APPENDIX C

Supporting Data Related to Part I

Forest Service Objectives and Procedures Relative to Federal Coal Leasing on Thunder Basin National Grassland

Stipulations for lands under jurisdiction of Department of Agriculture, the supplemental stipulations to be attached thereto, and BLM lease terms provide the means by which the Forest Service objectives can be met:

1. Preplan the entire lease area, affected adjacent areas, and offsite supporting facilities based upon
   a. Adequate resource and other pertinent data provided by the lessee to enable the mining plan (including reclamation) for the leased area to be prepared and approved prior to the time mining development actually commences; and
   b. Selection of the most appropriate mining and reclamation system to
      (1) Minimize environmental disturbance, and
      (2) Provide for recovery of onsite minerals, including coal in a single or sequential preplanned operation.
2. In surface mining, the operation will seek to reclaim the surface to achieve beneficial future use of the land in a harmonious and judicious pattern by predetermining the post mining landform for
   a. Urban development, including recreational, commercial, etc.;
   b. Wildlife and recreation related, including water developments;
   c. Agricultural cropland;

d. Uses similar to those made of the pre-mining land configuration; or the

3. Most desirable combination of above.

The mining plan (including reclamation) should be a flexible tool capable of periodic review to incorporate advances in technology. The Forest Service will determine whether or not it will concur in the mining plan to be approved by U.S. Geological Survey and will recommend modifications it considers necessary prior to plan acceptance.

The Forest Service will require a Lessee Surface Management Operation Plan which will more specifically indicate how Forest Service requirements will be met. When changes in operation are anticipated, such a plan will be modified and submitted to the Forest Supervisor for approval. The Forest Service will periodically review the mining operations, as they affect surface values, against the BLM general requirements, the Forest Service Lessee Surface Management Operation Plan, and the approved exploration or mining plan (including reclamation) prepared for that operation.

CLIMATE

Supporting Data

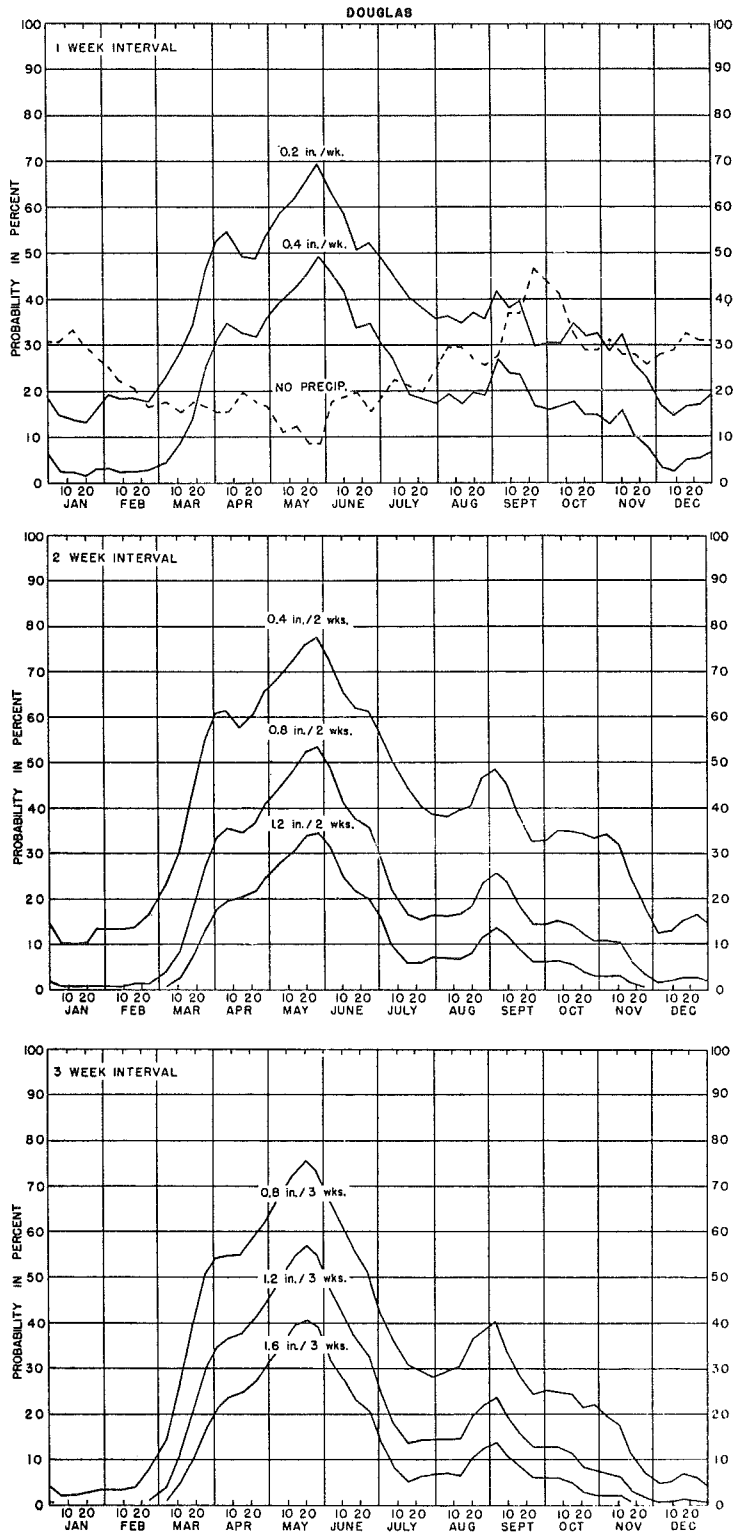


Figure 1

Probability, in percent, of Receiving Trace or Less and Exceeding Indicated Amounts of Precipitation During One, Two, and Three Week Intervals, Douglas

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 1

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 1-Week Periods, Douglas

PERIOD BEGIN	AVE.	O.T.	PRECIPITATION - IN INCHES 0.06	0.10	0.20	0.40	0.60	0.80	1.00	1.40	2.00
MAR 1	.12	15.8	62.1	47.1	21.9	4.2	.7	.1	.0	.0	.0
MAR 8	.15	14.9	66.0	52.7	28.5	8.2	2.6	.8	.3	.0	.0
MAR 15	.21	17.4	65.4	55.2	35.4	14.7	6.3	2.8	1.2	.2	.0
MAR 22	.22	17.4	68.1	60.1	44.1	23.7	12.7	6.8	3.5	.9	.1
MAR 29	.41	14.9	75.7	69.5	55.2	33.5	19.7	11.4	6.5	2.0	.3
APR 5	.36	14.9	74.4	68.3	54.7	34.4	21.3	13.2	8.2	3.2	.8
APR 12	.36	19.9	65.8	59.7	47.9	31.7	21.4	14.6	10.2	5.0	1.7
APR 19	.42	19.9	66.7	60.6	48.6	32.3	22.0	15.1	10.5	5.2	1.8
APR 26	.35	14.1	74.0	67.5	53.8	34.6	22.5	14.8	9.7	4.3	1.2
MAY 3	.47	12.4	77.2	71.2	58.4	39.5	26.8	18.3	12.5	5.8	1.7
MAY 10	.53	11.6	79.4	73.9	61.8	43.0	29.9	20.8	14.4	6.9	2.1
MAY 17	.45	9.1	82.9	77.5	64.8	44.5	30.3	20.4	13.7	6.2	1.8
MAY 24	.54	8.3	85.6	80.9	69.3	49.2	34.3	23.6	16.1	7.4	2.2
MAY 31	.63	15.8	79.5	75.7	65.9	48.4	34.7	24.5	17.2	8.3	2.6
JUN 7	.36	23.3	69.7	65.4	55.4	39.4	27.7	19.3	13.4	6.4	2.0
JUN 14	.43	17.4	70.7	64.7	52.3	34.7	23.3	15.7	10.6	4.8	1.3
JUN 21	.36	14.9	71.4	64.8	51.7	33.9	22.6	15.1	10.2	4.6	1.3
JUN 28	.41	19.9	68.2	62.0	49.1	31.3	20.4	13.4	8.9	4.1	1.2
JUL 5	.27	21.6	66.7	59.9	45.6	26.4	15.4	9.2	5.5	2.1	.5
JUL 12	.24	21.6	64.9	56.8	40.1	19.9	10.0	5.2	2.6	.7	.0
JUL 19	.18	19.9	64.3	55.3	37.2	16.8	7.9	4.0	2.1	.6	.0
JUL 26	.25	22.4	60.2	51.9	36.2	18.2	9.5	5.2	2.9	.9	.1
AUG 2	.20	31.6	54.5	47.9	35.1	19.1	10.4	5.7	3.1	.8	.0
AUG 9	.22	31.6	56.5	49.5	35.3	17.8	9.0	4.5	2.2	.5	.0
AUG 16	.19	24.1	60.1	51.9	36.2	18.1	9.4	5.0	2.8	.9	.2
AUG 23	.29	25.7	57.0	49.7	36.1	20.3	12.0	7.4	4.6	1.9	.5
AUG 30	.21	29.1	56.9	50.9	39.5	24.7	15.8	10.2	6.6	2.7	.7
SEP 6	.42	33.3	57.2	52.2	41.9	27.2	17.8	11.6	7.7	3.2	.8
SEP 13	.17	40.8	51.3	46.4	36.0	21.5	13.0	7.9	4.9	1.8	.4
SEP 20	.20	43.3	48.1	42.8	31.5	16.8	9.0	4.8	2.6	.7	.0
SEP 27	.19	45.8	44.9	39.8	29.3	15.9	8.8	4.9	2.8	.9	.1
OCT 4	.16	41.6	46.8	40.9	29.5	15.6	8.3	4.5	2.4	.6	.0
OCT 11	.22	30.7	55.8	48.8	34.8	17.9	9.2	4.7	2.3	.5	.0
OCT 18	.22	28.2	57.6	49.4	33.6	15.9	7.7	3.8	1.8	.4	.0
OCT 25	.11	29.9	54.5	45.5	28.9	12.3	5.7	2.7	1.3	.3	.0
NOV 1	.23	29.9	54.2	45.9	30.7	14.5	7.2	3.6	1.8	.3	.0
NOV 8	.16	29.1	53.8	45.9	31.3	15.0	7.3	3.5	1.6	.2	.0
NOV 15	.18	26.6	52.8	43.3	27.1	11.3	4.9	2.2	.9	.0	.0
NOV 22	.11	25.7	51.2	40.0	21.8	6.9	2.4	.9	.3	.0	.0
NOV 29	.11	26.6	48.8	36.4	17.2	3.8	.8	.1	.0	.0	.0
DEC 6	.08	28.2	45.8	32.7	13.7	2.3	.3	.0	.0	.0	.0
DEC 13	.08	32.4	43.5	31.9	15.0	4.1	1.5	.7	.3	.0	.0
DEC 20	.15	32.4	45.0	34.6	18.8	6.8	2.9	1.4	.6	.1	.0
DEC 27	.09	29.1	46.3	34.9	17.5	5.1	1.8	.7	.3	.0	.0
JAN 3	.10	31.6	46.0	34.2	15.5	3.2	.7	.1	.0	.0	.0
JAN 10	.09	34.1	46.4	34.0	14.0	2.2	.3	.0	.0	.0	.0
JAN 17	.08	29.9	46.3	32.9	12.9	1.7	.1	.0	.0	.0	.0
JAN 24	.10	26.6	48.5	35.6	15.9	3.0	.5	.0	.0	.0	.0
JAN 31	.12	26.6	55.4	42.7	19.7	3.7	.6	.1	.0	.0	.0
FEB 7	.12	22.4	60.0	45.6	18.9	2.4	.3	.0	.0	.0	.0
FEB 14	.10	19.1	56.9	41.7	17.1	2.4	.3	.0	.0	.0	.0
FEB 21	.12	19.1	56.3	41.7	18.8	3.6	.6	.1	.0	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 1 (Cont'd)

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 2-Week Periods, Douglas

PERIOD BEGIN	AVE.	0,T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
		PRECIPITATION - IN INCHES									
MAR 1	.27	2.4	89.8	81.4	56.9	21.6	7.9	1.4	.3	.0	.0
MAR 15	.43	5.7	86.0	79.9	65.4	42.6	27.5	11.3	4.7	1.2	.0
MAR 29	.77	3.3	92.8	89.6	80.7	62.8	47.2	25.1	12.8	4.4	.0
APR 12	.78	2.4	89.6	85.0	74.6	57.5	44.5	26.7	16.0	7.3	.2
APR 26	.82	1.6	93.9	90.6	82.0	65.8	52.0	31.6	18.8	8.4	.4
MAY 10	.98	4.9	92.4	90.2	84.0	70.7	58.3	38.2	24.4	12.1	1.0
MAY 24	1.18	4.1	94.8	93.7	89.8	79.0	66.9	44.8	28.2	13.1	.7
JUN 7	.79	2.4	92.7	89.2	80.4	64.3	50.8	31.1	18.7	8.6	.5
JUN 21	.77	4.9	90.5	87.0	77.9	60.8	46.8	27.0	15.3	6.4	.2
JUL 5	.52	6.6	88.9	84.7	72.6	50.0	33.2	14.3	6.1	1.7	.0
JUL 19	.43	1.6	86.7	79.8	64.1	40.3	24.9	9.5	3.7	.9	.0
AUG 2	.42	10.7	77.1	70.7	57.0	37.4	24.6	10.8	4.7	1.2	.0
AUG 16	.47	6.6	82.7	76.2	62.1	41.2	27.4	12.2	5.5	1.6	.0
AUG 30	.63	11.6	81.8	77.5	67.3	49.9	36.6	19.3	10.0	3.6	.0
SEP 13	.37	16.6	71.9	66.1	54.0	36.7	25.3	12.2	5.9	1.9	.0
SEP 27	.35	19.9	68.1	62.0	49.5	32.2	21.1	9.1	3.9	1.0	.0
OCT 11	.45	12.4	76.5	70.1	56.2	36.2	23.4	9.8	4.0	1.0	.0
OCT 25	.34	9.1	81.6	74.5	57.9	33.0	18.3	5.4	1.5	.2	.0
NOV 8	.34	11.6	77.5	70.4	54.5	31.8	18.2	5.8	1.7	.2	.0
NOV 22	.22	6.6	73.0	61.8	40.6	17.7	7.8	1.6	.2	.0	.0
DEC 6	.16	11.6	71.0	58.8	34.8	11.6	3.9	.5	.0	.0	.0
DEC 20	.24	7.4	73.0	61.8	40.3	17.0	7.3	1.3	.1	.0	.0
JAN 3	.19	12.4	73.3	61.2	36.0	10.7	2.9	.1	.0	.0	.0
JAN 17	.18	7.4	74.3	61.2	35.3	10.4	2.8	.1	.0	.0	.0
JAN 31	.24	7.4	85.3	75.7	48.6	14.3	3.3	.0	.0	.0	.0
FEB 14	.22	1.6	84.3	71.7	43.6	13.6	4.0	.3	.0	.0	.0

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 3-Week Periods, Douglas

PERIOD BEGIN	AVE.	0,T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
		PRECIPITATION - IN INCHES									
MAR 1	.48	.0	97.6	94.1	80.7	49.8	27.4	7.7	2.3	.4	.0
MAR 22	.99	1.6	97.4	96.2	91.5	78.6	64.4	39.8	23.0	9.4	.3
APR 12	1.13	1.6	96.5	94.8	89.4	77.5	65.7	45.5	30.6	16.4	1.7
MAY 3	1.45	.8	98.3	97.3	94.2	85.9	76.3	57.4	41.3	24.1	3.2
MAY 24	1.54	.8	98.8	98.3	96.5	90.5	82.5	63.9	46.4	26.5	2.8
JUN 14	1.20	.0	98.3	96.7	91.6	79.6	67.3	45.8	30.0	15.3	1.4
JUL 5	.70	1.6	96.5	94.3	86.6	67.7	50.0	25.0	11.8	3.7	.1
JUL 26	.67	1.6	90.8	85.8	74.1	54.4	39.5	20.7	10.8	4.0	.0
AUG 16	.69	3.3	93.0	89.7	80.6	62.6	47.3	26.0	14.0	5.5	.2
SEP 6	.79	6.6	87.6	83.8	74.7	58.5	45.2	26.4	15.2	6.5	.2
SEP 27	.57	5.8	86.1	80.9	68.8	49.4	35.2	17.8	8.9	3.1	.0
OCT 18	.56	4.1	91.4	87.6	76.2	53.1	34.9	13.8	5.1	1.0	.0
NOV 8	.45	4.1	89.4	83.8	69.4	45.1	28.2	10.4	3.7	.7	.0
NOV 29	.27	4.9	85.0	76.1	54.4	24.9	10.7	1.8	.2	.0	.0
DEC 20	.34	.8	88.9	80.0	58.4	28.3	13.1	2.7	.5	.0	.0
JAN 10	.26	2.4	87.8	78.0	53.9	22.0	8.1	.8	.0	.0	.0
JAN 31	.33	.8	95.6	89.7	69.0	30.9	11.5	1.2	.0	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

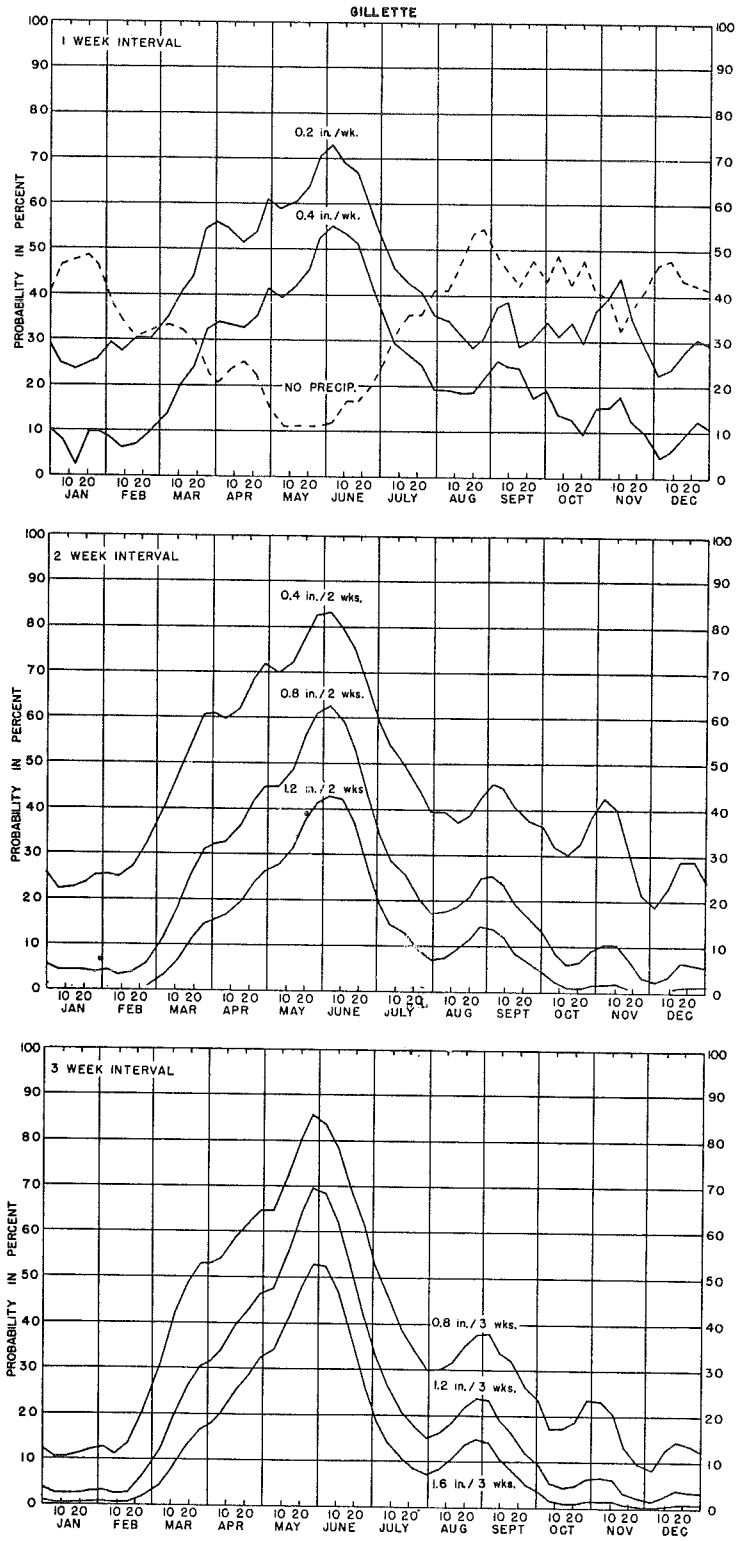


Figure 2

Probability, in percent, of Receiving Trace or Less and Exceeding Indicated Amounts of Precipitation During One, Two, and Three Week Intervals, Gillette

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 2

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 1-Week Periods, Gillette

PERIOD BEGIN	PRECIPITATION - IN INCHES AVE.	0,T.	0.06	0.10	0.20	0.40	0.60	0.80	1.00	1.40	2.00
MAR 1	.19	32.4	59.9	52.8	35.9	14.7	5.7	2.2	.8	.0	.0
MAR 8	.21	33.3	60.4	54.7	40.6	20.2	9.4	4.3	1.9	.3	.0
MAR 15	.28	29.9	63.8	58.4	45.1	24.8	13.0	6.7	3.3	.8	.0
MAR 22	.28	23.3	70.6	65.5	52.5	30.8	16.8	8.7	4.4	1.0	.0
MAR 29	.40	19.9	75.5	71.4	59.4	36.3	20.1	10.5	5.4	1.3	.1
APR 5	.33	23.3	71.1	66.4	54.2	33.0	18.8	10.3	5.6	1.5	.1
APR 12	.27	26.6	66.8	61.7	49.7	30.8	18.7	11.2	6.7	2.3	.4
APR 19	.44	22.4	71.3	66.6	55.3	36.9	24.1	15.5	9.9	4.0	1.0
APR 26	.43	14.9	77.6	72.5	60.4	40.8	27.2	17.9	11.7	4.9	1.3
MAY 3	.47	10.8	79.5	73.6	60.5	40.3	26.7	17.6	11.6	4.9	1.3
MAY 10	.41	10.8	77.7	71.7	59.0	40.4	27.9	19.3	13.4	6.5	2.2
MAY 17	.60	11.6	79.7	74.8	63.8	45.8	32.7	23.2	16.5	8.3	3.0
MAY 24	.54	10.8	84.9	81.3	71.5	52.7	37.4	26.1	18.1	8.5	2.7
MAY 31	.66	11.6	85.2	82.2	73.4	55.6	40.7	29.2	20.7	10.2	3.4
JUN 7	.65	16.6	80.0	77.2	69.3	54.0	41.0	30.6	22.6	12.2	4.6
JUN 14	.61	18.3	77.2	74.0	65.7	50.8	38.7	29.2	21.9	12.2	5.0
JUN 21	.62	17.4	75.8	71.4	61.0	44.4	32.3	23.5	17.2	9.2	3.6
JUN 28	.29	24.9	67.2	62.1	50.5	33.2	21.8	14.4	9.5	4.3	1.3
JUL 5	.30	32.4	60.7	56.1	45.5	29.3	18.6	11.8	7.4	2.9	.7
JUL 12	.38	34.1	59.4	54.9	44.4	28.4	18.2	11.7	7.5	3.2	.8
JUL 19	.20	37.5	55.7	50.8	39.4	22.9	13.3	7.8	4.6	1.7	.4
JUL 26	.24	40.8	52.3	47.4	36.1	20.2	11.0	6.0	3.2	.9	.1
AUG 2	.20	41.6	50.4	45.2	34.1	19.0	10.4	5.6	3.0	.8	.0
AUG 9	.19	44.9	46.5	41.7	31.6	18.3	10.7	6.3	3.8	1.3	.3
AUG 16	.25	54.1	39.3	35.9	28.8	19.1	12.9	8.8	6.2	3.0	1.0
AUG 23	.23	56.6	38.1	35.3	29.4	20.7	14.7	10.4	7.5	3.8	1.4
AUG 30	.29	47.4	47.8	44.8	37.6	26.0	17.6	11.9	8.0	3.6	1.1
SEP 6	.34	44.1	52.1	49.0	40.7	26.7	17.0	10.7	6.7	2.6	.6
SEP 13	.16	44.9	49.8	45.9	36.2	21.5	12.5	7.2	4.1	1.4	.2
SEP 20	.27	44.1	48.2	43.5	33.3	19.2	11.0	6.3	3.6	1.1	.1
SEP 27	.15	46.6	46.0	41.5	31.6	18.0	10.1	5.6	3.1	.9	.0
OCT 4	.21	46.6	48.5	44.3	32.7	15.3	7.2	3.5	1.7	.3	.0
OCT 11	.13	44.1	52.6	48.1	33.3	11.6	3.8	1.3	.5	.1	.0
OCT 18	.16	44.9	50.8	45.6	30.5	10.1	2.9	.7	.1	.0	.0
OCT 25	.13	44.9	50.8	46.1	33.2	14.0	5.1	1.7	.5	.0	.0
NOV 1	.24	37.4	60.0	56.3	42.2	17.3	5.8	1.8	.4	.0	.0
NOV 8	.18	32.4	64.3	59.8	43.3	16.1	5.2	1.7	.5	.0	.0
NOV 15	.21	35.8	57.7	51.6	35.5	13.8	5.2	2.0	.8	.1	.0
NOV 22	.12	41.6	51.2	44.1	27.3	9.2	3.2	1.1	.4	.0	.0
NOV 29	.11	46.6	48.1	41.0	22.4	4.5	.7	.1	.0	.0	.0
DEC 6	.10	48.3	47.0	40.5	23.0	5.6	1.4	.4	.1	.0	.0
DEC 13	.15	44.1	49.1	42.8	27.6	10.3	3.8	1.4	.5	.0	.0
DEC 20	.17	39.9	52.2	45.7	30.9	12.5	4.7	1.7	.6	.0	.0
DEC 27	.14	42.4	50.8	44.4	29.3	10.7	3.6	1.1	.3	.0	.0
JAN 3	.13	45.8	46.3	39.7	25.2	8.7	2.7	.7	.2	.0	.0
JAN 10	.11	48.3	42.6	36.1	22.9	8.5	3.0	.9	.3	.0	.0
JAN 17	.13	49.1	43.6	37.9	25.3	10.2	3.8	1.3	.4	.0	.0
JAN 24	.15	46.6	46.5	40.5	26.9	10.5	3.8	1.3	.3	.0	.0
JAN 31	.12	39.9	52.6	45.4	28.0	8.5	2.4	.6	.1	.0	.0
FEB 7	.17	32.4	60.0	51.6	30.1	6.9	1.2	.1	.0	.0	.0
FEB 14	.13	31.6	59.6	50.6	29.1	7.0	1.3	.2	.0	.0	.0
FEB 21	.15	32.4	58.8	50.4	30.9	9.7	2.8	.8	.2	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 2 (Cont'd)

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 2-Week Periods, Gillette

PERIOD BEGIN	AVE.	0,T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
			PRECIPITATION - IN INCHES								
MAR 1	.40	10.8	86.3	82.4	68.9	41.2	22.3	5.9	1.5	.2	.0
MAR 15	.56	7.4	88.7	85.0	74.5	53.9	37.4	16.8	7.2	1.8	.0
MAR 29	.73	5.8	91.5	88.8	80.4	62.1	45.8	23.2	11.1	3.3	.0
APR 12	.71	10.0	87.4	84.8	77.4	61.6	47.2	26.2	13.8	5.0	.0
APR 26	.90	4.9	93.4	91.6	85.7	71.5	57.3	34.4	19.6	7.9	.2
MAY 10	1.01	4.9	92.5	90.3	84.0	70.8	58.5	38.8	25.1	12.8	1.2
MAY 24	1.20	3.3	96.0	95.2	92.5	84.1	73.4	51.2	33.1	15.9	1.0
JUN 7	1.26	4.9	93.9	92.7	88.9	79.3	69.0	50.1	35.0	19.7	2.3
JUN 21	.90	5.8	91.3	88.6	81.4	66.6	53.6	33.8	21.0	10.3	.9
JUL 5	.68	11.6	84.3	80.9	71.7	54.3	40.2	21.2	10.9	3.9	.1
JUL 19	.43	17.4	77.3	73.1	62.4	43.6	29.7	13.2	5.7	1.5	.0
AUG 2	.39	19.9	72.9	68.1	56.6	38.3	25.4	11.0	4.6	1.2	.0
AUG 16	.47	29.9	63.3	59.5	50.9	37.7	28.0	15.7	8.9	3.8	.1
AUG 30	.63	21.6	73.5	70.1	61.7	47.0	35.3	19.6	10.7	4.2	.1
SEP 13	.43	21.6	72.4	68.2	57.6	40.2	27.6	12.6	5.6	1.7	.0
SEP 27	.37	19.9	74.2	69.4	56.8	35.5	21.5	7.9	3.0	.7	.0
OCT 11	.29	17.4	77.8	72.3	56.5	29.5	13.9	2.5	.3	.0	.0
OCT 25	.37	18.2	79.9	77.1	65.6	38.9	19.8	3.9	.5	.0	.0
NOV 8	.39	14.1	83.6	80.3	67.9	40.4	20.9	4.5	.7	.0	.0
NOV 22	.23	22.4	73.1	67.2	49.1	21.3	8.7	1.3	.1	.0	.0
DEC 6	.25	25.0	71.5	66.5	50.0	23.1	9.8	1.6	.1	.0	.0
DEC 20	.31	15.8	77.6	71.5	55.3	29.0	14.1	3.1	.6	.0	.0
JAN 3	.24	19.9	69.7	62.3	45.3	21.8	10.0	2.0	.3	.0	.0
JAN 17	.28	14.9	77.9	70.7	51.8	23.8	9.9	1.4	.1	.0	.0
JAN 31	.28	14.1	79.6	72.8	54.2	25.7	11.0	1.6	.0	.0	.0
FEB 14	.28	9.9	85.8	79.7	59.8	26.1	9.7	1.1	.0	.0	.0

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated During 3-Week Periods, Gillette

PERIOD BEGIN	AVE.	0,T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
			PRECIPITATION - IN INCHES								
MAR 1	.68	4.1	95.1	93.8	87.6	68.1	47.8	19.8	7.2	1.3	.0
MAR 22	1.02	.8	98.5	97.6	93.6	81.2	66.7	40.6	22.7	8.6	.0
APR 12	1.14	4.9	94.3	93.4	90.1	80.4	69.2	48.0	31.5	15.7	1.0
MAY 3	1.47	.0	98.6	97.3	93.2	83.6	73.6	55.2	40.3	24.5	4.2
MAY 24	1.85	2.4	97.4	97.4	97.1	95.5	91.7	78.7	61.8	37.8	3.9
JUN 14	1.51	.8	98.7	98.1	95.7	88.4	79.4	60.7	44.4	26.3	3.6
JUL 5	.88	5.8	92.7	91.1	85.7	72.2	58.1	34.7	19.3	7.4	.1
JUL 26	.63	11.6	85.0	81.9	73.3	56.0	41.3	21.3	10.5	3.5	.0
AUG 16	.77	13.3	81.4	77.9	69.7	55.5	44.2	27.8	17.5	8.7	.8
SEP 6	.77	9.9	86.5	83.6	75.3	59.2	45.4	25.9	14.5	6.0	.2
SEP 27	.50	6.6	89.3	85.3	73.7	51.3	34.1	14.1	5.6	1.2	.0
OCT 18	.53	9.1	89.7	87.8	79.5	55.7	34.0	10.0	2.3	.0	.0
NOV 8	.51	5.8	92.2	89.4	79.3	55.0	34.4	11.2	3.1	.3	.0
NOV 29	.35	12.4	84.8	80.7	66.5	37.5	18.5	3.7	.4	.0	.0
DEC 20	.44	4.1	90.2	84.6	69.3	42.7	24.8	7.7	2.2	.3	.0
JAN 10	.39	5.8	89.3	83.9	67.9	39.0	20.4	4.9	1.0	.0	.0
JAN 31	.41	2.5	91.9	86.4	71.0	42.7	23.7	6.5	1.6	.1	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 3

Probability That a Given Day Will Be Wet or Dry, Douglas

P(WET)=1 - P(DRY) P(WET/DRY)=1 - P(DRY/DRY) P(WET/WET)=1 - P(DRY/WET)

PERIOD	WET ≥ 0.01 INCHES			WET ≥ 0.05 INCHES			WET ≥ 0.10 INCHES		
BEGINS	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET
MAR 01	76	78	70	89	89	87	95	95	99+
MAR 08	77	80	68	88	90	75	94	94	78
MAR 15	80	81	78	88	88	86	91	92	85
MAR 22	74	79	61	86	89	74	92	93	86
MAR 29	71	76	65	79	81	75	83	85	78
APR 05	70	76	56	80	83	70	87	90	73
APR 12	78	82	64	87	90	64	90	92	73
APR 19	75	82	51	82	85	66	88	90	69
APR 26	68	76	51	78	82	66	86	87	74
MAY 03	69	79	48	78	85	51	83	89	54
MAY 10	66	76	46	75	81	58	80	84	67
MAY 17	65	75	46	75	82	54	83	85	76
MAY 24	61	68	50	71	76	61	78	81	67
MAY 31	62	73	46	72	76	61	78	79	76
JUN 07	70	77	55	76	82	57	83	86	69
JUN 14	64	70	55	75	77	66	81	82	73
JUN 21	71	78	57	80	85	65	90	92	69
JUN 28	77	83	58	85	88	70	89	93	60
JUL 05	76	80	63	82	83	76	90	91	86
JUL 12	78	80	72	87	88	88	92	93	90
JUL 19	80	82	74	88	88	94	92	92	92
JUL 26	77	80	65	88	90	75	93	94	71
AUG 02	83	85	73	90	92	71	93	95	87
AUG 09	83	87	71	88	90	78	94	94	92
AUG 16	83	84	67	90	91	73	92	91	83
AUG 23	81	86	59	88	90	78	92	94	79
AUG 30	84	87	71	89	92	73	91	92	80
SEP 06	76	82	53	83	85	76	89	90	80
SEP 13	84	90	52	89	93	56	93	94	73
SEP 20	80	86	56	85	89	64	90	91	83
SEP 27	86	91	56	91	94	55	93	95	61
OCT 04	85	87	71	90	91	77	92	93	79
OCT 11	84	87	71	88	90	73	92	93	90
OCT 18	83	88	50	89	90	73	91	91	85
OCT 25	83	86	62	90	91	77	93	94	83
NOV 01	77	82	59	85	88	65	91	91	85
NOV 08	85	88	70	91	92	75	93	95	76
NOV 15	80	84	58	86	89	63	93	94	85
NOV 22	84	85	76	90	92	78	95	95	96
NOV 29	83	85	68	92	93	85	96	96	99+
DEC 06	80	81	76	90	90	88	95	96	86
DEC 13	86	87	80	92	94	76	97	98	87
DEC 20	83	85	71	90	90	90	95	96	78
DEC 27	84	84	82	93	94	82	98	98	92
JAN 03	80	82	76	91	92	83	96	96	75
JAN 10	81	84	67	92	92	88	96	96	99+
JAN 17	81	84	67	92	93	75	96	96	88
JAN 24	79	83	66	89	91	78	97	97	92
JAN 31	82	83	78	89	90	88	95	95	86
FEB 07	80	82	75	88	89	86	94	95	83
FEB 14	78	81	68	90	91	79	95	95	71
FEB 21	80	83	71	88	88	93	94	94	97

Source: Colorado State University Experiment Station. Probability of Sequence of Wet or Dry Days for 11 Western States and Texas. Technical Bulletin 117.

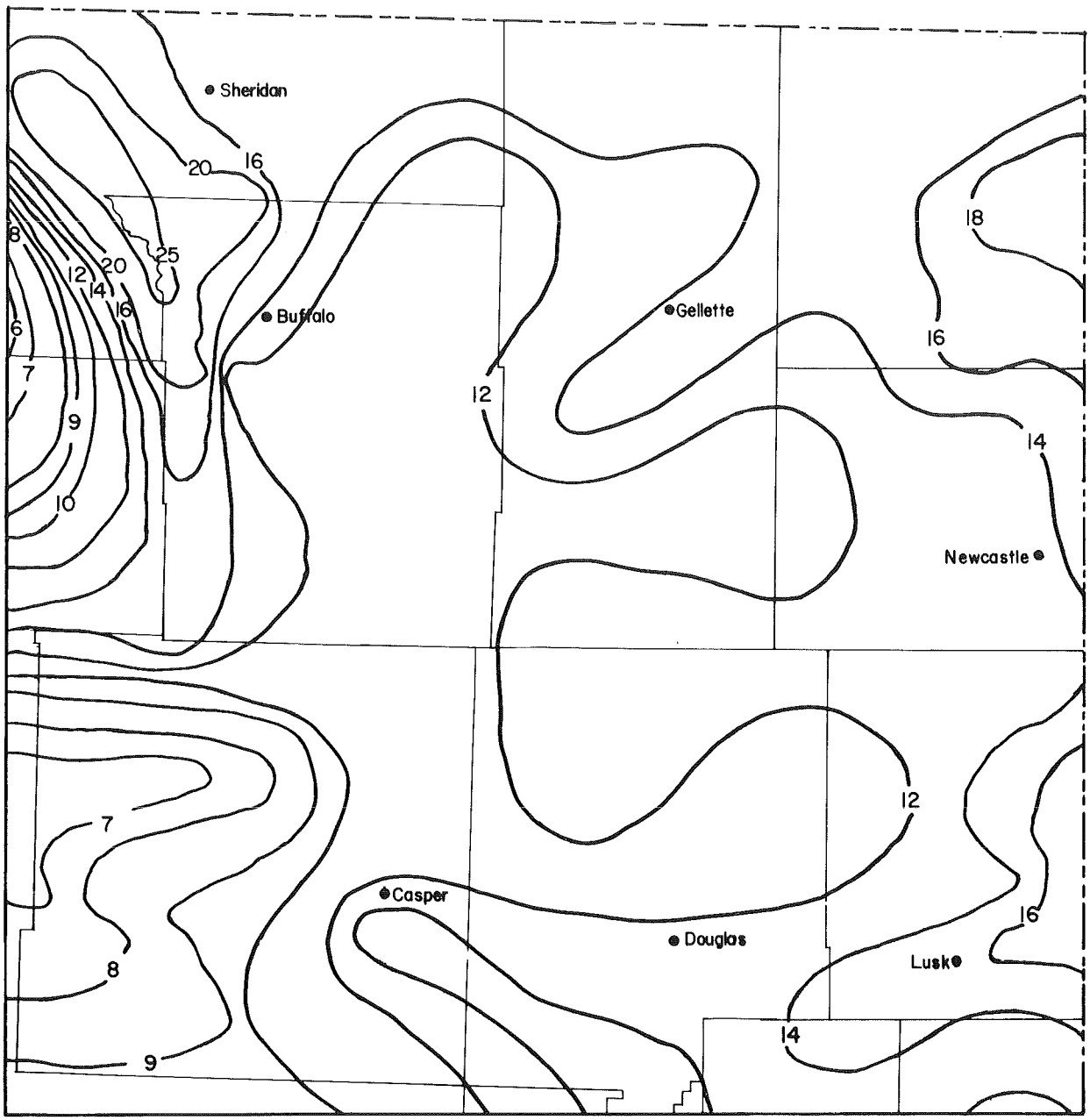
Table 4

Probability That a Given Day Will Be Wet or Dry, Gillette

P(WET)=1 - P(DRY) P(WET/DRY)=1 - P(DRY/DRY) P(WET/WET)=1 - P(DRY/WET)

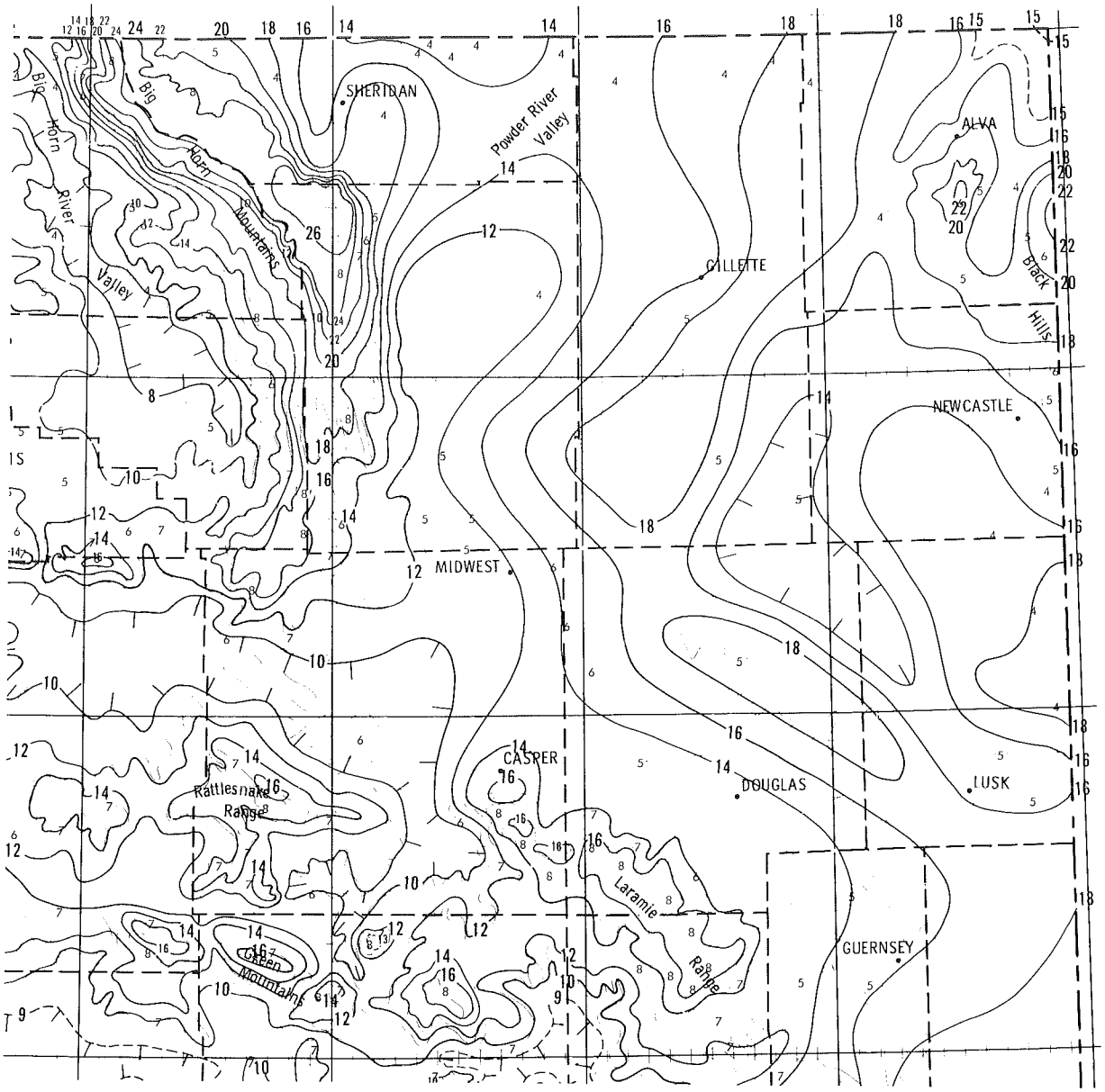
PERIOD	WET ≥ 0.01 INCHES			WET ≥ 0.05 INCHES			WET ≥ 0.10 INCHES		
BEGINS	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET
MAR 01	82	82	73	86	85	82	92	92	88
MAR 08	81	85	59	86	90	58	92	93	68
MAR 15	83	83	79	85	86	83	91	91	97
MAR 22	81	80	83	84	84	81	90	91	81
MAR 29	75	78	71	78	80	70	83	85	81
APR 05	75	81	58	80	81	71	86	87	78
APR 12	83	84	74	87	87	84	89	89	89
APR 19	74	80	54	78	83	60	82	87	69
APR 26	70	74	60	76	80	64	83	87	70
MAY 03	68	72	61	75	77	68	84	87	70
MAY 10	71	76	57	78	81	61	82	83	67
MAY 17	73	81	56	78	82	65	83	86	69
MAY 24	68	74	53	73	77	56	80	81	70
MAY 31	64	69	56	69	72	63	77	79	70
JUN 07	65	71	53	71	75	61	78	84	57
JUN 14	72	76	62	77	80	68	82	85	67
JUN 21	67	73	58	75	77	71	81	83	76
JUN 28	83	86	71	87	89	74	90	93	68
JUL 05	83	87	57	86	89	60	91	92	79
JUL 12	82	82	87	85	85	93	88	89	92
JUL 19	86	88	74	88	89	79	92	93	91
JUL 26	81	85	65	85	85	82	89	89	82
AUG 02	88	90	76	91	92	85	94	95	79
AUG 09	86	87	85	89	90	81	92	93	90
AUG 16	88	89	85	91	91	92	93	94	90
AUG 23	88	90	78	92	92	88	94	95	93
AUG 30	84	88	62	86	89	71	90	91	87
SEP 06	85	87	78	87	88	79	89	90	82
SEP 13	83	90	49	85	90	53	89	93	54
SEP 20	81	85	64	85	88	69	90	91	82
SEP 27	88	91	62	92	94	60	94	95	76
OCT 04	87	89	72	88	90	72	92	93	80
OCT 11	90	92	80	92	92	88	92	93	86
OCT 18	87	90	67	90	92	77	93	94	89
OCT 25	90	91	88	91	92	91	93	94	93
NOV 01	83	84	71	84	85	72	88	89	81
NOV 08	84	86	69	87	88	72	91	93	70
NOV 15	84	87	70	86	88	72	91	92	87
NOV 22	88	89	77	90	91	82	94	95	83
NOV 29	87	90	65	89	90	88	94	95	92
DEC 06	88	90	67	90	91	69	94	94	92
DEC 13	88	87	91	90	91	93	96	97	91
DEC 20	81	81	78	86	86	83	92	92	92
DEC 27	84	87	67	88	89	74	94	95	80
JAN 03	83	85	75	88	90	72	94	95	93
JAN 10	84	88	62	91	92	79	95	96	80
JAN 17	81	88	52	87	90	64	95	95	94
JAN 24	83	88	56	89	90	85	94	94	94
JAN 31	85	86	80	89	89	91	96	96	93
FEB 07	80	81	77	83	83	85	91	91	97
FEB 14	81	82	76	87	86	86	93	93	95
FEB 21	82	85	67	86	88	80	94	94	99+

Source: Colorado State University Experiment Station. Probability of Sequence of Wet or Dry Days for 11 Western States and Texas. Technical Bulletin 117.



Source: By the Wyoming Water Planning Program in Cooperation with E.S.S.A. Weather Bureau State Climatologist, Wyoming.

Figure 3
Mean Annual Precipitation as of 1965
(in Inches)



Prepared by :
U.S. Department of Commerce
For :
U.S. Department of Agriculture
August 1968

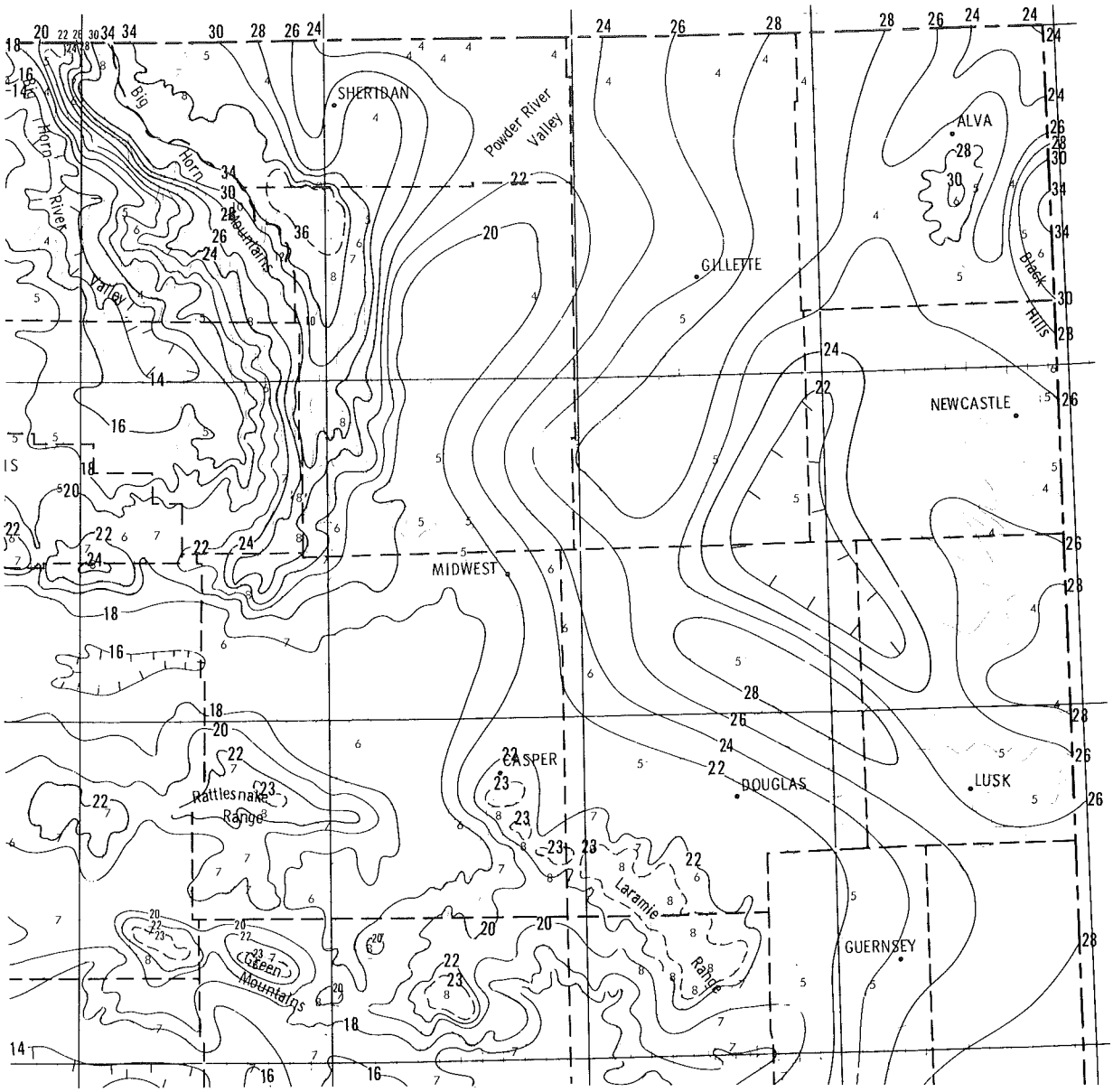
10 0 10 20 30 40
SCALE IN MILES

LEGEND

—26— Isopluvials of Precipitation in Tenths of an Inch Annual .

Figure 4

2 – Year 24-Hour Precipitation



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August 1968

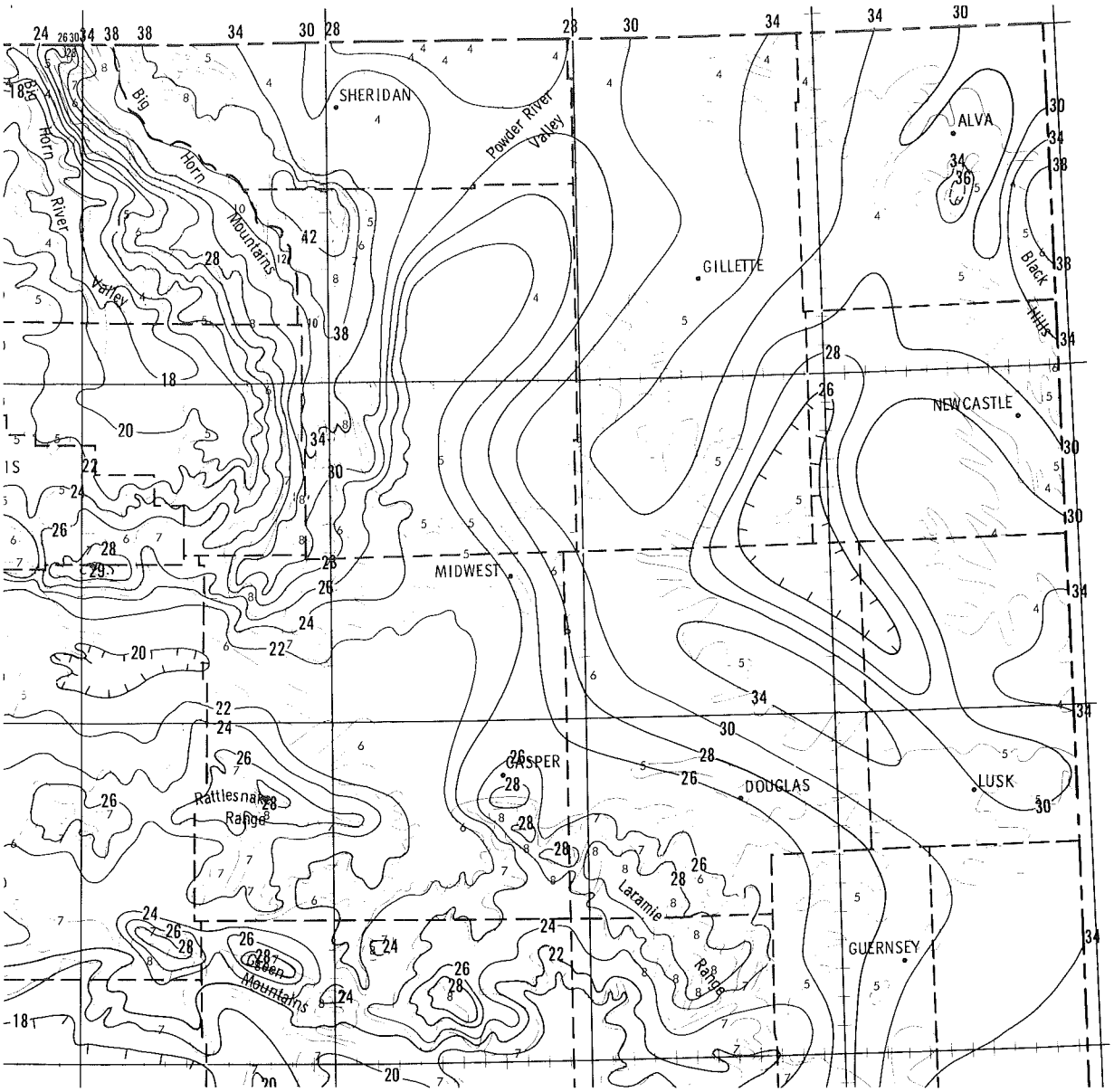
10 0 10 20 30 40
SCALE IN MILES

LEGEND

—26— Isopluvials of Precipitation in Tenths of an Inch Annual .

Figure 5

10 – Year 24-Hour Precipitation



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August 1968

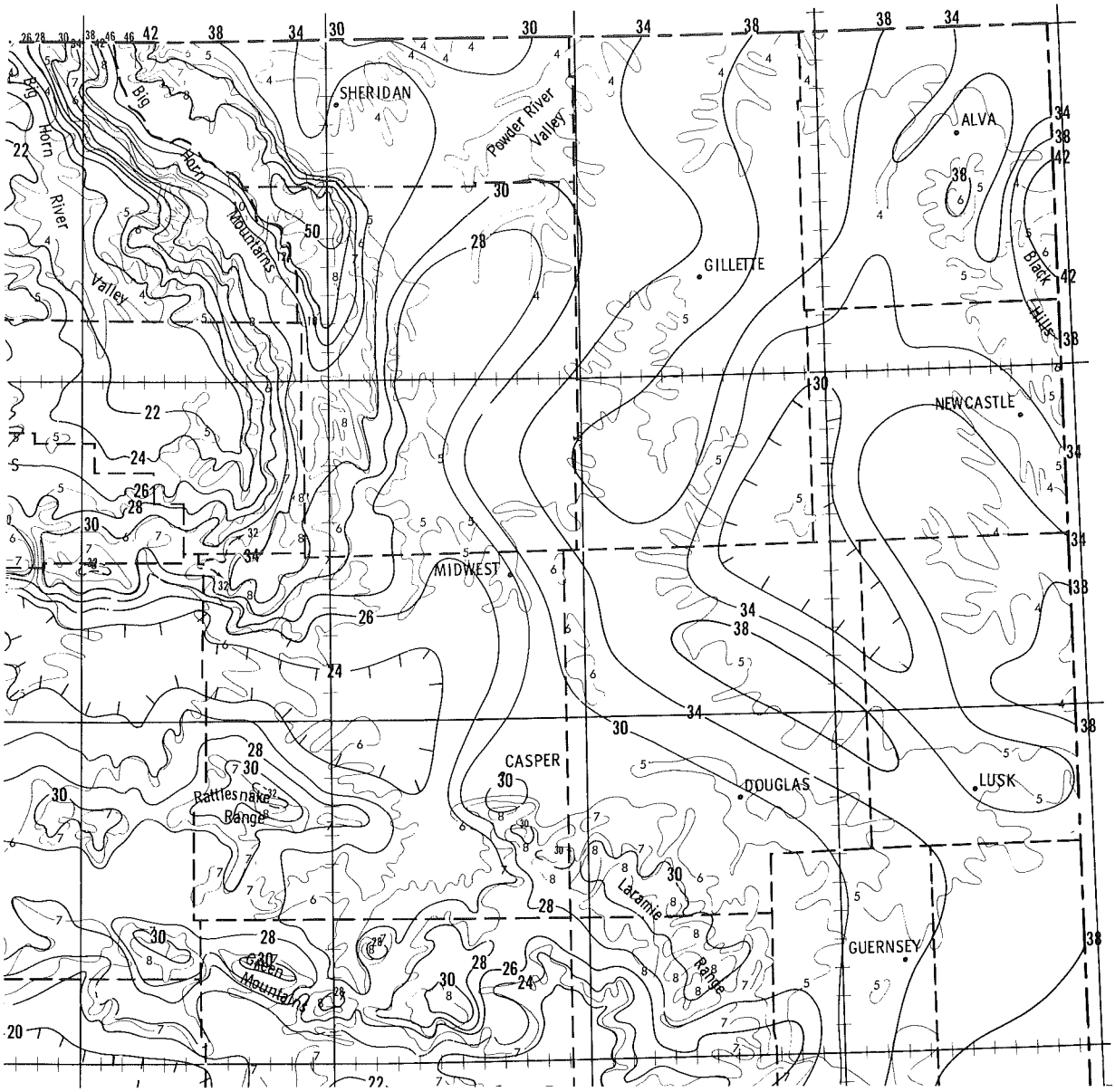
10 0 10 20 30 40
SCALE IN MILES

LEGEND

—26— Isopluvials of Precipitation in Tenths of an Inch Annual .

Figure 6

25 – Year 24-Hour Precipitation



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August 1968

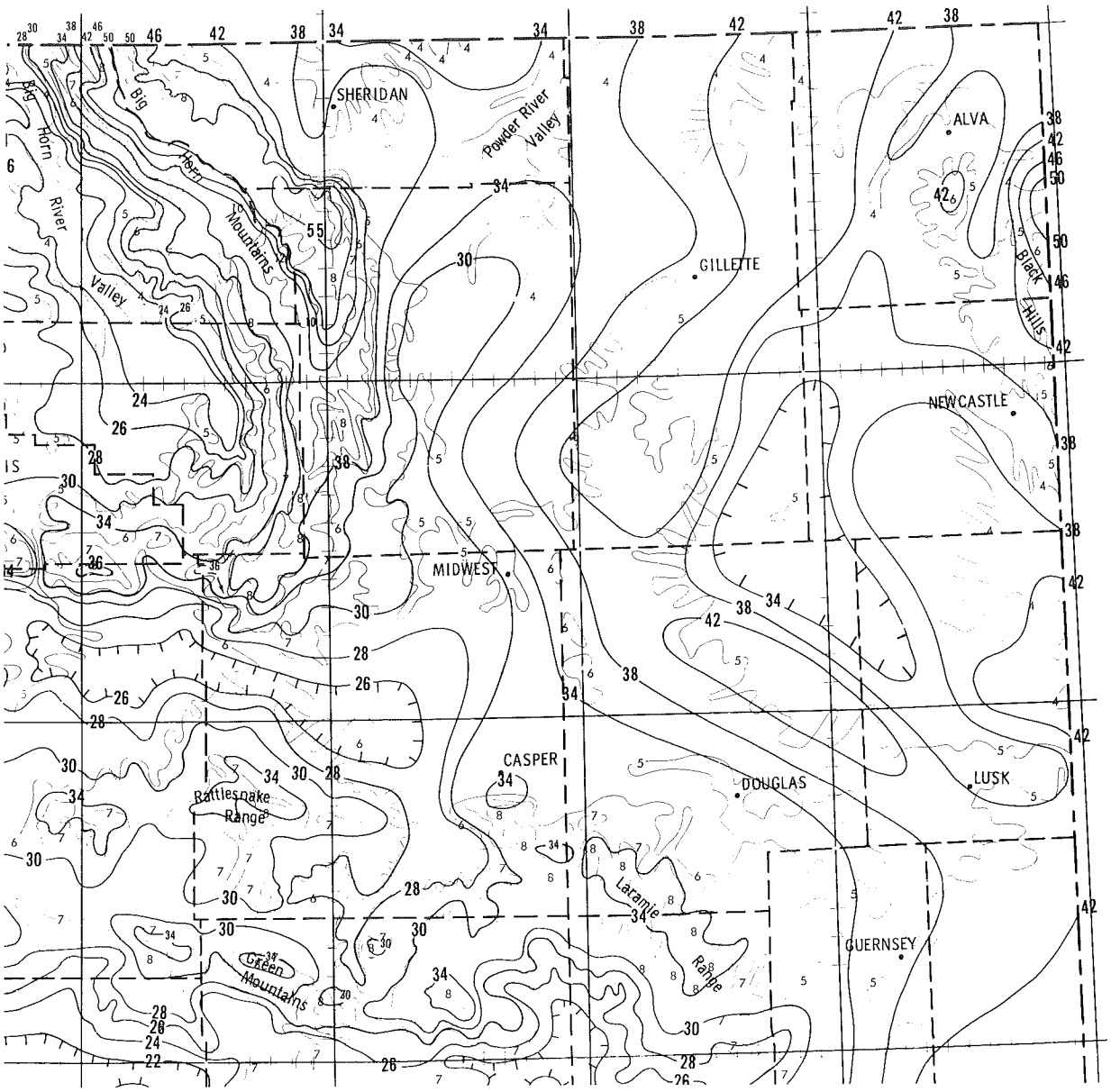
10 0 10 20 30 40
SCALE IN MILES

L E G E N D

—26— Isopluvials of Precipitation in Tenths of an Inch Annual .

Figure 7

50 – Year 24-Hour Precipitation



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For :
U.S. Department of Agriculture
August 1968

10 0 10 20 30 40
SCALE IN MILES

L E G E N D

—26— Isopluvials of Precipitation in Tenths of an Inch Annual .

Figure 8

100 – Year 24-Hour Precipitation

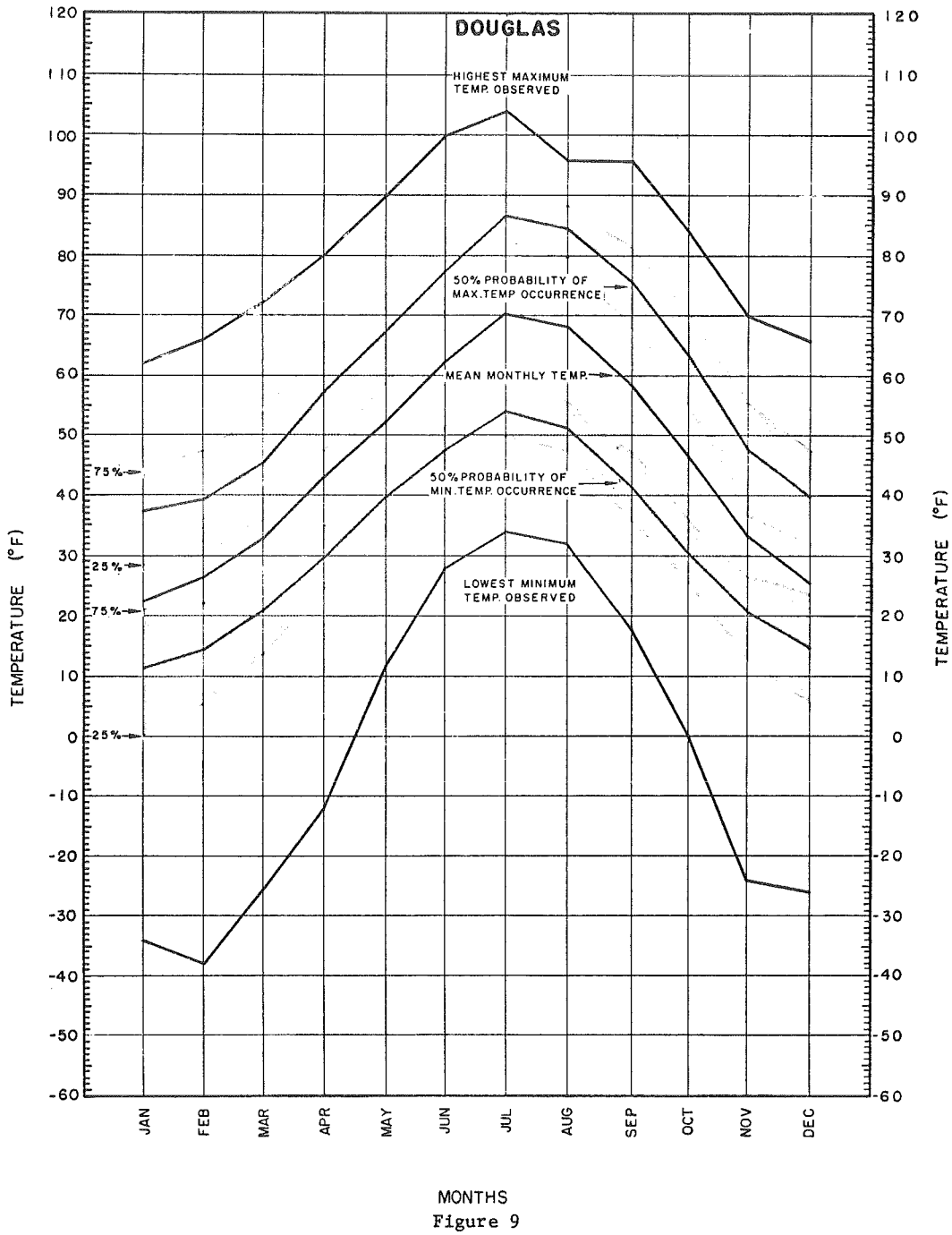

Figure 9

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Douglas

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 5

Empirical Probabilities of Observing Maximum Temperatures
Less Than or Equal To the Specified Values

LATITUDE: 42° 46'
LONGITUDE: 105° 25'
ELEV. (GROUND): 4853 feet

STATION: Douglas
PERIOD OF RECORD: 1931-1960

MAXIMUM TEMP. (°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-16												
-14												
-12												
-10	.10	.11										
-8	.10	.23										
-6	.32	.35										
-4	1.07	.47										
-2	1.18	.58										.21
0	1.93	.82									.11	.32
2	2.47	1.29									.11	.43
4	2.90	1.53	.10								.22	.64
6	3.54	2.12	.21								.22	.75
8	4.19	2.24	.53								.22	1.07
10	4.94	2.83	.96								.55	1.29
12	5.59	3.53	1.61								1.00	2.15
14	6.88	4.24	1.72	.11							1.33	3.01
16	8.17	4.95	2.36	.11							1.44	4.08
18	9.56	6.01	2.68	.11							2.22	5.16
20	12.04	7.90	3.33	.11							3.22	6.55
22	14.51	10.02	4.94	.11							3.88	9.24
24	17.31	13.08	6.34	.55							5.88	10.96
26	20.43	16.15	8.27	1.00						.10	8.00	13.22
28	23.54	20.63	10.96	1.00						.32	10.66	17.31
30	28.92	24.29	13.87	2.33	.10					.53	13.77	21.72
32	33.87	29.12	16.12	3.88	.43					1.18	17.66	26.23
34	39.13	35.14	19.89	6.44	.43					2.15	21.22	32.68
36	44.08	39.85	24.51	8.11	.53				.11	2.68	24.00	37.20
38	50.21	45.28	29.03	9.88	.86	.11			.33	3.22	27.77	43.22
40	58.06	51.41	33.97	12.44	1.39	.11			.55	4.83	31.55	50.64
42	65.48	58.25	38.49	14.77	2.15	.22			1.11	6.45	35.33	58.27
44	73.44	66.15	44.73	17.55	3.33	.22			1.66	9.35	41.44	66.02
46	81.50	70.75	51.39	22.11	5.05	.66			2.44	11.72	45.33	71.07
48	86.02	78.30	58.27	26.44	7.20	.66			2.88	14.73	51.33	77.20
50	91.07	82.90	64.19	29.77	9.24	1.11			3.77	17.09	57.88	82.58
52	93.54	88.08	69.24	35.00	12.04	1.44			4.77	20.10	63.77	88.17
54	96.77	90.56	75.59	41.55	14.73	2.66	.21	.10	6.33	23.87	70.11	92.15
56	98.38	92.68	80.32	46.66	19.24	3.55	.21	.10	7.00	28.60	75.88	94.83
58	99.13	95.63	86.55	52.11	23.33	4.55	.21	.21	9.00	32.90	82.11	96.77
60	99.46	97.52	90.75	58.55	28.17	6.44	.32	.43	11.44	38.70	87.66	98.38
62	99.89	98.82	93.11	62.66	33.44	9.00	.43	.86	14.55	45.91	91.55	99.46
64		99.29	95.59	70.77	40.86	13.11	.53	1.29	18.00	52.04	95.44	99.78
66		99.88	96.66	75.66	45.26	16.33	.53	1.82	21.00	58.27	97.55	99.89
68			97.95	81.00	53.33	20.44	.96	3.01	26.77	65.16	98.88	
70			98.81	87.66	63.01	25.88	2.25	4.40	32.11	72.15	99.55	
72			99.67	91.66	69.03	31.77	3.76	5.59	37.55	79.13		
74				94.55	75.91	37.55	6.02	9.35	44.44	86.02		
76				96.33	79.24	44.44	8.92	14.51	51.11	91.72		
78				98.33	84.83	51.11	12.79	20.75	59.66	95.26		
80				99.44	90.10	58.11	19.56	26.34	68.11	97.95		
82					93.01	66.44	27.41	34.51	77.66	99.35		
84					95.26	73.77	34.94	44.08	85.22	99.78		
86					97.52	79.44	46.66	57.52	89.66			
88					99.24	87.11	58.17	72.25	93.44			
90					99.89	92.22	70.64	83.01	96.55			
92						95.66	81.82	91.93	98.55			
94						98.33	90.21	96.88	99.55			
96						99.44	94.94	98.81	99.88			
98						99.55	96.88					
100						99.77	98.81					
102							99.35					
104							99.78					
106												
108												
110												
112												
114												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 6

Empirical Probabilities of Observing Minimum Temperatures
Less Than or Equal To the Specified Values

LATITUDE: 42° 46'
LONGITUDE: 105° 25'
ELEV. (Ground): 4853 feet

STATION: Douglas
PERIOD OF RECORD: 1931-1960

MINIMUM TEMP(°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-50												
-48												
-46												
-44												
-42												
-40												
-38		.11										
-36		.11										
-34	.10	.11										
-32	.10	.11										
-30	.43	.23										
-28	.64	.35										
-26	.86	.82	.10									.10
-24	1.18	1.29	.21								.11	.21
-22	1.82	2.00	.32								.22	.53
-20	2.90	2.71	.32								.44	.96
-18	4.30	3.18	.32								.55	1.29
-16	5.91	3.65	.64								.77	1.72
-14	7.74	4.83	.75								.88	2.25
-12	8.70	5.30	1.82	.11							1.33	3.54
-10	10.86	7.07	2.25	.11							1.88	4.73
-8	13.33	8.25	2.79	.11							2.11	5.91
-6	14.51	9.55	3.33	.11							3.22	7.74
-4	17.84	10.84	4.08	.44							4.11	9.78
-2	20.75	12.38	5.59	.66							5.33	12.47
0	24.94	16.50	7.09	.77						.10	7.77	16.34
2	27.74	19.33	8.49	.88						.10	9.55	18.70
4	32.04	22.87	10.00	.88						.21	12.22	22.04
6	36.55	27.12	11.93	1.00						.32	15.11	25.59
8	40.64	31.36	14.40	1.44						.53	17.55	30.86
10	46.12	35.96	18.70	2.00						.96	20.55	37.31
12	51.07	41.27	21.61	3.11	.10					1.50	24.00	43.11
14	57.31	49.41	26.02	4.33	.10					2.47	29.00	49.46
16	61.39	55.18	30.00	5.88	.32					3.65	33.77	53.11
18	66.55	60.84	36.66	8.77	.32				.11	4.30	40.22	58.81
20	72.04	68.39	44.51	12.00	.75				.55	7.74	47.22	65.37
22	77.09	74.29	52.25	17.44	1.39				1.00	11.72	54.77	70.96
24	83.01	79.24	62.68	23.66	2.25				1.66	17.74	63.11	77.74
26	87.52	83.83	70.96	32.11	3.97				2.55	25.16	72.11	82.36
28	92.04	88.32	77.52	40.88	5.91	.11			4.55	35.80	79.55	87.31
30	94.73	92.33	84.83	50.88	10.75	.33			8.55	48.38	85.11	90.75
32	96.23	95.28	90.10	62.22	18.49	1.77		.10	15.11	58.70	89.77	94.30
34	97.31	97.40	94.73	71.44	26.02	2.66	.10	.32	20.33	67.41	92.55	96.23
36	98.38	98.70	97.09	79.33	33.97	3.88	.32	.75	27.00	74.62	94.22	96.88
38	98.81	99.05	97.84	85.00	42.79	7.55	.96	2.04	36.11	80.64	96.33	97.52
40	99.45	99.41	99.03	90.11	54.08	13.00	1.82	3.44	45.00	86.88	97.88	98.17
42		99.64	99.56	94.11	64.51	20.11	2.90	5.91	53.44	90.64	99.33	98.92
44		99.88	99.67	97.22	75.80	30.00	4.83	9.89	63.11	94.62	99.77	99.03
46			99.78	98.77	84.73	40.66	8.70	17.63	70.66	96.77	99.88	99.67
48			99.89	99.33	91.39	54.00	14.94	26.55	77.77	98.38		99.78
50				99.77	94.94	64.77	25.05	38.06	83.22	99.03		99.89
52				99.88	97.09	74.11	36.12	50.10	88.44	99.56		
54					99.03	84.77	50.00	62.68	92.33	99.89		
56					99.67	90.00	62.68	75.16	95.77			
58					99.89	94.68	75.37	83.76	97.77			
60						97.33	86.45	91.50	99.33			
62						98.77	93.22	95.59	99.88			
64						99.44	96.98	97.52				
66						99.66	98.70	99.03				
68							99.35	99.78				
70							99.78					
72							99.89					
74												
76												
78												
80												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming

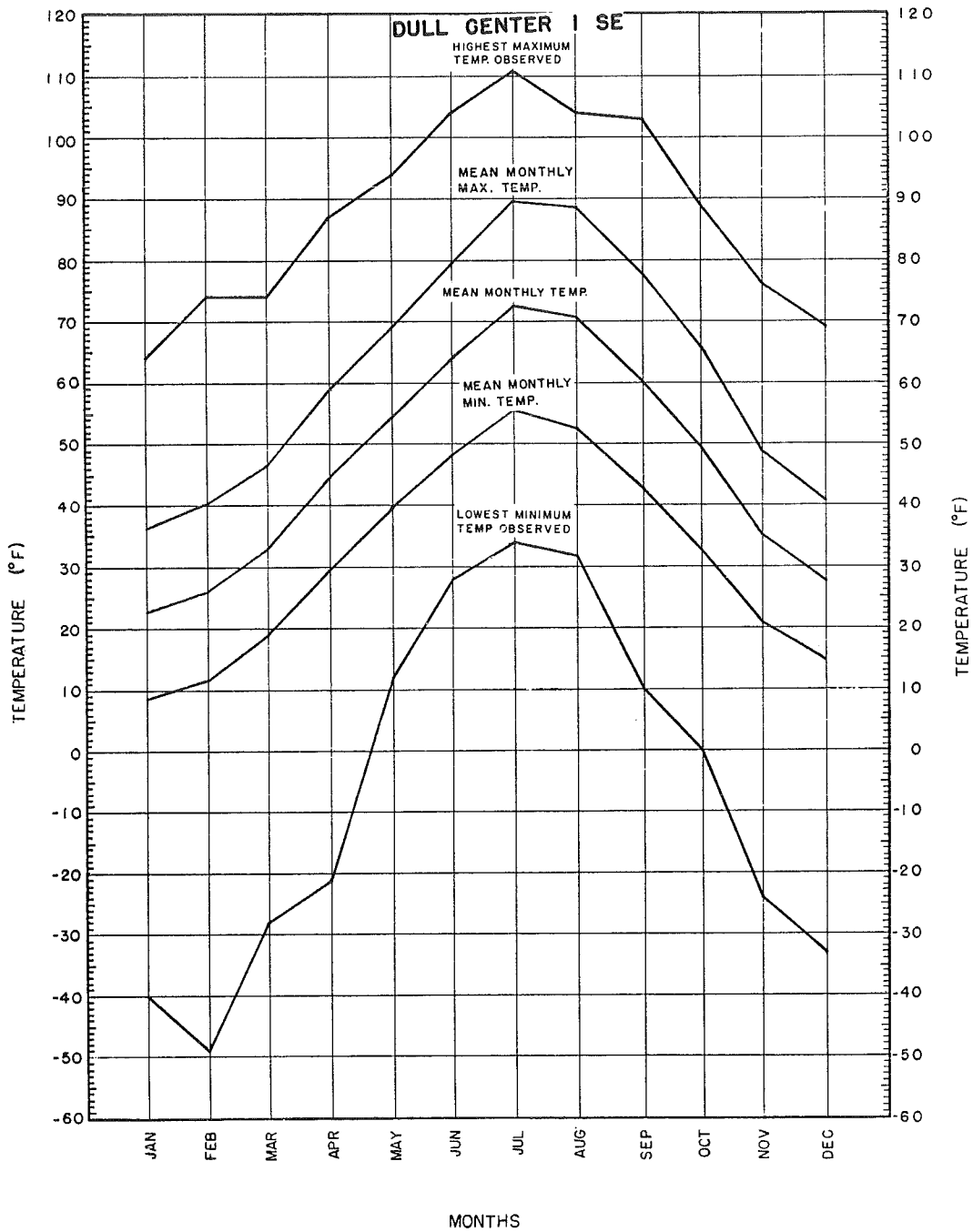

Figure 10

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Dull Center

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

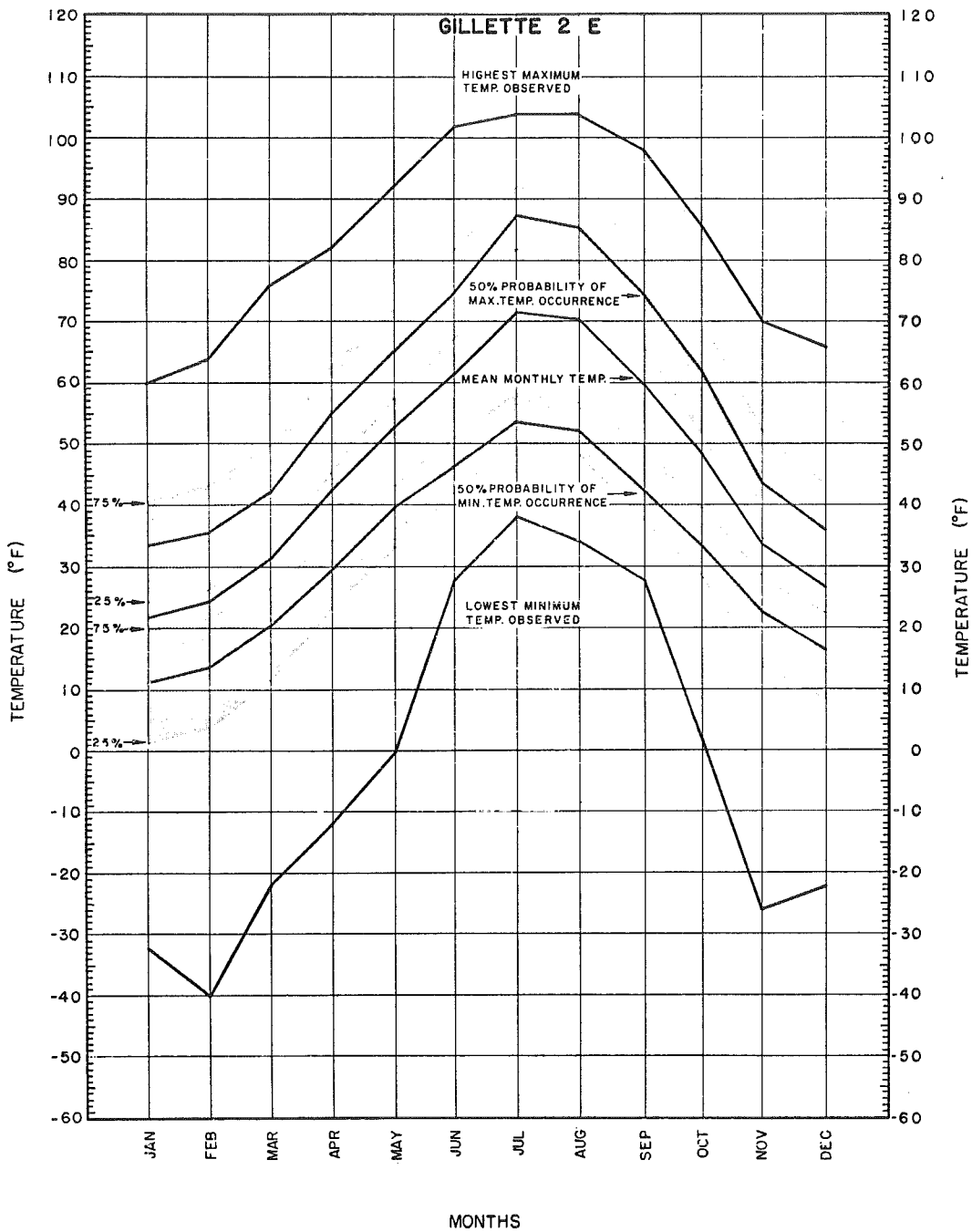

Figure 11

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Gillette

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 7

Empirical Probabilities of Observing Minimum Temperatures
Less Than or Equal To the Specified Values

LATITUDE: 44° 17'
LONGITUDE: 105° 28'
ELEV. (Ground): 4556 feet

STATION: Gillette 2E

PERIOD OF RECORD: 1931-1960

MINIMUM TEMP(°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-50												
-48												
-46												
-44												
-42												
-40		.11										
-38		.11										
-36		.11										
-34		.11										
-32	.10	.35										
-30	.21	.47										
-28	.43	.94										
-26	.53	1.41									.11	
-24	1.07	1.88									.11	
-22	2.15	1.88	.21								.22	.32
-20	3.44	2.24	.21								.44	.53
-18	4.19	3.18	.32								.55	.75
-16	5.59	3.77	.75								.66	1.18
-14	7.20	4.71	1.29								.77	1.93
-12	9.03	5.07	1.93	.11							.88	3.01
-10	12.47	6.25	2.47	.11							1.44	4.19
-8	13.76	8.01	3.01	.11							1.66	4.51
-6	15.37	10.02	3.87	.11							1.66	5.26
-4	17.74	12.02	5.48	.33							3.11	7.41
-2	20.32	15.33	6.66	.44							4.00	9.24
0	23.87	19.45	8.38	.44	.10					.10	5.66	12.25
2	26.34	21.93	9.89	.77	.10					.21	6.66	14.62
4	30.53	25.11	12.15	1.00	.10					.21	8.55	16.23
6	33.76	28.30	13.54	1.11	.10					.43	9.88	19.13
8	38.81	31.36	16.12	1.66	.10					.43	12.11	23.33
10	44.40	38.67	21.50	2.55	.21					.64	17.00	29.89
12	50.32	43.86	26.02	4.66	.21					1.18	20.77	37.41
14	56.23	50.35	29.78	6.77	.32				.22	1.72	25.22	45.69
16	60.21	55.89	31.93	8.11	.32				.22	2.58	27.22	48.49
18	66.12	61.20	37.20	10.44	.43				.33	3.76	32.66	55.37
20	74.94	69.33	47.74	14.44	.64				.44	6.12	39.88	66.12
22	81.39	76.65	56.66	20.77	1.29				.99	8.81	46.88	72.79
24	86.02	82.54	66.45	26.88	2.68				1.44	13.87	56.55	79.46
26	90.75	85.96	73.76	33.00	3.97				2.33	18.60	63.22	84.83
28	93.76	89.38	80.32	43.88	6.66	.22			3.55	24.94	71.00	88.70
30	96.55	93.51	88.49	54.33	12.79	.88			5.54	33.54	82.22	92.90
32	97.95	95.99	92.04	63.11	18.70	1.77			8.87	42.90	88.22	95.91
34	98.81	98.23	94.94	73.33	26.98	3.33		.21	14.65	52.58	92.55	97.41
36	99.56	99.05	96.55	78.55	34.40	5.11		.21	20.31	59.46	95.44	98.49
38	99.56	99.29	97.84	84.88	42.58	8.33	.10	.96	26.74	68.06	97.66	98.92
40	99.89	99.76	98.81	90.77	55.69	15.88	1.18	2.79	36.73	78.27	99.33	99.46
42			99.67	94.33	66.66	24.55	2.90	4.83	46.61	86.23	99.44	99.78
44			99.78	97.00	78.27	36.55	4.94	8.60	55.71	91.93	99.55	
46				99.11	85.91	48.00	8.17	13.97	62.81	95.05	99.88	
48				99.55	90.75	58.66	12.04	20.75	70.81	97.31	99.88	
50				99.77	94.51	69.88	23.54	33.44	78.46	98.60		
52				99.77	96.45	79.88	33.01	45.59	85.57	99.13		
54				99.88	98.27	87.22	45.59	57.74	90.12	99.78		
56					98.92	93.88	56.98	71.07	93.67	99.78		
58					99.46	96.77	70.21	80.21	96.00	99.89		
60					99.89	98.88	81.72	87.84	98.00	99.89		
62						99.55	89.89	93.22	99.33			
64						99.88	95.48	96.77	99.88			
66						99.88	97.31	98.17				
68						99.88	98.70	99.24				
70							99.67					
72							99.67					
74												
76												
78												
80												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 8

Empirical Probabilities of Observing Maximum Temperatures
Less Than or Equal To the Specified Values

LATITUDE: 44° 17'
LONGITUDE: 105° 28'
ELEV. (GROUND): 4556 feet

STATION: Gillette 2E

PERIOD OF RECORD: 1931-1960

MAXIMUM TEMP. (°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-16	.32	.11										
-14	.43	.35										
-12	.43	.58										
-10	.75	.70										
- 8	1.39	.94										.32
- 6	1.39	1.17										.32
- 4	1.82	1.41										.43
- 2	2.04	1.53									.33	.43
0	3.65	1.76	.21								.33	.53
2	4.51	2.12	.43								.33	.53
4	5.59	2.59	.75								.44	.86
6	5.91	3.41	1.18								.55	1.50
8	6.77	4.36	1.39	.11							.77	1.72
10	9.35	5.66	1.82	.11							1.33	2.58
12	10.32	6.48	2.58	.22							2.11	3.65
14	12.68	7.78	3.11	.22						.10	2.88	5.37
16	13.76	8.96	3.44	.33						.21	3.22	5.69
18	15.26	10.96	4.62	.33						.21	4.22	7.63
20	18.49	14.15	5.59	.44						.21	5.11	10.53
22	20.86	16.39	7.41	.44						.32	5.66	12.68
24	24.83	20.40	9.35	.77						.32	8.00	15.16
26	28.49	23.93	11.18	1.22						.43	9.55	17.63
28	31.93	28.06	14.73	2.11					.22	.53	12.88	22.79
30	37.63	34.66	19.89	2.77	.21				.22	.86	16.44	29.03
32	42.79	38.20	23.33	4.33	.21				.22	1.29	19.00	33.87
34	50.86	45.40	28.81	7.22	.43				.22	2.47	2[illegible].33	41.82
36	57.09	51.29	33.44	9.22	.75				.22	3.01	28.66	47.84
38	63.65	57.19	38.49	11.77	1.07	.11			.44	4.73	3[illegible].77	53.54
40	71.50	66.62	46.45	16.44	1.93	.22			1.10	6.88	40.44	62.58
42	79.56	71.93	53.01	19.33	2.90	.22			1.44	9.67	45.11	70.53
44	86.34	77.24	59.03	22.77	5.05	.77			1.99	12.79	51.22	77.63
46	90.10	81.25	64.19	26.00	6.77	.77			2.44	14.19	56.77	83.44
48	94.08	85.61	69.03	30.44	8.60	1.00	.10		3.32	16.77	61.22	86.98
50	96.23	89.03	76.34	36.55	12.36	1.66	.10		4.10	22.68	69.11	91.61
52	98.17	91.39	80.00	42.11	14.94	2.55	.10		5.66	26.02	73.66	94.40
54	99.24	94.45	84.40	47.77	18.38	4.44	.10		6.88	29.46	79.44	96.66
56	99.67	95.99	87.52	51.77	21.39	6.00	.21	.21	8.32	34.40	83.77	97.95
58	99.67	97.52	90.32	58.11	26.77	9.00	.21	.21	10.76	38.06	86.22	98.60
60	99.89	98.11	93.33	65.33	33.97	12.33	.32	.43	14.53	43.33	90.44	99.56
62		99.29	95.16	71.55	40.43	15.00	.64	.53	16.98	47.84	93.66	99.67
64		99.76	97.31	76.77	45.59	18.55	1.39	2.04	21.42	54.94	96.22	99.78
66			97.95	81.00	50.86	22.22	1.50	3.11	25.08	60.00	97.33	99.78
68			98.60	86.22	58.27	27.88	2.04	3.87	29.41	65.26	98.44	
70			99.24	91.33	66.45	33.22	5.16	6.12	35.84	72.90	99.77	
72			99.89	94.11	73.01	39.22	6.02	8.81	40.17	78.60		
74			99.89	96.22	79.03	47.22	8.49	11.82	47.61	85.37		
76			99.89	98.00	83.33	52.88	11.39	14.08	53.71	89.56		
78				98.88	87.95	59.88	15.59	19.78	59.26	93.11		
80				99.66	91.39	68.33	20.21	26.88	65.70	96.77		
82				99.88	93.87	74.66	25.59	33.76	71.92	98.60		
84					96.23	81.55	34.08	42.68	80.02	99.35		
86					97.52	87.77	42.25	50.21	86.12	99.89		
88					98.70	91.77	51.93	57.31	90.56			
90					99.35	95.22	64.51	69.56	94.45			
92					99.89	96.77	74.83	79.78	96.11			
94						98.33	83.97	90.86	98.44			
96						99.11	90.32	94.92	99.77			
98						99.77	94.40	97.84				
100						99.77	97.74	99.03				
102						99.88	99.35	99.67				
104							99.89	99.89				
106												
108												
110												
112												
114												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

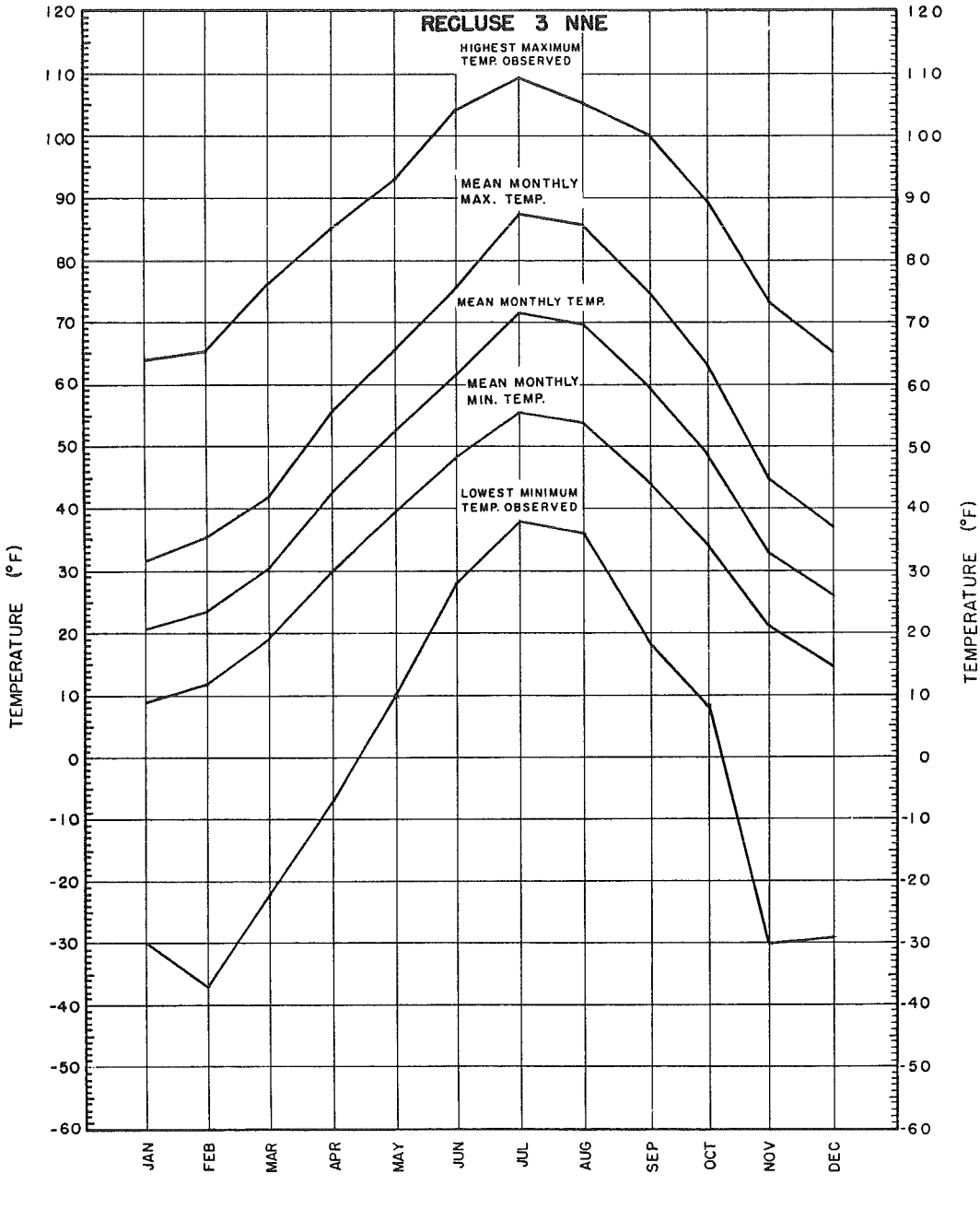

Figure 12

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Recluse

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 9
Normals of Precipitation and Evapotranspiration (inches)
Wyoming - Powder, Little Missouri, and Tongue Drainage

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	ANN	Seasonal 32°	Seasonal 28°
Gillette 2E															
P	0.6	0.6	1.1	1.7	2.2	2.6	1.2	1.0	1.1	0.7	0.8	0.6	14.0	6.4	7.8
PET	0.0	0.0	0.0	1.2	2.8	4.0	5.7	5.0	3.1	1.6	0.1	0.0	23.5	18.3	20.5
$E_a(2)$	0.0	0.0	0.0	1.2	2.7	3.4	1.9	1.0	1.1	0.7	0.1	0.0	12.1	8.1	9.8
$E_a(6)$	0.0	0.0	0.0	1.2	2.7	3.5	2.9	1.7	1.3	0.8	0.1	0.0	14.0	9.9	11.6
Dull Center 1SE															
P	0.2	0.3	0.6	1.5	2.3	2.2	1.5	1.2	0.9	0.8	0.4	0.3	12.2	6.2	7.4
PET	0.0	0.0	0.1	1.3	2.9	4.4	5.9	5.1	3.0	1.5	0.1	0.0	24.3	18.2	20.3
$E_a(2)$	0.0	0.0	0.1	1.3	2.8	3.0	1.9	1.3	0.9	0.8	0.1	0.0	12.2	7.6	9.0
$E_a(6)$	0.0	0.0	0.1	1.3	2.5	2.7	2.1	1.5	1.0	0.8	0.1	0.0	12.2	7.7	9.0
Douglas															
P	0.4	0.5	0.8	1.8	2.3	1.8	1.3	1.1	1.1	1.1	0.6	0.6	13.5	5.7	7.2
PET	0.0	0.0	0.1	1.3	2.8	4.2	5.4	4.7	2.9	1.4	0.1	0.0	23.0	17.1	19.4
$E_a(2)$	0.0	0.0	0.1	1.3	2.7	3.0	1.8	1.1	1.1	1.1	0.1	0.0	12.3	7.4	9.1
$E_a(6)$	0.0	0.0	0.1	1.3	2.6	3.0	2.5	1.6	1.3	1.1	0.1	0.0	13.5	8.6	10.2

P = Precipitation
PET - Evapotranspiration
$E_a(2)$ = Actual evapotranspiration, 2" available water capacity
$E_a(6)$ = Actual evapotranspiration, 6" available water capacity

Source: U. S. Department of Commerce - U. S. Department of Agriculture, Normals of Evapotranspiration (in inches) in Wyoming, undated.

SOILS

Supporting Data

Table 10

Aa-Ab - Arvada clay-clay loam

Arvada clay-clay loam occupies sloping terraces and alluvial fans that have been formed by local alluvium from upland soils. The soil has alkali or saline areas and bare spots where wind erosion has removed the surface and exposed the clay subsoil.

The surface horizon is light brownish gray friable clay or clay loam about 4 inches thick. The soil reaction (pH) ranges from slightly to strongly alkaline. The subsoil is brown to gray clay to clay loam about 20 inches thick and has columnar to prismatic structure. The substratum is clay loam to clay to 60 inches or more. The soil reaction of the subsoil and substratum ranges from strongly to very strongly alkaline. The internal drainage is very slow. The exchangeable sodium percentage of the subsoil and substratum is high, more than 15%.

Soil Classification: Ustollic Natrargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	0.06	A-7	CL-CH	Low	High	7.4 to 9.0+	alkali-salinity $CaCO_3$	250-600

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .65
Erosion Hazard (wind)	Moderate	fine textured, sodic and nearly level
Revegetation Potential	Low	saline, sodic, very slow permeability
Sprinkler Irrigation	Low	saline, sodic, very slow permeability
Final Cover for Mined Land (inches)	0	saline, sodic, slow permeability, clayey
Transportation Routes	Low	high shrink-swell, sodic, subject to piping
Roadfill Material	Low	high shrink-swell, sodic soils, subject to piping
Septic-Tank Absorption Fields	Low	very slow permeability - near streams
Sewage Lagoons	Low	near streams
Sanitary Landfills (trench)	Low	near streams, clayey textures
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	D	sodic, clayey, slow permeability

Table 11

Ac - Arvada loam

Arvada loam occupies sloping terraces that have been formed by local alluvium. The soil has alkali or saline areas and bare spots where wind erosion has removed the surface and exposed the clay subsoil. The surface horizon is 5 - 10 inches thick and ranges from sandy loam to loam. The subsoil is clay loam to clay and has columnar to prismatic structure. The substratum is clay to silty clay loam to 60 inches or more. The soil reaction of the subsoil and substratum ranges from strongly to very strongly alkaline. The internal drainage is very slow. The exchangeable sodium percentage of the subsoil and substratum is high, more than 15%.

Soil Classification: Ustollic Natrargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	0.06	A-7	CL-CH	Low	High	7.4 to 9.0+	alkali-salinity $CaCO_3$	250-600

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .54
Erosion Hazard (wind)	Moderate	medium textured, sodic, nearly level
Revegetation Potential	Low	saline, sodic, slow permeability, clayey
Sprinkler Irrigation	Low	saline, sodic, slow permeability, clayey
Final Cover for Mined Land (inches)	0	saline, sodic, slow permeability, clayey
Transportation Routes	Low	high shrink-swell, sodic, subject to piping
Roadfill Material	Low	high shrink-swell, sodic, subject to piping
Septic-Tank Absorption Fields	Low	very slow permeability - near streams
Sewage Lagoons	Low	near streams
Sanitary Landfills (trench)	Low	near streams, clayey textures
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	D	sodic, clayey, slow permeability

Table 12

Ba - Bankard fine sandy loam

Bankard fine sandy loam occupies nearly level floodplains that have been formed by local alluvium. The surface layer is grayish brown, mildly alkaline loamy sand about 3 inches thick. The subsoil is loamy fine sand texture, pale brown to light brownish gray and about 27 inches thick. The substratum is loamy sand to a depth of 60 inches or more. Internal drainage is very rapid. Soil reaction is moderately alkaline.

Soil Classification: Ustic Torrifluvent, sandy, mixed, calcareous, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loamy sand	2-4	.05-.07	6-20	A-2	SM	Moder-ate	Low	7.9 to 8.4	$CaCO_3$	1400-2500

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .17
Erosion Hazard (wind)	High	sandy
Revegetation Potential	Moderate	medium texture, deep
Sprinkler Irrigation	Low	intake rate too fast
Final Cover for Mined Land (inches)	0	too coarse, low water capacity
Transportation Routes	Moderate	occasional flooding
Roadfill Material	High	moderate frost action
Septic-Tank Absorption Fields	Moderate	occasional flooding
Sewage Lagoons	Very Low	rapid percolation
Sanitary Landfills (trench)	Very Low	percolation too rapid
Small Commercial Buildings	Low	flood hazard
Hydrologic Group	A	rapid permeability

Table 13

Bb - Satanta loam

Satanta loam occupies nearly level to undulating sloping uplands and high terraces. They formed in loamy, eolian materials that have been partially reworked by wind action. The surface horizon is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown clay loam about 25 inches thick. Soil reaction is neutral to slightly alkaline.

Soil Classification: Aridic Argiustoll, fine-loamy, mixed, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	8-10	<.5	0.6-2.0	A-4 to A-7	ML-CL	Low	Medium	6.1 to 8.4	-	1800-2500

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Medium	basic erosion rate .28
Erosion Hazard (wind)	High	coarse, loamy
Revegetation Potential	Moderate	low water holding capacity
Sprinkler Irrigation	Moderate	
Final Cover for Mined Land (inches)	9	good medium texture
Transportation Routes	Moderate	low strength, moderate shrink-swell
Roadfill Material	Moderate	moderate shrink-swell
Septic-Tank Absorption Fields	High	moderate permeability
Sewage Lagoons	Medium	too rapid permeability
Sanitary Landfills (trench)	Medium	slope
Small Commercial Buildings	Medium	moderate shrink-swell
Hydrologic Group	B	moderate permeability

Table 14

La - Haverson loam

Haverson loam occupies nearly level to very gently sloping floodplains that have been formed in alluvium. The surface horizon is light brownish gray loam, seven inches thick. The subsoil is light brownish gray loam stratified with thin lenses of sandy loam and very fine sandy loam to a depth of 60 inches.

Soil Classification: Ustic Torrifluvent, fine-loamy, mixed (calcareous) mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	6-10	.16-.18	0.6-2.0	A-4	ML	High	Moder-ate	7.9 to 8.4	$CaCO_3$	1800

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	
Erosion Hazard (wind)	Moderate	medium texture
Revegetation Potential	Moderate	moderate permeability
Sprinkler Irrigation	Moderate	medium texture
Final Cover for Mined Land (inches)	High	medium texture
Transportation Routes	Low	high susceptibility to frost heave
Roadfill Material	Low	high frost action
Septic-Tank Absorption Fields	Moderate	moderate permeability
Sewage Lagoons	Moderate	moderate permeability
Sanitary Landfills (trench)	Low	high frost action
Small Commercial Buildings	Low	high frost action
Hydrologic Group	B	moderate permeability

Table 15

Mb - McKenzie Clay

McKenzie clay occurs in shallow, intermittent lakes on upland landforms. The soil consists of gray or dark gray clay materials which have eroded from upland soils. McKenzie clay varies in stage of development as carbonate bearing layers may occur a few inches to several feet below the surface. The surface layer is 2 - 5 inches thick and ranges from sandy loam to clay. The substratum is dominantly a massive gray clay and may be more than 60 inches deep. Soil reaction is normally strongly to very strongly alkaline. Carbonate content is variable but usually increases with depth. Internal drainage is very slow. Saline and sodic salts are present in some locations.

Soil Classification: Typic Haplaquept, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble salts	Production Potential (#/AC dry wt.)
Clay	3-10	8-12	0.06	A-7	CL-CH	Moder-ate	High	7.0 to 8.5	Alkali-saline $CaCO_3$	400-1000

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .65
Erosion Hazard (wind)	Moderate	fine textured, nearly level
Revegetation Potential	Low	clayey, saline, sodic, ponded water
Sprinkler Irrigation	Low	slow permeability, ponded water
Final Cover for Mined Land (inches)	Low	clayey, saline, possible sodic
Transportation Routes	Low	high shrink-swell, ponded water
Roadfill Material	Low	high shrink-swell, possible piping due to sodic soils
Septic-Tank Absorption Fields	Low	slow permeability, possible water table contamination
Sewage Lagoons	Low	possible water table contamination
Sanitary Landfills (trench)	Low	possible water table contamination
Hydrologic Group	D	clayey, slow permeability

Table 16

Rb - Renohill clay loam

Renohill clay loam occupies gently sloping to rolling uplands. The parent material is weathered shale of the Wasatch, Lance, and Fort Union formations. The clay loam surface horizon is 3 - 6 inches thick and has granular structure. The upper subsoil is clay to clay loam with prismatic and blocky structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous extending to bedrock which occurs at depths of 20 - 40 inches. Soil reaction is normally neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	0.06-0.2	A-6 or A-7	CL	High	High	7.0 to 8.6	$CaCO_3$	750-1800

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .54
Erosion Hazard (wind)	Moderate	clayey surface texture, smooth slopes
Revegetation Potential	Moderate	clayey, slow permeability
Sprinkler Irrigation	Low	clayey, slow permeability
Final Cover for Mined Land (inches)	6	fair, due to high clay content
Transportation Routes	Low	high shrink-swell
Roadfill Materials	Low	high shrink-swell, low strength
Septic-Tank Absorption Fields	Low	slow permeability and moderate depth
Sewage Lagoons	Low	bedrock at 20 - 40"
Sanitary Landfills (trench)	Low	bedrock at 20 - 40"
Small Commercial Buildings	Low	high shrink-swell
Hydrologic group	C	clayey, slow permeability

Table 17

Rc - Renohill clay loam, rolling phase

This rolling phase differs from Renohill clay loam in topography, depth of soil and degree of erosion. The topography is rolling to steep. The depth to bedrock ranges from less than 10 inches to 40 inches. Bedrock is exposed on some of the steeper slopes. Natural erosion has formed gullies in some areas. The parent material is weathered shale of the Lance, Wasatch, and Fort Union formations. The clay loam surface layer is generally 3 - 6 inches thick and has granular structure. The subsoil and substratum are clay loam to clay with carbonates at depth of 6 - 20 inches. Soil reaction is normally neutral to moderately alkaline. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine montmorillonitic, mesic

Estimated Physical & Chemical Properites

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	.06-0.2	A-6 or A-7	CL	High	High	7.0 to 8.6	$CaCO_3$	500-1400

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .47
Erosion Hazard (wind)	Low	clayey, rolling topography
Revegetation Potential	Moderate	clayey, slow permeability
Sprinkler Irrigation	Low	clayey, slow permeability
Final Cover for Mined Land (inches)	6	fair, due to high clay content
Transportation Routes	Low	high shrink-swell
Roadfill Material	Low	high shrink-swell
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	C	clayey, slow permeability

Table 18

Rd - Renohill loam

Renohill loam occupies gently sloping to rolling uplands. The parent material is weathered shale of the Lance, Wasatch, and Fort Union formations. The loamy to sandy loam surface horizon is 3 - 8 inches thick. The upper subsoil is clay loam to clay with prismatic and blocky structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous extending to bedrock which occurs at depths of 20 - 40 inches. Soil reaction is usually neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	.06-0.2	A-6 or A-7	CL	High	High	7.0 to 8.6	$CaCO_3$	750-2000

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .47
Erosion Hazard (wind)	Moderate	medium textured, smooth slopes
Revegetation Potential	Moderate	medium texture, slow permeability subsoil
Sprinkler Irrigation	Moderate	medium texture, slow permeability subsoil
Final Cover for Mined Land (inches)	8	good, medium textures
Transportation Routes	Low	high shrink-swell, clayey
Roadfill Material	Low	high shrink-swell, clayey
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock 20-40"
Sanitary Landfills (trench)	Low	bedrock 20-40"
Small Commercial Buildings	Low	high shrink-swell, clayey
Hydrologic Group	C	clayey, slow permeability

Table 19

Re - Renohill loam, rolling phase

This rolling phase differs from Renohill loam in topography, depth of soil and degree of erosion. The topography is rolling to steep. The depth to bedrock ranges from less than 10 inches to 40 inches. Bedrock is exposed on some of the steeper slopes. Natural erosion has formed gullies in some areas. The parent material is weathered shale of the Wasatch, Lance, and Fort Union formations. The loam to sandy loam surface layer is usually 3 - 6 inches thick. The upper subsoil is clay loam to clay with blocky and prismatic structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous. Soil reaction is normally neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	.06-0.2	A-6 or A-7	CL	High	High	7.0 to 8.6	$CaCO_3$	600-1500

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .47
Erosion Hazard (wind)	Moderate	medium texture, rolling topography
Revegetation Potential	Moderate	medium texture, slowly permeable subsoil
Sprinkler Irrigation	Moderate	medium texture, slowly permeable subsoil
Final Cover for Mined Land (inches)	8	good, medium textures
Transportation Routes	Low	high shrink-swell, clayey
Roadfill Material	Low	high shrink-swell, clayey
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock 20-40"
Sanitary Landfills (trench)	Low	bedrock 20-40"
Small Commercial Buildings	Low	high shrink-swell, clayey
Hydrologic Group	C	clayey, slow permeability

Table 20

Rf - Rough Broken Land

Rough broken land consists of steep, eroded, strongly dissected areas along escarpments, steep-walled drainage channels and rock outcrops. The parent material is interbedded shale, sandstone, and limestone. Small areas of shallow to deep soils are intermingled in rough broken land. The density of vegetation is quite variable ranging from bare areas or sparse vegetation on rock outcrops to dense stands on the deeper soils. The physical and chemical properties of the unit are very variable.

Soil Classification: Unclassified and Ustic Torriorthents, loamy and clayey, montmorillonitic, calcareous, mesic, shallow

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Sandy loam to clay	2-6	0-3	.06-2.0	A-4 to A-7	SM-CL	Low to High	Low to High	7.0 to 8.4	$CaCO_3$	200-1000

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .65
Erosion Hazard (wind)	Low	roughness of topography
Revegetation Potential	Low	shallow soils, low AWC
Sprinkler Irrigation	Low	shallow soils, low AWC
Final Cover for Mined Land (inches)	0	locally 6-10" fair (minor)
Transportation Routes	Low	steep slopes, locally fair
Roadfill Material	Moderate	locally fair due to rock content
Septic-Tank Absorption Fields	Low	shallow to bedrock, steep slopes
Sewage Lagoons	Low	shallow to bedrock, steep slopes
Sanitary Landfills (trench)	Low	shallow to bedrock, steep slopes
Small Commercial Buildings	Low	greater than 15% slopes
Hydrologic Group	D	steep slopes, shallow soils

Table 21

Rh - Rough Broken Land, Searing soil material

This unit is a complex of rough broken land and eroded areas of scoria. Rough broken land includes steep, eroded, strongly dissected areas along escarpments, steep-walled drainage channels and rock outcrops. Scoria is a red or reddish colored shaly material and clinker produced by the heating and partial fusing of clays during the burning of underlying coal beds. Searing soil is characterized by a reddish brown gravelly loam surface horizon about 5 inches thick. The subsoil is a gravelly clay loam to loam which has blocky structure. The substratum is a friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. This unit has fragments and blocks of red shale, stone, and clinker scattered on the surface. Internal drainage is good.

Soil Classification: Unclassified and Ustic Torriorthent, loamy-skeletal over fragmental, mixed, non-acid, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Gravelly loam	2-4	2-3	.06-2.0	A-4 to A-7	SM-CL	Low	Low	7.0 to 8.4	$CaCO_3$	200-1500

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .47
Erosion Hazard (wind)	Low	roughness, dissected slopes
Revegetation Potential	Low	gravelly shallow soils, steep slopes
Sprinkler Irrigation	Low	gravelly shallow soils, steep slopes
Final Cover for Mined Land (inches)	0	locally fair due to rock content
Transportation Routes	Low	steep slopes, locally fair
Roadfill Material	Moderate	locally fair due to rock content
Septic-Tank Absorption Fields	Low	shallow to bedrock, steep slopes
Sewage Lagoons	Low	shallow to bedrock, steep slopes
Sanitary Landfills (trench)	Low	shallow to bedrock, steep slopes
Small Commercial Buildings	Low	greater than 15% slopes
Hydrologic Group	D	steep slopes, shallow soils

Table 22

Sb - Searing gravelly loam

Searing gravelly loam is developing in scoria, the beds of burned shale and clinker that have been formed by the burning of underlying coal beds. The scoria beds consist of red hardened shales and red to nearly black clinkers. This soil occurs on undulating to rolling areas and includes scattered outcrops of scoria. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is a reddish brown gravelly clay loam which has blocky structure. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Gravelly loam	2-5	2-4	0.2-0.6	A-4	ML-CL	Low	Low	7.0 to 8.5	$CaCO_3$	500-1300

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Low	rolling topography, medium textured
Revegetation Potential	Low	gravelly texture, bedrock at 20-40"
Sprinkler Irrigation	Moderate	bedrock at 20-40"
Final Cover for Mined Land (inches)	15	fair, scoria coarse fragments
Transportation Routes	Moderate	bedrock at 20-40"
Roadfill Material	Moderate	medium textures
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	sloping soils
Hydrologic Group	C	bedrock at 20-40"

Table 23

Ta - Terry sandy loam

Terry sandy loam occupies sloping to moderately steep (6-15%) sidehill slopes formed from sandstone. The surface layer is grayish brown, fine sandy loam about 4 inches thick. Soil reaction is mildly alkaline. The subsoil is brown, fine sandy loam about eight inches thick. The subsoil reaction ranges from mildly to strongly alkaline. Internal drainage is moderately rapid.

Soil Classification: Ustollic Haplargid, coarse-loamy, mixed, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Fine sandy loam	3-5	.10-.15	2.0-6.0	S-2 or A-4	SM-SC	Moder-ate	Low	6.8 to 8.6	$CaCO_3$	1000-2000

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	steep slopes
Erosion Hazard (wind)	Moderate	medium texture
Revegetation Potential	Low	rapid permeability
Sprinkler Irrigation	Low	rapid permeability
Final Cover for Mined Land (inches)	5	medium textures
Transportation Routes	Moderate	slope, shallow to bedrock
Roadfill Material	Low	
Septic-Tank Absorption Fields	Low	bedrock less than 20"
Sewage Lagoons	Low	bedrock less than 20"
Sanitary Landfills (trench)	Low	bedrock less than 20"
Small Commercial Buildings	Moderate	slope, shallow to bedrock
Hydrologic Group	C	slow permeability

Table 24

Ub - Ulm clay loam, shallow phase

This phase differs from Ulm loam in topography, texture, and depth of soil. The topography is rolling and the depth to interbedded sedimentary bedrock ranges from 10 - 20 inches. The steeper slopes have some rock outcrops. The surface horizon is granular clay loam about 6 inches thick. The subsoil is calcareous silty clay loam with prismatic structure. The subsoil normally becomes more loamy and friable with depth. Internal drainage is moderate to slow. Soil reaction normally ranges from neutral to moderately alkaline.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic, shallow

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Clay loam	3-6	2-4	0.2-0.6	A-6	ML-CL	Low	Mod-erate	7.0 to 8.6	$CaCO_3$	500-1300

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .41
Erosion Hazard (wind)	Moderate	medium textured, rolling topography
Revegetation Potential	Low	bedrock less than 20"
Sprinkler Irrigation	Low	bedrock less than 20"
Final Cover for Mined Land (inches)	6	fair, clayey texture
Transportation Routes	Low	shaley bedrock less than 20"
Roadfill Material	Low	clayey texture
Septic-Tank Absorption Fields	Low	bedrock less than 20"
Sewage Lagoons	Low	bedrock less than 20"
Sanitary Landfills (trench)	Low	bedrock less than 20"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	clayey, shallow

Table 25

Uc - Ulm loam

Ulm loam occupies gently sloping to rolling uplands. The parent material is interbedded sandstone, shale and loamstone. The surface horizon is friable loam 3 - 7 inches thick. The subsoil ranges from sandy clay loam to clay loam and has prismatic structure. The calcareous substratum ranges from sandy loam to clay loam and extends to weathered bedrock at depths of 20 - 40 inches. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moder-ate	7.0 to 8.5	$CaCO_3$	750-1800

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Moderate	medium texture, rolling topography
Revegetation Potential	Moderate	bedrock at 20-40", medium texture
Sprinkler Irrigation	Moderate	bedrock at 20-40", medium texture
Final Cover for Mined Land (inches)	16	fair, includes clayey subsoil
Transportation Routes	Moderate	clayey textured subsoil
Roadfill Material	Moderate	clayey textured subsoil, bedrock at 20-40"
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	bedrock at 20-40"

Table 26

Ud - Ulm loam, reddish subsoil phase

This phase occupies gently sloping to rolling uplands. It is developing in material weathering from brownish-red or light red sandy shale. The surface horizon is friable loam to sandy loam 6 inches thick. The reddish brown clay loam subsoil has blocky structure. The calcareous to neutral substratum ranges in texture from clay loam to sandy loam. The shaly parent material occurs at depths of 20 - 30 inches. Fragments of scoria are present on the surface and in the soil profile in most places. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moder-ate	7.0 to 8.5	$CaCO_3$	750-1800

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Moderate	medium texture, rolling topography
Revegetation Potential	Moderate	bedrock at 20-40", medium texture
Sprinkler Irrigation	Moderate	bedrock at 20-40", medium texture
Final Cover for Mined Land (inches)	16	fair, includes clayey subsoil
Transportation Routes	Moderate	clayey textured subsoil
Roadfill Material	Moderate	clayey textured subsoil, bedrock at 20-40"
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	bedrock at 20-40"

Table 27

Ue - Ulm loam, rolling phase

This phase differs from Ulm loam in topography, texture, and depth to bedrock. The topography is rolling to steep and often strongly dissected. The depth to bedrock is usually less than 20 inches. Bedrock is exposed on some of the steeper slopes. The parent material is inter-bedded sandstone, shale, and loamstone. Gullies have formed in some areas. The soil is more friable and sandy than Ulm loam. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moder-ate	7.0 to 8.5	$CaCO_3$	500-1500

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Low	medium textures, rolling topography
Revegetation Potential	Moderate	bedrock at 20-40", medium texture
Sprinkler Irrigation	Moderate	bedrock at 20-40", medium texture
Final Cover for Mined Land (inches)	10	good, medium texture
Transportation Routes	Moderate	clayey textured subsoil
Roadfill Material	Moderate	clayey textured subsoil
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	bedrock at 20-40"

Table 28

Wa - Wibaux - Searing Complex

This complex occupies rolling to hilly topography. It is characterized by numerous outcroppings or knolls of scoria which rise above the general surface of the land. Scoria is a reddish colored shaly material and clinker produced by the burning of underlying coal beds. The very shallow to shallow Wibaux soils occur on the knolls and steep slopes. It includes knolls, mounds, and steep slopes where unweathered scoria is exposed. The texture is gravelly to very gravelly loam and sandy loam. The depth to bedrock is less than 10 inches to 20 inches.

Searing soil normally occurs between the knolls. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is a reddish brown gravelly clay loam and has blocky structure. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet.

Soil Classification: Wibaux - Ustic Torriorthent, loamy-skeletal over fragmental, mixed, non-acid, mesic
Searing - Ustollic Haplargid, fine-loamy, mixed, mesic

Estimated Physical & Chemical Properties

Surface Texture	Surface Thickness Inches	AWC Inches	Perme-ability in/hr	Engineering Classification AASHO	Engineering Classification Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Gravelly loam	2-4	2-4	.06-2.0	A-2 to A-4	SM-CL	Low	Low	7.0 to 8.5	$CaCO_3$	450-1200

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .32 to .41
Erosion Hazard (wind)	Low	roughness, rolling to hilly topography
Revegetation Potential	Low	gravelly, shallow to bedrock, steep
Sprinkler Irrigation	Low	gravelly, shallow to bedrock, steep
Final Cover for Mined Land (inches)	8	poor, gravelly
Transportation Routes	Moderate	steep slopes, locally good
Roadfill Material	High	locally poor due to texture
Septic-Tank Absorption Fields	Low	shallow to bedrock
Sewage Lagoons	Low	shallow to bedrock
Sanitary Landfills (trench)	Low	shallow to bedrock
Small Commercial Buildings	High	locally poor due to steep slopes
Hydrologic Group	D	shallow to bedrock

WILDLIFE AND FISH

Supporting Data

Wildlife and Fish

Impacts Analysis

It is often stated that some particular action will benefit "wildlife." Such a statement is usually inappropriate when it does not relate to a particular species. All species are different. What is beneficial to one species may be detrimental to another. Where some critical element of an animal's habitat is replaced by a substitute that does not fulfill the role of the critical element, the action cannot be considered habitat rehabilitation or habitat improvement as far as that species is concerned. Even though the substitute may be quite attractive under certain conditions, the loss of the critical habitat element usually makes the action detrimental to the species involved. As an example, one might establish palatable grasses and forbs on a railroad or road right-of-way through deer winter range where browse is the major factor limiting deer. Browse is destroyed during construction. Deer are attracted to the grass and forbs in the spring where they are subject to increased mortality through train or auto collisions. Because of their concentration in the area, they overuse the browse adjacent to the right-of-way. The concentration of deer on the seeded grasses and forbs may give the appearance of exceptional "habitat improvement" while in reality it results in increased mortality and long-term winter carrying capacity loss to the habitat.

The variety of animals in the basin is too great to permit detailed description of development and rehabilitation impacts on each species. In Table 11, Chapter V, species are grouped according to important habitat requirements, habits or life forms. Species in each group will be similarly affected by development action and rehabilitation. These

species groups will be used to illustrate differences in impacts resulting from differences in the animals themselves.

Direct destruction of animals

A number of development operations will directly destroy wild animals ranging from individuals to entire populations. Those actions which will cause the greatest losses are those which initially excavate, bury, overturn, clear or grade large areas of previously undisturbed terrestial habitat. Examples are overburden removal, spoil piling, plant and facility site preparation, railroad and highway roadbed construction, pipeline excavation, homesite and service area preparation and canal and drainage diversion construction. The large machinery will bury, crush and suffocate many small animals, primarily those which are not capable of moving fast enough to escape and those which retreat to burrows for protection. A variety of invertebrates, mice, shrews, ground squirrels, prairie dogs, snakes, lizards, young birds, and eggs are potential casualties.

Any of the above operations, and others such as well drilling, blasting or industrial and municipal use of water, which cause dewatering of aquatic habitats will result in death to fishes, aquatic invertebrates, and amphibians in certain stages of life.

Permanent habitat losses

Considering the changes which have taken place in this country during the last 50 - 75 years and those probable in decades ahead, native wildlife habitat removed from the land for over 30 years must be considered permanently lost.

Actions which will result in permanent habitat losses include construction, operation and maintenance of railroads, highways, secondary roads, power plants and gasification plants and construction of office

buildings, equipment garages, coal loading and storage facilities and other mine site facilities. Additional habitat will be permanently lost with the expansion of population centers. Home building, commercial area expansion, new streets, parking lots, schools, sewage treatment plants, sanitary land fills, governmental facilities, airports, etc., will relegate thousands of acres of land to human use. All of the above actions will destroy wildlife habitat and preclude its reestablishment.

The greatest losses can be expected in the sagebrush and grassland ecosystems since these predominate in the area, but aquatic habitat and terrestrial habitat in other ecosystems will also be lost. Almost all animal species in the basin will be affected. Total permanently lost acreage, based on the projections, will approximate 5,000 acres in 1980, 8,000 acres in 1985 and 10,000 acres in 1990. Total local populations of some animals will be immediately lost where habitats involved are limited and well defined. Where aquatic habitats are destroyed, animals such as those listed in Group VIII, Table 11 (Chapter V), will be impacted most severely. Local populations of invertebrates, most reptiles and amphibians, and small animals with limited ranges will be quickly lost when their required habitat is destroyed. The more mobile and wide-ranging animals such as birds, antelope, deer, elk, rabbits, and the predators will be displaced into adjacent areas. However, since population levels are determined by the availability of suitable habitat, displaced animals eventually succumb to natural mortality or they displace other resident animals. The end result will be a net loss to the overall populations of such species involved.

One area of potential permanent habitat loss not covered by projections involves the situation where the aquatic habitat of small streams and springs is dryed up as a result of well drilling or mining operations.

The extent to which this may happen is unknown but it could cause significant additional losses of aquatic wildlife.

Permanent changes from terrestrial to aquatic categories may also occur. Water storage reservoirs and mine-pit lakes created where none previously existed can potentially convert hundreds of acres from terrestrial wildlife habitats to aquatic habitat. It is obvious that this could be quite beneficial to the animals of Group VIII, Table 11, while devastating to most of those in Groups II and III. These potentially permanent changes in habitat were not covered under "Disturbed Acres" in the projections either.

Initial habitat destruction followed by some degree of recovery in habitat value

Mined lands, haul roads, railroad and road rights-of-way, pipeline and power line rights-of-way, borrow areas, cleared fence lines, temporary parking areas, initial spoil areas, temporarily diverted streams, and other areas will be stripped of almost all wildlife habitat value by the widescale excavation, overturning and clearing of the land surface. Where significant changes in topography, ground water conditions, surface drainage patterns or surface soil conditions occur, the potential to reestablish some previously existing habitat types may be permanently lost. After smoothing, shaping and replacement of a viable soil material on the surface of most of these disturbed areas, natural processes, often times influenced by man's reclamation activities, will begin to restore wildlife habitat in one form or another.

Plants are the immediate or ultimate source of all foods and most cover for wildlife. Various characteristics of the vegetative cover in an area determine to a large extent the kinds of wildlife which will be present. The initial stages of plant succession will begin on disturbed lands almost immediately after the disturbance ceases. At the time of disturbance, the

habitat value is almost totally lost for all wildlife. As succession proceeds, continual changes in the plant community influence the availability of food and cover plants and thus the kinds and numbers of animals present. The results of several studies of succession on abandoned farmlands in the sagebrush-grasslands of the study area indicate that revegetation of development disturbed lands to approximately original conditions can be expected to take over 50 years if left to natural succession (Lang 1941; Lang 1973; Ries, Fisser, and Harrison 1974). Lang's studies on abandoned farms showed that in the early stages of succession, the vegetation changed from a predominately annual weed type to a predominantly perennial grass type. Figure 6, Chapter V, shows the relative densities of the vegetative groups. Keep in mind that, after 9 years, the total vegetative cover was only slightly over 3 percent; cover was less than 50 percent of that found on adjacent undisturbed lands (Lang 1941). In the A.R.Co. coal lease area, data from recent studies of farmlands abandoned between 40 and 45 years ago indicate that total vegetative cover still averages about 43 percent less than average total cover on adjacent undisturbed rangeland. Average sagebrush cover has now recovered to about the same as that on undisturbed lands (Ries, Fisser, and Harrison 1974).

The long time period and the pattern seen in natural vegetative recovery in the basin is highly pertinent to artificial rehabilitation efforts on disturbed lands and their value as wildlife habitat. The forces of natural succession will still be very much at play on the disturbed lands in spite of man's rehabilitation efforts. In all probability, disturbed areas will be leveled or reshaped, some type of soil material may be spread over the area and grass species will be seeded and possibly fertilized. A fair grass stand

may be expected to establish initially over much of the area. Significant areas of poor or no grass establishment can be expected due to locally inhibiting conditions of soil, moisture, erosion, wild animal damage and, where unfenced, livestock damage. After almost five years, reseeded pipeline rights-of-way on the Atlantic coal lease had an average of over 60 percent less vegetative cover directly over the pipeline, where soil was deeply disturbed, than the average on adjacent rangelands. This vegetation was almost all planted grasses and weedy species. The average vegetative cover along the border of the pipeline averaged about 20 percent less than the average on adjacent native rangelands. Much of vegetative cover here was residual native plants indicating that the disturbance along the borders was slight. On reseeded oil well sites, there was at least 30 percent less vegetative cover than on the adjacent undisturbed rangeland and an average of over 80 percent of the vegetation present was unplanted weedy forbs. Planted grass made up about 10 percent of the vegetation. All of the studies reviewed and the observations of Bureau of Land Management and Forest Service personnel familiar with the area indicate that the shrub group, predominately sagebrush, is lost or severely reduced on all sites disturbed to any appreciable degree of severity. This condition appears to persist for a minimum of 20 to 30 years with or without artificial rehabilitation efforts. (See Figure 7, Chapter V.)

After initial attempts to rehabilitate disturbed areas to perennial grasslands, the majority of the lands will eventually be subject to the same general conditions of climate, grazing and land use as other rangelands in the region. Reestablished vegetation which has been subject to special practices such as temporary irrigation, fertilization, total protection from grazing, etc., may not be able to survive. Where the artificial revegetation fails, natural plant succession will take over the long, slow process. Once these sagebrush grasslands have been severely disturbed,

they may be unable to recover to a point to which they will provide habitat of similar type, quality, quantity and for the array of species that presently exists on the undisturbed rangeland. In 1965, 20 plus years after his early research, Lang found that the vegetation on his original abandoned farmland and study area actually deteriorated further, rather than improving. Total ground cover decreased by 40 percent (Lang 1973, p. 408). This happened under conditions of grazing and climate which cannot be considered uncommon for this region.

After analysis of the available data, it seems reasonable to make several general observations concerning the nature of the vegetative cover which will be established on disturbed lands in the study area between now and 1995. They are:

--The total vegetative cover will be greatly reduced, probably near 50 percent of that found on adjacent undisturbed range.

--The shrub component will be absent or nearly so.

--There is a good possibility that reestablished plant communities will deteriorate rather than improve over time as they are exposed to periodic drought, continued grazing, etc.

--The composition trends of plant species groups will approxmiate those shown in Lang's graph (Figure 6, Chapter V). Exceptions will be, that where perennial grass establishment due to rehabilitation is fairly successful, the trend line will rise sharply in the first few years rather than later as shown, and that the weed or forb trend line will drop earlier.

Because of various important plant-animal interrelationships, the recovery of habitat value for many species will approximate the recovery of that portion of the plant community with which they have close ties. Figure 7, Chapter V, presents a qualitative indication of trends in habitat value for several of the animal groups listed in Table 11, Chapter V. The species groupings, while flexible, are logical for

the study area. They are based upon similarity of habitat requirements, habits or life form. The habitat value trends are based on a comparison of existing habitat types with those expected to develop as a result of rearranged topography, artificial vegetative rehabilitation efforts and the natural forces of plant succession, and erosion on disturbed areas.

The broad type called sagebrush-grassland usually includes a variety of different shrub and grass communities and gradations between them (Figure 13). Under natural conditions some animals more heavily depend upon, or thrive in association with, the shrub component, some with the perennial grassland component, and others with weedy annuals, forbs, etc., common on disturbed areas. For those animals closely associated with the sagebrush and shrub component of the sagebrush grassland, Group I in Table 11, habitat values are expected to remain severely reduced on disturbed lands throughout the study period. The animals of Group II, primarily heavy users of weed seed, forbs, and weedy species, will probably experience increases in habitat value a short time after the initial habitat loss. This group will probably be the only group to experience "habitat improvement" over present conditions, during the study period. Habitat value for Group III animals is expected to recover significantly within five to ten years after disturbance, depending heavily on the success of the expected efforts to reestablish perennial grasslands.

Many animals of the study area are primarily dependent upon various vegetative aspects of the more moist riparian community (see Figure 14). Where this community is destroyed by development, the grass-forb component is not expected to recover significantly for 5 to 10 years. If favorable hydrologic characteristics are not permanently destroyed,

habitat values of the shrub component may show significant recovery in 10 to 15 years. Almost no recovery of habitat values associated with cottonwood trees above the sapling stage is expected during the study period. In general, the habitat values for animals of Group IV will remain severely reduced far beyond the study period.

The total disturbed acreage of pine timber, juniper breaks and rough rocky areas which fulfill the habitat requirements of the animals of Group V is expected to be small. In those situations where they are destroyed, habitat values for the species involved will be lost, probably for many years beyond the study period.

Insects and other invertebrates, Group VI, occupy a multitude of micro-habitats throughout all biotic communities. Insects tend to reach their greatest abundance and species diversity in the intermediate stages of succession in grassland types (Kendeigh 1961, p. 115). It is probable that the majority of the sagebrush-grassland type in the study area is in intermediate stages of succession since most of this land has long been heavily grazed. Insect habitat value is probably near its greatest potential now, except in severely overgrazed areas. If grassland rehabilitation efforts are successful, intermediate stages of grassland development may be bypassed. In this situation abundance and species diversity would be reduced, but habitat for particular insect groups may recover rapidly. Total numbers and biomass of sagebrush-grassland invertebrates could be expected to remain reduced until such time as the reestablished plant community either progressed or digressed to one similar to the original community both in relative vegetative group density and total vegetative cover. It is estimated that this could take anywhere from 15 to over 50 years. Invertebrate habitate values, lost with the destruction of aquatic, riparian and other habitat types, will remain lost or reduced similar to the habitat values of the other animals found there.

The insectivores of Group VII and the predators of Group IX are secondary consumers dependent upon the plant communities for a food source through other animals. A particular species of either group may also depend heavily on the plant community for a particular type of cover, nesting site, etc. The quality of habitat for a particular species within either group is strongly influenced by the availability of its prey species. Recovery of destroyed habitat for the animals with flexible food habits or whose prey species are favored early in rehabilitation i.e., Group II, will probably be complete within a few years after disturbance. This may well be the case for red fox and coyote. Habitat for more specialized species such as the short horned lizard may not recover to pre-disturbance condition for 15 to 20 years. A severe reduction with negligible recovery of cottontail rabbit habitat due to loss and negligible recovery of the shrub component in sagebrush-grassland will also mean a reduction and negligible recovery of the winter food supply for golden eagles over the study area. With the types of habitat which will be disturbed and the vegetative recovery expected, the capability to support the present total numbers of biomass of predators and insectivores will be lost on the disturbed lands and will remain reduced well beyond the study period.

Aquatic and semi-aquatic animals are inseparably tied to the stream, lake and pond-marsh biotic communities. Where the water source is not lost during disturbance, there is potential for restoring aquatic communities. Where disturbance is slight, recovery will be rapid. Where streams are channeled and moved back and forth across the land as coal mining proceeds, aquatic communities cannot be expected to recover to any great extent. Aquatic habitat is limited in extent within the study area.

There appears to be a potential for significant additions with development of mine-pit lakes after mining. It is not known to what extent this is feasible. With proper construction to include aquatic habitat enhancement, these lakes could result in a gain in aquatic habitat over the present conditions in the basin. Here again, some species may gain while others loose, for example, where stream habitat is lost and lake habitat is gained. Aquatic habitat values over the study area are expected to remain reduced throughout most of the study period, but they may recover significantly in 15 to 20 years if mining companies see fit to construct mine-pit lakes.

Habitat impaired or reduced in value

In addition to those physical losses of habitat which are specific to a particular acreage of disturbance or development, wildlife will suffer further significant losses due to off-site reduction in habitat quality.

The almost three-fold increase in population expected by 1990 will foster tremendous increases in human activity over the immediate study area. Humans will be living, working and recreating in wildlife habitat never before impacted by this level of intrusion. In addition to the noise, activity, smell and pollution around the whole gamut of new developments and expansions, wildlife will be intruded upon by greatly increased numbers of workmen, planners, investigators, recreationists, etc., operating various utility and recreation vehicles and airplanes over the back country areas. Human intrusion is tolerated only to a certain point by most wild animals. The degree of tolerance varies widely between species. As long as their habitat is intact, insects, for example, are relatively indifferent to human activity. Conversely, habitat of most of the larger mammals and predators will be abandoned close to areas of intense human activity. Habitat

may be used only occasionally in areas near heavy intermittent human concentration or use may be only lightly reduced with low intensity human activity. Variable zones of extended human influence around developments affect, particularly, the living space component as well as the cover, food and water components of wildlife habitat. Some of the more obvious factors establishing these zones, which are often observed in Wyoming, are wide-ranging domestic cats and dogs, concentrations of shooting, hunting and trapping youngsters, motorcycles, dune buggy and 4-wheel drive race and "test" courses, weed control efforts, increased incidences of man-caused fires and accidental land and water pollution and the concentrated effects of converging transportation and utility routes. Another common phenomenon impacting wildlife, usually on the outskirts of towns and along stream courses, is the expansion of semi-rural "acreage" areas where large areas of land are occupied in 1 to 15 or 20 acre plots. These areas are often heavily cross-fenced and heavily overgrazed by family horses and other "pet" livestock. Around industrial sites and along transportation corridors, vegetation is often reduced in palatability by dust and smoke pollutants. Tight fencing and intense weed control is often practiced along railroads, highways and around industrial sites.

As an example of the extent of concentrated human activity which is projected for the study area in 1990, one might picture the approximately 48 aquare miles and 45,000 population of the urban area encompassing Casper, Wyoming, split onto about 20 sites in a 100 mile, north-south swath through the center of the study area. In terms of population, acreage of surface disturbance or permanent use, and on-site human activity, it is a fair approximation. If each of the twenty sites were of similar size the average

would be about 2.5 square miles. Considering, for example, a 1/2 mile wide strip around each site as an area of lost or severely reduced habitat value for big game animals, the additional impact area would be almost twice the size of the development area. The total area of habitat lost or reduced in each "spot" would cover almost seven square miles. Of course, the width of such an impact zone would vary with the species involved, type of activity taking place in the developed area, its physical shape and layout and the quality of escape cover, etc. An "influence" strip one mile wide around each spot would increase the habitat area influenced by almost five times.

Most of the habitat deteriorating effects of the more dispersed human activities which will increase in the study area are more difficult to define. The affects of harrassment and disturbance will disrupt the living space component of habitat. The more severe affects will be felt during stress periods and in crucial areas for various species. Where game bird and waterfowl nesting areas are subject to human activity, nesting success will be reduced. Where wintering big game are harrassed, losses of weakened animals and abortions may occur. Where boating, camping and other recreation activities take place in increased concentrations, as may be expected around Keyhole Reservoir and other recreational waters, aquatic and surrounding terrestrial habitat will be degraded from pollution and disturbance.

Development activites such as coal mining or well drilling may cause losses of surface waters critical to many species over significant areas in arid areas.

It appears certain that the combined affects of impaired wildlife habitats will result in reduced wildlife production on an additional acreage three to five times larger than the projected 30,000+ acres to be lost or reduced through actual habitat destruction by 1990. Nearly all species will suffer but those species of greatest interest to man will probably suffer most.

It is apparent that these actions described above will cause major cumulative negative impacts on wildlife habitats throughout the study area. Significantly, the magnitudes mentioned above do not take into consideration coal development after 1990, much of the development of private and state land coal, or developments already expanding in the basin related to production of uranium, oil and gas, and others.

Disruption of existing ecological interrelationships

Development of the basin will cause numerous secondary effects on wildlife through the disruption of food chains, behavior patterns, and various activities of species playing key roles in the ecosystem. These interactions are often subtle and complex but their disruption can cause significant negative impacts on certain species. Some of the more important examples follows.

Big game animals displaced into other areas of suitable habitat almost invariably encounter resident animals of the same species occupying the habitat at or near its carrying capacity. While natural mortality factors will eventually eliminate the excess animals if man doesn't, it is well documented that before this is accomplished the animals, especially browsers, often severely overuse the browse range. This can result in a

further overall reduction in carrying capacity and animal numbers in the region that will be evident for many years.

If the type of vegetation which establishes on significant acreages of disturbed land encourages high rodent populations, predators such as coyotes and fox will tend to increase in the general area. As vegetative composition progresses toward that of perennial grassland, rodent populations may sharply decline. The predators will then increase use of alternate prey species, often those of particular interest to man, such as sheep or game birds. Further, humans may react to this situation by demanding increased predator control which has further ramifications.

The burrow systems of prairie dog colonies are important to a number of species in the sagebrush grasslands. Loss of these colonies through mining or other development activities will reduce the available habitat for, among other species, the "endangered" black footed ferret and the western burrowing owl considered "status undetermined" by the U.S. Department of Interior. Overshooting of prairie dog colonies by varmint hunters will make these colonies unacceptable as ferret habitat.

Improved habitat

The broad-scale development forthcoming in the basin, both from coal related development and other industrial development, will bring about significant changes in the wild fauna. Most changes will be toward less total wildlife production and will involve trade-offs between species and types of wildlife or between wildlife in one area for wildlife in another. There is some potential for improved habitat and benefited wildlife if we keep in mind that this usually does mean trade-offs.

There is optimism that the potential exists for the creation of several hundreds of acres of fish and waterfowl habitat in mine-pit lakes.

Available water supply to fill and maintain water quality in these lakes may be a limiting factor. Large quantities of out-basin water may be imported for industrial use. Clean waste water from these sources may provide an additional water supply in some situations. Careful planning and construction of these lakes will be required if significant wildlife habitat values are to be realized.

The disturbance of large land areas is expected to result in vegetative changes favoring increases in population of some rodent species. Certain predators will benefit from these increases in prey species. These improved habitat conditions are expected to be temporary in any particular area of disturbed land.

In some areas of rough, steep terrain, where overburden becomes deep, areas of high-wall cliffs may be left exposed. These areas could provide increased nesting sites for birds such as the rare prairie falcon, eagles, various other raptors, and swallows.

Increased human populations will bring increases in the population of exotic wildlife which commonly thrive around human settlements. Some of these include the English sparrow, house mouse, Norway rat, and the starling.

Habitat changes resulting from off-site changes in land and water use

Impacts upon terrestrial and aquatic habitat falling outside of the study area must also be anticipated. Industrial water requirements in the Powder River Basin are certain to increase beyond that which is available "on-site." Several proposals and alternatives have been suggested to allow "importations" of additional water for use during coal development.

Drilling of deep wells in the study area would remove water from an aquifer which underlies lands outside of the study area as well. Off-site springs, seeps or wetlands, presently valuable to upland or aquatic fish and wildlife species may be reduced or eliminated through eventual lowering of the water table.

Trans-basin diversion (taking water from one drainage and placing it in another) might involve the construction of storage impoundments, on the Green River, for example, as well as change existing water uses. Flooding or drying of existing terrestrial and aquatic habitat will become a land affecting possibility. Adverse impacts on associated fauna can be expected. Several off-site storage reservoirs have already been proposed (Wheatland, Green River, Bighorn Slope, Nowood and increased storage in Lake DeSmet).

At the present time, most water consumed in northeastern Wyoming is used for irrigation and agriculture. Changes in existing agricultural water uses would affect fish and wildlife use patterns. A shortage of irrigation water may result in croplands reverting to native vegetation. Existing pheasant habitat, for example, may be lost. Many species of wildlife presently depend on irrigated lands for all or part of their habitat requirements.

Impacts on wildlife management

Projected population increases between 1970 and 1990 are estimated at over 200 percent of the present population in the study area and a 60 percent increase throughout northeast Wyoming. This will be accompanied by comparable increases in consumptive and non-consumptive pressures on wildlife resources. Most game species of fish, birds and mammals will not be able to absorb

increased pressures. Where population of some species are adequate to absorb increased pressure in general, problems of new access, denied access, closed lands and restricted areas will cause problems of over-exploitation in some areas, under-exploitation in others, more wildlife damage claims, etc.

The Wyoming Game and Fish Department presently employs Game Wardens, Big Game Biologists, Bird Biologists, Fisheries Biologists, Waterfowl Biologists and others amounting to 15 to 25 employees for enforcement and management in the study area. The present staff of employees, in each category, will be unable to adequately meet the increased enforcement, management and habitat development needs or the increased needs for studies, research, or coordination and cooperation with industry and government in the face of the proposed development.

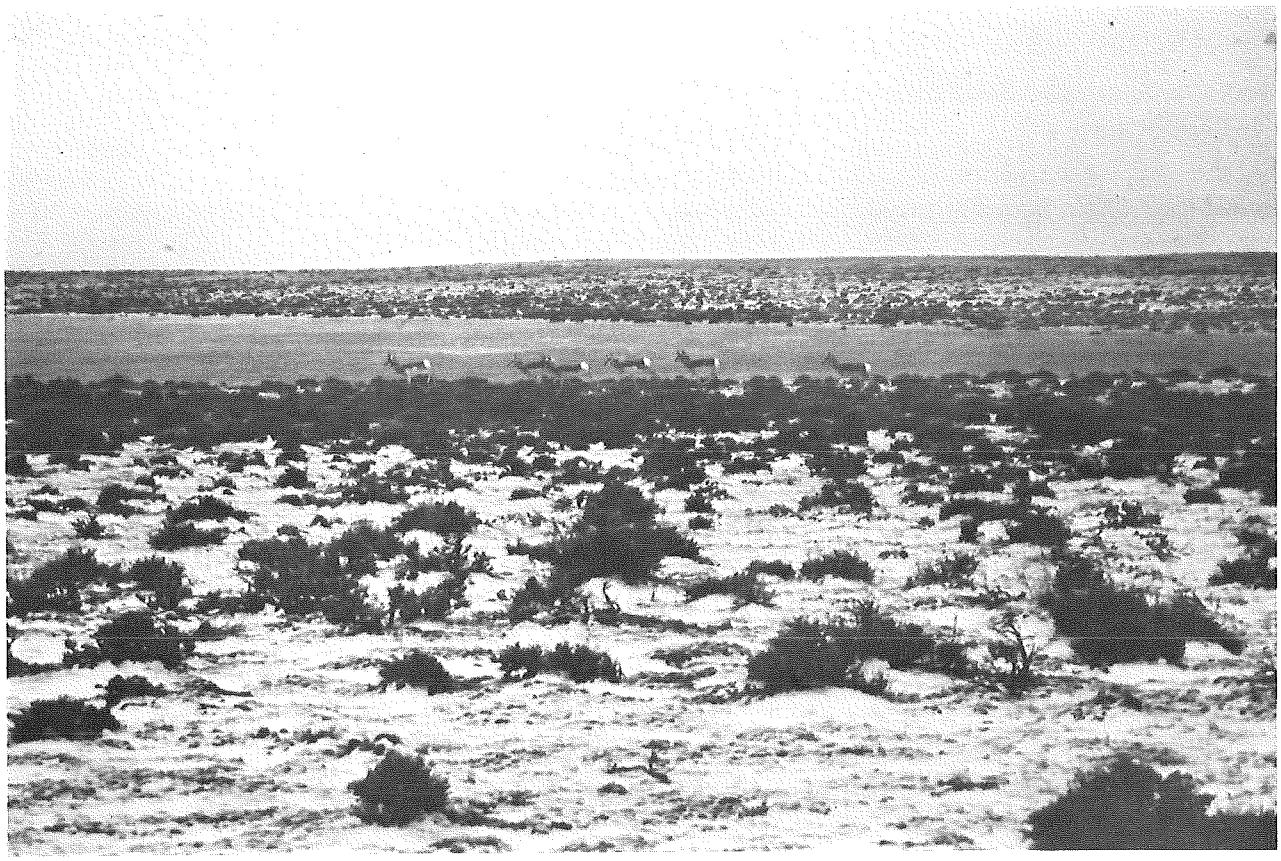

Figure 13

Antelope in Sagebrush-Grassland Habitat

Figure 14

Well-Developed Riparian Habitat in the Study Area

Table 29

Taxonomic Ranking, Scientific and Common Names for Mammals
Which May Be Found on or Near the Study Area

Species	Taxonomic Rank
	Order Marsupialia - Marsupials Family Didelphidae - Opossums
Didelphis marsupialis virginiana Kerr (opossum)	
	Order Insectivora - Insectivores Family Soricidae - Shrews
Sorex cinereus cinereus Kerr	
Sorex cinereus haydeni Baird (masked shrew)	
Sorex merriami leucogenys Osgood (Merriam's shrew)	
Sorex vagrans obscurus (vagrant shrew)	
	Order Chiroptera - Bats Family Vespertilionidae - Vespertilionid bats
Euderma maculata (spotted bat)	
Myotis lucifugus carissima Thomas (little brown myotis)	
Myotis subulatus subulatus (Say) (small-footed myotis)	
Myotis volans interior Miller (long-legged myotis)	
Lasionycteris noctivagans (Le Conte) (silver-haired bat)	
Myotis keenii septentrionalis (Trouessart) (Keen's myotis)	
Myotis evotis evotis (H. Allen) (long-eared myotis)	
Lasiurus cinereus cinereus (Palisot de Beauvois) (hoary bat)	
Plecotus townsendii pallescens (Miller) (Townsend's bat)	
Eptesicus fuscus pallidus Young (big brown bat)	
	Order Lagomorpha Family Leporidae - Rabbits and Hares
Sylvilagus nuttallii grangeri (J. A. Allen) (Nuttall's cottontail)	
Sylvilagus audubonii bailevi (Merriam) (desert cottontail)	
Lepus townsendii campanius Hollister (white-tailed jackrabbit)	
Lepus californicus melanotis Mearns (black-tailed jackrabbit)	
	Order Rodentia Family Sciuridae - Squirrels
Eutamias minimus operarius (least chipmunk)	
Eutamias minimus pallidus (J. A. Allen) (least chipmunk)	
Spermophilus tridecemlineatus olivaceus (thirteen-lined ground squirrel)	
Spermophilus tridecemlineatus pallidus J. A. Allen (thirteen-lined ground squirrel)	
Cynomys ludovicianus ludovicianus (Ord) (black-tailed prairie dog)	

Table 29 Continued

Species	Taxonomic Rank
	Family Geomyidae - Pocket gophers
Thomomys talpoides attenuatus Hall & Montague	
Thomomys talpoides bullatus V. Bailey (northern pocket gopher)	
Thomomys talpoides cheyennensis (northern pocket gopher)	
Thomomys talpoides nebulosus (northern pocket gopher)	
Geomys bursarius lutescens Merriam (plains pocket gopher)	
	Family Heteromyidae - Pocket mice and Kangaroo rats
Perognathus fasciatus olivaceogriseus Swenk (olive-backed pocket mouse)	
Perognathus flavus piperi Goldman (silky pocket mouse)	
Perognathus hispidus paradoxus Merriam (hispid pocket mouse)	
Perognathus fasciatus callistus (pocket mouse)	
Dipodomys ordii priscus Hoffmeister	
Dipodomys ordii terrosus Hoffmeister (Ord's kangaroo rat)	
Dipodomys ordii luteolus (Ord's kangaroo rat)	
	Family Castoridae - Beavers
Castor canadensis missouriensis Bailey (beaver)	
	Family Cricetidae - Cricetids
Reithrodontomys montanus albescens Cary (plains harvest mouse)	
Reithrodontomys megalotis dychei J. A. Allen (western harvest mouse)	
Reithrodontomys megalotis dychei	
Peromyscus maniculatus nebrascensis (Coues) (deer mouse)	
Peromyscus leucopus aridulus Osgood	
Onychomys leucogaster arcticeps Rhodes	
Onychomys leucogaster missouriensis (Audubon and Bachman) (northern grasshopper mouse)	
Neotoma cineria orolestes Merriam (bushy-tailed wood rat)	
Neotoma cineria rupicola (bushy-tailed wood rat)	
Microtus pennsylvanicus insperatus (J. A. Allen) (meadow vole)	
Microtus longicaudus longicaudus (Merriam) (long-tailed vole)	
Microtus ochrogaster haydenii (Baird) (prairie vole)	
Lagurus curtatus levidensis (Goldman) (sagebrush vole)	
Ondatra zibethicus cinnamominus (Hollister) (muskrat)	
	Family Muridae - Murids
Mus musculus domesticus Rutty (house mouse)	
	Family Erethizontidae - Porcupines
Erethizon dorsatum bruneri Swenk (porcupine)	
	Order Carnivora - Carnivores Family Canidae - Canids
Canis latrans latrans Say (coyote)	
Vulpes vulpes regalis Merriam (red fox)	
Vulpes velox velox (Say) (swift fox)	
Urocyon cinereoargenteus ocythous Bangs (gray fox)	

Table 29 Continued

Species	Taxonomic Rank
	Family Procyonidae - Procyonids
Procyon lotor hirtus Nelson & Goldman (raccoon)	
	Family Mustelidae - Mustelids
Mustela erminea muricus (Bangs) (ermine)	
Mustela frenata nevadensis Hall (long-tailed weasel)	
Mustela frenata longicauda (long-tailed weasel)	
Mustela vison letifera Hollister (mink)	
Taxidea taxus taxus Schreber) (badger)	
Mustela nigripes (Audubon & Bachman) (black-footed ferret)	
Spilogale putorius interrupta (Rafinesque) (spotted skunk)	
Mephitis mephitis hudsonica Richardson (striped skunk)	
	Family Felidae - Cats
Lynx rufus pallescens Merriam (bobcat)	
	Order Artiodactyla - Artiodactyls
	Family Cervidae - Deer
Cervus canadensis nelsoni V. Bailey (American elk)	
Odocoileus hemionus hemionus (Rafinesque) (mule deer)	
Odocoileus virginianus dacotensis (Goldman and Kellogg) (white-tailed deer)	
	Family Antilocapridae - Pronghorn
Antilocapra americana americana (Ord) (pronghorn)	

Table 30

Scientific and Common Names of Reptiles and Amphibians
Which May Be Found on or Near the Study Area

Family	Species: Common Name	Species: Scientific Name
Ambystomidae	Tiger salamander	*Ambystoma tigrinum*
Pelobatidae	Plains spadefoot toad	*Scaphiopus bombifrons*
Bufonidae	Great plains toad	*Bufo cognatus*
	Woodhouse's toad	*Bufo woodhousei*
Hylidae	Chorus frog	*Pseudacris triseriata*
Ranidae	Leopard frog	*Rana pipiens*
Chelydridae	Snapping turtle	*Chelydra serpentina*
Testudinidae	Painted turtle	*Chrysemys picta*
Trionychidae	Spiny softshell turtle	*Trionyx spiniferus*
Iguanidae	Sagebrush lizard	*Sceloporus graciosus*
	Short-horned lizard	*Phrynosoma douglassi*
Colubridae	Western hognose snake	*Heterodon nasicus*
	Smooth green snake	*Opheodrys vernalis*
	Racer snake	*Coluber constrictor*
	Gopher snake	*Pituophis melanoleucus*
	Milk snake	*Lampropeltis triangulum*
	Common garter snake	*Thamnophis sirtalis*
	Western terrestrial garter snake	*Thamnophis elegans*
	Plains garter snake	*Thamnophis radix*
Viperidae	Western rattlesnake	*Crotalus viridis*

Table 31

Scientific and Common Names of Birds Which May Be Found on or Near the Study Area

Order/Family	Common Name	Scientific Name
PODICIPEDIFORMES (Grebes)	Eared grebe	Podiceps caspicus
	Western grebe	Aechmophorus occidentalis
	Pied-billed grebe	Podilymbus podiceps
CICONIIFORMES (Herons, Ibises, Bitterns)	Great blue heron	Ardea herodias
	Black-crowned night heron	Nycticorax nycticorax
	White-faced ibis	Plegadis chihi
	American bittern	Botaurus lentiginosus
ANSERIFORMES (Waterfowl)	Canada goose	Branta canadensis
	Snow goose	Chen caerulescens
	Mallard	Anas platyrhynchos
	Gadwall	Anas strepera
	Pintail	Anas acuta
	Green-winged teal	Anas crecca
	Blue-winged teal	Anas discors
	Cinnamon teal	Anas cyanoptera
	American widgeon	Anas americana
	Northern shoveler	Anas clypeata
	Redhead	Aythya americana
	Ring-necked duck	Aythya collaris
	Canvasback	Aythya valisineria
	Lesser scaup	Aythya affinis
	Common goldeneye	Bucephala clangula
	Ruddy duck	Oxyura jamaicensis
	Common merganser	Mergus merganser
FALCONIFORMES (Vultures, Hawks, Falcons)	Turkey vulture	Cathartes aura
	Sharp-shinned hawk	Accipiter striatus
	Cooper's hawk	Accipiter cooperii
	Red-tailed hawk	Buteo jamaicensis
	Swainson's hawk	Buteo swainsoni
	Rough-legged hawk	Buteo lagopus
	Ferruginous hawk	Buteo regalis
	Golden eagle	Aquila chrysaetos
	Bald eagle	Haliaeetus leucocephalus
	Marsh hawk	Circus cyaneus
	Gyrfalcon	Falco rusticolus
	Prairie falcon	Falco mexicanus
	Peregrine falcon	Falco peregrinus
	Merlin	Falco columbarius
	American kestrel	Falco sparverius
GALLIFORMES (gallinaceous birds)	Sage grouse	Centrocerus urophasianus
	Sharp-tailed grouse	Pedioecetes phasianellus
	Chukar partridge	Alectoris chukar
	Gray partridge	Perdix perdix
	Ring-neck pheasant	Phasianus colchicus
GRUIFORMES (Cranes and their allies)	Sandhill crane	Grus canadensis
	Sora	Porzana carolina
	American coot	Fulica americana
	Virginia rail	Rallus limicola
CHARADRIIFORMES (Shorebirds, gulls, etc.)	Killdeer	Charadrius vociferus
	Mountain plover	Charadrius montana
	Long-billed curlew	Numenius americanus
	Whimbrel	Numenius phaeopus
	Upland plover	Bartramia longicauda
	Spotted sandpiper	Actitis macularia
	Solitary sandpiper	Tringa solitaria
	Willet	Catoptrophorus semipalmatus
	Greater yellow legs	Tringa melanoleucus
	Lesser yellow legs	Tringa flavipes
	Pectoral sandpiper	Calidris melanotos

Table 31 Continued

Order/Family	Common Name	Scientific Name
CHARADRIIFORMS (Continued)		
	Baird's sandpiper	Calidris bairdii
	Least sandpiper	Calidris minutilla
	Long-billed dowitcher	Limnodramus scolopaceus
	Semipalmated sandpiper	Caldris pusillus
	Western sandpiper	Calidris mauri
	Marbled godwit	Limosa fedoa
	Hudsonian godwit	Limosa haemastica
	American avocet	Recurvirostra americana
	Wilson's phalarope	Steganopus tricolor
	Common snipe	Capella gallinago
	California gull	Larus californicus
	Forster's tern	Sterna forsteri
STRIGIFORMES (owls)	Western burrowing owl	Speotyto cunicularia
	Short-eared owl	Asio flammeus
	Great horned owl	Bubo virginianus
	Long-eared owl	Asio otus
	Screech owl	Otus asio
	Saw-whet owl	Aegolius acadicus
CAPRIMULGIFORMES (goatsuckers)	Poor-will	Phalaenoptilus nuttalli
	Common nighthawk	Chordeiles minor
APODIFORMES (Swifts, hummingbirds)	White-throated swift	Aeronautes saxatalis
	Broad-tailed hummingbird	Selasphorus platycercus
	Calliope hummingbird	Stellula calliope
CORACIIFORMES (Kingfishers)	Belted kingfisher	Megaceryle alcyon
PICIFORMES (Woodpeckers)	Common flicker	Colaptes auratus
	Red-headed woodpecker	Melanerpes erythrocephalus
	Hairy woodpecker	Dendrocopos villosus
	Downy woodpecker	Dendrocopos pubescens
PASSERIFORMES (Perching birds)		
Family: Tyrannidae (tyrant flycatchers)		
	Eastern kingbird	Tyrannus tyrannus
	Western kingbird	Tyrannus verticalis
	Cassin's kingbird	Tyrannus vociferans
	Say's phoebe	Sayornis saya
	Western flycatcher	Empidonax difficilis
	Western wood pewee	Contopus sordidulus
	Olive-sided flycatcher	Nuttallornis borealis
	Least flycatcher	Empidonax minimus
	Hammond's flycatcher	Empidonax hammondii
	Dusky flycatcher	Empidonax oberholseri
	Traill's flycatcher	Empidonax traillii
Family: Alaudidae (larks)		
	Horned lark	Eremophila alpestris
Family: Hirundinidae (swallows)		
	Tree swallow	Iridoprocne bicolor
	Rough-winged swallow	Stelgidopteryx ruficollis
	Bank swallow	Riparia riparia
	Barn swallow	Hirundo rustica
	Cliff swallow	Petrochelidon pyrrhonota
	Violet-green swallow	Tachycineta thalassina
	Purple martin	Progne subis
Family: Corvidae (jays, magpies, and crows)		
	Blue jay	Cyanocitta cristata
	Pinyon jay	Gymnorhinus cyanocephalus
	Black-billed magpie	Pica pica
	Common crow	Corvus brachyrhynchos
	Common raven	Corvus corax
Family: Paridae (chickadees, titmice, etc.)		
	Black-capped chickadee	Parus atricapillus
Family: Sittidae (nuthatches)		
	Red-breasted nuthatch	Sitta canadensis
	White-breasted nuthatch	Sitta carolinensis
	Pygmy nuthatch	Sitta pygmaea
Family: Troglodytidae (wrens)		
	House wren	Troglodytes aedon
	Rock wren	Salpinctes obsoletus

Table 31 Continued

Order/Family	Common Name	Scientific Name
Family: Mimidae (mockingbirds and thrashers)		
	Mockingbird	Mimus polyglottos
	Gray catbird	Dumetella carolinensis
	Brown thrasher	Toxostoma rufum
	Sage thrasher	Oreoscoptes montanus
Family: Turdidae (thrushes, solitaires, and bluebirds)		
	American robin	Turdus migratorius
	Hermit thrush	Catharus guttatus
	Swainson's thrush	Catharus ustulatus
	Veery	Catharus fuscescens
	Mountain bluebird	Sialia currucoides
	Townsend's solitaire	Myadestes townsendi
	Western bluebird	Sialia mexicana
	Eastern bluebird	Sialia sialis
Family: Fringillidae (grosbeaks, finches, sparrows and buntings)		
	House finch	Carpodacus mexicanus
	Gray-crowned rosy finch	Leucosticte tephrocotis
	Purple finch	Carpodacus purpureus
	Black rosy finch	Leucosticte atrata
	Common redpoll	Acanthis flammea
	Pine siskin	Spinus pinus
	American goldfinch	Spinus tristis
	Red crossbill	Loxia curvirostra
	Green-tailed towhee	Chlorura chlorura
	Rufous-sided towhee	Pipilo erythrophthalmus
	Lark bunting	Calamospiza melanocorys
	Savannah sparrow	Passerculus sandwichensis
	Grasshopper sparrow	Ammodramus savannarum
	Baird's sparrow	Ammodramus bairdii
	Vesper sparrow	Pooecetes gramineus
	Lark sparrow	Chondestes grammacus
	Cassin's sparrow	Aimophila cassinii
	Black-throated sparrow	Amphispiza bilineata
	Sage sparrow	Amphispiza belli
	Slate-colored junco	Junco hyemalis
	White-winged junco	Junco aikeni
	Gray-headed junco	Junco caniceps
	Tree sparrow	Spizella arborea
	Chipping sparrow	Spizella passerina
	Clay-colored sparrow	Spizella pallida
	Brewer's sparrow	Spizella breweri
	Harris' sparrow	Zonotrichia querula
	White crowned sparrow	Zonotrichia leucophrys
	Lincoln's sparrow	Melospiza lincolnii
	Song sparrow	Melospiza melodia
	McCrown's longspur	Calcarius mccownii
	Lapland longspur	Calcarius lapponicus
	Chestnut-collared longspur	Calcarius ornatus
	Black-headed grosbeak	Pheucticus melanocephalus
	Evening grosbeak	Hesperiphona vespertina
	Blue grosbeak	Guiraca caerulea
	Lazuli bunting	Passerina amoena
	Dickcissel	Spiza americana
Family: Motacillidae (pipits and wagtails)		
	Sprague's pipit	Anthus spragueii
Family: Bombycillidae (waxwings)		
	Bohemian waxwing	Bombycilla garrulus
	Cedar waxwing	Bombycilla cedrorum

Table 31 Continued

Order/Family	Common Name	Scientific Name
Family: Laniidae (shrikes)		
	Northern shrike	Lanius excubitor
	Loggerhead shrike	Lanius ludovicianus
Family: Sturnidae (starlings)		
	Starling	Sturnus vulgaris
Family: Vireonidae (vireos)		
	Red-eyed vireo	Vireo olivaceus
	Warbling vireo	Vireo gilvus
	Solitary vireo	Vireo solitarius
Family: Parulidae (warblers)		
	Orange-crowned warbler	Vermivora celata
	Virginia's warbler	Vermivora virginiae
	Yellow warbler	Dendroica petechia
	Yellow-rumped warbler	Dendroica coronata
	Townsend's warbler	Dendroica townsendi
	Chestnut-sided warbler	Dendroica pensylvanica
	Blackpoll warbler	Dendroica striata
	Northern water thrush	Seiurus noveboracensis
	MacGillivray's warbler	Oporornis tolmiei
	Common yellow throat	Geothlypis trichas
	Yellow breasted chat	Icteria virens
	Oven bird	Seiurus aurocapillus
	Wilson's warbler	Wilsonia pusilla
	Canada warbler	Wilsonia canadensis
	American redstart	Setophaga ruticilla
	Black-throated gray warbler	Dendroica nigrescens
Family: Ploceidae (weaver finches)		
	House sparrow	Passer domesticus
Family: Icteridae (blackbirds, orioles, etc.)		
	Western meadowlark	Sturnella neglecta
	Red-winged blackbird	Agelaius phoeniceus
	Yellow-headed blackbird	Xanthocephalus xanthocephalus
	Orchard oriole	Icterus spurius
	Northern oriole	Icterus galbula
	Brewer's blackbird	Euphagus cyanocephalus
	Common grackle	Quiscalus quiscula
	Brown-headed cowbird	Molothrus ater
	Bobolink	Dolichonyx oryzivorus
Family: Thraupidae (tanagers)		
	Western tanager	Piranga ludoviciana

Table 32
List of Known and Probable Fish Species
Found in the Study Area*

Common Name	Scientific Name
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Rainbow trout	*Salmo gairdneri*
Largemouth bass	*Micropterus salmoides*
Smallmouth bass	*Micropterus dolomieu*
Green sunfish	*Lepomis cyanellus*
Bluegill	*Lepomis macrochirus*
Rock bass	*Ambloplites rupestris*
Channel catfish	*Ictalurus punctatus*
Black bullhead	*Ictalurus melas*
Stonecat	*Noturus flavus*
Walleye	*Stizostedion vitreum*
Sauger	*Stizostedion canidense*
Northern pike	*Esox lucius*
Yellow perch	*Perca flavescens*
River carpsucker	*Carpoides carpio*
Goldeye	*Hiodon alosoides*
Longnose sucker	*Catostomus catostomus*
White sucker	*Catostomus commersoni*
Mountain sucker	*Pantosteus platyrhynchus*
Northern redhorse	*Moxostoma macrolepidotum*
Carp	*Cyprinus carpio*
Creek chub	*Semotalus atromaculatus*
Lake chub	*Hybopsis plumbea*
Flathead chub	*Hybopsis gracilis*
Plains minnow	*Hybognathus placitus*
Sand shiner	*Notropsis stramineus*
Golden shiner	*Notomigonus crysoleucas*
Fathead minnow	*Pimephales promelas*
Longnose dace	*Rhinichthys cataractae*
Plains killifish	*Fundulus kansae*
Plains topminnow	*Fundulus sciadicus*
Brassy minnow	*Hybognathus hankinsoni*
Silvery minnow	*Hybognathus nuchalis*
Flathead catfish	*Pylodictus olivaris*

Officially considered to be rare in the State of Wyoming are:

Shovelnose sturgeon	*Scaphirhynchus platorynchus*
Pearl dace	*Semotilus margarita*
Finescale dace	*Phoxinus neogacus*
Sturgeon Chub	*Hybobsis gelida*
Goldeye	*Hiodon alosoides*

*Includes portions of the Belle Fourche, Cheyenne, Little Missouri, Little Powder and Powder River drainages.

RECREATION

Supporting Data

Table 33

WYOMING
Existing Outdoor Recreation Area Inventory

Annual Visits	County	Area Name	Ownership	Admin.	Land: Undeveloped	Land: Developed	Water: Marsh	Water: Water	Total
	Campbell	Nat'l Resource Lands	Federal	BLM	223,318				223,318
5,900	"	Thunder Basin Nat'l Grassland	"	USFS	157,600			405	158,005
	"	Edwards Rs. Public Fish Area	State	State	58				58
	"	Gillette St. Wildlife Area	"	"	18			40	58
	"	Dalby Mem Pk & Lake	County	County		60			60
	"	Gillette City Park	City	City		10			10
	Converse	Nat'l Resource Land	Federal	BLM	128,866				128,866
4,500	"	Thunder Basin NG	"	USFS	185,513			195	185,708
13,150	"	Medicine Bow NF	"	"	78,797	4		470	79,271
10,000	"	Fort Fetterman	State	WyomingRec.Comm	60				60
	"	AyersPark (Nat.Bridge)	County	County	20				20
	"	Boxelder Co. Park	"	"		2			2
	"	Douglas Riverside Pk	City	City		3			3
	"	Douglas Wash. Park	"	"		9			9
	"	Glenrock City Pk.	"	"		10			10
	Crook	Nat'l Resource Lands	Federal	BLM	103,025				103,025
50	"	Thunder Basin NG	"	USFS	302				302
66,200	"	Black Hills Nat'l For.	"	"	163,874	8		342	164,224
150,916	"	Devils Tower NM	"	NPS	1,326	21			1,347
	"	Keyhole Reservoir	"	B/R	6,740			9,394	16,134
91,516	"	Keyhole Res. Rec. Area	"	Wy Rec. Comm.	6,700			KeyholeRes	6,700
	"	Sand Creek	State	G & F	20				20
	"	Moorcroft Campground	City	City		2			2
	"	Moorcroft Noonan Picnic Ground	"	"		1			1
	"	Sundance Picnic Grnd	"	"		2			2
	Johnson	Nat'l Resource Lands	Federal	BLM	202,084				202,084
3,000	"	Cloud Creek Rec. Complex	"	"	141,255				141,255
7,000	"	Hole-in-the-Wall Rec. Complex	"	BLM					195,070
141,350	"	Bighorn Nat'l For.	"	USFS	327,909	201		3,491	331,601

Annual Visits	County	Area Name	Ownership	Admin.	Land: Undeveloped	Land: Developed	Water: Marsh	Water: Water	Total
	Johnson	Ft. Phil Kearny NHL	State	Wyo. Rec. Comm		3			3
	"	Ft. Reno Hist. Site	"	"		14			14
	"	Buffalo City Park	City	City	8				8
	"	Buffalo Municipal Campground	"	"		6			6
	"	Cold Springs Cmpgrnd.	"	"	20				20
	"	Cold Springs Picnic Ground	"	"	20				20
	Natrona	Nat'l Resource Lands	Federal	BLM	1,369,156				1,369,156
6,000	"	Muddy Mtn. Rec. Lands	"	"	1,260				1,250
26,500	"	Trapper Rtc. Canoe Trail (N. Platte R.)	"	"	3,264			(50mi)	3,264
5,000	"	Pathfinder NWR	"	BSF&W	12,644	10			12,654
1,800	"	Medicine Bow NF	"	USFS	5,445			90	5,535
	"	Evansville St. Rec. Ar.	State	G & FC	105	5			110
30,000	"	Independence Rock NHL	"	Wyoming Rec Comm	955	5			960
369,275	"	Alcova Res. Cmpgrnd.	Federal	Co. Pk. Bd.	3,237			2,500	5,737
	"	Archery Range	County	"	112				112
	"	Beartrap Meadow Park	"	"	160				160
	"	Casper Mtn. Pk.	"	"	480				480
14,580	"	Gray Reef Res.	Federal	"	43			181	224
60,368	"	Pathfinder Res.	"	"	26,417			15,528	41,945
	"	Rotary Park	County	"		59			59
	"	Casper Adams Park	City	City		2			2
	"	Casper City Park	"	"		4			4
	"	Conwell Park (Casper)	"	"		2			2
	"	Casper Eastdale Park	"	"		4			4
	"	Casper "F" St. Park	"	"		2			2
	"	Casper Huber Park	"	"		6			6
	"	Casper Manor Hgts. Pk.	"	"		3			3
	"	Casper Marion Criner Pk.	"	"		1			1
	"	Casper Mike Sedar Park	"	"	65				65
	"	Casper Nancy English Pk.	"	"		15			15
	"	Casper Randalette Pk.	"	"		1			1

Table 33 Continued

Table 33 Continued

Annual Visits	County	Area Name	Ownership	Admin.	Land: Undeveloped	Land: Developed	Water: Marsh	Water: Water	Total
	Natrona	Casper River View Pk	City	City		2			2
	"	Casper So. Ridge Pk.	"	"		2			2
	"	Casper Veterans Pk.	"	"		1			1
	"	Casper Washington Pk.	"	"		26			26
	"	Casper Westwood Pk.	"	"		3			3
	"	Casper Yesness Pk.	"	"		7			7
	"	Evansville Park	"	"		1			1
	"	Fort Casper	"	"		30			30
	"	North Casper Park	"	"	93				93
	"	Camp Wyoming B.A.	Private	Private	10				10
	"	Sun (Tom) Ranch NHL	"	"	960				960
	Niobrara	Nat'l Resource Lands	Federal	BLM	159,704				159,704
	"	Lance Creek Fossil	Fed-St-Pvt.	BLM-State	368,640(approx)				368,640
		Area NHL							
100	"	Thunder Basin NG	Federal	USFS	840				840
	"	Lusk Rest Area	State	Hwy. Dept.		15			15
	"	North Side Cmgrnd.	City	City		1			1
	"	Northside PkPicnic	"	"		1			1
		Grnd							
	"	Lusk Was. Mem. Park	"	"		1			1
	Sheridan	Nat'l Resource Lands	Federal	BLM	50,668				50,668
198,600	"	Bighorn Nat'l Forest	"	USFS	399,697	340		2,312	402,349
6,000	"	Connor Battlefield	"						
		Hist. Site	State	Wyoming		1.2			1.2
				Rec. Comm.					
	"	Tongue R. Pub. Fish Ar.	"	G & F	270			26	296
	"	Amsden Crk.St.W.Ref.	"	G & F	2,589			1	2,590
	"	Kerns St.Wildlife Ref.	"	"	5,142				5,142
	"	Sheridan Bird Farm	Local	"	47				47
	"	Sheridan Co. St. Wild.	"	"	7,731				7,731
		life Refuge							
	"	Sheridan Info Ctr.	State	Hwy.Dept.		25			25
	"	Sheridan Kendrick Pk	City	City		12			12
	"	Sheridan Wash. Park	"	"		1			1
	"	Sheridan Inn NHL	Private	Private		10			10

Annual Visits	County	Area Name	Ownership	Admin.	Land: Undeveloped	Land: Developed	Water: Marsh	Water: Water	Total
	Weston	Nat'l Resource Lands	Federal	BLM	78,684				78,684
5,350	"	Thunder Basin NG	"	USFS	226,940			505	227,445
1,600	"	Black Hills Nat'l For.	"	"	6,364				6,364
	"	Mallo Campground	County	County	153				153
	"	Newcastle Dow Park	City	City		2			2
	"	Upton City Cmpgrnd.	"	"	25				25
		STATE TOTAL			4,654,503	956.20		35,480	4,690,939.20

Source: Northern Great Plains Resource Program

Table 33 Continued

Table 34

MONTANA
Existing Outdoor Recreation Area Inventory

Annual Visits	County	Area Name	Ownership	Admin	Land: Undeveloped	Land: Developed	Water: Mars	Water: Water	Total
	Big Horn	Nat'l Resource Lands	Federal	BLM	27,208				27,208
	"	Crow Indian Reserva.	Tribal	BIA	66,676	75		583	67,334
	"	" " "	Federal	BIA	392	5		750	1,147
118,836	"	Big Horn Canyon NRA	Federal	NPS	2,110	1,090		5,760	8,960
387,717	"	Custer Battlefield Nat'l Monument	Federal	NPS	749	16			765
5,000	"	Chief Plenty Coups Memorial State Mon.	State	F & G	190	4			194
3,500	"	Arapooish Fish Access Area	"	"	93				93
5,000	"	Bighorn R. " " Area	"	"	78				78
16,000	"	Two Leggins Fish Access Area	"	"	34				34
	"	Tongue River Reservoir	"	State	352			5,195	5,547
	Carter	Nat'l Resource Lands	Federal	BLM	512,333				512,333
9,850	"	Custer Nat'l Forest	Federal	USFS	89,377	23			89,400
3,000	"	Medicine Rocks St. Pk.	State	F & G	300	20			320
	Powder River	Nat'l Resource Lands	Federal	BLM	257,836				257,836
	"	Custer Nat'l Forest	"	USFS	341,933	13			341,946

Source: Northern Great Plains Resource Program

Table 35

Summary of Planned Future Development

Type of Development -- Local	Fiscal Year	Amount
Converse County		
1. Douglas: Washington Park Improvements--install playground equipment, fencing of play area. (226)	1973*	$ 6,500.00*
2. Converse County: Ayre's Natural Bridge--site improvements, landscaping, installation of fencing, area lights, sprinkler system, graveling roadways. (233)	1975*	8,300.00*
County Total		14,800.00
Natrona County		
3. Natrona County: East End Road--(parks interconnect) complete road construction.	1972-1977	100,000.00
4. Casper: Nancy English Park--clean & grade North Creek area, install irrigation system for entire park, plant grass in north portion. (77)	1973*	13,994.40*
5. Casper: Automate golf course.	1973-1977	49,000.00
6. Casper: Bicycle trails.	1974	27,000.00
7. Edgerton: Town Park--construct dam, install fence, construct trap & rifle range, planning & engineering. (228)	1974*	23,500.00*
8. Midwest: Swimming Pool--improvement of existing swimming pool, filtration system, chlorination equipment, pool & first-aid equipment, building, septic tank, site improvements, planning & engineering. (232)	1974*	11,100.00*
9. Natrona County: Alcova Canyon--development of public use area, construction of roads & parking areas, develop trails for canyon overlook, construct & install toilets, beach shelter, boat ramp, informational and directional signs, site planning & engineering. (192)	1974*	17,385.00*
10. Casper: Develop historical site.	1974-1976	15,000.00
11. Casper: River front development.	1974-1976	80,000.00
12. Casper: Red Butte Battle Site	1974-1977	11,000.00
13. Casper: Golf course expansion (9 holes)	1974-1977	60,000.00
14. Edgerton: Lions Club Park--landscaping, picnic table & shelter, water hook-up, signs & perimeter fencing. (263)	1974*	1,800.00*
15. Natrona County: Archery Range--clean flight lines, construct trail, construct shooting stake positions, trail guides, bow racks & benches, construct access road, picnic area, sanitary facilities, trailer park area, construct parking area, shelter house/utility building, playground area, installation of playground equipment, fencing, gates, interpretive signs & water development. (159)	1975*	39,409.86*
16. Casper: North Park No. 2--install backstop & dugouts at North field. (259)	1975*	6,000.00
17. Natrona County: Ponderosa-Winter Recreation Area	1975	17,500.00
18. Casper: Park in Southeast Casper.	1975	25,000.00
19. Casper: Automation of park areas	1975-1976	18,000.00
20. Casper: Washington Park No. 2--backstop & scoreboard for ball field, sidewalk, landscaping, planning & engineering. (261)	1976*	10,000.00
21. Natrona County: Muddy Mountain Park (BLM transfer) 10 picnic units.	1976	Unknown
22. Natrona County: Crimson Dawn-Memorial Preserve--nature trails, fence.	1977	75,000.00
23. Casper: City Park Improvements. (Cheyenne Processing).		5,130.00*
24. Casper: Eastdale Park Improvements. (Cheyenne Processing).		12,298.50*
25. Casper: Meadow Park Improvements. (Cheyenne Processing).		1,885.00*
26. Casper: Mike Sedar Park Improvements No. 2. (Cheyenne Processing).		33,996.78*
27. Casper: Municipal Colf Course Improvements. (Cheyenne Processing).		78,420.38*
28. Casper: Westwood Improvements. (Cheyenne Processing).		5,887.00*
County Total		738,306.92

Table 35 (Cont'd)

Type of Development -- Local	Fiscal Year	Amount
Niobrara County		
29. Lusk: Golf Course Acquistion & Development--develop picnic facilities, playground equipment, tennis courts, trap shoot area, fishing improvements, landscaping, fencing, sanitary facilities, parking, lighting, water including irrigation facilities. (Acquisition Separate) (234)	1975*	$223,650.00*
County Total		223,650.00
Campbell County		
30. Gillette: Dalbey Park--site improvements, roads, parking, landscaping, ice skating facilities, restroom facilities, water system, lighting, planning & engineering. (256)	1977*	35,000.00*
31. Campbell County: Pioneer Stocktrail Park. (Cheyenne Processing).		32,164.00*
County Total		67,164.00
Crook County		
32. Crook County: Multiple-Use Recreation Area & Rodeo Arena.	1972-1977	Unknown
33. Crook County: Washington Park--earthwork, construction and installation of water, sewer, sanitary facilities, storage, foot bridge, parking area, picnic facilities, roads & landscaping. (185)	1973*	51,494.85*
34. Hulett: Hulett Recreation Area--rodeo arena, fencing, chutes, lighting, water & sewer system, utility building, sanitary facilities. (Acquisition Separate).	1975	60,212.00
County Total		111,706.85
Johnson County		
35. Buffalo: Frank Prosinski Park--construct dugouts, announcers booth, install public address system, planning & engineering. (266)	1974*	3,600.00*
36. Buffalo: Swimming Pool.	1974	100,000.00
37. Kaycee: Barnum School Recreation Area. (Cheyenne Processing).		2,525.00*
County Total		106,125.00
Sheridan County		
38. Sheridan: Sheridan Golf Course--underground sprinkler system to #1 & #9 fairways, install underground sprinkler system on 4 additional fairways, install 4 grass greens, install underground sprinkler system on 3 remaining fairways, install 5 remaining grass greens. (198)	1973*	200,000.00*
39. Sheridan: Thorne Rider Park--renovation of existing dugouts, develop Babe Ruth baseball field, picnic facilities, tennis courts, horseshoe courts, playground area & wading pool, support facilities, sidewalk, bleachers, dugouts, playground equipment, parking, road with curb & gutter, landscaping, sprinkler system, water, sewer, electricity, gas service, fencing, gates, entry booth, restroom/storage facilities, lighting, speaker system, scoreboard, planning and engineering. (243)	1976*	315,000.00
40. Sheridan: Golf course, sheltered acres (development) and native animal display (fencing).	1973-1977	Unknown
County Total		515,000.00
Weston County		
41. Newcastle: Dow Park Improvements--playground equipment, drinking fountain, trees, shrubs, landscaping, drainage structure and curb & gutter and surface paving. (49)	1973*	33,131.99*
County Total		33,131.99

Source: Wyoming Recreation Commission, Wyoming Statewide Comprehensive Outdoor Recreation Plan, 1973.

Recreation Facility	NRPA Standards	1970 Needs (12,957)	1975 Needs (14,396)	1980 Needs (28,956)	1985 Needs (44,278)	1990 Needs (56,959)
Tennis Courts	1/ 2,000 p.	6	7	14	22	28
Baseball Diamonds (lighted)	1/ 6,000 p.	2	2	5	7	9
Baseball Diamonds (unlighted)	1/ 4,000 p.	3	3	7	11	14
Swimming Pool	3% pop.x 20=s.f.	7,740*(2 pools)	8,637*(3 pools)	17,373*(6 pools)	25,566*(10 pools)	34,175*(12 pools)
Spray Pools	1/ 4,000 p.	3	3	7	11	14
Golf Courses	1/20,000 p.	9 holes	9 holes	18 holes	36 holes	45 holes
Shelter Buildings	1/ 4,000 p.	3	3	7	11	14
Picnic Area	5% pop./30=acres	21.6 acres	24 acres	48 acres	74 acres	95 acres
Voleyball Court	1/ 6,000 p.	2	2	5	7	9
Horseshoe Court	1/ 2,000 p.	6	7	14	22	28
Ice Skating Area	1/ 2,500 p.	5	6	11	18	23
Tetherball Poles	1/ 5,000 p.	10	12	22	36	46
Basketball Goals	1/ 1,500 p.	9	10	19	29	37
Running Tracks	1/15,000 p.	0	1	2	3	4
Camping Area	1 acre/1,000 p.	13 acres	14 acres	29 acres	44 acres	57 acres
Recreation Center	1/20,000 p.	1	1	1	2	3
Required Park Areas						
Developed Urban Parks	1 ac./100 p.	129.57 acres	143.96 acres	289.56 acres	442.78 acres	569.59 acres
Informal Rural Parks	1 ac./100 p.	129.57 acres	143.96 acres	289.56 acres	442.78 acres	569.59 acres
All Parks		259.14	287.92	579.12	885.56	1,139.18

* These pool needs are based on an average size pool and may be reduced because of weather conditions or through the use of larger pools.

Source: Campbell County Recreation Study.

Table 35a

Future Facility and Park Area Projections

Region and County	ATTENDING ATHLETIC EVENTS 1970	1990	% Inc. 90 over 70	BOATING AND CANOEING 1970	1990	% Inc. 90 over 70	CAMPING 1970	1990	% Inc. 90 over 70
Converse	16,381	18,529	13	4,635	8,210	77	24,366	41,068	68
Natrona	80,057	136,236	70	115,174	138,291	20	123,802	182,290	47
Niobrara	5,274	5,480	4	6,827	5,389	-21	11,219	14,396	28
Total	101,712	160,245	57	126,636	151,890	20	159,387	237,754	49
Campbell	10,719	31,986	198	21,783	43,485	100	40,160	80,852	101
Crook	7,934	9,874	24	11,876	17,626	48	40,035	68,082	70
Johnson	12,007	15,725	31	4,666	10,974	135	64,328	110,332	71
Sheridan	25,367	38,049	50	13,211	25,341	92	85,935	125,139	46
Weston	8,782	14,218	62	11,728	18,836	61	23,351	40,384	73
Total	64,809	109,852	69	63,264	116,262	84	253,809	424,789	67

Region and County	FISHING 1970	1990	% Inc. 90 over 70	GOLFING 1970	1990	% Inc. 90 over 70	HIKING 1970	1990	% Inc. 90 over 70
Converse	41,588	61,927	49	13,557	23,785	74	26,017	38,263	47
Natrona	309,044	420,580	36	110,153	225,614	105	127,185	187,926	47
Niobrara	14,691	14,167	- 4	6,348	8,782	38	7,447	12,710	70
Total	365,323	496,674	36	130,058	258,181	99	160,649	238,899	48
Campbell	90,050	187,855	109	15,876	55,240	248	23,200	54,491	138
Crook	55,549	88,029	58	3,115	9,633	209	25,339	46,927	85
Johnson	70,720	99,234	40	9,841	20,510	108	38,956	57,377	47
Sheridan	163,380	193,383	18	33,464	62,603	87	64,423	85,034	31
Weston	54,060	68,131	26	13,544	24,672	82	15,731	31,736	101
Total	503,663	646,632	26	75,839	172,658	128	167,649	275,565	64

Table 36

Estimated Total Recreation Participation by Region, 1970 and 1990

Table 36 Continued

Region and County	HUNTING 1970	HUNTING 1990	HUNTING % Inc. 90 over 70	ICE SKATING 1970	ICE SKATING 1990	ICE SKATING % Inc. 90 over 70	PICNICKING 1970	PICNICKING 1990	PICNICKING % Inc. 90 over 70
Converse	13,303	14,497	9	3,625	5,008	a	22,760	35,601	56
Natrona	83,955	126,922	51	31,302	43,380	a	67,288	102,653	52
Niobrara	2,055	3,392	65	1,786	2,448	a	21,966	34,905	58
Total	99,313	144,811	46	36,713	50,836	a	112,014	173,159	54
Campbell	9,405	27,974	197	7,912	10,943	a	127,633	225,314	76
Crook	11,642	10,841	-7	2,769	3,826	a	108,784	184,111	69
Johnson	15,409	16,157	5	3,412	4,726	a	59,801	98,699	65
Sheridan	57,057	52,575	18	10,900	15,107	a	68,969	107,064	55
Weston	16,930	17,358	3	3,850	5,317	a	18,564	31,881	71
Total	110,443	124,905	13	28,843	39,919	a	383,751	647,069	68

Region and County	RODEOS 1970	RODEOS 1990	RODEOS % Inc. 90 over 70	SIGHTSEEING & PLEASURE DRIVES 1970	SIGHTSEEING & PLEASURE DRIVES 1990	SIGHTSEEING & PLEASURE DRIVES % Inc. 90 over 70	SKIING 1970	SKIING 1990	SKIING % Inc. 90 over 70
Converse	20,527	30,125	46	40,706	49,150	20	0	4,358	00
Natrona	40,899	58,755	43	366,723	499,835	36	52,888	95,635	80
Niobrara	2,067	2,142	-18	16,929	16,973	1	208	1,704	719
Total	64,036	91,022	42	424,358	565,958	33	53,096	101,697	91
Campbell	12,511	24,354	94	39,404	107,413	172	731	12,486	1608
Crook	7,110	5,505	-33	30,674	33,471	9	426	3,330	681
Johnson	11,195	13,056	16	35,787	46,893	31	8,548	11,973	40
Sheridan	25,048	35,792	42	150,842	161,173	6	17,741	27,754	56
Weston	8,214	7,523	- 9	31,832	47,082	47	3,784	8,329	120
Total	64,078	86,230	34	288,539	396,032	37	31,230	63,872	104

Region and County	SLEDDING & TOBOGGANING 1970	1990	% Inc. 90 over 70	SNOWMOBILING 1970	1990	% Inc. 90 over 70	SOFTBALL & BASEBALL 1970	1990	% Inc. 90 over 70
Converse	1,518	2,096	a	4,670	2,888	a	8,935	12,385	a
Natrona	13,104	18,159	a	40,325	63,369	a	77,149	107,287	a
Niobrara	747	1,025	a	2,301	1,129	a	4,402	6,053	a
Total	15,369	21,280	a	47,296	67,386	a	90,486	125,725	a
Campbell	3,312	4,581	a	10,192	8,274	a	19,500	27,065	a
Crook	1,159	1,602	a	3,567	2,206	a	6,823	9,462	a
Johnson	1,428	1,978	a	4,395	7,934	a	8,409	11,689	a
Sheridan	4,563	6,324	a	14,041	18,390	a	26,864	37,363	a
Weston	1,612	2,226	a	4,960	5,519	a	9,490	13,150	a
Total	12,074	16,711	a	37,155	42,323	a	71,086	98,729	a

Region and County	SWIMMING 1970	1990	% Inc. 90 over 70	WATER SKIING 1970	1990	% Inc. 90 over 70	TENNIS 1970	1990	% Inc. 90 over 70
Converse	24,978	29,832	19	2,636	4,078	54	2,109	2,940	a
Natrona	207,896	259,717	24	35,451	52,095	46	18,209	25,470	a
Niobrara	16,067	20,624	28	382	964	152	1,039	1,437	a
Total	248,941	310,173	24	38,469	51,137	48	21,357	24,847	a
Campbell	54,127	100,664	85	6,351	14,986	135	4,603	6,425	a
Crook	29,494	49,596	68	2,415	4,408	82	1,611	2,246	a
Johnson	15,902	25,839	62	1,967	4,095	108	1,985	2,775	a
Sheridan	42,929	64,580	50	2,054	7,719	275	6,341	8,870	a
Weston	28,331	32,586	15	6,324	8,004	26	2,340	3,122	a
Total	170,783	273,265	60	18,111	39,212	116	16,880	23,438	a

Source: Wyoming, Wyoming Statewide Comprehensive Outdoor Recreation Plan, 1973

[a]This was one of five activities on the 1970 survey that was not included as a separate activity on the 1967 survey. Data were not available to allocate participation to the counties on the same basis as was done for those activities covered in the 1967 survey. Thus, the percentage increase for each county is the same as the estimated increase for the state (see Table VIII-16).

Table 36 Continued

SOCIO-ECONOMICS

Supporting Data

Population and Employment Projection Model

Background

Projections of population and employment used in this EIS were based on a predictive model developed originally by the Water Resources Institute of the University of Wyoming for the Northern Great Plains Resources Program (NGPRP), with more recent coal production estimates for Campbell and Converse Counties provided by the U.S. Geological Survey. These figures have been substituted into the model. The NGPRP Study has developed three alternative scenarios, each projecting a different coal production level for the eight counties of the Powder River Basin. Since coal development has been assumed to occur principally in Campbell and Converse Counties, the least additional development scenario of the NGPRP has been included in the population and employment projections of this report to provide a coal production base for each of the remaining six counties. The least additional development scenario assumes that no further coal development would take place other than that necessary to supply the future demand for coal within the Northern Great Plains Region (NGP) to fulfill contracts presently in existence or being negotiated for short term forseeable NGP coal demands.

Assumptions

The population and employment figures used in this report serve only to indicate what may happen in the future based on several assumptions and the best possible available information. As it is impossible to predict accurately future outcomes, these population projections are only indicative and should not be understood as real future occurrences. The assumptions for population and employment forecasts are critical and a discussion and outline of these follow.

Many assumptions exist for both the export and residentiary sectors. The estimates by the USGS of coal production and number of power and coal gasification plants is crucial. Given productivity levels for workers in coal mining, coal gasification, and power plants by permanent and construction status, the basis has been established to develop coal-related employment as part of the export sector. Productivity levels have been provided by USGS and the University of Wyoming.

Uranium mining and milling operations and employment are predicted on a survey undertaken by the Wyoming Department of Economic Planning and Development (DEPAD). The DEPAD questionnaires resulted in specific information concerning future sites, expected timing, and anticipated employment of firms with development interests in the basin. Levels of petroleum and natural gas employment are contained in the NGPRP study. Employment for the remaining export sectors of agriculture, railroads, other mining and manufacturing is premised upon a continuation of historic trends for each of these sectors as observed and analyzed by the University of Wyoming.

Employment in the construction and residentiary sectors is based on the existing relationships of employment in these sectors to populations. Levels of employment for each of the residentiary sectors, i.e., construction, consumer services, business services and government and education, were derived as a function of population through a cross-sectional analysis using 1970 census data. Construction employment has been increased to account for employment associated with construction necessary for coal mining, coal gasification facilities and powerplants.

A final assumption having important regional repercussions is the residential location of the workforce and their families in the same county where the coal development activity occurs. This assumption may prove incorrect as employees may choose to commute long distances and possibly cross county boundaries. Because it is difficult to measure commuting patterns of a future workforce, the workforce has been assumed to reside in that county where it works. It is equally difficult to estimate their location within the county.

Methodology

The model establishes a historic relationship between employment in export and local industries and population, and projects these relationships forward in time when supplied with the appropriate data. Export industries are those employment sectors where the production of goods and services is intended for distribution to areas outside the region. Export employment includes agriculture, petroleum and natural gas, synthetic gas, coal mining, uranium mining and milling, power generation, other mining and other manufacturing. Local or residentiary industries are the secondary and indirect effects of employment in the export sector. Essentially, residentiary industries produce those goods and services consumed locally and include employment in construction, consumer services, business services and government and education.

The University of Wyoming predictive model emphasizes a mutual determination of population and employment. The model yields employment and associated population projections resulting from multipliers operating upon basic employment. The growth of the local or residentiary sector as influenced by initial expansion of the export sector has been designed to fluctuate and reflect the availability of labor in the region. The relationship between

employment and population has been established through a cohort survival model where migration has been determined endogenously based upon relative unemployment rates and per capita income levels. For the purposes of this report, initial population and employment values have been developed under birth rate assumptions consistent with the Census Series "E" projections.

Table 37

Population Density and Percent Urban Population
United States, Wyoming and Neighboring States
1970

State or Area	Area* (Square Miles)	Population	Population per Square Mile	Percent Urban Population
United States	3,548,974	203,184,772	57.3	73.5
Wyoming	97,411**	332,416	3.4	60.5
Montana	145,736**	694,409	4.8	53.4
Idaho	82,708**	713,008	8.6	34.1
South Dakota	76,378	666,257	8.7	44.5
Utah	82,339	1,059,273	12.8	80.4
Nebraska	76,612	1,483,791	19.4	61.5
Colorado	103,884	2,207,259	21.2	78.5

*Does not included inland water area
** Includes Yellowstone National Park

Source: U.S. Bureau of the Census, Census of Population, 1970

Table 38

Urban and Rural Population of Wyoming
1950 - 1970

YEAR	TOTAL POPULATION	PERCENT URBAN*	PERCENT RURAL
1900	92,531	28.8	71.2
1910	145,965	29.6	70.4
1920	194,402	29.4	70.6
1930	225,565	31.1	68.9
1940	250,742	37.3	62.7
1950	290,529	49.8	50.2
1960	330,066	56.8	43.2
1970	332,416	60.5	39.2

*Places with 2,500 people and more.

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1970.

Table 39

Population Density: Wyoming Counties in Powder River Basin, Region, State of Wyoming and United States 1970

	Area (Square Miles)	Total Population	Population Per Square Mile
Campbell	4,756	12,957	2.7
Converse	4,281	5,938	1.4
Crook	2,882	4,535	1.6
Johnson	4,175	5,587	1.3
Natrona	5,342	51,264	9.6
Niobrara	2,614	2,924	1.1
Sheridan	2,532	17,852	7.1
Weston	2,407	6,307	2.6
Region Total	28,989	107,364	3.7
Wyoming Total	97,203	332,416	3.4
U.S. Total	3,548,974	203,184,772	57.2

Source: U.S. Bureau of the Census, Census of Population, 1950 Through 1970.

County or Area	Total Population	Percent Under 18 Yrs.	Percent 18-64 Yrs.	Percent 65 and over	Male %	Female %
Campbell	12,957	41.1	54.2	4.7	51.8	48.2
Converse	5,938	35.9	51.3	12.8	50.0	50.0
Crook	4,535	38.3	53.1	8.6	50.1	49.9
Johnson	5,587	34.4	52.6	13.0	50.2	49.8
Natrona	51,264	37.2	55.3	7.5	49.3	50.7
Niobrara	2,924	30.9	53.6	15.5	48.9	51.1
Sheridan	17,852	30.7	53.4	15.9	49.8	50.2
Weston	6,307	39.3	51.3	9.4	50.3	49.7
Region Total	107,364	36.4	54.1	9.5	50.1	49.9
State Total	332,416	36.1	54.8	9.1	50.2	49.8

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

Table 40

Population Distribution by Age and Sex
Powder River Basin Region
1970

Table 41

Population Distribution by Ethnicity
Powder River Basin Region
1970

Area or County	White	%	Black	%	Spanish	%	Indian	%	Other	%	Total
Campbell	12,540	96.8	2	.02	293	2.3	97	0.7	25	0.2	12,957
Converse	5,793	97.6	----	---	95	1.6	29	0.5	21	0.3	5,938
Crook	4,523	99.7	----	---	---	---	10	0.2	2	0.1	4,535
Johnson	5,448	97.5	3	.05	102	1.8	22	0.2	12	0.2	5,587
Natrona	49,246	96.1	410	0.8	1,173	2.3	220	0.4	215	0.4	51,264
Niobrara	2,917	99.8	----	---	----	---	6	0.2	1	---	2,924
Sheridan	17,366	97.3	39	0.2	296	1.7	78	0.4	73	0.4	17,852
Weston	6,185	98.1	1	---	90	1.4	23	0.4	8	0.1	6,307
Region	104,018	96.9	455	0.4	2,049	1.9	485	0.5	357	0.3	107,364
Wyoming State	305,073	91.8	2,568	0.8	17,951	5.4	4,980	1.5	1,834	0.5	332,416

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

County or Area	Total No. of Persons 24 Yrs. Old & Over	4 Yrs. of High School or More No.	%	4 Yrs. of College or More No.	%	Median School Yrs. Completed
Campbell	6,126	3,593	58.7	387	6.3	12.2
Converse	3,383	2,128	62.9	314	9.3	12.3
Crook	2,414	1,514	62.7	223	9.2	12.3
Johnson	3,217	1,901	59.1	296	9.2	12.2
Natrona	26,449	18,034	68.2	3,506	13.3	12.5
Niobrara	1,832	1,008	55.0	88	4.8	12.0
Sheridan	10,861	6,547	60.3	1,214	11.2	12.3
Weston	3,320	1,892	57.0	247	7.4	12.2
Region	57,602	36,617	63.6	6,275	10.9	12.4
State	175,649	110,397	62.9	20,693	11.8	12.4
U.S.	-------	-------	52.3	-----	10.7	12.1

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

Table 42

Years of School Completed by Persons
25 Years Old and Over
Powder River Basin Region

Table 43

Location of Regional Population Growth
from 1970-1990 by County, Powder River Basin, Wyoming

County or Area	1970	1980	1970-1980 Difference	% 1970-1980 Regional Growth	1990	1980-1990 Difference	% 1980-1990 Regional Growth	1970-1990 Difference	% 1970-1990 Regional Growth
Campbell	12,957	32,200	19,243	53.0	50,400	18,200	78.1	37,443	62.8
Converse	5,938	13,200	7,262	20.0	15,200	2,000	8.6	9,262	15.5
Crook	4,535	4,500	- 35	- 0.1	4,600	100	0.4	65	0.1
Johnson	5,587	7,500	1,913	5.3	7,400	- 100	-0.4	1,813	3.0
Natrona	51,264	59,000	7,736	21.3	61,800	2,800	12.0	10,536	17.7
Niobrara	2,924	2,800	- 124	- 0.3	2,600	- 200	-0.9	- 324	- 0.5
Sheridan	17,852	18,200	348	1.0	18,500	300	1.3	648	1.1
Weston	6,307	6,300	- 7	0.0	6,500	200	0.9	193	0.3
Regional Total	107,364	143,700	36,336	100.0	167,000	23,300	100.0	59,636	100.0

Table 44

Projected Population Levels and Projected
Population as a Percentage of 1970 Populations*

County, City or Area	1970 Population	1980 Population	1970-80 pop. change Population	1985 Population	1970-85 pop. change Population	1990 Population	1970-90 pop. change Population
Campbell	12,957	32,200	148.5	45,600	251.9	50,400	289.0
Gillette	7,194	17,900	148.8	25,300	251.7	28,000	289.2
Rural	5,763	14,300	148.1	20,300	252.2	22,400	288.7
Converse	5,938	13,200	122.3	14,900	150.9	15,200	156.0
Douglas	2,677	6,000	124.1	6,700	150.3	7,000	161.5
Glenrock**	--	3,400	124.4	3,800	150.8	4,000	164.0
Rural	3,261	3,800	16.5	4,400	34.9	3,800	16.5
Crook	4,535	4,500	- 0.8	4,600	1.4	4,600	1.4
urban	--	--	--	--	--	--	--
Rural	4,535	4,500	0.8	4,600	1.4	4,600	1.4
Johnson	5,587	7,500	34.2	7,400	32.5	7,400	32.5
Buffalo	3,394	4,600	35.5	4,500	32.6	4,500	32.6
Rural	2,193	2.900	32.2	2,900	32.2	2,900	32.2
Natrona	51,264	59,000	15.1	60,400	17.8	61,800	20.6
Casper	39,361	45,300	15.1	46,400	17.9	47,500	20.7
Rural	11,903	13,700	15.1	14,000	17.6	14,300	20.1
Niobrara	2,924	2,800	- 4.2	2,700	- 7.7	2,600	- 11.1
Urban	--	--	--	--	--	--	--
Rural	2,924	2,800	- 4.2	2,700	- 7.7	2,600	- 11.1
Sheridan	17,852	18,200	1.9	18,300	2.5	18,500	3.6
Sheridan	10,856	11,100	2.2	11,100	2.2	11,300	4.1
Rural	6,994	7,100	1.5	7,200	2.9	7,200	2.9
Weston	6,307	6,300	- 0.1	6,300	- 0.1	6,500	3.1
Newcastle	3,432	3,400	- 0.9	3,400	- 0.9	3,500	2.0
Rural	2,865	2,900	1.2	2,900	1.2	3,000	4.7
Study Area Total	107,364	143,700	33.8	160,200	49.2	167,000	55.5

*City population is projected at the 1970 proportion of city to county population.
**1970 population of Glenrock was 1,515 which is below the U.S. Census urban place population requirements of 2,500.

Source: Projections developed by Water Resources Institute, University of Wyoming.

Employment Sector Breakdown

For purposes of analysis, employment is divided into ten sectors on a format identical to that used by the Water Resources Research Institute at the University of Wyoming. The ten sectors and their individual components are as follows:

1. Agriculture - includes agriculture, forestry, and fisheries employment.
2. Petrochemicals - includes petroleum, natural gas, and synthetic gas employment. (As of 1970, synthetic gas played no part in employment in any of the eight counties. Synthetic gas is synonymous with coal gasification.)
3. Coal mining - is coal mining employment only.
4. Uranium mining and milling - is uranium mining and milling operations employment only.
5. Power generation - is electric power generation employment only.
6. Other mining - is mining activity employment not related to the mining and processing of fuels. This includes mining of bentonite and other clays, stone, and sodium sulphate.
7. Other manufacturing - comprises two types of employment not related to fuels or construction: (a) processing of farm and forest products, and (b) a variety of miscellaneous manufacturing activities.
8. Railroads - is direct railroad employment only.

9. Construction - in addition to conventional construction employment, this includes sand and gravel mining, the manufacture of cement block and other nonmetallic building products, and the fabrication of structural steel.

10. Other residentiaries - comprises employment in three service sectors: (a) consumer service which exists primarily to serve local households, exclusive of governmental and educational services; (b) government and education services and public administration as well as military employment; and (c) business services which exist in large part to provide services to the business community.

Approach and Methodology for Socio-Economic Impact Analyses

In the analyses a development concept model was utilized to serve as the baseline for evaluating the impacts on a diverse number of socio-economic factors and variables. A graphic illustration of this process follows this description section.

The approach assumes that coal development triggers a complex set of actions. Coal development can be described in terms of (1) development, (2) energy conversion, and (3) distribution. The system's model becomes operational through mining operations, utilization processes and distribution systems. These interactions produce or cause effects. The effects in essence constitute the impacts. Some of these relate specifically to the area's socio-economic environment.

Incidence of the impacts is evidenced in three major socio-economic factor areas. These are: (1) population, (2) employment, and (3) income. Impacts on these factors in turn generate demands by the population (including the industries, government and general public) for facilities and services. Facilities can be considered as being the actual physical center of the activities, while services are the activities themselves. Changes in the factors of population, employment and income causes demands to be generated for facilities of the following major types: (1) housing, (2) highways-roads-streets, (3) utilities, (4) commercial business, (5) health, (6) recreation-leisure-culture, (7) criminal justice-judicial administration, (8) schools, and (9) public services. Services demands are expressed in terms of the following:

(1) shelter, (2) mobility, (3) infrastructure, (4) goods and services, (5) physical and mental health services, (6) leisure time and cultural activities, (7) law enforcement-criminal justice-judicial administration activities, (8) protection services, and (9) education.

The impacts fall into two major categories: primary and secondary. Primary impacts are those which relate to basic, necessity types of socio-economic requirements of both existing and newly generated population influx. Secondary impacts relate to nonbasic requirements that are amenities which make for a higher level of quality of life and surroundings. In order to convert primary and secondary impacts into a facilities or services, an inventory is performed to determine the existing supply base.

Based on projected demands (i.e., in population, employment and income triggered by the development program) it is possible to relate existing supply to future demands. This relationship will give a description or quantification of any net deficiencies of future demands over current supply. From this, it is then possible to convert the net deficiency into a description of needs that are unmet over the development program time horizon under evaluation. These unmet needs must be related to the system's ability to supply facilities and services. Given net deficiencies in demands and equating this to the system's supply capability net deficiency between the gap in demand and supply can now be established.

The net deficiencies comprise the impacts against which mitigation measures can be developed. Based on mitigation measures that can be feasibly applied and their relative chance of success and/or failure one is left with those which will remain regardless of the effectiveness of the mitigating measures.

These net residual impacts remaining become the unavoidable adverse impacts, decision factors for consideration of alternatives to the proposed action, indicators to be utilized in performing trade-off analyses and optimization studies of short term gains versus long term losses or vice versa, and the impacts that ultimately become the commitment of resources to loss or destruction by the action as the result of implementation of an irreversible and irretrievable course of action.

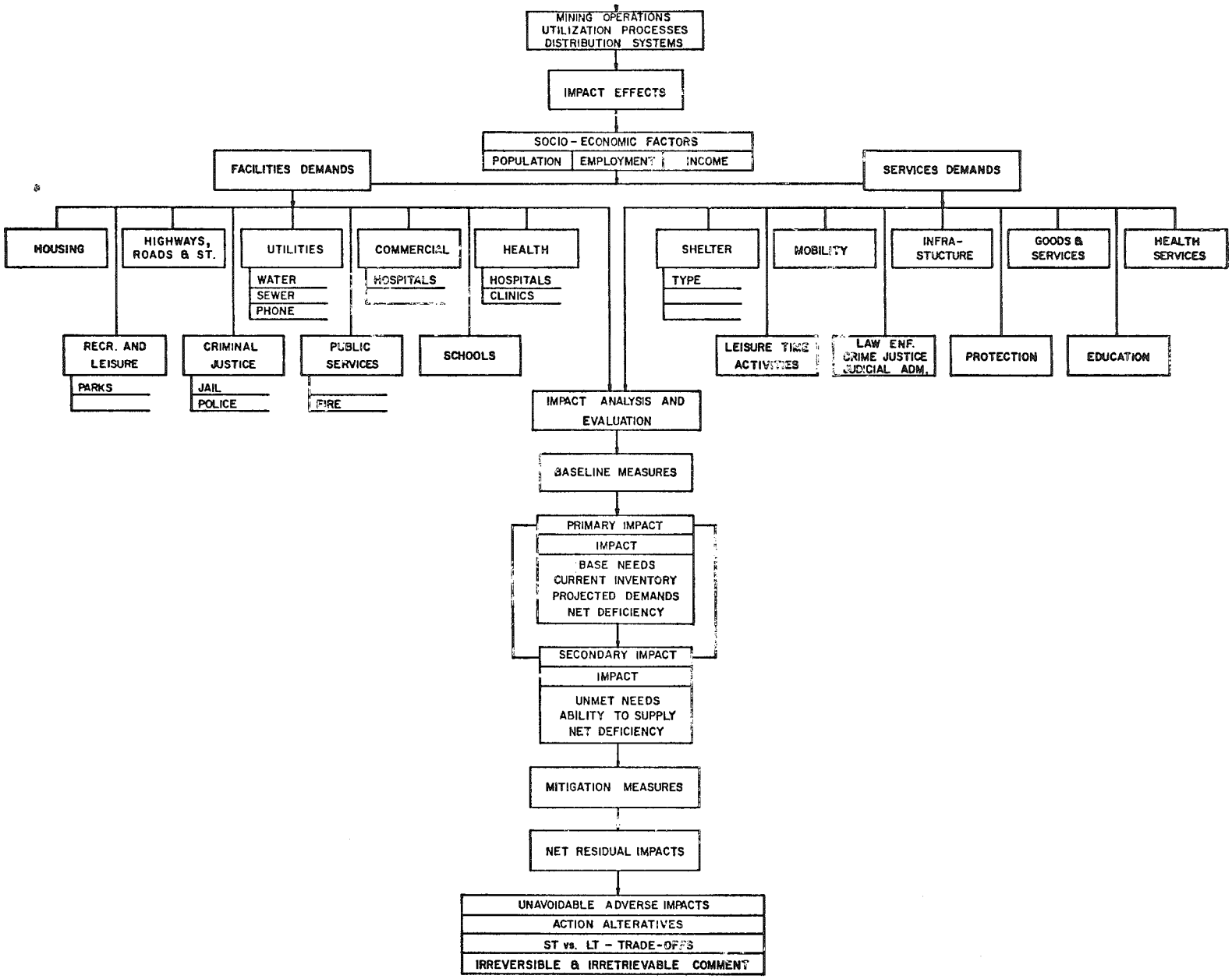
MINING OPERATIONS
UTILIZATION PROCESSES
DISTRIBUTION SYSTEMS
IMPACT EFFECTS
SOCIO-ECONOMIC FACTORS
POPULATION
EMPLOYMENT
INCOME
FACILITIES DEMANDS
SERVICES DEMANDS
HOUSING
HIGHWAYS, ROADS & ST.
UTILITIES
WATER
SEWER
PHONE
COMMERCIAL
HOSPITALS
HEALTH
HOSPITALS
CLINICS
SHELTER
TYPE
MOBILITY
INFRA-STUCTURE
GOODS & SERVICES
HEALTH SERVICES
RECR. AND LEISURE
PARKS
CRIMINAL JUSTICE
JAIL
POLICE
PUBLIC SERVICES
FIRE
SCHOOLS
LEISURE TIME ACTIVITIES
LAW ENF. CRIME JUSTICE JUDICIAL ADM.
PROTECTION
EDUCATION
IMPACT ANALYSIS AND EVALUATION
BASELINE MEASURES
PRIMARY IMPACT
IMPACT
BASE NEEDS
CURRENT INVENTORY
PROJECTED DEMANDS
NET DEFICIENCY
SECONDARY IMPACT
IMPACT
UNMET NEEDS
ABILITY TO SUPPLY
NET DEFICIENCY
MITIGATION MEASURES
NET RESIDUAL IMPACTS
UNAVOIDABLE ADVERSE IMPACTS
ACTION ALTERATIVES
ST vs. LT - TRADE-OFFS
IRREVERSIBLE & IRRETRIEVABLE COMMENT

Table 45

Eight Counties of Wyoming Powder River Basin Combined Employment*
Historic and Projected

	1960	1970		1975	1980		1985	1990	
Population	102,700	107,364		117,500	143,700		160,200	167,000	
Employment									
Agriculture	4,861	3,784	(9.2%)	3,659	3,510	(6.0%)	3,400	3,319	(4.7%)
Petrochemicals Petroleum and Natural gas	4,964	5,135	(12.4)	5,006	4,895	(8.4)	5,147	5,143	(7.3)
Synthetic Gas	---	---		---	800	(1.4)	1,600	1,600	(2.3)
Coal Mining	95	224	(0.5)	310	1,682	(2.9)	2,542	3,022	(4.3)
Uranium Mining and Milling	136	572	(1.4)	850	1,472	(2.5)	1,772	1,744	(2.5)
Power Generation	193	221	(0.5)	425	350	(0.6)	550	753	(1.1)
Other Mining	126	269	(0.7)	331	407	(0.7)	472	520	(0.7)
Other Manufacturing	1,150	931	(2.3)	993	1,052	(1.8)	1,159	1,316	(1.9)
Railroads	518	305	(0.7)	305	519	(0.9)	608	656	(0.9)
Construction	3,677	3,196	(7.7)	4,729	6,827	(11.7)	6,506	6,762	(9.6)
Other Residentiaries	22,799	26,616	(64.5)	29,870	36,799	(63.1)	43,506	45,463	(64.7)
Total Employment	38,519	41,253	(99.9)	46,478	58,313	(100.0)	67,262	70,298	(100.0)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

	1960	1970		1975	1980		1985	1990	
Population	5,861	12,957		16,500	32,200		45,600	50,400	
Employment									
Agriculture	670	601	(12.5%)	579	555	(4.0%)	538	527	(2.4%)
Petrochemicals									
Petroleum and Natural gas	224	1,364	(28.4)	1,332	1,302	(9.4)	1,376	1,375	(6.1)
Synthetic Gas	---	---		---	800	(5.8)	1,600	1,600	(7.2)
Coal Mining	32	32	(0.7)	152	1,466	(10.6)	2,330	2,810	(12.7)
Uranium Mining and Milling	2	---		---	150	(1.1)	250	250	(1.1)
Power Generation	---	40	(0.8)	73	73	(0.5)	273	473	(2.1)
Other Mining	---	---		---	---		---	---	
Other Manufacturing	18	131	(2.7)	141	148	(1.1)	163	189	(0.9)
Railroads	22	11	(0.3)	11	77	(0.6)	91	91	(0.4)
Construction	189	268	(5.6)	1,604	3,107	(22,4)	2,604	2,773	(12.5)
Other Residentiaries	1,120	2,356	(49.1)	3,041	6,174	(44.6)	10,839	12,079	(54.5)
Total Employment	2,277	4,803	(100.1)	6,933	13,852	(100.1)	20,064	22,167	(99.9)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

Table 46

Campbell County - Historical and Projected Employment

Table 47

Converse County - Historical and Projected Employment*

	1960	1970		1975	1980		1985	1990	
Population	6,366	5,938		9,900	13,200		14,900	15,200	
Employment									
Agriculture	580	486	(22.4%)	469	450	(8.3%)	437	424	(6.6%)
Petrochemicals									
Petroleum and Natural Gas	177	204	(9.4)	199	186	(3.4)	206	205	(3.2)
Synthetic Gas	---	---		---	---		---	---	
Coal Mining	17	39	(1.8)	68	194	(3.6)	190	190	(3.0)
Uranium Mining and Milling	30	71	(3.3)	350	572	(10.6)	772	772	(12.1)
Power Generation	25	---		188	188	(3.5)	188	188	(2.9)
Other Mining	---	---		---	---		20	---	
Other Manufacturing	16	16	(0.7)	17	18	(0.3)	20	23	(0.4)
Railroads	25	6	(0.3)	22	181	(3.3)	256	304	(4.8)
Construction	192	225	(10.4)	318	434	(8.0)	502	511	(8.0)
Other Residentiaries	1,345	1,121	(51.7)	2,348	3,198	(59.0)	3,699	3,765	(59.0)
Total Employment	2,407	2,168	(100.0)	3,979	5,421	(100.0)	6,270	6,382	(100.0)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

	1960	1970		1975	1980		1985	1990	
Population	4,691	4,535		4,500	4,500		4,600	4,600	
Employment									
Agriculture	637	461	(28.9%)	447	428	(25.5%)	414	405	(22.3%)
Petrochemicals Petroleum and Natural Gas	34	61	(3.8)	60	59	(3.5)	59	59	(3.3)
Synthetic Gas	---	---		---	---		---	---	
Coal Mining	---	---		---	---		---	---	
Uranium Mining and Milling	37	---		---	---		---	---	
Power Generation	---	---		---	---		---	---	
Other Mining	71	130	(8.1)	160	197	(11.7)	228	252	(13.9)
Other Manufacturing	88	60	(3.8)	64	68	(4.0)	75	85	(4.7)
Railroads	8	8	(0.5)	6	6	(0.4)	6	6	(0.3)
Construction	193	173	(10.8)	172	168	(10.0)	156	163	(9.0)
Other Residentiaries	550	703	(44.0)	725	754	(44.9)	796	843	(46.5)
Total Employment	1,618	1,596	(99.9)	1,634	1,680	(100.0)	1,734	1,813	(100.0)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

Table 48

Crook County - Historical and Projected Employment·

Table 49

Johnson County - Historical and Projected Employment*

	1960	1970		1975	1980		1985	1990	
Population	5,475	5,587		5,200	7,500		7,400	7,400	
Employment									
Agriculture	549	410	(18.6%)	398	382	(12.8%)	369	360	(12.1%)
Petrochemicals									
Petroleum and Natural Gas	146	101	(4.6)	98	96	(3.2)	96	96	(3.2)
Synthetic Gas	---	---		---	---		---	---	
Coal Mining	---	34	(1.5)	---	---		---	---	
Uranium Mining and Milling	3	---		---	250	(8.4)	250	250	(8.4)
Power Generation	---	---		---	---		---	---	
Other Mining	2	19	(0.9)	23	29	(1.0)	33	36	(1.2)
Other Manufacturing	63	44	(2.0)	47	50	(1.7)	55	62	(2.1)
Railroads	---	---		---	---		---	---	
Construction	235	294	(13.4)	210	290	(9.7)	268	268	(9.0)
Other Residentiaries	968	1,300	(59.0)	1,320	1,892	(63.3)	1,903	1,906	(64.0)
Total Employment	1,966	2,202	(100.0)	2,096	2,989	(100.0)	2,974	2,978	(100.0)

* Percentage of employment by sector in parentheses for 1970, 1980, and 1990
Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

	1960	1970		1975	1980		1985	1990	
Population	49,623	51,264		54,200	59,000		60,400	61,800	
Employment									
Agriculture	558	483	(2.4%)	467	448	(1.9)	434	423	(1.6)
Petrochemicals									
Petroleum and Natural Gas	3,745	2,906	(14.2)	2,839	2,774	(11.5)	2,932	2,930	(11.0)
Synthetic Gas	---	---		---	---		---	---	
Coal Mining	---	---		---	---		---	---	
Uranium Mining and Milling	64	501	(2.5)	500	500	(2.1)	500	472	(1.8)
Power Generation	78	106	(0.5)	106	31	(0.1)	31	34	(0.1)
Other Mining	10	17	(0.1)	21	26	(0.1)	30	33	(0.1)
Other Manufacturing	523	460	(2.3)	489	520	(2.2)	572	647	(2.4)
Railroads	255	145	(0.7)	130	114	(0.5)	114	114	(0.4)
Construction	1,845	1,545	(7.6)	1,734	2,134	(8.8)	2,279	2,327	(8.8)
Other residentiaries	11,943	14,233	(69.8)	15,390	17,634	(72.9)	19,097	19,609	(73.7)
Total Employment	19,021	20,396	(100.1)	21,676	24,181	(100.1)	25,989	26,589	(99.9)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Intitutue, University of Wyoming - Prepared for Bureau of Land Management.

Table 50

Natrona County - Historical and Projected Employment

Table 53

Weston County - Historical and Projected Employment*

	1960	1970		1975	1980		1985	1990	
Population	7,929	6,307		6,100	6,300		6,300	6,500	
Employment									
Agriculture	362	227	(9.9%)	222	215	(9.4)	208	203	(8.5)
Petrochemicals									
Petroleum and Natural Gas	509	394	(17.3)	377	377	(16.5)	377	377	(15.7)
Synthetic Gas	---	---		---	---		---	---	
Coal Mining	---	---		---	---		---	---	
Uranium Mining and Milling	---	---		---	---		---	---	
Power Generation	60	45	(2.0)	28	28	(1.2)	28	28	(1.2)
Other Mining	40	100	(4.4)	123	150	(6.6)	176	194	(8.1)
Other Manufacturing	120	9	(0.4)	10	10	(0.4)	11	12	(0.5)
Railroads	10	18	(0.8)	14	14	(0.6)	14	14	(0.6)
Construction	267	146	(6.4)	142	146	(6.4)	150	168	(7.0)
Other Residentiaries	1,526	1,345	(58.9)	1,313	1,347	(58.9)	1,380	1,404	(58.5)
Total Employment	2,894	2,284	(100.1)	2,229	2,287	(100.0)	2,344	2,400	(100.1)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

	Agriculture	Petrochemicals (Petroleum and Natural Gas)	Coal Mining	Uranium Mining & Milling	Power Generation	Other Mining	Other Manu-facturing	Railroads	Construction	Other Residentiaries	Total Employment
Campbell	15.9	26.6	14.3	----	18.1	----	14.1	3.6	8.4	8.9	11.6
Converse	12.8	4.0	17.4	12.4	----	----	1.7	2.0	7.0	4.2	5.3
Crook	12.2	1.2	----	----	----	48.3	6.4	2.6	5.4	2.6	3.9
Johnson	10.8	2.0	15.2	----	----	7.1	4.7	---	9.2	4.9	5.3
Natrona	12.8	56.6	----	87.6	48.0	6.3	49.4	47.5	48.3	53.5	49.5
Niobrara	8.4	.9	----	----	----	----	.5	2.3	2.3	2.5	2.7
Sheridan	21.1	1.1	53.1	----	13.6	1.1	22.1	36.1	14.8	18.3	16.2
Weston	6.0	7.7	----	----	20.4	37.2	1.0	5.9	4.6	5.1	5.5
Total %	100.0%	100.1%	100.0%	100.0%	100.1%	100.0%	99.9%	100.0%	100.0%	100.0%	100.0%

Table 54

Percentage of County Employment
by Sector Within 8 County Region
1970

Table 55

Percentage of County Employment
by Sector Within 8 County Region
1980

	Agriculture	Petrochemicals: Petroleum & Natural Gas	Petrochemicals: Synthetic Gas	Coal Mining	Uranium Mining & Milling	Power Generation	Other Mining	Other Manufacturing	Railroads	Construction	Other Residentiaries	Total Employment
Campbell	15.8%	26.6%	100%	87.2%	10.2%	20.9%	----	14.1%	14.8%	45.5%	16.8%	23.8%
Converse	12.8	3.8	---	11.5	38.9	53.7	----	1.7	34.9	6.4	8.7	9.3
Crook	12.2	1.2	---	----	----	----	48.4%	6.5	1.2	2.5	2.0	2.9
Johnson	10.9	2.0	---	----	17.0	----	7.1	4.8	----	4.2	5.1	5.1
Natrona	12.8	56.7	---	----	34.0	8.9	6.4	49.4	22.0	31.3	47.9	41.5
Niobrara	8.5	1.0	---	----	----	----	----	0.6	1.2	1.0	1.7	1.8
Sheridan	20.9	1.1	---	1.3	----	8.6	1.2	22.1	23.3	7.0	14.0	11.7
Weston	6.1	7.7	---	----	----	8.0	36.9	1.0	2.7	2.1	3.7	3.9
Total %	100.0%	100.1%	100%	100.0%	100.1%	100.0%	100.0%	100.2%	100.1%	100.0%	99.9%	100.0%

	Agriculture	Petrochemicals		Coal Mining	Uranium Mining & Milling	Power Generation	Other Mining	Other Manu-facturing	Railroads	Construction	Other Residen-tiaries	Total Employment
		Petroleum & Natural Gas	Synthetic Gas									
Campbell	15.9%	26.7%	100%	93.0%	14.3%	62.8%	----	14.4%	13.9%	41.0%	26.6%	31.5%
Converse	12.8	4.0	---	6.3	44.3	25.0	----	1.7	46.3	7.6	8.3	9.1
Crook	12.2	1.1	---	----	----	----	48.5%	6.5	0.9	2.4	1.9	2.6
Johnson	10.8	1.9	---	----	14.3	----	6.9	4.7	----	4.0	4.2	4.2
Natrona	12.7	57.0	---	----	27.1	4.5	6.3	49.2	17.4	34.4	43.1	37.8
Niobrara	8.5	0.9	---	----	----	----	----	0.5	0.9	1.0	1.3	1.5
Sheridan	20.9	1.0	---	0.7	----	4.0	1.0	22.1	18.4	7.2	11.5	9.9
Weston	6.1	7.3	---	----	----	3.7	37.3	0.9	2.1	2.5	3.1	3.4
Total %	99.9%	99.9%	100%	100.0%	100.0%	100.0%	100.0%	100.0%	99.9%	100.1%	100.0%	100.0%

Table 56

Percentage of County Employment
by Sector Within 8 County Region
1990

Table 57

Approximate Cost Breakdown of an Average
Single-Family House, 1969

Item	Percentage of Cost NAHB	FHA
Structure		
Basement and Masonry	9.6%	9.0
Envelope	15.6	15.7
Mechanical/Electrical Services	11.4	11.4
Balance of the Structure	10.7	11.3
Inside Work	7.3	7.1
Outside Work	2.1	1.7
Total Structure	56.7%	56.2%
Other Costs		
Land	22.8%	21.5%
Financing	6.5	7.5
Overhead and Profit	12.7	13.0
Other Expenditures	1.3	1.8
Total Other Cost	43.3%	43.8%
TOTAL COST OF UNITS	100.0%	100.0%

Source: "Housing Components", National Association of Home Builders, Dec. 1973

Education Assumptions

Assumption: There will be 250 families per 1,000 population; each family unit consists of 3.5 persons.

The 1970 Census of Population provides the following information concerning family size and number of families per 1,000 population:

	Family Size	Number of Families Per 1,000 Population
State of Wyoming Average	3.53	254.8
Urban Population	3.49	252.7
Cities with 2,500-10,000 people	3.58	247.6
Cities with 10,000 or more people	3.43	255.7
Rural Population	3.61	258.0

From these figures above, 250 families per 1,000 population and an average family size of 3.5 persons was assumed for the purposes of this report.

Assumption: There will be 1.0 school age child per family unit or 250 school age children per 1,000 population.

	State of Wyoming 1960	State of Wyoming 1970	Urban Population 1970	Rural Population 1970
Number of school age children per family	0.98	1.04	1.003	1.09

Source: U.S. Bureau of Census, Census of Population, 1970.

Assumption: The number of school age children per family by school grade level are provided below:

Type of School	Grade Levels	Number of school age Children Per Family Unit
Elementary	K - 6	0.500
Junior High	7 - 9	0.250
Senior High	10 - 12	0.250

Table 58 provides the percentage of elementary, junior high and senior high school students in Powder River Basin School Districts. The above assumptions were made using regional averages.

Table 58
Percentage of Elementary, Jr. High, Sr. High Students in School Districts of Powder River Basin
1972-1973

School Districts	Enrollment Fall	Elementary (K-6) Number	Elementary (K-6) %	Jr. High (7-9) Number	Jr. High (7-9) %	Sr. High (10-12) Number	Sr. High (10-12) %
Gillette	3,117	1,704	54.7	790	25.3	623	20.0
Douglas	1,153	590	51.2	280	24.3	283	24.5
Glenrock	685	359	52.4	172	25.1	154	22.5
Sundance	1,239	659	53.2	299	24.1	281	22.7
Buffalo	1,271	591	46.5	344	27.1	336	26.4
Casper	13,505	6,617	49.0	3,437	25.4	3,451	25.5
Lusk	661	330	49.9	165	25.0	166	25.1
Ranchester	627	267	42.6	185	29.5	175	27.9
Sheridan	3,276	1,593	48.6	812	24.8	871	26.6
Clearmont	115	52	45.2	32	27.8	31	27.0
Newcastle	1,289	654	50.7	339	26.3	296	23.0
Upton	381	161	42.3	103	27.0	117	30.7
Region	27,319	13,577	49.7	6,958	25.5	6,784	24.8
State	84,831	43,841	51.7	21,275	25.1	19,715	23.2

Source: Wyoming State Department of Education, Division of Management Information Services, (1974).

District	1968	1969	1968-69 % Change	1970	1969-70 % Change	1971	1970-71 % Change	1972	1971-72 % Change	1973	1972-73 % Change
Campbell	2,489	2,979	19.7	3,281	10.1	2,968	-9.5	3,146	6.0	3,060	-2.7
(1 Gillette)											
Converse	1,609	1,645	2.2	1,795	9.1	1,786	-0.5	1,846	3.4	1,783	-3.7
(1 Douglas)								(1,153)		(1,104)	(-4.2)
(2 Glenrock)								(693)		(679)	(-2.7)
Crook	1,251	1,269	1.4	1,283	1.1	1,237	-3.6	1,246	0.4	1,187	-4.7
(1 Sundance)											
Johnson	1,414	1,363	-3.6	1,359	-0.3	1,287	-5.3	1,271	-1.2	1,209	-4.9
(1 Buffalo)											
Natrona	14,533	14,561	0.2	14,403	-1.1	14,118	-2.0	13,769	-2.5	13,181	-4.3
(Casper)											
Niobrara	761	731	-3.9	698	-4.5	650	-6.9	665	2.3	616	-7.4
(1 Lusk)											
Sheridan	4,193	4,144	-1.2	4,107	-0.9	4,103	-0.1	4,079	-0.6	4,074	-0.1
(1 Ranchester)								(627)		(660)	(5.3)
(2 Sheridan)								(3,337)		(3,291)	(-1.4)
(3 Clearmont)								(115)		(123)	(7.0)
Weston	1,941	1,871	-3.6	1,826	-2.4	1,741	-4.7	1,683	-3.3	1,644	-2.3
(1 Newcastle)								(1,302)		(1,266)	(-2.8)
(7 Upton)								(381)		(378)	(-0.8)
State	86,013	86,440	0.5	86,886	0.5	86,430	-0.5	86,017	-0.5	85,391	-0.7

Source: Wyoming State Department of Education, Division of Management Information Services.

Table 59

Fall Enrollment in Powder River Basin School Districts
1968-1973

Table 60

Average Daily Membership*
(ADM)
1968-1973

District	1968-69	1969-70	Percent Change	1970-71	Percent Change	1971-72	Percent Change	1972-73	Percent Change
Campbell	2,561	3,021	18.0	3,116	3.1	2,799	-10.2	3,126	11.7
(1 Gillette)									
Converse	1,613	1,631	1.1	1,816	11.3	1,792	- 1.3	1,771	- 1.2
(1 Douglas)						(1,117)	(-)	(1,071)	(-4.1)
(2 Glenrock)						(675	(-)	(700)	(3.7)
Crook	1,257	1,262	0.4	1,283	1.7	1,219	- 5.0	1,245	2.1
(1 Sundance)									
Johnson	1,357	1,365	0.6	1,333	- 2.3	1,277	- 4.2	1,298	1.6
(1 Buffalo)									
Natrona	14,351	14,427	0.5	14,240	- 1.3	13,935	- 2.1	13,538	- 2.8
(1 Casper)									
Niobrara	766	712	- 7.1	692	- 2.8	659	- 4.8	655	- 0.6
(1 Lusk)									
Sheridan	4,241	4,093	- 3.5	4,144	1.3	4,128	- 0.4	4,051	- 1.9
(1 Ranchester)						(590)	(-)	(647)	(9.7)
(2 Sheridan)						(3,407)	(-)	(3,286)	(-3.6)
(3 Clearmont)						(131)	(-)	(118)	(-10.0)
Weston	1,934	1,855	- 4.1	1,797	- 3.1	1,724	- 4.1	1,698	- 1.5)
(1 Newcastle)						(1,316)	(-)	(1,301)	(-1.1)
(7 Upton)						(408)	(-)	(397)	(-2.7)
State	85,228	85,424	0.2	86,086	0.8	85,331	- 0.9	85,002	- 0.4

*ADM means the total numbers of pupils present plus the total number of pupils absent, divided by the actual number of days the school was in session for the year. When a pupil is absent more than 10 consecutive days, all those days over 10 are deleted. A pupil who withdraws is dropped from membership the day after the last day he attended.

Source: Wyoming Public Schools General Fund Accounting, 1968 through 1973.

County (District)	Number of Schools	ADM	CRU**	ADM/ CRU	Assessed Valuation Per Pupil in ADM: Dollars	Assessed Valuation Per Pupil in ADM: County Rank in State	Effective Expenditure Per Pupil in ADM: Dollars
Campbell	20	3,126	159	19.7	48,228	1	1,219
Converse*	21	1,771	111	16.0	38,679	2	1,067
(Douglas)	(14)	(1,071)	(70)	(15.3)	(44,417)		(1,107)
(Glenrock)	(7)	(700)	(41)	(17.2)	(29,876)		(1,004)
Crook	16	1,245	88	14.1	22,897	10	1,139
Johnson	9	1,298	77	16.9	26,336	6	1,097
Natrona	37	13,538	724	18.7	10,984	21	865
Niobrara	10	655	46	14.1	25,241	7	1,132
Sheridan*	23	4,051	242	16.7	10,968	22	908
(Ranchester)	(8)	(647)	(45)	(14.3)	(12,695)		(1,040)
(Sheridan)	(12)	(3,286)	(184)	(17.8)	(9,788)		(851)
(Clearmont)	(3)	(118)	(13)	(8.8)	(34,370)		(1,746)
Weston*	8	1,698	101	16.8	18,893	14	1,017
(Newcastle)	(5)	(1,301)	(73)	(17.7)	(17,686)		(995)
(Upton)	(3)	(397)	(28)	(14.2)	(22,810)		(1,092)
State	394	85,002	4,859	17.2	16,893		948

*County has more than one school district; school district figures are aggregated for the county; individual school district data are presented in parentheses above.

**Classroom Units

Source: Wyoming Public Schools General Fund Accounting 1972-73,i, Wyoming State Department of Education, Division of Planning, Evaluation and Information Services.

Table 61

ADM/CRU, Assessed Valuation and Total Expenditure Per Pupil in ADM
Powder River Basin School Districts
1972-1973

Table 62

Public School Revenues by School District
in Powder River Basin Counties: 1972-1973

District	Total Revenue Receipts	Sources of Revenues by Percent			
		District	County	State	Federal
Campbell (1 Gillette)	$ 5,457,573	58.5	36.9	4.5	0.09
Converse					
(1 Douglas)	1,465,323	54.8	38.7	6.4	0.12
(1 Glenrock)	812,977	52.4	40.2	7.0	0.40
Crook (1 Sundance)	1,653,021	41.8	26.1	32.0	0.13
Johnson (1 Buffalo)	1,530,389	53.0	31.7	14.7	0.64
Natrona (1 Casper)	12,148,074	30.3	18.8	49.1	1.74
Niobrara (1 Lusk)	865,107	43.4	28.1	28.4	0.11
Sheridan					
(1 Ranchester)	736,303	26.3	17.5	56.0	0.14
(2 Sheridan)	2,985,916	27.7	18.3	52.0	1.98
(3 Clearmont)	244,342	37.4	18.4	44.2	0
Weston					
(1 Newcastle)	1,324,691	45.0	26.1	28.7	0.20
(7 Upton)	513,560	44.4	26.4	29.2	0.08
Region	$29,737,276	40.1	25.4	33.5	1.00
State	$91,009,500	37.2	23.4	36.0	3.38

Source: Wyoming Public Schools General Fund Accounting, 1972-1973, State Department of Education, Division of Planning, Education and Information Services.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
CITY OF BUFFALO						
ELEMENTARY:						
1. Buffalo	1-8*	608	650	93.5	5	Three permanent buildings
SENIOR HIGH:						
1. Buffalo	9-12	400	500	60.0	10	Permanent building
RURAL SCHOOLS						
ELEMENTARY:						
1. Barnum	1-4	5	40	12.5	--	Permanent, mason building
2. Billy Creek	1-4	10	40	25.0	--	Permanent building
3. Kaycee	1-8	100	180	55.6	--	Permanent building
4. Kearney	1-4	4	20	20.0	--	Permanent, wood frame building
5. Linch	1-6	35	125	28.0	--	Permanent, brick building and wood frame building
6. Sussex	1-6	7	50	14.0	--	Permanent brick building
SENIOR HIGH:						
1. Kaycee	9-12	55	100	55.0	15-20	New, permanent

*Kindergarten class will start in Fall 1974.

Source: Mr. Gerald Carroll, District Superintendent, Johnson County Unified School District, March, 1974.

Table 63

Johnson County Unified School District
1974

Table 64

Public Schools in Sheridan County
1974

School District, Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	Percent of Maximum Capacity
Ranchester S.D. #1				
1. Tongue River Elementary	K-6	150	180	83.3
2. Tongue River Jr.-Sr. High	7-12	210	210	100.0
3. Big Horn Elementary	K-6	129	159	81.1
4. Big Horn Jr.-Sr. High	7-12	163	180	90.6
5. Slack Rural	1-5	9	15	60.0
6. Big Goose Rural	-	Closed	-	-
Sheridan S.D. #2				
Elementary:				
1. Coffeen	K-6	397	-	-
2. Highland Park	K-6	381	-	-
3. Hill	Sp.Ed.	69	-	-
4. Linden	K-6	340	-	-
5. Taylor	K-6	161	-	-
6. Woodland Park	K-6	209	-	-
Junior High:				
1. Central	7-8	427	-	-
2. Woodland Park	7-8	75	-	-
Senior High:				
1. Sheridan	9-12	1,104	-	-
Rural Schools:				
1. Acme	1-6	33	-	-
2. Beckton	1-6	6	-	-
3. Story	1-6	46	-	-
Totals		3,248	3,600	90.2
Clearmont S.D. #3				
1. Clearmont Elementary	1-6	29	40	48.3
2. Arvada Elementary	1-6	14	40	35.0
3. Clearmont Jr.-Sr. High	7-12	75	200	37.5

Source: School Superintendents of Ranchester and Clearmont Unified School Districts and Assistant Superintendent of Sheridan Unified School District, March 1974.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
SUNDANCE						
1. Elementary	K-6	251	330	76.1	12	Inadequate facilities
2. Junior High	7-8	100	130	76.9	--	Permanent building
3. Senior High	9-12	154	195	79.0	2-3	Permanent building
MOORCROST						
1. Elementary	K-6	187	220	85.0	20	Three schools located in
2. Junior High	7-8	67	110	60.9		a single, permanent
3. Senior High	9-12	100	140	71.4		education complex
HULETT						
1. Elementary	K-6	139	145	95.9	10	Three schools located in
2. Junior High	7-8	43	70	61.4		single, permanent
3. Senior High	9-12	86	105	81.9		education complex
RURAL SCHOOLS						
1. Baroid	1-6	19	40	47.5		Permanent, wood frame building
2. Brislawn	1-8	6	10	60.0		Trailer, school house
3. Bunny	1-8	4	18	22.2		Permanent building
4. Four Oaks	1-8	11	13	84.6		Mobile trailer
5. Homestake	1-8	3	30	10.0		Permanent building
6. Nebraska	1-8	5	10	50.0		Permanent building
7. Robinson	1-8	3	12	25.0		Permanent building

Source: Dr. Hugo Hendricks, District Superintendent, Crook County Unified School District, telephone interview, March 1974.

Table 65

Public Schools
Crook County Unified School District
1974

Table 66

Niobrara County Unified School District
1974

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
LUSK						
ELEMENTARY:						
1. Lusk	K-5	190	225	84.4	2	Permanent, brick and block bldg.
MIDDLE:						
1. Lusk Jr. High	6-8	145	150	96.7	2	Permanent building
SENIOR HIGH:						
1. Niobrara County	9-12	200	300	66.7	15-20	Permanent building
RURAL SCHOOLS						
1. Cheyenne River	1-8	6	25	24.0	-	2-room, wood frame building
2. Cow Creek	1-8	6	25	24.0	-	2-room, wood frame building
3. Fairview	1-8	2	25	8.0	-	2-room, wood frame building
4. Indian Creek	1-8	7	15	46.7	-	2-room, wood frame building
5. Lance Creek	1-8	14	125	11.2	-	8-room, wood frame building
6. Manville	1-8	32	100	32.0	-	2-storey, brick building
7. Seven Mile	1-8	2	25	8.0	-	2-room, wood frame building

Source: Mr. Lee Johsonbaugh, District Superintendent, Niobrara County Unified School District, April 3, 1974.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
SCHOOL DISTRICT #1*						
NEWCASTLE						
Elementary:						
1. Gertrude Burno	K-6	569	800	71.1	10	Permanent building
Junior High:						
1. Newcastle	7-8	206	250	82.4	5	Permanent building
Senior High:						
1. Newcastle	9-12	408	475	85.9	17	Permanent building
RURAL SCHOOLS						
1. Darlington	1-6	3	12	25.0	-	Permanent building
2. Osage	K-6	80	120	66.7	8	Permanent building
SCHOOL DISTRICT #7**						
UPTON						
1. Elementary	1-6	180	250	72.0	2-3	Permanent buildings complex houses the elementary and junior and senior high school
2. Junior High	7-8	75	95	80.0		
3. Senior High	9-12	150	225	66.7		

Source: * Mr. A. L. Albert, District Superintendent, Unified School District #1, March 1974, and
** Mr. Laverne Boal, District Superintendent, Unified School District #7, March, 1974.

Table 67

Public Schools in Weston County
Newcastle Unified School District #1 and Upton Unified School District #7
1974

Table 68

Public Schools in Casper, Natrona County Unified School District
1974

Type and Name of School	Grade Levels	Current Enrollment	Schoolsite Acreage
Elementary:			
1. Crest Hill	K-6	338	4.0
2. Evansville	K-6	242	2.15
3. Fairdale	K-6	381	5.05
4. Fort Casper	K-6	244	5.8
5. Garfield	K-6	230	4.1
6. Grant	K-6	350	2.06
7. Jefferson	K-6	283	1.6
8. Lincoln-Roosevelt	K-6	386	3.2
9. Manor Heights	K-6	332	6.8
10. McKinley	K-6	276	3.5
11. McKinley Annex	Sp.Ed.	51	-
12. Mills	K-6	289	2.2
13. Mountain View	K-6	286	3.85
14. Paradise Valley	K-6	336	8.0
15. Park	K-6	301	2.06
16. Pineview	K-6	385	8.47
17. Southridge	K-6	358	3.16
18. University Park	K-6	175	3.7
19. Westwood	K-6	363	3.3
20. Willard	K-6	359	2.5
21. Woods	Sp.Ed.	51	4.0
Sub-total		6,099	
Junior High:			
1. Cy	7-9	901	17.5
2. East	7-9	990	17.0
3. Morgan	7-9	1,457	4.4
Sub-total		3,348	
Senior High:			
1. Natrona County	10-12	1,847	11.3
2. Kelly Walsh	10-12	1,153	57.48
Sub-total		3,000	

Source: Mr. Gene R. Snider, Assistant Superintendent, Business Affairs, Natrona County Unified School District.

Table 69

Rural Schools and Learning Disabilities
Natrona County Unified School District
1974

Type and Name of School	Grade Levels	Current Enrollment	School Site Acreage
MIDWEST			
1. Elementary	K - 6	121	10.5
2. Jr.-Sr. High	7 - 12	139	10.5
Total		260	
RURAL SCHOOLS			
1. Alcova	1 - 7	19	-
2. Arminto	2 - 7	13	-
3. Bell Ranch	4 - 6	3	-
4. Forest Oil	2 - 5	4	-
5. Poison Spider	K - 6	153	-
6. Powder River	1 - 8	48	-
7. Red Creek	K - 1	3	-
8. Willow Creek	2 - 7	5	-
Total		248	
CASPER LEARNING DISABILITIES			
1. Fort Casper	-	25	-
2. Garfield	-	12	-
3. Grant	-	12	-
4. Jefferson	-	26	-
5. Lincoln Roosevelt	-	25	-
6. McKinley	-	37	-
7. Pineview	-	28	-
8. Willard	-	12	-
Total		177	

Source: Mr. Gene R. Snider, Asst. Superintendent, Natrona County Unified School District, April, 1974.

Table 70

Public School Enrollment Projections
Campbell County
1975-1990

	1970	1975	% Change 1970-74	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	12,957	16,500	31.0	32,200	95.2	45,600	41.6	50,400	10.5
No. of Families per 1000 population	238	250	----	250	----	250	----	250	----
Total No. of Families	3,085	4,120	33.7	8,050	95.4	11,400	41.6	12,600	10.5
School Age Children per Family	0.97	1.0	----	1.0	----	1.0	----	1.0	----
School Age Children per 1000 Popu.	230	250	----	250	----	250	----	250	----
Total School Enrollment	2,979	4,120	38.2	8,050	95.4	11,400	41.6	12,600	10.5
Elementary Pupils (K-6) (% of total enrollment)	1,749 (58.7%)	2,060 (50.0%)*	17.8	4,030	95.6	5,700	41.4	6,300	10.5
Junior High Pupils (7-9) (% of total enrollment)	681 (22.9%)	1,030 (25.0%)*	51.2	2,010	95.1	2,850	41.8	3,150	10.5
Senior High Pupils (10-12) (% of total enrollment)	549 (18.4%)	1,030 (25.0%)*	87.6	2,010	95.1	2,850	41.8	3,150	10.5

*Assumed percentages of enrollment apply from 1975 through 1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	5,938	9,900	66.7	13,200	33.3	14,900	12.9	15,500	4.0
No. of Families per 1000 Population	266	250	----	250	----	250	----	250	---
Total No. of Families	1,582	2,475	56.4	3,300	33.3	3,725	12.9	3,875	4.0
School Age Children per Family	1.04	1.0	----	1.0	----	1.0	----	1.0	---
School Age Children per 1000 Popu.	277	250	----	250	----	250	----	250	---
Total School Enrollment	1,645	2,475	50.5	300	33.3	3,725	12.9	3,875	4.0
Elementary Pupils (K-6)	848	1,235	45.6	1,650	33.6	1,865	13.0	1,935	3.8
(% of total enrollment)	(51.6%)	(50.0%)**							
Junior High Pupils (7-9)	435	620	42.5	825	33.1	930	12.7	970	4.3
(% of total enrollment)	(26.4%)	(25.0%)**							
Senior High Pupils (10-12)	362	620	71.3	825	33.1	930	12.7	970	4.3
(% of total enrollment)	(22.0%)	(25.0%)**							

*Includes Douglas Unified School District #1 and Glenrock Unified School District #2.

**Assumed percentages of enrollment apply from 1975 to 1990.

Table 71

Public School Enrollment Projections
Converse County*
1975-1990

Table 72

Public School Enrollment Projections
Johnson County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	5,587	5,200	-5.0	7,500	44.2	7,400	-1.3	7,400	0
No. of Families per 1000 Population	270	250	---	250	----	250	---	250	-
Total No. of Families	1,509	1,300	-13.9	1,875	44.2	1,850	-1.3	1,850	0
School Age Children per Family	0.9	1.0	----	1.0	----	1.0	---	1.0	-
School Age Children per 1000 Population	244	250	----	250	----	250	---	250	-
Total School Enrollment	1,363	1,300	-4.6	1,875	44.2	1,850	-1.3	1,850	0
Elementary Pupils (K-8) (% of total enrollment)	940 (69.0%)	865 (66.7%)*	-8.0	1,250	44.5	1,230	-1.6	1,230	0
Jr.-Sr. High Pupils (9-12) (% of total enrollment)	423 (31.0%)	435 (33.3%)*	2.8	625	43.7	620	-0.8	620	0

*Assumed percentages of enrollment apply from 1975 to 1990.

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	17,852	18,200	1.9	18,200	0	18,300	0.5	18,500	1.1
No. of Families per 1000 Population	267	250	----	250	-	250	---	250	---
Total No. of Families	4,766	4,550	-4.5	4,550	0	4,575	0.5	4,625	1.1
School Age Children per Family	0.87	1.0	----	1.0	-	1.0	---	1.0	---
School Age Children per 1000 Population	232	250	----	250	-	250	---	250	---
Total School Enrollment	4,144	4,550	9.8	4,550	0	4,575	0.5	4,625	1.1
Elementary Pupils (K-6) (% of total enrollment)	2,034 (49.1%)	2,270 (50%)**	11.6	2,270	0	2,285	0.7	2,315	1.3
Junior High Pupils (7-9) (% of total enrollment)	1,048 (25.3%)	1,140 (25%)**	8.8	1,140	0	1,145	0.4	1,155	0.9
Senior High Pupils (10-12) (% of total enrollment)	1,062 (25.6%)	1,140 (25%)**	7.3	1,140	0	1,145	0.4	1,155	0.9

*Includes Sheridan, Ranchester, and Clearmont Unified School Districts.

**Assumed percentages of enrollment apply from 1975 to 1990.

Table 73

Public School Enrollment Projections
Sheridan County*
1975-1990

Table 74

Public School Enrollment Projections
Crook County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	4,535	4,500	-0.8	4,500	0	4,600	2.2	4,600	0
No. of Families per 1000 Population	270	250	----	250	-	250	---	250	-
Total No. of Families	1,224	1,125	-8.1	1,125	0	1,150	2.2	1,150	0
School Age Children per Family	1.04	1.0	----	1.0	-	1.0	---	1.0	-
School Age Children per 1000 Population	280	250	----	250	-	250	---	250	-
Total School Enrollment	1,269	1,125	-11.3	1,125	0	1,150	2.2	1,150	0
Elementary Pupils (K-6) (% of total enrollment)	689 (54.3%)	565 (50%)*	-18.0	565	0	575	1.8	575	0
Junior High Pupils (7-8) (% of total enrollment)	202 (15.9%)	185 (16.7%)*	-8.4	185	0	190	2.7	190	0
Senior High Pupils (9-12) (% of total enrollment)	378 (29.8%)	375 (33.3%)*	-0.8	375	0	385	2.7	385	0

*Assumed percentages of enrollment apply from 1975 to 1990.

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	2,924	2,900	-0.8	2,800	-3.4	2,700	-3.6	2,600	-3.7
No. Of Families per 1000 Population	270	250	---	250	---	250	---	250	---
Total No. of Families	791	725	-8.3	700	-3.4	675	-3.6	650	-3.7
School Age Children per Family	0.92	1.0	---	1.0	---	1.0	---	1.0	---
School Age Children per 1000 Population	250	250	---	250	---	250	---	250	---
Total School Enrollment	731	725	-0.8	700	-3.4	675	-3.6	650	-3.7
Elementary Pupils (K-5) (% of total enrollment)	328 (44.9%)	305 (41.7%)*	-7.0	290	-4.9	280	-3.4	270	-3.6
Junior High Pupils (6-8) (% of total enrollment)	166 (22.7%)	180 (25%)*	8.4	175	-2.8	170	-2.9	165	-2.9
Senior High Pupils (9-12) (% of total enrollment)	237 (32.4%)	240 (33.3%)*	1.3	235	-2.1	225	-4.3	215	-4.3

*Assumed percentages of enrollment apply from 1975 to 1990.

Table 75

Public School Enrollment Projections
Niobrara County

Table 76

Public School Enrollment Projections
Natrona County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	51,264	54,200	5.7	59,000	8.9	60,400	2.4	61,800	2.3
No. of Families per 1000 Population	256	250	----	250	----	250	---	250	---
Total No. of Families	13,132	13,550	3.2	14,750	8.9	15,100	2.4	15,450	2.3
School Age Children per Family	1.1	1.0	----	1.0	----	1.0	---	1.0	---
School Age Children per 1000 Population	284	250	----	250	----	250	---	250	---
Total School Enrollment	14,561	13,550	-6.9	14,750	8.9	15,100	2.4	15,450	2.3
Elementary Pupils (K-6) (% of total enrollment)	7,814 (53.7%)	6,770 (50%)*	-13.4	7,370	8.9	7,500	2.4	7,730	2.4
Junior High Pupils (7-9) (% of total enrollment)	3,493 (24.4%)	3,290 (25%)*	-5.8	3,690	12.2	3,775	2.3	3,860	2.3
Senior High Pupils (10-12) (% of total enrollment)	3,254 (22.3%)	3,290 (25%)*	1.1	3,690	12.2	3,775	2.3	3,860	2.3

*Assumed percentages of enrollment apply from 1975 to 1990.

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	6,307	6,100	-3.3	6,300	3.3	6,300	0	6,500	3.2
No. of Families per 1000 Population	256	250	----	250	---	250	-	250	---
Total No. of Families	1,615	1,525	-5.6	1,575	3.3	1,575	0	1,625	3.2
School Age Children per Family	1.16	1.0	----	1.0	---	1.0	-	1.0	---
School Age Children per 1000 Population	297	250	----	250	---	250	-	250	---
Total School Enrollment	1,871	1,525	-18.5	1,575	3.3	1,575	0	1,625	3.2
Elementary Pupils (K-6)	984	760	-22.8	785	3.3	785	0	815	3.8
(% of total enrollment)	(52.6%)	(50%)**							
Junior High Pupils (7-8)	319	255	-20.1	265	3.9	265	0	270	1.9
(% of total enrollment)	(17.0%)	(16.7%)**							
Senior High Pupils (9-12)	568	510	-10.2	525	2.9	525	0	540	2.9
(% of total enrollment)	(30.4%)	(33.3%)**							

*Includes Newcastle Unified School District #1 and Upton Unified School District #7.

**Assumed percentages of enrollment apply from 1975 to 1990.

Table 77

Public School Enrollment Projections
Weston County*
1975-1990

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	1,363	1,224	1,875	1,850	1,850
B. Maximum Capacity of Existing School Facilities*		1,705	1,705	1,705	1,705
C. Difference, A-B (+ over, - under capacity)		- 481	+ 170	+ 145	+145
D. Percentage Over (+) or Under (-) Capacity, (A/B-1		-28.2%	+10.0%	+ 8.5%	+ 8.5%
ELEMENTARY ENROLLMENT (K-8)					
A. Projected Number of Pupils	940	769	1,250	1,230	1,230
B. Maximum Capacity of Existing School Facilities*		1,105	1,105	1,105	1,105
C. Difference, A-B (+ over, - under capacity)		- 336	+ 145	+ 125	+ 125
D. Percentage Over (+) or Under (-) Capacity, (A/B)-1		-30.4%	+13.1%	+11.3%	+11.3%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils	423	455	625	620	620
B. Maximum Capacity of Existing School Facilities		600	600	600	600
C. Difference, A-B (+ over, - under capacity)		- 145	+ 25	+ 20	+ 20
D. Percentage Over (+) or Under (-) Capacity, (A/B)-1		-24.2%	+ 4.2%	+ 3.3%	+ 3.3%
FULL-TIME TEACHERS					
A. Existing Number of Teachers	84	74	74	74	74
B. Required Number of Teachers		49	75	74	74
C. Difference, A-B (+ Surplus/-deficiency)		+25	- 1	0	0

* Includes figures for rural schools (grades 1-6)
** Based on students to teacher ratio of 25 to 1

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
Total Enrollment					
A. Projected Number of Pupils*	4,144	4,027	4,550	4,575	4,625
B. Maximum Capacity of Existing School Facilities*		4,645	4,645	4,645	4,645
C. Difference, A-B (+over, - under capacity)		- 618	- 95	- 70	- 20
D. Percentage Over (+) Under (-) Capacity, (A/B)-1		-13.3%	- 2.0%	- 1.5%	- 0.4%
ELEMENTARY ENROLLMENT (K-6)					
A. Projected Number of Pupils*	2,034	1,973	2,270	2,285	2,315
B. Maximum Capacity of Existing School Facilities*		2,255	2,255	2,255	2,255
C. Difference, A-B (+over, - under capacity)		- 282	+ 15	+ 30	+ 60
D. Percentage over (+) or under (-) capacity, (A/B)-1		-12.5%	+ 0.7%	+ 1.3%	+ 2.7%
JR.-SR. ENROLLMENT (7-12)					
A. Projected Number of Pupils*	2,110	2,054	2,280	2,290	2,310
B. Maximum Capacity of Existing School Facilities		2,390	2,390	2,390	2,390
C. Difference, A-B (+ over, - under capacity)		- 336	- 110	- 110	- 80
D. Percentage over (+) or under (-) capacity, (A/B)-1		-14.1%	- 4.6%	- 4.2%	- 3.3%
FULL-TIME TEACHERS					
A. Existing Number of Teachers	213	219	219	219	219
B. Required Number of Teachers**		201	227	229	231
C. Difference, A-B (+ surplus/-deficiency)		+ 18	- 8	- 10	- 12

* Includes figures for rural schools (grades 1-6) and special education school.
** Based on students to teacher ratio of 20 to 1.

Table 79
Sheridan County Unified School Districts #1, #2, and #3 Enrollment Projections, Impact on Enrollment Capacity, and Teacher Requirements

Table 80
Crook County Unified School District Enrollment Projections,
Impact on Enrollment Capacities and Teacher Requirements

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	1,269	1,178	1,125	1,150	1,150
B. Maximum Capacity of Existing School Facilities*		1,578	1,578	1,578	1,578
C. Difference, A-B (+ over, - under capacity)		- 400	- 453	- 428	- 428
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-25.3%	-28.7%	-27.1%	-27.1%
ELEMENTARY ENROLLMENT (K-6)					
A. Projected Number of Pupils*	689	628	565	575	575
B. Maximum Capacity of Existing School Facilities*		828	828	828	828
C. Difference, A-B (+ over, - under capacity		- 200	- 263	- 253	- 253
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-24.2%	-31.8%	-30.6%	-30.6%
JUNIOR HIGH ENROLLMENT (7-8)					
A. Projected Number of Pupils*	202	210	185	190	190
B. Maximum Capacity of Existing School Facilities		310	310	310	310
C. Difference, A-B (+ over, - under capacity)		-100	-125	-120	-120
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-32.3%	-40.3%	-38.7%	-38.7%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils*	378	340	375	385	385
B. Maximum Capacity of Existing School Facilities		440	440	440	440
C. Difference, A-B (+ over, - under capacity)		-100	- 65	- 55	- 55
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-22.7%	-14.8%	-12.5%	-12.5%
FULL-TIME TEACHERS					
A. Existing Number of Teachers		84	84	84	84
B. Required Number of Teachers**		59	56	57	57
C. Difference, A-B (+ surplus/-deficiency)		+25	+28	+27	+27

* Includes figures for rural schools (grades 1-8).
** Based on students to teacher ratio of 20 to 1.

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	731	604	700	675	650
B. Maximum Capacity of Existing School Facilities*		1,015	1,015	1,015	1,015
C. Difference, A-B (+ over, - under capacity)		- 411	- 315	- 340	- 365
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-40.5%	-31.0%	-33.5%	-36.0%
ELEMENTARY ENROLLMENT (K-5)					
A. Projected Number of Pupils*	328	259	290	280	270
B. Maximum Capacity of Existing School Facilities*		565	565	565	565
C. Difference, A-B (+ over, - under capacity)		- 306	- 275	- 285	- 295
D. Percentage Over (+) or Under (-) capacity, A/B-1		-54.2%	-48.7%	-50.4%	-52.2%
JUNIOR HIGH ENROLLMENT (6-8)					
A. Projected Number of Pupils*	166	144	175	170	165
B. Maximum Capacity of Existing School Faciliites*		150	150	150	150
C. Difference, A-B (+ over, - under capacity)		- 6	+ 25	+ 20	+ 15
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		- 3.3%	-16.7%	+13.3%	+10.0%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils*	237	200	235	225	215
B. Maximum Capacity of Existing School Facilities		300	300	300	300
C. Difference, A-B (+ over, - under capacity)		- 100	- 65	- 75	- 85
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-33.3%	-21.7%	-25.0%	-28.3%
FULL-TIME TEACHERS					
A. Existing Number of Teachers	51	43	43	43	43
B. Required Number of Teachers**		30	35	34	33
C. Difference, A-B (+ surplus/-deficiency)		+ 13	+ 8	+ 9	+ 10

* Includes figures for rural schools (grades 1-8).
** Based on students to teacher ratio of 20 to 1.

Table 81
Niobrara County Unified School District Enrollment Projections, Impact on Enrollment Capacities, and Teacher Requirements

Table 82
Weston County Unified School Districts #1 (Newcastle) and #7 (Upton) Enrollment Projections, Impact on School Facilities, and teacher Requirement

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	1,871	1,671	1,575	1,575	1,625
B. Maximum Capcity of Existing School Facilities**		2,225	2,225	2,225	2,225
C. Difference, A-B (+ over, - under capacity)		- 554	- 650	- 650	- 600
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-24.9%	-29.2%	-29.2%	-27.0%
ELEMENTARY ENROLLMENT (K-6)					
A. Projected Number of Pupils*	984	832	785	785	815
B. Maximum Capacity of Existing School Facilities**		1,180	1,180	1,180	1,180
C. Difference, A-B (+ over, - under capacity)		- 348	- 395	- 395	- 395
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-29.5%	-33.5%	-33.5%	-30.9%
JUNIOR HIGH ENROLLMENT (7-8)					
A. Projected Number of Pupils*	319	281	265	265	270
B. Maximum Capacity of Existing School Facilities		345	345	345	345
C. Difference, A-B (+ over, - under capacity)		- 64	- 80	- 80	- 75
D. Percentage Over (+) or Under (-) capacity (A/B)-1		-18.6%	-26.1%	-23.2%	-21.7%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils*	568	558	525	525	540
B. Maximum Capacity of Existing School Facilities		700	700	700	700
C. Difference, A-B (+ over, - under capacity		-142	-175	-175	-160
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-20.3%	-25.0%	-25.0%	-22.9%
FULL-TIME TEACHERS					
A. Existing Number of Teachers	113	106	106	106	106
B. Required Number of Teachers		84	79	79	81
C. Difference, A-B (+ surplus/-deficiency)		+22	+27	+27	+25

*Includes figures for rural schools (grades K-6).
**Based on students to teacher ratio of 20 to 1.

Table 83

Natrona County Unified School District Enrollment Projections, Impact on School Enrollment Capacities and Teacher Requirements

	1980	1985	1990
TOTAL ENROLLMENT			
Projected Number of Pupils*	14,750	15,100	15,450
Number over (+), under (-) capacity	+750	+1,100	+1,450
Percent over or under capacity	+5.4%	+7.9%	+10.4%
ELEMENTARY ENROLLMENT (K-6)			
Projected Number of Pupils*	7,370	7,500	7,730
Number over (+), under (-) capacity	+270	+500	+630
Percent over or under capacity	+3.8%	+5.6%	+8.9%
JUNIOR HIGH ENROLLMENT (7-9)			
Projected Number of Pupils	3,690	3,775	3,860
Number over (+), under (-) capacity	+130	+215	+300
Percent over or under capacity	+3.6%	+6.0%	+8.4%
SENIOR HIGH ENROLLMENT (10-12)			
Projected Number of Pupils	3,690	3,775	3,860
Number over (+), under (-) capacity	+315	+500	+585
Percent over or under capacity	+12.7%	+15.3%	+17.9%
FULL-TIME TEACHERS			
Projected Number Required**	590	604	618
Deficit***	+24	+10	-4

*Includes figures for rural schools (grades K-8).
**Based on students to teacher ratio of 25 to 1.
***Based on Fall 1973 levels (FTE Classroom Teachers).

Table 84

Gillette Police Department
Campbell County
Projections for Full-time Manpower, Office Facilities
and Patrol Vehicles

	1973	1980	1985	1990
POPULATION** OF GILLETTE	7,194	17,870	25,310	27,970
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	16	30	43	47
Deficit###	0	-14	-27	-31
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	3,500	3,040	4,300	4,750
Deficit###	0	0	-800	-1,250
PATROL VEHICLES				
Projected Number Required##	5	10	14	16
Deficit###	0	-5	-9	-11

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Campbell County by 55.5 percent, the county's urban population level in 1970.
***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports)
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demands minus existing (1973) levels.

Table 85

Douglas Police Department
Converse County
Projections for Full-time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF DOUGLAS	2,677	5,955	6,720	6,990
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	7	12	13	14
Deficit###	0	-5	-6	-7
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	1,000	1,200	1,300	1,400
Deficit###	0	-200	-300	-400
PATROL VEHICLES				
Projected Number Required##	3	4	4	5
Deficit###	0	-1	-1	-2

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Converse County by 45.1 percent, the county's urban population level in 1970.
*** Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.

Table 86

Glenrock Police Department
Converse County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF GLENROCK	1,515	3,370	3,800	3.950
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	5	7	8	8
Deficit###	0	-2	-3	-3
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	400	700	800	800
Deficit###	-100	-300	-400	-400
PATROL VEHICLES				
Projected Number Required##	1	2	3	3
Deficit###	-1	-1	-2	-2

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Converse County by 25.5%, the town's percentage of county population in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people. (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.

Table 87

Buffalo Police Department
Johnson County
Projections for Full-time Manpower, Office Facilities and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF BUFFALO	3,394	4,555	4,490	4,490
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	6	9	9	9
Deficit###	-1	-3	-3	-3
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	130	900	900	900
Deficit###	-770	-770	-770	-770
PATROL VEHICLES				
Projected Number Required##	2	3	3	3
Deficit###	0	-1	-1	-1

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Johnson County by 60.7 percent, the county's urban population in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.

Table 88

Sheridan Police Department
Sheridan County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF SHERIDAN	10,856	11,065	11,125	11,250
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	17	19	19	19
Deficit###	-1	-2	-2	-2
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	8,640	1,900	1,900	1,900
Deficit###	0	0	0	0
PATROL VEHICLES				
Projected Number Required##	5	6	6	6
Deficit###	0	-1	-1	-1

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Sheridan County by 60.8 percent, the county's urban population in 1970.
***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people. (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.

Table 89

Casper Police Department
Natrona County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF CASPER	39,361	45,315	46,390	47,465
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	56	77	79	81
Deficit###	-11	-21	-23	-25
OFFICE FACILITES IN SQUARE FEET				
Projected Area Required#	3,245	7,700	7,900	8,000
Deficit###	-3,455	0****	0	0
PATROL VEHICLES				
Projected Number Required##	16	26	26	27
Deficit###	-3	-10	-10	-10

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Natrona County by 76.8 percent, the county's urban population level in 1970.
***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people (FBI, Crime in the U.S. -1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.
****By 1980, department will have new facilities with 12,000 square feet.

Table 90

Mills Police Department
Natrona County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF MILLS	1,724	2,005	2,005	2,100
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	2	4	4	4
Deficit###	-1	-2	-2	-2
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	100	400	400	400
Deficit###	-100	-300	-300	-300
PATROL VEHICLES				
Projected Number Required##	1	1	1	1
Deficit###	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Natrona County by 3.4 percent, the town's percentage of county population in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).
###Deficits equal projected demand minus existing (1973) levels.

Table 91

Newcastle Police Department
Weston County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF NEWCASTLE	3,432	3,430	3,430	3,535
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	9	7	7	7
Deficit#	0	0	0	0
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	500	700	700	700
Deficit#	-400	-200	-200	-200
PATROL VEHICLES				
Projected Number Required###	2	2	2	2
Deficit#	-1	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projection for Weston County by 54.4 percent, the county's urban population level in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Deficits equal projected demand minus existing (1973) levels.
##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 92

Sundance Police Department
Crook County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF SUNDANCE	1,056	1,050	1,070	1,070
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	1	2	2	2
Deficit#	-1	-1	-1	-1
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	400	200	200	200
Deficit#	0	0	0	0
PATROL VEHICLES				
Projected Number Required##	1	1	1	1
Deficit#	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Crook County by 23.2 percent, the town's percentage of county population in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Deficits equal projected demand minus existing (1973) levels.
##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 93

Lusk Police Department
Niobrara County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	1973*	1980	1985	1990
POPULATION** OF LUSK	1,495	1,430	1,380	1,330
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	4	3	3	3
Deficit#	0	0	0	0
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	400	300	300	300
Deficit#	0	0	0	0
PATROL VEHCILES				
Projected Number Required###	1	1	1	1
Deficit#	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.
**Derived by multiplying 1980-1990 population projections for Niobrara County by 51.1 percent, the town's percentage of county population in 1970.
***Assume 2.0 full-time policemen per 1,000 population for cities with less than 1,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).
#Deficits equal projected demand minus existing (1973) levels.
##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).
###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 94

Required Fire Flow

Population	Gallons Per Minute
1,000	1,000
1,500	1,250
2,000	1,500
3,000	1,750
4,000	2,000
5,000	2,250
6,000	2,500
10,000	3,000
13,000	3,500
33,000	5,500
40,000	6,000
55,000	7,000

*Note: Fire flow may be increased or decreased in accordance with structural conditions and degree of congestion.

Source: Standard schedule for Grading Cities and Towns, U.S. National Board of Fire Underwriters, N.Y., Chicago, San Francisco.

Fire Flow	First Due*				First Alarm**				Maximum Multiple Alarm			
	Eng.		Lad.		Eng.		Lad.		Eng.		Lad.	
gpm	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.
less than 2,000	1	1½#	***1	##2	###2	4	***1	##2	###2	4	***1	##2
2,000	1	1½#	***1	##2	2	2½	***1	###2	2	2½	***	2,500
3,000	1	1½	***1	2	2	2½	***1	2	3	3	***1	2
3,500	1	1½	***1	2	2	2½	***1	2	3	3	***1	2
4,000	1	1½	1	2	2	2½	1	2	4	3½	1	2
4,500	1	1½	1	2	2	2½	1	2	4	3½	1	2
5,000	1	1	1	1½	2	2	1	1½	5	3½	2	2½
5,500	1	1	1	1½	2	2	1	1½	5	3½	2	2½
6,000	1	1	1	1½	2	2	1	1½	6	4	2	2½
6,500	1	1	1	1½	2	2	1	1½	6	4	2	2½
7,000	1	1	1	1½	2	1½	1	1½	7	4	3	3½
7,500	1	1	1	1½	2	1½	1	1½	8	4½	3	3½
8,000	1	1	1	1½	2	1½	1	1½	9	4½	3	3½
8,500	1	1	1	1½	2	1½	1	1½	9	4½	3	3½
9,000	1	3/4	1	1	3	1½	2	2	10	4½	4	4
10,000	1	3/4	1	1	3	1½	2	2	12	5	5	4½
11,000	1	3/4	1	1	3	1½	2	2	14	5	6	5
12,000	1	3/4	1	1	3	1½	2	2	15	5	7	5

*"First due" refers to the equipment needed to be within range to respond to a fire immediately.
**"First Alarm" refers to "first due" equipment plus additional equipment needed to be able to respond should fire prove to be too large to be handled by "first due" equipment.
***Where there are less than 5 buildings of a height corresponding to 3 or more stories, a ladder company may not be needed to provide ladder service.
#May be increased to 2 miles for residential districts of 1- and 2-family dwellings, and to 4 miles where such dwellings have an average separation of 100 feet or more.
##May be increased to 3 miles for residential districts of 1- and 2-family dwellings, and to 4 miles where such dwellings have an average separation of 100 feet or more.
###Same as first due where only one engine company is required in the municipality.

Table 95
Number of Engine and Ladder Companies Needed within Travel Distance of Required Fire Flow