SAND AND GRAVEL RESOURCE STUDY

OF THE

CUMBERLAND & T'SABLE RIVER AREA

VANCOUVER ISLAND - BRITISH COLUMBIA

By: BAYROCK AND REIMCHEN
SURFICIAL GEOLOGY LTD.
North Vancouver, British Columbia

PREPARED FOR

WELDWOOD OF CANADA LIMITED

PREPARED BY

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August 7, 1975

Mr. M. P. Curcio,
Weldwood of Canada Limited,
1055 West Hastings Street,
Vancouver, B.C.
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Dear Mike:

We are pleased to have had the opportunity to perform a study on the sand and gravel deposits of Cumberland and T'Sable River areas near Courtenay, British Columbia.

We have calculated that the minimum potential aggregate reserve of this area is in the order of 250,000,000 cubic yards.

Three areas have been delineated for development work. The sand and gravel deposits, with a minimum of alterations, have the necessary requirements for concrete aggregate. We would be pleased to answer any questions you may have regarding this report.

Sincerely,

THFR/mp

T.H.F. Reimchen, P. Geol.

VANCOUVER ISLAND RESOURCE STUDY
SAND AND GRAVEL SURVEY OF THE
CUMBERLAND AND T'SABLE RIVER AREA

INTRODUCTION

Terms of Reference

To conduct a survey of sand and gravel in the Cumberland and T'Sable River areas.

To evaluate the quality and quantity of sand and gravel deposits in the same area on a reconnaissance basis.

Previous Work

A soil survey for this area of Vancouver Island was conducted by Day, Farstad and Laird in 1959. The surface soils which overlie much of the sand and gravel deposits are brown podsols. A preliminary estimate of the quantity of some of the sand and gravel deposits for the Courtenay area was conducted by Leaming in 1968. The study is of a general nature but it does approximate a rough outline of some deposits. The surficial geology of the area was mapped on an exploratory basis by Fyles in 1960. The map identified many of the major deposits and their approximate outline.

Study Approach

This study is based on an interpretation of aerial photographs, published data, and Weldwood Company reports in conjunction with a field investigation. In addition, several samples were collected on a reconnaissance basis in an attempt to typify the deposits, both quantitatively and qualitatively.

Geological Setting

Vancouver Island forms part of a chain of mountains called Insular Mountains. These mountains form the outer fringe of the mountain range of the Coast Mountains. Vancouver Island Mountains consist of folded and faulted volcanic and sedimentary rocks, chiefly, of Mesozoic Age, which have been intruded by igneous rocks during Late Mesozoic and younger time. Consequently, the volcanic and sedimentary rocks have been metamorphosed by heat and pressure during the time of this igneous intrusion.

Lowlands form only a small portion of the whole of the Island. In general, those present on the east coast as a narrow belt parallelling the Strait of Georgia are termed the Nanaimo Lowlands. They are underlain by sedimentary rocks of Cretaceous and younger ages. The formations are flat to gently dipping and have not been involved in the orogeny of the Vancouver Island Mountains (the Cumberland and T'Sable River Lease Area is underlain for the

most part by cretaceous rocks of the Nanaimo Lowlands). The Georgia Depression which underlies the Strait of Georgia to the east, is an orogenically active depression belt. It contains a thick sequence of Cretaceous and younger sedimentary rocks which form part of the Coastal Trough.

The mountains of Vancouver Island are relatively young in the geomorphic sense as they show considerable ruggedness and relief. This is partly due to relatively recent uplift.

Post-glacial (the last 9,000 years) isostatic readjustment has been uneven on Vancouver Island as the highest marine deposits on the west coast of the island are found at an elevation of 50 feet above sea level; 300 feet above sea level at Victoria; rising to 600 feet above sea level north of Campbell River (Day et al. 1959). In the Courtenay area the upper limit of marine overlap seems to be at the 575 foot contour.

On the other hand, the fiords and narrow inlets on the west coast of the mainland along the Strait of Georgia and Queen Charlotte Sound signify for a fact that recent submergence of the land has occurred, drowning former well-integrated river systems.

During the last several million years, Western Canada has been subjected to numerous and

intense glaciations. These Continental Cordilleran glaciations resulted in sculpturing some of the mountains into Alpine topography, overdeepening of previous river valleys by valley glaciers and deposition of variable thicknesses of glacial deposits. On Vancouver Island glacial deposits are thin in the mountains and relatively thicker in the lowlands.

In the Beaufort Range and Forbidden Plateau west of Courtenay, small glaciers enlarged their cirque basins and flowed downslope. They became integrated into a large valley glacier which was situated in the depression now occupied by Comox Lake. As the glacier advanced eastward towards the sea, it eroded the underlying bedrock thereby overdeepening the Comox Lake Valley. The valley glacier issued forth onto the Nanaimo Lowlands depositing till at the base of the glacier. When the supply of ice was depleted in the cirque basins up stream, the valley glacier stagnated. At the junction of the mountains and the lowlands, east of Comox Lake, meltwater streams flowed from the glacier and deposited sand and gravel into the sea in the form of a delta. These sand and gravel deposits are greater than 150 feet in thickness in some places, and are thought to coarsen westward (up current). As the toe of this valley glacier decreased in size due to melting, sand and gravel became concentrated in cracks in the decaying ice sheet. Upon final melting of the ice, diverse sizes of linear to circular mounds of sand and gravel, resulted. These mounds of sand and gravel termed

kames grade north and east into the flat deltaic terrace deposits. The kames are thought to be coarser than the deltaic terrace deposits as less sorting has occurred.

As the lowlands of Vancouver Island emerged from the sea the waves washed and winnowed the surface of the surrounding glacial deposits. As a result, a thin cover (usually less than 10 feet) of horizontally bedded, coarse sands and gravels mantle the countryside.

In the latter phases of glacial stagnation and upon coastal emergence the Brown's, Puntledge, Trent and T'Sable Rivers incised themselves through the surface deposits into the underlying bedrock forming their present courses. Small terraces of limited extent were formed on the banks of these rivers prior to their incision into the bedrock.

GEOLOGY

Fieldwork

Conventional aerial photographs of two scales; 40 chain (1" = 2,640') and 80 chain (1" = 5,280') were studied for this area. The large scale photographs (80 chain) proved useful for broad descriptions and locations of surface deposits. Detailed delineations of all fluvial deposits were performed on the small scale (40 chain) photographs.

The results were investigated in the field in late June and early July. All accessible roads and trails were traversed by truck and motor bike, for all of the lease area.

Survey Results

Aggregate deposits (more than 250,000,000 yds.^{3}) of commercial value were located north and west of Cumberland.

A smaller deposit (6,000,000 yds.^{3}) of terrace gravel was located in the lease area, south of the Trent River.

No significant deposits of gravel were located on the lease blocks north of the T'Sable River.

As described previously, a thin deposit of horizontally bedded, coarse sands and gravels overlies much of the terrain below the 575 foot contour. These wave washed sediments, usually less than 10 feet in thickness, are too erratic in distribution and thickness for commercial development. Locally, they can be mined for road construction.

POTENTIAL AGGREGATE RESERVES

Air photo interpretation combined with field mapping delineated the location of the kames (gravel and sand) and deltaic terrace deposits (sand and gravel). After the geological sequence of events had been determined in the field, the drill hole data was reinterpreted. An isopach map of surface deposits was then constructed using the reinterpreted drill hole information and field work results.

A drill hole (BH-127) in northeast quarter Section 34, Township 10 contains 178 feet ± of sand and gravel. In support of the interpretation of this drill hole log, some of the gravel pits presently being mined in Section 36 have faces of 130 feet. Air photo interpretation and field data suggest a minimum of an additional 40 to 60 feet of sand and gravel below the floor of the pits. The sand and gravel in all cases rests on bedrock. Since the surface of the bedrock is flat to gently sloping between Cumberland and the Puntledge River, it is nearly certain that the central parts of the deltaic terrace are greater than 150 feet in thickness.

The linear to circular mounds of sand and gravel (kames) south of the delta vary in elevation from 30 feet to greater than 100 feet. It is assumed that the thickness of gravel and sand in

this area is in the order of 20 feet average. Locally, many areas can be found where the gravel will be 100 feet or more in thickness. It was found necessary to average the thickness of gravel in this area so that a volume estimate could be made. Superimposing the location map of sand and gravel deposits with that of the isopach map of surface deposits, on a grid pattern, an approximate volume of potential aggregate was determined. In this way, it was calculated that the minimum potential aggregate reserve of the Cumberland and T'Sable river area is in the order of 250,000,000 cubic yards.

Some of the deltaic gravel and sand deposits west of the headwaters of the Puntledge River and adjacent to the mountains, are covered by coarse, angular fan material about 10 feet in thickness. This alluvial material contains a significant proportion of fines in the silt and clay size fraction.

The sand and gravel supplies in the lease area south of the Trent River approximate 6,000,000 cubic yards. The presence of soft sandstones and shale in this deposit would seem to preclude its use for concrete. In addition, the sand and gravel because of its origin (river terrace deposit) contains a significant proportion of silt and clay size material. The aggregate supplies in this deposit are useful in general road construction.

QUALITATIVE ASPECT OF SAND AND GRAVEL DEPOSITS

The approximate outline of all comercially viable aggregate deposits are shown on the location map.

The river terrace deposit, south of the Trent River is thought to be unsuited for concrete aggregate because of its deleterious constituents. However, it is excellent aggregate for road construction as it would require a minimum of alteration.

The kames and deltaic terrace north and west of Cumberland have been samples on a reconnaissance basis. Thirteen samples were collected (see Location Map and Appendix 1). These samples, with an average weight of 50 pounds, were analysed with emphasis placed on their use for concrete aggregate.

MATERIAL TESTING
VANCOUVER ISLAND RESOURCE STUDY
PREPARED FOR
BAYROCK AND REIMCHEN SURFICIAL GEOLOGY LIMITED
BY TRYLOWSKY ENGINEERING LTD.

Introduction

Thirteen pitrun samples were received from Bayrock and Reimchen Surficial Geology Ltd. for the purpose of concrete aggregate quality evaluation. The samples were visually assessed and appropriate tests were performed as specified in CSA A23.1.

In all cases sieve analyses were done to determine the size distribution of the coarse and the fine fractions as well as the split between the two.

Five samples were also tested for soundness as per CSA A23.2.4 - Sulphate Resistance Test. A summary of the test results is attached together with the grain size distribution curves and other data.

Summary (Table I)

In general, all samples consisted of gravelly sands or sandy gravels where the sand (fine aggregate fraction) was clean and coarse, having F.M. (Fineness Modulus) values in the upper

range or above the specified limits.

The rock (coarse aggregate fraction) is generally sub angular or round, very hard and durable. Some samples contained rock stained with iron or manganese, this however, would not preclude their use for concrete manufacture.

Recommendations

1. The proportion of fine aggregate (sand) to the coarse (rock) is fairly high especially in the most accessible deposits (W-35 and W-36). The excess sand could be used for purposes other than the "normal" concrete. These could include production of precast products such as pipes, posts or panels.

The in situ sand is very clean requiring no washing; also it is in most cases too coarse for normal concrete production. Some blending (in most cases less than 20 per cent) would be recommended using either local beach sand (see sample W-35c) or Fraser River sand (sample SA 015).

2. The test results show the rock fraction to be of good quality and acceptable for the production of concrete aggregates. A simple crushing operation would be required to utilize all the available material and to produce the necessary sizing.

TABLE I

SUMMARY OF TEST RESULTS

SAMPLE NO.	FINE AGGREGATE			COARSE AGGREGATE			REMARKS
	% of Total	F.M.	% Minus # 100	% of Total	Soundness A23.2.9	% CSA 1-1/2"	
SPECS OR "NORMAL"	43	2.2 - 3.2	2 - 10	57	12%	0 - 5	
W-35 A 75	75	3.5	0.3	25	-	0	
W-35 B 75	49	3.7	0.3	51	-	16	
W-36 A 75	76	3.1	0.9	24	-	0	W_n of Sand-4.4%
W-37 - 75	33	3.2	2.1	67	0.37	56	Max. size of C.A.3"
W-38 - 75	50	2.7	5.0	50	-	34	
W-41 - 75	37	3.5	1.3	63	0.69	27	
W-42 - 75	46	3.6	1.5	54	0.09	0	
W-43 - 75	53	3.4	1.8	47	-	0	
W-45 - 75	48	3.8	1.0	52	0.72	0	
W-46 - 75	50	3.7	0.7	50	0.51	26	
W-48 - 75	62	3.8	0.9	38	-	0	Some sand coating on C.A.
W-49 - 75	30	3.7	2.7	70	-	0	Rust coating on C.A,
W-50 - 75	35	3.7	1.4	65	-	0	
W-35 C 75		1.4	2.3				Possible blend sand

W-44 was not analysed as it was considered to be the same as W-41.

CONCLUSIONS (TABLE III)

Large, commercially viable reserves of sand and gravel have been located in the Courtenay area. The aggregate has been sampled on a reconnaissance basis and found suitable for concrete aggregate with some alterations.

All of the samples analysed, except W-38, are lacking to some degree in fine sand (less than 100 mesh). The sand and gravel from location W-38 requires a small amount of crushing for use as concrete aggregate.

Samples W-35b, W-37, W-41 and W-46 have an overabundance of coarse aggregate above 1-1/2 inches and requires some degree of crushing.

Samples W-35a, W-36, W-37, W-43, W-48, W-49 and W-50 lack either sufficient gravel size materials or sand size materials for use as concrete aggregates. Blending of fine sand such as wind blown dune sand or the addition of sand from the delta of the Fraser River in Vancouver would be suitable. Coarse gravel size materials would have to be obtained from kame locations nearby.

The petrographic analyses of four samples was performed in accordance with CSA Standards for concrete aggregate (TABLE II). The samples were selected for the basis of a gross representation for the area. Since the source of all of these sand and gravel supplies is similar, the lithology will be the same.

TABLE II

PETROGRAPHIC ANALYSES OF FOUR SAND AND GRAVEL SAMPLES FROM THE CUMBERLAND AND T'SABLE RIVER AREAS

ROCK TYPE	SAMPLES W-36a	W-37	W-38	W-43	CLASSIFICATION	FACTOR
Fine grained acid volcanic	81.0	85.0	84.0	89.0	Good	1
Granite (hard)	8.5	6.0	6.0	3.0	Good	1
Quartzite (hard)	9.5	7.5	9.5	6.0	Good	1
Chert	1.0	1.5	--	1.0	Fair	3
Clay iron stone (encrustation)	--	--	--	1.0	Poor	6
Conglomerate	--	--	0.5	--	Good	1

The petrographic examination was made in accordance with CSA Standards on material retained on the 3/8 inch sieve.

TABLE III

MECHANICAL ALTERATION REQUIRED TO

IMPROVE PITRUN GRAVEL FOR

CONCRETE AGGREGATE

Sample	Crushing	Addition of fine sand	Addition of sand	Addition of gravel
W-35a		X		X
W-35b	X	X		
W-36		X		X
W-37	X	X	X	
W-38	X			
W-41	X	X		
W-42		X		
W-43		X		X
W-45		X		
W-46	X	X		
W-48		X		X
W-49		X	X	
W-50		X	X	

RECOMMENDATIONS (See Location Map)

1. The best deposit of sand and gravel is located at sample locality W-38 west of Cumberland by Comox Lake. The testing of the 80 foot face of exposed gravel shows it to be uniform in composition and would require the minimum amount of alteration for concrete aggregate. In the immediate area around the sample location approximately 6,000,000 cubic yards of concrete aggregate are present.

It is recommended to commence detailed development testing of the area as outlined on the Location Map.

2. Excellent gravel deposits are located at the northern end of the Pigeon Pond sanitation land fill, at sampling localities W-37, W-41 and W-42. The tests conducted on the gravel show it to be of very good quality with small alterations required for concrete aggregate beneficiation. It is estimated that in the vicinity of the above mentioned sample localities approximately 30,000,000 cubic yards of gravel are present.

It is recommended that additional testing be done in that locality in order to prove the extent of this deposit.

3. Excellent gravel deposits are located at the north end of Maple Lake around localities W-45 and W-46. The preliminary tests conducted at these localities show the gravel to be of good quality with only the addition of fine sand required for concrete aggregate. Although some large boulders will be present to the northeast of Maple Lake, a very minimum amount of crushing is expected. It is estimated that there are approximately 16,000,000 cubic yards of gravel present as outlined on the Location Map.

It is recommended that further testing be done to typify the sand and gravel.

REFERENCES CITED

Day, J. H., Farstad, L., and Laird, D. G. 1959 Soil Survey of Southeast Vancouver Island and Gulf Islands, British Columbia; Rept. 6, B. C. Soil Survey, 104 pages, 4 maps.

Fyles, J. C. 1960 Surficial Geology of Courtenay, British Columbia; Geol. Surv. Canada, Map 32-1960

Leaming, S. F. 1968 Sand and Gravel in the Strait of Georgia Area; Geol. Surv. Canada, Paper 66-60, 149 pages.

APPENDIX I

FIELD DESCRIPTIONS OF SAMPLES

SAMPLES

Field Descriptions:

Locality W-35 (Figure 1)

Gravel pit in Section 36, Township 10; 400 feet ± above sea level.

0 - 100 feet+ The top several feet consists of alternating beds of sand and gravel from granule to pebble size, horizontally bedded and heavily iron stained. This unit truncates cross-beds which dip westerly (265^{o} - 305^{o}) from 15 to 32 degrees. The cross-beds consist of alternating beds, 2 - 3 feet thick, of very clean, coarse sand with 10 per cent greater than number 4 sieve size and beds of granule to pebble size sand and gravel of maximum size less than 2 inches. There seems to be a shortage of fine sand in this deposit. Scattered in seemingly random layers are 3 foot beds of large cobbles up to 6 inches long diameter. The pebbles are heavily stained with iron and manganese oxides in the upper 20 feet. Below this iron oxide coatings tend to become rare but manganese coatings are

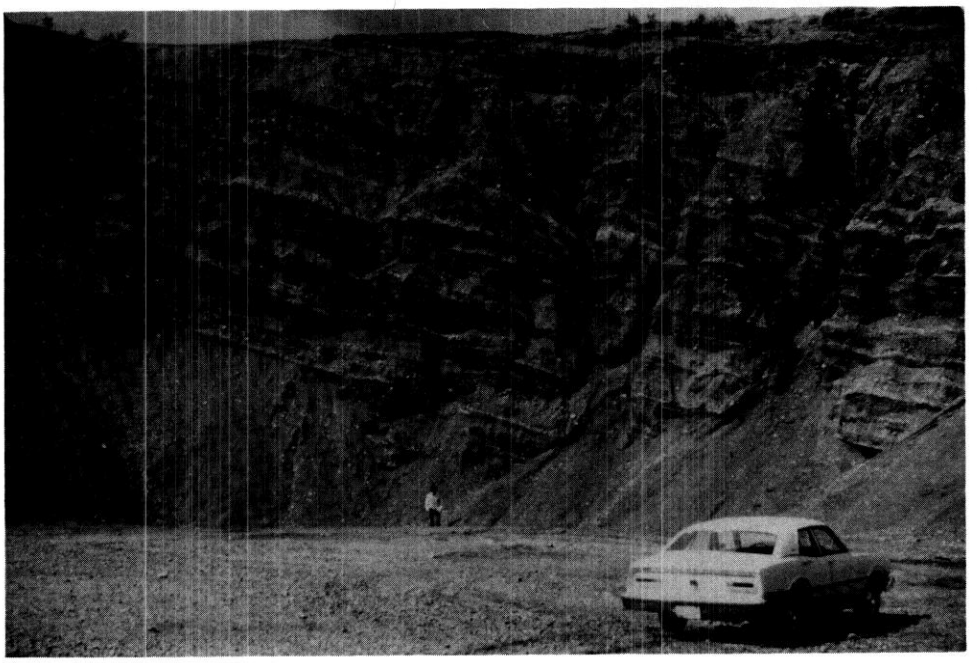


FIGURE 1: Locality W-35; Gravel pit showing cross-beds dipping westerly. In upper right-hand corner note horizontal bedded deltaic top set gravels. Face of pit is greater than 100 feet.

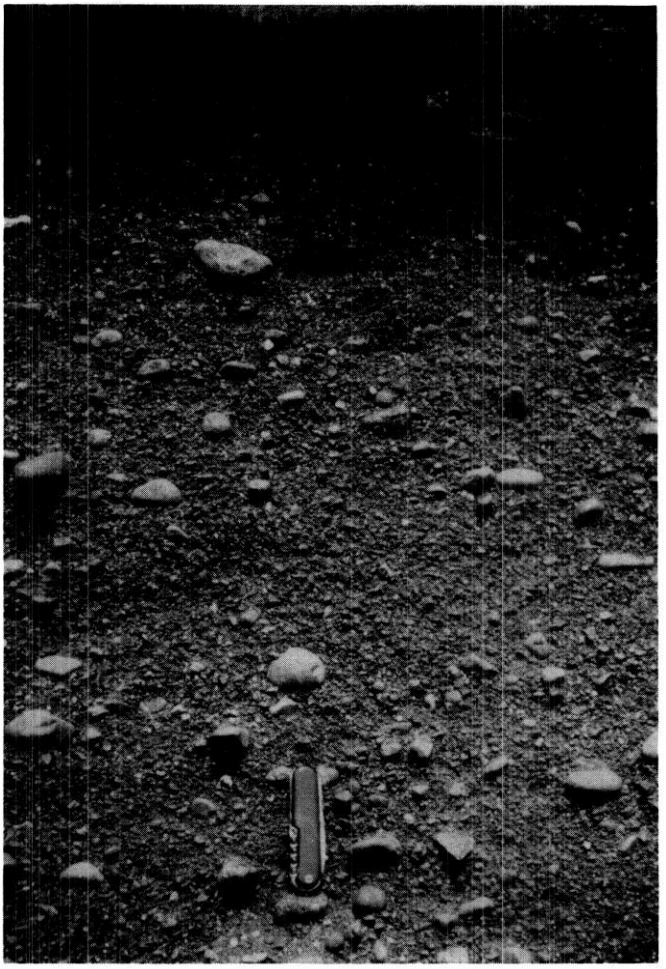


FIGURE 2: Locality W-35; Close-up of clean, coarse sandy layer

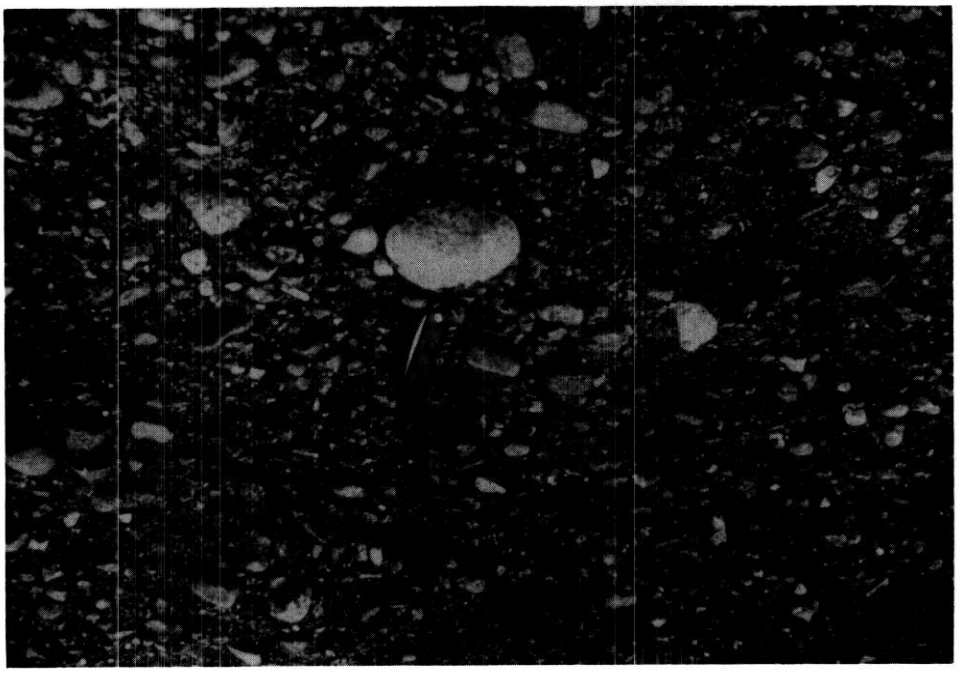


FIGURE 3: Locality W-35; Close-up of coarse, pebbly layer.

common. The sands and gravels are loose and uncemented and consist mainly of volcanic rocks (98 per cent) with minor amounts of quartzite, granites and chert.

Locality W-35a (Figure 2)

Channel sample taken of the very coarse, clean sand.

Locality W-35b (Figure 3)

Channel sample taken of the granule to pebble size layers.

Locality W-36

Gravel pit in eastern part of Section 36, Township 10; 400 feet ± above sea level.

0 - 120 feet+ This gravel pit is similar to W-35, although there seems to be more clean, coarse sand in beds ranging from 1 to 4 feet in thickness, (Figure 4). A channel sample was taken of the alternating beds of sand and sand and gravel as shown in Figure 4.

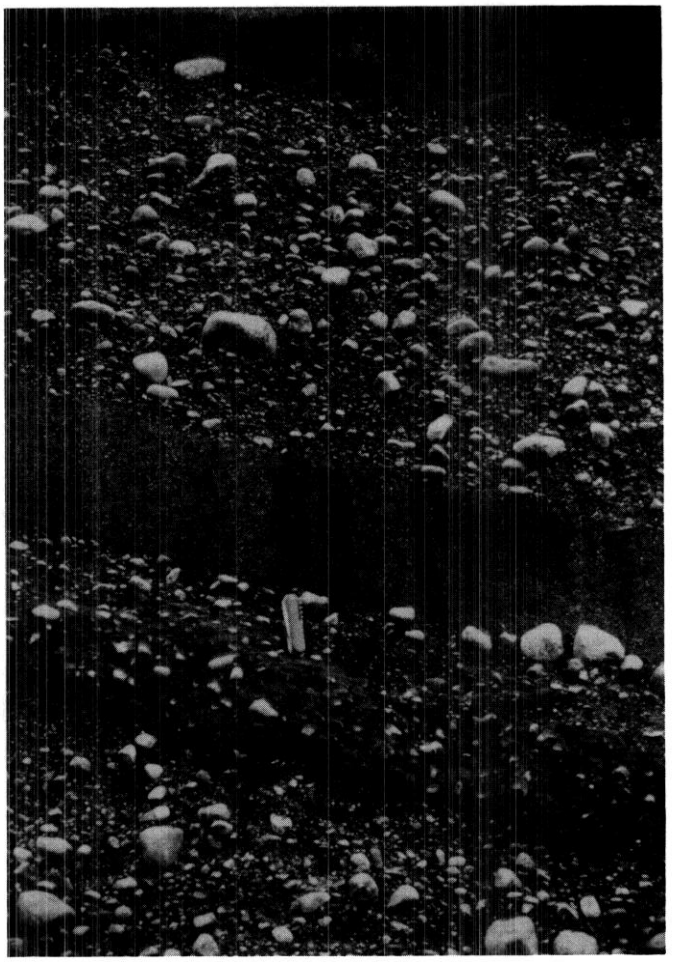


FIGURE 4: Locality W-36; Close-up of alternating beds of clean, coarse sand and pebbly sand and gravel.

FIGURE 5: Locality W-37; Panoramic view of the top one-half of a kame near the Pigeon Pond sanitation land fill. The bedding on the right-hand side of the photograph shows post-depositional slumping resulting from the melting out of ice after deposition.

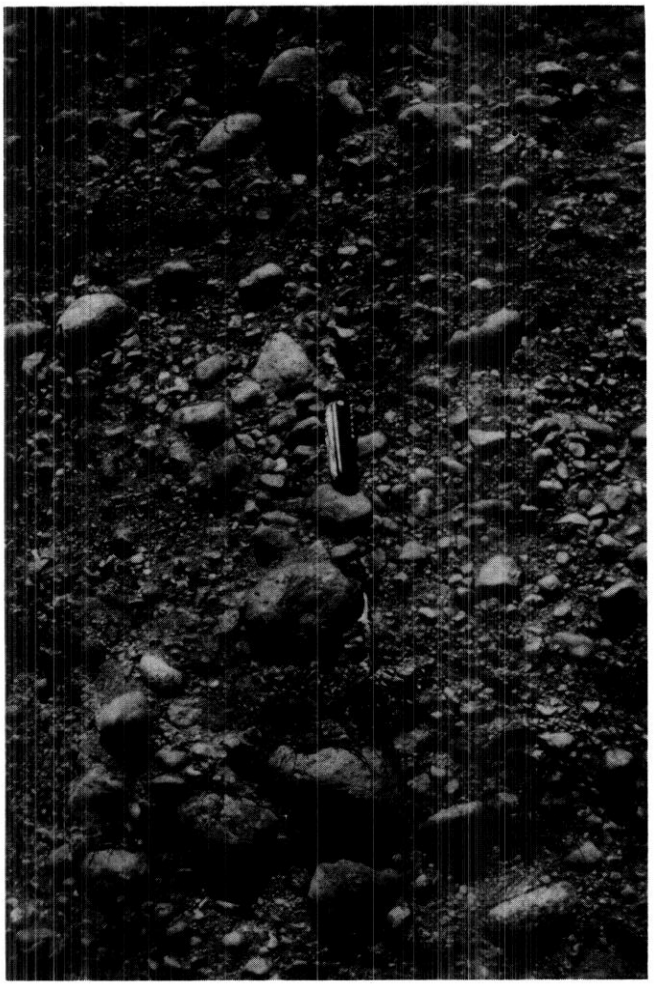


FIGURE 6: Locality W-37; Close-up of gravel and sand in the upper six feet showing iron staining and recent rootlets.

Locality W-37 (Figure 5)

Sanitation land fill (garbage dump) at Pigeon Pond about 1 mile northwest of Cumberland near old railway grade; 550 feet ± above sea level.

0 - 35 Feet+ Sand and gravel, poorly sorted, well-graded, granule to cobble size; modal size is 1 inch and comprises 30 per cent of the pebbles; 10 per cent of the pebbles are over 3 inches; the matrix is relatively clean, about 3 per cent would pass through a 200 mesh sieve. The iron staining seems to be concentrated near the base of the pebble layers, and around Recent rootlets which extend 8 feet down from the surface (Figure 6). The sands and gravels are loose and uncemented and the pebbles are sub to well-rounded. They consist predominately of volcanics (99 per cent) with minor amounts of granites, quartzites and the odd chert pebble. Channel sample taken.

Locality W-38 (Figure 7)

Gravel pit in Section 27 of Township 10, just east of Comox Lake; 500 feet + above sea level.

FIGURE 7: Locality W-38; Panoramic view of abandoned gravel pit by Comox Lake. Note horizontal top set beds near top which truncate cross-beds below.

0 - 60 feet+ Sand and gravel in mounds, some greater than 80 feet in height - kames. The upper 10 feet of these deposits are horizontally bedded and tends to be coarser than the underlying cross-beds it truncates. The cross-beds dip 20 to 30 degrees in a south-westerly direction. The cross-beds consist of alternating bands of coarse granular sand and granules with pebble to cobble size bands, poorly sorted (well-graded). No large rocks over 4 inches in long diameter are present (Figure 8). About 80 per cent of this deposit would probably pass through a 4 inch sieve. Some of the cross-beds are disrupted and show signs of post-depositional slumping. This faulting is most likely caused by ice melting out from below the gravel after deposition. The sands and gravels are loose and uncemented and consist predominately of volcanic rocks (78 per cent) and granites (18 per cent), minor amounts of quartzites and chert are present. Channel sample was taken.

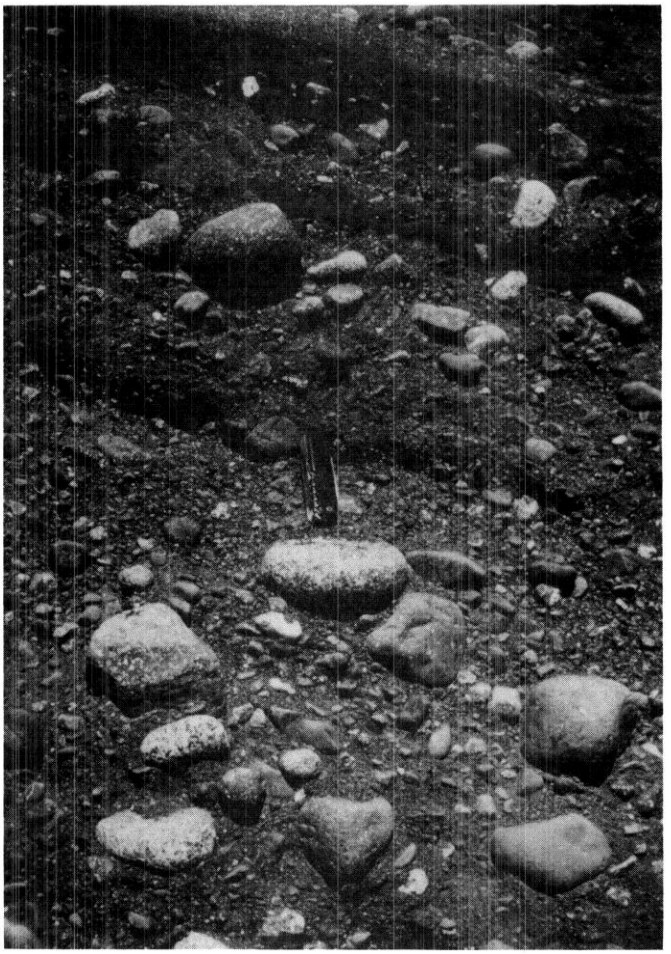


FIGURE 8: Locality W-38; Close-up of alternating beds of clean sand and sand and gravel.

Locality W-41

Backhoe hole at junction of delta and kames 1/4 mile east of Pigeon Pond sanitation land fill; 550 feet ± above sea level.

0 - 4 feet — Gravel and sand, pebble to cobble size grading to clean, coarse, pebbly gravel. The gravel and sand is horizontally bedded and heavily iron stained. This unit represents top set beds of the delta.

4 - 14 feet+ — Gravel and sand, horizontally bedded, pebble to cobble size, modal size is 1.5 inches and comprises 70 per cent of the pebbles. Beds of medium to coarse sand, 1 foot thick are present. The pebbles have manganese and iron oxide staining; the iron oxide seems to be concentrated in bands 4 inches thick. The lithology consists predominately of volcanic rocks (94 per cent) with minor amounts of granites and quartzites. Channel sample taken.

Locality W-42

Backhoe hole on old rail grade about 1/3 mile west of Pigeon Pond sanitation

land fill in Section 34, Township 10; 550 feet ± above sea level.

0 - 4 feet — Gravel and sand with large boulders of 12 inch long diameter, poorly sorted; less than 5 per cent of the pebbles are over 3 inches long diameter. The gravels and sands are heavily iron stained.

4 - 14 feet — Sand and gravel, little iron staining from 6 feet to 14 feet. Sand and gravel is clean and ranges from granules to boulders up to 2 feet in long diameter although the average size is less than 2 inches. Channel sample taken from 6 - 14 feet above the surface. This sample is taken 24 feet below the surface of the top of the delta, as sand and gravel was formerly removed for construction of a railway grade.

Locality W-43

Backhoe hole near the eastern edge of the delta in Section 34, Township 10. The top 3 feet of sand and gravel has been removed for construction of a roadway many years ago.

0 - 6 feet — Sand and gravel, loose, uncemented, very clean, no boulder sizes are present. 80 per cent of the material is less than 1 inch in size. The iron staining is concentrated in the coarse pebble bands.

6 - 11 feet+ — Sand and gravel, clean, coarse, granule to pebble size, no iron staining evident. Channel sample taken from 4 - 11 feet.

Locality W-44

Backhoe hole on trail 100 yards east from the Pigeon Pond sanitation land fill road. The surface of this area is flat to gently rolling with local relief of 20 feet; 550 feet ± above sea level.

0 - 10 feet+ — Sand and gravel, pebbles to cobble size, clean, coarse, heavily iron stained (Figure 9) in top 6 feet, boulders to 14 inches long diameter, 10 per cent pebbles by volume, less than 4 inches in size. The upper 6 feet of this unit is horizontally bedded and truncates cross-beds similar to W-35. The cross-beds are clean and fine-grained, greater than 90 per cent of the material is less than 3 inches

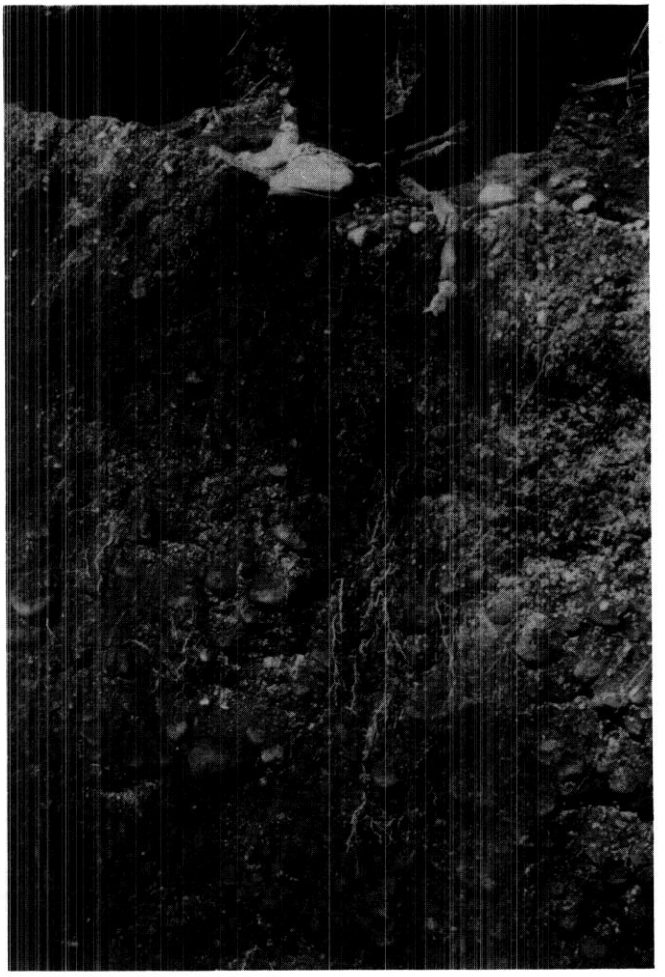


FIGURE 9: Locality W-44; Close-up view of iron staining in the top four feet. Recent rootlets extend several feet from the surface.

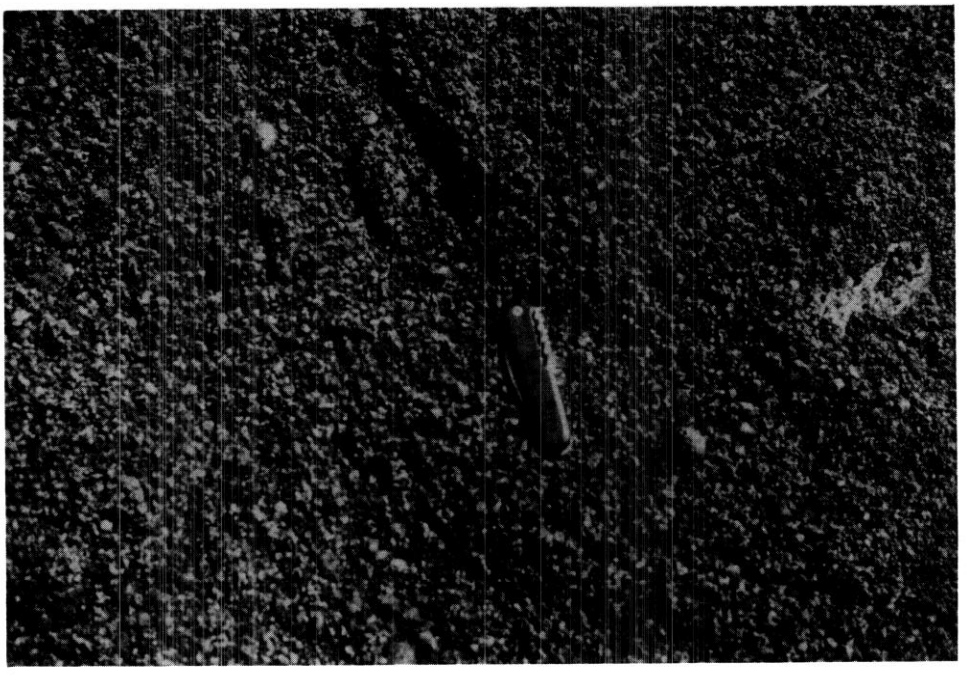


FIGURE 10: Locality W-44; Close-up view of sand size material near bottom of hole.

in size, (Figure 10). Channel sample taken from 0 - 10 feet.

Locality W-45

Backhoe hole on old road about 100 feet above Maple Lake to the north in Section 36, Township 10. This sample is taken near the junction of the delta and kames; 500 feet ± above sea level.

0 - 10 feet	Gravel and sand, coarse with 70 per cent pebbles by volume up to 16 inches long diameter, greater than 60 per cent of the pebbles are less than 4 inches (Figure 11).
10 - 13 feet+	Sand and gravel, clean, granules to pebbles, cross-bedded to horizontally bedded, loose, iron-stained, poorly sorted, although there is a conspicuous absence of sand size material. Channel sample taken from 0 - 13 feet.

Locality W-46

Backhoe hole on trail east of cemetary of Section 25, Township 10 by Maple Lake; 450 feet ± above sea level.

FIGURE 11: Locality W-45; Close-up view of coarse sand and gravel. Note iron and manganese staining on pebbles.

0 - 6 feet — Sand and gravel horizontally bedded granules to pebbles, 90 per cent are less than 3 inches long diameter. This bed is striking by its absence of matrix.

6 - 12 feet+ — Gravel and sand, pebble to cobble size, clean, loose matrix present. Channel sample taken from 2 - 12 feet.

Locality W-48

Backhoe hole one-half mile south-east of Pigeon Pond sanitation land fill on railway grade in Section 26, Township 10. This area is marked by strongly rolling mounds of sand and gravel greater than 30 feet in height. 530 feet ± above sea level.

0 - 12 feet+ — Gravel and sand, horizontal beds to cross-beds. Alternating bands of pebbles, 3 inches in thickness with clean, coarse sand beds, 3 inches in thickness. The granules to cobbles comprise about 75 per cent of the material by volume. The gravels are cemented somewhat by iron oxides down to the 5 foot level. Channel sample taken.

Locality W-49

Backhoe hole on trail west of Pigeon Pond sanitation land fill near a little lake in Section 27, Township 10; 550 feet ± above sea level. The area consists of linear to circular mounds of sand and gravel with local relief greater than 35 feet in height. Description of deposit same as W-48. Channel sample taken from 3 - 12 feet.

Locality W-50

Backhoe hole on trail in northeast Section 33, Township 10, on top of the delta, 550 feet ± above sea level.

0 - 13 feet Sand and gravel, horizontally bedded, cemented by iron oxides in upper 4 feet. Rootlets to 4 feet. About 50 per cent of the material is pebble size, boulders comprise less than 5 per cent of the material. Channel sample taken from 4 - 13 feet.

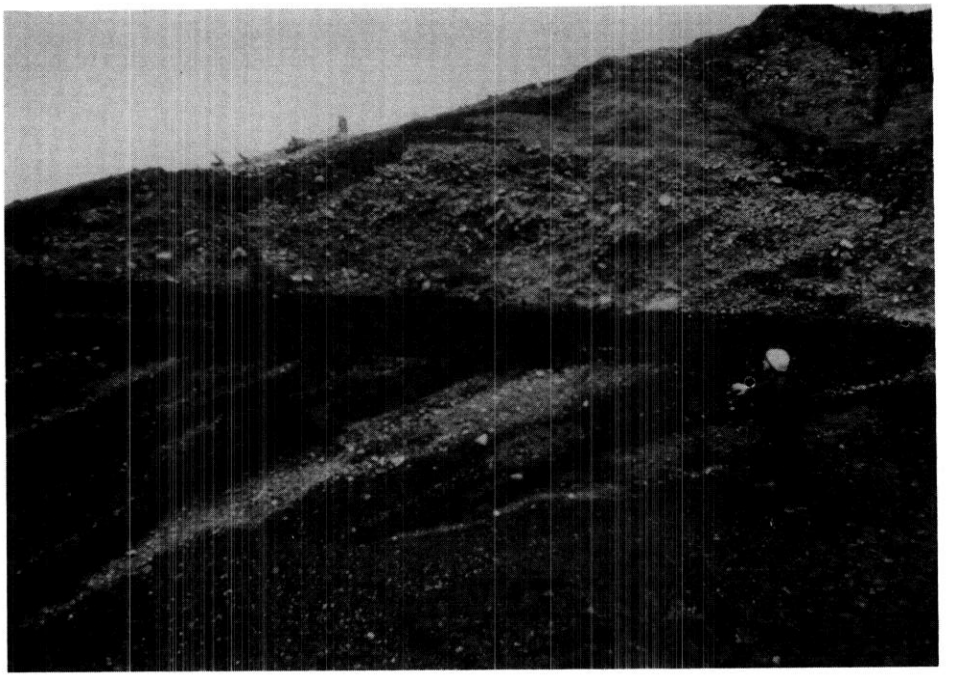


FIGURE 12: Close-up view of top set delta gravels truncating lower cross-beds in gravel pit by cemetary.

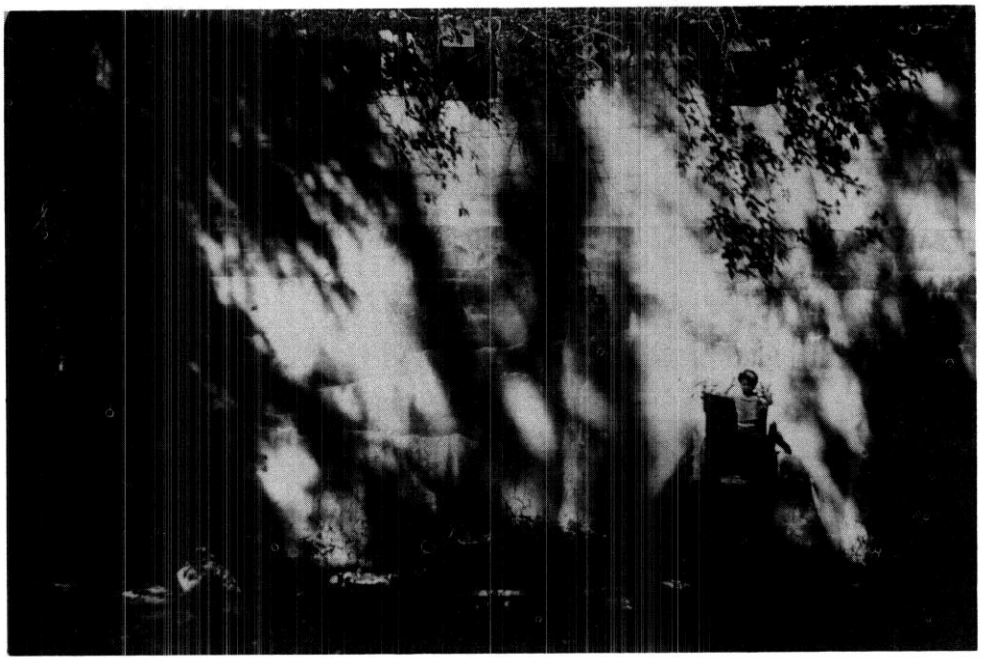


FIGURE 13: View of concrete out buildings constructed prior to 1918 near the east end of Comox Lake. The area is overgrown by vegetation to over 100 feet in height.

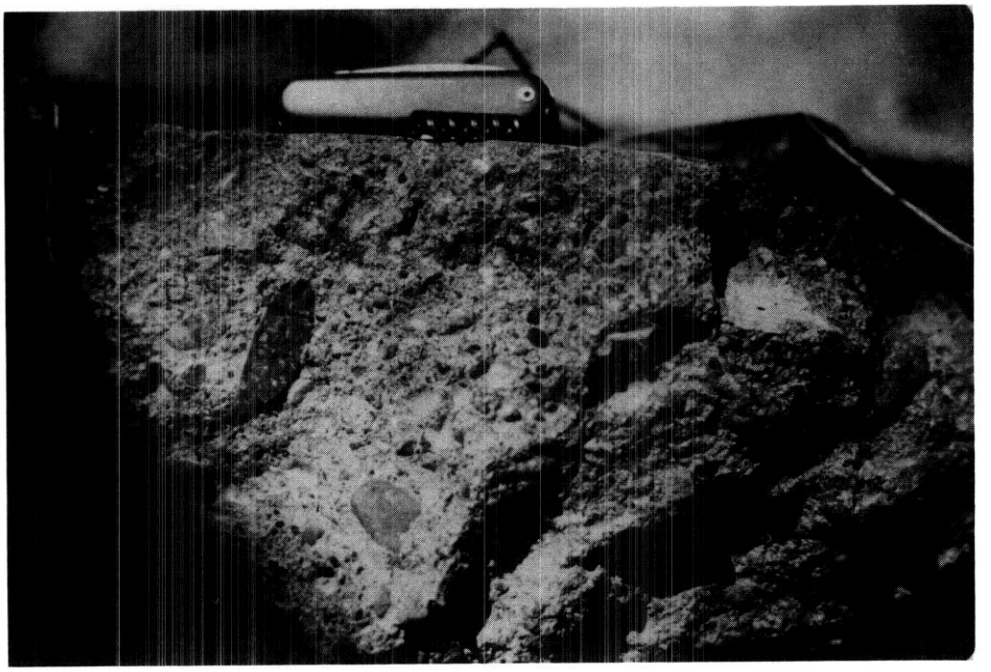


FIGURE 14: Close-up view of uncrushed pebbles, pit-run, used from gravel pit (Locality W-38) in construction of concrete out buildings of Fig.13.

APPENDIX II

CONCRETE AGGREGATE REPORT ANALYSES

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 30/75
SAMPLE NO. W35 A-75
TEST NO. SA 002
CLIENT P.O.

PROJECT

SOURCE

SAMPLE TYPE GRAVELLY SAND SAMPLED BY

DATE SAMPLED

DATE RECEIVED 2/7/75 DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	—	0
1½			8	24.6	24.6
1	11.1	11.1	16	30.9	55.5
3/4	12.5	23.6	30	24.8	80.3
1/2	19.2	42.8	50	13.8	94.1
3/8	13.2	56.0	100	5.6	99.7
No. 4	44.0	100.0	200		
8			Pan	0.3	100.0
Pan			F.M.		3.5

SHAPE SUB ANGULAR

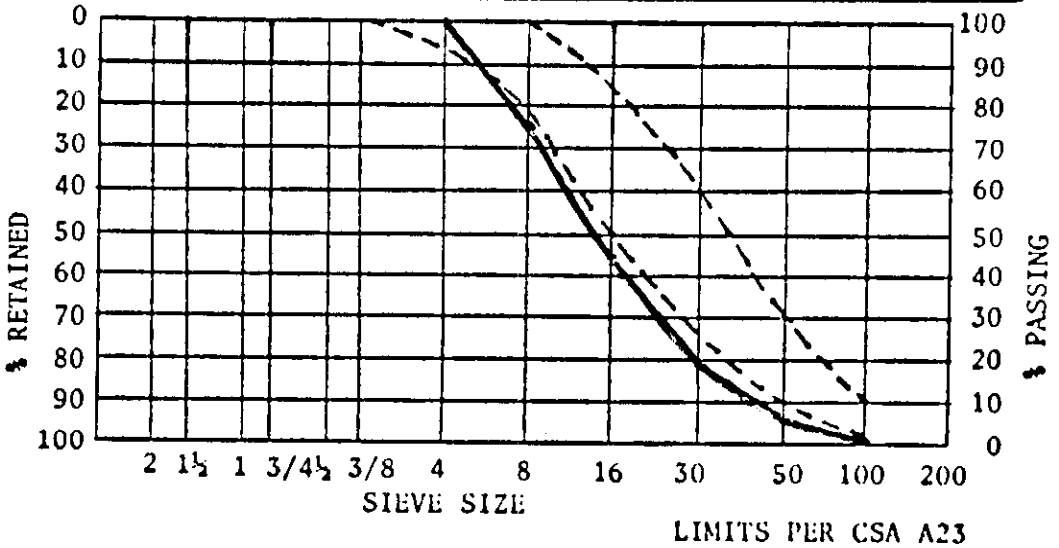
% CRUSH —
SOUNDNESS (VISUAL) V.G.

COAL CONTENT NIL
REMARKS

F.M. RANGE
2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200 < 3%
ORG. IMPURITIES NO.
COAL CONTENT NIL
REMARKS
REPR. 75% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



TESTED BY S.U.R

CHECKED BY

LIMITS PER CSA A23

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 30/75
SAMPLE NO. W 358-75
TEST NO. SA 006
CLIENT P.O.

PROJECT

SOURCE | SAMPLE TYPE | SAMPLED BY

DATE SAMPLED | DATE RECEIVED 2/7/75 | DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	0
1½			8	29.4	29.4
1	5.0	5.0	16	30.3	59.7
3/4	18.4	23.4	30	22.6	82.3
1/2	27.3	50.7	50	13.8	96.1
3/8	17.5	68.2	100	3.6	99.7
No. 4	29.4	97.6	200		
8			Pan	0.3	100.0
Pan	2.4	100.0	F.M.		3.7

SHAPE ROUNDED

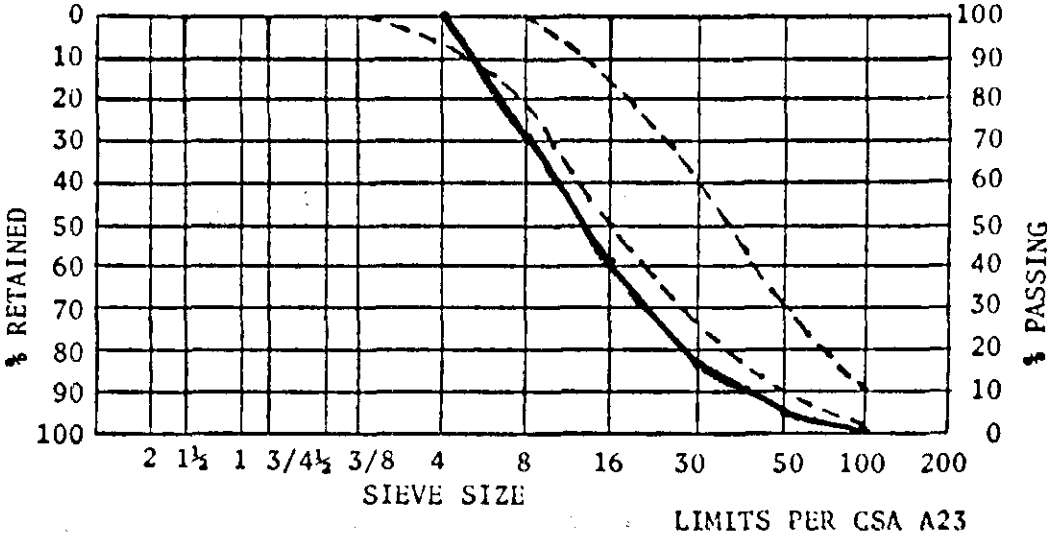
% CRUSH —
SOUNDNESS (VISUAL) VERY GOOD

COAL CONTENT NIL
REMARKS 16% WAS > 1½ IN.

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200 — 0
ORG. IMPURITIES NO.
COAL CONTENT NIL
REMARKS VERY CLEAN, GREY SAND
REPR. 49% OF TOTAL SAMPLE

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 30/75
SAMPLE NO. W36 A - 75
TEST NO. SA 003
CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND — SAMPLED BY

DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	0
1½			8	13.4	13.4
1	15.1	15.1	16	21.1	34.5
3/4	17.7	32.8	30	34.8	69.3
1/2	19.1	51.9	50	24.6	93.9
3/8	14.8	66.7	100	5.2	99.1
No. 4	33.3	100.0	200		
8			Pan	0.9	100.0
Pan			F.M.		3.1

SHAPE ROUNDED.

% CRUSH —
SOUNDNESS (VISUAL) V. G.

COAL CONTENT NIL
REMARKS GREY VOLCANIC ROCK.

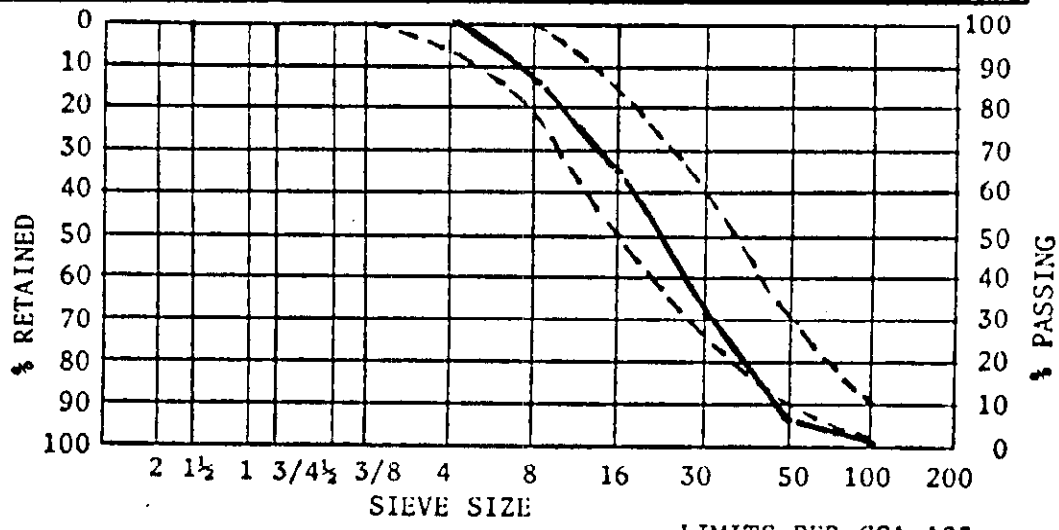
C.A. REPRES. 24% OF TOTAL.

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
→ 2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200 NIL
ORG. IMPURITIES NO.
COAL CONTENT NIL
REMARKS VERY CLEAN SHARP SAND

NAT. MOISTURE — 4.4%

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.

CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W-37-75

TEST NO. SA 004

CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND. SAMPLED BY

DATE SAMPLED — DATE RECEIVED 2/7/75 DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	—
1½	*		8	21.2	21.2
1	12.5	12.5	16	23.3	44.5
3/4	25.3	37.8	30	25.4	69.9
1/2	31.8	69.6	50	20.9	90.8
3/8	16.6	86.2	100	7.1	97.9
No. 4	11.9	98.1	200		
8			Pan	2.1	100.0
Pan	1.9	100.0	F.M.		3.2

SHAPE ROUNDED

% CRUSH —

SOUNDNESS (VISUAL) GOOD

COAL CONTENT

REMARKS * 56% OF C.A. WAS LARGER THAN 1½ IN — MAX 3". MOST ROCKS WITH IRON COATING.

F.M. RANGE → 2.2 - 2.6 FINE; 2.6 - 2.9 MEDIUM; 2.9 - 3.2 COARSE

% SAND

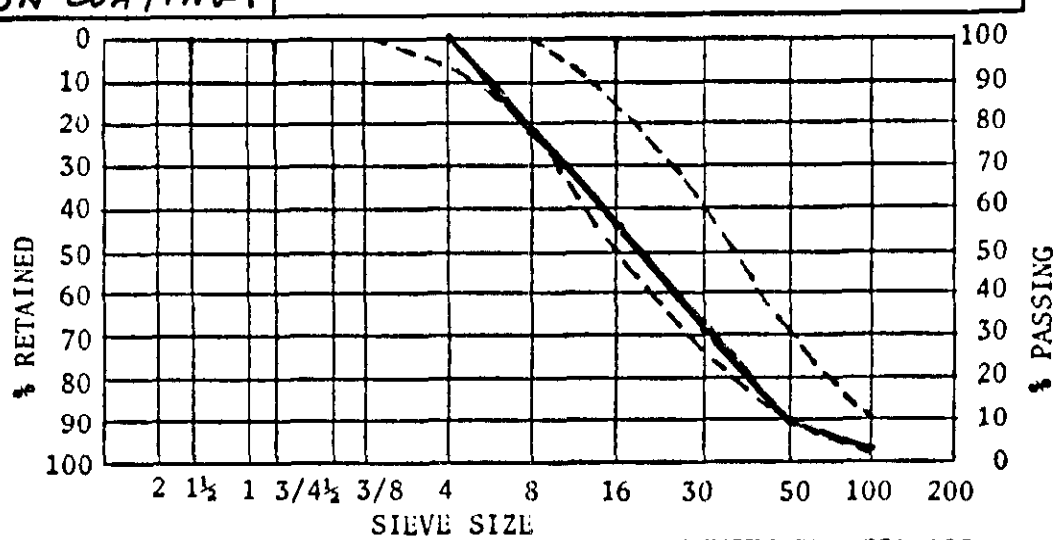
% FINER THAN No. 200 —

ORG. IMPURITIES NO.

COAL CONTENT NIL

REMARKS F.A. REPR. 33% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.

CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W 38-75

TEST NO. SA 005

CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND — SAMPLED BY

DATE SAMPLED — DATE RECEIVED 27/7/75 — DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	0
1½			8	13.0	13.4
1	15.9	15.9	16	13.7	26.7
3/4	30.9	46.8	30	23.7	50.4
1/2	21.3	68.1	50	30.2	80.6
3/8	14.8	82.9	100	14.4	95.0
No. 4	16.0	98.9	200		
8			Pan	5.0	100.0
Pan	1.1	100.0	F.M.		2.7

SHAPE ROUNDED

% CRUSH —

SOUNDNESS (VISUAL) GOOD

COAL CONTENT NIL

REMARKS 34% OF C.A. > 1½" ROCKS CLEAN

F.M. RANGE → 2.2 - 2.6 FINE; 2.6 - 2.9 MEDIUM; 2.9 - 3.2 COARSE

% SAND

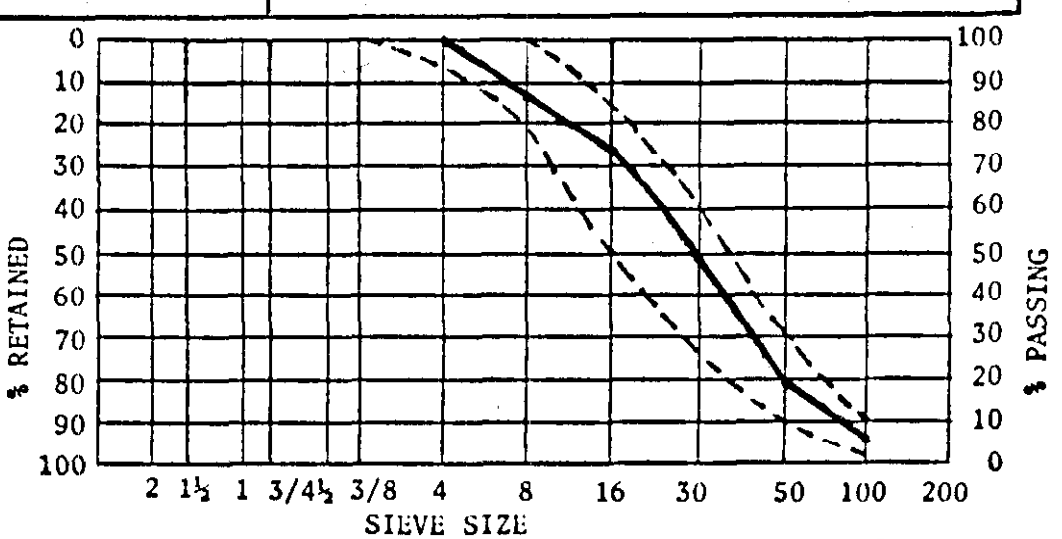
% FINER THAN No. 200 < 3 %

ORG. IMPURITIES NO.

COAL CONTENT NIL

REMARKS F.A. REPR. 50% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.

CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 31/75
CLIENT BAYROCK & REIMCHEN
SAMPLE NO. W 41-75
TEST NO. SA 012
CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND — SAMPLED BY
DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 29/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	—
1½			8	25.9	25.9
1	21.7	21.7	16	22.9	48.8
3/4	25.9	47.6	30	23.3	72.1
1/2	20.2	67.8	50	20.0	92.1
3/8	10.9	78.7	100	6.6	98.7
No. 4	19.0	97.7	200		
8			Pan	1.3	100.0
Pan	2.3	100.0	F.M.		3.5

SHAPE ROUNDED

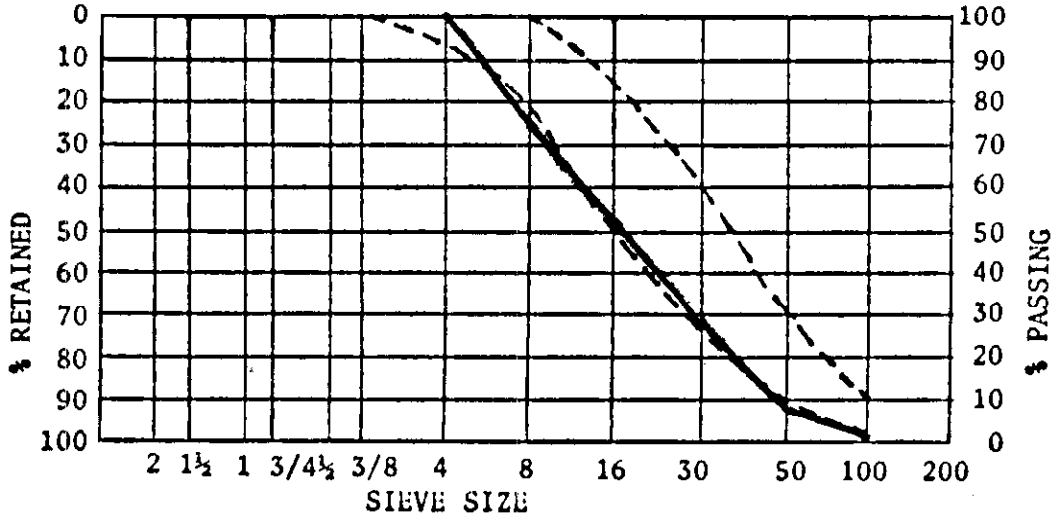
% CRUSH —
SOUNDNESS (VISUAL) GOOD

COAL CONTENT
REMARKS 27% WAS > 1½ IN

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200 < 3%
ORG. IMPURITIES NO.
COAL CONTENT — NIL
REMARKS
REPR. 37% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRILOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75
CLIENT BAYROCK & REIMCHEN
SAMPLE NO. W 42-75
TEST NO. SA 009
CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND — SAMPLED BY
DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 28/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	—	—
1½	23.6	23.6	8	28.1	28.1
1	11.5	35.1	16	23.9	52.0
3/4	11.4	46.5	30	22.6	74.6
1/2	18.5	65.0	50	17.7	92.3
3/8	11.3	76.3	100	6.2	98.5
No. 4	20.4	96.7	200		
8			Pan	1.5	100.0
Pan	3.3	100.0	F.M.		3.6

SHAPE ROUNDED

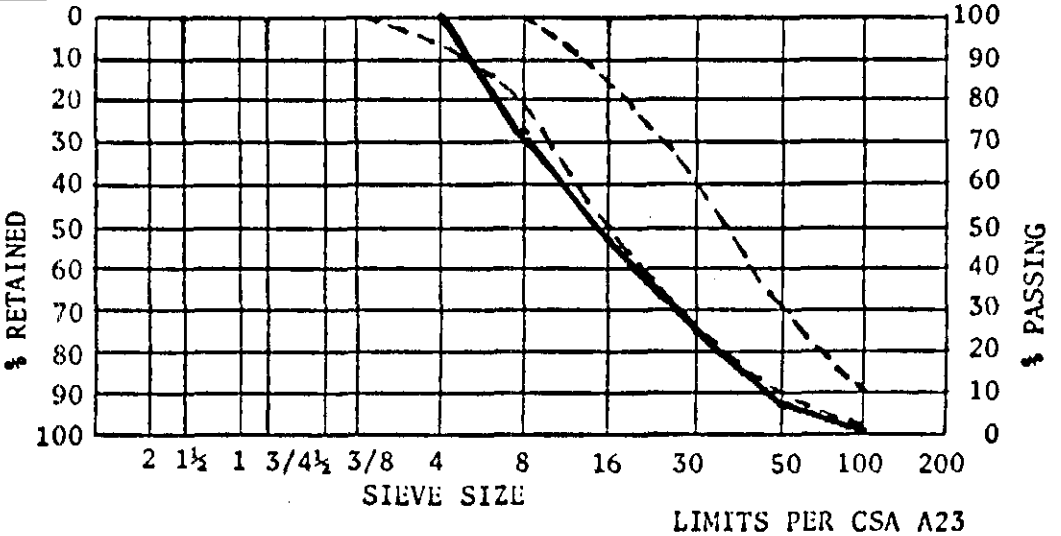
% CRUSH —
SOUNDNESS (VISUAL) GOOD

COAL CONTENT NIL
REMARKS ROCKS - CLEAN

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE →

% SAND
% FINER THAN No. 200 < 3%
ORG. IMPURITIES NO.
COAL CONTENT — NIL
REMARKS REPR. 46% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W 43-75

TEST NO. SA 010

CLIENT P.O.

PROJECT

SOURCE SAMPLE TYPE GR. SAND SAMPLED BY

DATE SAMPLED DATE RECEIVED 2/7/75 DATE TESTED 28/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	—
1½	15.2	15.2	8	24.4	24.4
1	6.0	21.2	16	22.9	47.3
3/4	7.7	28.9	30	21.6	68.9
1/2	16.3	45.2	50	20.7	89.6
3/8	14.3	59.5	100	8.6	98.2
No. 4	38.3	97.8	200		
8			Pan	1.8	100.0
Pan	2.2	100.0	F.M.		3.4

SHAPE SUB ANGULAR

% CRUSH —

SOUNDNESS (VISUAL) GOOD

COAL CONTENT NIL

REMARKS SOME SAND COATING

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND →

% FINER THAN No. 200 < 3%

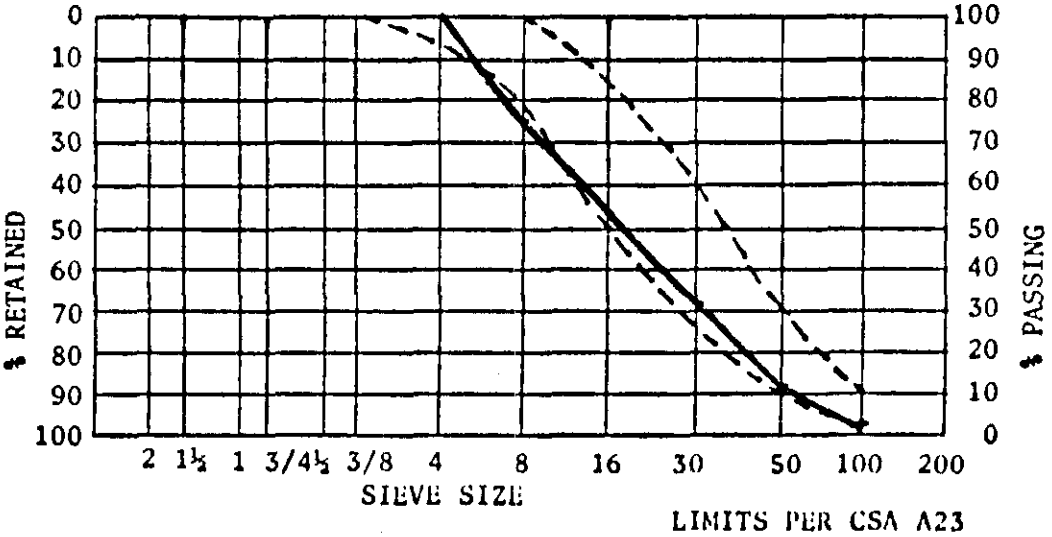
ORG. IMPURITIES NO.

COAL CONTENT - NIL

REMARKS REPR. 53% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED

	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



TESTED BY S.U.F.

CHECKED BY

LIMITS PER CSA A23

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 31/75
CLIENT BAYROCK & REIMCHEN
SAMPLE NO. W 45-75
TEST NO. SA 011
CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE GR. SAND — SAMPLED BY
DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 29/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	—
1½			8	33.8	33.8
1	15.9	15.9	16	26.6	60.4
3/4	11.0	26.9	30	21.9	82.3
1/2	21.9	48.8	50	12.8	95.1
3/8	9.4	58.2	100	3.9	99.0
No. 4	40.4	98.6	200		
8			Pan	1.0	100.0
Pan	1.4	100.0	F.M.		3.8

SHAPE ROUNDED

% CRUSH
SOUNDNESS (VISUAL) GOOD

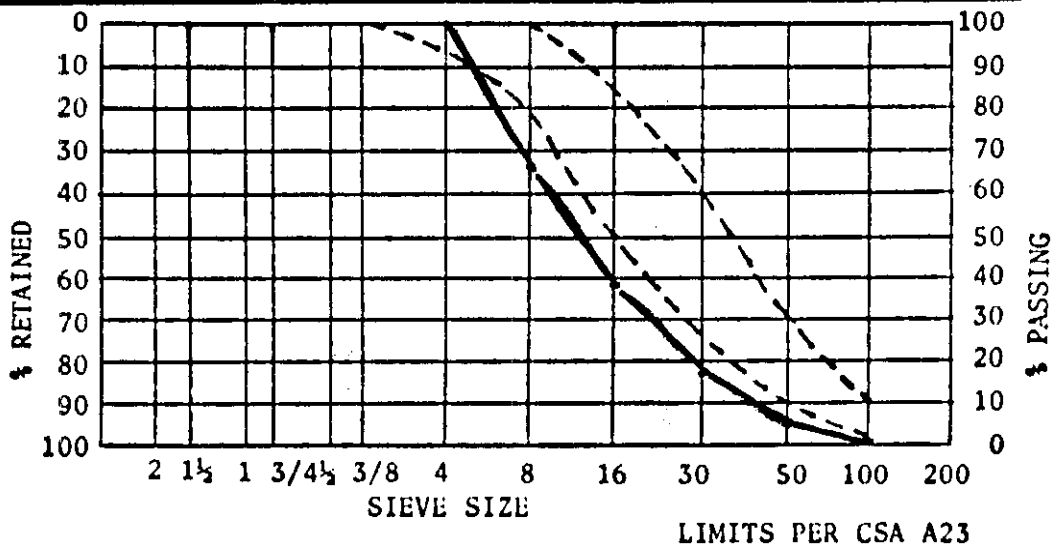
COAL CONTENT NIL
REMARKS

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE →

% SAND
% FINER THAN No. 200 — 0
ORG. IMPURITIES NO.
COAL CONTENT — NIL
REMARKS
REPR. 48% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS
% RETAINED

	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 31/75
SAMPLE NO. W 46-75
TEST NO. SA 013
CLIENT P.O.

PROJECT

SOURCE SAMPLE TYPE GR. SAND SAMPLED BY
DATE SAMPLED DATE RECEIVED 2/7/75 DATE TESTED 29/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	—
1½			8	36.0	36.0
1	12.7	12.7	16	25.7	61.7
3/4	15.4	28.1	30	15.3	77.0
1/2	21.0	49.1	50	18.6	95.6
3/8	15.6	64.7	100	3.7	99.3
No. 4	34.0	98.7	200		
8			Pan	0.7	100.0
Pan	1.3	100.0	F.M.		3.7

SHAPE ROUNDED

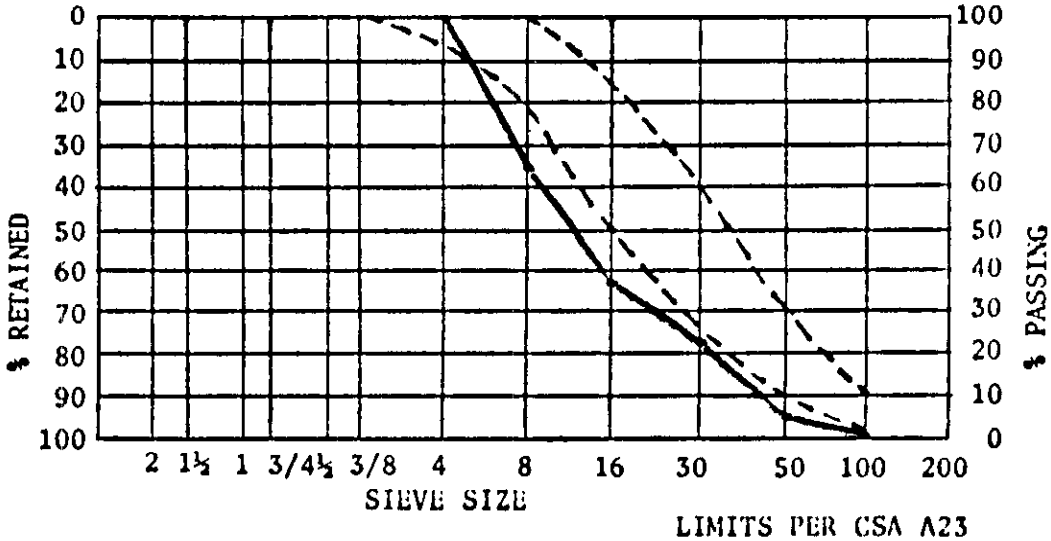
% CRUSH —
SOUNDNESS (VISUAL) GOOD

COAL CONTENT — NIL
REMARKS 26% > 1½ IN.
SOME LUMPS OF SANDSTONE

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE →

% SAND
% FINER THAN No. 200 ~~3.4~~ 0
ORG. IMPURITIES NO.
COAL CONTENT — NIL
REMARKS REPR. 50% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W 48-75

TEST NO. SA 008

CLIENT P.O.

PROJECT

SOURCE

SAMPLE TYPE GR. COARSE SAND SAMPLED BY

DATE SAMPLED

DATE RECEIVED 2/7/75 DATE TESTED 28/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	0
1½	15.0	15.0	8	30.6	30.6
1	12.9	27.9	16	35.3	65.9
3/4	9.0	36.9	30	22.7	88.6
1/2	20.0	56.9	50	8.6	97.2
3/8	13.8	70.7	100	1.9	99.1
No. 4	21.1	91.8	200		
8			Pan	0.9	100.0
Pan	8.2	100.0	F.M.		3.8

SHAPE ROUNDED

% CRUSH –

SOUNDNESS (VISUAL) GOOD

COAL CONTENT NIL

REMARKS SOME SAND COATING ALSO SEVERAL RUST STAINS

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND

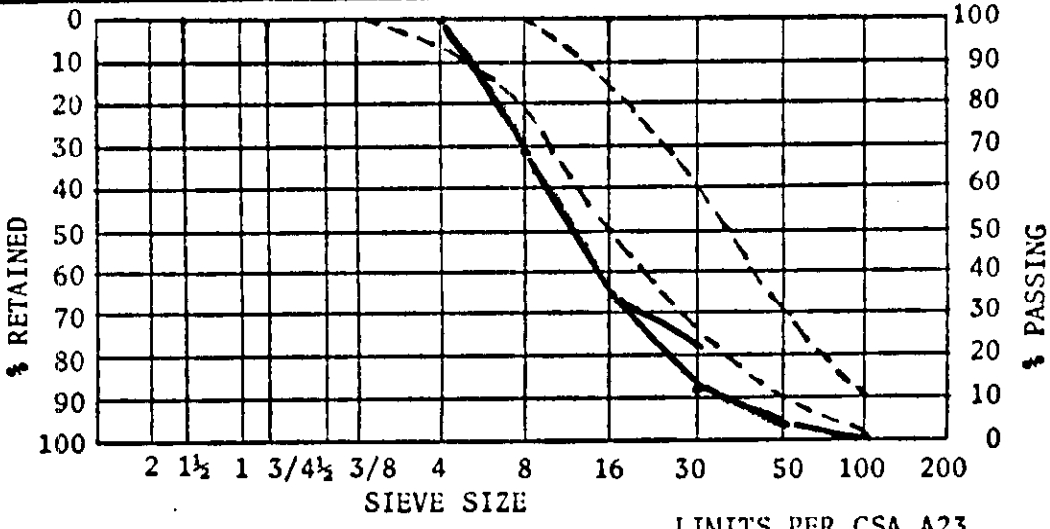
% FINER THAN No. 200 – 0

ORG. IMPURITIES NO.

COAL CONTENT – NIL

REMARKS REPR. 62% OF SAMPLE

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.

CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE JULY 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W 49-75

TEST NO. SA 007

CLIENT P.O.

PROJECT

SOURCE

SAMPLE TYPE SANDY GRAVEL SAMPLED BY

DATE SAMPLED

DATE RECEIVED 2/7/75 DATE TESTED 27/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	0	
1½	21.8	21.8	8	36.7	36.7
1	0.9	22.7	16	24.3	61.0
3/4	16.7	39.4	30	18.4	79.4
1/2	19.9	59.3	50	12.6	92.0
3/8	14.4	73.7	100	5.3	97.3
No. 4	22.9	96.6	200		
8			Pan	2.7	100.0
Pan	3.4	100.0	F.M.		3.7

SHAPE ROUNDED

% CRUSH —

SOUNDNESS (VISUAL) FAIR TO GOOD

COAL CONTENT

REMARKS MOST ROCK HAD RUST COATING

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE
→

% SAND

% FINER THAN No. 200 < 3%

ORG. IMPURITIES NO.

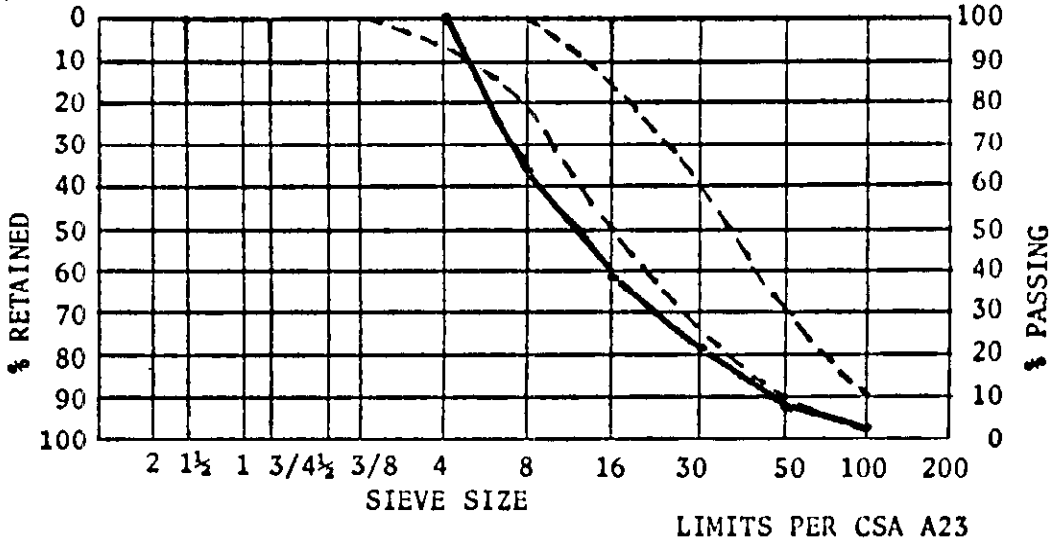
COAL CONTENT NIL

REMARKS SOME RUST COATING.

REPR. 30% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED

	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



TESTED BY S.U.F.

CHECKED BY BO

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 31/75
SAMPLE NO. W 50 -75
TEST NO. SA 014
CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE SANDY GRAVEL — SAMPLED BY

DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 29/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	—	
1½			8	30.4	30.4
1	13.4	13.4	16	27.4	57.8
3/4	17.0	30.4	30	23.8	81.6
1/2	29.5	59.9	50	13.4	95.0
3/8	14.0	73.9	100	3.6	98.6
No. 4	21.5	95.4	200		
8			Pan	1.4	100.0
Pan	4.6	100.0	F.M.		3.7

SHAPE ROUNDED

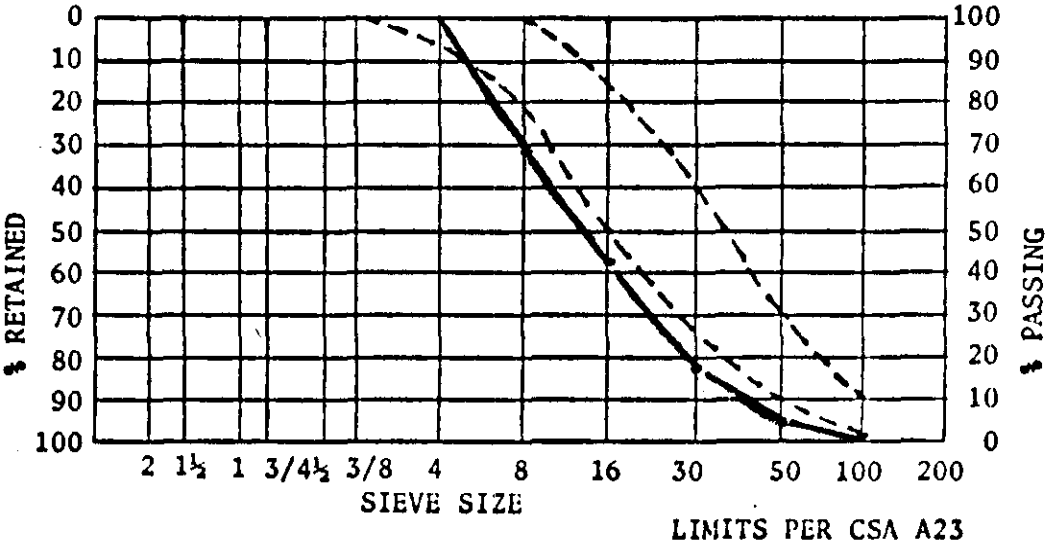
% CRUSH —
SOUNDNESS (VISUAL) GOOD

COAL CONTENT NIL
REMARKS 21 % > 1½ IN.

F.M. RANGE
2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200 — •
ORG. IMPURITIES NO.
COAL CONTENT NIL
REMARKS REPR. 35% OF TOTAL

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.U.F.
CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

DATE July 30/75

CLIENT BAYROCK & REIMCHEN

SAMPLE NO. W 35 C 75

TEST NO. SA 001

CLIENT P.O.

PROJECT

SOURCE — SAMPLE TYPE FINE SAND — SAMPLED BY

DATE SAMPLED — DATE RECEIVED 2/7/75 — DATE TESTED 25/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4		
1½			8		
1			16	0.4	0.4
3/4			30	2.8	3.2
1/2			50	35.9	39.1
3/8			100	58.6	97.7
No. 4			200		
8			Pan	2.3	100.0
Pan			F.M.		1.4

SHAPE

% CRUSH

SOUNDNESS (VISUAL)

COAL CONTENT

REMARKS

F.M. RANGE 2.2 - 2.6 FINE; 2.6 - 2.9 MEDIUM; 2.9 - 3.2 COARSE

% SAND

% FINER THAN No. 200 —

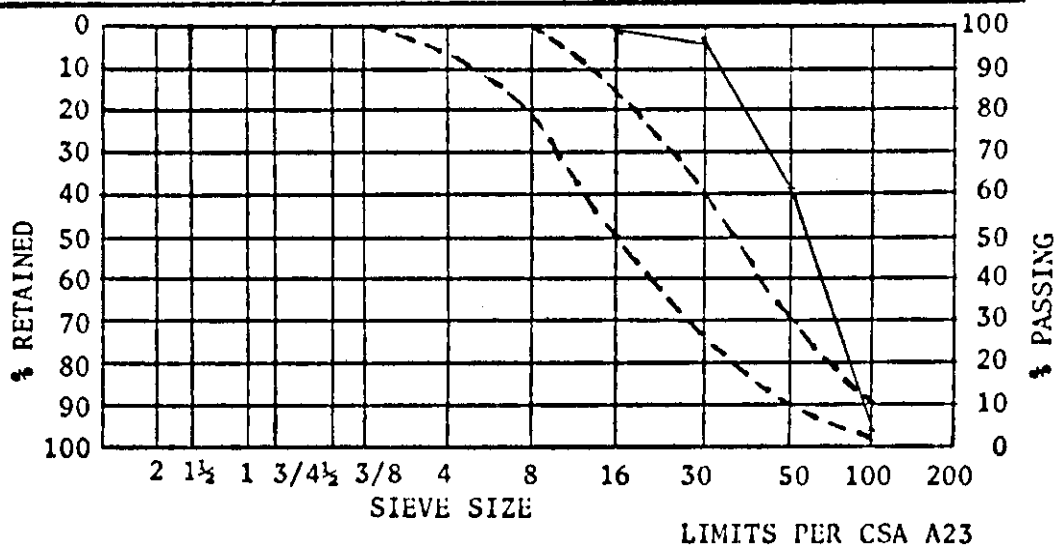
ORG. IMPURITIES NO.

COAL CONTENT —

REMARKS

CLEAN, YELLOW BEACH SAND.

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY S.V.F.

CHECKED BY

TRYLOWSKY ENGINEERING LTD.

CONCRETE AGGREGATE REPORT

CLIENT BAYROCK & REIMCHEN

DATE JULY 31/75
SAMPLE NO.
TEST NO. SA 015
CLIENT P.O.

PROJECT FRASER

SOURCE HWY 99 & WESTN. HWY SAMPLE TYPE RIVER SAND SAMPLED BY B.T.

DATE SAMPLED 31/7/75 DATE RECEIVED 31/7/75 DATE TESTED 31/7/75

COARSE AGGREGATE			FINE AGGREGATE		
SIEVE SIZE	% RETAINED		SIEVE SIZE	% RETAINED	
	INDIVIDUAL	CUMULATIVE		INDIVIDUAL	CUMULATIVE
			3/8		
2			No. 4	1.5	1.5
1½			8	0.8	2.3
1			16	1.8	4.1
3/4			30	4.4	8.5
1/2			50	47.8	56.3
3/8			100	41.8	98.1
No. 4			200	1.1	99.2
8			Pan	0.8	100.0
Pan			F.M.		1.7

SHAPE

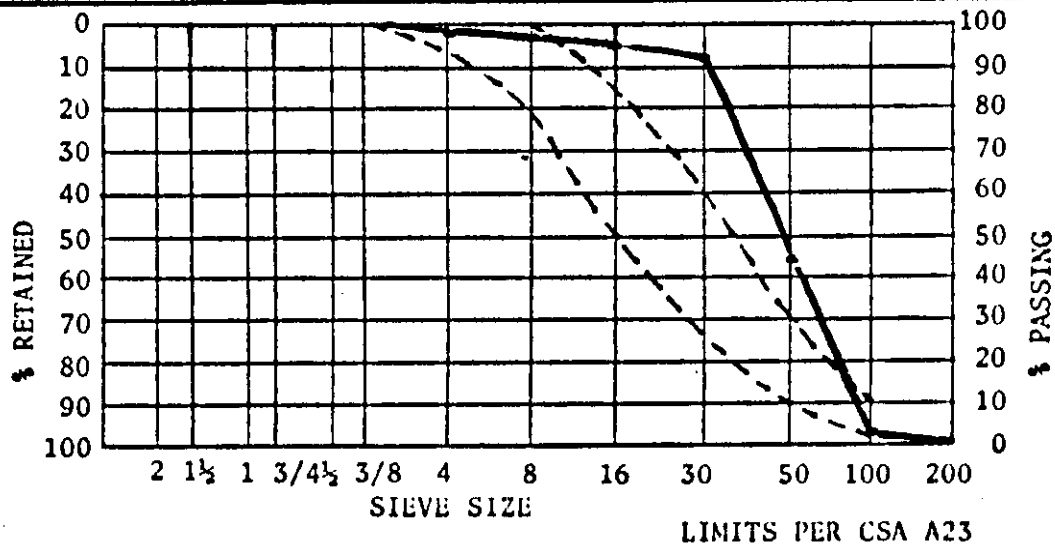
% CRUSH
SOUNDNESS (VISUAL)

COAL CONTENT
REMARKS

F.M. RANGE 2.2 - 2.6 FINE
2.6 - 2.9 MEDIUM
2.9 - 3.2 COARSE

% SAND
% FINER THAN No. 200
ORG. IMPURITIES NO.
COAL CONTENT
REMARKS

COARSE AGGREGATE GRADATION LIMITS % RETAINED			
	1½-4	1-4	3/4-4
2	0		
1½	0-5	0	
1		0-5	0
3/4	30-65		0-10
1/2		40-75	
3/8	70-90		45-80
No. 4	95-100	90-100	90-100
8		95-100	95-100



LIMITS PER CSA A23

TESTED BY B.T.
CHECKED BY

SPRATT BAILEY LABORATORIES LTD.

2455 Cypress Street, Vancouver, B.C. V6J 3M9 Phone 736-7736

TESTING
EXPEDITING
INVESTIGATIONS
RESEARCH
DEVELOPMENT

To: Mr. B. Trylowsky
2770 Hawser Avenue
Coquitlam, B.C.

Date: August 6, 1975

Project: -

File #: Misc. "T"/75

Report of: Aggregate Soundness

Report #: 1/75

INTRODUCTION

Five samples of bank-run aggregate were submitted by the client for testing in accordance with instructions. For each sample the material was split over the #4 screen and the coarse fraction was retained for testing to C.S.A. A23.1.5.4.4 Magnesium Sulfate Soundness Test. All samples were subjected to 5 cycles and the individual and average weighted losses are shown below.

TEST RESULTS

Sample#	Sieve Size	Grading of Original Sample	Weight of Test Fraction before Testing	%Passing designated Sieve after Test	Weighted Percentage Loss
W37	1½"-3/4"	26.2	1496	0.27	0.07
	3/4"-3/8"	20.5	1002	0.80	0.16
	3/8"-#4	10.3	300	1.30	0.14
	TOTALS	57.0	-	-	0.37 Weighted loss
W41	1½"-3/4"	34.0	1499	0.40	0.14
	3/4"-3/8"	28.0	1000	1.20	0.34
	3/8"-#4	16.0	300	1.30	0.21
	TOTALS	78.0	-	-	0.69 Weighted loss
W42	1½"-3/4"	29.8	1500	0.07	0.02
	3/4"-3/8"	31.1	998	0.10	0.03
	3/8"-#4	22.6	300	0.17	0.04
	TOTALS	83.5	-	-	0.09 Weighted loss

Cont../2

Sample#	Sieve Size	Grading of Original Sample	Weight of Test Fraction before Testing	%Passing designated Sieve after Test	Weighted Percentage Loss
W45	1½"-3/4"	30.1	1502	0.27	0.08
	3/4"-3/8"	34.7	1001	1.20 -	0.44
	3/8"-#4	20.4	300	1.00	0.20
	TOTALS	85.2	-	-	0.72 Weighted loss
W46	1½"-3/4"	28.9	1465	1.35	0.40
	3/8"-#4	32.8	300	0.33	0.11
	TOTALS	61.7	-	-	0.51 Weighted loss

NOTE:

C.S.A. A23.1 maximum allowable loss - 12%.

Technician: K. Moisuk

Supervisor

Location of Sand and Gravel Deposits

of the Cumberland and T'sable River Area

Area Recommended For Development

Weldwood Lease Area

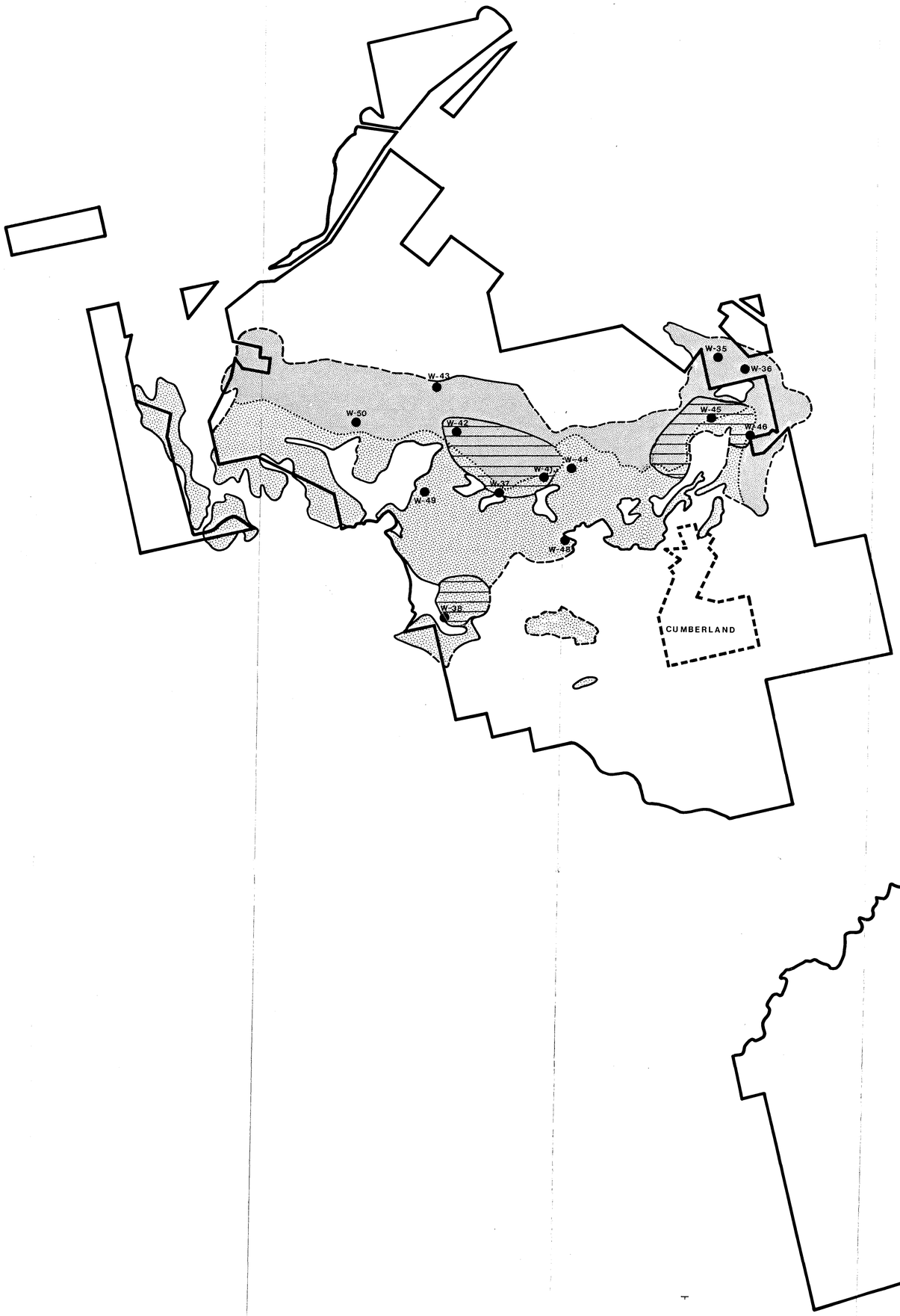
Gravel and Sand

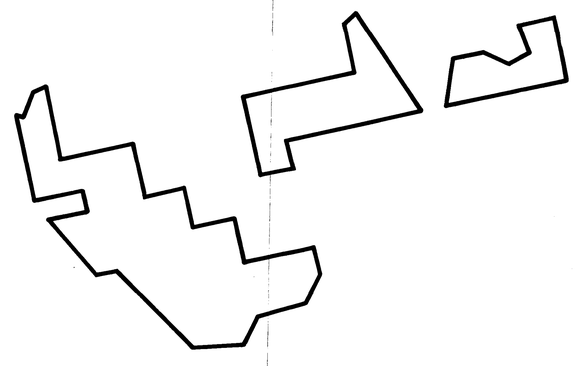
Sand and Gravel

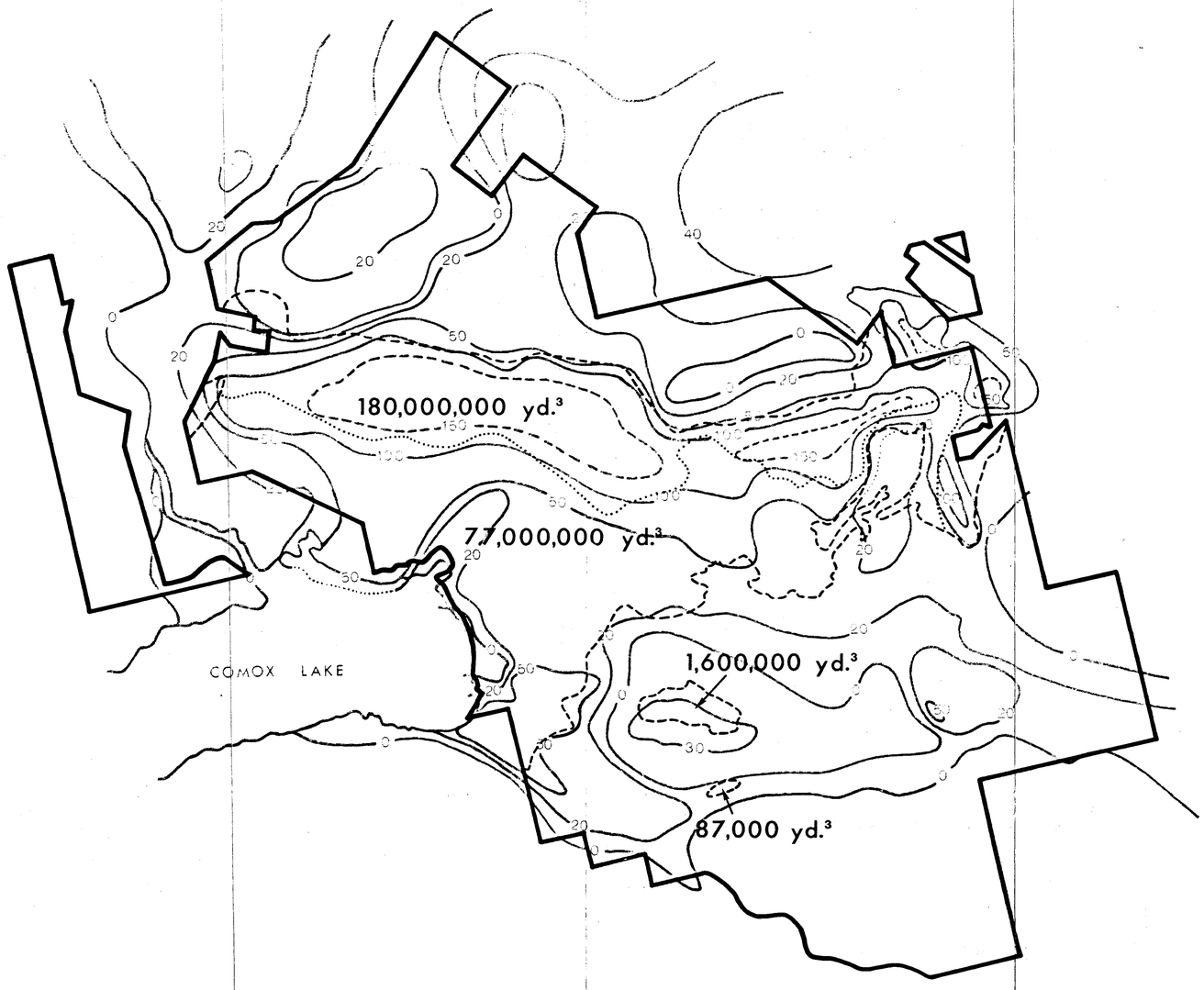
● Sample

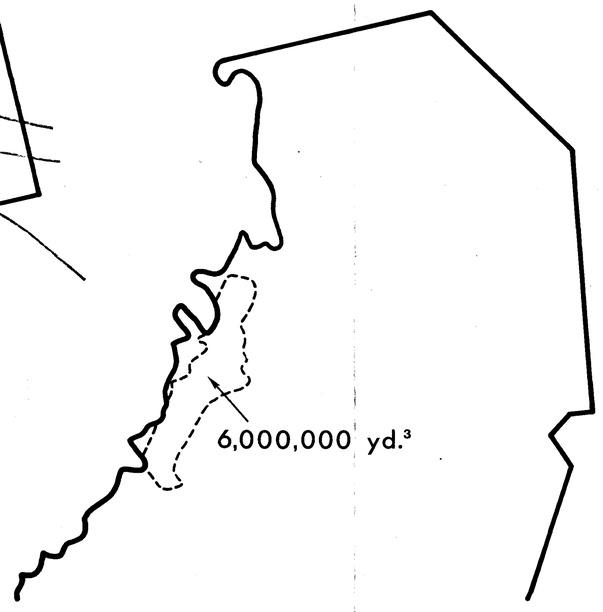
Scale : 1"=1320' July, 1975

BAYROCK AND REIMCHEN SURFICIAL GEOLOGY LIMITED









Isopach Map, Surface Deposits
Cumberland Area

727
694

Volume Estimate of Sand and Gravel,
Cumberland and T'sable River Area (yd.³)
Scale: 1"=1320' July, 1975

BAYROCK AND REIMCHEN SURFICIAL GEOLOGY LIMITED

M2