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October 6, 2003

RECEIVED

OCT - 7 2003

Department of Water Resources

Nick Spencer
Deputy Attorney General
Idaho Department of Water Resources
P.O. Box 83720
Boise, Idaho 83720-0098

Re: Water Right Nos. 37-7268, 37-7454, 37-7602 and 37-8679

Dear Mr. Spencer:

For review and consideration by appropriate Idaho Department of Water Resources representatives, I enclose 3 copies of C. G. Brockway's September 29, 2003 *Report on Well and Irrigation System Capacity for Leon Hubsmith, Dietrich, Idaho*. As you know, this report relates to the pending *Motion to Set Aside Judgments* in SRBA Subcase Nos. 37-7454 and 37-7602 that is scheduled for hearing on October 21, 2003. Mr. Hubsmith is seeking to have these judgments set aside so that the premature proof of beneficial use for Water Right No. 37-7602 can be addressed in conjunction with the corrected well system capacity information that is now available.

If you have any questions about these matters, please contact me. I look forward to discussing these matters further with you.

Sincerely,

HOFSTETTER LAW OFFICE, LLC



Dana L. Hofstetter

Enclosures

cc: Leon Hubsmith w/ enclosure
E:/4018.1/5683

Report on Well and Irrigation System Capacity for Leon Hubsmith, Dietrich, Idaho

Brockway Engineering, PLLC
C. G. Brockway, P.E.
September 29, 2003

Background

This report presents the results of a pump capacity analysis for a well and irrigation system owned by Leon Hubsmith. The well is located near Dietrich, Idaho in the NW1/4 NE1/4 Section 30, T. 6 S., R. 19 E. Water rights appurtenant to the well include 37-8679, 37-7268, 37-7454 and 37-7602. The Idaho Department of Water Resources conducted beneficial use examinations for water rights 37-7268 and 37-8679, the first on July 24, 1990 and the second on August 8, 1991. During both exams, it was not possible to measure the well discharge directly using flow meters available at the time because no suitable measurement location could be found. The examiner in 1991 attempted a measurement using an annubar, but the results were deemed inconclusive due to excessive turbulence at the measuring point. Both examiners therefore utilized an approximate theoretical method to estimate the maximum well discharge. To utilize this equation, the pump efficiency was assumed to be 70% (a default value used by IDWR) without reference to the actual pump performance curve. It appears that the system pressure may also have been estimated rather than measured. Neither examiner was able to directly measure the dynamic pumping level due to an obstruction preventing the electric probe from descending down the casing. The pumping level was estimated at 250 feet by the 1990 examiner and 242 feet by the 1992 examiner. Given the assumptions above, the examiners applied the theoretical equations correctly and computed a maximum system capacity of 6.28 cfs (2,818 gpm). In the licensing process, the maximum diversion under all appurtenant rights was limited to 6.28 cfs.

A review of the licensed diversion rate revealed that it is not consistent with the size and number of center pivots and hand line systems that are normally operated on the Hubsmith farm. Normally, four (4) center pivots plus at least one hand line field are operated simultaneously. The design flows of the pivots alone, based on data from the irrigation companies' design charts, indicate a diversion rate substantially greater than 6.28 cfs.

Pump Capacity Testing

In order to determine whether IDWR's capacity estimates may have been in error, additional system documentation and flow measurements were conducted on July 30 and 31, 2003. The purpose of this investigation was to determine what the actual pump capacity was at the time of the original beneficial use exams. According to documentation provided by Mr. Hubsmith, the well pump was replaced in 1989 and no

additional work has been performed on the system since the time of the original beneficial use examinations. The well pump, motor, manifold, mainlines, and irrigation systems are the same as in 1990-91. In other words, the components of the system and the installed equipment are the same in 2003 as they were during the 1990-91 exams, with one difference: the addition of a variable-frequency drive to the well pump. In order to replicate conditions with the fixed-speed drive in 1990-91, the pump was run at a frequency of 60.0 to 61.0 Hz during the tests.

The attached diagram illustrates the irrigation systems relative to the well, and shows the approximate location of the mainlines. For the test, a "maximum" operating condition was selected, consisting of the south pivot, west pivot, east pivot, and north pivot operating. Hand lines in field HL2 were also operating, but the other hand lines were off. The farm manager confirmed that this condition was a maximum operating condition and that turning on any further hand line systems would cause a low pressure condition. Operating pressure at the well was 48 psi during the test. The pivots are equipped with pressure regulators of 20 psi or less, so this system pressure was sufficient to operate the pivots. No low pressure condition was observed at any sprinkler system.

All flow measurements were made with a Fuji Portaflow X ultrasonic flow meter, using FLG1S transducers. This meter and transducer set was tested on April 11, 2003 using the University of Idaho testing lab at Kimberly, Idaho. It was found that with 8" steel pipe or greater, the meter error was 2.5% or less.

The attached photo of the well illustrates the manifold at the well and the various mainlines feeding each of the irrigation systems. This photo shows the difficulty of making measurements with any type of meter at this location. No acceptable location on either the manifold or any of the mainlines was evident. A measurement on one of the mainlines was attempted, but no reading could be obtained.

Because flow readings were not possible at the well, individual flow measurements were made at each of the center pivots and on the mainline feeding field HL2. At each location, an acceptable meter location was available, good signal strength was obtained, and the flow readings were stable. The volume was totalized for at least 10 minutes to obtain an average reading. Field worksheets and photos at each location are provided with this report. The flow measurements are summarized as follows:

Location	Measured flow (gpm)
South pivot, no handlines on, end gun on	893
West pivot	679
North pivot, end gun off	615
Field HL2 mainline	188
East pivot	823
Total measured flow	3,198 gpm

Adjustments to Measured Flow

In order to estimate the total discharge at the well, two adjustments to the sum of the individual measured flows were necessary to account for 1) system leakage, and 2) the

fact that the end gun on the north pivot was off due to the position of the pivot. Leakage at pipe joints, valves, or other pinhole leaks was estimated at 1% of the total discharge. The end gun discharge was assumed to be 50 gpm, which is at the low end of typical end gun discharges. Addition of the end gun discharge will not materially affect the remainder of the system flows since the center pivots are pressure-regulated. With these adjustments, the best estimate of discharge from the well pump on July 30-31, 2003 is 3,280 gpm.

To estimate the well pump capacity in 1990-91, an adjustment for pump performance deterioration must be made. Over a 13-year period, pump efficiency could be expected to decrease by 5 to 10%. In fact, the measured efficiency reduction is 5.4% (see analysis below). Efficiency reduction will be manifested as a decrease in discharge, TDH, or both, depending on the nature of the deterioration of the pump impellers and bowls. As an approximation, the pump curve may simply shift downward, and the corresponding reduction in discharge will then be governed largely by the slope of the total system curve at the point of intersection with the pump curve. Since the center pivot sprinkler nozzles on the Hubsmith farm all have pressure regulators, changes in system pressure will have limited effects on discharge; this fact tends to create a "steep" system curve. The hand line sprinklers are not pressure-regulated, so there will be a significant variation of discharge with system pressure for these fields. Given the unknown pressure-flow relationships of the various sprinkler systems, it is not possible to calculate the total system curve with reasonable accuracy. It is only possible to say that with a 5.4% decrease in pump efficiency, the change in discharge will likely be small. For the present analysis, the discharge change was assumed to be 2%. Applying this adjustment yields an estimate of the maximum system capacity in 1990-91 of 3,346 gpm, or 7.46 cfs.

The calculated discharge agrees closely with a flow measurement of 3,300 gpm made in 1994 by Richard Hawkes of the Idaho Power Company. It is not known precisely how this flow was measured or in what condition the system was operating during the test, but Mr. Hawkes' report indicates that a sonic meter was used.

Check of Measurements Against Pump Performance Curve

The flow measurements were verified against the pump performance curve for the installed Vertiline 14THC 5-stage vertical turbine pump. For a discharge of approximately 3,200 gpm, the following calculations were made:

System pressure = 48 psi = 110.7 feet (measured at gauge during test)
Pumping level = 250 feet (based on known 260 feet of pump column, estimated static water level of 235 feet recorded by the pump installer in 1976, and Idaho Power measurement of pumping level of 252 feet at a discharge of 3300 gpm in 1994)
Column friction loss for 12" column, 1-15/16" shaft = 10.1 feet (manufacturer's data)
Discharge head loss = 1.0 foot (manufacturer's data)
Velocity head in 12" pipe = 1.3 feet

TDH at pump bowls = $110.7 + 250 + 10.1 + 1.0 + 1.3 = 373.1$ feet.
TDH per stage = $373.1 / 5 = 74.6$ feet

From the pump curve, the rated TDH at 3200 gpm is 79.0 feet per stage, or 395 feet total. Therefore, the measured TDH is 22 feet less than the curve value, or 5.6% less. This corresponds to a decrease in efficiency of 4.4 percentage points (from 82% to 77.6%), a 5.4% reduction in efficiency. This measured pump performance deterioration is consistent with the effects of pump wear over 13 years, although it is likely on the low end of the expected range.

Capacity Prior to 1989

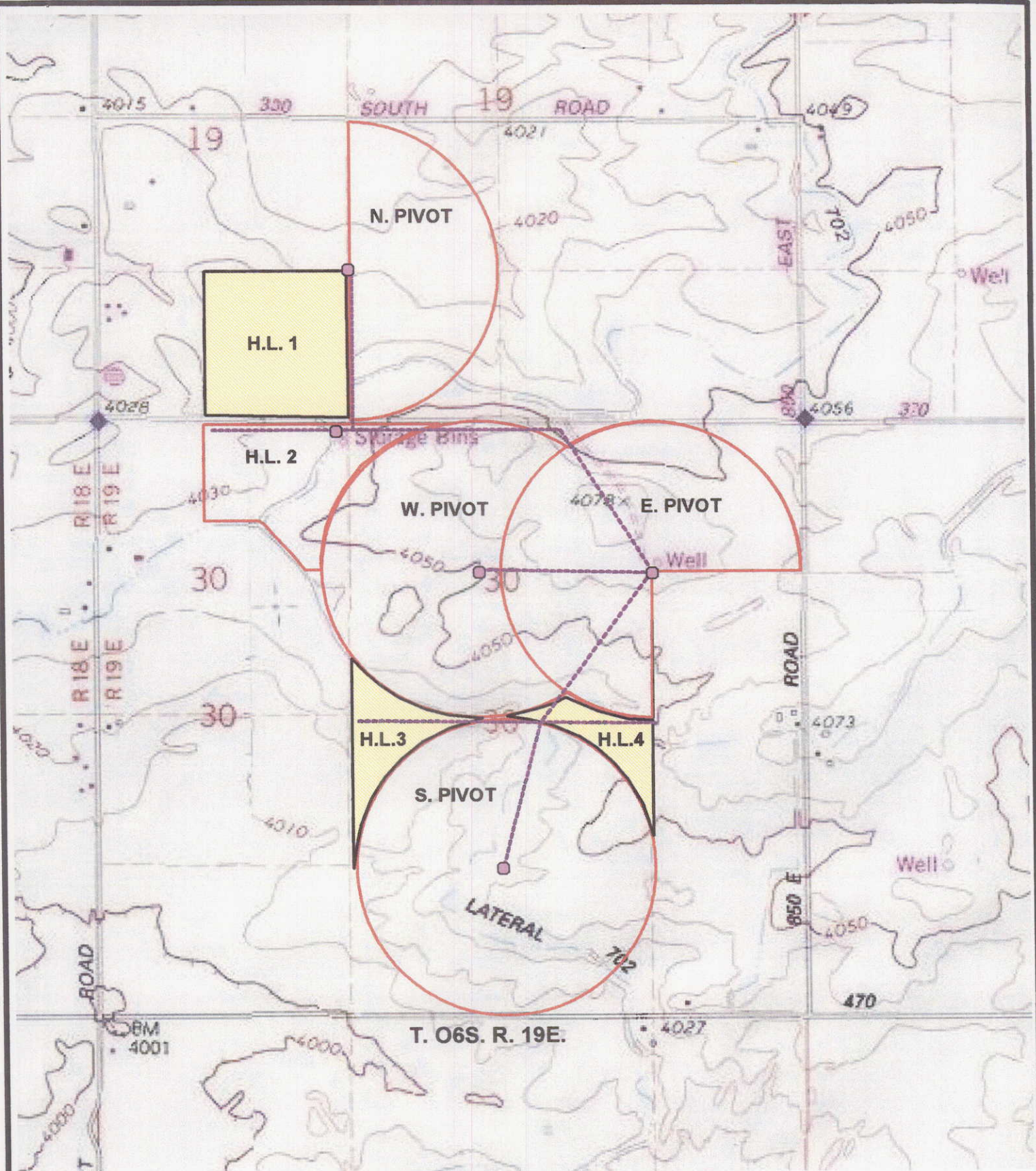
The well pump that existed prior to the pump change in 1989 was a Vertiline 16KHM. This pump has a higher rated discharge and TDH at the operating condition than the Vertiline 14THC. Therefore, the capacity prior to 1989 is at least as great as the capacity determined in the present analysis, provided the irrigation systems were substantially the same during that period.

Conclusions

Based on the data and analyses presented above, the best estimate of the capacity of the Hubsmith irrigation system at the time of the original IDWR field examinations (1990-91) is 3,346 gpm (7.46 cfs). The system capacity was at least as great prior to the pump change in 1989 if the irrigation systems were substantially the same during that period.

The error in the theoretical calculations made by the two IDWR field examiners was in the assumed efficiency value. The actual pump efficiency at the time of the examinations was 82%, based on the manufacturer's performance curves. If this value had been used instead of the "default" value of 70%, the examiners would have calculated discharges very close to the value of 7.46 cfs determined in the present analysis.





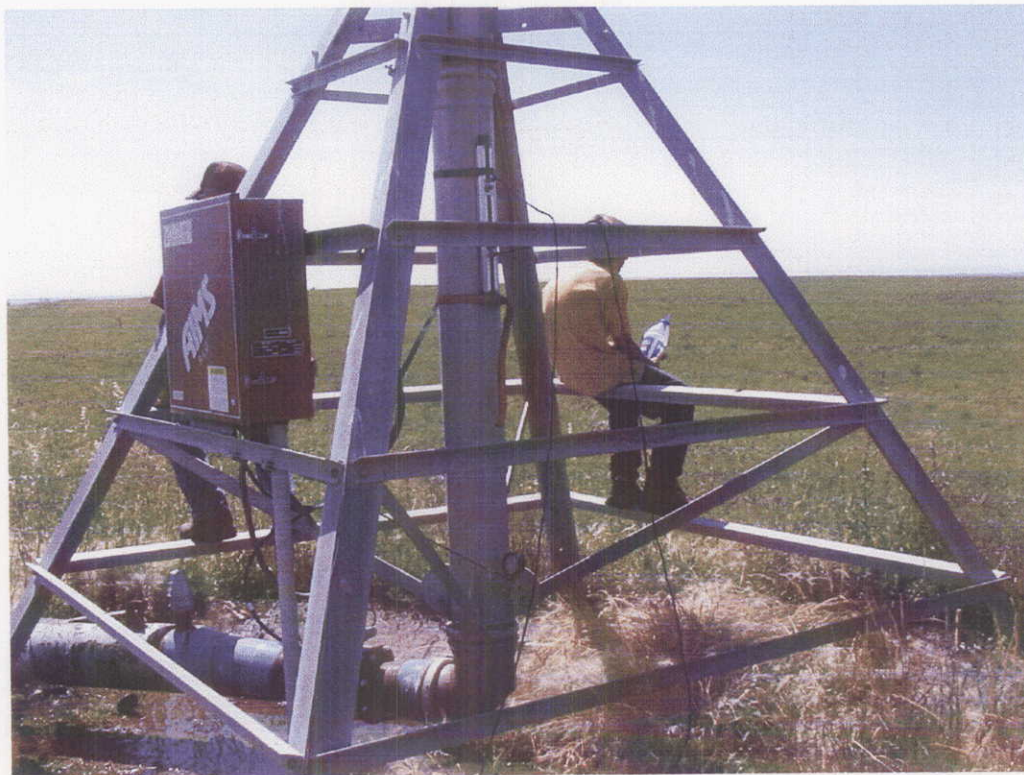
HUBSMITH SYSTEM CAPACITY TEST
Water Rights 37-8679, 37-7268, 37-7454, 37-7602

- LEGEND**
- Flow Measurement Point
 - Main Line
 - Fields Active During Test
 - Fields Inactive During Test

BROCKWAY ENGINEERING, PLLC.
ALR SEP. 29, 2003



North pivot flow measurement



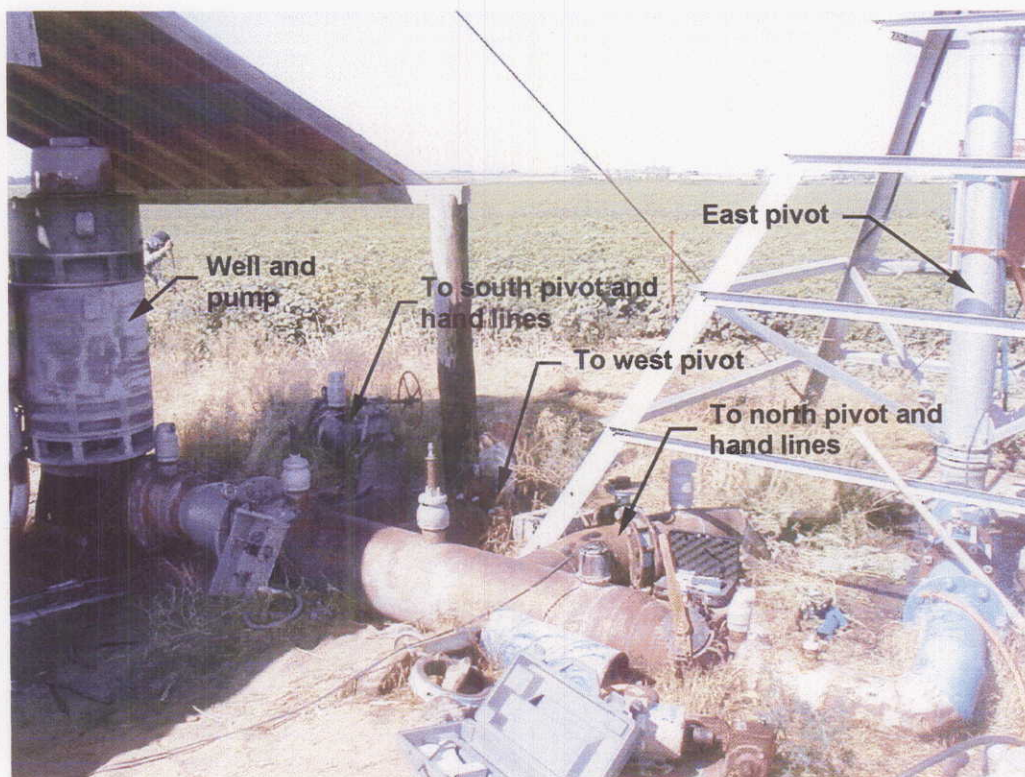
West pivot flow measurement



South pivot flow measurement



HL1 mainline flow measurement



Well, manifold, and east pivot

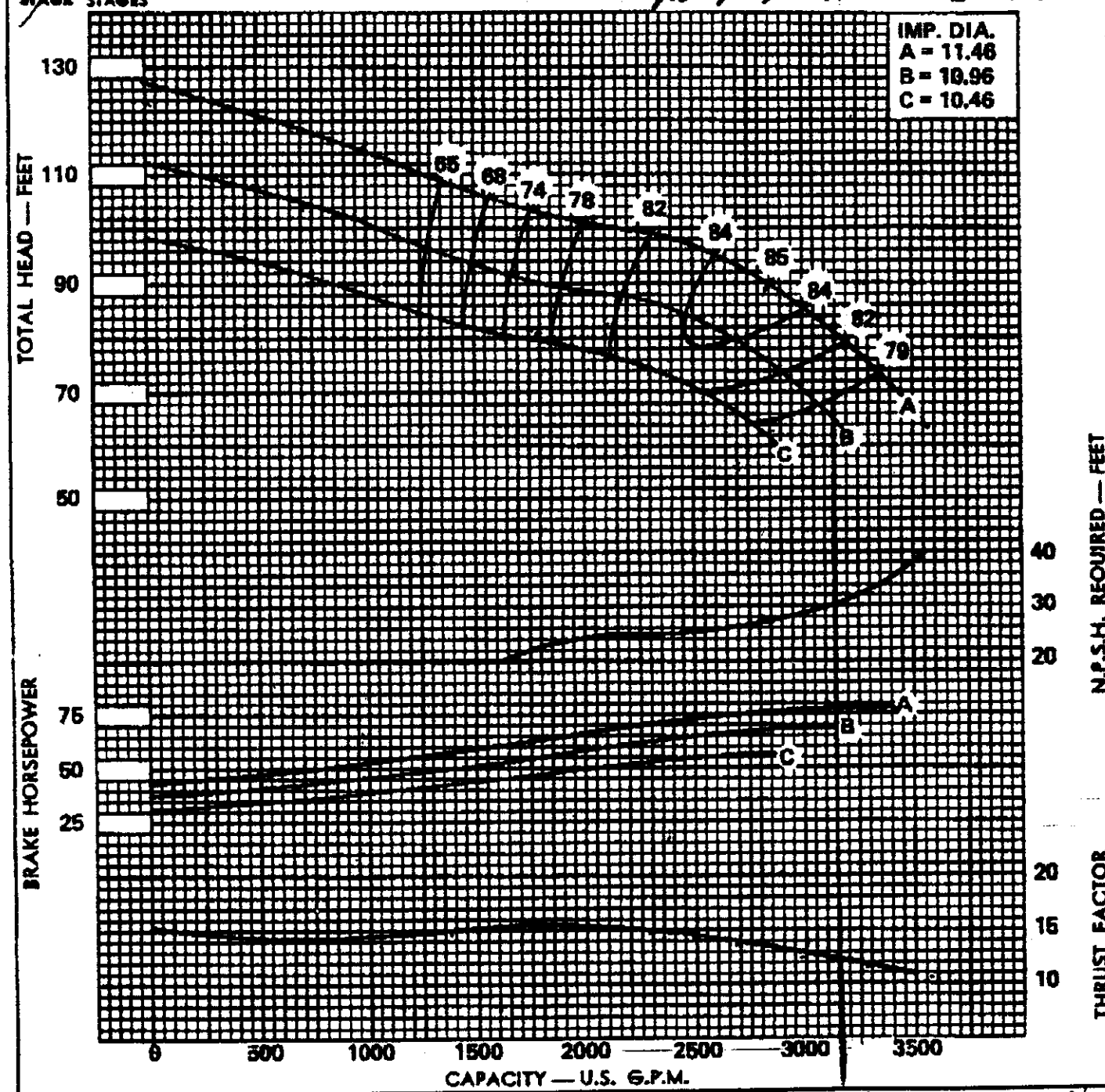


East pivot flow measurement

Leon H. Smith - 5 Stage Full Size

CURVE NO. 18-151X 6-1-80	No. Stages	Eff. Change	MATERIAL	Eff. Change	14THC	1770 R.P.M.
	1	-1	IMP.—C.I.	-1	SINGLE STAGE LAB PERFORMANCE WITH STANDARD MATERIALS. EFFICIENCY SHOWN FOR 2 OR MORE STAGES. HORSE POWER SHOWN FOR ONE STAGE BASED ON 2 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.	
	2	0	IMP.—NI-R	-1		
	3		BOWL—BRZ.	-1		
	4		BOWL—NI-R.	-1		

ONE / 15 / 260' of 12x3 x 1-10/16" CUSTOM PERFORMANCE 3155 GPM @ 402' TDA Pump S/N Venturini 87670510



EYE AREA — SQ. IN. = 35.81	IMPELLER WT.-LBS. = 31.8
WR ² PER IMPELLER = 2.75 LB.-FT. ²	ONE STAGE WT.-LBS. = 435
MAX. SPHERE SIZE = 1.25 in.	ADD'L STAGE WT.-LBS. = 164
MAX. NO. STD. STAGES = 7	IMPELLER NUMBER = 7T17
MAX. OPERATING P.S.I. = 390	DISCH. SIZES = 10.12
STD. LATERAL = 0.75 in.	SUCTION SIZES = 10
STD. SHAFT DIA. = 1.937 in.	MAX. LATERAL = 1.28 in.
MAX. SHAFT DIA. = 2.187 in.	BOWL CONN. FLANGED — COLLET
MIN. SUBMERGENCE = 47	ADD 13 — PER ADDITIONAL STAGE.

