

Analysis of Historical Rangen Spring Flows

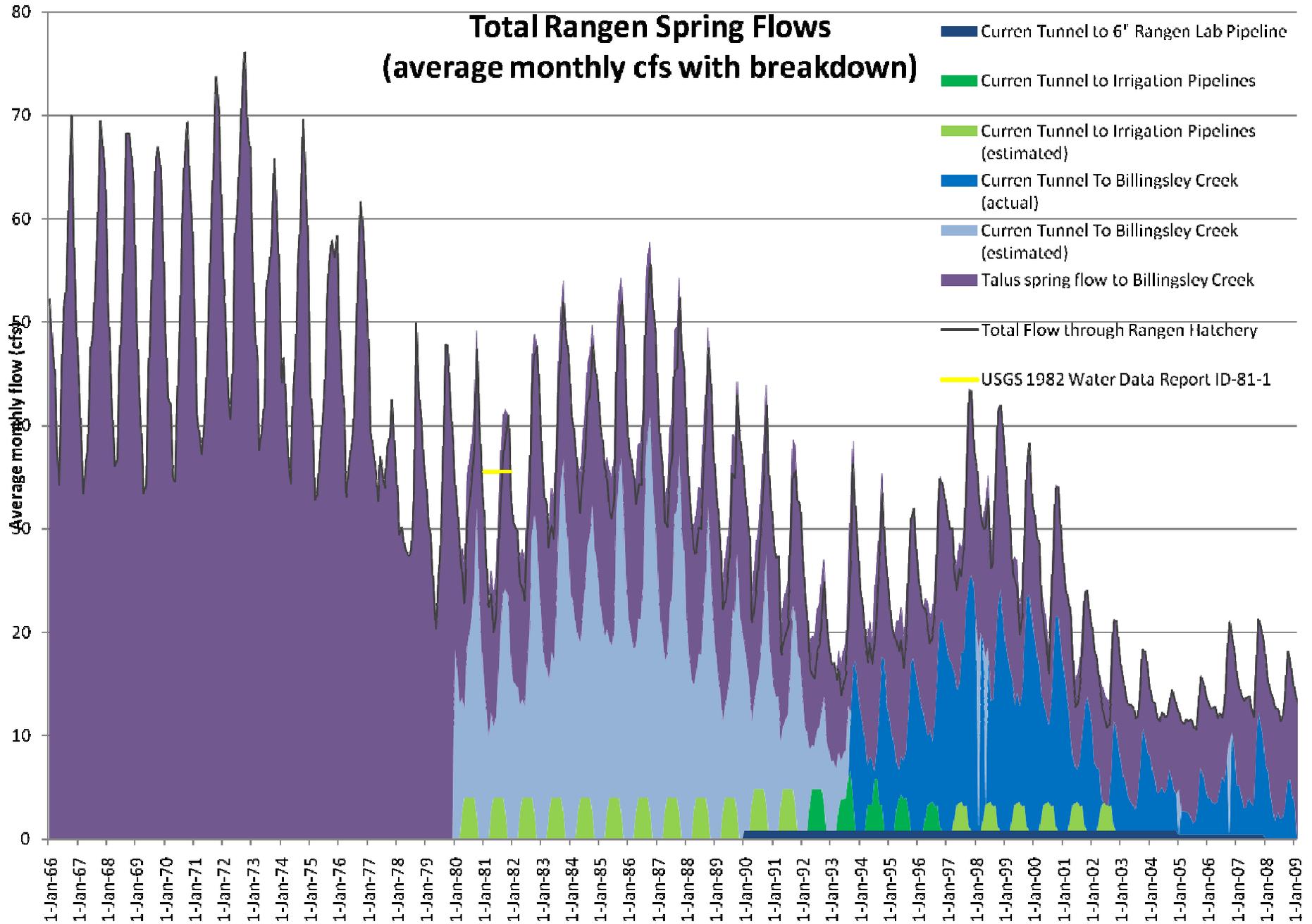
September 21, 2009
ESHMC Meeting, Boise, ID

Jim Brannon
Leonard Rice Engineers

Introduction

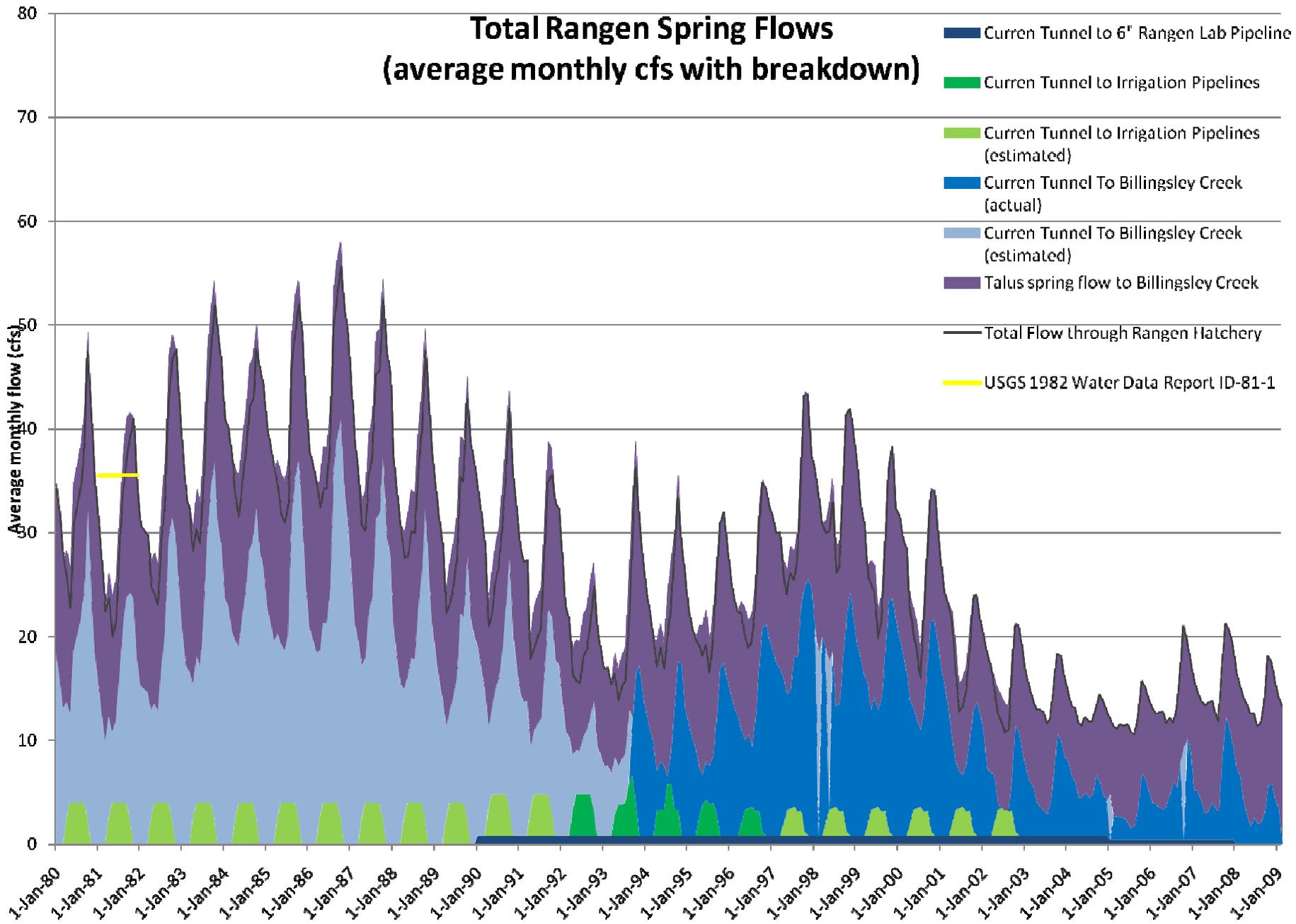
- Leonard Rice Engineers
 - Gregg Ten Eyck, Dennis McGrane
 - Wayne Courtney, Rangen Inc.
 - Declining spring flows and valuation
- Dr. Michael McDonald, Dr. Chuck Brendecke
- Before starting the trip, glimpse of where are we going.

Total Rangen Spring Flows (average monthly cfs with breakdown)



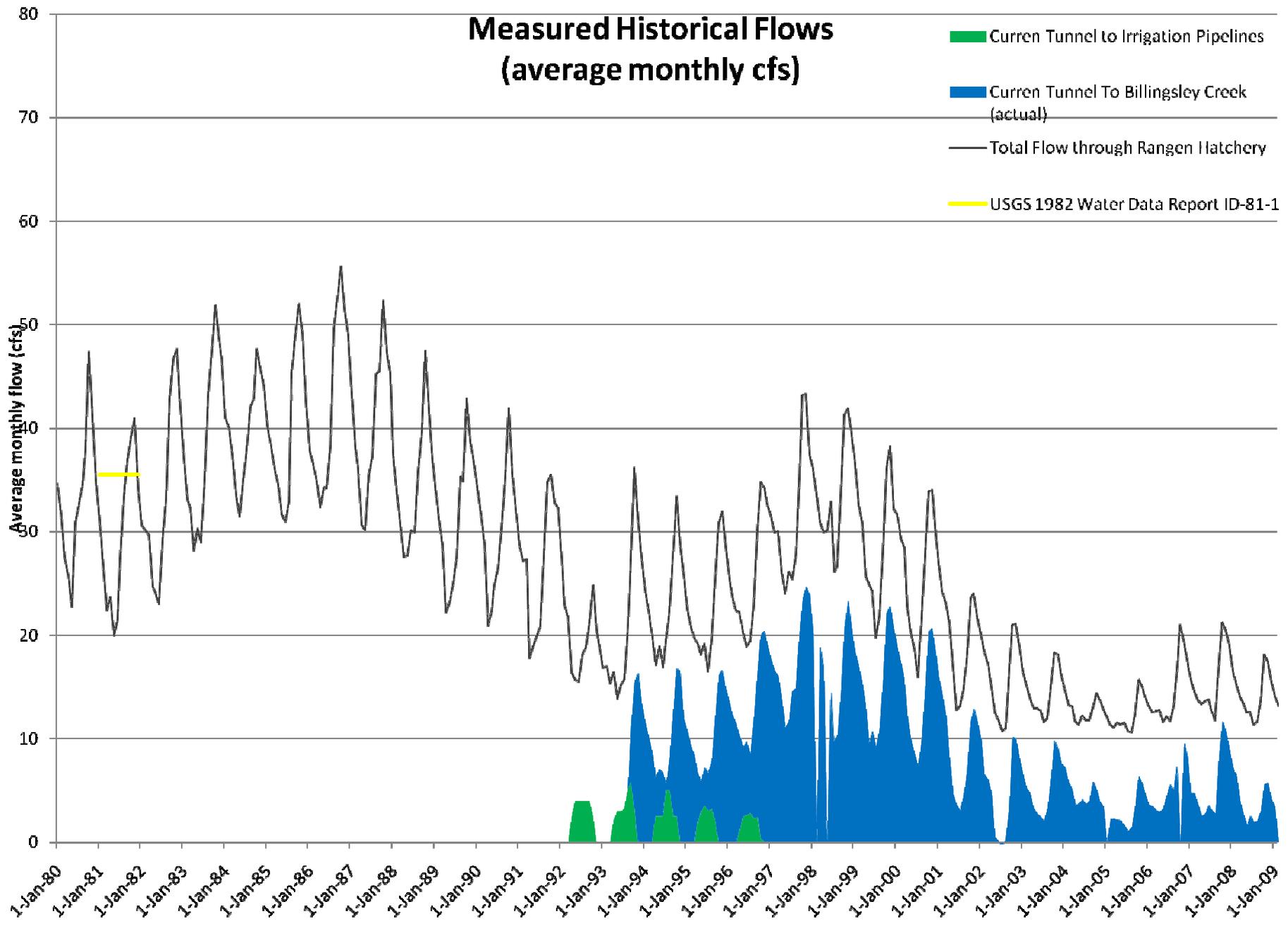
Total Rangen Spring Flows (average monthly cfs with breakdown)

- Curren Tunnel to 6" Rangen Lab Pipeline
- Curren Tunnel to Irrigation Pipelines
- Curren Tunnel to Irrigation Pipelines (estimated)
- Curren Tunnel To Billingsley Creek (actual)
- Curren Tunnel To Billingsley Creek (estimated)
- Talus spring flow to Billingsley Creek
- Total Flow through Rangen Hatchery
- USGS 1982 Water Data Report ID-81-1

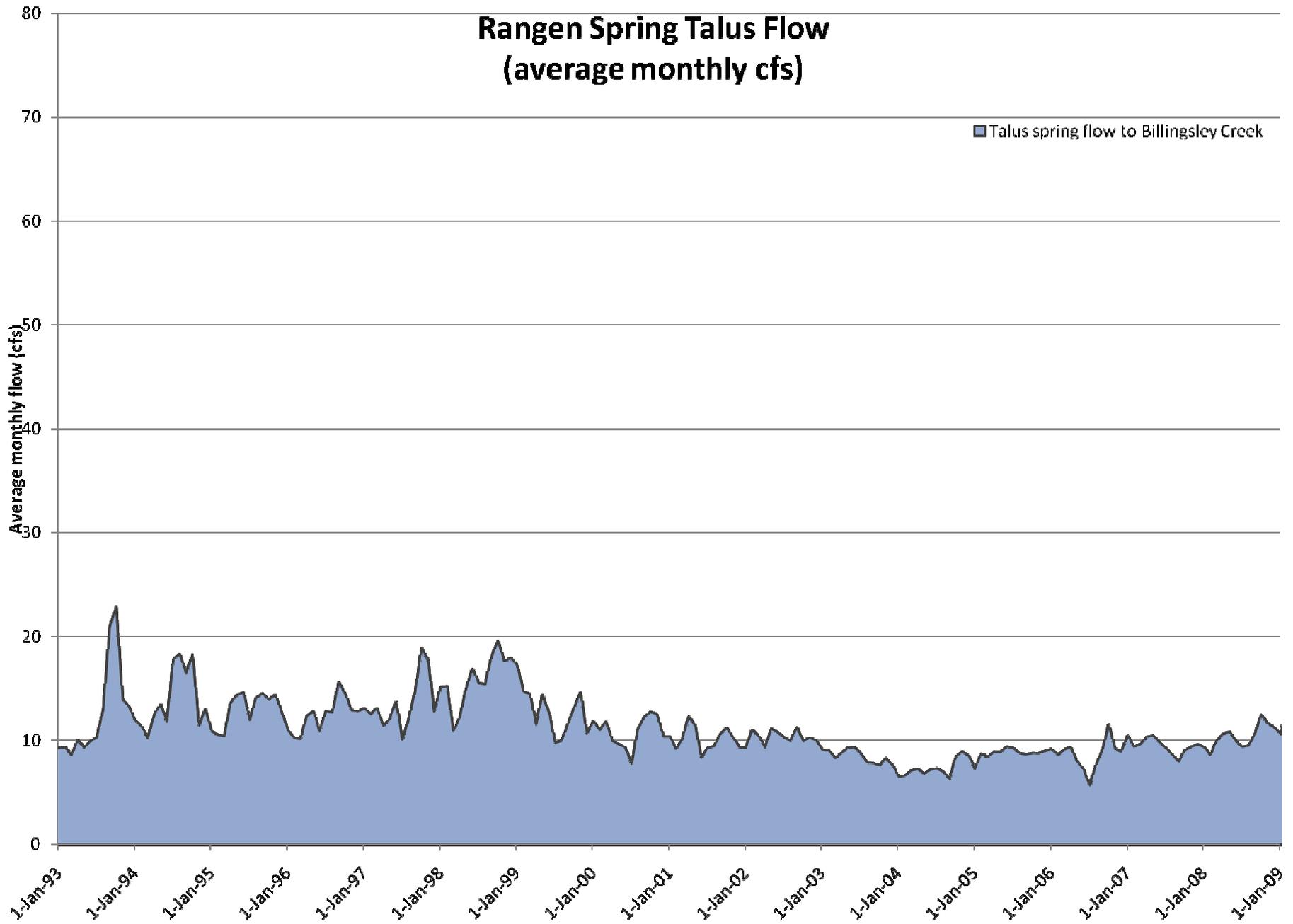


AVAILABLE DATA

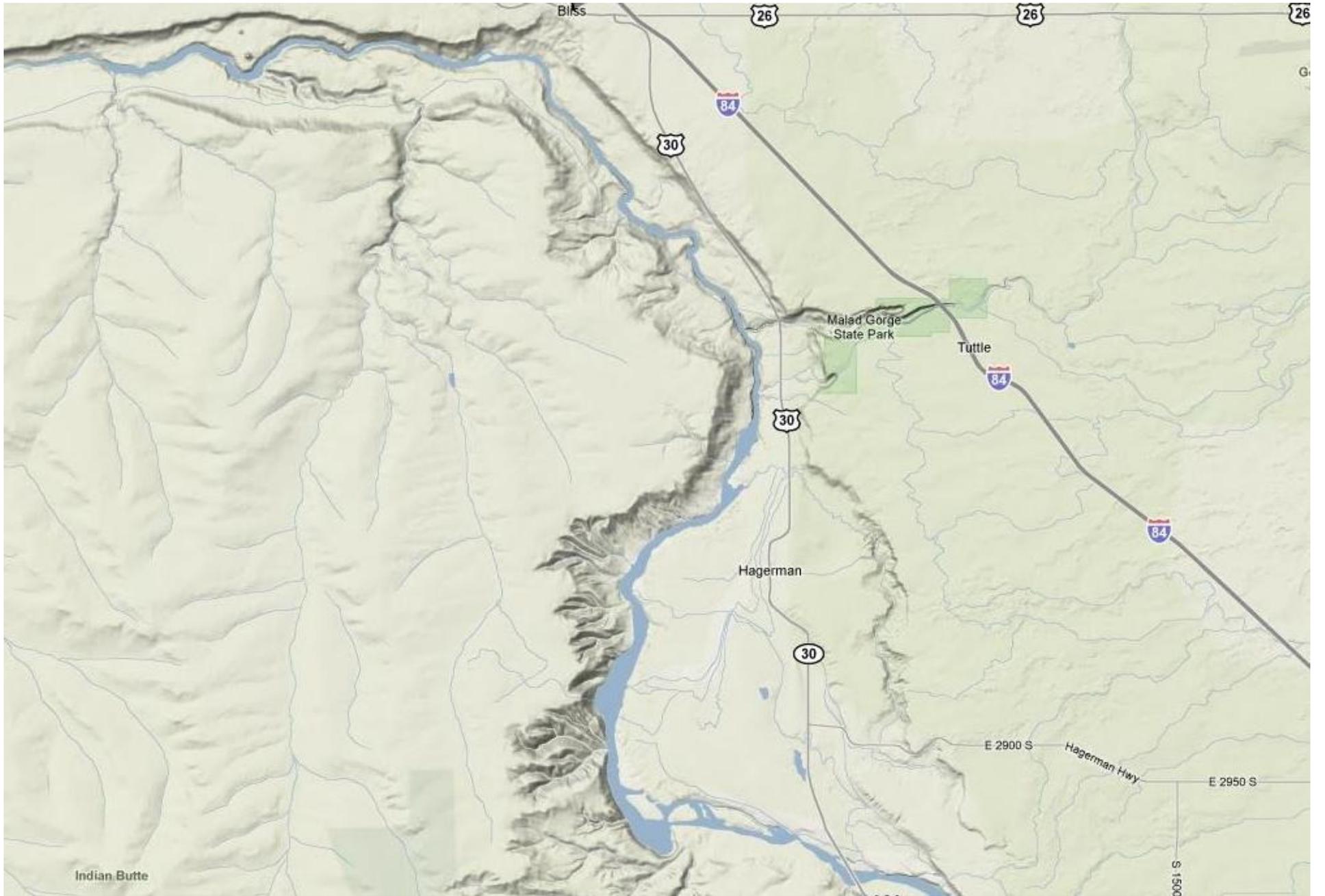
Measured Historical Flows (average monthly cfs)

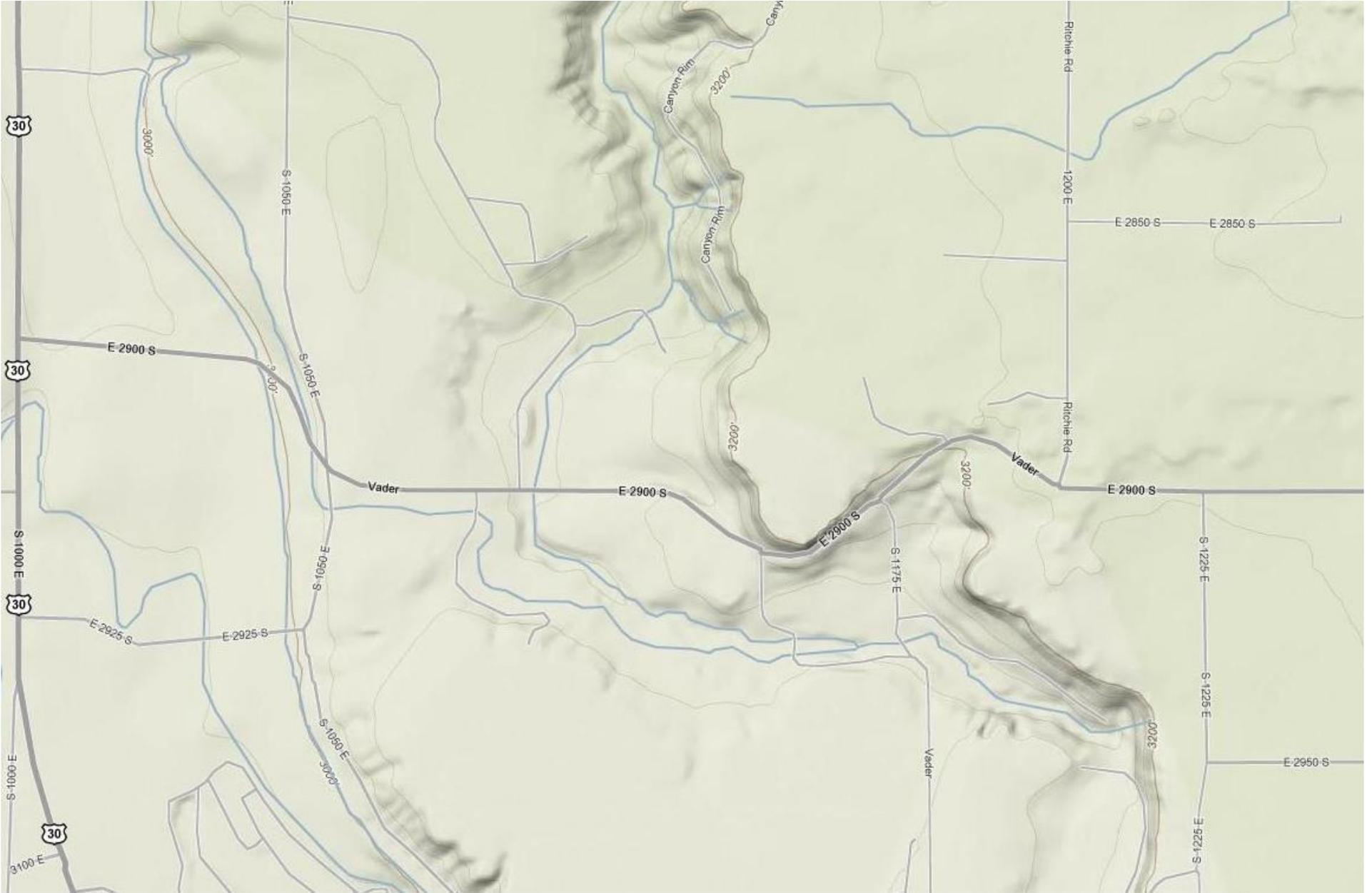


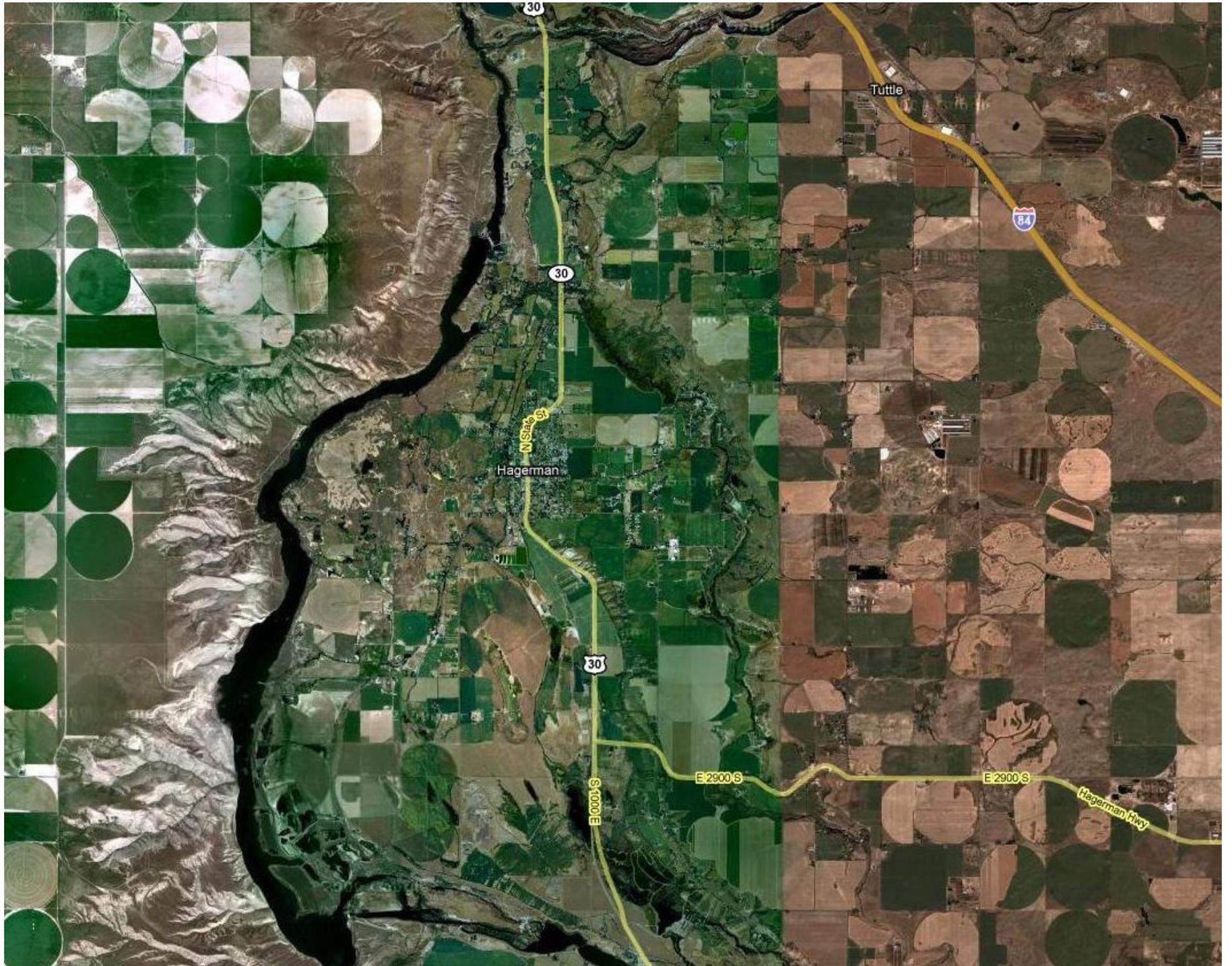
Rangen Spring Talus Flow (average monthly cfs)



PERSPECTIVE























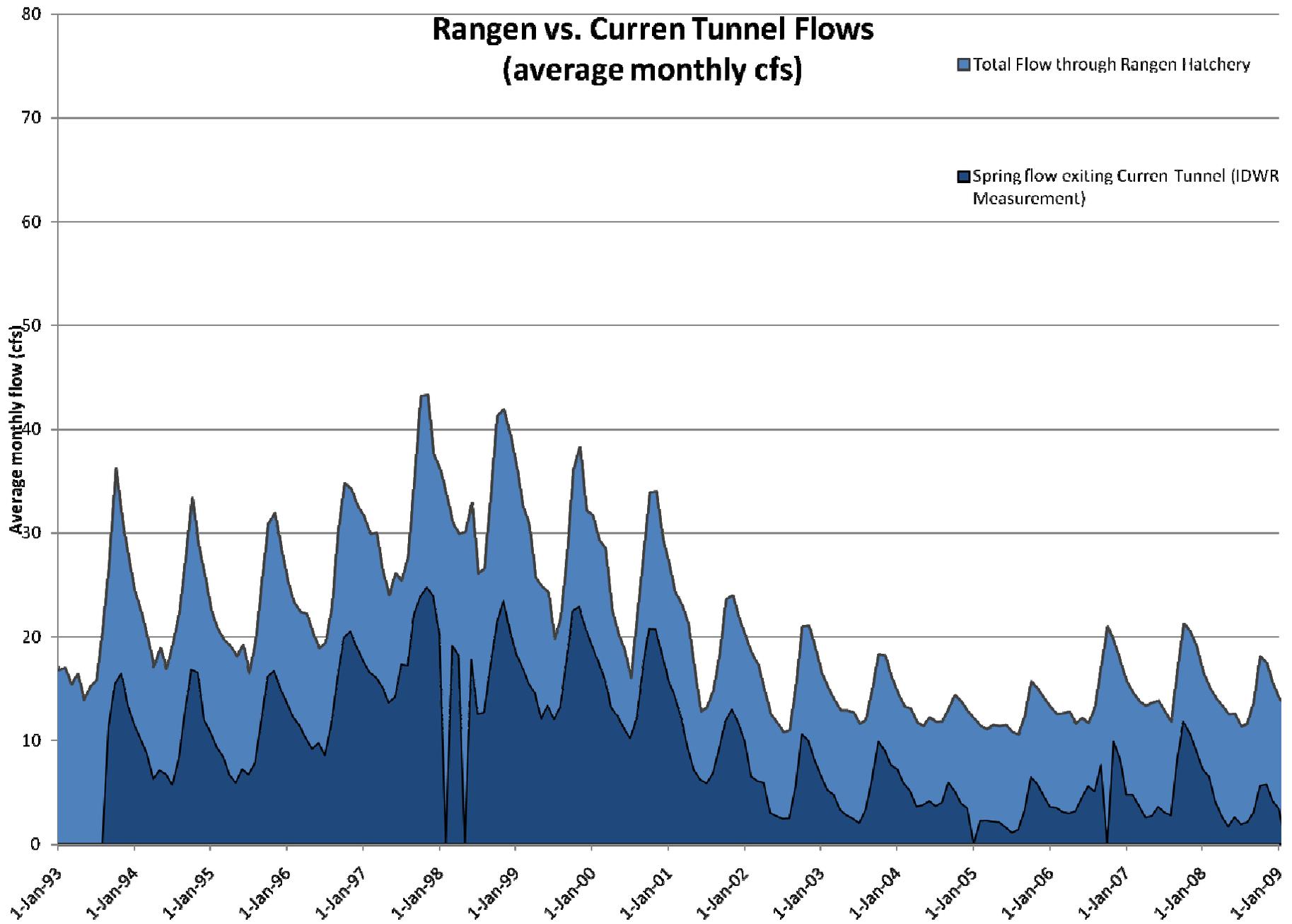




But what about the high variation and ratio?

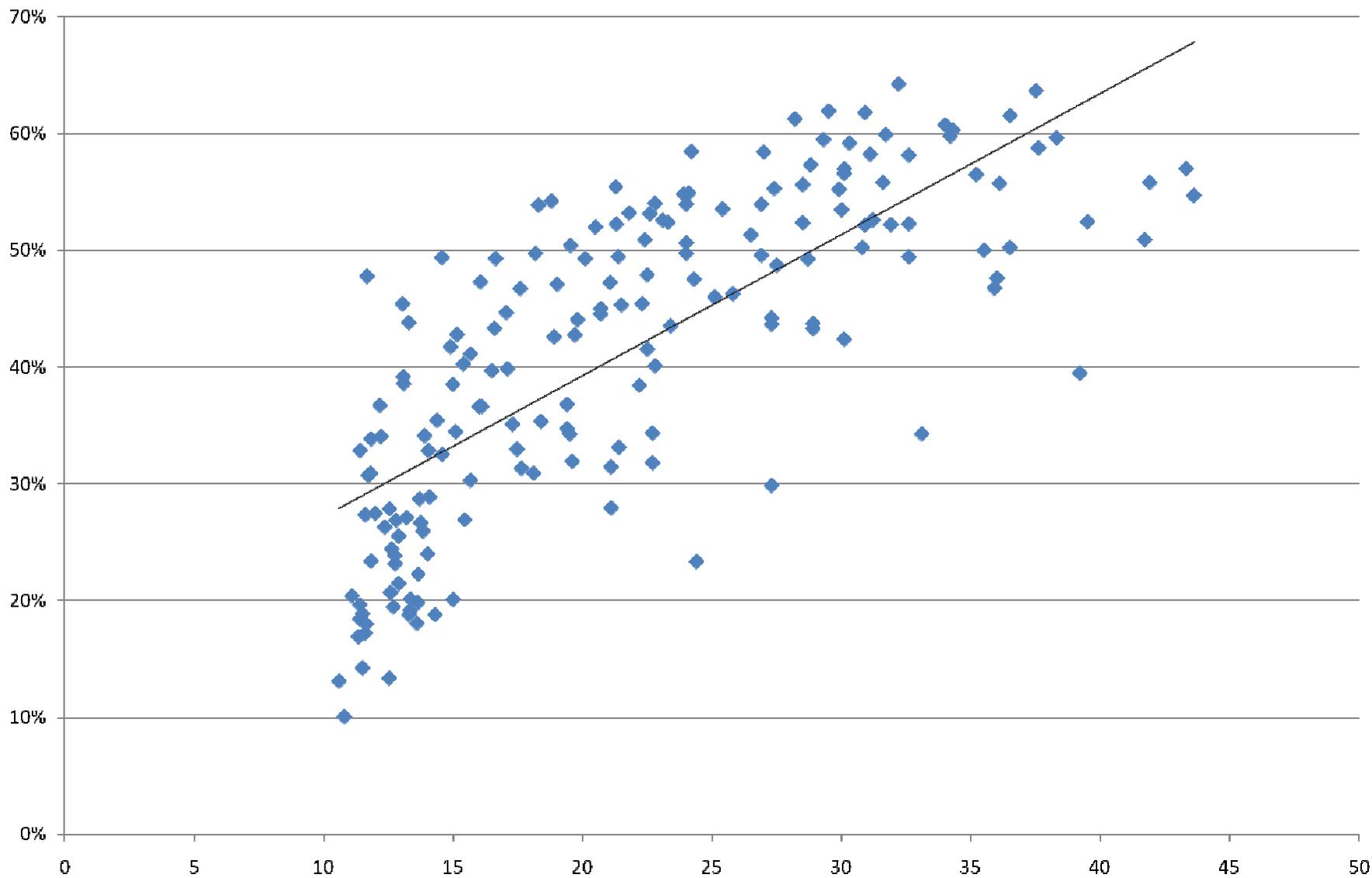
VERY CLOSELY CORRELATED

Rangen vs. Curren Tunnel Flows (average monthly cfs)



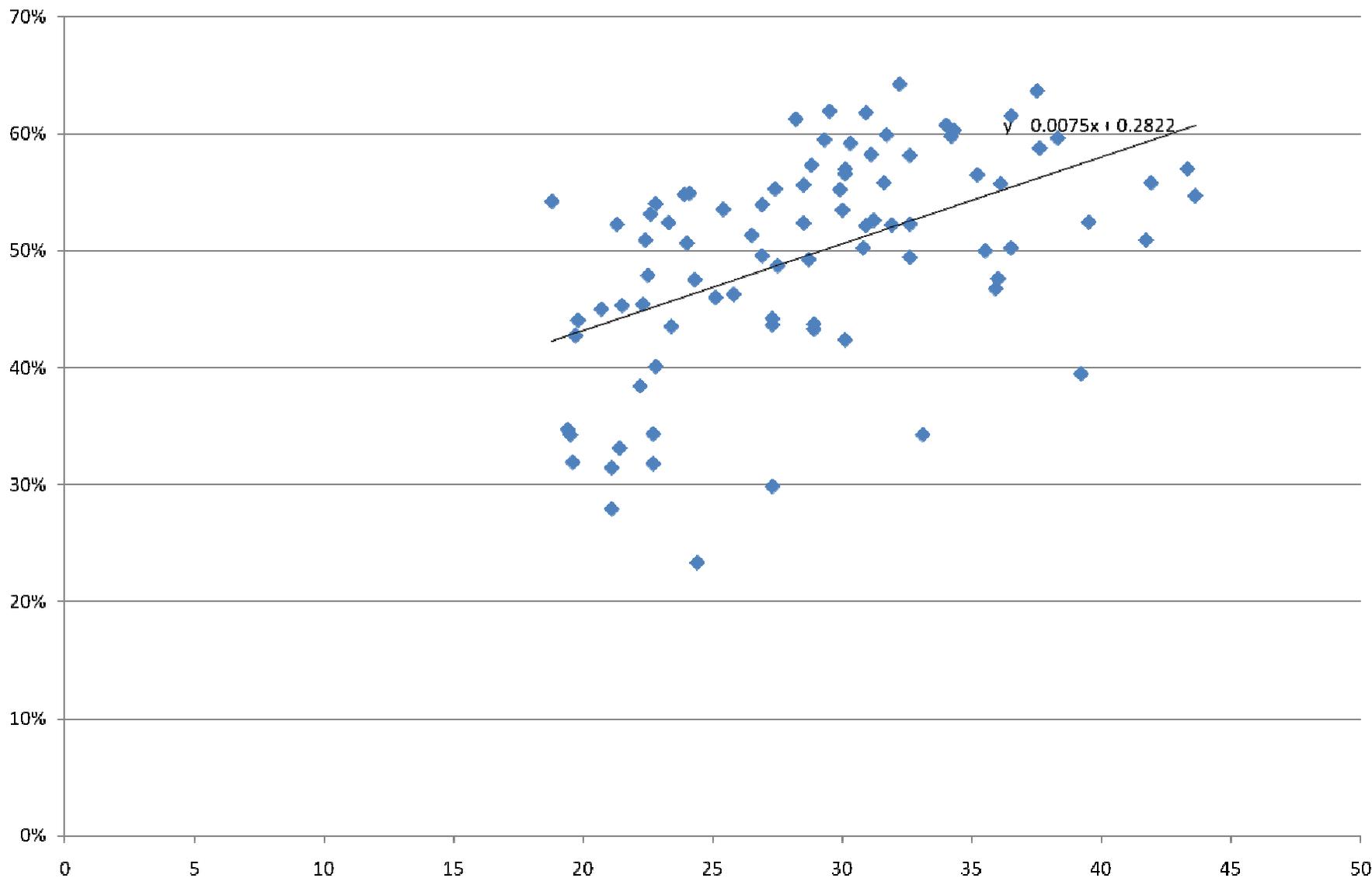
Current Tunnel as % of Total Curren Spring (93-08)

◆ Current Tunnel as % of Total Curren Spring — Linear (Current Tunnel as % of Total Curren Spring)



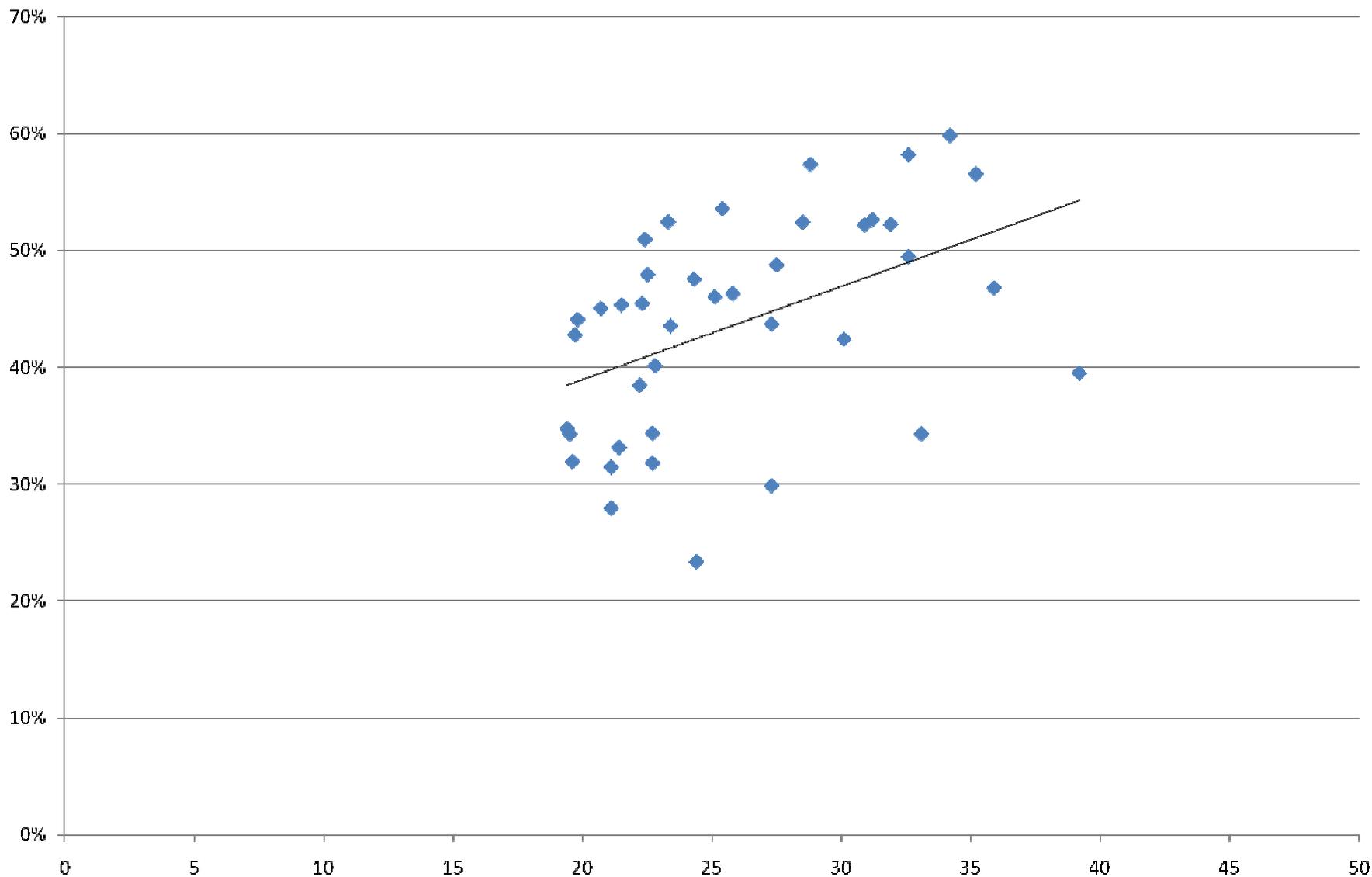
Curren Tunnel as % of Total Curren Spring (93-00)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



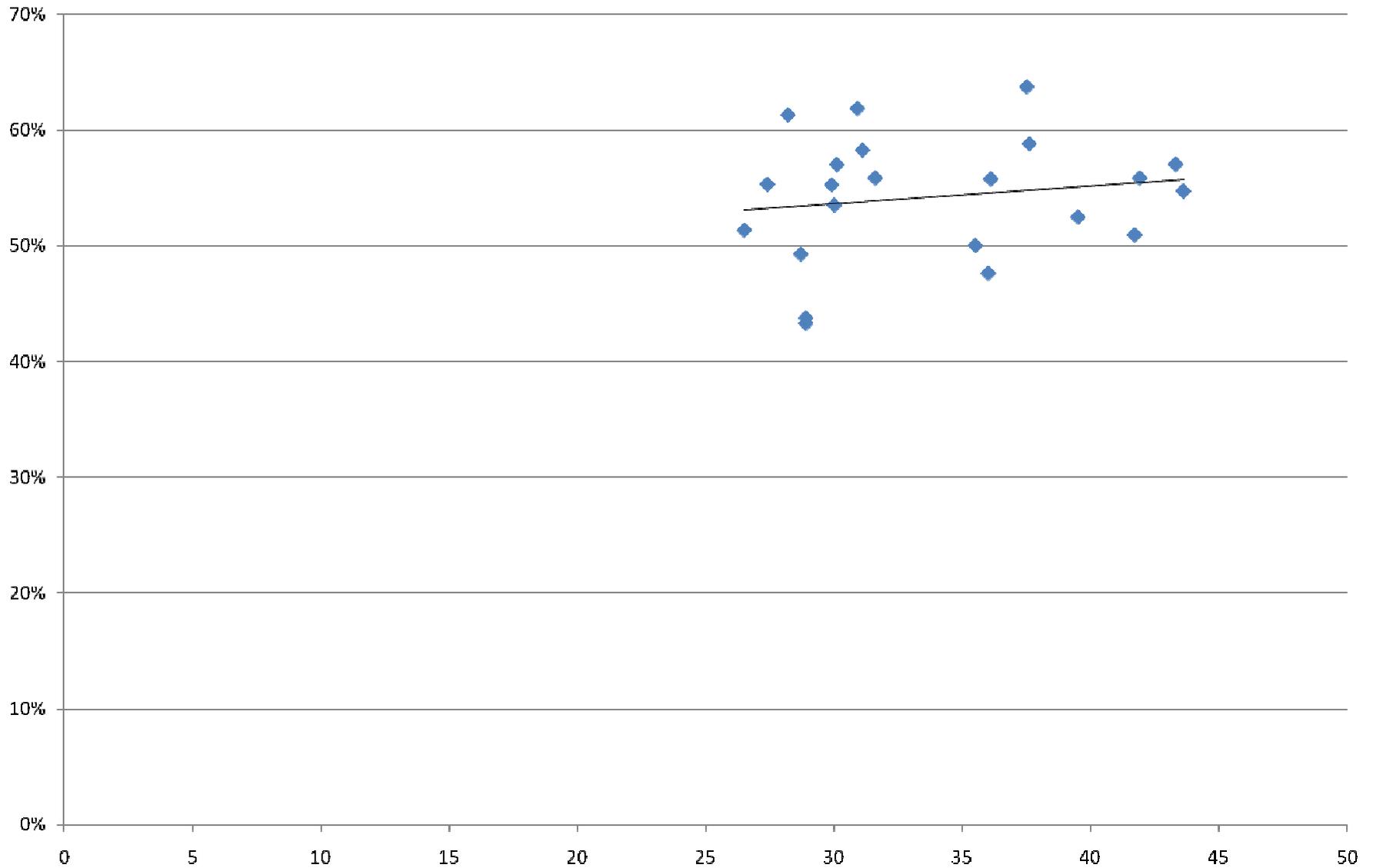
Curren Tunnel as % of Total Curren Spring (93-96)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



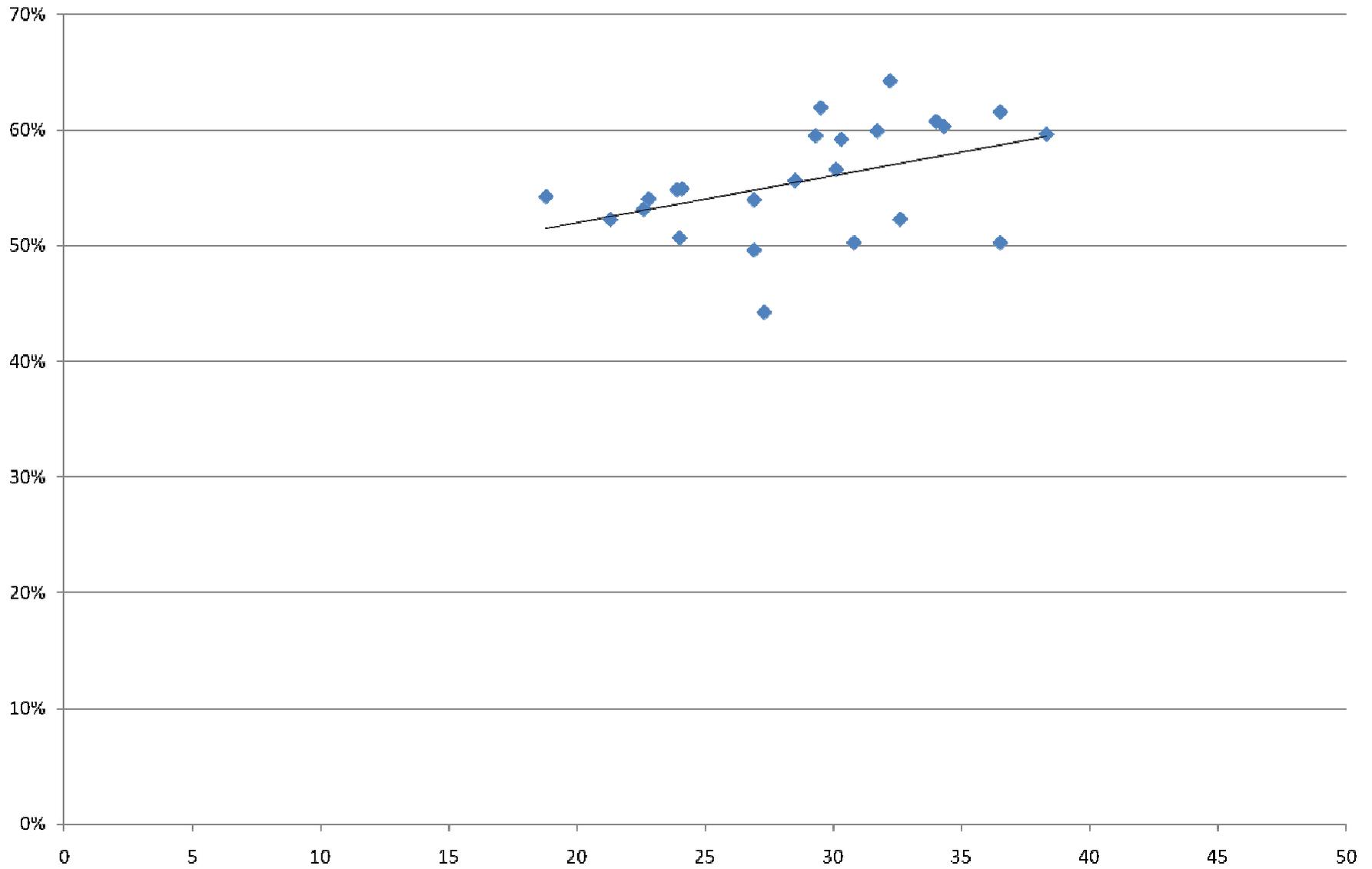
Curren Tunnel as % of Total Curren Spring (97-98)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



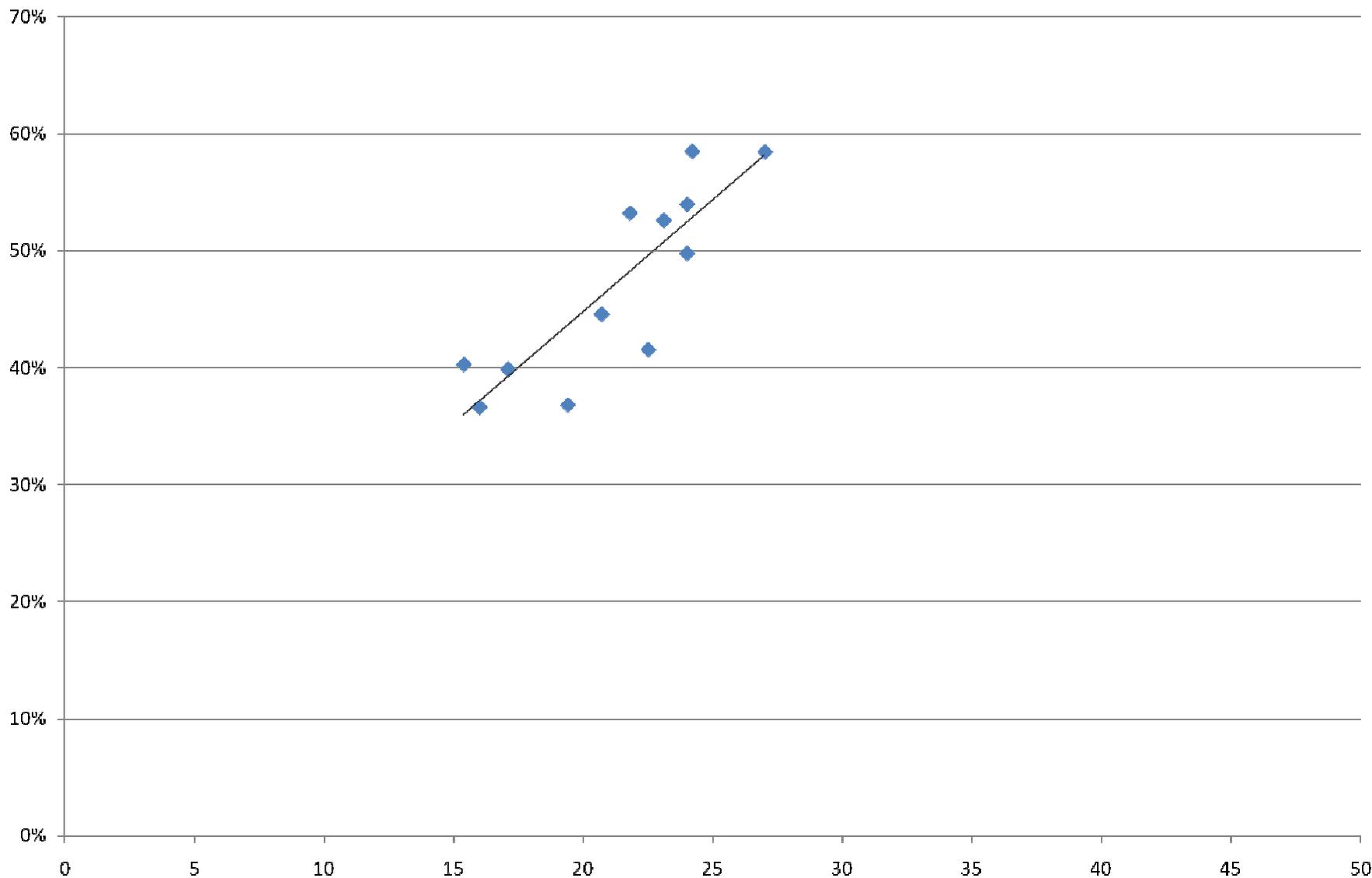
Curren Tunnel as % of Total Curren Spring (99-00)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



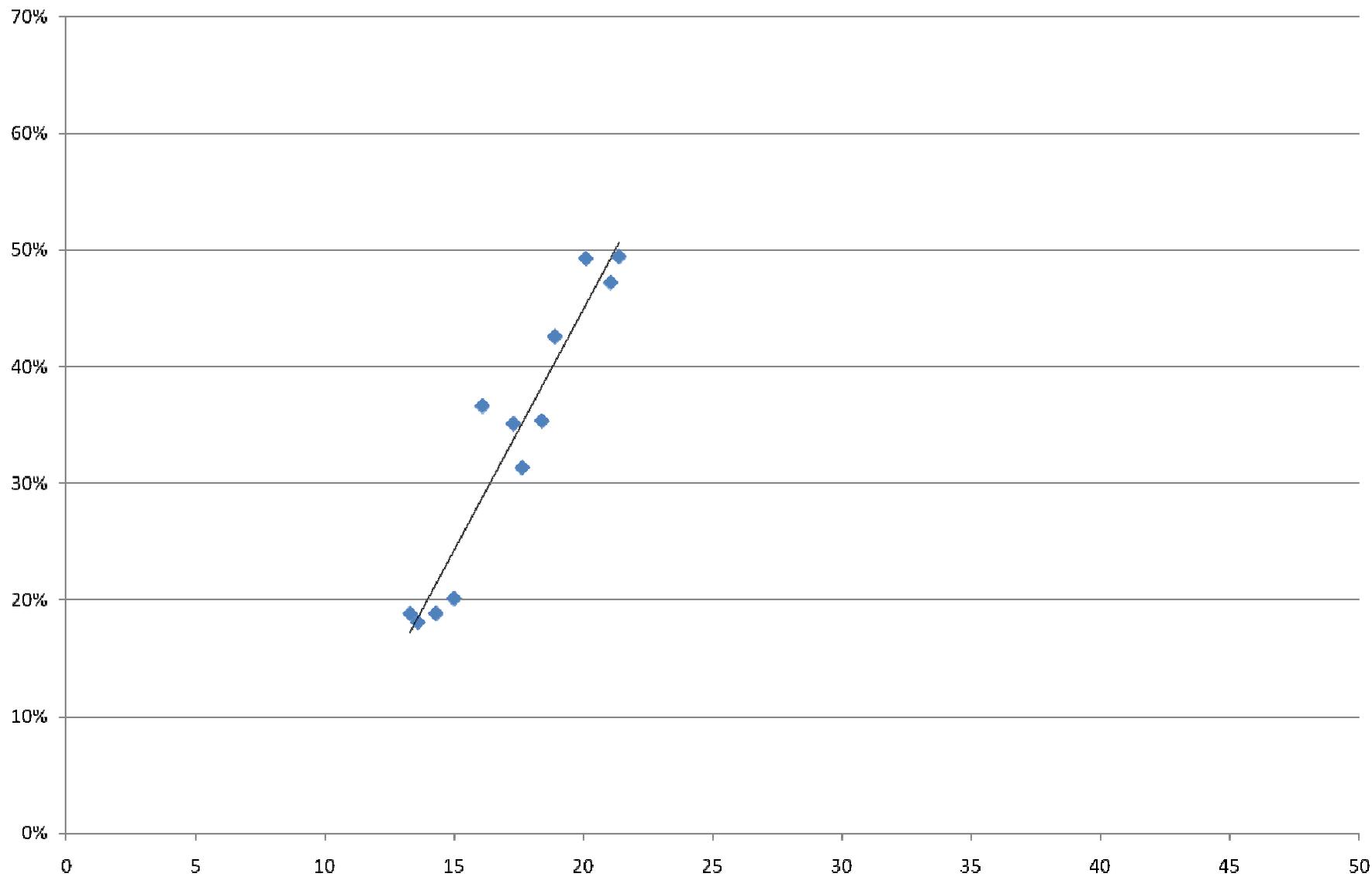
Curren Tunnel as % of Total Curren Spring (01)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



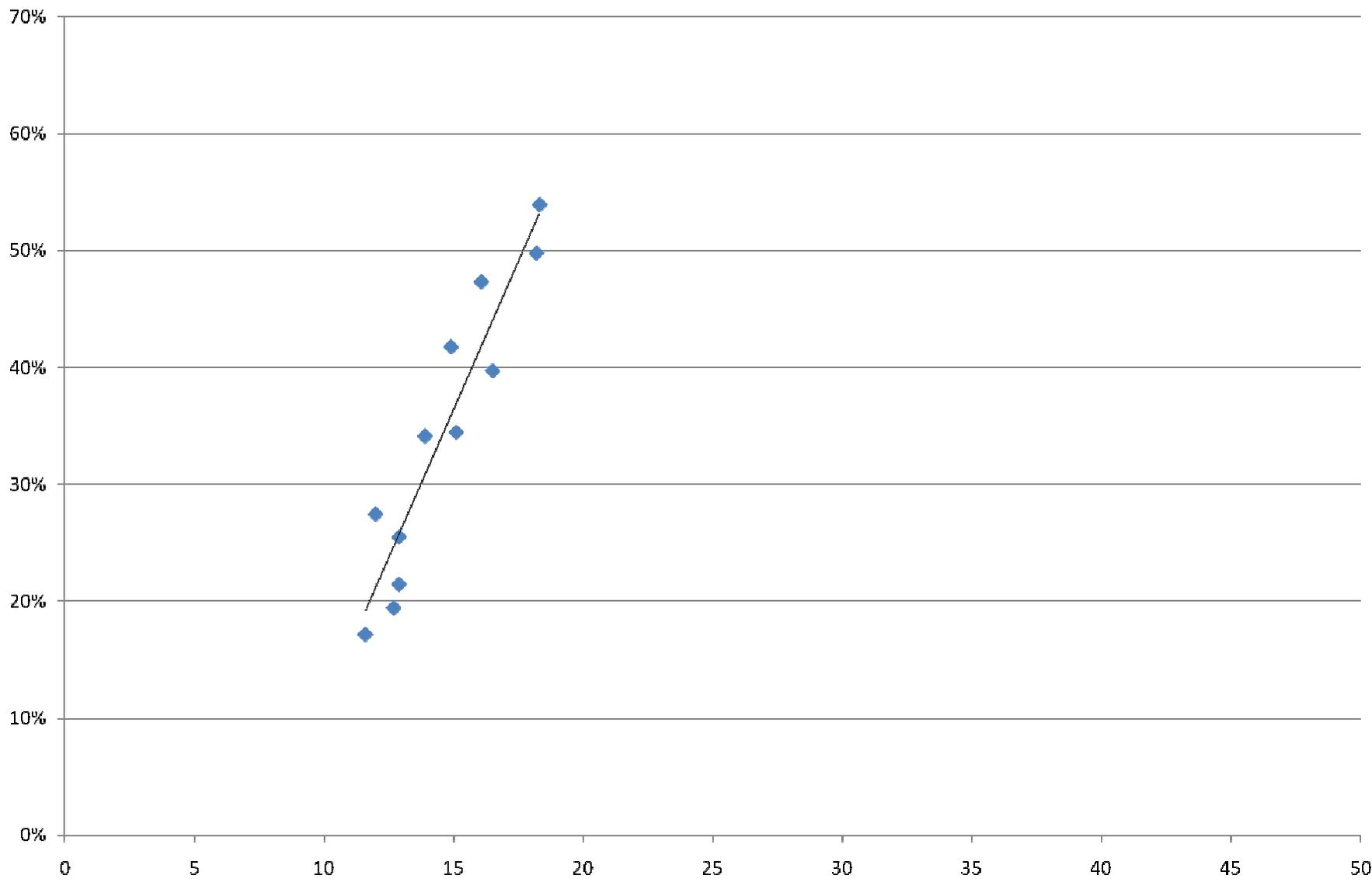
Curren Tunnel as % of Total Curren Spring (02)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



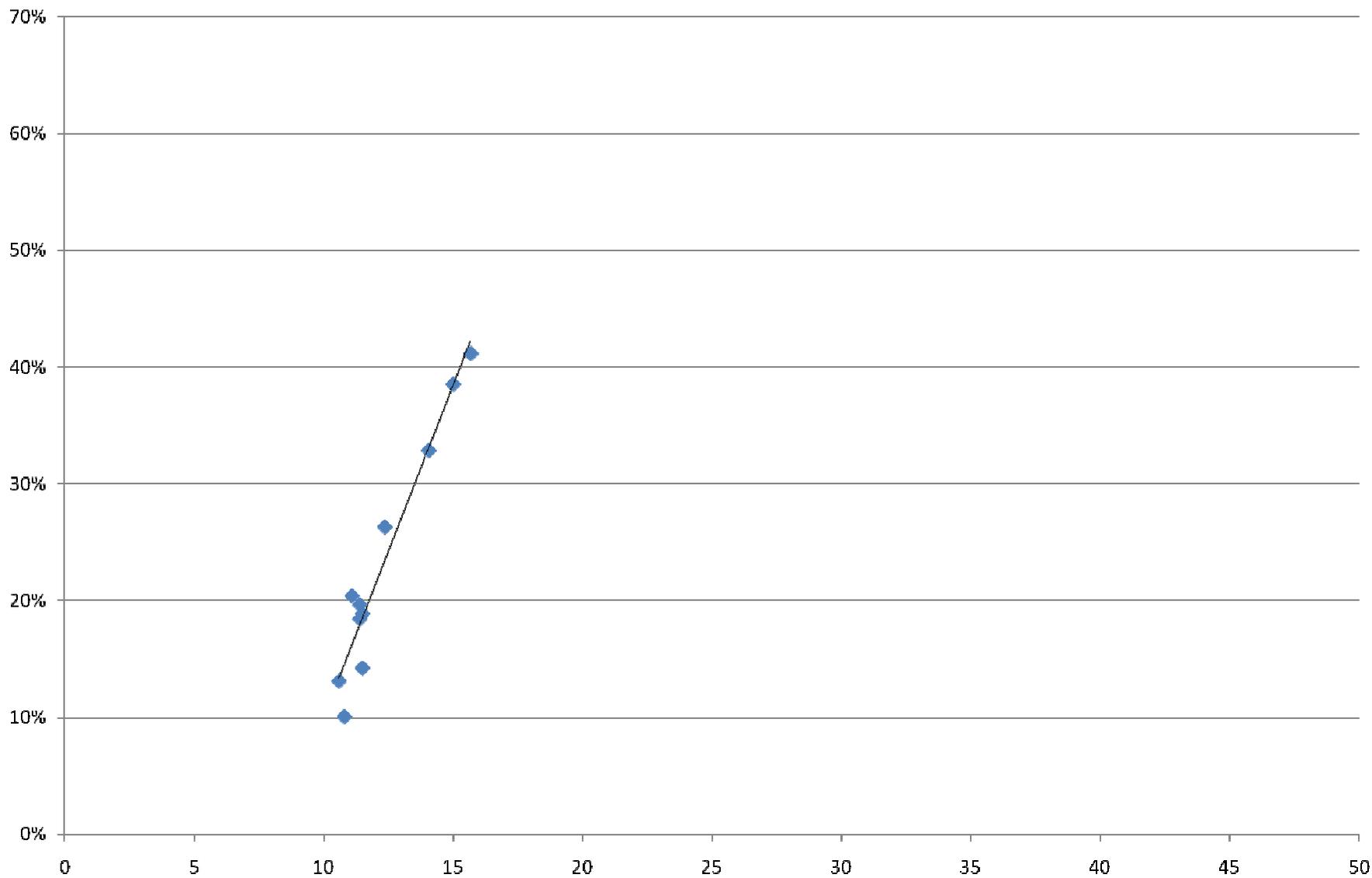
Curren Tunnel as % of Total Curren Spring (03)

◆ Curren Tunnel as % of Total Curren Spring — Linear (Curren Tunnel as % of Total Curren Spring)



Current Tunnel as % of Total Curren Spring (05)

◆ Current Tunnel as % of Total Curren Spring — Linear (Current Tunnel as % of Total Curren Spring)



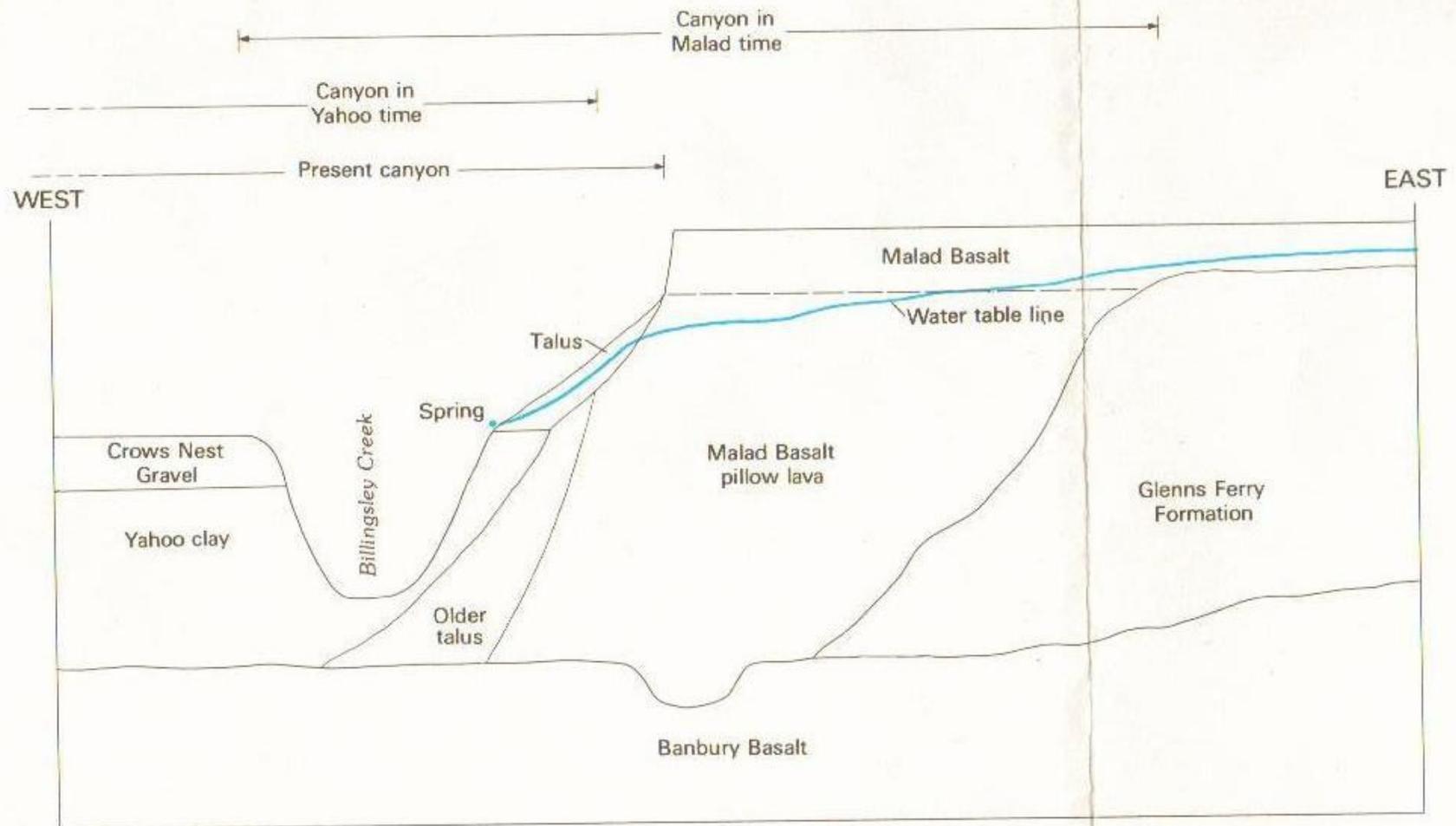
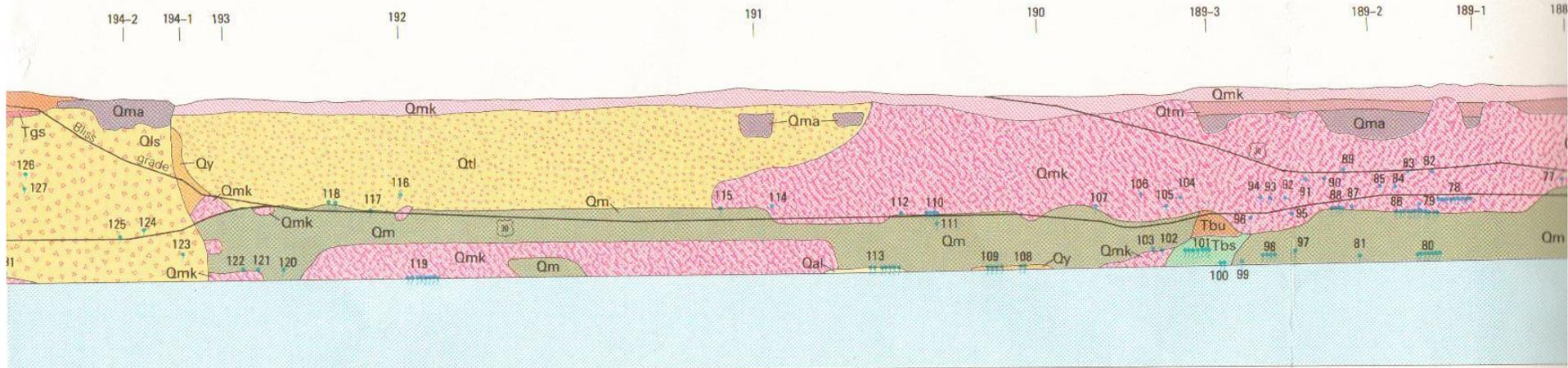
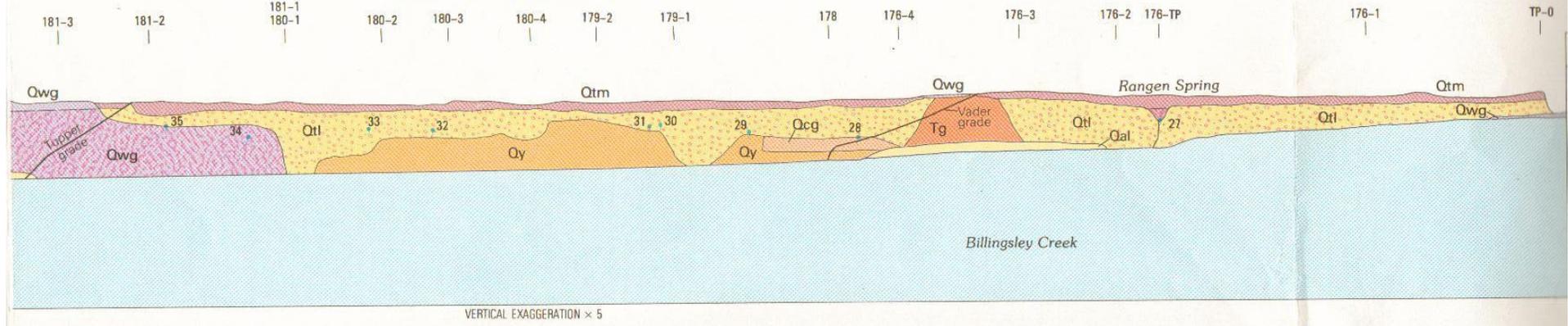


Figure 3. Schematic section of the canyon wall near profile-control location 179-1 east of Hagerman. Section shows the interpretative relation of the confining units of Yahoo Clay and Glens Ferry sediments to the Malad Basalt canyon filling deposits.

BLISS QUADRANGLE



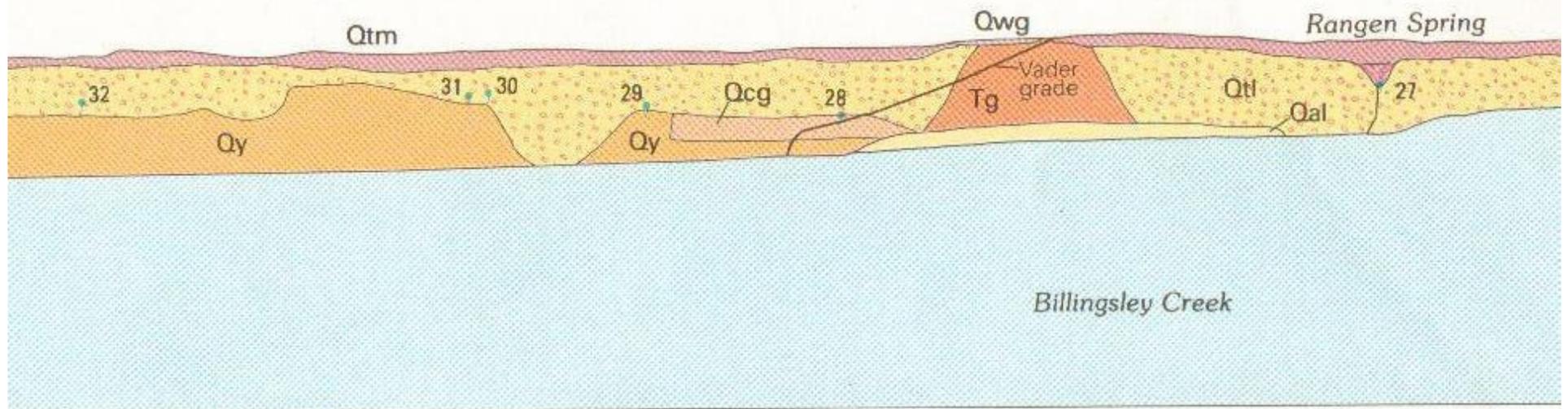
TUTTLE QUADRANGLE



VERTICAL EXAGGERATION × 5

TUTTLE QUADRANGLE

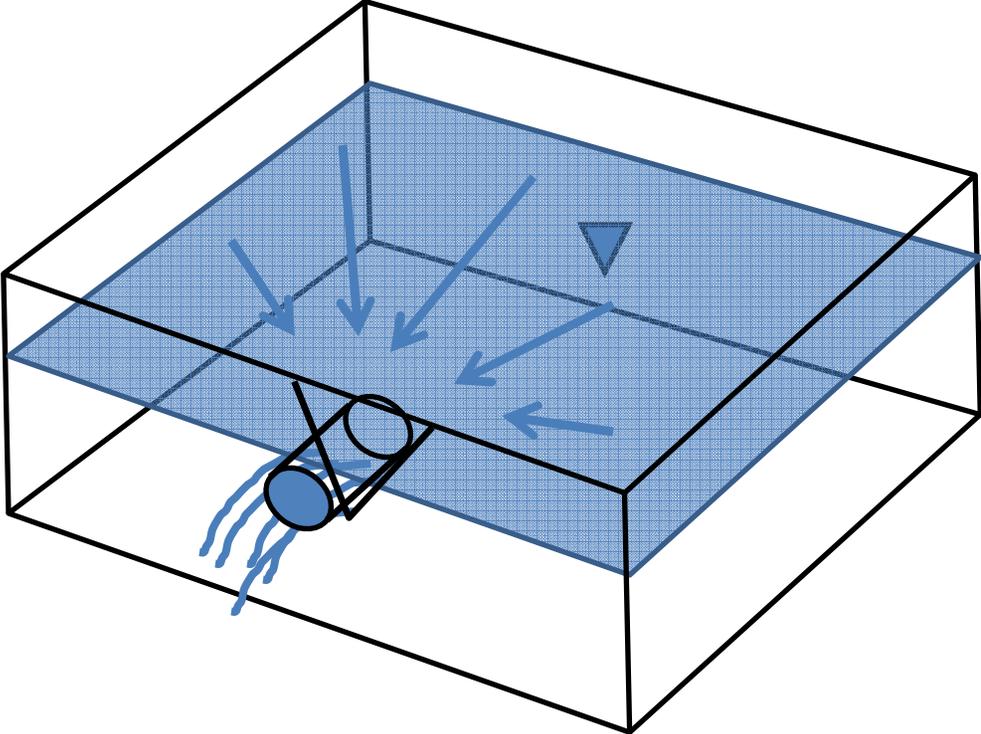
2 180-3 180-4 179-2 179-1 178 176-4 176-3 176-2 176-TP



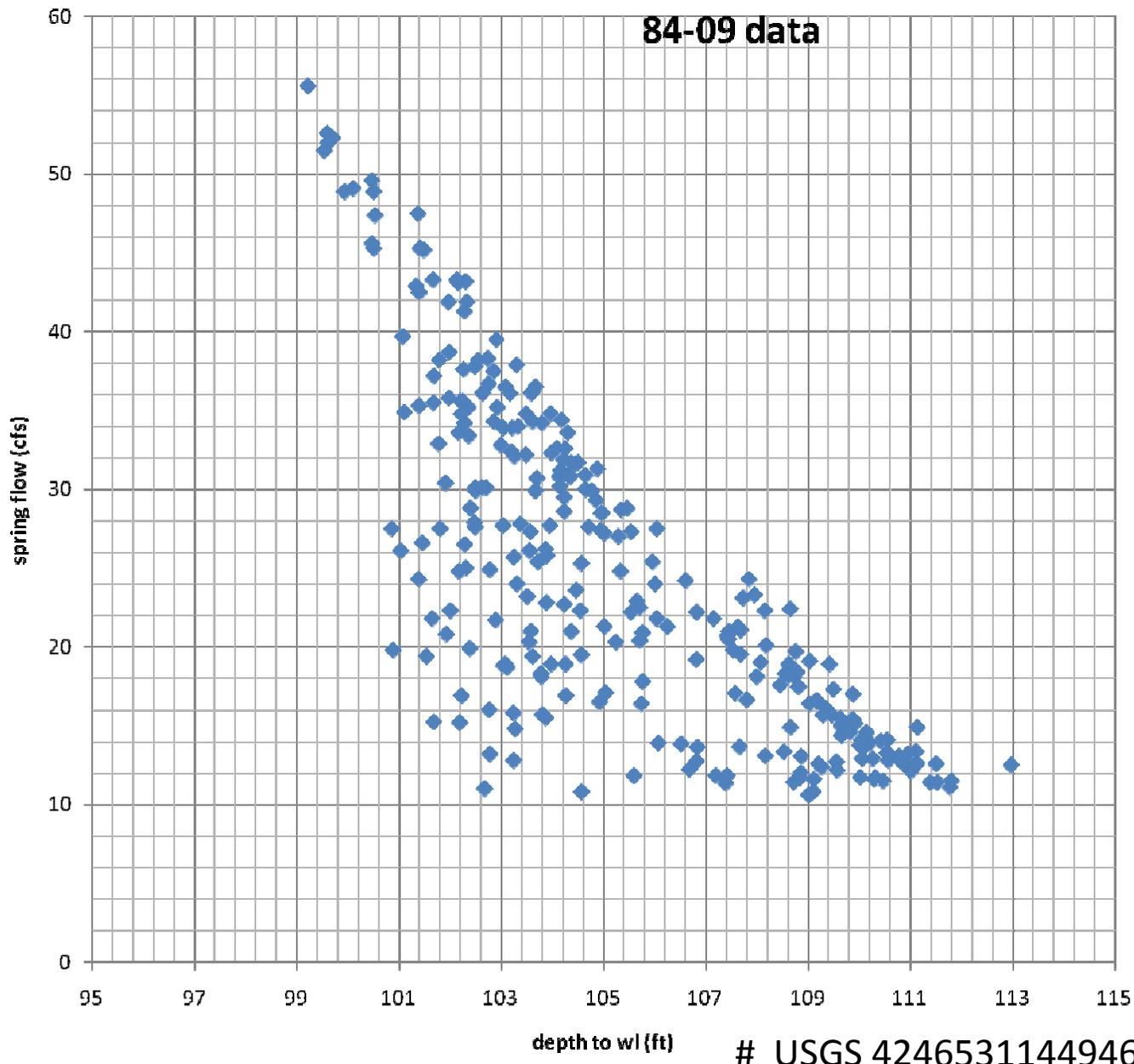
VERTICAL EXAGGERATION × 5

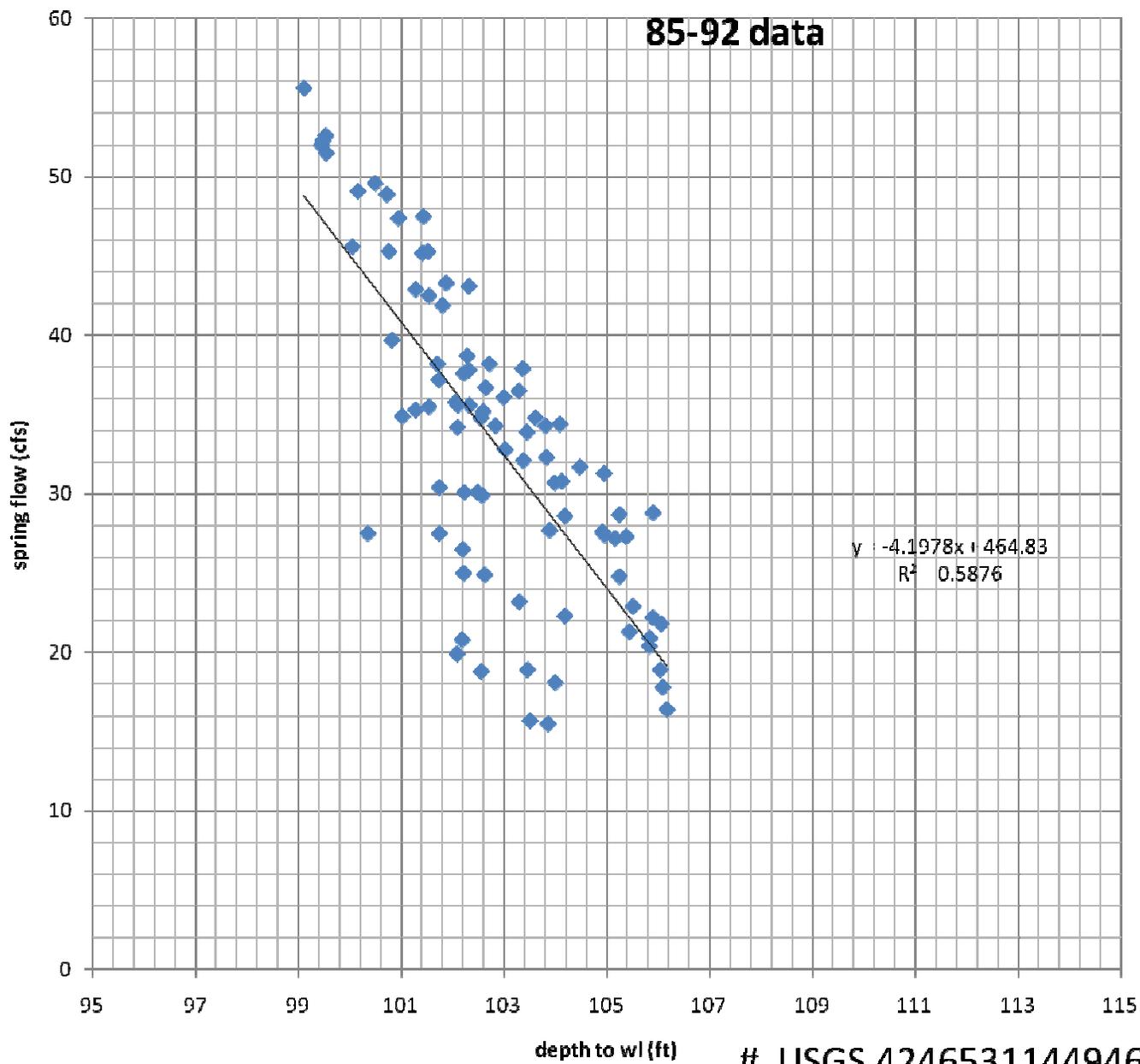
Understanding 1

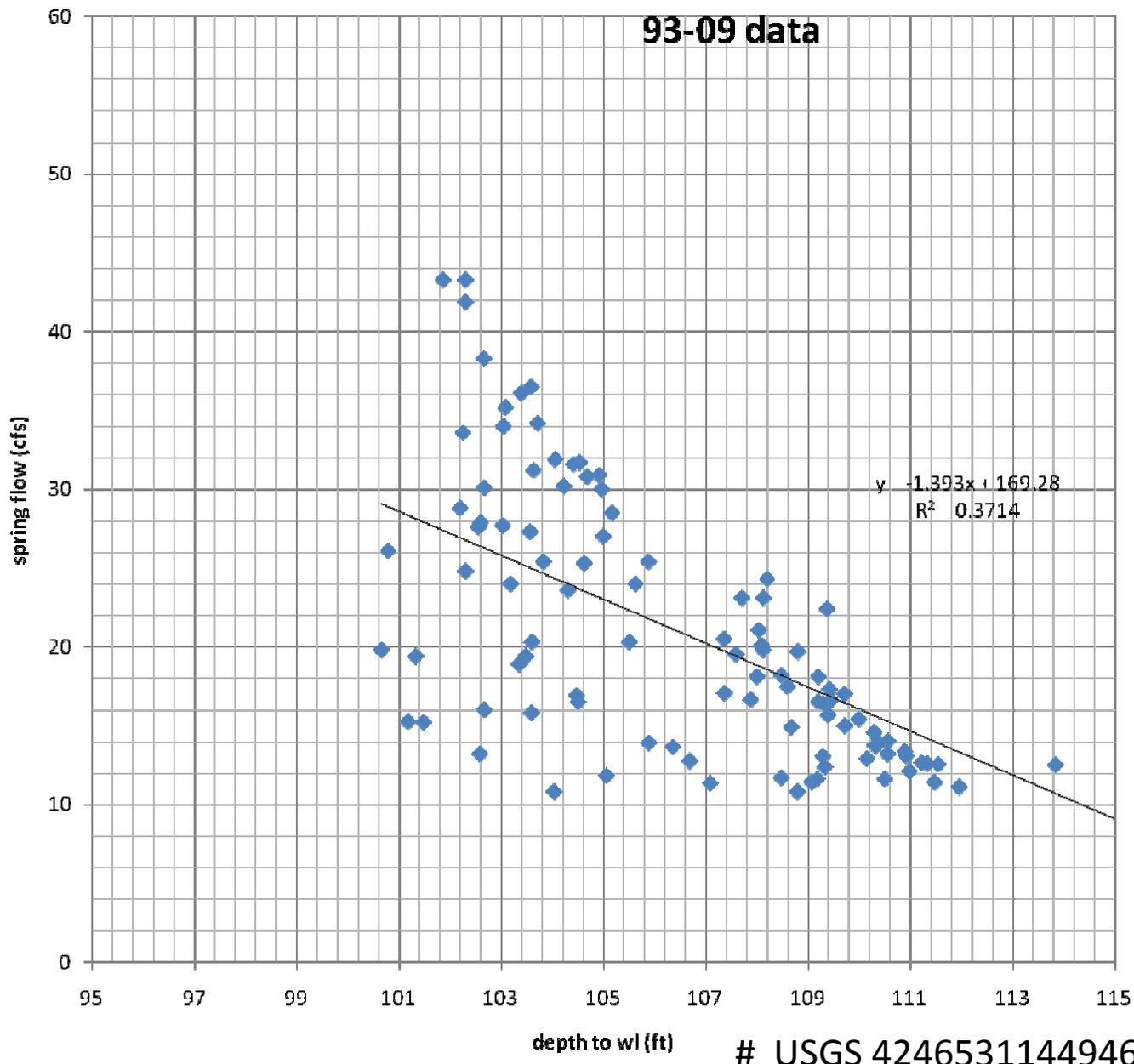
BATHTUB AND A V-NOTCH



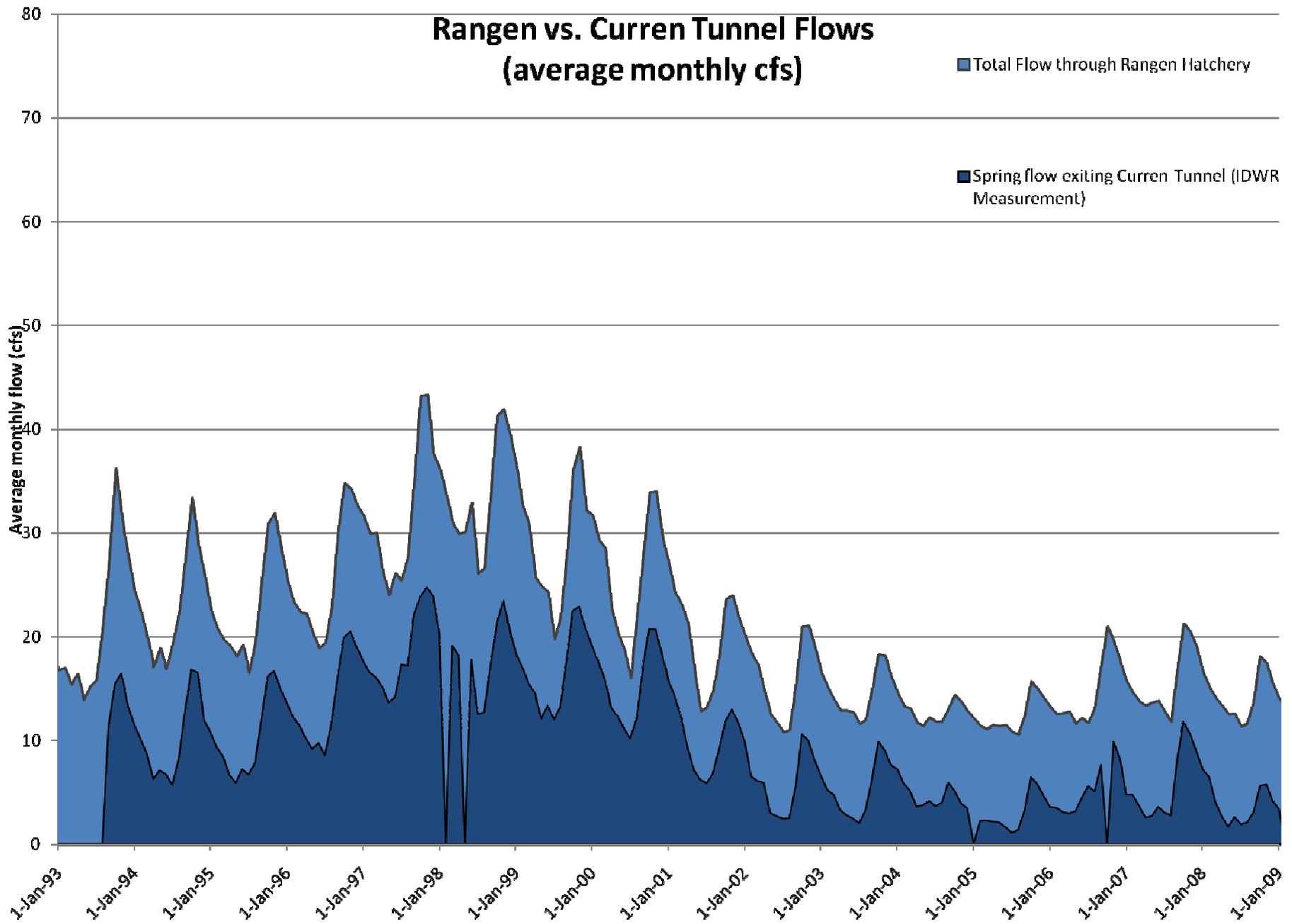
Seems like the hydrographs are indicating some hydrogeologic controls that exhibit faster responses than regional scale aquifer head controls on a notch....





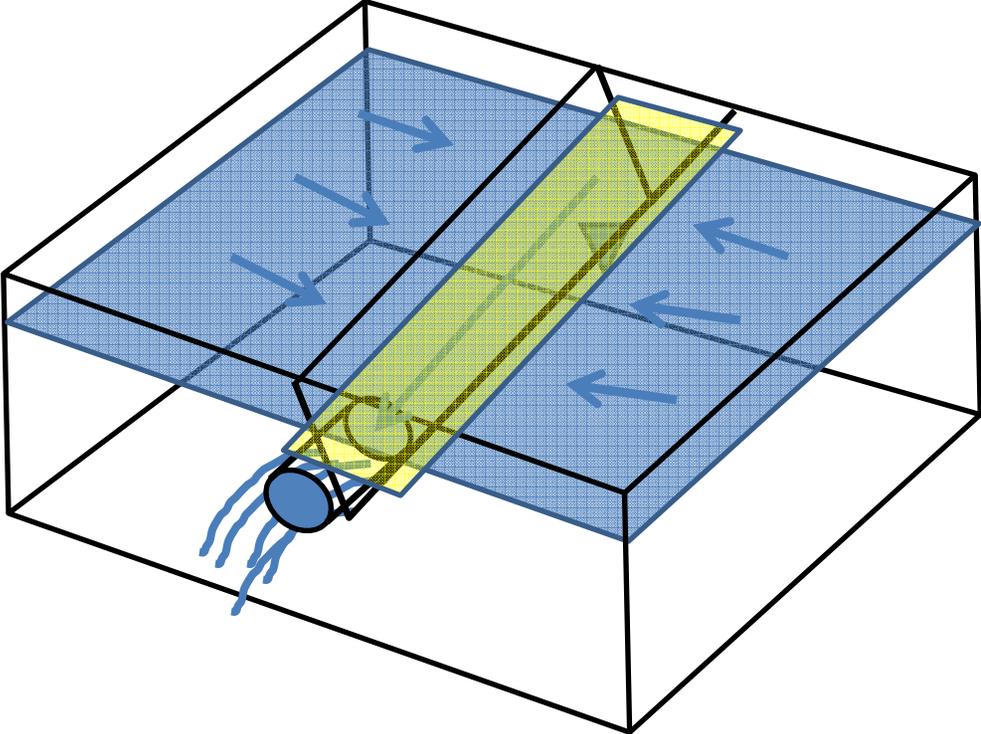


Rangen vs. Curren Tunnel Flows (average monthly cfs)



C. Neal Farmer, IDWR, "Review of Hydrogeologic Conditions Located At and Adjacent To the Spring at Rangen Inc.

LOCAL SCALE HIGHLY PERMEABLE CHANNEL



Straight face test...Darcy

A sq ft	dh	dx	K ft/day cfs	
5000	10	600	1000	0.96
5000	10	600	2000	1.93
5000	10	600	4000	3.86
5000	10	600	6000	5.79
5000	10	600	8000	7.72
5000	10	600	10000	9.65
5000	10	600	25000	24.11
5000	10	600	100000	96.45
103680	10	600	1000	20.00
51840	10	600	2000	20.00
25920	10	600	4000	20.00
12960	10	600	8000	20.00
6480	10	600	16000	20.00
3240	10	600	32000	20.00
1620	10	600	64000	20.00
51840	10	600	1000	10.00
25920	10	600	2000	10.00
12960	10	600	4000	10.00
6480	10	600	8000	10.00
3240	10	600	16000	10.00
1620	10	600	32000	10.00
810	10	600	64000	10.00

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