Map of the Republican River Basin above Hardy, Nebraska

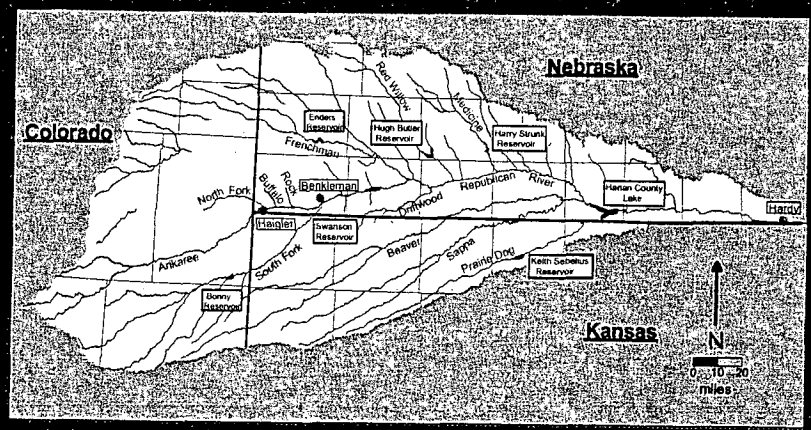

Figure 1

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Map of Ground Water System Associated with the Republican River above Hardy, Nebraska

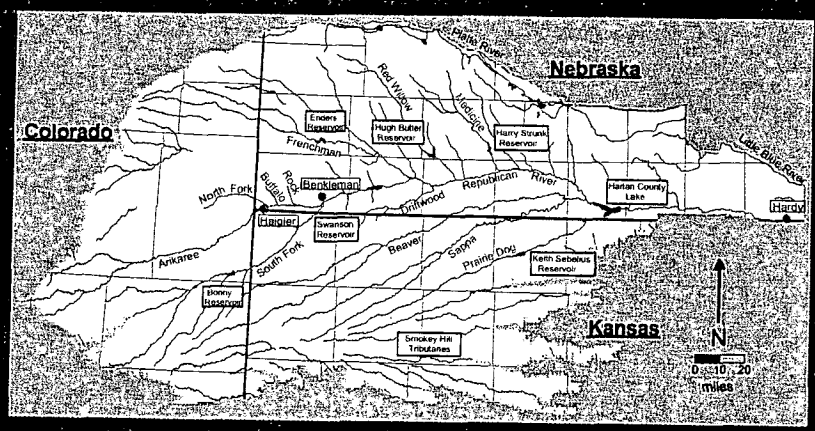

Figure 2

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Map Showing Counties and Nebraska NRDs

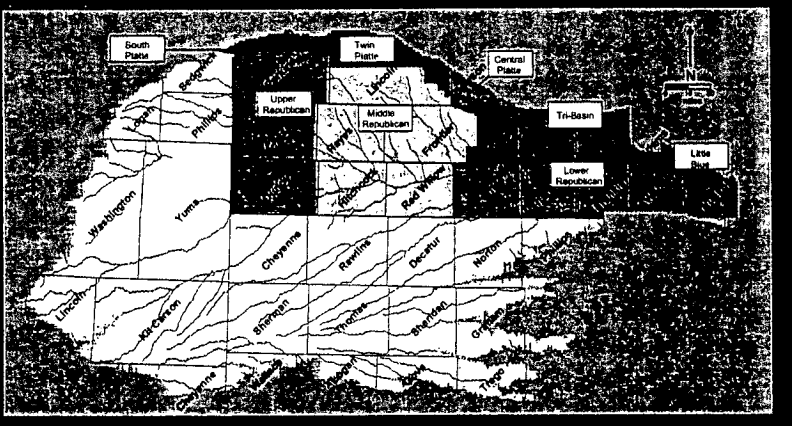

Figure 3

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Inflows and Outflows

Water Enters the System From:

- **Precipitation**
- **Rivers**

Water Exits the System To:

- **Rivers**
- **ET**

Figure 4

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Ground Water Inflows

Annual Average Amount in acre-feet (RRCA Model, July 1, 2003)

Years	Inflows					
	Recharge from Precipitation	Recharge from Excess GW Irrigation	Recharge from Excess SW Irrigation	Recharge from Canal Seepage	Recharge from Rivers	Decrease in Storage
1921-1930	1,440,697	0	0	0	222,780	424,581
1931-1940	601,512	1,264	421	15,996	229,750	632,529
1941-1950	1,916,460	15,262	47,777	632,988	208,071	467,162
1951-1960	1,283,039	69,083	99,152	652,719	207,269	812,763
1961-1970	1,479,667	237,718	102,332	598,784	230,134	1,217,401
1971-1980	1,452,260	595,112	111,638	665,139	236,637	2,511,248
1981-1990	1,740,645	572,102	101,767	623,134	233,679	2,309,917
1991-2000	1,998,741	498,803	86,742	607,402	234,982	2,221,763

Figure 5

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Ground Water Outflows

Annual Average Amount in acre-feet (RRCA Model, July 1, 2003)

Years	Outflows				
	Discharge to ET	Discharge to Rivers	Discharge to Wells	Increase in Storage	Net Increase in Storage
1921-1930	477,250	680,748	6,227	923,836	499,255
1931-1940	460,743	671,008	10,059	339,611	-292,918
1941-1950	466,106	1,023,047	52,441	1,746,297	1,279,135
1951-1960	502,402	1,158,687	227,993	1,234,618	421,855
1961-1970	542,580	1,149,087	898,512	1,276,170	58,769
1971-1980	493,572	1,109,996	2,553,584	1,414,830	-1,096,418
1981-1990	487,373	1,085,347	2,595,959	1,412,304	-897,613
1991-2000	470,615	1,053,612	2,537,878	1,586,317	-635,446

Figure 6

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INCREASE IN STORAGE - MOUND

Aquifer Hydraulic Conductivity Distribution Established by Model Calibration

RRCA Model, July 1, 2003

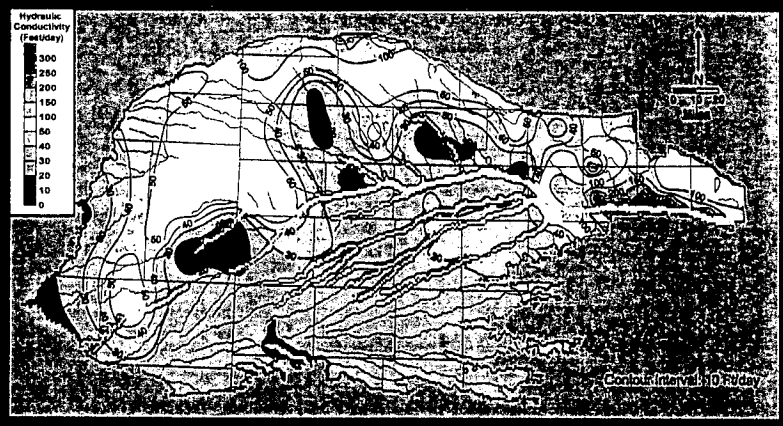

Figure 7

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Saturated Thickness Specified for Simulation Period

RRCA Model, July 1, 2003

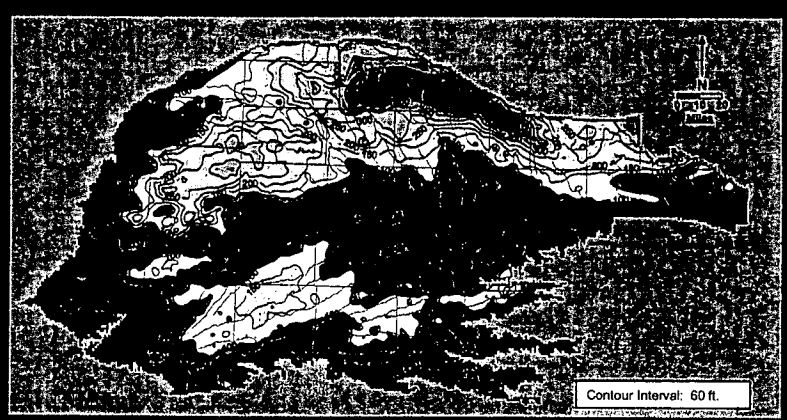

Figure 8

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Map Showing Precipitation Station Names

(Stations with Annual Averages from 1918-2000)

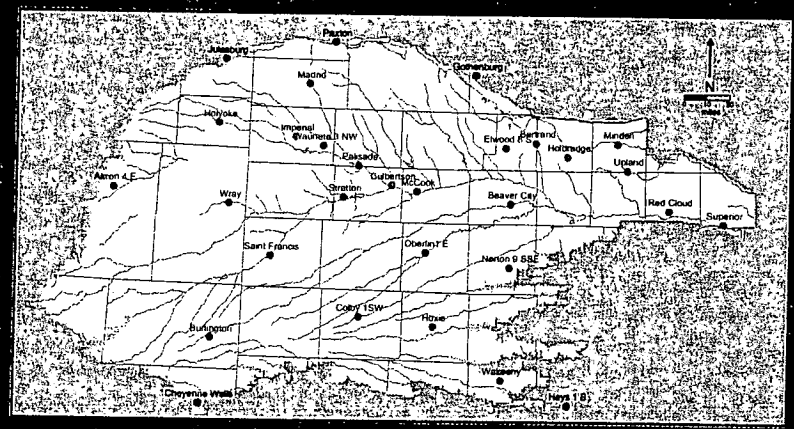

Figure 9

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Map Showing Average Precipitation from 1940 Through 2000

(Stations with Annual Averages from 1918-2000)

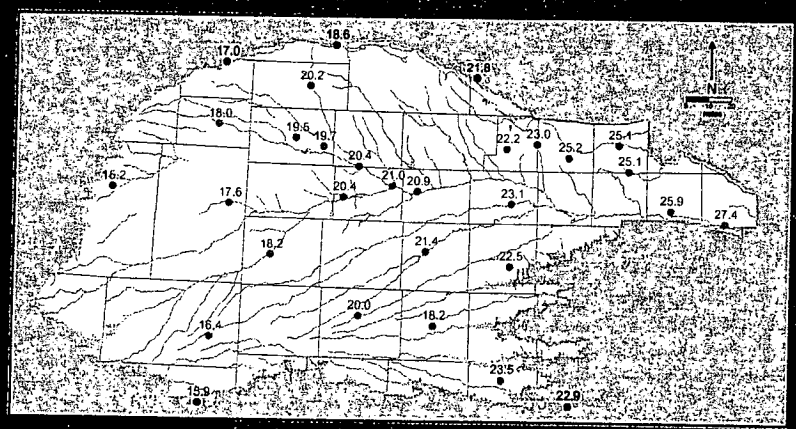

Figure 10

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Map Showing Average Precipitation from 1918 Through 1940

(Stations with Annual Averages from 1918-2000)

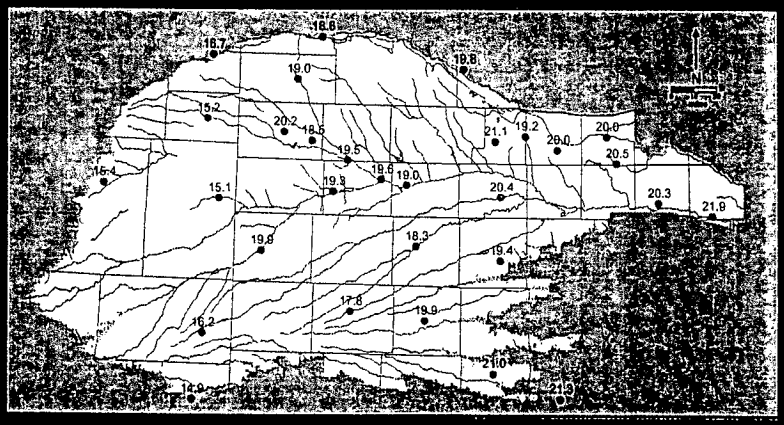

Figure 11

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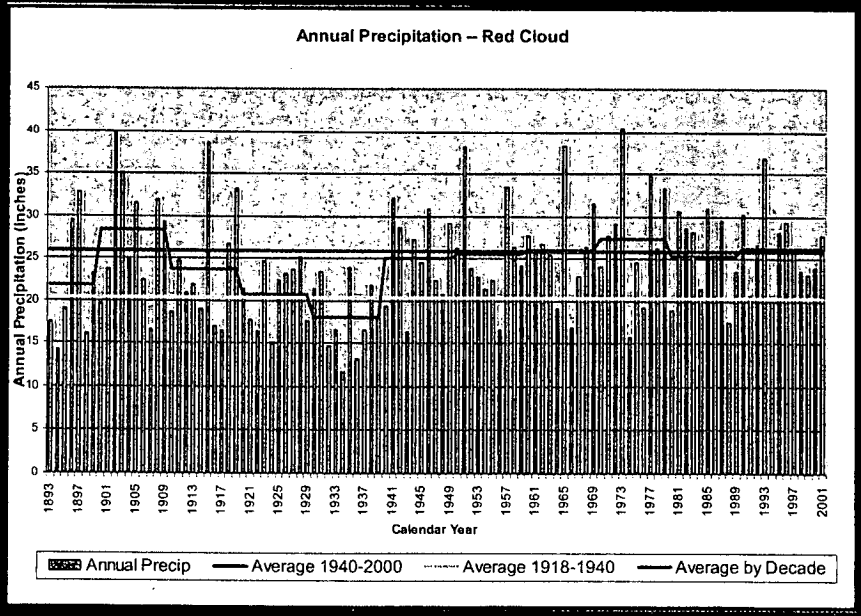

Figure 12

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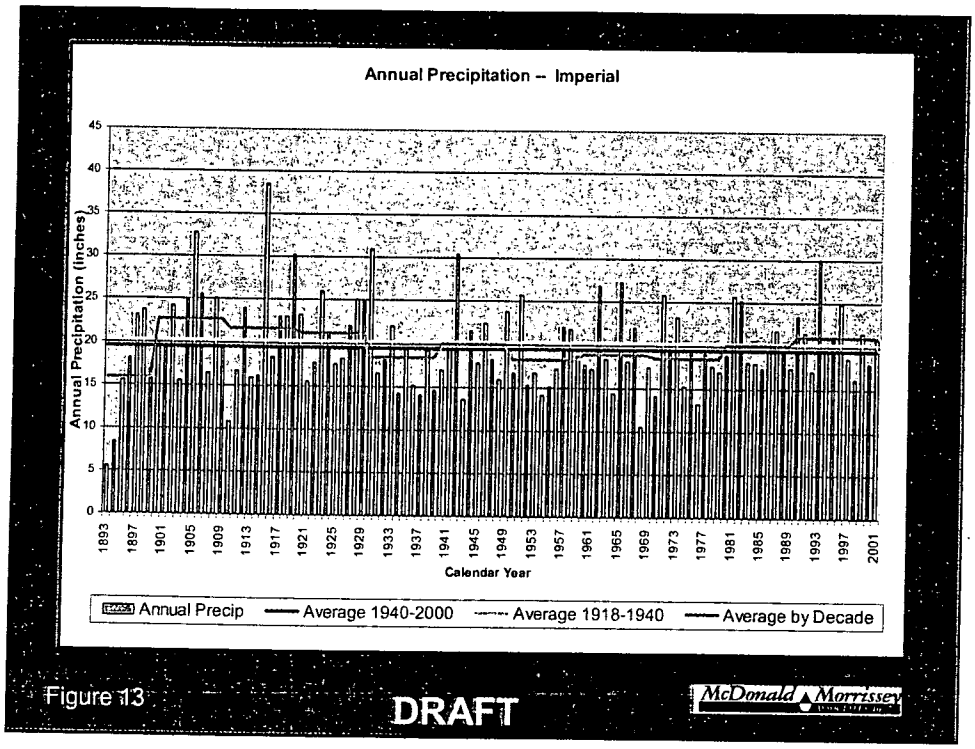
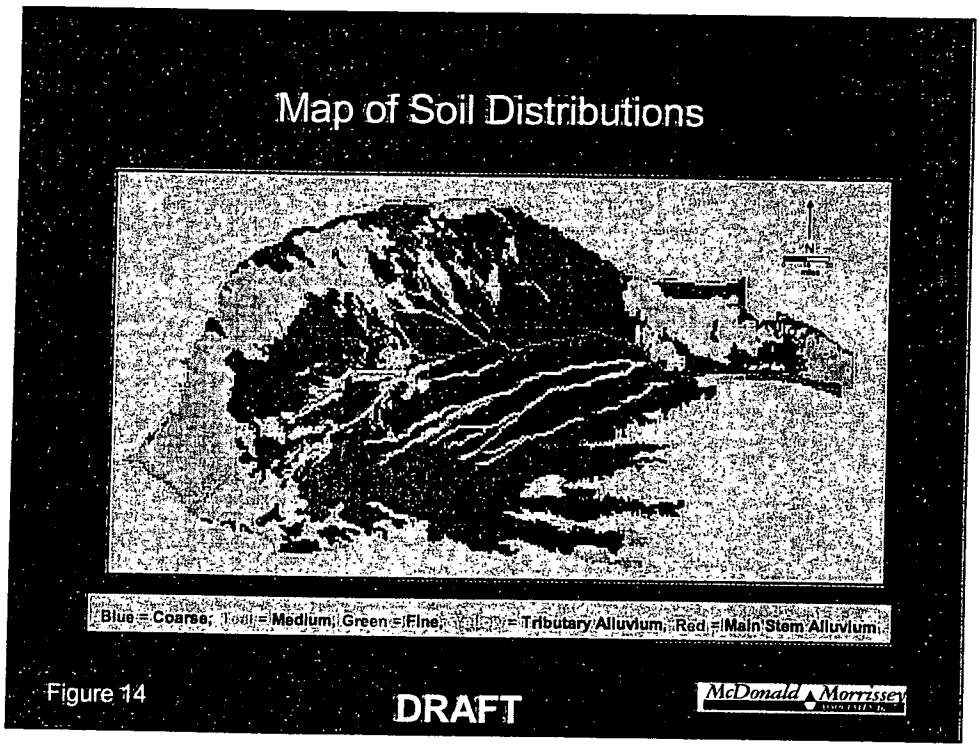

Annual Precipitation -- Imperial
Annual Precipitation (inches)
45
40
35
30
25
20
15
10
5
0
1893
1897
1901
1905
1909
1913
1917
1921
1925
1929
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
2001
Calendar Year
Annual Precip
Average 1940-2000
Average 1918-1940
Average by Decade
Figure 13
DRAFT
McDonald Morrissey


Map of Soil Distributions
Blue = Coarse, Tan = Medium, Green = Fine, = Tributary Alluvium, Red = Main Stem Alluvium
Figure 14
DRAFT
McDonald Morrissey

Map Showing Average Annual Recharge from Precipitation from 1940-2000 (Inches)

(RRCA Model, July 1, 2003)

Figure 15

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Location of Irrigation Wells in the Republican River Study Area as of 2000

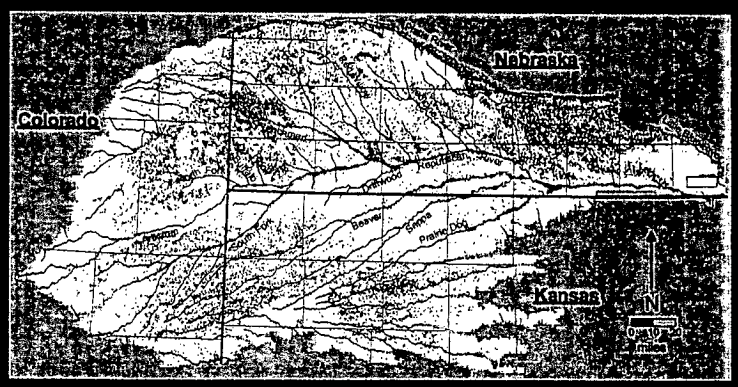

Figure 16

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Chart Showing Methods Used to Estimate Pumping by Three States

(RRCA Model, July 1, 2003)

Nebraska	Kansas	Colorado
Power records and well registration data used to determine volume pumped. Pumping distributed by county based on well records and irrigated acres.	Estimate Crop Irrigation Requirement (CIR) using ET, Precipitation and Cropping data. Compile well development history and cropping information. Use above to estimate pumping for 1940-1989 Water use data for pumping estimated for 1989-2000	GW Irrigated Acres (IGWA) determined from County Assessors and NASS Farm efficiencies (FE) estimated for various irrigation systems Crop water requirement (CIR) estimated with Hargreaves method County pumping is ((IGWA) x (CIR) x (fraction of CIR met)) / (FE)

Figure 17

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Map Showing Average Annual Recharge from Excess Irrigation by SW from 1940-2000 (Inches)

(RRCA Model, July 1, 2003)

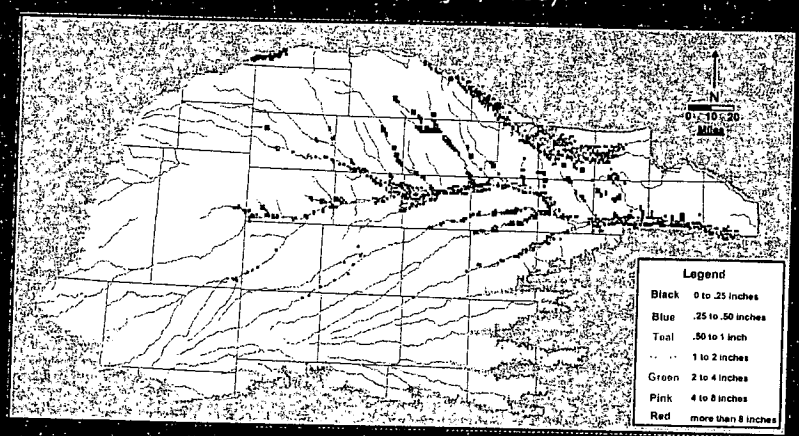

Figure 18

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Map Showing Distribution of Recharge from Excess Surface Water Irrigation from 1980-2000

(RRCA Model, July 1, 2001)

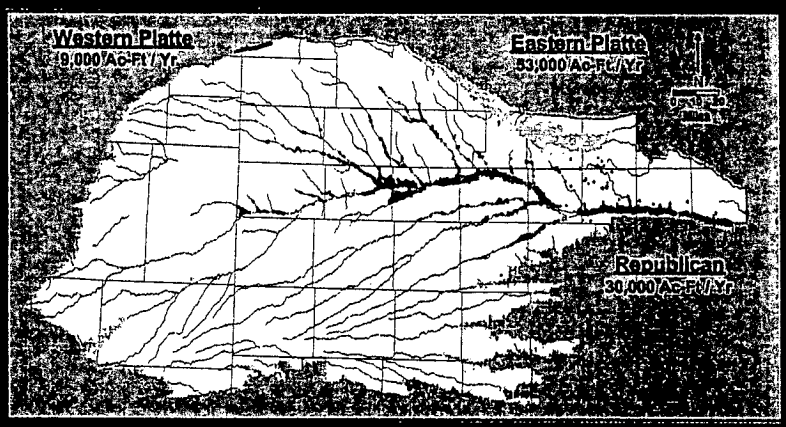

Figure 19

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CALCULATED BY DIFFERENCE BETWEEN UPSTREAM + DOWNSTREAM. SO ET ASSUMED = 0

Map Showing Average Annual Recharge from Canal Seepage from 1940-2000 (Inches)

(RRCA Model, July 1, 2003)

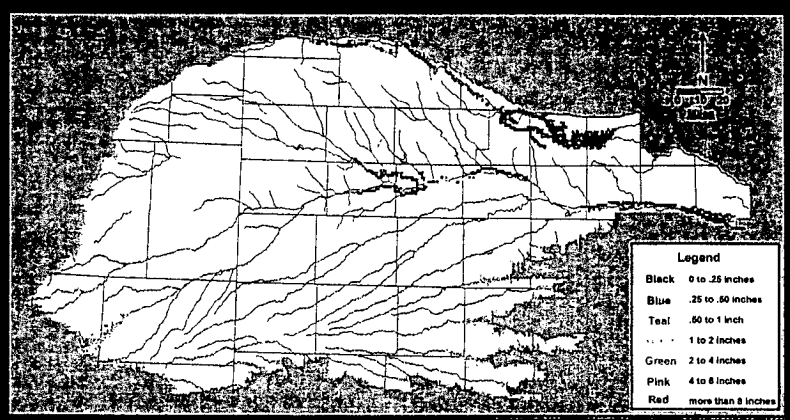

Figure 20

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Map Showing Canals and Average Seepage from 1980 to 2000

(RRCA Model, July 1, 2003)

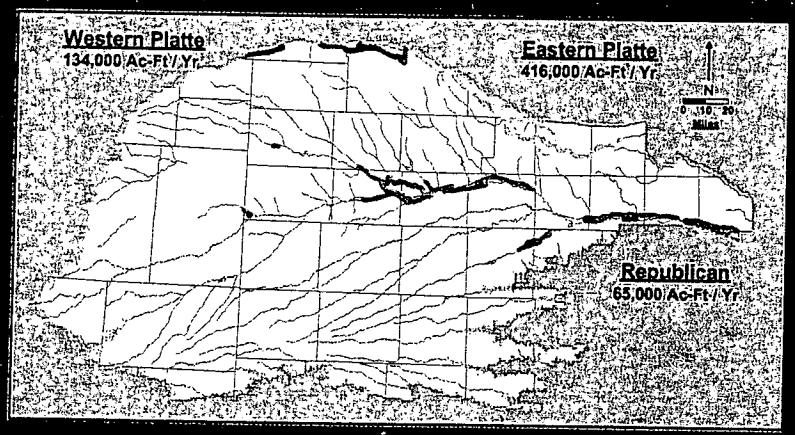

Figure 21

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Transmissivity

RRCA Model, July 1, 2003

Figure 22

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Map Showing Potentiometric Surface and Direction of Flow for the Pre-1918 Steady-State Condition

(RRCA Model, July 1, 2003)

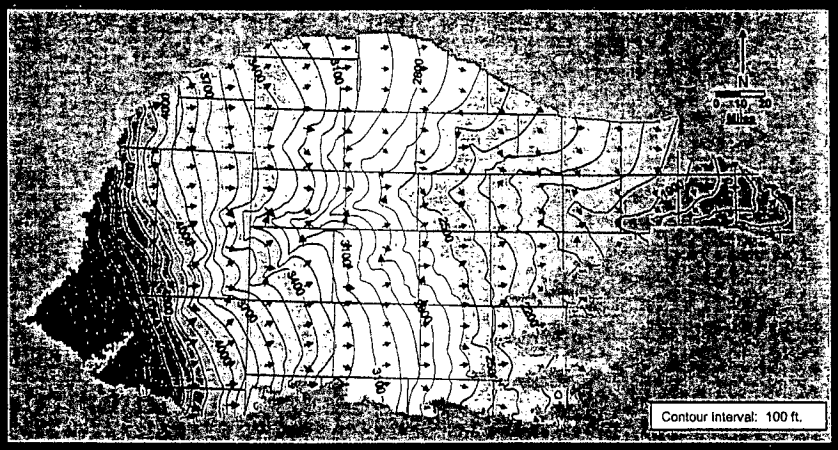

Figure 23

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Map Showing Distribution of Water Level Targets with Data Prior to 1940

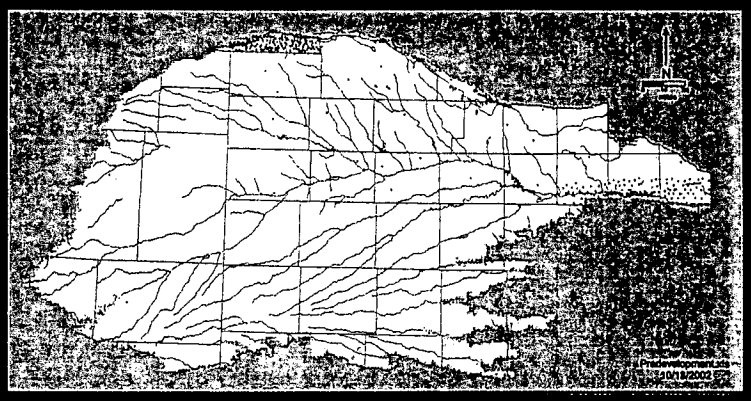

Figure 24

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Selected Water Level Hydrographs Showing Observed and Calculated Values

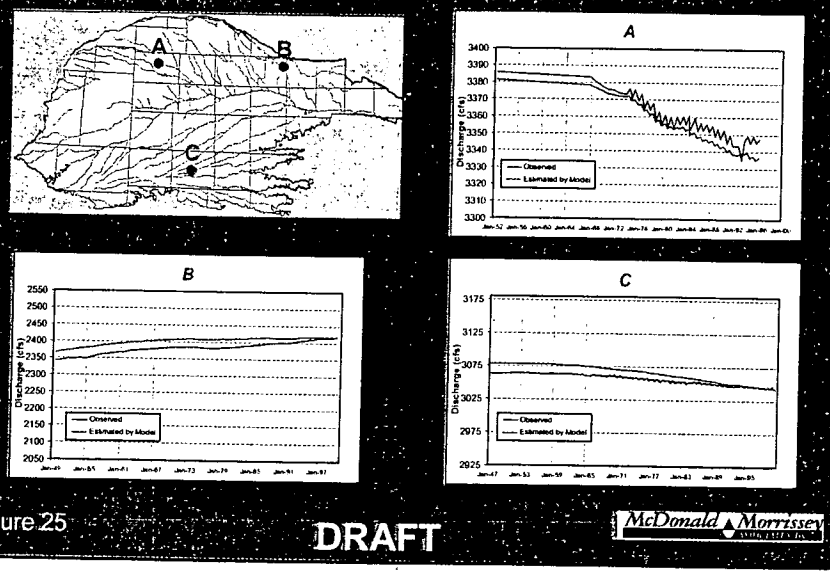

Figure 25

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Map Showing Change in water levels predevelopment to 1997

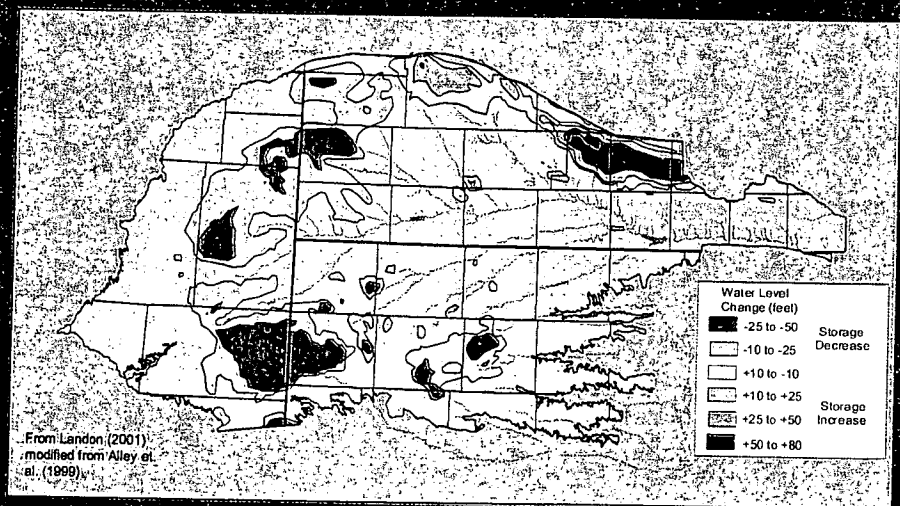

Figure 26

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Model Calculated Water Level Change, 1940 to 2000

(RRCA Model, July 1, 2003)

Figure 27

DRAFT

McDonald Morrissey

Selected Baseflow Hydrographs Showing Observed and Calculated Values

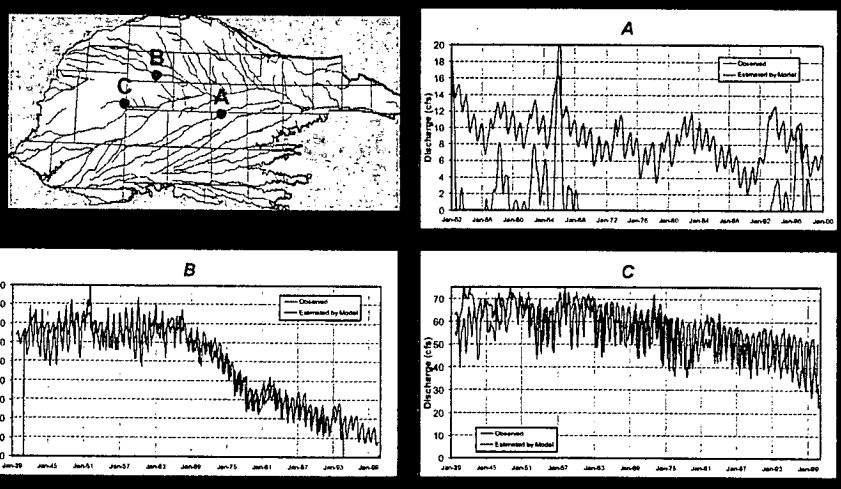

Figure 28

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Baseline Scenario

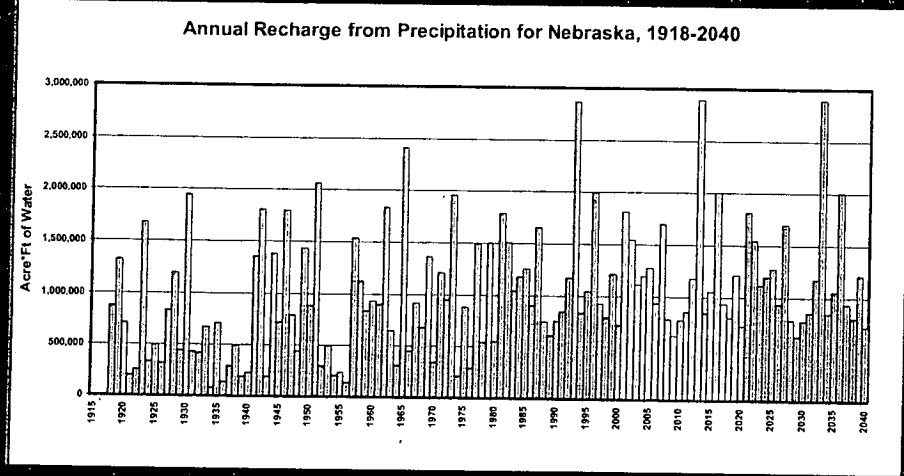

Figure 29

DRAFT

McDonald Morrissey

Baseline Scenario

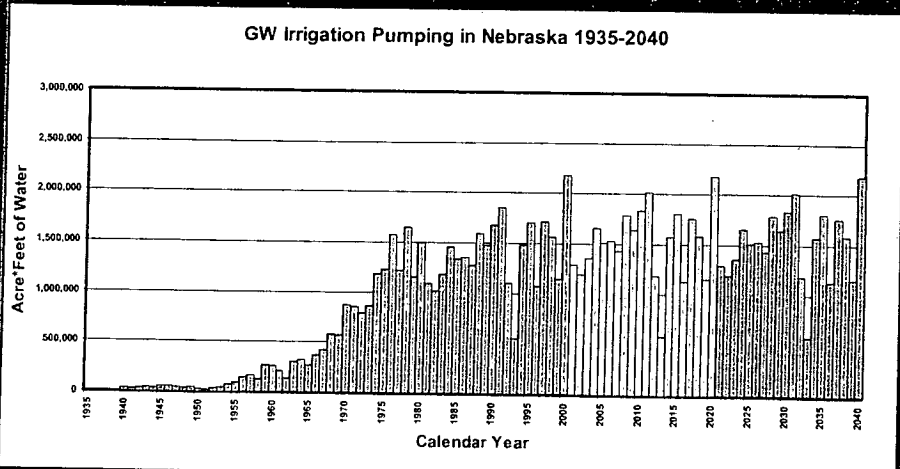

Figure 30

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McDonald Morrissey

Baseline Scenario

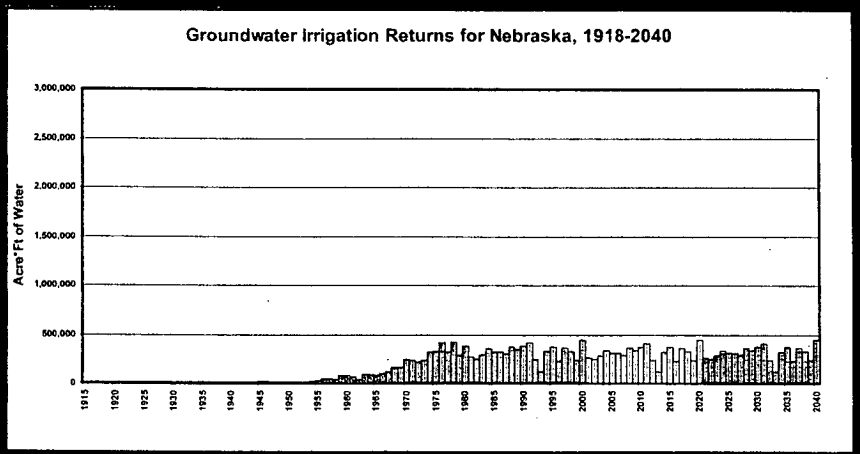

Figure 31

DRAFT

McDonald Morrissey

Baseline Scenario

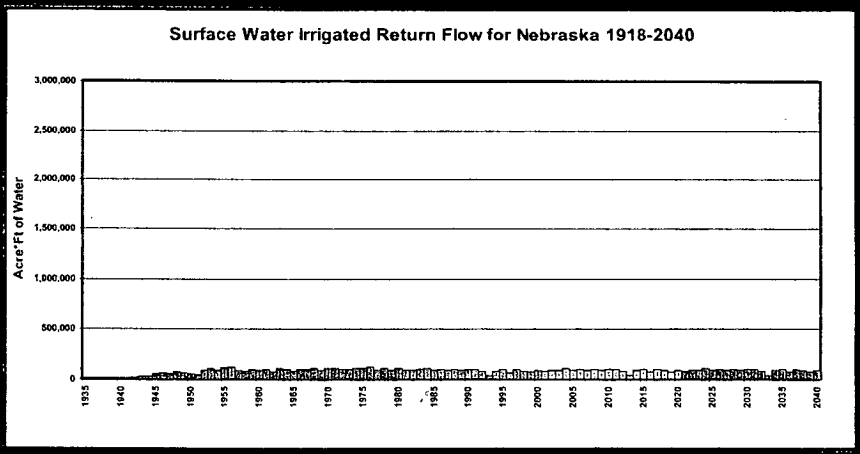

Figure 32

DRAFT

McDonald Morrissey

Baseline Scenario

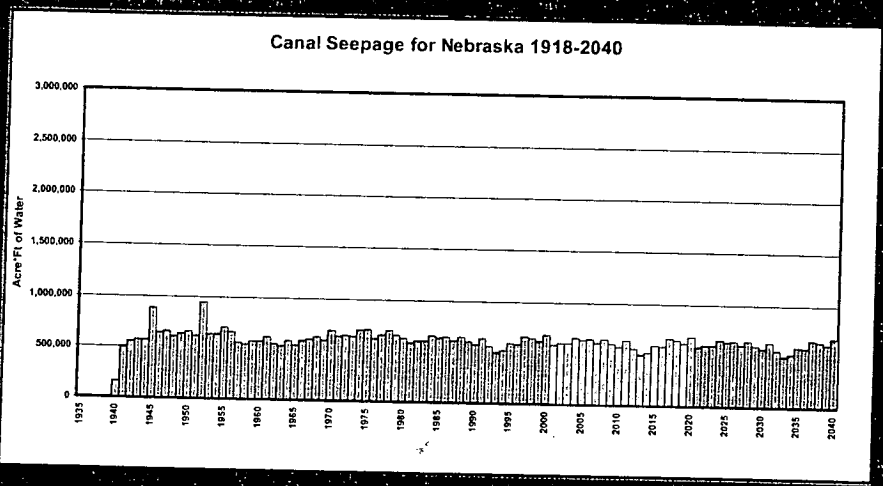

Figure 33

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Graph of Model Calculated ET Volume 1918-2040

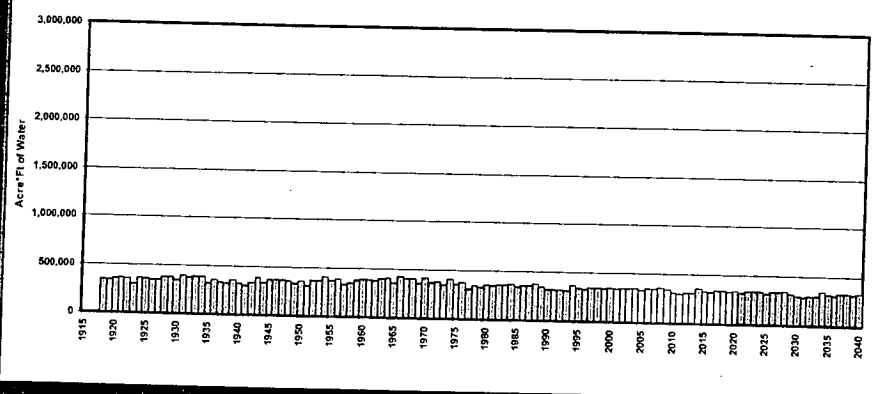

Figure 34

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Change in Storage (1918-2040)

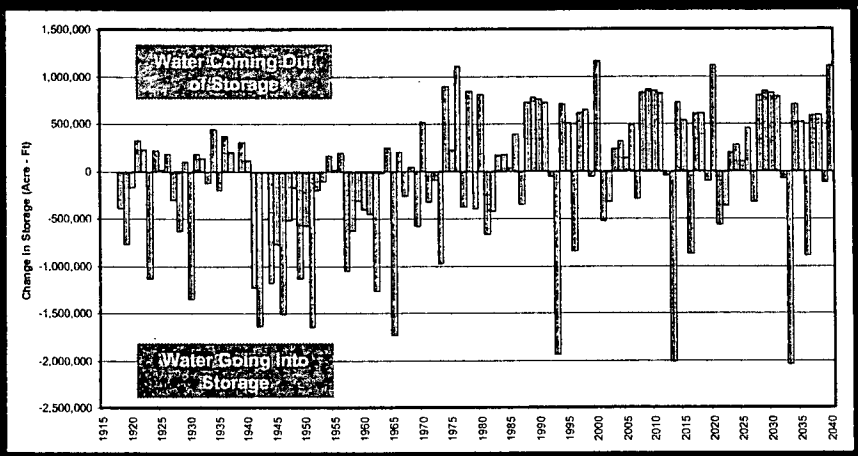

Figure 35

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Model Calculated Water Level Change, 1940 to 2000

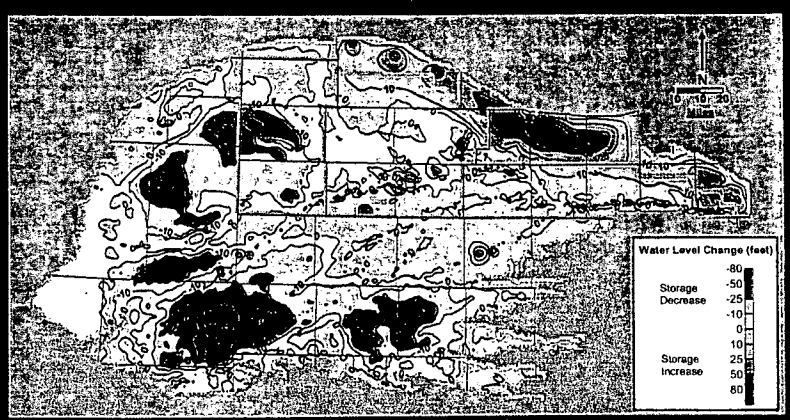

Figure 36

DRAFT

McDonald Morrissey

Model Calculated Water Level Change, 2000 to 2040

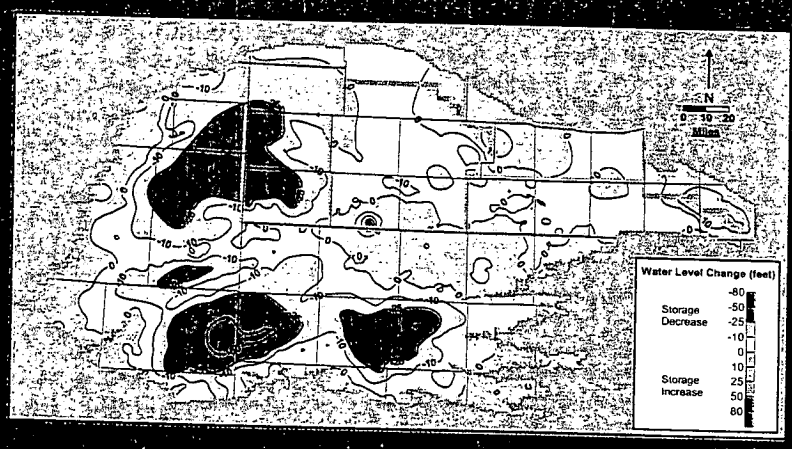

Figure 37

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Impacts of Historic and Future Pumping on Baseflow in Nebraska

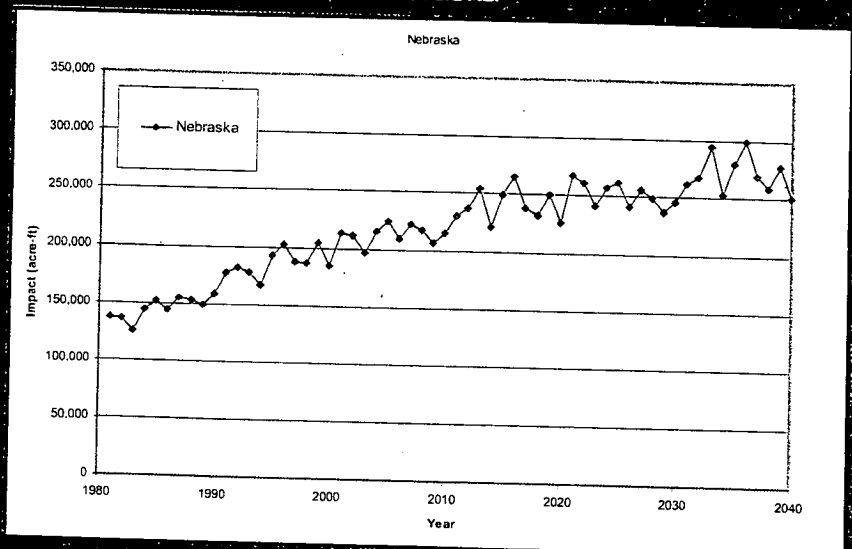

Figure 38

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Assumed Recharge from Irrigation would also ↓ 20%
This is a NE reduction only.