GRANULAR RESOURCE INVENTORY - MACKENZIE

PORTIONS OF MAHONY LAKE NTS 96F AND FORT FRANKLIN NTS 96G

Scale 1:125,000

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For - Department of Indian and Northern Affairs

Summary

The principal sources of unconsolidated granular material, although not extensive, are glaciofluvial deposits and eskers found in the central part of the Mahony Lake map area. Small quantities of glaciofluvial and lacustrine sands and gravels are also present in the southwestern portion of the Fort Franklin map area.

Bedrock suitable as construction material is available in the southeastern and south central portions of the Mahony Lake map area. Coherent carbonate rocks could be crushed to provide coarse granular material. The less coherent shale could be used for fill and sub grade material.

Because some of the unconsolidated deposits contain large amounts of ground ice, bedrock for some applications may be a better material.

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INTRODUCTION

This report attempts to assess the quantity of granular material available for construction from both unconsolidated and bedrock sources. Glaciofluvial materials are considered good sources of sand and gravel; lacustrine and fluvial deposits are of variable quality. Generally, moraines have been considered only where they are known to be hummocky and thus contain some coarse granular material. Terminal moraines are usually considered to be sources of granular material whereas ground moraines are not.

Bedrock is considered as a source of crushed material if it is coherent and resistant to weathering, i.e., limestones, dolomites, sandstones and most rocks of Precambrian age. Other rock types, such as shales, are considered in this report only as alternate material for construction purposes.

The information in this report and on the accompanying map has been compiled largely from published and unpublished manuscripts and from personal communication with officers of the Geological Survey of Canada. Supplementary data, mainly on depth, thicknesses and, in some cases, on texture of deposits have been obtained from confidential reports of other government departments and industry (See Sources of Information). Field checking was carried out during the summer of 1972.

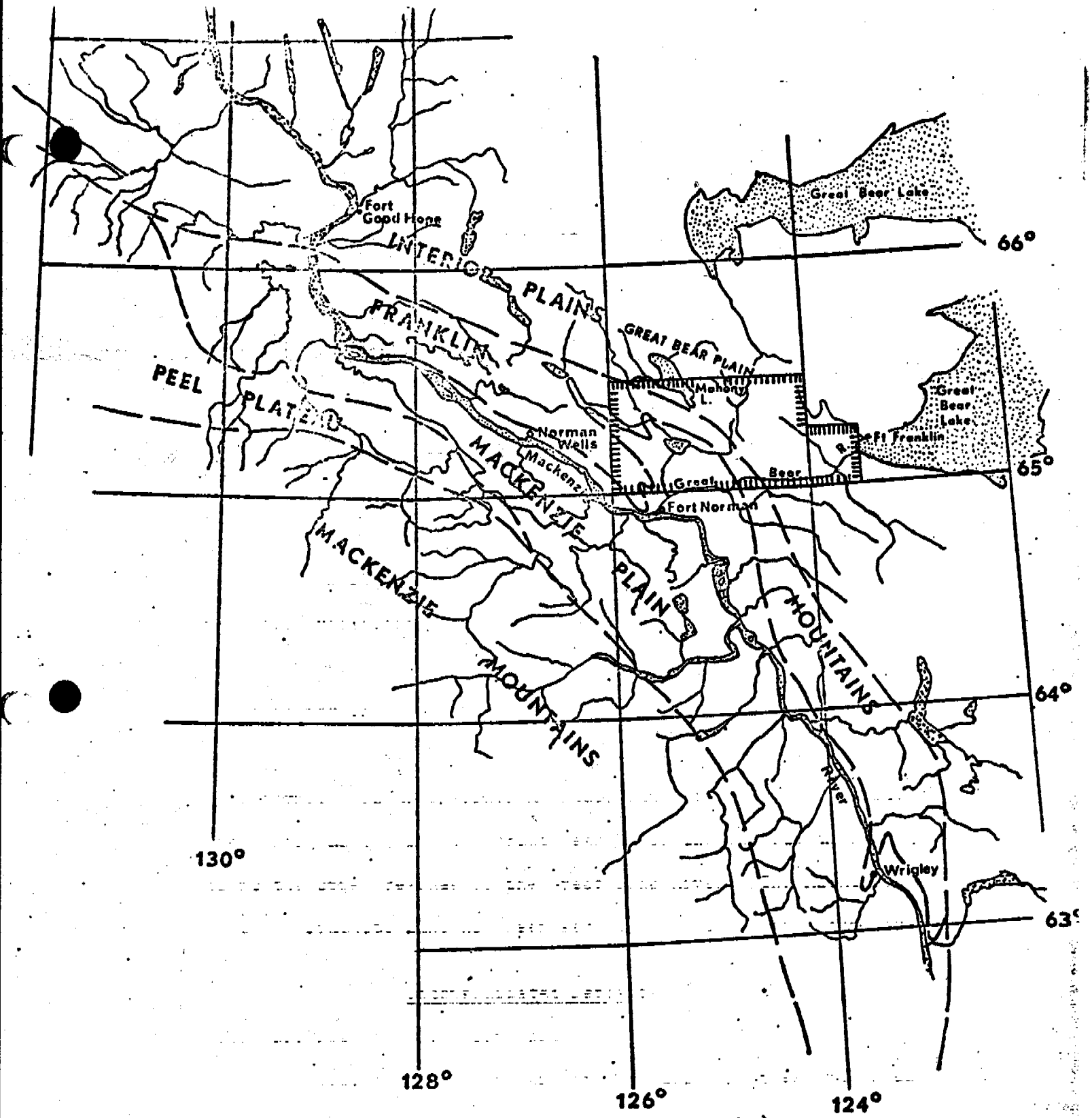
The basic documents used in this compilation and from which areal data were derived are surficial geology maps of the southern half of Mahony Lake (NTS 96F) and part of Fort Franklin (NTS 96G) at a scale of 1:250,000 (Fulton 1972, unpublished manuscripts). Data for all major unconsolidated deposits of granular material have been transferred to 1:125,000 scale maps.

A derived map for granular material has been produced from the basic surficial geology map complimented by field observations on thickness, texture, ice content, drainage, and the variability of the map units. To supplement thickness and textural data, additional information was gathered from seismic shot hole records and samples, and from other drill-hole logs.

Areal extent of the deposits was estimated by planimeter. Average thickness for each deposit was estimated from the data mentioned above and reduced according to drainage, height above water table, and amount of ground ice. A volume of granular material was estimated from the areal and thickness data. All estimated volumes of material appear in a tabular summary at the end of the paper.

In addition to the estimates of unconsolidated granular material, a bedrock geology map has been prepared as an overlay sheet (for the Mahony Lake map sheet only). This is intended to indicate where bedrock suitable for crushing or fill could be extracted if unconsolidated material is not available.

For purposes of description, areas of granular material are outlined on the surficial geology map and are numbered to correspond to a tabular summary of materials. Areas which appear to have little material with respect to anticipated demand or areas which require more detailed work are discussed in the report.



MAHONY LAKE & FORT FRANKLIN

PHYSIOGRAPHIC REGIONS

1 : 2,500,000

after Bostock 1948

GENERAL GEOLOGY AND PHYSIOGRAPHY

Three physiographic regions are represented in the Mahony Lake and Fort Franklin map areas: the Mackenzie Plain; the Franklin Mountains; and the Great Bear Plain (one of the Interior Plains). Bedrock is exposed in the Franklin Mountains. The Mackenzie Plain and the Great Bear Plain, are both underlain by unconsolidated materials which everywhere mantle the bedrock. The Franklin Mountains have elevations up to 2,000 feet whereas the elevations of the bordering plains are between 400 and 1,000 feet.

Shales underlie the Mackenzie and Great Bear Plains, in contrast with the predominantly carbonate rocks of the Franklin Mountains. When the continental glacier advanced northwestward across these areas, a ground moraine was deposited almost everywhere except at high elevations. As the glacier retreated, glaciofluvial deposits, eskers and morainal ridges were formed. Since glaciation, lacustrine deposits have formed where Great Bear Lake joins the Great Bear River and fluvial terraces have formed along the upper reaches of the Great Bear River. The Mackenzie Plain south of Brackett Lake has been seriously affected by thermokarst activity.

Unconsolidated Deposits

Glaciofluvial Deposits, sand and gravel, G

Glaciofluvial sand and gravel occurs in these map areas as hummocky and terraced deposits, and as glaciofluvial eskers. All of these vary in composition from predominantly sand to sand and gravel. The latter deposits are only found immediately south of Mahony Lake. A few deposits consist of gravel lenses in morainal till. In these approximately 80% of the well sorted gravel is available as construction material.

Glaciofluvial deposits west and southwest of Fort Franklin are mostly sand. Their use is probably restricted by ground ice.

The glaciofluvial sand and gravel deposits vary in thickness between 10 and 25 feet;available granular material varies between 40 and 80 per cent of these deposits.

Lacustrine Deposits, sand and gravel, L

There are two deposits of lacustrine origin which contain granular material in the Fort Franklin map area and none in the Mahony Lake area. The smaller, a beach deposit, is immediately southwest of the settlement of Fort Franklin and the larger, a terrace deposit, is south of that. These deposits are mainly sand with small amounts of gravel. They are approximately 10 feet thick and 60% of the material is available as a granular construction material.

Alluvial Deposits, At

Alluvial terraces along the Great Bear River are mainly sand and silt. Ground ice in these terraces may also restrict their exploitation.

Bedrock Geology

Carbonate bedrock of Cambrian, Ordovician and Devonian ages forms two prominant ridges in the Mahony Lake map area. One of these extends south from Mahony Lake to the Great Bear River; the other ridge extends along the western corner of the Mahony Lake map area. The Mackenzie Plain is underlain by non-marine shales of Tertiary age while the Great Bear Plain is composed of Cretaceous shales.

The carbonates are the best potential source of aggregate. Shales would be satisfactory and economical as a sub-base material as they have low ice content and are usually soft enough to be ripped.

MATERIALS

Deposits of unconsolidated granular material are not abundant in the Mahony Lake and Fort Franklin map areas. Principal deposits occur in the south-central portion of the Mahony Lake map area and at the head of the Great Bear River in the Fort Franklin map area. The glaciofluvial deposits and eskers tend to be small and of variable texture, many eskers are fine grained. The eskers and glaciofluvial units immediately south and to the west of Mahony Lake are coarser than the above mentioned deposits. Lacustrine beaches and alluvial terraces along the Great Bear River contain a considerable amount of material but it is mostly sand and silt.

Exposed bedrock in the Mahony Lake map area is mainly Cambrian, Ordovician and Devonian limestone and dolomite which could provide crushed material. Talus deposits derived from these carbonates would also be a source of material. Shale, which is less coherent than the limestone and dolomite could be used for fill and sub-grade material.

TABULAR SUMMARY

Description and Material	Area (sq. mi.)	Estimated Average Thickness (ft.)	Estimated Volume of Granular Material ($yds^3 \times 10^6$) total	available
MAHONY LAKE				
Area I SOUTHWEST OF WHITEFISH RIVER				
(a) Gt/Cv				
glaciofluvial terraced;sand and gravel;colluvial veneer.	7.26	25	188.92	151.13
(b) Esker;sand. (appendix II, station 29)	4.0 mi.	10	.16	.09
Area II GREAT BEAR RIVER				
(a) Gt				
glaciofluvial terraced; sand and gravel.	5.34	25	139.11	55.63
(b) Gh				
glaciofluvial hummocky; sand and gravel.	3.67	25	95.46	38.18
(c) GhMp				
glaciofluvial hummocky; sand and gravel; morainal plain.	1.32	25	34.49	13.79
(d) Eskers; 2; gravel.	3 mi.	10	.088	.072
Area III KELLY LAKE				
(a) Gh				
glaciofluvial hummocky; sand and gravel.	1.75	25	45.65	18.26
Area IV MAHONY LAKE - WEST SHORE				
(a) Esker; gravel.	0.8 mi.	10	.0236	.0188
Area V MAHONY LAKE - SOUTH SHORE				
(a) Eskers; 4; gravel.	3 mi.	10	.088	.072

TABULAR SUMMARY

Description and Material	Area (sq. mi.)	Estimated Average Thickness (ft.)	Estimated Volume of Granular Material ($yds^3 \times 10^6$) total	available
Area VI MAHONY LAKE SOUTHEAST				
(a) Gh				
glaciofluvial hummocky;sand and gravel. (appendix II, Station 26)	4.57	25	114.19	91.32
(b) Eskers; 5; gravel. (appendix II, Station 27)	6 mi.	10	.176	.140
Area I FORT FRANKLIN				
(a) GhMp				
glaciofluvial hummocky; morainal plain; sand and gravel.	2.66	25	69.14	27.65
Area II UPPER GREAT BEAR RIVER				
(a) sgLp				
lacustrine plain; sand and gravel.	1.25	10	12.19	7.79
(b) sgLpMp				
lacustrine plain; sand and gravel; morainal plain.	1.56	10	16.3	9.7
Area III PORCUPINE RIVER				
(a) GhMp				
glaciofluvial hummocky; morainal plain; sand and gravel hummocks.	1.75	12	11.41	9.1

SOURCES OF INFORMATION

Bostock, H.S.
1948: Physiography of the Canadian Cordillera, with special reference to the area north of the fifty-fifth parallel; Geol. Surv. Can., Mem. 247.

Cook, D.G.
1972: Manuscript of bedrock geology of Mahony Lake 96F; Geol. Surv. Can. (unpublished).

Fulton, R.J.
1972: Manuscript of surficial geology of part of Mahony Lake 96F and Fort Franklin 96G; Geol. Surv. Can.: (unpublished).

Prest, V.K., Grant, D.R., Rampton, V.N.
1967: Glacial map of Canada, Geol. Surv. Can. Map 1255A.

APPENDIX I, Part I

Unconsolidated Granular Materials

Each map sheet has a surficial geology legend (see appendix). This legend, differentiated by means of patterns, only indicates granular material classified by genetic characteristics. In some cases only part of a map unit has been patterned, indicating that only that portion is considered a suitable source for ganular material.

Legend

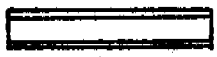
GLACIOFLUVIAL

coarse grained granular material: cobbles, pebbles, gravel; may be mixed with some coarse sand

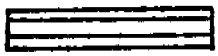
mixed or interbedded sand and gravel

predominantly sand or sand with some fine material

GLACIOLACUSTRINE



coarse grained granular material: cobbles, pebbles, gravel; may be mixed with some coarse sand.



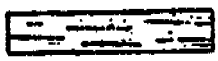
mixed or interbedded sand and gravel

predominantly sand or sand with some fine material

FLUVIAL

only sand and gravel deposits are patterned

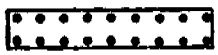
MORAINAL



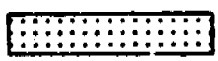
predominantly till; unsorted matrix of silt, clay, and sand imbedded with pebbles, cobbles and boulders

MARINE

coarse grained granular material: cobbles, pebbles, gravel; may be mixed with coarse sand



mixed or interbedded sand and gravel



predominantly sand or sand with some fine material

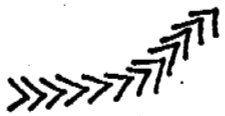
EOLIAN

fine and medium sandy material

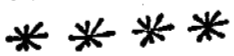
COLLUVIUM

only the patterned area is coarse grained

Symbols



eskers



gravel mounds

morainal ridge found within moraine

APPENDIX I Part (ii)

Bedrock Geology

(black line overlay)

The rock units which appear on the accompanying overlay are an engineering geological grouping according to gross lithology and age.

These units were derived from a more detailed geological map, whose units were subdivided largely on the basis of airphoto and stratigraphic interpretation. The units are identified by a two component code. The first component is upper case and designates age which is followed by a mnemonic designating gross lithology, e.g. Dls - Devonian limestone. When no lithology follows the age component, the unit is composed of many of the rock types listed below.

Legend

Age		Lithology	
T	Tertiary	car	carbonate limestone and/or dolomite
K	Cretaceous	ls	limestone
JR	Jurassic	dol	dolomite
TR	Triassic	ss	sandstone
Pr	Permian	sh	shale
C	Carboniferous		no mnemonic component indicates unit is composed of many of the above rock types
D	Devonian		
S	Silurian		
O	Ordovician		
Є	Cambrian		
P	Precambrian		

Symbols

Boundary of bedrock unit (approximate)

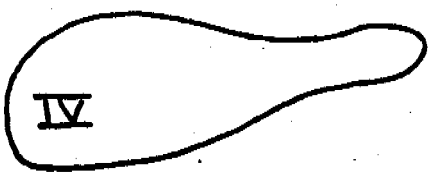
Boundary of bedrock unit inferred in areas of surficial cover

Limit of mapping

APPENDIX I, Part (iii)

GRANULAR RESOURCE UNITS

GRANULAR RESOURCE AREAS (black)



granular resource area (see text for corresponding description)

APPENDIX I, Part (iv)

SURFICIAL GEOLOGY AND LANDFORMS

TEXTURE		GENESIS		MORPHOLOGY		SLOPE (superscript)	
f	fen	O	organic	v	veneer	1	moderate ($<5^{\circ}$)
p	peat	M	morainic	p	plain		
c	clay	G	glaciofluvial	d	drumlin	2	steep (5° - 15°)
si	silt	L	lacustrine	s	fluted striated		
s	sand	A	alluvial fluvial	t	terrace		
g	gravel			h	hummocky		$>15^{\circ}$ normally in Cx unit
b	boulder	C	colluvial	r	ridged		
t	till	E	eolian	e	eroded		
		U	upland, rolling bedrock controlled	f	fan		
				m	rolling		
		R	rock outcrop	c	channelled		
				k	kettled thermokarst		
				x	complex		

Complex Units:

e.g. in: Mp-f0, f0 constitutes 25% to 49% of area
: Mp/f0, f0 = 5% - 24% of area

Using all four elements of the legend, a smooth ground moraine surface with moderate slope would be tMp^{1}; hummocky and ridged glaciofluvial gravel would be gGhr. Note that there are inconsistencies in the use of Mp and Mv mainly because of the difficulty in estimating till thickness.

APPENDIX II

TEXTURAL DATA

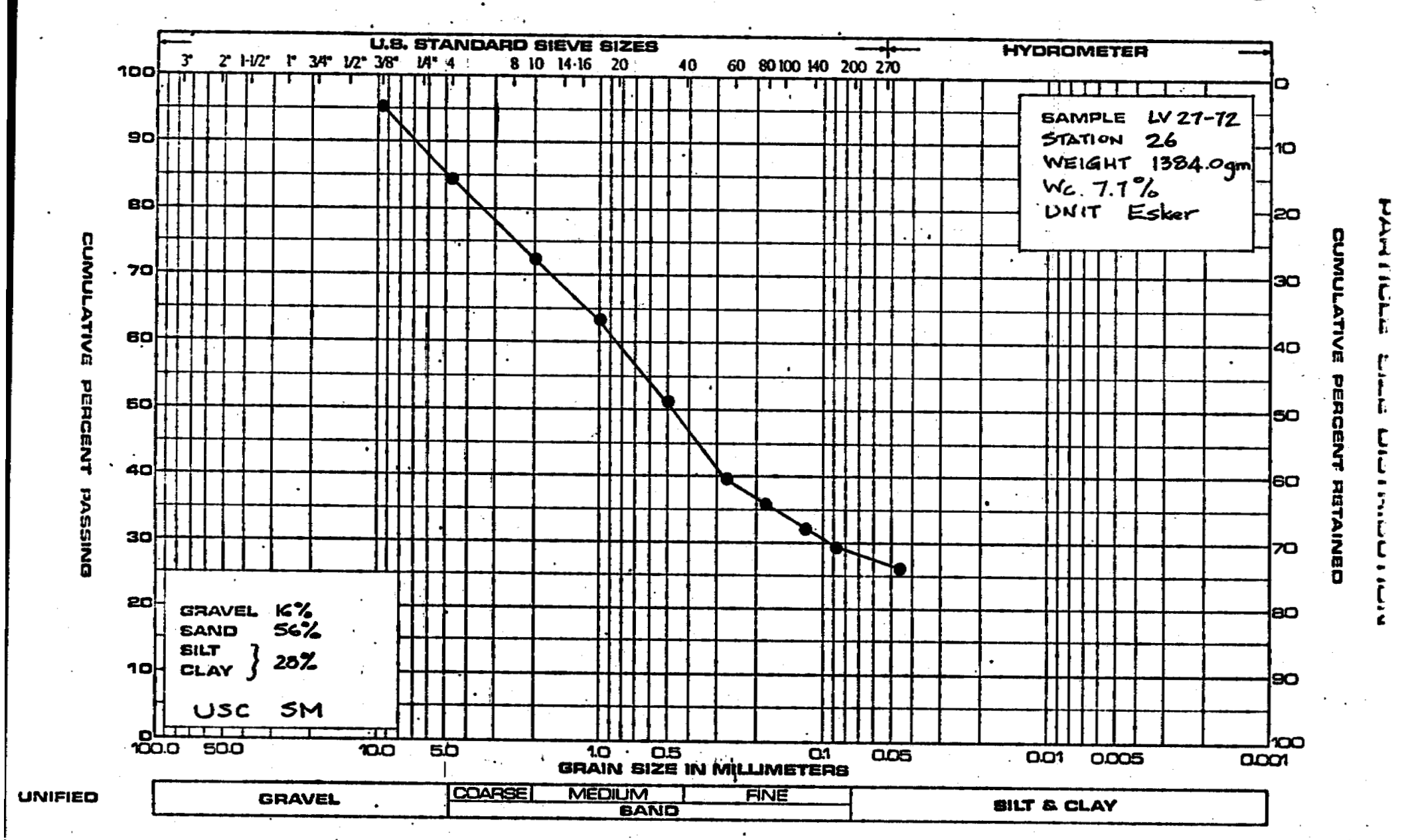
The textural data presented in this appendix were gathered during the summer of 1972 when spot checking of surficial and bedrock sources of granular materials was carried out. Although these grain size curves were plotted from the test results of single samples, it is believed that the samples are representative of the deposits tested.

Reference to samples are by station and sample number. Cross reference with the "Tabular Summary" and UTM grid is included so that location of data on a 1:250,000 scale map can be established (see table below).

SAMPLE LOCATIONS

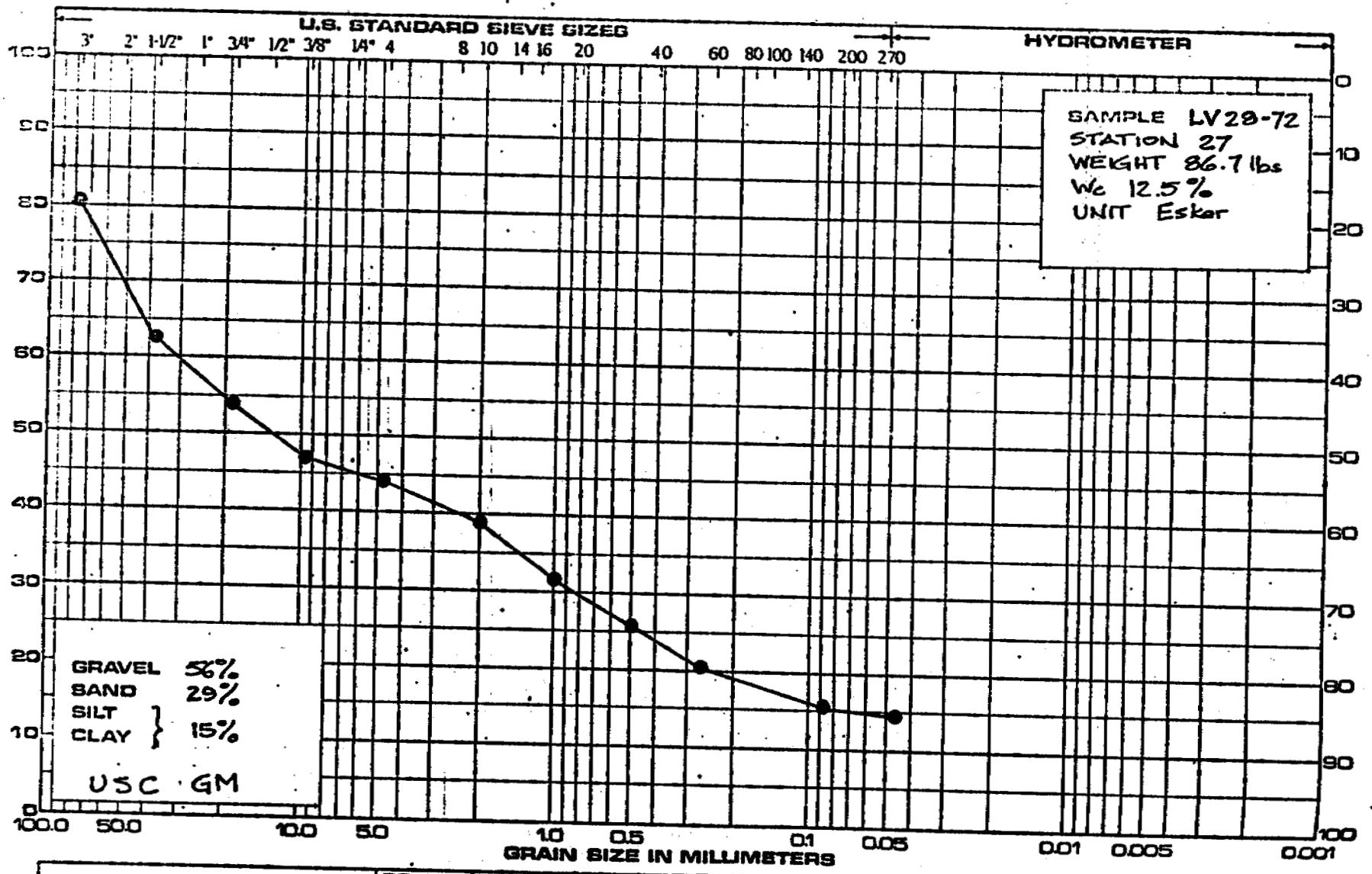
MAHONY LAKE

STA	Sample	TABULAR SUMMARY		GRID REFER.
		Area	Unit	UTM
26	LV27-72	VI a	Esker	CH678058
27	LV28-72	VI b	Esker	CH990442
29	LV29a-72 LV29b-72	I	Gt/Cv	DH223514



GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

PARTICLE SIZE DISTRIBUTION



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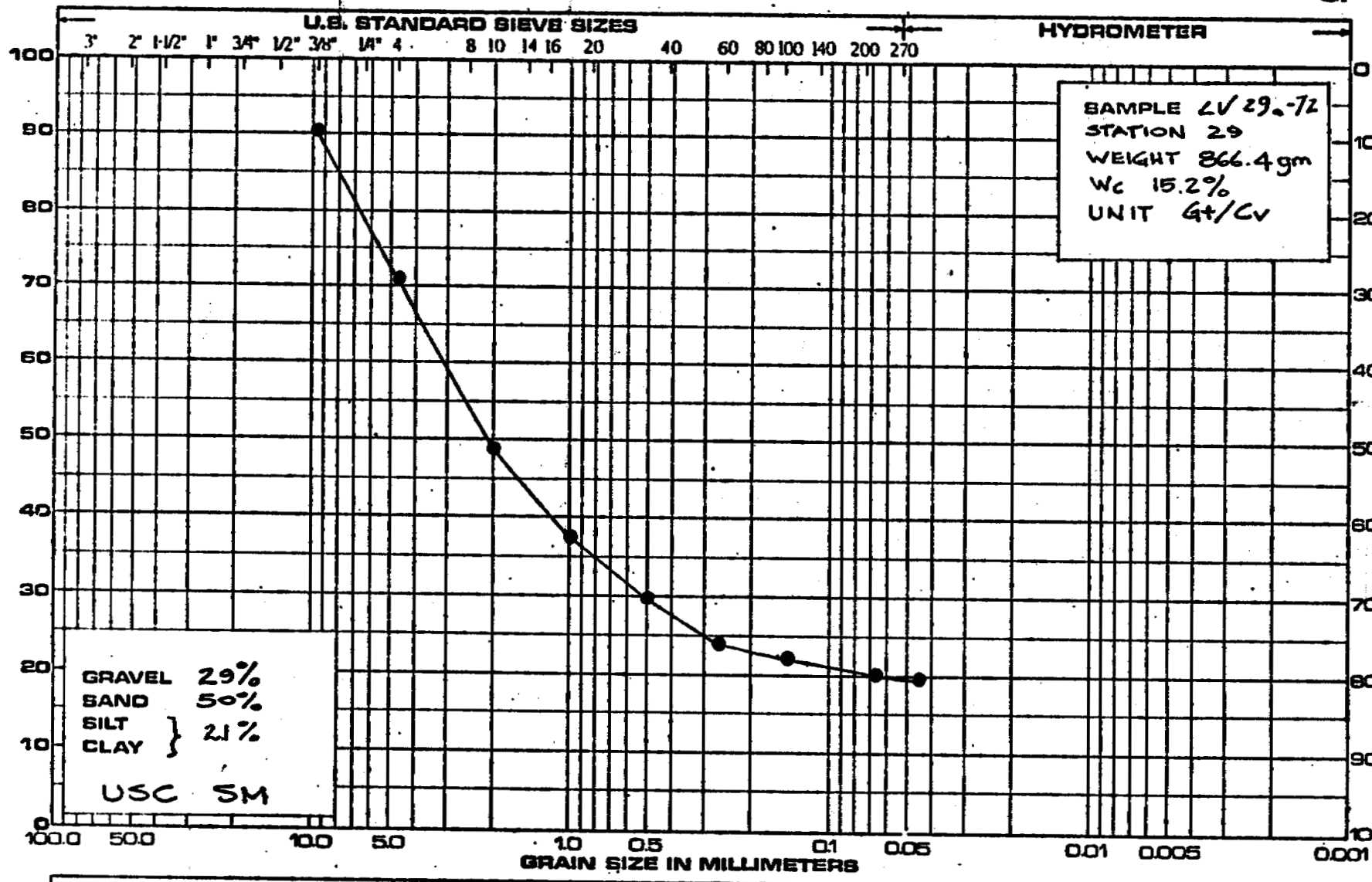
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

96 F



PARTICLE SIZE DISTRIBUTION

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

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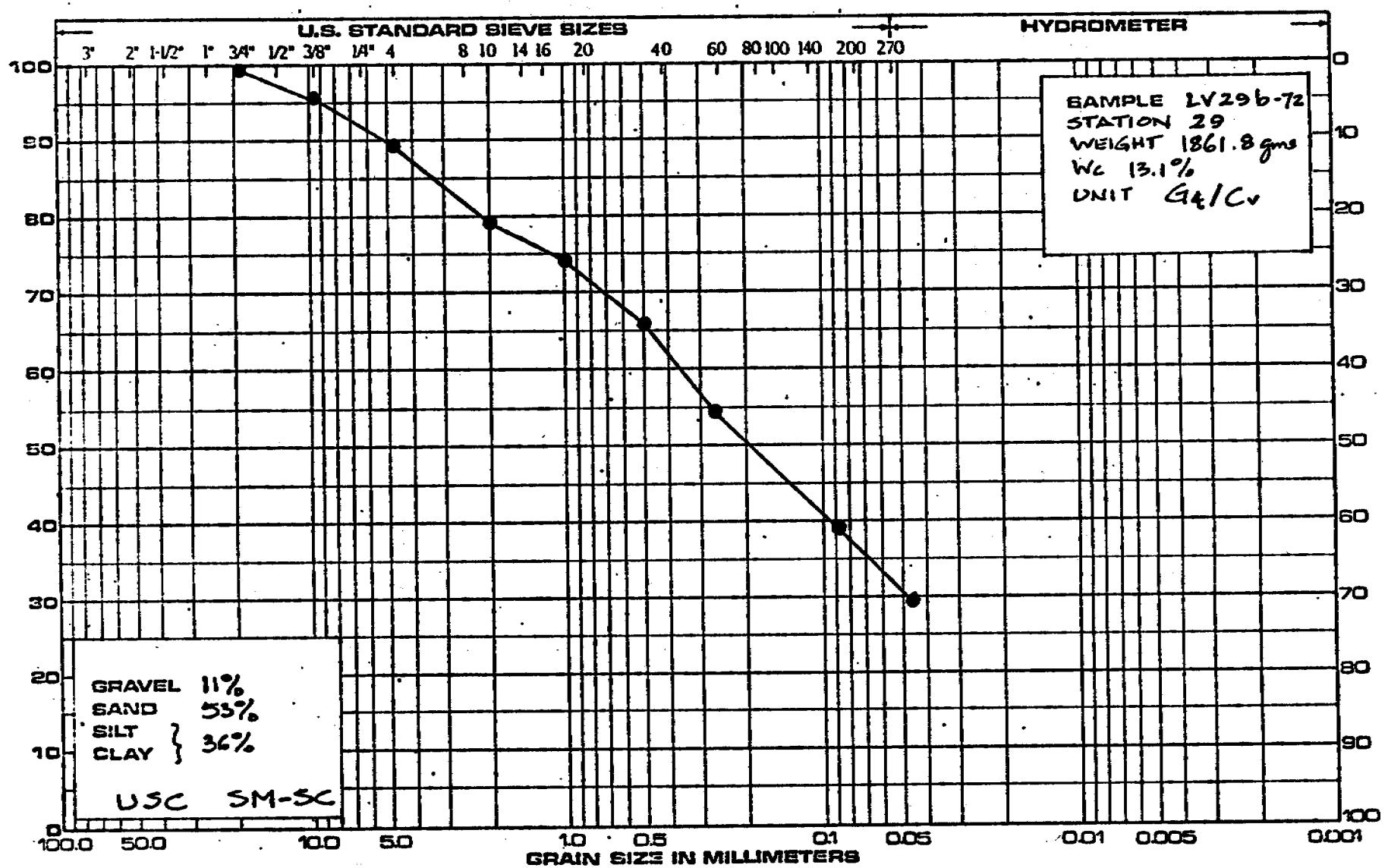

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