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Report on  
Irrigation Depletions Devil Creek above Three Creek Road  
Owyhee County, Idaho

by  
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## Irrigation Depletions Devil Creek above Three Creek Road Owyhee County, Idaho

### **Introduction**

Irrigation of pasture lands south of Three Creek Road on the Devil Creek Ranch is accomplished by gravity diversion from three branches of Devil Creek, referred to as the East, Middle, and West branches. Wild flooding from ditches is the mode of irrigation and waters from the east and middle branches can be intermingled. The three branches of the stream are spring fed and are the only source of irrigation water for the land south of Three Creek Road. Several low spots within fields and standing water during some periods indicates likely perching of ground water within the area possible confinement of the shallow aquifer to the areas along the streams..

Water rights administration in Idaho require measurement and control of irrigation diversions from streams to assure that permitted diversion rates are not exceeded and that seasonal allowable diversion volumes are not surpassed. These devices have been ordered by the Idaho Department of Water Resources under the water rights for Devil Creek Ranch but headgates have not been installed. The primary reason being that, historically, all flow of the streams has been diverted during the majority of the irrigation season and any water not utilized by vegetation has returned to Devil Creek for fulfilling downstream water rights. The concern by downstream users, namely Cedar Mesa Canal and Reservoir Company and the Cedar Canal, was that excess diversions, over and above licensed amounts, many not return to the creek with resulting loss of water for natural flow or storage rights.

### **Irrigated Area**

Irrigated fields have been delineated by the Farm Services Administration (Formerly ASCS) and are available on aerial photographs(Figure 1). The irrigated area by section, East, Middle, and West, as depicted on the FSA aerial photos is shown on the attached Water Balance spreadsheet (Figure 2).

Irrigated areas are delimited by ditches which generally run on the contour.

Riparian areas along each stream are not irrigated but do utilize water either from the stream, from surface irrigation return flow, or from subsurface sources. The total irrigated area is estimated at 112.4 acres and the estimated riparian area is 11.5 acres for a total of 123.9 acres utilizing water from the system.

**Consumptive Use**

Net depletion of the water sources by vegetation can be estimated from published values of consumptive use (evapotranspiration) if the crop type is known. All of the irrigated area along the branches of Devil Creek in 1996 was pasture. Estimates of consumptive use for NOAA weather stations in Idaho have been published by Allen and Brockway, 1983 and include estimates for the station at Three Creek which is most representative of the Devil Creek Ranch. Vegetation on the Devil Creek Ranch above Three Creek road includes primarily pasture and non-irrigated riparian vegetation along the streams. The following table shows the estimated acreage based on FSA aerial photos.

Table 1 Irrigated and Riparian Areas, acres

	East Branch	Middle Branch	West Branch	Total
Riparian	3.5	5	3	11.5
Total irrigated	14.2	76.1	22.1	112.4
Total	17.7	81.1	25.1	123.9

Consumptive use for riparian vegetated areas was assumed to be similar to that for pasture and the estimated maximum monthly and peak daily discharge depletion was estimated. The attached spreadsheet shows the procedure for estimating consumptive use from the Brockway and Allen data. Estimated maximum daily discharge depletion was 1.45 cfs and the average daily was estimated at 0.88 cfs.

### Water Measurements

In order to evaluate the net depletion of the surface streams and to determine whether or not diverted water not consumptively used returns to the streams, a series of discharge measurements was made during the 1996 season.

Personnel from the Idaho Department of Water Resources assisted with the water measurement evaluations.

Measurements were taken at four (4) times during the season with measurements on each inflow stream, East, Middle, and West, and on Devil Creek downstream of Three Creek Road. Measurement dates were April 16, July 18., September 30 and October 10, 1996. The dates were selected and irrigation adjusted so that measurements could be performed both when there was active irrigation and when there was no irrigation. On September 30, there was inadvertent irrigation from the smaller West stream. Weirs had been installed on the East and West channels and in the Crosscut ditch. Current meters or portable flumes were used for measurements when installed devices were not available. The attached water measurement summary sheets show the types of measurements and measured discharge. Table 2 shows the results of the water measurements and calculated gains in the system.

Table 2 Measured Gains in East, Middle and West Streams

Date	Inflow			Outflow	Gain(- loss)	Remarks
	East cfs	Middle cfs	West cfs	Devil Creek cfs		
16-Apr-96	1.80	3.64	0.70	6.78	0.64	No diversions
18-Jul-96	1.14	1.12	0.30	2.03	-0.53	Diversions from all three streams
30-Sep-96	0.66	0.98	0.30	2.66	0.72	Diversions from west onl
10-Oct-96	0.57	0.81	0.25	1.52	-0.11	Diversions from all three streams
Average Gain no diversions or minimal diversions					0.68 cfs	
Average loss during diversions					-0.32 cfs	
Difference					1.00 cfs	

During the two periods when little or no irrigation was occurring, there was a net gain in the streams averaging 0.68 cfs indicating that there is ground water entering the creek within the reach even during the early(April 16) measurement when shallow ground water buildup from irrigation would not be predominant. During the two measurements when irrigation diversions were occurring, there was a net loss of 0.32 cfs indicating that the consumptive use of the crop and riparian area was causing a depletion in the system averaging 1.00 cfs (0.68+0.32). Significant is the fact that the October 10 measurement shows a smaller loss (0.11 cfs) than the earlier measurement during irrigation which is consistent with the buildup of the shallow ground water system from continuous irrigation.

The average measured depletion of 1.00 cfs is consistent with the estimated depletion from consumptive use estimates of 0.88 cfs average to 1.45 cfs. One would expect the measured depletion to be less than the peak estimated depletion from consumptive use because the measurements included periods near the beginning and end of the irrigation season when evapotranspiration is low.

### **Conclusions and Recommendations**

The purpose of installing diversion control structures and water measurement devices on each ditch would be to insure that diversion rates do not exceed licensed amounts. From the standpoint of downstream users, Cedar Mesa Canal and Reservoir Company and Cedar Canal, the primary concern should be that diversions under applicable Devil Creek Ranch licenses do not result in decreased stream flows and/or runoff volumes which would result in decreased natural flow or storage allowable under appropriate licenses or decrees. The basic concern therefor is whether or not the discharge or volume outflow from the irrigated upper lands of Devil Creek Ranch depends on the level of diversion from the branches of the stream.

Based on the topography and stream flow measurements performed, it appears that any water diverted in excess of the consumptive use of crops and riparian vegetation returns to the stream either through surface runoff or ground water return flow. In other words, there is no apparent loss to deep ground water or out-of-basin flow and downstream flow, although attenuated and delayed somewhat by ground water temporary storage, is likely not diminished in volume. Because the aquifer system is shallow and the ground water travel distances are short, the time attenuation is estimated to be less than one month, although the exact time cannot be measured.

The amount of irrigated acreage above Three Creek Road (112.4 acres) may or may not be in excess of the amount authorized as the place of use under applicable water rights. It appears that there is no new irrigated acreage in the area and the current acreage is likely equal to the historically irrigated acreage. The cost of installation of permanent diversion control and water measurement devices at each diversion suitable to IDWR will not be insignificant and maintenance of the devices will be an annual function due to high flood flows.

A possible alternative to diversion measurement would be to require that total inflow from all three branches be measured and reported with suitable measuring devices and that an outflow device upstream of the confluence of Devil Creek and the Deadwood Ditch be installed. The maximum allowable measured reach loss (inflow-outflow) could be selected based on available and updated measurements. If the measured reach loss exceeded the allowable, then specific diversions could be shut off to increase outflow to a level at which the loss is below the allowable.

Assuming that the current irrigated acreage is equal to or less than the historical irrigated acreage and does not exceed the licensed acreage in the place of use, an alternative to installation of structures would be to assure that no change in the current place of use occurs including the number and location of irrigated fields. Specifically, even if no increase in acreage occurs in the

future, the location must remain the same to assure that the hydrology and return flow systems do not change. Transfer of place of use to lands not tributary to the stream or local aquifer would change the return flow relationships and result in decreased stream flow available to downstream users.

Any measuring devices installed in the system should be permanent, standard devices (weirs or flumes) with standard discharge ratings, permanently installed staff gages, accessible to the Watermaster, and adequately maintained. This should be the standard for any devices in the District.

Irrigated Area  
Devil Creek Ranch  
Owyhee County  
South of Three Creek Rd.





DEVIL CREEK WATERSHED  
 INFLOW OUTFLOW MEASUREMENTS APRIL 16, 1996  
 EAST, MIDDLE, AND WEST CHANNEL INFLOW AND OUTFLOW MEASURED AT THREE CREEK ROAD

MIDDLE CREEK AT UPPER DITCH DIVERSION CURRENT METERED

4/16/96 C.E. BROCKWAY, J. COLEMAN, MEL CROWLEY, ET AL  
 OTT METER 47966\* GAGE-NONE

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANGLE CORR.	VEL	DELTA AREA	DELTA Q	SUM Q
1	0.3	0.00	0		50	1	0.00	0.00	0.00	0.00
2	1.0	0.95	48		50	1	0.84	0.33	0.14	0.14
3	1.5	1.03	55		50	1	0.95	0.50	0.44	0.58
4	2.0	1.20	47		50	1	0.82	0.56	0.49	1.08
5	2.5	1.31	38		50	1	0.67	0.63	0.47	1.54
6	3.0	1.26	53		50	1	0.92	0.64	0.51	2.05
7	3.5	1.27	53		50	1	0.92	0.63	0.58	2.63
8	4.0	1.12	50		50	1	0.87	0.60	0.53	3.17
9	4.5	0.83	38		50	1	0.67	0.49	0.37	3.54
10	5.2	0.00	0		50	1	0.00	0.29	0.10	3.64

\* CALIBRATION V=(REV/SEC)\*C1+C2 FT/SEC

LOOKUP TABLE

R	C1	C2
0	0.7872	0.062
0.68	0.8495	0.02
100	0.8495	0.02

AVG. VEL 0.78 FPS  
 AREA 4.66 SQ FT  
 DISCHAR 3.64 CFS A

DEVIL CREEK EAST CHANNEL

WEIR- 24 INCH RECTANGULAR CONTRACTED WEIR WIDTH= 1.96 FT  
 AERATING PROPERLY WEIR POOL NEEDS CLEANING-BOTTOM IS 5 INCHES BELOW WEIR CREST  
 STUCK WEIR H= 5.25 INCH C.E. BROCK DISCHARGE= 1.80 CFS B

DEVIL CREEK WEST CHANNEL

WEIR-RECTANGULAR CONTRACTED WIDTH=1.95 FEET  
 H= 0.23 FT BY TIME LUKE DISCHARGE= 0.70 CFS C

DEVIL CREEK AT HIGHWAY BRIDGE ABOVE CONFLUENCE WITH DEADWOOD DITCH

CURRENT METERED BY TIM LUKE, IDWR AND C.E. BROCKWAY  
 SWOFFER 2100 CURRENT METER DISCHARGE= 6.78 CFS D

TOTAL INFLOW A+B+C 6.14  
 OUTFLOW= D 6.78  
 NET GAIN D-(A+B+C)= 0.64 CFS  
 PERCENT GAIN/LOSS 10.37 %GAIN

NOTE: NO WATER BEING DIVERTED FOR IRRIGATION-PRIOR TO SEASON

DEVIL CREEK WATERSHED  
 INFLOW OUTFLOW MEASUREMENTS JULY 18, 1996  
 EAST, MIDDLE, AND WEST CHANNEL INFLOW & OUTFLOW MEASURED BELOW THREE CREEK ROAD

MIDDLE CREEK ABOVE UPPER DITCH DIVERSION CURRENT METERED

7/16/96 C.E. BROCKWAY, J. COLEMAN, MEL CROWLEY, ET AL  
 OTT METER 47966\* GAGE-NONE

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANGLE CORR.	VEL	DELTA AREA	DELTA Q	SUM Q
1	0.5	0.12	0		50	1	0.00	0.00	0.00	0.00
2	1.0	0.39	52		50	1	0.90	0.13	0.06	0.06
3	1.5	0.40	58		50	1	1.01	0.20	0.19	0.25
4	2.0	0.45	74		50	1	1.28	0.21	0.24	0.49
5	2.5	0.48	75		50	1	1.29	0.23	0.30	0.79
6	3.0	0.40	54		50	1	0.94	0.22	0.25	1.03
7	3.6	0.20	0		50	1	0.00	0.18	0.08	1.12

\* CALIBRATION V=(REV/SEC)\*C1+C2 FT/SEC

LOOKUP	TABLE		AVG. VEL.	0.96 FPS
R	C1	C2	AREA	1.17 SQ FT
0	0.7872	0.062	DISCHARGE	1.12 CFS A
0.68	0.8495	0.02		
100	0.8495	0.02		

DEVIL CREEK EAST CHANNEL  
 WEIR- 24 INCH RECTANGULAR CONTRACTED WEIR WIDTH=1.96 FT  
 AERATING PROPERLY WEIR POOL NEEDS CLEANING-BOTTOM IS 5 INCHES BELOW WEIR CREST  
 STUCK WEIR H= 0.32 FT C.E. BROCK DISCHARGE= 1.14 CFS B

DEVIL CREEK WEST CHANNEL  
 WEIR-RECTANGULAR CONTRACTED WIDTH=1.96 FEET  
 H= 0.13 FT BY TIM LUKE DISCHARGE= 0.30 CFS C

DEVIL CREEK BELOW PATRICK #1 DIVERSION IN CROSSCUT DITCH  
 CURRENT METERED BY TIM LUKE AND BRYAN CONTOR, IDWR  
 SWOFFER 2100 CURRENT METER DISCHARGE= 2.03 CFS D

TOTAL INFLOW A+B+C 2.56  
 OUTFLOW= D 2.03

NET GAIN D-(A+B+C)= -0.53 CFS

PERCENT GAIN(LOSS) (20.77) %LOSS

NNOTE: WATER BEING DIVERTED FROM ALL STREAMS FOR IRRIGATION  
 NO WATER IN DEADWOOD DITCH

DEVIL CREEK WATERSHED  
 INFLOW OUTFLOW MEASUREMENTS SEPTEMBER 30, 1996  
 EAST, MIDDLE, AND WEST CHANNEL INFLOW AND OUTFLOW MEASURED ABOVE THREE CREEK ROAD

## DEVIL CREEK ABOVE THREE CREEK ROAD BELOW MIDDLE CREEK CONFLUENCE

9/30/96 C.E. BROCKWAY, MEL CROWLEY, AND RANDALL BREWER  
 OTT METER 47966\* GAGE-NONE

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANGLE CORR.	VEL	DELTA AREA	DELTA Q	SUM Q
1	0.6	0.00	0		50	1	0.00	0.00	0.00	0.00
2	1.0	0.68	8		50	1	0.19	0.14	0.01	0.01
3	1.5	0.80	11		50	1	0.24	0.37	0.08	0.09
4	2.0	0.85	22		50	1	0.41	0.41	0.13	0.22
5	2.5	0.97	31		50	1	0.55	0.46	0.22	0.44
6	3.0	1.00	45		50	1	0.78	0.49	0.33	0.77
7	3.5	1.03	60		50	1	1.04	0.51	0.46	1.23
8	4.0	1.03	53		50	1	0.92	0.52	0.50	1.74
9	4.5	0.94	45		50	1	0.78	0.49	0.42	2.16
10	5.0	1.06	20		50	1	0.38	0.50	0.29	2.45
11	5.5	0.82	14		50	1	0.28	0.47	0.15	2.60
12	6.0	0.65	0		50	1	0.00	0.37	0.06	2.66
13	6.6	0.40	0		50	1	0.00	0.32	0.00	2.66

\* CALIBRATION V=(REV/SEC)\*C1+C2 FT/SEC

LOOKUP TABLE

R	C1	C2
0	0.7872	0.062
0.68	0.8495	0.02
100	0.8495	0.02

AVG. VEL	0.68 FPS
AREA	3.88 SQ FT
DISCHAR	2.66 CFS D

## DEVIL CREEK EAST CHANNEL

WEIR- 24 INCH RECTANGULAR CONTRACTED WEIR WIDTH= 1.96 FT  
 AERATING PROPERLY WEIR POOL NEEDS CLEANING-BOTTOM IS 5 INCHES BELOW WEIR CREST  
 STUCK WEIR H= 0.22 FT C.E. BROCK DISCHARGE= 0.66 CFS A

## DEVIL CREEK WEST CHANNEL

WEIR-RECTANGULAR CONTRACTED WIDTH=1.95 FEET  
 STUCK WEIR H= 0.13 FT C.E. BROCK DISCHARGE= 0.30 CFS B

## DEVIL CREEK CENTER CHANNEL

MEASURED W/45DEG 2 INCH THROAT TRAPEZOIDAL FLUME-150 FT UPSTREAM OF BIFURCATION  
 HEAD= 0.82 FT DISCHARGE= 0.98 CFS C

TOTAL INFLOW A+B+C	1.94
OUTFLOW= D	2.66
NET GAIN D-(A+B+C)=	0.72 CFS
PERCENT GAIN/LOSS	36.95 %GAIN

NOTE: NO WATER WAS BEING DIVERTED FROM STREAMS FOR IRRIGATION  
 FROM THE EAST AND CENTER STREAMS. ALL WATER WAS BEING DIVERTED  
 FROM THE WEST STREAM FOR IRRIGATION  
 RANDALL BREWER HAD INSTRUCTED IRRIGATOR TO TURN ALL WATER ONTO FIELDS  
 IN THE MORNING OF THIS DAY. APPARENTLY THE IRRIGATOR MISUNDERSTOOD

## WEST STREAM INFLOW-OUTFLOW WATER BEING DIVERTED FOR IRRIGATION

DEVIL CREEK WEST CHANNEL AT WEIR AT HEAD  
 WEIR-RECTANGULAR CONTRACTED WIDTH=1.95 FEET  
 STUCK WEIR H= 0.13 FT C.E. BROCKWA DISCHARGE= 0.30 CFS B

## DEVIL CREEK WEST CHANNEL 200 YDS UPSTREAM OF CONFLUENCE WITH CENTRAL

MEASURED W/45DEG 2 INCH THROAT TRAPEZOIDAL FLUME-  
 HEAD= 0.26 FT DISCHARGE= E 0.07 CFS

TOTAL INFLOW B	0.30 CFS
OUTFLOW= E	0.07 CFS
NET GAIN D-(E-B)=	-0.23 CFS
PERCENT GAIN/LOSS	-76.69 %LOSS

**DEVIL CREEK WATERSHED**  
**INFLOW OUTFLOW MEASUREMENTS OCTOBER 10, 1996**  
**EAST, MIDDLE, AND WEST CHANNEL INFLOW & OUTFLOW MEASURED BELOW THREE CREEK ROAD**

10/10/96

C.E. BROCKWAY, MEL CROWLEY, RANDALL BREWER

**DEVIL CREEK EAST CHANNEL**

WEIR- 24 INCH RECTANGULAR CONTRACTED WEIR WIDTH=1.96 FT  
 AERATING PROPERLY WEIR POOL NEEDS CLEANING-BOTTOM IS 5 INCHES BELOW WEIR CREST  
 STUCK WEIR H= 0.2 FT C.E. BROCKWAY DISCHARGE= 0.57 CFS A

**DEVIL CREEK MIDDLE CHANNEL**

WEIR, 24 INCH RECTANGULAR CONTRACTED WEIR WIDTH=2.00  
 NEWLY INSTALLED BY R. BREWER , POOL ADEQUATE, AERATING PROPERLY, SHARP CREST  
 STUCK WEIR H= 0.25 FT C.E. BROCKWAY DISCHARGE= 0.81 CFS B

**DEVIL CREEK WEST CHANNEL**

WEIR-RECTANGULAR CONTRACTED WIDTH=1.96 FEET  
 STUCK WEIR H= 0.115 FT C.E. BROCKWAY DISCHARGE= 0.25 CFS C

DEVIL CREEK AT CHECK STRUCTURE BELOW PATRICK #1 DIVERSION IN CROSSCUT DITCH  
 WEIR, 36 INCH CIPPOLETTI WEIR WIDTH=3.00 NEWLY INSTALLED, STRUCTURE WIDTH 4.0 FT  
 AERATING PROPERLY, SHARP CREST, BOTTOM OF POOL IS 0.35 FT BELOW CREST  
 DISCHARGE IS CORRECTED FOR VELOCITY OF APPROACH  
 STUCK WEIR H= 0.28 FT C.E. BROCKWAY DISCHARGE= 1.52 CFS D

TOTAL INFLOW	A+B+C	1.64
OUTFLOW=	D	1.52

NET GAIN D-(A+B+C)=	-0.11 CFS
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PERCENT GAIN(LOSS)	(6.87) %LOSS
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NOTES: NO WATER ENTERING DEVIL CREEK FROM DEADWOOD  
 WATER WAS BEING DIVERTED FROM EAST, CENTRAL, AND WEST STREAMS INTO  
 IRRIGATION DITCHES. CENTRAL HAD THREE DITCHES DIVERTING.  
 NEW WEIR ON CENTRAL STREAM IS AT LOCATION OF PREVIOUS CURRENT METERING  
 NEW WEIR IN CROSSCUT DITCH IS IN LEFT BAY OF CONCRETE CHECK  
     NO LEAKS, SHARP CREST CIPPOLETTI, AERATING PROPERLY  
     CHECK BAY IS 4 FT WIDE, WEIR CREST IS 0.35 FT ABOVE POOL BOTTOM-  
     VELOCITY OF APPROACH INCREASES CROSSCUT DITCH Q FROM 1.48 TO 1.52CFS  
 NO DIVERSIONS FROM CROSSCUT DITCH

CEDAR CANAL PRELIMINARY  
 INFLOW OUTFLOW MEASUREMENTS OCTOBER 10, 1996  
 BETWEEN DIVERSION FROM CEDAR MESA CANAL AND TVERDY /RUBLE HEADGATE

10/10/96 C.E. BROCKWAY, MEL CROWLEY, SCOTT TVERDY(LATTER PART)

CEDAR CANAL AT DIVERSION FROM CEDAR MESA CANAL  
 INSTALLED 0.4 FT THROAT, 45 DEG TRAPEZOIDAL FLUME APPROX. 150 FT DOWNSTREAM OF OUTLET  
 FLUME WAS LEVEL, NO LEAKS, EXCELLENT MEASUREMENT  
 HEAD= 1.18 C.E. BROCKWAY DISCHARGE= 2.58 CFS A

CEDAR CANAL BELOW TVERDY/RUBLE HEADGATE  
 18 INCH PARSHALL FLUME IN RUBLE DITCH, ALL CEDAR CANAL WATER THROUGH FLUME  
 FLUME IS METAL, THOMPSON CO. MFG, CONCRETE HEADGATE, EXCELLENT MEASUREMENT  
 HEAD= 0.57 C.E. BROCKWAY DISCHARGE= 2.53 CFS B

TOTAL INFLOW A	2.58
OUTFLOW= B	2.53
NET GAIN(LOSS)B-A=	-0.05 CFS
PERCENT GAIN/LOSS	-1.94 %LOSS

NOTE: