Rick Potts
Geology
DR CHON

HYDROGEOLOGIC DOCUMENTATION
FOR
DOUBLE RUN SPRINGWATER SOURCE
LAKE COUNTY, FLORIDA

JANUARY, 1996

Prepared for:

Dr. H. J. Chon
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Orlando, Florida 32801

Prepared by:

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AT&E Project No. 7797

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January 12, 1996

Division of Consumer Services
Bureau of Food and Meat Inspection
Florida Department of Agriculture
3125 Conner Boulevard, M-A
Tallahassee, Florida 32399-1650

Attention: Mr. Gary Newton

Dear Mr. Newton:

Attached, please find a copy of a report prepared by Atlanta Testing & Engineering, Inc. (AT&E) for Dr. H. J. Chon, entitled Hydrogeologic Documentation for Double Run Springwater Source, Lake County, Florida. This report is submitted to demonstrate conformance of Dr. Chon's proposed springwater source with the rules and regulations governing labelling of bottled waters as "springwater" for sale and distribution within the state of Florida. The report identifies and documents the adjacent natural artesian spring and provides evidence that the springs and Dr. Chon's water well derive their flow exclusively from the same source, namely the freshwater-bearing upper part of the Floridan aquifer.

We trust that this report is suitable for your review and approval of Dr. Chon's water well (borehole) for commercial production of water to be labelled for sale as springwater. If you have any questions, or require further information, please feel free to contact the undersigned at your convenience.

Very truly yours,

ATLANTA TESTING & ENGINEERING, INC.

Richard L. Potts, Jr., P.G. #1113
Regional Manager
Principal Consultant

RLP/cld

copy to: Dr. H. J. Chon

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INTRODUCTION

Purpose and Scope

Dr. H. J. Chon owns real property adjacent to a natural artesian spring discharge area known locally as Double Run Spring. Dr. Chon has installed a water well near the spring area for the express purpose of producing springwater for commercial sale. Dr. Chon's well taps the uppermost Tertiary limestone formations forming the upper part of the regionally extensive artesian Floridan aquifer system.

The state of Florida provides for the use of constructed boreholes to obtain water labelled for sale as springwater provided that the borehole taps the same underground stratum that provides flow to naturally-occurring springs and provided that the borehole is located adjacent to the spring discharge. The purpose of this report is to present adequate geologic and hydrologic information, data and interpretations to demonstrate that Dr. Chon's well (springwater source) meets the strict definition of springwater as defined in Florida's Bottled Water Code regulations (Chapter 500, F. S.)

The scope of this investigation includes the real property owned by Dr. Chon as well as adjacent areas containing hydrogeologically significant features pertinent to demonstrating that his well obtains groundwater of identical quality and from the same source as springwater issuing from adjacent natural artesian springs.

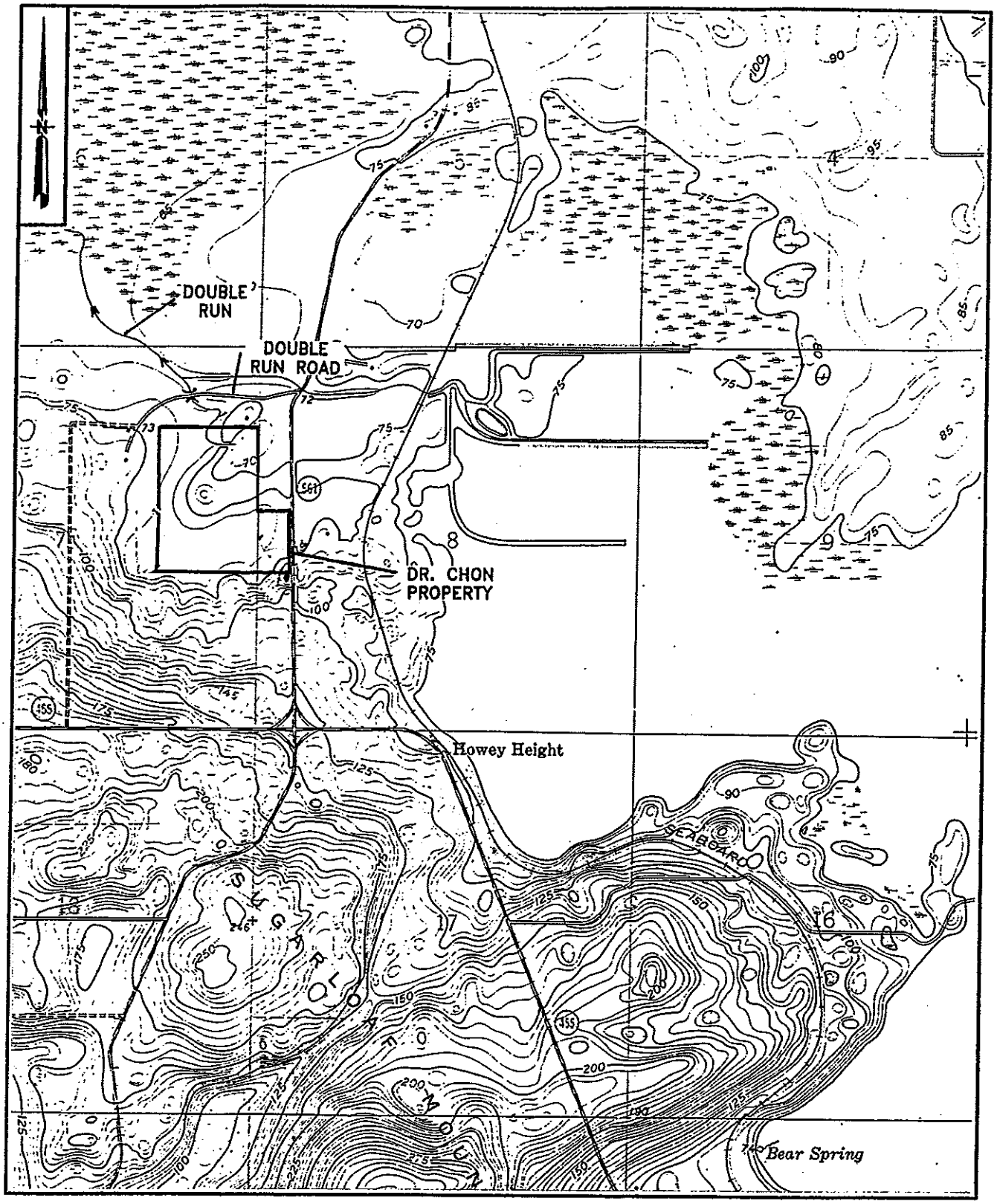
Project Location

The Dr. Chon property and Double Run Spring are located near the town of Howey-in-the-Hills in central Lake County, Florida. The project site is situated about 1.5 miles south of Little Lake Harris, near the intersection of C.R. 455 and C.R. 561. The location of the project site is shown on Figure 1.

PROJECT AREA DESCRIPTION

Regional Physiography

The Dr. Chon property and Double Run Spring are located near the center of the state of Florida in a physiographic province known as the Central Valley (Puri and Vernon, 1964), bounded immediately to the west by the upland landform described by White (1970) as the Lake Wales Ridge.



REFERENCE:

U.S.G.S. ASTATULA, FLORIDA
QUADRANGLE MAP, DATED 1962,
PHOTOREVISED 1970
SECTIONS 7 & 8
TOWNSHIP 21 SOUTH
RANGE 26 EAST

PROJ. NO.:	7797
DATE:	1-8-96
SCALE:	1" = 2000'

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U.S.G.S. QUADRANGLE MAP

DR. CHON PROPERTY
LAKE COUNTY, FLORIDA

FIGURE 1

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The Ridge is a northwest-southeast trending highland ridge which bisects central Florida and includes the point of highest land surface elevation in the Florida peninsula. Sugarloaf Mountain (elevation 312 feet above mean sea level) is situated about 2 miles to the south of the project area.

This region of Florida is characterized by high rolling hills and steep and shallow-sided sinkholes. Sinkholes in the area range in size from small, localized depressions hundreds of feet in diameter to large features measured in square miles. Most sinkholes are normally dry owing to bottom elevations above the water table surface; others are occupied by small ponds and large lakes. Land surface elevations range from over 300 feet above mean sea level (msl) at Sugarloaf Mountain to less than 70 feet above msl along the shoreline of Little Lake Harris.

Little Lake Harris and the other major lakes of the Ocklawaha Chain-of-Lakes (Apopka, Eustis, Griffin, Harris, Yale and Dora) occupy the Central Valley extending between the Lake Wales and Mount Dora ridges to the west and east, respectively. The Dr. Chon property is situated near the western margin of the Central Valley, characterized by less topographic relief, lower land surface elevations and numerous artesian springs stemming from the regionally extensive Floridan aquifer system.

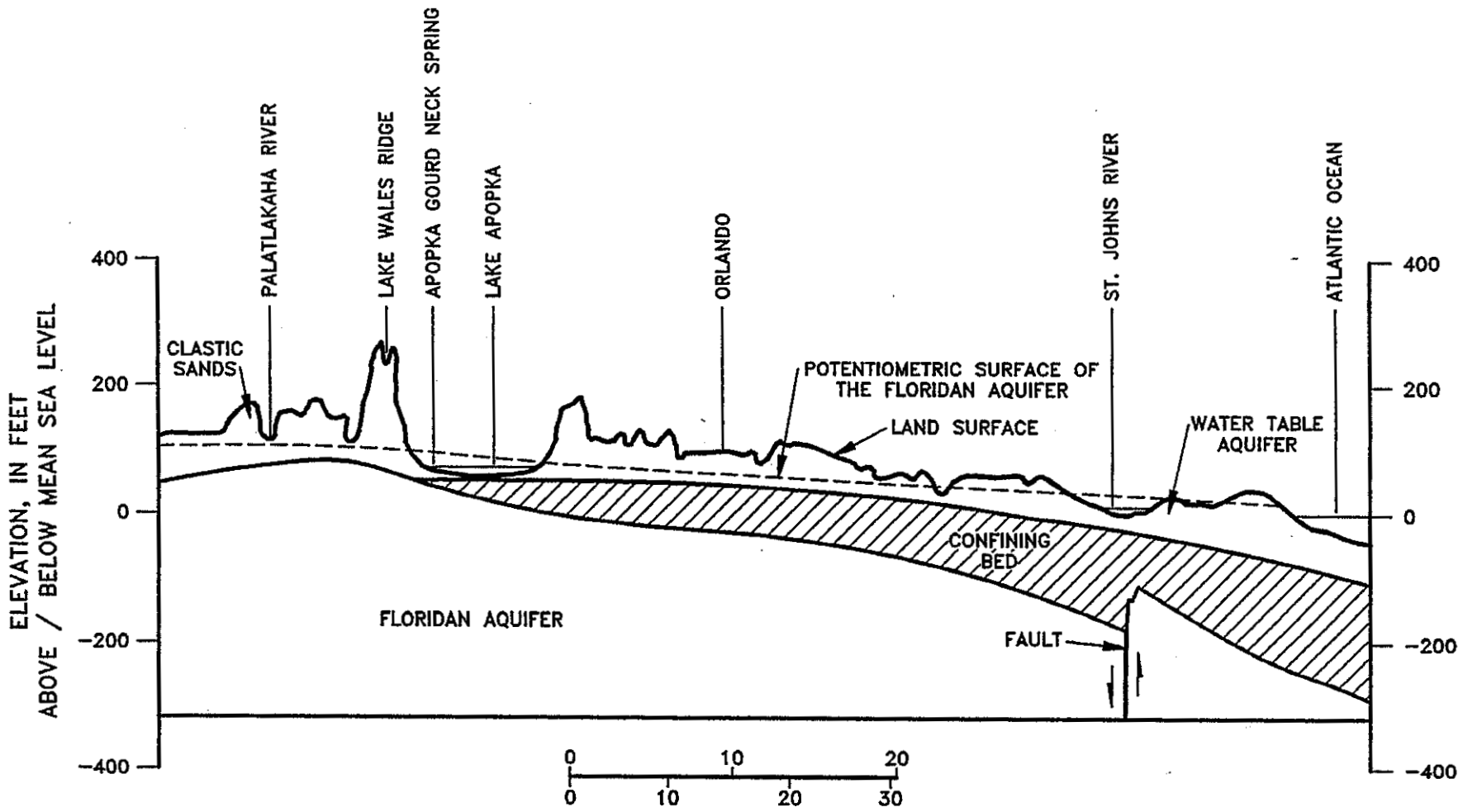
The location of the project site with respect to major geomorphic landforms is shown on Figure 2. Locations of known artesian springs in the region are shown on Figure 3.

Double Run Springs

Double Run Springs is a natural artesian discharge area occurring in a bowl-shaped land surface depression along the toe of the Lake Wales Ridge highlands to the west. Adjacent highland areas were formerly used for citrus groves, however, the freezes in 1984 and 1985 destroyed the citrus trees and these areas were not replanted.

The depression area around the springs is naturally wooded with cypress, bay and other water tolerant vegetation. Pine trees occur along the margin of the depression except where cleared for rural-residential use.

One perineal stream, locally known as Double Run, exits the depression on the north through a culvert under Double Run Road. The run discharges directly into Little Lake Harris as shown on



REDRAWN FROM KNOCHENMUS AND HUGHES, 1975

PROJ. NO.: 7797	GENERALIZED HYDROGEOLOGIC CROSS-SECTION FROM LAKE COUNTY TO ATLANTIC OCEAN
DATE: 1-8-96	DR. CHON PROPERTY
SCALE: NOTED	LAKE COUNTY, FLORIDA
atlanta testing & engineering	FIGURE 2

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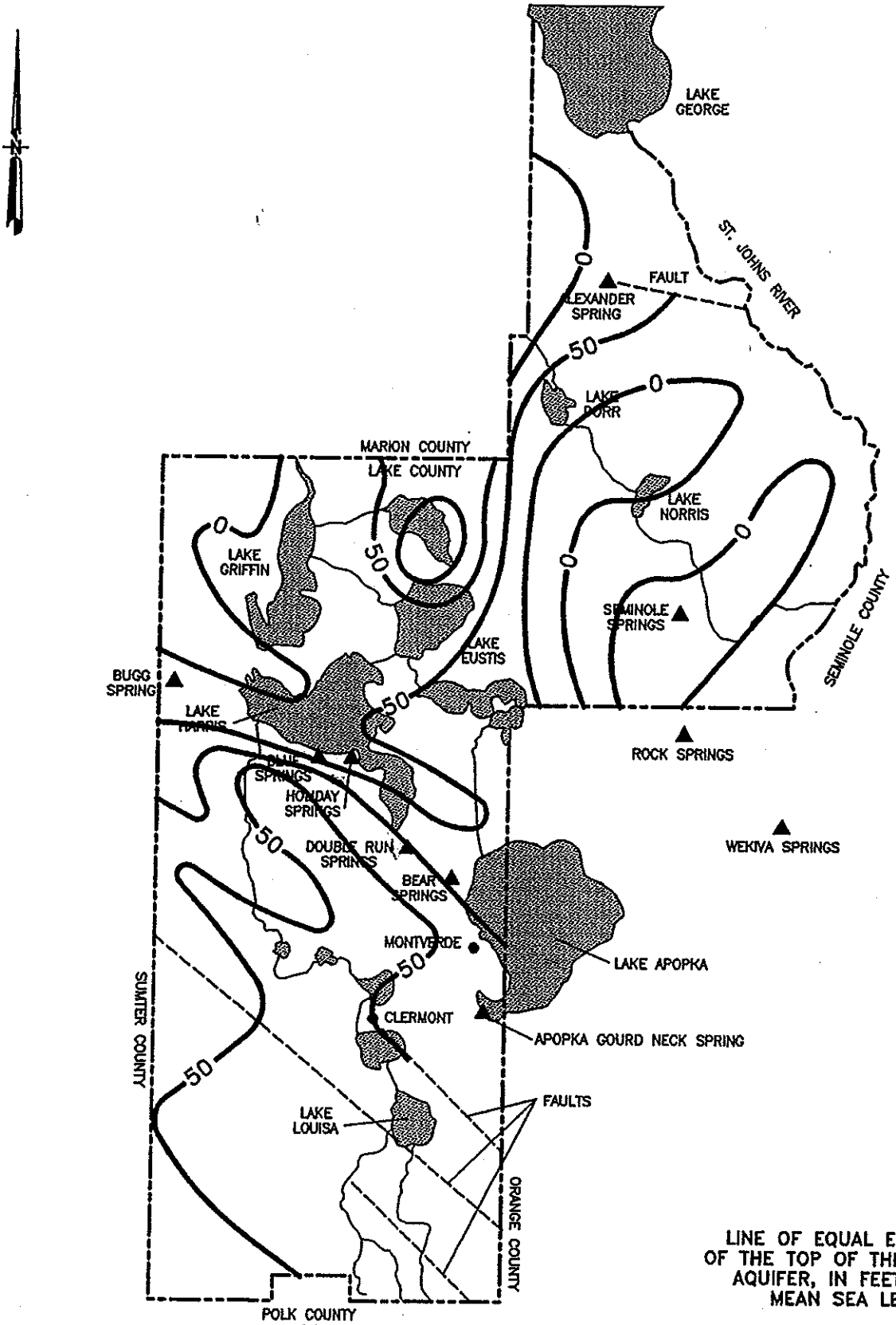

LINE OF EQUAL ELEVATION OF THE TOP OF THE FLORIDAN AQUIFER, IN FEET ABOVE MEAN SEA LEVEL

PROJ. NO.: 7797	ALTITUDE AND CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER IN LAKE COUNTY, FLORIDA
DATE: 1-8-96	DR. CHON PROPERTY LAKE COUNTY, FLORIDA
SCALE: 1" = 8 MILES	FIGURE 3
atlanta testing & engineering	

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Figure 4. The Double Run Springs depression is the headwaters for this stream. Surface drainage features, such as creeks, or streams, do not enter the depression from upland areas.

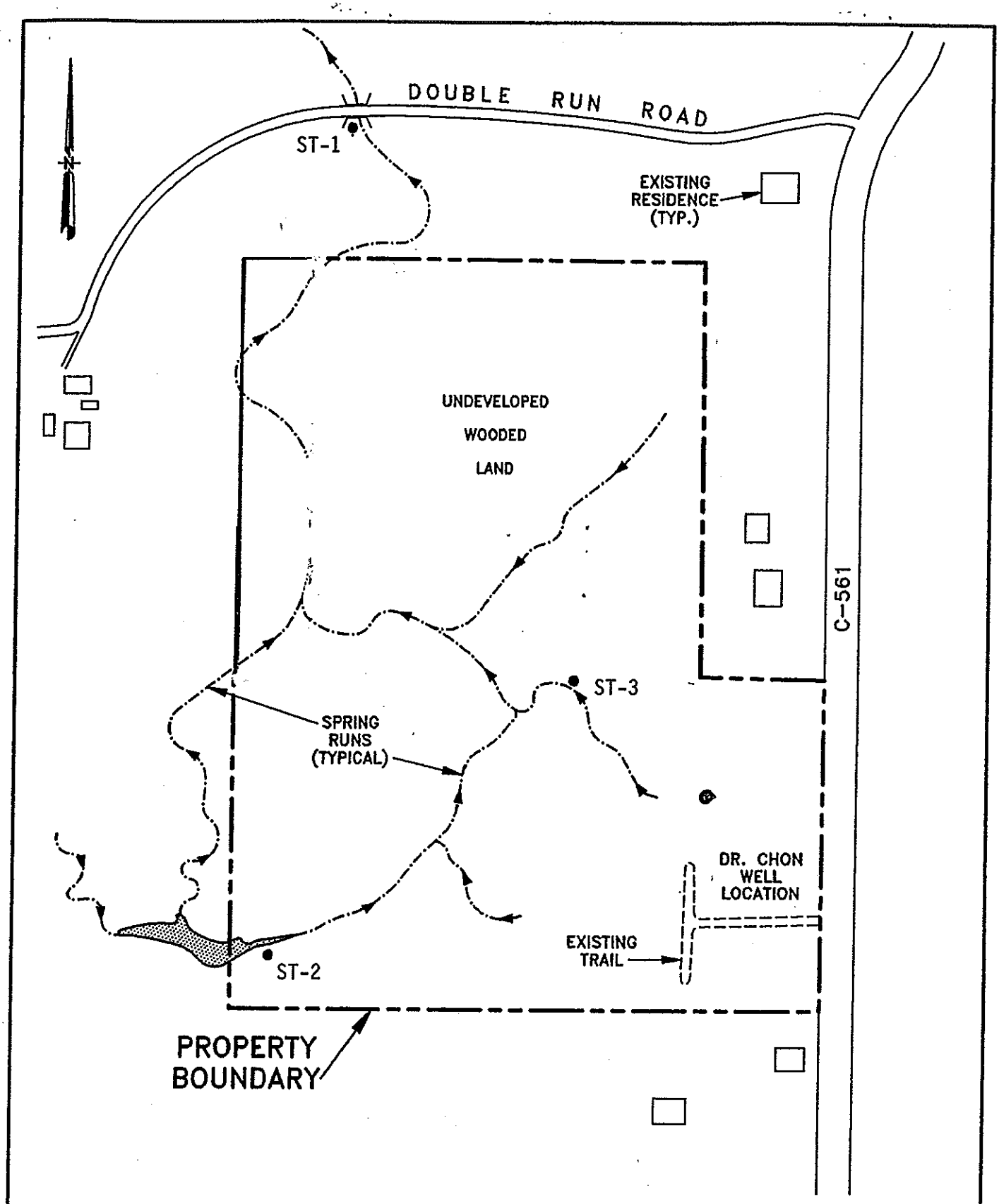
AT&E measured the velocity of water discharging through the culvert under Double Run Road and the width and depth of the streamflow on April 6, 1995. From these measurements, streamflow was estimated at about 21.7 cubic feet per second (cfs) or about 14 million gallons per day. The stream was clean and clear with the sandy bottom easily visible upstream and downstream of the culvert. According to residents of the area interviewed by AT&E, the stream flows year round regardless of rainfall conditions.

The spring area upstream of the Double Run Road culvert crossing is heavily wooded with access only on foot and with considerable difficulty. The main spring run winds through the area as a shallow (about 3 feet deep), narrow stream, on average less than 10 feet wide. In some areas, the banks of the run are well-defined, in other areas, the banks are flooded or marshy. The main run collects discharge from at least three smaller creeks that intersect at the locations depicted on Figure 4.

The main run begins abruptly near the western margin of the spring depression and flows southward into a wider pool in the southwest part of the area. This pool was covered completely by floating aquatic vegetation (commonly known as water lettuce) during three separate field visits to the site in 1994 and 1995. Water exits the pool at its eastern end as well defined channel flow. This channel winds to the east and north toward discharge through the culvert under Double Run Road. Three small tributary creeks were identified during field investigations, providing flow to the main run from the south and east. Each of these creeks rise abruptly from the ground at their heads and increase in size and flow with distance downstream prior to confluence with the main spring run. The creeks are generally shallow (less than 2 feet deep) with sandy bottoms covered in places by organic debris.

Chon Well

A water well was constructed within Dr. Chon's property to defined geologic conditions at the site and to provide a means of extracting springwater from the limestone aquifer. The well was constructed by Allen's Well Drilling of Umatilla, Florida, a licensed Florida Water Well Contractor



PROJ. NO.: 7797	HYDROLOGIC FEATURES
DATE: 1-8-96	DR. CHON PROPERTY
SCALE: 1" = 400'	LAKE COUNTY, FLORIDA
atlanta testing & engineering	FIGURE 4

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(License No. 1733). Construction of the well was completed on August 24, 1995. A copy of the driller's Well Completion Report submitted to the Florida Department of Environmental Protection is provided in the Appendix to this report.

Dr. Chon's well is cased from land surface to a depth of 167 feet. The open hole section of the well extends through limestone from the bottom of the casing to a total depth of 220 feet. The driller reports encountering cavities in the limestone between depths of 165 to 220 feet.

Dr. Chon's well was constructed in accordance with public drinking water supply well standards stipulated in Chapter 62-555, F.A.C.

REGIONAL HYDROGEOLOGY

Geology of The Project Area

General Geologic descriptions of the Dr. Chon project area and vicinity are provided by published information and reports prepared by the U. S. Geological Survey and Florida Bureau of Geology. Lichtler, et. al. (1968) describe the geology of Orange County, located immediately east of the project area. Knochenmus and Hughes (1976) have described geologic conditions within Lake County.

A generalized geologic cross-section, showing hydrologically significant units and formations, is redrawn from Knochenmus and Hughes (1976) and presented on Figure 2. The cross-section illustrates general geologic conditions from the western boundary of Lake County eastward to the east coast of Florida. Local land surface relief, especially in the western part of the section near the Lake Wales Ridge, is pronounced owing to the vertical exaggeration inherent in the horizontal to vertical scale ratio used to depict relatively shallow geologic conditions over a large horizontal to vertical scale ratio used to depict relatively shallow geologic conditions over a large horizontal distance.

According to Knochenmus and Hughes (1976) and Lichtler, et. al. (1968), three (3) major geologic units, each comprised of one or more formations, occur in the vicinity of the project area. The uppermost deposits consist of unconsolidated aeolian and marine sediments comprised primary of fine- to course-grained quartz sand. The top of these deposits forms the land surface in the area.

The unconsolidated surficial deposits range in thickness from over 200 feet beneath the hills along the axis of the Lake Wales Ridge to less then 50 feet near Lake Apopka. These deposits may be nearly absent directly beneath the lake.

The surficial sand deposits are underlain by the finer-grained, clay-rich Hawthorn formation in Orange County and in parts of Lake County. This formation thins and pinches out in eastern Lake County and becomes thicker and deeper towards the east coast.

The Hawthorn deposits rest unconformably on a thick sequence of Tertiary carbonate rocks which include, in descending order, the Ocala Group, the Avon Park Limestone and the Lake City Limestone. Other deeper carbonate formations exist below the Lake City Limestone formation, however, these deeper deposits are generally not important parts of the hydrologic system in central Florida.

Hydrologic Conditions

The portions of Lake and Orange Counties encompassed within the Lake Wales Ridge physiographic providence are hydrologically characterized as a buried Karst landform with predominately internal drainage. That is surface drainage of rainfall occurs primarily by way of infiltration into the soil rather than by surface flow in streams and rivers. The Lake Wales Ridge is characterized by a noticeable lack of surface drainage features and an abundance of features, such as sinkholes and lakes, indicative of drainage of excess rainfall to groundwater in a limestone region.

Groundwater Hydrologic Units

Groundwater in the vicinity of the project area occurs in two significant and distinct water-bearing formations, or aquifers. The uppermost aquifer consists of permeable portions of the surficial unconsolidated sand deposits and is commonly referred to as the water table aquifer. Water in this aquifer exists at prevailing atmospheric pressure and the water surface is free to rise and fall in response to recharge and discharge. The top of the aquifer forms the land surfaces. The base of the water table aquifer is formed by the less-permeable deposits of clayey sand, clay and marl occurring above and within the upper Hawthorn formation. These deposits retard the movement of water between the water table aquifer and underlying Floridan aquifer.

The Floridan aquifer is a name give to a thick group of limestone and dolostone deposits underlying the less-permeable deposits of clayey sand, clay and marl. In central Florida, the Floridan aquifer

is considered to consist of the Avon Park Limestone and deeper Lake City Limestone, the Ocala Group and permeable parts of the Hawthorn formation that are in hydrologic contact with the rest of the aquifer (Lichtler, et. al., 1968). The top of the Floridan aquifer is generally considered as the first occurrence of Hawthorn or Ocala limestone, or the Avon Park in areas where the Ocala has been removed by erosion.

The Floridan aquifer is the principal water supply source in central Florida. Virtually all municipal, agricultural and domestic drinking water and irrigation supplies are obtained from wells tapping the aquifer. Water meeting drinking water standards occurs at depths exceeding 2,000 feet in parts of central Florida.

The Floridan aquifer is artesian. Water levels in wells finished into the aquifer will rise above the top of limestone as the water is under pressure greater than atmospheric. The semi-confining bed formed by the overlying clay and marl deposits confines water in the aquifer and controls the rate at which the aquifer is replenished by recharge.

Three (3) primary groundwater hydrologic units exist in the vicinity of the Dr. Chon project area:

Hydrologic Unit 1: Water table aquifer comprised of the saturated portion of the uppermost deposits of fine-to-medium grained quartz sand. Base of aquifer is marked by clay-rich Hawthorn formation.

Hydrologic Unit 2: Confining Bed formed by clay-rich deposits of Hawthorn formation separating the water table aquifer from the underlying Floridan aquifer.

Hydrologic Unit 3: Floridan aquifer comprised of lower Miocene (Hawthorn) to middle Eocene limestones and dolostones. Freshwater thickness exceeds 2,000 feet in parts of Lake and Orange Counties (Lichtler, et. al., 1968). Behaves hydraulically as a leaky artesian aquifer. Elevations of the top of the limestone aquifer are shown on Figure 3.

Aquifer Recharge Areas

In general, water in the Floridan aquifer moves from areas of recharge to areas of discharge. The aquifer is recharged primarily by vertical leakage through the semi-confining bed from the overlying water table aquifer. Recharged can occur wherever the water table surface is above the pressure head, or potentiometric surface, of the underlying Floridan aquifer and suitable geologic conditions exist.

The Lake Wales Ridge area of Lake and Orange Counties is considered a prime recharge area for the Floridan aquifer, primarily as a result of the thick, permeable deposits of sand and a relatively thin, and in some areas missing, confining bed overlying the aquifer. A large portion of the Lake Wales Ridge in eastern Lake and western Orange Counties, immediately south and west of Lake Apopka, is totally internally drained by infiltration to groundwater and little, if any, water is discharged from the area as surface water.

Aquifer Discharge Areas

Certain portions of the area surrounding Lake Apopka and Little Lake Harris, including part of the lake basins themselves, are natural discharge areas for the Florida aquifer. Natural discharge areas occur whenever the potentiometric head in the Floridan aquifer is elevated above land surface and the confining bed overlying the aquifer is sufficiently permeable, breached or absent. Under these conditions, artesian springs can occur.

The Double Run Spring depression is identified as an artesian discharge area by Knochenums (1971). The water level in Little Lake Harris is normally at an elevation of around 63 feet above msl (U.S.G.S., 1986). Recent published potentiometric surface maps for the Floridan aquifer indicate that the head in the aquifer is at an elevation of about 70-75 fee above msl in the vicinity

of Double Run Springs, (Bradner, 1987), as presented on Figure 5. Land surface elevations are generally less than 65 feet above msl within the spring depression, or 5-10 feet below normal potentiometric surface elevations. Under these hydrolic conditions, groundwater in the Florida limestone moves upward as spring discharge.

Groundwater Movement

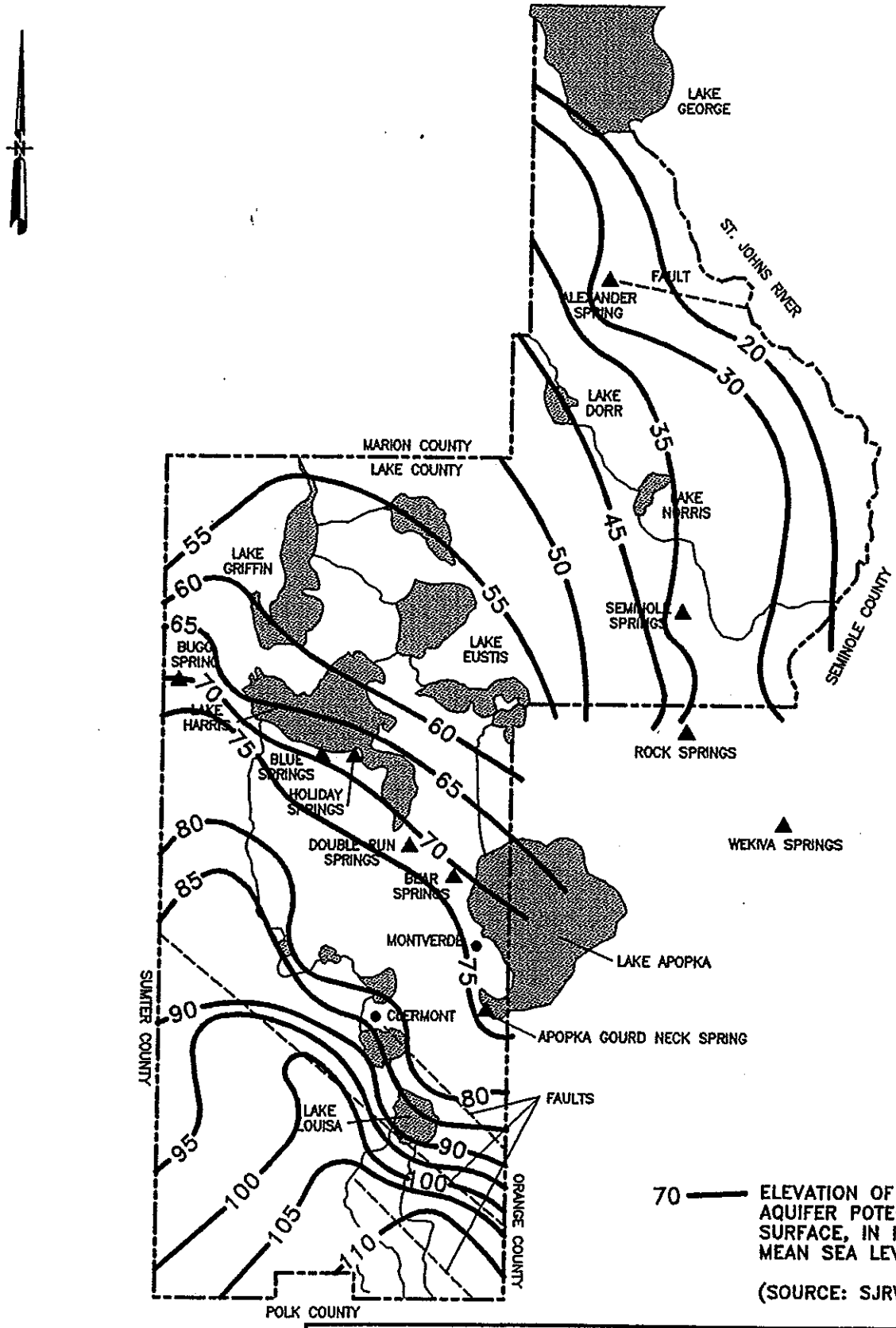
Groundwater in the Floridan aquifer generally moves from areas of high pressure (head) to areas of low pressure and ultimately to base level (sea level). As indicated by the configuration of the potentiometric surface on Figure 5, groundwater in the Floridan limestone moves from a potentiometric high (110 ft. +msl) centered near south Lake County towards the north-northeast.

The closely spaced potentiometric contours (80-105 ft.) to the southwest of Lake Apopka suggest either a relative decrease in aquifer transmissivity, a relative increase in discharge from the aquifer, a relative increase in recharge to the aquifer, or combinations thereof resulting in the steep hydraulic gradient. This area is a coincident with the axis of the Lake Wales Ridge sand hills and sinkhole landform and the steep hydraulic gradient is most likely reflecting substantial aquifer recharge to the south and southwest of Clermont and, according to Knowchenmus (1976) and Cherry (1966), a decrease in transmissivity due to sand filling of cavities and voids in the upper part of the Floridan aquifer.

The middle hydraulic gradient between the town of Clermont and Montverde, reflected by greater spacing between adjacent potentiometric surface contours, is probably the result of a significant increase in aquifer transmissivity in this area. An increase in transmissivity is reflected by the smaller gradient required to transmit a unit quantity of water through the aquifer owing to a decrease in formation resistance to flow. The existence of large open cavities and caves in the upper part of the Floridan aquifer limestones near and in Lake Apopka is documented by the U. S. Geological Survey (Rossenau, 1977), reports from area scuba divers and driller's logs for water wells in the area.

Groundwater Quality

The two major aquifers existing in the vicinity of the project area, namely, the non-artesian water table aquifer and the artesian Floridan aquifer, exhibit markedly different water quality characteristics. Water in the water table aquifer tends to be soft, owing primarily to the inert nature of the quartz sand deposits comprising the aquifer, and relatively low in mineral concentrations, especially calcium and magnesium.



70 — ELEVATION OF FLORIDAN AQUIFER POTENTIOMETRIC SURFACE, IN FEET ABOVE MEAN SEA LEVEL

(SOURCE: SJRWMD, 1991)

PROJ. NO.: 7797	ALTITUDE AND CONFIGURATION OF THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN LAKE COUNTY, FLORIDA
DATE: 1-8-96	DR. CHON PROPERTY LAKE COUNTY, FLORIDA
SCALE: 1" = 8 MILES	FIGURE 5
atlanta testing & engineering	

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Water in the Floridan aquifer tends to be more mineralized, or "hard," as a result of chemical dissolution of the limestones comprising the aquifer by slightly acidic waters derived from the overlying water table aquifer as recharge. Water from the Floridan aquifer in central Florida is characterized by the predominance of calcium and magnesium anions and bicarbonate cations. The water is described as calcium-bicarbonate type.

Information presented by Knochenums and Hughes (1976) and by Lichtler, et. al. (1968) indicates that water in the Floridan aquifer in the vicinity of the project area generally has hardness concentrations of less than 150 mg/l (milligrams per liter) and dissolved solids concentrations ranging from 50-149 mg/l. Total hardness and dissolved solids concentrations in the Floridan aquifer tend to increase with distance north and east across central Florida, away from the prime recharge area (Lake Wales Ridge).

CHON SITE HYDROGEOLOGIC CONDITIONS

Chon Well

Geologic Formations Penetrated

According to the driller's log, the well penetrates three (3) distinct geologic formations commonly encountered throughout central Florida. The uppermost formation represented in the log is unconsolidated deposits of mixtures of sand and clay extending from land surface to a depth of about 100 feet bls. These deposits are underlain by mixtures of clay, and interbedded clays and limestones from 100 to 165 feet bls overlying hard, grey limestone penetrated at 79 feet bls. The well is finished as an open hole section in white limestone from 167 to 220 feet bls.

The uppermost unconsolidated sands and clays are commonly assigned by the U. S. Geological Survey as belonging to Pliocene to Recent undifferentiated deposits. The sand, clay and limestone sediments penetrated from 100 to 165 feet bls are considered as belonging to the Miocene Hawthorn formation. The tan rock (limestone) noted by the driller from 128 to 165 feet bls is likely the lower limestone member of the Hawthorn. The underlying 128 white limestone represents the top of the Eocene limestone section and in central Florida is usually the upper part of the Ocala Group limestone formation.

Hydrologic Considerations

From the driller's log, the major hydrologic units penetrated by the Chon spring water source well are:

0 to 99 ft.	Water table aquifer comprised of unconsolidated clastic deposits (sand).
99 to 128 ft.	Confining bed comprised of mixture of sand, and clay.
128 to 220 ft.	Floridan aquifer comprised of the lower limestone member of the Hawthorn formation and the upper part of the Ocala Group limestone formation.

Based on the construction configuration of the Chon well as described by the driller's log, the well taps the uppermost part of the Floridan aquifer and produces water drawn from that source.

Hydrologic Relationship to Natural Springs

The eastern portion of Lake County and the western parts of Orange and Seminole Counties contain many natural springs. All major springs in Lake County, Orange County and Seminole County stem from the artesian Floridan aquifer (Knochenmus and Hughes, 1976, Lichtler, 1968 and Barraclaugh, 1972). These springs generally occur on the western margins of the two main river valleys draining central Florida, namely: the Oklawaha River Valley and the St. Johns River Valley. Both of the these rivers follow a course generally parallel with the east coast of Florida and with the high ridges running generally north-south through the center of the Florida peninsula. Natural springs occur where geologic and hydrologic conditions meet three criteria:

1. The top of the Floridan aquifer must be situated near or at land surface;

2. The confining bed overlying the Floridan must be breached, thin or absent at the spring site, and;

3. The potentiometric surface of the Floridan must be elevated above the spring vent and spring pool/run water level.

These conditions are met at Double Run Springs. The top of the Floridan occurs at a depth of about 128 feet at the Chon Springwater source well. Regional geologic information for the area indicates that the confining bed formed by the clayey member of the Hawthorn formation pinches out to the west in Orange and Lake Counties and is absent in central Lake County. The drillers' log for the Chon well indicates that the confining bed is about 30 feet thick and occurs as interbedded clay and sand deposits.

Maps of the potentiometric surface of the Floridan aquifer, prepared by the St. Johns River Water Management District indicate that at the head in the Floridan varies seasonally between 70 and 75 feet above msl in the vicinity of the Dr. Chon project area. The Chon wellhead is on ground at the elevation of about 75 feet above msl and flows by natural artesian pressure. Artesian discharge from the well seasonally as the head in the Floridan rises and falls through wet and dry seasons.

Breaches in the confining bed overlying the Floridan are evident from the springrun that exits the Double Run depression and flows year-round. Water quality analytical test results of samples collected from the run demonstrate that the water is discharging from the Floridan aquifer and not the water table aquifer.

Well and Spring Water Quality

Double Run Spring

Surface water samples were collected by AT&E from three (3) stations along the run of Double Run Springs on April 6, 1995. Sampling station locations are shown on Figure 4.

Each sample was collected under the direct supervision of an AT&E professional geologist using sampling containers provided by Environmental Conservation Laboratories, Inc. (ENCON), Orlando, Florida.

Water quality sample ST-1 (Station No. 1) was collected at the upstream side of the culvert passing the spring run under Double Run Road to ultimate discharge to Little Lake Harris. Sample ST-2 was collected from the pool near the southwest margin of the spring depression. Sample ST-3 was collected from a small tributary run discharging to the main spring run near the central part of the spring depression.

All water samples were collected in accordance with AT&E's Comprehensive Quality Assurance Plan (ComQAP) currently approved by and on file with the Florida Department of Environmental Protection.

Results of chemical analyses for selected water quality indicator parameters are presented in Table 1.

The analytical results indicate that surface water in the spring run and tributary creeks is a calcium-bicarbonate type water derived solely from the underlying artesian Floridan aquifer. The water at all three surface sampling stations is characterized by significant concentrations of calcium and magnesium ions, a neutral pH, moderate total hardness as calcium carbonate, and dissolved iron concentrations below the laboratory method detection limit.

Chon Well

Water samples were collected from Dr. Chon's well on October 9, 1995 by allowing the well to flow under natural artesian pressure. Collected samples were chemically analyzed for the complete parameter list contained in Chapter 62-550, F.A.C. for Primary and Secondary Drinking Water Standards. The results of these analyses are presented in Table 1 for direct comparison to the spring run sampling results.

The analytical results indicate that water discharged from Dr. Chon's well is derived exclusively from the artesian Floridan aquifer limestones. Measured concentrations of calcium, magnesium and pH are indicative of fresh recharge groundwaters typical for the Floridan aquifer in this portion of the state.

Discussion of Water Quality Results

Water contained in the Double Run spring run and water produced from Dr. Chon's well are chemically similar, both sources producing a calcium bicarbonate water of moderate hardness as calcium carbonate. Of the two groundwater bearing units (aquifers) existing in the vicinity of the Chon project area (water table aquifer and the artesian Floridan aquifer), only the Floridan aquifer is capable of producing calcium bicarbonate water. The water table aquifer is comprised of relatively inert quartz sand and typically produces water high in iron concentrations with a low, acidic pH and an absence of calcium and magnesium ions. The Floridan aquifer, on the other hand, produces calcium bicarbonate type water, owing to the soluble nature of the limestone deposits. Natural

TABLE 1

COMPARISON OF WATER QUALITY

Dr. Chon Well and Double Run Springs

PARAMETER (UNITS)	WELL[1]	ST 1[2]	ST 2[2]	ST 3[2]	AVERAGE OF SPRING
Calcium (mg/l)	21.0	23.1	20.2	18.4	20.6
Magnesium (mg/l)	6.9	9.29	9.04	5.70	8.01
Total Hardness (mg/l)	68	87.6	83.6	63.7	78.3
Iron (mg/l)	<.10	<.10	<.10	<.10	<.10
Chloride (mg/l)	8	14.6	12.6	7.8	11.7
Sodium (mg/l)	4.0	4.88	3.67	10.2	6.25
TDS (mg/l)	130	142	138	98	126
pH (pH units)	8.0	7.12	6.64	7.01	6.92
Sulfate (mg/l)	<5.0	16.9	24	6.2	15.70

[1] Analytical results by TriTech Laboratories, Inc., Orlando, FL

[2] Analytical results by Environmental conservation Laboratories, Inc., Orlando, FL

dissolution of the limestones results in the calcium and magnesium concentrations imparted to waters derived from this source.

Measured sulfate concentrations in the Chon well and from the surface sampling stations indicate the effects of vegetation and related organic debris on spring run water quality. Sulfate concentrations are noted from the spring run surface samples and was not detected in the water produced by the Chon well. Highest sulfate concentrations occur in sample ST-1 and ST-2. Both sampling stations were heavily vegetated with considerable organic debris on the sides and bottom of the spring run; sample ST-2 was collected from an impounded pool completely covered with floating aquatic vegetation and with several feet of organic detritus on the pond bottom. Water pH also appears to be similarly affected by acids produced by decaying organic deposits within and near the spring run.

A comparison of water quality between Dr. Chon's well, Double Run Springs and three nearby artesian springs discharging from the Floridan aquifer is presented in Table 2. Water quality data for Apopka Gourd Neck Spring, Blue Spring and Holiday Spring are taken from the U. S. Geological Survey (Rosenau, et al, 1977). The locations of the three nearby springs are shown on Figure 5.

Comparison of the water quality data demonstrates the similarity in primary water quality and water type indicators and further demonstrate that each groundwater discharge (Dr. Chon's water well and the four springs) issues from the same source, namely, the upper freshwater portion of the limestone formations comprising the Floridan aquifer. Deviations in absolute parameter values among the sample set are normal and within acceptable ranges considering natural fluctuations in the hydrologic cycle, time of sampling, and differences in analytical methods, equipment and procedures of the laboratories performing the chemical tests.

TABLE 2

WATER QUALITY COMPARISON OF SPRINGWATER SOURCES

PARAMETER	DR. CHON WELL	DOUBLE RUN SPRING (AVERAGE)[1/]	HOLIDAY SPRING[2/]	APOPKA SPRING[2/]	BLUE SPRING[2/]
Calcium	21	21	33	20	30
Magnesium	6.9	8.0	5.4	5.0	4.9
pH	8.0	6.9	8.0	7.7	7.9
Total Hardness (as $CaCO_3$)	68	78	100	70	95
Total Dissolved Solids	130	126	129	108	120

[1/] Average values calculated from 3 sampling stations.

[2/] Data from U.S. Geological Survey (Rosenau, et. al., 1977)

CONCLUSIONS

AT&E completed an assessment of hydrologic and geologic conditions within and near the property owned by Dr. Chon. The purpose of the assessment was to present adequate geologic and hydrologic information, data and interpretations to demonstrate that Dr. Chon's well meets the strict definition of springwater source as defined in Florida's Bottled Water Code regulations. These regulations require that Dr. Chon's well must tap the same source providing flow to adjacent natural springs and produce water of similar chemical composition for water from this well to be legally classified and marketed for sale in Florida as "springwater".

Based on observations, tests and explorations completed for this assessment, together with information published by the U. S. Geological Survey and the St. Johns River Water Management District, AT&E believes that Dr. Chon's water well meets the requirements for a springwater source. Significant findings supporting this opinion are:

1. The Double Run Springs depression is a naturally-occurring isolated depression in the land surface. Most of the depression area is normally wet and supports vigorous growth of wetland type, water-tolerant vegetation. Land surface elevations in the interior of the depression are less than 65 feet above mean seal level;

2. The potentiometric pressure surface of water in the underlying Floridan aquifer ranges between elevations of about 70 to 75 feet above mean sea level or 5 to 10 feet above the floor of the spring depression providing the hydraulic condition necessary for natural spring discharge at the land surface;

3. Double Run is the only surface drainage for the spring depression. No surface streams enter the depression from surrounding areas. Water flowing in Double Run is a calcium bicarbonate type water containing high concentrations, relative to rainfall, surface runoff or water from the water table aquifer, of calcium and magnesium ions. The only source for these minerals in these concentrations is groundwater in the underlying Floridan aquifer limestones;

4. According to local area residents interviewed by AT&E, Double Run is a perineal stream, flowing year-round regardless of rainfall conditions. The U. S. Geological Survey identifies the spring run as a perineal stream on the 71/2 minute Astatula Quadrangle Map;

5. Dr. Chon's water well, constructed specifically for this investigation and subsequent use as a springwater source, is cased through and sealed off from the water table aquifer and Hawthorn confining bed deposits and taps only the upper part of the freshwater-bearing limestones of the Floridan aquifer;

6. Water produced by Dr. Chon's well is of the same type and of similar quality as water collected from three stations along the Double Run Spring run. Slight variations in pH and sulfate concentration are attributable to chemical effects of growing vegetation and decaying organic deposits within and adjacent to the spring run.

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