



**PROJETO  
AMAZONAS**  
AÇÃO REGIONAL NA ÁREA DE  
RECURSOS HÍDRICOS



**ANA**  
AGÊNCIA NACIONAL DE ÁGUAS



**OTCA 40 anos**  
Organização do Tratado  
de Cooperação Amazônica



**ABC**  
AGÊNCIA  
BRASILEIRA DE  
COOPERAÇÃO  
MINISTÉRIO DAS RELAÇÕES EXTERIORES

## **COURSE OF HYDROSEDIMENTOLOGY FOR TECHNICALS OF ACTO MEMBER COUNTRIES**

### **OBJECTIVES**

The transfer of knowledge of engineering of sediments in studies in hydrographic basins, flow measurement, discharge of sediment into watercourses and studies of sedimentation of reservoirs, with emphasis on studies to the reality of the Amazon region.

### **TARGET AUDIENCES**

Professionals working in the field of water resources, especially those working with sedimentometric network in Brazil and the Member Countries of the Amazon Cooperation Treaty Organization – ACTO.

The following prerequisites for candidates are recommended:

- i) Technical training in engineering, hydrology, biology and similar;
- ii) At least two years of experience in flow measurement techniques, water quality, water monitoring and/or current need to justify the study in these areas; and
- iii) Preferential performance in institutions involved in the management of water resources.

### **PROGRAM CONTENT**

#### **1. Hidrosedimentology Notions**

- Importance of the study;
- Concepts of erosion, sediment transport in waterways and deposition;
- Soil erosion – factors, erosive agents, forms and types of erosion, interval measurement methods;
- Sediment transport – forms of sediment transport in watercourses;
- Sediment deposits in rivers, lakes and reservoirs;
- Discussion on sediment transport in rivers of the Amazon.

#### **2. Sedimentometry and its application**

- Planning of primary and secondary and tertiary sedimentometric network;
- Measuring Stations – installation, maintenance and operating frequency;
- Methods of direct and indirect measurement of discharge of suspended sediment and river bed (criteria of the USA Subcommittee in sedimentation);
- Sampling equipment or greater use measurement;
- Sampling methods in direct and indirect measurements;
- Indirect measurement – sampling of suspended sediment and of river bed;
- Appropriate amounts of suspended samples and river bed;
- Laboratory analysis – equipment, criteria, restrictions and methods for the analysis of suspended material and river bed for fine material and coarse material; care with samples;

- Methods and formulas for calculating discharge of suspended solids, the river bed, the river bed material and the whole;
- Data Processing – consistency analysis, sediment transport curves, series of liquid and solid flows, solid annual runoff, specific sediment discharge, parameters; continuous, daily and eventual data;
- Database construction, dissemination and availability to users - Database HidroWeb of ANA.

### **3. Studies in hydrographic basins**

- Diagnosis of sediments of the basin;
- Causes of the increase or reduction in performance in a basin;
- Determination of the rate of change of sediment transport.

### **4. Measurement of sedimentation of existing reservoirs**

- Method of studying the contour of the reservoir;
- Topo-bathymetric study methods for reservoirs - purpose, equipment;
- Frequency of studies and planning work;
- Fieldwork and office work;
- Sampling sediment in the reservoirs.

### **5. Evaluation of sedimentation of a reservoir to be formed**

- Evaluation criteria of sedimentation in the stages of inventory, feasibility, basic design and operation of the use of water resources;
- Addressing studies for small, medium and large reservoirs;
- Calculation of sediment height at the bottom of the reservoir and distribution of deposits along the reservoir;
- Evaluation of the life of the reservoir.

### **6. Sediment Control**

- Sediment control methods – preventive and corrective;
- Prevention of sediment control in reservoirs in the planning phase;
- Sediment Control in existing reservoirs;

### **7. Approach the study of the sedimentological effects downstream the reservoir**

- Morphological changes downstream of the reservoir and at the river mouth;
- Methods of simple study of degradation in the channel;
- Methods by sedimentological modeling.

### **8. Geophysical methods used in the research of reservoirs**

- Bathymetry;
- Side-Scan Sonar;
- Continuous seismic profiling.



## **9. Calculation of liquid discharge and solid discharge using computer programs**

- Examples of measurements made on the Madeira River.

## **10. Evaluation of sedimentation of reservoirs with the use of software**

- Examples of calculations in small and large size reservoirs.

## **11. Field practices with flow measurement and sampling of sediments in the hydrometric station of São Bartolomeu river**

- Participants will be invited to collect water-sediment samples using traditional methods.

## **12. The use of computer models to assess the sedimentological effects in reservoirs and downstream of the reservoir:**

- Introduction to the use of mathematical models of sediment transport;
- Choice of models and applications: one-dimensional and two-dimensional main models;
- Presentation of case studies;
- Studies of the effects downstream of the reservoirs.

## **TIME COURSE**

40 hours, including lectures, practical classes in the field and on computers.

## **DATE AND PLACE OF THE COURSE**

From June 10 to 14, 2019, in the SAS/ANA training room (**Setor Policial, área 5, Quadra 3, Bloco “L”**) – Brasília, Brazil.

## **STUDY MATERIAL**

1. Book *Hidrossedimentologia Prática*, of author of Newton de Oliveira Carvalho, 2<sup>nd</sup> edition by Editora Interciência Ltda.
2. Programs for solid discharge calculation – *Método modificado de Einstein, e Formulas para cálculo do material do leito e de arrasto* – in the CD attached to the aforementioned book.
3. Programs for evaluation of sedimentation in reservoirs – method of Borland & Miller, included in the CD attached to the book.



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## PROGRAMME

Schedule	10/06/2019	11/06/2019	12/06/2019	13/06/2019	14/06/2019
	Monday	Tuesday	Wednesday	Thursday	Friday
08:00 – 10:00	Sedimentometry	Field practical class: a) Liquid Discharge Measurement; b) Suspension Sediment Sampling - Equal-Width Increment Method (EWI); c) Suspension Sediment Sampling - Equal-Discharge Increment Method (EDI).	Discussion on the sampling procedures used in the field practice class	Notions of Hydrosedimentology Study in river basins	Solid discharge calculation and reservoir sedimentation evaluation through computer programs
10:00 – 10:15	Break		Break	Break	Break
10:15 – 12:30	Sedimentometry		Discussion on the sampling procedures used in the field practice class	Sediment control Sedimentological effects on canals downstream of reservoirs	Solid discharge calculation and reservoir sedimentation evaluation through computer programs
12:30 – 14:00	Lunch		Lunch	Lunch	Lunch
14:00 – 16:00	Sedimentometry		Geophysical methods adopted in reservoir research	Sedimentation of reservoirs	Theoretical class on one, two and three-dimensional models.
16:00 – 16:15	Break		Break	Break	Break
16:15 – 18:00	Sedimentometry		Geophysical methods adopted in reservoir research	Sedimentation of reservoirs	Theoretical class on one, two and three-dimensional models.

	Prof. Walszon
	Prof. Luiz Antônio
	Prof. Maximiliano
	Prof. Álvaro

## PROFESSORS

### WALSZON TERLLIZZIE ARAÚJO LOPES

Civil Engineer graduated by *Universidade Federal da Paraíba – UFPB*.

Master in Civil Engineer and Environment of *Universidad Federal de Campina Grande - UFCG*.

Hydrometeorology Data and Information Coordinator by *Agência Nacional de Águas – ANA*.

### MAXIMILIANO ANDRÉS STRASSER

Engineer of Water Resources by *Universidad Nacional del Litoral / Santa Fé – Argentina*.

Master and PhD in Water Resources by *COPPE / UFRJ*.

Consultant of *PCE – Projects and Engineer Consultancy Ltda*.

### LUIZ ANTÔNIO PEREIRA DE SOUZA

Geologist by *Universidad de São Paulo – USP*.

Master and PhD in Sciences in the area of Chemical and Geological Oceanography by *USP*.

Researcher at the *Instituto de Pesquisas Tecnológicas do Estado de São Paulo – IPT*.



## **ÁLVARO JOSÉ BACK**

Agronomist Engineer by *Universidade Federal de Santa Catarina – UFSC*.

Master in Agricultural Engineering by *Universidade Federal de Viçosa - UFV*.

PhD in Engineering Water Resources and Environmental Sanitation by *Universidade Federal do Rio Grande do Sul – UFRGS*.

Researcher of the Company of Agricultural Research and Rural Extension of Santa Catarina - Epagri

Professor at the *Universidade Extremo Sul Catarinense – Unesc*.

## **APPLICATION DEADLINE AND PROCEDURES**

Application procedures include:

- Completion of the attached Application Form.
- Send the form to ACTO no later than May 10, 2019 to the e-mail: [projeto.amazonas@otca.org.br](mailto:projeto.amazonas@otca.org.br), with a scanned copy of the passport or identity document.