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SUNIZONA ACRES SUBDIVISION REPORT ON UNDERGROUND WATER SUPPLY

Prepared by :

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Tucson, Arizona.

December 19, 1961.

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CONTENTS

I. GENERAL

LOCATION

Sunizona Acres Subdivision comprises portions of an area approximately eight miles wide by five miles deep lying adjacent to and north of highway 181 and east of highway 666, Cochise County, Arizona. (Townships 17-18 South and Ranges 26-27 EAst.) The nearest towns are Pearce, Arizona, seven miles west, Willcox, 32 miles north and Douglas, approximately 38 miles to the south.

TOPOGRAPHY

The terrain within the subdivision is predominately flat with a few minor washes and rises and is covered with range grass and varying amounts of mesquite and other brush. The land slopes from east to west at the rate of 30-35 feet per mile. The soil type varies from a very sandy loam to a clayish loam, with all the soil being adaptable for agricultural purposes. The subsoil may be either clay or a very clean open gravel depending upon the particular location. As of November 1961, no caliche or alkali deposits have been encountered.

CLIMATE

The average rainfall in Willcox, the nearest U. S. Weather Bureau station, has been 11.70 inches annually as determined from records for the period of 1880 to 1945. Over half of this rainfall falls during intense thundershowers in the months of July, August and September. The driest months are April, May and June. The average temperature during the period of record was 59.6°F with January being coldest with 41.6°F and July, high at 79.4°F. The average evaporation is 85 inches per year. In Arizona the required irrigation well capacity is usually figured to be 6 to 10 gallons per minute per acre of land to be irrigated, the exact capacity required to be determined by the climate and type of crops to be grown.

GEOLOGY

Sunizona Acres Subdivision lies near and slightly astraddle the surface-water divide that separates the Douglas and Willcox basins. Accordingly this report will deal with both basins, but only to the extent they affect the subdivision area. Both basins are characterized by valleys trending north and south lying between maturely dissected fault-block mountain ranges rising to 9 and 10 thousand feet on the east and 6 to 7 thousand feet on

the west. The basins are separated by the series of low, partially buried hills lying just south and west of the subdivision area. The valley areas are locally known as Sulphur Springs Valley and comprise some 70% of the area of the basin.

These valley areas are filled with debris and sediment eroded from the mountains and are known to be at least 2000 and more feet thick in some places. This sediment is the principal aquifer in the basin, containing and furnishing all the water of any consequence. For the purposes of irrigation supply only the upper 5 to 600 feet of this sediment can be considered as water-bearing due to the prohibitive pumping lifts below this depth and the decreasing permeability of the lower, older and more tightly cemented formations.

This upper valley fill or alluvium has been deposited since the beginning of Pleistocene times (approximately one million years ago). Recent alluvial fill has occurred in the subdivision area, and even within historical time perennial streams and gullying has occurred in Turkey Creek and Ash Creek.

A further discussion of the valley fill is warranted to describe as fully as possible the conditions affecting wells drilled into the fill areas. The valley fill consists of a large variety of sediments derived from erosion of rocks in the mountain areas, consisting of clay, silt, sand, gravel and boulders, all carried into the valley and deposited by streams and other runoff. The larger particles were, generally, deposited near the mountains and constituted the principal areas of recharge to the valley fill. Near the center of the valley, clay predominates to a very large extent and has been laid down to great thicknesses in some areas by ancient lakes. In all the valley fill areas a great variety of formations will be encountered in close proximity to each other. This is especially true of the Sunizona Acres Subdivision area, lying as it does in the Turkey Creek and Ash Creek alluvial belts.

The origins of the varying formations may be better understood if a stream channel can be imagined depositing a lens (or bar) of clay after one storm, but during a time of severe flooding depositing large areas of gravel, perhaps then to change course entirely leaving the old stream bed to fill with sand. The end result is a deposition of lens shaped and fingers of strata varying abruptly in gradation, consolidation, and texture both horizontally and vertically. Generally the gradation varies from large to smaller particles as the streams move away from the mountains and deposit the larger particles as the velocity of flow slows. The widely varying formations show up in the drillers' well logs, and correlation of individual formations from well to well is not possible. The beds are interconnected, as shown in the uniform water table throughout the area. The alluvial fill has been filled with water over a period of thousands of years, and now is being mined as is coal or copper ore, all over the State of Arizona with a resulting drop in the water level or water in storage.

II. GROUND WATER RESOURCES

WILLCOX BASIN

The Willcox Basin extends northwesterly from the drainage

divide in the Sunizona Acres area to another divide at the headwaters of Aravaipa Creek some 56 miles distant. The basin is unique in that it has no surface drainage outlet. The surface and ground water drains into a large flat southwest of the town of Willcox known as the Willcox Playa. Some ground water may drain from this basin through the valleys of alluvial fill near Pearce and Sunizona Acres. Whether this is true or what quantities are involved has never been proven.

Water is recharged to the Willcox Basin ground-water reservoir in the valley fill principally by run-off from the mountains into the coarse material adjacent to the mountains and also by precipitation and the return of irrigation water to the underground storage. An estimated 15% of the irrigation water applied to the land returns to the water table. A very small amount of the rainfall on the valley area escapes evaporation, mesquite and other vegetation to reach the underground supply. The total amount of recharge to the basin is not known.

Discharge from the basin occurs by evaporation estimated from 11,000 to 32,000 acre feet per year, by vegetation, principally mesquite, calculated to be 85,000 acre feet per year, by underflow from the basin, quantity unknown, and by artificial discharge by wells, pumped and artesian. In 1946, the estimated annual discharge from pumps was 200,000 acre feet. Since that time, agricultural development has increased enormously and the water level has dropped as much as 120 feet in some wells in the center of activity in the Kansas settlement area. While it was believed the annual safe yield of the basin had not been exceeded in the late 1940's, it undoubtedly has been at the present time. The amount of water in storage appears to be ample to fulfill the demand in the foreseeable future.

DOUGLAS BASIN

The Douglas Basin extends south from the drainage divide of the Willcox Basin 38 miles to the International Boundary Line and thence on into Mexico. It is centered about White Water Draw which originates in Rucker Canyon in the Chiricahua Mountains and eventually crosses into Mexico where it is a tributary to the Yaqui River and thence to the Gulf of California.

Recharge to the basin occurs primarily where the run-off infiltrates into the coarse sand and gravel near the mountain fronts. Some movement of ground water into the basin may occur in the vicinity of Turkey Creek, as mentioned in this report. The amount of recharge from precipitation and irrigation of crops is believed to be very small in the Douglas Basin. The total amount of recharge is estimated at 22,000 acre feet per year, of which 20,000 acre feet is from run-off from the mountains.

Discharge of the ground water occurs from evaporation and transpiration by plants, principally mesquite, in the amount of 8,000 to 13,000 acre feet annually. The flow out of the basin is estimated to be 7,000 acre feet per year. The amount pumped from wells was calculated in 1951 to be 41,000 acre feet. In summation, the total amount of discharge in recent years must be approximately 70,000 acre feet annually and the recharge approximately 20,000 acre feet annually, the difference being withdrawn from storage. The maximum drop of water table in the basin has been observed to

be about 40 feet in some wells in the last 50 years although the maximum general decline has been only 10 feet since 1947, occurring around the center of agricultural activity near Elfrida.[2]

III. QUALITY OF WATER

Waters in the Douglas Basin are classified as excellent to good for irrigation purposes and waters in the northern part of the basin are low in dissolved solids, generally less than one third of the suggested maximum of 1000 p.p.m. of the U. S. Public Health for municipal water supply.[2]

In the Willcox Basin the water away from the Playa is equal in quality to the water in the Douglas Basin, generally having 150 to 300 parts per million of dissolved solids and classified excellent to good as irrigation water.[1]

Flouride is a problem in both basins and especially in the Willcox Basin, in finding an acceptable domestic water supply. The maximum flourine content should not exceed 1.5 parts per million for growing children without mottling of the tooth enamel. On the other hand a 1.0 p.p.m. flourine content is desirable to form teeth more resistent to decay. Sunizona Acres Subdivision is fortunate in having a flourine content in a desirable range of 0.8 p.p.m. and 1.5 p.p.m. Flourine is not expected to become a problem in the ground water available for domestic use in the Sunizona Acres Subdivision area.

A copy of a water quality test of water from one well in the Sunizona Acres Subdivision land is attached at the end of this report. It shows an excellent quality of ground water; total dissolved solids are about one-half of the amount typically found in City of Tucson water.

The Willcox Basin, having no surface outlet, will gradually accumulate salts and other minerals as the water from the basin evaporates leaving behind these mineral elements in the remaining water. As irrigation and other water percolates through the subsoil to the water table, salts are leached out in the soil. Water from areas near the Playa are presently so highly mineralized as to be unfit for use either for irrigation purposes or drinking water. As the distance from the Playa increases, the quality of ground water in the Sunizona Acres Subdivision area will not, in the foreseeable future, become too mineralized for domestic use.

IV. SUNIZONA ACRES WELLS

Geology

As mentioned above Sunizona Acres Subdivision lies between Ash Creek and Fivemile Creek and astraddle the Turkey Creek alluvium. These alluvial deposits are apparent from the drillers' logs and the more permeable deposits (sand and gravel) furnish the water to the wells in Sunizona Acres. The surface water drainage divide is between Ash Creek and Turkey Creek (Ash Creek running into the Douglas Basin during periods of flow and Turkey Creek going to the Willcox Basin.)

South of the Subdivision area are Squaretop Hills and Ash Creek Ridge, and to the west are Turkey Creek Ridge and Sulphur Hills.

These isolated buttes and ridges are probably a northwestern extension of the Swisshelm Mountains, having similar structures and formations. They are formed of sedimentary and volcanic rocks, interconnected below the surface with only the tops showing above the alluvial fill. A few outcrops of bedrock occur above the fill around these buttes and ridges, and the thickness of fill between the various outcroppings is approximately proportional to the distance between them. This thickness of fill is important in predicting if any ground water moves from the Willcox Basin into the Douglas Basin.

It is believed that the greatest thickness of fill occurs between Turkey Creek Ridge and Ash Creek Ridge, because of the following factors:

1. The distance approximately 2 miles between these ridges;
2. Change from sedimentary rocks in Ash Creek Ridge to volcanic rock in Turkey Creek Ridge perhaps due to faulting.[2]

The results of the well drilled at the new sales office, discussed below, indicate that there is no flow between the Willcox and Douglas Basins through this area. Whether or not this underground flow exists is speculative and is, for the purposes of water supply, an academic question.

Recently a preliminary gravity anomaly survey has been completed in the Sunizona Acres area and a more detailed survey and study is planned in the near future (December, 1961). The gravity measurements taken to date indicate, with certain factors known or assumed, the relative depth to bedrock or conversely the thickness of alluvial fill. This preliminary survey shows the greatest thickness of fill passes through the center of the subdivision and out to the north with a rapid decrease to the west and south and a more gradual decrease to the Pat Hills to the northeast. (See attached map). The amount of water available is more or less dependent upon this thickness of alluvial fill. Therefore, it can be expected that wells will be better to the north with more depth of alluvial fill available and will be of decreasing capacity to the south and west. This depth of fill is of importance only when high volume irrigation type wells are desired. More detailed and accurate predictions of the thickness and type of alluvial fill will soon be available after the completion of the planned gravity survey and studies.

Well #5 at a 400 foot depth and Well #7 at a 432 foot depth were drilled, it is believed, very near to bedrock. While it is not believed that these wells actually penetrated the bedrock, the high percentage of fractured volcanic rocks found in the bottom samples indicated the bottom of the water bearing alluvial fill was very near. Well #6, half way between these wells and at a depth of 503 feet, did not encounter these rocks, nor did any of the other wells. This is to emphasize that the top of the bedrock is not uniform but is as rough and irregular as the top of any surface range of hills. Indeed, an unfortunate driller may strike the top of some sub-surface peak much shallower and in a location not anticipated.

STATIC WATER LEVELS

From the existing well logs the static water level has been plotted and a copy of this profile is attached at the end of this

report. From this profile, the static water level can be determined within about 5 feet for any location adjacent to the existing wells. Also readily apparent is the existing gradient of the water table, seen as approximately 10 to 11 feet per mile from east to west, the water moving very slowly (several hundred feet per year)[3] from the mountains to the center of the basin. The static water level has declined very little in recent years. The level in a well (since abandoned) in the northeast quarter of section 6, approximately one-half mile from Well #6 was measured in 1910 to be 100 feet below the surface.[4] By projecting the present static water level it can be seen that the static water level has fallen only some 10 to 15 feet in the last 50 years. This decline will be accelerated if pumping in the area is increased.

PRODUCTION OF EXISTING WELLS

The majority of the wells that have been drilled in the subdivision area were better than expected, generally being of irrigation capacity. Pumping lifts were not excessive although the amount of drawdown was high in most cases. The best well, #7, produces 1200 gallons per minute when tested to the capacity of the test pump, and very likely would produce 1500 g.p.m. or more if equipped and pumped to the maximum. Wells #5 through 10 were 12 inches in diameter and from 350 to 500 feet deep, and all have a capacity of 600 g.p.m. or more which is considered ample for irrigation of the 80 acre parcels on which they are situated.

A Summary of logs and the pumping test results are attached at the end of this report. While the results were not perfectly consistent, wells have been drilled and data accumulated that the production of any future well drilled within the area surrounding these wells can be closely predicted.

For a domestic supply only, say 5 to 10 g.p.m., a well would generally have to penetrate below the static water level some 30 to 40 feet, or to a depth of some 150 feet in most areas. A well casing 8 inches in diameter would be sufficient for a domestic well.

The old windmill well near the intersection of Fort Bowie Road and Chiracahua Drive is a good example of a domestic size well. This well is capable of almost 10 g.p.m. when pumped down to its maximum depth of 141 feet. The static level in this well is 119 feet below the surface, thus having available some 20 feet of water-bearing strata. The casing is of relatively thin galvanized steel and is 6 inches in diameter. The method of perforating is unknown but was probably done by drilling circular holes with a brace and bit.

To obtain water in large amounts sufficient for irrigation purposes a well should be at least 12 inches in diameter and drilled to a depth of 400 or 500 feet depending upon the location. Slight artesian pressures exist in some of the lower formations and even though the formations are generally less permeable with depth, frequently a great deal of water has been found available at depths of 350 to 450 feet. This is especially true when the coarse, fractured formation (basal gravel) lying directly on top of bedrock is encountered. Obviously the better wells are to be

found where the formations are an open and porous clean gravel. The poorer ones are drilled in higher percentage of impervious formation such as clay. Due to the valley fill conditions, no correlation of the formations from one well to the other can be accurately made; neither can the formations to be encountered be accurately predicted.

The following conclusions, based on observation of and experience with the 10 wells drilled to the present time, can be drawn and will hold true for the majority of cases.

1. With well depths of 350 to 500 feet, ample water for irrigation purposes is available at a pumping lift of 250 to 300 feet.
2. Increased capacity can generally be obtained with an increase in depth until bedrock is hit.
3. Wells located most distant from the hills and ridges, surrounding the subdivision area, tend to be more productive.

Comparison of the capacities of wells #8 at 353 feet (660 g.p.m.) and #9 at 392 feet (940 g.p.m.) and the results of deepening well #6 bear out the conclusion of increased production with increased depth. Well #6 was initially drilled to 403 feet and had a capacity of 525 g.p.m. when first tested. It was then deepened 100 feet, the bottom 60 feet being in a hard cemented gravel formation, called "rock" by the driller, and an 78% increase in capacity to 925 g.p.m. was gained. A comparison of the pumping test results (attached) for this well shows increased production at all the pumping levels tested.

An adjacent well of interest is the well on the ranch land about 1 mile north of Well #6. The pumping test conducted on it in July, 1958, showed the capacity to be in excess of 2500 g.p.m. from a pumping level of 260 feet. The exact depth of this well is unknown, but it is believed to be approximately 500 feet. It has been reported that deepening of the well resulted in greatly increased production.

Well #11 was drilled in July, 1961, just across the surface drainage divide in the Douglas Basin. This well is located at the new sales office at the northeast corner of the intersection of highways 181 and 666 and is currently supplying water to the sales office. The static water level is 104 feet below the surface or at an elevation of 4192 feet. The sudden drop in the water table from the windmill well (elevation 4238), a little over one mile east, to this well suggests that there is very little, if any, interflow between the two wells and the Douglas and Willcox Basins through the alluvial fill between Turkey Creek Ridge and Ash Creek Ridge.

A distinct difference in formation exists between Well #11 and the other 10 wells. From a depth of 135 feet to bedrock at 222 feet, the formation in well #11 was a hard, dirty, black clay and shale which was non-water-bearing. This well is currently producing about 10 g.p.m. from the more pervious formations at depths of 104 to 135 feet.

This black clay-shale formation was deposited by an ancient lake and probably lies under all of the Sunizona Acres property within the Douglas Basin. Therefore, no future wells for other than domestic supply should be drilled in this area, which comprises

only a very small percentage of the total Sunizona Acres Subdivision area.

V. CONCLUSION

It is anticipated that "water witching" done within the limits of Sunizona Acres Subdivision will yield results very similar to the predictions made in this report. The entire subdivision with the exceptions noted above is saturated with water below the static water level down to the top of the bedrock. Wells drilled into these saturated formations will yield water, the amount dependent upon the depth, size hole and permeability of the formations encountered. The last 6 wells drilled within the subdivided area all yielded substantially the same quantity of water and were located arbitrarily exactly 30 feet west of the lot corners common to the east 4 lots in an 80 acre tract.

Domestic wells can be developed anywhere in the subdivision area and should cost between $1000 and $1500 when completed and equipped. Wells of irrigation capacity may be developed in most locations within the subdivision area with economic pumping lifts to be expected. The cost of drilling, casing, and testing of irrigation size wells can be estimated by the following formula: Total cost = $0.90 x diameter of casing in inches x depth in feet.

Any report on water supply is necessarily limited and its accuracy controlled by the amount of information available. Accordingly, when the proposed work is completed by the U. S. Geological Survey and as additional wells are drilled in the area, this report will be revised to include this future information. Within the area results may be predicted with good accuracy. As wells are drilled further away from the existing wells less accuracy can be predicted and some surprises may be in store. Also, by the nature of the science of geology and of subsurface formations, no exact statements and predictions can be made, but it is hoped that this report gives clearly and accurately, within the above limitations, the ground water situation for Sunizona Acres Subdivision.

ACKNOWLEDGEMENTS

Sincere appreciation is extended to members of the Tucson Office of the United States Geological Survey, Ground Water Branch, for their assistance in assembling basic information and general assistance during the writing of this report. Also appreciated was the excellent co-operation of the well drillers and in particular Myron Ingle of Pearce, Arizona, whose knowledge and experience of local conditions was invaluable. Others assisting were Farmer's Pump Company, Willcox, Frank Lange, Elfrida, and, of course, the staff of this Engineer. Also without the excellent and unusual co-operation of the Developer, the Willen Corporation of San Mateo, California, whose desire was to test fully the available water supply none of this would have been possible.

REFERENCES

[1]Geology and ground-water resources of the Willcox Basin, Cochise and Graham Counties, Arizona. By R. S. Jones, R. L. Cushman, and J. D. Hem. May 1, 1947.

[2]Geology and ground-water resources of the Douglas Basin, Arizona. By D. R. Coates and R. L. Cushman. U. S. Geol. Survey Water-Supply Paper 1354, 1955.

[3]Field Measurements of the rate of movement of underground water, Slichter, G. S., U. S. Geological Survey Water-Supply Paper 140, 1905.

[4]Geology and water resources of Sulphur Spring Valley, Arizona. By O. E. Meinzer and F. C. Kelton, with a section on agriculture, by R. H. Forbes. U. S. Geol. Survey Water-Supply Paper 320, 1912.

Listed below are additional publications of interest to individuals seeking further information on Southern Arizona Ground Water.

Annual Report on Ground Water in Arizona, Arizona State Land Dept., Prepared annually by the U. S. Geological Survey, Phoenix, Arizona, Water Sources Report, published September each year.

Ground Water in the Gila River Basin and adjacent areas, Arizona a summary. U. S. Geological Survey Open File Report, 1952.

Ground Water in San Simmon Valley, Arizona. By A. T. Schwennesen with a chapter on agriculture by R. H. Forbes. U. S. Geol. Survey Water-Supply Paper 425-A., 1918.

SUNIZONA ACRES SUBDIVISION

Addendum to Report on Underground Water Supplies.

Geophysical Survey Sunizona Acres.

In April 1962, the Heinrichs Geoexploration Company performed a reconnaissance type geophysical survey on the Sunizona Acres Subdivision property for the purpose of adding to known information about ground water supplies. Using methods of induced polarisation-electrical resistivity and total intensity magnetic readings an attempt was made to correlate and project known characteristics in the area of the existing wells into areas where very little, if any, data was available. This is believed successful within the limits imposed on the geophysical survey.

In general answers to the following questions were sought; what production could be expected in the northeast and northwest areas of the Sunizona property, and what could be expected as wells are drilled closer to the areas of known bedrock in Section 11 east of the sales office.

Accordingly, induced polarization-electrical resistivity surveys were made, starting in the center of the area of wells 5, 6, and 7, tying in the areas of known bedrock, and then projecting the survey into the unknown areas to the northwest and northeast. In connection to the resistivity survey, a continuous total intensity magnetic profile was made, from which, an estimate can be made as to the approximate depth of bedrock along the survey line.

Geophysical surveys such as the ones made at Sunizona, show these things to the experienced interpreter;

1. The induced polarisation-electrical resistivity surveys, simply stated and without discussion of the many possible errors, show the vertical depth to bedrock, and where enough data is available, the general types of formation to be encountered. The lower readings indicate deeper bedrock, and the more permeable formations. A possible error here is that is the tighter, clay type or cemented formations will also give higher readings, similar to bedrock.

2. By comparison with known strata, bedrock or existing wells, other areas similar to known strata may be located, and relatively higher or lower readings may indicate even better production areas than the known areas.

3. The mobile magnetometer, total intensity magnetic survey records a continuous profile, as it travels along, of the magnetic intensity. The magnetic profile is roughly the same as the bedrock profile, that is the higher magnetic readings show shallower bedrock.

One of several possible errors here is that different types of rock formations will give different readings, although lying at the same elevation.

The reconnaissance type survey, by definition will overlook and miss many details, however the data assembled by the survey and properly interpreted adequately describes in a general way the unknown areas. The map attached shows the expected areas of good water production, and conversely the poor water production areas.

Subsurface geological features discovered by the geophysical surveys were:

1. The location of a buried volcanic hill in the general area of well # 7. Well # 7 was previously believed to have been drilled very close to bedrock, while # 6 even though 70' deeper did not approach bedrock. The geophysical readings, therefore support the original conclusions. For the purposes of irrigation wells this higher elevation bedrock is still so deep that it will be no problem

2. Section 35 and 2 in the northwest corner of the property show very deep valley fill and consequently should be good water production areas. The very south line of Section 2 appears to be underlain by shallow bedrock extending up from the south.

3. No production areas in Section 10 were discovered and the outline of shallow bedrock in Section 11 was approximately located. The possibility of a good well location in the very northwest corner of Section 11 was discovered, otherwise well drilling should be confined to the easternmost areas of Section 11. Additional geophysical surveys in Section 11 would be helpful in determining how far to the west wells could be drilled successfully. As may be seen on the map, the poorer production area skirts along the south line of the Sunizona property and the production from wells # 1, 2 and 3, bears this out.

4. The area around wells # 4 and 5 was judged to be a poorer production area in comparison to areas to the north and northeast. The entire northeast area of the property within limitations of the survey made is believed to be a good water production area. In the northeast corner of Section 32 was the deepest valley fill recorded on the property, and it is believed there is no bedrock in the area higher than 1000 feet deep and it may be as deep as 3500 feet in some places. Along the resistivity survey spreads, especially spread 9, line 5 some very low readings were made. The magnetic highs in this area still show bedrock so deep as to be of little concern.

The geophysical surveys made reaffirmed the previous beliefs about the good ground water production areas in Sunizona Acres Subdivision and further delineated the possible trouble spots. This data is valuable as an aid to planning the further development of the property. Further substantiation was found for the statement that all of the area away from the exposed hills is capable of good water production, the amount depending upon the type of drilling done and the formations encountered.

SUNIZONA ACRES SUBDIVISION

Addendum to Report on Underground Water Supplies
Wells 16, 17, 18 and 19

Wells 16, 17, 18 and 19 were drilled in the north half of Section 11, Township 19 South, Range 26 East G. & S. R. B. & M. in Sunizona Acres Subdivision for the purpose of testing the ground water production capacity in this area. These wells were drilled and tested during the months of October and November 1962. The specifications set forth in the water guarantee were followed as closely as possible, except for well 19 which was drilled to a depth of 300 feet to test an area shown to have a good water potential by the geophysical survey. Wells 16, 17 and 18 were located to explore areas believed to be poor locations for water production.

All the wells were capable of the guaranteed production of 10 g.p.m. several times over. The poorest well is #18, in which bedrock was struck at a depth of 115 feet, was capable of 36 g.p.m. The others have a projected capacity of up to 300 g.p.m. This is more than any efficient pump could produce from a six inch well.

No new strata were encountered other than the bedrock formation, which was deeper than anticipated. The static water level is between a depth of 83 and 90 feet as expected. The windmill well in the northeast corner of Section 11, is 116 feet deep and was tested to give a maximum of 13 g.p.m.

Copies of the well logs are attached at the end of this report. The test wells and pumping results show that the water guarantee is still valid and that all wells drilled in the north half of Section 11 will be capable of a minimum of ten gallons per minute. Bedrock may be encountered at depths of less than 175 feet, however it is not anticipated that any such wells will produce less than 10 g.p.m. To date, March, 1963 twenty wells, according to the best obtainable information, have been drilled by private owners under the guarantee and are capable of the guaranteed quantity several times over.

SUMMARY OF WELL & PUMP TEST RESULTS
SUNNIZONA SUBDIVISION

Well No.	Location By Lot Nos.	Depth of well	Casing size	Perforations from depth to depth	Static Water level	Test Pump	Test Pump Bowls top & bottom	Date of Test	Orifice for Measurement	Average Specific Capacity	Maximum Capacity
1	1,2,23,24	332'	10"	160'-324' 164	132'	A*	250'-267'	10/60	6" to 3"	G.P.M./ft. drawdown 2.42'	250 g.p.m.
2	7,8,17,18	267'	10"	148'-267' 119	139'	A	240'-257'	12/14/60	6" to 3"	1.35	115
3	35,36,37,38	263'	10"	155'-259' 104	158'	A	240'-257'	11/1/60	------- timed to fill container	.95	57
4	50,51,54,55	350'	10"	155'-315' 160	126'	A	280'-297'	12/60	6" to 3"	3.16	430
5	75,76,77,78	400'	12"	120'-385' 265	120'	B*	380'-396'	7/14/61	6" to 5"	5.77	930
6	81,82,95,96	(400' (504'	(12" (10"	(134'-400' 366 (404'-504'	110'	B	380'-398' 380'-397'	4/19/61 7/5/61	6" to 3½" 6" to 5" 6" to 5"	1.81 4.25	525 940
7	85,86,91,92	433'	12"	105'-432' 327	105'	B	390'-406'	July,'61	6" to 5"	7.83	1200 g.p.m.+
8	117,118,123, 124	353'	12"	140'-353' 213	105'	B	320'-338'	4/24/61	6" to 3½" 6" to 5"	3.56	660
9	113,114,127, 128	392'	12"	128'-392' 270	120'	B	370'-386'	7/22/61	6" to 5"	6.64	940
10	149,150,155, 156	351'	12"	142'-349' 201	111'	B	320'-338'	4/26/61	6" to 3½" 6" to 5"	5.33	860

mersible

*B = Test Pump "Layne-Bowler" 10 Stage-10" bowls. Ford V-8 Power Plant 400 H.P.

*A = Test Pump "Layne-Bowler" 7 stage-6" Diam. Minn. Moline Butane Power Plant 96 H.P.

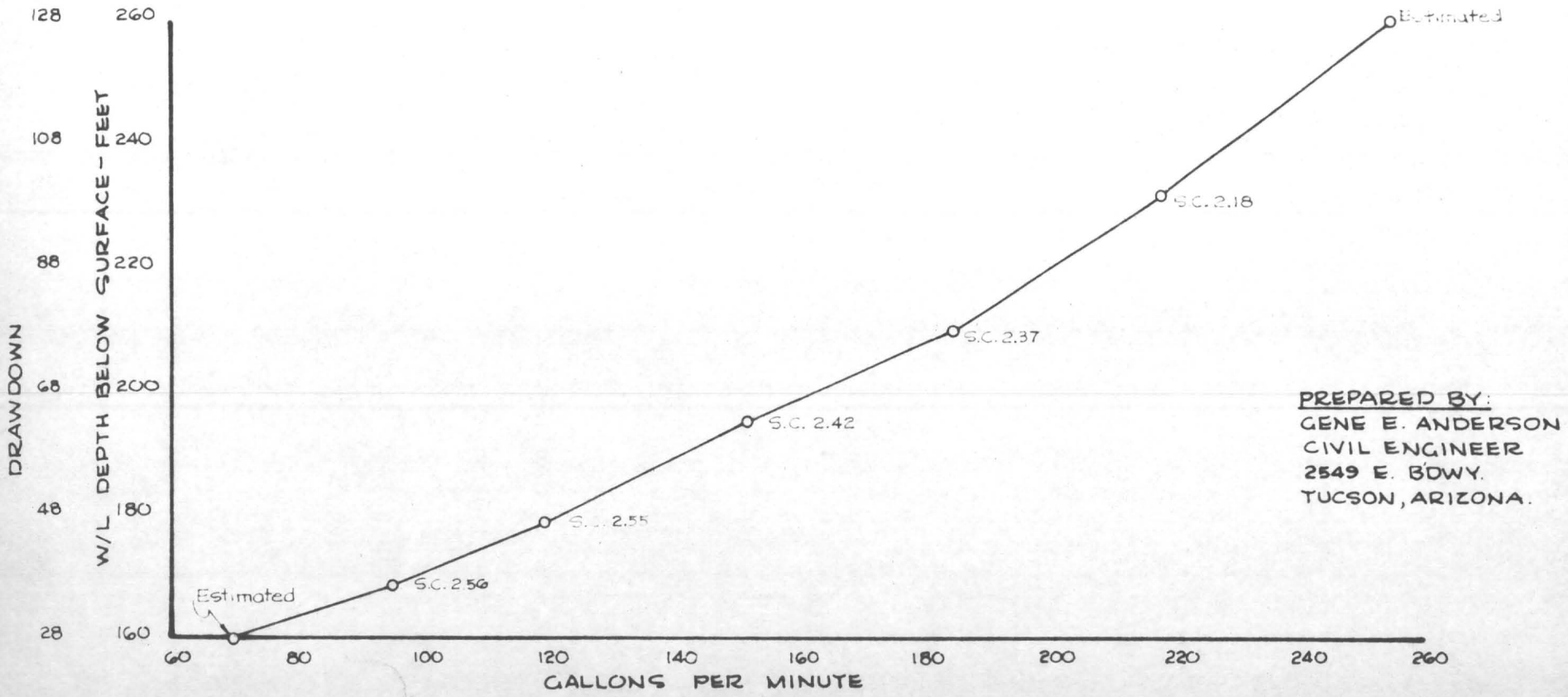
PUMPING TEST RESULTS
SUNIZONA ACRES #1

CENTER SW¼, SW¼, SEC. 8, T18S, R27E, G. & S.R.B. & M., COCHISE CO.

WELL No. 1

LOTS 1, 2, 23, 24

DEPTH OF WELL - 332'
10" DIA. CASING TO BOTTOM OF WELL - PERFORATED 160' TO 324'
4 PERFORATIONS AROUND, STAGGERED, TOTAL TWO 1' x 3/16" PERF./FT.
STATIC WATER LEVEL BEFORE START OF PUMPING - 132'
TEST PUMP - "LAYNE-BOWLER" - 7 STAGE - 6" DIA. - MINNEAPOLIS-MOLINE BUTANE POWER PLANT - 96 H.P.
TOP BOWLS - 250' - 7' BOWLS - 10' SUCTION - TOTAL DEPTH - 267'
STARTED PUMP @ 8:45 A.M. - WATER CLEAR @ 12:00 P.M.
ATTACHED 3" ORIFICE - 6" DISCHARGE PIPE @ 1:30 P.M.
WATER LEVEL READINGS BY AIR LINE AND GAUGE - 250' DEPTH
30 MINUTES BETWEEN READINGS.
AVERAGE SPECIFIC CAPACITY - 2.42' G.P.M./FT. DRAWDOWN



PREPARED BY:
GENE E. ANDERSON
CIVIL ENGINEER
2549 E. BDWY.
TUCSON, ARIZONA.

SUNIZONA ACRES UNIT Nº 1 - WELL LOG

CENTER OF SW¼ OF SW¼ OF SEC 8, T-18-S, R-21-E, G & SR B & M, COCHISE COUNTY, ARIZONA

LOT NOS 1, 2, 23, 24
WELL NO 1

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0 - 2	TOP SOIL - SANDY
2 - 17	CLEAN, COARSE GRAVEL
17 - 30	COARSE GRAVEL WITH CLAY
30 - 55	CLAY
55 - 90	SANDY CLAY
90 - 102	GRAVEL
102 - 140	SANDY CLAY
140 - 142	COARSE SAND - HAS LITTLE WATER - FIRST WATER
142 - 162	SANDY CLAY
162 - 165	COARSE SAND
165 - 190	SAND - CLAY
190 - 192	FINE SAND - DIRTY
192 - 230	SAND - CLAY
230 - 232	FINE SAND
232 - 252	SANDY CLAY
252 - 254	FINE SAND
254 - 262	SANDY CLAY
262 - 266	SMALL GRAVEL - BETTER WATER STRATA
266 - 280	CLAY
280 - 284	SMALL GRAVEL - GOOD WATER STRATA
284 - 307	CLAY
307 - 310	MEDIUM SIZE GRAVEL - GOOD WATER STRATA
310 - 331	GRITTY CLAY
331	BOTTOM OF HOLE

Too Shallow

NOTE:

CASING - PERFORATED 160' TO 324
4 CUTS AROUND STAGGERED
TOTAL - 2 CUTS PER FT
EACH CUT - 1'-0" X 0'-3/16"

PREPARED BY
GENE E ANDERSON
REG CIVIL ENGINEER
2549 E BROADWAY
TUCSON, ARIZONA
OCT 24, 1960

JOB Nº 641

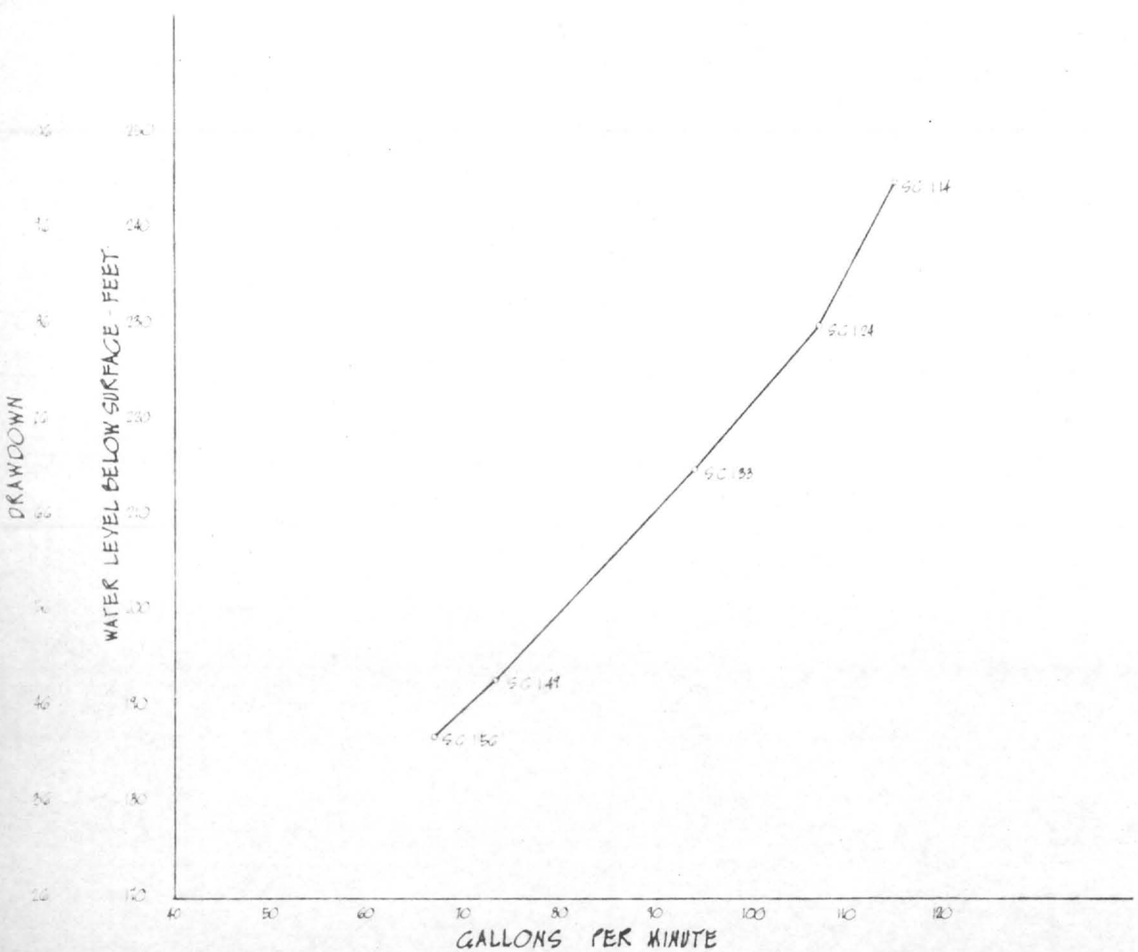
$C_s = 2.42$

PUMPING TEST RESULTS
SUNIZONA ACRES #1

CENTER, SE 1/4 OF SE 1/4, SEC. 8, T. 18 S., R. 27 E., G. & S. R. B. & M., COCHISE COUNTY, ARIZONA

WELL No 2

LOTS [illegible]



GENERAL NOTES:

1. DEPTH OF WELL 361 FT.
2. 10" CASING TO BOTTOM OF HOLE. PERFORATED [illegible] STAGGERED, 2 CUTS PER FOOT, EACH [illegible]
3. STATIC WATER LEVEL BEFORE PUMPING [illegible] AFTER PUMPING [illegible] AND STANDING OVERNIGHT 44
4. TEST PUMP LAYNE BOWLER [illegible] BUTANE POWER PLANT [illegible]
5. TOP BOWLS 240 [illegible] BOWLS [illegible]
6. WATER LEVEL BY AIR LINE AND GAUGE [illegible]
7. PUMPED [illegible] STARTED PUMP [illegible] WATER NEVER CLEARED, PUMPING LIGHT BROWN CLAY, SOME SAND [illegible]
8. MEASUREMENTS BY [illegible]
9. AVERAGE SPECIFIC CAPACITY [illegible] GPM PER FT. DRAWDOWN

PREPARED BY
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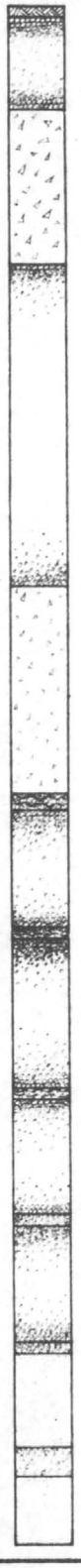
REG. CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZONA
10-15-60

SUNIZONA ACRES UNIT Nº 1 - WELL LOG

CENTER OF SE¼ OF SE¼ OF SE¼ OF SEC. 18 T-18 S. R. 27-E, G & S R & B & M. COCHISE COUNTY, ARIZONA

LOT NOS. 7, 8, 17, 18

WELL Nº 2



DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0 - 2	TOP SOIL
2 - 18	GRAVEL
18 - 45	CLAY WITH ROCK
45 - 101	GRAVEL
101 - 137	CONGLOMERATE ROCK
137 - 140	GRAVEL - SEEP (FIRST WATER)
140 - 160	GRAVEL - COMPACT
160 - 162	GRAVEL - SOFTER (BELIEVED TO HAVE WATER)
162 - 188	GRAVEL - COMPACT
188 - 190	GRAVEL - LOOSER - SOFT (BELIEVED TO HAVE WATER)
190 - 210	GRAVEL COMPACT (POSSIBLY CONGLOMERATE)
210 - 212	GRAVEL (POSSIBLE WATER STRATA)
212 - 232	GRAVEL - COMPACT
232 - 234	GRAVEL - (POSSIBLE WATER STRATA)
234 - 250	SANDY CLAY
250 - 255	GRAVEL (LOOKS GOOD)
255 - 267	LIGHT BROWN SANDY CLAY

Too Shallow

NOTES:

1. CASING PERFORATED 148' TO 267' 4 CUTS AROUND - 2 CUTS PER FOOT - EACH CUT 1'-0" X 0' 3/16"
2. STATIC WATER LEVEL BEFORE PUMPING - 139'
3. STATIC WATER LEVEL AFTER PUMPING 2.50 HOURS AND STANDING OVERNIGHT - 144'
4. SCALE - 1" = 20' (VERT.)

PREPARED BY
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REG. CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZONA

DEC. 15, 1960

JOB Nº 641

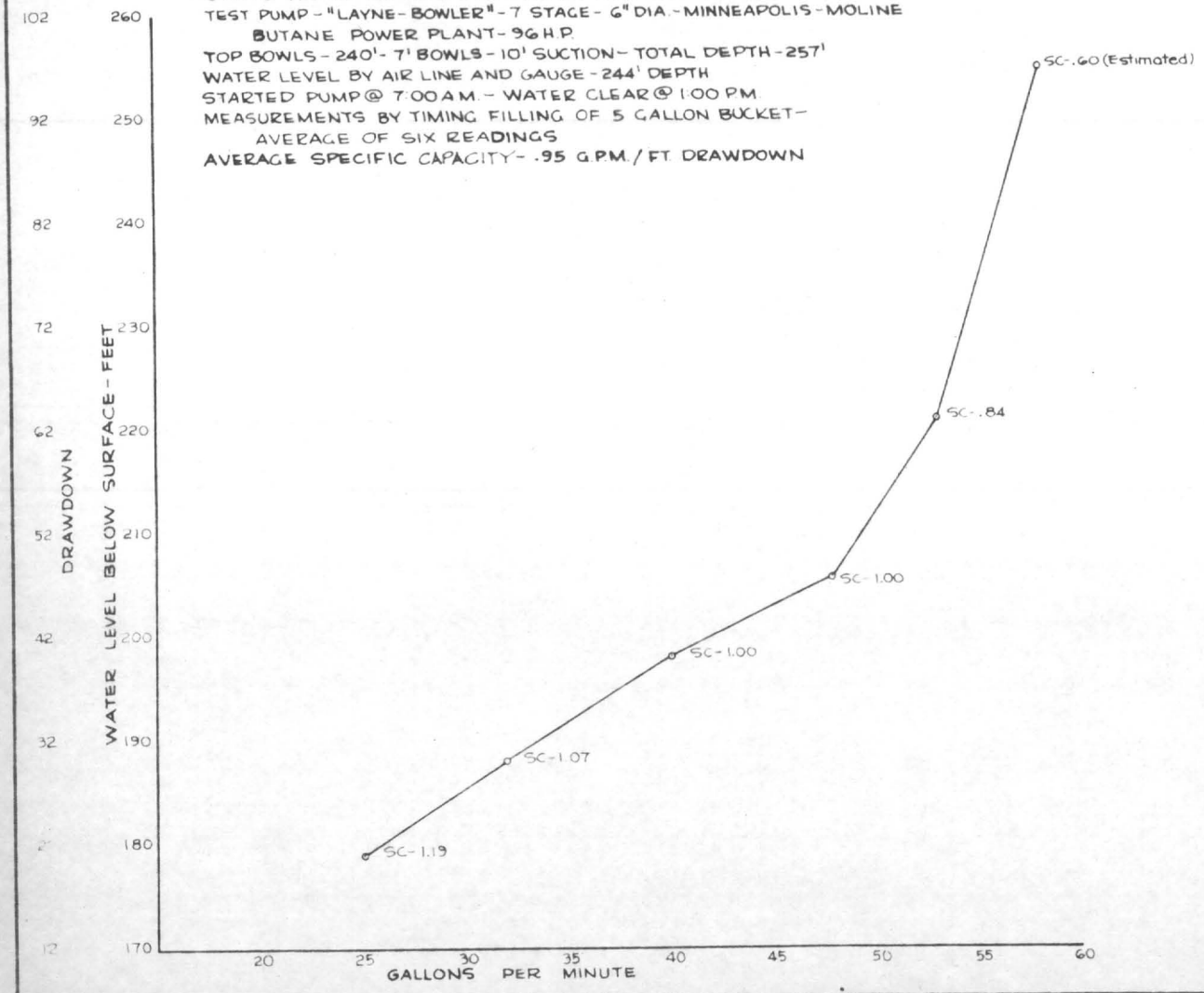
$C_5 = 1.35$

WELL NO. 3

PUMPING TEST RESULTS
SUNIZONA ACRES #1

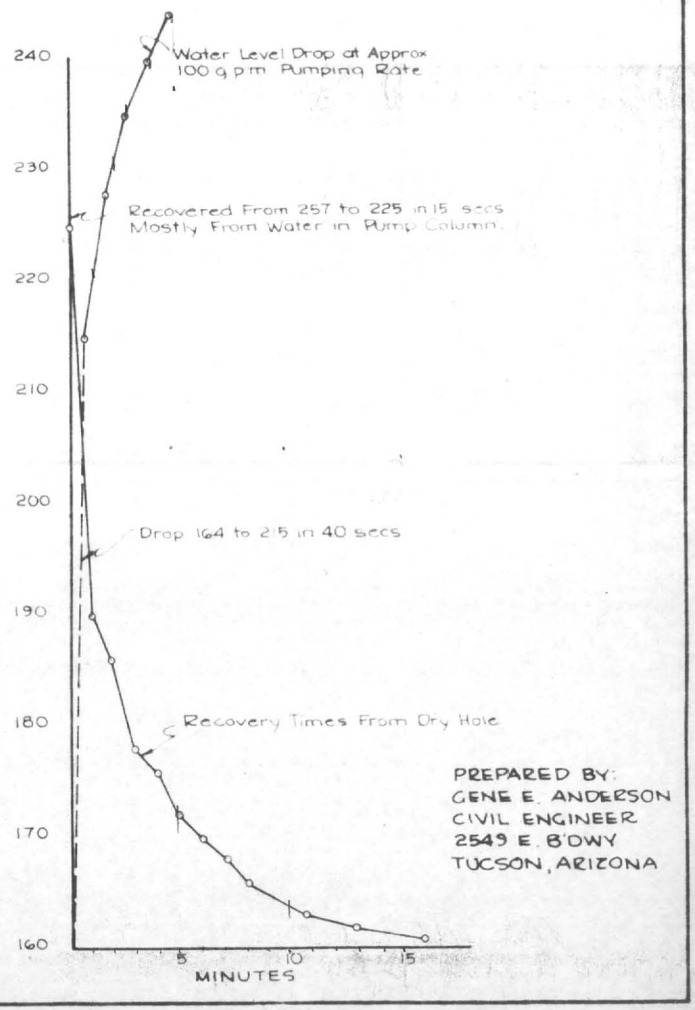
CENTER NE¼, SE¼, SEC. 9, T18S, R27E,
G. & S.R.B. & M., COCHISE COUNTY, ARIZONA
LOT NOS. 35, 36, 37, 38

DEPTH OF WELL - 263'
10" DIA. CASING TO BOTTOM OF WELL - PERFORATED 155' TO 259',
4 CUTS AROUND, STAGGERED, 2 CUTS PER FT., 1" x 3/16"
STATIC WATER LEVEL BEFORE START OF PUMPING - 158'
TEST PUMP - "LAYNE-BOWLER" - 7 STAGE - 6" DIA. - MINNEAPOLIS-MOLINE
BUTANE POWER PLANT - 96 H.P.
TOP BOWLS - 240' - 7' BOWLS - 10' SUCTION - TOTAL DEPTH - 257'
WATER LEVEL BY AIR LINE AND GAUGE - 244' DEPTH
STARTED PUMP @ 7:00 A.M. - WATER CLEAR @ 1:00 P.M.
MEASUREMENTS BY TIMING FILLING OF 5 GALLON BUCKET -
AVERAGE OF SIX READINGS
AVERAGE SPECIFIC CAPACITY - .95 G.P.M. / FT. DRAWDOWN



WELL No. 3

Lots 35, 36, 37, 38



PREPARED BY:
GENE E. ANDERSON
CIVIL ENGINEER
2549 E. B'DWY
TUCSON, ARIZONA

SUNIZONA ACRES UNIT Nº 1 - WELL LOG

CENTER OF NE¼ OF SE¼ OF SEC. 9, T-18-S, R-21 E.,
G & S.R.B & M., COCHISE COUNTY, ARIZONA

LOT NOS 35 - 38
WELL Nº 3

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
1 - 6	BLUE CLAY
6 - 33	DIRTY GRAVEL - BOULDERS
33 - 65	FINE CLAY
65 - 152	GRAVELLY CLAY
152 - 154	GRAVEL - FIRST WATER - SEEP
154 - 167	FINE CLAY
167 - 171	OPEN GRAVEL - WATER STRATA
171 - 193	FINE, LIGHT BROWN CLAY
193 - 197	GRAVEL
197 - 223	FINE, LIGHT BROWN CLAY
223 - 228	GRAVEL
228 - 248	FINE, STICKY, LIGHT BROWN CLAY
248 - 253	OPEN GRAVEL
253 - 263	CLAY

Too Shallow

NOTES:

1. SAND WASHED FROM HOLE WAS HARD SHARP & GRITTY
2. CASING PERFORATED 155 TO 253 - 4 CUTS AROUND STAGGERED 2 CUTS PER FOOT EACH CUT ¼" X 3" @ 3/16"
3. VERTICAL SCALE 1" = 20'

PREPARED BY
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2549 E. BROADWAY
TUCSON, ARIZONA
NOV. 3, 1950

JOB Nº 641

$C_S = .95$

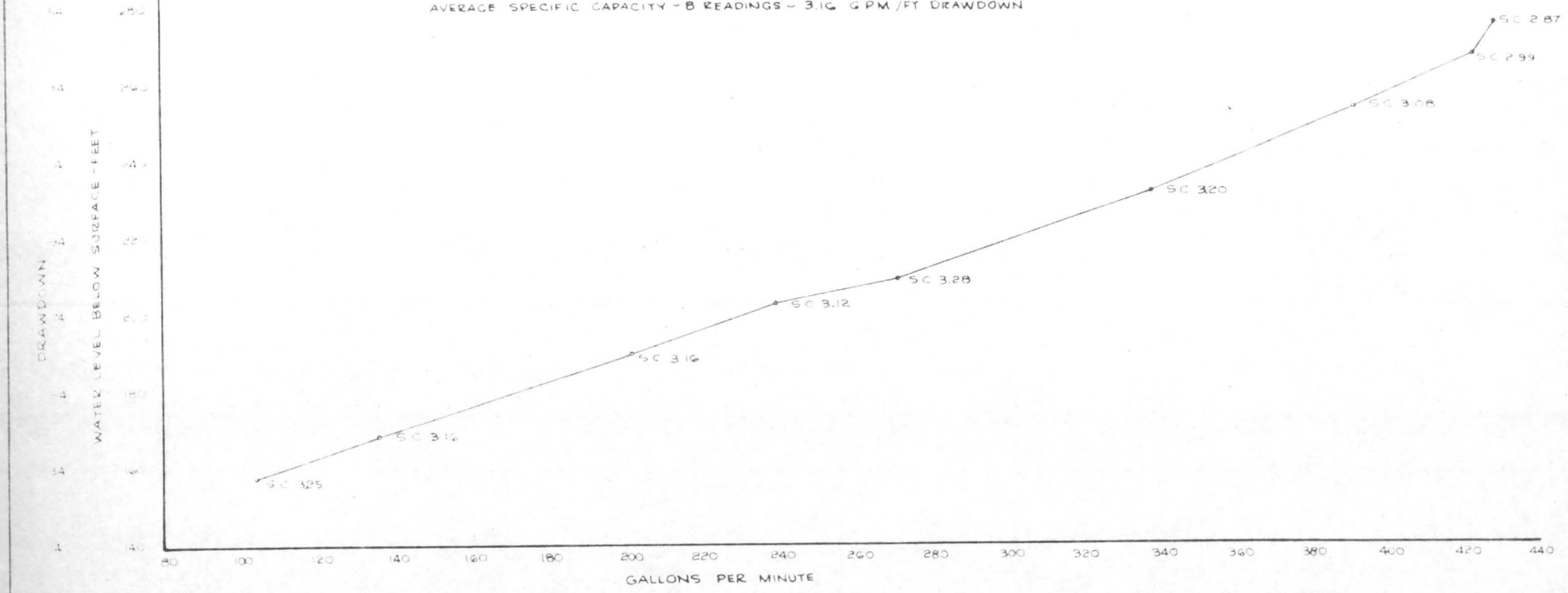
PUMPING TEST RESULTS
SUNIZONA ACRES #1

[CENTER S½, NW¼, SEC 8, T18S, R27E, G & SRB & M, COCHISE CO, ARIZONA]

WELL No. 4

Lots 50, 51, 54 55

DEPTH OF WELL - 350'
10" DIA CASING TO 316' DEPTH - PERFORATED 155' TO 315'
4 CUTS AROUND, STAGGERED 2 CUTS/FT, 1" x 3/16"
STATIC WATER LEVEL BEFORE START OF PUMPING - 126'
TEST PUMP: "LAYNE-BOWLER" - 7 STAGE - 6" DIA. - MINNEAPOLIS - MOLINE
BUTANE POWER PLANT - 96 H P
TOP BOWLS - 280' - 7' BOWLS - 10' SUCTION - TOTAL DEPTH = 297'
WATER LEVEL BY AIR LINE AND GAUGE - 280' DEPTH
STARTED PUMP @ 8.00 A.M - WATER CLEAR ALMOST IMMEDIATELY - SOME LIGHT BROWN CLAY
MEASUREMENTS BY 2" TO 5" ORIFICE AND 6" TO 3" ORIFICE
AVERAGE SPECIFIC CAPACITY - 8 READINGS - 3.16 G P M /FT DRAWDOWN



SUNIZONA ACRES UNIT Nº 1 - WELL LOG

CENTER S½, NW¼, SEC 8, T18S, R27E,
G & SRB & M, COCHISE COUNTY, ARIZ

LOT Nos 50, 51, 54, 55
WELL No 4

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
1-3	TOP SOIL
3-18	CALICHE
18-34	BOULDERS
34-60	CLAY ROCK (BOULDERS)
60-74	GRAVEL
74-103	CLAY-ROCK (BOULDERS)
103-132	GRAVEL-SEEPAGE - FIRST WATER (NOT ENOUGH TO DRILL WITH)
132-148	CLAY
148-150	GRAVEL (SOME WATER)
150-180	CLAY
180-183	GRAVEL
183-205	CLAY
205-208	GRAVEL AND SAND
208-225	CLAY
225-228	SAND WITH SMALL GRAVEL
228-307	SAND WITH NARROW STRIPS OF CLAY
307-309	GRAVEL AND SAND - POSSIBLE SOME WATER
309-350	COMPACT, GRITTY CLAY

Probable source of H_2O

Too shallow?

NOTE:
CASING PERFORATED 160'-324'
4 CUTS AROUND, STAGGERED
TOTAL = 2 CUTS PER FT
EACH CUT - 1'-0" x 3/16"

PREPARED BY
GENE E ANDERSON
REG. CIVIL ENGINEER
2549 E. BROWY
TUCSON, ARIZ

JOB Nº 641

$C_5 = 3.16$

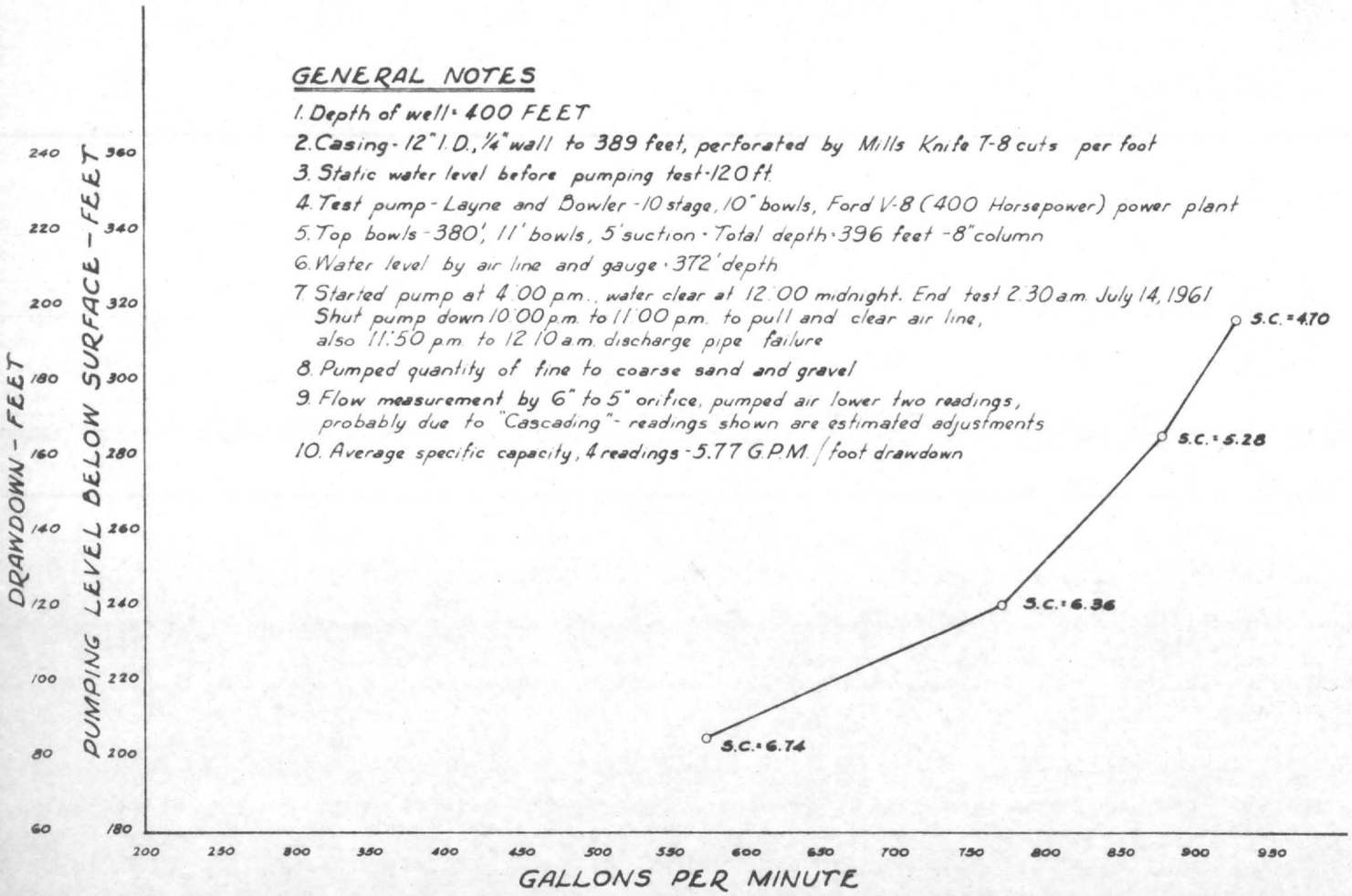
RNG

PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 5
Intersection Lots 75, 76, 77, & 78

GENERAL NOTES

1. Depth of well - 400 FEET
2. Casing - 12" I.D., ¼" wall to 389 feet, perforated by Mills Knife 7-8 cuts per foot
3. Static water level before pumping test - 120 ft.
4. Test pump - Layne and Bowler - 10 stage, 10" bowls, Ford V-8 (400 Horsepower) power plant
5. Top bowls - 380', 11' bowls, 5' suction - Total depth - 396 feet - 8" column
6. Water level by air line and gauge - 372' depth
7. Started pump at 4:00 p.m., water clear at 12:00 midnight. End test 2:30 a.m. July 14, 1961
   Shut pump down 10:00 p.m. to 11:00 p.m. to pull and clear air line,
   also 11:50 p.m. to 12:10 a.m. discharge pipe failure
8. Pumped quantity of fine to coarse sand and gravel
9. Flow measurement by 6" to 5" orifice, pumped air lower two readings,
   probably due to "Cascading" - readings shown are estimated adjustments
10. Average specific capacity, 4 readings - 5.77 G.P.M. / foot drawdown



PREPARED BY:
GENE E. ANDERSON
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2549 E. BROADWAY
TUCSON, ARIZONA
JULY 19, 1961

JOB Nº 785

WELL N° 5

SUNIZONA ACRES UNIT N° 2

SCALE 1"=10'

INTERSECTION - LOTS 75, 76, 77, 78

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-4	TOP SOIL
4-9	CLAY & GRAVEL
9-37	CEMENTED BOULDERS
37-43	CLAY & GRAVEL
43-49	RED SANDY CLAY
49-80	CLAY & GRAVEL
80-125	RED SANDY CLAY - STRUCK WATER at 120'
125-213	FINE SAND - LITTLE CLAY
213-335	RED SANDY CLAY
335-390	SANDY GRAVEL - LITTLE CAVEY
390-400	YELLOW SANDSTONE

NOTES:

1. CASING PERFORATED 120' TO 385' MILLS KNIFE 1-8 CUTS PER FOOT
2. STATIC WATER LEVEL - 120'
3. ENTIRE WELL DRILLED OPEN HOLE

PREPARED BY
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2549 E. BROADWAY
TUCSON, ARIZONA

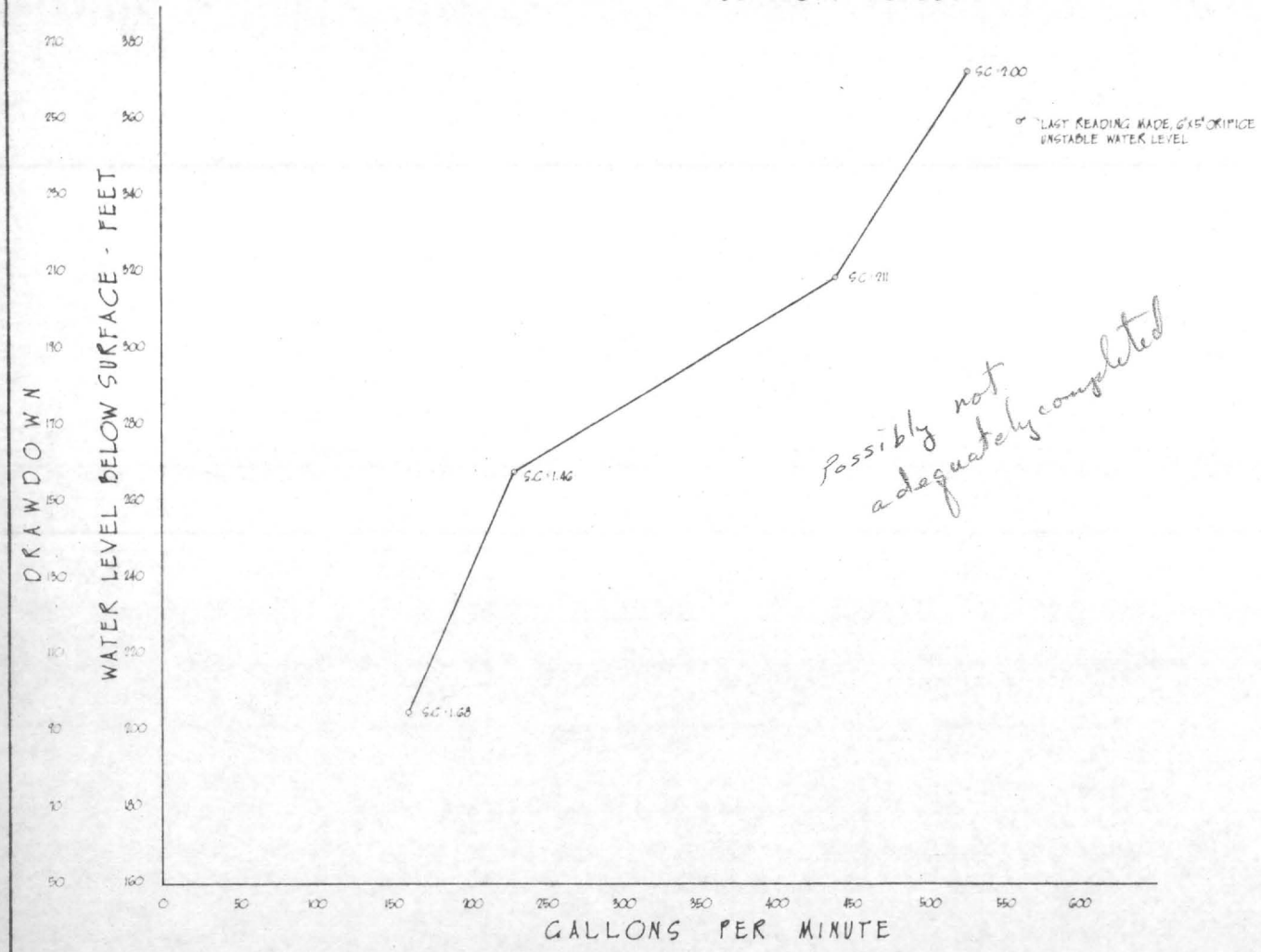
JOB N° 755

$Q_{20} = 5.77$

55'

PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 6
INTERSECTION - LOTS 81, 82, 95, & 96



GENERAL NOTES:

1. DEPTH OF WELL - 405 FT
2. 12" CASING (DIA.) - PERFORATED 186' TO 400' - 6' CUTS, STAGGERED - 3 1" x 3/16" CUTS PER FOOT
4. STATIC WATER LEVEL BEFORE START OF PUMPING 110 FT
5. TEST PUMP - LAYNE 6" BOWLER 7 STAGE, 10" BOWLS, 100 H.P. V.S. (400 HORSEPOWER) POWER PLANT
6. TOP BOWLS - 380', 8' BOWLS, 10' SUCTION - TOTAL DEPTH 398'
7. WATER LEVEL BY AIR LINE & GAUGE - 385 DEPTH
8. STARTED PUMP @ 11:8 A.M., ENDED TEST @ 5:30 P.M. (APRIL 19 1961)
9. MEASUREMENTS BY 6" 12.5 & 6" TO 8 1/2" ORIFICE
10. AVERAGE SPECIFIC CAPACITY - 4 READINGS 1.81 G.P.M. / FT. DRAWDOWN

PREPARED BY
GENE E. ANDERSON
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2549 E. BROADWAY
TUCSON, ARIZONA
5-1-61

JOB Nº 735

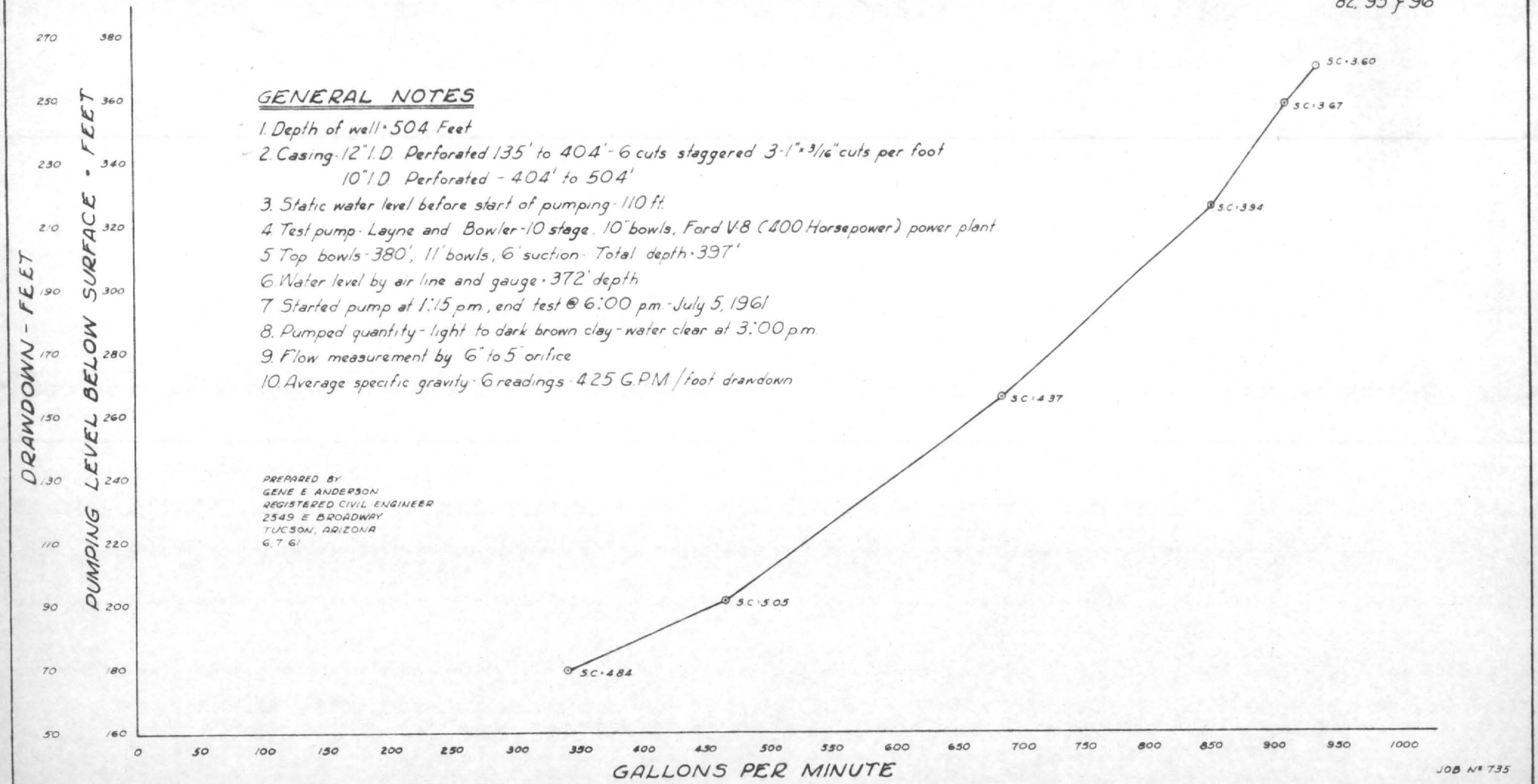
PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 6
Intersection - Lots 81, 82, 95 & 96

GENERAL NOTES

1. Depth of well - 504 Feet
2. Casing - 12" I.D. Perforated 135' to 404' - 6 cuts staggered 3 - 1" x 3/16" cuts per foot
   10" I.D. Perforated - 404' to 504'
3. Static water level before start of pumping - 110 ft.
4. Test pump - Layne and Bowler - 10 stage. 10" bowls, Ford V-8 (400 Horsepower) power plant
5. Top bowls - 380', 11' bowls, 6' suction - Total depth - 397'
6. Water level by air line and gauge - 372' depth
7. Started pump at 1:15 p.m., end test @ 6:00 pm - July 5, 1961
8. Pumped quantity - light to dark brown clay - water clear at 3:00 p.m.
9. Flow measurement by 6" to 5" orifice
10. Average specific gravity - 6 readings - 4.25 G.P.M./foot drawdown

PREPARED BY
GENE E. ANDERSON
REGISTERED CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZONA
6.7.61



JOB Nº 735

WELL N°6

SUNIZONA ACRES UNIT N° 2 - WELL LOG

INTERSECTION LOTS 14, 15, 19 & 20

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-5	SANDY LOAM TOP SOIL
5-10	CLEAN GRAVEL
10-20	GRAVELLY CLAY
20-30	RED CLAY
30-80	GRAVELLY CLAY
80-100	GRAVELLY CLAY
100-120	SANDY CLAY
120-125	FINE SAND WATER)
125-135	ROCKY RED CLAY
135-140	" " "
140-145	COARSE GRAVEL & SAND
145-165	SANDY CLAY
165-185	GRAVEL & SAND WATER
185-220	SANDY CLAY
220-230	ROCKY CLAY
230-240	SANDY CLAY
240-245	CLAY & ROCK
245-250	GRAVEL & SAND WATER
250-270	SANDY CLAY
270-275	GRAVEL & SAND WATER
275-295	SANDY CLAY
295-296	GRAVEL & SAND (WATER)
296-360	SANDY CLAY
360-361	GRAVEL GRAVEL FINE SAND (WATER)
361-380	SANDY CLAY
380-386	COARSE GRAVEL WATER
386-390	SANDY CLAY
390-409	CLAY
409-408	STICKY CLAY
408-445	LIGHT PURPLE CONGLOMERATE
440-445	BELIEVED TO BE WATER
445-504	ROCK

Basement

USGS LOG

405-445	GRAVELLY SAND
445-504	MUDDY GRAVELLY SAND PROBABLY NOT WATER YIELDING

NOTES:

1. 12" I.D. CASING FROM SURFACE TO 405. PERFORATED FROM 156-ft TO 400 WITH 3 1/2" x 1/16" CUTS PER FOOT. 10" I.D. CASING FROM 400' TO 504' PERFORATED FULL LENGTH 2 1/2" x 1/16" CUTS PER FOOT, 4 CUTS AROUND
2. FIRST WATER ENCOUNTERED AT 120' AT SECOND ENCOUNTER (140'-145') WATER LEVEL ROSE TO 116. REMAINED THERE TILL DEPTH OF 245' 2ND WAS REACHED, THEN ROSE TO 110 & REMAINED THERE.
3. MOST ACTIVE FORMATION WAS AT 296'-360' DEPTH. WASHED A GREAT DEAL OF MATERIAL FROM THIS LEVEL.

PREPARED BY:
GENE E. ANDERSON
REG. CIVIL ENGINEER
1549 E. BROADWAY
TUCSON, ARIZONA
JULY 9, 1961

JOB N° 759

$C_s = 4.25$ 37'

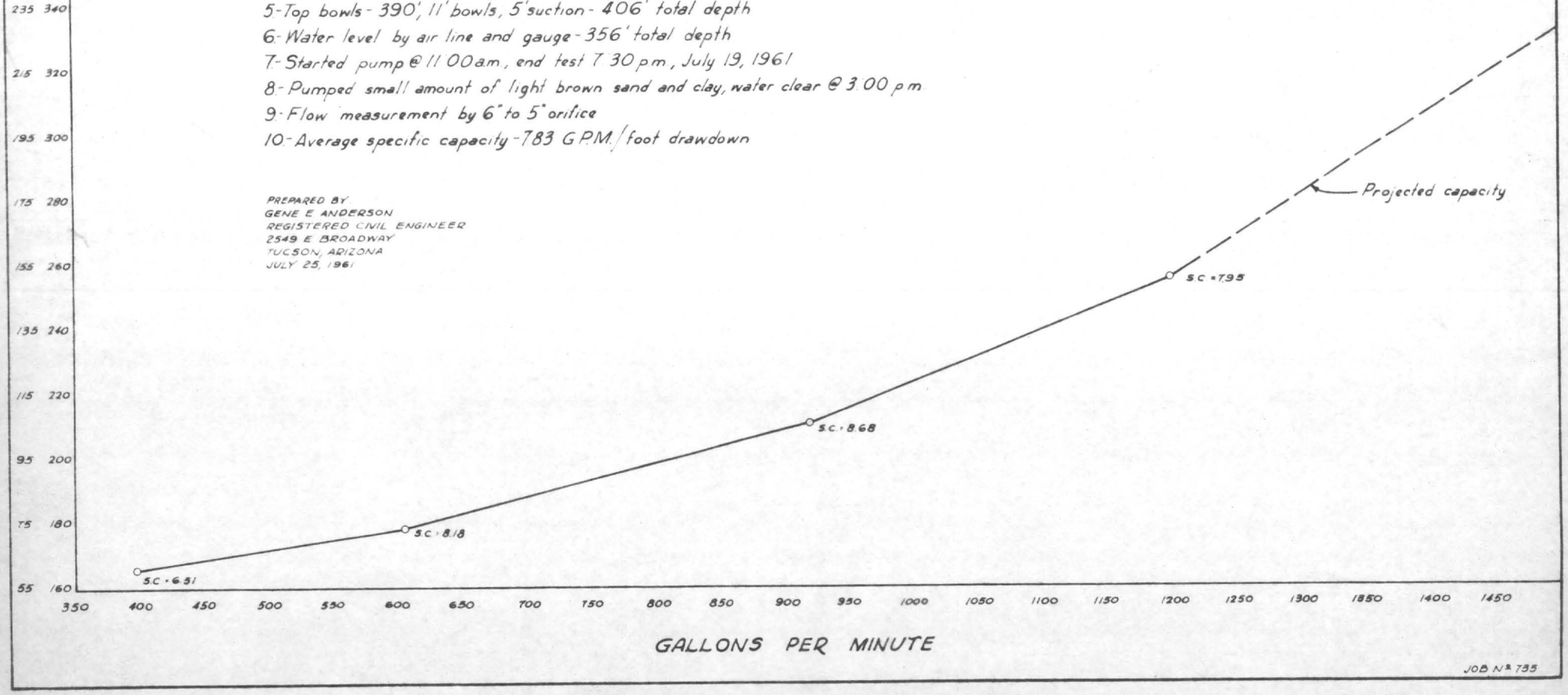
PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 7
Corner - Lots 85, 86, 91 & 92

GENERAL NOTES

1- Depth of well = 433 Feet
2- Casing - 12" I.D., ¼" wall, perforated 105' to 432', Mills Knife, 7-8 cuts per foot
3- Static water level before start of pumping - 105 Feet
4- Test pump - Layne and Bowler - 10 stage, 10" bowls, Ford V-8 (400 Horsepower) power plant
5- Top bowls - 390', 11' bowls, 5' suction - 406' total depth
6- Water level by air line and gauge - 356' total depth
7- Started pump @ 11:00 a.m., end test 7:30 p.m., July 19, 1961
8- Pumped small amount of light brown sand and clay, water clear @ 3:00 p.m.
9- Flow measurement by 6" to 5" orifice
10- Average specific capacity - 7.83 G.P.M./foot drawdown

PREPARED BY
GENE E. ANDERSON
REGISTERED CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZONA
JULY 25, 1961



JOB Nº 735

WELL N° 7

SUNIZONA ACRES UNIT N° 2 WELL LOG

CORNER - LOTS 85, 86, 91 & 92

SCALE: 1" = 20'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-8	TOP SOIL
8-39	CLAY & BOULDERS
39-105	SAND GRAVEL & CLAY
105-130	RED SANDY CLAY - STRUCK WATER 108'
130-180	SAND LITTLE CLAY
180-237	FINE RED SAND - LITTLE CLAY
237-385	SAND GRAVEL, SOME CLAY
385-423	CEMENTED GRAVEL
423-433	ROCK GRAY Basement

NOTES

1- CASING - 12" I.D., ¼" WALL, PERFORATED 105' TO 432', MILLS KNIFE, T-8 CUTS PER FOOT
2- STATIC WATER LEVEL BEFORE START OF PUMPING 105'
3- SURGED WELL 18 HRS - 70' SAND REMOVED
4- WHOLE WELL DRILLED OPEN HOLE

PREPARED BY
GENE E. ANDERSON
REG. CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZ.

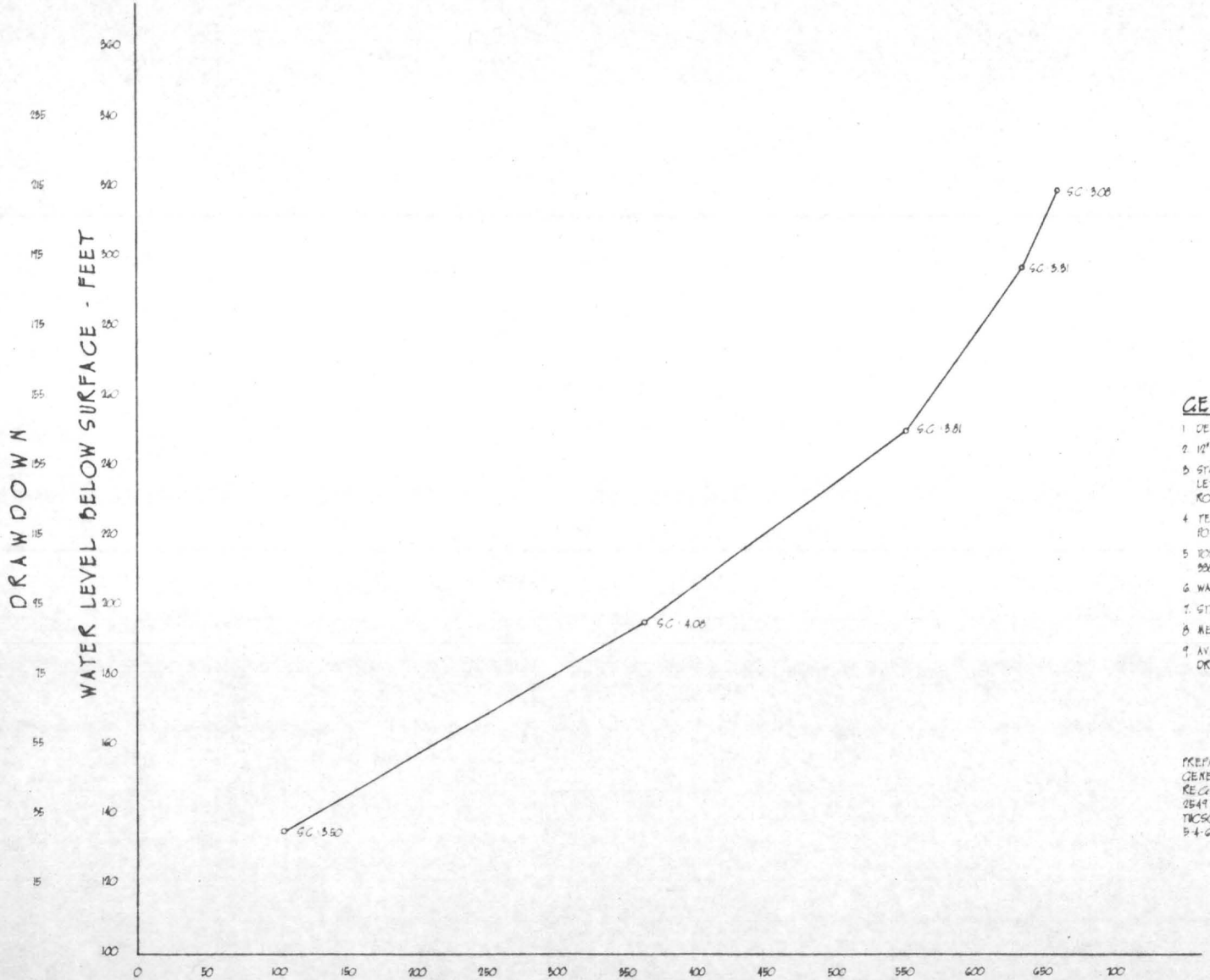
JOB N° 735

$C_s = 7.83$, 38'

[$C_s = 1.81$ @ 403' TD]

PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 8
INTERSECTION: LOTS 117, 118, 123 & 124



GENERAL NOTES:

1. DEPTH OF WELL 368'
2. 12" DIAMETER CASING
3. STATIC WATER LEVEL 108' BEFORE START OF PUMPING. FIRST WATER LEVEL AT 110', STAYED AT 110' UNTIL 256' DEPTH WAS REACHED. THEN ROSE TO 108' & STAYED.
4. TEST PUMP 'LAYNE & BOWLER' 7 STAGE, 10 BOWLS, 400 HP WKD V-8 POWER PLANT.
5. 10' BOWLS - 320' TO TOP OF BOWLS. 8 BOWLS, 10' SUCTION. TOTAL DEPTH 368'
6. WATER LEVEL BY AIR LINE & GAUGE. 350' TOTAL DEPTH
7. STARTED PUMP @ 10:45 A.M. ENDED TEST @ 8:15 P.M. APRIL 24, 1961
8. MEASUREMENTS BY 6" 90 B' ORIFICE & 6" 90 B 2" ORIFICE
9. AVERAGE SPECIFIC CAPACITY - 5 READINGS, 3.56 G.P.M./FT. OF DRAWDOWN

PREPARED BY
GENE E. ANDERSON
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2549 E. BROADWAY
TUCSON, ARIZONA
5-4-61

JOB Nº 755

WELL N° 8

SUNIZONA ACRES UNIT N° 2 - WELL LOG

SCALE: 1" = 20'

INTERSECTION - LOTS 117, 118, 123 & 124

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0 - 4	TOP SOIL
4 - 7	CLAY
7 - 15	GRAVEL
15 - 42	CLAY
42 - 52	RED CLAY
52 - 80	SANDY CLAY
80 - 90	SANDY CLAY
90 - 100	GRAVELY CLAY
100 - 110	GRAVELY CLAY
110 - 115	SMALL GRAVEL (FIRST WATER)
115 - 140	SANDY CLAY
140 - 142	COARSE GRAVEL (WATER)
142 - 166	GRAVELY CLAY
166 - 168	SAND & GRAVEL (WATER)
168 - 200	SANDY CLAY
200 - 202	GRAVEL (WATER)
202 - 253	SANDY CLAY
253 - 257	COARSE GRAVEL (WATER)
257 - 318	SANDY CLAY
318 - 330	SAND
330 - 388	SANDY CLAY
338 - 342	COARSE GRAVEL & SAND (WATER)
342 - 353	CLAY & CONGLOMERATE ROCK

Prob. Aquifer

NOTES:

1. CASING PERFORATED 140' TO 358' - 3 10"x0" 3/16" CUTS PER FOOT
2. ENCOUNTERED FIRST WATER AT 110'. WATER LEVEL REMAINED AT 110' TILL 255' DEPTH WAS REACHED, THEN ROSE TO 105' & REMAINED THERE
3. WASHED A GREAT DEAL OF FINE SAND FROM 318' - 330' LEVEL.

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TUCSON, ARIZONA
MAY 5, 1961

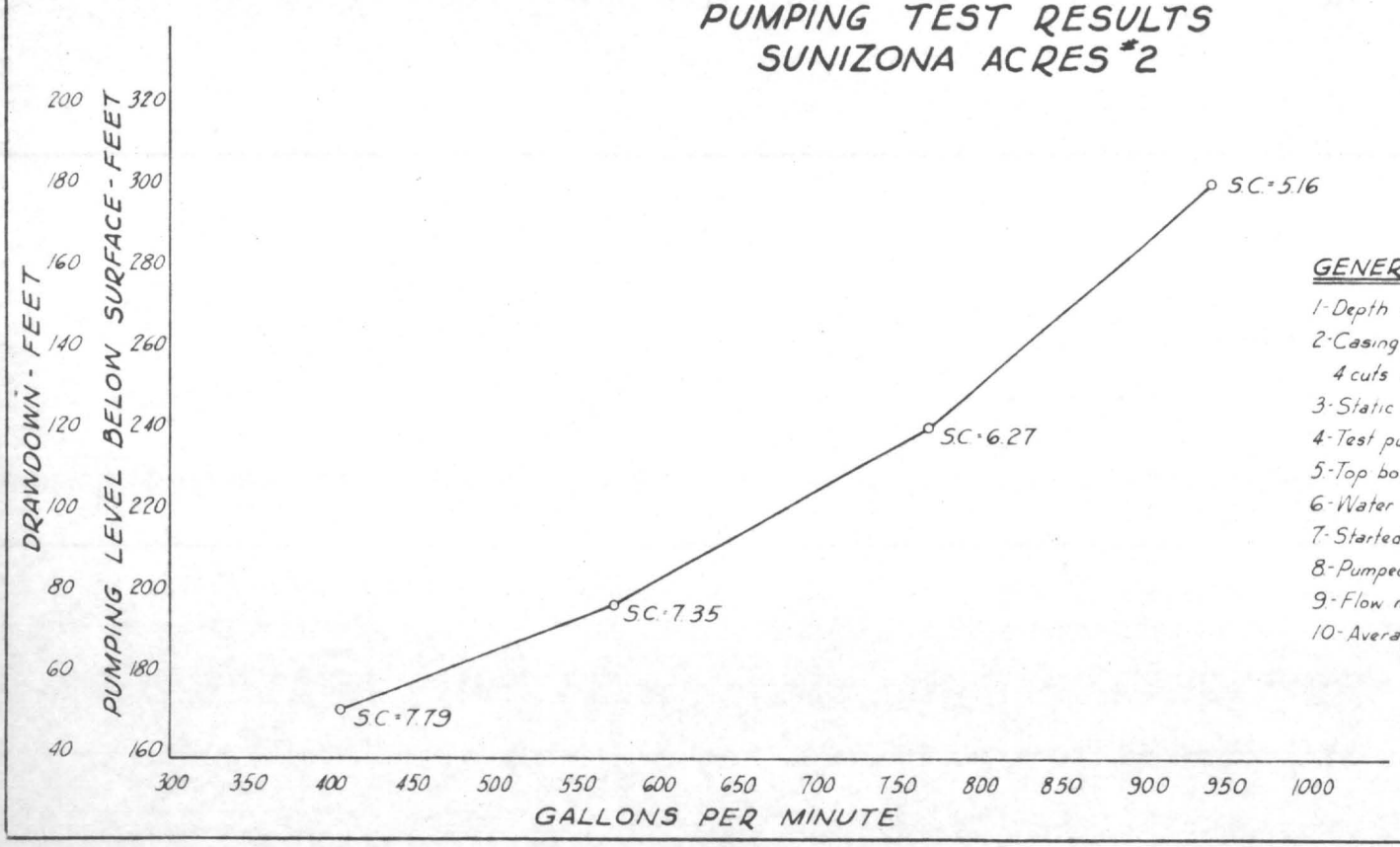
JOB N° 135

$C_S = 3.56$

15'

PUMPING TEST RESULTS
SUNIZONA ACRES #2

WELL Nº 9
Corner Lots - 113, 114, 127 & 128



GENERAL NOTES

1- Depth of well - 392'
2- Casing - 12" I.D. 1/4" wall, perforated 122' to 392', 4 cuts staggered - 12" x 1/2", 12" rings
3- Static water level before start of pumping - 120'
4- Test pump - Layne & Bowler - 10 stage, 10" bowls, Ford V-8 (400 h.p.) PP
5- Top bowls - 370', 11' bowls, 5' suction, total length 386', 8" column
6- Water level by air line and gauge - 356' total depth
7- Started pump @ 1.30 p.m., end test @ 7.30 p.m., July 22, 1961
8- Pumped some light brown sand, water clear at 4.00 p.m.
9- Flow measurement by 6" to 5" orifice
10- Average specific capacity - 6.64 GPM / foot drawdown

PREPARED BY
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TUCSON, ARIZONA
JULY 26, 1961

JOB Nº 735

WELL Nº 9

SUNIZONA ACRES UNIT Nº2 WELL LOG

SCALE 1"=20'

CORNER LOTS 113, 114, 129 & 128

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-7	TOP SOIL
7-22	CLAY & BOULDERS
22-27	RED CLAY
27-55	CLAY & BOULDERS
55-103	RED SANDY CLAY
103-175	CLAY & GRAVEL
175-218	RED SANDY CLAY - FINE SAND
218-315	RED SANDY CLAY - STICKY
315-345	RED CLAY & GRAVEL
345-367	RED HARD CONGLOMERATE - RED ROCK
367-392	CEMENTED BOULDERS - RED ROCK

Notes

1. CASING PERFORATED 122' TO 392' 4 CUTS STAGGERED - 12"x⅝", 12" RINGS
2. STATIC WATER LEVEL - 120'

PREPARED BY:
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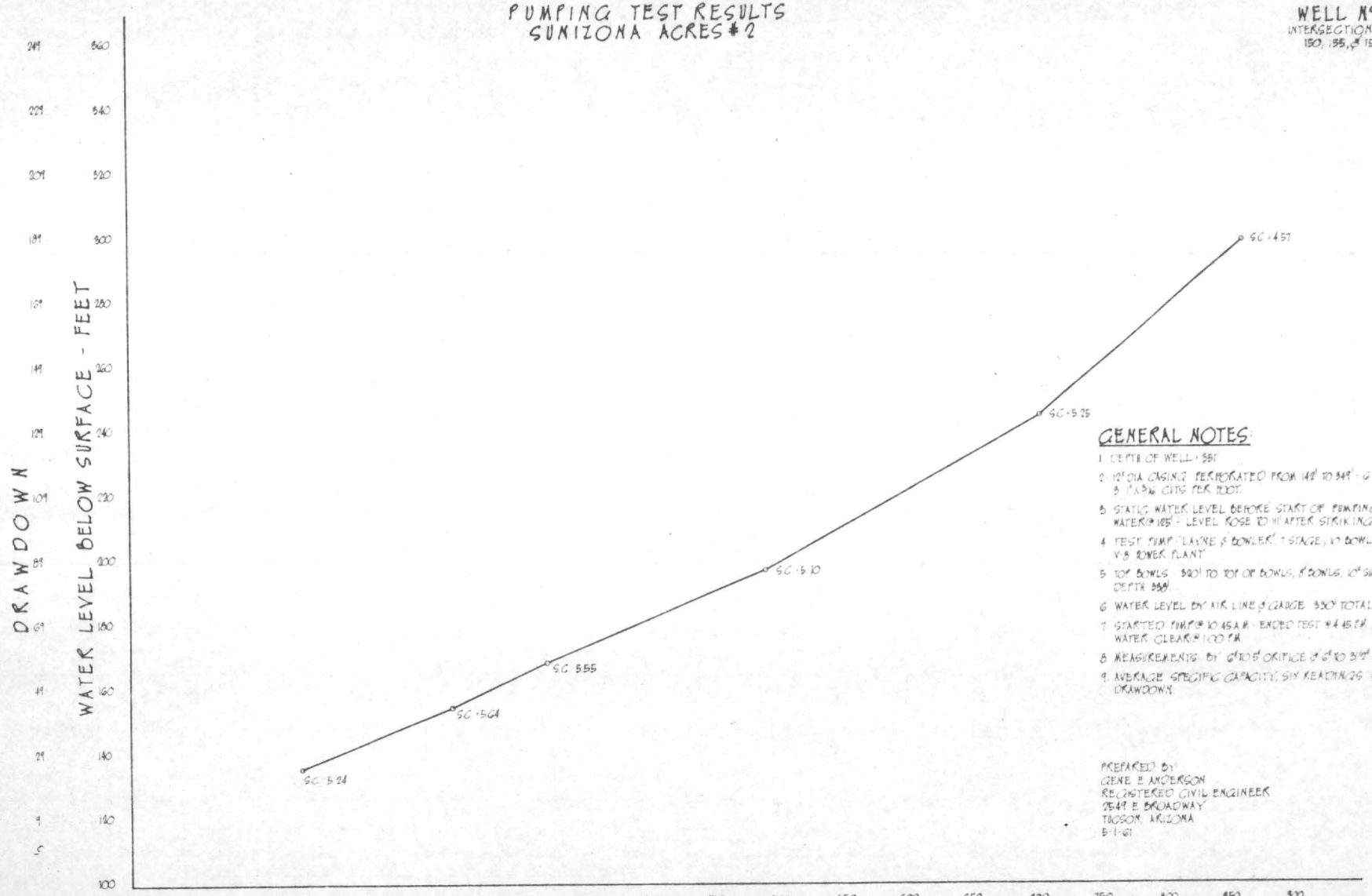
TUCSON, ARIZONA
JULY 29, 1961

$C_S = 6.64$ 77'

PUMPING TEST RESULTS
SUNIZONA ACRES # 2

WELL Nº 10
INTERSECTION - LOTS 149, 150, 155, & 156



GENERAL NOTES:

1. DEPTH OF WELL - 581'
2. 12" DIA CASING PERFORATED FROM 148' TO 349' - 6 CUTS STAGGERED - 3 1"x3/16 CUTS PER FOOT.
3. STATIC WATER LEVEL BEFORE START OF PUMPING - 111' FIRST WATER @ 185' - LEVEL ROSE TO 111' AFTER STRIKING 144-148 FORMATION
4. TEST PUMP "LAYNE & BOWLER" 1 STAGE, 10 BOWLS, 400 HP FOKO V-8 POWER PLANT
5. TOP BOWLS 320' TO TOP OF BOWLS, 8 BOWLS, 10" SUCTION - TOTAL DEPTH 550'
6. WATER LEVEL BY AIR LINE & GAUGE 330' TOTAL DEPTH
7. STARTED PUMP @ 10:45 A.M. - ENDED TEST @ 4:45 P.M., APRIL 26, 1961 - WATER CLEAR @ 1:00 P.M.
8. MEASUREMENTS BY 6" TO 8" ORIFICE & 6" TO 3 1/2" ORIFICE
9. AVERAGE SPECIFIC CAPACITY, SIX READINGS 5.33 GPM/FT DRAWDOWN.

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TUCSON, ARIZONA
5-1-61

JOB Nº 755

10

WELL Nº 10

SUNIZONA ACRES UNIT Nº 2 - WELL LOG

INTERSECTION LOTS 149, 150, 155, & 156

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-10	HEAVY TOP SOIL
10-20	GRAVEL & SAND
20-32	RED CLAY
32-60	SANDY CLAY
60-144	VERY SANDY CLAY
144-148	COARSE SAND & GRAVEL (FIRST WATER)
148-154	SANDY CLAY
154-156	COARSE SAND
156-175	SANDY CLAY
175-180	GRAVEL (WATER)
180-220	SOFT CEMENTED SANDSTONE
220-225	COARSE SAND (WATER)
225-238	SOFT SANDSTONE
238-243	CLAY
243-245	GRAVEL (WATER)
245-248	VERY STICKY CLAY
248-260	CONGLOMERATE ROCK
260-268	GRAVEL (WATER)
268-290	CONGLOMERATE ROCK
290-298	VERY LOOSE ROCK
298-321	CONGLOMERATE ROCK
321-325	CLEAN GRAVEL (WATER)
325-351	CONGLOMERATE ROCK

NOTES:

1. WASHED MOST MATERIAL FROM 321' TO 325' LOTS OF SHARP SAND ABOUT THE SIZE OF ANT GRAVEL.
2. A VERY SMALL SEEP APPEARED @ 125' TOO SMALL AN AMOUNT TO DRILL ON AT 144' TO 148' WATER RAISED TO 114' REMAINED THERE.
3. VERTICAL SCALE 1" = 20'

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MAY 4, 1961

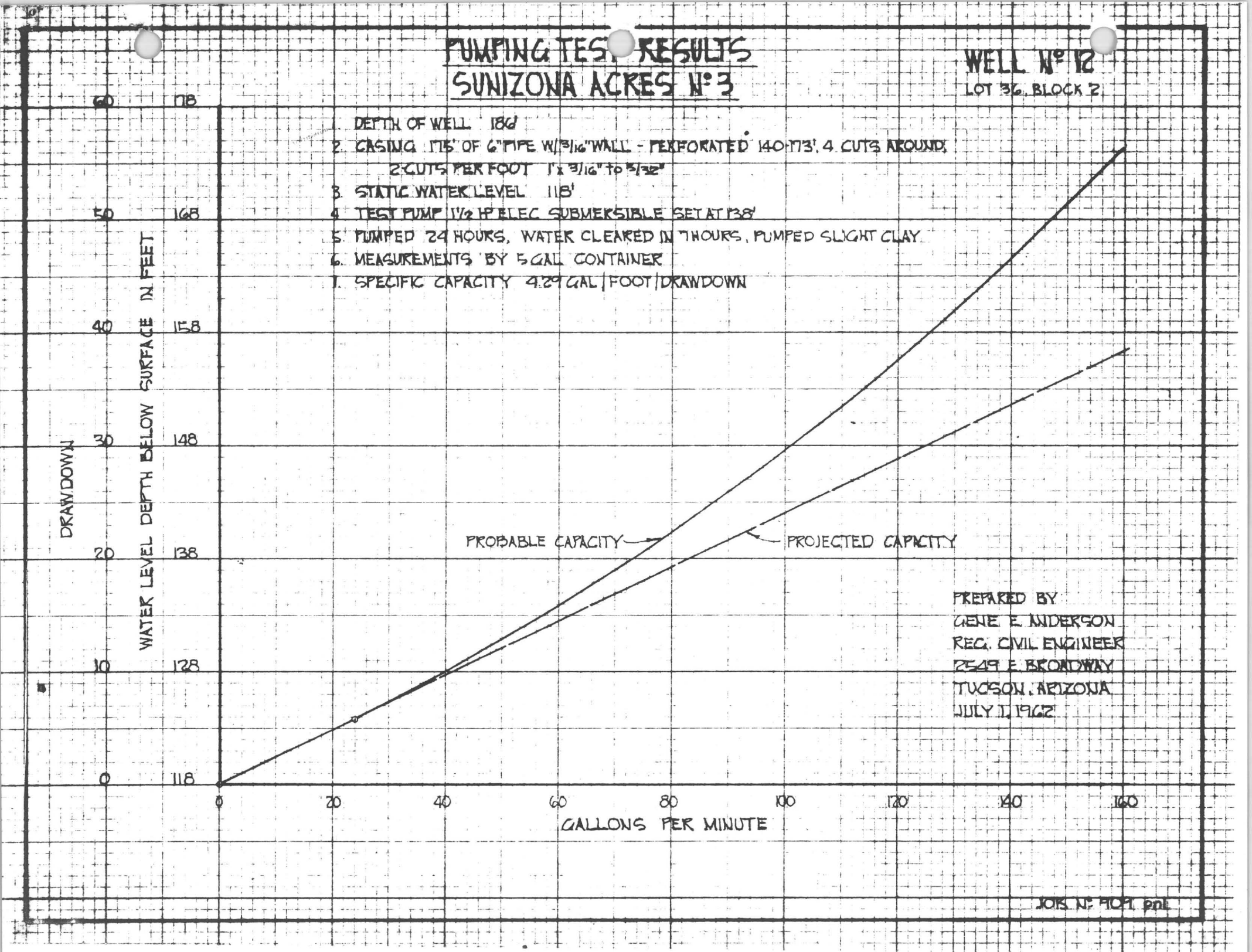
JOB Nº 735

$C_5 = 5.33$

PUMPING TEST RESULTS
SUNIZONA ACRES Nº 3

WELL Nº 12
LOT 36, BLOCK 2

1. DEPTH OF WELL 180'
2. CASING 175' OF 6" PIPE W/ 3/16" WALL - PERFORATED 140-173', 4 CUTS AROUND, 2 CUTS PER FOOT 1" x 3/16" to 5/32"
3. STATIC WATER LEVEL 118'
4. TEST PUMP 1½ HP ELEC SUBMERSIBLE SET AT 138'
5. PUMPED 24 HOURS, WATER CLEARED IN 7 HOURS, PUMPED SLIGHT CLAY
6. MEASUREMENTS BY 5 GAL CONTAINER
7. SPECIFIC CAPACITY 4.29 GAL/FOOT/DRAWDOWN



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TUCSON, ARIZONA

JULY 1, 1962

JOB Nº 9109 pnk

WELL Nº 12

SUNIZONA ACRES UNIT Nº 3 - WELL LOG

LOT 36, BLOCK 2

SCALE 1" = 30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
1-4	TOP SOIL, SANDY
4-12	GRAVEL AND SAND
12-28	GRAVEL AND SAND
28-40	GRAVEL AND CLAY
40-62	RED CLAY
62-70	SANDY CLAY
70-76	REAL FINE SAND
76-90	GRAVEL AND SAND
90-115	SANDY, GRAVELY CLAY
115-140	GRAVELY CLAY (135) SEEP
140-143	SANDY CLAY
143-148	GRAVEL, WATER, LOOSE GRAVEL WATER ROSE TO 110'
148-165	SANDY CLAY
165-169	SAND, SMALL GRAVEL, WATER
169-186	SANDY CLAY

NOTES:

1. CASING 175' 6" PIPE WITH 3/16" WALL
2. 32' OF 8" SURFACE PIPE
3. PERFORATED FROM 140' - 173', 4 CUTS AROUND, 2 CUTS PER FOOT 1' x 3/16" to 5/32"
4. STANDING LEVEL 110'
5. TEST PUMP 1½HP ELEC. SUBMERSIBLE SET AT 138'

PREPARED BY:
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TUCSON, ARIZONA
JUNE 29, 1962

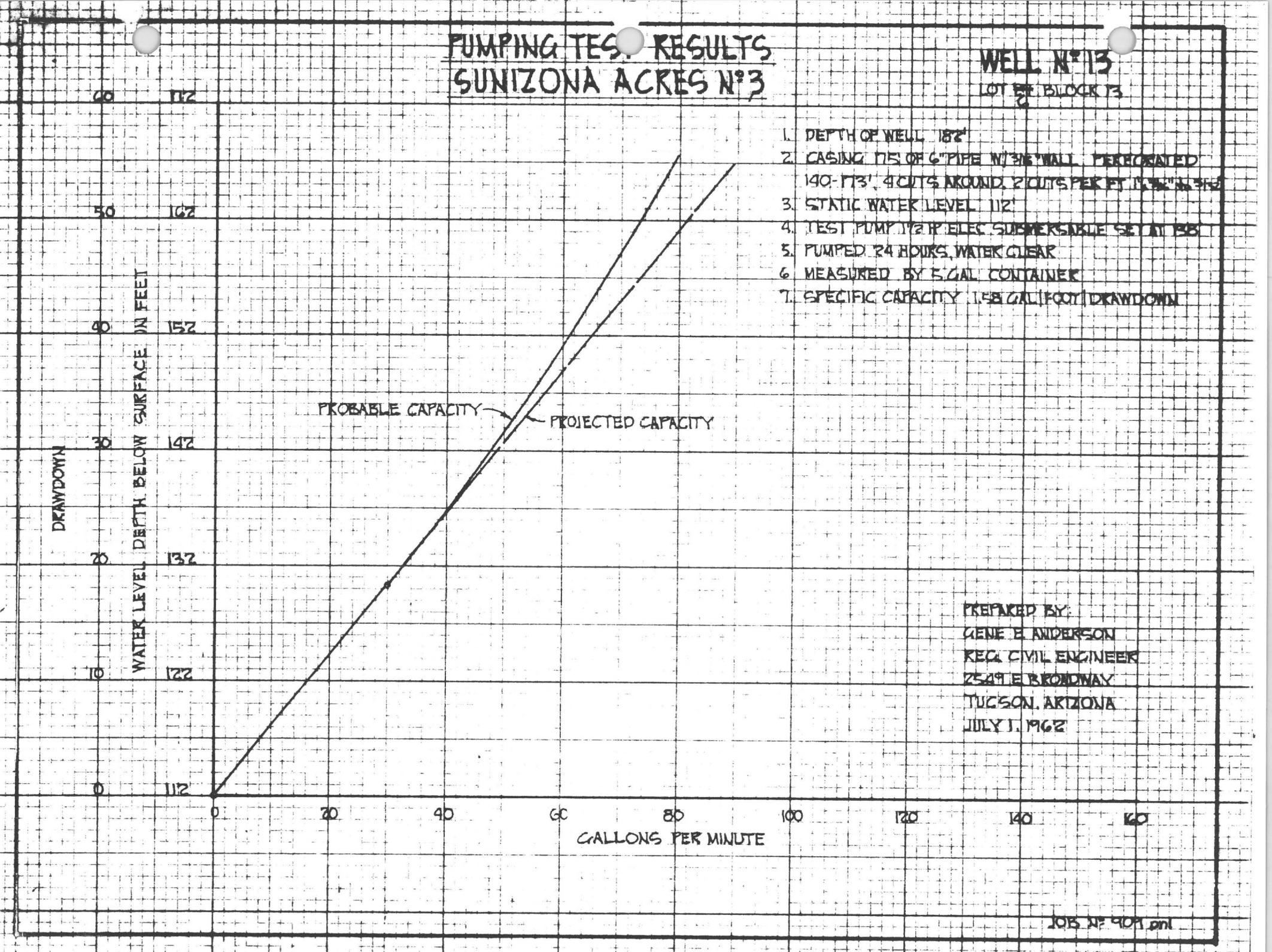
JOB Nº 909 pnl

PUMPING TEST RESULTS
SUNIZONA ACRES N°3

WELL N° 13

LOT 82 BLOCK 13

1. DEPTH OF WELL 182'
2. CASING 175' OF 6" PIPE W/ 3/16" WALL PERFORATED 140-173', 4 CUTS AROUND, 2 CUTS PER FT 1 3/8" to 3/4"
3. STATIC WATER LEVEL 112'
4. TEST PUMP 1½ HP ELEC SUBMERSIBLE SET AT 158'
5. PUMPED 24 HOURS, WATER CLEAR
6. MEASURED BY 5 GAL CONTAINER
7. SPECIFIC CAPACITY 1.58 GAL/FOOT/DRAWDOWN



PREPARED BY:
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2549 E BROADWAY
TUCSON, ARIZONA
JULY 1, 1962

JOB N° 9091 gnl

WELL Nº 13

SUNIZONA ACRES UNIT Nº 3 - WELL LOG

LOT ~~29~~ 6, BLOCK 13

SCALE 1"=30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
1-5	SAND
5-10	GRAVEL
10-20	SAND
20-25	GRAVEL
25-40	SAND
40-60	RED CLAY
60-85	RED CLAY WITH FINE SAND
85-100	FINE SAND LITTLE CLAY
100-110	GRAVEL AND CLAY
110-115	SAND AND GRAVEL
115-117	SAND, VERY LITTLE WATER
117-125	SANDY CLAY
125-130	SAND, GRAVEL, WATER
130-170	SANDY CLAY
170-182	SANDY GRAVEL

NOTES:

1. CASING 175' 6" PIPE WITH 3/16" WALL
2. 46'-8" OF 8" SURFACE PIPE
3. PERFORATED FROM 140'-173', 4 CUTS AROUND, 2 CUTS PER FOOT 1"x3/16" to 5/32"
4. REMOVED ONE YARD SAND
5. STANDING LEVEL 112'
6. TEST PUMP 1½ HP ELEC SUBMERSIBLE SET AT 138'

PREPARED BY:
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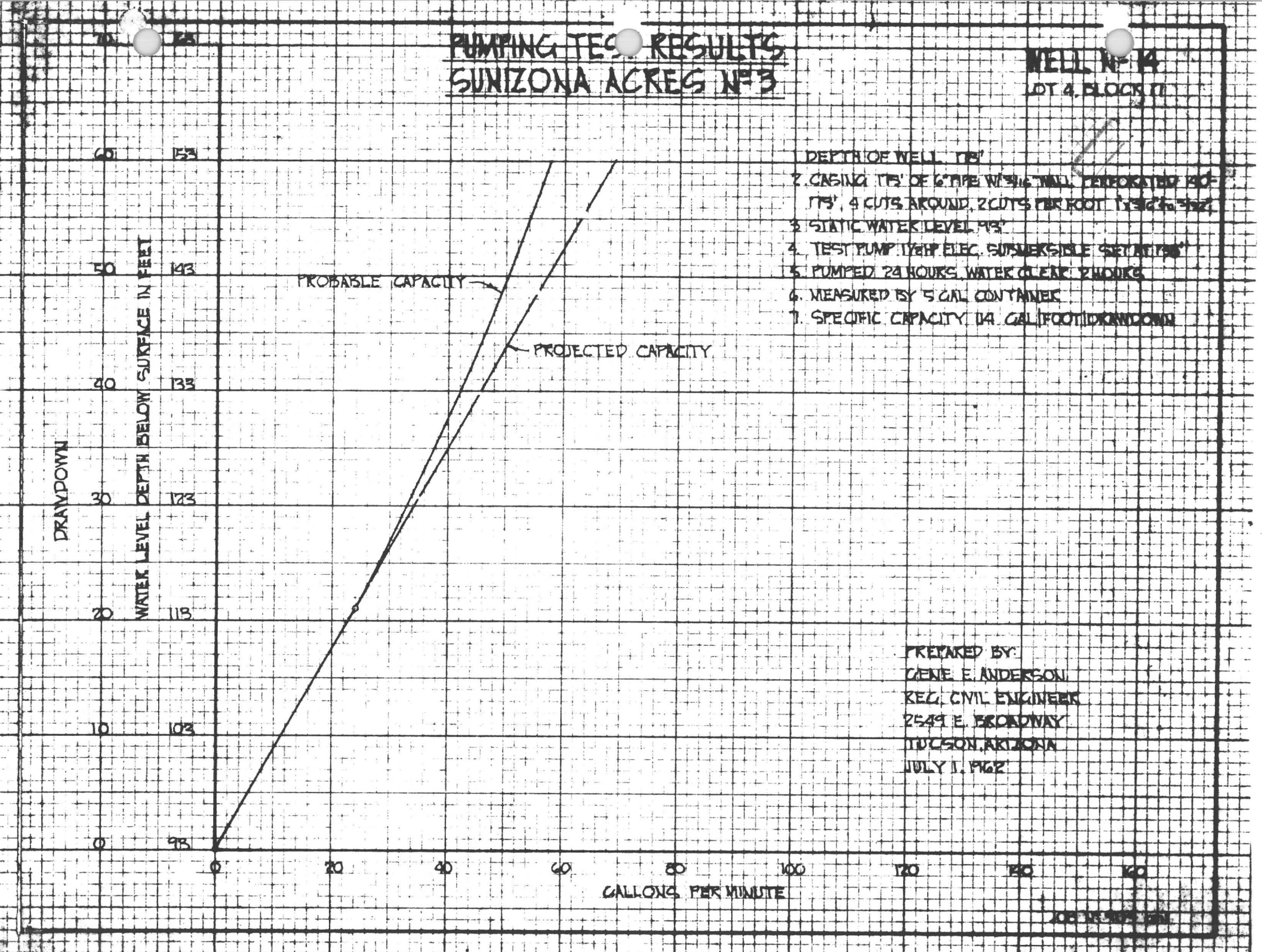
TUCSON, ARIZONA
JUNE 29, 1962

JOB Nº 909 pnl

PUMPING TEST RESULTS
SUNIZONA ACRES N°3

WELL N° 14
LOT 4, BLOCK 11

DEPTH OF WELL 178'
2. CASING 178' OF 6" TYPE W 5/16" WALL, PERFORATED 150'-178', 4 CUTS AROUND, 2 CUTS PER FOOT 1/8" & 3/32"
3. STATIC WATER LEVEL 93'
4. TEST PUMP 10 HP ELEC. SUBMERSIBLE SET AT 178'
5. PUMPED 24 HOURS, WATER CLEAR 2 HOURS
6. MEASURED BY 5 GAL CONTAINER
7. SPECIFIC CAPACITY 1.4 GAL/FOOT/DRAWDOWN



PREPARED BY:
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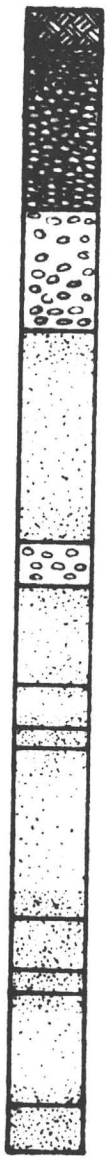
TUCSON, ARIZONA
JULY 1, 1962

WELL Nº 14

SUNIZONA ACRES UNIT Nº 3 - WELL LOG

SCALE 1"=30'

LOT 4, BLOCK 17



DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
1-6	TOP SOIL
6-31	GRAVEL
31-50	GRAVELY CLAY STICKEY
50-83	SANDY CLAY
83-90	GRAVEL, CLAY
90-105	SANDY CLAY
105-112	SANDY CLAY
112-115	SAND, SEEP
115-142	SANDY CLAY
142-150	DRY SAND
150-153	SAND, WATER
153-170	SANDY CLAY
170-178	SAND, WATER

NOTES:

1. CASING 175' 6" PIPE WITH 3/16" WALL
2. 31' OF 8" SURFACE PIPE
3. PERFORATED FROM 140'-173', 4 CUTS AROUND, 2 CUTS PER FOOT 1' x 3/16" to 5/32"
4. REMOVED 2 1/2 YARDS REAL FINE SAND.
5. STANDING LEVEL 108'
6. TEST PUMP 1 1/2 HP ELEC SUBMERSIBLE SET AT 138'

PREPARED BY:
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TUCSON, ARIZONA
JUNE 29, 1962

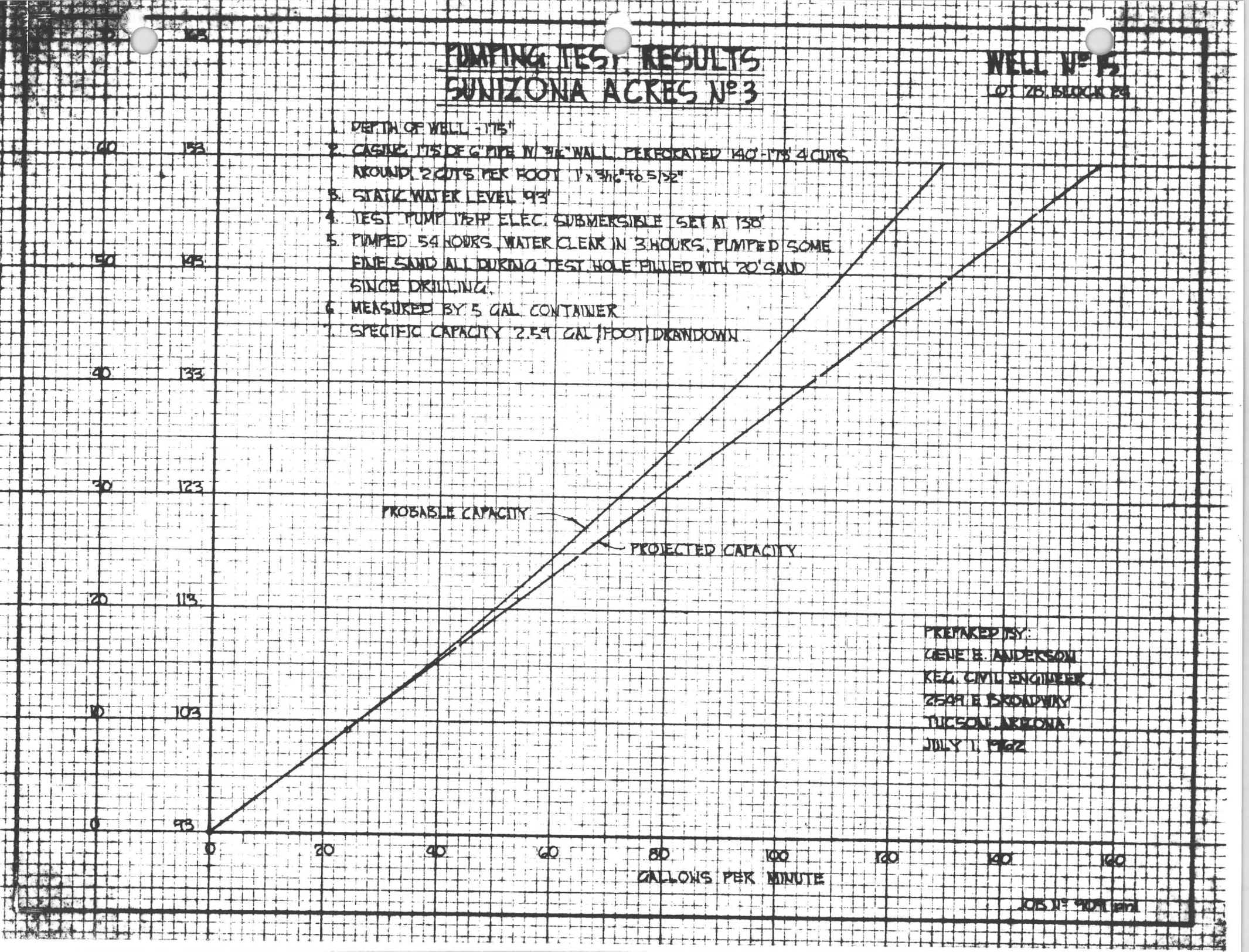
JOB Nº 909 pnl

PUMPING TEST RESULTS
SUNIZONA ACRES Nº 3

WELL Nº 15

LOT 28, BLOCK 29

1. DEPTH OF WELL - 175'
2. CASING 175' OF 6" PIPE W/ 3/16" WALL, PERFORATED 140'-175' 4 CUTS AROUND, 2 CUTS PER FOOT 1" x 3/16" to 5/32"
3. STATIC WATER LEVEL 93'
4. TEST PUMP 7½ HP ELEC. SUBMERSIBLE SET AT 138'
5. PUMPED 54 HOURS, WATER CLEAR IN 3 HOURS, PUMPED SOME FINE SAND ALL DURING TEST. HOLE FILLED WITH 20' SAND SINCE DRILLING.
6. MEASURED BY 5 GAL. CONTAINER
7. SPECIFIC CAPACITY 2.59 GAL/FOOT/DRAWDOWN



PREPARED BY:
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TUCSON, ARIZONA
JULY 1, 1962

JOB Nº 1904

WELL Nº 15

SUNIZONA ACRES UNIT Nº 3 - WELL LOG

SCALE 1" = 30'

LOT 28, BLOCK 24

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
 1-6	TOP SOIL, GOOD
6-15	SAND
15-25	SAND AND GRAVEL
25-35	SAND
35-40	SAND AND GRAVEL
40-47	SAND
47-75	SANDY CLAY
75-90	BROWN CLAY
90-96	SANDY CLAY
96-110	SANDY CLAY
110-120	DIRTY SAND (110 SEEP)
120-132	DIRTY SAND WITH A LITTLE CLAY
132-142	VERY FINE SANDY SILT
142-153	SILT
153-160	SAND, GRAVEL, WATER
160-175	SANDY CLAY

NOTES:

1. CASING 175' 6" PIPE WITH 3/16" WALL
2. 30'-3" OF 8" SURFACE PIPE
3. PERFORATED FROM 140'-173', 4 CUTS AROUND, 2 CUTS PER FOOT 1" x 3/16 to 5/32"
4. REMOVED ABOUT 4 YARDS. FINE SAND, ALMOST A SILT
5. STANDING LEVEL 90'
6. TEST PUMP 1½ HP ELEC. SUBMERSIBLE SET AT 138'

PREPARED BY
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TUCSON, ARIZONA
JUNE 29, 1962

JOB Nº 909 pnl

WELL Nº K6

SUNIZONA ACRES UNIT Nº 4 - WELL LOG

SCALE 1"=30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
 1-3	TOP SOIL
3-10	CLAY
10-27	VERY SANDY, SOME NARROW CLAY STREAKS
27-70	RED CLAY
70-100	SANDY CLAY
100-103	GRAVEL, SAND, LITTLE WATER
103-150	SANDY CLAY
150-160	JOINT CLAY, SOFT & CAVEY
160-163	GRAVEL ABOUT ANT SIZE, WATER
163-178	SANDY CLAY

NOTES:

1. CASING 175' 6" PIPE
2. PERFORATED FROM 140'-173', 4 CUTS AROUND 1/8" TO 3/16" WIDE BY 1' LONG.
3. 32' OF 8" SURFACE PIPE
4. TEST PUMP 3/4 HP ELEC SUBMERSIBLE SET AT 160'
5. STATIC LEVEL 97'-2"
6. REMOVED APPROXIMATELY 3 YARDS SAND

PREPARED BY
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2549 E BROADWAY
TUCSON, ARIZONA
MARCH 11, 1963

JOB Nº 983

WELL Nº 17

SUNIZONA ACRES UNIT Nº 4 - WELL LOG

SCALE 1"=30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
 1-10	SAND
10-30	SAND, SOME SMALL GRAVEL
30-38	SAND, GRAVEL
38-60	CLAY, LOTS OF ROCKS
60-80	CLAY
80-96	GRITTY CLAY
96-104	GRAVEL, SAND, SOME WATER
104-120	CLAY, GRAVEL
120-130	SAND, GRAVEL, WATER
130-140	SANDY CLAY
140-150	FINE DRY SAND BED
150-158	SANDY CLAY
158-165	SAND, GRAVEL, CLAY, ROCK
165-180	CLAY, ROCK

NOTES:

1. CASING 175'-3" 6" PIPE
2. PERFORATED FROM 130' TO 173', 4 CUTS AROUND 1/8" TO 3/16" WIDTH BY 1' LONG
3. 44'-3" OF 8" SURFACE PIPE
4. REMOVED ABOUT 2 YARDS SAND
5. STATIC LEVEL 80'

PREPARED BY
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TUCSON, ARIZONA
MARCH 11, 1963

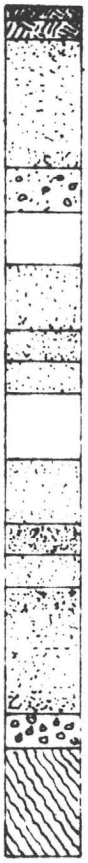
JOB Nº 989

WELL Nº 18

SUNIZONA ACRES UNIT Nº 4 - WELL LOG

SCALE 1" = 30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
0-2	TOP SOIL
2-5	SANDY SOIL
5-25	SANDY & GRITTY CLAY
25-32	CLEAN GRAVEL SAND
32-40	CLAY
40-50	SANDY CLAY
50-55	SANDY, TRACE CLAY
55-60	SANDY CLAY
60-70	CLAY
70-80	SANDY CLAY
80-85	FINE SAND, SILT
85-90	FINE SAND, SILT, LITTLE WATER
90-110	FINE SANDY SILT
110-115	GRAVEL, WATER
115-131.5	ROCK



NOTES:

1. CASED 131'-6" 6" PIPE 3/16" WALL
2. 39'-8" OF 8" SURFACE PIPE
3. PERFORATED 100'-130', 4 CUTS AROUND 1/16" TO 1/8" WIDE BY 1' LONG
4. REMOVED ABOUT 1/2 YARD SAND
5. STATIC LEVEL 90'-6"

PREPARED BY:
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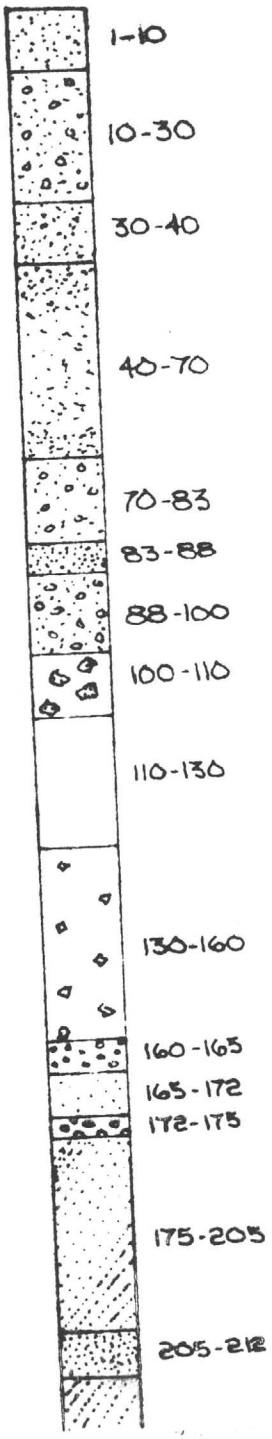
2549 E BROADWAY
TUCSON, ARIZONA
MARCH 11, 1963

JOB Nº 989

WELL Nº 19

SUNIZONA ACRES UNIT Nº 4 - WELL LOG

SCALE 1" = 30'

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
	
1-10	SAND
10-30	SAND, SMALL GRAVEL
30-40	SAND
40-70	SANDY CLAY
70-83	SAND, GRAVEL
83-88	FINE SAND
88-100	SAND, GRAVEL, WATER
100-110	CLAY, ROCK
110-130	JOINT CLAY, MUSHY & CAVEY
130-160	CLAY, SMALL ROCK
160-165	GRAVEL, WATER
165-172	GRITTY CLAY
172-175	GRAVEL, WATER
175-205	SANDSTONE
205-212	FINE SAND, WATER

212-260	SANDSTONE, HARD WITH SOFT STREAKS OFF AND ON. SOFT STREAKS DRILLED FAST, SEEMED TO BE POROUS. ESPECIALLY BETWEEN 250' & 260'. SOFT STREAKS BELIEVED TO BE CARRYING WATER.
260-285	SANDSTONE, FORMATION ALL LOOKED THE SAME WHICH BECAME MORE HARD AND COMPACT AT 265' AND 275' WAS SOFTER. QUESTIONABLE IF ANY WATER.
285-300	BROKEN ROCK, SANDY PUTTY IN SEAMS

NOTES:

1. CASING 175' WITH 6" PIPE
2. 45'-8" SURFACE PIPE
3. PERFORATED FROM 140-175' 4 CUTS AROUND 1/8" x 3/16" x 1'
4. REMOVED 1 YARD SAND
5. STATIC LEVEL 83'

PREPARED BY:
GENE E. ANDERSON
REG. CIVIL ENGINEER
2549 E. BROADWAY
TUCSON, ARIZONA
MARCH 12, 1963

JOB NO 989

Well No. 19

SUNIZONA ACRES - No. 1 3 11
(D-18 27)8c

Analyses by Geological Survey, United States Department of the Interior
9-268 q (parts per million)

Center of the SW¼SW¼, sec. 8 T. 18 S., R. 27 E., G.S.R.B. and M., Cochise County, Arizona			epm			
Date of collection						
Silica (SiO_2)						
Iron (Fe)						
Manganese (Mn)						
Calcium (Ca)						
Magnesium (Mg)						
Sodium (Na)						
Potassium (K)						
Bicarbonate (HCO_3)		168	2.75			
Carbonate (CO_3)						
Sulfate (SO_4)						
Chloride (Cl)		6.5	0.18			
Fluoride (F)						
Nitrate (NO_3)						
Dissolved solids - estimated on basis of spec. conductance		183				
Residue on evaporation at 180°C						
Hardness as $CaCO_3$		92	1.84			
Noncarbonate hardness as $CaCO_3$		0				
Alkalinity as $CaCO_3$						
Specific conductance (micromhos at 25°C)	282					
pH	7.9					
Color						

Garlitz Irrigation

125 N. Haskell

WILLCOX, ARIZONA

Phone 384-2961

IRRIGATION EFFICIENCY TABLE

For

Graded-row Irrigation Systems

Time that water is on set in hours	Sustained infiltration rate of soil in inches per hour	Average % of water wasted *
8	1/2	20
	1	30
	1 1/2	35
12	1/2	25
	1	35
	1 1/2	45
24	1/2	35
	1	50
	1 1/2	70

* Tail water and leaching

Leaching loss is usually from 2 to 4 times as great as tail water.

INDICATED ROW LENGTHS AND ROW GRADIENTS

Sustained infiltration rate of soil (In./hr.)	Row Gradient	Row Length
1/2	1 to 3 tenths per 100'	1500'
1	2 to 4 tenths	1000 to 1200'
1 1/2	2 to 5 tenths	800 to 1000'

For sustained infiltration rates of over 1 1/2 inches per hour, either sprinkler irrigation is indicated or 500 to 700 foot runs with 1 to 3 tenths per hundred gradient.

Well #16
Unit 4 - Sunizona Acres

Driller: Myron Ingle
Date: 1962 - November

1	- 3	Top soil
3	- 10	Clay
10	- 27	Real sandy - some narrow clay streaks
27	- 70	Red clay
70	- 100	Sandy clay
100	- 103	Gravel and sand - little water
103	- 150	Sandy clay
150	- 160	Joint clay (soft, cavey)
160	- 163	About ant-size gravel - ill shaped sharp (water) of different colors
163	- 178	Sandy clay

Cased - 175' with 6" pipe 3/16" wall
Perforated - 140' to 173'
4 cuts around 1/8" to 3/16" = foot long

Well #17
Unit 4 - Sunizona Acres

Driller: Myron Ingle
Date: 1962 - November

1	- 10	Sand
10	- 30	Sand with some small gravel
30	- 38	Sand gravel
38	- 60	Clay with lots of rock
60	- 80	Clay
80	- 96	Gritty clay
96	- 104	Gravel & sand (some water)
104	- 120	Clay with gravel
120	- 130	Sand gravel (water) gravel smooth
130	- 140	Sandy clay
140	- 150	Fine dry sand bed
150	- 158	Sandy clay
158	- 165	Sand and gravel - some smooth and some sharp gravel
165	- 180	Clay with rock

Cased - 175.13 with 6" pipe
Perforated 130' to 173'
4 cuts around 1/8" to 3/16" - 1 foot long

44' 3" of 8" pipe cemented in

Well #18
Unit 4 - Sunizona Acres

Driller: Myron Ingle
Date: 1962 - November

0	- 2	Top soil
2	- 5	Sandy clay
2	- 25	Sandy and gritty clay
25	- 32	Clean gravel sand
32	- 40	Clay
40	- 50	Sandy clay
50	- 55	Sandy - trace clay
55	- 60	Sandy clay
60	- 70	Clay
70	- 80	Sandy clay
80	- 85	Fine sand and silt
85	- 90	Fine sand and silt (little water)
90	- 110	Fine sandy silt
110	- 115	(Water) gravel ill shaped and sharp
115	- 131'6"	Rock

Cased - 131'6" with 3/16" - 6" pipe
Perforated - 100' to 130'
4 cuts around 1/16" to 1/8" - 1 foot long
due to sandy, silty formation

39' 8" of 8" pipe cemented in

Well #19
Unit 4 - Sunizona Acres

Driller: Myron Ingle
Date: 1962 - November

1 - 10	Sand
10 - 30	Sand with small gravel
30 - 40	Sand
40 - 70	Sandy clay
70 - 83	Sand and gravel
83 - 88	Sand fine (water) weak
88 - 100	Sand and gravel (water) weak
100 - 110	Clay with rock
110 - 130	Joint clay (marshy and cavey)
130 - 160	Clay and small rock
160 - 165	Gravel (water)
165 - 172	Gritty clay
172 - 175	Gravel (water) sharp - cleaned tools
175 - 205	Sandstone
205 - 212	Sand, fine (water)
212 - 250	Sandstone, hard - with soft streaks off and one soft streaks drilled fast - seemed to be porous - believed to be carrying water
250 - 285	Formation all looked the same - became more hard and compact at 260-275' was softer (questionable if any water)
285 - 300	Broken rock with a sandy putty in the seams

Cased - 175 h 6" casing
Perforated -)' to 173'
uts around 1/8" to 3/16" wide by 1 foot long
(ought wise not to perforate around 130' due to a mushy, cavey clay)

45' of 8" pipe cemented in

WELL Nº 22

SUNIZONA ACRES UNIT Nº 5 WELL LOG

SCALE 1" = 30'

LOT 20 BLK 75

DEPTH BELOW SURFACE IN FEET	TYPE OF FORMATION
	
0 - 70	CONGLOMERATE W/ RED CLAY
70 - 80	RED SAND
80 - 110	SAND & CLAY
110 - 135	CLAY
135 - 140	ROCK LEDGE
140 - 165	SAND & GRAVEL W/ CLAY STREAKS, WATER
165 - 169	HARD ROCK
169 - 175	SANDY CLAY WITH SOME GRAVEL
175 - 182	HARD ROCK

NOTES:

1 CASING 170' 6" PIPE
2 STATIC WATER LEVEL 116'-7"
3 WELL TEST 82 gpm @ 118'-4"

PREPARED BY
GENE E ANDERSON
REG. CIVIL ENGINEER
198 S TUCSON BLVD.
TUCSON, ARIZONA
JANUARY 14, 1964

JOB Nº 1186 pnl

Willcox Pump & Equipment Co.

522 N. Haskell Ave.
Willcox, Arizona

December 11, 1963

OTHO JOHNSON,
Owner

PHONE 384-2287
P. O. Box 907

WELL LOG

SUNIZONA WELL # 2

Lot 20 Block 75
Unit No. 5

0 -	70'	Conglomerate with Red Clay
70' -	80'	Red Sand
80' -	110'	Sand & Clay
110' -	135'	Clay
135' -	140'	Rock Ledge
140' -	165'	Sand & gravel w/clay streaks, water
165' -	169'	Hard Rock
169' -	175'	Sandy clay with some gravel
175' -	182'	Hard Rock

Static Water Level - 116'-7"

Well Test - 82 GPM @ 118'-4"

Willcox Pump & Equipment Co.

522 N. Haskell Ave.
Willcox, Arizona

OTHO JOHNSON,
Owner

PHONE 384-2287
P. O. Box 907

SUMMERNA WELL # 23 PEARCE RD.

WELL LOG

-	[illegible]	-	Sand
10	45	-	Sand, clay, small gravel
45	67	-	Sandy clay
[illegible]	88	-	" " W/gravel
[illegible]	100	-	Hard Packed Sandy Clay
100	108	-	Gravel
108	130	-	Brown Sand & Clay W/fine gravel
130	155	-	Reddish brown clay & sand
[illegible]	168	-	Gravel - 1st water
168	185	-	Reddish brown clay & sand W/gravel streaks
185	192	-	Gravel - Water
192	255	-	Gravel streaks in Brown red clay - Water

8" Casing set [illegible]-4"
6" Casing set 112' to 25[illegible] ft
Perforations 180' - 25[illegible] (3 rows-1 cut/ft.-12" length)
Static Water Level 137 ft.

Well Test: 48 gpm @ 1[illegible] ft.
65 gpm @ 1[illegible] ft.
95 gpm @ 1[illegible] ft.

Willcox Pump & Equipment Co.

522 N. Haskell Ave.
Willcox, Arizona

OTHO JOHNSON,
Owner

PHONE 384-2287
P. O. Box 907

25

SUNIZONA #3 [illegible] ORBA ROAD

WELL LOG

[illegible]	–	[illegible]	Top Soil
5	–	27	Heavy gravel, light clay
27	–	[illegible]	Clay
[illegible]	–	[illegible]	Clay, gravel, brown red sand
55	–	65	Hard sandy clay
65	–	75	Clay & gravel
75	–	90	Hard sandy & clay
90	–	105	Clay with streaks of small gravel
105	–	120	Clay, sand & gravel
120	–	125	Large gravel & clay, hard
125	–	170	Clay, fine gravel sand, medium hard
170	–	175	Clay & pea gravel (water)
175	–	215	Clay with heavy gravel
215	–	[illegible]	Hard, gravel & clay

[illegible]" Casing set to [illegible] ft.
Perforations: 160–[illegible] ft. [illegible] mesh – [illegible] slot – [illegible] Slot–3/16x8")

State water level:	[illegible]
Well Completed	Jan. 21, 1964
Well Test	Jan. 22, 1964
429 gpm	@ 150
50 gpm	@ 152
81 gpm	@ 156

WILLCOX PUMP & EQUIPMENT CO.

Otho Johnson

Map Key 4

H. H. ABBOTT LOT 29 BLOCK 3
UNIT 3

2	2	Feet	top soil.
14	12	"	sand, gravel.
48	34	"	clay.
102	54	"	sand, gravel, clay.
110	8	"	sand, gravel.
113	3	"	sand, gravel, water.
130	17	"	sand, gravel.
135	5	"	sand, gravel, water
150	15	"	sand, gravel.
160	10	"	sand, gravel, water.
170	10	"	sand, gravel, clay.
175	5	"	clay, gravel.

Static water level, 108 feet.

176 feet of 6 inch casing.

70 feet perforated with torch.

Symonds
~~Symmons~~ — LOT 13 BLOCK 7 [illegible] 3

Map Key B

2	2	Feet	top soil
30	28	"	sand gravel
32	2	"	clay
35	3	"	rock
37	2	"	clay
40	3	"	rock
70	30	"	sand gravel clay
112	42	"	sand gravel and small amount of clay
115	3	"	sand gravel water
138	23	"	sand gravel clay
141	3	"	sand gravel water
170	29	"	sand gravel clay
173	3	"	sand gravel water
180	7	"	sand gravel clay

Well drilled to a total depth of 180 feet.

Well drilled open hole and cassed with 6 inch cassing

Map Key C

Maggio Lot 21 Block 3 Tract 3

1	1	Foot	top soil.
40	39	Feet	clay.
112	72	"	clay, sand, gravel.
115	3	"	sand, gravel, water.
138	23	"	sand, gravel.
142	4	"	sand, gravel, water.
172	30	"	clay, sand, gravel.
176	4	"	sand, gravel, water.
180	4	"	clay, sand, gravel.

Well drilled to a total depth of 180 feet.

Well drilled open hole and cased with 6 inch casing.

Casing perforated from 110 feet to bottom with cutting torch.

Static water level, 112 feet.

Map Key D

AL ERICKSON
Lot 20-17 UNIT 3

3	3	Feet top soil.
13	10	Feet clay, gravel.
55	42	Feet sand, clay.
105	50	Feet clay, sand gravel.
108	3	Feet sand, gravel, water
142	34	Feet clay, sand.
145	3	Feet sand, gravel water.
171	26	Feet sand, gravel, clay.
176	5	Feet sand, gravel, water.
200	24	Feet sand, gravel, clay.

Well drilled to a total depth of 200 feet

First water at 105 feet, raised to 95 feet and stayed.

Well drilled open hole and cased with 8 inch casing.

Casing perforated from 105' to bottom with cutting torch.

Casing cemented 10 feet below surface to shut out surface water.

Map Key E

IRRIGATION WELL----LEO L. COCK--LOT, 134.

UNIT 7W1

4	4	Feet	top soil.
16	12	"	sand, gravel.
49	33	"	clay, gravel.
77	28	"	sand, gravel, clay.
105	28	"	sand, gravel.
108	3	"	sand, gravel, water.
138	30	"	sand, gravel, clay.
143	5	"	sand, gravel, water.
163	20	"	sand, gravel, clay.
175	12	"	sand, gravel, water.
195	20	"	sand, gravel.
198	3	"	clay, gravel.

Total depth: 198 feet.

Well drilled for 12 inch casing.

Drilled another 12" well alongside the above account lost tools while deepening & could not fish them out

Drilled to depth of 334 ft

No layers of rock

in water sand from 284 ft

50 ft of water producing sand & gravel

did not go thru to next clay or rock

strata.

A. E. Jackson

Map Key F

Wakefield Estates Lot 3 East ½ Unit 1

No. 9503 Dept. Date 8-27 1964

Name Ernest Illick

Address

SOLD BY	CASH	C. O. D.	CHARGE	ON ACCT.	MDSE. RETD.	PAID OUT	

QUAN.		DESCRIPTION	PRICE	AMOUNT	
0	1	4 Top Soil			
4	2	35 Boulder & Gravel			
35	3	44 Clay			
44	4	46 Gravel			
46	5	64 Clay			
64	6	120 Soft clay			
120	7	158 Rock			
158	8	166 Sand (Water)			
166	9	169 Rock			
169	10	196 Sand & Gravel			
196	11	198 Clay			
	12				
	13	Well Water			
	14	Test			
	15	Water			
	16				
	17				
	18				

Customer's Order No.

Rec'd By

KEEP THIS SLIP FOR REFERENCE

Rediform 5H 33

PHONE 297-2297

REPORT ON WELL TEST

Well 6

Gilbert PUMP of Tucson, Inc.
2840 RUTHRAUFF ROAD
TUCSON, ARIZONA 85705

AUG 1965
GEOEX

May 4, 1965 WELL TEST AT SUNIZONA VALLEY

TIME	RPM	GPM	WATER LEVEL	REMARKS
1:15 A.M.	1750	No Reading	381'	Muddy and Sand
2:15 " "	2400	" "	391'	" " "
3:15 " "	1750	" "	379.6'	" " "
4:15 " "	1750	" "	389'	" " "
5:15 " "	1750	" "	386.6'	" " "
6:15 " "	1750	" "	384.6'	Starting to Clear
7:15 " "	1750	" "	379.6	Clearing with Sand
8:15 " "	1750	" "	377'	Almost Clear
9:15 " "	1750	470	376.6'	Clear- Slight Sand
10:05 " "	1750	500	381'	" " "
10:25 " "	Surged Well			
11:15 " "	1750	538	384.6'	Clear- Very little sand
12:15 P.M.	1750	538	384.6'	" " " "
1:15 " "	Surged Well			
1:25 " "	1750	538	384.6'	Clear
2:00 " "	1750	538	379.6'	"
2:15 " "	Surged Well			
2:25 " "	1650	538	365.6'	Clear
2:35 " "	1650	558	365.6'	"
2:45 " "	1650	558	356.6'	"
2:50 " "	1525	435	296.6'	"
3:00 " "	1525	448	296.6'	"
3:05 " "	1450	No Reading	259.6'	"
3:10 " "	1550	538	312.6'	"
3:15 " "	Engine Stopped			

GILBERT PUMP OF TUCSON, INC.

Larkin Rice

FORM NO. IL-6/64

BJ PUMP ESTIMATE

Maj Key G 33028

BYRON JACKSON PUMPS . . . SINCE 1872

DEALER
WILLCOX PUMP & EQUIPMENT CO.
BOX 907
WILLCOX, ARIZONA

DATE	BJ DISTRICT OFFICE	PROPOSITION NO.	ORDER NO.
4-21-65			

Ship to _____

PURCHASER (Billing Address)
Name WILLEN CORP
Address _____
Mark _____

Subject to Gov't End Use _____ Mfg. Specs. _____ Inspection _____ Product Code _____ Industry Code _____

BJ Billing Office	Customer Order No.	Ship Via (Collect, Allowed, Charge)	Shipment Promised	F.O.B.

APPLICATION: Product _____ Spgr. _____ Temp. _____ °F.
Viscosity _____ Suction PSI _____ NPSH Avail. _____ Discharge PSI _____ Abrasive YES NO
GPM _____ Head (Differential) _____ Efficiency At Duty _____ Duty BHP _____
Max BHP _____ NPSH Required _____ IF PARTS ORDER, ORIGINAL JOB NO. _____

DRILLER LOG — Irrigation Well — Section 28

0 - 3 ft -	TOP SOIL
3 - 35	CALICHIE
35 - 60	SANDY CLAY
60 - 145	RED GUMMY CLAY
145 - 152	GRAY ROCK — 4 HRS DRILLING
152 - 195	SAND & GRAVEL (DRY)
195 - 302	SAND, SOME GRAVEL, SHALLOW CLAY STREAKS — GOOD WATER BRG.
302 - 323	CLAY, STICKY
323 - 346	SAND STONE
346 - 380	WATER SAND & LARGE GRAVEL
380 - 385	RED & PURPLE ROCK
385 - 390	GREY ROCK
390 - 494	GREY ROCK & BLACK MALIPAI
494 - 500	HARD ROCK
500 - 502	BROWN LIME & SANDSTONE, HARD

PREPARED BY _____
(FULL NAME)

Map Key H

Murray Riggs
Section 12

Driller: Myron Ingle
Date: March, 1965

1 - 8	Top soil
8 - 20	Clay
20 - 24	Gravel
24 - 40	Clay
40 - 70	Joint clay
70 - 74	Gravel
74 - 108	Clay
108 - 115	Gravel
115 - 182	Clay
182 - 190	Sand and coarse gravel (water)
190 - 230	Sandy silt
230 - 240	Gravel and sand
240 - 285	Clay
285 - 290	Gravel
290 - 340	Sandy clay
340 - 348	Sandy gravel
348 - 360	Conglomerate
360 - 370	Conglomerate turning purple (harder)
370 - 446	Purple rock (rhyolite)
446 - 450	Gravel (all colors)
450 - 470	Purple rock (rhyolite)
470 - 475	Gray rock (possible water) on top or bottom of rock
475 - 504	Purple rock (rhyolite)

Driller advises hit hard rock – rhyolite he called it at 370 ft. No water below

Map Key I

Drilled for Paul Riggs
(Now Horizon Land)

Driller: Myron Ingle
Date: 1962

1 - 8	Top soil
8 - 70	Dry sand with little clay
70 - 113	Dry sand and gravel
113 - 117	Small gravel (water)
117 - 134	Sandy clay
134 - 137	Gravel
137 - 155	Sandy clay
155 - 158	Gravel
158 - 189	Sandy clay
189 - 194	Gravel
194 - 240	Sandy clay
240 - 245	Gravel (all colors) good
245 - 268	Sandy clay
268 - 271	Gravel - blue
271 - 345	Sandy clay
345 - 349	Gravel - small
349 - 380	Sandy clay
380 - 386	Gravel (good)
386 - 440	Conglomerate
440 - 444	Gravel - blue
444 - 490	Conglomerate
490 - 495	Gravel
495 - 502	Rock

Paul Riggs
Well #5

Driller: Myron Ingle
Date: May, 1965

1 - 30	Caliche
30 - 70	Clay
70 - 73	Dry gravel
73 - 104	Clay
104 - 108	Gravel (water)
108 - 118	Clay
118 - 127	Joint clay (?)
127 - 135	Clay
135 - 142	Joint clay (?)
142 - 194	Clay
194 - 197	Gravel (water)
197 - 210	Gritty clay
210 - 240	Conglomerate - soft in streaks - possibly carrying water
240 - 403	Blue gray conglomerate

Cased to 280 ft.
Perforated from 100 ft. to 280 ft.

Wells - 2 thru 9 drilled for Paul Riggs

Myron Ingle says no water indicated below 220 ft. where he hit the blue-gray conglomerate

Well ⑧ tested about 1075 GPM - best of all most wells will produce 500 - 700 GPM.

Well -10 - Section 25 645 ft depth to hard blue rock
1000 GPM MAX with extremely deep draw down -

Well 11 Sect 25 700 ft depth to hard blue rock
Setting up test pump now -