



To: A.P. Kohut
Senior Geological Engineer
Groundwater Section
Water Management Branch

Date: May 16, 1986
Our File: 0329563-A

Re: Groundwater Quality Monitoring and Assessment Program 1985/86
Cowichan-Koksilah Estuary - Spring, 1986 Field Survey

Introduction

This memo discusses the results of the above which was carried out by F. Chwojka on April 7, 1986 (Chwojka, 1986). The survey was recommended by Wei (1985).

Surface Water Sampling

Surface water quality at the sites along the Cowichan-Koksilah Estuary has improved since September, 1985, and is similar to the quality in November, 1985 (Figure 1). This is probably due to increased discharge of the river system occurring after September (but before November). Comments from Chwojka (1986) suggest that sampling should be standardized because NaCl content varies with depth at any particular site along the river channel and with the tide. Sites 1,2,3,5,6, and 9 are located next to bridges and thus a sampling location could be set up at each bridge to measure the conductivity of water from the bottom part of the river channel (salty water underlies freshwater) with a conductivity probe (GW-6). For Sites 7 and 8, a new site could be set up at a small wooden bridge just downstream of Site 8. Site 4 should be dropped because of difficulty in getting a standardized sample at this location. Sampling should always be done during high tide (consult tide chart) and the date and time of sampling should always be noted. Discharge and tidal data of the local area when available should also be compared with the sampling data.

Groundwater Sampling

An updated summary of the well status is shown in Table 1. The Blackeley well has been abandoned and the Doman 5 well is now being used by a new fish hatchery.

. . . 2

Results of the sample analyses have been plotted in Figures 2 to 9. One sample was from the upper aquifer (Dinsdale's well); all others were from the lower aquifer. Water quality from sampling of the lower aquifer shows that all sites except the Johnstone and Doman 2 wells exhibited the same trends:

- 1) decrease of one or more order of magnitude of pH
- 2) increase in HCO_3^- content (M.O. Alkalinity)
- 3) no change in Hardness
- 4) increase in NaCl content and conductivity

Part of the decrease of pH can be explained by increase in temperature as the samples became heated in the truck. The only significant rise in NaCl content and conductivity was measured at the S. Hagar well; the rest of the wells showed only a slight increase. Water quality of the Johnstone well which previously showed the highest NaCl content of any of the wells in the lower aquifer has improved. The well is also flowing now whereas in September the water level was a few feet below ground level. The NaCl content of the Doman 2 well has also dropped noticeably. In both these wells where the NaCl content and conductivity decreased, the HCO_3^- content also decreased. The NaCl and HCO_3^- content of the lower aquifer may be correlatable. No interpretation is made at this time. More data is needed to map out any definite patterns of seawater intrusion in the lower aquifer.

The NaCl content of the Dinsdale well has decreased slightly (as reflected by the conductivity). Water quality in the shallow aquifer is probably intimately related to the discharge of the river system and the tide but may also vary because of sampling stagnant water in the abandoned well.

Results of the sampling suggest that conductivity is a better indicator of salty water than the Hach kit (NaCl) because it is more sensitive. Also the frequency of sampling needs to be increased to 4 times a year to gain confidence in the data. Sampling of the above 7 wells for field analysis should be done in March, June, September, and December. Field analysis should always be done immediately after the sample is taken. NaCl and Alkalinity should be tested using the procedures for "low range" testing. The same equipment should be used all the time for sampling and analysis (or the equipment should all be calibrated). The date and time of sampling should always be noted. Sampling for lab analysis and of the other wells in the estuary should continue as outlined in Wei (1985).

Establishment of Observation Wells

Another visit is needed to investigate the possibility of using the Dinsdale and Blackeley wells as observation wells to monitor the water level in the upper aquifer and to pick out sites for observation well drilling (see Figure 1 and refer to Wei, 1985). Arrangements should be made to receive data from Cowichan Bay Waterworks District on a monthly basis rather than the present bi-annual basis.

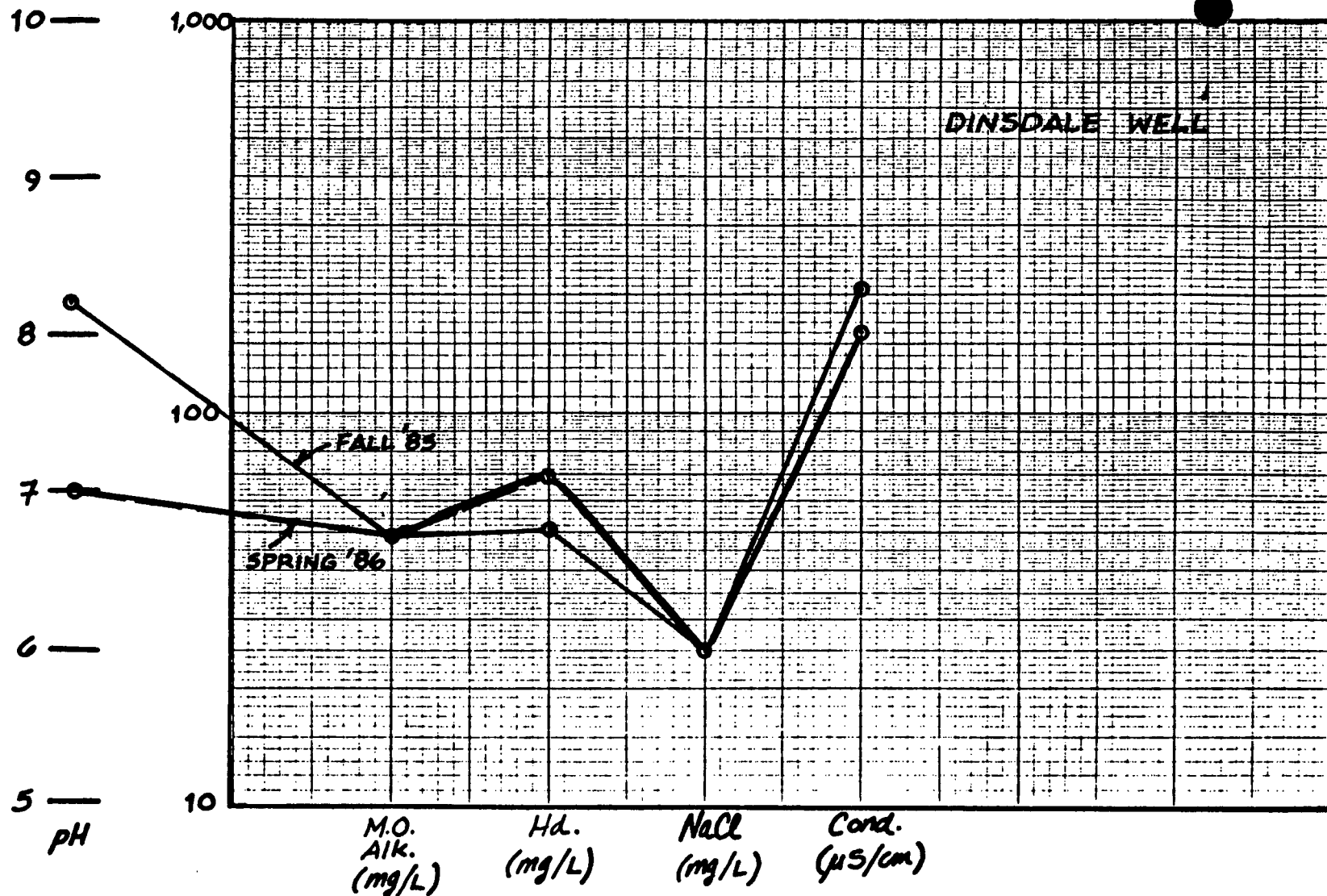
References

- Chwojka, F. 1986. Groundwater Quality Monitoring - Cowichan Bay Area - Duncan. Ministry of Environment, Groundwater Section, Victoria, B.C. File 0329563-A.
- Wei, M. 1985. Groundwater Quality Monitoring and Assessment Program 1985/86 - Cowichan-Koksilah Estuary - Fall, 1985 Field Survey. Ministry of Environment, Groundwater Section, Victoria, B.C. File 0329563-A.



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FIELD ANALYSES OF GROUNDWATER SAMPLING



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TO ACCOMPANY REPORT ON

COWICHAN-KOKSILAH ESTUARY.

SCALE: VERT. **AS SHOWN**

HOR. **N/A**

DATE

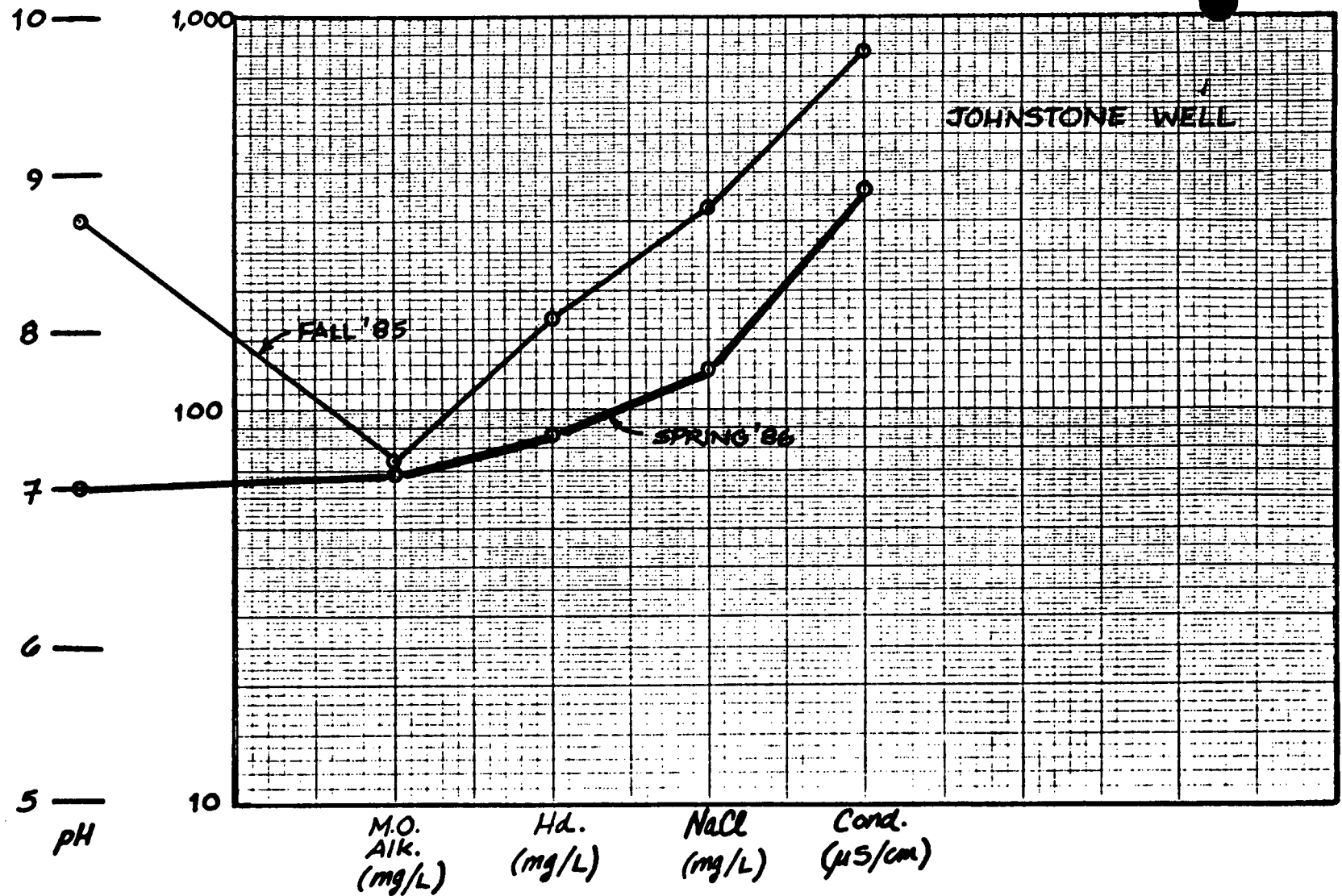
7/5/86

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FILE No **0329563-A** DWG. No **FIGURE 2**

FIELD ANALYSES OF GROUNDWATER SAMPLING



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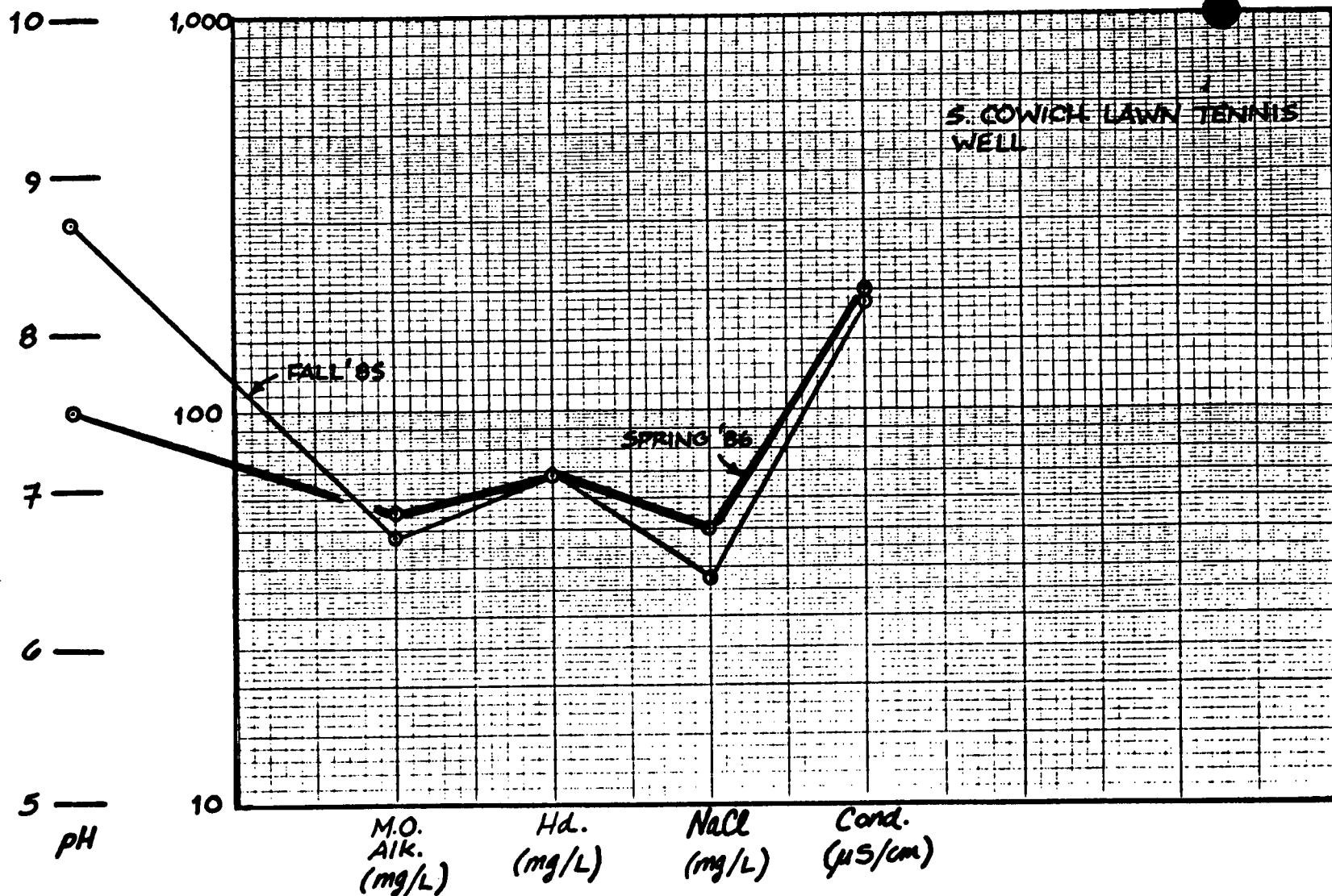
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FILE No **0329563-A** DWG. No. **FIGURE 3**

VANICAL - 7189

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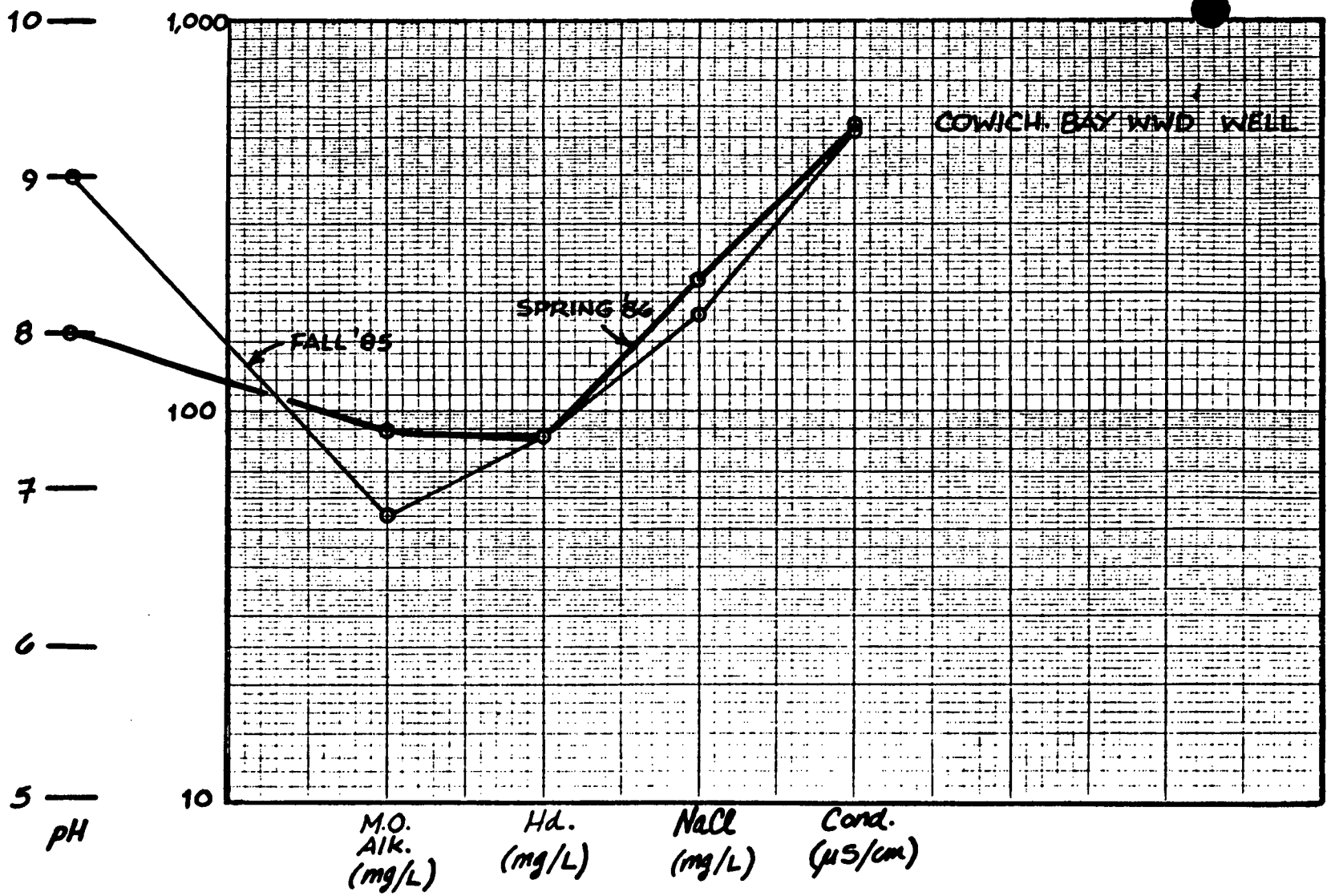
DATE

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FILE No. **0329503-A** DWG. No. **FIGURE 4**

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FIELD ANALYSES OF GROUNDWATER SAMPLING



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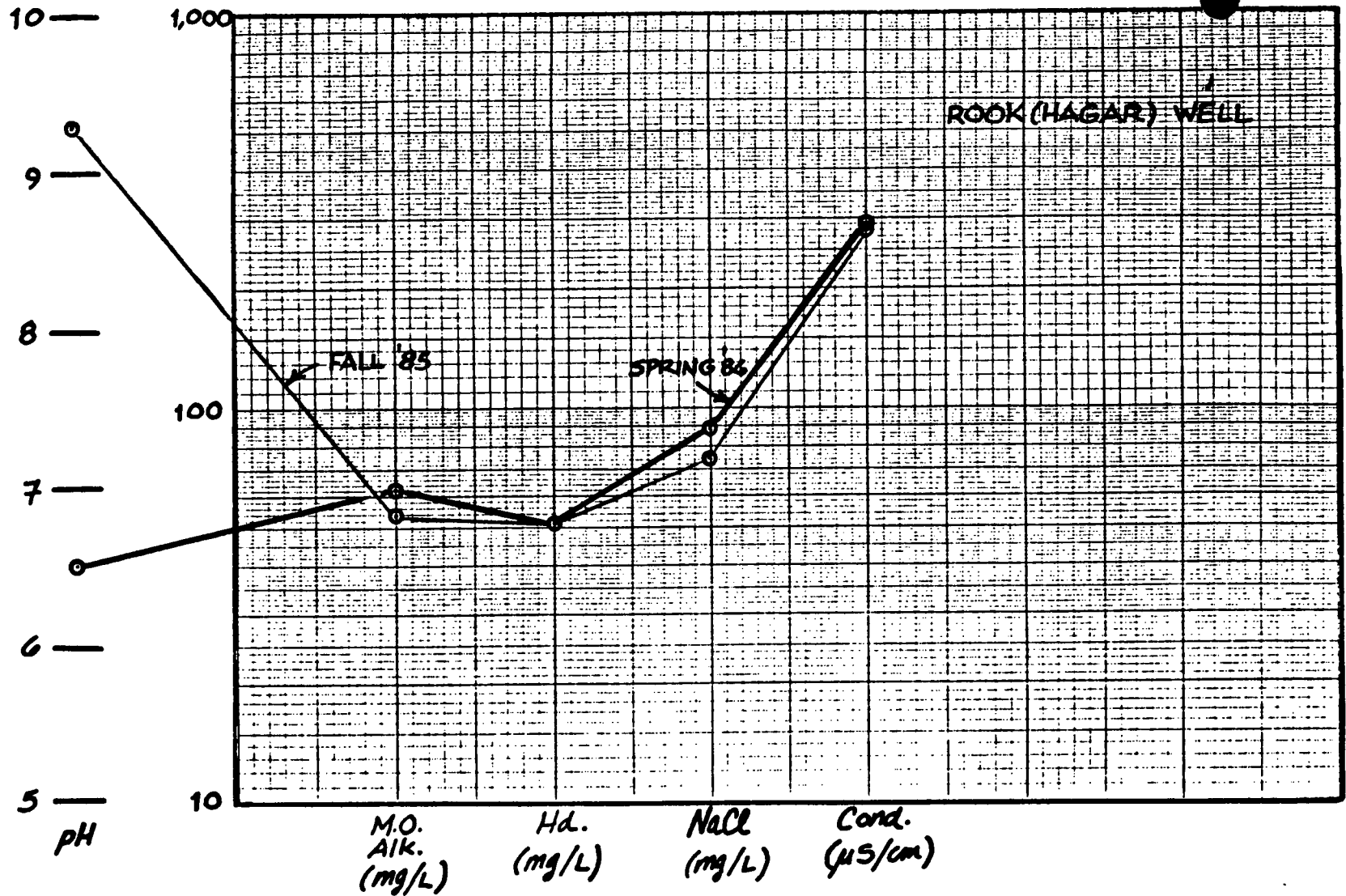
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FILE No **0329563-A** DWG No **FIGURE 5**

FIELD ANALYSES OF GROUNDWATER SAMPLING



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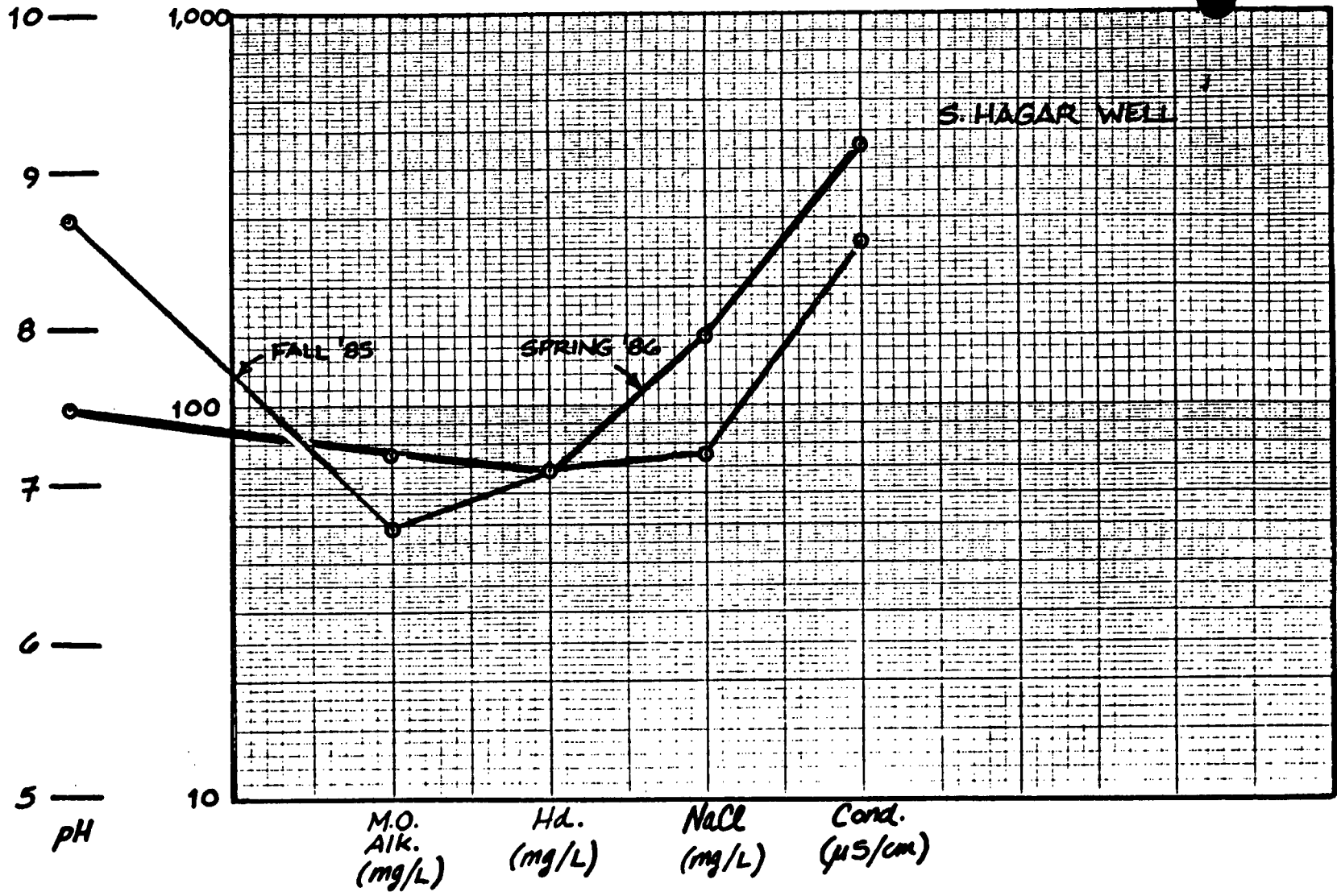
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FILE No. **0329563-A** DWG. No. **FIGURE 6**

VANCOUVER - 7188

FIELD ANALYSES OF GROUNDWATER SAMPLING



VANCAL - 7188



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COWICHAN-KOKSILAH ESTUARY.

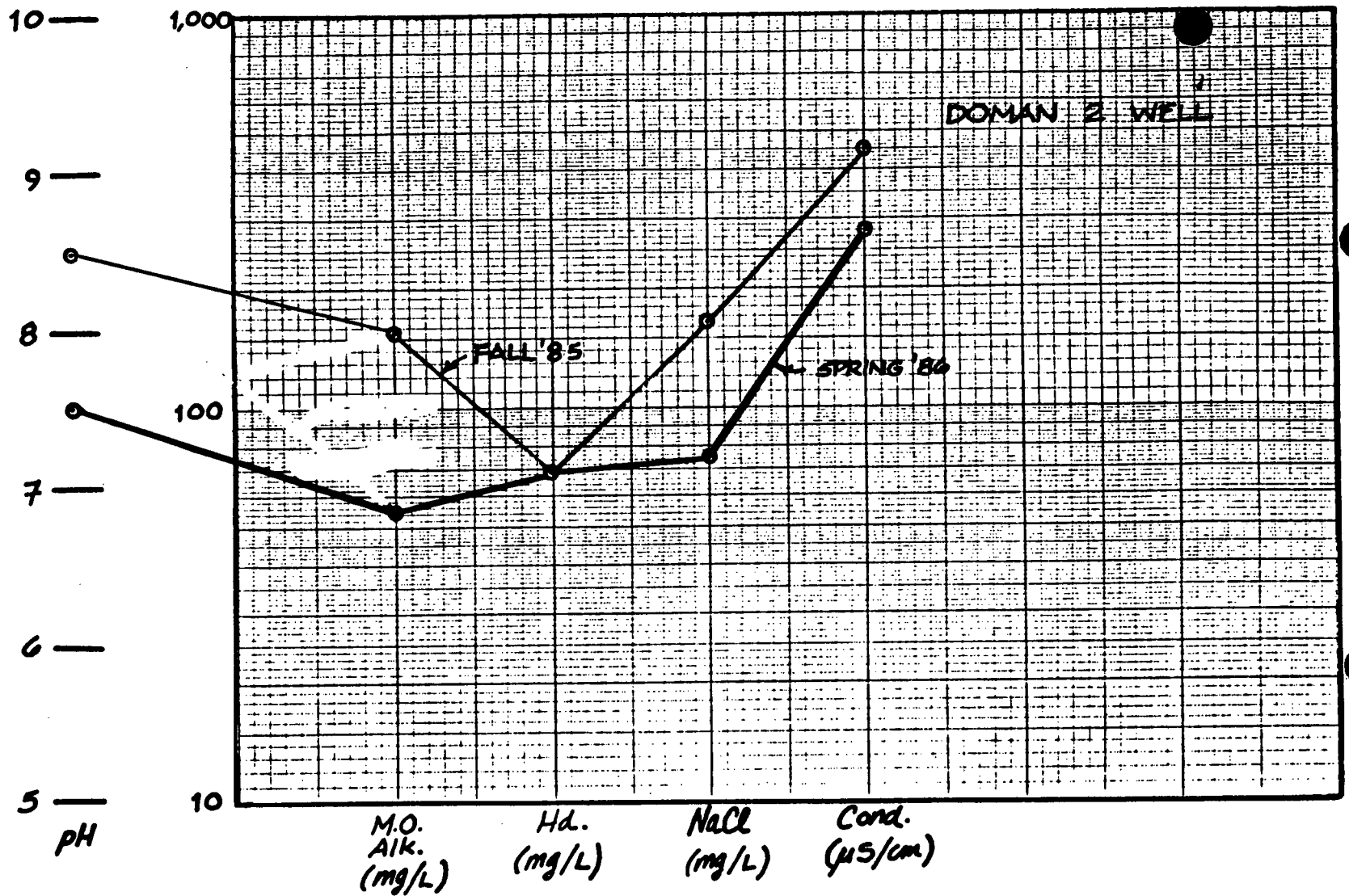
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FILE No **0329563-A** DWG No **FIGURE 7**

FIELD ANALYSES OF GROUNDWATER SAMPLING



VANCAL - 7186



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COWICHAN-KOKSILAH ESTUARY.

SCALE: VERT. **AS SHOWN**
 HOR. **N/A**

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FILE No **0329563-A** DWG No **FIGURE 8**

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USE SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
MILLER & ESCOFFER CO. MADE IN U.S.A.

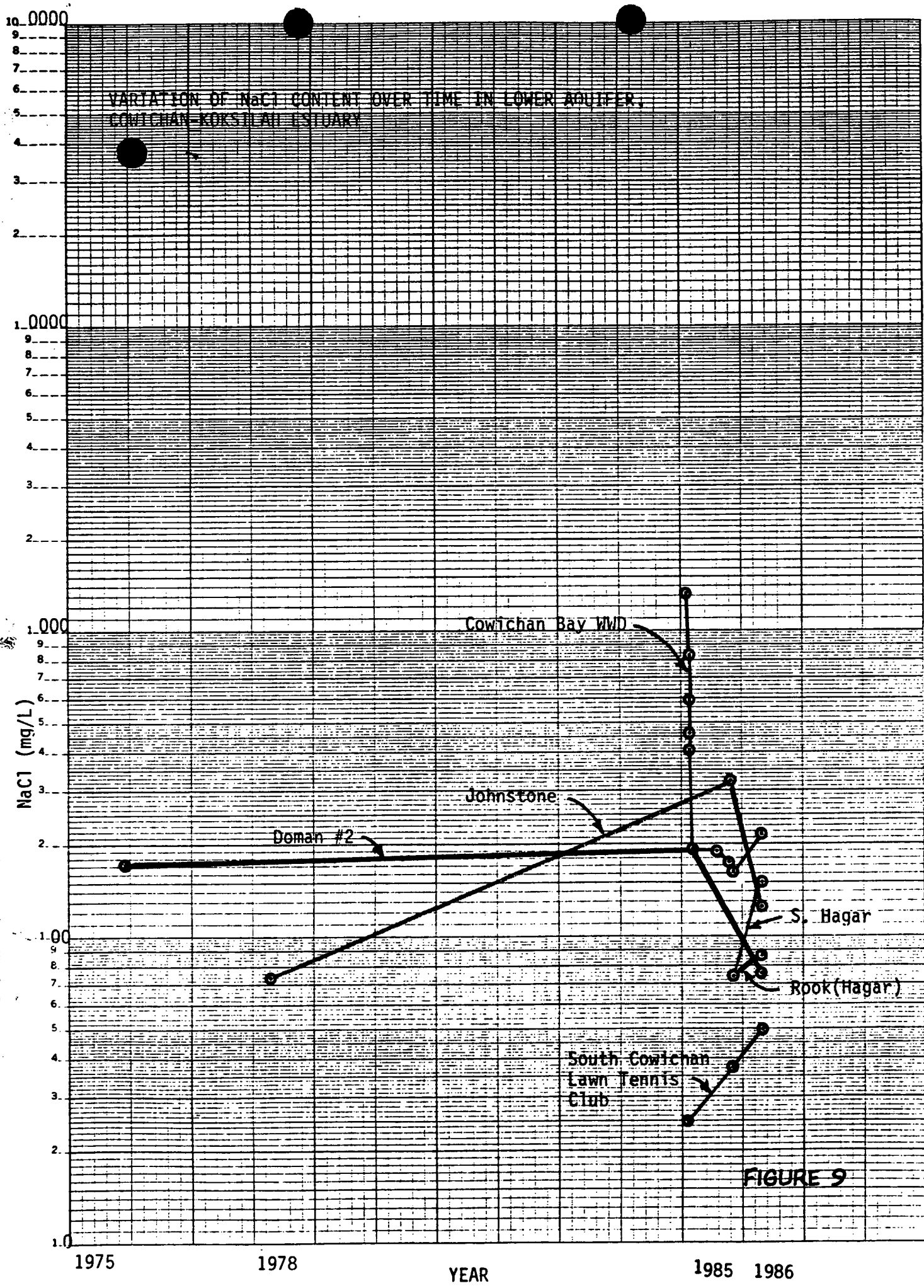


FIGURE 9

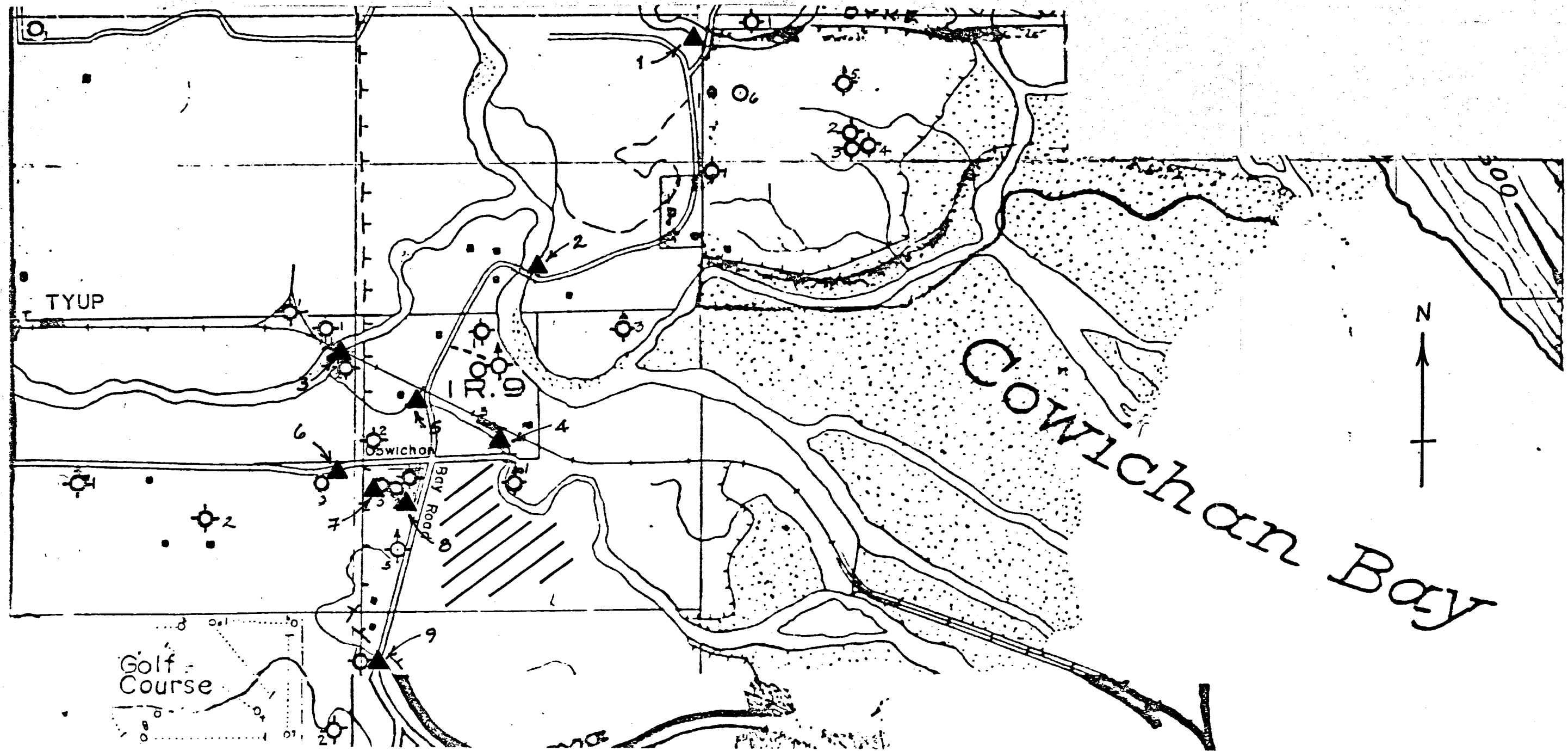
TABLE 1

Summary of Well Status and Water Use - Cowichan-Koksilah Estuary - Spring, 1986

WELL	NO.	SOURCE OF WATER	STATUS	WATER USE	EST. Q PUMPED/DAY	NOTES
Bernard	X1 Y10 #1	upper aquifer	in use	supplies small inn	100 US gal.	
Dinsdale	X1 Y10 #2	upper aquifer	status unknown	?	?	
Dinsdale	X1 Y10 #3	upper aquifer	not in use	--	--	
S.Cowichan Lawn Tennis	X2 Y10 #2	upper aquifer	abandoned	--	--	unreliable yield
McLeod	X2 Y10 #3	upper aquifer	abandoned	--	--	poor quality water
Indian Dept.	X1 Y11 #1	upper aquifer	abandoned	--	--	replaced by City water
C.N. Rail	X1 Y11 #2	upper aquifer	abandoned	--	--	
I.R. 9	X2 Y11 #1	upper aquifer	abandoned	--	--	replaced by City water
Indian Dept.	X2 Y11 #2	upper aquifer	abandoned	--	--	replaced by City water
I.R. 9	X2 Y11 #5	upper aquifer	not in use	--	--	salty water
Slegg Bros.	X3 Y12 #1	upper aquifer	abandoned	--	--	
Indian Coop.	X1 Y13 #1	upper aquifer	status unknown	?	?	
I.R. 1	X3 Y13 #1	upper aquifer	status unknown	?	?	
Blackeley	X3 Y13 #6	upper aquifer	abandoned	--	--	salty water, high Fe.
Doman Hog Fuel	X1 Y12 #1	middle aquifer	not in use	--	--	
Johnstone (Clarke)	X2 Y10 #1	lower aquifer	in use	domestic	up to several hundred USgal.	R.V. Park under const- ruction
S. Cowichan Lawn Tennis	X2 Y10 #4	lower aquifer	in use	domestic and irrigation	up to 10,000 USgal. + in summer	
Cowich.Bay WWD	X2 Y10 #5	lower aquifer	in use	water utility		records available from District
Rook (Hagar)	X2 Y11 #3	lower aquifer	in use	domestic and irrigation	?	
S. Hagar	X2 Y11 #4	lower aquifer	in use	domestic	200 USgal.	
Doman 2	X3 Y13 #2	lower aquifer	in use	industrial	up to several	
Doman 3	X3 Y13 #3	lower aquifer	in use	industrial	thousand + USgal.	Hooked up to Doman 2
Doman 4	X3 Y13 #4	lower aquifer	not in use	fire protection	--	Test run every Thursday
Doman 5	X3 Y13 #5	lower aquifer	in use	fish hatchery	?	
Sankey	X2 Y9 #1	bedrock	in use	domestic	200 USgal.	

Note: information based on field survey.

WATER QUALITY SAMPLING SITES - COWICHAN-KOKSILAH ESTUARY



LEGEND

- ▲ - SURFACE WATER SAMPLING SITE
- /// - AREA FOR OBS. WELL DRILLING

SCALE 1:12,000

FIGURE 1