Representation of Reservoirs/Impoundments in Phase 6 Watershed Model

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Topics

- Motivation
- Overview of P6 Representation of Reservoirs/Impoundments
  - HSPF
  - SPARROW/Stream-to-River Delivery Factors
- Options for Improving Representation of Reservoirs in P6
- Progress in Improving Representation of Reservoirs in P6
- Next Steps

Motivation

- Midpoint Assessment
  - Greater capture of local reservoirs and impoundments a midpoint assessment priority for Urban Stormwater Workgroup

- Representation of Reservoirs/Impoundments in watersheds Below Fall Line
  - WWTP discharges (to Bay) are captured in P5 but water withdrawals (divergences) are not captured because divergences only represented in reach simulations

Representation of Impoundments: P5 vs. P6

Scale	Phase 5	Phase 6
River Reach	35 HSPF reaches (in Chesapeake Bay watershed) represented as reservoirs	P5 reservoirs retained with option of representation of additional reservoirs if stakeholders provide necessary information
Finer Scale	No representation	Representation of effects of over 4,000 impoundments on nutrient delivery through incorporation of SPARROW representation of impoundments in

P5/P6 HSPF Representation of Impoundments

- Impoundment Hydraulics: FTABLE
  - Relate surface area, depth, outflow to volume
  - Can change in time (seasonally) through Special Actions
- Key water quality parameters calibrated in P5/P6 automated river calibration
  - Settling rate
  - Denitrification
  - Algal growth
- Simulation of reservoir nutrient retention dynamic: varies with flow, temperature, and many other factors
- Adding reservoirs may require non-trivial effort
  - Resegmentation?

SPARROW Representation of Effects of Impoundments

- For nitrogen and phosphorus, SPARROW calibrates an aquatic decay rate for impoundments
  - delivery rate = 1/(1+coefficient * inverse hydraulic loading rate), where
  - Hydraulic loading rate (m/yr) = annual flow/surface area
  - Annual flow = natural flow in reservoir reach
- These reservoir decay rates are included in calculation of stream-to-river (S2R) delivery factor for each land-river segment for all NHDPlus reaches at finer scales than P6 river reaches
- Static effect on nutrient loads: contributes to fixed delivery factor
- Relatively easy to add missing impoundments

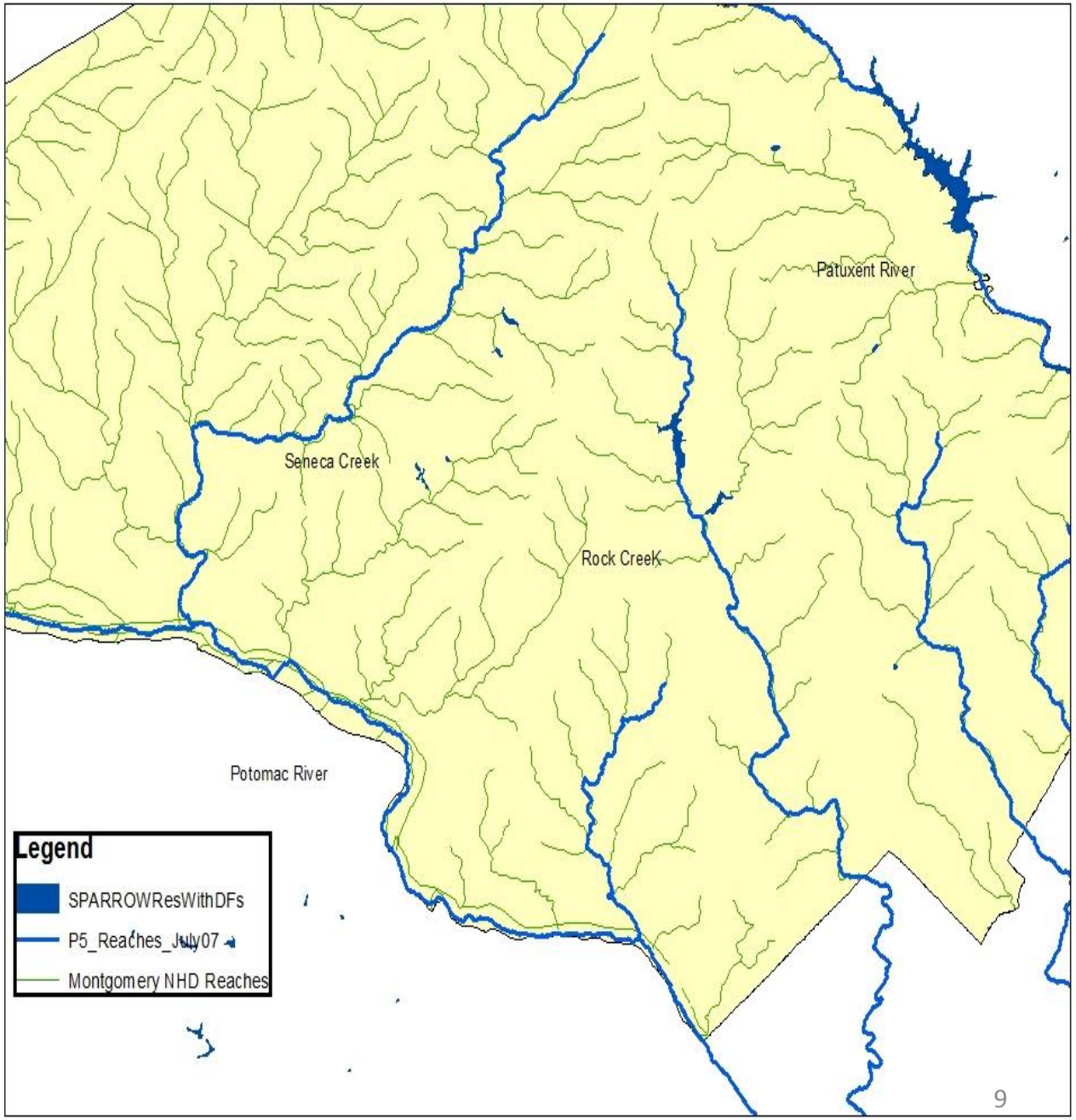
Problems with SPARROW Representation of Impoundments

- SPARROW does not represent effect of impoundments on sediment transport
- Some reservoirs/impoundments not represented in SPARROW
- Some SPARROW impoundments are storm water ponds or industrial waste ponds (double counted as BMPs)
- Effects of reservoirs/impoundments on P6 reaches which are in SPARROW but not explicitly represented in HSPF are not currently captured by S2R delivery factors

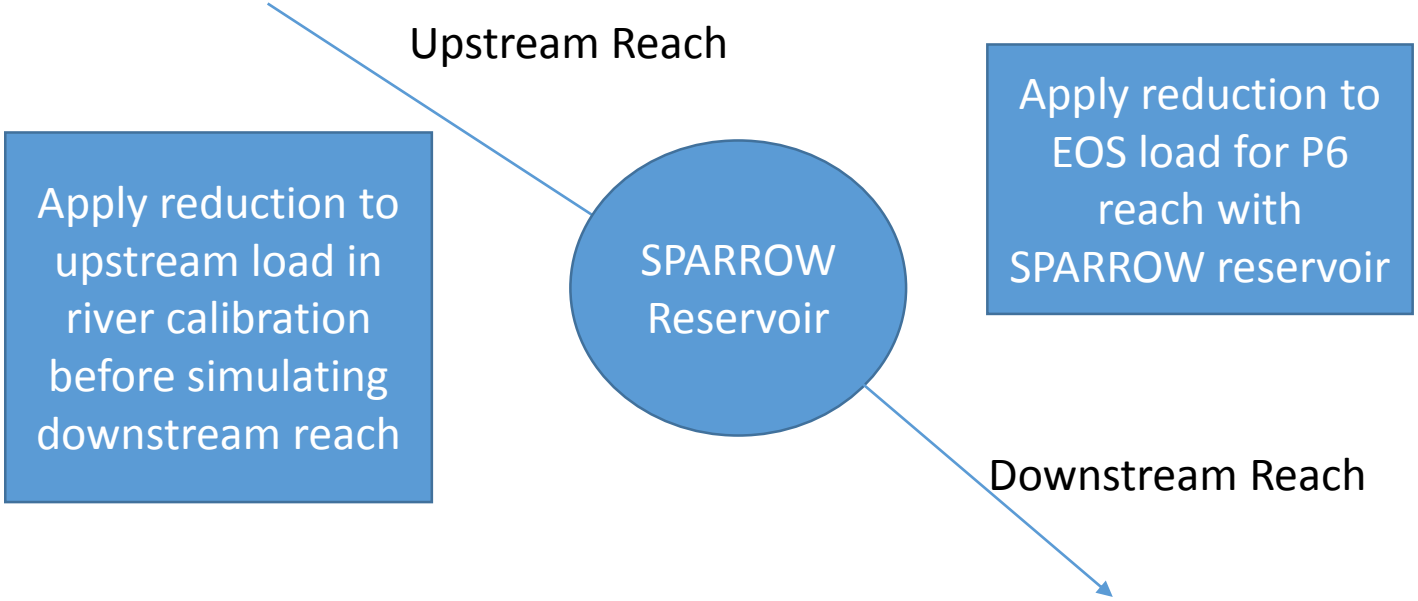
Classification of Impoundments

Scale	In SPARROW	Not in SPARROW
Not on NHDPlus Reach	Not Applicable	Don't represent in P6
On NHDPlus Reach but not on P6 Reach	Accounted for in S2R Delivery Factors	Add to S2R Delivery Factor by calculating effect from impoundment area a annual flow
On P6 Reach	Account for effect on upstream delivery in P6 Model and account for effect on EOS loads in S2R Delivery Factor	Calculate equivalent SPARROW delivery factor (as above) and treat the same way as SPARROW reservoirs

Montgomery Co., MD



SPARROW Reservoir on P6 Reach



Options for Improving Representation of Impoundments in P6

"Promote" reservoir or impoundment to P6 HSPF Reach	• Can be on or off current reach network • Need to supply information for FTABLE • Reservoir simulation only as good as water quality monitoring data available downstream to calibrate reservoir parameters
Add reservoirs/impoundments not in SPARROW	• Need to identify NHDPlus reach • Provide reservoir surface area
Remove SPARROW impoundments double-counted with BMPs	• Provide NHDPlus COMID of reservoir

Status of Reservoir/Impoundments

Jurisdiction	Status
Maryland	• Considering promoting 5-15 reservoirs • List of impoundments to be added to SPARROW • List of impoundments to be remove from SPARROW S2R calculations because double-counted with BMPs
Virginia	• Considering promoting Bath Co. Reservoir • Updating FTABLEs/Operating Rules for P5/P6 reservoirs • May identify major impoundments missing in SPARROW
Virginia (Hampton Roads)	• List of reservoirs to be added to SPARROW • Still considering reservoir promotion
New York West Virginia	No changes planned
District of Columbia Delaware Pennsylvania	No communication

Next Steps

- P6 Beta 1.0 (12/20/15):
  - No changes in HSPF or SPARROW reservoir representation
- P6 Beta 2.0 (approx. 4/30/16):
  - Remove effects of SPARROW impoundments double-counting BMPs
  - Add missing reservoirs to S2R delivery factor calculations
  - Add impacts of SPARROW reservoirs on reaches
  - (start) HSPF implementation of any promoted reservoirs
- April 30, 2016:
  - Deadline for information necessary to promote reservoirs to HSPF simulation