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Surface Water Availability in Select Tributaries of the Delaware River Basin

Water Management Advisory Council

October 14, 2026

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Delaware River Basin Commission

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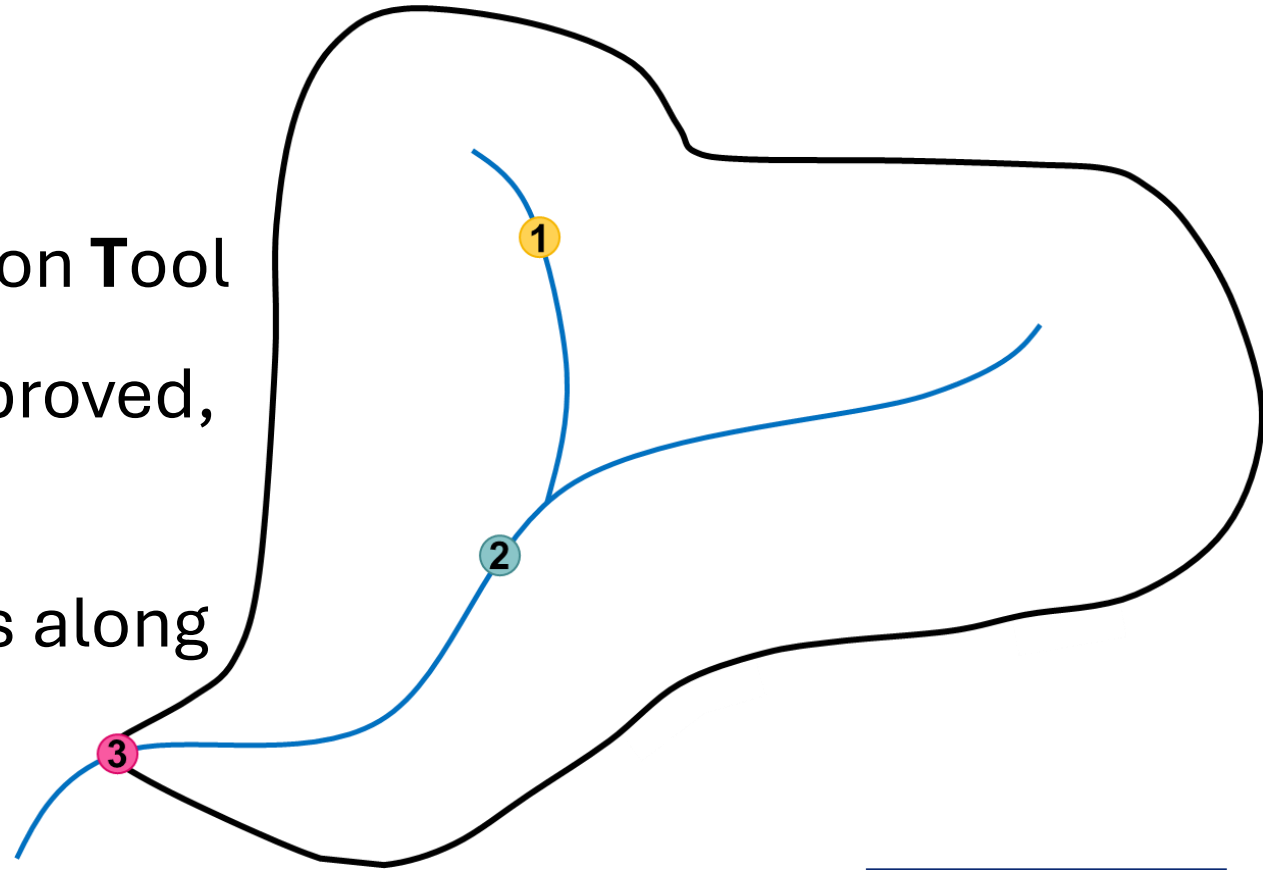
Would there be enough surface water during a repeat of the drought of record?

Using **2060** as a planning horizon

1. Current and projected future water demand: **published Oct. 2021**
2. Current and future groundwater availability
 - Annual evaluation: **published Dec. 2022**
 - Seasonal evaluation: **ongoing**
3. Evaluating additional storage sites
 - Phase 1 - Scoping study: **2023**
 - Phase 2 - Evaluating options: **ongoing**
4. Current and future surface water availability: **published Sept. 30, 2026**

SWEET evaluates surface water availability at individual withdrawal points

- **S**urface **W**ater **E**valuation & **E**stimation **T**ool
- Existing DRBC tool was updated, improved, and refined starting in 2023
- Focus on availability during dry times along select PA & DE tributaries

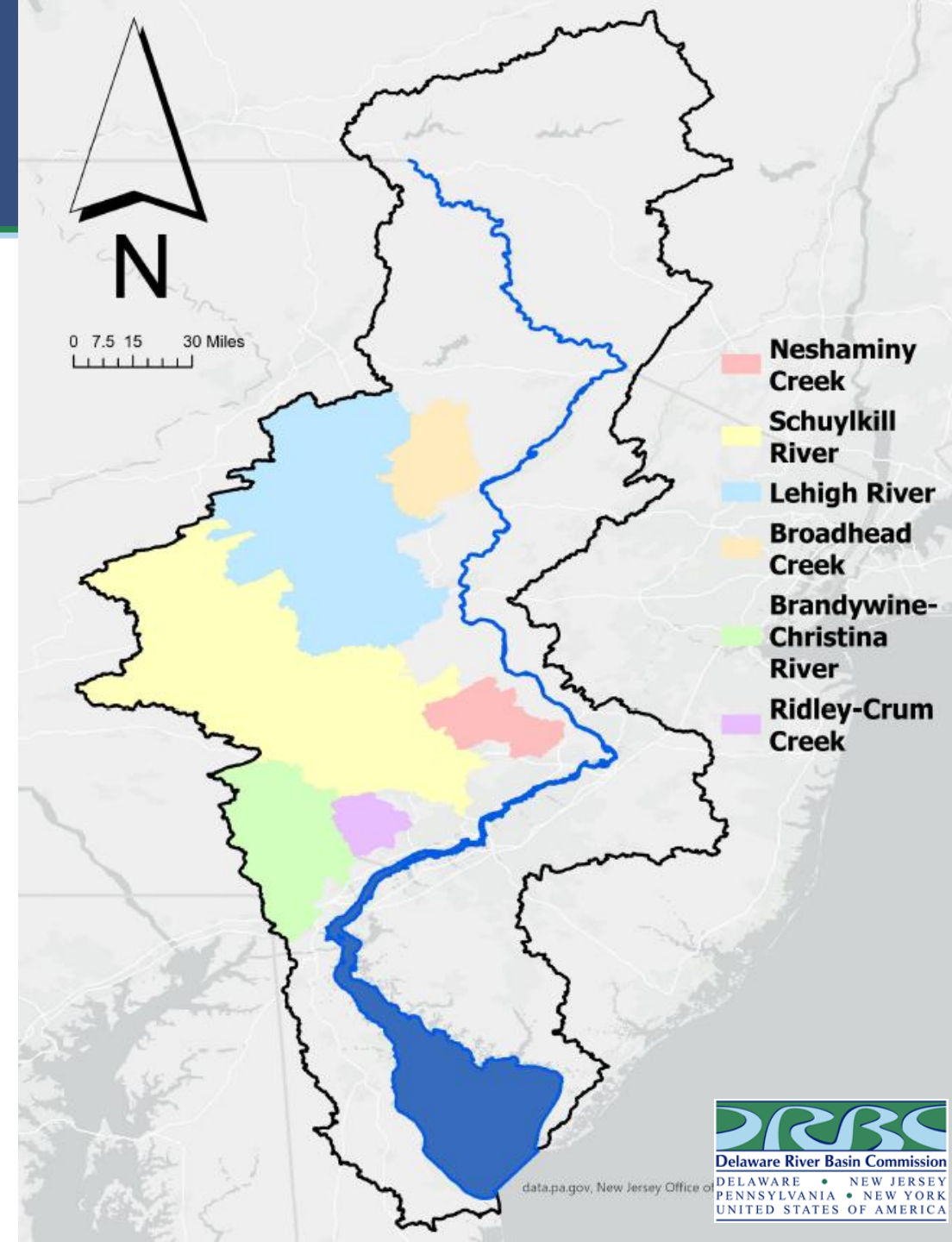


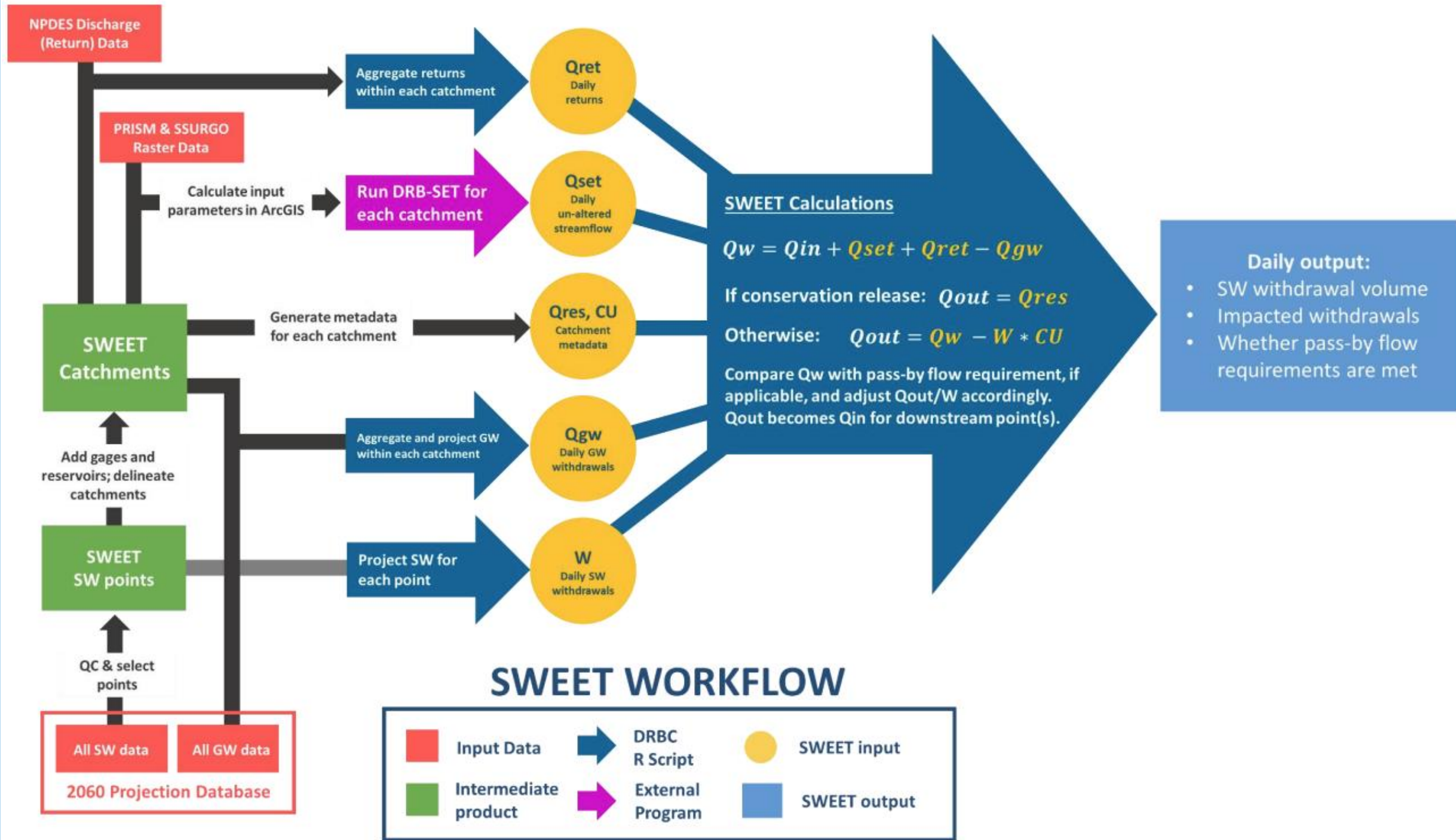
Methodology



Six Identified Watersheds

- These watersheds represent the majority of surface water withdrawals on **non-tidal tributaries**
- Screen for possible availability issues over a repeat of hydrologic conditions from 1960–2010
 - Focus on the drought of record (1961–1967) and 1998–2002 drought
- **Set the groundwork for a basin-wide analysis**
 - (non-tidal, non-main stem)



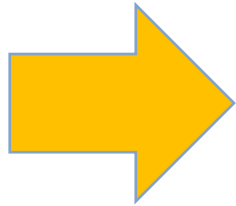


Surface water availability is evaluated at individual withdrawals

1. Flow In

(Available Water)

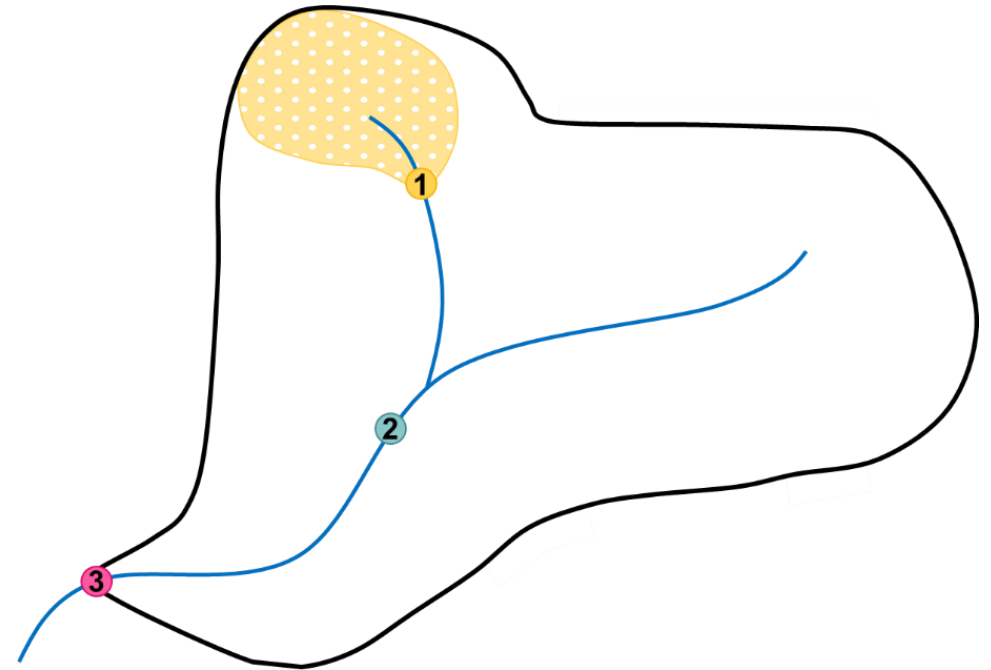
- Unaltered streamflow
 - USGS: DRB-SET
- Returns
 - EPA: NPDES
- Groundwater withdrawals
 - DRBC aggregation



1. Withdrawal

Calculation

- Intended withdrawal
 - DRBC projection
- Pass-by flow requirement
 - If applicable
- Flag when intended withdrawal cannot be taken

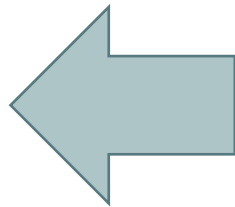


Surface water availability is evaluated at individual withdrawals

2. Flow In

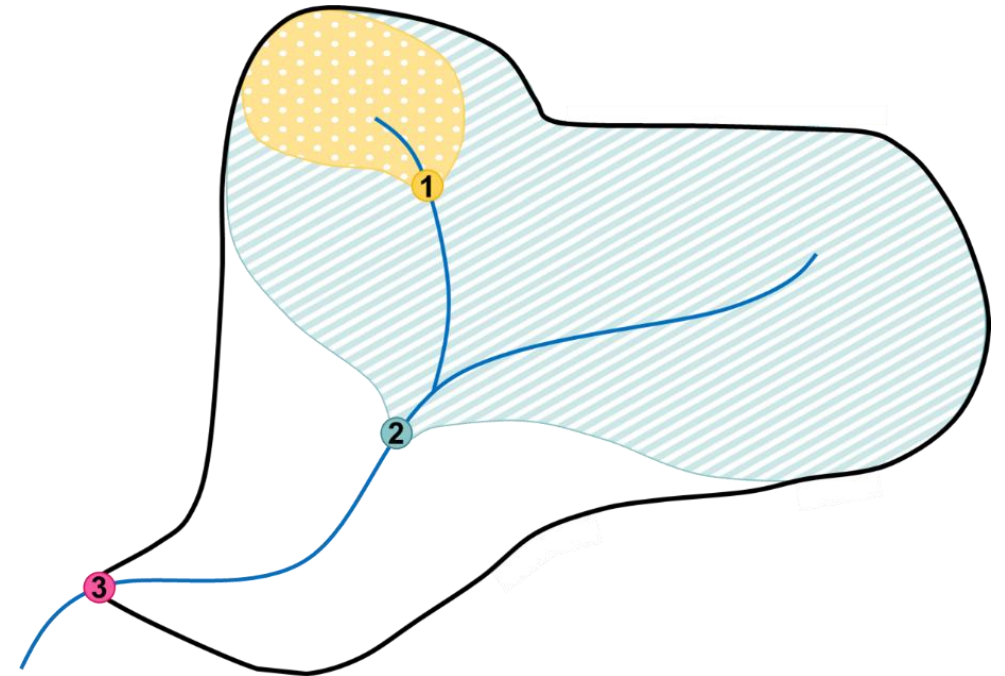
(Available Water)

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 - DRBC aggregation



1. Withdrawal Calculation

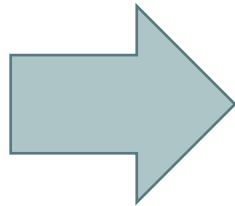
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Surface water availability is evaluated at individual withdrawals

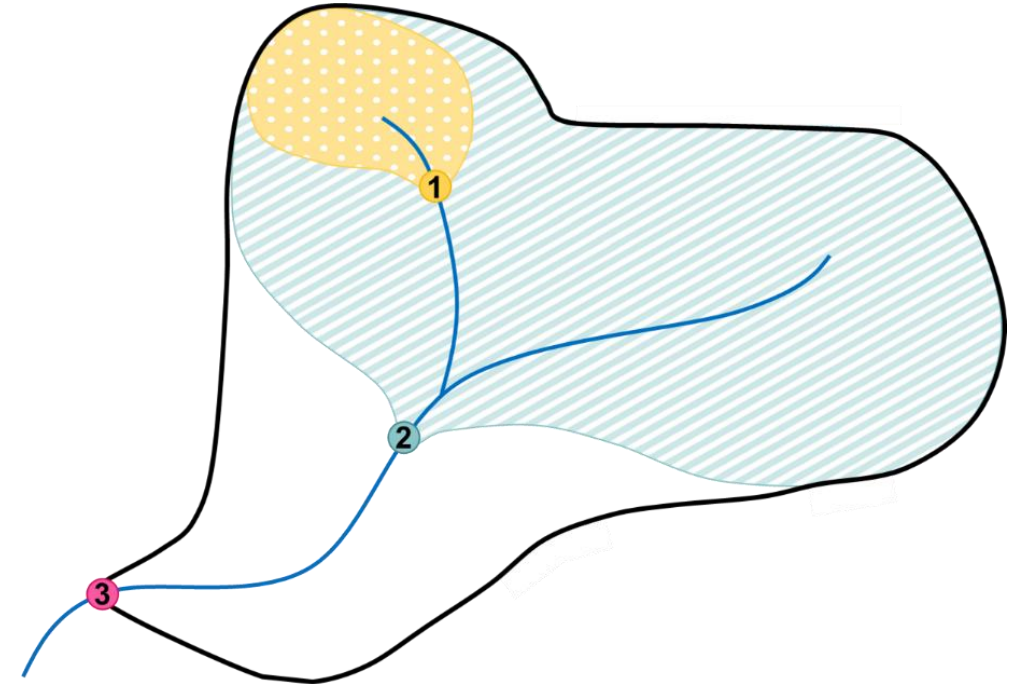
2. Flow In (Available Water)

- Unaltered streamflow
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2. Withdrawal Calculation

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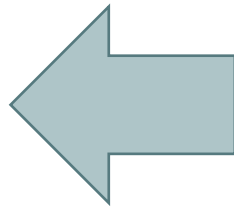


Surface water availability is evaluated at individual withdrawals

3. Flow In

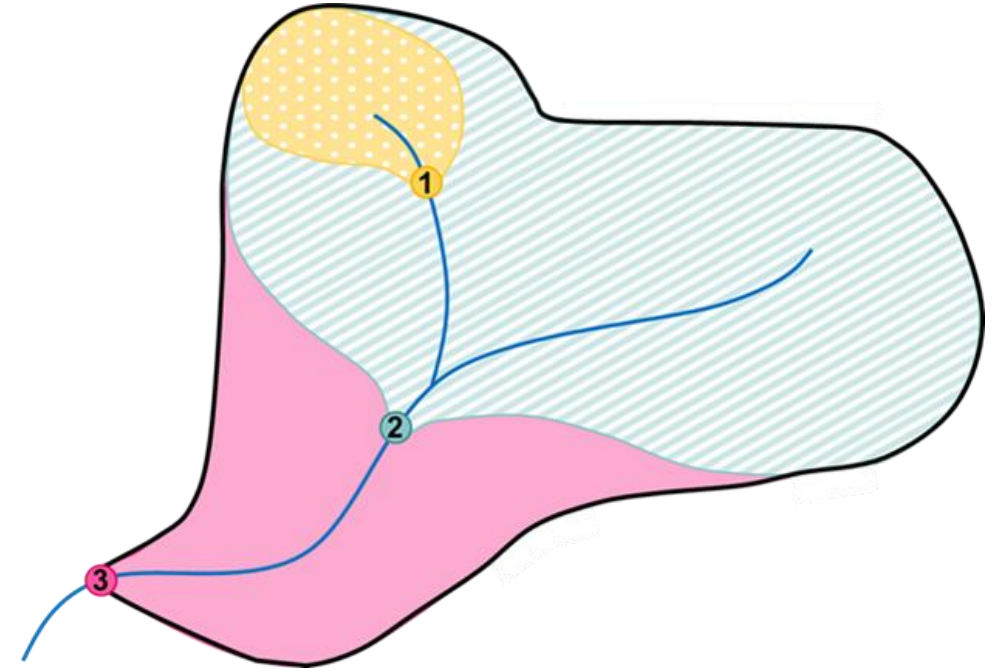
(Available Water)

- Unaltered streamflow
 - USGS: DRB-SET
- Returns
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- Groundwater withdrawals
 - DRBC aggregation



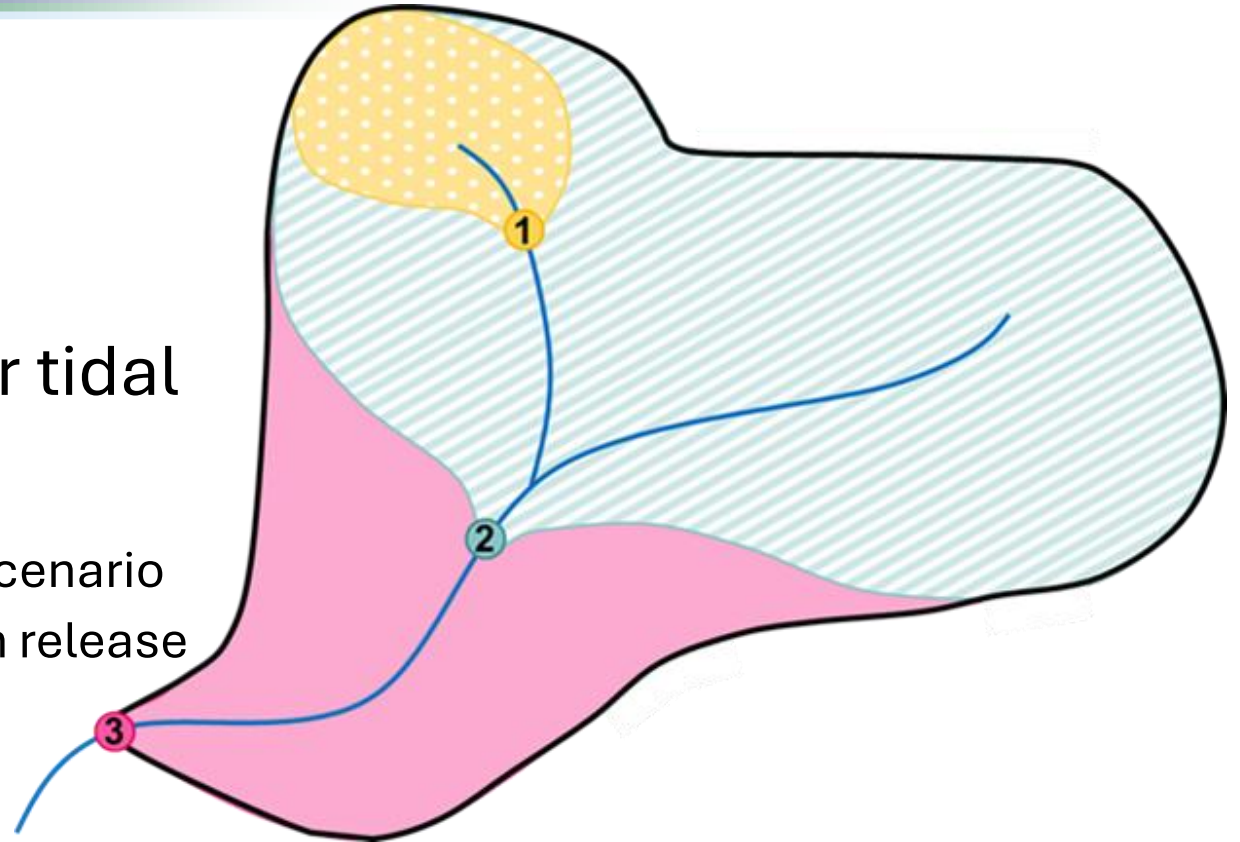
2. Withdrawal Calculation

- Intended withdrawal
 - DRBC projection
- Pass-by flow requirement
 - If applicable
- Flag when intended withdrawal cannot be taken



SWEET as a screening tool

- Conservative model assumptions
- Cannot model reservoir operations or tidal fluctuations
 - When possible, reservoirs use a “worst-case” scenario during the driest times, using their conservation release
- Limited by accuracy of input data
 - DRB-SET, NPDES, withdrawals, etc.



How does SWEET account for **reservoir releases**?

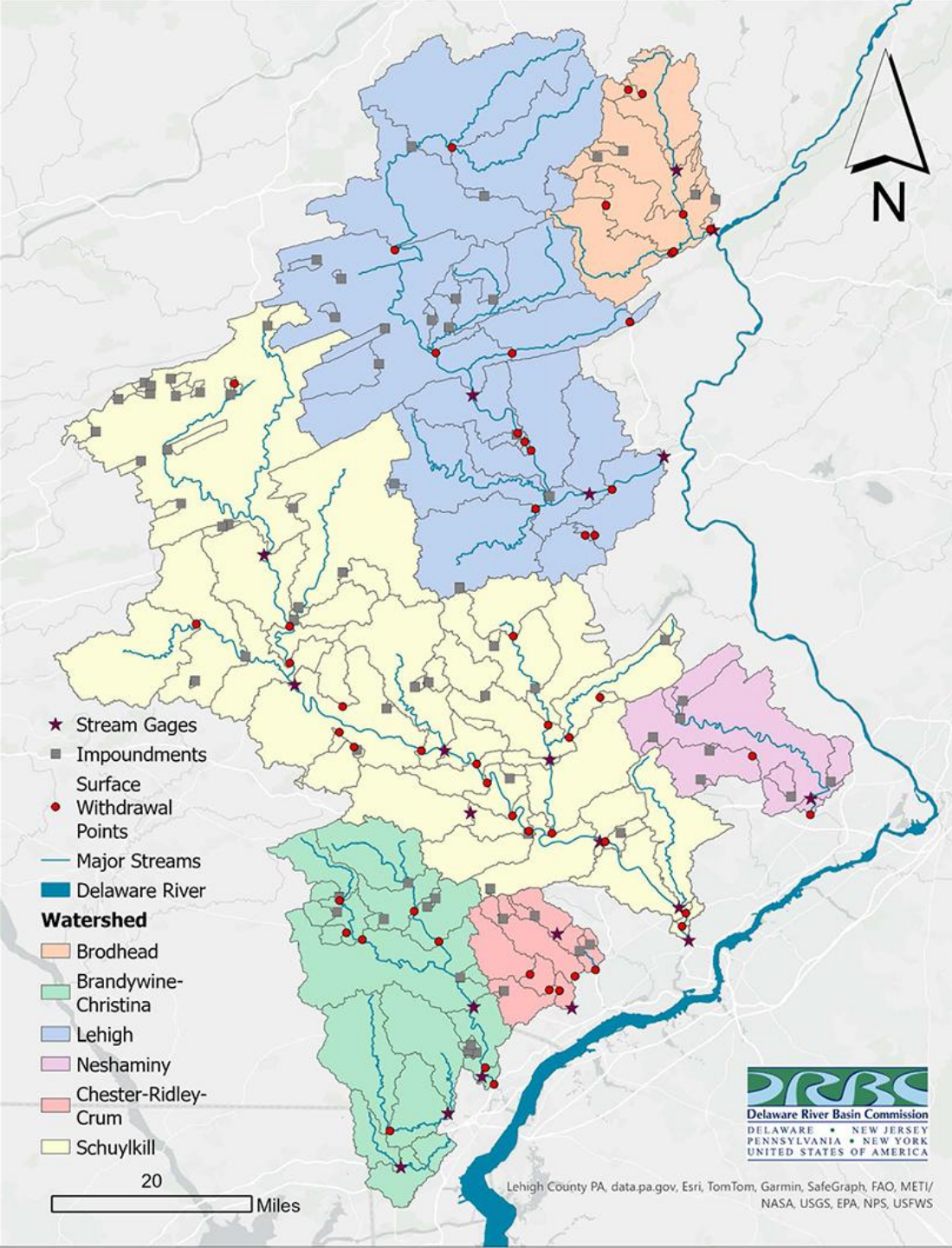


- Most factors impacting reservoir flow are not modeled in SWEET.
- **Minimum releases have the most impact on water availability**, so these were used as a conservative substitute.
 - Major reservoirs were modeled to output their minimum release every day.
- This approach almost certainly **underestimates** reservoir releases.

A couple of disclaimers about the results...

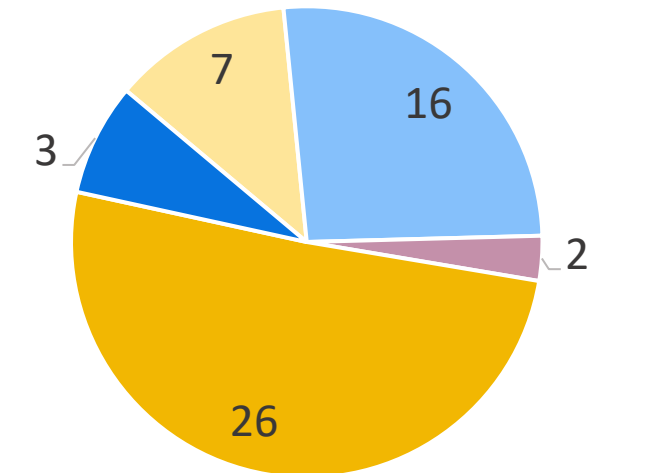
- 1. SWEET was not designed to recreate past conditions, but rather applies current water use to past hydrology.**
- 2. If a point is identified as having impacted withdrawals, it is the starting point for a more detailed analysis for that individual point, not a prediction.**
- 3. When a point is not flagged, it is highly likely to maintain adequate supply during a repeat of the DoR.**

148 Evaluated Points



- **SW Points: 54**
Where availability is evaluated
- **Impoundments: 74**
Included for completeness, but availability not evaluated
- **Stream gages: 21**
USGS gages used for “validation”

SW Points by Sector



- Commercial & Manufacturing
- Golf & Ski
- Mining
- Public Water Supply
- Thermoelectric

Results



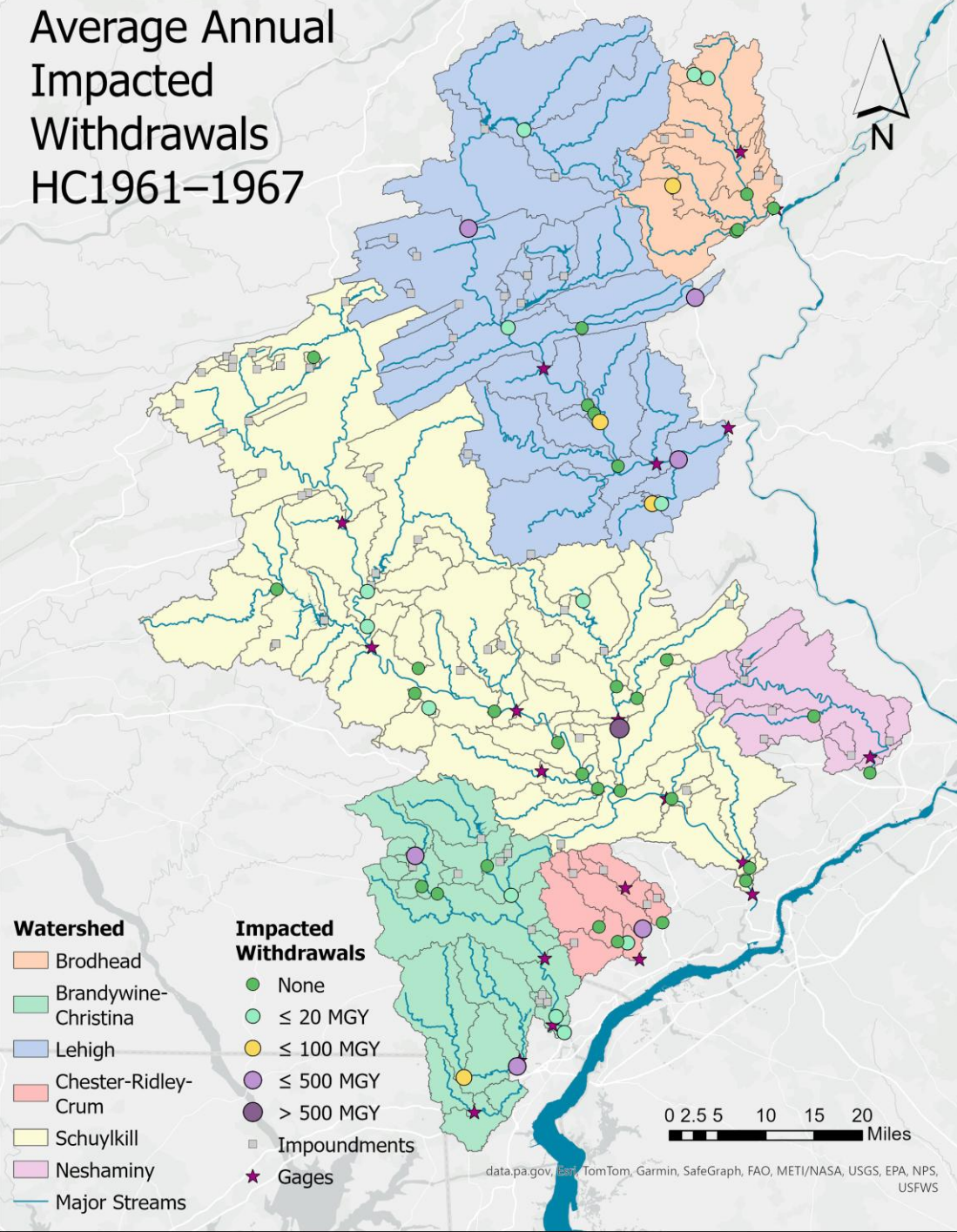
Impacted Withdrawals

- Definition: the volume of water that could not be withdrawn due to limited availability.
- Intended withdrawal volumes calculated via average of recent withdrawal data (2018-2022)
- If intended withdrawal is greater than the available streamflow on any day, that withdrawal point is “flagged” for potential surface water availability challenges.
 - Highly dependent on PBFs

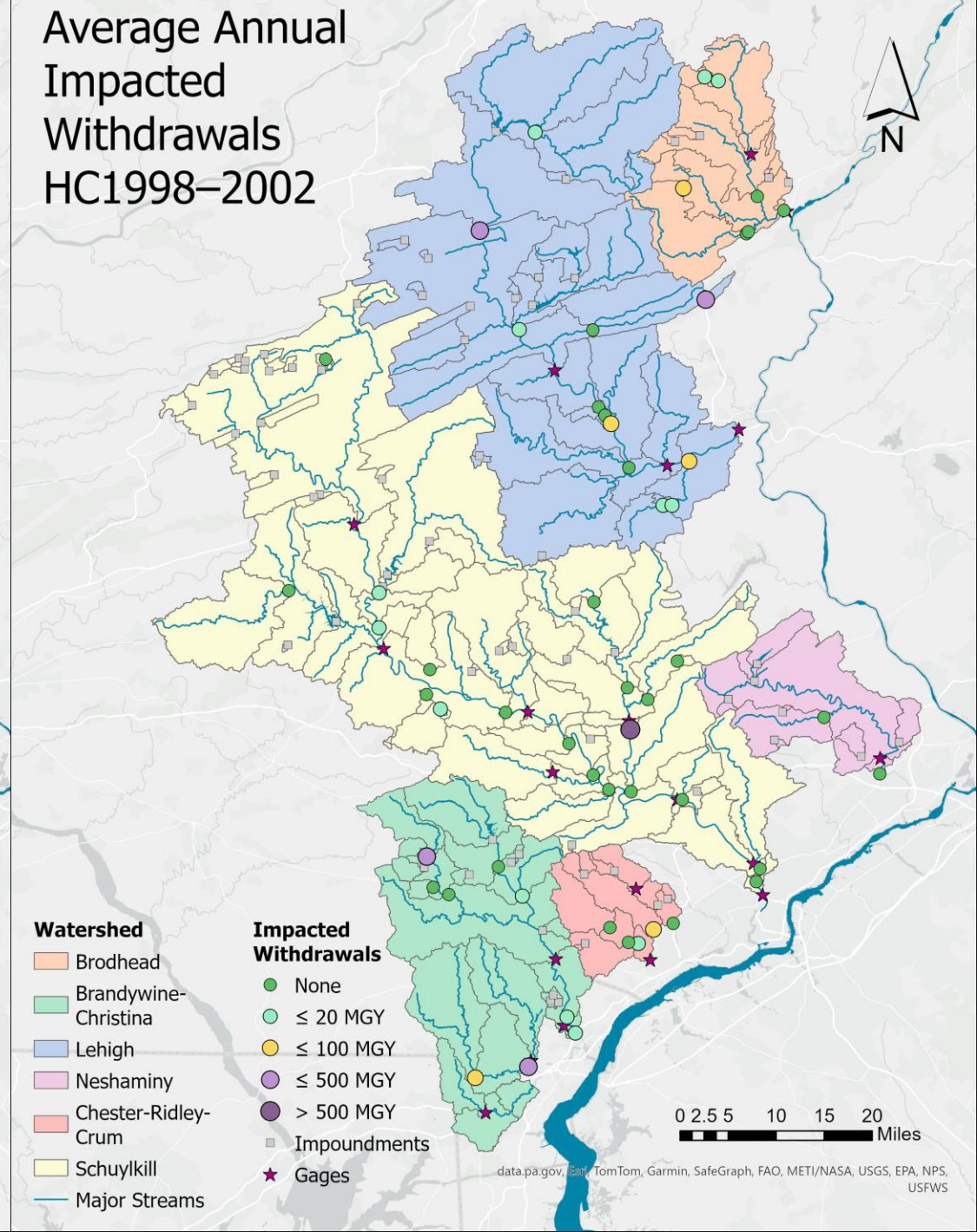
SW with IW in Tributaries	
Lehigh	10
Schuylkill	4
Brodhead	3
Brandywine	3
CRC	2
Neshaminy	0

Impacted Volumes

Average Annual
Impacted
Withdrawals
HC1961–1967



Average Annual
Impacted
Withdrawals
HC1998–2002



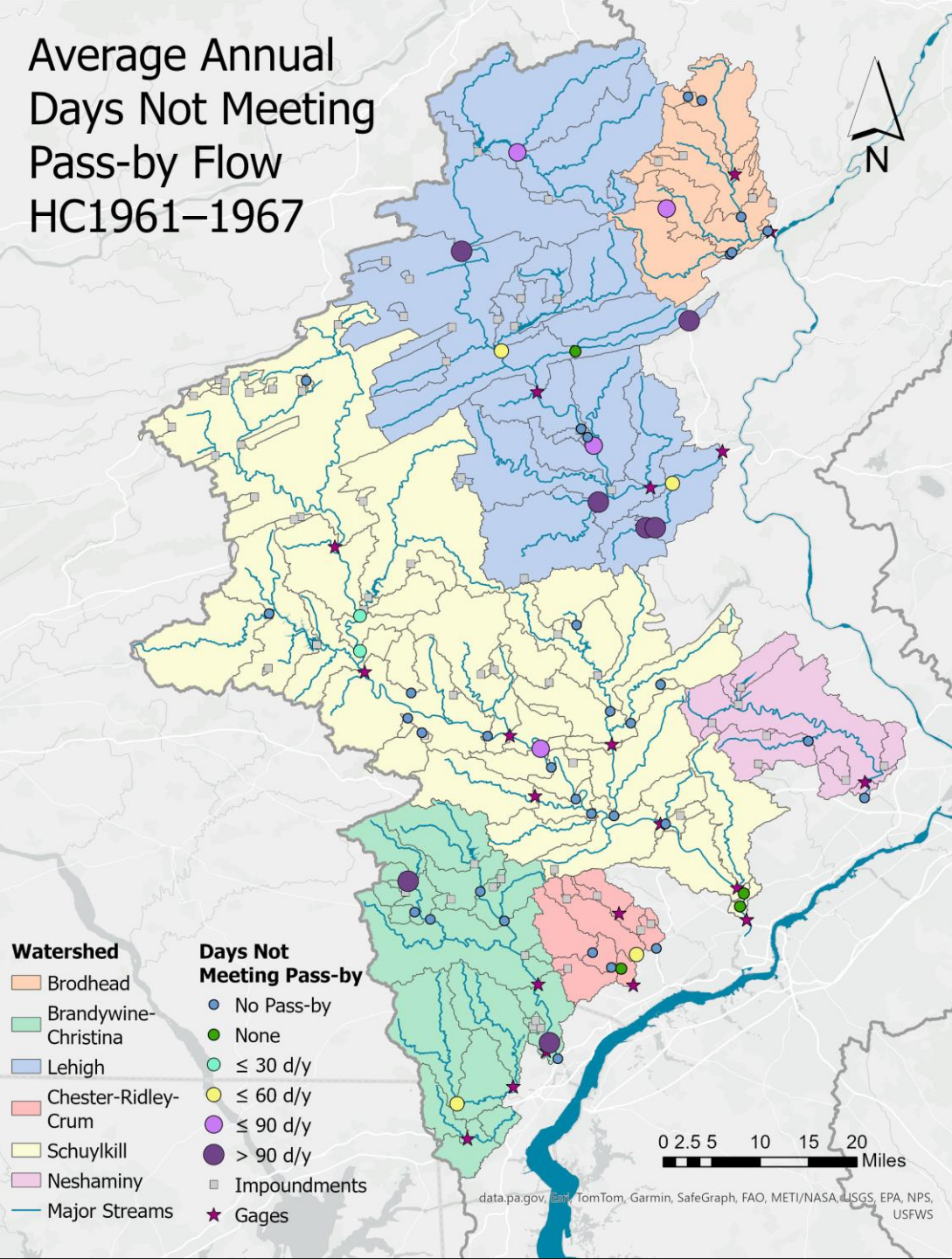
Days not meeting PBF

- Definition: a volume of streamflow that should be allowed to “pass by” after a withdrawal is taken
- If streamflow approaches the PBF value, a limited withdrawal amount may be taken to preserve streamflow at or above the PBF value
- If streamflow drops below the PBF value, no water should be withdrawn

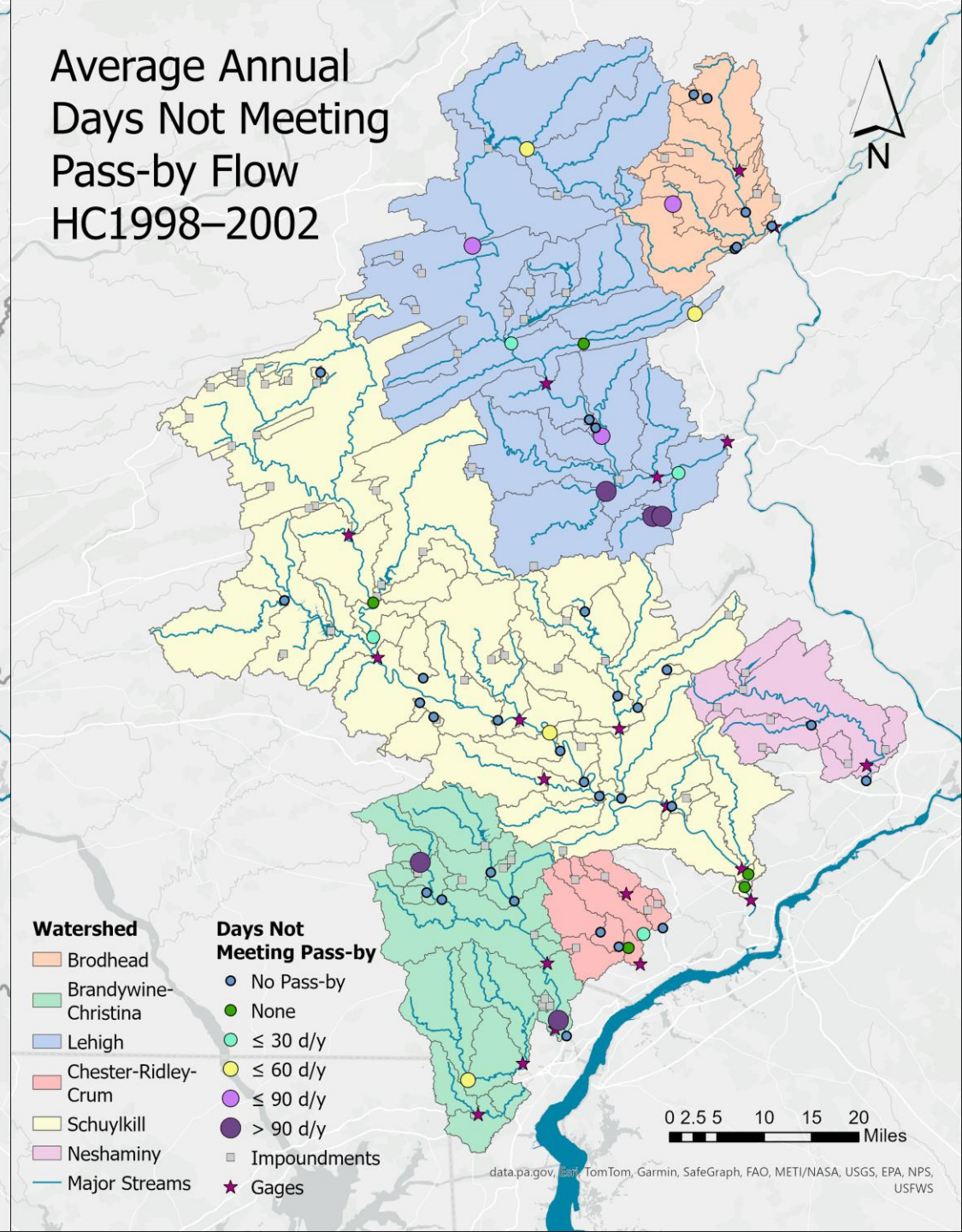
PBF Dynamics		
54 SW Points	32 no PBFs	All met their current withdrawal volumes on every modeled day under repeated hydrologic conditions (HC) from 1960 to 2010
	22 PBFs	All but 2 SW points <u>unable</u> to take their intended daily withdrawal volume at least some of the time during HC1960–2010.

Days not meeting PBF

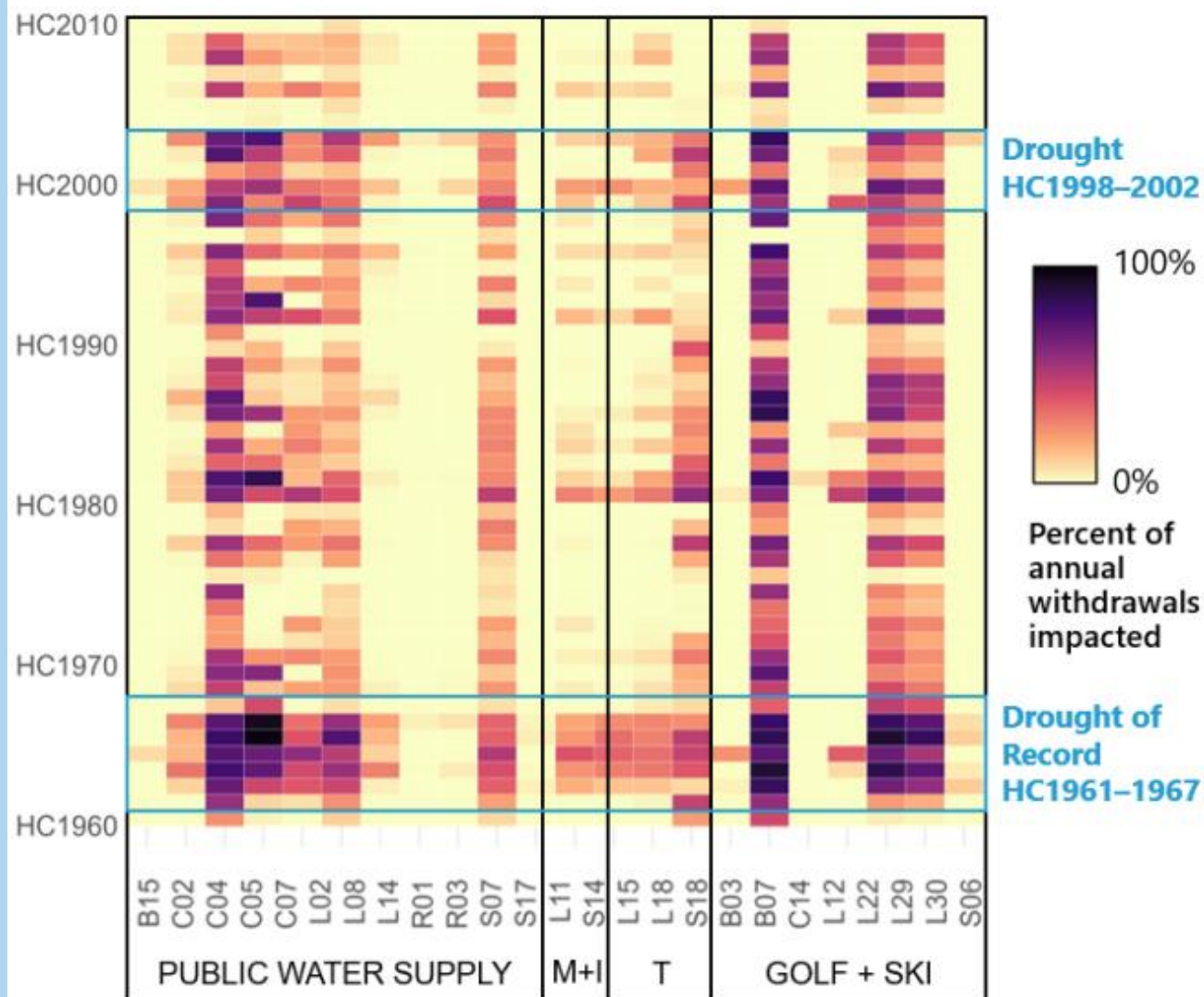
Average Annual
Days Not Meeting
Pass-by Flow
HC1961–1967



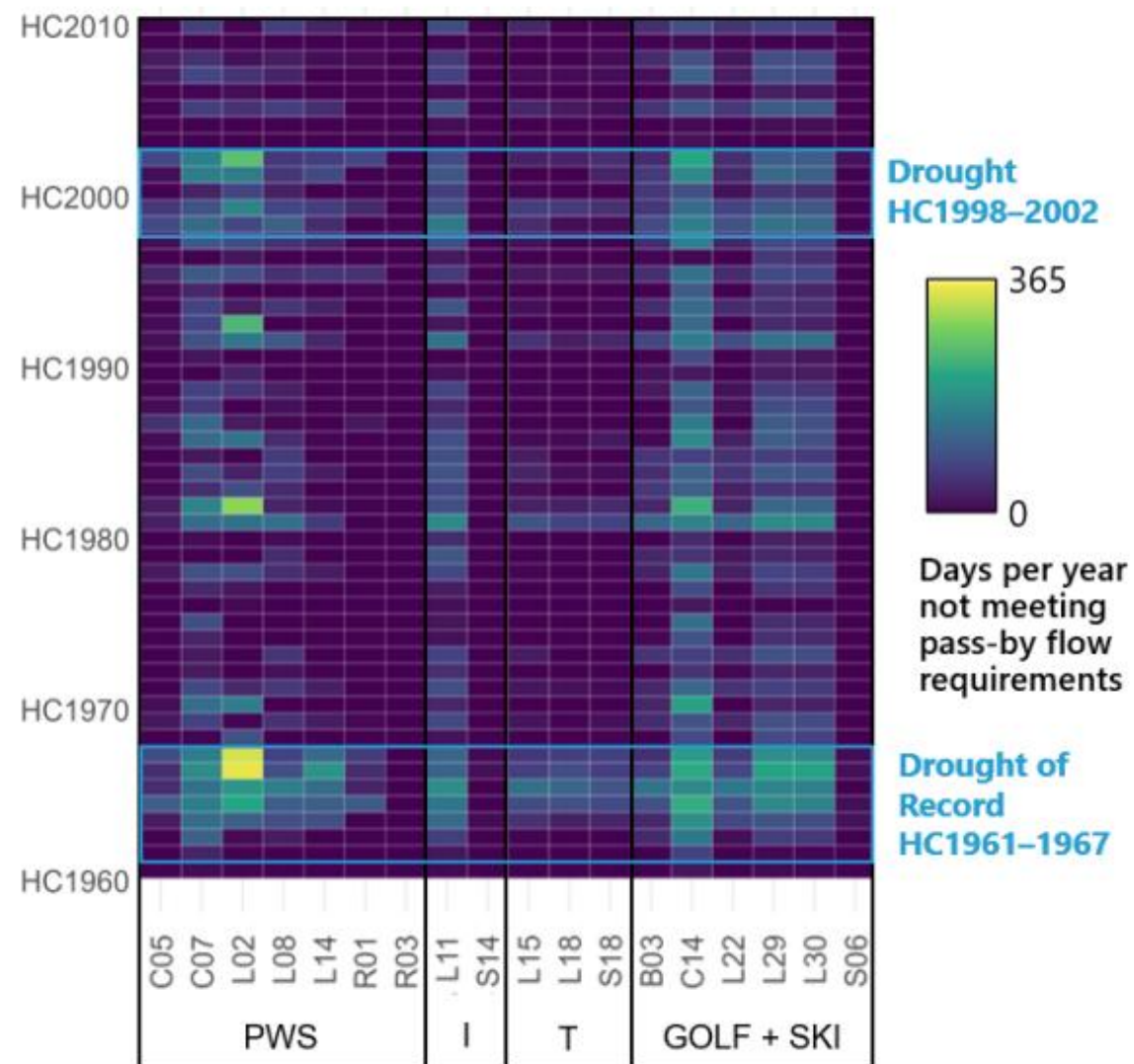
Average Annual
Days Not Meeting
Pass-by Flow
HC1998–2002



A. Percent of total withdrawals impacted



B. Days not meeting pass-by flow



Several public water suppliers were flagged

Flagged Suppliers

Aqua

Hazleton

LCA

Newark

PAWC

Veolia

Birdsboro

Buck Hill Falls

- If a point is flagged, it is the **starting point for a more detailed analysis** for that individual point, **not a prediction**.
- These suppliers had one or more flagged withdrawal points
 - In all cases, these impacts were due to pass-by flow requirements.
 - PWD withdrawal points have pass-by requirements but also no flag
- **Transparency** before publication—met with each supplier to:
 - Address suppliers' questions, comments, and concerns
 - Inform our interpretation of results with real-world data from suppliers

Conclusions



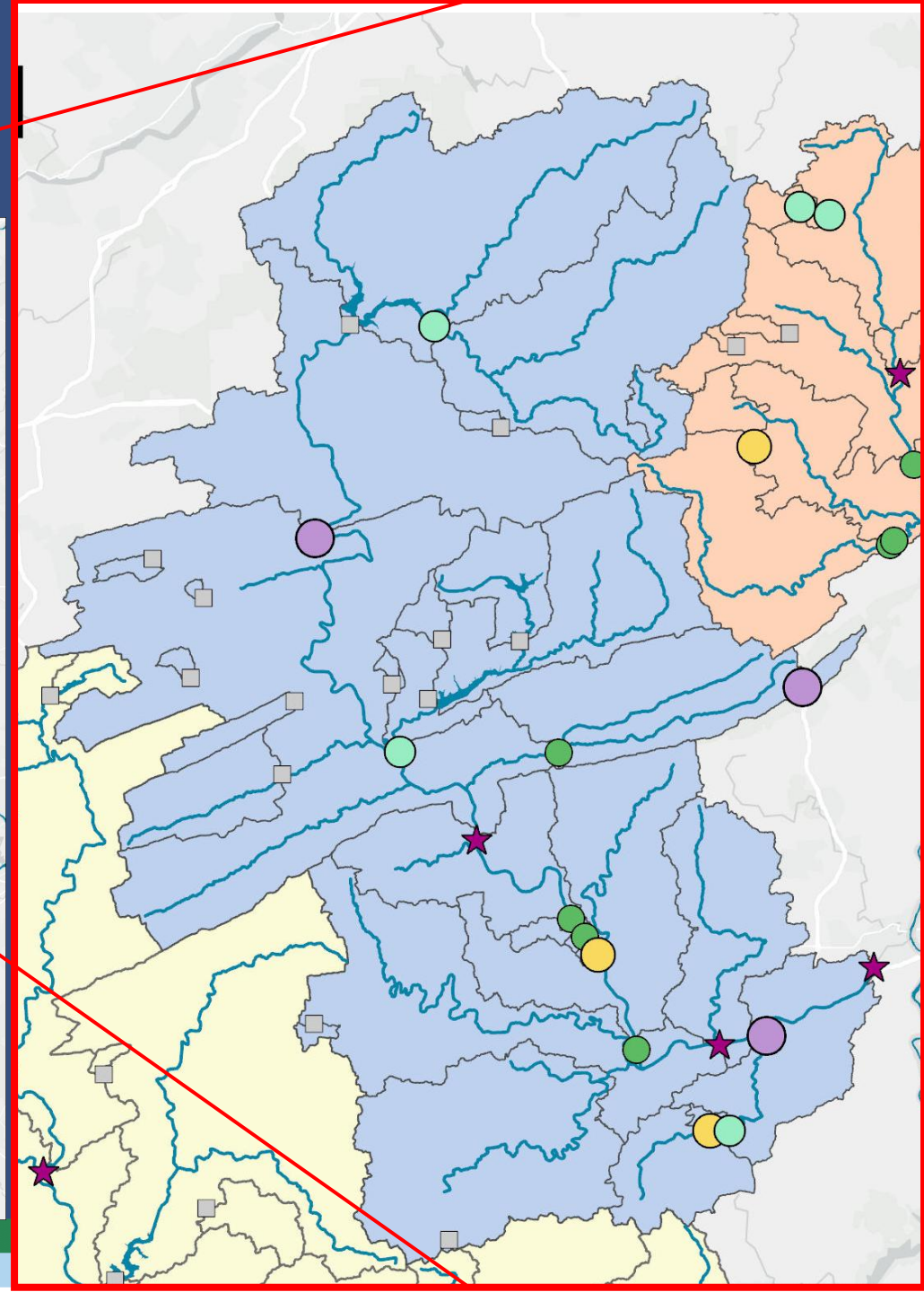
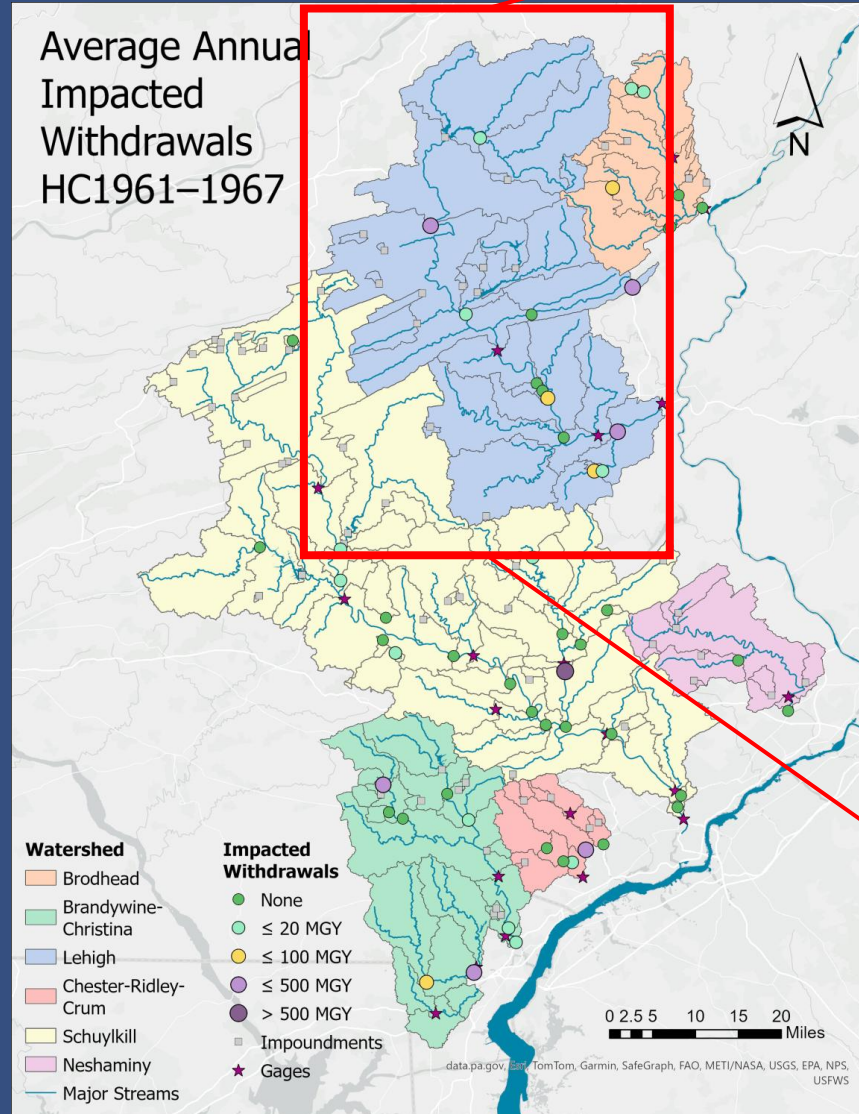
Geologic challenges in the Lehigh Valley



- Multiple flagged PWS SW points in the Lehigh watershed
 - PWS organizations were met with and are thoroughly aware of the impact of dry conditions
- Previous 2060 planning work by DRBC has indicated similar findings regarding long term availability concerns
- Karst geology complicates the hydrology modelling
 - Further study of this would improve accuracy

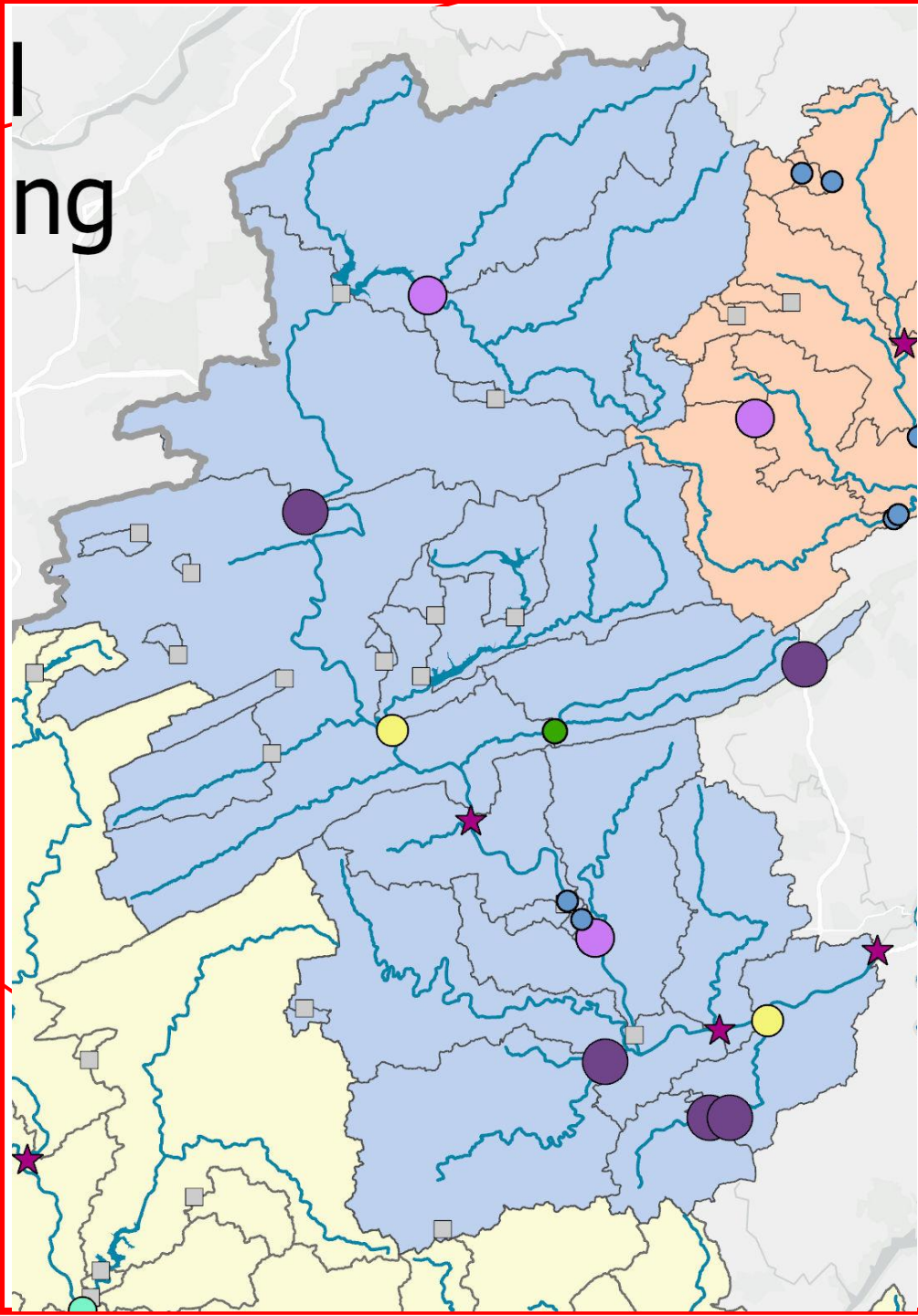
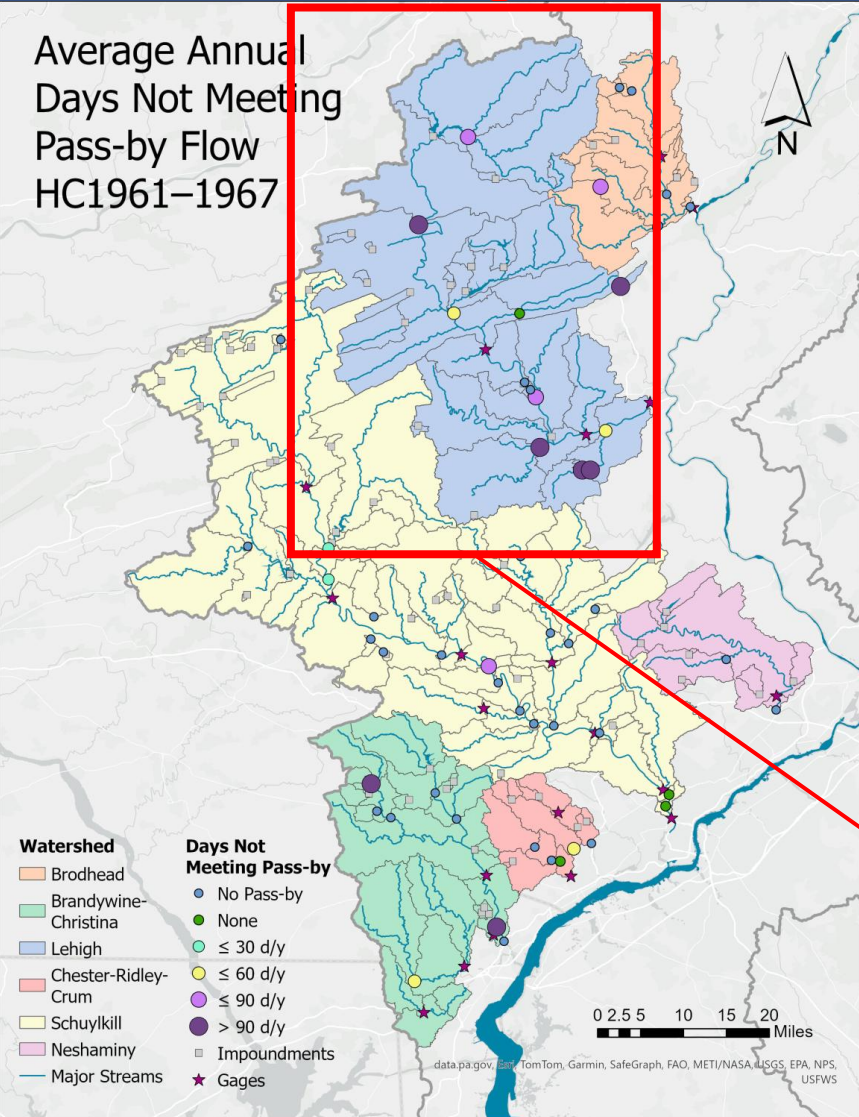
Impacted Volumes in the Lehigh

Watershed with the
highest
concentration of
significantly
impacted withdrawal
volumes



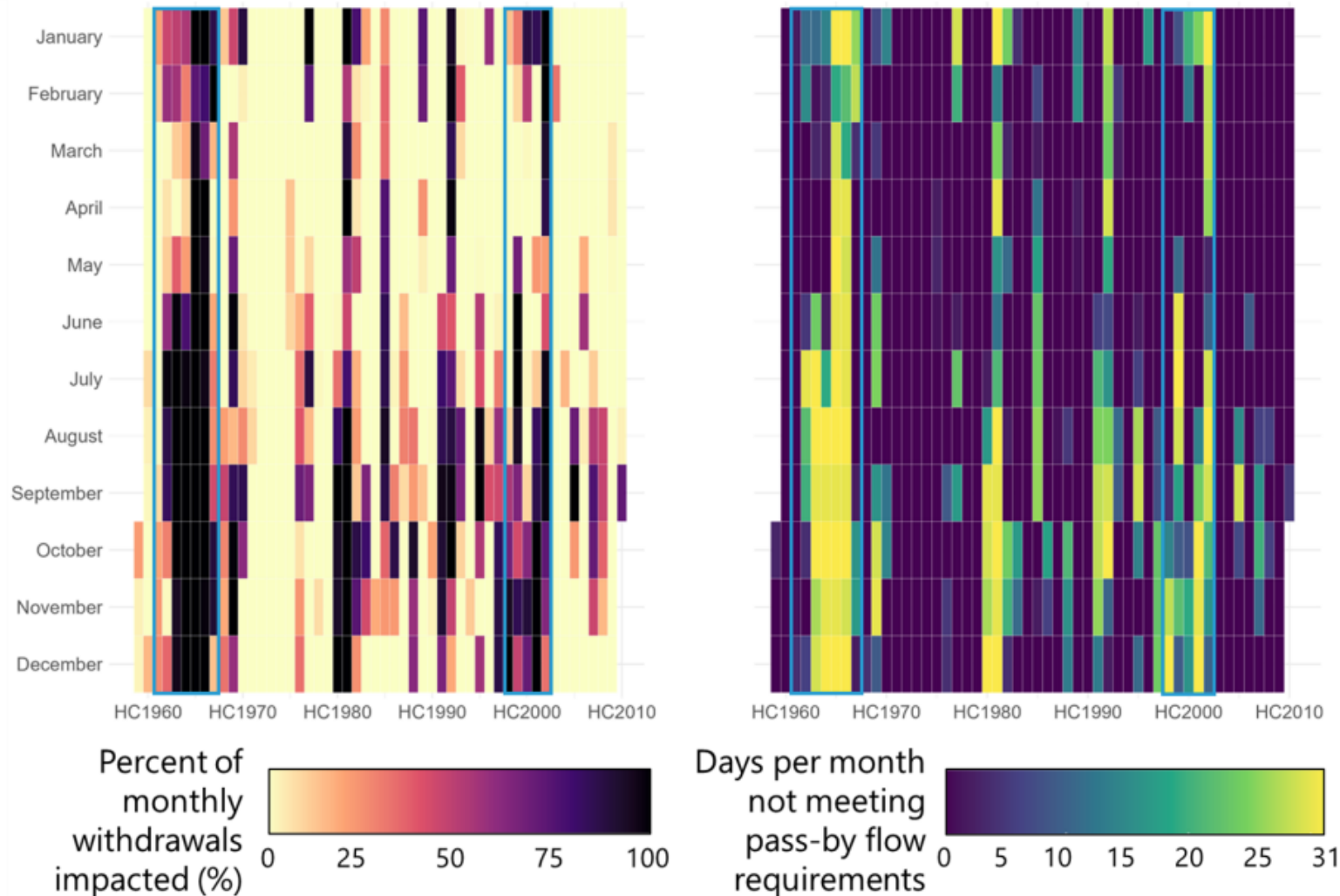
Impacted PBF Days in the Lehigh

Watershed with the highest concentration of significantly impacted days not meeting PBF



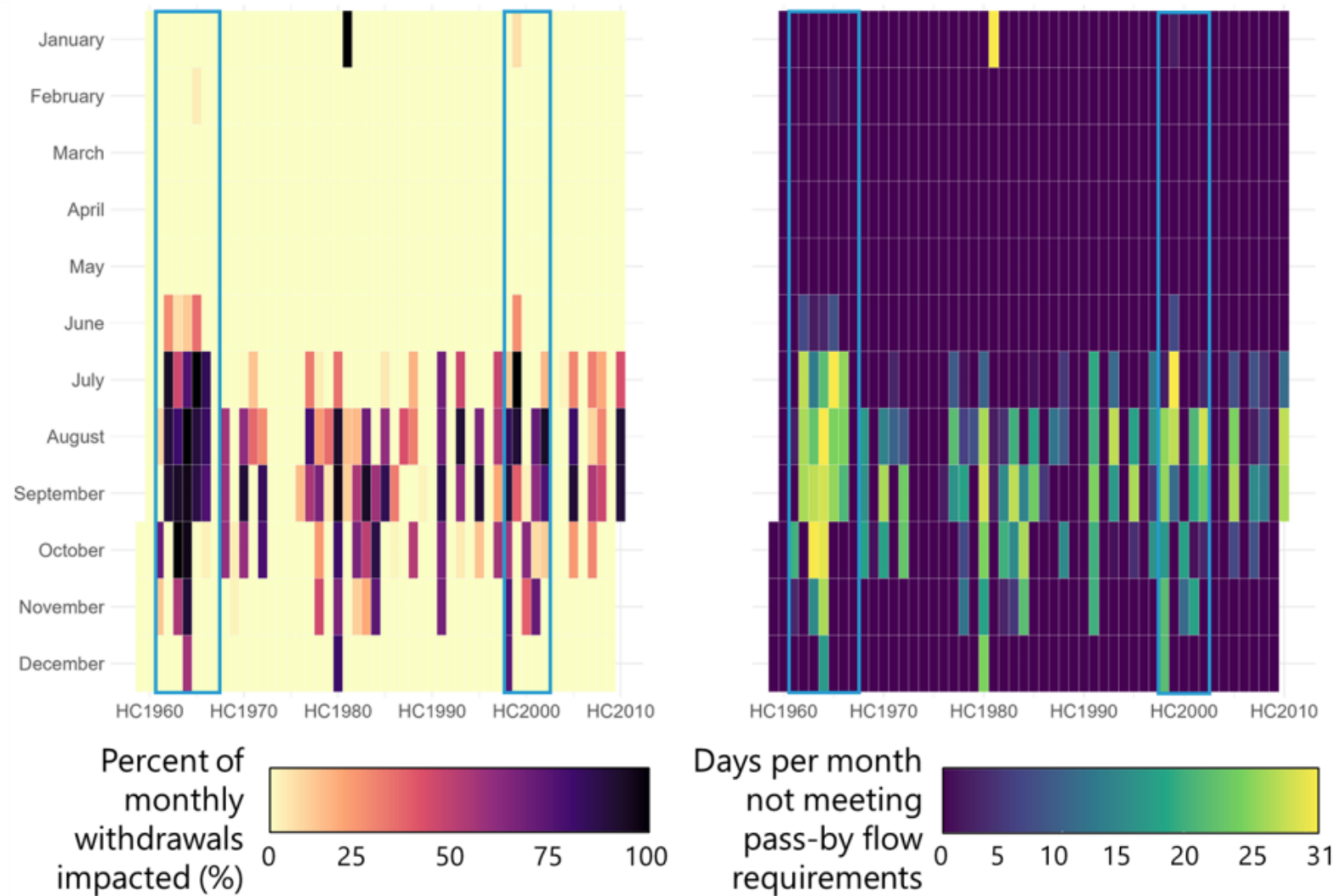
Individual SW point analysis: LCA

Lehigh County Authority's Little Lehigh Creek intake (L02)

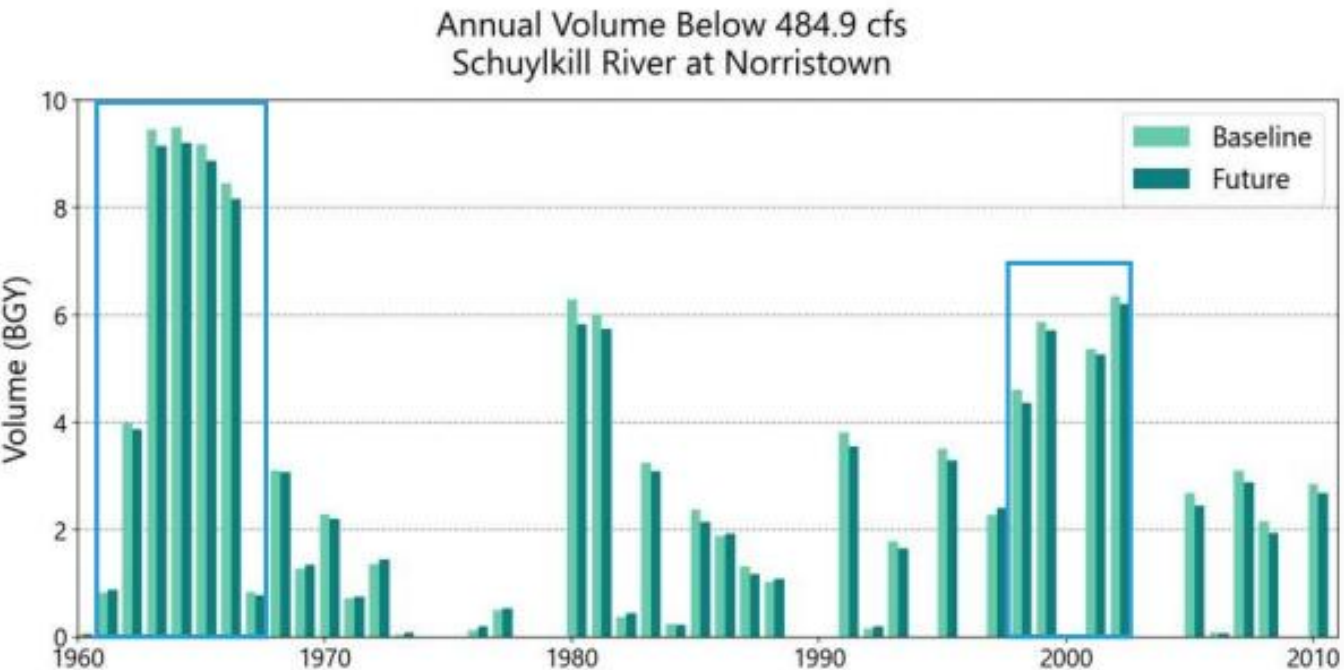
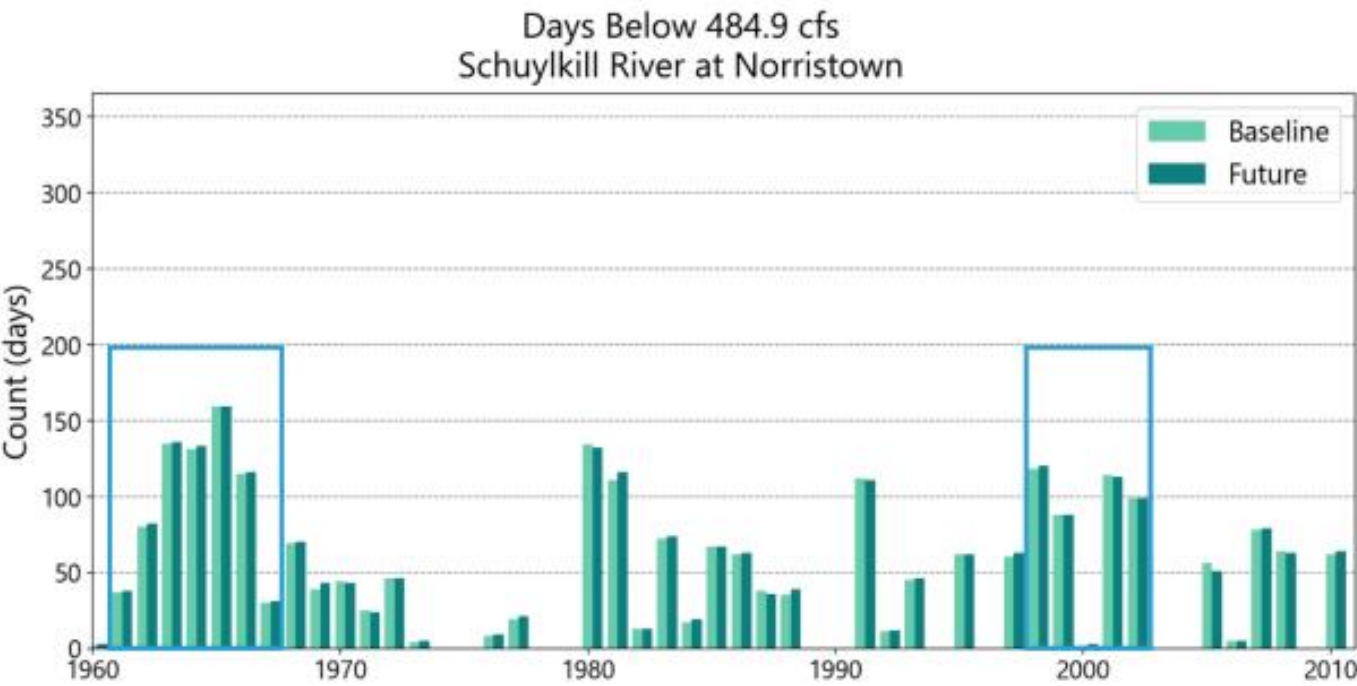


Individual SW point analysis: Hazleton

Hazleton City Authority's Lehigh River intake (L08)



PWD Analysis



- Current PBF 100cfs at Fairmount
- Modelled PBF 484.9cfs at Norristown (10 miles upstream)
 - SWEET predicts PBF met 87% of the time

“SWEET results from the baseline scenario show that the majority of run-of-river public water supply withdrawals from non-tidal tributaries to the Delaware River would likely be able to maintain supply during a repeat drought of record.”

Recommendations



Improvements: Data & tool enhancements for better SW availability modelling

1. Continue updating and improving DRB-SET to support models including HC beyond WY2010.
2. Continue logging altered or newly implemented PBFs in the model to balance both water availability and ecological needs.
3. Improve sewershed delineations to tie withdrawals to their associated returns to better represent consumptive uses.
4. Closer accounting to the relationship of groundwater and surface water to confirm or alter the 1:1 assumption.

Future work: SWEET can be maintained for continued use

1. Maintain the SWEET model for future applications.
2. Apply existing SWEET methodology to incorporate the impacts from recent dry periods.
3. Apply SWEET to support evaluation of the cumulative impact of proposed surface water withdrawals on water availability throughout the watershed.

Future work: SWEET can be applied for expanded uses

1. How much additional water may be needed to support the current surface water demand at a watershed scale during a repeat drought of record?
2. How does water loss impact water availability?
3. How does climate change explicitly impact future surface water availability?



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<https://tinyurl.com/DRBC-SWEET>

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