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Faculty of Engineering
Universitas Indonesia

**THE 12th
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CONFERENCE On QiR
(QUALITY in RESEARCH)**

in Conjunction with
ICSERA 2011

Program Book

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WELCOME FROM THE RECTOR OF UNIVERSITAS INDONESIA



I am honoured to have the opportunity to officially welcome you to the 12th International Conference on QIR (Quality in Research) 2011. As we are all aware that the impact of globalization has resulted in a very competitive business environment; a condition that makes the fulfilment of the needs of customer/clients' ever-sophisticated project, product, or service most challenging. Without any doubt, a sustainable design and technology is the key factors in assisting our industries to enhance their contributions to the future development of humanity. Therefore, it is our hope that this conference will be able to provide an international forum for exchanging knowledge and research expertise as well as creating a prospective collaboration and networking on various fields of sustainable engineering and architecture.

In order to achieve business objectives and benefits, engineering products or projects require various resources, skills, and technology. Accordingly, we need an application of knowledge, tools, and techniques necessary to develop sustainable products or projects, which are environmentally friendly, produced through efficient processes, and adapted to local conditions. And this may be achieved by eco-technology. Eco-technology is a technology that will give consumers what they want; lower cost, convenience, save money and deliver what people everywhere needs: less waste, less pollution, and green environment. Eco-technology practices can facilitate to conserve and restore the environment through the integration of engineering and ecological principles. However, eco-technology requires multidisciplinary synthesis of knowledge and skills; and the development and application of this technology in the sector of industry and services is therefore a crucial requirement for sustainable development process. For this reason, we urgently need new technologies and practical applications to be further developed based on the current knowledge.

Accordingly, I hope this conference can be a kick-off for the strengthened action and partnerships on creating a platform for us; national and international thinkers, academics, government officials, business executives and practitioners, to present and discuss the pivotal role of engineers in creating sustainable development.

I would like to thank the Faculty of Engineering of Universitas Indonesia for organizing this meaningful and timely event, and supporting organizations for their participation and contributions. I am sure that you will all find this conference stimulating and rewarding and with this, I wish you all a fruitful conference.

Prof. Dr. der. Soz. Gumilar Rusliwa Somantri
Rector
Universitas Indonesia

**WELCOME FROM THE DEAN OF FACULTY OF ENGINEERING
UNIVERSITAS INDONESIA**



On behalf of the Faculty of Engineering, University of Indonesia, it is my greatest pleasure to extend our warmest welcome to all of you to the 12th International Conference on QIR (Quality in Research) 2011. As we know that this conference is conducted to cover a wide range of sustainable design and technology issues, I hope this two days-conference will be spent in interesting discussions and exchange of ideas. I also hope that this conference will be able to provide a state-of-the-art information and knowledge in this challenging world of sustainable design and technology. The growing success of our institutions and expertise should urge us to develop our competitive capabilities, especially when we face certain challenges which should be overcome with hard work, cooperation, and working together hand in hand. We will work together to develop a common path and develop collaboration opportunities for future action and research on multi-disciplinary engineering areas for quality of life and humanity.

I am delighted that you have accepted our invitation to this conference in such a large numbers as indicated and that we will have many international speakers and papers from various countries to be presented and discussed in these two days. We will explore various issues on sustainable development and we must widen the scope of sustainability from a product-, system-, or an individual building-scale to the whole community-scale. At the same time, we have to widen the focus from ecological aspects to social and economic aspects. This means that environmental solutions should always be considered from the aspects of human health and well-being, safety, and economic point of view. This conference provides an excellent forum for engineering professionals, business executives, industry practitioners, and academicians to exchange ideas and to share their experience, knowledge and expertise to each other.

I would like to thank our sponsors, supported bodies, and various contributors for their generous support of this conference. I would also like to thank our distinguished speakers for agreeing to share their insights with us. To our friends from overseas and other provinces of Indonesia, I would also like to extend a warm welcome to you and wish you an enjoyable stay in Bali. Last but not least, I would invite you to join me in thanking the committed staff that made this conference happen and to make it success.

I wish us much success in the deliberations, discussions, and exchange of ideas which we will have within this conference and I wish you a very pleasant and enjoyable stay here in Bali.

Prof. Dr. Ir. Bambang Sugianto, M.Eng
Dean Faculty of Engineering
Universitas Indonesia

WELCOME FROM THE QIR 2011 ORGANIZING COMMITTEE



On behalf of the Organizing Committee, it is my greatest pleasure to extend our warmest welcome to all of you to the 12th International Conference on QIR (Quality in Research) 2011. The selected theme for this year's conference is "Integrated Design in Urban Eco-Technology for Quality of Life and Humanity". With this theme, the conference focuses on the scientific analysis and design of the key factors explaining the success applications of integrated design in urban eco-technology, their market perspectives, and their contributions to the existing and future development of humanity. In line with this theme, it is our utmost pleasure to hold the QIR 2011 in conjunction with the 2nd International Conference on Saving Energy in Refrigeration and Air Conditioning (ICSERA 2011).

With its continuous presence for 12 years, QIR has become an icon for Faculty of Engineering Universitas Indonesia in serving the objectives to provide engineering excellence for both national and international in all aspects of engineering, design, and architecture. For the first time, the QIR 2011 is held in a famous beautiful island of Indonesia - Bali. The QIR 2011 is supported by Universitas Udayana, in the spirit of strengthening of cooperation and mutual growth to be world class institution. I am delighted to inform you that we have such a large number of participants today, as indicated, that we will have 21 invited speaker presentation and more than 520 papers from more than 20 countries to be presented and discussed during these two days-conference. We are fortunate to have a lot of good quality papers belong to:

- 32 papers on ICSERA
- 39 papers on Chemical Engineering
- 115 papers on Electrical Engineering
- 37 papers on Mechanical and Naval Architecture Engineering
- 101 papers on Materials Engineering
- 54 papers on Architecture & Planning
- 75 papers on Industrial Engineering
- 72 papers on Civil Engineering

I would like to thank all contributors, speakers and participants for your generous support to this conference. It is my pleasant duty to thank all the members of Organizing Committee and the International Board of Reviewers for their advices and help. We are grateful to all Sponsors, Supporters, Exhibitors, Partner Universities and Professional Associations, for their spontaneous response and encouragement through committing funds and extending help in kind. I would like to sincerely thank the Rector of Universitas Indonesia and the Dean of Faculty of Engineering, for fully supporting the Committee and providing all supports to make this conference happen and to make it a success.

I wish you a very pleasant stay here in Bali; and finally, let me wish all of you a meaningful and fruitful conference. Thank you and we hope to see you again at the QIR 2013.

Prof. Dr. Ir. Bondan T. Sofyan, M.Si.
Chairman of QIR 2011 Organizing Committee

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Functions and Needs of Green Open Space as Recharge area in The North Jakarta

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ABSTRACT

One of the physiological needs of human being is water. The existence of water on earth depends on water cycle in the area. The amount of water on the surface of the earth is always fixed, but the spreading depends on the pattern of land use on it. Without realizing the public, land-use change will bring negative impact on the lives of the next few years. In the north of Jakarta, groundwater has been intrusion by sea water, making it unfit for consumption. With the question above, then conducted research aimed at the research objective is to build the Green Open Space Management Model as a Regional Catchment Area in order to increase water availability in North Jakarta. The method used is to create a spatial model of spatial dynamics, spacious as well as the presence of existing green space requires spatial data Landsat image. Area of green space required as recharge areas using data on the number and rate of population growth, per capita water consumption, supply capacity of PAM, potential lake or there, annual rainfall and potential green space allocation. Based on the discussion that there then can be found in North Jakarta PAM supply capable of supplying the domestic needs of ground water that exceeds the needs of the existing green open space management policy as a water catchment areas in North Jakarta area while maintaining the existing green space that serves as the region in order to prevent ground water filling intrusion of sea water and add green space located on the edge beach in the form of mangrove forests to prevent abrasion.

Keywords:

Green Open Space, Recharge Area, North Jakarta

1. INTRODUCTION

High population growth rate and limited land caused by causing the growth of physical development in the city of Jakarta is done by converting agricultural land, forests and other open spaces into land involve with pavement and building structures. This results in reduced area of green open space (green space), so space is reduced water absorption, become arid and hot environment and the loss of diversity of flora and fauna. To prevent further environmental damage caused by the growth of development will require the protection of the environment, in which each of construction in progress must be able to put forward the limitations

and advantages possessed by the environment itself.

One of the physiological needs of human being is water. Smoothness of human life would be disrupted if water is not available, and at the last stage, no more life. The existence of water on earth depends on water cycle in the area. The amount of water on the surface of the earth is always fixed, but the spreading depends on the pattern of land use on it. Without realizing the public, land-use change will bring negative impact on the lives of the next few years. In the north of Jakarta, groundwater has been intrusion by sea water, making it unfit for consumption. Not only occur in areas north of Jakarta alone, but also occurs in a large number of places in Jakarta. The more the amount of space resulted in a place built for pervasiveness in the rain water to be reduced, giving rise to negative impacts such as flooding in the rainy season and lack of availability of water in the dry season.

Studies and research on the extent and location of green space needs as catchment areas in Greater Jakarta to meet the needs of domestic groundwater is a very important thing, because it can contribute to the business management of green space as catchment areas in Jakarta.

2. RESEARCH PURPOSE

The purpose of this research is to build Green Open Space Management Modal as a Regional Catchment Area in order to increase water availability in North Jakarta. The objectives of are:

1. Studying the existence of the existing green open space and its ability to meet the needs of domestic groundwater
2. Prepare a map of the allocation of green open space potential as the recharge area in North Jakarta area
3. Develop Open Space Management Model Green as Regional Catchment areas in North Jakarta
4. Develop a scenario that required ground water adequacy in the management of green open space as a water catchment areas in North Jakarta to maximize water absorption
5. To formulate policy recommendations as the management of green open space Catchment areas water in North Jakarta.

3. METHODOLOGY

The data required are obtained from the data: Secondary data data ground water infiltration rate distribution maps, spatial data Landsat images, data on the number and rate of population growth, supply capacity of PAM and rainfall; Primary Data Field study using GPS in green space sites in North Jakarta. Rainfall data used are rainfall data hourly with the listing from 2003 to 2007 (Data Center area Cilincing Ciandane, Directorate General of Natural Resources Dep. PU) and monthly rainfall data from 1997 to 2006 from the observation station Meteorological Maritim Tanjung Priok.

The steps taken in this research procedure as follows:

1. Literature Review
2. Surveys and Data Collection
3. Analysis and Discussion

The calculation of the water needs of domestic (household) and domestic groundwater supplies in North Jakarta area on the basis of assumptions as follows:

1. Domestic water needs in North Jakarta area accounted for 10 years, from 2006 to 2016
2. The need of water per capita in North Jakarta area amounted to 150 liters / day / person or 54.75 cubic meter per year per people.
3. Ground water to meet domestic water demand in North Jakarta is obtained from the existing green space (2006), green space plans and other potential originating from the lake or that there are in North Jakarta
4. Take into account also supplies piped in North Jakarta as a reduction of ground water needs

To take into account the existing green space area (in 2006) in North Jakarta with spatial analysis of land suitability map that is in the image interpretation Landsat image Path / Row 122 064 1 October 2006 using Erdas E 8.5 and Arc View 3.3.

4. RESULTS AND DISCUSSION

The presence of green space that is in 2006 in North Jakarta area Based on the map of Jakarta landsat in 2006 created spatial maps of land based on its designation of North Jakarta area. Spatial data processed using Erdas 3.3 per wilayah 85 and Arcview project with the result:

Table 1 : Land Based Year 2006 Per-Purpose Zone Resapan in North Jakarta area

No.	Infiltration Area	Land Area (m ²) in 2006			
		Green Open Space (RTH)	Open Space	Lake	River
1	R8d	4,477,832.77	618,594.63	177,384.49	23,411.15
2	R9d	5,607,871.00	818,489.84	244,016.22	518,647.03
3	R10d	2,278,085.04	323,253.96	277,332.09	879,719.01
4	R11d	2,359,123.64	287,236.81	145,869.48	911,234.02
5	R12d	4,117,661.22	369,175.84	67,532.17	1,271,405.56
6	R13d	8,848,514.51	1,414,573.76	1,128,237.37	7,649,143.25
North Jakarta		27,689,088.19	3,831,324.84	2,040,371.82	11,253,560.02

Green Open Space Area in 2006 is 27,689,088.19 square meters (19.4 %) of the broad area of North Jakarta. Area of Land is open or 3,831,324.84 square meters or 2.75% Jakarta Area North of Area.

Table 2 : Area of green space to the Area of North Jakarta in 2006

No.	Zone Catchment Area	Land Area (square meter)		Percentage Green Open Space (%)	coefficient
		Green Open Space	Total Area		
1	R0d	4,477,832.77	11,857,036.09	37.77	0.3777
2	R9d	5,607,871.00	20,168,429.36	27.81	0.2781
3	R10d	2,278,085.04	10,997,421.20	20.71	0.2071
4	R11d	2,359,123.64	14,271,947.07	16.53	0.1653
5	R12d	4,117,661.22	27,398,537.19	15.03	0.1503
6	R13d	8,848,514.51	54,862,229.09	16.13	0.1613
North Jakarta		27,689,088.19	129,555,600.00	19.84	0.1984

Potential green space allocation map as Regional Catchment Area in North Jakarta

Allocation as a potential green space catchment areas in North Jakarta is based on the value of the final infiltration rate, ground water, population density and vast open areas in North Jakarta. The result can be seen in the following table.

Table 3 : Allocation of green space as a Regional Resapan Potential of Soil and Water Front Catchment area in North Jakarta area

No	Catchment area in North Jakarta	final infiltration rate (cm/m/minute)	Surface Ground Water (m)	Open Land Area (square meter)	Catchment Area Potential	Information
1	R0d	0.4	1-5	1,413,900.00	IV	Low Potential
2	R0d	0.35	1-5	618,300.00	IV	Low Potential
3	R11d	0.25	1-5	818,100.00	IV	Low Potential
4	R12d	0.15	1-5	323,100.00	IV	Low Potential
5	R13d	0.1	1-5	287,100.00	IV	Low Potential
6	R0d	0.45	1-5	369,000.00	IV	Low Potential

Table 4 : Allocation of green space as an Area of Potential Resapan of Population Density in North Jakarta area

Sub District	y Catchment Area in North Jakarta					
Pulidangan	122.80	R0d	R0d	R10d	R11d	R13d
Penjaringan	50.17	R13d	R13d			
Cilincing	60.01	R0d	R0d	R10d	R11d	R13d
Tanjung Priok	124.48	R0d	R0d	R10d	R11d	R13d
Kelapa Dua	66.36	R0d	R10d	R11d	R13d	

Based on the above table, the areas with the potential to be used as green space area in North Jakarta is an area that still has an open area, has a low density medium (51-100 people / hectare) and medium potential areas and above (ground water= 6 m) for North Jakarta area does not exist.

4.1. Green Open Space Management Model as a Regional Territory Catchment Area North Jakarta

Dynamic Model Management as a Regional Resapan green space in North Jakarta area is made by taking into account the domestic water needs for 10 years is the year 2006 to 2016 with per capita water demand amounts to 150 liters / day / person or 54.75 cubic meter per year per people. Ground water to meet domestic water demand is obtained from the existing green space (in 2006), green space plan, other potential originating from the lake or that there are in North Jakarta and also taking into account the supply of PAM in North Jakarta as a reduction of ground water needs. By Stella Research & Dynamic Management Model is prepared as a regional green space Catchment Area in North Jakarta area as shown in Figure below.

Based on the above table, the areas with the potential to be used as green space area in North Jakarta is an area that still has an open area, has a low density medium (51-100 people / hectare) and medium potential areas and above (surface ground water is

more 6 meter) for North Jakarta area does not exist.

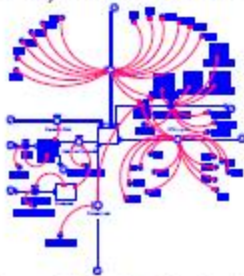


Figure 1 : Model Management Green as Regional Open Space District, North Jakarta

Results from the model calculation above obtained results as follows:

- a) The population of North Jakarta for 10 years (2006-2016)
- b) The number of domestic water needs of residents of North Jakarta for 10 years (2006-2016)
- c) Number of supply PAM North Jakarta residents for 10 years (2006-2016)
- d) The amount of ground water supplies from lakes or there in North Jakarta for 10 years (2006-2016)
- e) The amount of ground water supplies of green space in 2006 in North Jakarta

The results of model calculations presented in the following table:

Table 5 : Total Population of North Jakarta for 10 years (2006-2016)

Year	Population Growth (people/year)	Population in North Jakarta (people/year)
2006	1,180.97	1,180,967.00
2007	1,182.15	1,182,147.97
2008	1,183.33	1,183,330.11
2009	1,184.51	1,184,513.45
2010	1,185.70	1,185,697.96
2011	1,186.88	1,186,883.66
2012	1,188.07	1,188,070.54
2013	1,189.26	1,189,258.61

Table 6 : Number of Domestic Water Supplies Residents in North Jakarta for 10 years (2006-2016)

JAKARTA CENTER			
Years	Population Growth	Population	Domestic Water Needs
2006	1,494.16	878,518.00	48,120,760.50
2007	1,496.70	880,412.16	48,202,563.79
2008	1,499.25	881,908.86	48,284,510.15
2009	1,501.79	883,408.11	48,366,593.82
2010	1,504.35	884,909.90	48,448,817.03
2011	1,506.90	886,414.25	48,531,180.02
2012	1,509.47	887,921.15	48,613,683.03
2013	1,512.03	889,430.62	48,696,326.29
2014	1,514.60	890,942.65	48,779,110.04
2015	1,517.18	892,457.25	48,862,034.53
2016	1,519.76	893,974.43	48,945,099.99
Final		895,494.19	

Table 10 : Groundwater Supply of the existing green space in 2006 and Supply Lake / lakes in 2006 in North Jakarta area

Year	Water need in North Jakarta
	(m ³ /thn)
2006	64,657,943.23
2007	64,722,661.19
2008	64,767,323.79
2009	64,852,111.12
2010	64,916,963.23
2011	64,981,880.19
2012	65,046,862.07
2013	65,111,968.93
2014	65,177,020.84
2015	65,242,197.86
2016	65,307,440.06

Table 11 : Total Supply PAM Residents in North Jakarta for 10 years (2006-2016)

Year	Increase Demand PAM	Supply PAM in North Jakarta
	(m ³ /thn)	(cubic meter/year)
2006	-226,206.18	72,969,734.00
2007	-225,504.94	72,743,527.82
2008	-224,805.87	72,518,022.89
2009	-224,108.97	72,293,217.02
2010	-223,414.23	72,069,108.04
2011	-222,721.65	71,845,693.81
2012	-222,031.21	71,622,972.16
2013	-221,342.92	71,400,940.95
2014	-220,656.75	71,179,598.03
2015	-219,972.72	70,958,941.27
2016	-219,290.80	70,738,968.56

Table 12 : Number of Ground Water Supply from Lake or Sita in North Jakarta area for 10 years (2006 to 2016)

Year	t
	(cubic meter/ year)
2006	3,176,899.30
2007	3,176,899.30
2008	3,176,899.30
2009	3,176,899.30
2010	3,176,899.30
2011	3,176,899.30
2012	3,176,899.30
2013	3,176,899.30
2014	3,176,899.30
2015	3,176,899.30
2016	3,176,899.30

Table 13 : Number of Ground Water Supply of green space in 2006 in North Jakarta area

Year	Existing Green Open Space Area in 2006 (square meter)	Volume of Groundwater from existing Green Open Space in 2006 North Jakarta (cubic/year)
2006	27,689,088.18	43,139,599.38
2007	27,689,088.18	43,139,599.38
2008	27,689,088.18	43,139,599.38
2009	27,689,088.18	43,139,599.38
2010	27,689,088.18	43,139,599.38
2011	27,689,088.18	43,139,599.38
2012	27,689,088.18	43,139,599.38
2013	27,689,088.18	43,139,599.38

Scenario Management of green space as an area of North Jakarta District Rasapan Based on the results management model for processing of green space as a catchment area in North Jakarta is prepared 5 alternative green space management scenarios in order to meet the needs of domestic groundwater that is with the following result

Scenario Management of green space as an area of North Jakarta District Rasapan Based on the results management model for processing of green space as a catchment area in North Jakarta is prepared 5 alternative green space management scenarios in order to meet the needs of domestic groundwater that is with the following results:

Scenario 1: Area of green space like a vast green space there in 2006 and the Supply Lake / lakes in 2006 Area of existing green space in the year 2006 amounted to 27,689,088.18 m² or 19.84% by volume of ground water produced by 43,139,599.38 m³/thn while other potential volume of supply from the lake / it amounted to 3,178,899.30 m³/thn. So the existing green space in 2006 and other potential of the lake / there is only capable of supplying the domestic needs of ground water in 2006 until 2016 approximately 70.92% -71.64%, just as shown in following table.

Table 14 : Groundwater Supply of the existing green space in 2006 and Supply Lake / lakes in 2006 in North Jakarta area

2012	242,058.04	407,843.60	15,193,730.73	14,785,867.13
2013	242,058.04	407,843.60	16,188,375.38	15,780,531.78
2014	242,058.04	407,843.60	17,148,960.45	16,741,116.85
2015	242,058.04	407,843.60	18,076,768.72	17,668,925.12
2016	242,058.04	407,843.60	18,973,034.82	18,565,191.22

No	Zone Catchment Area	Land area (square meter)		Percentage Open Area (%)	Coef.
		Open Area	Total Area		
1	R8e	186,267.71	2,851,949.97	6.53	0.0653
2	R7e	43,192.51	1,453,701.09	2.97	0.0297
3	R7d	17,996.88	1,928,883.90	0.93	0.0093
4	R8e	9,898.28	5,950,033.25	0.17	0.0017
5	R8d	22,496.10	4,222,189.92	0.53	0.0053
6	R8c	2,699.53	2,945,797.28	0.09	0.0009

Scenario 2: Relying on domestic water supply needs of the population only from PAM alone North Jakarta PAM supply capable of supplying the domestic needs of ground water exceeds the needs of approximately 108.32% - 112.86%, just as shown in the table below. So the needs of domestic groundwater North Jakarta had to be fulfilled from the supply of PAM alone.

Domestic Water Supply Needs

Table 15 : Residents only from PAM alone in North Jakarta area

Year	Supply PAM North Jakarta cubic meter/ year	Kebutuhan Domestik Jakarta Utara (m ³ /th)	Persentase Keter- cukupan %
2006	72.969.734,00	64.657.943,25	112,86
2007	72.743.527,82	64.722.601,19	112,39
2008	72.518.022,89	64.787.323,79	111,93
2009	72.293.217,02	64.852.111,12	111,47
2010	72.069.108,04	64.916.963,23	111,02
2011	71.845.693,81	64.981.880,19	110,56
2012	71.622.972,16	65.046.862,07	110,11
2013	71.400.940,95	65.111.908,93	109,66
2014	71.179.598,03	65.177.020,84	109,21
2015	70.958.941,27	65.242.197,86	108,76
2016	70.738.968,56	65.307.440,06	108,32

Scenario 3: Area of green space like a vast green space available in 2006, Supply Lake / lakes in 2006 and PAM Ground water supplies from the existing green space in 2006, another potential of the lake / sim, North Jakarta, PAM is able to supply the needs of domestic groundwater exceeds the needs of approximately 179.24% - 184.49% only, as shown in the table below.

Groundwater Supply

Table 16 : The existing green space in 2006, Supply Lake / lakes in 2006 and PAM in North Jakarta area

Tahun	Volume Air Tanah dari RTH yang Ada (2006) Jakarta Utara (m ³ /th)	Volume Air Potensi Laki (Dasau/Situ) Jakarta Utara (m ³ /th)	Pasokan PAM Jakarta Utara (m ³ /th)	Total (m ³ /th)	Kebutuhan Domestik Jakarta Utara (m ³ /th)	Persentase Keter- cukupan %
2006	43.139.599,38	3.178.899,30	72.969.734,00	119.288.232,68	64.657.943,25	184,49
2007	43.139.599,38	3.178.899,30	72.743.527,82	119.062.026,50	64.722.601,19	183,96
2008	43.139.599,38	3.178.899,30	72.518.022,89	118.836.521,57	64.787.323,79	183,43
2009	43.139.599,38	3.178.899,30	72.293.217,02	118.611.715,70	64.852.111,12	182,90
2010	43.139.599,38	3.178.899,30	72.069.108,04	118.387.606,72	64.916.963,23	182,37
2011	43.139.599,38	3.178.899,30	71.845.693,81	118.164.192,49	64.981.880,19	181,84
2012	43.139.599,38	3.178.899,30	71.622.972,16	117.941.470,84	65.046.862,07	181,32
2013	43.139.599,38	3.178.899,30	71.400.940,95	117.719.439,63	65.111.908,93	180,80
2014	43.139.599,38	3.178.899,30	71.179.598,03	117.498.096,71	65.177.020,84	180,28
2015	43.139.599,38	3.178.899,30	70.958.941,27	117.277.439,95	65.242.197,86	179,76
2016	43.139.599,38	3.178.899,30	70.738.968,56	117.057.467,24	65.307.440,06	179,24

Scenario 4: Area of green space consists of green space plus a plan on potential areas of existing green space in 2006, Supply Lake / lakes in 2006 and PAM Because in scenario 3 ground water supply exceeds domestic needs which is about 179.24% - 184.49%, is not needed anymore additional green space plan, as shown in the table below.

Table 17 : Water Supply Plan Land of green space, green space available in 2006, Supply Lake / lakes in 2006 and PAM in North Jakarta area

Year	Green Open Space Area, North Jakarta (ha)	Percentage (%)	Volume Green Open Space plan, North Jakarta (m ³ /year)	Vol PAM + RTH 2006 + Another Potential North Jakarta (m ³ /year)	Total (m ³ /year)	Domestic water needs (m ³ /year)	Adequacy Percentage (%)	Excess North Jakarta (m ³ /year)
2006	0	0	0	119,284,232.68	119,288,233	64,657,943.25	184.49123	54,630,289.43
2007	0	0	0	119,062,026.50	119,062,027	64,722,601.19	183.95742	54,339,425.31
2008	0	0	0	118,836,521.57	118,836,522	64,787,323.79	183.42558	54,049,197.78
2009	0	0	0	118,611,715.70	118,611,716	64,852,111.12	182.89569	53,759,604.58
2010	0	0	0	118,387,686.72	118,387,687	64,916,963.23	182.36775	53,470,643.49
2011	0	0	0	118,164,192.49	118,164,192	64,981,880.19	181.84176	53,182,312.30
2012	0	0	0	117,941,470.84	117,941,471	65,046,862.07	181.31769	52,894,608.77
2013	0	0	0	117,719,439.63	117,719,440	65,111,908.93	180.79556	52,607,530.70
2014	0	0	0	117,498,096.71	117,498,097	65,177,020.84	180.27534	52,321,075.87
2015	0	0	0	117,277,439.95	117,277,440	65,242,197.86	179.75703	52,035,242.09
2016	0	0	0	117,057,467.24	117,057,467	65,307,440.06	179.24063	51,750,027.18

Scenario 5: Area of green space plan consists of green space, green space available in 2006, Supply Lake / lakes in 2006, PAM and supply of green space plus another Region

Under scenario 4 domestic ground water supply exceeds demand there is for m³/thn 51,750,027.18 - 54,630,289.43 m³/thn. Excess domestic supply of ground water can not be used to supply other areas because of the hydrological aspects of the North Jakarta does not affect other areas because it is an area which is the bottom of the release area. Existing ground water can be used as filler to prevent ground water intrusion of sea water.

Table 18 : Excess Water Supply Area of Land in North Jakarta

Year	Excess North Jakarta (cubic meter/year)
2006	54,630,289.43
2007	54,339,425.31
2008	54,049,197.78
2009	53,759,604.58
2010	53,470,643.49
2011	53,182,312.30
2012	52,894,608.77
2013	52,607,530.70
2014	52,321,075.87
2015	52,035,242.09
2016	51,750,027.18

Recommendation: Management of green space as an area of North Jakarta District Catchment Area

Based on the model and scenario management of green space as a catchment area in North Jakarta to recommend any of the following :

1. If you rely on the existing green space area and the potential of the lake and there is ground water that is produced do not meet domestic water needs of North Jakarta area residents because ketercukupannya years 2006-2016 only 70.92% - 71.64%
2. Supply PAM North Jakarta has been very inadequate domestic water needs of the population, so that you no longer need additional green space plan
3. While the existing green space in 2006 (19.84% area of North Jakarta) should be maintained because the ground water produced can be used as filler to prevent ground water intrusion of sea water.

5. CONCLUSIONS AND SUGGESTIONS

5.1. Conclusion

Based on the analysis and discussion that has been done, it can be concluded among other things:

1. The existence of the existing green open space (yr 2006) in North Jakarta amounted 27,689,088.19 m² (19.84% area of North Jakarta) and its ability to meet the needs of domestic groundwater.
2. Green Open Space Allocation potential as the recharge area in North Jakarta area who still have an open area, has a low density medium (51-100 people / ha) and medium potential areas and above (ground water- 6 m) to the North Jakarta area does not exist .
3. Scenario adequacy of ground water required in the management of green open space as a water catchment areas in North Jakarta to maximize water absorption is as follows:
 - a. Scenario 1: Area of green space like a vast green space there in 2006 and the Supply Lake / lakes in 2006 Existing green space in 2006 and other potential of the lake / there is only capable of supplying the domestic needs of ground water in 2006 until 2016 approximately 70.92% -71.64% only
 - b. Scenario 2: Relying on domestic water supply needs of the population only from PAM alone North Jakarta PAM supply capable of supplying the domestic needs of ground water exceeds the needs of approximately 108.32% - 112.86% only
 - c. Scenario 3: Area of green space like a vast green space available in 2006, Supply Lake / lakes in 2006 and PAM Ground water supplies from the existing green space in 2006, another potential of the lake / sim, North Jakarta, PAM is able to supply the needs of domestic groundwater exceeds the needs of approximately 179.24% - 184.49% only
 - d. Scenario 4: Area of green space consists of green space plus a plan on potential areas of existing green space in 2006, Supply Lake / lakes in 2006 and PAM Domestic ground water supply exceeds demand which is about 179.24% - 184.49%, is not needed anymore additional green space plan
 - e. Scenario 5: Area of green space plan consists of green space, green space available in 2006, Supply Lake / lakes in 2006, PAM and supply of green space plus another Reason Excess domestic supply of ground water can not be used to supply other areas because of the hydrological aspects of the North Jakarta does not affect other areas because it is an area which is the bottom of the release area. Existing ground water can be used as filler to prevent ground water intrusion of sea water.
4. Recommendations green open space management policy as a water catchment areas in North Jakarta area while maintaining the existing green space that serves as a regional ground water charging to prevent the intrusion of sea water and add green space located on the edge pantai in the form of mangrove forests to prevent abrasion.

5.2. Advice

Based on the results of research, discussion and conclusions, it is necessary to recommended further research is needed about the function and need for green space in North Jakarta in order to prevent intrusion of sea water.

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