PROGRAM BOOK

The 7th Annual Meeting of the Indonesian Association of Groundwater Experts (PAAI)-8th Asia Pacific Coastal Aquifer Management Meeting (APCAMM)

"Resilient Coastal Aquifer Management in Tropical Regions: Adapting to Climate Change and Urbanization"

Bandung 4 - 6 August 2025
BKAT Jakarta 7 August 2025,
Indonesia

Sponsored by :

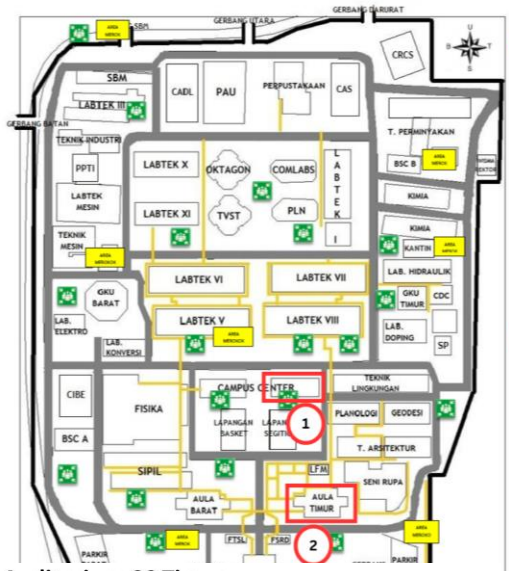
The 7th Annual Meeting of the Indonesian Association of Groundwater Experts (PAAI)-8th Asia Pacific Coastal Aquifer Management Meeting (APCAMM)

"Resilient Coastal Aquifer Management in Tropical Regions: Adapting to Climate Change and Urbanization"

PAAI
Bandung 4 - 6 August 2025 and BKAT Jakarta 7 August 2025, Indonesia

Venue Map

The joint APCAMM-PAAI meeting will be held in the Bandung geoscience hub and serves as a center for Institute of Technology (ITB), Jalan Ganesha no.10, Bandung City. Bandung, the capital of West Java Province, is renowned as Indonesia's academics and government agencies focused on groundwater management, making it an ideal location to host this joint APCAMM- Indonesian Groundwater Experts (PAAI) meeting. The venue location is the East Campus Center, ITB, equipped with a main auditorium, parallel meeting rooms for workshops and technical sessions, and a large entrance area for poster presentation.



1 East Campus Center (CC Timur)

2 East Halll (Aula Timur)

Auditorium CC Timur

Galeri CC Timur

Meeting Room CC Timur

Program Schedule

Workshop – Pre Event

Monday, August 4th 2025

Time	Agenda		
06.00-08.00	Preparation		
08.00-09.00	Workshop Registration		
09.00-10.00	Parallel Workshops		
	Workshop on Coastal Flood Modeling **Speakers:** 1. Dr. Edi RIawan 2. Dr. Eng Fikry Purwa Lugina 3. Dr.Eng. Faruq Khadami 4. Dr. Irwan Gumilar	**Introduction to Groundwater Modeling** **Speakers:** 1. Prof. Lilik Eko Widodo 2. Berry Casanova, M.T	**Environmental Hydrogeology in Energy and Mineral Industry** **Speakers:** 1. Prof Lambok M. Hutasoit 2. Irwan Iskandar, Ph.D 3. Riostantieka M. Shoedarto, Ph.D
	Understanding Land Subsidence	Groundwater model in problem solving cycle and Groundwater modeling basics	Environmental Impact Assessment, Regulations, and International Standards for Environmental Governance in the Energy and Mineral Industry
10.00-10.15	Coffee Break		
10.15-12.00	Predicting the Impact of Sea Level Rise	Illustrative simple 1D case using free AI and using software	Preparation of Technical Planning Documents for Industrial and Mine Wastewater and GW Management
12.00-13.00	Lunch and Prayer Time		

13.00-14.00	Analyzing Extreme Rainfall Events	Study Case	Geochemical and Isotopic Techniques for Environmental HG: Applications in Tracing, Monitoring, and Contaminant Source Identification
14.00-14.15	Coffee Break		
14.15-16.00	Case Study: Coastal Flooding in North Jakarta	Study Case	Geochemical and Isotopic Techniques for Environmental HG: Applications in Tracing, Monitoring, and Contaminant Source Identification

Main Event

Tuesday, August 5th 2025

Time	Agenda	Parallel Event
06.00-08.00	Preparation	
08.00-08.30	Registration	
08.30-09.00	**Opening:** 1. Indonesian National Anthem 2. Prayer (Doa) 3. Screening of a video on the history of groundwater utilization in Indonesia	
09.00-09.05	**Chairperson Report:** Dr. Dwi Sarah (BRIN)	
09.05-09.10	**Welcoming Speech from PAAI Chairman:** Irwan Iskandar, Ph.D (PAAI)	
09.10-09.40	**Keynote Speech:** **Keynote Speech 1:** Ministry of Energy and Mineral Resources, ESDM **Keynote Speech 2:** ITB Representative (Rector)	
09.40-09.45	Group Photo session	
09.45-10.00	Coffee Break	Press Conference

10.00-12.00	**Panel Discussion:** (Auditorium East Campus Center) Resilient Coastal Aquifer Management in Tropical Regions: Adapting to Climate Change and Urbanization **Moderator:** Anggita Agustin (Jacobs) **Presenter:** a. Prof. Heru Hendrayana (UGM) b. Prof. Hendarmawan (UNPAD) c. Prof Adrian Werner (Flinders University - Australia) **Panelist:** ● A coastal hydrogeologist/researcher (APCAMM) ● Representative from a coastal local government ● Expert in groundwater-surface water interaction or seawater intrusion ● NGO or community representative working on water access ● Policy expert or planner on integrated coastal management	**Keypoint Discussion:** 1. **Assessing the Impacts of Climate Change on Coastal Aquifer Recharge and Salinization** Explore how sea-level rise, extreme weather, and changing rainfall patterns affect freshwater availability and saltwater intrusion in tropical coastal aquifers. 2. **Urbanization Pressures: Land Use Change, Over-extraction, and Pollution Risks** Discuss how rapid urban expansion affects recharge areas, increases water demand, and exacerbates contamination risks from domestic and industrial sources. 3. **Integrated Coastal Zone and Aquifer Management Approaches** Promote cross-sector collaboration between water resource managers, urban planners, and coastal ecosystem stakeholders to ensure sustainable groundwater use. 4. **Nature-based and Technological Solutions for Aquifer Resilience** Evaluate options such as Managed Aquifer Recharge (MAR), green infrastructure, and smart monitoring systems to enhance resilience against climate and anthropogenic stressors.
12.00-13.00	Lunch and Prayer Time	

13.00-17.00	**Parallel Session 1:** Room 1 (Auditorium East Campus Center (CC))	**Parallel Session 1:** Room 2 (East CC Gallery)	**Parallel Session 1:** Room 3 (2nd Floor East CC)	**Parallel Session 2** (2 Groups) : Room 4 & 5 (East Hall)
18.00-20.00	Ice Breaking for All Participants			

Wednesday, August 6th 2025

Time	Agenda	Parallel Event	
06.00-07.30	Preparation		
07.30-08.00	Registration		
08.00-10.00	**Parallel Session 3:** Room 1 (Auditorium East CC)	**Parallel Session 3:** Room 2 (East CC Gallery)	**Parallel Session 3:** Room 3 (2nd Floor East CC)
10.00-10.15	Coffee Break		
10.15-12.00	**Continuation Parallel Session 3:** Room 1 (Auditorium East CC)	**Continuation Parallel Session 3:** Room 2 (East CC Gallery)	**Continuation Parallel Session 3:** Room 3 (2nd Floor East CC)
12.00-13.00	Lunch and Prayer Time		
13.00-13.15	**Industrial Representatives for Groundwater Society Remarks** (Auditorium East Campus Center)		
13.15-15.15	**Panel Discussion:** (Auditorium East Campus Center) Discussion Forum on Coastal Groundwater Management in the Asia-Pacific	**Keypoint Discussion:** 1. **Regional Hydrogeological Diversity and Common Challenges** Identify shared and unique coastal groundwater issues across Asia-Pacific nations, including salinization, over-extraction, and climate vulnerability in different island and continental settings.	

	Moderator: Dr.Sci. Rachmat Fajar Lubis (BRIN) **Presenter:** a. Prof. Jiu Jimmy Jiao (Hongkong University - Hongkong) b. Yongcheol Kim (Korea Institute of Geoscience and Mineral Resources) c. Ir. Agus Cahyono Adi, M.T. (ESDM - Indonesia) **Panelist:** ● Industry ● University ● A coastal hydrogeologist/researcher (APCAMM) ● Representative from a coastal local government ● Expert in groundwater-surface water interaction or seawater intrusion ● NGO or community representative working on water access ● Policy expert or planner on integrated coastal management	**2. Trans-boundary and Island-specific Groundwater Governance** Discuss the complexities of managing shared coastal aquifers and the specific challenges faced by small island developing states (SIDS) in ensuring water security. **3. Climate Change Adaptation and Disaster Risk Reduction Strategies** Explore proactive measures to address sea-level rise, saltwater intrusion, and extreme weather impacts on coastal aquifers in the region. **4. Innovations and Best Practices in Sustainable Groundwater Use** Highlight successful examples of Managed Aquifer Recharge (MAR), low-impact urban development, and traditional water management systems adapted for coastal settings. **5. Capacity Building, Policy Integration, and Regional Cooperation** Emphasize the need for strengthening institutional capacity, harmonizing policies, and fostering knowledge exchange among Asia-Pacific countries for effective coastal groundwater management.
15.15-15.30	Coffee Break	
15.30-16.15	Announcement for Best Presenter and Best Poster	
16.15 -16.30	Fieldtrip Announcement	

Fieldtrip

Thursday, August 7th 2025

Time	Event	Remarks
06.30-09.30	Heading to Jakarta from ITB Bandung	
09.30-11.45	Visiting JICA extensometer and “tanggul laut”	Extensometer data presentation and visiting land subsidence evidence
11.45-12.00	Heading PIK Mangrove	
12.00-13.30	PIK Mangrove	Lunch break and Presenting mangrove area
13.30-13.45	Heading to Museum Bahari	
13.45-14.40	Discuss at Museum Bahari	Land Subsidence Evidence (Menara Bahari) and visiting Museum Bahari.
14.40-15.00	Heading to BKAT	
15.00-17.00	Discuss at BKAT	Data Presentation and visiting groundwater monitoring facility at BKAT + Coffee Break
17.00-20.00	Heading to Bandung (Only for those who want to go to Bandung)	

Presentation Schedule

Tuesday, August 5th 2025

ROOM 1 (EAST CC AUDITORIUM)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
13.00 - 13.15	1	**Asep Irwan** Asep Irwan, Arif Bagas Kesuma, Mulyadi Maulana	Implications of Land Subsidence on Groundwater in The Northern Coastal Region of West Java	C. Sustainable practices, policies and finance for water resilience in the coastal regions	1
13.15 - 13.30	2	**Budi Joko Purnomo** Budi Joko Purnomo and Fikra Talenta Sada	Groundwater Recharge Area: Bridging Technical Aspect and Policy	C. Sustainable practices, policies and finance for water resilience in the coastal regions	
13.30 - 13.45	3	**Dendi Borneo Putra** Dendi Borneo Putra, Taat Setiawan, Enda Mora Nasution, Donny P. Simorangkir, Sitti Sofia Wahida	The Impact of Technical Recommendations for Groundwater Utilization Permits on Changes in Confined Groundwater Levels in The Jakarta Groundwater Basin (2018–2022 Period)	C. Sustainable practices, policies and finance for water resilience in the coastal regions	
13.45 - 14.00	4	**Saut Aritua Hasiholan Sagala** Saut Sagala, Rahastuti Tiara Adysti, Iqbal Hafizhul Lisan, Alifa Zalfa Poetry Wicaksono, Edi Riawan	Toward Water Resilience: Rethinking Clean Water Management in Coastal Communities within Informal Settlement of North Jakarta, Indonesia	C. Sustainable practices, policies and finance for water resilience in the coastal regions	
14.00 - 14.15	5	**Wahyudin** Wahyudin, Budi Joko, Fajar Dwinanto, and Ayu Fadhilah	The Historical Trajectory of Groundwater in Indonesia and Its Challenges	C. Sustainable practices, policies and finance for water resilience in the coastal regions	
14.15 - 14.30	6	**Norman Arif Muhammad** Norman Arif Muhammad, Andre Putra Arifin, Kartika Dirayati	Detecting groundwater storage decline in Java Island using GRACE and GLDAS datasets (2002–2017)	K. Remote sensing and artificial intelligence application on hydrogeology	
14.30 - 14.45	**COFFEE BREAK**				
14.45 - 15.00	7	**Firman Maliki**	Determination of Recharge, Transition, and Discharge Area Based on Water Level vs Well Depth Diagram on Palu Groundwater Basin	I. Research and case studies of groundwater in urban areas, extractive industries, conservation measures	1

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
15.00 - 15.15	8	**Intining** Intining and Ryan Dzulfiqar Ahmad	Hydrogeological Characterization of Confined Groundwater in Padang City, West Sumatera Province	I. Research and case studies of groundwater in urban areas, extractive industries, conservation measures	
15.15 - 15.30	9	**Munib** Dasapta Erwin Irawan, Munib Ikhwatun Iman, Agus Mochamad Ramdhan, Ahmad Darul	Spatial Evaluation of the Bandung-Soreang Groundwater Conservation Zone 2024	I. Research and case studies of groundwater in urban areas, extractive industries, conservation measures	
15.30 - 15.45	10	**Sugiarto Badaruddin** Sugiarto Badaruddin, Haeril Abdi Hasanuddin, Nur Adilla, and Asnawi Suhana Yunus	Groundwater Contamination Modeling and Pumping-Based Remediation of Landfill Leachate: A Case Study in Makassar, Indonesia	I. Research and case studies of groundwater in urban areas, extractive industries, conservation measures	
15.45 - 16.00	11				
16.00 - 17.00	**POSTER SESSION**				

Tuesday, August 5th 2025

ROOM 2 (EAST CC GALLERY)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
13.00 - 13.15	1	**Bayu Nugraha** Bayu Nugraha, Naufal Fajar Revanda, Muhammad Ghozi	Assessing Salinity Dynamics and Carbon Emissions in Peatlands: A Conceptual Model of Freshwater–Saltwater Interactions	E. Groundwater-surface water interaction	2
13.15 - 13.30	2	**Dr. Suryansyah Surahman, S.P., M.Si** Suryansyah Surahman, Andi Widiasari Maruddani, Gilang Bayu Prawira	Water, Land, and Food: A SWAT-Based Approach to Sustainable Resource Management in Tanralili Sub Watershed South Sulawesi	E. Groundwater-surface water interaction	
13.30 - 13.45	3	**Le Viet Hung** Viet-Hung Le, Quoc-Cuong Tran, Thanh-Tam Vu, Okke Batelaan, Quy-Nhan Pham	Factors controlling land subsidence in the Southern Hau River Region, Vietnam	E. Groundwater-surface water interaction	
13.45 - 14.00	4	**Faza Haniyah Firstrizanda** Faza Haniyah Firstrizanda, Edi Riawan	Estimation of Groundwater Extraction in the Bandung Basin Based on Surface Water and Withdrawals by Communities and Industries	E. Groundwater-surface water interaction	
14.00 - 14.15	5	**ZUO JINCHAO** Zuo Jinchao, Luo Xin, Jiao Jimmy Jiujiu	From SGD to LGD: A brief review in China	E. Groundwater-surface water interaction	
14.15 - 14.30	6	**Agah Drajat Garnadi**	Generative AI for 2D Geoelectric Imaging Forward Model	J. Advanced technology on hydrogeology	
14.30 - 14.45	**COFFEE BREAK**				
14.45 - 15.00	7	**Yang Tao** Tao Yang, Jiu Jimmy Jiao, Rong Mao, Jiawei Liang, Guodong Chen	3D Groundwater Flow Modeling and Hydrogeological Evaluation of Tunnel Drainage Systems: A Case Study of the Poshan Tunnel	G. Groundwater management in infrastructure project and geotechnical issues	2

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
15.00 - 15.15	8	**Charles Hanock Haniel Paiki S.T.** Charles Paiki, Yan Adhitya Wesda Wardhana, Andre Putra Arifin, Akhmad Yusron, Dipta Alfian R, Nur Alzair, Erikha M. Mayzarah	Analysis of Suspected Aquifer Distribution at the Planned Administrative Office Area of the Newly Established South Papua Province (DOB) in KTM Salor, Salor Indah Village, Kurik District, Merauke Regency, South Papua Province	G. Groundwater management in infrastructure project and geotechnical issues	
15.15 - 15.30	9	**Isyraq zakir** Isryaq Zakir, Jossi Erwindy, Yan Adhitya W.W., Arif Rahmat M., Andre P.A., Yudi Khardiman, Maulana G.A., Dipta Alfian, Dewi Shinta R.	Lithological Characterization of the Main and Borrow Areas Using 2D Geoelectrical Method: Implications for the Jatinegara Dam Planning	G. Groundwater management in infrastructure project and geotechnical issues	
15.30 - 15.45	10	**Jiu Jimmy Jiao**	Urban Construction and Coastal Groundwater Systems: Impacts on Hillslope Stability and Landslide Risk	G. Groundwater management in infrastructure project and geotechnical issues	
15.45 - 16.00	11	**Muhammad Najib** Muhammad Najib; Agathon Chandra; Eko Purwanto	Integration of Subdrain System, Hydrogeological Monitoring and Geotechnical Monitoring for Stability Control of the Partolang Waste Dump	G. Groundwater management in infrastructure project and geotechnical issues	
16.00 - 17.00	**POSTER SESSION**				

Tuesday, August 5th 2025

ROOM 3 (Meeting Room East CC 2nd floor)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
13.00 - 13.15	1	**Adam Maulana** Adam Maulana, Mohamad Sapari Dwi Hadian, Adi Haryono	Analysis of Groundwater Vulnerability using The Drastic Method in the Quarry X Area of PT Y	F. Groundwater quality and pollution	3
13.15 - 13.30	2	**Annisa Nurisma** Annisa Nurisma, Fahira A. Ramadhani, Arief Nur Muchamad	Potential Groundwater Pollution Based on Hydrochemical Analysis in Jatisari Village, Bandung	F. Groundwater quality and pollution	
13.30 - 13.45	3	**Arief Nur Muchamad** Arief Nur Muchamad, Anissa Fatma Fadilah, Nilam Sari, Adila Nur Salma	Geochemistry evolution processes and driving mechanisms of groundwater contamination in the Eastern Bandung region, Indonesia	F. Groundwater quality and pollution	
13.45 - 14.00	4	**Arif Susanto** Arif Susanto, Muhammad Sultoni, Dasapta Erwin Irawan	Characterization of Groundwater Using Hydrogeological Survey, Geoelectrical Methods, and Drilling in Tumpangkrasak, Kudus	F. Groundwater quality and pollution	
14.00 - 14.15	5	**Fildzah Ayunda**	Evaluating the Cost and Environmental Risk of Tailings Placement Methods at Gold Mining in Sulawesi, Indonesia	F. Groundwater quality and pollution	
14.15 - 14.30	6	**Brenda Aulia Valleiryna** Brenda Aulia Valleiryna, Taddeus Arnold Suwargatama, Muhammad Ghozi, Bayu Nugraha	Impacts of Anthropogenic and Urbanization on Water Quality in Groundwater: A Review Study	F. Groundwater quality and pollution	
14.30 - 14.45	**COFFEE BREAK**				
14.45 - 15.00	7	**Emanuel Grace Manek** Emanuel Grace Manek, Doni Prakasa Eka Putra, Heru Hendrayana	Conventional Pumping Remediation Modeling in the Case of Fuel Pollution in the Groundwater of Tugu Station, Yogyakarta, Indonesia	F. Groundwater quality and pollution	3

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
15.00 - 15.15	8	**Faizal Abdillah** Faizal Abdillah, Ricky Nelson Tambunan, Janice Clementine da Costa, Kemala Wijayanti, Irwan Iskandar	Hydrogeochemical Interaction between Water and Rock from CO_2 Injection in a Tailing Storage Facility Model	F. Groundwater quality and pollution	
15.15 - 15.30	9	**Fattah Ghiffari** M.K Agung Aristo; Fattah Ghiffari; Ignatius Wily Virman; Shofiudin Mochamad; Asri Wulandari	Comparative Study of Hydrogeochemistry and Physical Characteristics in the Geothermal Tourism Areas of Banyu Panas Gempol–Palimanan and Mount Tangkuban Perahu	F. Groundwater quality and pollution	
15.30 - 15.45	10	**Yan ZHANG** Yan ZHANG; Cheng XING; Yi LIU	The Composition and Pollutant Interception of Iron Minerals in Sandy Coastal Aquifers	D. Environmental hydrogeology in various geological settings	
15.45 - 16.00	11	**Janice Clementine da Costa** Janice Clementine da Costa, Irwan Iskandar	Lateritic Nickel Ore – Rainwater Interaction: The Formation of Cr(VI) in Lateritic Nickel Mine	F. Groundwater quality and pollution	
16.00 - 17.00	**POSTER SESSION**				

Tuesday, August 5th 2025

ROOM 4 (EAST HALL ITB)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
13.00 - 13.15	1	**Medina Dwi Andriani** Medina Dwi Andriani, Erika Herliana, Arief Nur Muchamad	The Potential Impact of Leachate Contamination on Groundwater Quality Around the Inactive Jelekong Landfill, Bandung Regency	F. Groundwater quality and pollution	4
13.15 - 13.30	2	**Nillam Sari Priangan** Nillam Sari Priangan, Gede H Cahyana, Arief Nur Muchamad	Modeling of Groundwater Flow and Groundwater Quality Based on Visual Modflow Flex in Panyileukan District, Bandung City	F. Groundwater quality and pollution	
13.30 - 13.45	3	**Nur fatikha** Nur Fatikha, Damar Sayyidina Zulfi, Bayu Nugraha, Naufal Fajar Revanda	Overview of Groundwater Vulnerability with DRASTIC Method in Bandung-Soreang Groundwater Basin, West Java	F. Groundwater quality and pollution	
13.45 - 14.00	4	**Prayoga Satyagraha Kombara** Prayoga Satyagraha Kombara, Mohamad Sapari Dwi Hadian, Mochamad Nurisyam Barkah	Aquifer Geometry Model Approach for Identification of Hydrogeologic Conditions and Simulation of Groundwater Pollution in the City of Bandung	F. Groundwater quality and pollution	
14.00 - 14.15	5	**Savikri Misbahul Umar** Savikri Misbahul Umar, Narulita Santi	Analysis of Groundwater Quality of Confined Aquifer in Semarang City Based on Chemical, Biological and Stable Isotope Factors	F. Groundwater quality and pollution	
14.15 - 14.30	6	**Tantowi Eko Prayogi** Tantowi Eko Prayogi, Taat Setiawan, Sitti Sofia Wahida, Faizal Abdillah, Hirundini Rustica Absari, Tias Febriana Hanifa Lestari, Shabrina Maulida Agustine	Spatial and Temporal Dynamics of Groundwater Salinity in the Unconfined Aquifer of Northern Jakarta Groundwater Basin	F. Groundwater quality and pollution	
14.30 - 14.45	**COFFEE BREAK**				

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
14.45 - 15.00	7	**Wirandika Mayzzani Hadiana**	Modeling Arsenic Contaminant Transport in the Unsaturated Zone Using Visual MODFLOW at Tailings Site of a Gold Mine	F. Groundwater quality and pollution	4
15.00 - 15.15	8	**Yi Liu** Hongkai Qi, Yi Liu*, Haoran Wang, Xingxing Kuang, Jiu Jimmy Jiao Jianping Gan	Carbonate Weathering Enhances Nitrogen Assimilatory Uptake in Rivers Globally	D. Environmental hydrogeology in various geological settings	
15.15 - 15.30	9	**Zulis Septian** Zulis Septian, Irwan Iskandar	Hydrogeochemical Characterization and Tracer Investigation of Sinkholes Systems	D. Environmental hydrogeology in various geological settings	
15.30 - 15.45	10	**Risma Nurulfallah** Risma Nurulfalah Saepulloh, Firman Malik	Hydrochemical Characteristics of the Pekanbaru Groundwater Basin, Riau Province	D. Environmental hydrogeology in various geological settings	
15.45 - 16.00	11	**Dan Ramadhan Achmad** Dan Ramadhan Achmad, Amsor, Edi Yulindra, Karlan Rusmana, Erik Hermawan, Riri Febrina	Identifying Hydrocarbon Contamination in Unconfined Aquifers with Implementation of 2D Geoelectric Method: Case Study in Minas Area, Siak Regency, Riau Province	D. Environmental hydrogeology in various geological settings	
16.00 - 17.00	**POSTER SESSION**				

Tuesday, August 5th 2025

ROOM 5 (EAST HALL ITB)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
13.00 - 13.15	1	**Dede Nurohim** Dede Nurohim, Budhi Setiawan	Groundwater Management Strategy as Mitigation of Agricultural Land Drought Hazards on the North Coast of Indramayu Regency	H. Groundwater and drought	5
13.15 - 13.30	2	**Dennis Fahriansyah** Dennis Fahriansyah, Yudhi Listiawan, Janner Rahmat Sudianto, Hendarmawan	Spatial Distribution of Groundwater Level Decline in Unconfined and Confined Aquifer of Jakarta, Indonesia	H. Groundwater and drought	
13.30 - 13.45	3	**Ignatius Wily Virman** Ignatius Wily Virman, Muh. Altin Massinai, Syamsuddin, Virman	Identification of Aquifer Zones Using the Geoelectrical Resistivity Method in Vim Subdistrict, Jayapura City	H. Groundwater and drought	
13.45 - 14.00	4	**Lalang Satrian Wiraputra** Lalang Satrian Wiraputra, Mohamad Sapari Dwi Hadian, Mochamad Nurisyam Barkah	Aquifer Geometry Modeling and Simulation of Groundwater Level Decline in Unconfined Aquifer of Bandung City, Indonesia	H. Groundwater and drought	
14.00 - 14.15	5	**Muhammad Ilham Haerik** M. Ilham Haerik, Zulham Ammar, Zainab Sausan, Bagus Firmansyah	Aquifer Characterization Using Multi-Point Geoelectric Data for Raw Water Well Planning in Rural Areas: A Case Study of Maiwa District Enrekang Regency, South Sulawesi Province	H. Groundwater and drought	
14.15 - 14.30	6	**Nur Alifah** Nur Alifah, Muhammad Rifqi Irshad, Naufal Fajar Revanda, Bayu Nugraha, Irgi Bintang Pamungkas, Damar Sayyidina Zulfi	Analysis of the Impact of El Niño on Groundwater Quantity around the Equatorial Region of Indonesia, Case Study: Central Kalimantan	H. Groundwater and drought	
14.30 - 14.45	**COFFEE BREAK**				
14.45 - 15.00	7	**Rafi Pandu Widyadhana** Rafi Pandu Widyadhana, Ricky Pratama Ferdiansyah, Nesya Hasna Muslimah, Dandy Setya Valiano	Analysis of Water Balance and Conservation Strategies in Cikeruh Village, Jatinangor: A Hydroclimatological and Anthropogenic Review	H. Groundwater and drought	5

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
		Harianja, Ajeng Febrianti, Hamizan Muhammad Nasution, Irgi Bintang Pamungkas, Muhammad Ghozi			
15.00 - 15.15	8	**Rien AC Dam** Dr. Rien A.C. Dam; Dr. Ahmad Taufiq S.T, M.T., Ph.D	Groundwater Information Management for Conjunctive Water Use	B. Water resource management in coastal regions	
15.15 - 15.30	9	**Rizky Nur M. Failasufi** Rizky Nur Muhammad Failasufi; Agus Hendratno; Doni Prakasa Eka Putra	Hydrogeology and Identification of Groundwater Potential Zones in Seraya Besar Island, East Nusa Tenggara	B. Water resource management in coastal regions	
15.30 - 15.45	10	**Pham Quy Nhan** Pham Quy Nhan, Le Viet Hung; Hoang Dai Phuc, Vu Ngoc Đuc	Strategies for Mitigating Groundwater Salinization in Extraction Boreholes in the Vietnam's Mekong Delta	B. Water resource management in coastal regions	
15.45 - 16.00	11	**Fattah Ghiffari** Fattah Ghiffari, Edi Riawan	Flood Modeling Based on Baseflow Variations in the Upper Citarum Watershed: A Case Study of the Baleendah Flood	B. Water resource management in coastal regions	
16.00 - 17.00	**POSTER SESSION**				

Wednesday, August 6th 2025

ROOM 1 (EAST CC AUDITORIUM)

Time	No	Presenter Name	Abstract Title	Topic	Parallel Session's Room
08.00 - 08.15	1	**Angelique Agischa Natasya Tampi** Angelique Agischa Natasya Tampi, Arya Yudha Wiratama, Deina Mayroske Nabillah, Denny Lumban Raja	Identification of Groundwater Potential in Karst Area Using Analytic Hierarchy Process (AHP) and Remote Sensing Data in Cipatat, West Bandung	A. Hydrogeology, climate change and urbanization impact to tropical coastal aquifers	1
08.15 - 08.30	2	**Bayu Nugraha**	A Conceptual Model of Tidal Recession Effects on Estuarine River Dynamics and Their Implications for Seawater Intrusion.	A. Hydrogeology, climate change and urbanization impact to tropical coastal aquifers	
08.30 - 08.45	3	**Yuliana Ginting** Yuliana Ginting, Taat Setiawan , Dendi Borneo Putra , Tias Febrina Hanifa Lestari, Shabrina Maulida Agustine	Analysis of Nitrite and Nitrate Quality in the Jakarta Groundwater Basin	A. Hydrogeology, climate change and urbanization impact to tropical coastal aquifers	
08.45 - 09.00	4	**Huang Yanqiong** Yanqiong Huang; Xin Luo; Jiu Jimmy Jiao; Jinchao Zuo; Rong Mao	Integrating surface and subsurface interactions in continental silicate weathering	A. Hydrogeology, climate change and urbanization impact to tropical coastal aquifers	
09.00 -09.15	5	**Luthfia Thahir** Luthfia Thahir, Mochamad Nursiyam Barkah, Yudhi Listiawan, Teuku Yan Waliana Muda Iskandarsyah, Dewandra Bagus Eka Putra, Rodeano Roslee, Mohamad Sapari Dwi Hadian	Integration of Vulnerability Analysis and Groundwater Quality Assessment to Examine Seawater Intrusion in Pangandaran	A. Hydrogeology, climate change and urbanization impact to tropical coastal aquifers	
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Hydrogeology, Climate Change, and Urbanization Impact to Tropical Coastal Aquifers

A Conceptual Model of Tidal Recession Effects on Estuarine River Dynamics and Their Implications for Seawater Intrusion

B. Nugraha[1], N.F. Revanda, M[1]. Ghozi[1]

[1]Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, Universitas Padjadjaran. West Java – Indonesia. 45363.

Abstract. Indonesia is an archipelagic country with a coastline stretching approximately 108,000 kilometers, resulting in extensive coastal areas that interact directly with marine waters. Currently, groundwater quality issues are becoming an increasingly prominent global concern, including in various regions across Indonesia. Coastal development, industrial activities, and other anthropogenic pressures have significantly contributed to the growing vulnerability and declining sustainability of groundwater systems, notably through the potential risk of seawater intrusion.

This study aims to develop a conceptual model that illustrates the probability of seawater intrusion occurring through estuarine zones and potentially affecting inland groundwater systems. The research was conducted at the estuary of the Way Seputih River, where surface water salinity and several other parameters were measured as preliminary indicators. The results revealed variability in salinity levels, although not at a highly significant magnitude. Nevertheless, fluctuations in river water levels due to tidal influence suggest a potential mechanism by which seawater may enter subsurface formations and impact freshwater aquifers.

The conceptual model developed in this study offers a new perspective on understanding seawater intrusion processes, particularly those driven by tidal dynamics in estuarine regions. This model is expected to serve as a baseline for assessing groundwater vulnerability in coastal areas and to support efforts toward sustainable groundwater protection and management.

Keyword: Coastal Groundwater, Estuary, Sea Water Intrusion, Tidal Effect.

Analysis of Nitrite and Nitrate Quality in the Jakarta Groundwater Basin

Yuliana Ginting[1*], Taat Setiawan[2] , Dendi Borneo Putra[3] , Tias Febrina Hanifa Lestari[4], Shabrina Maulida Agustine[4]

Groundwater Conservation Center, Center for Groundwater and Environmental Geology, Geological Agency, Ministry of Energy and Mineral Resources

[*]Email : yuliana.ginting@esdm.go.id

Abstract. Groundwater contamination by nitrite (NO_2^-) and nitrate (NO_3^-) compounds is an increasingly pressing environmental issue, especially in densely populated urban areas such as Jakarta. The rising use of synthetic fertilizers, waste disposal, and land-use changes are the main factors responsible for elevated nitrite and nitrate concentrations in groundwater. This study was conducted in the Jakarta Groundwater Basin, which covers the administrative areas of DKI Jakarta, Bekasi, Depok, and Tangerang. Water sampling was carried out from 111 shallow groundwater wells (unconfined aquifers) and 112 deep wells (confined aquifers) during the years 2023–2024. Laboratory analysis was conducted using Ion Chromatography (IC) based on ASTM D4327-17 to determine nitrite and nitrate concentrations. For the 111 samples from unconfined aquifers, nitrite concentrations ranged from 0.0 to 13.51 mg/L in 2023 and 0.0 to 8.42 mg/L in 2024, while nitrate concentrations ranged from 0.0 to 126.9 mg/L in 2023 and 0.0 to 179.37 mg/L in 2024. In the 112 samples from confined aquifers, nitrite levels also ranged from 0.0 to 13.51 mg/L in 2023 and 0.0 to 8.42 mg/L in 2024, while nitrate levels were between 0.0 and 126.9 mg/L in 2023 and 0.0 to 179.37 mg/L in 2024. The results showed that a small number (<5) of water samples from both unconfined and confined aquifers contained nitrite concentrations exceeding 3 mg/L. For nitrate, concentrations exceeding the safe limit of 20 mg/L were found in six samples from confined aquifers in 2023 and three samples in 2024. In unconfined aquifers, 35 samples exceeded the safe limit in 2023 and 36 samples in 2024. These findings indicate that unconfined aquifers are more vulnerable to nitrite/nitrate contamination due to their proximity to anthropogenic activities. Additionally, nitrate concentrations were relatively higher in the southern part of the basin compared to the northern areas, likely due to more dominant domestic activity in the southern region. This study highlights the need for stricter groundwater quality monitoring and better management of domestic waste to prevent further contamination.

Keywords: nitrite, nitrate, groundwater, Jakarta groundwater basin

Analysis Of Recharge In The Lower Kutai Basin Based On Groundwater Anions And Isotopes

Geraldin Andira Cayarani Putri[1*], Rusmawan Suwarman[2], A Arifin[1]

[1] Department of Groundwater Engineering, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[2] Department of Meteorology, Institut Teknologi Bandung, Bandung, Indonesia

[*]E-mail address: cahyaraniputri@gmail.com

Abstract. The Lower Kutai Basin in East Kalimantan is a strategically important area for supporting water security, particularly for the new capital city of Indonesia (Ibu Kota Nusantara or IKN), which is projected to experience a significant increase in water demand. This study aims to analyze groundwater recharge processes in the region using hydrogeochemical and stable isotope approaches. Water samples were collected from rainfall (~200 samples) and groundwater (~55 samples), and analyzed for chloride ion concentrations as well as stable isotope ratios of $\delta^{18}O$ and $\delta^{2}H$. Groundwater recharge estimation was conducted using the Chloride Mass Balance (CMB) method, while the influence of rainfall intensity on recharge was assessed through comparison of isotope compositions between groundwater and rainfall.

The expected outcome of this research is to improve understanding of the recharge ratio and dynamics in the Lower Kutai Basin, providing a basis for sustainable groundwater resource management in support of IKN development.

Keywords: groundwater, recharge, stable isotopes, chloride ion, Lower Kutai, Ibu Kota Nusantara

Combined Effect of Tides and Sea-level Rise on Groundwater Salinization and Submarine Groundwater Discharge in Unconfined Coastal Aquifers

Wenhong wang[1*], Yonggen Zhang[1], Cong-Qiang Liu[1]
[1] School of Earth System Science, Tianjin University, Tianjin, China

[*]E-mail address: whwang@tju.edu.cn

Abstract. Climate change will exacerbate the threat of freshwater resources in coastal aquifers, impacting coastal communities and land use viability. Coastal aquifers are also impacted by tide that maintains an "upper saline plume" (USP) in the intertidal region, which is closely related to groundwater flow and solute transport processes in coastal aquifers. However, these aquifers are becoming increasingly vulnerable to salinization driven by ongoing sea level rise (SLR). Given these challenges, this study integrates physical experiments and numerical modeling to investigate the future dynamics of ocean-aquifer mixing and submarine groundwater discharge (SGD), using northern Bohai Bay, China, as an example of a hydrologic setting. A two-dimensional finite element model, the SUTRA model, was employed to simulate density-dependent flow and transport in coastal groundwater aquifers. Numerical model results indicate that high hydraulic conductivity lead to larger upper saline plume which relieved the seawater intrusion in the lower aquifer. Simulated SLR will force the migration of the USP landward, amplifying salinization of freshwater resources. These findings suggest the importance of considering the combined impacts of tidal fluctuations and SLR in assessing the processes of surface saltwater intrusion.

Keywords: Numerical Simulation; Seawater Intrusion; USP; Variable Density

Evaluation of Saltwater Upconing and Recovery Dynamics in a Coastal Aquifer Using a Interface-Egg Sensor

Yongcheol Kim[1*], Junhwan Bang[1], Heesung Yoon[2], Soo-hyung Lee[1]

[1] Groundwater Resources Research Center, Korea Institute of Geoscience and Mineral Resources, 124 GWahang-ro, Yuseong-gu, Daejeon, Republic of Korea

[2] Formerly at Korea Institute of Geosicence and Mineral Resources, no current affiliation, Seoul, Republic of Korea

[*]E-mail address: yckim@kigam.re.kr

Abstract. The location and temporal variation of the freshwater-saltwater interface (FSI) are critical for managing coastal aquifer systems. However, conventional methods—such as electrical conductivity (EC) monitoring at fixed depths and geophysical logging—have limitations in capturing real-time interface dynamics. To address this, a novel FSI tracking sensor, the "interface-egg," was employed in a coastal aquifer in Seocheon, located on the mid-western coast of the Korean Peninsula. Multiple pumping tests were conducted: four short-term, three long-term, one step-drawdown, and one reverse step-drawdown, with pumping rates ranging from 19.86 to 48.71 m^3/day and durations from 60 to 2,851 minutes.

The interface-egg effectively captured the temporal movement of the FSI. During a 24-hour pumping period, the interface rose from -86.0 m to -77.6 m above mean sea level (amsl), and after two days, it further rose to -40.8 m amsl. Correspondingly, the freshwater lens thickness decreased from 88.1 m to 78.4 m and then to 42.3 m. These trends indicate pronounced saltwater upconing, which was also corroborated by pre- and post-pumping EC profile logging. Notably, recovery of the interface was slow, occurring at a rate of approximately 1.5 cm/day over three months following the cessation of pumping. Furthermore, the data indicated a discernible tidal influence on both the interface position and groundwater levels during the tests.

The results demonstrate that the interface-egg provides valuable high-resolution, time-series data on FSI dynamics, offering a practical tool for sustainable coastal aquifer management, especially in regions subject to variable pumping for agricultural and domestic water supply.

Keywords: Freshwater-salt water interface (FSI), Interface-egg sensor, salt water upconing, costal aquifer management, pumping test monitoring

Groundwater Conditions in Bangka Island

Deni Kamal[1]*, Ryan Dzulfiqar Ahmad[1], Kristanti Wulandari[1]

[1]Pusat Air Tanah dan Geologi Tata Lingkungan, Badan Geologi, Kementerian Energi dan Sumber Daya Mineral, Jl. Diponegoro No. 57, Bandung

*E-mail address: denikamal76@gmail.com

Abstract. The conditions for the development of population growth and development in the Bangka Island area are very rapid, especially in Pangkalpinang City is already dense, with the increase in development on Bangka Island, especially the development of public facilities and infrastructure, trade and industry, agriculture and plantations will increase the need for raw water. This condition has led to an increase in the need for clean water resources which is in line with the increase in groundwater exploitation. This situation can cause serious problems in the future, especially if there are no efforts to control the use of groundwater resources in accordance with the conditions and characteristics as well as the hydrogeological cycle in the region. However, to formulate a groundwater conservation and control strategy, preliminary activities are needed, namely mapping groundwater potential through aquifer mapping and aquifer rock layers to identify groundwater basin zones, not groundwater basins and their recharge area sources.

Along with the issuance of Law Number 17 of 2019 and Minister of Energy and Mineral Resources Number 14 of 2024 based on the river area of Bangka Island included in the central authority and the massive application for groundwater licensing on the island of Bangka, it is necessary to conduct a preliminary survey of groundwater conditions on Bangka Island which aims to provide groundwater data and information in the study area as a foundation for groundwater management in the area. The field survey was conducted for 20 days in February - March 2024. Observations were carried out on drilled wells including measurement of groundwater level depth, in-situ measurement of groundwater parameters, groundwater sampling and pumping tests. Groundwater samples are sent to the PATGTL Groundwater Quality Laboratory. The information obtained from the survey in this Non-CAT area is in the form of a free groundwater level that varies generally from 0.5 – 28 m in a flat area or relatively high elevation with a height of up to 35 m. The research area has not found any indications of seawater intrusion and land subsidence. In terms of groundwater quality, as many as 16 out of 40 samples did not meet drinking water standards based on Permenkes 2/2023, indicating that some groundwater samples had no indication of TDS pollution below 350 ppm. The water sample was divided into two phases, namely Ca-HCO_3 and Na-HCO_3. The isotope values δ2H and δ18O are clustered on the right side of the Local Meteoric Water Line (LMWL) and do not indicate any elevation grouping of the sampling point. Non-CAT area located in the central part that dominates Bangka Island survey area with Qopt (optimal discharge) of 4.28 liters/second

Keywords: Groundwater, Bangka Island, Water Table

Groundwater Quality of Unconfined Aquifer and Confined Aquifer in Pekalongan City, Central Java

Sokhwatul Aghnia, ST, M.Eng[1], Vydia Ridha Ariati, ST[1], Ulfi Fauzia, ST[1]
[1]Department of Energy And Mineral Resources Central Java Province

Abstract. Pekalongan City is experiencing a rapid increase in development and population growth. This condition is the cause of the increasing demand for clean water where no less than 60% of clean water supply comes from groundwater, especially for the fulfillment of basic daily needs and industry. The large utilization of groundwater that is not balanced with recharge has resulted in a decline in groundwater quality in the region. It is necessary to study groundwater quality in Pekalongan and surrounding areas using secondary data from groundwater quality measurements in free aquifers and depressed aquifers in Pekalongan City. The purpose of this study is to determine the condition of groundwater quality in the Pekalongan City area. The purpose of this study is to determine the value of groundwater quality in free aquifers and depressed aquifers in Pekalongan City. This research was conducted with data analysis method in the form of measurement of physical properties of groundwater (dissolved solids and electrical conductivity) from 30 dug wells and 24 drilled wells scattered in Pekalongan City. The collected data were then analyzed to determine the zonation of free and suppressed groundwater quality conditions. From the results of the study, it is known that the quality of groundwater in the free aquifer is very poor-good with the nature of water is brackish water-fresh water and fresh water-brackish water, while the quality of groundwater in the depressed aquifer is moderate-excellent with the nature of water is fresh water.

Keywords: Groundwater, Quality, Unconfined Aquifer, Confined Aquifer, Pekalongan City

Identification of Groundwater Potential in Karst Area Using Analytic Hierarchy Process (AHP) and Remote Sensing Data in Cipatat, West Bandung

Angelique Agischa Natasya Tampi[1] , Arya Yudha Wiratama[2], Deina Mayroske Nabillah[3], Denny Lumban Raja[4]

[1,2,3,4]Geological Technology, Bandung Polytechnic of Energy and Mining, Indonesia

[*]E-mail address: angeliqueagischa@gmail.com

Abstract. Groundwater is a crucial source of clean water for drinking, agriculture, and daily use. Groundwater is an important source of clean water for drinking, farming, and daily needs. Cipatat, in West Bandung, is a karst area with many limestone hills, underground rivers, and caves like Pawon Cave. These features help store and move groundwater. However, mining activities in Cipatat have damaged water sources and reduced spring flow, especially in the dry season. This makes good groundwater management in Cipatat very important for local people and sustainable development.

Previous studies have shown that remote sensing and multi-criteria decision analysis methods such as the Analytical Hierarchy Process (AHP) are effective in identifying groundwater potential zones, particularly in areas with limited hydrological data. However, specific studies focusing on the groundwater potential in Cipatat, West Bandung Regency, are still lacking. This study aims to mapping the groundwater potential in the Cipatat region by integrating remote sensing data and AHP for spatial analysis and decision-making.

Several parameters commonly associated with groundwater availability, including geology, slope, rainfall, land use, vegetation index, hydrogeology, and lineament density. Remote sensing data such as satellite imagery and digital elevation models were used to derive these parameters. Each parameter was standardized, classified, and weighted using AHP based on expert input, and the results were overlaid in a Geographic Information System (GIS) environment to produce a groundwater potential map.

The study area was divided into four classes: very low, low, moderate, and high groundwater potential. Validation using existing spring data indicated a strong correlation between mapped potential and actual field conditions. This study demonstrates that combining remote sensing with AHP is an effective approach for identifying groundwater potential zones. The resulting map can support sustainable groundwater management and development planning in the study area.

Keywords: Analytical Hierarchy Process; groundwater potential; remote sensing; spatial analysis; Cipatat

Integrating Surface And Subsurface Interactions In Continental Silicate Weathering

Yanqiong Huang[1]; Xin Luo[1, 2]; Jiu Jimmy Jiao[1, 2]; Jinchao Zuo[1]; Rong Mao[1]

[1] Department of Earth Sciences, The University of Hong Kong

[2] Shenzhen Institution of Research and Innovation (SIRI), The University of Hong Kong

Corresponding Author(s): xinluo@hku.hk

Abstract. Chemical weathering of silicate rocks is crucial for Earth's climatic stability through CO_2 sequestration. The lithium isotopic system, with its distinct isotopic fractionation during chemical weathering, is used to investigate weathering status and water-rock interactions. This study explores Li concentrations and isotopic compositions in dissolved loads within a groundwater-fluvial system. It emphasizes the need to define the contributions of various sources to chemical weathering represented by dissolved Li isotopes (δ^7Li), resulting from surface and subsurface processes such as water-rock interaction and geothermal dynamics. Our landscape investigation shows that Li concentrations are highest in geothermal waters, followed by shallow groundwater, with river water being significantly depleted. Isotopic compositions reveal high spatial heterogeneity, with river and shallow groundwater exhibiting enriched δ^7Li, while geothermal water displays depleted δ^7Li. The reactive transport model of geothermal water indicates that the chemical weathering process is temperature-dependent. As temperature increases, it promotes mineral dissolution while inhibiting the formation of secondary minerals and lithium isotope fractionation. This results in high lithium concentrations and lithium isotope compositions that closely resemble the original rock in high-temperature geothermal water. A novel Li-δ^7Li reactive-transport model quantifies the effects of dissolution and secondary mineral precipitation under varying influences, including geothermal water. This study aims to enhance understanding of how subsurface systems reshape chemical weathering and advocates for a hydrogeological approach to studying weathering processes in river basins.

Keywords: Chemical weathering; Lithium isotopes; Subsurface water-rock interaction

Integration Of Vulnerability Analysis And Groundwater Quality Assessment To Examine Seawater Intrusion In Pangandaran

Luthfia Thahir[1], Mochamad Nursiyam Barkah[1], Yudhi Listiawan[1], Teuku Yan Waliana Muda Iskandarsyah[1], Dewandra Bagus Eka Putra[2], Rodeano Roslee[3], Mohamad Sapari Dwi Hadian[1]

[1] Geological Engineering, Universitas Padjadjaran, Jatinangor, Indonesia
[2] Geoscience, Seoul National University, Seoul, South Korea
[3]Science and Natural Resources, Universiti Malaysia Sabah, Sabah, Malaysia

[*]E-mail address: sapari@unpad.ac.id

Abstract. Seawater intrusion is one of the primary threats to the sustainability of groundwater resources in coastal areas, particularly in tourism regions such as Pangandaran. The intrusion of seawater into aquifer systems raises concerns over potential contamination that may degrade groundwater quality. This study aims to identify early indications of excessive groundwater abstraction in the tourism areas of Pangandaran Regency. To achieve this, observations were conducted at selected wells to determine the physical and chemical characteristics of groundwater, including pH, electrical conductivity (EC), and total dissolved solids (TDS). These measurements were used to assess potential interactions between groundwater and seawater. The results showed significant variation in EC and TDS values between sampling points. In 2022, EC values ranged from 195 to 1,424 µS/cm, and TDS values ranged from 344 to 2,551 mg/L. In 2024, EC values ranged from 284 to 1,686 µS/cm, and TDS values ranged from 461 to 2,689 mg/L. Several locations recorded values exceeding the freshwater threshold, indicating the potential influence of seawater. These groundwater parameters were further analyzed using Geographic Information Systems (GIS) to map the spatial distribution of areas potentially affected by seawater intrusion. The findings of this study are expected to serve as a recommendation for sustainable groundwater management in the tourism zones of Pangandaran Regency. Periodic monitoring of groundwater quality and quantity is necessary to prevent the expansion of seawater intrusion zones.

Keywords: seawater intrusion, groundwater quality, electrical conductivity (EC), total dissolved solids (TDS), Pangandaran, geographic information system (GIS)

Linking Groundwater Pumping to Escalating Tidal Flooding Events: A Case Study from Semarang

Sanidhya Nika Purnomo[1*], Wahyu Widiyanto[1], Gibran Chafid Abdullah[1]

[1] Department of Civil Engineering, Universitas Jenderal Soedirman, Jl. Mayjen Sungkono KM 5, Purbalingga, Jawa Tengah, Indonesia

[*]E-mail address: sanidhyanika.purnomo@unsoed.ac.id

Abstract. Northern Semarang, which lies immediately close to the Java Sea, has suffered hundreds of years of sedimentation as a result of coastal processes, resulting in the advancement of the shoreline. As a result of changes in land use into residential, industrial, and service districts, alluvial soil originating from the sedimentation process experiences land subsidence due to the weight of buildings, infrastructure, and excessive water pumping. At the same time, due to the tides, locations affected by land subsidence eventually experience tidal flooding.

The purpose of this study was to investigate the long-term impact of excessive water pumping on land subsidence and coastal flooding in Semarang coastal area. Numerous groundwater abstraction scenarios in northern Semarang that resulted in land subsidence were simulated using a numerical model, followed by simulations of several coastal flooding scenarios resulting from land subsidence and sea level rise. This study was carried out by numerically modeling groundwater and land subsidence with MODFLOW and coastal flooding with HEC RAS 2D.

The findings revealed that coastal flooding and land subsidence caused by groundwater pumping poses a major hazard to the northern part of Semarang City. Using DEM from DEMNAS in EXT scenario, it can be seen that the area experiencing inundation due to coastal flooding is 76.22 km^2.

Keywords: groundwater abstraction, land subsidence, coastal flooding, numerical model.

Preliminary Hydrogeological Insights into the Karangbolong Uplifted Karst: Exploring the Potential of Stable Isotope Analysis

Nandian Mareta[12*], M Sapari Dwi Hadian[3], Rachmat Fajar Lubis[4], Nana Sulaksana[3]

[1]Directorate of Scientific Collections Management, DIRI, BRIN

[2] Doctoral Student, FTG, Universitas Padjadjaran

[3] Faculty of Geological Engineering, Universitas Padjadjaran

[4] Research Center for Limnology and Water Resources, BRIN

*Corresponding author: nandian.mareta@brin.go.id

ORCID: 0000-0003-4024-4205

Abstract. The Karangbolong Karst region, located in Kebumen Regency, Central Java, presents a unique and highly promising setting for hydrogeological investigation. This area features a distinct geological configuration, where carbonate rocks of the Kalipucang Formation—forming a prominent uplifted karst landscape—are flanked by non-carbonate formations: volcanic rocks of the Gabon Formation to the south and clastic sediments of the Halang Formation to the north. This juxtaposition provides a rare opportunity to explore groundwater dynamics across karst and non-karst systems. Preliminary observations suggest that the southern volcanic highlands serve as the main recharge zone, feeding the underlying karst aquifer system. The tropical karst morphology, dominated by conical hills and cockpit dolines, highlights the region's active karstification process, making it a significant site for both scientific and conservation interest. This study is designed to investigate the hydrogeological characteristics of Karangbolong through an integrated approach combining geological mapping, stable isotope analysis (^{18}O and ^{2}H), and hydrochemical studies. The outcomes are expected to contribute to sustainable groundwater management strategies and to strengthen scientific understanding of tropical karst systems within the context of the Karangsambung–Karangbolong National Geopark.

Keywords: Karangbolong Karst, groundwater, recharge zone, stable isotopes, tropical karst hydrogeology

The Effects of Shallow Coastal Aquifer of Kota Bharu, Kelantan, Malaysia Area to Climate and Land Use Activity

Norsyafina Roslan*, Nur Ainina Syairah binti Mohamad, Amalin Athirah Mohd Nasir & Nurul 'Aina Izzatil Binti Roslan

Programme Geology, Department of Earth Sciences & Environment, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia.

[2] Department, Affiliation, Address, Country

*E-mail address: finalan@ukm.edu.my

Abstract. Groundwater in Kelantan is extensively used for domestic purposes, serving as primary water source for 75% of the state's water needs. Almost every single house especially in Kota Bharu area has their own pumping well with up to 10 m depth. On top of that, there are 110 pumping wells in 9 water treatment plants area. Therefore, studies were conducted to evaluates the hydrogeological conditions in Kota Bharu area with a specific focus on shallow aquifer in coastal environment. The studies utilized soil sampling and laboratory analysis, secondary data analysis including borehole data, rainfall data, groundwater levels and river water levels that obtained from JMG, NAHRIM and JPS. The well water level was measured at 27 houses using electrical dipper and physico chemistry of well water was measured in situ using YSI meter. All the results were integrated using ArcGIS to produce hydraulic head maps and well water chemical composition distribution maps. The soil at study area consists of sandy loam and sand. The interpretation of data from 13 drill holes indicate that the study area consists of three types of sediment layers with varying thickness, namely sand (15 – 20 m), clay (10 – 20 m) and silt (20-30 m). Total recharge from rainfall data analysis into the aquifers ranged from 168.49 mm to 635.02 mm/year from 2011 to August 2024. Groundwater levels were found to correlate directly with rainfall and river levels. The groundwater levels in two monitoring wells were lower than river levels for few years likely due to high groundwater abstraction activities and low rainfall. The hydraulic head maps show the groundwater flows towards the Pintu Geng Water Treatment Plant and Kg Puteh Water Treatment Plant every year, suggesting ongoing groundwater abstraction activities except in 2020. Most of the house with clean well water (63 %), with TDS values that less than 100 mg/l and zero salinity. The average TDS value for remaining wells is 122.4 mg/l and 0.1 ppt for salinity. The highest TDS value of well water recorded is 261.6 mg/l and 0.2 ppt for salinity. The TDS value and salinity of well water are highly affected by the condition of surrounding well and naturally high content of Ferum in well water of study area.

Keywords: Kota Bharu, shallow coastal aquifer, climate, land use activity

Abstracts of Parallel Sessions:

Water Resource Management in Coastal Regions

Application of Infiltraton Galleries (Horizontal Wells) in Pacific Atolls

Adrian D. Werner[1,2*], Amir Jazayeri[1,2]
[1] College of Science and Engineering, Flinders University, Australia
[2] National Centre for Groundwater Research and Training, Flinders University, Australia

[*]E-mail address: adrian.werner@flinders.edu.au

Abstract. Infiltration galleries, otherwise known as skimming wells, are horizontal or inclined, perforated pipes used to extract fresh groundwater from many Pacific and Indian islands, especially flat-lying islands such as atolls. This study firstly reviewed the state of knowledge of infiltration galleries installed in Pacific and Indian atolls, including their design and performance. This was extended through engagement with hydrogeologists and operators from across the Pacific, in cooperation with the Pacific Community (Fiji). The review summarized key infiltration gallery design elements, including layout, pipe characteristics and pumping rates, gallery performance (pumping rates and salinities), and other aspects. Several critical research gaps are identified, as well as critical knowledge about infiltration gallery design and operation that has thus far been reported only in engineering reports and other unpublished documents. A key design element of infiltration galleries should include the freshwater lost as discharge to the sea and through mixing with saltwater, because these are often overlooked in atoll island water-balance analyses. The insights gained from applying infiltration galleries to Pacific atolls offers opportunities for more widespread applications within continental aquifers, in particular to capture submarine fresh groundwater discharge that is otherwise lost through mixing with seawater and to mitigate seawater intrusion, thereby contributing to global groundwater management strategies. The research included a workshop held at Kiritimati Island (Republic of Kiribati) in November 2023 with Pacific Island operators, hosted by the Pacific Community (Fiji). This workshop produced a summary of construction details and operational performance information, which was used as the basis for summarising design components of infiltration galleries, and to develop guidance on their future use, drawing on the collective experience of decades of trial-and-error throughout the Pacific.

Keywords: Skimming well, Seawater intrusion, Up-coning, Freshwater lens, Groundwater management

Applying Aquifer Storage and Recovery (ASR) for Mitigating Water Shortage and Saltwater Intrusion: A Case Study at My Chanh Commune, Tra Vinh Province, Vietnam

Thanh-Le Tran[1], Thi-Thoang Ta[1], Quang-Khai Ta[2], Van-Tuan Pham[3], Quy-Nhan Pham[1]

[1]Hanoi University of Natural Resources and Environment (HUNRE), No 41 A Phu Dien Road, Phu Dien Ward, North Tu Liem Dist., Hanoi, Viet Nam

[2]Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet St., Dist. 10, Ho Chi Minh City, Vietnam

[3]Department of Water Resources Management, 10 Ton That Thuyet St., Hanoi

Abstract. The Vietnam's Mekong Delta is increasingly facing severe water shortages and saline intrusion due to climate change, population growth, and over-extraction of groundwater. This study investigates the feasibility and effectiveness of Aquifer Storage and Recovery (ASR) technology as a practical solution for managing freshwater supply in coastal areas, particularly My Chanh commune, Tra Vinh province. The ASR system involves capturing excess freshwater from shallow sand dune during the rainy season and injecting it into saline-affected aquifers, allowing for recovery during the dry season. A comprehensive methodology was implemented, including geophysical TEM surveys, hydrogeological drilling, water quality assessments, and field-scale injection-extraction trials. Numerical modeling using SEAWAT and PHREEQC was applied to evaluate salinity transport and aquifer responses. Results demonstrate significant improvements in groundwater level and reduction in total dissolved solids (TDS) post-injection, with recovered water maintaining quality within potable standards. The study confirms that ASR is a viable technique for mitigating groundwater salinization and sustaining water availability in climate-vulnerable coastal zones of the Mekong Delta.

Keywords: Aquifer Storage and Recovery (ASR); Saline intrusion, Groundwater recharge, Water scarcity, Mekong Delta, Tra Vinh, Climate change adaptation

Delineation of Sea Water Intrusion Indication in Kendal Groundwater Basin

Andre Putra Arifin[1*], Muhammad Winniardli[1], Wijayanti Ashuri[1], Tita Rahma Puspita[1], Dipta Alfian Rinaldi[1], Rian Mohammad Azhar Sukandar[1], Jossi Erwindy[1]

[1] Implementing Unit of Groundwater, Directorate General of Water Resource, Ministry of Public Works, Jl. Ir. H. Juanda No. 193, Dago, Bandung, 40135, Indonesia

[2] Department, Affiliation, Address, Country

[*]E-mail address: andreputraarifin@pu.go.id

Abstract. The Kendal Industrial Estate (Kawasan Industri Kendal, KIK) represents the largest industrial development zone in Central Java, encompassing a total area of approximately 2,200 hectares. Situated along the northern coast of Kendal Regency and the estate is located within the Kendal Groundwater Basin (Cekungan Air Tanah, CAT Kendal). The expansion of industrial activities in this region has led to a significant increase in water demand, part of which is met through groundwater extraction. However, unregulated exploitation of groundwater in coastal areas poses a substantial risk of seawater intrusion into aquifers. One of the effective mitigation strategies involves delineating the natural extent of seawater intrusion into groundwater systems to inform sustainable water resource management. This study aims to delineate seawater intrusion within the Kendal Groundwater Basin. Primary data were obtained from 11 Vertical Electrical Sounding (VES) survey points and 17 in-situ water quality measurements, including temperature, pH, and Total Dissolved Solids (TDS). Secondary data comprised regional and local geological information as well as groundwater facies characterization. The results indicate the presence of seawater intrusion, with lateral spreading observed up to the central part of the basin. This finding is corroborated by the groundwater facies data, which show sodium chloride (NaCl)-type groundwater dominating the central area of the basin. Furthermore, local geological conditions, particularly alluvial deposits influenced by transgressive and regressive marine processes, support the presence of saline water within the aquifer system. The spatial distribution of seawater intrusion tends to intensify towards the northern part of the basin, with evidence of trapped saline water likely resulting from past sedimentation events. Based on these findings, it is recommended that future water supply strategies for industrial development and supporting infrastructure within the Kendal Groundwater Basin prioritize alternative water sources over groundwater, due to its vulnerability to seawater intrusion.

Keywords: CAT Kendal, intrusi air laut, pengembangan industri, *Vertical Electrical Sounding* (VES)

Flood Modeling Based on Baseflow Variations in the Upper Citarum Watershed: A Case Study of the Baleendah Flood

Fattah Ghiffari[1,*], Edi Riawan[2]

[1]Groundwater Engineering Department, Faculty of Earth Science and Technology, Institut Teknologi Bandung, 40132, Indonesia

[2]Atmospheric Science Research Group, Faculty of Earth Sciences and Technology, Institut Teknologi Bandung, 40132, Indonesia

[*] Corresponding author: fattahghiffari25@gmail.com

Abstract. This study examines the effect of baseflow variation on flood discharge in the Upper Citarum Watershed, using the 2019 flood event in Baleendah as a case study. The flood, which lasted from February 9 to March 12, was characterized by prolonged inundation and recurring overflow. To understand the event, hydrometeorological data including rainfall, river discharge, and direct runoff were analyzed. Baseflow separation was carried out using the Arnold & Allen (1999) recursive digital filter method, with sensitivity testing during both wet and dry periods. The analysis yielded an optimal beta coefficient of 0.85 for separating baseflow components. Further examination of monthly baseflow patterns revealed two peak periods: the first in December and the second, higher peak, in April. The lowest baseflow was observed in September, indicating seasonal shifts in groundwater contribution. Flood modeling using HEC-RAS with different baseflow scenarios demonstrated that baseflow plays a significant role in maintaining high river stages even before heavy rainfall occurs. The elevated baseflow causes river levels to hover near the flood threshold, so additional rainfall-triggered runoff results in immediate flooding. This study concludes that baseflow should not be overlooked as a passive contributor but instead must be considered an active factor in increasing flood susceptibility. The findings provide important insight for flood early warning systems and watershed management, particularly in areas like Baleendah that are prone to prolonged inundation.

Keywords: *Baseflow, Baleendah, Flood Modeling*

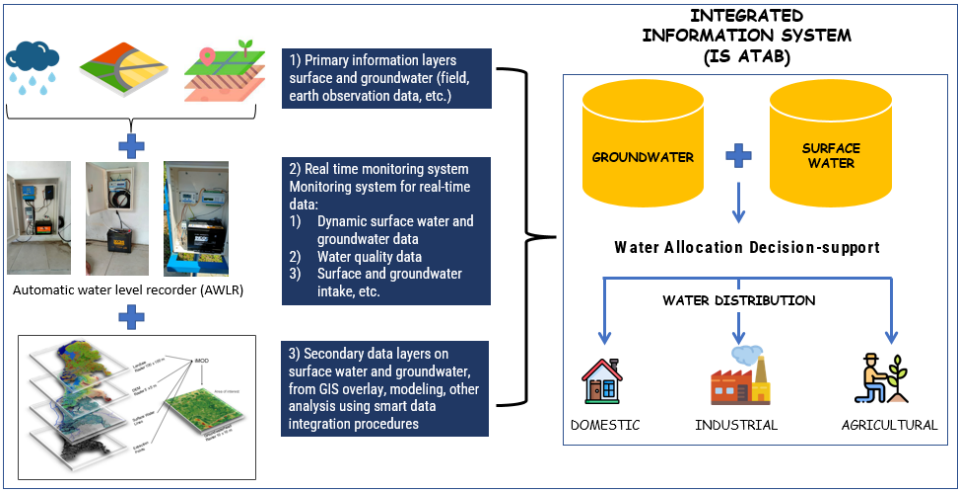
Groundwater Information Management for Conjunctive Water Use

Dr. Rien A.C. Dam[1], Dr. Ahmad Taufiq, S.T, M.T., Ph.D
[1] Consultant, WaterLand Experts, Amsterdam, The Netherlands
[2] Balai Wilayah Sungai Maluku Utara, Direktorat Jenderal SDA, Kem. PUPR, Indonesia

[*]E-mail address: rien.dam@outlook.com

Abstract. Collection and integration of ground- and surface water system data: Traditionally, groundwater resources are not well considered in water resource inventories and/or use guidelines. Truly conjunctive management of ground- and surface water resources requires appropriate investigation and assessment of groundwater systems and collection of relevant field data (aquifer characteristics, groundwater potential, groundwater quality, well characteristics, etc.). A further challenge is to collect and utilize suitable surface water system parameters; after all ground- and surface water systems are rather different in terms of flow dynamics and resource depletion scenarios. Spatial integration using GIS computational capacity is next, among others showing river catchments (surface water) and connected aquifer systems (groundwater) and eventually presenting relevant information to water users or oversight agencies.

Concept Water Management Information System for Conjunctive Water Use



Selected data and information can be aggregated in appropriate spatial units, allowing the integration and visualization into usable information for resource management and user guidelines. The presentation will introduce the challenges to develop a useful information management system for the Central Java northern coastal region and propose an approach. Key is the awareness that regional ground- and surface water systems can be regarded as a unified system, but for optimal resource utilization different water users can use specific indicators. Data/information overload should be avoided.

Keywords: conjunctive water use, information management

Groundwater Management Challenges in Ternate Volcanic Island

Nofi Muhammad Alfan Asghaf[1]*, Munib Ikhwatun Iman[1], Kadri Daud[1]

[1]Pusat Air Tanah dan Geologi Tata Lingkungan
Badan Geologi, Kementerian ESDM
[1]Prodi Teknik Mesin Universitas Khairun Ternate

*geologialvan@gmail.com

Abstract. Ternate Island, located in an active volcanic region, presents substantial challenges in sustainable groundwater extraction within the Ternate Groundwater Basin (CAT Ternate). This study investigates the hydrogeological characteristics, water quality, and conservation zoning to support effective groundwater management. Geological and morphological analysis shows the island is dominated by andesitic and basaltic volcanic rocks, influencing aquifer storage and groundwater flow. Observations from 38 hydrogeological points indicate a mixed aquifer system of fractures and intergranular porosity.

Hydrochemical data reveal varied groundwater types, driven by interactions with volcanic formations, with electrical conductivity levels exceeding 1500 µS/cm in coastal zones—suggesting over-extraction and seawater intrusion. Spatial and socio-economic analyses identify high-demand areas in densely populated and industrial zones along the eastern and southern coasts, underlain by alluvial aquifers.

The findings highlight key challenges: limited optimal discharge capacity, water quality degradation, and increasing pressure from land use. Integrated groundwater management is essential, emphasizing recharge area protection (>600 masl in western Ternate), conservation zoning, and extraction control in critical zones to ensure long-term water resource sustainability.

Keywords: Volcanic Island, groundwater, aquifer, hydrogeology, electrical conductivity, Mount Gamalama, water conservation, Ternate.

Groundwater Potential as a Basis for Coastal Area Development in the Medan Groundwater Basin

Ryan Dzulfiqar Ahmad[1], Dyan Yudhanagara[1]
[1]Pusat Air Tanah dan Geologi Tata Lingkungan, Badan Geologi, Kementerian Energi dan Sumber Daya Mineral, Jl. Diponegoro No. 57, Bandung

*E-mail: ryan.dzulfiqar@gmail.com

Abstract. The Medan Groundwater Basin (CAT Medan) is a strategically important region in Indonesia, supporting major economic sectors such as the Belawan Port, the Medan Industrial Zone, and the production of key agricultural commodities including palm oil and rubber. Administratively, the basin spans across most of North Sumatra Province and a small part of Aceh Province, covering several major regencies and cities, with a total area of approximately 10,014.6 km².

This study aims to evaluate the groundwater potential and aquifer characteristics in the Medan Basin, and to analyze their relationship with regional development patterns, particularly in coastal areas. Investigations in the Medan City area indicate the presence of high-potential aquifers with transmissivity values ranging from 50. to 200 m²/day, consisting of unconfined aquifers (0–40 m), confined aquifer 1 (80–100 m), and confined aquifer 2 (150–200 m). In contrast, the southern part of the basin—such as Asahan to Labuhan Batu—generally exhibits lower aquifer potential, with smaller transmissivity values and confined aquifers found at depths of 60–120 m.

Isotopic analysis suggests that the groundwater in the Medan City area primarily originates from recharge zones in the Sibayak Highlands to the west and from southern mountainous regions, while groundwater in the southern basin is mostly recharged from western uplands. The spatial distribution of groundwater potential is closely aligned with regional development trends, where areas such as Deli Serdang, Serdang Bedagai, and the southern coastal zones, which have higher groundwater potential, are experiencing rapid growth. These findings highlight the critical role of groundwater availability in shaping urban expansion and coastal development in the Medan Groundwater Basin.

Keywords: Medan Groundwater Basin, groundwater potential, aquifer characteristics, regional development, coastal area, isotopic analysis

Hydrogeochemical Investigation of Submarine Groundwater Discharge from Borneo to the South China Sea: Enrichment of Iron and Aluminum and Its Role in Ocean Acidification

Amna Abdelwahab [1,*], Pg Emeroylariffion Abas [2], David Marshall [1], Mario Schirmer [3,4,5], Lieyana Azffri [1] and Stefan Gödeke [1,*]

[1]Faculty of Science, Universiti Brunei Darussalam
[2]Faculty of Integrated Technologies, Universiti Brunei Darussalam
[3]Eawag, Swiss Federal Institute of Aquatic Science and Technology
[4]Centre of Hydrogeology and Geothermics, University of Neuchâtel, 2000 Neuchâtel, Switzerland
[5]Department of Geology and Geological Engineering, Université Laval, Quebec City, Canada

*Correspondence: 23h1442@ubd.edu.bn; stefan.godeke@ubd.edu.bn; SG

Abstract. Submarine groundwater discharge (SGD) and its influence on ocean acidification, as well as iron and aluminum dynamics, remain understudied in Borneo. This research examines SGD from northwest Borneo into the South China Sea, focusing on the chemical composition—particularly iron and aluminum—hydrogeochemical controls, and the potential contribution of SGD to ocean acidification. Samples were collected along a spatial gradient from the peritidal zone to offshore waters to assess geochemical transformations along the groundwater flow path. The study focused on two coastal sites—Tungku and Empire beaches—where SGD sampling was conducted across three intertidal zones (low, mid, and high tide), defined by their relative position within the tidal range. Supplementary samples were taken from streams, pools, seawater, and beach sand as a representative solid phase. Sampling occurred during Brunei's peak wet season in 2022 and 2023. Elevated concentrations of iron and aluminum were observed, with the highest iron concentration (13 mg/L) and aluminum concentration (9.05 mg/L) both recorded in SGD samples at Tungku Beach. Many samples exhibited low pH values, with the lowest recorded at 6.6, indicating acidic conditions.

Keywords: Submarine groundwater discharge; Coastal aquifers; Ocean acidification; Climate change; Sustainability; Borneo Island

Hydrogeology and Identification of Groundwater Potential Zones in Seraya Besar Island, East Nusa Tenggara

R N M Failasufi[1], A Hendratno[1], D P E Putra[1*]

[1] Department of Geological Engineering, Faculty of Engineering, Gadjah Mada University, Yogyakarta, Indonesia

[*]E-mail address: putra_dpe@ugm.ac.id

Abstract. Seraya Besar Island in East Nusa Tenggara is a small island predominantly composed of low-porosity carbonate rocks, resulting in significant limitations in groundwater availability. Amid rising demand for clean water driven by population growth and tourism, hydrogeological information and groundwater potential mapping on the island remain limited. This study aims to identify the hydrogeological conditions and delineate groundwater potential zones based on surface hydrogeology factors. Field observations were conducted to assess lithology, fractures, and groundwater emergence points such as dug wells and springs, complemented by measurements of the physical and chemical properties of the water. These data were integrated with rainfall and landform information derived from satellite imagery. Five key parameters were used in the groundwater potential mapping: fractures, lithology, topography, drainage, and rainfall. The results indicate that the island's aquifer system consists of unconfined and fractured aquifers with local-scale, limited-flow characteristics and uneven distribution. Most groundwater emergence points are located in the southern part of the island, with relatively shallow water table depths. Groundwater potential zones are classified into two levels: low and moderate, with no high-potential zones identified. All 19 water points fall within the moderate potential zone. The majority of the groundwater is brackish due to seawater intrusion, with total dissolved solids (TDS) exceeding the threshold for freshwater. Fractures and lithology are the primary controlling factors in groundwater occurrence. This study demonstrates that spatial mapping methods based on hydrogeology parameters can be effectively applied in data-scarce regions and serve as a valuable reference for clean water resource management in island areas.

Keywords: Groundwater Potential Index; hydrogeology; small island; Geographic Information Systems

Probabilistic Harmful Algal Blooms Forecasting with Machine Learning in Tolo Harbour, Hong Kong

Zhangbo LIU[1*], XIN Luo[1], Jiu Jimmy JIAO[1]
[1] Department of Earth and Planetary Science, The University of Hong Kong, Hong Kong, China

[*]E-mail address: zbliu@connect.hku.hk

Abstract. Harmful algal blooms (HABs) have increased in frequency and severity worldwide new century, degrading coastal ecosystems and aquaculture and costing millions of dollars in economic losses. Hong Kong ranks as one of the most severely affected regions, with 1,731 documented HAB events between 1975 and 2025; fully 25.2 % of these have occurred in Tolo Harbour. This semi-locked basin in the northeastern New Territories (50 km² area, average depth 12 m, 16 km long) exhibits weak water flushing rates, prolonged water-residence times, and frequent stratification, all of which causes the enhancement of nutrient to fuel HABs. Early eutrophication signals were recorded even before modern urban development. To enable timely warnings of HABs, we developed a real-time forecasting system by enhancing a traditional diffusion model with a novel HAB-quantification index. Drawing on more than thirty years of monitoring data, our system generates probabilistic forecasts of bloom occurrence and severity levels. Validation against historical records demonstrates that the model achieves accurate, long-term predictions of algal growth and eutrophication dynamics in Tolo Harbour, offering a valuable decision-support tool for coastal managers and aquaculture operators.

Keywords: harmful algal blooms, forecasting system, machine learning, diffusion model

Resistivity Characteristics of Aquifer Layers Based on Geoelectrical Surveys in the Cimanuk Delta, Indramayu Regency

Riefandy Setiadi[1*], Jossi Erwindy[1], Arif Rahmat M. [1], Ginar Sukma P. [1], Charles H. [1], Perdhani Asmoro Suchi[1], Dipta Alfian R.[1], Tasya Asyantina[2], Luqman Fadhillah [3]

[1] Technical Implementation Unit for Groundwater, Ministry of Public Works, No. 193, Ir. H. Juanda Street, Dago, Bandung City, West Java 40135, Indonesia

[2]River Basin Organization for Citarum, Ministry of Public Works, Inspeksi Cidurian Soekarno-Hatta Street, STA 5600, Rancasari District, Bandung 40292, Indonesia

[3]River Basin Organization for Cimanuk Cisanggarung, Ministry of Public Works, No. 40, Pemuda Raya Street, Kesambi District, Cirebon City, West Java 45132, Indonesia

[*]E-mail address: riefandysetiadi@pu.go.id

Abstract. Indramayu Regency, which is located in the northern coastal area of West Java, is an area formed from the Cimanuk delta complex due to the accretion process. The river flow from the Cimanuk watershed has a dendritic (twisting) pattern and a meandering (winding) pattern. The difference in river discharge during the rainy season (1200 m3/second) and the dry season (5 m3/second) results in a sedimentation process in the Cimanuk Delta with high mud content and only a small amount of fine to medium sand.
The existence of an aquifer that is ideally located in the sandstone layer does not occur in the Indramayu Regency area, however, from the Ministry of Public Works' well drilling data, the average discharge is taken from deep wells (100m - 150m).
From the results of the research using geoelectric surveys, the average resistivity value of the measurement area has a range of 0.5 Ωm to >30 Ωm. Referring to these results, it can be interpreted that the value of 0.5 Ωm – 5 Ωm is clay/mud (aquiclude), 5 Ωm – 10 Ωm is silt (aquitard), >10 Ωm is fine sand to sand (aquifer). From the resistivity data of geoelectric results compared with drilling data, the water-bearing layer (aquifer) in the Cimanuk Delta area of Indramayu Regency has a small resistivity value (10 Ωm - >30 Ωm) in the fine sand layer.

Keywords: Cimanuk Delta, Resistivity, Aquifer, Indramayu Regency

Soil Microbiology and Hydrogeology Responses to Drainage in Badas Peatland, Brunei

Muhammad Hadi Sahat[1*], Rahayu Sukmaria Sukri[2], Salwana Jaafar[2], Stefan Gödeke[1]

[1] Universiti Brunei Darussalam, Faculty of Science, Geosciences Programme, Brunei Darussalam
[2]Universiti Brunei Darussalam, Institute for Biodiversity and Environmental Research, Brunei Darussalam

[*]E-mail address: 24m1442@ubd.edu.bn

Abstract. Peatlands, characterized by the accumulation of organic peat from decaying plant matter under high water saturation conditions, are globally significant ecosystems crucial for biodiversity conservation and climate regulation. However, industrial activities such as drainage for agriculture and development have disrupted these vital environments, leading to detrimental consequences. This study investigated how soil microbiology and hydrogeology at Badas peatland, Brunei, are affected by drainage canal, specifically examining microbial communities, their diversity, and microbial biomass carbon (MBC). Solinst transducers in three piezometers perpendicular to the drainage canal measured water and barometric pressure, while a rainfall station with a HOBO pendant recorded rainfall. High-resolution LiDAR and a Bosch GOL 26D optical level provided topography data for a GeoStudio cross-section model simulating hydraulic head. After field surveys and soil sampling along Jalan Badas Middle (JBM) and North (JBN) transects, laboratory analysis with a microBIOMETER© kit determined microbial composition and MBC. At JBM, the point closest to the canal showed 58 % fungi and 42 % bacteria with 729 µgC/g MBC, shifting to 76 % fungi, 24 % bacteria, and 1496 µgC/g MBC at the furthest point. At JBN, fungi rose from 56 % (763 µgC/g) near the canal to 70 % (1178 µgC/g) at the furthest point, while bacteria fall from 44% to 30%. An inverse relationship between distance from the canal and fungal abundance suggests fungi are more negatively impacted by drainage than bacteria in peatland environments. Observations during wet (monsoon) and dry (El Niño) conditions recorded a peak rainfall of 342 mm per day and a dramatic precipitation drop at El Niño onset. Results show an immediate hydraulic head increase post-rainfall followed by a steep decline, with head variance of 43.4 cm, indicating that blockages did not fully retain water.

Keywords: peatlands; soil microbiology; drainage; hydraulic head; rainfall.

Strategies for Mitigating Groundwater Salinization in Extraction Boreholes in the Vietnam's Mekong Delta

Pham Quy Nhan[1], Le Viet Hung[1]; Hoang Dai Phuc[2], Vu Ngoc Đuc[3]

[1]Hanoi University of Natural Resources and Environment (HUNRE)

[2]National Center for Water Resources Planning and Investigation (NAWAPI)

[3]Cosultancy, Technology Development and Construction Company of the University of Mining and Geology (CODECO)

Abstract. The salinization of groundwater extraction boreholes in the Quaternary-Neogene sedimentary aquifers of the Vietnam's Mekong Delta is increasingly impacted by climate change, rising sea levels, and growing demand for groundwater. This study identifies the key criteria influencing salinization and develops a set of mitigation strategies. These criteria are divided into three categories: aquifer characteristics (e.g., water table depth, permeability, and groundwater quality), supplementary water sources (e.g., rainfall, proximity to surface water, and saltwater boundaries), and management factors (e.g., proximity to water supply areas and contamination risks). By applying the Analytic Hierarchy Process (AHP) and GIS-based map overlays, the study successfully identifies the most effective solutions to mitigate salinity across 42 water-scarce regions in the Vietnam Mekong Delta. These findings provide a comprehensive framework for mitigating salinization and ensuring sustainable groundwater resources.

Keywords: Key words: Salinization; Groundwater extraction boreholes; Water-scarce areas; AHP; GIS; Solutions

Subsurface Aquifer Geometry Characterization on Small Islands Using Geoelectrical Data: Case Studies of Gili Ketapang, Lusi, Laut, and Karimunjawa Islands

Dino Gunawan Pryambodo[1,2*)], Rachmat Fajar Lubis[1)], Hendra Bakti[1)], Nico Anatoly[1)], Priyo Hartanto[1)], Prabang Setyono[2)], and Budi Legowo[3)]

[1)] Research Center for Limnology and Water Resources - BRIN
[2)] Environmental Science, UNS
[3)] Physics, Faculty of Mathematics and Natural Sciences, UNS
Jl. Raya Bogor KM.46 Cibinong, Bogor 16912

*E-mail: dino001@brin.go.id

Abstract. Freshwater availability in small islands is scarce distribution due to limited recharge capacity, saltwater intrusion, and complex subsurface characteristics. This research aims to delineate subsurface aquifer geometry across four Indonesian small islands presented coral, sediment, monadnock located at Gili Ketapang (Probolinggo), Lusi (East Java), Laut (Natuna), and Karimunjawa (Central Java). Geophysical surveys were conducted using resistivity methods with Wenner and Schlumberger array to identify subsurface lithological structures and potential aquifer zones. Results indicate that aquifers typically range between 2.5 and 45 meters subsurface, exhibiting resistivity values ranging from 0.651 to 206 Ω·m. The aquifer-bearing formations are predominantly composed of sandstone, siltstone, and limestone, which function as key groundwater reservoirs. The constructed aquifer models contribute to a better understanding of subsurface hydrogeological systems in small island settings and offer valuable input for environmental evaluation and sustainable freshwater resource planning.

Keywords: Geophysical, Resistivity methods, Aquifer geometry model, Small islands

The Effect of Land Use Changes on Groundwater Availability in The Coastal Region of The Madura Strait: A Review Study

Muhammad Nabiel Nahensa Athallah[1]*, Yudhi Listiawan[1], Muhammad Ghozi[1], Mohamad Sapari Dwi Hadian[1]

[1]Enviromental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD, Jl. Ir. Soekarno Km.21 Jatinangor, Sumedang District, West Java-Indonesia 45363

*E-mail address: muhammad22419@mail.unpad.ac.id

Abstract. Coastal areas play a vital role in Indonesia's economy and tourism industry. As one of the largest archipelagic countries in the world, Indonesia's growth is also highly dependent on maritime areas. Therefore, coastal regions have significant demands for natural resources, with water being one of the most crucial. The dynamics of residential and industrial growth in the coastal area create intensive competition for limited groundwater resources. The requirement for abundant water demands sufficient supplies of clean water. Drinking water, mainly sourced from groundwater, faces supply challenges due to changes in land use. This study aims to assess the impact of land use change in the coastal regions of the Madura Strait, which is a highly productive coastal area on groundwater supply. The method employed in this study is based on a review of previous research results and utilizes Driving Forces, Pressures, State, Impacts, and Responses (DPSIR) analysis for environmental impact evaluation. The changes in land use within the coastal region of the Madura Strait, driven by population growth and economic activities, have led to a reduction of groundwater catchment zones and a decline in the soil's capacity to store groundwater. The decrease of water catchment zones within the coastal regions of the Madura Strait is a genuine danger to the accessibility of groundwater as a vital resource. Regulatory policies for sustainable land use are essential, including the preservation of groundwater catchment areas, effective waste management, and the utilization of groundwater within safe exploitation limits to ensure the sustainable availability of groundwater in the coastal regions of the Madura Strait.

Keywords: Environmental Impact; Groundwater Availability; Land Use Change; Madura Strait.

The Significance of Groundwater Abstraction Control on Land Subsidence Potential in the Pekalongan Groundwater Basin, Central Java

Idham Effendi[1], Abdullah Husna[1], and Ryan Dzulfiqar Ahmad[1]
[1]Pusat Air Tanah dan Geologi Tata Lingkungan, Badan Geologi, KESDM

Abstract. Groundwater abstraction in coastal aquifers has been closely linked to land subsidence, driven by soil compaction and exacerbated by sea level rise and urban development. Pekalongan, a rapidly growing coastal city in Central Java, faces such challenges as groundwater levels continue to decline, contributing to increased flood vulnerability. This study employs MODFLOW-2005, a three-dimensional groundwater flow model, integrated with the Subsidence (SUB) package to simulate the interaction between groundwater depletion and subsidence in the region. Results show that groundwater levels have declined significantly over the past few decades, forming cones of depression in urbanized areas, with levels reaching up to 26 meters below sea level in 2020.

Model calibration using the PEST automatic parameter estimation technique identified sandy clay and clayey sand lithologies as the most sensitive to changes in hydraulic conductivity. Refining these values significantly improved model performance, reducing the RMSE from 11.297 to 7.228. The calibrated model more accurately represents groundwater behavior, and spatial analysis confirms that areas of substantial groundwater drawdown closely align with zones of high land subsidence.

To address these risks, the study proposes a comprehensive groundwater management strategy, emphasizing reduced dependence on groundwater abstraction, increased utilization of surface water sources, and the implementation of policy measures tailored to the unique hydrogeological conditions of the Pekalongan Basin. These actions are critical to mitigating land subsidence, enhancing flood resilience, and ensuring the long-term sustainability of water resources in coastal urban environments.

Keywords: groundwater, abstraction, land subsidence, climate change, coastal

Abstracts of Parallel Sessions:

Sustainable Practices, Policies, and Finance for Water Resilience in the Coastal Regions

Groundwater Recharge Area: Bridging Technical Aspect and Policy

Budi Joko Purnomo dan Fikra Talenta Sada
(Pusat Air Tanah dan Geologi Tata Lingkungan - Badan Geologi)

E-mail: purnomobudi80@gmail.com
HP: 082134638735

Abstract. Groundwater recharge area has very important roles in groundwater conservation, hence it is regulated as protection areas. This policy is stated in two regulation sectors, i.e. water resources and landuse planning. As a protection area, groundwater usage in a groundwater recharge area is strictly limited, therefore delineation of the border of groundwater recharge area is substantially very strategic case. Technically many methods have been well known in identifying groundwater recharge area, such as morphology, rocks layer configuration, groundwater head, hydrochemistry, and isotopes. The complex geological condition in Indonesia makes a technical standard in delineating groundwater recharge could not be applied to all groundwater basin. Moreover, delineation of groundwater recharge area is highly risked conflicted with economic development of a region. Therefore, it is required to establish a bridging policy between technical aspect with geological condition and potential of economic loss. Other factors, such as existing landuse, classification of industrial characteristic in affecting recharge function and implementation of artificial recharge to optimize recharge function can be additional factors applied in delineating groundwater recharge area.

Keywords: groundwater, recharge area, policy

Implications of Land Subsidence on Groundwater in the Northern Coastal Region of West Java

Asep Irwan[1*], Arif Bagas Kesuma[2], Mulyadi Maulana[3]

[1] Civil Engineering, Bandung of Institute Technology Sains, Bandung, Indonesia

[2] Civil Engineering, Sumatera Institute of Technology, Lampung, Indonesia

[3] Urban and Regional Planning, Bandung Institute of Technology Sains, Bandung, Indonesia

[*]E-mail: asep.irwan@itsb.ac.id

Abstract. This study investigated the relationship between land subsidence and groundwater subsidence in the coastal area of northern West Java. Utilizing imagery data (Sentinel-1 InSAR/Landsat) and historical groundwater level data, spatial and temporal analyses were conducted to identify patterns of subsidence and groundwater depletion. Results showed highly significant correlations, indicating unsustainable groundwater management practices. Impacts groundwater management sustainability by exacerbating saltwater intrusion and increasing flood risks. Excessive groundwater extraction for domestic and industrial use, coupled with the area's geology, accelerates subsidence, leading to a relative rise in sea level and inundation of coastal areas. This necessitates integrated management strategies that address both groundwater and coastal protection. This research proposes integrated policy interventions to prevent irreversible aquifer degradation and strengthen the long-term resilience of water resources in coastal areas. The challenges of land subsidence in northern West Java require a multi-faceted approach involving government agencies, local communities, and researchers. Effective management requires a combination of policy interventions, technological solutions, and community engagement to ensure the long-term sustainability of groundwater resources and coastal areas.

Keywords: groundwater sustainability, land subsidence, west java

The Historical Trajectory of Groundwater in Indonesia and Its Challenges

Wahyudin[*)], Budi Joko[*)], Fajar Dwinanto[*)], and Ayu Fadhilah[*)]
*) Center for Groundwater and Environemntal Geology, Geological Agency, Ministry of Energy and Mineral Resources

Asbtract. The Algeemen Waterreglement (AWR) of 1936 was established during the Dutch East Indies Colonial era, which contained regulations on irrigation. After the Independence of the Republic of Indonesia (RI), there are 3 (three) laws related to Water Resources were issued, namely Law (UU) No. 11 of 1974 concerning Irrigation, Law No. 7 of 2004 and Law No. 17 of 2019 concerning Water Resources.

The groundwater regulation based on the above law and its derivative regulations has experienced several changes in providing technical recommendations and groundwater permits authority also basis of the area of authority in implementing groundwater management.

Groundwater regulations in the AWR of 1936 until the enactment of Law 7 of 2004 and the Constitutional Court decision in 2013 which again referred to Law 11 of 1974, contain the authority to grant groundwater drilling permits granted by the local Regional Government based on technical advice from agencies that have duties and functions in the mining or geology sector. Groundwater management since 2000 has been carried out based on the Groundwater Basin boundary. Furthermore, when Law 17 of 2019 was enacted, groundwater management was carried out based on the boundaries of the River Basin. Groundwater permits and their technical recommendations are given by the Ministry of Energy and Mineral Resources, Governors, Regents/Mayors in accordance with their authority. The regulation of groundwater permits is one of the efforts to conserve groundwater through controlling the groundwater use so that it can be used sustainably.

Based on Bappenas data in 2021, it shows that only 11% of the water supply is used to meet demand, impacting the use of groundwater for various needs. Along with the increasing population and development activities in various sectors that will require water supplies including groundwater, more comprehensive groundwater regulation is needed and accompanied by its implementation.

Keywords: Water Resources, Groundwater Regulation, Technical Advice, Groundwater Permits, Groundwater Basin, River Basin

The Impact of Technical Recommendations for Groundwater Utilization Permits on Changes in Confined Groundwater Levels in the Jakarta Groundwater Basin (2018–2022 Period)

Dendi Borneo Putra[1]*, Taat Setiawan[2], Enda Mora Nasution[3], Donny P. Simorangkir[4], Sitti Sofia Wahida[5]
Groundwater Conservation Center, Center for Groundwater and Environmental Geology, Geological Agency, Ministry of Energy and Mineral Resources

*Email: dendi.putra@esdm.go.id

Abstract. Indonesia is one of the highest groundwater-consuming countries in the world. Due to the limited availability of surface water sources, groundwater is used not only to meet basic community needs but also to support various sectors and industries. Until 2022, the Geological Agency of the Ministry of Energy and Mineral Resources held the authority to issue technical recommendations for groundwater utilization permits. These recommendations include discharge limitations based on the criteria and groundwater conservation zones established by Ministerial Decree No. 195 of 2021 and were implemented in accordance with Government Regulation No. 121 of 2015. This study discusses the impact of these technical recommendations on changes in confined groundwater levels in the Jakarta Groundwater Basin (CAT Jakarta) by analysing confined groundwater level data from 2018 to 2022. The analysis is compared with permit data issued by provincial governments within the CAT Jakarta area, as well as the conformity of these permits with the technical recommendations provided by the Geological Agency. Between 2018 and 2022, the Geological Agency issued 2,595 technical recommendations for groundwater utilization permits, out of a total of 3,608 applications, and rejected 1,013 applications. Through the issuance of these technical recommendations and permit limitations, groundwater conservation in CAT Jakarta reached a total of 87,728 m^3/day. This was supported by a gradual recovery of confined groundwater levels in various areas of CAT Jakarta, with recovery rates ranging from 0.05 to 6 meters per year. The provision of discharge recommendations in accordance with groundwater conservation zones is expected to support the sustainable management of groundwater resources in the Jakarta Groundwater Basin.

Keywords: groundwater recovery, technical recommendation, conservation zone, Jakarta Groundwater Basin

Toward Water Resilience: Rethinking Clean Water Management in Coastal Communities within Informal Settlement of North Jakarta, Indonesia

Saut Sagala[1,2*], Rahastuti Tiara Adysti[2], Iqbal Hafizhul Lisan[2], Alifa Zalfa Poetry Wicaksono[2], Edi Riawan[3]

[1]Urban and Regional Planning, School of Planning Policy Development, Institut Teknologi Bandung, Bandung, Indonesia

[2]Resilience Development Initiative, Bandung, Indonesia

[3]Atmospheric Sciences Research Group, Faculty of Earth Sciences and Technology, Institut Teknologi Bandung, Bandung, Indonesia

*E-mail address: saut.sagala@itb.ac.id

Abstract. Clean water issues remain a persistent challenge for coastal communities in the North Jakarta area, particularly within informal settlements marked by significant land subsidence and limited affordability of clean water services. While the PAM Jaya initiative, with its water kiosk program, represents a notable governmental intervention, its scale and sustainability remain insufficient to address the complexity of clean water insecurity in the North Jakarta area. This study offers a novel contribution by integrating policy analysis, spatial mapping, and a water justice framework to critically assess existing initiatives on clean water and identify leverage points for policy reform. Utilising satellite imagery, this study also reveals patterns of informal settlement growth and its effects on the declining access to clean water in the area. Drawing from these findings, this paper develops a collaborative model for water stewardship that highlights its implementation as not only essential but increasingly urgent. This further facilitates the transition from centralized and top-down clean water supply provision toward more inclusive, locally-led, and people-centered approaches. This subsequently enables stronger stakeholder ownership, enhances adaptive capacity, and supports sustainability and water resilience in the low-income coastal communities.

Keywords: coastal communities; north jakarta; policy reform; water resilience; water stewardship

Abstracts of Parallel Sessions:

Environmental Hydrogeology in Various Geological Settings

Analysis of Aquifer Potential in the Bukit Semarang Baru (BSB) Area, Mijen District, Semarang City

Nofelia Dwi Kurniawati[1*], Sokhwatul Aghnia[2]
[1] Department of Geological Engineering, Universitas Diponegoro, Semarang, Indonesia
[2] Department of Energy and Mineral Resources (ESDM), Central Java, Indonesia

[*]E-mail address: sokhwatulaghnia@gmail.com

Abstract. Population growth and industrial development in Mijen District, particularly in Bukit Semarang Baru (BSB), have led to an increasing demand for clean water in the area. Groundwater has become the main alternative to meet this demand due to the limited availability of surface water. This study aims to analyze the aquifer potential in the BSB area using the resistivity geoelectric method with the Schlumberger configuration. Data were collected at 15 sounding points to map subsurface conditions. The data include electrode spacing (AB/2 and MN/2), conversion factor (K), and electrical parameters such as voltage, current, and resistivity. Field data were processed using IPI2WIN software to produce one-dimensional inversion models showing subsurface layer thickness and lithological variations. These models were then grouped into five profiles and visualized as two-dimensional subsurface cross-sections using RockWorks software. The interpretation results revealed the presence of rock layers such as soil/cover, bouldery tuff, sandy tuff, tuffaceous clay, tuff breccia, tuff sandstone, tuff, breccia, sandstone, tuffaceous breccia, marl, and volcanic breccia, with moderate to high resistivity values. Sandstone, tuff sandstone, and sandy tuff were interpreted as potential aquifer zones, both unconfined and confined. Volume estimation using Surfer software produced a solid volume of approximately ±71 million m³ for the unconfined aquifer and ±174 million m³ and ±260 million m³ for the two confined aquifer layers. The total effective groundwater volume was obtained by multiplying these volumes by the Specific Yield (SY) values, resulting in an estimated effective groundwater volume of approximately ±68 million m³. These findings indicate that the BSB area has significant groundwater potential, particularly within the deeper confined aquifer system, which is more stable and protected from surface contamination.

Keywords: Aquifer, Groundwater, Resistivity, Geoelectrical, Schlumberger Configuration, IPI2Win, Surfer, Bukit Semarang Baru.

Characterization of Groundwater Flow System in the Bandar Lampung Basin using Hydrochemistry and Stable Isotope Signatures

Akbar Norma Arief[1] dan Munib Ikhwatun Iman[1]

[1]Pusat Air Tanah dan Geologi Tata Lingkungan

Abstract. This study delineates the groundwater flow system in the Bandar Lampung Basin, Indonesia, by integrating hydrochemical and stable isotope (δ18O and δ2H) analyses. Groundwater samples from 22 monitoring wells were assessed for physicochemical parameters (pH, TDS, conductivity, major ions) and stable isotopes. Results reveal significant spatial heterogeneity: TDS ranges from 95 to 5,688 mg/L, indicating fresh to saline conditions, with elevated salinity (e.g., BL-22B: TDS = 5,688 mg/L) suggesting seawater intrusion in coastal areas. Hydrochemical facies, classified via Piper diagram, are predominantly Ca-HCO3 in inland zones, transitioning to Na-Cl near the coast, reflecting rock-water interactions and anthropogenic influences. Stable isotope signatures (δ18O: -9.98 to -6.20‰; δ2H: -100.70 to -34.71‰) cluster near the Global Meteoric Water Line (GMWL), confirming meteoric origin. However, enriched isotopic values in high-salinity samples (e.g., BL-24: δ18O = -6.20‰) imply evaporation or mixing with saline water. Nitrate contamination (up to 23.85 mg/L) is detected in agricultural/urban areas. Groundwater table elevations (2.23-90.20 m) correlate with topography, indicating recharge from highland regions and discharge toward the coast. This integrated approach identifies recharge zones, flow paths, and contamination hotspots, providing a foundation for sustainable groundwater management in the basin.

Keywords: Groundwater flow system, Hydrochemistry, Stable isotopes, Bandar Lampung Basin, Salinity intrusion, Isotopic signature, Recharge characterization, Water-rock interaction.

Carbonate Weathering Enhances Nitrogen Assimilatory Uptake in Rivers Globally

Hongkai Qi[1], Yi Liu[1,2]*, Haoran Wang[1], Xingxing Kuang[3], Aditya Nugraha Putra[4], Jiu Jimmy Jiao[5], Jianping Gan[2,6]

[1] Earth, Ocean and Atmospheric Sciences (EOAS) Thrust, Function Hub, The Hong Kong University of Science and Technology (Guangzhou), Guangzhou, China
[2] Center for Ocean Research in Hong Kong and Macau (CORE)
[3] Guangdong Provincial Key Laboratory of Soil and Groundwater Pollution Control, School of Environmental Science and Engineering, Southern University of Science and Technology, Shenzhen, China
[4] Department of Soil Science, Faculty of Agriculture, University Brawijaya, Veteran Steer Malang, Indonesia
[5] Department of Earth Sciences, University of Hong Kong, Hong Kong, China.
[6] Department of Ocean Science and Department of Mathematics, Hong Kong University of Science and Technology, Hong Kong, China

* Corresponding author (yiliuyl@hkust-gz.edu.cn).

Abstract. Bedrock composition, particularly the proportion of carbonate, can influence the dissolved inorganic carbon (DIC) concentration and so the carbonate chemistry of rivers, but its effects on nitrogen N cycle in rivers are usually overlooked. Here we present geochemical composition measurements of rivers across the Pearl River Basin in China that show that dissolved organic nitrogen (DON) positively correlated with dissolved inorganic nitrogen (DIN) and follows the variation in solar radiation in the carbonate-dominated region during the wet season, but not in the non-carbonate-dominated region. In-situ incubations show that organic nitrogen production is strengthened in the high DIC region with high temperature and solar radiation. DON zonation in the dry season is not obvious owing to the limitation of low temperature on nitrogen assimilation. We also report a similar DON contrast in carbonate-dominated and non-carbonate-dominated regions in Malang in Indonesia. Furthermore, from analysis of global published data, we find that a modified Michaelis-Menten model considering carbon limitation much better fits the latitudinal distribution of DON globally. Hence we propose that carbonate weathering enhancement of organic nitrogen production occurs ubiquitously.

Evaluation of Land Subsidence on Changes in Groundwater Conditions in the North Jakarta Region

Janner Rahmat Sudianto[1*], Taat Setiawan[2], Harris Andriyanto[3], Muhammad Aditya Munajat[4], Delano Ichsan Hakkina[5], Imtiyaz Azzah Nugroho[6]

Groundwater Conservation Center, Geological Agency, Tongkol Street No. 4, Pademangan, Jakarta, Indonesia

[*]E-mail address: jrs.nbbn@gmail.com

Abstract. The northern region of Jakarta and its surroundings is one of the areas experiencing the phenomenon of land subsidence among other cities on the North Coast of Java. Land subsidence is mostly caused by excessive groundwater exploitation, thick clay layers, and massive building/infrastructure loads. This study aims to determine the rate of land subsidence and analyze the relationship between land subsidence and depressed groundwater level. The method of measuring land subsidence using GPS GNSS Geodetic tools with static surveys where measurements have started from 2015 to 2023. GPS observation locations reached 53 locations spread across the northern part of the Jakarta Groundwater Basin area. The results of the monitoring analysis show a subsidence rate of 0.2 to 5.65 cm/year. Subsidence rates of more than 2 cm/year are dominantly distributed in the western and northeastern parts of the North Jakarta area. The high rate of land subsidence in North Jakarta is in accordance with the condition of the depth of the depressed groundwater table which is below sea level. The monitoring results in 2023 showed that the depth of the depressed groundwater table in the Penjaringan - Cengkareng area reached 35 meters, Kalideres a depth of 30 meters, Tanjung Priok a depth of 10 meters, and Tarumajaya - Babelan reached a depth of 20 meters from the land surface. This shows that in some locations there is a correlation between land subsidence and depressed groundwater levels.

Keywords: land subsidence, depressed groundwater, Northern Jakarta

Evaluation of the Palembang – Kayuagung Groundwater Basin Condition in 2024

Rusmawan Sumarwan[1], Fabio Anatra Rahmana[2], Habib Fathur Rohman[3], Munib Ikhwatun Iman[4], Dan Ramadhan Achmad[3], Erik Hermawan[3], Riri Febrina[3] , Meila Puspita[3]

[1] Faculty of Earth Science and Technology, Bandung Institute of Technology, [2] Inspectorate General MEMR, [3] LAPI ITB Foundation, [4] Center for Groundwater and Environmental Geology, Geological Agency MEMR

Email: rusmawan@itb.ac.id

Abstract. A groundwater basin is an area bounded by hydrogeological boundaries, where all hydrogeological events such as recharge, flow, and release of groundwater occur. The Palembang-Kayuagung Groundwater Basin (CAT Palembang-Kayuagung) is one of the groundwater basins in Sumatra whose existence has been determined through the Regulation of the Minister of Energy and Mineral Resources Number 2 of 2017 concerning Groundwater Basins in Indonesia. Based on the ministerial regulation, this CAT has an area of 8,652 km^2 which includes Palembang City, Prabumulih City, Musi Banyuasin Regency, Ogan Komering Ilir Regency, Ogan Ilir Regency, Muara Enim Regency, and Banyuasin Regency. Evaluation of the condition of the Palembang-Kayugung CAT was specifically carried out for aquifers in the 50-150 m depth zone, by identifying the aquifer system and parameters, observing groundwater levels and physical chemical properties, and conducting numerical simulations to understand groundwater flow system. The evaluation results show: 1. The groundwater flow pattern in the 50-150 m aquifer flows relatively northeastward, 2. Groundwater quality, represented by the TDS value, indicates a safe condition, <300 ppm, 3. The Palembang-Kayuagung Basin is a safe zone, with a maximum withdrawal discharge of 260 m3/day/well, with limited number of wells per km^2.

Keywords: groundwater basin evaluation, Palembang-Kayuagung CAT

Groundwater Constraint in Oligo-Miocene Volcanic Rock of a Small Catchment Area of the Mandalika Special Economic Zone and Its Surroundings

Kusnadi[1], Boy Yoseph[2], Taat Setiawan[3], & Dicky Muslim[4]

[1] Mining & Energy Agency, West Nusa Tenggara Province, Mataram, Indonesia
[2] Geological Engineering Faculty, Padjadjaran University, Bandung, Indonesia
[3] Geological Agency, Ministry of Energy and Mineral Resources, Bandung, Indonesia
[4] Geological Engineering Faculty, Padjadjaran University, Bandung, Indonesia

[*]E-mail address: kusnadi.dpe@gmail.com

Abstract. The Mandalika Special Economic Zone (KEK) is located on the South coast of Lombok Island which is a special economic zone for tourism. The fairly rapid economic growth has had an impact on the use of groundwater in this area. This area is dominated by volcanic rocks and Oligo-Miocene intrusions which in some places have mineralized. This area also has a small water catchment zone.

This study was conducted to determine the potential of groundwater in relation to the distribution and variation of rocks and their water catchment zones by combining remote sensing, GIS, geophysics (geoelectric & logging), analysis drill logs and pumping tests.

The Groundwater potential is divided into 3 zones, namely the valley zone, the fractured hill zone, and the alteration hill zone. The valley zone located in the middle along the coast and composed of alluvial layers in the form of sand and clay with a thickness of between 10-15 meters. This zone tends to have greater groundwater potential with a discharge of between 1-3 liters/second. The fractured hill zone is generally affected by geological structures, located in the hill section along the fault zone. It has a groundwater potential that varies depending on the distance from faults. It generally consist of breccia or tuff lapilli rocks with a discharge of between 0.5 - 1.5 liters /second. The alteration hill zone has a lower groundwater potential because the tuff or breccia rocks have become clay so that the groundwater potential is small with a discharge of less than 0.5 liters / second.

In addition to these four zones, there are resistant rocks that form ridges in the form of volcanic breccia and andesite which separate the Mandalika Special Economic Zone area into several narrow groundwater zones.

Keywords: Groundwater, KEK Mandalika, Combination, groundwater zone, discharge

Groundwater Quality Analysis and Its Relationship with Land Subsidence Vulnerability Zones in the Coastal Area of the Jakarta Groundwater Basin

Delano Ichsan Hakkina*, Taat Setiawan, Hirundini Rustica Absari, Moch. Sani Salam, Imtiyaz Azzah Nugroho
Balai Konservasi Air Tanah, Pusat Air Tanah dan Geologi Tata Lingkungan,
Badan Geologi, Kementerian ESDM

*E-mail address: ichsandelano@gmail.com

Abstract. Land subsidence has become a common issue in coastal areas of Indonesia in recent years. Jakarta, the capital city, is even known as a city that is "sinking." The Jakarta Special Capital Region (DKI Jakarta) which hydrogeologically lies within the Jakarta Groundwater Basin (CAT Jakarta), is geologically composed of alluvial deposits and other young rock formations, high demand for groundwater usage, and the large number of urban infrastructures are factors that contribute to the high rate of land subsidence in CAT Jakarta. This study aims to determine the correlation between land subsidence and groundwater quality characteristics. The method used to assess land subsidence vulnerability is a scoring method that includes parameters such as the thickness of sandy clay layers, the depth of confined groundwater levels, and types of land use. These are then correlated with data on electrical conductivity (EC) and chloride ion (Cl^-) concentrations in groundwater samples. The results show that several areas with high land subsidence vulnerability have EC values ranging from 1,531 to 5.500 µS/cm and Cl^- ion concentrations ranging from 247 to 1.792 mg/L. This indicates a correlation between land subsidence and groundwater quality, where areas experiencing high land subsidence tend to have groundwater with more saline characteristics.

Keywords: groundwater; groundwater quality; land subsidence; coastal Jakarta

Hydrogeochemistry of Jakarta Groundwater Basin

Faizal Abdillah[1*], Taat Setiawan[1], Enda Mora Nasution[1], Hirundini Rustica Absari[1], Shalsabila Nur Halizah[1], Shinta Rafidah[1]

[1] Groundwater Conservation Office, Ministry of Mineral and Energy Resources, Tongkol Street No. 4, Ancol, Pademangan, North Jakarta

[*]e-mail address: faizal.abdillah@esdm.go.id

Abstract. The Jakarta Groundwater Basin has a multi-layered aquifer system that is an important source of groundwater for the people of Jakarta and its surroundings. As the main provider of clean water, understanding the hydrogeochemical characteristics is crucial. This study was conducted by analyzing 224 groundwater samples representing two types of aquifers, namely unconfined aquifers (<40 m) and confined aquifers (>40 m). Laboratory analysis was carried out using IC and ICP-OES to identify the main ion composition, which was then analyzed graphically to determine the water type. The results of the analysis showed that the dominant facies in the unconfined aquifer were of the Ca-HCO_3 type, while in the confined aquifer, it was of the Na-HCO_3 type. The shift in cation dominance from Ca^{2+} to Na^{+} indicates the occurrence of ion exchange processes in both unconfined and confined groundwater. Further analysis using the Gibbs diagram showed that around 90% of groundwater samples had a rock dissolution dominance pattern as the main mechanism controlling the chemical composition of groundwater in the study area.

Keywords: Jakarta Groundwater Basin, Hydrogeochemistry, Ion Exchange

Hydrochemical Characteristics of the Pekanbaru Groundwater Basin, Riau Province

Risma Nurulfalah Saepulloh[1], Firman Maliki[1]
[1]Pusat Air Tanah dan Geologi Tata Lingkungan, Badan Geologi, Kementerian Energi dan Sumber Daya Mineral, Jl. Diponegoro No. 57, Bandung

*E-mail: risma.nurulfalah.s@gmail.com

Abstract. The Pekanbaru Groundwater Basin located in the southern part of Riau Province, Indonesia, serving as a major source of raw water for domestic, agricultural, and industrial use. This study aims to characterize the hydrochemical properties of groundwater in Pekanbaru Groundwater Basin by analyzing water chemistry and its relation to the region's geology, land use, rainfall patterns, and aquifer productivity. The study integrates secondary data from geological, hydrogeological, rainfall, and land cover maps, as well as primary data from borehole sampling and laboratory analysis of groundwater quality.

Results indicate that groundwater in the region is moderately to highly productive and primarily hosted within Quaternary alluvial deposits and sedimentary formations such as the Minas and Kasai Formations. The dominant hydrochemical facies are Ca-HCO3 and Na-Cl, which are shaped by mineral dissolution, mixing, and anthropogenic influence from agricultural runof and residential wastewater. Areas with land use dominated by plantations and high rainfall (>2500 mm/year) show higher ion concentrations, likely due to leaching processes. Minor contamination was observed in zones of intense land use.

The study highlights the need for sustainable groundwater management through hydrogeochemical zoning and integrated land–water resource planning to safeguard groundwater quality for future use.

Keywords: Groundwater basin; hydrochemistry; aquifer productivity; Pekanbaru; water quality; land use; hydrogeology

Hydrogeochemical Characterization and Tracer Investigation of Sinkholes Systems

Zulis Septian[1*], Irwan Iskandar[2]
[1] Magister Groundwater Engineering ITB, Student, Bandung, Indonesia
[2] Mining Engineering Department ITB, Lecturer, Bandung, Indonesia

[*]E-mail address: zulisseptian@gmail.com

Abstract. This study integrates passive hydrogeochemical analyses and active tracer tests to explain the structure, flow dynamics, and geochemical evolution of the carbonate aquifer system in the location with exposed sinkhole. In the passive phase, in-situ measurements such as pH, TDS, salinity, and electrical conductivity revealed natural anomalies in groundwater chemistry, with total dissolved solids exceeding 1,000 ppm at several points. Major ion determinations via ion chromatography and ion-balance assessments (<10% discrepancy) allowed classification of facies using Piper diagrams: the majority of surface and groundwater samples plotted within the Ca–HCO_3 facies—indicative of meteoric recharge through a karstified limestone matrix—while minor groups showed mixed Ca–Na–HCO_3–Cl and Na–Cl signatures, suggesting limited influence from evaporative, ion-exchange, or saline/hydrothermal sources. ICP-MS analyses detected elevated lithium (650–4,600 ppb) and boron (3,300–6,600 ppb) in deeper wells, indicating a secondary hydrothermal component. Stable isotope ($\delta^{18}O$, $\delta^{2}H$) data clustered around the Local Meteoric Water Line, confirming rapid infiltration of meteoric waters, with slight heavy-isotope shifts in anomalous samples aligning with hydrothermal fluid exchange.

In the active phase, controlled NaCl injections into identified sinkholes and boreholes were monitored across multiple observation points. Simultaneous spikes in TDS, EC, and salinity delineated hydraulic connectivity between sinkholes and specific monitoring wells. Applying a modified Darcy's law, inter-point hydraulic conductivities ranged from 8.7×10^{-3} to 0.299 m/s, reflecting highly transmissive limestone network.
The combined findings delineate two discrete aquifer regimes: (1) a rapid limestone network dominated by meteoric recharge, and (2) a deeper, cooled-down hydrothermal-affected system. These insights have critical implications for groundwater management, contamination risk assessment, and sustainable mine-water stewardship in the terrains..

Keywords: limestone, sinkhole, tracing, hydrogeochemical, isotope, ion.

Hydrogeologic Conceptual Model of Cold Spring Water at Southeastern Flank of Slamet Volcano, Banyumas Regency, Central Java

Fania An Nisaa[1*], Doni Prakasa Eka Putra[1], Lili Retno Kusnaeni[1]
[1] Geological Engineering Department, Universitas Gadjah Mada, Yogyakarta, Indonesia

[*]E-mail address: fania.an.n@mail.ugm.ac.id

Abstract. The occurrence of spring on Mount Slamet is particularly abundant on the southeastern flank of the mountain. Some of them are Baturaden Hot Spring, Sendang Mulya Spring, Lirip Spring, Damar Payung Spring, and Kawung Carang Spring. The occurrence of those springs is located in the quaternary rock formation product of Mount Slamet. The hydrogeological system of hot springs differs from the cold springs. This research aims to provide an overview of the hydrogeological system of the aquifer for the occurrence of cold springs on the southeastern slope of Mount Slamet by representing it in a conceptual hydrogeological model.

Field observations were carried out using hydrogeological mapping to determining groundwater flow patterns and the physical-chemical properties of groundwater, geological mapping to gather data on geological conditions, and groundwater sampling to evaluate the groundwater quality of cold springs and their surroundings.

The research results that geologically, the springs in the study area are found in three geological units, namely the volcanic breccia unit, the interbedded volcanic breccia and andesite-basalt lava unit, and the lahar deposits. The lahar deposit unit and the interbedded volcanic breccia and andesite-basalt lava unit have porous characteristics and potentially to become aquifer layers that contain groundwater. In contrast, the volcanic breccia unit is a non-aquifer layer that is compact and impermeable. The elevation of the groundwater table in the research area ranges from 130 to 740 meters above sea level, with the highest groundwater table located on the northern side of the research area, causing the direction of groundwater flow to be relatively towards the south. According to hydrochemical analysis, the water from the springs in the study area shows a bicarbonate water facies type (Ca-Mg-HCO_3) with low groundwater temperature, pH, EC, and TDS values. These characteristics indicate that the groundwater comes from a shallow, unconfined aquifer and has a short period in the water-rock interaction process.

Keywords: hydrogeochemistry, cold spring, conceptual model, Mount Slamet

Identification of Groundwater Aquifers in Volcanic Rocks using the Schlumberger Configuration Resistivity Geoelectric Method in the Pemuteran Area, Buleleng Regency, Bali

Ida Bagus Oka Agastya[1,3*], Putu Diyan Diwyastra[1,2], DewaAriana[1,2], Suryo Hespiantoro[1,2], I Ketut Ariantana[1]

[1] Perhimpunan Ahli Airtanah Indonesia Bali
[2] PPSDM Geominerba KESDM
[3] Bali Geoscience Research Group

[*]E-mail address: iokaagastya@gmail.com

Abstract. The need for clean water in the Pemuteran-Tanjung Ser area is quite high, where to serve daily needs and support the tourism industry to meet these needs, groundwater sources are utilized as raw water sources. In order to determine the potential of groundwater in volcanic areas, a geoelectric study was conducted that focused on lithological characteristics, aquifer types, and aquifer zones. Administratively, the research area is located in the Pemuteran-Tanjung Ser Area, Gerokgak District, Buleleng Regency, Bali, located at coordinates -8.133328 LS, 114.645327 BT. The method used in this study is the geoelectric method with a schlumberger configuration which is then analyzed for its geological and hydrogeological conditions. Based on the identification of groundwater aquifers using the geoelectric method, the research area shows the potential for aquifers controlled by volcanic rocks originating from the Pulaki Volcanic Formation, with the type of lithology identified as having low - medium resistivity values, namely Alluvium or soil, sand, Lapilli, Tuff, Andesite Breccia and Basal Lava. This condition is in line with the area whose geological formation is influenced by the activity of the Pulaki Ancient Volcano, with layers that have the potential as groundwater aquifers found in the lapilli rock layer. Based on these data, the research area has an aquifer layer that is included in the medium productivity aquifer with a discontinuous aquifer with a confined aquifer type. The research location is also considered to have the potential for groundwater with salty quality - medium quality groundwater.

Keywords: Aquifer, Groundwater, Resistivity, Volcanic, Pemuteran

Identification of Potential Groundwater Recharge Zones using AHP and GIS in Cibadak Sub-watershed, Bogor, West Java

Evan Fahar Priatama[1*], Mohamad Sapari Dwi Hadian[2], and Mochamad Nursiyam Barkah[3]

[1,2,3] Faculty of Geological Engineering, Padjadjaran University, Jatinangor, West Java, Indonesia - 45363

[*]E-mail address: evan21002@mail.unpad.ac.id

Abstract. Groundwater resources depend on recharge zones as an important part of the hydrological cycle, especially in the Cibadak Sub-watershed located on the eastern slopes of Mount Salak, Bogor Regency. The Cibadak sub-watershed is part of the Cisadane watershed and Upstream Cisadane sub-watershed with an area of 11,46 km^2. The increase in built-up areas and groundwater use requires accurate identification of recharge zones to support conservation and sustainable planning. A multi-criteria decision-making approach combined with geographic information systems was applied. Seven parameters were considered: lithology, rainfall, land cover, lineament density, drainage density, soil permeability, and slope. Thematic maps were made for each parameter. Parameter weights were determined using the Analytical Hierarchy Process (AHP) with the following results: lithology 34 %, rainfall 3 %, land cover 10 %, lineament density 5 %, drainage density 7 %, soil permeability 18 %, and slope 24 %. The integration of each thematic map using weighted overlay method and resulted in in a map with four zonations, namely zone of very poor (0,11 %), poor (25.75 %), moderate (52.92 %), good (21.02 %), and very good (0.20 %) recharge potential. The groundwater potential recharge map results show that moderate and good recharge zones dominate the Cibadak sub-watershed, while highly suitable areas are concentrated in regions with permeable lithology / soil and gentle slopes. Areas with very poor recharge potential are limited. Sensitivity analysis revealed that increasing the weight of rainfall had minimal impact on the overall zone distribution, confirming model robustness. These findings provide a scientific basis for upstream groundwater conservation planning.

Keywords: AHP, GIS, Groundwater, Recharge

Identifying Hydrocarbon Contamination in Unconfined Aquifers with Implementation of 2D Geoelectric Method: Case Study in Minas Area, Siak Regency, Riau Province

Dan Ramadhan Achmad[1], Amsor[2], Edi Yulindra[3], Karlan Rusmana[1], Erik Hermawan[1], Riri Febrina[1]

[1] LAPI ITB Foundation, [2]Ministry of Environment, [3]Pertamina Hulu Rokan

Abstract. One of the geophysical methods used in the exploration process of natural resources such as coal, metal minerals, and groundwater is the 2D geoelectric method. This method is intended to determine the subsurface resistivity value, where each material on earth has a different resistivity value. With hydrocarbons having high resistivity values, the method can also be used to identify their presence, which are considered as contaminants. The output of this method is used to help identify the distribution of hydrocarbons vertically and laterally, by tying the cross-section of the subsurface resistivity value to contamination information from hand drilling core observations and laboratory analysis results. The final results show that the 2D geoelectric method can be used to help identify the presence of subsurface hydrocarbons in unconfined aquifers vertically and laterally.

Keywords: 2D geoelectric method, hydrocarbon, contaminant, unconfined aquifers

Potential Groundwater Connectivity between the Coastal Area and Small Islands around Jakarta Bay

Hendra Bakti[1*], Rachmat Fajar Lubis[1], Nico Anatoly[1], Priyo Hartanto[1], Dino Gunawan Pryambodo[1], Gumilar Utamas Nugraha[1], Sulistiani[2]

[1]Research Center for Limnology and Water Resources, National Research and Innovation Agency (BRIN), Bogor, Indonesia

[2]Department of Geophysics and Meteorology, Faculty of Mathematics and Natural Sciences, IPB University, Bogor, Indonesia

[*]E-mail address: hend009@brin.go.id

Abstract. The rapid development of major cities in coastal areas and small islands necessitates a sufficient supply of freshwater resources to meet the growing water demand. In the coastal region of Jakarta and Kepulauan Seribu, groundwater is commonly used to fulfill clean water needs. Generally, groundwater originates from recharge areas in the southern region and flows northward. Based on groundwater age analysis using carbon-14 (^{14}C), groundwater in southern Jakarta is relatively younger compared to that in the coastal areas of Jakarta, ranging gradually from 610 ± 200 to 34,720 ± 4,550 years. In contrast, groundwater in the Kepulauan Seribu shows an age range of 20,925 ± 580 to 23,175 ± 760 years. These findings indicate the need for further research to explore and verify the potential connectivity between groundwater in coastal Jakarta and Kepulauan Seribu. This literature review is expected to provide insights that can support groundwater conservation policies and ensure long-term water security in the Jakarta Bay area and its surroundings.

Keywords: Groundwater Connectivity; Groundwater Age; Jakarta Bay; Small Islands

Rainwater - Rock Interaction in a Tailing Storage Facility Model: Potential CO_2 storage in Ultramafic Mine Waste

Janice Clementine da Costa[1], Nico Anatoly[1*] , Muhamad Luthfi Luthansyah[1], Faradilla Putri Jasanagara[1], Irsyadulhaq[1], Hirundini Rustica Absari[2], Irwan Iskandar[3]**

[1]Master Program in Groundwater Engineering, Faculty of Earth Sciences Technology, Bandung Institute of Technology
[2]Master Program in Geological Engineering, Faculty of Earth Sciences Technology, Bandung Institute of Technology
[3]Earth Resources Exploration Research Group, Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology

[*]E-mail address: nico001@brin.go.id
**corresponding author: irwan@itb.ac.id

Abstract. Raising of nickel mine and mineral processing in Indonesia resulting large area of mine waste and huge amount of greenhouse gas emitted from the said facility however this mine waste area has a potential to became a CO_2 storage facility through CO_2 mineral sequestration. This study aims to investigate the leaching process of rainwater into a tailing facility system using a physical model and to determine how ultramafic rocks aquifer could contain CO_2 from atmosphere. The model was constructed using dry tailings from a Tailing Storage Facility rich in Fe, Ca, and S, and bedrock material dominated by Mg, Si, and Fe. The physical model was built inside an acrylic box measuring 0.15 m × 0.5 m × 0.75 m, with the bedrock layer placed at the bottom and dry tailings on top. Monitoring wells were installed to observe changes over time.

Over a 30-day period, rainwater dripped into the system. Water samples were analyzed for physical parameters and major ions. The results indicated increases in Total Dissolved Solids (TDS), Electrical Conductivity (EC) while the Oxidation-Reduction Potential (ORP) and alkalinity in the water fluctuative over time.
Rock analysis using Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), and X-Ray Fluorescence (XRF) revealed the formation of carbonate minerals, particularly dolomite ($(Ca,Mg)CO_3$), mainly in the bedrock layer. This suggests that mineral carbonation occurred as result of leaching process of rainwater into the ultramafic mine waste.

Keywords: groundwater, mineral carbonation, dry tailings, geochemical interaction, ultramafic rocks

Study of Land Subsidence due to Groundwater Extraction along North Coast of Western Java: A Literature Review

Sarah Suci Ramadhani*, Damar Sayyidina Zulfi, Muhammad Ghozi, Bayu Nugraha
Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD, Jl. Ir. Soekarno Km.21 Jatinangor, Sumedang District, West Java-Indonesia 45363

*E-mail address: sarah22016@mail.unpad.ac.id

Abstract. Land subsidence refers to gradual sinking of the earth's surface due to natural processes and human activities that affect major environmental issues in coastal and urban regions worldwide. One of the primary factors contributing to land subsidence is the excessive extraction of groundwater from aquifers. This over-extraction reduces subsurface pressure, causing the compaction of soil layers and resulting in land surface deformation. Consequently, this deformation leads to significant infrastructure damage, increased tidal flooding, seawater intrusion, and a deterioration of water quality in affected areas. Rapid urbanization, population growth, and uncontrolled groundwater extraction have made this issue increasingly several cities in the northern coastal areas of West Java and Banten, such as Serang, Greater Jakarta, Cirebon, and Indramayu. This study aims to examine and synthesize the relationship between groundwater usage and the rate of land subsidence in several cities located in the northern part of Java. The research is conducted through a comprehensive literature review, analyze scientific publications, reports, and geospatial studies that employ remote sensing techniques, including Interferometric Synthetic-Aperture Radar (InSAR) time-series data. The findings reveal that excessive groundwater extraction, combined with the presence of soft alluvial soils, are the primary factors driving land subsidence in these areas that elevates the risks of infrastructure damage, flooding, and environmental degradation.

Keywords: Groundwater extraction; Land subsidence; Soft alluvial soil; West java north coast

Submarine Groundwater Discharge-Derived Carbon Exports and Emissions from Mai Po Natural Mangrove-Mudflat Wetland in Hong Kong

Wenli Hu[1,2], Jiu Jimmy Jiao[1*], Hailong Li[2]

[1] Department of Earth and Planetary Sciences, The University of Hong Kong, Hong Kong, China
[2] School of Environmental Science and Engineering, Southern University of Science and Technology, Shenzhen, China

[*]E-mail address: jjiao@hku.hk

Abstract. Submarine groundwater discharge (SGD) in intertidal mangrove-mudflat wetlands plays a crucial role in carbon (C) cycling, facilitating the transport of carbon from sediments to surface waters and ultimately to the ocean or atmosphere. SGD acts as a significant source of dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) in coastal waters, while also contributing to carbon dioxide (CO_2) and methane (CH_4) emissions, thereby influencing coastal carbon budgets. Despite its importance, SGD-derived carbon components (DIC, DOC, CO_2, and CH_4) remain poorly quantified in mangrove-mudflat wetlands characterized by extensive tidal creek networks and seepage faces. This study investigates SGD-derived carbon exports (DIC and DOC) and emissions (CO_2 and CH_4) in a natural mangrove-mudflat wetland at the Mai Po Inner Deep Bay Ramsar Site, Hong Kong, with a focus on quantifying fluxes and assessing their spatial and temporal variability. The findings aim to enhance understanding of SGD-mediated carbon dynamics in coastal wetland ecosystems.

Keywords: carbon emissions; carbon exports; mangrove-mudflat wetland; SGD

The Composition and Pollutant Interception of Iron Minerals in Sandy Coastal Aquifers

Yan ZHANG; Cheng XING; Yi LIU*
Earth, Ocean and Atmospheric Sciences (EOAS) Thrust, Function Hub, The Hong Kong University of Science and Technology (Guangzhou), Guangzhou, China

*Corresponding author, Email: yiliuyl@hkust-gz.edu.cn

Abstract. Iron minerals in coastal aquifers can trap land-sourced pollutants such as phosphorus (P) and mercury (Hg) carried by groundwater discharging to the ocean. However, what kinds of iron mineral and how they interact with pollutants are not well understood. In this study, we applied the sequential extraction techniques to differentiate the iron minerals in supratidal zone, freshwater discharge tube (FDT) sides, and upper saline plume of a sandy beach aquifer in Guanghai Bay, Guangdong China and quantified their pollutant interception capabilities, respectively. Results show that reducible oxides (Fe_{Ox2}) represent the largest iron pool (39%), followed by silicate minerals (Fe_{SI}, 35%), easily reducible oxides (Fe_{Ox1}, 15%), and carbonate-associated iron (Fe_{Carb}, 6%), with magnetite (Fe_{Mag}) having the lowest proportion at 5%. Highly reactive iron minerals (Fe_{HR}=Fe_{Carb}+Fe_{Ox1}+Fe_{Ox2}+Fe_{Mag}) constitute 65% of the total iron (Fe_T), with iron oxides Fe_{Ox} (Fe_{Ox} = Fe_{Ox1} + Fe_{Ox2}) minerals being the largest iron pool. Iron mineral content, particularly iron oxides, enriched in the groundwater table fluctuation zone and freshwater-saltwater interface but depleted in the tidal flashing zone due to coarse-grained minerals creating preferential pathways that cause scouring. There is a strong correlation between Fe_{Ox2} minerals and the P and Hg while Fe_{Ox1} iron minerals show minimal P and Hg affiliation in the vadose zone but high affiliation in saturated zone. Over 70% of P and Hg are adsorbed by Fe_{Ox} minerals. Dissolved phosphate (PO_4^{3-}) is strongly adsorbed by iron minerals enriched at freshwater-saltwater interface when they pass through and leading to nearly zero PO_4^{3-} within the upper saline plume. Thus, iron minerals in coastal aquifers are effective in intercepting pollutants from groundwater, with iron oxides minerals being the most crucial among them.

Keywords: Iron minerals; Coastal aquifer; Pollutant; Iron curtain; Iron oxides

Unraveling Nitrogen Dynamics in Sandy Beach: The Role of Tidal Forces and Aquifer Heterogeneity

Cheng Xing[1], Yan Zhang[1], Hongkai Qi[1], Ding He[2, 3], Yi Liu[1]

[1] Earth, Ocean and Atmospheric Science (EOAS) Thrust, Function Hub, The Hong Kong University of Science and Technology (Guangzhou), Guangzhou, China

[2] Department of Ocean Science, The Hong Kong University of Science and Technology, Hong Kong, China

[3] Center for Ocean Research in Hong Kong and Macau (CORE)

Corresponding author: Yi Liu (yiliuyl@hkust-gz.edu.cn)

Abstract. Coastal groundwater is one of the major nitrogen (N) sources to marine systems, yet its contribution is often misrepresented due to limited understanding of in-situ biogeochemical processes, particularly under tidal fluctuations and aquifer heterogeneity. High-resolution groundwater monitoring across spring-neap tidal cycles revealed vertically stratified dissolved inorganic N (DIN) speciation controlled by redox zonation. Nitrate (NO_3^- >230 μM) dominated the shallow aquifer (<1.5 m) with coarse sediments, while ammonium was extremely high (NH_4^+ >340 μM) in the deep aquifer (>1.5 m), where sediments consist of high-organic content and low-permeability marine deposits. A two-endmember mixing model indicates the production of NO_3^- and NH_4^+ in the aquifer. The identical distribution of high NH_4^+ and high salinity in the low-permeability, anoxic, organic-rich marine deposits suggest DIN production via soil organic matter (SOM) remineralization coupled with sulfate reduction. NO_3^- enrichment in the oxic zone is a result of strong nitrification. Sediment incubation with labeled δ^{15}N-NH_4^+ showed nitrification rate was 10-fold higher in the shallow aquifer than in the deep aquifer. Submarine groundwater discharge increased by 15% from neap (6.94 m^2 d^{-1}) to spring tide (8.00 m^2 d^{-1}), yet DIN export decreased by 7% (from 1.24 to 1.15×10^3 mmol d^{-1} m^{-1}). This paradox is led by the enhanced flow dynamics during spring tide, which shortens groundwater residence time and thereby limits SOM remineralization. Our findings highlight coastal aquifers as dynamic biogeochemical reactors strongly influenced by aquifer heterogeneity and tidal forces. Coastal groundwater N may be geogenic locally from marine deposits rather than transported from terrestrial groundwater.

Keywords: Coastal aquifer, Heterogeneity, Nitrification, Nitrogen, Remineralization, Tide

Abstracts of Parallel Sessions:

Groundwater-Surface Water Interaction

Assessing Salinity Dynamics and Carbon Emissions in Peatlands: A Conceptual Model of Freshwater–Saltwater Interactions

B. Nugraha[1], N.F. Revanda, M[1]. Ghozi[1]
[1]Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, Universitas Padjadjaran. West Java – Indonesia. 45363.

Email: geo.bayunugraha@gmail.com

Abstract. Carbon emissions have become a central concern in the context of global climate change. In 2021, global carbon emissions increased by 4.8%, reaching 34.9 $GtCO_2$ (Liu et al., 2023), and this trend is expected to continue alongside industrial growth and other anthropogenic activities. Reducing annual carbon emissions is therefore essential to mitigate the impacts of greenhouse gases, including climate change, ice melt, deforestation, and methane release from thawing permafrost (Friedlingstein et al., 2022).

Recent studies have highlighted that peatland ecosystems, particularly in coastal areas such as the North Sea region, function both as carbon sources and sinks, with carbon emissions influenced by salinity fluctuations due to tidal seawater intrusion. Salinity is known to inhibit anaerobic microbial decomposition, thereby affecting CO_2 release. Within the hydrological cycle, groundwater flow contributes to salinity variation in aquatic environments and influences the concentration of carbon released into the atmosphere.

The integration of the carbon and water cycles offers new perspectives for understanding carbon dynamics in peatlands, including the carbon archive preserved in sediment layers. Although numerous studies have been conducted, research specifically addressing the interaction between seawater intrusion and groundwater in peatlands as a driver of carbon and methane dynamics remains limited. Therefore, the development of a conceptual model is necessary to comprehensively understand the temporal dynamics of peatland systems in response to climate change and salinity shifts.

Keywords: Carbon Emissions, Peatlands, Seawater Intrusion, Salinity Dynamics

Estimation of Groundwater Extraction in the Bandung Basin Based on Surface Water and Withdrawals by Communities and Industries

Faza Haniyah Firstrizanda[1*], Dr. Edi Riawan, S.Si., M.T.[2]

[1] Groundwater Engineering, Bandung Institute of Technology, Geospatial Center, 1st Floor, 10 Ganesha Street, Bandung, Indonesia

[2] Groundwater Engineering, Bandung Institute of Technology, Geospatial Center, 1st Floor, 10 Ganesha Street, Bandung, Indonesia

[*]E-mail address: haniyahfaza@gmail.com

Abstract. Groundwater is a vital resource for sustaining life, particularly in urban areas such as the Bandung Basin, where access to surface water is limited due to river pollution and land use changes. The quality and quantity of groundwater have declined significantly over the past decades; however, accurate information regarding the volume of groundwater extraction by communities and industries remains scarce. To address this gap, this study aims to develop an estimation approach for groundwater extraction based on a combination of surface water data and residential settlement information.

The methods employed in this study include processing streamflow data from multiple monitoring stations to separate direct runoff and baseflow components, as well as analyzing community water use through building distribution data extracted from satellite imagery. The analysis focuses on the dry season to avoid interference from rainfall-induced flow and is examined across temporal and spatial dimensions.

The hypothesis of this study suggests that there is a significant correlation between the decline in groundwater volume and increasing water consumption among populations not connected to public water networks. It also posits that an estimation approach combining surface water and settlement data can provide a reliable representation of groundwater extraction levels. The outcomes are expected to support the formulation of more sustainable groundwater management policies in densely populated urban regions.

Keywords: baseflow; groundwater; direct runoff; surface water

Factors Controlling Land Subsidence in the Southern Hau River Region, Vietnam

Viet-Hung Le[1], Quoc-Cuong Tran[2], Thanh-Tam Vu[3], Okke Batelaan[4], Quy-Nhan Pham[1]

[1]Hanoi University of Natural Resources and Environment (HUNRE), No 41 A Phu Dien Road, Phu Dien Ward, North Tu Liem Dist., Hanoi, Viet Nam

[2]Institute of Geological Sciences (IGS), Vietnam Academy of Science and Technology, Alley 84, Chua Lang Str., Dong Da Dist., Hanoi, Viet Nam

[3]National Center for Water Resources Planning and Investigation (NAWAPI), 93/95 Vu Xuan Thieu St., Sai Dong Ward, Long Bien Dist., Hanoi, Viet Nam

[4]National Centre for Groundwater Research and Training (NCGRT), College of Science & Engineering, Flinders University, Australia

Abstract. The Vietnam's Mekong Delta (VMD) is known to be sinking below the sea due to climate change induced seawater level rise on one hand and land subsidence on the other hand. This phenomenon has deleterious ramifications for sustainable socio-economic advancement, manifesting in infrastructure degradation, recurrent inundation, intrusion of saline water, and reduction of habitable and cultivable areas within the region. Notably, in locales such as the Southern Hau River Region (SHRR), land subsidence rates as high as 10 cm/year have been documented, primarily associated with excessive groundwater extraction. Previous investigations have corroborated this relationship through the congruence between groundwater drawdown cones and areas of subsidence detected via InSAR (Interferometric Synthetic Aperture Radar) or through coupled Terzaghi consolidation theory-groundwater flow numerical modeling. This study extends the understanding of subsidence drivers in the SHRR beyond the groundwater level declining, encompassing tectonic activity, geological - lith ological features, and landuse. Utilizing geostatistical analyses based on individual InSAR monitoring points, the study evaluates the respective contributions of these factors to land subsidence in the SHRR. Findings indicate that auto-compaction of young sediments, structural loading, and sediment compaction due to induced groundwater level decline are the principal factors precipitating land subsidence in the SHRR.

Keywords: Land subsidence; Groundwater extraction; InSAR; Sediment compaction; The Southern Hau River Region Vietnam (SHRR).

From SGD to LGD: A Brief Review in China

Zuo Jinchao[1], Luo Xin, Jiao Jimmy Jiujiu

[1]Department of Earth Sciences, The University of Hong Kong

Abstract. This review is motivated by the fragmented state of lake and groundwater research in China, particularly in mega lake basins such as Taihu, Dongting, Poyang, Hongze, and Chaohu. These lakes, critical for agriculture and over 120 million residents, face severe ecological challenges, including shrinking water volumes (e.g., Poyang) and persistent eutrophication (e.g., Taihu and Chaohu). Despite extensive scientific efforts, these issues persist, highlighting the urgent need for integrated management strategies that address both surface water and groundwater systems.

Lakes function as outcrops of regional groundwater systems, necessitating a holistic understanding of hydrological and biogeochemical processes, particularly lacustrine groundwater discharge (LGD) and associated nutrient fluxes. This review provides a historical overview of groundwater-lake interactions in China, revealing that over 22% of the country's 673 largest lakes were groundwater-fed before the 2000s. Key study areas—such as the Badain Jaran Desert, Qinghai-Tibetan Plateau, Yangtze plains, and volcanic lakes—are examined, alongside methodological advances in LGD research. We also identify critical knowledge gaps, including driving mechanisms, scale effects, and temporal dynamics, and call for enhanced multidisciplinary collaboration to improve lake protection from a hydrogeological perspective.

Water, Land, and Food: A SWAT-Based Approach to Sustainable Resource Management in Tanralili Sub Watershed South Sulawesi

Suryansyah Surahman[1*], Andi Widiasari Maruddani[2], Gilang Bayu Prawira[3]

[1] Department of Food Technology, Bacharuddin Jusuf Habibie Institute of Technology, Parepare, Indonesia

[2] Department of Civil Engineering, Bacharuddin Jusuf Habibie Institute of Technology, Parepare, Indonesia

[3] Department of Food Technology, Bacharuddin Jusuf Habibie Institute of Technology, Parepare, Indonesia

[*]E-mail address: suryasurahman@ith.ac.id

Abstract. Sustainable water resource management is crucial in supporting food security, especially in areas experiencing pressure on water availability and land-carrying capacity, such as the Tanralili Sub-DAS in South Sulawesi. Although this area has relatively high water resource potential, in-depth scientific studies on the utilization of its hydrological dynamics to support the agricultural sector are still limited. This study aims to develop a water resources management model based on geographic information systems and a hydrological simulation approach to evaluate the potential and efficiency of water distribution to support food security at the local level. The methods used include land use analysis, climate and hydrological data processing, and the design of a numerical simulation model to describe water flow patterns spatially and temporally. The model was calibrated and validated using field observation data to ensure accuracy. The results show that the model can identify areas at risk of water deficit during the planting season and present water management scenarios that can potentially increase the efficiency of irrigation water use by up to 20%. In addition, this model also allows for the sustainable expansion of productive agricultural land. These findings provide significant contributions in providing data-based decision-making tools for water resource management planning and have the potential to be replicated in other areas with similar characteristics.

Keywords: food security, hydrological simulation, land use , Sub-DAS, South Sulawesi, water management

Abstracts of Parallel Sessions: Groundwater Quality and Pollution

Analysis of Groundwater Quality of Confined Aquifer in Semarang City Based on Chemical, Biological and Stable Isotope Factors

Savikri Misbahul Umar[1*], Narulita Santi[2]
[1] Department of Geological Engineering, Gadjah Mada University, Special Region of Yogyakarta, Indonesia
[2]Department of Geological Engineering, Diponegoro University, Semarang, Indonesia

[*]E-mail address: savikri03@gmail.com

Abstract. Groundwater is one of the most vital natural resources for humans. Semarang City, which is one of the big cities in Indonesia with a population of 1.7 million people, 80% of the total population uses groundwater for household, industrial and other needs. Several factors that can affect the quality and characteristics of groundwater such as the chemical properties of water, microbiological content, and stable isotopes. Groundwater quality analysis was carried out on 30 drilled wells from confined aquifers spread across Semarang City. This study uses the Chlorite Bicarbonate Ratio (CBR) value calculation method and piper diagram analysis on the chemical factors of the water, while for the analysis of microbiological content the Most Probable Numbers (MPN) method was used. The presence of coliform bacteria in the well is correlated with rock characteristics and stable isotope calculations, where in this research area there are 10% of wells that have Total Coliform bacteria content caused by geological conditions in the form of fault layers that trap the bacteria and do not experience predation by other bacteria. The hypothesis is strengthened by the value of d-excess <10 which indicates that the groundwater in the area is a type of deep groundwater and is not affected by surface water conditions. In the chemical analysis of water using the piper diagram, groundwater facies with the magnesium bicarbonate type were found. From several factors, a correlation was carried out to find which areas have good water quality for consumption and the influence of the surrounding geological conditions.

Keywords: Groundwater; Semarang; CBR; MPN; geology

Analysis of Groundwater Vulnerability using The Drastic Method in The Quarry X Area of PT Y

Adam Maulana[1*], Mohamad Sapari Dwi Hadian[2] , Adi Haryono[3]
[1] Faculty of Enginnnering Geology, Universitas Padjadjaran, Jalan Soekarno km 21, Jatinangor West Java, Indonesia - 45363

[*]adam21002@mail.unpad.ac.id

Abstract. Groundwater is a vital resource whose quality is more stable than surface water, but it is vulnerable to pollution from anthropogenic activities such as mining in the Quarry X area in Klapanunggal, Bogor Regency. As a result, an analysis of groundwater vulnerability zoning is needed as a basis for environmental mitigation. Groundwater protection requires the identification of vulnerability zones, one of which can be done using the DRASTIC method based on Geographic Information Systems (GIS) that integrates seven hydrogeological parameters. This study aims to analyze groundwater vulnerability in the Quarry X area of PT Y using the GIS-based DRASTIC method. The background of the study shows that mining activities have the potential to contaminate groundwater, but there has been no comprehensive study on vulnerability -zoning in the area. The DRASTIC method integrates seven hydrogeological parameters: groundwater depth (D), recharge (R), aquifer medium (A), soil type (S), topography (T), vadose zone impact (I), and hydraulic conductivity (C). Data were obtained from field surveys, boreholes, geophysical surveys, and DEM imagery, then processed using ArcGIS for weighting and spatial overlay. The study results showed DRASTIC index values ranging from 111 to 133, with 56.62% of the area classified as low vulnerability (blue) and 43.38% as moderate-low (dark green). The dominant factors influencing vulnerability are groundwater depth (1.5–15 m), karst limestone as the aquifer medium, and low hydraulic conductivity (0.000084 cm/second). The resulting zoning map can serve as a reference for pollution mitigation and sustainable groundwater management in the mining area.

Keywords: DRASTIC; groundwater; quarry; vulnerability.

Water Quality Assessment in a Subsiding Coastal Village A Preliminary Study from Timbulsoko Village, Demak

Arif Susanto*[1], Muhammad Sultoni[1], Dasapta Erwin Irawan[1], Deny Juanda Puradimaja[1]

[1 1] Faculty of Earth Science and Technology, Institut Teknologi Bandung, Bandung, Indonesia

*E-mail address: arifs@itb.ac.id

Abstract. This study investigates the water quality in Desa Timbulsloko, a coastal village in Demak, Indonesia, experiencing significant environmental degradation due to land subsidence, coastal erosion, and tidal flooding. Two water samples were collected from different locations (TS-1 and BR-1) and analyzed for physical, chemical, and microbiological parameters according to national regulatory standards. Results revealed severe water quality issues, particularly in BR-1, which is frequently inundated by seawater. Elevated levels of Total Dissolved Solids (TDS), sodium, chloride, sulfate, and aluminum were observed, with BR-1 exhibiting values far exceeding permissible limits. Microbiological testing detected Total Coliform in BR-1, indicating potential fecal contamination. These findings highlight the significant impact of seawater intrusion and anthropogenic activities on coastal water resources. The study emphasizes the urgent need for comprehensive water treatment infrastructure, sustainable groundwater management, ecosystem restoration, and community-based adaptation strategies to address these interconnected challenges before they reach irreversible tipping points.

Keywords: Groundwater; Water Quality; Subsiding Coastal Village; Timbulsloko

Aquifer Geometry Model Approach for Identification of Hydrogeologic Conditions and Simulation of Groundwater Pollution in The City of Bandung and Its Surroundings

Prayoga Satyagraha Kombara[1*], Mohamad Sapari Dwi Hadian[1], Mochamad Nurisyam Barkah[1]

[1] Geological Engineering, Padjadjaran University, Jl. Raya Bandung Sumedang KM 21, Sumedang, 45363, Indonesia

[*]E-mail address: prayoga21001@mail.unpad.ac.id

Abstract. Groundwater pollution problems in Bandung City and its surroundings are increasingly complex along with population growth and industrial activities. This research develops an aquifer geometry model approach to identify hydrogeologic conditions and simulate contaminant movement within the aquifer system using numerical model-based software. The method used involves the integration of subsurface geological data in the form of 1-D geophysical data and well-logs linked to regional geological data and spatial analysis to develop a three-dimensional model of the aquifer system which then becomes input data for numerical modeling.

The resulting aquifer geometry model describes the hydrostratigraphic sequence of units, including the distribution and thickness of aquifer and non-aquifer layers, as well as their volume. Based on the aquifer geometry model, it is known that the hydrostratigraphic unit consists of shallow and deep aquifers, aquitards, and aquicludes. In this study, groundwater flow and contaminant transport simulations were conducted in the shallow aquifer to predict the direction and rate of contaminant migration from domestic activities.

The simulation results show that densely populated areas and areas with open sanitation systems have a high potential for pollution, especially in shallow aquifers.
The aquifer geometry model approach to determine hydrogeological conditions and contaminant distribution can provide a fairly simple visualization to support sustainable water resources management strategies. This approach is also useful for spatial planning and environmental policy in the Bandung City and surrounding areas.

Keywords: Bandung City, Aquifer Geometry Model, Spatial Analysis, Numerical Modelling, Hydrostratigraphy Unit, Groundwater Pollution

Characterization of Groundwater Using Hydrogeological Survey, Geoelectrical Methods, and Drilling in Tumpangkrasak, Kudus

Arif Susanto*[1], Muhammad Sultoni[1], Dasapta Erwin Irawan[1]
[1] Faculty of Earth Science and Technology, Institut Teknologi Bandung, Indonesia

*E-mail address: arifsusanto220@gmail.com

Abstract. Water is a vital resource for human life. According to WHO data, 1 in 3 people worldwide lack access to safe drinking water. Based on surveys, the problem in this area is that both dug wells and bore wells suffer from anthropogenic pollution, with water appearing yellowish-brown, having a metallic odor, and being muddy and slightly oily.

To address this issue, a groundwater characterization study was conducted. The hydrogeological survey included measurements of physical water parameters from 37 dug wells, 7 bore wells, and 6 rivers. Two 1D geoelectrical survey lines were carried out to identify aquifer layers. Drilling was conducted to a depth of 80 meters to locate and determine the thickness of the aquifer layers. Water chemistry analysis was performed on one sample, and microbiological analysis was conducted on two samples.
The study area is a lowland region composed of Holocene-aged alluvial deposits. Based on drilling results, these alluvial deposits consist of alternating layers of sand and clay. Several wells do not meet the requirements according to Minister of Health Regulation No. 2 of 2023. Specifically, 4 wells have TDS values ranging from 332 to 413 mg/L; 9 wells have pH values between 5.93 and 6.49; and 1 well has cloudy and odorous water. S-01 water sample contain Escherichia coli, Staphylococcus aureus, Salmonella sp., and Pseudomonas aeruginosa.

Drilling at TK-1 well successfully found a thick confined aquifer layer at depths of 62-68 meters and 73-80 meters. Bore well water exhibits good quality—clear, odorless, tasteless—and has a high yield (1.4 L/sec). Chemical and microbiological analysis results show that bore well water meets drinking water standards.

Keywords: Groundwater; Hydrogeology; Geoelectrical; Drilling; Water Chemistry

Comparative Study of Hydrogeochemistry and Physical Characteristics in the Geothermal Tourism Areas of Banyu Panas Gempol–Palimanan and Mount Tangkuban Perahu

M.K Agung Aristo[1]; Fattah Ghiffari[2*]; Ignatius Wily Virman[2]; Shofiudin Mochamad[2]; Asri Wulandari[3]

[1]Geothermal Engineering Department, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, 40132, Indonesia

[2]Groundwater Engineering Department, Faculty of Earth Science and Technology, Institut Teknologi Bandung, 40132, Indonesia

[3]Geological Engineering Department, Faculty of Earth Science and Technology, Institut Teknologi Bandung, 40132, Indonesia

[*] Corresponding author: *fattahghiffari25@gmail.com*

Abstract. The Banyu Panas Gempol-Palimanan and Domas Crater areas on Mount Tangkuban Perahu offer unique geothermal phenomena, reflecting both the beauty of nature and the complexity of geothermal systems. This study aims to compare the hydrogeochemical and physical characteristics of the geothermal systems in two locations: Banyu Panas Gempol-Palimanan and Domas Crater on Mount Tangkuban Perahu. The research methods include sampling of hot and cold water, measurement of physical parameters (pH, temperature, ORP, TDS, DO, salinity), and chemical analysis using Piper, Ternary, and Cl-Li-B diagrams to map the composition of major ions, as well as stable isotope analysis (δ18O and δ2H) to understand the origin and dynamics of the fluids. The results show that the water type in Palimanan is dominated by chloride-bicarbonate facies, influenced by hydrothermal fluid interaction with carbonate rocks, resulting in travertine deposits. In contrast, samples from Domas Crater reflect a sulfate-type water with strong magmatic influence due to the condensation of volcanic gases. Stable isotope analysis indicates contributions from deep fluids and rock-fluid interaction at both locations. This comparison provides valuable insight into the differing geothermal systems, shaped by local geological conditions and volcanic activity.

Keywords: Palimanan, Tangkuban Parahu, Hydrogeochemistry

Conventional Pumping Remediation Modeling in the Case of Fuel Pollution in the Groundwater of Tugu Station, Yogyakarta, Indonesia

Emanuel Grace Manek[1*], Doni Prakasa Eka Putra[2], Heru Hendrayana[2]

[1] Mining Engineering of Universitas Jember, Jl. Kalimantan No. 37 - Tegalboto Campus, Jember, East Java, 68121, Indonesia.

[2] Geological Engineering of Universitas Gadjah Mada, Jl. Grafika Bulaksumur No.2, Senolowo, Sinduadi, Sleman Regency, Yogyakarta, 55284, Indonesia.

[*]E-mail address: emanuelmanek@unej.ac.id

Abstract. Groundwater contamination from fuel leakage is a common environmental concern in urban areas. In Yogyakarta, Indonesia, a significant case of contamination occurred in 1997 when a leaking underground fuel storage tank at Tugu Station polluted the shallow aquifer. Despite the passage of time, the local population continues to experience limited access to clean groundwater due to elevated levels of organic pollutants. While the nature and spread of the contamination have been previously studied, limited efforts have focused on evaluating remediation scenarios to reduce its long-term impact.

This study presents a conventional groundwater pumping remediation model to manage and reduce the spread of the contaminated zone. The remediation strategy was developed based on a calibrated groundwater flow and contaminant transport model, which had acceptable accuracy compared to observed field data. Using numerical modeling software, several remediation configurations were simulated, including the use of one, three, and seven pumping wells, each evaluated based on their effectiveness in reducing the polluted area and minimizing negative impacts on groundwater availability.

The results demonstrate that a remediation design using three pumping wells with calculated daily discharge values offers an effective solution. This configuration successfully reduces the polluted area from 8047 m^2 to 4776 m^2 over a 30-year period. Compared to the one-well scenario, which allowed further plume migration, and the seven-well scenario, which caused excessive drawdown in groundwater levels, the three-well configuration was both effective and sustainable for densely populated urban settings. The findings suggest that simple, cost-effective pumping remediation can significantly contribute to controlling long-term groundwater pollution in similar urban contamination cases.

Keywords: Pumping remediation; Groundwater Modelling; Groundwater contamination.

Evaluating the Cost and Environmental Risk of Tailings Placement Methods at Gold Mining in Sulawesi, Indonesia

Fildzah Ayunda[1], Irwan Iskandar[2*]
[1] Groundwater Engineering, ITB, Bandung, Indonesia
[2] Groundwater Engineering, ITB, Bandung, Indonesia

[*]E-mail address: irwan@itb.ac.id

Abstract: The increase in mineral processing activities in Indonesia has led to a significant rise in tailings production, which are classified as hazardous waste. Although various methods for tailings disposal are widely known—such as backfilling, landfill, and dam construction—their comparative environmental risks and long-term costs remain poorly understood, particularly in hydrologically and geologically sensitive regions. This study aims to evaluate and compare the economic and environmental implications of different tailings disposal methods, with a focus on hydrological and hydrogeological risks.

A mixed-methods approach was used, combining a literature review, field survey data, cost estimation, and hydrogeological impact analysis. The study focused on a mining site in Central Sulawesi, Indonesia, using backfill, landfill, and dam-based tailings placement as case scenarios. Key factors considered included initial construction costs, long-term operational and closure expenses, groundwater contamination potential, and structural stability under local geological conditions.

The results show that the backfill method is the most cost-effective option when sufficient mined-out space is available, offering lower groundwater contamination risks. Landfill and dam methods provide larger storage capacity but incur higher infrastructure and maintenance costs and pose greater environmental hazards, especially in areas with shallow groundwater or active fault zones. The study highlights that integrating backfilling with modern dewatering technology offers a balanced approach to cost and environmental protection. These findings provide a basis for more informed decision-making in tailings management practices in Indonesia and similar developing regions.

Keywords: environmental impact; groundwater contamination; mining waste; risk assessment; tailings management; waste disposal methods

Geochemistry Evolution Processes and Driving Mechanisms of Groundwater Contamination in the Eastern Bandung Region, Indonesia

Arief Nur Muchamad[1*], **Anissa Fatma Fadilah**[1], **Nilam Sari**[1], **Adilah Nur Salma**[1]

[1] Universitas Kebangsaan Republik Indonesia, Bandung, Jawa Barat, Indonesia

*)Author Correspondence: ariefnurmuchamad@ukri.ac.id

Abstract. This study examines groundwater quality changes in eastern Bandung, where groundwater serves as a crucial and widely used alternative source of raw water across several districts. Its accessibility and low cost have led to extensive exploitation, raising concerns about declining quality and quantity. This research focuses on the hydrochemical evolution of groundwater and contamination mechanisms, particularly involving nitrate and total dissolved solids (TDS). Groundwater samples were collected from springs, dug wells, and bore wells representing unconfined and confined aquifers, respectively. Piper diagram analysis shows the dominant groundwater facies as HCO_3-Mg-Cl, suggesting meteoric origins from rainfall. Rainwater infiltration transports surface-derived constituents into unconfined aquifers, influencing water chemistry. The Gibbs diagram indicates that groundwater composition is shaped by rock-water interactions, including silicate weathering in volcanic rocks and sedimentary deposits. TDS and nitrate variations are influenced by aquifer depth, mineral dissolution, and water–rock interaction. Elevated concentrations of these constituents are found in lowland areas with dense populations and intensive land use, where anthropogenic inputs from domestic and agricultural sources are prevalent. Excessive groundwater extraction alters the drawdown cone, facilitating nitrate migration into deeper aquifers. The study concludes that topographic elevation and slope significantly affect groundwater flow, mineral dissolution, and infiltration. Rapid infiltration and limited denitrification in lower areas contribute to deteriorating groundwater quality in the region. This study underlines the need for integrated groundwater management based on hydrogeological and topographic considerations.

Hydrogeochemical Interaction between Water and Rock from CO_2 Injection in a Tailing Storage Facility Model

Faizal Abdillah[1], Ricky Nelson Tambunan[1], Janice Clementine da Costa[1], Kemala Wijayanti[1], Irwan Iskandar[2*]

[1]Master Program in Groundwater Engineering, Faculty of Earth Sciences Technology, Bandung Institute of Technology
[2]Earth Resources Exploration Research Group, Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology

[*]E-mail address: faizalabdillah@hotmail.com
corresponding author: irwan@itb.ac.id

Abstract. The presence of carbon dioxide (CO_2) in the atmosphere can interact with groundwater, either dissolving into the water or reacting with surrounding rocks to form carbonate minerals. This study aims to investigate the reaction of CO_2 when injected into a groundwater-rock system using a physical model. The model was constructed using dry tailings from a Tailing Storage Facility rich in Fe, Ca, and S, and bedrock material dominated by Mg, Si, and Fe. The physical model was built inside an acrylic box measuring 0.15 m × 0.5 m × 0.75 m, with the bedrock layer placed at the bottom and dry tailings on top. Monitoring wells were installed to observe changes over time.
Over a 30-day period, 1 m^3 of high-purity CO_2 was injected into the system, with the rocks fully saturated using rainwater. Water samples were analyzed for physical parameters and major ions. The results indicated increases in Total Dissolved Solids (TDS), Electrical Conductivity (EC), Oxidation-Reduction Potential (ORP), alkalinity, and concentrations of Na, Mg, K, Ca, and Mn in the water.

Rock analysis using Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), and X-Ray Fluorescence (XRF) revealed the formation of carbonate minerals, particularly dolomite ($(Ca,Mg)CO_3$), mainly in the bedrock layer. This suggests that mineral carbonation occurred as a result of CO_2 injection into the water-saturated rock system.

Keywords: CO_2 injection, groundwater, mineral carbonation, dry tailings, geochemical interaction

Impacts of Anthropogenic and Urbanization on Water Quality in Groundwater: A Review Study

Brenda Aulia Valleiryna*, Taddeus Arnold Suwargatama, Muhammad Ghozi, Bayu Nugraha

Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD, Jl. Ir. Soekarno Km.21 Jatinangor, Sumedang District, West Java-Indonesia 45363

*E-mail address: brenda22001@mail.unpad.ac.id

Abstract. Urbanization and anthropogenic activities are major contributors to the deterioration of water quality, particularly in groundwater systems across different parts of the world. These activities can lead to increased contamination by heavy metals, microbes, pesticides, and various other chemical pollutants, especially in countries experiencing rapid population growth. This study seeks to systematically explore how human activities and urban development influence groundwater quality. Using a structured literature review approach, this study systematically collects, analyzes, and synthesizes recent research findings to offer a thorough and comprehensive understanding of the impacts of urbanization and human activities on groundwater quality. The analysis reveals that declining groundwater quality poses significant risks, affecting both public health and environmental sustainability. Several case studies from Indonesia, China, and India have shown that urbanization and rapid population growth can exacerbate the frequency and severity of water pollution, especially through combined sewer runoff mechanisms and reduced infiltration capacity. Therefore, a comprehensive understanding of the interactions between urbanization, anthropogenic activities, and water quality is essential in formulating sustainable solutions and supporting future policy-making and research. Collaborative efforts between governments, researchers, and the community are needed to effectively address these challenges.

Keywords: Anthropogenic; Environmental Sustainability; Groundwater Quality; Rapid Population Growth

Lateritic Nickel Ore – Rainwater Interaction: The Formation of Cr (VI) in Lateritic Nickel Mine

Janice Clementine da Costa[1*], Irwan Iskandar [2]

[1] Master Program in Groundwater Engineering, Faculty of Earth Sciences Technology, Bandung Institute of Technology

[2] Earth Resources Exploration Research Group, Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology

[*]E-mail address: janicedacosta29@gmail.com

Abstract. Chromium is one of many elements that humans need to help metabolism process in limited quantities, however there are chromium ions that have carcinogenic effects and harmful to humans, namely the hexavalent chromium ion, Cr(VI). The concentration of Cr(VI) found in surface water that flows near nickel laterite mining areas became a concern because it can be a potential source of contaminants for the surrounding area and groundwater aquifers. In an effort to determine the potential for Cr(VI) pollution in laterite nickel mining areas, especially the formation of Cr(VI) in mine voids and sediment ponds, laboratory-scale research was conducted with an experimental approach to determine the factors that influence the formation of Cr(VI). Simulations were conducted for ten days on nickel laterite ores from two different sources which were then soaked by rainwater. Data collection on the physical-chemical properties of water was carried out every day and water samples were taken for laboratory testing to see water's the physical-chemical properties and the chemical composition changes, especially dissolved metals concentration in water including total Cr and Cr(VI). The results of laboratory measurements and tests show that laterite nickel ores containing more serpentine minerals and alterations produce more Cr(III) that can be oxidized to Cr(VI), especially in limonite and saprolite, while bedrock doesn't release ion Cr(III) during the simulation. The factor that determines the formation of Cr(VI) is the pH of the water, where an alkaline pH can oxidize Cr(III) and keep Cr(VI) stable but the pH of rainwater can only oxidize Cr(VI) in FeOx-rich environments. The duration of UV irradiation and the presence of O_2 gas favor the formation of Cr(VI) in greater amounts in FeO_x-rich environments, indicating that Cr(VI) enrichment in water interacting with laterite nickel ore outcrops is dominated through photochemical oxidation processes.

Keywords: Nickel laterite ore; chromium; Cr(VI); ultramafic rocks; pH; photochemical; oxidation; serpentinenization

Modeling Arsenic Contaminant Transport in the Unsaturated Zone Using Visual MODFLOW at Tailings Site of a Gold Mine

Wirandika Hadiana[1*]
[1] Groundwater Engineering, ITB, Bandung, Indonesia

[*]E-mail address: wirandika.m.h@gmail.com

Abstract. The management of gold tailings containing arsenic poses a significant risk of groundwater contamination through the unsaturated (vadose) zone. This study models the transport of dissolved arsenic contaminants from three tailings placement methods: backfilling, landfill, and tailings dam, using Visual MODFLOW. Each method employs different protective systems, such as geomembranes, drainage channels, and leachate collection systems. Simulation results show that the landfill method is the most effective in limiting contaminant migration, followed by backfill, while the tailings dam exhibits the widest arsenic dispersion. These differences are influenced by the physical form of the tailings and the configuration of containment systems. The findings provide a scientific basis for selecting tailings placement strategies that minimize future groundwater contamination risks.

Keywords: vadose zone, tailings management, Visual MODFLOW, groundwater modeling, contaminant transport

Modeling of Groundwater Flow and Groundwater Quality Based on Visual Modflow Flex in Panyileukan District, Bandung City

Nillam Sari Priangan[1*], Gede H Cahyana[1], Arief Nur Muchamad[1]

[1] Environmental Engineering, National University of the Republic of Indonesia, Bandung, West Java, Indonesia

[*]E-mail address: nilamsarip10@gmail.com

Abstract. Panyileukan District is situated in a relatively low-lying topographic area where variations in geographical conditions, anthropogenic activities, and industrial development potentially affect groundwater quality. This study aims to identify the hydrogeological and hydrogeochemical characteristics as a basis for modeling the spatial distribution of groundwater chemistry. Groundwater modeling was conducted using Visual Modflow Flex through numerical simulation with the finite difference method and contaminant transport analysis to determine the distribution of groundwater chemistry. The hydrogeological characteristics were identified through environmental baseline assessments, with well depths ranging from 11 to 65 meters and groundwater table depths from 5.1 to 39.19 meters, underlain by lacustrine deposits Groundwater quality analysis indicated that all samples exceeded the TDS standard, two samples exceeded E. coli limits, and four samples exceeded Total Coliform limits. Nevertheless, the Water Quality Index (WQI) remained in the good category. Based on the Piper diagram plotting, groundwater in the study area is classified as calcium-magnesium-bicarbonate (Ca-Mg-HCO_3) type and derived from meteoric water. The modeling results produced a correlation coefficient of 0.99 and a Normalized Root Mean Square (NRMS) of 5.24%, indicating southward groundwater flow and contaminant transport. These results align with field observations, confirming that groundwater quality decreases with decreasing elevation.

Keywords: groundwater; groundwater quality; modeling; visual modflow flex

Overview of Groundwater Vulnerability With Drastic Method in Bandung-Soreang Groundwater Basin, West Java

Nur Fatikha*, Damar Sayyidina Zulfi, Bayu Nugraha, Naufal Fajar Revanda
Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD, Jl.Ir. Soekarno Km.21 Jatinangor, Sumedang District, West Java-Indonesia 45363

*E-mail address: nur22004@mail.unpad.ac.id

Abstract. Pressure on groundwater resources in the Bandung-Soreang basin has escalated as a result of rapid urbanization and population growth, highlighting the critical need for spatial evaluations of groundwater vulnerability. This study aims to provide an overview of groundwater vulnerability in the Bandung-Soreang groundwater basin by synthesizing findings from previous research. The assessment systematically examines factors influencing groundwater vulnerability by applying the DRASTIC method, which considers Depth to Water Table, Recharge Area, Aquifer Media, Soil Texture, Vadose Zone Index, and Hydraulic Conductivity. The analysis compares vulnerability and spatial distribution patterns across three key regions: West Bandung, Bandung City, and South Bandung. In West Bandung, only 5% of the area (approximately 5,915 ha) is classified as vulnerable, while the remaining 95% (around 120,411 ha) is considered not vulnerable. In Bandung City, vulnerability is distributed across high (22%), moderate (72%), and low (6%) zones. Meanwhile, South Bandung exhibits two classes of vulnerability: low (52.83%) and moderate (47.17%). The dominant factors influencing groundwater vulnerability vary between regions but generally include geological conditions, slope gradient, and aquifer type. Areas characterized by shallow water tables and permeable lithological formations tend to have higher DRASTIC indices. The findings offer quantitative and spatially explicit insights that can inform the delineation of groundwater protection zones and support policy-making for vulnerability-based groundwater management across the Bandung Basin.

Keywords: Bandung-Soreang Groundwater Basin; DRASTIC; Groundwater Vulnerability; Urbanization

Potential Groundwater Pollution Based on Hydrochemical Analysis in Jatisari Village, Bandung

Annisa Nurisma[1]*, Fahira A. Ramadhani[1], Arief Nur Muchamad[1],
[1]Universitas Kebangsaan Republik Indonesia, Bandung, West Java, Indonesia

*) Corresponding author: annisanurisma@gmail.com

Abstract. Groundwater is a natural resource that is very important in supporting human daily life activities. This study aims to assess the quality of groundwater in Jatisari Village, Bandung City, through the analysis of physical, chemical, and microbiological parameters based on the standards set in the Regulation of the Minister of Health of the Republic of Indonesia No. 2 Year 2023. Water samples were taken from eight locations with different environmental characteristics, including densely populated settlements, agricultural areas, structured housing, and school environments. The testing process was conducted at the Instrumental Chemistry Laboratory of SMKN 13 Bandung. The test results showed that some samples exceeded the threshold, especially those from shallow wells. In contrast, samples from deep boreholes showed relatively better water quality. This study shows a correlation between the surrounding environment, well depth, aquifer, and anthropogenic conditions with the level of groundwater pollution. This study is expected to contribute to sustainable groundwater management efforts in urban areas.

Spatial and Temporal Dynamics of Groundwater Salinity in the Unconfined Aquifer of Northern Jakarta Groundwater Basin

Tantowi Eko Prayogi[1]*, Taat Setiawan[2], Sitti Sofia Wahida[3], Faizal Abdillah[4], Hirundini Rustica Absari[5], Tias Febriana Hanifa Lestari[6], Shabrina Maulida Agustine[7]

Groundwater Conservation Office, Center for Groundwater and Environmental Geology, Geological Agency, Ministry of Energy and Mineral Resources
Jl. Tongkol No. 4 Pademangan – North Jakarta, Indonesia

*E-mail address : Tantowi89.geounpad10@gmail.com

Abstract. Jakarta and its surrounding area's growth as a megapolis has led to a drastic increase in the need for clean water. However, the suboptimal supply from the Drinking Water Company (PAM) has led people to become highly dependent on groundwater from dug wells and shallow wells, especially in coastal areas. This study was conducted to identify the dynamics of groundwater salinity in the unconfined aquifer in the North Jakarta Groundwater Basin by referring to the classification of groundwater salinity levels by PAHIAA (Ad Hoc Committee for Saltwater Intrusion), Na/Cl ratio analysis, and observing changes in Electrical Conductivity (EC), Total Dissolved Solid (TDS) and Chloride Ions (Cl-) parameters during the period 2021 to 2024. The study was conducted on dug wells and shallow wells with a depth of <20 meters. In general, the results of the analysis show that groundwater in the unconfined aquifer in the study area is divided into 3 (three) categories, namely freshwater, fresh-brackish, and brackish. In addition, an increasing trend of EC and TDS values was found in several locations indicating gradual degradation of groundwater quality with Na/Cl ratios of < 1. This finding emphasizes the importance of sustainable groundwater monitoring and management efforts in the North Jakarta Groundwater Basin so that groundwater can continue to be used safely and sustainably to meet community needs.

Keywords : Groundwater; unconfined aquifer; groundwater quality; groundwater salinity; Northern Jakarta Groundwater Basin

The Potential Impact of Leachate Contamination on Groundwater Quality Around the Inactive Jelekong Landfill, Bandung Regency

Medina Dwi Andriani[1*], Erika Herliana[2], Arief Nur Muchamad[3]
[1] Enviromental Engineering, Universitas Kebangsaan RI, Bandung, West Java, Indonesia

[*]E-mail address: medinadwi16@gmail.com

Abstract. The Jelekong Landfill, located in Bandung Regency, has been inactive for over 20 years. Over time, the landfill area has been repurposed by local residents into residential areas, plantations, and compost production sites. Although the landfill is no longer in operation, the presence of leachate still generated from residual waste and compost raises concerns about the potential contamination of the surrounding groundwater. This study aims to identify the potential leachate contamination of groundwater in the area surrounding the inactive Jelekong landfill. To assess the potential contamination, the Piper diagram method and Water Quality Index (WQI) assessment were used. A total of 17 wells, consisting of dug wells and bore wells at varying distances from the landfill site, were used as sampling points. The analysis was carried out by measuring water quality parameters in situ using a Water Quality Checker (temperature, pH, DO, TDS, salinity, and conductivity), as well as laboratory testing on samples from 4 selected wells. Based on the Piper Diagram, the groundwater is classified as bicarbonate type with dominant Ca-Mg-HCO_3 cations and anions, and is categorized as meteoric or young groundwater derived from rainfall. The Water Quality Index (WQI) results show scores ranging from 17 to 80, with the well located 200 meters from the former Jelekong landfill falling into the 'good' category, while the other three wells are classified as 'very good'. This study is expected to provide a comprehensive overview of groundwater quality conditions and the potential environmental impacts resulting from the existence of the Jelekong landfill.

Keywords: groundwater; water quality; leachate pollution; Water Quality Index (WQI)

Abstracts of Parallel Sessions:

Groundwater Management in Infrastructure Project and Geotechnical Issues

3D Groundwater Flow Modeling and Hydrogeological Evaluation of Tunnel Drainage Systems: A Case Study of the Poshan Tunnel

Tao Yang[1], Jiu Jimmy Jiao*, Rong Mao[1], Jiawei Liang[1], Guodong Chen[1]
[1]Department of Earth Sciences, The University of Hong Kong, Hong Kong, China

*E-mail address: jjiao@hku.hk

Abstract. In steep mountainous regions undergoing rapid urbanization, groundwater dynamics are influenced by complex terrain, geological structures, and abundant precipitation, resulting in significant uncertainties. Hong Kong, known for its mountainous terrain and a long history of landslide failures. A Poshan tunnel drainage system was constructed in the northwest of Hong Kong Island to manage groundwater and enhance slope stability in the Poshan hillslope. This paper presents the first case study based on the Poshan drainage tunnel system, utilizing it as an example for a three-dimensional groundwater flow model to investigate groundwater distribution and the effects of drainage behaviors on the groundwater system. Results show that groundwater discharges primarily from high elevations toward the northern coast, driven by steep topography and high hydraulic gradients. Deeper depths are associated with higher pressures within the mountain interior. Moreover, the operation of the Poshan drainage tunnel facilitates the release of pressure head within the slope as groundwater flows into the tunnels. After 30 years of operation, the groundwater system is expected to reach a steady state, with groundwater release extending up to approximately 100 meters around the tunnel area. These findings provide valuable insights for urban development in mountainous areas vulnerable to landslides, offering guidance for risk mitigation and sustainable planning.

Keywords: groundwater system; hillslope; tunnel drainage; dynamic mechanism

Analysis of Suspected Aquifer Distribution at the Planned Administrative Office Area of the Newly Established South Papua Province (DOB) in KTM Salor, Salor Indah Village, Kurik District, Merauke Regency, South Papua Province

Charles Paiki[1]*, Yan Adhitya Wesda Wardhana[1], Andre Putra Arifin[1], Akhmad Yusron[1], Dipta Alfian R[1], Nur Alzair[2]*, Erikha M. Mayzarah[2]

[1] Groundwater Center, Directorate General of Water Resources, Ministry of Public Works, Jl. Ir. H. Juanda No. 193, Dago, Bandung 40135, Indonesia, [2] Department of Geological Engineering, Faculty of Mining and Petroleum Engineering, University of Papua, Jl. Gunung Salju No. 1, Amban, Manokwari 98314, Indonesia

*E-mail address: n.alzair@unipa.ac.id, charleen1023@gmail.com

Abstract. Effective water-resource planning for a provincial administrative-office complex is essential to ensure a reliable and sustainable water supply during construction, development, and day-to-day governmental operations. A crucial first step is groundwater exploration. This study was conducted at the proposed government-office site of South Papua Province, situated within the *Salor Kota Terpadu Mandiri* (KTM Salor) area, Salor Indah Village, Kurik District, Merauke Regency (8° 17′ 19.19″ S, 140° 25′ 07.96″ E). The objective was to analyze the potential and probable distribution of groundwater-hosting aquifers. Key parameters evaluated included rock resistivity, aquifer depth, aquifer thickness, and aquifer boundaries. A one-dimensional geoelectrical resistivity survey delineated subsurface lithological characteristics related to the groundwater system, calibrated with local geological data. Interpretation of the resistivity profiles indicates aquifers generally occur 60–100 m below ground level within sand and sandstone layers, suggesting viable groundwater resources for the planned complex. These findings will enable the South Papua Provincial Government to optimize well-site selection, allocate budgets efficiently, and formulate long-term groundwater-management policies that ensure a reliable water supply for the new administrative center.

Keywords: aquifer; geoelectrical; groundwater; hydrogeology; Merauke

Integration of Subdrain System, Hydrogeological Monitoring and Geotechnical Monitoring for Stability Control of the Partolang Waste Dump

Muhammad Najib[1*], Agathon Chandra[2] , Eko Purwanto[3]
[1] Geotechnical and Hydrogeological Section, Wetar Copper Mine, Merdeka Copper Gold[2]

[*]E-mail address: muhammadnajib31.mn@gmail.com

Abstract. The subdrain system at the Partolang Waste Dump was designed to control pore water pressure and maintain slope stability, particularly in the buttress area, which is highly risk to saturation and potential failure. The system consists of a Main Subdrain and Side Subdrain constructed from stacked rock materials with high porosity, wrapped in non-woven geotextile to prevent clogging by fine particles. Monitoring of the subdrain system includes flow rate measurements at the subdrain outlets using a V-Notch weir and groundwater level monitoring use Vibrating Wire Piezometers (VWP) installed at several key locations. To assess the geotechnical response, hydrological data are correlated with slope deformation monitoring obtained from inclinometer and prisms. The result indicate that implementation of the subdrain system, supported by surface water management such as slope grading and drainage channels, can minimize infiltration and maintains groundwater levels. Furthermore, no significant slope movement was detected throughout the monitoring period. These finding show the integration of a subdrain sytem, hydrogeolocigal monitoring and geotechnical monitoring provides a reliable approach for maintaining waste dump stability and serves as critical component of water management and geotechnical risk mitigation strategies in mining area.

Keywords: waste dump; subdrain; VWP; inclinometer; geotechnical; pore water pressure

Lithological Characterization of the Main and Borrow Areas Using 2D Geoelectrical Method: Implications for the Jatinegara Dam Planning

Isryaq Zakir[1*], Jossi Erwindy[1], Yan Adhitya W.W. [1], Arif Rahmat M. [1], Andre P.A. [1], Yudi Khardiman[1], Maulana G.A.[1], Dipta Alfian[1], Dewi Shinta R. [2]

[1] Technical Implementation Unit for Groundwater, Ministry of Public Works, No. 193, Ir. H. Juanda Street, Dago, Bandung City, West Java 40135, Indonesia

[2] River Basin Organization for Pemali Juana, Ministry of Public Works, No. 375, Brigjen Sudiarto Street, Pedurungan District, Semarang City, Central Java 50246, Indonesia

[*]E-mail address: isyraqzakir@pu.go.id

Abstract. The Ministry of Public Works through River Basin Organization for Pemali Juana (Balai Besar Wilayah Sungai Pemali Juana), plans to construct the Jatinegara Dam in Jatinegara District, Tegal Regency, and Warungpring District, Pemalang Regency. With the construction of this dam, it is expected that the planting season can be increased to three times a year.

As part of the construction planning, one critical requirement is subsurface information by characterizing lithology, which serves as a consideration for planning in the main area of the project. Four proposed borrow area locations need to be assessed to determine the most suitable site. Therefore, 2D geoelectrical surveys are necessary to investigate subsurface conditions at those locations.

Based on the survey results, it is concluded that the subsurface lithology in the main area is predominantly composed of tuff layers, underlain by harder layers. This lithological character indicates the potential presence of springs, landslide risk on both the right and left abutment hills due to slip planes, and groundwater potential that may lead to seepage during and after the dam construction.

The most potential locations to be used as borrow areas for dam core material are Jatinegara Village and Datar Village. It is recommended that during construction, local geological and hydrogeological surveys be conducted to better understand the groundwater dynamics in the main construction area, as groundwater may pose challenges during the development process.

Keywords: 2D geoelectrical surveys, lithology, borrow area, groundwater

Urban Construction and Coastal Groundwater Systems: Impacts on Hillslope Stability and Landslide Risk

Jiu Jimmy Jiao, Department of Earth Sciences, The University of Hong Kong

Abstract. This presentation investigates how human-driven modifications to groundwater systems—particularly in coastal hilly regions—can trigger landslides in areas where urbanization encroaches on steep slopes. In densely populated coastal zones with limited land availability, practices like coastal land reclamation, deep foundation construction, and large-scale excavations are common. These activities drastically alter subsurface hydrology by disrupting natural groundwater flow patterns, elevating porewater pressures, and weakening slope stability. However, their impacts on coastal hillslope hydrogeology are frequently overlooked in geotechnical assessments, despite growing evidence linking landslides to nearby urban development. The presentation argues that such occurrences are not coincidental but stem from the interplay between anthropogenic interventions and the unique hydrodynamic conditions of coastal environments.

A case study from Siu Sai Wan, Hong Kong—a coastal area shaped by extensive land reclamation and deep foundation works—demonstrates how these activities modified local hydrogeology, leading to destabilizing increases in groundwater levels within adjacent hillslopes. By integrating site history, field observations, and hydrological modeling, the analysis highlights how land reclamation and deep foundations may amplify landslide risks. The findings advocate for integrating coastal hydrogeological assessments into urban planning frameworks, emphasizing the need to address human-induced subsurface changes in hazard mitigation strategies for rapidly urbanizing coastal terrains.

Abstracts of Parallel Sessions: Groundwater and Drought

Analysis of the Impact of El Niño on Groundwater Quantity around the Equatorial Region of Indonesia, Case Study: Central Kalimantan

Nur Alifah[1]*, Muhammad Rifqi Irshad[1], Naufal Fajar Revanda[1], Bayu Nugraha[1], Irgi Bintang Pamungkas[1], Damar Sayyidina Zulfi[1]

[1]Enviromental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD, Jl.Ir. Soekarno Km.21 Jatinangor, Sumedang District, West Java-Indonesia 45363

*Email : nur22013@mail.unpad.ac.id

Abstract. El Niño-Southern Oscillation (ENSO) is a natural climate phenomenon characterized by fluctuations in sea surface temperatures and atmospheric conditions in the tropical Pacific Ocean. It consists of two phases, El Niño and La Niña, which significantly influence weather and climate patterns worldwide. The El Niño phenomenon plays a crucial role in shaping climate dynamics in tropical regions, such as Indonesia. One of its most notable effects is the alteration of rainfall patterns, which in turn indirectly influences the availability of groundwater resources. One observed impact is a decline in groundwater levels ranging from approximately 1,3 to 1,4 meters following the year 2015 in Central Kalimantan. This finding demonstrates that variations in precipitation patterns can significantly influence groundwater table fluctuations within a region. This study aims to quantitatively assess the effect of El Niño events on groundwater availability by analyzing changes in precipitation patterns over three different periods: 1997–1998, 2015–2016, and the most recent years. The research focuses on equatorial regions, with several areas of Central Kalimantan chosen as a representative case study. Precipitation information obtained from local meteorological stations were subjected to thorough statistical analyses to distinguish critical anomalies in precipitation during El Niño events and to evaluate their impact on groundwater quantity. The results indicate a significant reduction in rainfall during El Niño periods, leading to decrease groundwater levels and increase risk of drought. Despite the continuation of El Niño events through 2020, the resulting rainfall variability continues to affect groundwater stability. Therefore, adaptive water resource management based on long-term data is essential. This study discuss the importance of continuous monitoring of rainfall and groundwater in equatorial regions. Trend analysis should be integrated into climate change adaptation and disaster risk reduction strategies to ensure sustainable groundwater availability and improve resilience against future extreme climate events.

Keywords: Central Kalimantan; Climate change; El Niño; Groundwater level

Analysis of Water Balance and Conservation Strategies in Cikeruh Village, Jatinangor: A Hydroclimatological and Anthropogenic Review

Rafi Pandu Widyadhana*, Ricky Pratama Ferdiansyah, Nesya Hasna Muslimah, Dandy Setya Valiano Harianja, Ajeng Febrianti, Hamizan Muhammad Nasution, Irgi Bintang Pamungkas, Muhammad Ghozi

Environmental Geology and Hydrogeology Laboratory, Faculty of Geological Engineering, UNPAD Jl. Ir. Soekarno KM 21, Jatinangor, Sumedang District, West Java-Indonesia, 45363.

*E-mail address: rafi22001@mail.unpad.ac.id

Abstract. Cikeruh Village has undergone rapid transformation in line with the development of Jatinangor as a center for higher education, residential areas, and supporting infrastructure. This transformation has affected the water availability due to increased urbanization, land-use changes, and local climate variability. This study aims to evaluate the water balance condition in Cikeruh Village over the past five years (2020–2024) by analyzing the relationship between water availability and demand, particularly in the domestic and non-domestic sectors. This research was conducted using a quantitative approach. Water balance was calculated using the Thornthwaite method based on rainfall data, while water demand refers to the standards of the Ministry of Public Works for the domestic sector and Indonesian National Standard (SNI) for the non-domestic sector. Supporting data used include rainfall, temperature, and land cover. From field data processing in the period of 2020 to 2024, it was found that the average annual rainfall was 2094.76 mm, the infiltration discharge was 832606.42 m^3/year, and an increase of built up area was 50600 m^2. Regression analysis results show a linear relationship between rainfall and land cover with infiltration discharge, which is a key component in the groundwater recharge process. Meanwhile, water demand continues to increase, driven by population growth and regional activities. The absence of actual data on groundwater extraction remains a major obstacle in assessing whether the water balance is in surplus or deficit. These findings emphasize the importance of data-based groundwater management to maintain the sustainability of water resources, especially in facing future regional development pressures and climate change challenges.

Keywords: Cikeruh Village; Climate Change; Thornthwaite; Urbanization; Water Balance; Water Demand

Aquifer Characterization Using Multi-Point Geoelectric Data for Raw Water Well Planning in Rural Areas: A Case Study of Maiwa District Enrekang Regency, South Sulawesi Province

M. Ilham Haerik[1*], Zulham Ammar[1] , Zainab Sausan[1] , Bagus Firmansyah.[2]

[1] Directorate General of Water Resources, Ministry of Public Works, Jalan Pattimura No.20, Jakarta, Indonesia

[2] Graduated Student of The Master of Geological Engineering Program, Gadjah Mada University, Jalan Grafika No.2, Yogyakarta, Indonesia.

[*]E-mail address: ilhamhaerik@pu.go.id

Abstract. Limited availability of surface water in rural areas, especially during the dry season, drives the utilization of groundwater to meet water needs in such regions. Therefore, a study is necessary to map the characteristics of aquifers to determine the potential availability of water, which can serve as a reference in selecting efficient and sustainable raw water well locations. This study takes a case example in Maiwa district, Enrekang Regency, South Sulawesi, using a non-invasive multipoint geoelectrical method to obtain groundwater table depth in the area, which is then used to create a spatial map of groundwater table depth. The methodology involves subsurface electrical resistivity measurements through Vertical Electrical Sounding (VES) and two-dimensional (2D) resistivity mapping. The resistivity data acquired were analyzed to identify aquifer layers indicating the saturated zone. Integration of geoelectrical data with local geological maps strengthens the interpretation and validation of these observations. The geoelectrical survey conducted in Maiwa District revealed a complex aquifer system with resistivity values ranging between 0.00827 and 10,372 ohm-meters, reflecting diverse lithologies. The groundwater table depth ranges from 15 to 115 meters. Low resistivity values indicate productive, water-saturated layers such as sand and fractured volcanic rock, whereas higher resistivity values denote less permeable formations. The combination of resistivity data and geological maps allows accurate mapping of aquifer thickness and groundwater table depth. Comprehensive analysis of these data reveals significant spatial variability in aquifer characteristics, including depth, thickness, and resistivity values. These findings provide a scientific basis for well design, optimization of water extraction yields, and minimizing costs and environmental impacts. This study supports sustainable management of groundwater resources in the rural area under investigation.

Keywords: Aquifer; Geoelectric; Groundwater; Resistivity; Spatial

Aquifer Geometry Modeling and Simulation of Groundwater Level Decline in Unconfined Aquifer of Bandung City, Indonesia

Lalang Satrian Wiraputra[1*], Mohamad Sapari Dwi Hadian[1] , Mochamad Nurisyam Barkah[1]

[1] Geological Engineering, Padjadjaran University, Jl. Raya Bandung Sumedang KM.21 West Java 45363, Indonesia

[*]E-mail address: lalang21001@mail.unpad.ac.id

Abstract. The city of Bandung and its surroundings have experienced a significant decline in groundwater levels over the past few years due to rapid population growth, high urbanization flows, and uncontrolled groundwater extraction. This study aims to model the geometry of the unconfined aquifer system in this area and simulate changes in groundwater level to better understand the conditions of groundwater level decline.

The method applied includes the integration of subsurface geological data, namely 1-D resistivity data and well-logging data at various locations, which are then associated with regional geological information and spatial analysis. The results of this integration are used to build a three-dimensional model of the aquifer system, which then becomes the input data for numerical modeling. Based on the aquifer geometry model, it is known that the hydrostratigraphic unit consists of shallow and deep aquifers, aquitards, and aquicludes. Numerical simulations were then conducted using MODFLOW to analyze groundwater flow and predict the impact of continued extraction in various area.

Result show that the unconfined aquifers in the study area have different thicknesses and types of rock formations. Additionally, the uneven distribution of population also plays a significant role in how quickly and extensively groundwater levels are dropping. Simulations suggest that some areas within the Bandung city are at serious risk of having an aquifers depletion if the current extraction rates continue in the future. These results underscore the importance of a coordinated approach to groundwater management and the need for government policies to protect and sustain these vital water resources for the long term.

Keywords: groundwater level decline, aquifer geometry, groundwater simulation, unconfined aquifer, MODFLOW, Bandung Basin.

Groundwater Management Strategy as Mitigation of Agricultural Land Drought Hazards on the North Coast of Indramayu Regency

Dede Nurohim[1], Budhi Setiawan[1*]
[1] Program Study of Geological Engineering, Sriwijaya University, Indonesia

[*]E-mail address: budhi.setiawan@unsri.ac.id

Abstract. The danger of El-Nino in recent years in coastal areas, especially in Indramayu Regency, will cause drought in the groundwater irrigation network or jaringan irigasi air tanah (JIAT). This disaster has an impact on the level of agricultural productivity of the community, such as the event that occurred in 2024. Hydrogeologically, the research area is located in a coastal aquifer with characteristics of loose sediment in the form of fine silty sand and has groundwater productivity in the moderate category with a discharge of <5 liters/second. The drought event in the groundwater irrigation network (JIAT) is caused by excessive exploitation without considering the time series needed for the aquifer to recover, especially during the El-Nino period in the future. Calculation of runoff volume and water infiltration using the FJ Mock water balance method is very much needed to develop a groundwater management strategy in dealing with drought disasters, especially in the coastal aquifer of the area. The meteorological data series in 2019-2025 showed that the area experienced a level of groundwater deficit and surplus in the same time span as the dry season period. The highest deficit level occurred in 2024 in August at 353.67 mm/month and had an average deficit of 196.8 mm that year. In the coastal aquifer system, this value is very high and has the potential for drought levels that year. The coastal aquifer system management strategy to deal with the El-Nino hazard is mapped by considering land use and its interaction with seawater which shows a "guided" and "possible" ratio in land suitability assessment.

Keywords: drought, coastal aquifer, water balance, deficit, strategy

Identification of Aquifer Zones Using the Geoelectrical Resistivity Method in Vim Subdistrict, Jayapura City

Ignatius Wily Virman[1]), Muh. Altin Massinai[2]), Syamsuddin[3]), Virman[4])

[1]) Graduate Student of Groundwater Engineering, Faculty of Earth Science and Technology, Institut Teknologi Bandung, Indonesia

[2]), [3]) Department of Geophysics, Faculty of Mathematics and Natural Sciences, Hasanuddin University, Indonesia

[4]) Physics Education Program, Faculty of Teacher Training and Education, Cenderawasih University, Indonesia

*E-mail: wilygeophysics@gmail.com

Abstract. The rapid population growth in Jayapura City has led to an increased demand for clean water, while the local water company (PDAM) has yet to meet this demand adequately. This study aims to map the location, depth, and physical properties of aquifer zones in Vim Subdistrict, Abepura District, using the Schlumberger configuration of the geoelectrical resistivity method. Electrical current is injected into the ground through two current electrodes, while the potential distribution is measured using potential electrodes to obtain apparent resistivity values. Data were collected along three survey lines and processed using IPI2Win software, producing a 1-D resistivity model for each line. Interpretation reveals the presence of water-saturated layers at depths ranging from 5 m to 70.5 m, with resistivity values between 10.1 Ωm and 74.3 Ωm, indicating the presence of unconfined and confined aquifers within water-saturated sand-gravel lenses. These findings confirm the effectiveness of the geoelectrical method in mapping the distribution and characteristics of aquifers in alluvial environments, providing a scientific basis for determining production drilling points and groundwater conservation strategies in Jayapura City.

Keywords: resistivity; Schlumberger geoelectrics; aquifer; groundwater; Jayapura

Spatial Distribution of Groundwater Level Decline in Unconfined and Confined Aquifer of Jakarta, Indonesia

Dennis Fahriansyah[1*], Yudhi Listiawan[1], Janner Rahmat Sudianto[2], Hendarmawan[1]
[1] Geological Engineering, Padjadjaran University, Jl. Raya Bandung Sumedang KM.21 West Java 45363, Indonesia
[2] Jakarta Groundwater Conservation Center, Ministry of Energy and Mineral Resources, Jl. Tongkol No. 4 Jakarta 14430, Indonesia

[*]E-mail address: dennis21001@mail.unpad.ac.id

Abstract. The decline in groundwater levels is a critical issue in densely populated urban areas, such as Jakarta, where high water demand coincides with declining groundwater reserves. This study aims to assess the potential areas of groundwater level decline in unconfined and confined aquifers across Jakarta by using subsurface lithological and numerical groundwater flow modeling. The methodology includes subsurface lithofacies analysis and the application of steady-state and transient-state simulations over a five-year period using calibrated parameters within a groundwater modeling software environment. The results show a significant drawdown in the unconfined aquifer, especially in North and West Jakarta, where groundwater levels declined between 3 to 16 meters. The upper confined aquifer showed considerably greater depletion, ranging from 3 to 21 meters, with the most impacted zones situated in Central and West Jakarta. Model calibration yielded a correlation coefficient (R^2) of 0.785 and a root mean square error (RMSE) of 20.33 meters. The third simulation period (2555 days) was the most accurate match to observed field data. Over-extraction, declining recharge area, and high urban population density have all contributed to the observed groundwater decrease. These results show us how urgently integrated groundwater management plans and ongoing data updates are needed to enable the establishment of sustainable water resource plans and policies in Jakarta and other rapid urbanizing areas.

Keywords: groundwater depletion, aquifer drawdown, numerical modeling, urban groundwater, Jakarta

Abstracts of Parallel Sessions:

Research and Case Studies of Groundwater in Urban Areas, Extractive Industries (Mining, Oil and Gas, other industries), Conservation Measures

Determination of Recharge, Transitions, and Discharge Area Based on Water Level versus Well Depth Diagram in the Palu Groundwater Basin

Firman Maliki Abdullah

Abstract. The Palu Groundwater Basin is located in Central Sulawesi Province with an area of 312.7 km2 covering most of Palu City, the northern part of Sigi Regency, and part of Donggala Regency. The Palu River divides right in the middle of the Groundwater Basin and is the main river in Palu City. The population of Palu City according to the 2023 population census is around 779,918 people, thus requiring around 117,000 m3/day of water if it is assumed that water consumption per person is equivalent to 150 liters, some of which is of course met by groundwater. In this regard, the fulfillment of the community's water needs can be partly met by groundwater through drilling, but of course it is not possible to drill water in the groundwater recharge zone because it is prohibited or limited by regulations. Therefore, a method is needed that can determine where the recharge, transition, and groundwater discharge areas are in a groundwater basin so that groundwater utilization can be optimal. One relatively easy and inexpensive method is plotting groundwater level data against well depth into a diagram or graph so that it can be seen whether the well is in the recharge, transition, or discharge zone. If the groundwater level and well depth data are sufficient and evenly distributed, the three zones can be delineated in a groundwater basin. The results show that the northern part of the Palu Groundwater basin is a discharge zone, the central part is a transition zone, while the recharge zone is in the southern part.

Keywords: Palu Groundwater Basin, groundwater level, well depth, groundwater zonation

Groundwater Contamination Modelling and Pumping-Based Remediation of Landfill Leachate: A Case Study in Makassar, Indonesia

Sugiarto Badaruddin[1*], Haeril Abdi Hasanuddin[1], Nur Adilla[2], Asnawi Suhana Yunus[3]

[1] Civil Engineering Department, Politeknik Negeri Ujung Pandang, PO Box 90245, South Sulawesi, Indonesia

[2] PT Adhi Karya Persero, PO Box 12510, Jakarta, Indonesia

[3] PT PLN (National Electricity Company), PO Box 12160, Jakarta, Indonesia

[*]E-mail address: sugibadaruddin@poliupg.ac.id

Abstract. The Tamangapa Final Waste Disposal Site (TPA) in Makassar Indonesia has been operating since 1995 and is the sole facility managing municipal solid waste in the city. Over time, the accumulation of waste has produced leachate that poses a significant threat to the surrounding groundwater quality. This study aims to model the spatial distribution of leachate contamination and to simulate groundwater remediation strategies. Numerical modelling was conducted using Visual MODFLOW and MT3D to simulate groundwater flow and the transport of contaminants, focusing on iron (Fe) and manganese (Mn) concentrations. The simulation revealed that leachate disperses from the northwest toward the east, following the natural groundwater flow direction, and affects several community wells. To mitigate this, remediation was simulated through pumping scenarios. The most effective strategy involved groundwater extraction at a rate of 1500 m^3/day over 15 months, which successfully reduced the contaminant concentrations in the affected wells. This research provides a scientific basis for managing groundwater contamination in the vicinity of landfills and offers a practical framework for leachate remediation using numerical modelling.

Keywords: leachate; groundwater contamination; numerical modelling; MODFLOW; MT3D; remediation.

Groundwater Modeling of Bekasi – Karawang Groundwater Basin to Support Groundwater Management Simulation Based On The Regulation Of The Minister Of Energy And Mineral Resources Of The Republic Of Indonesia No. 14 of 2024

A Husna[1]*, D Kamal[1], M N Rizka[1] , P P Anggara[1] and T Ismail[1]

[1] Pusat Air Tanah dan Geologi Tata Lingkungan, Badan Geologi - Kementerian ESDM, Bandung, Indonesia

*E-mail: husnagng@gmail.com

Abstract. The Bekasi – Karawang Groundwater Basin is one of the strategic areas in the West Java Province facing high pressure on groundwater utilization due to rapid industrial growth and urbanization. Excessive groundwater extraction beyond aquifer's capacity in the study area can cause significant groundwater decline and permanent damage to the aquifer. To address this issue, a groundwater management simulation is essential to promote sustainable groundwater management. Groundwater modeling is carried out using numerical simulations with MODFLOW, based on field survey data and literature studies. Hydrostratigraphy from geoelectric interpretation indicates a northward fining lithology pattern, transitioning from sandy breccia in the south to clay-silt in the north, with a confined aquifer hydraulic conductivity value ranging from 10^{-7} to 10^{-5} m/s based on pumping tests. The model shows the observation points with negative residuals (simulated groundwater level is shallower than the observed results), in the low extraction areas. Conversely, if the K value is reduced to produce a decrease in the groundwater level in accordance with the negative residual point, it will produce more positive residuals in the high extraction zones, indicating the possible presence of unregistered wells. Groundwater flow simulation for 30 years using PATGTL data (as of September 2024) shows that there has been a decrease in regional groundwater levels of up to -40 m from sea level since 1990. Under the conservation scenario following The Regulation Of The Minister Of Energy And Mineral Resources Of The Republic Of Indonesia No. 14 of 2024, without taking aquifer compaction into account, groundwater recovery in damaged and critically damaged zones is projected to be achieved within 10 years.

The results of this study are expected to be a technical and policy reference in efforts to conserve groundwater in national priority basin areas.

Keywords: Model, Groundwater management, conservation

Hydrogeological Characterization of Confined Groundwater in Padang City, West Sumatera Province

Intining[1*], Ryan Dzulfiqar Ahmad[1]

[1] Center for Groundwater and Environmental Geology, Geological Agency, Ministry of Energy and Mineral Resources, Jl. Diponegoro No. 57, Bandung

[*]E-mail address: intituingtuing@gmail.com

Abstract. The investigation aimed to assess the condition of confined groundwater in Padang City, West Sumatra Province. A field survey was carried out in July 2024 at nine boreholes with depths ranging from 100 to180 meters. The activities included measuring the depth of groundwater table, in-situ measurement of pH and electrical conductivity (EC), and groundwater sampling. Groundwater samples were sent to the PATGTL Groundwater Quality Laboratory for further analysis. The depth of the confined groundwater ranged from 1.58 to 8.49 meters. Groundwater quality analysis showed pH value ranging from 6.44 to7.9 and EC values between 220 and 871 µS/cm. All samples were classified as freshwater, none met the drinking water quality standards based on Ministerial Regulation of the Ministry of Health No. 2 of 2023. Hydrochemical analysis identified two water facies, namely calcium bicarbonate (Ca-HCO_3) and sodium bicarbonate (Na-HCO_3). Water with the Ca-HCO_3 facies associated with wells located closer to hilly areas, whereas Na-HCO_3 facies were found in wells near the coastal area. Stable isotope analysis indicated δ^2H values ranging from -51.93‰ to -59.24‰ and $\delta^{18}O$ values from -8.39‰ to -9.61‰. When plotted on the Local Meteoric Water Line (LMWL), groundwater samples were clustered on the left side. Heavier isotope values were found in wells near the hills, while lighter values were observed in wells closer to the sea.

Keywords: Confined Groundwater, Padang City, Groundwater Quality, Stable Isotope

Spatial Evaluation of The Bandung-Soreang Groundwater Conservation Zone 2024

Dasapta Erwin Irawan[1], Munib Ikhwatun Iman[2], Agus Mochamad Ramdhan[1], Ahmad Darul[3]

Abstract. The Bandung-Soreang Groundwater Basin (CAT) is a vital water resource supporting the activities of residents and the economy in the Bandung Raya area, West Java. It is estimated that 70% of the water resources used are groundwater. The focus of the spatial evaluation of the conservation zone in the Bandung-Soreang CAT is the confined aquifer in the middle section at a depth of 40m-150m, with the main aquifers being the Cibeureum Formation, Banjaran Formation, Cicalengka Formation, and Kosambi Formation. The deepest groundwater level around Leuwigajah reaches 117.8 meters below the ground surface, and modelling and numerical analysis of the groundwater flow contours reveal that most areas have experienced a decline in groundwater levels of more than 80%. The results of the spatial evaluation of the conservation zone in the Bandung-Soreang CAT in 2024 indicate an increase in the area of the vulnerable-critical-damaged zone of 10% compared to the conservation zone in 2010. The vulnerable and critical zones decreased by 6% and 3% respectively. However, the damaged area increased by 19% spread across densely populated areas and industrial zones, namely Soreang, Ketapang, Margahayu, Rancaekek, Dayeuhkolot, as well as most of Bandung City and Cimahi City.

Keywords: Groundwater conservation, Bandung-Soreang CAT, spatial evaluation.

The Role of Monitoring Wells in Groundwater Conservation: A Case Study of Babakan Penghulu, Bandung City

Iman Prakasa
Badan Geologi, Pusat Air Tanah dan Geologi Tata Lingkungan

Abstract. Groundwater is a strategic resource that supports domestic and industrial demands, particularly in densely populated urban areas such as Bandung City. Intense exploitation without proper monitoring and management poses risks of groundwater level decline and deterioration in both quality and availability. This study aims to evaluate local hydrogeological conditions and the role of a monitoring well in groundwater conservation, with a case study at the Babakan Penghulu Monitoring Well, Cinambo District, Bandung. Site selection and geophysical surveys were conducted prior to drilling down to 125 meters, followed by borehole cutting analysis and geophysical logging to identify aquifer geometry. Groundwater level (GWL) was continuously monitored using an Automatic Water Level Recorder (AWLR). The main aquifer was identified at depths of 76–123 meters, while the average GWL was recorded at 41.42 meters below ground surface. The decline of GWL to nearly half the aquifer thickness indicates increasing stress on the groundwater system. According to Ministry of Energy and Mineral Resources Regulation No. 31/2018, the area is classified as a vulnerable groundwater conservation zone. This study highlights the importance of applying systematic drilling and monitoring procedures as a foundation for adaptive and sustainable groundwater management.

Keywords: groundwater, monitoring well, groundwater level, conservation zone, Bandung

Abstracts of Parallel Sessions:

Advanced Technology on Hydrogeology

Generative AI for 2D Geoelectric Imaging Forward Model

Agah Drajat Garnadi[1*]
[1] FMIPA, IPB, Indonesia

[*]E-mail address: agah.garnadi@gmail.com

Abstract. This report investigates the utility of Large Language Models (LLMs) in generating code for the Geoelectric Imaging Forward Model, focusing on a novel approach that models current injection as a boundary value problem to avoid nonhomogeneous Poisson equation singularities. Utilizing *QWen*, the study demonstrates the generation of MATLAB code based on mathematical prompts detailing geometry, governing equations, and boundary conditions. The iterative refinement of the generated code through subsequent prompts proved effective in correcting errors and achieving accurate results. This work showcases the considerable capability of LLMs in numerical code generation and their ability to learn from refinement processes with precise prompting. The findings suggest that LLMs can serve as valuable tools for programming assistance, particularly in reducing syntax errors and establishing logical programming frameworks.

Keywords: Automated generated codes, Homogeneous Poisson Eq., Generative AI, Geoelectrical Imaging, Semianalytic Forward Model

Abstracts of Parallel Sessions:

Remote Sensing and Artificial Intelligence Application on Hydrogeology

Detecting Groundwater Storage Decline in Java Island using GRACE and GLDAS Datasets (2002–2017)

Norman Arif Muhammad[1*], Andre Putra Arifin[2], Kartika Dirayati[1]
[1] Directorate of Raw Water and Groundwater, Ministry of Public Works, Jalan Pattimura No.20, Kebayoran Baru, South Jakarta 12110, Indonesia
[2] Implementation Unit of Groundwater, Ministry of Public Works, Jalan Ir. H. Juanda No.193, Dago, Coblong, Kota Bandung, West Java 40135, Indonesia

[*]e-mail address: norman.muhammad@pu.go.id

Abstract. Rice production in Indonesia is crucial for food security and can act as a buffer to counteract groundwater depletion. The open-channel flood irrigation system, commonly used in paddy rice cultivation, although highly inefficient due to substantial water losses from evaporation and infiltration, can contribute positively by recharging local groundwater reserves through its infiltration flux. The ongoing reduction of paddy rice fields, coupled with rapid urban expansion, has led to a decline in groundwater recharge from irrigation and an increase in groundwater extraction to meet urban demand. Although climate change has had a minimal impact on total annual precipitation in Java Island, it has significantly altered the temporal distribution of rainfall. A shift toward more frequent heavy rainfall events has reduced the effectiveness of soil infiltration compared to lighter, more evenly distributed rainfall.

This study utilizes the GRACE Global Mascons and GLDAS soil moisture dataset spanning from 2002 to 2017 to identify a declining trend in terrestrial groundwater storage across Java Island. We observe a widespread decline in groundwater storage across Java Island, with a maximum decline rate of 7 mm/year of water equivalent. Conversely, a few coastal areas exhibit increasing trends, which we tentatively attribute to seawater intrusion into coastal aquifers. These findings highlight the impact of land use, irrigation practices, and urbanization on shaping regional groundwater dynamics on the island of Java.

Keywords: groundwater depletion; irrigation recharge; Java Island; land use change; remote sensing.

Abstracts of Poster Session:

Analysis of Meteorological and Hydrogeological Drought Propagation in the Serang-Lusi Watershed, Central Java

Fadhilah Nurzaki Waliyatullah[1*], Rusmawan Suwarman[2]
[1] Master Program in Groundwater Engineering, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia
[2] Atmospheric Science Research Group, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[*]E-mail address: fadila.nurzaki@gmail.com

Abstract. Drought is a hydrometeorological disaster that significantly affects water availability, agriculture, and socio-economic conditions. In 2023, the Serang-Lusi Catchment in Central Java experienced prolonged dry conditions associated with the El Niño phenomenon, marked by reduced rainfall, declining groundwater levels, and river desiccation. While these symptoms suggest the occurrence of drought propagation, the relationship between meteorological drought and the response of the hydrogeological system in this catchment has not been thoroughly investigated.

This study aims to analyze the propagation of drought from meteorological to hydrological and hydrogeological aspects in the Serang-Lusi Catchment. It also seeks to determine the critical thresholds of drought duration and severity that trigger the transition from meteorological drought to impacts on streamflow and groundwater levels. The integrated SWAT-MODFLOW model (QSWATMOD) is employed to simulate streamflow and groundwater dynamics based on inputs such as land use, soil type, climate data, and aquifer parameters. Drought indices—Standardized Precipitation Index (SPI), Standardized Streamflow Index (SSI), and Standardized Groundwater Index (SGI)—are used to assess drought characteristics across multiple timescales.

The study hypothesizes that there exists a critical threshold in meteorological drought duration and severity, beyond which hydrological and hydrogeological droughts are initiated. Furthermore, drought propagation follows a temporal sequence in which surface water systems respond earlier than groundwater, reflecting a delayed hydrogeological response. Through spatio-temporal analysis of drought indices and simulation outputs, this research identifies how prolonged and severe meteorological droughts influence the onset and intensity of water scarcity in both surface and subsurface systems. Understanding drought propagation and its critical thresholds is essential for improving drought mitigation strategies and sustainable water resource management in catchments Serang-Lusi.

Keywords: drought propagation; SWAT-MODFLOW; groundwater; Serang-Lusi watershed

Coastal Water Dynamics in Rupat Island: A Study on Quality, Quantity, and Saline Intrusion

Sutanto Tri Juni Putro[1], Kozan Osamu[1], Erik Febriarta[2]
[1]Center for Southeast Asian Studies, Kyoto University

[2]Professional Engineer, Faculty of Engineering, Binus University, Jakarta, Indonesia

Abstract. Water resource management in coastal regions presents significant challenges due to unique geological conditions and the pervasive threat of seawater intrusion. This study examines the water resources of Rupat Island, a coastal area characterized by young and old surface deposits, extensive peatlands acting as natural water reservoirs, and a northern coast with transported silica sand. The southern part of the island, however, is dominated by muddy sediments, while western Malacca Strait submarine sediments are primarily lithogenous. These geological and sedimentary features profoundly influence the island's hydrogeology. Rupat Island's aquifer potential is moderate, with low to moderate intergranular permeability and discharge rates ranging from less than 5 L/s to 5-10 L/s. Both aquifer types are composed of unconsolidated alluvial deposits, ranging from gravel and sand to clay and peat in the north, and coarser-grained alluvial deposits with clay interbeds in the south. The island's relatively flat topography contributes to low hydraulic conductivity, leading to varying water quality—from brackish to saline—primarily due to seawater intrusion and localized marine/fluvial entrapment. Our research aimed to characterize Rupat Island's water resources through detailed observations of groundwater dynamics. The findings indicate that while groundwater quantity is relatively high, its quality varies considerably. Water quality is classified as fresh, brackish, or saline, with increasing salinity directly correlating with declining quality and unsuitability for local consumption. This study offers crucial insights into the groundwater interaction boundaries within Rupat Island, emphasizing the delicate balance between water availability and quality in this complex coastal environment.

Contamination of Unconfined Aquifer at Sarimukti Landfill Site, West Bandung Regency

Yundhera Danazahra[1*], Deny Juanda Puradimaja[2], Agus Mochamad Ramdhan[2], Muhammad Iqbal Musthofa[1]

[1] Master Program in Groundwater Engineering, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[2] Applied Geology Research Group, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[*]E-mail address: yundheradanazahra@gmail.com

Abstract. Sarimukti Landfill has a process of landfilling waste with open dumping and sanitary landfill systems which generally produces pollutants in the form of leachate water so that it can cause water pollution in the vicinity. This study aims to determine contaminants in unconfined aquifers in the Sarimukti landfill area by comparing chemical data of groundwater, rainwater, river water, and leachate water with Piper Diagrams and Scholler Diagrams and the distribution of contaminants using Visual Modflow software. The data used in both hydrogeochemical analysis and modeling are secondary data obtained from the literature in the form of geology and topography, concentration of ion compounds in each type of water, climatology, groundwater table elevation, and hydraulic conductivity. Based on the comparison of water facies in the study area, the facies of leachate water and contaminated river water were obtained, as well as the results in the SP2 DS monitoring well, namely Na-HCO3. With the comparison of Schoeller Diagrams, it was found that the highest concentrations in groundwater at point SP2 DS were Na^+, Cl^-, and HCO_3^- with each reaching 1,031.4 mg/L, 1,374.02 mg/L, and 4,901.96 mg/L. This is due to the decomposition of waste. The leachate water from the sewage treatment plant was compared with Government Regulation No. 22 of 2021 and it was found that chloride ions exceeded the quality standard limit. From the modeling results, it is found that the flow direction moves from north to south with a hydraulic gradient of 0.07-0.08. There is flow into river water so that river water experiences ion enrichment such as Na^+, Cl^-, and HCO_3^- with each reaching 226.81 mg/L, 408.79 mg/L, and 1,434 mg/L (Point A5). In addition, there is a flow to the south of the Sarimukti Landfill area, namely at point SP2 DS and accumulates at that point.

Keywords: Sarimukti Landfill, Groundwater, Hydrogeochemistry, Flow

Estimation of Hydraulic Parameters in Coastal Shallow Aquifers Using Electrical Resistivity Tomography (ERT) and Pumping Tests: A Case Study of Vannamei Shrimp Aquaculture on the Southwest Coast of Aceh, Indonesia

Ir. Khalif Alfaiz, S.T., M.T., IPM. ASEAN. Eng[1*], Ahmad Mufazzal, S.T.[1], Habibul Awal, S.T.[1], Kamal Azhari Abdi, S.T.[1], Mustika Nadia, S.T., M.T.[1], Cut Safira Fatharani, S.T.[1], Zahratunnisa, S.T., M.T.[2]

[1] Geotama Multi Resources, Aceh Besar, Indonesia

[2] Geology Engineering Department, Universitas Syiah Kuala, Banda Aceh, Indonesia

[*]E-mail address: Khalifalfaiz@geotamaservices.id

Abstract. Vannamei shrimp farming in Southwest Aceh relies on a stable supply of brackish groundwater, which is increasingly threatened by seawater intrusion due to climate change, sea level rise, and coastal urbanization. The long-term viability of coastal aquifers is critical for environmental sustainability and local community livelihoods. This study integrates geophysical and hydrogeological approaches to assess aquifer capacity and vulnerability, supporting resilient coastal aquifer management.

The research was conducted in Geulima Jaya Village, Susoh Sub-District, where a 3.6-hectare vannamei shrimp pond relies on groundwater as its primary water source. Fieldwork involved four Electrical Resistivity Tomography (ERT) profiles using the Schlumberger configuration and drilling of four test wells to depths of 30–35 meters. Step-drawdown and recovery pumping tests were conducted to evaluate key aquifer properties.

ERT results identified seawater intrusion zones at depths of 12–30 meters, with resistivity values (ρ) below 1 Ω·m. Pumping tests yielded an average hydraulic conductivity (K) of 0.10 m/h, transmissivity (T) of 65.3 m²/h, and optimal discharge (Q) of 8.8 L/s. These findings confirm the technical feasibility of using brackish groundwater for shrimp aquaculture and highlight the need for adaptive water resource management.

The integration of ERT and pumping test data provides a robust quantitative foundation for sustainable management of coastal aquifers under evolving environmental conditions. It enables proactive planning in anticipation of a projected sea level rise of +30 cm by 2050. This research contributes to tropical coastal water resource management by demonstrating how integrated subsurface characterization can guide adaptive strategies to preserve aquifer resilience amid climate change and ongoing development pressures.

Keywords: Coastal aquifer management; Water resource sustainability; Climate change adaptation; Saltwater intrusion; Electrical resistivity tomography; Pumping test; Shrimp aquaculture; Tropical coastal zone

Groundwater Modelling Using the Finite Difference Method with a Stochastic Ordinary Kriging Approach in Cimahi City

Achmad Darul[1,2,*], Gumilar Ramadhan[3], Dasapta Erwin Irawan[4], Prihadi Sumintadireja[4], Arif Gunawan[4]

[1]Program Profesi Insinyur – Universitas Padjadjaran, Bandung, Indonesia.,[2]Program Studi Teknik Geologi – Institut Teknologi Sumatera, Lampung, Indonesia.,[3]Balai Teknik Bendungan – Kementrian Pekerjaan Umum, Jakarta, Indonesia, [4]Fakultas Ilmu dan Teknologi Kebumian, Institut Teknologi Bandung, Bandung, Indonesia.

[*]E-mail address: achmad24010@mail.unpad.ac.id

Abstract. This study presents a refined regional-scale groundwater simulation of the Bandung Aquifer Basin, expanding on the initial 2009 finite difference model comprising 16,900 grid cells (0.5 km² resolution) that delineated lithological units from surface to bedrock—including the Kosambi aquitard, the Cibeureum aquifer, and the Cikapundung bedrock. Building on prior assumptions of an isotropic aquifer with anisotropic conductivity (Kx = Ky > Kz), a stochastic kriging-based approach was employed to assimilate sub-regional K-value distributions into a unified regional model using 170 borehole records. Validation through directional and omni-directional variograms yielded a Mean Percent Error of 16.33, a correlation coefficient of -0.616, and a coefficient of determination of 0.379 in the Cimahi sector (43 boreholes). A total of 121,000 interpolated hydraulic conductivity points were generated and implemented in MODFLOW using a 100×100×10 m grid. Results indicate a groundwater table ranging from 660 to 600 masl within the industrial agglomeration zone, exhibiting a southward flow trend and a distinct cone of depression at the center of industrial activity.

Keywords: Bandung Groundwater Basin, Groundwater modelling, finite difference method, hydraulic conductivity, stochastic.

Health Risk Analysis From Heavy Metal Exposure in The Cirasea River

Siti Annisa[1], Etih Hartati[2], Rizka Maria[3], Anna Fadliah R[4]
[1] Faculty of civil and environmental engineering, ITENAS, Bandung, Indonesia
[2] Faculty of civil and environmental engineering, ITENAS, Bandung, Indonesia
[3] National Research and Innovation Agency, Bandung, Indonesia
[4]National Research and Innovation Agency, Bandung, Indonesia

[*]E-mail address: siti.annisa@mhs.itenas.ac.id

Abstract. The Cirasea River is part of the Citarum River Basin, which serves as the main buffer in meeting the raw water needs for agriculture, livestock, and other purposes. Over time, there have been changes in land conditions around the Cirasea River, leading to the conversion of land into residential, agricultural, and livestock areas. These changes contribute to the increase in liquid waste containing heavy metals. This study aims to analyze the risk level of heavy metal exposure in the water of the Cirasea River. Primary data were collected from nine sampling locations, with testing for heavy metal content such as Manganese (Mn), Iron (Fe), Copper (Cu), Lead (Pb), Cadmium (Cd), Chromium (Cr), and Mercury (Hg). Data processing was carried out using the descriptive research method, namely Environmental Health Risk Analysis (EHRA), which aims to calculate or estimate the risk to human health due to exposure to heavy metals. The analysis results show that the health risk from exposure to Iron (Fe) in all samples varies between 1 – 2 mg/kg/day, with a Risk Quotient (RQ) value > 1. Based on the risk category, these results indicate the potential health impact from exposure to Iron (Fe). As a mitigation step, more effective liquid waste management efforts and increased public awareness about the dangers of heavy metal exposure are needed. In addition, monitoring of land use changes and water resource utilization needs to be tightened to ensure the water quality of the Cirasea River remains preserved and safe for the environment and public health.

Keywords: ARKL, Cirasea River, Heavy Metal, Health Environmental

Hydrogeochemical and Isotope Studies on Interaction of Seawater and River Water with Groundwater in Unconfined Aquifers in Coastal Cirebon City

Muhammad Iqbal Musthofa[1]*, Irwan Iskandar[2], Mutiara Rachmat Putri[3], Yundhera Danazahra[1], Daud Al Amin Rahmatulloh[4], Hanifa Octaviani[1]

[1]Master Program in Groundwater Engineering, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[2]Exploration of Earth Resources Group, Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology, Bandung, Indonesia

[3]Environmental Oceanography Research Group, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia

[4]Bachelor Program in Geological Engineering, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia*

E-mail address: iqbalmusthofa12@gmail.com

Abstract. The coast of Cirebon City zone is a hydrogeological transition zone that experiences direct interaction between groundwater, seawater, and river water. The presence of aquifer systems in this area is influenced by natural processes from the land, such as precipitation and river flow, as well as oceanographic dynamics like tides and seawater intrusion. These processes create unique hydrogeochemical conditions that can affect the stability of flow and hydraulic pressure in the unconfined aquifer, which serves as the primary source of clean water for the community in the coastal area of Cirebon City. This study aims to identify the interaction between seawater and river water on groundwater in the unconfined aquifer of the coastal area of Cirebon City through a hydrogeochemical approach and stable isotope analysis of δ18O and δ2H. Eleven water samples from the inland to coastal zones were analyzed using Piper diagrams, Schoeller diagrams, and isotope plots to evaluate the mixing patterns and origins of each water source.

Based on the research results, from the Piper diagram, seawater (C-AL-1 and C-AL-2) and river water (C-AS-1 and C-AS-2) are dominated by the Na-Cl type, while most groundwater (C-AT-2, C-AT-3, and C-AT-5 to 7) exhibit the Ca-Mg-HCO3 type. However, some groundwater samples, such as C-AT-1 and C-AT-4, exhibit the characteristic composition of saline water (Na-Cl), indicating the occurrence of seawater intrusion. River water samples (C-AS-1 and C-AS-2) show transitional characteristics, with significant similarity to seawater due to the influence of tides and backflow in the estuary zone. The Schoeller diagram supports these findings, with high concentrations of Cl^- and Na^+ in some groundwater samples (C-AT-1 and C-AT-4) and river water samples (C-AS-1 and C-AS-2), indicating mixing of groundwater with seawater and river water. The high fluoride value in C-AT-1 (41.34 mg/L) also indicates potential enrichment from seawater or geogenic processes. All groundwater samples (C-AT-1 to C-AT-7) are close to the Java Meteoric Water Line (JMWL), indicating that their primary source is

local precipitation. However, the isotopic positions of all groundwater and river water samples (C-AS-1 and C-AS-2) that are close to the mixing line between groundwater and seawater indicate the presence of mixing processes and seawater intrusion into the unconfined aquifer system along the coast of Cirebon City.

Keywords: Hydrogeochemistry, Isotopes, Groundwater, Seawater, River, Cirebon City

Hydrogeology and Hydrogeochemistry Study on Waste Dump Area of PT. XYZ

Hanifa Octaviani[1]*, Irwan Iskandar[2], Andy Yahya Al Hakim[3]

[1]Master's Program in Groundwater Engineering, Faculty of Earth Sciences and Technology, Institut Teknologi Bandung, Jalan Ganesha No. 10, Bandung 40132, Indonesia
[2]Department of Mining Engineering, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Jalan Ganesha No. 10, Bandung 40132, Indonesia
[3]Department of Mining Engineering, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Jalan Ganesha No. 10, Bandung 40132, Indonesia

*E-mail address: hanifaoctaviani@gmail.com

Abstract. This study was conducted to assess the source and mechanism of increased seepage in the waste dump area of PT.XYZ, which occurred along with the elevation of the waste dump. The seepage that occurs has a significant discharge and has the potential to disrupt geotechnical stability and the quality of the surrounding environment. This study integrates hydrogeological and hydrogeochemical approaches to understand the hydrogeological and geochemical characteristics of the water. Data collection was conducted through in situ measurements of water physico-chemical parameters, as well as sampling from springs, groundwater, surface water and rainwater.

Laboratory analysis involved testing the content of major ions and other dissolved metals using IC and ICP-MS methods, δ2H and δ18O stable isotopes using Picarro Analyzer, and δ13C using IRMS. The test data were plotted in Piper diagrams showing the diversity of water facies and indications of mixing between water sources. The isotope results support the notion that the seepage originated from mixing between shallow groundwater and surface water infiltrating through local permeable geological structures.

A conceptual model of subsurface water flow was developed to describe potential seepage pathways and their interaction with local geology. This research provides a better understanding of water dynamics in the mine environment and recommends technical mitigation measures to reduce potential environmental impacts. The findings are expected to provide an important basis for sustainable water resources management in open-pit mining areas.

Keywords: Hydrogeology; hydrogeochemistry; groundwater flow; seepage; waste dump

Modeling The Distribution of Pollutants in Cirasea River Bandung Regency using QUAL2Kw Methods

Nissa Syakira[1], Etih Hartati[2], Dyah Marganingrum[3], Rizka Maria[4], Anna Fadliah[5]

[1] Faculty of Civil and Environmental Engineering, ITENAS, Bandung, Indonesia
[2] Faculty of Civil and Environmental Engineering, ITENAS, Bandung, Indonesia
[3]National Research and Innovation Agency, Bandung, Indonesia
[4]National Research and Innovation Agency, Bandung, Indonesia
[5]National Research and Innovation Agency, Bandung, Indonesia

[*]E-mail address: nissasyakira9@gmail.com

Abstract. The Cirasea sub-watershed is experiencing severe erosion due to massive agricultural activities, threatening the forest landscape and quality degradation due to the discharge of domestic, agricultural, livestock and industrial wastewater without adequate treatment. Water quality modeling is an important aspect of river water resources management, as it can predict the impact of pollution on the environment. The aim of this research is to assess the water quality of Cirasea River by determining the water quality status using the pollutant index method, calculating potential pollutant loads, and simulating various scenarios using the QUAL2Kw application to identify water quality patterns and pollution control strategies. Sampling was conducted at 9 points by testing parameter such as temperature, pH, DO, BOD, COD, TSS, Phosphate, Nitrate. The results of this research show that from the 9 river points that were sampling locations, it was found that the Cirasea River was included in the lightly polluted category because the pollution index has a value below 5. The dominant contributing pollutant source was the domestic sector and the highest value of pollutant load in each parameter was BOD in the domestic sector, 2063.68 kg/day; COD in the livestock sector 3146.03 kg/day; TSS Domestic sector 1687.99 kg/day; Total N in the domestic sector is 156.45 kg/day and total P in the agricultural sector is 132.87 kg/day. To reduce pollution, it is necessary to implement better waste processing, increase public awareness, and strictly monitor land use to maintain water quality and the Cirasea River ecosystem.

Keywords: Cirasea River; Modeling; Pollution Index; QUAL2Kw

Modification of The DRASTIC Method for Assessing Groundwater Contamination Risk from Underground Coal Gasification

Faradilla Putri Jasanagara[1], Hirundini Rustica Absari[2], Kemala Wijayanti[1], Lilik Eko Widodo[3]

[1] Faculty of Earth Sciences and Technology, Institut Teknologi Bandung, Indonesia
[2] Balai Konservasi Air Tanah, Indonesia.
[3] Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Indonesia

[*]E-mail address: Faradilla.p.jasanagara@gmail.com

Abstract. Underground Coal Gasification (UCG) is an in-situ coal conversion technology with significant potential to affect groundwater quality due to the possible migration of combustion gases, volatile organic compounds (VOCs), and heavy metals into surrounding aquifers. Despite this risk, there is currently no standardized framework specifically designed to assess groundwater vulnerability in UCG settings. This study proposes a modified version of the DRASTIC method, a widely used framework for groundwater vulnerability assessment, to evaluate the contamination risk associated with UCG operations. The modification involves revisiting the relevance of the original DRASTIC parameters and introducing UCG specific factors such as cavity depth, fracture presence, and operating pressure. The method is applied to a conceptual UCG site to test its applicability. Results suggest that the modified approach provides a more representative and adaptable framework for identifying potential groundwater contamination risks from UCG, and may contribute to the development of more robust environmental risk assessment tools in subsurface energy technologies.

Keywords: underground coal gasification; modified DRASTIC method; environmental risk assessment; hydrogeological vulnerability.