

MUBAYA WEIR CONSTRUCTION REPORT



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1.0 Introduction

Mubaya Weir dam is a combination of both mass gravity and earth fill embankment. The mass gravity dam type of masonry wall was constructed across Chipiti River as the main dam. This type of dam rely on the mass of the structure to provide stability against sliding and overturning. Earth fill embankment was used as a saddle dam to raise ground elevation. According to the land survey, the dam can hold an approximation of 75 000m³ at full supply level. However, there is need for a proper hydrographic survey to account for areas deepened by the excavator.

1.1 General information

1.1.1 Purpose of dam

Mubaya Weir Dam is to supply 13 village with water for cattle watering and domestic needs. Water may ultimately be drawn to supply community gardens.

1.1.2 Weir details

| | |
|-----------------------|-------|
| Masonry Wall length | 61m |
| Earth Fill Embankment | 18m |
| Maximum Depth | 3.20m |
| Spill Way Crest Width | 1m |

1.1.3 Water permits

Refer to the permit application to the Manyame Catchment. Need to service water permit with Middle Manyame sub-catchment council.

1.1.4 Hydrology

The Weir is supplied by the Chipiti River. The area receives a minimum annual rainfall (MAP) of 802mm and potential annual evaporation 1781 mm per annum. Estimated river flow data for the Weir site is shown on the table below. It can be used to gain a “feel” of the inflows expected into the dam.

| | |
|-------------------|-------------------|
| Hydrological Zone | CH3 |
| Catchment Area | 9 km ² |
| M. A. Rainfall | 115mm |
| C.V. | 85% |

1.1.5 Climate

The area receives a minimum annual rainfall (MAP) of 802mm and potential annual evaporation 1781 mm per annum.

1.1.6 Geology

The geology of the area is comprised of older gneisses, Great Dyke serpentine and pyroxinites and minor Shamvaian metasediments and Bulawayan greenstones.

1.1.7 Hydrogeology

The area is underlain by various lithologies with the predominant lithologies being Great Dyke rocks and gneisses. The groundwater occurrence within the lithologies is controlled by the development of secondary structures such as fractures, faults and weathering and shearing within the greenstones and Great Dyke rocks.

1.2 stakeholders Consultations

Before the construction of Mubaya Weir, all stakeholders involved and the locals represented by their village heads were engaged to hear their concerns on the project. The feedback was positive and village heads mobilised households to participate in the gathering and transportation of river sand and stones.



Plate 1: Stakeholder's meeting held at the Weir Dam site

2.0 Construction

There follows a resume of the Weir's construction features:

2.1 Masonry Wall

Masonry weir wall was constructed over the impervious floor. Cut-off walls are provided at both ends of the floor. Water spills at the centre of masonry weir vertical on downstream face. One knowledgeable builder was hired by the Mubaya Eco-village and was assisted by community volunteers.

A foundation of 4000 mm wide was dug to reach an impervious rock. Foundations was cleaned of all loose material. A wider base width of 4m was put to ensure a water tight seal along the foundation. On the joint between Masonry and Earth Fill embankment, a key trench was excavated in the foundation material.



Plate 2: Villagers digging the weir foundation.



2.3 Materials

Mass gravity dam make as much use as possible of locally available materials. This often means constructing of local stone and mortar. A mortar grade of 1:3 was used for construction (cement and river sand).



Plate 4: Weir Dam construction in progress

1. Cut off trench excavated to firm sub soil. No hard excavation.
2. Core material from upstream areas
3. Fill material primarily from the dam basin



Plate 5: Middle Manyame Sub-catchment personnel taking levels

Outlet Works

The weir does not have outlet works, water spills at the top centre of the wall.



3.0 Operation of the weir

This reservoir will be under the control of Mubaya Ecovillage. The Mubaya ecovillage water use committee will be directly responsible for the operation of the dam and checking on the general conditions. The draw down rate of the reservoir is governed by abstraction or pumping rate.

3.1 Monitoring and inspection

All aspects of the Weir must be checked regularly and any deviation from the norm must be monitored continuously and written observation of date, time and occurrence entered into the Weir Record Book for the information of the Engineer.

Report such changes to the Water Resources Engineer as soon as possible.

Check the following regularly and record having done so:

- i. Seepage, particularly new or increased discharges. Seepage containing silt must be reported immediately as it could be a sign of major failure.
- ii. Cracks at the crest or slopes.
- iii. Erosion of the crest or slopes.
- iv. Ant hills and bush growth on the embankments.

3.2 Left Bank Seepage and Minor Leaks

On 15 December 2021, water seeping from the masonry foundation was noticed on the left bank of the wall facing downstream. The amount of water leaking is insignificant though there is need to do plastering of the upstream face wall. This is still work in progress and the remaining 25 bags of cement are enough to complete the job. The plastering mortar should be mixed with impermo with a total of 37 kilograms needed for the exercise. Another option is to provide sufficient length of impervious flow to reduce exit gradient on the downstream side.

4.0 Bill of quantities for a weir construction at Mubaya Eco-Village, Zvimba.

| ITEM | DESCRIPTION | Contractual Bill of Quantity | | | |
|------|-----------------------------|------------------------------|-----|----------|------------------|
| | | UNIT | QTY | RATE, \$ | Amount, USD \$ |
| A | MATERIALS | | | | |
| A1 | Cement | 50kg bags | 940 | 9.00 | 8 460.00 |
| A2 | River sand | m ³ | 95 | 5 | Community |
| A3 | Pit sand | m ³ | 40 | 5 | Community |
| A4 | Stones (40mm-100 mm) | m ³ | 260 | 5 | Community |
| | Sub-total | | | | 8 460.00 |
| B | LABOUR | | | | |
| B1 | Supervision (Fuels) | | | | 921.00 |
| B2 | Builder | Man-Days | 60 | 10 | Community |
| B3 | Casuals | Man-Days | 240 | 6 | Community |
| B4 | Excavations | | | | Community |
| | Sub-total | | | | 921.00 |
| C | TRANSPORT | | | | |
| C1 | Transportation of materials | - | - | - | 750.00 |
| | Sub-Total | | | | 750.00 |
| | TOTAL PROJECT PRICE | | | | 10 131.00 |

5.0 Challenges encountered during the project

- I. Covid 19 pandemic and lock down restrictions.
- II. Inability of the community members to provide consistent supply of man-power.
- III. The builder failed to adhere to the weir design drawings as well as the project engineer's instructions.

5.0 Conclusion

The weir dam was designed in accordance to engineering standards and the construction was done by unqualified builders though under the supervision of Middle Manyame. The weir dam is now complete and has already started to serve the intended purpose.

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