Exhibit 80
Book 11 2-16-12
Patterson Reporting & Video

Appendix D-2

Pumping Test Data in the Republican River area, Kansas

	A	B	C	D	E	I	J	K	L	M	N
4		Well Number	Location						Geologic	Transmissivity	Type of
5	County	Report	Township	Range	Section	1/4 Section	1/4, 1/4 Section	1/4, 1/4, 1/4 Section	Source	(gpd/ft)	Test
6	Republic	1-3W-3bc	1	3W	3	NW	SW		Qd	320,000	SC
7		1-3W-5aa	1	3W	5	NE	NE		Qd	190,000	SC
8		1-4W-17ab	1	4W	17	NE	NW		Qd	288,000	SC
9		1-5W-15ab	1	5W	15	NE	NW		Qd	50,000	SC
10		2-4W-31bc	2	4W	31	NW	SW		Qd	60,000	SC
11		3-4W-8ccb	3	4W	8	SW	SW	NW	Qa	100,000	OW
12		3-4W-17bd	3	4W	17	NW	SE		Qa	72,000	SC
13		3-4W-17db	3	4W	17	SE	NW		Qa	45,000	SC
14		3-4W-20aa	3	4W	20	NE	NE		Qa	60,000	SC
15		3-4W-32da	3	4W	32	SE	NE		Qa	110,000	SC
16		4-4W-4bc	4	4W	4	NW	SW		Qa	50,000	SC
17		4-4W-4db	4	4W	4	SE	NW		Qw	175,000	SDD
18		4-4W-4dc	4	4W	4	SE	SW		Qw	130,000	OW
19		4-4W-8ad	4	4W	4	NE	SE		Qa	75,000	SC
20		4-4W-8bd	4	4W	4	NW	SE		Qa	65,000	SC
21		4-4W-8dd	4	4W	4	SE	SE		Qa	75,000	SC
22		4-4W-9ab	4	4W	9	NE	NW		Qw	125,000	SC
23		4-4W-9ca	4	4W	9	SW	NE		Qa	150,000	SC
24		4-4W-15cd	4	4W	15	SW	SE		Qi	10,000	SC
25		4-4W-17da	4	4W	17	SE	NE		Qa	200,000	SC
26		4-4W-17dd	4	4W	17	SE	SE		Qa	90,000	SC
27		4-4W-21caa	4	4W	21	SW	NE	NE	Qw	170,000	SDD
28		4-4W-21cab	4	4W	21	SW	NE	NW	Qw	120,000	SDD
29		4-4W-22ca	4	4W	22	SW	NE		Qi	60,000	SC
30		4-4W-22cc	4	4W	22	SW	SW		Qi	95,000	SC
31		4-4W-27ddc	4	4W	27	SE	SE	SW	Qw	70,000	SDD
32		4-4W-29db	4	4W	29	SE	NW		Qa	80,000	SC
33		4-4W-33aa	4	4W	33	NE	NE		Qw	140,000	SC
34		4-4W-34baa	4	4W	34	NW	NE	NE	Qw	120,000	SC

Source: Fader (1968)

Summary of Transmissivity

		T (gpd/ft)
Alluvium Median:	K.A.R. 5-3-11	100,000
Upland Loess Deposits Range of T:	Qi	10,000
	Qi	60,000
	Average	35,000

***Values in yellow applied in SWE analysis**

	A	B	C	D	E
1	source:	Glover_Distance_KBID.dbf			
2	Id	SWE_Name	Type	Legth_ft	Descript
3	0	Spring 1	X	6,246	On-Farm Loss
4	0	Spring 1	W	10,901	On-Farm Loss
5	0	Spring 2	X	986	On-Farm Loss
6	0	Spring 2	W	2,764	On-Farm Loss
7	0	White Rock	X	7,777	On-Farm Loss
8	0	White Rock	W	16,543	On-Farm Loss
9	0	Alluvium 2	X	2,582	On-Farm Loss
10	0	Alluvium 2	W	2,944	On-Farm Loss
11	0	Alluvium 1	X	2,539	On-Farm Loss
12	0	Alluvium 1	W	4,319	On-Farm Loss
13	0	Alluvium 3	X	3,918	On-Farm Loss
14	0	Alluvium 3	W	7,622	On-Farm Loss
15	0	Alluvium 4	X	5,366	On-Farm Loss
16	0	Alluvium 4	W	7,709	On-Farm Loss
17	0	Alluvium 5	X	1,806	On-Farm Loss
18	0	Alluvium 5	W	9,245	On-Farm Loss
19	0	Alluvium 6	X	3,037	On-Farm Loss
20	0	Alluvium 6	W	5,561	On-Farm Loss
21	0	Alluvium 7	X	1,182	On-Farm Loss
22	0	Alluvium 7	W	2,104	On-Farm Loss
23	0	Alluvium 8	X	6,235	On-Farm Loss
24	0	Alluvium 8	W	10,309	On-Farm Loss
25	0	Alluvium 9	X	2,758	On-Farm Loss
26	0	Alluvium 9	W	3,821	On-Farm Loss
27	0	Alluvium 10	X	2,844	On-Farm Loss
28	0	Alluvium 10	W	3,287	On-Farm Loss
29	0	Alluvium 11	X	4,773	On-Farm Loss
30	0	Alluvium 11	W	5,309	On-Farm Loss
31	0	Alluvium 12	X	2,588	On-Farm Loss
32	0	Alluvium 12	W	3,070	On-Farm Loss
33	0	Alluvium 13	X	1,709	On-Farm Loss
34	0	Alluvium 13	W	2,862	On-Farm Loss
35	0	Buffalo	X	4,572	On-Farm Loss
36	0	Buffalo	W	8,684	On-Farm Loss
37	0	Beaver 1	X	4,828	On-Farm Loss
38	0	Beaver 1	W	9,834	On-Farm Loss
39	0	Beaver 2	X	4,812	On-Farm Loss
40	0	Beaver 2	W	9,118	On-Farm Loss
41	0	Beaver 3	X	1,894	On-Farm Loss
42	0	Beaver 3	W	12,626	On-Farm Loss
43	0	Mud 1	X	1,901	On-Farm Loss
44	0	Mud 1	W	3,409	On-Farm Loss
45	0	Mud 2	X	2,141	On-Farm Loss
46	0	Mud 2	W	4,710	On-Farm Loss
47	0	School	X	8,926	On-Farm Loss
48	0	School	W	10,780	On-Farm Loss
49	0	Dry 1	X	2,794	On-Farm Loss
50	0	Dry 1	W	4,621	On-Farm Loss
51	0	Dry 2	X	614	On-Farm Loss

	A	B	C	D	E
52	0	Dry 2	W	1,795	On-Farm Loss
53	0	upper section	X	9,911	Canal Loss
54	0	upper section	X	8,421	Canal Loss
55	0	upper section	X	3,482	Canal Loss
56	0	upper section	X	1,699	Canal Loss
57	0	Oak / Republican	X	1,957	Canal Loss
58	0	Oak / Republican	X	2,917	Canal Loss
59	0	Oak / Republican	X	4,380	Canal Loss
60	0	Oak / Republican	X	4,071	Canal Loss
61	0	Oak / Republican	X	6,103	Canal Loss
62	0	Oak / Republican	X	6,563	Canal Loss
63	0	Oak / Republican	X	10,407	Canal Loss
64	0	Spring	X	3,128	Canal Loss
65	0	Spring	X	1,176	Canal Loss
66	0	Spring	X	317	Canal Loss
67	0	Spring	X	7,354	Canal Loss
68	0	White Rock North	X	6,111	Canal Loss
69	0	White Rock North	X	10,148	Canal Loss
70	0	White Rock North	X	12,957	Canal Loss
71	0	White Rock North	X	14,429	Canal Loss
72	0	White Rock North	X	16,702	Canal Loss
73	0	White Rock South	X	680	Canal Loss
74	0	White Rock South	X	5,124	Canal Loss
75	0	White Rock South	X	3,345	Canal Loss
76	0	White Rock South	X	2,257	Canal Loss
77	0	White Rock South	X	3,191	Canal Loss
78	0	Marsh	X	3,680	Canal Loss
79	0	Marsh	X	3,617	Canal Loss
80	0	Marsh	X	10,508	Canal Loss
81	0	Marsh	X	13,713	Canal Loss
82	0	Marsh	X	11,355	Canal Loss
83	0	Buffalo / Beaver divide	X	16,605	Canal Loss
84	0	Buffalo / Beaver divide	X	14,315	Canal Loss
85	0	Buffalo / Beaver divide	X	13,049	Canal Loss
86	0	Buffalo / Beaver divide	X	8,440	Canal Loss
87	0	Buffalo / Beaver divide	X	11,006	Canal Loss
88	0	Buffalo / Beaver divide	X	6,455	Canal Loss
89	0	Buffalo / Beaver divide	X	9,110	Canal Loss
90	0	Buffalo / Beaver divide	X	3,053	Canal Loss
91	0	Buffalo / Beaver divide	X	10,104	Canal Loss
92	0	Buffalo / Beaver divide	X	5,091	Canal Loss
93	0	Buffalo / Beaver divide	X	9,653	Canal Loss
94	0	Buffalo / Beaver divide	X	8,514	Canal Loss
95	0	Buffalo / Beaver divide	X	8,782	Canal Loss
96	0	Buffalo / Beaver divide	X	10,707	Canal Loss
97	0	Buffalo / Beaver divide	X	11,281	Canal Loss
98	0	Buffalo / Beaver divide	X	13,111	Canal Loss
99	0	Buffalo / Beaver divide	X	14,431	Canal Loss
100	0	Mud / Beaver divide	X	19,081	Canal Loss
101	0	Mud / Beaver divide	X	10,289	Canal Loss
102	0	Mud / Beaver divide	X	7,885	Canal Loss

	A	B	C	D	E
103	0	Mud / Beaver divide	X	3,587	Canal Loss
104	0	Mud / Beaver divide	X	3,518	Canal Loss
105	0	Mud / Beaver divide	X	4,853	Canal Loss
106	0	Mud / Beaver divide	X	12,862	Canal Loss
107	0	Mud / Beaver divide	X	12,410	Canal Loss
108	0	Mud / Beaver divide	X	9,847	Canal Loss
109	0	Mud / Beaver divide	X	7,873	Canal Loss
110	0	Mud / Beaver divide	X	9,122	Canal Loss
111	0	Mud / Beaver divide	X	11,338	Canal Loss
112	0	Mud / Beaver divide	X	11,710	Canal Loss
113	0	Mud / Beaver divide	X	12,521	Canal Loss
114	0	Mud / Beaver divide	X	5,361	Canal Loss
115	0	Mud / Beaver divide	X	4,284	Canal Loss
116	0	Mud / Beaver divide	X	6,238	Canal Loss
117	0	Mud / Beaver divide	X	9,397	Canal Loss
118	0	Mud / Beaver divide	X	6,969	Canal Loss
119	0	lower section	X	1,194	Canal Loss

	A	B	C	D	E	F
1	**source: Courtland_Canal_glover_sections.dbf**					
2	Id	Location	Name	Location_2	WaterShed	Length
3	0	Kansas	Courtland Canal	Above	White Rock North	27,618
4	0	Kansas	Courtland Canal	Below	Mud / Beaver divide	70,347
5	0	Kansas	Courtland Canal West	Below	Buffalo / Beaver divide	59,302
6	0	Kansas	Courtland Canal	Above	upper section	16,588
7	0	Kansas	Courtland Canal	Above	Oak / Republican	31,742
8	0	Kansas	Courtland Canal	Above	Spring	18,964
9	0	Kansas	Courtland Canal	Above	White Rock South	21,186
10	0	Kansas	Courtland Canal	Below	Marsh	22,281
11	0	Kansas	Courtland Canal	Below	lower section	3,243

Appendix D
Table D-2
Glover Parameter Calculatio

SWE Name	Type	Length (ft)	Glover Location	Acres	Weight (%)
On-Farm Loss					
Above KBID					
Alluvium 4	X	5,366	Above KBID	655	3.1%
Alluvium 1	X	2,539	Above KBID	918	4.3%
Alluvium 3	X	3,918	Above KBID	1,262	5.9%
Spring 2	X	986	Above KBID	2,004	9.4%
Spring 1	X	6,246	Above KBID	3,730	17.6%
White Rock	X	7,777	Above KBID	12,679	59.7%
Total				21,248	
Weighted X		**6,338**			
Alluvium 4	W	7,709	Above KBID	655	3.1%
Alluvium 1	W	4,319	Above KBID	918	4.3%
Alluvium 3	W	7,622	Above KBID	1,262	5.9%
Spring 2	W	2,764	Above KBID	2,004	9.4%
Spring 1	W	10,901	Above KBID	3,730	17.6%
White Rock	W	16,543	Above KBID	12,679	59.7%
Total				21,248	
Weighted W		**12,923**			
Below KBID					
Alluvium 10	X	2,844	Below KBID	29	0.1%
Alluvium 2	X	2,582	Below KBID	32	0.1%
Alluvium 13	X	1,709	Below KBID	32	0.1%
Alluvium 9	X	2,758	Below KBID	132	0.3%
Alluvium 11	X	4,773	Below KBID	171	0.5%
Alluvium 12	X	2,588	Below KBID	190	0.5%
Alluvium 5	X	1,806	Below KBID	217	0.6%
Beaver 3	X	1,894	Below KBID	235	0.6%
Alluvium 7	X	1,182	Below KBID	244	0.6%
Alluvium 8	X	6,235	Below KBID	1,407	3.7%
Dry 1	X	2,794	Below KBID	1,556	4.1%
School	X	8,926	Below KBID	1,636	4.3%
Dry 2	X	614	Below KBID	1,650	4.4%
Alluvium 6	X	3,037	Below KBID	1,865	4.9%
Mud 1	X	1,901	Below KBID	2,017	5.3%
Buffalo	X	4,572	Below KBID	3,707	9.8%
Mud 2	X	2,141	Below KBID	4,338	11.5%
Beaver 2	X	4,812	Below KBID	7,954	21.0%
Beaver 1	X	4,828	Below KBID	10,394	27.5%
Total				37,807	
Weighted X		**4,125**			

Appendix D
Table D-2
Glover Parameter Calculati

Alluvium 10	W	3,287	Below KBID	29	0.1%
Alluvium 2	W	2,944	Below KBID	32	0.1%
Alluvium 13	W	2,862	Below KBID	32	0.1%
Alluvium 9	W	3,821	Below KBID	132	0.3%
Alluvium 11	W	5,309	Below KBID	171	0.5%
Alluvium 12	W	3,070	Below KBID	190	0.5%
Alluvium 5	W	9,245	Below KBID	217	0.6%
Beaver 3	W	12,626	Below KBID	235	0.6%
Alluvium 7	W	2,104	Below KBID	244	0.6%
Alluvium 8	W	10,309	Below KBID	1,407	3.7%
Dry 1	W	4,621	Below KBID	1,556	4.1%
School	W	10,780	Below KBID	1,636	4.3%
Dry 2	W	1,795	Below KBID	1,650	4.4%
Alluvium 6	W	5,561	Below KBID	1,865	4.9%
Mud 1	W	3,409	Below KBID	2,017	5.3%
Buffalo	W	8,684	Below KBID	3,707	9.8%
Mud 2	W	4,710	Below KBID	4,338	11.5%
Beaver 2	W	9,118	Below KBID	7,954	21.0%
Beaver 1	W	9,834	Below KBID	10,394	27.5%
Total				37,807	
Weighted W		**7,794**			

Canal Loss

SWE Name	Type	Length to Stream(ft)	Glover Location	Length of Canal Section (ft)	Weight (%)
		Above KBID			
upper section	X	9,911	Above		
upper section	X	8,421	Above		
upper section	X	3,482	Above		
upper section	X	1,699	Above		
Avg Distance		**5,878**		16,588	14.3%
Oak / Republican	X	1,957	Above		
Oak / Republican	X	2,917	Above		
Oak / Republican	X	4,380	Above		
Oak / Republican	X	4,071	Above		
Oak / Republican	X	6,103	Above		
Oak / Republican	X	6,563	Above		
Oak / Republican	X	10,407	Above		
Avg Distance		**5,200**		31,742	27.3%
Spring	X	3,128	Above		
Spring	X	1,176	Above		
Spring	X	317	Above		
Spring	X	7,354	Above		

Appendix D
Table D-2
Glover Parameter Calculatio

	A	B	C	D	E	F	G	H
2								
3								
4								
95		**Avg Distance**		**2,994**		18,964	16.3%	
96		White Rock North	X	6,111	Above			
97		White Rock North	X	10,148	Above			
98		White Rock North	X	12,957	Above			
99		White Rock North	X	14,429	Above			
100		White Rock North	X	16,702	Above			
101		**Avg Distance**		**12,069**		27,618	23.8%	
102		White Rock South	X	680	Above			
103		White Rock South	X	5,124	Above			
104		White Rock South	X	3,345	Above			
105		White Rock South	X	2,257	Above			
106		White Rock South	X	3,191	Above			
107		**Avg Distance**		**2,919**		21,186	18.2%	
108								
109		**Weighted X**		**6,154**				
110								
111				**Below KBID**				
112		Marsh	X	3,680	Below			
113		Marsh	X	3,617	Below			
114		Marsh	X	10,508	Below			
115		Marsh	X	13,713	Below			
116		Marsh	X	11,355	Below			
117		**Avg Distance**		**8,575**		22,281	14.4%	
118		Buffalo / Beaver divide	X	16,605	Below			
119		Buffalo / Beaver divide	X	14,315	Below			
120		Buffalo / Beaver divide	X	13,049	Below			
121		Buffalo / Beaver divide	X	8,440	Below			
122		Buffalo / Beaver divide	X	11,006	Below			
123		Buffalo / Beaver divide	X	6,455	Below			
124		Buffalo / Beaver divide	X	9,110	Below			
125		Buffalo / Beaver divide	X	3,053	Below			
126		Buffalo / Beaver divide	X	10,104	Below			
127		Buffalo / Beaver divide	X	5,091	Below			
128		Buffalo / Beaver divide	X	9,653	Below			
129		Buffalo / Beaver divide	X	8,514	Below			
130		Buffalo / Beaver divide	X	8,782	Below			
131		Buffalo / Beaver divide	X	10,707	Below			
132		Buffalo / Beaver divide	X	11,281	Below			
133		Buffalo / Beaver divide	X	13,111	Below			
134		Buffalo / Beaver divide	X	14,431	Below			
135		**Avg Distance**		**10,218**		59,302	38.2%	
136		Mud / Beaver divide	X	19,081	Below			
137		Mud / Beaver divide	X	10,289	Below			
138		Mud / Beaver divide	X	7,885	Below			
139		Mud / Beaver divide	X	3,587	Below			
140		Mud / Beaver divide	X	3,518	Below			
141		Mud / Beaver divide	X	4,853	Below			

	A	B	C	D	E	F	G	H
2						**Appendix D**		
3						**Table D-2**		
4						**Glover Parameter Calculati**		
142		Mud / Beaver divide	X	12,862	Below			
143		Mud / Beaver divide	X	12,410	Below			
144		Mud / Beaver divide	X	9,847	Below			
145		Mud / Beaver divide	X	7,873	Below			
146		Mud / Beaver divide	X	9,122	Below			
147		Mud / Beaver divide	X	11,338	Below			
148		Mud / Beaver divide	X	11,710	Below			
149		Mud / Beaver divide	X	12,521	Below			
150		Mud / Beaver divide	X	5,361	Below			
151		Mud / Beaver divide	X	4,284	Below			
152		Mud / Beaver divide	X	6,238	Below			
153		Mud / Beaver divide	X	9,397	Below			
154		Mud / Beaver divide	X	6,969	Below			
155		**Avg Distance**		**8,902**		70,347	45.3%	
156		lower section	X	1,194	Below			
157		**Avg Distance**		**1,194**		3,243	2.1%	
158								
159		**Weighted X**		**9,197**				
160								

	I	J	K	L	M	N	O
1					conversion		
2					1	acre	
3					43,560	(ft^2)	
4	ons						
5							
6							
7		**Transmissivity Weight %**					
8							
9		Above KBID					
10				Weight (%)			1991
11		Total Alluvium Acres	2,835	13%			1992
12		Total Loess Acres	18,413	87%			1993
13		Total Acres	21,248	36%			1994
14							1995
15							1996
16		Below KBID					1997
17				Weight (%)			1998
18		Total Alluvium Acres	4,319	11%			1999
19		Total Loess Acres	33,488	89%			2000
20		Total Acres	37,807	64%			2001
21							2002
22		Total KBID Acres	59,055				2003
23							2004
24							2005
25							2006
26							2007
27							2008
28							2009
29							2010
30							Avg 1994-2000
31							Normalized
32							
33							**KBID Classified Ac**
34							
35							Acres
36							Area (ft^2)
37							
38							Source: KBID Annu
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							

	M	N
	1	acre
	43,560	(ft^2)

ons

ocatio	WaterShed	Canal Length (ft)
Above	White Rock North	27,618
Below	Mud / Beaver divide	70,347
Below	Buffalo / Beaver divide	59,302
Above	upper section	16,588
Above	Oak / Republican	31,742
Above	Spring	18,964
Above	White Rock South	21,186
Below	Marsh	22,281
Below	lower section	3,243

Above KBID Length (ft)	116,097
Below KBID Length (ft)	155,172
Total Canal Length (ft)	271,269

	I	J	K	L	M	N	O
2					1	acre	
3					43,560	(ft^2)	
4	ons						
95							
96							
97							
98							
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140							
141							

	I	J	K	L	M	N	O
2					1	acre	
3					43,560	(ft^2)	
4	ons						
142							
143							
144							
145							
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147							
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159							
160							

	P	Q	R	S	T	U	V
1							
2							
3							
4							
5							
6	**Classified and Irrigated Acres in KBID**						
7							
8	KBID	KBID	Above	Below	Irrigated % of		
9	Classified	Irrigated	Lovewell	Lovewell	Classified	% Above	% Below
10	42,488	30,881	7,346	23,211	72.7%	23.8%	75.2%
11	42,458	23,589	9,880	13,708	55.6%	41.9%	58.1%
12	42,537	33,858	11,153	22,705	79.6%	32.9%	67.1%
13	42,523	34,933	10,701	24,125	82.2%	30.6%	69.1%
14	42,523	38,485	12,357	26,118	90.5%	32.1%	67.9%
15	42,574	35,431	14,932	20,242	83.2%	42.1%	57.1%
16	42,574	38,985	13,282	25,703	91.6%	34.1%	65.9%
17	42,574	38,485	12,693	25,563	90.4%	33.0%	66.4%
18	42,650	38,788	12,686	26,081	90.9%	32.7%	67.2%
19	42,863	40,711	12,284	27,588	95.0%	30.2%	67.8%
20	42,805	39,173	12,248	26,837	91.5%	31.3%	68.5%
21	42,922	39,499	12,412	26,894	92.0%	31.4%	68.1%
22	43,021	36,460	13,433	23,027	84.7%	36.8%	63.2%
23	43,114	23,035	0	23,034	53.4%	0.0%	100.0%
24	43,100	23,439	0	23,438	54.4%	0.0%	100.0%
25	43,048	28,580	5,925	22,653	66.4%	20.7%	79.3%
26	43,018	32,979	8,923	24,032	76.7%	27.1%	72.9%
27	43,045	35,356	9,795	25,538	82.1%	27.7%	72.2%
28	43,018	36,362	10,346	25,985	84.5%	28.5%	71.5%
29	43,055	36,758	9,872	26,723	85.4%	26.9%	72.7%
30	42,612	37,974	12,705	25,060	89.1%	33.5%	66.0%
31	42,612	37,974	12,775	25,199	89.1%	33.6%	66.4%
32							
33	reage						
34	Total		Above	Below			
35	42,612		14,335	28,276			
36	1,856,160,051		624,454,216	1,231,705,836			
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38	al Reports						
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Appendix D-3

Glover Inputs (Alluvial Aquifer Method)

On-Farm Losses

Kansas Bostwick Irrigation District

Location	(1) T (gpd/ft)	(2) Sy	(3) X (ft)	(4) W (ft)
Above KBID	43,700	0.2	6,338	12,923
Below KBID	42,400	0.2	4,125	7,794

Notes:

(1) Weighted transmissivity calculated from pump tests (Fader, 1968 and K.A.R. 5-3-11.)
(2) Estimated specific yield
(3) Average length from point of return to stream calculated in GIS
(4) Average length to boundary calculated in GIS

Appendix D-4

Glover Inputs (Alluvial Aquifer Method)

Canal Losses

Kansas Bostwick Irrigation District

Location	(1) T (gpd/ft)	(2) Sy	(3) X (ft)	(4) W (ft)
Above KBID	43,700	0.2	6,154	12,923
Below KBID	42,400	0.2	9,197	9,197

Notes:

(1) Weighted transmissivity calculated from pump tests (Fader, 1968 and K.A.R. 5-3-11.)
(2) Estimated specific yield
(3) Average length from main canal to stream calculated in GIS
(4) Average length to boundary calculated in GIS

Appendix D-5

Glover Inputs (Parallel Drain Method)

Kansas Bostwick Irrigation District

Location	(1) T (gpd/ft)	(2) Sy	(3) Area (ft^2)	(4) Drain Length (ft)	(5) Avg Drain Spacing (ft)	(6) X (ft)
Above KBID	43,700	0.2	624,454,216	532,893	1,172	590
Below KBID	42,400	0.2	1,231,705,836	1,051,107	1,172	590

Source: Transient Ground Water Hydraulics, Robert E. Glover, Chapter 8

Notes:

(1) Weighted transmissivity calculated from pump tests (Fader, 1968 and K.A.R. 5-3-11.)

(2) Estimated specific yield

(3) Area of KBID based on 1994 - 2000 average (KBID Annual Reports)

(4) Estimated total lenth of drains within the KBID service area - assuming 300 miles of drains (reference email from Kenny Nelson, 9/16/2011)

(5) Calculated as (3) / (4)

(6) Midway between drains, Calculated as (3) / 2, rounded to the nearest tenth

	A	B	C	D	E	F	G	H	I
1	On-Farm Loss T STREAM DEPLETION - CALCULATED USING GLOVER (ALLUVIAL AQUIFER)								
2									
3	Volume pumped first month:			100.015 acre-feet					
4	Volume pumped months 2-151:			0 acre-feet					
5	T =	43,700 gpd/ft							
6	Amount to wrap (depletions to 90%):			9.95480		SUM:	1.000000	1.000000	
7	Stream Depletion		Vol. of Dep.	Vol. of Dep. This Step		Cum. %	Depletion	Return Flow	
8	Time (months)	Dep. Rate (CFS)	(acre-feet)	(af)	Month	Recovery	Factors	Factors	
9	1	0	0	0	1	0.0%	0.00059610	0.0019130958	
10	2	0.0013	0.0197	0.0197	2	0.0%	0.00079310	0.0019310958	
11	3	0.0087	0.2898	0.27	3	0.3%	0.00329610	0.0019480958	
12	4	0.0189	1.1275	0.8378	4	1.1%	0.00897410	0.0019660958	
13	5	0.0266	2.5157	1.3881	5	2.5%	0.01447710	0.0019840958	
14	6	0.0311	4.2707	1.7551	6	4.3%	0.01814710	0.0020030958	
15	7	0.0333	6.223	1.9523	7	6.2%	0.02011910	0.0020210958	
16	8	0.0339	8.2548	2.0318	8	8.3%	0.02091410	0.0020400958	
17	9	0.0335	10.2923	2.0375	9	10.3%	0.02097110	0.0020590958	
18	10	0.0327	12.2916	1.9993	10	12.3%	0.02058910	0.0020780958	
19	11	0.0315	14.2283	1.9367	11	14.2%	0.01996310	0.0020980958	
20	12	0.0302	16.0898	1.8615	12	16.1%	0.01921110	0.0021180958	
21	13	0.0288	17.8709	1.7811	13	17.9%	0.01840710	0.0021380958	
22	14	0.0275	19.5709	1.7	14	19.6%	0.01759610	0.0021580958	
23	15	0.0262	21.1918	1.6209	15	21.2%	0.01680510	0.0021790958	
24	16	0.025	22.7372	1.5454	16	22.7%	0.01605010	0.0022000958	
25	17	0.0239	24.2115	1.4742	17	24.2%	0.01533810	0.0022210958	
26	18	0.0228	25.6192	1.4078	18	25.6%	0.01467410	0.0022430958	
27	19	0.0218	26.9653	1.3461	19	27.0%	0.01405710	0.0022640958	
28	20	0.0209	28.2544	1.2891	20	28.3%	0.01348710	0.0022860958	
29	21	0.0201	29.4909	1.2365	21	29.5%	0.01296110	0.0023090958	
30	22	0.0193	30.679	1.1881	22	30.7%	0.01247710	0.0023310958	
31	23	0.0186	31.8227	1.1436	23	31.8%	0.01203210	0.0023540958	
32	24	0.018	32.9254	1.1027	24	32.9%	0.01162310	0.0023780958	
33	25	0.0174	33.9904	1.065	25	34.0%	0.01124610	0.0024010958	
34	26	0.0168	35.0206	1.0303	26	35.0%	0.01089910	0.0024250958	
35	27	0.0163	36.0188	0.9982	27	36.0%	0.01057810	0.0024490958	
36	28	0.0158	36.9874	0.9686	28	37.0%	0.01028210	0.0024740958	
37	29	0.0154	37.9285	0.9411	29	37.9%	0.01000710	0.0024980958	
38	30	0.015	38.8442	0.9157	30	38.8%	0.00975310	0.0025240958	
39	31	0.0146	39.7362	0.892	31	39.7%	0.00951610	0.0025490958	
40	32	0.0142	40.6061	0.8699	32	40.6%	0.00929510	0.0025750958	
41	33	0.0139	41.4553	0.8492	33	41.5%	0.00908810	0.0026010958	
42	34	0.0136	42.2852	0.8299	34	42.3%	0.00889510	0.0026270958	
43	35	0.0133	43.0969	0.8117	35	43.1%	0.00871310	0.0026540958	
44	36	0.013	43.8915	0.7946	36	43.9%	0.00854210	0.0026820958	
45	37	0.0128	44.6699	0.7784	37	44.7%	0.00838010	0.0027090958	

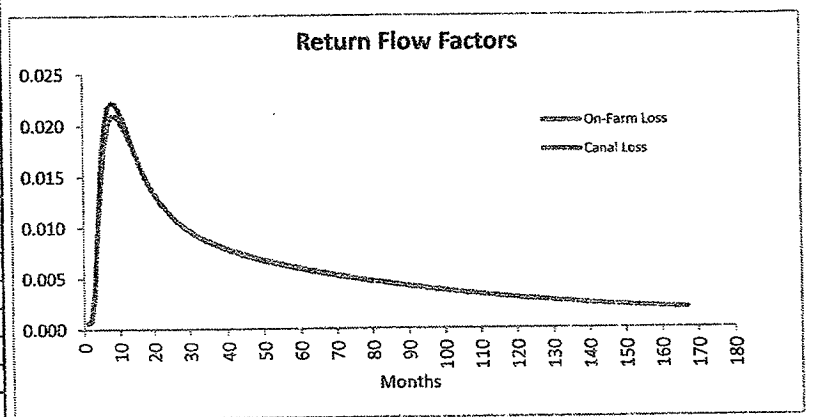
	A	B	C	D	E	F	G	H
1	On-Farm Loss T STREAM DEPLETION - CALCULATED USING GLOVER (ALLUVIAL AQUIFER)							
2								
3	Volume pumped first month:			100.015 acre-feet				
4	Volume pumped months 0-101:			0 acre-feet				
5	T =	42,400 gpd/ft						
6	Amount to wrap (depletions to 90%):			9.81930		SUM:	1.000000	1.000000
7	Stream Depletion		Vol. of Dep.	Vol. of Dep. This Step		Cum. %	Depletion	Return Flow
8	Time (months)	Dep. Rate (CFS)	(acre-feet)	(af)	Month	Recovery	Factors	Factors
9	1	0.0028	0.0237	0.0237	1	0.0%	0.00174766	0.0050146615
10	2	0.0409	1.1559	1.1322	2	1.2%	0.01283266	0.0051396615
11	3	0.0719	4.7294	3.5735	3	4.7%	0.03724566	0.0052696615
12	4	0.0771	9.3074	4.578	4	9.3%	0.04729066	0.0054036615
13	5	0.0728	13.8518	4.5444	5	13.9%	0.04695466	0.0055416615
14	6	0.0661	18.0436	4.1918	6	18.0%	0.04342866	0.0056856615
15	7	0.0597	21.8358	3.7923	7	21.8%	0.03943366	0.0058346615
16	8	0.0542	25.2664	3.4306	8	25.3%	0.03581666	0.0059886615
17	9	0.0496	28.3918	3.1254	9	28.4%	0.03276466	0.0061476615
18	10	0.0458	31.2654	2.8736	10	31.3%	0.03024666	0.0063126615
19	11	0.0427	33.9318	2.6664	11	33.9%	0.02817466	0.0064846615
20	12	0.0401	36.4261	2.4943	12	36.4%	0.02645366	0.0066616615
21	13	0.0379	38.7753	2.3492	13	38.8%	0.02500266	0.0068446615
22	14	0.0359	41.0003	2.225	14	41.0%	0.02376066	0.0070356615
23	15	0.0343	43.1169	2.1166	15	43.1%	0.02267666	0.0072316615
24	16	0.0328	45.1374	2.0206	16	45.1%	0.02171666	0.0074356615
25	17	0.0314	47.0715	1.9341	17	47.1%	0.02085166	0.0076466615
26	18	0.0301	48.9266	1.8551	18	48.9%	0.02006166	0.0078656615
27	19	0.029	50.7089	1.7823	19	50.7%	0.01933366	0.0080926615
28	20	0.0279	52.4232	1.7143	20	52.4%	0.01865366	0.0083266615
29	21	0.0269	54.0737	1.6505	21	54.1%	0.01801566	0.0085696615
30	22	0.0259	55.664	1.5902	22	55.7%	0.01741266	0.0088216615
31	23	0.025	57.1969	1.5329	23	57.2%	0.01683966	0.0090816615
32	24	0.0241	58.6752	1.4783	24	58.7%	0.01629366	0.0093516615
33	25	0.0232	60.1013	1.4261	25	60.1%	0.01577166	0.0096306615
34	26	0.0224	61.4773	1.376	26	61.5%	0.01527066	0.0099206615
35	27	0.0216	62.8053	1.328	27	62.8%	0.01479066	0.0102206615
36	28	0.0209	64.087	1.2817	28	64.1%	0.01432766	0.0105306615
37	29	0.0201	65.3243	1.2372	29	65.3%	0.01388266	0.0108526615
38	30	0.0195	66.5187	1.1944	30	66.5%	0.01345466	0.0111856615
39	31	0.0188	67.6717	1.1531	31	67.7%	0.01304166	0.0115306615
40	32	0.0181	68.785	1.1133	32	68.8%	0.01264366	0.0118886615
41	33	0.0175	69.8598	1.0748	33	69.9%	0.01225866	0.0122586615
42	34	0.0169	70.8976	1.0378	34	70.9%	0.01188866	0.0126436615
43	35	0.0163	71.8997	1.002	35	71.9%	0.01153066	0.0130416615
44	36	0.0158	72.8671	0.9675	36	72.9%	0.01118566	0.0134546615
45	37	0.0152	73.8013	0.9342	37	73.8%	0.01085266	0.0138826615

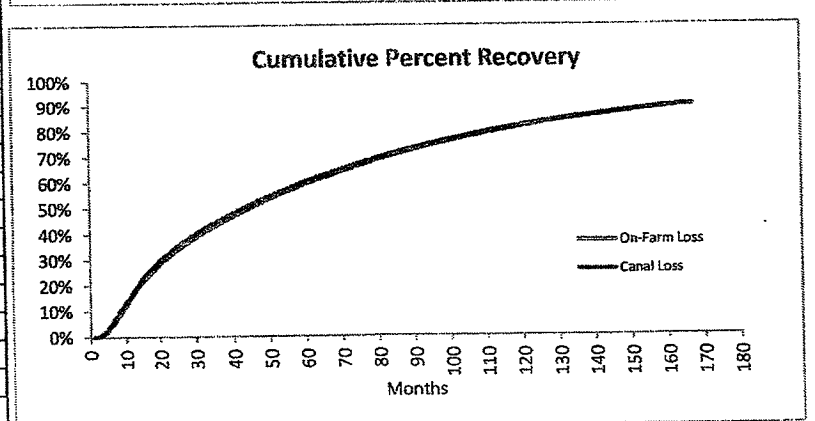
AWAS Below KBID alluvial

	A	B	C	D	E	F	G
1							
2	**Above KBID**						
3	transmissivity	43700	GPD/FT				
4	sarurated depth	1	ft				
5	specific yield	0.2					
6	Field Width	590	ft				
7							
8	Notes:						
9							
10							
11							
12		STREAM DEPLETION - CALCULATED USING GLOVER - PARALLEL DRAIN					
13							
14							
15							
16							
17		0.00024					
18	Stream Depletion			Cumulative Percent	Depletion	RETURN FLOW	
19	Time (months)	Factor	Cumulative %	Recovery	Factors	FACTORS	
20	1	0.86963	86.96300	87.0%	0.86975	0.1302	
21	2	0.13013	99.97600	100.0%	0.13025	0.8698	

	H	I	J	K	L	M	N
1							
2		**Below KBID**					
3		transmissivity	42400	GPD/FT			
4		sarurated depth	1	ft			
5		specific yield	0.2				
6		Field Width	590	ft			
7							
8		Notes:					
9							
10							
11							
12		STREAM DEPLETION - CALCULATED USING GLOVER - PARALLEL DRAIN					
13							
14							
15							
16							
17			0.00029				
18		Stream Depletion			Cumulative Percent	Depletion	RETURN FLOW
19		Time (months)	Factor	Cumulative %	Recovery	Factors	FACTORS
20		1	0.86569	86.56900	86.6%	0.86583	0.1342
21		2	0.13402	99.97100	100.0%	0.13417	0.8658

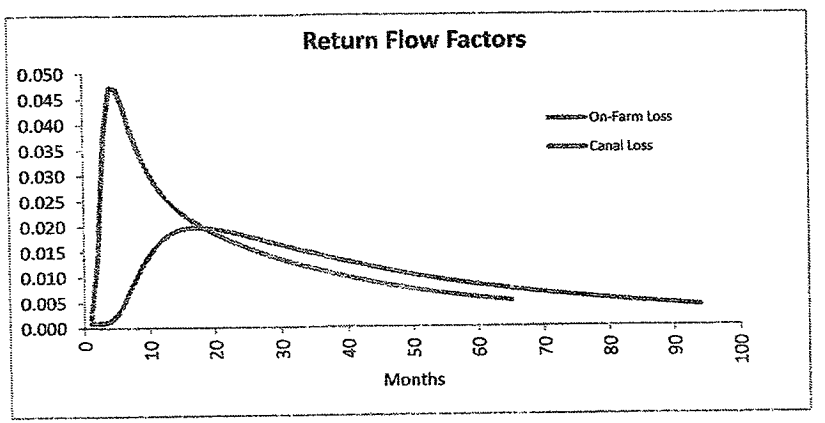
Appendix D-6
Glover Results (Alluvial Aquifer Method)
Above KBID

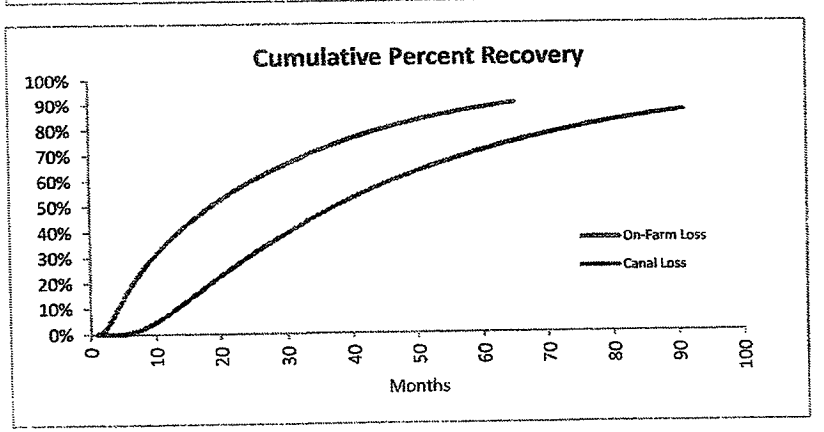




Note:
The factors were calculated until 90% percent returns to the river. The remaining 10% percent was distributed evenly among the factors.

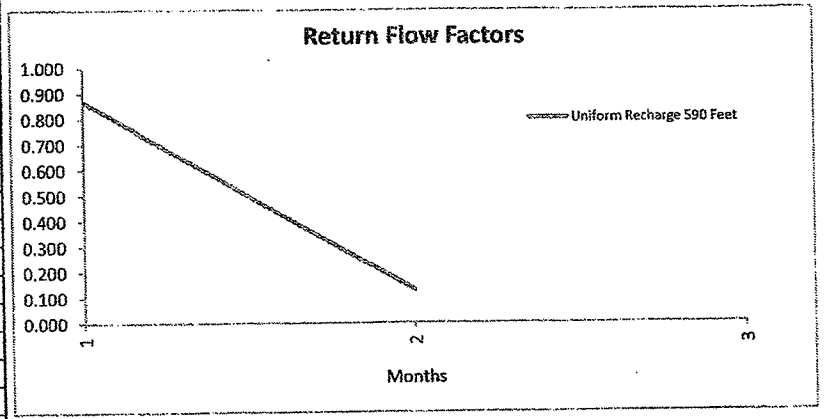
Appendix D-7
Glover Results (Alluvial Aquifer Method)
Below KBID

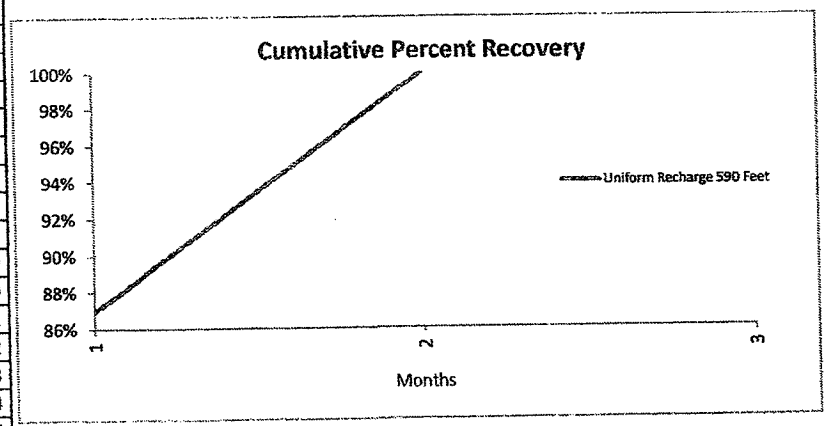
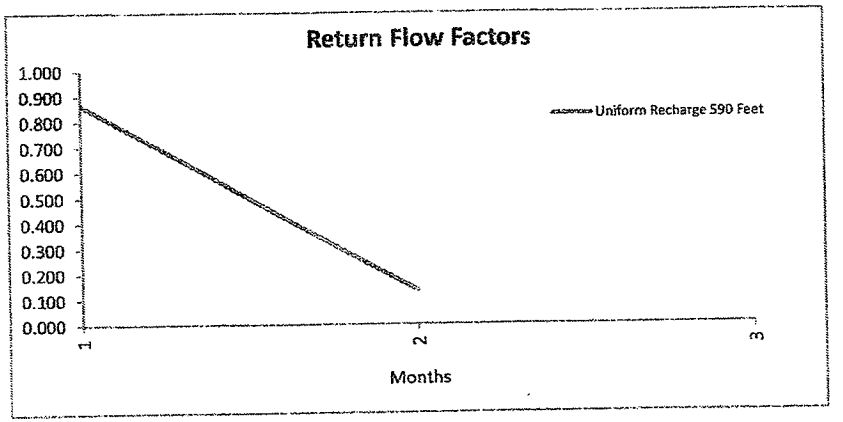
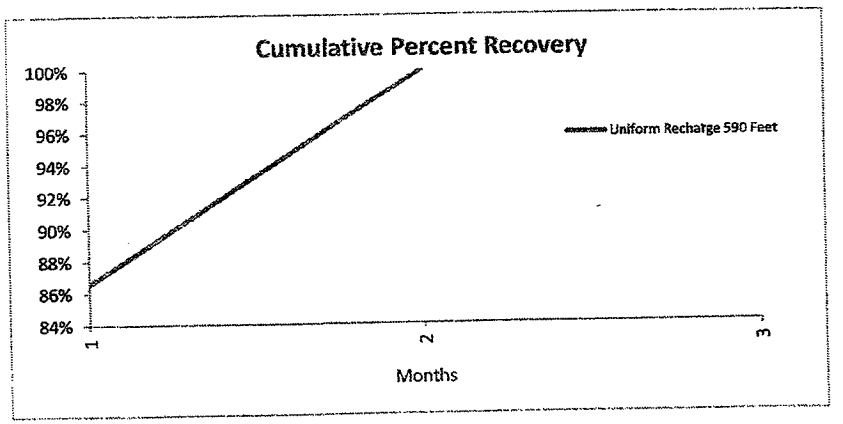




Note:
The factors were calculated until 90% percent returns to the river. The remaining 10% percent was distributed evenly among the factors.

Appendix D-8
Glover Results (Parallel Drains)
Above KBID





Appendix D-9
Glover Results (Parallel Drains)
Below KBID