II. Preliminary statement for the hydraulic development of the river Jökulsá á Fjöllum.

Reykjavík, 15. May, 1957,
Sigurður Thoroddsen

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Installed machine power 260.000 kw.
Q_{max} = 200 m^3/s, h_{br} = 165 m
Drawing: A -

1. Material

This statement is based on the following material:

1. General Staff maps of Iceland, scale 1:100 000.
2. Maps by The State Electricity Authority, Fnr. based on aerial photographs. Scale: 1:5000 showing 2 m contours.
3. Drawings showing Lognitudinal section of the river Jökulsá á Fjöllum, made by The State Electricity Authority. Total 6 kwgs. Fnr. 2839 - 2844 inclusive.
4. Two Geological Surveys made by dr. Sigurdur Thórarinsson with regard to possible hydraulic development of the river Jökulsá á Fjöllum. First survey from March 1954, second survey from April 1957.
5. Icelandic Fresh Waters I, by Sigurjón Rist. Issued by The State Electricity Authority 1956.
6. Mean-flow curves by The State Electricity Authority. Fnr. 3087 and 3088.
7. Survey report by Sigurdur Thoroddsen on The Hydraulic Development of the river Jökulsá á Fjöllum. March 1954.

2. Flow and regulation

The catchment area of the river Jökulsá at the site of the dam is about 7000 km^2. Continous discharge measurements have been carried out at Jökulsá since 1939, showing an average flow of the river about 193 m^3/s, which corresponds to about 27 1/2 $l/s\ km^2$ from the catchment area. The best regulation possibilities are at the proposed dam at Selfoss waterfall and also at Núpakot and Miðfell.

Here it is proposed to store about 2500 · $10^6 m^3$, in the reservoir at Selfoss, which is available with a difference of 25 m at the head water level (Heights 340 m - 365 m). Such a storage corresponds to 41% of the annual mean discharge and in the majority of years it guarantees full utilization of the mean discharge.

According to (6) about 90% of the annual mean flow may be obtained during the most favourable year.

It is proposed to develop a maximum of 200 m^3/s, and the operation of the plant would therefore be guaranteed for abt. 7700 hours, during the most unfavourable year.

Here it is right to state that the estimated volume of the reservoir is uncertain as sufficiently detailed proofs are not available.

3. Arrangement of development

Proposed is to dam Jökulsá abt. 1 km above the Selfoss waterfall. A rock-fill dam abt. 4.9 km long and with a maximum height of 45 m is intended at this site. The upper edge of the rock-fill dam is at an altitude of 370 m, ant it will have a tightening core of reinforced concrete.

On the west side of the river the rock-fill dam sways northwards on the eastern side of the bottom of a depression of subsidence adjoining the Jökulsá canyon, just north of Hafragil.

It is proposed to build a concrete dam of the so called lamel-type across the aforementioned depression.

This dam will be about 550 m long with a maximum height of 37 metre. The upper edge of concrete dams will be an altitude of 368 m. About this dam at the eastern edge of the depression, two circular shaped intakes are proposed and three wash-out sluices through the dam are planned. On the west side of the depression abt. a 700 m long concrete

gravity dam is proposed, with a 500 m long overflow at an altitude of 365 m. This dam is very low everywhere.

Thus all the by-pass water of the river comes into Hafragil, and through it down to the Jökulsá canyon, below the tailrace from the station and this is an advantage.

The bottom of the depression is partly covered with lava. This lava layer is considered to be rather thin (4).

As regards the bedrock, which is mainly composed of dolerit, reference is in other respects made to the survey of dr. Sigurdur Thorarinsson.

From the intake, there will be two vertical intake-tunnels to the powerhouse all of which will be underground.

The intake-tunnels will be lined with steel. Discharge tunnels from the powerhouse will be abt. 2,2 km long.

The tunnels are lined with concrete, and come out in a creek in Jökulsá about 0,4 km below Hafragilsfoss.

Two aggregates each of 130 000 kw are proposed.

A 1.3 km long entrance tunnel will lead to the power-house. In this tunnel air- and cable channels are proposed.

To the south of the rock-fill dam it is intended to blast the brow which forms the eastern edge of the afore-mentioned depression, so as to procure material for the rock-fill dam, thus securing a flow to the intake during low water periods in the dammed-up lake.

4. Rough estimate of costs

Dam	Kr.	670.000.000,-
Powerhouse and waterways	-	105.000.000,-
Machines and electrical equipment ..	-	290.000.000,-
Road construction and harbour improvements	-	25.000.000,-
Total	Kr.	1.090.000.000,-

Capital outlay will therefore be abt. 4200,- kr/kw.

If an allowance is made for 8000 hours operation, the power production will be 2,08. 10^9 kw-hours. With an annual cost of 10%, the power price at site will be 5,25 aur/kwhr. Respecting the rough cost estimated it is right to point out that the following unit prices of the chief kinds of materials are anticipated:

Blasted rock for dam . . . kr.	50,-	pr. m^3
Concrete . . . . . -	500,-	- -
Mould-construction . . . . -	120,-	- m^2
Reinforcing iron . . . . . -	6000,-	- ton
Blasting for cut-off wall -	220,-	- m^3
Blasting in tunnels . . . -	120,-	- -

Conclusion

This statement supersedes my previous survey-report from March 1954. Since it was made further information has been added, namely:

1) Reports on discharge measurements (5) (6).
2) Maps of the development area of the upper plant, of which an account has been made here.
3) Profile measurements of the river.
4) A supplimentary survey by dr. Sigurdur Thorarinsson respecting the geological formation of the area (4).

When considering the development, described in this statement, it must be borne in mind, that the dam, which is a big and costly construction, contains storage for both this development and the lower one and it will utilize a head from 200 m down to 30 m.

Sufficient proofs are not yet available to make a corresponding estimate for the lower development, but it may be presumed that the arrangement will be a great

deal less costly than anticipated in my previous survey report, since dam constructions in Jökulsá, will be smaller than proposed therein, and moreover, the arrangement proposed was not the most practical one available.

Reykjavík, 15. May 1957,

Sigurður Thoroddsen