

MEMORANDUM

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WATER RESOURCES
WESTERN REGION

To: File, 65-3617 & 65-8627
cc: Garrick Baxter
From: Scott King 
Date: July 8, 2003

Subject: Associated Earth Sciences, Inc. final recommendations

Accompanying this memo are final field headgate requirement and conveyance loss calculations performed by Harley Noe of Associated Earth Sciences, Inc. My review indicates that the field headgate requirement calculations are based on an appropriately applied Hubble Analysis. Conveyance losses are based on the same 29.3 percent-of-field-headgate value that was previously determined and applied to several rights delivered in the Johnson-Higby Ditch, and agreed upon by both parties.

ASSOCIATED EARTH SCIENCES, Inc.
BIOLOGY GEOLOGY ENGINEERING SOIL SURVEYS SOIL & WATER QUALITY
RESOURCE PLANNING SITE INVESTIGATION

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Boise, Idaho 83709
Boise, Idaho 83712

(208) 672-9213
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July 6, 2003

Scott King
Idaho Dept. of Water Resources
301 N. Orchard St.
Boise, ID 83706

Attached are copies of calculated values and support documentation for the George Colwell water rights 65-08627 and 65-03617. These values represent the changes initiated as a result of our May 15th field visit. I incorporated the intake family and corresponding application rates we discussed for the six problem fields. As you recall, Mr. Colwell and his irrigator stated that fields 3, 9, 10, 11, 17 & 18 were difficult to get water across even with extended sets. All other fields utilized the original soils values and efficiencies as per your optimum calculations. I highlighted in color the elements in the summary that are changed subsequent to our field visit.

All information is displayed in the "On-farm Requirement Summary" sheet. Field requirements for all fields are shown in the summary. It is supported by copies of FURROW runs for each field and the FIR spreadsheet for each water right. The final values are:

3617 (SNK)

Water Right 65-08617 20.45 CFS 0.050 CFS per acre 2.49 miners inch
Water Right 65-08627 4.56 CFS 0.043 CFS per acre 2.17 miners inch

The conveyance loss for these parcels is calculated based on the Tuthill loss rate of 29.3% of the field headgate requirement. The resulting value is as follows.

Field headgate requirement of 25.01 X .293 = 7.33 CFS

Please let me know if you see any discrepancies from our earlier calculations. These results should match up with your most recent runs we discussed. I have made several generations of Hubble evaluations and I want to be sure we have it correct in this final run.

Contact me at 850-4926 or phone or FAX at 939-8602.



HARLEY R. NOE
Professional Soil Scientist

Attachments

On-farm Requirement Summary

Water Right 65-03617

Field Number	Adjusted Acres	Run Length	Set Time (hours)	Intake Family	Rep. Soil Series	MAD Value	Efficiency (%)	Total Field Req. (CFS)
2	15.0	560	12	0.55	Notus	1.4	30	0.65
3	68.1	550	12	0.70	Notus	1.4	22	4.01
6	36.5	1040	12	0.55	Notus	1.4	27	1.75
7	5.6	720	12	0.55	Notus	1.4	29	0.25
9	28.1	650	12	0.70	Notus	1.4	21	1.74
10	46.6	600	12	0.70	Notus	1.4	22	2.75
11	54.7	840	12	0.70	Notus	1.4	20	3.55
12	36.9	480	12	0.55	Moulton	2.3	48	0.97
13	52.0	1040	12	0.55	Moulton	2.3	44	1.49
14	28.0	480	12	0.55	Notus	1.4	29	1.25
15	12.1	320	12	0.55	Notus	1.4	26	0.60
16	5.2	480	12	0.55	Chance	2.3	48	0.14
17	22.1	640	12	0.70	Notus	1.4	22	1.30

TOTAL	411.0							20.45
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Total on-farm requirement for water right 65-03617 in miner's inches.

2.49

Total requirement in CFS per acre

0.050

Items shown in orange are values changed from Scott King's calculations of March 26, 2003. All other values remain as per his calculations.

Field 11 was calculated using half-length runs of 840 feet to derive useable values for efficiency.
Revised calculations based on field visit w/ IDWR specialists on May 15, 2003.

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.55	1.40	.005	2.00	560	3.0	12	679.7	3.09	0.00	0.00	0.00	0.00
0.55	1.40	.005	2.00	560	3.5	12	414.1	3.61	0.00	0.00	0.00	0.00
0.55	1.40	.005	2.00	560	4.0	12	285.6	4.12	0.00	0.00	0.00	0.00
0.55	1.40	.005	2.00	560	~~4.5~~	<u>12</u>	213.9	4.64	3.77	0.06	3.19	<u>30.17</u>
0.55	1.40	.005	2.00	560	5.0	12	169.7	5.16	4.09	0.43	3.32	27.15
0.55	1.40	.005	2.00	560	5.5	12	140.5	5.67	4.32	0.83	3.45	24.68

Field 2

30%

Field 3 22%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.70	1.40	.005	2.00	550	10.0	12	67.2	10.50	6.60	3.57	5.53	13.33
0.70	1.40	.005	2.00	550	9.0	12	76.9	9.45	6.38	2.70	5.35	14.82
0.70	1.40	.005	2.00	550	8.0	12	90.9	8.40	6.12	1.84	5.16	16.67
0.70	1.40	.005	2.00	550	7.0	12	112.7	7.35	5.79	1.01	4.94	19.05
0.70	1.40	.005	2.00	550	6.5	12	128.7	6.82	5.60	0.60	4.82	20.51
0.70	1.40	.005	2.00	550	6.0	12	150.2	6.30	5.36	0.21	4.69	22.22
0.70	1.40	.005	2.00	550	5.5	12	180.4	5.77	5.36	0.21	4.69	22.22
0.70	1.40	.005	2.00	550	5.0	12	224.6	5.25	5.36	0.21	4.69	22.22

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.55	1.40	.005	2.00	1040	10.0	12	271.7	5.55	4.08	0.28	3.87	25.21
0.55	1.40	.005	2.00	1040	9.5	12	300.8	5.28	3.84	0.10	3.78	26.54
0.55	1.40	.005	2.00	1040	9.0	12	336.8	5.00	3.84	0.10	3.78	26.54

Field 6

27%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.55	1.40	.005	2.00	720	7.0	12	184.1	5.61	4.29	0.59	3.62	24.94
0.55	1.40	.005	2.00	720	6.0	12	253.2	4.81	3.77	0.03	3.39	29.09
0.55	1.40	.005	2.00	720	6.5	12	213.3	5.21	4.06	0.30	3.51	26.85
0.55	1.40	.005	2.00	720	5.5	12	310.1	4.41	4.06	0.30	3.51	26.85
0.55	1.40	.005	2.00	720	5.0	12	395.5	4.01	4.06	0.30	3.51	26.85

Field 7 Notus 29%

Field 9

21%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.70	1.40	.005	2.00	650	10.0	12	98.9	8.88	6.36	2.02	5.46	15.76
0.70	1.40	.005	2.00	650	9.0	12	115.9	8.00	6.09	1.32	5.27	17.51
0.70	1.40	.005	2.00	650	8.0	12	141.3	7.11	5.75	0.64	5.06	19.70
0.70	1.40	.005	2.00	650	7.5	12	159.1	6.66	5.54	0.31	4.95	21.01
0.70	1.40	.005	2.00	650	7.0	12	182.3	6.22	5.54	0.31	4.95	21.01

Field 10 12 hrs/split length

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.70	1.40	.005	2.00	600	10.0	12	81.8	9.62	6.49	2.73	5.50	14.55
0.70	1.40	.005	2.00	600	9.0	12	94.7	8.66	6.25	1.95	5.31	16.16
0.70	1.40	.005	2.00	600	8.0	12	113.7	7.70	5.95	1.19	5.11	18.18
0.70	1.40	.005	2.00	600	7.0	12	143.8	6.74	5.57	0.45	4.89	20.78
0.70	1.40	.005	2.00	600	6.5	12	166.2	6.26	5.33	0.10	4.76	22.38
0.70	1.40	.005	2.00	600	6.0	12	196.8	5.77	5.33	0.10	4.76	22.38

22%

Field 11

20%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Pt/Pt	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.70	1.40	.005	2.00	840	10.0	12	193.9	6.87	5.63	0.20	5.28	20.36
0.70	1.40	.005	2.00	840	9.0	12	238.0	6.19	5.63	0.20	5.28	20.36
0.70	1.40	.005	2.00	840	9.5	12	213.7	6.53	5.63	0.20	5.28	20.36
0.70	1.40	.005	2.00	840	11.0	12	164.1	7.56	5.99	0.69	5.47	18.51

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.55	2.30	.005	2.00	480	3.5	12	232.1	4.21	0.00	0.00	0.00	0.00
0.55	2.30	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	2.24	47.79
0.55	2.30	.005	2.00	480	4.0	24	168.8	9.62	7.20	1.91	5.41	23.90
0.55	2.30	.005	2.00	480	5.0	12	108.1	6.02	4.41	1.22	2.50	38.24
0.55	2.30	.005	2.00	480	6.0	12	80.3	7.22	4.72	2.21	2.71	31.86
0.55	2.30	.005	2.00	480	8.0	12	55.4	9.62	5.15	4.28	3.05	23.90
0.55	2.30	.005	2.00	480	8.0	24	55.4	19.25	8.80	10.29	6.66	11.95

Field 12 Moulton
Field 16 Chance

48%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.55	2.30	.005	2.00	1040	9.5	12	380.8	5.28	3.84	0.10	2.88	43.60
0.55	2.30	.005	2.00	1040	9.0	12	336.8	5.00	3.84	0.10	2.88	43.60

Field 13
44%

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.55	1.40	.005	2.00	480	5.0	12	108.1	6.02	4.41	1.22	3.40	23.27
0.55	1.40	.005	2.00	480	5.5	12	91.9	6.62	4.58	1.71	3.51	21.16
0.55	1.40	.005	2.00	480	4.5	12	131.8	5.41	4.20	0.73	3.28	25.86
0.55	1.40	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	3.14	29.09
0.55	1.40	.005	2.00	480	3.5	12	232.1	4.21	3.93	0.27	3.14	29.09

Field 14 Notus 29%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Pt/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION APPLICATION Inches	NET IRRIGATION APPLICATION Inches	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
0.55	1.40	.005	2.00	320	3.0	12	87.8	5.41	4.12	1.00	3.01	25.86
0.55	1.40	.005	2.00	320	3.5	12	66.2	6.32	4.33	1.76	3.15	22.17
0.55	1.40	.005	2.00	320	4.0	12	53.5	7.22	4.50	2.54	3.28	19.39
0.55	1.40	.005	2.00	320	4.0	8	53.5	4.81	3.27	1.35	2.06	29.09

Field 15 Notus 26%

INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS	NET	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
								IRRIGATION APPLICATION Inches	IRRIGATION APPLICATION Inches			
0.55	2.30	.005	2.00	480	3.5	12	232.1	4.21	0.00	0.00	0.00	0.00
0.55	2.30	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	2.24	47.79
0.55	2.30	.005	2.00	480	4.0	24	168.8	9.62	7.20	1.91	5.41	23.90
0.55	2.30	.005	2.00	480	5.0	12	108.1	6.02	4.41	1.22	2.50	38.24
0.55	2.30	.005	2.00	480	6.0	12	80.3	7.22	4.72	2.21	2.71	31.86
0.55	2.30	.005	2.00	480	8.0	12	55.4	9.62	5.15	4.28	3.05	23.90
0.55	2.30	.005	2.00	480	8.0	24	55.4	19.25	8.80	10.29	6.66	11.95

Field 12 Moulton

Field 16

Chance

48%

Field 17 22%

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.70	1.40	.005	2.00	640	10.0	12	95.3	9.02	6.39	2.16	5.47	15.52
0.70	1.40	.005	2.00	640	9.0	12	111.4	8.12	6.12	1.44	5.28	17.24
0.70	1.40	.005	2.00	640	8.0	12	135.4	7.22	5.80	0.74	5.07	19.39
0.70	1.40	.005	2.00	640	7.5	12	152.2	6.77	5.59	0.41	4.96	20.69
0.70	1.40	.005	2.00	640	7.0	12	173.9	6.32	5.36	0.08	4.84	22.17
0.70	1.40	.005	2.00	640	6.5	12	202.9	5.86	5.36	0.08	4.84	22.17

On-farm Requirement Summary

Water Right 65-08627

Field Number	Adjusted Acres	Run Length	Set Time (hours)	Intake Family	Rep. Soil Series	MAD Value	Eff. (%)	Total Field Req. CFS
18	38.4	770	12	0.70	Notus	1.4	21	2.37
19	60.3	1120	12	0.55	Moulton	2.3	42	1.81
20	6.3	160	12	0.55	Moulton	2.3	21	0.38
Total	105.0							4.56
Total on-farm requirement for water right 65-08627 in miner's inches								2.17
Total requirement in CFS per acre								0.043

Items shown in orange are values changed from Scott King's calculations of March 26, 2003. All other values remain as per his calculations.

Revisions recalculations based on field visit w/ IDWR specialists on May 15, 2003.

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.70	1.40	.005	2.00	770	10.0	12	152.5	7.50	5.95	0.75	5.35	18.67
0.70	1.40	.005	2.00	770	9.0	12	184.0	6.75	5.58	0.20	5.15	20.74
0.70	1.40	.005	2.00	770	8.5	12	205.4	6.37	5.58	0.20	5.15	20.74

Field 18
21%

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.55	2.30	.005	2.00	1120	10.5	12	307.4	5.41	3.89	0.14	2.97	42.48
0.55	2.30	.005	2.00	1120	10.0	12	339.5	5.16	3.89	0.14	2.97	42.48

Field 19

42%

INTAKE	DESIGN	FURROW	FURROW	FURROW	INFLOW	APPROXIMATE	ADVANCE	GROSS	NET		DEEP	IRRIGATION
FAMILY	APPLIC.	SLOPE	SPACING	LENGTH	RATE	INFLOW TIME	TIME	IRRIGATION	IRRIGATION	RUNOFF	PERC.	EFFICIENCY
	Inches	Ft/Ft	Feet	Feet	Gpm	Hours	Minutes	Inches	Inches	Inches	In.	%
0.55	2.30	.005	2.00	160	4.0	12	12.7	14.44	4.70	9.70	2.44	15.93
0.55	2.30	.005	2.00	160	4.0	8	12.7	9.62	3.49	6.10	1.23	23.90
0.55	2.30	.005	2.00	160	3.5	12	14.1	12.63	4.58	8.01	2.32	18.21
0.55	2.30	.005	2.00	160	3.5	8	14.1	8.42	3.40	4.98	1.14	27.31
0.55	2.30	.005	2.00	160	3.0	12	16.3	10.83	4.45	6.33	2.20	21.24
0.55	2.30	.005	2.00	160	3.0	8	16.3	7.22	3.30	3.87	1.05	31.86

Field 20 Mountain 21%

Howerton, Ron

From: King, Scott
Sent: Wednesday, May 28, 2003 9:59 AM
To: Baxter, Garrick; Howerton, Ron
Subject: Colwell

Garrick & Ron,

Harley Noe and I met yesterday to discuss his revised results. Changes to prior work include:

1) Adjusting conveyance loss infiltration coefficient based on our field visit. The ditches on this property were much like I had envisioned. The lower, smaller ones were trampled by cattle and had a thick layer of fine materials lining the bed, which will tend to inhibit ditch losses. In fact, one long stretch of ditch had several inches of standing water with little to no apparent supply to keep water in the ditch; this one was leaking very little. The upper, larger ditches were deeper and extended into the deeper gravel and sand layer as Harley described. Some of these had a thinner layer of fines. We agreed in the field that ditch loss factors of 1.5 and 2.5 may be applicable for the lower and upper ditches respectively. Using these values, Harley estimates a total loss of 11.22 cfs, just a little less than the 12.17 cfs value previously estimated, and still much higher than the 5.61 predicted earlier by Tuthill.

During our office meeting, Harley and Terry seemed to describe a ditch that would be very difficult to measure, thereby making any measurements of ditch loss difficult or impossible. However, based on our field visit, I think that we could measure flow in the ditch in a number of places, making it possible to refine our loss estimates by using actual measured losses for representative sections. Jeff Peppersack and I discussed this case, and Jeff suggests that since measurements appear possible, and since there is such a large discrepancy in values, and also for other reasons, we should measure the losses in this ditch. I suggest that we offer a choice of using either the losses calculated by Tuthill, or we measure losses and use the actual measured values. There is a possibility that the measured losses will be less than Tuthill's earlier estimates.

2) Although this was not part of our earlier discussion in the office, Harley suggested that he make changes to the field irrigation requirements. Specifically, he would like to change the 'intake family' value for 6 fields which Mr. Colwell describes as more difficult to get water across, and which can be described by the Notus soil type. Harley's refined numbers were based on using the FURROW program with intake family of 0.7 (prior value was 0.55), MAD of 1.4 (prior value of 2.3), existing run lengths for most fields, 24-hour set times, and using 'furrow' application methods. Harley should change these runs by using 'corrugate' application where he will find that run lengths greater than about 950 feet will not run with this higher intake family number, and long runs should be shortened until the program will run. In addition, 12-hour sets will generally produce more efficient results than 24-hour. A table below is extracted from my earlier memo with a new row indicating the likely results of these revisions (these are not Harley's final numbers). However, even with shorter runs at 12-hour sets using 'corrugate' application methods, efficiency for these fields is still quite low (Harley gets around 16%, I get about 21%) and this adjustment makes a significant difference to the Field Irrigation Requirement.

I agree that, based on soil descriptions, the Notus soils could be described as being in a higher intake family, and that this higher value may be applicable to some of the fields being reviewed.

	65-3617		65-8627		
	Total Irrigation Requirement (cfs)		Rate (cfs/acre)		Total
	Irrigation Requirement (cfs)		Rate (cfs/acre)		
Directors Report	8.22	0.02	2.10	0.02	
Noe, 2002	28.17	0.069	5.19	0.049	
King, 2003	15.61	0.038	3.22	0.031	
Revised	20.45	0.050	4.56	0.043	

I am to contact Harley soon and let him know if I agree with his revised numbers so that he can finalize his report.

Thank you,
Scott

MEMORANDUM

To: Garrick Baxter
From: Scott King 
Date: March 26, 2003

Subject: Review of Noe's diversion rate analysis for 65-03617 & 65-08627

I have reviewed the irrigation requirement analysis prepared for the above listed water rights (Noe, 2002). The report documents a Hubble analysis for 516 acres of river-bottom land along the Payette River north of New Plymouth. It finds irrigation requirements of 0.069 and 0.049 cfs per acre for 65-03617 & 65-08627, respectively. In addition, conveyance loss is determined to be 12.17 cfs for the Johnson-Higby ditch based on a Worstell-type assessment.

In general, I agree with the methodology applied in this analysis, but I disagree with parameters used in both the irrigation requirements and conveyance loss calculations. Determination of irrigation diversion rates that exceed the state standard are based on reasonable optimum Field Application Efficiency (FAE) values, and not the actual efficiency based on current management practices. The determination of reasonable efficiency focuses on proper management and low-cost improvements that can be made within the confines of the existing system types and soil characteristics (Dreher and Tuthill, 1999; IDWR, 1992).

Field Irrigation Requirements

Noe performed the irrigation requirement analysis using an inflow time of 24 hours, as this is the actual practice. A 12-hour set time results in higher FAE, can provide the required quantity of water, and is a reasonable management alternative. My analysis indicates that efficiencies in many fields could be further improved with shorter inflow times, such as 8 hours. However, IDWR does not consider inflow times shorter than 12 hours to be practical on a continuous basis.

For 65-03617, Noe finds a total field requirement of 28.17 cfs based on 24-hour inflow times. Using 12-hour sets, I find a total field requirement of 15.61 cfs. All other parameters are identical to Noe's except for 850 foot furrow lengths for field 11 instead of 1680 foot long furrows as the FURROW program indicates incomplete irrigation at the longer length. The 1680-foot furrow is the longest on this farm, and a shorter furrow length is a reasonable management alternative and appears consistent with other fields on this farm, and also with nearby irrigated fields.

For 65-08627, Noe finds a total field requirement of 5.19 cfs, again based on 24-hour inflow times. Application of 12-hour sets yields a total field requirement of 3.22 cfs. Table 1

provides a comparative perspective between these results.

The analysis demonstrates the higher irrigation requirements for the lands served by these water rights. However, application of the analysis must be based on finding a reasonable optimum efficiency, and therefore results based on 12-hour set times are recommended.

Table 1. Field irrigation requirement comparison for 65-3617 & 65-8627.

	65-3617		65-8627	
	Total Irrigation Requirement (cfs)	Rate (cfs/acre)	Total Irrigation Requirement (cfs)	Rate (cfs/acre)
Directors Report	8.22	0.02	2.10	0.02
Noe, 2002	28.17	0.069	5.19	0.049
King, 2003	15.61	0.038	3.22	0.031

Conveyance Losses

Claim files indicate conveyance losses were determined in 1978 by David Tuthill using Macallister's modification of the Moritz formula. Tuthill determined that of 18.82 cfs diverted, 14.56 cfs is delivered and 4.26 is loss, resulting in a 29.3 percentage loss. This loss rate was later applied to 65-7461 so that the total diversion, delivery and loss is presented in Table 2. This loss is applied by the following equation:

$$Loss = 0.293 * Q_{Field\ Headgate}$$

Table 2. Rights delivered in Johnson-Higby Ditch

Right	Owner	Priority	Acres	Application Rate (cfs/acre)	Field Headgate (cfs)	Loss (cfs)	Total (cfs)
65-3617	Colwell	1890	411	0.02	8.22	2.41	10.63
65-8627	Colwell	1882	105	0.02	2.10	0.62	2.72
65-11261	Colwell	1882	10	0.013	0.13	0	0.13
65-7461*	Colwell	1975	159	0.03	4.77	1.40	6.17
65-5921	Johnson	1882	195	0.02	3.90	1.14	5.04
65-11255	Pence	1882	7	0.02	0.14	0.04	0.18
Totals:			887		19.26	5.61	24.87

*65-7461 overlaps with 65-3617 & 65-11261 by about 25 acres total, and thus total acres and discharge rates should be reduced appropriately, but are not in this table.

Noe performed a Worstell-type analysis of conveyance losses for the Johnson-Higby ditch. He finds a total conveyance loss of 12.17 cfs, more than double the total in Table 2. Tuthill and Noe used different formulae to compute loss, which is part of the reason for the discrepancy. Noe also determined losses for conveyance in ditches beyond the point where the field headgate would typically be defined. In addition, different seepage rate constants (i) were used. Noe used a seepage rate constant of 2.5 (feet/day) as representative of sand and gravel type soils. Tuthill used a value of 1.5 (feet/day) based on a sandy loam soil type.

Detailed NRCS descriptions for three soil types are provided in Noe's report, and a summary is provided in Table 3. It appears these three are fairly representative of the other sandy loam soils found along the ditch length. The upper profiles are composed of sandy loams, while the lower profiles are sands and gravels. The sands and gravels will have higher permeability rates than sandy loams. However, there are several properties that combine to decrease the likely seepage rate. First, finer sediments from the upper profiles and in the diverted river water will likely settle along the ditch bottom, sealing the ditch over time and reducing infiltration rates. Based on the ditch dimensions provided by Noe in Table D, and also the low slope of the ditch, flow velocities in the ditch are likely low and thus the settling of sealing fines is supported. In addition, soil descriptions suggest a seasonal water table at depth from 1 to 4 feet. The high water table along the river bottom reduces the amount of loss from the ditch, and as suggested by Dan Nelson in his field exam for 65-7461, these ditches may actually gain water along their length.

Table 3. Primary soil types provided in Noe's report.

properties	Chance fine sandy loam (Ch)	Soils	
		Moulton fine sandy loam (Mo)	Notus coarse sandy loam (No)
upper profile	fine sandy loam	fine sandy loam	coarse sandy loam
lower profile	sand, gravel and sand	sand and gravel	very gravelly sand
drainage	poorly drained	poorly drained	somewhat poorly drained
permeability	moderately rapid	moderately rapid	moderately rapid
seasonal water table	fluctuates between 1	fluctuates between 2	fluctuates between 2
depth:	to 2 feet	to 4 feet	and 3 feet, depending upon the level of water in the adjacent river

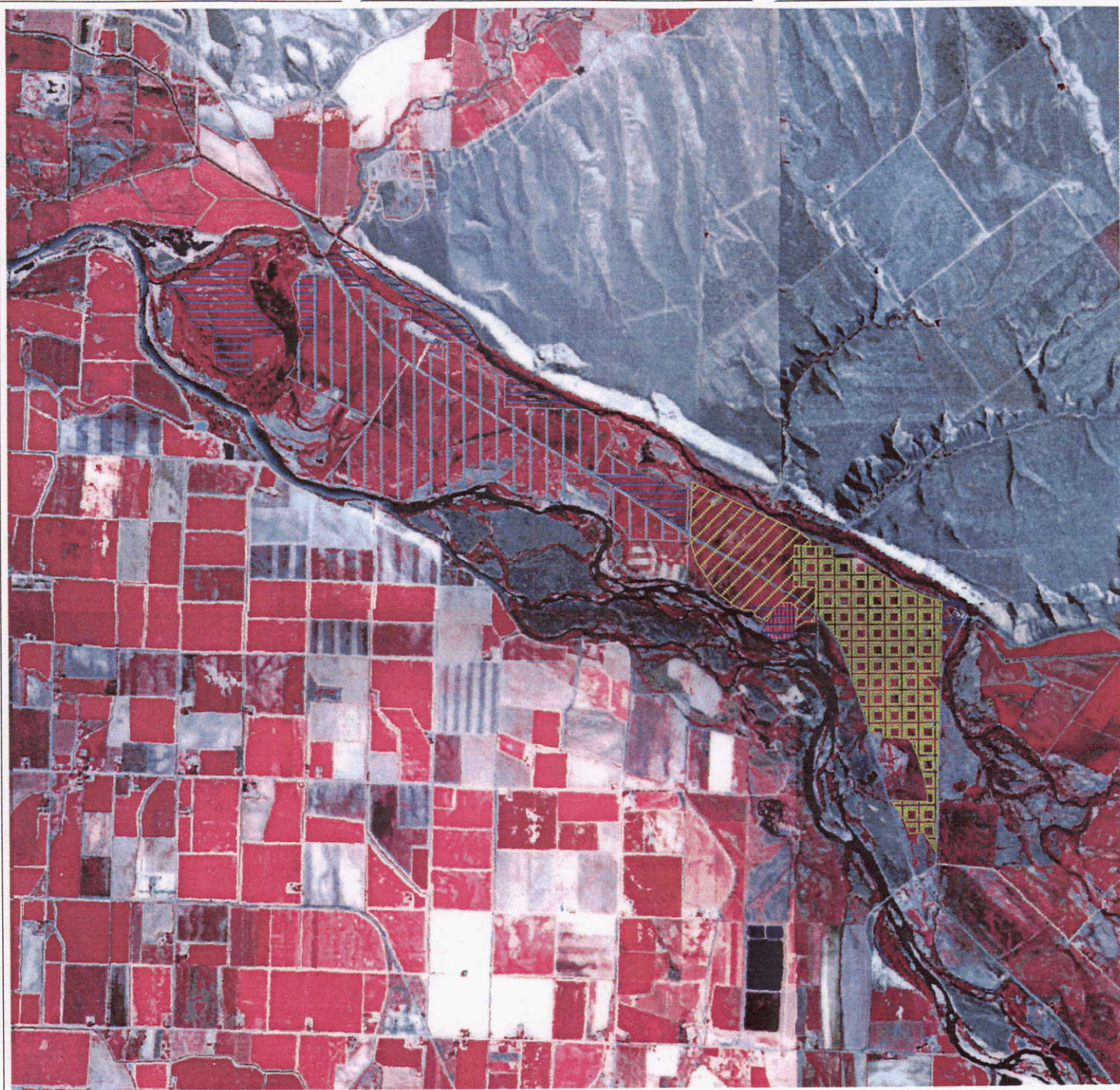
Given the combination of these factors, I suggesting maintaining the seepage rate coefficient of 1.5 feet per day as used by Tuthill rather than the higher 2.5 feet per day value used by Noe as the lower value is likely most representative of field conditions. Application of the 1.5 feet/day seepage value to Noe's Worstell computations results in a total loss of 7.28 cfs, which is in close range to the total of 5.61 cfs determined using the Moritz formula. Also, if some of the more distant ditch segments beyond the field headgate are removed from the loss analysis, the total loss approaches 5.61 cfs.

Conclusions and Recommendations

Noe's field irrigation requirement analysis appears to be a consistent application of the Hubble methodology except for utilizing 24-hour inflow times instead of more efficient 12-hour sets. If adjustments to the recommended diversion rates based on Hubble analysis for these rights are contemplated, the irrigation requirements should be based on more efficient 12-hour sets.

The Worstell-type analysis performed by Noe provides results similar to those obtained by Tuthill's use of the Mortitz formula when similar seepage loss rate coefficients are applied. The seepage value of 2.5 feet per day in Noe is too high and does not appear representative of likely actual conditions; instead a seepage value of 1.5 feet per day as applied by Tuthill is recommended. A conveyance loss of 29.3% of the field headgate requirement should be applied to these rights because it is consistent with the loss previously determined and applied to other rights from the same diversion, and because it is consistent with Worstell loss analysis when the seepage coefficient is set at 1.5 feet per day.

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- Dreher, K.J., and Tuthill, D.R., Jr., 1999, Report Regarding Evaluation of Irrigation Diversion Rates: Idaho Department of Water Resources.
- IDWR, 1992, Irrigation Diversion Requirmenets - New Computations in the Payette River Area: Idaho Department of Water Resources.
- Noe, H.R., 2002, Irrigation Requirement Analysis, George Colwell property (Birding Island Ranch), Water Rights 65-03617 & 65-08627: Associated Earth Sciences.



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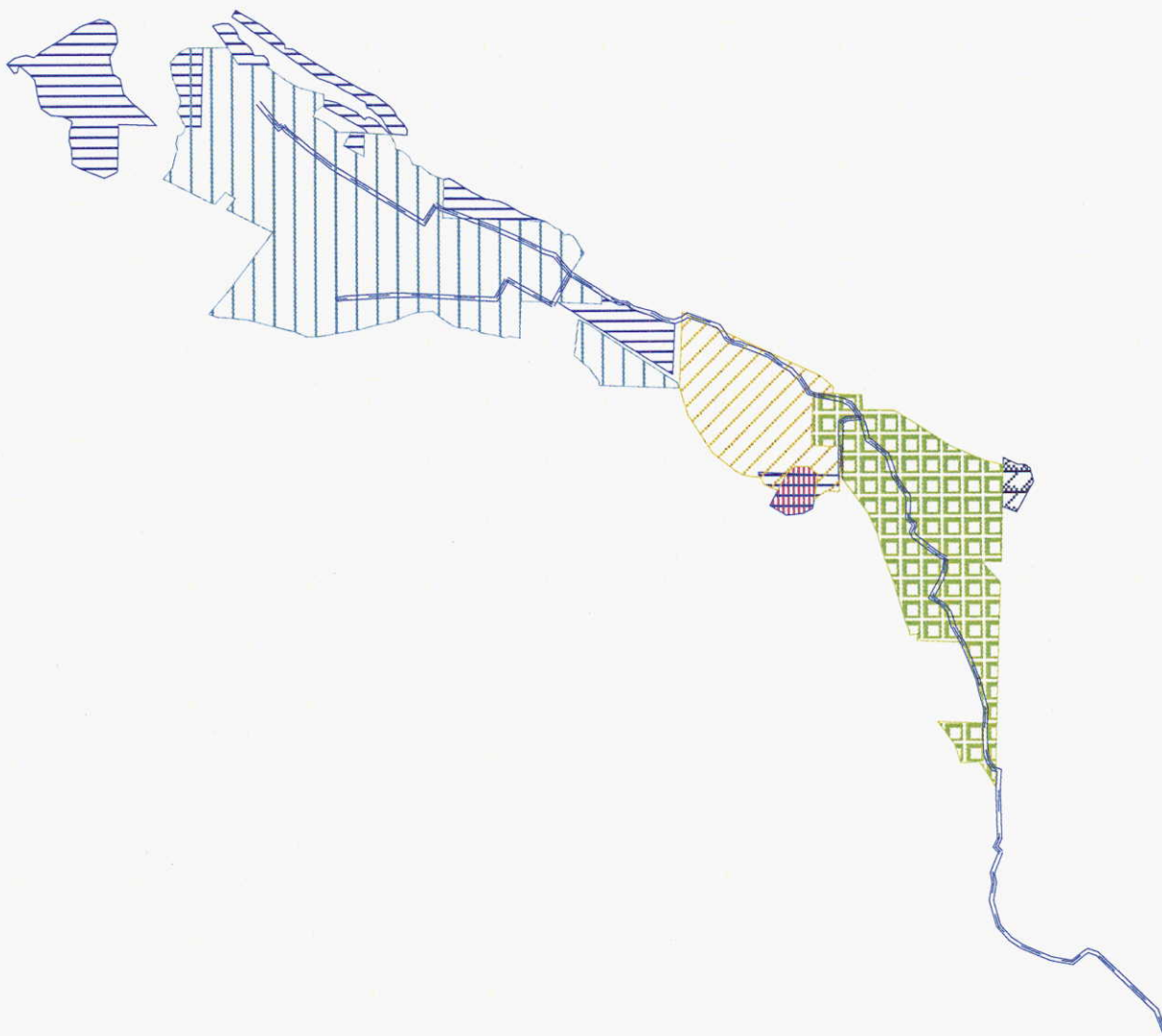
Rights

	65-3617
	65-8627
	65-11261
	65-7461
	65-11255 Pence
	65-5921 Johnson

0.5 0 0.5 1 1.5 Miles

Rights Delivered in Johnson-Higby Ditch
 Prepared for Colwell Hubble Analysis
 1987 NAPP aerial photography
 Prepared by: Scott King
 Date prepared: 3/26/2003





Rights

Rights

	65-3617
	65-8627
	65-11261
	65-7461
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Rights Delivered in Johnson-Higby Ditch
Prepared for Colwell Hubble Analysis
1987 NAPP aerial photography
Prepared by: Scott King
Date prepared: 3/26/2003



65-3617

Field

	INTAKE FAMILY	DESIGN APPLIC. Inches	FURROW SLOPE Ft/Ft	FURROW SPACING Feet	FURROW LENGTH Feet	INFLOW RATE Gpm	APPROXIMATE INFLOW TIME Hours	ADVANCE TIME Minutes	GROSS IRRIGATION	NET IRRIGATION	RUNOFF Inches	DEEP PERC. In.	IRRIGATION EFFICIENCY %
									APPLICATION	APPLICATION			
									Inches	Inches			
2	0.55	1.40	.005	2.00	560	4.5	12	213.9	4.64	3.77	0.06	3.19	30.17
3	0.55	1.40	.005	2.00	1100	10.0	12	321.3	5.25	3.75	0.05	3.80	26.67
6	0.55	1.40	.005	2.00	1040	9.5	12	300.8	5.28	3.84	0.10	3.78	26.54
7	0.55	1.40	.005	2.00	720	6.0	12	253.2	4.81	3.77	0.03	3.39	29.09
9	0.55	2.30	.005	2.00	800	7.0	12	253.0	5.05	3.89	0.12	2.63	45.52
10	0.55	1.40	.005	2.00	1200	11.0	12	344.6	5.29	3.67	0.02	3.87	26.45
10*	0.55	1.40	.005	2.00	600	5.0	12	211.0	4.81	3.87	0.14	3.28	29.09
11	0.55	2.30	.005	2.00	850	7.5	12	264.1	5.10	3.88	0.11	2.68	45.14
12	0.55	2.30	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	2.24	47.79
13	0.55	2.30	.005	2.00	1040	9.5	12	300.8	5.28	3.84	0.10	2.88	43.60
14	0.55	1.40	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	3.14	29.09
15	0.55	1.40	.005	2.00	320	3.0	12	87.8	5.41	4.12	1.00	3.01	25.86
16	0.55	2.30	.005	2.00	480	4.0	12	168.8	4.81	3.93	0.27	2.24	47.79
17	0.55	2.30	.005	2.00	640	5.5	12	210.4	4.96	3.94	0.20	2.46	46.35

10* optional shorter furrow length improves efficiency a little.
 11 furrow length shortened from 1680 to 850 ft; longer furrow failed.

65- 3617

	<u>Page A</u>	<u>Page B</u>	<u>Total</u>
Total On-Farm Irrigation Requirement (cfs) =	14.27	1.35	15.61
Acres =	371.5	39.4	410.90
			0.038

