APPENDIX F

OKANAGAN VALLEY SEISMIC SURVEY

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OKANAGAN VALLEY SEISMIC SURVEY

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F.1 INTRODUCTION

This revised report was prepared in order to incorporate the new data available as a result of the nine hole drilling program carried out in the autumn of 1970.

The seismic data has been reviewed an in places re-interpreted to provide a combined geological-geophysical picture which is compatable with all the data. For this purpose, revised seismic refraction profiles and reflection sections have been prepared. A table of percentage error in prognoses is presented. Predicted bedrock depths based on the Geologic Survey of Canada program are indicated on the seismic refraction profiles.

F.2 DISCUSSION OF RESULTS OF 1970 TEST HOLE PROGRAM

The seismic profiles have been revised on the basis of the following criteria:

1. New test hole data
2. Revised refraction interpretation
3. Revised reflection interpretation

Table F.1 was prepared to focus attention on problem areas. The limit of error expected on this project was +- 10%. Where this is exceeded, it is likely that the basic assumptions made in the calculation are incorrect. In all cases, a review of the data has provided a reasonable explanation. In particular, the new test hole data provided a more detailed reflection interpretation which was a major factor in revising the seismic refraction profiles.

The following brief discussion of each profile should serve to explain the basis for revision in each case.

LINE 1

Three test holes drilled on this line showed a wide range of accuracy in the seismic prognosis. Test Hole No. 1, at Station 5, encountered gravel only 20 feet shallower than predicted, but an incorrect seismic interpretive assumption together with an inaccurate extrapolation of surface dips of the valley wall led to a large error in bedrock depth calculation.

TABLE F.1

PERCENTAGE ERROR IN PROGNOSES

HOLE	CONTACT	PREDICTED	ACTUAL	% ERROR
Deep Hole 1	Bedrock	1,645	1,884	+ 13%
Deep Hole 2	Gravel	880	950	+ 7%
	"Quartzite" (Base of till)	1,227	1,230	0%
Deep Hole 4	Bedrock	800+	800+	0%
Test Hole 1	Gravel	105	85	- 24%
	Bedrock	475	95	- 500%
Test Hole 2	Silt	430	440	+ 2%
Test Hole 3		880	415 ?	- 110%?
Test Hole 4	Base oridized zone	200	200	0%
	Bedrock	510	548	+ 7%
Test Hole 5	Bedrock	650	872	+ 25%

In Test Hole No.2, a silt layer correlated very well with the 6,000 ft/sec. layer noted on the seismic refraction profile. The initial report postulated a thin layer which seems to be the case as the log reverts to sand after 70 feet of silt.

Deep Test Hole. No.1 encountered a hard shale or till at the predicted bedrock level. It is likely that this bed is a refracting interface which masks the true bedrock. A deeper event on the reflection section shows the bedrock to be 230 feet deeper if an average seismic velocity of 7,500 ft/sec for the 230 foot interval is used (a reasonable assumption from the hole log). A strong reflection not interpreted previously ties to the gravel. One observation that gives credence to this gravel reflection is its absence at Station 102, in proximity to C23 TH1. north of Station 98. No gravel was logged in this well, implying that a discontinuous sand-gravel interface does exist as shown on the seismic refraction profile.

LINE 2

Two test holes were drilled on this line. Deep Test Hole No.2 at Station 40 verified the predicted gravel-sand sequence and hit bedrock below the deepest refracting interface as predicted. The "quartzite" logged in the Enderby No.1 Well likely is the white sand and silty sand reported below the till. As was the case on Line 1, it is likely that the till at 1,150 feet is a refractor which masks the bedrock refraction in the deeper part of the valley. A deep reflection at Station 35 correlates with the bedrock.

Test Hole No.3 hit bedrock 440 feet above the predicted level. A review of the refraction plots reveals good evidence for a high velocity (10,000 ft/sec) layer extending from Station 101 to 67. The plots from Station 69 west are atypical for the area but with no reflection or geological data, a simplified interpretation was made initially. Whether the bedrock logged is a thin stringer or detrital or a moundlike mass of detrital and gravel is not determinable, however, there is a good chance that it is not the true bedrock.

LINE 3

Test Hole No. 5 found the bedrock 220 feet deeper than predicted. In this instance, a recomputation of the bedrock depth using the criteria used in re-calculating the east end of Line 1, provides a tie with the bedrock which is confirmed by a deep reflection.

Note that this line was shot by the B.S.C. and that their prognosis was 140 feet lOw, of -16%. I think the relative inaccuracy of both surveys at this point is related to the fact that this is the deepest, narrowest portion of the valley surveyed.

The main reason I do not attribute the error to a masking effect by the till logged is that, unlike the data on Lines 1 and 2, the seismic data on Line 3 can be reinterpreted to yield a deeper bedrock. Where this is the case, I think it more likely that the bedrock is indeed the refracting interface.

LINE 4

Test Hole No.4 (Station 16) verified the seismic interpretation very well. The 200 foot thick low velocity determined at the nearest control point (Station 22) correlates with the oxidized sand. The bedrock was found within the expected limit of error.

LINE 5

Deep Test Hole No.4 hit congolmerate 40 feet below the predicted bedrock. With the hole drilled off the seismic line and the various extrapolations that are possible from surrounding control points, it is likely that the bedrock is very close to the predicted level.

F.3 CONCLUSIONS

The seismic survey appears to have been reasonably accurate on the central portions of Lines 1 and 2, Line 4, and Line 5. On the flanks of the valley, steep dips, erratic gravel deposits and poorer seismic control combine to make interpretation more hazardous. However, we are likely more concerned with the deeper sections of the valley for purposes of the total program.

By carefully combining geological and seismic data the seismic interpretation is fortified. It can be anticipated that additional drilling in the area would show more overall accuracy in the revised profiles than was found in the initial program. In particular the reflection sections are more understandable and yield more predictive information.

The degree to which the program has been a success and the advisability of using more seismic in the future must be defined in terms of the objectives of the program. With the exceptions noted above, the bedrock valley profile was in general successfully predicted. The other aim, to determine the lithology of valley fin deposits, was achieved in some places. The silt lense detected by Line 1 refraction data and verified by Test Hole N0.2; the gravel-sand sequence predicted by Line 2 reflection data and verified by Deep Test Hole No.2; and the deep 200 foot weathered sand interpreted on Line 4 refraction data, verified by Test Hole No.4 are examples of the ability of the program to achieve, to some extent, this more demanding objective.

The possibilities of detailed gravity work have been investigated. Gravity work would not help in determining valley fill lithology and would not help in making depth determinations where the bedrock profile is relatively smooth, but ridges, terraces and channels would be observable and would permit a depth to bedrock cat dilation where they occurred. Thus gravity may detect the bedrock terrace indicated by seismic underlying the west half of Line 4. It would resolve the problem on the northwest end of Line 2 where the "bedrock" encountered in Test Hole No.3 may be a detrital stringer, thick detrital lense or a bedrock terrace. The bedrock highs underlying Lines 2 and 5 would be discernable even without the proximity of large outcrops.

Note that the total cost of last year's seismic program was about $1,600 per mile. The cost of a small gravity survey would not exceed $100 per mile.

Regarding the seismic operations, I would in future recommend an increased effort to obtain reflection data by shooting additional holes. It appears the slight extra expense would yield a rewarding amount of data. This should of course only be attempted in areas where satisfactory record quality can be anticipated.

If it is necessary to define the valley lithology, and configuration in more detail, I think seismic has a role to play. The knowledge obtained from each test hole can be extrapolated over a larger area more economically than by drilling. It is possible that gravity will solve some specific problems of bedrock configuration. Incorporated with seismic and geological data there is a good chance that meaningful gravity results can be obtained.