

F O R E W O R D

It is to be remembered that a full and complete report on this subject would cover more time and expense than is permitted, or possibly desired at this time.

Therefore the matter herewith submitted is necessarily brief, in some instances the facts are stated without giving their derivation, some conclusions are given without all of the data and groundwork leading up to their determination.

It is hoped, that at least, a foundation has been laid, that may in the future, by someone, be built upon; and that a path has been pointed out, that will eventually lead to a final, proper, and just adjudication of the Water Rights of the Provo River.

I N T R O D U C T O R Y

On May 25, 1914, the Honorable A. B. Morgan, Judge of the Fourth District Court of the State of Utah, appointed T.F.Wentz, as Commissioner of the Lower Division of Provo River.

The Commissioners were appointed to carry into effect the terms of the Stipulation entered into between the parties to this action, on the 25th day of May 1914, and to collect such data as would assist the Court, and the parties to make a final disposition of the waters of the Provo River.

Work was begun on June 1, and ended on Oct. 1. In the early part of the season particular attention was given to the installation of proper measuring and regulating devices. As will be seen from the section of present equipment, there still remains a great deal to do in this line, and unless a specific order is made it is probable this deplorable condition will exist indefinitely.

It is intended to set forth:

- a. The physical facts that form a basis of determination.
- b. The general and specific conditions and practices, with comments as to proper or improper regulation, and the remedy for misuse and unlawful appropriation of water.
- c. The standard of economical and beneficial use, shall be the standard of right and title.
- d. The full and complete submittal of judgement on the vital points.
- e. The duty of water to the Primary Rights, within a safe margin, that a tentative order maybe made pending final settlement.

It is admitted that a statement of an improper practice, without an adequate remedy therefor, is without value.

Where the writer advances judgments and recommendations, or shows faulty conditions, or improper practices that affects the litigants, - approval is neither expected nor hoped for.

SECTION 1.

THE PROVO RIVER.

Descriptive:-

" Provo River rises in the Uinta Mountains and flows Westward in a steep, narrow canyon until it reaches Heber of Provo Valley, through which it winds in a well defined channel. Leaving the valley it flows southwestward, cutting through the Wasatch Range in another steep, narrow, and extremely rough canyon, and finally, discharging its surplus waters into Utah Lake."

"In the mountain regions the principal rock is a compact limestone. Except in Heber Valley little soil is found in any part of the basin. Small groves of fir and aspen are, however, scattered over almost the entire area, and there is a light growth of underbrush. No extensive forests, meadows, or marches exist. In the canyons the stream receives numerous short and swift tributaries, which derive their principal supply from springs, but also a part from the melting of the snow that covers portions of the mountains during the entire year."

Heber or Provo Valley, comprising an area of 24,000 acres, of which practically all is irrigated during the highwater period of each year and more than half irrigated during the whole season, is the second largest farming district on the Provo.

The soil on the higher lands is a sandy and gravelly loam, with a loose subsoil of coarse gravel. In the lower parts of the valley the soil is a sedimentary deposit of a clay loam, rich in humus, with a stiff clay sub-soil.

The application of enormous quantities of water on the higher lands has brought the subsoil to complete saturation, and raised the ground water plane to within a few feet of the surface in the central and lower portions of the valley.

Along the river a well defined and substantial inflow of seepage and percolating water has been established, by the use of such quantities of water on the higher lands. The amount of this inflow is shown by the following:-

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On July 20, 1914, a tight dirt dam was in place across Provo River, at the Upper Midway Diversion. Below this point and above the diversions of the Utah Valley, approximately 40 second-feet was diverted for irrigation. The discharge at the U.S. geological Survey rating station was 352 second-feet, and from this station to the several points of measurement of the canals in the Utah Valley, there was an inflow of approximately 20 second-feet, making a total available amount below the tight dirt dam of 412 second-feet. Of this amount approximately 90 second-feet flows directly to river from South Fork, North Fork, Deer Creek and Round Valley Creek, the remaining 322 second-feet approximately, derived from inflow from seepage percolation and small springs along river.

From this fact it will be seen that the lower portion of the Provo River, depends largely upon the extent of irrigated area and the amount of applied water in the Provo Valley, and the Provo Valley is by the past practice, and can be in the future by proper manipulation of the waters of Provo River, the storage reservoir of the lower river and the Utah Valley.

The elevation of the Provo Valley ranges from 5,400 to 5,600 feet above sea level, its greatest width is about ~~ix~~ six miles, and its length some 15 miles.

Hay and Grain are raised almost exclusively, however a small area is being used for diversified farming.

The Provo River Enters the valley at its Northern extremity and leaves it at the South-west corner. During flood water season many creeks contribute to the flow of the river, but during the normal irrigating season all of the creeks on both the east and west sides are utilized.

" The section susceptible of irrigation from the Provo in the Utah Lake Valley lies between the lake on the west and the foothills which form the eastern rim of the valley on the east. It extends northward almost to the town of Pleasant Grove and southward to a point 3 or 4 miles South of Provo. The area within these limits approximates 30,000 acres, 18,000 acres of which is a liberal estimate of the area entitled to water from the Provo and which could be irrigated if the water supply of the river were properly controlled.

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The Remaining 12,000 acres are located along the shores of the lake and are of a marshy nature, being saturated by seepage from the irrigated lands above. The land is too wet for cultivation and is used only for meadows and pasture. The irrigable section consists largely of bench lands lying on either side of the river and bottom lands lying along the river's course.

At the point where the river enters the valley it has cut its way through the stepped benches which at different times formed the shore lines of Lake Bonneville, and has made for itself a channel which gradually increase in width as it leaves the mouth of the canyon until, at the point where the benches terminate, the river bottoms have a width of a mile or more. The soil in these river bottoms is an extremely, fertile alluvial deposit. The soil on the bench land,*****, is also fertile but of less depth and more gravelly than the bottom lands, and has a porous subsoil which insures good drainage.

The river, after leaving the mouth of the canyon flows in a southerly direction until it reaches the northern limit of Provo City, then turns in a westerly direction and flows toward the lake, ~~ent~~ entering it 3 miles due west of Provo City.

The canals which divert ~~wate~~r below the mouth of the canyon are developed from the ditches that were taken from the river by the settlers who came into the valley in the early days. Those small crooked ditches have from time to time been enlarged, their courses straightened, and in many instances, the points of diversion changed." Extract Bulletin No.124 U.S.dept. Of Agriculture. The area given is ~~rather~~ larger than our present figures.

At this point a page might be devoted to the history of irrigation along the Provo, but owing to the briefness of this report it is assumed that all parties are partially familiar with this topic.

Secl.

Explanation of River Tables and Plates.

Table I., is a tabulation of the monthly discharge of the Provo, extending from July 1889 to Oct.1, 1914.

The time 1889 to 1900 inclusive is designated the First Period, 1901 to 1914 inclusive, the second period, and 1889 to 1914 inclusive the whole period.

Note:- About the time of the ending of the first period, an extensive area of land was brought under irrigation, in the Provo Valley, and which is fully watered during the season of an available supply.

Rating stations are marked and particularly described.

Records from which compilation is made is noted in margin.

Inflow below rating station and the addition of water to river by the Provo Reservoir Company is noted and the ~~proper~~ proper correction made, that the table shows the natural flow of Provo River and Spring Creek, below the Mouth of the Provo Canyon in the Utah Lake Valley, available for irrigation and waterworks.

For each year ~~minimum~~ twelve combinations are shown, for each month in each of the three periods twelve combinations are shown, for each maximum, minimum, mean, and period, for each of the three periods, twelve combinations are shown, making a total of 876 deductions. The number of months observed in each year and the number of years of each month observed is shown. This table is based on 8,247 observations.

Table II.

Table II is a tabulation of stage duration and the time Flood waters have receded to the 500 and the 400 second-foot stage, it shows the number of days of each month of the irrigating season for the past ten years, the river discharge was between 100 to 200 second-feet, 200 to 300 second-feet, 300 to 400 second-feet, 400 to 500 second feet, and above 500 second-feet.

It shows the total number of days in each month for the ten years of each stage, the maximum, the minimum, and the average number of days in each month for the ten years, the maximum of the flow recession to the 400 and the 500 foot stage. The Minimum of the flow recession to the 400 and 500 foot stage, and the average time of the flood waters have receded to the 400 and the 500 foot stage.

The corrections to observed flow are shown at the head of table.

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Plate I.

Plate I is a graphic ~~xxx~~ presentation of the fluctuations of Utah Lake, the precipitation, and the mean discharge of the Provo River for years as shown, the second feet discharge is shown on the extreme right.

Plate II.

Plate II is a graphic presentation of the fluctuations of Great Salt Lake, the precipitation, and the mean discharge of the Provo River for years as shown, the second feet discharge is shown on the extreme right.

Plate III.

Plate III is a graphic presentation of the "Mean Provo River 1905 to 1914" is based on the natural flow and is corrected for inflow and the diversion to river by the Provo Reservoir Company. & It is the result of 1830 observations. Also is shown by broken line the 1914 Natural Provo River.

Table III.

Table III is the tabulation of the "Mean Provo River" as ~~graphic~~ *ally show on* Plate III.

Table IV.

Table IV is a summary of period comparisons, for the months of April, May, June, July, August, and September, it shows the comparative difference of the Second period to the First Period, and the effect of the greater irrigation of the Provo Valley.

SUMMARY OF TABULATION AND PERIOD COMPARISON

Month of April

Table IIII

First Period				Second Period			Whole Period			Comparative Diff. 2nd to 1st Period.		
Max.	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
Max.	1548	842	885	1600	610	944	1600	842	944	52*	232-	59*
Min	470	310	407	525	278	359	470	278	359	55*	32-	48-
Mean	1083	529	691	991	419	637	1033	469	662	92-	110-	54-

Month of May.

Max	4180	1350	1946	2380	890	1500	4180	1350	1956	1800-	460-	446-
Min	1162	420	987	780	341	508	780	341	508	382-	79-	479-
Mean	2126	857	1358	1623	570	1014	942	700	1171	503-	287-	344-

Month of June.

Max	3375	1484	2375	3660	1670	2290	3660	1670	2375	285*	186*	65-
Min	1988	185	434	753	254	429	753	185	429	235-	69*	7-
Mean	1955	644	1216	1732	605	1062	1839	624	1135	223-	39-	154-

Month

Month of July

Max	1920	360	709	2140	519	1160	2140	519	1160	220*	159*	451*
Min	180	179	180	260	166	235	180	166	180	80*	13-	55*
Mean	728	363	369	656	271	416	690	267	393	72-	92-	47*

Month of August.

Max	474	360	367	498	399	427	498	399	427	24*	39*	60*
Min	179	174	175	179	174	174	179	148	167	000	00	91-
Mean	295	245	261	327	241	272	312	243	267	32*	4-	11*

Month of September.

Max	530	360	460	680	399	484	680	399	484	150*	39*	24*
Min	197	137	180	213	142	183	197	137	180	16*	5*	3*
Mean	332	250	284	348	249	287	340	250	285	16*	1*	3*

* Denotes the second period greater than the first, in second-feet.
 - Denotes the second period less than the first, in second-feet.

Sec. 2. Office Provo River Water Commission.

Provo, Utah Sept., 15, 1914.

List of Diversions, and respective measuring devices, Provo River, Provo Division. Compiled by T.F. Wentz.

No.	Name	Measur.	Devise	Date Instal.
100AC	Midway Irrigation Company (Upper Diversion)	8 foot	Cipp. Weir.	
100BD	" " " (Lower ")	6x1 ft.	Sup. Weir.	1914.
100E	" " " Mahogany Springs	None.		
100F	" " " Epperson Springs	None.		
100G	" " " Snake Creek Above Town	12' x 1'	Sup Weir	1914.
100H	" " " Probest Ditch	3 ft.	Rect Weir.	
100I	" " " West Bench Ditch	5 ft.	Rect. Weir.	
100J	" " " Mound Ditch	None		
100K	" " " Lower Springer Ditch	None.		
100L	" " " Upper " "	None.		
101	Ford Ditch (Lewis Ford & Smith Estate)	6" 1' x 6"	Sup Weir.	1914.
101B	Effie Haws Ditch -----	None.		
102	Remund Ditch -----	3' x 1'	Sup Weir	1914.
103	Mitchel Ditch -----	3' x 1'	Sup Weir	1914.
104	Spring Creek Ditch Irrig. Co. & Sage Brush Irrig. Co.	None.		
105A	Charleston Irrig. Co., Upper Branch.	None.		
107	Nelson Ditch -----	3 ft.	rating Flume	1914.
107A	Alder Ditch -----	None.		
108	Averett Ditch -----	None.		
109	George R. Carlile, Sub-irrigates by Backing up Slough.			
110	Hicken Slough (W. Casper, & J Casper)	None.		
111	Watkins Slough (J. M. Casper) -----	None.		
112	Meaks Bottom Slough -----	None.		
113	Van Wagenen Snake Creek Ditch -----	None.		
114	Charleston Midway Ditch -----	None.		
115	Winterton Bottoms Spring Branch -----	None.		
116	River Ditch -----	None.		
117	Springer & Tate Springs -----	None.		
118	Bonner Slough & Soldier Hollow -----	None.		
119	North Drain Ditch -----	None.		
120	Fowers Springs -----	None.		

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List of Diversion, Provo River, Provo Division. And Miscellaneous Points.

No.	Name	Measr. Devise	Date. Inst.
121	W.D.Wright Springs-----	None.	
122	Daybell Springs -----	None.	
123	Richie Ranch -----	None.	
124	Charleston Irrigation Co. Lower Canal -----	None.	
125	Pioneer Irrigation Co.-----	None.	
126	Wright Ranch -----	None.	
127	Allen & McAfee-----	Not complete.	
128	Webster Springs -----	None.	
129	Tate Pasture Drain -----	None.	
117A	Bonner Drain Ditch -----	None.	
202	Provo River Below Upper Midway Dam -----	None.	
201	Snake Creek Weir Below All Diversions-----	5 ft. rect.weir.	
200	Provo River Below Lower Midway Dam -----	None.	
130	John W. Hoover -----	None.	
131	Sam Rieske-----	Not known.	
132	Wildwood Resort Co. -----	None.	
133	Conrad Bros. South Fork -----	None.	
134	Thomas & Giles, South Fork -----	Not Known.	

List of Diversions		Provo River	Provo Division.	
No.	Name.		Measr. Devise	Date Inst.
1.	Provo Reservoir Company-----		10 ft. R.Flume.	1914.
1A.	Sego Irrigation Company-----		3' x 1' Sup.Weir.	1914.
2.	Timpanogus Canal Company -----		7 ft.rating flume	
3.	Provo Bench Canal & Irrigation Co.-----		15ft.rating flume & Register.	
4.	West Unoin,Smith Ditch,& Carter Ditch (jointly)		12' x1' Sup Weir	1914.
5.	River Bottoms.			
5a	Barton & Young Ditch -----		3' x1' Sup.Weir.	1914.
5b	Par & Nuttal Ditch -----		3' x1' Sup. Weir.	1914.
5c	Henry Smith Ditch No 1. -----		None.	
5d	John Gordon Ditch -----		3'x1' Sup.Weir (incomplete)	
5e.	MrsJensen Ditch -----		None.	
5f.	Smith Ditch No.2 -----		None.	
5g.	Startup Ditch -----		None.	
5h.	Richmond Ditch -----		3' x1'Sup.Weir (incomplete)	
5h 2.	Richmond Ditch No.2. -----		None.	
5i.	Ferguson Ditch No.4. -----		3' x1' Sup.Weir (Incomplete)	
5j.	" " No.3. -----		3' x1' Sup.Weir (incomplete)	
5k.	Ferguson Ditch No.1. -----		2' x1' Sup.Weir (incomplete)	
5l.	" " No.2. -----		3' x1' Sup.Weir (incomplete)	
5m.	Booth Meldrum Ditch -----		3' x1' Sup.Weir (incomplete)	
5n.	West Booth Ditch -----		None.	
5o.	Jacob Baum Ditch -----		3' x1' Sup.Weir (incomplete)	
5p.	George Baum Ditch-----		None.	
5q.	Thomas Foote Ditch -----		None.	
5r.	Barnett Ditch -----		None.	
6	Upper East Union & Fausett Field (Jointly) ---		8 ft.x1 ft.Sup Weir	191
7	Upper East Union -----		8 ft. rating flume.	
8	Provo City.			
a.	East Unoin -----		7.73' x1' Sup.Weir	1914
b.	Factory Race -----		16 ft. rating flume.	
c.	City Race -----		8 ft. rating flume.	
d.	Tanners Race -----		7.96' x1'Sup.Weir.	1914
e.	Young Ditch -----		None.	
f.	Cluff & Dixon Ditch -----		None.	

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List Of Diversions, Provo River, Provo Division.

No.	Name.	Measuring Devise	Date Inst.
8g	Provo City Waterworks system.		
9	Little Dry Creek Irrigation Company -----	5 ft. rating flume.	
10	Lake Bottom Canal Co.-----	10 ft. rating flume.	
11.	Fort Field Irrigation Co.-----	3 ft. rating flume.	1914.
12.	Spring Creek Diversions.-----		
a.	Tanner Farm Flume Ditch -----	Rating Flume.	
b.	Tanner Farm East Ditch -----	Rating Flume.	
c.	Tanner Farm West Ditch -----	2 ft. Cipp. Weir.	
d.	Clyde Ditch -----	3' x1' Sup. Weir.	1914.
e.	Clyde Davis Ditch -----	Rating Flume.	1914.
f.	Roy Brown Ditch -----	3' x1' Sup. weir.	1914.
g.	Stephen Jones Ditch -----	Rating Flume	1914.
h.	Partridge Ditch -----	Suppressee Weir.	
i.	Asther Taylor Ditch -----	None.	
j.	George Taylor Ditch -----	None.	

Sec.3.

(Copy. of Copy)

Mr. R.J.Murdock, President,
Provo, Reservoir Company,
Provo, Utah.

Dear Sir;

A preliminary estimate of the land irrigated under the ~~various~~ various canal systems by the Provo River in this Valley as tabulated from my investigations, is as follows:

Provo Bench System:

Provo Bench Canal & Irrigation Co:

Wentz &) Highwater-----	2711.16	Acres.
Stewart) Low-water-----	2042.34	"

North Union Irrigation Co:

Wentz &) Highwater	1621.37	"
Stewart) Low water.	1038.81	"

Timpanogus Canal Co:

Wentz &) High water	846.98	"
Stewart) Low water	708.53	"

Upper East Union Canal Co:

Probably not to exceed 762.18 "

Provo City, including East Union: Excluding road areas, most of First Ward Pasture, swamps and meadow. Probably less than 2682.20 "

River Bottoms, Exclusive of Faucett Field 516.00 "

Faucett Field 108.75 "

Dry Creek, probably less than 506.00 "

Fort Field , probably not to exceed 574.30 "

Lake Bottoms, probably not to exceed 1275.00 "

West Union, including Smith Ditch: And Carter ditch, estimated at 430.0 acres, Probably not to exceed. 1900.00 "

Under the last three named canals systems there are additional areas served from seepage and from artesian wells.

Very Respectfully,

Scott P. Stewart.

(Copy of Copy.)

Sec.3. ~~Copy.~~

Copy.

Provo, Utah, Jan. 2, 1915.

Mr. T.F. Wentz, Com.,
Provo River,
Provo, Utah.

Dear Sir;

In reply to your verbal inquiry regarding the total irrigated ares under Spring Creek Branch of Provo River, you are advised that there are under irrigation ~~276~~ 276 acres.

Yours Truly,
(Signed) Frank S. Allen
Engineer.

Sec.3.

Copy.

Provo City,Utah,September 23rd,1914.

Mr. Frank Wentz,
Deputy Commissioner for Provo River.
Provo City,Utah

Dear Sir;

The following is a statement of the lots and lands irrigated under the Irrigation system of Provo City.

Total acres 1991.81

Total lots 1789.42

equivalent to an acreage of 3781.23

It requires as much water for a city lot as for an acre of farm land measured at the head of the ditch.

Respectfully,

G.C.Swan

City Engineer.

Table V.

Sec.3.

IRRIGATED ACREAGE, ?UTAH LAKE VALLEY, PROVO RIVER AND SPRING CREEK.

Compiled from surveys and data as shown by letters herewith.

<u>Provo Bench Canal & Irrigation Co. Including North Union Irrigation Company</u>	4333.00	Acres.
<u>Timpanogus Canal Company</u>	847.00	"
<u>Upper East Union Canal Co.</u>	762.	"
<u>Faucett Field</u>	109.	"
<u>River Bottoms</u>	516.	"
<u>Dry Creek</u>	506.	"
<u>Fort Field</u>	574.	"
<u>Lake Bottoms</u>	1275.	"
<u>Spring Creek</u>	276.	"
<u>West Union, Smith and Carter ditches</u>	1900.	"
<u>Provo City Acreage</u>	1992.	"
<u>Provo City Lots</u>	1789.	an
<u>area of, including streets</u>	1200.	"
<u>Total</u>	14,290.	"

Note:

For the Purposes of this report, the above noted acreage will be used.

The present irrigated acreage under the Provo Bench Canal & Irrigation Company, and the Timpanogus Canal Company, was compiled by jointly by a representative of each of these companies and a representative of the Provo Reservoir Company, and which amounts, I believe, are acceptable and satisfactory to both parties.

The Provo City acreage is submitted by Provo City.

The acreage of the other parties, excepting the First Ward Pasture Company, is submitted by The Provo Reservoir Company, on a compilation of a hydrographic survey, and until a joint compilation is made, or an acceptable amount determined this data, the result of an actual survey, will be admitted as being correct.

The acreage allowed under the Provo City lots, includes streets, buildings, pavements ect., the amount under this head is a very difficult problem, but the amount ^{of water} allowed, ^{hereafter} in my opinion is fully adequate to cover all uses.

DISTRIBUTION OF PROVO RIVER UNDER " MORSE DECREE "

Table VI

Canal.	15000 m.f.	14999 m.f.	12000 m.f.	11999 m.f.	*Max.
	Prop. Amt.	Prop. Amt.	Prop. Amt.	Prop. Amt.	Cap'ty Date.
Lake B.C.Co.	.0545 13.625	.0595 14.875	.0595 11.900	.0633 12.660	27.27 7-2-04
P.B.C.&I.Co.	.2295 57.375	.1765 44.125	.1765 35.300	.1444 28.880	139.88 6-2-13.
Timpanogus.	.0395 9.875	.0355 8.875	.0355 7.100	.0290 5.800	39.65 6-2-13.
U.E.U.&F.F.	.0774 19.350	.0845 21.125	.0845 16.900	.0905 18.100	47.62 6-2-13.
Provo City et.	.3525 88.125	.3895 97.375	.3895 77.900	.4023 80.460	185.34 6-2-13.
L.D.Creek	.0321 8.025	.0390 9.750	.0390 7.800	.0430 8.600	20.17 6-6-05.
River Bot.	.0875 21.875	.0875 21.875	.0875 17.500	.0879 17.580	101.85 6-7-05.
W.Union et al.	.1260 31.500	.1270 31.750	.1270 25.400	.1385 27.700	69.88 6.20-04.
M.Tanner	.0010 .250	.0010 .250	.0010 .200	.0011 .220	No Record.
Totals	1.0000 250.00	1.0000 250.0	1.0000 200.0	1.0000 200.0	667.28 622.66

* Maximum measured flow, and date. Note; - Amounts are given in second feet.

DISTRIBUTION OF PROVO RIVER UNDER " CHIDESTER DECREE "

Canal.	Class "A" (17467 M.F.).	Class "B".	Class "B". after deducting "A"
	16931*		
Provo City et al	17000		17000/17960=95%
Hyrum Heilset	9.		
Springdell R.CO.	60.		
George Duke	30.		
J.Mecham	20.		
Ed Mecham	40.		
C.S.Conrad	50.	24.	
J.R.Hooks	30.		
J.H.Snider	40.		
S.Fork Cattle Co.	4.	18.	
George Taylor	8.	8.	
J.W.Hoover	114.		
Wright Estate	60.		
Blue Cliff	69 *		960/17960 =5%
Total	17465.	" 50. A"	

reserves

Sec.7. The Telluride Power Co. ~~has~~ right to use of such water ~~as~~ as it may require for domestic purposes, from the springs arising in Lot 3, sec.33, tp. 5 S. Range 3 East.

Also; The telluride Power Co. has the right to use for domestic and irrigation purposes, at such place as it may elect, all of the water of "Johnson's Springs" (These two paragraphs refer to the ~~same~~ same water)

DISTRIBUTION OF PROVO RIVER UNDER " MORSE DECREE " BY PROPORTION.

	15000 m.f. and up.	15000 to 12000.	12000 and below.
Lake B.C.Co.	.0545	.0595	.0633
P.B.C.&I.Co.	.2295	.1765	.1444
Timpanogus	.0395	.0355	.0290
U.E.U.&F.F.	.0774	.0845	.0905
Provo City et al	.3525	.3895	.4023
L.D.Creel	.0321	.0390	.0430
River Bottoms	.0875	.0875	.0879
W.Union et al	.1260	.1270	.1385
M.Tanner	.0010	.0010	.0011
Totals	1.0000	1.0000	1.0000

TABLE SHOWING DISTRIBUTION AND WATER DUTY UNDER THE "MORSE DECREE".

Canal System.	Irrig Area.	At 300 sf. Stage Prop.	Quant	Stage Duty.	At 250 sf. Stage Prop Amt.	Stage Duty	At 250- sf. stage Prop	Amt.	Stage Duty	
Provo Bench Canal & I.Co	4333	.2295	68.85	<u>63</u>	.2295	57.37	<u>76</u>	.1765	44.12	<u>98</u>
Timpanogus Canal Co.	847	.0395	11.85	<u>72</u>	.0395	9.87	<u>86</u>	.0355	8.87	<u>105</u>
Upper East Union	762	.0605	18.15	<u>42</u>	.0605	15.12	<u>50</u>	.0665	16.62	<u>46</u>
Faucett Field	109	.0169	5.07	<u>21</u>	.0169	4.22	<u>26</u>	.0180	4.50	<u>24</u>
River Bottoms	516	.0875	26.25	<u>20</u>	.0875	21.87	<u>23</u>	.0875	21.87	<u>24</u>
Little Dry Creek	506	.0321	9.63	<u>53</u>	.0321	8.02	<u>63</u>	.0390	9.75	<u>52</u>
Lake Bottoms	1275	.0545	16.35	<u>78</u>	.0545	13.62	<u>94</u>	.0595	14.87	<u>86</u>
West Union Smith, Carter	1900	.1260	37.80	<u>50</u>	.1260	31.50	<u>60</u>	.1270	31.75	<u>60</u>
Provo City	3192	.3525	85.30	<u>37</u>	.3525	67.67	<u>47</u>	.3895	66.82	<u>48</u>

Note: The amount to Provo City as shown is 20.45 less than the proportionate part. 19.3 second feet allowed for machine interests, and 1.15 for Blue Cliff Right.

Table VIII

TABLE SHOWING DUTY OF WATER IN THE UTAH VALLEY WITH CANALS
AT THE MAXIMUM RECORDED CAPACITY.

	Irrig Area.	Max.Rec. Cap.	Duty.
Provo Bench	4333	139.88	31
Canal & Irrig Co.	132x88		
Timpanogus Canal Co.	847.	39.65	21
Upper E.Union &Faucett Fd.	871	47.62	18
River Bottoms	516	101.85	5.
Little Dry Creek	506	20.17	25.
Lake Bottoms	1275	27.27	47
West Union Smith,Carter	1900	69.88	27
Provo City	3192	110.43 (185.34)	29

Note: The total diversion to Provo City was 185.34 sec.ft. 74.91 sec.ft. in the Factory Race, this amount is deducted in the calculation.

" This table is given to show the inconsistency of claimants for allotment to full capacity. "

TABLE SHOWING DISTRIBUTION AND WATER DUTY.

For July 28, 1914.

Under Stipulation of May 25, 1914, and on order of Commissioner
of July 28, 1914.

	Irrig Area	Amt. sf.	Duty.
Provo Bench Canal & I. Co.	4333	106.00	<u>41</u>
Timpanogus Canal Co.	847	18.00	<u>47</u>
Upper E. Union & Faucett Fd.	871	23.20	<u>38</u>
River Bottoms	516	26.25	<u>20</u>
Dry Creek	506	10.00	<u>51</u>
West Union Smith Carter	1900	37.80	<u>50</u>
Provo City	3192	98.70	<u>32</u>

Note; The amount to Provo City as shown is 19.30 second-feet less than the amount allotted, 19.3 second-feet allowed for machine interests.

TABLE SHOWING DISTRIBUTION AND WATER DUTY.

August 15-28, 1914.

This table is only an approximation, and merely assumes to show the relative duties of water during this period.

	Irrig Area.	Amount Sec.feet	Duty.
Provo Bench Canal & I.CO.	4333	86.75	50
Timpanogus	847	18	47
Upper East Union & Faucett Fd.	871	23.20	38
River Bottoms	516	26.25	20
Dry Creek	506	10.	51
West Union Smith, Carter	1900	37.80	50
Provo City	3192	95.3	33 (Exclusive Machine Water)
Fort Field	574	7.03	81
Lower Charleston	500	21	24
Spring Creek & Sagebrush	1200	21.37	56
Upper Charleston	653	20.47	32 (6 s.f. added for inflow)
Midway Irrig.Co.	4109	47.21	87
Wasatch Canal Co.60(Reported by John Clegg)

The duty to Wasatch Canal Co. does not include storage water.

The amount to Provo City as shown is 19.3 sec.ft. less than the amount allotted, 19.3 sec.ft. is allowed for machine interests.

TABLE SHOWING EVAPORATION LOSSES. FROM FREE WATER SURFACES.

Mean evaporation of Utah Lake, from record of Louis C. Kelsey, City Engineer Salt Lake City, published in Fifth biennial Report of Utah State Engineer, page 305.

April	May	June	July	August	Sept.	Total for six months	
.386	.547	.733	.784	.631	.564		3.645 feet,

which equals 44 inches (Approx.)

Mean evaporation for three localities in Idaho, as shown by Book 1. (Ninth biennial Report of the State Engineer Of Idaho) page 297, shows an average loss for April to September, inclusive, Of 1.53 inches per week, or a total loss of ~~32x~~ 40. inches.

EVAPORATION FROM IRRIGATED SOILS.

Compiled from Bulletin No. 248, U.S. Dept. Agriculture. Office of Exp. Stations.

Deductions from tables on page 12:

1. Experiments were made at Davis, California, June, - July 1908. period 21 days.
2. Maximum temperature during time 88° F. (Mean)
3. Mean Minimum temperature 49.7° F.
4. Total loss of water from free surface for the 21 day period 8.27 inches.
5. the loss of water from unmulched surface 1.35 inch, which was equal to 22.6 per cent of total amount applied in irrigation, and which loss equaled 1.08 per cent daily average.
6. The loss on a three inch mulched surface, equaled 5.2 per cent of water applied by irrigation, or .25 per cent daily average.

Deductions from Tables on page 14:-

1. Experiments were made at Davis, Cal., Sept. 1, to Oct. 3, 1908. period 32 days.
2. Mean Maximum temperature during period 85.3° F.
3. Mean Minimum temperature during period 50.9° F.
4. Total loss of water from free surface for period 10.19 inches.
5. Loss of water from unmulched surface 2.15 inches, or 35.9 per cent of total applied by irrigation, a daily average loss of 1.12 per cent of water applied.
6. The loss from a 3 inch mulched surface was 0.91 inch, or 15.2 per cent of water applied, or 0.48 per cent daily average loss.

Deductions from tables on page 16:-

1. Experiment were made at Reno, Nev., June 9-30, and Sept 1-22, tables show a average of of the two periods.
 2. Loss from free water surface 4.68 inches.
 3. Loss from unmulched surface 1.41 inch, or 23.6 per cent of total water applied by irrigation, or a daily average loss of 1.14 per cent.
 4. Loss from 3 inch mulched surface 0.88 inch, or 14.6 per cent of total water applied, a daily average loss of .7 per cent.
- Note Total water applied 6 inches.

Deduction from tables on page 29:-

An average of experiments shown in the table shows:-

1. Evaporation from unmulched surface is 28.15 per cent for a period of 21 days, an average daily loss of 1.34 per cent of water applied.
2. Evaporation from a 3 inch mulched surface for a period of 21 days is 13.4 per cent loss, or an average daily loss of .64 per cent of water applied.

Deductions from tables on page 48:-

This table shows a summary of experiments, and is therefore an approximate average of general conditions.

1. Loss from free water surface is 9.71 inches for a period of 28 days, or an average loss daily of .35 inch.
2. Loss from cultivated surface 1.58, for a period of 28 days, an average daily loss 0.056 inch, an average loss of 26.5 per cent of total applied an average daily loss of 0.95 per cent of total water applied.
3. Loss from uncultivated surface is 2.13 inches, for a period of 28 days, an average daily loss of 0.076 inch, and average loss of 35.6 per cent of total water applied, an average daily loss of 1.57 per cent of water applied.
4. Cultivation reduces evaporation approximately 25 per cent.
5. Mean Temperature under these experiments was 66.3 F.

Note. Mean normal temperature for Provo for the month of June is 64.8° F. for July is 73.3° F. for August is 71.1, for Sept. 70.9, for May 57.4, an average mean normal for May, June, July, August and Sept. of 67.5° F.

CONCLUSIONS:- For all practical purposes average daily loss of water from uncultivated soils is 1.5 per cent, daily average, of water applied.

For all practical purposes average daily loss of water from by evaporation from Cultivated soils is 1. per cent, of water applied.

Sec.5.

TRANSMISSION LOSSES.

No.1. July,23,1914.

Lateral No.1,Provo Bench Canal & Irrigation Co.

Flow of system was at the approximate two-thirds stage.

100 feet below head,discharge 11.3. second-feet.
 2 $\frac{1}{2}$ miles below head RayPartridge house,discharge 8.66 sec.ft.
 Diverted at Jos.Richmond,1.34 sec.ft.
 Diverted at John Jones, 0.27 sec. ft.(ByDemming)
 Loss in transmission 1.04 second-feet.
 Loss per mile 0.42 sec.ft.
 Loss per cent per mile 3.6

Soil,gravellyloam with porous subsoil.
 Condition of lateral,fair.

No.2. July 29,1914.

North Union Canal.

Flow of system at approx two-thirds stage.

At survey station 5.discharge 31.79 second-feet.
 At Station 103,discharge 29.96 " "
 Loss----- 1.83 " "

Distance 98 Stations,1.85 miles.
 Loss per cent 3.7
 Loss per cent per mile 2.

Soil,gravellyloam,with porous subsoil.

Condition of channel,bad, -- not a uniform grade,poor alingment, large growth of moss.

No.3 July 29,1914.

North Union Canal.

Flow at approximate two-thirds stage.

Station 103 plus,below lateral No.1.Discharge 26.09 second feet.
 Station 127 lateral No.2 diverts ----- 4.08 sec.ft.

July 30,same stage by gaging points.

Lateral No.3	Diverts -----	0.00	"	"
" " 4.	" -----	0.00	"	"
Station 154 lateral No5.	Diverts-----	7.63	"	"
" 158 " " 6.	" -----	3.70	"	"
Station 161 Main Canal, Discharge	-----	9.75	"	"
Total	-----	<u>26.09</u>	<u>25.16</u>	
Loss	-----			0.93 s.f

Distance 58 station,1.1 miles.
 Loss per cent. 3.6
 Loss per cdnt on whole distance,per mile,3.3

Soil on first two-thirds distance is a gravelly loam,with porous sub-soil,and soil on the last third of distance is a clay loam,and at station 161 is a clayloam with an impervious claysubsoil.

Sec. 5.

TRANSMISSION LOSSES.

(2)

No.4. July 30,1914.
North Union Canal
Flow as stated heretofore.

Station 161,discharge 9.75 secon-feet.
Lateral No.7 diverts ----- 0.00 sec.ft.

Lateral No.8.at stat.187 diverts 2.24 sec.feet.
" " 9 " " 0.00 " "
" " 10 " " 210 " ~~3.22~~ "3.50 sec.ft.
At Station 210 inflow of 0.10 sec ft.
Main Channel at station 210 3.99 sec.ft.
Total initial discharge 9.85 sec.feet.
Total available discharge 9.73 " "
Loss----- 0.12 " " .

Loss a negligable quantity,
Soil is a clay loam,with a stiff ~~clay~~ light colored subsoil.

No5. August 8,1914.
Lower Charleston Canal.

From a point near the head to the center of Charleston Town,near the home of Bishop Ritchie, there is no difference in flow,there is no loss,or inflow and loss balance.

No.6. Provo City,irrigation system.
Sept 28,1914.
Ditch on West side 9th west street.

150 feet South of Center street.
Depth on 1 ft. Cipp.Weir 5 inches,discharge 0.916 sec.ft.

75 Feet North of 6th South Street.
Depth on 1 ft. Cipp. weir 4 3/4 inches, discharge 0.852 sec.ft.

Difference 0.064 sec.ft.
Distance 0.48 mile.
Loss per mile ~~1.33~~ .133 sec.ft.
Loss per cent per mile 15.

No.7. Provo City Irrigation Syatem.
Sept 29,1914.
Ditch on East side of 1st East street.

50 Feet South of 8th North Street.
Depth on lft. Cipp. weir 3 1/4 inches,discharge 0.472 sec.ft.

100 Feet North of 1st South Street.
Depth on 1 ft. Cipp.weir. 3 1/16 inches,discharge 0.430 sec.ft.

Difference 0.042 sec.ft.
Distance 0.78 mile.
Loss per mile 0.054 sec.ft.
Loss per cent per mile 11.

Sec.5. TRANSMISSION LOSSES.

(3)

No.8. Provo City Irrigation System.
Sept.29,1914.
Ditch on ~~East~~ West side of 1st East Street, at 8th North, along South side of ~~7th~~ 7th North street to the West side of Academy Avenue, and South along the West side of Academy Avenue.
60 Feet South of 8th North Street,
Depth on 1 ft. Cipp. weir 5 inches, discharge 0.916 sec.ft.
Academy Avenue and 2nd North Street.
Depth on 1 ft. Cipp. weir 4 13/16 inches, discharge 0.867 sec.ft.
Difference 0.049 sec.ft.
Distance 0.62 mile.
Loss per mile 0.079 sec.ft.
Loss per cent per mile 8.6

No.9. Provo City Irrigation System.
Sept.29,1914.
Ditch on East side of 3rd East Street.
80 Feet South of 8th North.
Depth on 1 ft. Cipp. weir 3 3/4 inches. Discharge 0.58 sec.ft.
40 Feet South of Center Street.
Depth on 1 ft. Cipp. weir 3 1/2 inches. Discharge 0.53 sec.ft.
Difference 0.05 sec.ft.
Distance 0.73 mile.
Loss per mile 0.068 sec.ft.
Loss per cent per mile 12.

Explanatory; In each and every case in these measurements, extreme care was taken to obtain precise results, fine point gage hubs were set and observed to determine if there ~~was~~ occurred any difference of flow at either the head or tail station, and no change of flow during time of observation occurred.

The 1 foot Cipp. Weir used, is of steel, of good construction, and perfect lines, furnished by Provo City.

Where weir is not specified, meter No.1350 was used, on rating of April 2, 1914, by the Rensselaer Polytechnic Institute Hydraulic Laboratory. Watch "New York Standard No. 5509953".

TABLE SHOWING COST PRODUCTION OF DIFFERENT CROPS IN UTAH VALLEY, UTAH.

Items	Crop (Cost per acre)			
	Sugar Beets	Alfalfa	Wheat	Potatoes.
Flowing -----	\$3.50		\$3.00	\$3.50
Disking and harrowing -----	1.00	\$2.00	1.00	1.00
Leveling -----	.50			
Seeding -----	2.75		1.00	2.00
Seed -----			1.80	5.00
Ditch repairs -----	.50	.50	.50	.50
Furrowing out and cultivating -----	2.40		.50	4.00
Cutting and Shocking -----			2.00	
Cutting and raking -----		1.25		
Hauling -----		4.00	2.00	
Threshing -----			4.00	
Harvesting -----	19.50			12.00
Thinning -----	5.00			
Hoing -----	2.00			2.00
Irrigating -----	2.00	5.00	1.00	3.00
Fertilizer -----	10.00		10.00	10.00
Wear and tear on farm equipment	1.00	1.00	1.00	1.00
Interest on investment (Land and water valued at \$250. per acre) at 8% -----	20.00	20.00	20.00	20.00
Interest on investment in farm equipment -----	2.00	2.00	2.00	2.00
Totals -----	\$72.15	\$35.75	\$49.30	\$66.00
Average market price per bushel -----			.80	4.0
Average market price per ton -----	5.00	10.00		
Number of bushels yield necessary to cover cost of production -----			62.00	165.00
Number of tons yield necessary to cover cost of production -----	14.4	3.6		

TABLE SHOWING YIELD OF CROPS WITH DIFFERENT QUANTITIES OF APPLIED WATER.
(Yields diminished by excess of water are omitted.)

Crop	Inches of applied water.											
	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	60.00
Wheat	37.81	41.54	43.53	45.71		46.46		48.55				
Straw	2986	3301	3452	3954		4311		4755				<u>49.38 bu.</u> 5332 lbs.
Oats	62.28		54.76	71.54	<u>80.70</u>					79.06		Bu.
Straw	2092		2269	2617	<u>3031</u>					<u>3611</u>		lbs.
Barley		<u>68.76</u>		67.66		66.15						
Straw		<u>3946</u>		4437		4477			62.59*			bu. lbs.
									<u>5929*</u>			
Corn	79.14	89.52	93.93	91.58	<u>99.16</u>	97.12						
Stover	7189	6007	8279	8692	<u>9492</u>	10390						96.78(55 in.) bu. 10258 " " lbs
Timothy	3982		3844			6054						<u>8406 lbs.</u>
Orchard Grass		2829	2685						4042			<u>5270 lbs.</u>
	2526											
Bromus Enern.	4480	<u>4957</u>	3821						4757			lbs.
Rye Grass.	2327		2218									<u>3201 lbs.</u>
Alfalfa		9884	7546	9097	9354	8840					<u>10813</u>	lbs.
Su.Beets	13.78	18.63	19.45	21.28		20.82					<u>24.54</u>	tons.
Carrots	34577	33223	49507		46755		56930					<u>68420 lbs.</u>
POTatoes	154.182	195.0	227.	267.		244.			253.			<u>304.</u> bu. Xixim.
Onions			21471	22038		32437						(65) <u>34171#</u>
Cabbage	18490(12.5)			18524	16310			20432				(70) <u>23098#</u>

* Approximate.

Highest production is underscored.

Note:-

This sheet is a compilation of "Utah Agricultural College Experiment Station Bulletin No. 117" (Conventional mark 3)

See cont.

Table XIV.

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TABLE SHOWING DEPTH PER ACRE PER DAY OF WATER DUTY							
Duty	Depth.	Duty	Depth.	Duty	Depth.	Duty	Depth
1.	.98347	50.	.03967	100.	.01983	150.	.01322
2.	.99174	51.	.03889	1.	.01964	1.	.01314
3.	.66116	52.	.03814	2.	.01945	2.	.01305
4.	.49587	53.	.03742	3.	.01926	3.	.01296
5.	.39669	54.	.03673	4.	.01907	4.	.01288
6.	.33058	55.	.03606	5.	.01889	5.	.01280
7.	.28335	56.	.03542	6.	.01871	6.	.01271
8.	.24793	57.	.03480	7.	.01858	7.	.01263
9.	.22039	58.	.03420	8.	.01837	8.	.01255
10.	.19835	59.	.03362	9.	.01820	9.	.01248
11.	.18032	60.	.03306	110.	.01803	160.	.01240
12.	.16529	61.	.03252	1.	.01787	1.	.01232
13.	.15257	62.	.03199	2.	.01771	2.	.01224
14.	.14168	63.	.03148	3.	.01755	3.	.01217
15.	.13223	64.	.03099	4.	.01740	4.	.01209
16.	.12397	65.	.03052	5.	.01726	5.	.01203
17.	.11667	66.	.03005	6.	.01710	6.	.01195
18.	.11019	67.	.02960	7.	.01695	7.	.01188
19.	.10439	68.	.02917	8.	.01681	8.	.01181
20.	.09917	69.	.02875	9.	.01667	9.	.01174
21.	.09445	70.	.02834	120.	.01653	170.	.01167
22.	.09016	71.	.02794	1.	.01639	1.	.01160
23.	.08624	72.	.02755	2.	.01625	2.	.01153
24.	.08265	73.	.02717	3.	.01613	3.	.01147
25.	.07934	74.	.02680	4.	.01600	4.	.01140
26.	.07629	75.	.02645	5.	.01587	5.	.01133
27.	.07346	76.	.02610	6.	.01574	6.	.01127
28.	.07084	77.	.02576	7.	.01565	7.	.01121
29.	.06840	78.	.02543	8.	.01550	8.	.01114
30.	.06612	79.	.02511	9.	.01538	9.	.01108
31.	.06398	80.	.02479	130.	.01526	180.	.01102
32.	.06255	81.	.02449	1.	.01514	1.	.01096
33.	.06011	82.	.02419	2.	.01503	2.	.01090
34.	.05834	83.	.02390	3.	.01491	3.	.01084
35.	.05667	84.	.02361	4.	.01480	4.	.01078
36.	.05510	85.	.02334	5.	.01470	5.	.01072
37.	.05361	86.	.02306	6.	.01459	6.	.01066
38.	.05220	87.	.02280	7.	.01448	7.	.01061
39.	.05086	88.	.02254	8.	.01437	8.	.01055
40.	.04959	89.	.02229	9.	.01427	9.	.01050
41.	.04838	90.	.02204	140.	.01417	190.	.01044
42.	.04723	91.	.02180	1.	.01407	1.	.01039
43.	.04613	92.	.02156	2.	.01397	2.	.01033
44.	.04508	93.	.02133	3.	.01387	3.	.01028
45.	.04408	94.	.02110	4.	.01377	4.	.01022
46.	.04312	95.	.02088	5.	.01368	5.	.01017
47.	.04220	96.	.02066	6.	.01359	6.	.01012
48.	.04132	97.	.02045	7.	.01349	7.	.01007
49.	.04048	98.	.02024	8.	.01340	8.	.01002
50.	.03967	99.	.02004	9.	.01331	9.	.00997
		100.	.01983	150.	.01322	200.	.00992

EXISTING DECREES.

It is, indeed, a question at this time, to explain, or account for, the basis or conditions, upon which the "Morse" and "Chidester" decrees were made. Was it an exaggeration of areas irrigated, or was it based on biased or unqualified testimony on the quantity of water necessary, or was it based on a small river without consideration of data that might have been admitted as testimony? It is reasonable to suppose that all the factors played a prominent part.

By Table VI the "Chidester" decree gives to the canyon rights as class "A" a second-foot for 60 acres, and some no xx participation in the class "B" water. It does not define to the plaintiffs a definite quantity ~~in second-feet~~, but decrees the remaining whole of Provo River, without regard to necessities..

On this allotment and using the "Morse" decree proportions, when the Provo River on June 7, 1909, was flowing 3,660 second-feet, the Provo City Water right was nearly 1,300 second feet about eight times their highest recorded carrying capacity, the Provo Bench water right was more than 800 second-feet, about six times their maximum recorded carrying capacity, the West Union and Smith Ditch, more than 400 second feet, about six times their recorded maximum carrying capacity. It is useless to cite more of these cases, or to admit argument that any such title is valid, or to be able to deduct from this decree any rights quieted except the amounts specifically stated.

Turning now to Table VII., and noting the column of water duty under the 300 second-foot stage, "Morse Decree", and also noting by Plate III that the average mean low water approximates 300 second feet, the decree awarded to the Provo Bench a second-foot for 63 acres, the Timpanogus a second-foot for 72 acres, Upper East Union a second-foot for 42 acres, Faucett Field a second-foot for 21 acres, River Bottoms a second-foot for 20 acres, Dry Creek a second-foot for 53 acres, Lake Bottoms a second-foot for 78 acres, West Union and Smith Ditch et al a second-foot for 50 acres, and Provo City a second-foot for 37 acres, extremes of a 78 acre duty and a 20 acre duty.

Sec. 7.

The River Bottoms drawing a 20 acre duty, to the 72 acre duty of the Timpanogus, the former more than three and one-half times greater than the latter, The River Bottoms for 100 days a depth of 9.92 feet per acre, the Timpanogus a depth of 2.75 feet per acre.

Note also the duties under the first column of the 250 second-foot stage, ranging from 23 acres per second-foot to 94 acres per second-foot.

And Note also the last column the 250 second-foot stage, duties ranging from 24 acres per second-foot to 105 acres per second-foot, ~~more than~~ a greater difference than 4 to 1.

By Table VIII., note the duty of water compared to capacity of canals, this is considered by some as a factor of right and title, A duty as low as a second-foot for 5 acres, .4 of an acre foot per day per acre, enough to cover all the land 12 feet deep per month. Which of these titles is equitable?

At this point, please bear in mind, that, in this discussion, I intend not, to cast reflections on the Court, I have stated before the probable causes that have brought about these conditions, the Court was evidently aware of this and inserted paragraph XV ("Morse Decree") which reads as follows; " That all the rights, fixed, declared and decreed herein, are founded upon appropriation of water, necessary for some beneficial uses, and that all such rights, hereby fixed, declared and decreed are subject in their exercise, to the conditions that they are required and necessary for some beneficial use, and that all such rights are expressly subject to the limitations and conditions that such waters are used for some beneficial purpose, and are used economically without waste, and with due care, and are reasonably and fairly necessary for such use,*****

Then all above this amount, so specifically stated, is subject to appropriation.

Later, in 1910, the Plaintiff in this action, came as a new appropriator, basing its project, on a small storage supply, the unappropriated flood waters, and the amount of natural flow not "used economically" and "without waste".

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After four years of "brotherly conferences", "Proffered stipulations" and "get together squabbles", the parties with their attorneys, appeared before the Court in the Spring of 1914, to agree on a working basis for the season. They finally submitted to the Court for signature, on May 25, 1914, a stipulation, it bears the earmarks of "An attorneys first experience with irrigation, and a farmers first experience with court."

However it was intended to bring peace and a solution of all existing evils. Let us see the affects, turn to Table IX, and note the duties: 42,47,38,20,51,50, and 32,.

Then turn to Table X and note the duties: 50,47,38,20, and 27.

In all these decrees and stipulations, were the facts at hand: Equity, and right, and ~~x~~ the statute provisions, were entirely unconsidered.

"These evils have long been recognized by practical irrigators and by lawyers and judges".

" In a brief before the State supreme Court (Colorado), Judge Elliot, an ex-justice of that court, thus forcibly describes them:"

"Excess priority decrees are a crying evil in the State. From every quarter the demand for their correction is strong and loud. Such crying demand cannot be silenced by declaring that the meaning and effect of such decrees can never be enquired into, construed or corrected after four years.

In many cases such decrees are so uncertain, so ambiguous, so inequitable, so unjust, and their continuance is such a hardship, that litigated cases will be continually pressed upon the attention of the courts until such controversies are heard and settled, and settled right. Litigation in a free country can never end while wrongs are unrighted".

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" Another distinguished irrigation authority, Mr. ~~Portt~~ Rogers of Denver, has added his testimony in the same direction:- "

" The decrees, in their entirety, are falsehoods and universally accepted as such. They furnish a fresh illustration of the truism that ' a lie never ceases to do evil'. If the construction heretofore placed upon them in some cases is to prevail, we have legalized a method of accomplishing the precise thing the Constitution intended to prevent, viz., speculation in water."

In the report of Commission appointed to revise Water Laws of Colorado, in speaking of the results of adjudications clearly summarized their defects as follows:-

" It (has) resulted that the amount of water to which the several appropriators of the works of diversion were entitled was ascertained and determined in these decrees by the interested conjecture of those proprietors; that almost invariably the amount awarded largely ~~ex~~ exceeded** sometimes threefold-- the carrying capacity of the ditch, ~~and the xxxxxxxx of the stream was~~ ~~absolutely and judge to the xxxxxxxx appropriators *****.~~

The decrees, therefore, instead of affording, as was intended, a just, true, and absolute measure of the rights of ~~the~~ all appropriators for irrigation, are in fact, false, and misleading, even as to those who participated in the enquiry upon which they are founded, and absolutely void as to all others."

The Hon. A.J. McCune an ex state Engineer of Colorado states in a report along this line as follows:-

" It appears to us that the most serious question connected with irrigation is the unstable condition of our water rights. In many instances, as the communities depending on irrigation grow older, complications seem to increase rather than ~~diminish~~ decrease Many of our troubles have arisen from carelessness in issuing decrees and by overappropriation, the present method being a kind of grab game without the necessary public supervision."

To the parties to this action, Plaintiff and defendants, I say, do not continue this practice of inequitable distribution, "get to-gether" and first, acknowledge, that, the existing decrees are neither equitable, just, nor practical, and second, ~~they~~ agree on a tentative duty for each system for a season, when you find defects meet and make corrections, and you will be able to make a fair and proper solution of this problem.

The writer hereafter gives a duty and a quantity for each system, that may be acceptable with few exceptions. Consider it fairly, and where you find necessary revise.

This suggestive duty is given to help you, and points out the only road to successful adjudication, that will stand against continuous litigation, and expense.

WATER RIGHTS.

Water rights originally began, on the Provo, with the beginning of irrigation, in the early settlement of this State.

The Constitution of the State Of Deseret made no mention of water rights, but the legislature made grants to the use of water.

In 1851 Congress created the Territorial Government of Utah, but made no provisions for the use of the waters of the territory, but the legislature continued to assume the right to dispose of water. It also passed a law delegating this power to the County Courts of the several counties. Organization of ^{the} North Union Irrigation Company ^{District} and to the Provo Bench Canal Company ^{Districts} are examples of record under this system.

A new irrigation law was passed in 1880, which provided a system of supervision, ^{By the County Court for} hearing of disputes, quieting of ~~the~~ titles, and the recording of rights. It also defined the Primary and Secondary rights. All of the provisions of this law were never fully enforced.

" One principle of this law has lived, however, and been reenacted and its principle extended in court decisions. This is the definition of primary and secondary rights."

" Primary rights include all rights acquired up to the time when the sum of the rights equals the average flow of the stream at low water stage. Secondary rights are acquired to any supply in excess of the average low water flow, and are subject to the complete enjoyment of the primary rights. Whenever there is not enough for all the primary rights, the flow of the stream is divided among them pro rata. When there is more than enough for the primary rights, but not enough for all the secondary rights, the excess over the primary rights is divided among the secondary rights pro rata."

No further irrigation legislation was enacted until 1897. Utah Became a state in 1896 and the Constitution

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adopted Article XVII (Existing Right Confirmed) "All existing rights to the use of ~~waters~~ any of the waters in this State for any useful or beneficial purpose, are hereby recognized and confirmed."

By the revised Statutes of 1898 section 1265, and by our present statute section 1288x27 the law of Priority Among Appropriators is defined as follows:-

"Appropriators shall have priority among themselves according to the dates of their respective appropriations, so that each appropriator shall be entitled to receive the whole supply to which his certificate entitles him before any subsequent appropriator shall have any right; provided, that whenever the natural flow of any stream shall have receded in volume in the annual low water stage, then the rights of all users to such flow at such stage shall be deemed to be equal as to priority, and the water, when at or below such stage, shall be apportioned pro rata among said users. But in times of scarcity, while priority of appropriation shall give the better rights as between those using water for the same purpose, the use for domestic purposes shall have preference over use for all other purposes, and ~~the~~ use for agricultural purposes shall have preference over use for ^{any} ~~all~~ other purpose except domestic use.

And to the quantity of water an appropriator is entitled to; ~~in his certificate~~ footnote 1288x5 R.S. 1907.

"Only entitled to what he needs Though one appropriates a specific quantity of water for a specific purpose, he is entitled to such quantity only as will satisfy the purpose for which the appropriation was made."

"Reasonable necessity and reasonable use. An appropriator of water is not confined to an appropriation simply for the amount of land irrigated during the first year of his diversion. The extent of an appropriation of water is determined by the reasonable necessity for the use of the water, by the intention of the appropriator, followed by reasonable diligence

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in executing such intent, and by the beneficial purpose for which the appropriation is made."

"Appropriation and use. The right of a prior appropriator is fixed by the extent of his appropriation for a beneficial use, and others may subsequently appropriate any water of the stream not so used by a prior appropriator. The right of the former being thus fixed, he cannot enlarge his rights to the detriment of the latter."

And also note 1288x20 R.S. 1907.

"Beneficial use. Beneficial use shall be the basis, the measure, and the limit of all rights to the use of water in this State.

The State Engineer clearly summarizes the necessity of a definition of water rights, in his report of 1902 and 1903, page 15, from which I insert the following;

" The definition of existing rights appears to be of first importance. This is not only necessary to pacify present ~~contention~~ contention, but to prevent future conflicts and encourage further progress. There can be no safe basis for future work before existing rights are known and made of public record. All future works and rights on existing systems must be based on the remnant of unappropriated water of these systems. The extent of this remnant can not be ascertained before the measure of unappropriated water is known, and the sum of the existing rights is the measure of the appropriated water, it is evident that the extent of the remnant can not be known before the existing rights have first been determined.

To defer the definition of these rights is not only to prolong the present general conflict, but to extend the cause of contention by permitting the number of uncertain rights to increase. In the meantime all plans of betterment must of necessity be based on no better foundation than that of the uncertain rights, and be liable to the same disturbances, litigation, and loss that involve all present undefined rights."

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This case I cite as particularly worthy of mention: In the adjudication of the Upper Provo River, the Hon. Judge Dusenberry, in the findings of fact and conclusions of law, ~~paragraph 18, finds~~ finds and decrees.

" That a cubic foot of water per second for each sixty acres, is necessary, to properly irrigate the lands irrigated by the plaintiffs."

This section clearly defines the extent and limitations of water rights, and which is so specifically stated in the findings and decree of the Court in a former case known as the "Morse Decree" paragraph XV and which has heretofore been inserted under section 7. And which is so forcibly outlined by our present statute, "beneficial use shall be the basis, the measure, and the limit of all rights in this State."

The main questions before the Court for determination in this case are, first, the extent of beneficial use of the primary rights, second, the average low water stage of the Provo River, and third, the flow of Provo River that is denoted as "times of scarcity".

Hereinafter under section devoted to the duty of water I give an approximate definition of the extent of the primary rights, which is subject to trial until a final determination can be made.

Plate III and Table III give the average low water stage of the Provo River in the Utah Valley, this data and the chronological Table II show the dates this stage covers.

Webster defines scarcity as : Smallness of quantity to the wants or demands: deficiency: lack of plenty." I interpret the meaning of the statute to be: a deficiency that will cause a material loss or a permanent injury to the agricultural interests if continued over any considerable time. In the Utah Valley, the requirements of crops demand an application of water at times not to exceed fourteen days, and the irrigating season must continue to nearly the first of October, and the last complete irrig-

ATION, cannot be earlier than September 10th, then "a time of scarcity" may occur prior to this date of September 10th.

This question will bear great consideration, and to fix a quantity at this ~~the~~ time without a definite determination of economic use, is rather a matter of conjecture, but rather than avoiding this matter or leaving it open, I submit my judgment as follows:

When the Provo River has receded to and is below an amount that will supply to the primary rights, a quantity to maintain eighty per cent of the amount hereinafter found to be the extent of the economic duty rights, before September 10th, it is then "a time of scarcity", and is subject to distribution according to the "preference rights".

(11)

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At the conclusion of this section I wish to impress upon the litigants:

Your right and title to the waters of the Provo River is limited by the extent of beneficial use, under the specific conditions set forth in this section, and which is so well defined by the Hon. Judge Morse.

No Matter what your custom has been in the past, or what amounts you have used, or for how many years, whether it be one or fifty, neither time or quantity, will be a factor in the final determination.

Under the laws of this State, by equity, and by right, you will be given the amount to supply your reasonable necessities, no more, no less.

Duty Defined: The duty of water in irrigation is the area of crop which can be matured with a given volume. It is the greatest area a unit of water will serve, under practical management, and insure successful crop production.

This term is expressed as a 50 acre duty, a 60 acre duty, meaning 50 and 60 acres respectively per second-foot of continuous flow.

Factors affecting the duty of water:

- a. The kind and peculiarities of the crop. Crops of different duty requirements throughout this district are diversified in all sections, and varying in different seasons. An area of alfalfa or sugar beets of this year, may be next season planted to grain or orchard. With this ~~factor~~ condition this factor must be considered to cover a general adequate amount covering the general practice and kinds of crops.
- b. The physical character of the soil. Sandy and loose soils require more than the clay and denser soils.
- c. Depth of soil. Shallow soils require more than deep soils.
- d. The character of the sub-soil. Subsoils that affect drainage to great depth at all seasons, require a less duty than sub-soils that become saturated by application of irrigation water.
- e. Frequency of Irrigation. The losses by necessary frequent irrigation are greater than were the applications made at greater intervals.
- f. ~~Frequency~~ Amount and distribution of rainfall.
- g. The amount and time of applying water, and the length of run. Water applied in the night is more efficient than if applied in the day. Water applied during the early growing season, keeping the soil to high moisture content, increase the duty of the available amount in a later period.

On a shallow soil with a porous sub-soil the duty of water varies with the amount applied and the length of run.

Fig.1. represents a cross section of a field (vertical scale exaggerated) irrigated by the flooding method it requires .3 foot for a complete irrigation, or to bring the soil ABHI to full

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moisture content, and provided an even distribution could be made. With an irrigation of four hours duration, the loss by percolation is represented by BDI. The average depth of application is considered as one foot. The depth applied at HI is .3 foot, then the depth applied at ~~AB~~ AD is 1.7 feet, ~~xx~~ were the percolation uniform throughout the whole run. Were this tract divided by another cross-ditch at G, the the loss by deep percolation is BCE and EFI, and the amount of loss EFCD is illimitated, and the amount applied is but two-thirds the ~~applied~~ amount of application when the irrigation was made in one run.

And with this same soil, a shallow soil on a porous sub-soil, the application of 1.7 feet at AD, and the application of .3 foot at HI, 12 hours after the irrigation or when water ceases to percolate into the sub-soil, then the amount of water at HI and AB is the same, that is to say the application of .3 foot is just as efficient as the application of 1.7 feet.

This illustration is assumed, but which is a common condition, and show fairly this factors determination on the duty of water.

h. The Climate.

i. Method of applying water.

j. The Tillage Practice.

k. The time of harvest.

l. And lastly, the skill of the irrigator, the greatest of all factors determining the duty of water.

With all these factors affecting the duty of water, it is not possible to ^{set} any definite amount which should be used by each system ~~until~~ until the basic facts ^{are determined} and tests are made ~~known~~. But at this time it is possible to specify a duty that will be applicable temporarily and which is given with the following conditions imposed:

- a. It must cover the general crops, the soils, and the conditions.
- b. It assumes that all irrigators are competent and diligent.
- c. It leaves no risks to the primary rights.
- d. Is a fair and a reasonable amount, and does not admit of a

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/question
of insufficiency.

The question may arise, why do I assume the skill of the irrigator to be perfect? For this reason, the skill, the care, and the diligence of the irrigator, is capable of the highest efficiency, and is required by all users of water, "used economically without waste, and with due care." It is not a physical fact or condition impossible of remedy.

The water ^Psupply is a fixed quantity, and wholly insufficient for the area of land, the irrigator who has been using a one-half duty is depriving an equal amount of land of a water ~~supply~~ supply.

Pending the final adjudication of this case, and the determination of the exact and proper amount/^{necessary} for irrigation, a tentative duty must be in vogue, a definition of the primary rights as against later appropriators, and the distribution of the river flow when the amount is greater and when less than the primary rights.

The actual irrigated area, coupled with the duty determines the rights of the defendants.

The basis of allotment is the irrigated acreage with its necessities, computed on the Net duty (N.D.) The total amount allowed at the measuring station is designated the gross duty which includes the net duty plus the losses in transmission, or the net duty less the inflow between the point of measurement and the point of use. Losses or inflow shall be for canal and main laterals, but no allowance should be made for farm distribution.

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~~It is true, but the allowable should be determined by actual tests,~~

With this method it will be possible to give to each system a relatively proper net duty, and will correct the existing differences experienced by not taking into account the losses in transmission, or the inflow.

The allowable losses in transmission should be determined by actual test, with all the system in perfect condition, in good order and repair, and in no case, even after determination should a loss be allowed of more than a reasonable and practical amount.

The amount of inflow should be determined by actual tests, at such times as may be necessary.

In this discussion there is recognized two distinct classes of agriculture, viz; extensive farming and intensive farming, and with each class two distinct seasons.

Extensive farming embraces the Provo Valley and all the lands above the mouth of Provo Canyon. The individual ownership of land is great, averaging more than one hundred acres, the crops are of low profitable returns per acre, the irrigator cannot be with each stream of water constantly, night and day, and therefore the irrigated area per unit of water is less, and the water duty correspondingly lower. In this section the general adaptability of land and climate is for raising of grains, hay, and pasture. The season for the hay and ~~grains~~ pasture lands extends over four and one-half months, from May 1st, to September 15th. The season of irrigation for grains begins on June 1st. and ends on August 1st., a period of two months.

Intensive farming embraces the Utah Valley. In this district the individual ownership of land is low, about twenty acres, the irrigator is able and by the kind of crop is necessarily with each irrigation constantly, attending to distribution of flow, at all times, night and day, The crops are of high, marketable value per acre and warrant greater expenditure in production than the crops in the extensive district. Under this care a higher duty may be maintained, and the quantity of water not doing a full efficiency is reduced to a minimum.

The staple crops, are grain, alfalfa, sugar beets, orchards,

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berries, and truck, all of which require more frequent irrigations than the crops in the extensive district.

Twenty-five per cent of the area is ^suceptable of cultivation, during the greater part of the season.

The amount of water necessary by irrigation for maintaining a sufficient quantity of moisture in the root zone, under proper and practical farm management and conditions, is designated as the "utilized amount."

The amount of applied water, under proper conditions, less the "utilized amount" is "loss".

The amount of applied water less the "utilized amount" and less the "loss" is "waste".

Where by location a canal system can by application of water to an amount of more than the present actual duty, store in the soil, or create a system of spring and seepage to be used by a lower canal, so that the identical water is stored, or is used two or more times during the same irrigating season, all of the amount above the present "utilized amount" and "loss" may be classed as "permissible appropriation."

Any water that passes through this river system, without doing, by proper regulation and manipulation, it's full and complete maximum duty, the amount less than it's reasonable possibilities is misuse or "waste" and is subject to appropriation.

To explain the meaning of the word "manipulation" and it's relation to duty, I give the following example:

Were the quantity of water in the Utah Valley enough to supply prior to August 1st. a 60 acre duty, and the quantity of water in the Provo Valley was enough to supply a 40 acre duty, and a portion of the flow of the Provo Valley was diverted to the R Utah Valley directly, then the duty of this water would be less, than if used in the Provo Valley and returned by seepage to the river and used again in the Utah Valley.

There is however an exception to this rule of "waste" viz: Immediately after a heavy rainstorm, inflowing water from mineralized land render in some cases the stream unfit for use, in this instance it is diverted to ^{the} lake and is "loss."

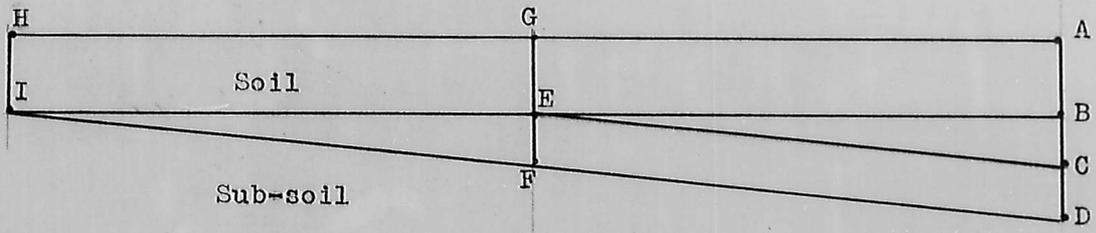


Figure 1. Vertical scale exaggerated.

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The duty of water in the intensive district ~~is~~ is the "utilized amount" plus the "loss", or, the "applied amount" less the "waste."

The duty of water in the extensive district is the "utilized amount" plus the "loss" and plus the "permissible appropriation," it is the applied amount less the "waste".

This brings us directly to the fact; the duty of water in the extensive district, is a variable quantity, both in amount and point of time, and is shown by example:

The duty of water used intensely under the Wasatch Canal ~~is~~ is "D", water used in excess of this amount and a portion of the "loss", used before August 1st. returns by seepage and percolation to the lands lower in elevation, then the permissible duty to this date ~~is~~ ^{four-fifths} may be as low as ~~two-thirds~~ ^{four-fifths} D, but after the time say August 1st. that the return of the water used in excess of D does not reach the lower user before his irrigation season has closed then the duty for this canal is D.

The duty in the intensive district is at all time^s D, and the primary rights are entitled to this amount as against all later appropriators.

The primary rights in the extensive district are entitled to ^{four-fifths} a duty ~~two-thirds~~ D up to August 1st. as against all appropriators, and after August 1st. are entitled to a duty D as against all appropriators ~~not~~ in the primary rights.

In case of insufficiency of flow after August 1st. to supply all the primary rights, then there is no priority among the primary rights, and each district shall operate pro rata according to their respective duties.

In this section and hereafter the term "duty D" is used as the specific and economic amount necessary to that particular system in question.

The time to which a system is entitled to a low duty depends on its location on the river system, being earlier, as the locations approach the head of the river. It is possibly a fact that water used on the higher lands of the upper river in the early season flows through a number of systems before doing ~~xxxxx~~ ~~xxx~~ it's final duty in the Utah Valley.

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This ~~ix~~ condition is very noticable in Table I.

This report is confined to the lower division of the Provo River, and will discuss this topic within the limits imposed.

The point know as the "Upper Midway Dam" is the natural dividing line between the Upper ^{River} and Lower River. And at this point the normal flow of the river does not exceed the reasonable necessities of the appropriators, the duty during only flood season is as low as $\frac{4}{5}$ D, then all of the parties taking water at and above this point have right and title to all of the flow, as against all lower users up to the date of July 15 (the approximate limit of permissable appropriation), and after this date their title and right is a duty D. That is to say the water users at and above the Upper Midway, as against all appropriators, are entitled to a $\frac{4}{5}$ D up to July 15, and after July 15th to a duty D.

The tentative duty of water in the Utah Valley. In this division, excepting the land under the Fort Field Ditch and the Lake Bottom Canal, generally;

The soil is a loose loam.

The subsoil is porous.

The crops are diversified.

And complying with the duty requirements heretofore set forth the net duty for the lands, for the season up to July 1st (the season of first watering) with the relative amounts of application and time is as follows;

One-fourth area cultivated, requiring water every fourteen days .4 foot deep-- a duty of 69.5 acres. Crops included in this class are, sugar beets, orchards, corn, ect.

One-fourth area, uncultivated, requiring water every fourteen days, .5 foot ~~deep~~ in depth,-- a duty of 55.5 acres. Crops included in this class are, alfalfa, grain, ect.

One-half area, uncultivated, requiring water every seven days, .3 foot in depth, a duty of 46 acres. Crops included in this class are, orchards in harvest time, berries, truck, potatoes, ect.

An average net duty of 55 acres per second-foot.

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The soil under the Fort Field Ditch is a uniform clay loam, of fine texture, and rich in humus. The subsoil affects good drainage over the greater area.

The duty under this ditch is 80 acres per second-foot. No appreciable difference exists between the net and gross duty.

The soil under the Lake Bottom Canal is a clay loam, some areas a heavy clay, all rich in humus. Ground water is near the surface, and the greater part requiring drainage.

The duty under this canal is 100 acres per second-foot. There is a considerable inflow into this canal, the amount of which I do not know.

In this summary of water necessary for the "Defendants" in the Utah Valley, the First Ward Pasture Tract is omitted, on which I have not sufficient information or belief to base a tentative allotment. This tract uses some water from springs and the East Drain which is not included in the natural flow of the Provo River as outlined in this report. This tract also uses some water from the Factory Race on an area, the extent of which I do not know, which amount of water can be diverted from the Factory Race after being used by all the power interests excepting the Smoot Lumber Company. And considering the Smoot Lumber Company as using all the flow allotted this area would then be an addition to the amount in the "Defendants rights."

For general summary of amounts to the "Defendants" rights in the Utah Valley see Table XV.

Note: In the compilation of this table the gross tentative duty is given, to be used until the transmission losses and inflow have been determined.

"Season, April 1st to July 1st."

Name of System.	Acres Irrigated	Net Duty	Tentative Gross Duty.	Amount
Provo Bench Canal & Irrigation Co.	4333	55	50	86.66 sf.
Timpanogus Canal Company....	847	55	50	16.94 "
Upper East Union Canal Co....	762	55	50	15.24 "
Faucett Field	109	55	50	2.18 "
River Bottoms	516	55	50	10.32 "
Dry Creek	506	55	50	10.12 "
Fort Field	574	80	80	7.18 "
Lake Bottom	1275	100	100	12.75 "
Spring Creek	276	55	50	5.52 "
West Union, Smith Carter Ditch.....	1900	55	50	38.00 "
Provo City.....	3192	55	50	63.84 "
Total.....	14,290			268.75 "
Machine interests below the mouth of Provo Canyon.....				19.30 "
Provo Reservoir Company, Blue Cliff Title				1.15 "
Total				289.20

Note: The machine interest are given in a later section.

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Water Duty in the Provo Valley, below the Upper Midway Dam.

Hay lands require to be well watered until about about July 15, the time of 'first cutting'. During the time of July 15th to August 10th, the hay lands are not watered, but after this season of 'first cutting' they are again watered for fall pasture. With this practice the diversions appear to be intermittent.

Heretofore in this Report a provision has been suggested to allow a 4/5 duty to August 1st, and after this date a 4/5 duty may be allowed for a period, providing that the amount of water used, between Aug. 1st, and August 20th, and between August 20th and September 15th does not exceed a 50 acre net duty.

I have not sufficient reliable data on the area under the canals in this section to formulate a table showing the amount to be allowed, but I submit a rule to be used tentatively for the season of 1915.

The water users in the Provo Valley below the Upper Midway Dam, may use for the season of 1915 the following amounts of water:

For the irrigating season to and including Aug. 1st a net duty of 40 acres per second foot, from Aug 1st to August 20th an average net duty of 50 acres per second-foot, from August 20th to September 15th an average net duty of 50 acres per second-foot. During the times of Aug. 1st., to August 20th, and August 20th., to September 15th, a lower duty may be used for short periods, but in no case shall the total amount exceed in either of these periods a greater amount than a 50 acres net duty, Providing, that the flow of Provo River in the Utah Valley will supply to the primary rights a net duty "D", and in case this flow is deficient the users in the Provo Valley and the users in the Utah Valley shall operate pro rata according to their respective duties "D".

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In this general discussion of water duty, it is to be borne in mind, that no specific soil survey exists over the areas in question, the amount allowed, with two exceptions, is based on a low duty soil. There are, however, ^{that} areas ~~xxx~~ can do well on a duty higher than the duty herein given. I have no knowledge of the extent of these areas, but I call attention to the main tracts, viz;

The Northern ^{and South Western} part of the Provo City Irrigation System.

The Eastern part of Provo City.

The Northern part of the Provo Bench.

The Southern part of the River Bottoms.

The land near the terminus of the West Union Canal.

The lower land of the Upper East Union.

The Northern part of the Timpanogus Canal, tract.

Part of the lands under Dry Creek.

Sometimes when the flow of Spring Creek is not utilized, water is diverted over the Lake Bottom Canal Spillway, and ~~xxx~~ allowed to pass down the river bed into the Utah Lake unused.

The Lake Bottom Canal, and other lowlands along Spring Creek, do not use, and do not require an amount of water after August 1st, that is used during June and July, on these low land a moderate amount of water in August, insures better maturity, and ripening of crops. In the period after August 1st, the Provo River ~~ix~~ reaches its lowest stage, and in some seasons is inadequate to supply the proper amount to the canals depending on direct flow.

At present there is no means of control between the Spring Creek and the main River, and to remedy this condition, I suggest that the "brown Ditch" diverting water from Spring Creek in the Forsyth property, be enlarged and continued Easterly along the State highway to Provo River to a point above the intake of the "Tanner Race", with this improvement the waters that have in the past been allowed to escape may in the future be utilized.

At the lower end of Spring Creek, near and below the Spillway of the Lake Bottom Canal heads "Jacobs Creek", with

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water sufficient to justify construction of control channel leading to river ~~and~~ and Fort Field.

Generally for a few days each year a part of the natural flow of the river is necessarily allowed to pass the dam of Dry Creek to supply the Fort Field, by the control channel from Jacobs Creek, this water may be used on the higher canals.

Table XV, page 52, is intended to be used only to July 1st., however, this table may be continued into July, it is believed that after the use of this table for a time, and with the co-operation of the water users, a distribution may be made that will give better results ~~than~~ than we could expect, without a try-out under this system of acreage and requirements, for this reason a late season ~~table~~ duty table is not here submitted.

I advise the parties to this action: make a determination of your water duty; establish the extent and the limit of your rights by beneficial use; acquaint yourselves with the details of crop requirements; do not, always, irrigate simply because "its your turn";

If you have used a thirty acre duty for forty years, do not be led to believe, that, you can continue this practice if a sixty acre duty will produce the same results.

Because you may have never owned a lantern, watered all night nor a Sunday, does not deduct from the requisite that every stream must be used, beneficially without waste, twenty-four hours of each and every day.

MACHINE RIGHTS.

The Provo Pressed Brick Company made application to the State Engineer, No. 1221, on February 28, 1907, for 100 second-feet of water for power purposes.

The Provo Reservoir Company, made application to the State Engineer, No. 2077A-C, September 15, 1908, for water to irrigate lands.

The County Court of Utah County on June 6th 1865, Book A, page 267 Records County Court, upon petition, organized the Provo Bench into an irrigation district.

I am unable to find of record the organization of the North Union Irrigation district, however, in Book A, page 267 Records of the Utah County Court, this district makes report to the Court it is therefore quiet probable this district was organized prior to June 1865.

If the organizations of these districts carried also a valid grant of water, they may be considered as lawful appropriations, and are to be recognized as such, with this inference, and with no request of the Provo Pressed Brick Company to maintain the amount applied for in application No. 1221, and also admitting the question of 'Higher Use' as a factor, I made distribution of water during the season of 1914. Continuing this inference I have, hereinafter designated the organization of these districts as "the application of the Provo Bench Canal And Irrigation Company."

The Provo Bench Canal and the North Union Canal Company, consolidated, and built a canal, and in 1878 enlarged it to a capacity to irrigate its whole area.

Part of the lands under the application of the Provo Reservoir Company, lie under the system and under the application of the Provo Bench Canal And Irrigation Company. And the Provo Reservoir Company is supplying some 1,600 acre shares to these lands, and there still remains some 900 acres non-irrigated.

If these application are all valid, and admitting the question of ~~higher~~ higher use as a factor, then the application of the ~~Provo~~

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of the lands under the application of the Provo Bench Canal and Irrigation Company, are entitled to water supply as against the application No.1221.

It matters not, with the question of right or title, as between the land not irrigated, ~~and xxxxxx~~ and under the application of the Provo Bench Canal And Irrigation Company, and the application No.1221, as to which canal shall transmit this water.

The foregoing explains my understanding of the facts on this ~~point~~ point, and why in the distribution of Provo River, during the season of 1914, that, the application No.1221, was not admitted to participation according to the demands of the application.

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This question is, however, purely a question of law for the Court to make determination.

If the title is found to be with the land, it will also be necessary to find which canal shall transmit this water, the Provo Bench, or the Provo Reservoir.

Provo City has assumed to own the waters within its limits, including the Machine Interests Rights, by what authority or under what grant this assumption is made, I am unable to state. I have been unable to find any legislative or probate court grant of water right to Provo City.

Provo City has made grants to the Machine Interests, by what right or power this has been done I do not know, one writer in discussing this practice asks the question: "Why do they stop at granting water rights, why not, also, issue patents to land?"

~~I do not know of any provision whereby a title to water may be acquired, or that water leased.~~

A person acquires right only to the use of water for his purpose, and does not, and cannot ever come to absolute title. Water may be used for power, for irrigation, for sewerage, ect., but in no case does the lord or tenant, acquire any rights more than to that use.

If A has a right to the use of water, he may assign that right of use to B, but the absolute title always remains with the public.

In the category of water rights there are no such terms as lessor, lessee, owner, ect., but there are terms of assignor, assignee, appropriate for use, has right to the use of, ect.

In my opinion, the water rights of Provo City and the Machine Interests are separate and apart, and in my opinion

the Machine Interests, their successors, or assigns, in the enjoyment or in the assignment of the right to the use of the Factory Race water, need be little concerned, in either the approval or disapproval of Provo City.

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Taking the customary usage and allotment, the Factory Race has been supplied with 45 second-feet of water, with this amount during the season of 1914, there has been no complaint of shortage, or call for an additional amount by any of the mill interests, and for the purposes of this report this amount will be used as the proper allotment.

Assuming this right covers only the ~~xxx~~ time from 6'o' clock a.m. to 6 o'clock p.m. of the six working days of the week, and which is equal to a continuous flow of 19.3 second-feet.

The Provo Reservoir Company as a successor in interest to the Blue Cliff Canal Company, has right to 2.00 second-feet nights and Sundays of this Factory Race water, which is equal to 1.15 second-feet continuous run, and which they have used as continuous flow the past two seasons.

It has occurred in the past "in times of scarcity" that all of the flow of the Provo has been used for irrigation and domestic ~~xxxx~~ purposes.

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Power developed by Factory Race and Substitution.

Taking as a basis of Right for calculation 19.3 second-feet, and the "heads" of the different mills the power developed is shown by the following table.

Name of Mill	Head	Theo. H.P.	Actual H.P. at 80% Eff.	Cost per M. At \$4. per H.P.
Provo Pressed Brick Co.14	30.70	24.56	\$.98.24
Provo Ice & Cold Storage Co.	14.25	31.25	25.00	\$100.00
Hoover Bros. Mill	8	17.55	14.04	56.16
Knight Woolen Mills	16	35.09	28.08	112.32
Ward & Sons.	7.5	16.45	13.16	52.64
Smoot Lumber Company.	14	30.70	24.56	98.24
Total	73.75	161.74	129.40	517.60

And as shown by the total, taking them collectively is equal to a theoretical horse power of 161.74, and allowing the probable highest efficiency of 80% equals an actual output of 129.4 horse power. Which if supplanted by electric power would cost \$517.60 per month, figuring horse power at \$4.00 per month.

During the time of July 1st to October 1st, or when all of the flow of Provo River is necessary for irrigation, it would be well to make this substitution, and taking into account that four of the six power interests do now use auxiliary power, it surely would be more satisfactory to these four and probably to all during this time to use electric power solely.

The present installation along the Factory Race, except the Smoot Lumber Company, in the utilization of the Factory Race Water, certainly do not transmit to their line shafts more ~~xxx~~ than 55 per cent of their theoretical horse power.

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UTAH POWER & LIGHT COMPANY

Provo
Provo Canyon.

The Utah Power & Light Company diverts the greater part of the Provo River by means of a timber dam, located about five miles above the mouth of the Provo Canyon.

From the dam the water is carried along the North side of the canyon in a rectangular wooden flume, and is conveyed to the power house at Olmstead by three circular steel pipes, and returned to the river above the points of diversion of all *canals* of the Utah Valley, excepting the Timpanogus Canal and the Provo Reservoir Company canal.

This company also uses a small flow for irrigation, which is specified in the "Chidester Decree".

In addition to the flow diverted at the dam, "Lost Creek", "Upper Guard Quarters Springs," and "Lower Guard Quarters Springs" are diverted into the flume. And at the Bridal Veil Falls a pumping plant is installed that may direct a flow from river into the flume.

November 6-9, 1914, I went over the whole length of flume to determine the "point of minimum capacity".

On November 9th, 1914, after the rating No. 4 at "Donnons", at a point 300 feet below gate house, run of water surface was ~~2x~~ 0.65 foot below top of siding, and crest of waves 0.40 foot below top of siding. At a point 271 feet below gate house, flume appears to have been raised, making a break in grade line at this point run of water surface was 0.60 foot below top of siding, and crest of waves 0.34 foot below top of siding. This is "point of minimum capacity." At 130 feet below gate house surface run of water was 1. foot below top of siding, and ~~ixxx~~ marked by a nail, there is also a nail at 0.86 foot below top of siding, ~~ixp~~ ~~ix~~ wave crest is 0.57 foot below top of siding and marked by a nail.

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At the "Donnons Rating Station" gage height is 0.84 foot below top of flume, and from this point down to the enlarged flume near the tunnel the surface run ranges from 0.84 foot to 1.80 foot below top of siding.

From the upper end of the enlarged section to the pressure box the flume is built to permit of a small storage for "peak loads".

The field work on the measurements of this flume and the discharge, was done with the greatest care and precision.

You will note from the accompanying details that two meters were used, No. 1351 and No. 1843, both of which were in perfect condition and fully equipped.

Immediately after the rating of November 10th, I delivered these instruments to the United States Geological Survey for individual ratings by the Bureau Of Standards. I received the instruments with the individual ratings on each in December.

Where the flume measurements were made by both meters, they were mounted on the same rod, at distances apart of approximately one-half the depth of flow, and were run at the same time.

Meter No. 1351 was timed by New York Standard Watch No. 5509953.

Meter No. 1843 was timed by Swiss Movement Watch marked -VXX-.

During all of the time of these measurements in November, except one watch while making the ratings, I kept both watches in my possession, and on November 14th, delivered them to the Chipman Jewelry Company of Provo, for certificate of correctness, which I submit herewith.

The discharge shown on the details and on the rating curve are all calculated on the Bureau Of Standards rating of meters, and are corrected for watch error.

For the season of 1914, three rating stations were selected.

The Donnon Rating Station is about 1,000 feet below the point of diversion. Herewith I submit cross-section of this station, and details of four ratings. Between the time of July 27, 1914 and October 19, 1914, the flume near this station was changed.

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Ratings Nos. 2,3,&4, when platted for rating curve as ~~xx~~ shown by "Segment of Rating Curve" describe practically a straight line, that is the discharge varies directly with the gage height. Assuming this condition to continue to gage height 5.39, and that an increase in depth of 0.34 foot at the point of 'minimum capacity' will also cause an increase in depth of the same amount at Donnons Rating Station, then, the Maximum flume capacity at the point of Minimum Capacity is approximately 24~~8~~. second-feet.

The Nunns Rating Station is located about 600 feet below the pressure box of the Nunns Plant, herewith is submitted detail cross-section of flume, and details of ratings.

The Tunnel Rating Station is located about 60 feet above the spillway, near the tunnel, herewith is submitted a detail cross-section of flume, and details of ratings.

On November 6,7, and 9, I made measurements of the inflow to flume as follows:

Lower Guard Quarters	0.05 sec.ft.
Upper Guard Quarters	0.79 " "
Bridal Veil Falls	4.42 " "
Lost Creek	<u>2.76 " -"</u>
Total	8.02 " "

And also measured the leakage at Nunns pressure box which was 0.53 sec.ft.

Flow at these station was marked for future reference.

On November 10, 1914, I visited, from 9. a.m. to 9:30 am., Upper Guard Quarters, Lower Guard Quarters, Leakage at Nunns, Bridal Veil Falls inflow to flume, and Lost Creek, and find all flowing the same as when measured.

Gage Heights at Donnons Rating Station were observed as follows:

Nov.10,1914.	Time.	Gage Ht.
	9:45 a . . .	4.99
	10:00 a . . .	4.99
	10:15 a . . .	4.99
	10:30 a . . .	4.99

constant

An ~~AVERAGE~~ gage height of 4.99, and by rating curve a discharge

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of 215.3 second-feet.

Caleb Tanner and Theo. Farley Jr. go to Tunnel Rating Station this morning to note the gage heights. At 10:30 a.m. I leave Donnons Rating Station, arriving at Tunnel Rating Station at 11:30 a.m. , Mr. Tanner and Mr. Farley, report "no fluctuations" by gage points, three gage nails are set in spillway and the Stilwell in flume.

During the time from 11:30 a.m. to 4: p.m. ~~xxxxxx~~ ~~xxxxxx~~ still-well and gage nails are observed, every two to three minutes, and during this time, absolutely no fluctuations occurred, denoting the same flow at head.

The Gage height was 5.78 feet and discharge 216.34 ~~sec.~~ feet. Then the losses in transmission are shown:

Inflow	215.3	Sec.Ft.	Discharge at Tunnel	216.34
	<u>8.02</u>	" "	Leakage at Nunns	<u>.53</u>
Total	223.32	" "	216.87

Loss in transmission 6.45 second-feet.

There is approximately 3.34 second-feet going over spillway the remaining 212.5 second-feet going through plant on this date.

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CHANGE OF POINT OF DIVERSION.

"Any person, corporation, or association entitled to the use of water may change the place of diversion and may use the ~~wa~~ water for other purposes than those for which it was originally appropriated, but no such change shall be made, if it impairs any vested right, without just compensation: *****" Section 1288x24 Compiled Laws 1907.

I have shown in preceeding sections the effects of irrigation in the Provo Valley on the flow of the Provo in the Utah Valley, and that the lower river is dependant to a great extent on the amount of water used above the mouth of the Provo Canyon.

Any transfer of water right from the Provo Valley or any point above the mouth of Provo Canyon, to points that do not contribute an equal seepage supply to the Provo River above the mouth of the Provo Canyon, diminish^{es} the amount of flow of the river to the lower valley, and such transfer impairs a vested right.

A part of the water applied on lands above the mouth of the Provo Canyon, that lie adjacent and near the river, finds its way back to the natural channel very soon after the application.

The relation of seepage and percolating water to the flow of a lower river, has long been recognized by the Courts, as shown by the following:

In case No. 957 (Chidester Decree) the Court finds and ~~dec~~ decrees, " The Springdell Resort Company" is entitled to 60 minute feet of water, and said water shall not be used at any other place, than on the land of the above named parties at Springdell in Provo Canyon.

And the Court also finds that Joshua J. Mecham et. al. " is the owner and entitled to the use of water, which shall consist of water directly from the South Fork Of Provo River.

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And the Court decrees; Joshua J.Mecham et.al. is entitled to waters to be taken from the South Fork of Provo River.

And in the Stipulation in this case, " as to the rights to the use of water by the Estate of William Wright**** it is hereby stipulated -***** that the Estate of William Wright,deceased, ***** has and is entitled to the use of water upon the farm and meadow lands belonging to said Estate. In this stipulation the water is made ~~appurtenant~~ appurtenant to the land to be confined to use upon these specific lands. But in this particular case the Court does not include this stipulation in the decree and findings,~~but~~ and finds and decrees that *****"is the owner and entitled to the use of this water,"^{making}without/any reference to the lands.

In the adjudication of the Upper Provo the Hon. Judge Dusenberry finds; " That the lands irrigated by the waters of said river are of such a nature,and are so situated,that large quantities of seepage water from said irrigation,seep and flow back into said river,and into some of the canals diverting water from said river,after the same has been used for irrigation. That said seepage water flowing into said canals and into said river is available for irrigation,and in order to make an equitable distribution of the waters of said river among the persons entitled thereto,it is necessary to measure said water so as to include said seepage! And in the Conclusions of law; " That for the purpose of equitably dividing and distributing the waters of said river so that the parties thereto may receive for use the quantity, to which they are entitled,none of the parties hereto shall have the right to extend the use of the waters herein awarded to them upon other lands than those now irrigated,so as to cause the seepage or drainage therefrom to be diverted away from the channel of said river,or from the lands heretofore irrigated thereby."

This question of change of point of diversion has been raised by the Plaintiff and by some of the Defendants.

In viewing the facts,the findings and decrees of Courts, and the Statutes on this point,it appears to me as not even

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permitting of argument, it seems so unreasonable, and so devoid of a shadow of right to change the point of use to a place that will diminish the flow of a lower user, when that lower user has not more than enough to supply a duty "D".

MISCELLANEOUS.

Distribution To Canals. In this district, the Upper Midway Dam to the Utah Lake, one commissioner is necessary, to have exclusive control of all regulating and measuring devices and to make the entire distribution from the natural channel.

This Commissioner will have to deal with a fluctuating stream, his duties will require a great deal of hard work and good judgement, he should be given reasonable discretion in the manipulation and distribution of the water, and should be supplied with the necessary recording devices, telephone, ect., and should be empowered to make such ^{improvements} /as are necessary for proper control.

Equipment. Proper regulating and measuring devices should be installed before May 1st, 1915.

Schedules Satisfactory schedules should be complete in advance for the whole season, showing the rotation and the duration of time.

Rotation I have had personal experience with daily change of 14 hours, 12 hours, 8 hours, and 6 hours, and recommend generally a daily change of 8 hours, to bring this clearly to the parties I give the following practical illustration:

Water Schedule of John Doe, for season of 19**.

7 days and 8 hours between rotations.

Duration of time 17 hours. Area of tract 20 acres.

Flow of lateral 4.14 second-foot gross.

Gross duty 50 acres per second foot.

Time beginning.

Time Ending

Date	Hour	Date	Hour.
May 1 . . .	6:00 a.m. . . .	May 1 . . .	11:00 P.M.
May 8 . . .	2:00 p.m. . . .	May 9 . . .	7:00 a.m.
May 15. . .	10:00 p.m. . . .	May 16. . .	3:00 p.m.
May 23. . .	6:00 a.m. . . .	May 23. . .	11:00 p.m.

Graphic Representation.

1st.	2nd	3rd	4th.
OOOOO	HHHHHH	HHHHHH	HHHHHO
HHHHHH	HOOOOO	OOHHHH	HHHHHH
HHHHHH	HHHHHH	HHHOOO	OOOOHH
	12hrs. 13hrs	13hrs	13Hrs.

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The first and fourth quarters represent the night time, the second and third quarters the day light, note how well the change occurs and the ven distribution.

This hourly change should be used no matter what the daily ~~ex~~ change may be.

Size Of Head. No distribution should be allowed with streams of less than four second-feet, better to use six second-feet as the minimum. The Commissioner should be empowered where there are a number of users diverting small heads, to combine them with a proper sized stream on rotation, and in case one party is isolated he also should be given a proper sized head on rotation.

Determination Of Duty. Determination of duty and the extent of beneficial use, should begin not later than April 1st, 1915. The person in charge of this work should determine the duties for each system for both the high and the low water periods of the season, and should revise the tentative duty tables when by actual tests and observation such change is substantiall^v warranted.

In this investigation special attention should be directed to determine the Municipal Right of Provo City, which amount may be considered as a constant.

Special Recommendation. The Storage and other waters passing from the Upper Division into the Lower Division has been a source of uncertainty on account of irregular flow, the exact amount has been impossible of determination. It is therefore recommended that;

The Court order a suitable measuring devise constructed and equiped with a register, to be complete not later than June 1st, 1915.

The Concrete rating flume of the Provo Reservoir Company, near the Wasatch Dam may be converted into a suppressed weir for this purpose.

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Raise The Minimum River. In section 14 I have stated that this report does not take up the general discussion of the Provo River, and in section 10, page 61, I have stated in regard to the Factory Race Water ' it would be well to make this substitution', to leave this thought merely broched, ^awould probably warrant someone to entertain the idea that this particular point bears very little importance, therefore I make a brief discussion of the general effects.

The extent of irrigated area in permanent agriculture is largely controlled by the minimum average flow of the source of supply, providing that low period extends greater than the limit that crops will withstand a scant supply of water. A farmer plants only to the extent that he can mature.

Referring to Plate III, you will note the "Mean River" is well above the 300 second-feet stage to August 1st, and that during the month of September it averages about 305 second-feet.

I have shown in red ink on Plate III the effect of the use of the Factory Race Water for irrigation from August 4th to September 3rd. You will also note there is a period from August 14th to 22nd. that the flow is below the general average, this period of eight days is also the general average period of rotation, or in other words each irrigator would be for one irrigation supplied with a smaller quantity of water than usual.

In practical irrigation with rotations of 7-8 days, a scant supply on one of these applications does not materially affect the ~~gx~~ general results, when that decreased supply does not extend over a period of more than 15 days.

In a general deduction of a river, where the rotation periods was 7-8 days, and there was a time when the flow was below normal for a period not exceeding 7-8 days then this deficiency would be ignored, and not considered as a factor in the "Typical River."

It is advisable in the adjudication of a river to place the point of average low water flow at the highest possible point.

It would be absurd to say, that the area irrigated under the "Provo", for April, for June, for July, and for September, should be controlled by a low period of 7-8 days duration in August., and

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it would be equally absurd to say that a minimum point should be the basis of the river to be adjudicated.

With the addition of the Factory Race water to irrigation "by substitution" the period of low flow is cut shorter and raised, and it brings to use in April, May, June, July, and September, an equal amount of water to the extra supplied in the ~~ix~~ period of low flow.

With this "substitution" as shown it is possible to make the average mean low water stage of the "Provo" to be 300 -305 second-feet.

Other deductions could be advanced by a further investigation along this line.

EXPLANATORY

The Provo River, as a river "Typical," "Average," and "Mean" is not discussed in this report, it would require three to four months, at the least, to make ~~xxxxxxxx~~ complete deductions, before the final adjudication of this case this matter should be determined.

There are several other topics omitted in this report that will also require very extensive discussion.

The measurements, ratings, ect. of 1914, have been forwarded to Mr. Demming, and therefore are not included in this report.

In the order of the Court, requiring reports, instructions were given to not duplicate on any part of the ~~xx~~ work, in discussing only a limited number of the topics concerned, this report may appear more or less incomplete.

C O N C L U S I O N

The Provo River, in this division, is worth \$6,500 per second-foot, a total value greater than \$3,000,000, which should warrant the greatest care in maintenance, and the utmost precision in distribution.

In this division the "Provo" brings to productiveness more than 25,000 acres of land that yields annually \$1,000,000 worth of produce.

Then:

If by lax methods.

If by improper distribution of the river by the decree of the Court.

If by poor manipulation or poor control by commissioner.

If by inadequate equipment, or if by any, or by all causes the highest efficiency in the economical distribution of Provo River is reduced, say 10 per cent, then there is \$300,000 worth of water right lost and wasted, and there is 2,500 acres of land lying barren and unproductive, and crop returns are \$100,000 less annually.

With this amount of value in title and right, should there be any hesitancy, in expending \$1,500 or \$2,000 annually, 7 to 8 cents per acre, for its proper care and distribution? Most certainly not.

This district that depends solely on agriculture for maintenance and enlargement, can extend only to the limit of area it places upon the river.

Past practices and conditions cannot continue.

I earnestly say to the Court, and to the parties to this action; It is imperative, that you place the duty of the "Provo" at the point that it will reach its highest efficiency.

Concluding I insert an extract from "Irrigation Institutions":

" The importance of irrigation is now realized in the West as never before, and the best elements of citizenship are endeavoring to remove the obstacles which have heretofore hampered both public and private enterprise. The East, as a whole, is beginning to realize the great part which the West is to have in the events of the twentieth century. Worldwide forces are working to hasten the day of its complete development, and the utilization of all its rich resources.

The essence of the problem to be met at the outset is the control

and distribution of the water-supply, since not only the enduring prosperity but the very existence of the homes created will be conditioned upon the ability to use the rivers of the region for irrigation. The diverse interests of individuals and communities, and even of different states, will all depend on streams flowing from a common source. To reclaim all the land possible will involve the spreading of water over a surface as large as New England with New York added. Standing now near the beginning of things and looking down the vista of the future, we can see in the courses of these rivers the dim outline of a mighty civilization, blessed with peace and crowned with a remarkable degree of prosperity, in case wise laws and just policies shall prevail in the years of the immediate future, while institutions are forming.

But if it be otherwise, ___ if greed and ignorance are allowed to govern, and we ignore the experience of older countries than ours, ___ there will remain to us only a gloomy forecast of legal, economic, and, possibly, civic strife."

Original

Provo, Utah, November 14, 1914.

T.F. Wentz.

Provo, Utah.

Dear Sir; In accordance with your verbal request, I have this day tested "Stop watch number 5509953 New York Standard" as follows; Watch was started at 11:05 am and run continuously for one hour, until 12:05 p.m. and stopped, it registered 59 minutes 56.9 seconds, or 3.1 seconds slow per hour.

Also at your verbal request I have tested "Swiss Movement watch marked ~~-vxx-~~ as follows;

Watch was started at 11:05 a.m. and run continuously for one hour, until 12:05 p.m. and stopped, it registered 59 minutes 57.1 seconds, or 2.9 seconds slow per hour.

In each of these tests the time of one hour was measured by " 21 Jeweled Waltham Watch Number 17121783, which is in perfect condition and is keeping perfect time.

Resp. Submitted,

Chipman Jewelry Company

By *Sell Chipman*
Manager.

Observation and test made by

 Sell Chipman

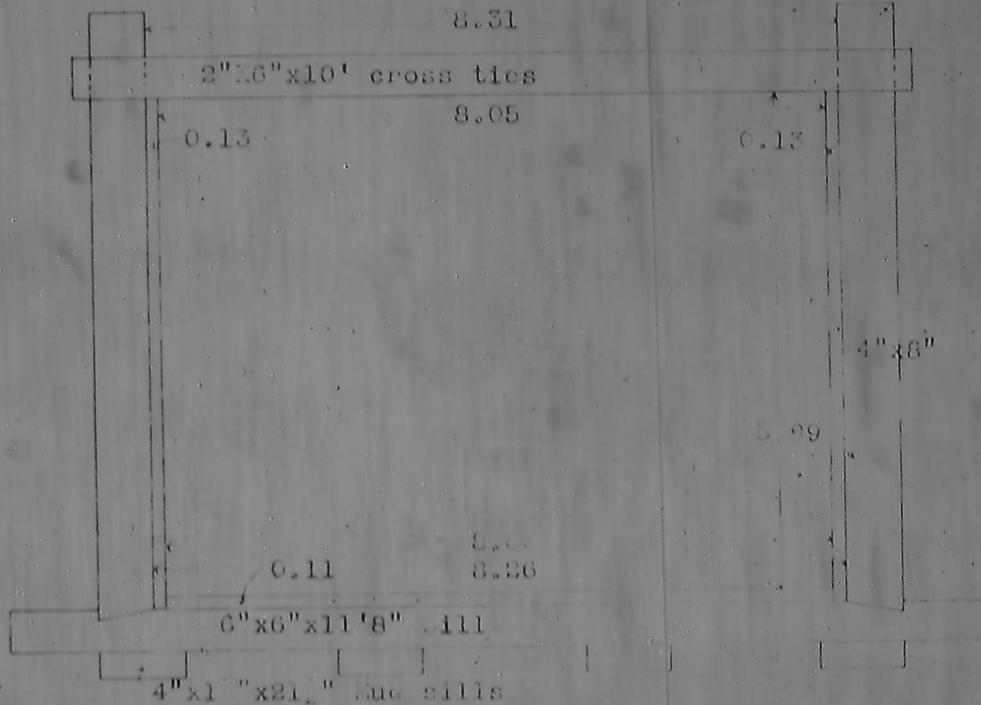
Watches delivered and received by T.F. Wentz.

UTAH POWER & LIGHT COMPANY FLUME.

Provo Canyon.

Section

"Donnon's Rating station"



Scale 1 inch equals 3 feet.

Actual and precise measurements are shown in feet and decimals. Custom lumber dimensions in feet and inches.

Nov. 7, 1914.

T. J. Wentz

Caleb Tanner Observer.

UTAH POWER & LIGHT CO. FLUME

Provo Canyon.

No. 1 "Donnons Rating Station"

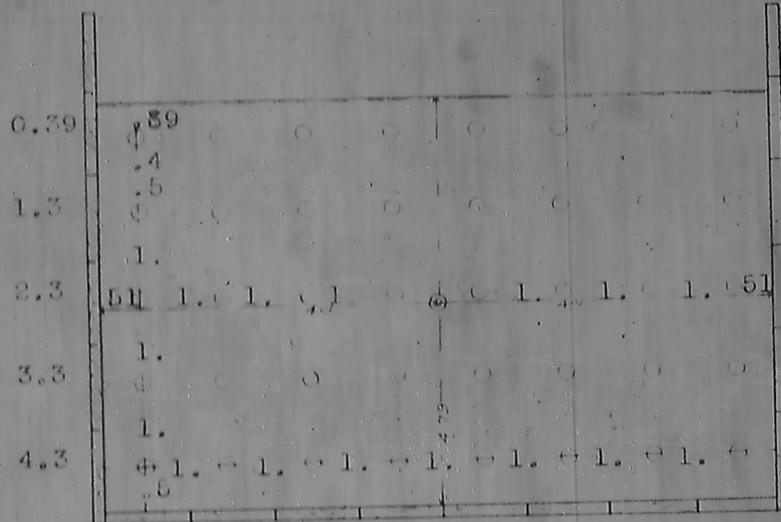
Sketch showing locations of meter velocity observations of rating of July 27, 1914, made by T.F. Wentz and Caleb Tanner.

Meter No. 1843, on rating Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland. Watch "Swiss movement marked -vxx-"

Depth of flow 4.79 feet.

Area 38.42

Average width of conduit 8.02 feet.



Number of velocity observations 40. Small circles denote location of

Mean velocity 5.93 feet per second. Meter observations.

Discharge 227.83 second-feet.

Scale 1 inch equals 2 feet.

Calculations made Dec. 31, 1914.

by T.F. Wentz

UTAH POWER & LIGHT CO. FLUME.

Provo Canyon

No 2 "Dommons Rating Station"

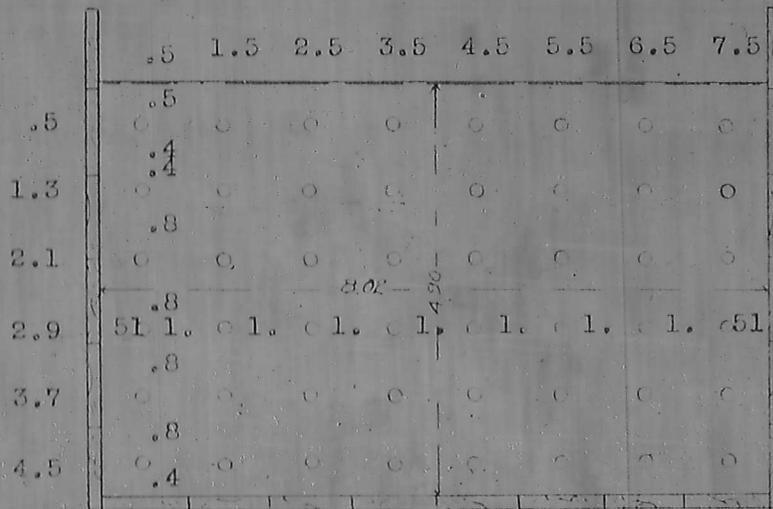
Sketch showing locations of meter velocity observations of rating of Oct., 19, 1914., made by T.F. Wentz and Caleb Tanner.

Meter No. 1351, on rating of Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland. Watch "New York Standard No. 5509953"

Depth of flow 4.90 feet.

Area 39.30 square feet.

Average width of conduit 8.02 feet.



Number of Velocity observations 48.

Note: Small circles denote location of meter observations.

Mean Velocity 5.29 feet per second.

Scale 1 inch = 2 feet.

Discharge 207.92 second feet.

Computations made by

Sketch made by T.F. Wentz

T.F. Wentz

Jan. 1, 1915.

Caleb Tanner.

UTAH POWER & LIGHT CO. PLUMB.

Provo Canyon

No 4

"Donnons Rating Station"

Sketch showing location of meter velocity observations of rating of

Nov. 9, 1914, made by T.F. Wentz and Caleb Tanner.

Meter No. 1843, on rating Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland. Watch "Swiss movement marked -vxx-"

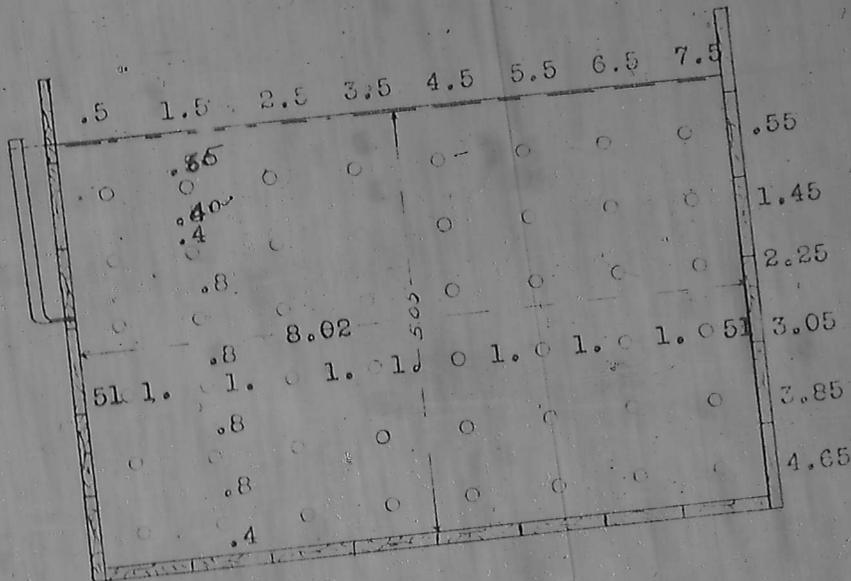
And Meter No. 1351, on rating of Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland, Watch "New York Standard No. 5509953."

Depth of flow 5.05 feet.

Area 40.50 square feet.

Average width of conduit 8.02 feet

Still-well Section.



Number of observations by each meter 48.

Mean Velocity by Meter No. 1843 5.424 feet per second.

" " " " " 1351 5.457 " " "

Discharge by meter No. 1843 219.66 second feet.

" " " " " 1351 221.00 " " "

Mean discharge by meter No. 1843 and meter No. 1351, 220.33 second feet.

Note; Small circles on sketch denote location of meter observations.

Sketch made by T.F. Wentz
Jan. 1, 1915

Computations made by
T.F. Wentz.

"Donnons Rating Station"

Sketch showing locations of meter velocity observations of rating of Nov. 6, 1914, made by T.F. Wentz and Caleb Tanner.

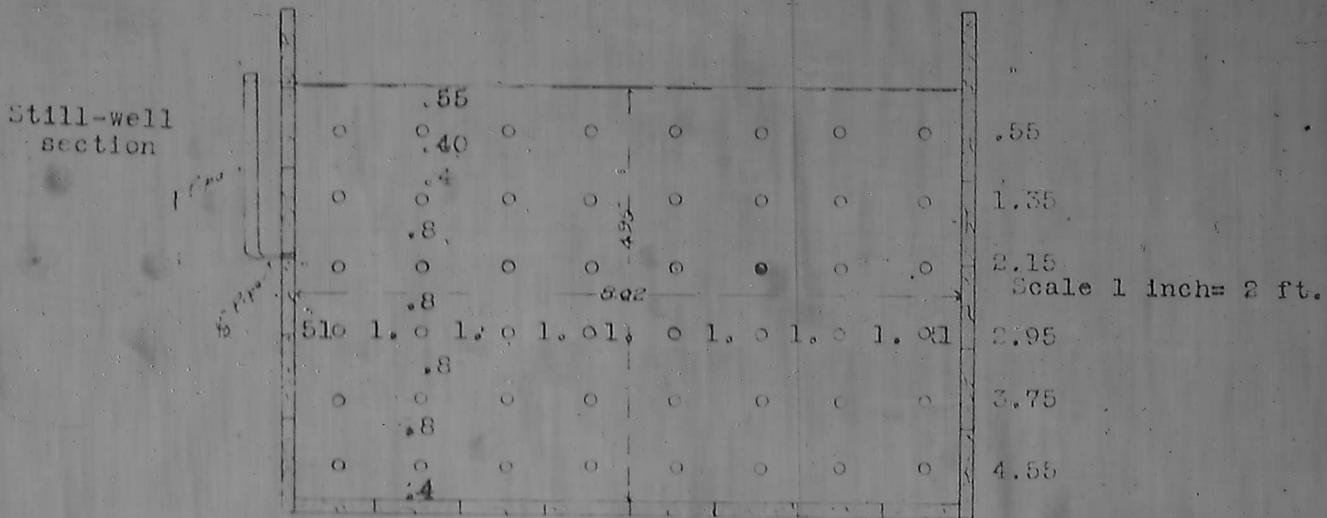
Meter No. 1843, on rating of Nov. 24, 1914, by Bureau of Standards, Chevy Chase Maryland. Watch "Swiss movement marked -vxx-"

And Meter No. 1351, on rating of Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland, Watch "New York Standard No. 5509953"

Depth of flow 4.95 feet.

Area 39.70 square feet.

Average width of conduit 8.02 feet.



Number of Velocity Observations by each meter 48.

Mean Velocity by Meter No. 1843, 5.359 feet per second.

Mean Velocity by Meter No. 1351, 5.324 feet per second.

Discharge by meter No. 1843, 212.75 second feet.

Discharge by meter No. 1351, 211.36 second-feet.

Mean discharge meter No. 1843 and meter No. 1351, 212.06 second feet.

Note; Small circles on sketch denote location of meter observations.

Computations made by

Sketch made by T.F. Wentz.

T.F. Wentz

Dec. 31, 1914.

Caleb Tanner.

480
200
490
500
510
520
530
540
550

" DONNONS RATING STATION "
UTAH POWER & LIGHT COMPANY FLUME
Provo Canyon.
Segment of Rating curve.

210

No. 2

No. 3

No. 4

220

No. 1 July 27 1914

230

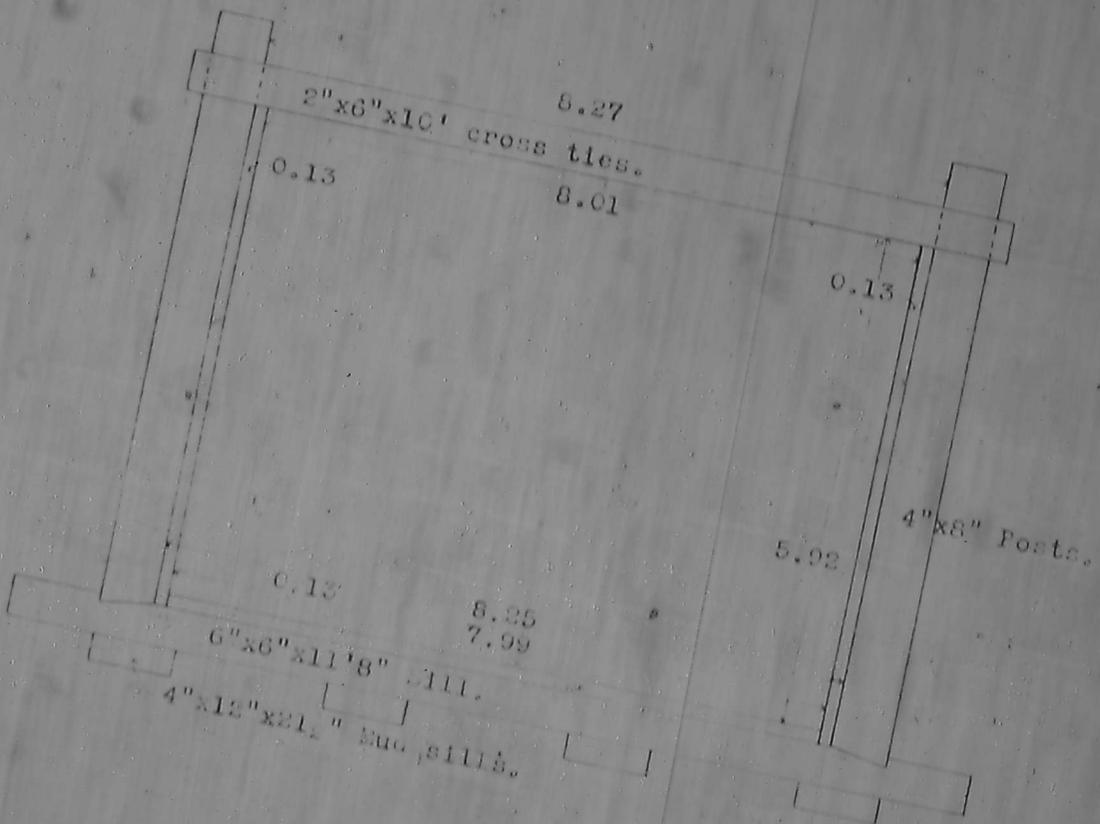
240

250

6.39-24 00 S.F. (Approx) U.P. Co.

UTAH POWER & LIGHT COMPANY FLUME.
Provo Canyon.

Section
"Kunn's Rating Station"



Scale 1 inch equals 2 feet.

Actual and precise measurements are shown in feet and decimals. Custom lumber dimensions in feet and inches.

Nov. 7, 1914.

T.F. Wentz

Caleb Tanner
Observer.

UTAH POWER & LIGHT CO. FLUME

Provo Canyon.

"Nunns Rating Station"

Sketch showing location of meter velocity observations of rating of Nov. 6, 1914, made by T. F. Wentz and Caleb Tanner.

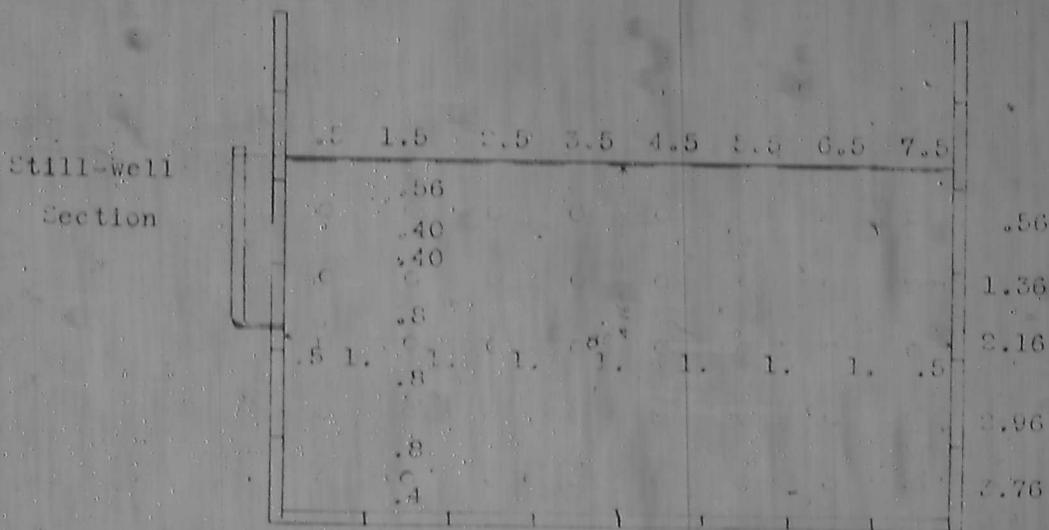
Meter No. 1843, on rating of Nov. 24, 1914, made by the Bureau of Standards, Chevy Chase, Maryland. Watch "Swiss movement marked -vxx-"

And meter No. 1351, on rating of Nov. 24, 1914, made by the Bureau of Standards at Chevy Chase, Maryland. Watch "New York Standard No. 5509953."

Depth of flow 4.16 feet

Area 33.28 square feet.

Average width of conduit 8.00 feet.



Number of observations by each meter 40.

6.29

Mean velocity by meter No. 1843, feet per second.

" " " " " 1351 6.298 " "

Discharge by meter No. 1843 209.33 second feet.

" " " " 1351 209.59 " "

Mean discharge by meter 1843 and meter No. 1351, 209.44 second-feet.

Note: Small circles on sketch show location of meter observations.

Computations made by

T. F. Wentz.

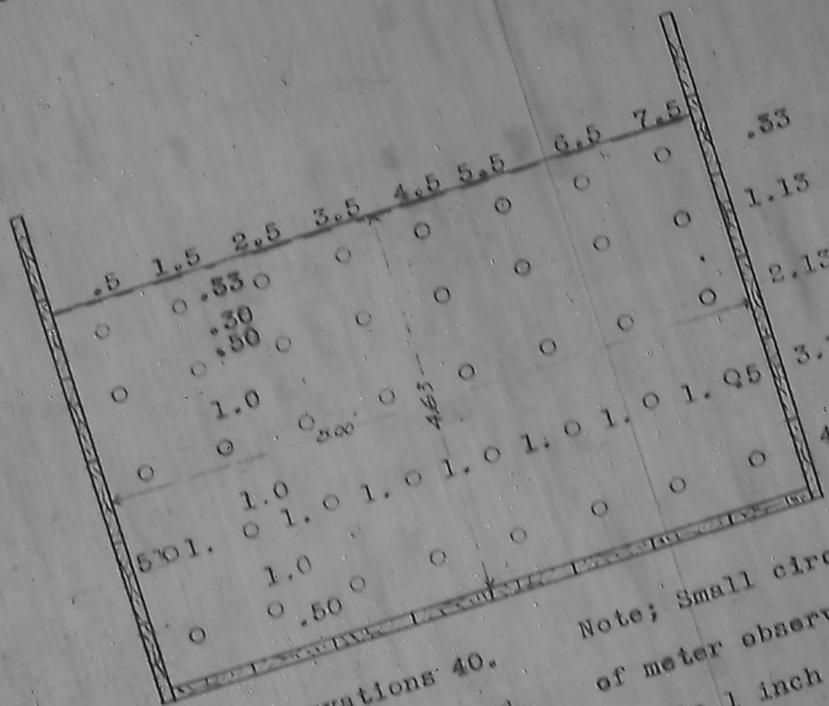
Sketch made by

T. F. Wentz.

Jan. 1, 1915.

UTAH POWER & LIGHT CO. FLUME
 Provo Canyon
 "Nunns Rating Station"

Sketch showing location of meter velocity observations of rating of
 July 27, 1914, made by T.F. Wentz, and Caleb Tanner.
 Meter No. 1843, on rating Nov. 24, 1914, by the Bureau of Standards, Chevy
 Chase, Maryland. Watch "Swiss movement marked -vxx-"
 Depth of flow 4.63 feet. Area 37.04 square feet.
 Average width of conduit 8.00 feet.



Number of velocity observations 40.
 Mean velocity 6.392 feet per second.
 Discharge 236.74 second-feet.
 Computations by
 T.F. Wentz.

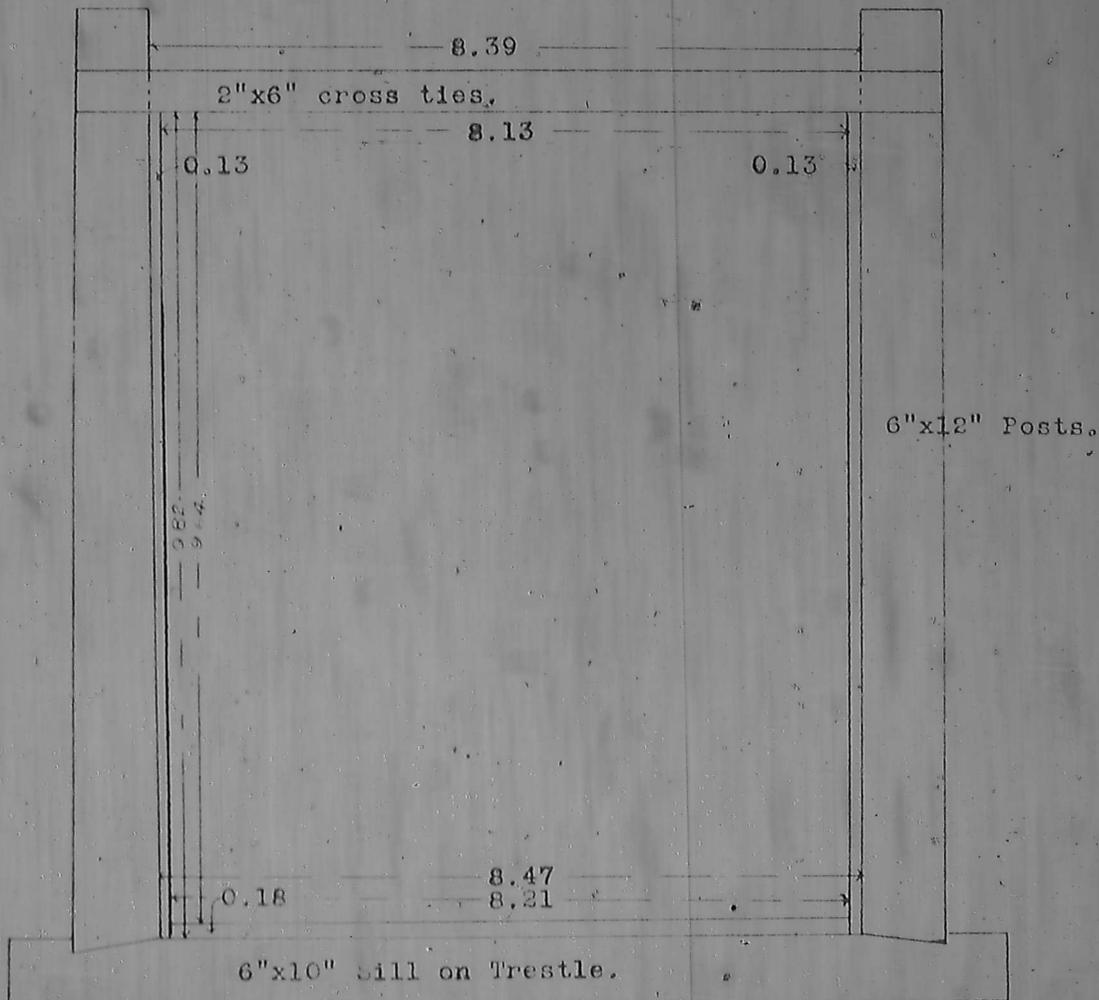
Note; Small circles denote location
 of meter observations.
 Scale 1 inch = 2 feet.
 Sketch made Jan. 1, 1915, by
 T.F. Wentz.

UTAH POWER & LIGHT COMPANY FLUME.

Provo Canyon.

Section

"Tunnel Rating Station"



Scale, 1 inch equals 2 feet.

Actual and precise measurements are shown in feet and decimals, custom lumber dimensions in feet and inches.

Nov. 10, 1914.

T. F. Wentz.

Caleb Tanner. Obser's.

Theo. Farley Jr.

UTAH POWER & LIGHT CO. FLUME.

Provo Canyon.

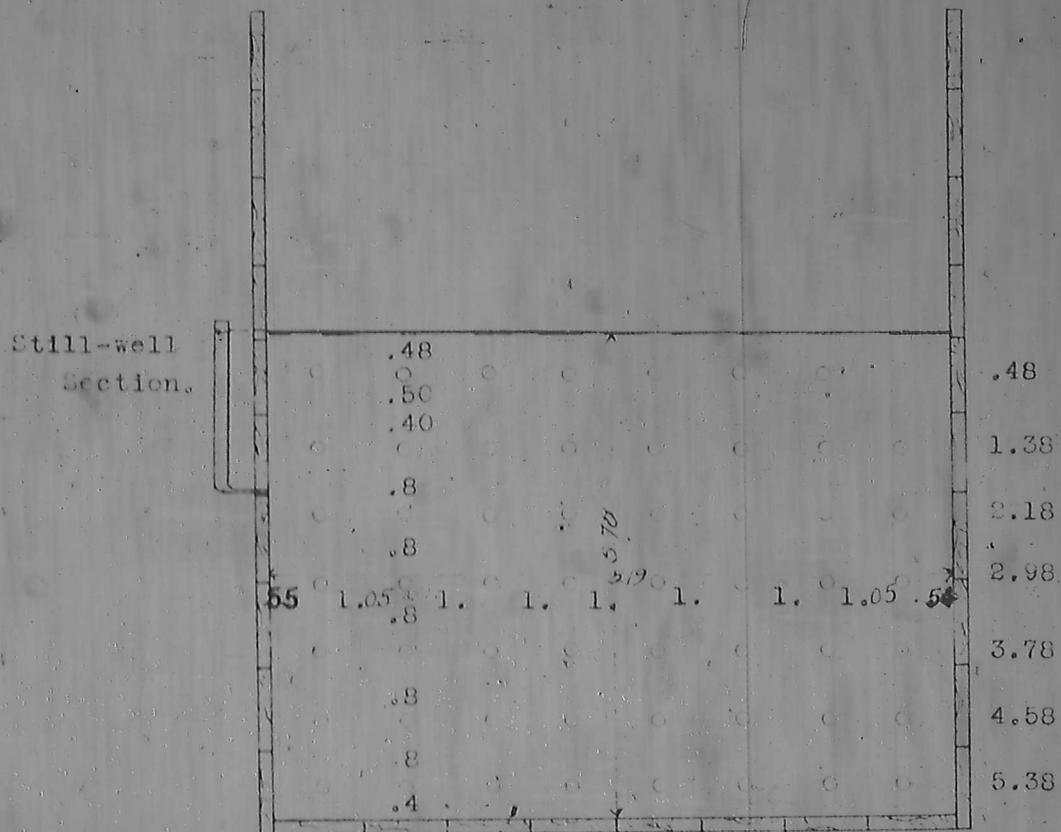
" Tunnel Rating Station "

Sketch showing location of meter velocity observations of rating of Nov. 10, 1914, made by T.F. Wentz and Caleb Tanner.

Meter No. 1843, on rating of Nov. 24, 1914, by the Bureau of Standards, Chevy Chase, Maryland. Watch "Swiss movement marked -vxx-"

And Meter No. 1351, on rating of Nov. 24, 1914, by Bureau of Standards, Chevy Chase, Maryland. Watch "New York Standard No. 5509953"

Depth of flow 5.78 feet. Average width of conduit 8.19 ft. Area 47.34 Sq.ft.



Number of observations by each meter 56.

Mean velocity by meter No. 1843 4.55 feet per second.

" " " " " 1351 4.59 " " "

Discharge by meter No. 1843, 215.37 second feet.

" " " " " 1351 217.30 " "

Mean discharge by meter No. 1843 and meter No. 1351, 216.34 second-feet.

Note. Small circles on sketch show location of meter observations.

Computations made by

T.F. Wentz.

Sketch made by

T.F. Wentz

Jan. 2, 1915.

Tabulated "Natural Discharge" of Provo River

Station "A" This station was established July 27, 1889. It is located about 3 miles north of Provo, about 1,900 feet above Jimstead Station, and 1,280 feet above the power house of the Telluride Power Co. The station was originally established to determine the total flow of the Provo, above all diversions, to the Utah Lake Valley. Records of observations are available for this station from July 1889 to Dec. 31, 1904, as reported by the U. S. Geol. Survey, to the reported discharge is added 40 second-feet for inflow below station and Spring Creek. This tabulation represents the available natural flow for irrigation of the Provo River and Spring Creek, below the mouth of Provo Canyon, in the Utah Lake Valley.

Station "B" This station was established Feb. 1, 1905, to determine the total flow of the river into this valley, takes the place of the station at the mouth of the canyon. It is located about one-half mile below Forks Station, about 3 miles above the mouth of the canyon. Records of observations are available for this station from Jan. 1, 1905 to Dec. 31, 1911, as reported by the U. S. Geol. Survey, to the reported discharge is added 40 second-feet for inflow and Spring Creek. This tabulation represents the available natural flow of the Provo River and Spring Creek, below the mouth of the Provo Canyon, in the Utah Lake Valley.

Station "C" This station was established Oct. 27, 1911. It works with 13 miles above Provo, at a point 150 feet above the confluence of the South Fork with the Provo River. Also a station is established on the South Fork 2,400 feet above the mouth. The discharge obtained by the total of the station on the South Fork is added to the River station discharge. Records of observations are available for these stations from Jan. 1, 1911, to Oct. 1, 1914, as reported by the U. S. Geol. Survey, to the reported discharge is added 40 second-feet for inflow and Spring Creek. This tabulation represents the available natural flow of the Provo River and Spring Creek, below the mouth of the Provo Canyon, in the Utah Lake Valley.

Note: During a part of the years 1910, 1911, 1912, 1913, 1914, the Provo Reservoir Company, have diverted to Provo River, amounts and duration as shown by following table:

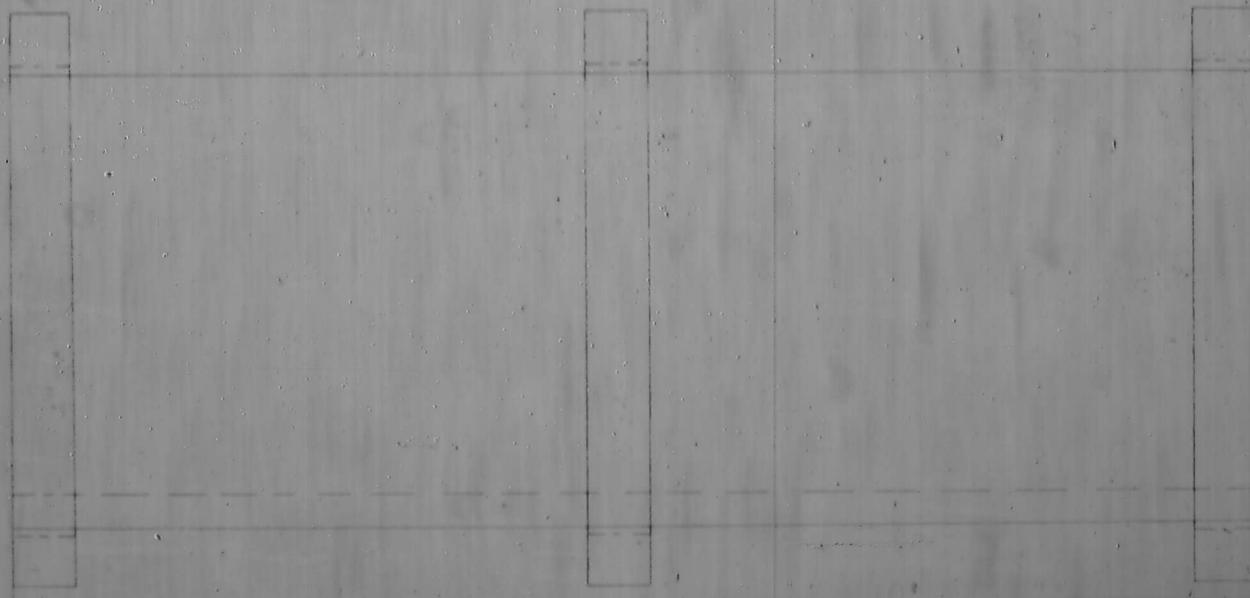
Year	Months	Amount, cfs.	Notes
1910	July, Aug., Sept.	35	Approx. 100 cfs above amounts shown in this table, the observed flow, plus the inflow before the observed flow, and represents the natural flow of Provo River and Spring Creek, below the mouth of the Provo Canyon, in the Utah Lake Valley.
1911	" " "	40	"
1912	" " "	45	"
1913	" " "	50	"
1914	Aug., Sept.	50	"

Compilation and Computations made by

T. P. Wentz

Period	1889-1904	1905-1911	1911-1914	1914-1915	1915-1916	1916-1917	1917-1918	1918-1919	1919-1920	1920-1921	1921-1922	1922-1923	1923-1924	1924-1925	1925-1926	1926-1927	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948	1948-1949	1949-1950	1950-1951	1951-1952	1952-1953	1953-1954	1954-1955	1955-1956	1956-1957	1957-1958	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	1968-1969	1969-1970	1970-1971	1971-1972	1972-1973	1973-1974	1974-1975	1975-1976	1976-1977	1977-1978	1978-1979	1979-1980	1980-1981	1981-1982	1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030	2030-2031	2031-2032	2032-2033	2033-2034	2034-2035	2035-2036	2036-2037	2037-2038	2038-2039	2039-2040	2040-2041	2041-2042	2042-2043	2043-2044	2044-2045	2045-2046	2046-2047	2047-2048	2048-2049	2049-2050	2050-2051	2051-2052	2052-2053	2053-2054	2054-2055	2055-2056	2056-2057	2057-2058	2058-2059	2059-2060	2060-2061	2061-2062	2062-2063	2063-2064	2064-2065	2065-2066	2066-2067	2067-2068	2068-2069	2069-2070	2070-2071	2071-2072	2072-2073	2073-2074	2074-2075	2075-2076	2076-2077	2077-2078	2078-2079	2079-2080	2080-2081	2081-2082	2082-2083	2083-2084	2084-2085	2085-2086	2086-2087	2087-2088	2088-2089	2089-2090	2090-2091	2091-2092	2092-2093	2093-2094	2094-2095	2095-2096	2096-2097	2097-2098	2098-2099	2099-2100
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Year	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
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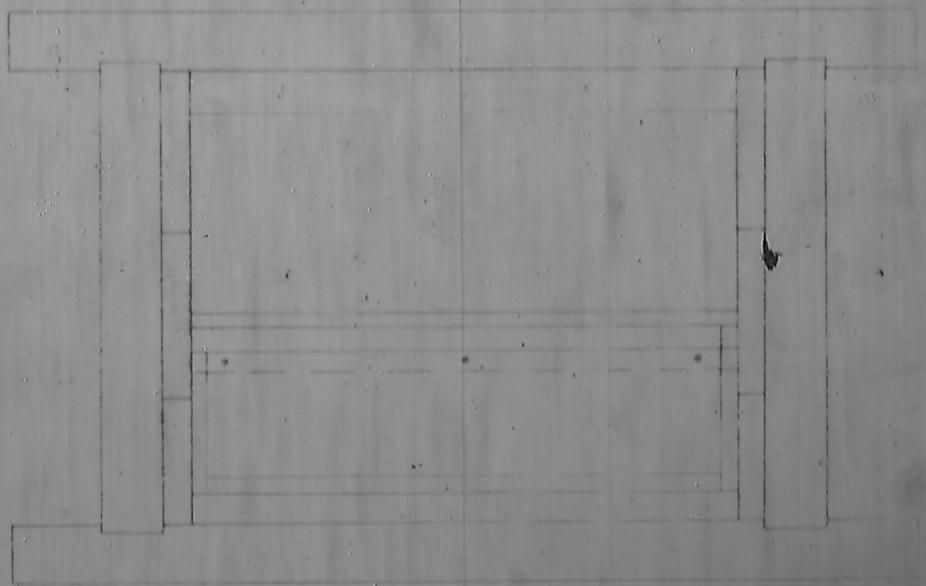






1/8" steel plate

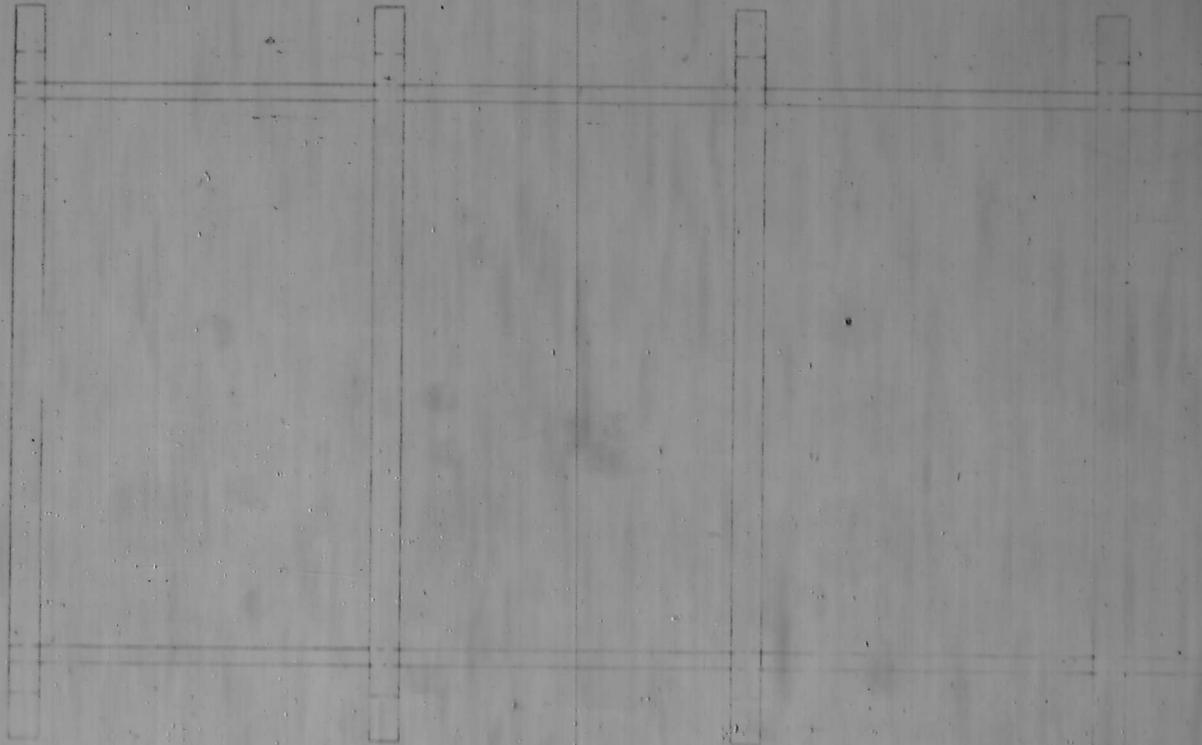
3/4" bolt



at least four inches above
the water line below site.

SEE DRAWING

Scale 1/2" = 1'-0"



TOP VIEW

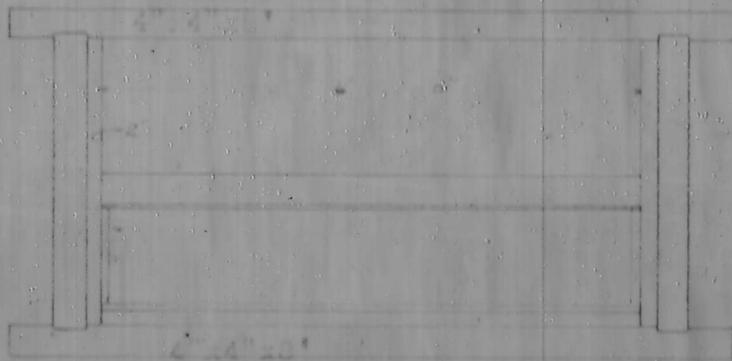


Office New River Water Co. Station
Provo, Utah. June 1914.



London
1914.

1914



Self front to be set four inches above
 side of the frame.

to be set up as shown
 to be 1 inch 2 feet



DIAGRAM
GREAT SALT LAKE



DIAGRAM

GREAT SALT LAKE



MEAN

PROVO RIVER

1005 - 1914

Completed Computations
1915

100

1000

10000

100000

MEAN
NATURAL
PROVO RIVER

1905 - 1914

Comparison Completed Plotted

TE WENTZ

Jan 1915











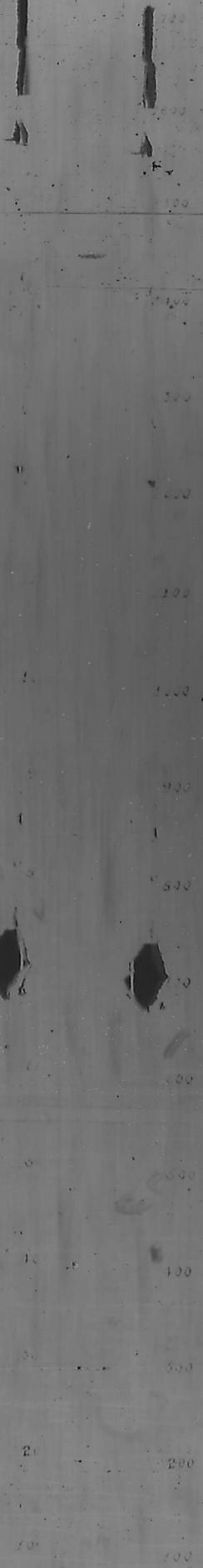
MEAN
(Natural)
PROVO RIVER

1905 - 1914

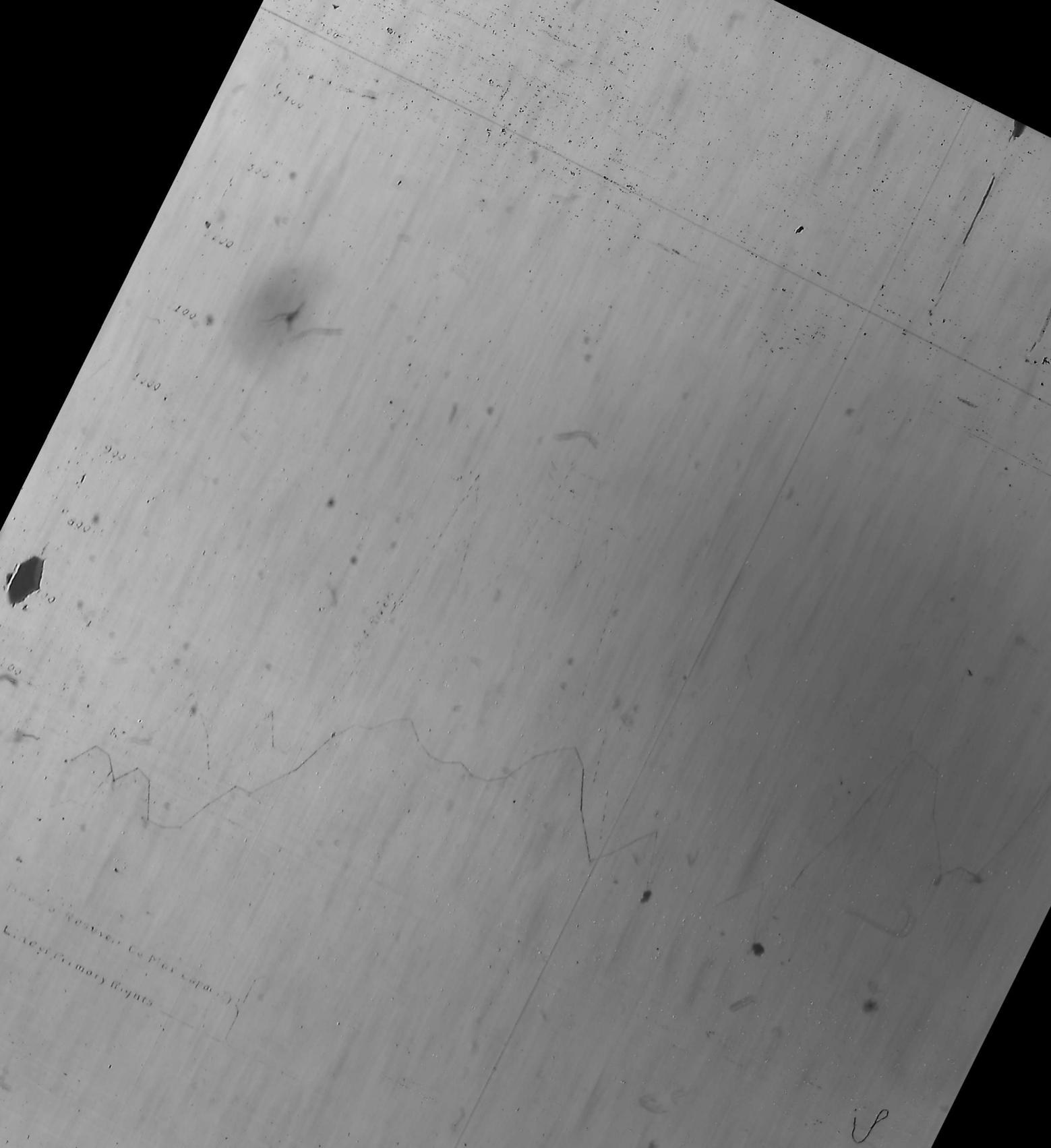
Complete Computer Plotted

TEWENTY

JAN 1915



W R



Technical drawing text, possibly including a title or description, oriented vertically.

Handwritten mark or signature.

Артіл

M



April

May



ay

JVI

June

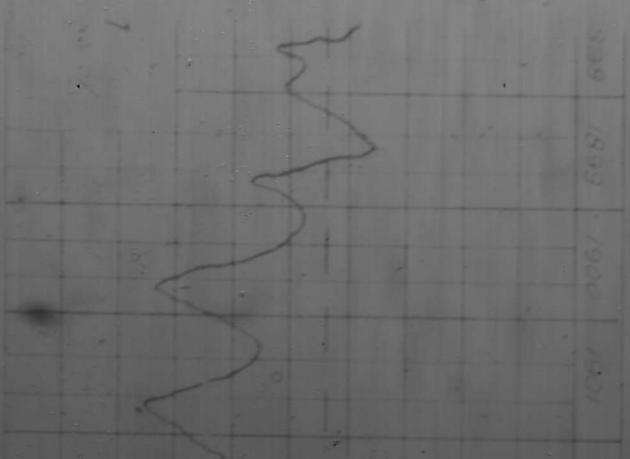
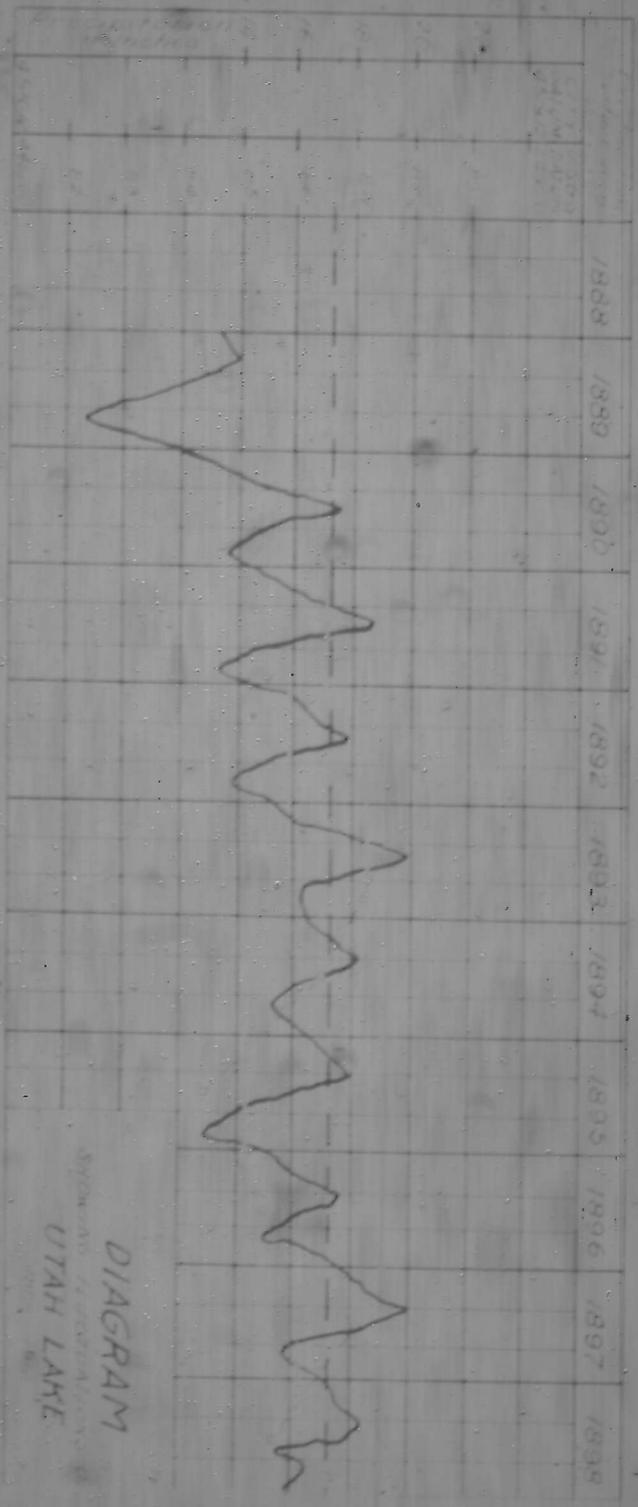
July

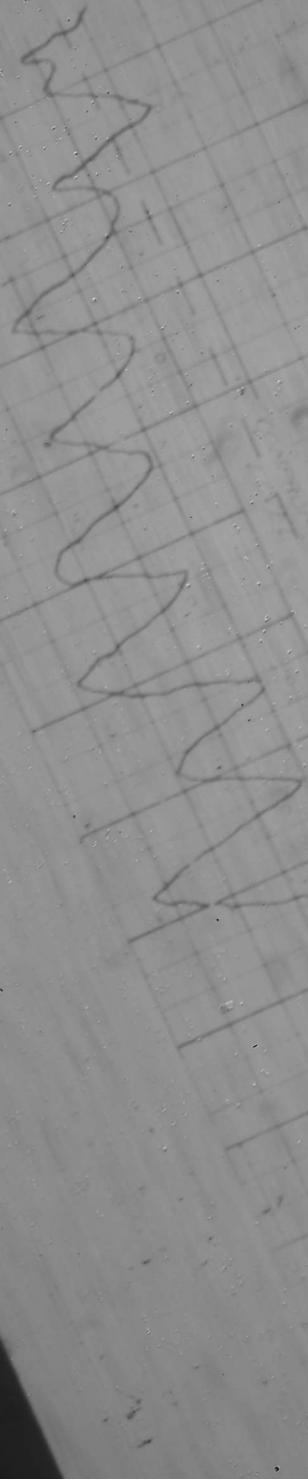
August

September

Septemb

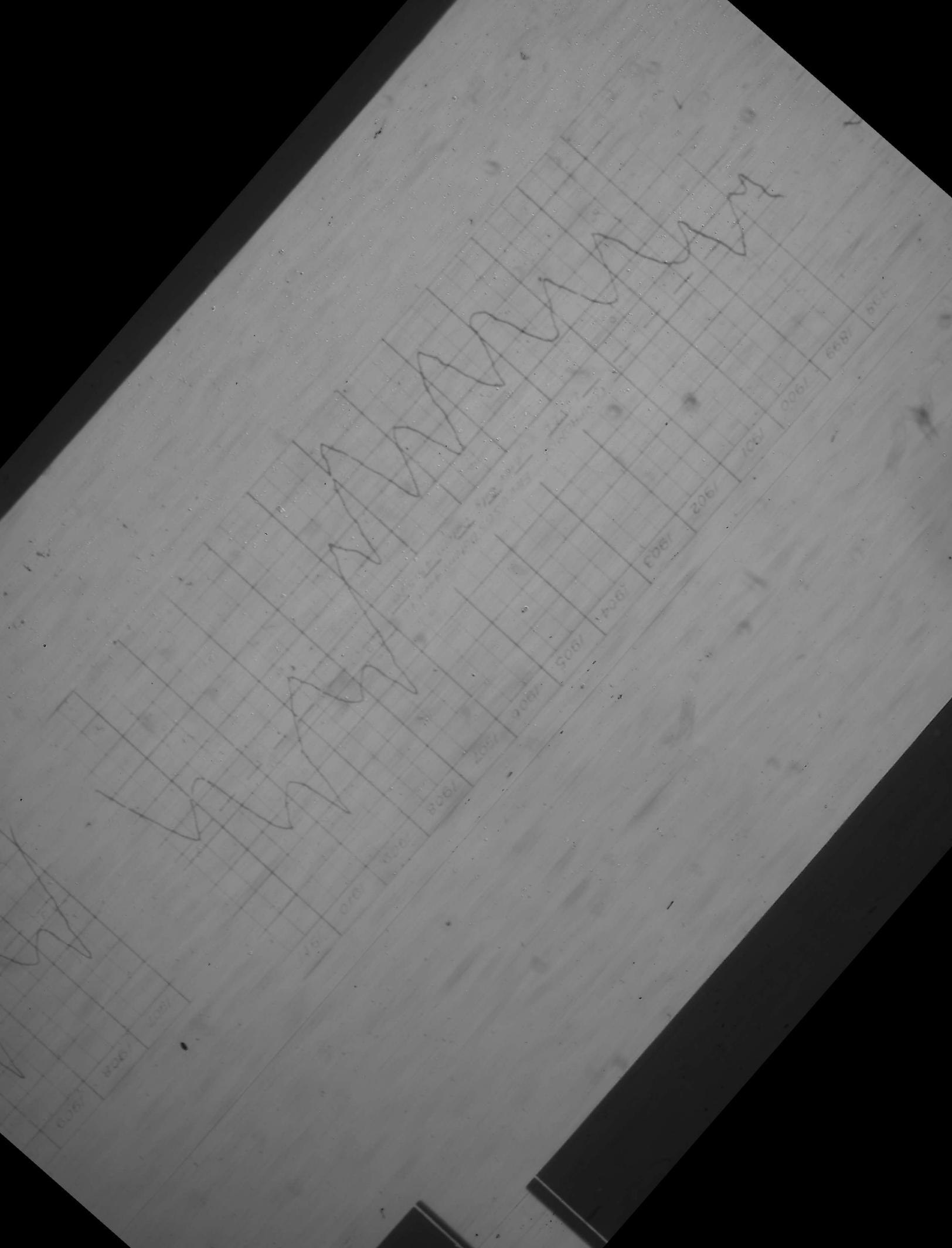
September

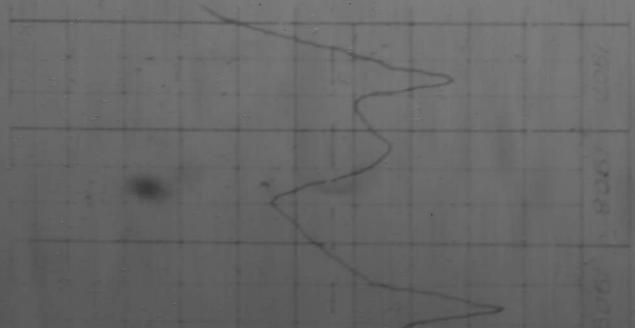
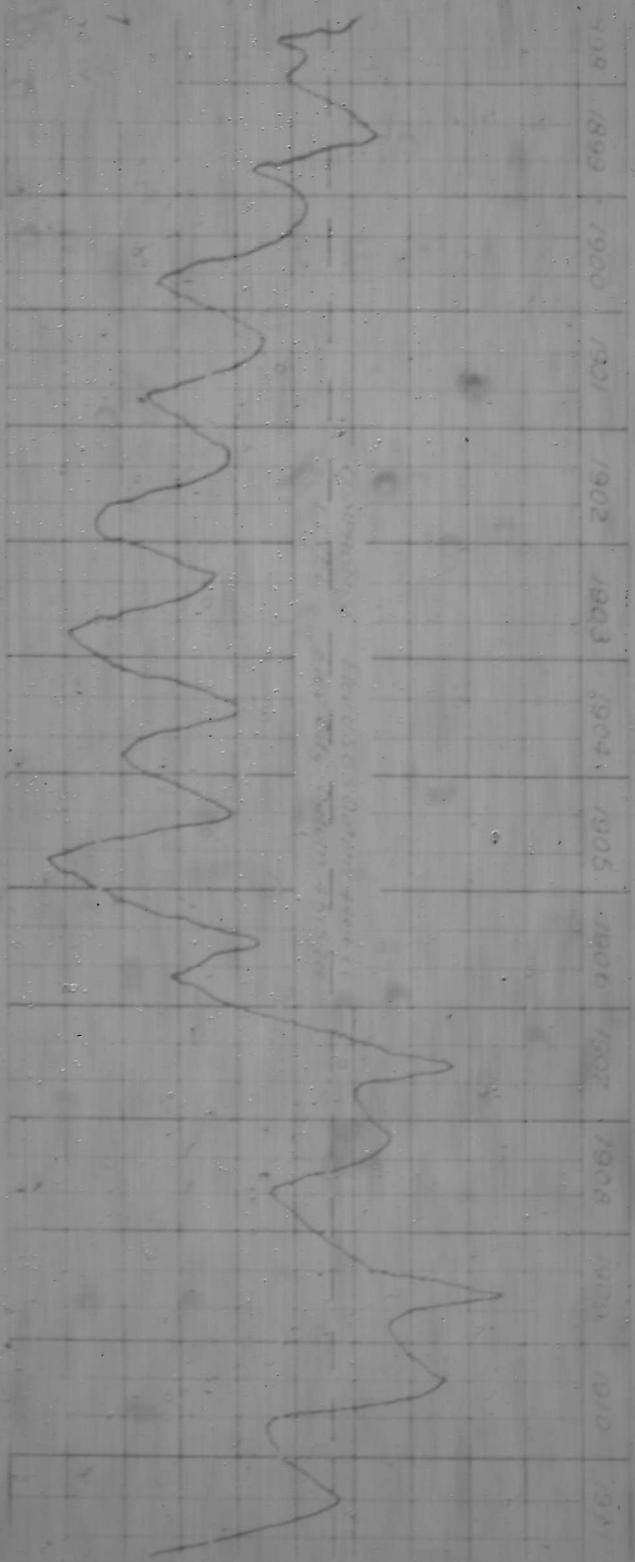




1901
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1911
1912







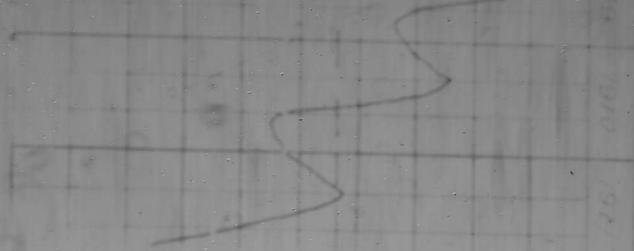
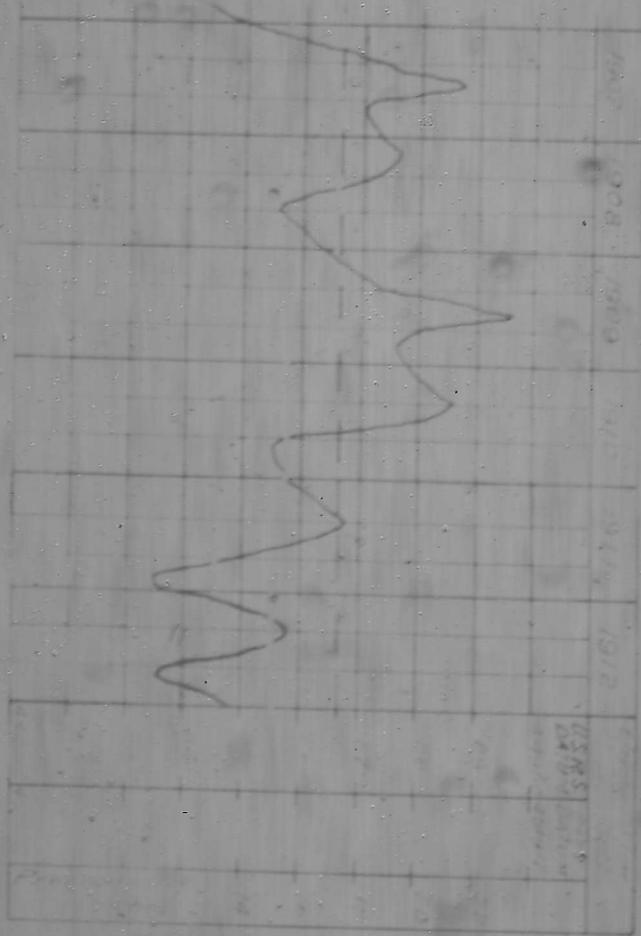


Table III "MEAN (Natural) PHOTO RIVER NEA-LAKE VALLEY" April 1905-1914

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
"APRIL"																				
1905	294	294	294	294	278	294	294	294	294	315	375	341	341	341	341	341	375	375	375	
1906	315	320	370	394	394	394	394	435	435	570	570	485	485	485	485	485	570	570	570	
1907	458	440	570	574	574	574	574	625	625	700	700	1015	1015	1015	1015	1015	700	700	700	
1908	330	350	350	350	345	345	350	350	350	350	350	350	350	350	350	350	350	350	350	
1909	510	570	550	710	590	590	490	490	410	530	530	530	530	530	530	530	530	530	530	
1910	615	635	705	625	590	705	610	655	715	710	655	655	655	655	655	655	655	655	655	
1911	540	590	645	550	580	580	580	530	530	570	530	490	490	490	490	490	490	490	490	
1912	494	405	494	508	557	519	515	530	530	530	530	490	490	490	490	490	490	490	490	
1913	945	1170	774	632	675	655	554	535	535	535	534	613	634	634	634	634	634	634	634	
1914	409	485	489	577	618	679	641	641	602	645	705	685	685	685	685	685	685	685	685	
Total	5342	5855	5519	5554	5540	5565	5099	5152	5306	5542	5995	5995	5995	5995	5995	5995	5995	5995	5995	
Max.																				
Min.																				
Mean	534	585	551	555	554	556	510	515	530	554	599	599	599	599	599	599	599	599	599	
"MAY"																				
1905	486	486	525	486	411	375	375	375	419	411	375	375	375	375	375	375	375	375	375	
1906	570	570	570	615	710	695	394	715	605	955	999	1375	1475	1175	975	975	975	975	975	
1907	920	920	855	755	755	755	755	674	674	674	674	674	674	674	674	674	674	674	674	
1908	540	674	720	614	755	910	614	614	910	1010	910	925	1010	910	925	925	925	925	925	
1909	1040	890	940	1140	1365	1365	1440	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	
1910	1365	1140	902	1012	975	890	775	912	902	1110	1405	1440	1374	1440	1440	1440	1440	1440	1440	
1911	590	530	570	450	530	590	750	710	710	600	710	750	710	775	680	680	680	680	680	
1912	405	475	401	401	441	442	442	505	525	575	614	685	671	675	680	680	680	680	680	
1913	953	905	815	754	732	753	773	817	945	900	945	997	930	975	975	975	975	975	975	
1914	809	808	745	695	915	1035	1011	1064	1221	1221	1221	1174	1212	1064	1179	1179	1179	1179	1179	
Total	7700	7441	7172	7355	7654	7669	7175	8269	8720	9540	10901	10740	10695	9533	9573	9573	9573	9573	9573	
Max.																				
Min.																				
Mean	770	744	717	737	765	767	715	827	872	954	1090	1074	1069	953	957	957	957	957	957	
"JUNE"																				
1905	603	919	915	1015	1094	965	919	1109	1260	1117	919	603	603	603	603	603	603	603	603	
1906	1376	1138	932	938	938	1044	1475	1135	925	1544	925	1475	1311	1131	1131	1131	1131	1131	1131	
1907	1160	1325	1780	1840	2060	2060	2060	2060	2060	1900	1755	1755	1755	1755	1755	1755	1755	1755	1755	
1908	1110	1010	1000	1010	1110	1080	1010	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110	
1909	1695	1670	2100	2890	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	
1910	1035	990	935	805	795	890	1035	935	935	935	935	935	935	935	935	935	935	935	935	
1911	960	990	890	965	1110	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	
1912	1010	1317	1497	1904	1915	1900	2015	2115	2115	2115	2115	2115	2115	2115	2115	2115	2115	2115	2115	
1913	740	722	705	685	597	525	510	475	475	475	475	475	475	475	475	475	475	475	475	
1914	1495	1427	1527	1705	1500	1511	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	
Total	11960	15691	14912	16145	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	14787	
Max.																				
Min.																				
Mean	1196	1569	1491	1614	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	1478	
"JULY"																				
1905	511	325	315	325	354	314	325	325	314	325	325	314	314	314	314	314	314	314	314	
1906	510	525	525	525	525	525	415	415	525	525	525	525	525	525	525	525	525	525	525	
1907	1750	1900	1900	1900	1140	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
1908	1110	1060	1060	1010	1010	1010	910	910	910	910	910	910	910	910	910	910	910	910	910	
1909	1310	1300	1340	1300	1400	1400	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	
1910	500	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	245	
1911	300	285	270	270	300	300	285	285	285	285	285	285	285	285	285	285	285	285	285	
1912	315	369	365	365	367	311	361	361	367	367	367	367	367	367	367	367	367	367	367	
1913	415	347	347	305	305	275	275	275	275	275	275	275	275	275	275	275	275	275	275	
1914	357	405	347	347	347	419	405	395	395	371	371	367	367	367	367	367	367	367	367	
Total	7000	6909	6901	6909	7009	6897	6897	6897	6897	6897	6897	6897	6897	6897	6897	6897	6897	6897	6897	
Max.																				
Min.																				
Mean	700	690	690	690	700	689	689	689	689	689	689	689	689	689	689	689	689	689	689	
"AUGUST"																				
1905	305	272	283	250	251	250	249	240	247	245	241	240	240	240	240	240	240	240	240	
1906	325	308	308	305	308	305	265	265	265	305	305	305	305	305	305	305	305	305	305	
1907	425	425	425	425	425	425	415	415	415	415	415	415	415	415	415	415	415	415	415	
1908	310	315	298	298	305	317	305	305	298	298	298	298	298	298	298	298	298	298	298	
1909	305	330	315	315	290	345	305	305	315	315	315	315	315	315	315	315	315	315	315	
1910	275	245	245	245	260	260														

