BUREAU OF INDIAN STANDARDS
(WATER RESOURCES DEPARTMENT)
AGENDA

Reservoirs and Lakes Sectional Committee, WRD 10			**25th Meeting**
Day and Date	**Time**	**Venue**	**Contact details**
Thursday, 12 Dec 2024	From 15 00 Hrs (**3 PM**)	Virtual Meeting	**wrd@bis.gov.in**
Link: https://bismanak.webex.com/bismanak/j.php?MTID=m3c7fb953680851718f5dfaeb9d545f91			
CHAIRPERSON: Dr. M. K. GOEL, DIRECTOR, NATIONAL INSTITUTE OF HYDROLOGY, ROORKEE		**MEMBER SECRETARY:** SHRI NAVDEEP YADAV, ASSISTANT DIRECTOR, WRD, BIS	

ITEM 0 WELCOME AND INTRODUCTORY REMARKS

ITEM 1 CONFIRMATION OF THE MINUTES OF THE PREVIOUS MEETING

The 24th meeting of WRD 10 was held on 5 Feb 2024 and the minutes duly approved by the Chairperson were circulated vide BIS email dated 1 March 2024. No comments have been received on the circulated minutes.

The Committee may CONFIRM the minutes as circulated.

ITEM 2 COMPOSITION OF THE SECTIONAL COMMITTEE

2.1 The present composition and attendance of the last three meetings of the Committee is given at Annex 1.

The Committee may REVIEW.

2.2 Following new nomination has been received from member organization.

National Institute of Hydrology, Roorkee	Dr. S.D. Khobragade, Scientist 'G' Dr. A.R. Senthil Kumar, Scientist 'G' (Alternate)

The Committee may NOTE.

2.3 Water Resources Division Council in its 22nd meeting held on 15 July 2024 decided to withdraw Membership of 'Andhra Pradesh Engineering Research Labs Hyderabad' upon inactive participation.

The Committee may NOTE.

ITEM 3 SCOPE AND PROGRAMME OF WORK

3.1 The present scope and Programme of work under this Committee is given in Annex 2**.**

The Committee may NOTE.

3.2 Five-Yearly Review of Published Standards

All Indian Standards shall be reviewed periodically, at least once in five years by the concerned Sectional Committee. The standards have been formulated by the technical committee and are now to be revalidated as national standards. Members must participate in the review exercise. While reviewing a standard, a committee has the following five options available:

i) Reaffirmation: Indicating the continuation of the current standard without change.
ii) Amendment and reaffirmation: Indicating the continuation of the current standard with necessary changes to bring it up to date.
iii) Take up for revision: Involving the routine procedure for a new project and reaffirming for the time being.
iv) Declaration of obsolescence: Indicating by an amendment that the standard is not recommended for use in new equipment but needs to be retained to maintain existing equipment that is expected to have a long working life.
v) Withdrawal: Indicating that the standard is no longer needed.

The following list of standards is due for review in 2024-25 and the Committee may kindly review the standards:

S. no	IS No.	Title of Standard	Last Reaffirmation
1	IS 15472: 2004 Reviewed In : 2019	Guidelines for planning and design of low-level outlets for evacuating storage reservoirs	2019
2	IS 5477 (Part 2) : 2020	Methods for Fixing the Capacities of Reservoirs Part 2 Dead Storage (Second Revision)	-

The Committee may NOTE and DECIDE.

3.3 Standards National Action Plan (2022 – 27)

3.3.1 In the last meeting, The Committee observed that the following subjects are relevant to this sectional committee and decided to take them as agenda items for standard formulation. Further, the Committee also deliberated and decided to formulate guidelines for the integrated management of lakes. The Committee requested members to express their willingness to provide input on the below subjects.

1. Sediment Management and Disposal

2. Optimization and Simulation of Reservoir Operation (will also cover the subject efficient use of water resources)
3. Standards on Artificial Ponds/ Lakes
4. Performance Monitoring of Hydraulic Structures. (Already Taken up in Hydraulic Structures Instrumentation Sectional Committee, WRD 16)
5. Seepage Losses in Reservoirs (already taken up in the Agenda)
6. Performance Evaluation of Rejuvenation/Conservation of Traditional Water Bodies.

No inputs have been received from the members. The Committee may NOTE and DECIDE.

ITEM 4 DRAFT INDIAN STANDARDS NOTIFIED GAZETTE

4.1 Doc. No. WRD 10 (18947) Revision of IS 14654:1999 Minimizing evaporation losses from reservoirs – Guidelines

{Earlier Doc. No. WRD 10 (12301)}

In the last meeting, the committee deliberated on the comment raised by the WRDC Chairperson and FINALIZED the document for adoption and printing. The document was notified gazette on 1 August 2024.

The Committee may NOTE.

4.2 Doc. No. WRD 10 (23313) Revision of IS 8237:1985 Code of Practice for Protection of Slope for Reservoir Embankments

In the last meeting, the committee deliberated and resolved the comments received from SSNNL and FINALIZED the document for adoption and printing. The document was notified gazette on 1 August 2024.

The Committee may NOTE.

ITEM 5 DRAFT STANDARDS FOR FINALIZATION

5.1 Doc. No. WRD 10 (21163) Revision of IS 7323: 1994 Guidelines for Operation of Reservoirs

In the last meeting, representative from CWC informed the Committee that they would review the unresolved comments (as placed in Annex 3) and submit their inputs within 15 days. The Committee also requested the Member Secretary to circulate the received comments from CWC to all the Committee members for submission of their views and authorized the Chairperson to resolve the comments based on the inputs received from the Committee members and finalize the document for adoption and printing. In this regard, inputs were requested vide BIS email dated 18 March 2024, 10 April 2024 and 2 May 2024.

Inputs are still awaited.

It is submitted before the Committee that the existing WC-draft (Doc No. 21163) has already crossed the BIS time frame of standards preparation and the document still requires further technical deliberations before reaching a final shape. The Document therefore needs to reviewed at its present stage of Wide Circulation and circulated as a fresh document with new document number.

The Committee may NOTE and DECIDE.

5.2 Doc. No. WRD 10 (25190) Revision of IS 12182: 1987 Guidelines for Determination of Effects of Sedimentation in Planning and Performance of Reservoirs

As decided in the last meeting, the Committee requested the Member Secretary to incorporate all the resolved comments in the draft document and place the document in wide circulation requesting comments from the Committee members. In this regard, the document was placed in Wide circulation dated 3 May 2024 for comments. The comments received from Dr. A. L. Ramanathan on the wide circulation draft are placed in Annex 4 for deliberation.

The Committee may NOTE and DECIDE.

ITEM 6 DRAFT STANDARDS UNDER P DRAFT CIRCULATION

6.1 Doc. No. WRD 10 (25683) Revision of IS 6939: 1992 Methods for determination of evaporation from reservoirs

In the last meeting, The Committee deliberated on the status of the draft document which contains resolved comments from THDC and decided to circulate the document as P-draft circulation among members to seek their comments within one-month time. In this regard, document was placed in P-draft circulation dated 16 May 2024 for comments. As decided in the last meeting, a webinar was held on December 6, 2024, to gather additional inputs for revising the standard. Esteemed speakers, including Dr. Suhas Khobragade, Scientist-G, NIH; Dr. Chandrasekar K, Scientist-G & Head of WRMD, NRSC; and Shri V. Raghunath, Executive Engineer, Irrigation & CAD Department, Telangana, delivered presentations during the event. Following the decision, these speakers have been invited to join the Committee for further discussions to integrate their inputs into the draft document.

The Committee may NOTE and DECIDE.

6.2 Doc. No. WRD 10 (25635) Revision of IS 5477 Part 1: 1999 Fixing the capacities of reservoirs methods Part 1 general requirements

In the last meeting, the Committee deliberated and resolved the comments received from NHPC and decided to circulate the document after incorporating the resolved comments as P-draft circulation among Committee members for further comments. The document was placed in P-draft circulation dated 14 May 2024 for comments. In this regard, the comments have been received from Dr. A. L. Ramanathan and were placed in Annex 5 for deliberation.

The Committee may NOTE and DECIDE.

6.3 IS 15840: 2009 Determination of volume of water and water level in lakes and reservoirs

It is to be informed that Smt. Neena Isaac has been appointed as Convener, ISO/TC 113/SC 1/WG 6)

The Committee may NOTE.

ITEM 7 NEW SUBJECTS FOR STANDARDIZATION

7.1 Guidelines for flushing sediments from reservoirs (New Subject approved by DC in its 13th meeting in June 2010)

In the last meeting, the Committee asked SJVNL to prepare a base draft document incorporating the inputs received from NHPC and WAPCOS. The Committee requested the Member Secretary to circulate the received document as a P-draft to all Committee members for their comments. In this regard draft document was requested vide BIS email dated 03 May 2024. The draft document is still awaited.

The Committee may NOTE and DECIDE.

7.2 Methods for determination of seepage losses from reservoirs (New Subject approved by DC in its 17th meeting in June 2021)

In the last meeting, the Committee requested NIH to include the isotope-related paragraph in the draft document. Furthermore, the Committee requested the Member Secretary to reach out to the National Geophysical Research Institute (NGRI) and the National Dam Safety Authority (NDSA) for additional comments. In this regard, comments were requested vide BIS email dated 03 May 2024. The comments are awaited.

The Committee may NOTE and DECIDE.

7.3 Methods for control of seepage losses from reservoirs

In the last meeting, the Committee requested members to submit their inputs on the draft provided by Dr. A. L. Ramanathan. Additionally, the Committee requested the Member Secretary to circulate Dr. A.L. Ramanathan's inputs to the National Geophysical Research Institute (NGRI) and National Dam Safety Authority (NDSA) for additional comments. In this regard, inputs from Dr. A.L. Ramanathan were circulated vide BIS email dated 03 May 2024 to National Geophysical Research Institute (NGRI) and National Dam Safety Authority (NDSA) for comments. The comments are awaited.

The Committee may NOTE and DECIDE

7.4 Desilting methods including guidelines for silt removal in upstream projects (New Subject approved by DC in its 17th meeting in June 2021)

In the last meeting, The Committee requested CWPRS and NHPC to refer to relevant publications of UNESCO for the table of contents of the document. The Committee requested NHPC and CWPRS to submit their comments within three months' time. In this regard, email was sent requesting for inputs. The inputs are still awaited.

The Committee may NOTE and DECIDE.

ITEM 8 RESEARCH & DEVELOPMENT PROJECTS FOR FORMULATION AND REVIEW OF STANDARDS

BIS has realized the indispensable role of research and development (R&D) projects in the standardization process. Hence, BIS has started a scheme of awarding R&D projects for standards formulation. The guidelines for the same have been circulated with the agenda (also circulated earlier).

The Committee may NOTE.

ITEM 9 ANY OTHER BUSINESS

ANNEX 1

(Item 2)

COMPOSITION OF RESERVOIRS AND LAKES SECTIONAL COMMITTEE, WRD 10

SCOPE: ***Standardization of criteria for planning, design, operation, maintenance and other related aspects of reservoirs/lakes***

Last 3 meetings	**22nd Meeting – 10th Oct 2022**	**23rd Meeting -22nd June 2023**	**24th Meeting – 5th Feb 2024**

Sl. No.	**Name of the Organization**	**Represented by**	**Meetings Attended**		
			22nd	**23rd**	**24th**
1)	National Institute of Hydrology, Roorkee	DIRECTOR (NIH) [Presently Dr. M. K. GOEL] [CHAIRPERSON]	Y	Y	Y
2)	Bhakra Beas Management Board, Chandigarh	Shri H. L. Kambosh (Dy. Chief Engineer	Y	Y	X
3)	Central Water and Power Research Station, Pune	Mr. P. S. Kunjeer, Scientist D Dr. V.M. Prabhakar, Sc C (Alternate) Mr. Nishchay Malhotra, Scientist-B (Alternate II)	X	Y	Y
4)	Central Water Commission, New Delhi	Mr. Md. Faiz Director, Hyd. (C) Shri Amithabh Meena, Director R O (Alternate)	X	X	Y
5)	DHI Group India, New Delhi	Dr. Shresth Tayal, Head of Water Resources – International Development Mr. Manish Kumar, Senior Manager - MIKE Powered by DHI (Alternate-I) Ms. Jeba Grace J, Water Resource Engineer (Alternate-II)	X	X	Y

6)	Indian Institute of Technology, Bombay	Prof. V. Jyothiprakash, Civil Engineering	Y	Y	Y
7)	Indian Institute of Technology Roorkee, Roorkee	Prof Arun Kumar, HRED Prof. Sumit Sen, Hydrology (Alternate)	Y	Y	X
8)	Irrigation Research Institute, Roorkee	Shri Dinesh Chandra, CE Shri Shankar Kumar Saha Superintending Engineer (Alternate)	Y	Y	Y
9)	J&K Lakes And Water Way Development Authority, Srinagar	Executive Engineer	X	X	X
10)	Ministry of Irrigation, Sardar Sarovar Construction Advisory Committee, Vadodara, Gujarat	Shri N K Bhandari Secretary Shri K V Rathod Assistant Secretary (Alternate)	X	Y	Y
11)	Narmada And Water Resources, Water Supply & Kalpsar Deptt., Gujarat	Shri R.M.Patel, Chief Engineer & Director Mrs. D. N. Pradhan, Research Officer, Narmada Hydraulics Division (Alternate)	Y	Y	Y
12)	National Hydroelectric Power Corporation, Faridabad	Ms. Manjusha Mishra, Deputy General Manager (Civil) Shri Praveen Kumar Jain, Deputy General Manager Alternate) Ms. Ankur Sharma Assistant Manager Civil (Alternate II)	Y	Y	Y
13)	National Institute of Hydrology, Roorkee	Dr. S.D. Khobragade, Scientist ‘G’ Dr. A.R. Senthil Kumar, Scientist 'G' (Alternate)	Y	Y	Y
14)	National Remote Sensing Centre, Hyderabad	Dr. V. Venkateshwar Rao Shri Abdul Hakeem Head, (Alternate)	Y	Y	X
15)	National Thermal Power Corporation Limited, New Delhi	Shri. Rakesh Sharma Manager (Design) , Hydropower Dr. A. K. Singh (Alternate)	X	X	X

16)	National Water Academy, Pune	Shri Ashok Kumar Kharya, Chief Engineer Shri S N Pande, Director (Alternate)	X	Y	Y
17)	National Water Development Agency, New Delhi	Mr. R K Jain Chief Engineer HQ Mr. S.C. Awasthi, Superintending Engineer (Alternate)	X	X	X
18)	Sardar Sarovar Narmada Nigam Limited, Gandhinagar	C. V. Nadpara, Director (Canals) R. G. Kanoongo (Alternate)	X	X	Y
19)	Satluj Jal Vidyut Nigam Limited	Shri Vinay Guleria, Manager Sudha Devi, Manager (Alternate)	X	Y	Y
20)	Tehri Hydroelectric Development Corporation Limited, Rishikesh	Shri Virendra Singh AGM (OMS-HM & EM) Shri. Atul Kumar Singh DGM (OMS-CIVIL) (Alternate)	X	Y	Y
21)	UVCE Bangalore University	Dr. Inayathulla M, Prof. Civil Engineering	Y	Y	Y
22)	Water and Power Consultancy Services Limited	Dr. A K Sharma Chief (Project) Director Shri A Stephen Leo, General Manager (Alternate)	Y	Y	Y
23)	Water Resources Department, Andhra Pradesh	Shri A. Suri Babu Superintending Engineer	X	X	X
24)	Water Resources Department, M.P., Bhopal	Shri B.C. Purandare Chief Engineer Shri S R Uikey (Alternate)	X	X	X
25)	Water Resources Department, Maharashtra	Shri. Rajesh M. More SE (Dam) Shri A. P. Kohikar DIRECTOR GENERAL (Alternate)	X	Y	X
26)	Maharashtra Engineering Research Institute, Nashik	Mr. Yashavantrao Bhadane ,SE (Dam Safety)	X	X	Y
27)	Water Resources Department, Odisha	Chief Engineer (D&R) Director (Headworks) (*Alternate*)	X	X	X

28)	Water Resources Department, Govt. of Punjab	Shri Pawan Kapoor Shri. K. K. Gupta CE (Dam Rsdd) (*Alternate*) Shri N.K Jain Chief Engineer (*Alternate II*)	X	X	X
29)	Wetlands International South Asia	Dr. Ritesh Kumar, Director Mr. Harsh Ganapathi Technical Officer – Water Management (*Alternate*)	Y	X	X
30)	In Personal Capacity	Dr. Ramanathan, Professor	X	X	Y
31)	In Personal Capacity	Prof. M L Kansal, IIT Roorkee	X	X	X
32)	In Personal Capacity	Dr. Jagannatha V	Y	Y	Y

ANNEX 2

(Item 3.1)

Program of Work

SCOPE: Standardization of criteria for planning, design, operation, maintenance and other related aspects of reservoirs/lakes.

STANDARDS PUBLISHED

Sl. No	IS No.	Title
1.		Glossary of terms relating to river valley projects Part 6 reservoirs Second Revision
2.	IS 5477 Part 1 : 1999	Fixing the capacities of reservoirs methods Part 1 general requirements First Revision
3.	IS 5477 Part 2 : 2020	Methods for Fixing the Capacities of Reservoirs Part 2 Dead Storage Second Revision
4.	IS 5477 Part 3 : 2002	Fixing the capacities of reservoirs - Methods Part 3 live storage First Revision
5.	IS 5477 Part 4 : 2019	Methods for fixing the capacities of reservoirs Part 4 surcharge storage First Revision
6.	IS 6518 : 2017	Guidelines for control of sediment in reservoirs Second Revision
7.	IS 6939 : 1992	Methods for determination of evaporation from reservoirs First Revision
8.	IS 7323 : 1994	Operation of reservoirs - Guidelines First Revision
9.	IS 8237 : 1985	Code of practice for protection of slope for reservoir embankment First Revision
10.	IS 12182 : 1987	Guidelines for determination of effects of sedimentation in planning and performance of reservoirs
11.	IS 13665 : 2017 ISO 6421 : 2012	Hydrometry - Methods for assessment of reservoir sedimentation First Revision
12.	IS 14654 : 1999	Minimising evaporation losses from reservoirs - Guidelines
13.	IS 15472 : 2004	Guidelines for planning and design of low level outlets for evacuating storage reservoirs
14.	IS 15840 : 2009	Determination of volume of water and water level in lakes and reservoirs

ANNEX 3

(Item 5.1)

Sl. No.	Committee/ Organization/ Individual	Clause/ Sub-clause Paragraph Figure/ Table	Type of Comment General/ Technical/ Editorial	Comments (Justification For Change)	Proposed Change
3.	NHPC	**Clause/ Sub-clause 4.1.1**	Technical	Something specific may be mentioned for principal of operation of single purpose reservoirs created for hydropower generation.	A New sub-clause 4.1.1(c) may be created and detailed as below: c) Hydropower-- Generally reservoirs created for hydropower projects are small and meant for generation of power with sufficient pondage for supplying water for meeting diurnal or weekly fluctuation of demand. For effective flood and sediment management reservoir water levels are maintained near Minimum Draw Down Level MDDL during high flow periods (monsoon). Though there is some loss of head but keeping in view the effectiveness in sediment management leading to extended useful life of reservoir, this operational methodology is very useful especially for reservoirs located in Himalayan region. During low flow periods reservoir water level fluctuates between FRL and Minimum Draw Down Level (MDDL) depending upon inflow and power requirement.

4.	NHPC	**Clause/ Sub-clause 4.1.2.1 (b)**	Technical	The extent of "Flood Control Zone" definition may be defined.	The Flood Control Zone may be defined as: **Flood control zone** — This is the storage space earmarked as temporary storage for absorbing high flows for alleviating down-stream flood damages. This should be space emptied as soon as possible to negotiate next flood event. This zone is generally between Full Reservoir Level (FRL) and a pre-defined level between FRL & MDDL / Dead Storage level (DSL).
8.	NHPC	Clause / Sub-clause 6.3	Technical	The real time operation of hydropower reservoirs in Himalayan region requires implementation of Early Warning.	A new **subclause 6.3 (h)** may be inserted as: Hydropower Projects located at Himalayan regions are most vulnerable for multiple kind of disasters such as Landslides, Cloudburst, Flash floods, Earthquakes, Avalanches, Glacial Lake Outburst Flood (GLOF), and Landslide Lake Outburst Flood (LLOF)etc. To reduce the risk to the life and property due to such disasters a comprehensive Early Warning System (EWS) need to be implemented. CEA has Prepared SOPs for Early Warning System (Dec 2021 & Jun 2022) and circulated it to all the developers for implementation.

ANNEX 4

(Item 5.2)

Comments from Dr. A.L Ramanathan on IS 12182: 1987 Guidelines for Determination of Effects of Sedimentation in Planning and Performance of Reservoirs

Sl. No.	Committee/ Organization/ Individual	Clause/ Sub clause Paragraph Figure/Table	Type of Comment General/ Technical/ Editorial	Comments (Justification For Change)	Proposed Change
1.	JNU	5.0	Modeling Approaches (Numerical Modeling) Using hydrological models (SWAT) (HEC-ResSim), to simulate reservoir behavior, including evaporation losses, based on input data and model parameters. Artificial Intelligence (AI) and Machine Learning:	Remote sensing techniques details to be added to estimate the evaporation loss as well	To be added

			Using historical data to predict evaporation rates in reservoirs based on meteorological, hydrological, and reservoir-specific variables. They can capture complex relationships and provide accurate forecasts. Integrated Monitoring Systems: Deploying a combination of direct measurement techniques, remote sensing, and modeling approaches to capture evaporation dynamics comprehensively. Integrating multiple data sources :for more accurate and robust estimates of evaporation losses. The methods have to be tailored to the specific characteristics of the reservoir and the surrounding environment to assess evaporation losses in tropical reservoirs,		

ANNEX 5

(Item 6.1)

Comments from Dr. A. L. Ramanathan on IS 5477 Part 1: 1999 fixing the capacities of reservoirs methods Part 1 general requirements

Sl. No.	**Committee/ Organization/ Individual**	**Clause/ Sub clause Paragraph Figure/Table**	**Type of Comment General/ Technical/ Editorial**	**Comments (Justification For Change)**	**Proposed Change**
	JNU	5.12	Bed load estimation from Suspended laod	The suspended sediment load of a river is composed primarily of clay and silt particles. According to Knighton (1998, p.118), this equates to the <0.062-mm fraction. The magnitude of the suspended sediment load of a river will reflect the denudation processes operating in the upstream catchment The clastic load of the rivers of the world is about four times larger than the dissolved load. Similarly, the suspended load is several times greater than the bed load transport. Values	(https://iahs.info/uploads/dms/13022.26%20182-188%20S11-38%20Babinski.pdf)refer this paper https://doi.org/10.22092/ijwmse.2015.100821

				commonly fall within the bounds 85–99% suspended load to 1–15% bed load The ratio of bed load to suspended load can be determined more accurately using reservoir sediment bathymetric information.	
2.		5.0	More information is required on lithology and soil characteristics Slope Meteorological conditions (microclimate changes)		
3				Need more information on wind directions to put natural wind breakers (trees and vegetation) for shading effect etc. maximum orientation of the dams for exposure to sun etc., may be added	

		5.4	Loses in reservoirs	Check dams and green grass covers may be considered when channels bring more sediment load into system -even enhance trap efficiency before reaching the system	
4		5.9	GLOF	More detailed information is required due to changing climate and increasing temperatures - causing landslides, avalanches etc., Also the permafrost region loss is be taken into consideration for C storage and release and stability and seepage aspect etc.,	