CHARACTERIZATION OF ANNUAL MAXIMUM DAILY RAINFALL IN TIMIKA REGION, PAPUA

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ABSTRACT

Characterization of annual maximum daily rainfall is one important point that is to be used in Modified Ajkwa Deposition Area development planning e.g. embankment, river channel. It is expected that the result of this study can be used as an input to the formulation of homogeneous regions in the regional analysis. The hourly rainfall data from one rainfall station during one day which has annual maximum daily rainfall data is matched to other stations to get correlation coefficient. It is assumed that two stations have strong relationship when the coefficient of correlation has a value of more than 0.70. The data used in this study is taken from 10 stations around PT Freeport Indonesia with the total length of the recorded data is about 4 years. The temporal characteristic is also studied in the viewpoint of wet and dry season by using frequency analysis of occurring extreme rainfall.

Keywords: *extreme rainfall, spatial, temporal, correlation coefficient, tendency*

1. Introduction

The concession of PT Freeport Indonesia is covered more than 100 km, from Alpin zone in highland area on the north as far as Ajkwa in lowland area in the south. The elevation in this concession is between 20 – 4500 above mean sea level. Local rainfall often occurred in this area that is occurred in highland area and probably not occurred in lowland area. For instance, there is no recorded data in the rainfall station at lowland area,

but high rainfall has been recorded in the rainfall station at highland area, this phenomenon provides difficulties in hydrological analysis, especially in development planning in Modified Ajkwa Depositional Area e.g. embankment river channel, gabion design etc. For this reason, the knowledge of spatial and temporal characteristic of annual maximum hourly rainfall is needed.

The characterization of annual maximum daily rainfall is shown by spatial and temporal characteristic. The spatial is expressed by covering rainfall area as local or regional, on the hand, the temporal is observed to get knowledge about frequency occurrence in the highland and lowland area both wet and dry season.

The study area is done is concession of PT Freeport Indonesia using the hourly rainfall data from 12 stations with 4 years of data length. Location of the study is shown in Figure 1.

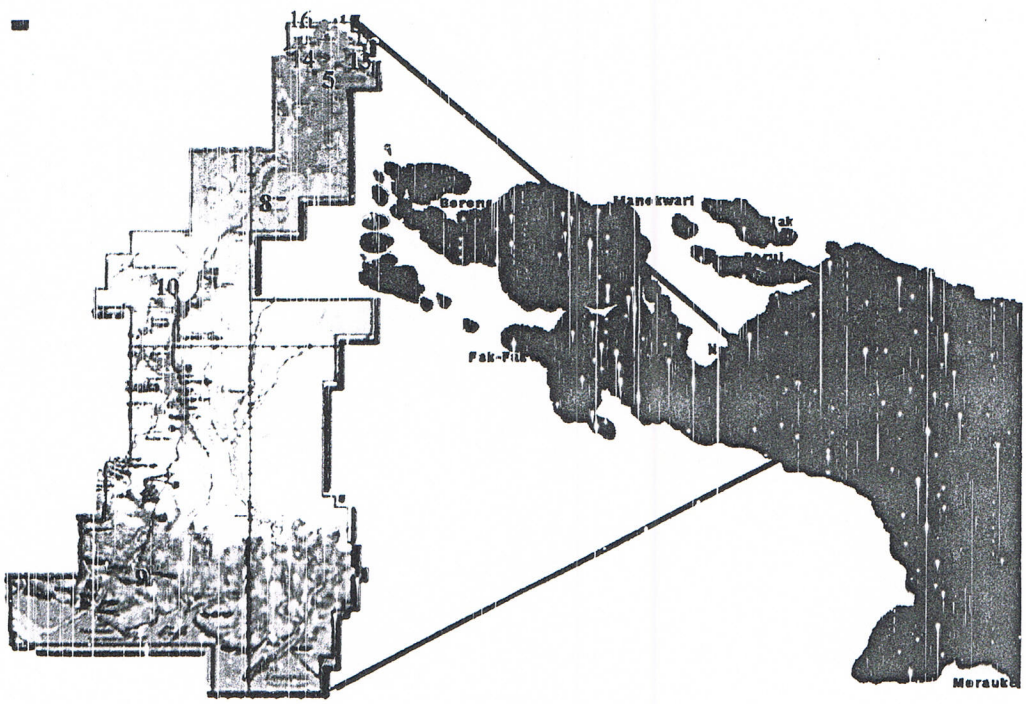

Figure 1. Location of the study area in the concession of PT Freeport Indonesia

2. Research Method

Spatial characteristic of annual maximum hourly rainfall is analyzed using correlation coefficient among hourly rainfall data series during one day with the same period. The hourly rainfall data series of one rainfall station contain annual maximum hourly rainfall is chosen as centre and it is correlated to data series of neighboring stations.

The weak and strong relationship between X station and Y station data series is measured by correlation coefficient as follows:

$$r(X,Y) = \frac{\sum_{i=1}^{n}(X - \bar{X})(Y - \bar{Y})}{\{(\sum_{i=1}^{n}(X - \bar{X})^2)(\sum_{i=1}^{n}(Y - \bar{Y})^2)\}}$$

Where:

$r(X,Y)$: correlation coefficient X and Y data series

X,Y : data series X and Y

$\bar{X},\bar{Y}$: average rainfall data for X and Y data series

n : the number of data

Correlation coefficient is expressed with range from -1 to +1, the value of 0 give a meaning that there is no any correlation between two series data. In this study, correlation coefficient greater then and same with 0.7 is assumed having strong correlation among rainfall stations (Mulyantari and Triweko, 2009).

The spatial characteristic of annual maximum hourly rainfall consist of two categories, these are local and regional characteristic (Mulyantari and Triweko, 2009). Local rainfall can be described as rainfall that occurs in narrow area and measured only in one rainfall station. It ,means that this rainfall station does not have any correlation or weak correlation with neighboring stations which correlation coefficient is smaller than 0.7. Regional characteristic can be divided by two type, these are Symmetrical Regional Rainfall and Asymmetrical Regional Rainfall. Symmetrical

characteristic occurs in large area having the shape of circle with coefficient correlation greater than or same with 0.7. On the other hand, Asymmetrical Regional occurs in large area too, but there is probably no rainfall in the closest rainfall stations with correlation coefficient smaller than 0.7.

Temporal characteristic of annual maximum hourly rainfall is examined by frequency analyzed occurrence in the wet and dry season both in highland and lowland area. Correlation analyses is done with regional approach, when the closer station have negative coefficient and the further station with the same direction having positive coefficient, so both stations should be neglected although one of them having high positive coefficient.

3. Result and Discussion

3.1 Rainfall Stations

The total of rainfall station in the study area is 19 stations, which in this study only mentioned 12 stations as shown in Table 1. The elevation of each station is between 27 above mean sea level at Met-21 Reclamation Area until 4270 above mean sea level at MBB Menado Batu Bersih.

The distance and difference elevation between each station are shown in Table 2 and 3, respectively. The farthest distance is 90 km and the shortest is 2 km, with the highest different elevation is 4300 m and the lowest is 13 m.

Table 1. Rainfall Station at study area

No	Stations ID	Location	South	East	Elevation (Meter)	Start on
1	**Met 12**	Dispatch Tower Mine	4°04'5.7"	137°06'50.04"	4109	17-Sep-98
5	**Met 2**	Ridge Camp	4°06'38.0"	137°05'55.8"	2410	18-Jan-91
8	**Met 7**	Mile 50	4°17'06.6"	137°00'41.5"	617	01-Jan-92
9	**Met 8**	Port Site	4°49'44.5"	136°50'28.2"	14	01-Jan-93
10	**Met 11**	Kuala Kencana	4°24'27"	136°51'23"	67	18-Feb-95
11	**Met 21**	Reclamation Area	4°37'05.7"	136°54'27.8"	27	14-Jul-97
12	**CST_01**	Carstensz			4050	19-May-04
13	**GBT_01**	GBT			3702	29-Apr-04
14	**HTR_01**	Heatroad			3755	19-May-04
15	**KTK_01**	Koteka Besar			4145	01-Jul-04

16	MBB_01	Menado Batu Bersih	4270	18-May-04
17	SBY-01	Surabaya	4000	19-May-04

Table 2. Distance between each stations in

	1-MET	5-MET	8-MET	9-MET	10-MET	11-MET	12-CST	13-GBT	14-HTR	15-KTK	16-MBB	17-SBY
1-MET		4.97	26.55	89.42	47.18	65.00	1.89	1.51	0.79	3.02	3.74	2.52
5-MET			27.40	90.01	48.40	65.62	1.18	1.73	3.02	4.95	5.07	3.25
8-MET				63.05	21.90	38.60	28.06	25.81	26.15	27.69	29.36	28.98
9-MET					46.65	24.45	90.80	88.54	89.09	90.73	92.39	91.90
10-MET						24.02	48.88	46.71	46.64	47.65	49.37	49.41
11-MET							66.39	64.13	64.65	66.28	67.94	67.47
12-CST								2.26	2.64	4.04	3.94	2.08
13-GBT									2.01	4.51	5.21	3.76
14-HTR										2.58	3.64	2.83
15-KTK											1.72	2.58
16-MBB												1.91

Table 3. Difference elevation between each station

	1-MET	5-MET	8-MET	9-MET	10-MET	11-MET	12-CST	13-GBT	14-HTR	15-KTK	16-MBB	17-SBY
1-MET		1699	3492	4095	4042	4082	59	407	354	36	161	109
5-MET			1793	2343	2383	1640	1292	1345	1735	1860	1590	2410
8-MET				603	550	590	3433	3085	3138	3528	3653	3383
9-MET					53	13	4036	3688	3741	4131	4256	3986
10-MET						40	3983	3635	3688	4078	4203	3933
11-MET							4023	3675	3728	4118	4243	3973
12-CST								348	295	95	220	50
13-GBT									53	443	568	298
14-HTR										390	515	245
15-KTK											125	145
16-MBB												270

3.2 Correlation analysis

The total length of recorded data for all station is 48 years with average length is 4 years in every station. This analysis is executed by choosing one station as a center of station groups in surroundings area. The average correlation coefficient and standard deviation each station is shown in Table 4 and 5, respectively.

Table 4. Average correlation coefficient between each station (2004-2009)

	1-MET	5-MET	8-MET	9-MET	10-MET	11-MET	12-CST	13-GBT	14-HTR	15-KTK	16-MBB	17-SBY
1-MET												
5-MET	0.45											
8-MET	0.12	0.22										
9-MET	0.02	0.04	0.02									
10-MET	0.07	0.14	0.17	0.10								
11-MET	0.04	0.08	0.06	0.29	0.17							
12-CST	0.78	0.54	0.13	0.01	0.09	0.03						
13-GBT	0.74	0.68	0.18	0.03	0.11	0.04	0.76					
14-HTR	0.83	0.63	0.16	0.03	0.10	0.04	0.81	0.83				
15-KTK	0.73	0.53	0.13	0.02	0.08	0.02	0.80	0.70	0.82			
16-MBB	0.55	0.39	0.12	0.02	0.08	0.02	0.63	0.51	0.61	0.01		
17-SBY	0.63	0.39	0.10	0.01	0.04	0.01	0.69	0.55	0.66	-0.02	0.72	

Table 5. Standard deviation correlation coefficient between each station (2004-2009)

	1-MET	5-MET	8-MET	9-MET	10-MET	11-MET	12-CST	13-GBT	14-HTR	15-KTK	16-MBB	17-SBY
1-MET												
5-MET	0.239											
8-MET	0.049	0.022										
9-MET	0.016	0.011	0.008									
10-MET	0.042	0.022	0.020	0.015								
11-MET	0.019	0.012	0.042	0.095	0.089							

12-CST	0.24	0.02	0.01	0.02	0.01	0.03					
	8	6	7	3	9	2					
13-GBT	0.21	0.03	0.02	0.02	0.00	0.02	0.03				
	7	7	5	2	8	8	4				
14-HTR	0.23	0.03	0.02	0.02	0.01	0.03	0.03	0.02			
	4	6	3	4	6	4	1	0			
15-KTK	0.24	0.06	0.01	0.02	0.01	0.04	0.03	0.07	0.06		
	9	6	2	1	4	1	3	2	0		
16-MBB	0.20	0.03	0.01	0.02	0.01	0.02	0.03	0.01	0.01	0.03	
	4	9	4	6	4	4	5	7	2	6	
17-SBY	0.21	0.03	0.01	0.01	0.04	0.02	0.09	0.07	0.06	0.05	0.08
	7	4	4	9	0	2	5	3	9	2	4

The result shows that the farthest distance having strong correlation reach 5 km, the closest distance is 1 km and the average distance is 2,5 km, such as shown in Figure 2. On the other hand, the biggest difference of elevation between station is 500 m, the lowest is 10 m, and the average is 205 m, like as shown in Figure 3..

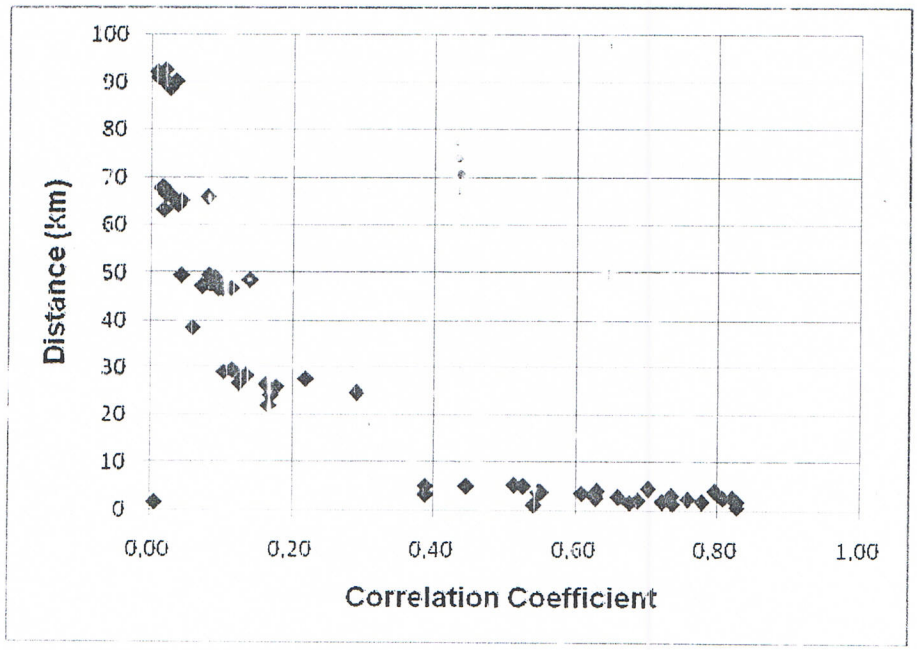

Figure 2. The relationship between distance and correlation coefficient

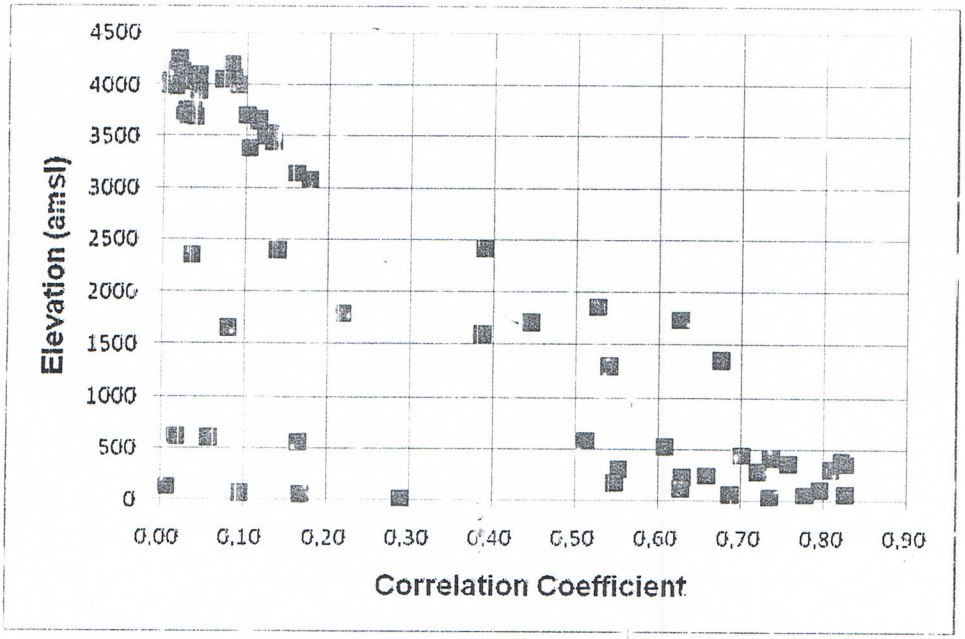

Figure 3. The relationship between elevation and correlation coefficient

3.3 Discussion

The result of this analysis indicates that there is no relationship both between distance and correlation coefficient and difference of elevation and correlation coefficient. In the other word, there is no guarantee that closer distance and elevation will give strong correlation and the farther distance will give weak correlation. The result is correlation between average data series with neighboring station, which is illustrated in Figure 2 and 3. This figures show that there is no relationship between distance and correlation coefficient; the closer distance contain small value and the opposite of this, the farther distance getting high value nearly one.

From the above analysis, it can be said that a close distance will have strong correlation, while a far distance will have weak correlation. The strong correlation will occur at highland area, while the weak correlation will occur at lowland area.

4. Conclusions

a. It is difficult to found the wet season and dry season in the highland

area, while it could be found in the lowland area.

b. The most dominant characteristic of the annual maximum hourly rainfall in highland area is Regional Rainfall, while in the lowland area is local rainfall.
c. There is no strong correlation between distance and correlation coefficient. The result shows that the farthest distance having strong correlation reach 5 km, the closest distance is 1 km and the average distance is 2,5 km.
d. From the analysis of annual maximum hourly rainfall data series per year, it was not found an indication of the trend.

5. Acknowledgement

The authors would like to express their gratitude to the PT Freeport Indonesia for providing data and Budhi Kuswan Susilo, ST., MT. for informal discussion.

6. References

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PERTEMUAN ILMIAH TAHUNAN (PIT) XXVI HATHI

23 - 25 Oktober 2009
Banjarmasin, Kalimantan Selatan

HIMPUNAN AHLI TEKNIK HIDRAULIK INDONESIA

VISIT SOUTH KALIMANTAN 2009
PERTEMUAN ILMIAH TAHUNAN (PIT) XXVI HATHI
Banjarmasin, 23 -25 Oktober 2009

Sertifikat

diberikan kepada

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KTA : 152136

Jadual Sidang Komisi PIT XXVI HATHI Banjarmasin 23-25 Oktober 2009

Sub Tema : 1. Revitalisasi Pemanfaatan Rawa di Indonesia
Tempat : Arum Ballroom
Remark : *Reza Adhi Fajar*
Pj Ruang : *Syeh Fachrir / Kartiansyah Achmad*

Hari/Tanggal	Waktu	Sesi	Panel	Nama Pemakalah	Judul Makalah
(1)	(2)	(3)	(4)	(5)	(6)
Sabtu, 24-10-2009	10.30 - 12.30	SESI - 1	Panel - 1	L. Budi Triadi	Reposisi dan Inovasi Teknik Hidraulik Dalam Pengambangan Rawa Di Masa Depan
				H.Eddy Harsono,Ah.T	Revitalisasi Pemanfaatan Lahan Rawa Pasang Surut Dengan Penerapan Sistem Aliran Satu Arah
				Siti Fatimah	Rawa Sebagai Pengendali Banjil dan Pembersih Limbah
			Panel - 2	Oki Setyandito, Nur Yuwono, Radianta Triatmaja, Nizam, Panggua Pandin	Keseimbangan Profil Pantai Pasir Buatan
				Wati Asriningsih Pranoto, Ratna Hidayat	Kajian Sistem Irigasi Curah Pada Desa Seiengan Kecamatan Bayan, Lombok Utara, NTB
				Supriya triwiyana, Willem minggu, Endang R Alis	Peran Daerah Rawa Sekitar S.Tallo Bagi Lingkungan dan Pembangunan Kota Makassar
	13.30 - 15.00	SESI - 2	Panel - 3	Robertus Chandrawidjaja	Karakteristik Lahan Perianian Daerah Rawa (Studi Kasus Unit Barambai Kab.BATOLA Kal-Sel)
				Rony Riduan	Pengembangan Model Hidrodinamika dan Kualitas Air Untuk Perkiraan Konsentrasi Besi (Fe) Terlarut Pada Saluran Reklamasi Rawa Pasang Surut
				Reza Adhi Fajar	The Sustainable Building Construction Management on Local Wisdom For Tropical Lowland Zone in Kalimantan
			Panel - 4	Abd. Nasser Hasan, Anshari Dahlan	Pemanfaatan Rawa Sebagai Pengendali Banjir (Studi Kasus Rawa Tappareng Palisu Kabupaten Wajo)
				Syamsuddin, Zulvyah Faisal	Simulasi Fluktuasi Muka Air Tanah Di Daerah Pesisir Jeneponto
				Achmadi Partowijoto	Pengembangan dan Kajian Lahan Rawa di Pulau Sumatera dan Kalimantan

(1)	(2)	(3)	(4)	(5)	(6)
	15.30 - 17.30	SESI - 3	Panel - 5	A. Maliki, Mislan, Hj.Asniah	Pengelolaan Kolaboratif Kawasan Danau Di DAS Mahakam
				Robertus Chandrawidjaja	Memahami Pengembangan Daerah Rawa (Implikasi dari Tata Ruang Nasional)
				Supriya triwiyana, Willem Minggu, Endang R Alis	Pengaruh Sedimentasi Eksternal Terhadap Revitalisasi Rawa Asmat Papua
			Panel - 6	Herliyani Farial Agoes, Prof.Fathurrazie Shadiq	Analisis Sistem Dinamis Tata Air Pertanian Rawa Muning Kabupaten Tapin Prop Kalsel
				Muhammad Noor (Balitra)	Potensi dan Kendala Sistem Pengairan Pertanian Lahan Gambut Kalimantan Selatan
				Birendrajana, Reza Adhi Fajar	Tinjauan Implementasi Pengembangan Rawa Barito Kuala (Batola) Propinsi Kalimantan Selatan
Minggu, 25-10-2009	09.00 - 11.00	SESI - 4	Panel - 7	Ben Brahim S. Bahat, Jarot Widyoko, Free Vynou, Feri Moun Hepy	Pengelolaan Wilayah Sungai Di Indonesia (Studi Kasus Wilayah Sungai Barito)
				Deri Indrawan, Suhedi, Deni	Permodelan Genangan Banjir Dengan SIG: Studi Kasus Sungai Citarum Hulu
				Ir. A.Tommy M. Sitompul, M.Eng	Neraca SDA: Peran, Kesimpangsiuran Informasi dan Urgensi Kebijakan Sistem Informasi
			Panel - 8	Fathurrazie Shadiq, Muhammad Azhari Noor, Auliana	Studi Model Alokasi Air-Jaringan Irigasi Batang Alai (MAA-JIBA) di Kalimantan Selatan
				Herman Idrus,CES, Erni Murniati,M.Sc, Hendra Rachtono, Agus Suranto	Sistem Informasi Sumber Daya Air Perum Jasa Tirta II (SISDA PJT II) sebagai Sistem Pendukung Pengelolaan Sumber Daya Air di Satuan Wilayah Sungai Citarum
				Dian Kamila, Reza Adhi Fajar	Rehabilitasi Polder Alabio Propinsi Kalimantan Selatan

Panitia Pelaksana,

Ir. Birendrajana, MT
Ketua

Jadual Sidang Komisi PIT XXVI HATHI Banjarmasin 23-25 Oktober 2009

Sub Tema : 2. Manajemen Sistem Informasi dalam Mendukung Pengelolaan Sumber Daya Air
Tempat : Banjarmasin Room
Remark : *Novitasari*
Pj Ruang : *Adzroi*

Hari/Tanggal	Waktu	Sesi	Panel	Nama Pemakalah	Judul Makalah
(1)	(2)	(3)	(4)	(5)	(6)
Sabtu, 24-10-2009	10.30 - 12.30	SESI - 1	Panel - 1	Achmad Syarifudin. H. Hendri	Peran Serta Masyarakat Dalam Penentuan Sempadan Sungai
				Nadajadji Anwar, Mahendra Andiek M	Aplikasi Storm Water Management Model (SWMM) Untuk DAS Deluwang Situbondo Jawa Timur
				Dwi Agus Kuncoro	Penyusunan Model Alokasi Air Terpadu Dengan Software Yang Familiar Untuk Mendukung Kegiatan Rekomtek
			Panel - 2	Fatchan Nurrochmad, Ariesto Krestiadi, Joko Sujono	Analisis Prioritas Rehabilitasi Sistem Jaringan Irigasi
				Don Gaspar N. da Costa	Implikasi Aspek Pengelolaan SDA Dalam Produk Perencanaan Tata Ruang
				Mulkan Hermansyah	Diplomasi Kelautan Dan Kepentingan Indonesia Dalam Mengelola Potensi Laut Indonesia
	13.30 - 15.00	SESI - 2	Panel - 3	Lily Montarcih, L.. Arif Budi Santoso	Kesesuaian Hidrograf Satuan Sintetik (Studi Kasus Pada Sub DAS Brantas Hulu)
				Nilna Amal	Identifikasi Hidrograf Satuan Terhadap Metode Pemisalahan Aliran Dasar
				Runi Asmaranto	Kajian Tingkat Bahaya Erosi dan Arahan Fungsi Lahan pada sub DAS Roban Bangun Kabupaten Mojokerto Berbasis Sistem Informasi Geografis (SIG)
			Panel - 4	Mukhsan Putra Hatta, idris mandang, Ryan Hidayat, Anto Basry, Haris Umar	Manajemen Sistem Informasi berbasis SIG pada daerah Irigasi, Studi kasus Daerah Irigasi Cambajawaya Kabupaten Maros
				Sufrizal	Keseimbangan Air Danau Toba Terkait Dengan PLTA Asahan dan Penggunaan Lahan
				Sri Amini Yuni Astuti	Perbandingan Penggunaan Skema Implisit dan Eksplisit Pada Model Angkutan Sedimen Di Sungai

(1)	(2)	(3)	(4)	(5)	(6)
	15.30 - 17.30	SESI - 3	Panel - 5	Mislan dan MZ.Iksan	Karakteristik ENSO (Elmina dan Lanina) dan Hubungannya Dengan Curah Hujan di Samarinda
				Tania Edna Bhakty, Chairul Paotonan, Nur Yuwono, Sajiharjo, Bambang Susmono, Edgaloyn	Studi Model Fisik Kolam Pengendap Sedimen dan Peredam Gelombang Berbentuk Lingkaran Di PLTGU Cilegon
				Ussy Andawayanti dan Ery Suhartanto	Uji Rancang Bangun Alat Pengukur Tinggi Muka Air dan Debit Skala Laboratorium Dan Lapangan Sebagai Dasar Informasi Bahaya Banjir, Erosi dan Longsor
			Panel - 6	Chairul Paotonan, Tania Edna Bhakty, Oki Setyandito, Hasdinar Umar, Nizam, Tonny Syarief, Sistia B. S	Transmisi Gelombang Pada Kolam Peredam Gelombang Bentuk Bujur Sangkar dan Gaya Gelombanag Pada Pintu Intake (Studi Kasus: Permodelan Fisik 3D Saluran Intake PLTGU Cilegon)
				Ahmad Perwira Mulia Tarigan, Safari Kelana Putra	Pemanfaatan Enceng Gondok Sebagai Bahan Baku Biogas Untuk Meningkatkan Kualitas Perairan Danau Toba
				Novitasari, Nurfansyah	Tinjauan Pengembangan Pola Pemukiman Dan Pengelolaan Sempadan Sungai Martapura
Minggu, 25-10-2009	09.00 - 11.00	SESI - 4	Panel - 7	Erman Mawardi, Y. Sugimura, Ririn Rimawan	Upaya Melibatkan Masyarakat Dalam Pengendalian Daya Rusak Air S.Brankal Di Sooko Mokokerto Jawa Timur
				Konstantji Nait, Philiphi de Rozari	Monitoring Kualitas Air Kali Dendeng, Kota Kupang Menggunakan Metode Prati Indeks
				Moch. Memed, Agustin Purwanti	Evaluasi Kinerja Dalam Rangka Desain Rehabilitasi Dan Penyempurnaan Bendung Prafi
			Panel - 8	Nasrun Sidqi	Pemberdayaan Masyarakat Dalam Pengelolaan SDA Kasus Embung Tambak Boyo
				R. Toufan, Ishak Yunus	Analisis Debit Banjir Pada Kolam Retensi Simpang Polda Palembang
				Nyoman Jelun, Radianta Triatmadja, Adhi Susanto, Thomas Sri Widodo	Aplikasi Sistem Akusisi Citra Stereo Untuk Mengukur Jarak Dan Elevasi Untuk Aplikasi Bidang SDA
				SSN. Banjarsanti	Polder Dengan Spillway Samping Sebagai Alternatif Pengendali Banjir Pada DAS Sempaja

Panitia Pelaksana,

Ir. Birendrajana, MT
Ketua

Jadual Sidang Komisi PIT XXVI HATHI Banjarmasin 23-25 Oktober 2009

Sub Tema : 3. Adaptasi Pengelolaan SDA terhadap Perubahan Iklim Global di Indonesia

Tempat : Samarinda Room

Pemark : *Dewi Noviaty Azizah*

Pj Ruang : *Masrai Zulzai SN*

Hari/Tanggal	Waktu	Sesi	Panel	Nama Pemakalah	Judul Makalah
(1)	(2)	(3)	(4)	(5)	(6)
Sabtu, 24-10-2009	10.30 - 12.30	SESI - 1	Panel - 1	Anang M. Farhansyah dan Gagah Gunur Aribowo	Adaptasi Lokasi Air Akibat Indikasi Perubahan Iklim dan Kompleksitas Sistem SDA Di Wilayah Sungai Pulau Lombok (Studi Kasus Alokasi Air DAS Renggung)
				Andreas Gustiniady Ahas	Dampak Pengelolaan Air Bersih PROAIR Bagi Masyarakat NTT
				Budhi Setiawan, Edy Sutriyono, Didiek Subagio and Edi Riawan	Characterization Of Annual Maximum Daily Rainfall In Timika Region, Papua
			Panel - 2	Dede M. Sulaiman, Mahdi Erhawan	Pemacan Gelombang Ambang Rendah Berbahan Geotube Untuk Pengedalian Erosi Pantai
				Djoko Tri Kidanto	Penyebab Keruntuhan dan Penanganan Pantai Boom Tuban Jawa Timur
				Dwi Agus Kuncoro	Analisis Penentuan Masa Pemeliharaan Dan Jangka Waktu Pertanggungjawaban Atas Kegagalan Konstruksi Untuk Bendungan Pada Paska Konstruksi
	13.30 - 15.00	SESI - 2	Panel - 3	Fabian Prandani, Rosita Halim	Perlingnya Mengurangi Non-Revenue Water Sebagai Antisipasi Ketidakstabilan Ketersediaan Air Baku Akibat Climate Change
				Suprapto	Pemilihan Alternatif Armor Pada Bangunan Seawall Reklamasi Pulau Nipah Dengan Menggunakan Metode AHP
				Happy Mulya, Tiny Mananoma, Wasis Wardoyo	Mengubah Bencana Menjadi Berkah (Studi Kasus Pengendalian dan Pemanfaatan Banjir di Ambon)
			Panel - 4	Priyambono	Pengaruh Perubahan Iklim Global Terhadap Penanganan Erosi Pantai Barat Kalimantan Barat
				Andreas Gustiniady Ahas	PROAIR Mengelola Krisis Air Bersih Dengan Pendekatan Berbasis Masyarakat Di Kodi Utara - Sumba Barat Daya - NTT
				Sarwono	Pengendalian Kerusakan Lingkungan Sungai Yang Disebabkan Oleh Respon Sungai
				Chairul Paotonan, M.Arsyad Thang	Pengaruh Porositas Terhadap Gaya Gelombang Tsunami

(1)	(2)	(3)	(4)	(5)	(6)
	15.30 - 17.30	SESI - 3	Panel - 5	Soedarwoto Hadhisiswoyo	Teknik Hidraulik Masa Lalu, Kini dan Masa Datang
				Tiny Mananoma, Lambertus Tanudjaja, Alex Binilang, Happy Mulya	Kajian Manajemen Air Baku Strategi Antisipatif Terhadap Dampak Perubahann Iklim Global (Studi Kasus Kecamatan Kotabunan Sulawesi Utara)
			Panel - 6	Widandi Soetopo	Penggunaan Program Dinamikk Pada Optimasi Operasi Waduk Dengan Batasan Pelestarian Lingkungan
				Suwarno Hardjo Padijo; Kusairi Saleh	Adaptasi Pengeloaan SDA Terhadap Dampak Pemanasan Global (Kekeringan dan Banjir)
				Devizar, Masimin, Zouhrawaty A. Ariff, Ziana	Prediksi Banjir Musiman Terhadap Titik Posisi Matahari Di Aceh
Minggu, 25-10-2009	09.00 - 11.00	SESI - 4	Panel - 7	Masimin	The structure of 1-day temporal storm pattern within the design storms
				Hidayati, A.Perwira Mulia Tarigan	Pengelolaan Sungai Deli dan Sungai Belawan Dalam Paradigma Adaptasi dan Mitigasi
				Juliastuti, Wisnu Subarkah	Tantangan Eran Globalisasi Pemanfaatan Sistem Informasi Manajemen Untuk Mengelola Daerah Irigasi Di Indonesia
			Panel - 8	Melly Lukman, Eko Susanto	Studi Perbandingan Berbagai Model Distribusi Peluang Hujan Dalam Upaya Mengantisipasi Perubahan Iklim Global
				Nur Yuwono, Nizam, Oki Setyandito, Any Nurhasanah, Tony Syarief, Sajiharjo, Bambang Susmono, Sistia B S	Studi Model Fisik 2D Peredam Gelombang Saluran Intake PLTGU Cilegon
				Radianta Triatmadja, Any Nurhasanah	Pengaruh Porositas Terhadap Gaya Gelombang Tsunami

Panitia Pelaksana,

Ir. Birendrajana, MT
Ketua