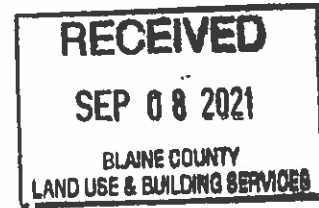




Memo

To: Sam Stahlnecker, Galena Engineering
From: Charles G. Brockway, P.E.
Cc:
Date: August 31, 2021
Re: Preliminary evaluation of inverted siphon for Lateral 75 subdivision



Design considerations:

- Inverted siphon to carry the west split of District canal across Glendale Road
- Design should be based on guidance in the Bureau of Reclamation's Design of Small Canal Structures.
- Design flow. Based on the daily diversion records for the District canal, 1979-2020, the peak annual diversion regularly comes close to 320 cfs. About 20% of the service area is served by the west split. Design flow = 0.20×320 plus 10%, or 70 cfs.
- Pipe length assumed to be 100 feet to allow for future road widening and intersection improvements (might get by with 80 feet)
- Available head loss: freeboard in canal is low, assume less than 0.75 feet of drop is available at this location.
- Pipe material: HDPE preferred, may need to use steel due to availability or cost.
- Concrete transitions at inlet and outlet, USBR Type 1, 3, or 4. Earth/rock transitions might be used to save cost, head loss would be greater.
- Grating over inlet, at least, for safety. Trash rack is possible but would require daily cleaning.

Conclusions:

- Single 54" HDPE IPS DR-21 could be used, head loss 0.54 feet
- Double 42" HDPE IPS DR-21 could be used, head loss 0.34 feet
- Concrete volume each transition: about 7 cy for single 54" pipe, 12 cy for double 42" pipe
- Riprap: 4 cy each end

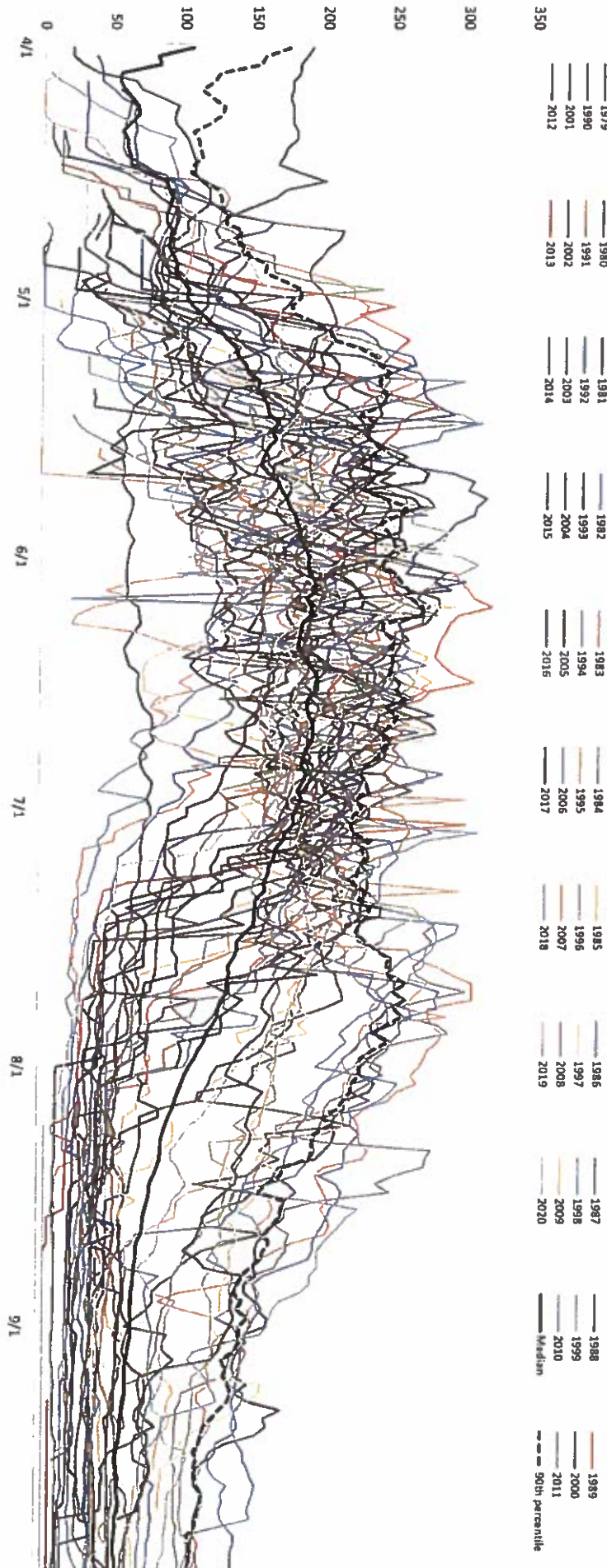


Preliminary Inverted Siphon Evaluation

CGB 8/31/2021

Design flow	70 cfs		
Pipe length	100 ft		
Pipe inside diameter	48.549	37.76 in	HDPE IPS DR-21
Number of pipes	1	2	Single 54" or double 42"
Upstream canal velocity	3	3 ft/s	
Pipe absolute roughness	0.000005	0.000005 ft	
Calculations:			
Flow per pipe	70	35 cfs	
Pipe velocity	5.45	4.50 ft/s	
Pipe velocity head	0.46	0.31 ft	
Canal velocity head	0.14	0.14 ft	
Inlet convergence loss coeff	0.4	0.4	
Inlet convergence loss	0.13	0.07	
Outlet loss coeff	0.7	0.7	
Outlet loss	0.22	0.12	
Trash rack loss coeff (clean)	0.20	0.20	
Trash rack loss	0.06	0.03	
Pipe Re	1805715	1160827	
Pipe friction factor	0.0105	0.0113	
Pipe friction loss	0.12	0.11 feet	
Total head loss	0.54	0.34 feet	
(Inlet + outlet + friction + trash rack)			
Minimum seal	0.48	0.26 ft	
Head at minimum seal	2.50	1.84 ft	
Check orifice equation flow	98	101 cfs	
	ok	ok	

District Canal Daily Diversions 1979-2020



1979
1990
2001
2012

1980
1991
2002
2013

1981
1992
2003
2014

1982
1993
2004
2015

1983
1994
2005
2016

1984
1995
2006
2017

1985
1996
2007
2018

1986
1997
2008
2019

1987
1998
2009
2020

1988
1999
2010
Median

1989
2000
2011
90th percentile

0
50
100
150
200
250
300
350

4/1
5/1
6/1
7/1
8/1
9/1