

**ASSESSMENT AND MAPPING OF GROUNDWATER
QUALITY AND ITS SUITABILITY FOR DRINKING
PURPOSE: A CASE STUDY ON MANALKADU
COASTAL AREA (VADAMARACHCHI EAST
AQUIFER), JAFFNA PENINSULA, SRILANKA.**

Dhayaparan Yasotharan

198501J

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

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Thesis submitted in partial fulfilment of the requirements for the degree Master of
Science

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DECLARATION

“I affirm that this work is entirely my own creation. To the best of my understanding, it does not include any previously published or written material by others, except where proper credit is given. Furthermore, I have not incorporated any content from previous submissions for academic degrees. I retain the right to utilize all or part of this content in my future writing endeavors, including books and articles.”

Signature:

Date:

"As the student's supervisor, I certify that the student as mentioned above performed research for their dissertation or master's thesis. I attest to the integrity and accuracy of the student's statement.”

Name of Supervisor: Prof. Jagath Manatunge

Signature:

Date:

Name of External Supervisor: Mrs.Anoja Niroshan

Signature:

Date:

ABSTRACT

In so many parts of the world, groundwater is an essential resource for domestic water, and Sri Lanka is no exception. This is especially true in rural areas. The Jaffna Peninsula is considerably more reliant on groundwater, mostly from sand dune and limestone aquifers, due to its lack of permanent rivers and infrequent rainfall. The village of Manalkadu, in Vadamarachchi, is the subject of this study. In order to determine if the groundwater in Manalkadu is suitable for drinking, this study intends to thoroughly evaluate and map the physicochemical, microbiological, and possible heavy metal pollution of the groundwater. Analysing important water quality factors, measuring indicator bacteria, making spatial maps, looking for specific heavy metals, computing water quality indices, and making suggestions for long-term care and possible treatments are some of the specific goals.

Seventy-six dug wells from Kudathanai North (Karaiyoor), Kudathanai, and the Vadamarachi East area of Manalkadu were chosen for this investigation. The test findings showed that the presence of organic matter or a small physical contamination in the chosen area is likely indicated by the turbidity (39.5%) and colour (51.3%) compliance. The chemical parameters, EC, TDS (85.5%), total hardness (73.7%), total alkalinity (79%), pH (100%), nitrate (100%), nitrite (100%), chloride (92.1%), fluoride (96.1%), total iron (85.5%), total phosphate (94.7%), and sulphate (94.8%), mostly meet SLS standards, indicating a chemical composition that is generally acceptable. Due to their limited interaction with minerals and organic matter, sand dune aquifers in Manalkadu, Karaiyoor, and Kudathanai have less of an impact on water quality. However, in some areas of Kudathanai, organic deposits and clay/silt exhibit elevated levels of certain parameters, suggesting a possible influence of geological composition on water quality.

Given that *Escherichia coli* and total coliform are found in every well, it is likely that faeces have also contaminated the groundwater. Most likely, the source of this contamination is a nearby septic tank that is either poorly managed or situated too close to the wells. An encouraging conclusion is that there were no measurable quantities of

chemical and bacterial solution in the water samples, suggesting that industrial activity is not a significant source of contamination in the area.

The physical and chemical water quality index revealed that just 18% of home wells were unfit for human consumption. But when microbiological factors are taken into account, all of the wells in the chosen dug wells are deemed unsafe to drink. Although the chemical characteristics of Manalkadu's groundwater were found to be largely acceptable, the widespread presence of faecal coliform necessitated prompt intervention. It is recommended that short-term measures such as heating water for drinking, chlorinating wells, and installing appropriate filtration systems be given priority. But more comprehensive approaches are needed for long-term sustainability. Building recharge ponds for rainwater can enhance the quality of the water. Implementing catchment and source protection measures is essential because it tackles the underlying cause of contamination, protecting potable water supplies and guaranteeing the long-term health of groundwater resources. Prioritising these preventive actions together would help policymakers, communities, and industries address water security and waterborne illnesses in the Manalkadu region. Together, we can ensure the community's essential groundwater resource and a healthy future for both.

Keywords: Groundwater quality, Geological composition, water quality indexing

DEDICATION

I produce this to my parents, my dear wife, my kids, and my family with much fondness, in appreciation of their constant love and support.

My parents, whose continuous love, support, and selflessness have served as the foundation of my academic endeavours. Your confidence in me has helped me through every setback and victory.

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LIST OF ABBREVIATIONS

TDS = Total Dissolved Solids

SLS = Sri Lankan Standard

TH = Total Hardness

WQI = Water Quality Index

MI = Metal Index

USEPA = United States Environmental Protection Agency

MCL = Maximum Contaminant Level

NTU = Nephelometric Turbidity Units

ADWG = Australian Drinking Water Guidelines

EC = Electrical Conductivity

SLSI = Sri Lankan Standard Institution

APHA = American Public Health Association

AAS = Atomic Absorption Spectroscopy

GNSS = Global Navigation Satellite System

IDW = Inverse Distance Weighted