


Cambodia • Lao PDR • Thailand • Viet Nam  
For sustainable development




# BioRA DSS Workshop

## Preliminary Calibration: Geomorphology

BioRA DSS Technical Workshop  
Phnom Penh, Cambodia  
15-19 February 2016

[www.mrcmekong.org](http://www.mrcmekong.org)



## Contents

- Calibration scenarios
- Geomorphology results by indicator
  - Erosion
  - Bed material grain-size
  - Availability exposed sandy habitat
  - Availability inundated sandy habitat
  - Availability exposed rocky habitat
  - Availability inundated rocky habitats
  - Depth of bedrock pools
  - Water clarity
- Final comments

[www.mrcmekong.org](http://www.mrcmekong.org)

# Calibration Scenarios



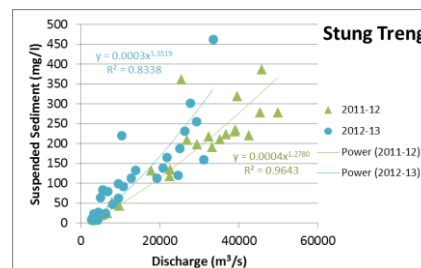
Scenario	Characteristics
CS1	High dry season flow, low wet season flow
CS2	6 dry years, followed by 6 wet years, etc.
CS3	A shortened wet season
CS4	Sediment supply at 75% of Preliminary Reference
CS5	Migration blocked between FA1 and FA2 ONLY
CS7	Extreme dry year (1992 – 10%) repeated for whole sequence
CS8	Migration blocked between FA4 and 5 ONLY
CS9	Migration blocked between FA1 and 2 <u>AND</u> between FA4 and 5
CS10	Sediment supply at 25% of Preliminary Reference

www.mrcmekong.org

# Comments on Calib Scenarios



- Flow & sediments are typically correlated in the LMB
- Each calib scenarios only changes **one** parameter
  - Either flow or sediment
  - Needs to be recognised in interpretation
- Migration 'blocks' do not affect sediment or flow
  - Not Applicable to geomorph
- Underlying trends in sediment data sets



Now sediment concentration

www.mrcmekong.org

# Changes to Indicators

Scenarios CS5, CS8, CS9 Not applicable to Geomorphology



Indicators	Calibration scenarios									
	CS1	CS2	CS3	CS4	CS5	CS7	CS8	CS9	CS10	
Discipline : Geomorphology										
Erosion (bank / bed incision)	-4.9	0.7	-10.1	9.2	0.7	-8.7	0.7	0.7	36.4	
Average bed sediment size - dry season	1.0	0.8	0.6	1.2	0.3	1.1	0.3	0.3	2.5	
Availability exposed sandy habitat - dry season	7.9	-5.3	4.1	-4.5	0.2	4.8	0.2	0.2	-20.8	
Availability inundated sandy habitat -dry season	1.9	0.4	2.3	-5.2	-2.0	-0.4	-2.0	-2.0	-15.4	
Availability exposed rocky habitat -dry season	-1.0	-5.0	-7.3	7.2	1.0	-3.3	1.0	1.0	25.2	
Availability inundated rocky habitat -dry season	<0.1	5.8	-3.9	5.4	0.1	-5.2	0.1	0.1	20.6	
Depth of bedrock pools in dry season	-7.1	-0.3	-4.7	5.3	0.2	-7.7	0.2	0.2	12.3	
Water clarity	1.2	27.5	38.9	16.4	1.2	53.6	1.2	1.2	242.4	

www.mrcmekong.org

# Changes to Indicators

■ <-20   
 ■ 20 - 50%   
 ■ 50 - 70%   
 ■ >70%

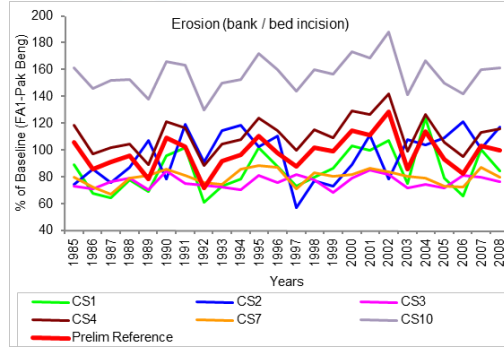


Indicators	Calibration scenarios									
	CS1	CS2	CS3	CS4	CS5	CS7	CS8	CS9	CS10	
Discipline : Geomorphology										
Erosion (bank / bed incision)	-4.9	0.7	-10.1	9.2		-8.7			36.4	
Average bed sediment size - dry season	1.0	0.8	0.6	1.2		1.1			2.5	
Availability exposed sandy habitat - dry season	7.9	-5.3	4.1	-4.5		4.8			-20.8	
Availability inundated sandy habitat -dry season	1.9	0.4	2.3	-5.2		-0.4			-15.4	
Availability exposed rocky habitat -dry season	-1.0	-5.0	-7.3	7.2		-3.3			25.2	
Availability inundated rocky habitat -dry season	<0.01	5.8	-3.9	5.4		-5.2			20.6	
Depth of bedrock pools in dry season	-7.1	-0.3	-4.7	5.3		-7.7			12.3	
Water clarity	1.2	27.5	38.9	16.4		53.6			242.4	

# Erosion All Seasons

Response Curves based on:  
Shear stress  $\propto$  Flow  
 $Flow_{wet} \gg Flow_{dry}$

Sediment  $\propto 1/Erosion$   
 $\downarrow Sediment_{Load} = \uparrow Erosion$

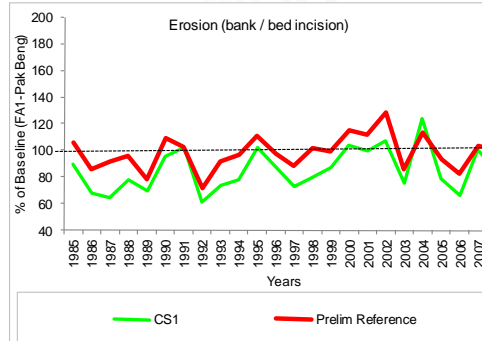


CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	-4.9	Dec in wet flow reduces erosion more than inc in dry season increases erosion
CS2	6 dry, 6 wet	0.7	Inc. in dry & dec in wet = net '0'
CS3	A shortened wet season	-10	Reduced erosion from reduced flows
CS4	Sediment supply at 75%	+9	Inc due to less sediment avail for transport
CS7	Extreme dry year	-9	Low flow = red shear stress with same sed
CS10	Sediment supply at 25%	+36	Inc due to less sediment avail for transport

www.mrcmekong.org

## Erosion at FA1: CS1

- High dry season, low wet season
- High shear stress in dry, low in wet
- High sediment load in dry
- Dec in erosion due to reduced wet combined with inc. sediment load in dry
- Change = -5%

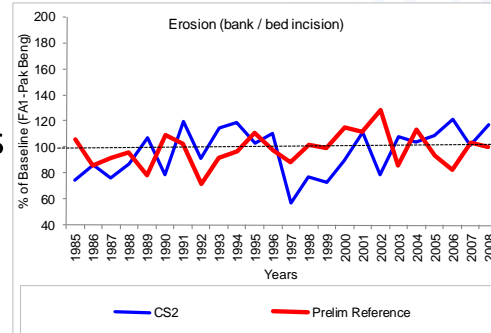


www.mrcmekong.org



## Erosion at FA1: CS2

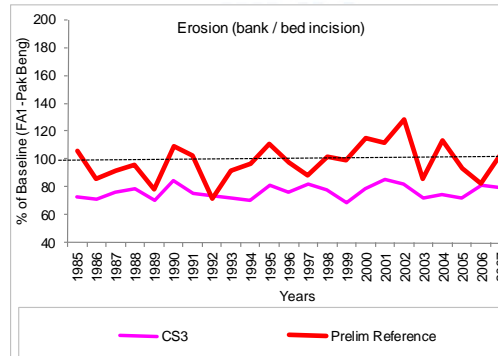
- 6 dry, 6 wet years
- Lower in dry years
- Higher in wet years
- T1 sed & shear stress v. low
- No Net change
  - Change = <1%



www.mrcmekong.org

## Erosion at FA1: CS3:

- Short wet season
  - Wet duration is lower (103 v 143)
- Sed duration lower
  - 54 days v 62 days
- Shear stress the same as P Ref
- Change = -10%

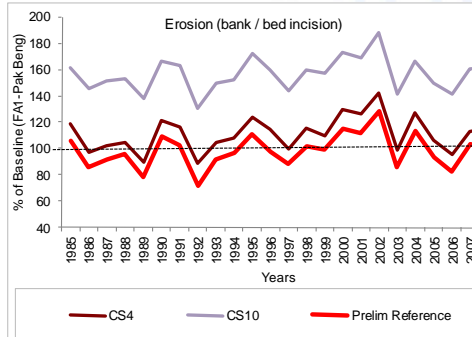


www.mrcmekong.org

## Erosion at FA1: CS4 & CS10



- Sediment reduction
  - CS4: Sed load = 75%
  - CS10: Sed load = 25%
- All other parameters the same
- Change
  - CS4: Erosion increases by 9%
  - CS10: Erosion increases by 36%

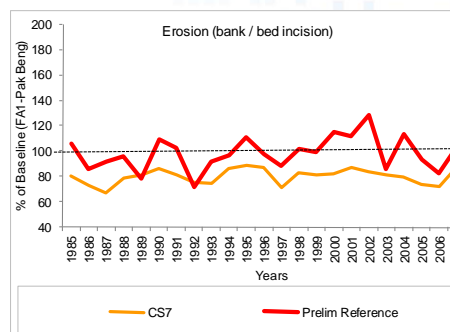


www.mrcmekong.org

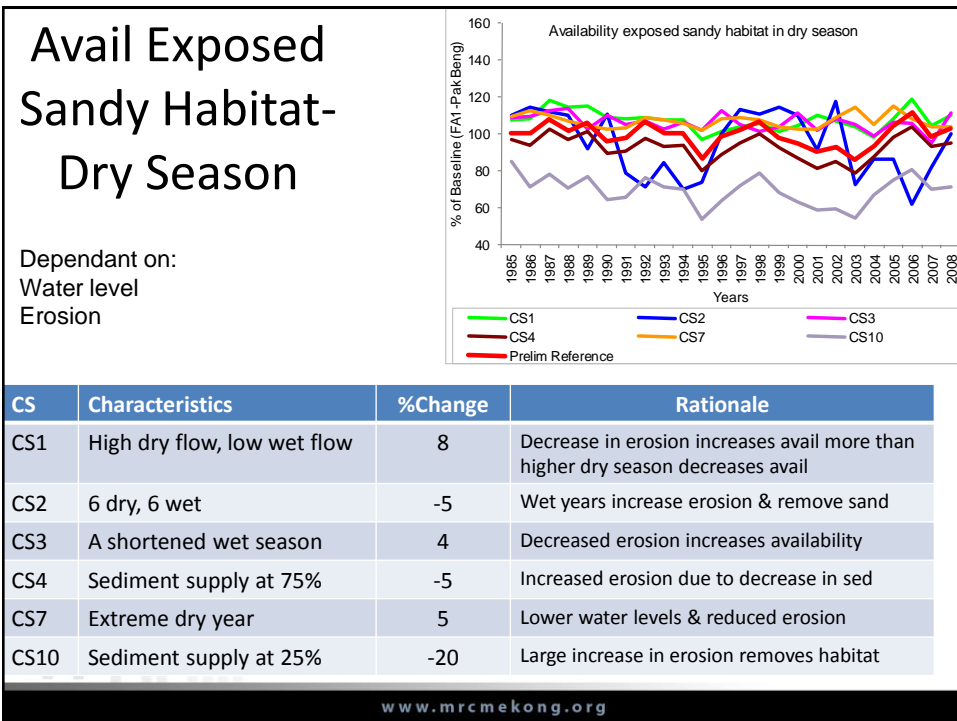
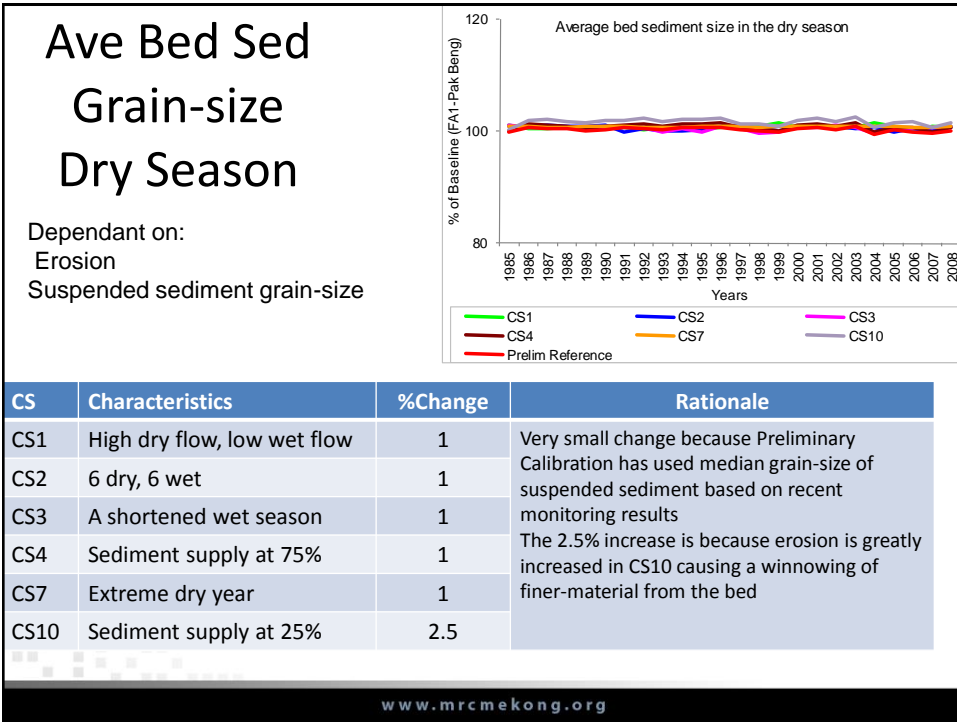
## Erosion at FA1: CS7



- Extreme dry year
- V. low sediment concentrations
- Reduced shear stress
- Change:
  - Erosion decreases by 10%

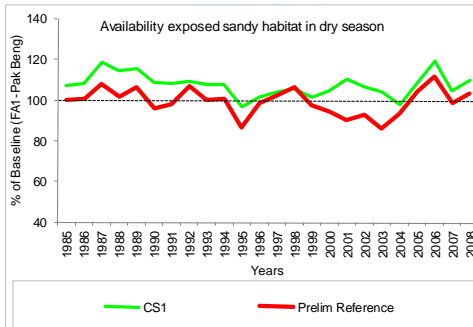


www.mrcmekong.org



## Sandy Habitat at FA1: CS1

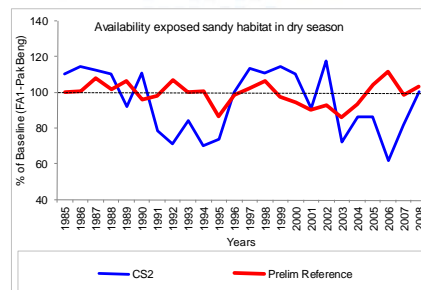
- High Dry, Low Wet
- Decrease in erosion
  - Erosion CS1= -5%
- Max dry season WL
  - Increase by 0.3 m
- High sed load in dry
- Dec in erosion greater influence than increase in water level
- Net change +8%



www.mrcmekong.org

## Sandy Habitat at FA1: CS2

- 6 Dry, 6 Wet
- No net change in erosion
- Max dry season WL
  - Increase by 0.55 m
- Inc during dry years
- Decrease during wet
- Net change +8%

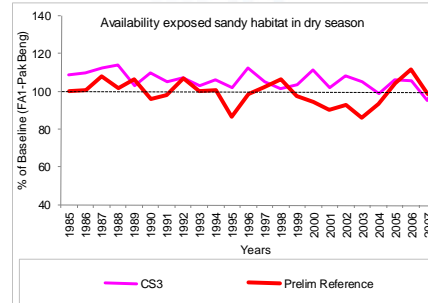


www.mrcmekong.org



## Sandy Habitat at FA1: CS3

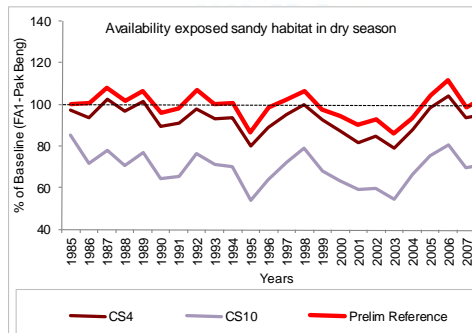
- Short Wet Season
- Decrease in erosion
  - -10%
- Max dry season WL
  - Increase by 0.6 m
- Inc during dry years
- Small net change +4%



www.mrcmekong.org

## Sandy Habitat at FA1: CS4 & CS10

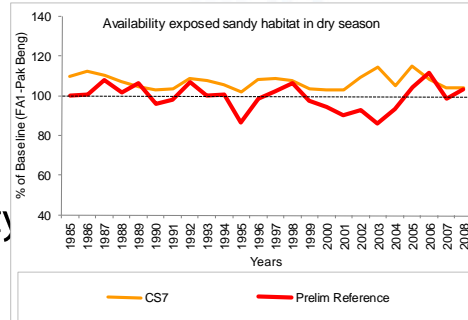
- Reduction in sediment
  - CS4: 75% P Ref
  - CS10: 25% P Ref
- Water levels the same
  - Difference is due to erosion
- Increase in erosion results in less availability
  - CS4: -5% availability
  - CS10: -20% availability



www.mrcmekong.org

## Sandy Habitat at FA1: CS7

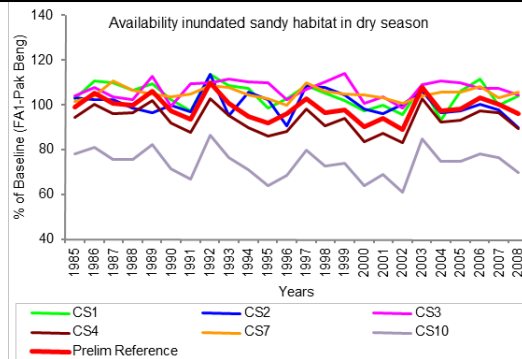
- Extreme dry
- Lower water levels
- Dec in erosion
- 5% Increase in availability



www.mrcmekong.org

## Avail Inundated Sandy Habitat

Dependant on:  
Water level  
Erosion



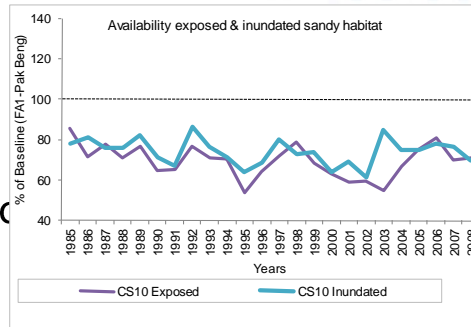
CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	2	Changes on an annual scale but virtually no change – increases & decreases balance out over the period of record
CS2	6 dry, 6 wet	<1	
CS3	A shortened wet season	2	
CS4	Sediment supply at 75%	-5	Reduced sediment reduces availability of sandy habitat
CS7	Extreme dry year	<-1	Low water levels decrease availability
CS10	Sediment supply at 25%	-15	Loss of sandy habitat due to increased erosion

www.mrcmekong.org

## Sandy Habitat at FA1: Compare Exposed & Inundated CS10



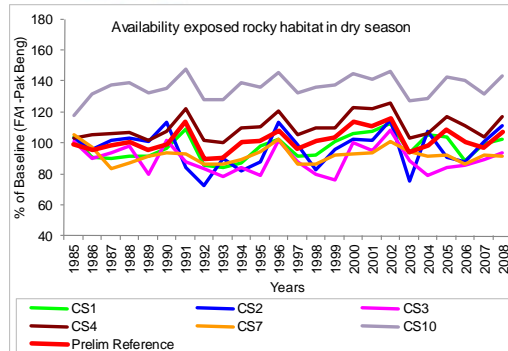
- 25% Sediment load
- Large increase in erosion
- Decrease in both exposed & inundated availability



www.mrcmekong.org

## Avail Exposed Rocky Habitat- Dry Season

Dependant on:  
Water level  
Erosion



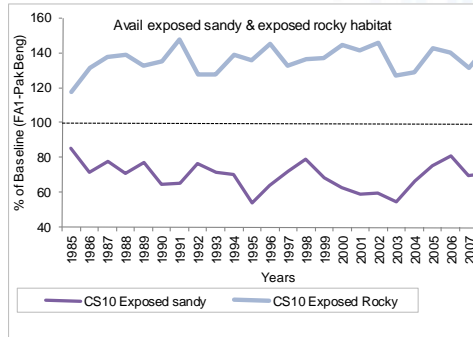
CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	-1	Annual changes but no net change
CS2	6 dry, 6 wet	-5	Dry increases, wet decreases & net is slight decrease
CS3	A shortened wet season	-7	Dec in erosion covers rock with sediment
CS4	Sediment supply at 75%	7	Reduced sediment increases erosion so more rock exposed
CS7	Extreme dry year	-3	Increased deposition reduces rock availability
CS10	Sediment supply at 25%	25	Large increase in erosion exposes more rock

www.mrcmekong.org



## Sandy Habitat at FA1: Compare Exposed Sandy & Exposed Rocky CS10

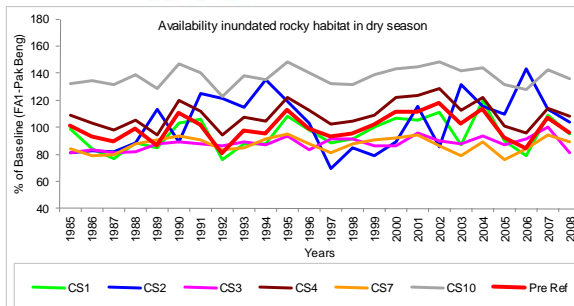
- 25% Sediment load
- Large increase in erosion
- Inc in rocky habitat as availability of sandy decreases



www.mrcmekong.org

## Avail Inundated Rocky Habitat- Dry Season

Dependant on:  
Water level  
Erosion

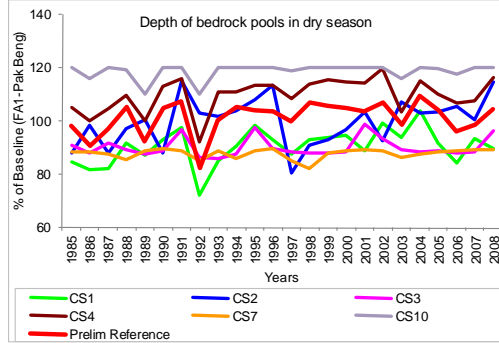


CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	<1	Change in annual pattern but no net change
CS2	6 dry, 6 wet	6	Dry decreases, wet increases & net is slight increase
CS3	A shortened wet season	-4	Dec in erosion covers rock with sediment
CS4	Sediment supply at 75%	5	Increase in erosion increases exposure of rock
CS7	Extreme dry year	-5	Lower water levels decrease availability
CS10	Sediment supply at 25%	20.6	Large increase in erosion exposes more rock

www.mrcmekong.org

# Depth of Bedrock Pools Dry Season

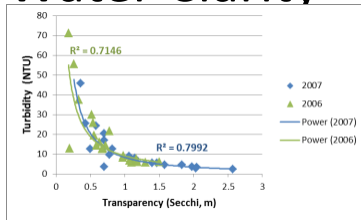
Dependant on:  
Erosion  
Sediment timing  
Water level



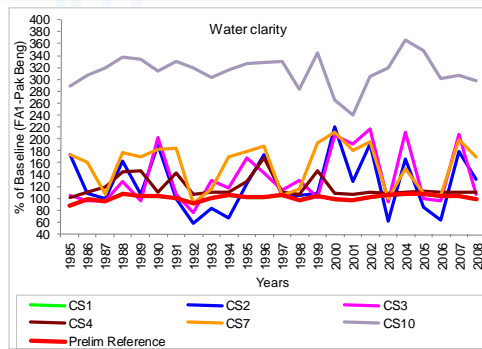
CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	-7	Low wet reduces scour of pools
CS2	6 dry, 6 wet	<-1	Large annual changes but no net change
CS3	A shortened wet season	-5	Reduced erosion to scour pool
CS4	Sediment supply at 75%	5	Less sediment results in less deposition
CS7	Extreme dry year	-8	Reduced erosion to scour pool
CS10	Sediment supply at 25%	12	Less sediment results in less deposition so depth increases

www.mrcmekong.org

# Water Clarity



Dependant on:  
Sediment Load  
Grain-size



CS	Characteristics	%Change	Rationale
CS1	High dry flow, low wet flow	1	No change to sediment loads
CS2	6 dry, 6 wet	28	V. Large increase during dry seasons
CS3	A shortened wet season	39	Increased duration of low sed conc.
CS4	Sediment supply at 75%	16	Red. Sediment increases clarity
CS7	Extreme dry year	54	Dry year has low sediment concentrations
CS10	Sediment supply at 25%	242	V. low sediment concentrations

www.mrcmekong.org

## Final comments

- Calibration scenarios results are consistent with physical processes & Mekong characteristics
- Small changes each year
  - Combine to create change
  - Balance out in 'dynamic equilibrium'
    - E.g. 6-dry, 6 wet have distinct annual signal but create little change overall
- Final calibration after DSF results available

[www.mrcmekong.org](http://www.mrcmekong.org)

Cambodia • Lao PDR • Thailand • Viet Nam  
For sustainable development



Thank You

[www.mrcmekong.org](http://www.mrcmekong.org)