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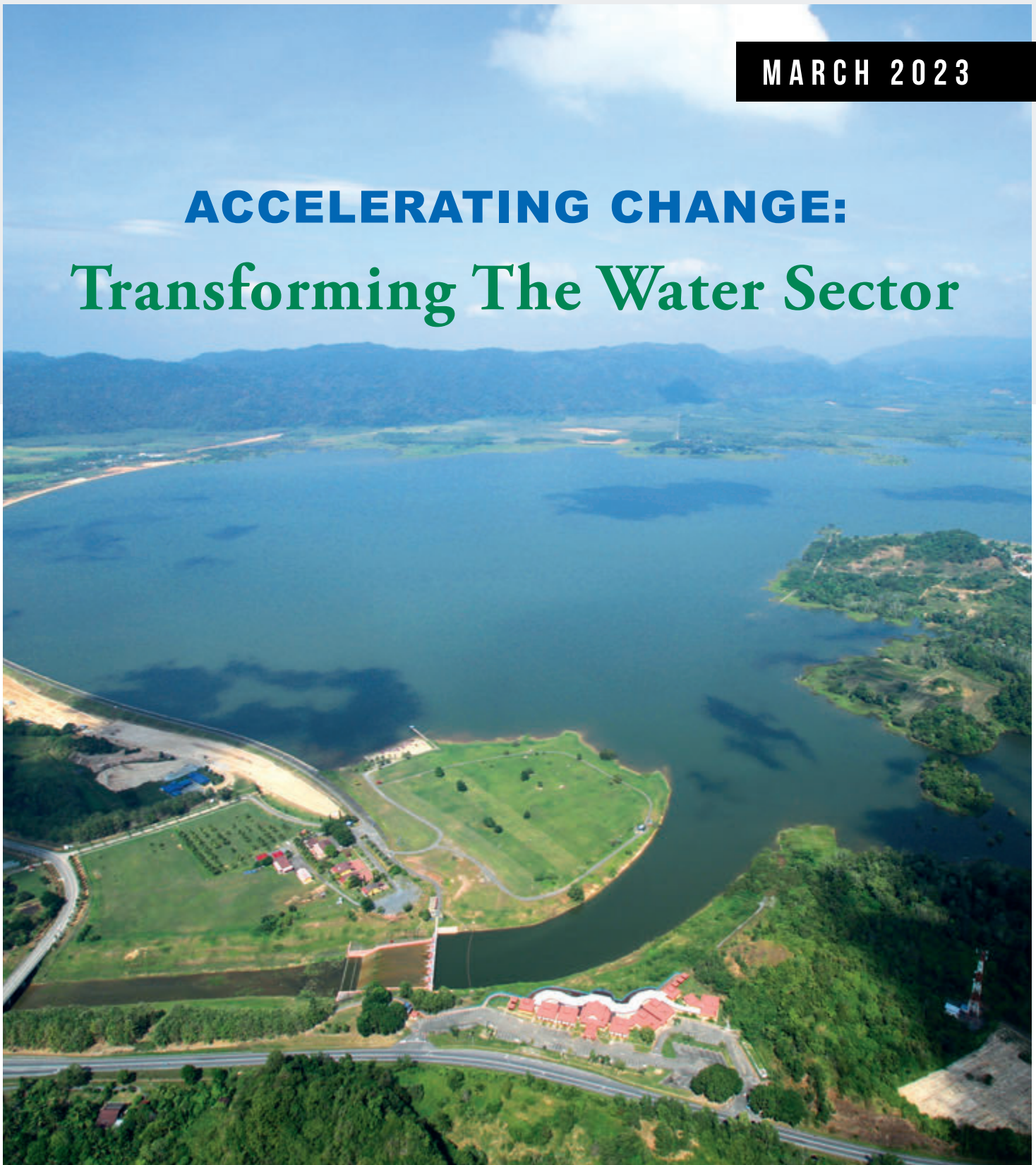
THE MONTHLY BULLETIN OF THE INSTITUTION OF ENGINEERS, MALAYSIA

MARCH 2023

## ACCELERATING CHANGE:

## Transforming The Water Sector



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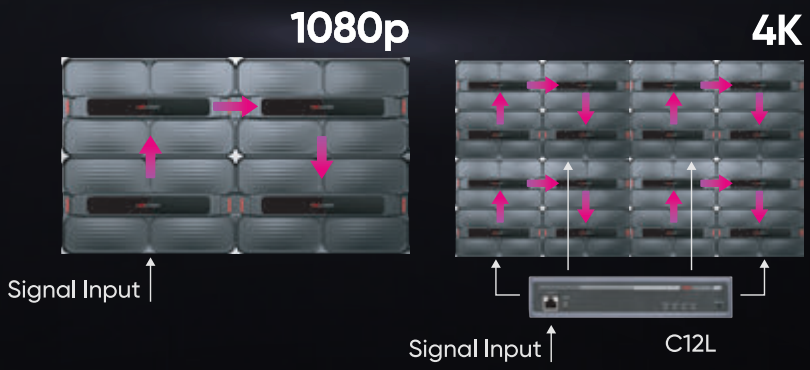


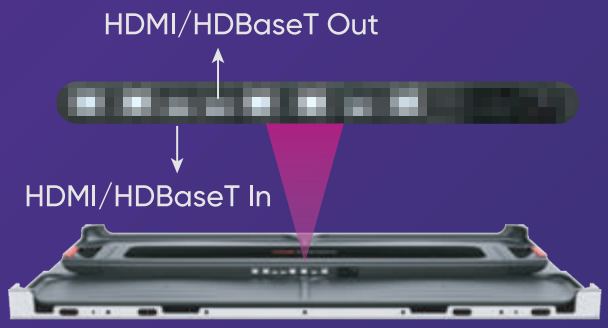


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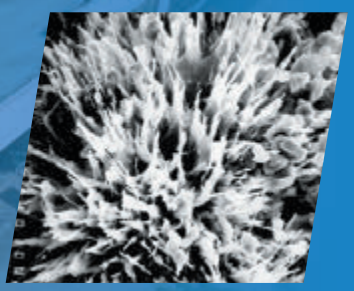

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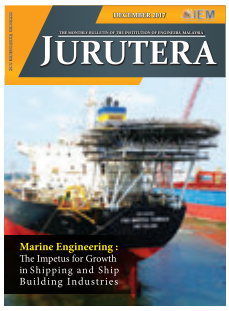





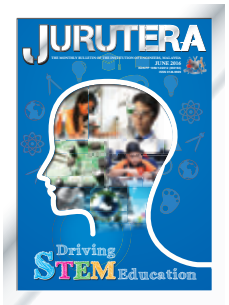


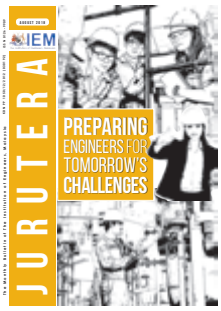


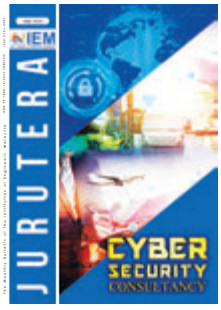


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*by Y. Bhg. Dato' Kapt.(B) Ir. Hj. Anuar bin Hj. Yahya*
*Chairman, Water Resources Engineering Technical Division*

# COVER NOTE

## Accelerating Change : Transforming the Water Sector

The current weather pattern has transformed the way we deal with things and the way we manage our water resources. It has forced us to look seriously into managing water resources in an integrated manner to meet the demands of the various stakeholders. This should be viewed as an impetus for us to strive to drive integrated water resources management (IWRM) to accelerate change in the water sector. There are 4 central components of IWRM: Stormwater management, wastewater treatment, water supply and conservation of existing water sources.

According to the United Nations Environment Programme (UNEP), IWRM is a cross-sectoral policy approach designed to replace traditional and fragmented sectoral approaches to water resources and management which have led to poor services and unsustainable resource use. IWRM is based on the understanding that water resources are an integral component of the ecosystem, a natural resource and a social and economic good.

In this issue, Dato' Ir. Nor Hisham bin Mohd. Ghazali, FIEM Chairman Malaysian Water Partnership (MyWP) and Ir. Dr Wong Wai Sam, FIEM, Director MegaConsult Sdn. Bhd., elaborate on the challenges, strategies, prospects and safety issues of the water sector, especially stormwater management. ■

# EDITOR'S NOTE

## Water Matters

*by Ir. Dr Siow Chun Lim*
*Principal Bulletin Editor*

Water. Malaysia is blessed with bountiful water resources all year round. Sometimes though, we get too much water and that's when problems arise. So, is this another problem that engineers can help solve? Let's take a look at what the Water Resources Technical Division has prepared for us to resolve this million-ringgit question.

Since November last year, we had been busy with celebrations for Deepavali, Christmas and Chinese New Year, major festivals that fell within 3 months of each other. But guess what… Hari Raya Aidilfitri is just around the corner. Meanwhile, to our Muslim readers, Selamat Menunaikan Ibadah Puasa Bulan Ramadan 2023. ■

# Accelerating Change:

## TRANSFORMING WATER RESOURCES FOR SECURITY & SUSTAINABILITY

*World Water Day 2023 falls on 22 March. Adopting the theme, Accelerating Change, the global campaign encourages people to "Be The Change" and to take action to transform the way we use, consume and manage water. JURUTERA talks to* ***Dato' Ir. Dr Md Nasir bin Md Noh****, the Director-General of the Department of Irrigation & Drainage (DID), on how the department can help accelerate the changes necessary in managing Malaysia's water sector.*

**Dato' Ir. Dr Hj. Md. Nasir**

*Director-General of the Department of Irrigation & Drainage, Ministry of Environment and Water, has served in DID for more than 30 years. He specialises in river engineering, water quality and flood management and has published over 30 academic papers. Internationally, he was named Chairman of the ASEAN Senior Government Officer Working Group on Integrated Water Resources Management, Vice Chairman for Network Asian River Basin Organisation and Co-Chairman of International Association for Hydro-Environment World Congress. He was also appointed Panel Expert on Coastal Reservoir at the University of Wollongong (Australia) and established UNESCO Chair on Water, Energy & Disaster Management for Sustainable Development, Kyoto University.*

Jabatan Pengairan & Saliran (JPS) or DID, under the Ministry of Natural Resources, Environment & Climate Change (MNRECC), had been at the forefront as guardian of Malaysia's water resources for the past 91 years, from when the country was still under the British colonial rule.

Its initial role was to facilitate the development of irrigation facilities for paddy fields which pushed for the establishment of the department in 1932 but since then, JPS had expanded and undertaken additional functions, including river basin management and coastal zone, water resources management and hydrology, eco-friendly drainage, flood management and mitigation, coastal/river engineering and water-related special projects.

As we move into the 21st Century, a new area of concern has emerged – climate change and the crucial need for environmental protection and conservation. As a natural resource, water in many areas has also been becoming scarce, while worsening pollution has marred the quality of water, all of which call for better management of water.

The world must transform and accelerate the change required to deal with current issues that affect the security and sustainability of water resources. Malaysia is not spared either. JPS is one of the public bodies involved in the transformation of the country's water sector. Led by its Director-General, Dato' Ir. Dr Md Nasir bin Md Noh, JPS indeed has a mammoth task ahead.

## Water Sector Transformation 2040

About JPS's strategy to ensure water security and sustainability in Malaysia in the long run, Dato' Ir. Dr Md Nasir says the department will follow through with the strategic action plans outlined in the study on Water Sector Transformation 2040 (WST 2040). The Economic Planning Unit (EPU) of the Prime Minister's Department commissioned the Academy of Sciences, Malaysia (ASM) to conduct the study on WST 2040, which subsequently became a vital reference for accelerating changes in transforming the water sector and addressing current issues on water resources management.

The key agenda in WST 2040 is to set a strategic direction to ensure that the water sector will be a dynamic growth driver while ensuring adequate water supply for all. The 12th Malaysia Plan (12MP: 2021-2025) document released by EPU states that the transformation will be implemented in 4 phases according to the Malaysia Plan period (2021-2040), with a specific focus in each phase to achieve our aspiration to become a regional water industry hub by 2040. These are:

- Phase One (2021-2025): Intensifying the adoption of Integrated Water Resources Management (IWRM) of the 12MP, covering social equity, economic efficiency and environmental sustainability.
- Phase Two (2026-2030): Developing local technologies on par with international standards.
- Phase Three (2031-2035): Achieving economies of scale.
- Phase Four (2036-2040): Becoming the hub of the regional water industry.

Dato' Ir. Dr Md Nasir says: "JPS has already vetted the parts on water resources which are included in the WST 2040 study report. We have already looked into the factors to ensure the sustainability and security of our water resources."

Touching on the adoption of IWRM in Phase One, Dato' Ir. Dr Md Nasir says it will be intensified. Accelerating the implementation of IWRM is also in line with the United Nation's SDG 6.5 which has set 2030 as the deadline for all nations to fully achieve its implementation. It is most critical for the transformation of the water sector as it is an approach towards integrating and effectively co-ordinating policies, programmes and practices. IWRM is the way forward to a sustainable future by keeping development at a level within the carrying capacity of the river basins while protecting and restoring the environment.

Considering that water and land is a State matter under the Federal Constitution, Dato' Ir. Dr Md Nasir says co-ordination is all the more vital between the Federal and State Governments. At the same time, co-operation and co-ordination are also required to address water-related issues, which take into consideration the various aspects of socio-economic development and the conservation of the environment.

"The Federal Government may set the policy, put up standards and code of practice but because the laws and regulations come under the states, state water authorities are very important as they are the ones to implement and regulate all water-related measures. I don't think the Federal Government wants to invest in everything, such as building dams and so on; some will go to the State Governments to invest," he says.

## Flood Mitigation Measures

When talking about water resources, Dato' Ir. Dr Md Nasir says it is also important to touch on water related-hazards. In Malaysia, these are mainly in the form of floods and landslides, which may become more frequent and more intense, primarily due to climate change and global warming.

He says JPS will continue to mitigate floods, adding that last year, JPS presented to a proposal to the Malaysian Cabinet to increase the measurement of flood probability in the country from 100-year Average Recurrence Interval (ARI) to 200-year ARI. This encompasses dams, coastal bunds and flood bunds. However, the ARI for drainage will be set at 100 years and below. ARI is the average time period between floods of a certain size. For example, a 100-year ARI flow will occur on average once every 100 years. Another measurement is Annual Exceedance Probability (AEP) which is the probability of a certain size of flood flow occurring in a single year.

He also mentions another proposal which involves the conversion of single-function dams (barriers across a body of water) to those with multi-purpose functions. Examples of multi-functional dams are those that can combine storing and supplying water for irrigation, as well as fulfill industry and human consumption needs with other uses, including flood control, power generation, navigation, run-off storage and water discharge regulation. A multi-purpose dam is a part of hydro infrastructure project.

"We must invest and upgrade our dams to become multi-functional. Now it is all very sectoral. Hydro power dams for the energy sector must also be converted to serve other functions," he says.

He also touches on the issues of headwater (water surge) phenomenon and storm surge. "We must invest in mitigation measures such as building coastal bunds. How much and how high, NAHRIM can tell us. We are not so worried about sea leverage because it is based on high tide and low tide, but our concern is storm surge which can cause a lot of damage to coastal areas and this makes it necessary to have storm surge structure," says Dato' Ir. Dr Md Nasir, adding that for the rest of water resources such as water supply and water needs, the way to go is to build underground dams for water storage.

**NAHRIM** stands for National Water Research Institute of Malaysia which comes under MNRECC. NAHRIM conducts basic and applied research on the water sector, covering such areas as river basin, water resources and climate change, coastal and oceanography, hydrology and water quality and environment.

"We know that temperatures rise and although we have a certain amount of rainfall, the evaporation process will be higher than it is now; dams will be easily exploited and get drier. This is why we should invest in underground storage for even better control, not exactly to pump water but to store water (both flood water and water supply)," he explains.

Delving further into flood mitigation, Dato' Ir. Dr Md Nasir also says JPS uses instrumentations for flood forecast.

"Our forecast system to tell the public about flood occurrence is working well at the moment. Though there are still some hiccups involving simulations and data coming in which do not tally, we can still predict up to 70% to 80% during the monsoon period. We use the Public Infobanjir system (PRABN)," he says.

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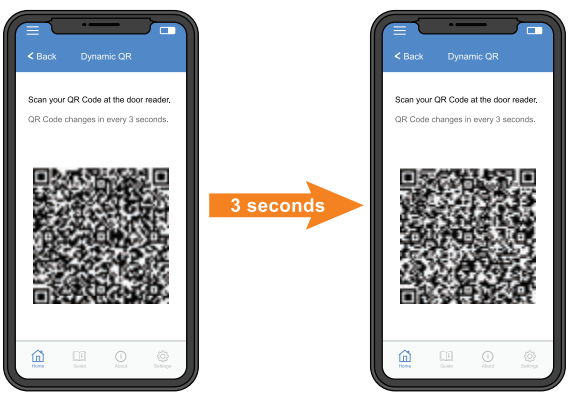


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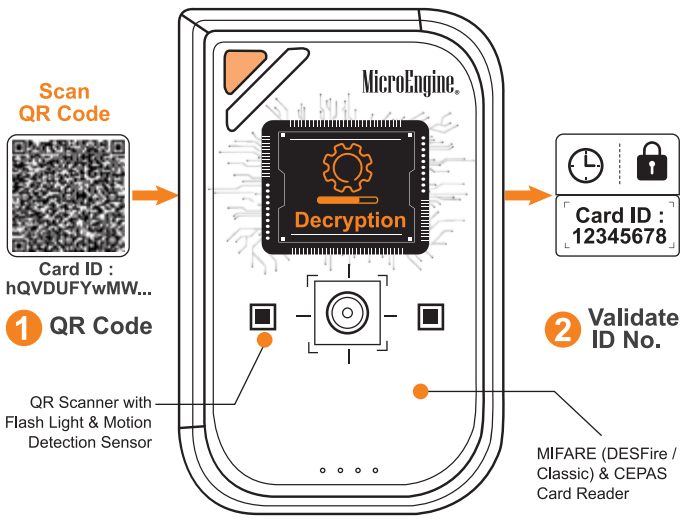


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PRABN works by collecting real-time rainfall water level data from nearly 200 hydrological stations across the country. Dato' Ir. Dr Md Nasir says the system can predict flood probability 1-2 days ahead. There is also a second system which uses water level prediction that comes a few hours before any flood event.

"We also have a third system, the South-Eastern Asian Oceaner Flash Flood Guiding system (SAOFFG), which we link with Jakarta. It is for flash flood prediction with 50% accuracy. Malaysia, through MET (Meteorological Department), will install radar system to evaluate meteorological data coming from the United States, United Kingdom and Japan. This is good because there is integration with our region to have data on flood hotspots and intensity of floods and rain."

## Need for Storm Water Act

Dato' Ir. Dr Md Nasir emphasises on the need for greater storm water management. Storm water originates from precipitation (storm), including heavy rain and meltwater from hail and snow. In tropical countries like Malaysia, storm water is water from rain or storm events that flows off a house or building site. Storm water can cause problems downstream when peak events cause flooding. It can also be a source of pollution when litter, sediment, nutrients and chemicals are washed into waterways.

To better manage storm water, Dato' Ir. Dr Md Nasir says JPS wants to transform the Drainage Works Act 1954 (1988) into a Storm Water Act. This, in his opinion, will be even better because the Drainage Works Act only governs drainage and irrigation for agriculture. According to him, this dated back to the British colonial era when the focus was more on agriculture instead of other developments.

He says: "Area development comes under the Street, Drainage & Building Act 1974 (1994), while rivers and any natural water body come under the Waters Act 1920 which, until now, has yet to be revised properly. If JPS has water resources law, we can do it directly under us, but for now we have to convince states in this country to put in their enactment. Storm water can transform water coming from rooftops, secondary drains and main drains before it reaches rivers and part of storm water also comes from retention and flood ponds. Having the Storm Water Act means we can cover the complete water dynamics."

He reiterates: "We have to think about this. Water resources come from various sources while water supply is managed differently. The management of water is segmented. This concerns water resources, water supply and water services. Many parties are involved – the relevant ministries at Federal level, water bodies at state level and even JKR (Jabatan Kerjaraya or Public Works Department). The idea to form a Water Ministry or Department will

have to consider all these. We tried to, from the Jabatan Air Negara (National Water Department) but the states disagreed. We have had some discussions but it does not look like it will happen.

"JKR, for instance, put a stop to it because water supply came under it, while states preferred to maintain JPS. In my opinion, the different water segments, including water supply, sewerage and water resources can be managed together and having a ministry from the management perspective is possible. It makes policy-making easier and the implementation can be carried out by the different departments. Policy ownership will be with the ministry, not the departments.

"Departments can handle implementations guided by the relevant policy guidelines and acts. For example, JPS may, one day, have the Climate Change Act for adaptation. That is why I am thinking we have to set the Storm Water law; convert the Drainage Works Act first so that adaptation will be easy. We are prepared for it. It is just a stepping stone towards having a higher type of act and the name, Storm Water Act, can even be changed to another name when it's adapted into the Drainage Works Act. The adaptation involving both acts can result in a different name and a rebranding."

However, he says this proposal will not affect the Water Act so as to avoid more conflict between water services, water supply and water resources. Water resources belong to the states and are governed by state laws.

"States already have the enactments which I think is proper and JPS should not handle this area. Water Resources Act cannot be implemented at the Federal level because it is a model law and is adopted by states; each state adopts according to what it wants. That is what is happening now. What is not in place actually is the drainage and storm water part because it is quite different from water law," he says.

Furthermore, there is also the matter of revenue collection for the states as contained in the state water resource enactment. Dato' Ir. Dr Md Nasir says the states decide how much to charge so that they can sustain from revenue collections.

"Storm water law is quite different. It is more about limitations: How to manage storm water and water coming from different areas, such as agriculture areas, mining areas and others. All these can be controlled using the storm water law. Having the Storm Water Act is possible, so the study is going to be done and JPS will pursue this matter," he says.

Furthermore, he adds, JPS has produced the Urban Storm Water Management (MSMA), which serves as a comprehensive guideline to manage storm water. The manual covers environmental process and stormwater management, administration aspects and planning processes. It also offers detailed information on hydrology and hydraulics, runoff quantity control and conveyance, structural and non-structural water quality controls during construction, vegetation and watercourse management and special stormwater applications. Therefore JPS is well-positioned to look at the adaptations necessary in order to have a law governing storm water.

## Community Involvement

Malaysia has water partnerships and integration with a few NGOs under MyWP, which supports and promotes the adoption of IWRM practices as well as storm water organisation looking into storm water guidelines. Dato' Ir. Dr Md Nasir acknowledges all the different views coming from the NGOs, including those with international links through treaties.

"The water sector is very big, which is why we also get the NGOs to help us. JPS implements policies on the ground but we know that our engineers, for example, cannot be on site all the time. So the public helps us a lot, not only in providing input for creating new policies but also to help us in implementing guidelines and dealing with day-to-day problems like rubbish, pollution and so on."

Besides looking into the Storm Water Act, Dato' Ir. Dr Md Nasir says the Government also needs to consider having a Dam Safety Act. "Dam safety, in terms of dealing with hazards, is still needed although the majority of State Governments did not approve it when it was first discussed some time ago. But if the NGOs and the public think dam safety law should be enforced, we can look at it again but in a more proper way, not just in terms of safety and dam integrity but also the overall function of dams."

At present, JPS manages 15 dams located in various states, which provide adequate irrigation

water, flood mitigation and silt retention. The issue of dam safety is crucial as dam failure often results in catastrophe with considerable loss of life and property. Therefore, the structure has to be properly managed to ensure its integrity at all times. Having a law to govern dam safety is therefore much needed.

## Contributing towards Malaysia's Economic Growth

On the opportunities to transform water into a new economic sector that will contribute towards the GDP, Dato' Ir. Dr Md Nasir says a lot must be done to solve the water shortage issue first.

"Certain areas cannot be developed because of water shortage. No one wants to invest in an area that lacks water resources. This is why the Government invests a lot in developing water resources to facilitate water supply for commercial and human needs. To have adequate water supply, we must have water storage and underground storage is the way forward. This is important to help expand industries. We have to ensure there is enough water for all sectors and business purposes. If there is not enough water, the economy cannot grow. Water resource transformation that can contribute towards the country's economic growth is relevant," he says.

"During a workshop for water sector innovation until 2040 held by NAHRIM, there were two very good proposals, namely creating a water bank to serve as water financial instrument and creating sukuk (syariah-compliant bond) to help finance water infrastructure. Also discussed were making greater RE Energy (trading and distribution of energy and products related to the energy industry), turbine storage, generation of electricity, water quality and detection of pollution."

In terms of new technology for water sector transformation, Dato' Ir. Dr Md Nasir cites the use of robotics technology. "In the future, we hope we can detect and monitor water pollution using robots such as robotic fish and underwater sensors as well as drones and satellite. JPS is looking into such innovations and we have to find out how much is needed to tackle water pollution until 2100.

"We know we can send drones to detect pollution and capture pictures in affected areas. But this will not help to pinpoint the culprits causing the pollution. If we can, it will enable us to take them to court for polluting. Water pollution suspects include factories which dump diesel, detergents and other chemicals into the water supply. What we can do is to deploy drones to identify hotspots and focus on these areas similar to the way we identify flood hotspots. We certainly must adapt to new technologies, including those that can deal with various effects of climate change."

## Addressing Climate Change

There is an immediate need to address climate change using the global framework to avoid dangerous climate change by limiting the increase in global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. In so far as water resources management is concerned, Dato' Ir. Dr Md Nasir says JPS focuses on adaptation and mitigation efforts to achieve the climate goal.

Global climate change can lead to an increase in sea level rise, impacting coastal zones, increasing the frequency and intensity of storms and storm surges, shoreline erosion, inundation of land, flood damage and saltwater intrusion into freshwater land, among others.

Dato' Ir. Dr Md Nasir says that when it comes to new areas of focus, particularly climate change, JPS will also further learn from NAHRIM.

Another area to look at is the development of a water resource data bank, which involves the use of big data approach to water resources engineering. Big data can be used in many water-related applications, such as studying climate change impacts, planning optimum water systems, forecasting and detecting natural and manmade calamities, scheduling irrigations and mitigating environmental pollution.

He says further studies on the application of big data in water resources engineering and other related studies must be undertaken as part of the measures to achieve the objectives of WST 2040. ■

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# Integrated Approach to Flash Flood Management

**Written and Prepared by:**

**Ir. Dr Wong Wai Sam**

*Director at MegaConsult Sdn. Bhd., is a Committee Member of the Water Resources Technical Division of IEM.*

Flash floods are the most common and disruptive hydro-meteorological phenomena that Malaysian cities experience. Urban areas, in particular Kuala Lumpur, are experiencing more incidences of flash floods today than in the past.

While many mitigative and adaptive initiatives have been implemented, flash floods remain a major concern in many urban areas. Therefore, it is important to revisit the subject matter for achieving sustainability of urban areas and bringing balance in the urban development and flood management. Understanding the impact of flash floods is also important for the proper set-up and implementation of land use regulations and implementing stricter laws about socio-economic development of catchment areas.

This paper highlights the impact of flash flood and focuses on pertinent issues that cause flash floods in urban areas. More importantly, it proposes various action plans with appropriate measures to mitigate flash flood problems and to move towards more resilient and sustainable development in urban areas.

## Background

Although various mitigation measures have been undertaken by various authorities, especially by local councils and Jabatan Pengairan & Saliran (JPS) as well as the introduction of Manual Saliran Mesra Alam (MSMA) about 20 years ago, there are still issues of flash flood occurrences which are still a major concern in many urban areas and cities. Recent examples of flash floods in Kuala Lumpur happened on 7 March 2022, 18 December 2021, 13 April 2021 and 10 September 2020. These events, which saw an average maximum flood depth of 1-3m in various parts of the city that lasted for more than 4 hours, resulted in major devastation of public infrastructures and utilities, private properties as well as caused major disruptions to the socio-economic activities of city dwellers.


*Figure 1: Flash floods around Kuala Lumpur City Centre*

## Causes & Impact of Flash Floods

Through feedback from various agencies, stakeholders and literature reviews, it was found that factors which potentially contributed to flash floods included the following:

- Very high intensity short duration rainfall.
- Rapid and high density of urban development.
- Under-capacity of drainage system.
- Development exceeding basic capacity of the drainage system.
- Backflow of water from downstream swelling river flows.
- Severe erosion and sediment wash-off from construction site.
- Clogging of drainage system by sediment, rubbish and debris.
- Lack of public awareness.
- Poor land use planning, conflict usage as well as priorities.
- Lack of understanding and data in urban drainage design and implementation.
- Lack of integration, interaction and cooperation in the implementation of infrastructures and developments.
- Budget constrains for maintenance and improvement of drainage system.

- Lack of enforcement capacity and capability.
- Deficiency of MSMA implementation.

The occurrence of flash floods is expected to become more prevalent with the potential impacts of climate change and climate variability. The impacts of flash floods can be broadly grouped into the following 3 categories:

- Economy impact: In urban areas, there are many high value properties and infrastructures such as high-rise buildings, hotels, shopping complexes etc., with a network to the road system, commuter train system, telecommunication system, electrical power networks, water reticulation system, etc. These structures may be damaged by flash floods and so cause disruption in services as well as physical damages. Besides, disruptions to economic activities will have far-reaching and long-term damages if the occurrences become more severe and frequent.
- Social impact: The social impact is expected to be significant because flash flood can happen in a sudden and unpredictable manner, which leaves people unprepared. As a result, the disruption in lives and emotions as well as physical injuries can have a severe impact on those affected and when lives are lost.
- Environmental impact: A variety of direct impacts on the environment and ecosystems from flash floods can result in environmental degradation. The most extensive and difficult to repair damages usually occur in developed areas located in the floodplain. Flooding can directly impact the health and wellbeing of wildlife and livestock, cause riverbank erosion and sedimentation, the dispersal of nutrients and pollutants, surface and groundwater supplies, local landscapes and habitats. It can also cause overflowing from the sewerage system to surrounding areas and, to certain extent, toxic substances from manufacturing areas.

## Integrated Approach to Managing Flash Floods

There are many studies and measures undertaken by the federal government, state governments and local governments to minimise the occurrence of flash flood in urban areas. However, an integrated approach is needed and this requires the problems to be mitigated holistically, based on the key areas categorised below (with proposed action plans):

**Risk Assessment & Vulnerability**

1. Risk assessment for areas affected by flash floods should be carried out in order for high resolution flood risk/hazard maps to be generated to provide vital information on areas that are vulnerable.
2. Flood risk maps are very useful from planning and budgetary stages to rescue operations and should be prepared for each urban risk area. With these maps, priority and emphasis can be given to areas of high risk and vulnerability and they are very useful in assessing the premium for insurance coverage too.
3. Inventory mapping of all assets within the flash flood zones and for all the stormwater drainage system assets so that their vulnerability when exposed to flash flood can be assessed. This will also facilitate in the inspection and maintenance of such assets by relevant parties.

**Participatory Planning & Approval.**

1. Up-to-date integrated stormwater drainage management master plans with comprehensive hydrology and hydraulic analysis and modelling are needed in all urban areas and should be gazetted as planning tools so that they can be incorporated into all land use planning, design and approval stages when preparing local and structural plans.
2. Compliance with the approved land use plan is vital and if any deviation happens, the impact to the drainage system should be thoroughly addressed.
3. The participation of the public and stakeholders in the planning and approval stages is important so that all concerns, especially for those impacted by flash floods, will be taken into account when formulating the master plan and new developments.
4. Gazette all drainage reserves and flood detention facilities to avoid these being encroached on for other purposes.
5. Require a holistic paradigm shift to allow multi-purpose functional land usage for water infrastructures in urban areas, e.g. to allow JPS and Bahagian Bekalan Air (BBA) to jointly share the reserves to build elevated water reservoirs on top of the JPS detention ponds.
6. Share a common database among all agencies and authorities through the establishment of a central hub/ One-Stop Centre (OSC) by centralising all pertinent information (Geospatial format) so that all parties can refer to one common information. This also allows them to keep abreast of all the latest developments and information.

**Design Guidelines & Implementation**

1. Compliance with all relevant guidelines in new developments, especially MSMA2, is required during the planning/design stage and should be followed through and enforced during the implementation stage to ensure designs are strictly adhered to during construction.
2. Responsibility and accountability of all relevant parties need to be defined at various levels from planning to maintenance, so that in the case of any non-compliance, appropriate action can be taken accordingly.
3. Design guidelines need to be periodically reviewed, updated and upgraded with findings of any shortcoming in the design and implementation as well as practical issues during operation and maintenance (O&M). The guidelines also need to be revised to incorporate new innovations and technologies.

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4. Identify and evaluate existing drainage systems which are under capacity and which do not comply with the latest design guidelines so that these can be prioritised accordingly for upgrading, to reduce flood risk and damage.
5. Clear guidelines and approval conditions are required for all infrastructures and utilities that need to cross or encroach into stormwater drainage system reserves to ensure that these do not compromise the functions or future improvement plans of the drainage systems. A heavy penalty should be imposed if found otherwise.

**Technology, Innovation & Forecast/Warning**

1. Explore and adapt as well as encourage and carry out more specific or dedicated R&D on advanced and innovative measures (i.e. state-of-the-art technologies for planning & design, surveys, construction, project management, operations and maintenance) by local universities, National Hydraulic Research Institute Malaysia (NAHRIM), private industries and relevant research institutions by referring to the use of these technologies from other sectors.
2. Local universities and NAHRIM should undertake more research and pilot projects in collaboration with governing agencies, private industries, research institutes, etc. All these should utilise state-of-the-art technologies, accumulate knowledge and lessons learnt for further enhancement of the design and efficiency of the systems to minimise the damage and risks from flash floods.
3. More funding/subsidies should be allocated to encourage local technology development and technology transfer from developed countries.
4. Develop effective high spatial-resolution Rainfall & Flood Forecasting and Warning System (RFFWS) dedicated for high risk and vulnerable urban areas in order to provide timely and accurate information, including the multi-hazard impact-based forecast (IBF) as suggested by World Meteorological Organisation (WMO) Guidelines No. 1150 (2015) and flash flood guidance system by WMO initiatives.
5. Develop artificial intelligence (AI) and machine learning model-based flash flood forecasting and warning system including the use of real-time water level sensors which will improve forecast lead time and warning system for high risk and vulnerable urban areas.
6. The authorities should develop apps or an online portal to allow the public to provide input (flooding condition – depth, extent, location, duration, flood photos, causes and source of flooding etc). It will also be a good platform for the public/enforcement agencies to contribute current conditions/activities at stormwater systems such as intruders, illegal littering/dumping, vandalism of stormwater assets, reporting of flood/failure incidents, etc.

**Climate Change & Adaptation**

1. To create and enhance knowledge and awareness of climate change, including micro-climate and heat island phenomenon in urban areas. These require the need for establishing thorough R&D, sharing of information and comparing notes with overseas counterparts as well as educating the public and all relevant parties (from designers and authorities to policy makers) on the reality, impact and consequences of climate change and worsening flash flood problems.
2. To develop an integrated future stormwater drainage system which can cope with water cycle changes to provide climate-resilient infrastructures such as a sponge-city concept.
3. To integrate the climate change factor (increase in rainfall intensity) in policy, guidelines, standards and design criteria for stormwater and drainage infrastructure planning and design.
4. To carry out assessment and related analysis of the impact of climate change on the drainage capacity of existing and future stormwater infrastructure systems.
5. To integrate the climate change-related resilient initiative of stormwater infrastructure planning and design in National Adaptation Plan (NAP) and new National Climate Change Policy. [Economic Planning Unit (EPU), Ministry of Natural Resources, Environment and Climate Change (NRECC), JPS, NAHRIM, local government].

**Awareness, Preparedness & Public/Community Participation**

1. There is a need, even during normal times, for continued awareness of flash flood issues in the general public and for sustaining awareness by conducting programmes to raise awareness of flash flood, especially in urban areas. Frequent simulation exercises will be useful to help the community visualise each individual's role and responsibility in an actual flooding situation.
2. Need to improve flood warning systems. The systems should indicate the possibility of flooding, level of flooding, evacuation routes and destination shelter/camps.
3. Comprehensive SOPs for Emergency/Response Action Plan (E/RAP) are required to ensure an effective and swift response by the various parties when flash flood occurs. The E/RAP must be drawn up to include the participation of individual/family, the community and higher levels (municipal, district, state and national). It should be revised and improved based on lesson learnt from each immediate past event and should be one of the main agendas in the state's Mesyuarat Penyelarasan Banjir/Mesyuarat Bencana Negeri.
4. The public should provide input (flooding conditions: Depth, extent, location, duration, flood photos, causes and source of flooding, etc.) in the app/online portal developed by the authorities.

5. Instill awareness of the importance of environmental sustainability and its impact on flood control as well as consequences of climate change, etc. into the national education system (theoretical and practical) so as to equip them with basic knowledge and understanding of this subject.

**Capacity Building & Training**

1. It is vital and necessary to train personnel within the community with appropriate local technical knowledge and skills, relief facilities and other necessities so that adequate resources including knowledgeable and experienced personnel can be mobilised immediately before, during and after floods based on the available SOPs of the E/RAP.
2. It is required to upgrade the knowledge and experience of approving authorities, designers and implementers on stormwater drainage related fields through, training courses, seminars, etc. to ensure their competency.
3. To fortify an understanding of the importance of water management strategies through Integrated Water Resources Management (IWRM), Integrated River Basin Management (IRBM) and Pelan Induk Saliran Mesra Alam (PISMA) among town planners, state governments and local authorities. It is necessary to share data and resources to improve understanding and assist in better/cost effective designs, equip the local authorities with the capability to perform engagement programmes with the community, empower building owners/community to mitigate and adapt to flash flood responses through the understanding of established E/RAP.
4. To instill awareness of the importance of environmental sustainability and its impact on flood control as well as the consequences of climate change, etc. in the school syllabus and other relevant courses in order to equip the younger generation with a basic knowledge and understanding of this subject.

**Organisational Requirements, Enforcement, Legal & Institutional Frameworks**

1. Empower JPS through Cabinet consent to legalise its roles in areas such as repair/maintenance works and for it to have enforcement power in order to execute its duties more effectively with support from all levels of stakeholders (e.g. JKR, local authorities, state governments etc).
2. Empower JPS to lead as the centralised coordinator and as the authorised agency for repair and maintenance programmes where all other agencies/municipalities shall submit the relevant operation expenditure (OPEX) budget and planning to JPS for compilation and management. There is also a need to centralise its operation roles where state agencies, departments and municipalities need to work collaboratively with JPS at regional and central offices.
3. Enforcement power is required to empower JPS through delegation of power via existing laws to carry out routine inspection/repair & maintenance programmes, to curb illegal activities affecting rivers and main drains by setting up a special task force to carry out periodic asset management and to issue summons to law breakers from both public and private sectors.
4. Form a legitimate board or centralised agency within JPS which will be led by the Ministry Of Natural Resources, Environment & Climate Change, supported by the Director-General of JPS and co-managed by relevant directors on the Board.
5. Set up an Asset Management Department (AMD) to manage the repair/maintenance of the waterways/ drainage systems up to the tertiary system. The department from state/municipality levels shall be managed/controlled by the dedicated Head of the AMD of JPS both at regional and sectoral level. For drainage system beyond tertiary level, it will be managed under the State/Municipality.
6. Revise Act 133 (Street, Drainage and Building Act. 1974) to look at increasing penalties and the additional scope of offences related to activities causing flash floods.
7. Local authorities should strengthen enforcement on the issues related to flash flood on site.

**Insurance, Budgetary & Maintenance Issues**

1. Need to conduct flood risk studies to provide accurate data for premium assessment where high risk areas will need higher premiums; this will also limit development in flood prone areas. Make known the risk that people are facing through awareness and technical justifications so that they would be more willing to pay the higher insurance premium.
2. Need for adequate federal funding to expedite the preparation of comprehensive drainage master plans for all cities and major towns and to improve major problematic drainage systems as well as for O&M expenditures. Furthermore, state governments need to raise funds through the collection of drainage contributions from new developments to cater to improving local drainage systems as well as to increase the yearly local government tax to cover the drainage maintenance cost.
3. Regular inspection and maintenance of the stormwater drainage systems is required to ensure they are in good condition and are functioning as well as to avoid encroachment and vandalism through periodic patrol and inspection by relevant officers, provision of perimeter fencing and CCTVs, drones, etc.

## Conclusion

Flash flood management encompasses a number of phases: Prevention & mitigation, preparedness, response and recovery. Too often, emphasis is on the response phase.

But more resources should be invested in prevention and mitigation strategies as these can result in lives being saved, injuries being minimised and damages to infrastructure and the economy being reduced. Paradigm shifts that should take place in mitigating and managing the flash floods are summarised and concluded in the following table.

| From | To |
|---|---|
| Hazard focus | Vulnerability focus |
| Reactive strategies | Proactive strategies |
| Single-agency responsibilities | Multi-agency, whole-of-government coordination |
| Science/engineering approach | Multi-disciplinary approach |
| Response management | Risk management |
| Planning for communities | Planning with communities |
| Communicating to communities | Communicating with communities |
| Narrow disaster-management approach | Broader public-safety context |

## Acknowledgements

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## Upcoming Activities

**5-Day IEM Energy Manager Training Course (EMTC) - A Preparation Course for Registration as a Registered Electrical Energy Manager (REEM) with Suruhanjaya Tenaga**

Date : 13 - 17 March 2023 (Monday - Friday)
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: Ir. Gopal Narian Kutty
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: Ir. Chong Chew Fan
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**Technical Visit to "Indah Water Konsortium Sdn. Bhd. (IWK)"**

Date : 13 March 2023 (Monday)
Time : 10.00 a.m. – 12.00 p.m.
Venue : Pantai 2 Sewage Treatment Plant (KLR399), RSTP Pantai 2, 58100 Kuala Lumpur, Selangor
Approved CPD : 2

**1-Day Course on "The Drive towards an Environmentally Responsible Fire Suppression Foam System"**

Date : 14 March 2023 (Tuesday)
Time : 9.00 a.m. – 5.30 p.m.
Venue : Hotel Sheraton, Petaling Jaya
Approved CPD : 6

# Debris Flood Events of Yan and Baling, 2021-2022

**Written and Prepared by:**

**Nor Hisham Ghazali**

*Y.Bhg. Dato' Ir. Nor Hisham Ghazali is former DG of the Dept of Irrigation & Drainage Malaysia and Chairman of IEM's Disaster Risk Reduction Advisory Board.*

Flood is a common natural disaster in Malaysia. It is our biggest threat and one that we know very well. The two most common types are monsoonal floods and flash floods. Monsoonal floods typically occur during the monsoon seasons when rainfall is prolonged and the flood duration exceeds 6 hours. The onset of flooding is when water levels exceed the river bank levels. Flash floods recede in under 6 hours and occur after intense, localised rainfall. In urban settings, standard local drainage systems are often overwhelmed when rainfall exceeds the Average Recurrence Interval (ARI) of 2-5 years they were designed for. Other types of floods are coastal flooding and the most recent to enter the flood glossary is *banjir genang* or standing flood* which will typically take weeks to recede.

In rural areas, however, a different kind of flash flood has recently grabbed public attention. Debris floods, characterised by high flows containing large volumes of sediment and forest debris, have caused damage to several villages last year. Debris floods are not new but two events in the districts of Yan and Baling in Kedah, have received a lot of attention for various reasons. The nature of these floods – deemed to have a connection to geological processes – have brought new challenges to both the geological and engineering communities as the search for solutions begin in the wake of extensive media reports.

## Debris Flood

Debris floods are colloquially referred to in Bahasa Malaysia as *kepala air*+ and described as a sudden surge of water causing stream water levels to rise. Surges occur due to the collapse of semi or meta-stable blockages in the stream or river due to the accumulation of forest debris and sediments. The sediments can be from riverbank failures or landslides that introduce large quantities of loose sediment into the watershed. The blockages are temporary and upon collapse, the flow of released water is not unlike a dam breaking.

## Debris Flood: Gunung Jerai Forest Reserve, Districts of Yan and Kuala Muda, Kedah

This occurred on 18 August 2021 following an extreme rainfall event and a series of landslides in numerous places on the slopes of Gunung Jerai which straddles the districts of Yan and Kuala Muda. The flooded areas were Gurun, Yan Besar and Merbok. According to the Department of Irrigation & Drainage (DID), hydrological stations at Gunung Jerai and Kampung Singkir Genting recorded cumulative rainfalls of 281mm and 172mm[1]. By 6.00 p.m. the same day, cumulative rainfall value had exceeded the 50-year ARI. The subsequent flows engulfed essentially all the rivers in the Gunung Jerai catchment, causing banks to collapse and swiftly overloading them with sediment and forest debris.

*Figure 1: River condition after debris flood event in Yan*

*Floods that appear to be stagnant although actually receding through ground seepage and evaporation
+Literally, head waters

Debris flood flow continued downstream to more inhabited areas and inundated the middle and lower reaches of Sungai Dara Mandi (Yan) and Sungai Bujang (Kuala Muda, also referred to as Sungai Tupah), encompassing other tributaries and resulting in 6 deaths and up to 30cm of mud deposition in the many riverside villages and the town of Yan downstream. Among the rivers affected were Sungai Batu Hampar, Sungai Seri Perigi and Sungai Singkir in Yan, and Sungai Lubuk Panjang, Kuala Muda.

Up to 31 August 2021, the Department of Minerals & Geosciences reported 69 landslide locations and 5 locations where mudslides had occurred. The data is cumulative and should not be attributed purely to the rainfall prior to 18 August 2021. It is however, indicative of the geological disposition of the Gunung Jerai slopes.

## Debris Flood - Sungai Kupang, Baling, Kedah

On 4 July 2022, a flash flood was reported in the small settlement of Kg. Iboi on the banks of Sungai Kupang at the lower reaches of Gunung Inas, Baling, Kedah. Although they were accustomed to the annual floods that occur during the middle of each year, the residents were unprepared for the ferocity of this particular event. A special report on the incident, released by the then Ministry of Energy & Natural Resources[±], stated that 3,500 people were affected with 3 fatalities. Damage was estimated at about RM26 million.

This was the second incident of debris flood in Kedah within a 12-month period. A peculiar element of the event was that the rainfall recorded at the Kg. Iboi hydrological station was a modest 38 mm. Video and witness reports however, showed flows of higher energy than a rainfall of this value, which only registered as a 2-year ARI event, could produce. But rainfall could have been heavier and more widespread in the upper catchment areas beyond the coverage of the existing hydrological stations.

## Causal Factors

Debris and mud flood disasters involve heavy or extreme rainfall, slope failures and landslides as well as river flooding. On 18 August 2021, Sg Tupah, Yan was the site of a sudden debris flood originating from massive and numerous landslides from the foothills of Gunung Jerai. Images from Gunung Jerai revealed that at least 25 areas had been cleared in the upper catchments of Sungai Batu Hampar and Sungai Tupah.

The Kg Iboi disaster came in the wake of 3 hours of continuous rainfall as per the records of a JPS hydrological station located at Kg Iboi, off Sg Kupang. What was surprising was that the 3-hour rainfall with only 38 mm of rain brought down an estimated 7.5 million cubic metres of debris and sediment as reported.

As these questions arose, fingers started pointing at the massive durian plantations which had supposedly altered the landscape and terrain in the upper parts of the river. Locals pointed out that many ponds, supposedly for irrigation, had been built on terraces and that these ponds had either failed or overflowed. One possible scenario would be that as these ponds were already near their limits due to recent rainfall events, the torrential downpour of July 4, 2022 was the proverbial straw that broke the camel's back.

Another significant factor was that Sungai Kupang was already heavily sedimented as a result of past events and this was backed by the increasing frequency of flash floods which Kg Iboi had experienced in the last decade. The presence of ponds on the slopes introduced an added risk factor to slope stability. Seepages could have been extensive or perhaps the depths were too deep or located on narrow terraces too close to the slopes.

## The Sabo Solution

The conventional way to mitigate river floods in the plains is to widen and deepen rivers, often supplemented by the construction of bunds. However, flooding events in the upper part of the catchment prompts changes in river flow and often alters the river course.

In the Yan and Kuala Muda incident, some tributaries were almost entirely filled with sediment debris. Hence, the purpose of mitigation would be to reduce the flow rather than to contain it within its banks in the typical way.

To do this, the Sabo concept was chosen. The Japan Society of Erosion Control Engineering defines Sabo as the practice of preventing or mitigating sediment-related disasters. The history of Sabo goes back to 17th or 18th century Japan when the first Sabo dams or structures were first constructed.

Sabo structures are built across rivers to slow down high flows and intercept boulders, stones, logs and forest debris. To fit the situation, Sabo structures (see Figure 1) may come in various designs and can be made of masonry, concrete, steel struts or even steel cables.

Sabo structures are built to be permanent and are essentially small dams. As sediment is retained and accumulated behind the structures, the bed gradient progressively becomes gentler, thereby reducing river flow velocity. Accumulated forest debris should be removed periodically to ensure the functionality of the structures as traps. Points of interception must be judiciously chosen for creating the sediment and debris traps.

After considering the flood event, river environment, terrain and accessibility, the DID built 2 Sabo structures across Sungai Dara Mandi at Taman Rekreasi Titi Hayun and Sungai Bujang near the Tupah Water Treatment Plant.

[±]In 2023 the Ministry of Energy & Natural Resources was amalgamated with the Ministry of Environment & Water to form the Ministry of Natural Resources, Environment & Climate Change (NRECC)

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The structures across Sungai Dara Mandi and Sungai Bujang were completed in September 2022 and were purportedly the first concrete Sabo structures in Malaysia.

## Emerging Threat

A similar solution is being considered as mitigation measures for the Baling incident where local terrain and environment will eventually influence the design. The Baling case, however, is mired in much controversy over the activities of land clearing and durian plantations on the slopes of Gunung Inas. As we eagerly await the mitigative measures to manifest, the issue of land development or the apparent ineffectiveness of the current control and enforcement mechanism is actively being discussed by state and federal authorities. Debris floods are a foothills-related phenomena. If they are to be mitigated, engineering must come in not only as a curative tool in the aftermath of disaster but also as a preventive or "best management" tool in other aspects of averting future disasters. This should include involvement during the planning and design processes of opening hillside or highland forests for creating forest plantations.

But even if Environmental Impact Assessment (EIA) is mandatory for large scale development, what means do the authorities have to constantly monitor these activities? Without monitoring and enforcement, the technical input of engineers at planning and design will risk being ignored once the project is approved and implemented. While it is convenient to point at climate change as the underlying cause for the flood woes we now face, we must leave no stone unturned in reducing the risks we already understand.

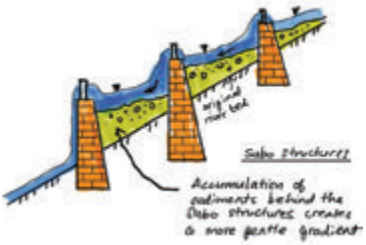


*Figure 2: Sabo structures*

As land begins to be scarce and developers start encroaching into the upper catchments, the risk of landslides and debris flood disasters will increase. The extensive debates, reports and interviews in the months following the Kedah events have revealed that this threat has been defined. In fact, the solutions – both the engineering and the administrative – are already known although the outcome remains to be seen. Let us not forget that disaster risk reduction is a continuous endeavour and we must respond to the signs or die trying. Passivity will perennially be a threat unto ourselves. ■

## REFERENCE

[1] https://www.facebook.com/KementerianAlamSekitarDanAir/photos/a.101343758165623/386400676326595/

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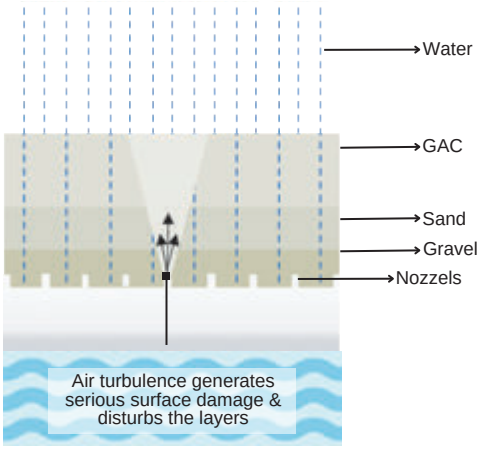
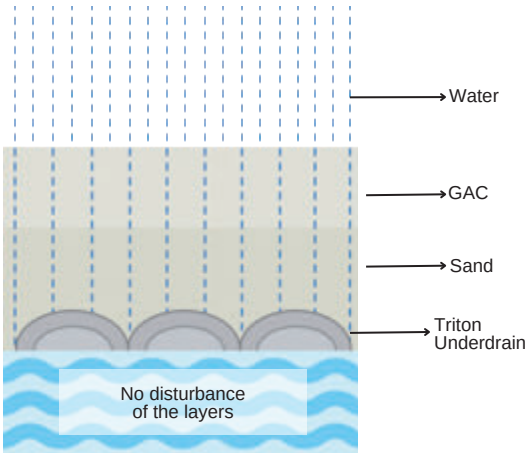
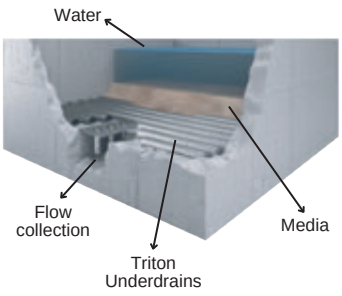



Example of Conventional System




Example of Triton Underdrain System

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# Crude Oil Boiling Point Characterisation for Process Simulation of an Atmospheric Crude Distillation Tower

**Written and Prepared by:**

**Ir. Rafil Elyas**

*Founding owner and Principal Engineer of East One-Zero-One Sdn Bhd (East101) with 30 years' work experience in the oil and gas industry.*

The simulation of refinery processes offers a technical and learning challenge to engineers. While many engineers focus their attention on modelling facility equipment, distillation columns, heat exchangers or rotating equipment, the most critical exercise in building a refinery simulation model is the characterisation of the feedstocks ANAD products.

This article provides a brief overview of how to characterise crude oil using Unisim, a process simulation software from Honeywell. Once the crude is characterised, it can then be used as a basis for simulating various refinery operations, the atmospheric crude distillation tower, pre-heat train and product stabilisers. This is the most basic characterisation strategy which allows an engineer to generate the fundamental heat and material balances. The characterisation exercise formed the core module in the training programme to design a Crude Oil Refinery – previously organised under IEM's Structured Training Programme.

## Crude Oil Boiling Points & Laboratory Distillations

Crude oil can contain up to 30,000 different components, primarily hydrocarbons (normal and branched paraffins, olefins, aromatics, and naphthenes) with normal boiling points ranging from -162°C (methane) to over 1,000°C. Upon fractionation, crude oil yields the following typical products... C6+ product yields are typically defined by boiling point ranges. [Note: "C6+" herein denotes molecular product yields containing hexane ($C_6H_{14}$) and heavier components].

Boiling point curves for crude oil feedstock and atmospheric and vacuum unit products are obtained from laboratory distillations. The following laboratory analyses are employed to generate boiling point curves:

1. ASTM 2892 True Boiling Point (TBP). Packed Column (typically 15 theoretical stages with 3 or 4 to 1 reflux). This is generally used for crude feedstocks.

| Boiling Point Range (°C) | Product |
|---|---|
| -162 to -42 | Off Gas |
| -42 to 36 | LPG |
| 36 to 93 | Light Naphtha |
| 93 to 191 | Heavy Naphtha |
| 191 to 274 | Kerosene |
| 274 to 316 | Diesel |
| 316 to 357 | Atomospheric Gas Oil |
| 357 to 700+ | Atmospheric Residue |

Light ends, C1 (methane) up to C5 (pentanes) can be characterized on a compositional basis by Gas Chromatography (GC)

Light naphtha, generally comprising of C6 (hexanes) up to C8 (octanes) can, when necessary, be characterized by compositional analysis using PIONA (GC)

Heavy Naphtha (nonanes and heavier) product generally can't be adequately characterized by discrete chemical or molecular composition

*Table 1: Atmospheric crude tower products and their corresponding boiling point ranges*

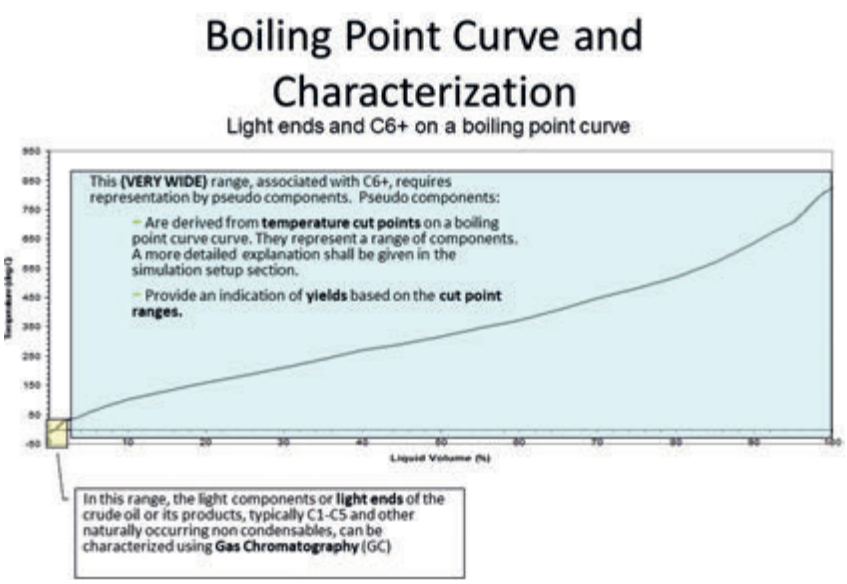



*Figure 1: Crude oil true boiling point temperature vs cumulative liquid volume*

2. ASTM D86. Single stage non-refluxed distillation for naphtha and other middle distillates.
3. ASTM D1160. Single stage vacuum non refluxed distillation for atmospheric residues.
4. ASTM 2887. Simulated Distillation, high temperature gas chromatography.

Laboratory distillation results and other analyses are consolidated in a crude assay report. The following is a partial extract from a typical crude assay report.

| SOURCE OF SAMPLE | | CRUDE DATA | | ASSAY SUMMARY/TBP DATA | | |
|---|---|---|---|---|---|---|
| Reference | A13502 | Gravity | 21.1 | Yield on Crude | wt | vol |
| | | Light Hydrocarbon Analysis | | Gas to $C_4$ (corrected) | 0.9 | 1.45 |
| | | | | Light Distillate to 149°C (API) | 15.2 | 20.65 |
| | | | | Kerosine 149 - 232°C | 3.85 | 4.3 |
| Field | COLD LAKE/MARGOSITY | $H_2S$ ppm wt | <2 | Gas oil 232 - 342°C | 11.7 | 12.1 |
| | | Methane wt | - | Residue above 342°C | 68.35 | 61.5 |
| | | Ethane wt | 0.01 | | | |
| | | Propane wt | 0.03 | Gas to $C_4$ (corrected) | 0.9 | 1.45 |
| Export | | Isobutane wt | 0.12 | | | |
| Terminal | Hardisty, Canada | n-Butane wt | 0.74 | Total to 95°C (API) | 12.7 | 17.95 |
| | | | | 149°C | 16.1 | 22.1 |
| Source | Hardisty, Canada | | | 175°C | 17.1 | 23.25 |
| | | Total $C_5$ - $C_6$ | 0.9 | 232°C | 19.95 | 26.4 |
| | | | | 342°C | 31.65 | 38.5 |
| | | | | 369°C | 35.4 | 42.2 |
| Sample Date | 11-Jan-02 | Isopentane wt | 3.19 | 509°C | 53.25 | 59.3 |
| | | n-Pentane wt | 3.31 | 550°C | 58.35 | 64.0 |
| Date Rec'd | 12-Feb-02 | | | Volume expansion of 0.4 per cent vol on crude distributed across whole distillation | | |

| | | | DISTILLATES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TBP cut point °C API | | Total Crude | $C_4$-95 ** | 95-175 (C) | $C_6$-149 (C) | 149-232 | 232-342 | 342-369 | 369-509 | 509-550 |
| Yield on crude | wt | 100.0 | 11.8 | 4.4 | 15.2 | 3.85 | 11.7 | 3.75 | 17.85 | - |
| Yield on crude | vol | 100.0 | 16.5 | 5.3 | 20.65 | 4.3 | 12.1 | 3.7 | 17.1 | - |
| Density at 15°C | kg/litre | 0.9265 | 0.6609 | 0.7650 | 0.6802 | 0.8197 | 0.8914 | 0.9352 | 0.9634 | - |
| Sulphur | wt | 3.74 | 0.058 | 0.190 | 0.077 | 0.590 | 1.82 | 3.01 | 3.18 | - |
| Mercaptan sulphur | wt | - | 0.0248 | 0.013 | 0.023 | 0.0025 | - | - | - | - |

*Table 2: Crude assay report extract*

A small portion of a crude assay is shown (Table 2). A crude assay contains a significant amount of information on the properties of the total crude as well as the properties for various boiling range "cuts" on the crude.

In some cases, a TBP distillation is also performed on crude oil products and a reconstituted TBP curve can be created by overlaying all the product cuts on a common axis. Note the appearance of boiling point gaps and overlaps between the product cuts.

In this article, we will focus on the boiling point characterisation of crude oil and its products. However, in addition to boiling point distributions, laboratory analyses may also be performed to obtain:

1. Thermophysical and transport property curves, density and viscosity.
2. Impurities, like sulphur and metals (important information as these components can poison catalysts).

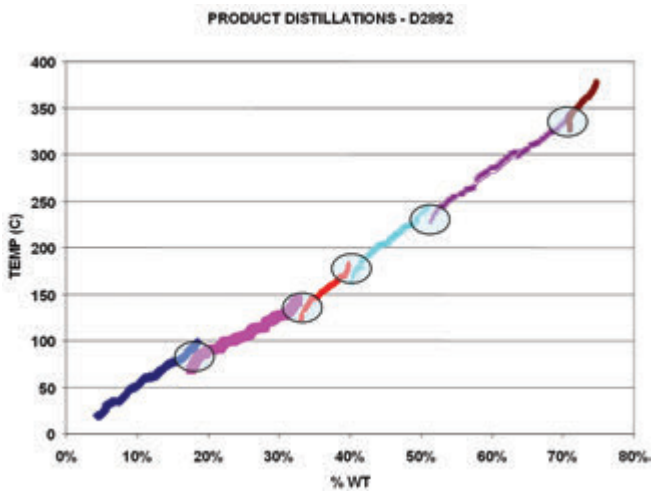



*Figure 2: Reconstituted TBP curve using product distillation curves*

## Process Simulation

Table 1 and Figure 1 show that a very small amount (3%) of the crude oil in this example, may be represented by chemical or molecular representation. This is true for all crude oils, middle distillates and heavier products.

In a commercial flowsheet simulator like Unisim, various calculations on oil streams require a set of MESH (Material Balance, Equilibrium, Summation and Heat Balance) to be solved. For example, MESH calculations are performed at every stage in a distillation tower in Unisim to determine the compositions of the vapour and liquid leaving the trays as well as their flow rates. Various thermal and physical properties (for example heat capacity, vapour pressure, density, molecular weight, and heat of vapourisation) are required to solve the MESH equations. The light end components (methane up to pentanes, which may represent off gas and LPG) are well defined, their chemical structures known and their thermophysical properties are available in most commercial flowsheet simulator databases.

However, the C6+ components need to be represented using "hypothetical components" or hypos. The thermophysical properties of these components must be calculated and they are typically correlated from normal boiling point and density. The normal boiling point curve and bulk density of a crude are the minimum amount of data required by most commercial flowsheet simulators to characterise an oil. As mentioned, viscosity, sulphur and metal content are also used in crude simulations but are out of the scope of this article.

Therefore, the laboratory boiling point analysis is one of the most important data required for fluid characterisation in a simulator.

It should be noted that the closest approximation to a pure component's normal boiling point is the true boiling point which, in this case, is obtained from the ASTM D2892 TBP analysis. Hence, if boiling point data using other distillation analyses are used, for example ASTM D86, it is necessary to convert that data to TBP data.

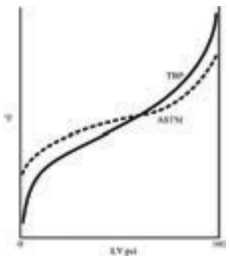



*Figure 3: TBP and ASTM D86 interconversion*

This interconversion methodology and correlations are documented in the API Technical Manuals as well as the Unisim user manual. Examples of interconversions are:

1. ASTM D86 interconversion methods API 1974, API 1987 and API 1995 and Edmister Okamoto (1959).
2. ASTM D2887 interconversion methods consist of API 1987, API 1994 Direct and API 1995 Indirect.

## Setting Up Basic Crude Characterisation in Unisim

The minimum data for characterising an oil stream in a flow sheet simulator are as follows:

1. Light ends analysis.
2. Bulk property definition: Typically, API or specific gravity is used.
3. Boiling point curve input: For TBP, ASTM D86 and ASTM D1160, the typical input data is boiling point temperature as a function of cumulative liquid volume or liquid weight percentage.

In this example, the crude defined in Table 2 shall be characterised in the Unisim process simulator.

A summary of the steps is as follows:

1. Set up the light end components and select the property package.
2. Input the light ends, bulk API gravity and boiling point curve.
3. Generate hypothetical components by "cutting" the crude.
4. Use the boiling point curve to estimate product yields.
5. Install the crude in the flowsheet.

**Step 1. Set up the light end components and select the property package.**

In this example the Peng-Robinson equation of state has been selected. Since most components in crude oil and its products are non-polar, equations of state are frequently used when modelling refinery separations.

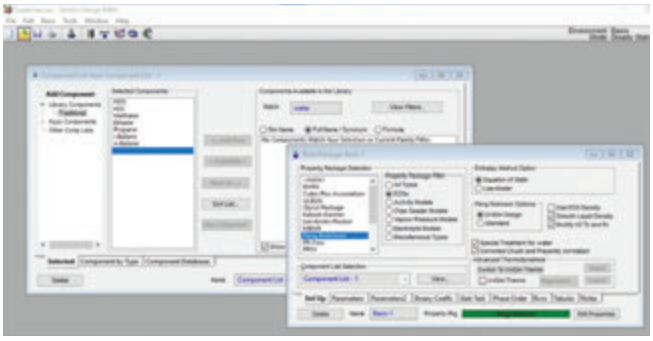


*Figure 4: Component and property package selection*

**Step 2. Enter the Oil Manager and define bulk properties, light ends and boiling point curve.**

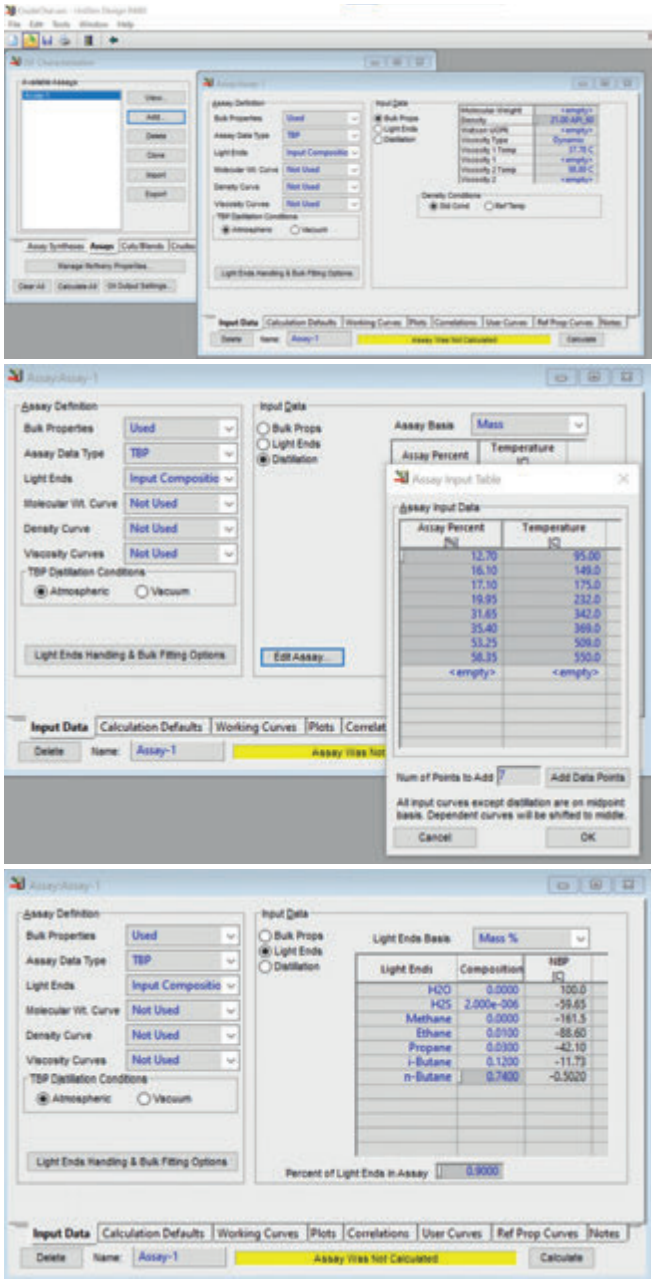


*Figure 5: Basic assay definition*

Note the following:

1. Distillation only goes up to 58%. In most cases, the assay for crude feed may go up to 70% or 80%, requiring one to extrapolate to 100% for the final boiling point. This extrapolation may be done manually (input the 100% temperature to say 900°C) or one may leave it up to the various extrapolation algorithms in Unisim. Probability or LaGrange methods of extrapolation are typically employed. It should be noted that this final boiling point temperature may be used as a tuning parameter as it will affect the temperature profile of the distillation column.
2. The light end components need to be input, otherwise Unisim will perform an extrapolation and generate lower boiling point hypothetical components which may lead to erroneous results. Low boiling point hypothetical components need to be scrutinised when studying light ends fractionation performance.

**Step 3. Generate the hypothetical components by "cutting" the crude.**

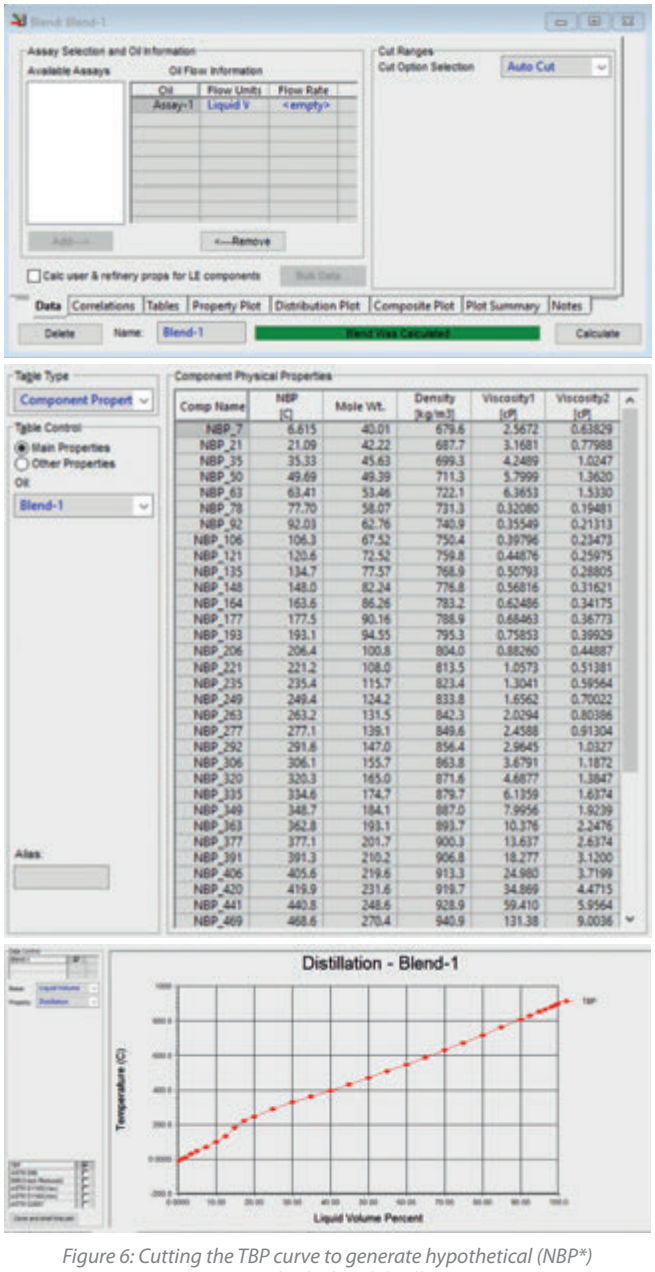
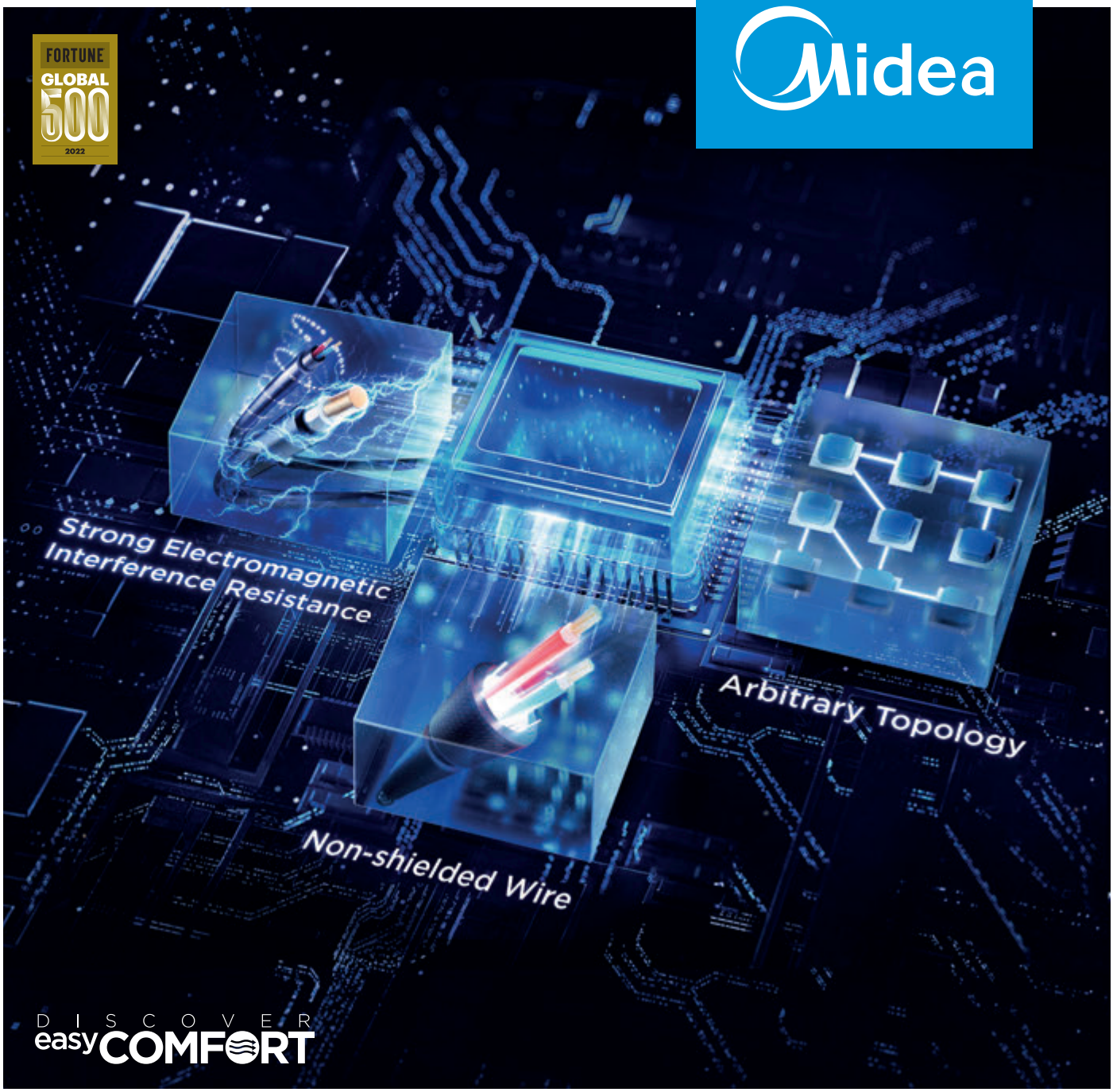



*Figure 6: Cutting the TBP curve to generate hypothetical (NBP*) components and calculated distillation curve*

Unisim uses a working boiling point and bulk specific gravity property to estimate the necessary thermophysical properties curve for each component generated by the cut and blend algorithm.

In this example the Auto Cut option is implemented. This creates hypothetical components (NBP_7, NBP 21 and so forth) based on the following boiling point widths:

| | |
|---|---|
| IBP-800°F | 25°F per cut |
| 800°F- 1200°F | 50°F per cut |
| 1200°F- 1650°F | 100°F per cut |

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It is important to ensure that these cut points provide sufficient resolution for the boiling point curve that was input, typically 50-10 cuts per product. In some cases, it may be necessary to manually specify the cut point temperatures.

After the hypothetical components have been generated, Unisim then creates a distillation curve based on these hypothetical components. This is illustrated in Figure 6.

**Step 4. Estimating Product Yields.**

Now that a distillation curve has been generated, it is possible to estimate the respective product yields. In this case, the crude oil feed to an atmospheric column has been input. Figure 7 shows some typical product yields for this crude oil. This is an extremely useful feature, as these yields can then be used as initial estimates when setting up the crude distillation column.

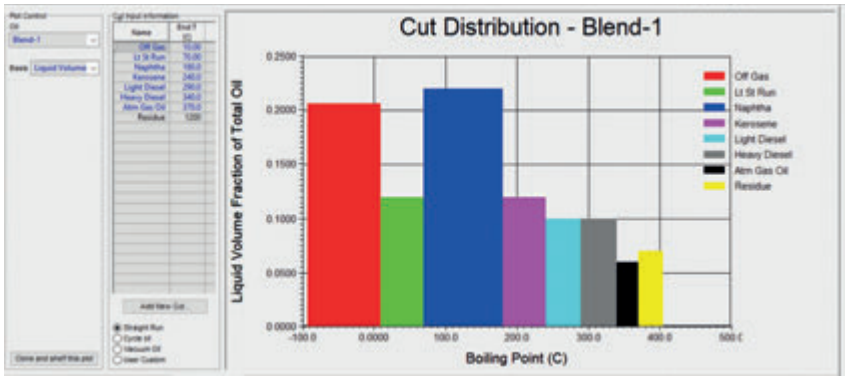


*Figure 7: Product yields*

The following must be noted when using these product yields:

1. The user needs to define the end point temperatures for each of these product cuts.
2. The yields are based on a simple mathematical partitioning of boiling point components using the distillation curve. Product gap and overlaps are not represented.

**Step 5. Installing the crude.**

Once the hypothetical components of crude oil have been generated, it is necessary to install it in the flowsheet.

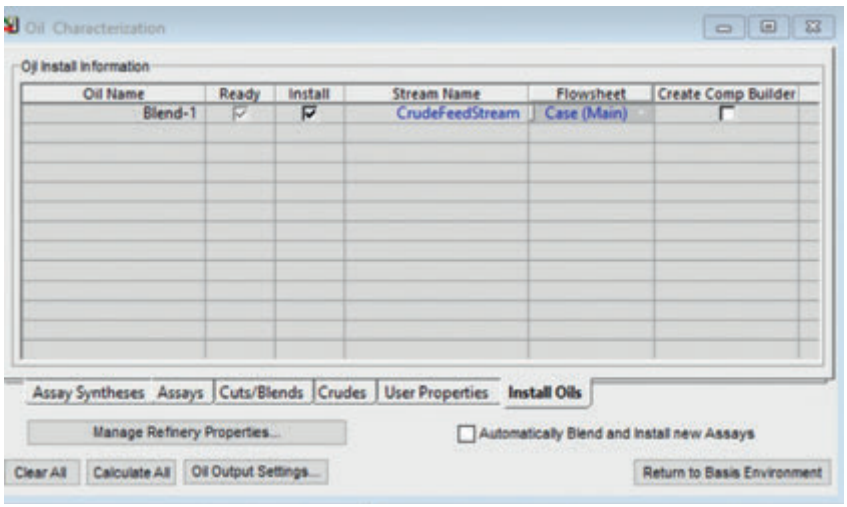


*Figure 8: Installation of oil in Unisim flowsheet*

## Conclusion

This article covers a brief overview of the characterisation of a crude oil for use in a process simulator. The characterisation outlined provides the minimum required input (boiling point curve and bulk specific gravity only) to enable an engineer to generate a material and energy balance for a crude oil fractionation system. A model constructed using these basic definitions would be useful for:

1. Distillation column separation design and performance evaluation. Product yields based on boiling point ranges. Stabiliser performance. Column hydraulics, flooding estimation.
2. Heat exchanger heat transfer, preheat train/pump around coolers.
3. Utilities (heating/cooling) requirements.
4. Heat integration (pinch analysis).
5. Pressure relief studies.
6. Equipment sizing.

A model based on this input will not be suitable for:

1. Planning/LP vector generation. For this refinery product properties such as cetane index, pour point, sulphur content and metal content would be required.
2. Detailed reactor modeling. This would require PIONA or molecular/pseudo-molecular detail to be defined to allow for reactor kinetics to be represented.

It should be noted that commercial simulation software tools such as Unisim, HYSYS, PetroSIM and Symmetry have fluid definition options and the necessary unit operations that would allow for planning and detailed reactor modelling. In this case, the fluid characterisation and definition would be more complex, and would require a significant amount of laboratory data. ■

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[3] Kaiser, M.K; Gary J. H; Handwerk, G. E (2007), Petroleum Refining: Technology and Economics (5th Edition). Florida, USA: CRC Press.

## Upcoming Activities

**Webinar Talk on "Circular Economy for a Sustainable Environment"**

Date : 14 March 2023 (Tuesday)
Time : 3.00 p.m. – 5.00 p.m.
Venue : Digital Platform
Approved CPD : 2
Speaker : Puan Sarifah binti Yaakob

**[Physical] and [Online] - Half-Day Seminar on "CIDB Act 520 Amendment 2021, Construction Industry Standard CIS22:2021 (Safe Use of Scaffolding in Construction) & CIS23:2021 (Safe Use of Falsework in Construction)" and "Falsework Design and Testing of Falsework Structures" - Rescheduled from 29 November 2022**

Date : 15 March 2023 (Wednesday)
Time : 9.00 a.m. – 1.30 p.m.
Venue : Wisma IEM and Digital Platform
Approved CPD : 4
Speakers : Seminar 1: Ir. Lee Kee Bau (Ir. KB Lee)
: Seminar 2: Ir. Dr Lim Boon Tiong

**Technical Talk on Design and Construction of Basement Wall & Pile foundation In Limestone Formation – Case Study**

Date : 15 March 2023 (Wednesday)
Time : 5.00 p.m. – 7.00 p.m.
Venue : Wisma IEM
Approved CPD : 2
Speaker : Mr. Komma Srinivasulu (Vasu)

**Webinar Talk on "The Evolution of Simulator Development: From Historical Milestones to Modern Technologies and Applications"**

Date : 16 March 2023 (Thursday)
Time : 3.00 p.m. – 5.00 p.m.
Venue : Digital Platform
Approved CPD : 2
Speaker : Dr Ahmad Faisal Mohamad Ayob

**Webinar Talk on "Sustainable Conscious Community and Property Management Cost: Smart City in the Making"**

Date : 17 March 2023 (Friday)
Time : 10.30 a.m. – 12.30 p.m.
Venue : Digital Platform
Approved CPD : 2
Speaker : Ir. Prof. Dr Lam Wei Haur

**Webinar Talk on Navigating Your Career as Engineering Professionals – How can you improve your chance of success?**

Date : 18 March 2023 (Saturday)
Time : 9.00 a.m. – 11.00 a.m.
Venue : Digital Platform
Approved CPD : 2
Speaker : Ms. Nurzalina binti Jamaluddin

# Protecting Our Rivers

**Written and Prepared by:**

***Dato' Ir Mohd Azmi Ismail***

*Former Deputy DG1 of DID, VP of Malaysian Stormwater Organisation, Executive Committee Member of MANCID, Malaysian National Committee on Large Dams, MyWP and Committee Member of WRTD IEM.*

The Quintuple Helix Community encourages local communities to take ownership of river protection by establishing initiatives such as community gardens, tree-planting projects and others. By engaging local communities in the National River Trail, we can work together to ensure rivers remain healthy and sustainable for future generations to join and support the national river trail and river care programmes.

*DS Ir. Dr Zaini Ujang leading the river clean-up programme at Sg Air Itam, Kampung Dato Abu Bakar Baginda*

The Corporate Social Responsibility programme was conducted in collaboration with the Ministry of Natural Resources, Environment & Climate Change (NRECC), Department of Irrigation & Drainage (DID), Majlis Pengurusan Komuniti Kampung Dato' Abu Bakar Baginda, Friends of Langat River, Universiti Kebangsaan Malaysia (UKM), Universiti Tenaga Nasional (UNITEN), Universiti Putra Malaysia (UPM), Malaysian National Committee on Large Dams (MYCOLD) as well as other government and private agencies.

This programme is part of the National River Trail project by DID to build river trails spanning some 10,000km along rivers, ponds and other water bodies throughout the country by 2030 and is part of efforts to address socio-environmental challenges. Sg. Air Hitam is part of the Sg. Langat River Basin and flows through Kg. Datuk Abu Bakar Baginda. ■

*The Director General of DID took part in the river cleaning programme*

*More than 50 UNITEN staff and student volunteers were involved in cleaning up Sg. Air Itam*

## ACKNOWLEDGEMENT

NRECC, DID, MYCOLD, UNITEN 7 MPKK KDABB

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# Equatorial Rainforest Challenges: Essence of Erosion & Sediment Control Theory, Design & Practices

**Written and Prepared by:**

**Carine Wong Koh Yin**

Ir. Leong Kwok Wing, a licensed Civil Engineer (California 1981), was invited to speak on Environment & ESCP: Equatorial Rainforest Challenges – Essence Of Erosion & Sediment Control Theory, Design & Practices at Malakoff Auditorium, Wisma IEM. The event, held on 10 January 2023, was jointly organised by the Water Resources Technical Division (WRTD), IEM and Malaysian Stormwater Organisation (MSO).

The objective was to increase the participants' knowledge and awareness on factors that influenced erosion and sedimentation as well as possible mitigation measures to reduce environmental impacts.

Our climate is categorised as equatorial, with very high annual rainfall and high average temperatures throughout the year. Ir. Leong shared case studies where erosion and sedimentation had occured due to nature (soil type, terrain, rainfall, etc.) and human activities.

Excessive erosion and sedimentation cause deterioration in water quality in natural water bodies and worsen flood conditions due to decreased waterway capacities. Proper design and implementation of Best Management Practices (BMPs) erosion and sediment control are mandatory to reduce such environmental impacts.

The course was conducted in four modules with quizzes at the end of each module to help ensure participants had a good understanding of the topics.

For publication of Ir. Leong's paper on the Equatorial Rainforest Challenges & Lack of Appropriate Construction Practices, please click on link from IECA: https://ieca.mynewscenter.org/perspective-the-equatorial-rainforests-role-in-climate-change-and-sea-level-rise/ ■

*Photo 1: Ir. Leong Kwok Wing, presenter*

*Photo 2 and 3: Ir. Leong Kwok Win during the event*

*Photo 4: Participants focusing on the lecture*

*Photo 5 and 6: Participant raised questions during Q&A session*

*Photo 7: Participants asnwering quzzes*

## Upcoming Activities

**Half-Day Seminar on "Hydrogen Economy from the Perspective of an Engineer"**

| | | |
|---|---|---|
| Date | : | 18 March 2023 (Saturday) |
| Time | : | 9.00 a.m. - 1.00 p.m. |
| Venue | : | Wisma IEM |
| Approved CPD | : | 4 |
| Speakers | : | Professor Dato' Ir. Dr Wan Ramli Wan Daud FASc |
| | : | Ts. Dr Kean Long Lim |

**Webinar Talk on "Accident Investigation Using Tripod Beta Analysis"**

| | | |
|---|---|---|
| Date | : | 18 March 2023 (Saturday) |
| Time | : | 9.00 a.m. - 11.00 a.m. |
| Venue | : | Digital Platform |
| Approved CPD | : | 2 |
| Speaker | : | Ir. Mohamad Khalil bin Ishak |

# Planning & Design Processes for Agricultural Irrigation and Drainage (Paddy) Training

**Written and Prepared by:**

**Ir. Shah Izzni Talif**

**Ir. R. Sreedaran**

The Planning & Design Processes for Agricultural Irrigation and Drainage (Paddy) training, co-organised by the IEM's Water Resources Technical Division (WRTD) and Malaysian National Committee on Irrigation & Drainage (MANCID), was held at Wisma IEM on 24 August 2022. Delivered by Ir. Shah Izzni Talif and Dato' Ir. Loh Kim Mun from RPM Engineers Sdn. Bhd., it was attended by 14 engineers, including those starting out in their careers to retirees.

The opening statement was given by session chairman Ir. R. Sreedaran on behalf of the WRTD Chairman. The one-day introductory course placed emphasis on the principles and basic practices of planning and designing large scale paddy cultivation area with controlled water sources.

It started with a look at current food security challenges such as reduced arable land, increased consumption and economic viability of growing rice as a source of income. It then covered paddy planting cycle, design criteria, survey and soil investigation planning, designs (hydrology, water resources, irrigation, drainage) as well as practical design elements to ensure smooth planting and harvesting operations.

*A group picture with the participants*

The programme ended with a case study of MADA, the largest paddy producing area, deep diving into the learnings gathered over the past 50 years.

Overall, the course successfully instilled an appreciation of a niche yet crucial part of agricultural engineering which will, hopefully, steer the nation towards a strong and reliable food security programme. ■

## Upcoming Activities

**Webinar Talk on "Transformation to Smart Energy: Energy Storage and Energy Harvesting Devices"**

| | | |
|---|---|---|
| Date | : | 18 March 2023 (Saturday) |
| Time | : | 10.00 a.m. - 12.00 p.m. |
| Venue | : | Digital Platform |
| Approved CPD | : | 2 |
| Speaker | : | Prof. Dr Ramesh T. Subramaniam |

**Virtual Half-Day Course on Project Management and PMP Certification**

| | | |
|---|---|---|
| Date | : | 20 March 2023 (Monday) |
| Time | : | 9.00 a.m. - 1.00 p.m. |
| Venue | : | Digital Platform |
| Approved CPD | : | 4 |
| Speaker | : | Ir. Assoc. Prof. Dr Abang Annuar Ehsan |

**Webinar Talk on "Industry Sharing: Re Imaging Engineering the Dyson Way"**

| | | |
|---|---|---|
| Date | : | 21 March 2023 (Tuesday) |
| Time | : | 3.00 p.m. - 5.00 p.m. |
| Venue | : | Digital Platform |
| Approved CPD | : | 2 |
| Speaker | : | Ms. Azalea Shezdiana binti Badrulshah |

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*Updated May 2018*

# One-Day Seminar for IEM Sabah

**Written and Prepared by:**

**Ir. Dr Quek Keng Hong**

IEM Sabah organised a one-day seminar, How the Advent of New Storm Data Affects the Design of Drainage Structures including On-Site Detention (OSD) and the Application of Software for Impact Assessment, on 7 November, 2022. The speaker was Ir. Dr Quek Keng Hong.

Held at IEM Sabah Branch Seminar Room from 8.30 a.m. to 5.30 p.m., the seminar was attended by 28 participants in a lively session that included lots of questions and active interaction between participants and the speaker.

The main focus for the event was the optimal design of drainage structures, including On-Site Detention (OSD) using up-to-date storm data in compliance with the Drainage Design Guidelines titled "Manual Saliran Mesra Alam Malaysia" (MSMA) or "Urban Stormwater Management Manual for Malaysia", published by JPS. The following key topics were covered:

## Topic No. 1: Impact of New Storm Data on Drainage Design

1. Currently, there are 3 main references available for computing design storms: MSMA (2000, 2011) or drainage design guidelines published by JPS, and HP1 (2021) and HP26 (2018) which are the Hydrological Procedures published by JPS containing the storm data for West and East Malaysia, respectively.
2. The differences in design storms based on MSMA (2000, 2011), HP1 (2021) and HP26 (2018) were compared for major storm stations in the country.
3. These storm intensities were used as input for the Rational Method and the Time-Area Method to estimate the peak discharges and flow hydrographs.
4. Storm intensities and the computed peak discharges based on the more up-to-date storm data in HP1 and HP26, are about 7-27% higher than for MSMA (2000, 2011) and are recommended for use in the design of drainage structures.

## Topic No. 2: Design & Optimisation of On-Site Detention

1. Currently, MSMA provides guidelines on the design of OSD based on the Approximate Swinburne Method in MSMA (2011).
2. The Approximate Swinburne Method is limited in applicability to only 17 major towns in West Malaysia but is not applicable in Sabah and Sarawak.
3. The application of the Exact Swinburne Method (Quek, 2017), based on the latest storm data from anywhere in Malaysia, can result in the optimisation of the SSR (Site Storage Requirement) estimate in the design of OSD by 50% or more.

## Topic No. 3: Application of Online Software for Drainage Design

1. The seminar covered the application of an online software MSMAware for computing the design storm intensities based on MSMA (2011), HP1 (2021) and HP26 (2018) and the design of OSD using the Approximate Swinburne Method and Exact Swinburne Method. The application of the software can result in significant reduction in the size of drainage structures and the volumes of detention storage required.
2. Participants were offered free access to the MSMAware online software. Details at: http://welcomeVideo.msmaware.com.
3. Participants were also offered free access to download useful tools and resources on MSMA in the seminar via: http://Seminar1.msmam.com. Access to this and MSMAware is opened to all IEM members (limited to the first 1,000 members). ■

### REFERENCE

[1] Quek (2017). "Review of Changes in the Second Edition of MSMA-On-Site Detention Computation" The Monthly Bulletin of the Institution of Engineers, Malaysia, March 2017, Pg. 18-24.

*Group picture of the participants*

*Seminar in progress*

*Presenting a token of appreciation to Dr Quek*

Tarikh: 8 Februari 2023

Kepada Semua Ahli,

## SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2023

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2023.

Mengikut Undang-Undang Kecil IEM, Seksyen 3.8, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2023.

Sekiranya terdapat Ahli Korporat yang mempunyai bantahan terhadap mana-mana calon yang didapati tidak sesuai untuk menduduki Temuduga Profesional, surat bantahan boleh dikemukakan kepada Setiausaha Kehormat, IEM. Surat bantahan hendaklah dikemukakan sebulan dari tarikh penerbitan dikeluarkan.

**Ir. Prof. Dr Zuhaina binti Zakaria**
*Setiausaha Kehormat, IEM*

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Pengumuman yang ke-172

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Institusi mengucapkan terima kasih kepada semua yang telah memberikan sumbangan kepada tabung Bangunan Wisma IEM. Ahli-ahli IEM dan pembaca yang ingin memberikan sumbangan boleh berbuat demikian dengan memuat turun borang di laman web IEM http://www.iem.org.my atau menghubungi secretariat di +603-7968 4001 / 5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan Januari 2023 adalah seperti jadual di bawah:

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| 17 | 13400 | MR. SEET JEN PING |
| 18 | 45867 | Ir. LEE FEI HAN @ LEE KOT CHUEN, LENIOR |
| 19 | 10801 | MR. BOEY WEI LUN |
| 20 | 22410 | EN. AZALI BIN ARDY @ AZALI AH SIONG |
| 21 | 13215 | Ir. LIM CHEE KOK |
| 22 | 53831 | Ir. TAY KHO JIM |
| 23 | 16870 | Ir. SAW WOOI KOON |
| 24 | 12809 | Ir. DR MOHD SABRI BIN ABDULLAH |
| 25 | 86300 | MR. SIP MING FEI |
| 26 | 74853 | SDR. SHARVIN A/L RAMACHANDRAN |
| 27 | 14692 | MR. TEH KIM ONG |
| 28 | 10928 | DATIN Ir. NOR ASIAH BT. OTHMAN |
| 29 | 62186 | MR. MOHD ZUBIR BIN MAT DAHAN |
| 30 | 08728 | Ir. HJ. SAARI BIN ABDULLAH |
| 31 | 21575 | Ir. NGIM CHIN KIM |
| 32 | 111099 | MS. SITI HAWA ADILA BINTI MOHD YUSOF |
| 33 | 11511 | MR. MOHAMAD AZMI BIN ABDULLAH @ MAMAT |
| 34 | 87227 | MR. MUHAMMAD AMIRULHAFIZ BIN BOLHASSAN |
| 35 | 24851 | MR. KOH PENG CHUN |
| 36 | 28999 | MR. NURUL HUDA BIN ROMLI |
| 37 | 22421 | MR. AMIRUDDIN BIN SAAD |
| 38 | 22936 | Ir. LIAW WEI LOONG |
| 39 | 80677 | MR. RAJA ANDIFARIZAN RAJA AHMAD |
| 40 | 04172 | Ir. HENG WENG LONG |
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## CONTINUATION FROM FEBRUARY ISSUE 2023

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| No. Ahli | Nama | Kelayakan |
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| **KEJURUTERAAN AERONAUTIKAL** | | |
| 109192 | MUHAMMAD AFIQ BIN MOHD HATTA | Dip. (Aircraft Maintenance)(PBS) 2014 |
| **KEJURUTERAAN AWAM** | | |
| 115933 | ADLI HAFETZ BIN ABD HALIM | DIP (PMM) (CIVIL,2015) |
| 108393 | MOHAMAD SYAFIQ BIN SENIN | Dip. (PMK) 2013 |
| 104178 | MOHAMAD SAFWAN BIN MOHD NAWI | Dip. (PTSB) 2011 |
| 113073 | SYED AHMAD FAIRUS BIN SYED ABDUL GHANI | Dip. (PUO) 2007 |
| **KEJURUTERAAN ELEKTRIKAL** | | |
| 56631 | THURAISINGAM A/L CHANDRA SEHKARAN | Dip. (PTSB) 2009 |
| **KEJURUTERAAN MARIN** | | |
| 64564 | MOHD HASRANI BIN MOHD SANI | Dip. (PUO) 1992 |
| **KEJURUTERAAN MEKANIKAL** | | |
| 114686 | MOHD SABRIE BIN AZAMAN | Dip. (PSA) 2013 |
| 26950 | CHIEW CHIN HING | Dip. (PUO) 1987 |
| 51741 | MUHAMMAD HEIKAL BIN NASARUDIN | Dip. (PUO) 2007 |
| **KEJURUTERAAN MEKATRONIK** | | |
| 108394 | GANESH KUMAR A/L THANGARAJU | Dip. (PUO) 2013 |
| **KEJURUTERAAN PERKHIDMATAN BANGUNAN** | | |
| 114684 | BALAMUNI A/L MALAYSIAN | Dip. (PSA) 2014 |
| 101095 | MOHD RAFIQ FITRI BIN ABDUL RADZI | Dip. (PSA) 2015 |

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| **KEJURUTERAAN BUILDING SERVICES** | | |
| 116091 | MUHAMMAD MUZZAMIL BIN AHMAD RAZALI | DIP BSE (POLIMAS) 2016 |
| **KEJURUTERAAN ELECTRICAL** | | |
| 115489 | UZAIR BIN NOR JASMIN | DIP ELECTRICAL ENGINEERING |

### PERMOHONAN MENJADI AHLI 'INCORPORATED'

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| **KEJURUTERAAN AWAM** | | |
| 115738 | CHIEW KAH WAI | BE HONS (SWANSEA UNI.)(CIVIL, 2016) |
| 115425 | DINESH CHERYAN | BE HONS (NOTTINGHAM UNI.) (CIVIL, 1997) |
| 115911 | LI MI | BE HONS (THE UNI. OF NOTTINGHAM)(CIVIL, 2016 |
| **KEJURUTERAAN ELEKTRIKAL** | | |
| 115914 | YEE CHENG HANN | BE HONS (THE UNI. OF LEEDS)(ELECTRONIC & ELECTRICAL, 2013) |
| **KEJURUTERAAN ELEKTRONIK** | | |
| 115913 | KARTHIGESU A/L BALA | BE HONS (UNI. OF NORTHUMBRIA) (ELECTRICAL & ELECTRONIC, 2007) |
| **KEJURUTERAAN KOMPUTER** | | |
| 115912 | MATHURI A/P GURUNATHAN | BSc HONS (UNITEN) (SOFTWARE, 2018) |
| **KEJURUTERAAN MEKATRONIK** | | |
| 115910 | RIEDUAN AHMAD SUKORI | BE HONS (UNIMAP) (MECHATRONIC, 2008) |

### PERMOHONAN MENJADI AHLI 'ASSOCIATE'

| No. Ahli | Nama | Kelayakan |
|---|---|---|
| **KEJURUTERAAN BANGUNAN** | | |
| 116029 | ONG KAM HENG | DIPLOMA IN TECH. (TARC)(BUILDING, 2010) |
| **KEJURUTERAAN TELEKOMUNIKASI** | | |
| 115735 | FAIZ BIN RUZALI | DIPL. (POLITEKNIK UNGKU OMAR) (ELECTRONIC - COMMUNICATION, 2016) |

***Note:*** *Continuation would be published in April 2023. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at http://www.myiem.org.my.*

## Upcoming Activities

**1-Day Course on "Highway Drainage Design"**

Date : 22 March 2023 (Wednesday)
Time : 9.00 a.m. – 5.30 p.m.
Venue : Wisma IEM
Approved CPD : 7
Speaker : Ir. Chee Shai Choon

**Half-Day Course on "Soil Stabilisation with Mechanically Stabilised Layers (MSL)"**

Date : 25 March 2023 (Saturday)
Time : 9.00 a.m. – 1.00 p.m.
Venue : Digital Platform
Approved CPD : 4
Speaker : Ir. Lau Joe Jiunn

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