Soil Survey

University of Idaho Research and Extension Center

and

USDA Snake River Conservation Research Center

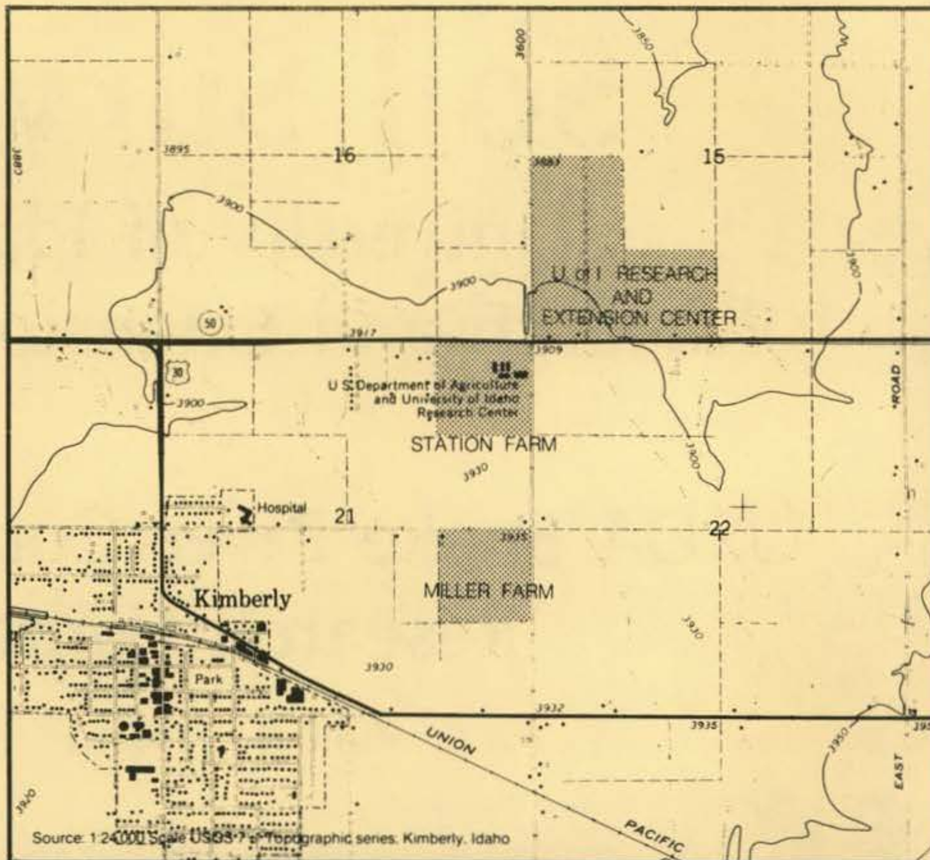
Kimberly, Idaho

Agricultural Experiment Station
College of Agriculture
University of Idaho

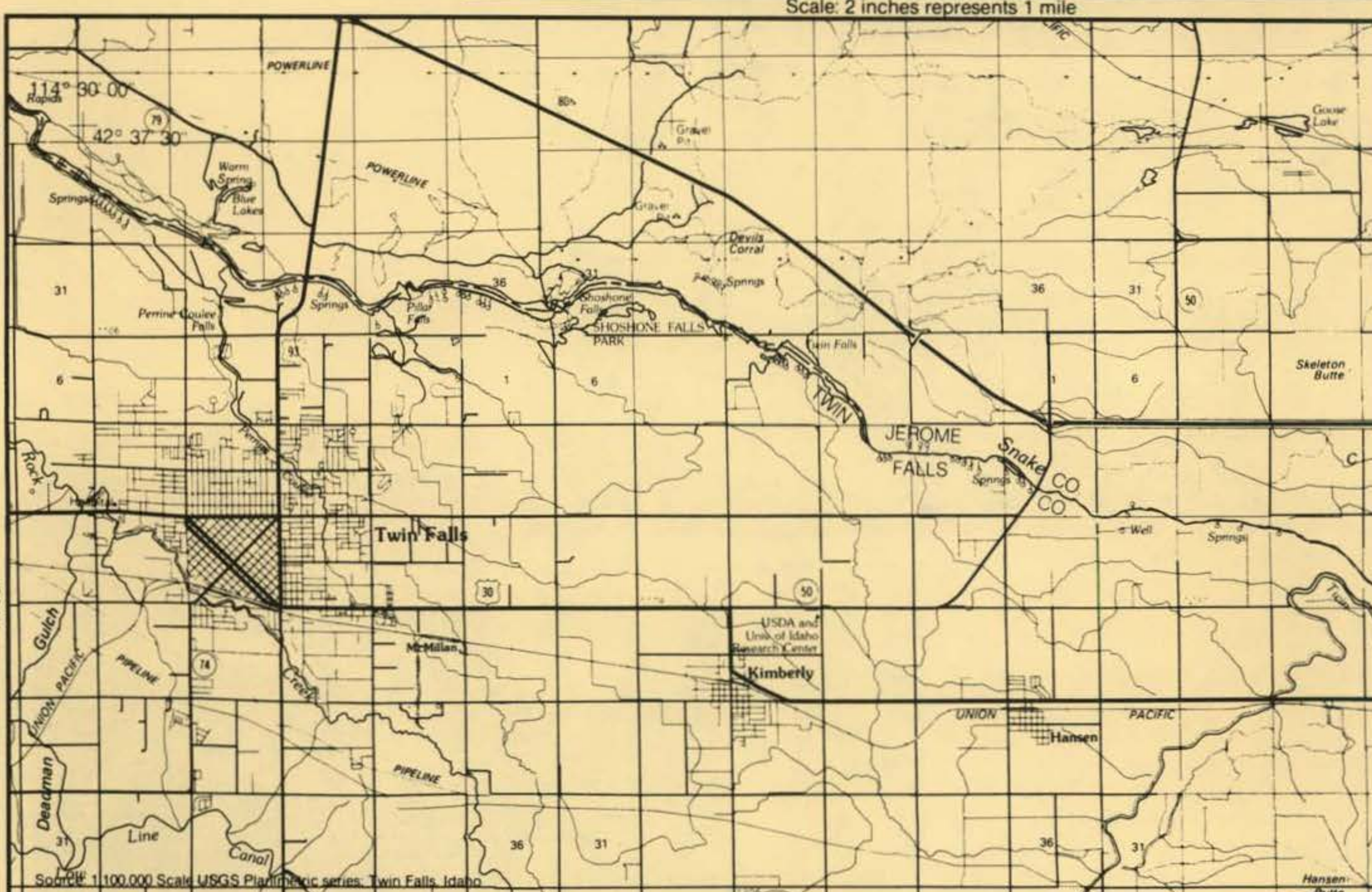
Bulletin No. 656

UNIVERSITY OF IDAHO RESEARCH AND EXTENSION CENTER

LOCATION MAP



Scale: 2 inches represents 1 mile



R.17E. Scale: ½ inch represents 1 mile R.18E. R.19E.

VICINITY MAP

Prepared by M.C. Beaty, USDA-SCS, Boise, Id., January 1986.

Soil Survey

University of Idaho Research and Extension Center, Kimberly
USDA Snake River Conservation Research Center, Kimberly

R. E. McDole and H. B. Maxwell*

Location

The 120-acre University of Idaho Research and Extension Center at Kimberly and the 80-acre USDA Snake River Conservation Research Center at Kimberly are two separate facilities. They are located near Kimberly about 5 miles east of Twin Falls.

The University of Idaho Research and Extension Center consists of 120 acres in the W½SW¼ and the SE¼SW¼ section 15, township 10 south, range 18 east of Boise-Meridian. It is bordered on the south by U.S. Highway 30 and on the west by county road 3600 E.

The USDA Snake River Conservation Research Center is situated on 40 acres in the NE¼NE¼ of section 21, township 10 south, range 18 east. It is bordered on the north by U.S. Highway 30 and on the east by county road 3600 E. A second parcel of land consisting of 40 acres, referred to as the Miller farm, is located in the NE¼SE¼ of section 21, township 10 south, range 18 east.

The elevation of both Centers is about 4,000 feet above mean sea level. They are located approximately at latitude 42° 30 minutes and longitude 114° 8 minutes.

History

University of Idaho Research and Extension Center, Kimberly

Research on breeding and improvement of beans in Idaho was started in the early 1920s by Dr. C. W. Hungerford. Between that time and 1950, this work was conducted on rented land at a number of locations in the Magic Valley area. The 30th session of the Idaho State Legislature passed House Bill 345 (1949) to further the research and development of the dry bean industry in Idaho. This act provided for a tax of 2 cents per hundredweight on beans entering primary channels of trade.

In September 1950, the regents of the University of Idaho purchased the 80 acre G. H. Smith farm (Fig. 1). In 1983, the University purchased an additional 40 acres east of the original 80-acre tract. The original tract included a two-story house and a barn. The house was used as a superintendent's residence, and the barn was converted into a machine shed. A seed storage and cleaning building was constructed in 1951. Marshall J. LeBaron was hired as superintendent soon after the first tract of land was purchased. He retired from the University in 1982.

Establishing a permanent experiment station in the Twin Falls area fulfilled a pressing need for a research program in one of Idaho's most intensive agricultural areas. The primary objective was to conduct research in all phases of bean production. Research was also conducted on other crops common to the area, including alfalfa, small grains, potatoes and sugarbeets.

By December 1951, the present field layout was established after some land leveling and moving of original farm ditches (see page 10). Cut and fill areas represent removal of topsoil from one site (cut area) and deposition of topsoil in others (fill area). The cuts and fills ranged in depth from 0.6 to 10 inches. Field numbers were established in 1951 and remained the same until 1983 when the additional 40-acre tract was purchased. At that time, some changes were made in field numbers.

Irrigation facilities on the Center have been improved through the years to the present system of concrete pipe and ditches. Beginning in about 1975, sprinkler irrigation equipment was introduced in some fields. A high pressure buried mainline was installed in 1985 to enable sprinkler irrigation throughout the Center.

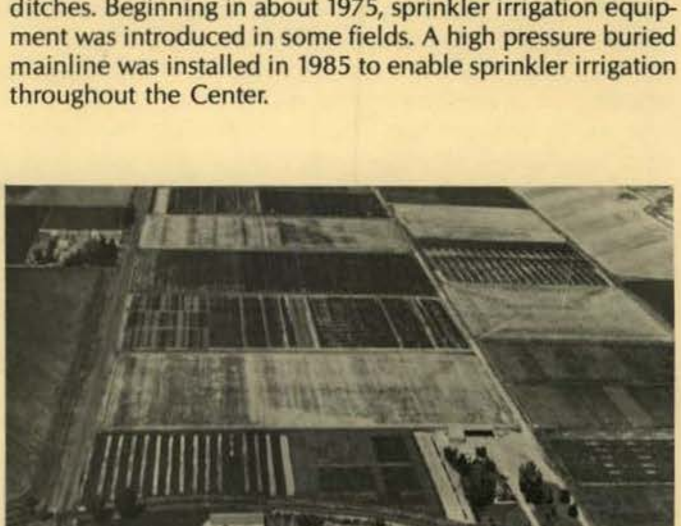


Fig. 1. Aerial view, taken in 1960, of University of Idaho 80-acre tract (looking north). Superintendent's house and shop in lower right and seedhouse between canal and highway slightly left of center at lower edge of photo.

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Snake River Conservation Research Center

In 1958, the USDA conducted a national study on soil and water conservation research needs. The study was made with the assistance of numerous public and private organizations and individuals. The report of this study, released in 1959, entitled "Facility Needs in Soil and Water Conservation Research," was submitted to Congress and was published by the Senate Committee on Appropriations as Senate Document 59, 86th Congress. This study pointed out that a major field station was needed in the Snake River Basin to attack a wide variety of serious problems in soil and water management. In 1960, Congress appropriated money for design and construction of the Snake River Conservation Research Center. Building plans were completed and construction began in September 1962, and the facilities were completed in October 1963.

Local citizens interested in the Center donated the 10-acre building site across the road from the existing University Research and Extension Center. This close proximity encouraged excellent cooperative relationships between University and USDA-ARS research personnel. The USDA has made office, laboratory and greenhouse space available to University research personnel. The U.S. Weather Bureau located a station at the USDA Snake River Conservation Research Center in 1965. This weather station has been engaged in agricultural weather forecasting and weather research related to crop production. The remaining 30 acres of the 40-acre tract on which the headquarters are located was leased by the USDA in 1962. In 1966, the 40-acre Miller farm was leased by USDA to increase the land available for use by the research staff.

The buildings initially constructed at the site (Fig. 2) included the office-laboratory complex, greenhouse facilities and shop and storage buildings for equipment and vehicles. Laboratories include space for work in soil chemistry, soil fertility, soil physics, soil mechanics and soil microbiology. A separate hydraulics laboratory provides facilities for studies in irrigation and drainage. The facility was planned to employ 50 to 60 people, including 20 to 25 professional scientists and engineers. Research at the Center was to concentrate on the most pressing regional soil and water management problems. Research has been directed toward improved management of plant nutrients, soil and water on crops including potatoes, small grains, sugarbeets, beans, alfalfa and range or pasture. Water management studies have been made on improving irrigation practices, irrigation systems and water quality. An intensive study of crop water use has been conducted with the aid of two excellently instrumented weighing lysimeters. A USDA entomological research program was moved to Kimberly from Twin Falls in 1975. Field layout and identification for the USDA Research Center and the Miller farm are shown on pages 8-9.

Geology

The two Research Centers lie in the large intermountain valley known as the Snake River Plain. Topography in this area of the Snake River Plain ranges from nearly level to gently undulating. The soils are formed in silty parent materials that range in thickness from a few feet to more than 100 feet. Some disagreement exists on the origin of this silty parent material. The most commonly accepted theory is that the material was wind-deposited (Lewis et al. 1975). Other scientists recognize a thin surface loess mantle (6 to 20 inches) but consider most of the silts to be of lacustrine origin (Lund et al. 1981). Some areas in the vicinity of the Research Centers have relatively thin layers of soil material over basaltic bedrock. The layered basaltic bedrock can be easily observed in the walls of the Snake River Canyon about 3 miles north of the Research Centers.

Sources of the wind-carried silty materials that comprise the soils of the Research Centers are considered to be the lacustrine lakebed sediments located to the west and floodplain deposits from glacial runoff water from the Snake River during the Pleistocene and Recent geologic times. The cemented duripans, or caliche layers, found in the lower depths of the profile are thought to be much older loess deposits than the present-day surface soils.

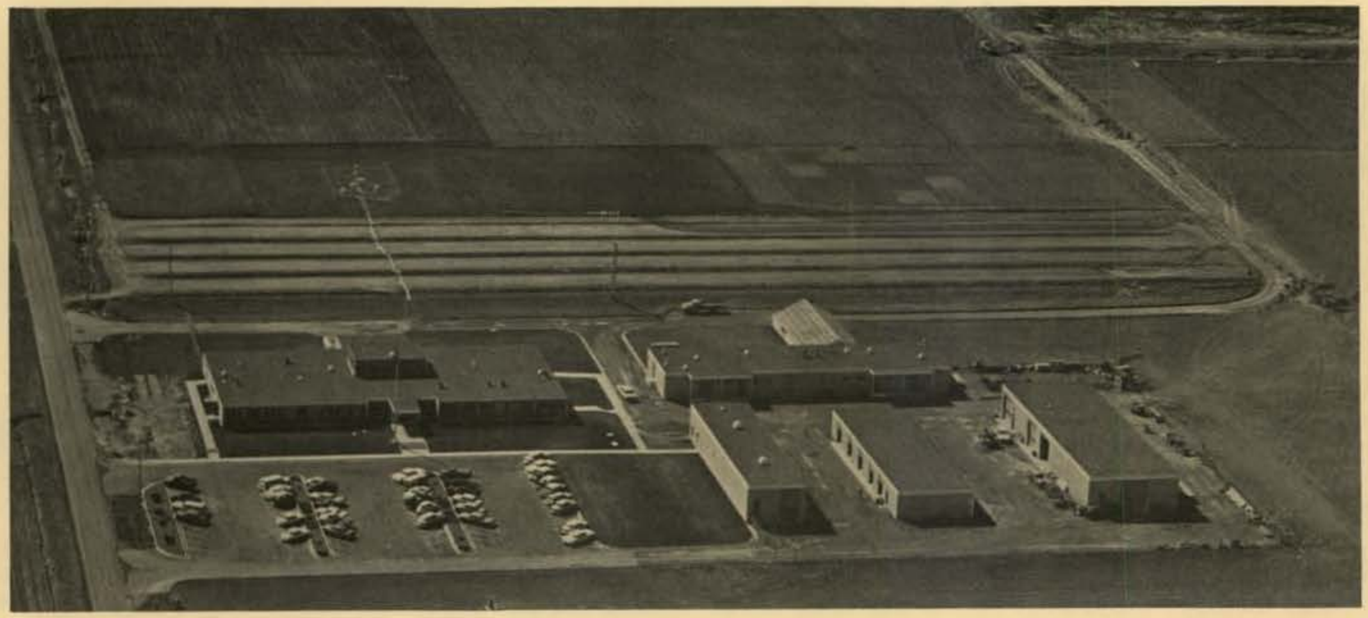


Fig. 2. Aerial view, taken about 1970, of USDA-Snake River Conservation Research Center near Kimberly.

Climate

The climate of Twin Falls County, in which the Research Centers are located, is characterized by low annual precipitation, a dry atmosphere, hot summers and cold winters. It is a continental climate with storms moving in from the southwest and west following their origin over the Pacific Ocean. Average annual precipitation (Table 1) is slightly over 11 inches per year. This is fairly evenly distributed through the year, with July and August slightly lower and November through January and March slightly higher than the other months. Precipitation in December through February usually is in the form

Table 1. Average precipitation by month.

	Precipitation (inches)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
1963	—	—	—	1.09	1.04	2.24	0.00	1.40	0.87	0.20	1.88	0.98	—
1964	0.97	0.16	0.53	0.91	1.04	2.14	0.16	0.18	0.24	0.89	1.30	4.01	12.53
1965	0.79	0.21	0.18	2.08	1.14	0.51	0.38	0.87	0.60	0.00	0.74	0.79	8.39
1966	0.36	0.22	0.85	0.26	0.33	0.10	0.00	0.00	0.00	0.28	1.15	0.56	4.11
1967	0.80	0.10	1.20	1.90	0.58	2.38	0.29	0.01	0.28	0.94	0.36	0.17	9.01
1968	0.76	1.68	1.00	0.44	0.93	0.93	0.00	3.23	0.29	0.31	1.62	1.97	13.16
1969	0.51	0.76	0.08	0.27	0.12	1.01	0.16	0.00	0.85	0.43	0.68	1.22	6.09
1970	3.38	0.19	0.57	0.75	1.10	1.62	1.09	0.05	1.03	0.58	2.32	1.09	13.77
1971	2.09	0.31	0.95	2.04	2.00	1.40	0.01	0.29	0.75	0.71	1.90	1.23	13.68
1972	2.81	1.18	1.14	0.35	0.32	0.09	0.01	0.32	0.92	1.32	0.89	1.36	11.52
1973	0.97	0.38	1.84	1.00	0.60	1.07	0.50	0.07	0.89	0.26	2.10	1.78	11.46
1974	0.75	0.77	1.91	0.70	0.15	0.25	0.27	0.08	0.00	1.19	0.37	1.31	7.75
1975	0.84	1.71	2.18	1.44	2.79	0.37	0.45	0.06	0.02	2.59	0.86	0.49	13.80
1976	1.52	1.29	0.43	0.87	0.41	0.81	0.26	2.02	0.79	0.72	0.10	0.00	9.22
1977	0.34	0.22	0.18	0.14	1.86	0.72	1.27	0.36	0.78	0.04	1.77	2.03	9.71
1978	1.32	0.83	1.72	1.40	1.19	0.14	0.12	0.22	2.41	0.01	0.52	0.30	10.18
1979	2.28	0.49	1.13	0.32	0.73	0.46	0.11	0.78	0.02	0.83	0.82	0.32	8.29
1980	2.71	0.88	0.34	0.88	2.74	0.99	0.18	0.11	1.73	0.34	0.77	1.04	12.71
1981	0.51	0.44	1.33	1.92	0.76	0.28	0.01	T	0.35	1.21	1.72	2.91	11.44
1982	0.77	1.08	1.38	0.94	0.39	0.52	0.70	0.43	1.46	1.60	0.76	1.25	11.28
1983	0.78	1.36	2.10	0.69	1.37	0.84	0.43	0.84	0.95	0.78	2.63	3.13	15.90
1984	0.31	1.65	0.46	0.76	1.05	1.74	0.33	0.90	0.51	1.24	1.69	0.65	11.29
Mean	1.22	0.76	1.57	0.96	1.03	0.97	0.31	0.56	0.71	0.75	1.23	1.26	11.30

Table 2. Average maximum air temperature by month.

	Temperature (°F)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual avg.
1963	—	—	—	56.3	69.3	69.8	83.2	84.1	77.9	69.2	48.4	34.1	—
1964	33.1	35.1	41.6	55.6	67.6	71.6	87.2	81.7	71.9	67.3	45.6	39.6	58.3
1965	38.0	44.6	47.9	59.4	62.9	73.5	83.8	80.6	67.3	69.1	54.4	39.5	60.2
1966	38.2	39.5	51.6	59.5	74.0	76.7	86.8	83.6	78.0	61.9	51.1	36.8	61.6
1967	40.5	47.0	51.5	51.8	67.1	72.2	88.8	89.5	79.6	62.6	50.4	33.6	61.3
1968	38.8	45.6	54.4	55.8	67.4	76.1	87.9	75.8	72.4	62.5	45.6	36.7	60.0
1969	39.6	38.4	47.4	62.2	73.5	74.4	84.8	86.6	77.6	56.1	51.2	40.5	61.2
1970	39.9	49.1	48.9	51.8	66.7	77.3	84.6	86.4	68.0	58.5	47.9	36.4	59.7
1971	37.7	42.6	46.4	55.7	67.8	73.5	85.2	87.9	69.5	57.5	45.9	33.8	58.7
1972	34.2	40.1	54.0	57.3	69.3	77.1	83.4	84.9	68.5	60.1	44.8	32.1	58.9
1973	33.5	41.4	48.5	56.9	70.6	76.9	84.1	83.1	71.6	64.3	45.5	41.1	59.9
1974	32.1	42.3	48.7	58.1	66.2	82.5	85.1	82.8	77.1	62.9	49.0	38.1	60.5
1975	33.2	37.6	47.0	48.9	62.0	73.8	87.5	79.7	76.5	60.6	45.0	42.3	58.0
1976	35.9	38.4	43.7	56.8	70.6	74.2	85.3	78.4	75.5	62.9	54.0	44.0	60.0
1977	31.5	48.1	48.4	65.6	61.2	81.2	83.5	83.4	73.9	65.7	48.4	42.2	61.1
1978	40.5	42.3	56.3	57.2	64.0	76.0	83.4	81.2	71.1	66.6	44.9	33.8	59.8
1979	24.2	38.9	50.6	57.4	69.0	78.1	85.4	82.6	80.5	65.9	44.0	41.6	59.9
1980	34.6	45.0	48.1	62.9	64.1	74.4	84.1	80.4	73.3	—	48.9	43.2	59.9
1981	40.1	45.5	53.8	60.0	64.8	74.9	85.4	88.2	77.3	57.6	50.9	41.8	61.7
1982	31.5	34.8	48.6	55.2	65.9	75.7	80.7	86.0	71.7	58.3	44.4	36.6	57.5
1983	40.5	45.0	50.8	54.3	65.9	74.4	81.0	84.7	74.7	63.3	48.4	30.3	59.4
1984	28.7	32.9	47.5	55.8	66.2	72.4	85.4	86.6	72.9	57.2	44.9	31.9	56.9
Mean	35.4	41.4	49.3	57.0	67.1	75.3	84.8	83.6	73.9	62.3	48.1	37.5	59.7

Table 3. Average minimum air temperature by month.

Year	Temperature (°F)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual avg.
1963	—	—	—	33.5	43.5	46.0	50.5	51.9	49.2	38.8	29.1	18.9	—
1964	16.9	16.8	24.4	31.8	40.5	46.8	54.5	49.8	39.6	34.2	26.7	25.7	34.0
1965	24.6	23.3	21.9	38.0	39.4	47.5	52.4	51.2	39.5	34.6	30.8	19.4	35.3
1966	20.5	21.5	26.0	32.6	43.0	47.4	53.6	51.9	47.3	31.8	30.0	21.7	35.7
1967	25.4	25.3	28.1	30.7	41.0	48.2	55.8	54.2	47.2	32.4	28.8	16.0	36.2
1968	16.1	27.0	29.5	30.7	40.8	49.4	53.5	49.3	41.8	32.3	28.9	20.5	35.0
1969	22.8	21.6	24.7	34.6	44.2	49.2	53.9	51.7	45.4	30.4	25.7	23.9	35.8
1970	25.5	26.9	27.7	29.3	40.8	48.1	54.6	53.4	38.9	31.0	30.3	20.0	35.6
1971	23.9	23.5	26.4	32.4	42.0	48.0	53.5	54.6	37.4	32.3	28.1	17.5	35.0
1972	17.8	22.7	31.3	31.9	40.3	50.0	51.1	52.3	40.6	35.5	27.3	14.8	34.7
1973	18.4	23.7	27.8	32.4	41.9	47.8	52.9	52.1	42.2	33.9	29.4	25.5	35.7
1974	17.7	24.8	27.7	32.4	40.5	49.9	52.6	48.8	41.8	34.0	28.0	22.2	35.1
1975	16.4	22.9	28.1	29.9	38.3	47.4	57.2	48.3	41.9	35.1	26.2	25.2	34.8
1976	21.7	20.8	23.0	32.5	41.2	45.2	53.2	48.3	43.6	31.8	24.6	15.8	33.5
1977	14.5	19.4	25.1	33.9	38.9	51.9	52.7	52.3	40.9	33.3	26.0	27.5	34.8
1978	26.7	26.3	31.2	34.5	38.7	45.9	52.1	47.1	42.6	32.7	23.6	16.3	34.8
1979	7.9	24.4	29.6	32.5	41.0	47.3	51.8	51.7	45.3	37.2	21.6	22.3	34.5
1980	17.5	28.2	27.9	34.8	42.1	46.4	53.7	48.9	44.7	—	26.5	23.0	35.8
1981	23.4	22.2	28.5	35.7	41.0	48.4	50.1	51.7	42.8	33.1	29.9	25.1	36.0
1982	15.0	17.6	29.8	28.8	38.0	47.1	52.4	51.9	44.6	33.8	24.0	22.4	33.8
1983	26.2	27.4	31.4	30.5	39.3	46.3	49.3	55.3	42.7	35.1	30.9	18.5	36.1
1984	15.5	17.6	29.1	32.7	40.5	45.5	54.5	53.8	40.2	32.6	28.9	13.2	33.6
Mean	19.7	23.0	27.6	32.6	40.8	47.7	53.0	51.4	42.7	33.6	27.5	20.5	35.0

of snow. Extremely hot days in the summer and extremely cold days in the winter are not uncommon, but periods of extreme temperatures are relatively short in duration.

The National Oceanic and Atmospheric Administration has maintained a weather station at the USDA Research Center since 1965. Earlier weather data were collected at a site in Twin Falls. Maximum and minimum air temperatures for the past 18 years are given in Tables 2 and 3. Growing degree days are given in Table 4. The frost-free season is about 138 days at Kimberly (Table 5) and 131 days at Twin Falls (Table 6). Dates of killing frost in spring and fall are given in Table 7 with the extreme occurrences of freezing temperatures given in Table 8.

Table 4. Growing degree days by month using 40° and 50° bases.[1]

Base	March	April	May	June	July	Aug.	Sept.	Oct.
40°	191	352	525	641	796	746	574	414
50°	73	202	348	454	625	583	426	258

[1]Twin Falls Weather Station — discontinued in 1965.
Everson et al. 1978.

Table 5. Length of growing season at the Weather Station Office, Kimberly, for four temperature thresholds.[1]

	Temperature threshold[2]			
	20°F	24°F	28°F	32°F
Days	217	182	154	138

[1]Everson et al. 1978.
[2]At 50 percent probability or average occurrence of these temperatures in the spring and fall.

Table 6. Length of growing season at the Twin Falls Weather Station[1] for four temperature thresholds.[2]

	Temperature threshold[3]			
	20°F	24°F	28°F	32°F
Days	232	195	164	131

[1]Station discontinued in 1975.
[2]Everson et al. 1978.
[3]At 50 percent probability or average occurrence of these temperatures in the spring and fall.

Table 7. Probability of spring and fall freezing thresholds.[1]

Temp.	Percent probability of indicated or lower temperature occurring on or after date in spring					Percent probability of indicated or lower temperature occurring on or after date in fall				
	90%	75%	50%	25%	10%	10%	25%	50%	75%	90%
20	Mar 16	Mar 24	Apr 32	Apr 12	Apr 20	Oct 15	Oct 25	Nov 5	Nov 16	Nov 26
24	Mar 25	Apr 3	Apr 13	Apr 22	May 1	Sept 28	Oct 4	Oct 12	Oct 19	Oct 26
28	Apr 18	Apr 25	May 3	May 10	May 17	Sept 20	Sept 26	Oct 4	Oct 11	Oct 18
32	May 4	May 7	May 12	May 16	May 19	Sept 14	Sept 20	Sept 27	Oct 4	Oct 10

[1]Everson et al. 1978.

Crop Production

The 130- to 140-day growing season and extreme winter temperatures somewhat limit the crops adapted to the area. The main crops grown, all irrigated, include beans, sugarbeets, potatoes, small grains and forages. Some corn and tree fruits are grown in the area, but care must be taken to select winter-hardy varieties adapted to the short growing season. Table 9 gives the yields for the main agricultural crops grown in the area under good management.

Soil Fertility

The Research Centers' soils are highly fertile with fairly high cation exchange capacity (15 to 20 meq/100 gm). Nitrogen fertilizer is the main nutrient needed for crop production. Phosphorus soil test levels (sodium bicarbonate extract) range from moderate to high (7 to 20 ppm P). Potassium soil test levels (sodium bicarbonate extract) range from low to high (130 to 250 ppm K). Organic matter content ranges from 1.0 to 2.8 percent. Zinc soil test levels range from low to high (0.5 to 2.0 ppm) with a critical level of 0.6 ppm. Irrigation water and native soil minerals supply relatively large amounts of sulfur, potassium, calcium and other nutrients (Table 10).

The soils tend to be alkaline (pH 7.5 to 8.4) with little or no free lime (calcium or other carbonates) occurring in the native topsoils. Tillage operations have made most of the surface soils at least slightly calcareous, however. Subsoils contain moderate to very high levels of calcium carbonate (12 to 40 percent calcium carbonate equivalent). The limey soil materials can reduce phosphorus and zinc availability, especially where land leveling or erosion has removed the surface soil, leaving the subsoil materials at the surface. The

Table 8. Extreme occurrences of freezing thresholds.[1]

Temperature	Spring		Fall	
	Earliest	Latest	Earliest	Latest
28°F	April 13, 1971	May 23, 1966	Sept. 18, 1965	Oct. 25, 1972
32°F	May 3, 1969	May 23, 1966	Sept. 12, 1972	Oct. 13, 1967

[1]Everson et al. 1978.

Table 9. Approximate yields of main irrigated agricultural crops in Kimberly area.

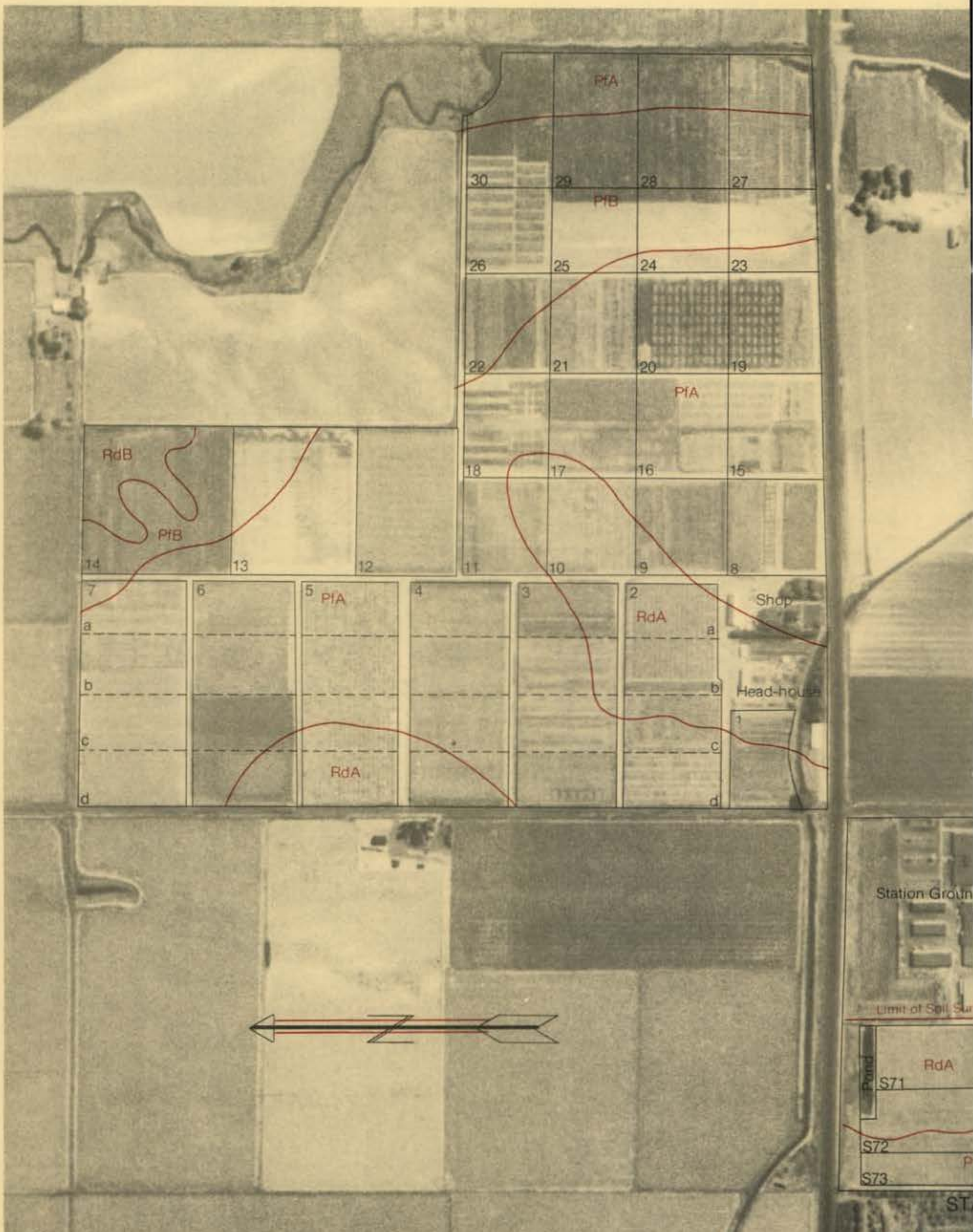
Crop	Yields*
Beans	25 to 33 hundredweight (sacks)/acre
Potatoes	350 to 450 hundredweight (sacks)/acre
Sugarbeets	23 to 27 ton/acre
Barley	90 to 110 bu/acre
Wheat	85 to 105 bu/acre
Alfalfa	5 to 6 tons/acre

*Average yields produced with optimum management.

Table 10. Cation and anion concentrations and other water quality parameters during irrigation season at diversion from Snake River, 1968-1970 (from Carter et al. 1973).

Water quality parameter	Year	Sampling date*							
		6/4	6/18	7/1	7/15	7/29	8/12	8/26	9/9
Na^+ (meq/l)	1968	0.9	1.0	0.8	0.7	0.7	0.8	1.0	1.0
	1969	—	0.6	—	0.7	—	0.7	—	0.9
	1970	—	0.7	—	0.6	—	0.7	—	0.7
K^+ (meq/l)	1968	0.14	0.15	0.09	0.10	0.10	0.10	0.14	0.12
	1969	—	0.11	—	0.12	—	0.09	—	0.10
	1970	—	0.10	—	0.11	—	0.11	—	0.10
Ca^{++} (meq/l)	1968	3.3	2.1	1.8	1.8	2.3	2.8	2.8	2.5
	1969	—	2.0	—	1.9	—	2.1	—	2.5
	1970	—	2.8	—	2.6	—	2.5	—	2.0
Mg^{++} (meq/l)	1968	1.6	0.9	0.9	1.1	0.8	1.3	1.4	1.3
	1969	—	1.1	—	1.3	—	1.4	—	1.5
	1970	—	1.5	—	1.5	—	1.2	—	1.4
Cl^- (meq/l)	1968	0.77	0.76	0.48	0.54	0.56	0.41	0.47	0.38
	1969	—	—	—	0.74	—	0.66	—	0.61
	1970	—	0.58	—	0.49	—	0.40	—	0.40
HCO_3^- (meq/l)	1968	4.6	4.5	4.4	4.4	4.3	3.6	3.7	3.7
	1969	—	3.8	—	2.7	—	3.4	—	3.3
	1970	—	3.0	—	3.0	—	3.0	—	3.1
SO_4-S (ppm)	1968	12	11	16	15	11	14	15	14
	1969	—	14	—	11	—	12	—	—
	1970	—	9	—	7	—	6	—	7
PO_4-P (ppm)	1968	—	0.07	0.11	0.13	0.22	0.24	0.17	0.17
	1969	0.02	0.01	0.01	0.01	0.03	0.03	0.06	0.04
	1970	—	0.06	—	0.03	—	0.08	—	0.06
EC (μmho/cm)	1968	502	544	533	447	475	535	511	468
	1969	419	424	399	436	411	405	437	451
	1970	—	415	—	430	—	420	—	425
pH	1968	8.4	8.4	8.3	8.2	8.4	8.3	8.3	8.4
	1969	—	8.2	—	8.1	—	8.2	—	8.0
	1970	—	8.3	—	8.3	—	8.0	—	8.1

*Average date which varied slightly from year to year.



Source: Photobase NHAP 84 Aerial Photograph

Prepared by M.C. Beaty, USDA-SCS Boise, Id., December 1985.

Scale: 1 inch represents 500 feet.

PfA — Portneuf Silt Loam, 0-2% slope

PfB — Portneuf Silt Loam, 2-4% slope

RdA — Rad Silt Loam, 0-2% slope

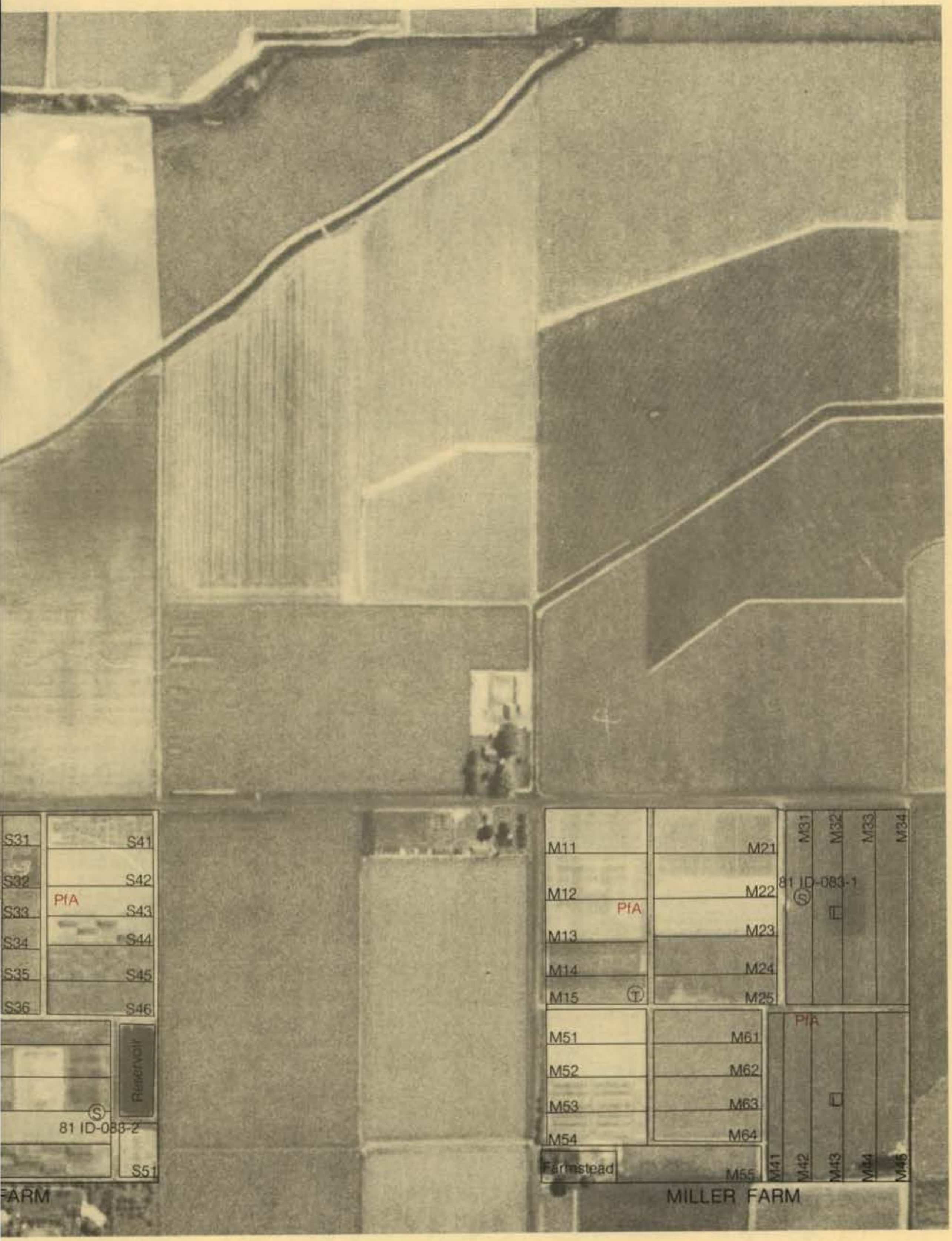
RdB — Rad Silt Loam, 2-4% slope

Ⓢ Sample Site

Lysimeter

WS Weather Station

Ⓣ Type Location



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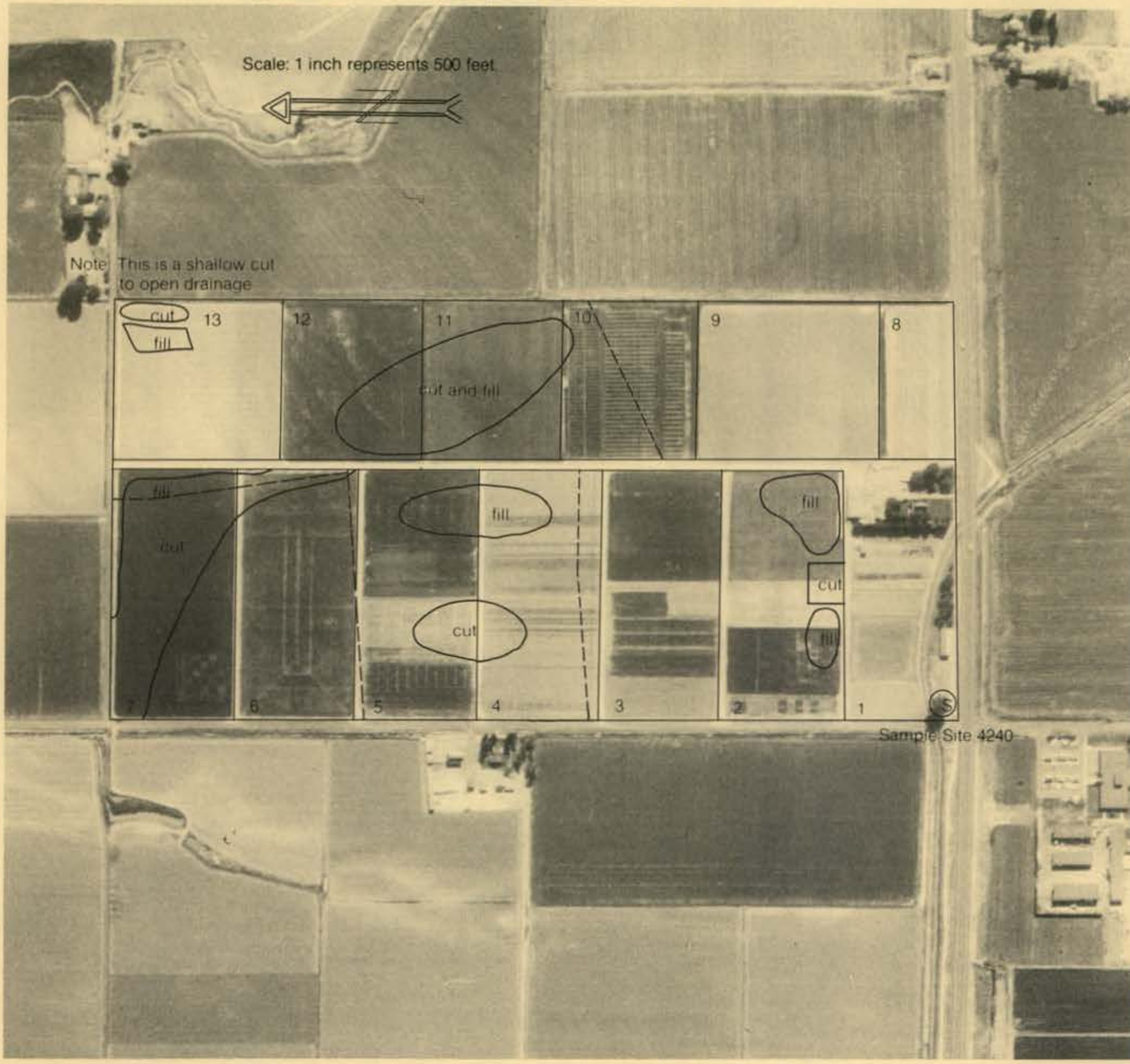
Location of leveled areas of the Kimberly Research and Extension Center



Prepared by M.C. Beaty, USDA-SCS Boise, Id., December 1985.

Old irrigation ditches, removed 1951.

Source: Photobase ASCS '76 Aerial Photograph

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subsoil materials are usually much lighter in color and produce lower crop yields (Rasmussen and Cary 1979). Zinc has been shown to be deficient, especially in beans and sugarbeets, crops that are especially sensitive to low zinc levels. Lower crop yield can be overcome, at least in part, by heavy applications of organic material such as manure.

Native Vegetation

All of the land comprising the Research Centers and most of the adjacent land was cleared of native grasses and shrubs about 1915 and has been cultivated, irrigated and cropped continuously since that time. The native vegetation under which the soils originally developed included Thurber's Stipa (*Stipa thurberiana*), Sandbergs bluegrass (*Poa secunda*), big sagebrush (*Artemisa tridentata* ssp. *wyomingensis*) and numerous forbs. The habitat type name is *Artemisia wyomingensis/Stipa thurberiana* (Hironaka et al. 1983).

Irrigation

Without irrigation water, soils of the Research Centers would be desert, capable only of producing grass, forbs and shrubs adapted for grazing. With irrigation water, these soils produce high yields of many agricultural crops.

Irrigation water for the Research Centers is supplied from the Snake River, delivered from the Twin Falls Irrigation District canal system. The water is diverted from the Snake River at Milner Dam located about 20 miles east of the Research Centers. This water contains varying amounts of plant nutrients depending on the time of year and the stream flow. Table 10 gives the cations and anions found in the Snake River water at various dates during the year.

Irrigation on the Research Centers includes both surface or furrow irrigation and sprinkler irrigation. The surface or furrow irrigation uses concrete lined ditches, siphon tubes or gated pipe to deliver water into the corrugates or furrows. Sprinkler irrigation systems include solid set, handmove and linear overhead system.

Research

Research at the University and USDA Research Centers includes studies on soils, crop production, irrigation, plant breeding, plant nutrition, entomology, plant pathology and several other areas. Crops included in research are small grains, beans, sugarbeets, potatoes, corn and forage crops. Work is also conducted on environmental problems such as waste disposal, irrigation water quality, return flow, soil erosion, sediment and nutrient runoff and irrigation efficiency.

Research Center Layout

The field configuration of the University of Idaho Research and Extension Center original 80 acres was established when the land was purchased in 1951. To obtain this field layout and water delivery system, land was leveled and old fences and ditches were removed. (See pages 8-9 for field layout and numbers for UI R&E Center and the USDA Research Center.) These fields were laid out and numbered much as they presently exist when the two parcels of land were obtained.

Soils

Two soil series are found on the Research Centers — the Portneuf series and the Rad series. The Portneuf series is predominant from the standpoint of total acreage. The Rad series comprises about one-third of the area of the main USDA Research Center and the University of Idaho Research and Extension Center. The rest of those areas and all of the Miller farm are made up of Portneuf series.

Portneuf Series

The Portneuf series is classified as coarse-silty, mixed, mesic, Durixerollic Calciorthids. Portneuf series consists of very deep, well-drained soils formed in loess or alluvium from loess or silty lacustrine sediments. These soils are on uplands and terraces and have slopes less than 4 percent. Permeability is moderate in the A horizon and slow in the B horizon. The surface (A horizon) is light colored (10YR 6/2 or 6/3 when dry; 10YR 4/2 or 4/3 when moist). The Bkq horizons have high amounts of lime (calcium carbonate), often more than 20 percent. These horizons are very firm when moist with weak silica cementation. Below the horizons of lime and silica accumulation (Bkq horizons), the silty materials are soft to hard. The surface soil and subsoil are silt loam throughout, often approaching a silt texture (over 80 percent silt-sized particles). The substratum (C horizons) are silt loams often approaching a very fine sandy loam texture.

Pedon Description

Portneuf silt loam on a nearly level slope in field No. 15 of the Miller farm was described by SCS personnel as follows (other pedon descriptions with laboratory data are included in the Appendix):

AP — 0 to 28 cm (0 to 11 inches). Pale brown (10YR 6/3) silt loam, brown to dark brown (10YR 4/3) when moist; weak fine granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine to medium roots; many fine tubular pores, 12 percent calcium carbonate; moderately alkaline; abrupt smooth boundary.

Bkq1 — 28 to 66 cm (11 to 26 inches). Light or very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; extremely hard when dry, very firm when moist, nonsticky and nonplastic when wet; 45 percent durinodes ½ to 1 inch diameter which are very hard when dry, very firm when moist; few very fine roots matting on ped surfaces 28 to 38 cm; 18 percent calcium carbonate; moderately alkaline; clear smooth boundary.

Bkq2 — 66 to 94 cm (26 to 37 inches). Pale brown (10YR 6/3) silt loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; 20 percent oblong durinodes ½ to 1 inch diameter which are very hard when dry, very firm when moist; few microtubular pores; 15 percent calcium carbonate; moderately alkaline; clear smooth boundary.

C1 — 94 to 198 cm (37 to 78 inches). Pale brown (10YR 6/3) very fine sandy loam; brown to dark brown (10YR 4/3) when moist; weak, medium subangular blocky structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; few microtubular pores; strongly alkaline; 8 percent calcium carbonate.

Rad Series

The Rad series is classified as coarse-silty mixed mesic, Durixerollic Camborthids. Rad series consists of very deep, well drained soils formed in loess or alluvium from loess or silty lacustrine sediments. These soils are on terraces and have slopes of less than 4 percent. Permeability is moderate in the A and Bw horizons and slow in the Bkq horizons. The Cambic (Bw) horizon has little or no increase in clay over the surface horizon. The surface soil (A horizon) is light colored (10YR 6/2 to 6/3 when dry and 10YR 3/2 to 3/3 when moist). Beneath the Bw horizon, the soils have high amounts of lime (calcium carbonate), often more than 20 percent. These horizons (Bkq horizons) are firm or very firm when moist with weak silica cementation. Below the layer of lime and silica accumulation, silty parent materials are soft to hard. With increasing depth, the layers are loose to extremely hard with silt loam to very fine sandy loam textures.

Pedon Description

Rad silt loam on a nearly level slope under cropland across State Highway 30 (north) from the USDA Research Center was described as follows by SCS personnel:

A1 — 0 to 5 cm (0 to 2 inches). Pale brown (10YR 6/3) silt loam, very dark grayish brown (10YR 3/2) when moist; weak medium platy structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; many very fine, fine and medium roots; many very fine tubular pores; mildly alkaline; abrupt smooth boundary.

A2 — 5 to 15 cm (2 to 6 inches). Pale brown (10YR 6/3) silt loam, very dark grayish brown (10YR 3/2) when moist; strong fine and medium granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; many medium, very fine and common fine roots; many very fine tubular pores; mildly alkaline; abrupt smooth boundary.

Bw1 — 15 to 30 cm (6 to 12 inches). Pale brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak very coarse subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine, common fine and few medium roots; common very fine, few medium and fine tubular pores; moderately alkaline; clear smooth boundary.

Bw2 — 30 to 41 cm (12 to 17 inches). Very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; moderate medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine, common fine and few medium roots; common very fine and fine, few medium tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bkq — 41 to 65 cm (17 to 26 inches). Very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common very fine roots; few fine, common very fine tubular pores; strongly effervescent (26 percent calcium carbonate); moderately alkaline; clear smooth boundary.

Bk — 65 to 150 cm (26 to 60 inches). Very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few fine and common very fine tubular pores; strongly effervescent (25 percent calcium carbonate); moderately alkaline; clear smooth boundary.

Mapping Units

The Research Centers include four mapping units, two in the Portneuf series and two in the Rad series.

PfA — Portneuf silt loam, 0 to 2 percent slopes. This is the most extensive mapping unit on the two Research Centers.

PfB — Portneuf silt loam, 2 to 4 percent slopes. This unit is of minor extent and is found in the NE corner of the University R&E Center. The steeper slopes create erosion problems when surface irrigated.

RdA — Rad silt loam, 0 to 2 percent slopes. This mapping unit comprises one-fourth to one-third of the two Research Centers.

RdB — Rad silt loam, 2 to 4 percent slopes. This minor mapping unit occurs only in the NE corner of the University R&E Center. The slope in this area causes serious erosion problems under surface irrigation.

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Appendix A

Portneuf Silt Loam — Site 4240

General Site Characteristics

Location: About 40 feet north and 90 feet east of the southwestern corner of the SW ¼, sec. 15, T 10 S., R 18 E. (Junction of Highway 30 and County Road 3600 E) in the southwest corner of University R&E Center; **Described and sampled:** M. A. Fosberg and S. Holzhey, July 26, 1962; **Elevation:** 3,900 feet; **Topography:** gently undulating, site located on a northwest slope of less than 1 percent, ½ mile long; **Drainage:** well drained; **Parent material:** loess mantling basalt; **Erosion:** not evident; **Climate:** mean annual temperature is about 49F; **Vegetation:** alfalfa and grass; **Stoniness:** none; **Land use:** irrigated cropland.

Profile Description

Ap1 — 0 to 9 cm (0 to 3 inches). Pale brown (10YR 6/3) silt loam; dark brown (10YR 4/3) when moist; weak, fine platy breaking to moderate, coarse and medium granular structure; very hard, friable, slightly sticky and slightly plastic; slightly calcareous; abundant medium roots, few coarse, fine and very fine roots; abrupt smooth boundary.

Ap2 — 9 to 16 cm (3 to 6 inches). Pale brown (10YR 6/3) silt loam; dark brown (10YR 4/3) when moist; weak, medium and fine platy structure; very hard, friable, slightly sticky and slightly plastic; many medium tubular pores; weakly calcareous with strongly calcareous patches; abundant fine and very fine roots, plentiful medium roots, few coarse roots; indistinct wavy boundary.

Ap3 — 16 to 22 cm (6 to 8 inches). Pale brown (10YR 6/3) silt loam; dark brown (10YR 4/3) when moist; common light yellowish brown (10YR 6/4.5) mottles, yellowish brown (10YR 5/5) when moist; weak fine and very fine platy structure; hard, friable, slightly sticky and slightly plastic; many medium tubular pores; non calcareous with weakly calcareous zones; abundant fine and very fine roots, plentiful medium roots, few coarse roots; indistinct wavy boundary.

Bw — 22 to 30 cm (8 to 12 inches). Brown (10YR 5/3) silt loam, brown (10YR 5.5/3) crushed; dark brown (10YR 4/3) when moist, brown (10YR 4/3) crushed; moderate fine and very fine subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; thin continuous clay

A1. Laboratory analyses on Portneuf silt loam (sample No. 4240.)

Horizon	Depth (cm)	pH Paste	EC (mmho/cm)	$CaCO_3$ equivalent (%)	CEC (meq/100 g)	Exchangable cation Ca	Mg (meq/100 g)	Na	K	Soluble cations Ca	Mg (meq/1000 g)	Na	K*
Ap1	0-9	7.6	1.3	6.1	19.2	19.6	5.2	0.2	1.7	3.7	2.7	0.6	0.4
Ap2	9-16	7.6	1.2	3.3	19.4	16.9	4.6	0.3	1.0	2.9	2.1	0.8	0.2
Ap3	16-22	7.6	1.2	2.2	16.6	15.3	4.4	0.3	1.0	2.5	1.8	0.7	0.1
Bw	22-30	7.3	1.0	2.4	26.3	19.3	5.4	0.4	1.0	2.9	1.5	1.0	0.1
Bk	30-38	7.6	1.2	5.9	19.7	29.7	4.4	0.4	0.8	2.7	1.7	1.4	0.2
Bkq1	38-60	7.6	1.2	27.3	11.5	18.3	3.3	0.3	0.4	1.9	1.4	1.1	0.1
Bkq2	60-90	7.7	1.4	24.2	11.7	17.8	2.9	0.4	0.4	2.4	1.7	1.4	0.1
Bkq3	90-120	8.0	0.9	21.2	12.7	36.6	5.7	0.4	0.5	1.8	1.2	1.0	0.1
Bk1b	120-155	7.7	1.8	18.0	12.8	12.0	3.6	0.4	0.6	3.1	2.4	1.2	0.1
Bk2b	155-195	8.0	1.0	17.3	10.6	15.7	3.6	0.3	0.7	2.0	1.3	0.8	0.1
C1	195-235	7.8	1.5	10.5	14.0	37.3	5.3	0.5	1.0	2.5	1.7	0.9	0.1
C2	235-255	8.0	1.1	5.2	19.4	35.8	4.7	0.5	0.9	2.0	1.4	0.9	0.1
C3	255-285	8.0	1.4	12.3	19.0	12.4	4.4	0.6	0.9	2.5	2.0	1.0	0.1

Unpublished data G. C. Lewis, Univ. of Idaho, Moscow.

A2. Particle size distribution of Portneuf silt loam (sample No. 4240).

Horizon	Depth	Clay (<0.002)*	Silt (0.002-0.05)	Very fine sand (0.05-0.1)	Fine sand (0.1-0.25)	Medium sand (0.25-0.5)	Coarse sand (0.5-1.0)	Very coarse sand (1.0-2.0)	Total sand
		%							
Ap1	0-9	5.9	74.5	18.3	0.91	0.07	0.12	0.21	19.6
Ap2	9-16	5.7	78.9	14.3	1.00	0.02	0.01	0.00	16.3
Ap3	16-22	5.3	71.3	22.2	1.05	0.05	0.02	0.10	23.4
Bw	22-30	5.2	75.3	17.2	2.21	0.04	0.03	0.00	19.5
Bk	30-38	5.1	77.7	16.7	0.50	0.01	0.01	0.01	17.2
Bkq1	38-60	13.6	78.4	7.7	0.29	0.02	0.00	0.00	8.0
Bkq2	60-90	4.9	83.7	11.2	0.25	0.01	0.01	0.00	11.5
Bkq3	90-120	3.5	86.3	9.9	0.29	0.00	0.01	0.00	10.2
Bk1b	120-155	5.2	77.5	16.9	0.36	0.01	0.01	0.00	17.3
Bk2b	155-195	4.4	80.1	15.0	0.56	0.01	0.01	0.00	15.6
C1	195-235	7.2	57.3	31.9	3.53	0.10	0.05	0.03	35.6
C2	235-255	5.7	51.9	32.3	6.23	1.70	2.07	0.27	42.6
C3	255-285	3.9	49.7	33.3	6.91	2.21	3.81	0.15	46.4

Unpublished data G. C. Lewis, Univ. of Idaho, Moscow.
*Millimeters

A3. Clay mineralogy of coarse clay fraction of Portneuf silt loam (sample No. 4240).

Horizon	Depth	Montmorillonite	Vermiculite	Illite	Kaolinite	Quartz
	(cm)	(%)				
Ap1	0-9	12	5	55	16	12
Ap2	9-16	13	0	59	14	15
Ap3	16-22	10	5	53	14	17
Bw	22-30	21	8	49	11	11
Bk	30-38	18	0	57	15	10
Bkq1	38-60	14	6	49	21	11
Bkq2	60-90	21	8	45	17	9
Bkq3	90-120	24	9	38	13	16
Bk1b	120-155	22	9	46	17	6
Bk2b	155-195	20	10	51	15	5
C1	195-235	15	11	56	17	0
C2	235-255	17	0	49	14	20
C3	255-285	16	14	39	9	22

Unpublished data G. C. Lewis, Univ. of Idaho, Moscow.

films; many medium tubular pores; non-calcareous with patches weakly calcareous; plentiful fine and very fine roots, few medium and coarse roots; clear wavy boundary.

Bk — 30 to 38 cm (12 to 15 inches). Pale brown (10YR 6/3) silt loam; brown (10YR 4/3) when moist; weak medium and fine subangular blocky structure; extremely hard, friable, slightly sticky and slightly plastic; thin patchy clay films; few medium tubular pores; calcareous; plentiful fine and very fine roots, few medium and coarse roots; gradual smooth boundary.

Bkq1 — 38 to 60 cm (15 to 24 inches). Light gray (10YR 7/1.5) silt loam; light brownish-gray (10YR 6/2.5) when moist; few ped surfaces have light brownish-gray (10YR 6.5/2.5) organic stains; massive structure with durinodes; extremely hard, friable, slightly sticky and slightly plastic; very few medium tubular pores; strongly calcareous; few roots; gradual smooth boundary.

Bkq2 — 60 to 90 cm (24 to 36 inches). Light gray (10YR 7.5/2) silt; pale brown (10YR 6/3) when moist; massive with greater than 20 percent durinodes; cementation in cicada casts slightly greater than in Bkq1; extremely hard, friable, slightly sticky and slightly plastic; very few medium tubular pores; strongly calcareous; very few roots; gradual wavy boundary.

Bkq3 — 90 to 120 cm (36 to 48 inches). Same as Bkq2.

Bk1b — 120 to 155 cm (48 to 62 inches). Pale brown (10YR 6/3) silt loam; brown (10YR 5/3) when moist; massive with few cicada casts; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; gradual boundary.

Bk2b — 155 to 195 cm (62 to 78 inches). Silt; massive; slightly hard; few hard medium and fine granules.

C1 — 195 to 235 cm (78 to 94 inches). Silt loam; massive; slightly hard; common hard medium and coarse subangular blocks resembling cicada casts; few threads of lime in blocks.

C2 — 235 to 255 cm (94 to 102 inches). Silt loam; massive; slightly hard; common extremely hard, fine and very fine granules, and few extremely hard medium and coarse subangular blocks resembling cicada casts.

C3 — 255 to 285 cm (102 to 114 inches). Very fine sandy loam; massive; hard; many very hard fine and very fine granules, few extremely hard fine and very fine granules, and common medium and coarse subangular blocks resembling cicada casts; surfaces of blocks and granules are lime or silica coated.

Appendix B

Portneuf*

General Site Characteristics

Pedon number: S81 ID-083-1; **Classification:** Coarse-silty, mixed, mesic Durixerollic Calciorthids; **Location:** NE ¼ NE ¼ Section 21, T 10S, R 18EBM on Miller Farm, Snake River Conservation Research Center near Kimberly; **Use and vegetation:** Cropland presently in alfalfa; **Parent material:** Loess with some influence from silty alluvium or lake sediment; **Slope:** Less than 0.5 percent; **Sampled and described by:** Larry F. Ratliff on 6-18-81.

Ap — 0 to 28 cm (0 to 15 inches). Very dark grayish brown (10YR 3/2) silt loam; weak fine and medium granular structure; hard, very friable; many fine and medium roots; common wormcasts; weak effervescence, moderately alkaline; gradual smooth boundary.

Bk — 28 to 58 cm (15 to 23 inches). Pale brown (10YR 6/3) silt loam; weak coarse platy parting to weak fine subangular blocky structure; very hard, friable; many fine and medium roots; common fine and medium pores; few wormcasts; few rounded and brittle nodules; common light brownish gray (10YR 6/2) coatings on plates and nodules; dark brown and yellowish brown stains around roots; violent effervescence, moderately alkaline; clear wavy boundary.

Bkq1 — 58 to 102 cm (23 to 41 inches). Pale brown (10YR 6/3) silt loam; moderate coarse irregular platy structure; extremely hard, very firm and compact in place; plates brittle, surrounded by friable matrix; common rounded and brittle durinodes irregularly distributed throughout; common fine and very fine roots between plates; common fine and very fine pores, few coarse pores; few fine faint yellowish brown mottles; few threads of $CaCO_3$; violent effervescence, strongly alkaline; gradual wavy boundary.

Bkq2 — 102 to 165 cm (41 to 66 inches). Pale brown (10YR 6/3) silt; weak coarse irregular platy structure; very hard, firm and slightly compact in place; about 20 percent by volume of brittle plates in a friable matrix; few rounded and brittle durinodes; common fine and medium roots; common fine and very fine pores, few coarse pores; violent effervescence, strongly alkaline; diffuse wavy boundary.

C1 — 165 to 216 cm (66 to 86 inches). Brown (10YR 5/3) silt loam; massive; hard, friable; few brittle plates; few fine roots; common fine pores; strong effervescence, strongly alkaline; clear wavy boundary.

Ck2 — 216 to 254 cm (86 to 102 inches). Brown (10YR 5/3) very fine sandy loam; massive; hard, friable; about 20 percent coarse brittle plates consisting of layers of white $CaCO_3$ and brown silica; common fine pores; violent effervescence, strongly alkaline.

Remarks: Colors are for moist soil.

*This soil is taxadjunct to the Portneuf series in that it has darker colors and more organic matter in the surface layer than is normal for the Portneuf series. This could be due to long time irrigation and management that may have increased the organic matter content.

B1. Soil characterization analyses on sample No. S81 ID-083-1 (USDA-SCS National Soil Survey Laboratory, Lincoln, Nebraska).

Horizon	Depth (cm)	Organic matter (%)	pH (1:1 water)	EC (mmho/cm)	$CaCO_3$ equivalent (%)	Available soil moisture (in/foot)	Available soil moisture (cm/cm)	Bulk density (g/cc)
Ap	0-28	1.7	8.0	0.7	2	1.98	0.15	1.48
Bk	28-58	1.0	8.4	0.5	24	2.45	0.20	1.45
Bkq1	58-102	0.6	8.5	0.5	21	-	-	-
Bkq2	102-137	0.4	8.5	0.5	16	2.42	0.20	1.42
	137-165	0.4	8.6	0.4	18	1.96	0.16	1.21
C1	165-183	0.3	8.6	0.5	12	3.37	0.28	1.46
	183-216	0.4	8.6	0.5	15	1.50	0.12	1.20
Ck2	216-254	0.6	8.5	0.5	23	-	-	-

Horizon	Clay (<0.002)*	Silt (0.002-0.02)	Silt (0.02-0.05)	Very fine sand (0.05-0.1)	Fine sand (0.1-0.25)	Medium sand (0.25-0.5)	Coarse sand (0.5-1.0)	Very coarse sand (1.0-2.0)
	%							
Ap	20.2	27.3	39.1	12.1	0.8	0.2	0.1	0.2
Bk	21.2	32.8	38.2	7.3	0.4	0.1	T	T
Bkq1	4.1	32.2	47.6	12.7	1.3	1.2	0.7	0.2
Bkq2	1.2	31.7	49.4	16.2	1.0	0.4	0.1	T
	3.7	36.2	44.7	14.3	0.9	0.2	T	T
C1	2.5	27.2	40.0	28.0	1.7	0.3	0.2	0.1
	6.6	28.1	29.1	26.3	3.2	1.2	1.8	3.7
Ck2	6.3	22.1	24.7	22.0	6.3	4.8	7.1	6.8

*Millimeters

Appendix C

Portneuf

General Site Characteristics

Pedon number: S81 ID-083-2; **Classification:** Coarse-silty, mixed, mesic Durixerollic Calciorthids; **Location:** NE ¼ SE ¼ Section 21, T 10S, R 18EBM. Snake River Conservation Research Center near Kimberly; **Use and vegetation:** Cropland - presently fallow - previously cropped to beans; **Parent material:** Loess with some influence from local alluvium or lake sediment; **Slope:** Less than 0.5 percent; **Sampled and described by:** Larry F. Ratliff on 6-19-81.

Ap — 0 to 25 cm (0 to 10 inches). Dark brown (10YR 4/3) silt loam; weak fine and medium granular structure; hard when dry, very friable when moist; common fine roots; few fine pores; few wormcasts and burrows filled with material from the underlying horizons; strong effervescence, moderately alkaline; clear smooth boundary.

Bk — 25 to 43 cm (10 to 17 inches). Pale brown (10YR 6/3) silt loam; moderate medium platy parting to weak fine subangular blocky structure; hard when dry, friable with a few brittle nodules when moist; common fine roots and pores, few medium pores; few fine faint light brownish gray (10YR 6/2) coatings on plates and nodules; few fine faint yellowish brown stains; violent effervescence, moderately alkaline; clear wavy boundary.

Bkq1 — 43 to 91 cm (17 to 36 inches). Brown (10YR 5/3) silt loam; moderate coarse irregular platy structure that is interrupted by rounded nodules; extremely hard, plates and durinodes, brittle and compact in places, surrounded by friable matrix; few fine roots between plates; common fine pores, few medium and coarse pores; common very fine yellowish brown stains; horizon less brittle with depth; violent effervescence, strongly alkaline; gradual wavy boundary.

Bkq2 — 91 to 137 cm (36 to 55 inches). Brown (10YR 5/3) silt loam; weak coarse irregular platy structure; very hard, compact and brittle in about 20 percent of mass, friable between plates; few brittle durinodes; common fine and very fine pores; common dark brown stains; violent effervescence, strongly alkaline; gradual wavy boundary.

C1 — 137 to 198 cm (59 to 79 inches). Yellowish brown (10YR 5/4) silt loam; weak medium platy structure; hard, friable with few brittle plates; common fine and very fine pores; few dark brown stains; violent effervescence, strongly alkaline; diffuse wavy boundary.

C2 — 198 to 244 cm (79 to 98 inches). Yellowish brown (10YR 5/4) silt loam; massive; hard, friable; violent effervescence, strongly alkaline.

Remarks: The degree of cementation in the Bkq1 horizon is approaching a duripan. Colors are for moist soil.

C1. Soil characterization analyses on sample No. S81 ID-083-2 by USDA-SCS National Soil Survey Laboratory, Lincoln, Nebraska.

Horizon	Depth (cm)	Organic matter (%)	pH (1:1 water)	EC (mmho/cm)	$CaCO_3$ equivalent (%)	Available soil moisture (in/foot)	Available soil moisture (cm/cm)	Bulk density (g/cc)
Ap	0-25	1.3	8.2	0.7	8	1.90	0.16	1.55
Bk	25-43	0.8	8.4	0.7	27	2.97	0.25	1.40
Bkq1	43-91	0.6	8.5	0.5	22	-	-	-
Bkq2	91-137	0.4	8.5	0.5	17	-	-	-
C1	137-198	0.4	8.5	0.6	15	-	-	-
C2	198-244	0.3	8.5	0.5	10	2.66	0.22	1.35

Horizon	Clay (<0.002)*	Silt (0.002-0.02)	Silt (0.02-0.05)	Very fine sand (0.05-0.1)	Fine sand (0.1-0.25)	Medium sand (0.25-0.5)	Coarse sand (0.5-1.0)	Very coarse sand (1.0-2.0)
	%	%	%	%	%	%	%	%
Ap	18.8	31.0	37.4	11.4	1.0	0.2	0.1	0.1
Bk	12.0	35.2	41.4	9.6	1.1	0.4	0.2	0.1
Bkq1	2.9	29.7	45.8	14.3	2.1	2.5	2.4	0.3
Bkq2	2.1	26.2	51.6	18.0	1.1	0.3	0.1	T
C1	4.9	31.7	46.1	16.4	0.8	0.1	T	T
C2	5.0	27.6	40.5	25.6	1.2	0.1	0.1	T

*Millimeters

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