Thailand

Water Quality and Sanitation

By Michael Sutherland

Methodology

Research for this project consisted of mainly online sources, starting with the use of library databases. After library databases failed to produce significant results, Google scholar yielded a large portion of the cited sources. The main goal of the research was to obtain a greater knowledge of disparities or benefits of Thailand's approach to their water supply issues. Is the model for solving the issue was effective and what innovations are being made to address the pending crisis? Much government research from Thailand was used including Thai case studies. This research method presented a minor obstacle because translated sources had to be located. Most of these sources were transfers from a different format to make them readable internationally. Despite this minor issue, the research goal was accomplished. One question was never answered, which may answer why Thailand has water issues, what is the treatment system in Thailand? Despite weeks of searching for the answer to that one question, no appropriate research was obtained.

Most of the information within this paper is compiled from multiple sources and cannot be credited to a single source. Information that is creditable to a single source has been cited as such. Figures used in this paper are not the property of the author.

Introduction

The Kingdom of Thailand is known for its beautiful landscapes, bustling cities and great history. Lesser known is the fact that Thailand has the least amount of usable water per person in Southeast Asia. Because Thailand is a nation surrounded by water with long wet seasons, this may come as a surprise. Once one ventures from the nation's beauty and its past, one can see that its growth and journey into the modern world has created a problem with the water supply that is fast approaching. The nation is facing a water crisis in nearly a decade and has made great strides towards avoiding this crisis and has been both a proving ground for experimentations in water quality control along with a base for innovations in sustainable water treatment.

Thailand- Geography and Demographics

Thailand is a nation of 68 million people living on a 515,115 square kilometer land mass in Southeast Asia. Fifty million Thai people live in rural areas leaving the remaining 18 million within the urban centers such as Bangkok and Chiang Mai. This distribution of the population leaves the urban centers extremely crowded which leads to higher percentages of pollution and lower water quality. Despite the two-fold divide in population, Thailand is defined by six geographic regions: North, South, Central Plains, East, West and the Northeast. These six regions are then further divided in to 25 river basins which make up Thailand's water ways and serve as a source of life and contribute greatly to the way of life. These river basins and rivers are central to the way of life in Thailand. Most community and urban centers use them as a focal point for their development. Much as in the way water determines the development of Thai communities rainfall determines the seasons, which are divided between wet and dry like most other tropical and subtropical nations. The wet season, which can vary depending on the region, can last up to eight months out of the year and can yield nearly 799, 990 million cubic meters of rainfall annually (see figure for regional breakdown). The long rainy season is followed by four straight dry months.

Region	Catchment area (km²)	Average annual rainfall (mm/year)	Amount of rainfall (million m³)	Amount of runoff (million m³)
Northern	169 640	1 280	217 140	65 140
Central	30 130	1 270	38 270	7 650
North-eastern	168 840	1 460	246 500	36 680
Eastern	34 280	2 140	73 360	22 000
Western	39 840	1 520	60 560	18 170
Southern	70 140	2 340	164 130	49 240
Total	**512 870**	-	**799 960**	**198 880**

Table 1 Regional rainfall from The Water Project

Water-Crisis

In Thailand one could create a correlation, if not causation, between population density and high levels of pollutants in water. This however could be due to city centers being built further downstream causing for a greater build-up in pollutants as the river runs its course or bad sanitation practices due to large populations. Nationally, a major cause of pollution and degradation of water quality can be pin pointed: Expansion. Since the nation has begun to expand water quality has had an inverse relationship as it plummeted. The main causes for the pollution in Thailand's waterways are byproducts from construction, hazardous waste, general wastewater and agricultural waste and runoff. Because these pollutants are mainly sourced from urban centers and rural areas, which are built around or on the rivers, the coastal waters have remained nearly unaffected by pollution and are the only areas with water quality considered to be good by international standards. Despite this fact, forty percent of water is considered unsuitable for human consumption indefinitely. None of Thailand's water is considered to be suitable for consumption after regular treatment, which consists of boiling or basic filtration.

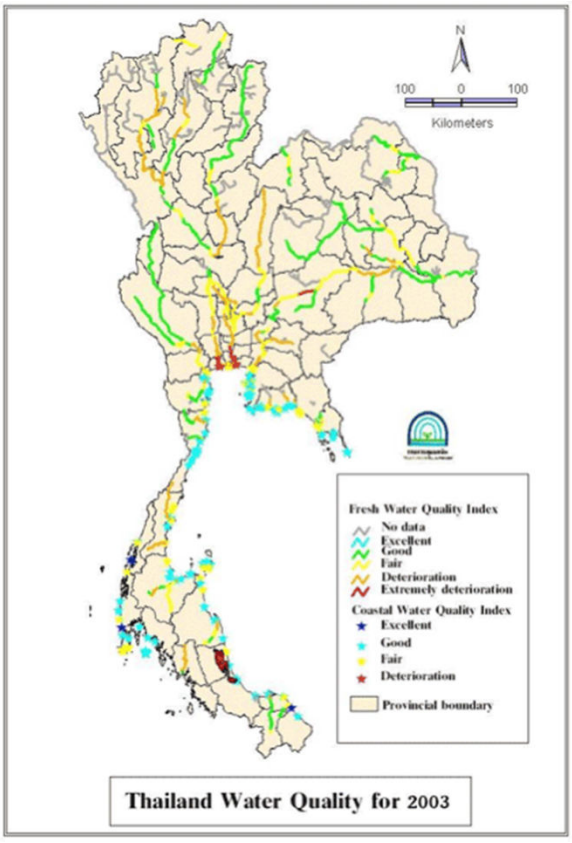


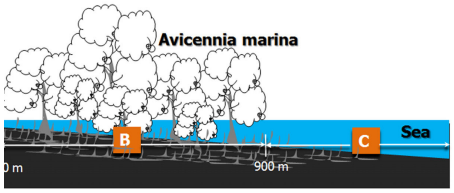
Figure 1 from WEPA

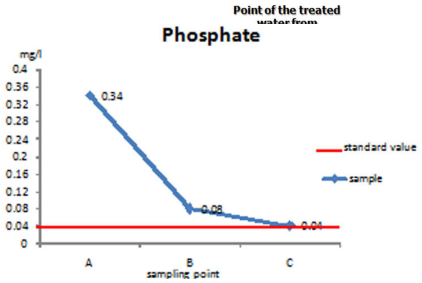
The water crisis in Thailand does not only come from pollution. According to world organizations, including the World Health Organization (WHO) and the United Nations, the water supply in Thailand is considered to be in danger; the use of groundwater is considered to be unsustainable and is even considered an exploited resource. The amount of available water per capita/year is 3,300 cubic meters, this comes out to roughly 230, 000 million cubic meters of water available per year, with a growing demand for water which greatly exceeds the supply. Despite the water shortages and overuse, which is estimated to run Thailand nearly dry by the year 2025, the agricultural sector uses seventy percent of the nation's water leaving only 30 percent to the people and other ventures. This usage disparity is contributing the majority of the nation's water supply to one of the biggest culprits of pollution for the water supply, thus the majority user of the nation's is polluting its own water sources indirectly.

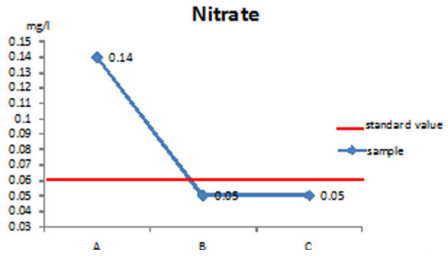
Thailand's water crisis does not end at misuse and overuse; the efforts to treat the water supply in Thailand have been nearly futile. The capital city alone produces 200 million cubic meters of wastewater per day and the city of Bangkok is only able to treat twenty percent of the wastewater. Along with this deficit in water treatment come issues with water distribution. To create a point of perspective, Thailand is able to provide even some of the most remote areas of the nation with electricity, but water distribution does not come as easily in a nation with shortages such as Thailand's. The major government provider of water is The Provincial Waterworks Authority (PWA). Tasked with providing water to the majority of the nation, the PWA spends nearly 176.7 million United States dollars solely on supplying water to the Bangkok area. After government grants and other investments PWA loses roughly 75.7 million US dollars providing the area with water. Due to this inadequate distribution, Thailand has been labeled by the United Nations as having inefficient water supply schemes. Most developed nations having the capacity to provide water to their inhabitants without suffering any monetary losses consider this label for Thailand to be appropriate.

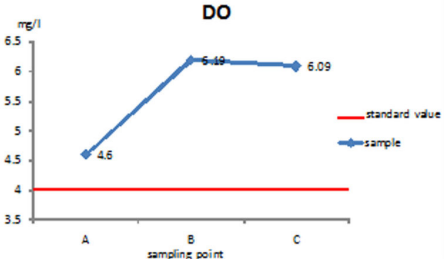
Laem Phak Bia- A Case Study

As a case study of sustainable methods of water treatment The King's Royally Initiated Laem Phak Bia Environmental Research and Development Project, known as the Royal LERD, is quite amazing. The Royal LERD is a mangrove forest that was originally created along the coast of Thailand as a reserve effort for protection of Avicennia Marina (mangrove trees). This dense forest is situated in the mouth of a major river that flows in to the Gulf of Thailand. In the early twenty-first century the Royal LERD became the site of sustainable water sanitation testing due to the area receiving large amounts of waste water but still surviving.

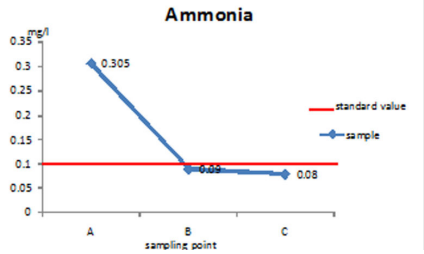








The main focus of the Royal LERD project was on the water quality of the river as it traveled through the dense mangrove forest. The quality of water was tested in three locations along the river: prior to the forest (A), in the forest (B), exit of the forest in to the Gulf (C). The water quality was measured using six criteria: water temperature, pH levels, dissolved oxygen, phosphorous, nitrate, and ammonia. Phosphate, Nitrate and Ammonia levels were well below national standards for water quality prior to entry in to the forest while the other three criteria were right on the edge. During testing water quality was found to improve as it passed through the mangrove forest into the Gulf, the best being in location (B) but still being improved once it reached the sea (Jitthaisong).



The study of the Royal LERD was conclusive in its findings that Mangrove forests increase water quality according to the six tested criteria. Because of this study mangroves are accepted as a supplementary and sustainable form of water sanitation. The benefit of using the mangrove forest as an accessory source of waste water treatment is that these forests are a natural, cost effective source of treatment that would help to improve the current system by improving treatment efficiency.

Thachin River Basin

The Thachin River Basin is the largest basin in Thailand, serving the majority of Thailand's central region as well as the city of Bangkok. The Thachin River Basin was the site of a major fish kill due to extremely poor water quality. This crisis, due to the river's importance to the region, led to a national initiative to improve the water quality within the waterway. The program consisted of using Integrated Management within the communities by involving them in controlling the river's water quality. This was considered an experiment in Integrated Management of watersheds due to the diversity of land utilization of the river; the northern portion consists of farmland while the southern portion consists of industrial zones. The major health issues presented by the Thachin River included washouts during the wet season,

agricultural pollutants from livestock and fields, sewage tributaries and a Dissolved Oxygen level that was below the national standard.

The plan was to use Integrated Water Resource Management within the communities to decrease their respective contributions to water way pollutants. This was done through education and public participation in remediation of the water quality issue, furthering research of the issue, installing water gates and catchments to control release of discharges in to the river and continued monitoring of the situation. The model was set to be studied and in place by 2010 but sufficient data was collected by 2007, four years in to the project, to deem the Integrated Management model to be an effective form of water quality control, due to improvements in water quality, that could be implemented in the future (Simachaya).

While water quality was shown to improve in the region, the Integrated Water Resource Management study did show that the majority of improvements were made in the upstream agricultural region. Consequently, water quality still dropped as it ran down stream towards the industrial zones. However, the fact that the communities could be utilized to improve the quality of this precious resource proved invaluable to improving the situation in Thailand.

Conclusion

Thailand's water supply, while still in danger, has received boosts in its longevity due to community initiatives, use of natural resources and innovations in water quality management. If Thailand is able to continue to expand its resources for water management as well as utilizing tools such as Integrated Water Resource Management on a nationwide scale, it is possible that the crisis can be averted by increasing the water supply. This opportunity puts Thailand in a position to be a forerunner in creating a sustainable infrastructure for the precious resource that is water. As more and more nations approach the realization that they too could be nearing a water shortage they can look to countries such as Thailand who have placed such an initiative on restoring a resource that is too close to being completely destroyed.

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