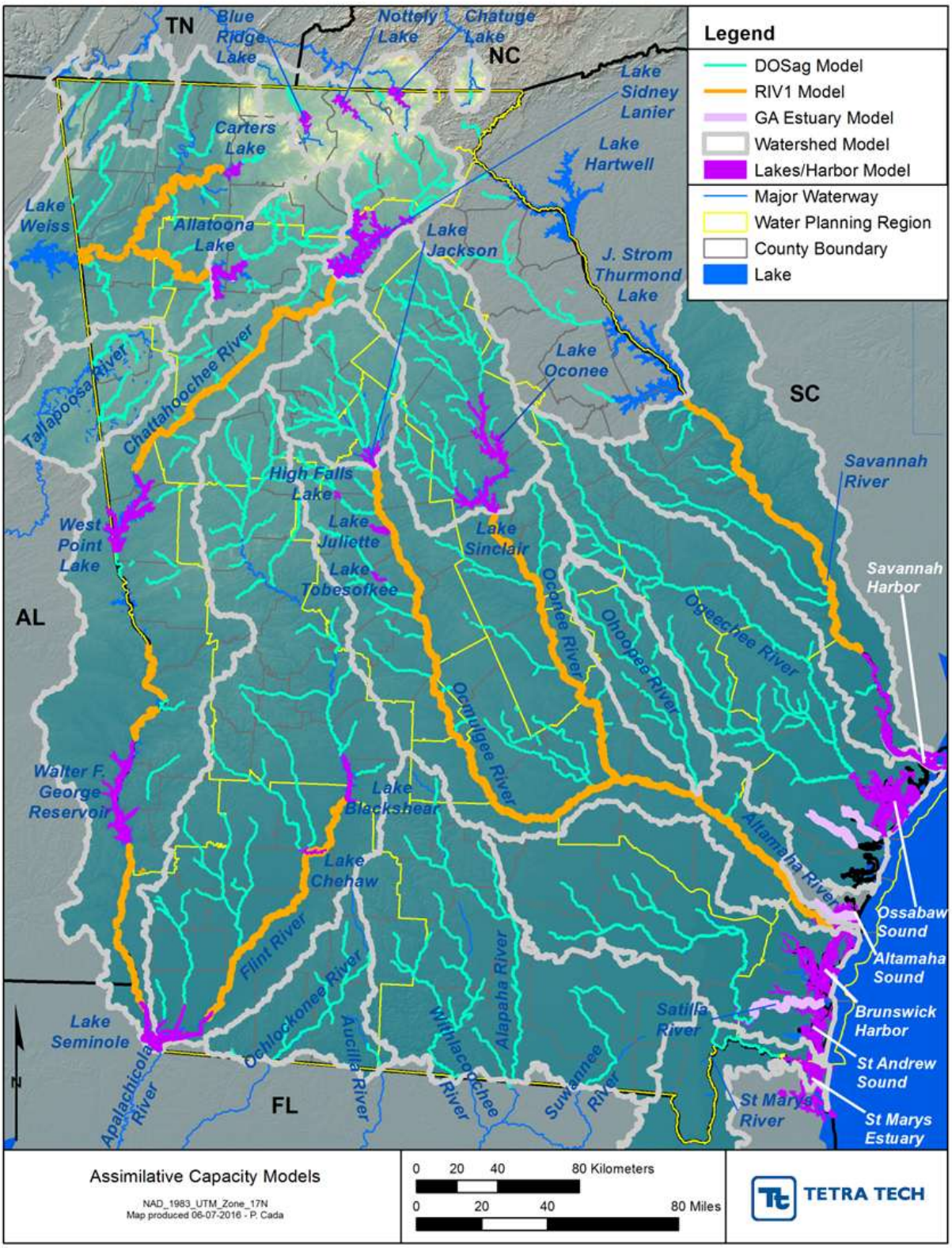
UPDATED WATER QUALITY (ASSIMILATIVE CAPACITY) ASSESSMENT
FLINT BASIN



PERMITTED FACILITY INFORMATION

FLINT BASIN

Changes in Permit Limits Associated with Modeling Assumptions under Future Conditions (2050)

- **Permitted wastewater discharge facilities were modeled under current conditions using their current permit limits**.
- The annual average discharge flow from each facility for the year 2014 was projected forward to 2050 using a population-based percent change (based on the percent change in County-level population projections between 2014 and 2050). The resulting **2050 projected discharge flow** was then compared to the current permitted flow limit.
  - Where the 2050 projected discharge flow was 85% or more of the current permitted flow limit, an assumption was made that the facility's permitted flow would be increased prior to 2050 to provide for both operational flexibility and increased demands. In such instances, the current permitted flow limit was doubled to provide an **increased permitted flow limit** to use in the future conditions modeling effort.
    - Example: 2014 annual avg. discharge flow = 1.2 MGD
      Permitted flow limit = 1.5 MGD
      20% increase in population from 2014 to 2050
      2050 projected discharge flow = 1.44 MGD (which is 96% of the current permitted flow limit)
      Permitted flow limit of 1.5 MGD doubled to 3.0 MGD for future conditions modeling
  - **10%** of the permitted wastewater discharge facilities in the Flint Basin were assigned an **increased permitted flow** limit for future conditions modeling purposes based on the above assumptions.
- **Additional assumptions** were incorporated into the future conditions modeling regarding each facility's permit limits for biochemical oxygen demand (BOD), dissolved oxygen (DO) and ammonia (NH_3). The assumptions included:
  - New or tighter ammonia limits would **meet the 2013 Ammonia Criteria**; affects 72% of permits
  - Tighter biochemical oxygen demand limits would **meet the instream DO criteria;** affects 26% of permits
  - New or tighter dissolved oxygen limits would **meet the instream DO criteria**; affects 10% of permits

Changes in Permit Limits Associated with Modeling Assumptions under Future Conditions (2050)

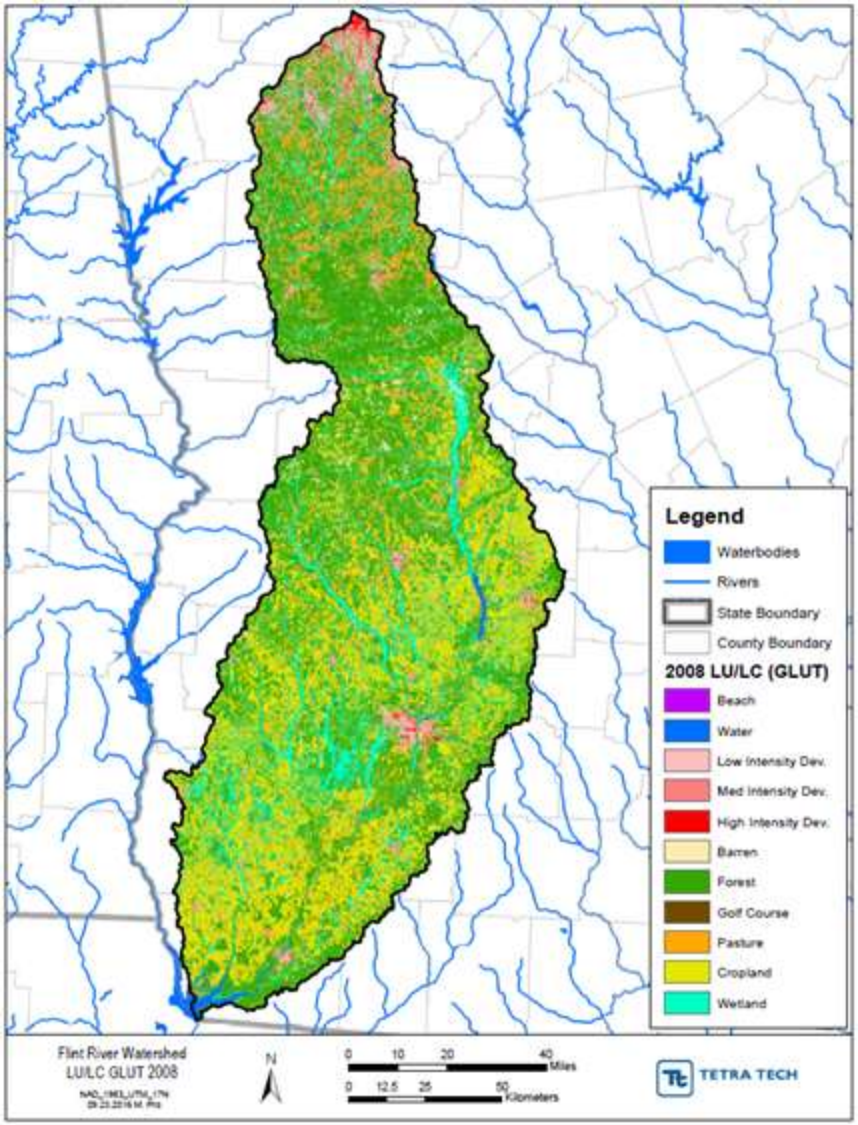
River Basin	Number of Permitted Facilities	Number of Facilities with Increase Permitted Flow in 2050	Number of Facilities with Tighter BOD limits in 2050	Number of Facilities with Tighter NH_3 limits in 2050	Number of Facilities with Tighter DO limits in 2050
Flint	**58**	**6**	**15**	**42**	**6**

BOD = biochemical oxygen demand
NH_3 = ammonia
DO = dissolved oxygen

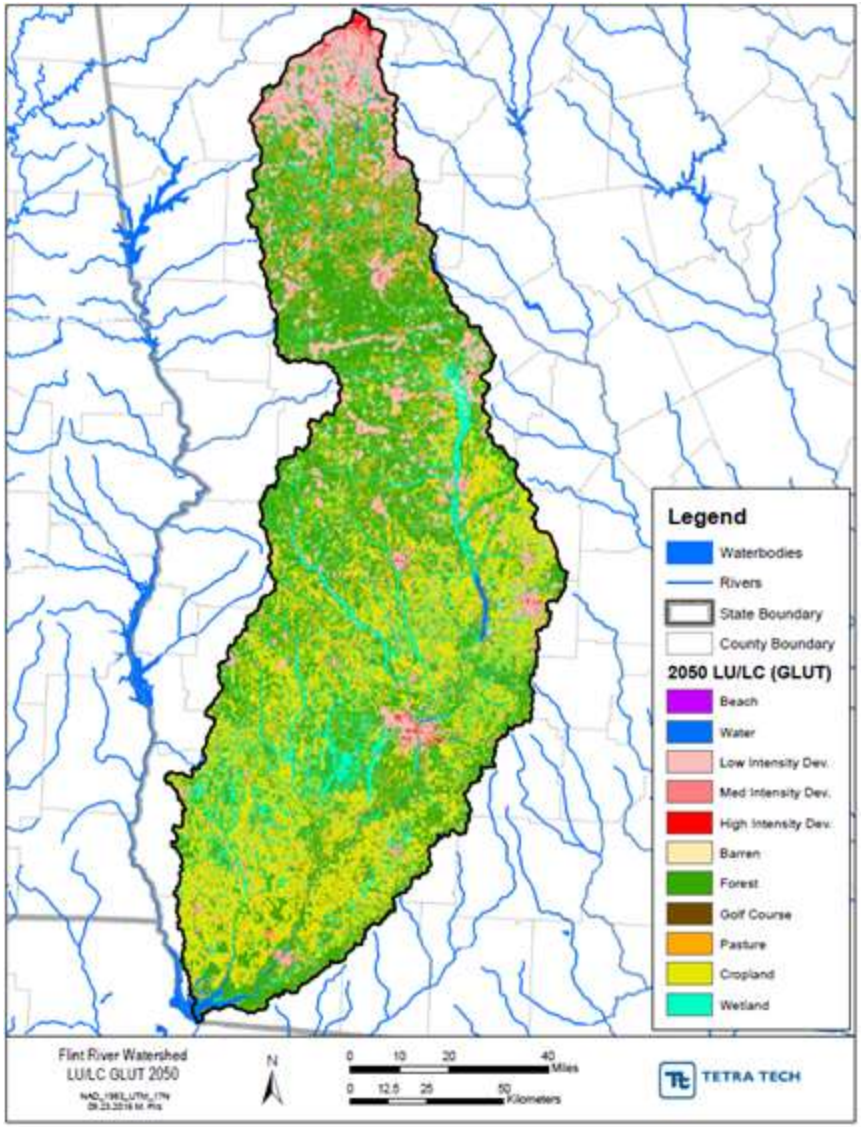
CURRENT AND PROJECTED LAND USE

FLINT BASIN

Flint Landuse (2008)



Flint Landuse (2050)



Changes in Landuse between 2008 and 2050

Landuse	Flint	
	2008	2050
Beaches/Dunes/Mud	0.15%	0.13%
Open Water	1.04%	1.00%
Utility Swaths	0.29%	0.25%
Developed, Open Space	3.62%	7.97%
Developed, Low Intensity	2.26%	3.99%
Developed, Medium Intensity	0.29%	0.43%
Developed, High Intensity	0.03%	0.03%
Clearcut/Sparse	3.78%	3.31%
Quarries/Strip Mines	0.10%	0.07%
Rock Outcrop	0.00%	0.00%
Deciduous Forest	13.15%	12.17%
Evergreen Forest	23.27%	20.83%
Mixed Forest	5.95%	5.45%
Golf Courses	0.02%	0.01%
Pasture	7.58%	5.60%
Row Crop	13.37%	9.18%
Irrigated Row Crop	11.81%	15.92%
Forested Wetland	11.19%	10.88%
Non-forested Salt/Brackish Wetland	0.00%	0.00%
Non-forested Freshwater Wetland	0.39%	0.41%
Developed, Low Intensity (Impervious)	0.63%	1.03%
Developed, Medium Intensity (Impervious)	0.40%	0.56%
Developed, High Intensity (Impervious)	0.45%	0.49%
All Other Impervious	0.00%	0.03%
Landuse Application Systems	0.17%	0.17%
Failed Septic Systems	0.09%	0.08%

GA DOSAG MODEL RESULTS

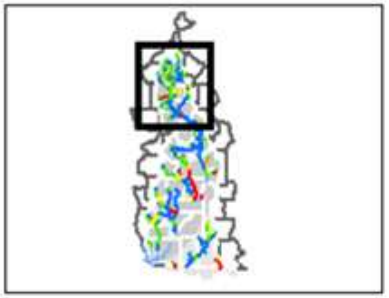
DISSOLVED OXYGEN

CURRENT & FUTURE CONDITIONS

FLINT BASIN

GA DOSAG is a model that estimates dissolved oxygen, showing the effects of oxygen-demanding compounds in wastewater and other factors on instream dissolved oxygen levels. Results indicate how much the dissolved oxygen is above the standard, given the modeled assumptions.

FLINT BASIN: GA DOSAG MODEL RESULTS

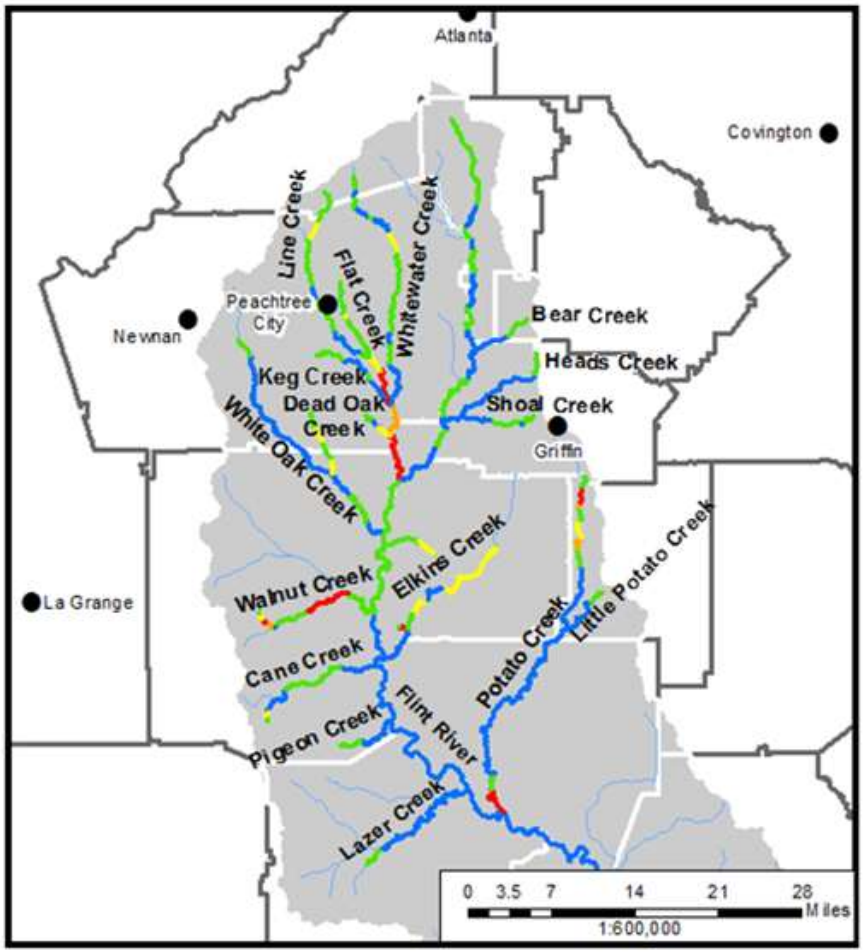


Legend

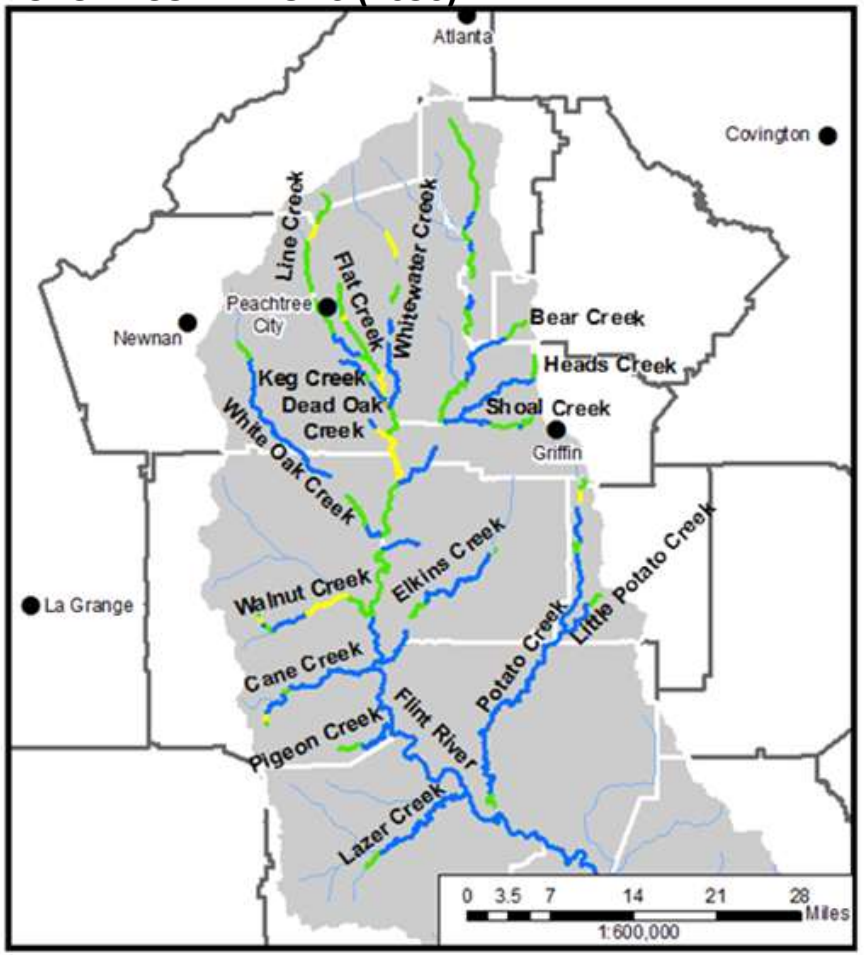
Available Assimilative Capacity

- Very Good ≥ 1 mg/L DO available
- Good 0.5 mg/L to < 1 mg/L DO available
- Moderate 0.2 mg/L to < 0.5 mg/L DO available
- Limited >0 mg/L to <0.2 mg/L DO available
- At Assimilative Capacity 0 mg/L DO available
- None or Exceeded < 0.0 mg/L DO available
- Unmodeled Lakes and Streams

CURRENT CONDITIONS

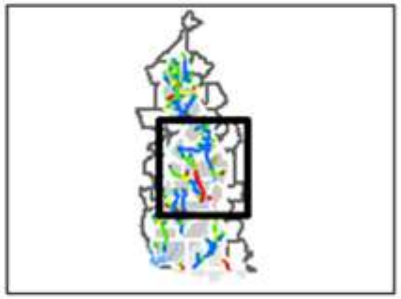


FUTURE CONDITIONS (2050)



Results presented are DRAFT and are subject to change.

FLINT BASIN: GA DOSAG MODEL RESULTS



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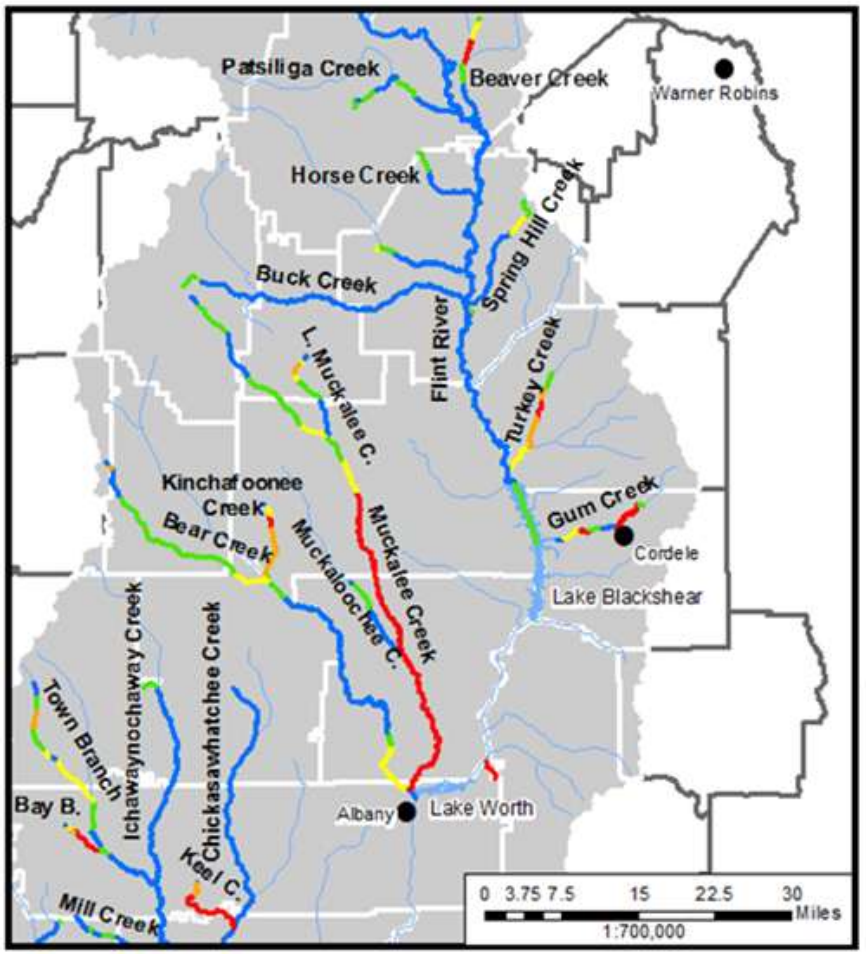
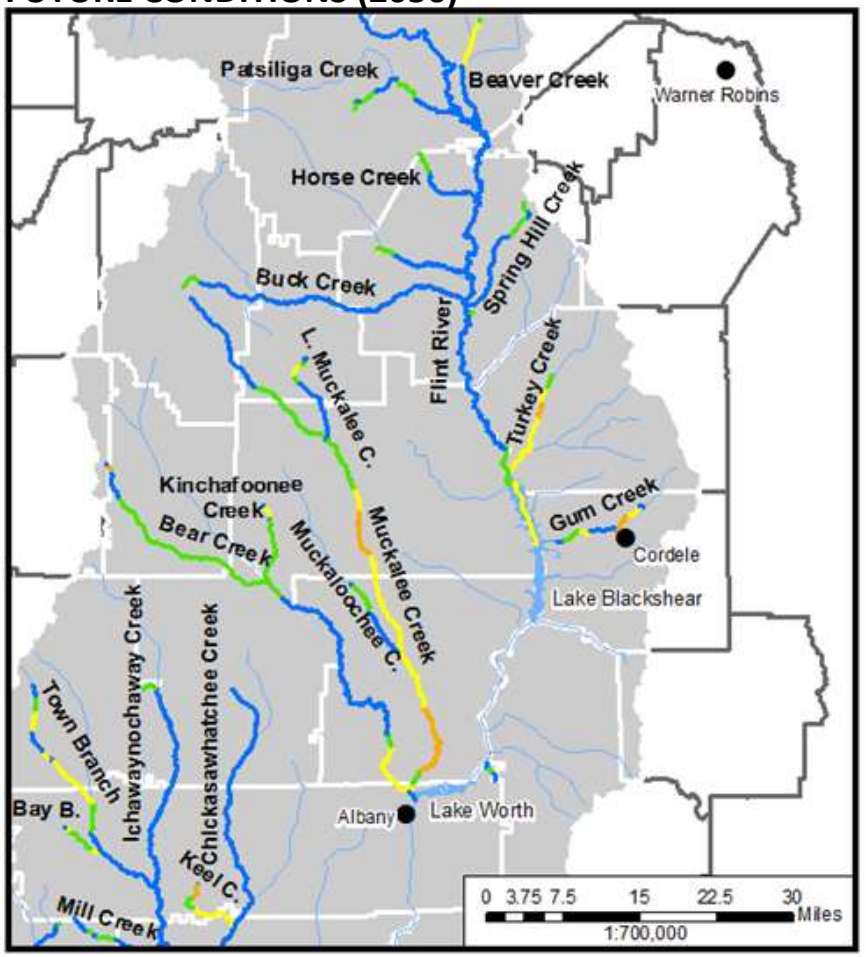
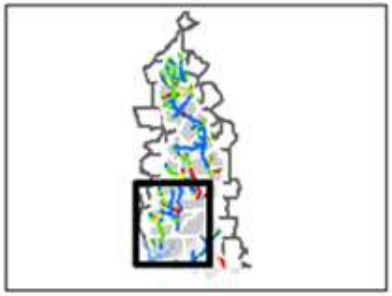
CURRENT CONDITIONS



FUTURE CONDITIONS (2050)



FLINT BASIN: GA DOSAG MODEL RESULTS



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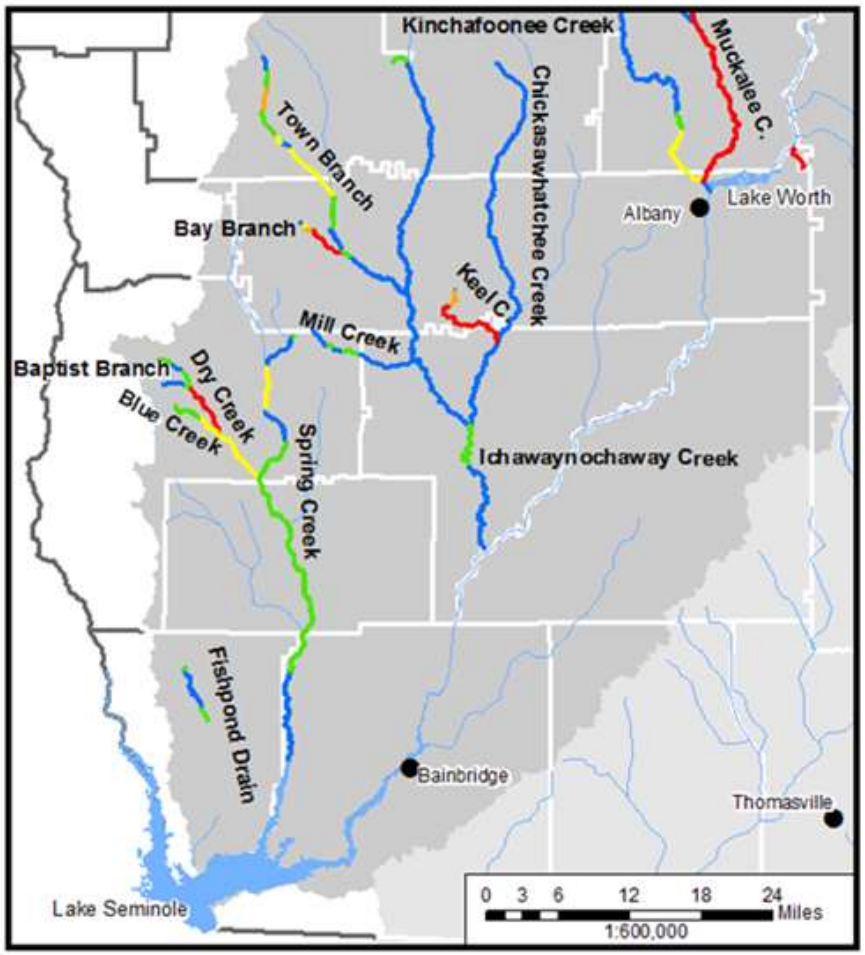
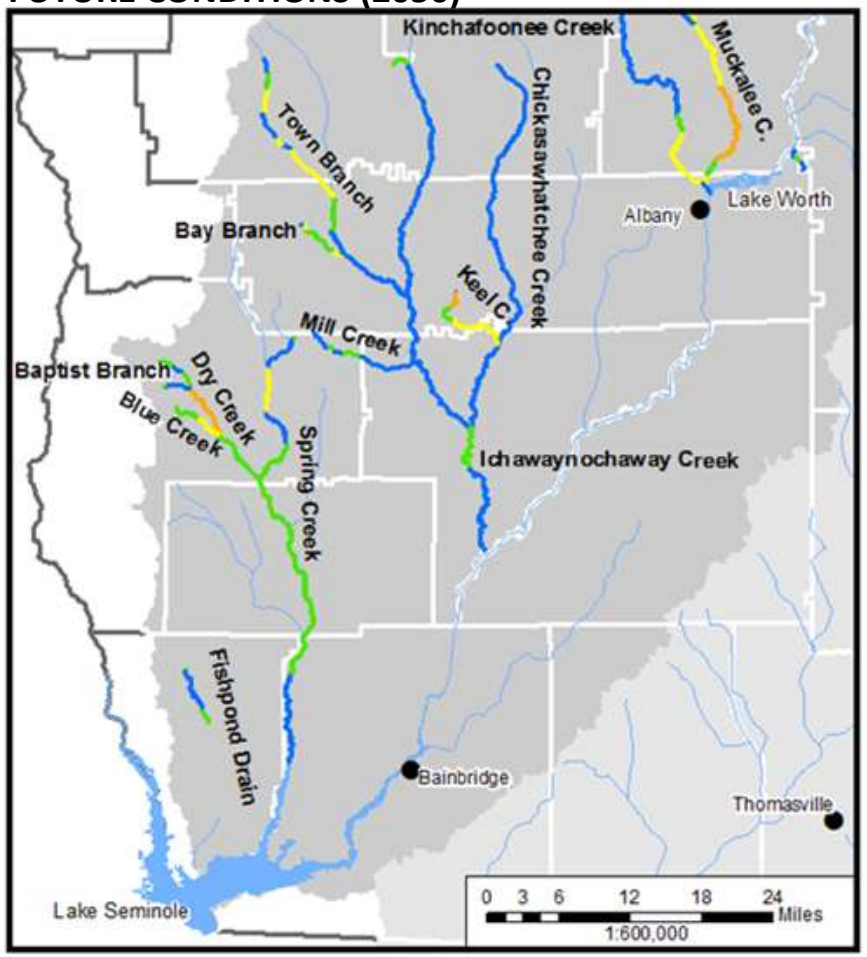
CURRENT CONDITIONS



FUTURE CONDITIONS (2050)



Results presented are DRAFT and are subject to change.

LSPC (WATERSHED) MODEL RESULTS

TOTAL PHOSPHORUS (P)

TOTAL NITROGEN (N)

BIOCHEMICAL OXYGEN DEMAND (BOD)

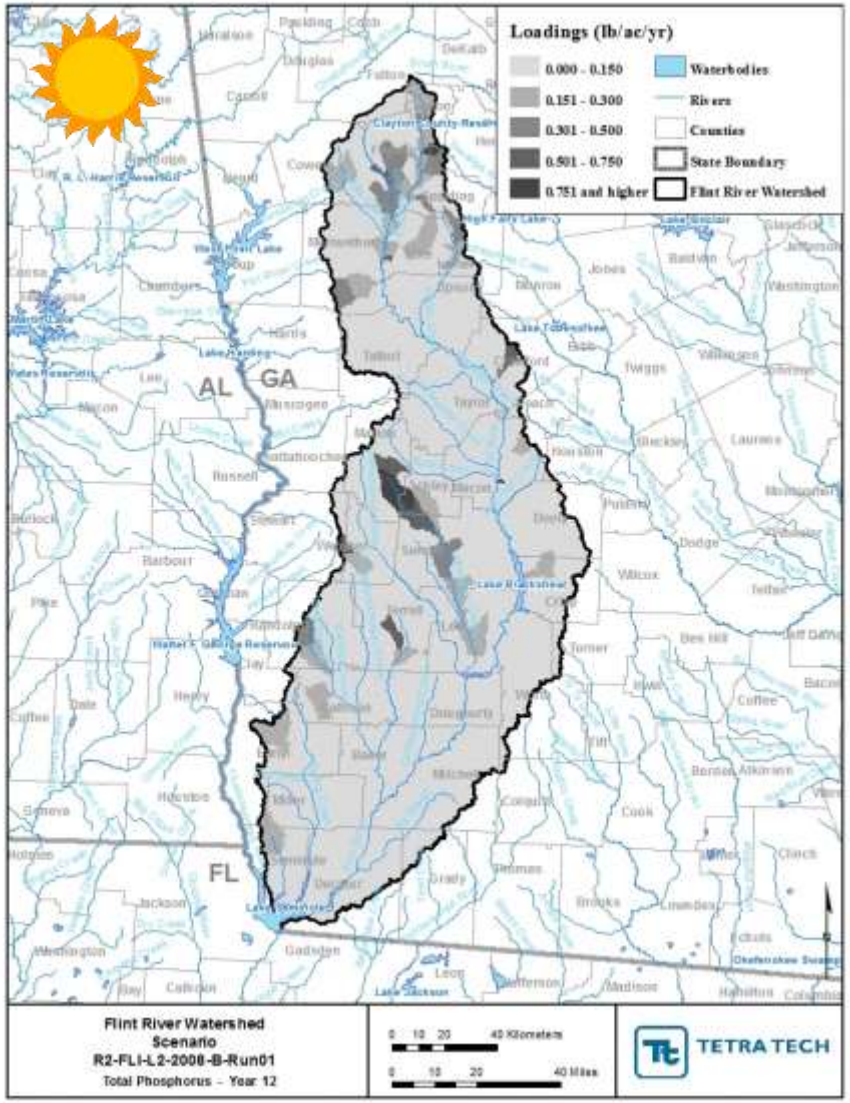
CURRENT & FUTURE CONDITIONS

FLINT BASIN

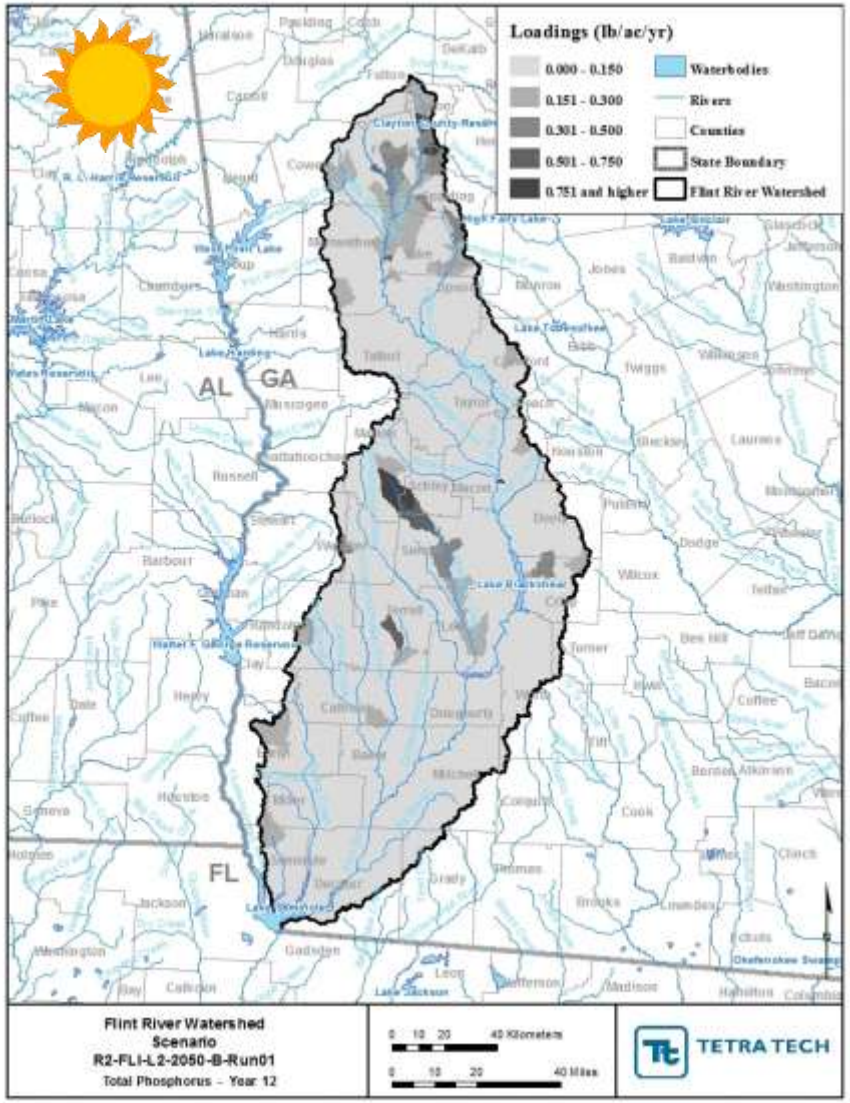
LSPC is a model that estimates the amount (or loading) of a pollutant that enter waterbodies in the basin. This assessment evaluates nutrients (total nitrogen and total phosphorus) and oxygen-demanding compounds (biochemical oxygen demand or BOD). Nutrients and BOD can come from treated wastewater discharges, which may be a larger portion of the total load in drier years, and from stormwater or non-point sources, which may be a larger portion of the load in wetter years. Based on an analysis of rainfall in the Flint basin, the following results are shown for 2012 as the driest year and 2009 as the wettest year in the modeled period.

FLINT BASIN: TOTAL P "HEAT MAPS" – DRY YEAR

CURRENT CONDITIONS

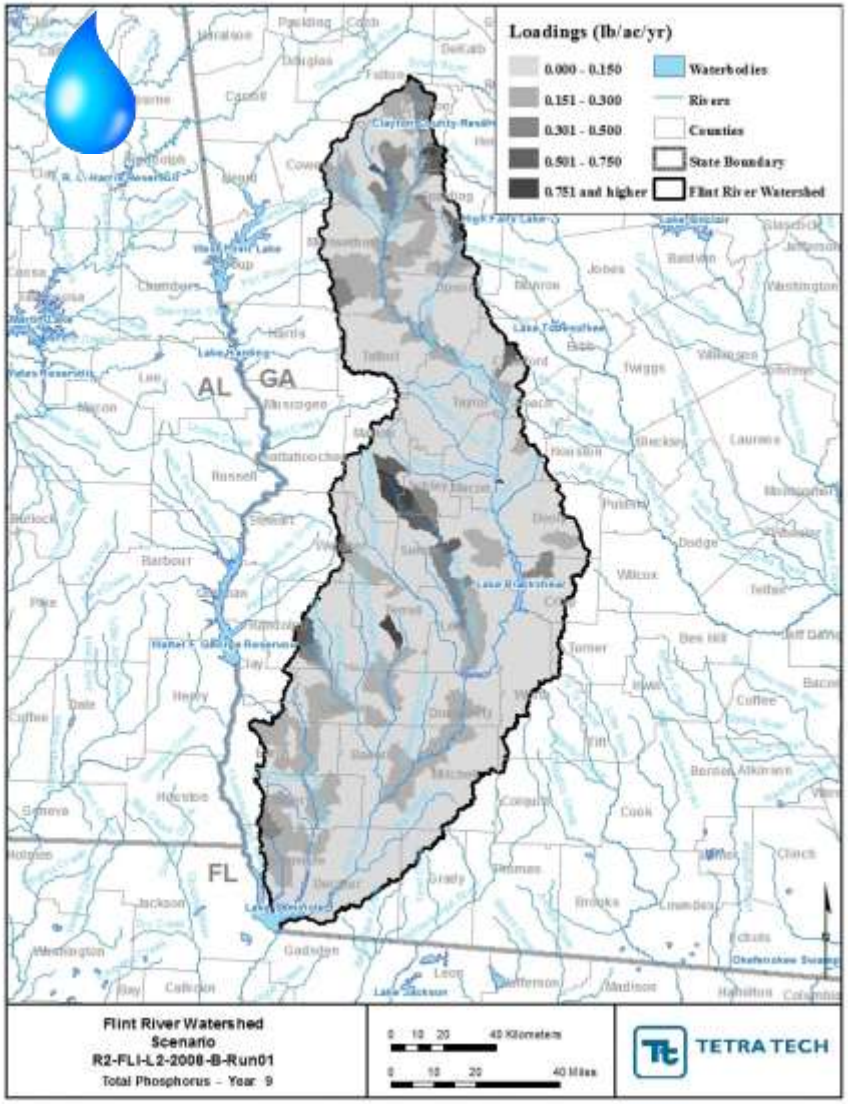


FUTURE CONDITIONS (2050)

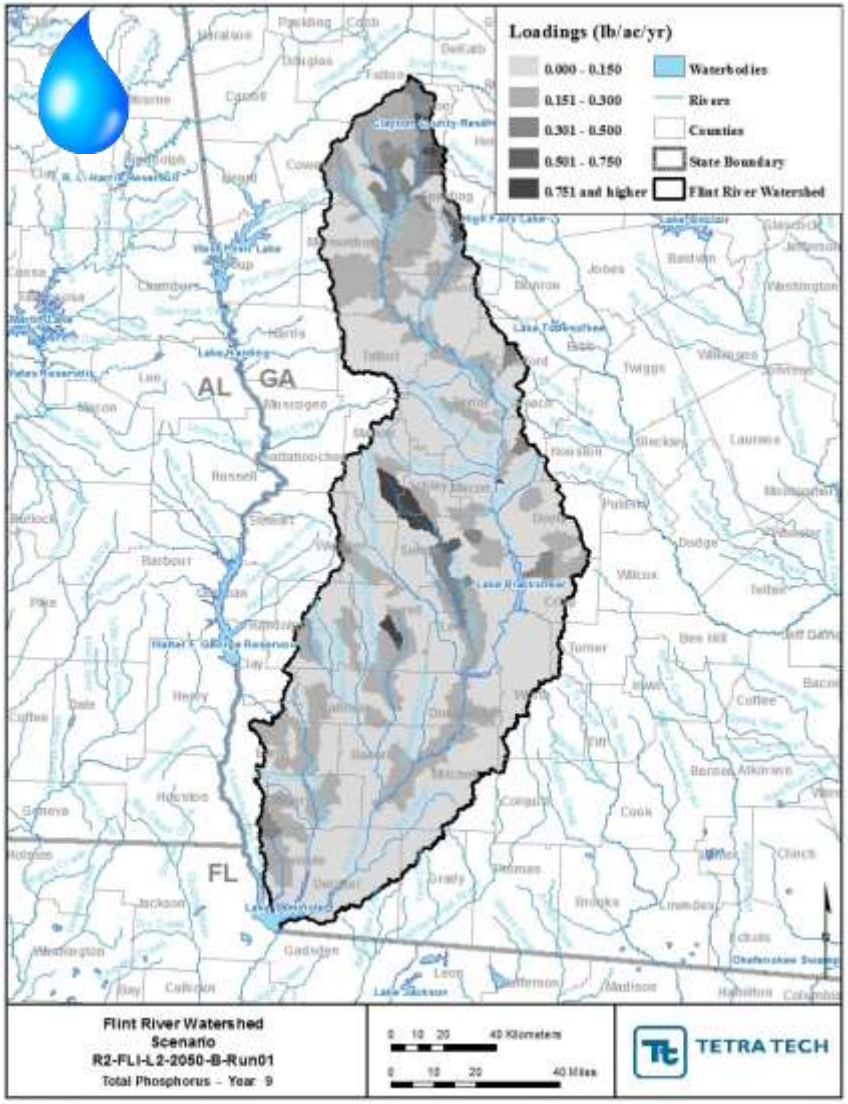


FLINT BASIN: TOTAL P "HEAT MAPS" – WET YEAR

CURRENT CONDITIONS

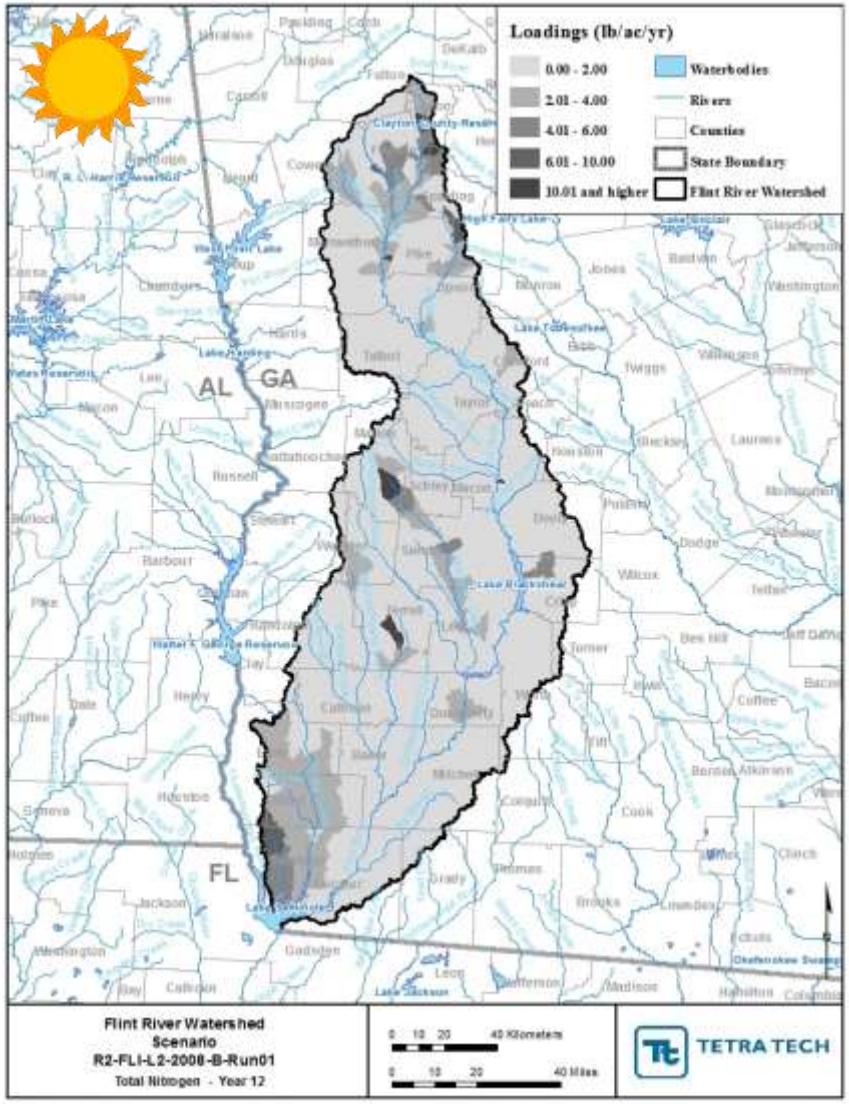


FUTURE CONDITIONS (2050)

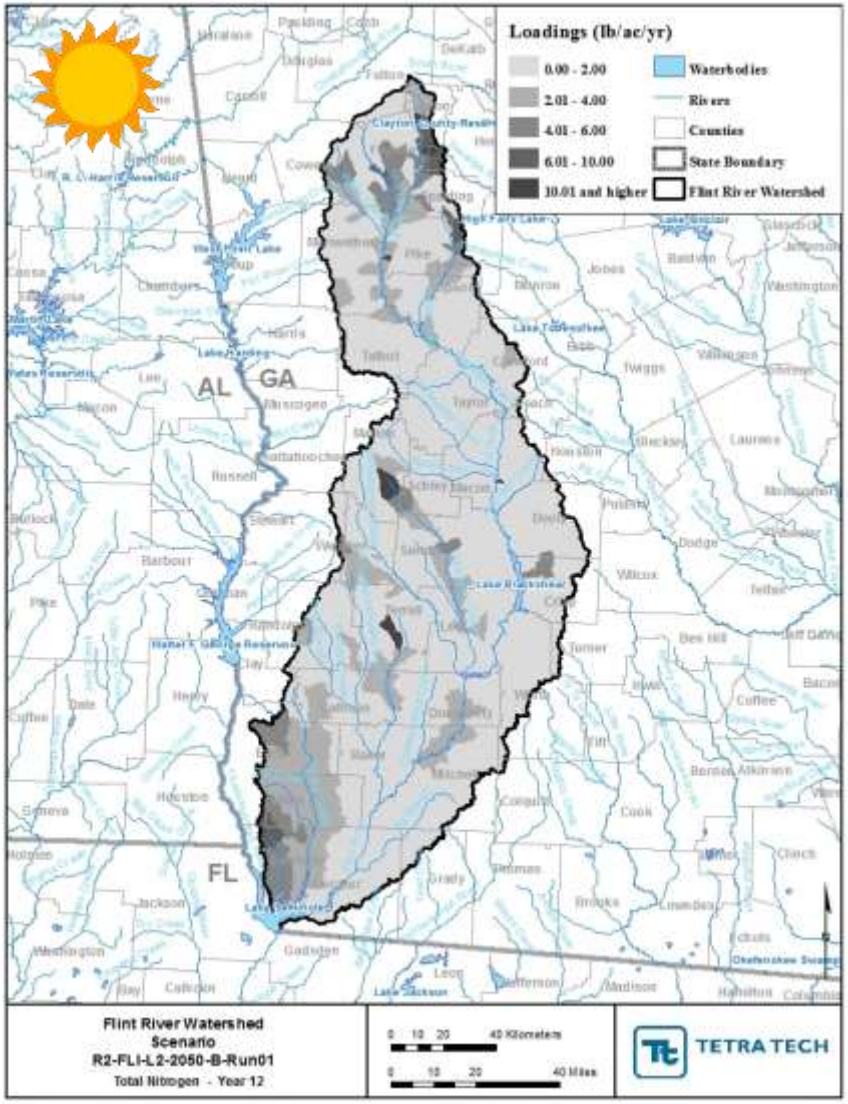


FLINT BASIN: TOTAL N "HEAT MAPS" – DRY YEAR

CURRENT CONDITIONS

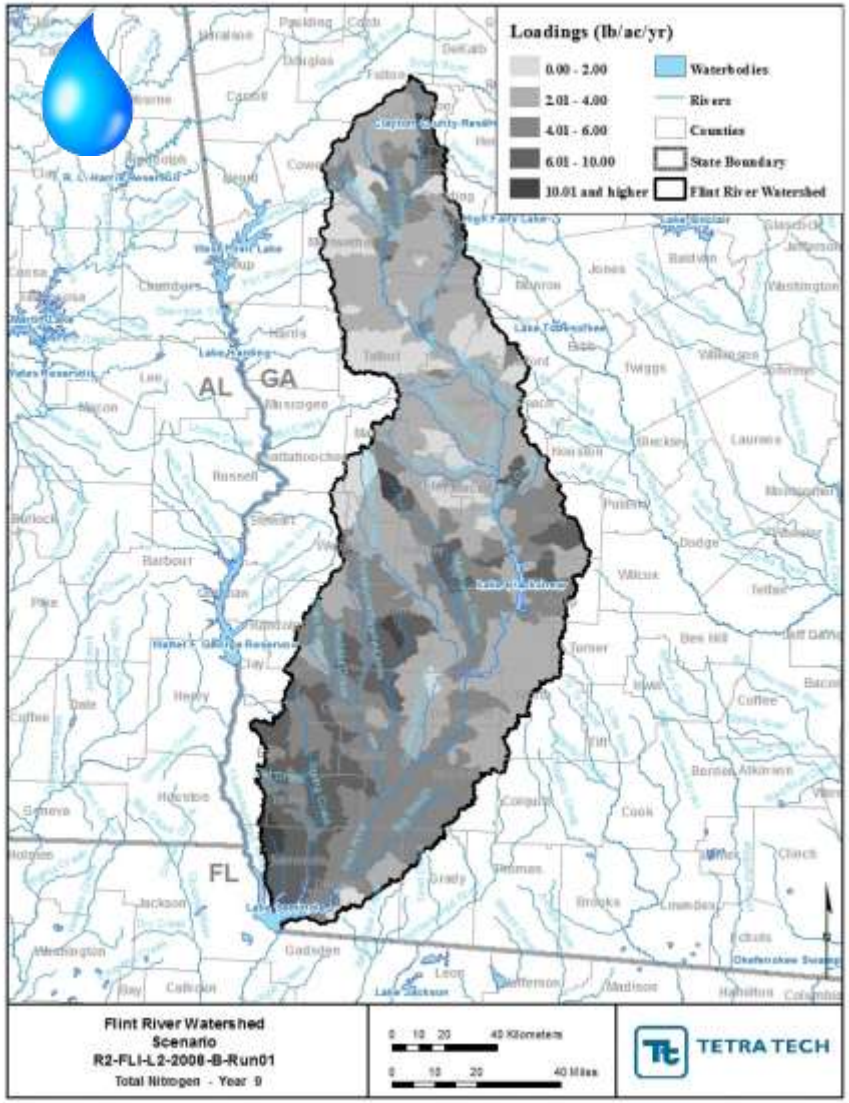


FUTURE CONDITIONS (2050)

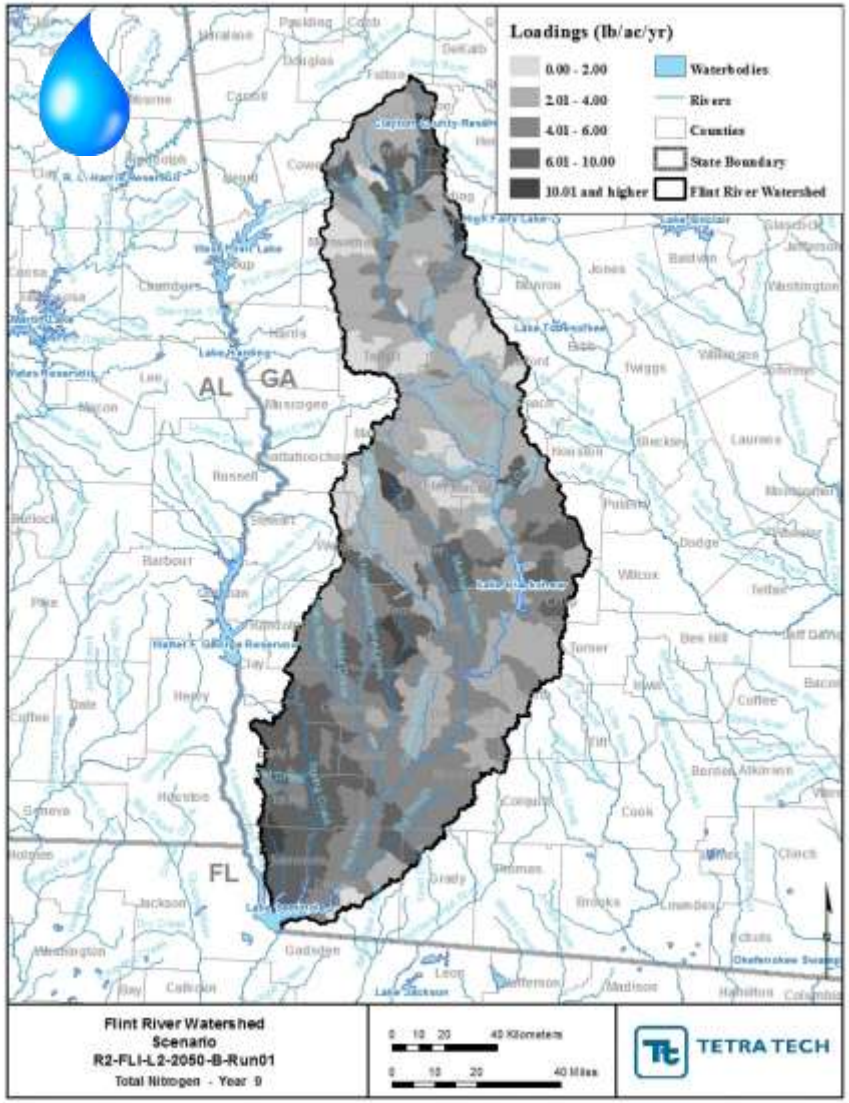


FLINT BASIN: TOTAL N "HEAT MAPS" – WET YEAR

CURRENT CONDITIONS

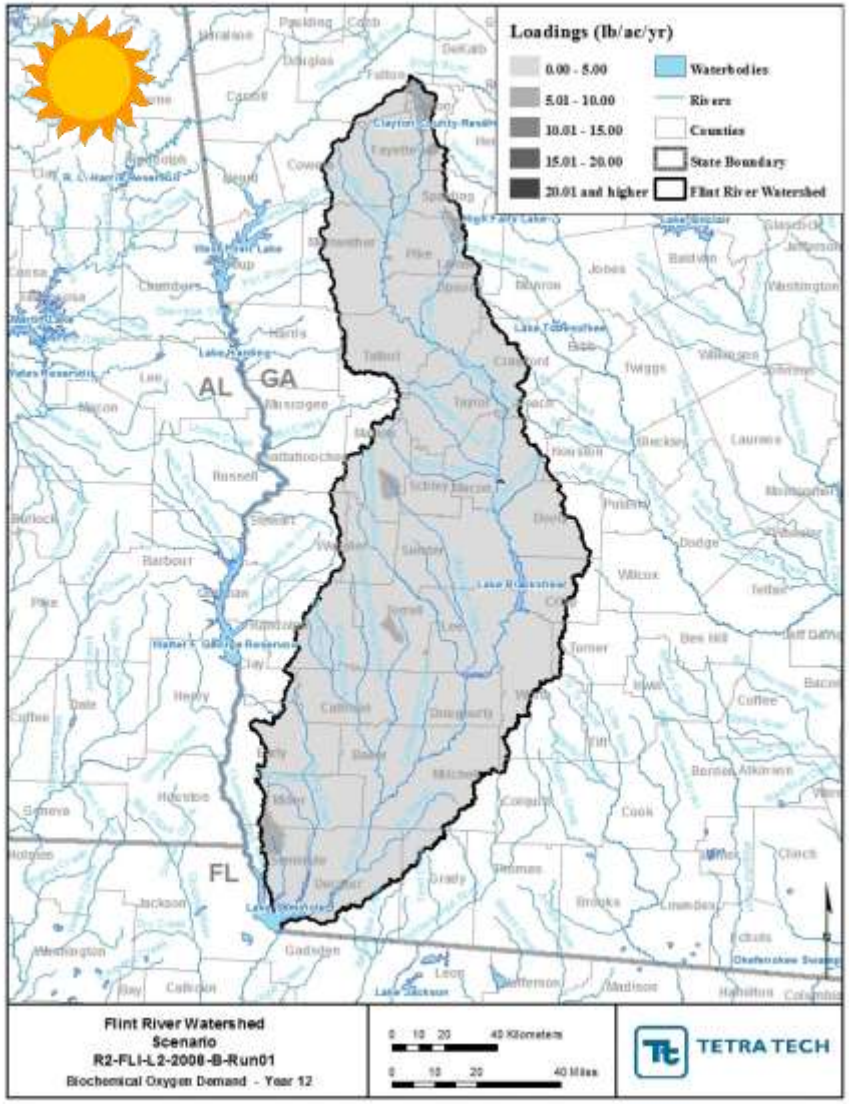


FUTURE CONDITIONS (2050)

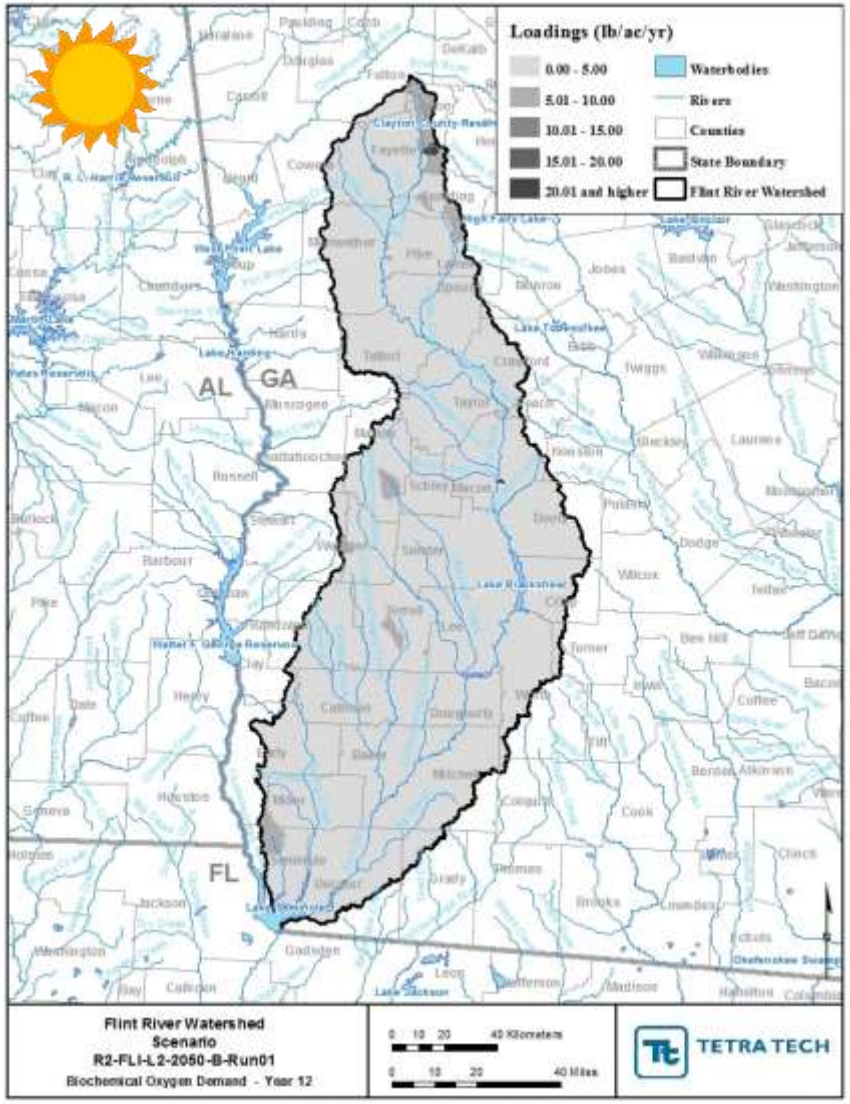


FLINT BASIN: BOD "HEAT MAPS" – DRY YEAR

CURRENT CONDITIONS

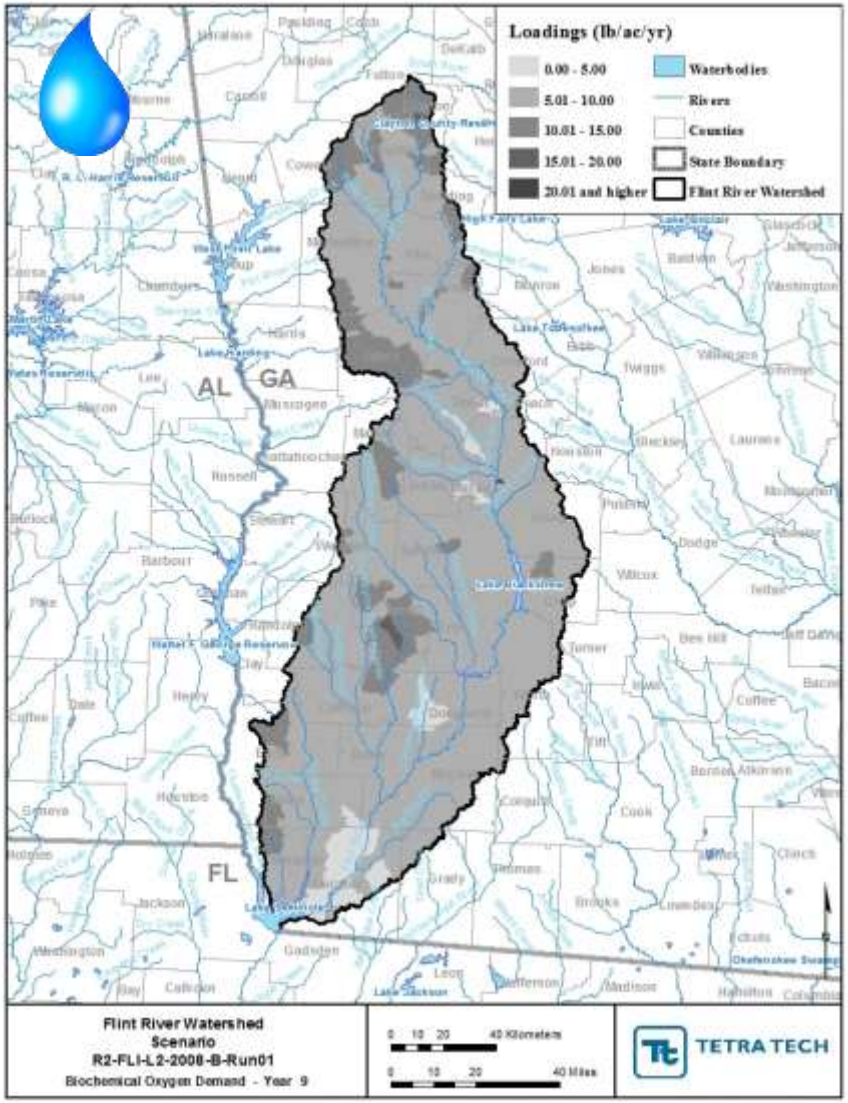


FUTURE CONDITIONS (2050)

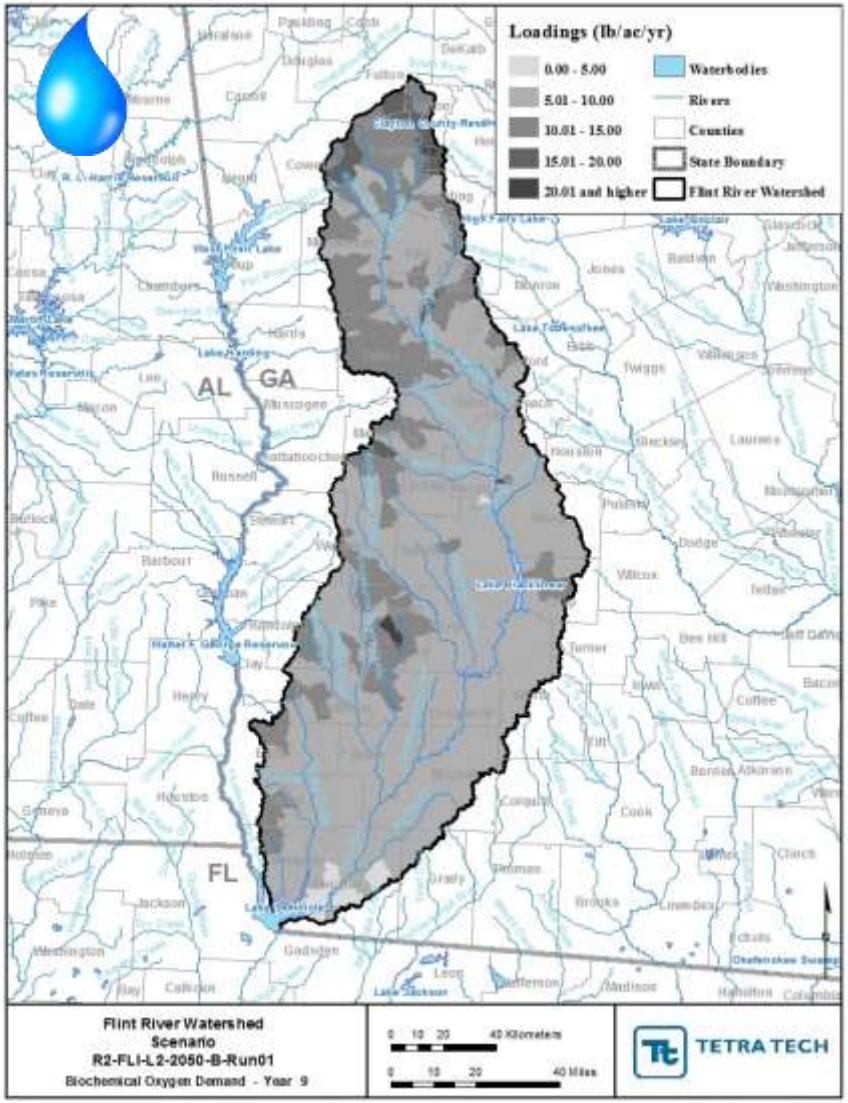


FLINT BASIN: BOD "HEAT MAPS" – WET YEAR

CURRENT CONDITIONS



FUTURE CONDITIONS (2050)



LAKE MODEL RESULTS

CHLOROPHYLL A

TOTAL PHOSPHORUS (P)

TOTAL NITROGEN (N)

CURRENT & FUTURE CONDITIONS

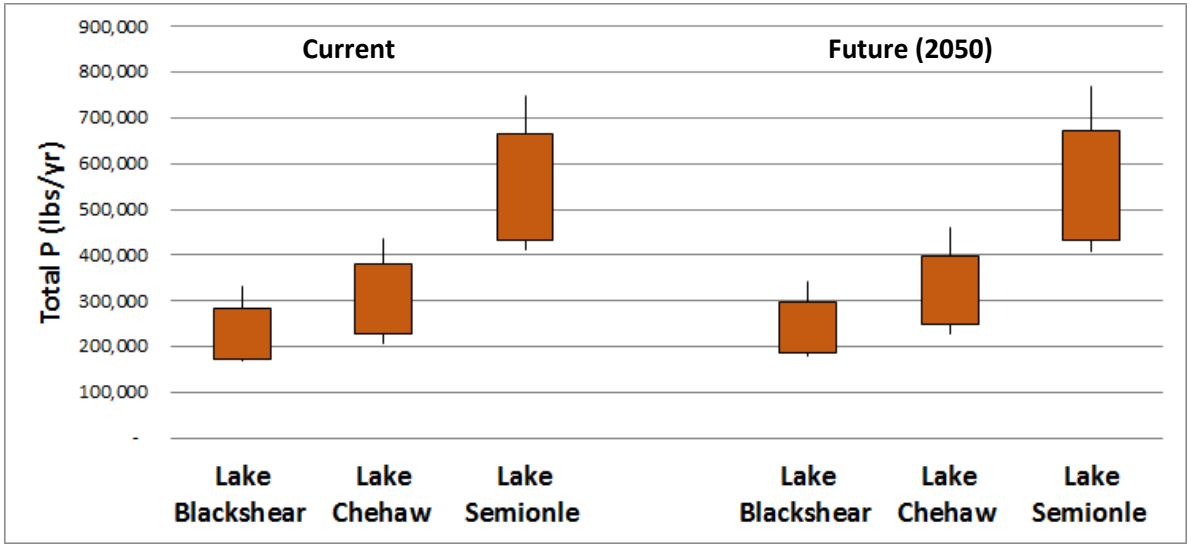
LAKE BLACKSHEAR & LAKE CHEHAW

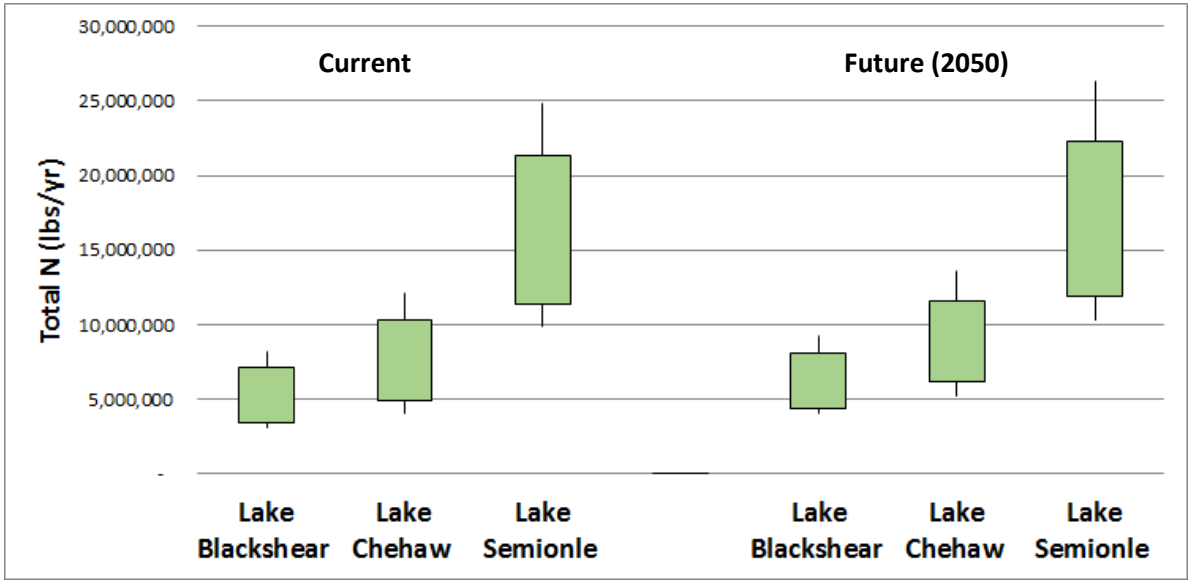
LSPC is a watershed model that estimates the amount (or loading) of nutrients (total nitrogen and total phosphorus) that enter the lakes in the basin.

EFDC is a 3-dimensional hydrodynamic water quality model that estimates the response to the nutrients delivered to a lake, specifically the effect of nutrients on lake chlorophyll *a* levels. This model receives inputs from the LSPC models.

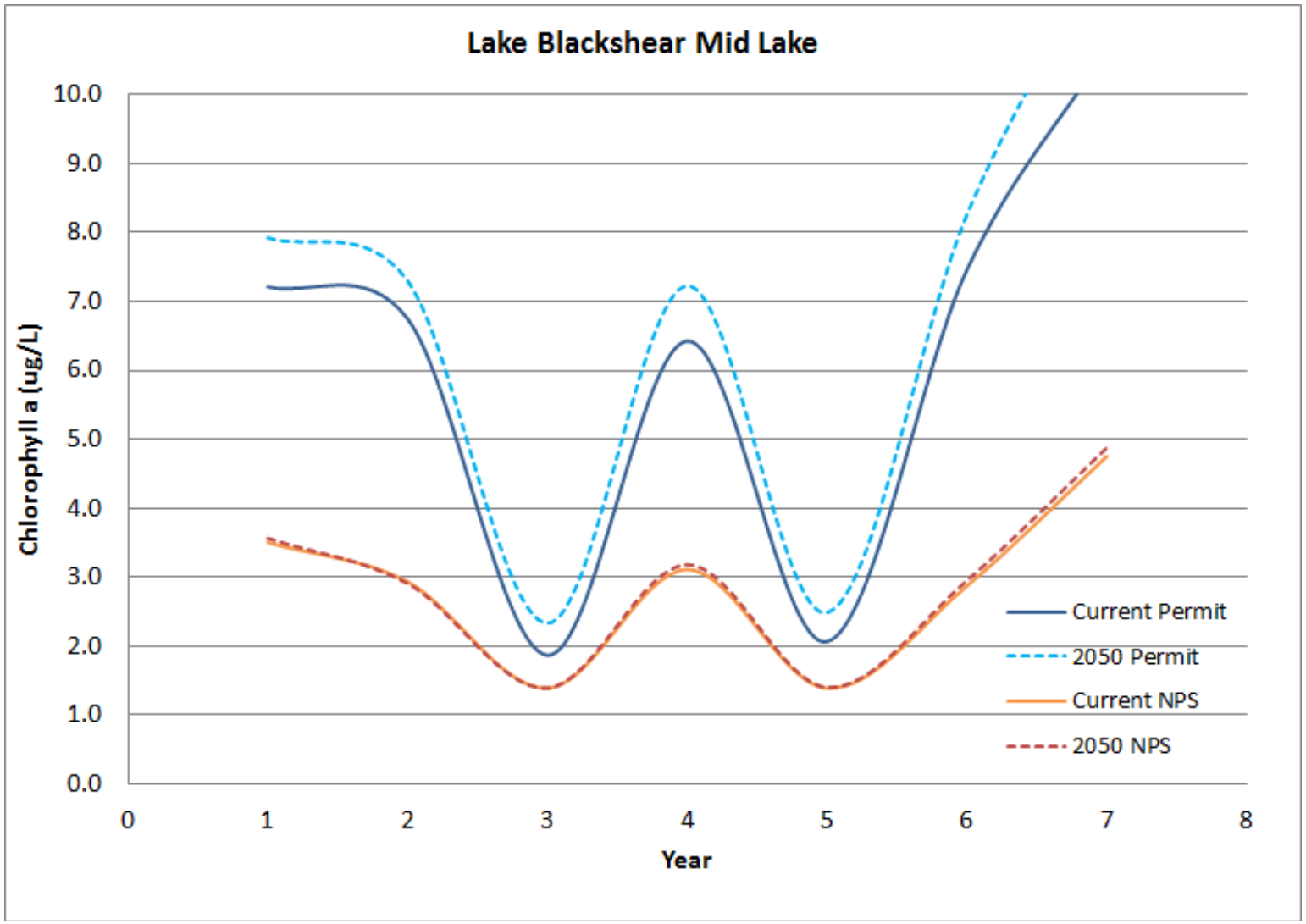
EFDC Lake model results for Lake Seminole are still being compiled. They will be provided to the Council once they are complete.

FLINT BASIN: NUTRIENT LOADS (lbs/yr) BEING DELIVERED TO FLINT BASIN LAKES



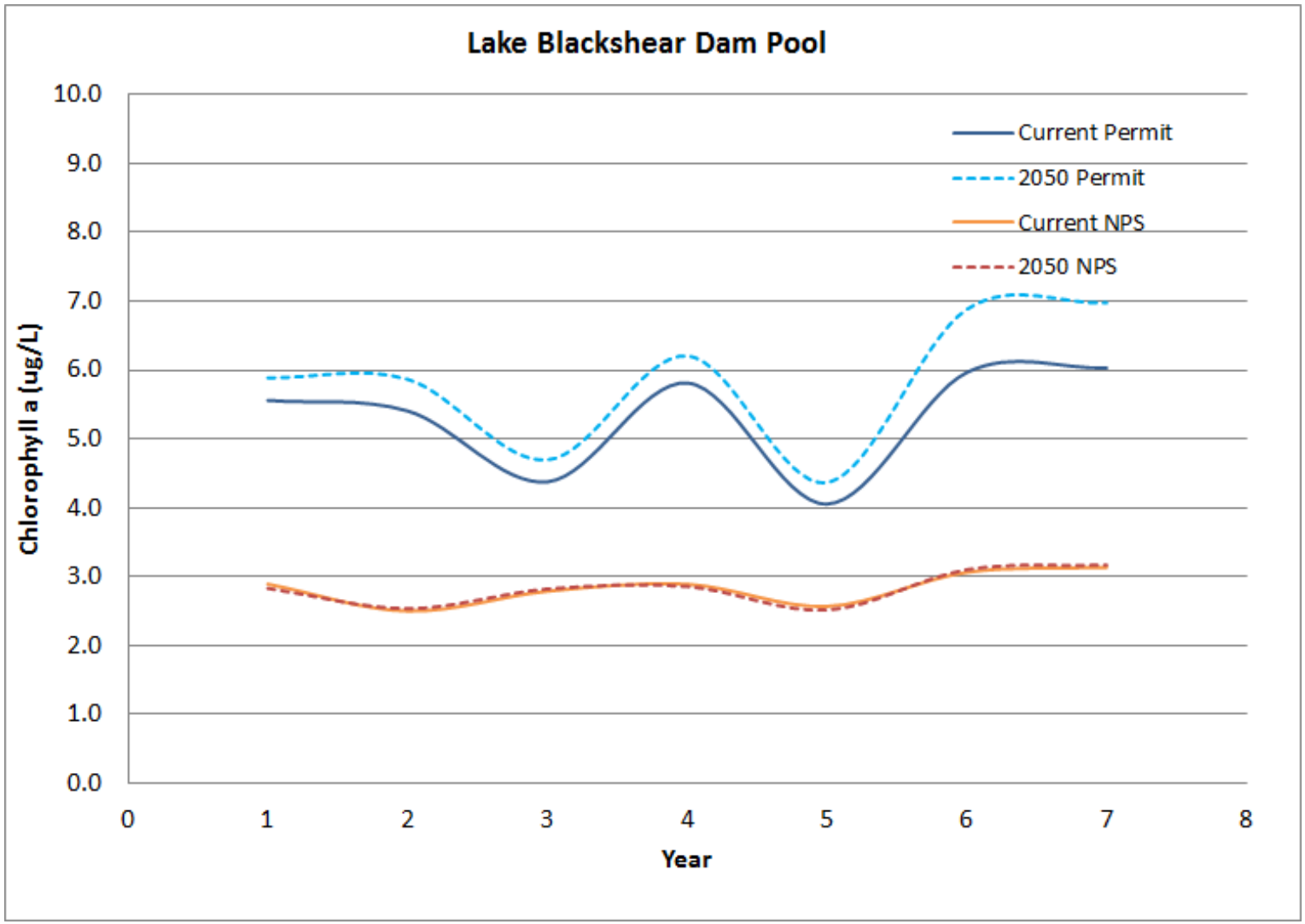


CURRENT AND FUTURE LAKE BLACKSHEAR CHLOROPHYLL *a* LEVELS FROM POINT AND NONPOINT SOURCES



The blue lines above show the chlorophyll *a* levels that result from modeling the loads from wastewater discharge permits and nonpoint source pollution. The orange lines show the levels attributed just to nonpoint source pollution (NPS). For both, the solid lines show current levels and the dotted lines show levels projected for 2050.

CURRENT AND FUTURE LAKE BLACKSHEAR CHLOROPHYLL *a* LEVELS FROM POINT AND NONPOINT SOURCES



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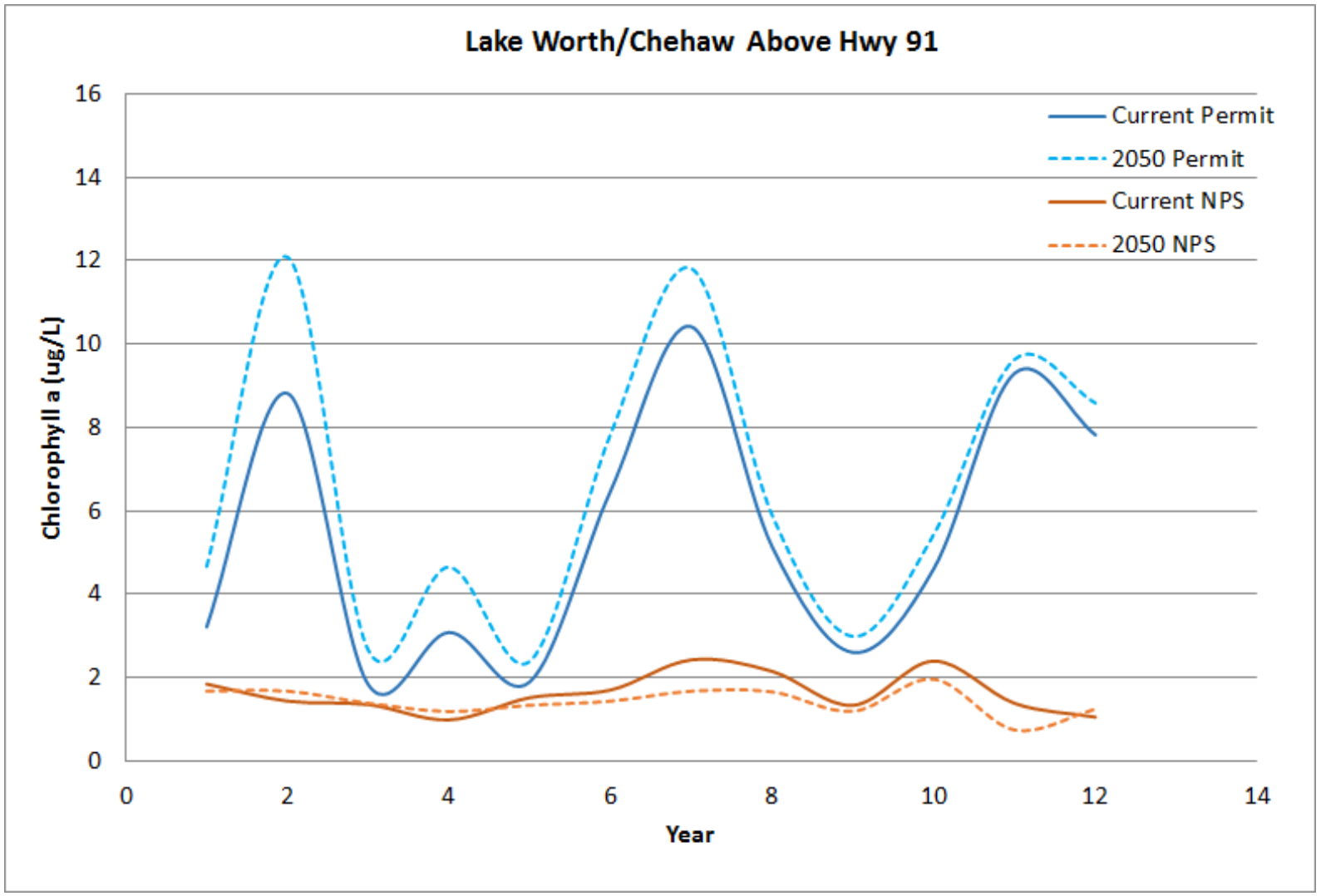
CURRENT AND FUTURE LAKE CHEHAW/WORTH CHLOROPHYLL *a* LEVELS FROM POINT & NONPOINT SOURCES



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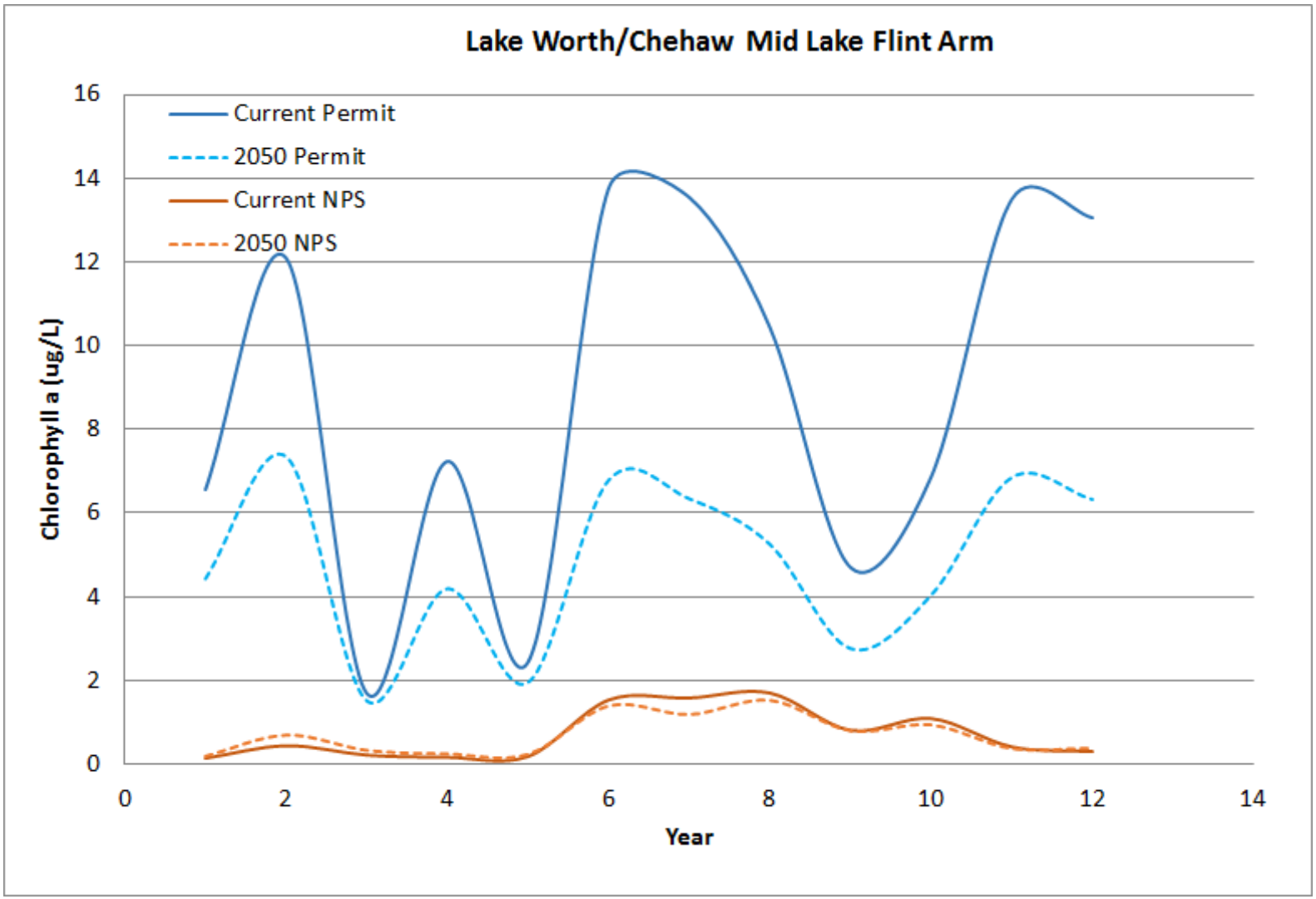
CURRENT AND FUTURE LAKE CHEHAW/WORTH CHLOROPHYLL *a* LEVELS FROM POINT & NONPOINT SOURCES



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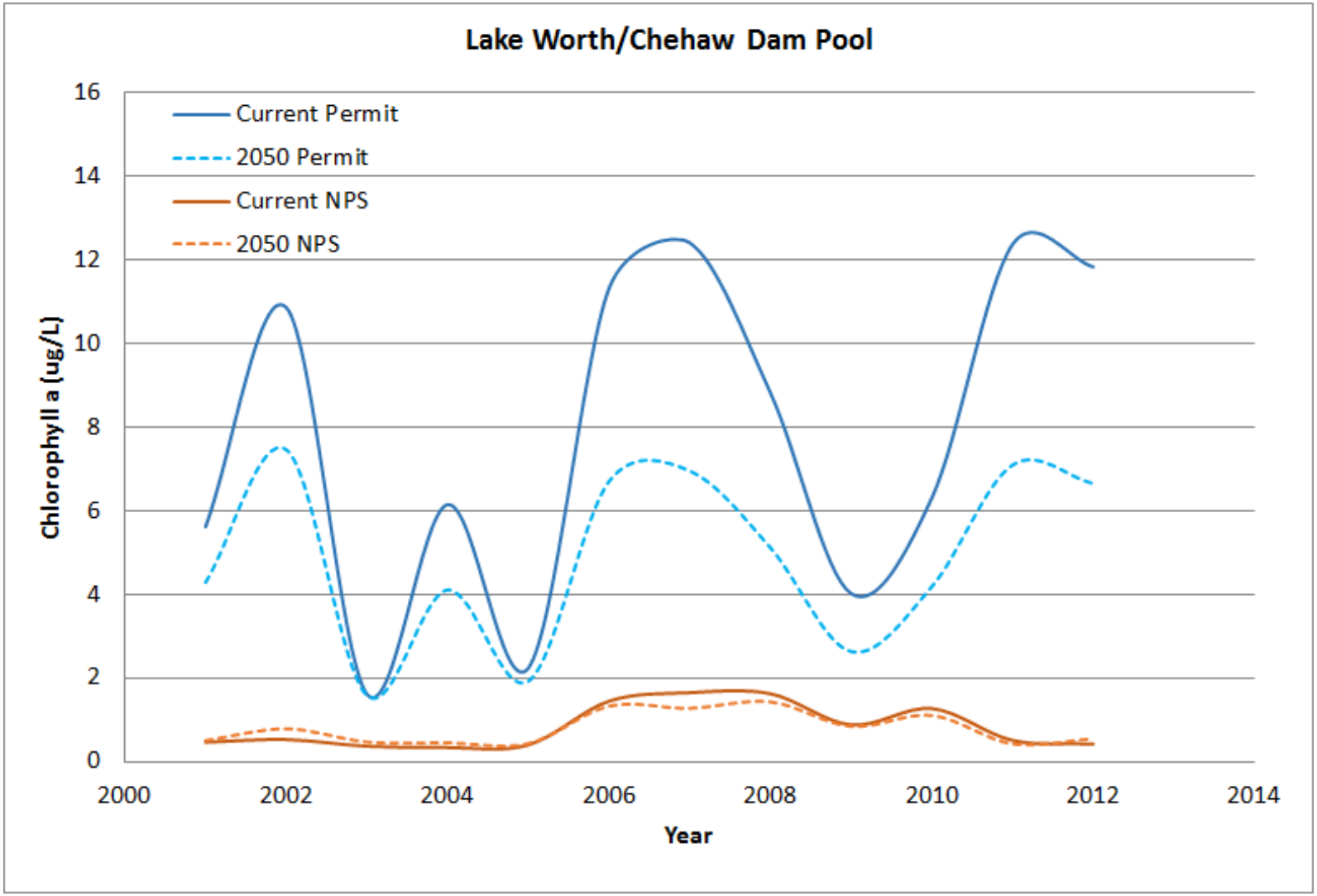

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GROWING SEASON AVERAGE TOTAL NITROGEN AND TOTAL PHOSPHORUS LEVELS (CURRENT AND FUTURE CONDITIONS)

	Scenario	Lake Worth/Chehaw
Total Nitrogen (mg/L)	Current (Non-Point Sources)	1.08
	Current (Point Sources + Non-Point Sources)	2.05
	2050 (Non-Point Sources)	1.10
	2050 (Point Sources + Non-Point Sources)	2.20
Total Phosphorus (mg/L)	Current (Non-Point Sources)	0.058
	Current (Point Sources + Non-Point Sources)	0.173
	2050 (Non-Point Sources)	0.060
	2050 (Point Sources + Non-Point Sources)	0.195

Growing Season: April - October

Lake Blackshear, Lake Chehaw/Worth, and Lake Seminole do not currently have lake standards

Maximum Total Nitrogen Concentrations:

- Lake Blackshear - under Current and Future Permit conditions did not exceed 4 mg/L
- Lake Chehaw/Worth - under Current Permit conditions 4.6 mg/L
- Lake Chehaw/Worth - under Future Permit conditions 4.8 mg/L