PRELIMINARY PROJECT OF WATER SUPPLY FOR NDATA FARM, MALAWA

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ABSTRACT: The water resources project of 320 Ha second stage reclamation, in which including an University City, out of 800 Ha Ndata Farm, Malawa, had been under studied in this research. The challenge of C value of runoff coefficient was obtained as 0.8, by introducing the attenuation factors method, proposed by second author, an IDF dimensionless method customary used in Taiwan, proposed by the third author, is translated further to solve the project design rainfall; Rational Method, thus, obtains 11.5 CMS as the 5 year recurrence storage. The final job, completed by the third author's on-site performance, includs field alignments and discussions with the trustee, Malawa President H. E. Dr. Bingu Wa Mutharika, when a special concern of anti-theft. In order to provide sufficient supply up to an amount of 44,000 M3 during April to November, the sketch package includes 6 measurements: one water barrage, one sluice gate, one intake, one sediment reservoir, one water reservoir, and 3199 Km long gravity-driving hydraulic pipe.

Keywords: Attenuation factors method; IDF dimensionless method; Concern of anti-theft; Field alignment project

1. INTRODUCTION

Ndata Farm, with the Lunchenza river flowing around northern boundary, is located at southern part in Malawa (Figure 1). It occupies 800 ha but only 50 ha for tobacco and corn now, is located on the southeast of Blantyre, the biggest city with population of 13 millions. A second stage reclamation will expand its area into 320 ha to include a University city of population of 1,200 and for main crops of corn, tea, and sugarcane. This farm stretched from 870 m to 745 m above sea level (Figure 2). Yearly rainfall is about 800~1,200 mm, 80% of it comes from period starting December to March. Average yearly high temperature is 28 $^{\circ}$C while low temperature is 14 $^{\circ}$C. A water supply project, therefore, is issued.

Figure 1. Location of Ndata Farm (Google Earth, 2007)

The Lunchenza river with high variation stream flow conditions, between them, the flood condition as shown in Photo 1, and the dry condition as shown in Photo 2, both showing the cultivations can be performed as shown in Photo 3, due to an existing dam as shown in Photo 4.

Photo 1. The Lunchenza River during Wet Season

Photo 2. The Lunchenza River during Dry Season

Photo 3. Corn Cultivation along Ditch

Photo 4. An Existing Dam in Lunchenza River

Figure 2. Topography Map of the Ndata Farm

2. MATERIAL AND METHODOLOGY

The University city projected with a population of 1,200, water demand amounts to 64,200 m^3/year due to an additional 10% loss. The 0.6 yearly demand for 320 ha is 15,000 m^3/year if 2.500 m^3/ha of water is required for corn. These two potions add up to make a total projected amount of 480,000 m^3/year. Water supply project need a runoff coefficient if rational method is applied. It is 0.8 if the attenuation method by second author (Liang, 1997) proposed is employed. Since the design storm needs an IDF curve to evaluate the storage capacity. The dimensionless curve method, which customarily employed in Taiwan, is proposed by the third author to translate further to solve the project design runoff. Rational Method, thus, obtains a value of 11.5 CMS for the 5 year recurrence with 30 min. concentration time at a given watershed area of 3293 m^2.

$$I_{32}^{25} = \left[\frac{1200}{25.29 + (0.094 \times 1200)}\right]^2 = 75.515836$$

$$\therefore I_{30}^{5} = (G + H \times \log T)\frac{A}{(t+B)^c} \times I_{60}^{25}$$

$$= \left\{\left[0.46230 + (0.37368 \times \log 5)\right]\frac{25.20544}{(30+55)0.67379}\right\} \times 75.515836$$

$$\approx 69\ mm/hr$$

$$Q_5^1 = \frac{1}{360} \times 0.8 \times I_{30}^5 \times 75$$

$$\approx 11.50\ m^3/s$$

when a special concern of anti-theft is emphasized in Malawa, the alignment dam project finished by the first author's field alignments and discussions with the trustor side, Malawa President H. E. Dr. Bingu Wa Mutharika. It should supply an amount of 44,000 m^3 during April to November.

3. THE SKETCHED PACKAGE

There is not good enough data to evaluate the water supply according to some sophisticate method or considering more sources (Liang, 1996). The sketched package as shown in Figure 3, therefore, includes 6 measurements as follows:

#1 one water barrage of 40.5 M in length (Figure 4 and Photo 5)
#2 one sluice gate (Figure 4),
#3 one intake (Figure 4),
#4 one sediment reservoir on the left bank (Figure 4),
#5 one off-channel reservoir (Figure 4), and
#6 a total of 3199 Km long gravity-driving hydraulic pipe as shown in Figure 4.

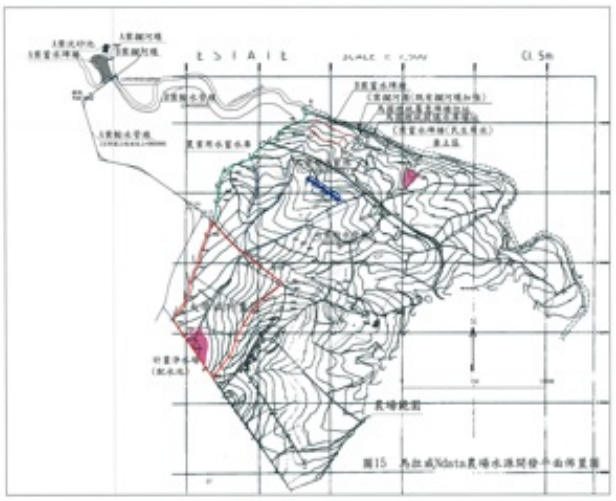

Figure 3. The Sketched Package Including 6 Measurements

Photo 5. The Barrage Site

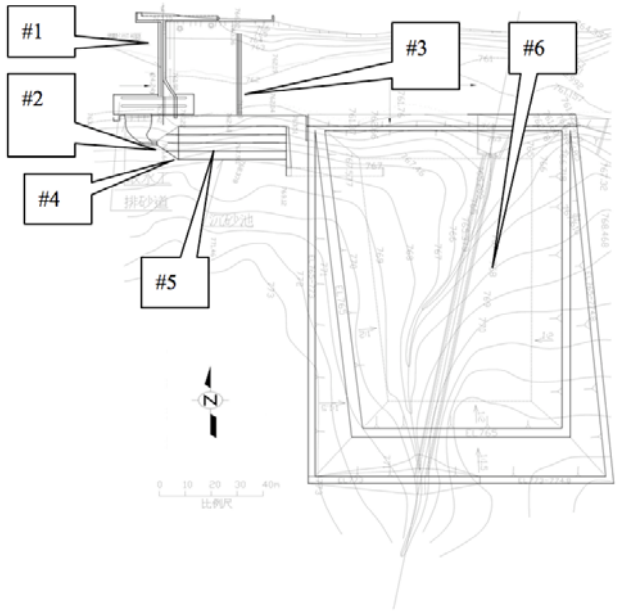

Figure 4. The Top View for Projected Package

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