

# **Role of MSMA in Promoting Sustainable Urban Drainage Systems in Malaysia**

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## **Abstract**

The Urban Stormwater Management Manual for Malaysia (MSMA) is a guideline published by the Department of Irrigation and Drainage Malaysia (DID) in 2000 to indulge the long term nationwide directions and needs in ensuring sustainable urban drainage systems are fully utilized. Concurrently, the Cabinet gave full approval and directive for this manual to be referred and followed by every development project starting from 1<sup>st</sup> January, 2001. The manual enables overarching issues like flash flood, excessive sediment outflow and water quality deterioration generated by any land opening activities are controlled within its own project boundaries.

The emphasis on the control at source techniques proposed by MSMA could be divided into three main items, which includes water quantity control, erosion and sediment control, and water quality control. Water quantity control is measures to curb post construction flash flood problems while erosion and sediment control is measures to minimize erosion and sedimentation problems during construction stage. The final item, which is the water quality control; measures intended to reduce post construction non-point source pollution problems.

This paper intends to scrutinize the evolution of MSMA as a focal urban stormwater management guideline in Malaysia and share the milestones faced in promoting and implementing it. The paper also elaborates some of the success stories achieved since the last 8 years of implementation while outlines some of the strategic directions and action plans required to cushion any unprecedented debacles through practical and sound engineering practices so that MSMA will hold itself as a prime reference in Malaysia for all stakeholders i.e. the public and private sectors.

Keywords: Control at source, water quantity control, erosion and sediment control, water quality control, enforcement activities and strategic directions

## **Introduction**

Since 20 to 30 years ago Malaysia's pace of development is unimaginable. Towering structures, airports, highways and railways, massive industrial and housing estates are just some parts of on going natural landscape alteration processes. With yearly precipitation between 2000~3000mm, the degree of excess runoff generated from these areas is tremendous. Flash flood, scenes of garbage flowing into rivers and silts generated from on going and abandoned construction areas are some common views causing severe damages to natural river system and its habitat.

To tackle these problems, the Government embarks programs like Clean Our River Campaign since 1993 to discourage people from throwing rubbish in rivers, streams and drains; followed by the establishment and utilization of MSMA in Malaysia in 2001. In a matter of few years, eco- friendly stormwater management facilities as proposed by MSMA become compulsory

yet popular among the public especially potential buyers. Value added infrastructures that support the livelihood of urban community become future development trend. This induces stormwater management facilities to be compulsory structures; proudly visualized among various urban infrastructures.

## **Background**

MSMA has been introduced as a replacement of the previous Urban Drainage Design Standards and Procedures for Peninsular Malaysia, published in 1975. The manual emphasizes on control at source strategy with in depth explanation on water quantity control and water quality control through best management practices (BMPs). Besides enabling all new development areas to practice sound erosion and sediment control techniques through the implementation of Erosion and Sediment Control Plan (ESCP), MSMA is also meant to ensure peak discharge generated by extra runoff should align according to the downstream river capacity. In this respect, the extra discharge to be released by any developed area should be contained within that compound itself especially during peak flow. Once the flood recedes the extra volume accumulated could be released towards the downstream section without affecting the livelihood of the downstream community.

Immediately after launching, the 1<sup>st</sup> phase of MSMA focuses on the water quantity control agenda where requirements are instilled within all Drainage Layout Plans submitted by developers. Two (2) years later in 2003, the 2<sup>nd</sup> phase of MSMA was initiated where DID started to promote the Erosion and Sediment Control Plan (ESCP) as part of Earthwork Plan. In this respect, all development projects have to submit ESCP to ensure earthwork does not pose unnecessary threat to receiving water bodies. This is followed by the 3<sup>rd</sup> phase of MSMA where post construction water quality control measures were emphasized utilizing treatment control facilities like gross pollutant traps (GPTs), constructed wetlands, engineered waterways, fat oil and grease traps (FOGs), infiltration facilities, bio-retention facilities, sediment forebays, swales and etc.

Furthermore, DID as the focal department promoting MSMA initiates extra role through retrofitting exercises to ensure rapid disposal facilities are converted to eco-friendly stormwater facilities. This exercise involves heavy financial needs and investment; hoping by 2020 this program shall visualize its own and unique success stories. In terms of training and awareness, more than 10,000 stakeholders have attended conferences, seminars, workshops and courses that are related to MSMA consists of professional like engineers, planners and architects from Government Agencies as well as consultants, developers and contractors.

Until today, DID still faces obstacles in promoting MSMA especially in terms of maintenance of completed stormwater facilities. With more than 2000 detention ponds already constructed by developers, the amount of funds required for maintenance program is tremendous. To avoid any negative perceptions, DID embarks special exercises where detailed cost benefit analysis was conducted. Consequently, the economic analysis shows that these detention ponds are saving billions of tax payer's money due to the fact that without these stormwater facilities, the public will have to finance more towards unnecessary flood mitigation works. On the yearly basis, the ratio of saving is four to one (4:1).

### **Water quantity control**

Stormwater management in Malaysia has traditionally focused primarily on managing the impacts of flooding by adopting *conveyance-oriented approach*. Stormwater systems designed in accordance with this approach provide for the collection of runoff, followed by the immediate and rapid conveyance of the stormwater from the collection area to the point of discharge in order to minimise damage and disruption within the collection area. Stormwater runoff is viewed as a nuisance to be disposed of as quickly and efficiently as possible.

Until recently, stormwater management has developed to the point where there are now two fundamentally different approaches to control the quantity, and to some extent, the quality of stormwater runoff. In addition to the traditional *conveyance-oriented approach*, a potentially effective and preferable approach to stormwater management is the *storage-oriented approach*. The function of this approach is to provide for the temporary storage of stormwater runoff at or near its point of origin with subsequent slow release to the downstream stormwater system or receiving water (detention), or infiltration into the surrounding soil (retention). This approach can minimise flood damage and disruption both within and downstream of the collection area. Runoff may also be stored for re-use as a second class water supply for irrigation and domestic purposes. The principal elements and techniques used in a *storage-oriented* system are stormwater detention facilities and retention facilities like *on-site storage*, *community storage* and *regional storage*.

Retention facilities are also utilised and designed to reduce the volume of stormwater runoff from small frequent storm events by storing collected runoff and allowing it to infiltrate into the surrounding soil. Retention is a suitable technique for infiltrating pre-treated runoff into areas with relatively high permeability soils. Pre-treatment by filtering to remove coarse sediment and debris is necessary to minimise blockage of the infiltration media. Regular maintenance is also essential for their effective operation.

### **Water quality control**

The primary objective of stormwater quality control is to achieve good water quality standards released from completed development project. The activities outline in this program is based on three types of best management practices (BMPs).

**Housekeeping BMPs:** Housekeeping BMPs are techniques that aim to change human behaviour to reduce the amount of pollutants that enter stormwater systems by targeting the control and/or prevention of pollution at its source. These techniques are:

- community education and participation activities;
- management activities, such as landuse planning and development control;
- operations and maintenance activities, such as garbage collection and street sweeping, and
- improved site planning and management.

**Source Controls BMPs:** Source controls BMPs are those practices that tend to keep both runoff and pollutants contained at their source. These include pervious areas and buffer strips towards which runoff is directed, infiltration controls, porous pavement, erosion and sediment control plan (ESCP), which include the submission and compliance to the approved plans and etc.

**Treatment Controls BMPs:** To protect the quality of local streams, lakes, and river systems, a number of treatment controls BMPs may be adopted as follows:

- the establishment of lakes, primarily as biological treatment systems;
- the utilisation of water quality control ponds and wetlands, as physical and biological treatment systems, upstream of lakes;
- the incorporation of gross pollutant traps on inlets of lakes and water quality control ponds and wetlands to intercept trash and debris and the coarser fractions of sediment, and
- the incorporation of 'off-stream' sediment basins into land development to intercept (and chemically treat if necessary) runoff prior to its discharge to stormwater systems.

### **Erosion and sediment control**

Erosion and sediment control (ESC) activities during construction works is based on the preparation of Erosion and Sediment Control Plan (ESCP). Accordingly, six principles of ESC are governed, which include 1) Planning Considerations, 2) Vegetative Stabilization, 3) Physical Stabilization, 4) Diversion of Runoff, 5) Flow Velocity Reduction, and 6) Sediment Trapping/Filtering. Some of the ESC measures outline in the ESCP are topsoil stockpile, preserve vegetations, seeding and planting of vegetations, mulching, stabilization, earth bank, diversion channel, slope drain, outlet and inlet protection, check dam, sediment fence, sand bank barrier, brush or rock filter, sediment trap and basin.

The utilization of ESCP for developed areas becomes compulsory since October 2005 after being endorsement by the National Council for Local Government. In short, every development project that is more than 1 hectare has to submit ESCP and Earthwork Plan together to DID to be reviewed and endorsed before approval is given by Local Authority. For area that is less than 1 ha, ESC measures shall be put straight away inside the Earthwork Plan allowing small scale development to skip full ESCP submission.

### **Enforcement activities**

Model study conducted in the State of Selangor since 2005 shows that enforcement activities need to be addressed collectively by various Agencies steered by strong political commitment. Current legislation like Street, Drainage and Building Act (SDBA) has been used in Selangor emphasizing on polluters pay policy. Until the middle of 2008 more than RM15 million compounds have been collected by Local Authorities from developers that failed to comply ESCP requirements e.g. poor earthwork controls. Since the success of the program in securing clean runoff water, the Federal Government has approved its utilization for the entire nation in August 2008 through the endorsement obtained from the National Water Resources Council. Future success of this program is vital to ensure developers, contractors and consultants are aligned with national strategic stormwater programs.

### **Strategic directions**

Under the Vision 2020, Malaysia is targeted to be a developed nation. The current manual paves the way for a nation to achieve its vision through a sustainable fashion. To ensure achievable goals, the strategic direction was set especially to examine existing problems arise among stakeholders and streamline specific actions that should be taken by decision makers. The National Stormwater Management (SWM) Goal – “Stormwater shall be managed so that it contributes towards sustainable development of the country”. The strategic direction is

divided into three areas 1) SWM infrastructure asset, 2) Stormwater and related eco-system as a resource, and 3) Stakeholders and users of the resource and the SWM infra asset.

#### **SWM Infrastructure Asset**

To develop a world-class SWM infrastructure accompanied with an equally world-class O&M to achieve an efficient, safe and eco-friendly SW management system. World-class infrastructure shall embody the contemporary best practices and technologies benchmarked against those found in developed countries. Strategies related to this program are i) upgrade existing infrastructure, ii) improve operation and maintenance, iii) improve development planning and control, iv) address point source pollution, v) tighten regulatory and enforcement, vi) knowledge and development and vii) training and education.

#### **Stormwater and Related Eco-System as a Resource**

To have an equitable, beneficial and sustainable utilization of the resources. The resources may be utilized as alternative source for non-potable use in urban areas, allow recreation, conducive to tourism and as a source for water supply and for the eco-system. This program elaborates on i) establish policy on stormwater utilization, ii) promote stormwater through education with strong provision on resource control, and iii) strengthen legal aspects.

#### **Stakeholders and Users of the Resource and the SWM Infra Asset**

To promote effective stakeholder participation towards the development of stormwater facilities and environment while at the same time benefiting from their proper use. This program emphasizes on i) education, ii) improve framework for public participation, and iii) improve regulatory and enforcement.

#### **Way forward**

Stormwater management is a continuous process involving various stakeholders. Future activities that up hold the strategic directions need to be addressed tactfully to ensure MSMA continuously indulges Malaysia in becoming a developed nation by 2020. Among important future activities are establishing the Total Maximum Daily Loads (TMDL) in various catchments, tax incentives initiatives for developers and investors that fully complied MSMA requirements and revision of the existing manual and guidelines to include additional needs like climate change.

In terms of providing adequate experts to fulfill the knowledge gaps, capacity building programs embarks by DID shall focus on training and accreditation exercises. Consultants, contractors and site supervisors shall be required to attend and pass certain minimum standards before being allowed to submit drainage and ESC plans. The program also ensures competent consultants responsible for the design while competent site supervisors handle site supervision works. Most of the training courses conducted by DID nowadays focus on hands on programs so that the level of knowledge increases according to the current and future needs.

#### **Conclusions**

Stormwater Management Program especially in urban areas is vital for a developing nation. Spearheading by “VISION 2020”, stormwater program in Malaysia is moving forward towards streamlining the strategic direction into strategic action plans. Most of developed nations have developed their own National Stormwater Management Framework complete

with their vision, mission, objectives, targets and strategies. Some countries have succeeded their short, medium and long term programs to the extent of full scale strategic action plans implementations.

In its 8<sup>th</sup> year of implementation, MSMA has evolved into a main stream guideline to ensure nation building programs fulfill sustainable development agenda as required by various international standards and signatory bodies. Malaysia is committed in promoting sustainable development and it is obvious that MSMA achievements set clear directions; thus, filling the gaps created by our ancestors while provides hopes for our children to inherit.

Malaysia still has a long way to go in getting full success in this program. The basic foundation for eco-friendly urban stormwater management program has been launched more than 5 years ago. With more than 12 years to go before reaching the year 2020, it is indispensable to strengthen this effort by exercising coordinated and integrated management approaches among relevant Agencies to ensure all requirements are fulfilled at the stage of pre-construction, during construction and post construction. Consequently, the targets for higher quality of life through sustainable development could also be achieved concurrently without compromising the environmental needs.

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