Reclamation

SJRIP E flows Meeting 2, April 5-6 2016

Requested Supplemental Plots

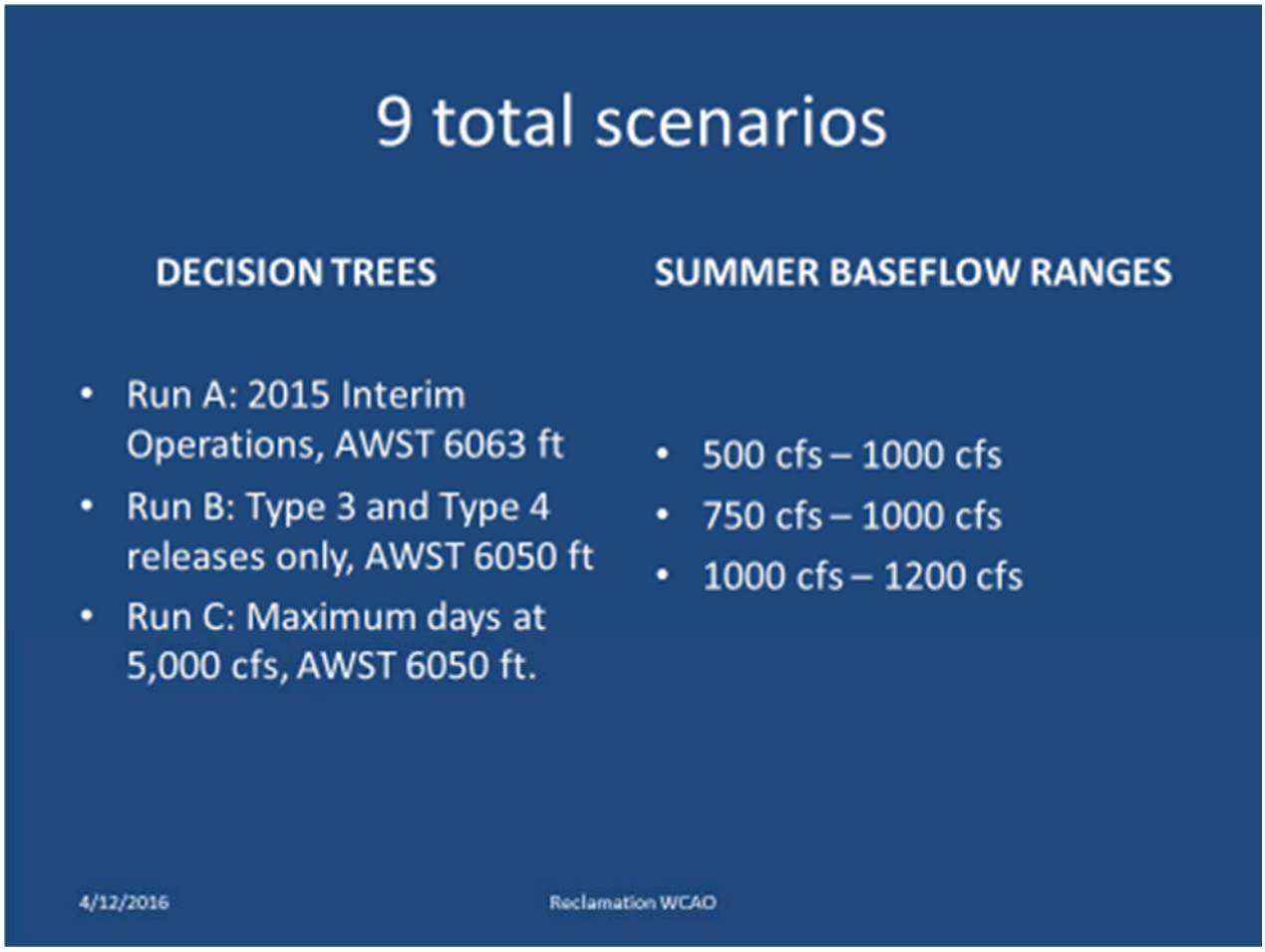
SNB 4/13/2016

Included in this packet:

1. Scenario Summaries
2. Time Series Plots
3. Cumulative Plots
4. Flow Statistics at Four Corners
5. Data Summaries

Spreadsheet of output data is available upon request.

Scenario Summaries



RUN A

AWST: 6063 ft
EWYST: 6063 ft

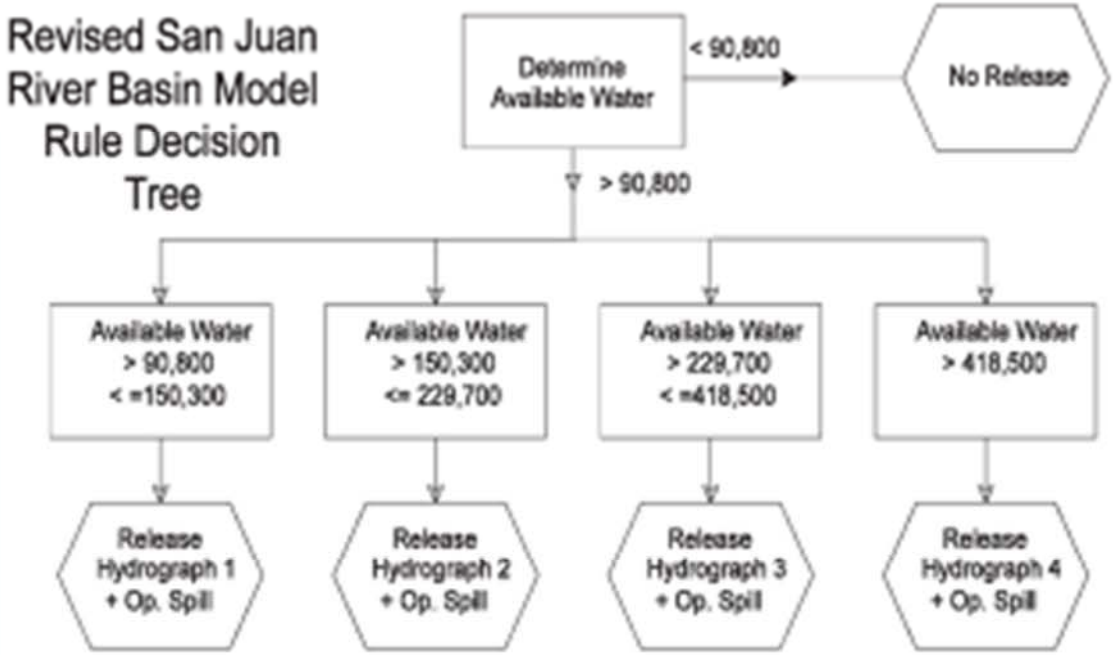
SPR options: Type 1
Type 2
Type 3
Type 4

Op Spill: Nose
Increased TBF
Fall Spike

Likely results in more frequent SPRs, but the size of them overall may be lower on average, and there will be more small SPRs.
Excess for other purposes is typically available.

4/12/2016

2015 interim operations decision tree, EWYST 6,063



Notes on Spring Peak Releases (SPR):
Hydrograph 1: 1-week at 5,000 cfs with 3 day ramps up and down: 90,843 af
Hydrograph 2: 2-weeks at 5,000 cfs with 3 day ramps up and down: 150,347 af
Hydrograph 3: 3-weeks at 5,000 cfs with 3 day ramps up and down: 229,686 af
Hydrogarph 4: Full Hydrograph, 3-weeks at 5,000 cfs with full ramps: 418,512 af

Operational spill (Op. Spill) = (Available water - SPR) Released as nose water if full hydrograph (4) was selected and then remaining water is released as an increase in target base flows and then a fall spike release. For Hydrographs 1 to 3, released first as increase in target base flow and then fall spike release.

RUN B

AWST: 6050 ft
EWYST: 6063 ft

SPR options: Type 3
Type 4

Op Spill: Nose
Increased TBF
Fall Spike

Results in less frequent releases overall, but the releases that are made are on average larger volumetrically. Very little Excess typically available.

Flexible EWYST decision tree releasing Type 3 and Type 4 releases

Calculate Available Water (AW) under AWYST 6050. Is Available Water < 229,700?	--YES-->	No release. EWYST changes to 6063 ft.
NO		
229,700 af <Available Water <418,500 af	--YES-->	Release Type 3. EWYST changes to 6063 ft after release.
NO		
Available Water > 418,500 af	--YES-->	Release Type 4. EWYST changes to 6063 ft after release.

4/12/2016 Reclamation WCAO

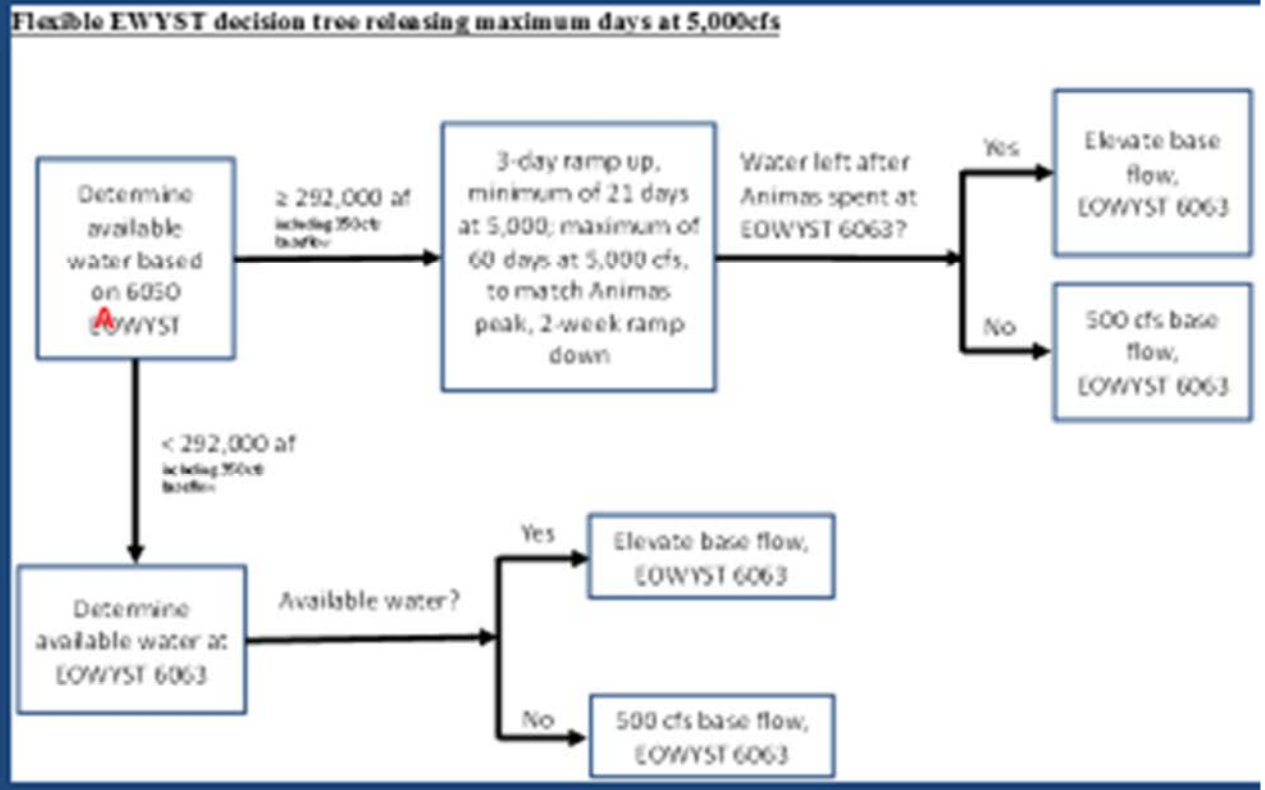
RUN C

AWST: 6050 ft
EWYST: 6063 ft

SPR options:
21 – 60 days
at 5,000 cfs

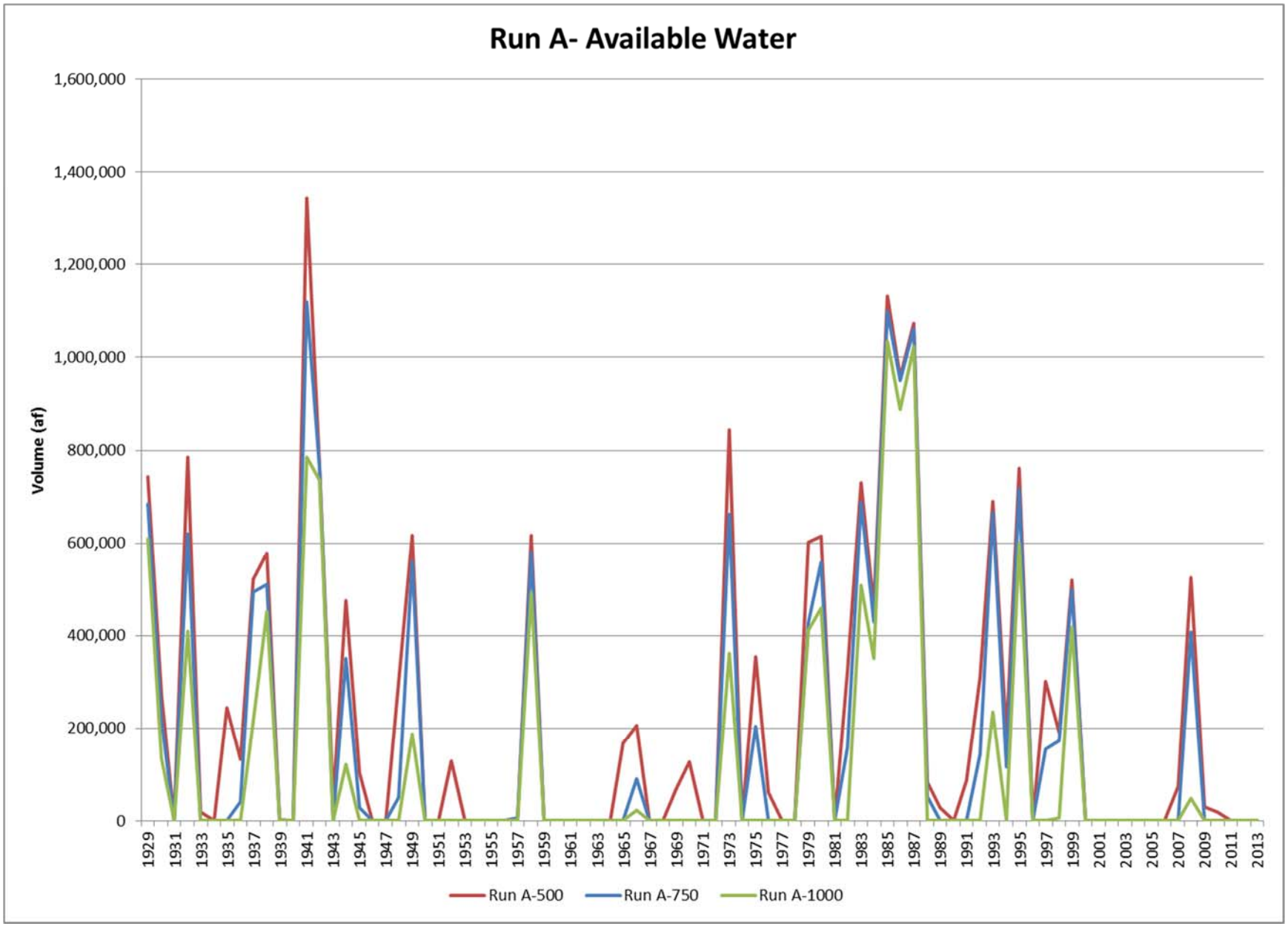
Op Spill: Nose
Increased TBF
Fall Spike

Results in a frequency between Run A and Run B. Most AW is put to the SPR. Little Excess is typically available.



4/12/2016 Reclamation WCAO

TIME SERIES PLOTS


Run A- Available Water
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
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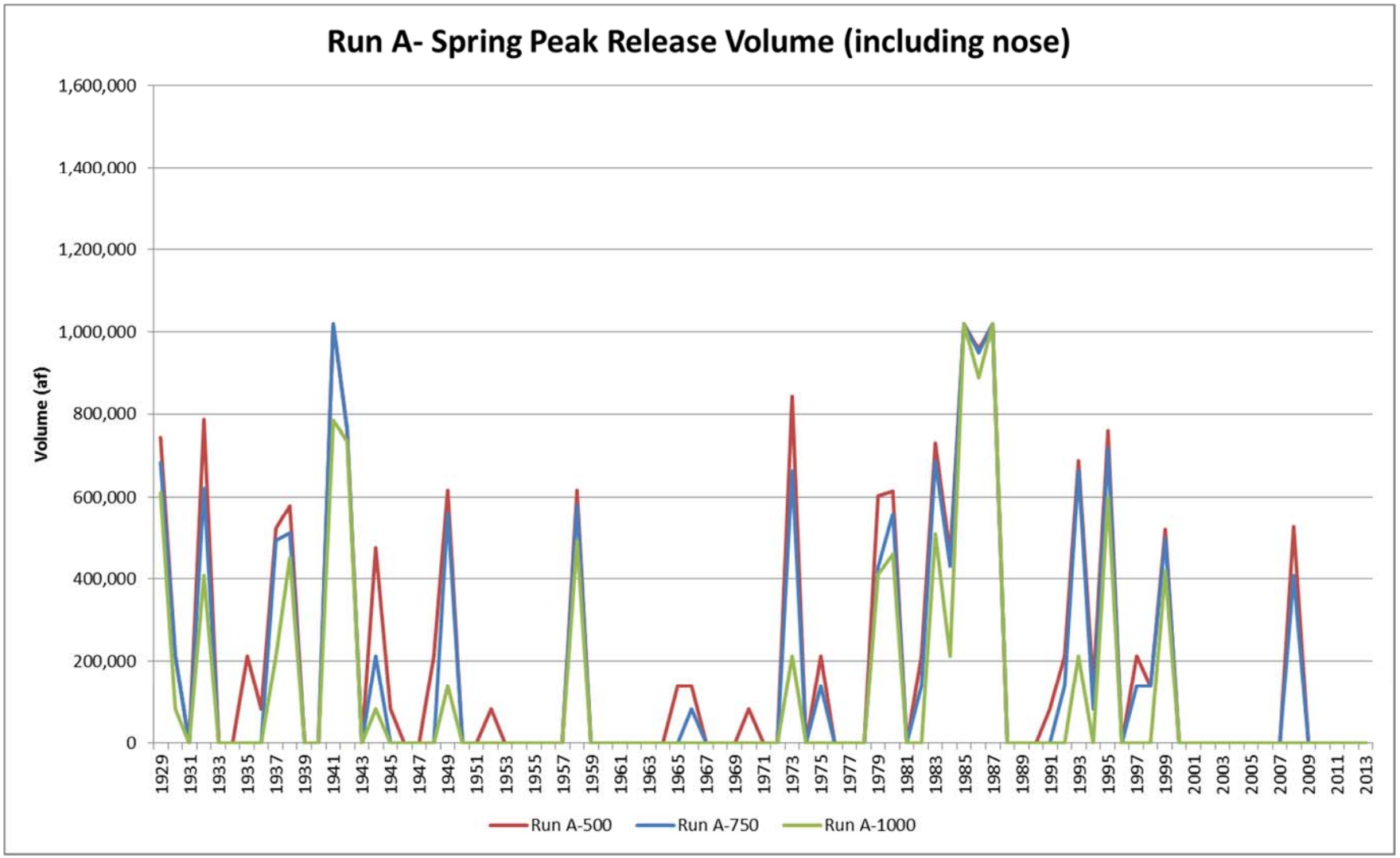
Run A-500
Run A-750
Run A-1000


Run A- Spring Peak Release Volume (including nose)
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
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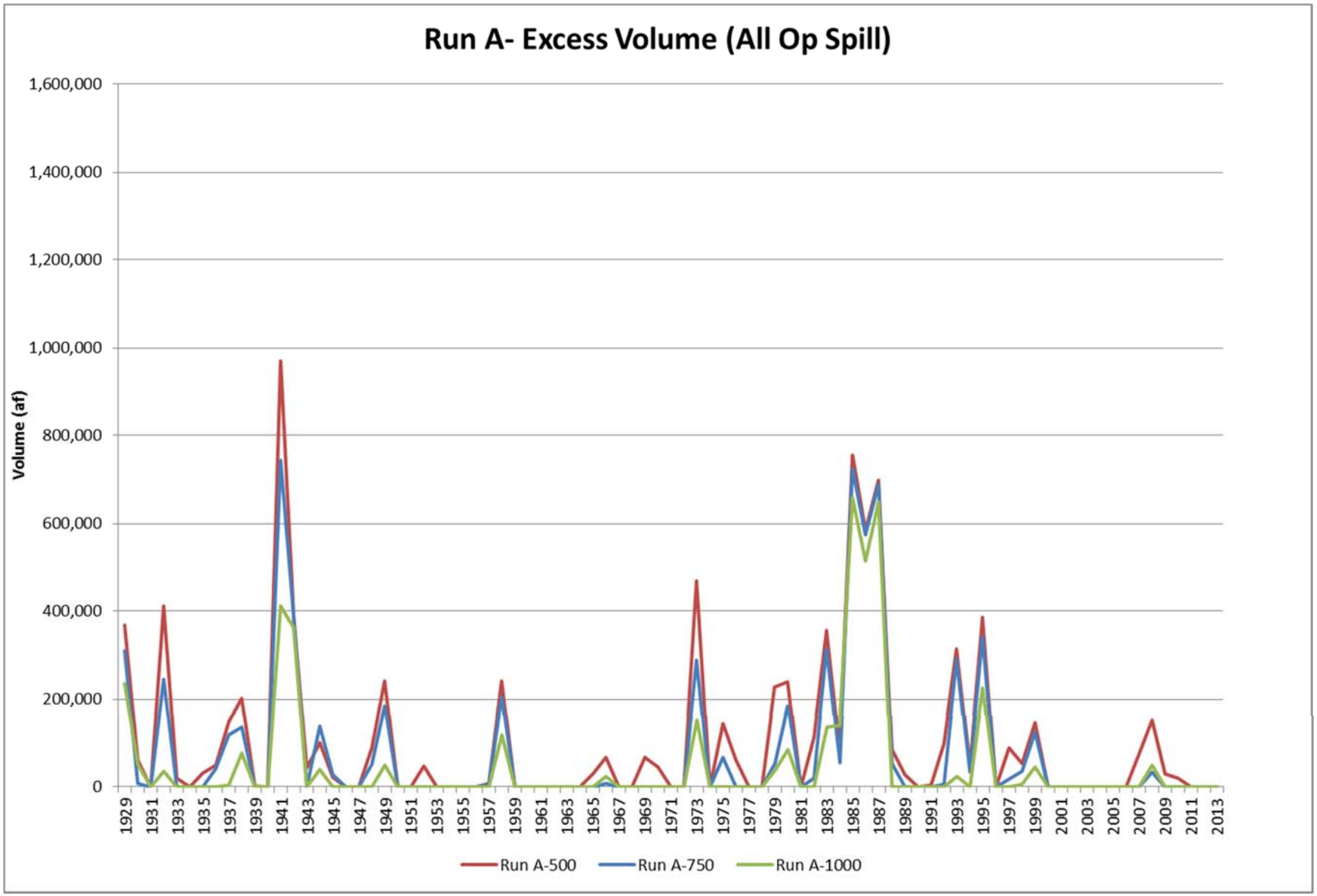
Run A-500
Run A-750
Run A-1000


Run A- Excess Volume (All Op Spill)
Volume (af)
1,600,000
1,400,000
1,200,000
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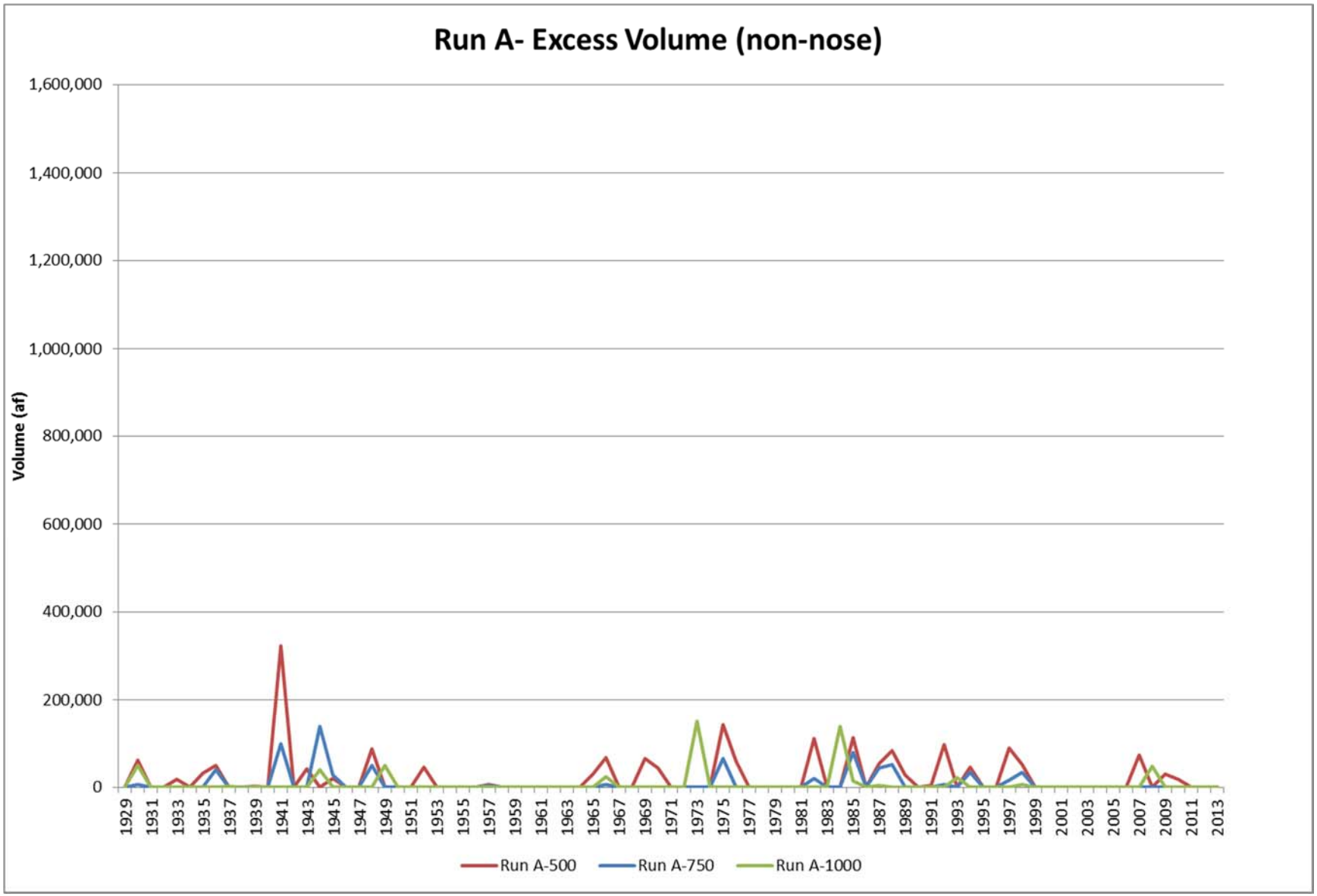
Run A-500
Run A-750
Run A-1000


Run A- Excess Volume (non-nose)
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
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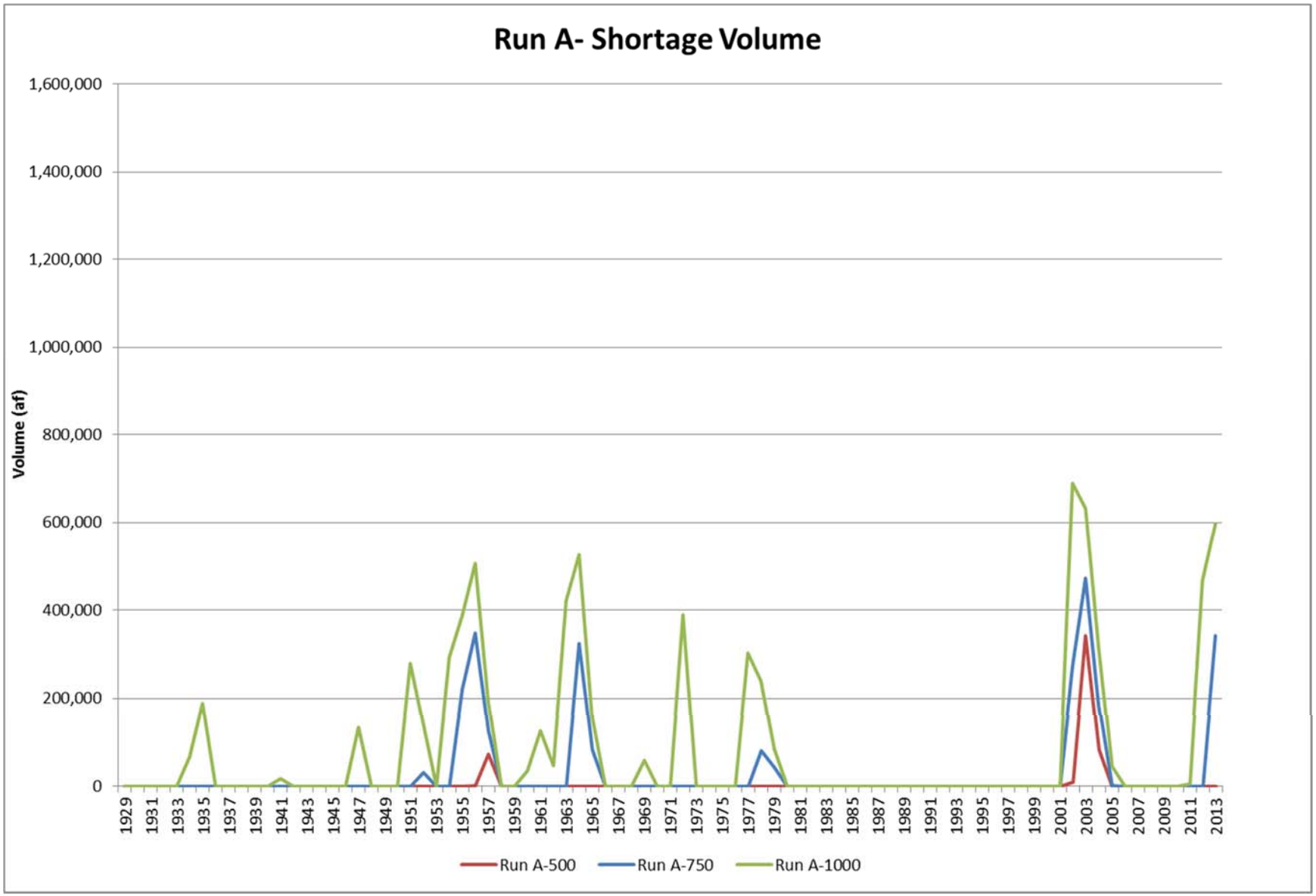
Run A-500
Run A-750
Run A-1000


Run A- Shortage Volume
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
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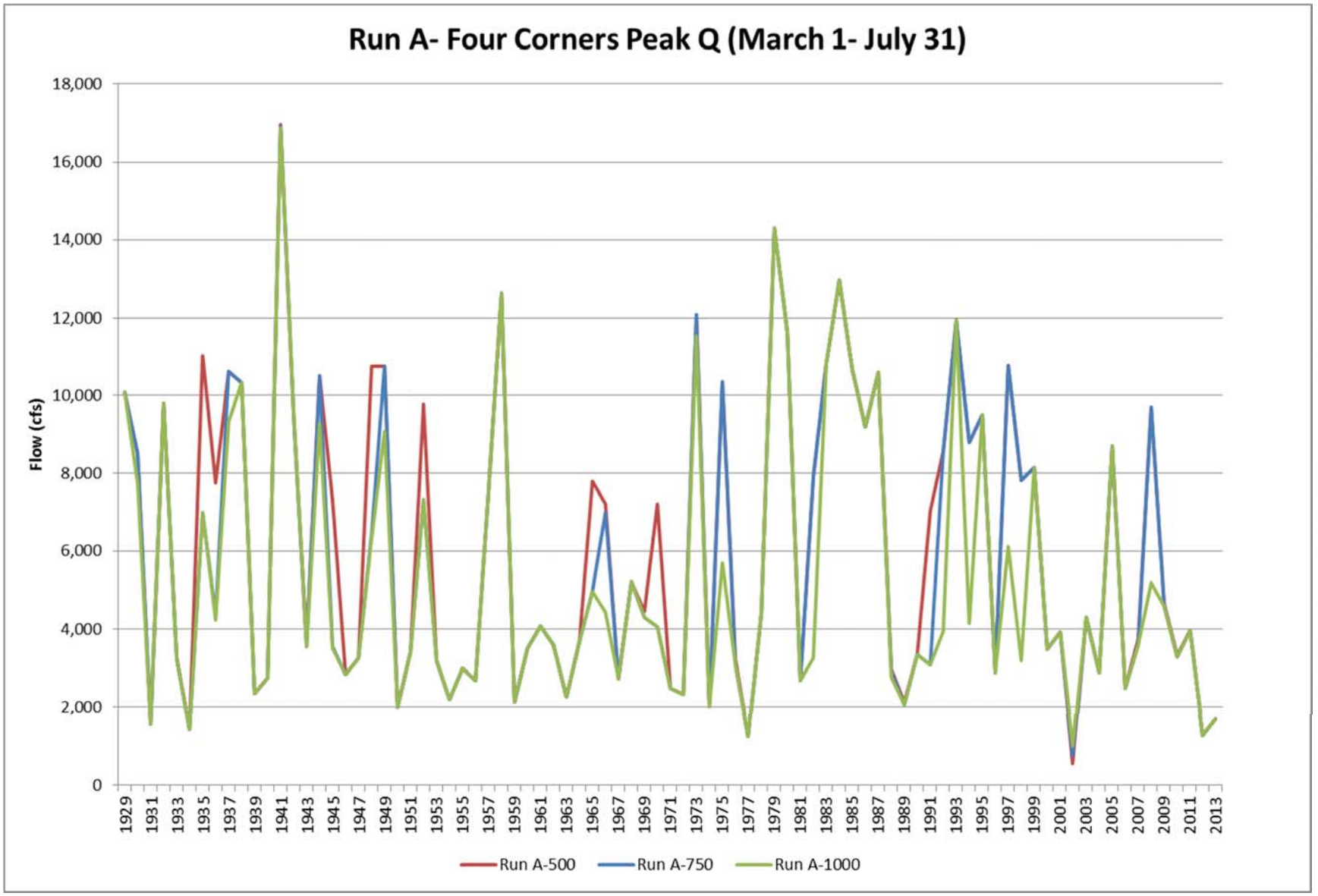
Run A-500
Run A-750
Run A-1000


Run A- Four Corners Peak Q (March 1- July 31)
Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
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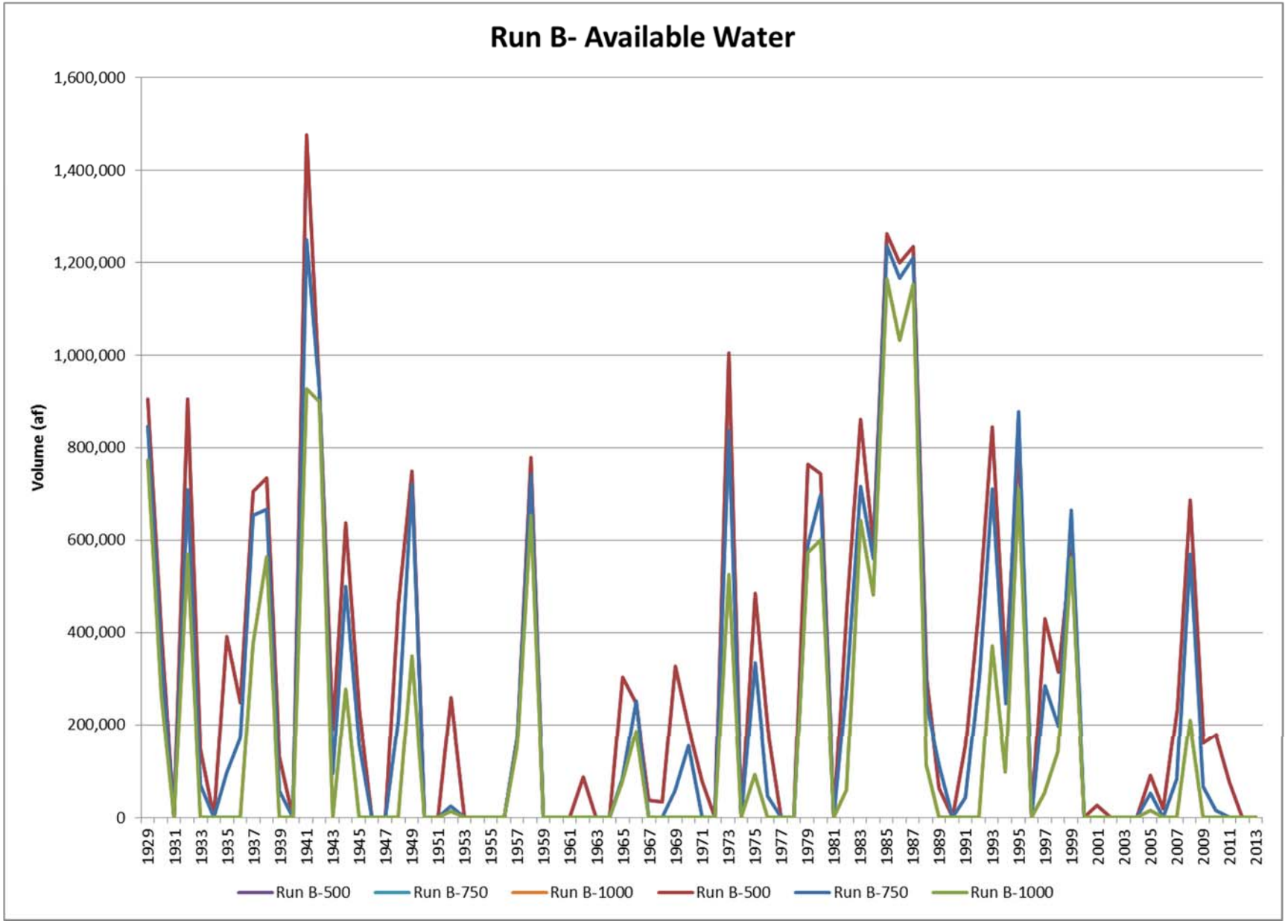
Run A-500
Run A-750
Run A-1000


Run B- Available Water
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
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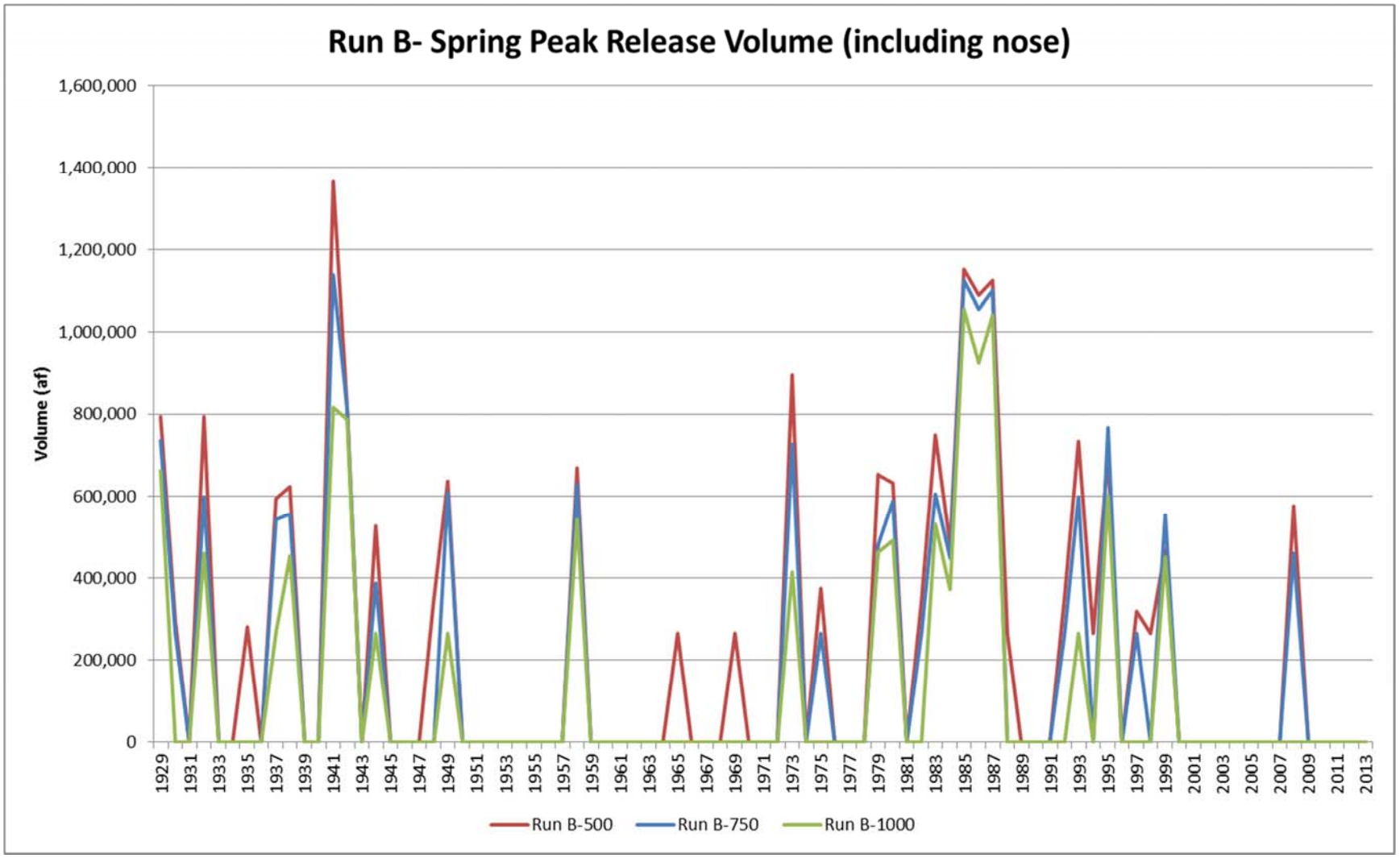
Run B-750
Run B-1000
Run B-500
Run B-750
Run B-1000


Run B- Spring Peak Release Volume (including nose)
Volume (af)
1,600,000
1,400,000
1,200,000
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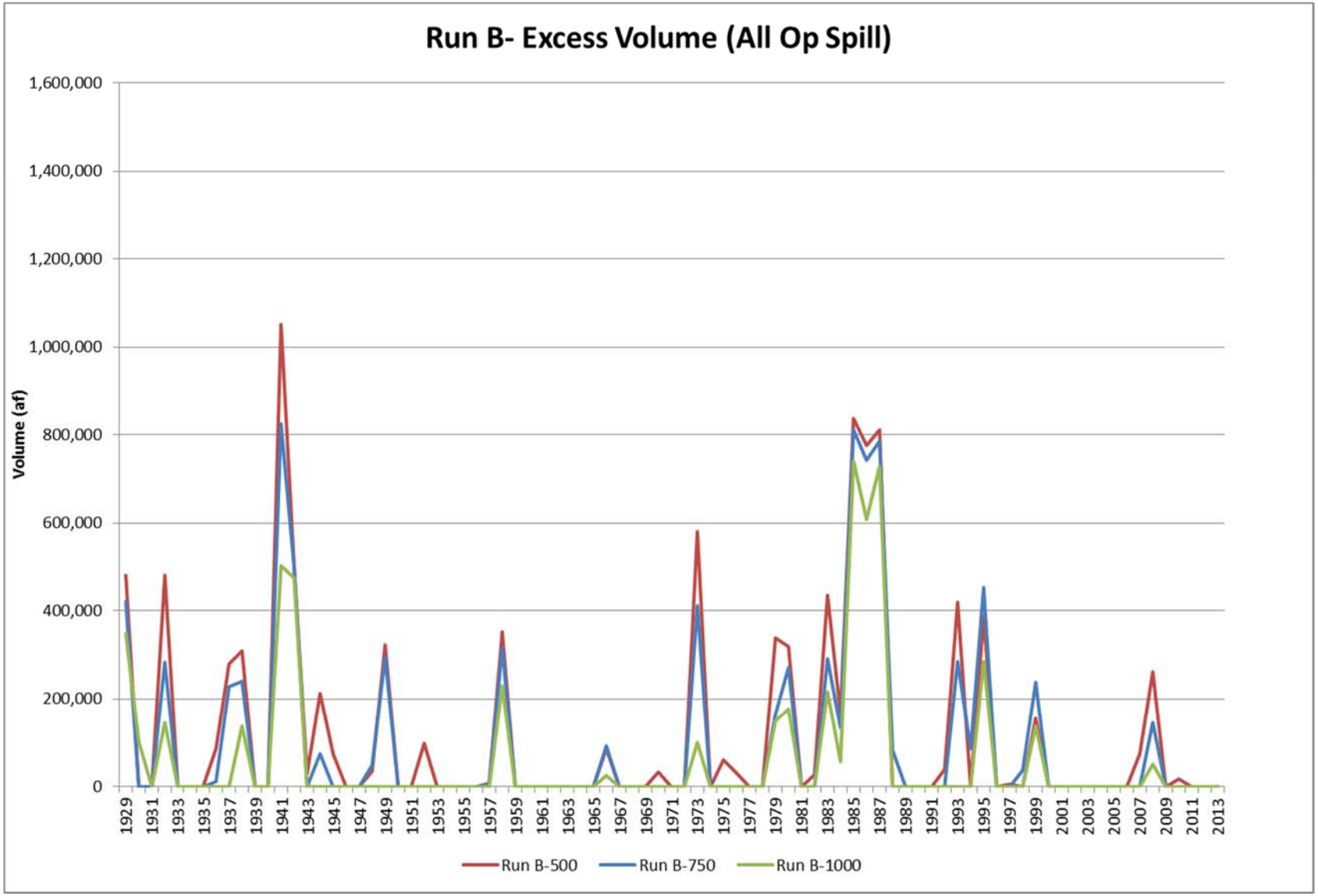
Run B-500
Run B-750
Run B-1000


Run B- Excess Volume (All Op Spill)
Volume (af)
1,600,000
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1,200,000
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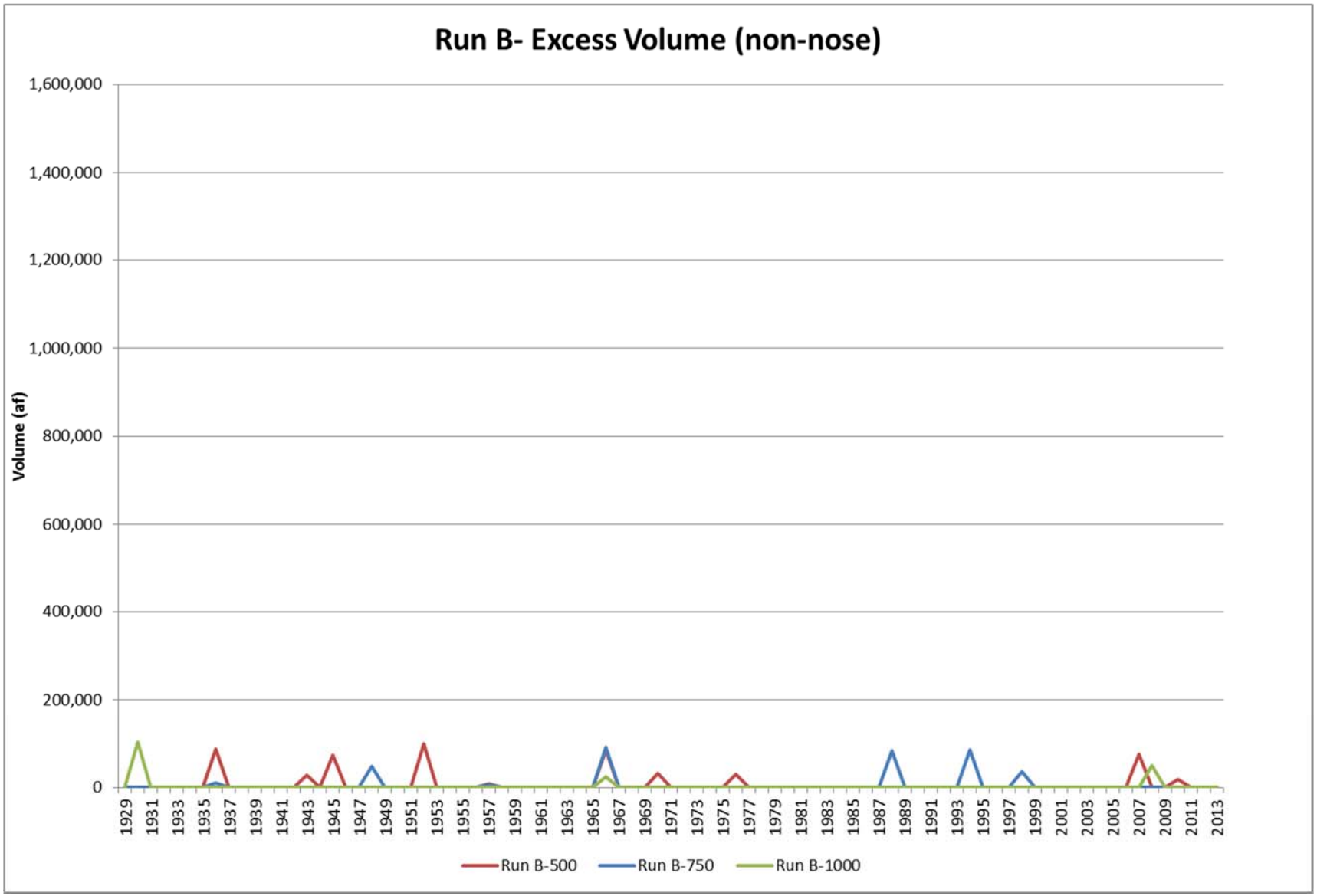
Run B-1000


Run B- Excess Volume (non-nose)
Volume (af)
1,600,000
1,400,000
1,200,000
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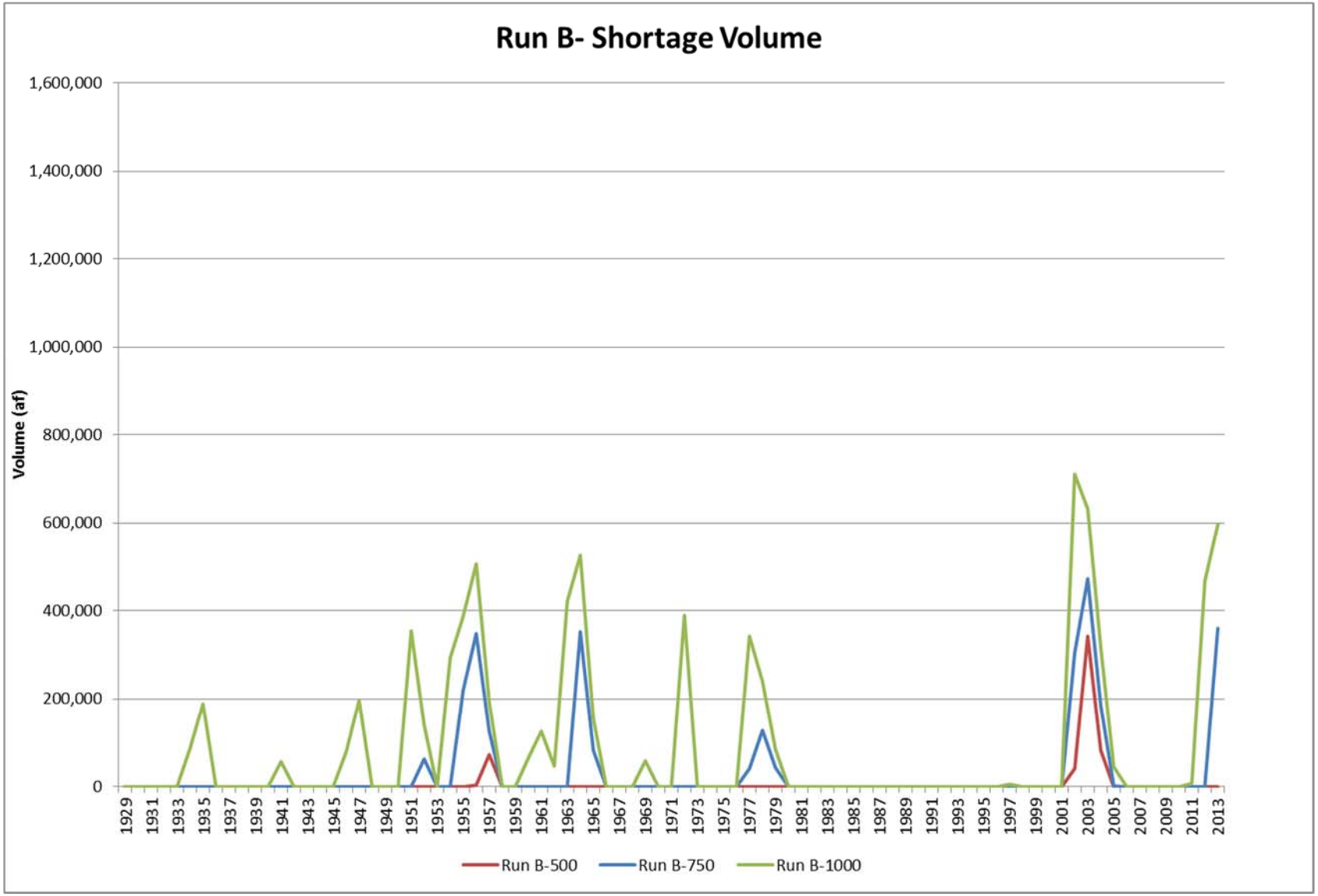
Run B-500
Run B-750
Run B-1000


Run B- Shortage Volume
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
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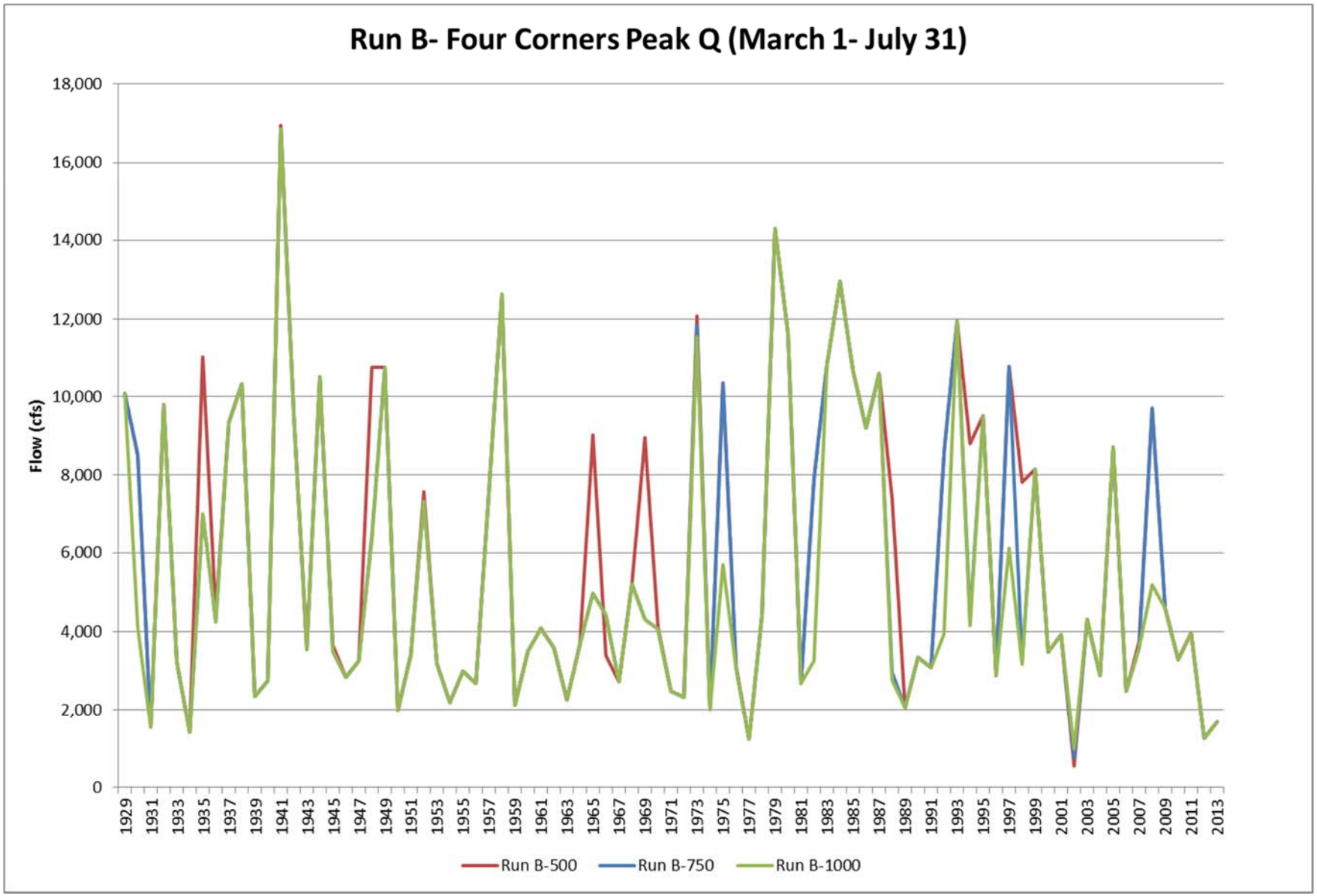
Run B-500
Run B-750
Run B-1000


Run B- Four Corners Peak Q (March 1- July 31)
Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
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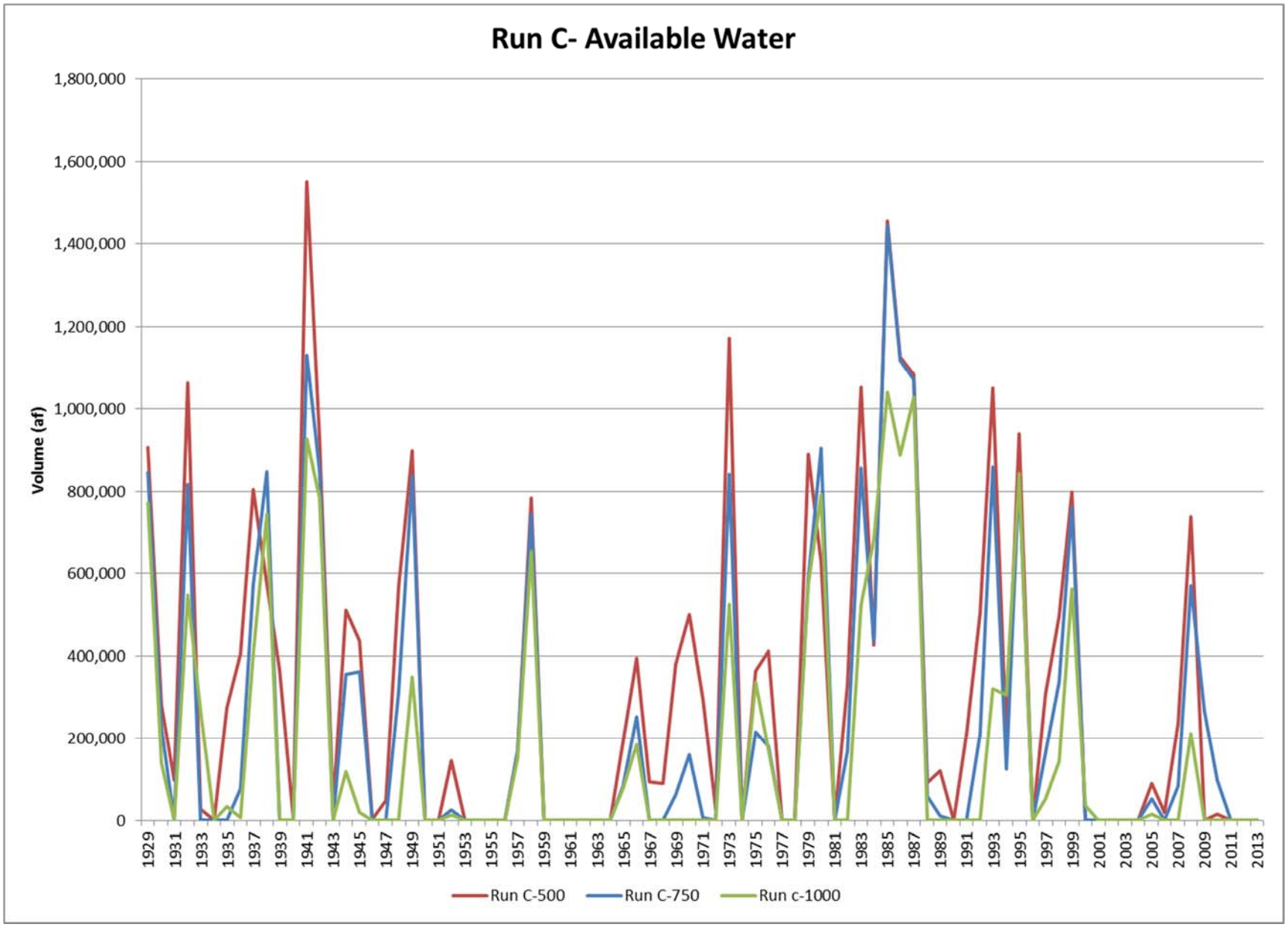
Run B-500
Run B-750
Run B-1000


Run C- Available Water
Volume (af)
1,800,000
1,600,000
1,400,000
1,200,000
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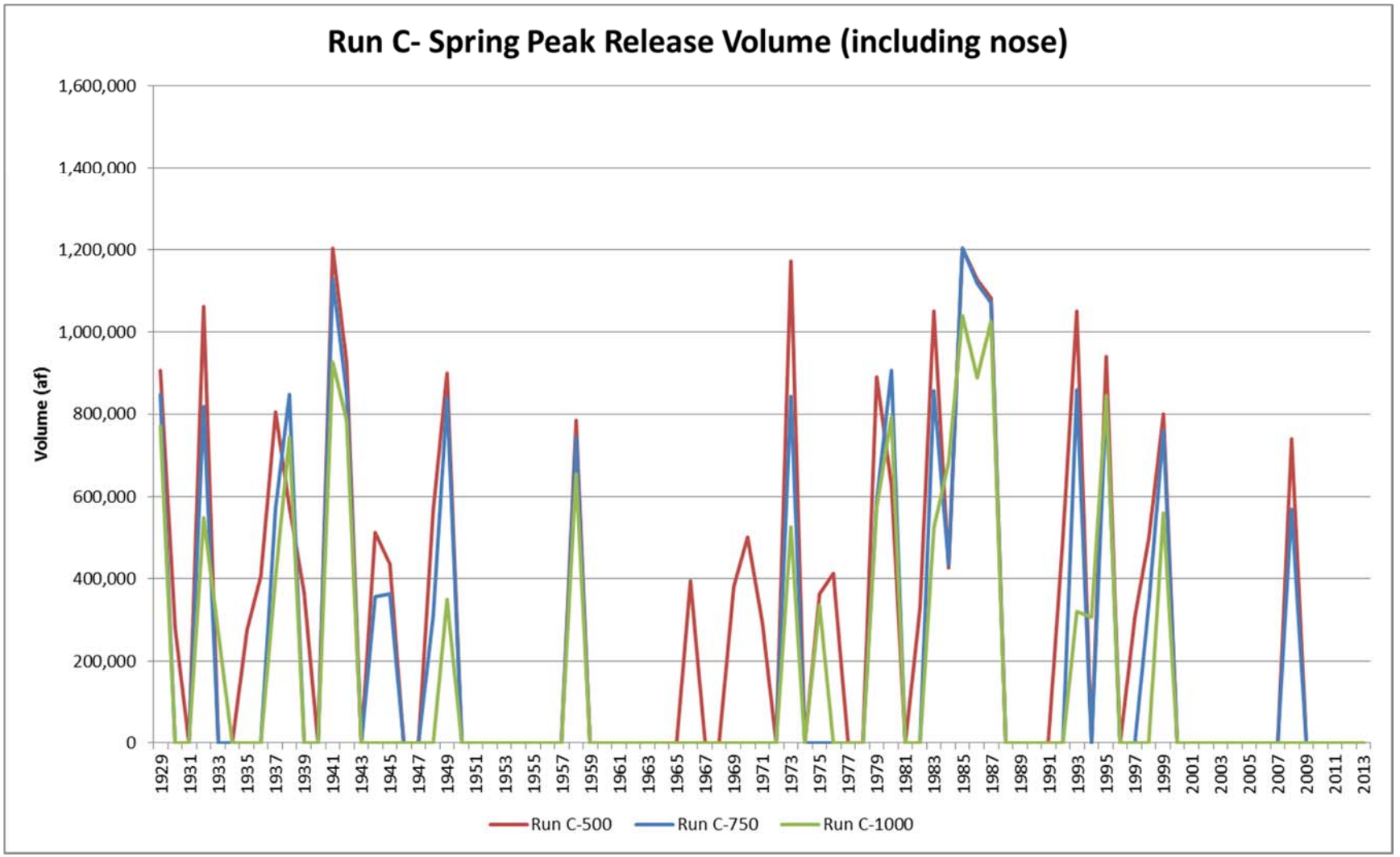
Run C-500
Run C-750
Run c-1000


Run C- Spring Peak Release Volume (including nose)
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
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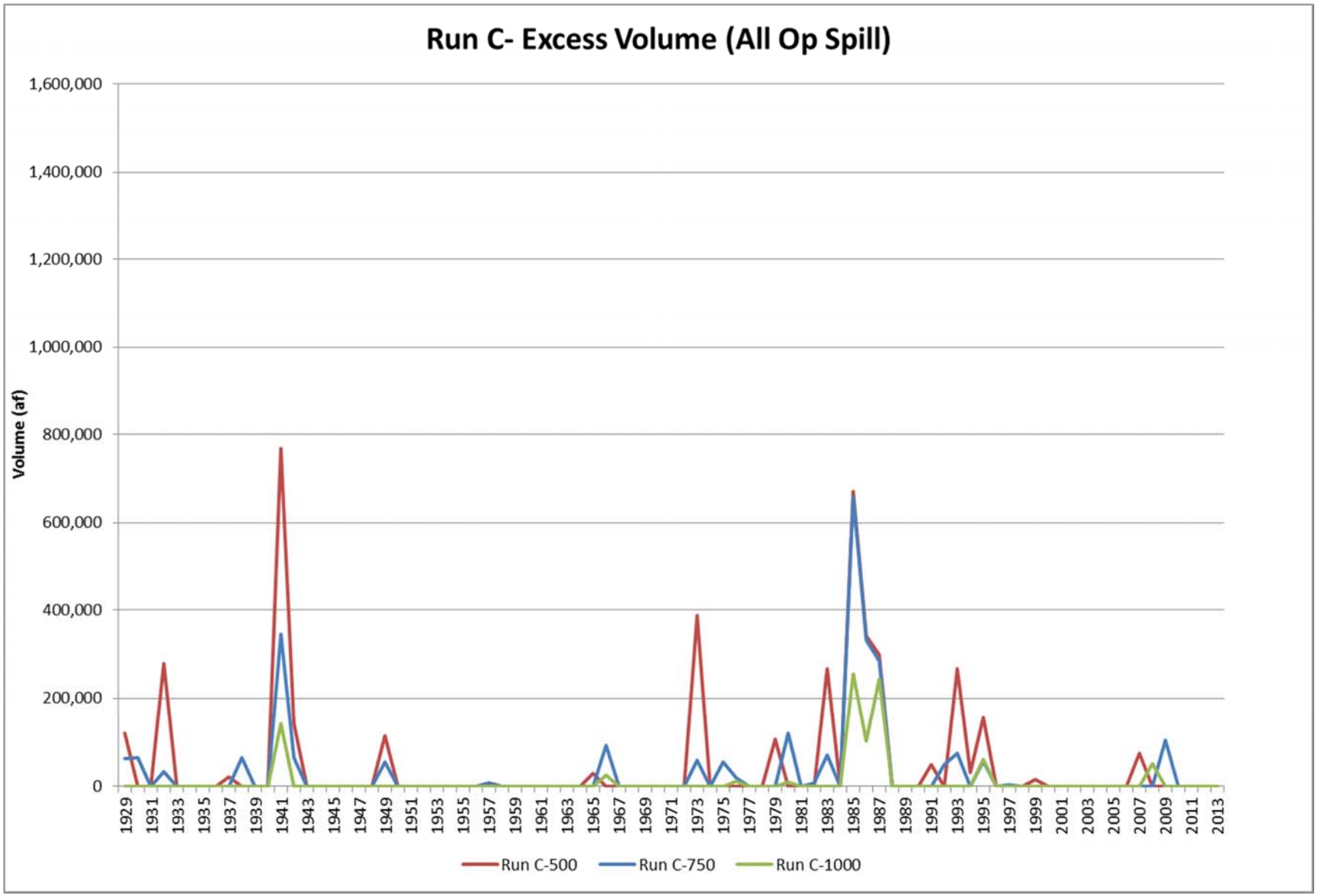
Run C-500
Run C-750
Run C-1000


Run C- Excess Volume (All Op Spill)
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
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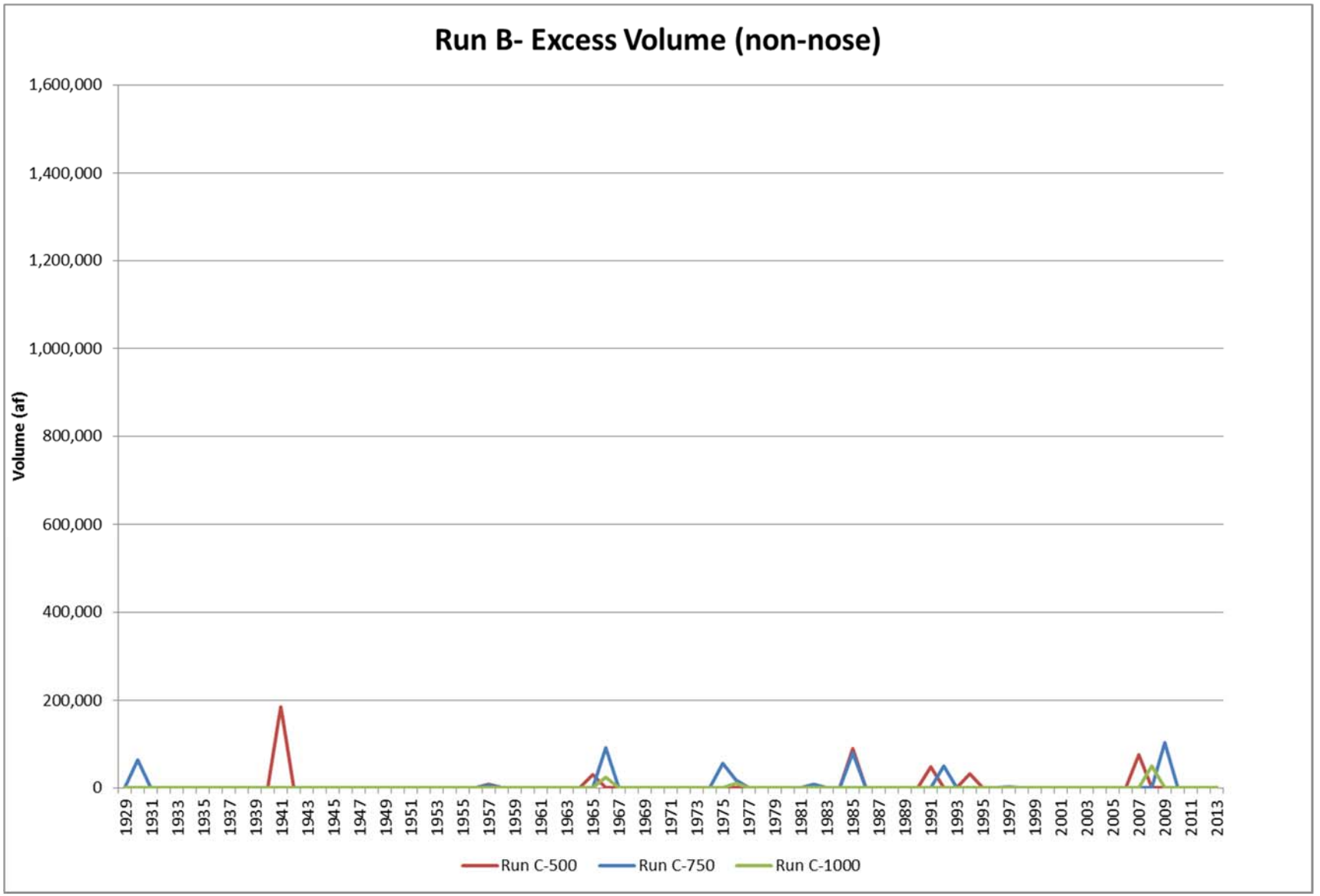
Run C-500
Run C-750
Run C-1000


Run B- Excess Volume (non-nose)
Volume (af)
1,600,000
1,400,000
1,200,000
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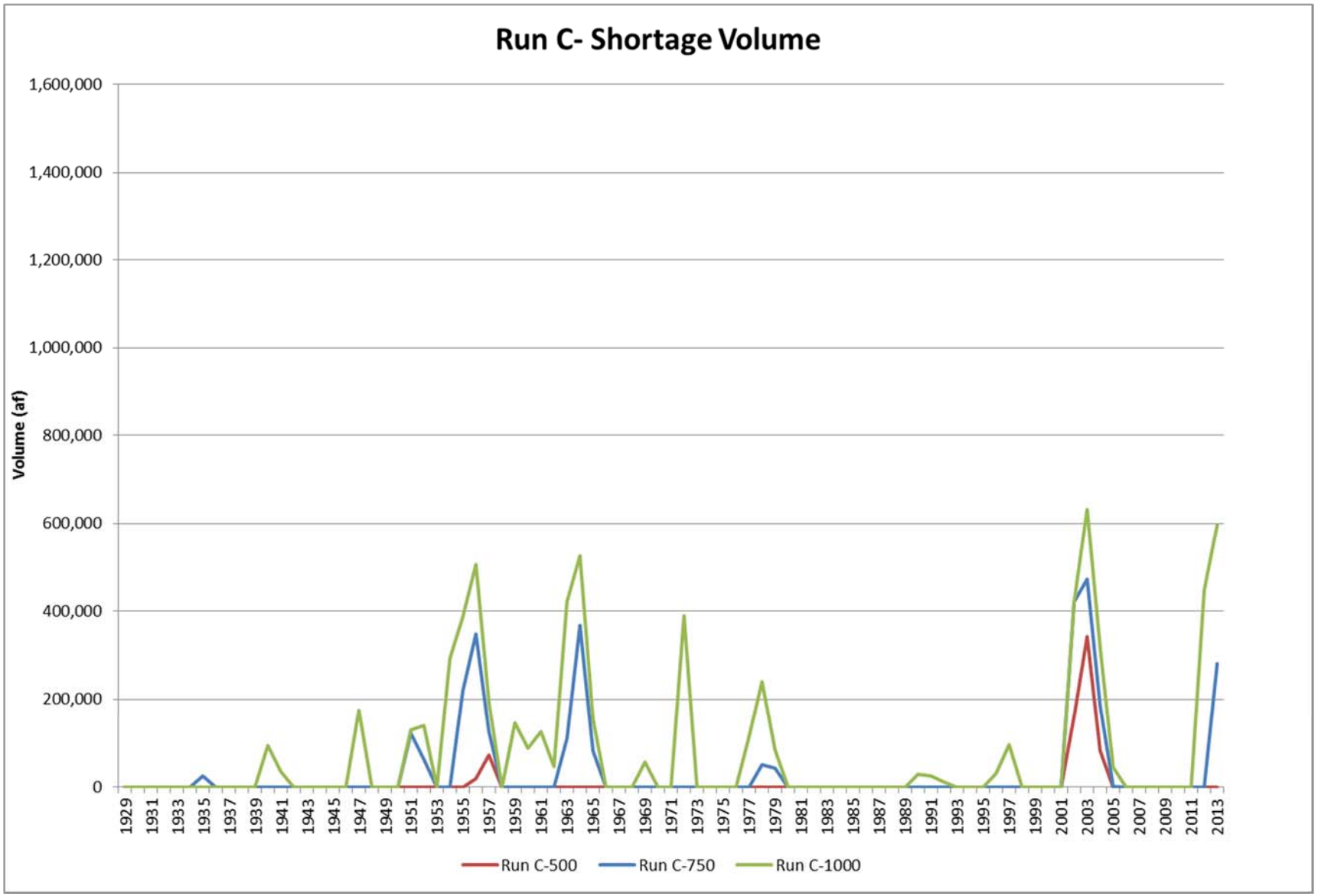
Run C-500
Run C-750
Run C-1000


Run C- Shortage Volume
Volume (af)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
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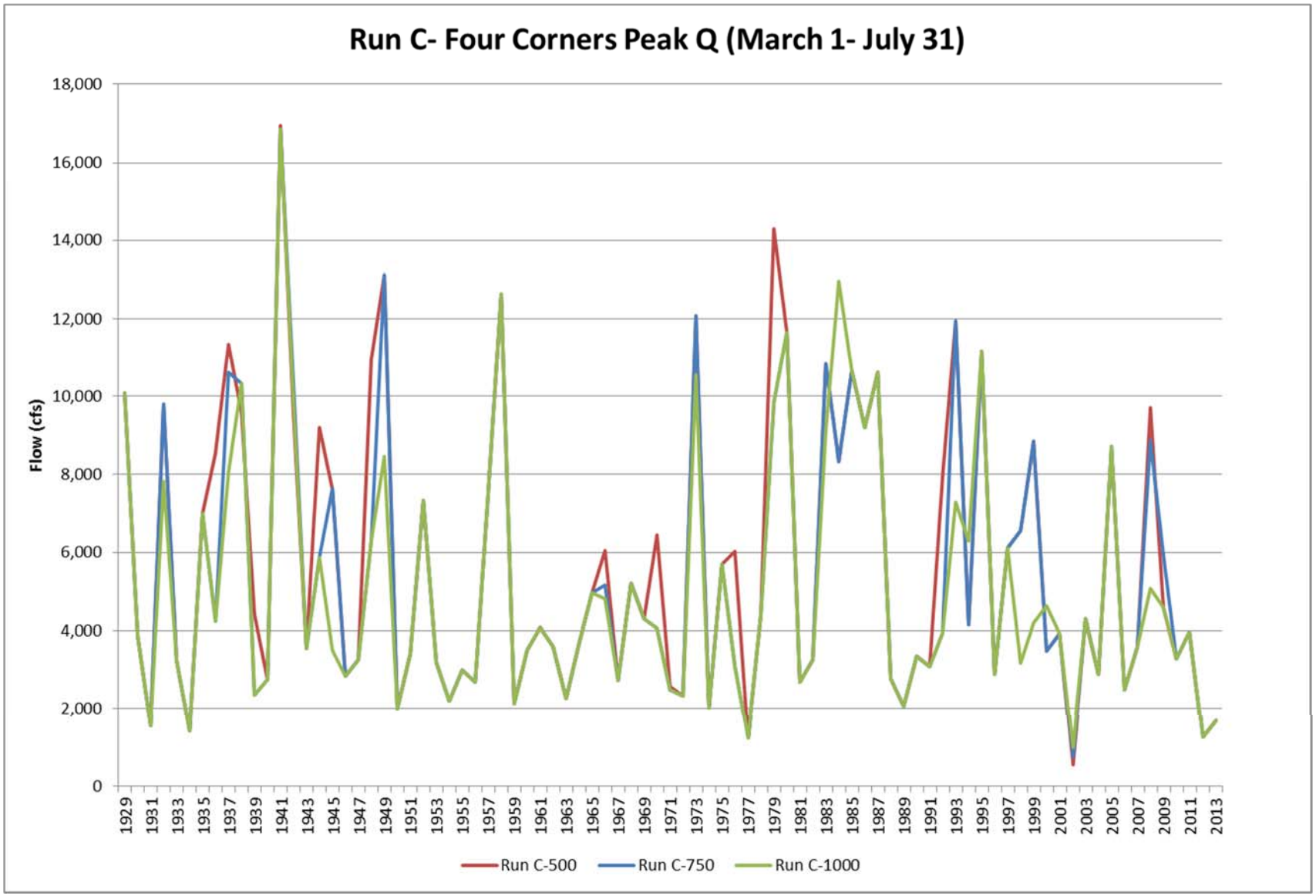
Run C-500
Run C-750
Run C-1000


Run C- Four Corners Peak Q (March 1- July 31)
Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
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4,000
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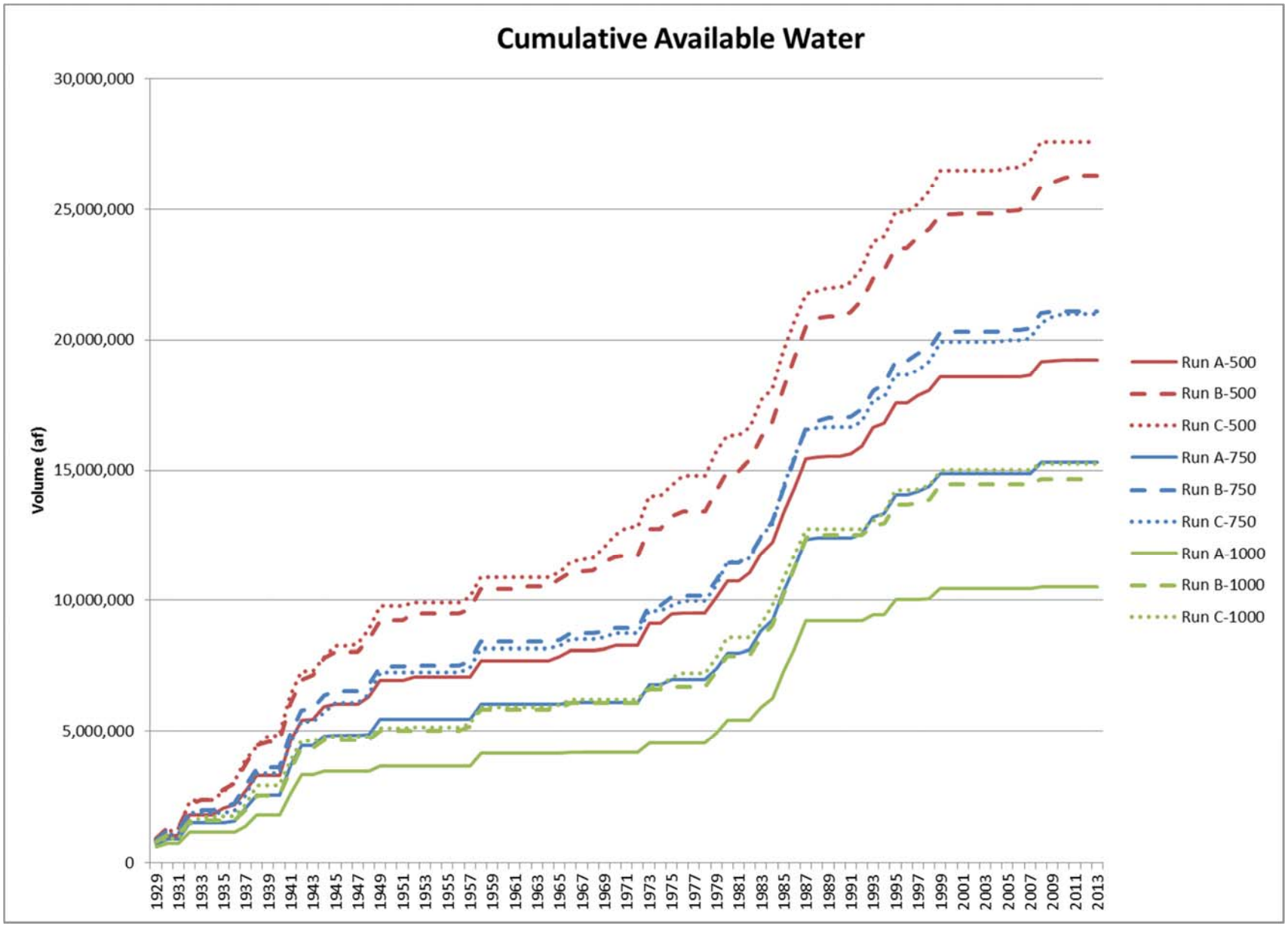
Run C-500
Run C-750
Run C-1000

CUMULATIVE PLOTS


Cumulative Available Water
Volume (af)
30,000,000
25,000,000
20,000,000
15,000,000
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5,000,000
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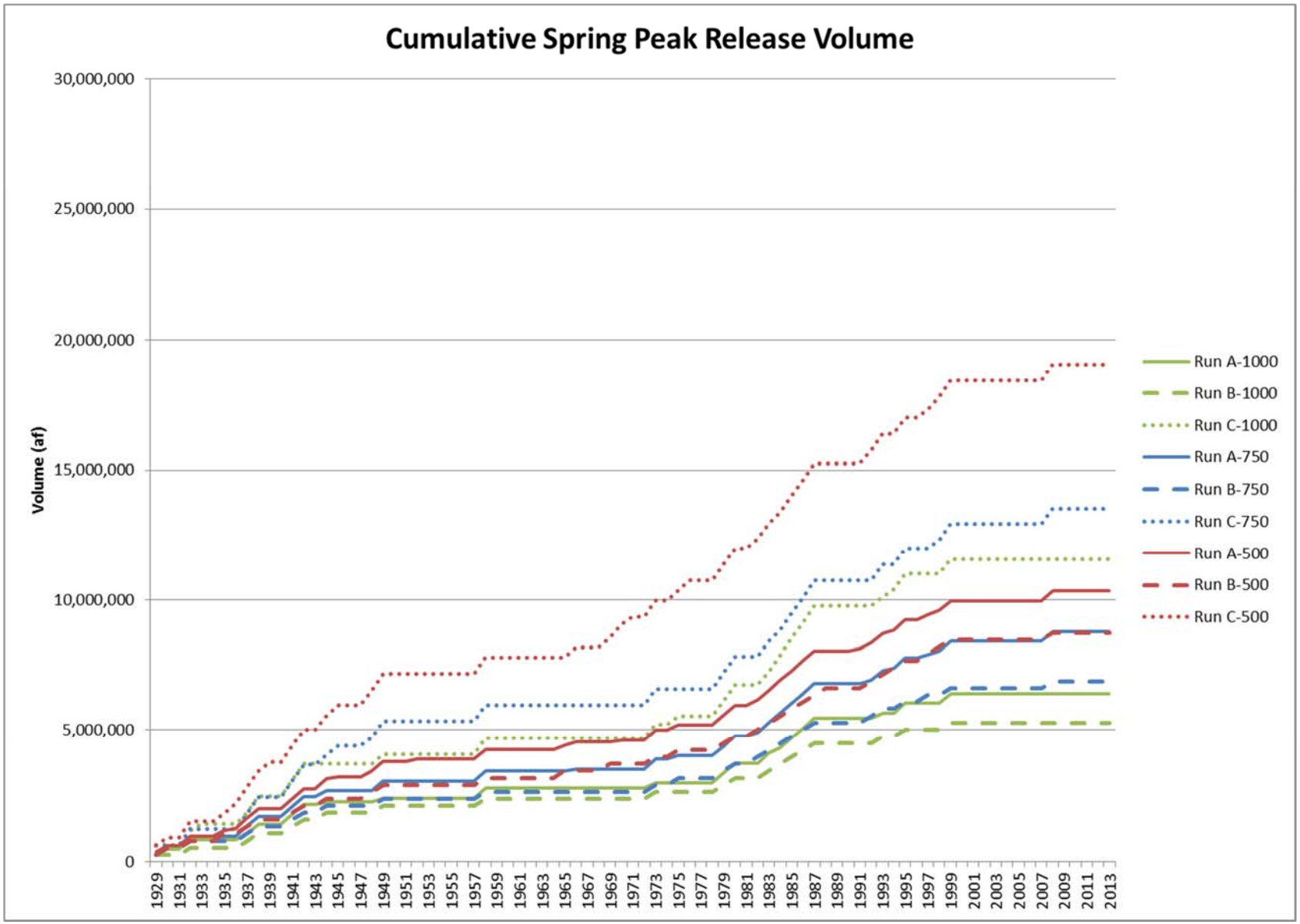
Run A-500
Run B-500
Run C-500
Run A-750
Run B-750
Run C-750
Run A-1000
Run B-1000
Run C-1000


Cumulative Spring Peak Release Volume
Volume (af)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
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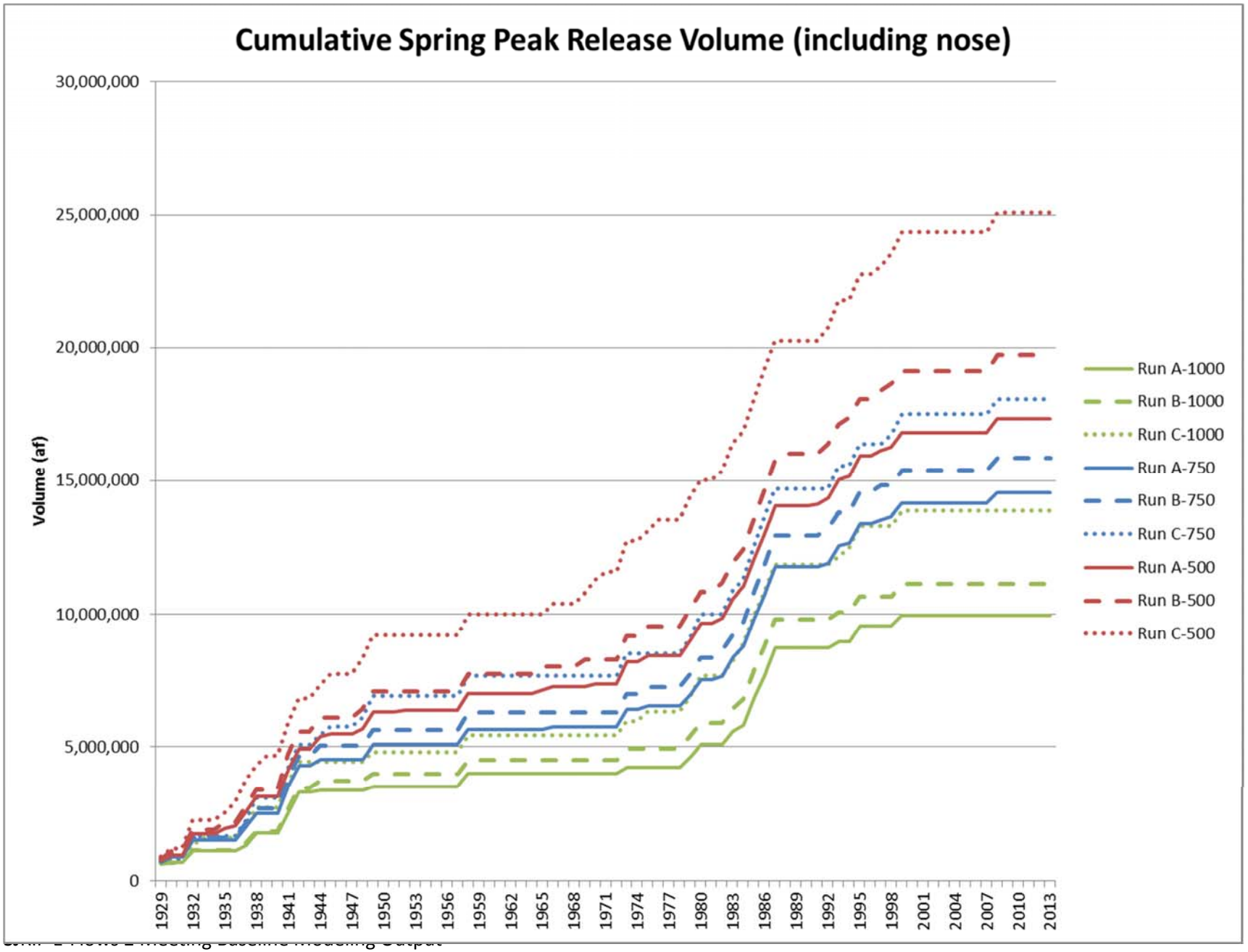
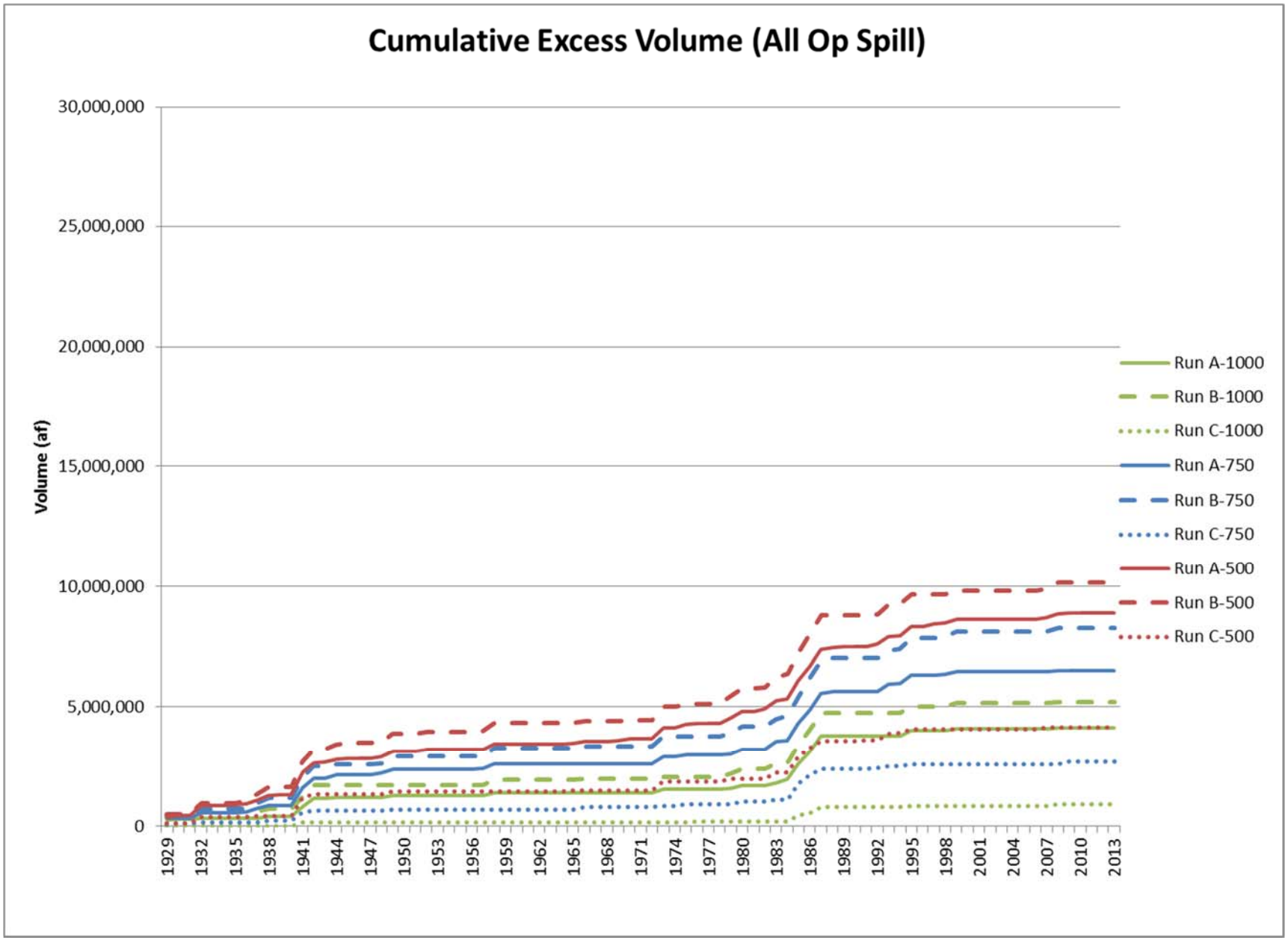
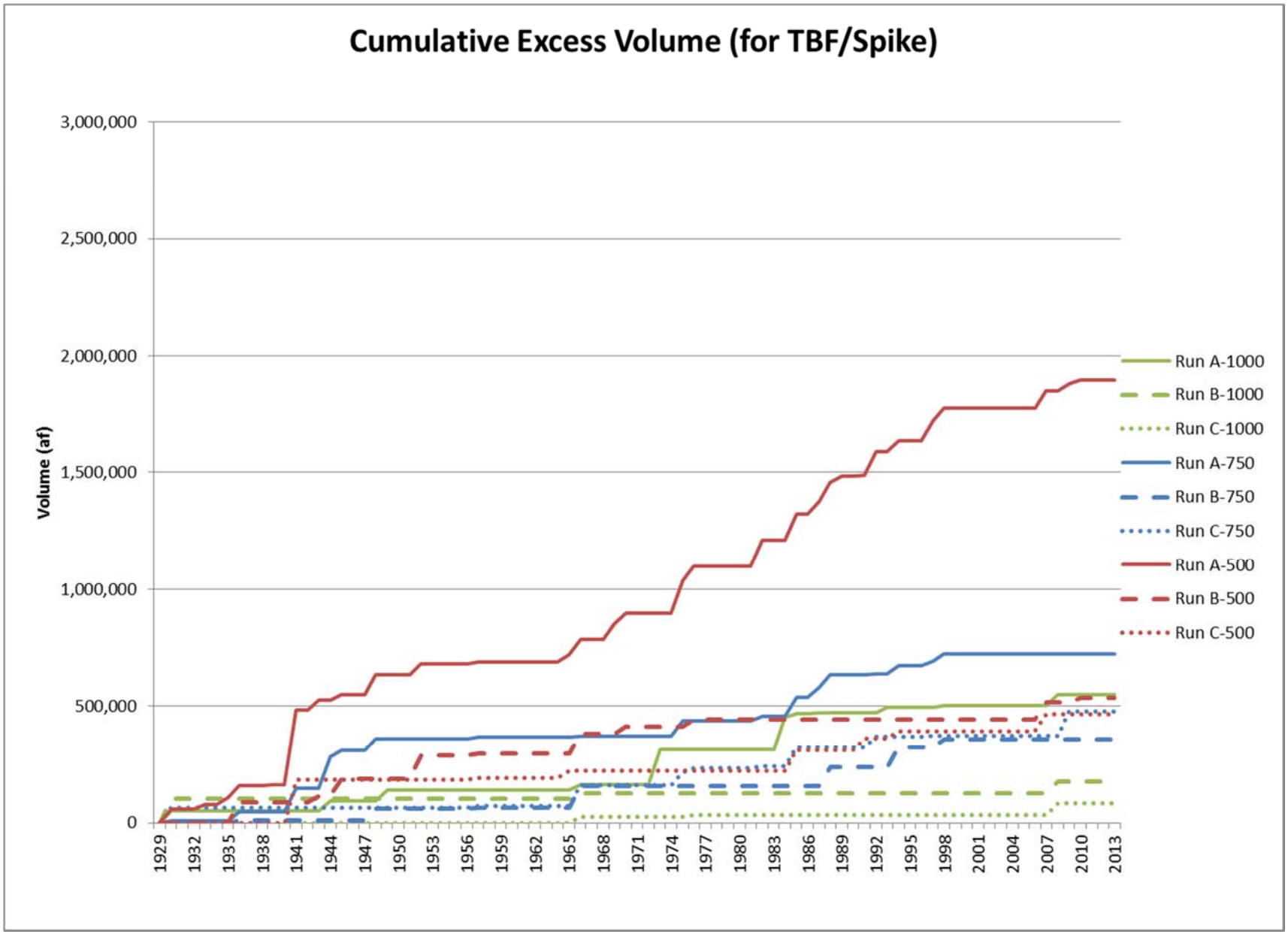
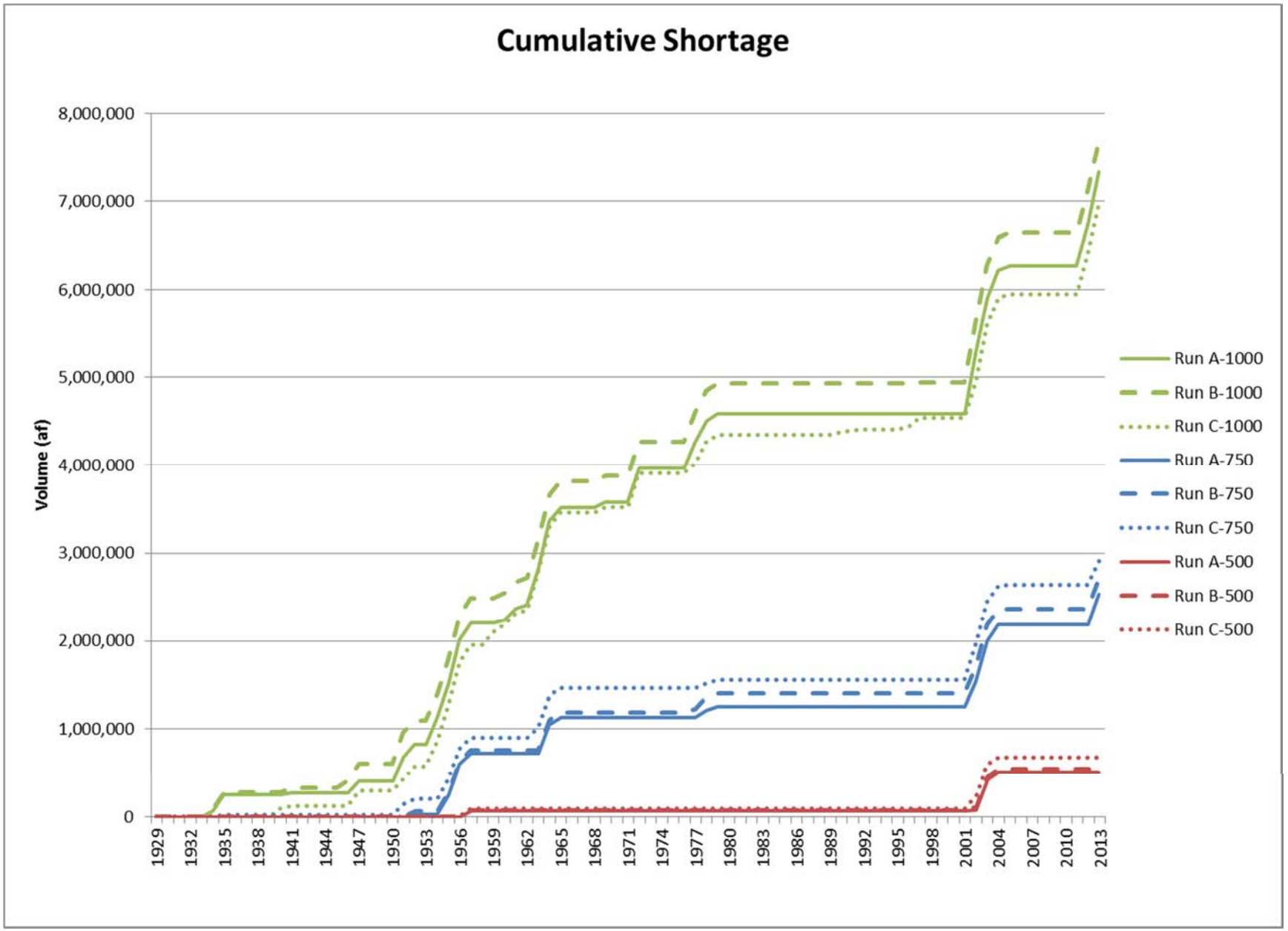
Run A-1000
Run B-1000
Run C-1000
Run A-750
Run B-750
Run C-750
Run A-500
Run B-500
Run C-500


Cumulative Spring Peak Release Volume (including nose)
Volume (af)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Run A-1000
Run B-1000
Run C-1000
Run A-750
Run B-750
Run C-750
Run A-500
Run B-500
Run C-500


Cumulative Excess Volume (All Op Spill)
Volume (af)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Run A-1000
Run B-1000
Run C-1000
Run A-750
Run B-750
Run C-750
Run A-500
Run B-500
Run C-500


Cumulative Excess Volume (for TBF/Spike)
Volume (af)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Run A-1000
Run B-1000
Run C-1000
Run A-750
Run B-750
Run C-750
Run A-500
Run B-500
Run C-500


Cumulative Shortage
Volume (af)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Run A-1000
Run B-1000
Run C-1000
Run A-750
Run B-750
Run C-750
Run A-500
Run B-500
Run C-500

FLOW STATISTICS AT FOUR CORNERS

85 year total

Duration	Run A-500			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	24%	36%	47%	82%
5 days	19%	35%	46%	75%
10 days	12%	29%	42%	68%
15 days	7%	25%	40%	61%
20 days	4%	24%	38%	58%
30 days		13%	28%	47%
40 days		7%	25%	41%
50 days		2%	21%	34%
60 days		1%	20%	29%
80 days			13%	26%

Duration	Run B-500			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	22%	38%	44%	82%
5 days	19%	36%	42%	75%
10 days	11%	29%	42%	69%
15 days	6%	27%	41%	62%
20 days	2%	22%	41%	56%
30 days		11%	31%	48%
40 days		7%	22%	44%
50 days		2%	21%	38%
60 days		1%	20%	32%
80 days			15%	28%

Duration	Run C-500			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	18%	28%	44%	84%
5 days	15%	27%	41%	75%
10 days	14%	25%	39%	69%
15 days	11%	24%	33%	62%
20 days	6%	22%	31%	56%
30 days		19%	25%	48%
40 days		13%	22%	42%
50 days		8%	21%	36%
60 days		4%	21%	28%
80 days			18%	22%

Duration	Run A-750			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	21%	33%	42%	82%
5 days	18%	31%	40%	75%
10 days	11%	25%	40%	68%
15 days	7%	22%	34%	61%
20 days	4%	20%	32%	52%
30 days		9%	25%	45%
40 days		6%	24%	38%
50 days		1%	20%	34%
60 days		1%	19%	29%
80 days			9%	22%

Duration	Run B-750			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	19%	32%	39%	82%
5 days	16%	31%	36%	75%
10 days	9%	25%	36%	68%
15 days	5%	25%	35%	61%
20 days	1%	18%	35%	52%
30 days		7%	27%	45%
40 days		6%	21%	39%
50 days		1%	20%	35%
60 days		1%	20%	29%
80 days			9%	25%

Duration	Run C-750			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	19%	25%	40%	82%
5 days	14%	24%	35%	74%
10 days	12%	21%	32%	68%
15 days	7%	21%	28%	61%
20 days	4%	20%	28%	52%
30 days		16%	22%	44%
40 days		12%	20%	38%
50 days		8%	20%	35%
60 days		5%	19%	27%
80 days			16%	22%

Duration	Run A-1000			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	14%	25%	36%	82%
5 days	13%	25%	33%	74%
10 days	8%	20%	31%	68%
15 days	4%	18%	28%	60%
20 days	4%	13%	27%	52%
30 days		7%	19%	44%
40 days		5%	18%	36%
50 days		1%	14%	33%
60 days		1%	12%	27%
80 days			6%	15%

Duration	Run B-1000			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	16%	25%	35%	82%
5 days	15%	25%	32%	74%
10 days	9%	20%	31%	68%
15 days	4%	20%	28%	60%
20 days	1%	14%	27%	52%
30 days		7%	24%	45%
40 days		5%	18%	36%
50 days		1%	14%	33%
60 days		1%	9%	27%
80 days			7%	20%

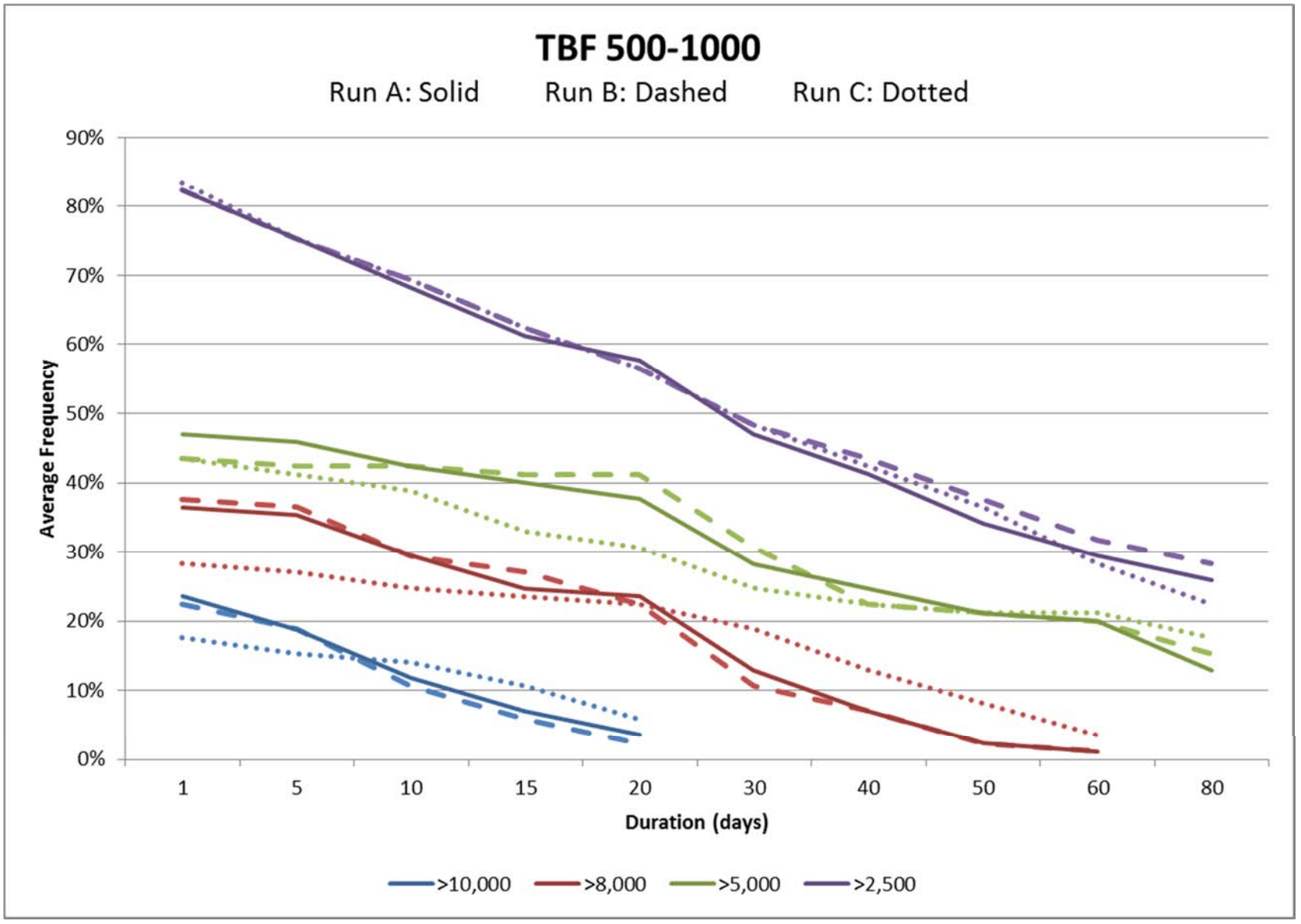
Duration	Run C-1000			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	14%	21%	35%	82%
5 days	9%	18%	31%	74%
10 days	8%	15%	29%	68%
15 days	6%	14%	25%	60%
20 days	2%	14%	21%	53%
30 days		13%	16%	44%
40 days		11%	15%	36%
50 days		7%	14%	33%
60 days		2%	13%	25%
80 days			9%	16%

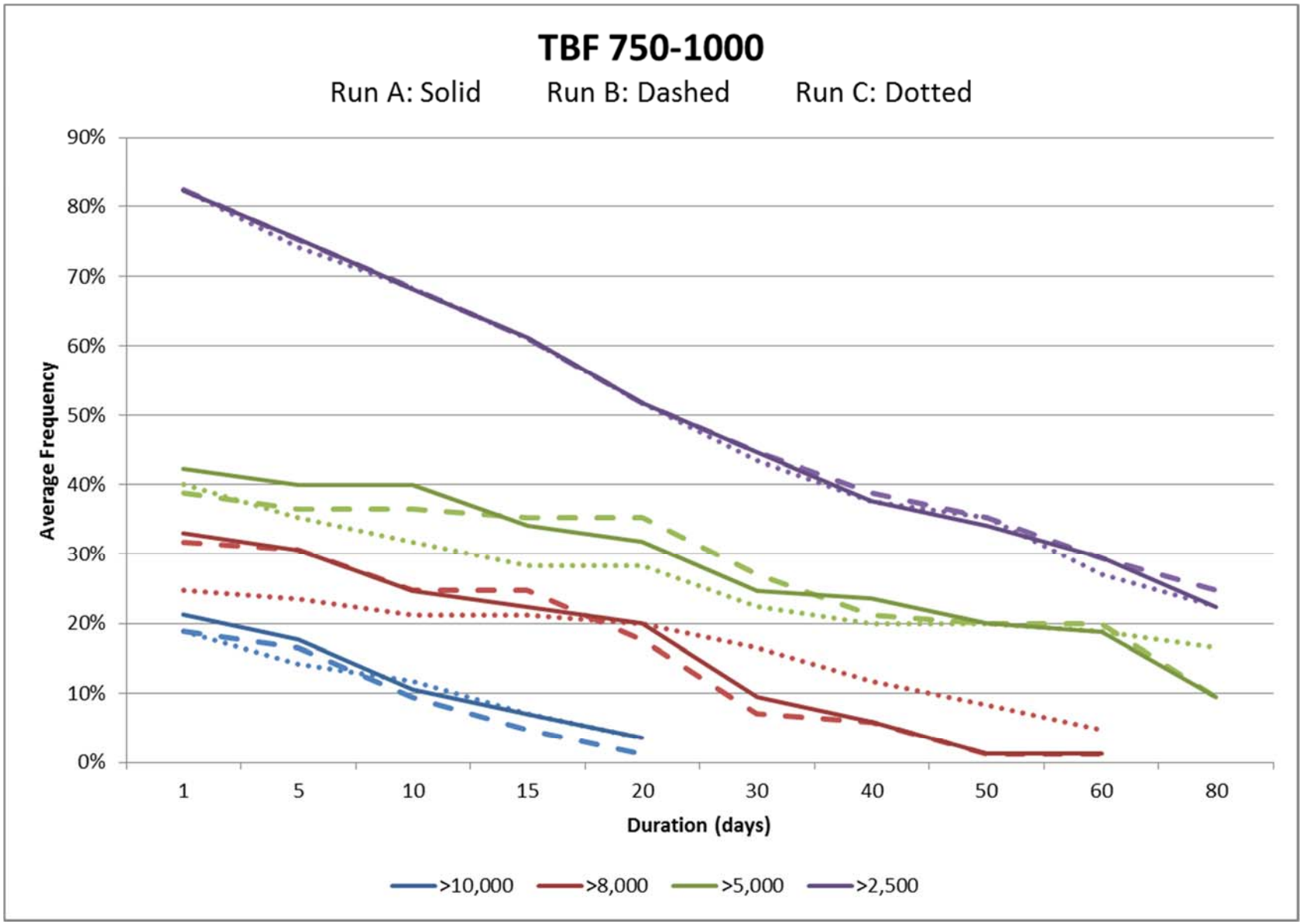
Maximum Years between Events

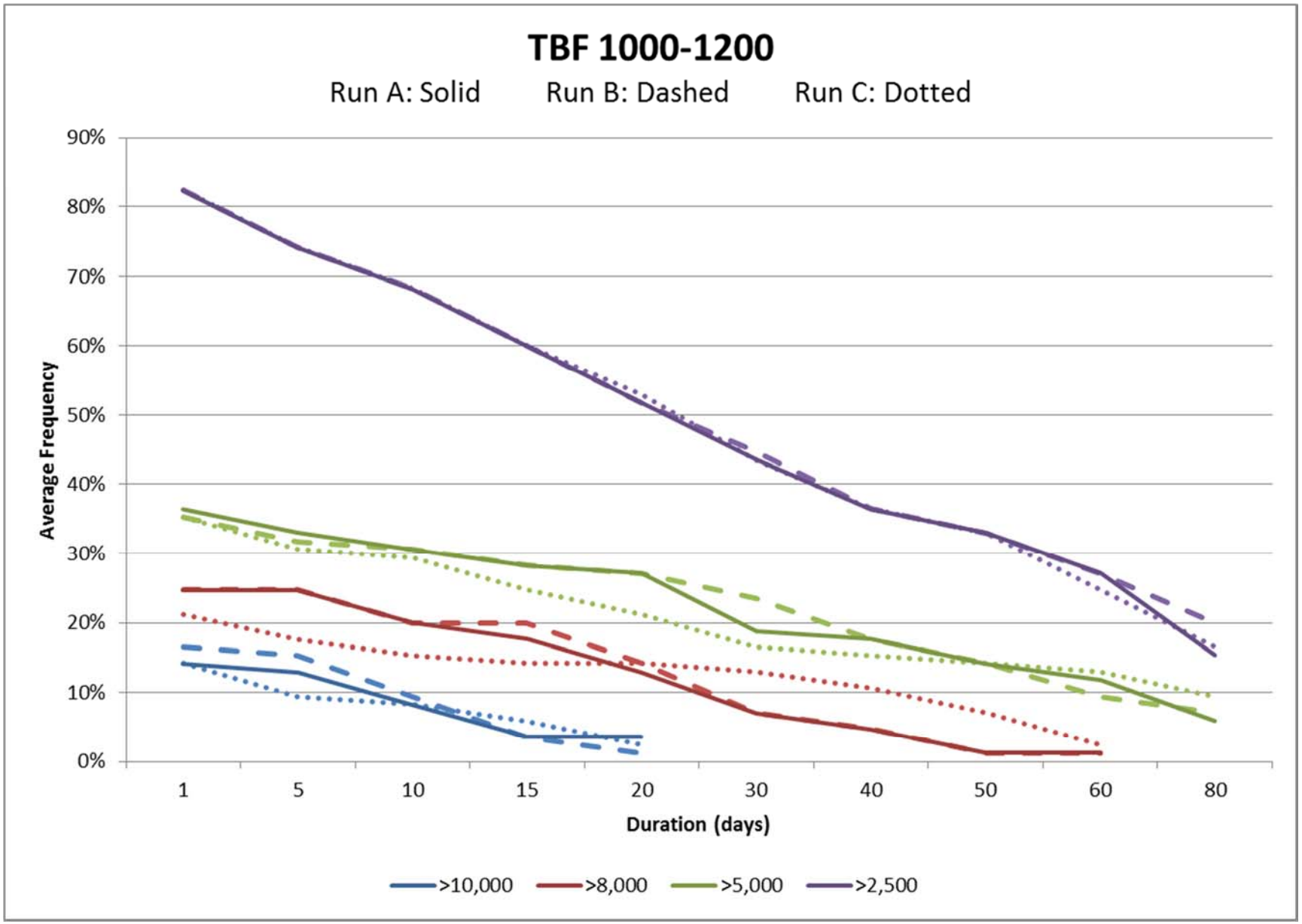
Flow Criteria - Max Duration	Run A-500	Run A-750	Run A-1000
9700 cfs for 5-days	16	16	20
7760 cfs for 10-days	14	14	18
4850 cfs for 21-days	8	14	14
2450 cfs for 10-days	3	3	3

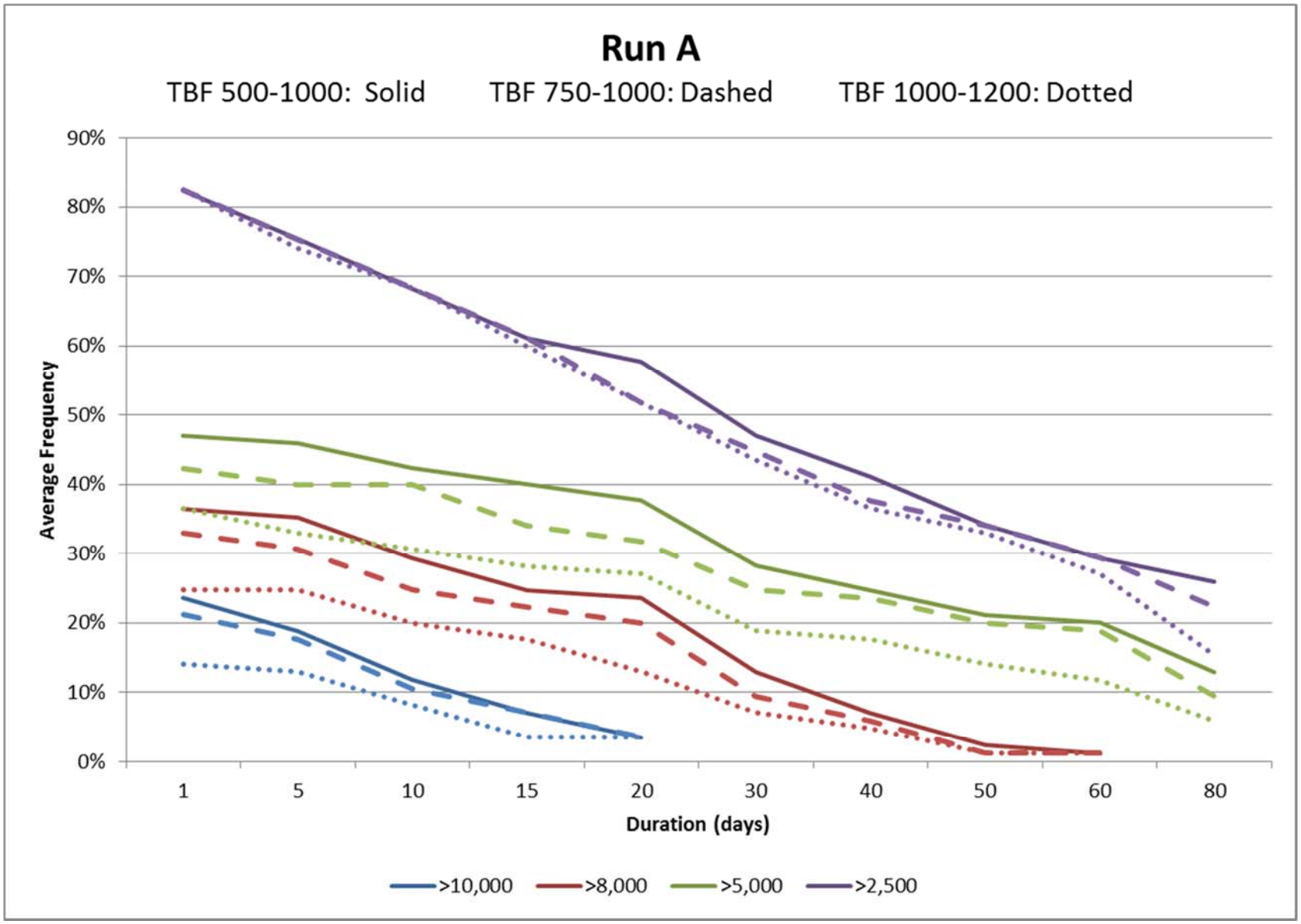
Flow Criteria - Max Duration	Run B-500	Run B-750	Run B-1000
9700 cfs for 5-days	16	16	20
7760 cfs for 10-days	14	14	18
4850 cfs for 21-days	8	14	14
2450 cfs for 10-days	3	3	3

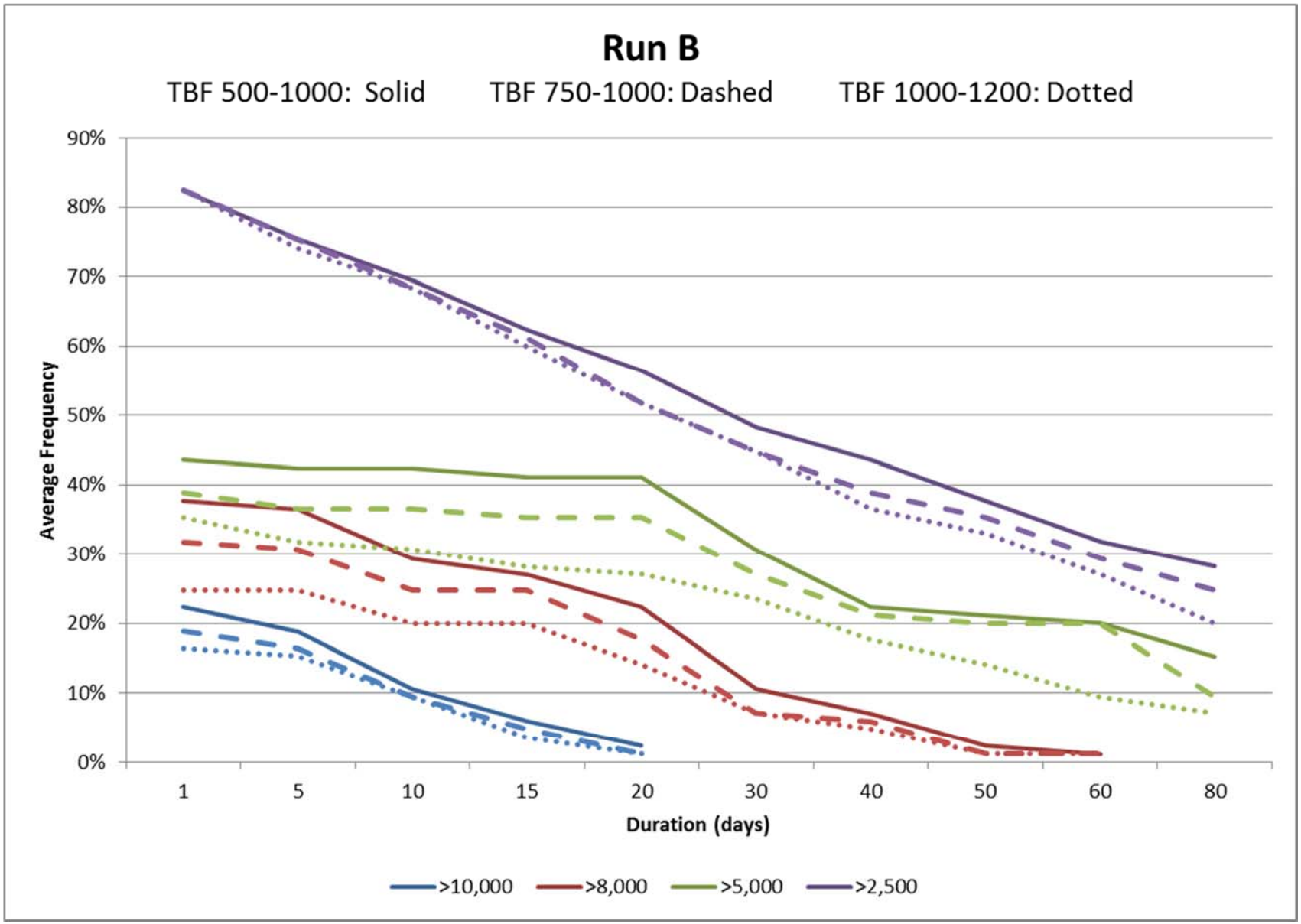
Flow Criteria - Max Duration	Run C-500	Run C-750	Run C-1000
9700 cfs for 5-days	18	18	21
7760 cfs for 10-days	14	14	18
4850 cfs for 21-days	14	14	18
2450 cfs for 10-days	3	3	3

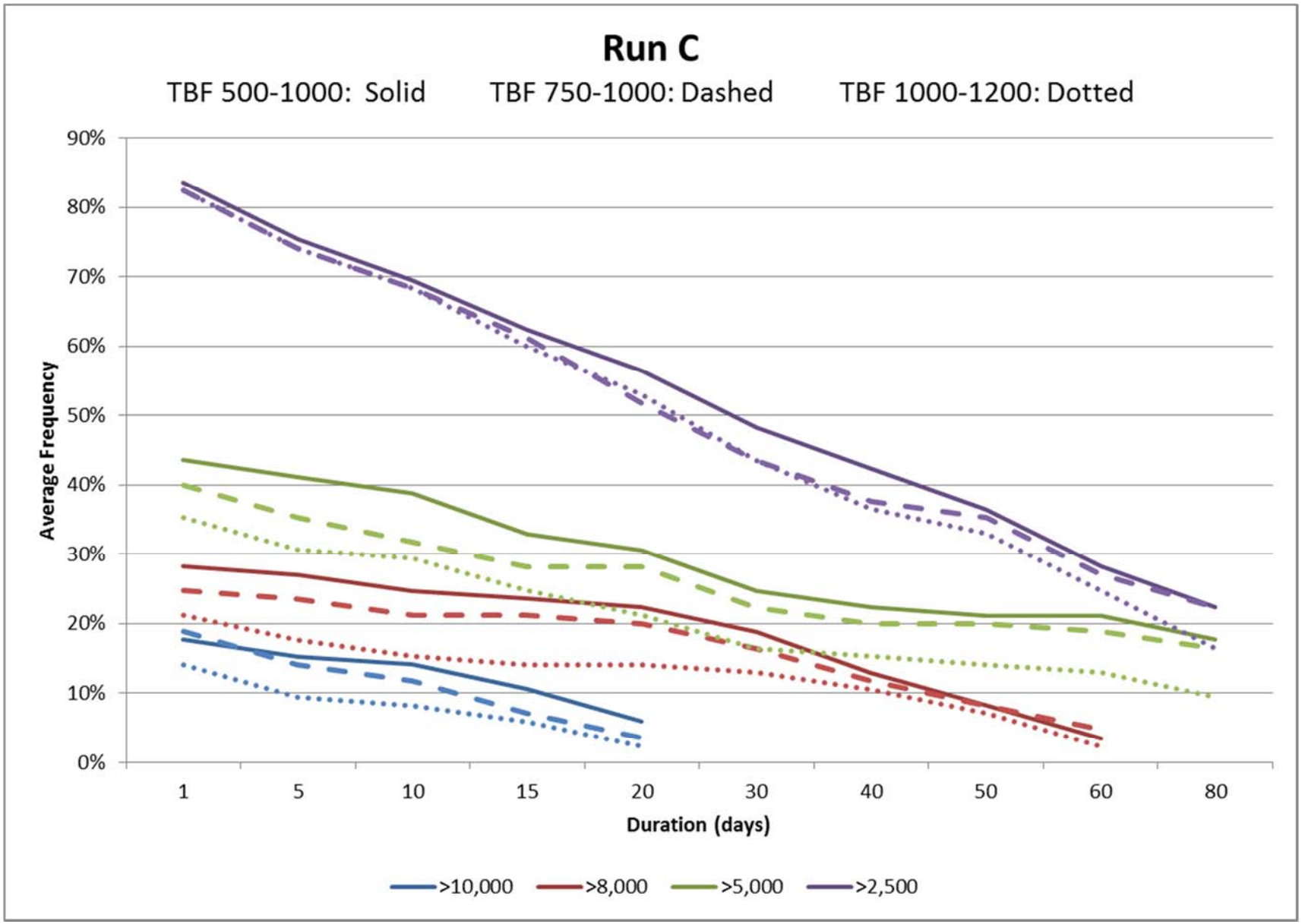

TBF 500-1000
Run A: Solid
Run B: Dashed
Run C: Dotted
Average Frequency
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500


TBF 750-1000
Run A: Solid
Run B: Dashed
Run C: Dotted
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Average Frequency
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500


TBF 1000-1200
Run A: Solid
Run B: Dashed
Run C: Dotted
Average Frequency
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500


Run A
TBF 500-1000: Solid
TBF 750-1000: Dashed
TBF 1000-1200: Dotted
Average Frequency
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500


Run B
TBF 500-1000: Solid
TBF 750-1000: Dashed
TBF 1000-1200: Dotted
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Average Frequency
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500


Run C
TBF 500-1000: Solid
TBF 750-1000: Dashed
TBF 1000-1200: Dotted
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Average Frequency
1
5
10
15
20
30
40
50
60
80
Duration (days)
>10,000
>8,000
>5,000
>2,500

Over the 85 year period,
How many times do we go without meeting target for X years?

RUN A-500

years	>2450	>4850	>7760	>9700
2	6	11	11	11
5		4	5	6
8		1	3	3
10		0	2	2
12		0	1	2
15		0	0	1
18		0	0	0
20				0

Run B-500

years	>2450	>4850	>7760	>9700
2	5	12	11	12
5		3	5	6
8		1	3	3
10		0	2	2
12		0	1	2
15		0	0	1
18		0	0	0
20				0

Run C-500

years	>2450	>4850	>7760	>9700
2	5	13	12	9
5		5	6	7
8		2	3	3
10		1	1	2
12		1	1	2
15		0	0	1
18		0	0	1
20				0

Run A-750

years	>2450	>4850	>7760	>9700
2	6	11	11	11
5		5	6	6
8		2	3	3
10		1	2	2
12		1	1	2
15		0	0	1
18		0	0	0
20				0

Run B-750

years	>2450	>4850	>7760	>9700
2	6	10	10	11
5		3	6	6
8		2	3	4
10		1	2	2
12		1	1	2
15		0	0	1
18		0	0	0
20				0

Run C-750

years	>2450	>4850	>7760	>9700
2	6	13	11	9
5		6	6	7
8		2	3	3
10		1	2	2
12		1	2	2
15		0	0	1
18		0	0	1
20				0

Run A-1000

years	>2450	>4850	>7760	>9700
2	6	12	10	8
5		4	7	6
8		2	3	4
10		2	2	3
12		2	2	3
15		0	1	2
18		0	1	1
20				1

Run B-1000

years	>2450	>4850	>7760	>9700
2	6	12	9	10
5		4	6	6
8		2	4	4
10		2	2	2
12		2	2	2
15		0	1	1
18		0	1	1
20				1

Run C-1000

years	>2450	>4850	>7760	>9700
2	6	9	8	7
5		6	6	5
8		3	4	4
10		2	3	3
12		2	3	3
15		1	2	3
18		1	1	2
20				1

Targets: 9700 cfs for 5-days, 7760 cfs for 10-days, 4850 cfs for 21-days, 2425 cfs for 10-days (March – July)

Over the 85 year period,
How many times is the target met X years in a row?

RUN A-500

years	>2450	>4850	>7760	>9700
2	12	1	2	1
3	6	1	1	
4	5	1	1	
5	2	1	0	
6	0	0		

Run B-500

years	>2450	>4850	>7760	>9700
2	12	3	2	1
3	6	2	1	
4	5	1	1	
5	2	1	0	
6	1	1		

Run C-500

years	>2450	>4850	>7760	>9700
2	12	2	1	0
3	6	2	0	
4	6	1	0	
5	2	0	0	
6	0	0		

Run A-750

years	>2450	>4850	>7760	>9700
2	12	1	1	1
3	6	1	1	
4	5	1	1	
5	2	0	0	
6	0	0		

Run B-750

years	>2450	>4850	>7760	>9700
2	12	1	1	1
3	6	1	1	
4	5	1	1	
5	2	1	0	
6	0	0		

Run C-750

years	>2450	>4850	>7760	>9700
2	12	1	1	0
3	6	1	0	
4	5	1	0	
5	2	0	0	
6	0	0		

Run A-1000

years	>2450	>4850	>7760	>9700
2	12	1	1	1
3	6	1	1	
4	5	1	1	
5	2	0	0	
6	0	0		

Run B-1000

years	>2450	>4850	>7760	>9700
2	12	1	1	1
3	6	1	1	
4	5	1	1	
5	2	0	0	
6	0	0		

Run C-1000

years	>2450	>4850	>7760	>9700
2	12	1	1	0
3	6	1	1	
4	5	1	1	
5	2	0	0	
6	0	0		

Targets: 9700 cfs for 5-days, 7760 cfs for 10-days, 4850 cfs for 21-days, 2425 cfs for 10-days (March – July)

DATA SUMMARIES

Run	Statistic	SJ4C Outflow	AW Volume	SPR Volume	SPR + Nose Volume	Non-Nose Op Spill	SPR Occurance % of Yrs	Shortage	Days>2425	Days>4850	Days>7760	Days>9700
A-500	Min	481	0	0	0	0		0	0	0	0	0
A-500	Average	1,438	226,112	121,492	203,814	22,298	44%	5,980	43	24	10	3
A-500	Max	16,948	1,343,408	374,777	1,019,504	323,904		341,756	150	125	67	44
A-500	Sum	44,641,005	19,219,507	10,326,843	17,324,201	1,895,306		508,320	3,639	2,044	828	257
A-750	Min	666	0	0	0	0		0	0	0	0	0
A-750	Average	1,476	179,827	103,286	171,297	8,531	34%	29,735	40	21	8	3
A-750	Max	16,880	1,118,449	374,777	1,019,504	137,656		472,072	149	123	65	44
A-750	Sum	45,816,250	15,285,325	8,779,339	14,560,221	725,104		2,527,515	3,438	1,795	708	232
A-1000	Min	835	0	0	0	0		0	0	0	0	0
A-1000	Average	1,557	123,696	75,308	117,224	6,472	25%	86,327	38	16	6	2
A-1000	Max	16,857	1,034,123	374,777	1,019,504	150,368		689,568	149	114	64	43
A-1000	Sum	48,341,438	10,514,168	6,401,157	9,964,066	550,102		7,337,774	3,192	1,352	547	177
B-500	Min	481	0	0	0	0		0	0	0	0	0
B-500	Average	1,439	309,290	102,610	231,916	6,297	39%	6,352	45	25	10	3
B-500	Max	16,945	1,476,062	264,298	1,365,583	98,726		341,756	149	122	65	44
B-500	Sum	44,675,768	26,289,616	8,721,818	19,712,851	535,272		539,958	3,786	2,140	813	235
B-750	Min	666	0	0	0	0		0	0	0	0	0
B-750	Average	1,479	248,282	80,844	186,381	4,236	31%	32,049	42	22	8	2
B-750	Max	16,871	1,249,563	264,298	1,139,084	91,023		472,072	149	122	64	44
B-750	Sum	45,932,537	21,104,006	6,871,736	15,842,367	360,040		2,724,130	3,551	1,839	658	207
B-1000	Min	835	0	0	0	0		0	0	0	0	0
B-1000	Average	1,564	172,672	62,188	130,839	2,073	24%	90,736	39	16	6	2
B-1000	Max	16,857	1,165,411	264,298	1,054,932	102,288		710,320	149	114	64	43
B-1000	Sum	48,543,881	14,677,117	5,285,950	11,121,302	176,166		7,712,567	3,322	1,371	545	185
C-500	Min	481	0	0	0	0		0	0	0	0	0
C-500	Average	1,443	324,698	224,173	295,272	5,500	44%	7,965	44	26	11	3
C-500	Max	16,948	1,551,908	624,000	1,205,058	185,983		341,756	150	132	73	58
C-500	Sum	44,811,861	27,599,369	19,054,675	25,098,132	467,477		677,067	3,726	2,186	933	278
C-750	Min	666	0	0	0	0		0	0	0	0	0
C-750	Average	1,483	246,995	158,987	212,529	5,614	28%	34,298	40	22	10	3
C-750	Max	16,859	1,444,507	624,000	1,205,058	103,263		472,072	140	126	72	57
C-750	Sum	46,038,460	20,994,548	13,513,931	18,064,999	477,165		2,915,308	3,425	1,872	832	241
C-1000	Min	835	0	0	0	0		0	0	0	0	0
C-1000	Average	1,551	179,324	136,207	163,202	988	26%	82,265	37	16	7	2
C-1000	Max	16,857	1,039,404	624,000	1,039,404	49,544		631,802	119	109	72	57
C-1000	Sum	48,158,813	15,242,582	11,577,567	13,872,196	84,006		6,992,483	3,143	1,340	626	183

1 = best/most									
9 = worst/least									

parameter	Run A			Run B			Run C		
	500-1000	750-1000	1000-1200	500-1000	750-1000	1000-1200	500-1000	750-1000	1000-1200
Available Water	5	6	9	2	3	8	1	4	7
SPR + Nose Vol	4	6	9	2	5	8	1	3	7
SPR Frequency	1	4	8	3	5	9	2	6	7
Excess TBF	1	2	3	4	7	8	6	5	9
Shortage	1	4	8	2	5	9	3	6	7
Days > 5000	3	6	8	2	5	7	1	4	9
Days > 8000	3	5	8	4	6	9	1	2	7
Days > 10000	2	5	9	4	6	7	1	3	8