

RIO DE FLAG FLOOD CONTROL PROJECT VALUE ENGINEERING STUDY

March 16, 2010, Flagstaff, Arizona

Priority Alternative Cost Summary

WRC Consulting Services, Inc.

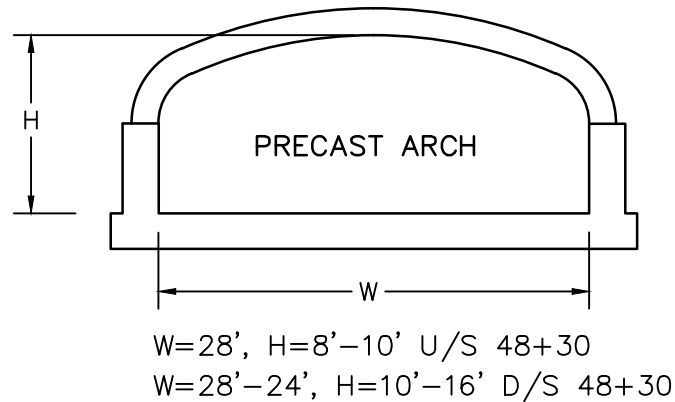
Alternative	Approximate 90% Station & Nearby Streets	Description	Original Design (million)	Current Design (million)	Cost Saving (million)
1	Entire Project	Replace Arch Culvert with Composite RCB and grasslined or turf mat lined Open Channel	\$ 27.87	\$ 18.15	\$ 9.72
2A	48+30 to 54+65 Beaver and Existing RDF Park	Shorten Confluence with underground Junction Box	\$ 4.00	\$ 2.50	\$ 1.50
2B	48+30 to 54+65 Beaver and Existing RDF Park	Shorten Confluence with Open Composite RC Channel w/Greenbelt Bank and RCB / Greenbelt Bank	\$ 4.00	\$ 2.00	\$ 2.00
3	62+00 to 86+17 Santa Fe/Route 66 to Bonito	Replace Arch Culvert with Composite RCB and grasslined or turf mat lined Open Channel	\$ 7.83	\$ 5.11	\$ 2.72
4A	CAW 32+00 to 36+95 Blackbird Roost to Trailer Park	Realign the CAW Arch Culvert and reduce impacts on Trailer Park	\$ 1.86	\$ 1.73	\$ 0.13
4B	CAW 36+95 to 48+55 U/S Trailer Park	Replace RC with unlined open Earthen Channel	\$ 1.04	\$ 0.73	\$ 0.31
5	97+50 TO 112+00 Thorpe to Beal	Flood Wall vs Channel w/o Bridge Cost	\$ 3.77	\$ 1.85	\$ 1.92
6	40+15 TO 54+10 along BNSF RR Tracks	Areas which allow excavation and Reduce Shoring	\$ 1.51	\$ 0.98	\$ 0.53
7	CAW 18+00 TO 28+00 Five-Point Intersection to McCracken	CAW Replace Arch Culvert with RC Channel	\$ 2.99	\$ 1.38	\$ 1.61
8	77+50 TO 86+00 Sitgreaves to Bonito	Replace Arch Culvert with Open Channel	\$ 2.25	\$ 0.55	\$ 1.70
9	62+50 TO 70+00 Santa Fe/Route 66 to Birch	Replace Arch Culvert with Open Channel	\$ 2.25	\$ 1.59	\$ 0.66

Notes:

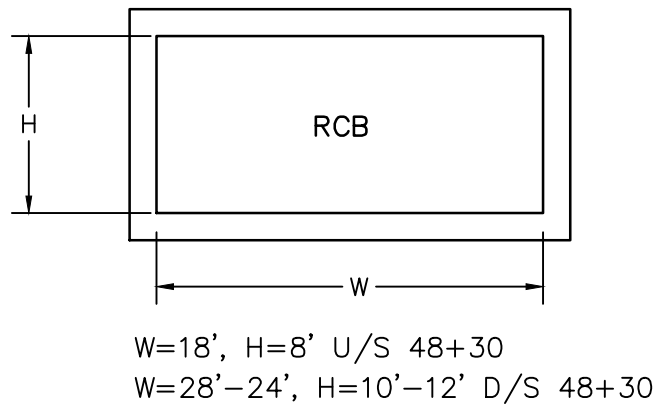
1. Original design is the 90% plan design
2. City's unit cost data were applied to both current and original design unless no changes to channel types and dimensions
3. See quantity and cost calculations in Illustration Sheets. Some sheets were modified for accuracy and completeness after the workshop.
4. Estimates shown include the affected construction elements comparing current and original design only

ALTERNATIVE 1
REPLACE ARCH CULVERT WITH RCB AND ADJUST SIZE AND GRADE
ENTIRE PROJECT

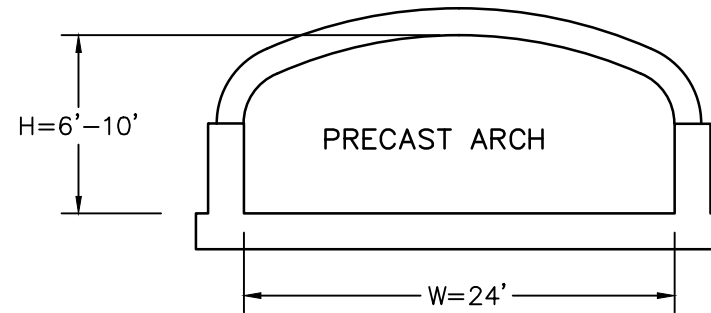
RDF – ORIGINAL DESIGN



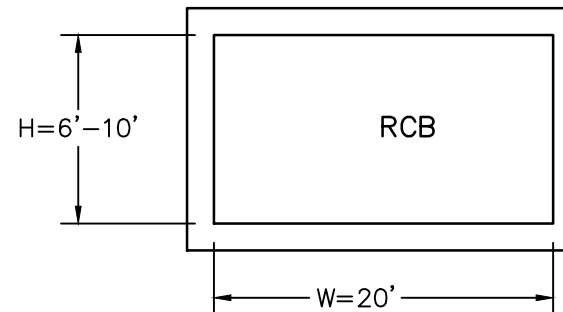
RDF – CURRENT DESIGN



CAW – ORIGINAL DESIGN



CAW – CURRENT DESIGN



ORIGINAL DESIGN COST*

\$16.80 million / RDF

\$11.07 million / CAW

CURRENT DESIGN COST*

\$9.75 million / RDF

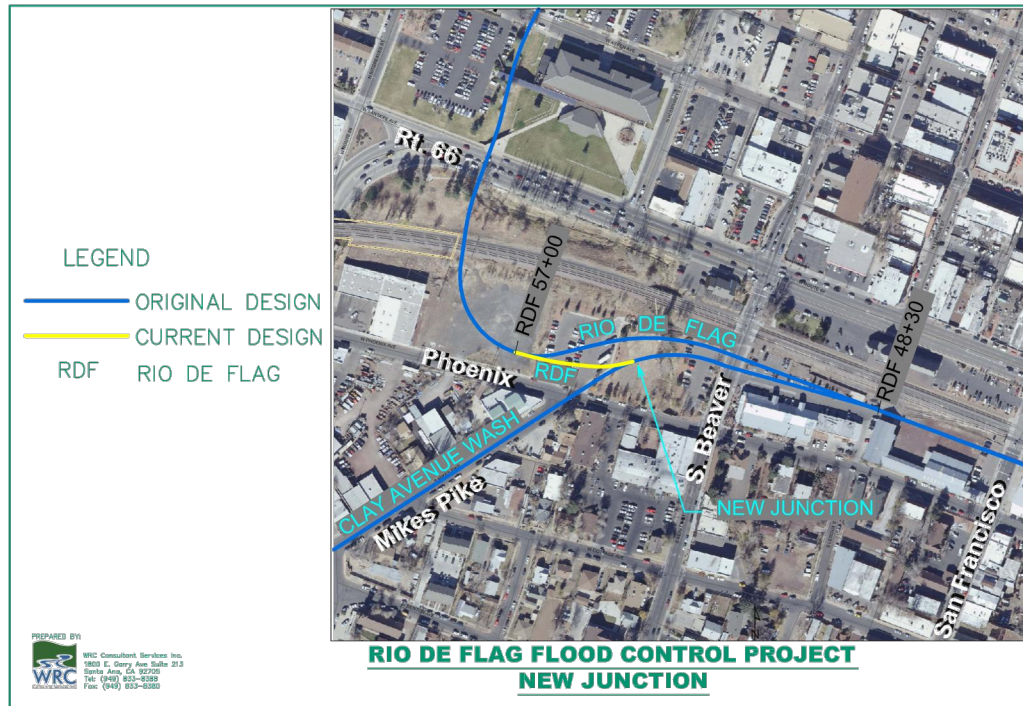
\$8.40 million / CAW

SAVING

\$9.72 million

* ONLY FOR PRIMARY
 COST ITEMS RELATING TO
 THE CHANNEL

ALTERNATIVE 2A **SHORTEN CONFLUENCE WITH UNDERGROUND JUNCTION BOX** **RDF STATION 48+30 TO STATION 54+65** **BEAVER AND EXISTING RDF PARK**



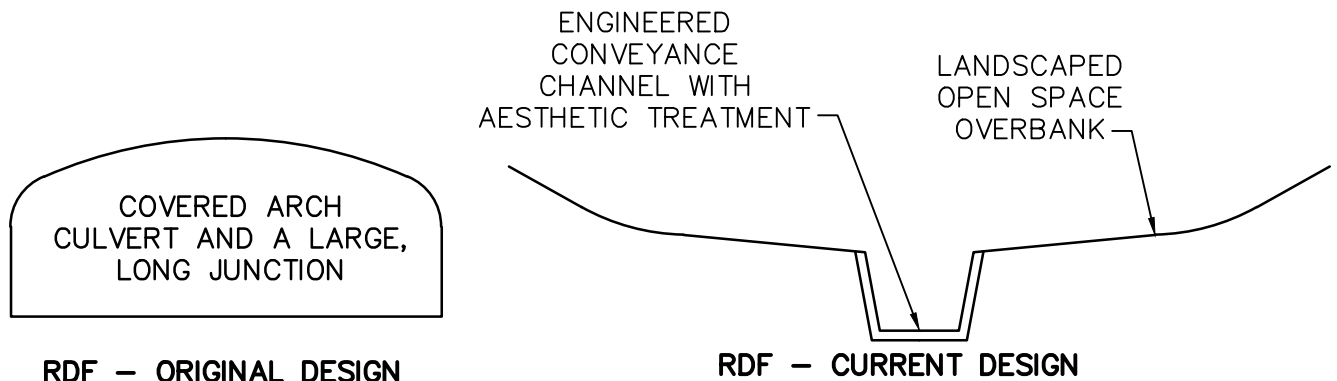
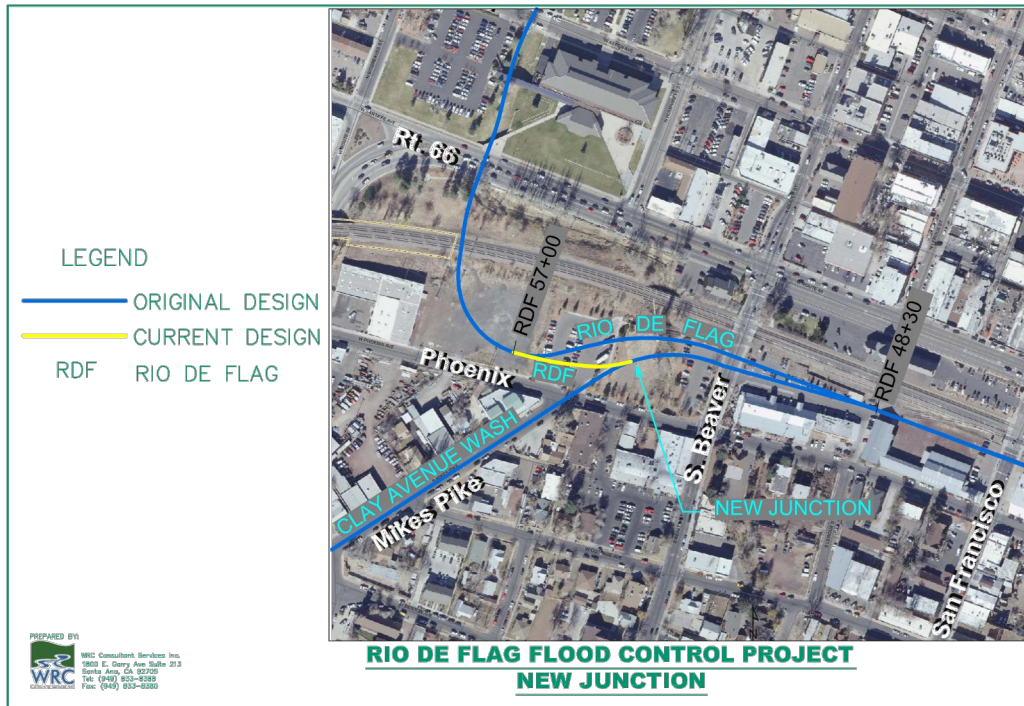
RDF – ORIGINAL DESIGN
870± LF
DISTANCE FROM RDF STATION
57+00 TO RDF STATION 48+30 THE
ORIGINAL JUNCTION

RDF – CURRENT DESIGN
235± LF
DISTANCE FROM RDF STATION
57+00 TO RDF STATION 54+65 THE
NEW JUNCTION

ORIGINAL DESIGN COST	\$3.5 million + \$500,000* + COST FOR RDF 52+70 TO 54+65 28' WIDE ARCH CULVERT
CURRENT DESIGN COST	\$2.5 million + COST FOR RDF 52+70 TO 54+65 24' WIDE ARCH CULVERT
SAVING	>\$1.5 million
* CAW 1+50 TO 3+00± (PHOENIX AVE) U/S EX. CONFLUENCE WILL BE ELIMINATED WITH NEW CONFLUENCE ADJUSTMENT	

ALTERNATIVE 2B

SHORTEN CONFLUENCE WITH OPEN CHANNEL AREA RDF STATION 48+30 TO STATION 54+65 BEAVER AND EXISTING RDF PARK



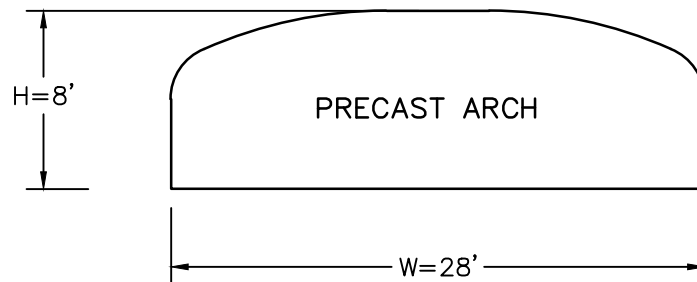
ORIGINAL DESIGN COST	\$3.5 million + \$500,000* + COST FOR RDF 52+70 TO 54+65 28' WIDE ARCH CULVERT
CURRENT DESIGN COST	\$2.0 million + COST FOR RDF 52+70 TO 54+65 24' WIDE ARCH CULVERT
SAVING	>\$2.0 million

* CAW 1+50 TO 3+00 ± U/S EX. CONFLUENCE WILL BE ELIMINATED WITH NEW CONFLUENCE ADJUSTMENT

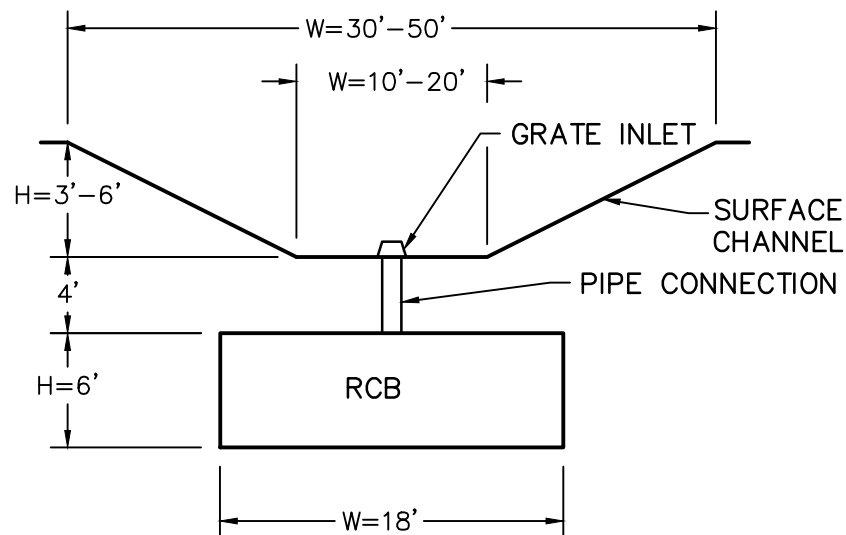
ALTERNATIVE 3

REPLACE ARCH CULVERT WITH COMPOSITE RCB
AND GRASSLINED OR TURF MAT LINED OPEN CHANNEL
RDF STATION 62+00 TO STATION 86+17 – ROUTE 66 TO BONITO

RDF – ORIGINAL DESIGN



RDF – CURRENT DESIGN



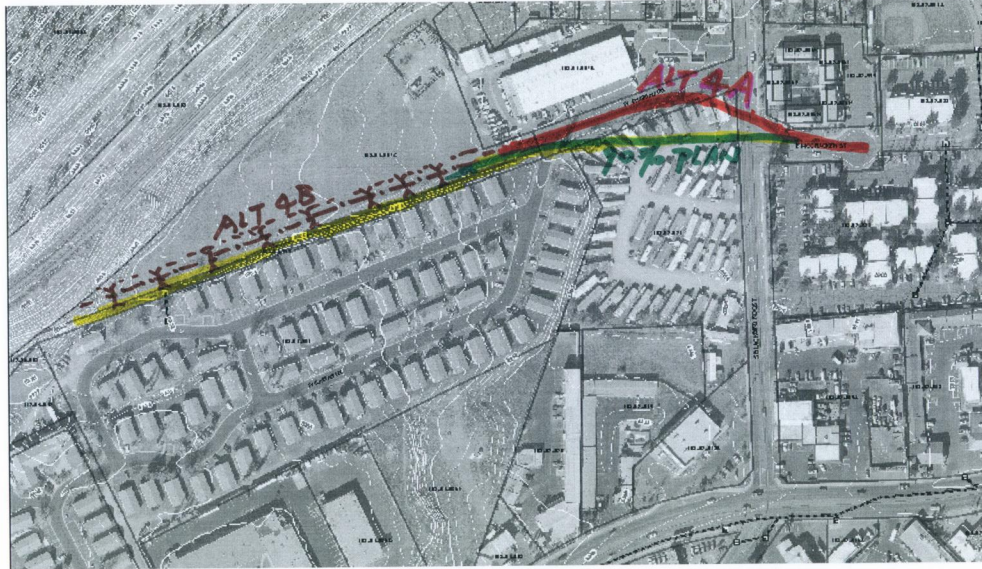
ORIGINAL DESIGN COST	\$7.83 million
CURRENT DESIGN COST	\$5.11 million
SAVING	\$2.72 million

ALTERNATE TURF MAT OPEN CHANNEL ON TOP OF RCB

ORIGINAL DESIGN COST	\$7.83 million
CURRENT DESIGN COST	\$6.76 million
SAVING	\$1.08 million

ALTERNATIVE 4A

REALIGN THE CAW ARCH CULVERT AND REDUCE IMPACTS ON TRAILER PARK
CAW STATION 32+00 TO STATION 36+95
U/S BLACKBIRD ROOST TO TRAILER PARK



CAW – ORIGINAL DESIGN

ARCH CULVERT THROUGH TRAILER PARK TAKING ABOUT 7 TRAILERS

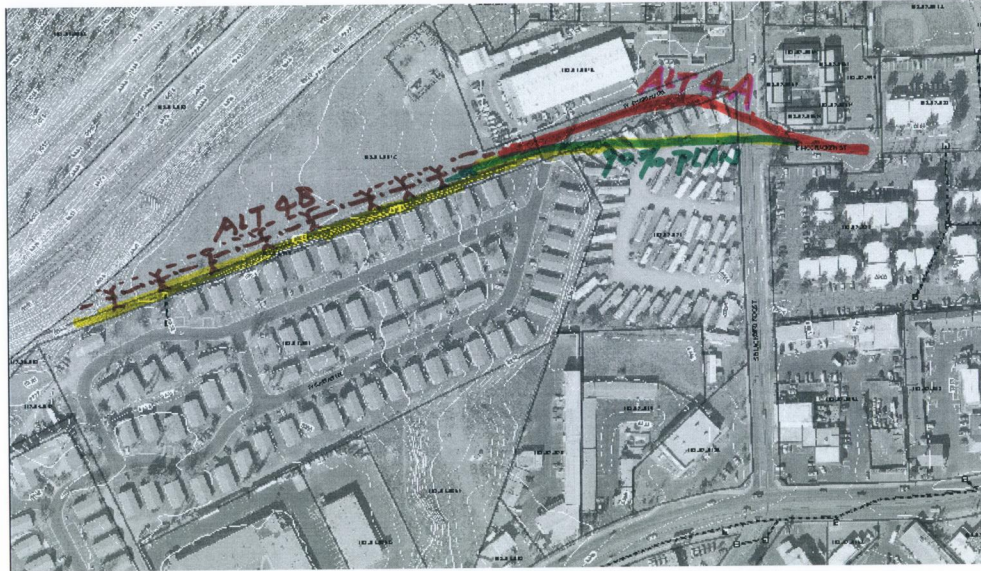
CAW – CURRENT DESIGN

ARCH CULVERT THROUGH NORTH SIDE OF TRAILER PARK ALONG W. CHATEAU DRIVE UNTIL THE CORNER OF W. CHATEAU AND S. BLACKBIRD ROOST. CUT THE CORNER TO JOIN E. McCRAKEN ST. ALIGNMENT. THIS WILL TAKE ABOUT 3 TRAILERS AND INCREASE THE CULVERT FROM 400 LINEAR FEET TO 480 LINEAR FEET

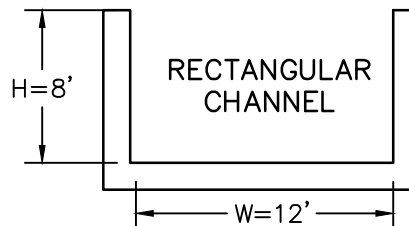
ORIGINAL DESIGN COST	\$1.86 million
CURRENT DESIGN COST	\$1.73 million
SAVING	\$0.13 million

ALTERNATIVE 4B

WIDEN CHANNEL – REPLACE RC CHANNEL WITH UNLINED OPEN EARTHEN CHANNEL
CAW STATION 36+95 TO STATION 48+55
U/S TRAILER PARK



CAW – ORIGINAL DESIGN



CAW – CURRENT DESIGN

2
1

EARTHEN CHANNEL

H=10'

W=10'

ORIGINAL DESIGN COST	\$1.04 million
CURRENT DESIGN COST	\$0.73 million
SAVING	\$0.31 million

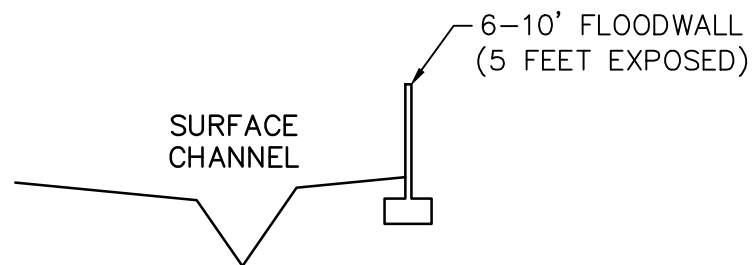
ALTERNATIVE 5

CHANNEL IMPROVEMENTS WITH A BERM(S).

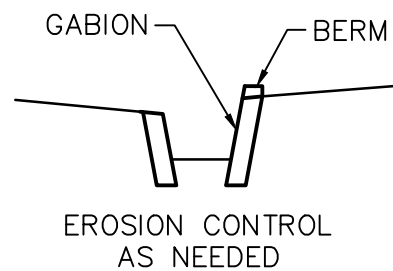
ELIMINATE FLOODWALL

RDF STATION 97+50 TO STATION 112+00 – THORPE TO BEAL

RDF – ORIGINAL DESIGN



RDF – CURRENT DESIGN



ORIGINAL DESIGN COST	\$3.77 million
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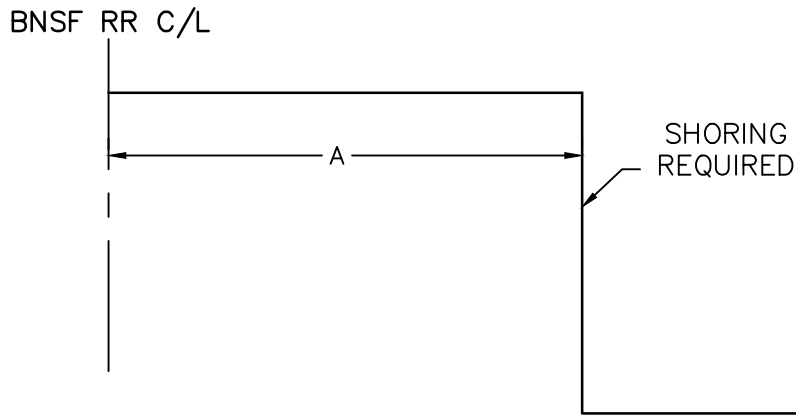
CURRENT DESIGN COST	\$1.85 million
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SAVING	\$1.92 million
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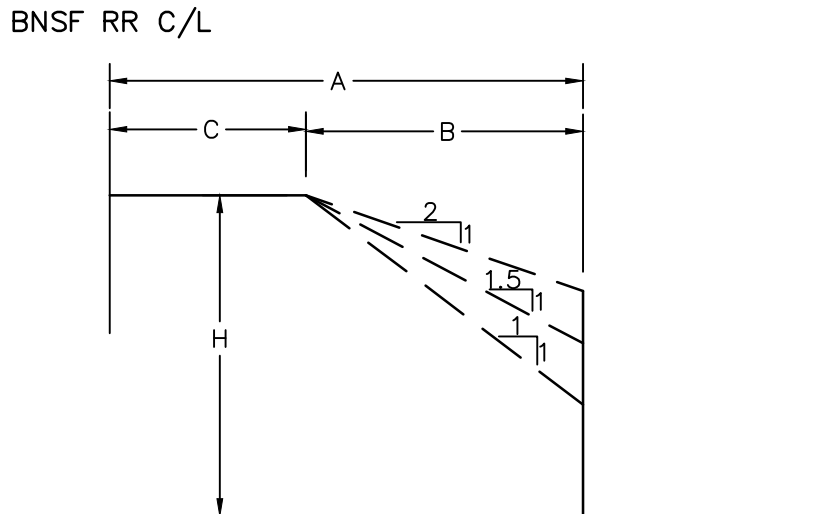
ALTERNATIVE 6

NEGOTIATE A LARGER CONSTRUCTION EASEMENT TO REDUCE SHORING
RDF STATION 40+15 TO STATION 54+10
ALONG BNSF RR TRACKS

RDF – ORIGINAL DESIGN



RDF – CURRENT DESIGN



H= OVERALL EXCAVATION HEIGHT
A = MAINLINE C/L TO EDGE OF TRENCH
B = SLOPE DISTANCE
C = OFFSET FROM MAINLINE C/L

ORIGINAL DESIGN COST	\$1.51 million
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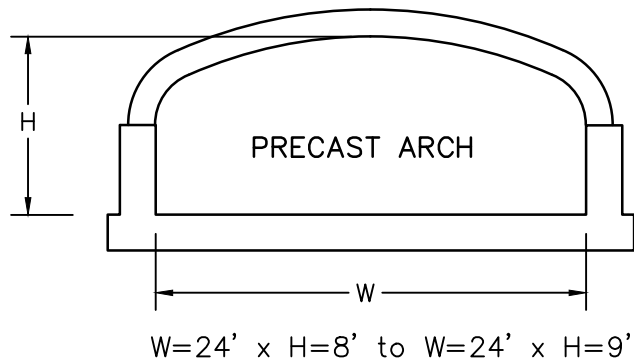
CURRENT DESIGN COST	\$0.98 million
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SAVING	\$0.53 million
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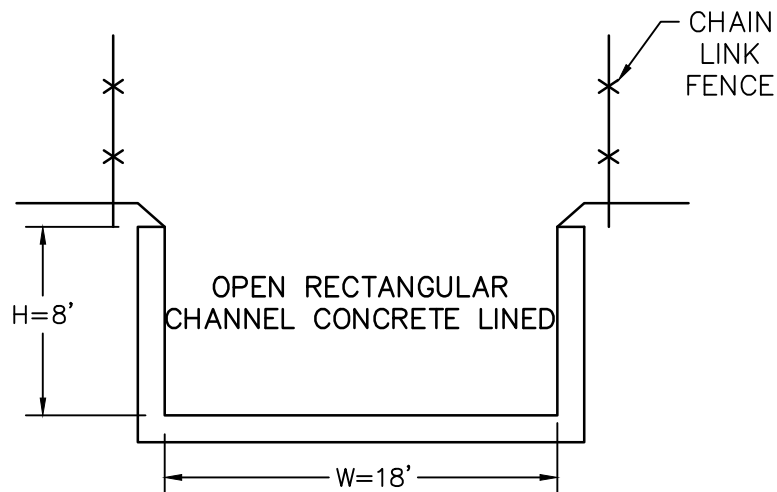
ALTERNATIVE 7

REPLACE ARCH CULVERT WITH RC CHANNEL
CAW STATION 18+00 TO 28+00
FIVE-POINT INTERSECTION TO McCRAKEN

CAW – ORIGINAL DESIGN



CAW – CURRENT DESIGN

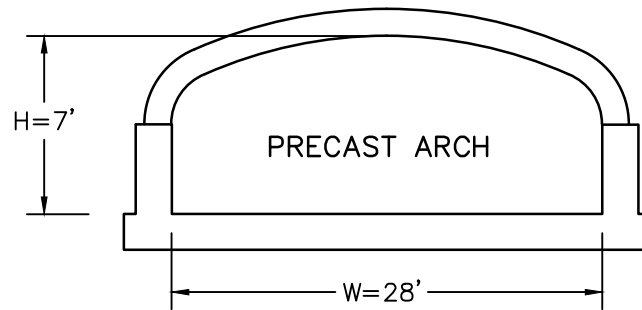


ORIGINAL DESIGN COST	\$2.99 million
CURRENT DESIGN COST	\$1.38 million
SAVING	\$1.61 million

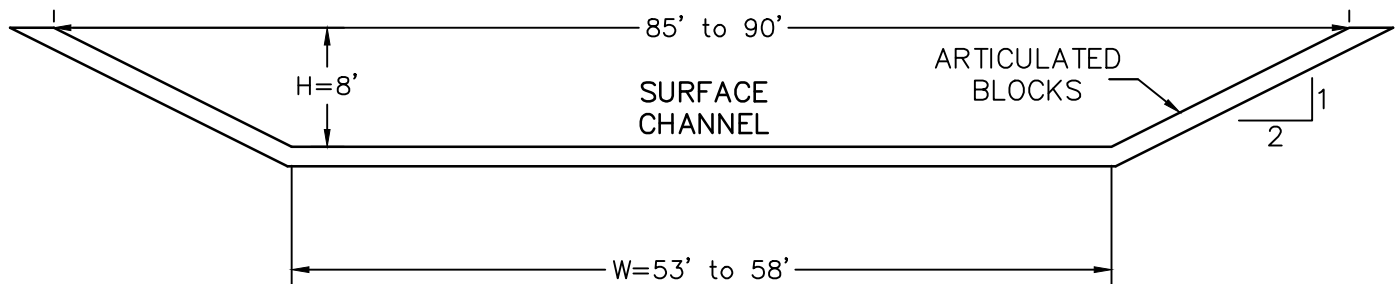
NOTE: FIRE STATION PROPERTY RESALE VALUE MAY BE REDUCED W/ OPEN CHANNEL

ALTERNATIVE 8
REPLACE ARCH CULVERT WITH OPEN CHANNEL
RDF STATION 77+50 TO STATION 86+00
SITGREAVES TO BONITO

RDF – ORIGINAL DESIGN



RDF – CURRENT DESIGN



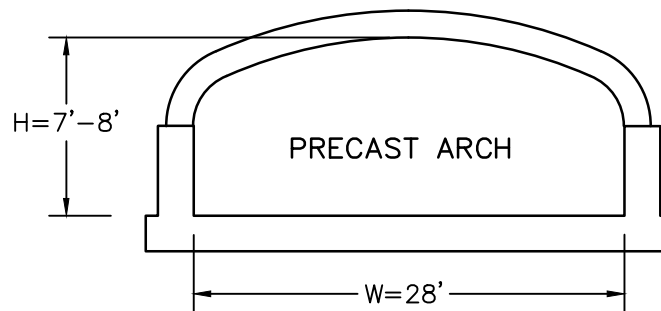
ORIGINAL DESIGN COST	\$2.25 million
CURRENT DESIGN COST	\$0.55 million
SAVING	\$1.7 million

. UNIT PRICE DURING VE WORKSHOP MAY INCREASE OR DECREASE DEPENDING ON AVERAGE CONTRACTOR COST
. 30% DESIGN CONSIDERED OPEN CHANNEL FOR STATION 62+50 TO 70+00 AND 77+50 TO 85+50.

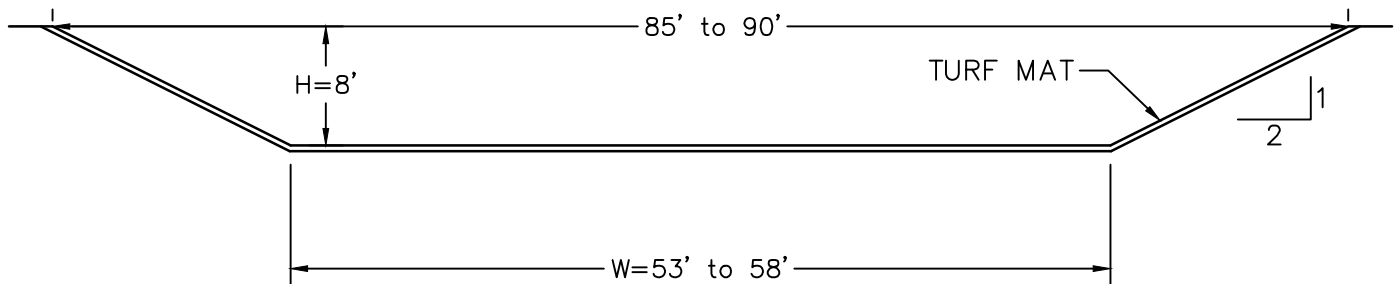
ALTERNATIVE 9

REPLACE ARCH CULVERT WITH OPEN CHANNEL
RDF STATION 62+50 STATION 70+00
SANTA FE/ROUTE 66 TO BIRCH

RDF – ORIGINAL DESIGN



RDF – CURRENT DESIGN



ORIGINAL DESIGN COST	\$2.25 million
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CURRENT DESIGN COST	\$1.59 million
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SAVING	\$0.66 million
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. UNIT PRICE DURING VE WORKSHOP MAY INCREASE OR DECREASE DEPENDING ON AVERAGE CONTRACTOR COST
. 30% DESIGN CONSIDERED OPEN CHANNEL FOR STATION 62+50 TO 70+00 AND 77+50 TO 85+50.