Province of British Columbia
Ministry of the Environment
WATER INVESTIGATIONS BRANCH

MEMORANDUM

To: Dr. J. C. Foweraker, Head
Groundwater Section
Hydrology Division

Date: June 27, 1978

File: 92-B-13

Re: Somenos Road Area of the North Cowichan - Groundwater Potential

Introduction

In a memorandum dated April 4, 1978 to Mr. H. Hunter, Chief of the Hydrology Division, Mr. J. Fuller, Chief of the Engineering Division, Water Investigations Branch, has requested information regarding the groundwater potential in the Somenos Road-Drinkwater Road area of North Cowichan. The following report is an office study of all the available groundwater information regarding the above area, including geologic maps, aerial photographs, well data from the Groundwater Section files and previous groundwater reports. Also included is a review of the existing wells located along York Road and near the sewage lagoons.

Bedrock Geology

According to Muller (1977), the study area is underlain by Cretaceous shale, siltstone and sandstone of the Haslam or Cedar District Formation. The estimated thickness of each formation is 200 m and 300 m, respectively.

Surficial Geology

Figure 1 illustrates the surficial geology of the area. It can be seen that most of the study area is underlain by glacio-marine deposits consisting of relatively impermeable silt, clay, stony clay and till-like mixtures up to 75 feet thick. In the southwestern corner of the study area, there is a glacio-fluvial deposit of gravel and sand lenses of till. The aerial photographs indicate the presence of several sand and gravel pits in this deposit.

Well Card Data

Figure 2 shows the location and distribution of drilled and dug wells within the study area. A summary of pertinent information regarding these wells is found on Table 1. From this data several hydrogeologic cross-sections (Figures 3 and 4) have been constructed to show the nature and extent of the surficial deposits and bedrock material underlying the study area.

Previous Groundwater Reports

The following statements, summarizing the groundwater potential in the North Cowichan, are extracts taken from previous groundwater reports.

1) "From the many test wells drilled in the Lower Cowichan Valley, it appears that only those drilled along the banks of the Cowichan River produce high quality potable water in large quantities."

(J.D. Sansom, 1970)

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2) "Based on a review of all available groundwater data, maps, air photos and groundwater reports on file for this area, there is apparently only one area "the Cowichan River Aquifer" located on either side of the Cowichan River south of Duncan, which appears to have the required potable groundwater potential to supply the municipal requirements for some time into the future."

"Apart from the two York Street wells, a survey of other wells located in the Duncan area and away from the Cowichan River, are generally poor producers."

(J.C. Foweraker, 1975)

3) "The geological formations in the North Cowichan area are such that the only prospects of finding a groundwater source of sufficient quantity and quality to satisfy the municipal requirements are in those areas along the Chemainus and Cowichan Rivers where stream deposited gravels may exist and where hydraulic connection to the rivers would allow sufficient aquifer recharge."

(S. Mould, 1976)

Groundwater Potential - Discussion

An analysis of the geologic data and the hydrogeologic cross-sections indicates that the Somenos Road-Drinkwater Road area has a very limited groundwater potential. The surficial material underlying the area is till, generally less than 50 feet thick. Almost all the wells constructed in this material have been low yielding (less than 5 gpm). The bedrock material underlying the till deposit is generally shale. Wells constructed in the shale have also been low yielding (less than 10 gpm).

Previous groundwater explorations in the North Cowichan area and the subsequent reports indicate that there is a general lack of good groundwater potential in the area northwest of Somenos Lake. Apparently the only two areas that would favour further groundwater exploration and development are the Cowichan and Chemainus River floodplains.

York Street Wells

The two York St. wells (Figure 5) were drilled and completed in 1966 and had a combined design capacity of 830 gpm. In 1967, they were incorporated into the South End Water Supply System. By 1970, the productive capacity of the two wells decreased to 580 gpm, which made them inadequate in supplying a peak demand of 850 gpm. According to Foweraker (1975), "the two York Street well logs show about 12 feet of silt and clay, over 12 feet of sand and gravel, over fine clays and silts. The sand and gravel components in the aquifer in which the York Street wells are located contain some finer matrix and this may be clogging the natural sand pack surrounding the well screen and thereby reducing the well performance."

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Chemical tests on samples of well water indicate that the water is extremely aggressive (pH 5.6) and must therefore be chemically treated to bring it up to safe drinking standards.

Just west of the York Street wells, there were several test holes drilled (1967) into a buried channel filled with highly permeable sand and gravel. Preliminary pump tests indicated that there was a potential yield of approximately 900 gpm from each well. Unlike the York Street wells, the quality of water was not found to be aggressive; instead, initial field water quality tests indicated that the well water was high in iron.

Wells near the Sewage Lagoons

Two test wells known as Riverside Nos. 1 and 2, located north of the Cowichan River and south of the sewage lagoons, (Figure 5) were constructed in 1969 for the Corporation of the District of North Cowichan.

Pump test data show that the wells have estimated yields of 2280 UGgpm and 3000 USgpm, respectively. Because of adverse public opinion regarding the proximity of the Duncan and North Cowichan sewage lagoons (approximately 500 feet north of Riverside Well No. 2), these wells have not been incorporated into the South End water system. However, after analyzing the hydrogeologic data, Brown (1973) believes that the chances of the well water becoming polluted by sewage effluent is remote.

Summary and Recommendations

1) On the basis of available geologic and hydrogeologic data, the Somenos Road-Drinkwater Road area of North Cowichan has poor groundwater potential and thus would not be able to supply a peak flow requirement of approximately 3000 USgpm.

2) The York Street wells, presently yielding 580 gpm, are also not capable of supplying the required peak flow. In order to obtain 3000 USgpm from this area, it would be necessary to drill and develop at least three additional wells near the present York Street wells. Further development in the area is not recommended because of the cost involved in drilling and developing the additional wells; water quality problems; and probable reduction in well performance after several years.

3) The development of the Riverside Test/Production Wells 1 and 2, having a combined potential yield of 4500 USgpm, could satisfy the demands of the proposed irrigation scheme for many years. However, further evaluation, testing and a monitoring program would be required to determine the effects, if any, of the sewage lagoons upon the water quality of the Riverside wells (during production). Alternatively, well sites further removed from the lagoon system and within the Cowichan River aquifer, could be considered for development.

Marc Zubel.

M. Zubel
Geological Engineer
Groundwater Section

MZ/lml

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References:

Brown, W. L. (1973) - "Groundwater Geology and Hydrology of Fish Gut Alley - Rotary Park, City of Duncan", Robinson, Roberts and Brown (March).

Foweraker, J. C. (1975) - "Groundwater Potential available to the Corporation of the District of North Cowichan at the South End of the District", Groundwater Section, N.T.S. File No. 92-B-13 (March 21).

Mould, S. (1976) - Municipality of North Cowichan - Water Supply Study, Water Resource Service, Ministry of the Environment (January).

Muller, J. E. (1977) - Geology of Vancouver Island - Eastern Half, Map O.F. 463, Geological Survey of Canada.

Sansom, J. D. (1970) - "Feasibility Report on Alternative Future Water Supplies for the South End Water District", Thurber Consultants (December).

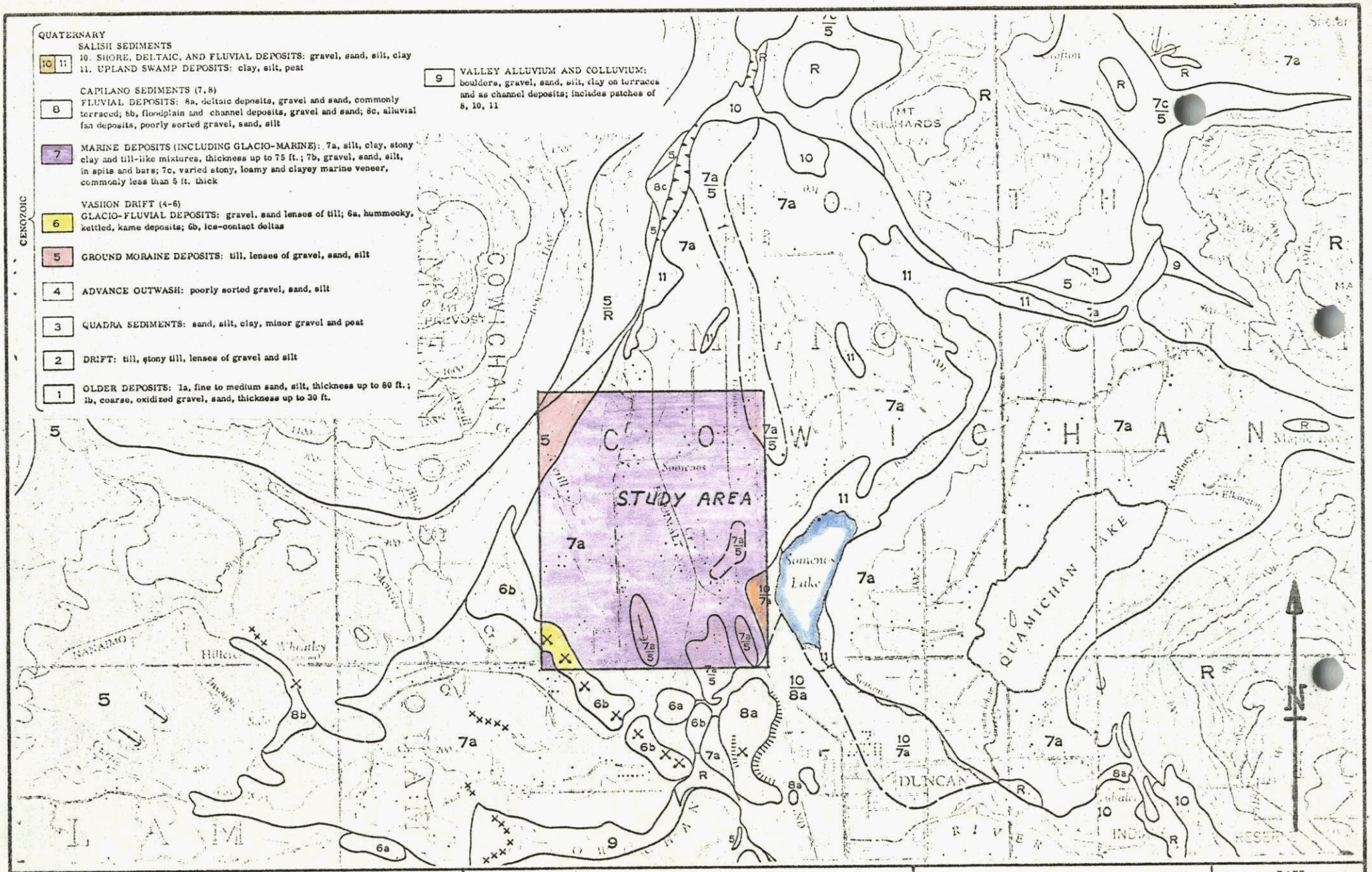

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FIGURE 1
Surficial Geology of Study Area

SCALE: VERT.
HOR. 1" = 1 mile

DATE
JUNE '78

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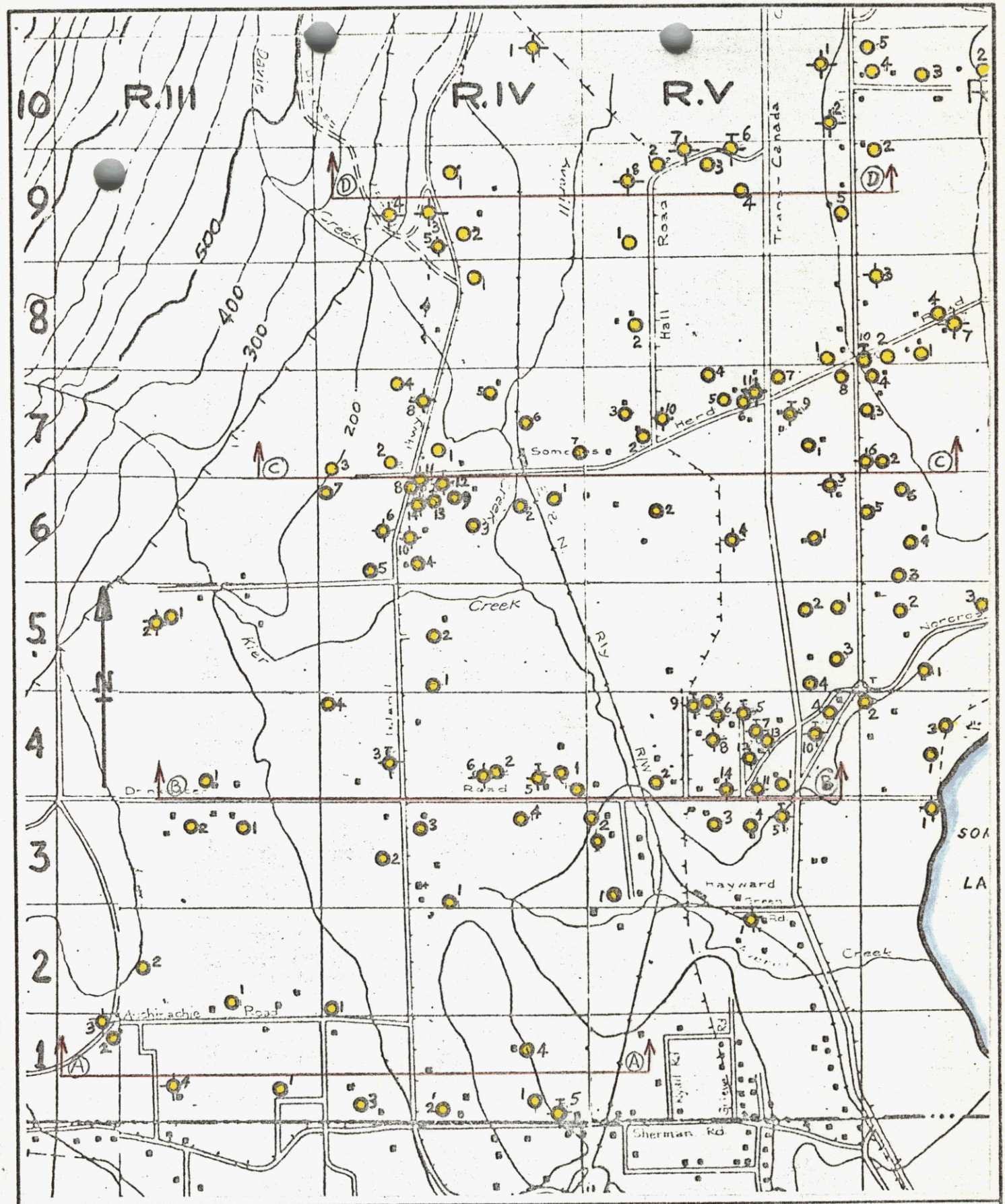

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FIGURE 2

Well Locations

○ - DUG WELL
⊙ - DRILLED WELL

SCALE: VERT. .....
HOR. 1" = 1600'

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JUNE 1978

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TABLE 1
Summary of Wells in Study Area

LOCATION			DEPTH		DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
R.	SEC.	WELL NO.	DUG	DRILLED				
3	1	1	✓				Sand-Hardpan	
3	1	2	26				Sand-Gravel	Moderately Hard
3	1	3		107	26	2½	Soft Shale	
3	1	4		38	27	4	Silty Gravel	
3	2	1	14				Sand	Good Supply
3	2	2	<10					Very Good Supply
3	3	1	✓				Rock	
3	3	2	10		4		Gravel	Flows in Winter
3	4	1	✓				Shale	Inadequate Supply
3	5	1	32		10		Hardpan	Flows in Sept. Moderately Hard
3	5	2		60	18	1.4	Shale	
4	1	1	30					Insufficient Supply
4	1	2	12				Sand or Gravel	Good Supply
4	1	3	20				Sand	Fills in Winter
4	1	4	✓					
4	1	5		138	40	1/3	Shale	
4	2	1	14				Shale	Adequate Supply
4	3	1	30					Insufficient Supply
4	3	2	17					Moderate Supply
4	3	3	14				Shale	Fairly Limited Supply
4	3	4	17				Shale	Inadequate Supply
4	4	1	12&17					Adequate Supply
4	4	2	17&22				Shale	Limited Supply - Hard
4	4	3		60	13	3.2	Shale	Adequate Supply
4	4	4	6					High Iron
4	4	5		135	15	½	Shale	
4	4	6		80				
4	5	1	✓				Shale	High Iron
4	5	2	✓					Limited Supply
4	6	1	10-15				Shale	Small to Moderate Supply
4	6	2	8				Shale	Limited Supply
4	6	3	20				Shale	Considerable Iron
4	6	4	✓					Adequate Supply
4	6	5	20				Boulder Clay	Limited Supply
4	6	6		130	40	½	Shale	
4	6	7	17				Boulder Clay	Sulphury Smell
4	6	8	17					Too Much Iron
4	6	9	5					Moderate Supply
4	6	10		77		8	Shale	
4	6	11		102	4	2/3	Shale	
4	6	12		120	17	½	Shale	
4	6	13		36	16	2	Shale	
4	6	14		150			Shale	Water in Winter

TABLE 1 (cont.)

LOCATION			DEPTH		DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
R.	SEC.	WELL NO	DUG	DRILLED				
4	7	1	14				Blue Clay	Soft-Some Iron
4	7	2	12					Good Supply Somewhat Sulphury
4	7	3	17				Boulder Clay	Inadequate Supply
4	7	4	12					Inadequate Supply
4	7	5	8					Some Iron
4	7	6	✓					Good Supply
4	7	7	8					Adequate Supply
4	7	8		88	20	½	Shale	
4	8	1	10				Shale	Rusty Water
4	9	1	8				Shale	Good Supply
4	9	2	✓				Shale	
4	9	3		69	12	4	Shale	
4	9	4		240		1-2½	Shale	
4	9	5		170	5	3+	Shale	
4	10	1		167	23	½+	Shale	
5	2	1		300	65		Shale	Salt
5	3	1	26					Adequate
5	3	2	14/22					Fairly Hard
5	3	3	✓					Adequate Supply
5	3	4	20				Shale	Adequate Supply
5	3	5		70	4	1	Shale	
5	4	1	11					Fairly Hard
5	4	2	15		3		Solid Rock	
5	4	3	11					Inadequate Supply
5	5	4	18				Hardpan	Dry 1953 (July)
5	4	5		55	5.5	8	Shale	
5	4	6		55	17	2½	Shale	
5	4	7		121	14	1	Shale	
5	4	8		✓				
5	4	9		76	20	5	Shale	
5	4	10		64	9	1	Shale	
5	4	11		63		2+	Shale	
5	4	12		40	8	8	Shale	
5	4	13		71	18	6	Shale	
5	4	14		60	10	1½	Shale	
5	5	1	15					Soft Water
5	5	2	15/20				Shale	Inadequate Supply
5	5	3		75			Bedrock	Adequate Supply
5	5	4	✓					Well Goes Dry
5	6	1	✓					
5	6	2	8			5+	Sand	
5	6	3		210	3.6	0.5	Shale	
5	6	4		153		3	Shale	
5	7	1	29				Quicksand	Adequate Supply
5	7	2	21		17			
5	7	3	4				Rock	
5	7	4	6					Very Hard Water
5	7	5	16		12		Sand	Some Iron

TABLE 1 (cont.)

LOCATION			DEPTH		DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
R.	SEC.	WELL NO.	DUG	DRILLED				
5	7	6	15		7		Shale	Poor Quality
5	7	7	✓		8			
5	7	8	6				Shale	
5	7	9		65	7	1.3	Shale	
5	7	10		100	8	2½	Shale	
5	7	11		50	10	1/3		
5	8	1	11				Gravel	Moderately Hard
5	8	2	14		10		Pure Sand	Good Supply
5	9	1	10		6		Shale	Small Supply
5	9	2	✓					Not Very Good Water
5	9	3	20		10		Rock	Good Water
5	9	4					Sand	
5	9	5	11				Sand	Adequate Supply
5	9	6	80			10	Shale	
5	9	7		200		3	Shale	
5	9	8		160	12	1½	Shale	
5	10	1		186	34	5	Shale	
5	10	2		200	37	2	Sandstone-Shale	
6	3	1		80	3	2½	Shale	Hole Capped (1% Salt)
6	4	1	14					
6	4	2	14					Inadequate Supply
6	4	3	6					
6	5	1	18					
6	5	2	13				Bedrock	Fair Supply
6	5	3	20-30					Inadequate Supply
6	6	3	25					Fairly Hard, Good Supply
6	6	4	30				Boulder Clay	Very Good Supply
6	6	5	33					Fairly Hard
6	6	6	8					Fairly Hard
6	7	2	21.5		9			Fairly Hard
6	7	3	25				Boulder Clay	Not Enough Water
6	7	4	29		12		Boulder Clay	Very Hard Water
6	7	6		96	8	1½	Shale	
6	8	1	15				Gravel	Good Supply
6	8	2	24		6			
6	8	3		30				
6	8	4		30				
6	8	7		61	37	4	Blue Clay	
6	8	10		100	8			
6	9	2	35					
6	10	2	27				Stoney Clay	
6	10	3	38		35½		Blue Clay	
6	10	4	24				Sand	
6	10	5	38				Gravel	

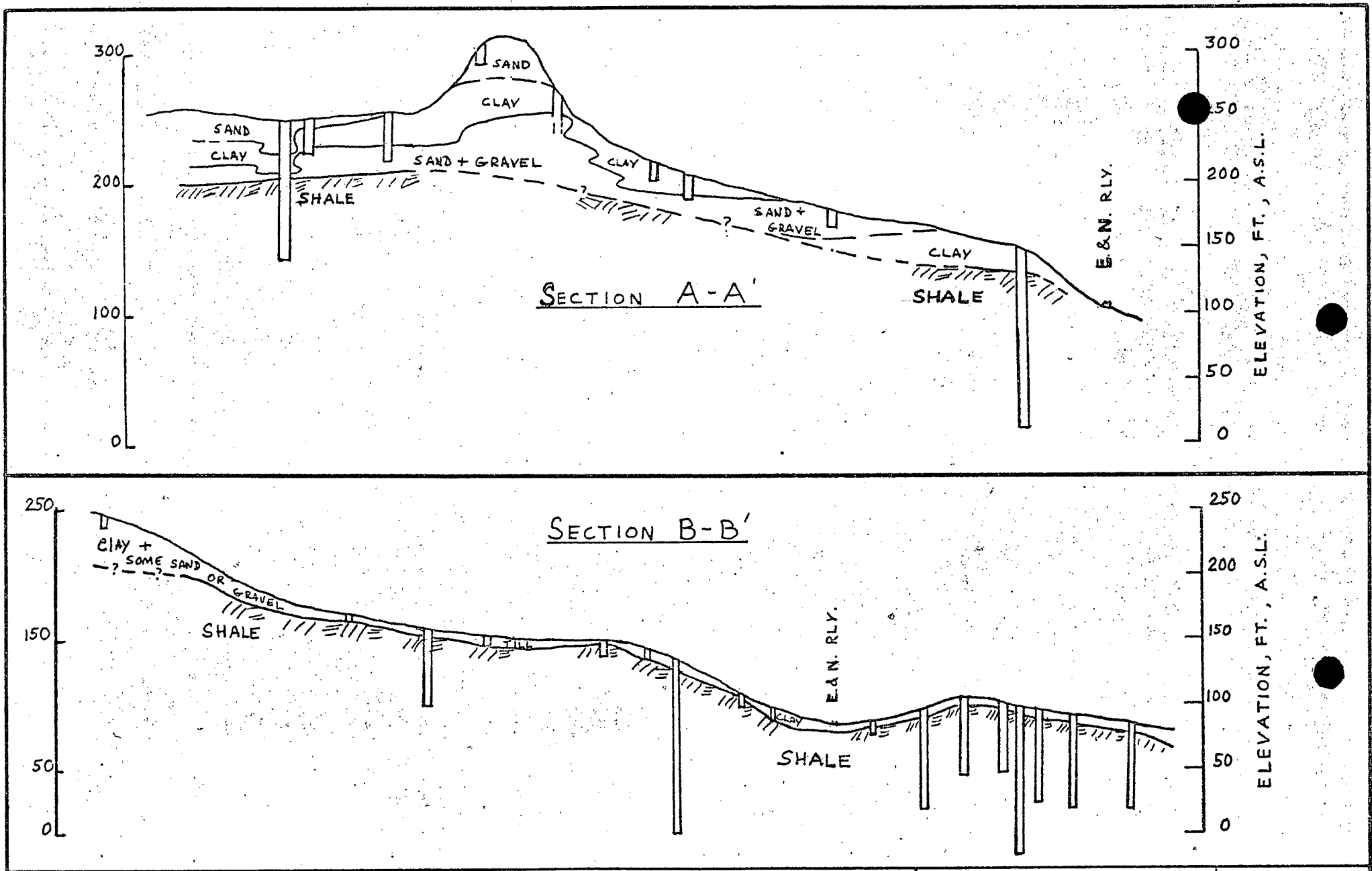

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FIGURE 3

Sections A-A' and B-B'
Somenos Lake area

SCALE: VERT. 1" = 100'
HOR. 1" = 1000'

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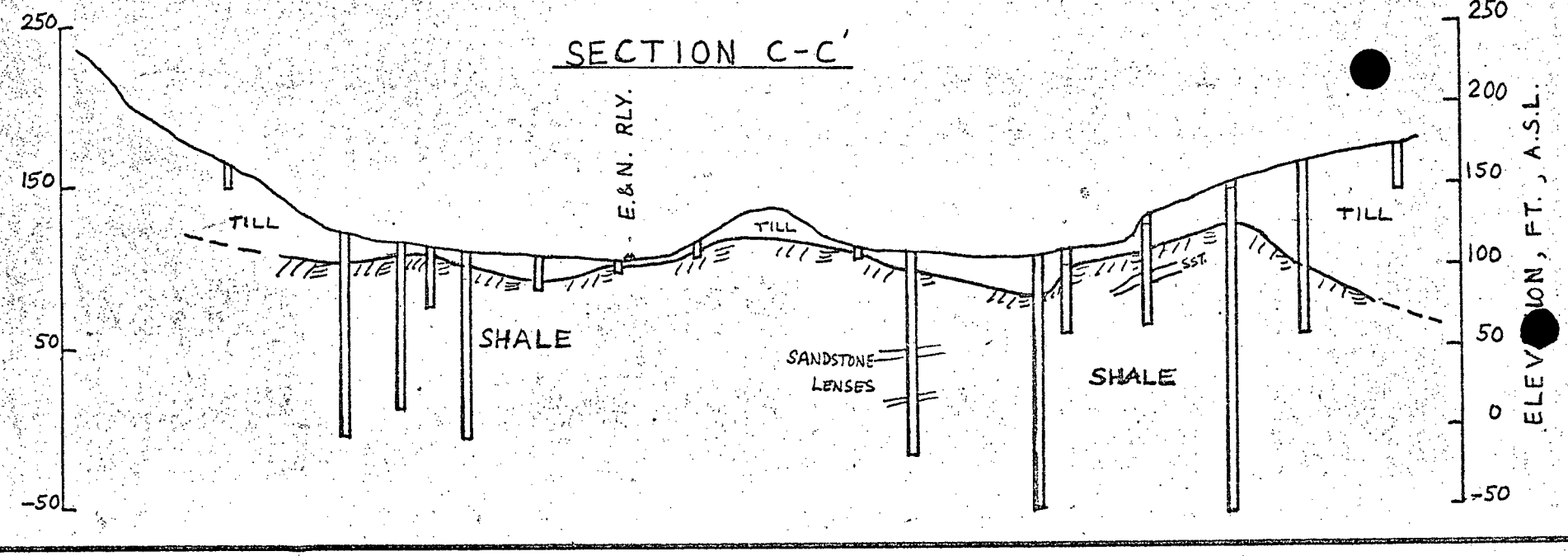

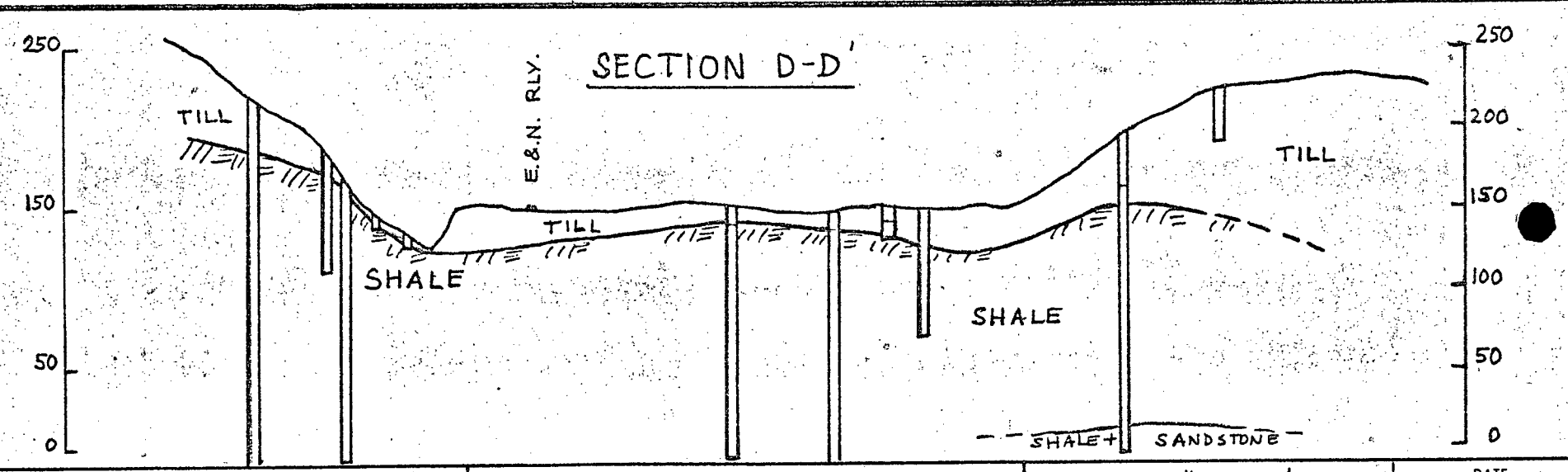

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FIGURE 4

Sections C-C' and D-D'
Somenos Lake area

SCALE: VERT. 1" = 100'
HOR. 1" = 1000'

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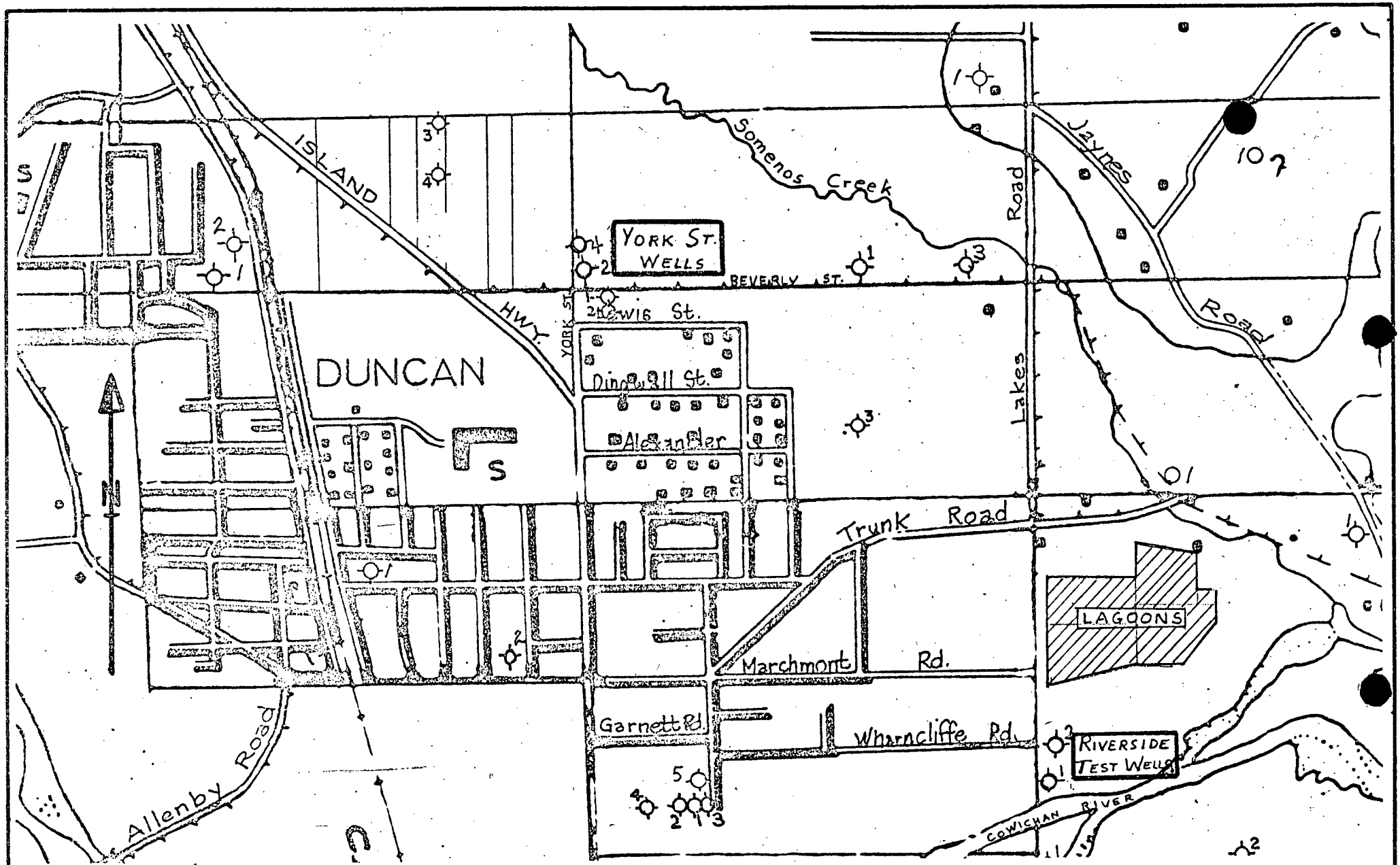

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FIGURE 5
Location of York Street Wells & Riverside Test Wells (near sewage Lagoons)

SCALE: VERT.
HOR. 1" = 1000'

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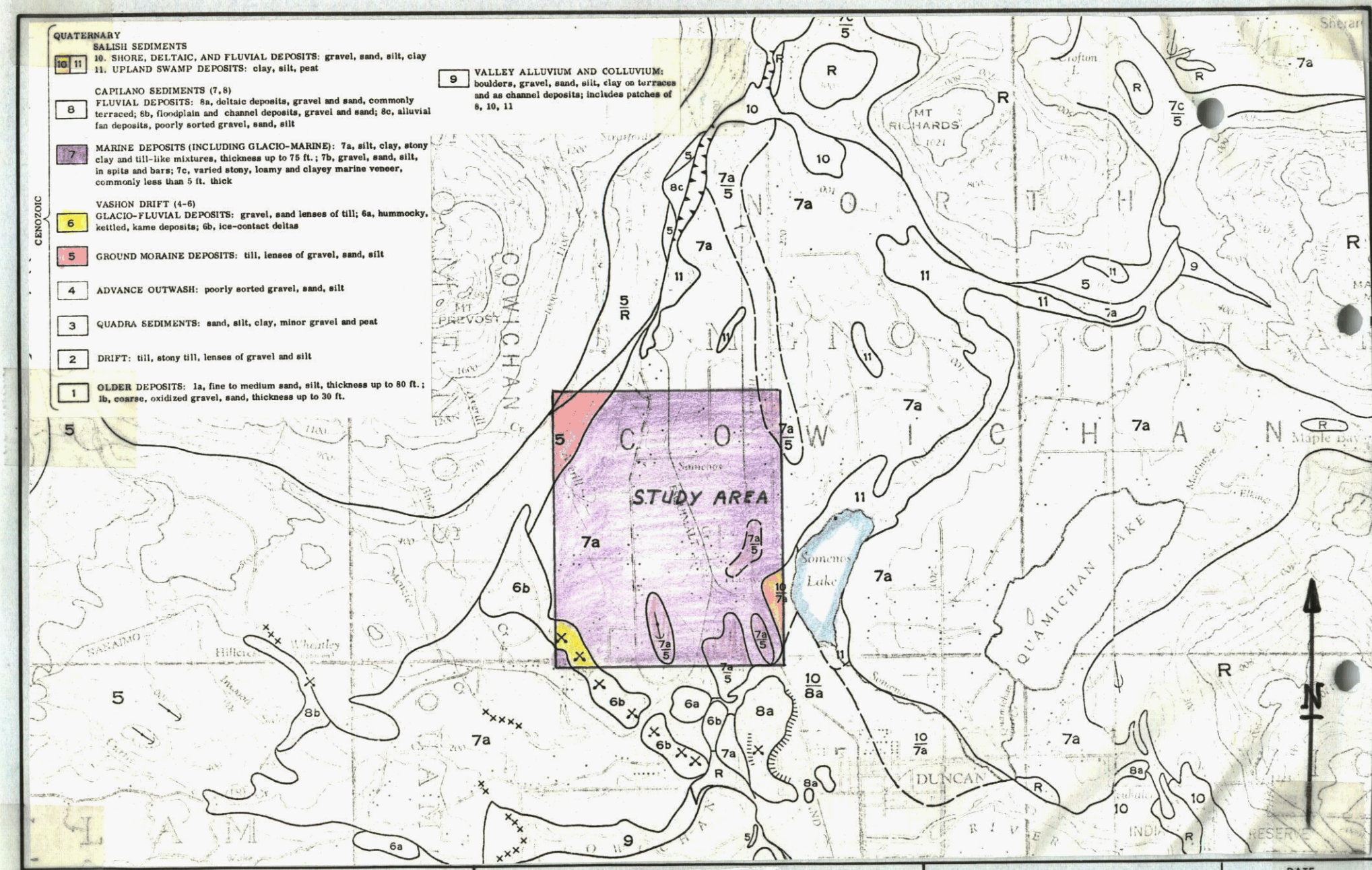

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FIGURE 1
Surficial Geology of Study Area

SCALE: VERT.
HOR. 1" = 1 mile

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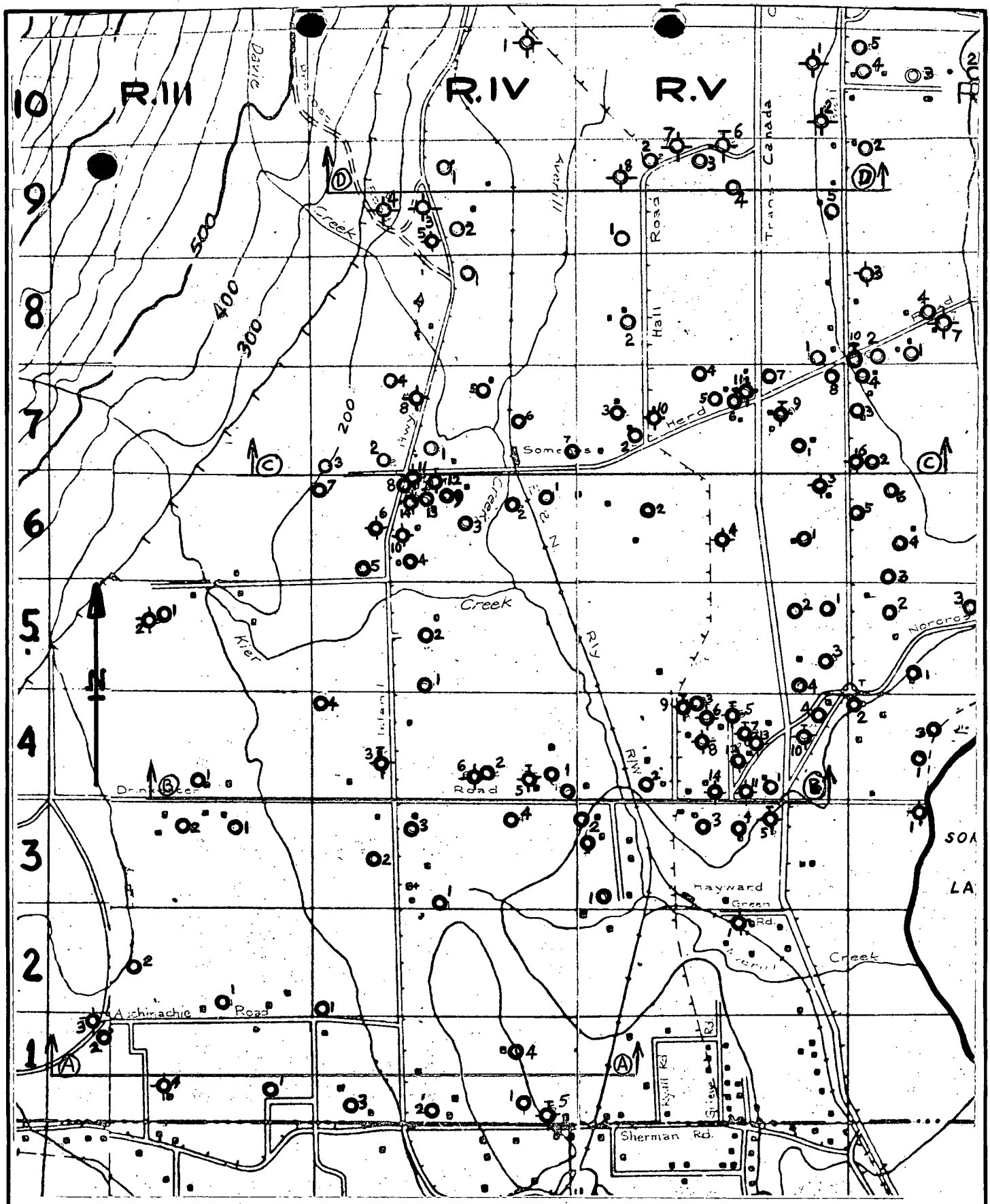

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FIGURE 2

Well Locations

O - DUG WELL

⊖ - DRILLED WELL

SCALE: VERT.

HOR. 1" = 1600'

DATE

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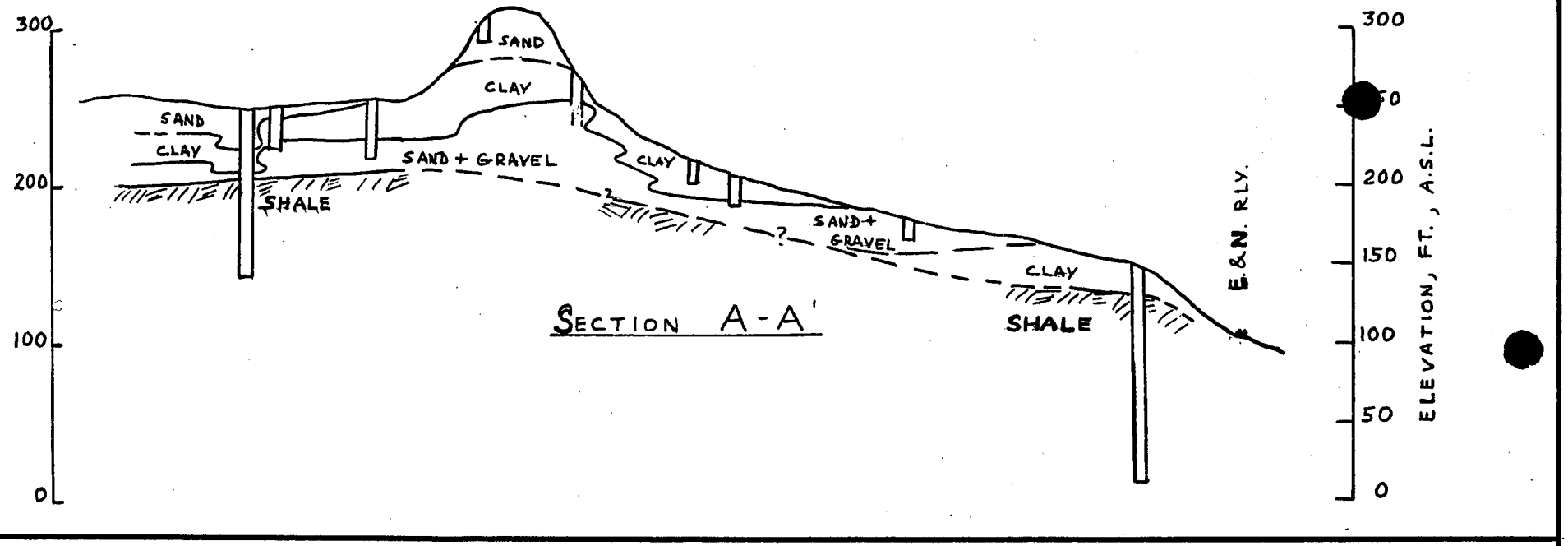
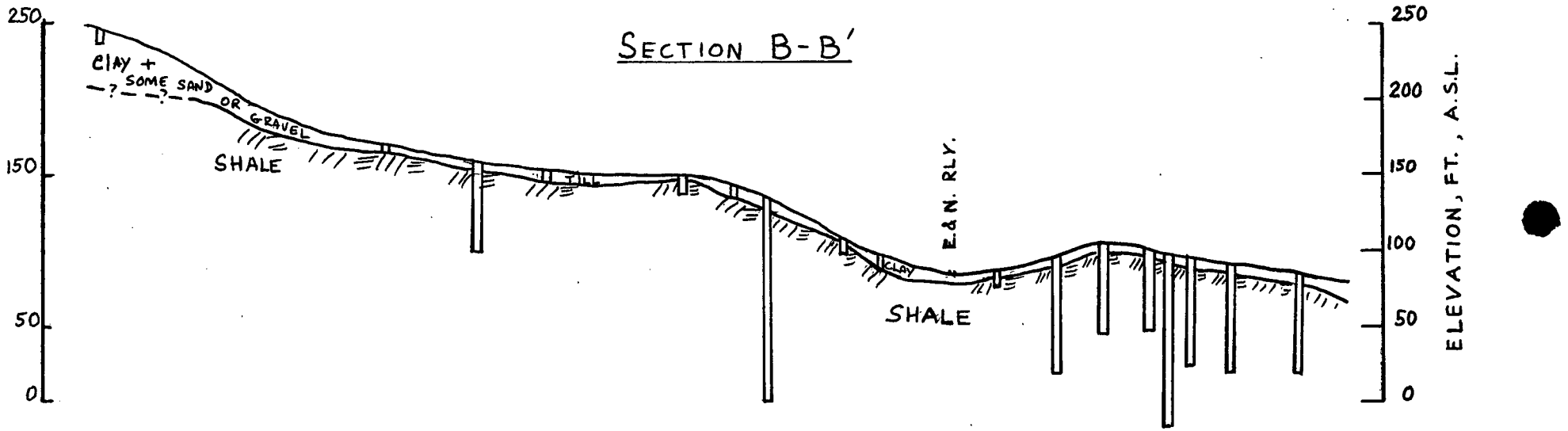


SECTION A-A'



SECTION B-B'

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FIGURE 3

Sections A-A' and B-B'
Somenos Lake area

SCALE: VERT. 1" = 100'
HOR. 1" = 1000'

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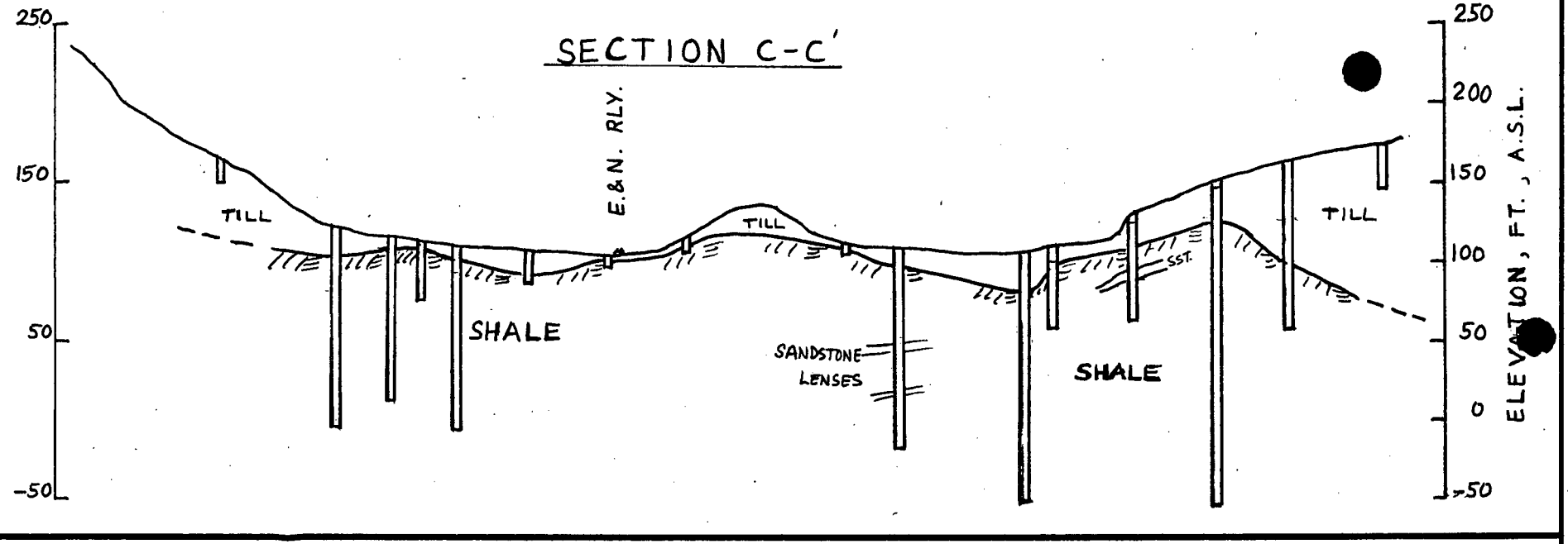

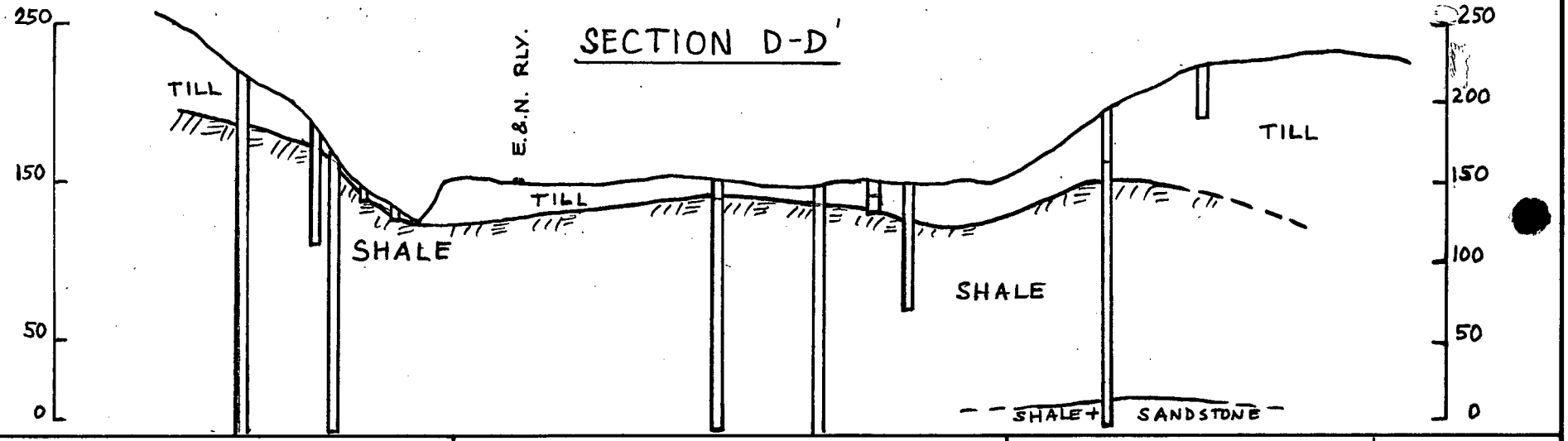

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FIGURE 4

Sections C-C' and D-D'
Somenos Lake area

SCALE: VERT. 1" = 100'
HOR. 1" = 1000'

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TABLE 1
Summary of Wells in Study Area

LOCATION			DEPTH		DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
R.	SEC.	WELL NO.	DUG	DRILLED				
3	1	1	✓				Sand-Hardpan	
3	1	2	26				Sand-Gravel	Moderately Hard
3	1	3		107	26	2½	Soft Shale	
3	1	4		38	27	4	Silty Gravel	
3	2	1	14				Sand	Good Supply
3	2	2	<10					Very Good Supply
3	3	1	✓				Rock	
3	3	2	10		4		Gravel	Flows in Winter
3	4	1	✓				Shale	Inadequate Supply
3	5	1	32		10		Hardpan	Flows in Sept. Moderately Hard
3	5	2		60	18	1.4	Shale	
4	1	1	30					Insufficient Supply
4	1	2	12				Sand or Gravel	Good Supply
4	1	3	20				Sand	Fills in Winter
4	1	4	✓					
4	1	5		138	40	1/3	Shale	
4	2	1	14				Shale	Adequate Supply
4	3	1	30					Insufficient Supply
4	3	2	17					Moderate Supply
4	3	3	14				Shale	Fairly Limited Supply
4	3	4	17				Shale	Inadequate Supply
4	4	1	12&17					Adequate Supply
4	4	2	17&22				Shale	Limited Supply - Hard
4	4	3		60	13	3.2	Shale	Adequate Supply
4	4	4	6					High Iron
4	4	5		135	15	½	Shale	
4	4	6		80				
4	5	1	✓				Shale	High Iron
4	5	2	✓					Limited Supply
4	6	1	10-15				Shale	Small to Moderate Supply
4	6	2	8				Shale	Limited Supply
4	6	3	20				Shale	Considerable Iron
4	6	4	✓					Adequate Supply
4	6	5	20				Boulder Clay	Limited Supply
4	6	6		130	40	½	Shale	
4	6	7	17				Boulder Clay	Sulphury Smell
4	6	8	17					Too Much Iron
4	6	9	5					Moderate Supply
4	6	10		77		8	Shale	
4	6	11		102	4	2/3	Shale	
4	6	12		120	17	½	Shale	
4	6	13		36	16	2	Shale	
4	6	14		150			Shale	Water in Winter

TABLE 1 (cont.)

LOCATION R.	SEC.	WELL NO.	DEPTH DUG	DEPTH DRILLED	DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
4	7	1	14				Blue Clay	Soft-Some Iron
4	7	2	12					Good Supply Somewhat Sulphury
4	7	3	17				Boulder Clay	Inadequate Supply
4	7	4	12					Inadequate Supply
4	7	5	8					Some Iron
4	7	6	✓					Good Supply
4	7	7	8					Adequate Supply
4	7	8		88	20	½	Shale	
4	8	1	10				Shale	Rusty Water
4	9	1	8				Shale	Good Supply
4	9	2	✓				Shale	
4	9	3		69	12	4	Shale	
4	9	4		240		1-2½	Shale	
4	9	5		170	5	3+	Shale	
4	10	1		167	23	½+	Shale	
5	2	1		300	65		Shale	Salt
5	3	1	26					Adequate
5	3	2	14/22					Fairly Hard
5	3	3	✓					Adequate Supply
5	3	4	20				Shale	Adequate Supply
5	3	5		70	4	1	Shale	
5	4	1	11					Fairly Hard
5	4	2	15		3		Solid Rock	
5	4	3	11					Inadequate Supply
5	5	4	18				Hardpan	Dry 1953 (July)
5	4	5		55	5.5	8	Shale	
5	4	6		55	17	2½	Shale	
5	4	7		121	14	1	Shale	
5	4	8		✓				
5	4	9		76	20	5	Shale	
5	4	10		64	9	1	Shale	
5	4	11		63		2+	Shale	
5	4	12		40	8	8	Shale	
5	4	13		71	18	6	Shale	
5	4	14		60	10	1½	Shale	
5	5	1	15					Soft Water
5	5	2	15/20				Shale	Inadequate Supply
5	5	3		75			Bedrock	Adequate Supply
5	5	4	✓					Well Goes Dry
5	6	1	✓					
5	6	2	8			5+	Sand	
5	6	3		210	3.6	0.5	Shale	
5	6	4		153		3	Shale	
5	7	1	29				Quicksand	Adequate Supply
5	7	2	21		17			
5	7	3	4				Rock	
5	7	4	6					Very Hard Water
5	7	5	16		12		Sand	Some Iron

TABLE 1 (cont.)

LOCATION R.	SEC.	WELL NO.	DEPTH DUG	DEPTH DRILLED	DISTANCE TO WATER (FT.)	G.P.M.	WELL ENDS IN	REMARKS
5	7	6	15		7		Shale	Poor Quality
5	7	7	✓		8			
5	7	8	6				Shale	
5	7	9		65	7	1.3	Shale	
5	7	10		100	8	2½	Shale	
5	7	11		50	10	1/3		
5	8	1	11				Gravel	Moderately Hard
5	8	2	14		10		Pure Sand	Good Supply
5	9	1	10		6		Shale	Small Supply
5	9	2	✓					Not Very Good Water
5	9	3	20		10		Rock	Good Water
5	9	4					Sand	
5	9	5	11				Sand	Adequate Supply
5	9	6	80			10	Shale	
5	9	7		200		3	Shale	
5	9	8		160	12	1½	Shale	
5	10	1		186	34	5	Shale	
5	10	2		200	37	2	Sandstone-Shale	
6	3	1		80	3	2½	Shale	Hole Capped (1% Salt)
6	4	1	14					
6	4	2	14					Inadequate Supply
6	4	3	6					
6	5	1	18					
6	5	2	13				Bedrock	Fair Supply
6	5	3	20-30					Inadequate Supply
6	6	3	25					Fairly Hard, Good Supply
6	6	4	30				Boulder Clay	Very Good Supply
6	6	5	33					Fairly Hard
6	6	6	8					Fairly Hard
6	7	2	21.5		9			Fairly Hard
6	7	3	25				Boulder Clay	Not Enough Water
6	7	4	29		12		Boulder Clay	Very Hard Water
6	7	6		96	8	1½	Shale	
6	8	1	15				Gravel	Good Supply
6	8	2	24		6			
6	8	3		30				
6	8	4		30				
6	8	7		61	37	4	Blue Clay	
6	8	10		100	8			
6	9	2	35					
6	10	2	27				Stoney Clay	
6	10	3	38		35½		Blue Clay	
6	10	4	24				Sand	
6	10	5	38				Gravel	