PRRIP Extension Legislation Update

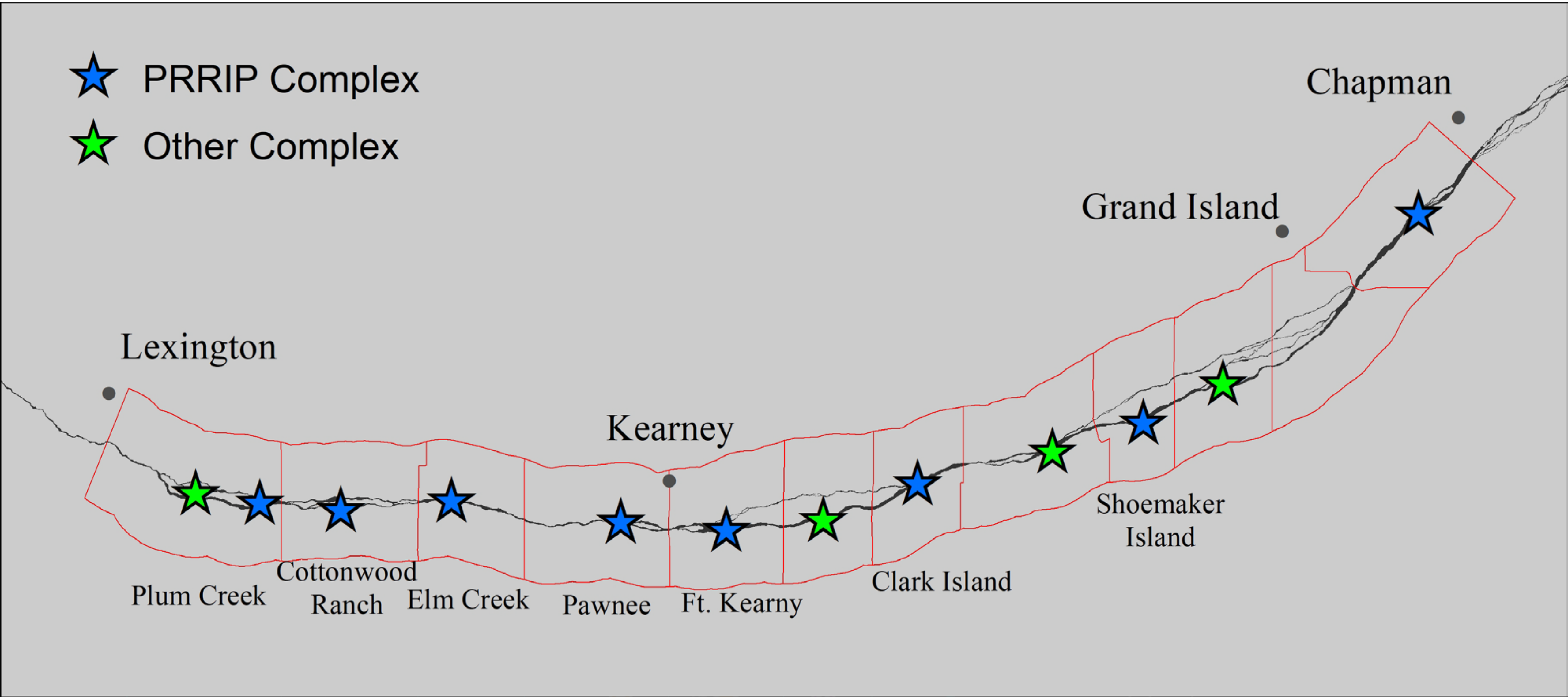
&

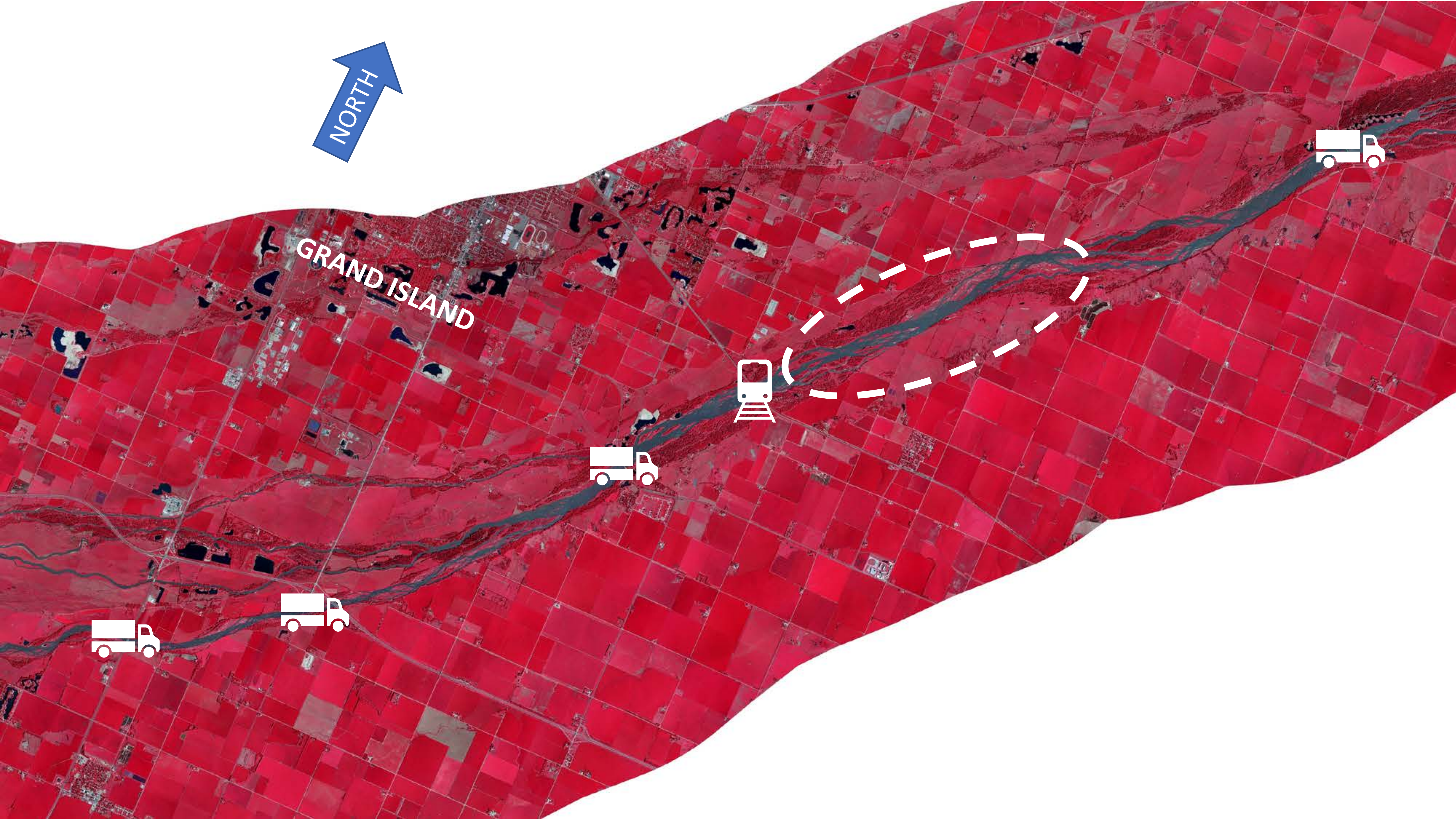
2019 Land Update

Jason Farnsworth
Executive Director

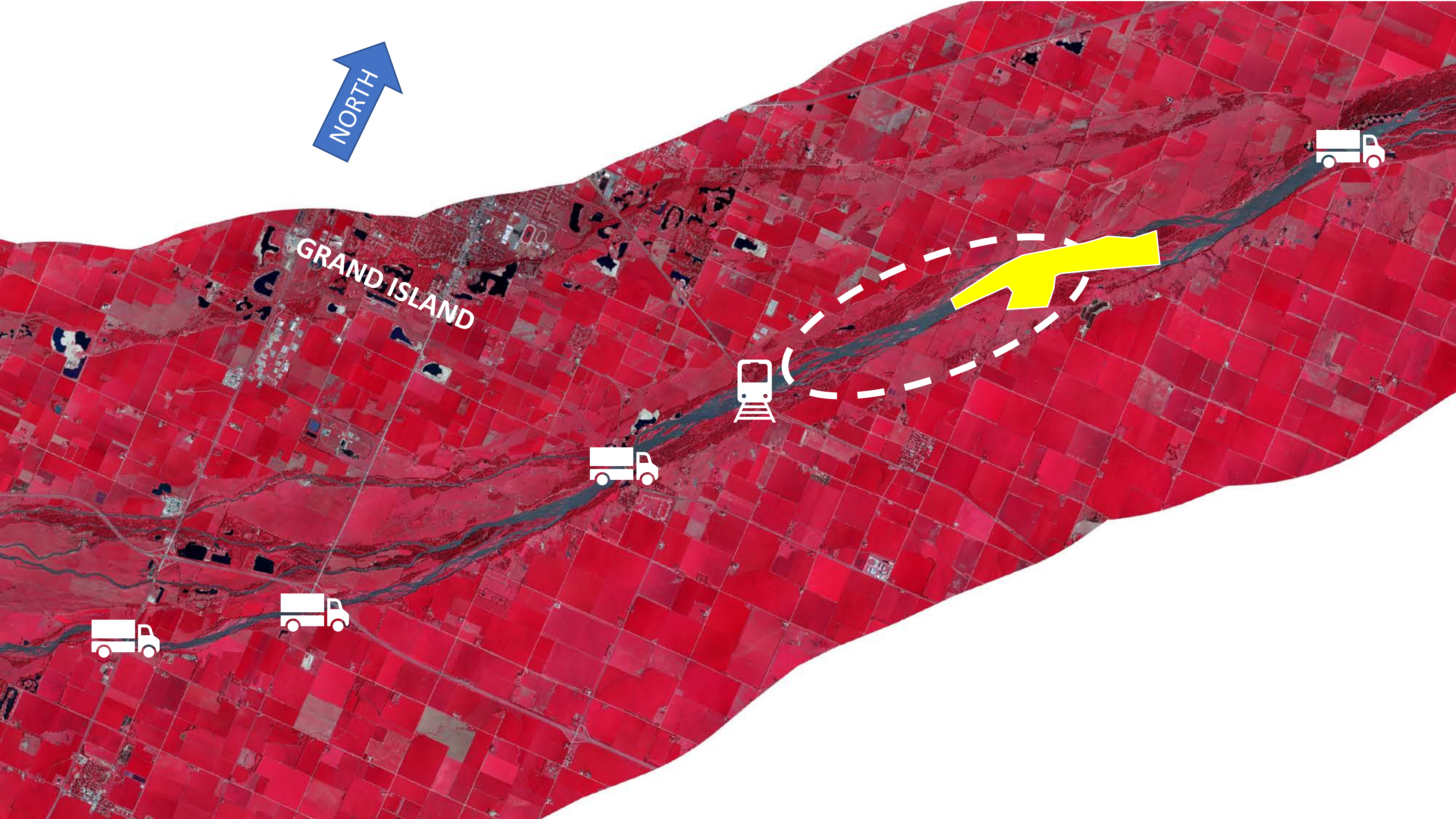

PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

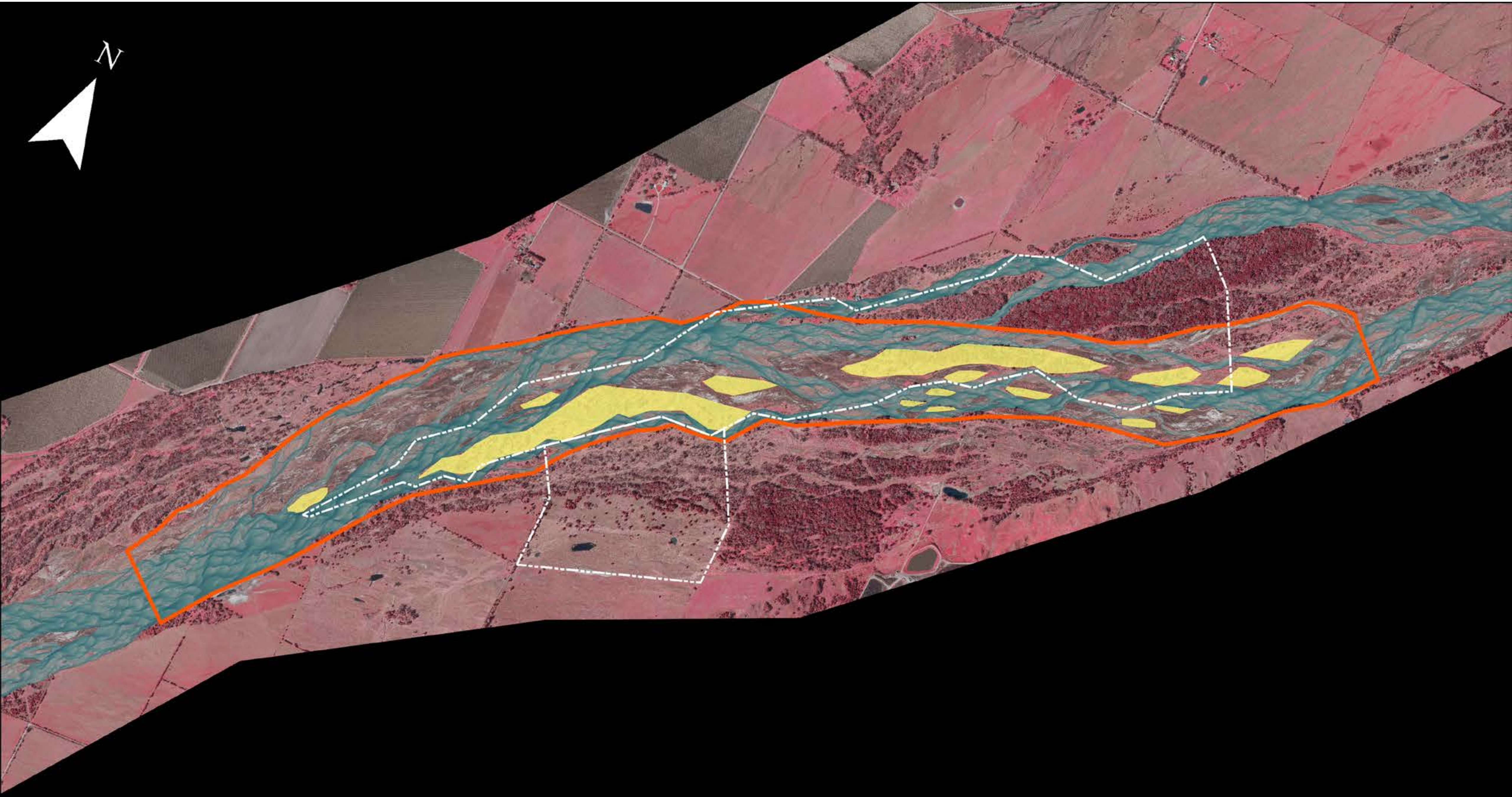
Habitat Type	Purch.& Ease.	Lease & Sponsor.	Man. Agree.	Total
Complex (9,200 ac)	7,572	2,650	1,652	11,874
Non-Complex (800 ac)	630	15	0	645
Plus-Up (1,500 ac)	705	0	0	705
Total	8,907	2,665	1,652	**13,224**

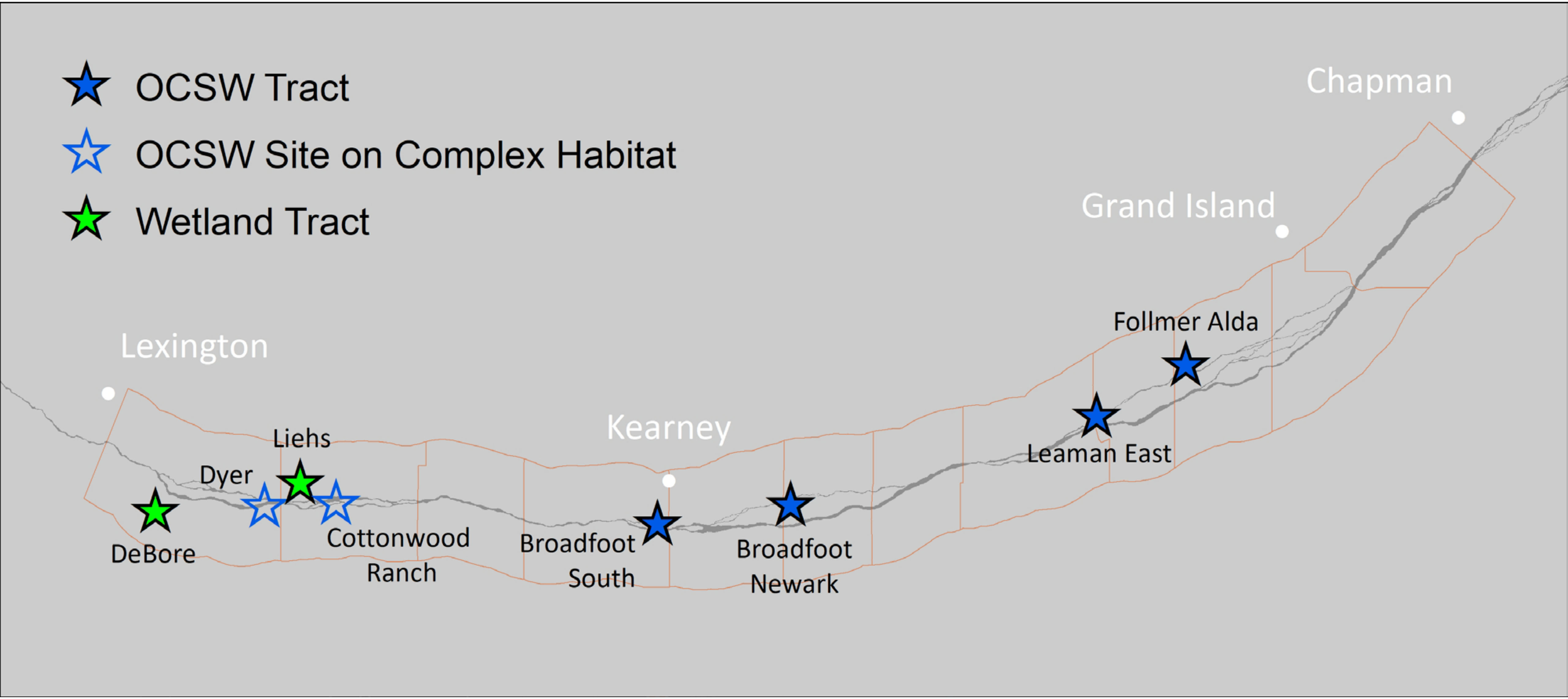

PRRIP Complex
Other Complex
Chapman
Grand Island
Lexington
Kearney
Shoemaker Island
Clark Island
Plum Creek
Cottonwood Ranch
Elm Creek
Pawnee
Ft. Kearny



NORTH
GRAND ISLAND


NORTH
GRAND ISLAND

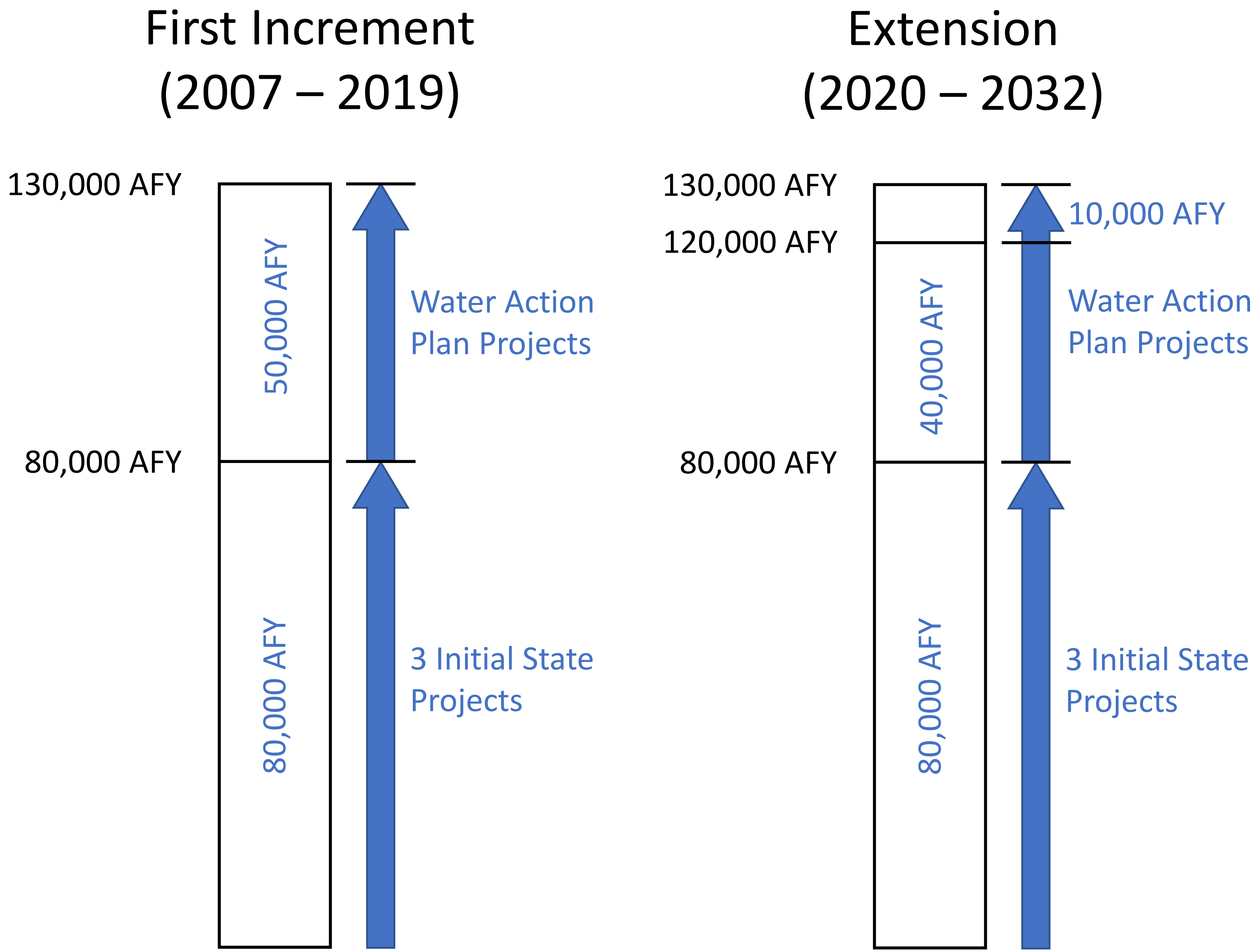

N


OCSW Tract
OCSW Site on Complex Habitat
Wetland Tract
Chapman
Grand Island
Lexington
Kearney
Follmer Alda
Leaman East
Liehs
Dyer
DeBore
Cottonwood Ranch
Broadfoot South
Broadfoot Newark

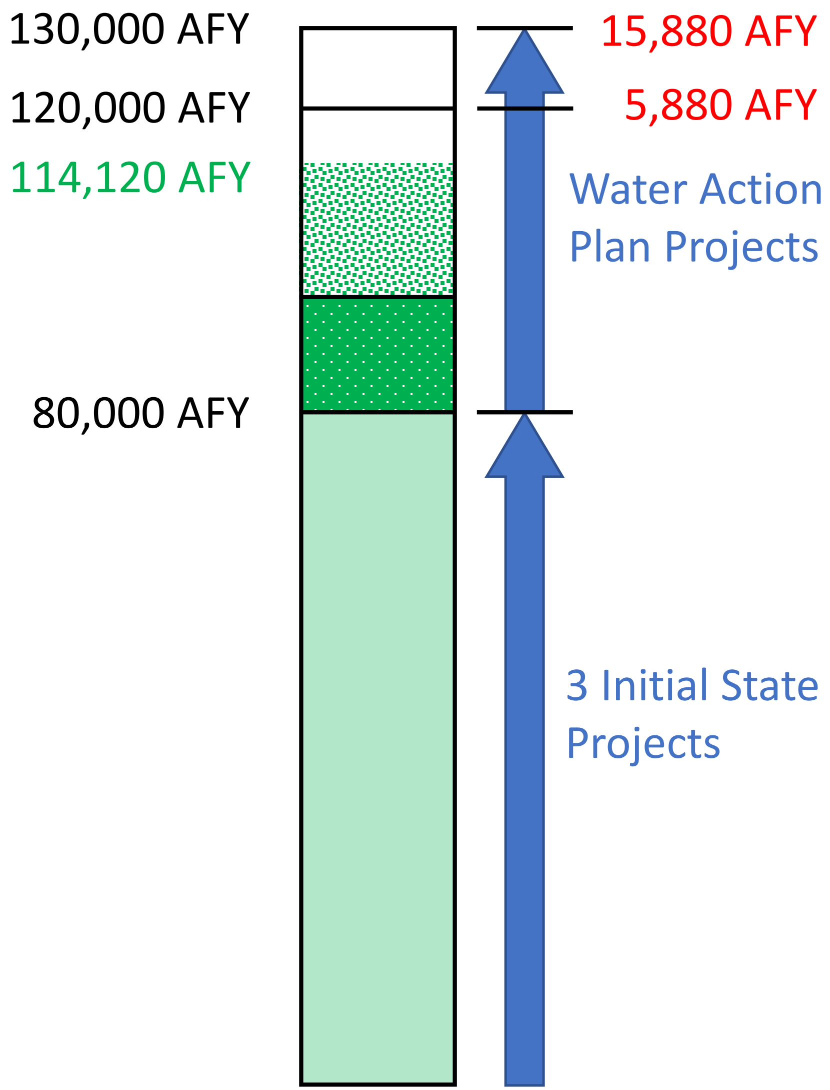

PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

2019 Water Plan Update

Seth Turner, P.E.
Kevin Werbylo, P.E.
Executive Director's Office


First Increment
(2007 – 2019)
130,000 AFY
80,000 AFY
50,000 AFY
80,000 AFY
Water Action
Plan Projects
3 Initial State
Projects
Extension
(2020 – 2032)
130,000 AFY
120,000 AFY
80,000 AFY
10,000 AFY
40,000 AFY
80,000 AFY
Water Action
Plan Projects
3 Initial State
Projects

Overview of Current Water Portfolio



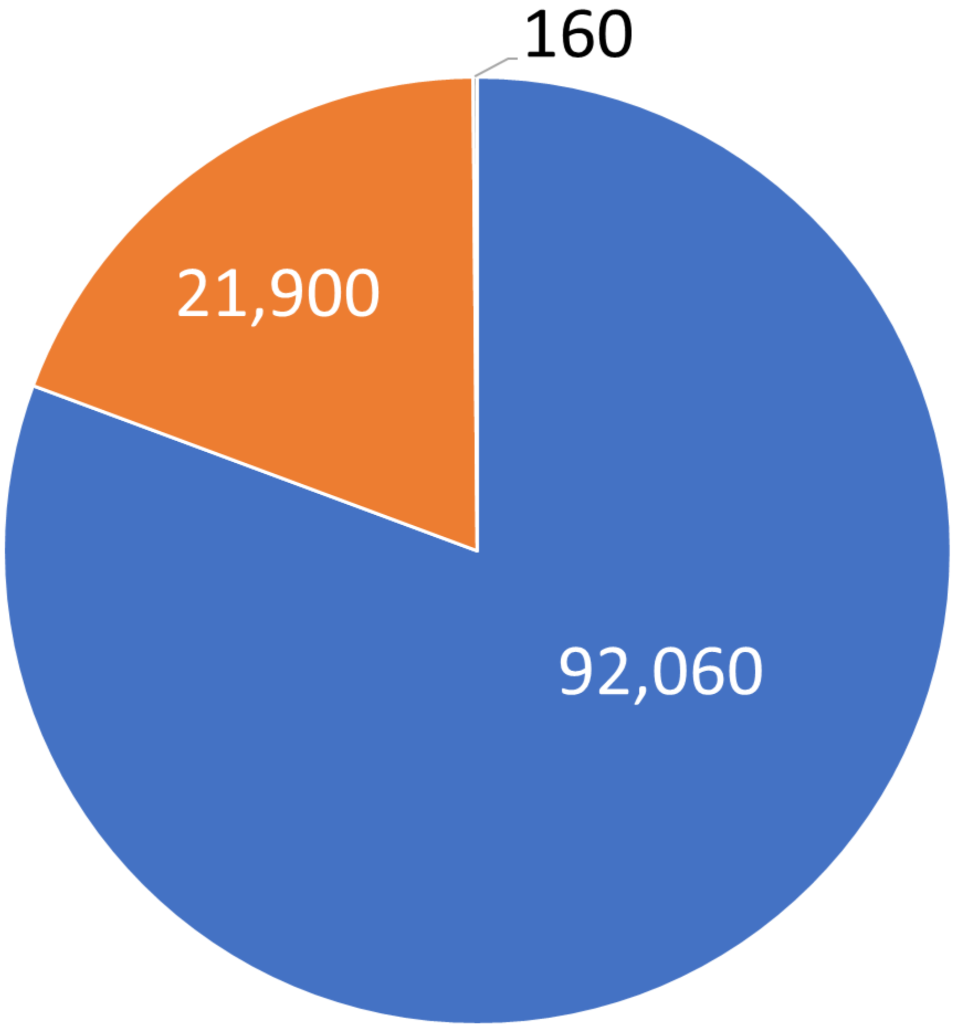
Project	Score [AFY]
3 Initial State Projects	80,000
6 Active WAP Projects (Accepted)	14,170
5 Active WAP Projects (Estimated)	19,950
TOTAL =	**114,120**

Current Water Portfolio
Controllable vs Uncontrollable

Storage - Controllable

Retiming - Uncontrollable

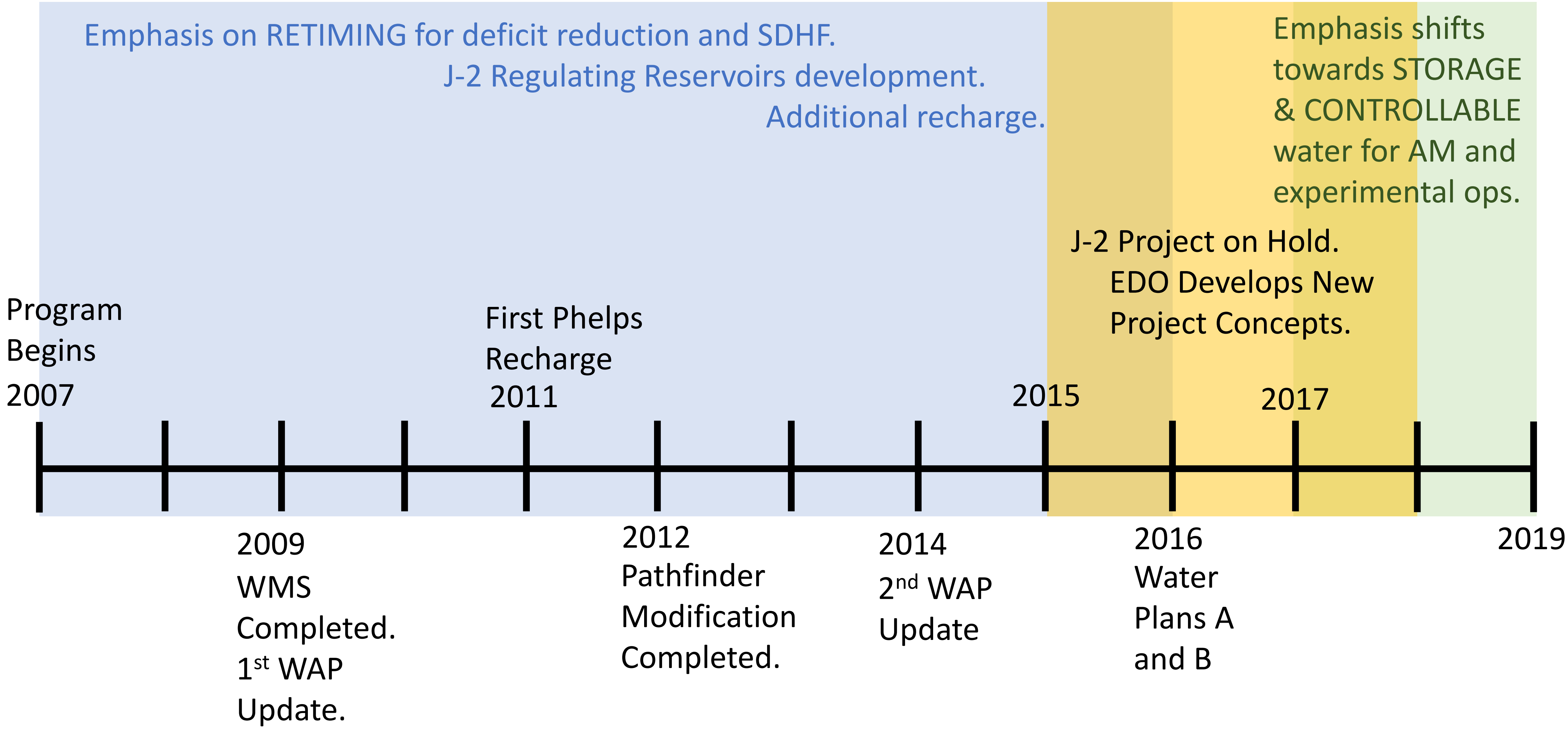
Retiming - Controllable



Operational Variability

Normal and Wet Years	Dry Years
• Entire First Increment • Reliable storage supplies • Reliable excess flows for retiming • Banked large volume through recharge	• Expect during Extension • Storage and controllable supplies much more reliable for operations • Excess flows for retiming reduced significantly

Evolving WAP Priorities

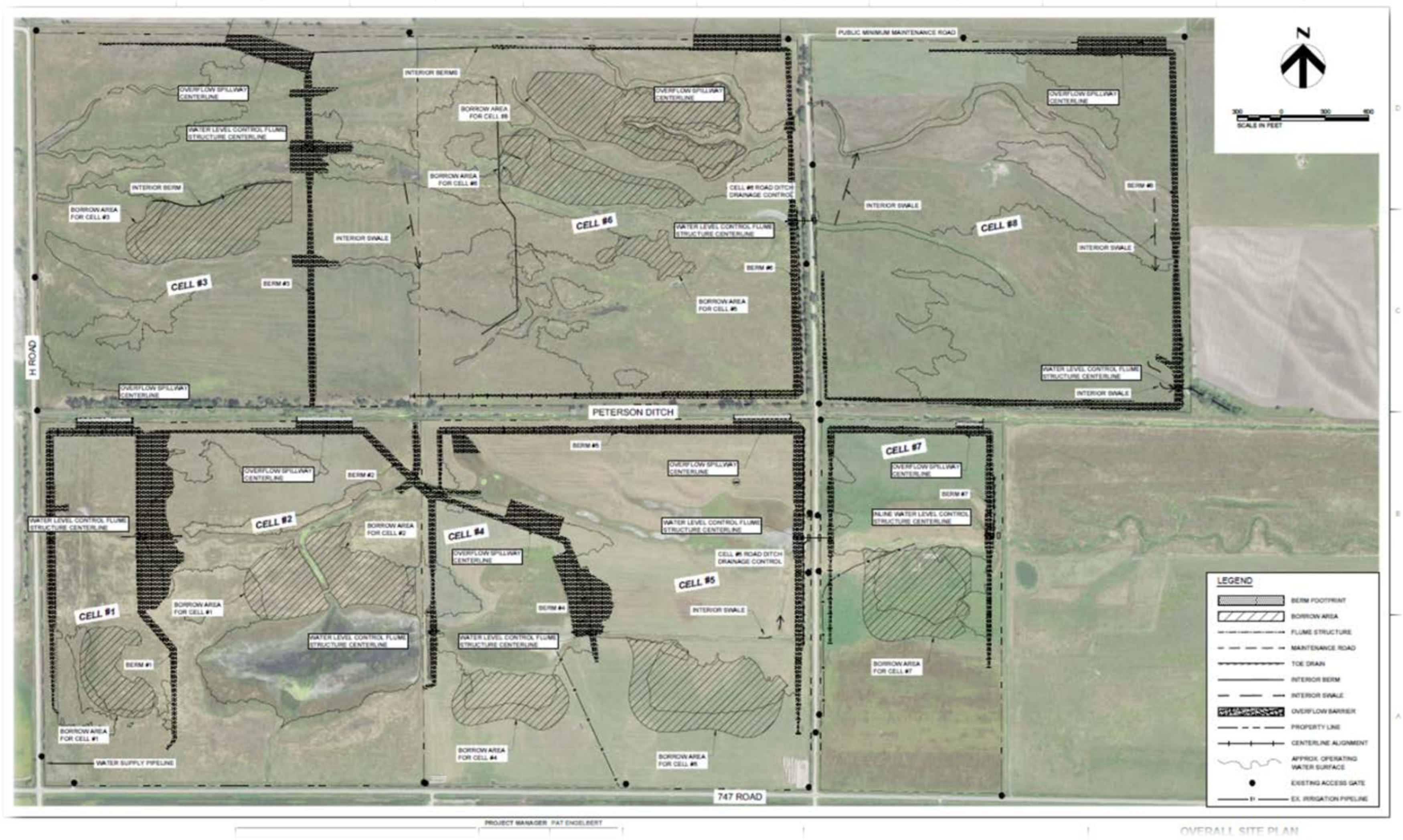


Design and Implementation: Current WAP Projects


Cottonwood Ranch Broad-Scale Recharge Facility


Lakeside Slurry Wall Storage Facility

Design and Implementation: CWR Broad-Scale Recharge Facility



Design and Implementation: CWR Broad-Scale Recharge Facility

Design and Implementation: Lessons Learned

- Expensive and time-consuming
- Storage and other facilities exist
- Program time best spent where, where and how much water to use given several controllable buckets/projects
- If designing and building: pursue simple and cheap, controllable projects

Future WAP Projects – Path to 120,000 AFY

Project	Score [AFY]
Recharge Recapture Project(s)	8,000
North Platte Irrigator Lease(s)	2,500
Lakeside Gravel Pit	2,800
CNPPID Storage Lease	6,600
TOTAL =	**19,900**

- Need about 6,000 AF to reach 120,000 AF.
- All options under review are CONTROLLABLE water supplies.
- Recapture takes advantage of water already purchased and intentionally recharged.
- Implementation to begin as early as 2020.

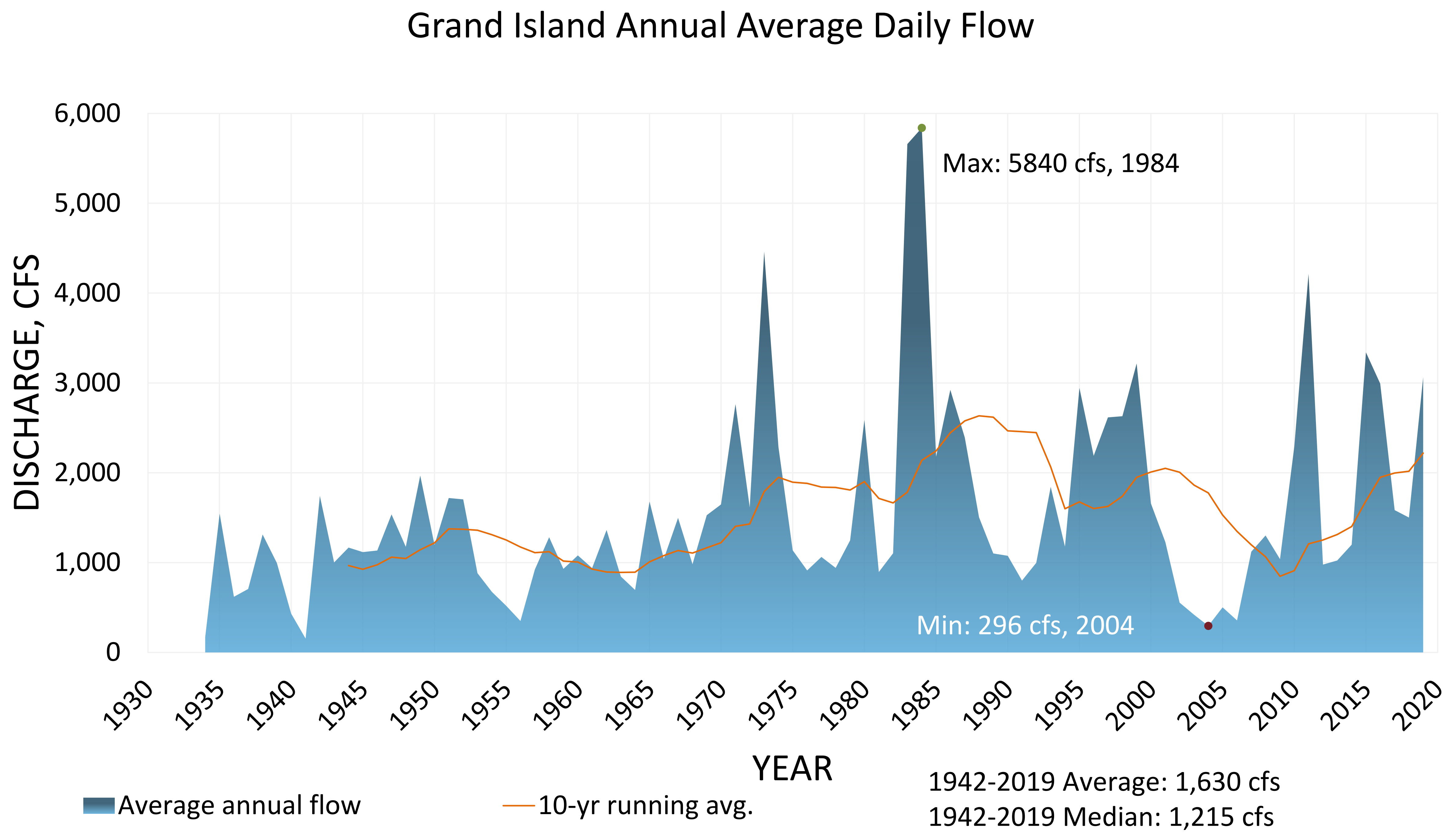
Take Away Messages

- Closing in on achieving water goals.
- Transitioning to a more operational and experimental phase.
- Prioritizing controllable water (storage and recapture) for remaining WAP projects.
- Focus of future operations and experiments will be on coordinated use of stored water in Lake McConaughy EA and recharge water controlled by recapture wells.
- Recharge accretions will continue to provide continuous baseflow contributions and some shortage reductions through the Extension and beyond.

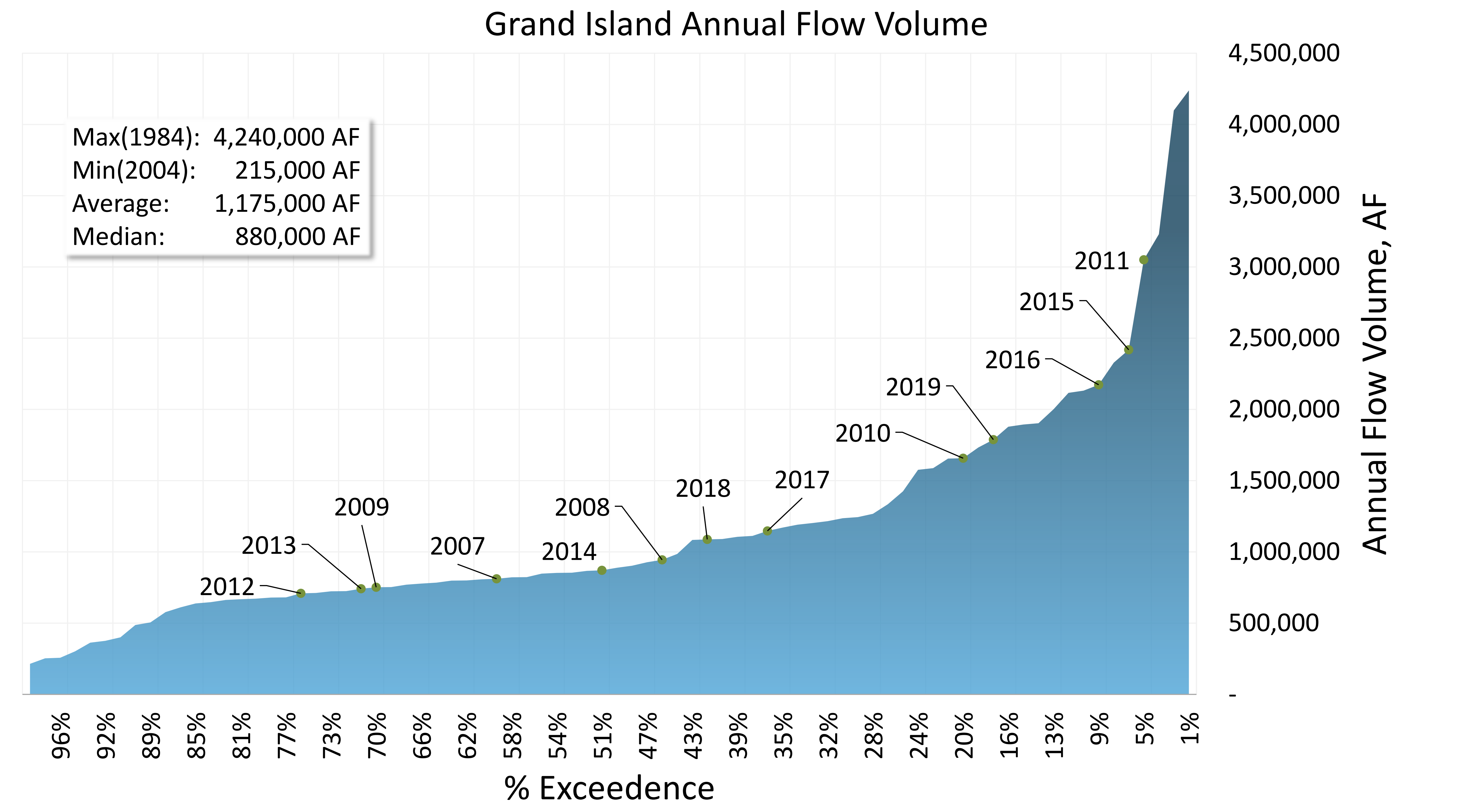

PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

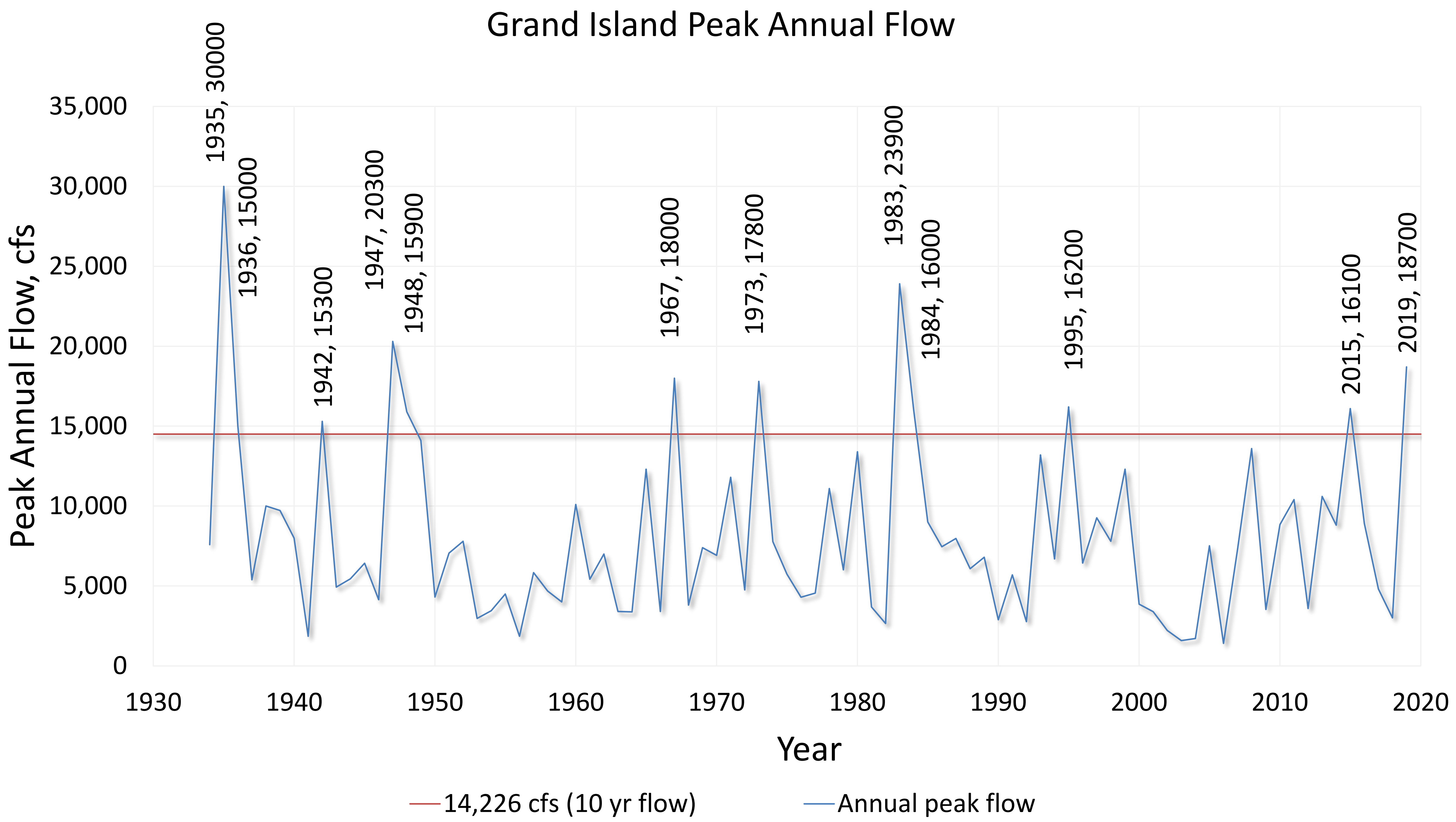
2018-2019 Flow Summary

Scott Griebling
Sr. Water Resources Engineer

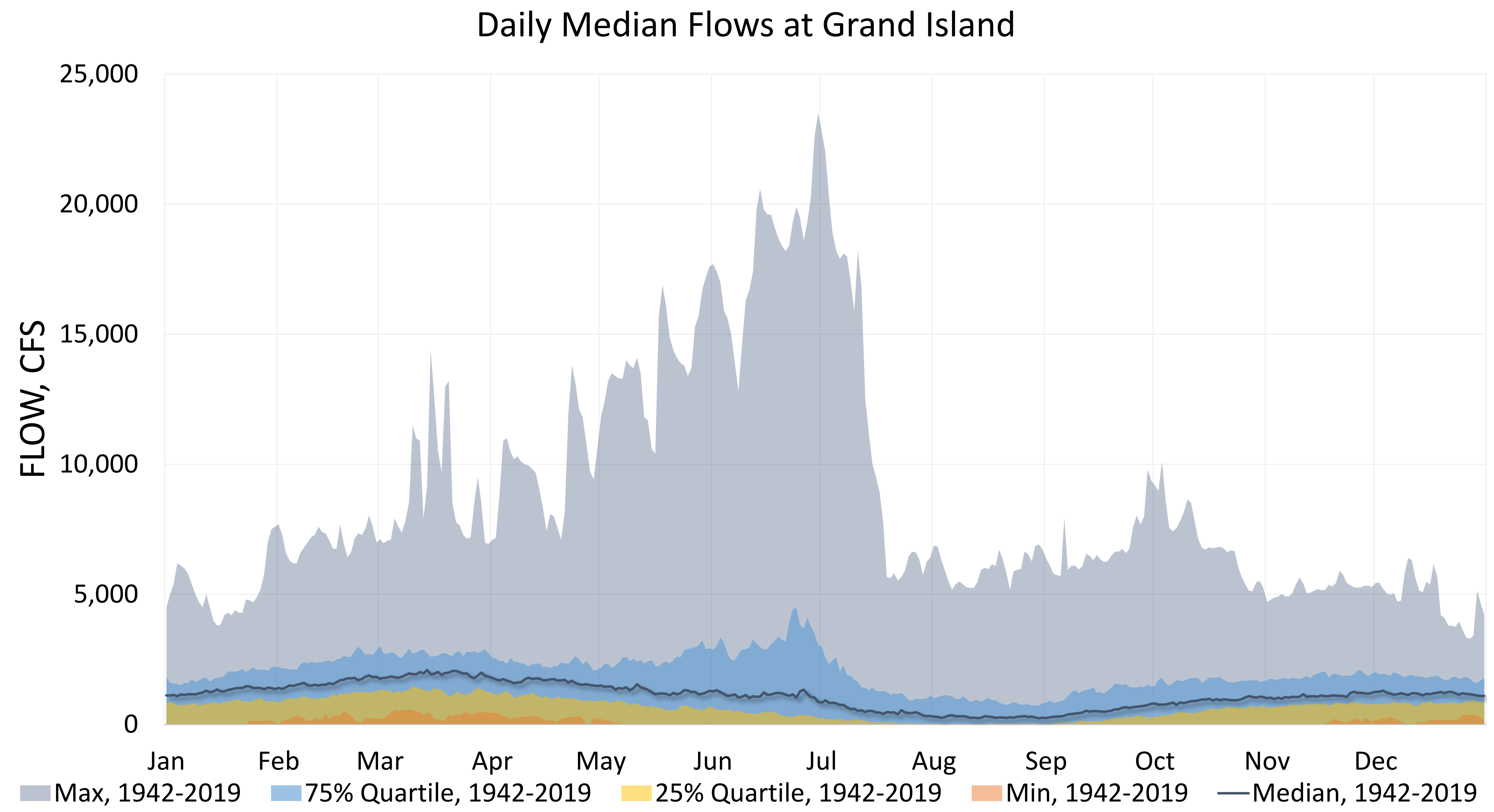


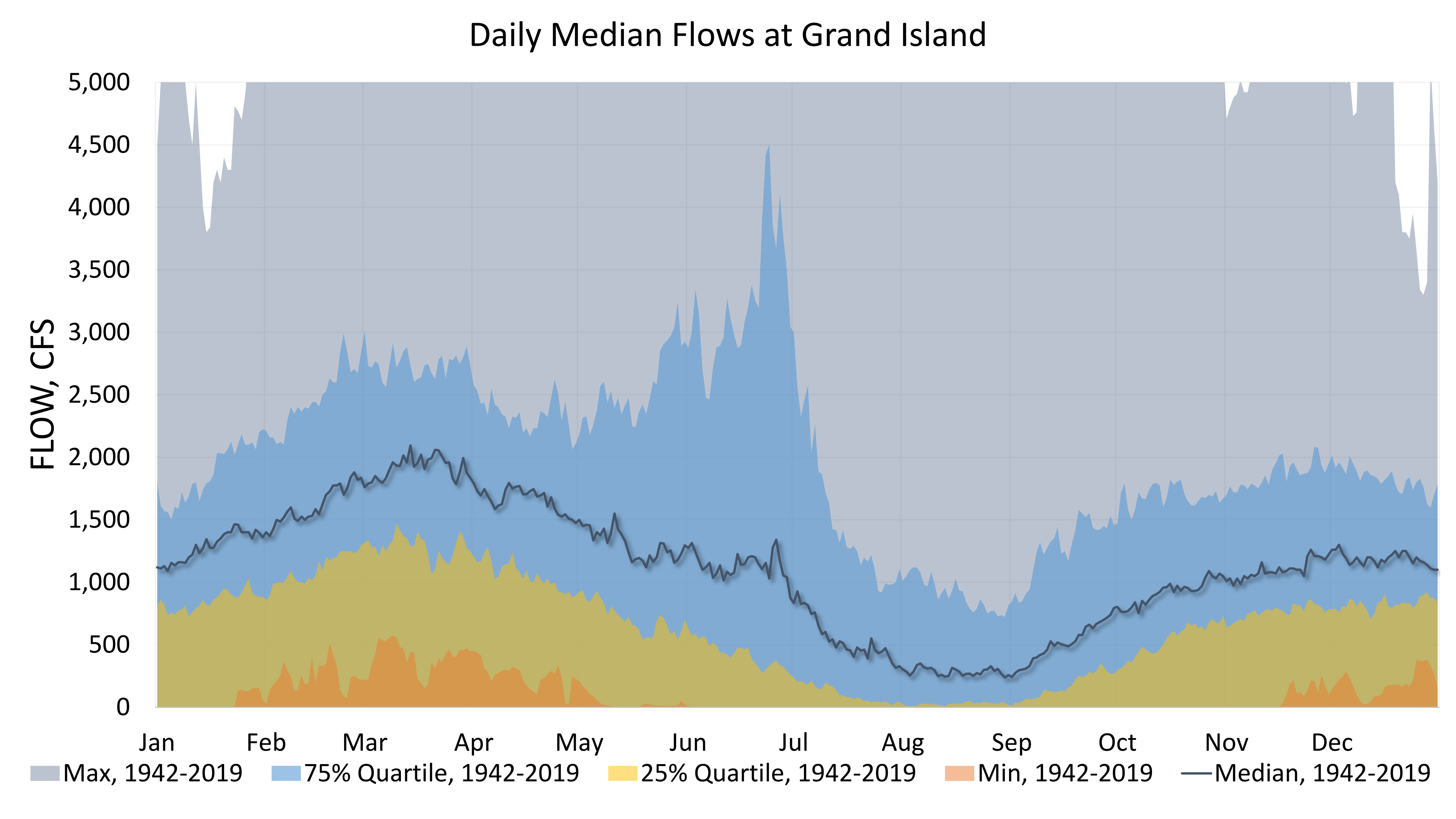
Grand Island Annual Average Daily Flow
DISCHARGE, CFS
6,000
5,000
4,000
3,000
2,000
1,000
0
Max: 5840 cfs, 1984
Min: 296 cfs, 2004
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
YEAR
Average annual flow
10-yr running avg.
1942-2019 Average: 1,630 cfs
1942-2019 Median: 1,215 cfs

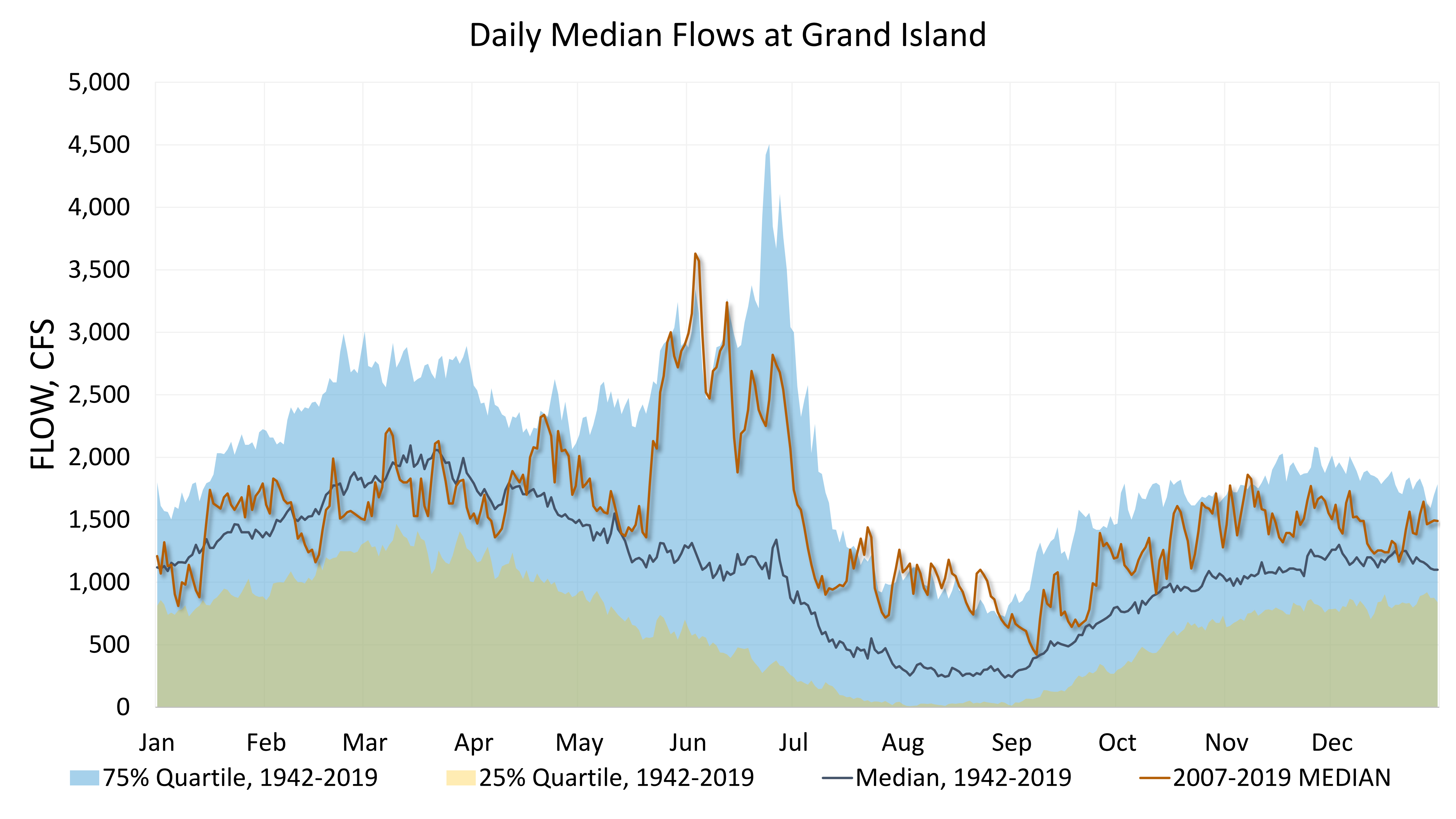

Grand Island Annual Flow Volume
Max(1984): 4,240,000 AF
Min(2004): 215,000 AF
Average: 1,175,000 AF
Median: 880,000 AF
2011
2015
2016
2019
2010
2017
2018
2008
2014
2007
2009
2013
2012
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
Annual Flow Volume, AF
96%
92%
89%
85%
81%
77%
73%
70%
66%
62%
58%
54%
51%
47%
43%
39%
35%
32%
28%
24%
20%
16%
13%
9%
5%
1%
% Exceedence



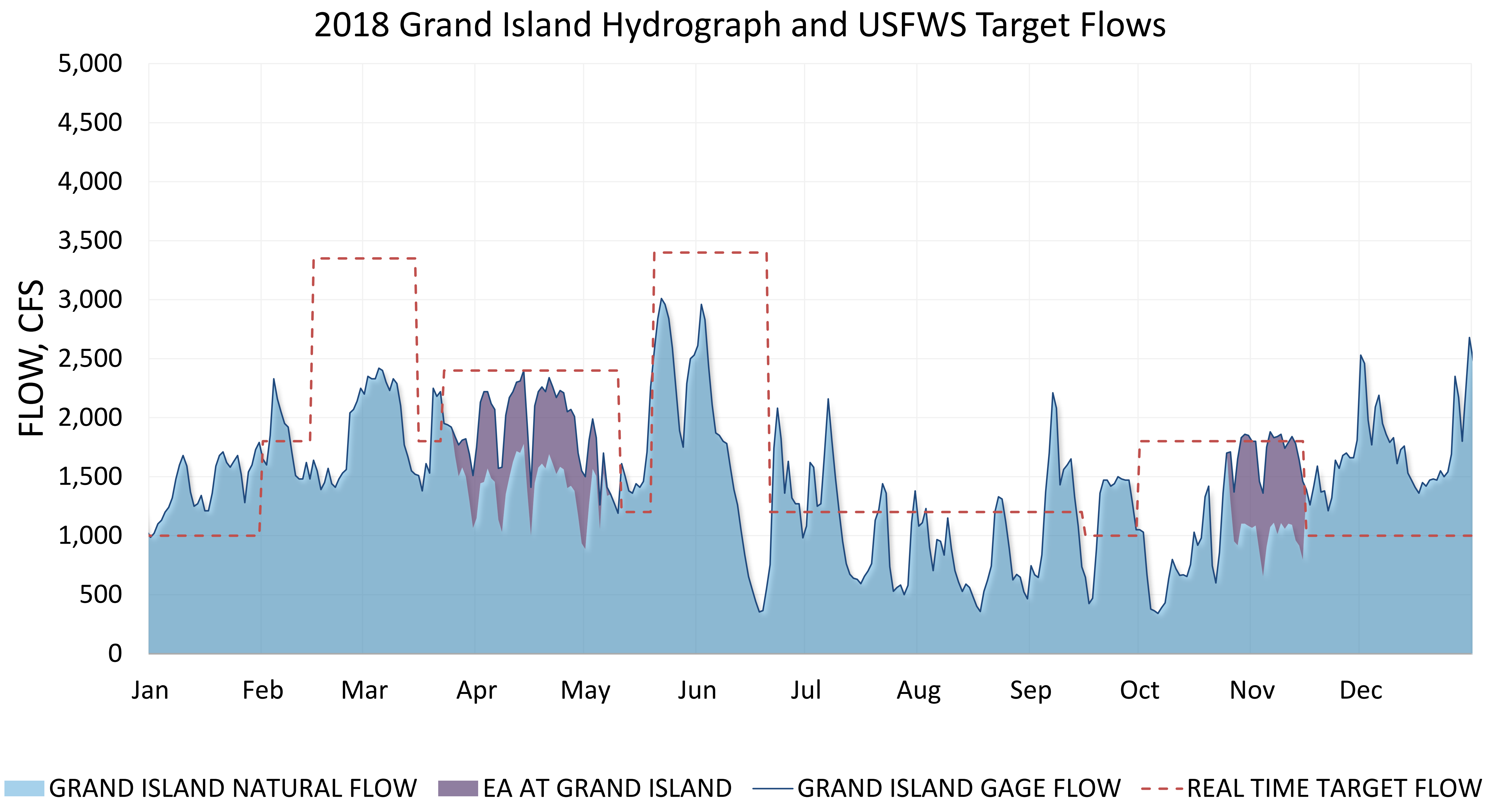
Grand Island Peak Annual Flow
Peak Annual Flow, cfs
Year
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
1935, 30000
1936, 15000
1942, 15300
1947, 20300
1948, 15900
1967, 18000
1973, 17800
1983, 23900
1984, 16000
1995, 16200
2015, 16100
2019, 18700
14,226 cfs (10 yr flow)
Annual peak flow


Daily Median Flows at Grand Island
FLOW, CFS
25,000
20,000
15,000
10,000
5,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Max, 1942-2019
75% Quartile, 1942-2019
25% Quartile, 1942-2019
Min, 1942-2019
Median, 1942-2019

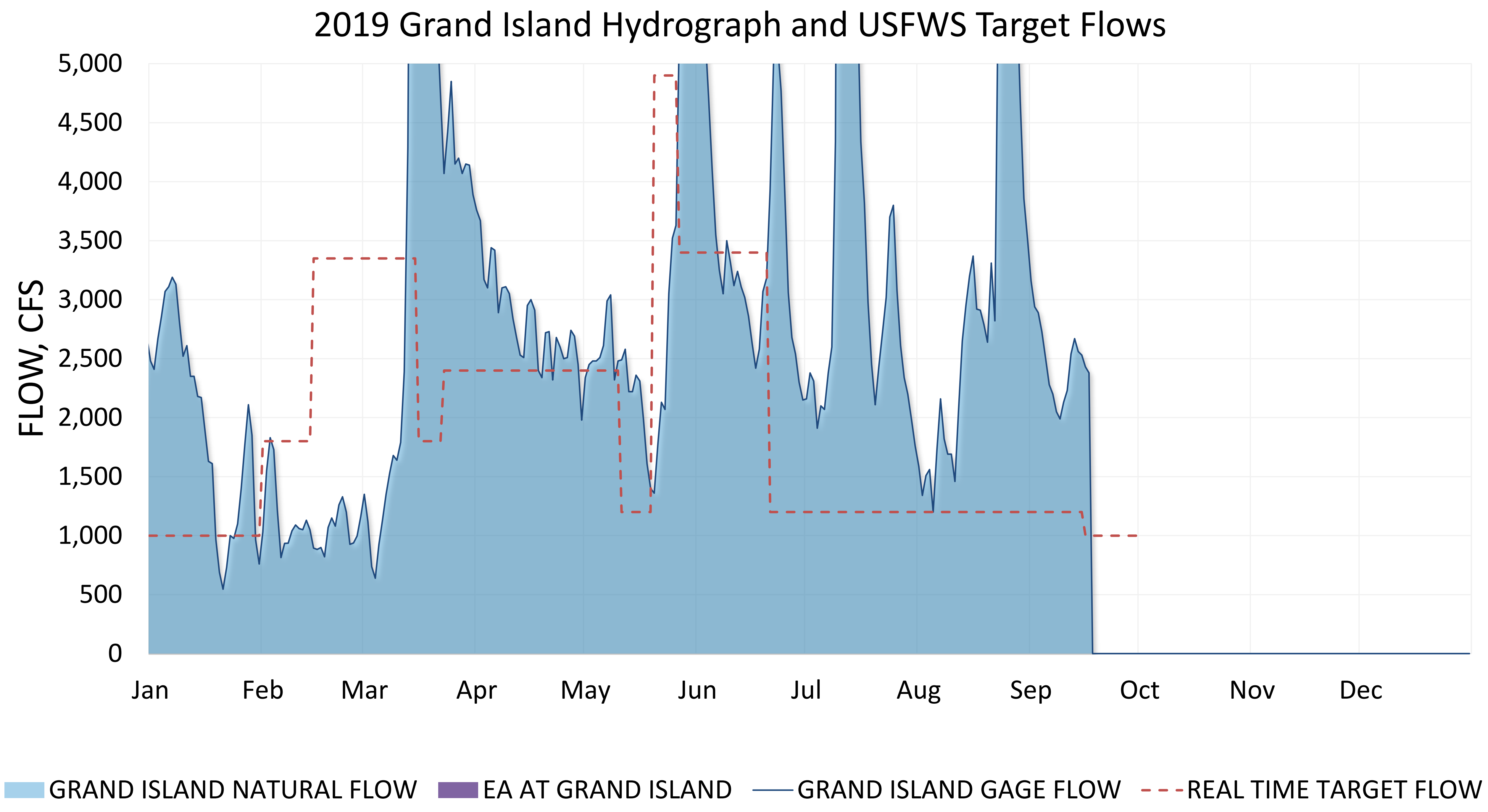

Daily Median Flows at Grand Island
FLOW, CFS
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Max, 1942-2019
75% Quartile, 1942-2019
25% Quartile, 1942-2019
Min, 1942-2019
Median, 1942-2019



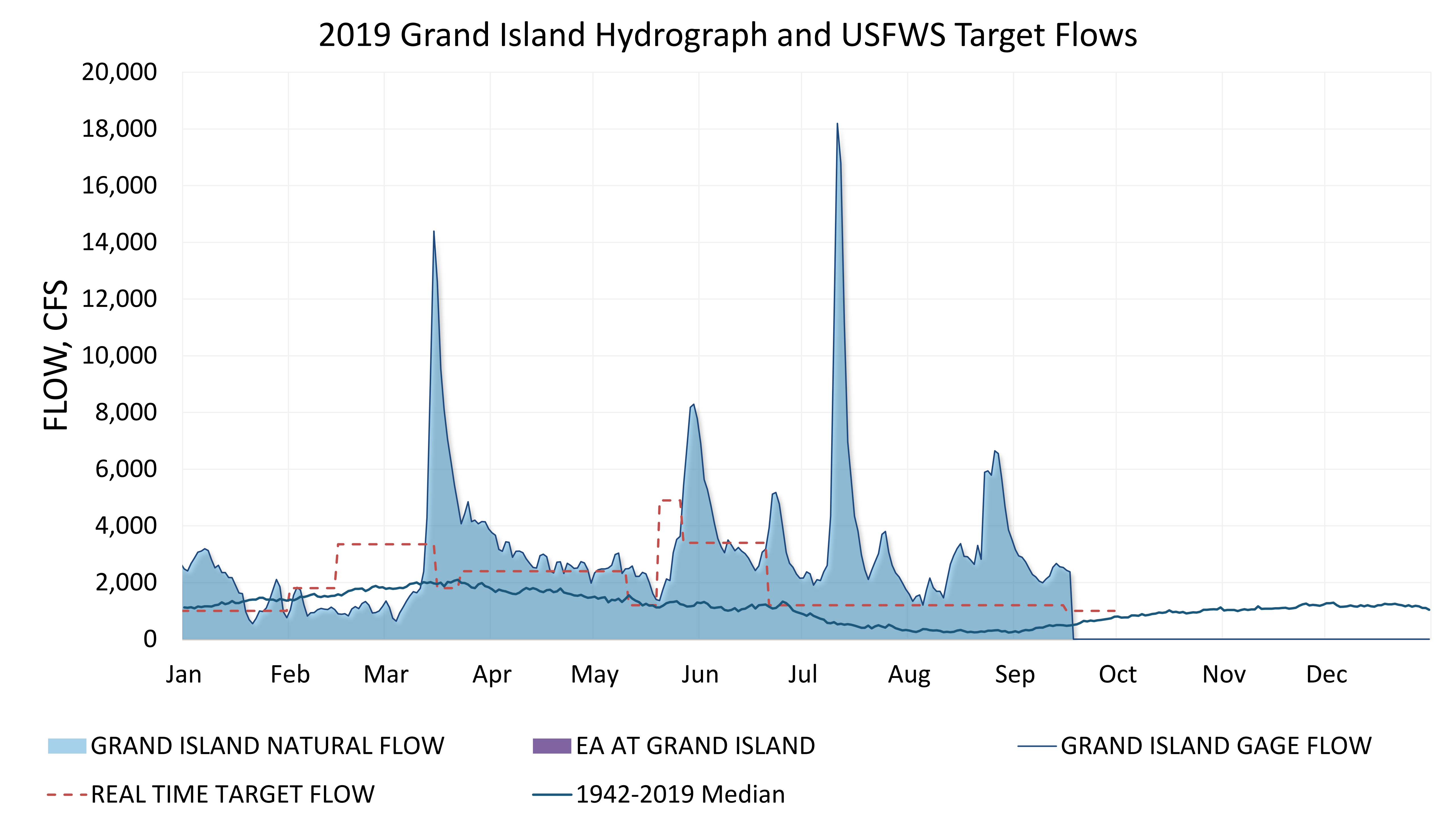
Daily Median Flows at Grand Island
FLOW, CFS
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
75% Quartile, 1942-2019
25% Quartile, 1942-2019
Median, 1942-2019
2007-2019 MEDIAN



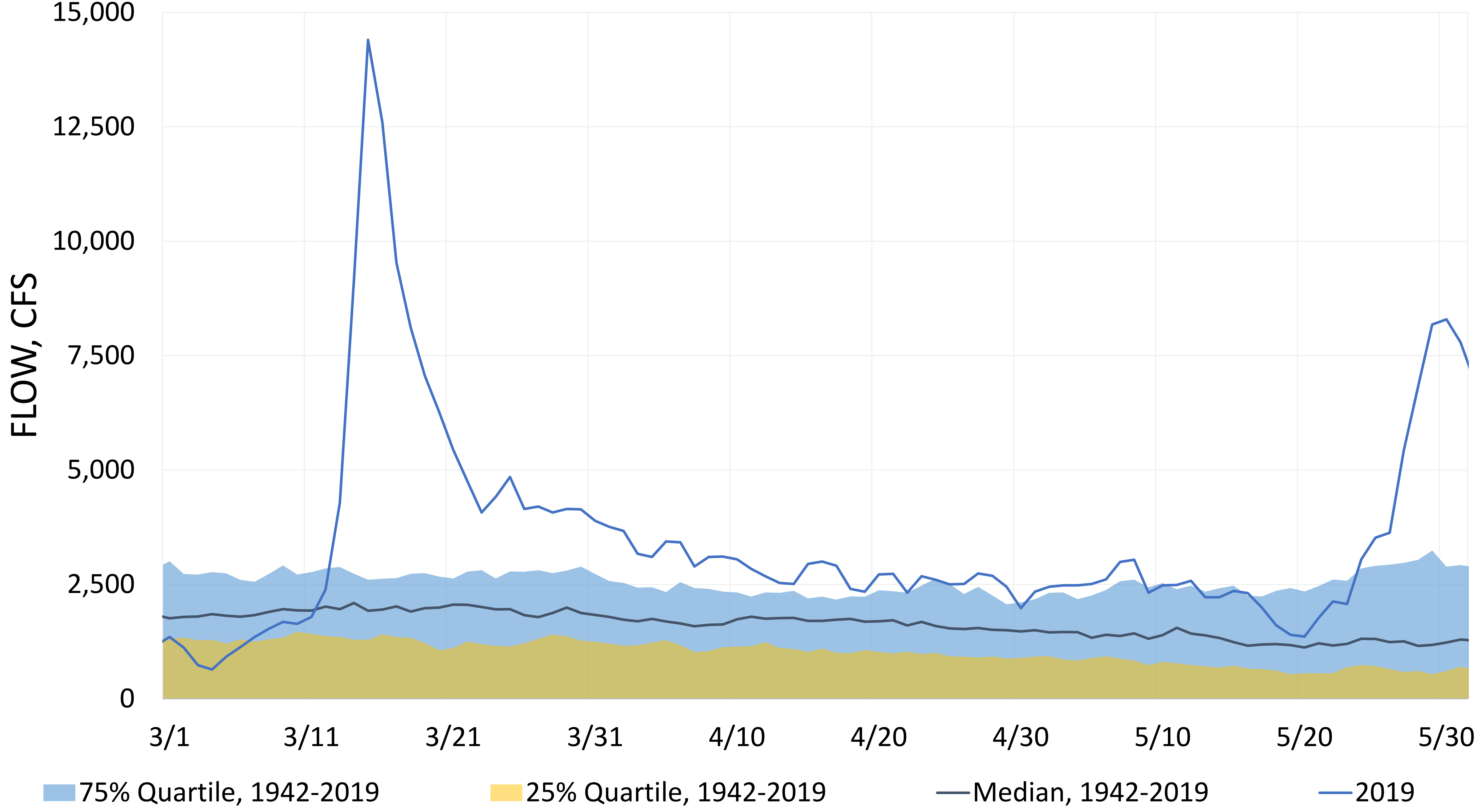
2018 Grand Island Hydrograph and USFWS Target Flows
FLOW, CFS
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
GRAND ISLAND NATURAL FLOW
EA AT GRAND ISLAND
GRAND ISLAND GAGE FLOW
REAL TIME TARGET FLOW



2019 Grand Island Hydrograph and USFWS Target Flows
FLOW, CFS
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
GRAND ISLAND NATURAL FLOW
EA AT GRAND ISLAND
GRAND ISLAND GAGE FLOW
REAL TIME TARGET FLOW


2019 Grand Island Hydrograph and USFWS Target Flows
FLOW, CFS
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
GRAND ISLAND NATURAL FLOW
EA AT GRAND ISLAND
GRAND ISLAND GAGE FLOW
REAL TIME TARGET FLOW
1942-2019 Median

Daily Median Flow at Grand Island: Spring WC Season



2019 Target Species Updates

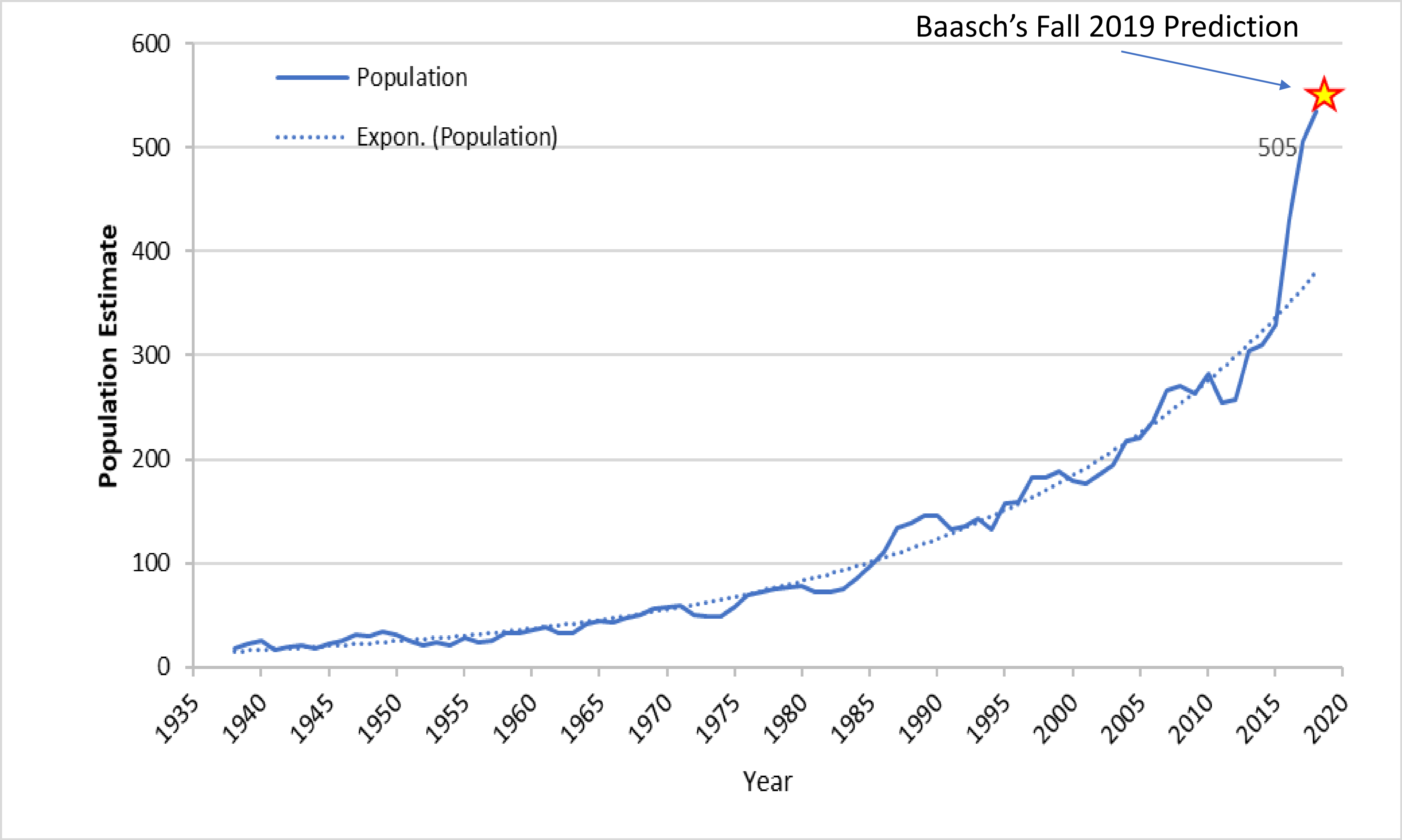
Mallory Jaymes, Kari Mohlman, Kaley Keldsen

Wildlife Biologists

2019 Whooping Crane Update

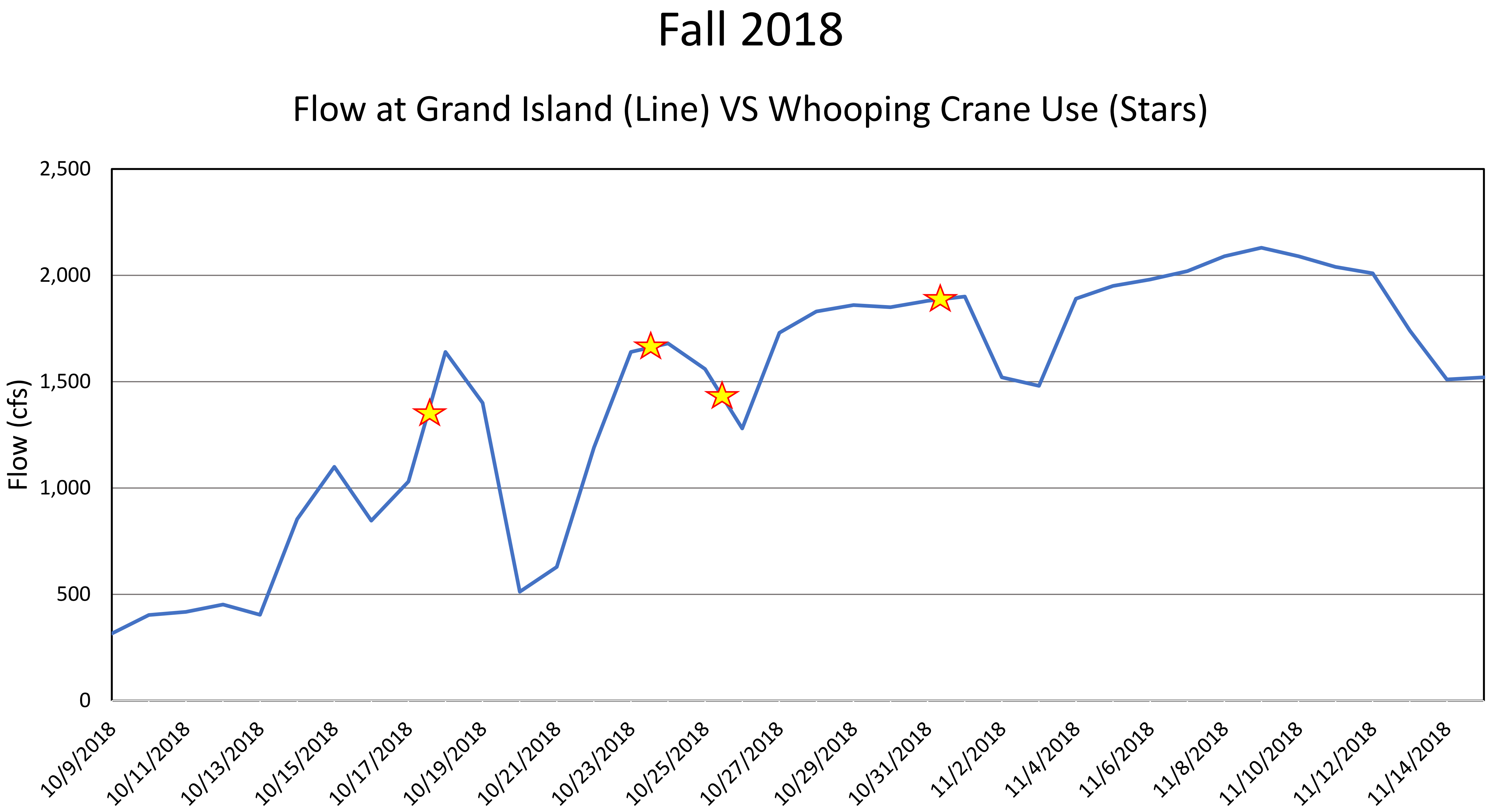
Mallory Jaymes

Biologist


Baasch's Fall 2019 Prediction
Population
Expon. (Population)
505
Population Estimate
600
500
400
300
200
100
0
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year

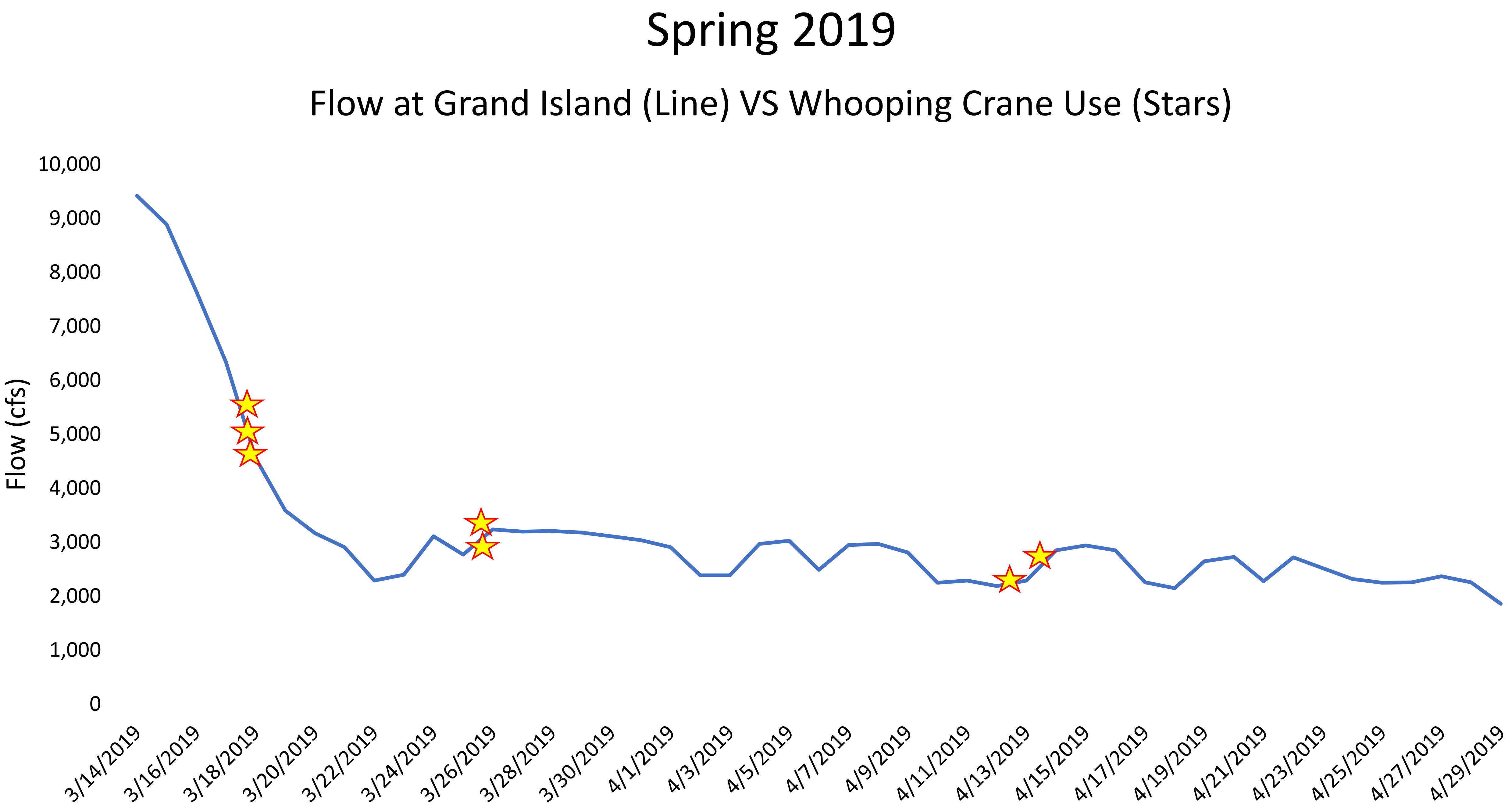
General Stats- Fall 2018

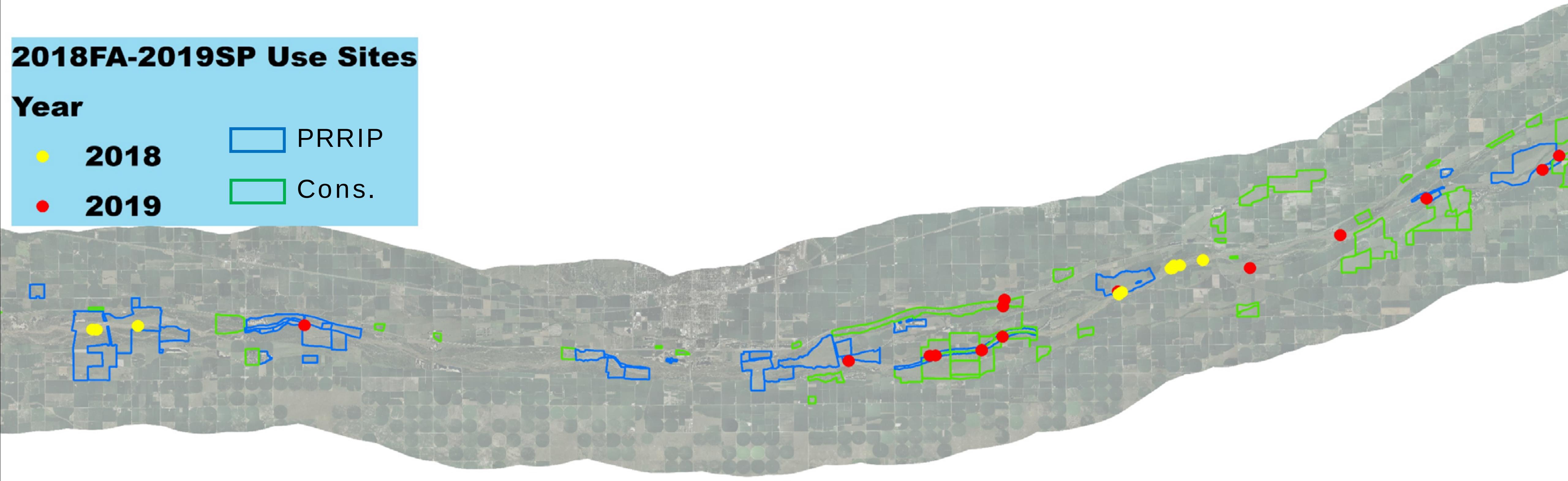
- Unique Cranes
  - 21
- Crane use Days
  - 90
- Unobstructed Channel Width
  - Range 283 - 1,152 feet
  - Average 742 feet


Fall 2018
Flow at Grand Island (Line) VS Whooping Crane Use (Stars)
Flow (cfs)
2,500
2,000
1,500
1,000
500
0
10/9/2018
10/11/2018
10/13/2018
10/15/2018
10/17/2018
10/19/2018
10/21/2018
10/23/2018
10/25/2018
10/27/2018
10/29/2018
10/31/2018
11/2/2018
11/4/2018
11/6/2018
11/8/2018
11/10/2018
11/12/2018
11/14/2018

General Stats-
Spring 2019

- Unique Cranes
  - 9
- Crane use Days
  - 71
- Unobstructed Channel Width
  - Range 65-1,261 feet
  - Average 699 feet


Spring 2019
Flow at Grand Island (Line) VS Whooping Crane Use (Stars)
Flow (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
3/14/2019
3/16/2019
3/18/2019
3/20/2019
3/22/2019
3/24/2019
3/26/2019
3/28/2019
3/30/2019
4/1/2019
4/3/2019
4/5/2019
4/7/2019
4/9/2019
4/11/2019
4/13/2019
4/15/2019
4/17/2019
4/19/2019
4/21/2019
4/23/2019
4/25/2019
4/27/2019
4/29/2019

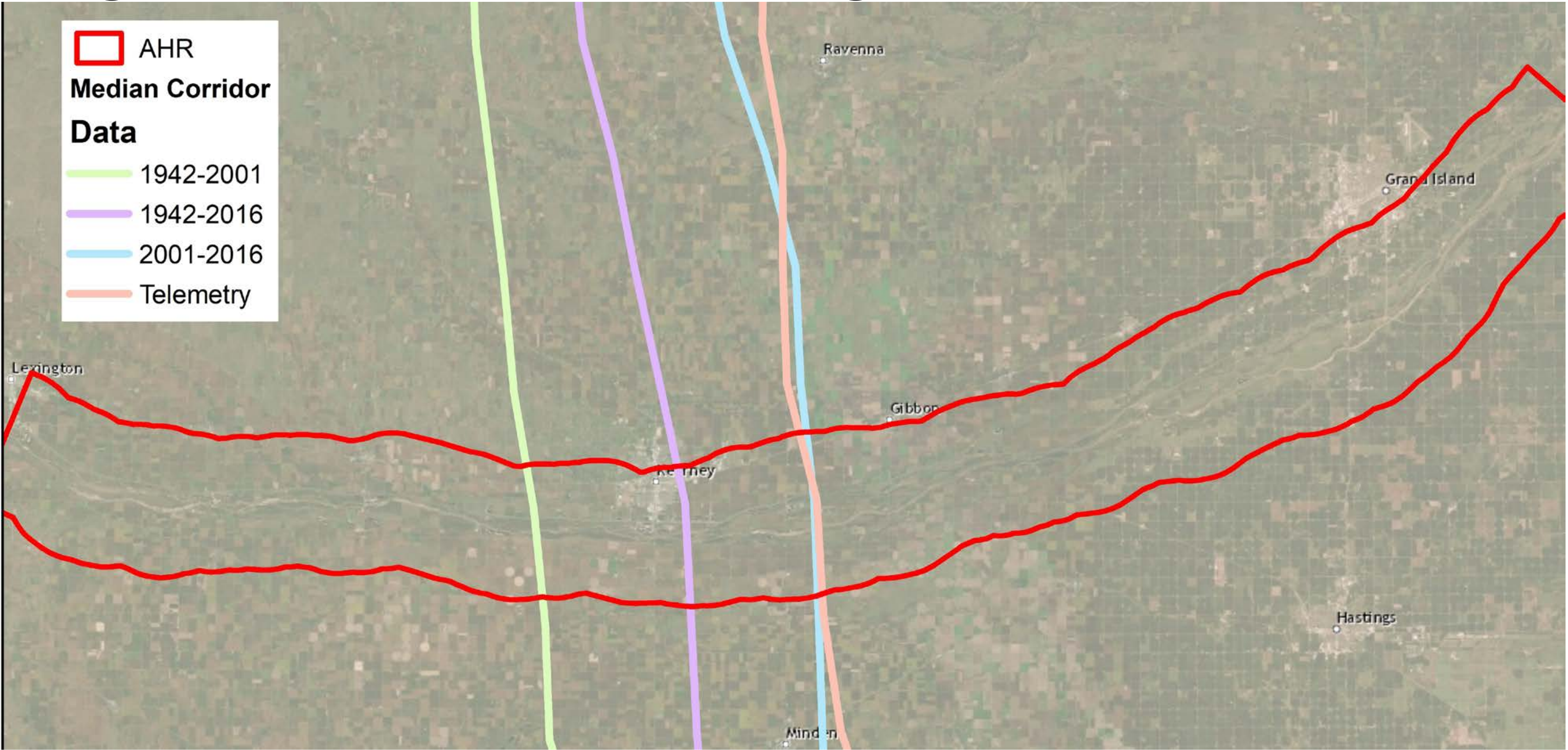


PRRIP Lands – 45% (17/38)

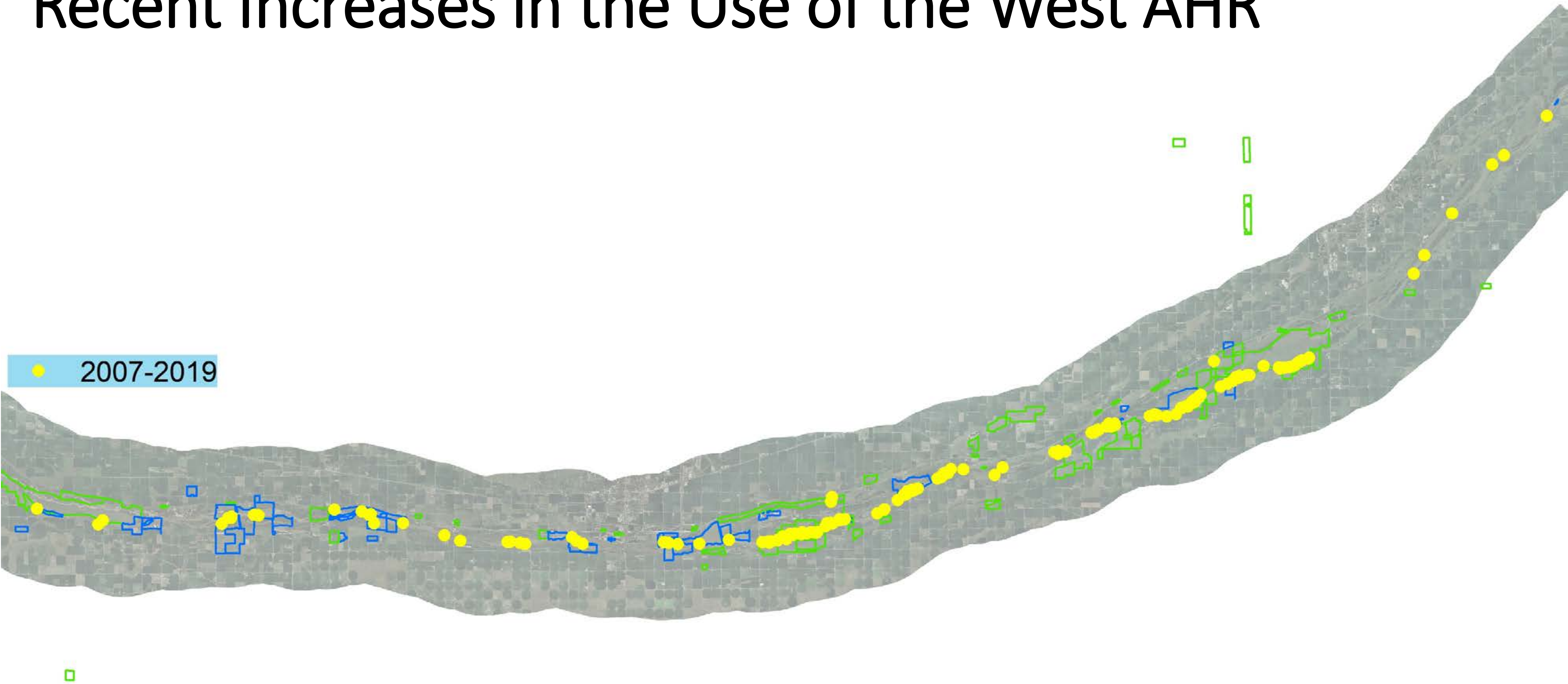
Conservation Lands – 34% (13/38)

Non-conservation Lands – 21% (8/38)

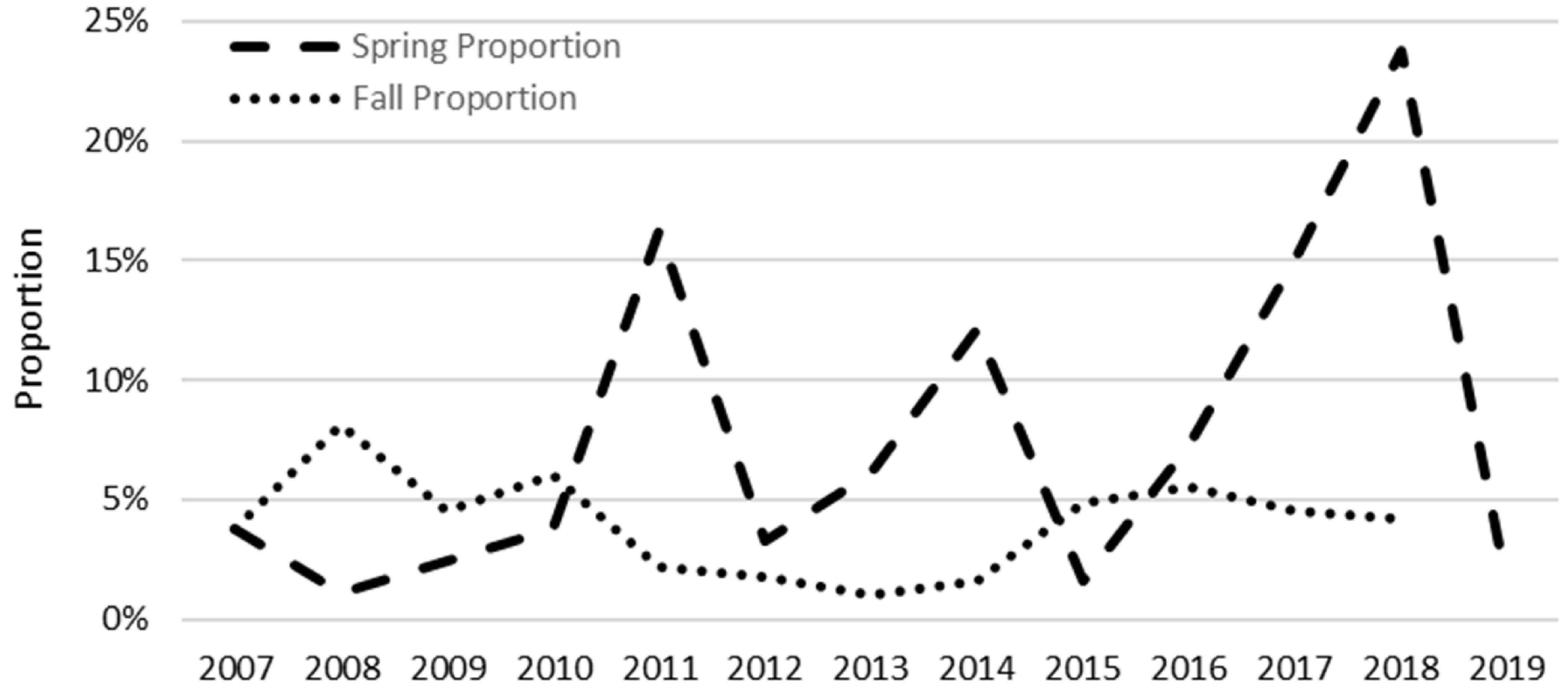
Migration Corridor Trending East

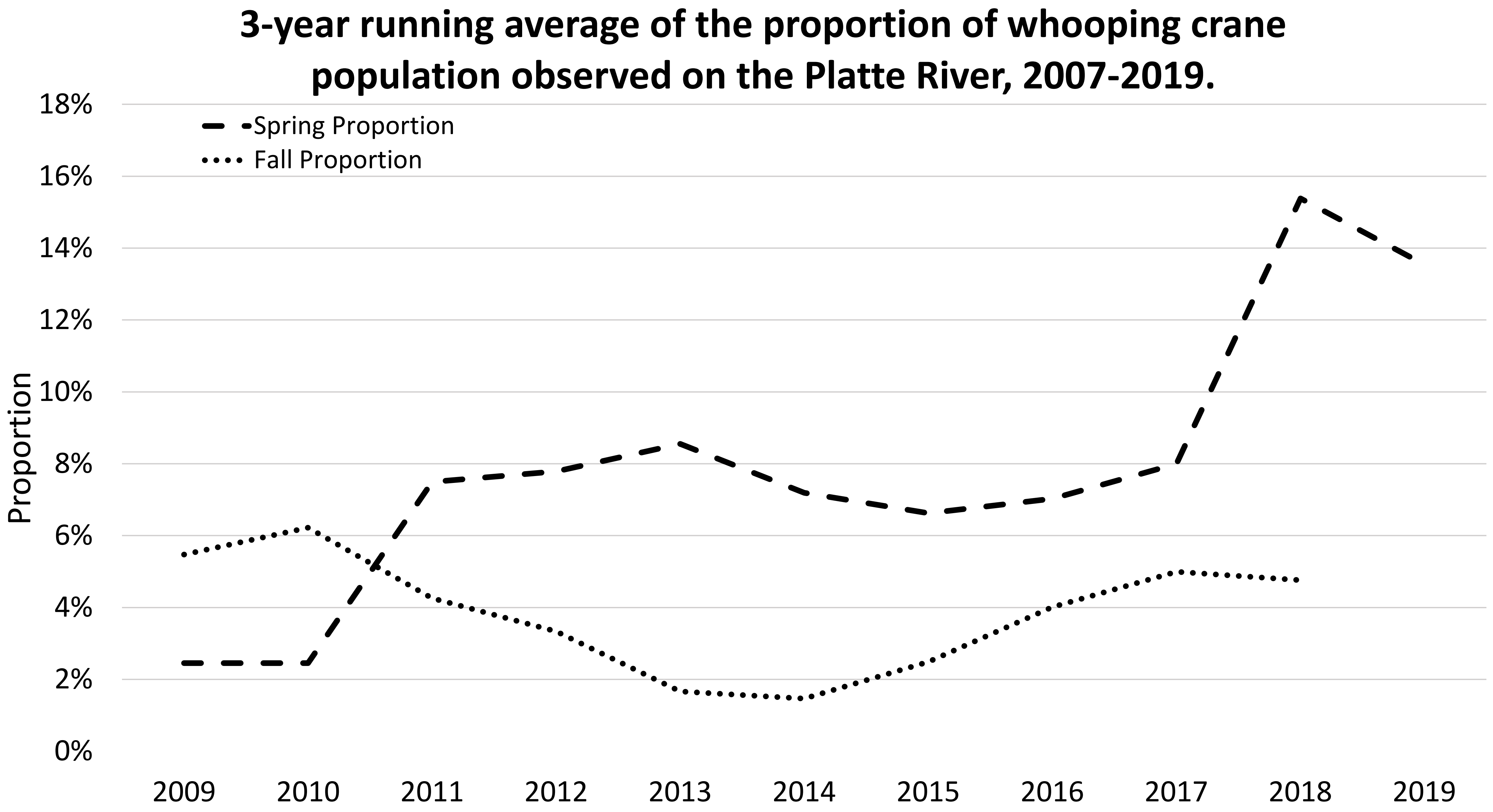


Recent Increases in the Use of the West AHR

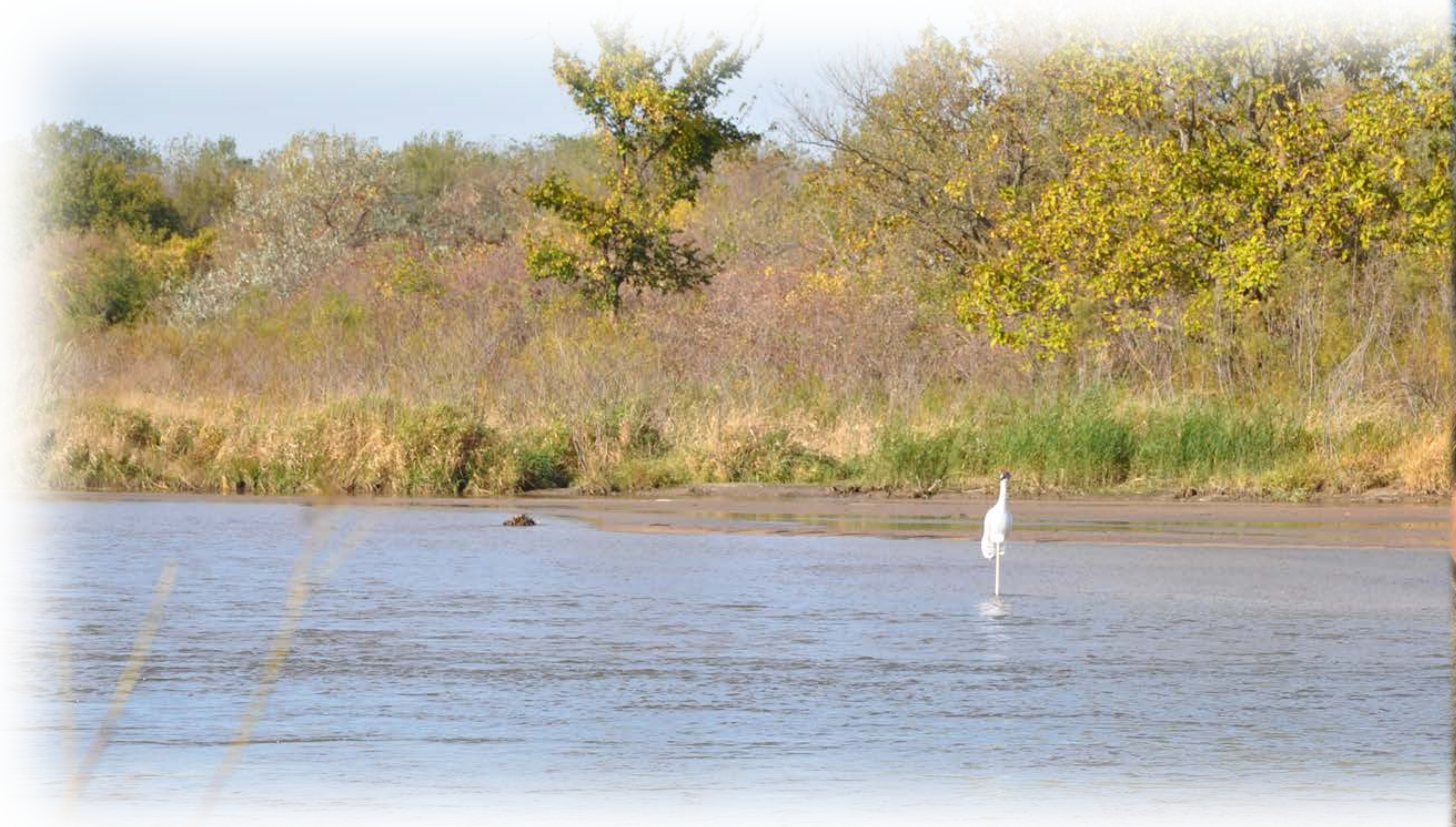


Proportion of whooping crane population observed during systematic or opportunistic aerial flights, 2007-2019.

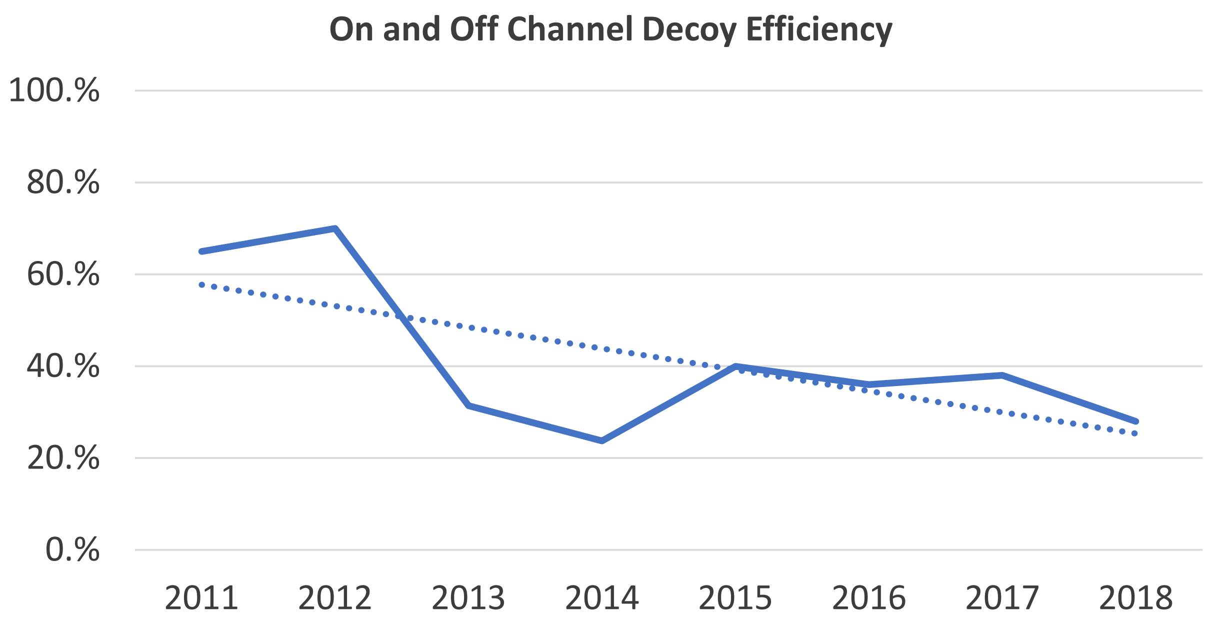


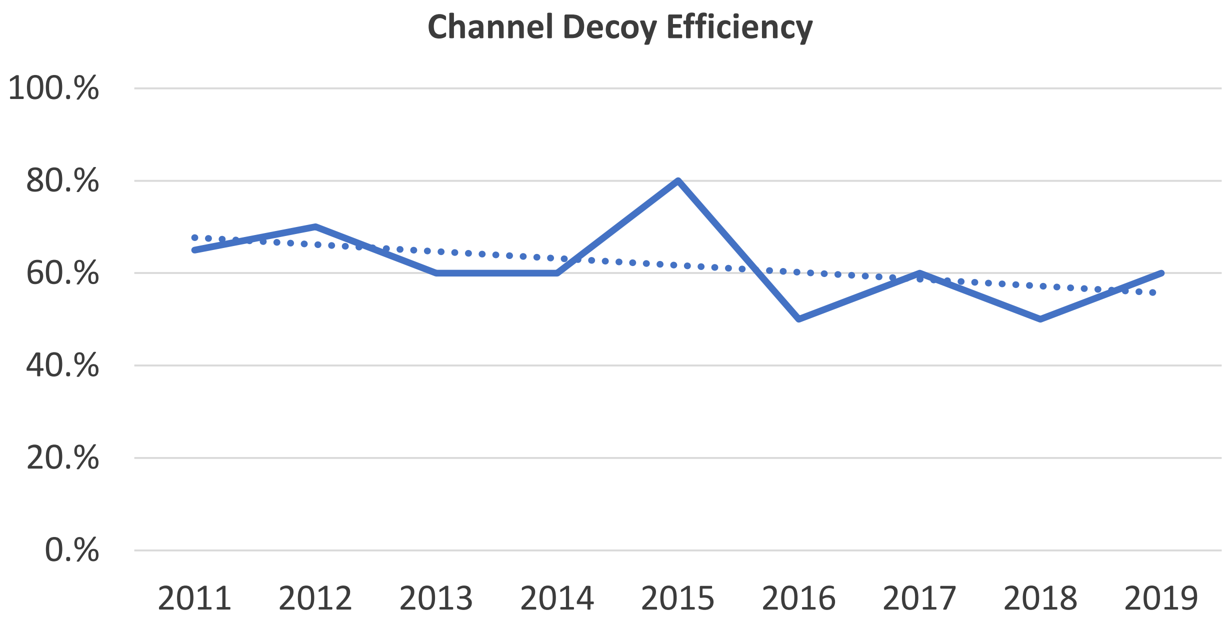

3-year running average of the proportion of whooping crane population observed on the Platte River, 2007-2019.
Spring Proportion
Fall Proportion
Proportion
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


Jensen
©2011

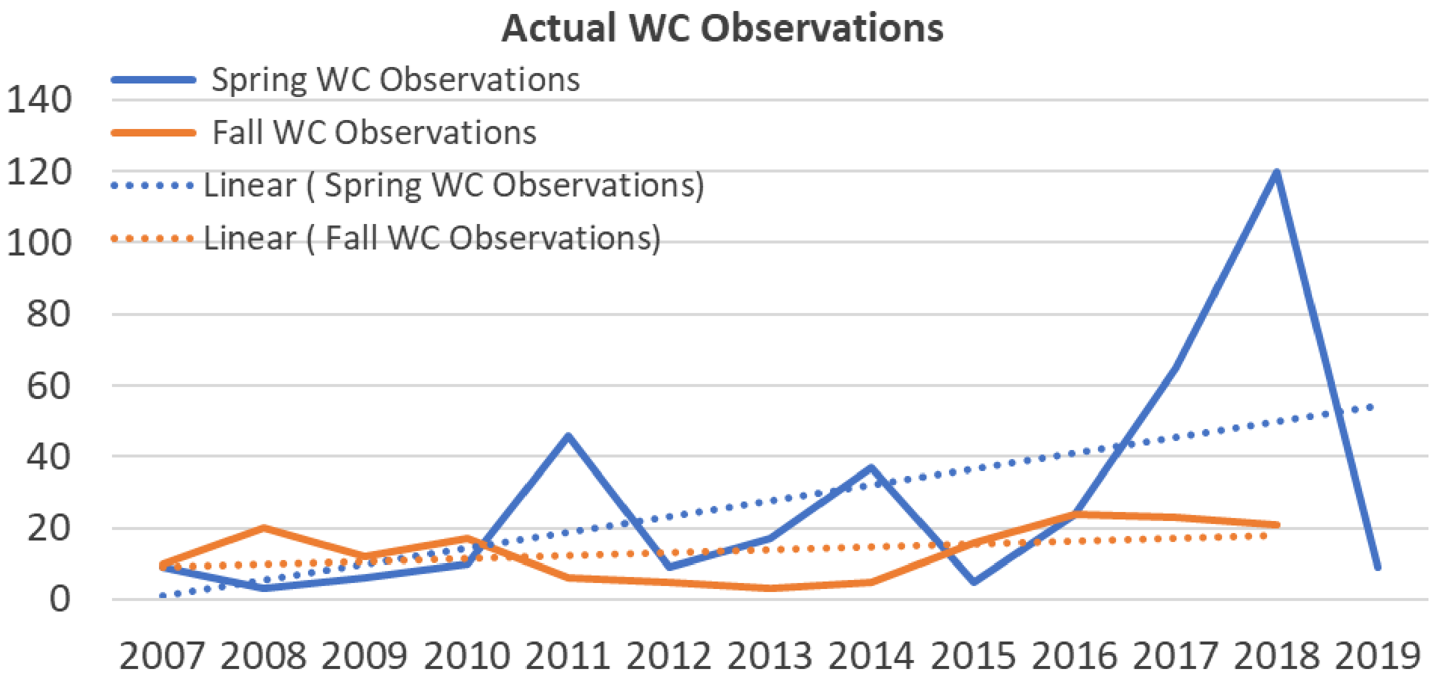



Decoy Spotting Efficiency

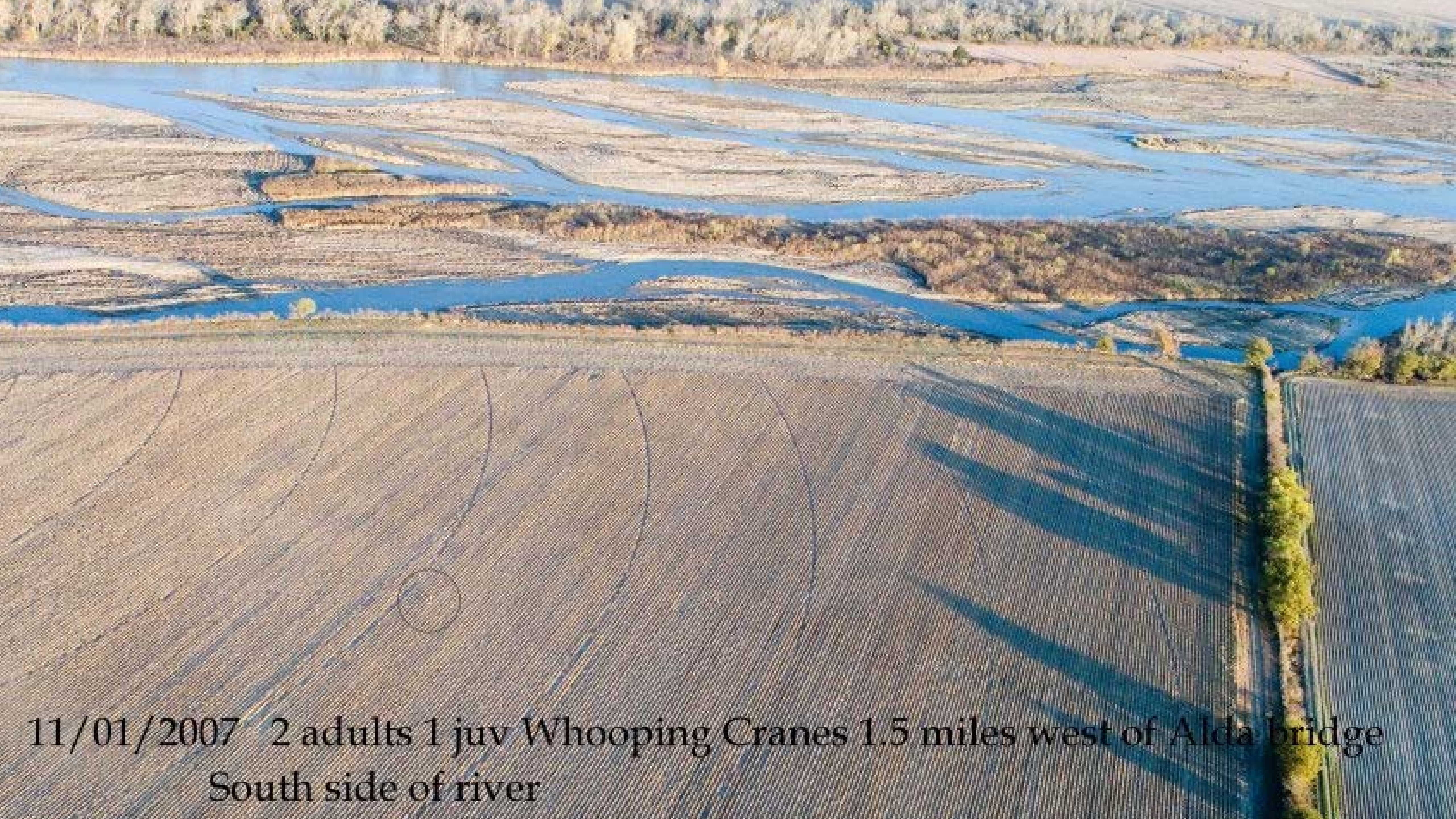




Actual Whooping Crane Spotting Efficiency



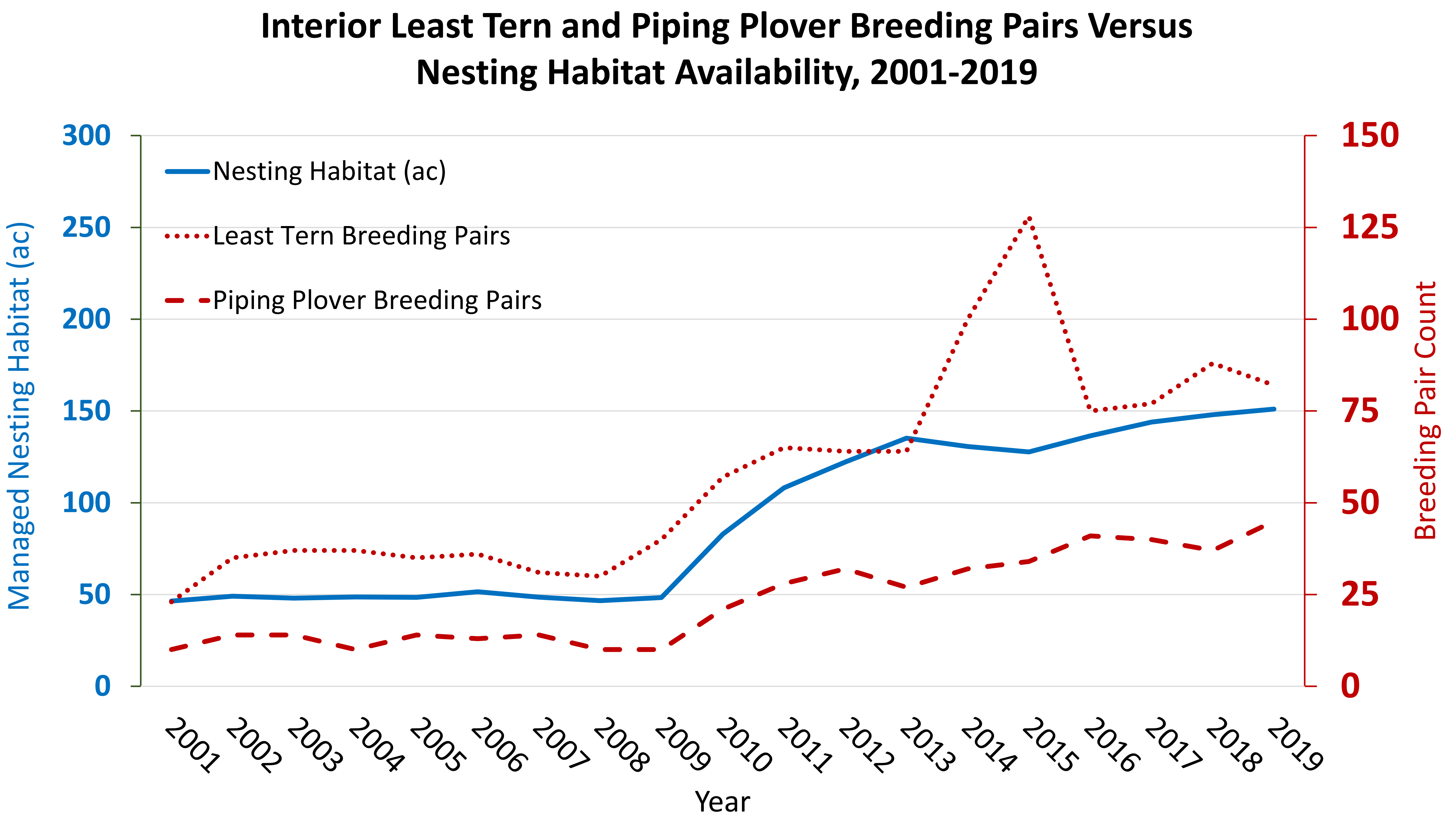
Proportion of USFWS Reported Cranes Detected by PRRIP	**91.0%**
Proportion of USFWS Reported Groups Detected by PRRIP	**98.1%**



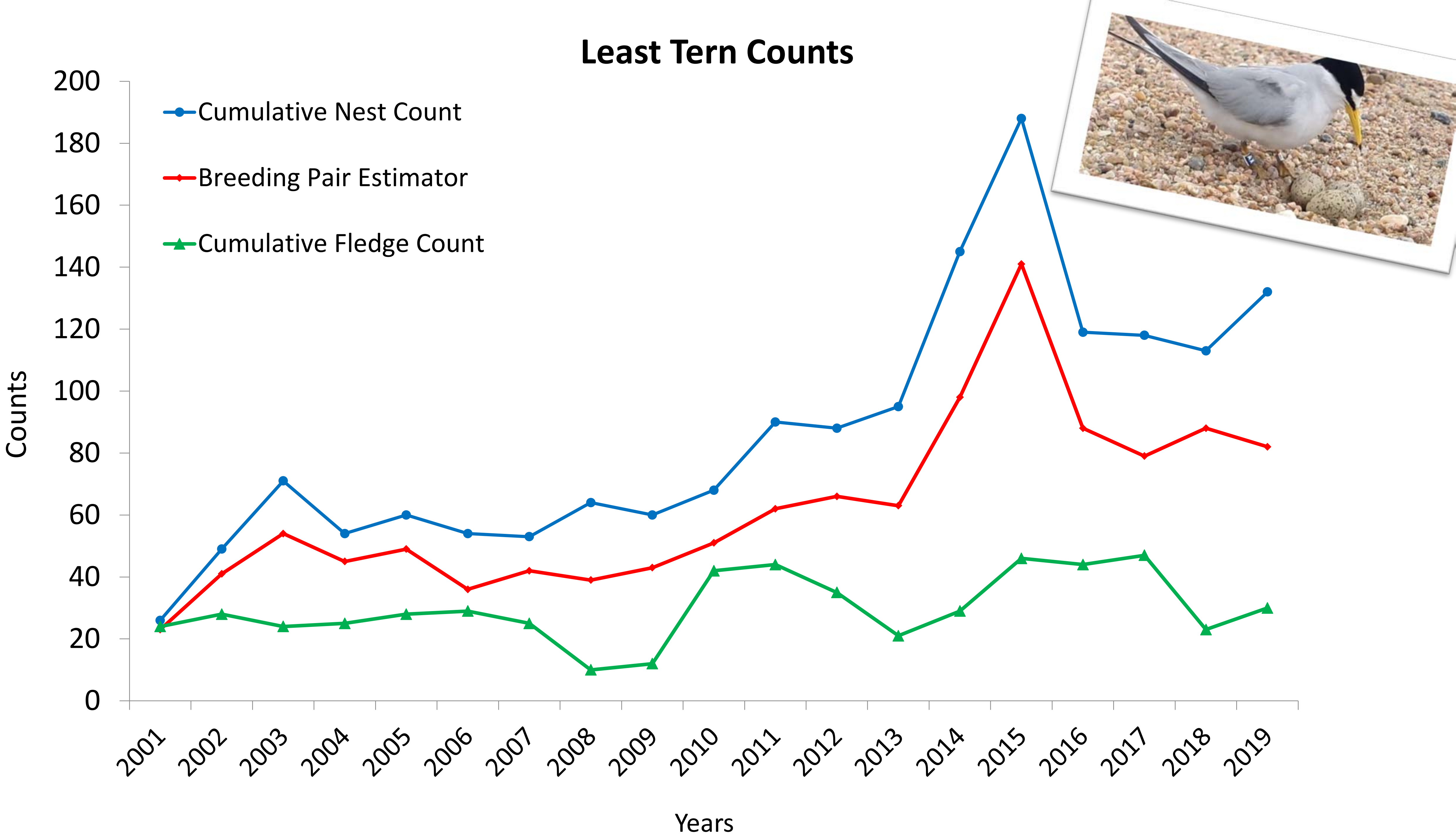
11/01/2007 2 adults 1 juv Whooping Cranes 1.5 miles west of Alda bridge
South side of river

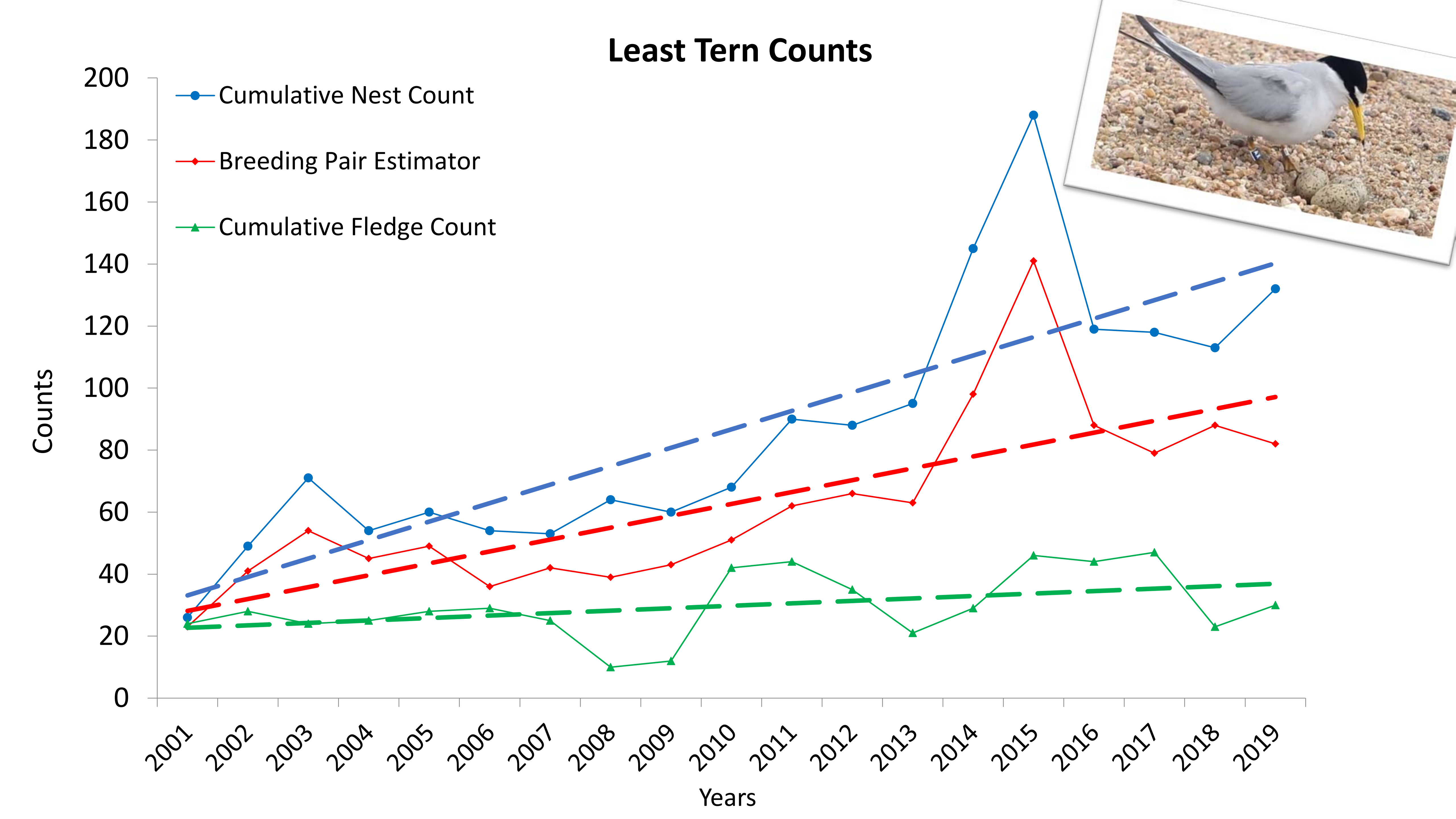
2019 Least Tern and Piping Plover Update

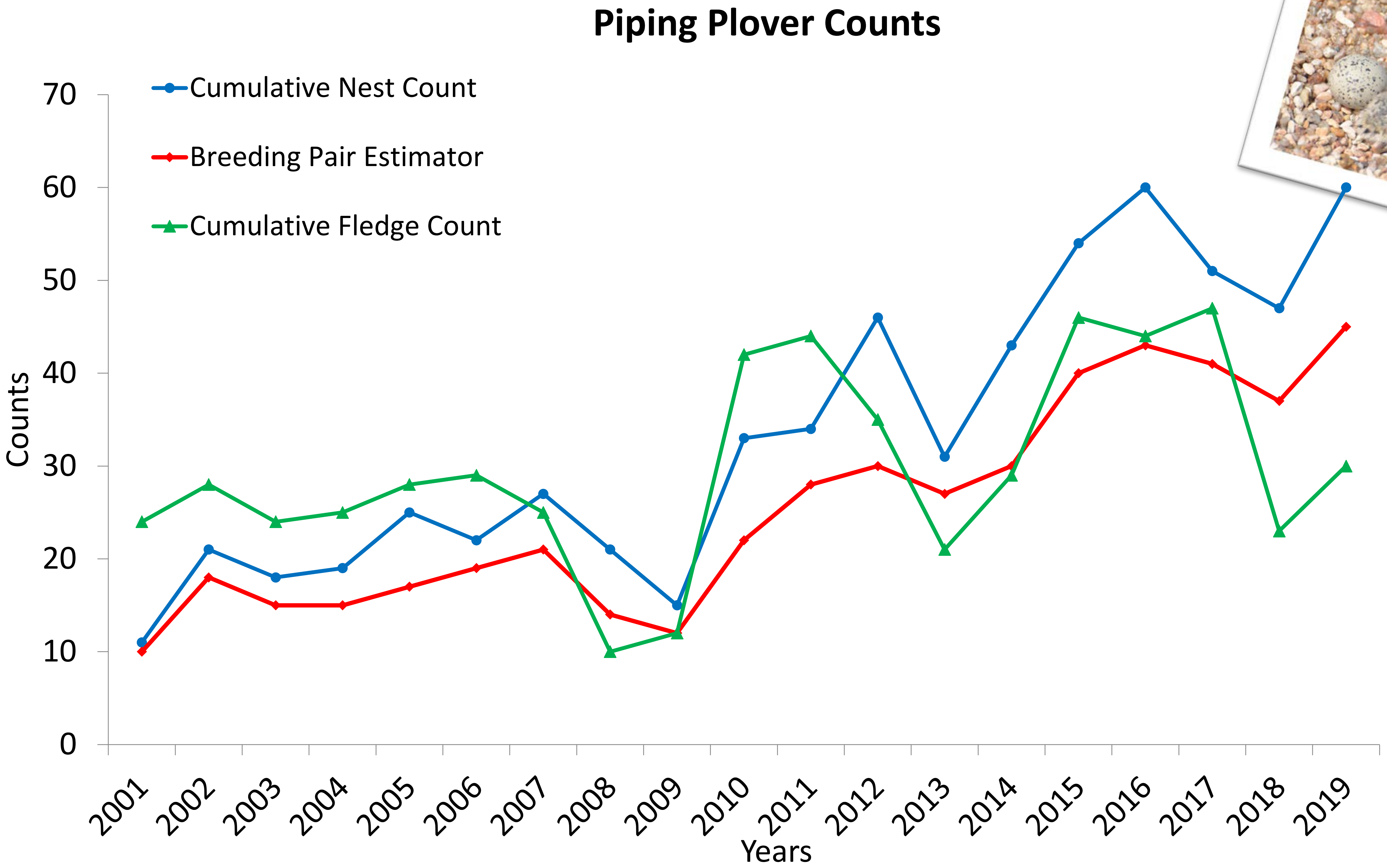
Kari Mohlman
Biologist



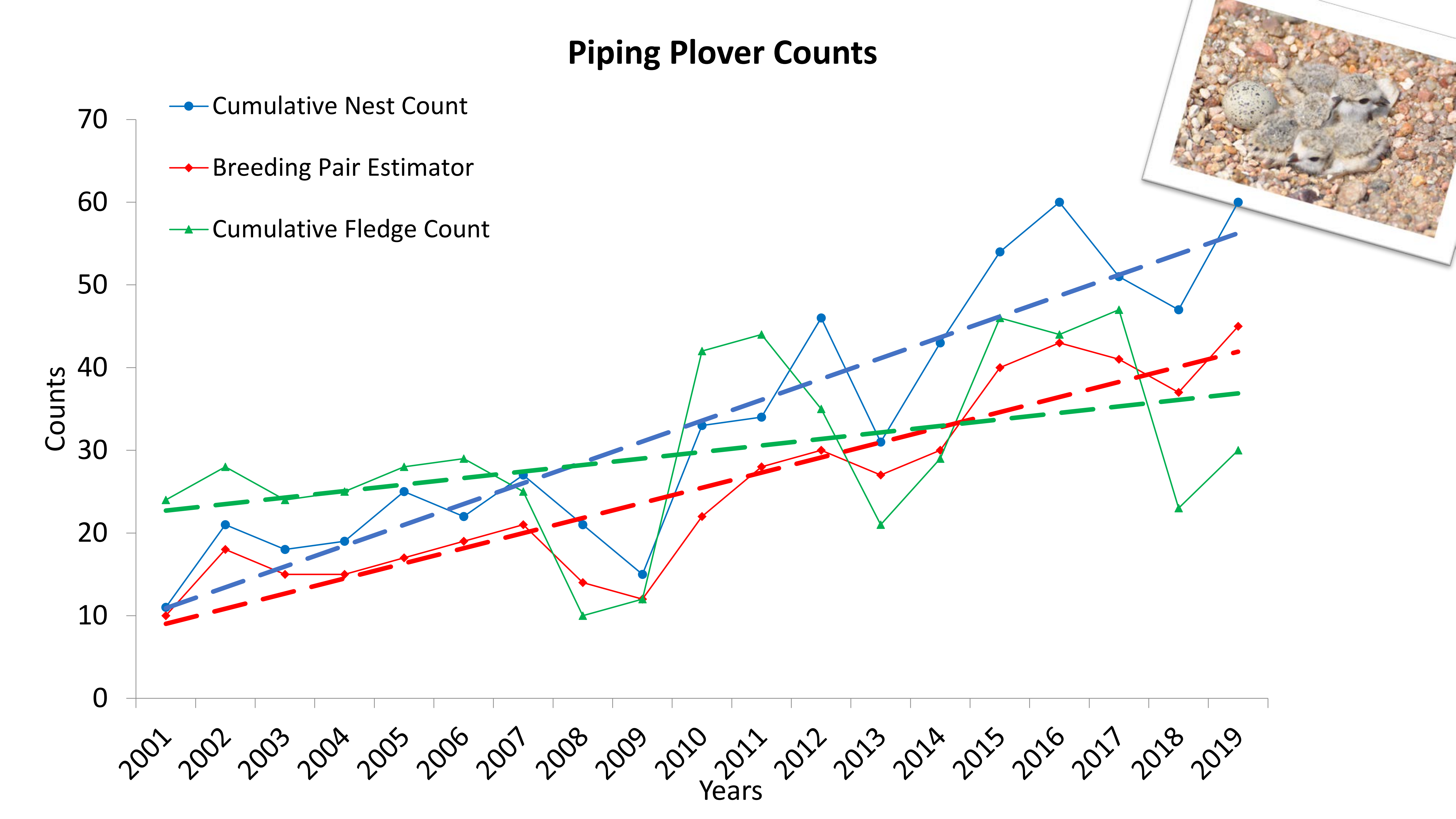
Interior Least Tern and Piping Plover Breeding Pairs Versus Nesting Habitat Availability, 2001-2019
Nesting Habitat (ac)
Least Tern Breeding Pairs
Piping Plover Breeding Pairs
Managed Nesting Habitat (ac)
Breeding Pair Count
Year
0
50
100
150
200
250
300
0
25
50
75
100
125
150
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


Least Tern Counts
Cumulative Nest Count
Breeding Pair Estimator
Cumulative Fledge Count
Counts
Years
200
180
160
140
120
100
80
60
40
20
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

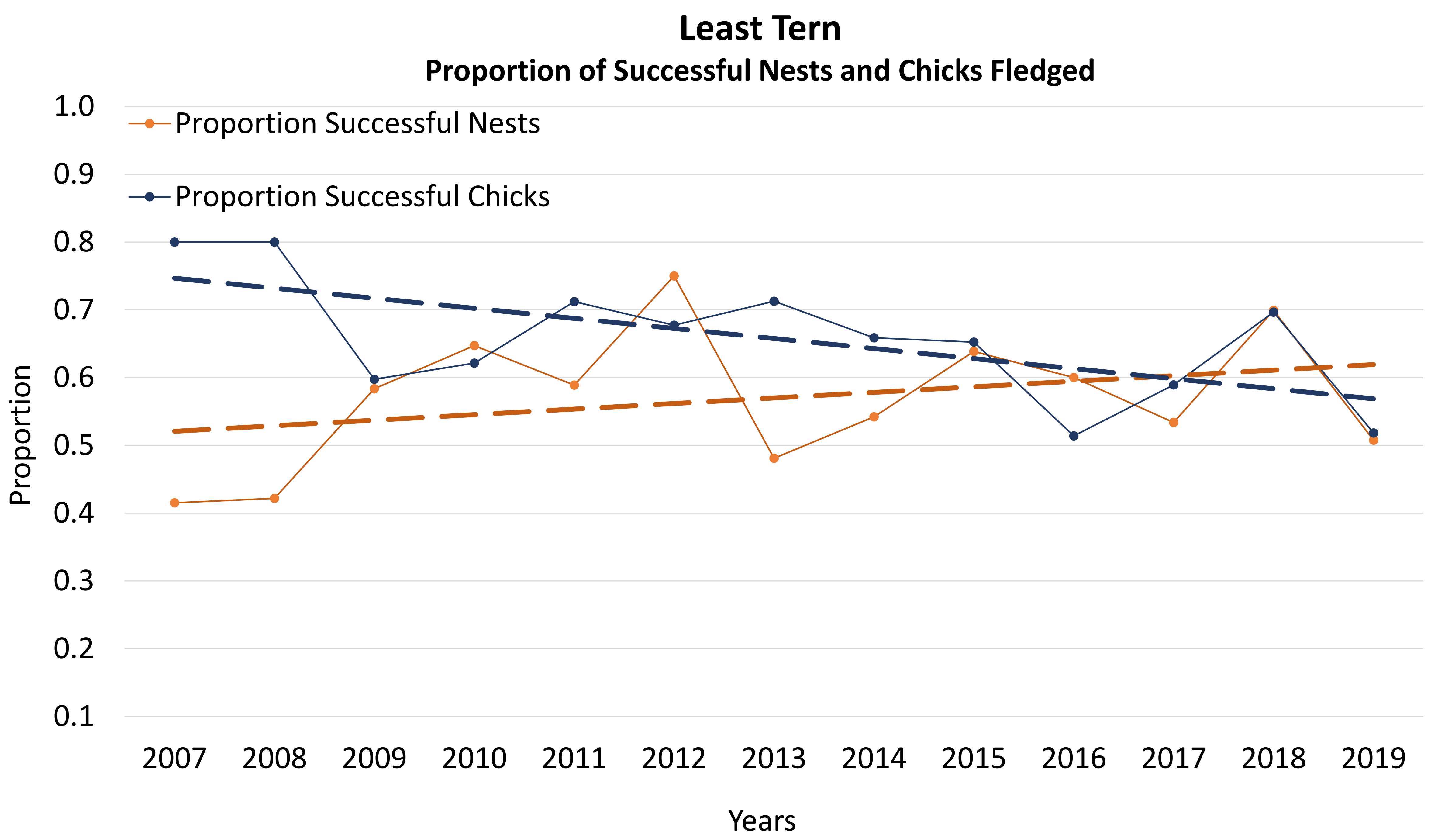

Least Tern Counts
Cumulative Nest Count
Breeding Pair Estimator
Cumulative Fledge Count
Counts
0
20
40
60
80
100
120
140
160
180
200
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Years

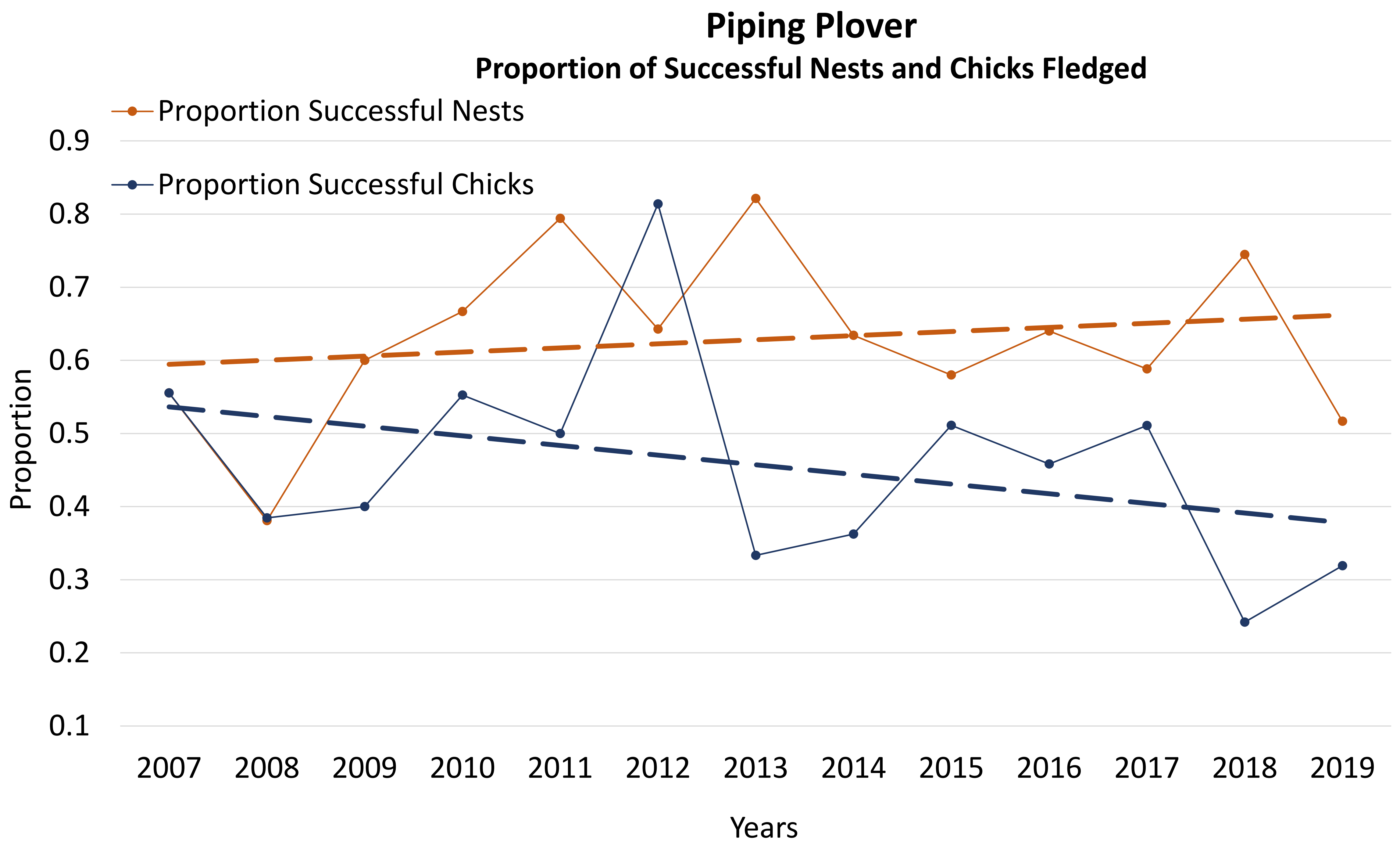


Piping Plover Counts
Cumulative Nest Count
Breeding Pair Estimator
Cumulative Fledge Count
70
60
50
40
30
20
10
0
Counts
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Years



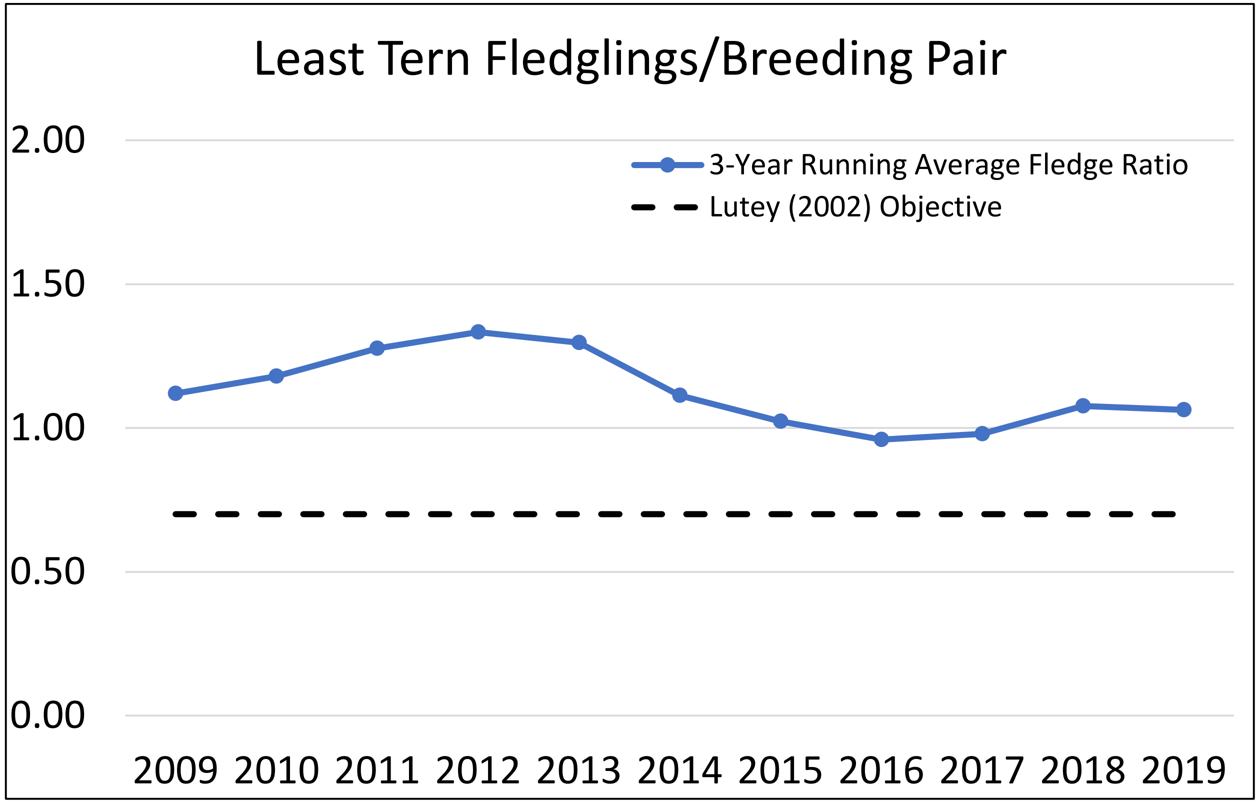
Piping Plover Counts
Cumulative Nest Count
Breeding Pair Estimator
Cumulative Fledge Count
Counts
0
10
20
30
40
50
60
70
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Years

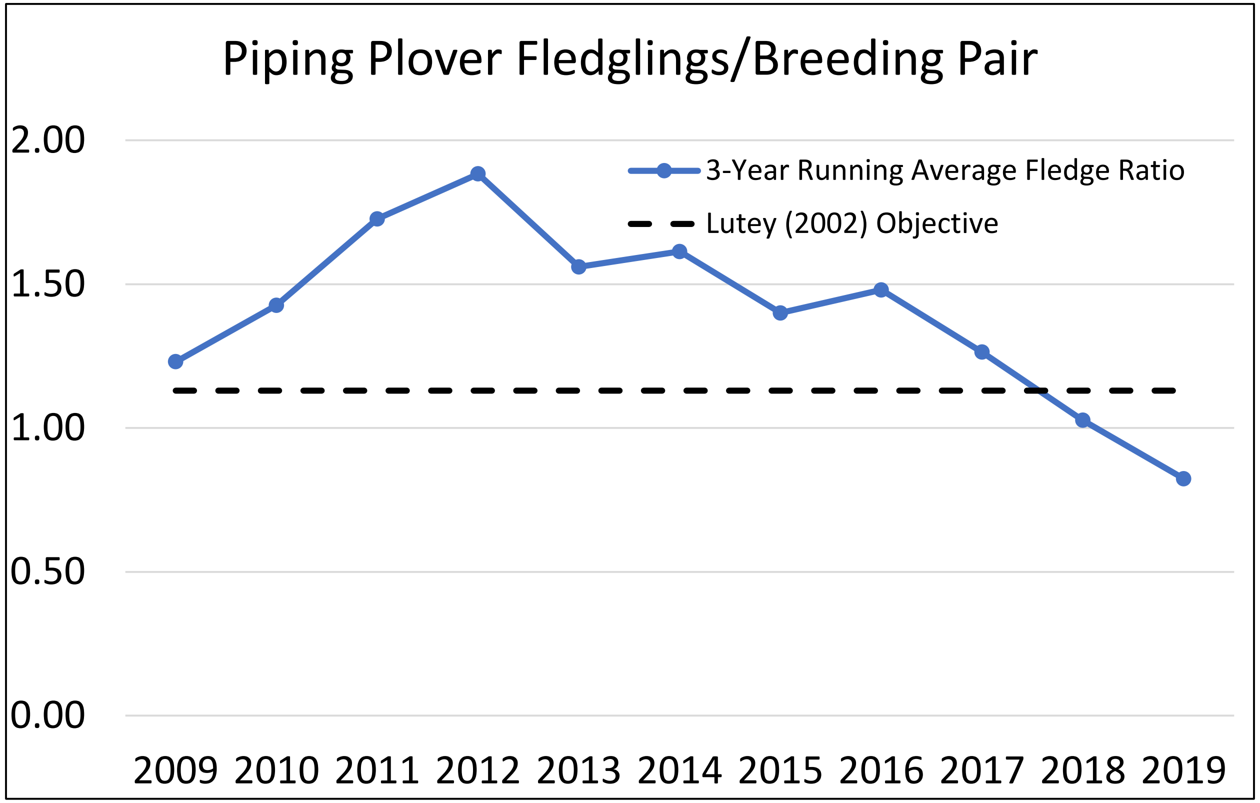

Least Tern
Proportion of Successful Nests and Chicks Fledged
Proportion Successful Nests
Proportion Successful Chicks
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Proportion
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Years


Piping Plover
Proportion of Successful Nests and Chicks Fledged
Proportion Successful Nests
Proportion Successful Chicks
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Proportion
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Years

Least Tern and Piping Plover

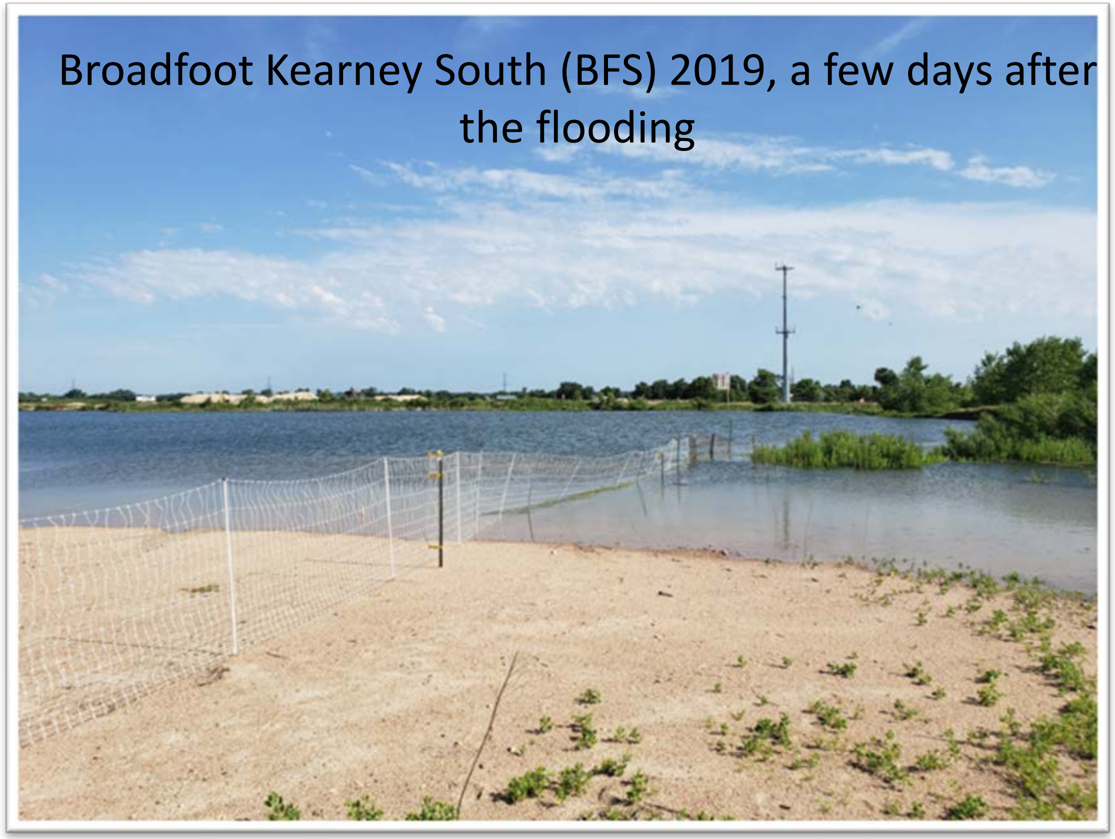
3-Year Running Average Fledge Ratios





Unknowns and Failed Nests

- Total Failed and Unknown for Both LT and PP across all sites:
  - Failed UNK= 42
  - Failed Predated= 11
  - Failed Weather= 5 (hail, heavy rain, cold temperatures)
  - Failed Flooded= 3
  - Unknown= 32
    - Nest disappeared around hatch time (usually between visits)
    - Unable to see or visit nest again or within estimated hatch time



Catastrophic Events

- Leaman
  - Severe Flooding (2015)
  - Hailstorm (2015)

- Kearney Broadfoot South
  - Severe Flooding/Weather (2019)
  - Fox (2017 and 2019)

- Bluehole
  - Predation-coyote and fox (2016,2018, and 2019)
  - Flooding/Severe Weather (2015 and 2019)

Fox at BFS 2019

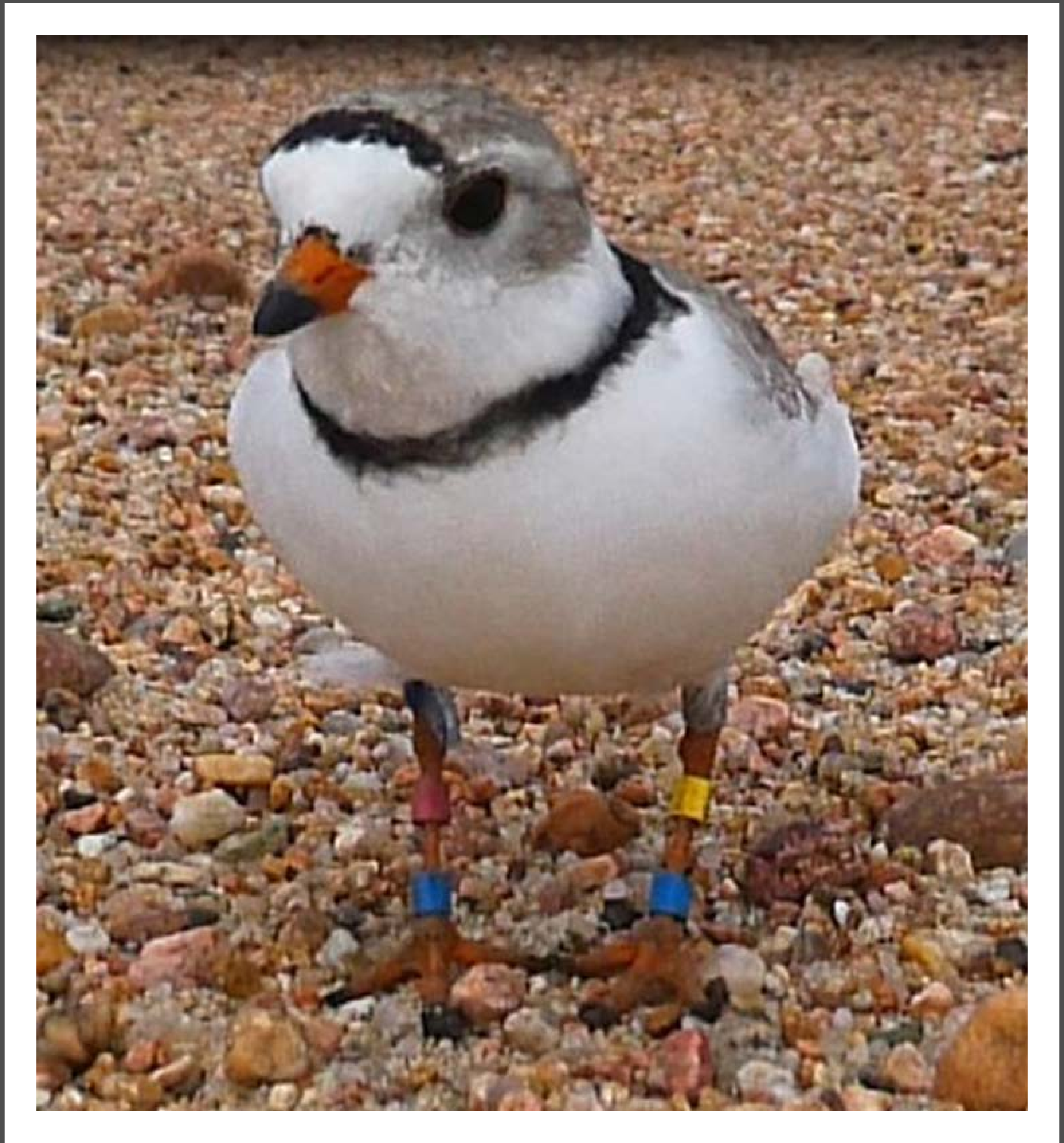

Dead LETE adult at BFS 2019

2019 Band Resighting Results

Band Resighting Process and Importance

Resighting Results

- Interior Least Tern
  - 45 Adults recorded
  - 64% banded
- Piping Plover
  - 28 Adults recorded
  - 50% banded



Presentation Topics

Predator Management Results

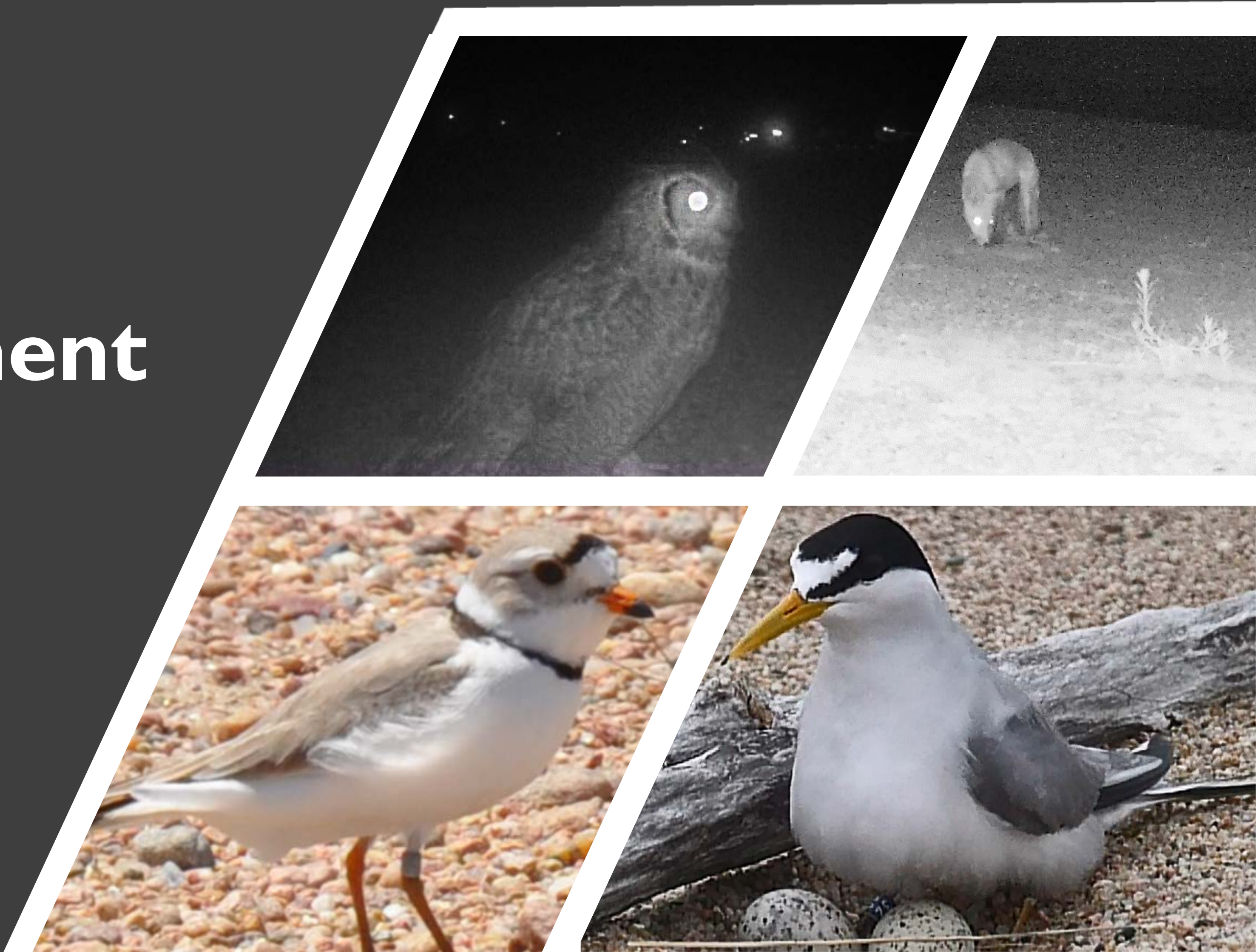
Predator Fence Camera Results 2017-2018

Nest Site Predator Camera Results 2017-2018

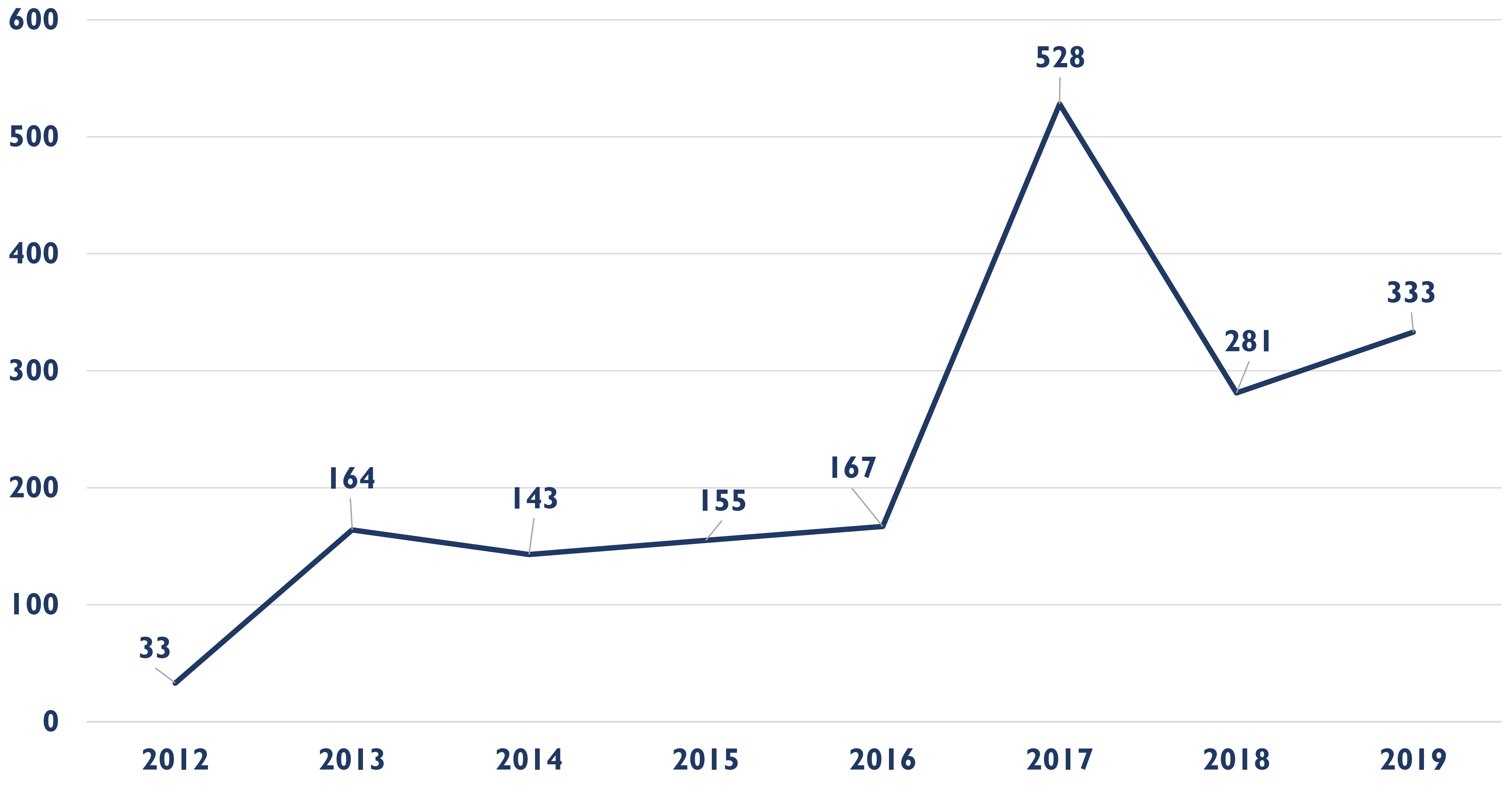
Nest Monitoring Camera Results 2019

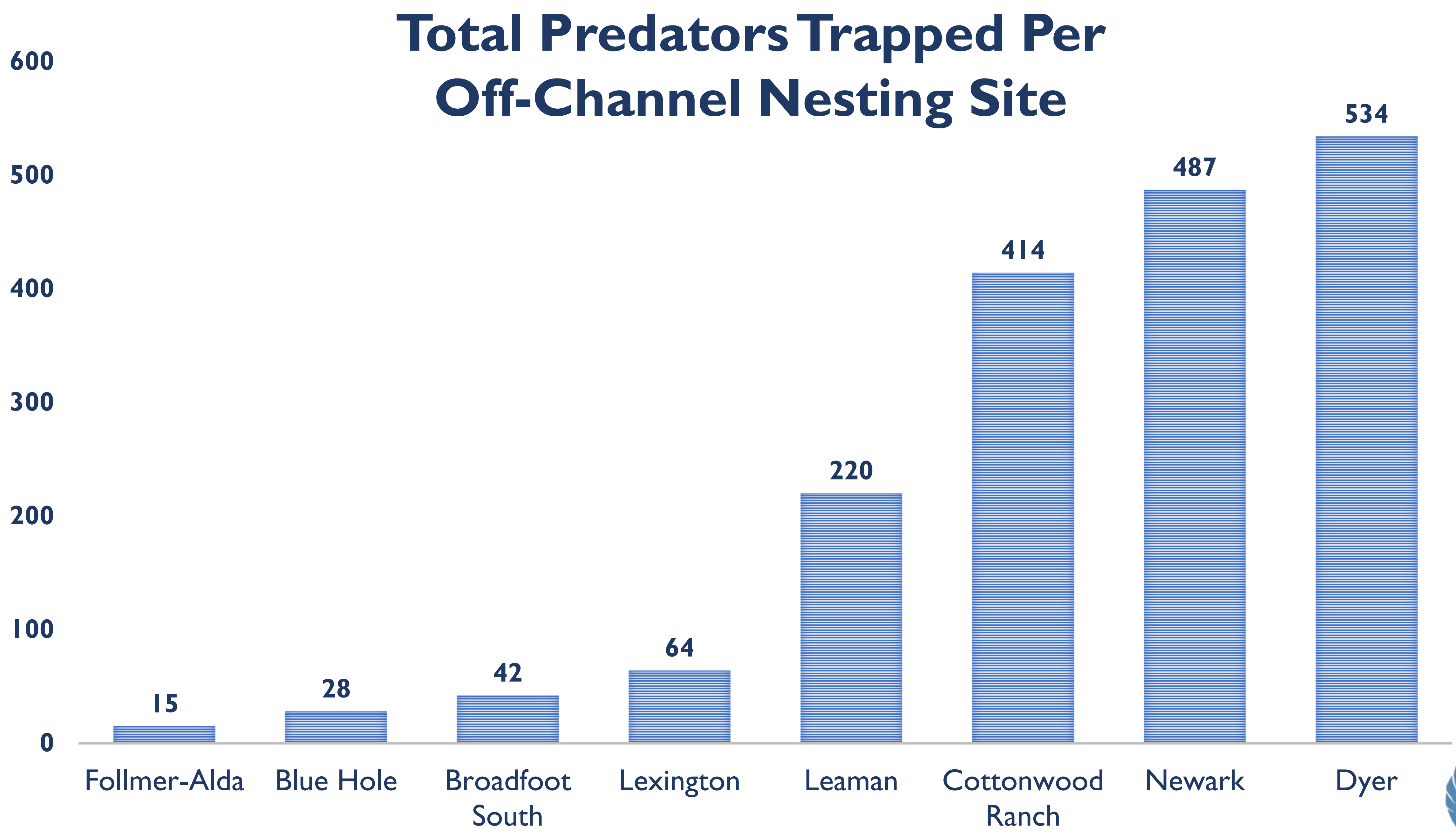
Kaley Keldsen
Wildlife Biologist

Predator Management

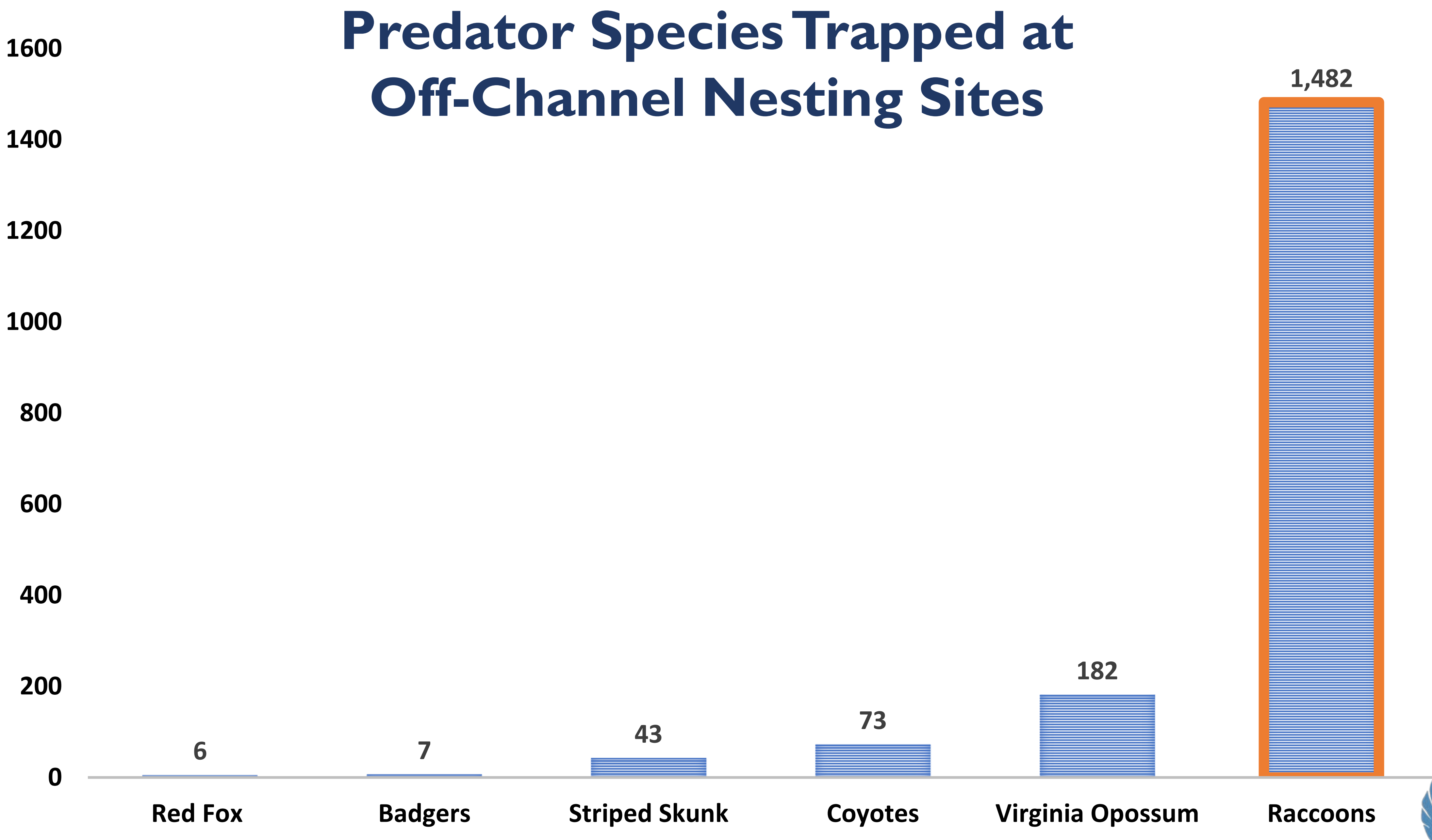


Cumulative Predator Trapping at Off-Channel Nesting Sites



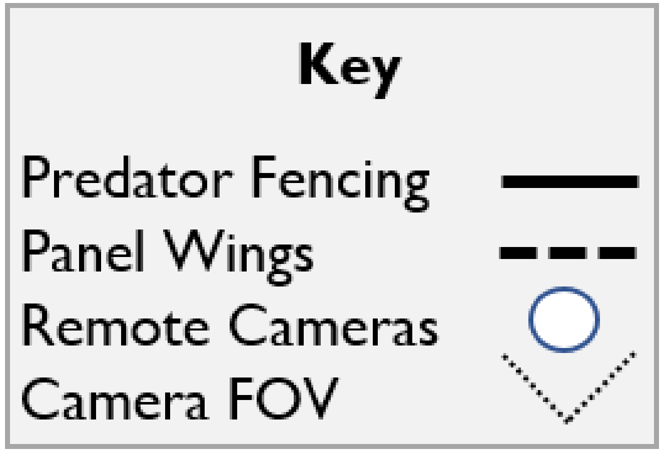


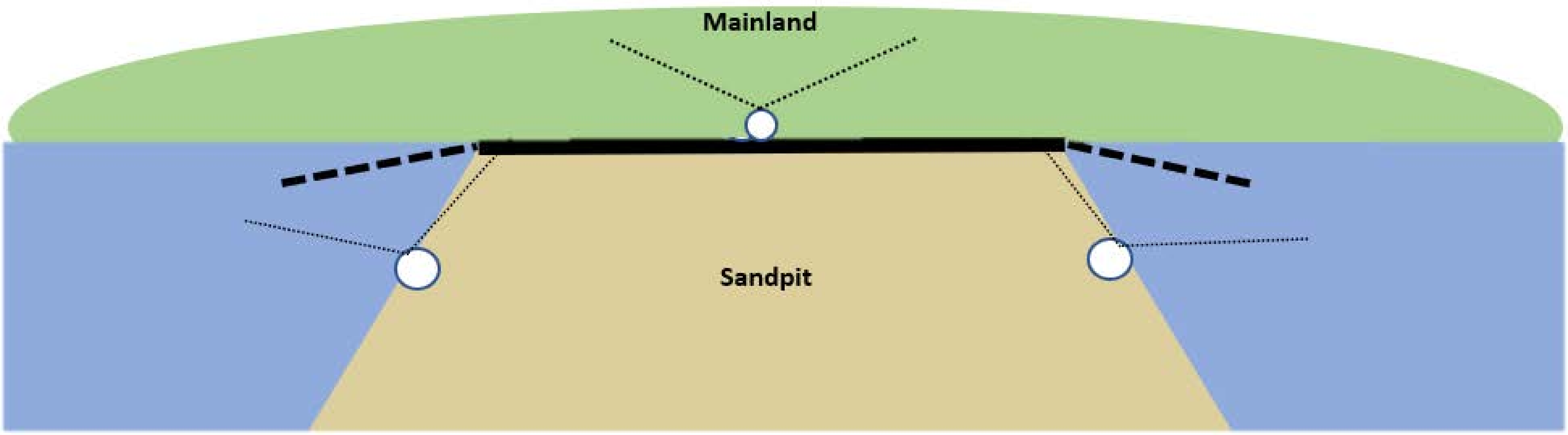
Total Predators Trapped Per Off-Channel Nesting Site
600
500
400
300
200
100
0
15
28
42
64
220
414
487
534
Follmer-Alda
Blue Hole
Broadfoot South
Lexington
Leaman
Cottonwood Ranch
Newark
Dyer

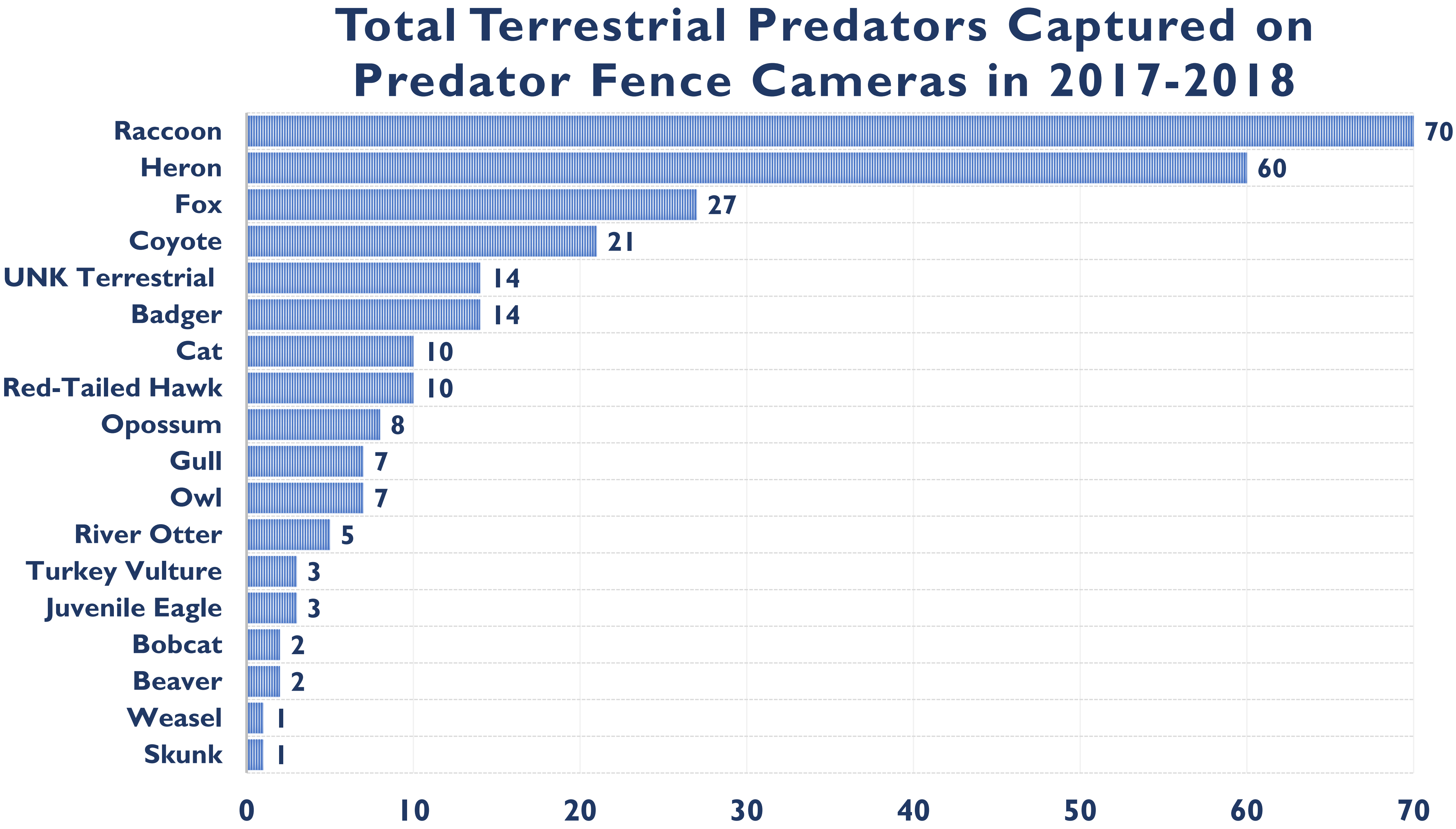

Predator Species Trapped at
Off-Channel Nesting Sites
1600
1400
1200
1000
800
600
400
200
0
6
7
43
73
182
1,482
Red Fox
Badgers
Striped Skunk
Coyotes
Virginia Opossum
Raccoons

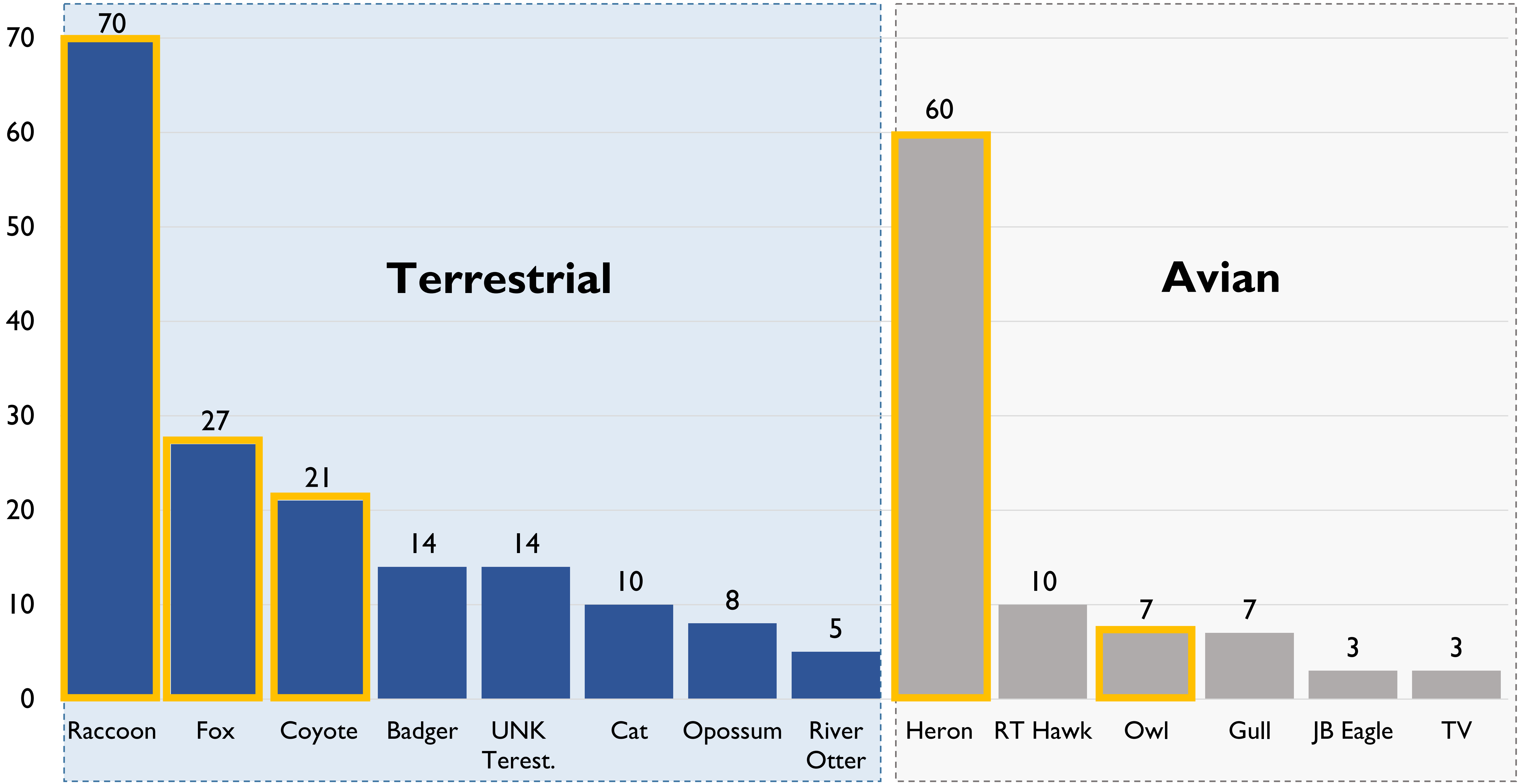
Predator Fence Camera Results 2017-2018

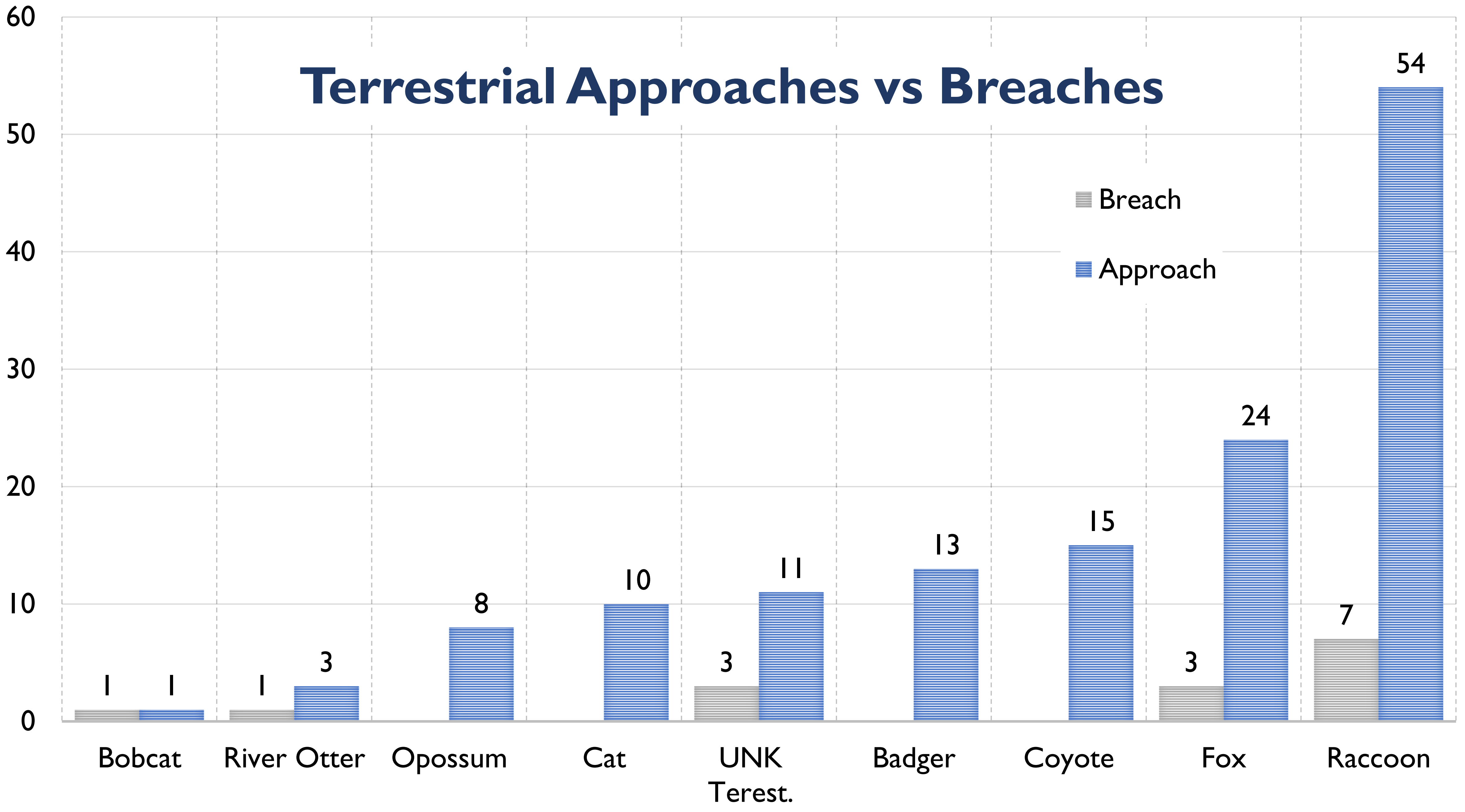
Predator Fence Camera Setup





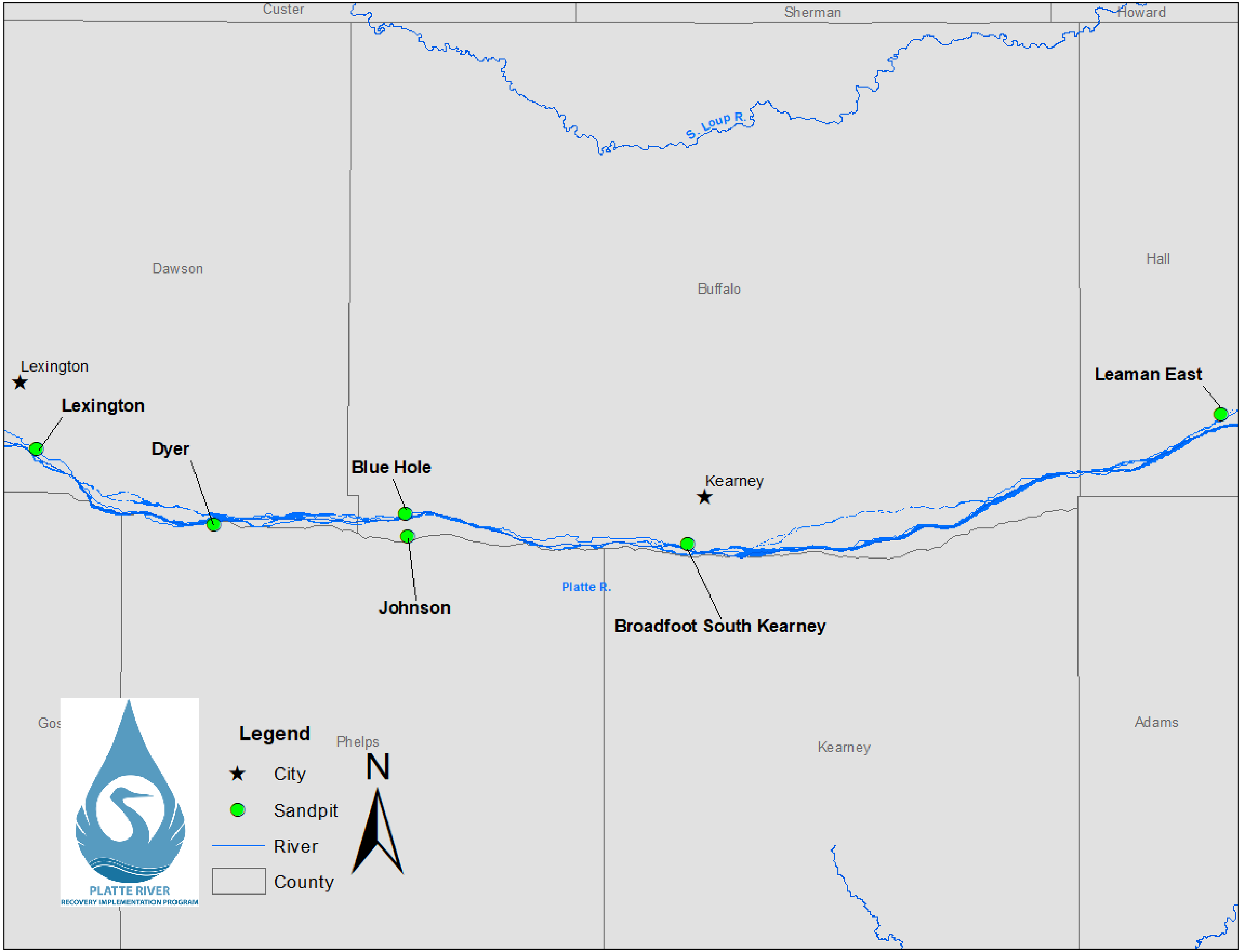

Total Terrestrial Predators Captured on Predator Fence Cameras in 2017-2018
Raccoon 70
Heron 60
Fox 27
Coyote 21
UNK Terrestrial 14
Badger 14
Cat 10
Red-Tailed Hawk 10
Opossum 8
Gull 7
Owl 7
River Otter 5
Turkey Vulture 3
Juvenile Eagle 3
Bobcat 2
Beaver 2
Weasel 1
Skunk 1
0
10
20
30
40
50
60
70


Terrestrial
Avian
70
60
50
40
30
20
10
0
70
27
21
14
14
10
8
5
60
10
7
7
3
3
Raccoon
Fox
Coyote
Badger
UNK Terest.
Cat
Opossum
River Otter
Heron
RT Hawk
Owl
Gull
JB Eagle
TV

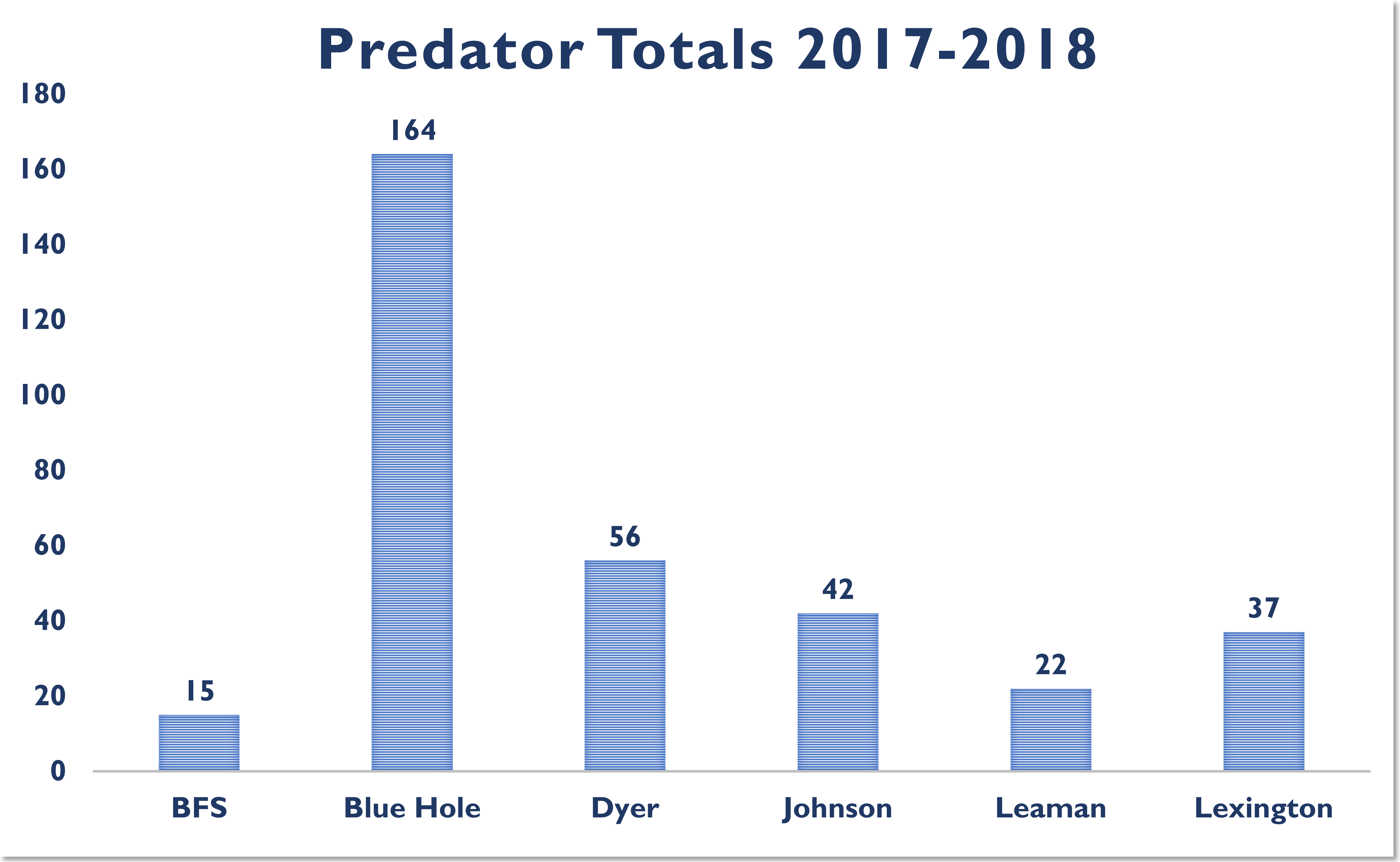


Terrestrial Approaches vs Breaches
Breach
Approach
60
50
40
30
20
10
0
1
1
1
3
8
10
3
11
13
15
3
24
7
54
Bobcat
River Otter
Opossum
Cat
UNK Terest.
Badger
Coyote
Fox
Raccoon

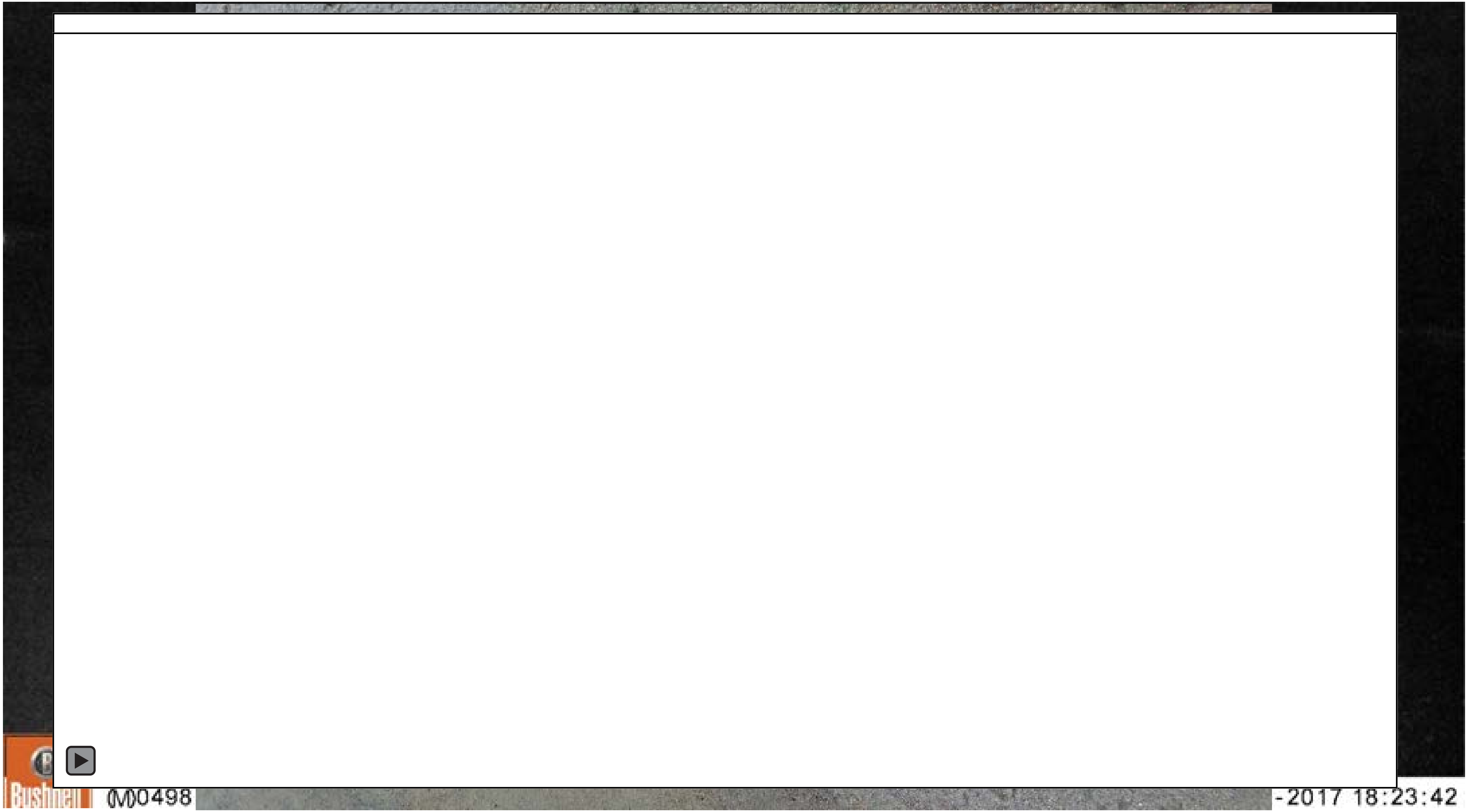
Nest Site Predator Camera Results 2017-2018


Custer
Sherman
Howard
S. Loup R.
Dawson
Buffalo
Hall
Lexington
Lexington
Leaman East
Dyer
Blue Hole
Kearney
Johnson
Platte R.
Broadfoot South Kearney
Gos
Legend
Phelps
City
Sandpit
River
County
N
Kearney
Adams
PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

etup


Predator Totals 2017-2018
180
160
140
120
100
80
60
40
20
0
164
56
42
37
22
15
BFS
Blue Hole
Dyer
Johnson
Leaman
Lexington

60
50
40
30
20
10
0
1
39
51
Osprey
Barn
orned
Owl
Juvenile
Bald
Eagle
Bushnell
M0490BFS
98 °F36 °C


(M)0498
-2017 18:23:42

Predator Study Conclusion

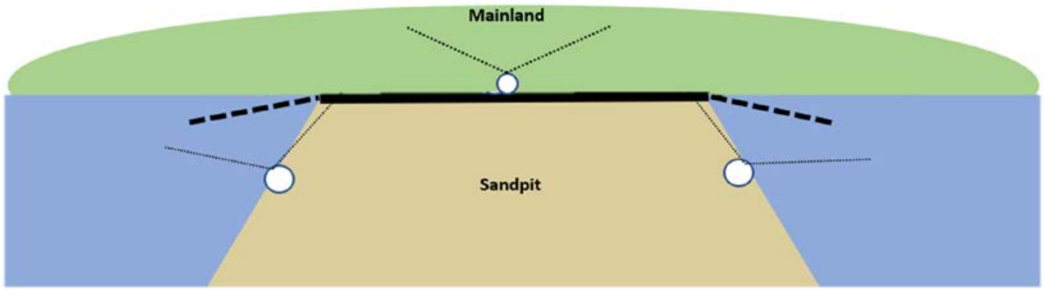
Nest Monitoring Camera

Results 2019

Past Research:

Outcomes:

Predator fence cameras



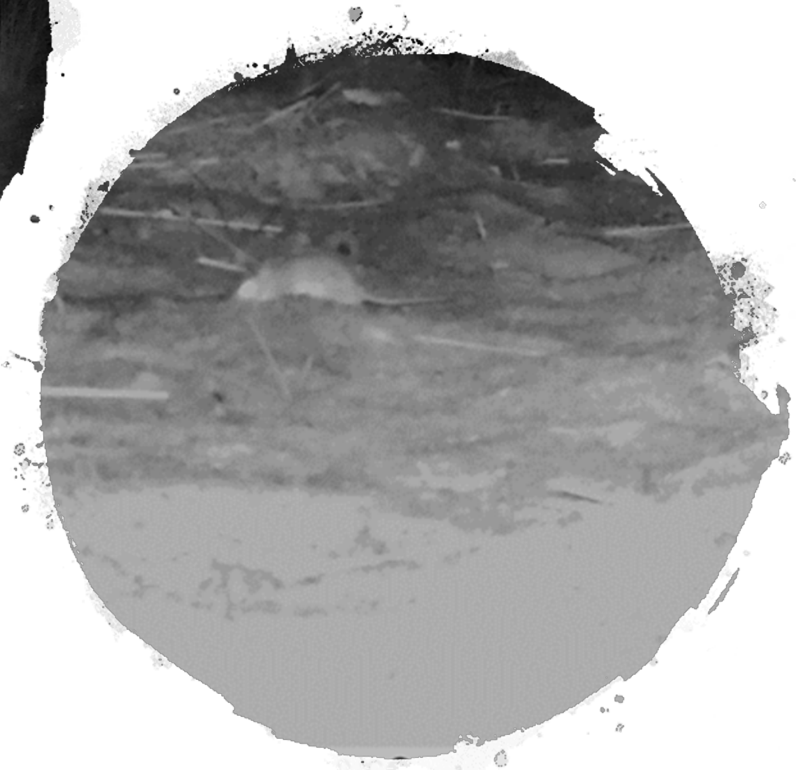
- Terrestrial predator species composition
- Effective at deterring terrestrial predators

Nest site predator cameras

- Predator species composition
- Predator species activity

Remaining Question:

What species of predators are depredating Least Tern and Piping Plover nests?

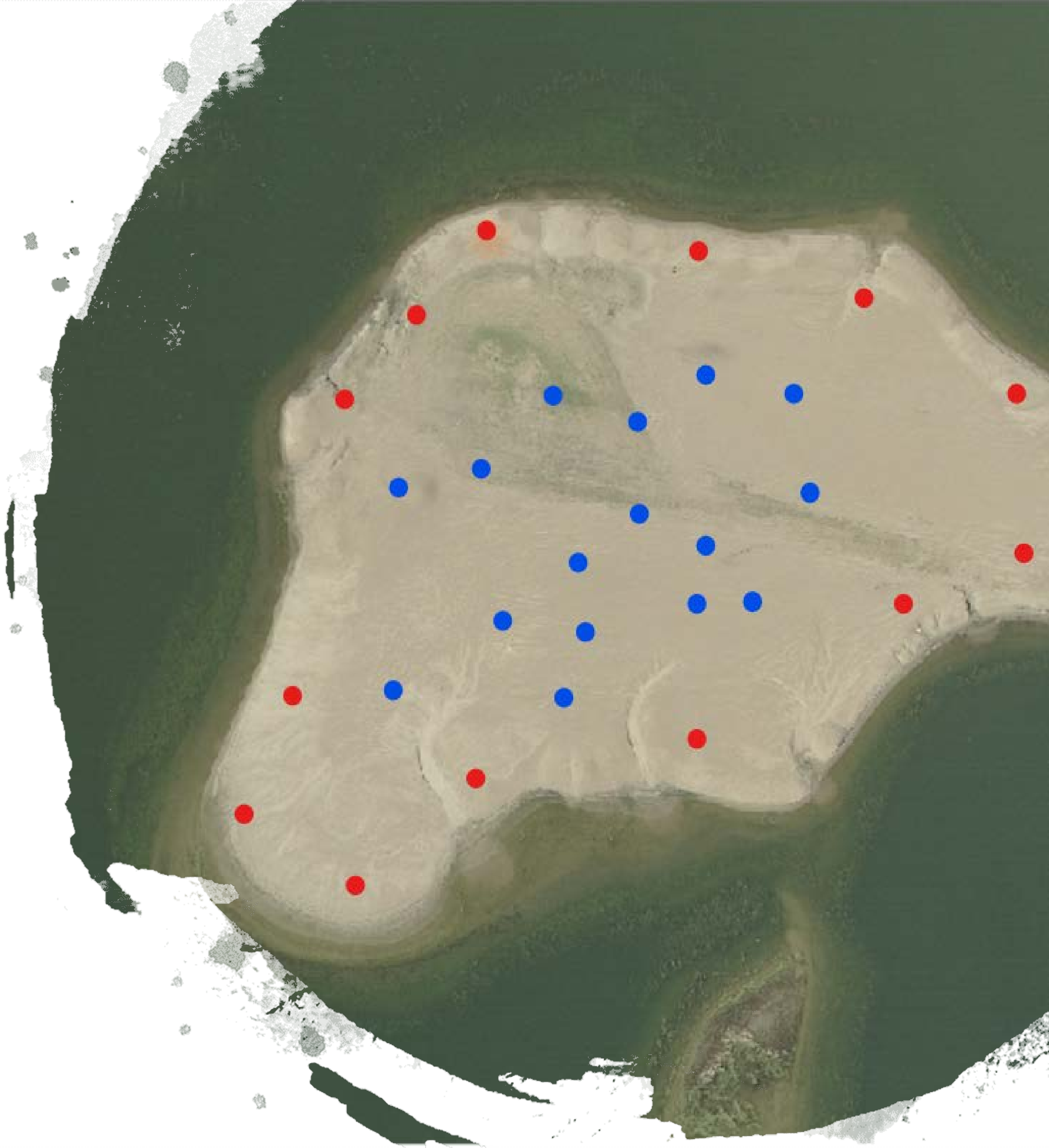


Design

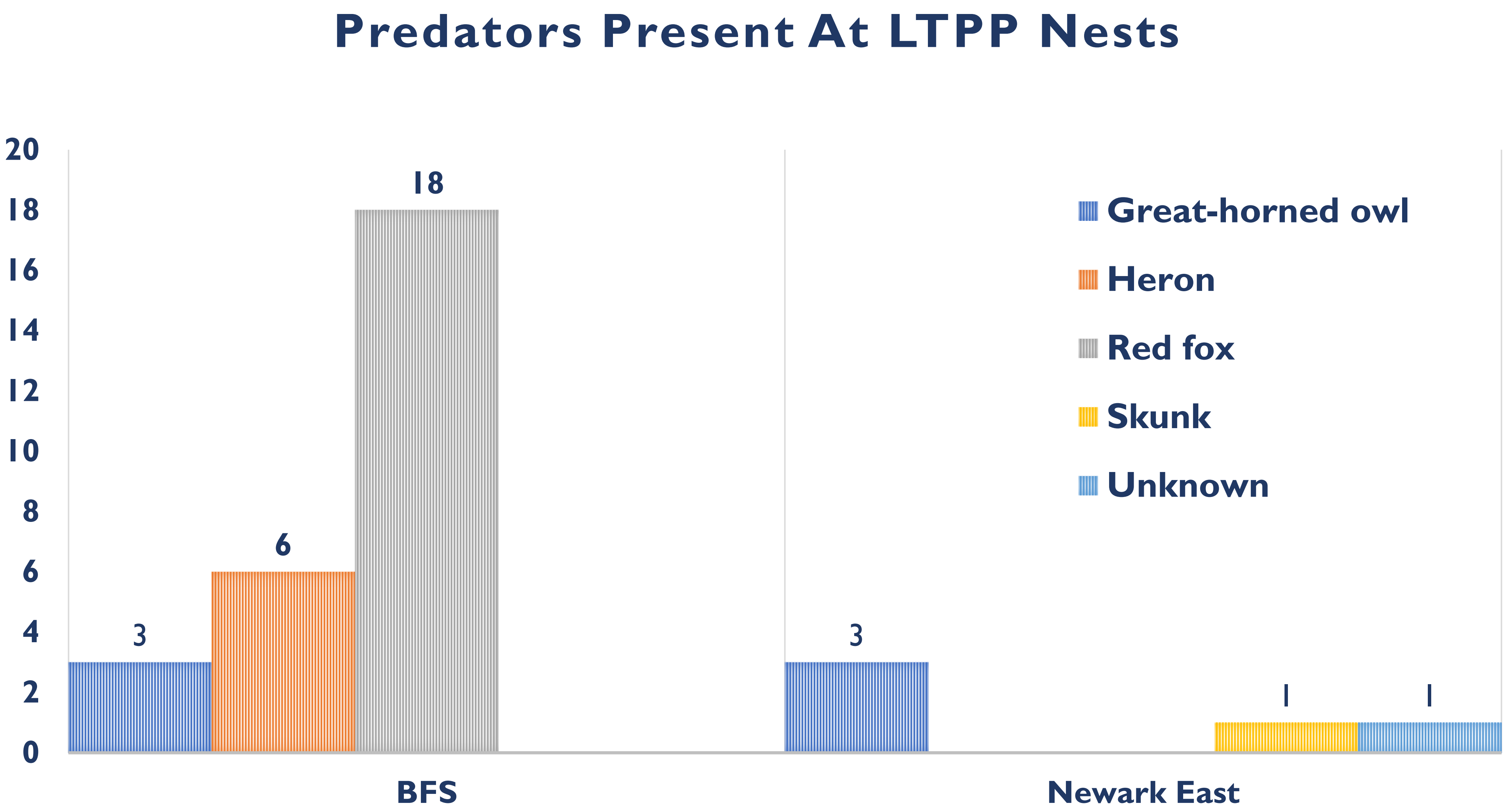
Design

Off-Channel Nesting Sites:

Newark West
Newark East
Broadfoot South



Results


Predators Present At LTPP Nests
20
18
16
14
12
10
8
6
4
2
0
3
6
18
3
1
1
BFS
Newark East
Great-horned owl
Heron
Red fox
Skunk
Unknown

Implications

- Fox caches
- More cameras are needed—possibly different type of camera
- Will utilize the video and photo feature in the future

Interesting Findings

- Adult behavior after predation
- Pair behavior while incubating eggs
- Photo evidence:
  - Band Combos
  - Chicks at different ages

Questions?

2019 State of the Platte

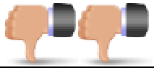
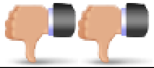
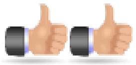
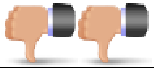
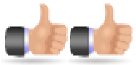
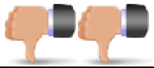
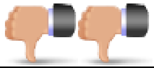
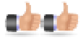
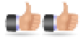
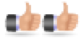
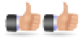
Big Questions
First Increment Summary of Learning
What Don't We Know but Want to Learn?

2019 AMP Reporting Session
Omaha, NE

October 08, 2019

Chad Smith/Dave Baasch/Patrick Farrell/Tom Smrdel
PRRIP Executive Director's Office

TABLE 2. Big Question assessments, PRRIP First Increment (2007-2019).

PRRIP Big Question	First Increment Assessment	Basis for Assessment
Implementation – Program Management Actions and Habitat		
1. Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?		Conclusively answered.
2. Will implementation of SDHF produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?		Conclusively answered.
3. Is sediment augmentation necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?		Trending positive and certainty about the sediment deficit in the south channel above the Overton bridge; uncertainty about the role of that deficit in habitat creation and maintenance in the rest of the AHR. This Big Question will either be retained in its current form or revised and addressed through implementation of AMP Version 2.0 during the Extension.
4. Are mechanical channel alterations (channel widening and flow consolidation) necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?		Conclusively answered.
Effectiveness – Habitat and Target Species Response		
5. Do whooping cranes select suitable riverine roosting habitat in proportions equal to its availability?		Conclusively answered.
6. Does availability of suitable nesting habitat limit tern and plover use and reproductive success on the central Platte River?		Conclusively answered.
7. Are both suitable in-channel and off-channel nesting habitats required to maintain central Platte River tern and plover populations?		Conclusively answered.
8. Does forage availability limit tern and plover productivity on the central Platte River?		Conclusively answered.
9. Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?		This Big Question will either be retained in its current form or revised and addressed through implementation of AMP Version 2.0 during the Extension.
10. Do Program management actions in the central Platte River cumulatively 1) produce detectable changes in the physical environment (i.e. habitat) and 2) result in a detectable increase in tern, plover, and whooping crane use of the Associated Habitats?	**LTPP Off-Channel** Habitat  Species Response  **WC On-Channel** Habitat  Species Response 	Conclusively answered.

Management Objective #1 – Improve production of the interior least tern and piping plover from the central Platte River.

- **Summary of First Increment Learning – Tern and Plover**
  - As currently stated, the Program **met** Management Objective #1 during the First Increment.
  - Least tern and piping plover populations in the AHR have increased significantly and proportionately to increases in habitat availability due to Program off-channel habitat creation efforts. Productivity on off-channel habitats has been sufficient to maintain a stable to growing subpopulation.
  - Based upon available data, least tern and piping plover productivity is insensitive to river flow. Periods of low flow have not reduced productivity due to a limitation in forage availability.
  - The Program agreed to acquire/develop and manage 60 more acres of off-channel tern and plover nesting habitat and 10 acres if MCA habitat to meet the Service's requirement of maintainting stable or growing tern and plover populations within the AHR.
  - **Remaining uncertainties** – need for and mechanics of avian predator control related to tern and plover productivity (related to Species Performance indicators in revised CEM).

Management Objective #2 – Contribute to the survival of whooping cranes during migration.

- **Summary of First Increment Learning – Whooping Crane**
  - As currently stated, the Program **met** Management Objective #2 during the First Increment.
  - Whooping crane use of the AHR has increased significantly and proportionally to increases in habitat suitability that are in part due to Program management actions.
  - Whooping crane use of the AHR increased significantly while wet meadow use remained stable and low.
  - **Remaining uncertainties** – mechanics of flow releases (spring and fall migration flows, summer vegetation germination suppression flows) to ensure Program continues to meet management objective (related to Whooping Crane Use and Occurrence indicator in CEM).

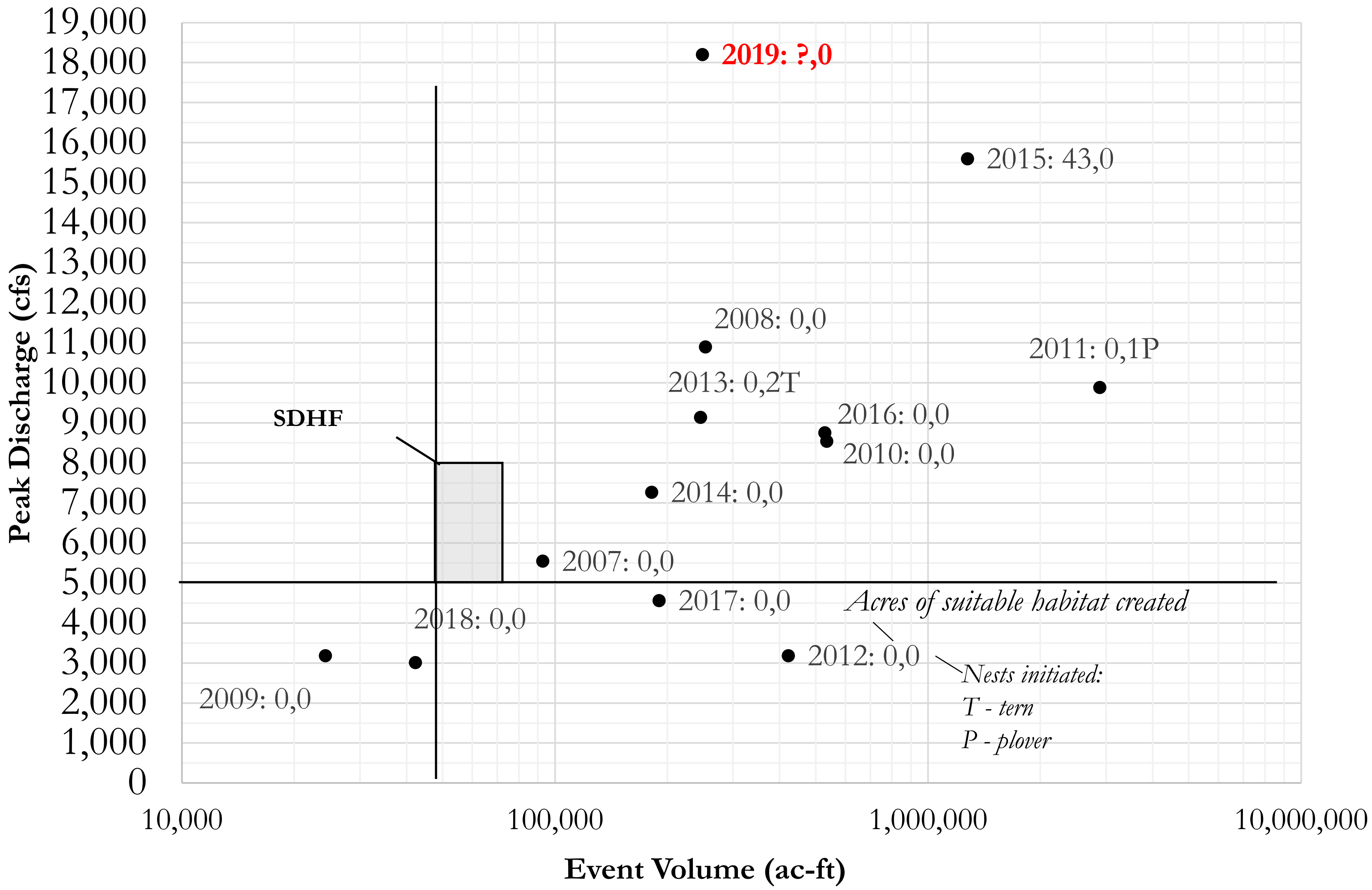
Management Objective #3 – Avoid adverse impacts from Program actions on pallid sturgeon populations.

- **Summary of First Increment Learning**
  - As currently stated, it is **unknown** if the Program met Management Objective #3 during the First Increment.
  - Translation of Program flow management actions from the central Platte to the lower Platte is difficult to detect and thus difficult to relate to effects on habitat and species response.
  - **Remaining uncertainties** – substantial uncertainty relating to the life history of pallid sturgeon in the lower Platte River (use, productivity, recruitment) limits the the ability of the Program to develop a clear set of testable hypotheses, management actions, monitoring protocols, and a plan for data analysis and synthesis (related to Pallid Sturgeon Use and Occurrence and Reproduction indicators in CEM).

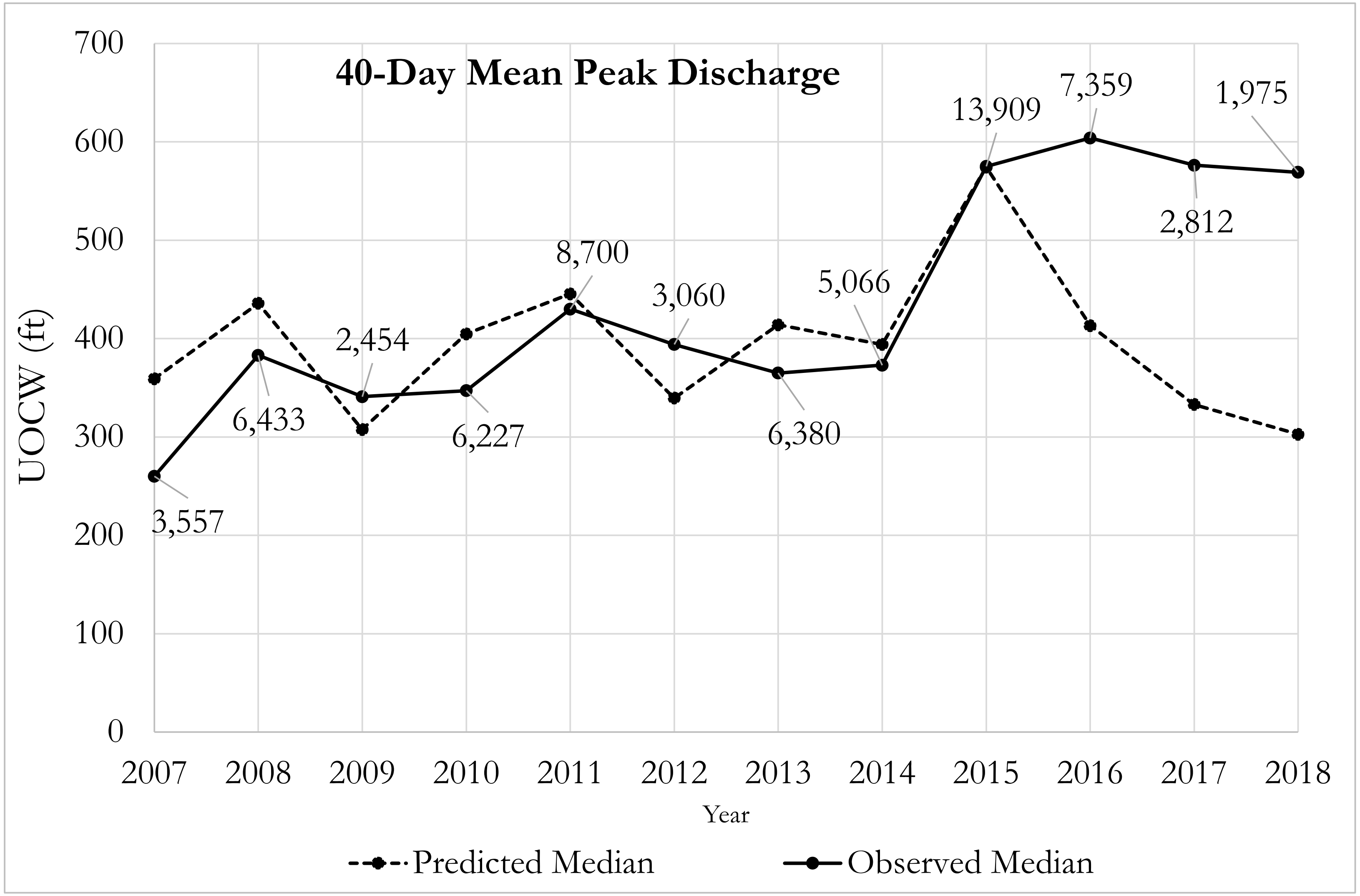
System Learning

- **Summary of First Increment Learning**
  - Attempts to implement the FSM management strategy have **generally produced poor results**.
  - SDHF (5,000-8,000 cfs for three (3) days at Overton, NE) will not create or maintain suitable least tern and piping plover nesting habitat or whooping crane roosting habitat.
  - Flow consolidation is not feasible due to legal and permitting constraints.
  - A sediment deficit exists in the south channel downstream of the J-2 Return. Five to seven years of full-scale sediment augmentation are necessary to assess efficiency and effectiveness in preventing downstream migration of incision and narrowing.
  - First Increment learning occurred largely through natural flow events as the Program was unable to implement a true SDHF and was not able to conduct flow consolidation actions.
  - **Remaining uncertainties** – effectiveness of summer vegetation germination suppression flow and spring/fall WC migration flows in maintaining channel width (both related to Riparian Vegetation Characteristics and Channel Characteristics indicators in CEM).

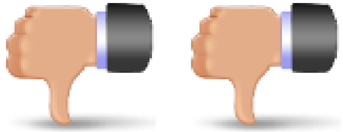
Big Question #2 - Will implementation of Short-Duration High Flow releases produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?



Big Question #2 - Will implementation of Short-Duration High Flow releases produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?



Big Question #2 - Will implementation of Short-Duration High Flow releases produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?

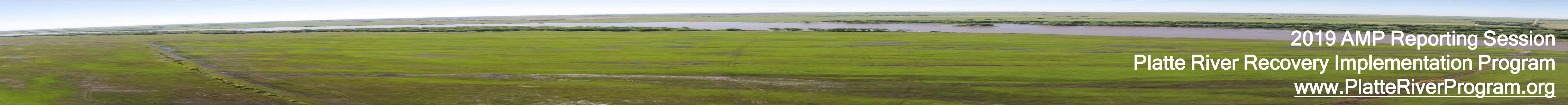


2015 - ~ 13,000 cfs

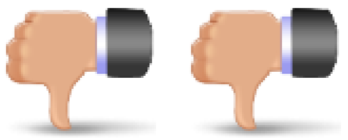

2019-06-26 11:30:00 AM 82°F T 1/1
2019 – June 26th
(3,000 cfs)
PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM
ULTRAFIRE XR6
RECONYX

2019 – July 10th
(~19,000 cfs)


2019-07-26 09:30:00 AM
86°F
T 1/1
2019 – July 26th
(3,000 cfs)
PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM
ULTRAFIRE XR6
RECONYX



Big Question #2 - Will implementation of Short-Duration High Flow releases produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?



Implementation of Short-Duration High Flow releases **will not** produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis.

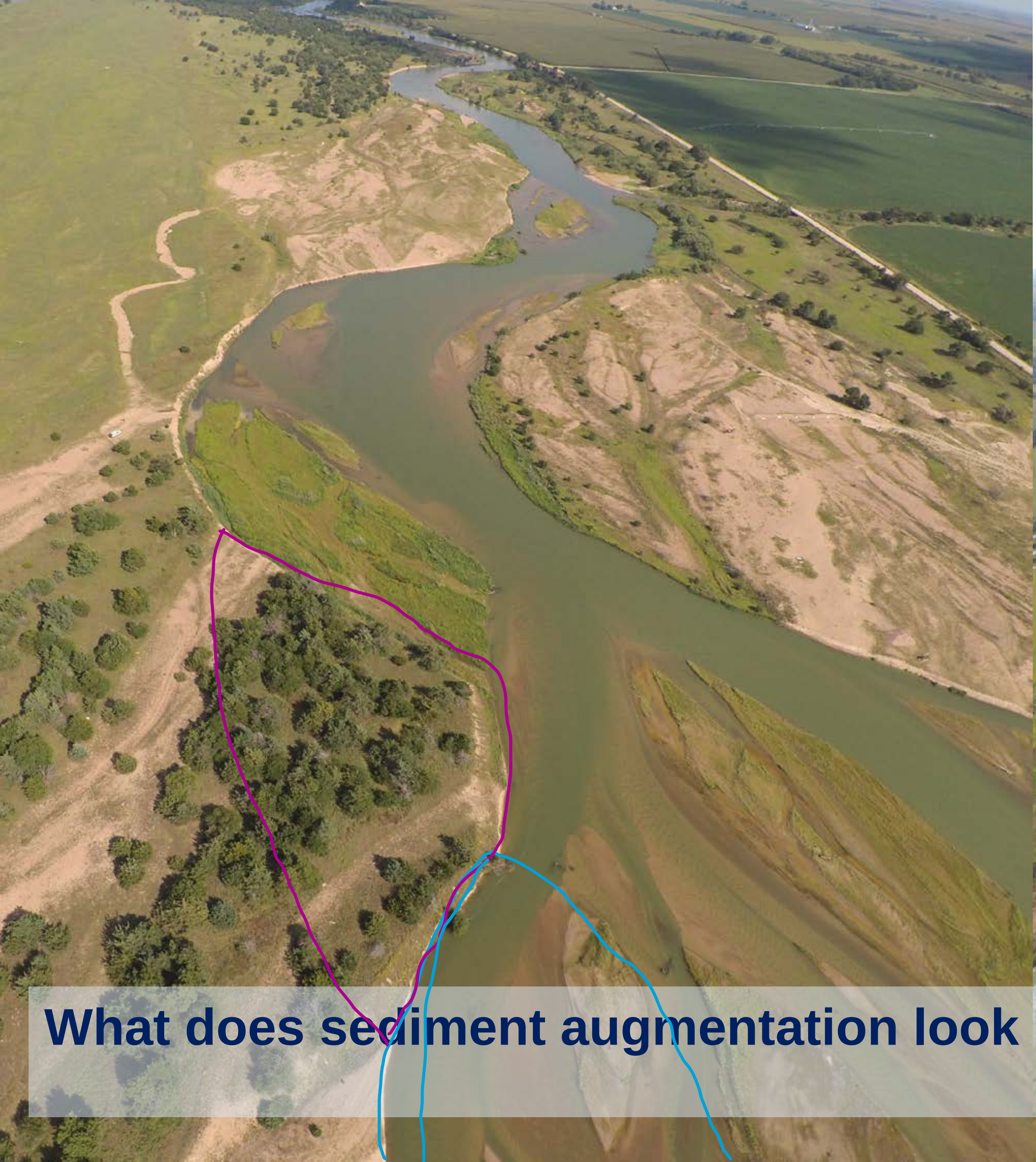
State of the Platte Report

Big Question 3: Is sediment augmentation necessary for the creation and/or maintenance of suitable riverine tern, plover and whooping crane habitat?

Tom Smrdel
Fluvial Geomorphologist

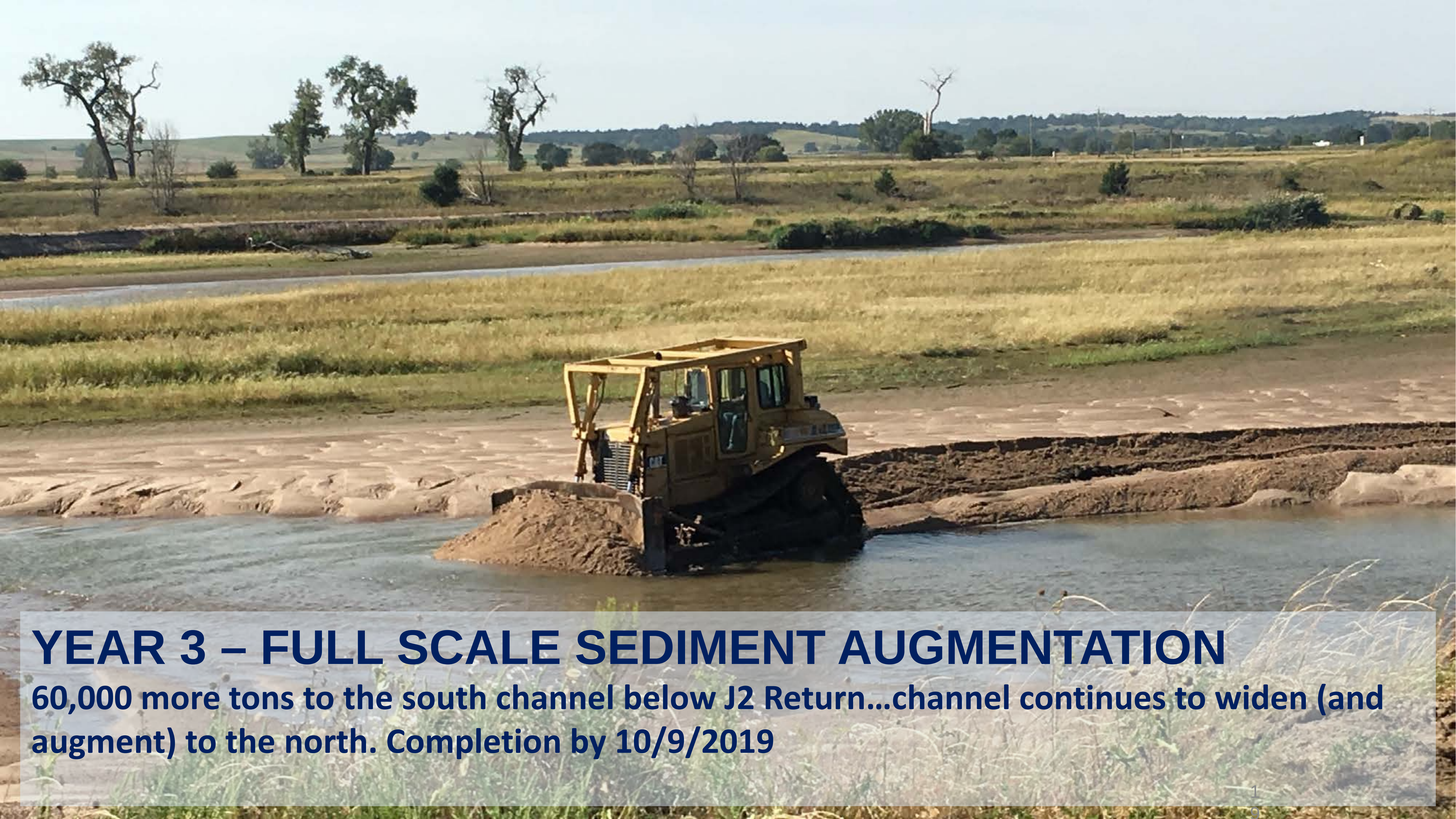
Is sediment augmentation necessary for the creation and/or maintenance of suitable riverine tern, plover and whooping crane habitat?

Hypothesis – Full Scale Sediment Augmentation is a viable mechanical action to mitigate for incision and narrowing.




What does sediment augmentation look like? (flow…1600 or 1000)

Water Year	Sediment Augmented (tons)	Augmentation Location
2006	15,570	Cottonwood Ranch
2007	21,875	Cottonwood Ranch
2008	42,500	Cottonwood Ranch
2009	50,000	Cottonwood Ranch
2010	50,000	Cottonwood Ranch
2011	50,000	Cottonwood Ranch
2012	0	
2013	182,000	Cottonwood Ranch & Plum Creek Complex
2014	0	
2015	0	
2016	0	
2017	75,000	J2 Return ($172,315)
2018	60,000	J2 Return ($66,800)
2019	60,000	J2 Return ($109,560)



YEAR 3 – FULL SCALE SEDIMENT AUGMENTATION

60,000 more tons to the south channel below J2 Return…channel continues to widen (and augment) to the north. Completion by 10/9/2019

New Video of flyover

-Assessment of volume and where they went. More? Stop?
-Continue monitoring
-Satisfy Permit requirements
-Extend permit
-Start moving downstream (of use one more year at Jeffrey…

Where do we go from here?

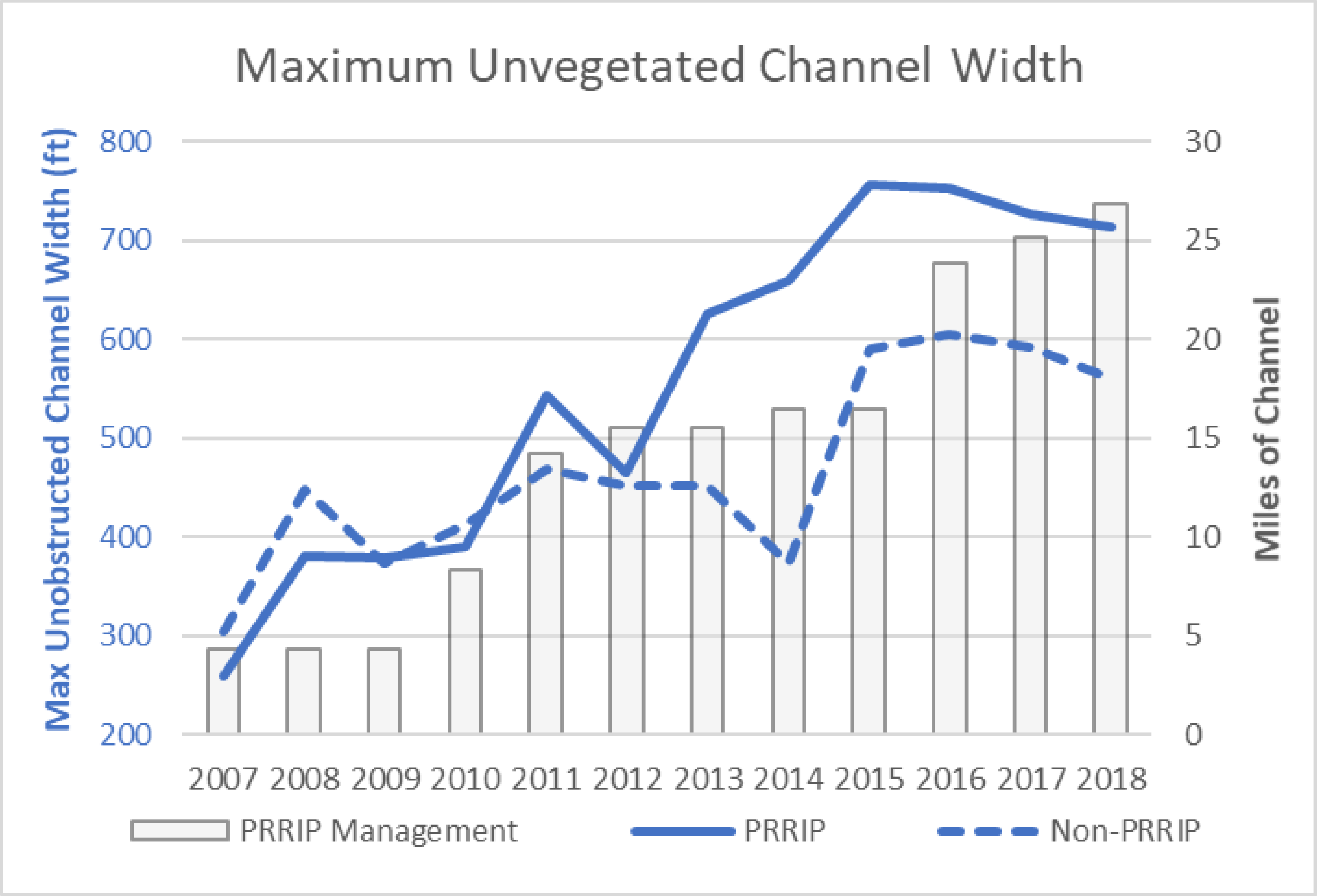
Big Question #9 - Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?

- What is the Program's obligation to pallid sturgeon in the lower Platte River?
- Uncertainty about pallid sturgeon life history and use in the lower Platte River
- What is pallid sturgeon habitat?
- What is the Program ability to influence flow and pallid sturgeon habitat (once defined) in the lower Platte River?
- GC direction – treat pallid sturgeon like other target species in development of Extension AM; where does that lead us?

Big Question #10 - Do Program management actions in the central Platte River cumulatively produce detectable changes in the physical environment (i.e. habitat) that are associated with a detectable increase in tern, plover, and whooping crane use of the Associated Habitats?

Species 👍👍

Habitat 👍👍



Big Question #10 - Do Program management actions in the central Platte River cumulatively produce detectable changes in the physical environment (i.e. habitat) that are associated with a detectable increase in tern, plover, and whooping crane use of the Associated Habitats?

Species

Habitat

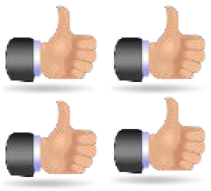
- Unvegetated channel widths on Program lands transitioned from narrower than non-Program lands in 2010 to significantly wider in 2013 through 2019.
  - Whooping crane use has increased significantly
  - Use of Program in-channel habitat has increased significantly
  - Wet meadow and palustrine use has remained steady and low

- Tern and plover use has increase 4-fold as habitat increased

Big Question #10 - Do Program management actions in the central Platte River cumulatively produce detectable changes in the physical environment (i.e. habitat) that are associated with a detectable increase in tern, plover, and whooping crane use of the Associated Habitats?

Species

Habitat



Program management actions **DO** produce detectable changes in the physical environment (i.e. habitat) that are associated with a detectable increase in tern, plover, and whooping crane use of the Associated Habitats.


PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

AMP Tools

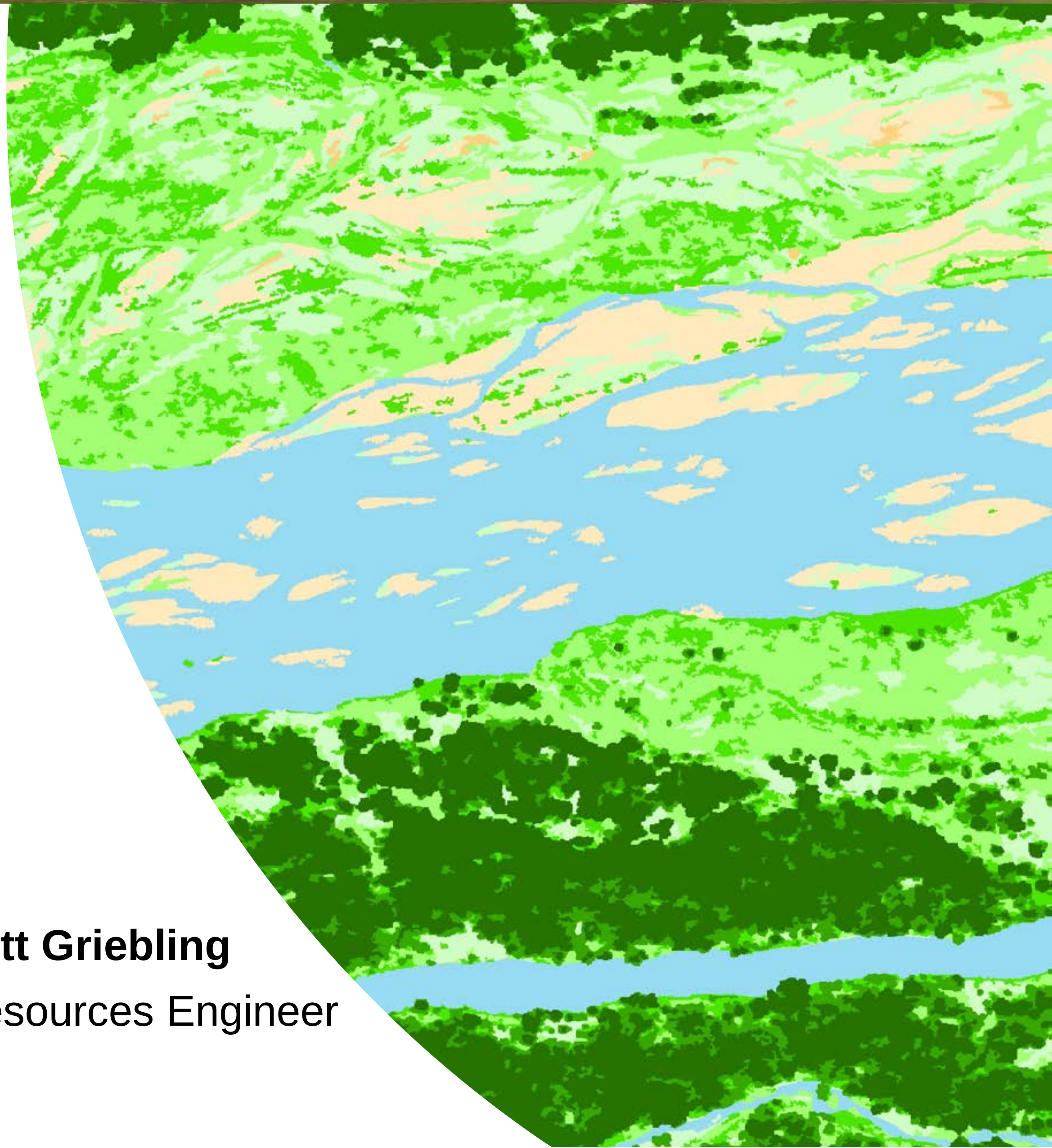
- ***2-D Model***
- ***Operations Model & Flow Scenarios***
- ***Decision Tree Model***

2019 AMP Reporting Session
Omaha, NE
October 09, 2019

Patrick Farrell
Statistical Ecologist

Tom Smrdel
Fluvial Geomorphologist

Scott Griebling
Water Resources Engineer



“How can we best use Program water to meet species objectives?”

WC Metrics

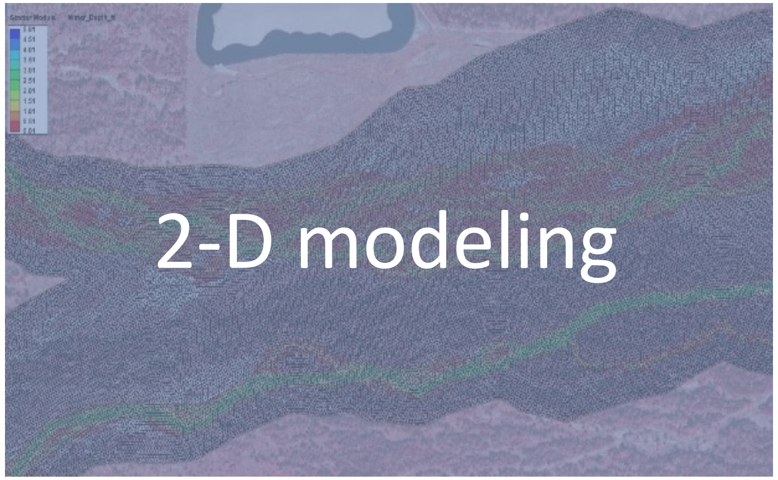
During Migration

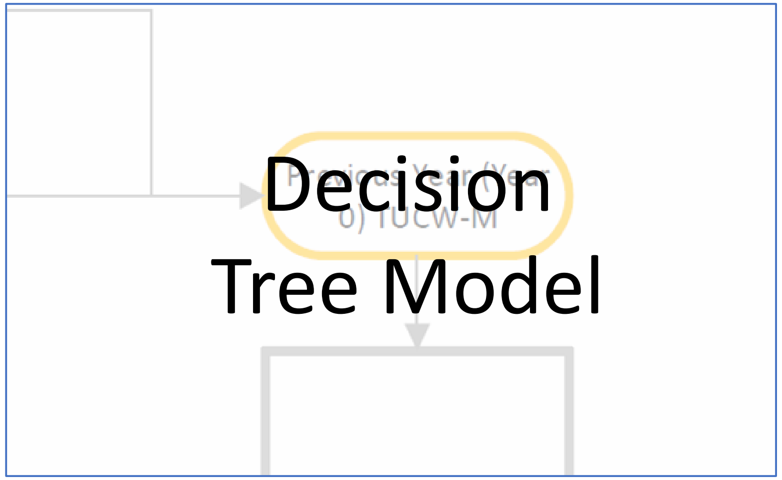
- MUCW of 650’
- water depth ≤0.7 ft

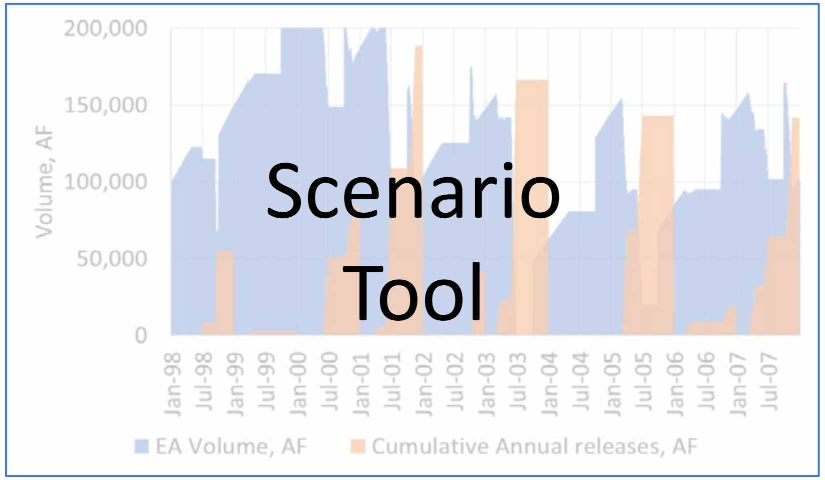
- **How can we best use Program water to provide suitable WC riverine habitat?**

Response to Flow Timing, Duration, Magnitude

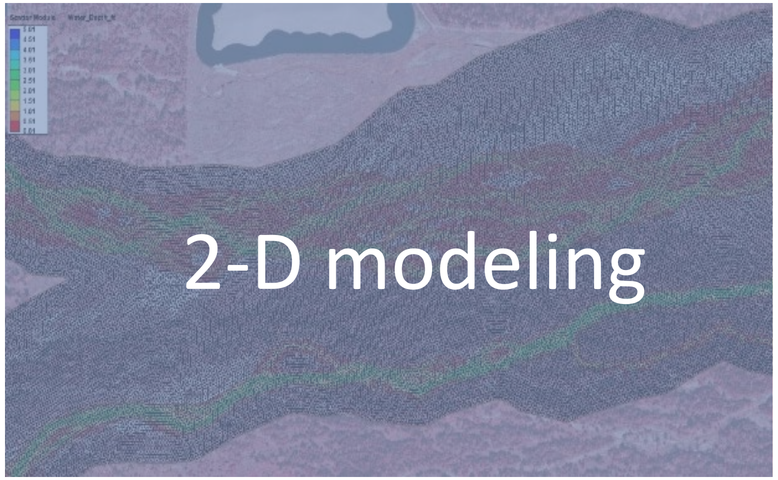
Flow Release Feasibility

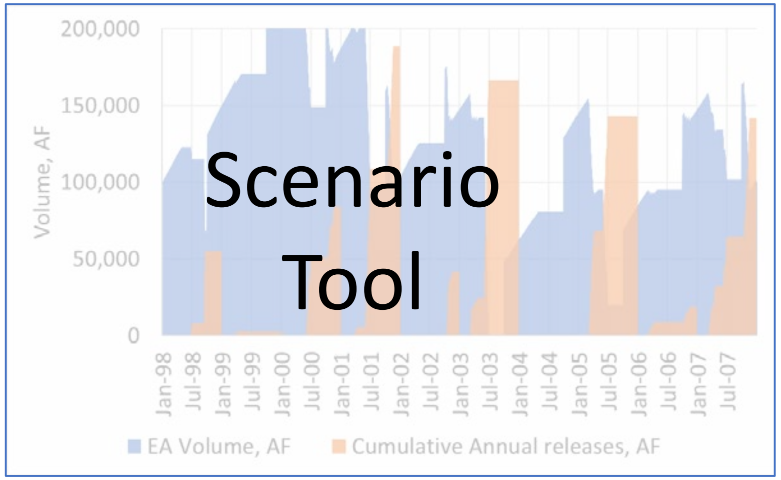


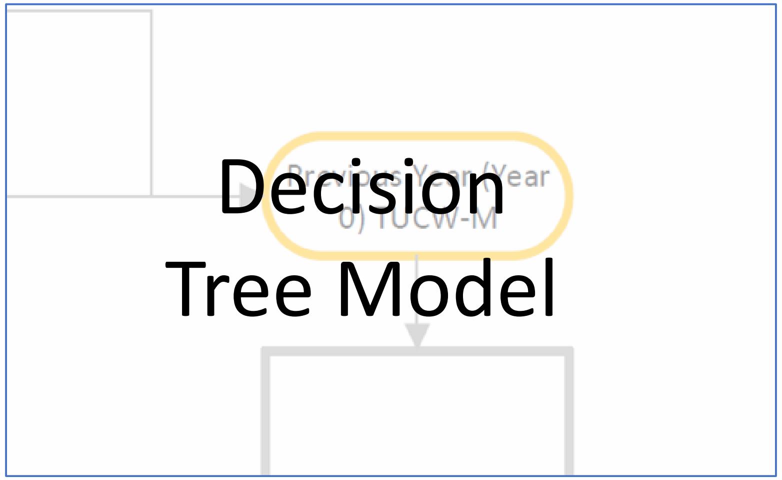


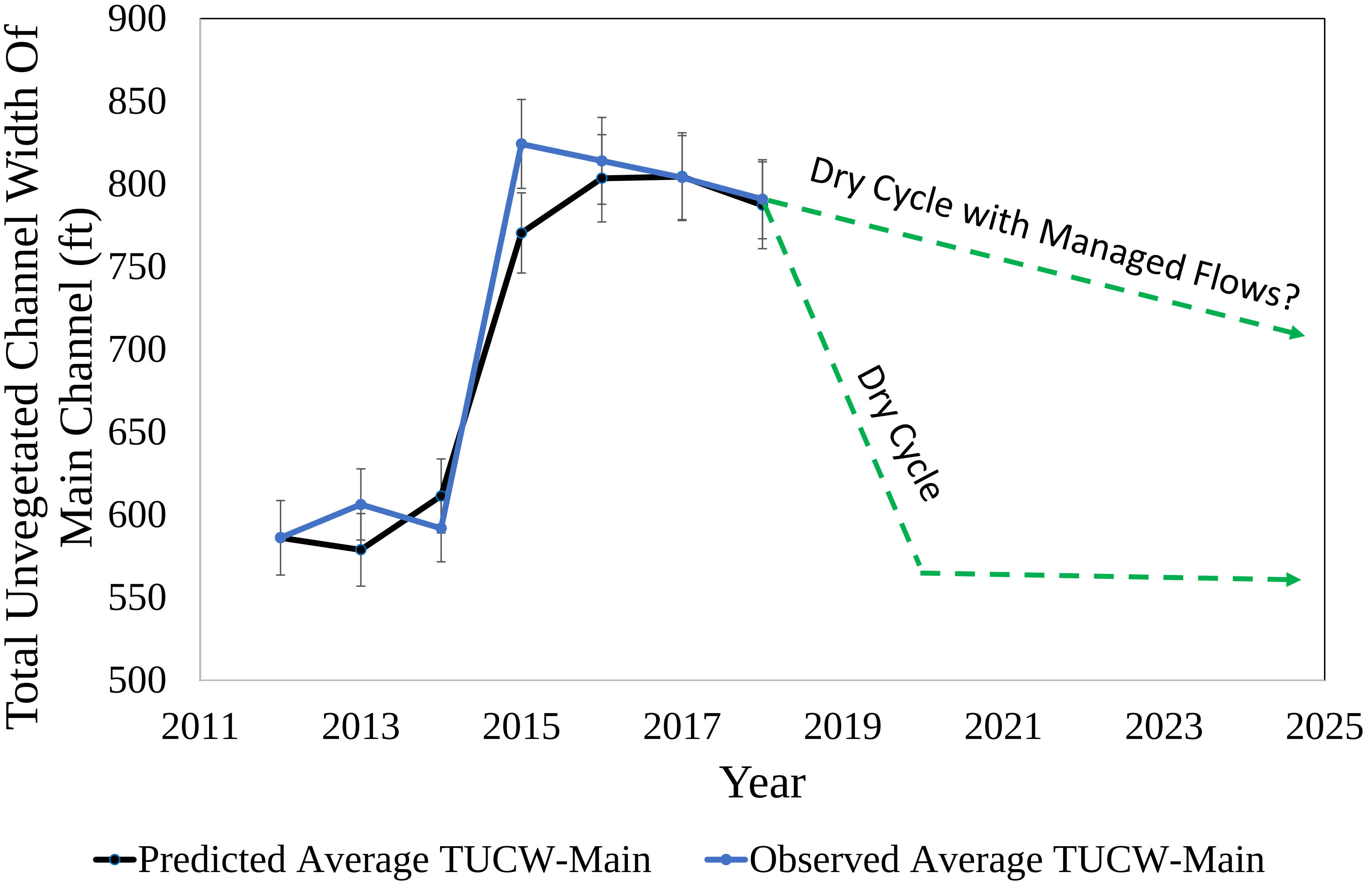


Program Example – Germination season and fall peak flows for channel width maintenance








900
850
800
750
700
650
600
550
500
Total Unvegetated Channel Width Of Main Channel (ft)
2011
2013
2015
2017
2019
2021
2023
2025
Year
Dry Cycle with Managed Flows?
Dry Cycle
Predicted Average TUCW-Main
Observed Average TUCW-Main

AMP Tools

2-D MODELING

What is 2-D hydrodynamic modeling & why use it?

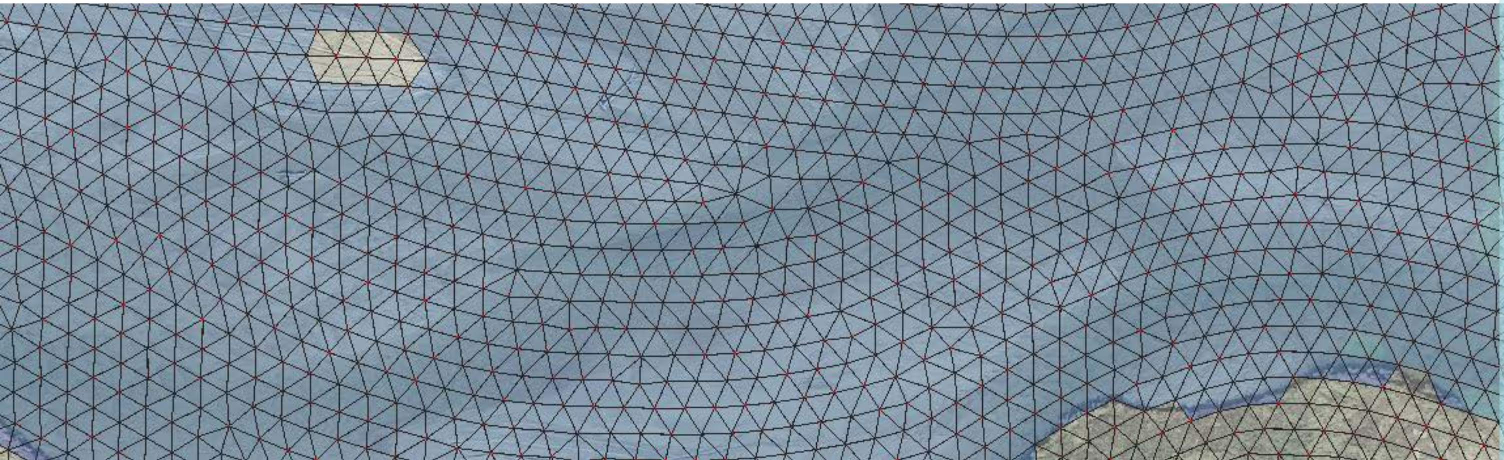
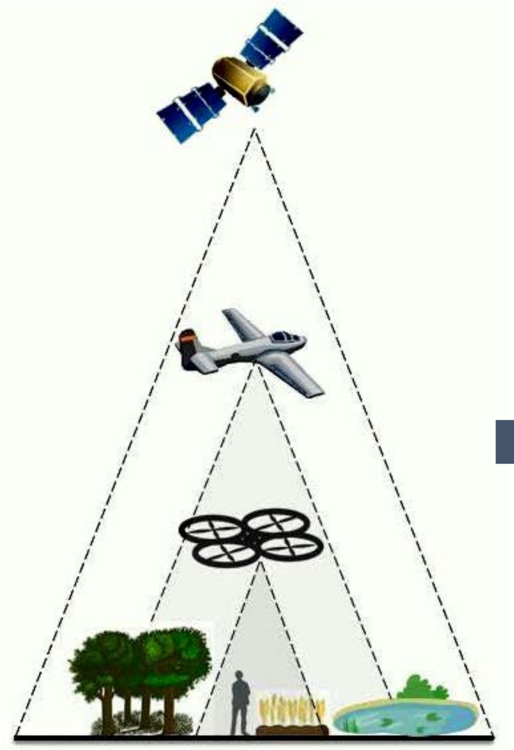


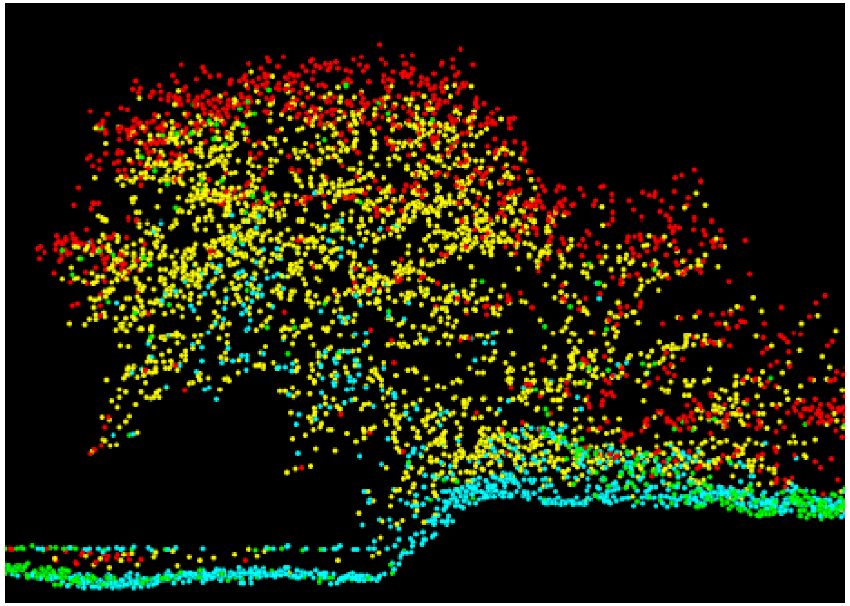
Image from gcd.riverscapes.com

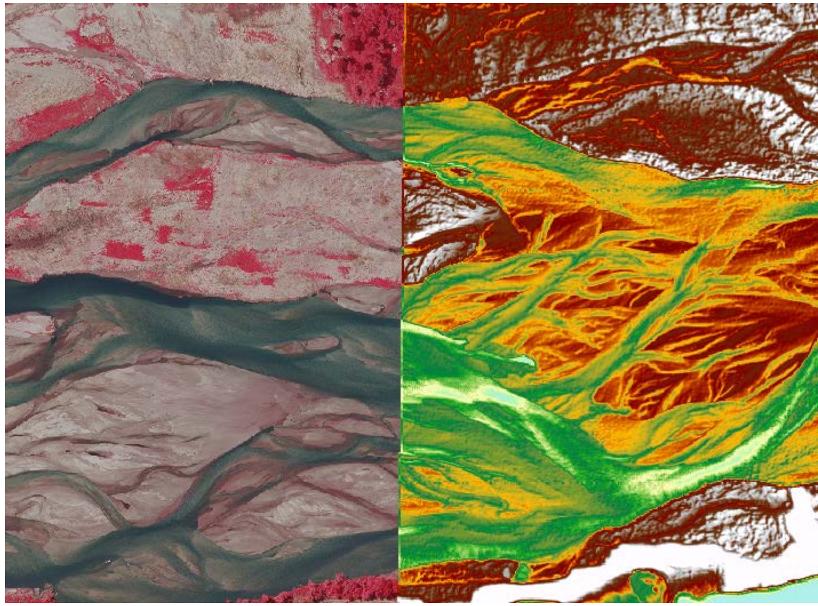
CHANNEL METRICS

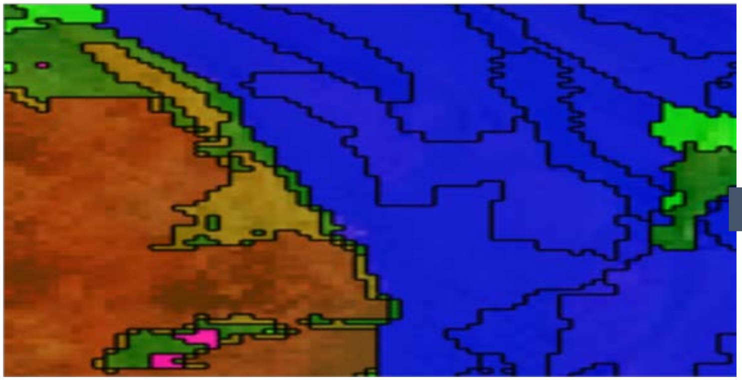
>>> Whooping Cranes

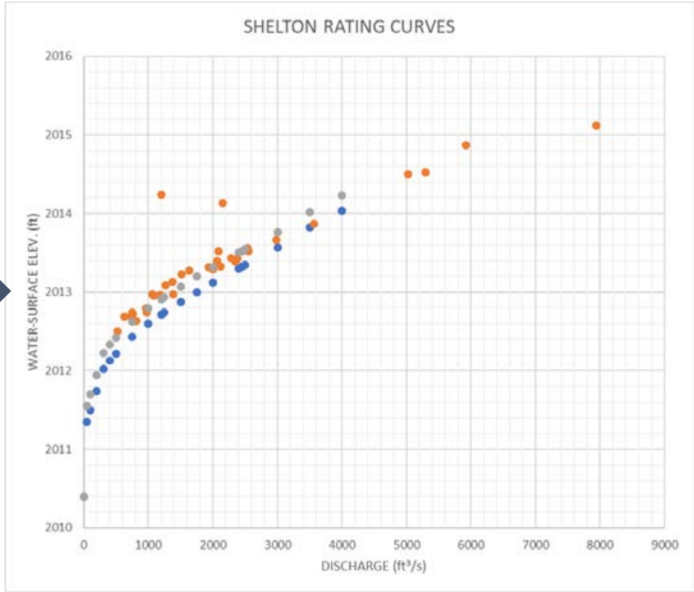
DATA REQUIREMENTS

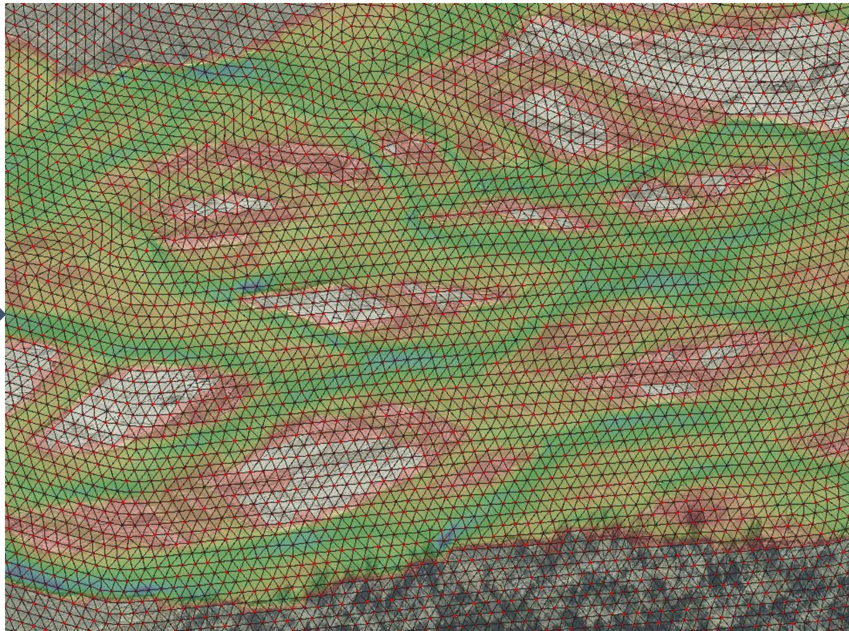




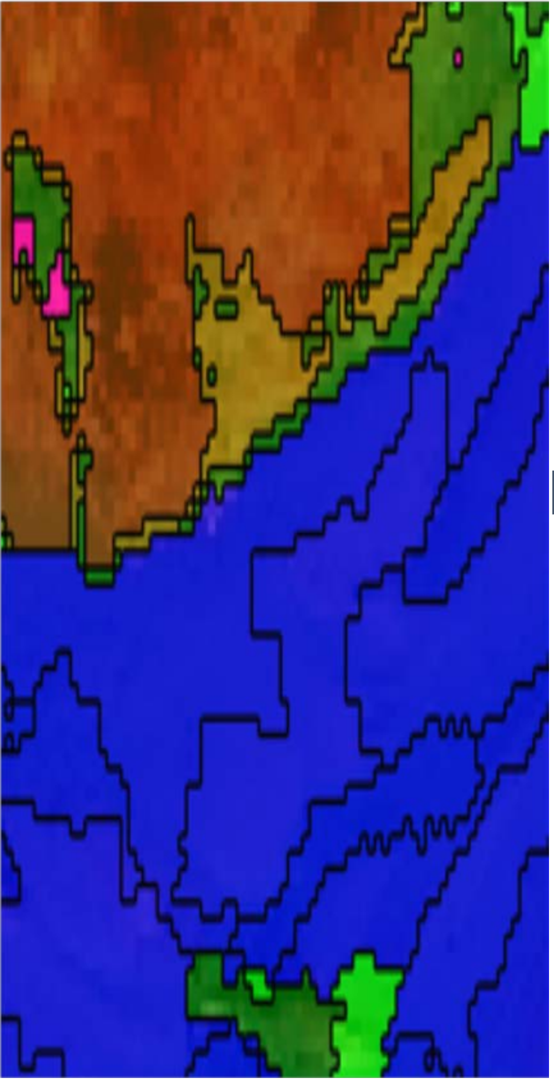


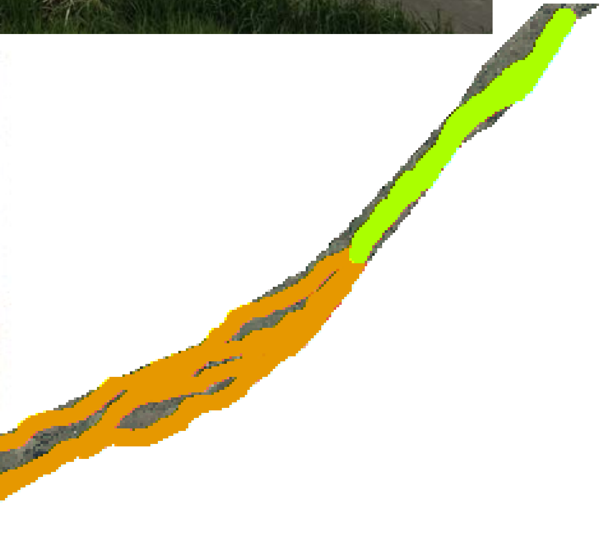






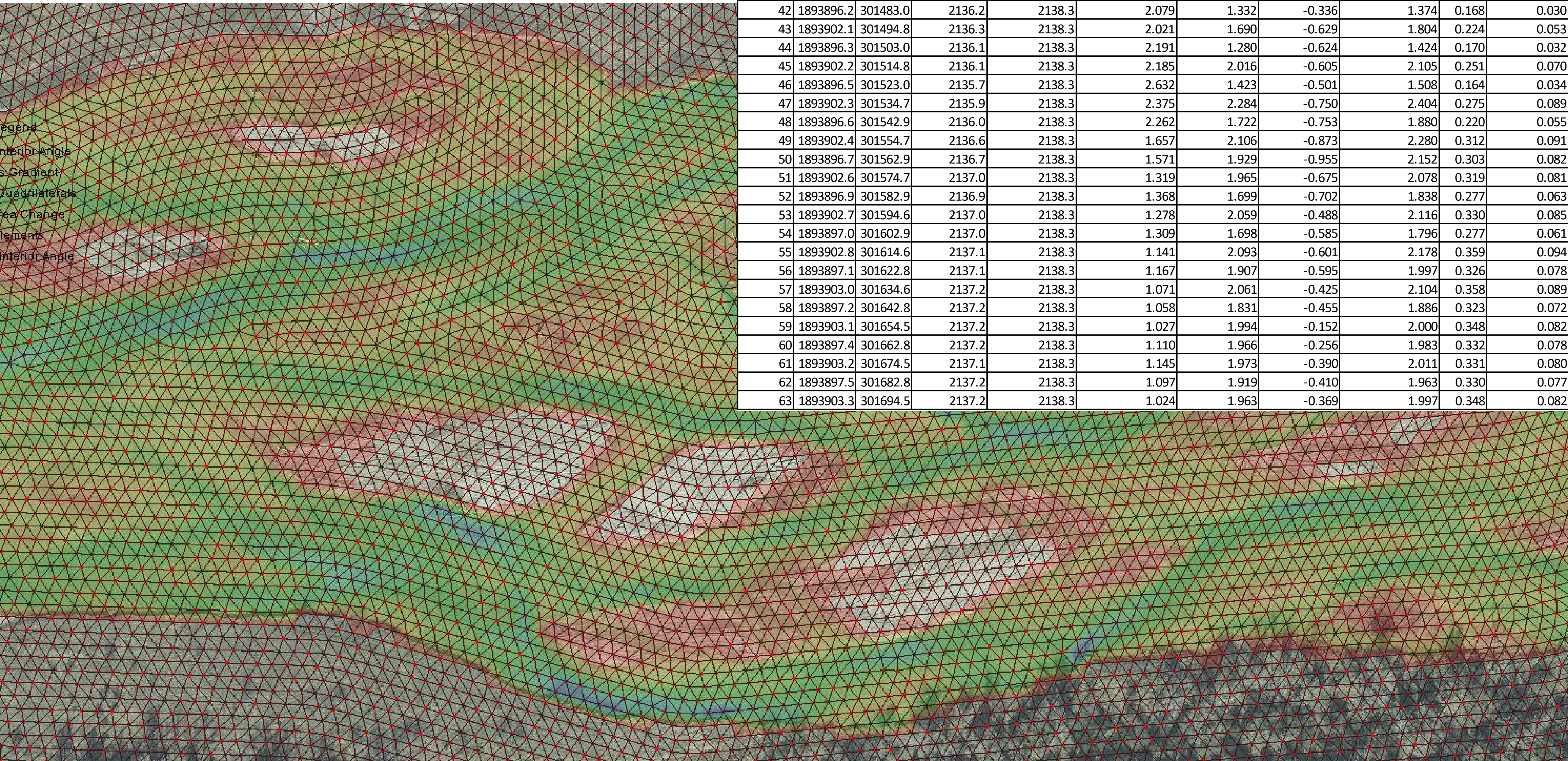
CALIBRATION & VALIDATION





ANSWERS

Point_ID	X_ft	Y_ft	Bed_Elev_ft	Water_Elev_ft	Water_Depth_ft	Vel_X_ft_p_s	Vel_Y_ft_p_s	Vel_Mag_ft_p_s	Froude	Strs_lb_p_ft2
37	1893901.7	301434.9	2138.0	2138.3	0.315	0.944	0.357	1.009	0.317	0.031
38	1893896.0	301443.0	2137.0	2138.3	1.219	0.447	0.424	0.617	0.098	0.007
39	1893901.8	301454.9	2136.5	2138.3	1.777	1.327	0.170	1.338	0.177	0.030
40	1893896.1	301463.0	2136.3	2138.3	1.997	1.244	0.055	1.245	0.155	0.025
41	1893901.9	301474.8	2136.2	2138.3	2.058	1.536	-0.262	1.558	0.191	0.039
42	1893896.2	301483.0	2136.2	2138.3	2.079	1.332	-0.336	1.374	0.168	0.030
43	1893902.1	301494.8	2136.3	2138.3	2.021	1.690	-0.629	1.804	0.224	0.053
44	1893896.3	301503.0	2136.1	2138.3	2.191	1.280	-0.624	1.424	0.170	0.032
45	1893902.2	301514.8	2136.1	2138.3	2.185	2.016	-0.605	2.105	0.251	0.070
46	1893896.5	301523.0	2135.7	2138.3	2.632	1.423	-0.501	1.508	0.164	0.034
47	1893902.3	301534.7	2135.9	2138.3	2.375	2.284	-0.750	2.404	0.275	0.089
48	1893896.6	301542.9	2136.0	2138.3	2.262	1.722	-0.753	1.880	0.220	0.055
49	1893902.4	301554.7	2136.6	2138.3	1.657	2.106	-0.873	2.280	0.312	0.091
50	1893896.7	301562.9	2136.7	2138.3	1.571	1.929	-0.955	2.152	0.303	0.082
51	1893902.6	301574.7	2137.0	2138.3	1.319	1.965	-0.675	2.078	0.319	0.081
52	1893896.9	301582.9	2136.9	2138.3	1.368	1.699	-0.702	1.838	0.277	0.063
53	1893902.7	301594.6	2137.0	2138.3	1.278	2.059	-0.488	2.116	0.330	0.085
54	1893897.0	301602.9	2137.0	2138.3	1.309	1.698	-0.585	1.796	0.277	0.061
55	1893902.8	301614.6	2137.1	2138.3	1.141	2.093	-0.601	2.178	0.359	0.094
56	1893897.1	301622.8	2137.1	2138.3	1.167	1.907	-0.595	1.997	0.326	0.078
57	1893903.0	301634.6	2137.2	2138.3	1.071	2.061	-0.425	2.104	0.358	0.089
58	1893897.2	301642.8	2137.2	2138.3	1.058	1.831	-0.455	1.886	0.323	0.072
59	1893903.1	301654.5	2137.2	2138.3	1.027	1.994	-0.152	2.000	0.348	0.082
60	1893897.4	301662.8	2137.2	2138.3	1.110	1.966	-0.256	1.983	0.332	0.078
61	1893903.2	301674.5	2137.1	2138.3	1.145	1.973	-0.390	2.011	0.331	0.080
62	1893897.5	301682.8	2137.2	2138.3	1.097	1.919	-0.410	1.963	0.330	0.077
63	1893903.3	301694.5	2137.2	2138.3	1.024	1.963	-0.369	1.997	0.348	0.082



Limitations & Performance

- 20 ft spacing
- single n-value
- in-channel flow
- takes time
- fall topography

- single calibration
- limited validation
- steady state
- 100 – 5,000 ft^3/s

- < 0.10 ft main channel
- < 0.17 ft side channels
- flow split predictions
- data heavy
- predictions are static

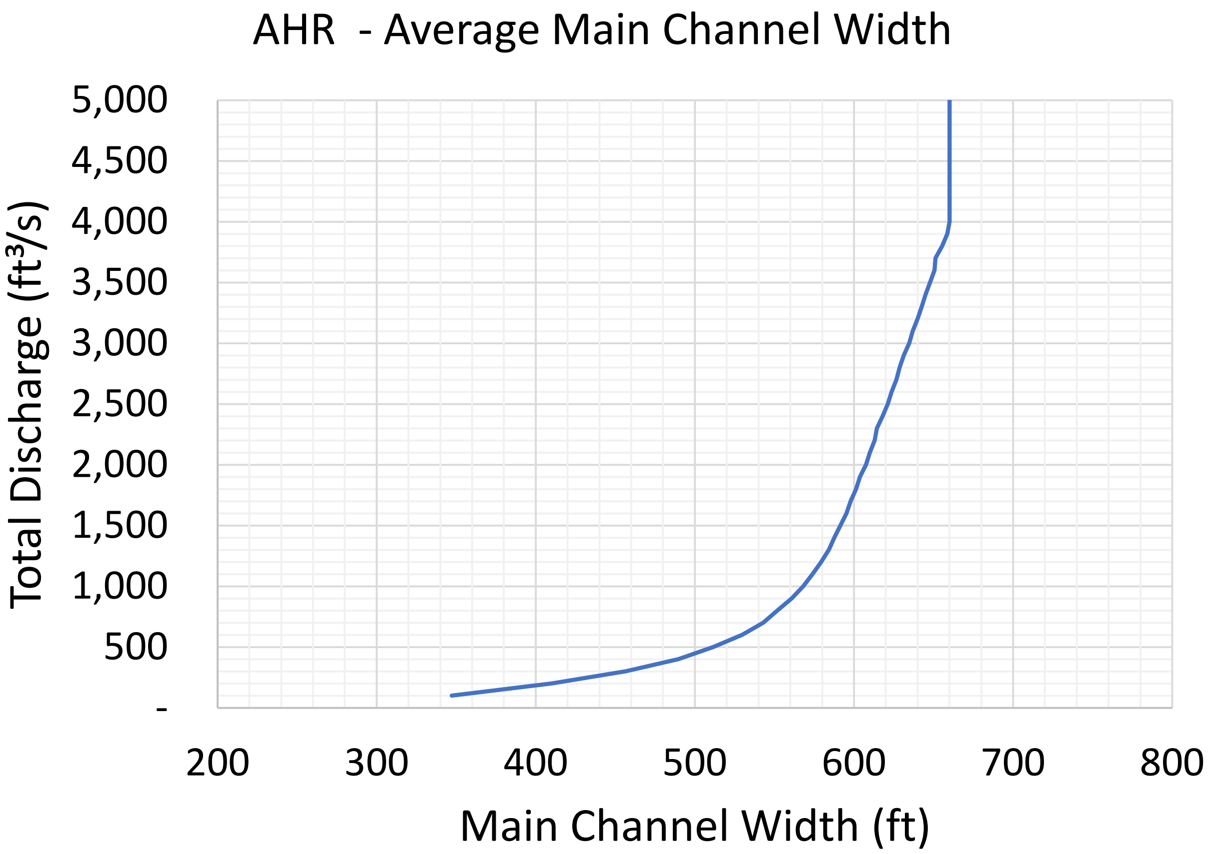
SPECIFIC APPLICATION

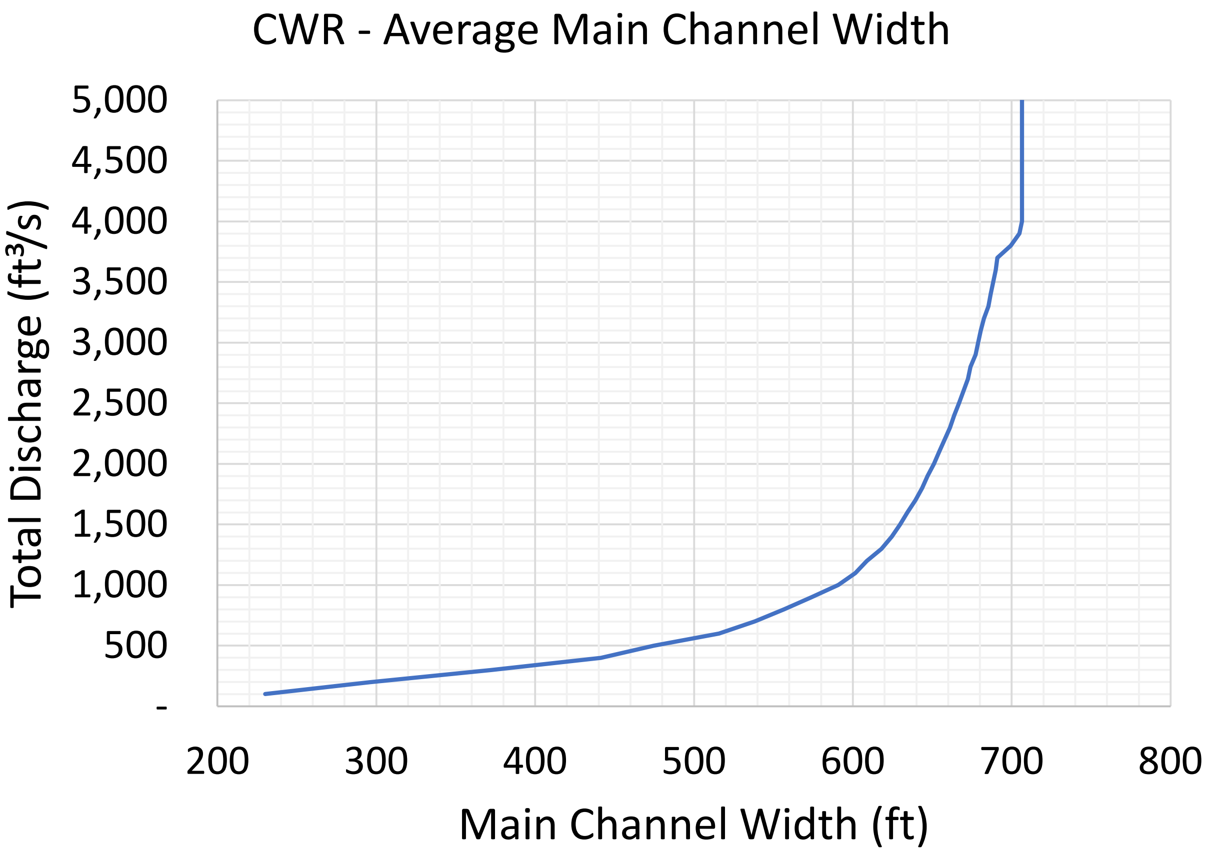
How can a 2-D model assist PRRIP with assessment channel conditions?

- ≥ 650 ft maximum unobstructed channel width
- ≤ 0.7 ft channel depth
- > 2.6 ft overtopping depth

PRELIMINARY RESULTS

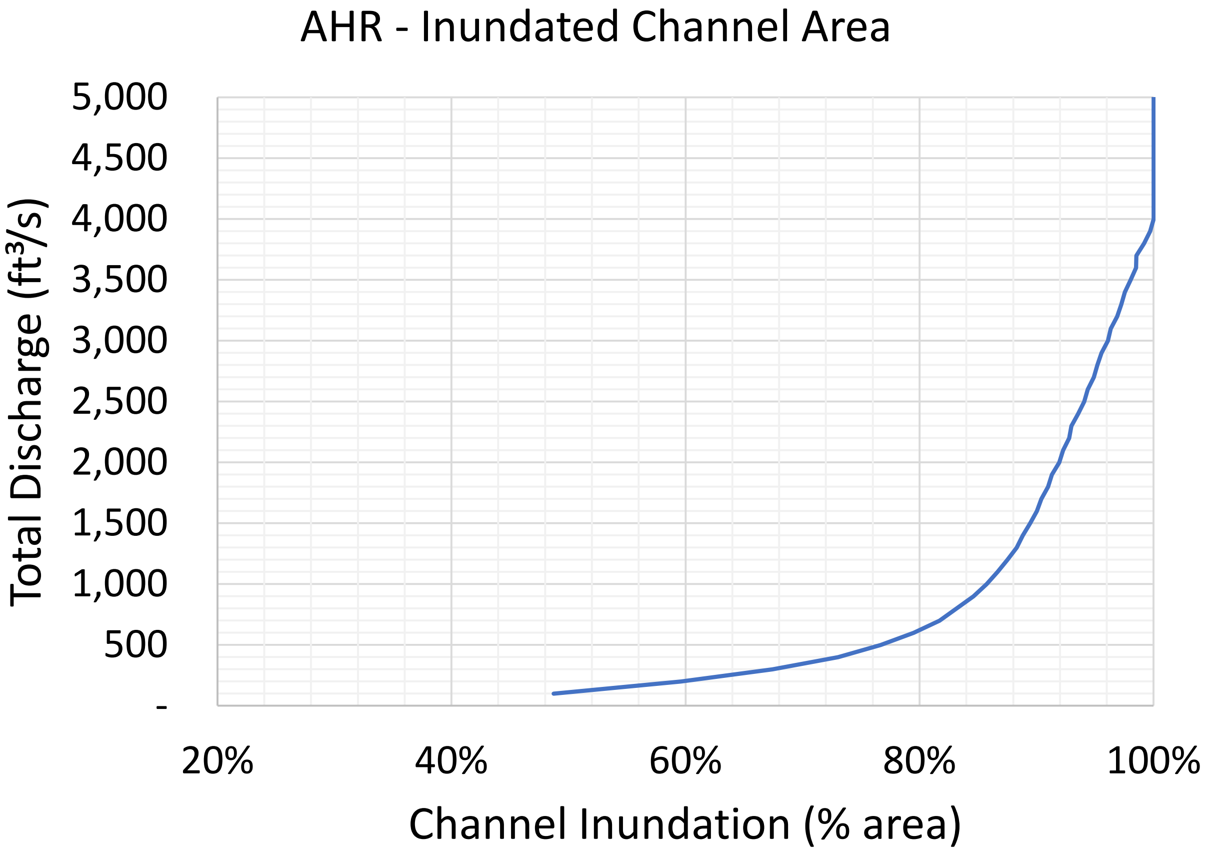
CHANNEL WIDTH (REACH AVERAGE)

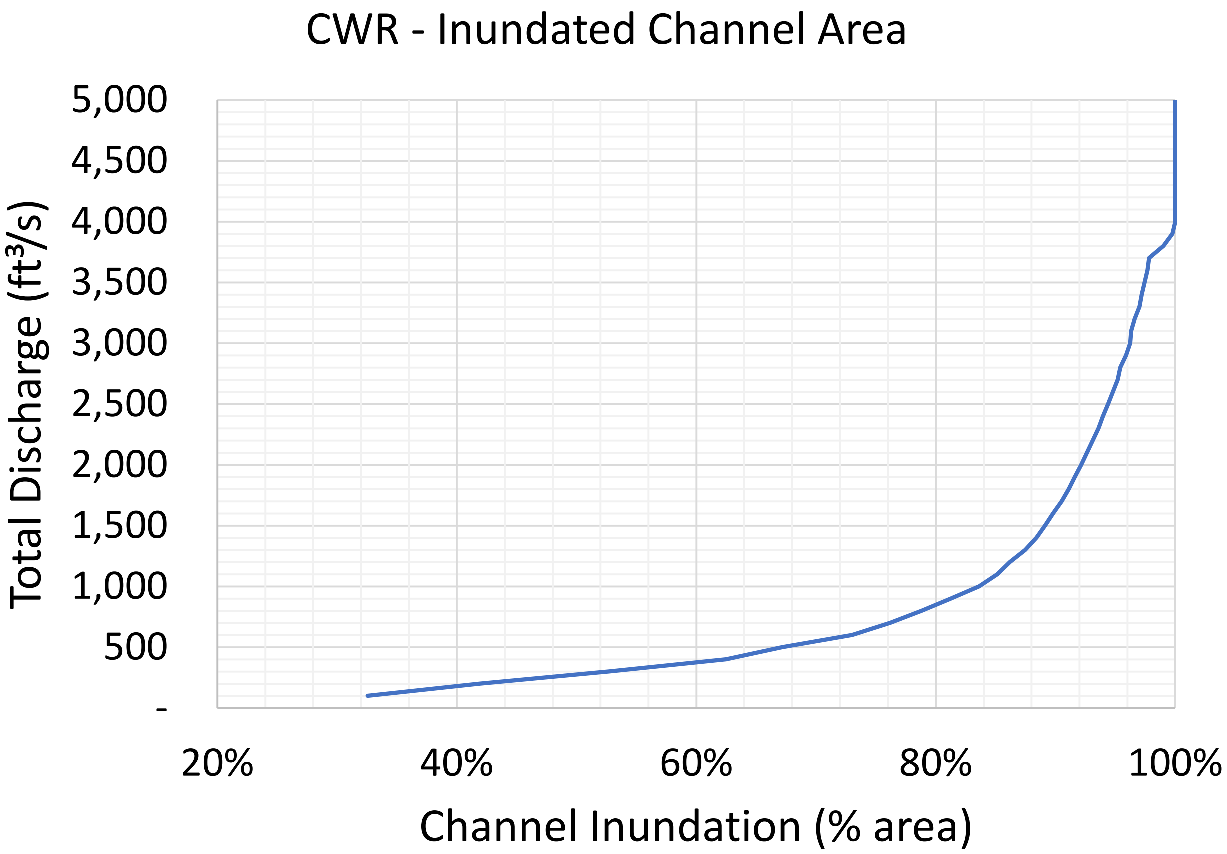




PRELIMINARY RESULTS

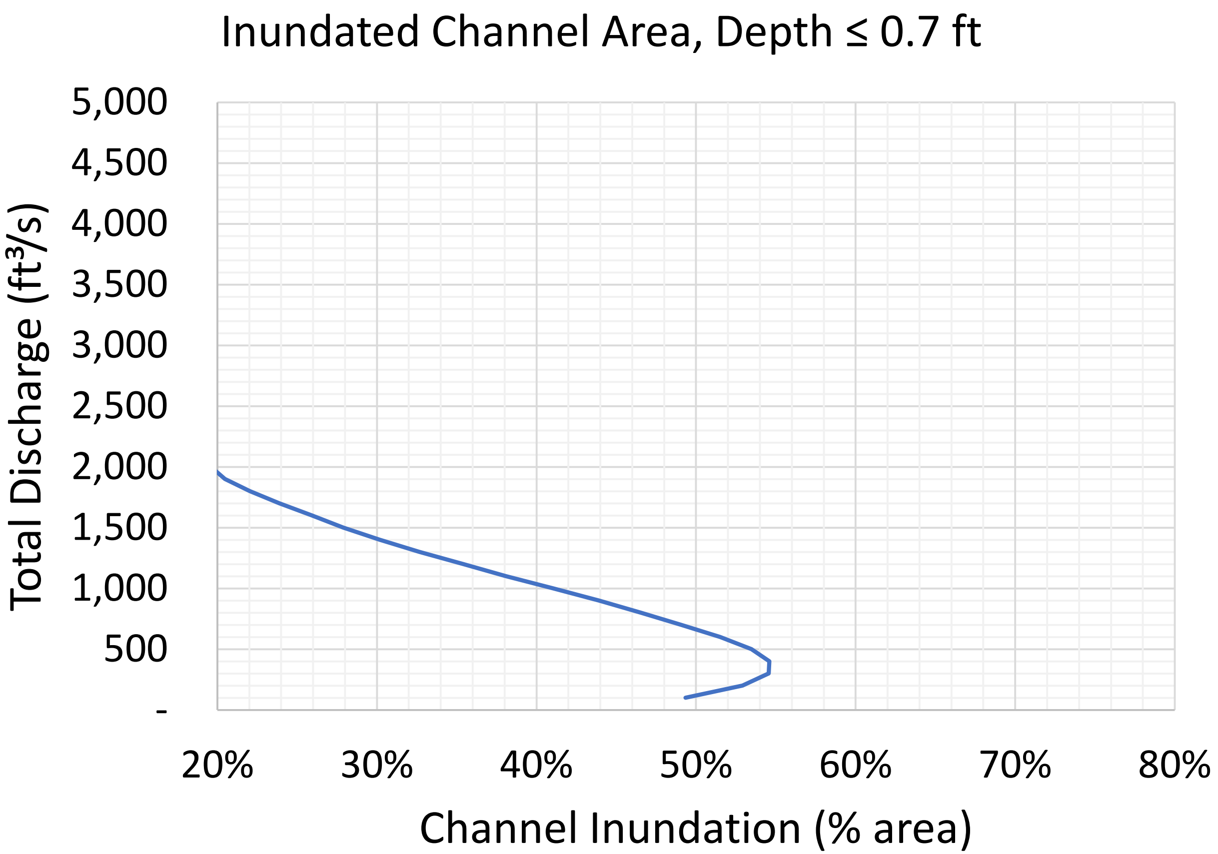
INUNDATED CHANNEL AREA

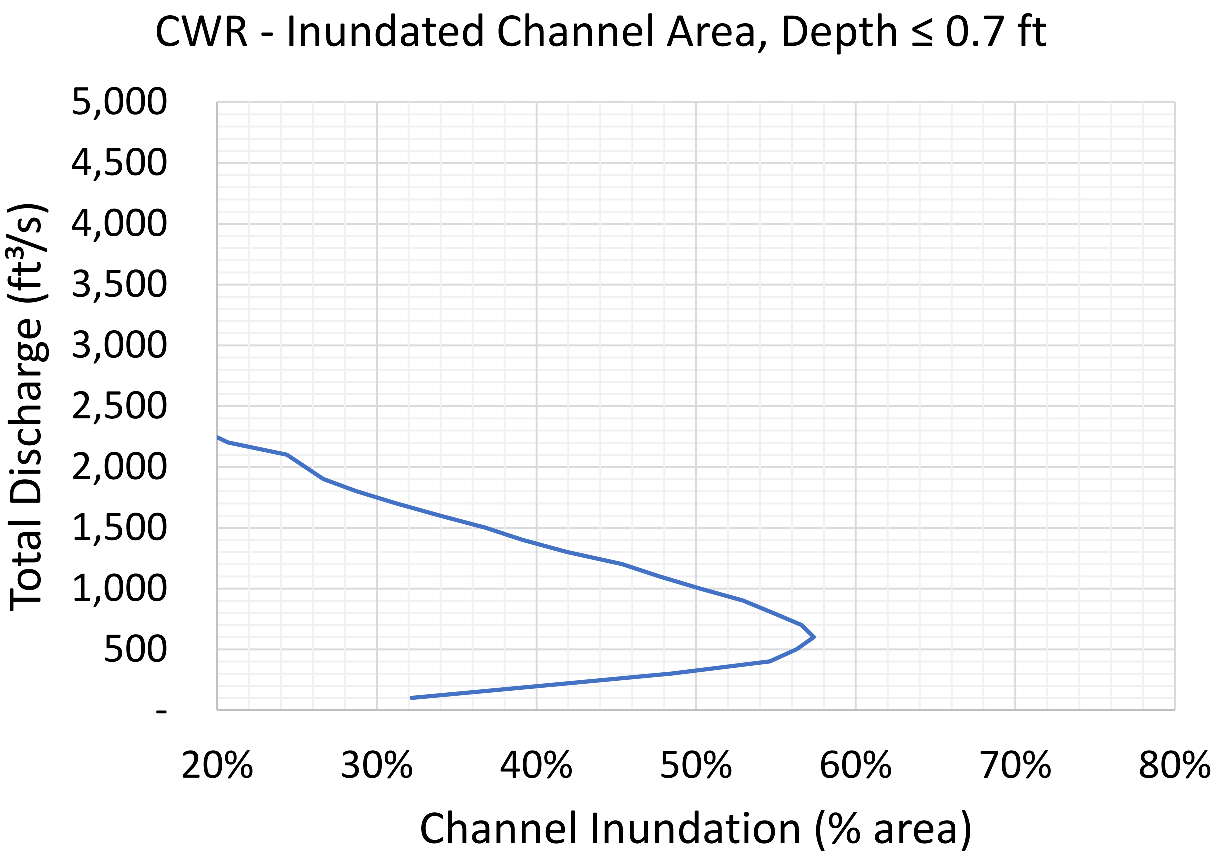




PRELIMINARY RESULTS

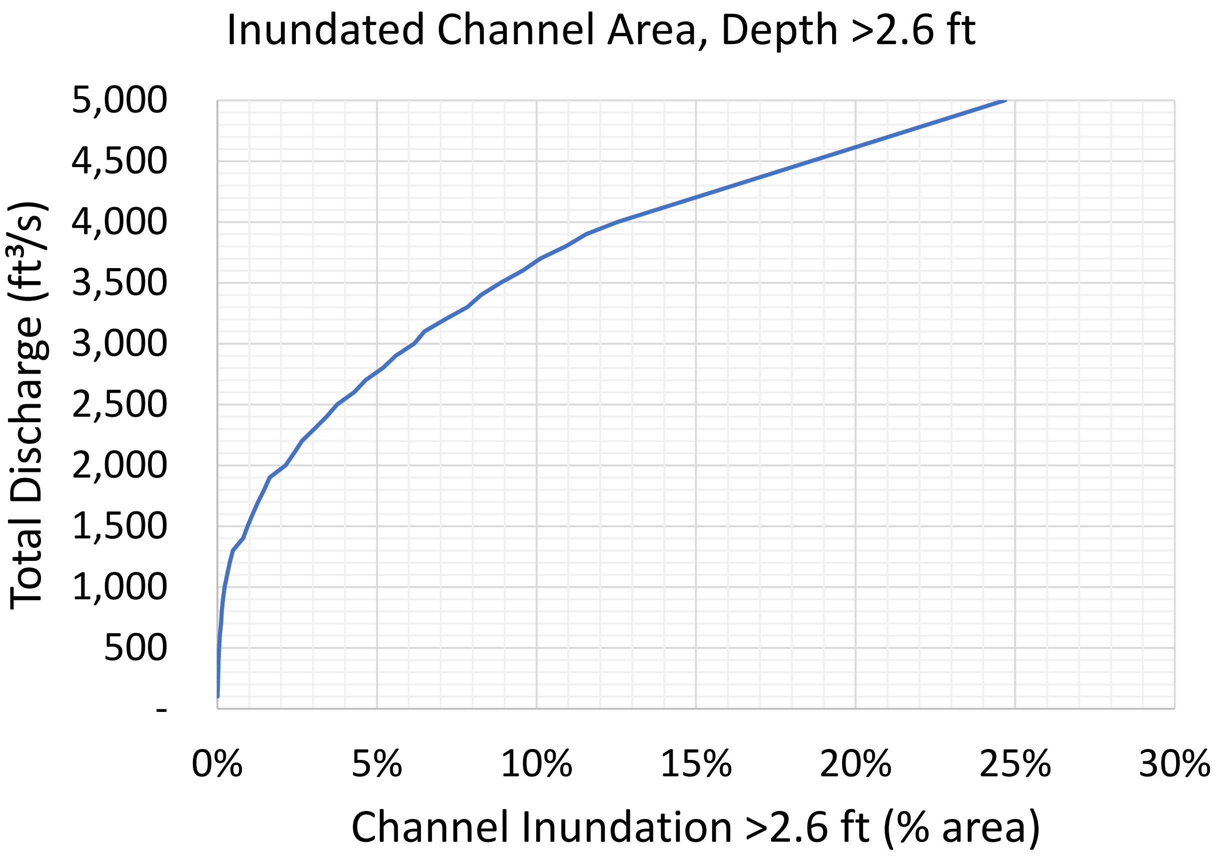
INUNDATED CHANNEL AREA ≤ 0.7 FT DEEP

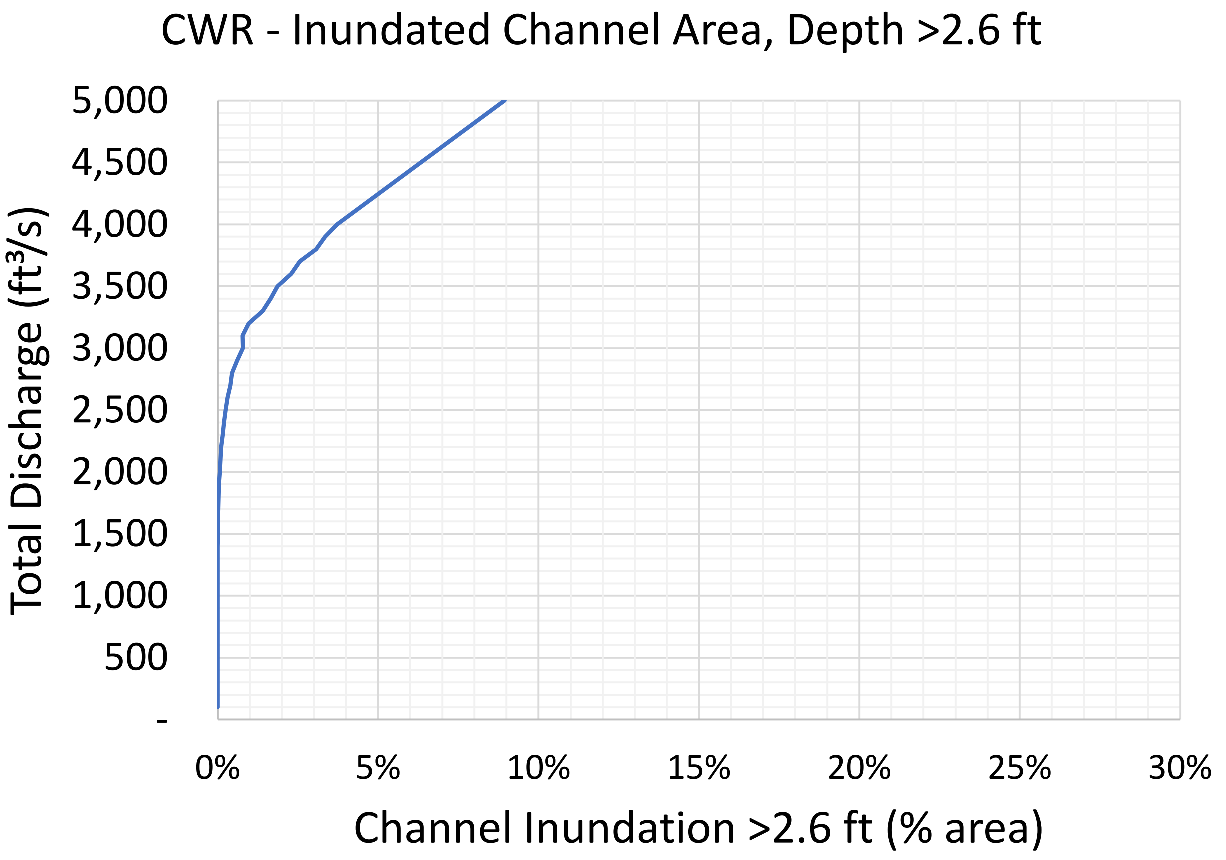




PRELIMINARY RESULTS

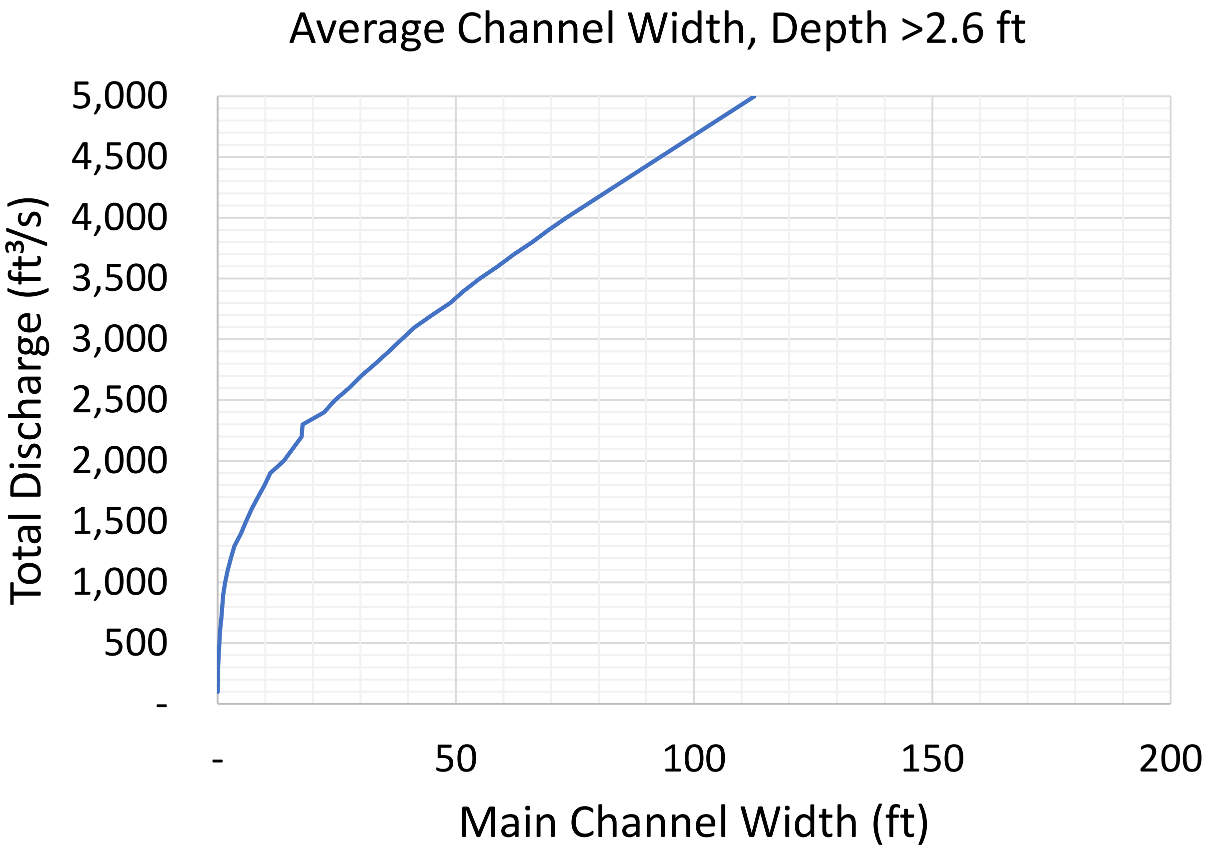
INUNDATED CHANNEL AREA >2.6 FT DEEP

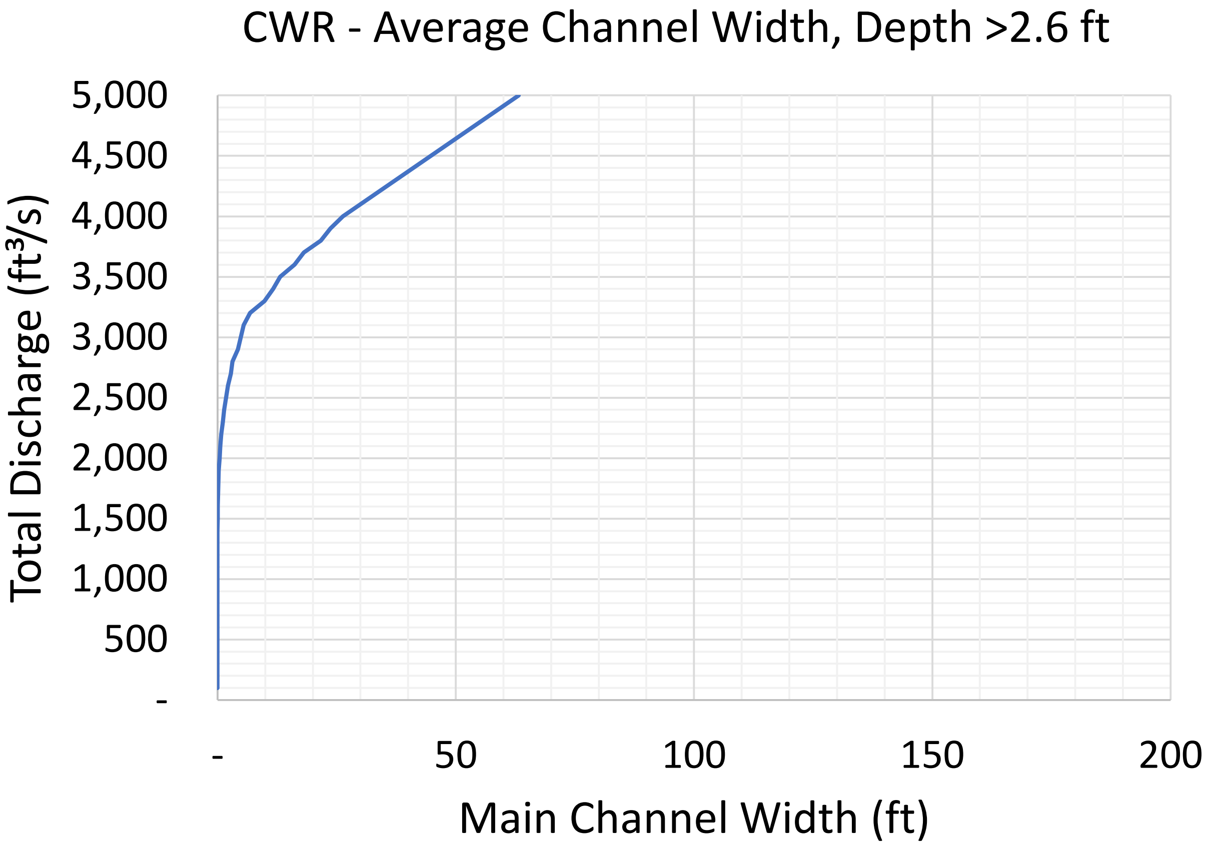




PRELIMINARY RESULTS

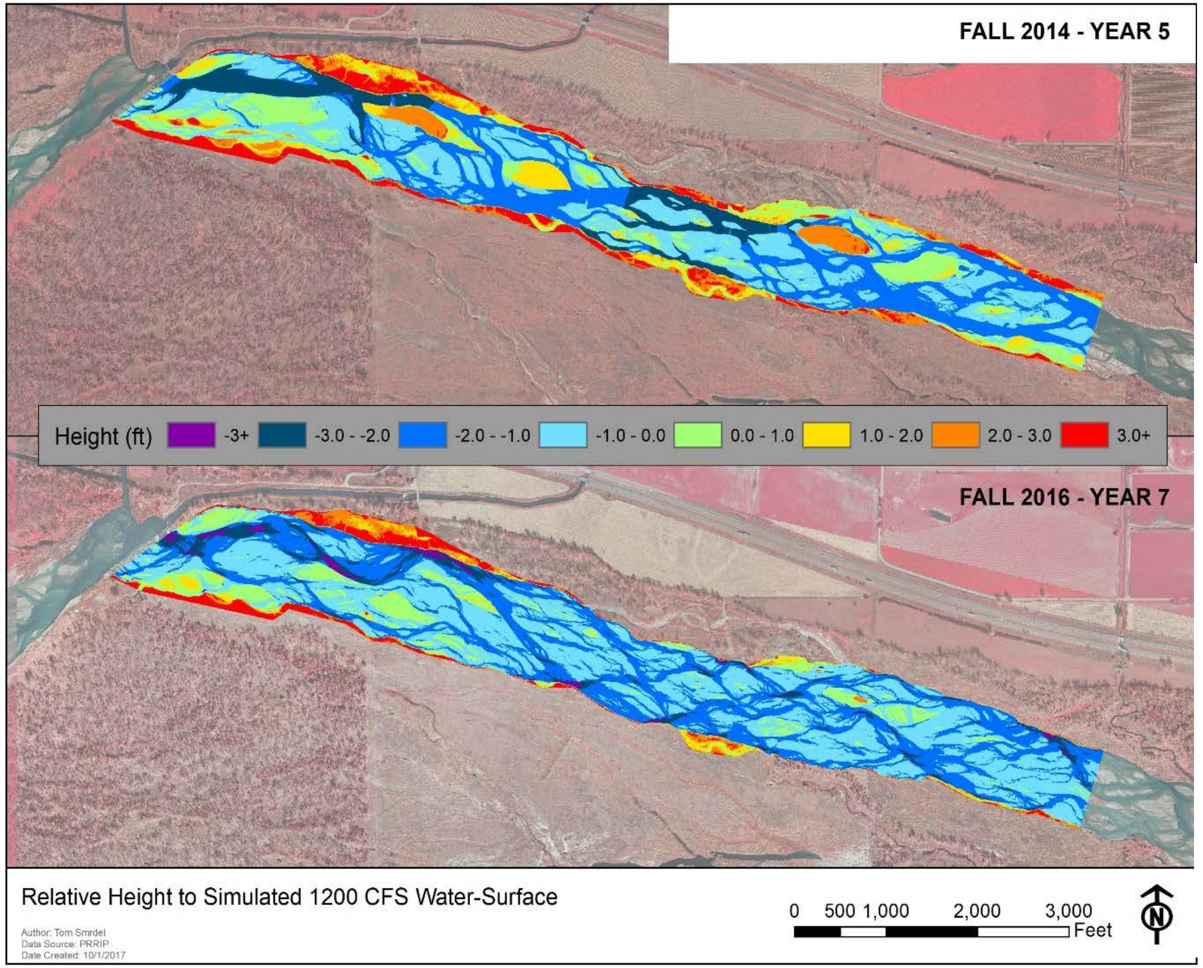
REACH AVERAGE CHANNEL WIDTH >2.6 FT DEEP

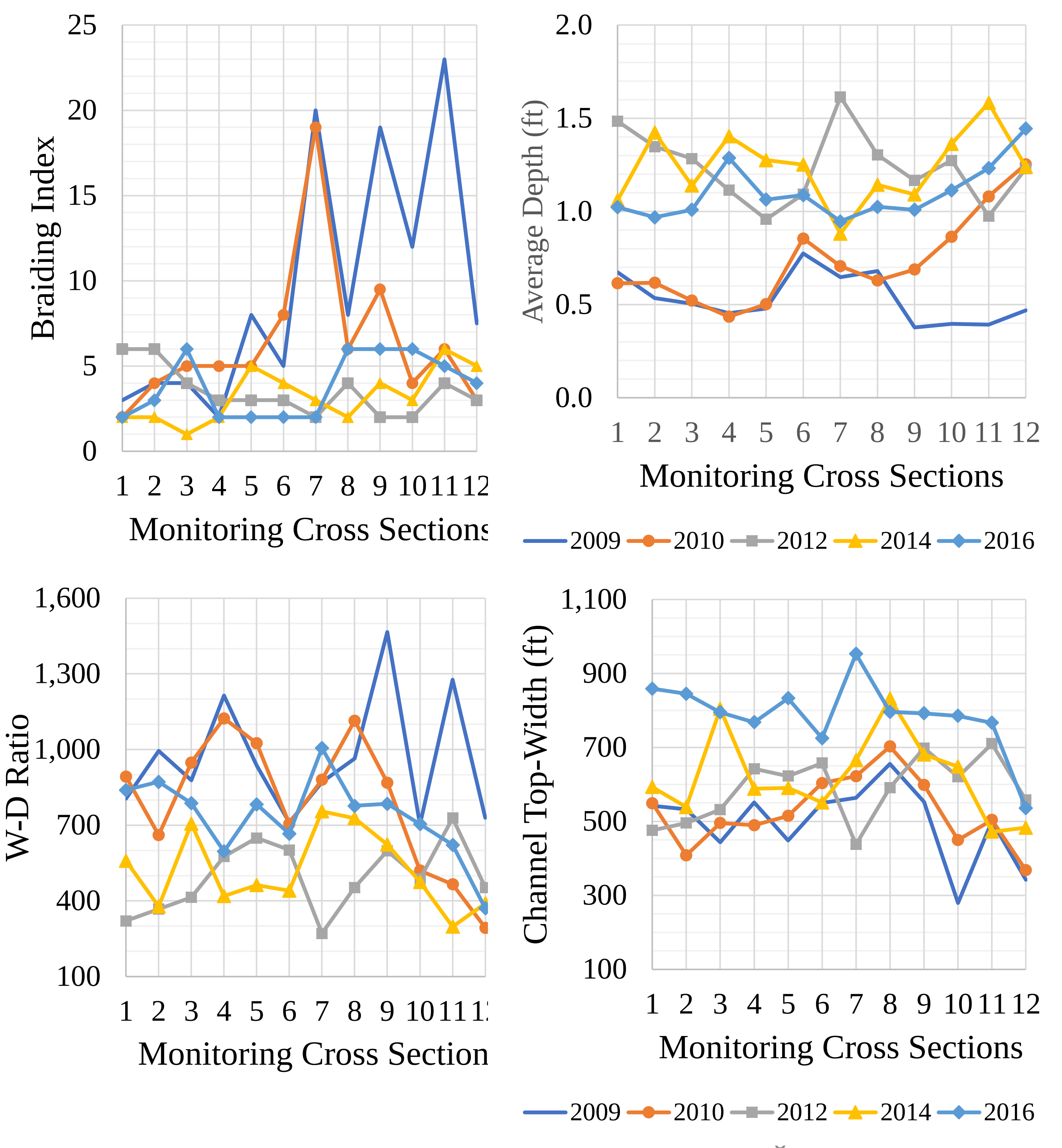




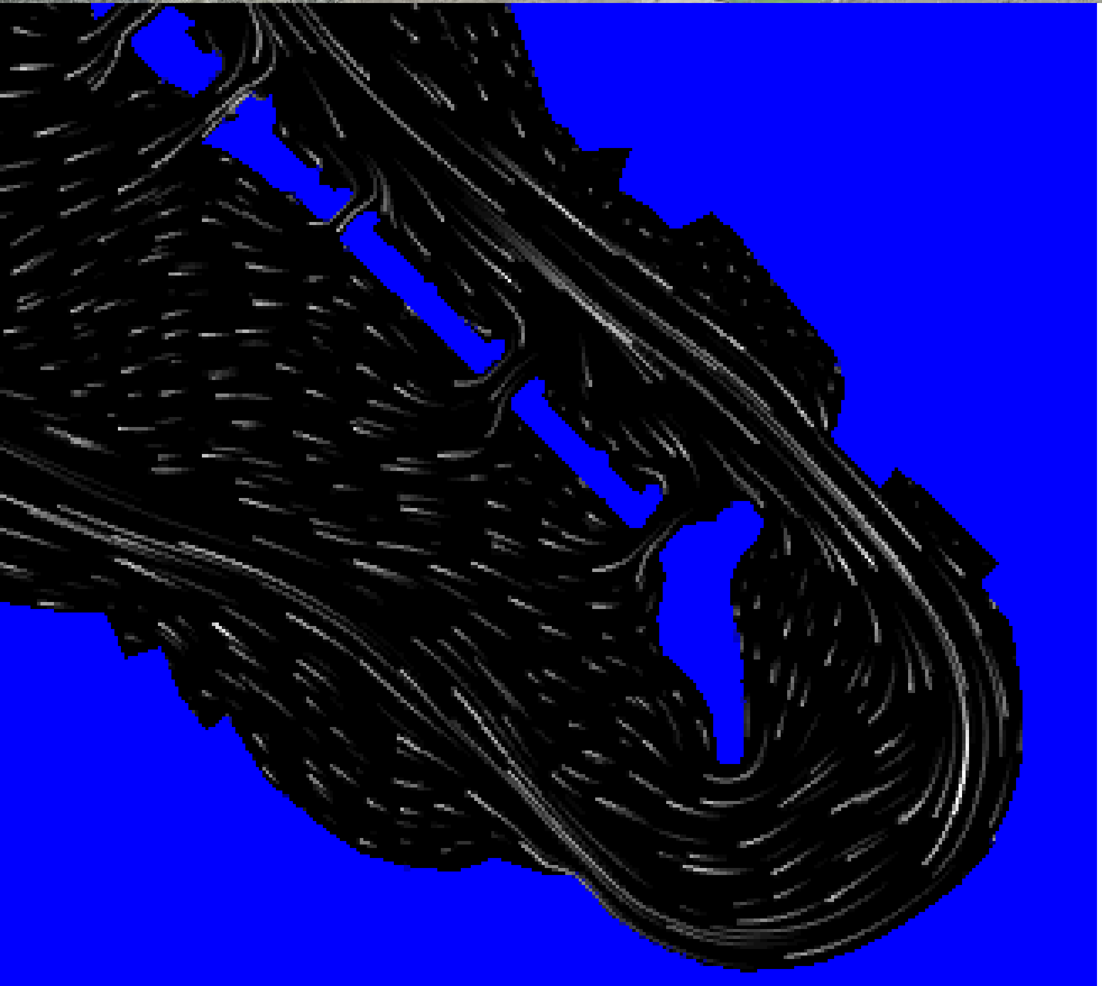
OTHER APPLICATIONS

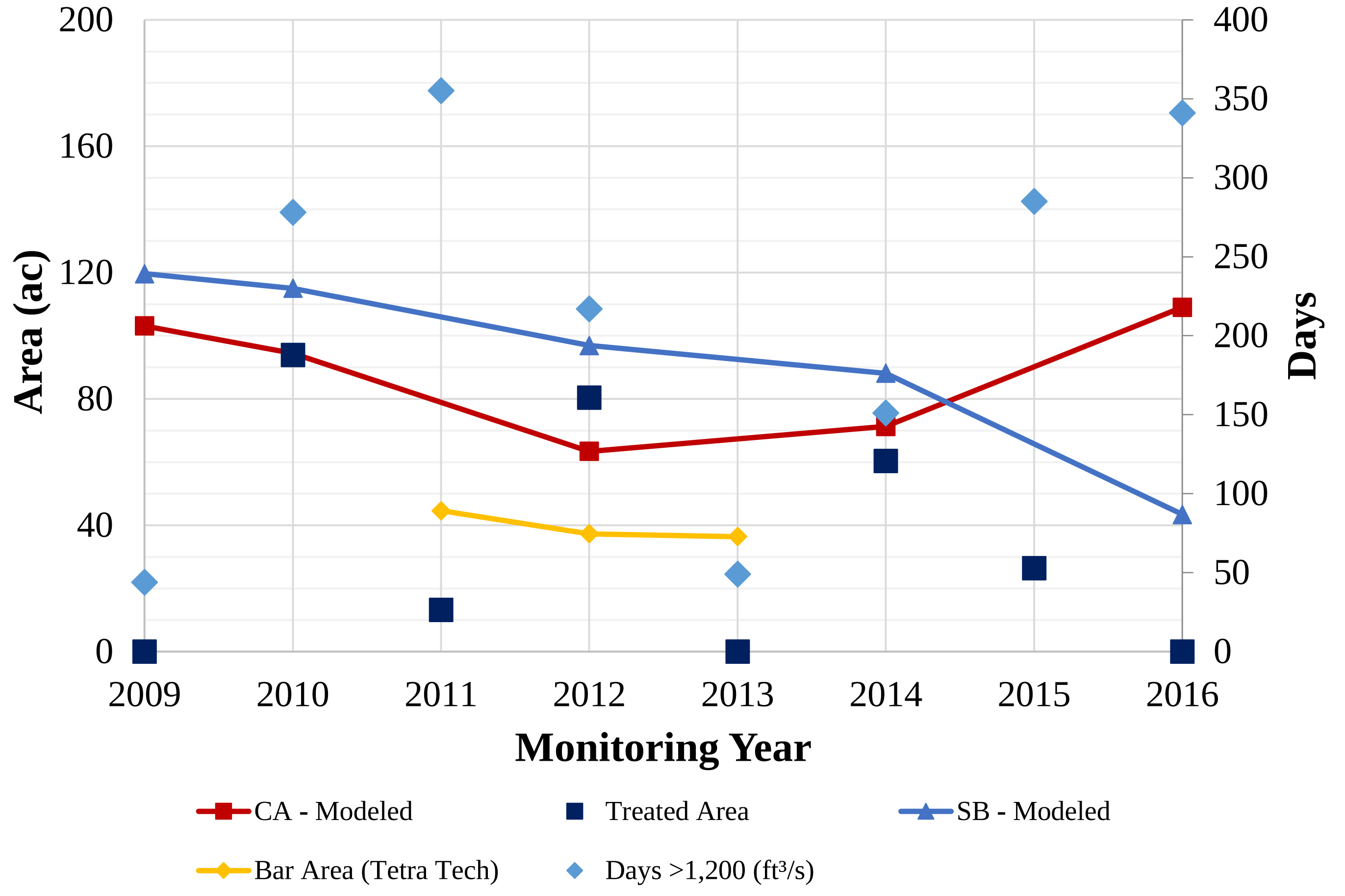
ELM CREEK





OTHER APPLICATIONS





OTHER APPLICATIONS

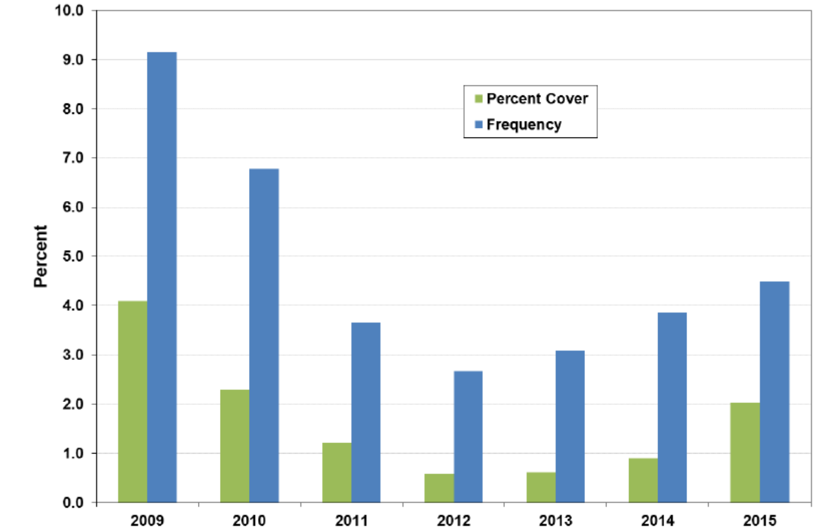
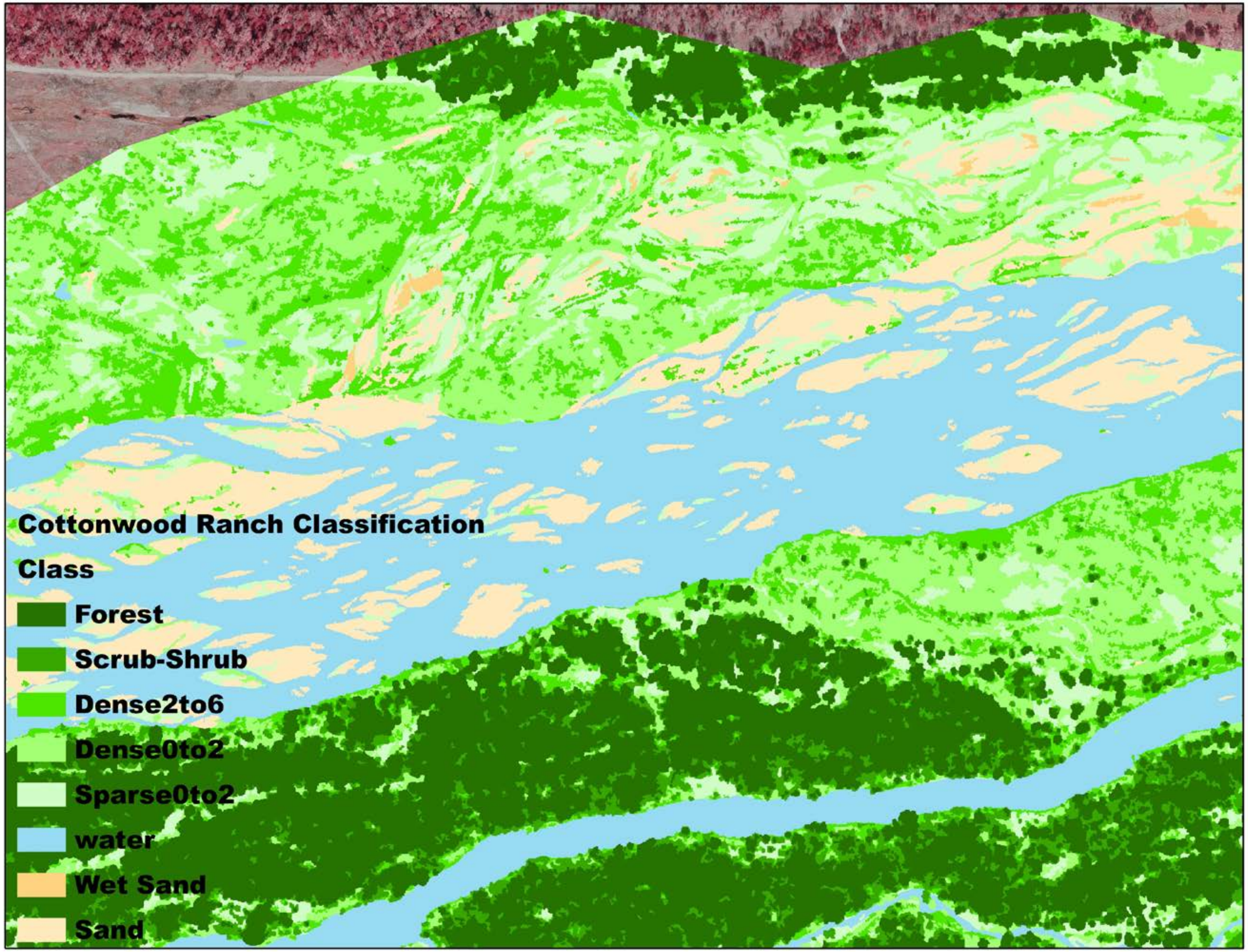
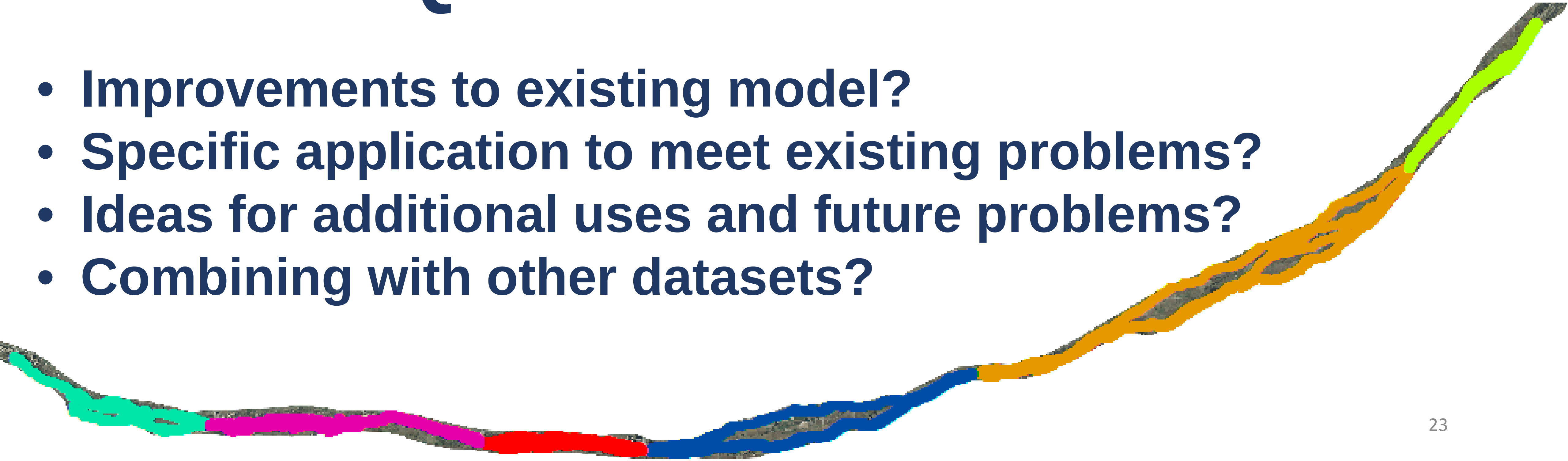


Figure 4.27. Average frequency of occurrence and percent cover for common reed (*Phragmites australis*) on a reach averaged basis observed during each of the six monitoring surveys.



QUESTIONS?

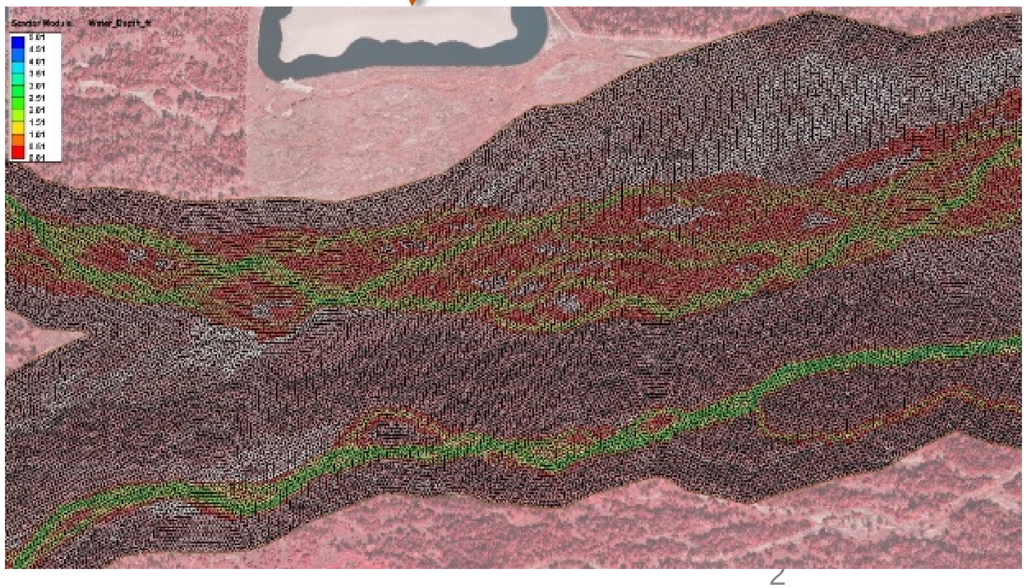
- **Improvements to existing model?**
- **Specific application to meet existing problems?**
- **Ideas for additional uses and future problems?**
- **Combining with other datasets?**



AMP Tools

Flow Scenario Tool
&
Operations Model

Release Feasibility Tools



Question to think about:

Level of complexity

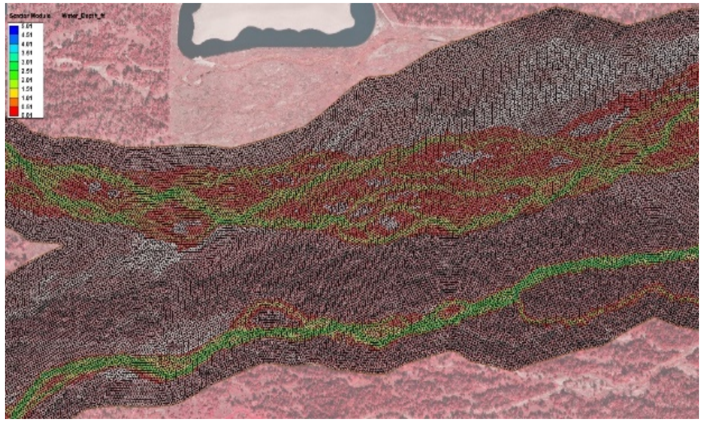
Underlying hydrology

Scenarios

Losses

Why a Scenario Tool?

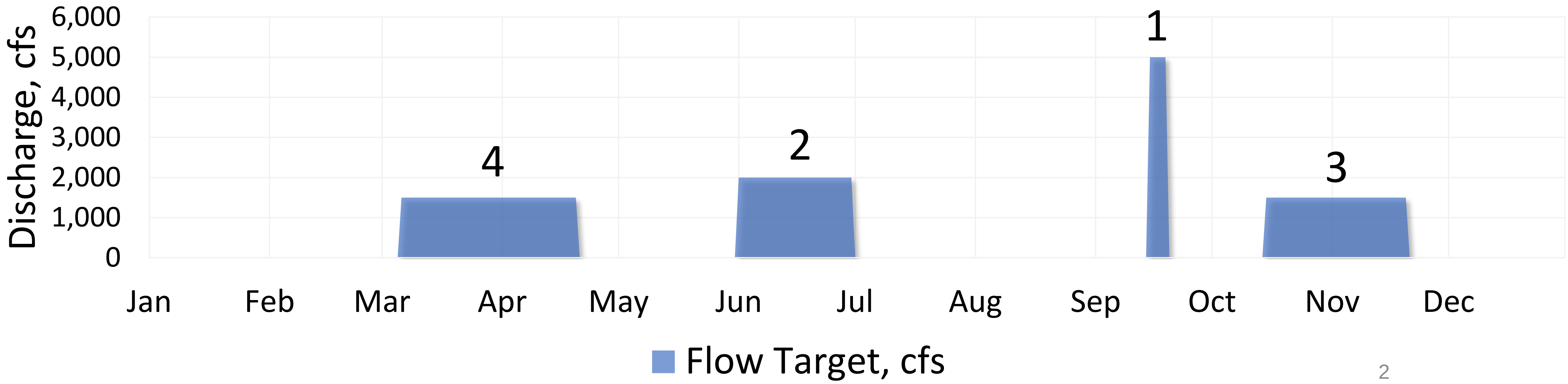
- Quantify EA water needed for a release
- Evaluate feasibility of a combination of releases

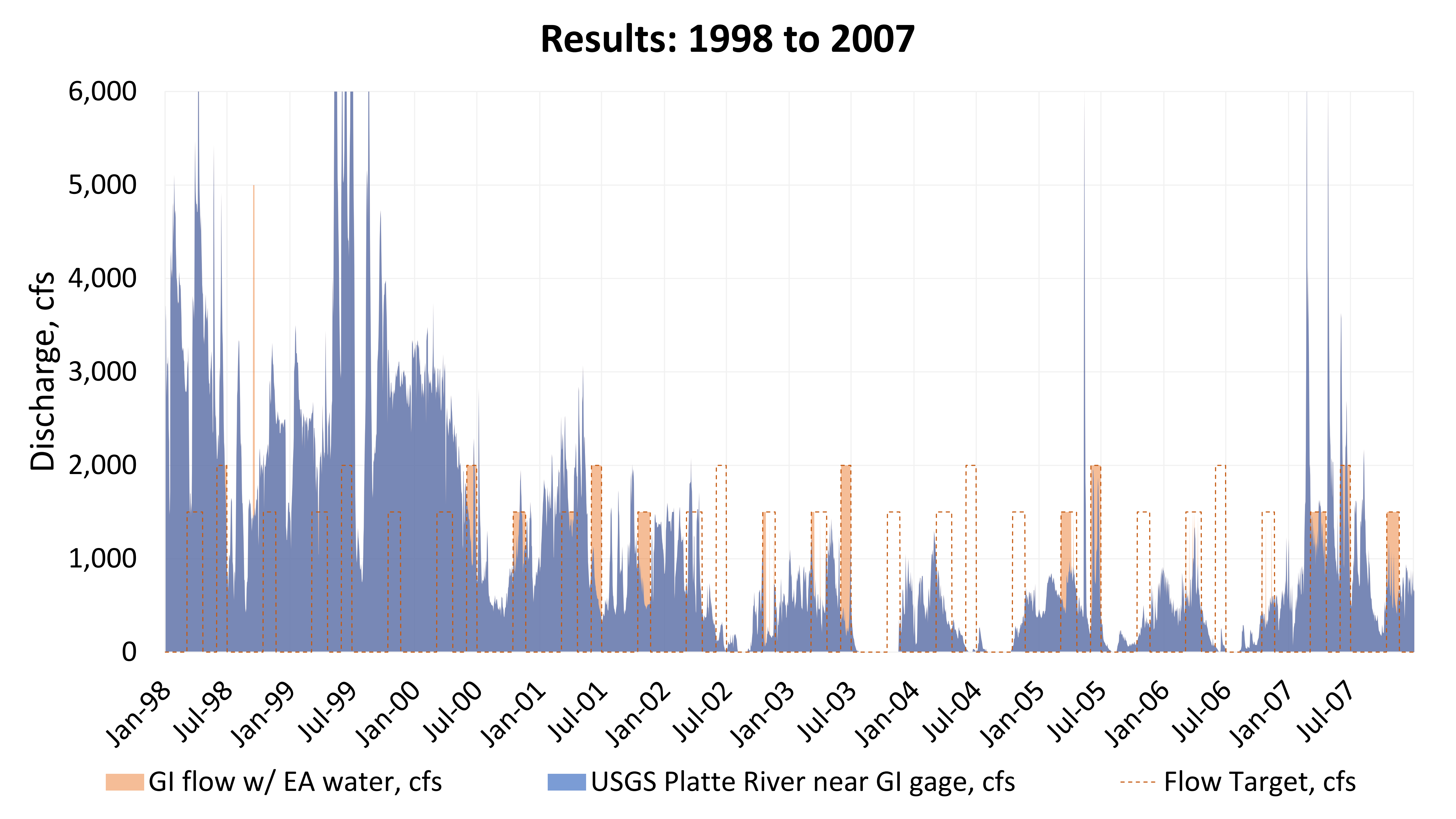


How does it work?

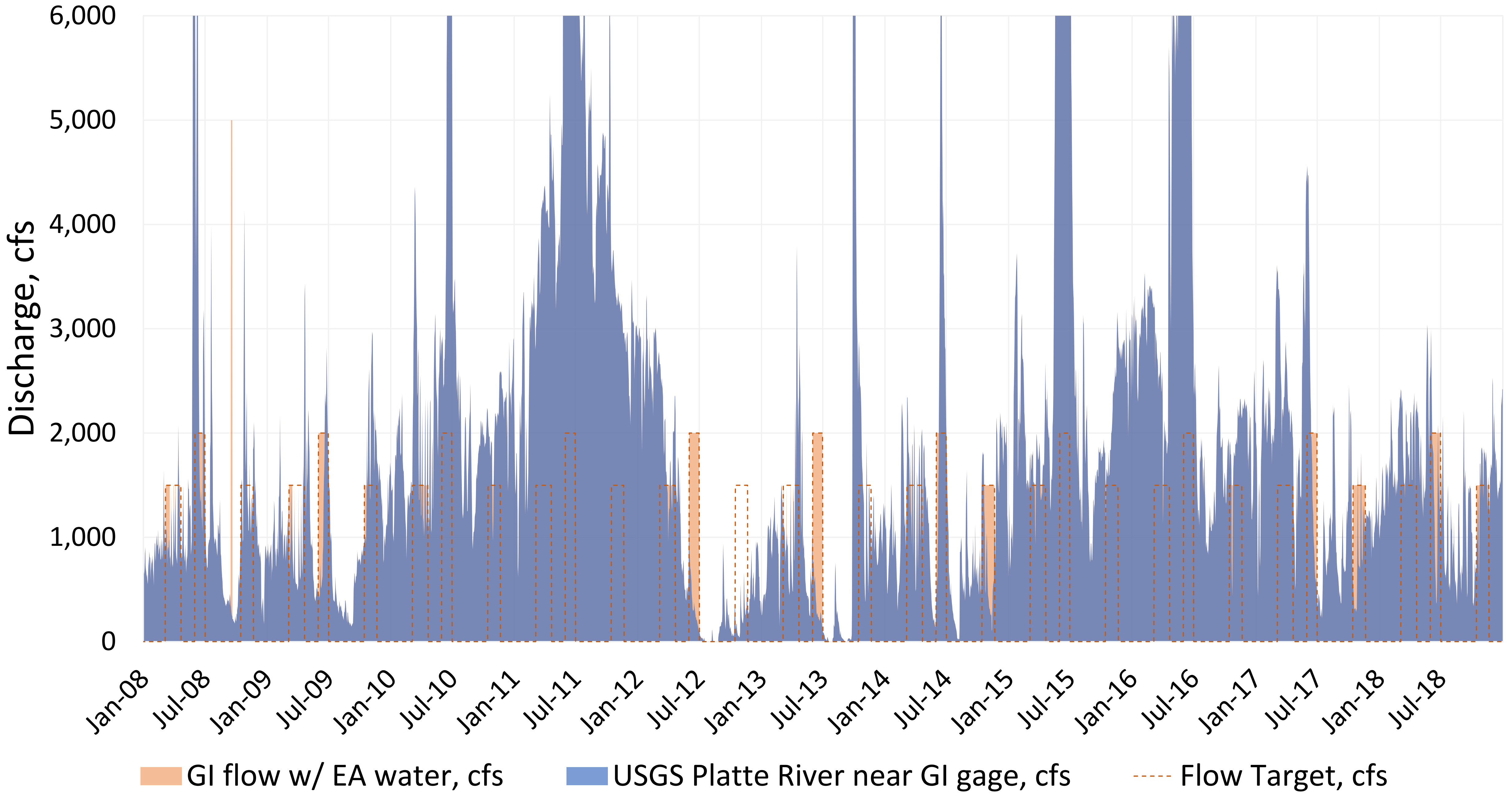
Example release logic:

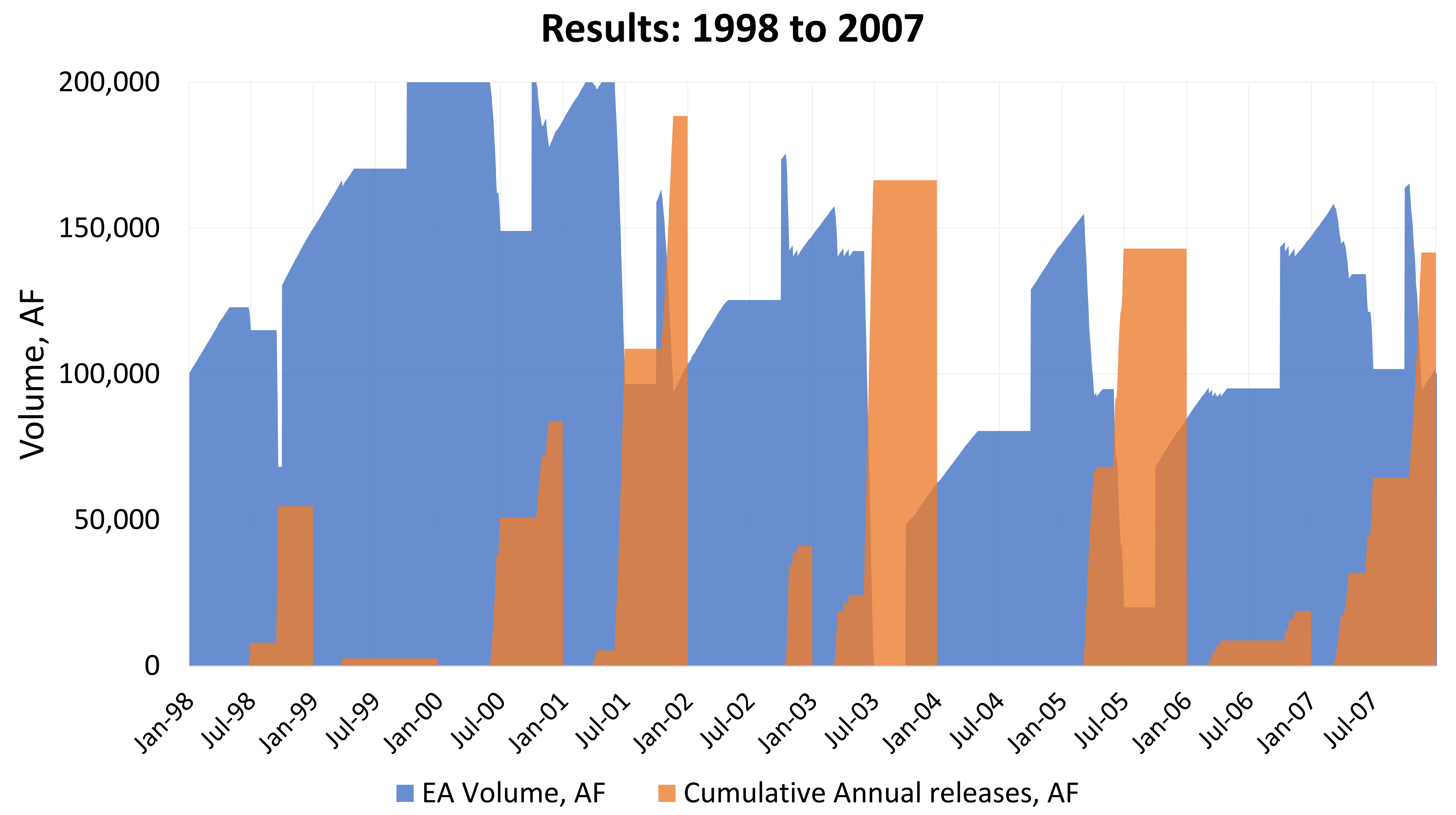
1. Make a SDHF release as soon as water is available
2. Reserve median volume for germination release
3. Make a fall WC release if extra water in fall
4. Make a spring WC release if extra water in spring

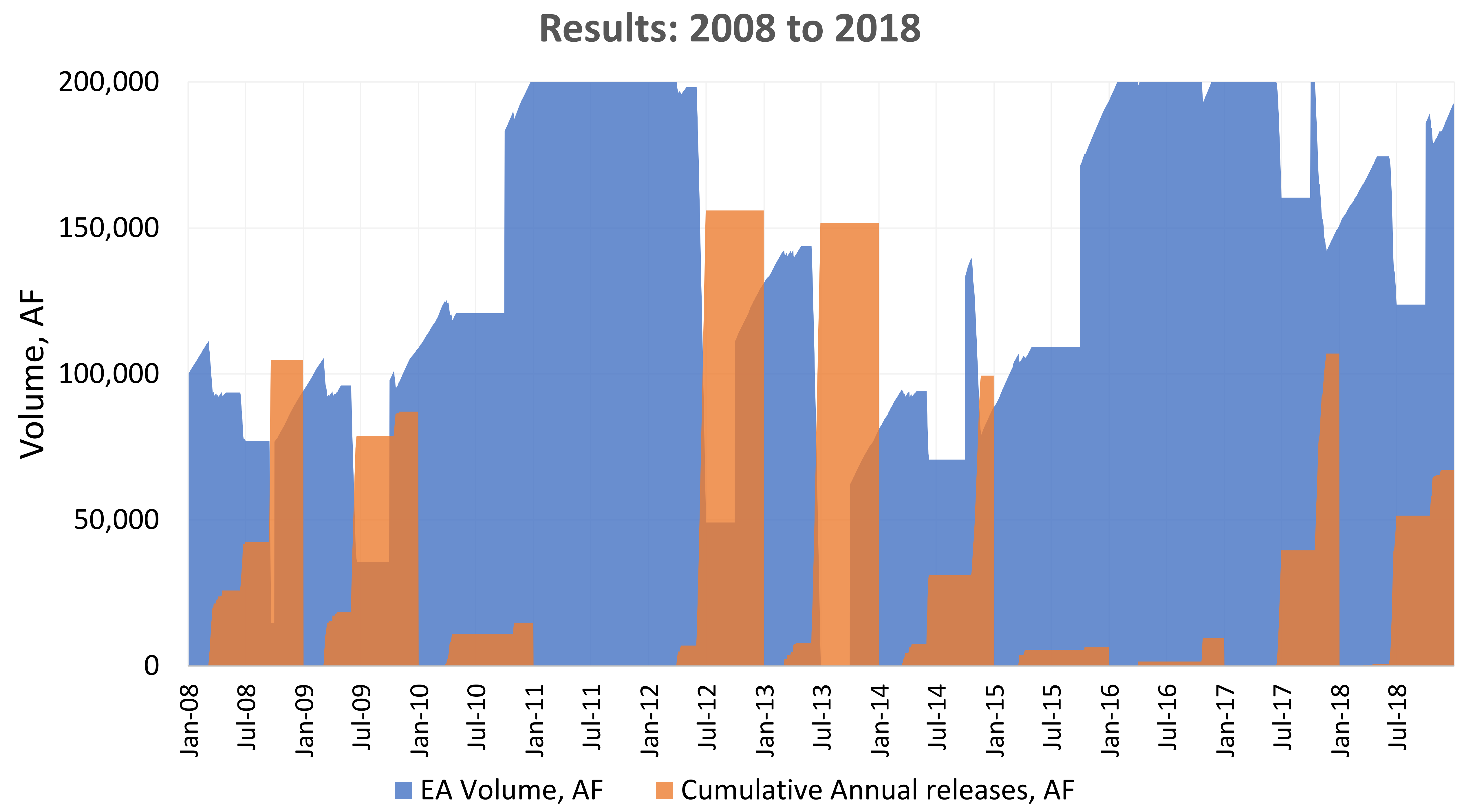



Results: 1998 to 2007
Discharge, cfs
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
GI flow w/ EA water, cfs
USGS Platte River near GI gage, cfs
Flow Target, cfs

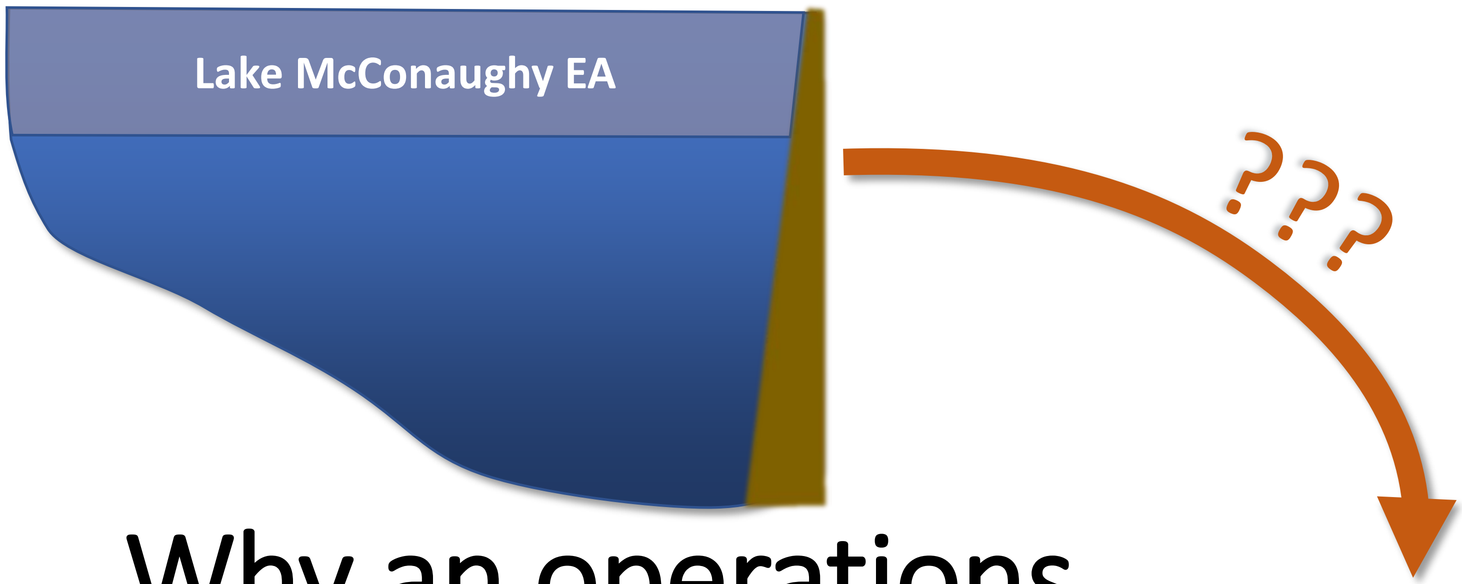
Results: 2008 to 2018



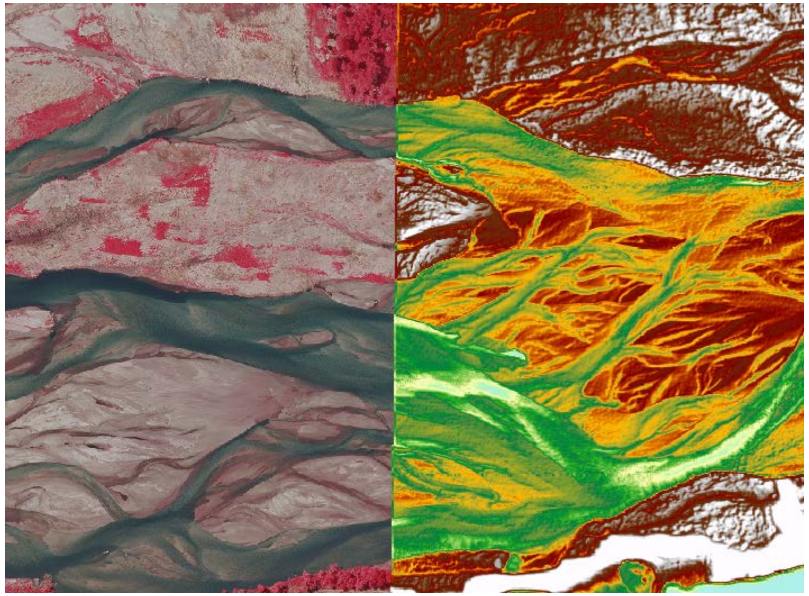

Results: 1998 to 2007
Volume, AF
200,000
150,000
100,000
50,000
0
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
EA Volume, AF
Cumulative Annual releases, AF



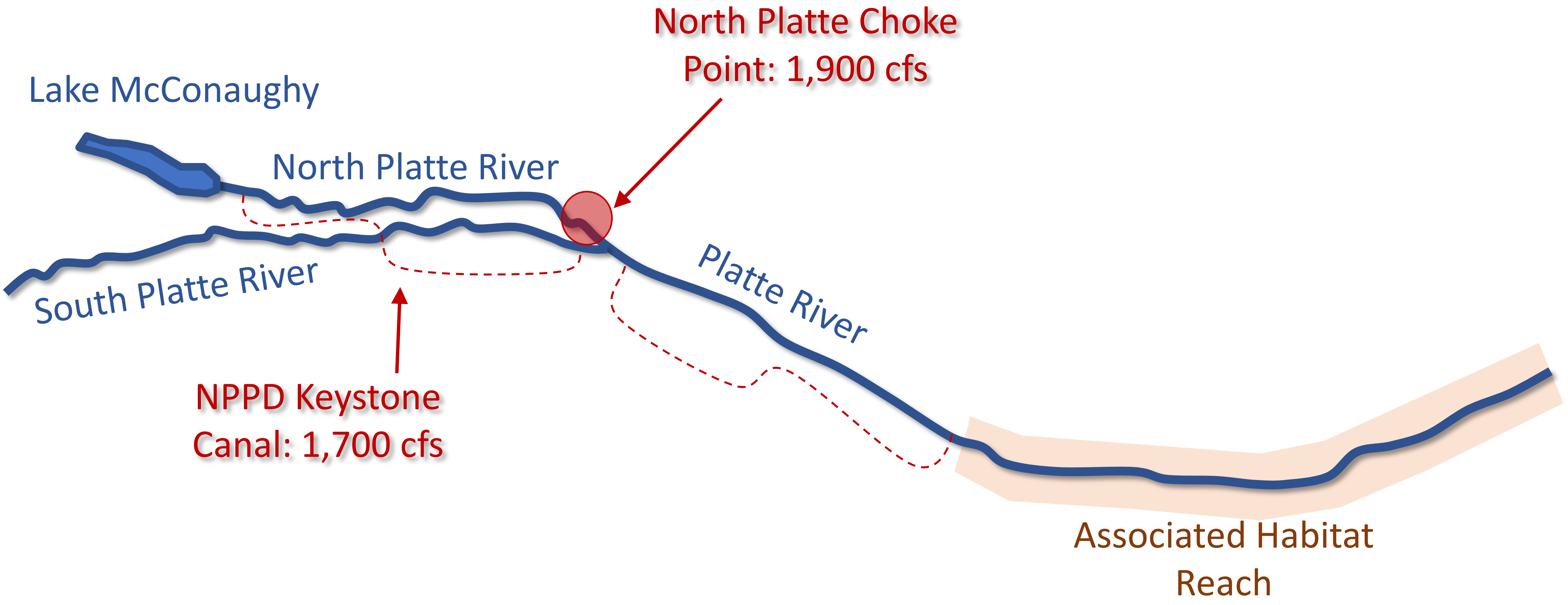
Results: 2008 to 2018
Volume, AF
200,000
150,000
100,000
50,000
0
Jan-08
Jul-08
Jan-09
Jul-09
Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
EA Volume, AF
Cumulative Annual releases, AF



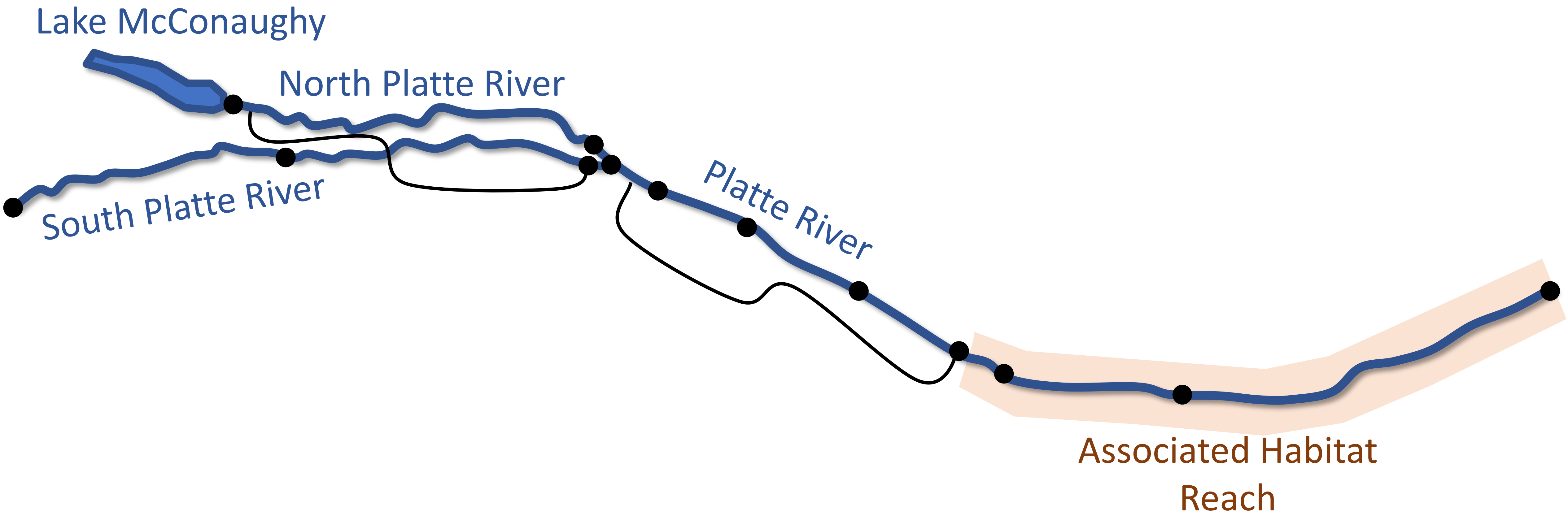
Why an operations model?



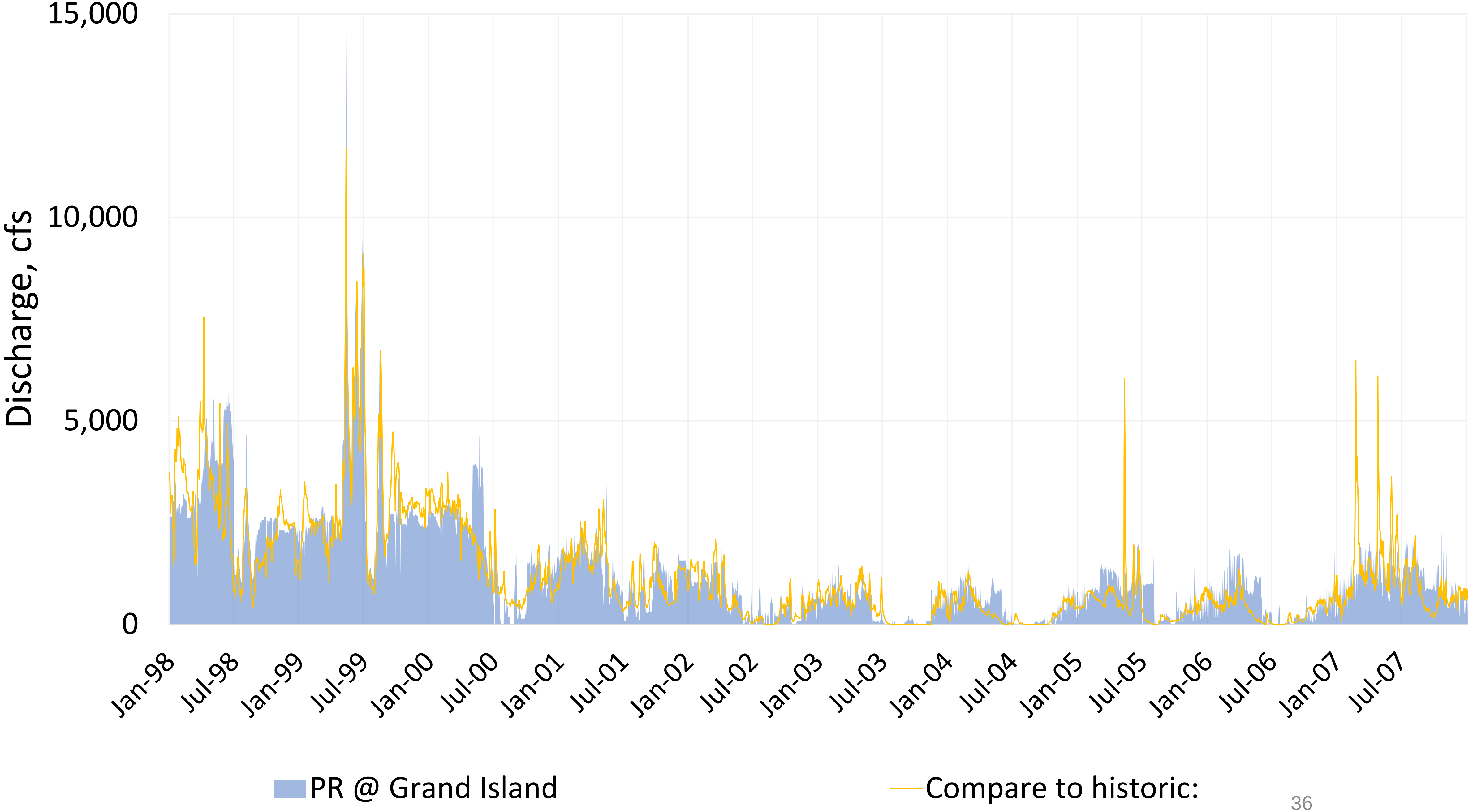
Capacity Constraints


North Platte Choke
Point: 1,900 cfs
Lake McConaughy
North Platte River
South Platte River
Platte River
NPPD Keystone
Canal: 1,700 cfs
Associated Habitat
Reach

How does it work?



Results: 1998 to 2007



Scenario Tool vs. Operations Model

Question to think about:

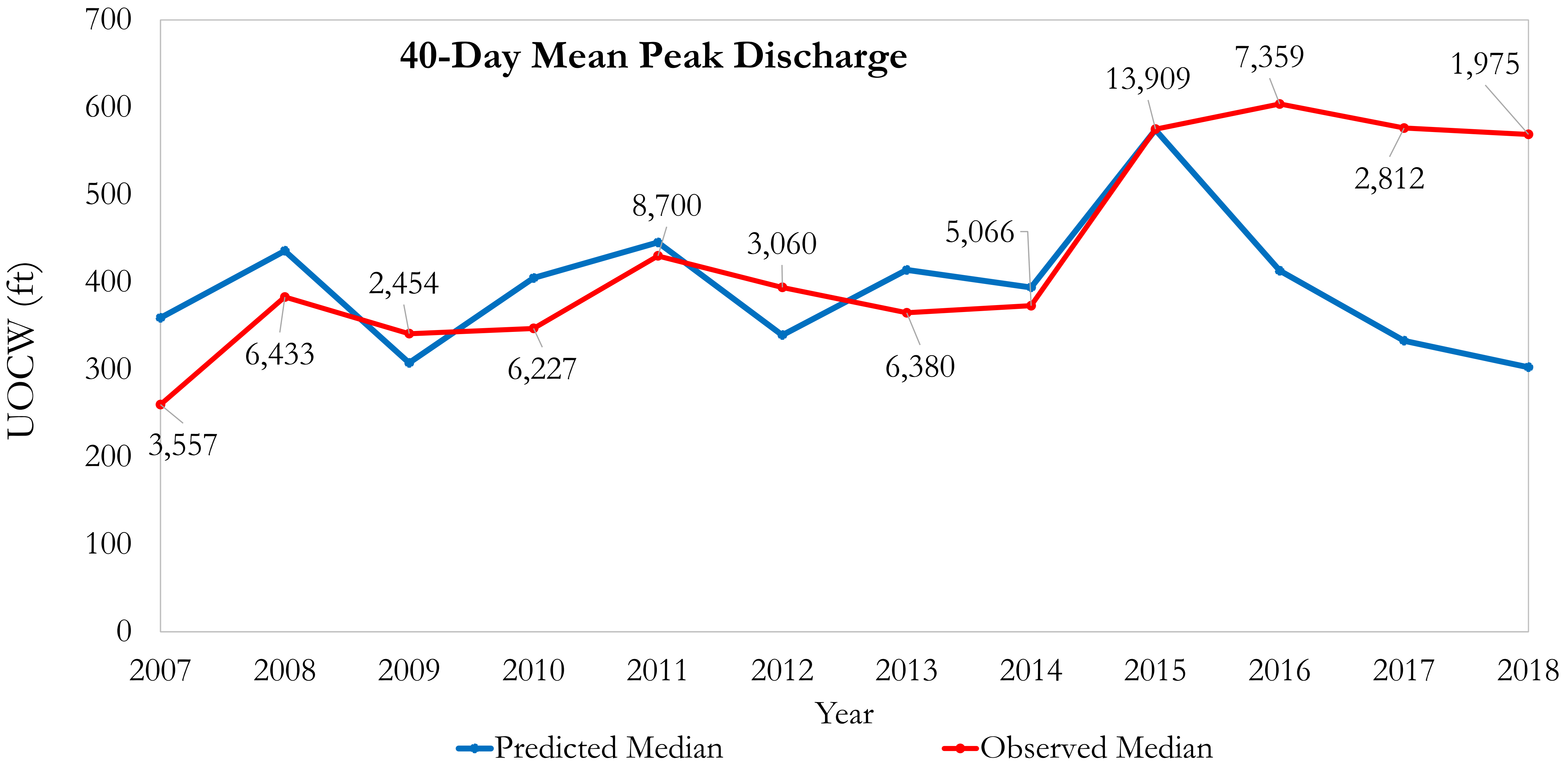
Level of complexity

Underlying hydrology

Scenarios

Losses

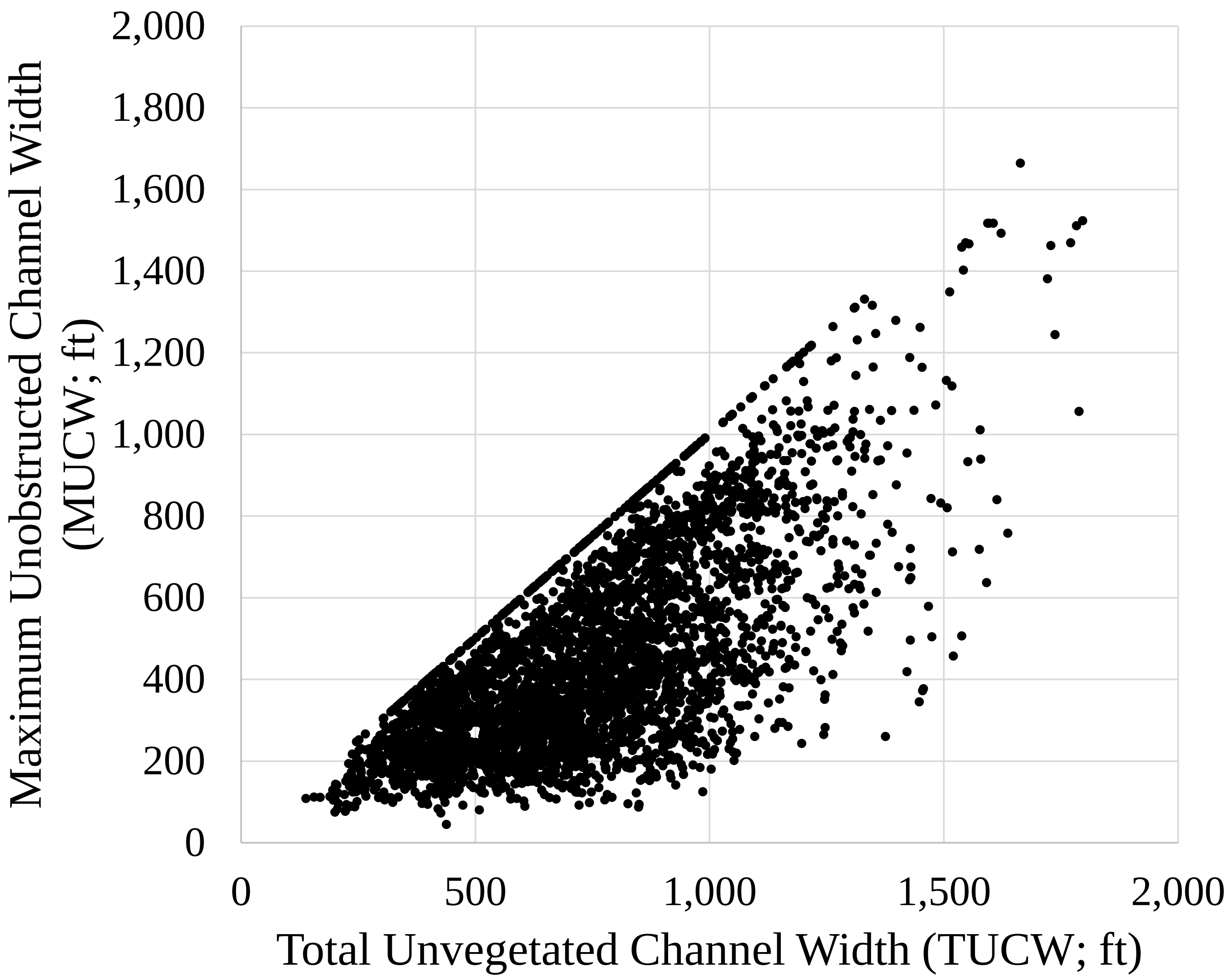
Decision Tree Model

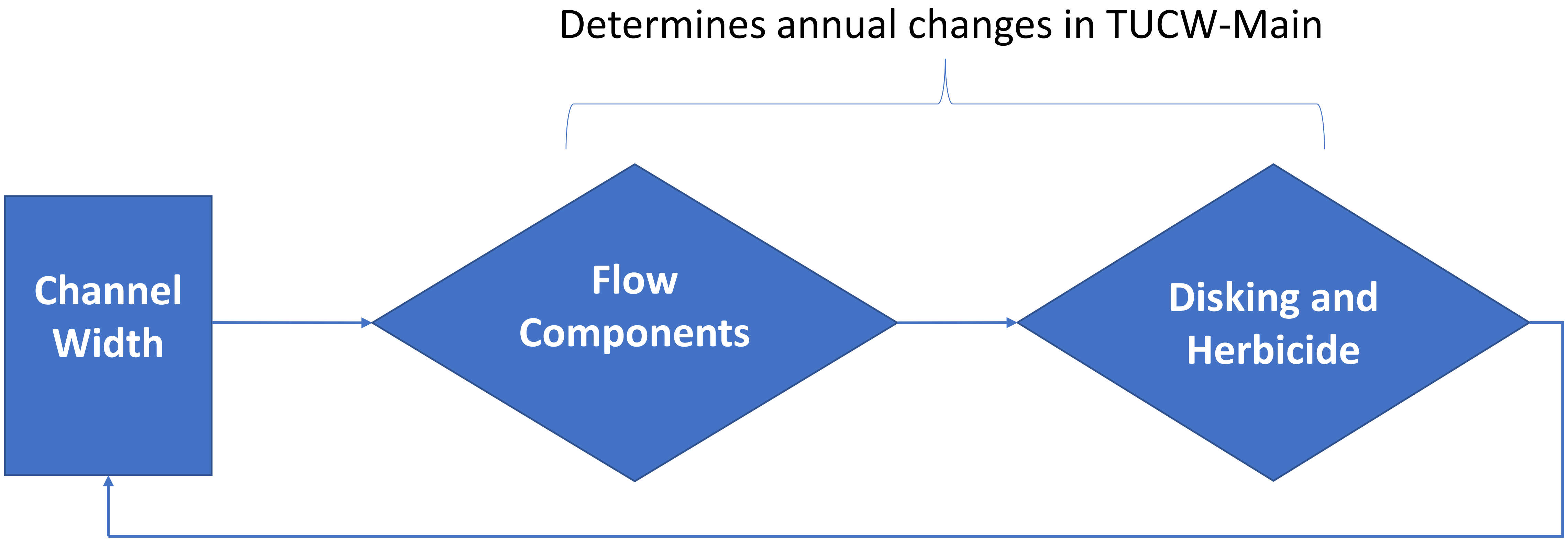

40-Day Mean Peak Discharge
UOCW (ft)
700
600
500
400
300
200
100
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
3,557
6,433
2,454
6,227
8,700
3,060
6,380
5,066
13,909
7,359
2,812
1,975
Predicted Median
Observed Median

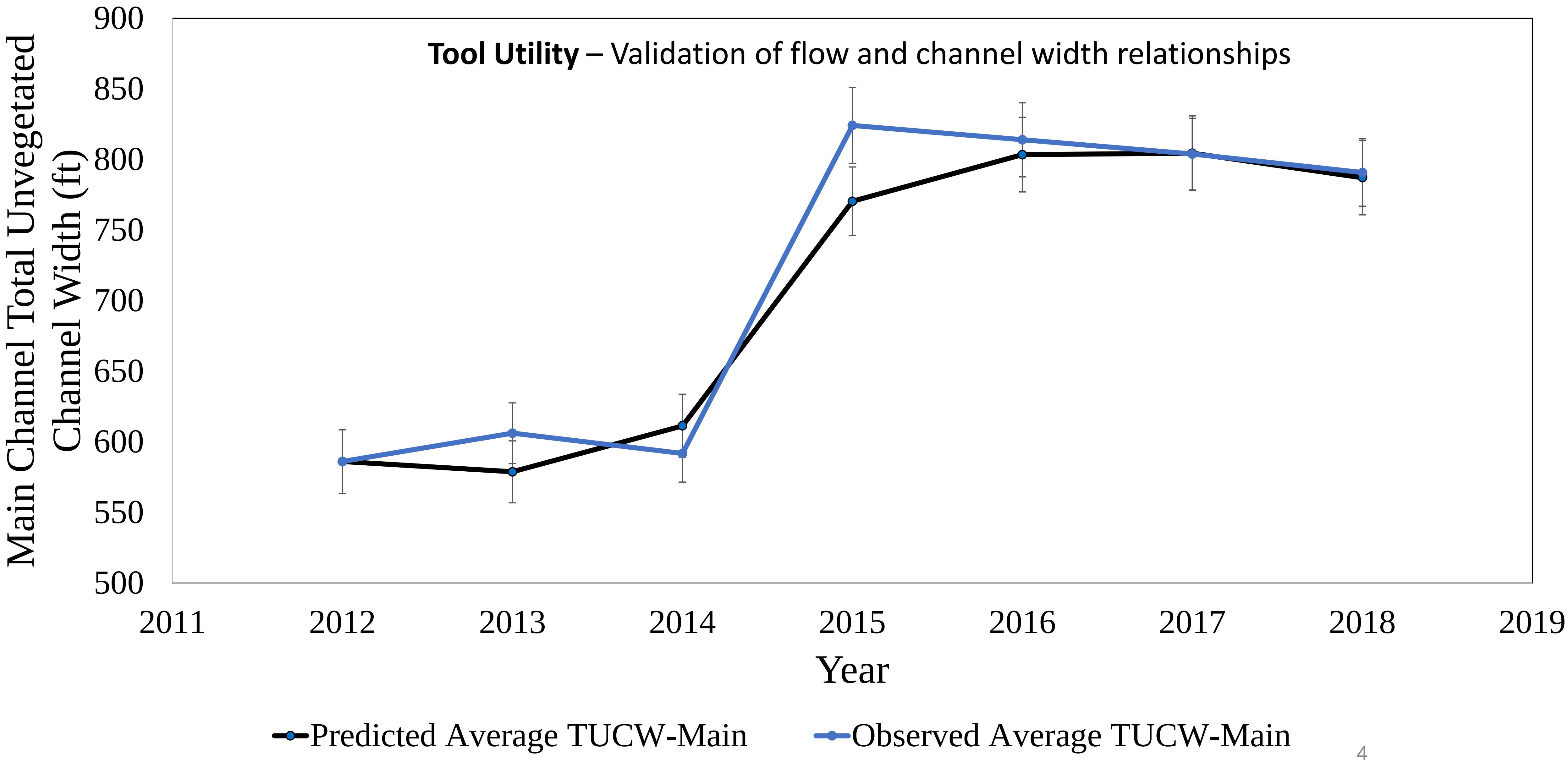
River Process

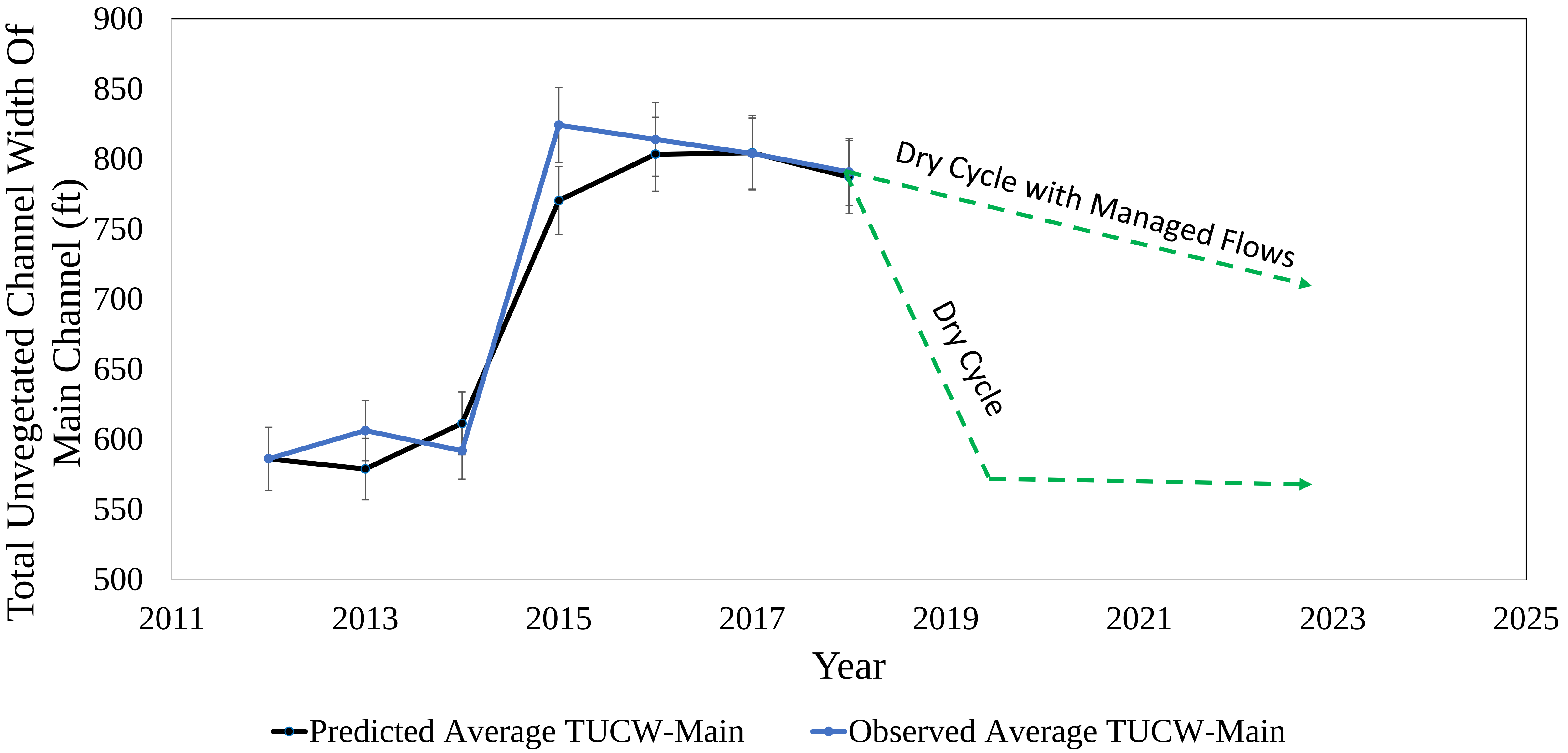
- Total Unobstructed Channel Width
- Main Channel Total Unobstructed Channel Width
- Maximum Unobstructed Channel Width

Habitat Metric

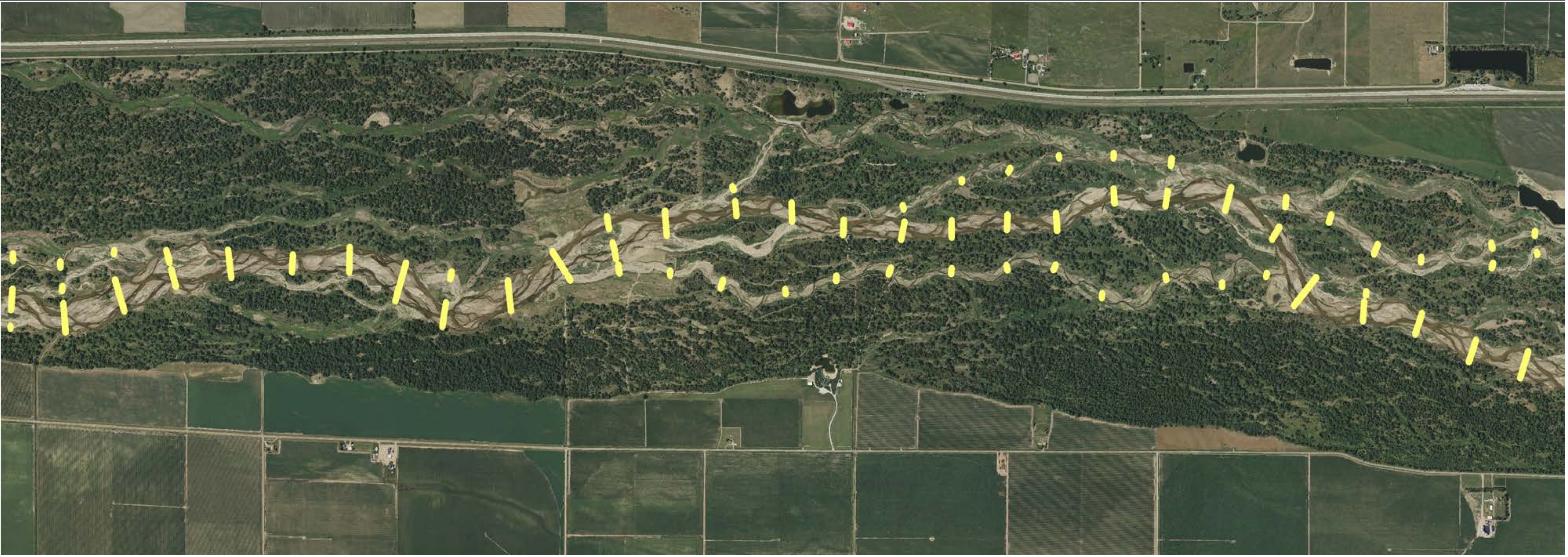



Determines annual changes in TUCW-Main
Channel Width
Flow Components
Disking and Herbicide

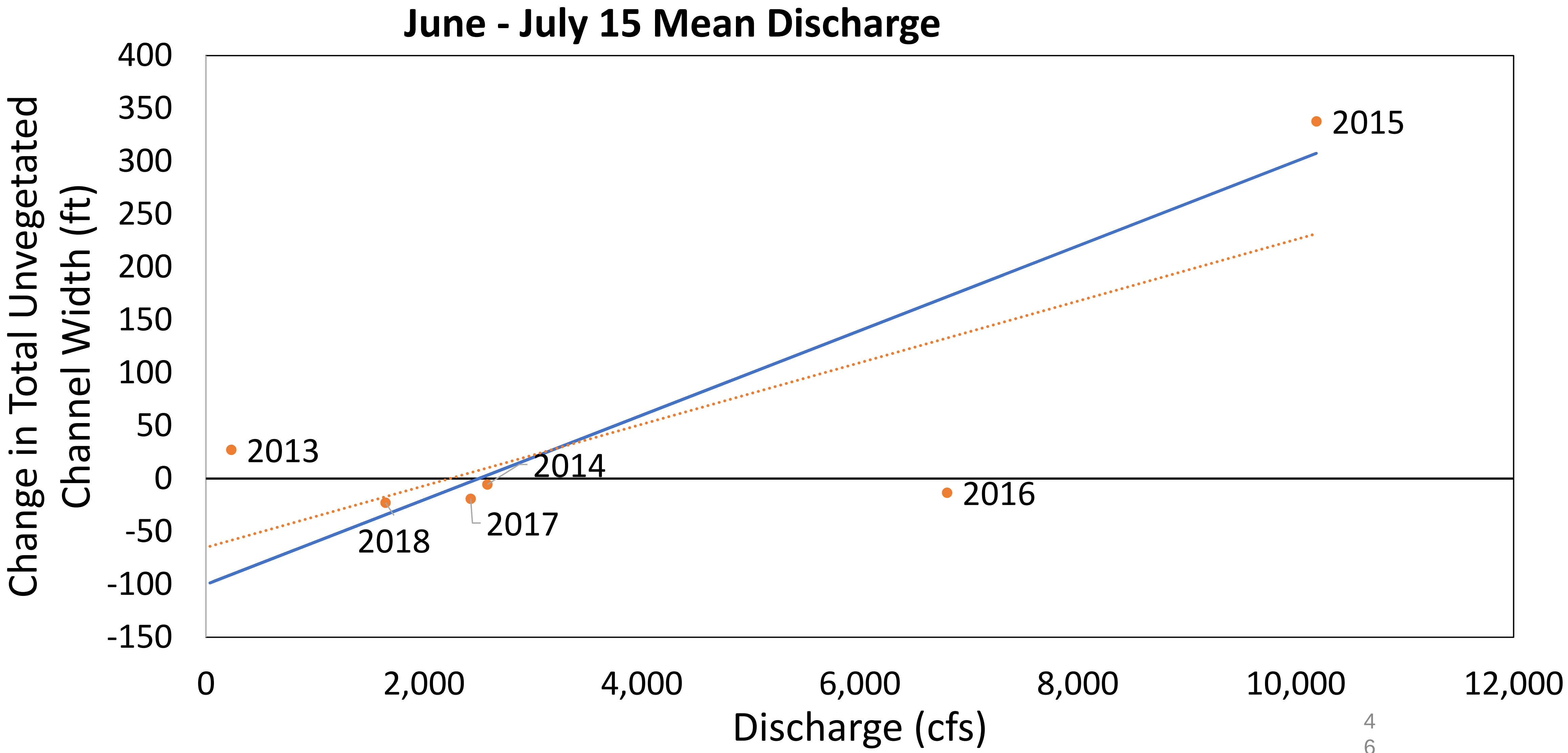

Tool Utility – Validation of flow and channel width relationships
Main Channel Total Unvegetated Channel Width (ft)
900
850
800
750
700
650
600
550
500
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year
Predicted Average TUCW-Main
Observed Average TUCW-Main


Total Unvegetated Channel Width Of Main Channel (ft)
900
850
800
750
700
650
600
550
500
2011
2013
2015
2017
2019
2021
2023
2025
Year
Dry Cycle with Managed Flows
Dry Cycle
Predicted Average TUCW-Main
Observed Average TUCW-Main

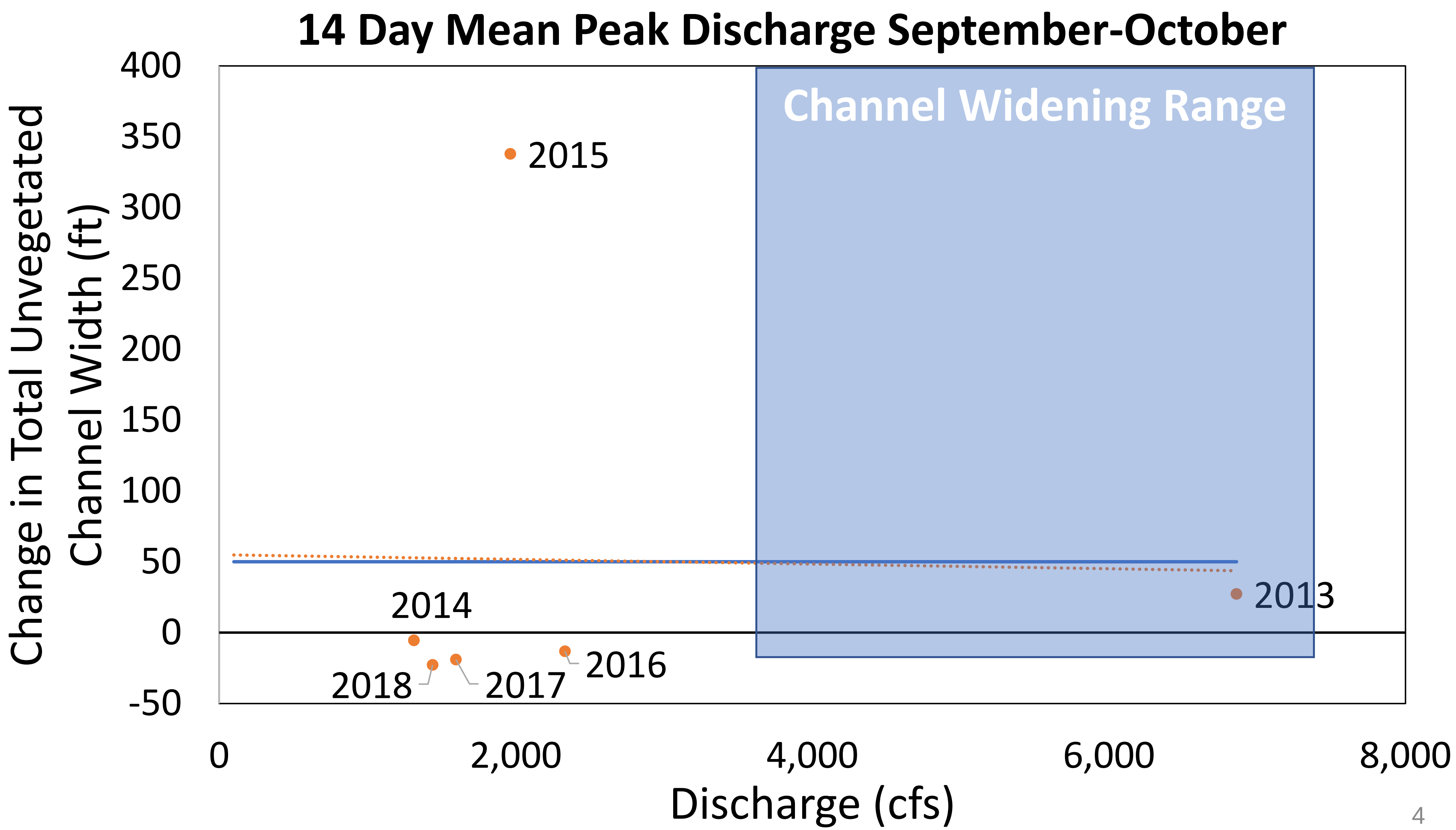
Inputs – Starting Year Total Unvegetated Channel Width (TUCW) and Main Channel Total Unvegetated Channel Width (TUCW-Main)



Inputs – Flow Component: Germination Season Flows



Inputs – Flow Component: Fall Peak Flows

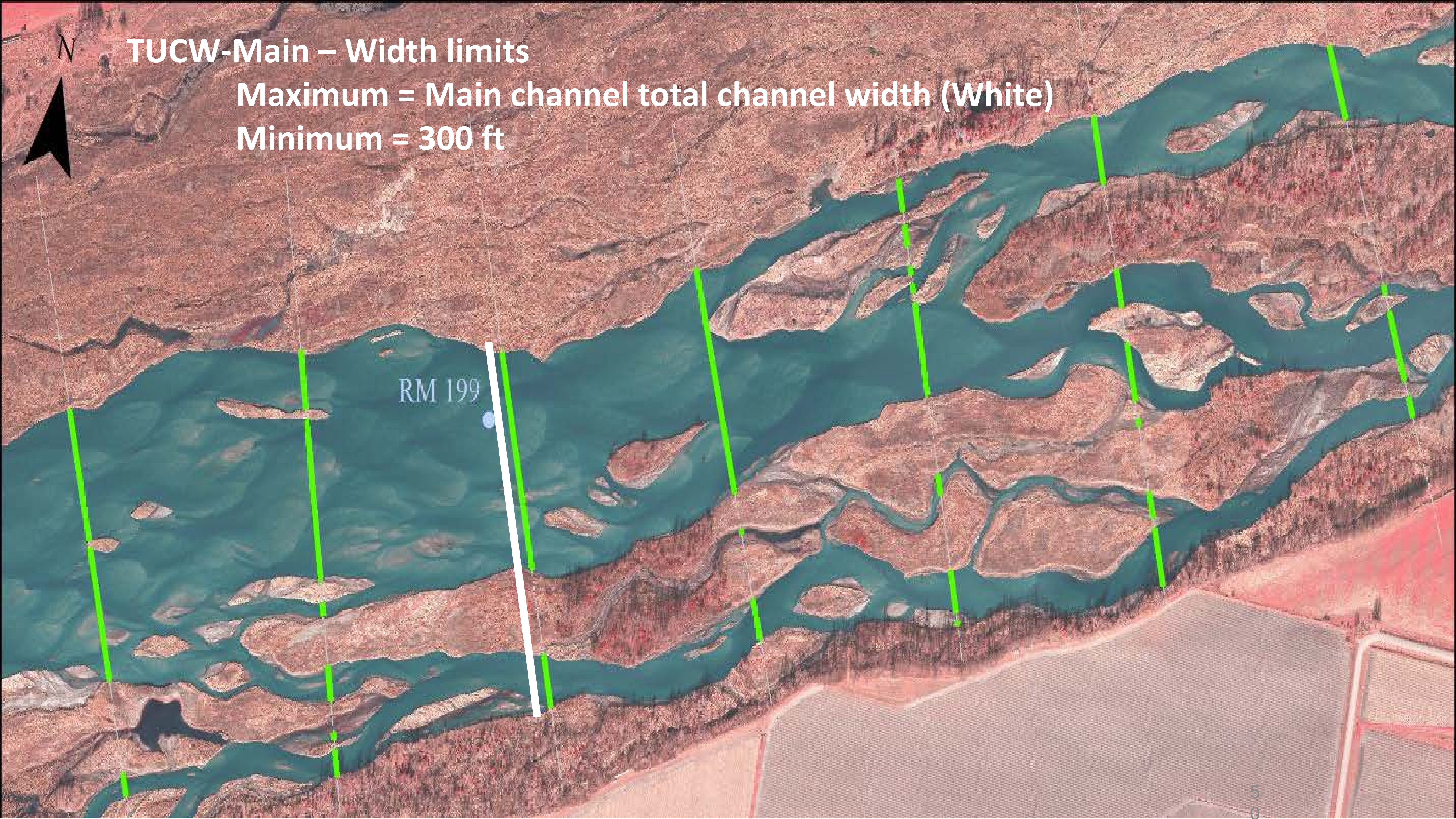


Inputs – Herbicide (Systematic)

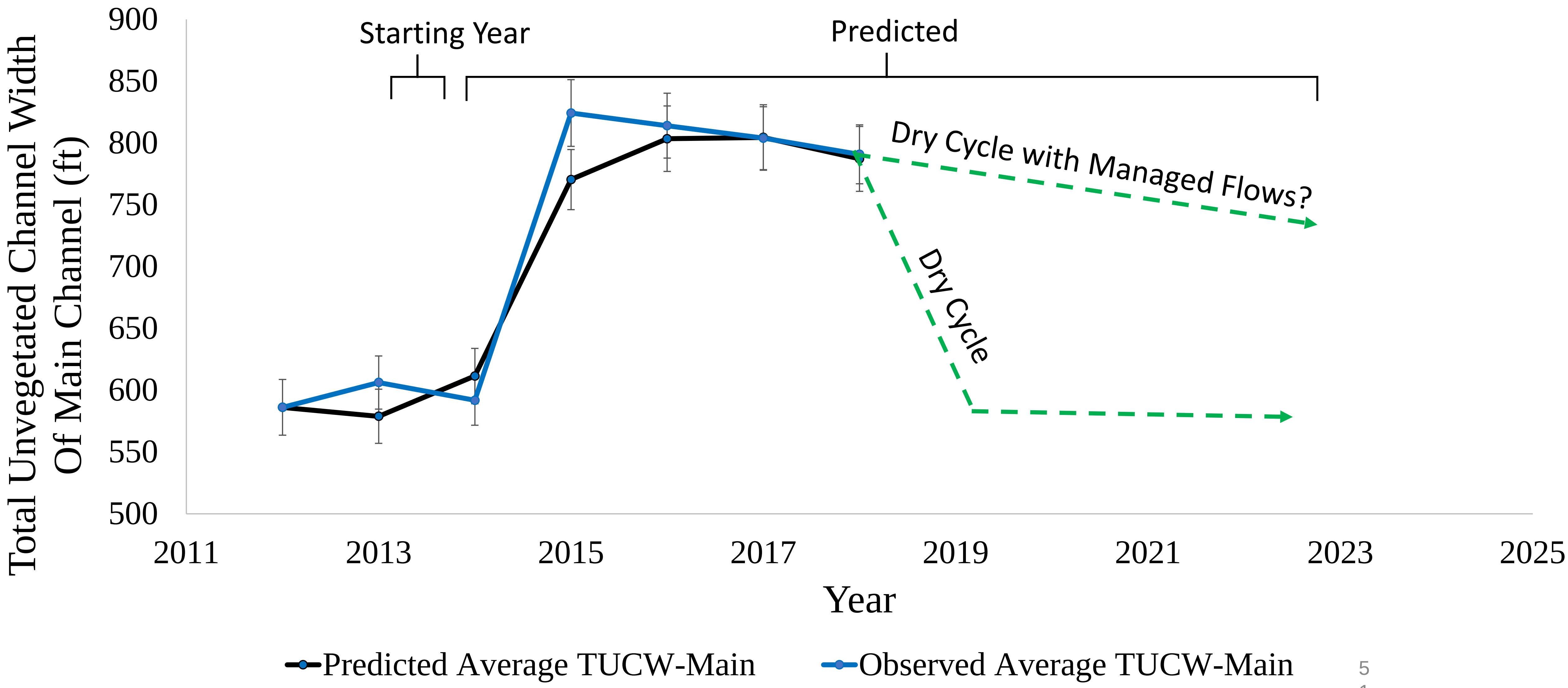
Without

With

Inputs – Disking (Transect-Specific)


N
TUCW-Main – Width limits
Maximum = Main channel total channel width (White)
Minimum = 300 ft
RM 199

Output – Predicted Main Channel Total Unvegetated Channel Width (TUCW-Main)



Possible Improvements

- More robust regression relationship
  - Non-linear relationships
- More specific minimum channel width constraints
- Winter flow consideration
- Other mechanical channel activities included (woody vegetation removal)

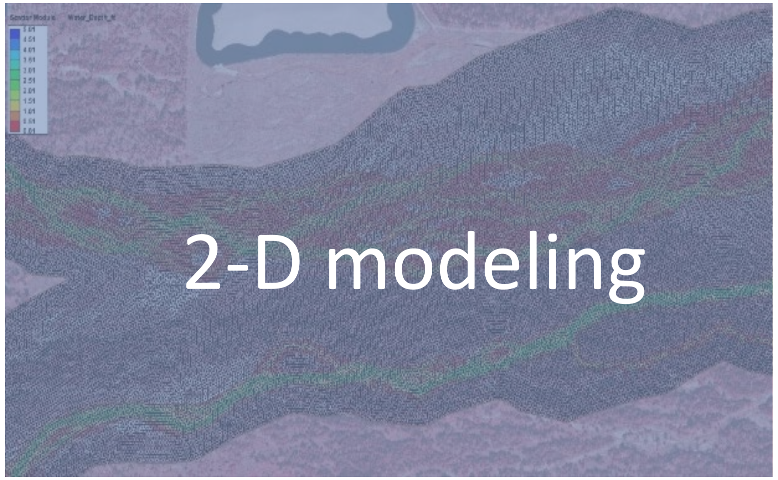
Decision Tree Model Uncertainties

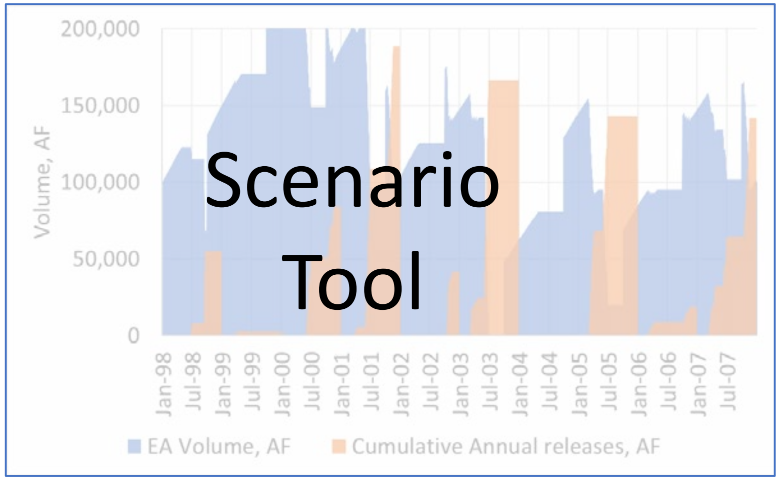
- Are current model assumptions appropriate?
- What other physical processes would increase predictability?
- Are we capturing flow/channel widths relationships appropriately (functional form, etc.)?
- Should wet/dry cycles have different flow/channel width relationships?
- How to integrate direct measures of channel suitability for whooping cranes (maximum unobstructed channel width)?

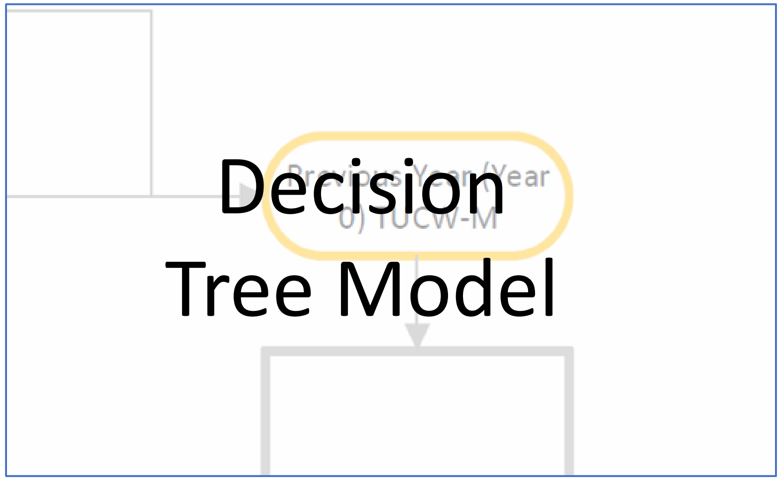
AMP Tools

Example

Program Example – Germination season and fall peak flows for channel width maintenance

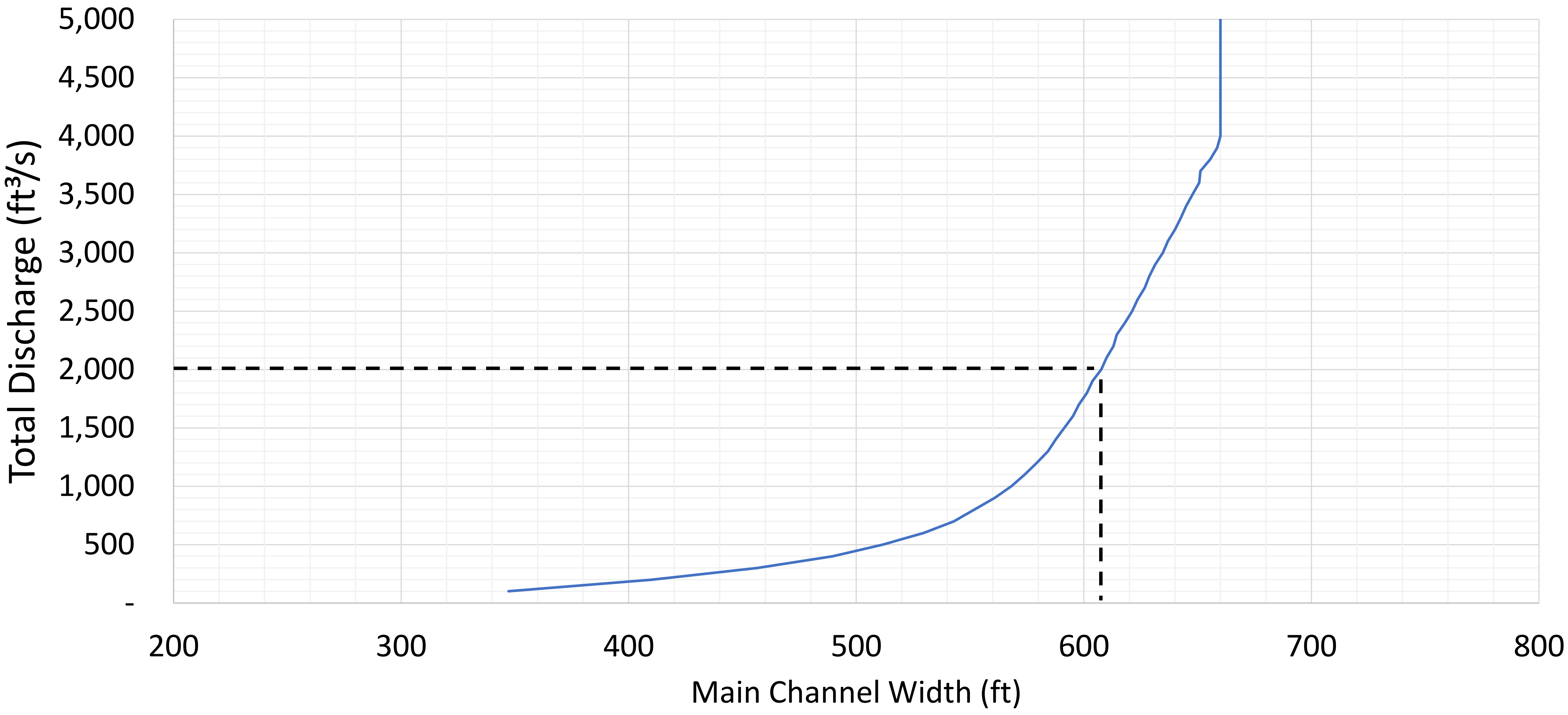


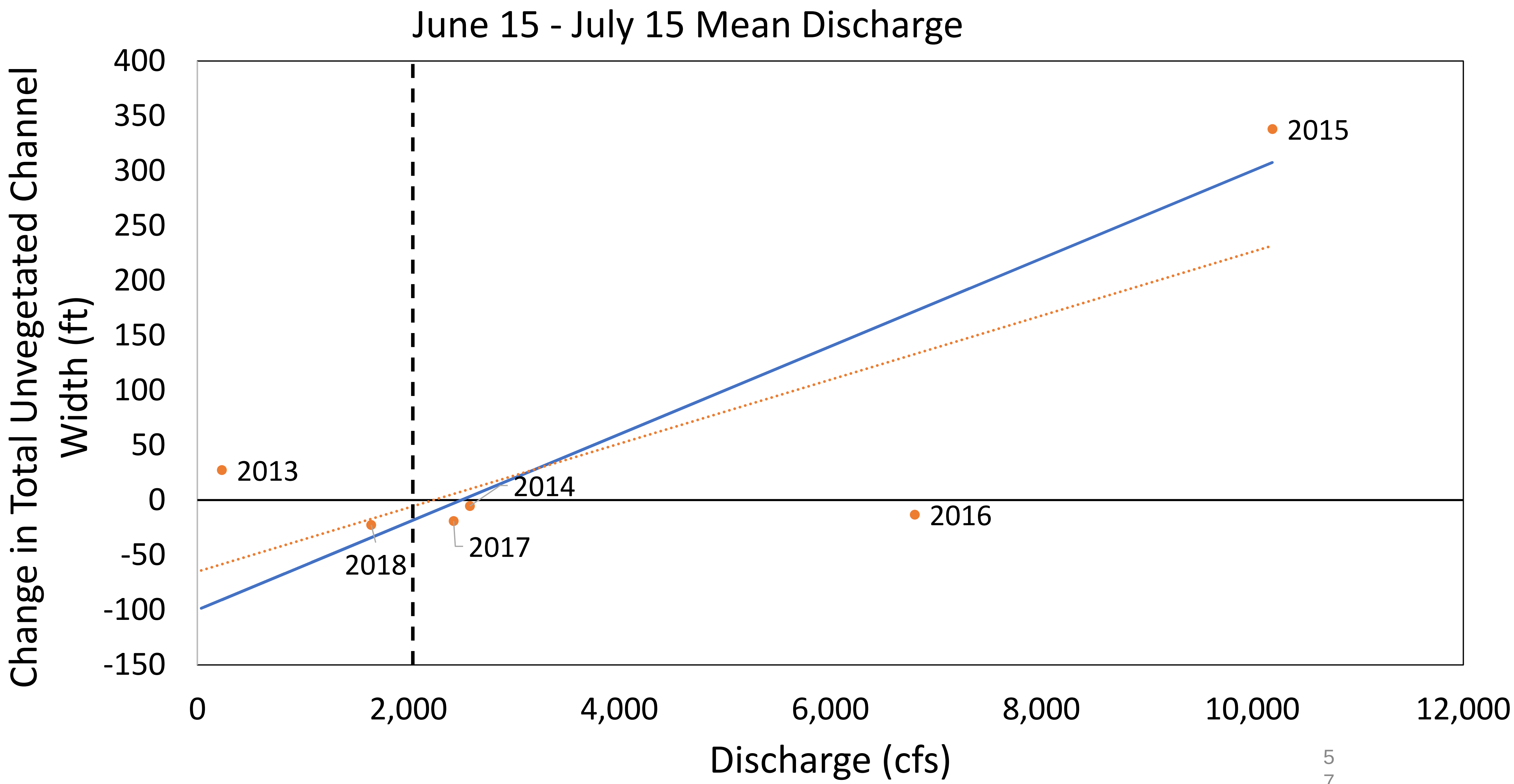


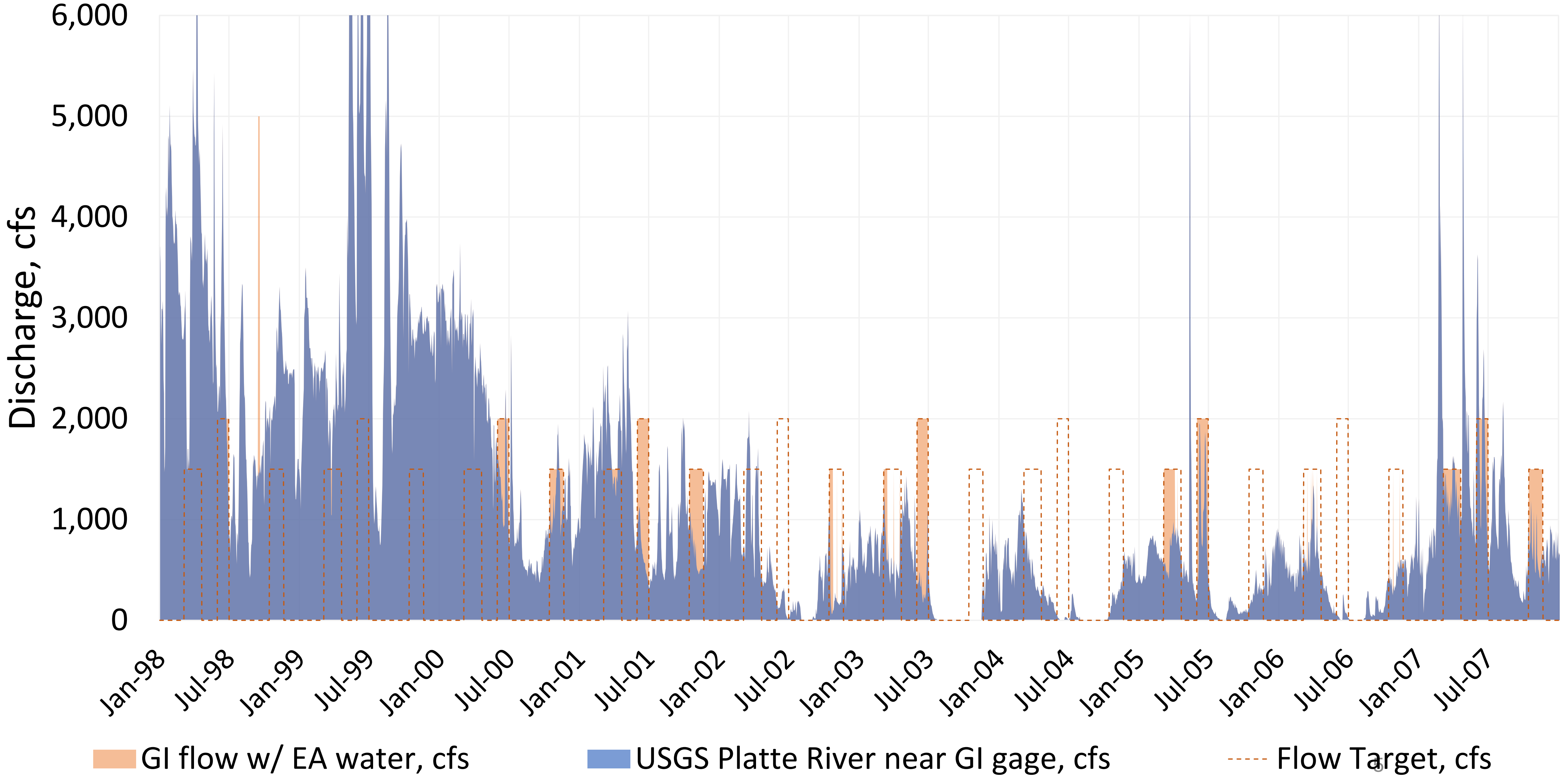


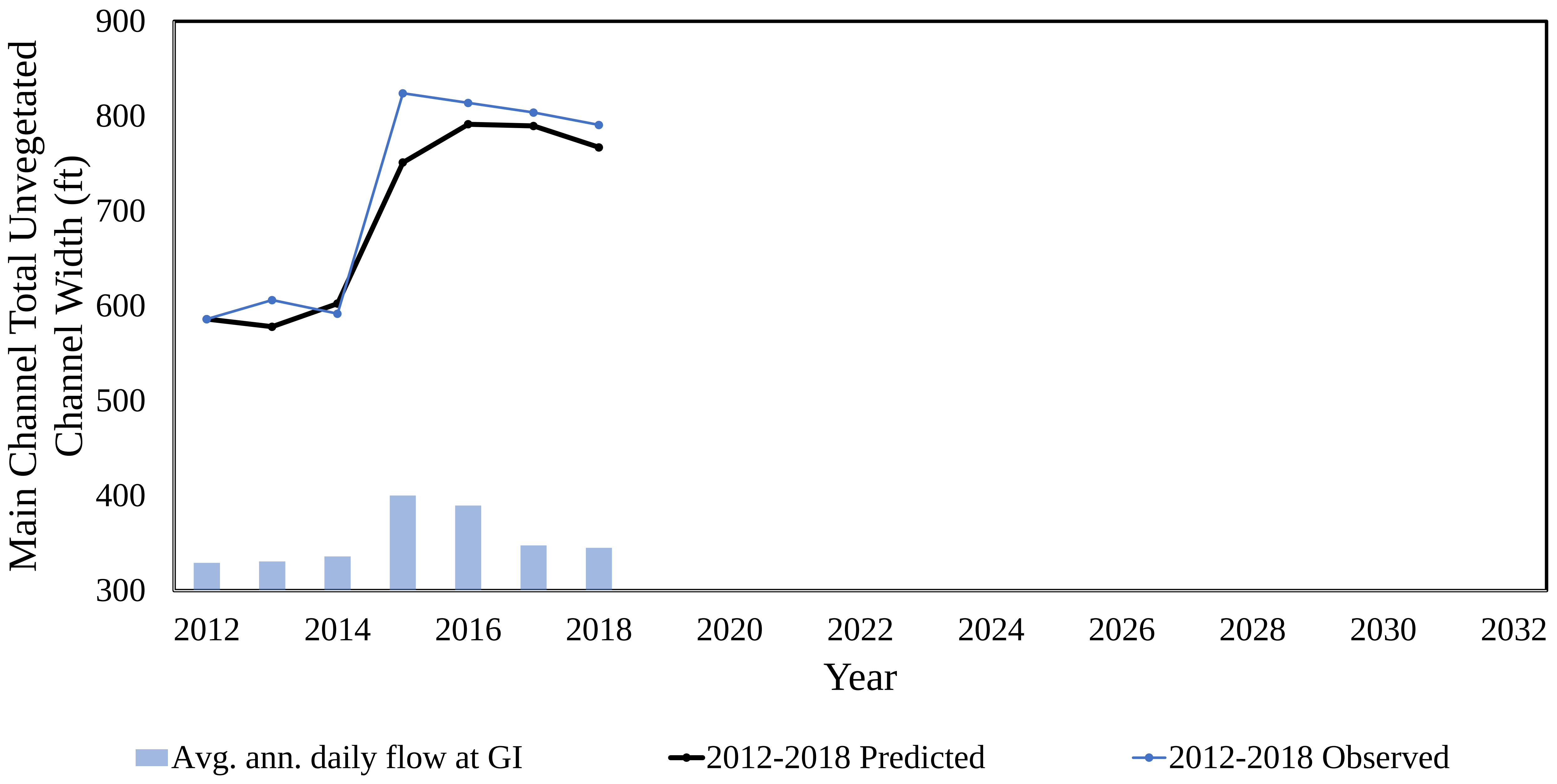
5
5

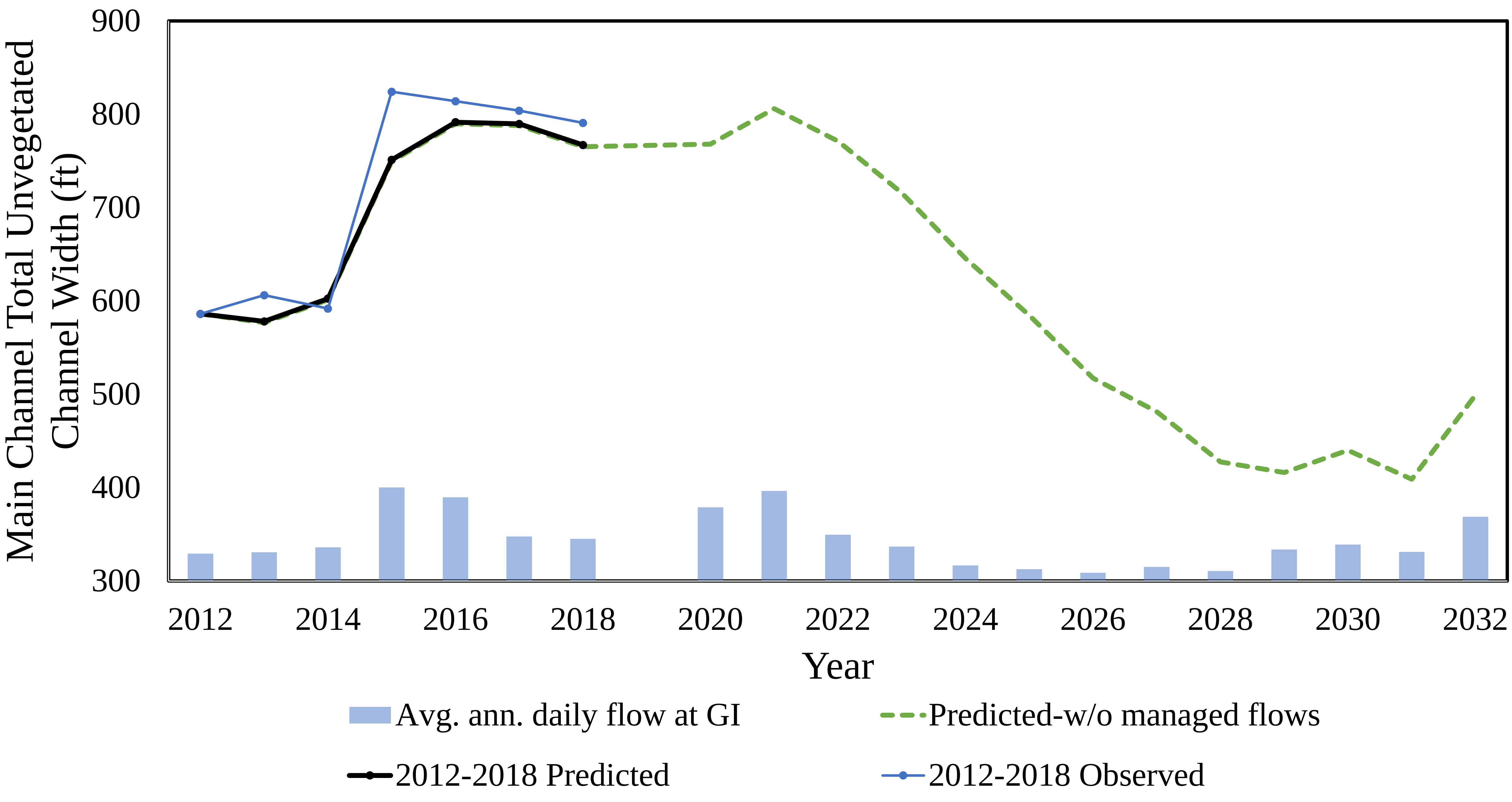
AHR - Average Main Channel Width



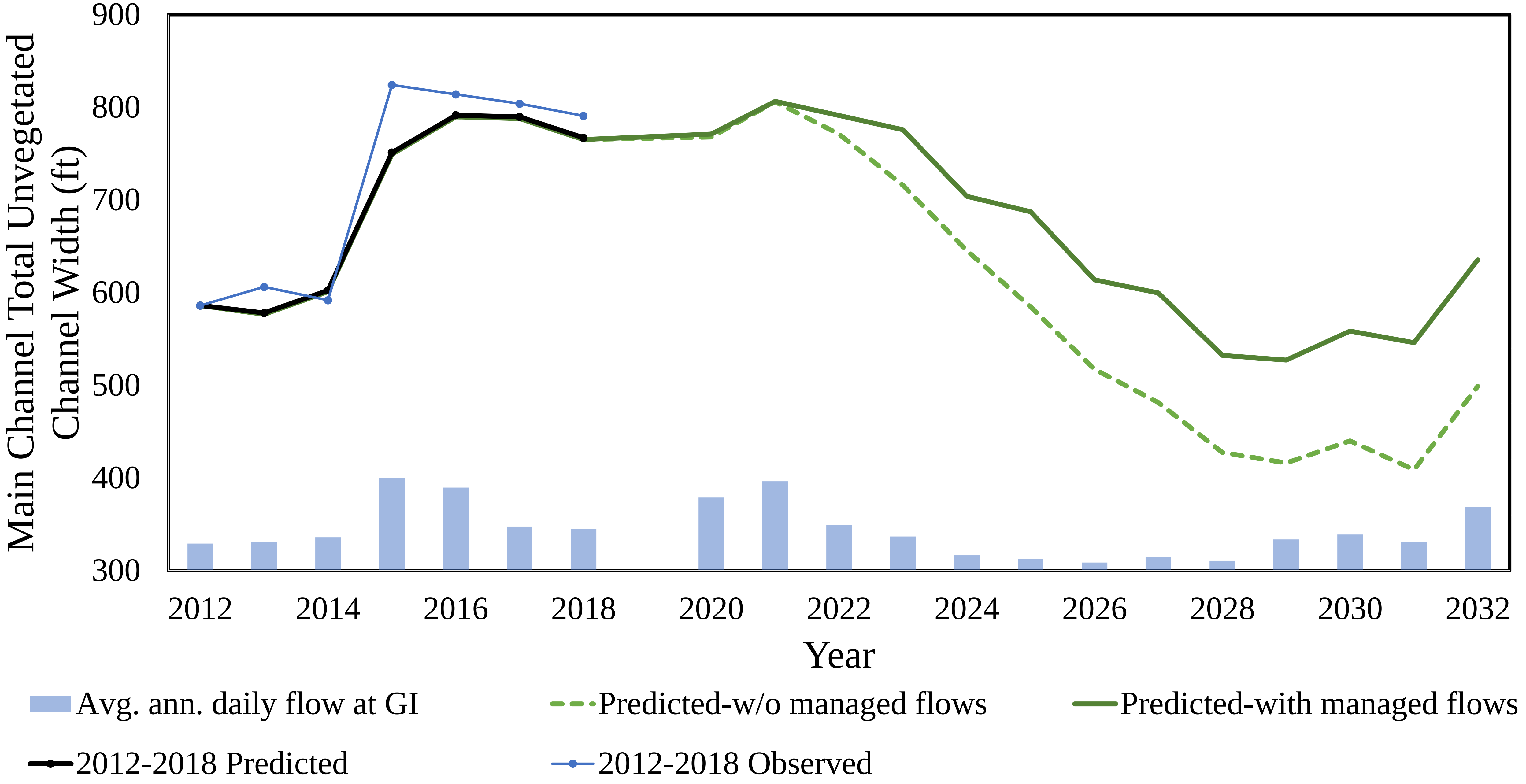

June 15 - July 15 Mean Discharge
Change in Total Unvegetated Channel Width (ft)
400
350
300
250
200
150
100
50
0
-50
-100
-150
2013
2014
2015
2016
2017
2018
0
2,000
4,000
6,000
8,000
10,000
12,000
Discharge (cfs)


6,000
5,000
4,000
3,000
2,000
1,000
0
Discharge, cfs
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
GI flow w/ EA water, cfs
USGS Platte River near GI gage, cfs
Flow Target, cfs


Main Channel Total Unvegetated Channel Width (ft)
900
800
700
600
500
400
300
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
Avg. ann. daily flow at GI
2012-2018 Predicted
2012-2018 Observed



Main Channel Total Unvegetated Channel Width (ft)
900
800
700
600
500
400
300
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
Avg. ann. daily flow at GI
Predicted-w/o managed flows
2012-2018 Predicted
2012-2018 Observed



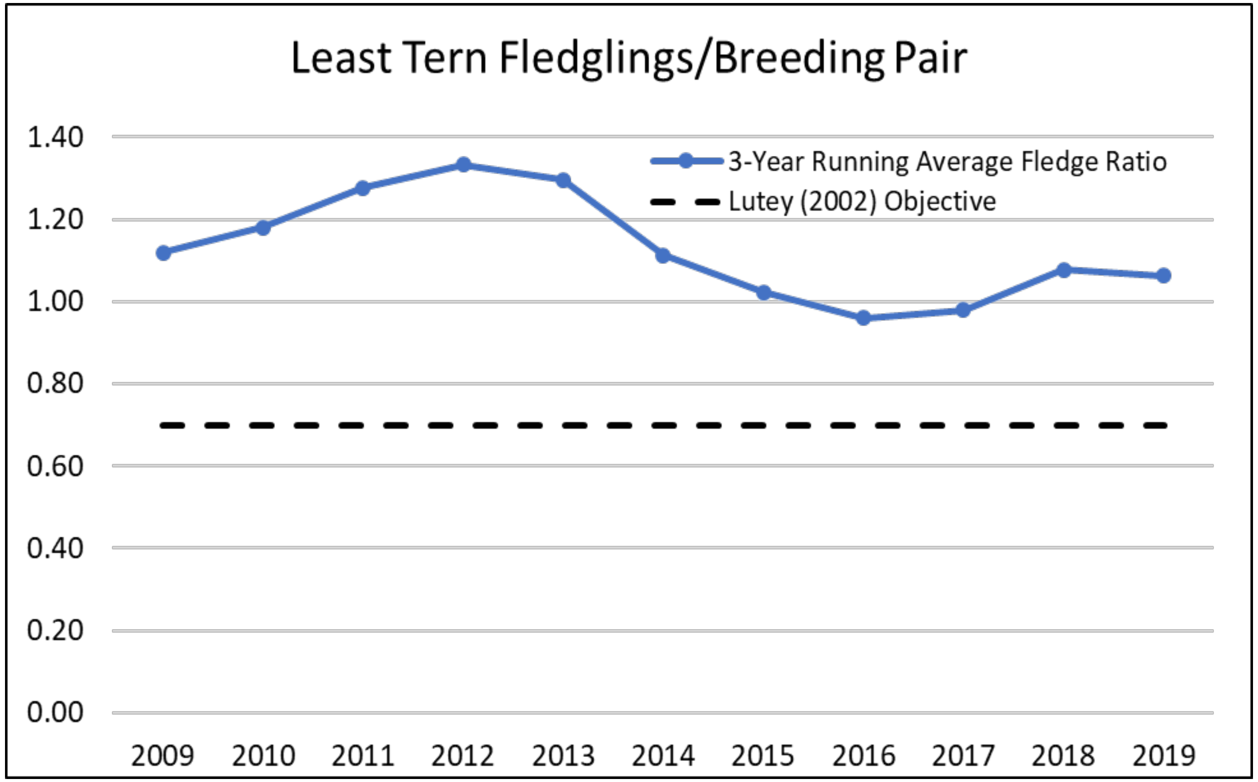
Main Channel Total Unvegetated Channel Width (ft)
900
800
700
600
500
400
300
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
Year
Avg. ann. daily flow at GI
Predicted-w/o managed flows
Predicted-with managed flows
2012-2018 Predicted
2012-2018 Observed

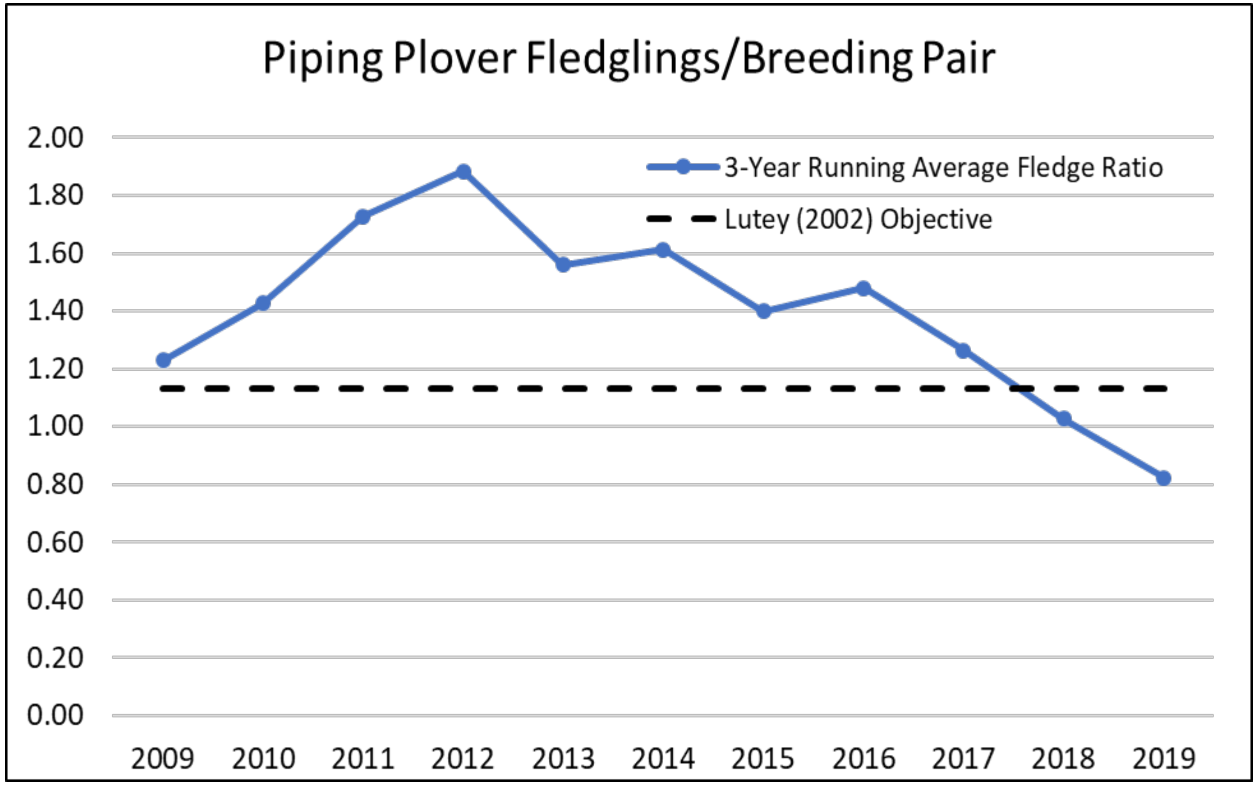
Flow Scenario Uncertainties

- **Magnitude**
  - Flow versus inundation and inundation patterns
- **Timing**
  - Cottonwood Inundation versus germination suppression
- **Duration**
  - What flow duration is necessary to suppress germination? Cottonwood establishment?
- **Flow Variability**
  - Should hydrocycling be considered in flow identification?
- **Vegetation types to inundate/control**

Deeper-Dive Topics

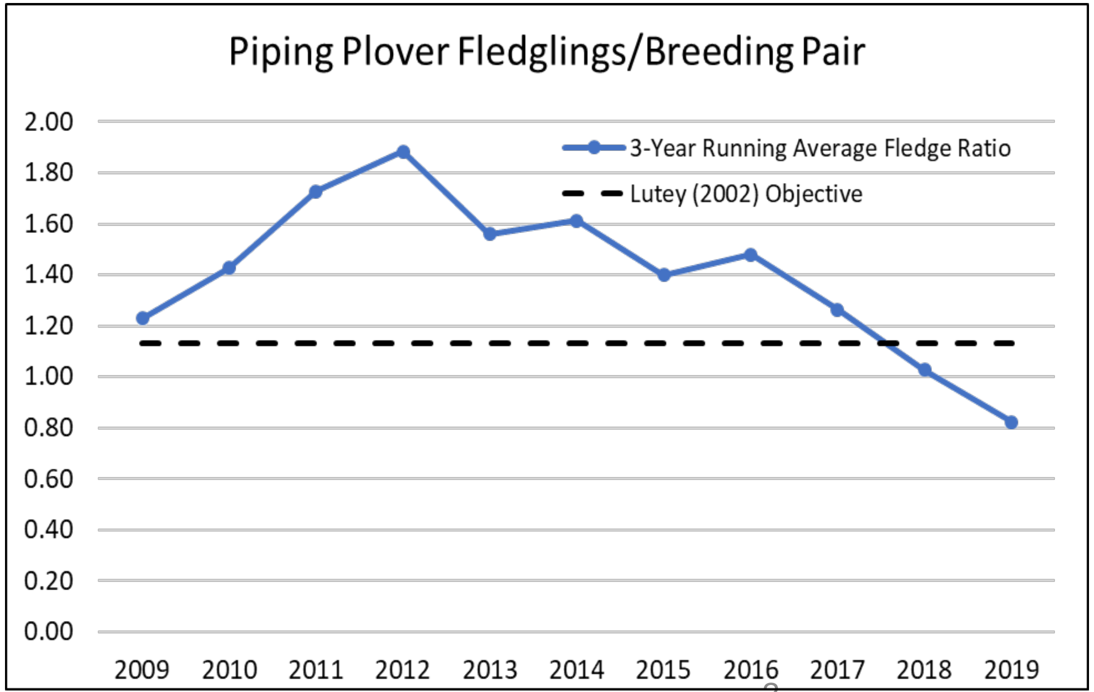
Tern and Plover Predator Management

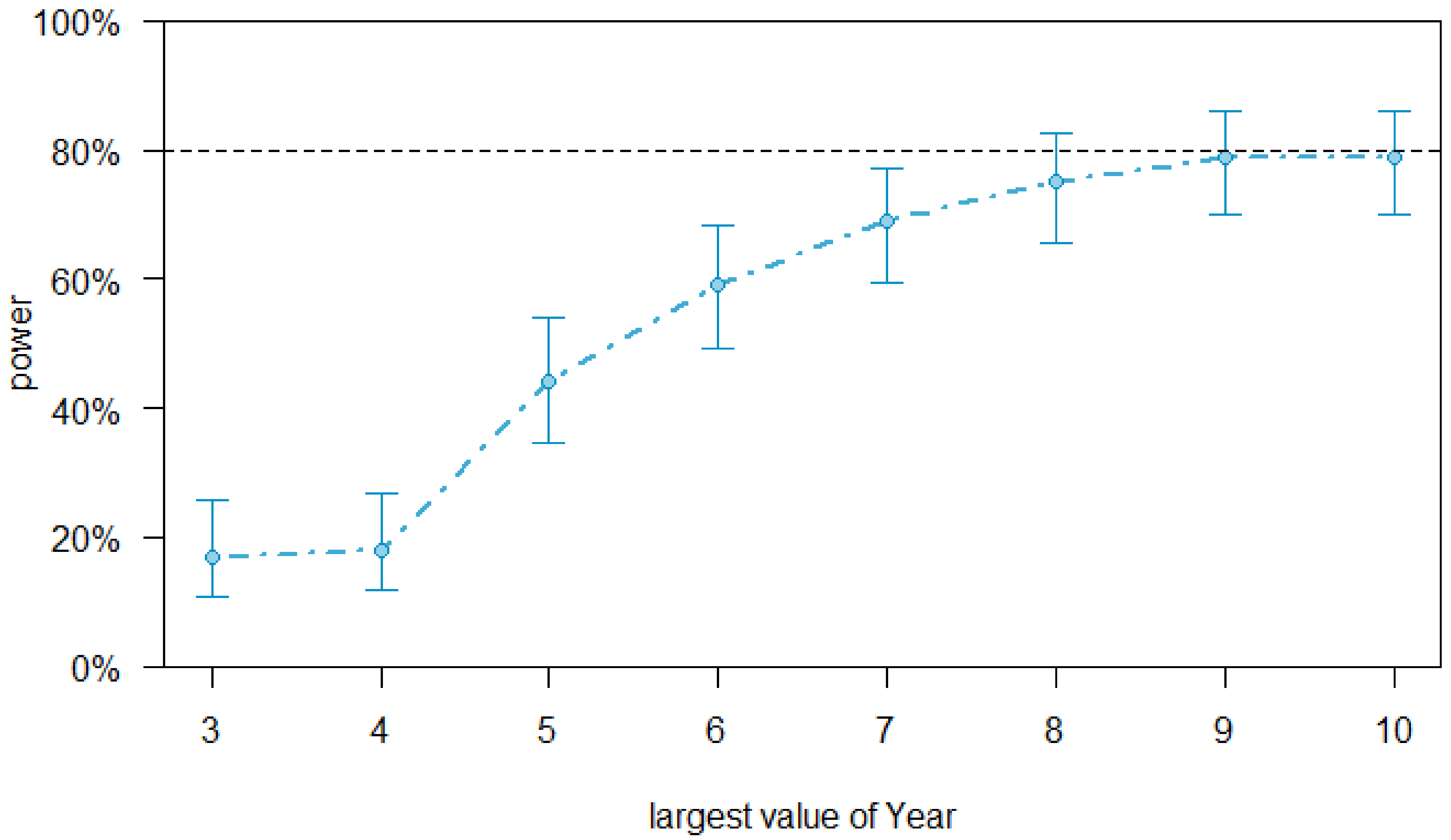

Least Tern Fledglings/Breeding Pair
3-Year Running Average Fledge Ratio
Lutey (2002) Objective
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


Piping Plover Fledglings/Breeding Pair
3-Year Running Average Fledge Ratio
Lutey (2002) Objective
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

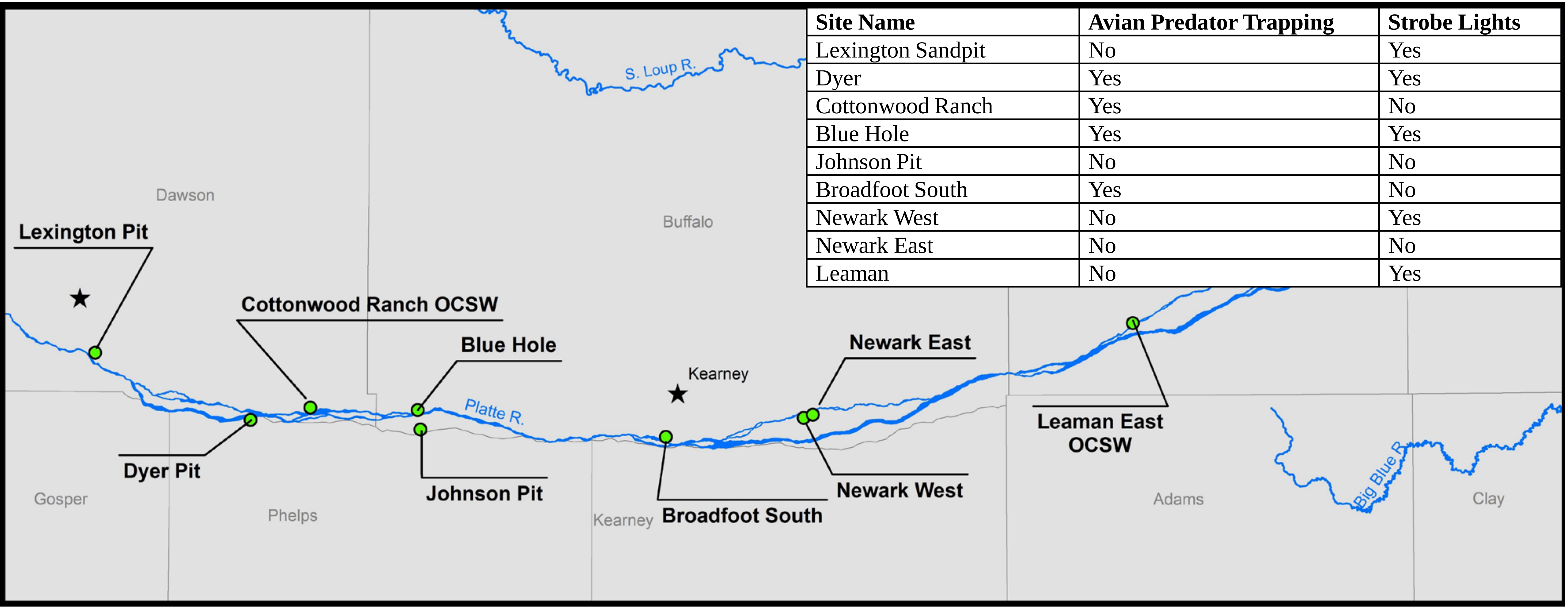
Power Analysis

- Data – PIPL fledglings per nest 2012 – 2019
  - 2012-2016 = Avian management
  - 2017-2019 = No avian management
- Assumed fledglings per nest
  - 0.75 = No avian management
  - 1.06 = Strobe lights
  - 1.06 = Avian trapping
  - 1.50 = Strobe lights and avian trapping





100%
80%
60%
40%
20%
0%
power
3
4
5
6
7
8
9
10
largest value of Year



Site Name	Avian Predator Trapping	Strobe Lights
Lexington Sandpit	No	Yes
Dyer	Yes	Yes
Cottonwood Ranch	Yes	No
Blue Hole	Yes	Yes
Johnson Pit	No	No
Broadfoot South	Yes	No
Newark West	No	Yes
Newark East	No	No
Leaman	No	Yes