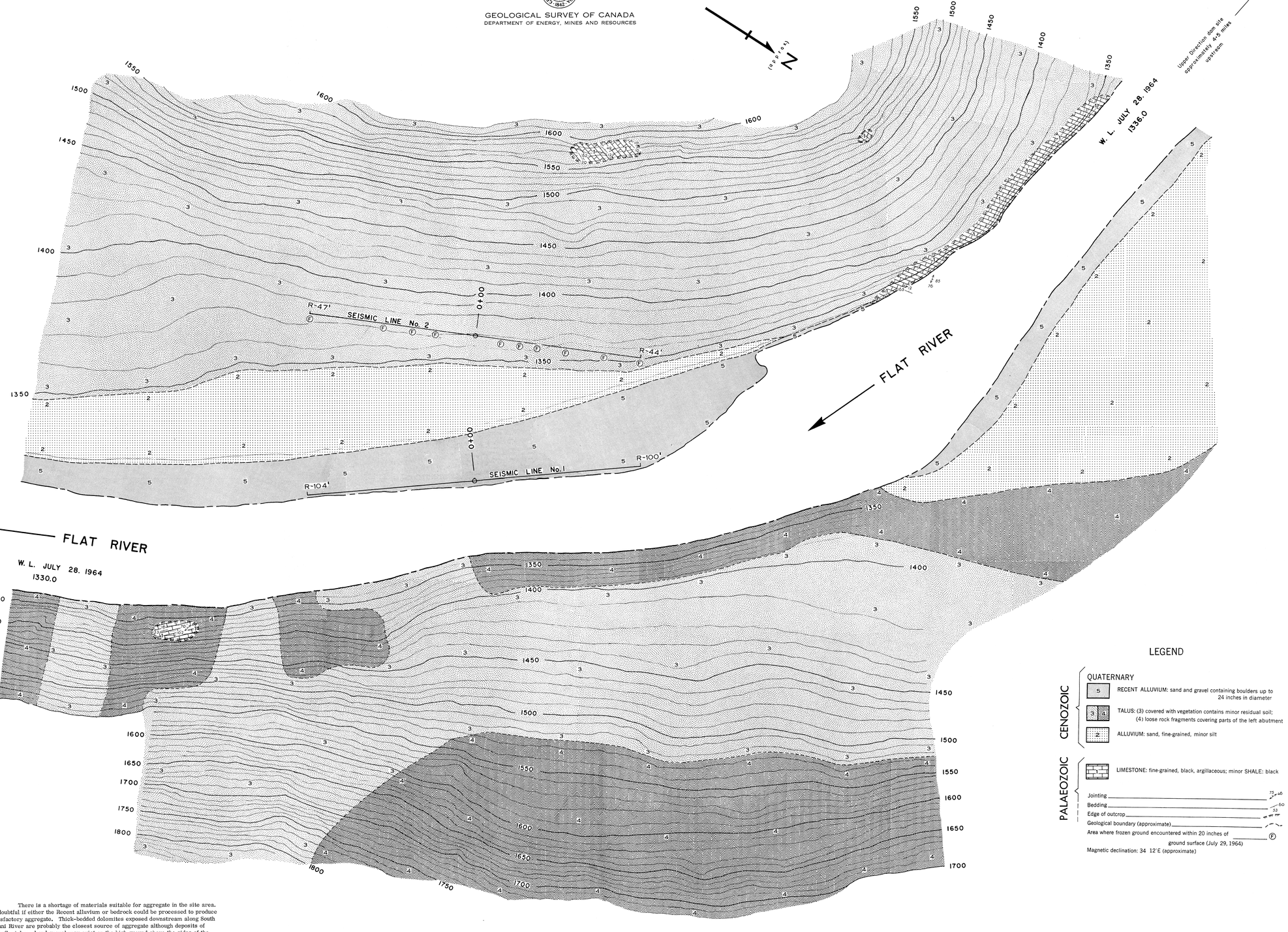
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES



Descriptive Notes

At Lower Direction dam site Flat River is flowing in a southeasterly direction along a narrow valley the steep sides of which are largely covered with talus. The area included on the accompanying geological map covers only the lower part of the valley and, as indicated on the map, bedrock is exposed only as scattered outcrops in this part. However, along the left side of the valley, above the limits of the map, a bedrock cliff extends to a height greater than 900 feet above the river. Sliding is common on both sides of the valley. This has resulted in an accumulation of colluvium, which is till-like in appearance, along the bottoms of the slopes.

Overburden at the site consists of Recent alluvium, alluvium and talus. The Recent alluvium is exposed in a large bar along the right side of the river. The material consists chiefly of sand and gravel containing boulders up to 24 inches in diameter. The results of seismic line No. 1 indicate the thickness of overburden beneath the bar varies from 100 to 104 feet. Consequently, if the dam were founded upon bedrock, large quantities of this material would be excavated. The high shale content of the Recent alluvium would preclude it from being used as aggregate. The alluvium covers level terraces along both sides of the river up to elevation 1,348 (about 20 feet above the river). It is not a flood plain deposit but is believed to have been laid down at some previous time when Flat River flowed at a higher elevation. The alluvium consists of fine-grained sand with minor silt (Sample No. 14). Talus consists of rock fragments which have resulted from the mechanical disentegration of adjacent bedrock. The size and shape of the fragments derived from sedimentary rocks is dependent upon the thickness of the beds and the spacing of the jointing as well as the angles at which these structures intersect. Most of the fragments in the talus at Lower Direction dam site range from sand-size particles to angular boulders less than 12 inches in diameter. In places, however, there are accumulations of boulders up to several feet in diameter.

The thickness of overburden on the sides of the valley should seldom exceed 10 feet. However the thickness of the colluvium, which is a mixture of talus and residual soil, along the bottoms of the slopes is greater than 40 feet. This is indicated by the results of seismic line No. 2. The depths to bedrock obtained from seismic line No. 1 (100 - 104 feet) suggests bedrock surface continues to slope steeply downward beneath the river.

Bedrock exposed in the dam site area consists chiefly of fine-grained, dark grey to black, argillaceous limestone in beds varying in thickness from 2 to 12 inches. Interstratified with the limestone are thin beds of black shale which are seldom more than 3 inches thick. Similar rocks are exposed along the left side of the valley above the site area. Interbedded with these rocks is a distinct, plainly visible bed of fine-grained, grey-weathering, dolomitic limestone some 25 feet in thickness (Plate 1). Many of the large rock fragments in the talus are from this massive bed. In general, the bedding is parallel to the river and dips at low angles into the right side of the valley. Minor undulations, however, have resulted in some variations in its attitudes. The prominent dolomitic limestone bed exposed high up on the left side of the valley projects downward toward the bottom of the right side. There is no joint set that is prominent throughout the dam site area. Most of the jointing is irregular with the spacing ranging from 2 to 12 inches. The north-trending thrust faults visible in the upper part of the left side of the valley are parallel to the valley at the site. It is possible the direction of the valley is controlled by the bedding and/or the faulting. Also, a fault parallel to the valley may underlie the river at the site. The existence of a fault beneath the river would seriously effect construction at the site and should be taken into consideration in the design of the structures.

There is a shortage of materials suitable for aggregate in the site area. It is doubtful if either the Recent alluvium or bedrock could be processed to produce a satisfactory aggregate. Thick-bedded dolomites exposed downstream along South Nahanni River are probably the closest source of aggregate although deposits of glacio-fluvial sand and gravel may exist on the high ground above the sides of the valley. The dolomites along the South Nahanni could also be quarried for riprap and rock fill. The glacio-lacustrine silty clay (Sample 15) could be used as core material for a rolled earth dam. Deposits of this material are exposed for several miles along South Nahanni and Flat Rivers.

There are no groundwater springs or seepages in the dam site area nor was groundwater encountered above the frost line in the shot holes of seismic line No. 2. However, minor seeps occur along the thrust faults in the upper part of the left side of the valley. Frozen soil was encountered in the till-like colluvium exposed in the shot holes of seismic line No. 2. In most instances it occurred within 20 inches of ground surface. The depth depended upon the thickness of the overlying cover of moss and organic material.

LEGEND

CENOZOIC
- QUATERNARY
- 5 — RECENT ALLUVIUM: sand and gravel containing boulders up to 24 inches in diameter
- 3 4 — TALUS: (3) covered with vegetation contains minor residual soil; (4) loose rock fragments covering parts of the left abutment
- 2 — ALLUVIUM: sand, fine-grained, minor silt

PALAEOZOIC
- LIMESTONE: fine-grained, black, argillaceous; minor SHALE: black

Jointing — 75 — 26
Bedding — 60 — 53
Edge of outcrop
Geological boundary (approximate)
Area where frozen ground encountered within 20 inches of ground surface (July 29, 1964) — F
Magnetic declination: 34 12'E (approximate)

MACKENZIE RIVER DRAINAGE BASIN

SITE NO. 23

LOWER DIRECTION DAM SITE

TO ACCOMPANY TOPICAL REPORT NO. 120

GEOLOGY BY E.B. OWEN, 1964