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Publisher:

Malaysian Stormwater Organisation (MSO)

d/a Jabatan Pengairan dan Saliran Malaysia,

Bahagian Saliran Mesra Alam,

Jalan Sultan Salahuddin,

50626 Kuala Lumpur.

T : +6017-2229675

E: mso.renewal@gmail.com

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Message from the Immediate Past President

Greetings to MSO Members,

As we embark on 2025, it is my pleasure to address you in the third issue of our bulletin, "STORMWATER." Over the past year, MSO has achieved significant milestones, thanks to the dedication and commitment of our members. The success of SWaM 2024 and other MSO-organised activities has not only strengthened our organisation's presence but also furthered our shared mission to advance stormwater management practices in Malaysia.

Looking ahead, I am pleased to share that MSO will be organising more activities and training sessions throughout 2025. These initiatives are aimed at equipping our members with the latest knowledge and skills in stormwater management, erosion, and sediment control. I encourage all members to actively participate and make the most of these opportunities to contribute to our collective goals.

On a personal note, as I conclude my tenure as President, I am deeply honoured to have served MSO and to witness its growth and impact over the years. While I now step into the role of Immediate Past President, I remain committed to supporting MSO and contributing to its continued success. It has been a privilege to work alongside such talented and passionate individuals, and I look forward to engaging with all of you in new ways as we drive the organisation forward.

Finally, I extend my heartfelt gratitude to every MSO member, friend, and sponsor for your unwavering support. Together, we will continue to create positive impacts in stormwater management, fostering sustainability and resilience for Malaysia and beyond.

Wishing you all a productive and fulfilling 2025!

Immediate Past President
Mejar (K) Dato' Ir. Hj. Ahmad Anuar Bin Othman

Editor Notes

Greetings from the Malaysian Stormwater Organisation,

It is my privilege and honor to present the third issue of STORMWATER in year 2025. As we step into a new year, our commitment to advancing stormwater management remains unwavering. On behalf of MSO, I extend my best wishes for a productive and inspiring year ahead to all our members.

This issue features a range of insightful articles that address pressing challenges in erosion and sediment control, showcasing innovative approaches and practical solutions. Our cover story, contributed by the Department of Environment Malaysia (DoE), delves into the implications of the Environmental Quality Act 1974 (ACT 127) on managing erosion and sedimentation. It highlights concerns over water quality deterioration in Malaysia's river systems due to soil erosion and sedimentation, emphasizing the urgent need for action. The second article introduces a new perspective on erosion and sedimentation control through the implementation of the LDP2M2 Plan for EIA projects, featuring findings from the DoE during enforcement. This piece outlines the nine key prevention elements and three key mitigation measures, offering valuable insights into effective management strategies. The third article explores persistent erosion and sedimentation issues in earthwork projects, exacerbated by Malaysia's high-intensity rainfall patterns. The challenges posed by these conditions and the measures needed to mitigate their impacts are thoroughly examined. Continuing his series, Dato Fuad addresses frequently asked questions (FAQs) on the Urban Stormwater Management Manual for Malaysia (MSMA) in our fourth article, with a particular focus on erosion and sediment control and the ESCP for urban areas.

In the fifth article, we delve into protecting Malaysia's highlands through soil erosion and rainfall studies, a collaborative effort between the Department of Agriculture (DOA) Malaysia and REDAC, Universiti Sains Malaysia. The study sheds light on rainfall variability, soil erodibility, and erosion risks, offering data-driven insights for conservation. The sixth article, contributed by NAHRIM, highlights debris flow mitigation through Sabo infrastructure, complemented by other comprehensive measures for effective debris flow management. Lastly, the seventh article examines managing urban floods through catchment rehabilitation, using the Sungai Klang basin as a case study. It demonstrates how these interventions, though costly, yield long-term benefits in resilience, sustainability, and adaptability.

As MSO looks ahead, we are excited to organise more activities and training sessions throughout 2025. These initiatives aim to equip our members with the latest knowledge and skills while fostering collaboration and professional development. We welcome your contributions to future editions of STORMWATER to enrich our shared knowledge and collective expertise. Together, let us continue driving progress in stormwater management for a sustainable future.

Editor
Ir. Ts. Gs. Dr. Chang Chun Kiat

COVER STORY - EROSION AND SEDIMENT CONTROL IN ENVIRONMENTAL QUALITY ACT 1974 (ACT 127)

Authors:

Rohimah Ayub
Assessment Division,
Department of Environment Malaysia

1.0 Introduction

Lately, there is increased concerns in Malaysia over the deterioration of water quality in many river systems due to soil erosion and sedimentation as it indirectly impacts the ecological system and services. A few domestic water treatment plants have been shut down due to excessive siltation or turbidity. Besides that, urban areas and highlands areas experience flash floods including Kuala Lumpur and Cameron Highlands due to negligence of erosion and sediment controls during development that involve land clearing, earth works and construction activities and during operation such as mining and quarrying activities.

River of soil debris

Biomass covering the river and blocking flows

2.0 Legislation in Relation to Erosion and Sediment Control

Since erosion and sedimentation are the major environmental problems during and after land development process, there are requirements to minimize by implementing practicable sound environmental practices for preventing serious environmental degradation.

The first step, the government introduced the policy for environmental protection and management under the Seventh Malaysia Plan 1996-2000, which was stated in Chapter 19. The Plan acknowledged that indiscriminate clearing for development projects, unsound practices in a sequence of activities, inadequate legislation lack of enforcement of legislation has resulted in soil erosion, sedimentation and water quality problems. The government committed during the Plan period to integrate soil conservation planning with physical development, reviewed current legislation and guidelines and considered the need for a Soil Conservation and Sediment Control Act.

There are existing statutory requirements with respect to erosion and sediment control in Malaysia that can be found various pieces of legislation listed below:

- The Ninth Schedule of the Malaysian Constitution (Malaysia, 1995)
- Land Conservation Act, 1960
- National Forest Act, 1984 (Amendment 1993)
- Mineral Development Act 1994 (Amendment 2008)
- State Mineral Enactments
- Street, Drainage and Building Act 1974 (Amendment 2019)
- Local Government Act 1976
- Town and Country Planning Act 1976 (Amendment 2007)
- State Water Enactments
- Environmental Quality Act 1974 (Amendment 2024)

These legislations had taken considerable amendments as per requirements in the Seventh Malaysian Plan for soil erosion and sediment controls

3.0 Legislative Framework for Erosion and Sediment Control in Environmental Quality Act 1974

As entrusted with the task of ensuring sustainable development, the Department of Environment Malaysia (DOE) has taken serious implementation on the issues of environmental degradation due to soil erosion and sedimentation. After four years the enactment of Environmental Quality Act 1974 (Act 127), the first formal document was published which is entitled 'Guidelines for Prevention and Control of Soil Erosion and Siltation". The Guidelines identified four categories of activities as contributing substantially to erosion and sedimentation. The activities are housing development and road construction, logging, agriculture and mining and quarrying. The Guidelines was published in order to assist planners, developers and construction practitioners to control erosion and sedimentation.

After the requirement of Environmental Impact Assessment (EIA) under Section 34A, Act 127, starting 1st April 1988 onwards, the Guidelines were mandatorily used as references in preparing, assessing and in approving conditions for EIA Report and also during preparing Environmental Management Plan and its enforcement. However, the mandatory requirements were dedicated for 19 prescribed activities listed in Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 (EIA Order 1987). In 1992, the Guidelines were reviewed in order to enhance soil erosion preventive measures and entitled as "Guidelines for the Prevention and Control of Soil Erosion and Siltation" and reviewed again in 1996.

Between 1994 to 1996, DOE had published guidelines relating to the preparation of EIA for each 19 prescribed activities listed in EIA Order 1987. All these documents contained general guidelines pertaining to preventive measures in soil erosion and sedimentation.

The pursuing of better preventive measures and mitigation measures never stopped DOE in reviewing existing Guidelines in controlling soil erosion and sedimentation. In 2008, the "Guidelines for the Prevention and Control of Soil Erosion and Siltation" was reviewed and a new title of the Guidelines was published as " Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia".

In strengthening the environmental management system in Malaysia, an EIA Report has been recognized as one of the planning tools in development activities and amendment in Section 34A, Act 127 in 2012 and the EIA Order 2015 have been considered in strengthening the soil erosion and sedimentation issues by mandatory requirement in preparing the EIA Report in assessing erosion and sedimentation under one dedicated chapter as being required in " Environmental Impact Assessment Guidelines in Malaysia (EGIM) 2016. DOE has also published another guideline in assisting the preparation of the dedicated chapter on erosion and sedimentation which is "Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)" in 2017. The term land disturbing has been used due to the nature of development sequence of work stating land disturbance by planning, sequence of work, land clearing of vegetation and ending with the stabilization of the bare land through covering with Best Management Practices (BMPs) such as mulching, spot turfing or hydroseeding. The LD-P2M2 Guidelines is introducing erosion and sediment control which are practical and effective measures to protect the river water quality and minimize the degradation and deterioration of the environment during land disturbing activities and causing the disturbance of the ecological system.

Under Act 127, DOE only focuses on prescribed activities under the EIA Order 2015. There are many development activities that are not listed under the EIA Order 2015 which are also major contributors to the degradation dan deterioration of the environment the need to be addressed during approval by relevant authorities and during enforcement.

4.0 Way Foward - Addressing Erosion and Sedimentation in Malaysia

Several agencies such as the Department of Irrigation and Drainage Malaysia (DID), Public Works Department (JKR), Department of Agriculture, Department of Mineral and Geoscience Malaysia (JMG) and local governments have strengthened their legislation, published guidelines and standard procedures in relation to controlling erosion and sedimentation.

DOE is drafting a new regulation on EIA in order to enhance the compliance of the prescribed activities during implementation which also focuses on soil erosion and sedimentation. Under Section 49A, DOE introduce the requirement of competent person as an Environmental Officer during land disturbing activities for EIA projects. This competent person is a part of self-regulation policy requirement.

Capacity building for all the officers in related agencies is also a must in order to strengthen during approving certain permits or plans relevant to erosion and sedimentation control, enforcement on the ground and as an expert witness if being challenged in court. These capacity building through competency shall be one of the national agenda in helping minimize soil erosion and sedimentation issues.

By enhancing the existing legislation, strengthening the enforcement on the existing regulations, capacity building on stakeholders by introducing competency at all levels, or introducing a new legislation dedicated for erosion and sedimentation from land disturbing activities as recommended in Seventh Malaysian Plan, is seen as a way forward in handling soil erosion and sedimentation.

5.0 Conclusion

In conclusion, Act 127 alone cannot handle the erosion and sedimentation issues as it has its limitation in implementation and enforcement on developments. A big step needs to change the erosion and sedimentation scenario in Malaysia by collaborating with various agencies and stakeholders including non-governmental-organizations (NGOs).

References

1. Department of Environment Malaysia (DOE) (2008). Guidelines for Prevention and Control of Soil Erosion in Malaysia.
2. DOE (2016). Environmental Impact Assessment Guidelines in Malaysia (EGIM), 2016.
3. DOE (2017). Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2).

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A NEW PERSPECTIVE IN SOIL EROSION AND SEDIMENTATION CONTROL THROUGH THE IMPLEMENTATION OF THE LDP2M2 PLAN FOR EIA PROJECTS

Author:

Ts. Dr. Abdul Rahman Mahmud
Department of Environment,
Pulau Pinang

1.0 Introduction

The issue of soil erosion and sedimentation at project sites subjected to Environmental Impact Assessment (EIA) is becoming increasingly critical, reflecting deficiencies in planning and implementing sustainable control measures. This phenomenon is often associated with various problems such as river pollution, degradation of water quality, and rising complaints of mud floods from nearby residents. These negative impacts not only harm the environment but also disrupt aquatic ecosystems, damage public infrastructure, and affect the daily lives of communities. Despite the introduction of various Best Management Practices (BMPs) to address this issue, their implementation is often inadequate and ineffective, particularly when constrained by a lack of competent personnel, irregular maintenance, and preventive measures that are more reactive than proactive. A more strategic and prevention-oriented approach is urgently needed to ensure the long-term stability of development projects and the preservation of environmental quality.

2.0 Key Issues from EIA Projects

Soil erosion and sedimentation resulting from development projects often lead to severe river pollution. This is primarily caused by uncontrolled earthworks, which subsequently degrade river water quality. Insufficient and reactive pollution control measures exacerbate the situation. Although BMPs have been implemented, they often fail to completely prevent pollution. The lack of understanding of the root causes and the need to enhance control measures remain significant challenges. These adverse effects are not limited to ecological aspects but also have a substantial impact on local communities, such as infrastructure damage and disruption to their daily activities.

More concerningly, current approaches rely heavily on temporary solutions that are only implemented after problems arise. Statements such as “locking the stable door after the horse has bolted” reflect the current reality where preventive measures are often neglected. Aspects like regular maintenance of BMPs, selection of appropriate control structures, and the presence of certified personnel are frequently overlooked. Under such circumstances, the issue of soil erosion and sedimentation is likely to remain a major challenge that is difficult to address without more comprehensive changes in EIA project management and monitoring approaches.

3.0 DOE Findings During Enforcement

Findings by the Department of Environment (DOE) highlight several significant issues during inspections and enforcement at EIA project sites. One of the primary issues identified is the improper installation of BMPs, where the selection of BMPs is often made without considering the actual topographical and soil conditions of the area. This leads to BMPs that are not optimally effective in controlling erosion and sedimentation. Additionally, the maintenance of BMPs has emerged as a serious concern due to inconsistent and inadequate upkeep. Control structures such as sediment traps, silt fences, and retention ponds are not regularly maintained, resulting in significantly reduced effectiveness and increased pollution risks.

No maintenance for earth drain at project site

Another major issue is the absence of competent personnel at project sites. The lack of qualified staff specializing in erosion and sedimentation management has contributed to failures in professionally monitoring and managing the sites. Furthermore, earthworks are often conducted simultaneously without phased planning. This approach rapidly exposes large areas without adequate controls, thereby increasing the risk of uncontrolled soil erosion and sediment flow.

Improper runoff and stockpile control

Absence temporary erosion control

Absence erosion control

Compounding these problems are complaints from nearby residents about frequent mud floods. Sediment from project sites flows into residential areas, causing severe property damage and widespread dissatisfaction among the local community. This situation not only affects the well-being of residents but also heightens pressure on authorities to address these issues more effectively. These findings underscore the urgent need for stricter and more effective preventive measures to ensure sustainable and responsible management of EIA projects.

Mud floods

Siltation in river

i) Prevention Approach in LDP2M2

To address challenges related to soil erosion and sedimentation, the Department of Environment has outlined a strategic approach under the concept of "pollution prevention." This initiative aims to minimize pollution risks by emphasizing proactive efforts to prevent sources of damage before negative impacts occur. Unlike reactive approaches that respond to issues after they arise, this prevention-focused strategy offers a more sustainable framework. Additionally, it provides cost-efficient solutions in the long term while strengthening overall ecosystem stability. By identifying and mitigating pollution sources at the early stages, the need for complex and costly remedial actions can be significantly reduced. This fosters ecological resilience and sustainable development, aligning with national aspirations.

ii) LDP2M2 Plan as a Mandatory Requirement for EIA Projects

Since 2017, the LDP2M2 (Land Disturbances Pollution Prevention and Mitigation Measure Plan) Plan has been integrated as a mandatory requirement for projects subject to Environmental Impact Assessment (EIA). This initiative represents a significant paradigm shift from reactive to proactive, prevention-oriented approaches. The plan not only incorporates Best Management Practices (BMPs) as strategies for erosion and sedimentation control but also emphasizes enhanced adherence to prevention principles at the early planning stages of projects.

This approach ensures that all development projects prioritize environmental sustainability. It includes detailed assessments of areas identified as high-risk for erosion and sedimentation, such as steep slopes and watershed zones. Through comprehensive risk analyses, developers can formulate more strategic, structured, and effective mitigation plans, thereby significantly reducing environmental impacts. This step also enhances the effectiveness of environmental controls through advance planning, efficient technical implementation, and continuous monitoring and evaluation throughout the project lifecycle.

Pollution Prevention

- Comprehensive Assessment of Erosion and Sedimentation
- Protection of Environmentally Sensitive Areas
- Phased Earthwork Planning
- Regular Monitoring and Maintenance
- Comprehensive LDP2M2 Plan
- Presence of Competent Environmental Officers
- Regular Environmental Audits
- Environmental Monitoring
- Comprehensive Environmental Reporting

Mitigation Measure

- Scientific and Engineering Approach
- Before, during and after land disturbance
- Erosion control measure
- Runoff control measure
- Sediment Control Measure

iii) 9 Key Prevention Elements in the LDP2M2 Plan

1. Comprehensive Erosion and Sedimentation Impact Assessment
   - Conduct in-depth analyses of erosion risks and potential sedimentation before project initiation to ensure appropriate mitigation measures. This assessment considers various parameters such as soil type, rainfall intensity, and the sensitivity of surrounding areas, combining them to produce a clear and comprehensive risk profile.

2. Protection of Environmentally Sensitive Areas
   - Strict protection is enforced for areas such as steep slopes, watershed zones, and ecologically sensitive locations to prevent degradation. This includes restrictions on development activities in specific areas and the establishment of adequate buffer zones to shield these areas from both direct and indirect impacts of development.

3. Phased Earthwork Planning
   - Minimize exposed areas by implementing phased earthwork plans to reduce erosion risks. For instance, only a minimum size of the site is excavated at a time, and these areas are promptly replanted or covered upon completion of construction activities.

4. Regular Monitoring and Maintenance
   - Ensure that BMP structures such as sediment traps and ground covers remain effective through systematic inspections and regular maintenance. This requires a structured monitoring schedule and periodic status reports to ensure prompt action is taken in the event of any failures.
5. Provision of LDP2M2 Drawing Plans
   - These plans include pre-bulk and post-bulk conditions of the project to ensure detailed planning is executed throughout the project duration. The plans aim to guide contractors and developers to implement every preventive measure effectively.
6. Competent Environmental Officers on Site
   - Presence of trained environmental officers to supervise, monitor, and ensure proper implementation of preventive measures. These officers also provide technical advice to developers and ensure all work adheres to established guidelines.
7. Frequent Environmental Audits
   - Conduct regular audits to assess compliance with regulations and the performance of implemented control measures. This process includes document reviews, site visits, and discussions with stakeholders to ensure the effectiveness of the implemented plans.
8. Environmental Monitoring
   - Includes regular water quality testing and site inspections to ensure no uncontrolled pollution occurs. This monitoring also aids in detecting environmental changes that may require immediate action.
9. Comprehensive Environmental Reporting
   - Regular reports covering erosion and sedimentation control measures are submitted to DOE to ensure transparency and project compliance with guidelines. These reports also provide improvement recommendations based on current findings, enabling more effective control measures to be implemented.

iv) Mitigation Measures in the LDP2M2 Plan

The LDP2M2 Plan also adopts structured approach to mitigation by integrating Best Management Practices (BMPs) that are tailored to address erosion control, surface runoff management, and sediment control. These strategies are grounded in technical analyses and environmental assessments to ensure both effectiveness and sustainability.

1. **Erosion Control**
   Erosion control measures aim to reduce soil displacement resulting from construction activities and to protect vulnerable areas using engineered and vegetative solutions. A detailed description in Environmental Impact Assessments (EIA) guides the implementation of these measures by evaluating factors such as soil types, rainfall patterns, and terrain characteristics. Effective practices like turfing and hydroseeding are applied to stabilize slopes, minimizing the risk of soil erosion and sediment transport. These interventions provide immediate stabilization to exposed areas while promoting long-term soil conservation.

2. **Surface Runoff Control**
   Surface runoff management focuses on regulating water flow to mitigate risks such as localized flooding and uncontrolled discharges from construction sites. Temporary measures, such as drainage channels and sedimentation ponds, are implemented to redirect and slow down surface water flow. These measures are often validated during the EIA process through hydrological modeling and flow simulations. Permanent drainage infrastructure is also designed to accommodate peak flow rates, providing a durable solution for runoff control and ensuring long-term site stability.

3. **Sediment Control**
   Sediment control strategies are designed to intercept and reduce the movement of sediment into adjacent water bodies. Tools like sediment traps and sediment ponds and active treatment systems are strategically installed to capture sediment effectively, preventing degradation of downstream water quality and aquatic habitats. These solutions are supported by site-specific analyses during the EIA phase to ensure they are appropriately configured for maximum efficiency. Vegetative buffers and sediment retention structures are often incorporated as additional layers of control to reinforce the primary measures.

Summary

The LDP2M2 Plan represents an innovative approach and new perspective to address long-standing gaps in erosion and sedimentation control. Historically, reliance solely on mitigation measures (structural BMPs) has proven inadequate for managing these issues holistically, as they often fail to address root causes. Prevention measures, such as protecting sensitive areas, phased earthwork planning, and deploying competent personnel, focus on minimizing risks early, reducing the need for extensive remediation and ensuring long-term cost efficiency. Meanwhile, mitigation measures, including Best Management Practices (BMPs) like sediment traps, drainage systems, and vegetative buffers, provide targeted solutions for managing unavoidable risks. The synergy between prevention and mitigation measures is the cornerstone of this plan, creating a robust framework that ensures holistic and sustainable environmental protection. By reducing the severity of impacts through proactive prevention and enhancing the effectiveness of mitigation efforts, the LDP2M2 Plan bridges gaps in traditional practices, ensures compliance with environmental regulations, and promotes sustainable development, addressing the limitations of past approaches while paving the way for better project outcomes for the future.

References

1. Department of Environment Malaysia (DOE) (2016). Environmental Impact Assessment Guidelines (EGIM).
2. DOE (2017). Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures
3. Abdul Rahman Mahmud (2017). Evaluation of EIA Reports on the Aspects of Study, Soil Erosion, and Sedimentation, Universiti Kebangsaan Malaysia
4. Department of Irrigation and Drainage Malaysia (DID). (2012). *Urban Stormwater Management Manual for Malaysia (MSMA) 2nd Edition*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.

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Second (2) Schedule (17) ~ Agriculture, Aerodrome, Drain & Irrigation, Fisheries, Forestry, Industry, Land Reclamation, Mining, Petroleum, Ports, Power Generation & Transmission, Development in Coastal Area, National & State Park, Development in Slope Area, Waste Treatment & Disposal, Construsction of Dam, Transportation, Radioactive Material & Radioactive Waste.

EIA

ENVIRONMENTAL MANAGEMENT PLAN (E.M.P)

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EMP

ENVIRONMENTAL MONITORING

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MONITORING

ENVIRONMENTAL MONITORING / AUDIT

Air quality
Water quality
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MONITORING/AUDIT

LAND DISTURBING POLLUTION PREVENTION & MITIGATION MEASURES (LDP2M2) / EROSION SEDIMENT CONTROL PLAN (E.S.C.P.)

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ecosynergysolution@gmail.com
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EROSION AND SEDIMENTATION ISSUES: A PERSISTENT CHALLENGE IN EARTHWORK PROJECTS

Authors:

Ir. Ts. Abdul Hayyi bin Awang
ES Eco Smart Sdn. Bhd.

Geetha P Kumaran
ES Eco Smart Sdn. Bhd.

Erosion and sedimentation remain critical issues in development projects, particularly those involving large-scale earthworks. As a tropical country with high annual rainfall, Malaysia faces unique challenges in managing these risks. The high intensity and frequency of rainfall increases the potential for erosion and sedimentation, making it a significant concern in earthwork projects.

Erosion and sedimentation play a key role in the following aspects: -

1. Preventing Soil Erosion
   Malaysia's diverse geography, including coastal regions, rainforests, and mountainous terrain, makes it highly vulnerable to soil erosion. Intense rainfall, particularly during the monsoon seasons, can exacerbate this problem, especially in areas of deforestation or cleared land. Erosion can lead to the loss of topsoil, which reduces agricultural productivity and damages landscapes.

2. Sediment Control in Construction and Development
   Rapid urbanization, industrial expansion and infrastructure development in Malaysia require strict erosion and sediment control to protect water bodies from contamination. During construction projects, sediment can wash into nearby rivers and lakes, degrading water quality, harming aquatic ecosystems and contributing to flooding.

3. Mitigating Flood Risks
   Malaysia experiences frequent flooding, especially in urban areas and flood-prone regions. Soil erosion exacerbates the problem by reducing the land's ability to retain rainwater, leading to quicker runoff and increased flood risks.

4. Protecting Water Quality
   Malaysia is home to many rivers, lakes, and coastal areas, which provide drinking water, agricultural irrigation and fisheries resources. Sedimentation from construction, agriculture and deforestation can seriously degrade the quality of these water resources, making water treatment more costly and less effective.

5. Sustainable Agricultural Practices
   Agriculture is a significant sector in Malaysia, with palm oil, rubber and rice being key crops. However, poor land management practices in agriculture—such as overgrazing, deforestation for forest plantations and improper irrigation can contribute to erosion and sedimentation issues.

6. Compliance with Environmental Regulations
   The Malaysian government, through agencies such as the Department of Environment (DOE) and the Malaysian Environmental Quality Act (EQA) 1974 and its subsidiary legislations, has set regulations to control erosion and sedimentation from construction and land development projects through the preparation and submission of Environmental Impact Assessments (EIAs) which requires the implementation of sediment control measures to minimize the environmental impact of their activities.

7. Protecting Coastal and Marine Ecosystems
   Malaysia's coastline and marine ecosystems are vital for tourism, fisheries and biodiversity. Sediment runoff from land-based activities, particularly construction and agriculture, can smother coral reefs, mangroves and seagrasses, threatening these important ecosystems.

In Malaysia, these issues are addressed through regulations and guidelines which project proponents and contractors must adhere to, ensuring that projects are implemented in a controlled manner. However, challenges and gaps in implementation remain, particularly for the projects in hilly terrains, steep slopes and linear developments as well.

Credit to: Fawwaz Media

Current Practices and Challenges

Most of the time, the Erosion and Sediment Control Plan (ESCP) are often designed for post-bulk earthwork phases, ie: after the completion of the design platform levels. While these plans are critical, they are often inadequate and lack the necessary depth for projects in challenging terrains. Contractors often find these plans impractical for immediate use upon site mobilization. For such scenarios, pre-bulk earthwork (pre-construction) ESCP are essential to address erosion and sedimentation risks based on the current topography.

For example, proposed sediment basins or silt traps are located

Credit to: Fawwaz Media

at cut or fill areas based on the final platform design. To make it worse, these ponds are located deep inside the project sites, requiring extensive land clearing to build access roads etc. These factors make it difficult for contractors to implement the ESCP in the early stages of the project, leading to the risk of untreated runoff discharge until the access is established. Addressing this gap is critical to ensure the sediment-laden run-off discharge is properly mitigated throughout the project.

Another common challenge is the lack of detailed method statements during the early phases of earthwork. Since site-specific conditions sometimes can only be fully assessed after land clearing begins, it becomes difficult to create ESCP plans that are immediately applicable.

Recommendations for Improvement

Budgetary Provisions

However, for Environmental Impact Assessment (EIA) Prescribed Activities, the Department of Environment's (DOE's) requirement for the formulation and implementation of the Land Disturbing and Pollution Prevention (LD-P2M2) measures can be used to guide Contractors to implement ESC measures that are practical and implementable for all phases of the works. Consultants that rely on the ESCP drawing provided by the Civil & Structural (C&S) consultant might be misguided as most of the time, the ESCP is typically designed by the C&S consultants just for the post-bulk earthwork phases. Hence, it is the responsibility of the EIA consultant to facilitate and have continuous discussions with the C&S Engineers to develop the pre-bulk ESCP accordingly. Although the final project design may not be 100% complete, a conceptual plan reflecting near-final conditions should be developed. This plan can serve as a reference during construction and help to estimate project costs more accurately.

One of a practical approach (already implemented in some projects) is for the project proponents to include a requirement in the tender contracts for the contractors to appoint a qualified professional engineer to prepare intermittent ESCP (including the pre-bulk earthwork) as soon as they are mobilized. These ESCP should be treated as a dynamic and live document which is required to be updated regularly to reflect real-time conditions and project progress. However, this updating work during transitional phase is inherently complex. It requires careful consideration and full cooperation of site personnel, as site conditions are often subjective. For sure, the cost of Best Management Practices (BMPs) or ESCP components must be accurately estimated in terms of costing during the tender stage to ensure they are fully accounted for in the initial contract.

Policy and Framework Enhancements

To address these challenges more systematically, stakeholders should advocate for these requirements to be formalized in guidelines or regulations. Project proponents should also include these measures in consultants' scope of works, providing adequate time for the preparation of comprehensive plans. Doing so would help project proponents better estimate the actual costs needed for construction and minimize unforeseen issues.

ESCP practices must continue to evolve through ongoing research and development to ensure the quality of the environment is preserved. With the increasing impact of climate change, including more frequent and intense rainfall, erosion and sedimentation issues must be addressed more closely and with practical, forward-thinking solutions.

Training and Competency Needs

The requirement for having ESC plans being designed by trained and competent personnel is seen to be a step in the right direction as it allows for efficiency and efficacy in design and implementation that is crucial for plans to be implementable. Having competent personnel at the site to supervise and ensure environmental protection works are proactive measures done to avoid expensive remedial works in the event of ESC failures is also key to the concept of self-regulation at sites. Having trained and competent personnel will be a primary focus of us moving forward in ensuring ESC measures at planning, design and implementation levels are effective and sustainable.

By strengthening current practices and fostering collaboration among stakeholders, the industry can minimize adverse environmental impacts of earthwork projects and move towards more sustainable developments in the Country.

Credit to: Fawwaz Media

Dialogue on MSMA - Part III: Erosion and Sediment Control & the ESCP for Urban Areas

Dato' Ir. Ahmad Fuad Bin Embi
Malaysian Stormwater Organisation (MSO)

The first edition of the MSMA manual in 2000 had four chapters out of 42, written on "Erosion and Sediment Control (ESC)". Now, why would ESC be an important factor in a manual on Urban Stormwater Management? This is what we will briefly examine in this Part III of our Dialogue. Especially on what progress we have made so far in this area and the obstacles encountered which have yet to be fully resolved.

1. What is the relevance of ESC in urban stormwater management?

Cities all over the world are characterized by large areas of man-made infrastructure - roads, drains, buildings, pavements and car-parks, which are impervious to stormwater. All these need to be carved out from greenery or previously forested surfaces, through intensive earthworks, which if not controlled will result in:

- Water Quality Degradation: sediment in runoff can carry pollutants like fertilizers, pesticides, and heavy metals into water bodies, harming aquatic life and degrading water quality.
- Habitat Destruction: Sedimentation can smother aquatic habitats, reducing oxygen levels and destroying ecosystems.
- Increased Flooding: Sediment buildup in waterways reduces their capacity, increasing the risk of flooding during heavy rainfall events.

2. What about damage to infrastructure and the costs involved?

Primarily the damage comes from:

- Clogged Drainage Systems: Sediment can clog storm drains, pipes, and culverts, leading to flooding and

which leads to Economic Costs from:

- Cleanup and Restoration: cleaning up polluted rivers and restoring damaged ecosystems can be very costly as shown by our "River of Life" project which cost Billions of Ringgit just to clean up a few kilometers.
- Infrastructure Repair: Repairing damaged infrastructure due to erosion and sedimentation can be expensive.
- Property Damage: Flooding caused by clogged drainage systems can damage homes and businesses.

In addition there are the Public Health Risks:

- Waterborne Diseases: Contaminated water can lead to waterborne diseases.
- Air Quality: Dust and particulate matter from erosion can contribute to air pollution, affecting respiratory health.

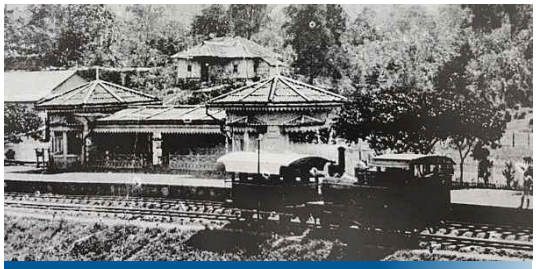
Sediment is well documented as the biggest polluter of waterways in the world.

3. Has there been any initiative in Malaysia to do ESC before the advent of MSMA ?

The British colonial administration left many records of ESC works in our country, but they were all meant to control extreme sedimentation from tin mining, which seriously damaged rivers in all the areas involved. Sg Lembing town in Pahang is one (see Fig.1).

Fig.1: Sungai Lembing, once the richest town in Pahang, was for a 100 years one of the largest producers of underground tin in the world, under PCCL (Pahang Consolidated Co. Ltd), with subterranean tunnels up to 600m deep and 10 km long and hallways 3 m high.

Fig.2: Kuala Kubu was a huge tin mining area with a large dam as a mining method for collecting tin ore at the bottom of the river.



Kuala Kubu town was inundated when the Ulu Selangor dam ruptured and flooded it. The British reconstructed a new town upstream, Kuala Kubu Baru (which remains today) and a new dam to contain sediment from the mines.

4. What about ESC for urban areas, as provided for in the MSMA manual?

ESC for urban areas is specifically targeted for earthworks involved in land development for housing, industry and other infrastructure in urban areas which can be very large as shown in the picture. These are more recent initiatives (1990s) due to the rapid growth of urbanization in cities all over the world. They were pioneered by an NPO (Non-profit organization) in the USA, that came up with "certifications" that gave those who passed their certification exams the seal of competency in ESC for construction sites.

CPESC (Certified Professional in Erosion and Sediment Control) was the first such NPO that produced manuals, training courses and conducted the exams. Over the decades since then, CPESC evolved into ECI (EnviroCert International) with some eight certifications (CESSWI, CPSWQ, CPISM, CPMSW etc) covering the fields of water quality, municipal stormwater management and so on. Another player in ESC is CISEC (Certified Inspector in Sediment and Erosion Control) which certifies inspectors in ESC. ECI has established affiliates in Canada, Australia and some 40 other countries, including Malaysia.

5. Why are these certifications necessary in addition to the BE and BSc engineering qualifications produced by universities all over the world?

This is the whole crux of the issue which presently is preventing the effective implementation of ESC. Whenever there is a sizeable earthwork on a construction site, there will have to be an ESCP (Erosion and Sedimentation Plan) which lays out the plan on how to control the earthworks, phase by phase, so that all erosion and sedimentation is controlled.

Unfortunately however, engineers do not study such subjects in their already crowded undergraduate courses. Soil erosion and soil conservation are topics taught in undergraduate degrees in agriculture, never in engineering. This is against a background of disastrous soil losses in the vast farming areas (think thousands of acres) of the American west, which necessitated such urgent countermeasures to be implemented by the farmers. And Erosion is a subject taught in geology courses. A reasonable knowledge of Hydrology is also required but most civil engineering courses only offer this as a minor option.

That is why engineers need to attend training programs and be certified before they can produce effective ESCPs. It is not much different from civil engineers having to attend courses and be certified in other specialized areas like hydrologic modelling before they can effectively model river catchments. These aspects are barely understood by the layman and those not familiar with ESCPs.

6. Has ESCP been effectively implemented in the country after 16 years?

Our Malaysian affiliate to ECI, the Malaysian Stormwater Organization (MSO), has managed to register more than 1000 inspectors in the CESSWI and CISEC programs to inspect earthworks in urban construction sites and especially EIA approved sites (under the DOE). The present impasse lies in the designers of the ESCPs - engineers who are supposed to design and supervise the plans to manage ESC on site. The Malaysian Board of Engineers (BEM) has refused to allow additional certifications (like CPESC) to be imposed on Professional Engineers to sign such ESCPs, in accordance with the Registration of Engineers Act 1967. Hence ESCPs are being signed by PEs with no competency in such designs. Which is why ESC in our present construction sites in urban areas is still not effective, and this is why sediment from such areas are still pouring out to the rivers and coastal areas.

Clearly the BEM decision to protect the interests of the small number of engineers who do ESCP is at enormous expense to the country and public who have to bear the heavy costs of increased flooding from our rivers, depletion of fish and aquatic life and loss of biodiversity. Is the BEM not clear that public interest is the main reason it was set up in the first place?

7. Is sediment from urban areas the biggest contributor to sediment in Malaysian rivers?

The huge amount of sediment load in the rivers of our highly urbanized Klang Valley are clear evidence of poorly controlled earthworks in the catchments. But the fact that most of our larger rivers like Sg Perak, Sg Kelantan and Sg Pahang are also badly sedimented, points to the presence of other larger sources of sediment: logging, agriculture (especially in highland areas), aquaculture, mining, plantation and highway construction. These undoubtedly contribute to much larger sources of sediment to our rivers as a whole, as can be seen from Figs.3 and 4.

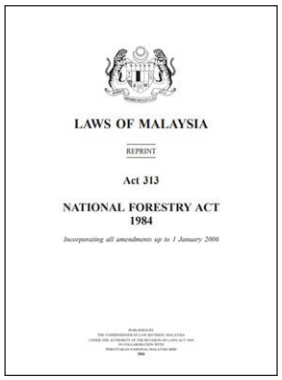
Fig.3: Vegetable farming in Cameron HIghlands (pic.1) choking up hydropower lake at Ringlet (pic.2) and Sand mining upstream of Sg Melaka (pic.3)

Fig.4: Peninsular logging (pic.1), HIghlands highway (pic.2) and disastrous sedimentation at a treatment plant from the highway construction (pic.3)

Our heavy tropical rains can quickly erode any exposed area of soil, and carry away large quantities of soil particles by surface runoff. There do not seem to be any attempt at ESC by the contractors involved in such activities. With regulators also in the dark about ESC measures, these activities will continue to severely pollute our rivers. Not only that, the topsoil that has taken thousands of years to build up in the forested catchments, are forever lost and will take thousands of years more to be restored. The forests have lost their sponge layer which used to absorb meters of heavy monsoon rainfall. Each heavy monsoon storm will now bring with it worse flooding than before - which explains why our large rivers are now more prone to large scale flooding in the monsoon season.

8. These other sectors should have their own respective regulatory bodies with relevant legislations. Why is it that we don't hear of miners, loggers or plantations being prosecuted for such wanton crimes against our water environment?

Those activities lie under the jurisdiction of regulatory bodies like the Forestry Dept, Mining Dept, Agriculture Dept and the HIghway Authority, who each have their own legislation which can address such serious pollution issues in their sectors. Unfortunately however, these legislations were drafted for the purpose of their own core activities. Logging contractors have to comply with logging regulations which are primarily aimed at controlling forestry priorities like tree species conservation. River pollution was never a key function of any of those departments concerned. Hence, penalties were not specified at all for water pollution in the legislations. When you don't have exact penalties prescribed, offenders cannot be taken to court. Hence the departments concerned cannot prosecute any of their contractors for such environmental crimes.


LAWS OF MALAYSIA

REPRINT

Act 313

NATIONAL FORESTRY ACT 1984

Incorporating all amendments up to 1 January 2006

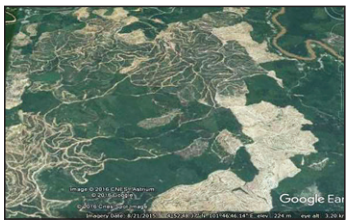
As an example, the National Forestry Act (Act 313) has only one clause under PART VII MISCELLANEOUS OFFENCES AND PENALTIES Section 83: Offensive Littering

83. (1) No person shall commit offensive littering in a permanent reserved forest. (2) Any person who contravenes subsection (1) shall be guilty of an offence and shall on conviction be liable to a fine not exceeding one thousand ringgit or to imprisonment for a term not exceeding six months or to both such fine and imprisonment.

This is the only safeguard in the forestry Act against environmental pollution! Littering! Not only is this totally outdated by 40 years in terms of penalties, but it totally disregards the destruction to forest rivers from the massive amount of sediment churned out by logging operations and logging trails.

9. Besides water pollution which destroys river ecology and biodiversity, what other consequences are there from these decades of neglect on ESC in our major river catchments?

Rivernet Consultants have done model simulations which clearly show the effects of the thousands of hectares of "Ladang Rakyat" on the upper catchment of Sg Kelantan.



Google satellite images of the catchment shows the extent of tree cover which has been stripped away from the catchment. Large areas of soil are exposed compared to nearby areas of green trees. Every heavy rainfall on these open areas will wash away whatever topsoil that remains until what is left is just compacted clay subsoil.

The thickly sedimented tributaries of Sg Kelantan are typified by Sg Berok coming down from Cameron Highlands, as shown in the picture. There is so much sediment in the river (estimated to be at 10,000 ppm concentration) that it is inconceiveable that there can be aquatic life in such waters.

2024 monsoon this year was also the worst on record in terms of people evacuated - the floods can only get worse with climate change kicking-in.

The clearing of the upper catchments of Cameron Highlands for vegetable farming has been going on since the 1950s. Heavy sedimentation of the lake at Ringlet reservoir has become an annual fixture requiring millions of Rgt to excavate every year.

10. Who then should be responsible to get these sectoral regulators to take responsibility for our deteriorating environment and start to prosecute river polluters in their industry?

The Ministry of Natural Resource and Environmental Sustainability (NRES) has several of these regulators like DOE, Fisheries Dept and the Mines Dept. Others like the Dept of Agriculture, the Highway Authority and the Plantations sector are under other ministries. Early 2023, the Academy of Science (ASM) tried to push for the creation of an Environmental Ombudsman (an ombudsman's role is to investigate and resolve complaints in a fair, impartial, and confidential manner) but it got nowhere.

ASM should be following up on such critical initiatives if we are to get our environment to improve to developed country standards. Our NGOs and public mentality seems to be at developing country levels, more preoccupied with materialistic matters.

Now that DID is under a new ministry - Energy Transition and Water Transformation (ETWT) , river pollution is an even more critical issue with the frequent water supply disruptions from river pollution! There is a stronger than ever case for DID (through ETWT) to push for NRES to put in the enforcement clauses and the heavy penalties for river pollution in the Forestry, Mining and Fisheries legislations, before moving on to other ministries.

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Tel: +6011-2685 6788
Email: marketing@gammascientific.com.my
www.gammascientific.com.my

Training of Trainers (ToT) Program – Ecohydrology and Applied Ecology

19th - 23rd August 2024

The Humid Tropics Centre Kuala Lumpur (HTC) under JPS organised 2 sessions of this ToT program between 12th August to 23rd August. MSO was represented in the second session between 19th August to 23rd August by Ir Sreedaran Raman, Ir Carine Koh and Ms Geetha P Kumaran. Professor Luis Chicharo, Dr Pawel Jarosiewicz and Dr Rahmah Elfithri from the University of Algarve Portugal, University of Lodz Poland and Division of Water Sciences of UNESCO-IHP respectively were the trainers for the sessions.

The Program was conducted via online by Presenters Dr Rahmah and Professor Maciej Zalewski while Professor Luis Chicharo and Dr Pavel did their sessions physically. The topics ranged from the basic principles of Ecohydrology and Applied Ecology including case studies on how this has been successfully implemented.

Putrajaya Wetlands, being the only Ecohydrology site presently acknowledged by Unesco in Malaysia, is a classic example of how Ecohydrology and Applied Ecology is successful in its objectives to achieve good management of water quality and quantity. The final day was a culmination of group presentations on the topics learnt and how it can be implemented on local Projects , a quiz and the official closing ceremony by YBhg. Dato' Ir. Rozman bin Mohamad, Deputy Director General (Specialist Sector) of JPS Malaysia. Overall, the participants gained in depth knowledge of the Subject matter and feel that implementing such principles in the Malaysian context is a very timely and effective way to ensure water quality and quantity management of our water bodies remain a top priority for the Country.

Empowering Erosion and Sediment Control: Innovative Tools for Efficient ESCP Design & Management

7th - 8th October 2024

The seminar titled **"Empowering Erosion and Sediment Control: Innovative Tools for Efficient ESCP Design & Management"** was jointly organized by MSO and ACEM. Held over two days, the event aimed to introduce a suite of innovative tools designed to transform the management of Erosion and Sediment Control Plans (ESCP).

The seminar's primary objective was to showcase the benefits of using advanced technology at every stage of the construction project lifecycle. Specifically, the tools were explored across four critical stages: Pre-Grading, During Grading, During Construction, and Post-Construction. Case studies were integrated throughout the seminar to highlight the practical advantages of these tools, demonstrating how they can significantly enhance the efficiency of the design, construction, inspection, and reporting stages of project development. Moreover, these case studies were intended to emphasize the importance of integrating environmental considerations into the ESCP management process.

Participants in the seminar were expected to gain a thorough understanding of these innovative tools and how they can improve the overall flow of construction projects. By learning about how new technology can revolutionize ESCP design, inspections, and reporting, attendees were provided with the opportunity to apply these tools to enhance their own projects. In addition to the practical knowledge gained from the case studies, participants were encouraged to engage with challenges, allowing them to apply their problem-solving skills and gain deeper insights into innovative project execution methods.

Malaysian Certified Inspector Sediment and Erosion Control (MY-CISEC) Training and Certification Examination

Years	Number of Participants	Date	Venue
2024	39	23 - 26 July 2024	Ibis Hotel, Kuala Lumpur City Centre
	36	21 - 24 October 2024	Dorsett Hotel Kuala Lumpur
	35	25 - 28 November 2024	Concorde Hotel, Kuala Lumpur

MY-CISEC Training and Certification Examination is a certification program in sediment and erosion control offered by **CISEC Inc.** This program provides participants with an understanding of sediment and erosion processes and how the discharge of pollutants associated with construction activities can impact the environment. In addition, the program educates, trains, and certifies multi-disciplined environmental professionals who serve both public and private clients, providing intelligent, responsible, and practical environmental compliance guidance.

During the three-and-a-half-day program, participants will cover topics such as rules and regulations, the role and background of an inspector, best management practices for inspections, and conducting construction site inspections. Participants will also have the opportunity to engage in exercises reviewing **Erosion and Sediment Control (ESC)** practices, learn how to write inspection reports, and present their findings.

Upon completion of the training course, participants will sit for a 3.5-hour certification examination on the final day, with instruction provided by Ir. Leong Kwok Wing, a licensed civil engineer in California since 1981; Mr. Cheong Hon Loong, an expert in environmental issues, erosion, and sedimentation risk assessment; and Ms. Wong Koh Yin, an engineer with the Department of Irrigation and Drainage (DID) Malaysia for 16 years, while representatives from DID Malaysia and the Department of Environment (DOE) will also speak on the program module related to rules and regulations The number of participants per session typically ranges from 35 to 40 registrants. To become a certified registrant, participants must pass the written examination. The passing rate for this certification program in 2023 and 2024 has ranged from 85% to 90%. Finally, after passing the certification examination for MY-CISEC, certified registrants must maintain their designation by renewing their certification annually with CISEC Inc.

23rd - 26th July 2024



21st – 24th October 2024







25th - 28th November 2024

The Concept and Design of Sabo Structures

6th November 2024

On November 6, 2024, the Malaysian Stormwater Organisation (MSO) conducted a one-day workshop on the concept and design of Sabo structures at Wisma IEM, Petaling Jaya. 43 participants attended the workshop, including MSO members, IEM members, and the MSO Executive Committee. Ir. Dr. Wong Wai Sam, the Director of Mega Consult Sdn Bhd, was invited as a speaker for the event.

The workshop aimed to introduce the concept of Sabo structures for controlling debris and sediment flows from headwaters, as well as the sizing and design of various components of Sabo Dam structures, with a case study included.

Sabo is a Japanese term which means Erosion and Sediment/ Debris Management. It consists of the Sabo Master Plan, Landslide Prevention Plan, Steep Slope Failure Prevention Plan, Avalanche Control and Impact Mitigation Plan, Comprehensive Sediment Disaster and Impact Mitigation Plan for Debris Flow, or a combination of these phenomena.

PROTECTING MALAYSIA'S HIGHLANDS: INSIGHTS FROM SOIL EROSION, RAINFALL STUDIES

Authors:

Assoc. Prof. Dr. Mohd Remy Rozainy Mohd Arif Zainol
River Engineering and Urban Drainage Research Centre (REDAC),
Universiti Sains Malaysia

Junaidah Abdullah
REDAC,
Universiti Sains Malaysia

Muhammad Zaki Mohd Kasim
REDAC
Universiti Sains Malaysia

Mohd. Fazly Yusof
REDAC
Universiti Sains Malaysia

Zakiyyah Binti Jasni
Department of Agriculture Malaysia

Mustadza Bin Shukor
Department of Agriculture Malaysia

Introduction

Malaysia's highland regions, such as those in Cameron Highlands (Pahang), Lojing (Kelantan), and Kinta (Perak), contribute significantly to the nation's agriculture and ecological balance. Fertile soils and high agricultural potential characterize these areas. However, they are increasingly under threat from soil erosion, driven by heavy rainfall and unsustainable farming practices. Soil erosion not only leads to the degradation of land quality but also contributes to sedimentation in downstream water bodies, impacting both agricultural productivity and environmental health. The growing impacts of climate change have further intensified these challenges, with extreme weather events exacerbating erosion and destabilizing highland soils. This situation underscores the urgent need for targeted research to understand the interplay between rainfall patterns, soil properties, and human activities in highland regions.

Figure 1: Soil Erosion at Lojing, Kelantan

This study, conducted by the Department of Agriculture Malaysia in collaboration with Universiti Sains Malaysia, seeks to address these concerns by investigating rainfall variability, soil erodibility, and erosion risks in Malaysia's highlands. The research also aims to propose sustainable mitigation strategies that integrate scientific findings with practical applications.

This study analyses rainfall variability and soil erodibility to understand their roles in driving soil erosion in Malaysia's highlands. The research assesses long-term rainfall data to identify trends, high-risk periods, and their direct impact on soil stability. It conducts comprehensive soil sampling and laboratory tests to classify soil types and evaluate their susceptibility to erosion under varying rainfall conditions.

Based on these findings, the study proposes sustainable mitigation strategies, including infrastructure improvements like contour drains and terraces, and sustainable agricultural practices such as cover cropping and minimal tillage. It also engages local farmers and communities to promote conservation practices that balance agricultural productivity with environmental sustainability. Finally, the study provides policymakers with evidence-based recommendations to guide the development of strategies for the long-term protection of Malaysia's highlands.

Figure 2: Sampling Point and Rainfall Station Map

By integrating data from multiple rain gauge stations and soil samples, the study provides an understanding of the challenges faced by these regions, shedding light on the interplay between natural factors and human activities.

Figure 3: Site Sampling

Rainfall Analysis

Rainfall data from 15 stations covering the years 2000 to 2023 revealed significant trends. Annual rainfall variability was notable, with Lojing experiencing rainfall ranging from 2,436 mm to 3,455 mm and Kinta recording an average of 3,040 mm in 2023 alone. This variability underscores the need for location-specific strategies to manage water resources and mitigate erosion.

High-risk periods were identified, particularly in November, December, and January, when rainfall intensity and frequency peaked. These months present heightened risks of soil displacement due to prolonged and heavy downpours. Moreover, certain stations recorded daily rainfall peaks exceeding 140 mm, a stark reminder of the potential for severe runoff and erosion during extreme weather events.

Soil Composition and Erodibility

Soil samples were collected from multiple sites and subjected to detailed laboratory testing. The results revealed that 52% of the samples were classified as sandy loam, while the remaining 48% were identified as loamy sand. Both soil types are known for their susceptibility to erosion under intense rainfall conditions.

Alarmingly, all the soils analysed were deemed critically erodible. This finding highlights the fragile nature of highland terrains and the urgent need for robust soil conservation measures. Without intervention, the combination of high rainfall and erodible soils could lead to severe environmental degradation, threatening agricultural productivity and biodiversity.

Figure 4: Soil Sampling Activities

Figure 5: Laboratory Work

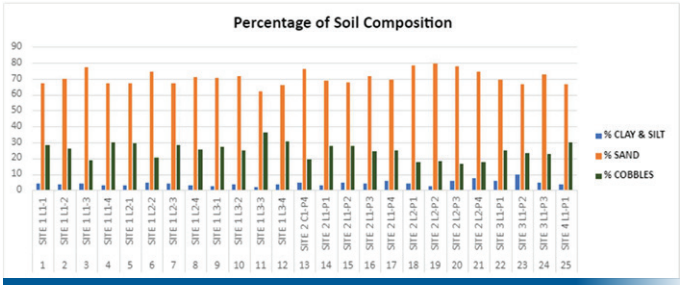

Figure 6: Percentage of Soil Composition

Proposed Mitigation Strategies

To address these challenges, the study outlines a series of recommendations:

- Infrastructure Improvements: The construction of contour drains and terraces is important to managing water flow and reducing erosion. Additionally, installing sediment traps can help capture runoff sediments, preventing them from being washed away and degrading water quality downstream. Stormwater management systems such as retention basins and permeable pavements can also contribute a significant role in reducing the velocity and volume of water runoff.

- Agricultural Best Practices: Farmers are encouraged to adopt minimal tillage techniques and cover cropping to preserve soil structure and enhance its resilience to erosion. Crop rotation is also recommended to distribute land use pressures and maintain soil fertility. Additionally, incorporating stormwater harvesting into agricultural practices can help optimize water use and minimize runoff.

- Community Engagement: Educating farmers and local communities about sustainable practices is important. Workshops and participatory conservation programs can empower stakeholders to take an active role in preserving their environment. Encouraging the adoption of stormwater management techniques within communities can further amplify efforts to reduce erosion and safeguard resources.

Future Implications

The insights from this study emphasise the urgent need for integrated solutions to protect Malaysia's highland regions. By considering sustainable stormwater management and agricultural practices, Malaysia can protect these critical ecosystems for future generations.

Stormwater management is essential for preventing erosion, maintaining water quality, and mitigating flood risks. Acting now not only addresses immediate risks but also positions Malaysia as a leader in balancing development with environmental management. The findings from this research encourage policymakers, researchers, and communities to collaborate in building a resilient and sustainable future.

For further details or to collaborate on similar initiatives, do not hesitate to contact the Department of Agriculture Malaysia or Universiti Sains Malaysia. Together, we can ensure the protection of Malaysia's highlands.

DEBRIS FLOW: SABO INFRASTRUCTURE AS MITIGATION APPROACH

Authors:

Ir. Liew Yuk San
National Water Research Institute of Malaysia (NAHRIM)

Ir. Ts. Gs. Dr. Safari Mat Desa
NAHRIM

Introduction

Heavy rainfall was observed on August 18, 2021 in the northern part of Peninsular Malaysia, affecting states of Perlis, Kedah, Penang, and Perak. Rainfall station at Mount Jerai and Kampung Singkir Genting had recorded 281 millimetres and 172 millimetres respectively. In a span of 60 minutes, the most total rainfall measured was 91 mm. According to the data recorded by Department of Irrigation and Drainage (DID), the rainfall surpassed the Average Recurrence Interval (ARI) of 50 years at 6:00 pm on August 18, 2021. The highest point was measured at 8:00 pm, surpassing a 70-year average rainfall event with a total of 270 mm. The Department of Mineral and Geoscience (JMG) also noted unusual intense downpour in a brief duration near Mount Jerai, Yan, Kedah, starting at 2:30 pm. The Isohyet map in Figure 1 shows the 7-hour maximum rainfall around Mount Jerai on August 18, 2021.

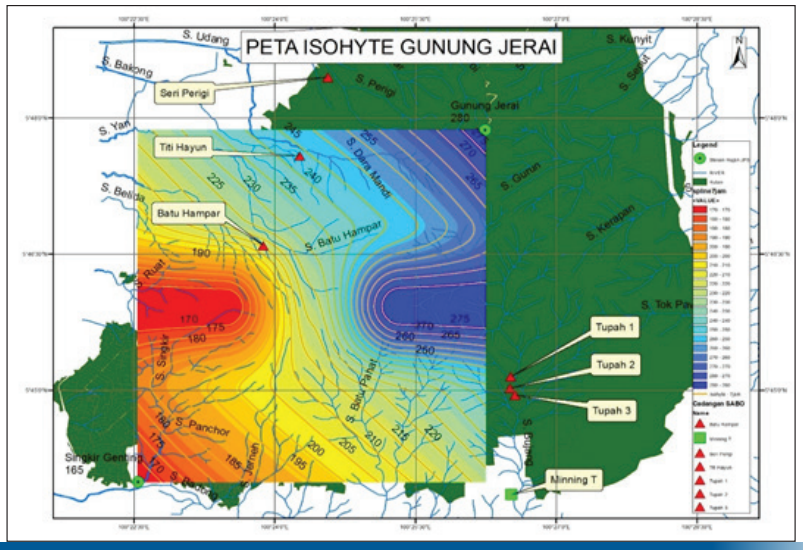

Figure 1: Isohyet map for 7-hour maximum rainfall around Mount Jerai on August 18, 2021 (Source: NAHRIM, 2021)

Consequently, Yan and Kuala Muda districts were hit by debris flow near Mount Jerai, causing significant damage to popular tourist destinations including Titi Hayun Recreational Forest, Batu Hampar Recreational Park in Yan District, and Tupah Recreational Forest in Kuala Muda District. The event occurred due to a sudden increase magnitude of waterfall near Mount Jerai, resulting in mud floods in Kuala Muda and Yan measuring between 0.1 to 0.3 meters and 0.2 to 1.5 meters respectively. Debris mainly from geological shift, landslide, boulders and log has obstructed the river crossings, thus inundated into neighboring communities such Kampung Tupah and Taman Tupah. The debris flow resulted in 6 fatalities, the evacuation of 258 individuals from 72 households, and losses amounting to RM75 million (JMG, 2023). Figure 2 depicts basic geological data, as well as landslides and debris flow occurrences at Mount Jerai. Figures 3 to 4 display images of the mud flow at the disaster location. The impacted areas consist of the foothills of the mountain and the surrounding river areas, such as Seri Perigi, Teroi Bukit, Singkir, Kampung Permatang Keramat, Kampung Lubok Boi, Pekan Yan Besar, Titi Teras, Kampung Acheh, and Kampung Setol. Figure 5 demonstrates the contrast between the situations in Hutan Lipur Titi Hayun, Yan District, Kedah, both before and after the mud flood.

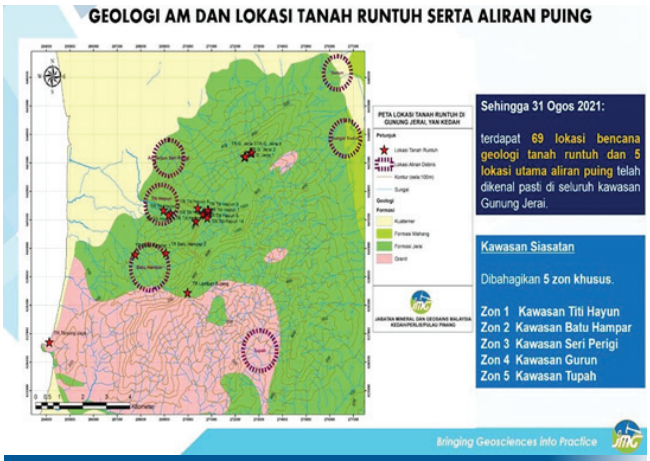

Figure 2: General Geological Data, Landslides and Debris Flow at Mount Jerai (Source: JMG, 2021)

Figure 3: The Debris Flow Situation at the Disaster Location (Source: DID, 2021)

Figure 4: The Debris Flow Situation at the Disaster Location (Source: DID, 2021)

Figure 5: Comparison between the Situations Before and After the Mud Flood in Titi Hayun Recreational Forest, Yan District, Kedah (Source: NAHRIM, 2021)

Sabo Infrastructure- Debris Flow Mitigation Measures

A technical working group comprising agencies such as DID, JMG, and NAHRIM has been established to observe the site and develop measures to reduce the impact of debris flow at Mount Jerai. After several meetings and discussions with stakeholders, NAHRIM has reinitiated the implementation of Sabo Technology, originally proposed for Mount Kinabalu in the year 2018, to be implemented at Mount Jerai. This is to reduce debris flow and minimize its downstream impact. NAHRIM was also assigned to help DID in developing suitable conceptual designs for Sabo Infrastructures in Yan and Kuala Muda District. Figures 6 depicts the Site Visit conducted by NAHRIM and DID Kedah to Yan District and Kuala Muda, Kedah on 27 to 28 August, 2021. This technical visit aimed to assess the potential for building Sabo Infrastructure at various locations where recent debris flows occurred.

Sabo comes from the Japanese words “Sa” and “Bo,” indicating activities to control erosion and sediment in mountainous regions to shield people and structures in lower areas from erosion and sedimentation calamities. Japan has constructed over 50,000 Sabo facilities since 1897 to combat around 1,000 cases of erosion and landslides annually (Nishiyama et al., 2017). Countries like Nepal, the Philippines, and Indonesia have also utilized Sabo Infrastructures to effectively manage debris flows, thus improving safety and resilience to volcanic disasters (Adhikari, 2008; JICA, 2010; Kompas.com, 2020). The term “Sabo Works” is used to describe the system for protecting mountainous areas. This system consists of small, medium, and large buildings that cover tactics in integrated watershed management (Chanson, 2004).

Sabo Technology, established in Japan in 1897 with the Sabo Act, will be implemented for the first time in Malaysia to prevent debris flow at Mount Jerai. Sabo Infrastructure construction in Kedah will effectively manage debris flow from Mount Jerai, capturing rocks, boulders, sediment, and mud from Yan and Kuala Muda areas. This will lower the chances of property damage, infrastructure destruction, and loss of life caused by debris flow events.

Since October 2021, DID has initiated the design and construction of Sabo Infrastructures at two (2) sites near Mount Jerai namely Titi Hayun Recreational Forest and Bujang River, Tupah 1 at the SADA Water Treatment Plant. The Sabo Infrastructure at Titi Hayun Recreation Forest was completed in June 2023 and displayed in Figure 7.

Figure 6: Site Visit by officials from NAHRIM and DID on August 28, 2021 (Location: Puteri Mandi Waterfall, Yan District, Kedah)

Figure 7: Sabo Infrastructure at Titi Hayun Recreation Forest (Source: NAHRIM, 2023)

Way Forward

In addition to the Sabo infrastructures, other mitigation measures must be established for a comprehensive and efficient debris flow management system. The summary of these measures are as follows according to NAHRIM (2021):

a) Establishing an integrated management and monitoring plan for managing debris flow incidents in eco-forest parks and state forest parks through:
   i. Installation of warning signboards for debris flow incidents in recreational areas of Eco-Forest Parks and State Forest Parks.
   ii. Installation of a suitable real-time prediction and warning system in Eco-Forest Parks and State Forest Parks.
   iii. Installation of monitoring systems such as soil movement sensors and Closed Circuit Television (CCTV) for early detection in critical areas.
   iv. Development of a Debris Flow Forecasting and Warning System.
   v. Formation of a Task Force Group for collective and integrated monitoring of debris flow incidents.

b) Designing Search, Rescue, and Evacuation Plans during debris flow incidents in Eco-Forest Parks and State Forest Parks according to the priority of tourist and local resident safety.

c) Data sharing to streamline research projects and optimize study outcomes with smart collaboration with National Disaster Management Agency (NADMA), DID, JMG, Malaysian Space Agency (MySA), Forestry Department of Peninsular Malaysia (JPSM) and related State Government.

Conclusion

Implementing Sabo infrastructure at Mount Jerai is a crucial measure to reduce the risk of debris flows. The infrastructure of Sabo Infrastructures strategically placed aims to reduce the impact of debris flows in surrounding areas such as Yan and Kuala Muda, Kedah by trapping rocks, boulders, sediment, and mud during heavy rainfall events. Implementing this proactive measure not only safeguards lives, properties, and infrastructure but also boosts communities' resilience against natural disasters in mountainous areas susceptible to flash floods and debris flows, demonstrating the efficacy of Sabo technology. Furthermore, setting up a comprehensive management and monitoring strategy for debris flow that includes search, rescue, and evacuation plans can help reduce the impacts of upcoming debris flow incidents.

References

Adhikari, B. R. (2008). Application of SABO Technology to Control Debris Flow and Landslides: Experience from Mugling-Narayanghat Highway Disaster, Asian Disaster Reduction Conter March 2008. Retrieved August 27, 2021, from https://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-2008e/6.Nepal.pdf

Chanson, H. (2004). Sabo Check Dams: Mountain protection systems in Japan. International Journal of River Basin Management. Vol. 2. 4 (2004). Pp: 301-307. Retrieved August 27, 2021, from http://staff.civil.uq.edu.au/h.chanson/sabo.html

Department of Irrigation and Drainage Malaysia (DID). (2021). *Laporan Kejadian Banjir 18 Ogos 2021 di Yan/ Kuala Muda, Kedah.*

Department of Mineral and Geoscience (JMG). (2023). *Bahaya Aliran Puing dan Kepala Air.*

Japan International Cooperation Agency (JICA). (2010). Sabo Dam Pilot Project. Retrieved September 1, 2021, from https://www.jica.go.jp/project/english/philippines/0600933/news/general/100616.html

Kompas.com. (2020). *Mengenal Sabo Dam, Solusi Penanggulangan Banjir Lahar Gunung Merapi*. Retrieved August 27, 2021, from https://www.kompas.com/tren/read/2020/11/22/190500965/mengenal-sabo-dam-solusi-penanggulangan-banjir-lahar-gunung-merapi-?page=all

National Water Research Institute of Malaysia (NAHRIM). 2021. *Slaid Pembentangan Webinar Perhutanan: Kejadian Kepala Air: Kaedah Mengatasi dan Hala Tuju Penyelidikan. 21 September 2021.*

Nishiyama, K. (2017). Outline and Future Strategies Sabo Works in Japan. Technical Conference on Sediment Disaster Risk Management, Japan-Austria. 18 May 2017.

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MANAGING URBAN FLOODS THROUGH CATCHMENT REHABILITATION

Authors:

Najihah Kamaruzzaman
River Care Sdn. Bhd.

Ir. Ts. Dr. Abd Jalil bin Hassan
River Care Sdn. Bhd.

Dato' Ir. Ahmad Fuad Embi
River Care Sdn. Bhd.

1. Introduction

Urbanization significantly increases peak flood discharges. This is a well-established facet of urban hydrology observed all over the world. The two main characteristics of urbanization that increase peak discharges are:

- **Increase in impervious areas which leads to the increase in runoff volume, leading to more frequent flash flooding.**
- **Reduction in times of concentration of sub-catchments due to channelization of drainage routes which shifts the 'critical storm' into much shorter rainfall durations with higher intensities, with the consequent sharp increase in runoff.**

Studies have shown that catchments with 100 % natural greenery as ground cover will only have about 10% of storm precipitation converted to surface runoff. In contrast, urban catchments with 75-100 % of impervious cover (from urbanization) can result in 55% or more, of the storm precipitation being converted to surface runoff.

Sungai Klang has implemented numerous flood mitigation efforts centered on structural measures, including the construction of bunds, widening river channel, diversions and SMART Tunnel. This paper highlights non-structural solutions, emphasizing the concept of catchment rehabilitation as a means of reducing surface runoff and hence, rampant flash floods in the Sungai Klang basin.

2. Deterioration of Soil Infiltration Rates in Urban Catchments

The Soil Conservation Service (SCS) Curve Number (CN) method is a model that estimates surface runoff from rainfall. The CN represents the relationship between rainfall and runoff depth. The number is based on the soil's hydrology, land use, management, and antecedent moisture content.

Stormwater runoff from a catchment depends on soil characteristics. There are four soil classes applicable when using the SCS-CN method. Lower CN indicates that runoff rates are lower, when there is more infiltration into the soil.

Figure 1: Double Ring Infiltrometer Test

To assess surface runoff in various parts of the Sg Klang catchment, soil infiltration tests which is called Double Ring Infiltrometer Test were conducted on different land use all over the catchment (See Figure 1). It does not control factors such as soil type and soil moisture.

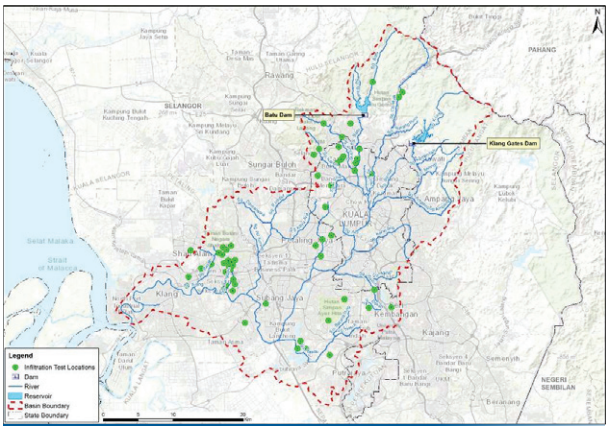

Figure 2: Soil Infiltration Test Locations in the Study Area

Figure 3 shows the box-whisker plots of infiltration rates based on land use. Forest has very high infiltration rates with a mean of 143 in/hr and a median of 118 in/hr. The maximum value obtained is 472 in/hr. The median value for all other land use (apart from forest) is less than 3 in/hr with a mean of less than 15 in/hr. There are a few locations in the 'non-forest' category however, that have high infiltration rates of more than 40 in/hr such as of agricultural, recreational, and roadside, but these are exceptions to their general land use infiltration rates. For green areas around roundabouts, the infiltration rates are very small, at less than 1 in/hr. This can be explained by the laterite (clay) generally used as fill material at local construction sites, without the addition of topsoil, which is difficult to obtain.

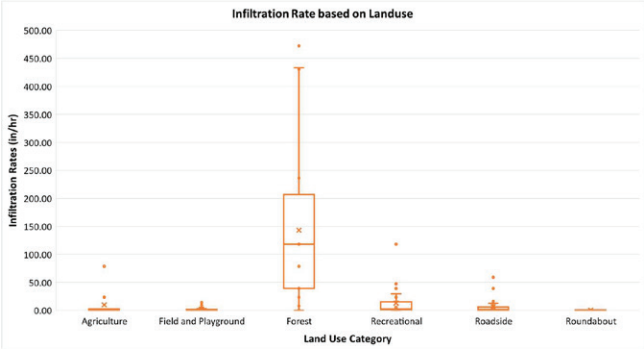

Figure 3: Infiltration Rates based on Land Use

The total number of sites tested for infiltration rates-based on land use are shown in Table 1.

Table 1: Number of Samplings based on Land Use

Land Use	Number of Sites Tested
Agriculture	11
Recreational/Field/Playground	57
Forest	20
Grassland/Bushes/ Roadside/ Roundabout	33
Total	**121**

The soil group classification based on the infiltration rate can be obtained from the National Engineering Handbook – Part 630 Hydrology by USDA as given in Table 2 . The infiltration rates for each soil group indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting.

Table 2: Soil Groups and Infiltration Rates

Soil Group	Infiltration Rate (in/hr)
A	> 5.67
B	≤ 5.67 to > 1.42
C	≤ 1.42 to > 0.14
D	≤ 0.14

shows the value of CN under existing and "designed" conditions. "Designed" conditions are when the soil is treated to enable optimum infiltration rates to be achieved.

Table 3: Existing and After Rehabilitation CN

Land Use	Soil Group	Adopted Group	Existing CN	Designed CN
Agriculture	A, D	A	75	75
Cleared Land	A, C, D	C	76	76
Recreational Field and Playground	A, B, D	C	65	60
Commercial	B	B	92	92
Forest	A	A	60	60
Grassland/ Bushes • Roundabout • Roundabout	A, C, D	C	70	65

Based on the relative results of the infiltration tests, areas where infiltration rates have deteriorated are at roundabouts, roadsides, fields, and playgrounds where the soils have undergone compaction, and the grass is poorly maintained. Hence, the type of land use to be targeted for soil rehabilitation are cleared land, recreational areas, grassland / bushes.

2.1 Potential Runoff Reduction

The catchment area for Upper Klang is 545.7km^2 and about 16.2km^2 can be potentially rehabilitated (Refer to Figure 4). This upper catchment was simulated for existing conditions versus rehabilitated catchment conditions under various ARI (2, 5, 10, 20, 50 and 100-year) using storm durations from 0.5 to 12 hours. Figure 4 shows the percentage difference between runoff for the different durations and ARIs.

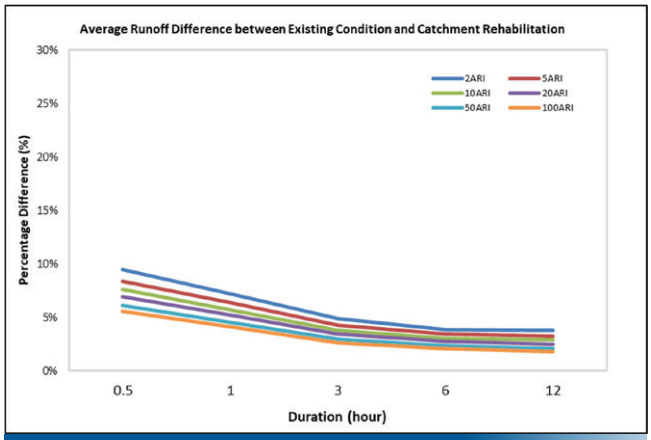

Figure 4: Percentage Difference in Runoff between Existing Conditions and Rehabilitated Catchment Conditions

From the graph, it can be seen that short duration storms have higher percentage runoff difference compared to longer duration storms. Low ARI storms have a higher percentage runoff difference compared to high ARI storms, irrespective of the duration.

The analysis shows that catchment rehabilitation reduces catchment runoff irrespective of ARI and storm durations, which of course should be the case. The proposed "catchment rehabilitation" involves an increase in vegetation and soil infiltration (through topsoil restoration), all of which should result in a decrease in runoff. The percentage runoff difference differs depending on the overall catchment characteristics and the percentage of catchment area rehabilitated. The heavily urbanized sub-catchments in the upper areas of Sg Klang just do not have large areas of greenery left which can be "rehabilitated" to increase their greenery and soil infiltration. While their impact may be small for main river flooding however, they will significantly reduce localized flash floods, for the reason that they will form a large percentage of the small and localized sub-catchments.

3. Non-Structural Measures (Nsm)

NSM essentially aims at restoring natural flood control mechanisms in the catchment which have been compromised by development. The merging of development areas grows into urban areas, which are mostly impervious surfaces which cannot infiltrate stormwater into the ground like before, leading to large increases in surface runoff and flash floods. The concept of Sustainable Urban Drainage Systems (SUDS) or Sponge Cities or Low Impact Development (LID), as they are variously called in other parts of the world, is to build up the infiltration capacity of the soil to absorb rainwater and put back the natural delay mechanisms to runoff in the catchment. The direct way to improve the infiltration capacity of urban catchments is to rehabilitate the soils in their green areas, mulching with fibrous material like paddy husks or stalks, or cane sugar stalks and adding to the mix, compost as nutrients to the soil to increase the density of trees and greenery in the whole catchment. The components in catchment rehabilitation are:

- **Reform of Maintenance Practices for Green areas**
- **Soil Rehabilitation in Green areas of cities**
- **Reforestation with Tree Planting using Miyawaki Method for example**
- **Green Roofs and Vertical Green**

Studies have shown that catchments with 100 % natural greenery as ground cover will only have about 10% of storm precipitation converted to surface runoff. In contrast, urban catchments with 75-100 % of impervious cover (from urbanization) can result in 55% or more, of the storm precipitation being converted to surface runoff.

Sungai Klang has implemented numerous flood mitigation efforts centered on structural measures, including the construction of bunds, widening river channel, diversions and SMART Tunnel. This paper highlights non-structural solutions, emphasizing the concept of catchment rehabilitation as a means of reducing surface runoff and hence, rampant flash floods in the Sungai Klang basin.

3.1 The Importance of Topsoil in Soil Rehabilitation

Topsoil, rich in organic matter and microorganisms, supports plant growth by providing vital nutrients and is the site of most biological soil activity. Before planting, especially with methods like the Miyawaki method, proper pH and nutrient levels suitable for specific tree species should be ensured. Topsoil plays a crucial role in supporting plant growth by improving drought resistance, retaining moisture to reduce evaporation, and ensuring plants have water during dry periods. It enhances plant health by delivering nutrients and oxygen to roots, promoting solid root systems, better drainage, and reduced erosion. Additionally, topsoil naturally contains nutrients and helps retain added fertilizers or organic matter, further enriching the soil for optimal plant development.

3.2 Soil Amendment Materials

Soil amendment involves adding materials like peat, wood chips, or compost to improve soil properties such as water retention, drainage, and aeration, creating a better environment for plant growth. Thorough mixing is essential to prevent layering and ensure root development. Soil amendments enhance soil properties and support plant growth in various ways. Paddy husks make soil loose and airy, aiding oxygen uptake and providing effective weed control. Coco chips improve aeration and moisture retention while adding nutrients and suppressing weeds. Charcoal stabilizes soil, retains nutrients, improves drainage, and enhances microbial activity, with long-lasting effects due to its high stability. Compost enriches soil with nutrients, improves structure, and can be used as mulch or incorporated into the soil for lasting benefits.

4. Potential Green Areas in Sg Klang Catchment Which Can Be Rehabilitated

Areas with potential for soil rehabilitation in Upper Klang were identified through GIS. The area involved is about 16.2 km2, or 3% of total catchment area. Figure shows the potential areas for soil rehabilitation. These include green areas such as roundabouts, playgrounds, roadsides and recreational areas.

5. Comments

The two-year review study on river flooding in the Sungai Klang catchment highlights that most structural measures have already been extensively explored. Integrating non-structural measures is crucial as we prepare for more frequent extreme storms due to climate change. Despite their costs, these measures offer long-term benefits in resilience, sustainability, and adaptability, making them a valuable investment.

Collaborative efforts between relevant authorities and stakeholders will be key in implementing such measures. While the Department of Irrigation and Drainage (DID) continues to focus on improving channel capacity to accommodate higher flows, local authorities (LAs) can play a critical role in reducing runoff from the catchment. Initiatives such as rehabilitating remaining green areas, promoting sustainable urban drainage systems (SUDS) and improving grass maintenance practices to enhance soil infiltration will significantly contribute to these efforts.

Catchment rehabilitation on green areas if carried out properly will reduce runoff for short duration storms which cause flash floods. This approach requires better understanding on improving soil properties and the use of topsoil. Local authorities will have to be trained and made more aware of the importance of such measures.

Catchment rehabilitation should be part of the new concept of Sponge City and Low Impact Development (LID) where runoff is controlled at source.

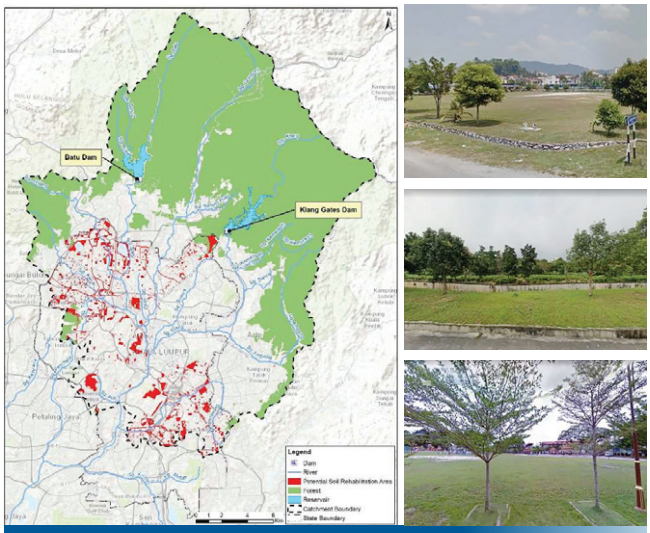

Figure 5: Potential Soil Rehabilitation areas for Upper Klang Catchment

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