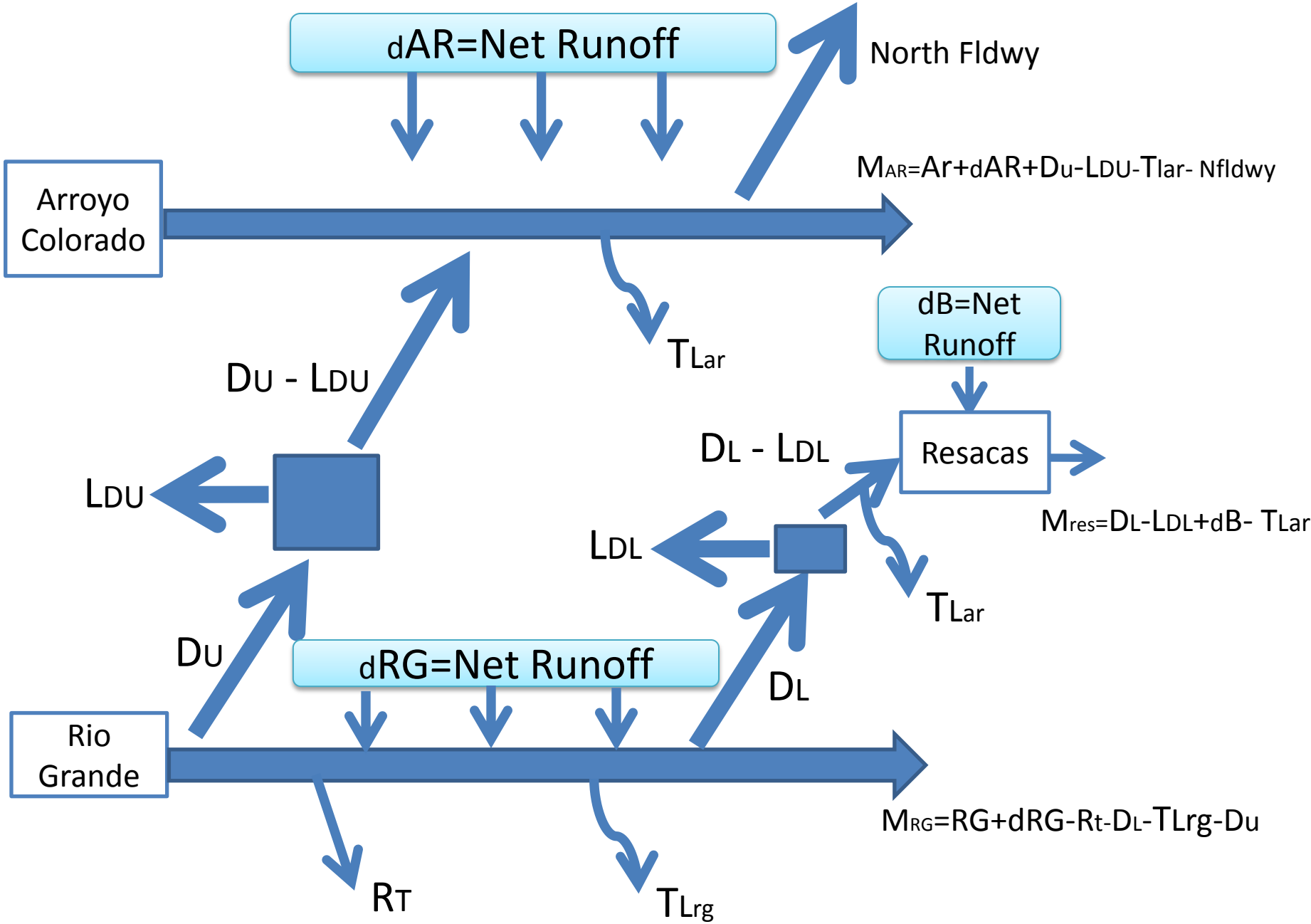
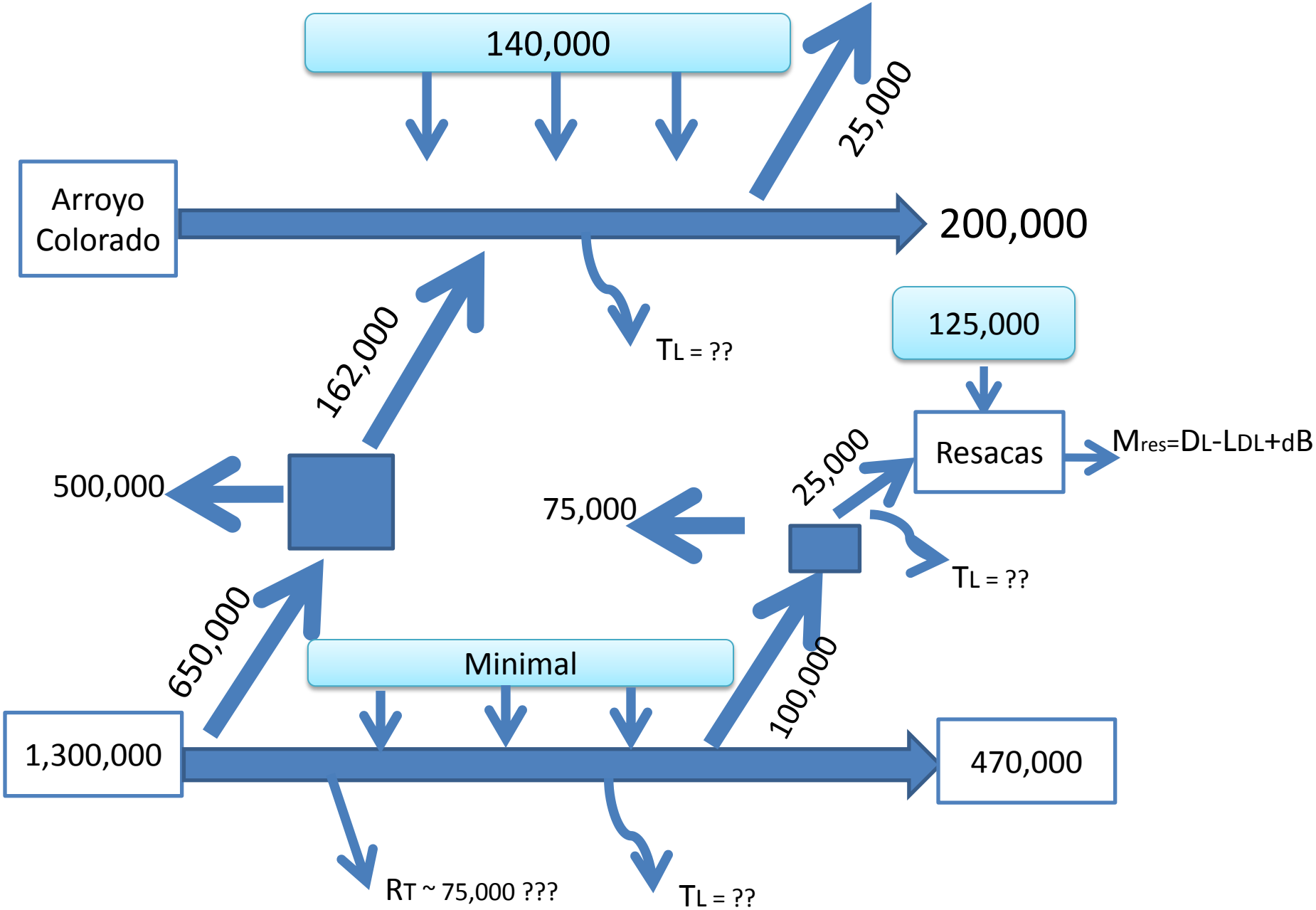
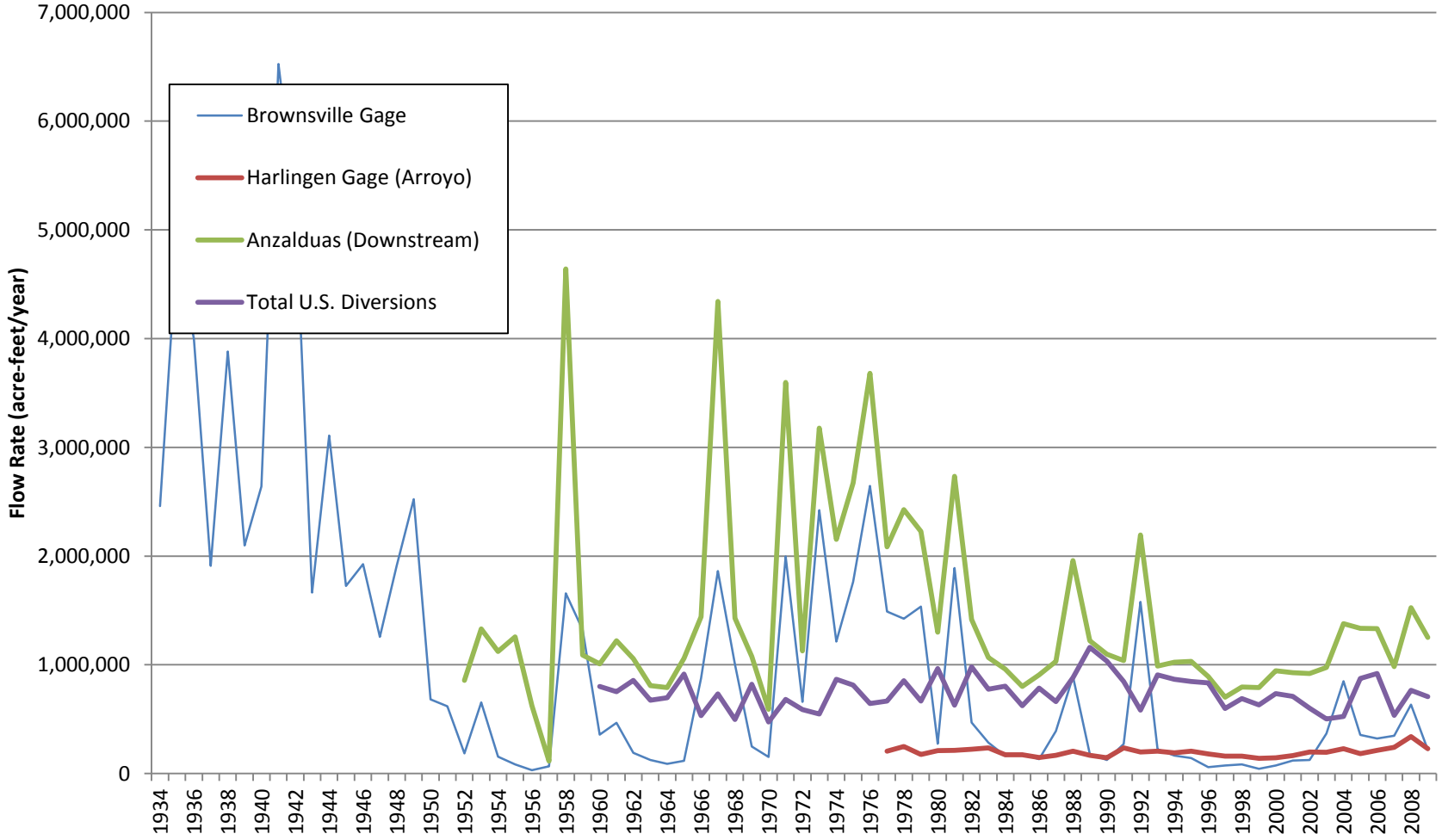
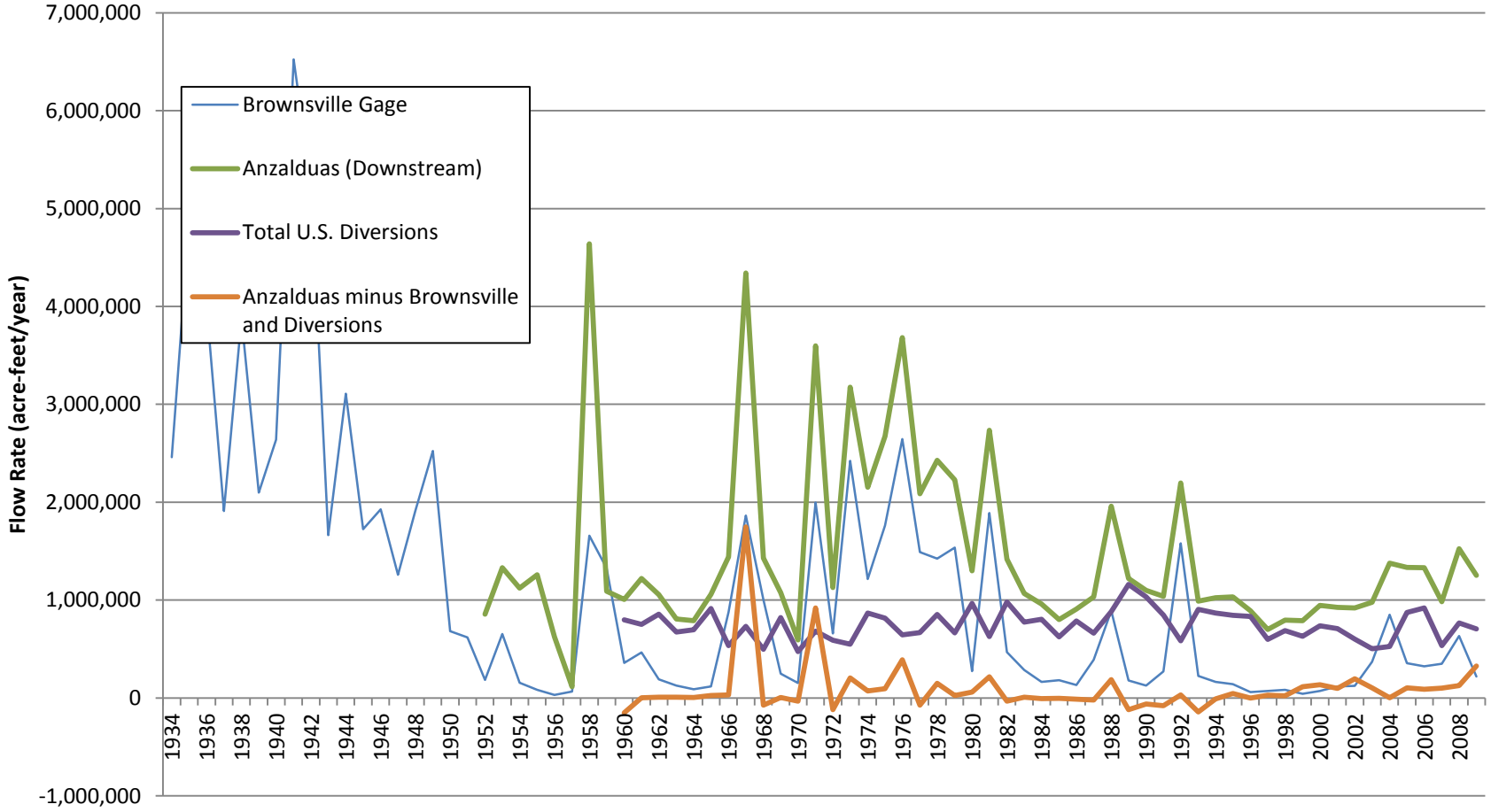

dAR=Net Runoff
North Fldwy
Arroyo Colorado
MAR=Ar+dAR+Du-LDU-Tlar- Nfldwy
TLar
dB=Net Runoff
DU - LDU
Resacas
DL - LDL
LDU
Mres=DL-LDL+dB- TLar
LDL
TLar
DU
dRG=Net Runoff
DL
Rio Grande
MRG=RG+dRG-Rt-DL-TLrg-Du
RT
TLrg


140,000
25,000
Arroyo Colorado
200,000
TL = ??
162,000
125,000
Resacas
Mres=DL-LDL+dB
500,000
25,000
75,000
TL = ??
650,000
Minimal
100,000
1,300,000
470,000
RT ~ 75,000 ???
TL = ??

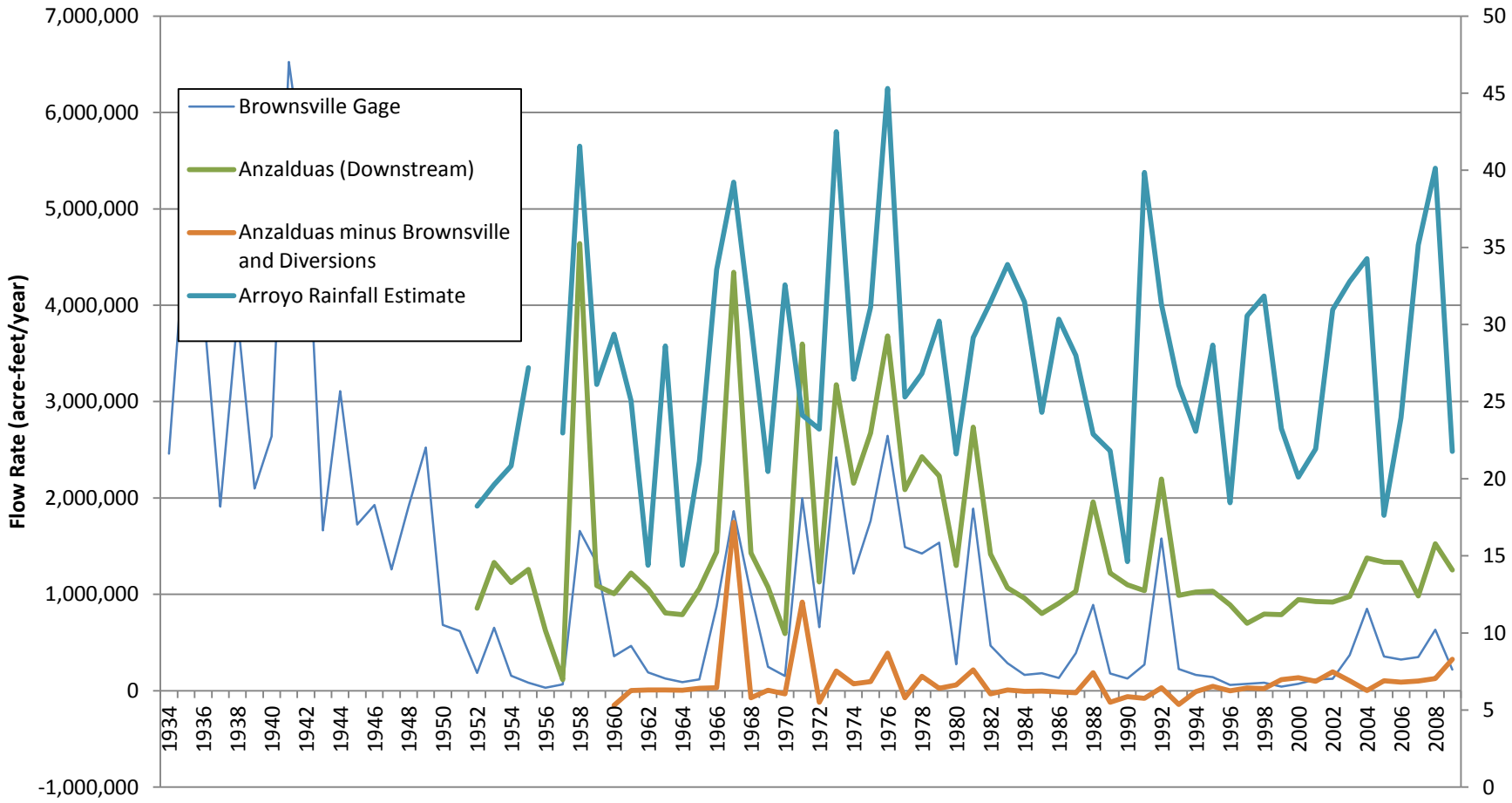
Annual Gage Flow Analysis

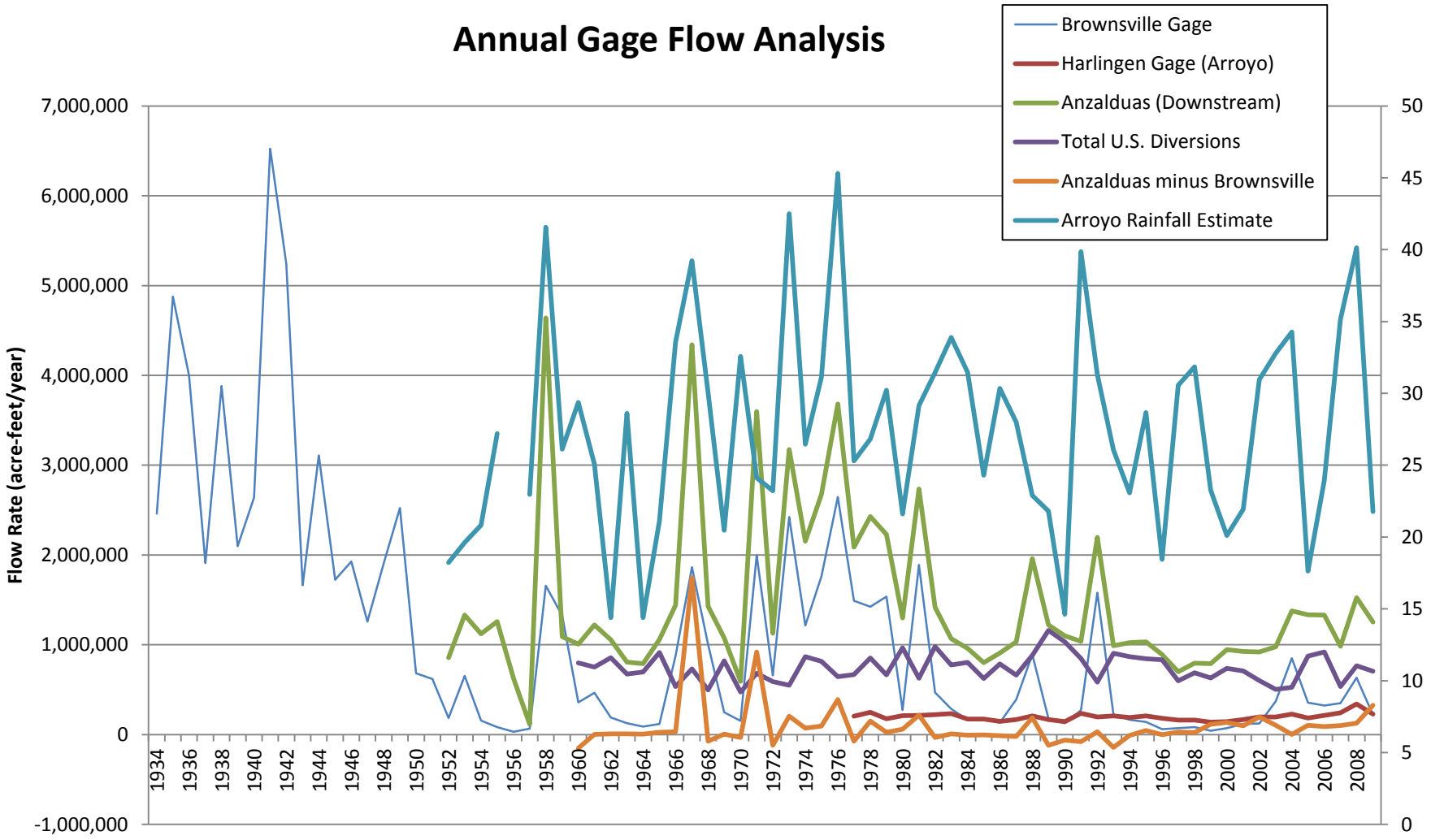


Annual Gage Flow Analysis



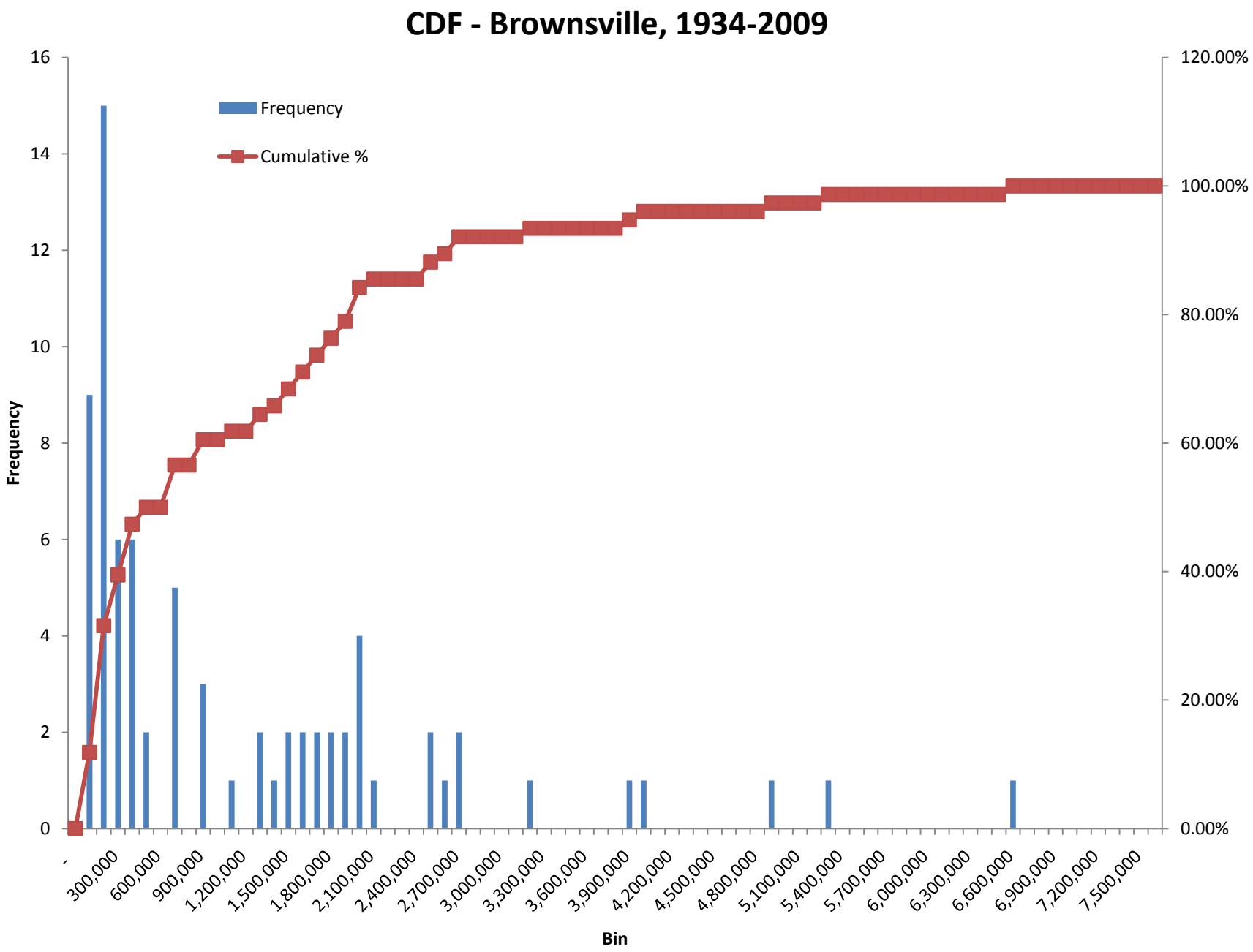
Annual Gage Flow Analysis

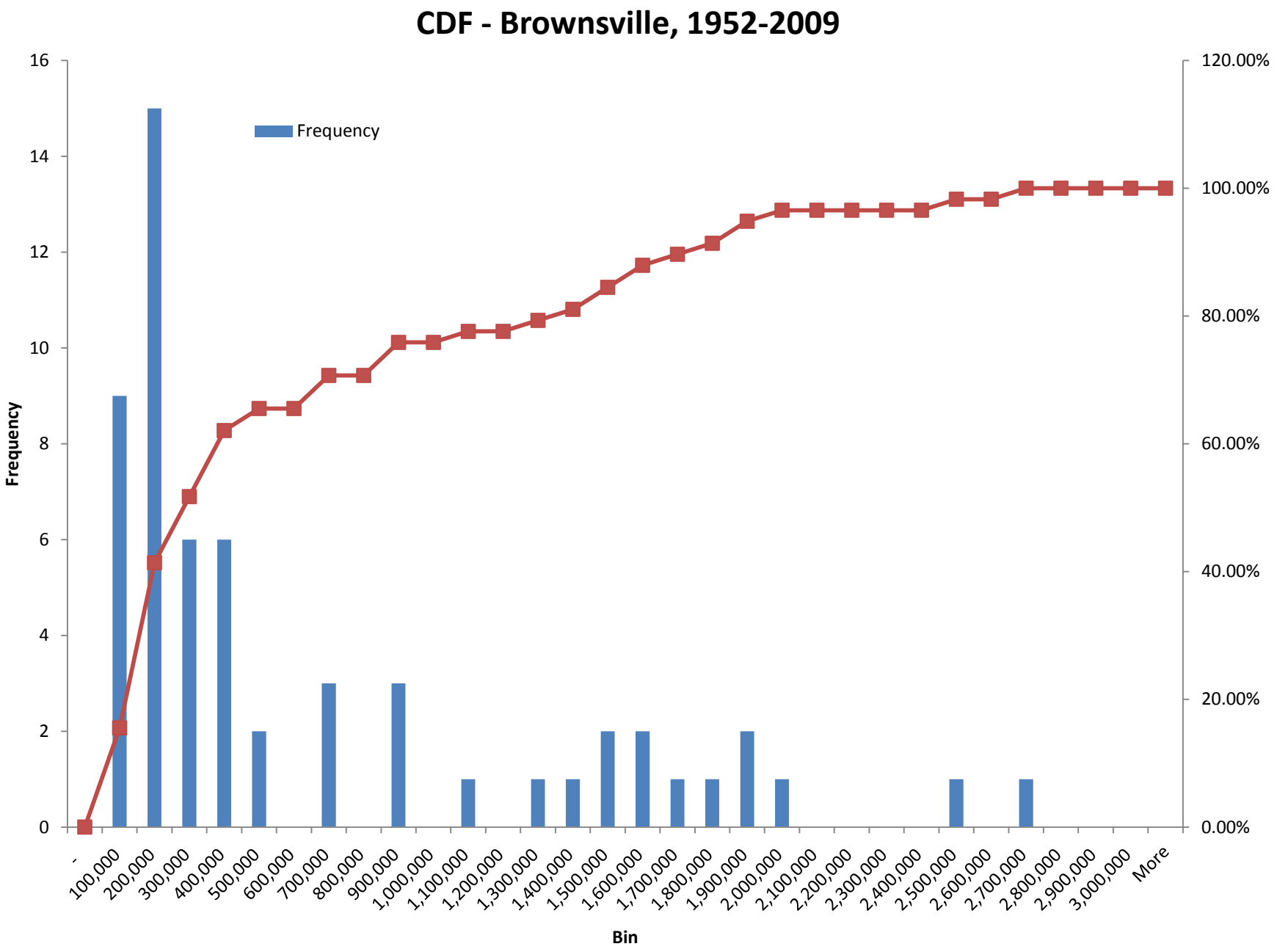


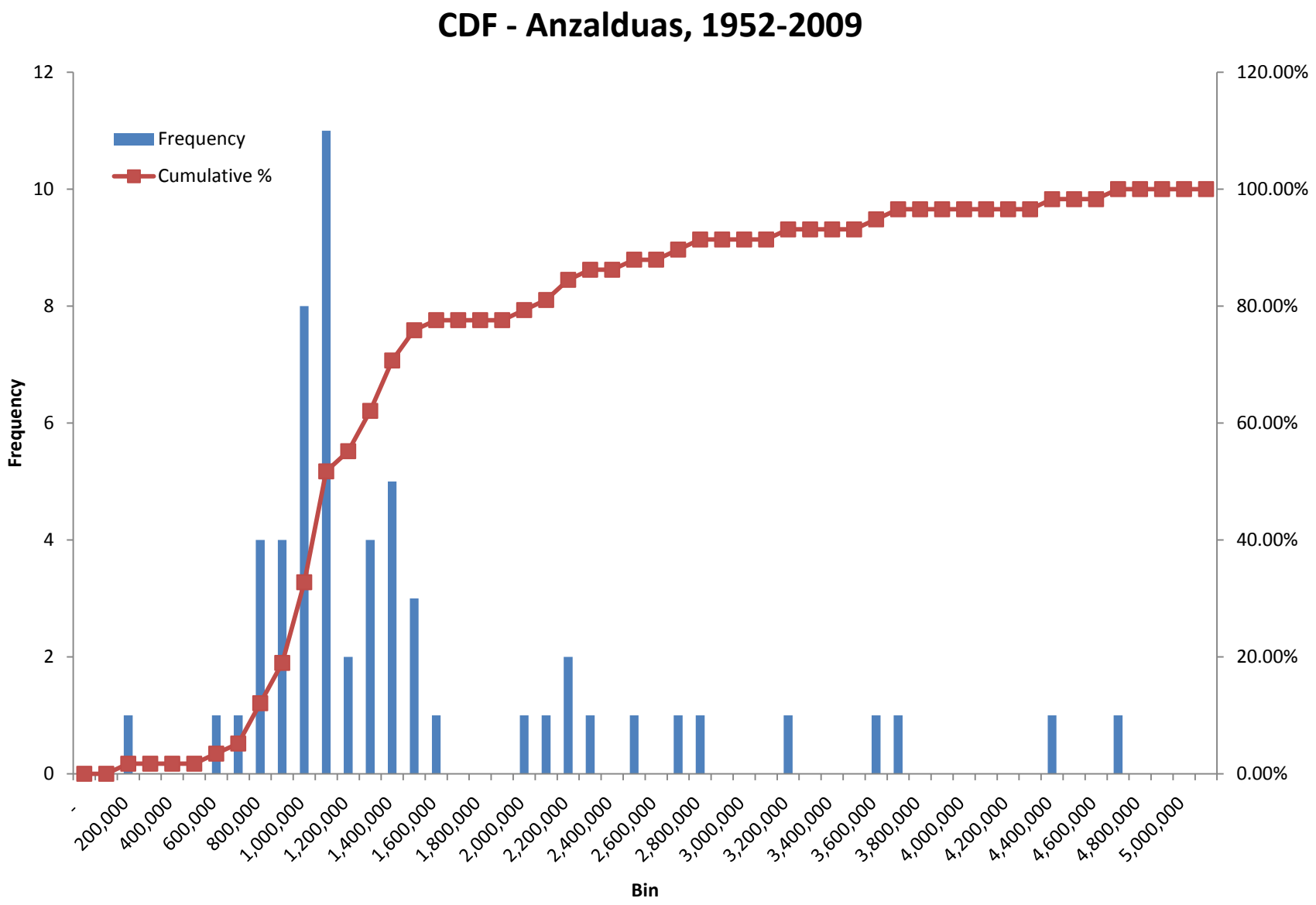

Annual Gage Flow Analysis
Brownsville Gage
Harlingen Gage (Arroyo)
Anzalduas (Downstream)
Total U.S. Diversions
Anzalduas minus Brownsville
Arroyo Rainfall Estimate
Flow Rate (acre-feet/year)
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
-1,000,000
50
45
40
35
30
25
20
15
10
5
0
1934
1936
1938
1940
1942
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008

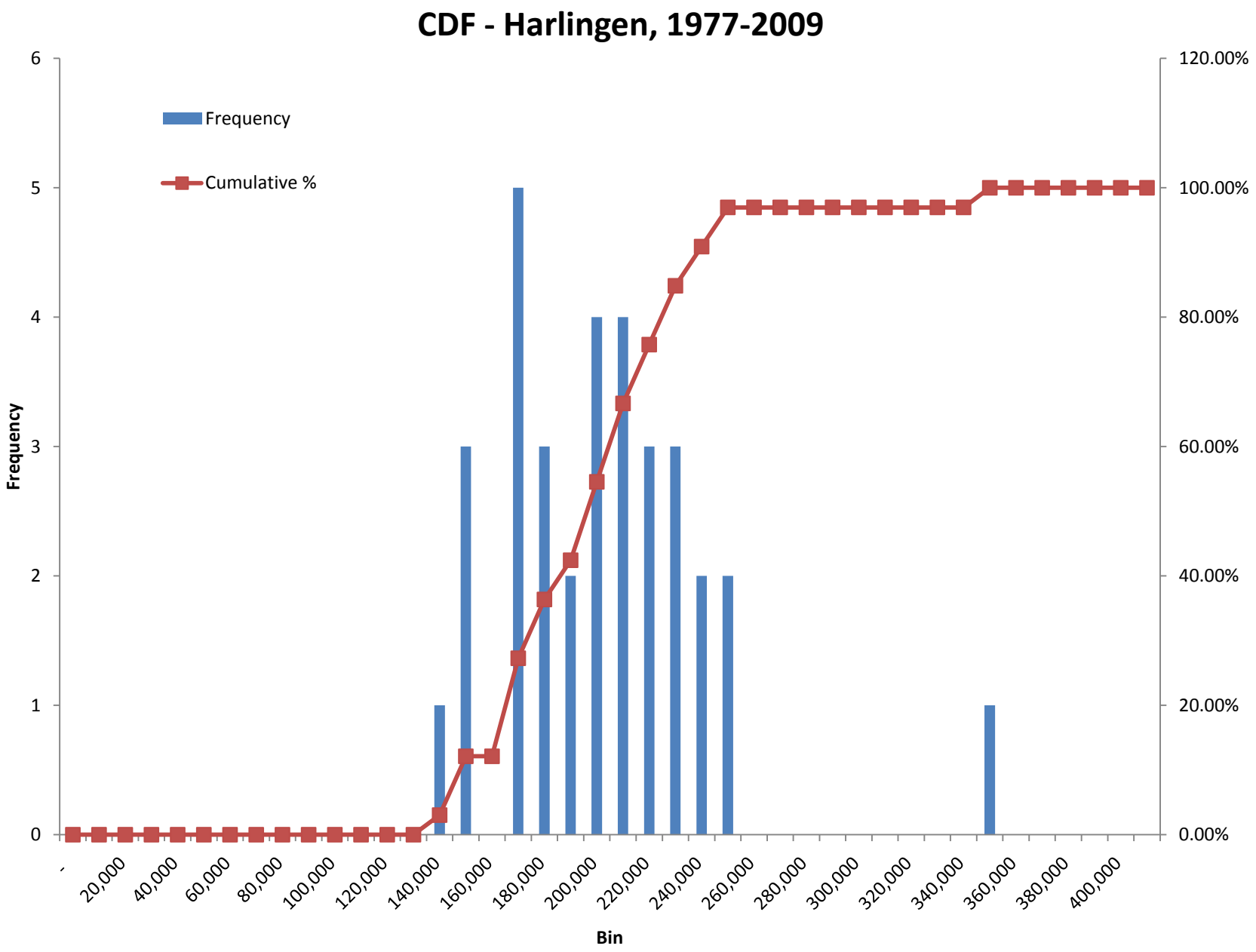
Points to Consider

- Rio Grande water balance is good
  - Relatively minor Mexican diversions downstream of Anzalduas
  - Minimal runoff as expected
- Arroyo Colorado balance requires additional analysis
  - Irrigation return flow
    - 25% ?
  - Does withdrawal data include municipal use?
  - Compare runoff estimated (simple coefficient) with existing models
    - TxRR for Resacas watershed and ungaged portion of Arroyo
    - May require more detailed model for Arroyo Colorado


CDF - Brownsville, 1934-2009
Frequency
Cumulative %
Frequency
Bin
0
2
4
6
8
10
12
14
16
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%
120.00%
-
300,000
600,000
900,000
1,200,000
1,500,000
1,800,000
2,100,000
2,400,000
2,700,000
3,000,000
3,300,000
3,600,000
3,900,000
4,200,000
4,500,000
4,800,000
5,100,000
5,400,000
5,700,000
6,000,000
6,300,000
6,600,000
6,900,000
7,200,000
7,500,000


CDF - Brownsville, 1952-2009
Frequency
Frequency
Bin
0
2
4
6
8
10
12
14
16
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%
120.00%
-
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
900,000
1,000,000
1,100,000
1,200,000
1,300,000
1,400,000
1,500,000
1,600,000
1,700,000
1,800,000
1,900,000
2,000,000
2,100,000
2,200,000
2,300,000
2,400,000
2,500,000
2,600,000
2,700,000
2,800,000
2,900,000
3,000,000
More


CDF - Anzalduas, 1952-2009
Frequency
Cumulative %
Frequency
Bin
0
2
4
6
8
10
12
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%
120.00%
-
200,000
400,000
600,000
800,000
1,000,000
1,200,000
1,400,000
1,600,000
1,800,000
2,000,000
2,200,000
2,400,000
2,600,000
2,800,000
3,000,000
3,200,000
3,400,000
3,600,000
3,800,000
4,000,000
4,200,000
4,400,000
4,600,000
4,800,000
5,000,000


CDF - Harlingen, 1977-2009
Frequency
Cumulative %
Frequency
Bin
0
1
2
3
4
5
6
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%
120.00%
-
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
180,000
200,000
220,000
240,000
260,000
280,000
300,000
320,000
340,000
360,000
380,000
400,000