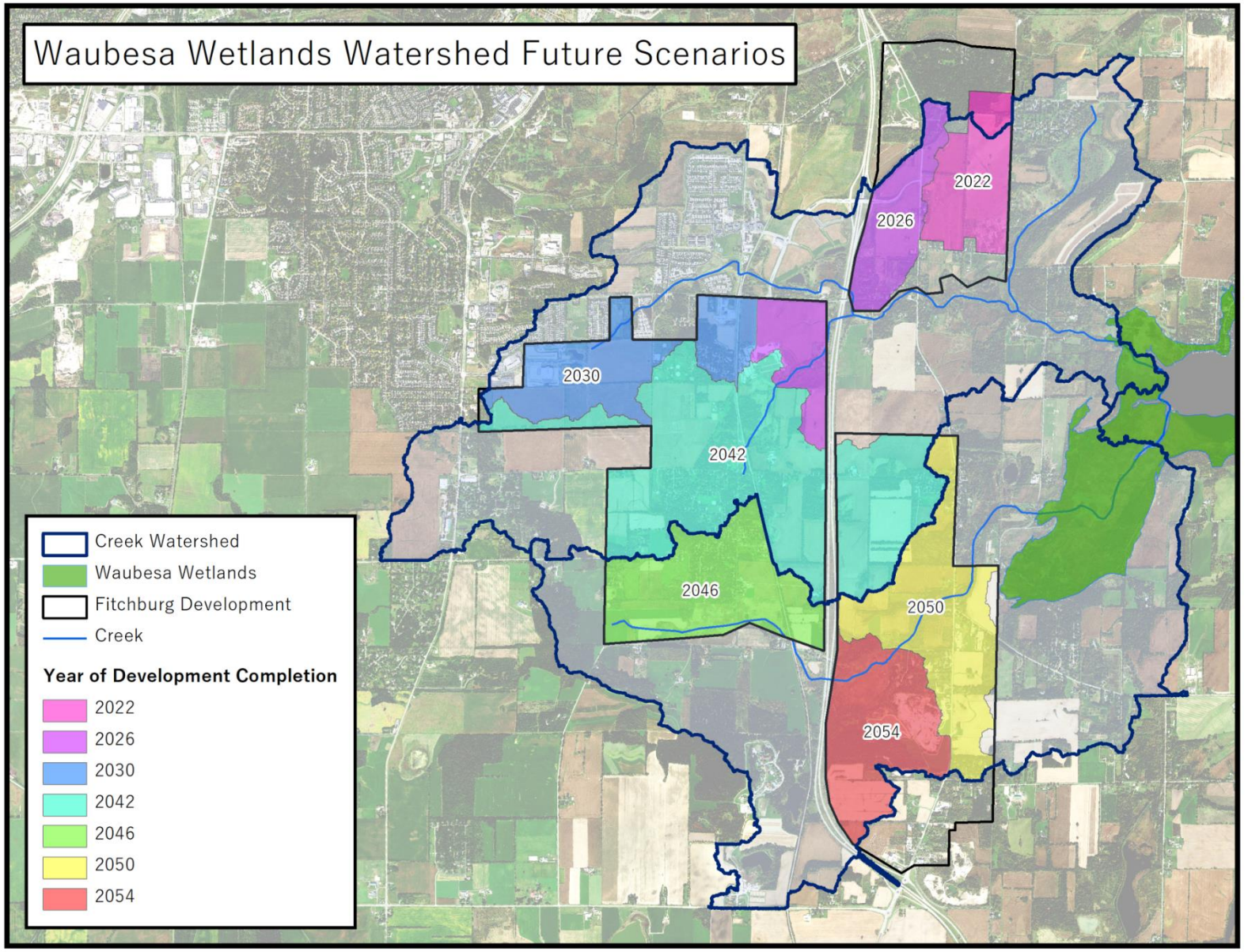
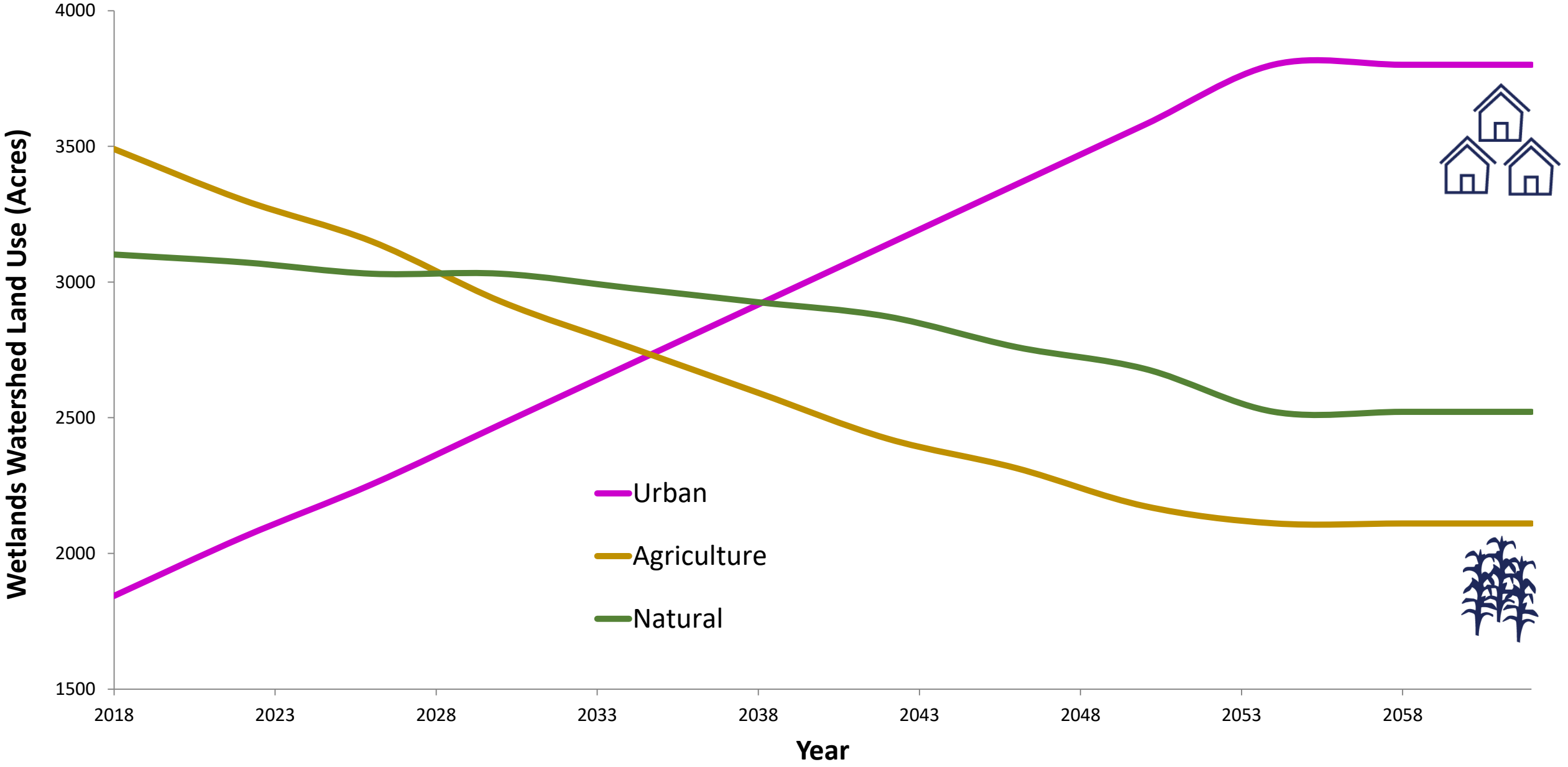

Waubesa Wetlands Watershed Future Scenarios
2022
2026
2030
2042
2046
2050
2054
Creek Watershed
Waubesa Wetlands
Fitchburg Development
Creek
Year of Development Completion
2022
2026
2030
2042
2046
2050
2054

Increasing urbanization



Surface water models

HydroCAD

- Water *quantity*
- Predicts stream peak flow and volume
- Based on synthetic storms

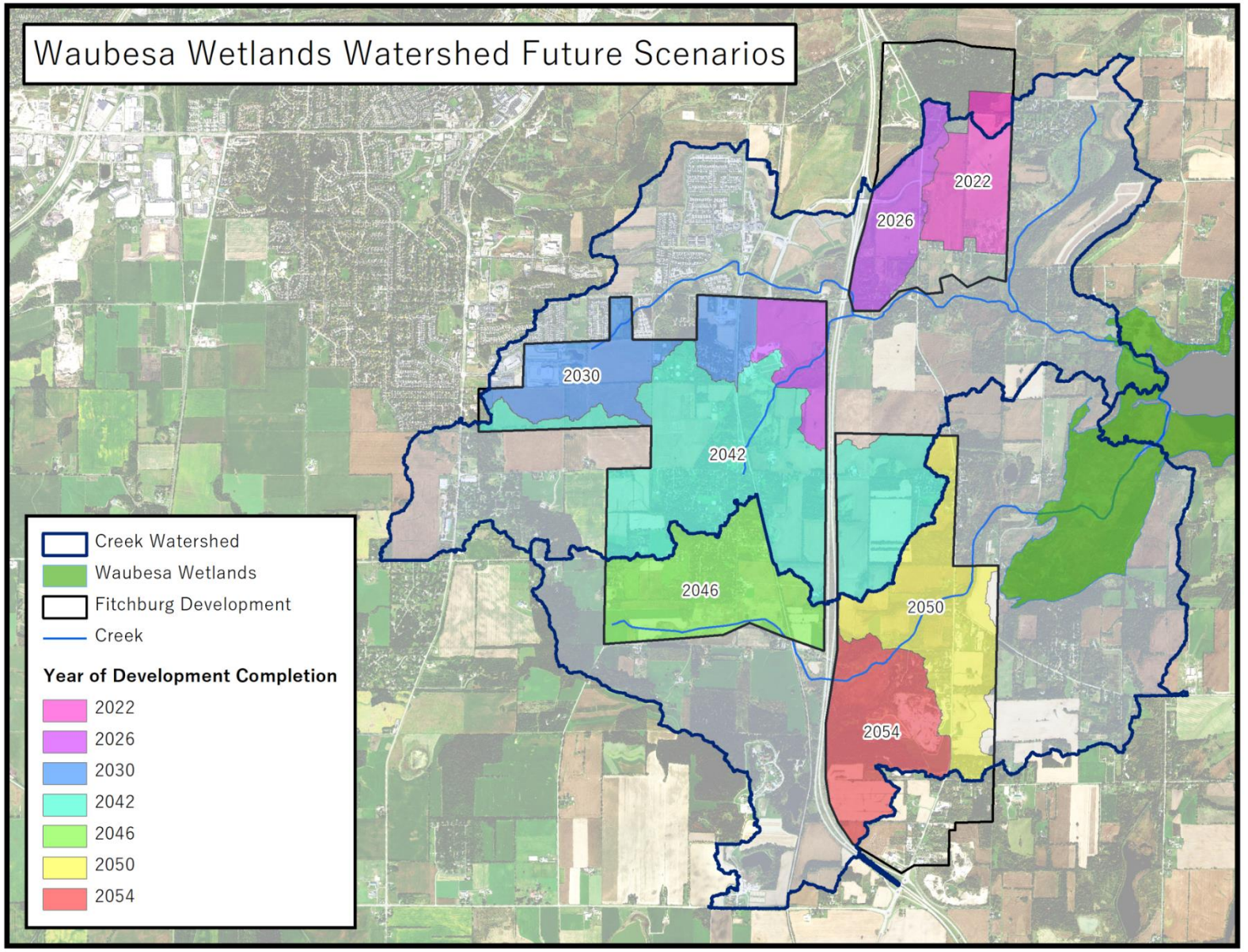
STEPL

- Water *quality*
- Estimates pollutant loads
- Based on land use and BMPs

Water *quantity* modeling

Four Scenarios:

Climate Change	Watershed Development
Climate Change Watershed Development	Climate Change Watershed Development No Stormwater Management



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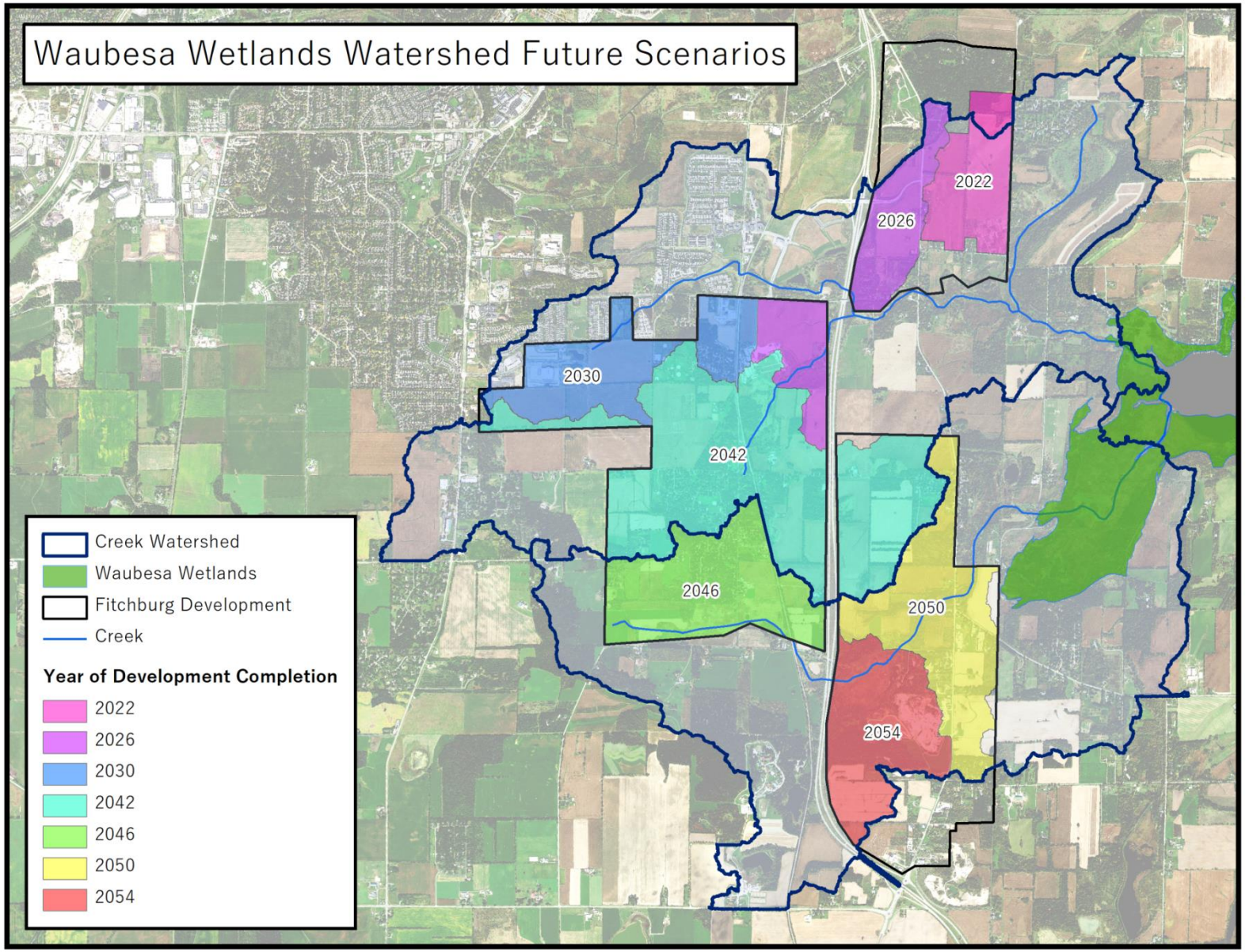
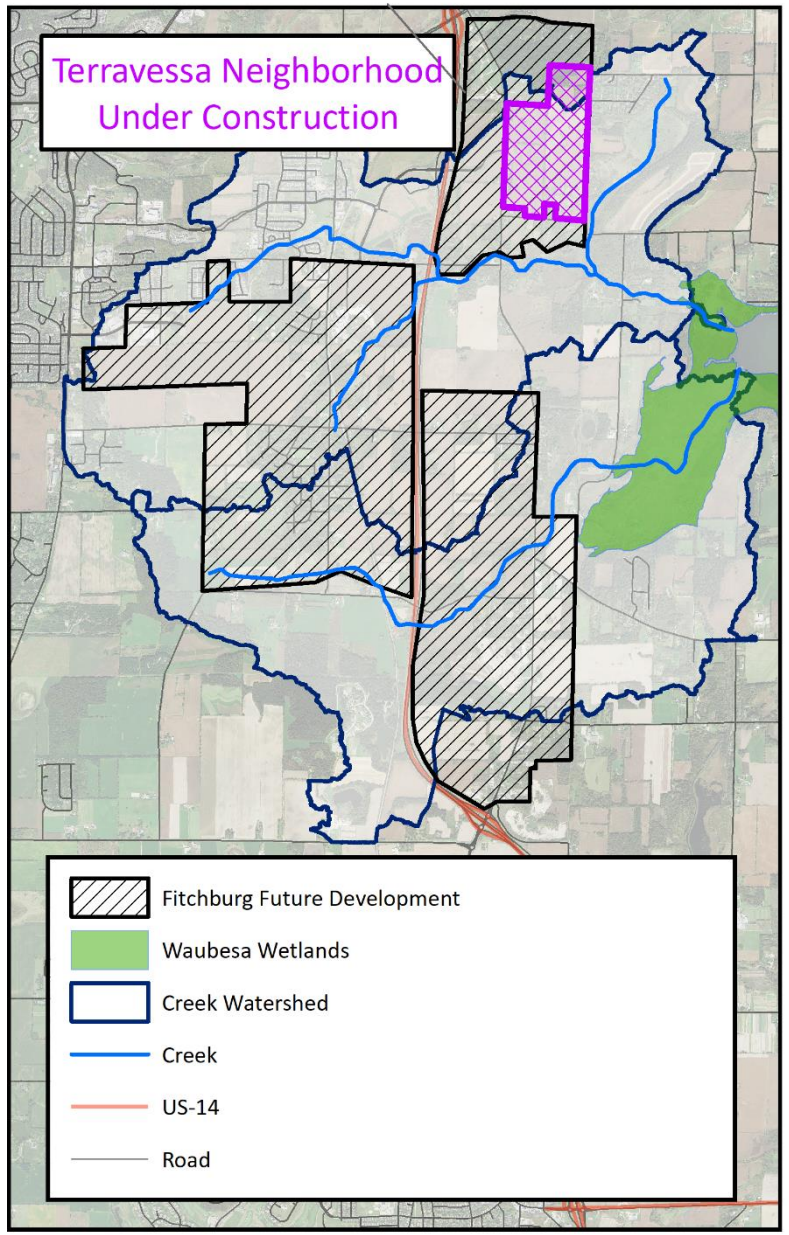


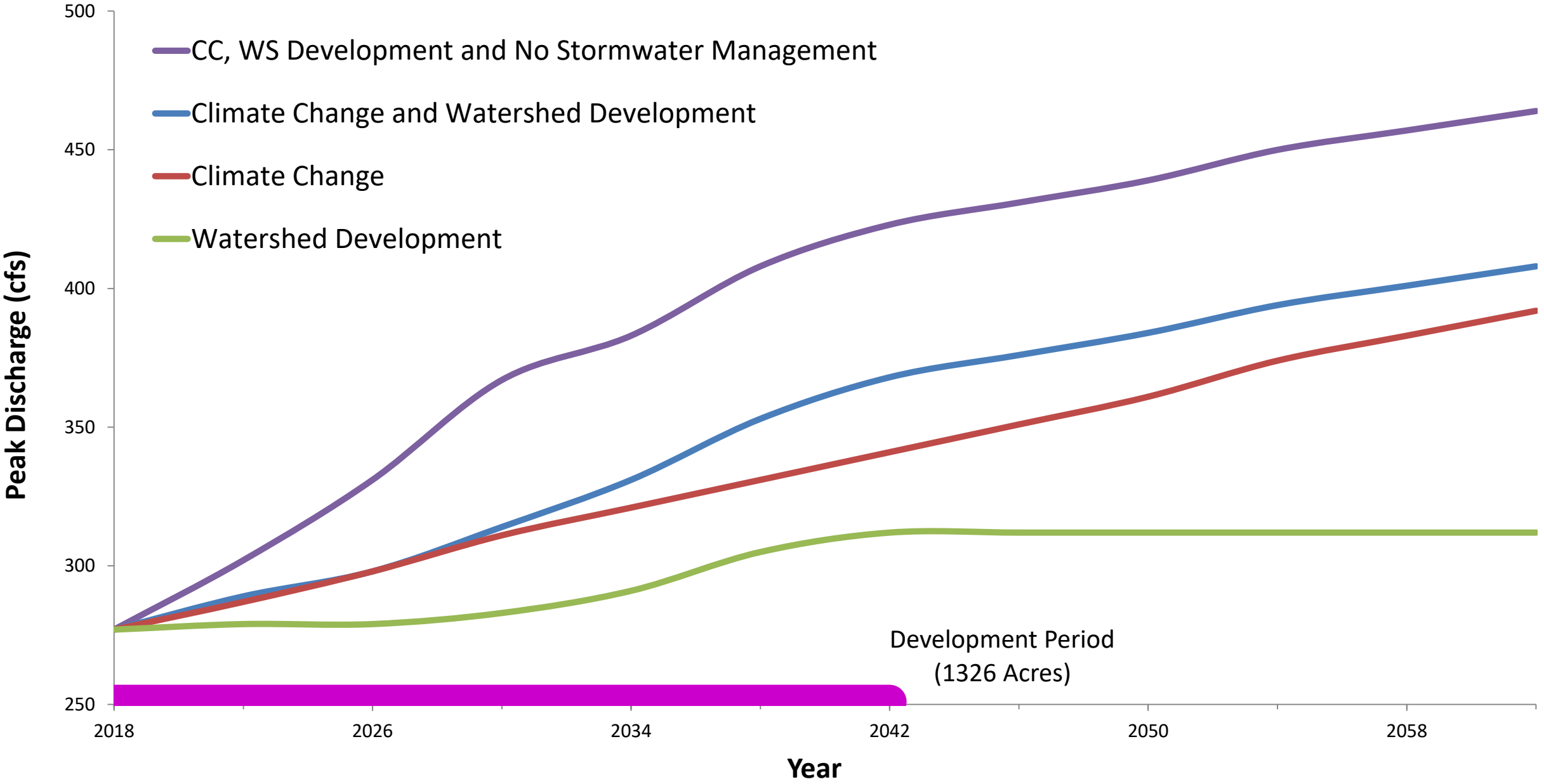
Water *quantity* modeling

The Terravessa Neighborhood

- Control peak flow rates to predevelopment conditions
- Maintain 90% “stay-on” volume of predevelopment conditions
- Retain 80% of sediment



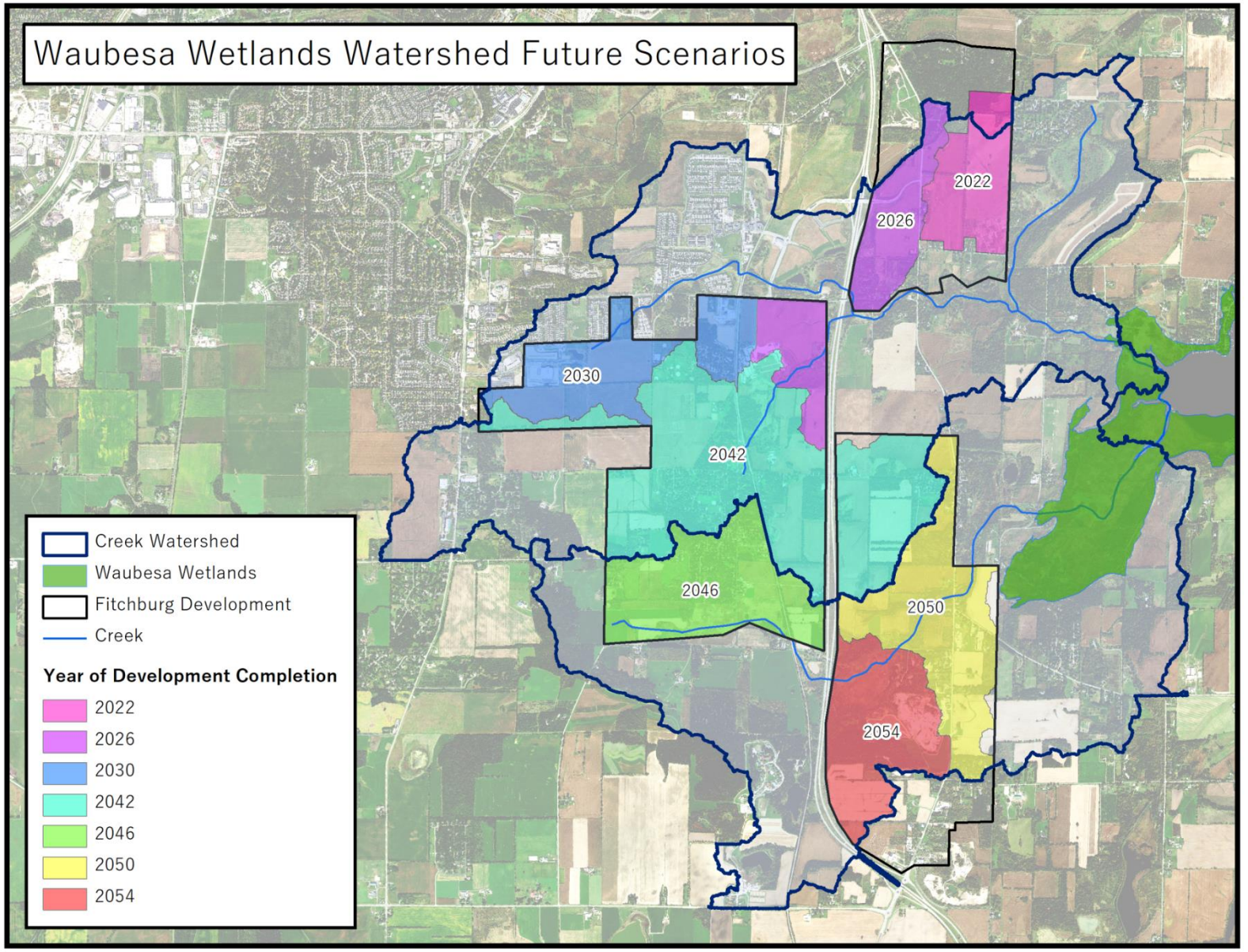
Peak discharge increases



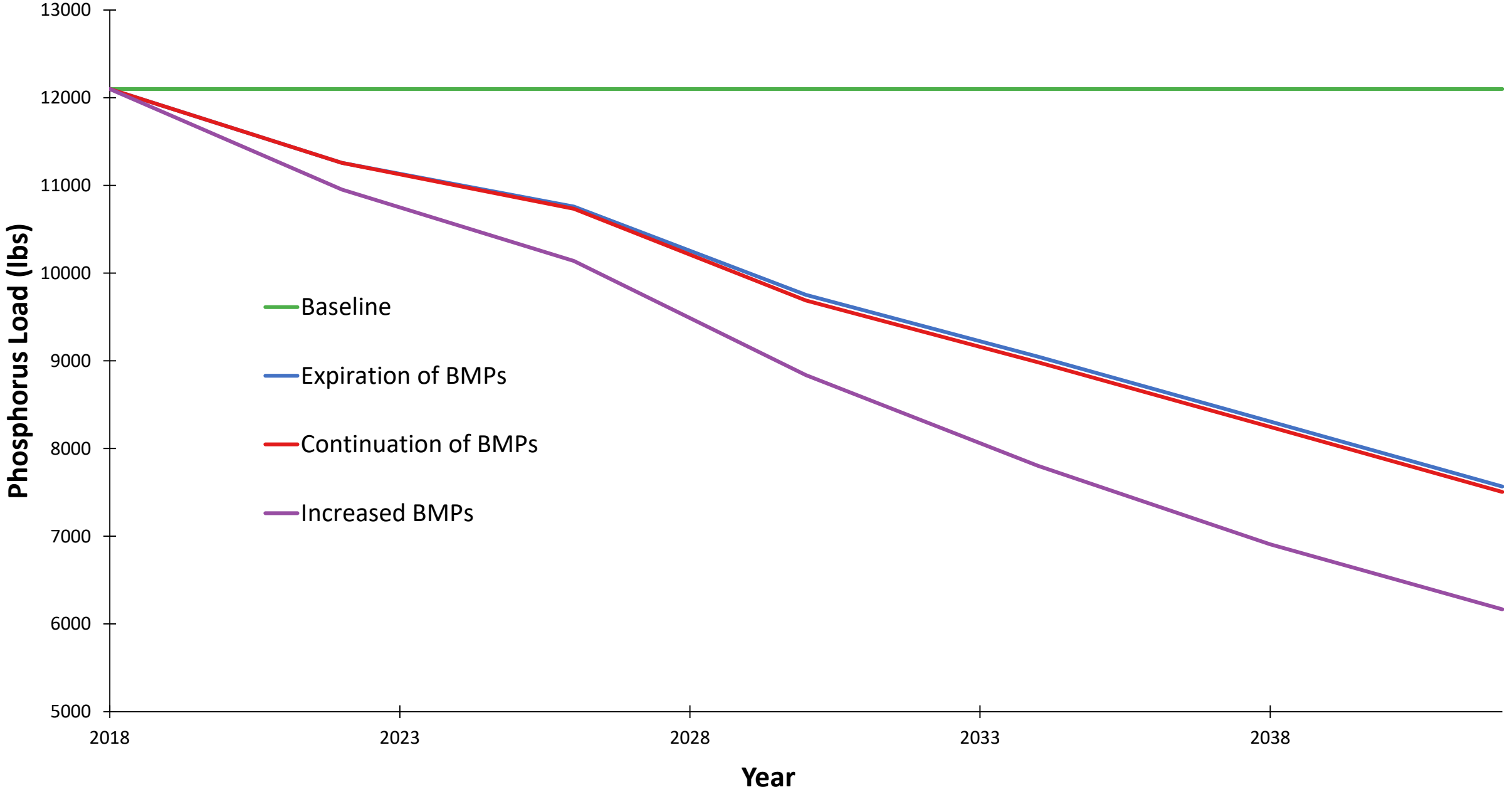
Water *quality* modeling

Four Scenarios:

Baseline	Expiration
Continuation of existing	Expanded implementation



Phosphorus loads decrease



Management Recommendations

1. Build a long-term surface water dataset.

- **Monitor** through development
- Develop a **rating curve** for Swan Creek
- Increase support for **citizen science**

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3. **Coordinate future land management at a watershed scale.**

   - Consider **cumulative effects** of land use change
   - **Restore** target upstream areas
   - Harmonize **upstream and downstream actions**

Community Engagement

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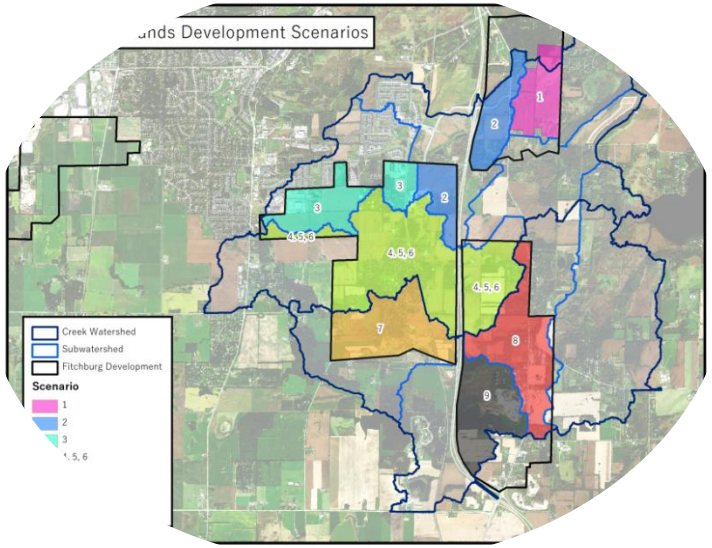

Modeling


NELSON
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Special Acknowledgements

Sarah Fuller[1,2]

Anita Thompson[1]

Sharon Long[1]

1. UW-Madison
2. CARPC

Acknowledgements

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Dane County Natural Resources Education Center
Joanne Kleine
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Eric Thompson (MSA)
Mike Kakuska (CARPC)
Ryan Stenjen (MA)
Beverly Nevalga (UW-Madison)
Nick Miller (TNC)

Landowners

Questions?