

January 4, 1972

NOTES ON DRILLING AND CONSTRUCTION OF DOMESTIC WELLS  
FOR WARDNER WATER FRONT PROJECT  
CONTRACT # 46

GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
B. C. WATER RESOURCES SERVICE

From August 13 -- September 4, 1971, four wells were drilled under contract #46 (see location map Fig. 1), to replace wells of local residents at Wardner, B.C. which will be flooded when the Libby Dam project is completed. Alpine Drilling Co. of Cranbrook B.C. was the drilling contractor and used a Seismic Model 1700 rotary drilling rig to drill and construct the wells.

DRILL LOG

Site #1:

0 - 10' Silty sandy gravel with boulders  
10 - 70' Gravel with sand (lost pit of mud at 53 feet. Drilled 53-70 feet using bran to combat lost circulation.)

Site #2:

0 - 3' Fill  
3 - 47' Shale (no fractures observed)  
47 - 60' Shattered shale (w.b.) (Argillaceous and Quartzitic Carbonates)

Site #3:

0 - 43' Gravel with sand  
43 - 45.5' Bedrock (Argillaceous and Quartzitic Carbonates)

Site #4:

0 - 46' Gravel with sand  
46 - 47' Some white marl and pieces of clay  
47 - 49' Bedrock (Argillaceous and Quartzitic Carbonates)

WELL CONSTRUCTION

A diagram of each well with construction and completion details is attached.

97

DEVELOPMENTSite #1:

The mud cake was broken down by surging with air and pumping with air lift.

Site #2:

This well was drilled with air and needed no developing.

Site #3:

Same as well at site #1.

Site #4:

The mud cake was broken down by air surging, high-velocity jetting and air lifting.

GROUTING

The well at site #2 was grouted to 47 feet below ground level. The other wells were grouted to a depth of approx. 3 - 5 feet.

CHLORINATING WELLS

Prior to final testing, each well was treated with a chlorine solution. The water in the well was agitated with air to mix the solution thoroughly. See appendix 1 for bacteriological test results. The well at site #1 and site #3 tested unsatisfactorily and should be chlorinated again and tested before being used.

PUMP TEST AND RECOVERY SUMMARYSite #1:

The well was pumped for 60 mins. at 8.5 I.G.P.M. Total drawdown at the end of this time was .42 feet. The well recovered to within .02 feet of static in 2 mins. The water pumped clear and no sand was observed in it.

Site #2:

The well was pumped for 35 mins. at 8.5 I.G.P.M. After 25 mins. the water level had drawn down 2.81 feet. Water level readings could not be taken during the last 10 mins. of pumping as the top of the submersible pump was in the way. The pump was pulled and recovery readings were taken for 27 mins. The pump was ran in again and pumping was continued at the same rate as above for 17 more mins. Water samples were taken during this period. The water pumped turbid at times.

PUMP TEST AND RECOVERY SUMMARY (cont.)Site #3:

The well was pumped for 1 hour at 8.5 I.G.P.M. Total drawdown at the end of this time was .63 feet. The well recovered to within .12 feet of static in 6 mins. The water pumped clear and no sand was observed in it.

Site #4:

The well was pumped at a constant rate of 8.5 I.G.P.M. for 35 mins. Total drawdown at the end of this period was 1.43 feet. The well recovered to within .01 feet of static in 4 mins. The well produced sand free clear water.

See appendix 2 for drawdown and recovery readings for each well. Time-drawdown graphs are also attached.

RECOMMENDATIONS FOR PUMP SETTING AND TYPESite #1:

A submersible or jet pump should be installed at this site with the intake at approx. 60 feet.

Site #2:

A jet pump should be installed in this well with the intake set below the 4 inch liner casing in the open rock hole. The intake should be set at about 54 - 57 feet. I would recommend the pump rate be set at 4--5 G.P.M.

Site #3:

A jet pump should be installed in this well with the intake at 38 feet. Mr. Holmes has two jet pumps and possibly one of these could be used on this well. This well should not be pumped over 8 I.G.P.M. as the lead packer is not the right one for the casing size used. Sand pumping may occur at a higher rate of pumping.

Site #4:

A submersible or jet pump should be installed on this well with the intake at 39 feet. Mr. Holmes has two jet pumps and possibly one of these could be used on this well.

*Dave Johanson*

D. Johanson  
Technician  
Groundwater Division

APPENDIX #I  
BACTERIOLOGICAL TEST RESULTS  
WARDNER, B.C.

SITE #1

DIVISION OF LABORATORIES BRITISH COLUMBIA HEALTH SERVICES		REGULATION AND REPORT FORM 15 (REV. 5/69) <b>WATER BACTERIOLOGY</b>		LABORATORY USE ONLY	
SENT BY: <u>D. JOHNSON</u>				21312 SEP 771	
TEST: <u>AS BELOW</u>				DATE REPORTED: <u>9-9-71</u>	
COLLECTED: <u>SEPT 4/71</u>				SOURCE OF SAMPLE: <u>WELL. SAMPLE FROM PUMP DISCHARGE</u>	
<p align="center">LABORATORY DIVISION WATER INVESTIGATIONS BRANCH PARLIAMENT BUILDINGS VICTORIA, B.C.</p>					
<p align="center">PRINT OR TYPE IN BOX FULL POSTAL ADDRESS OF HEALTH UNIT OR OF PERSONS AUTHORIZED TO RECEIVE REPORT. SEE REVERSE FOR INSTRUCTIONS, INTERPRETATION, AND NOTES.</p>					

THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20°C	35°C	0.0001	0.001	0.01	0.1	1.0	10		
							5/5	>16.0	

Note: "MR JOHNSON'S WELL" copied from sample bottle label.

RT

DIVISION OF LABORATORIES BRITISH COLUMBIA HEALTH SERVICES		REGULATION AND REPORT FORM 15 (REV. 6/69) <b>WATER BACTERIOLOGY</b>		LABORATORY USE ONLY	
SENT BY: <u>D. JOHNSON</u>				21311 SEP 771	
TEST: <u>AS BELOW</u>				DATE REPORTED: <u>9-9-71</u>	
COLLECTED: <u>SEPT 4/71</u>				SOURCE OF SAMPLE: <u>WELL. SAMPLE FROM PUMP DISCHARGE</u>	
<p align="center">GROUND WATER DIVISION WATER INVESTIGATIONS BRANCH PARLIAMENT BUILDINGS VICTORIA, B.C.</p>					
<p align="center">PRINT OR TYPE IN BOX FULL POSTAL ADDRESS OF HEALTH UNIT OR OF PERSONS AUTHORIZED TO RECEIVE REPORT. SEE REVERSE FOR INSTRUCTIONS, INTERPRETATION, AND NOTES.</p>					

THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20°C	35°C	0.0001	0.001	0.01	0.1	1.0	10		
							7/5	>16.0	

Note: "MR JOHNSON'S WELL" copied from sample bottle label.

SITE #2

DIVISION OF LABORATORIES  
BRITISH COLUMBIA HEALTH SERVICES  
WATER BACTERIOLOGY

BY: *D. JOHNSON*

ADDRESS: *AT NEW*

DATE COLLECTED: *SEPT 4/71*

LABORATORY USE ONLY

21310 SEP 771

DATE REPORTED: *9-9-71*

*GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.*

SOURCE OF SAMPLE:  
*Well. SMALL FARM  
PUMP DISCHARGE.*

PRINT OR TYPE IN BOX FULL POSTAL ADDRESS OF HEALTH UNIT OR OF PERSONS AUTHORIZED TO RECEIVE REPORT.  
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THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20° C	35° C	0.0001	0.001	0.01	0.1	1.0	10		
								<i>0/5</i>	<i>&lt;2.2</i>

*Note: "MR MERCIER'S WELL"  
copied from sample bottle  
label.  
Sample of pipe, grey  
as intended. JE*

DIVISION OF LABORATORIES  
BRITISH COLUMBIA HEALTH SERVICES  
REQUISITION AND REPORT FORM L5 (REV. 6/69)  
WATER BACTERIOLOGY

LABORATORY USE ONLY

BY: *GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS, VICTORIA, B.C.*

ADDRESS:

21309 SEP 771

DATE COLLECTED: *SEPT 4/71*

DATE REPORTED: *13-9-71*

*GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.*

SOURCE OF SAMPLE:  
*PUMP DISCHARGE*

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THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20° C	35° C	0.0001	0.001	0.01	0.1	1.0	10		
								<i>0/5</i>	<i>&lt;2.2</i>

*11-12-71  
GROUNDWATER SAMPLING*

*Note: "MR MERCIER'S WELL,  
WARDNER, BC" copied  
from sample bottle label.*

SITE #3

DIVISION OF LABORATORIES  
BRITISH COLUMBIA HEALTH SERVICES

REQUISITION AND REPORT FORM L5 (REV. 6/69)  
**WATER BACTERIOLOGY**

LABORATORY USE ONLY

SENT BY: *D. JOHANSEN*

21314 SEP 771

ADDRESS: *AS BELOW*

DATE COLLECTED: *SEPT 4/71*

DATE REPORTED: *10-9-71*

*GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.*

SOURCE OF SAMPLE:  
*WELL HEAD SAMPLE  
FROM PUMP DISCHARGE*

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**THIS IS YOUR REPORT—LABORATORY USE ONLY**

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20° C.	35° C.	0.00001	0.0001	0.001	0.01	0.1	1.0	10	
								<i>3/5</i>	<i>9.2</i>

Note: "MR HOLMES NORTH WELL" copied from sample bottle label.

*R*

DIVISION OF LABORATORIES  
BRITISH COLUMBIA HEALTH SERVICES

REQUISITION AND REPORT FORM L5 (REV. 6/69)  
**WATER BACTERIOLOGY**

LABORATORY USE ONLY

SENT BY: *DAVE JOHANSEN*

21313 SEP 771

ADDRESS: *GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS, VICTORIA*

DATE COLLECTED: *SEPT 4/71*

DATE REPORTED: *10-9-71*

*GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.*

SOURCE OF SAMPLE:  
*WELL, SAMPLE FROM  
PUMP DISCHARGE.*

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SEE REVERSE FOR INSTRUCTIONS, INTERPRETATION, AND NOTES.

**THIS IS YOUR REPORT—LABORATORY USE ONLY**

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20° C.	35° C.	0.00001	0.0001	0.001	0.01	0.1	1.0	10	
								<i>2/5</i>	<i>5.1</i>

Note: "MR HOLMES NORTH WELL, WARDNER, BC" copied from sample bottle label.

*R*

SITE #4

DEPARTMENT OF HEALTH SERVICES  
PUBLIC HEALTH LABORATORIES

DEPARTMENT OF HEALTH SERVICES  
WATER BACTERIOLOGY

LABORATORY USE ONLY

SENT BY: Doug Johnson  
ADDRESS: Groundwater Division  
Water Investigations Branch, Parliament  
Buildings, Victoria  
DATE COLLECTED: Sept 4/71

21315 SEP 771  
DATE REPORTED: 9-9-71

Ground Water Division  
Water Investigations Branch.  
Parliament Buildings,  
VICTORIA BC

SOURCE OF SAMPLE:  
NOTE:  
"MR HOLMES  
SOUTH WELL, WARDNER, BC  
Copied from sample bottle  
label

PRINT OR TYPE IN BOX FULL POSTAL ADDRESS OF HEALTH UNIT OR OF PERSONS AUTHORIZED TO RECEIVE REPORT.  
SEE REVERSE FOR INSTRUCTIONS, INTERPRETATION, AND NOTES.

THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20°C	35°C	0.00001	0.0001	0.001	0.01	0.1	1.0	10	
								<u>0/5</u>	<u>&lt;2.2</u>

DEPARTMENT OF LABORATORIES  
BRITISH COLUMBIA HEALTH SERVICES

REQUESTION AND REPORT FORM L5 (REV. 6/69)  
WATER BACTERIOLOGY

LABORATORY USE ONLY

SENT BY: D. Johnson  
ADDRESS: AS BELOW  
DATE COLLECTED: Sept 4/71

21316 SEP 771  
DATE REPORTED: 9-9-71

GROUNDWATER DIVISION  
WATER INVESTIGATIONS BRANCH  
PARLIAMENT BUILDINGS  
VICTORIA, B.C.

SOURCE OF SAMPLE:  
Well Head. From  
PUMP DISCHARGE.

PRINT OR TYPE IN BOX FULL POSTAL ADDRESS OF HEALTH UNIT OR OF PERSONS AUTHORIZED TO RECEIVE REPORT.  
SEE REVERSE FOR INSTRUCTIONS, INTERPRETATION, AND NOTES.

THIS IS YOUR REPORT—LABORATORY USE ONLY

COPY TO:  DEPUTY MINISTER OF HEALTH.

STANDARD PLATE COUNT PER ML		COLIFORM TEST PER ML							MPN PER 100 ML
20°C	35°C	0.00001	0.0001	0.001	0.01	0.1	1.0	10	
								<u>0/5</u>	<u>&lt;2.2</u>

Note: "Mr Holmes South Well" copied from sample bottle label.

R

APPENDIX #2

DRAWDOWN AND RECOVERY READINGS

ON DOMESTIC WATER WELLS

WARDNER, B. C.

Site #1:

Pump test: SEPTEMBER 4, 1971.

All measurements were taken approx. 2 feet above ground level.

Static Water Level: 49.55'

Constant pumping rate of 8.5 I.G.P.M.

<u>TIME</u>	<u>WATER LEVEL</u>	<u>DRAWDOWN</u>
1:37 P.M. PUMP STARTED		
○		
1:38	49.90'	.35'
1:39	49.91'	.36'
1:40	49.91'	.36'
1:41	49.92'	.37'
1:43	49.92'	.37'
1:47	49.93'	.38'
1:50	49.93'	.38'
1:54	49.93'	.38'
2:00 P.M.	49.95'	.40'
2:05 P.M.	49.95'	.40'
2:10	49.96'	.41'
2:15	49.95'	.40'
2:20	49.96'	.41'
2:25	49.97'	.42'
2:34	49.97'	.42'
2:37 P.M. PUMP SHUT DOWN	49.97'	.42'
2:37.5 RECOVERY	49.50'	
2:38	49.58'	
2:39	49.57'	



Pump t: SEPTEMBER 4, 1971.

Site #2:

All measurements were taken 1 foot above ground level.

Static Water Level: 45.55'

Constant pumping rate of 8.5 I.G.P.M.

<u>TIME</u>	<u>WATER LEVEL</u>	<u>DRAWDOWN</u>
2:51 P.M. PUMP STARTED		
2:52	45.87'	.32'
2:53	46.05'	.50'
2:54	46.20'	.65'
2:55	46.32'	.77'
2:56	46.46'	.91'
2:57	46.57'	1.02'
2:58	46.67'	1.12'
2:59	46.78'	1.23'
3:00	46.87'	1.32'
3:01	46.96'	1.41'
3:03	47.12'	1.57'
3:05	47.27'	1.72'
3:10	47.73'	2.18'
3:16	48.36'	2.81'

3:26 PUMP BROKE SUCTION--COULDN'T GET WELL LINE ALONGSIDE PUMP FOR MEASUREMENTS DURING LAST 10 MINS.

RECOVERY

3:32	48.08'
3:33	47.95'
3:34	47.84'
3:35	47.75'
3:37	47.57'
3:39	47.42'
3:41	47.28'
3:43	47.13'
3:48	46.87'
3:51	46.70'
3:53	46.62'

3:57--4:14 P.M. PUMPED WELL AT SAME RATE AS ABOVE--TOOK WATER SAMPLES--NO WATER LEVEL READINGS COULD BE TAKEN. WATER WAS TURBID AT TIMES.

4:14 P.M. PUMP SHUT DOWN

RECOVERY

6:33 P.M.	45.71'
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Pump test: SEPTEMBER 4, 1971

Site #3:

All measurements were taken 1.30 feet above ground level.

Static Water Level: 31:30'

Constant pumping rate of 8.5 I.G.P.M.

<u>TIME</u>	<u>WATER LEVEL</u>	<u>DRAWDOWN</u>
4:24 P.M.	PUMP STARTED	
4:25	31.80'	.50'
4:26	31.81'	.51'
4:27	31.81'	.51'
4:29	31.83'	.53'
4:33	31.84'	.54'
4:36	31.86'	.56'
4:41	31.89'	.59'
4:48	31.90'	.60'
4:54	31.90'	.60'
5:00	31.91'	.61'
5:05	31.91'	.61'
5:13	31.92'	.62'
5:18	31.92'	.62'
5:23	31.93'	.63'

5:24 P.M. PUMP SHUT DOWN

RECOVERY

5:25	31.43'
5:26	31.45'
5:27	31.44'
5:27	31.44'
5:28	31.43'
5:30	31.42'

HOLMES WELL AT SITE#4 IS DRILLED 39 FEET SOUTH OF THIS WELL. DURING PUMPING OF THIS WELL MEASUREMENTS WERE TAKEN ON WELL AT SITE #4. THEY ARE AS FOLLOWS:

4:38 P.M.	32.06'
5:02 P.M.	32.09'

RECOVERY

5:31	32.07'
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Pump test: SEPTEMBER 4, 1971

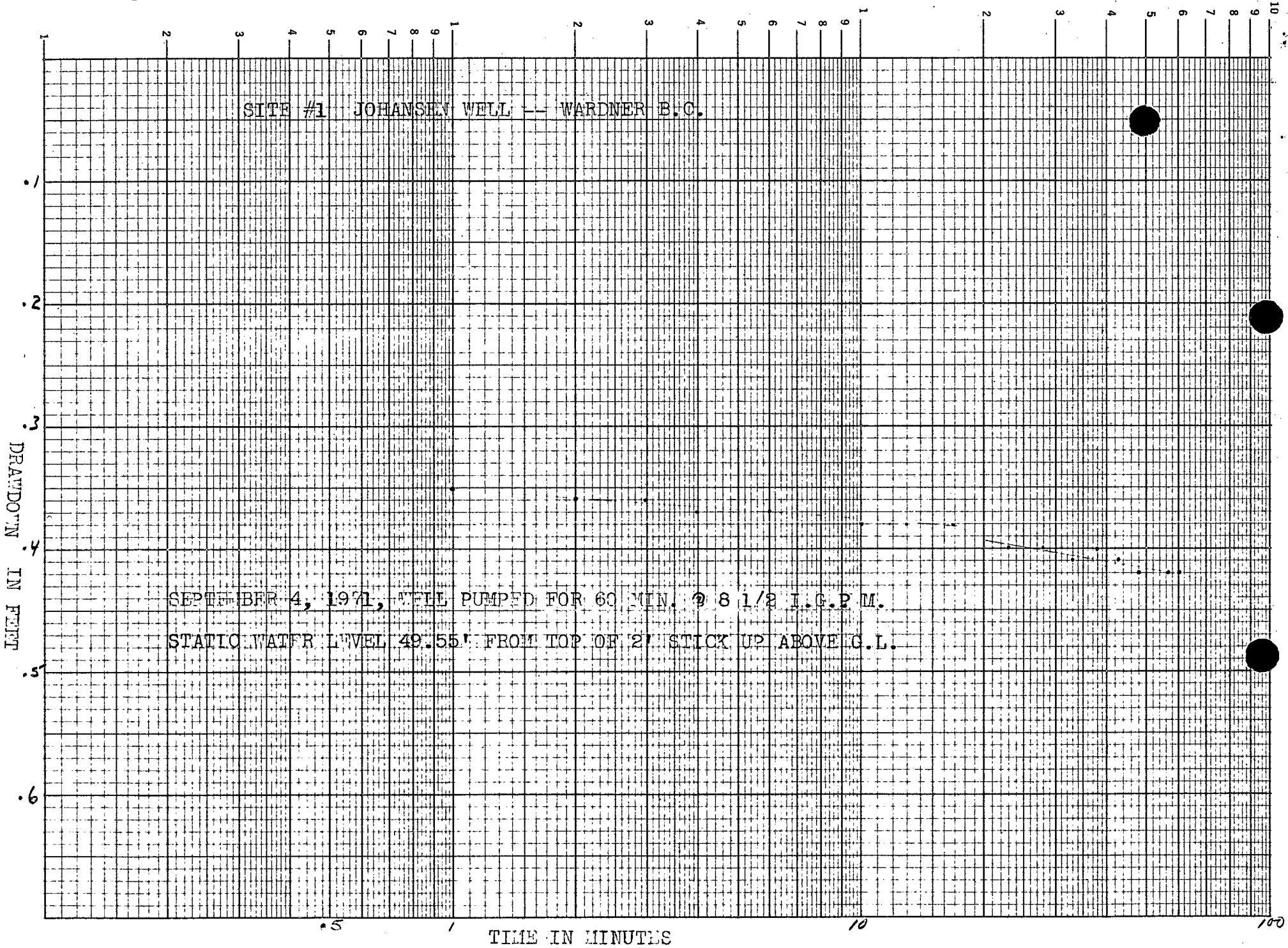
Site #4:

All measurements were taken .8 feet above ground level.

Static Water Level: 32.07'

Constant pumping rate of 8.5 I.G.P.M.

<u>TIME</u>	<u>WATER LEVEL</u>	<u>DRAWDOWN</u>
5:35 P.M. PUMP STARTED		
5:36	33.29'	1.29'
5:37	33.37'	1.37'
5:38	33.37'	1.37'
5:40	33.38'	1.38'
5:45	33.40'	1.40'
5:51	33.41'	1.41'
5:55	33.41'	1.41'
6:00	33.44'	1.44'
6:10	33.43'	1.43'
6:10 P.M. PUMP SHUT DOWN		
<u>RECOVERY</u>		
6:11	32.08'	
6:12	32.11'	
6:13	32.07'	
6:14	32.08'	

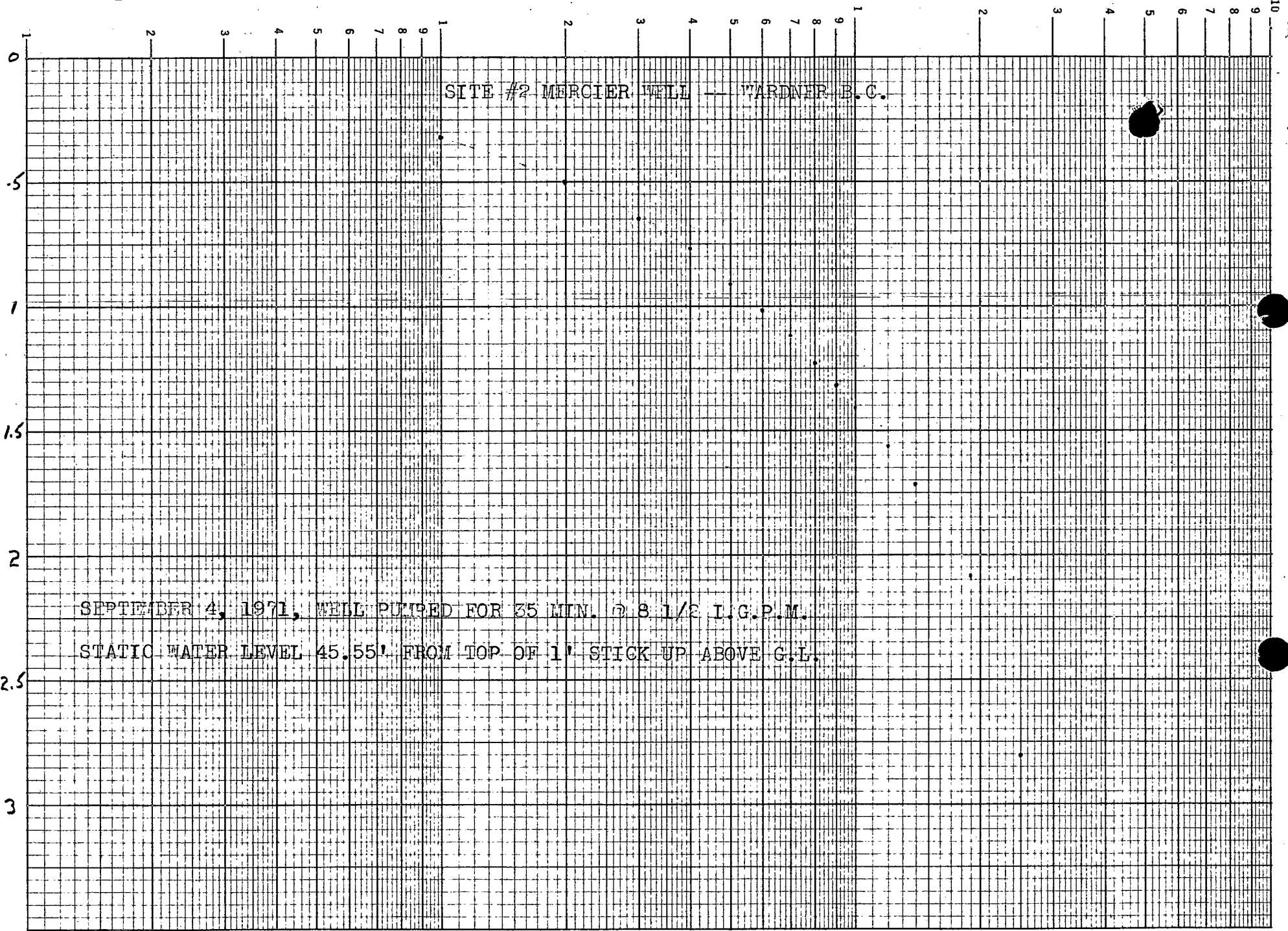


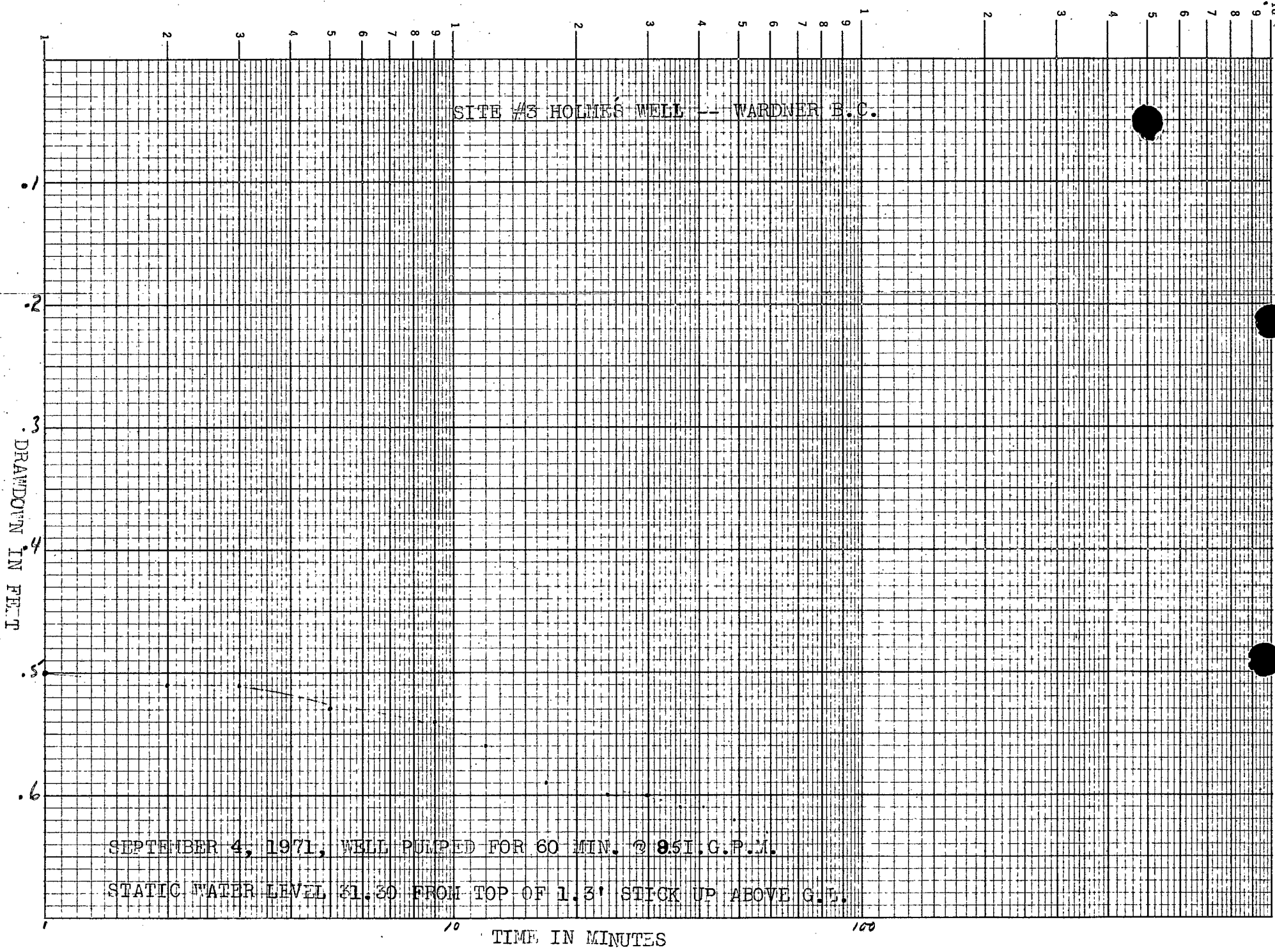
SITE #2 MERCIER WELLS - WARDNER B.C.

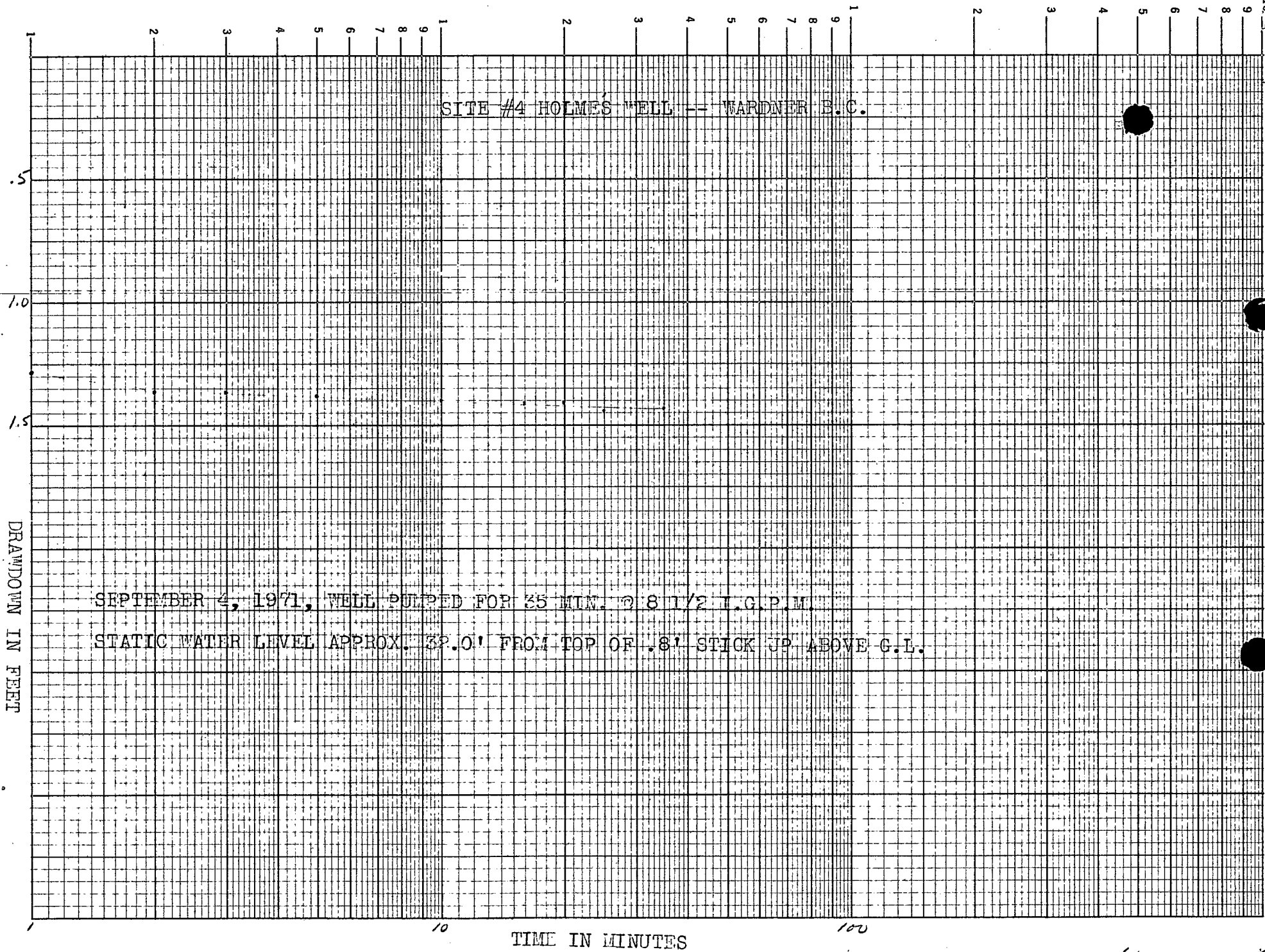
SEPTEMBER 4, 1971, WELL PUMPED FOR 35 MIN. @ 8 1/2 I.G.P.M.  
STATIC WATER LEVEL 45.55' FROM TOP OF 1' STICK UP ABOVE G.L.

TIME IN MINUTES

DRAWDOWN  
IN  
FEET







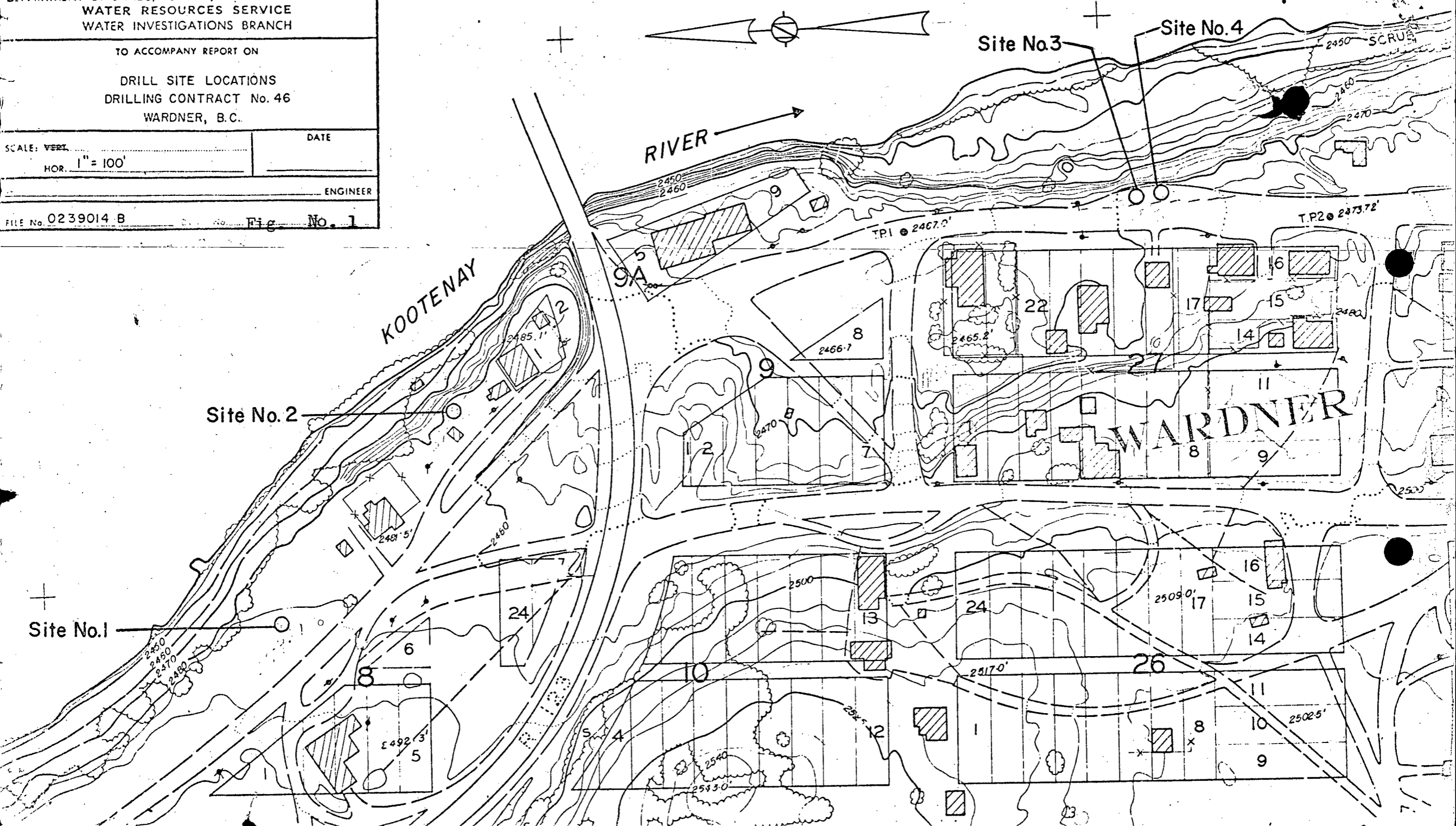
Wardner, B.C.

BRITISH COLUMBIA  
DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES  
WATER RESOURCES SERVICE  
WATER INVESTIGATIONS BRANCH

TO ACCOMPANY REPORT ON  
DRILL SITE LOCATIONS  
DRILLING CONTRACT No. 46  
WARDNER, B.C.

SCALE: VERT. \_\_\_\_\_ DATE \_\_\_\_\_  
HOR. 1" = 100'

ENGINEER \_\_\_\_\_  
FILE No. 0239014 B No. Fig. No. 1



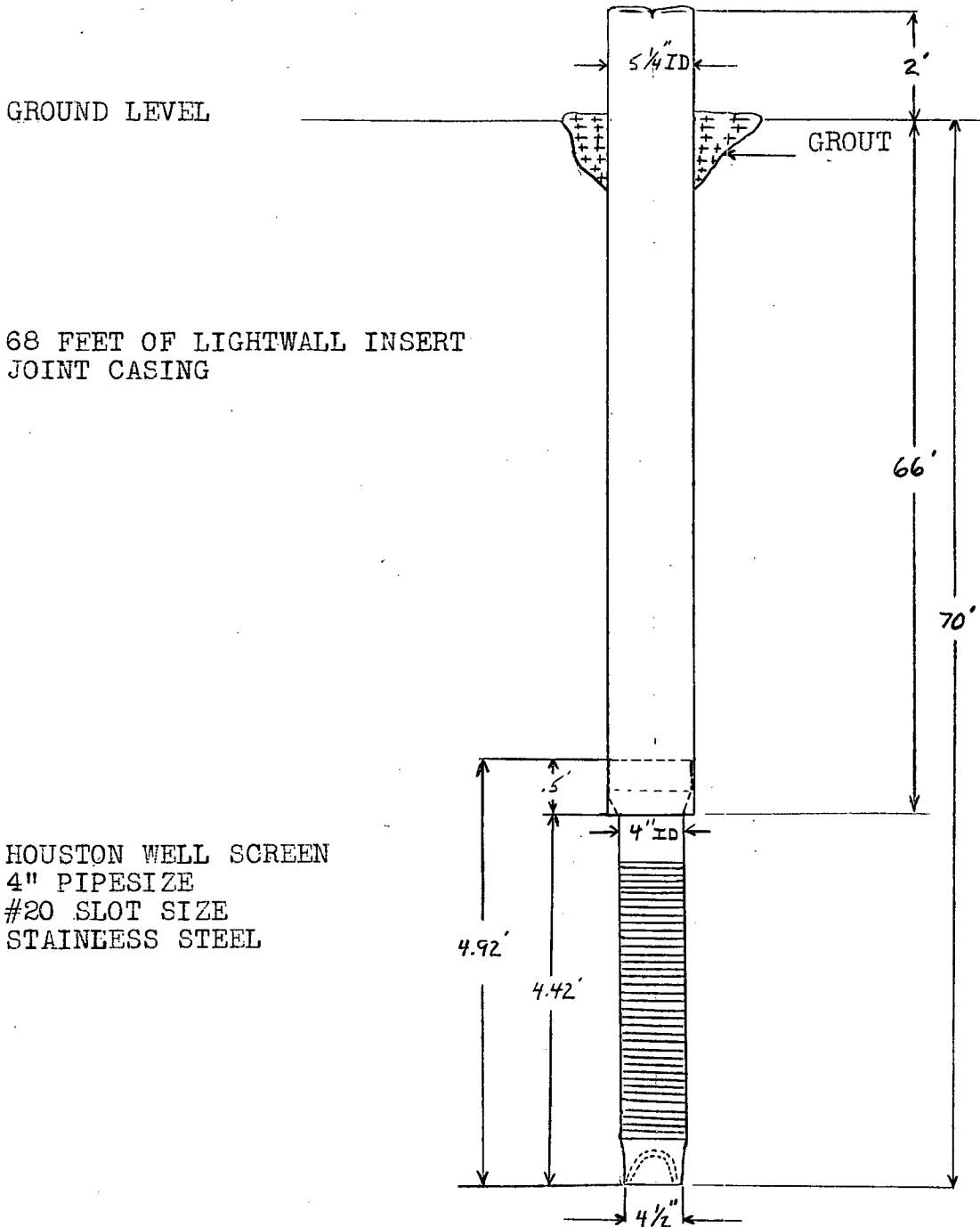


January 4, 1972

WELL CONSTRUCTION  
WARDNER, B.C.

CONTRACT #46

Site #1:



NOT DRAWN TO SCALE

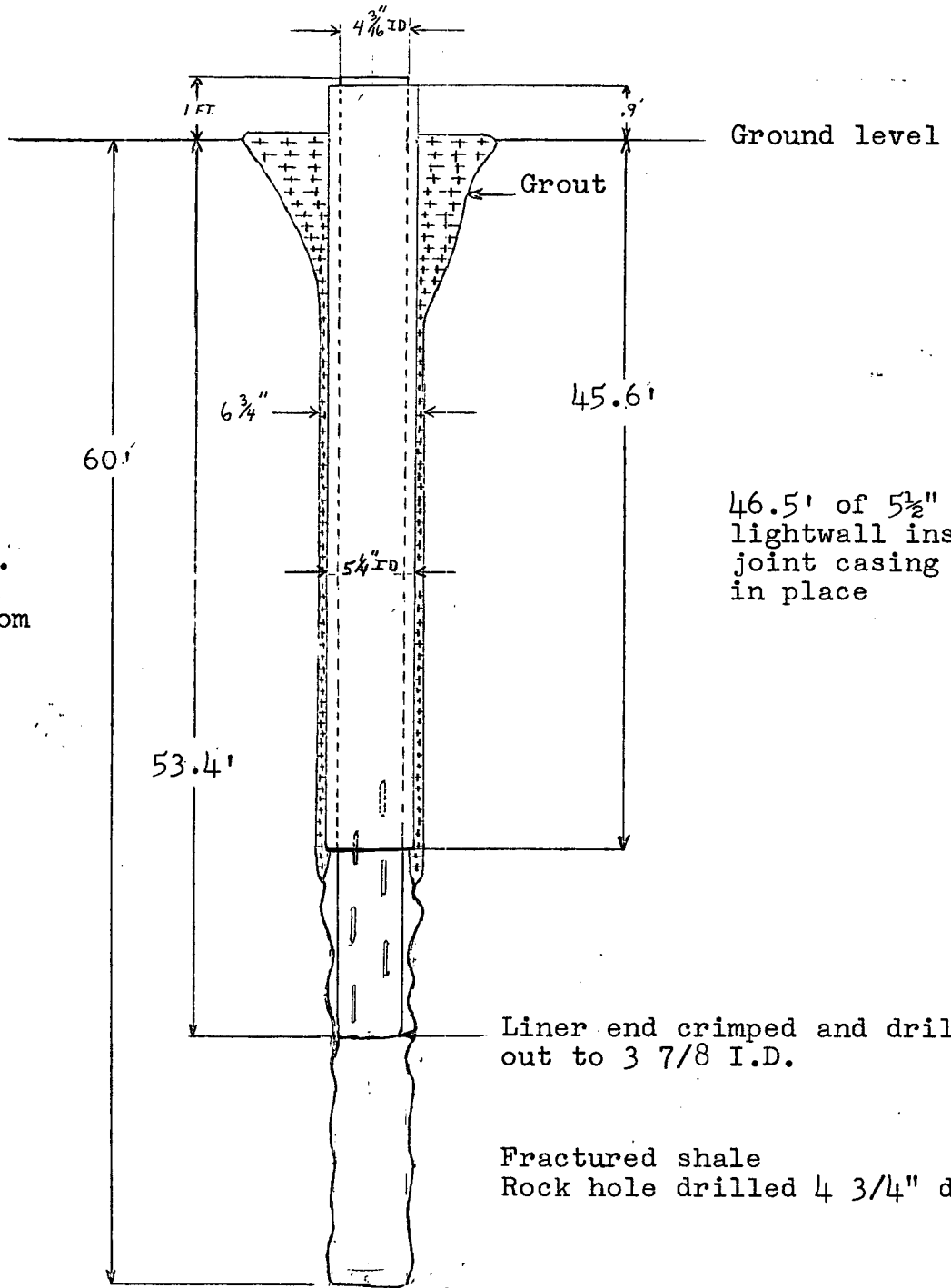
January 10th, 1972

WELL CONSTRUCTION

WARDNER, B. C.

CONTRACT #46

SITE #2



54.4' of 4 1/2" O.D.  
 lightwall insert  
 joint liner casing.  
 Unable to drive  
 liner deeper. Bottom  
 15' slotted.

46.5' of 5 1/2" O.D.  
 lightwall insert  
 joint casing grouted  
 in place

Liner end crimped and drilled  
 out to 3 7/8 I.D.

Fractured shale  
 Rock hole drilled 4 3/4" diam.

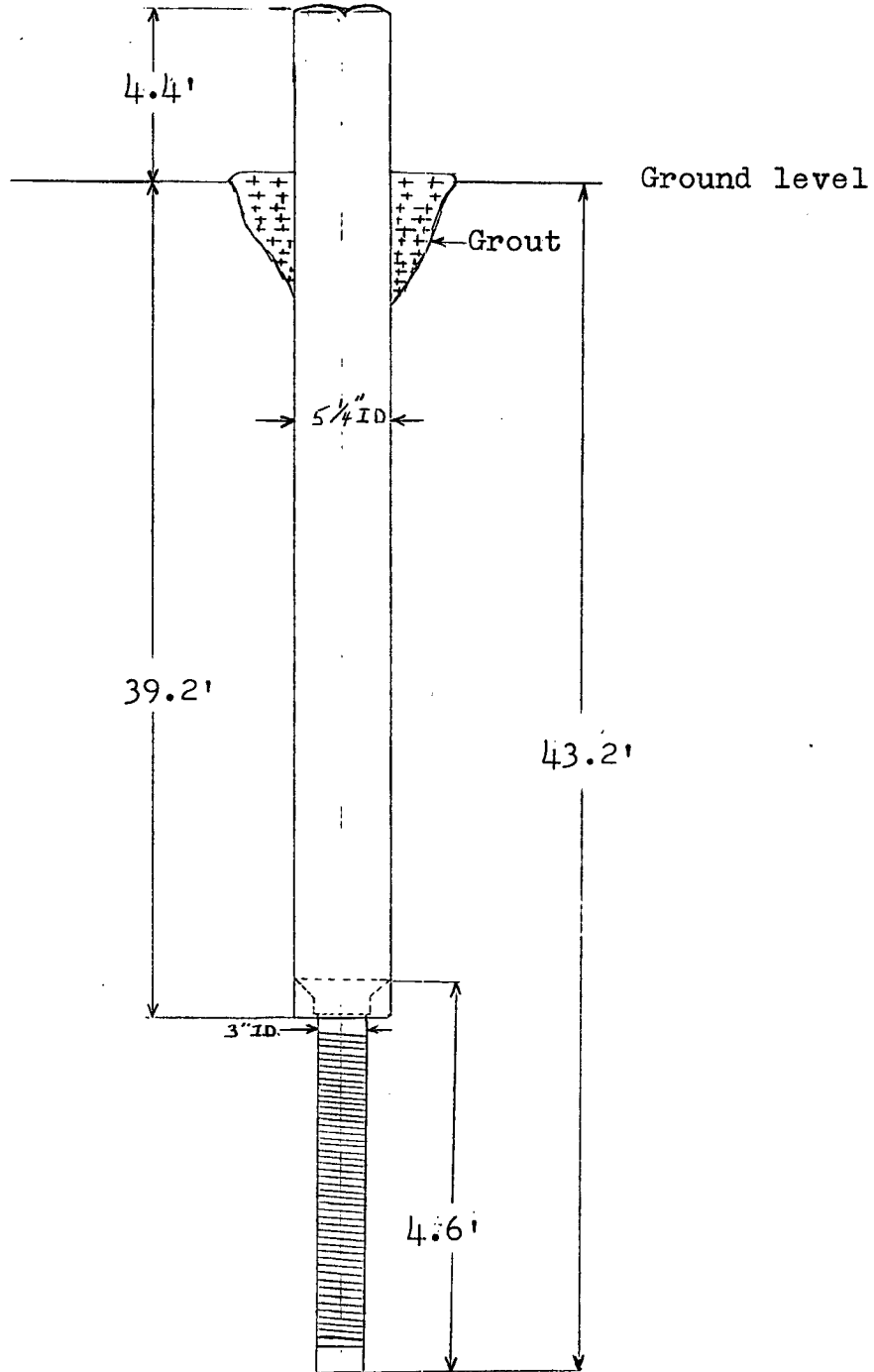
January 1972

WELL CONSTRUCTION

WARDNER, B. C.

CONTRACT #46

SITE #3



43.6' of lightwall  
insert joint casing

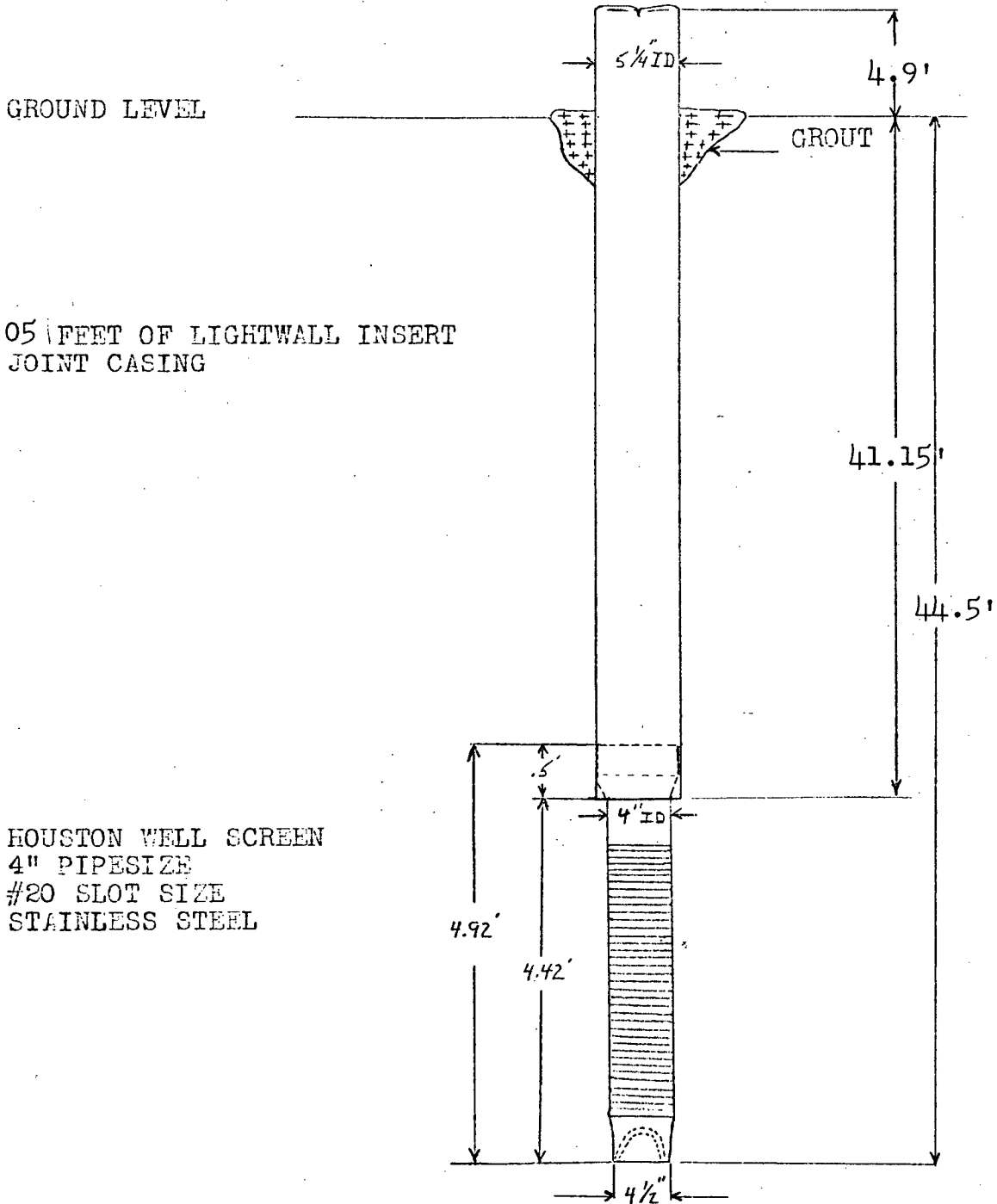
Houston well screen  
4" telescope  
#15 slot size  
Stainless steel  
4" led packer is  
swedged out to fit  
5 1/4" I.D. casing.

January 4, 1972

WELL CONSTRUCTION  
WARDNER, B.C.

CONTRACT #46

Site #4



46.05 FEET OF LIGHTWALL INSERT  
JOINT CASING

HOUSTON WELL SCREEN  
4" PIPESIZE  
#20 SLOT SIZE  
STAINLESS STEEL

NOT DRAWN TO SCALE