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A mathematical modelling approach towards efficient water distribution systems: a case study of Zomba - Malawi's water distribution network

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Final Correction Report

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Abstract
Corrections, rewordings, spellings
It's Changed to **its,**
Against all odds Removed as suggested
It turned out that Removed, now reads it was found that …
… was determined as the order of one-hundredth of a meter now reads … was determined to be on the order of one centimeter
Related to the second problem Removed as suggested
Exhibit the most gradual change now reads '… exhibit diminished, as opposed to increased, height changes with demand changes'
Chapter 1
More agricultural stuff now reads Agricultural products
Besides being surrounded by … An extension has been added that reads … (whose water can be made available for use with desalination processing), …
P7 how can we map water demand… now reads How can we model water demand …
Eficiency, Effeciency spelling Corrected to 'efficiency'
Section 1.7 Deleted as suggested
Section 1.8 Moved to Chapter 4 as suggested
Section 1.9 Moved to Chapter 2 as suggested
Firstly no mention of influencing factors … this was Removed
Water Board of Zomba City Now reads the Southern Region Water Board
P19 All pages indicating the papers and publications are now removed as suggested. The this is now as one monograph

Chapter 2

This means more water must be produced in the day …
Now text reads .. This means more water must be treated and supplied to households during the day.

Figure 2.1 ….
x-axis changed as suggested

The dam is able to supply up to 3,35million cubic meters …
Now text reads the dam has a carrying capacity of 3, 35 million cubic meters

… to reach their minimum levels at midnight
Now text reads …. production readings are at their lowest level after midnight and before daybreak.

Below it's carrying capacity
now reads Below its carrying capacity

P26 needed a clarification on carrying capacity and demand changes
An explanation was added … It must be emphasized that despite the assumption that the population is at it's carrying capacity, other factors such as well being of the people will still affect the demand. For example, when an individual buys a car, he or she will require extra water to clean it. The same principle applies to someone moving into an independent home. He or she may require extra water than when staying by parents home.

P28 linear relationship
An explanation was added … the observed deviations from the linear pattern are a result of inconveniences in the network such as closures to maintain pipes and pipe bursts, water disconnections and others

P28 80.3m^3/person/year

Now text reads which is below the threshold of 1000m^3 as defined in Nomenclature section, despite being enough for basic consumption only, excluding water needed for extras like food production

Fig 2.2
now caption reads …. Linear relationship between estimated population growth and consumption

P30
An explanation comparing results to World Bank estimates was included. The tank has capacity of up to 2035, but the treatment plant's capacity was still small. It needed to be upgraded, which at the time of doing research, was happening.

P32 and Table 2.2
'validated ….' Was removed as suggested

Approach of defining null hypothesis differs amongst authors. The approach taken in this thesis was based on the cited literature

Equation 2.8
Mathematical modeling differs from statistical modeling. Mathematical modeling assumes continuity of function and hence the Pearson's chi squared test was used.

P33 tolerance
A text was added and now reads In our case, the tolerance was 100 since the meter readings were of the order of 1000,

P34

A text was added which says … 'which was already under construction as of 2002 according to [10] and was completed in 2013'

Chapter 3

Corrections, rewordings, spellings

P38 (3), P40 (1), P43 (2)

- rewritten as suggested

Figure 3.1

Removed as suggested

P47 equation

Now π is included in the brackets. The calculation is now correct, i.e. the last part of the equation now reads

$((0.0018\mathrm{m}^3/\mathrm{s})^2 - (0.06\mathrm{m}^3/\mathrm{s})^2)/(\pi \times 0.05\mathrm{m})^2$

Chapter 4

Corrections, Rewording, spellings

P55, P56, P60, P61 and P62

– done as suggested

P68

Explanations added, now reads '…This is because P^2carries the source hammer effects that get spread to the other two pipes. Essentially the sum of pressures due to hammer effects in pipes $P^1$and P^3 may not exceed those of pipe P^2.'

P68

A footnote explains the developments that have happened since research was done: '… an effort towards installing the electronic system on the network is in place. In April 2016, an advert appeared in local newspapers Daily Times and Nation requesting bids for the supply, installation and commissioning of a SCADA system on the network'

Chapter 5

Corrections, Rewording, spellings

P76 (3), P81 (1)

- done as suggested

P83

now reads '… exhibit diminished, as opposed to increased, height changes with demand changes'

Chapter 6

Corrections, Rewording, Spellings

P84, P85 (removed), P86 (removed), P87 (2), P88, P90

– done as suggested

P84

- summary of other topics included
P88 – now reads '…. exhibit diminished, as opposed to increased, height changes with demand changes'