

# Overall Management of Underground Water Resource in Hanoi Area for Satisfying Water-consumed Demand of the City

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**ABSTRACT:** Hanoi city locates in the centered position of the Hong River Delta to have the large Hong and Duong River streaming throughout. The Hong River that is the second largest river in Vietnam starts from China to continuous in Vietnam land at Laocai province and to reach the East Sea. Water resource underneath ground level of Hanoi city is very plentiful. In accordance with the assessment results on water reserves approved by the National Committee for Assessment of Water Reserves, total exploited water volume for whole Hanoi region is 837,600m<sup>3</sup>/ngd. Underground water potentiality in Hanoi area is very huge, but detected water reserves are still not much as expectation.

In the pass years, water resource management in Hanoi has been sufficient and has not been paid adequate attention. State management of water resource is dispersed and overlapped at many management agencies. There has been no distinct definition between state administration and business management for water resource. The water resource exploitation without plan at some region of the city has become seriously worse, causing deterioration and depletion of water source both in quantity and quality, lowering the water level and water environment pollution.

The conclusion of above matter, there is a demand in meeting the water consumed requirement of Hanoi city in terms of quality and quantity. The management of water resources in general and underground water resources in specific needs a suitable attention of city leaders and good coordination of specialized bureaus and local authorities. It guests allocating responsibility among relevant parties and mobilizing the participation of organizations, enterprises and society in order to bring about practical efficiency

Keywords: Water supply, water resources, urban management, Hanoi

## 1. Introduction

Hanoi city locates in the centered position of the Hong River Delta to have the large Hong and Duong River streaming throughout. The Hong River that is the second largest river in Vietnam starts from China to continuous in Vietnam land at Laocai province and to reach the East Sea. Water resource underneath ground level of Hanoi city is very plentiful. In accordance with the assessment results on water reserves approved by the National Committee for Assessment of Water Reserves, total exploited water volume for whole Hanoi region is 837,600m<sup>3</sup>/day. Underground water potentiality in Hanoi area is very huge, but detected water reserves are still not much as expectation.

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## 2. Current situation of water supply management in Hanoi

### 2.1. Framework of organization of water supply industry

Hanoi is consisting 9 urban districts and 5 suburban districts, with total area of 900 square meter and the population of 3.5 million people. Hanoi water supply system was firstly built in 1894 under French domination. Since then, after more than a century of operation, the system has been expanded and upgraded many times.

The system of water supply in Hanoi is managed by Hanoi Water Trading Company. Hanoi Water Trading Company was restructured from Hanoi Water Supply Company, and is under the management of Hanoi Department of Transportation and Public Works and Hanoi People's Committee. Hanoi Water Trading Company is responsible to provide 8 inner districts including Hoankiem, Dongda, Haibatrung, Badinh, Caujiay, Tayho, Thanhxuan, Hoangmai and 2 suburb districts including Tuliem and Thanhtri with fresh water. Hanoi Water Trading Company No. 2 supplies water to Longbien and 2 suburb district including Gialam, Donganh. Hanoi Water Trading Company produces and trades fresh water in accordance with the regulations of Hanoi People's Committee. According to the administrative levels, Hanoi People's Committee assigns Hanoi Water Trading Company to plan the projects of investing Hanoi water supply development, suitable with Hanoi master plan, to manage the provided budget, to produce the supplying pipes, clepsydras, specific equipments. At the same time, Hanoi Water Trading Company should cooperate related authorities and specific inspectors to protect the source of underground water and the entire system of water supply under the management of the company.

## 2.2. Fresh water production

By the end of 2006, there have existed 12 water supply plants (except for smaller stations) located evenly in the city for the purpose of underground water exploitation. Totally, exploitation capacity is 460,000 cubic meter/day (including the outputs of Hanoi Water Trading Company No. 2 to the north of the city which is 47,000 cubic meter/day) with over 150 wells, in average 65 – 75 meter deep, with the capacity is 30 – 100litre/second. The network of supplying pipes is over 1000 km long with the two appralle systems: the old and new, in which 98% has been applied since 1985. Although the supplying system has been improved remarkably, the system in the southern part of the city lacks about 300,000 cubic meter/day compared with the practical demands. In many parts of the city, there has not been the system of water supply, and there has been a serious lack of water in many residential areas.

In the other hand, the quality of water provided by several plants in southern parts of the city has not reached the Amonium Standard. Currently, only Nam Du Water Plant has assembled the appropriate system of Amonium Treatment. As a result, the quality of treated water has met the standards of living water issued by Ministry of Heath Care 1329/2002/BYT/QD. The water supplied the other plants in the southern parts including Hadinh, Phapvan, Tuongmai remain under – standard of Amonium. Besides, in some plants of Hanoi, due to the degradation of the works, the output water still consists of some indexes higher than allowed. The production structure and financial situation of the company still remains inadequacies, so that it can not attract the

different economic organizations into fresh water production and trading.

## 2.3. The situation of fresh water trading

The service level of the supplying system remains low, and it can not create the trusts from customers. The reason is that the supply is not usual, inadequate in terms of flows and pressure, 8 hours/day in average. The quality as well as the flow of water supplied to certain areas, at certain times is unstable. The standard criterion to meet the daily demand in Hanoi is only 100 litre/person/day, compared with the average estimated 150 litre. The loss of water supplied and revenue are the most concerned issue in water supply service in Hanoi. In recent years, Hanoi Water Trading Company has tried its best to decreased the loss of supplied water and revenue. However, due to many leaks and breaks in the pipe system, there are a lot of difficulties in cutting the illegal connections. The usage of the old system of supplying or the combination between the old and the new pipes has decreased the the presurre of the new pipes in many areas. The rate of water and revenue loss remains high: 40 – 54 % in 2004 and over 38.61% in August 2005. The company has not completed the network separation in order to search for the reasons to have an appropriate measure. So as to decrease the loss, apart from the method of network separation and division for easier management, it is necessary to apply methods of loss controlling by the means of remote devices, systems of voucher receipt recording at ward level, GIS, frequency changers in pumping stations level II...

Under the circumstance of large loss of water supply, according to the policies of Ministry of Construction on water and revenue loss controlling in water supply trading, under the management of Hanoi People's Committee, Hanoi Department of Transportation and Puclic Communication, Hanoi Water Trading Company has focused on a plan of water and revenue loss controlling and plan of implementation in the coming time. There also exists many troubles in the system of water supply management and operation. The situation of fixed price and quantities for the plants is not close, for the reason that the network has not been seperated and the general water-clocks of the network. The operation of the network in some parts of the city still depends on subjective experiences without regulated exact parameters. Customer management remains weak, the rate of fixed price and quantities usage is still at high level. The inner inspection and breaking cases investigation is not good.

## 2.4. Price of water supplied

Due to the incompletely self – managed in terms of finance, the price of water supplied is limited at the level appropriate with the purchasing power. This can not reflex exactly the costs of production and trading. Moreover, because the rate of water and revenue loss remains high (the average rate of the cities nationwide is 36%), meanwhile, that of Hanoi is higher the average rate of

other cities: 38.61; the revoking the whole costs immediately is infeasible. In order to resolve this problem, Circular No.104 (which replacing Circular No. 03) is issued on November 8th 2004 by Ministry of Finance and Ministry of Construction on guiding the principles, measures of confining the rights of making decisions on fresh water price in cities, industrial zones, rural residential areas. Circular No. 104 has marked an important change in policies in the sector of water supply, that has been expected by many water trading companies for years. Till May 2005, Hanoi have decided to increase the price of water supplied. However, to avoid a sudden change of the price, Hanoi is unable to account completely all the costs of production, allocation and reasonable profits into the water price as regulated by Circular No. 104. The water prices applied by Hanoi Water Trading Company and Hanoi Water Trading Company No. 2 since May 2005 are as follows

Unit : thousands VND

### 3. Current situation and causes of pollution of underground water resource in Hanoi

#### 3.1 Current situation of pollution of underground water in Hanoi

Situation of pollution of underground water source in Hanoi is placed on seriously alert. Hanoi is slope down the South and Southeast, the dirt is moved toward by the whole surface water. At the South and Southeast of Hanoi city, underground water resource is heavily polluted. Amoni content is much higher than limitation. Especially, wells of Phapvan water manufactory contains 30mg/l NH4. Underground water level decreased, the water flow went down considerably in many regions in Hanoi. Some areas have the subsidence of ground, deformation of ground surface, underground water level went down over 10 meter in many wells, and the water flow reduced as half as that at the first time. More seriously, there were subsidence, splitting, and deformation of ground surface in some areas which will damage construction work. In 1993, Hanoi built 6 survey stations at Ngocha, Phapvan, Luongyen, Maidich,... The first result showed that surface depression have linear relation with decreasing of underground water level at the first experimental station, and at Phapvan station, ground depressed 20 to 30 meter. According to the data provided by League of hidrological geology and northern geological construction work, the happening of changing of underground water level in the first six months in 2006, the average water level (measured with strict height) at middle-high water contained level Pleistocen (qp) in first 6 -month of the

year 2006 lower than same period of last year as well as past average figures.

In exploited areas that flow water is very high, underground water level is still decreasing rapidly. The deepest underground water level is lower than that at this time last year, at 0.84 meter. Underground water level is forecasted that it can be down more 0.05 meter in the last six months, it means that, the underground water level is at 25.6 meter depth underneath the ground.

#### 3.2 Causes of underground water pollution

Underground water in Hanoi is polluted because:

- Water surface is polluted organically and microorganically, total coliform content is at high volume, over TCCP type B 3 times. The reason is that waste water from production and life is not treated when it is let out. In accordance with statistic data provided by Bureau of Protecting Environment in May, 2006, the total capacity of living waste water is about 450,000 cubic meter per day, part of which is treated preliminarily at the detritus tank, and then it is let out in the public drain, or drainage canal, pond, lake system. Waste water is drained off rivers in some places that pollute the water. There are about 400 operations in Hanoi, the amount of 400,000 cubic meter of waste water is let out the draining system per day. To 2004, there are only 36 industrial operations that had waste water treatment stations, in the others operations, waste water is treated preliminarily through mechanical filter tank system, or is let out directly to the city draining system. Rivers within Hanoi city are polluted, especially, Kimnguu and Tolich rivers are heavily polluted, dirt content is at very high volume. Amount of waste water that stream to Kimnguu and Tolich Rivers is very much, there is no capability for self-cleaning. BOD5 content is over TCCP B 3 times, coliform content is over TCCP B 57 times.

No	Companies	Living water price (SH)				Water price for industrial production	Water price for administrative and management	Water price for commerce and services
		SH 1	SH 2	SH 3	SH 4			
1	Hanoi Water Trading Company	2.8	3.5	5.0	7.0	4.5	4.0	7.0
2	Hanoi Water Trading Company No. 2	2.8	3.5	5.0	7.5	4.5	4.0	7.5

Districts	Exploitation of living water (Wells)	Exploitation of business water (Wells)	Exploitation of surface water (organizations)	Drainage of waste water (Organizations)	Unfilled drilling holes (Wells)
HaiBaTrung	2.814	270	0	58	0
HoangMai	14.880	23	0	52	458
ThanhTri	13.386	55	26	182	785
HoanKiem	254	51	0	44	7
ThanhXuan	2.146	13	0	64	300
TuLiem	24.087	591	4	73	4
TayHo	9.411	95	5	329	160
DongAnh	51.582	187	2	6	110
LongBien	13.650	121	0	114	69
SocSon	32.101	40	36	20	355
Gialam	38.489	25	52	24	16
BaDinh	510	62	0	20	73
<b>Total</b>	<b>199.634</b>	<b>1.530</b>	<b>121</b>	<b>988</b>	<b>2.108</b>

- Underground water is exploited uncontrolled, without licence. According to incomplete statistics, until December 31st 2006 there are 12 Districts that reported due

to decision No 195/2006 (there are only two districts: Dongda and Cau Giay districts haven't reported), the specific results are as follows

(Source: Report of Situation of doing water resource management in 2006 by Department of Resource, Environment and Land)

The action of uncontrolled and overloaded exploiting underground water has made flow of water reduce, underground water level decrease, ground surface depresses, and water environment is polluted.

- There are more than 2108 drilling holes which are not used, unfilled carefully. Those holes become absorbed way in which polluted surface water goes down underground water easily. There are many urban UNICEF wells equipped with pumps are not used in our country, which potentially create the danger of pollution can go down underground water.

- Because of leaking water from rubbish dumps that were not designed with right technique, and the spontaneous rubbish dumps, or leaking water from septic tanks absorb through ground layer that have poor capability of protecting underground water, or leaking water absorb

from wells, concrete stakes, borepiles of construction work.

- Because the amount of chemical fertilizer, insecticide, which are used in agriculture, go down the ground, however this process may take very long time.

- It is possible that there is radiation from underground minerals, untreated radiate garbage, untechnical elimination of garbage, can slowly absorb through ground layers and go down underground water in many years.

#### 4. State management of Hanoi underground resource

4.1. Government and Hanoi People's Committee documents about management of exploiting Hanoi underground water.

Performing Law of water resource in order to surmount the situation of illegal exploitation water resource, and illegal drainage waste water cause water become exhausted and polluted, the Government has promulgated:

- Decree No.149/2000 is issued in July 27th, stipulated for issuing licenses of survey, exploitation, usage of water resource and drainage of waste water.

- Decree No.34/2005 issued in March 17th 2005, was about punish administrative infringement in water resource field.

- Circular No.02/2005 is issued in July 22nd 2005 by Ministry of Resource and Environment, instructs to perform Decree No 34/2005 issued in March 17th 2005 by the Government.

- Decision No.22/2006 is issued in December 18th 2006 by Ministry of Resource and Environment, is about obligatory applying Vietnamese standard in environment.

- Decision No.17/2006 is issued by Ministry of Resource and Environment, is about permission to drill water underground in a small scale.

Hanoi People's Committee has promulgated:

- Decision No.195/2005 is issued in November 22nd 2005, stipulated for issuing license of survey, exploitation of water resource, and drainage of waste water, issuing license for drilling water underground in Hanoi city.

- Decision No.132/2006 is issued in January 9th 2006, decided to establish Mission of interdisciplinary inspection to inspect exploitation, usage of water resource and drainage of waste water to water source in Hanoi city. This decision also stipulated for issuing license of surveying, exploiting water resource, draining waste water to water source, drilling water underground in Hanoi city (is issued with Decision No.195/2006 issued in December 22nd 2005 by Hanoi People's Committee).

- Instruction No.27/2005 is issued in December 30th 2005 by Hanoi People's Committee, instructed to reinforce management of exploiting, using water resource and draining waste water to water source in Hanoi city.

4.2 Division of management of water resource in Hanoi.  
Hanoi People's Committee instructed:

- Involved Offices, Departments, People's Committee of Districts, Precincts, Communes, towns, organizations, individuals who take part in exploitation, usage of water resource, drainage of waste water to Hanoi water source to implement seriously Law of water resource, decree issued by Government, stipulation issued by Hanoi People's Committee which stipulated for issuing license of survey, exploitation, usage of water resource, drainage of waste water to water source. Hanoi People's Committee rigidly prohibited organizations, individuals to exploit, use water resource and drain waste water illegally.

- Department of Resource, Environment and Land is responsible for:

+ Performing promptly instruction No.279 issued in July 6th 2005 by Hanoi People's Committee, planning project in order to survey current situation and assess water reserver, management of exploitation, usage of water resource in city.

+ Planning exploitation project, developing water resource including specifying potential water source, business water-consumed demand. Firstly, determining limited exploitation regions, allowed depth to exploit underground water, protected sanitation of regions which to serve licence to exploit, use water resource and drain waste water, in order to develop water resource and environmental sanitation steadily.

+ Inspecting making list of survey, exploitation wells; specifying quantity, position, situation of unused wells (including families's small wells, exploitation wells of organizations, survey wells which are not in used). Planning to fill wells in, proposing to complete survey station system in city. Co-operating with interdisciplinary offices, departments, Districts People's Committee to check the exploitation, usage of water resource and drainage of waste water to water source, drilling of water underground. Punishing organizations, individuals who infringe the law resolutely, suspending illegal activities.

+ Propagandizing to citizen about Law of Water Resource and drainage of waste water to water source, training managers of environmental resource at districts, precincts, towns in order to protect, exploit, use water resource steadily.

- Department of Finance to co-operate with involved Offices, Departments to plan policy of collecting money from exploitation of water resource, establish assess cost structure, fee of issue license in management of water resource field in order to create incomes to remain, develop water resource steadily; reporting to City People's Committee, propose to the Government to correct unsuitable contents.

- Department of Constructions to co-operate with Department of Resource, Environment and Land to update, exchange information from the results of survey ground surface depression network because of changing in underground water level and survey data of survey

changing water level station in order to explore information effectively invested by the Budget.

- Department of Planning and Investment need pay attention to detail of providing, draining water project during the assessment of project.

- Department of Communications and Public Works to instruct under operations who are exploring water in the city to obey Law of water resource strictly.

- Department of Public Health is responsible for checking quality of explored living water, especially to large scale Water Trading Companies; If the quality of water is not good enough, explorers have to surmount immediately, and report, propose to City People's Committee to handle.

- Department of Interior preside to co-operate with involved Offices, Departments to define function, assignment of state management and task of business management in water resource branch in the city, simultaneously propose additional staff plans to water resource management in levels of departments, which based on current Law of Water Resource Management.

- People's Committee of districts, precincts, communes, towns check organizations, individuals who is exploiting, using water resource and draining waste water to water source in the city; classify operations which are working legally or not; treat as jurisdiction and synthesize reports, propose effective water resource management; organize to register explored water construction works that it is not necessary to ask permission to issue license in the region; make lists of small broken down, unused family's wells, report to Department of Resource, Environment and Land to make plan to fill wells in.

- Public information operations need reinforce to advertise legal stipulation of exploitation, usage of water resource and drainage of waste water in order to make citizen understand, implement, discovery and reflect on infringement about water resource management to exploit, use water resource steadily.

City People's Committee assign Department of Resource, Environment and Land to supervise and speed up levels, departments to implement seriously, report results to City People's Committee regularly.

#### 4.3. Results of Water resource Management in 2006

Hanoi Department of Resource, Environment, and Land report the situation of deploying water resource management in 2006.

- Hanoi Department of Resource, Environment and Land deployed to build database project of water resource in city, in order to serve management to submit to Hanoi People's Committee approved in Decision No.5149 issued in November 16th 2006 and implement in 2006 – 2008.

- Implemented instruction No.27 issued in November 30th 2005 by Hanoi People's Committee; Association of interdisciplinary Investigation organize to carry out the first, second investigation, the results of investigation showed that there was instructed document which suggest

way to solve some problems involved in Hanoi People's Committee's reports.

- Trained, deployed to implement Government's Decrees, Ministry of Resource and Environment's Circulars, Hanoi People's Committee's Decisions, Instructions; all of which is about management of water resource and management of drainage of waste water to water source in the whole city.

- Co-operated, assisted in explaining, propagandized Law and legal documents of water resource to Districts Offices of Resource and Environment, and organize to instruct of enumeration, registration, synthesis of figures of exploiting, using water resource and draining waste water to water source at Districts in the whole city.

- In order to promote propaganda, popularization, Hanoi Department of Resource, Environment and Land use require users have to make documents to ask permission to explore water and drain water to water source, make list of paying drainage fee according to Decree No.67/2006 issued by the Government.

- Instructed, investigated survey works for water condition in Hanoi city; promote to handle the rest of survey network form Department of Agriculture and surban Development to Department of Resource, Environment and Land use.

- Handled and dealt with documents that ask for agreement, survey, exploitation of water.

- Solve assignments that involved in management of water resource with Department of Communications and Public Works and under companies: Hanoi Water Trading Company and Hanoi Water Trading Company No.2. Required Government-owned one-member water drainage company Ltd to make documents ask permission for draining waste water due to Law at locations that company will drain waste water, for instance: Yenso water-pump station which pump water to Hong River, KimLien and TrucBach waste water-treat station.

- Contributed ideas to draft legal documents involved in water resource management of Central Government.

#### 4.4 Plans in 2007

- Continue to assist in explaining, propagandizing Law and legal documents of water resource at Districts, precincts, communes.

- Continue to speed up making list, totalling up all figures of exploitation, usage of water resource and drainage of waste water at Districts, precincts, communes water source in the whole city.

- Association of Interdisciplinary Investigation continue to invest exploitation of water, drainage of waste water and drill of explored-wells of organizations, individuals according to Decision No.132 issued in January 9th 2006 and Decree No.27 issued in November 30th 2005 by Hanoi People's Committee.

- instruct, check and implement survey works for water condition in Hanoi city.

- Carry out projects of building database about Hanoi water resource.

- Plan and carry out the filling unused, broken wells up.

- Promote co-operation with Department of Communications and Public works, Department of Agriculture and surban Development and involved organizations in water resource management.

- Carry out field research and study current documents to define and set preliminarily "protected sanitation refion", "allowed exploration depth" in some regions where it is not necessary to ask permission in order to popularize to Districts, precincts, communes; Specify the aim of surface water usage to issue license of draining waste water to water source.

- Promote to require operations to ask permission and assess documents that ask for exploiting water and draining waste water due to Decision No.195/2005 issued in November 22nd 2005 by Hanoi People's Committee in order to totally manage water exploitation and waste water drainage in the city.

- Intensify the division of administrative procedure: submit to Hanoi People's Committee to fix Decision No.195/2005 issued in November 22nd 2005, due to division of responsibility between Districts in water resource management, including divide responsibility between districts in issuing licenses.

## 5. Conclusions

In 1998, the Parliament promulgated Law of Water resource, and in 1999, the Government issued Decree No.179, instruct to implement Law of Water Resource. This is important legal basic that affirmed macroscopic management roles of our State to precious and limited water resource of Vietnam. The Government issued Decision No.67 in June 15th 2006, decided to establish National Council of Water Resource to consult the Government to issue important decision of water resource management due to Government's duty and power. This is very important advantage for Ministries and Departments to co-operate together to manage water resource effectively.

However, management of water resource is a very big problem, as a matter of fact, there are a lot of insufficiencies in management. Thus, it needs huge efforts of people, costs, etc., in order to get dedicated results. In order to satisfy water-consumed demand increasing daily, management of water resource and protection of the quality of water source need to be reinforced immediately. Besides unanimous instructions from Central government to locations, legal documents, it is necessary to deploy activities that increase Vietnam citizen's awareness of water resource management, so that it can make Vietnamese have self-awareness to take part in water resource management.

In order to reorganize, reinforce water resource management in Hanoi city, strictly control and solve out illegal survey, exploit water, drain waste water; to protect,

guarantee to exploit water resource in long time, steadily and prevent the water consequence, Hanoi People's Committee issued Decision No.195/2005, this decision decide to issue licenses of exploiting, using water resource and draining waste water to water source in Hanoi.

Thus, to carry out water resource management, Hanoi People's Committee issued documents and

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assigned jurisdictional offices to deploy activities unanimously. We hope in the future (2007-2010) the pollution of Hanoi underground water will be ameliorated considerably, so that, in private, Hanoi citizen will feel secure about quality of living water and in general, quality of water will be guaranteed to satisfy urban water-consumed demand.

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