

**UTAH
DEPARTMENT OF
AGRICULTURE
AND FOOD**

State Ground-Water Program 1997



By

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STATE GROUND-WATER PROGRAM REPORT 1997

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STATE GROUND-WATER PROGRAM REPORT 1997

The State Ground-Water Program is funded by the legislature to assist private well owners and other agencies, organizations and concerned citizens in having a better understanding of water quality. The provisions of the Clean Water Act exclude irrigation wells, livestock wells, and other private wells, although these wells account for the majority of ground water use in the State of Utah.

This report covers activities of the Utah Department of Agriculture and Food's (UDAF) State Ground-Water Program for 1997.

Cooperative Effort

The UDAF has a memorandum of understanding (MOU) with the Utah Division of Water Rights for collecting ground water data from the Pahvant and Curlew valleys. During 1997, Water Rights sampled Curlew Valley. Though UDAF did not participate in the actual sampling of the wells the data is presented in this report (Tables 7a and 7b). Sample analysis were done for inorganic and organic contaminants that influence water quality. Guidance from the Utah Division of Water Rights has helped in selecting sampling areas and sharing data.

The UDAF also works closely with the Department of Environmental Quality (DEQ) in providing expertise into the State Pesticide Management Plan and other ground-water programs. This relationship benefits UDAF by allowing agriculture's voice to be heard and their ideas considered during the planning process. The UDAF is an intricate link between DEQ and the farmers and ranchers of the state in environmental issues. During 1997, UDAF joined with DEQ in coalition to improve water quality on the Sevier River using a watershed approach.

The State Ground-Water Program uses the local Utah Soil Conservation District (UACD) members to locate sample areas. Their knowledge of the area has been very beneficial in the selection of wells, meeting well owners, and distributing information.

UDAF's Ground-Water Sampling Procedures

UDAF met with several SCDs to educate them on ground-water issues. The districts then selected wells in their area for sampling (excluding Beaver, Curlew, and Pahvant valleys). The districts obtained preliminary sample information by using UDAF's Pre-Sample Information Form (Fig. 1).

The local district then escorted UDAF personnel to the selected well sites. Location of each well location was determined using GPS. Well samples were collected for inorganic and pesticide analysis. The samples were packed in ice and taken to the appropriate laboratory. UDAF analyzed for pesticides and USU performed the inorganic analysis. Laboratory results were sent to each well owner and local SCD. GPS information was provided to UDAF's GIS administrator who provided maps of the sampled areas.

During 1997, UDAF tested the use a nitrate specific ion probe. Readings from this devise did not compare with laboratory measurements. Currently the manufacture is working with UDAF to ensure that the probe will be reliable during the 1998 sampling season.

Areas Sampled

During 1997, 187 wells, drains, and springs, in ten areas of the state were sampled. The areas included west Morgan County; Vernon, Clover, Erda, and Grantsville in Tooele County; Minersville, Milford, and Beaver in Beaver County; Curlew Valley in Box Elder County; and Pahvant Valley in Millard County. Each of the sampling areas will be addressed individually with a map showing sample location and a table of the chemical analysis data. Beaver's data is similar to last years and has been given to the Beaver SCD and is not included in this years report. Narrative reports are provided for each sampled area except Curlew, and Pahvant valleys. For those areas only the data tables are listed (See Tables 6a, 6b, 7a, and 7b.)

The shaded laboratory data on each table shows which values exceed either drinking water, livestock, irrigation, or Clean Water Act standards. Appendix I lists the critical values for each standard.

PRE-SAMPLE INFORMATION FORM

(This is a non-regulatory program. Data from sampling this well will be for your use and information)

Name: _____ Telephone #: _____
Address: _____ Water Right #: _____
City: _____ Depth of Well: _____
Conservation District: _____ Depth of Water: _____

Please sketch a map showing how to locate your well (North is the top of the page.) Please give street name, and distances from major intersections or any other landmarks that may be significant. If you need more room sketch map on back of sheet.

Can we turn your pump on without you being present? _____
Are there instructions we need to sample your well? _____

By signing this form you are giving permission for the State of Utah Department of Agriculture to cross your property and sample your well.

I the undersigned am the lawful agent of the above described well and grant permission to the Utah Department of Agriculture to sample said well. I also grant access permission to the well.

Sign on the above line

Date

For any further information contact:

Mark Quilter, Ground Water Specialist,
UDA, 350 North Redwood Road
Box 146500
Salt Lake City, UT 84114-6500
(801) 538-9905 Fax: (801) 538-9431.

FIG. 1. Pre-Sample Information Form

Morgan County

Under the direction of the Morgan SCD 19 wells were sampled in Morgan County on April 24, 1997. These wells are used for irrigation, culinary purposes, and livestock. Generally this water is well suited for irrigation and no serious problems were found. The chemical analysis are listed on Tables 1a and 1b. Map #11 shows the location of all sample sites

Irrigation Quality

The water in this area is generally low in salts with only 6 of the 19 samples having EC values exceeding 750 umhos / cm. The EC values range is from 345 umhos / cm at well (number 12) to 1,310 umhos / cm at well (number 1). Most of the water in the area has an EC around 700 umhos / cm. This is suitable for irrigation.

All wells have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruits market appeal. In this area since other salts are so low bicarbonate should not be much of a problem.

All R_{Na} and SAR values are acceptable to use the water for irrigation.

Livestock Quality

All of the wells are suitable for livestock use.

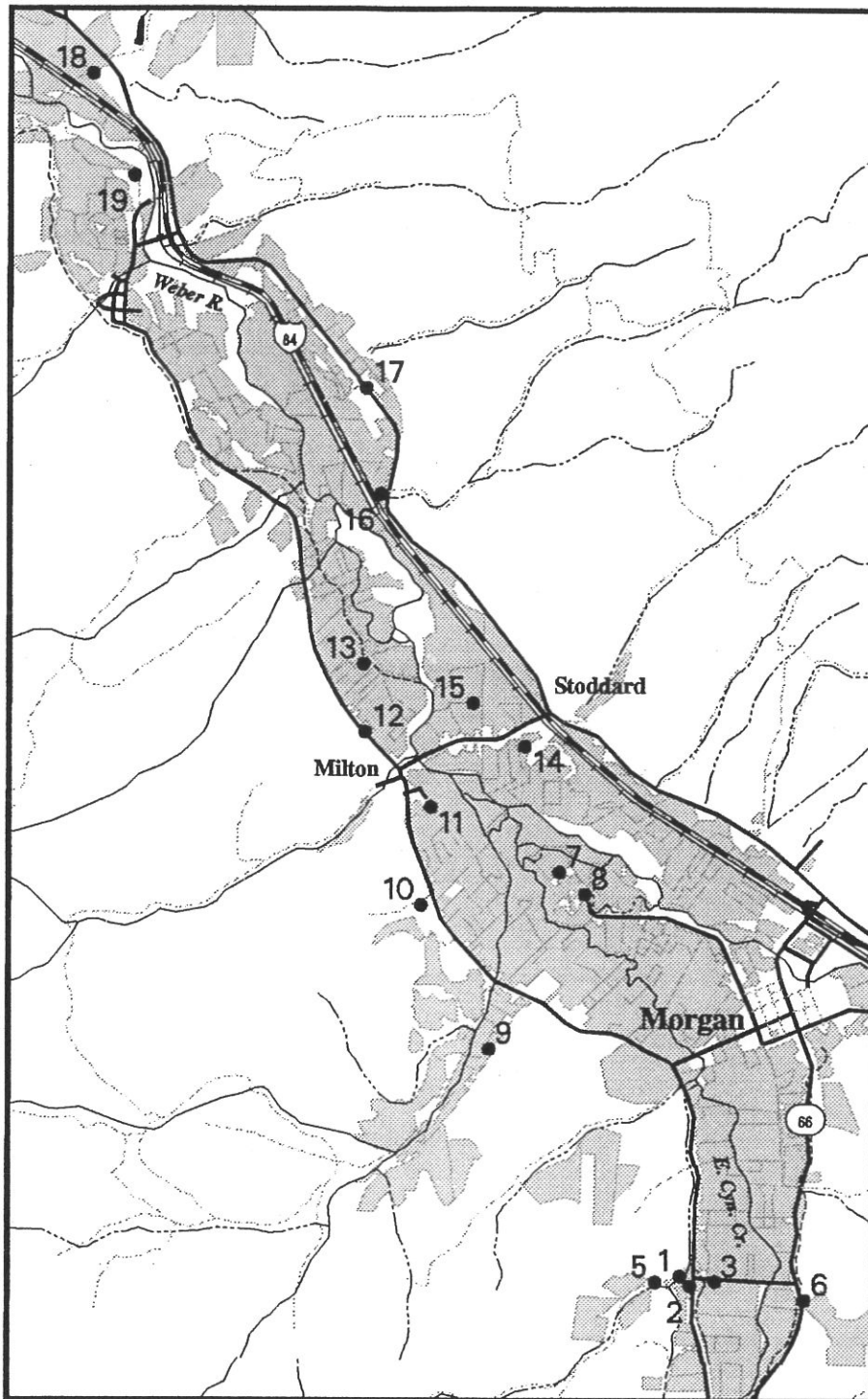
Drinking Water

Nitrate was detected in all but well number 12. Only well number 1 is a concern. The nitrate level of 24.5 ppm exceeds the drinking water standard by a factor of 2.

The broadleaf herbicide 2,4-D was detected in one shallow well (sample location number 11) at 14.83 ppb. The maximum contaminant level set by Utah for this compound in drinking water is 70.0 ppb.











1997 UDAF Ground Water Sampling Locations

Morgan County, Utah



Map Scale 1:90,000 (1 inch = 1.4 miles)

LEGEND

- | | | | |
|---|---------------------|---|--------------------|
|  | Ag Land |  | Interstate Highway |
|  | Water Body |  | Primary Road |
|  | Perennial Stream |  | Secondary Road |
|  | Intermittent Stream |  | Railroad |
|  | Ditch or Canal |  | Sampling Location |

MAP LOCATION



Table 1a - Morgan County

Map (1997 UDAF Ground Water Sampling Locations - Morgan County, Utah)

Irrigation and infiltration qualities areas of Morgan County, Utah. Samples taken on April 24, 1997. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.2	1310	192.00	28.33	48.23	5.36	1.78	0.86
2	7.3	700	65.30	27.33	43.81	5.00	1.51	1.15
3	7.1	762	112.00	22.13	31.92	5.71	1.24	0.72
4	7.4	650	84.50	18.04	35.41	5.71	1.45	0.91
5	7.4	632	80.40	18.33	32.16	4.07	1.30	0.84
6	7.3	710	91.00	29.98	24.29	5.36	0.83	0.56
7	7.2	739	115.00	21.07	27.18	5.03	1.10	0.61
8	7.2	762	96.10	18.25	26.47	5.18	1.10	0.65
9	7.4	710	99.80	20.53	26.48	4.93	1.06	0.63
10	7.5	750	96.10	19.61	23.80	4.64	0.96	0.58
11	7.0	1075	139.00	26.44	47.86	9.75	1.73	0.98
12	7.4	345	52.40	7.26	12.28	2.78	0.61	0.42
13	7.3	720	107.00	21.42	21.89	5.36	0.86	0.51
14	7.2	720	102.00	23.52	26.72	5.00	1.01	0.62
15	7.2	732	104.00	24.97	24.76	5.18	0.92	0.57
16	7.3	860	102.00	26.52	43.03	5.36	1.56	0.98
17	7.3	648	83.79	24.60	29.26	4.50	1.08	0.72
18	7.4	630	86.90	20.58	30.24	4.28	1.19	0.76
19	7.5	730	96.10	24.31	24.43	5.00	0.91	0.58

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 1b - Morgan County

Map (1997 UDAF Ground Water Sampling Locations - Morgan County, Utah)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Morgan County, Utah. Samples taken on April 24, 1997. **Shaded** values exceed established guidelines.

*Sample Sites	Al p.m.	B p.m.	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Si ppm	Sr ppm	Zn ppm
1	0.00	0.00	109.0	0.00	10	0.00	24.5	0.00	20.9	29.8	0.75	0.28
2	0.00	0.00	54.9	0.00	7	0.00	3.2	0.00	8.1	14.5	0.98	0.00
3	0.00	0.00	41.0	0.00	5	0.00	3.8	0.00	17.0	12.5	0.49	0.00
4	0.00	0.00	58.0	0.00	0	0.00	0.9	0.00	22.0	4.99	0.35	0.00
5	0.00	0.00	58.0	0.00	7	0.00	1.2	0.00	12.9	23.1	0.46	0.13
6	0.00	0.00	62.8	0.00	12	0.00	0.7	0.00	6.49	35.5	0.73	0.00
7	0.00	0.00	48.4	0.00	0	0.00	2.2	0.00	19.2	6.88	0.37	0.00
8	0.00	0.00	45.5	0.00	0	0.00	2.2	0.00	15.7	6.41	0.29	0.00
9	0.00	0.00	56.7	0.00	7	0.00	1.3	0.00	13.1	19.7	0.37	0.00
10	0.00	0.00	78.0	0.00	5	0.00	2.1	0.00	10.4	19.7	0.33	0.00
11	0.00	0.00	40.9	0.00	10	0.00	1.0	0.00	13.5	8.27	0.56	0.00
12	0.00	0.00	16.7	0.00	0	0.00	0.0	0.00	7.70	25.0	0.20	0.00
13	0.00	0.00	43.7	0.00	0	0.00	2.0	0.00	15.8	7.99	0.37	0.14
14	0.00	0.00	39.8	0.00	0	0.00	2.4	0.00	21.0	5.97	0.40	0.15
15	0.00	0.00	42.1	0.00	0	0.00	2.1	0.00	21.6	6.35	0.43	0.14
16	0.00	0.00	105.0	0.00	0	0.00	2.2	0.00	10.4	9.95	0.31	0.00
17	0.00	0.00	39.3	0.00	0	0.00	1.9	0.00	16.0	14.0	0.31	0.09
18	0.00	0.00	31.1	0.00	0	0.00	4.0	0.00	17.4	13.5	0.35	0.46
19	0.00	0.00	58.2	0.00	0	0.00	0.9	0.00	16.8	9.78	0.41	0.00

* Sample Sites: wells, drains and springs

Vernon Area

Under the direction of the Shambip SCD 20 wells were sampled in the Vernon area of Tooele County on May 6, 1997. These wells are used for irrigation, culinary purposes, and livestock. Generally this water is well suited for irrigation and no serious problems were found. The chemical analyses are listed on Tables 2a and 2b. The map shows the location of all sample sites

Irrigation Quality

The water in this area is moderate in salts with 13 of the 20 samples having EC values exceeding 750 umhos / cm. The EC values range is from 492 umhos / cm at well (number 7) to 8,900 umhos / cm at well (number 16). The average EC for the area is 1,486 umhos/cm. This is fairly high and would pose some problems with irrigation.

All wells have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruits market appeal. In this area since other salts are so low bicarbonate should not be much of a problem.

All R_{Na} and SAR values are acceptable to use the water for irrigation excepting numbers 11, 16, 17, and 18. The R_{Na} is a more conservative estimate of the effect of sodium on the soil and tends to exaggerate the problem. The SAR values for wells 16 and 17 do indicate that this water may create problems if used for irrigation. Well 17 would just present a very marginal problem where well 16 could present more serious challenges. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali.

Sample sites 2, 5, 6, 8, 9, 11, 15, 16, 17, 18, 19, and 20 all have high chloride levels. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage crops. The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation. The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

Well number 16 exceeds the livestock standard for EC. This water has more salts in it than is recommended for livestock.

Drinking Water

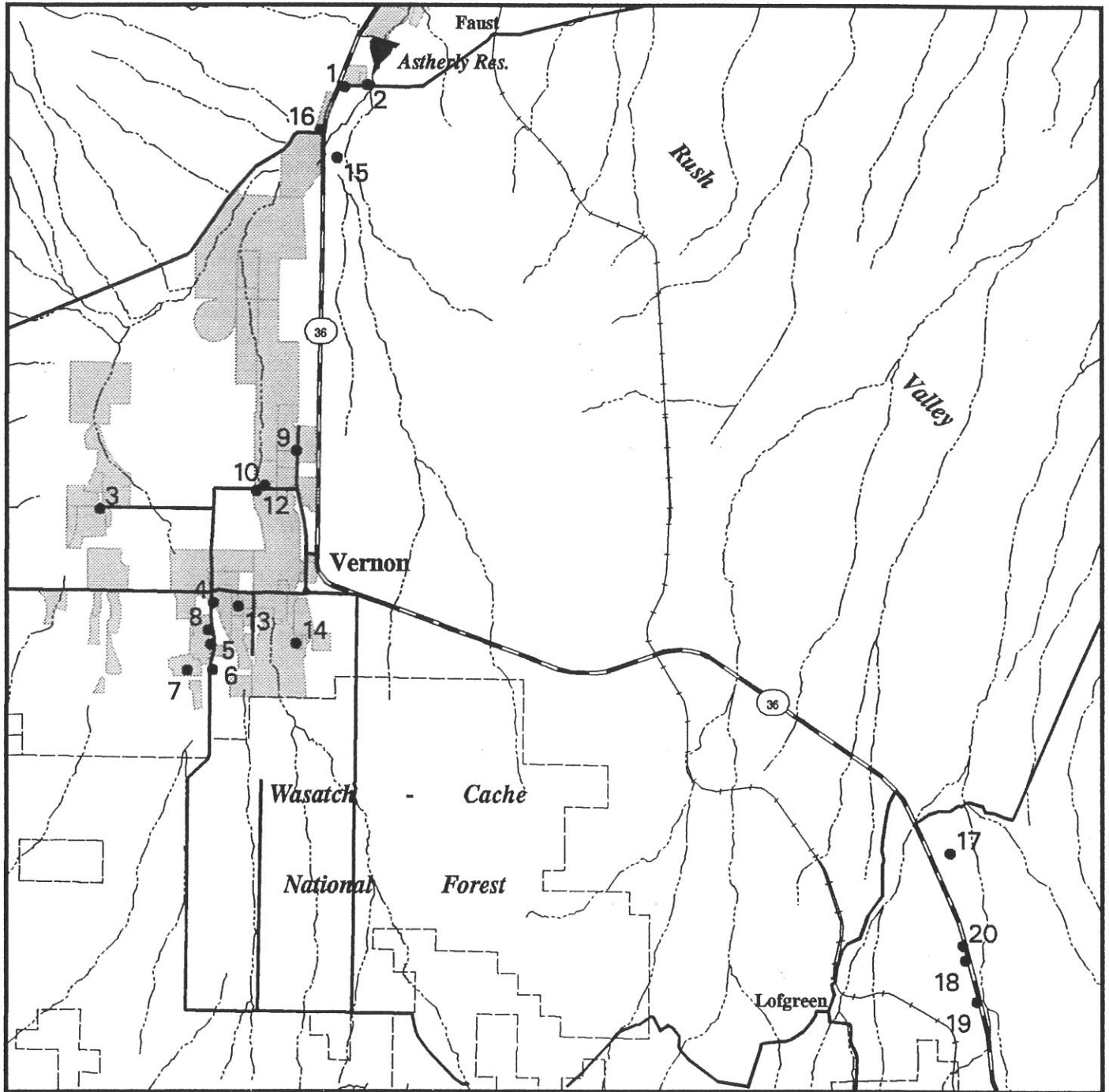
Nitrate was detected in all but well number 15. None of the Nitrate levels is high enough to be of concern. No pesticides were detected in any of the samples.

The EC values of sample sites 2, 5, 9, 11, 15, 16, 17, 18, 19, and 20 exceed the aesthetic water quality standard. This means that these wells may be off flavored. Well site number 16 and spring site 18 exceed the EPA health level for drinking water. This water is too salty to drink according to the EPA standard.

Well 16 also exceeds the EPA aesthetic water quality standard for sulfate. Sulfate in the water can cause diarrhea in those not accustomed to drinking it. This is an aesthetic standard and is not health related.









1997 UDAF Ground Water Sampling Locations

Vernon Area, Tooele County, Utah



Map Scale 1:114,000 (1 inch = 1.8 miles)

LEGEND

- | | | | |
|--|---------------------|---|-------------------|
|  | Ag Land |  | Primary Road |
|  | Water Body |  | Secondary Road |
|  | Perennial Stream |  | Railroad |
|  | Intermittent Stream |  | Sampling Location |



MAP LOCATION

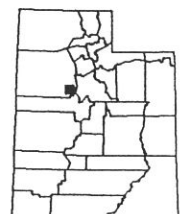


Table 2a - Vernon Area

Map (1997 UDAF Ground Water Sample Locations, Vernon Area, Tooele County, Utah)

Irrigation and infiltration qualities areas of Vernon, Utah. Samples taken on May 6, 1997. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.3	785	59.70	33.70	49.60	3.93	1.58	1.27
2	7.5	862	62.80	40.10	55.40	3.93	1.65	1.34
3	7.2	555	41.30	22.60	33.10	2.14	1.16	1.03
4	7.3	750	85.40	20.20	32.60	2.14	1.29	0.82
5	7.0	870	100.00	20.90	35.30	1.71	1.40	0.84
6	7.3	740	86.90	17.00	31.60	1.86	1.33	0.81
7	7.3	492	55.40	15.30	25.80	2.5	1.06	0.79
8	7.4	760	93.50	18.10	31.50	2.14	1.31	0.78
9	7.2	1500	142.00	47.60	98.50	4.93	2.85	1.83
10	7.3	590	63.20	19.00	28.50	2.32	1.11	0.81
11	7.0	2850	283.00	73.30	144.00	5	3.39	1.97
12	7.4	565	68.00	18.30	26.20	2.86	1.04	0.73
13	7.0	528	57.40	14.90	26.10	2.5	1.08	0.79
14	7.5	620	68.20	17.40	33.00	2.93	1.32	0.92
15	7.7	1240	62.10	53.30	112.00	5.18	2.96	2.52
16	7.3	8900	381.00	372.00	864.00	6.43	9.55	7.54
17	7.0	1250	49.20	45.80	122.00	2.86	3.39	3.01
18	6.9	3400	172.00	177.00	227.00	2.93	3.51	2.90
19	7.0	1460	106.00	75.90	51.90	2.64	1.21	0.94
20	7.0	1010	49.40	48.30	76.00	3.03	2.07	1.84

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 2b - Vernon Area

Map (1997 UDAF Ground Water Sample Locations, Vernon Area, Tooele County, Utah)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Vernon, Utah. Samples taken on May 6, 1997. Shaded values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Si ppm	Sr ppm	Zn ppm
1	0.00	0.00	112.0	0.00	11	0.00	1.7	0.00	17.6	7.31	0.49	0.00
2	0.00	0.00	1339.	0.00	4	0.00	0.5	0.00	17.4	8.16	0.58	0.00
3	0.00	0.00	89.0	0.00	0	0.00	0.5	0.00	13.4	9.87	0.47	0.00
4	0.00	0.00	143.0	0.00	0	0.00	1.0	0.00	14.3	8.29	0.46	0.00
5	0.00	0.00	183.0	0.00	0	0.00	1.3	0.00	15.1	7.64	0.50	0.00
6	0.00	0.00	145.0	0.00	0	0.00	1.2	0.00	14.5	7.71	0.41	0.05
7	0.00	0.00	62.9	0.00	0	0.00	0.7	0.00	10.9	8.45	0.33	0.00
8	0.00	0.00	147.0	0.00	0	0.00	1.1	0.00	15.6	8.05	0.44	0.00
9	0.00	0.23	277.0	0.00	0	0.00	5.9	0.00	38.8	9.87	0.77	0.79
10	0.00	0.00	95.7	0.00	0	0.00	0.8	0.00	15.9	6.92	0.37	0.00
11	0.00	0.00	734.0	0.00	0	0.00	1.5	0.00	57.0	9.09	1.25	0.00
12	0.00	0.00	79.8	0.00	0	0.00	0.8	0.00	15.6	8.59	0.28	0.10
13	0.00	0.00	65.8	0.00	0	0.00	1.3	0.00	15.4	8.31	0.32	0.00
14	0.00	0.00	96.4	0.00	0	0.00	0.9	0.00	11.0	8.21	0.34	0.06
15	0.00	0.00	219.0	0.00	5	0.00	0.0	0.00	25.2	23.2	0.89	0.00
16	0.00	0.00	2907.	0.00	13	0.00	0.2	0.00	170.0	22.5	8.14	0.00
17	0.00	0.00	271.0	0.00	8	0.00	0.4	0.00	21.8	21.1	1.34	0.09
18	0.00	0.00	1005.	0.00	12	0.00	0.2	0.00	55.7	29.2	4.06	0.00
19	0.00	0.00	3452.	0.00	5	0.00	2.5	0.00	17.0	24.7	1.51	0.00
20	0.00	0.00	198.0	0.00	9	0.00	0.8	0.00	17.0	33.0	1.31	0.00

* Sample Sites: wells, drains and springs

Clover Area

Under the direction of the Shambip SCD18 wells were sampled in the Clover area of Tooele County on May 21, 1997. These wells are used for irrigation, culinary purposes, and livestock. The chemical analyses are listed on Tables 3a and 3b. The map shows the location of all sample sites

Irrigation Quality

The water in this area is high in salts with 15 of the 18 samples having EC values exceeding 750 umhos / cm. The EC values range is from 640 umhos / cm at sample site number 9, to 2,880 umhos / cm at well number 5. Sample sites 9 is a spring and has the highest quality of water tested. The other wells 1, 13, 14, and 15, which have low EC values are at a higher gradient than the other wells sampled and are on the outskirts of the St. Johns area. The average EC for the area is 1,728 umhos/cm. This is fairly high and would pose some problems with irrigation.

All wells have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruits market appeal. In this area since other salts are so low bicarbonate should not be much of a problem.

Eight of the sites have R_{Na} and SAR values that are acceptable to use the water for irrigation. Wells 2, 3, 4, 5, 7, 10, 11, 16, 17, and 18 have R_{Na} values which are high. The R_{Na} is a more conservative estimate of the effect of sodium on the soil and tends to exaggerate the problem. The SAR values for wells 3, 4, 5, 11, 16, 17, and 18 do indicate that this water may create problems if used for irrigation. Wells 2, 7, and 10 would present a marginal problem. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali.

Sample sites 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 15, 16, and 18, all have high chloride levels. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage crops. The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation. The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

None of the sites sampled exceeded values established for livestock.

Drinking Water

Nitrate was detected in all wells. None of the Nitrate levels is high enough to be of concern. No pesticides were detected in any of the samples.

The EC values of sample sites 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 17, and 18 exceed the aesthetic water quality standard. This means that these wells may be off flavored. No sampling sites exceed the EPA health level for drinking water.

Well 11 also exceeds the EPA aesthetic water quality standard for sulfate. Sulfate in the water can cause diarrhea in those not accustomed to drinking it. This is an aesthetic standard and is not health related.









1997 UDAF Ground Water Sampling Locations

Clover Area, Tooele County, Utah



Map Scale 1:20,000 (1 inch = .32 miles)

LEGEND

- | | |
|--|--|
|  Ag Land |  Secondary Road |
|  Ditch or Canal |  Field Boundary |
|  Intermittent Stream |  Well |
|  Primary Road |  Spring |

MAP LOCATION



Table 3a - Clover Area

Map (1997 UDAF Ground Water Sample Locations, Clover Area, Tooele County, Utah)

Irrigation and infiltration qualities areas of Clover, Utah. Samples taken on May 21, 1997. **Shaded** values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.3	710	72.80	24.10	35.30	4.11	1.10	0.92
2	7.1	2420	211.00	51.40	179.00	3.93	3.75	2.87
3	7.2	2850	230.00	59.80	232.00	4.28	4.65	3.52
4	7.3	2700	226.00	57.50	201.00	4.28	4.07	3.09
5	7.0	2880	218.00	54.80	258.00	4.28	5.35	4.04
6	7.2	1700	173.00	36.00	112.00	3.75	2.63	2.02
7	7.2	1235	98.00	32.30	117.00	4.64	3.30	2.62
8	7.1	1450	126.00	52.40	108.00	4.28	2.46	2.04
9	7.1	640	75.70	19.90	33.70	3.93	1.09	0.89
10	7.2	2110	126.00	98.00	184.00	7.5	3.55	2.99
11	7.2	1900	103.00	50.30	246.00	6.07	6.06	4.97
12	7.2	1370	129.00	33.50	106.00	3.57	2.63	2.15
13	7.3	920	94.40	24.30	69.50	4.64	2.12	1.65
14	7.5	740	81.90	27.40	25.20	2.86	0.72	0.62
15	7.5	920	122.00	20.40	35.40	3.39	0.98	0.78
16	7.3	1225	71.70	23.20	175.00	5.35	5.74	4.59
17	7.0	1075	64.70	22.60	146.00	4.28	4.77	3.98
18	7.1	2600	200.00	52.70	268.00	4.64	5.72	4.36

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 3b - Clover Area

Map (1997 UDAF Ground Water Sample Locations, Clover Area, Tooele County, Utah)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Clover, Utah. Samples taken on May 21, 1997. Shaded values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Si ppm	Sr ppm	Zn ppm
1	0.00	0.00	94.3	0.00	0	0.00	0.3	0.00	8.3	20.7	0.78	0.37
2	0.00	0.00	633.0	0.00	0	0.00	2.0	0.00	19.8	10.8	1.34	0.00
3	0.00	0.18	724.0	0.00	0	0.00	2.9	0.00	32.2	11.2	1.50	0.00
4	0.00	0.00	716.0	0.00	0	0.00	2.3	0.00	24.9	10.9	1.43	0.51
5	0.00	0.00	707.0	0.00	0	0.00	2.2	0.00	59.2	9.22	1.24	0.22
6	0.00	0.00	397.0	0.00	0	0.00	0.3	0.00	15.4	10.3	1.02	0.06
7	0.00	0.00	201.0	0.00	0	0.00	0.4	0.00	23.2	9.95	0.67	0.00
8	0.00	0.25	247.0	0.00	0	0.00	0.9	0.00	56.1	19.4	1.33	0.08
9	0.00	0.00	58.4	0.00	0	0.00	0.3	0.00	6.5	7.06	0.45	0.00
10	0.00	0.00	333.0	0.00	0	0.00	3.2	0.00	73.8	24.1	2.12	0.00
11	0.00	0.39	249.0	0.00	9	0.00	5.3	0.00	88.7	18.5	1.08	0.05
12	0.00	0.00	275.0	0.00	0	0.00	1.3	0.00	21.1	10.1	0.83	0.00
13	0.00	0.00	122.0	0.00	0	0.00	4.6	0.00	13.9	7.12	0.51	0.09
14	0.00	0.00	114.0	0.00	0	0.00	1.5	0.00	9.1	7.54	0.69	0.06
15	0.00	0.00	167.0	0.00	0	0.00	1.4	0.00	8.5	5.61	0.52	0.11
16	0.00	0.00	160.0	0.00	6	0.00	2.8	0.00	29.3	10.8	0.56	0.06
17	0.00	0.00	138.0	0.00	0	0.00	1.2	0.00	27.3	13.1	0.66	0.06
18	0.00	0.00	636.0	0.00	0	0.00	2.4	0.00	42.2	10.9	1.29	0.08

* Sample Sites: wells, drains and springs

Erda / Grantsville Area

Under the direction of the Grantsville SCD 27 wells and springs were sampled in the Erda / Grantsville area of Tooele County on June 10, 1997. These wells and springs are used for irrigation, culinary purposes, and livestock. Generally this water is well suited for livestock use. The water may be used for salt tolerant crops and when properly managed can be used for irrigation. The chemical analyses are listed on Tables 4a and 4b. The map shows the location of all sample sites

Irrigation Quality

The water in this area is moderate in salts with 21 of the 27 samples having EC values exceeding 750 umhos / cm. The EC values range is from 490 umhos / cm at well (number 27) to 3,400 umhos / cm at well (number 24). The average EC for the area is 1,249 umhos/cm. This is fairly high and could pose problems with improper irrigation.

All but three sites have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruits market appeal. In this area since other salts are so low bicarbonate should not be much of a problem.

All R_{Na} and SAR values except for sites 5, 7, 15, 16, 25, and 26 could cause problems when this water is used for irrigation. The R_{Na} is a more conservative estimate of the effect of sodium on the soil and tends to exaggerate the problem. The SAR values for all sites excepting 5, 6, 7, 15, 16, 25, 26, and 27 do indicate that this water may create problems if used for irrigation. None of the SAR values are in the severe area so with proper irrigation the water can be used without damaging soil. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali.

Sample sites 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, and 25 all have high chloride levels. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage crops. The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation (sites 23, 24, and 25 have Cl values in this area). The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

There are no limits on this water for livestock use.

Drinking Water

Nitrate was detected in all but well number 11. None of the Nitrate levels are high enough to be of concern. The herbicide 2, 4-D was found in wells 17 and 27. This is above the detection limit but does not exceed the health advisory level and does not affect drinking water quality. (2,4-D was not detected when well #27 was resampled.)

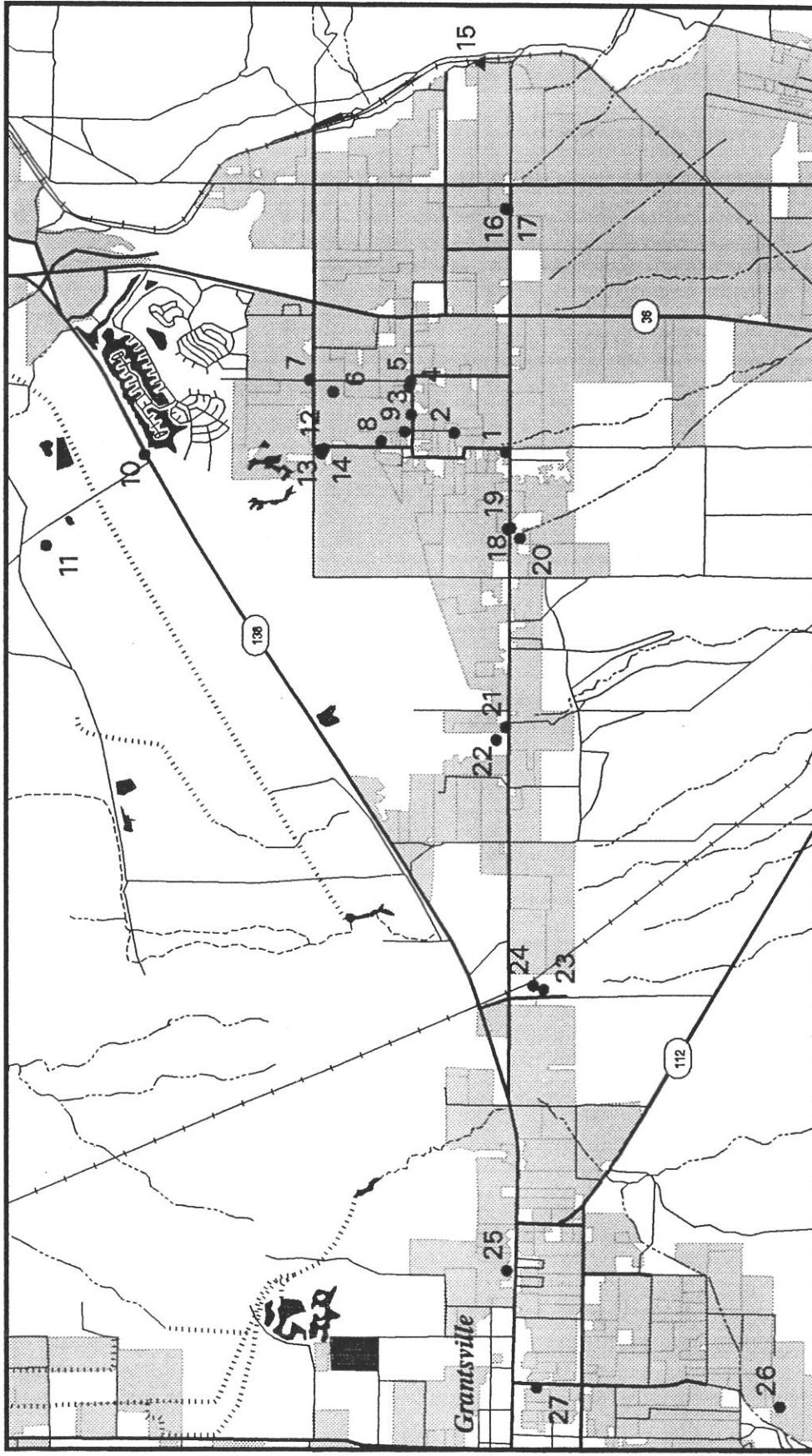
The EC values of sample sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, and 25 exceed the aesthetic water quality standard. This means that these wells may be off flavored. Well site number 24 exceeds the EPA health level for drinking water. This water is too salty to drink according to the EPA standard.

Well 24 also exceeds the EPA aesthetic water quality standard for sulfate. Sulfate in the water can cause diarrhea in those not accustomed to drinking it. This is an aesthetic standard and is not health related.

Sample sites 11, 17, 23, and 27 exceed the EPA standard for manganese.

1997 UDAF Ground Water Sampling Locations

Grantsville Area, Tooele County, Utah



Map Scale 1:77,000 (1 inch = 1.2 miles)

LEGEND

- | | | | |
|--|----------------------|--|----------------|
| | Ag Land | | Primary Road |
| | Water Body | | Secondary Road |
| | Perennial Stream | | Field Boundary |
| | Ditch/Canal/Aqueduct | | Well |
| | Intermittent Stream | | Spring |



MAP LOCATION

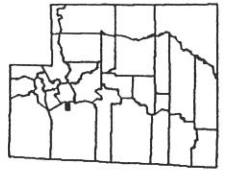


Table 4a - Grantsville 97

Map (1997 UDAF Ground Water Sample Locations, Grantsville Area, Tooele County, Utah)

Irrigation and infiltration qualities areas of Erda and Grantsville, Tooele County, Utah. Samples taken on June 10, 1997. Shaded values exceed established guidelines. Underlined are severe.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.6	1300	57.80	20.60	197.00	4.28	6.67	5.66
2	7.5	1500	60.60	21.70	224.00	4.28	7.38	6.28
3	7.6	1030	60.30	21.10	128.00	3.85	4.20	3.61
4	7.6	880	57.60	20.60	106.00	3.93	3.59	3.05
5	7.4	840	77.80	27.20	66.50	3.93	1.97	1.65
6	7.4	740	48.50	17.70	88.40	3.75	3.15	2.76
7	7.3	955	97.10	34.40	63.10	3.75	1.68	1.40
8	7.5	1000	54.10	18.80	145.00	3.68	4.95	4.33
9	7.6	1800	67.90	25.40	256.00	3.75	7.60	6.73
10	7.5	1300	44.70	23.20	187.00	3.93	6.27	5.65
11	7.6	1400	45.80	41.00	174.00	2.85	4.69	4.50
12	7.4	995	51.20	18.00	130.00	3.93	4.57	3.98
13	7.5	1010	49.10	17.20	141.00	3.93	5.04	4.41
14	7.5	1150	42.90	17.10	188.00	4.28	7.01	6.14
15	7.3	695	71.40	28.30	36.00	4.64	1.10	0.91
16	7.2	680	71.50	28.20	35.90	4.28	1.07	0.91
17	8.7	685	11.80	35.10	131.00	1.07	3.91	4.32
18	7.4	1600	93.10	33.70	177.00	3.57	4.67	4.00
19	7.3	1700	96.40	34.70	183.00	3.75	4.79	4.06
20	7.4	1500	90.40	31.90	164.00	3.57	4.41	3.78
21	7.4	1100	65.40	23.60	134.00	4.28	4.26	3.61
22	7.3	1230	67.40	26.60	151.00	3.21	4.47	3.94
23	7.5	1900	56.60	25.90	279.00	3.03	8.22	7.71
24	7.4	<u>3400</u>	120.00	50.30	448.00	0.36	5.92	8.66
25	7.2	2250	159.00	60.60	169.00	1.00	2.88	2.89
26	7.5	595	68.20	18.30	23.50	2.85	0.73	0.65
27	7.0	490	37.60	6.81	39.10	0	3.21	1.54

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 4b - Grantsville 97

Map (1997 UDAF Ground Water Sample Locations, Grantsville Area, Tooele County, Utah)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Erda and Grantsville, Tooele County, Utah. Samples taken on June 10, 1997. **Shaded** values exceed established guidelines. Underline are severe.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Mo ppm	Sr ppm	Zn ppm
1	0.00	0.00	<u>264.0</u>	0.00	0	0.00	2.0	0.00	14.6	0.00	0.41	0.00
2	0.00	0.00	<u>301.0</u>	0.00	0	0.00	1.8	0.00	23.4	0.36	0.45	0.00
3	0.00	0.00	<u>158.0</u>	0.00	0	0.00	2.1	0.00	26.2	0.55	0.38	0.00
4	0.00	0.00	94.1	0.00	0	0.03	1.8	0.00	37.4	0.44	0.35	0.00
5	0.00	0.00	55.9	0.00	0	0.00	2.9	0.00	53.3	0.35	0.38	0.00
6	0.00	0.00	72.3	0.00	0	0.00	1.6	0.00	23.3	0.48	0.24	0.00
7	0.00	0.00	67.1	0.00	0	0.00	3.8	0.00	70.4	0.59	0.40	0.00
8	0.00	0.00	<u>171.0</u>	0.00	0	0.00	2.1	0.00	20.4	0.51	0.34	0.00
9	0.00	0.00	<u>255.0</u>	0.00	0	0.00	1.7	0.00	23.0	0.63	0.51	0.00
10	0.00	0.00	<u>233.0</u>	0.00	8	0.00	0.5	0.00	14.2	0.36	0.55	0.00
11	0.00	0.00	<u>339.0</u>	0.00	0	<u>0.07</u>	0.0	0.00	6.7	0.38	1.08	0.00
12	0.00	0.00	<u>150.0</u>	0.00	0	0.00	1.8	0.00	18.5	0.36	0.31	0.36
13	0.00	0.00	<u>158.0</u>	0.00	0	0.00	1.8	0.00	14.6	0.16	0.31	0.07
14	0.00	0.00	<u>212.0</u>	0.00	0	0.00	0.9	0.00	18.2	0.60	0.31	0.05
15	0.00	0.00	41.7	0.00	0	0.00	0.3	0.00	20.0	0.47	0.15	0.00
16	0.00	0.00	41.4	0.00	0	0.00	0.2	0.00	22.7	0.62	0.15	0.00
17	0.00	0.00	<u>171.0</u>	0.00	0	<u>0.07</u>	0.0	0.00	51.8	0.50	0.01	0.00
18	0.00	0.00	<u>327.0</u>	0.00	0	0.00	2.6	0.00	24.0	0.57	0.59	0.00
19	0.00	0.00	<u>332.0</u>	0.00	0	0.00	2.8	0.00	18.8	0.41	0.62	0.00
20	0.00	0.00	<u>297.0</u>	0.00	0	0.00	2.6	0.00	24.0	0.51	0.55	0.00
21	0.00	0.00	<u>188.0</u>	0.00	0	0.00	4.2	0.00	18.6	0.49	0.56	0.12
22	0.00	0.00	<u>240.0</u>	0.00	0	0.00	3.0	0.00	27.9	1.33	0.66	0.11
23	0.00	0.00	<u>362.0</u>	0.00	6	<u>0.05</u>	0.4	0.00	21.4	0.51	0.96	0.00
24	0.00	0.00	<u>804.0</u>	1.12	9	0.00	2.1	0.00	<u>88.3</u>	4.26	1.95	0.08
25	0.00	0.00	<u>523.0</u>	0.00	4	0.00	0.7	0.00	50.0	2.82	1.03	0.00
26	0.00	0.00	77.5	0.00	0	0.00	1.0	0.00	10.1	0.49	0.25	0.00
27	0.00	0.00	122.0	0.00	0	<u>0.10</u>	0.2	0.00	16.2	0.15	0.64	0.58

* Sample Sites: wells, drains and springs

Twin M Area

Under the direction of the Twin M SCD 20 wells were sampled in the Milford and Minersville area of Beaver County on June 24, 1997. These wells are used for irrigation, culinary purposes, and livestock. The chemical analyses are listed on Tables 5a and 5b. The map shows the location of all sample sites.

Irrigation Quality

The water in this area is moderately high in salts with 12 of the 20 samples having EC values exceeding 750 umhos / cm. The EC values range is from 300 umhos / cm at sample site number 6, to 1,510 umhos / cm at well number 9. Generally wells on the East of the Beaver river have lower salts than those west of the river. The average EC for the area is 930 umhos/cm.

All wells have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruits market appeal. In this area since other salts are so low bicarbonate should not be much of a problem.

Well number 11 has a R_{Na} value that is slightly elevated. The R_{Na} is a more conservative estimate of the effect of sodium on the soil and tends to exaggerate the problem. The SAR values for all wells are within acceptable levels. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali. This should not be a problem in this area.

Sample sites 1, 4, 5, 7, 9, 11, 12, and 14, all have high chloride levels. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage sensitive crops (ornamentals and vegetables). The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation. The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

None of the sites sampled exceeded values established for livestock.

Drinking Water

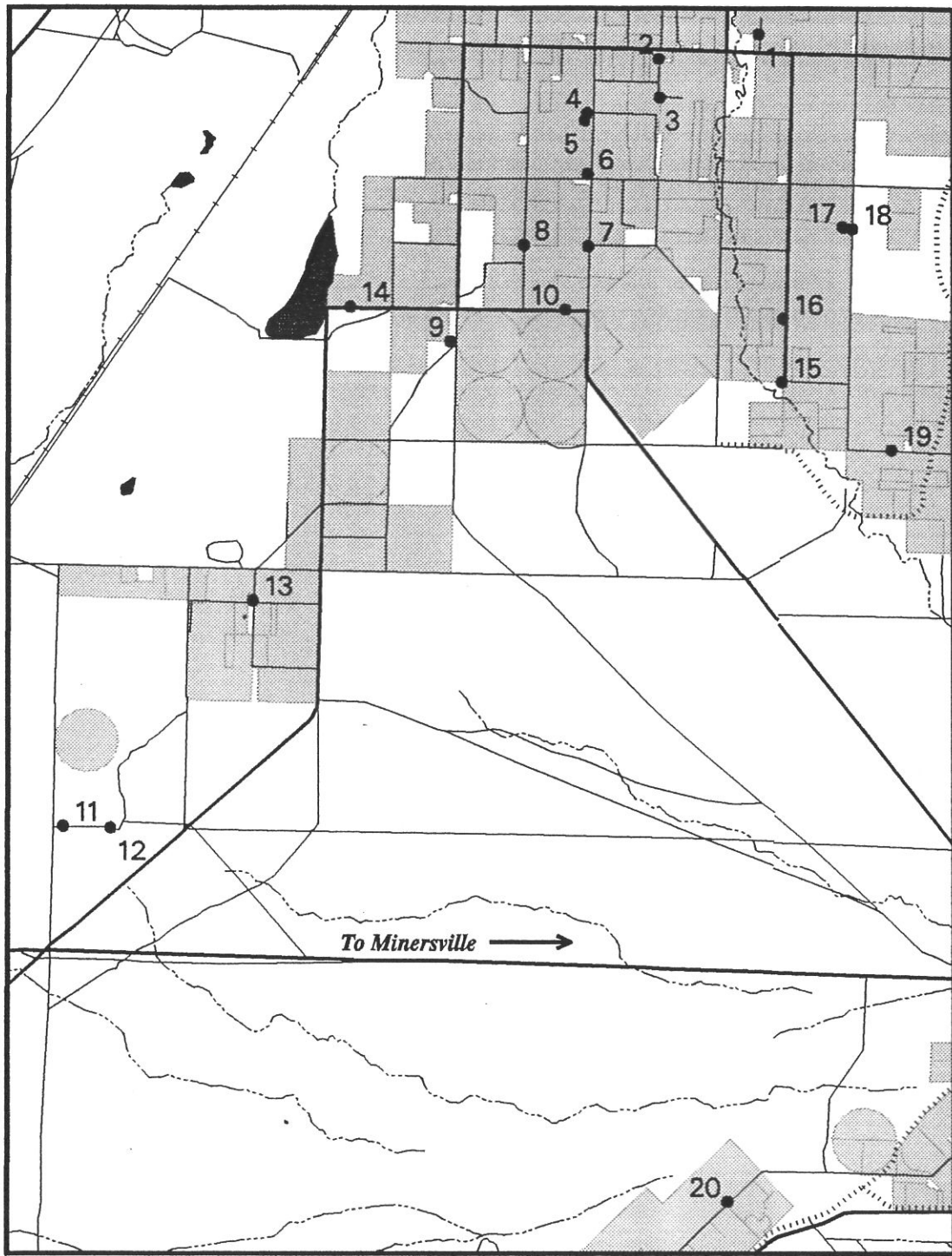
Nitrate was detected in all wells. Only well number 9 has a value that exceeds the 10 ppm level established by EPA. The continual drinking of this water by infants younger than six months old could pose health problems. No pesticides were detected in any of the samples.

The EC values of sample sites 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 14, and 15 exceed the aesthetic water quality standard. This means that these wells may be off flavored. No sampling sites exceed the EPA health level for drinking water.

For the most part the valley has good water quality that should not limit its use.


1997 UDAF Ground Water Sampling Locations

Milford Area, Beaver County, Utah



Map Scale 1:81,250 (1 inch = 1.28 miles)

LEGEND

- | | |
|--|--|
|  Ag Land |  Primary Road |
|  Intermittent Water Body |  Secondary Road |
|  Ditch or Canal |  Field Boundary |
|  Intermittent Stream |  Well |

MAP LOCATION



Table 5a - Beaver County

Map (1997 UDAF Ground Water Sample Locations, Milford Area, Beaver County, Utah)

Irrigation and infiltration qualities areas of Milford and Minersville, Beaver County, Utah. Samples taken on June 24, 1997. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.2	1220	155.00	34.50	35.70	4.46	0.88	0.68
2	7.1	1320	176.00	35.80	45.40	6.96	1.19	0.82
3	7.2	910	112.00	24.20	28.30	4.11	0.82	0.63
4	7.5	1220	153.00	33.00	35.50	4.5	0.88	0.68
5	7.4	1440	188.00	38.40	54.60	6.43	1.40	0.95
6	7.1	300	22.90	8.18	25.90	2.14	1.15	1.18
7	7.2	1190	152.00	32.00	33.60	3.93	0.84	0.65
8	7.4	1040	128.00	27.50	30.60	3.75	0.82	0.64
9	7.1	1510	191.00	38.70	37.90	2.86	0.82	0.65
10	7.4	360	20.00	8.82	39.30	1.96	1.75	1.84
11	7.2	1360	80.80	45.40	120.00	3.93	3.05	2.65
12	7.4	1200	65.40	37.00	107.00	3.03	2.90	2.62
13	7.1	530	50.10	11.60	31.60	2.14	1.13	1.05
14	7.1	1150	143.00	30.30	33.30	2.14	0.76	0.66
15	7.4	1100	134.00	27.20	56.80	7.32	1.68	1.17
16	7.5	650	79.60	18.20	24.10	3.93	0.79	0.63
17	7.0	390	24.00	12.90	31.30	1.96	1.23	1.28
18	7.1	640	51.00	28.30	27.10	1.79	0.77	0.75
19	7.4	675	70.00	17.10	35.50	3.39	1.19	0.99
20	7.1	390	31.50	7.72	29.20	2.14	1.19	1.21

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 5b - Beaver County

Map (1997 UDAF Ground Water Sample Locations, Milford Area, Beaver County, Utah)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for south, southwest, and western areas of Milford and Minersville, Beaver County, Utah. Samples taken on June 24, 1996. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Se ppm	Sr ppm	Zn ppm
1	0.00	0.00	160.0	0.00	7	0.00	5.3	0.00	44.2	0	1.10	0.00
2	0.00	0.00	136.0	0.00	7	0.00	4.0	0.00	43.8	0	1.17	0.00
3	0.00	0.00	105.0	0.00	5	0.00	3.6	0.00	29.5	0	0.79	0.00
4	0.00	0.00	159.0	0.00	7	0.00	4.5	0.00	35.6	0	1.06	0.00
5	0.00	0.00	193.0	0.00	8	0.00	4.8	0.00	44.6	0	1.18	0.00
6	0.00	0.00	9.4	0.00	0	0.00	0.3	0.00	10.6	0	0.30	0.00
7	0.00	0.00	162.0	0.00	6	0.00	8.8	0.00	37.3	0	1.02	0.00
8	0.00	0.00	141.0	0.00	6	0.00	6.6	0.00	31.5	0	0.93	0.00
9	0.00	0.00	292.0	0.00	8	0.00	13.1	0.00	43.2	0	1.29	0.00
10	0.00	0.00	13.6	0.00	0	0.00	0.8	0.00	14.0	0	0.45	0.00
11	0.00	0.32	160.0	0.00	12	0.00	0.4	0.00	79.7	0	2.31	0.00
12	0.00	0.29	162.0	0.00	8	0.00	0.3	0.00	59.0	0	1.82	0.00
13	0.00	0.00	38.6	0.00	5	0.00	0.8	0.00	25.2	0	0.41	0.00
14	0.00	0.00	151.0	0.00	8	0.00	4.6	0.00	68.6	0	1.05	0.00
15	0.00	0.00	69.2	0.00	8	0.00	3.1	0.00	32.0	0	0.96	0.00
16	0.00	0.00	36.1	0.00	5	0.00	2.1	0.00	18.0	0	0.65	0.00
17	0.00	0.00	19.2	0.00	0	0.00	0.9	0.00	15.4	0	0.50	0.00
18	0.00	0.00	65.3	0.00	0	0.00	1.9	0.00	33.8	0	0.99	0.00
19	0.00	0.00	55.1	0.00	5	0.00	3.9	0.00	20.6	0	0.58	0.00
20	0.00	0.00	22.5	0.00	6	0.00	5.1	0.00	9.2	0	0.34	0.00

* Sample Sites: wells, drains and springs

Table 6a - Pavant Area

Map (1997 UDAF Ground Water Sample Locations, South Pahvant Valley Milford Area, Beaver County, UT and 1997 & 1996) and

Map (1997 UDAF Ground Water Sample Locations, North Pahvant Valley Milford Area, Beaver County, UT and 1997 & 1996)

Irrigation and infiltration qualities areas of Pavant Valley, Utah. Samples taken on August 18, 1997. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
4	7.6	840	42.00	30.10	79.60	3.21	2.44	2.29
7	7.9	5700	30.30	86.70	836.00	5.53	17.94	17.49
10	7.4	1000	76.10	24.30	84.30	4.64	2.66	2.15
12	7.4	1150	119.00	32.90	58.40	6.57	1.66	1.22
16	7.1	1020	93.80	33.20	69.90	6.25	2.07	1.58
17	8.3	5300	52.90	56.80	834.00	0.71	15.52	18.97
19	7.4	7200	85.20	29.30	27.90	5.53	0.80	0.66
20	7.8	1110	67.30	56.50	70.50	3.75	1.69	1.53
22	7.1	1600	229.00	69.00	46.20	4.28	0.91	0.69
25	7.4	930	65.70	35.10	82.90	6.78	2.50	2.05
27	7.2	1500	133.00	70.60	55.50	4.28	1.18	0.97
29	6.3	1450	161.00	63.20	51.90	4.64	1.09	0.88
30	6.9	1750	117.00	119.00	75.40	3.92	1.30	1.17
31	7.3	670	58.60	37.20	21.20	4.28	0.62	0.53
33	7.4	850	72.00	45.60	35.50	5.71	0.95	0.81
34	7.1	940	85.60	33.20	34.20	2.14	0.86	0.79
35	7.3	1400	100.00	60.60	99.30	4.5	2.28	1.93
37	7.3	1100	98.40	50.90	36.40	4.28	0.89	0.74
38	7.3	590	36.90	30.30	35.90	3.05	1.12	1.06
39	7.3	700	54.00	35.70	28.70	3.75	0.82	0.74
40	7.2	1320	135.00	48.30	55.80	4.5	1.34	1.05
41	7.0	7550	455.00	281.00	748.00	4.28	8.27	6.80
42	7.2	8500	548.00	363.00	592.00	4.1	5.80	4.81
43	7.4	820	70.80	32.20	39.70	4.1	1.13	0.98

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 6b - Pavant Area

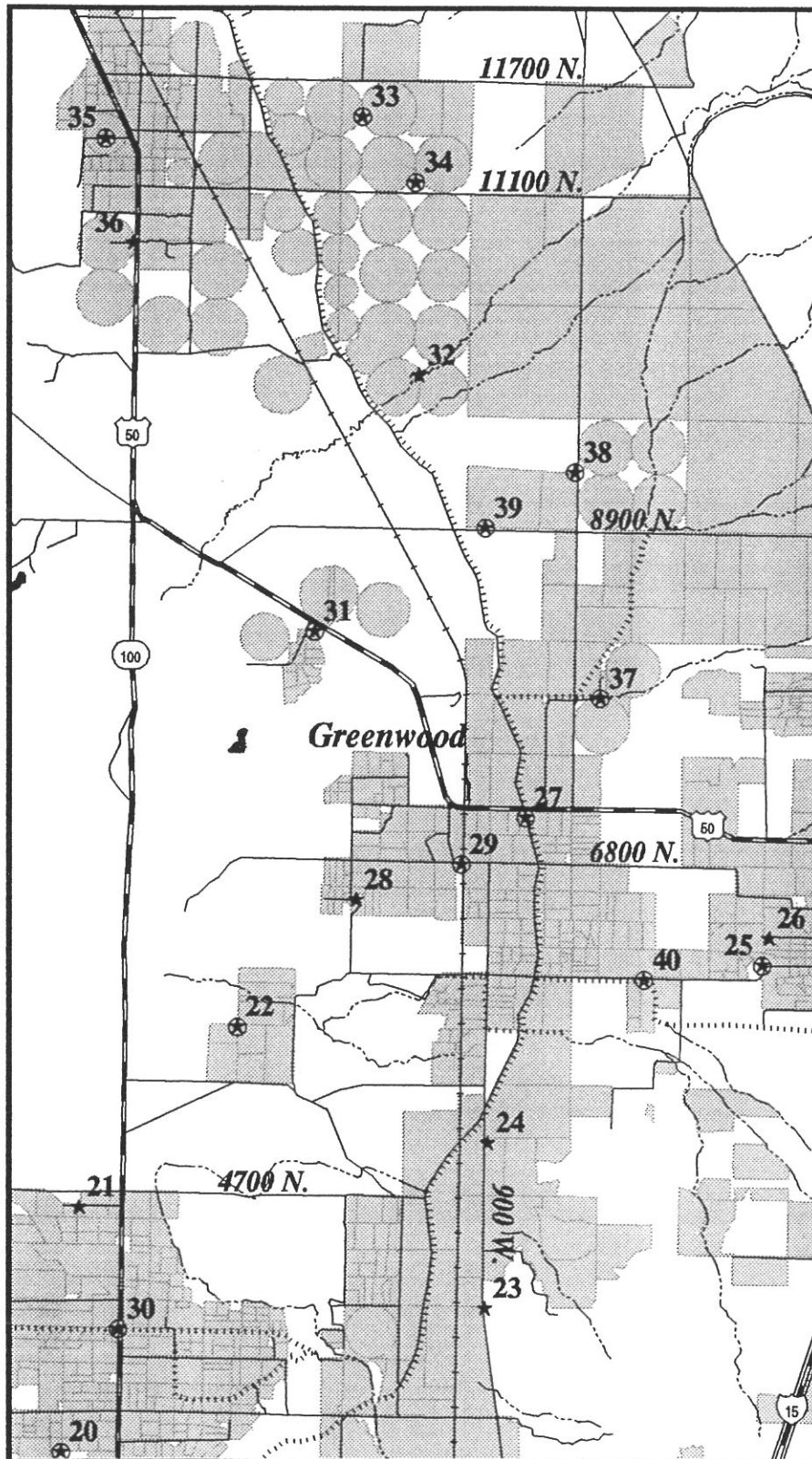
Map (1997 UDAF Ground Water Sample Location, South Pahvant Valley Milford Area, Beaver County, UT and 1997 & 1996) and
 Map (1997 UDAF Ground Water Sample Location, North Pahvant Valley Milford Area, Beaver County, UT and 1997 & 1996)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Pavant Valley, Utah. Samples taken on August 18, 1997. **Shaded** values exceed established guidelines.












*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	Mo ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Sr ppm	Zn ppm
4	0.00	0.00	82.1	0.00	0	0.00	0.00	3.2	0.00	21.1	0.56	0.00
7	0.00	2.29	1572.0	0.45	67	0.28	0.00	5.5	0.00	0.0	0.74	0.00
10	0.00	0.40	131.0	0.00	13	0.00	0.00	4.6	0.00	21.0	0.54	0.00
12	0.00	0.00	168.0	0.00	0	0.00	0.00	6.6	0.00	39.3	0.46	0.00
16	0.00	0.24	94.7	0.00	0	0.00	0.52	6.3	0.00	29.1	0.44	0.00
17	0.00	1.79	1463.0	0.00	95	0.16	0.00	0.7	0.00	91.2	1.70	0.00
19	0.00	0.00	37.3	0.00	0	0.00	0.00	5.5	0.00	10.4	0.34	0.05
20	0.00	0.00	130.0	0.00	11	0.00	0.00	3.8	0.00	64.3	2.21	0.00
22	0.00	0.00	89.1	0.00	4	0.00	0.00	4.3	0.00	205.0	1.98	0.00
25	0.00	0.00	47.2	0.00	0	0.00	0.23	6.8	0.00	17.4	0.25	0.00
27	0.00	0.00	280.0	0.00	0	0.00	0.00	4.3	0.00	37.9	0.57	0.00
29	0.00	0.00	173.0	0.33	4	0.00	3.31	4.6	0.00	125.0	1.18	0.00
30	0.00	0.00	192.0	0.00	4	0.00	0.84	3.9	0.00	136.0	2.10	0.00
31	0.00	0.00	69.3	0.00	0	0.00	0.27	4.3	0.00	7.9	0.36	0.00
33	0.00	0.00	70.5	0.00	0	0.03	0.18	5.7	0.00	15.2	0.33	0.16
34	0.00	0.00	181.0	0.12	0	0.03	0.29	2.1	0.00	17.7	0.39	0.00
35	0.00	0.00	191.0	0.00	0	0.00	0.00	4.5	0.00	49.6	0.57	0.00
37	0.00	0.00	155.0	0.00	0	0.00	0.00	4.3	0.00	10.9	0.38	0.00
38	0.00	0.00	71.4	0.00	0	0.00	0.35	3.1	0.00	10.0	0.50	0.00
39	0.00	0.00	89.9	0.10	0	0.00	0.22	3.8	0.00	8.7	0.53	0.05
40	0.00	0.00	192.0	0.00	0	0.00	0.00	4.5	0.00	29.1	1.11	0.00
41	0.00	1.89	1541.0	0.00	51	0.00	0.00	4.3	0.00	541.0	6.92	0.00
42	0.00	1.23	2227.0	0.00	30	0.00	0.14	4.1	0.00	339.0	6.37	0.00
43	0.00	0.00	97.6	0.00	6	0.00	0.00	4.1	0.00	14.7	0.55	0.00

* Sample Sites: wells, drains and springs

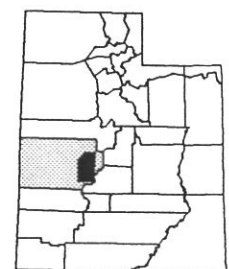
1997 and 1996 UDAF Ground Water Sample Locations N. Pahvant Valley (Millard County), Utah



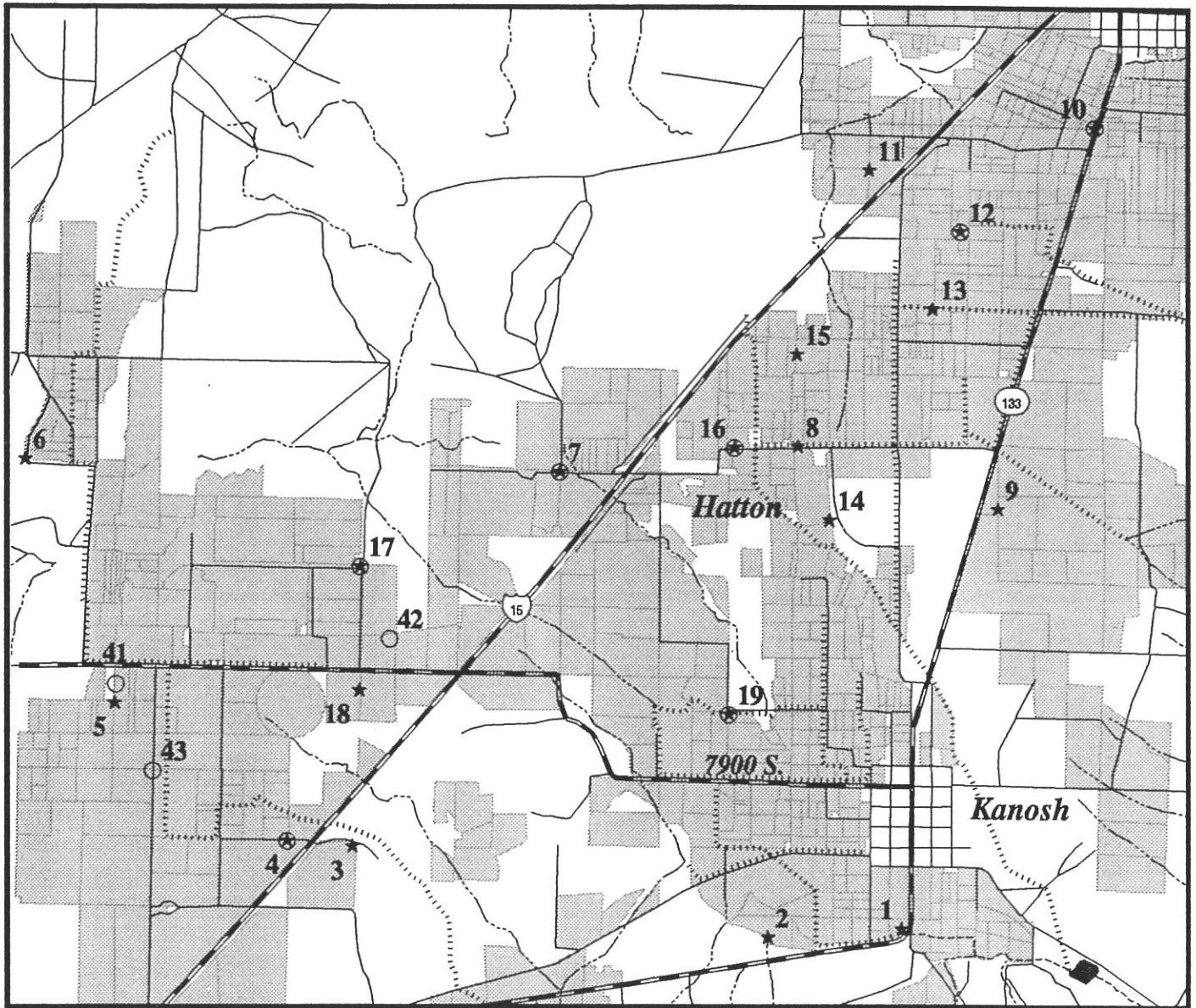
LEGEND

-  *Perennial Stream*
-  *Ditch or Canal*
-  *Intermittent Stream*
-  *Primary Road*
-  *Secondary Road*
-  *Railroad*
-  *Field Boundary*
-  *Agricultural Land*
-  *Water Body*
-  *1997 Sampling Site - Well*
-  *1996 Sampling Site - Well*

MAP LOCATION



1997 and 1996 UDA Ground Water Sample Locations S. Pahvant Valley (Millard County), Utah



LEGEND

	<i>Perennial Stream</i>		<i>Field Boundary</i>
	<i>Ditch or Canal</i>		<i>Agricultural Land</i>
	<i>Intermittent Stream</i>		<i>Water Body</i>
	<i>Primary Road</i>		<i>1997 Sampling Site - Well</i>
	<i>Secondary Road</i>		<i>1996 Sampling Site - Well</i>
	<i>Railroad</i>		

MAP LOCATION

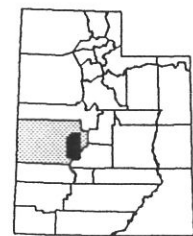


Table 7a - Curlew Area, Box Elder, County, Utah

(No Map)

Irrigation and infiltration qualities areas of Curlew Valley, Utah. Samples taken on August 5, 1997. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.2	2700	77.10	32.40	219.00	4.11	6.12	5.28
3	7.5	1500	82.40	41.20	174.00	4.82	3.49	3.91
4	7.1	3340	185.00	93.30	373.00	4.5	6.79	5.58
6	7.0	2250	142.00	69.00	188.00	4.28	3.88	3.24
7	7.0	3380	88.10	33.20	493.00	3.39	12.84	11.36
9	7.1	3380	73.30	30.50	543.00	3.57	15.07	13.45
10	7.0	5500	281.00	183.00	578.00	4.82	7.84	6.59
11	7.1	910	93.80	22.40	35.90	2.32	0.96	0.86
14	7.5	1010	84.20	32.00	60.80	2.5	1.59	1.43
15	7.1	610	63.10	11.70	19.00	2.5	0.64	0.58
16	7.3	490	84.20	32.00	60.80	2.5	1.72	1.43
18	7.2	1600	78.60	38.00	183.00	3.21	4.83	4.24
30	7.2	3610	76.40	31.20	579.00	3.75	15.98	14.10
31	7.2	2700	151.00	60.50	293.00	4.64	6.38	5.09
32	7.0	2880	195.00	74.70	284.00	4.64	5.56	4.38
33	6.9	8100	591.00	187.00	591.00	1.96	6.49	5.43
34	7.0	2300	160.00	44.30	212.00	2.68	4.49	3.82
35	7.0	3250	189.00	58.50	337.00	3.57	6.87	5.49
36	6.8	1150	111.00	29.30	53.40	2.68	1.36	1.16
37	7.1	6000	94.00	30.70	1034.00	3.21	23.82	23.67
38	7.5	3280	267.00	77.80	217.00	2.32	3.65	3.00
39	6.8	1370	140.00	35.20	58.40	1.96	1.28	1.14
40	6.7	9400	714.00	186.00	725.00	1.43	7.51	6.25
41	6.8	5280	330.00	88.80	472.00	1.96	6.68	5.95

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 7b - Curlew Area, Box Elder County, Utah

(No Map)

Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Curlew Valley, Utah. Samples taken on August 5, 1997. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Se ppm	Sr ppm	Zn ppm
1	0.00	0.00	349.0	0.00	9	0.00	0.1	0.00	24.8	0.00	1.23	0.84
3	0.00	0.00	246.0	0.00	11	0.00	0.2	0.00	57.8	0.00	1.09	0.00
4	0.00	0.17	751.0	0.00	19	0.00	1.3	0.00	126.0	0.00	2.81	0.00
6	0.00	0.00	487.0	0.00	12	0.00	4.3	0.00	46.6	0.00	2.94	0.00
7	0.00	0.00	1109.0	0.00	23	0.00	0.3	0.00	22.1	0.00	1.54	0.00
9	0.00	0.00	947.0	0.00	9	0.00	0.3	0.00	19.9	0.00	2.32	0.00
10	0.00	0.00	1262.0	0.00	23	0.00	18.5	0.00	212.0	0.00	3.35	0.00
11	0.00	0.02	172.0	0.00	13	0.00	1.2	0.00	12.6	0.00	0.58	0.00
14	0.00	0.00	195.0	0.00	11	0.00	1.0	0.00	18.1	0.00	0.89	0.00
15	0.00	0.00	84.7	0.00	8	0.00	0.4	0.00	15.8	0.00	0.47	0.00
16	0.00	0.00	49.7	0.00	5	0.00	0.6	0.00	11.3	0.00	0.27	0.00
18	0.00	0.00	335.0	0.00	5	0.00	0.8	0.00	16.1	0.00	1.59	0.00
30	0.00	0.00	932.0	0.00	9	0.00	0.2	0.00	20.3	0.00	2.40	0.00
31	0.00	0.00	647.0	0.00	17	0.00	1.8	0.00	56.2	0.00	2.18	0.00
32	0.00	0.00	594.0	0.00	15	0.03	0.7	0.00	122.0	0.00	2.01	0.00
33	0.00	0.16	2506.0	0.00	44	0.03	3.4	0.00	31.7	0.00	4.48	0.00
34	0.00	0.00	566.0	0.00	19	0.00	3.7	0.00	36.6	0.00	1.05	0.00
35	0.00	0.00	877.0	0.00	24	0.00	1.3	0.00	40.4	0.00	1.62	0.00
36	0.00	0.00	250.0	0.00	14	0.00	0.6	0.00	20.0	0.00	0.76	0.00
37	0.00	0.19	1691.0	0.00	28	0.00	0.2	0.00	31.6	0.00	3.15	0.18
38	0.00	0.00	969.0	0.00	22	0.00	2.8	0.00	16.6	0.00	1.85	0.00
39	0.00	0.00	314.0	0.00	16	0.00	2.7	0.00	19.7	0.00	0.85	0.00
40	0.00	0.19	2932.0	0.00	57	0.00	0.8	0.00	24.0	0.00	7.41	0.00
41	0.00	0.00	1544.0	0.00	30	0.00	8.2	0.00	20.6	0.00	2.59	0.00

* Sample Sites: wells, drains and springs

Appendix I: Critical Values for Tested Parameters

Irrigation Parameters	Magnitude of Problem	
	Moderate	Severe
EC (Electrical Conductivity) Measures total salts in solution:	> 750 umhoms/cm	> 3,000 umhoms/cm.
SAR (Sodium Absorption Ratio) Estimates activity of Sodium in the soil.	> 3 meq/l.	> 9 meq/l.
Chloride.		
For sprinkler irrigation		> 3 meq/l.
For surface irrigation	> 4 meq/l.	> 10 meq/l.
Boron.	> 0.7 ppm	> 10.0 ppm.
HCO₃ (Bicarbonate).		
For sprinkler irrigation.	> 1.5 meq/l.	> 8.5 meq/l.
Al (Aluminum).	> 5.0 ppm.	
Cu (Copper).	> 0.2 ppm.	
Fe (Iron).	> 5.0 ppm.	
Mn (Manganese).	> 0.2 ppm.	
Zn (Zinc).	> 2.0 ppm.	
Se (Selenium).	> 0.02 ppm.	

Livestock

	Min. Level
EC (umhoms/cm)	> 8,332
Sulfate	> 167 ppm
Nitrate	> 100 ppm
Al (Aluminum)	> 5 ppm
As (Arsenic)	> 0.2 ppm
B (Boron)	> 5.0 ppm
Cd (Cadmium)	> 0.05 ppm
Cr (Chromium)	> 1.0 ppm
Co (Cobalt)	> 1.0 ppm
Fl (Fluoride)	> 2.0 ppm
Pb (Lead)	> 0.1 ppm
Se (Selenium)	> 0.05 ppm
Zn (Zinc)	> 25.0 ppm

Human

	Min. Level
EC (umhoms/cm)	> 3,333 (833.33*)
Nitrate	> 10 ppm
As (Arsenic)	> 0.05 ppm
Ba (Barium)	> 1.0 ppm
Cd (Cadmium)	> 0.01 ppm
Cr (Chromium)	> 0.05 ppm
Cu (Copper)	> 1.0 ppm
Fl (fluoride)	> 2.0 ppm
Fe (Iron)	> 0.3 ppm*
Pb (Lead)	> 0.05 ppm
Mn (Manganese)	> 0.05 ppm*
Se (Selenium)	> 0.01 ppm
Zn (Zinc)	> 5.0 ppm*
Sulfate	> 83 ppm*

Critical values are from: Table 1, page 8 and Table 6, page 40 of "Water Quality for Agriculture", FAO Irrigation and drainage paper 29 revision 1; and USU information sheets, "Water Quality Analysis (For Irrigation)" and "Analysis of Water Quality for Livestock" EL 280.

*These values are for secondary Drinking Water Standards and for aesthetics water quality.