Soft Conversions

Presentation to the
Comprehensive Aquifer Management
Plan Committee
Idaho Falls, February 2008

B. Contor

IDAHO WATER RESOURCES RESEARCH INSTITUTE

The Potential Application of Additional Surface Water to Irrigated Lands Having Both Surface-water and Ground-water Irrigation Rights, to Benefit the Eastern Snake Plain Aquifer:

Soft Conversions

Prepared by Idaho Water Resources Research Institute
In fulfillment of Task 4
of Contract # CON00762
TECHNICAL ASSISTANCE FOR EASTERN SNAKE PLAIN AQUIFER
COMPREHENSIVE AQUIFER MANAGEMENT PLAN STUDIES

for
The Idaho Water Resource Board
and
The Idaho Department of Water Resources

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7 February 2008

Idaho Water Resources Research Institute
Technical Completion Report 2008-002

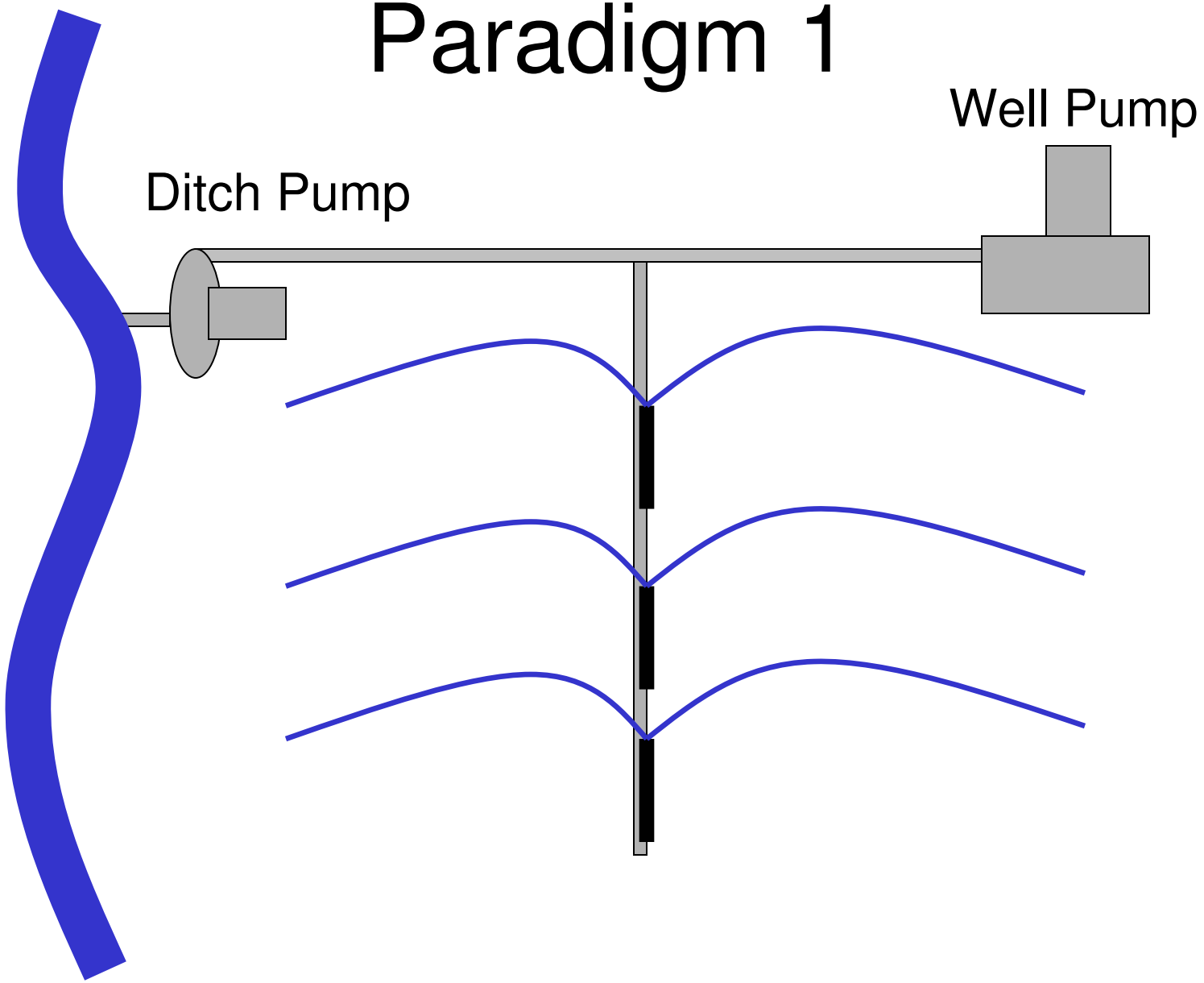
Why conversions?

- Legal status of water use is *irrigation*
- Double benefit to aquifer
  - reduce pumping
  - increase incidental recharge
- Keeps land in production
  - "main-street" economic benefits
- Recharge is broadly distributed
  - fewer water-quality concerns

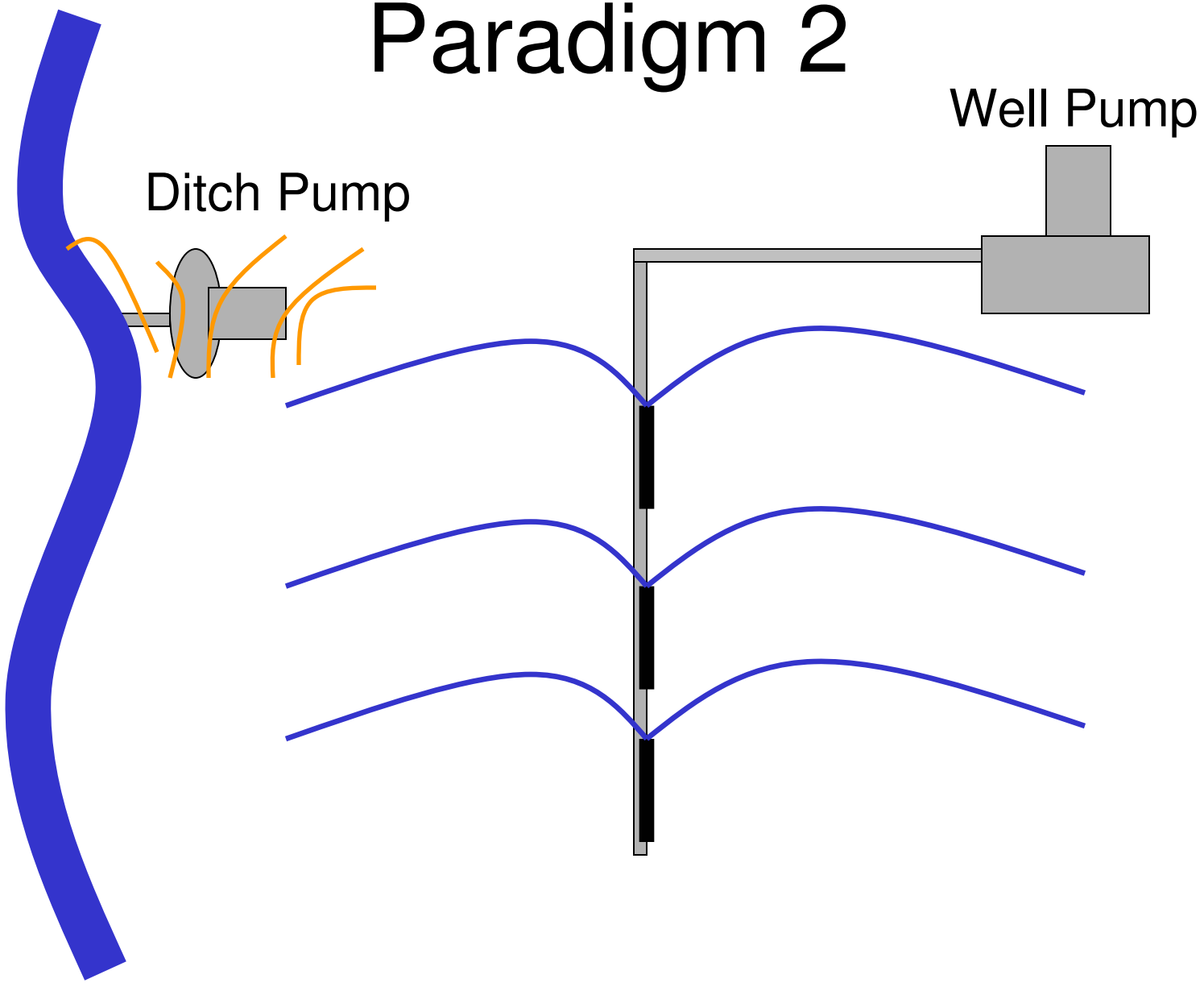
What are "mixed-source" lands?

- Lands that have both a valid surface-water right *and* a valid ground-water right

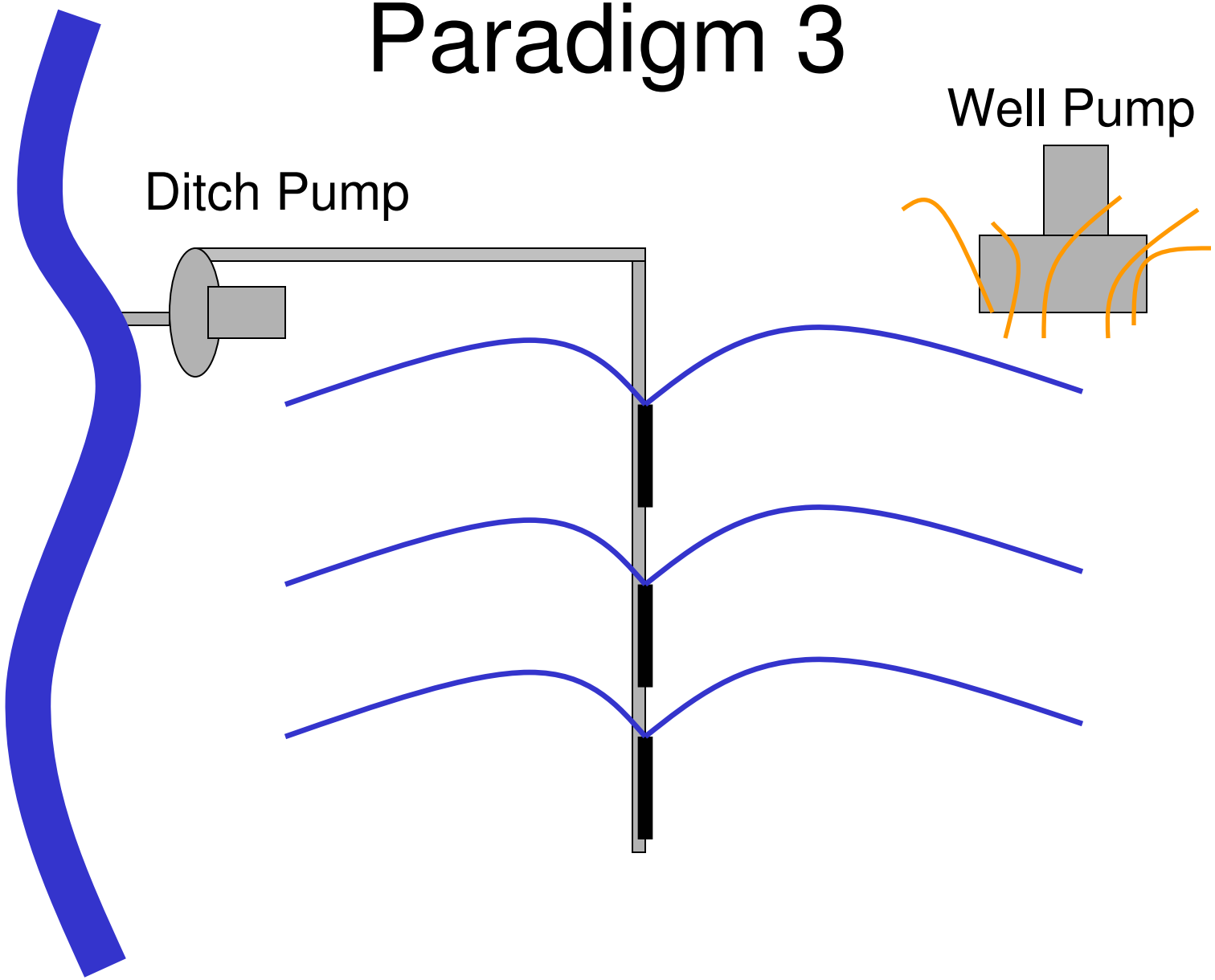
Paradigm 1



Paradigm 2



Paradigm 3



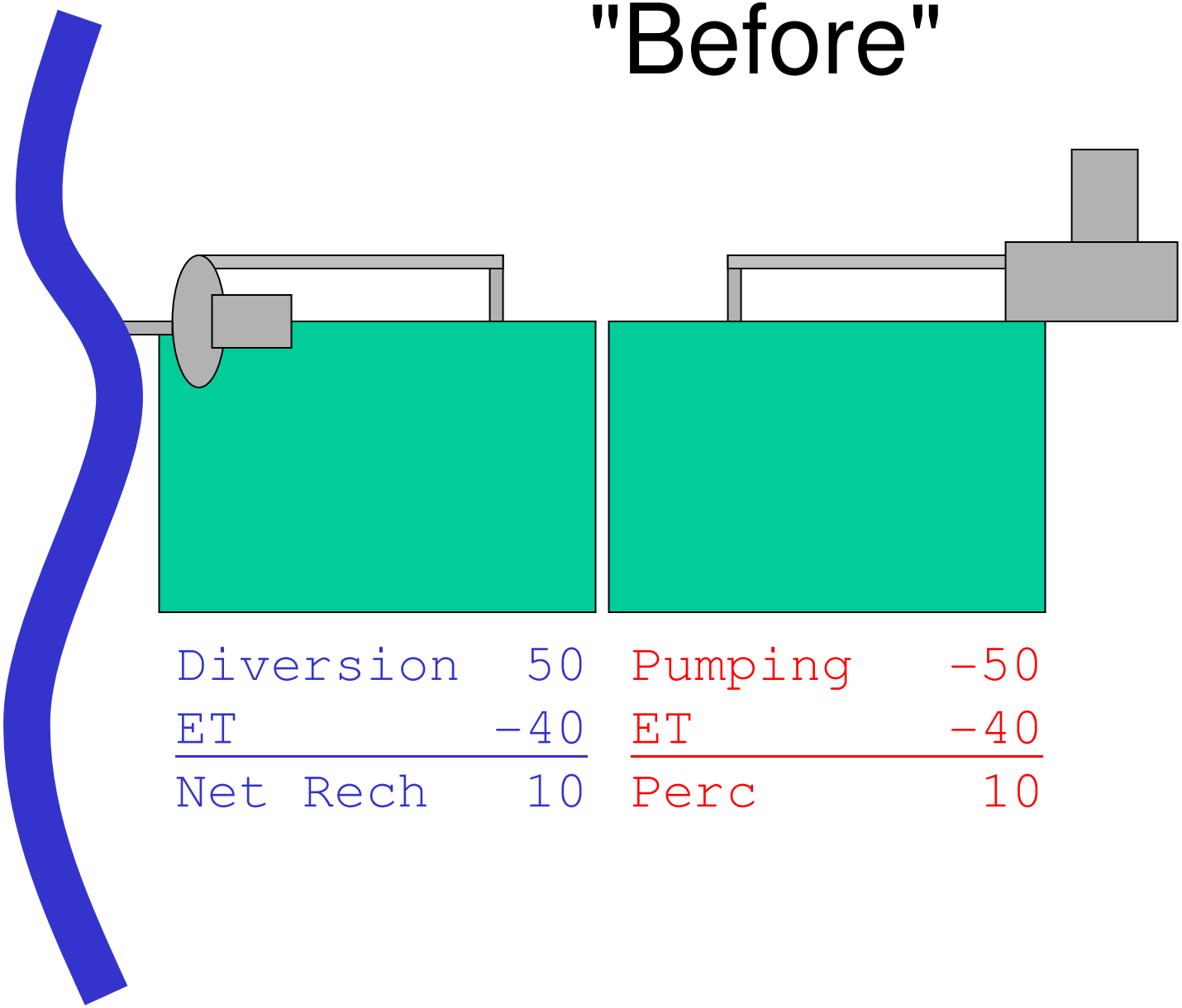
What are "soft conversions?"

- Full or partial replacement of ground-water with surface water, to irrigate **mixed-source** lands
  - already have surface water rights
  - major infrastructure components (diversions & main canals) already exist

- To benefit the aquifer, there must be ***additional*** *surface water delivered.*

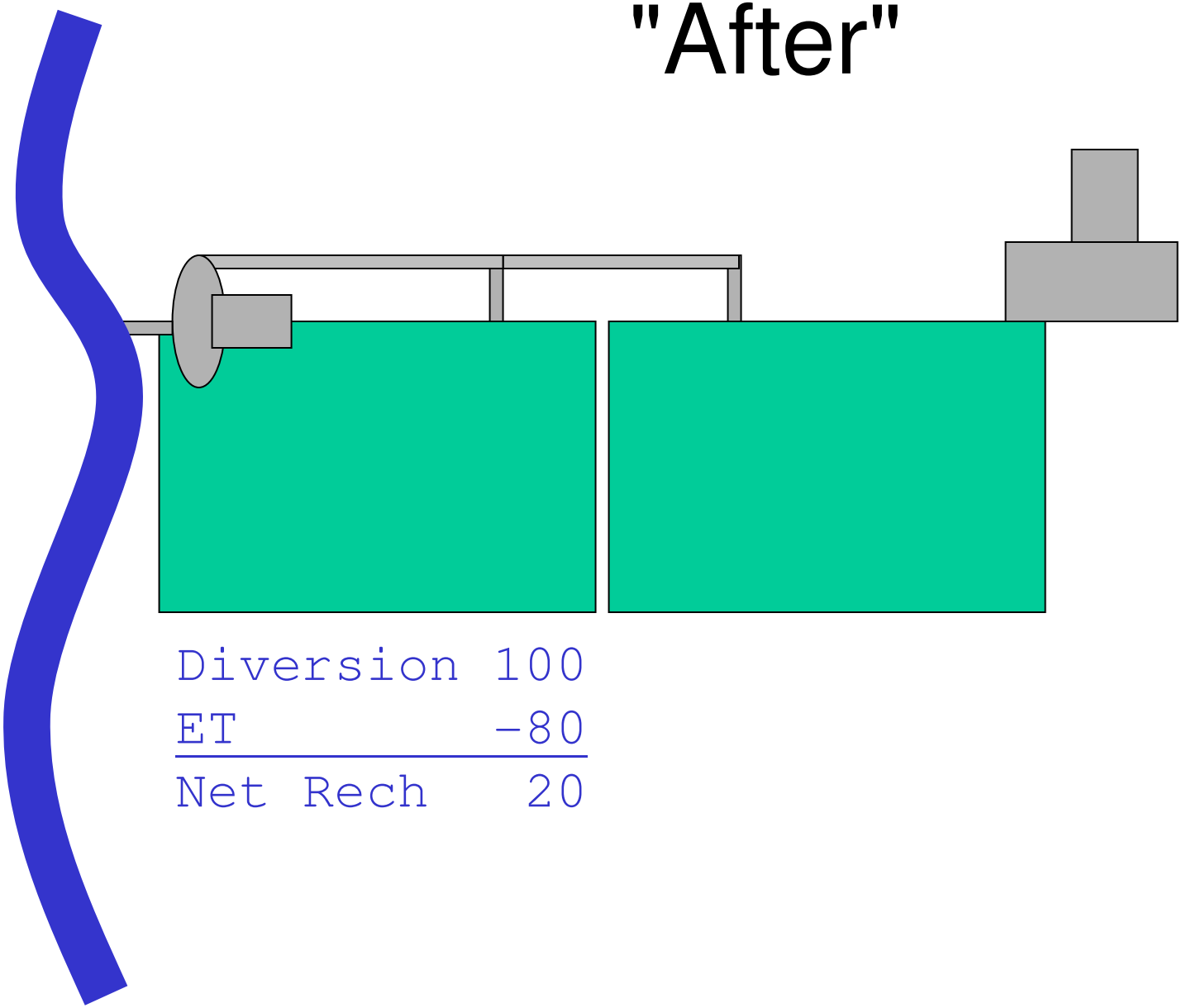
Illustration 1: Soft Conversion with Additional SW Delivery

"Before"



Diversion	50	Pumping	-50
ET	-40	ET	-40
Net Rech	10	Perc	10

"After"



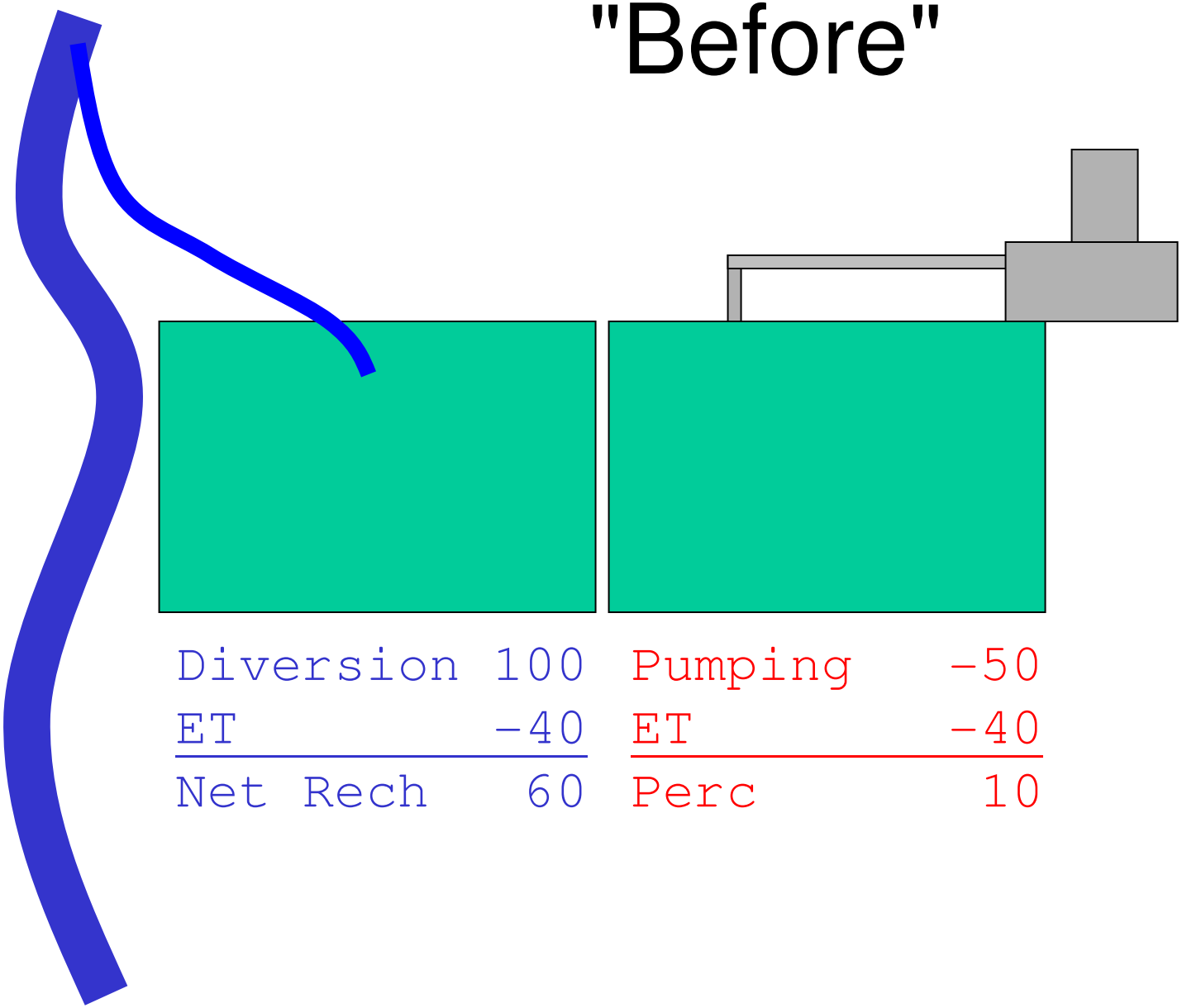
Diversion	100
ET	-80
Net Rech	20

Comparison

Before			After	
Diversion	50	⟷ 50 acre ft new diversions	Diversion	100
ET	-40		ET	-80
Net Rech	10		Net Rech	20
Pumping	-50			
ET	-40			
Perc	10			
Combined			Combined	
GW Pump	-50			
Net Rech	+10	50 acre ft aquifer benefit	GW Pump	0
GW Perc	+10		Net Rech	+20
Total	-30	⟷	Total	+20

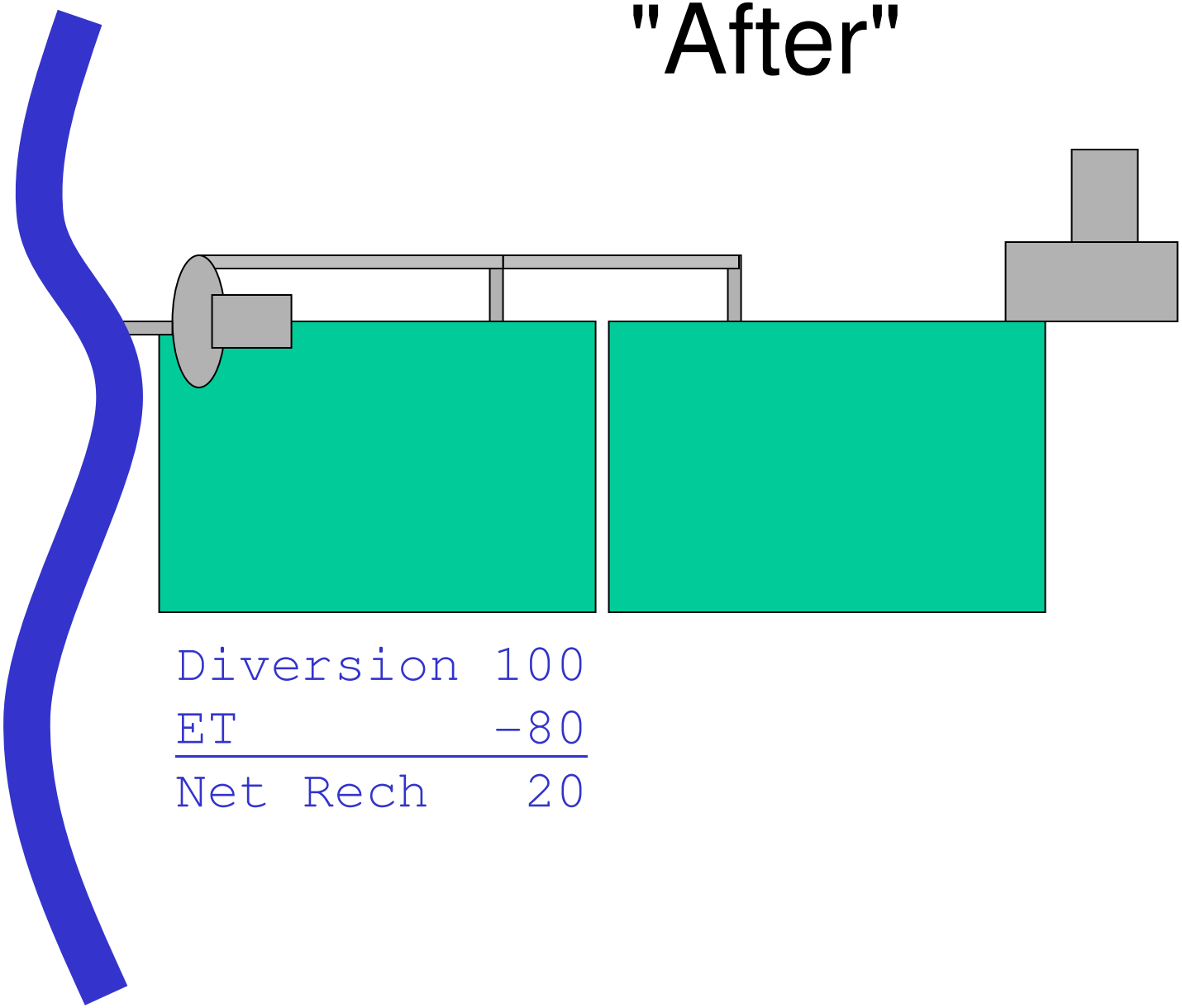
Illustration 2: Soft Conversion *without* Additional SW Delivery

"Before"



Diversion	100	Pumping	-50
ET	-40	ET	-40
Net Rech	60	Perc	10

"After"



Diversion	100
ET	-80
Net Rech	20

Comparison

Before			After	
Diversion	100	⟷	Diversion	100
ET	−40	no new diversions	ET	−80
Net Rech	60		Net Rech	20
Pumping	−50			
ET	−40			
Perc	10			
Combined			Combined	
GW Pump	−50			
Net Rech	+60	no new aquifer benefit	GW Pump	0
GW Perc	+10		Net Rech	+20
Total	+20	⟷	Total	+20

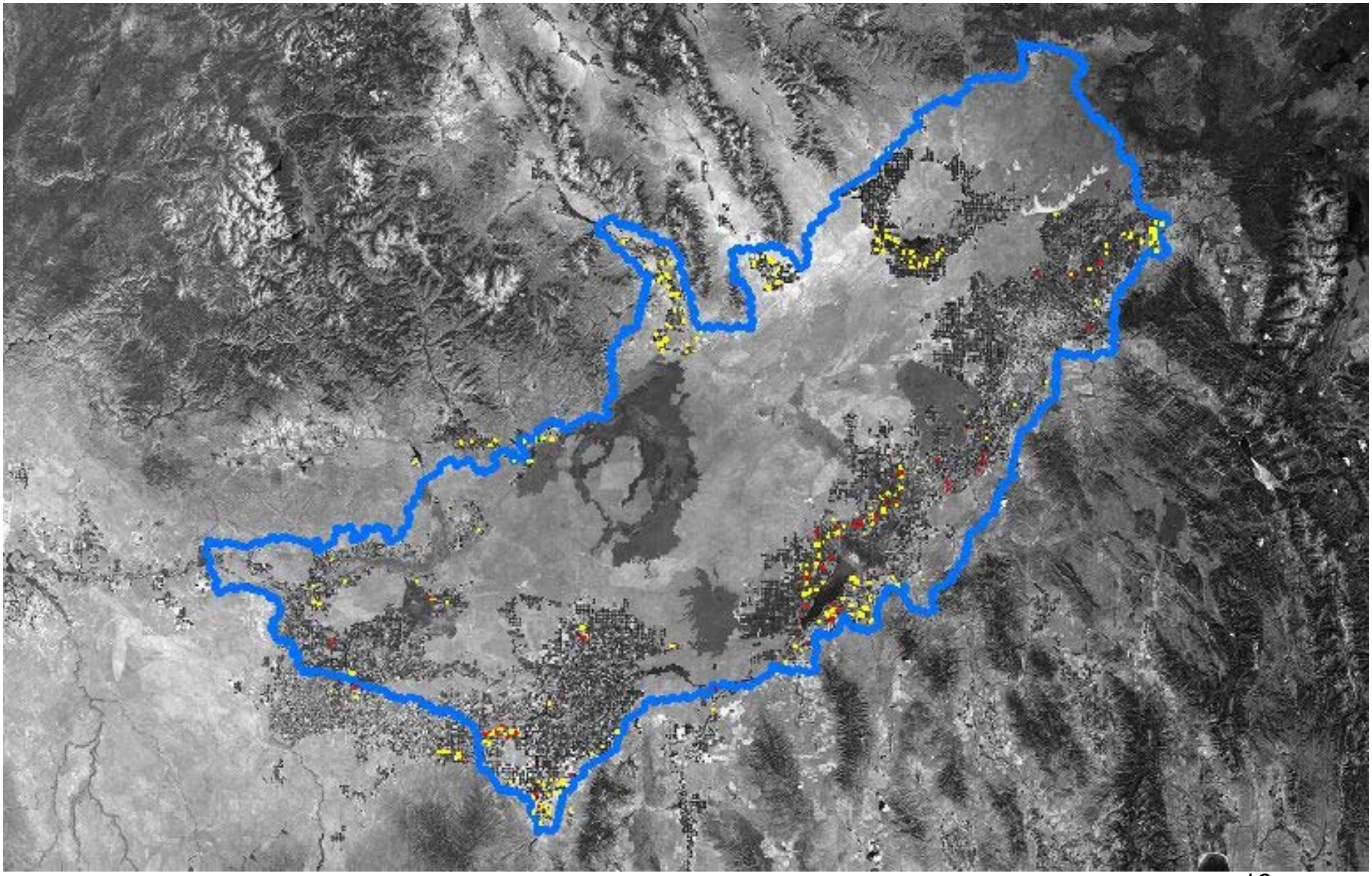
Study Questions:

- How many mixed-source lands can receive additional surface-water supplies?
- What would it take to convert the rest?
- Can the canals deliver to all these parcels?

- ***Is there water available?***

Study Approach:

- How many mixed-source lands can receive additional surface-water supplies?
  - Field inspection & WR file review



Study Approach:

- What would it take to convert the rest?
  - Field inspection & IDWR engineering expertise
- Can the canals deliver to all these parcels?
  - Review of diversion data
  - Letters to canal managers

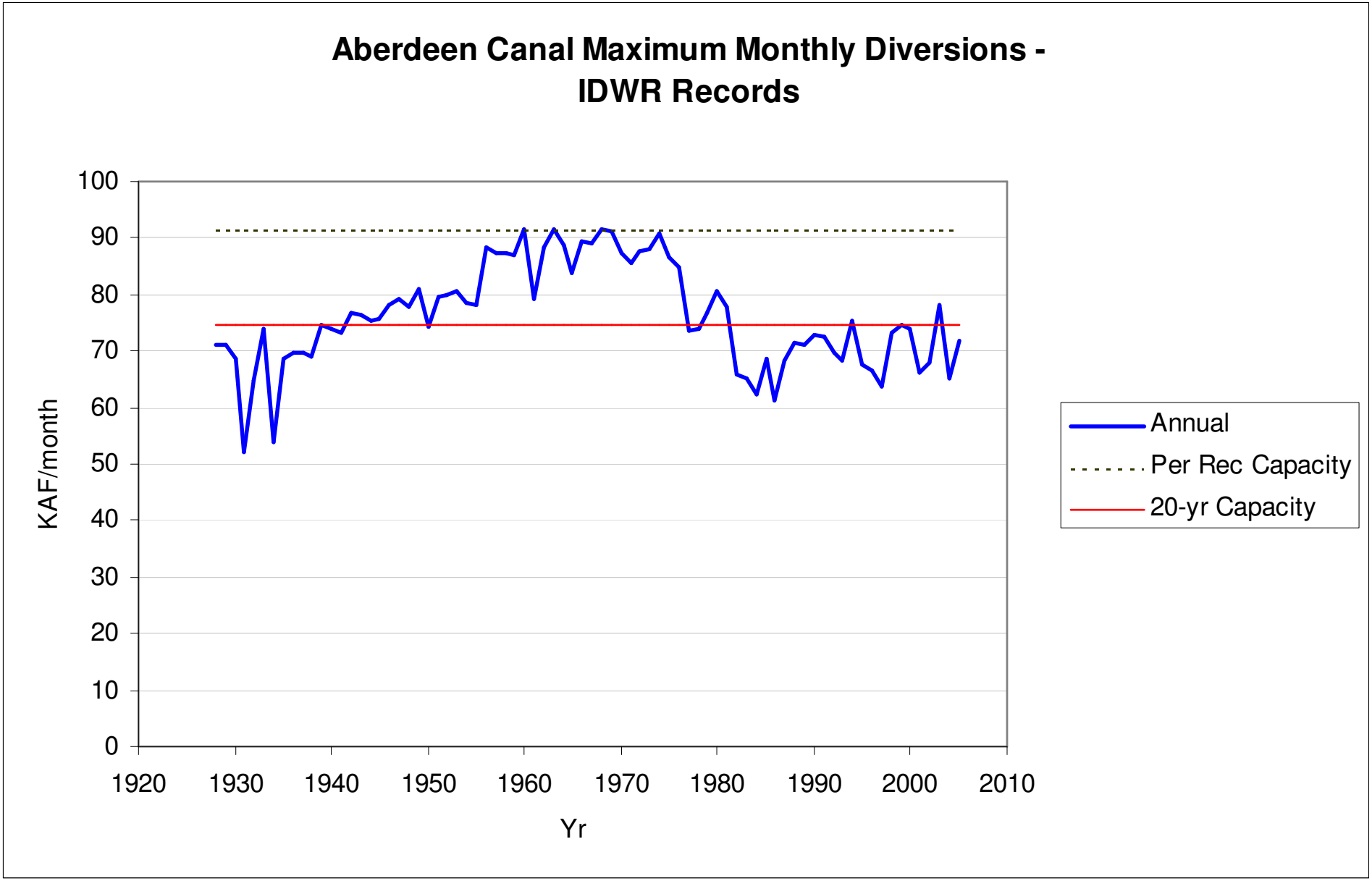


Figure 2 from report

- *Is there water available?*
  - assessed by IDWR, not part of this study

Results:

- Most parcels are physically supplied by either GW or SW
- Very few are actually supplied by both
- Very few still have both types of infrastructure

- About 53,000 acres could reasonably be converted
  - nearly all would require a ditch pump
  - about 2/3 would require additional improvements
    - 3-phase power
    - ditch
    - mainline

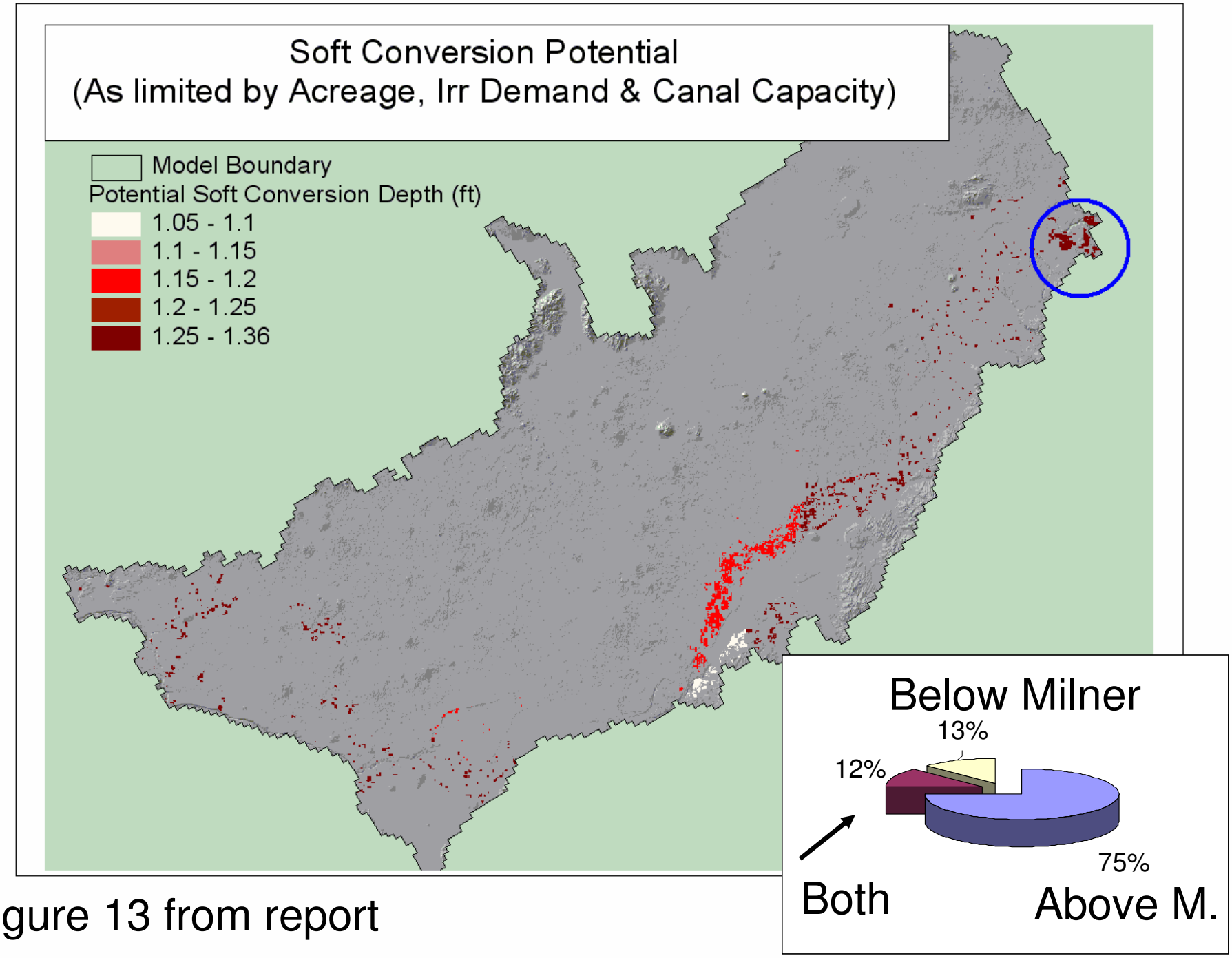


Figure 13 from report

- Most canals have adequate capacity to support soft conversions
  - One manager said laterals might need enlargement
- Canals that are capacity-limited *are only limited during peak demand*
- Great benefit could still be obtained by delivering to soft conversions *only in the spring and fall*

Bottom Line:

- 53,000 acres reasonably convertible
- Considering seasonal irrigation demand, canal-capacity limitations & acreage under each canal, potential benefit to aquifer is 180,000 acre feet per year
- Cost is $3,000,000 for the easiest 1/3, $15,000,000 for all 53,000 acres

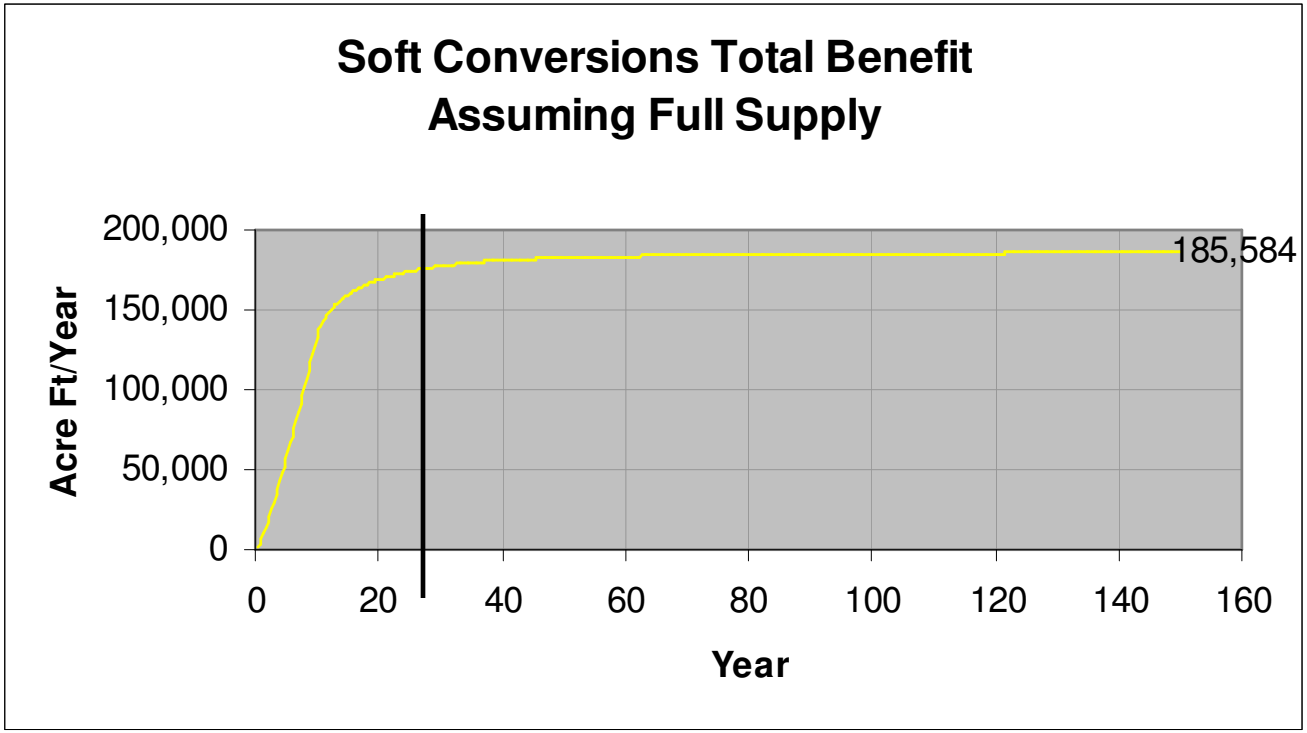
- $15,000,000/180,000 acre feet =
  $82 *one-time* investment
  for capacity to deliver
  1 acre foot/year benefit

- $3,000,000/57,000 acre feet =
  $53 *one-time* investment
  for capacity to deliver
  1 acre foot/year benefit

- If this were the lowest-cost alternative, would supplies be available in many (most) years to supply these conversions? *(see IDWR water-supply results)*

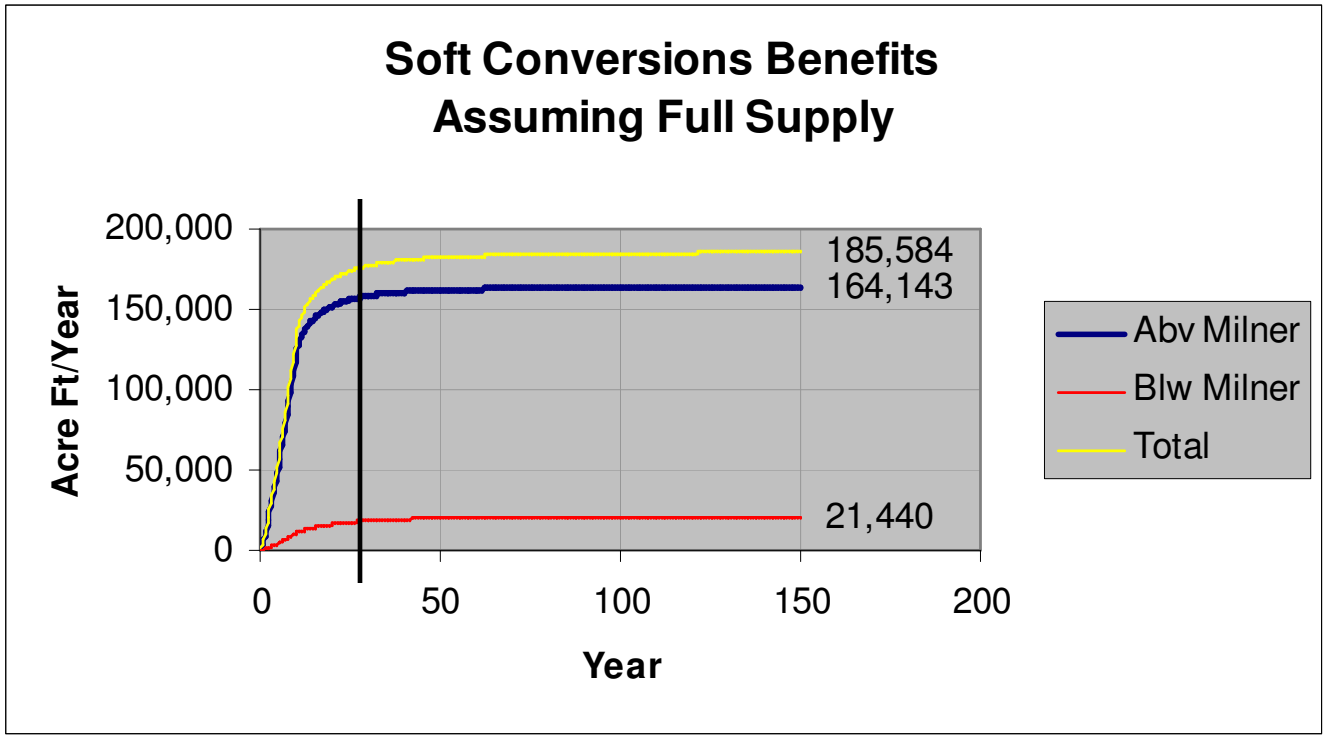
  – Presentations this afternoon assume available water is delivered to other uses first

- If soft conversions were supplied every year, most benefits would be realized at springs & rivers within 20 years (assuming 10-year phase-in)



(NOT a prediction of gains, ESTIMATE of IMPROVEMENT)

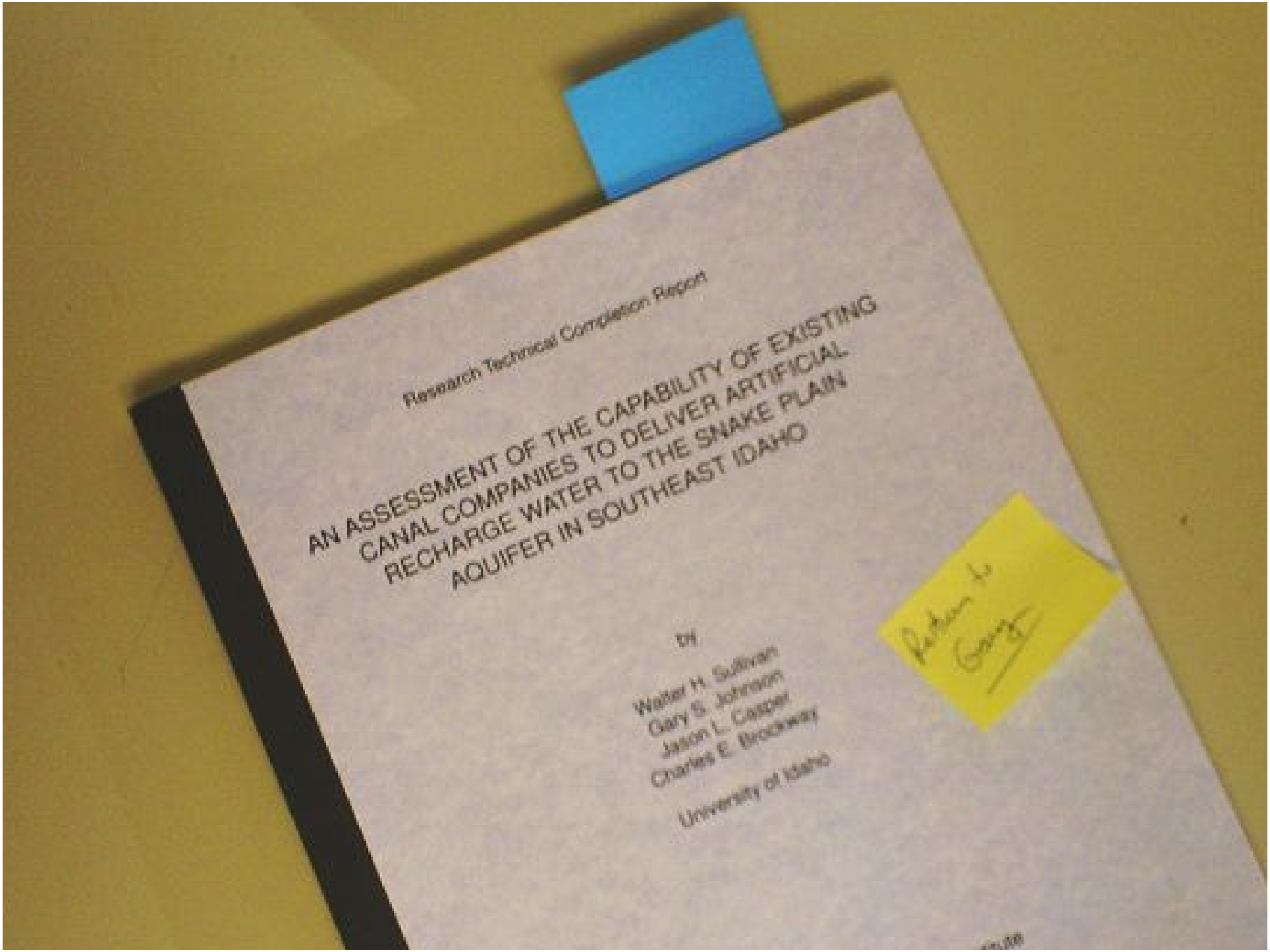
- Most of the benefit would be available at Milner and above



(NOT a prediction of gains, ESTIMATE of IMPROVEMENT)

Discussion

Backup slides


Research Technical Completion Report
AN ASSESSMENT OF THE CAPABILITY OF EXISTING CANAL COMPANIES TO DELIVER ARTIFICIAL RECHARGE WATER TO THE SNAKE PLAIN AQUIFER IN SOUTHEAST IDAHO
by
Walter H. Sullivan
Gary S. Johnson
Jason L. Casper
Charles E. Brockway
University of Idaho

W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1928	16.5	3.3	0	0	0	0	3.1	57.4	56.3	62.1	71.2	53.1	323
1929	16.5	3.3	0	0	0	0	3.1	57.4	59.7	71.2	52.1	33.8	297.1
1930	16.5	3.3	0	0	0	0	3.1	47.9	68.6	63	39.5	32.5	274.4
1931	16.5	3.3	0	0	0	0	5	40.1	52	44.1	28.6	12.8	202.4
1932	16.5	3.3	0	0	0	0	3.1	44.3	60.4	64.8	48	24.9	265.3
1933	16.5	3.3	0	0	0	0	3.1	39.1	74.1	67.2	51.8	27.2	282.3
1934	16.5	3.3	0	0	0	5.6	9.1	53.7	26.8	35.1	15	11.5	176.6
1935	16.5	3.3	0	0	0	0	3.1	47.7	68.7	61.1	35.6	14.8	250.8
1936	16.5	3.3	0	0	0	0	3.1	58.4	65.6	69.7	40.8	27.6	285
1937	16.5	3.3	0	0	0	0	3.1	51	66.3	69.6	48.2	20	278
1938	16.5	3.3	0	0	0	0	3.1	50.7	64.9	69.1	51.4	31.6	290.6
1939	16.5	3.3	0	0	0	0	3.1	71.7	74.4	74.8	55.5	35.6	334.9
1940	16.5	3.3	0	0	0	0	3.1	67.7	73.9	58.2	45	16.3	284
1941	16.5	3.3	0	0	0	0	3.1	63.4	73.3	66	48.1	32.6	306.3
1942	16.5	3.3	0	0	0	0	3.1	46.9	72.2	76.6	61.2	40.5	320.3
1943	16.5	3.3	0	0	0	0	3.1	65.7	64.3	76.4	69.8	53.7	352.8
1944	16.5	3.3	0	0	0	0	3.1	54.7	51.1	75.5	63.8	45.2	313.2
1945	16.5	3.3	0	0	0	0	3.1	58.8	56.5	75.7	64.5	52.4	330.8
1946	16.5	3.3	0	0	0	0	3.1	67.1	65.3	78.1	61.9	38.5	333.8
1947	16.5	3.3	0	0	0	0	3.1	71.9	56.5	79.3	68.5	43.7	342.8
1948	16.5	3.3	0	0	0	0	3.1	53.2	62.9	77.7	67.4	44.2	328.3
1949	16.5	3.3	0	0	0	0	3.1	59	69.6	81.1	62.7	40.6	335.9
1950	16.5	3.3	0	0	0	0	3.1	62	65.1	74.3	74.2	47.3	345.8
1951	16.5	3.3	0	0	0	0	3.1	59.6	70.3	79.7	67.7	56.2	356.4
1952	16.5	3.3	0	0	0	0	3.1	61.5	67	79.9	73.6	51.5	356.4
1953	16.5	3.3	0	0	0	0	3.1	51.5	57.9	80.8	67.6	42.5	323.2
1954	16.5	3.3	0	0	0	0	3.1	69.1	62.6	78.6	68.1	46.7	348
1955	16.5	3.3	0	0	0	0	3.1	55.7	73.3	78.3	66.9	41.4	338.5
1956	16.5	3.3	0	0	0	0	3.1	66.7	72.4	88.5	73.8	52.5	376.8
1957	16.5	3.3	0	0	0	0	3.1	32.7	76.7	87.5	80.4	56.7	356.9
1958	16.5	3.3	0	0	0	0	3.1	69.5	77.8	87.4	62.4	40.3	360.3
1959	16.5	3.3	0	0	0	0	3.1	67	80.9	86.8	69.4	47.3	374.3
1960	16.5	3.3	0	0	0	0	3.1	68.5	83.8	91.6	65.2	49.7	381.7
1961	17.6	0.1	0	0	0	0	5.6	66.1	75.5	79.3	57.7	15.3	317.2
1962	17.6	0.1	0	0	0	0	5.6	61	74.6	88.4	70.2	61.6	379.1
1963	17.6	0.1	0	0	0	0	5.6	39.5	56.4	91.5	72.4	42.7	325.8
1964	17.6	0.1	0	0	0	0	5.6	40.2	58.6	88.9	77.8	56.3	345.1
1965	17.6	0.1	0	0	0	0	5.6	50.8	79	83.9	68.5	54.2	359.7
1966	17.6	0.1	0	0	0	0	5.6	76.7	82.6	89.3	72.8	47.5	392.2
1967	17.6	0.1	0	0	0	0	5.6	45.8	59.3	89.2	79.7	66	363.3
1968	17.6	0.1	0	0	0	0	5.6	71	76	91.7	56.4	44.2	362.6
1969	17.6	0.1	0	0	0	0	5.6	77.9	71.8	91.1	82.3	60.3	406.7
1970	17.6	0.1	0	0	0	0	5.6	46.6	76	87.5	76.4	48.4	358.2
1971	17.6	0.1	0	0	0	0	4.1	52.2	74.3	85.7	71.7	43.2	348.9
1972	17.6	0.1	0	0	0	0	7	73.7	74.5	87.7	70.2	46.3	377.1
1973	20.2	0	0	0	0	0	5	66.4	85.2	88.2	74.6	49.3	388.9
1974	24.5	0	0	0	0	0	6.8	61.9	86.5	90.9	67.7	52.4	390.7
1975	26.3	0	0	0	0	0	0	21.1	80.9	86.6	70.6	55	340.5
1976	28.2	0	0	0	0	0	0	41.8	61	85	52.1	45.2	313.3
1977	29.3	1.3	0	0	0	0	16	52.7	66.2	73.7	51.5	33.3	324
1978	18.8	0	0	0	0	0	7.2	43.2	68.5	74.1	58.1	39.9	309.8
1979	31.4	0	0	0	0	0	4.2	59.5	72.1	76.6	58.3	48.7	350.8
1980	26.9	0	0	0	0	0	3	39.9	61.5	80.5	57.4	42.8	312
1981	21.6	0	0	0	0	0	5.8	37.6	65.2	77.8	62.2	52.1	322.3
1982	18.6	0.1	0	0	0	0	4.6	44.9	57.4	65.9	54	38.9	284.4
1983	17.4	0	0	0	0	0	10.3	38.5	58.7	65.3	52.1	45.6	287.9
1984	19.3	0	0	0	0	0	3.9	37.4	54.5	62.2	44.8	41.7	263.8
1985	22.1	0	0	0	0	0	5.9	48.7	65.1	68.8	54.6	37	302.2
1986	16.8	0	0	0	0	0	12.9	43	61.1	59.9	49.3	37.2	280.2
1987	19.7	0	0	0	0	0	22.7	59.7	68.3	61.9	54.4	42.6	329.3
1988	19.7	0	0	0	0	0	20.7	61.3	71.5	64	51	29	317.2
1989	20.5	0	1.2	0	0	0	13.6	59.4	67.2	71	53.6	41.8	328.3
1990	19.1	0	0	0	0	0	23.8	55	64.9	72.8	55.8	46.2	337.6
1991	20.2	0	0	0	0	0	14.4	37	66.3	72.5	57.2	44.5	312.1
1992	21.1	0	0	0	0	0	25.1	69.6	64.9	55.7	34.9	30.3	301.6
1993	4.5	0	0	0	0	0	2.6	37.3	53.4	68.3	49.1	39.7	254.9
1994	20.4	0	0	0	0	0	19.9	61.9	75.4	74.5	56.7	46	354.8
1995	13.7	0	0	0	0	0	23.9	48.7	49.3	67.6	55.6	48.2	307
1996	26	0	0	0	0	0	23.6	55.3	66.5	66.7	57.2	46.2	341.5
1997	29.5	0	0	0	0	0	18.8	57.1	62	63.6	50.1	45.5	326.6
1998	22.1	0	0	0	0	0	28.1	57.1	59.4	73.2	58.4	45.6	343.9
1999	17.5	0	0	0	0	0	22.3	49.7	58.3	74.5	61.1	52.9	336.3
2000	38.6	0	0	0	0	0	39.6	63.5	74	73.9	62.9	47.9	400.4
2001	23.4	0	0	0	0	0	15.5	62.1	66.1	61.1	35.4	19.9	283.5
2002	0	0	0	0	0	0	5.4	53.8	67.9	64.9	52.5	21.6	266.1
2003	0.6	0	0	0	0	0	29.7	59.3	78.1	70.1	25.4	19.2	282.4
2004	0	0	0	0	0	0	18.3	62.5	65.1	62.3	50	36.2	294.4
2005	0	0	0	0	0	0	9.1	47.3	65.1	71.7	54.4	46.5	294.1

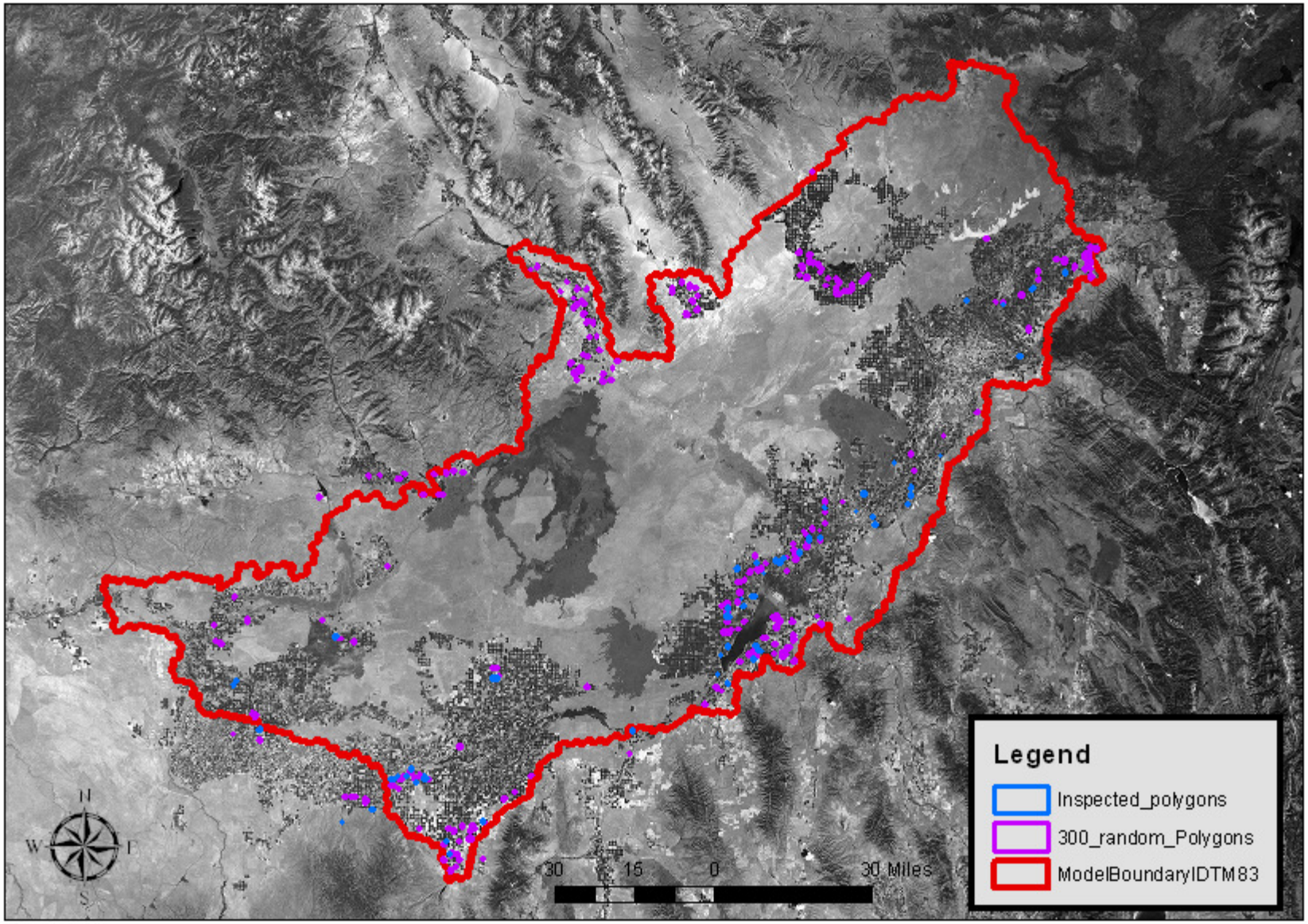


Figure 1 from report

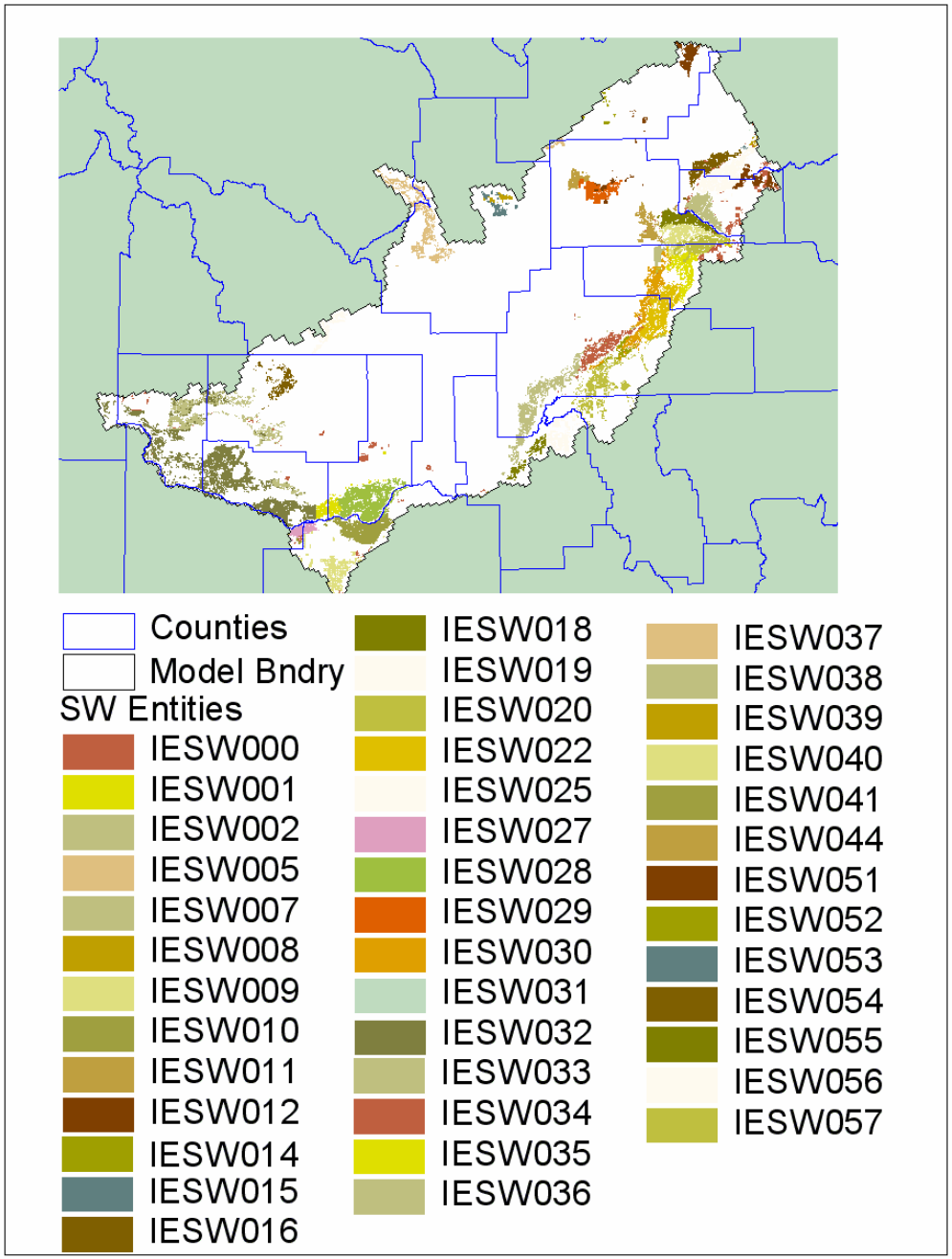


Figure 3 from report

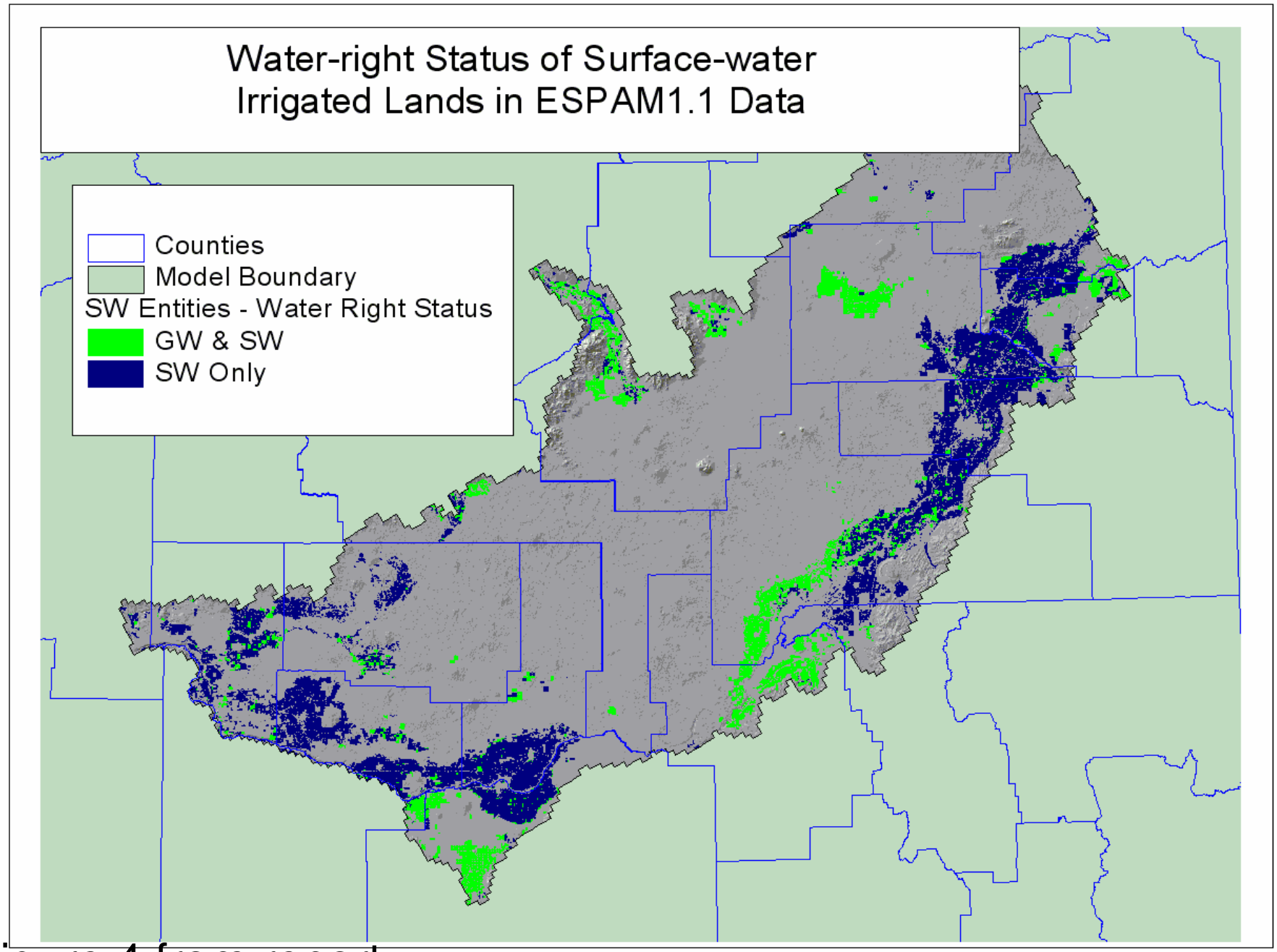


Figure 4 from report

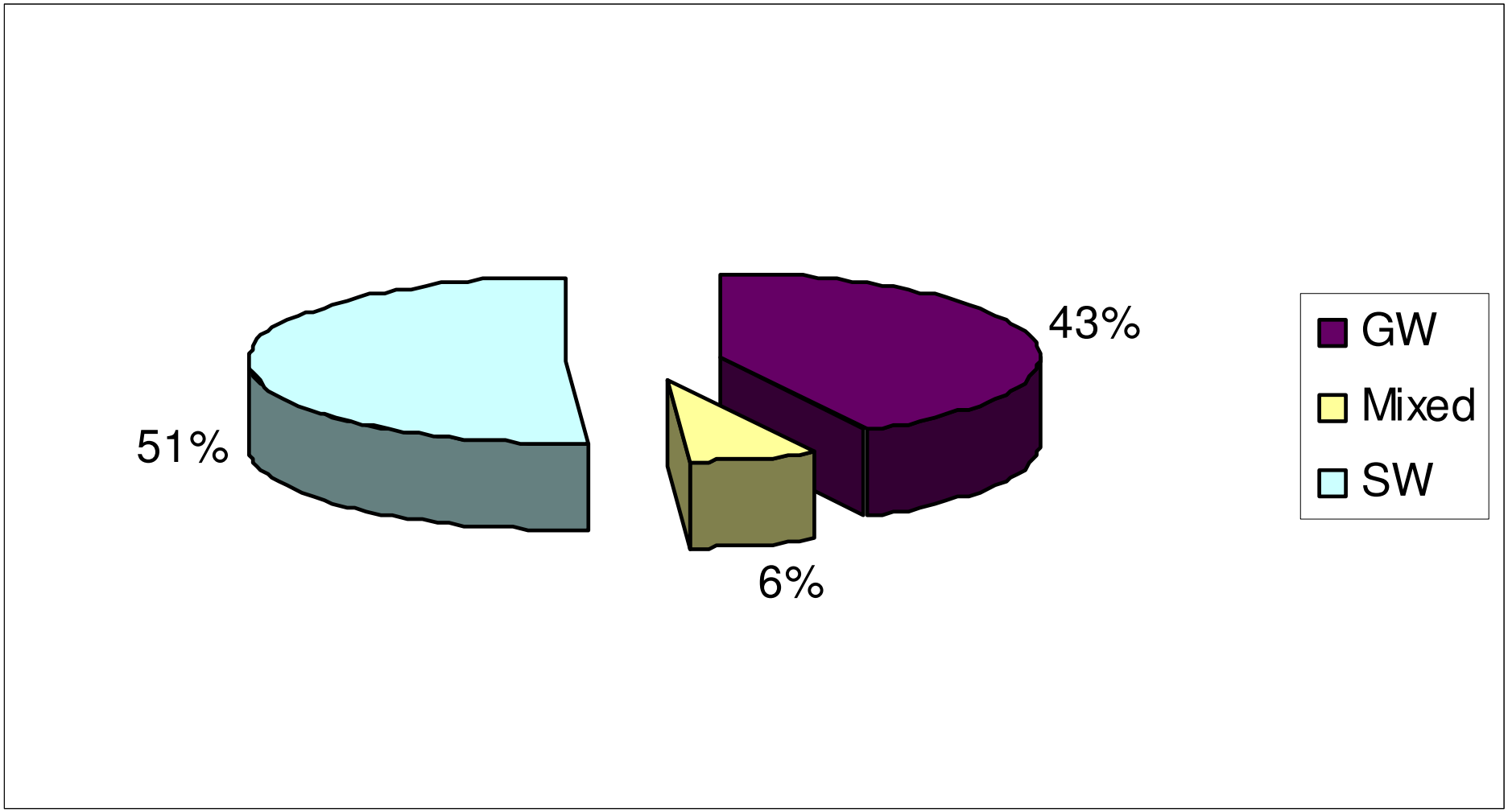
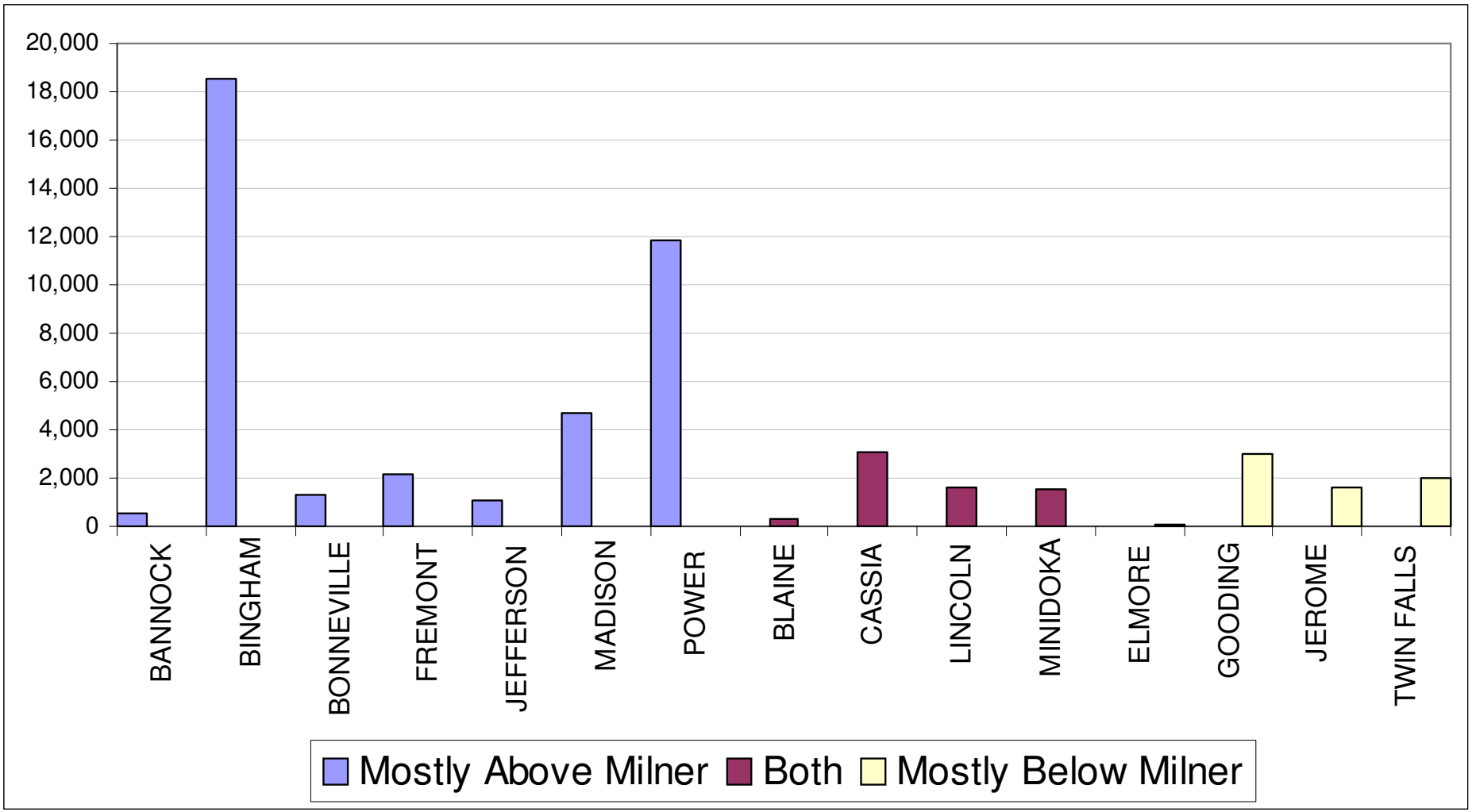


Figure 5 from report


20,000
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BANNOCK
BINGHAM
BONNEVILLE
FREMONT
JEFFERSON
MADISON
POWER
BLAINE
CASSIA
LINCOLN
MINIDOKA
ELMORE
GOODING
JEROME
TWIN FALLS
Mostly Above Milner
Both
Mostly Below Milner

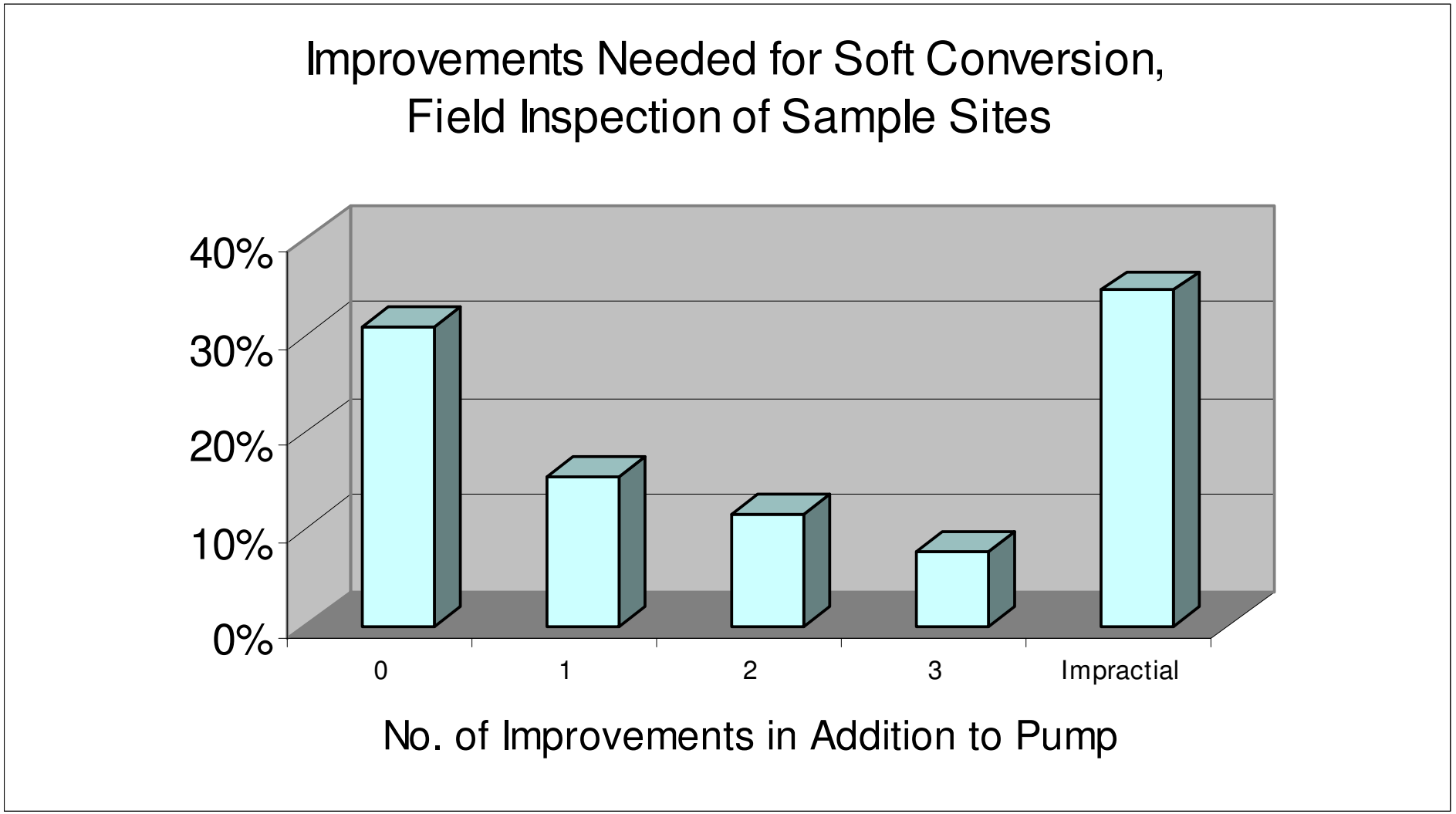

Figure 6 from report

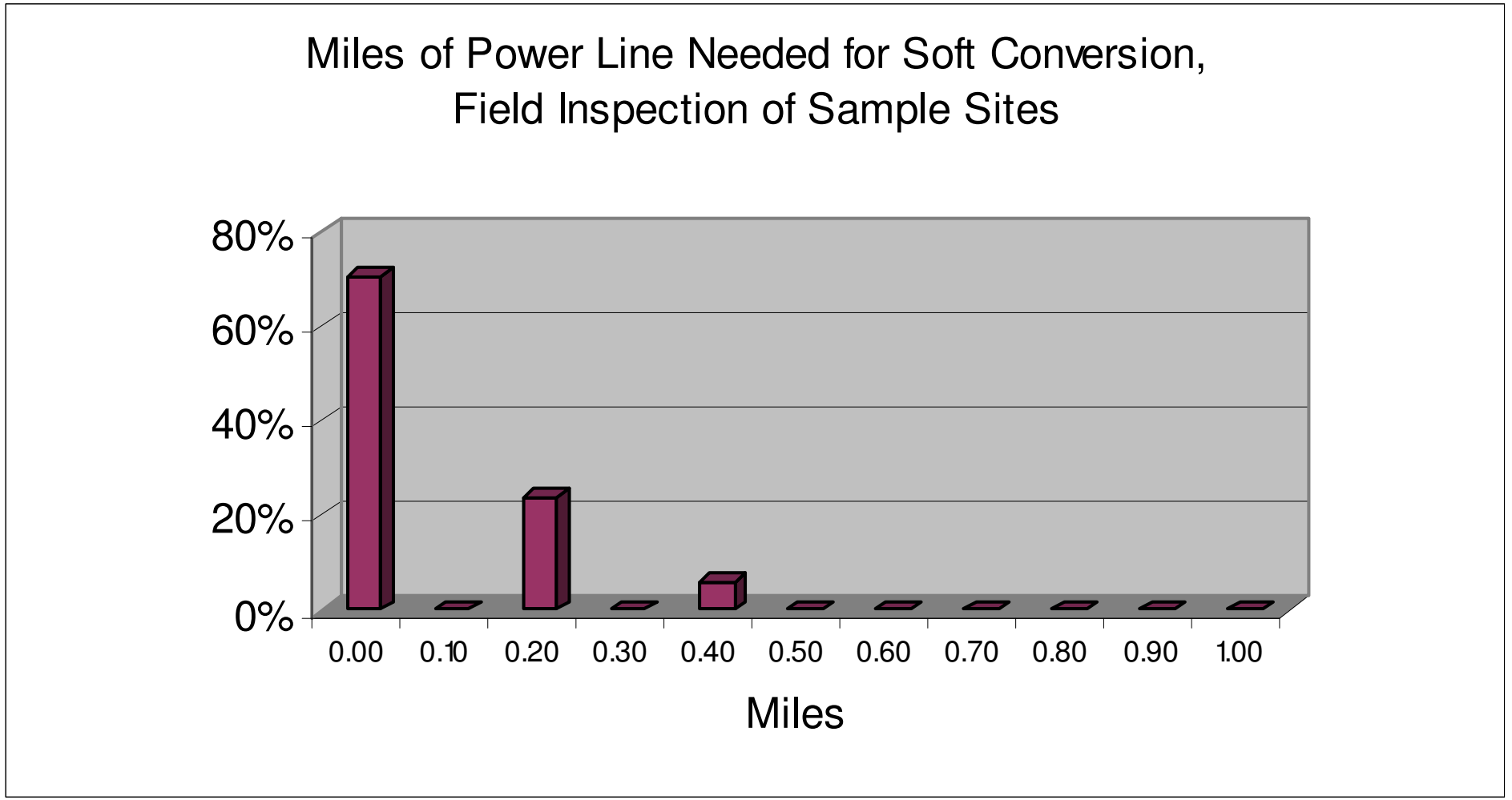

Figure 7 from report

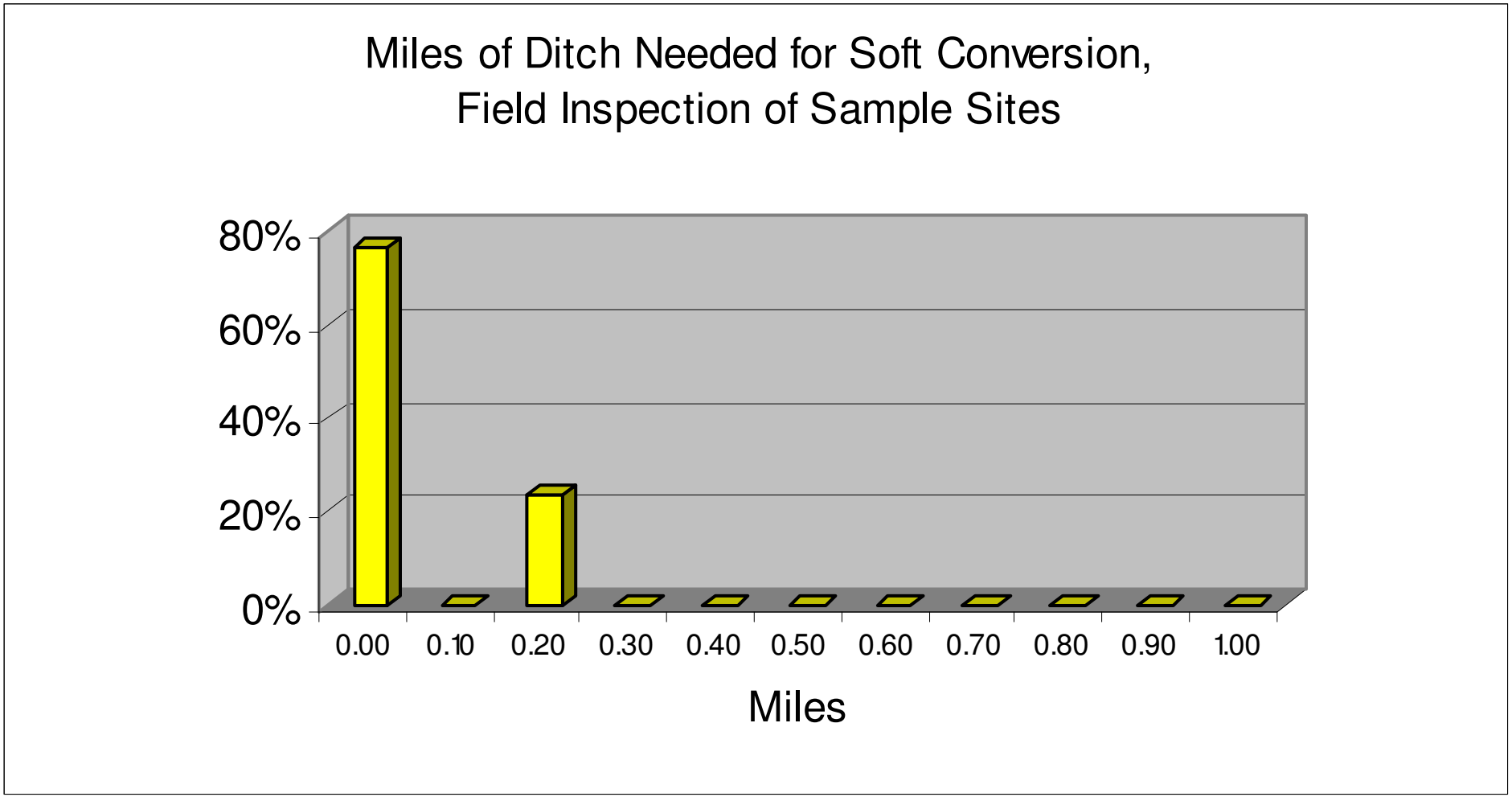

Figure 8 from report

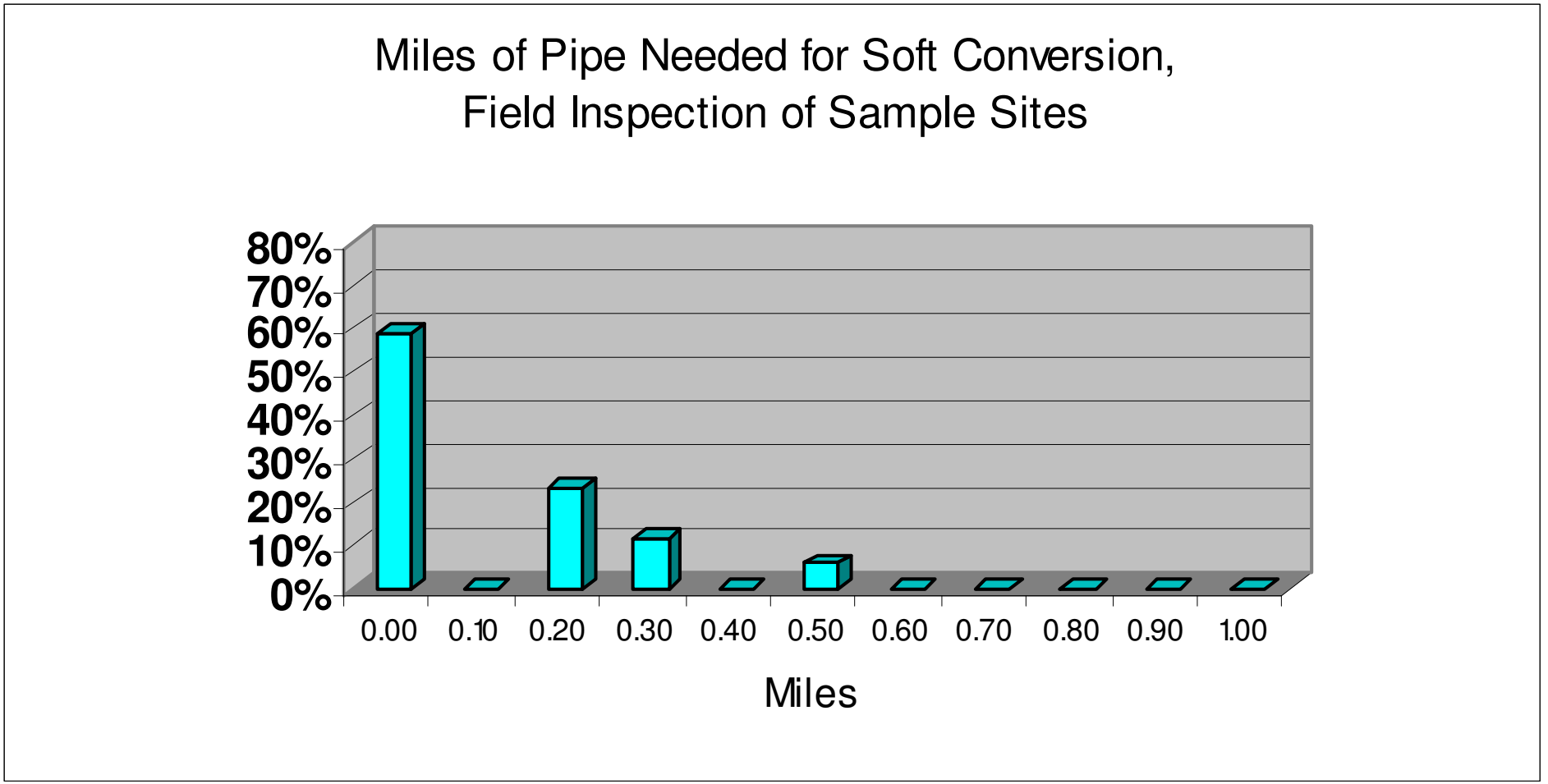

Figure 9 from report

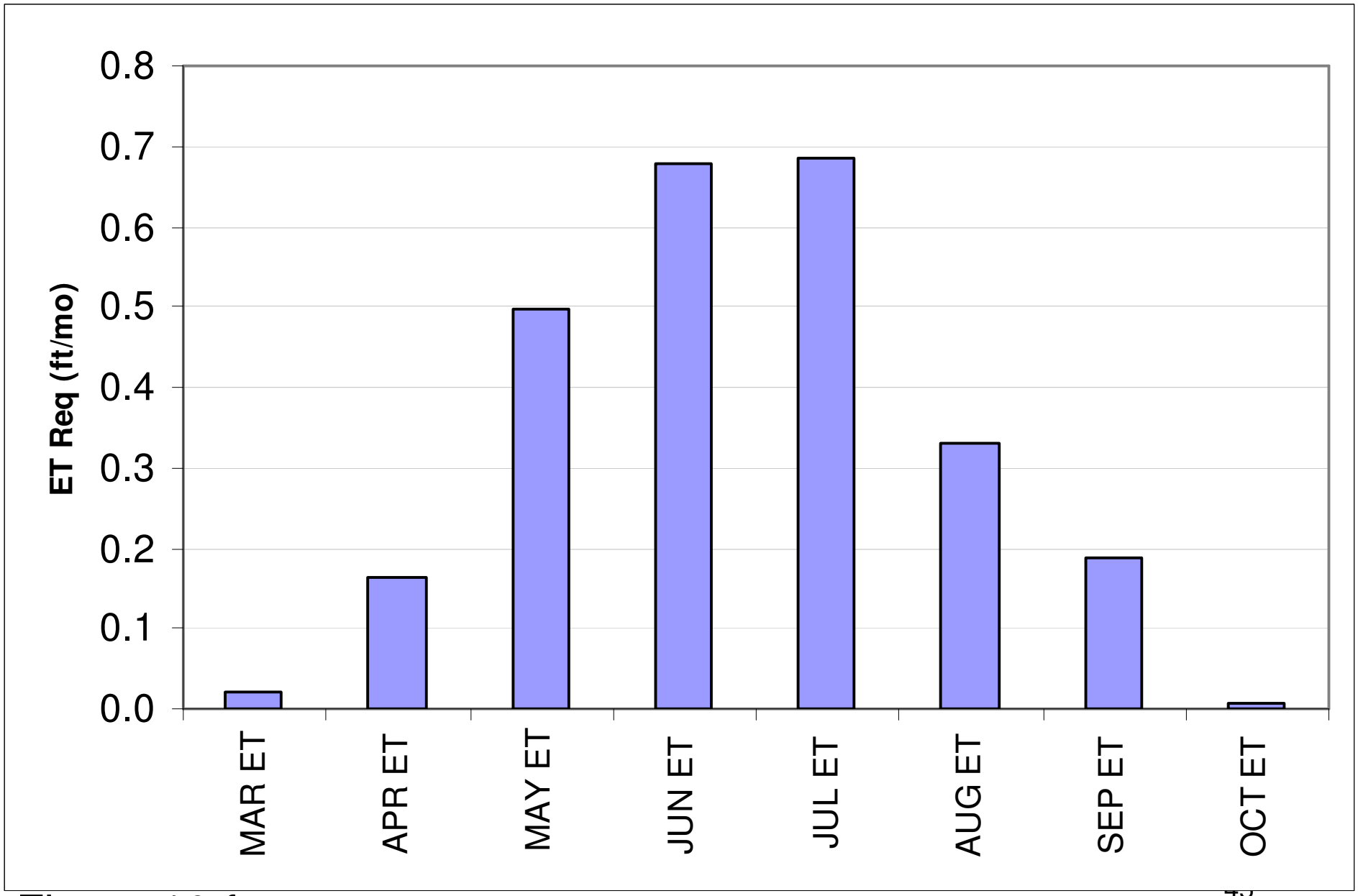

Figure 10 from report

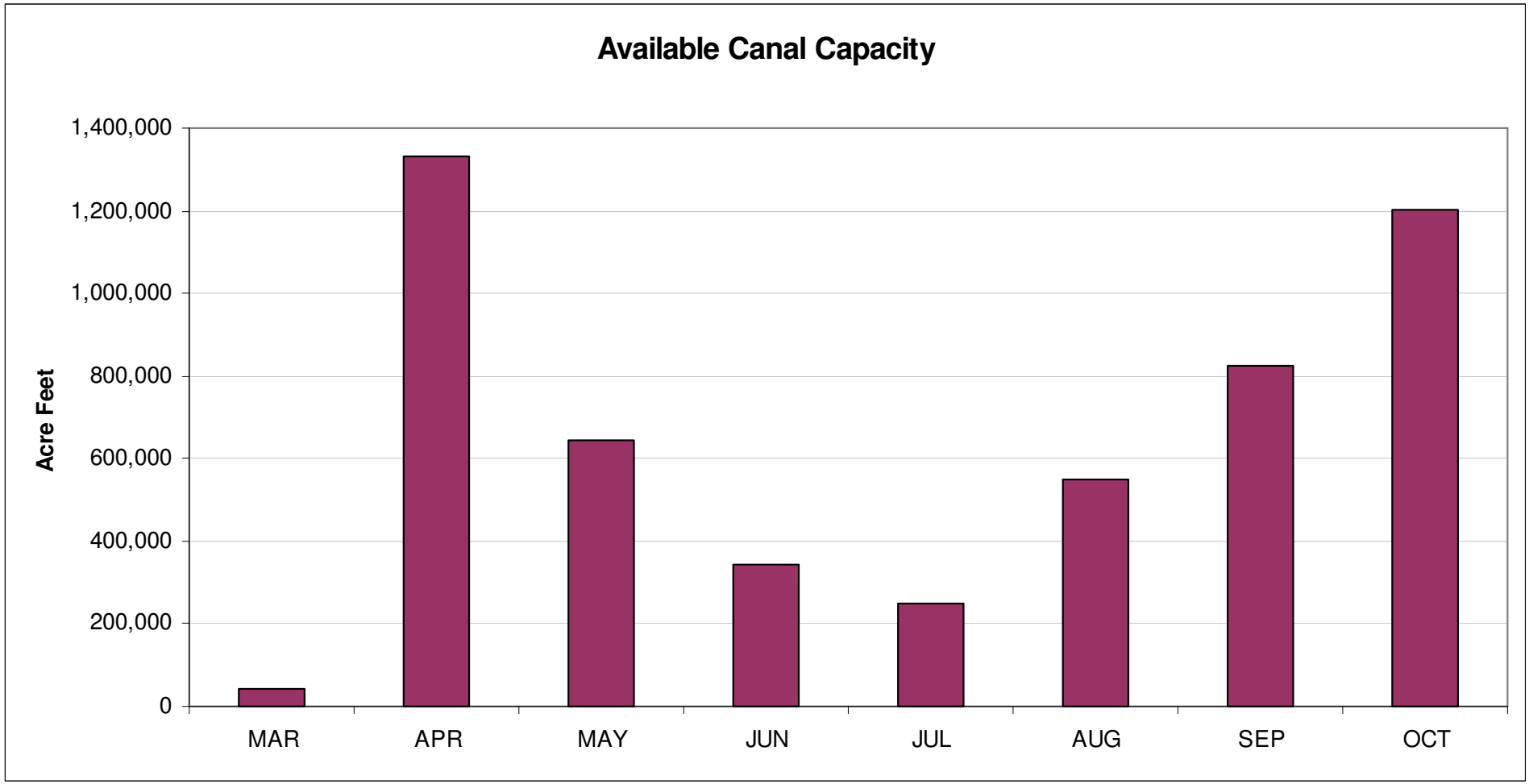

Figure 11 from report

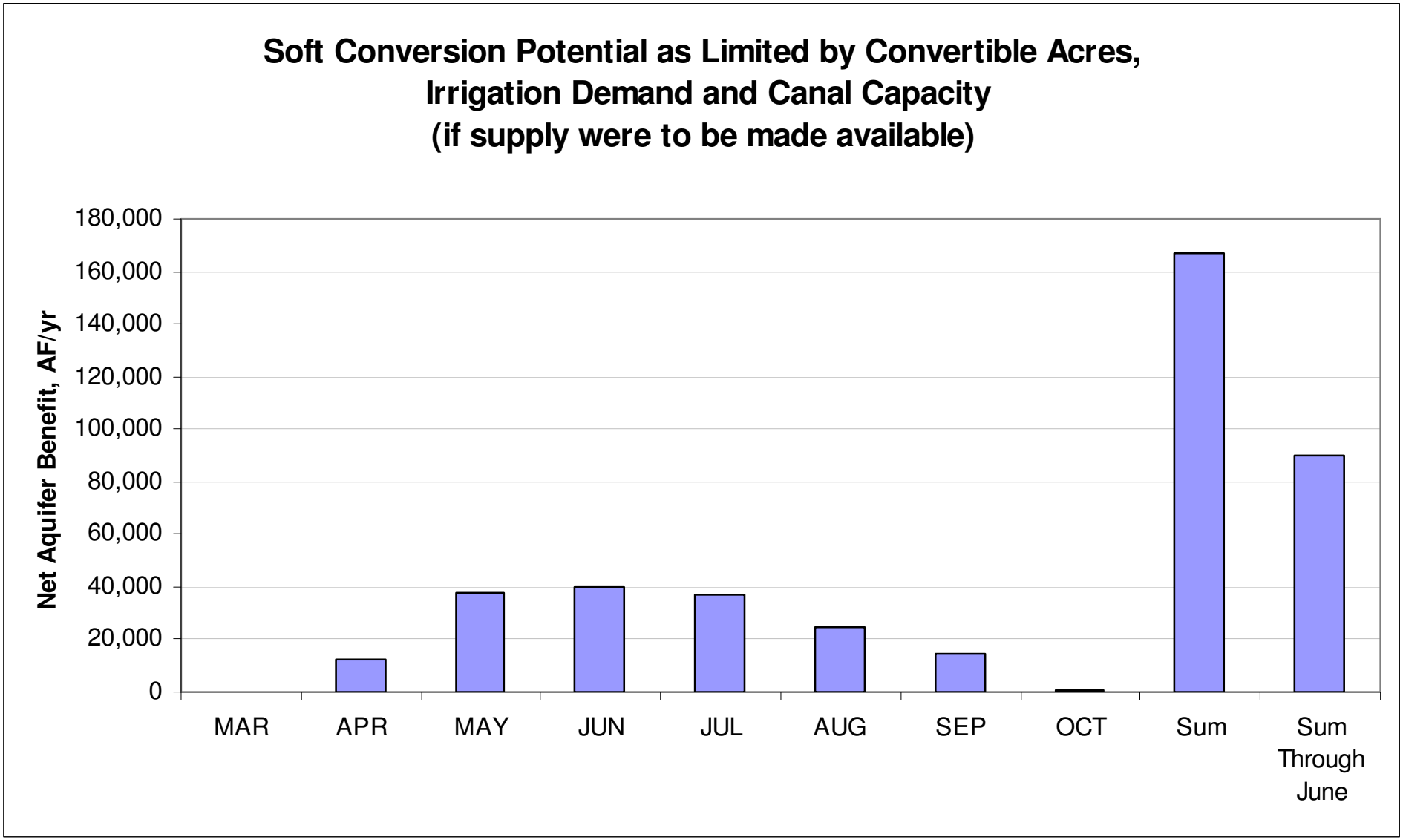

Figure 12 from report

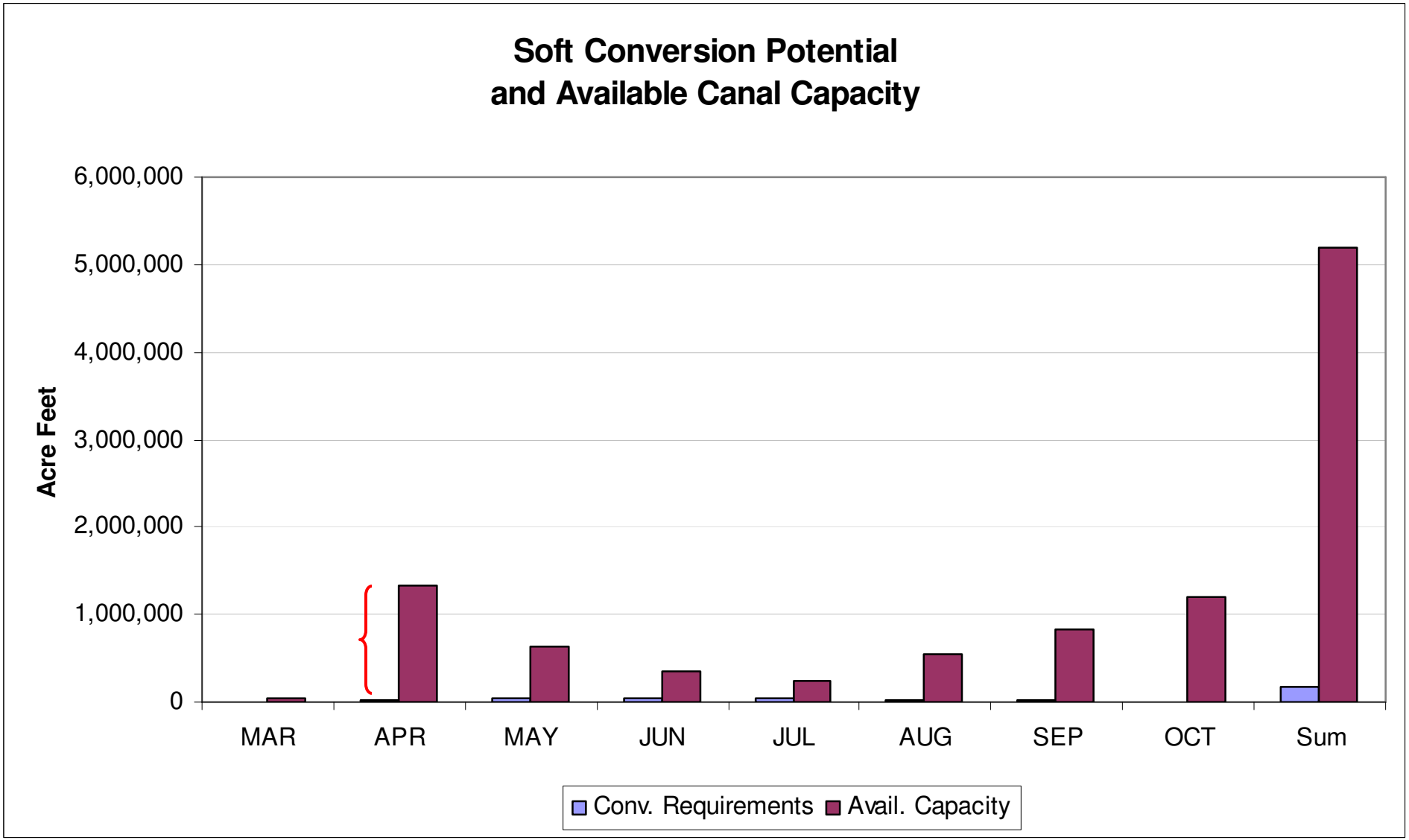

Figure 14 from report

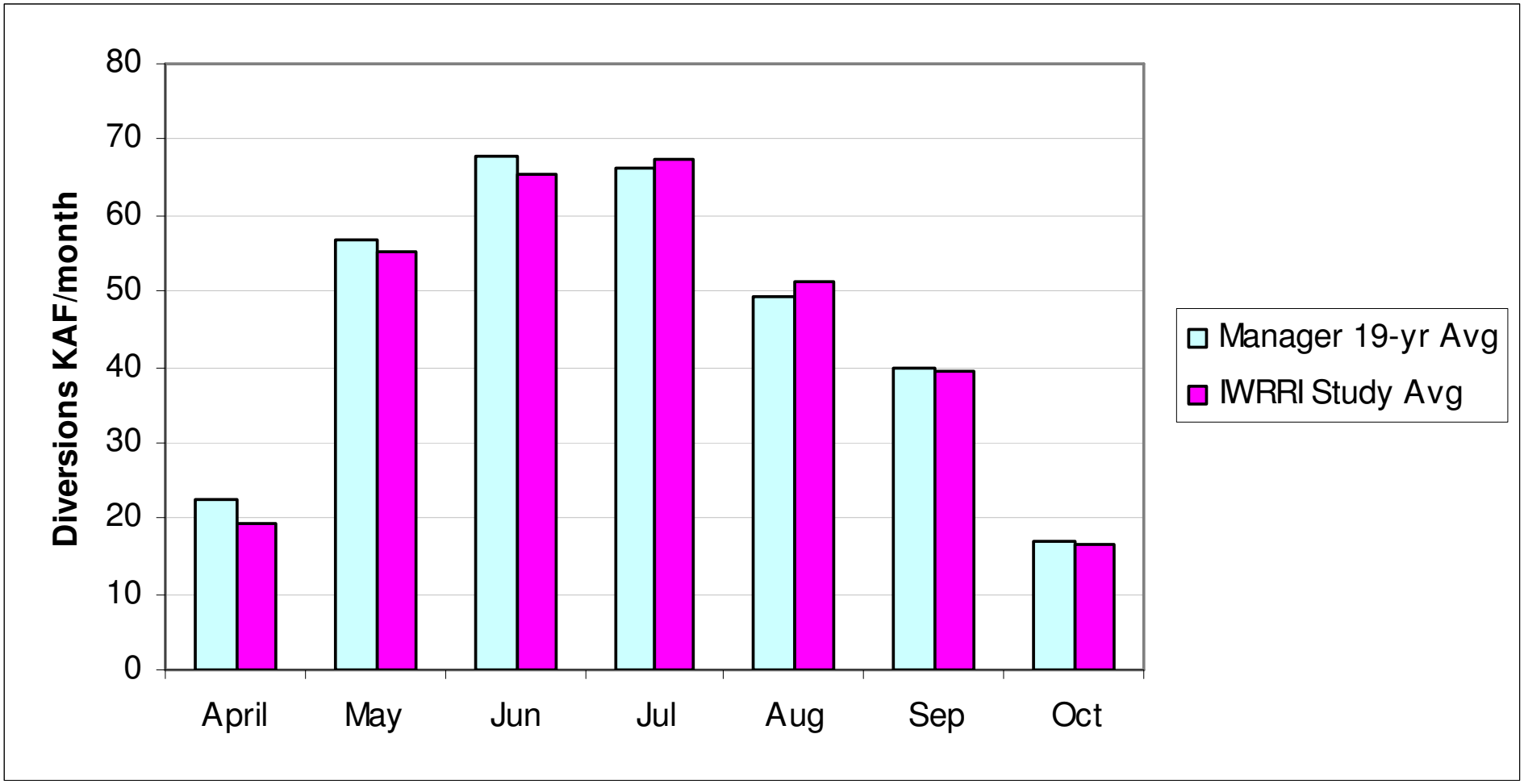

Figure 15 from report

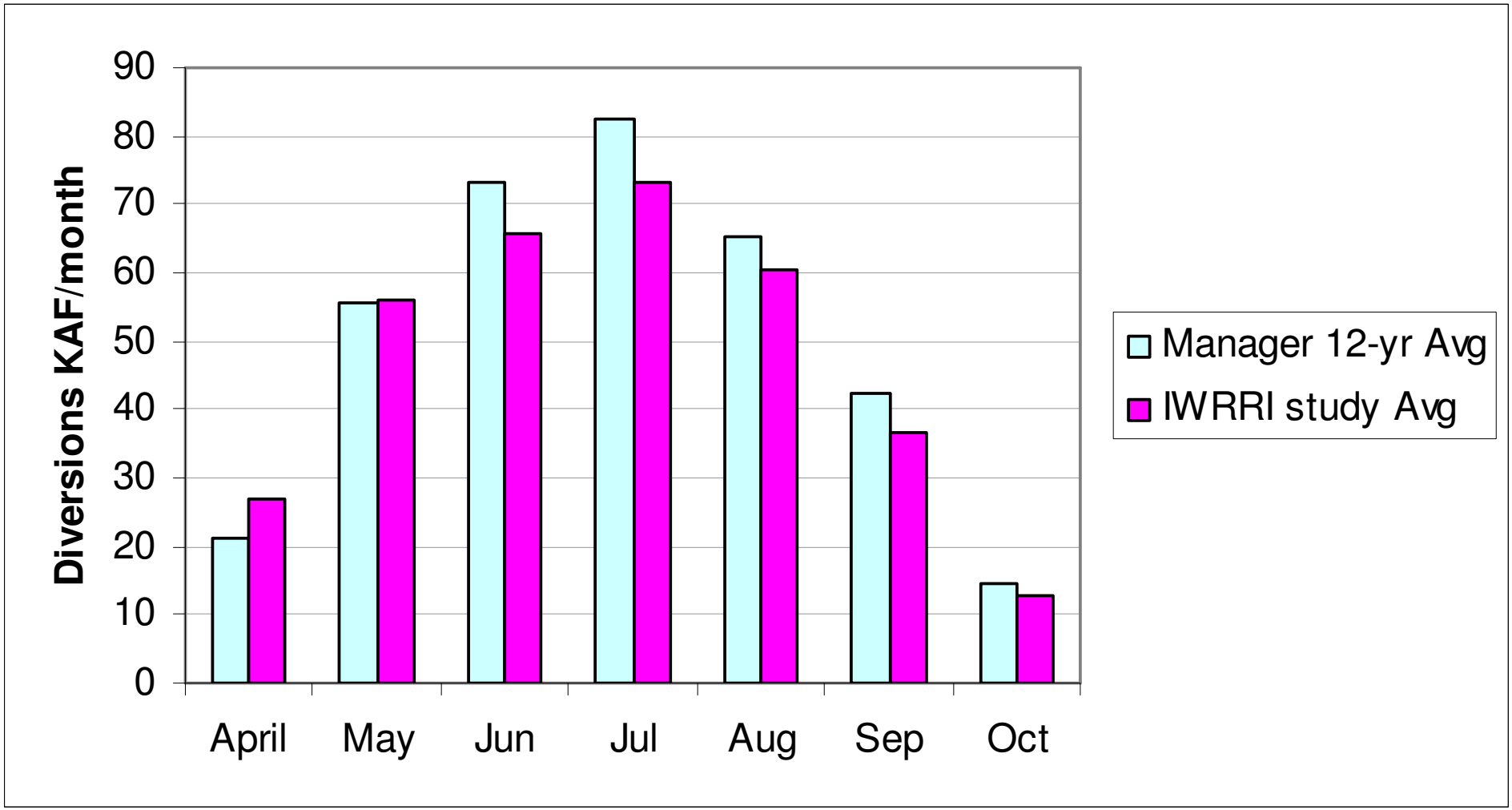

Figure 16 from report

Table 1
Infrastructure Improvements Needed
for Soft Conversion of 53,000 Acres (410 sites)
Within the Eastern Snake Plain Aquifer

Improvement	**Number**	**Approximate Cost**
Pumping plant	410	$9,060,000
3-phase power line	29 miles	$3,220,000
Earthen ditch	19 miles	$150,000
Buried pipeline	46 miles	$2,470,000
Total cost		$14,900,000
Average cost/site		$36,500

Table 1 from report

Table 2
Soft-conversion Convertible Acres
by Surface-water Irrigation Entity

Entity	Acres	Entity	Acres	Entity	Acres
IESW001	112	IESW018	4,317	IESW034	4,924
IESW002	19,020	IESW019	2,471	IESW035	448
IESW007	3,310	IESW020	495	IESW036	623
IESW009	555	IESW022	2,627	IESW038	60
IESW010	1,976	IESW027	932	IESW039	280
IESW011	302	IESW028	634	IESW055	241
IESW012	1,508	IESW030	1,562	IESW056	762
IESW014	753	IESW031	0		
IESW015	0	IESW032	4,157		
IESW016	695	IESW033	72		

Table 2 from report

Table 3
Average Percentage of Irrigation Requirement
for Soft Conversions that Can Be Served
With Available Unused Canal Capacity

Entity	Apr	May	Jun	Jul	Aug	Sep	Oct
ESW001	100%	100%	100%	100%	100%	100%	100%
ESW002	100%	100%	***37%***	***27%***	100%	100%	100%
ESW007	100%	100%	100%	100%	100%	100%	100%
ESW009	100%	100%	100%	100%	100%	100%	100%
ESW010	100%	100%	100%	100%	100%	100%	100%
ESW011	100%	100%	100%	100%	100%	100%	100%
ESW012	100%	100%	100%	100%	100%	100%	100%
ESW014	100%	100%	100%	100%	100%	100%	100%
ESW015	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ESW016	100%	100%	100%	100%	100%	100%	100%
ESW018	100%	100%	***31%***	***27%***	100%	100%	100%
ESW019	100%	100%	100%	100%	100%	100%	100%
ESW020	100%	100%	100%	100%	100%	100%	100%
ESW022	100%	100%	100%	100%	100%	100%	100%
ESW027	100%	100%	100%	100%	100%	100%	100%
ESW028	100%	100%	100%	100%	100%	100%	100%
ESW030	100%	100%	100%	100%	100%	100%	100%
ESW031	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ESW032	100%	100%	100%	100%	100%	100%	100%
ESW033	100%	100%	100%	100%	100%	100%	100%
ESW034	100%	100%	100%	100%	100%	100%	100%
ESW035	100%	100%	100%	100%	100%	100%	100%
ESW036	100%	100%	100%	100%	100%	100%	100%
ESW038	100%	100%	100%	100%	100%	100%	100%
ESW039	100%	100%	100%	100%	100%	100%	100%
ESW055	100%	100%	100%	100%	100%	100%	100%
ESW056	100%	100%	100%	100%	100%	100%	100%

Table 3 from report

Table A1
Cost Estimates to Develop One Site

Item	**Cost**
100hp pump with screen and panel	$14,250
3 - phase power using 350mcm wire	$19,000
1320 feet of 6" PVC mainline	$7,000
Installation cost	$10,000
Plus 20% contingency fee on equipment	$8,050
Total	$58,300

Table A1 from report

Table A2
Adjusted Per-improvement Unit Costs

Item	**Base Estimate**	**Pump Only**	**Power Line**	**Mainline**	**Ditch**
Pumping Plant	$14,250	$14,250			
Power	$19,000		$19,000		
Mainline	$7,000			$7,000	
Ditch[1]	$2,000				$2,000
Installation	$10,000	$5,000	$5,000	$5,000	
Contingency (20%)	$8,050	$2,850	$3,800	$1,400	
Total	$60,300	$22,100	$27,800	$13,400	$2,000
Unit		Site	Mile	Mile	Mile
Units in Base Estimate		1	0.25	0.25	0.25
Per Unit		$22,100	$111,200	$53,600	$8,000

Table 1 in the body of the text applies the per-unit costs from Table A2, rounding the total to the nearest $10,000.

Table A2 from report