25. GENERAL CONSIDERATIONS AND SUMMARY OF THE SIX JORDAN RIVER DAM SITES MAPPED GEOLOGICALLY BY THE DEPARTMENT OF MINES, MARCH – JUNE, 1967

by P. C. Stevenson

INTRODUCTION

Between March and June 1967, six dam sites on the Jordan River were mapped geologically by the Department of Mines on request from the Rivers and Water Supply Commission.

At each of the sites, a fifty-foot rock fill dam was envisaged. The dam sites were as follows:—

No. 1 about one mile downstream from the Midland Highway crossing of the Jordan River at Jericho.

No. 5 about half a mile down stream from the junction of the Exe Rivulet and the Jordan River.

No. 6 about three-quarters of a mile downstream from the Lower Marsh Road bridge at Rutland.

No. 9 about three-quarters of a mile downstream from the Lake Highway crossing of the Jordan River at Apsley.

No. 12 at the upstream end of the gorge about one mile NW of Kempton.

No. 15 at the upstream end of the gorge half a mile E of Broadmarsh.

TOPOGRAPHY

The drainage pattern of the Jordan River is highly irregular, most of the water coming from a catchment area of about 470 square miles, around Lake Dulverton and Lake Tiberias. In detail the course of the Jordan is sinuous, the river flowing successively NW, N, E, S and E before turning S into the Derwent near Bridgewater. Incised meander gorges alternating with aggraded sections through shallow basins are numerous. The whole river course shows signs of having been gouged out under greater rainfall conditions than those current. Little down-cutting is likely to be taking place under the present climatic conditions.

GEOLOGY

The geology of the Jordan basin is known in general outline but not in detail. The present mapping of dam sites has to some extent enlarged our knowledge of the area.

Triassic rocks, dominantly quartz sandstone in the lower part and less pure lithic sandstone above, are about 1,500 feet thick in the area. Mudstones occur at many horizons, and these, and the lithic sandstones, are very variable in thickness, even over short distances. Coal seams occur but have not been encountered in the present dam site surveys.

Below the Triassic, Permian rocks outcrop in some places, but they have been encountered only marginally in the present surveys.

The Triassic rocks generally lie at low angles of dip, and such tilting and faulting as exists, appears to be closely related to the intrusion of Jurassic dolerite. Many of the intrusive contacts are also fault contacts, i.e., relative movement has taken place during intrusion along pre-existing or contemporaneous fault planes.

The dolerite dominates the topography of the Jordan catchment, and is often, but not invariably the origin of the gorges. Similarly the basin areas of the river course are usually formed in softer Triassic sediments. The dolerite does not adhere to one horizon or topographic level, but can intrude in both concordant or discordant fashion, and over the area of any dam site may show a variety of relationships with the sediments. The general metamorphism resulting from the dolerite intrusions is slight, but contact regions of the dolerite with the sediments are usually closely jointed.

The significant geological features of the various sites are summarised in the following table.

	No. 1 Jericho	*No. 5 Exe/ Rutland*	*No. 6 Rutland*	*No. 9 Apsley*	*No. 12 Kempton*	*No. 15 Broad-marsh*
Rock types present in dam site	Dolerite and sandstone	Sandstone	Sandstone	Sandstone, mud-stone and dolerite	Sandstone and dolerite	Dolerite
Fractures present in rocks at dam site—						
(i) Joints	Many	Few	Open, widely spaced	Many, variable	Many	Many, variable
(ii) Faults	Nearby	One small	Nil	Nil	Nil	Nil
Faults present	Possibly small crush zone	? possibly basalt filled	Nil	Nil	Nil	Present
Rock-fill available	Dolerite	Dolerite 1½ miles	Dolerite	Dolerite	Dolerite	Dolerite
Clay available	Basalt clay	? alluvial clay, Triassic mud-stone	Dolerite and alluvial clay at some distance	Dolerite, clay?	Alluvial clay	Nil
Access	Good, road near	Poor. 1 mile from track, 3 miles from road	Good, road near	Good, road and old rail bed	Poor. 1 mile from track, 2 miles from road	Fair, farm track near site

From these purely geological factors, it seems that all the sites are feasible, depending on the amount of leakage that can be tolerated. Some diamond drilling and pressure testing will be required at each site, either because of jointing in dolerite or permeability and faulting in the sandstones. The presence of a fault in the dam or reservoir area may be of little significance but a small amount of drilling would enable the leakage to be estimated.

In view of these factors, and depending on the amount of leakage that can be tolerated, some diamond drilling is required—

(*a*) to estimate leakage due to jointing and weathering in abutments by means of pressure testing;

(*b*) to locate and estimate leakage in fault zones, where these are present, by means of pressure testing, to determine the presence of sound rock in rock-fill quarry areas;

(*c*) as dolerite outcrops are a notoriously poor guide to the state of weathering of the rock at depth; and

(*d*) if clay is to be used as core material, then a power auger or pitting programme will be needed to determine reserves.

Further it is recommended that immediate abutment areas be cleared of vegetation, soil and loose rock so that a more accurate assessment of rock permeability and strength can be made.