

MEMORANDUM

TO..... Dr. J. C. Foweraker, Head.....
 Groundwater Section
 Hydrology Division.....
 Water Investigations Branch.....

FROM A. P. Kohut
 Senior Geological Engineer
 Groundwater Section.....

February 4, 1977.....

SUBJECT Abbotsford Trout Hatchery Production
Well Retests, Well 7 (2)

OUR FILE 0239016.....

YOUR FILE.....

Following the January 19, 1977, telephone request from Mr. Les Gilbert, Mr. Lomas and myself attended the startup and running of the retest on Well 7 (Hatchery No. 2) on January 20 and 21. During the first day, procedures for the retest were reviewed with Mr. Gilbert and a general inspection was made of the other wells tied into the supply system. In preparation for the retest, time gears were moreover changed from a 32-day to 24-hour recording period in the automatic recorder installed in observation well 3 located 46 feet south of well 7. The retest was carried out the second day starting at 9:00 a.m. with pumping carried out for 5 hours until 2:00 p.m.. Prior to discussing the results of the retest a brief description of the site design, pump design, monitoring equipment and well operation prior to the retest are as follows:

Site Design

Three wells designated Hatchery wells 1, 2 and 3 have been incorporated in the water supply system and are respectively wells 8, 7 and 1 which were completed by the Groundwater Section. The wells are situated numerically in line with Hatchery well 3 (Groundwater well 1) furthest from the Hatchery.

Pump Design and Monitoring Equipment

Wells 7 and 1 are equipped with Verti-line Aurora turbine pumps powered by 25 and 20 h.p. U. S. Electrical motors and are rated at 740 USgpm at 105 feet and 500 USgpm at 95 feet respectively. Well 8 is temporarily equipped with a turbine pump and construction is being finalized on the pump house and a new high capacity (2000 USgpm) pump is at the site for installation. This latter pump will be powered by a 75 h.p. motor with auxiliary standby diesel generating unit.

Apart from the pump and motor assembly, the discharge line set up in each pump house includes a check valve followed by a butterfly valve and a length of discharge pipe with a "Measurell" discharge elbow to monitor flow. The discharge elbow can be monitored with a portable flow meter and will be

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connected to automatic chart recording equipment at the main control room of the Hatchery during production.

Well 7 is equipped with an automatic bubbler system as supplied by B.C.A. Industrial Controls and sufficient access is available to monitor water levels manually with an electric probe. The sand tester provided by our Section was installed in an existing vertical outlet located at the top of the discharge line between the butterfly valve and the check valve.

Well 1 (Hatchery well 3) does not have sufficient access for obtaining manual water level readings but is presently equipped with small diameter tubing for the bubbler system. The bubbler monitoring system has been ordered for all of the production wells.

Well Operation Prior to Retesting of Well 7

Well 1 (3) was not in operation but had been pumped occasionally in the past at rates above 600 USgpm. Prior to running the retest on well 7, well 1 was throttled down to 370 USgpm by Mr. Gilbert in the event the well would be required to supply the old Hatchery operation.

Well 7 (2) had not been pumped previously. The well also had not been sounded to check for sand as this would require removing of the pump assembly.

Well 8 (1) had been operating more or less continuously at an approximate rate of 350 USgpm. This well was to remain in operation during the retesting of Well 7.

Retest Procedures

With Well 8 pumping continuously the evening and morning prior to the test, the water level in Observation well 3 was monitored with the automatic recorder and found to remain essentially static at approximately 30.5 feet below ground surface for an 18-hour period. With more or less stabilized drawdown conditions attained in the wells, therefore prior to retesting well 7 no problems in assessing the performance of well 7 due to well 8 pumping were evident.

Procedures for the startup were to set the butterfly valve at a very low setting, start the pump and adjust the flow meter and valve to obtain an initial rate of 200 to 250 USgpm. The well would be run at this low rate for a few hours and then the rate would be increased to 500 USgpm for the remainder of the test.

Results

Initially upon startup, difficulties were experienced in obtaining an appropriate flow meter reading. At low pumping rates the meter drew in air through the low pressure flow valve. Discharge was increased until the flow meter appeared to function properly and held at a rate corresponding to 220 USgpm. At this rate, however, drawdown reached just over 10 feet indicating a specific capacity of 22 USgpm per foot of drawdown. This value was approximately half that determined from initial testing of the well in 1969. After one hour of pumping the flow meter was readjusted and was found to be in error, possibly because of air entrapped within the meter. The final meter reading obtained indicated a flow of 425 USgpm resulting in a specific capacity of 42.5 USgpm per foot of drawdown, comparable to the 1969 test which gave 40.7 USgpm/ft. at 400 USgpm and 42.5 USgpm/ft at 200 USgpm (Parry, 1969). After 150 minutes pumping at the rate of 425 USgpm the rate was increased to 513 USgpm and held at this rate for an additional 150 minutes. Apart from the flow meter readings, no other means of checking the flow rate was available.

Recovery measurements were taken in the pumped well and observation well after shutdown, over a period of 48 minutes, with the water level returning to within 0.4 feet of the initial pre-pumping level in the pumped well and 0.2 feet in the observation well. Residual drawdowns of these magnitudes do not appear incompatible with previous tests results (Callan, 1971) where final recovery is slowed possibly due to trapped air within the cone of influence of the well under water table conditions. Data obtained during the test is tabulated in Table I.

Conclusions

Results of the retesting of well 7 compare favourably with those obtained during initial testing of the well in 1969. The specific capacity of the well, as determined from the tests, has not changed significantly since the initial testing and therefore well performance has not been affected by standing idle for several years. Although no sand was obtained in the sand tester during the test, some sand was reported in the hatchery during operation of the well. Since the sand tester was not connected to a horizontal outlet in the discharge line, it may not have been operating properly. Other sources of the sand, however, could be from well 8 and/or residual sand introduced into pipes during construction.

Recommendations

1. Sand testers should be installed on all well discharges connected to horizontal outlets as recommended by the manufacturer.

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2. An alternative means of measuring flow and water quantity pumped, such as an in-line totalizing meter, should be incorporated in the monitoring system of each well. This would provide reliable backup data should the elbow meter fail to operate at any time due to air entrapment, electrical breakdowns etc.. A mechanical meter at the well head would also facilitate any manual flow adjustments which will be controlled by the butterfly valve during operational periods.
3. Although check valves are incorporated in the discharge lines from each well, an additional check valve installed in the rising main of each well would prevent backflushing of the wells at shutdown. Backflushing could result in a lowering of well performance through disturbance of the developed portion of the aquifer around the well screen.



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APK:wf

References

- Callan, D. M. (1971) - Results of an eight-day field pumping test of two production wells at the Fraser Valley Trout Hatchery near Abbotsford, September, 1970, Water Investigation Branch, Dept. of Lands, Forests & Water Resources, File 0239016.
- Parry, J. (1969) - Notes on pumping tests on well 7, Fraser Valley Trout Hatchery near Abbotsford, Water Investigations Branch, Dept. of Lands, Forests & Water Resources. File 0239016.

ABBOTSFORD TROUT HATCHERY

APPENDIX

rdgs. by KOHUT

Well B pumping 50 USgpm.
Well 1 shutdown.

"CONSTANT RATE" PUMPING TEST DATA FROM WELL NO. 7

Date JAN 21/77

| Time | Time (t) since start of pumping in mins. | Depth to water in well from top of casing in feet | Drawdown in well in feet (static = 30.35) | Height of water in tube on orifice pipe in inches <i>H</i> FLOW METER | U.S.gals. per min. discharge from well | |
|------|--|---|---|---|--|--|
| 8:30 | 0 | 30.35 | | | | |
| | 0.5 | — | | | | |
| | 1.0 | 48.91 | | | | |
| | 1.5 | 30.78 | | 4" | | Adjust flow, |
| | 2.0 | — | | | | initial start |
| | 2.5 | 30.71 | | | | |
| | 3.0 | 30.45 | | | | |
| | 3.5 | 30.40 | | | | |
| | 4.0 | 30.45 | | | | |
| | 4.5 | 30.40 | | | | |
| | 5.0 | 30.36 | | | | |
| | 6.0 | 30.38 | | | | |
| | 7.0 | 30.39 | | | | |
| | 8.0 | 30.35 | | | | |
| | 9.0 | 30.36 | | | | |
| | 10.0 | 30.35 | | | | |
| | 12 | 30.34 | | | | |
| | 14 | 30.35 | | | | |
| | | | | | | *Note pump running but very little flow— |
| | | | | | | meter reading erroneous, air in system. |
| | | | | | | pump left running |

$C = 118$
 $D = C\sqrt{H}$

ABBOTSFORD TROUT HATCHERY

WELL 8 pumping ≈ 350 USgpm

APPENDIX

KOHUT
LOMAS
GILBERT

WELL 1 shut down "CONSTANT RATE" PUMPING TEST DATA FROM WELL NO. 7

rdgs. by
KOHUT

Date JAN 21/77

| Time | Time (t) since start of pumping in mins. | Depth to water in well from top of casing in feet | Drawdown in well in feet (static = 30.33) | H Height of water in tube on orifice pipe in inches FLOW METER | U.S.gals. per min. discharge from well | FLOW ELBOW C CONSTANT = 118 DISCHARGE = $C\sqrt{H}$ |
|-------|--|---|---|--|--|--|
| 9:00 | 0 | 30.33 | | | | |
| 9:005 | 0.5 | 30.85 | | ↑ RATE METER ADJUSTING AND ↓ | | Adjust butter fly valve start of test |
| 9:01 | 1.0 | 30.40 | | | | |
| 9:015 | 1.5 | 32.04 | | | | |
| 9:02 | 2.0 | 32.33 | | | | |
| 9:025 | 2.5 | 32.30 | | | | |
| 9:03 | 3.0 | 32.28 | | | | |
| 9:035 | 3.5 | 32.25 | | | | |
| 9:04 | 4.0 | 32.25 | | | | |
| 9:045 | 4.5 | 32.25 | | | | |
| 9:05 | 5.0 | 32.28 | | | | |
| 9:06 | 6.0 | 32.32 | | | | |
| 9:07 | 7.0 | 32.30 | | | | |
| 9:08 | 8 | 32.27 | | | | |
| 9:09 | 9 | - | | 3" | | * METER NOT FUNCTIONING PROPERLY |
| 9:10 | 10 | - | | - | | |
| 9:12 | 12 | - | | - | | |
| 9:14 | 14 | - | | - | | |
| 9:16 | 16 | 40.3 | | 3.5" | | |
| 9:18 | 18 | - | | - | | |
| 9:20 | 20 | - | | - | | |
| 9:25 | 25 | 40.4 | | 3.5" | | |
| 9:30 | 30 | 40.38 | | 3.5 | | |
| 9:35 | 35 | 40.38 | | 3.5 | | |
| 9:40 | 40 | 40.35 | | 3.5 | | |
| 9:45 | 45 | 40.38 | | 3.5 | | |
| 9:52 | 50 52 | 40.40 | | 3.5 | | * Meter knocked over REBLEED METER READING CHANGE 3.5 ROL NOT REP? Rate ≈ 425 USgpm. |
| 10:01 | 60 61 | 40.42 | | 13 | | |
| 10:10 | 70 | 40.42 | | 13 | | |
| 10:20 | 80 | 40.42 | | 13 | | |
| 10:30 | 90 | 40.45 | | - | | |
| 10:40 | 100 | 40.45 | | 13.5 | | |
| 11:00 | 120 | 40.50 | | 13.5 | | |
| 11:30 | 150 | 40.50 | | 13.5 | | |
| 11:31 | 151 | 41.61 | | 18 | | |

INCREASE RATE
18 ≈ 500 USgpm.

ABBOTSFORD TROUT HATCHERY

APPENDIX"CONSTANT RATE" PUMPING TEST DATA FROM WELL NO. 7Date JAN. 21/77

| Time | Time (t) since start of pumping in mins. | Depth to water in well from top of casing in feet | Drawdown in well in feet (static =) | Height of water in tube on orifice pipe in inches | U.S.gals. per min. discharge from well |
|---------|--|---|--------------------------------------|---|--|
| 11:32 | 152 | | 41.80 | 18 | |
| 11:32.5 | 152.5 | | 41.88 | 18 | |
| 11:33 | 153 | | 41.88 | 18 | |
| 11:33.5 | 153.5 | | 41.88 | 18 | |
| 11:34 | 154 | | 41.87 | 18 | |
| 11:34.5 | 154.5 | | 41.89 | 18 | |
| 11:35 | 155 | | 41.89 | 18 | |
| 11:36 | 156 | | 41.89 | 18 | |
| 11:45 | 165 | | 41.96 | 18 1/2 | |
| 12:00 | 180 | | 42.06 | 18 1/4 | |
| 12:15 | 195 | | 42.14 | 19 | (513 USgpm) |
| 12:30 | 215 | | 42.24 | 19 | |
| 13:00 | 240 | | 42.28 | 19 | |
| 13:30 | 270 | | 42.31 | 19 | |
| 14:00 | 300 | | 42.31 | 19 | |
| 14:05 | 305 | | 42.32 | 19 | |

APPENDIX

READINGS TAKEN ON OBSERVATION WELL NO. 3 DURING
"STEP DRAWDOWN" PUMPING TEST

OF WELL #7

Date 21st January 1977

| Time | Time (t) since start of pumping in mins. | Depth to water in well from top of casing in feet | Drawdown in well in feet (static = 30.04) | MEASUREMENTS TAKEN TO FLOOR OF BOX ELEV. 77.90' ELEV. OF # 6 WELL 82.77' |
|------|--|---|---|---|
| | 0.00 | 30.04 | | INITIAL STATIC (#6 WELL 33.16') |
| | 0.00 | 30.06 | | STATIC AT START OF RETEST |
| | 0.5 | 30.06 | | |
| | 1.0 | 30.07 | | |
| | 1.5 | 30.075 | | |
| | 2.0 | 30.105 | | |
| | 2.5 | 30.115 | | |
| | 3.0 | 30.12 | | |
| | 3.5 | 30.12 | | |
| | 4.0 | 30.12 | | |
| | 4.5 | 30.12 | | |
| | 5.0 | 30.12 | | |
| | 6.0 | 30.1225 | | |
| | 7.0 | 30.125 | | |
| | 8.0 | 30.13 | | |
| | 9.0 | 30.13 | | |
| | 10.0 | 30.1325 | | |
| | 12 | 30.135 | | RATE ADJUSTED |
| | 14 | 30.26 | | |
| | 15 | 30.31 | | |
| | 16 | 30.32 | | |
| | 17 | 30.325 | | |
| | 18 | 30.33 | | RATE INCREASED TO 425 GPM (APPROX) THOUGHT TO BE 217 GPM AT TIME |
| | 19 | 30.41 | | |
| | 19.5 | 30.42 | | |
| | 20 | 30.42 | | |
| | 20.5 | 30.4225 | | |
| | 21 | 30.425 | | |
| | 21.5 | 30.43 | | |
| | 22 | 30.43 | | |
| | 22.5 | 30.455 | | |
| | 23 | 30.47 | | |
| | 23.5 | 30.4725 | | |

APPENDIX

READINGS TAKEN ON OBSERVATION WELL NO. 3 DURING
"STEP DRAWDOWN" PUMPING TEST

ON WELL #7

Date 21st JANUARY 1977

| Time | Time (t) since start of pumping in mins. | Depth to water in well from top of casing in feet | Drawdown in well in feet (static = 30.04) |
|------|--|---|--|
| | 24 | 30.475 | |
| | 25 | 30.48 | |
| | 26 | — | |
| | 27 | 30.49 | |
| | 28 | 30.495 | |
| | 29 | 30.50 | |
| | 30 | 30.50 | # 6 WELL 33.99' |
| | 32 | 30.51 | |
| | 35 | 30.52 | |
| | 40 | 30.525 | |
| | 45 | 30.53 | |
| | 50 | 30.54 | |
| | 60 | 30.55 | |
| | 70 | 30.565 | |
| | 80 | 30.59 | FLOAT TAPE STICKING # 6 WELL 34.10' |
| | 90 | 30.60 | |
| | 100 | 30.61 | |
| | 110 | 30.625 | |
| | 120 | 30.626 | |
| | 130 | 30.63 | |
| | 150 | 30.64 | FLOAT TAPE STICKING RATE INCREASED TO 500 GPM |
| | 151 | 30.67 | |
| | 152 | 30.675 | |
| | 153 | 30.68 | |
| | 154 | 30.685 | |
| | 155 | 30.695 | |
| | 156 | 30.705 | |
| | 157 | 30.705 | |
| | 158 | 30.706 | |
| | 159 | 30.708 | |
| | 160 | 30.71 | TAPE READING CHECKED (OK) |
| | 162 | 30.711 | |
| | 164 | 30.712 | |
| | 166 | 30.715 | |

APPENDIX

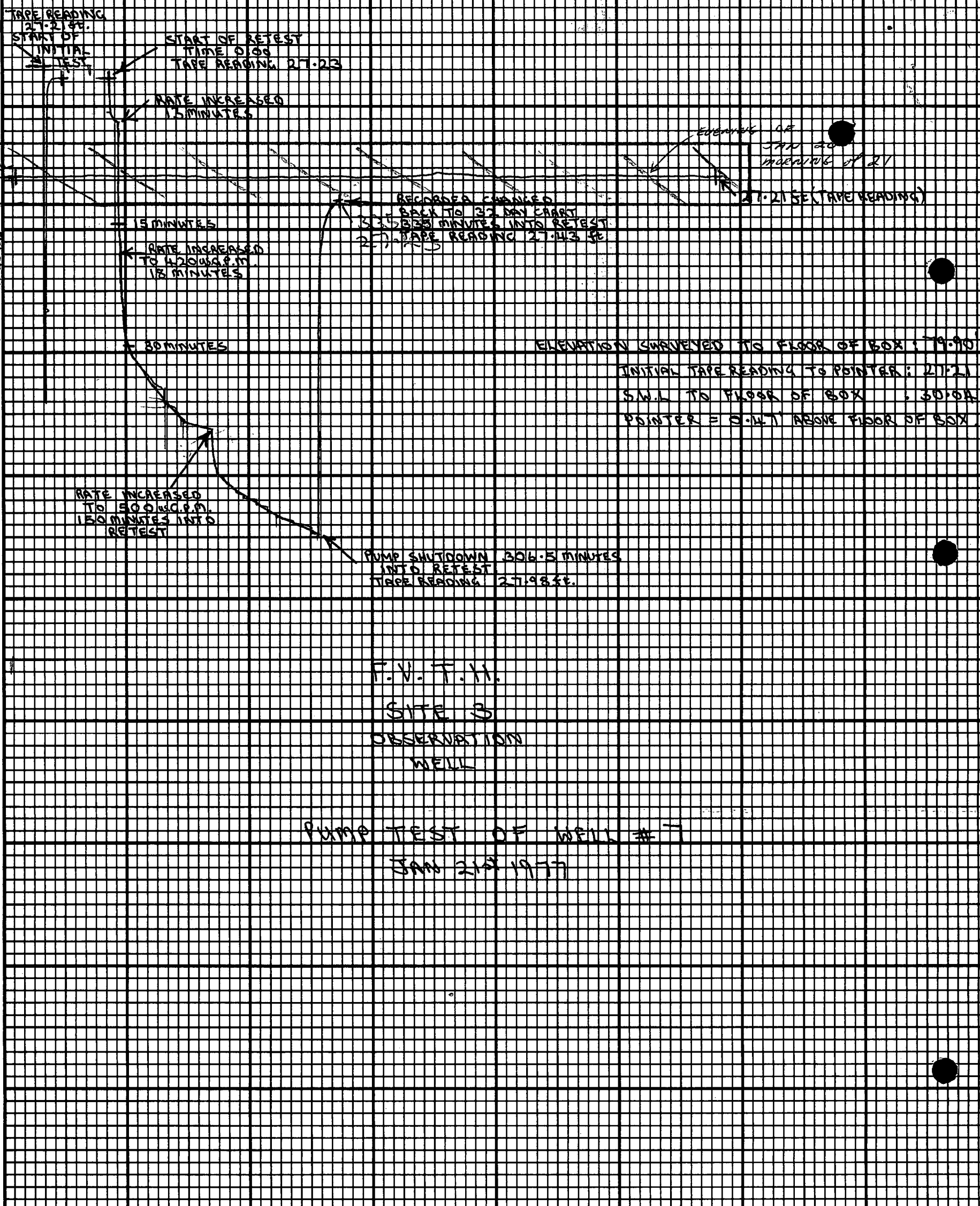
RECOVERY READINGS TAKEN ON OBSERVATION WELL NO. 3
AFTER "STEP DRAWDOWN" PUMPING TEST.

ON WELL # 7

Date 21st JANUARY 1977.

| Time | Time (t) since start of pumping (in mins.) | Time (t') since pumping stopped (in mins.) | Value to t / t' | Depth to water in well from top of casing in feet | Residual Drawdown in well in feet (static =) | MEASUREMENTS TAKEN TO FLOOR OF BOX ELEV. 77.90 |
|------|--|--|-----------------|---|---|--|
| | 306.5 | 00.0 | | 30.81 | | #6 WELL 34.46 (ELEV OF TOP OF CASING 82.77) |
| | 307 | 0.5 | | 30.5 | | |
| | 307.5 | 1.0 | | 30.42 | | |
| | 308 | 1.5 | | 30.39 | | |
| | 308.5 | 2.0 | | 30.37 | | |
| | 309 | 2.5 | | 30.36 | | |
| | 309.5 | 3.0 | | 30.35 | | |
| | 310 | 3.5 | | 30.34 | | |
| | 310.5 | 4.0 | | 30.33 | | |
| | 311 | 4.5 | | 30.325 | | |
| | 311.5 | 5.0 | | 30.325 | | |
| | 312 | 5.5 | | 30.32 | | |
| | 313 | 6.5 | | 30.3125 | | |
| | 314 | 7.5 | | 30.305 | | |
| | 315 | 8.5 | | 30.3 | | |
| | 316 | 9.5 | | 30.297 | | |
| | 317 | 10.5 | | 30.295 | | |
| | 318 | 11.5 | | 30.285 | | |
| | 319 | 12.5 | | 30.285 | | |
| | 320 | 13.5 | | 30.285 | | |
| | 322 | 15.5 | | 30.278 | | |
| | 324 | 17.5 | | 30.272 | | #6 WELL 33.60' |
| | 326 | 19.5 | | 30.27 | | |
| | 328 | 21.5 | | 30.268 | | |
| | 330 | 23.5 | | 30.268 | | |
| | 335 | 28.5 | | 30.262 | | |
| | 345 | 38.5 | | 30.24 | | |

Leupold & Stevens, Inc., Beaverton, Ore. TA 2702 (GN) JAN 20 1977 S.W.L. TO POINT 30.5'



F.V.F.H.
SITE 3
OBSERVATION
WELL

PUMP TEST OF WELL # 1
JAN 21 1977

ABBOTSFORD T.H. JAN 20, 21/77