MALAYSIAN
STORMWATER
ORGANIZATION

Towards Designing a Perfect Sediment Basin

Good Petang…..

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CHT-NATURAL SOLUTIONS SDN BHD

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~~Learning~~ objectives

* what makes construction site “teh tarik”?
* where does “teh tarik” water discharge to?
* how can we reduce “teh tarik” discharges?
* some SCS BMPs to solve “teh tarik” challenge

* … Sediment Containment System .. last defense..(2) sets of BMPs…

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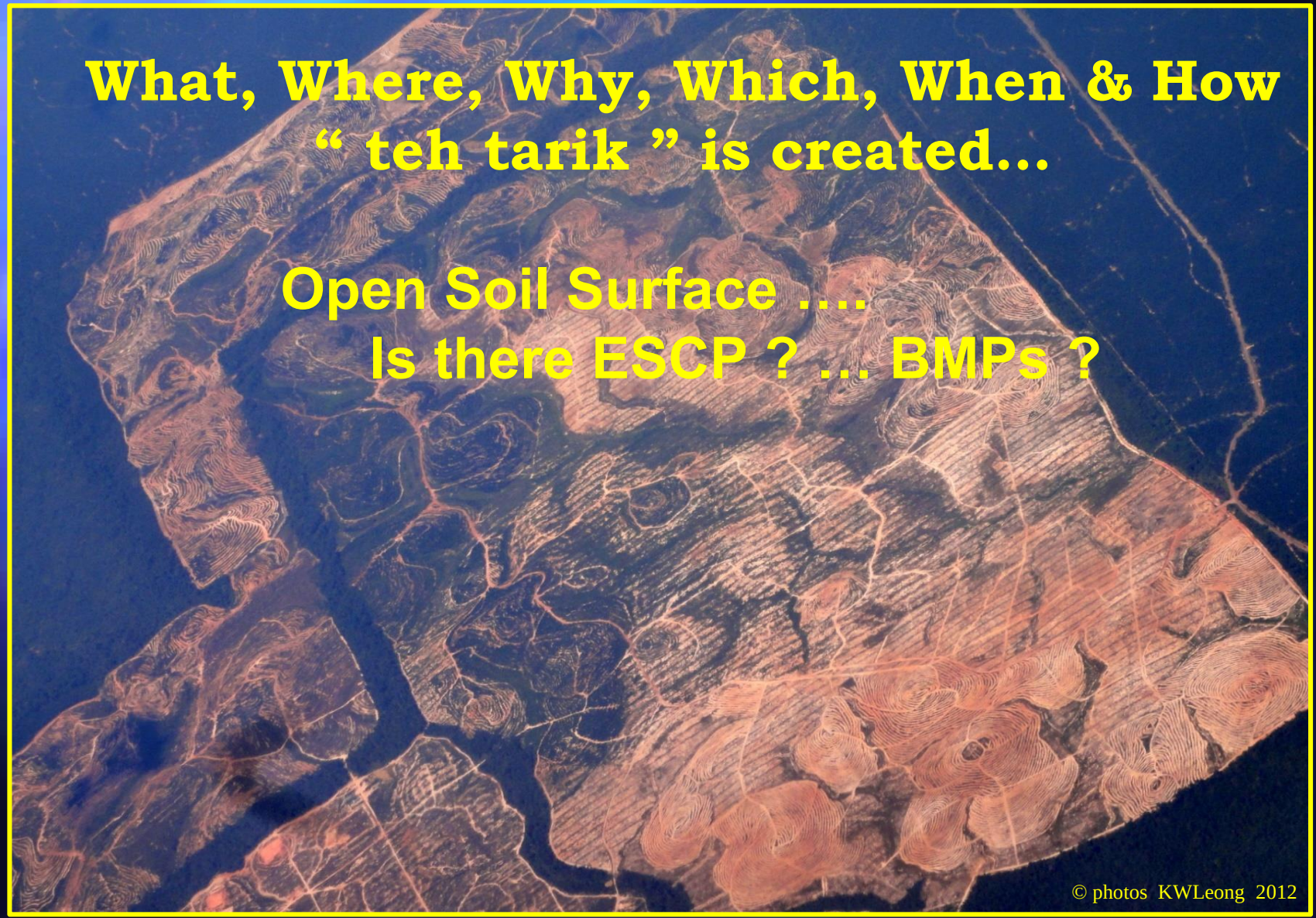

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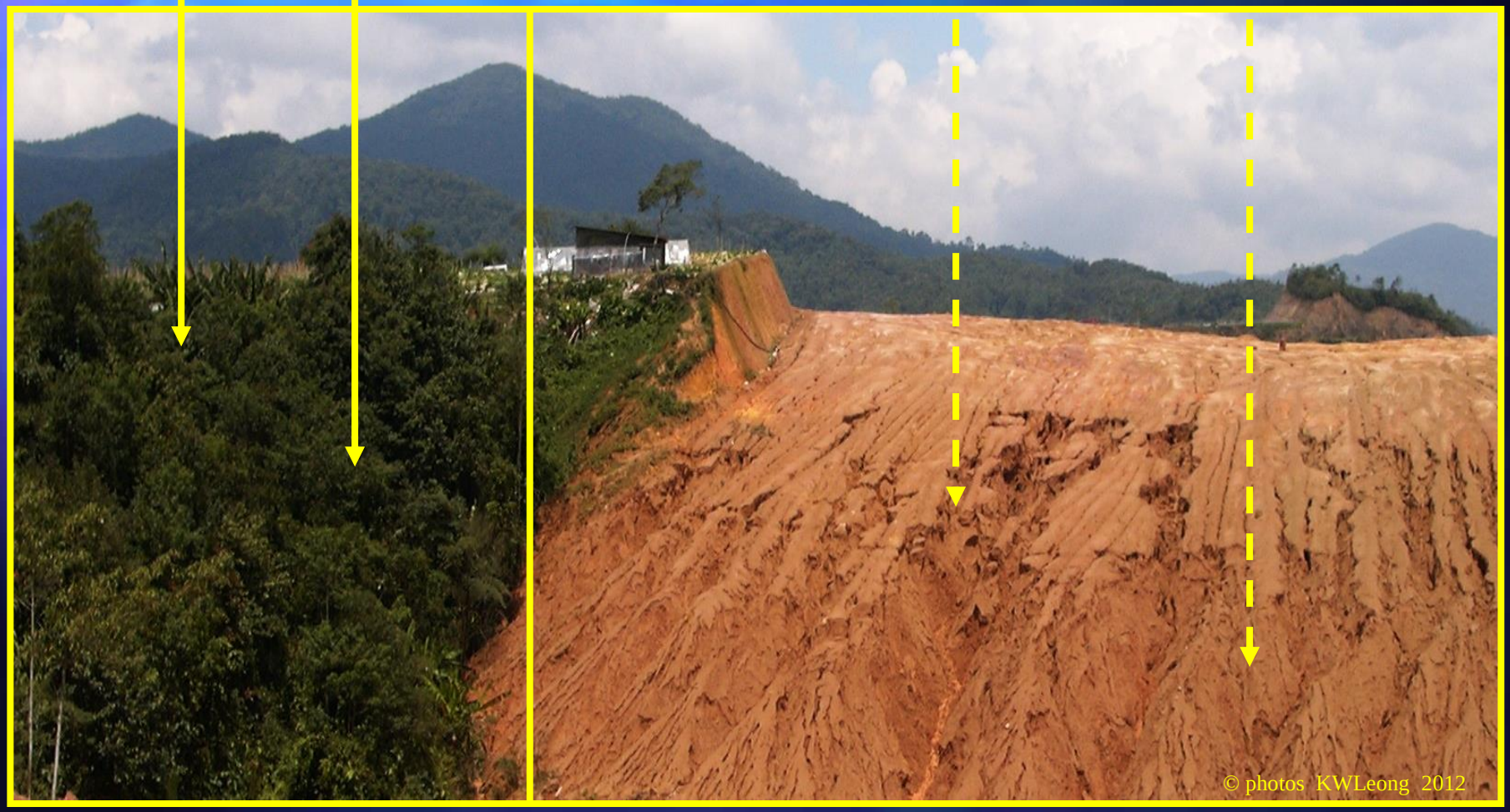
……Pre-Bulking
…Natural forest…

…Post-Bulk & grading…
…Vegetation stripped…



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IS THIS AN EFFECTIVE SEDIMENT BASIN & REMOVAL SYSTEM?

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Relative Rate of Erosion caused by Man-Activities

	Soil Loss tons/ac-yr	Relative Forest
Forest	0.04	1 ***BASE-LINE***
Grassland	0.38	10
Abandoned mines	3.75	100
Cropland	7.50	200
Harvested Forest	18.75	500
Active Surface Mining	75.00	2000
Construction Sites	76.00	2000

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We the public asks…

Why are our rivers & reservoirs "…teh tarik…"

?

….. the problem goes downstream and pollutes our waters…… ?

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Where does all OUR Malaysian soil go to….

???

THE MALAYSIAN SOIL JOURNEY……..

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first & last defense..install..
Sediment Containment Systems prior…

BEFORE start work *pre*-Bulking *pre*-Grading *phase*

… install sediment containment bmps FIRST ,
….. *Why ?*

..Erosion Control Measures although most effective
but *Can't be done*…
NOT PRACTICLE *in Real World...*
Rain can & will occur during Construction Activities

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..However installation of Small SCS …
Silt fence, Silt traps & small Sediment ponds..

… has limited effectiveness….. *Why ?*

…Design are often undersize at grading activities..
When- **Possibly : 1) wrong assumptions used…**
2) poor installation & 3) poor maintenance

… Solution: Increase size of Retention Basin /
Detention Basin? but BUT NO Space – *How?*

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… *new* Sediment Containment System
..last defense..

Learning objectives

(2) sets of SCS BMPs…

– "Physical Orientation" BMP of SCS

– "Polymer Enhance" BMP for SCS

Result:

**** Increase Sediment Removal Effectiveness,***
**** Reduce SCS space & Fast action…***

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SEDIMENT CONTAINMENT SYSTEMS SCS

- BEST BMP TO REMOVE SEDIMENT FROM RUNOFF IS
- A "WELL- DESIGNED SEDIMENT BASIN" !!

- NOTE: SCS EFFECTIVENESS IN SEDIMENT CAPTURE
- DEPENDS ON DISCHARGE RATE FROM SCS

- MAX EFFECTIVENESS WHEN SEDIMENT BASIN (RETENTION POND) IS BIG ENOUGH TO CAPTURE ALL RUNOFF,
- BUT NOT PRACTICAL AS NOT ENOUGH LAND

- DIFFICULTY ARISES WHEN SUSPENDED SOLIDS ARE < 0.02 MM,
- THE CLAY & SILT RANGE, RETENTION PONDS HAVE
- TO BE VERY LARGE

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What: SCS -silt traps is basically a hole in the ground..
…where dirty water is contained…"
… *small hole* ...

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Bigger hole in the ground are call sediment pond

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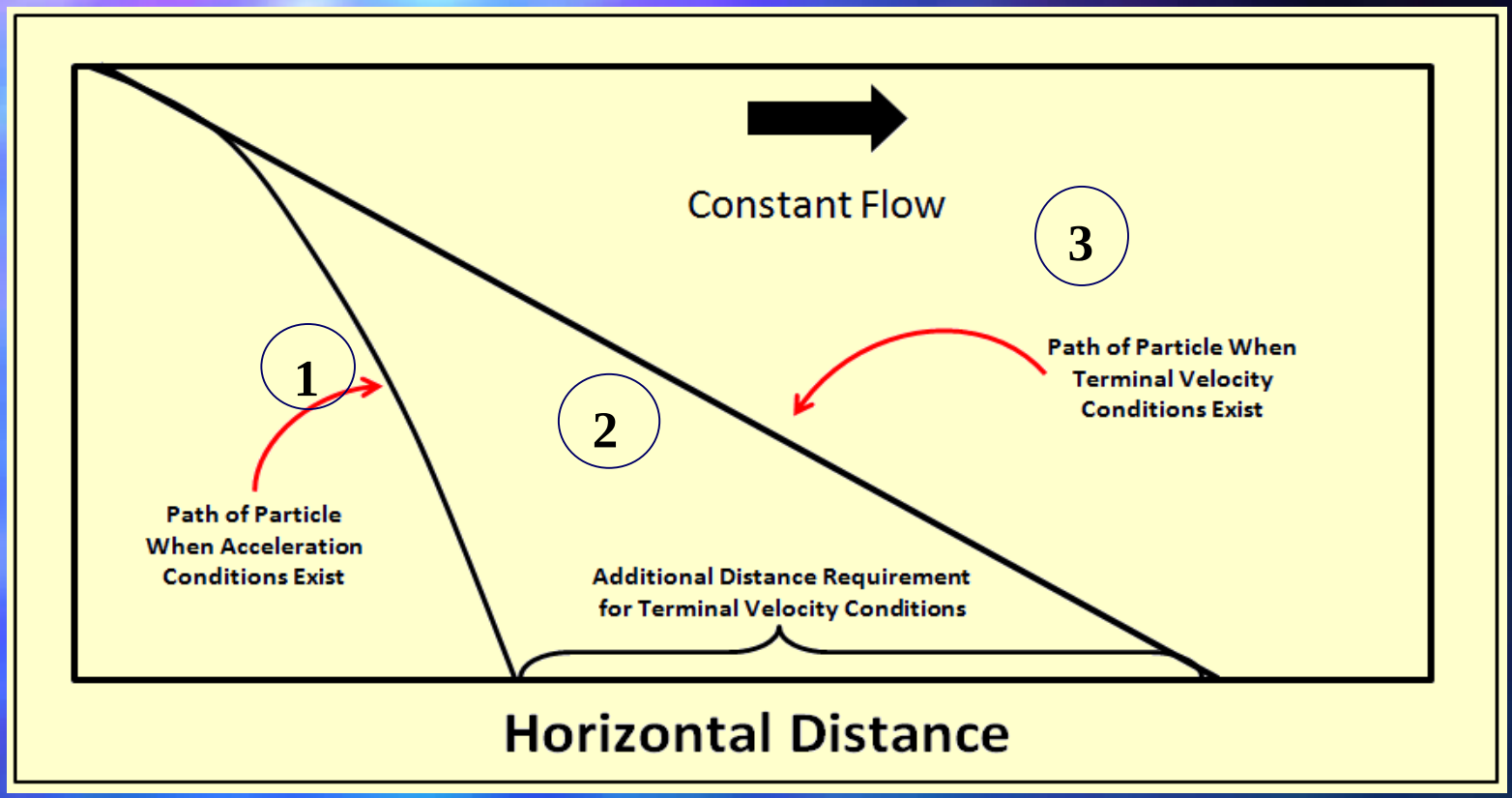
Sediment Pond is like a "..bath-tub…."
..the bigger it is…the more it can hold…

If this is the longitudinal profile of the pond..



- **1) Newtonian Physics**: Larger particles (mass > 0.02mm) accelerates through column of water and falls to bottom of SCS.
- **2) Stokes' Law**: Smaller particles (mass < 0.02mm) encounter fluid resistance will not accelerate but fall through water column at terminal velocity.
  Terminal Velocity $V = [2g \times D^2 \times (d_1 - d_2)] \div (9 \times \eta)$
- **3) Brownian Movement**: Very small particles, colloidal particles (mass < 0.01mm) fine clays –silts take extensive time to settle, days….

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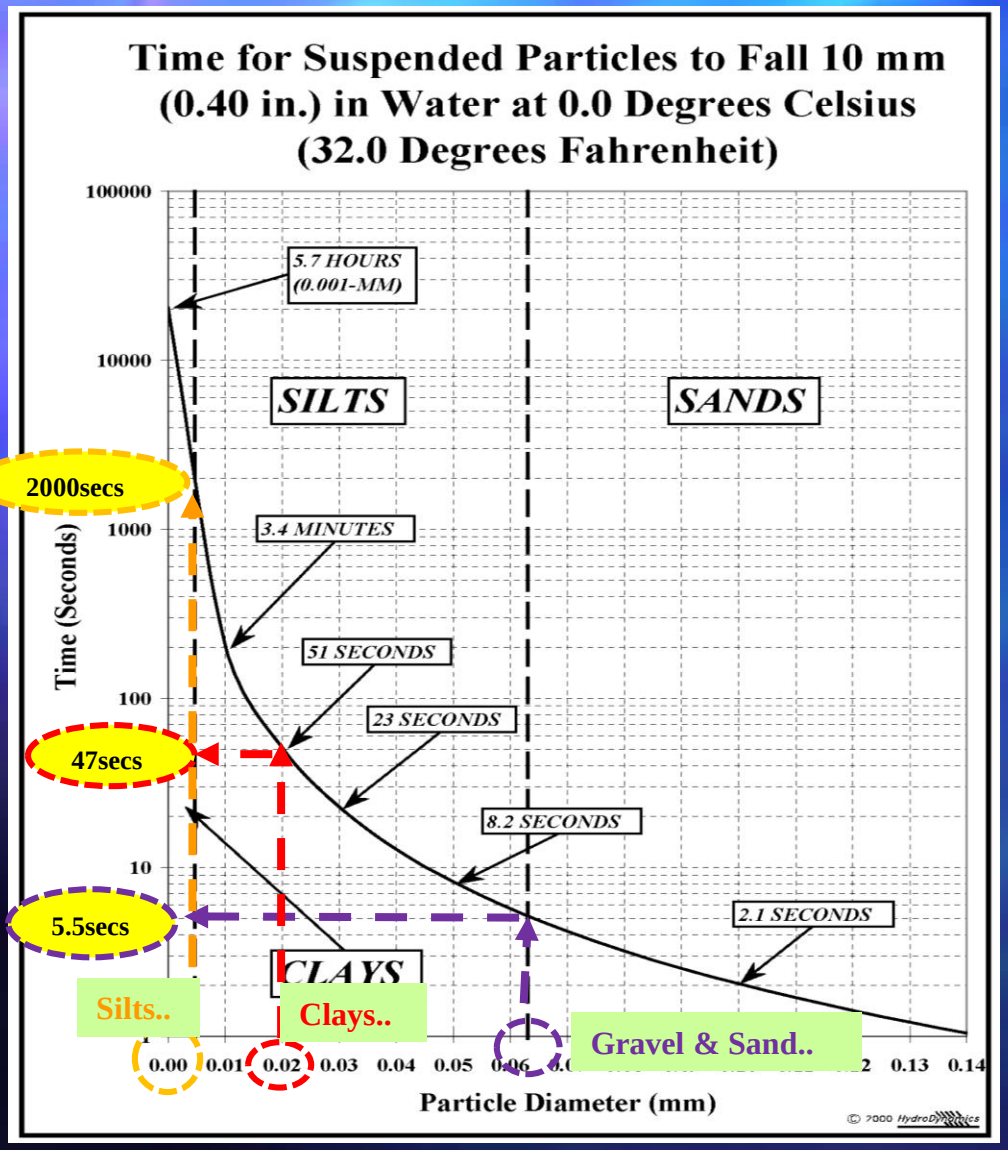

- How Fast Sediment Settles in SCS is dependent on its Size & Mass

- Clays & Silts takes a much Longer time to Settle compared to Sand & Gravel….

Table SCS -3.1: Large SCS Terminal Velocity of Suspended Particles as Calculated by Stokes' Law

Equation SCS -3.1: $V = [2g \times D^2 \times (d1 - d2)] \div (9 \times \eta)$

Diameter (microns)	Diameter (mm)	Settling Velocity in 10^{-5} Metres per Second					Type of Particle
		5°C	10°C	15°C	20°C	25°C	
10	0.01	5.9	6.9	7.9	9.0	11	Fine Silt
20	0.02	24	27	32	36	45	Medium Silt
30	0.03	53	62	71	81	102	
40	0.04	95	110	126	143	182	Coarse Silt
50	0.05	148	172	197	224	284	
60	0.06	213	247	284	323	408	
70	0.07	290	337	386	439	556	Very Fine Sand
80	0.08	379	440	505	573	726	
90	0.09	479	557	639	726	919	
100	0.10	592	687	789	896	1135	

Where: V = Terminal velocity (cm/sec); g = Acceleration gravity (980 cm/sec^2;
d^1 = Density of particle (gm/cm3); d^2 = Density of water (gm/cm3);
D = Diameter of the sediment particle (cm); η = Coefficient of viscosity of water (dyne-sec per cm^2)

Large SCS: Important Parameters for Laminar Flow Zone

Fig. SCS -3.3 How the Surface Area of an SCS may Vary to Capture Suspended Particles for Detained Runoff Waters at 10°C

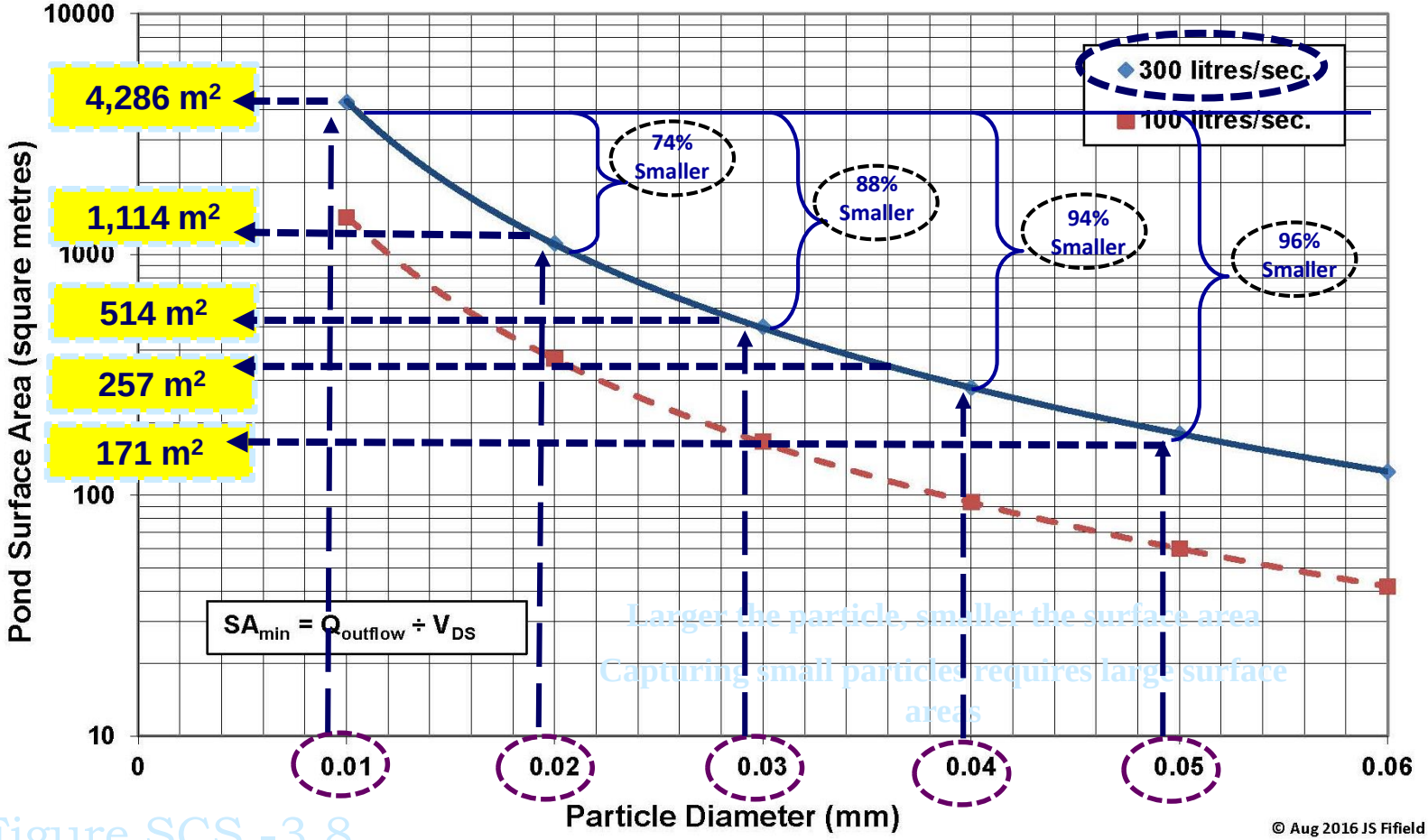

Figure SCS -3.8

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SCS -BMP: Physical Orientation of Pond Outlet

BMP1: Pond dimensions L > 3W
(…so pond should be as long as possible…
Why? More Flow Path Length…)

BMP2: Pond Outlet to be located as far as possible from Pond Inlet ….
(…Why: more Flow Path Length…)

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..but what if land is small and square..?

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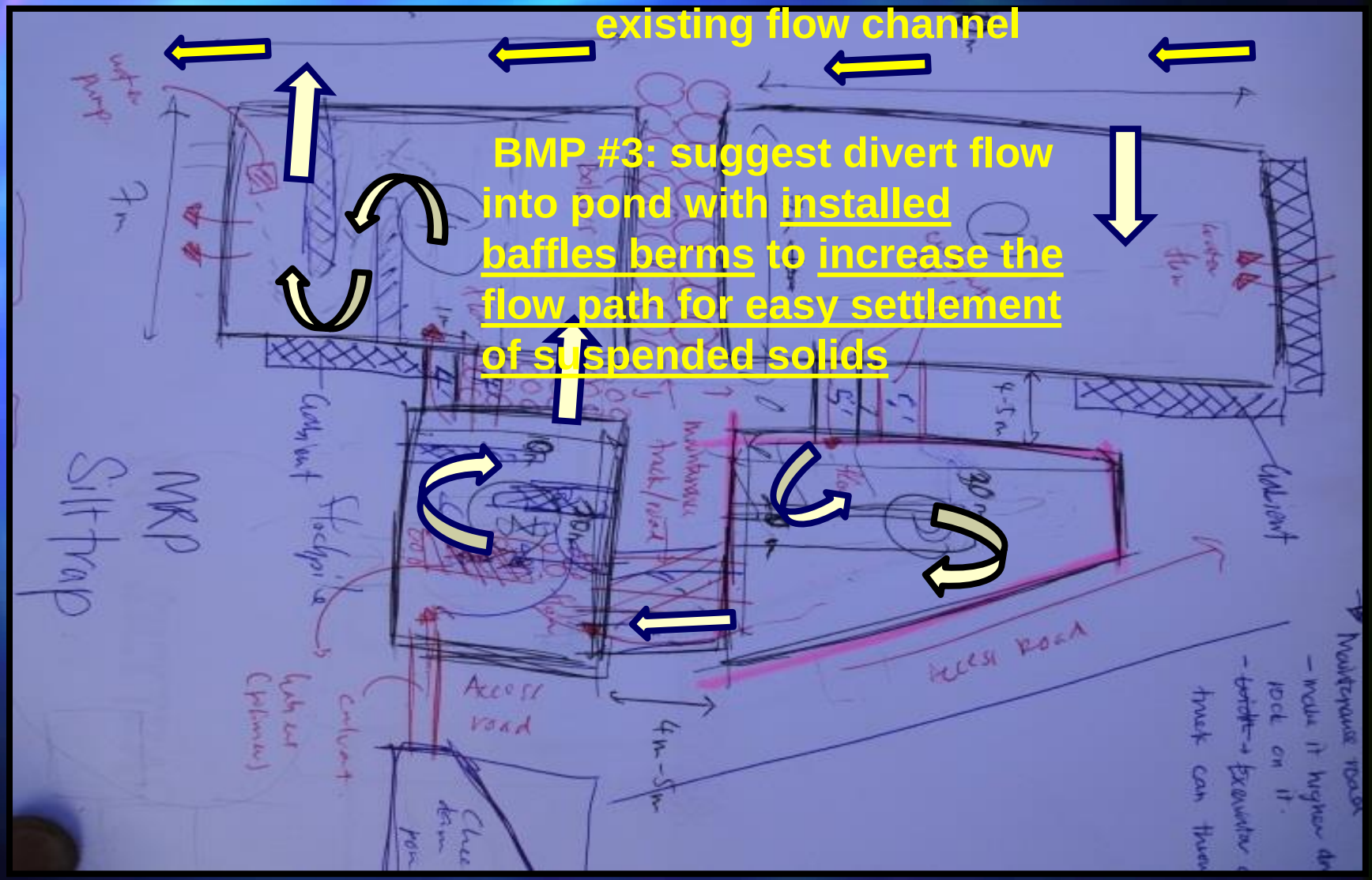

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BMP3: Pond with Baffles to increase flow path…

How do we improve further ?

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BMP4: Improve Pond Performance with installation of Anionic PAM Blocks …

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BMP4: Polymer Enhanced BMP
with Anionic PAM Blocks (PassiveTreatment System)

Flocculated and settled-out suspended solids

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BMP4: Improve Pond Performance
PE-BMP w/Passive Treatment System

Install Anionic PAM Blocks at Pond Inlet drain

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BMP4: Improve Pond Performance

Fast & Effective deposition of flocculated sediment

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BMP5: Improve Silt Trap Performance at Linear Construction Site …

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Traditional Solution: Site Silt Traps -low efficiencies..

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BMP5 ATS MINI : LINEAR CONSTRUCTION WITH LIMITED SPACE

Sludge sample test with anionic polymer treatment

Pre-treatment
Reading: 328 (fail)

Post-treatment
Reading: 20 (past)

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BMP5 ATS MINI : LINEAR CONSTRUCTION WITH LIMITED SPACE

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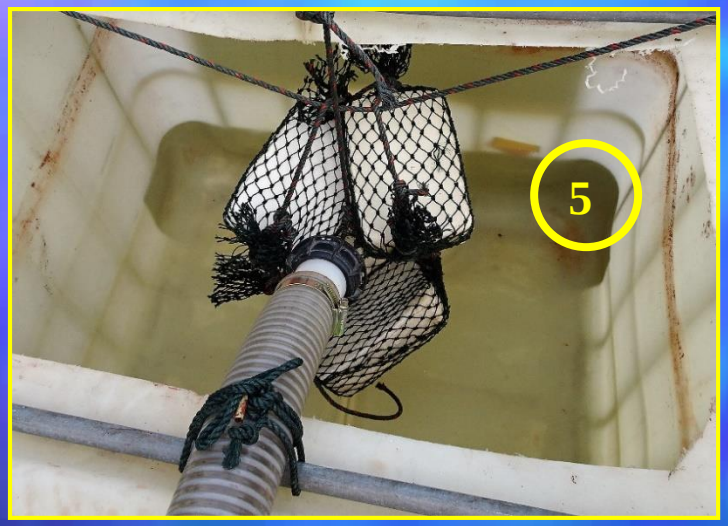
BMP5 ATS MINI : LINEAR CONSTRUCTION WITH LIMITED SPACE



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BMP5 ATS MINI : LINEAR CONSTRUCTION WITH LIMITED SPACE

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BMP6 ATS MINI : LINEAR CONSTRUCTION WITH LIMITED SPACE *& MOBILE UNIT*

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… Sediment Containment System
… First & Last defense..

Learning objectives recap: (2) Sets of BMPs shared

A) "Physical Orientation" BMP of SCS
- **BMP1: Pond dimensions L > 3W**
- **BMP2: Pond Outlet to be located as far as possible from Pond Inlet**
- **BMP3: Pond with Baffles to increase flow path…**

B) "Polymer Enhance" BMP for SCS
- **BMP4: Apply Polymer Enhanced BMP with**
- **Anionic Polymer Blocks (Passive Treatment System)**
- **BMP5: Apply ATS MINI for Linear Construction with Limited Space**
- **BMP6: Apply Mobile ATS MINI for "Rapid Response" to arrest discharge from silt trap sumps at linear construction with limited space**

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….most "polluted waters - sediment flow" contains (5-15)% Suspended Particles

…the Balance (85-95)% is Water…

..the bmps is to :
Capture Suspended Particles & discharge Clean Water back to Environment….

QUIZ- REVIEW Towards
Designing a Perfect Sediment Basin

1. Erosion rates on Harvested Forest is same as Construction Sites

   True / False

2. ……. Is sometimes referred to the First & Last Defense at Construction site.

   a) Erosion control, b) Runoff control,
   c) Sediment Control or d) House keeping

3. BEST BMP to remove sediment from runoff is a “well- designed sediment basin” !!

   True / False

QUIZ- REVIEW Towards Designing a Perfect Sediment Basin

5. Smaller sediment (clay) has a longer travel path and therefore needs a larger/longer sediment basin True / False

6. An ideal sediment basin has the following shapes
   a) Round, b) Square, c) Triangular
   or d) Rectangular with sides L > 3W

7. Inlet and Outlet in a sediment pond should be located as far apart, preferably diagonally in a rectangular shape sediment basin
   True / False

QUIZ- REVIEW Towards Designing a Perfect Sediment Basin

8. Baffles when located appropriately can improve flow path and increase effectiveness of sediment basin. True / False

9. Anionic Polymer Blocks when applied to correctly can effectively reduce Sediment Basin size True/False

10. Anionic Polymer Blocks are most effective when applied at the sediment basin at the
a) Inlet, b) outlet c) at the Baffle or d) in middle

Quotes….

It has been said that:

A NATION THAT DESTROYS ITS SOIL, DESTROYS ITSELF….

F.D. ROOSEVELT

"Soil is more valuable than oil—and just as nonrenewable"

Tsampa Soup with Garden Veggies, 1 star: "The Nepalis don't load up their tsampa with salt."

"The thing we're gonna run out of first is water," he says. "And the second one is topsoil." He cites John Jeavons, co-founder of Ecology Action, who warns we have maybe 30 more years of topsoil. "Let's say you just don't believe it. Double it to 60. It's still a scary fact."

Quotes….

It is so critical that we do not splurge /waste our valuable assets through water, nutrients soil erosion process….

and convert it to <u>downstream public misery</u>…

Next CISEC CLASS 21 - 24 October 2019

CISEC Training Modules

&

Certification Examination

21 – 24 October 2019

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Organiser reserves the right to reschedule and/or cancel this program

About CISEC Inc.

Its a non-profit 501(c)6 organization which administers an international certification program that recognizes the abilities, skills, experience, and knowledge of inspectors who demonstrate their proficiency in observing, inspecting, and reporting on the implementation of Storm Water Pollution Prevention Plans (SWPPPs) & EMP.

The CISEC Programs : *CISEC* provides two comprehensive sediment and erosion and stormwater pollution control inspector programs; i) the CISEC & ii) the CISEC-IT.

i) CISEC Registrant* Program

Individuals with two or more years of construction site inspection experience can apply for the CISEC Registrant Examination and upon passing be certified CISEC Registrant.

ii) CISEC-IT Registrant* Program

Individuals that do not qualify for the CISEC Registrant program can apply for an "In-Training" (CISEC-IT) examination and upon passing shall be designated CISEC-IT.

By passing the examination CISEC Registrant:

- Demonstrates comprehensive knowledge in the principles and practices of controlling sediment, erosion, and storm water pollutants.
- Demonstrates the skills to observe onsite and offsite conditions that impact storm water discharges from active construction sites.
- Demonstrates inspection expertise on BMPs to determine if the mitigation measures will minimize the discharge of pollutants from active construction sites.
- Demonstrates the ability to communicate and report on their inspection of construction sites as to whether compliance situations exist.

* A Registrant is a person who has passed the certified examination.

Training Modules

Day 1 8:00am – 1:00pm (5hrs)

Module 1: Rules & Regulations Information

- Malaysian Rules & Regulations
  including but not limited to: Environment Quality Act 1974- EIA Sect 34A, Federal Land Conservation Act 1960, Water Act 1920, Local Government Act 1976, Town and Country Planning Act 1976, Street, Drainage and Building Act Sect 70A, B,C & 71, Uniform Building By-Laws Sect 83, Fisheries Act 1985 Sect 38(1)(k)…incl. new DOE- LDPPMM
- Evaluating Construction Submittal Processes & Inspector Requirements
- Understanding EMP and the S&EC Drawings

Next CISEC CLASS 21 - 24 October 2019

Day 1 2:00pm – 6:00pm (4hrs)

Module 2 : Inspector Background Material Covered

- Definitions
  - Erosion
  - Sediment
  - Sedimentation
- Polymers and Sedimentation
- A Primer on Hydrology
  - Topographic maps
  - Hydrographs and Sedigraphs
- Critical Inspector Requirements
  - EMPs and BMPs
  - Communication
  - Recognizing limitations
- CISEC Code of Ethics

Module 3 : Best Management Practices

- Understanding the Phases of Construction
- Inspecting
  - Barriers
  - Check structures
  - Drains and Inlets Sediment Containment Systems
  - Polymers
  - Wind/Dust control methods
  - Erosion control practices
  - Hazardous waste material sites
- Writing and Assessing Inspection Reports

Day 2 8:00am–1:00pm (5hrs)

Module 4 : Conducting Inspections

- Inspection Requirements
  - Role of Designers, Inspectors, and Contractors
- Inspector Responsibilities During Construction Activities
  - Inspection Reports
  - Reporting on BMP Maintenance
  - Documentation and Communication
  - Working with Contractors and Clients
- Inspecting a Construction Site
  - During construction, Before grading
  - During construction, After grading

Day 2 2:00pm– 6:00pm (4hrs)

Module 5 : General Exam Review

Malaysian Rules & Regulations for inspectors as they apply to EMPs and S&EC plans

- Knowledge about BMPs and Pollutants
- BMP inspection requirements, assessing construction sites for compliance
- Identifying non-compliance conditions
- Writing Inspection Reports

Day 3 8:00am – 1:00pm (5hrs)

Module 6 : Field-Trip Project Site

- Class is divided into teams of 5-6 each w/divided roles & responsibilities, must have safety gear
- Visit to construction site eg. LRT, Residential / Commercial Development EIA or without
- Teams shall identify & report BMPs installed correctly or otherwise; w/ 5W+1H questions

Day 3 2:00pm – 6:00pm (4hrs)

Module 7 : Teams Critique Site Findings, Develop Reports & Present to Class

- Teams work separately to develop site sedimentation & erosion management report
- Teams presentation to the class

Day 4 9:00am – 12:30pm (3.5hrs)

Module 8 : CERTIFICATION EXAMINATION INSPECTORON SEDIMENT & EROSION CONTROL (CISEC)

CISEC REGISTRANT EXAM :3.5 hour

CISEC-IT REGISTRANT EXAM :1.0 hour


…. some serious clean waters ….
Thank
You

References & acknowledgement with thanks

Malaysian Department of Environment (DOE) and EiMAS material from LDP2M2 Designer and Reviewer Training Program (2019)

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