Rapid Flow Change Mitigation Bank Evaluation

Report from the Subcommittee on Ecological Flows

to the Regulated Flow Advisory Committee

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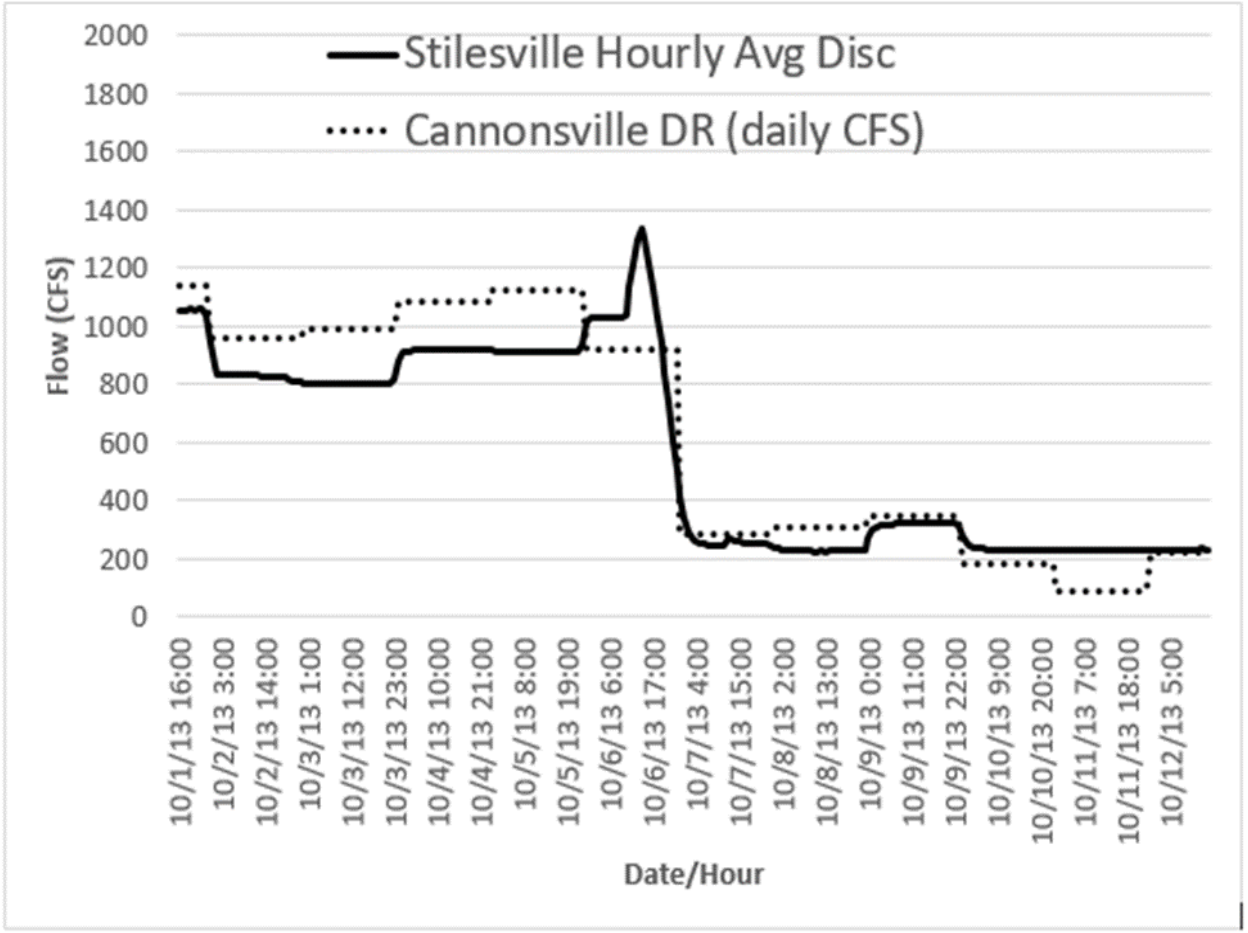
RFCM Background

- SEF was charged to review the guidelines for the Rapid Flow Change Mitigation Bank as part of the 2017 FFMP
- The RFCM is used to mitigate for abrupt changes in stream flow when ORDM Directed Releases are significantly reduced
- Occurs when required baseflows are low and directed releases to meet Montague target are reduced



2017 FFMP Rapid Flow Change Mitigation Protocol - Review

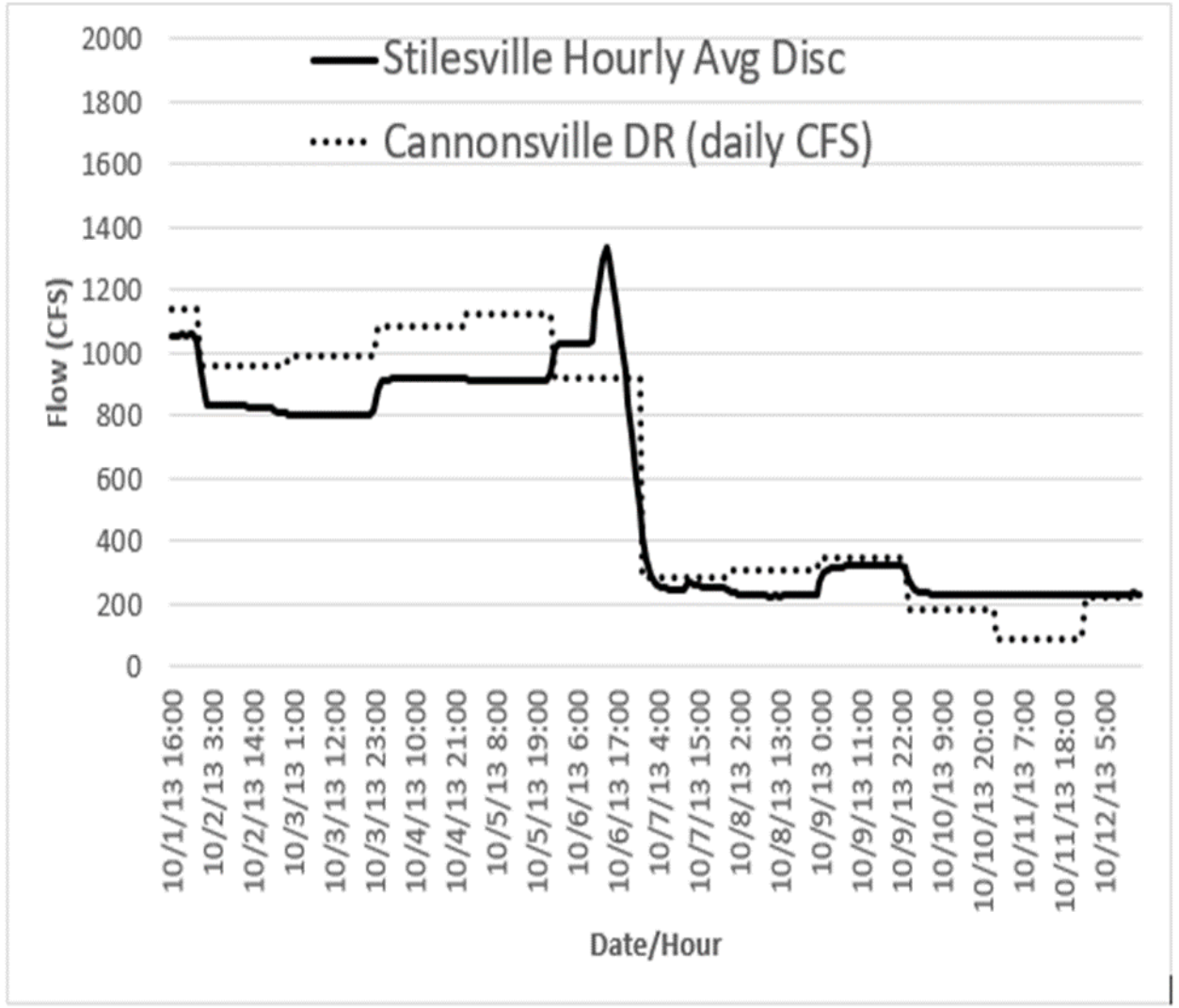
- Starting Cannonsville >700 cfs
  - Day 1 – Cannonsville 500 cfs
  - Day 2 – Cannonsville 300 cfs
  - Day 3 – Lower Rate
- Starting Cannonsville <700 cfs and >450 cfs
  - Day 1 – Cannonsville 300 cfs
  - Day 2 – Lower Rate
- Lower Rate (min flow) is L1 or L2 rates from Table 4 of 2017 FFMP plus ODRM DR
  - Although DRs can be reduced to zero, minimum flow (Conservation Releases) must be maintained
- 1,000 cfs-days available per year

Identification of Rapid Flow Change Events

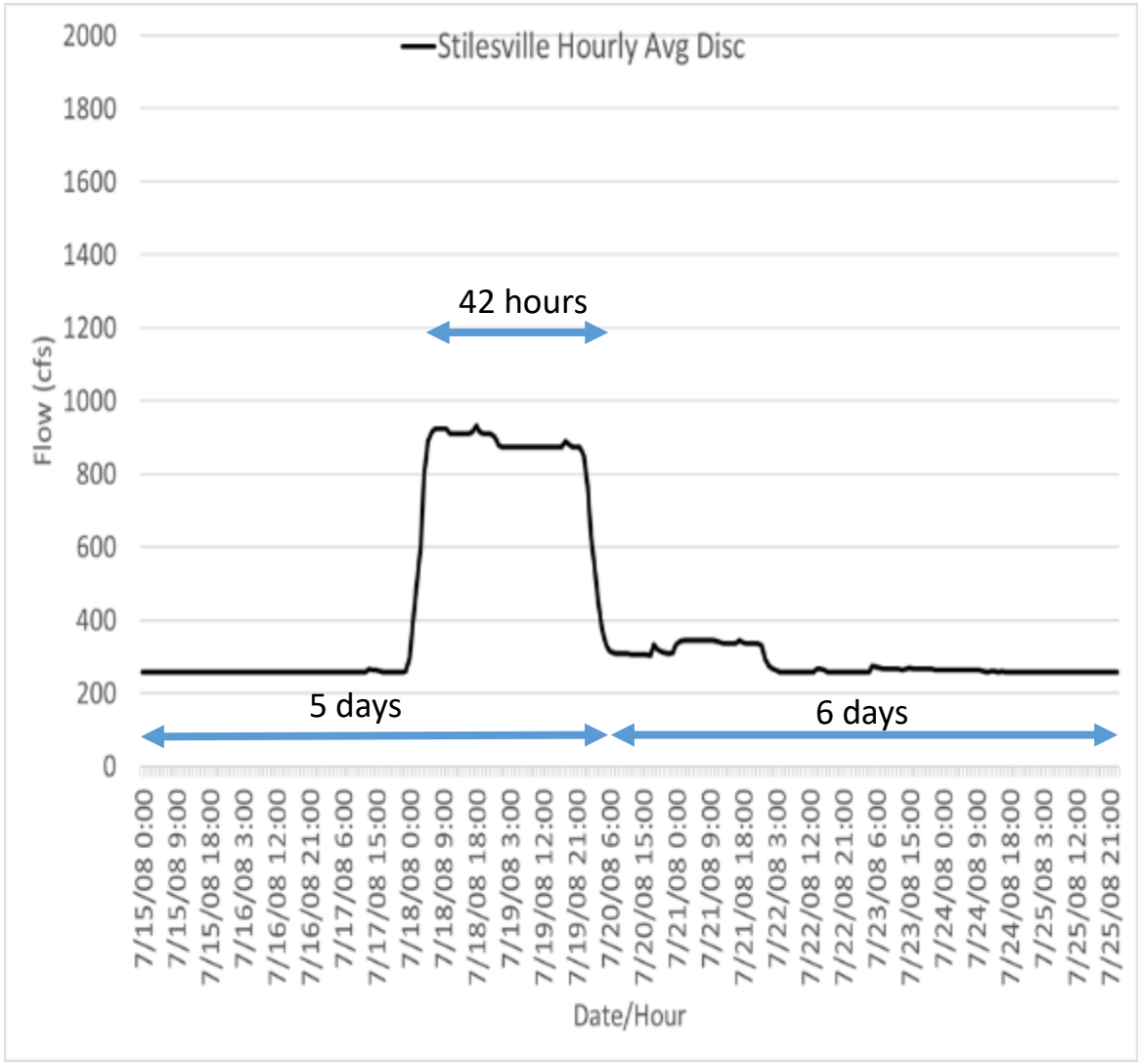
- A complete list of RFC events was not provided to SEF
- SEF developed criteria to identify RFC events
  - Data for 2008-2017 time series
  - Occurred during or within 2 days of end of ORDM Directed Release
  - Flow Reduction resulted in Cannonsville release <500 cfs
  - Flow Reduction >250 cfs in 8 hr period
  - Occurred during non-drought periods
  - Retained 38 events
- Refined criteria – Temp Flow Events
  - Events with temporary flow increase and decreases were removed
  - Retained 30 events
- Refined criteria - Standardized historic flows to 2017 FFMP
  - Retained 27 events

Rapid Flow Change – Identification of Event

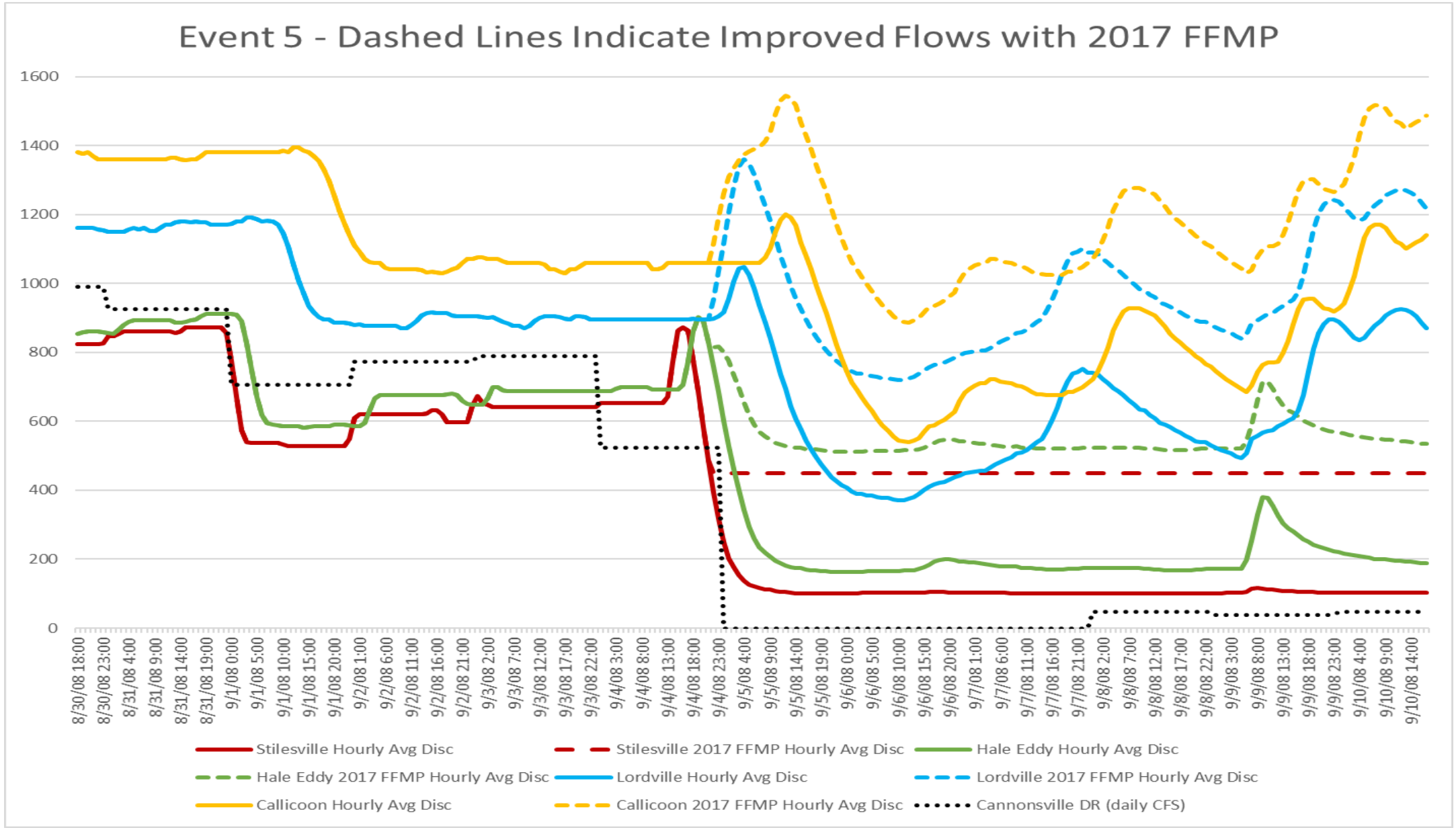
RFC Event = Yes



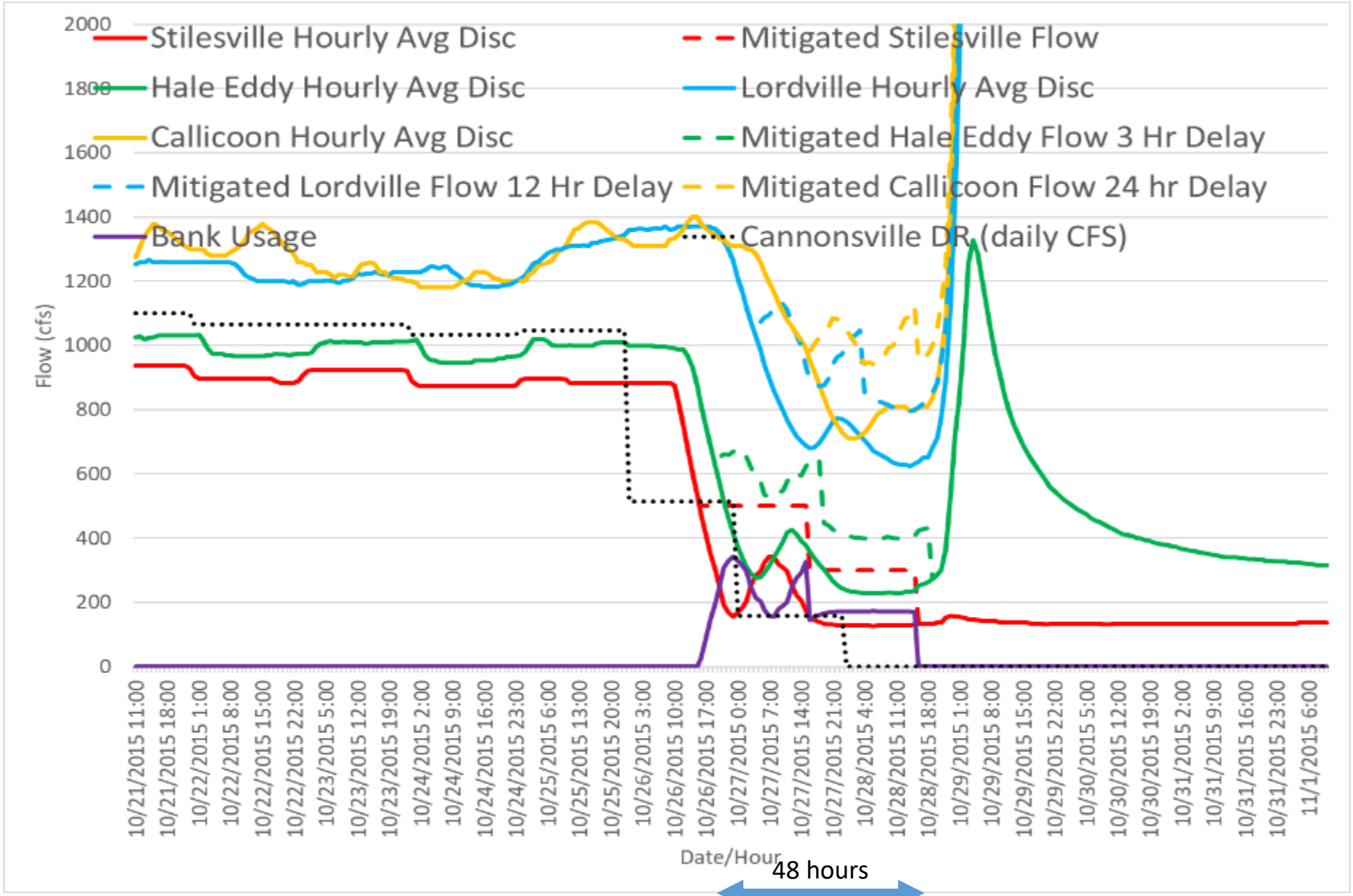
RFC Event = No



Improved Flows with FFMP 2017



RFC Event with Mitigation Applied – Current Protocol



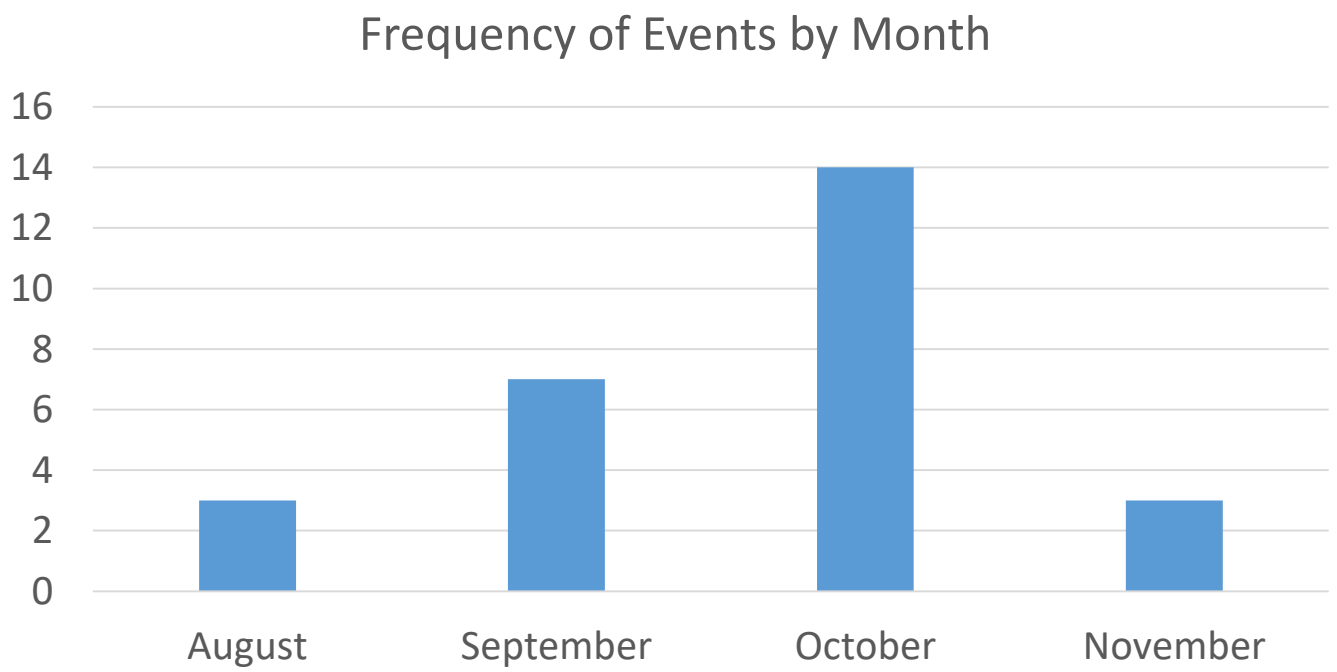
Criteria to Evaluate Mitigation Protocols

- Achievement of Current Bank Allotment
  - Annual water availability ≤1,000 cfs-days
- Achievement of downstream flow criteria
  - Met presumed fully-watered conditions for 48 hours and 72 hours post-event
    - Stilesville 300 cfs
    - Hale Eddy 325 cfs
    - Callicoon 560 cfs & 930 cfs

  OR
  - If fully-watered conditions did not exist prior to event, then achievement of pre-event 5-day median flow for 48 hours and 72 hours post-event
    - 2 @ Stilesville, 2 @ Callicoon
- Achievement of Stilesville flow reduction <200 cfs post-mitigation

Current Protocol Evaluation

- 27 events evaluated
  - 0-6 events per year
  - Results indicate “Perfect” water usage
  - Bank was not exceeded in any year



Year	Mitigation Required (cfs)	# Events
2008	517	2
2009	146	1
2010	481	2
2011	0	0
2012	231	2
2013	666	5
2014	764	3
2015	527	3
2016	934	6
2017	775	3

Current Protocol Evaluation

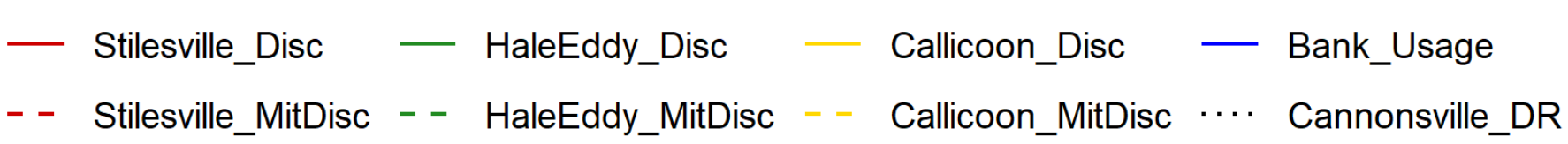
Criteria	No Mitigation	Current Protocol
<1,000 cfs-days/yr	N/A	100%
Stilesville > 300 cfs 48-hr	63%	**94%**
Stilesville > 300 cfs 72-hr	63%	**86%**
Hale Eddy > 325 cfs 48-hr	80%	**97%**
Hale Eddy > 325 cfs 72-hr	83%	**95%**
Callicoon >560 cfs 48-hr	97%	**99%**
Callicoon >560 cfs 72-hr	98%	**99%**
Callicoon > 930 cfs 48-hr	66%	**80%**
Callicoon > 930 cfs 72-hr	72%	**81%**
Stilesville dropped < 200 cfs	N/A	100%
Average cfs-days per event	N/A	187

Preferred Alternative Protocol

- Similar starting conditions to current protocol but reduced ramp rate and longer implementation of mitigation
  - Decreased ramp to 100 cfs per day (versus 200 cfs per day)
  - Extended mitigation an additional 12 hours (60 hrs total versus 48 hrs)
- Proposal
  - Starting Cannonsville >700 cfs
    - Day 1 – Cannonsville 500 cfs
    - Day 2 – Cannonsville 400 cfs
    - Day 3 (first 12 hrs) – Cannonsville 300 cfs
    - Day 3 (last 12 hrs) – Lower Rate
  - Starting Cannonsville <700 cfs and >450 cfs
    - Day 1 – Cannonsville 300 cfs
    - Day 2 – Cannonsville 200 cfs
    - Day 3 - Lower Rate

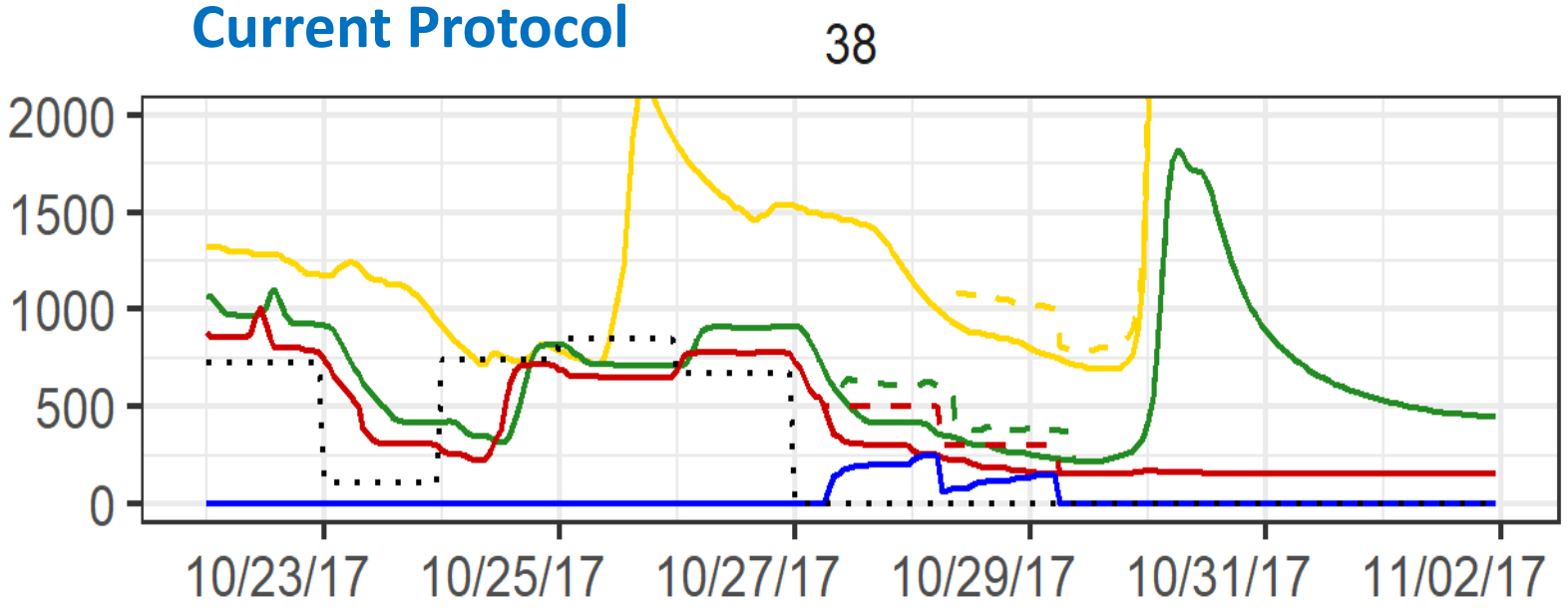
Protocol Evaluation Comparison

Criteria	Current Protocol	Preferred Alt. Protocol
<1,000 cfs-days/yr	**100%**	90%
Stilesville > 300 cfs 48-hr	94%	94%
Stilesville > 300 cfs 72-hr	86%	**89%**
Hale Eddy > 325 cfs 48-hr	97%	**98%**
Hale Eddy > 325 cfs 72-hr	95%	**98%**
Callicoon >560 cfs 48-hr	99%	99%
Callicoon >560 cfs 72-hr	99%	99%
Callicoon > 930 cfs 48-hr	80%	**81%**
Callicoon > 930 cfs 72-hr	81%	**82%**
Stilesville dropped < 200 cfs	100%	100%
Average cfs-days per event	187	235

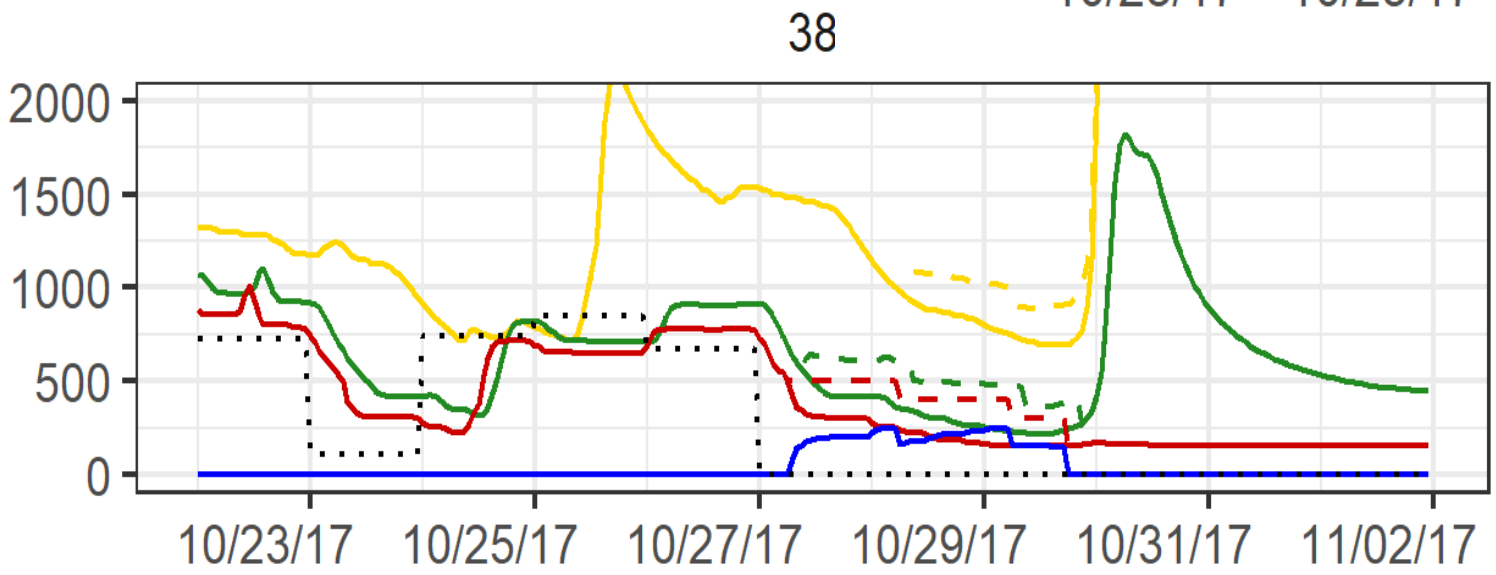


Protocol Comparison Example

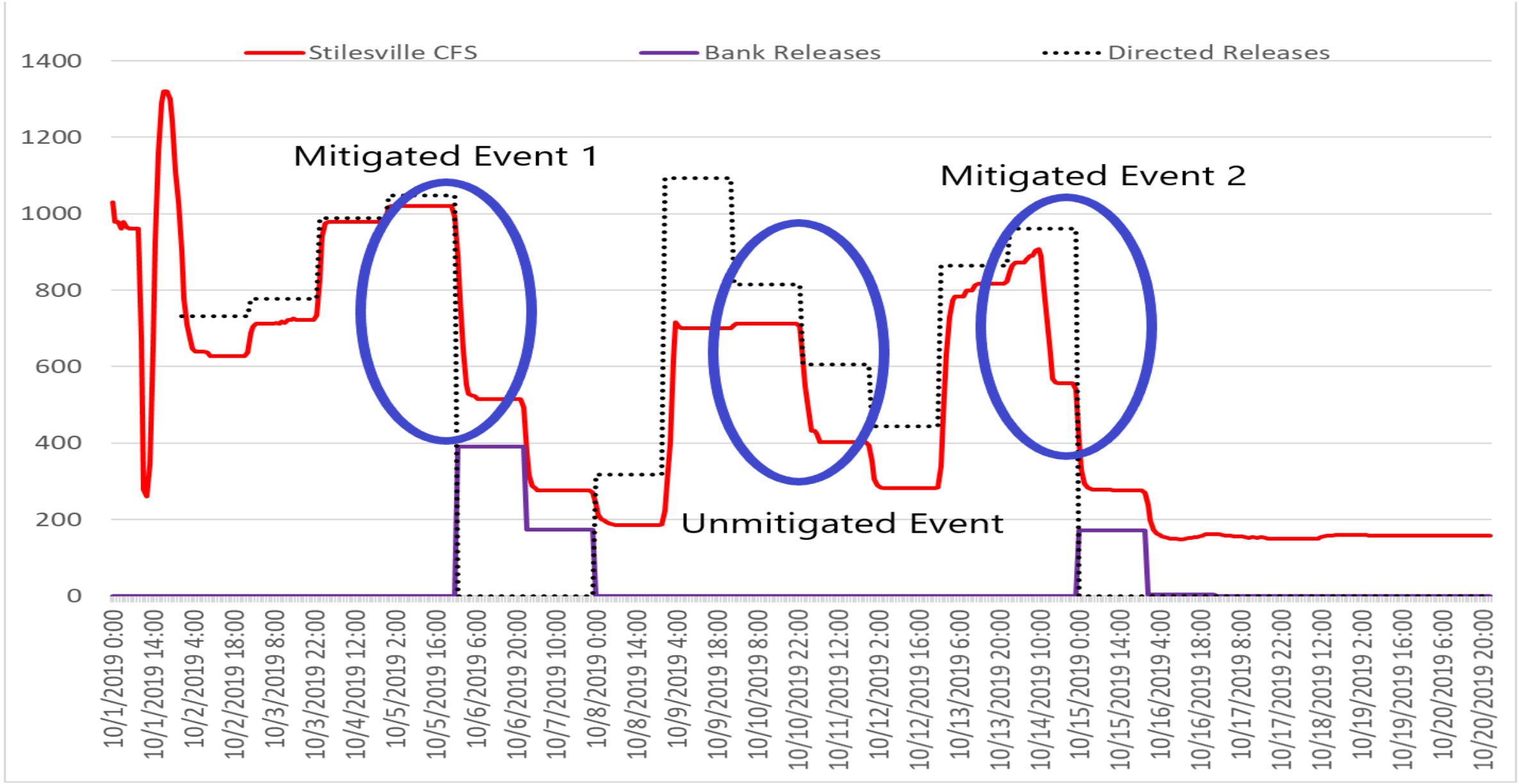
Current Protocol



Preferred Alternative Protocol



2019 RFC Event Review



2019 Protocol Evaluation

Criteria	Event 1 - Implemented	Event 1 - Alternative	Event 2 - Implemented	Event 2 - Alternative
cfs-days used	**564**	775	**175**	572
Stilesville > 300 cfs 48-hr	56%*	**100%**	29%	**100%**
Stilesville > 300 cfs 72-hr	38%*	**89%**	19%	**88%**
Hale Eddy > 325 cfs 48-hr	100%	100%	83%	**100%**
Hale Eddy > 325 cfs 72-hr	100%	100%	85%	**100%**
Callicoon >560 cfs 48-hr	100%	100%	100%	100%
Callicoon >560 cfs 72-hr	100%	100%	100%	100%
Callicoon > 930 cfs 48-hr	38%	**52%**	31%	**33%**
Callicoon > 930 cfs 72-hr	58%	**68%**	54%	**56%**
Stilesville dropped < 200 cfs	Y	Y	Y	Y

2019 Summary

- Dry fall with high demand for RFC mitigation bank
- Total of 739 cfs-days actually used
  - Preferred Alternative Protocol implemented for all 3 events = 1,543 cfs-days
- Stilesville may not be representative of Cannonsville Releases
  - Inflated estimated bank demand for the Preferred Alternative Protocol
- For 2nd event, flows were modified prior to an event to reduce mitigation needs
  - Effort made to conserve Bank

Conclusions

- The Current Protocol is generally successful in achieving SEF Criteria
- The Alternative Protocol preforms better than the Current Protocol
  - The Alternative Protocol would have exceeded available bank in 2019
- Any updated protocol or guidance should have clear language in what criteria are used to identify a RFC Event
- SEF recommends that the Alternative Protocol be implemented in future years
- SEF recommends that the RFC Bank should be fully exhausted when needed