

MAY 29 2007

DEPARTMENT OF WATER RESOURCES

★ Please direct inquiries to Ed Squires at 342-8369.

Permit No. **63-31283**

Current Address: 621 Cleveland Blvd., Caldwell, Idaho 83605

Relationship to Permit Holder: Assistant City Engineer and Operator for Caldwell Water Department respectively

[illegible][illegible]

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size / ditch size / pipe I.D. as applicable.

See attached sheets, appendices, and figures:

XX Copy of USGS Quadrangle Attached showing location(s) of point(s) of diversion and place(s) of use (Figures 1 & 2).

XX Aerial Photo Attached (required for irrigation of 10+ acres).

XX Photos of Diversion and System Attached

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
Caldwell City Well #4-B Canyon Hill Cemetery	Franklin Elec. Model # 2391056004	125	C04/88071251-GT-02	Goulds Pumps 9CHC 2-stage 6.56" impeller	SN = 2422387-F 8-inch discharge

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calibration Date
Flow Meter	Propeller	Sparling	P-12	121077 (on top)	6-inch	unknown
			P-12	123919 (# on base)		

2. **Measurements:** Discharge measurements for this examination were made using the impeller flow-meter listed above (Figure 3). The minimum piping installation recommendations of the manufacturer (Appendix A) were not precisely met because a 40-inch length of straight-run 6-inch pipe, without obstructions, was not available upstream of the meter. However, the Sparling P-12 meter does have integral straightening vanes which greatly compensate for the irregularities (an upstream reducer and 90° ell within 5 pipe diameters). A call to the Sparling technician (Steve Herold) determined that the old meter may be a "hybrid" using parts from two Sparling meters (same Model #) but that that would not necessarily result in inaccuracy. According to Steve, if turbulent flow (which could cause meter inaccuracy) was present within the flow stream, then the flow rate needle would fluctuate erratically. This was not observed to be the case, therefore, it is generally believed likely that the flow-meter was generally reading correctly (Figure 3). Circular orifice weir data from a pumping tests were used to cross-check the flow-rates and the specific capacity of the well (Figure 4)

E. NARRATIVE/REMARKS/COMMENTS

The field examination for this permit was carried out on March 13, 2003 by me, Ed Squires, accompanied by Mr. Ben Weymouth of the City of Caldwell Engineering Department. Also present, was Doug Bergstrom of the Caldwell water Department. The Caldwell #4-B well is housed outside (100 feet due east) of a 19-foot by 24-foot cinder block pump house (Figures 5 & 6) located on the east side of Canyon Hill Cemetery and connected to the pump house via a pit-less adaptor and underground main line (Figure 7). The 16-inch diameter well (Figure 8) is equipped with a Goulds Pumps 9-inch, 2-stage, Model 9CHC deep well turbine pump (Figure 9) set on 210-feet of 8-inch steel column (Figure 10) with the pump intake set at 218.5 feet below top of 18" casing (pit-less body). The efficiency design point of the pump is 1000 gallons per minute (gpm) at 328-feet of total dynamic head (Figure 11). For maximum efficiency the pump is coupled with a variable frequency drive unit to allow the motor to be over-spiced to run the pump to the right of the performance curve to 1,375 gpm (6.5625" impeller trim) during periods of peak demand. The pump is driven by a 125 hp, 460 volt, 3,600 rpm, Franklin Electric submersible motor (Figure 10). The 8-inch diameter discharge-piping is comprised of a series of 8 and 6-inch plumbing fittings and fixtures, including check-valve, tees, couplings, flow-meter, and control valve (Figure 12) prior to exiting through the pump-house floor. The pumping plant can discharge directly to the Caldwell integrated water distribution system including the irrigation system for Canyon Hill Cemetery through various control valves and pressure-sensing equipment. The flow-meter on the 8-inch discharge records all discharge from the well. The well pump is set to operate automatically against system pressure. The well produces more water against less pressure in peak demand (summer) season compared to less production during periods when the system pressure is higher (generally the winter or low-use season).

When we arrived on-site, the well was not operating due to low seasonal demand (March). I measured the non-pumping water level at the well (outside pump house) at 63.60 feet below the top of the 18-inch casing (pit-less adaptor) at 8:35 A.M. I was unable to observe the system pressure in the pump house before the well was activated when the City guys started flushing the well to a drain through two 4-inch flush lines (Figure 5). After flushing the well for about 20 minutes the pumped water was turned into the system and gradually ramped up to 1,130 gpm where the VFD digital readout was indicating 100% speed at 64 psi system pressure. I measured the pumping water level during this discharge rate twice, about 10 minutes apart and obtained approximately the same measurement of 123.55 feet below top of 18-inch casing at 9:36 A.M. with a system pressure of 56 psi (Figure 12). Water-level measurements are facilitated through a 1/2-inch diameter measuring tube located under the Pit-less adaptor cap (Figure 7). The pump was operating according to its performance curve (Figure 11) and the well was producing almost exactly according to its calculated specific capacity (Figure 11). The field examination was conducted during the early spring (low-use season) so that it is presumed, and reasonable, that the well likely pumps against lower system pressures during the summer months. Even without over-speeding the pump motor (possible with the variable drive unit), the installed pumping plant appears capable of producing the water right against 40 psi system pressure (the lower end of acceptable municipal requirements of the IDEQ). By over-speeding the pump motor (~10% allowable) the plant would have no problem meeting the water right flow rate during lower system pressures of peak season demand.

A 1,250 gpm constant-discharge pumping test carried out on August 28th, 2000 shows the Caldwell Well #4-B to have a short-term (8 1/2-hours) specific capacity of 15.7 gpm/foot of drawdown (Figure 4). At this instantaneous flow rate, and assuming no stabilization of the rate of drawdown, the well could maintain the constant, non-interrupted

discharge for a projected 45 days while still maintaining the required net positive suction head (submergence of the pump intake) at the current setting (218.5 feet) of the pump intake. Therefore, the well, as equipped, appears capable of the water right instantaneous flow-rate and the well, itself, of significantly more owing to the additional 21-feet available within the pump-chamber casing. The specific capacity shown by this pumping test (Figure 4) compares almost exactly with the specific capacity measured during the Beneficial Use Licensing Examination for the same time period (60 minutes).

RECOMMENDATIONS:

With the installed pumping plant and well head plumbing configuration, the well appears to be capable of producing the water right flow rate of 3.0 cfs (1,346 gpm) under reasonably foreseeable well head conditions depending on system pressure and municipal demand. I observed 2.6 cfs (1,150) gpm during early spring (low-demand/higher system pressure) conditions during the licensing examination and 1,250 gpm during an 8.5 hour constant-discharge test of the well using a circular orifice weir to measure discharge. Evaluation of the pump performance curve with respect to the well's specific capacity and system pressures compared with observed well head conditions indicate the well and installed pumping plant are capable of yielding the full water right. Therefore, I recommend that the City of Caldwell municipal water right No. 63-31283 be licensed at a diversion rate of 3.0 cfs (1,346 gpm).

Have conditions of permit approval been met? X yes ___ no

F. FLOW CALCULATIONS

X Additional Computation Sheets Attached

Measured Method:

Instantaneous flow rates are based on field-observed readings of an older, impeller flow-meter installed with less installation tolerances than recommended by the manufacturer. The measured readings are supported by: 1) the operating conditions and pump performance curve, and 2) by the well-documented capacity of the City's #4-B groundwater well during previous pumping tests. Therefore, the observed, calculated, and recommended maximum flow rates for the well appear to be justified.

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I,R} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$$

$$V_{D,R} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 =$$

$$V = \text{Smaller of } V_{I,R} \text{ and } V_{D,R} =$$

B

2. Volume Calculations for Other Uses:

Not applicable to a municipal water right.

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use From	To	Rate of Diversion Q (cfs)	Annual Volume (afa)
<u>Municipal</u>	<u>Jan 1.</u>	<u>Dec. 31</u>	<u>3.00 cfs</u>	<u>N/A</u>
Totals:			<u>3.00 cfs</u>	<u>N/A</u>

2. Recommended Amendments

 Change P.D. as reflected above Add P.D. as reflected above XX None
 Change P.U. as reflected above Add P.U. as reflected above Other

I. AUTHENTICATION

Field Examiner's Name Edward Squires CWRE No. 07-125 Date May 25, 2007

Reviewer _____ Date _____

SEAL



1) Specific Capacity from Beneficial Use Exam measurements.

$$\begin{array}{rcl}
 124 \text{ feet bmp} & = & \text{Pumping water level (measured)} \\
 - 63 \text{ feet bmp} & = & \text{Non-pumping water level (measured)} \\
 \hline
 61 \text{ feet} & = & \text{draw down at 1130 gpm}
 \end{array}$$

$$\frac{1130 \text{ gpm}}{61 \text{ feet of draw down}} = 18.5 \frac{\text{gpm}}{\text{ft}} \text{ at 1 hour}$$

2) Comparison of pumping plant TDH to actual measurements.

$$\begin{array}{rcl}
 280 \text{ feet} & = & \text{total dynamic head (design point)} \\
 - 148 \text{ feet} & = & 64 \text{ psi} \times 2.31 \text{ ft/psi} = \text{measured system pressure} \\
 \hline
 132 \text{ feet} & & \\
 - 124 \text{ feet} & = & \text{measured pumping water level} \\
 \hline
 + 8 \text{ feet} & = & \text{available head above requirement}
 \end{array}$$

3) Capacity of the Caldwell #4-B Supply Well.

$$\begin{array}{rcl}
 218.5 \text{ feet bmp} & = & \text{pump intake screen.} \\
 - 45 \text{ feet} & = & \text{net positive suction head (submergence needed)} \\
 \hline
 \sim 173 \text{ feet bmp} & & \\
 - 64 \text{ feet bmp} & = & \text{non-pumping water level in well.} \\
 \hline
 109 \text{ feet} & = & \text{available draw down.}
 \end{array}$$

$$\begin{array}{rcl}
 109 \text{ feet available draw down} & & \\
 \times 15.7 \text{ gpm/ft (specific capacity)} & & \text{at } 8\frac{1}{2} \text{ hours (1250 gpm)} \\
 \hline
 1719 \text{ gpm} & = & \text{theoretical well productive yield *}
 \end{array}$$

* does not take into account total length of pump chamber which would increase gpm available

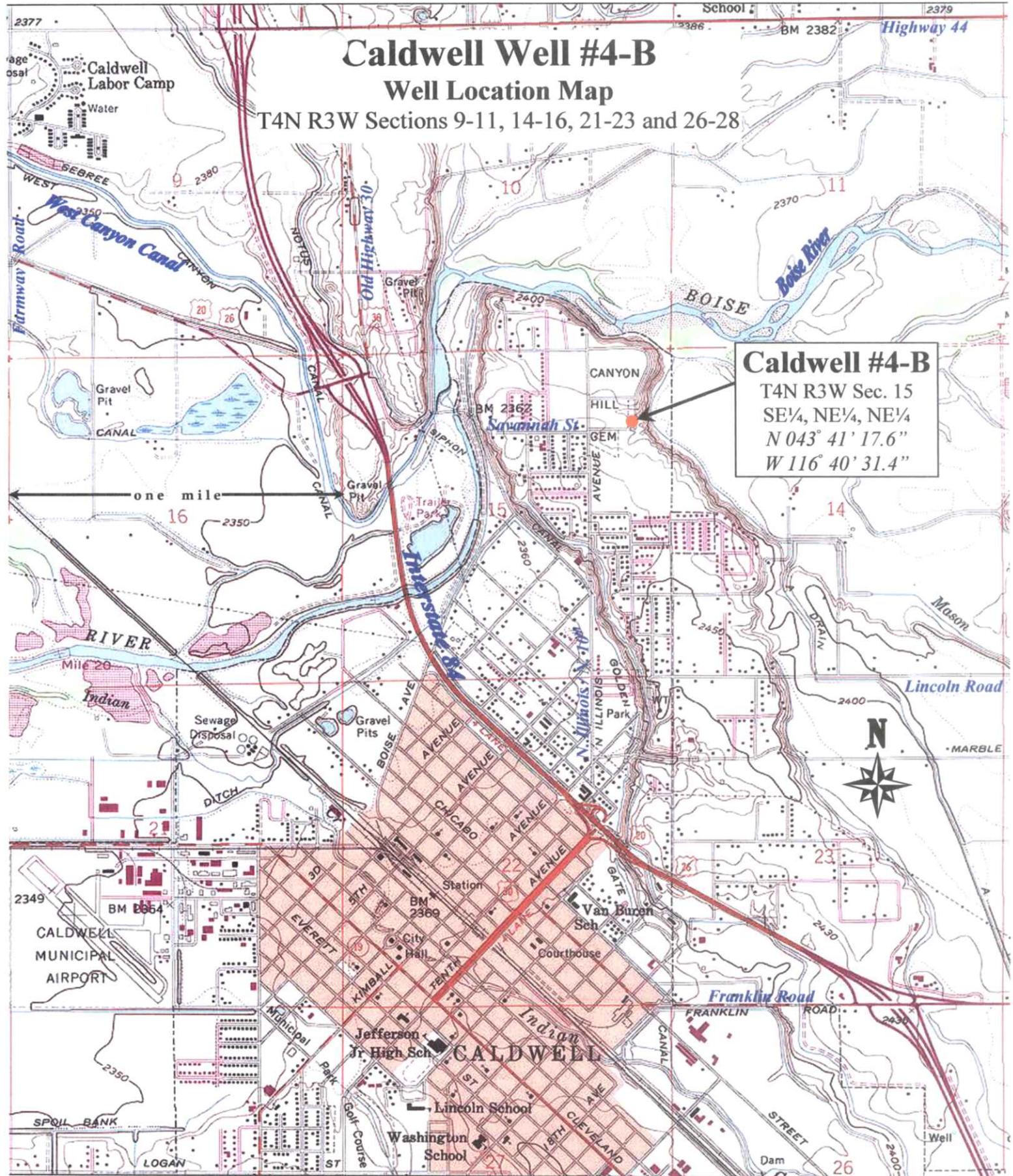


Figure 1. Hydro Logic, Inc. - Boise, Idaho



Figure 2. Aerial photograph showing the location of Caldwell Municipal Supply Well #4-B with respect to the City, Interstate Highway I-84, and the Boise River. The well is located on Canyon Hill within the Canyon Hill Cemetery.

Figure 2.

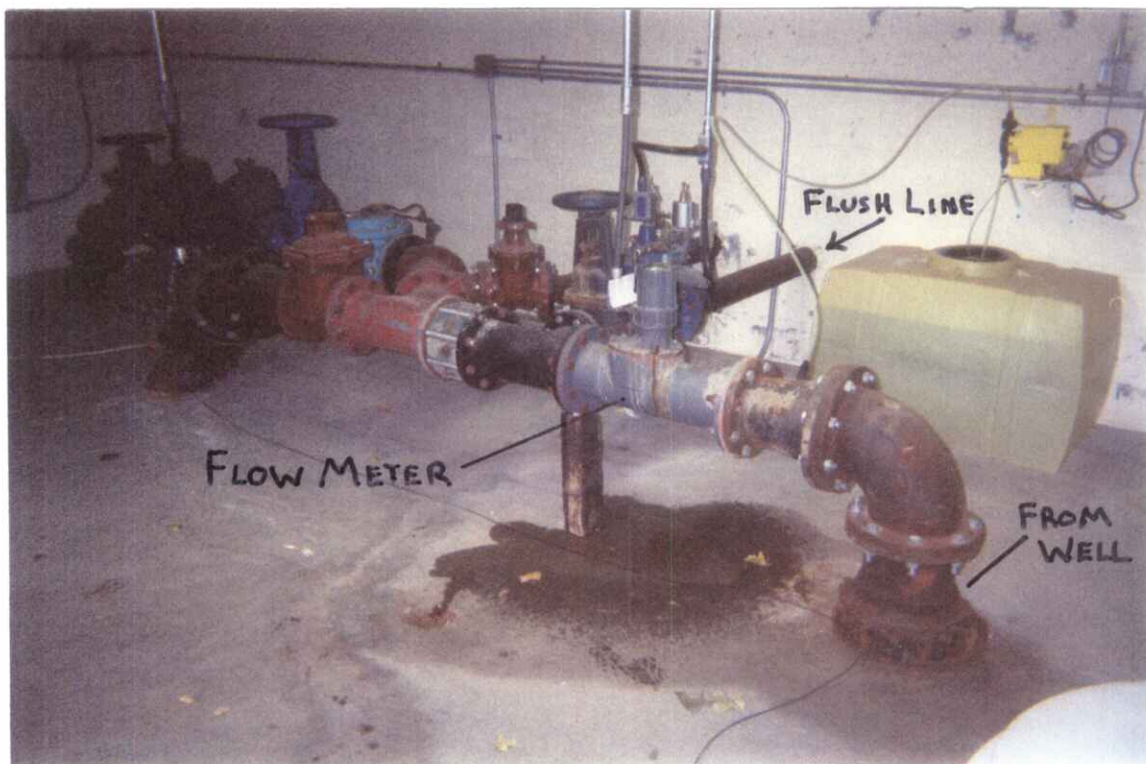
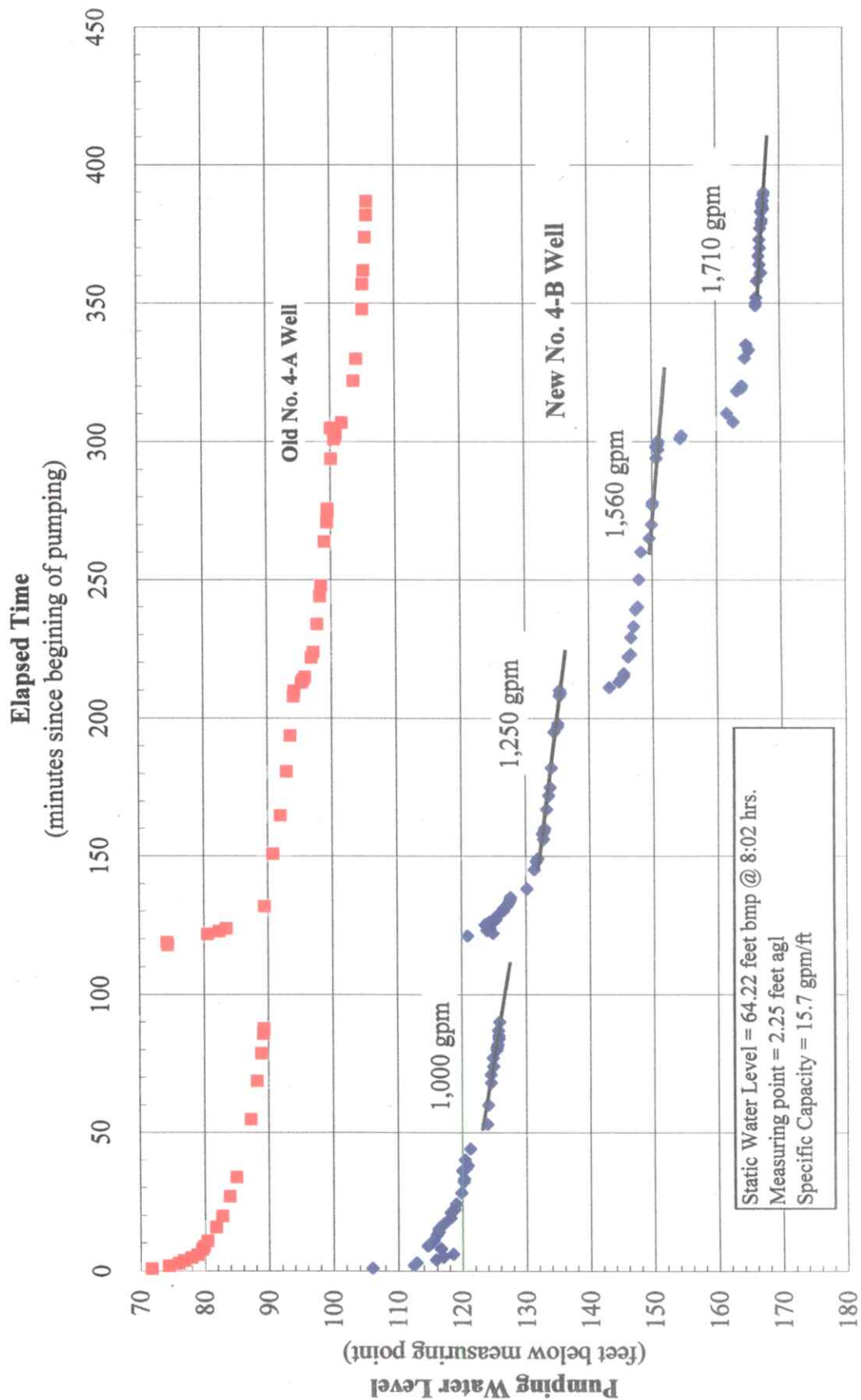


Figure 3. Photographs of the Sparling totalizing flow-meter installed in the discharge piping of the Caldwell municipal Well #4-B. Upper view shows the plan-view open face of the propeller meter and totalizer numerals. The lower photo depicts the meter's configuration in the well head plumbing. Two serial numbers at separate locations on the flow-meter show that this meter has been re-built using parts from two meters of the same model number. Hand-cut gasket material of upper view supports this observation. Also, the manufacturer's specifications for upstream smooth pipe distance is not met. Because the meter is equipped with "straightening" vanes the manufacturer's technician feels that the meter is most likely accurate, a conclusion supported by existing pump-testing and calculated specific capacity of the well from draw down measurements. Lower picture also shows the well house plumbing, including control valves, check valve, flush-line, and disinfection system, and the main-line configuration leaving the well house through floor

Figure 3.

Caldwell #4-B Municipal Supply Well - Hydraulic Stepped-Discharge Testing



Hydro Logic, Inc.
 1002 W. Franklin Street
 Boise, Idaho 83702-5431

Figure 4.



Figure 5. Photographs of the Caldwell Well #4-B pump control house. The upper view shows the Well #4-B in the foreground and looks west to the east wall of the control house with Canyon Hill Cemetery in the background. The lower view is of the west side of the pump control house.

Figure 5.



Figure 6. Photographs of the Caldwell Well #4-B pump control house. The upper view shows the Well #4-B in the background and looks east to the north and west walls of the control house. The two well flushing lines are visible exiting the pump house into a grated drain. The lower view is of the south side of the pump control house showing access.

Figure 6.

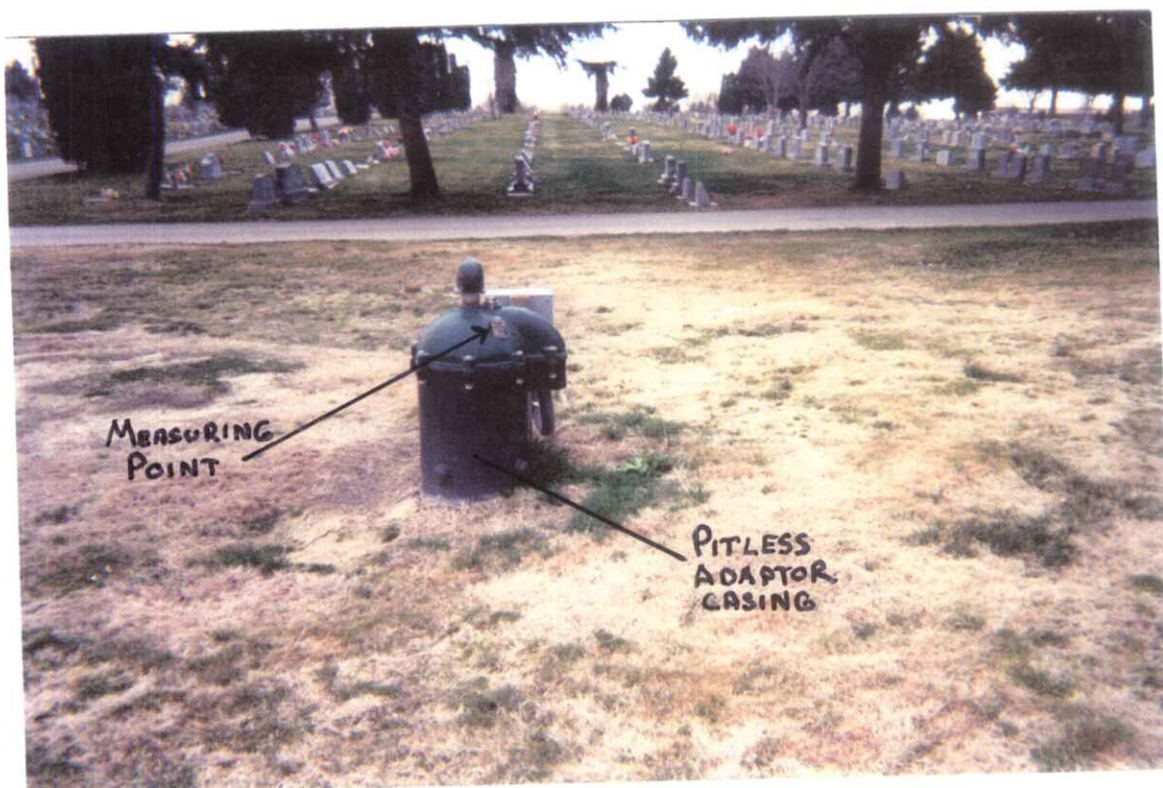


Figure 7. Photograph of the Caldwell Well #4-B well head. The above-ground casing is actually an 18-inch diameter industrial pit-less unit that is an extension of the 16-inch diameter steel well casing. The underground 8-inch discharge and main line piping extends to the nearby pump house shown in Figures 5 and 6. The view is to the north with Canyon Hill Cemetery in the background.

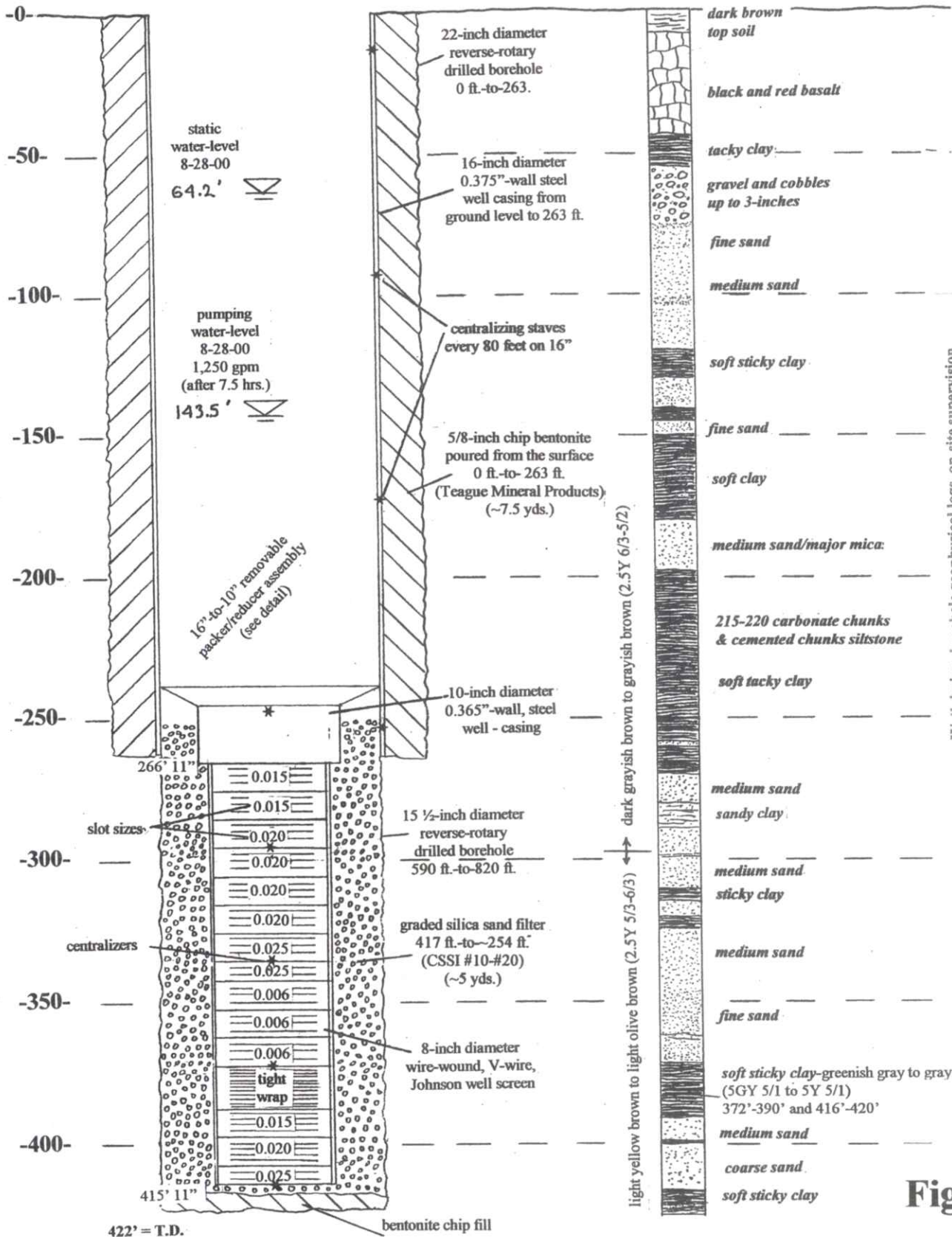
Figure 7.

Depth
(feet bgl)

Well Construction

horizontal scale 0.1"=1"
vertical scale 1"=50'

Lithology



Well design, borehole geophysical logs, on-site supervision during construction, hydraulic test design and measurements, water-quality sampling, and pumping plant design by Hydro Logic, Inc.

Figure 8.

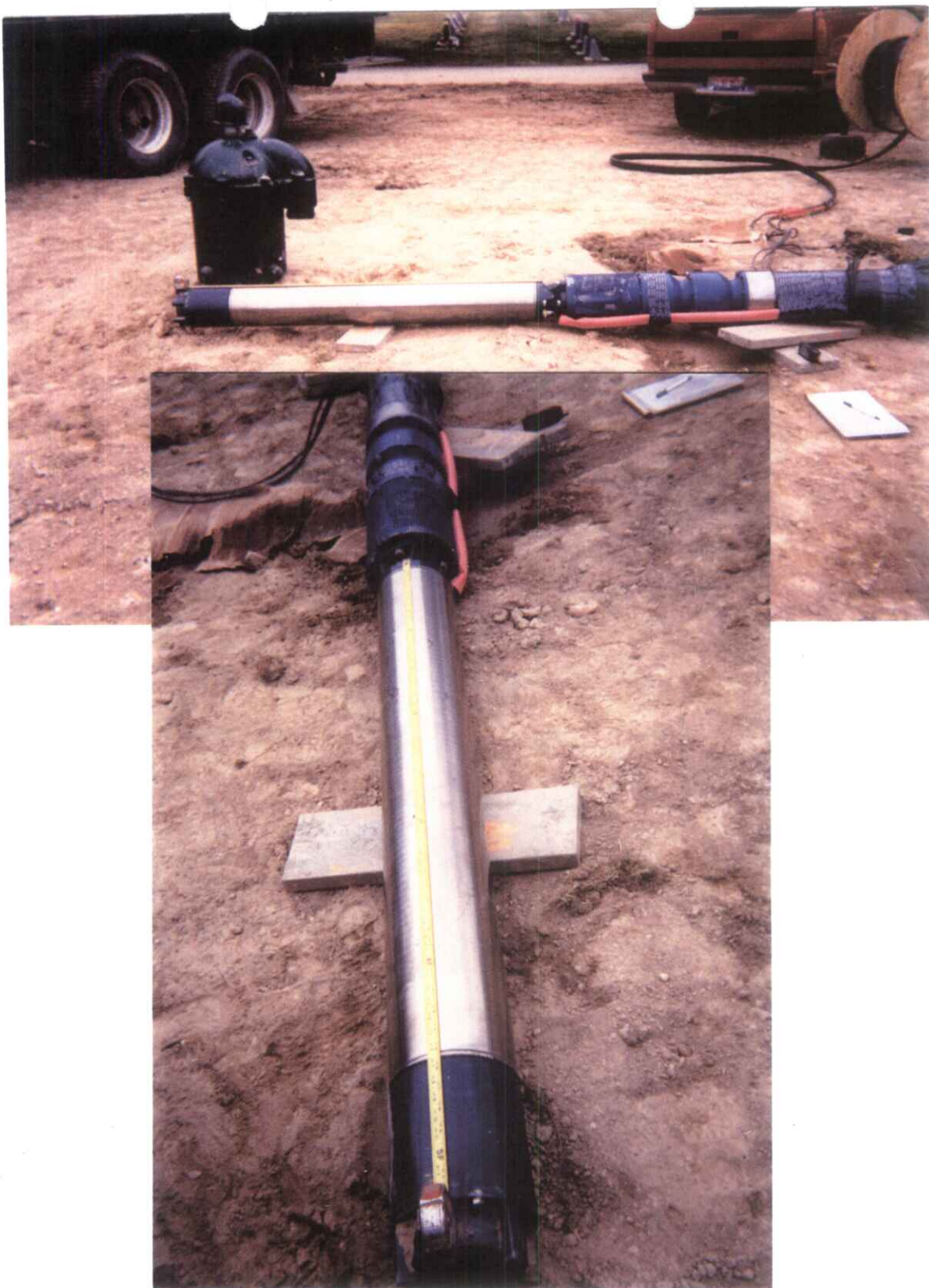
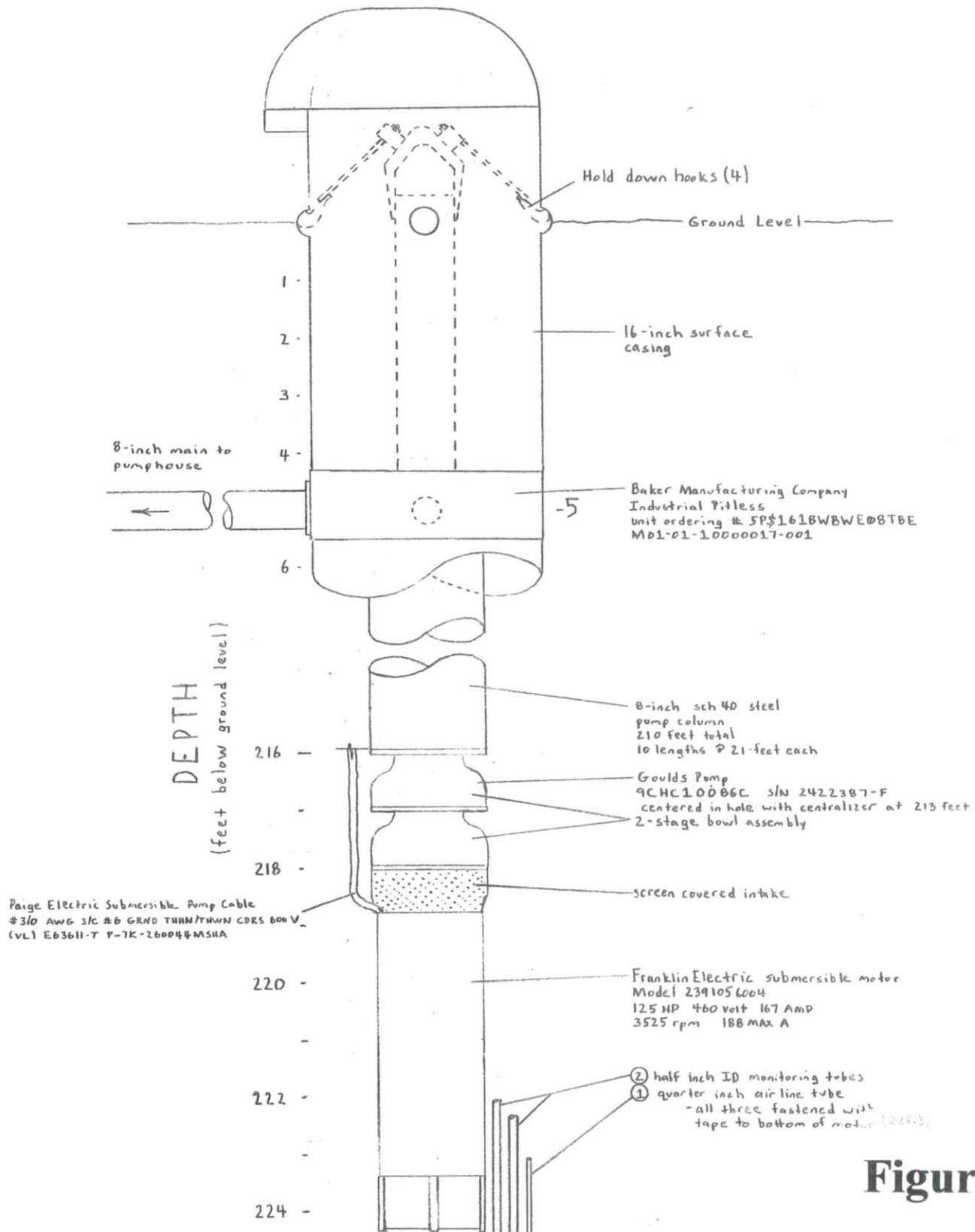


Figure 9. On-site photographs of the Caldwell Well #4-B 2-stage 9-inch submersible pump and 8-inch motor just prior to installation in the newly completed well.

Figure 9.

CITY OF CALDWELL NO. 4 SUPPLY WELL

SCHEMATIC OF SUBMERSIBLE PUMP INSTALLATION



vertical scale: 0.04 inches = 1 foot

Figure 10.

Hydro Logic Inc.

PUMP DATA SHEET
Goulds Turbine 60 Hz

Selection file: (untitled)
Catalog: TURB60.MPC v 1.6.1

Curve: E6209CCPCO

Design Point: Flow: 1000 US gpm
Head: 330 ft

Fluid: Water Temperature: 60 °F
SG: 1
Viscosity: 1.122 cP
Vapor pressure: 0.2568 psi_a
Atm pressure: 14.7 psi_a

Pump: TURBINE - 3600 **Size: 9RCHC, (2 stages)**
Speed: 3350 rpm Dia: 6.5625 in

Limits: Temperature: — °F Sphere size: 0.56 in
Pressure: 400 psi_g Power: — bhp

NPSHa: — ft

Specific Speed: Ns: 2300 Nss: —

Piping: System: —
Suction: — in
Discharge: — in

Vertical Turbine: Bowl Size: 9.25 in Max Lateral: 0.88 in
Thrust K Factor: 3.1

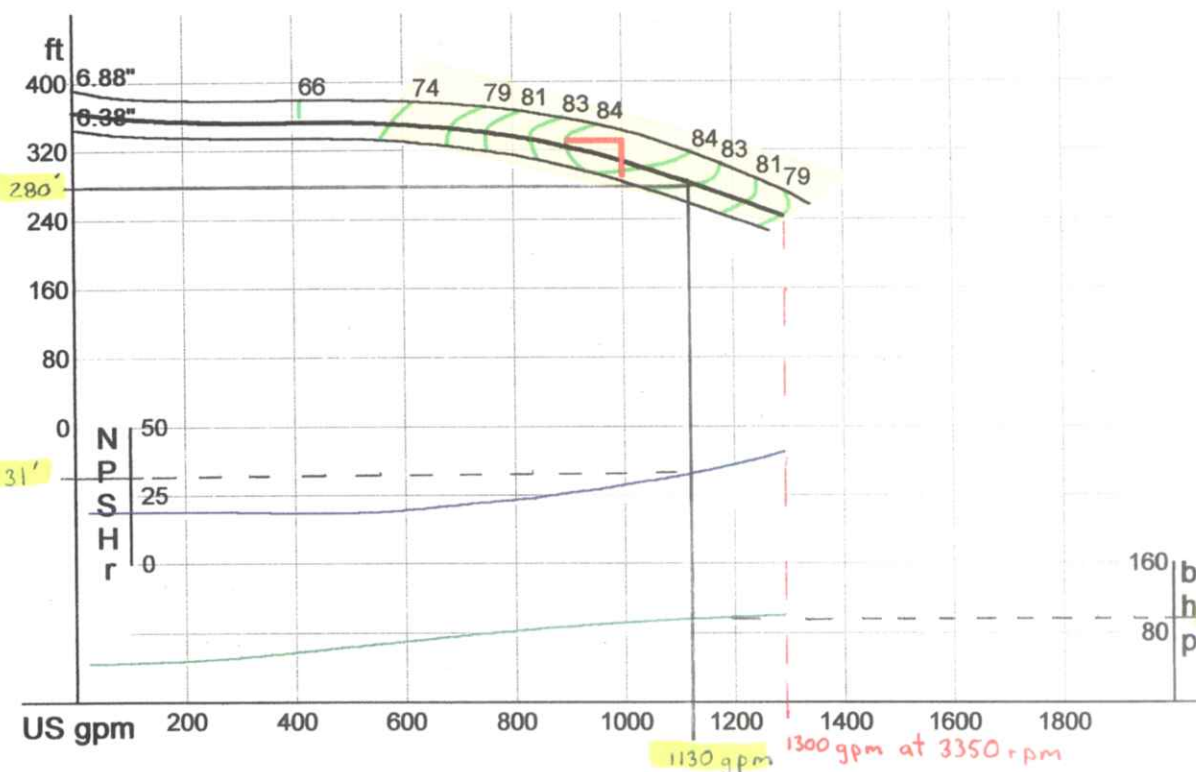
Motor: 100 hp Speed: 3600 Frame: 405TS
NEMA Standard TEFC Enclosure
sized for Max Power on Design Curve

Suction Size-6" Discharge Sizes-5", 6", 8"

— Data Point —
Flow: 950 US gpm
Head: 315 ft
Eff: 84.2%
Power: 89.7 bhp
NPSHr: 27.1 ft

— Design Curve —
Shutoff Head: 365 ft
Shutoff dP: 158 psi
Min Flow: - US gpm
BEP: 84.4% eff
@ 979 US gpm
NOL Pwr: 100 bhp
@ 1291 US gpm

— Max Curve —
Max Pwr: 113 bhp
@ 1339 US gpm



— PERFORMANCE EVALUATION —

Flow US gpm	Speed rpm	Head ft	Pump %eff	Power bhp	NPSHr ft	Motor %eff	Motor kW	Hrs/yr	Cost /kWh
1200	3350	264	81.5	98.1	36.1				
1000	3350	306	84.2	91.8	28.6				
800	3350	336	82.2	82.5	23.3				
600	3350	350	75	70.6	19.7				
400	3350	352	57.1	59.1	19.2				

Figure 11.

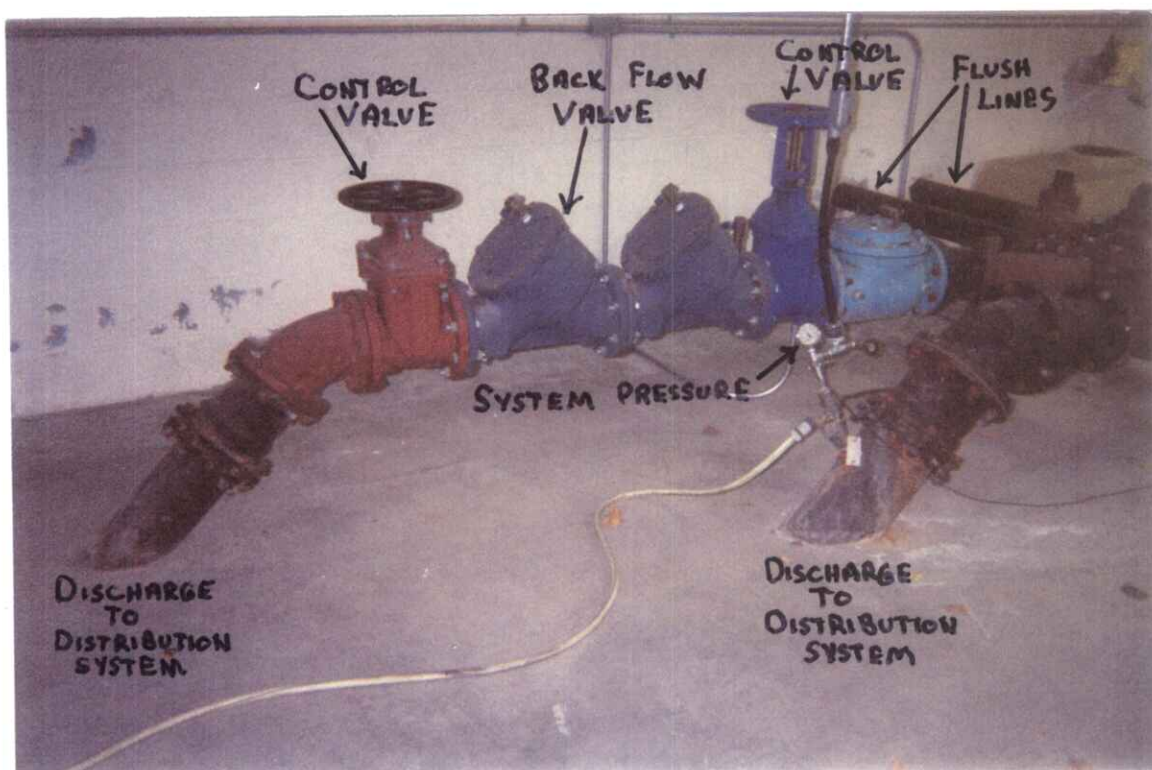
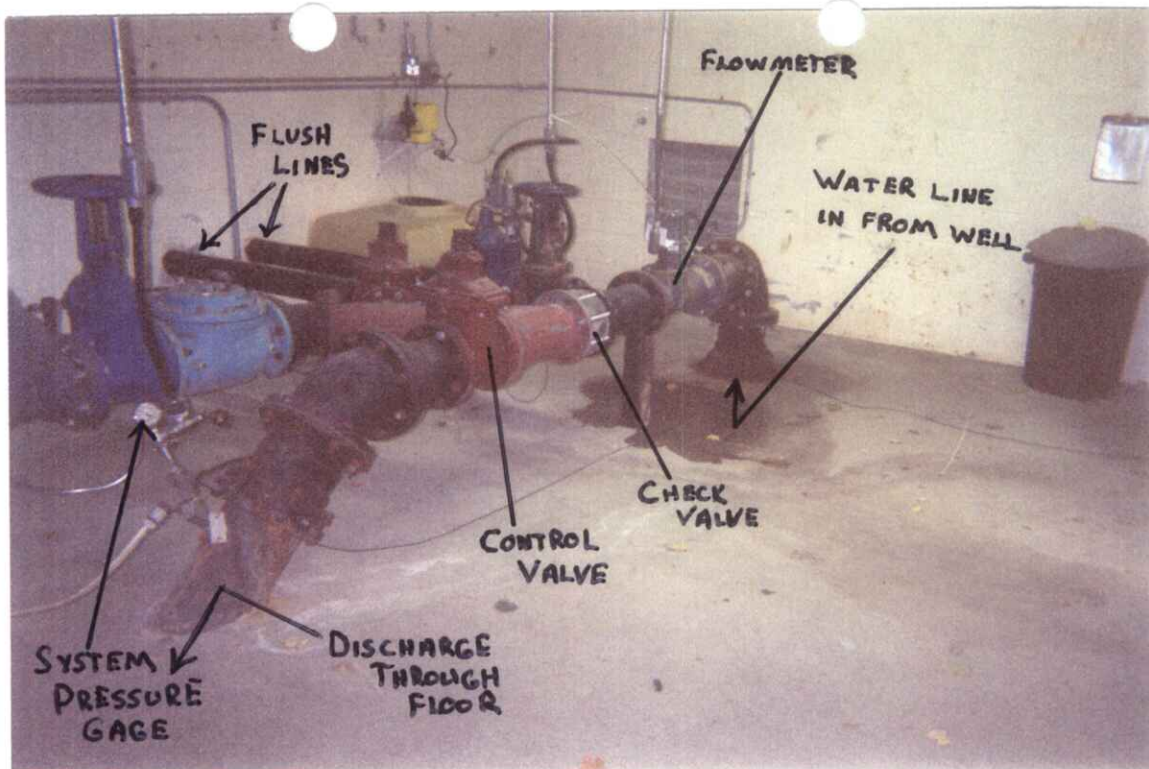


Figure 12. Photographs of the inside of the Caldwell Well #4-B pump control house. The upper view shows the water main line entering the pump house from the well located outside. The upper view shows the pump house plumbing of the municipal distribution system including valves, pressure gage, flush lines and system pressure gage. The lower picture is a close up of the second leg of the distribution plumbing and its discharge through the floor of the pump control house not visible in the upper photo.

Figure 12.



Figure 13. Photographs of the circular orifice weir discharge during hydraulic testing of the Caldwell municipal supply Well #4-B. The well was discharged at rates between 1,000 gpm and 1,710 gpm for the stepped discharge testing and a constant discharge test was conducted for 8½ hours at 1,250 gpm. Discharge was to the basalt rim rock of Canyon Hill above Mason Creek.

Figure 13.