THE GEOLOGICAL SURVEY OF WYOMING
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REPORT ON THE UNDERGROUND WATER RESOURCES OF CROW CREEK VALLEY, LARAMIE COUNTY, WYOMING

by

Dr. S. H. Knight and Arthur M. Morgan

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Introduction.- The area covered in this report lies in that part of the drainage basin of Crow Creek within the borders of Laramie County, Wyoming. Crow Creek, in this county, drains an area of approximately 500 square miles. The three forks of Crow Creek, North, South and Middle Crow Creeks head in the Laramie Range and join to form Crow Creek proper just east of the mountains. From the junction the stream flows a little south of east across the high plains and passes from Wyoming into Colorado in Range 62 West.

Crow Creek and its three forks are perennial streams from the western margin of Laramie County to a point one mile west of Arcola, a station on the Burlington Railroad 18 miles east of Cheyenne. At that point the flow disappears and the stream is intermittent to a point two and one-half miles east of Arcola. There the flow reappears and the stream is perennial for one and one-half miles. Two miles north of Carpenter the flow again disappears and the stream is intermittent to a point one-half mile from the state line where it again flows on the surface. Porter Draw, an intermittent tributary to Crow Creek, heads in sec. 35, T. 13 N., R. 67 W. and drains a large part of the area between Crow Creek and the Colorad-Wyoming line. The stream flows eastward across the southern part of the

county and p asses out of Wyoming in sec. 17, T. 12 N., R. 63 W., meeting Crow Creek a short distance south of the state line. Porter Draw is an intermittent stream through most of its course in Laramie County but has a short perennial stretch through secs. 7, 18 and 17, T. 12 N., R. 63 W.

Topography.- Most of the drainage basin of Crow Creek in Laramie County has the relatively flat rolling topography of the western Great Plains. The uplands are flat or gently rolling and the valleys are from one-half mile to two miles wide with flat bottoms and steep walls. The valley bottoms are from 50 to 100 feet below the adjoining upland surface.

The western part of the area includes a portion of the Laramie Range. Here the topography is rough and mountainous with steep-walled narrow valleys and rough broken upland. Separating the rough mountainous area in the Laramie Range and the rolling topography of the Great Plains is a wide flat lowland extending north-south parallel to the mountains. The lowland is from three to seven miles in width and is bounded by the Laramie Range on the west and a steep escarpment on the east. At Granite Canyon the rocks underlying the Plains overlap directly onto the east flank of the Laramie Range with no break in the east-west profile. This overlap marks the southern end of the lowland separating the mountains and the plains.

Geology.- The rocks underlying the Crow Creek drainage basin in Laramie County range from pre-Cambrian to Miocene in age. The Laramie Range and the lowland adjoining it on the east are underlain by the older rocks. The Great Plains area is underlain by more recent Oligocene and Miocene deposits.

Pre-Cambrian.- The pre-Cambrian rocks of this area consist of coarse-grained pink granite, granite gneiss, schist and granite porphyry.

These rocks underlie the western portion of Laramie County and give rise to the rough topography mentioned above. They form the main mass of the Laramie Range.

Pennsylvanian.- The Casper formation is the representative of the Pennsylvanian rocks in the district. The formation consists of from 571 feet to 795 feet of dolomitic limestone, limestone, sandstone and shale of red, pink, purple and buff colors. These rocks outcrop along the east flank of the Laramie Range, for the most part, in a narrow belt forming a pronounced ridge which is broken by water-gaps and overlapping tongues of the later Tertiary rocks. The narrowness of the belt of outcrop is caused by the steep eastward dip of the formation. However, near the Colorado-Wyoming line, on Duck Creek and at Mesa Mountain north of the North Fork of Crow Creek the beds dip less steeply and the outcrops are from one-fourth mile to two miles in width.

Triassic.- Overlying the Casper formation and outcropping in a belt parallel to it is a series of red sandstones and shales with a thickness of approximately 1,100 feet. These beds are of Triassic age and gelong to the Chugwater formation. The Chugwater dips steeply to the east and outcrops in a narrow north-south band on the North Fork of Crow Creek and on Middle Crow Creek northwest of Hecla. Near the Colorado-Wyoming line the dip decreases and the outcrop is from one-half mile to one mile in width.

Jurassic.- The Jurassic rocks of the area are divided into two formations, the Sundance overlying the Chugwater and the Morrison overlying the Sundance.

The Sundance consists of 30 feet of greenish sandy shale overlain by 10 feet of buff massive sandstone. The formation outcrops in two small exposures on North Crow and Middle Crow Creeks.

The Morrison formation consists of approximately 200 feet of hard clay or massive shale varying from pale greenish gray to maroon in color. It outcrops with the Sundance in the two small exposures on North Crow and Middle Crow Creeks.

Cretaceous.- The Cretaceous rocks of the area consist of a great thickness of shales and sandstones ranging in age from Lower Cretaceous to late Upper Cretaceous. They are divided into the Cloverly formation at the base, the Benton, the Niobrara, the Pierre and the Fox Hills formations.

The Cloverly consists of a lower sandstone and conglomerate, a middle shale member and an upper sandstone. The formation is from 70 to 100 feet in thickness in this region. It outcrops in the two small exposures on North Crow and Middle Crow Creeks.

The Benton formation consists of from 700 to 1000 feet of gray and black shales with a 25-foot sandstone near the base. The Benton in the Crow Creek Basin outcrops only in the small exposure on the North Fork of Crow Creek.

Overlying the Benton is a series of limestones and calcareous shales varying from 375 to 400 feet in thickness. These beds constitute the Niobrara formation. The Niobrara outcrops in the small exposure on North Crow Creek.

The Pierre formation in the Crow Creek Basin consists of approximately 5,000 feet of dark gray shale with bands of sandstone and sandy shale. The formation outcrops along North Crow Creek and there is a partial exposure on Middle Crow Creek. In sec. 12, T. 14 N., R. 70 W. and sec. 7, T. 14 N., R. 69 W. there is a wide exposure of Pierre, where it is faulted against the granite.

The uppermost Cretaceous formation exposed in the area is the Fox Hills formation. It consists of more than 600 feet of gray sandstones and sandy shales. It outcrops along North and Middle Crow Creeks and has a wide exposure in secs. 9, 10, 11, 13, 14, 15 and 16, T. 14 N., R. 69 W.

Oligocene.- The Oligocene rocks of the area belong to the White River Group and are divided into the Chadron and Brule formations.

The Chadron consists of from 20 to 100 feet of brown sandstone, coarse arkose, and conglomerate. The amount of coarse arkose and conglomerate increases toward the mountains. In places the beds are loosely consolidated but, for the most part, they are well cemented and hard. The beds lie on the eroded edges of the older rocks, some of which project through the Chadron. The formation outcrops in the western portion of the lowland east of the mountains. The beds dip gently to the east, passing beneath the Brule.

The Brule formation consists of 250 feet or more of buff clay, fine sand, and volcanic ash with some beds or lenses of gravel near the mountains. The formation outcrops in the eastern portion of the lowland east of the mountains, passes beneath the Harrison formation to the east, and comes to the surface again along Crow Creek three and one-half miles north of Carpenter. Here the Brule underlies the wide valley west of Carpenter.

Miocene.- Overlying the Brule and immediately underlying the land surface of the greater part of Laramie County is the Harrison (Arikaree) formation of Miocene age. In the western part of the area the formation consists of coarse sand and gravel. To the east the coarse beds thin out and their place is taken by beds of fine-grained sandstone, clay, and shaly sand. For the most part, the beds are not well consolidated, but some of the finer-grained beds in the eastern part of the area are well

cemented and contain numerous pipelike and nodular concretions. The Harrison caps the westward-facing escarpment on the east side of the lowland bordering the mountains and also caps the escarpment on the west side of the wide valley near Carpenter. The Harrison, like the Chadron and the Brule, dips gently to the east. The thickness of the formation varries from 0 to 250 feet.

Alluvium.- Along Crow Creek and its tributaries North, Middle and South Crow Creek there are deposits of recent alluvium varying in width and thickness. The alluvial deposits are from a few hundred yards to a half mile in width and from a few feet to 15 or 20 feet in thickness.

Underground Water.- Little information could be obtained relative to the underground water in the mountains or in the lowland east of the mountains. There are few wells in that portion of the area and little information about them could be obtained. In the mountains there are numerous springs which contribute to the flow of the streams in the deeper valleys.

In the plains portion of the area good stock or domestic wells can be obtained at depths of less than 200 feet over the entire area. The depths vary with the topography and much greater on the upland than in the valleys. Most of the plains area is underlain by the Harrison formation and the underground water conditions vary with the change in the character of the formation as the distance from the mountains increases. Near the mountains the Harrison contains numerous beds and lenses of coarse sand and gravel with interbedded clays and ash beds. The beds dip gently to the east and in a belt parallel to the mountains through the eastern part of R. 68 W. and

the western part of R. 67 W. numerous artesian wells have been developed from the sand and gravel beds which outcrop farther west and pass beneath this belt at depths of from 50 to 200 feet. Flowing wells have been obtained only in the lower portions of the valleys, though the water rises above the water table in corresponding wells on the uplands. A few artesian wells have been developed along Crow Creek and Clear Creek in and near Cheyenne and on the bottoms of the wide low swale two miles south of Cheyenne in the Allison Addition.

To the east the coarse sand and gravel beds are, to a large extent, replaced by fine sand and clay and few artesian wells have been developed. East of Cheyenne the wells are with few exceptions of the water table type. The depth to the water table on the upland averages approximately 100 to 120 feet. In the valley bottoms along Crow Creek and Porter Draw the depth to the water table varies from 20 to 60 feet.

In the vicinity of Carpenter on the low flats east of the escarpment that crosses R. 63 W. in T. 12 N. and T. 13 N. the water table is from 20 to 70 feet below the surface. On the higher portions of the flats east of Crow Creek the depth to the water table is between 60 and 70 feet. Along the Crow Creek flood plain there is some water in the alluvium at depths of 10 to 16 feet, but here the water table is from 30 to 50 feet below the surface. West of Crow Creek in the Carpenter region the water table is from 30 to 60 feet from the surface. Both east and west of Crow Creek in the Carpenter region the depth to water decreases to the south. Near the Colorado line the water table is from 11 to 36 feet from the surface. West of Crow Creek on or near the State Line there is a ridge, rising 30 to 50 feet above the flats, which forms the divide at that point between

Crow Creek and Porter Draw. On the ridge the water table is over 150 feet below the surface and there are few good wells.

The Harrison formation, which is the surface formation over most of Crow Creek Basin in Laramie County consists, as mentioned before, of fine to coarse sand and gravel in the western portion of its outcrop area and fine sand and clay in the eastern portion. There is a gradation to the east of coarse to fine material. In the western part of the Harrison exposure, especially in the artesian belt described above, there are a number of wells capable of producing water in quantity, that is from 200 to 500 gallons per minute. Throughout the remainder of the Harrison exposure, however, the formation is too fine-textured to release its water readily enough to make large capacity wells. It is capable of supporting many stock and domestic wells and there are few wells in the area which do not give sufficient water to supply a pump driven at full capacity by a windmill for long periods. There are a few gravel or coarse sand lenses even in the eastern portion of the area, which, when encountered below the water table, might be capable of producing water in quantity for irrigation. None of the wells developed in the Harrison east of Cheyenne have been tested for capacity, however, and consequently no actual capacity estimates can be made.

The Brule formation consists, for the most part, of volcanic ash and clay with occasional fine sandy beds or lenses. In the western belt of exposure just east of the mountains the formation contains a few beds and lenses of coarse sand and gravel, especially in or near the base. In the eastern exposure near Carpenter between Crow Creek and the eastward-facing escarpment a few miles to the west there are no coarse beds. The Brule in places has a tendency to develop

fractures and joints, which give the formation a water-carrying capacity not dependent upon. Where the Brule is fractured and broken it is capable of storing considerable water and the fractures and joints are large enough to release water readily. In places where the topography is such that the run-off from a considerable area is concentrated in the valley bottoms underlain by fractured and broken Brule clay a large proportion of the run-off seeps into the ground and replenishes the underground reservoir. In these places there is a possibility of developing wells capable of producing water in sufficient quantity for irrigation. In the Carpenter area only three wells in the Brule have been tested for capacity. They are on the Bunnell place in sec. 33, T. 13 N., R. 63 W., three to three and one-half miles west of Crow Creek and a short distance east of the Harrison escarpment. Two of the wells were considered "no good" and abandoned, the third had a capacity of 350 gal. per minute. The water table was encountered in the two abandoned wells at 60 feet and in the third well at 50 feet. It is probable that the fractured zone here extends only a short distance below the water table, giving only a small reserve supply. Without other capacity tests in the area it is impossible to outline any potentially productive zone in which wells with a capacity sufficient for irrigation can be developed. The best possibilities for irrigation wells are in those areas in which the water table is less than 40 feet from the surface and where the run-off is concentrated to supply considerable water for recharge of the underground reservoir.

East of Crow Creek in the Carpenter area the Brule is overlain by a variable thickness of fine to coarse sand with a few gravel lenses in the Lower Harrison formation. In the vicinity of Carpenter there

there are approximately 60 feet of sand above the Brule Clay (locally called "magnesia"). The sands are, for the most part, dry and the water is encountered in the underlying "joint clay" or "magnesia". No tests for capacity have been made in this part of the area and it is not known whether any of the wells, all of which are good stock or domestic wells, are capable of producing large quantities of water. It is possible that part of the water brought in by Crow Creek is moving eastward down the dip of the beds through the porous Lower Harrison and possibly through fractured and broken upper Brule.

WATER WELLS.--CROW CREEK VALLEY

Name	Location	Depth of Well	Depth to Water	Capacity
Goodman	Federal	247	200	---
C. Adolphson	Federal	390	--	---
-------	Center 14-15-69	228	220	----
-------	SE¼ 14-15-69	280	--	----
J.A. Francis	NW¼ 23-14-69	30	28	----
-------	Center 13-15-69	151	---	----
-------	NW¼ 24-15-69	130	--	---
Warren Land and Livestock	SE¼ 30-15-68	490	133	20 g.p.m.
Warren L. & L.	S½ 31-13-68	372	115	20 g.p.m.
-------	Sec. 22-15-68	390	--	---
City of Cheyenne Silver Crown #1	NW¼ 20-14-68	945	72	300 g.p.m.
Silver Crown #2	NW¼ 20-14-68	843	--	250 g.p.m.
Silver Crown #3	SW¼ 17-14-68	855	--	---
Silver Crown #4	NW¼ 20-14-68	137	--	Abandoned
Silver Crown #5	NW¼ 20-14-68	914	--	260 g.p.m.
Happy Jack Ranch	NW¼ 8-13-68	230	214	---
-------	Sec. 28-15-69	276	--	500 g.p.d.
-------	Sec. 33-15-68	331	--	1000 bbls.
Happy Jack Ranch	NE¼ 4-13-68	100	84	---
Happy Jack Ranch	NE¼ 34-14-68	90	60	---
Happy Jack Ranch	NW¼ 14-14-68	133	83	---
Warren L. & L. Prairie Oil & Gas	SE¼ 22-13-68	637	235	Flowing
Warren L. & L.	SE¼ 34-13-68	96	96	Flow---125 g.
City of Cheyenne Bailey #1	NW¼ 26-14-68	215	169	Flow--200 g. Pump---500 g.

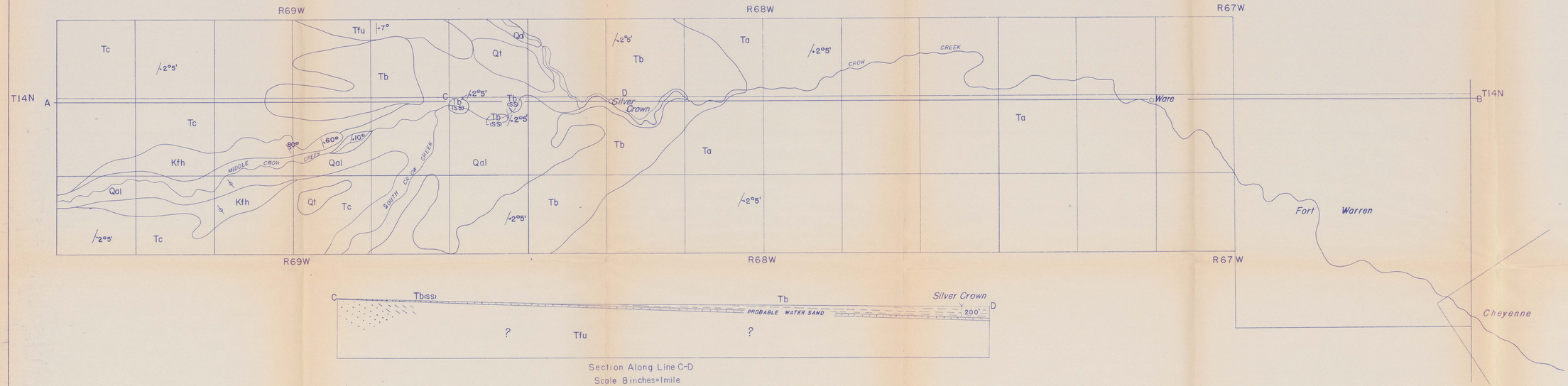
Name	Location	Depth of Well	Depth to Water	Capacity
Bailey #2	NE¼ 26-14-68	290	---	Abandoned
Bailey #3	SW¼ 26-14-68	177	148	Small Flow
Warren L. & L.	NE¼ 26-13-68	96	53	Flow---125
Warren L. & L.	SW¼ 11-12-68	420	---	---
------	SE¼ 24-15-68	247	--	1000 bbl.
Warren L. & L.	SW¼ 25-15-68	264	260	18 g.p.m.
City of Cheyenne Holman #1	SE¼ 24-14-68	286	276	Flow Pump---500 g.
Happy Jack Ranch	NW¼ 25-14-68	44	15	---
City of Cheyenne Elker #1	NW¼ 25-14-68	334	--	Pump---500 g.
City of Cheyenne Elker #2	NE¼ 25-14-68	---	--	Flowing
Warren L. & L.	SE¼ 36-13-68	134	128	Flow---80 g.
Warren L. & L.	SE¼ 36-13-68	175	123	100 g.p.m. f
G. Hewlett	NE¼ 19-14-67	310	--	5 g.p.m. flo
City of Cheyenne Eddy #1	SW¼ 19-14-67	322	--	---
G. Hewlett	SE¼ 19-14-67	330	10	240 g.p.m.
Jim Morton	NW¼ 6-13-67	45	45	---
Art King	SW¼ 6-13-67	100	45	Flow.
Art King	SW¼ 6-13-67	110	10	---
City of Cheyenne Rees #2	NW¼ 7-13-67	173	170	Flow---200 g.p.m. Pump---450 g.p.m.
City of Cheyenne Rees #1	Center 18-13-67	300	160	25 g.p.m. flow
City of Cheyenne	NE¼ 8-14-67	207	156	20 g.p.m.
G. Hewlett	NW¼ 20-14-67	330	220	10 g.p.m. flow.

Name	Location	Depth of Well	Depth to Water	Capacity
City of Cheyenne Ware #1	NE¼ 20-14-67	189	--	Abandoned
City of Cheyenne Ware #2	NE¼ 20-14-67	675	--	Abandoned
City of Cheyenne Rees #3	NW¼ 8-13-67	180	171	20 g.p.m. flow
City of Cheyenne	NE¼ 9-14-67	151	47	---
Experiment Farm	NW¼ 16-14-67	82	75	Raised to 38' 80 g.p.m.
Poor Farm	NW¼ 12-13-67	260	200	Small flow
Kauffman	Allison Addition Cheyenne	207	207	Flow
Pendarvis	Allison Addition	206	206	Flow
Millerman	Allison Addition	214	214	Flow
Hanlon	Allison Addition	350	350	Water rose to 30'
Nocl	Allison Addition	320	320	---
Spires	Allison Addition	321	310	---
A.C. Volk	Sec. 4-13-66	430	190	---
W.J. Merna	NW¼32-13-66	110	40	7 g.p.m.
W.J. Merna	SE¼ 32-13-66	85	55	3 g.p.m.
W.J. Merna	SW¼ 32-13-66	86	55	---
Veterans Hospital #1	SW¼ 28-14-66	247	177	---
Veterans Hospital #2	SW¼ 28-14-66	86	86	Water raised to 36'. 45-50 g.p.m.
Veterans Hospital #3	SW¼ 28-14-66	850	99	30 g.p.m.
Wyo Hereford Ranch	NE¼ 11-13-66	200	--	Little water
Wyo Hereford Ranch	NW¼ 13-13-66	400	360	---
Wyo Hereford Ranch	NW¼ 6-13-65	400	120	20 g.p.m.

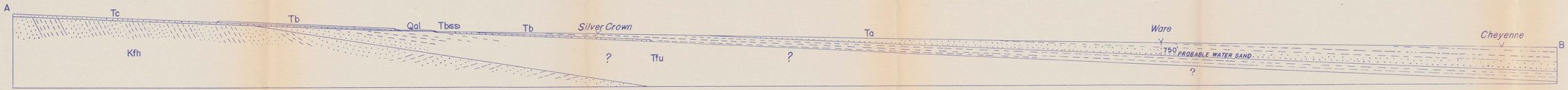
Name	Location	Depth of Well	Depth to Water	Capacity
Wyo Hereford Ranch	NW¼ 6-13-65	130	--	Water raised to 2". 22 g.p.m.
Wyo Hereford Ranch	SW¼ 6-13-65	80	60	---
Wyo Hereford Ranch	SW¼ 19-13-65	240	210	---
W.J. Merna	NW¼ 18-12-65	225	215	4½ g.p.m.
Wyo Hereford Ranch	NW¼ 5-13-65	100	70	---
Wyo Hereford Ranch	SE¼ 5-13-65	100	70	---
Wyo Hereford Ranch	SW¼ 29-13-65	240	180	---
Wyo Hereford Ranch	SW¼ 33-13-65	160	--	---
Archer Experiment Farm	NW¼ 27-14-65	280	200	---
Wyo Hereford Ranch	Center 15-3-65	100	--	---
Wyo Hereford Ranch	SW¼ 34-14-65	170	130	---
Wyo Hereford Ranch	Center 12-13-65	200	--	Little water
Wyo Hereford Ranch	NE¼ 24-13-65	120	--	---
Wyo Hereford Ranch	SE¼ 24-13-65	120	--	---
Wyo Hereford Ranch	NE¼ 1-12-65	100	--	---
Wyo Hereford Ranch	Center 19-13-64	120	--	---
Wyo Hereford Ranch	NE¼ 30-13-64	120	--	-------
Wyo Hereford Ranch	SW¼ 31-13-64	140	120	---
Wyo Hereford Ranch	SE¼ 5-13-64	80	53	---
Wyo Hereford Ranch	SE¼ 5-13-64	100	70	---
Wyo Hereford Ranch	NE¼ 17-13-64	160	120	---
Wyo Hereford Ranch	Center 29-13-64	120	112	---
Wyo Hereford Ranch	SW¼ 32-13-64	160	--	---
Wyo Hereford Ranch	SW¼ 4-12-64	80	--	---

Name	Location	Depth of Well	Depth to Water	Capacity
Wyo Hereford Ranch	Center 15-13-64	120	100	---
Wyo Hereford Ranch	SE¼ 3-12-64	100	30	---
Martin Miller	SW¼ 12-13-64	--	20	---
Martin Miller	SE¼ 12-13-64	--	20	---
Wyo Hereford Ranch	SW¼ 36-13-64	140	80	---
Wyo Hereford Ranch	SW¼ 31-13-63	140	120	---
F.E. Bollin	Center 7-12-63	24	4	---
H.E. Kittell	SW¼ 8-13-63	42	38	---
RR. Well at Arcola	NE¼ 17-13-63	75	30	---
T.J. Forcum	NE¼ 20-13-63	60	40	---
George L. Reader	NW¼ 28-13-63	113	60	---
George L. Reader	SE¼ 28-13-63	90	79	---
Bunnell	SW¼ 33-13-63	--	50	350 g.p.m.
Bunnell	SE¼ 33-13-63	---	60	---
Bunnell	SE¼ 33-13-63	---	60	---
George L. Reader	NE¼ 4-12-63	65	35	---
Ralph Kent	SE¼ 15-13-63	35	--	---
James Enfield	SE¼ 22-13-63	60	53	---
James Enfield	NE¼ 34-13-63	71	60	---
Ed Oline	SE¼ 34-13-63	39	29	---
Ed Oline	SW¼ 34-13-63	70	--	---
Herman Springer	NW¼ 3-12-63	210	40	---
Herman Springer	NW¼ 15-12-63	---	18	---
J.L. Bowen	NE¼ 14-13-63	70	--	---
J.L. Bowen	NW¼ 14-13-63	67	42	---
Ed Oline	NW¼ 26-13-63	67	50	---

Name	Location	Depth of Well	Depth to Water	Capacity
Ed Oline	SW¼ 26-13-63	55	50	---
Gordon	NE¼ 2-12-63	91	60	---
Dudley Terrell	NW¼ 14-12-63	36	--	---
Otis Breedon	NE¼ 14-12-63	35	--	---
Otis Breedon	SE¼ 14-12-63	--	11	---
Lee Upp	NE¼ 24-13-63	70	--	---
Springer	SW¼ 36-13-63	--	80	---
Springer	SE¼ 36-13-63	--	16	---
G.W. Cushing	NE¼ 1-12-63	67	45	---
R.B. Kirby	NE¼ 30-13-62	70	48	---
H.R. Hill	SW¼ 30-13-62	60	30	---
In Carpenter	----------	--	78	---
In Carpenter	----------	--	70	---
L.D. Christy	NE¼ 20-13-62	48	--	---
L. C. Shifflett	SW¼ 8-12-62	90	60	---
L.A. Noyer	NE¼ 17-12-62	58	42	---
Everett Van Doran	NW¼ 28-13-62	70	60	---
M.A. Little	SW¼ 33-13-62	115	45	---
O.M. Miller	SW¼ 10-12-62	63	42	---
Bob Boggs	SE¼ 10-12-62	55	38	---
L.A. Noyer	NW¼ 15-12-62	50	42	---
----------	NE¼ 11-12-62	32	27	---
Ed Jacobson	NW¼ 14-12-62	40	36	---
John Poelma	SW¼ 14-12-62	42	26	---
----------	NE¼ 12-12-62	52	40	---



Section Along Line C-D
Scale 8 inches = 1 mile



Section Along Line A-B
Scale 2 in = 1 mile

Geologic Map
of
CHEYENNE WATER SHED

THE GEOLOGICAL SURVEY OF WYOMING

Scale 2 in. = 1 mile

LEGEND

Terrace Gravels
- Qt
- Alluvium — Qal

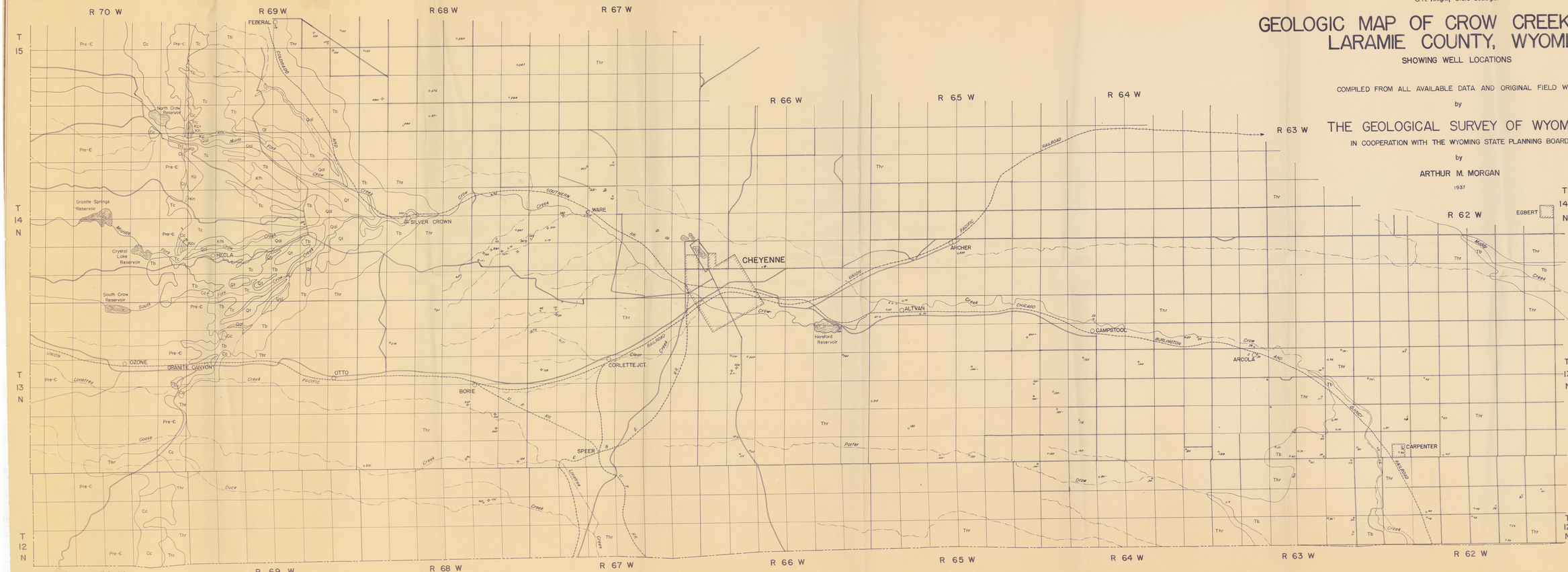
} Quaternary

- Arikaree — Ta
- Brule — Tb
- Chadron — Tc
- Fort Union — Tfu

} Tertiary

- Fox Hills — Kfh

} Cretaceous



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UNIVERSITY OF WYOMING, LARAMIE
S.H. Knight, State Geologist

GEOLOGIC MAP OF CROW CREEK VALLEY LARAMIE COUNTY, WYOMING

SHOWING WELL LOCATIONS

COMPILED FROM ALL AVAILABLE DATA AND ORIGINAL FIELD WORK

by

THE GEOLOGICAL SURVEY OF WYOMING

IN COOPERATION WITH THE WYOMING STATE PLANNING BOARD

by

ARTHUR M. MORGAN

1937