EWCE 461
River Engineering and Flood Management
3 Credit Hour

Md. Atikuzzaman
Lecturer
Department of EWCE

Sec-B: Flood Management- 1.0 Credit

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Syllabus of Sec-A: 2.0 Credit

- Behavior of alluvial rivers
- River channel pattern and fluvial processes
- Aggradations and degradation
- Local scours
- River training and bank protection works
- Navigation and dredging of sediment movement in river channels
- Bed form and flow regimes
- Case studies

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Syllabus of Sec-B: 1.0 Credit

- Flood and its causes
- Flood process in urban and rural area
- Flood management measures: structural and non-structural measures such as dams, reservoirs
- Diversion channels and floodways
- **Improvement of Channel Capacity by Dredging**
- Land management, Flood proofing, Flood zoning, Flood hazard mapping
- Flood forecasting and warning, Flood damage assessment

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Course Outcome (CO)

CO1	Be able to explain the relationships of river planforms with the river Morphological parameters
CO2	Be proficient in calculating and estimating sediment distribution and sediment load of a river
CO3	Be able to apply different engineering perceptions to estimating the scour depth.
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes
CO5	Apply knowledge of flood processes and management strategies to analyze and assess flood risk.

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Reference Books

- Any book on Flood Management and Mitigation
- **Water Resources Engineering by R. K. Linsley, J. B. Franzini, D. L. Freyberg and G. Techobanojlous**
- Fluvial Processes in River Engineering (1992) by H. H. Chang
- **Flood Control and Drainage Engineering, Fourth Edition, S.N. Ghosh**
- Urban Flood Management; by Chris Zevenbergen (Author), Adrian Cashman (Author), Niki Evelpidou (Author), Erik Pasche (Author), Stephen Garvin (Author), Richard Ashley (Author)
- Flood Risk: Planning, Design and Management of Flood Defence Infrastructure, By: Paul Sayers
- Vulnerability and Adaptation to Climate Change in

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Lecture 5

Improvement of Channel Capacity by Dredging

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DREDGING

- Dredging is an excavation activity or operation usually carried out at least partly underwater, in shallow seas or fresh water areas with the purpose of gathering up bottom sediments and disposing of them at a different location.

- A **Dredger** is a piece of equipment which can dig, transport and dump a certain amount of under water laying soil in a certain time.

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Purpose of Dredging

- Channel deepening and maintenance
- Reclamation of land
- Beach nourishment and restoration
- Mining for aggregates and minerals

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Purpose of Dredging



Channel Deepening



Maintenance



Beach building



Aggregate Mining



Reclamation and Use

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THREE Steps of DREDGING

(1) Pretreatment :

- *Pretreatment means treatment of the ground before the dredging operations*
- *It usually consists of a separate operation carried out independently of other dredging*
- *There are two basic methods of pretreatment: chemical and mechanical and both are applied to rock or cemented soil*

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THREE Steps of DREDGING

(2) Extraction:

- *The extraction process involves the movement of the spoil from its natural pretreated position into vertical transportation and its delivery to the transport system*
- *Extraction processes are often a combination of at least two operations: the primary operation which disintegrates or dislodges the soil and the secondary operation which moves it*
- *The first of these operations is performed either mechanically or hydraulically.*

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THREE Steps of DREDGING

(3) Disposal :

- *Disposal facilities consist of*
  - ✔ *bottom discharge*
  - ✔ *grab*
  - ✔ *scrapers*
  - ✔ *Pipelines*
  - ✔ *land based unit*
  - ✔ *natural processes*

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Different Types of DREDGING

(1) Mechanical Dredging:

Mechanical dredging involves removal of material by a bucket, placement of the material in a scow or on a barge, and towing that scow or barge to a disposal or transfer area.

(2) Hydraulic Dredging:

Hydraulic pipeline dredging involves use of a hydraulic (suction) dredge, most commonly for either beach nourishment of suitable sands, or deposit into an upland containment area (for dewatering or direct disposal)

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Mechanical Dredging:



Aerial view of Mechanical Dredging



Dredged materials being pulled out

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Mechanical Dredging:







Dredged materials are being stored on a barge

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Mechanical Dredging:



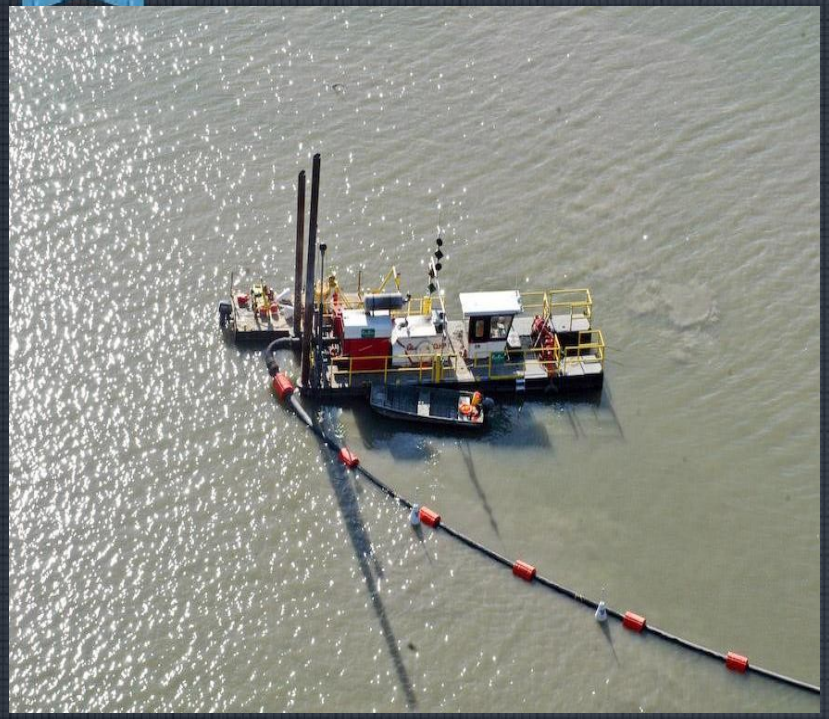
Dredged materials being transported to disposal area



Dredged materials being disposed

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Hydraulic Dredging:



Aerial view of barge with hydraulic dredging equipment removing ash from the navigation channel



Ash and water are pumped though this pipeline

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Hydraulic Dredging:



Relay pump in the middle of the pipeline



Ash and water discharge into holding area . Sediment can then be de-watered and either replanted or trucked off location

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Mechanical & Hydraulic Dredgers

Types of Mechanical Dredgers :

- ✔ Bucket Ladder Dredger
- ✔ Grab Dredger
- ✔ Dipper/ Black Hoe Dredger
- ✔ Hopper Dredger
- ✔ Rock Dredger

Types of Hydraulic Dredgers :

- ❑ Dipper and backhoe dredger
- ❑ Plain suction dredger
- ❑ Trailing suction hopper dredger
- ❑ Cutter dredger

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Comparison

it can be stated that every type of dredger has its own applied working area in which its production is optimal in a technical way as well as in an economical way. It will be clear that the boundaries of these applied working areas are not strictly determined, but are also determined by other working conditions, which can differ from lob to job.

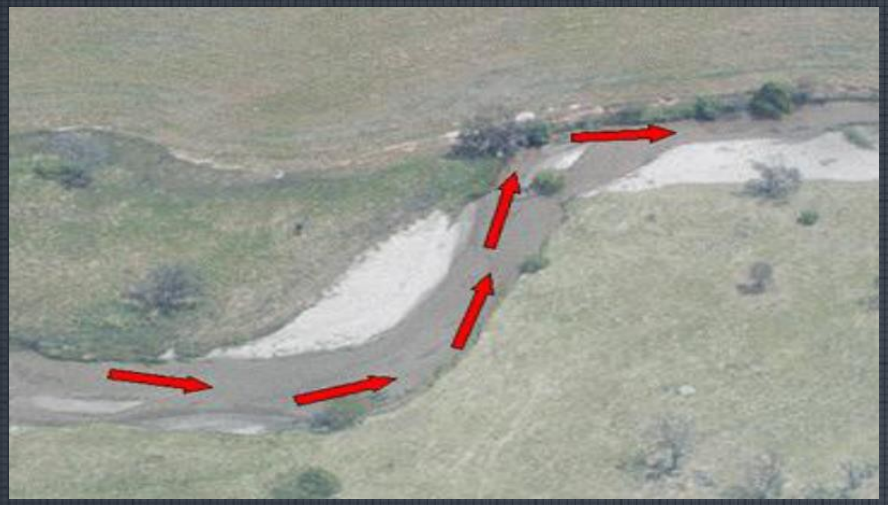
In the table below the possibilities of the different types are shortly summarized.

	Bucket Dredger	Grab Dredger	Backhoe Dredger	Suction Dredger	Cutter Dredger	Trailer Dredger	Hopper Dredger
Dredging sandy materials	yes	yes	yes	yes	yes	yes	yes
Dredging clayey materials	yes	yes	yes	no	yes	yes	no
Dredging rocky materials	yes	no	yes	no	yes	no	no
anchoring wires	yes	yes	no	yes	yes	no	yes
Maximum dredging depth [m]	30	> 100	20	70	25	100	50
accurated dredging possible	yes	no	yes	no	yes	no	no
working under offshore conditions possible	no	yes	no	yes	no	yes	yes
Transport via pipeline	no	no	no	yes	yes	no	no
Dredging in situ densities possible	yes	yes	yes	no	limited	no	no

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Dredging and River Bank Protection

Dredging is getting popular day by day as a means of river training work to improve the navigational depth as well as attain channel



Dredging To Deepen Critical Sections

- The combined use of dredging, dikes and the disposal of dredged material in the dike fields can introduce major changes in the cross sectional characteristics of a river.
- The dredging and contraction reduce the width-to-depth ratio of a river upto an extent.
- They increase the channels capacity for transport of suspended portion of bed material.

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MORPHOLOGICAL AND HYDRAULIC RESPONSE DUE TO DREDGING

Dredging effects the morphological and hydraulic behaviour of a channel section.

- Due to initial deepening or capital dredging of a channel, the river bed is degraded until the balance between the sediment load supplied to the river reach and the sediment transport capacity of the flow is restored.
- In the long term the result will be degradation to a more gentler slope and a greater depth downstream of the point of dredging.
- Degradation will also occur in upstream which leads to lowering of river bed with initial slope.

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IMPACTS OF DREDGING

Dredging activities have the potential to change the environment.

- ✔ At the sites of dredging and disposal the seabed and associated communities are disturbed and for some distance, suspended sediment may cause turbidity in water and increased sedimentation on the bottom.
- ✔ Depending upon the nature of the dredged material, its disturbance from the sea bed may lead to changes in the chemical composition of the water.
- ✔ As well as toxicants, the nutrient elements, particularly nitrogen and phosphorus, which control the rate of marine plant growth can also be released from sediments during dredging, with a risk of triggering algal blooms.
- ✔ Another biological risk from dredging involves the transport of species in dredgers from one port (or even country) to another

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Dredging in Bangladesh

Two types of dredging are conducted in Bangladesh:

- ✔ Capital Dredging
  (Example: Gorai River Project by BWDB)
- ✔ Maintenance Dredging
  (Example: Paturia and Daulatdia Ferry Ghats by BIWTA)

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Gorai River



General Project Description

- ✔ **Involved parties**: Boskalis, Dredging International, HAM, VOACZ
- ✔ **Total Project Cost :** US$ 126.28 million
- ✔ **Commitment Amount :** US$ 79.60 million

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Gorai River Project:





cutter suction dredger at work

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