26. REDESIGNING AND FIXING THAC QUA PUMPING STATION TO IMPROVE CITIZEN LIFE

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Climate change is an interesting topic which is being referred in the meeting between countries on the world. The countries and their citiziens are affected negatively. In this report, one of affected areas is described. Thac Qua is low area where is always inundated by high rainfall. With the disadvantage characteristic, the economy of this area cannot develop in normal. A solution is shown here is redesigning and fixing Thac Qua pumping station. After bulding the pumping station, the economy of this low area is developing, citizen life is better.

Key Words: *pumping station, channel, redesign, compute, pumping system*

1. INTRODUCTION

Climate change is an interesting topic which is being referred in the meeting between countries on the world. The countries and their citizens are affected negatively. Vietnam is one of developing countries is sustaining the most severely from the influence of climate change. With harsh natural situation combining climate change, the economy of Vietnam is facing up to many problems. Especially the agriculture has to face up to disaster as flooding and drought. The study area is one of the cultivation area having difficulty with the inundation for a long time. It is expected that the solution, building pumping station will help this area improve the economy by reducing inundation situation.

2. CHARACTERISTIC OF AREA

(1) Environmental condition of system

a) Geography of area

Drainage pumping station Thac Qua is in the East of Dong Anh district, and drains water from the low area such as Duc Tu, Van Ha, Lien Ha, Viet Hung to Ngu Huyen Khe river. In 1.100 ha, the total of area, there is approximate 870 ha for cultivation, and 230 ha for others. Topography of the area is low, specially Chau Phong, Ha Vi, Gia Luong, Phuc Hau, and Thac Qua. Because almost land is made from alluvium of Ngu Huyen Khe river combining with inundation in long time, the soil is aluminous. That is a reason of low agriculture productivities.

b) Climate of area

This area climate is tropical monsoon with two main seasons. The rainfall per year is high, approximate 1.680 mm and sometimes 2.625 mm, and concentrate in 6th to 9th month. Therefore in this time, the area sustains the best negative effect. In summer, 7th and 8th month, there are 3-5 storms affecting to area.

(2) Economy of area

The main occupation in this area is agriculture. Because time of inundation is long, productivity is low, and citizen life is poor. The other occupation as industry is not strong advantage so cannot develop dramatically in these districts.

3. SYSTEM SITUATION AND SOLUTION

(1) The situation of Thac Qua pumping system

Thac Qua pumping station was designed and built in 1977; there are four pumping machines which is designed to have a pumping capability of 4000 m3/h/machine but actually the machines only provided 50% of design capability, approximate 7500 m3/h/machine. Moreover after functioning for over 30 years without effective maintenance, these machines' quality are lower while have no equipment to fix. Therefore these machines may broke down anytime.

Not only the pumping machines, there are also some problems of the main channel and branch channels. The main drainage channel's length is 4.258 m from Cau Bai sewer to Thac Qua. The deposition and landslide of the banks makes the channels more and narrower. At the same time, it also caused some opposite slope areas at the bottom of channels.

(2) The solution

Thus a solution to solve the problem while the rainfall is high is rebuilding the pumping station, fixing channels.

4. REBUILD THE PUMPING STATION

Rebuilding the pumping station should be following four steps.

(1) Find the best location of the station

While computing draining capability of station, should find the best condition to have advantage when draining water.

+The station should be put at place with low elevation to easily collect water from field.

+The dug mass of soil should be the least.

+Put the station at place where there is low water level to drain water fast.

+The mass of building structure is small, reducing initial investment.

(2) [3]The best method to set up drainage tank

There are two suggestions to set up drainage tank

+Drainage tank is adjacent to station

+Drainage tank is near station.

Estimate the advantages and disadvantages of both suggestion to choose the best one.

Table 1 The data of water level of river from 1969 to 1997

	Year	Maximum in 1 day	Average of maximum in 5 day
1	1969	704.39	669.17
2	1970	626.32	595.00
3	1971	820.18	779.17
4	1972	618.42	587.50
5	1973	699.12	664.17
6	1974	514.04	488.33
7	1975	656.14	612.30
8	1976	499.12	474.17
9	1977	613.16	582.50
10	1978	794.74	755.00
11	1979	676.32	632.50
12	1980	639.47	607.50
13	1981	521.93	495.83
14	1982	676.32	642.50
15	1983	681.58	647.50
16	1984	651.75	617.17
17	1985	742.98	705.83
18	1986	793.86	754.17
19	1987	506.14	480.83
20	1988	613.16	578.50
21	1989	567.54	539.17
22	1990	706.14	670.83
23	1991	579.82	550.83
24	1992	742.11	705.00
25	1993	480.70	456.67
26	1994	644.74	612.50
27	1995	708.77	663.33
28	1996	656.14	623.33
29	1997	624.56	593.33

(3) To compute hydrological elements

In order, collect daily rainfall, then use these numbers to compute hydrological elements.

According the **Table 1** get a computable method following steps.

+ Pick sample

+Draw line of frequency (**Fig.1**), **(Fig.2**) by using momentum method or 3 points method.

After drawing line of frequency, compute the water level of river following daily rain.

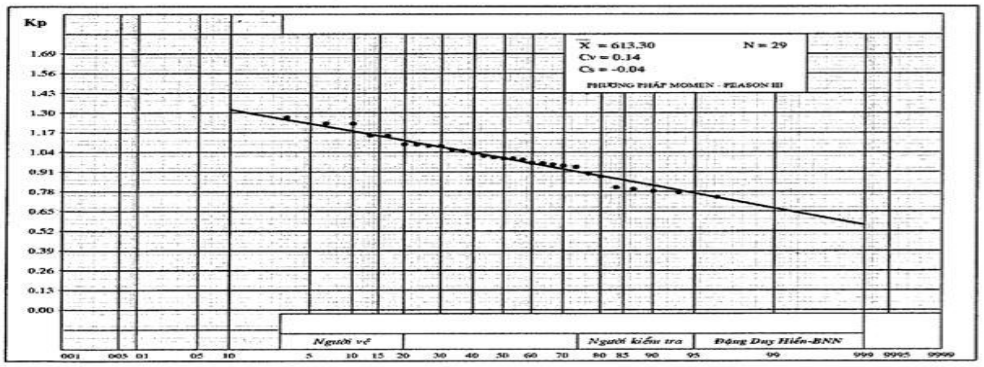

Fig.1 Frequency line of water level of maximum in 5 days result

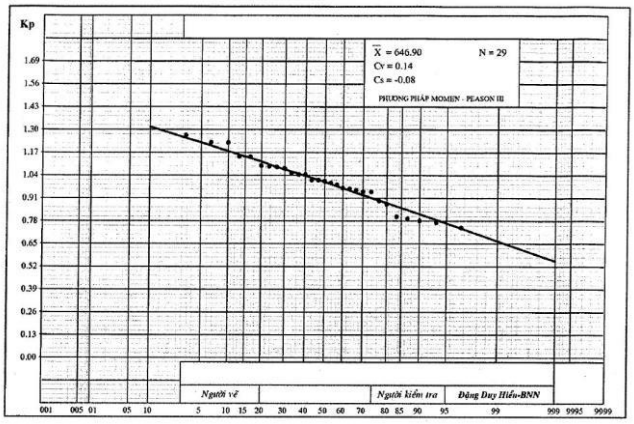

Fig.2 Frequency line of water level of maximum in 1 day result

(4) Possible discharge of pumping station

$$Q_{tk} = q_{tk} \cdot A \quad (1)$$

Q_{tk} : design discharge (m^3/s)

q_{tk} : design drainage coefficient ($l/s.ha^{-1}$)

A : area of cultivation (ha)

$$Q_{\min} = \frac{Q_{tk}}{3} \quad (2)$$

$Q_{\min}$: minimum discharge (m^3/s)

$$Q_{\max} = k \cdot Q_{tk} \quad (3)$$

$Q_{\max}$: maximum discharge (m^3/s)

k: dependent Q_{tk} coefficient

5. REDESIGN TO FIX CHANNELS OF

(1) Redesign approach and drainage channels

a) Approach channel

To redesign approach channel by finding the channel width, design water level of channel, the height of channel bottom and channel bank and channel bank width, compute the equation depending on basic parameter of channel such as bottom slope, roughness coefficient, design discharge. After that, have to check how much safety of channel.

b) Drainage channel

Similarly to approach channel, I can find the parameters of drainage channel.

(2) Compute water levels of absorb tank and drainage tank

a) Water level of absorb tank

Water level of absorb tank is computed by equations.

$$Z_{bh}^{tk} = A_0 + h_0 - \sum i \cdot l - \sum \psi_i \quad (4)$$

$$Z_{bh}^{\min} = A_0' + h_0 - \sum i \cdot l - \sum \psi_i \quad (5)$$

Z_{bh}^{tk} : design water level of absorb tank

$Z_{bh}^{\min}$: minimum water level of absorb tank

A_0: high of field water (m)

h_0: maximum layer of water in (m)

$\sum i \cdot l$: total of lost water from field to absorb tank (m)

$\sum \psi_i$: total of lost water in structure of channel (m)

$Z_{bh}^{\max}$ is when there is hard rain and need to drain fast.

b) Water level of drainage tank

$$Z_{bt}^{tk} = Z_s^{10\%} - \sum h \quad (6)$$

$$Z_{bt}^{\max} = Z_{s1day\max}^{5\%} - \sum h \quad (7)$$

$$Z_{bt}^{\min} = Z_{dk}^{kt} + h_{kt}^{\min} \quad (8)$$

Z_{bt}^{tk} : design water level of drainage tank

$Z_{bt}^{\max}$: maximum water level of drainage tank

$Z_{bt}^{\min}$: minimum water level of drainage tank

$Z_s^{10\%}$: 10% frequency water level of river

$Z_{s1day\max}^{5\%}$: 5% frequency maximum water level of river in 1 day.

$\sum h$: lost water when goes through dike.

c) Water level checking

Test water level of station.

$$H_{kt}^{\max} = h_{bt}^{dh\max} + \sum h_t \quad (9)$$

$$h_{kt}^{dh\max} = Z_{bt}^{\max} - Z_{bh}^{\min} \quad (10)$$

$$H_{kt}^{\min} = h_{kt}^{dh\min} + \sum h_t \quad (11)$$

$$h_{kt}^{dh\min} = Z_{bt}^{\min} - Z_{bh}^{\max} \quad (12)$$

If $H_{kt}^{\max}$ is negative number, river's water level is lower than field's water level, so have to open sewer until river's water level is the same as field's water level.

Table 2 Result of water level

Water level (m)		Water level (m)	Discharge (m^3/s)
Absorb tank	Drainage tank		
Z_{bh}^{tk} =3.9	Z_{bt}^{tk} =7.43	H_{tk} =4.38	Q_{tk} =8.7
$Z_{bh}^{\min}$ =3.3	$Z_{bt}^{\min}$ =5.68	$H_{kt}^{\min}$ =4.4	
$Z_{bh}^{\max}$ =6.4	$Z_{bt}^{\max}$ =8.14	$H_{kt}^{\max}$ =6.04	

After computing and checking basic parameters of pumping station, receiving the result (**Table 2**), design the approach and drainage channels and tanks. Otherwise, I designed other structure such as pumping house, staff house, and the play court for staff to become more beautiful than old station.

6. CONCLUSION AND PURPOSE

After rebuilding Thac Qua pumping station, in undating problem is solved, agriculture products increases, and the pumping station gets economy success.

Dong Anh district is one of poor districts which need to be invested to improve citizen life. Because of high rainfall and low area, the agriculture here cannot develop. Therefore building Thac Qua pumping station is good idea should be realized to make economy here positively develop, productivity improve, and citizen life be better.

In purpose, with many advantage which drainage pumping station bring to, I hope this solution will be used generously, special low and small area. Otherwise, I hope investors will increase in investment to poor district like Dong Anh to help citizen and country develop.

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