

***Guadalupe, San Antonio, Mission, & Aransas Rivers and  
Mission, Copano, Aransas, & San Antonio Bays  
Basin and Bay Area Stakeholder Committee (GSA BBASC)***

***Technical Analyses of GSA  
BBEST Recommendations –  
Part 2: Mid-Basin Project***

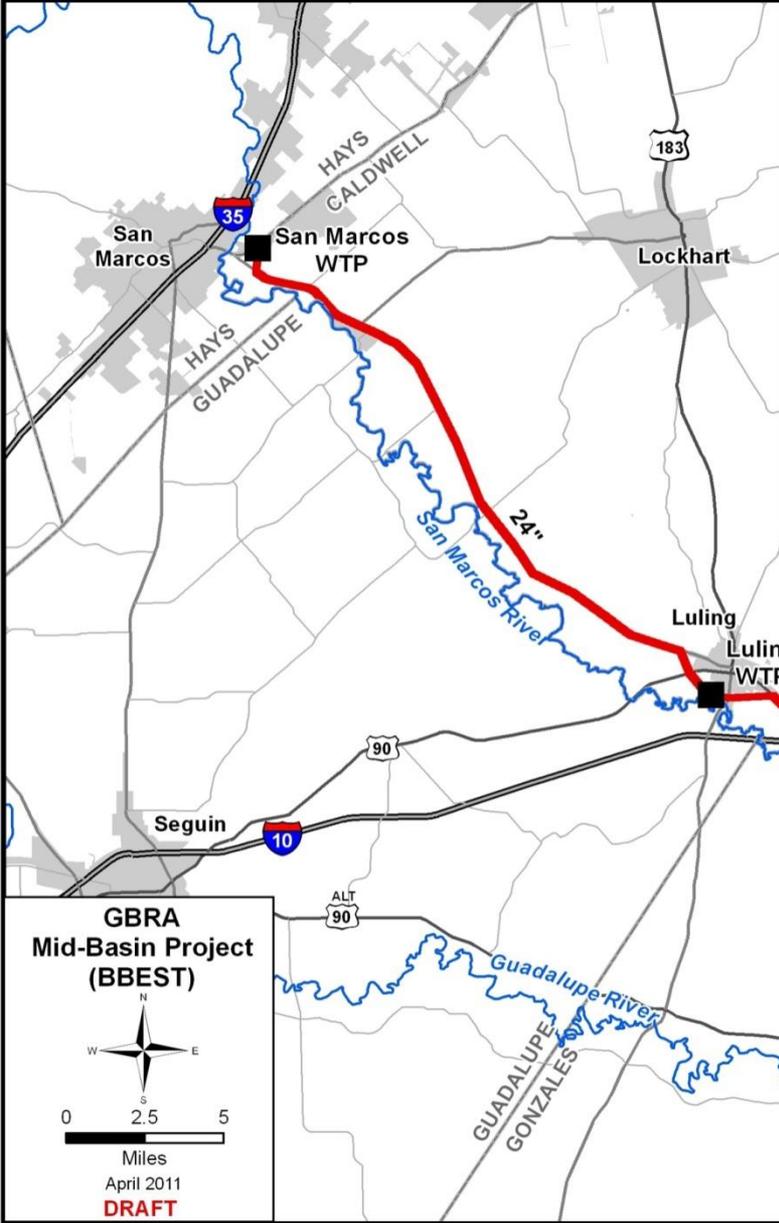
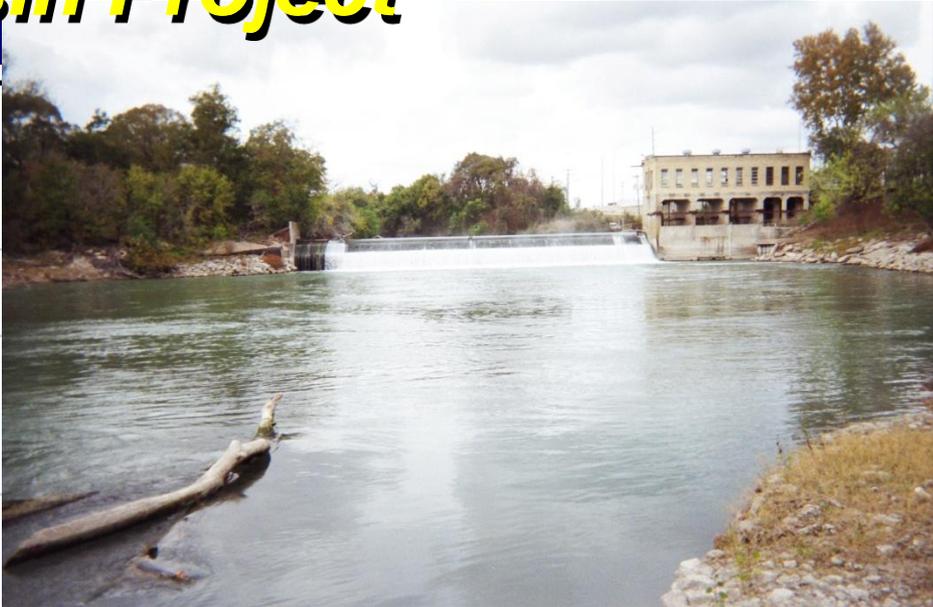
**Brian Perkins, PE  
Ed Oborny  
Norman Johns, PhD**

**May 4, 2011**

# ***Presentation Format***

- 1) Project Description**
- 2) Project Hydrology: Firm Yield**
- 3) Project Cost**
- 4) Instream Ecology**
- 5) Estuary Ecology**
  
- 6) Questions / Clarifications**
  
- 7) Discussion by the BBASC**

# Mid-Basin Project



**GBRA**  
**Mid-Basin Project**  
**(BBEST)**

0 2.5 5  
Miles  
April 2011  
**DRAFT**

Potential Reservoir Site  
Pump Station  
Intake and Pump Station

# ***Mid-Basin Project***

- ❑ **Diversions from Guadalupe River @ Gonzales**
- ❑ **Maximum Diversion Rate of 500 cfs**
- ❑ **2 - 96-inch Diversion Pipelines**
- ❑ **105,500 acft of Off-Channel Storage near Goliad**
- ❑ **Uniform Delivery of Firm Yield to Luling and San Marcos WTPs**
  
- ❑ **Scenarios:**
  - **No Environmental Flow**
  - **Lyons Method**
  - **CCEFN**
  - **BBEST Recommendations**



# ***Mid-Basin Project***

- ❑ **No Environmental Flow**
  - **Theoretical maximum firm yield of project subject to downstream senior water rights only.**
- ❑ **Lyons Method**
  - **TCEQ desktop environmental flow used in permitting. Uses 40% (Oct – Feb) and 60% (Mar – Sept) of monthly medians as flow criteria.**
- ❑ **Consensus Criteria for Environmental Flow Needs (CCEFN)**
  - **TWDB default 3-tiered (Medians, Quartiles, and 7Q2) flow criteria used in regional planning.**
- ❑ **BBEST Recommendations**
  - **Full flow regime recommendation of the GSA BBEST.**

# Mid-Basin Project

## ❑ No Environmental Flow (cfs)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

## ❑ Lyons Method (cfs)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
398.2	399.0	668.8	794.8	839.7	766.2	544.2	443.5	499.3	366.6	345.3	333.2

## ❑ Consensus Criteria for Environmental Flow Needs (CCEFN) (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Median</b>	820.6	887.5	867.3	923.5	1068.6	945.0	755.3	641.0	691.8	733.1	742.6	793.7
<b>Quartile</b>	580.3	610.0	585.9	581.1	625.8	576.5	545.0	545.0	545.0	545.0	545.0	531.8
<b>7Q2</b>	545.0	545.0	545.0	545.0	545.0	545.0	545.0	545.0	545.0	545.0	545.0	545.0

# Mid-Basin Project

## BBEST Recommendations

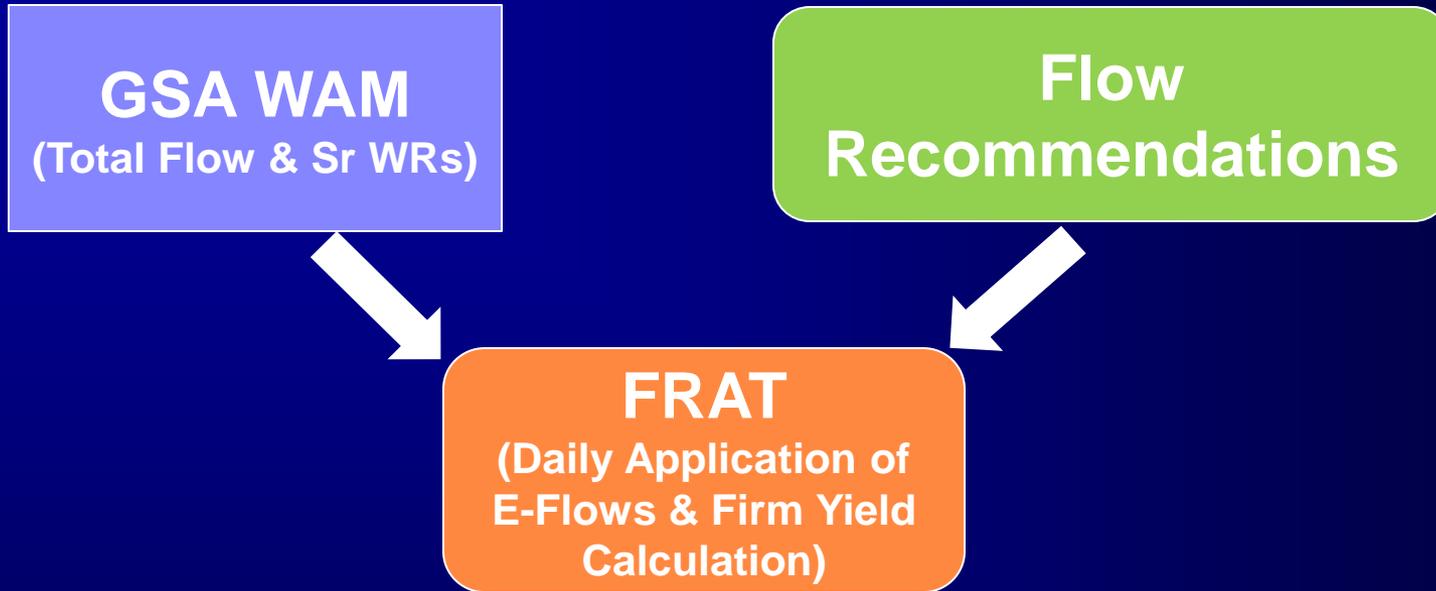
<b>Overbank Flows</b>	Qp: 36,700 cfs with Average Frequency 1 per 5 years Regressed Volume is 492,000 Duration Bound is 70											
	Qp: 24,400 cfs with Average Frequency 1 per 2 years Regressed Volume is 306,000 Duration Bound is 57											
	Qp: 14,300 cfs with Average Frequency 1 per year Regressed Volume is 165,000 Duration Bound is 43											
<b>High Flow Pulses</b>	Qp: 4,140 cfs with Average Frequency 1 per season Regressed Volume is 48,300 Duration Bound is 29			Qp: 6,590 cfs with Average Frequency 1 per season Regressed Volume is 58,400 Duration Bound is 24			Qp: 1,760 cfs with Average Frequency 1 per season Regressed Volume is 14,800 Duration Bound is 14			Qp: 4,330 cfs with Average Frequency 1 per season Regressed Volume is 41,200 Duration Bound is 23		
	Qp: 1,150 cfs with Average Frequency 2 per season Regressed Volume is 9,640 Duration Bound is 13			Qp: 3,250 cfs with Average Frequency 2 per season Regressed Volume is 26,900 Duration Bound is 17			Qp: 950 cfs with Average Frequency 2 per season Regressed Volume is 7,060 Duration Bound is 10			Qp: 1,410 cfs with Average Frequency 2 per season Regressed Volume is 11,400 Duration Bound is 13		
<b>Base Flows (cfs)</b>	860			870			800			810		
	690			650			650			690		
	540			440			440			510		
<b>Subsistence Flows (cfs)</b>	210			210			210			180		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Winter			Spring			Summer			Fall		

<b>Flow Levels</b>	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

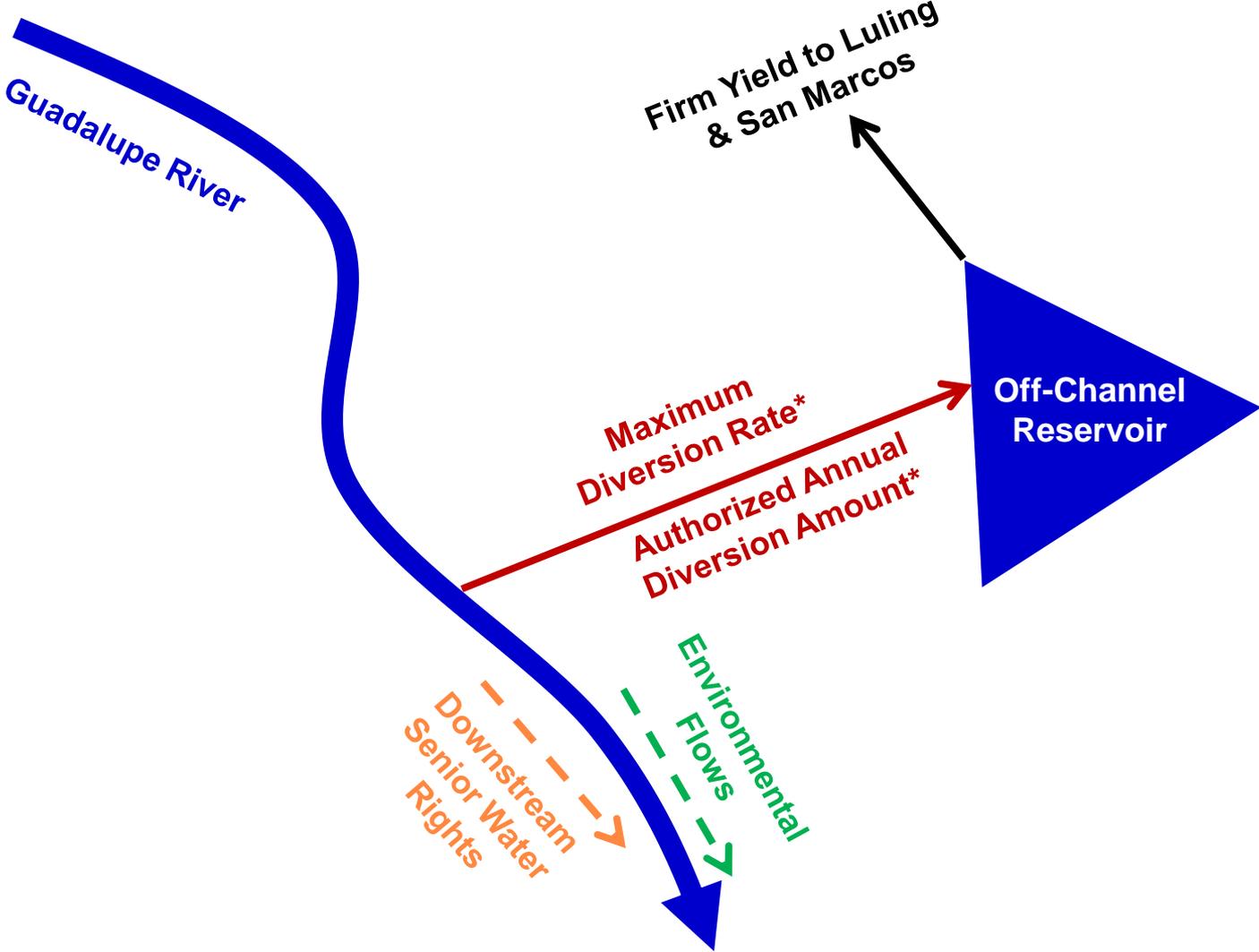
**Notes:**

1. Period of Record used : 1/1/1940 to 12/31/2009.
2. Volumes are in acre-feet and durations are in days.

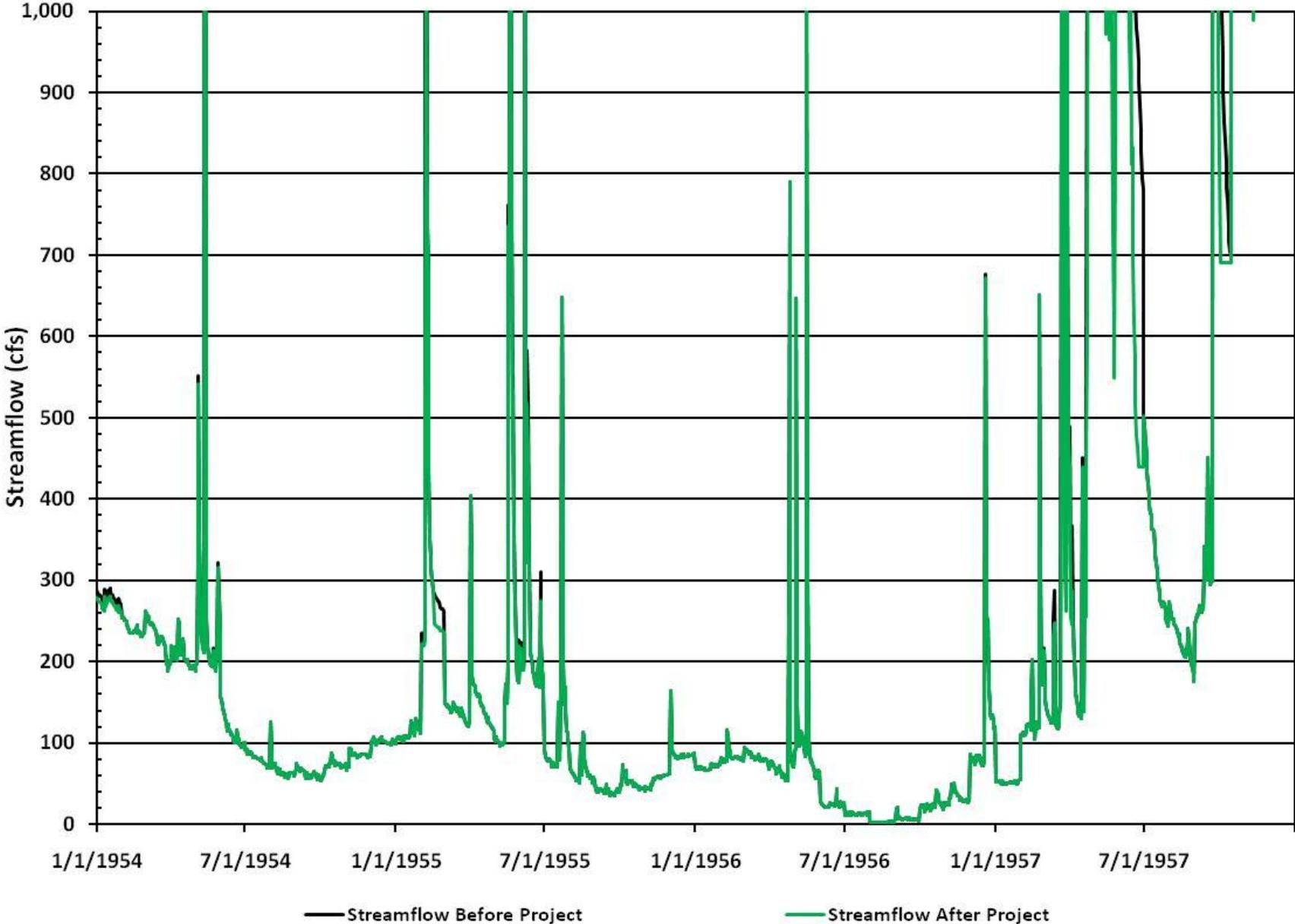
# ***Mid-Basin Project***



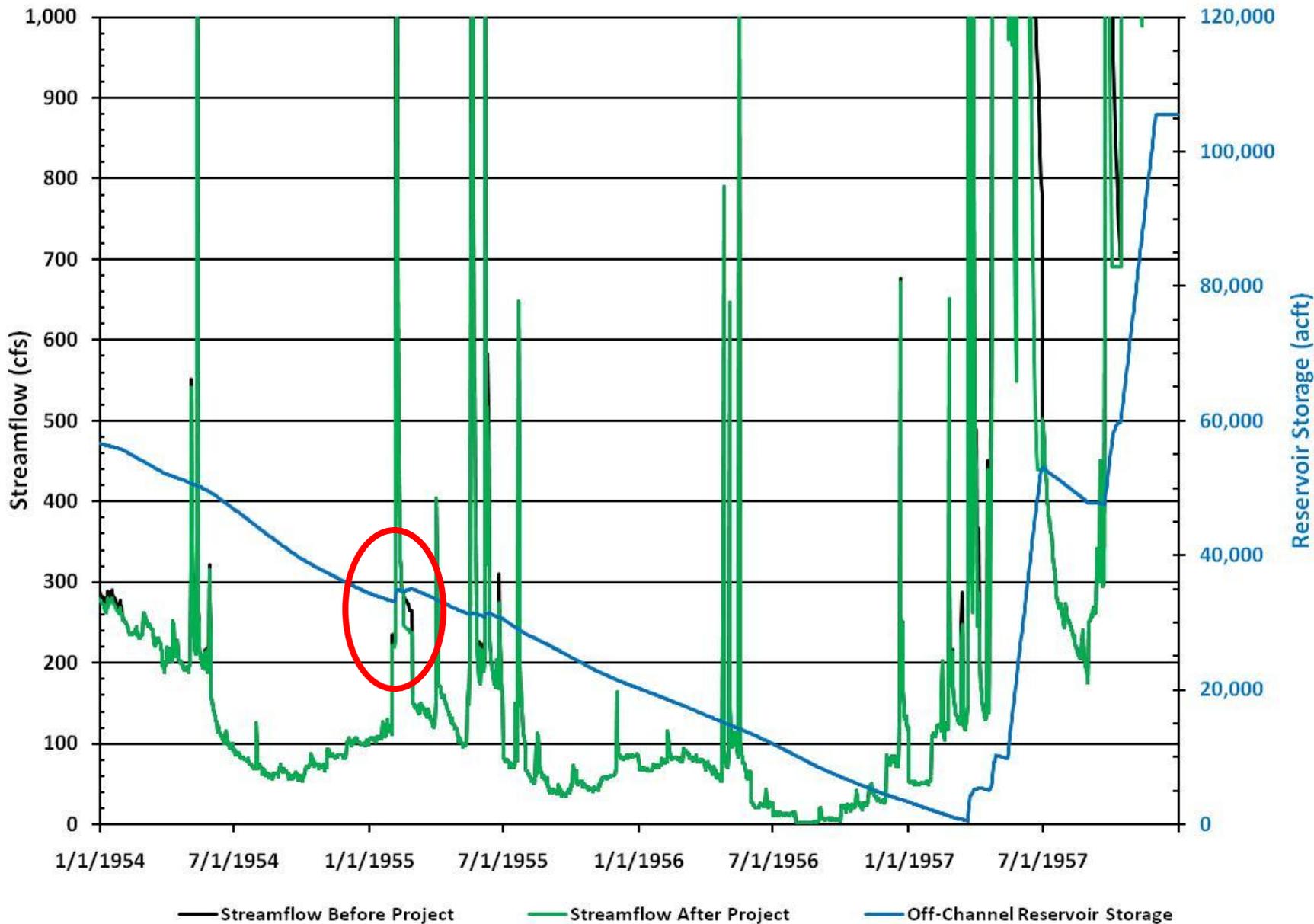
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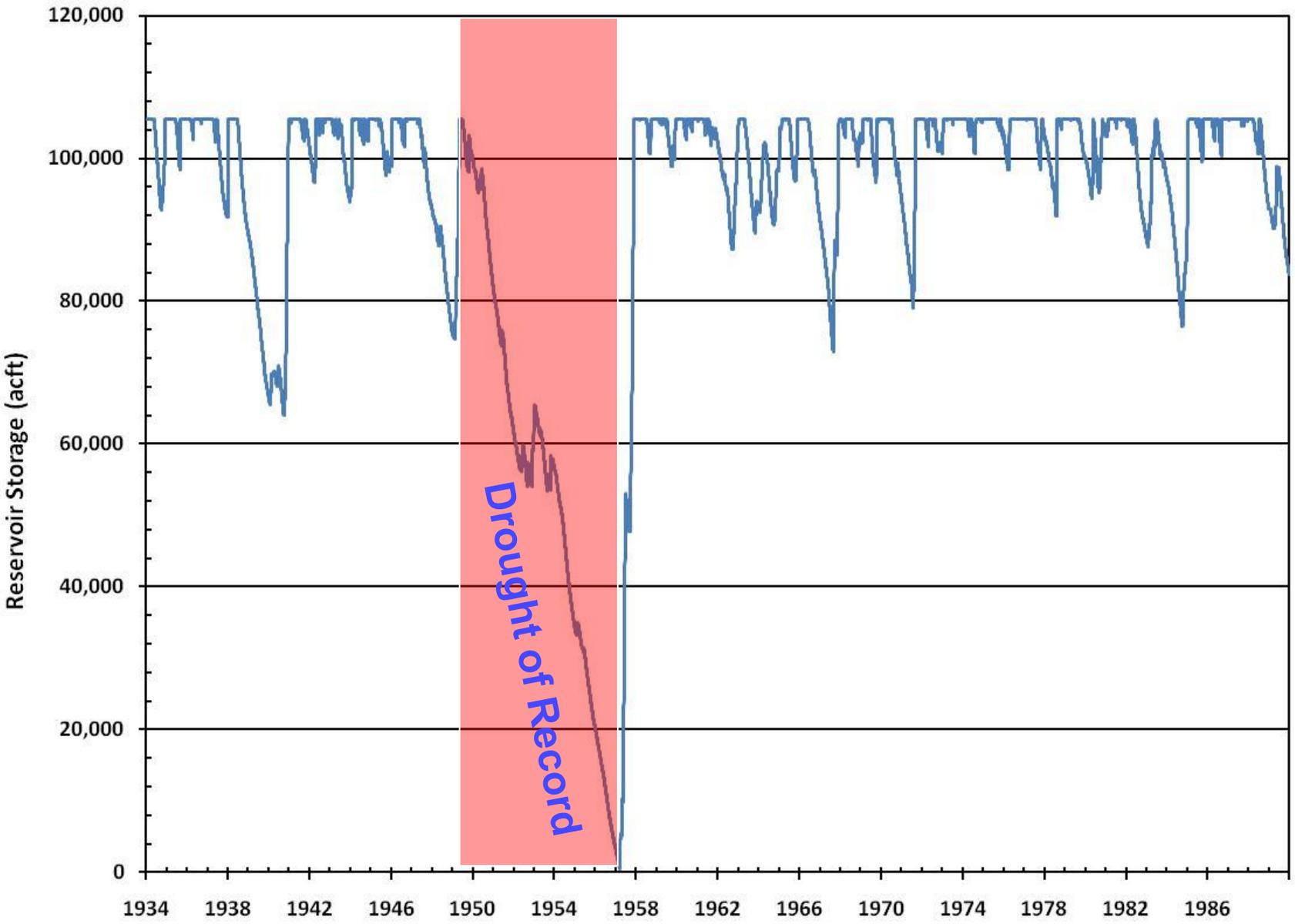
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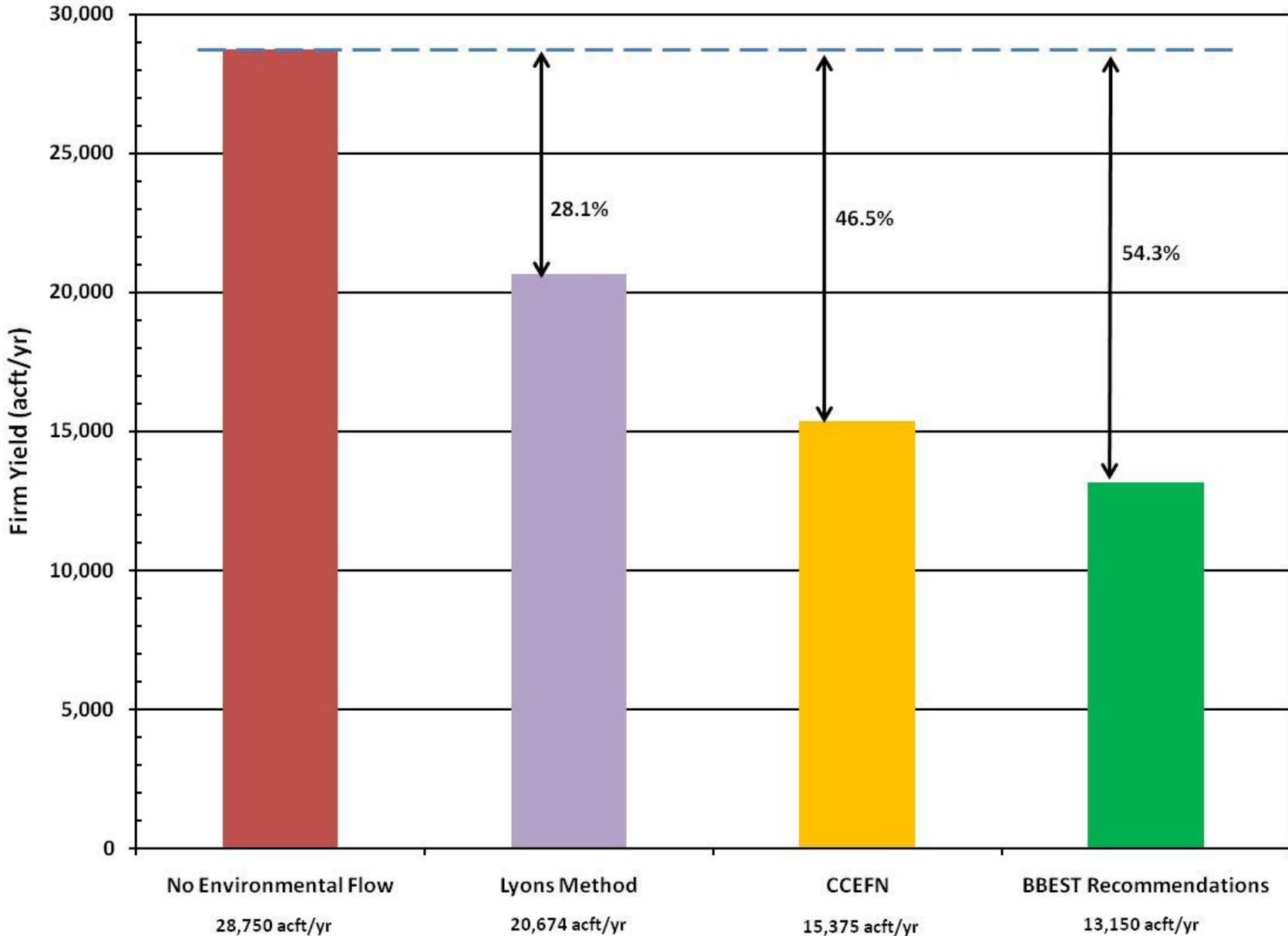
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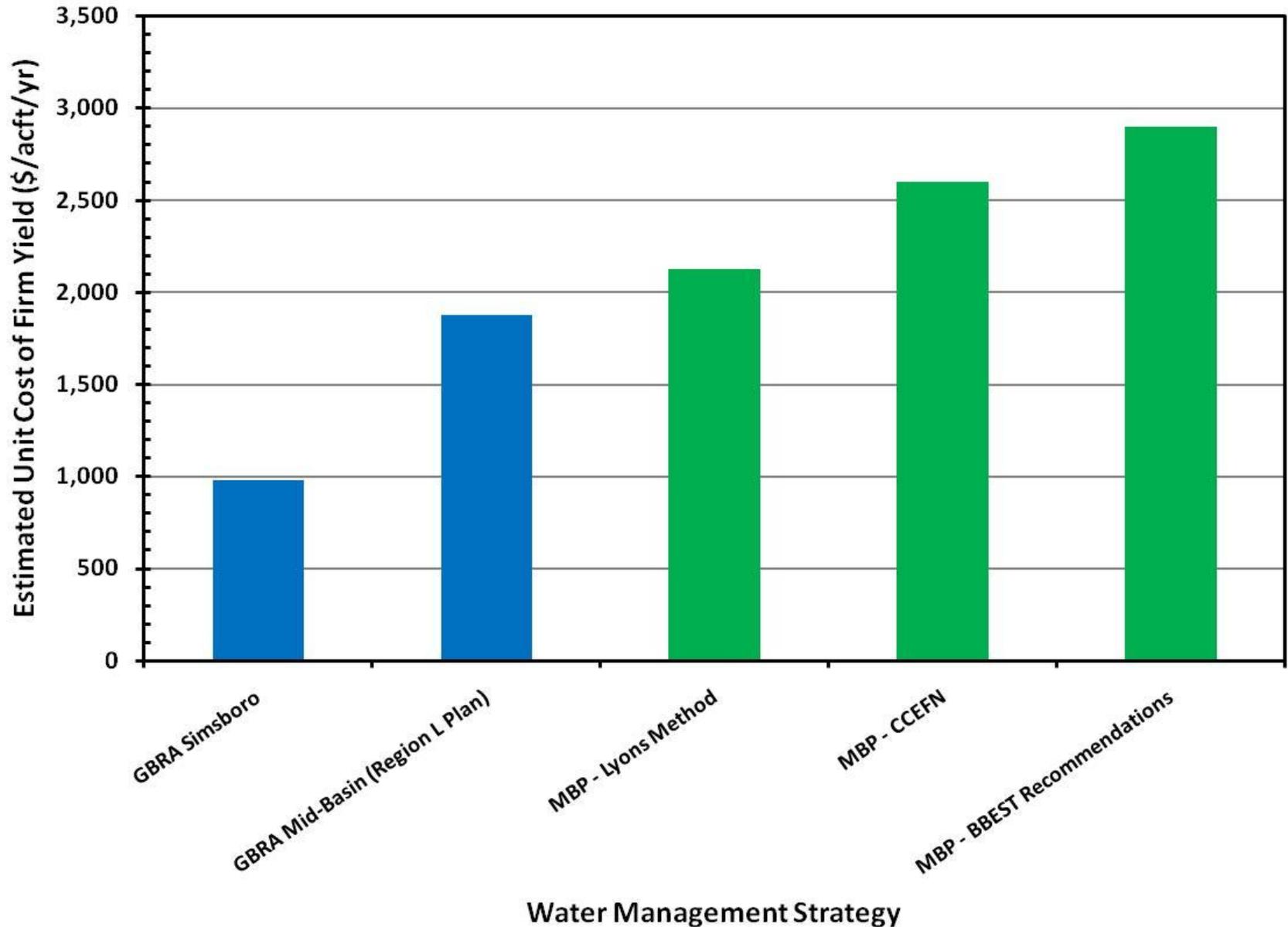
# Mid-Basin Project



# Mid-Basin Project

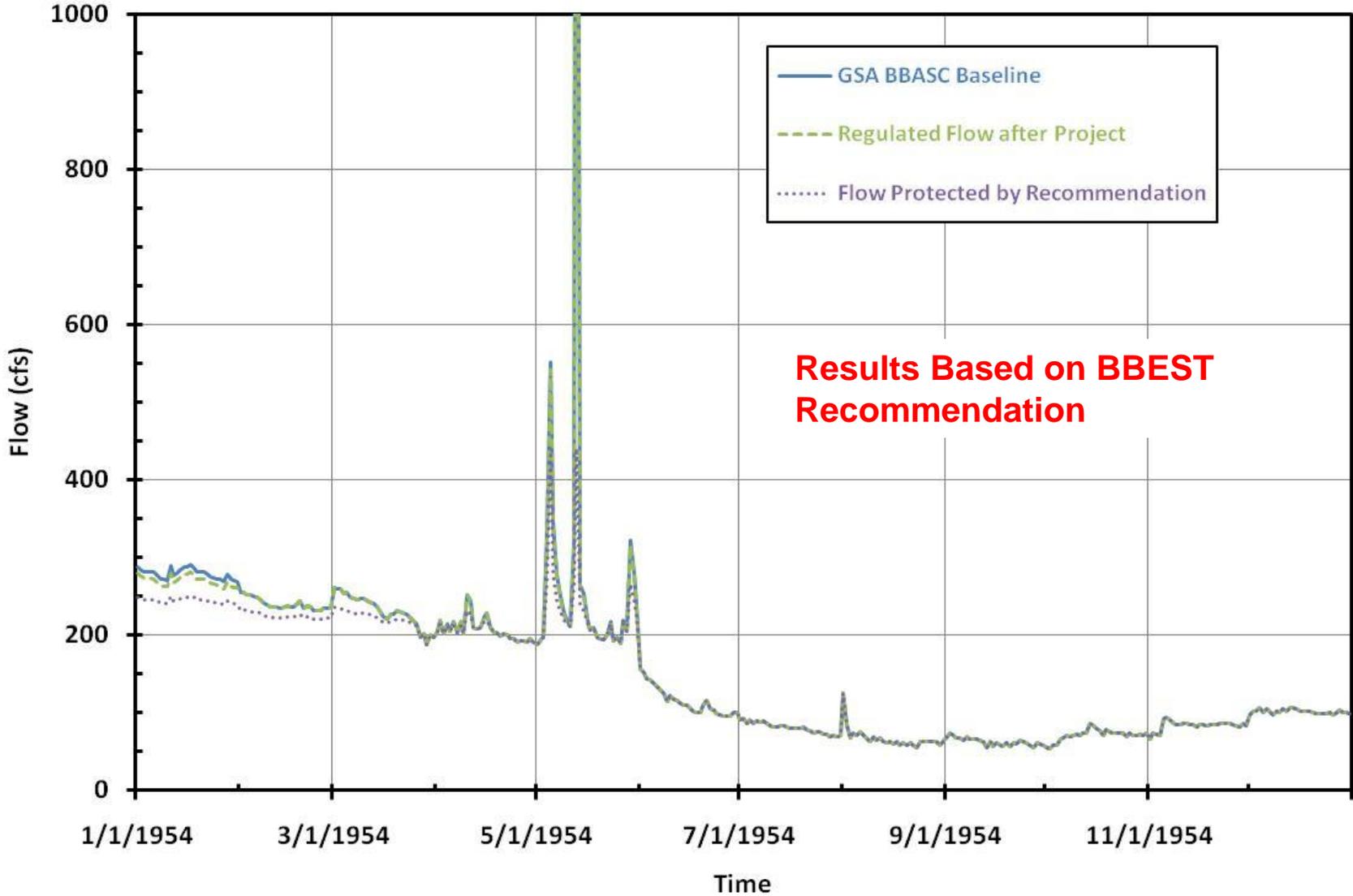
	No Environmental Flow	Lyons Method	CCEFN	BBEST Recommendation
Available Project Yield (acft/yr)	28,750	20,674	15,375	13,150
<b>Raw Water at Reservoir</b>				
Total Project Cost	\$262,321,000	\$262,321,000	\$262,321,000	\$262,321,000
Total Annual Cost	\$23,929,000	\$23,875,000	\$23,657,000	\$23,584,000
Annual Cost of Raw Water (\$ per acft)	\$832	\$1,155	\$1,539	\$1,793
Annual Cost of Raw Water (\$ per 1,000 gallons)	\$2.55	\$3.54	\$4.72	\$5.50
<b>Treated Water Delivered</b>				
Total Project Cost	\$485,924,000	\$424,777,000	\$395,727,000	\$380,758,000
Total Annual Cost	\$50,735,000	\$43,913,000	\$39,933,000	\$38,145,000
Annual Cost of Water (\$ per acft)	\$1,765	\$2,124	\$2,597	\$2,901
Annual Cost of Water (\$ per 1,000 gallons)	\$5.42	\$6.52	\$7.97	\$8.90

# Mid-Basin Project



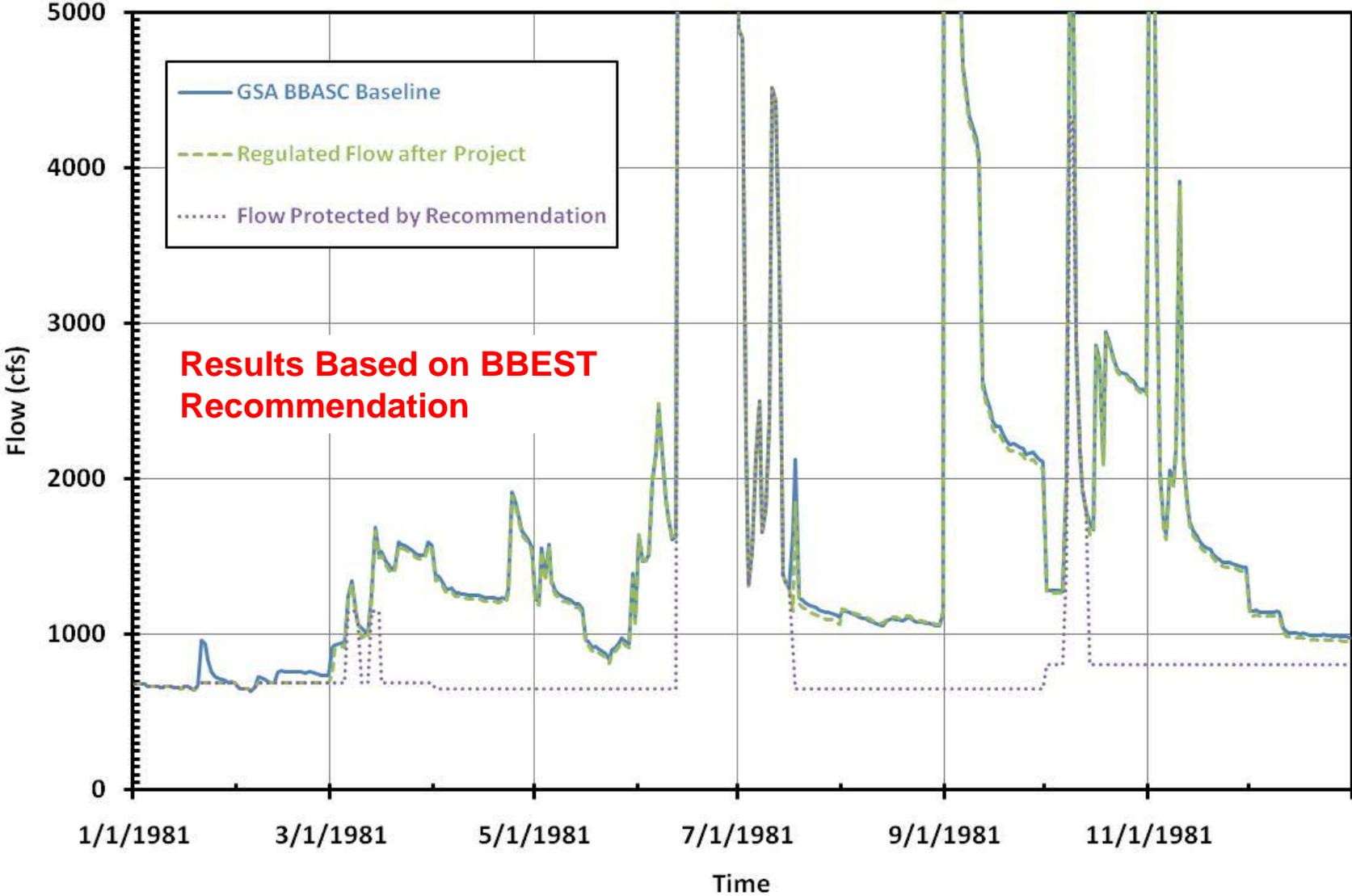
# Mid-Basin Project

Application Example - Dry Year



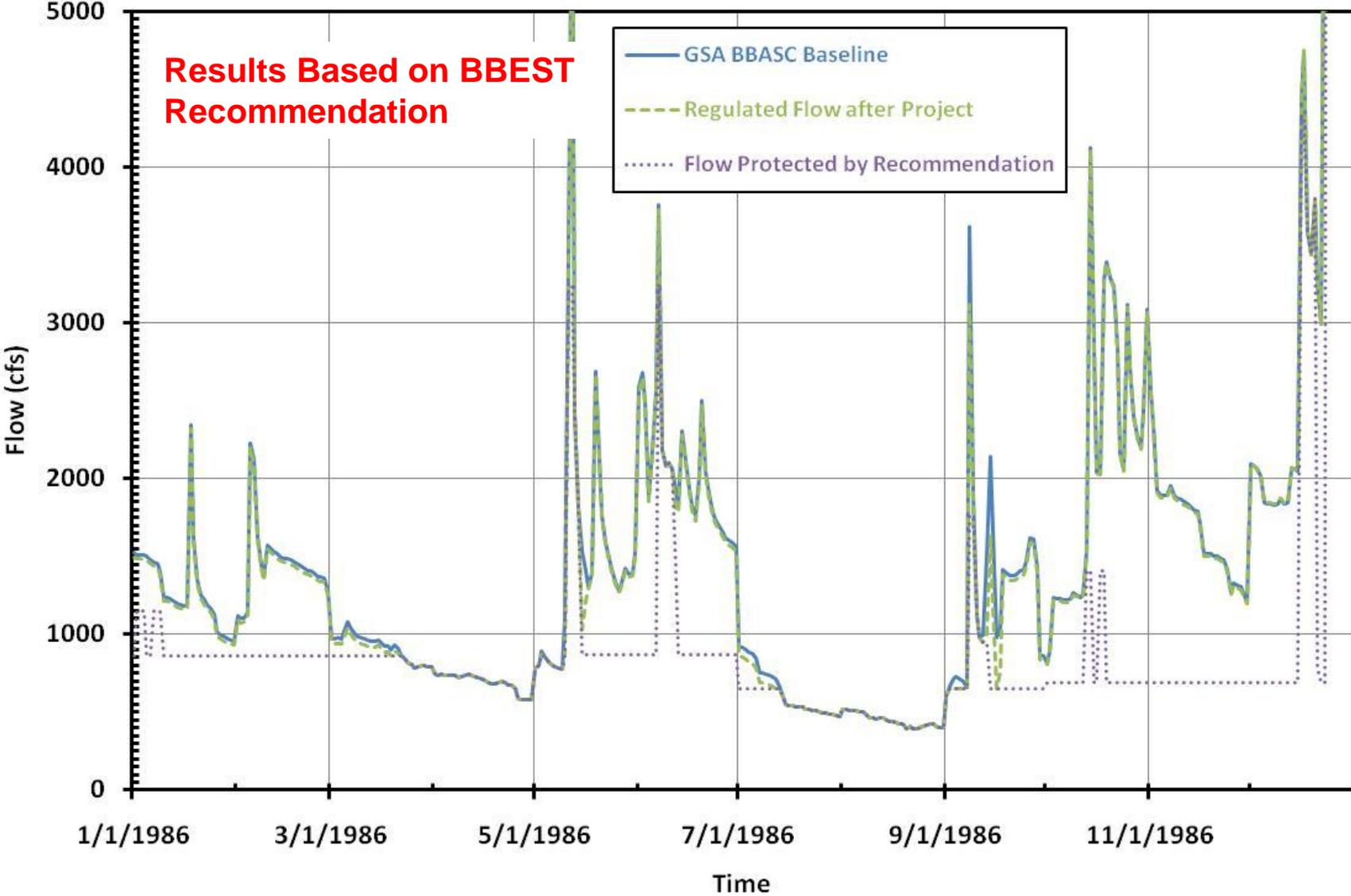
# Mid-Basin Project

Application Example - Average Year



# Mid-Basin Project

Application Example - Wet Year

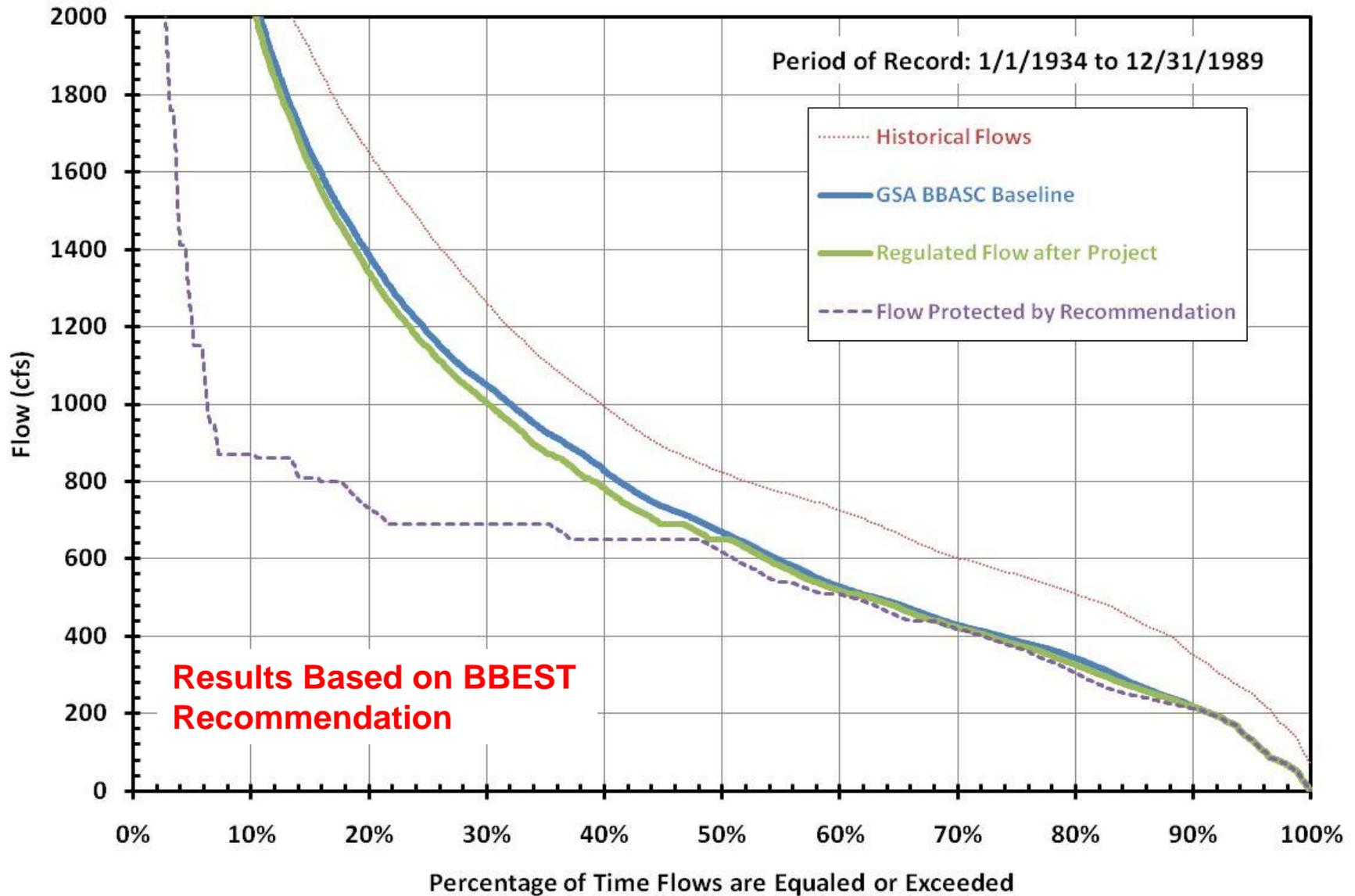


**Results Based on BBEST Recommendation**

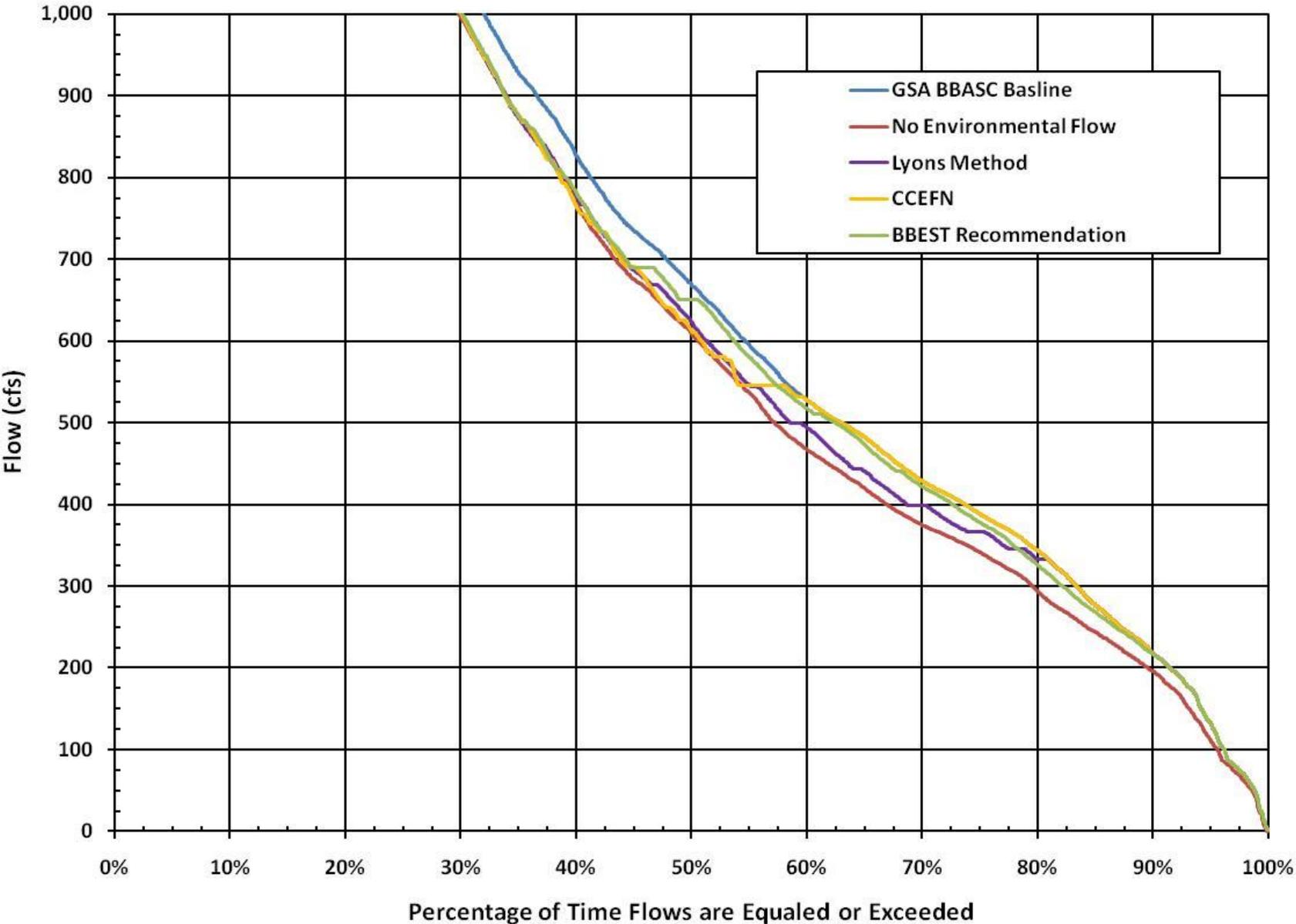
- GSA BBASC Baseline
- - - Regulated Flow after Project
- ..... Flow Protected by Recommendation

# Mid-Basin Project

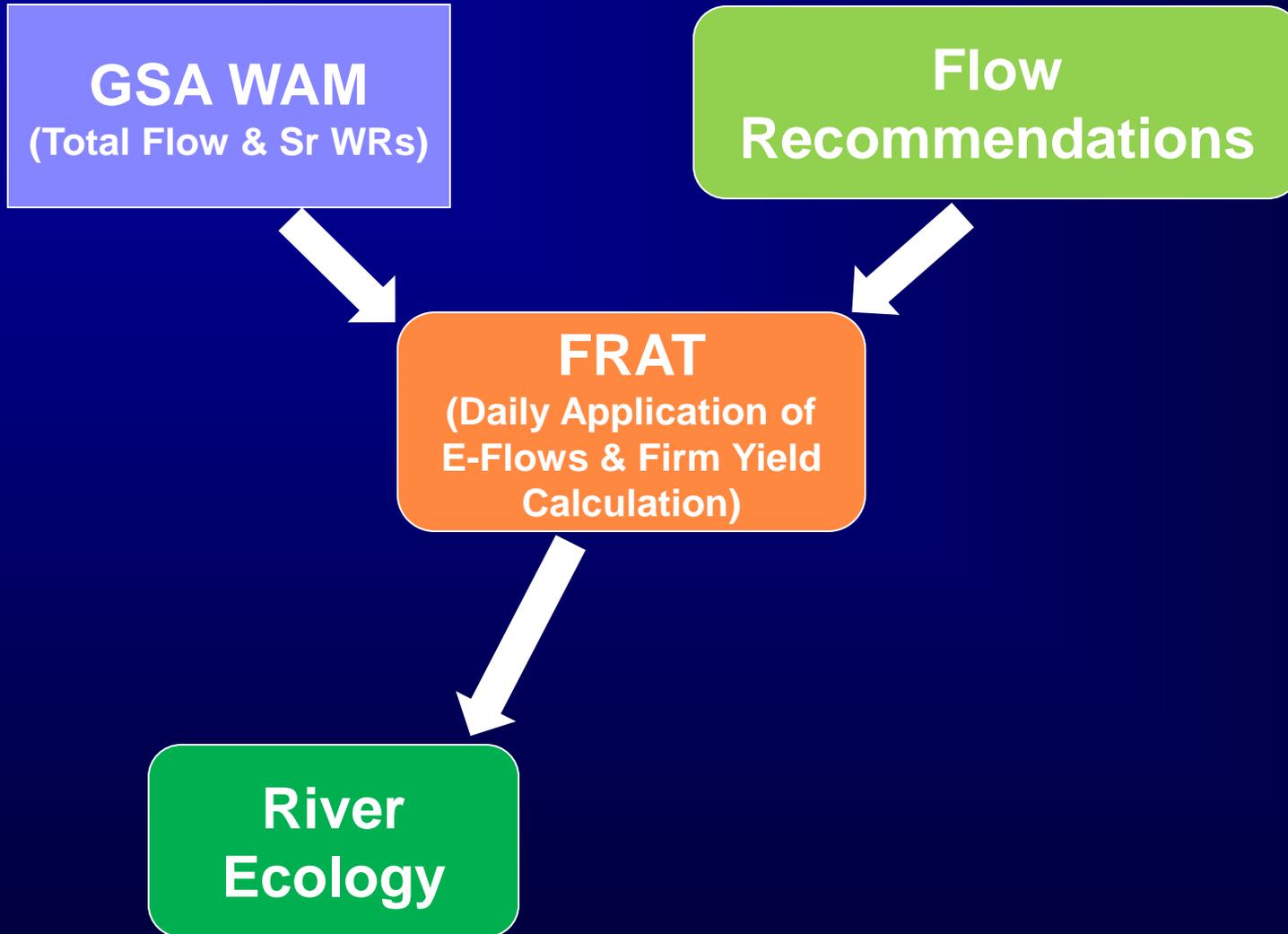
## Mid Basin Project - Annual Flow Frequency Curve



# Mid-Basin Project



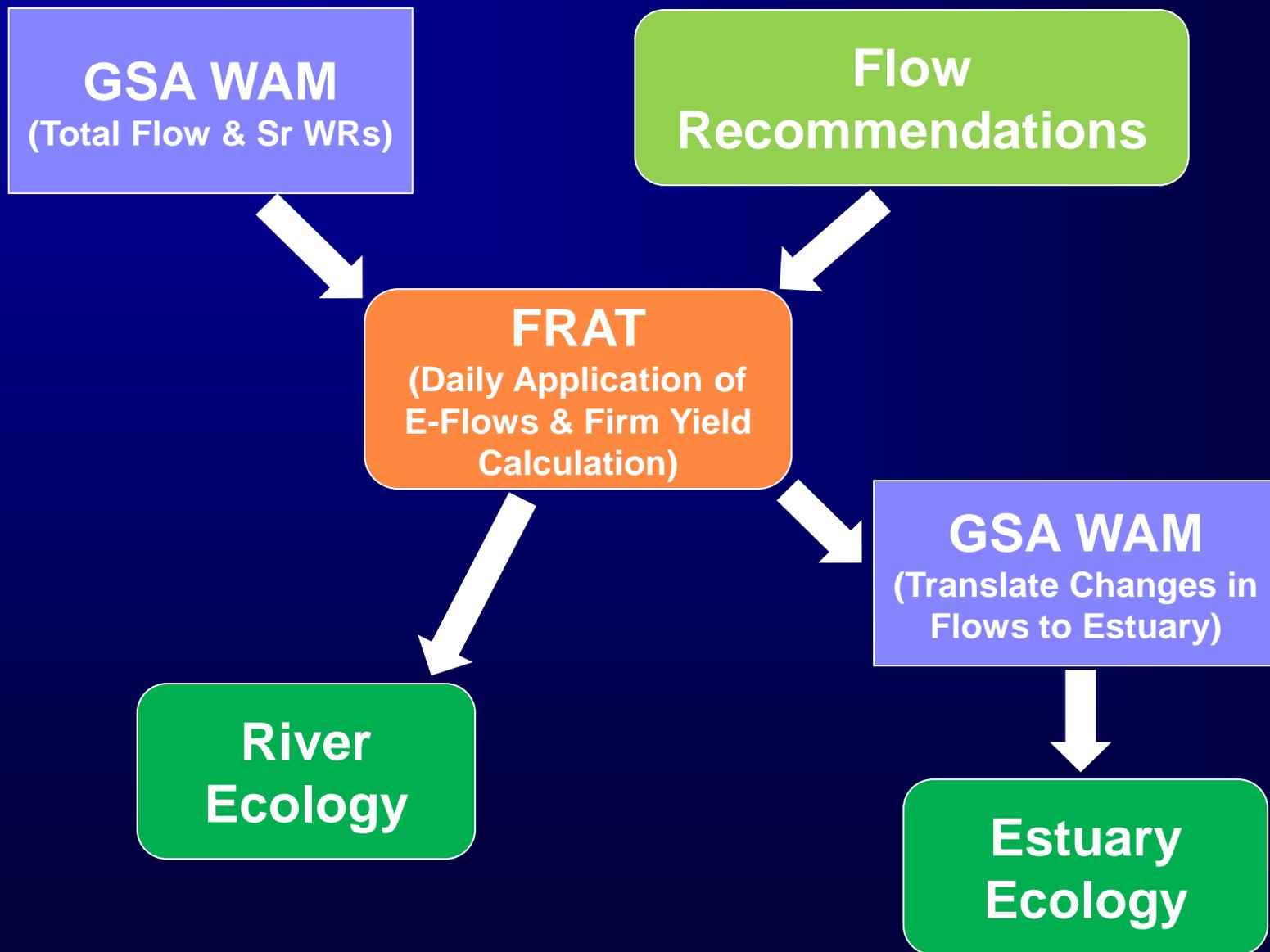
# Mid-Basin Project



# ***Mid-Basin Project***

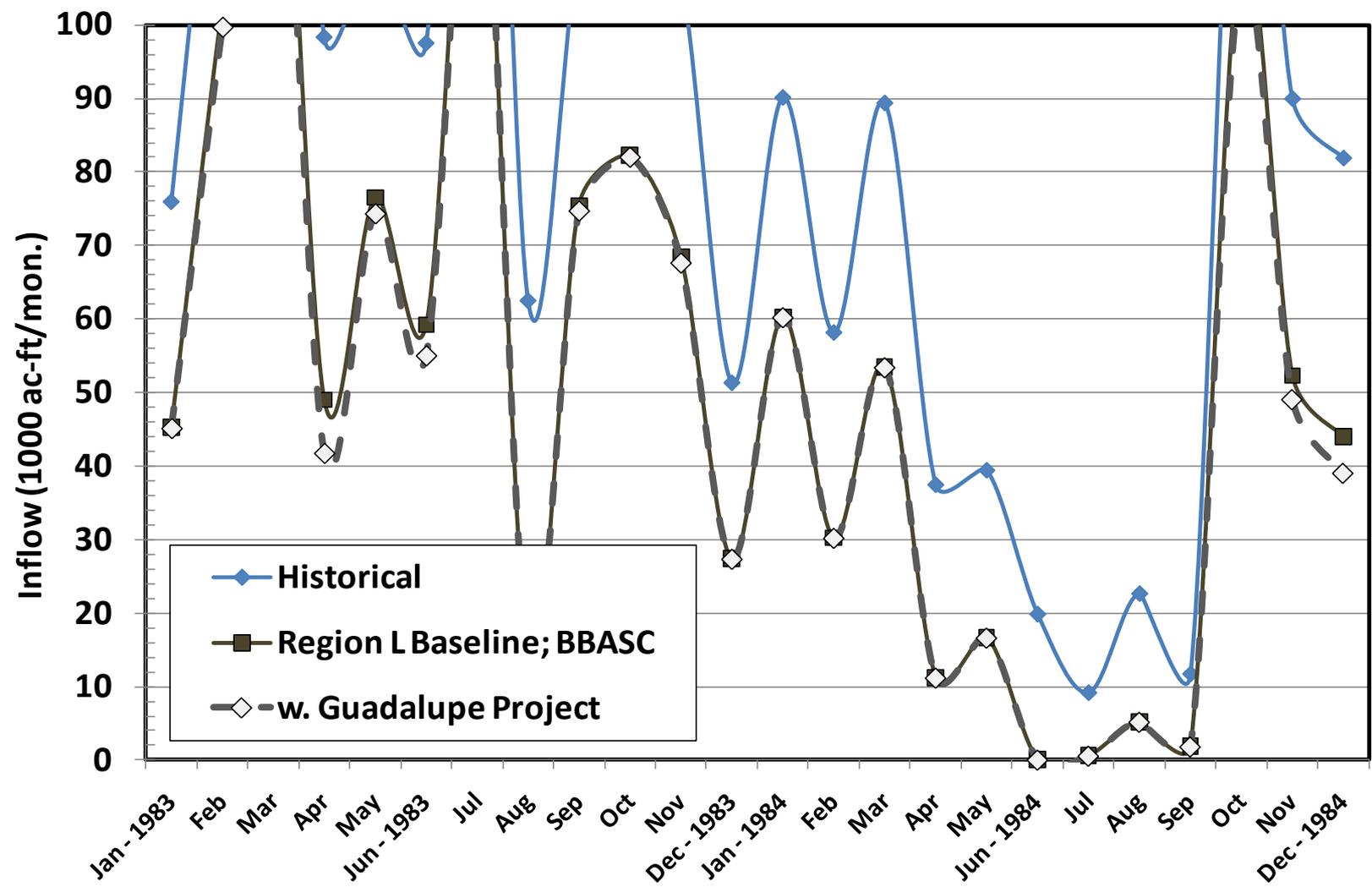
**BIO-WEST  
Presentation**

# Mid-Basin Project

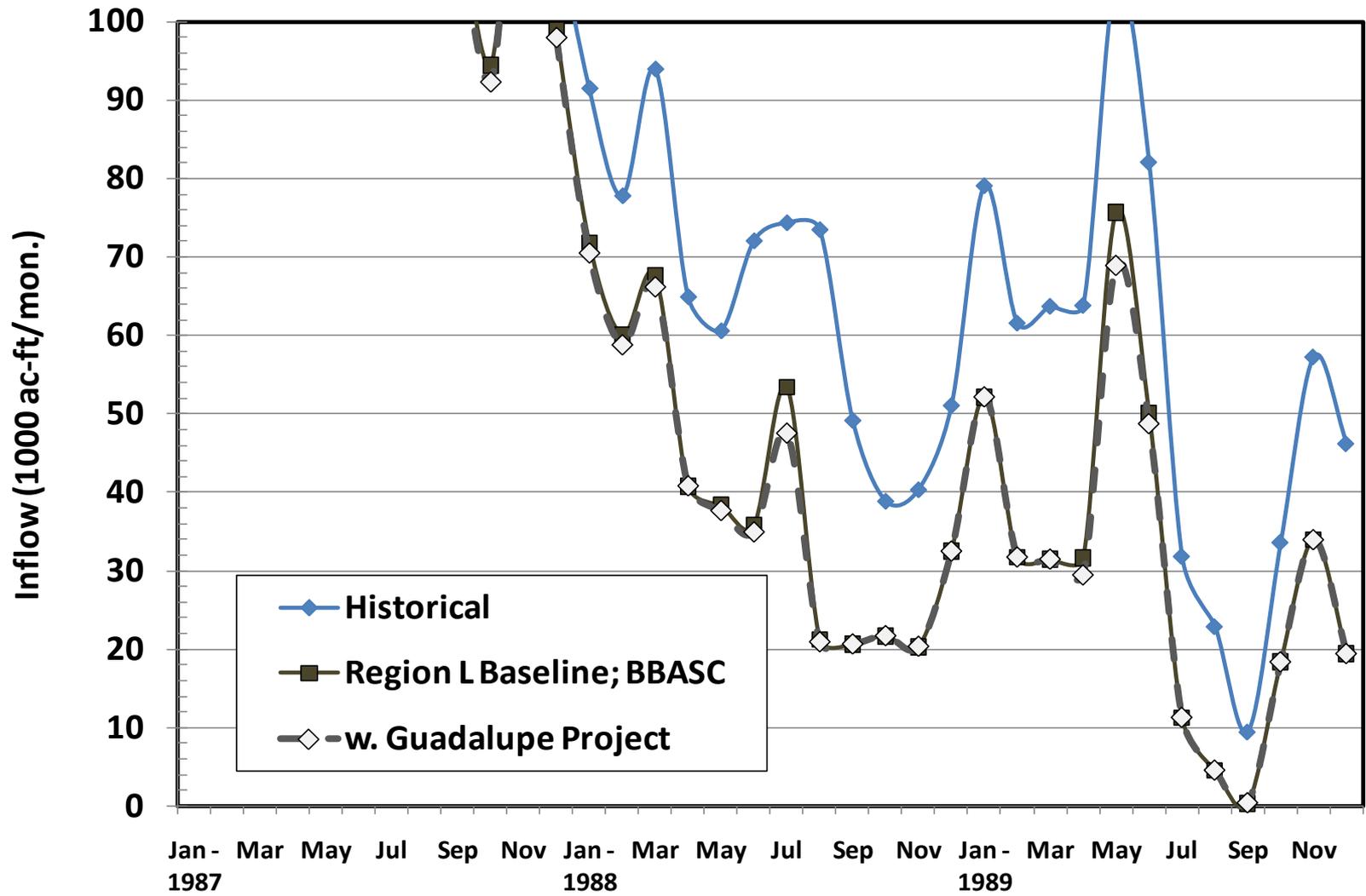


# ***Mid-Basin Project Slides***

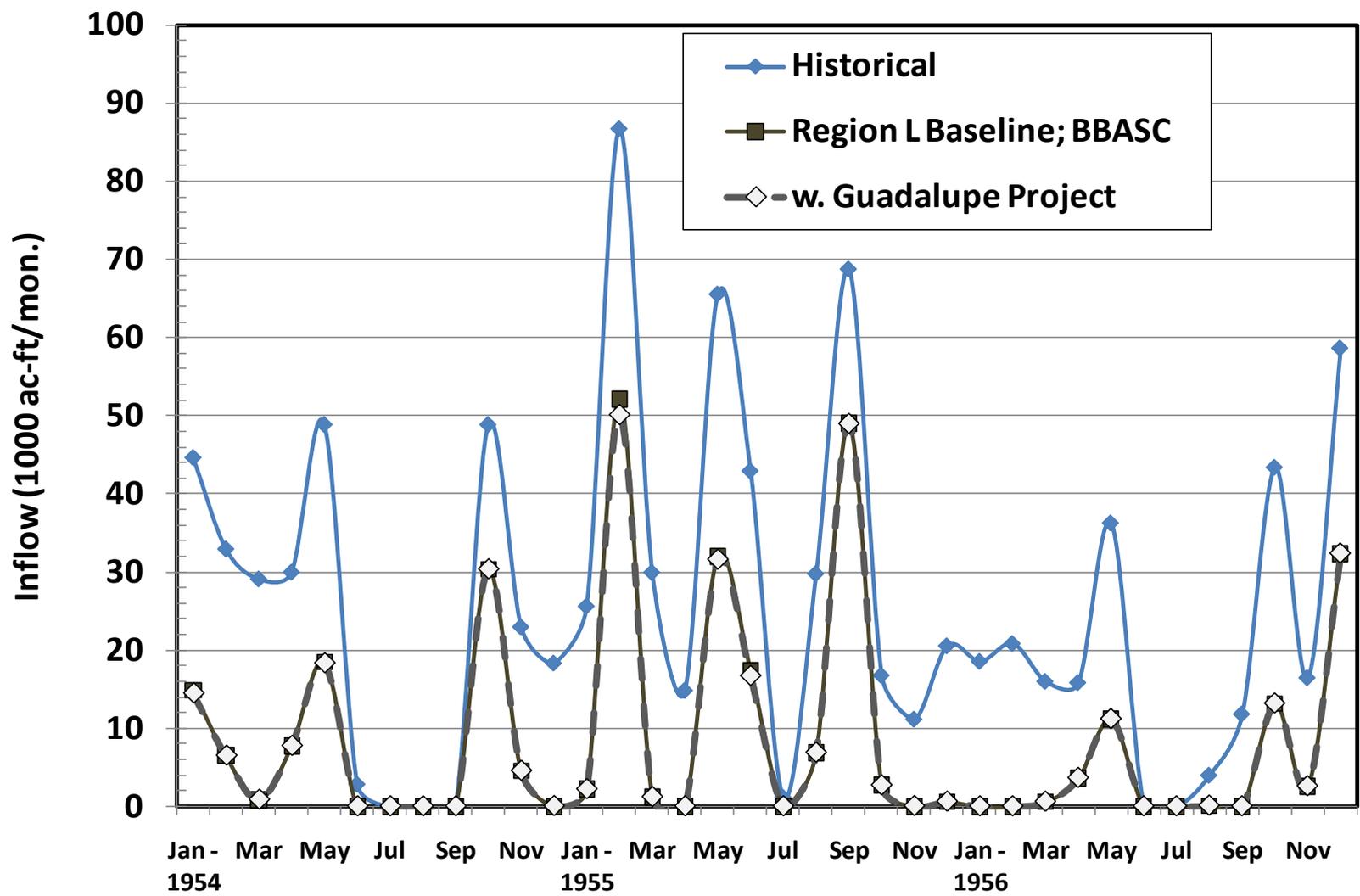
### Guadalupe Estuary - Inflows under various scenarios



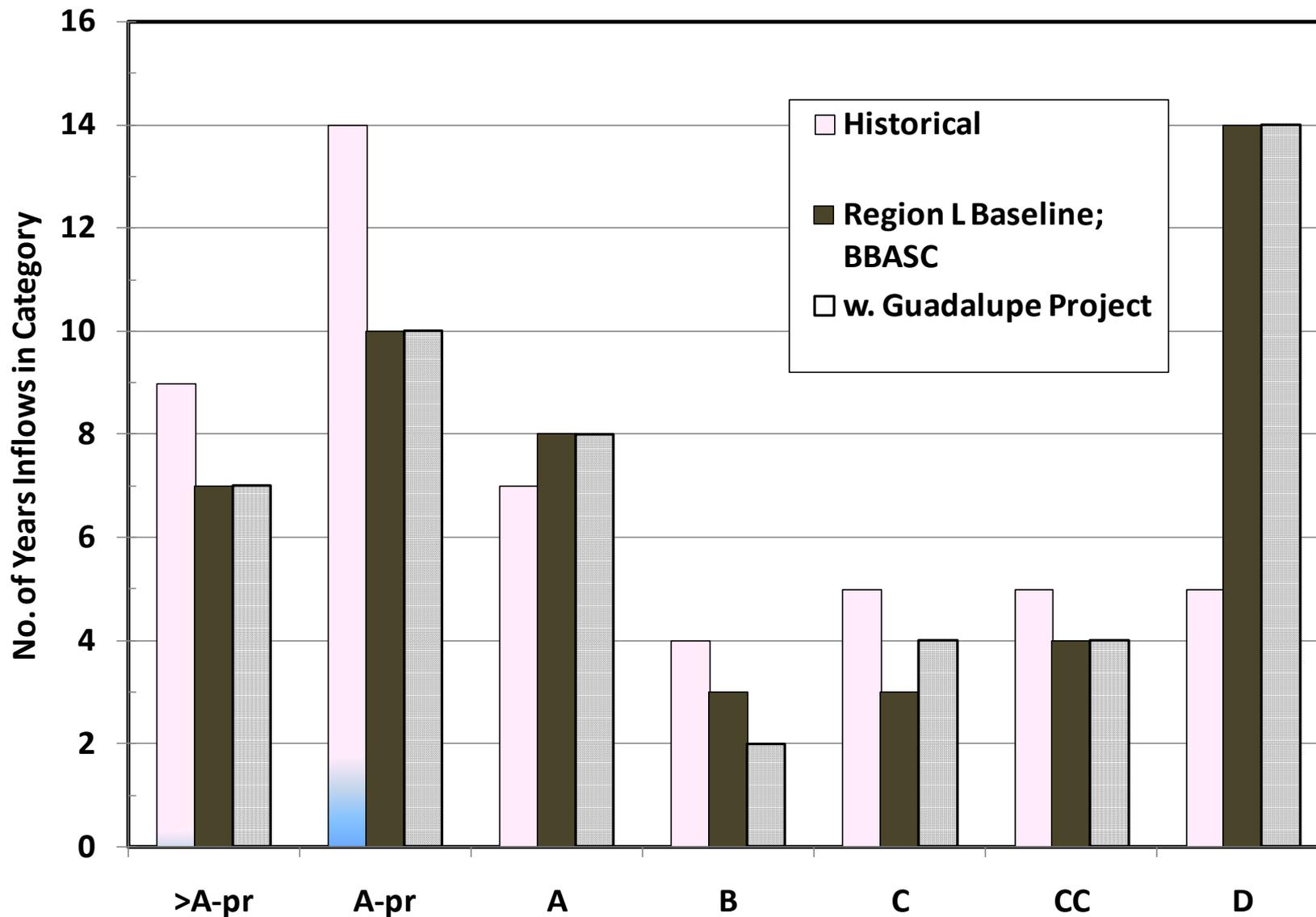
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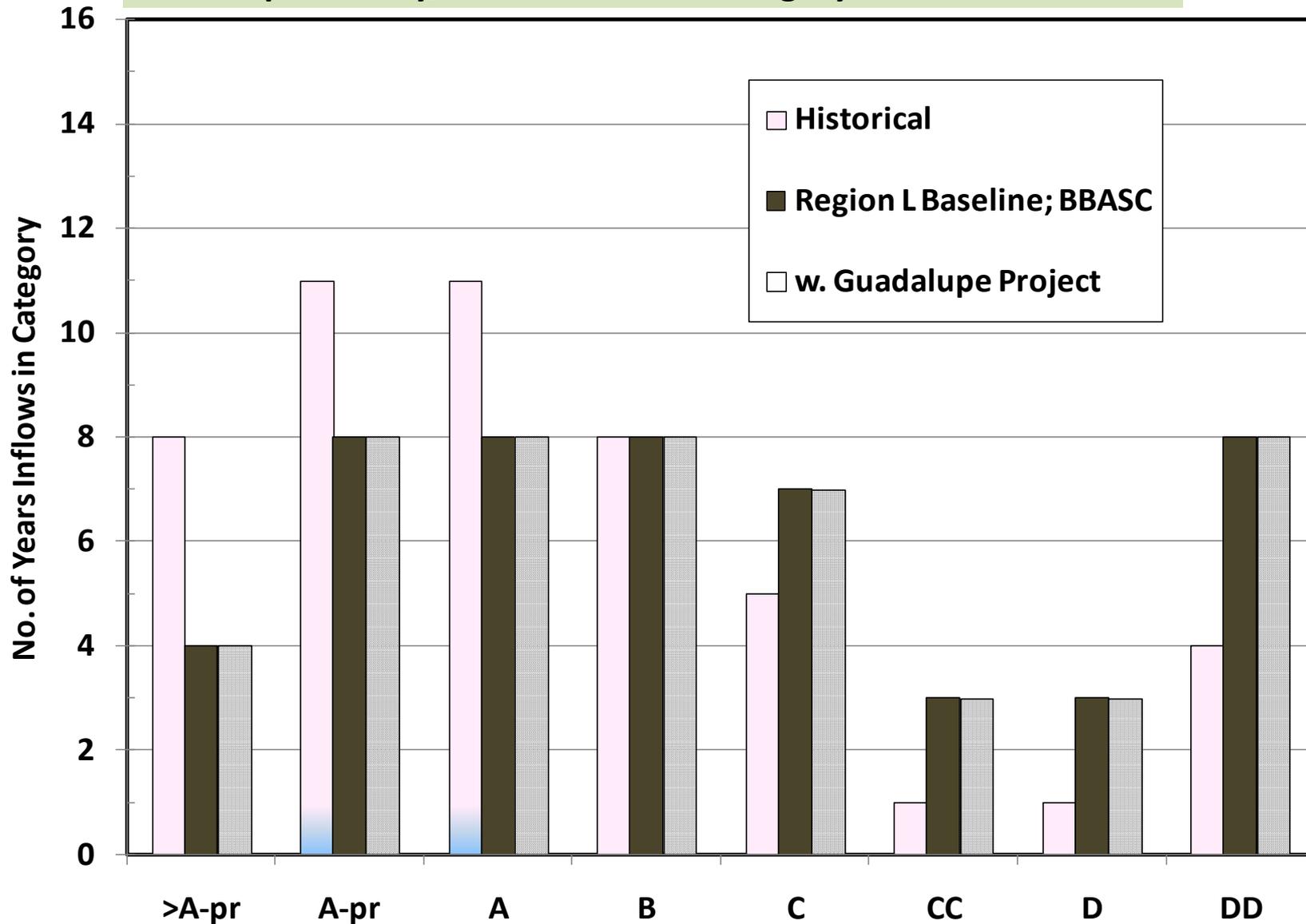
## Guadalupe Estuary - Inflows under various scenarios



# Guadalupe Estuary, Criteria Set G1 - Category Attainment 1941-89



# Guadalupe Estuary, Criteria Set G2 - Category Attainment 1941-89



# Summary – Attainment of G1 Springtime Criteria (Rangia) with the Mid-Basin Project

Counts	Criteria G1 Attainment (no. years)								sum
	>A-pr	A-pr	A	B	C	CC	D		
Historical	9	14	7	4	5	5	5	5	49
Present	8	14	4	5	5	5	5	8	49
Region L Baseline; BBASC	7	10	8	3	3	4	14	49	
w. Guadalupe Project	7	10	8	2	4	4	14	49	
TCEQ Baseline; (Run 3)	7	10	8	1	5	3	15	49	

see Tables 4.5-3 & 4.5-6

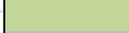
>12% >12% <=9%

Attain. - Singles	Single G1 criteria attainment (% of yrs.)							
	>A-pr	A-pr	A	B	C	CC	D	
Historical		28.6%	14.3%	8.2%	10.2%	10.2%	10.2%	
Present		28.6%	8.2%	10.2%	10.2%	10.2%	16.3%	
Region L Baseline; BBASC		20.4%	16.3%	6.1%	6.1%	8.2%	28.6%	
w. Guadalupe Project		20.4%	16.3%	4.1%	8.2%	8.2%	28.6%	
TCEQ Baseline; (Run 3)		20.4%	16.3%	2.0%	10.2%	6.1%	30.6%	

see Table 4.5-3

>17% >=19% <=2/3

Attain. - Joints	Joint G1 criteria attainment (% of yrs. and fractions)					
	>A-pr	A & B	C & CC	frac. CC		
Historical		22.4%	20.4%	50.0%		
Present		18.4%	20.4%	50.0%		
Region L Baseline; BBASC		22.4%	14.3%	57.1%		
w. Guadalupe Project		20.4%	16.3%	50.0%		
TCEQ Baseline; (Run 3)		18.4%	16.3%	37.5%		

Color coding convention	
	-OK, met criteria
	-Near miss. (rounding; p-o-record)
	-Not met, but departure not great
	-Very bad

# Summary – Attainment of G2 Summer Criteria (oysters) with the Mid-Basin Project

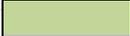
Counts	Criteria G2 Attainment (no. years)								sum
	>A-pr	A-pr	A	B	C	CC	D	DD	
Historical	8	11	11	8	5	1	1	4	49
Present	5	11	8	10	8	1	1	5	49
Region L Baseline; BBASC	4	8	8	8	7	3	3	8	49
w. Guadalupe Project	4	8	8	8	7	3	3	8	49
TCEQ Baseline; (Run 3)	4	6	9	8	6	4	3	9	49

see Tables 4.5-2; 4.5-4	>12%	>17%							<=6%
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Attain. - Singles	Single G2 criteria attainment (% of yrs.)							
	>A-pr	A-pr	A	B	C	CC	D	DD
Historical		22.4%	22.4%	16.3%	10.2%	2.0%	2.0%	8.2%
Present		22.4%	16.3%	20.4%	16.3%	2.0%	2.0%	10.2%
Region L Baseline; BBASC		16.3%	16.3%	16.3%	14.3%	6.1%	6.1%	16.3%
w. Guadalupe Project		16.3%	16.3%	16.3%	14.3%	6.1%	6.1%	16.3%
TCEQ Baseline; (Run 3)		12.2%	18.4%	16.3%	12.2%	8.2%	6.1%	18.4%

see Table 4.5-2			>=30%		>10%	<=1/6		<=9%
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Attain. - Joints	Joint G2 criteria attainment (% of yrs. and fractions)					
	>A-pr	A & B	C & CC	frac. CC	D & DD	
Historical		38.8%	12.2%	16.7%	10.2%	
Present		36.7%	18.4%	11.1%	12.2%	
Region L Baseline; BBASC		32.7%	20.4%	30.0%	22.4%	
w. Guadalupe Project		32.7%	20.4%	30.0%	22.4%	
TCEQ Baseline; (Run 3)		34.7%	20.4%	40.0%	24.5%	

Color coding convention	
	-OK, met criteria
	-Near miss. (rounding; p-o-record)
	-Not met, but departure not great
	-Very bad

# ***Questions, Comments, & Discussion***



# ***Developing Balance – Options***

## **Weighted Too Heavy Toward Human Needs**

- 1) Increase Subsistence Flows**
- 2) Eliminate Diversions Below Baseflows**
- 3) Increase Average or Wet Baseflows**
- 4) Add More Pulses / Increase Pulses**
- 5) Shift Period of Record for Flow Standard Recommendation**

## **Weighted Too Heavy Toward Environmental Needs**

- 1) Eliminate the 50% Requirement between Subsistence & Dry Base**
- 2) Eliminate Wet and/or Average Baseflows**
- 3) Eliminate Some/All Pulses**
  - Annual / Multi-Year**
  - Seasonal**
- 4) Place Hydrologic Conditions on Pulses**
- 5) Shift Period of Record for Flow Standard Recommendation**

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