

EFFECTIVENESS OF GROUNDWATER EXPLOITATION AND USAGE MANAGEMENT POLICIES IN O MON DISTRICT

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ABSTRACT

This research was carried out to assess effectiveness of enforcement procedures for groundwater management policies in O Mon district of Can Tho city. The specific research objective were: (i) assessment of groundwater level declining from 2000 to 2013; (ii) assessment effectiveness of groundwater policy and (iii) to propose solutions to improved effective groundwater management in the research area. Methods were used: (i) collection and classification of legal groundwater resources documents (valid); (ii) basic statistical data analysis to assess groundwater level declining; (iii) field trip observation and interview both households and businesses were used groundwater about current groundwater management policy; and (iv) Consultation both experts and local authorities were proposed solutions to improved efficiency of groundwater management. The research results showed that, from 2001 to 2010, groundwater level has been declining rapidly in upper-Pleistocen and lower-Pleistocen, in which, lower-Pleistocen was the highest declining with average speed (-0,39 m/year). From 2010 to 2013, groundwater level trends stabilize. The groundwater management policy for groundwater exploited license and adjourn groundwater exploited license were shown integrity and unity. However, effective enforcement is not high appreciation due to lack of human resource management without water resources management major. Local staffs manage not only groundwater resources but also mineral resources, hydrometeorology, climate change. Due to expert's opinion, department of environment and Natural resources need high quality staffs with major in Water Resources Engineering, Hydrogeology. Besides, exploited violations have been popularized, especially, lack of exploited groundwater license. Penance violations were showed both integrity and concretize due to Viet Nam water resources law. According to expert's opinion, Punishment is enough for dissuasive groundwater over-exploitation. However, we should enhance education and popular Viet Nam water resources law in communities combined with regular inspection of enforced law so that ensuring groundwater resources management is more effective.

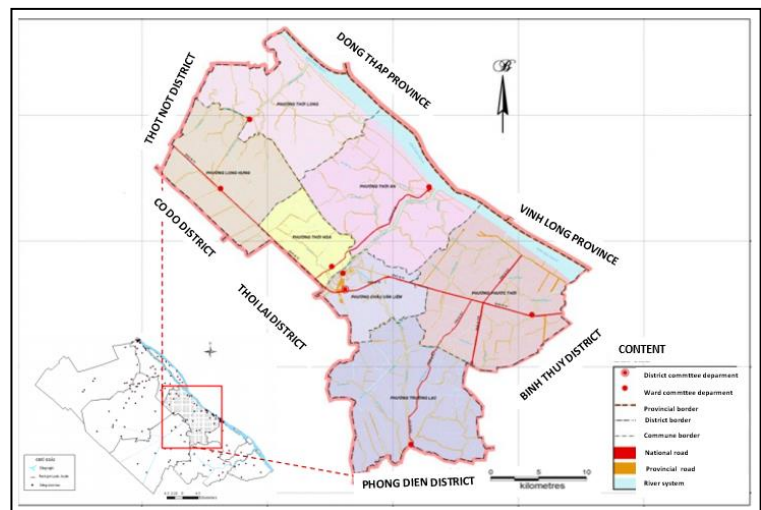
Keywords: groundwater, management policy, effectiveness, O Mon District.

1. INTRODUCTION

Together with rapid urbanization, industrialization process, Can Tho city has been facing with a lot of environmental issues. Especially, groundwater level drawdown. In the

context of climate change, domestic surface water pollution and saline intrusion have been occurred increasingly complex led to groundwater exploitation both domestic activities and industrial production purpose in Vietnamese Mekong Delta.

Figure 1: Study area



Using groundwater is more favorable than using surface water. Further more, it is cheaper than using pure water from water supply factory. So, local residents and businesses has been chosen to use groundwater than others. Groundwater in Can Tho city has mainly exploited in shallow and average depth located in Pliocene and Pleistocene aquifers, not in Holocene and Miocene aquifers. In particular, Pleistocene aquifer accounting for 61.54% of total licensed wells. Groundwater exploitation has been mainly exploited to serve domestic water supply that total exploitation volume is 62,708 m³/day (accounting for 79.3%). For groundwater exploitation license and renewal, there are 312 groundwater exploitation licenses with total exploitation volume 79,068 m³/day. In particular, O Mon district has exploited 16,866 m³/day (accounting for 21.5% total groundwater exploitation volume in Can Tho city). Most of groundwater exploitation areas are concentrated in the city's industrial zones (According to general statistics from Can Tho Department of Natural resources and Environment). So, this leads to decline groundwater level in Can Tho city, especially, industrial zone. Currently, the application of Vietnam water resources law as well as the policies of local authorities in management have been still facing many difficulties and shortcomings. Before this situation, the study "Effective management of groundwater exploitation and use in O Mon District - Can Tho City" is going to kick off with following specific objectives: (i) evaluating groundwater level trend (ii) determine effective groundwater management in O Mon District – Can Tho city.

2. MATERIALS AND METHODS

2.1. Data collection

Secondary data: collecting data on groundwater level in 2001 - 2013 period from Can Tho Monitoring Centre of Natural Resources and Environment, Can Tho Department of Water Resources - Minerals - Hydrometeorology. Since 2000, Can Tho Department of

Natural Resources and has designed and run groundwater level monitoring network system in whole city. Currently, Can Tho city has 16 groundwater level monitoring stations, of which there is one of the important national monitoring well (QT16) located in Tra Noc 2 Industrial zone. At each cluster station, it divided into three groundwater level monitoring wells: (i) in upper Pleistocene aquifer; (ii) in lower Pleistocene aquifer; (iii) in Holocene aquifer. Collect law, decision that have been applied in the study area.

Primary data: interviews from experts from Can Tho water resource management, Can Tho Department of Natural Resources and Environment, businesses companies from Tra Noc industrial zone, local households.

2.2. Data analysis

Using mathematical functions (Average, Max, Min) to calculated the groundwater level changes in 2001-2013 period; represent calculated data as graphs and tables.

To assess the integrity and consistency of groundwater exploitation licensed, sanctioned delinquent behavior due to Vietnam water resources law, research was conducted: (i) comparison general policies with the general law guidelines; (ii) comparison policies with reality requests; (iii) comparison separated policies with policies management system.

To evaluate performance of licensed activities, license renewal and sanctions delinquent behavior about groundwater resources field, research conducted: (i) assess the impact of effective influence working licensed use and exploitation and sanctioned activities; (ii) assess the effects (positive and negative) of these impacts.

3. RESULTS AND DISCUSSION

3.1. Assessment of groundwater level trend in O Mon district, Can Tho city

The results showed that groundwater level in upper-Pleistocene and lower-Pleistocene have been declining over time (Fig 2).

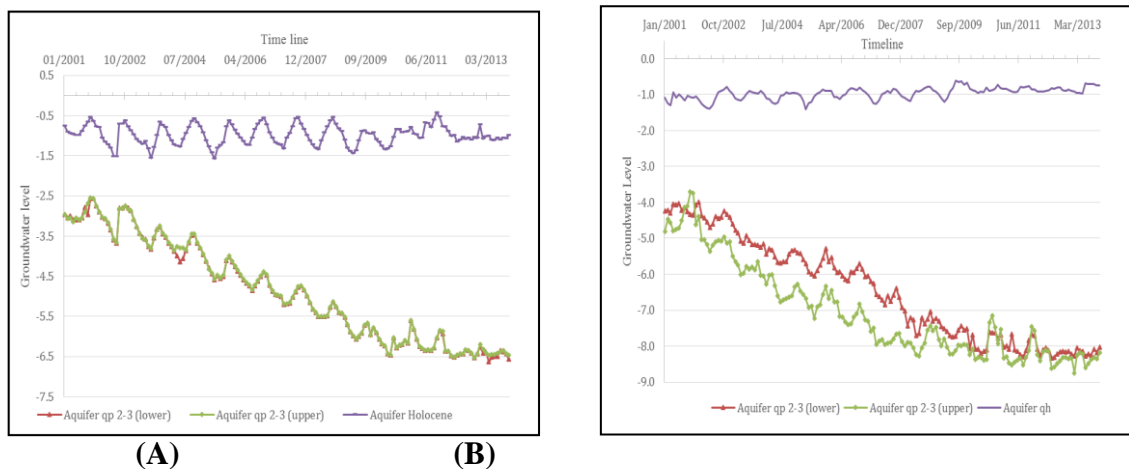


Figure 2. Groundwater level trend at QT16 (A) and QT8 (B) monitoring station in 2001-2013 period

Figure 2 showed groundwater level in study area from 2001 to 2013 in upper-Pleistocene, Holocene and lower-Pleistocene. In 2001-2010, groundwater level both upper-Pleistocene and lower-Pleistocene have been declining rapidly. In particular, groundwater level in lower-Pleistocene is the highest declining with an average speed 0.39 m/ year and upper-Pleistocene is 0.32 m/year.

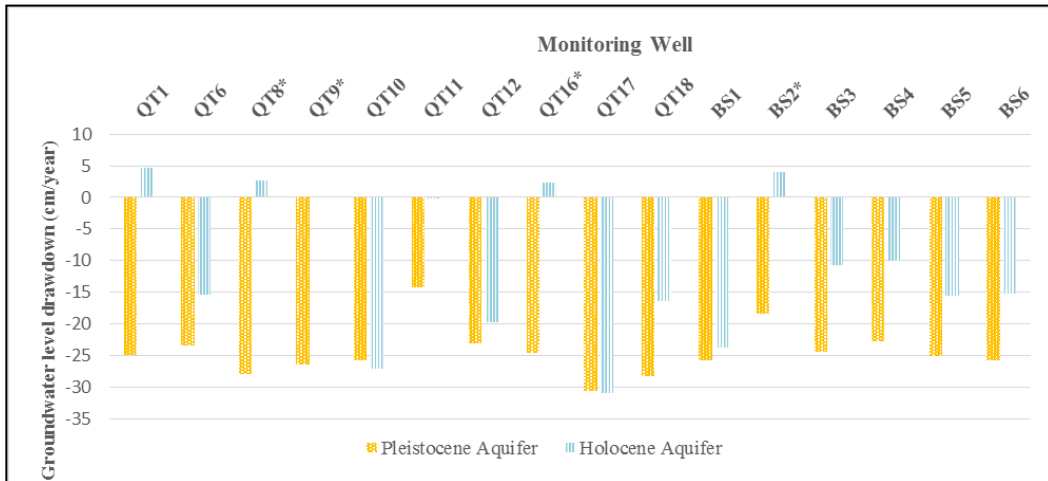


Figure 3. Groundwater level drawdown in all monitoring wells in Can Tho city during 2001-2013 period. Note: (*) Monitoring wells in study area

Another research by Huynh Van Men “Assessment of groundwater level and quality in O Mon and Binh Thuy districts, Can Tho city” also showed that groundwater level in Pleistocene aquifer has been declining highly. This cause Tra Noc Industrial zone has many a large of exploitation wells with high capacity from 50-80 m³/ hour, So, it has affected the natural groundwater level dynamic. According as the experts’ opinion from the Can Tho Department of Natural Resources and Environment, Holocene aquifer receives to recharge from local rainfall sources and Bassac river into groundwater, so groundwater in this aquifer has been less changed for cyclical season.

3.2. Policy management exploitation and use of groundwater resources

To assess effectiveness of groundwater management policy, this research was assess the integrity, consistency and enforcement procedures of policies affect to 02 objects: (i) licensed mission, license renewal of groundwater resources exploitation; (ii) The sanctioning exploitation and using groundwater.

3.2.1 Licensed mission, license renewal of groundwater resources exploitation

The integrity and consistency of licensed mission, license renewal of groundwater resources exploitation.

Groundwater exploitation licensed requirements in study area were depended on exploited purposes. For exploitation to serve small scale resident activities; small scale business production and religious, cultural activities. User do not need a permit for groundwater license except two cases (i) Exploitation volume exceed 10 m³/ day (serve for cultivation, breeding, water supply for Fall-Winter rice crop) and (ii) limited exploitation

areas according as Can Tho general planning sustainable development in groundwater resources.

Authority to permit groundwater exploitation license in study area was divided into exploitation scales. For constructions with exploitation volume exceed $10 \text{ m}^3/\text{day}$ to less than $3,000 \text{ m}^3/\text{day}$ will control under Can Tho Department of Natural Resources and Environment, Can Tho City People's Committee is primary approval authority. These constructions with exploitation volume greater $3,000 \text{ m}^3/\text{day}$ will be manage under Vietnam Ministry of Natural Resources and Environment. Based on the issuance of groundwater exploitation license, O Mon was permitted 48 water supply stations and 6 business enterprises, including four enterprises in Tra Noc 2 Industrial Zone. According to the field trip survey, all of enterprises were permitted groundwater license prior to drilling wells.

For extension of groundwater license, article 21 in Decree 201/2013 /ND-CP (decision by Vietnam government) stipulate that term of groundwater license, use is one decade in maximum, at least three years and has been considered for extension several times, each extension time at least 2 years and maximum 5 years. According direction 1369 / VBUB of the chairman People's Committee of Can Tho city "Exploitation and use groundwater resource in Can Tho city". According as direction only permit or extend groundwater in areas that they do not have pure water supply system across on its. These places where water supply systems across. Enterprises must be oblige to use water sources for business by factory supply. In permitted case, only has allowed to exploit to end of 2015. In this case, for extension of groundwater license at least two years with exploitation volume reducing 50% comparison the first license permission due to the 2728 / UBND - KT of the Can Tho people's committee on "Extension groundwater license in Can Tho city".

In brief, groundwater resources policy management about issuance of license and extension license groundwater exploitation have shown integrity and unity in study area.

3.2.2. The enforcement procedures of licensed mission, license renewal of groundwater resources exploitation

The result showed that observance inspection has been done by Can Tho Department of Natural Resources and Environment in almost case. In others case including small scale enterprise with exploitation volume maximum $10 \text{ m}^3/\text{day}$, observance inspection has been done by O Mon Department of Natural Resources and Environment (1 time/ year). To assess observance of permit and renewal groundwater license in study area, research assessed impact of human resources to control observance of permit and renewal groundwater license under Vietnam law (Fig 4).

The study results showed that have been facing to lack of human resources with high quality in groundwater resources management system. In addition to management of water resources sector, staff has arranged variety of tasks such as mineral resources management, hydrometeorology and climate change. Besides, staffs majority have not been working on their specialized (Table 1)

Figure 4. *Impact of human resource management policies to manage groundwater resources*

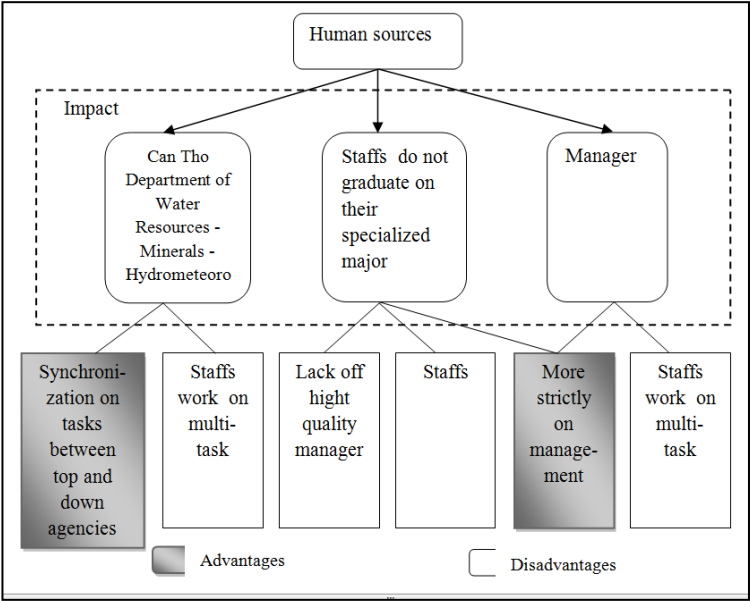


Table 1. *Human resources management on groundwater resources in Can Tho city*

Province	Count of interview paper	Count of staffs	Specialized capacity		Field
			Post graduated	Graduated	
Can Tho	02	04	02	02	Master of environment science
					Engineer of Soil science
					Engineer of Irrigation

Manager majority have specialized on environmental management not in water resources management. In experts' opinion from every provincial in Department of Natural Resources and Environment can be seen that every department need to add staffs, especially in water resource management major. In particular, Can Tho Department of Natural Resources and Environment should propose additional specialized staffs on water resources technology and geology hydrology.

In brief, effectively enforcement of permit and renewal license on groundwater resource exploitation is not highly acclaim in study area. Human resources management is still lack of high quality. Staffs have still been undertaken on multi-task.

3.3. Assessment of law sanction in exploitation and using groundwater

3.3.1. The integrity and consistency authority sanction

Constitution of 2013 on environmental protection: Constitutional provisions State environmental protection policy; management, effective use, sustainability of natural resources; nature conservation, biodiversity; proactive prevention of natural disasters, responding to climate change. The State encourages all activities of environmental protection, development and use of new energy, renewable energy. Organizations and individuals causing environmental pollution, depletion of natural resources and biodiversity decline should be dealt with severely and responsible overcome, compensate for damage (Article 63).

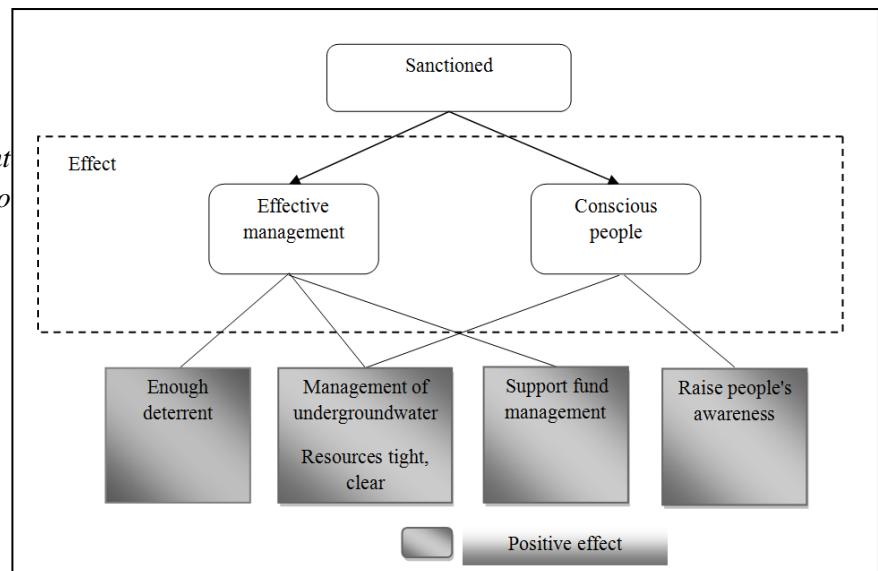
Decree 201 / ND-CP / 2013 was issued that specified threshold exploitation and use of groundwater for production activities, trading, small-scale services. Accordingly, the extraction flow exceeds 10 m³ / day need a license. The managers based on which to manage the flow of groundwater exploitation of people. However, in the opinion of management experts, the cases of violation of the exploitation of groundwater does not ask for permission to use a common occurrence. The violations were for cases that do not know the traffic utilization has exceeded the permitted level, need to register the license.

In Article 6, Decree 142 / ND-CP / 2013 of the Government has specified the level of administrative sanctions in the field of water resources capacity. Accordingly, caution or a fine of 100,000 VND to 500,000 VND for acts of exploitation of underground water belongs to register cases without registration as prescribed.

Thus, the policy management of groundwater resources on the work of sanctions has shown integrity and concretize the rules sanctioned by the law.

3.3.2. Enforcement of sanctions work due to water resources law

Figure 5. Impact of groundwater management policies resources work to handle violations



Working handle violations more effectively achieve positive; especially improve the efficiency of management of groundwater resources as well as people's awareness on the use of savings and protection of groundwater resources. According to the experts, the form has enough teeth to sanction threat, the case had violated the law on use of groundwater exploitation after full implementation of remedial measures in accordance with the competent bodies the right to request for a license to remain to be resolved. However, the need to strengthen the education and propaganda, to synthesize inspectors checked regularly to ensure the management of groundwater resources more effective.

4. CONCLUSIONS

The research results showed that, from 2001 to 2010, groundwater level has been declining rapidly in upper-Pleistocen and lower-Pleistocen, in which, lower-Pleistocen was

the highest declining with average speed (-0,39 m/ year). From 2010 to 2013, groundwater level trends stabilize.

The groundwater management policy for groundwater exploited license and adjourn groundwater exploited license were shown integrity and unity. However, effective enforcement is not high appreciation due to lack of human resource management without water resources management major.

The exploited violations have been popularized, especially, lack of exploited groundwater license. Penance violations were showed both integrity and concretize due to Viet Nam water resources law. According to experts opinion, Punishment is enough for dissuasive groundwater over-exploitation. However, we should enhance education and popular Viet Nam water resources law in communities combined with regular inspection of enforced law so that ensuring groundwater resources management is more effective.

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