Superintending Engineer
Dam Safety Organisation
Dindori Road, Nashik-422004.
Phone (Off.): 0253 – 2530030.
Fax: 0253 – 2530030.
E-mail: se.damsafety@gmail.com
Website: www.mahadso.org

सत्यमेव जयते
महाराष्ट्र शासन
जलसंपदा विभाग

GOVERNMENT OF MAHARASHTRA
WATER RESOURCES DEPARTMENT

अधीक्षक अभियंता,
धरण सुरक्षितता संघटना,
दिंडोरी मार्ग, नाशिक- ४२२ ००४.
दूरध्वनी (ऑ.): ०२५३ - २५३००३०
फॅक्स : ०२५३ - २५३००३०.
ई-मेल : se.damsafety@gmail.com
वेबसाईट : www.mahadso.org

No.DSO/DSD1/ ACHSR/ 267 /2020 | Date - 19 / 06 / 2020

To,

The Chief Engineer (DSO),
Central Water Commission,
Dam Safety monitoring Directorate,
8th Floor, (N), Seva Bhavan,
R. K. Puram,
New Delhi – 110 066

Sub - Annual Consolidated Health Statues Report of Identified Large Dams in Maharashtra State, for the Year - 2019 -20

Annual Consolidated Heath Status Report of Identified Large Dams in Maharashtra State for Year – 2019-20 based on pre monsoon-2019 & post monsoon-2019 Inspection Reports, covering dam safety activities, is prepared and furnished herewith for information. Acknowledgement of the same may please be sent to this office.

D.A. – As Above 1 copy

19/06/2020
(Y. K. Bhadane)
Superintending Engineer
Dam Safety Organization
Nashik

Copy Submitted to the Secretary, Water Resources Management & Command Area Development (WRM & CAD), Water recourse Department, Mantralaya, Mumbai – 32 for information please.
(Kind Attention – Shri A. A. Kapole, Chief Engineer, (I), Joint Secretary)
D.A. – As Above 1 copy

Copy to the Director General, (DTHRS), MERI, Nashik-4 for information please.
D.A. – As Above 1 copy

Copy Submitted to the Director (DSM), Central Water Commission, Dam Safety Monitoring Directorate, 8th Floor (N), Seva Bhavan, R. K. Puram, New Delhi – 110066 for information please.
D.A. – As above 1 copy

Copy to the Chief Engineer, Planning & Hydrology, Nashik for information please.
D.A. – As Above 1 copy

Copy to Executive Engineer, Dam Safety Division No.1, / 2 / 3, Nashik for information please.
D.A. – As Above 1 copy

Copy to Library, Dam Safety Organisation for record.
D.A. – As Above 1 copy

No. DSO/DSD1/ACHSR/267/2020, Date-19/06/2020

GOVERNMENT OF MAHARASHTRA
WATER RESOURCES DEPARTMENT

Waghur River Project
Tal. Bhusawal, Dist. Jalgaon

Annual Consolidated Health Status Report (ACHSR)
Of
Identified Large Dams (Class-I, II)
For
Maharashtra State for Year 2019-20

Superintending Engineer,
Dam Safety Organization,
CDO Building Dindori Road,
Nashik- 4

FOREWORD

1. Maharashtra has the distinction of having largest number of completed large dams (2394), i.e about 45% of total population of completed large dams (5334) in the country (as per NRLD register 2019). There are 1398 large dams (class I and II) in the Maharashtra state, in which 270 class I dams and 1128 class II dams.

2. The Regionwise Annual Consolidated Health Status Report (ACHSR) of Identified Large Dams (class I and II) in Maharashtra state for the Year 2019-20 is prepared and forwarded to all concern field officers. ACHSR is based on the Inspection Reports (Pre and Post Monsoon 2019) received from field officers and the test inspections carried out by Dam Safety Organisation, Nashik during year 2019-20.

3. In order to have overall health status of dams in State, consolidation of all the regionwise Health Status is prepared herewith. This report provides condensed summary of dam deficiencies noticed during inspection carried out by field officers and Dam Safety Organisation in the year 2019-20. Field officer/ Owners of dams are requested to remove deficiencies to achieve dam safety aspect and send compliance reports.

4. This Consolidated Report of Maharashtra, as per guidelines received from Dam Safety Monitoring Unit of Central Water Commission, New Delhi vide letter No. 3/19/NCDS/ HS/ DSM/ 2001 dt. 28/8/2002, comprises of following parts.

   Part-I: Action Taken Report on the Health Status Report 2018 on deficiencies classified under Category I & II.

   Part-II: Annual Consolidated Health Status Report prepared for the year 2019-20as described above for identified Large Dam Class-I and Dam Class-II on the basis of deficiencies classified under Category No. 1, 2 & 3.

   Part-III: Annual Report of Performance of Dam Instruments installed on identified large dams.

   Part-IV: Annual Report of Performance of Meteorological Instruments installed on large Dams.

   Part-V: Status of NCDS documents submitted to D. S. O. (including private dams)

   Part-VI: DHARMA : Dam Health and Rehabilitation Monitoring Application

   Part-VII: Status report of various gated dams in the region (including private dams)

   Annexure-3 - Detailed Health Status Reports of all six regions in Maharashtra State are annexed.

5. The Executive Engineers-Shri. P. R. Shirsat and Shri. N. S. Dusane, Deputy Engineers - Shri. D.T. Phalak Shri.K. V. Joshi, Shri.V. Z. Nemade; AE-II / Jr. Engr.- Shri. R. R. Salunkhe, Shri. H. P. Devkate, Asstt. Scientific Officer Smt.Vaishali Jagtap have taken efforts to prepare this report under the guidance of **Shri. M. A. Matey,** Chief Engineer, Planning and Hydrology, Nashik and Shri**. Y. K. Bhadane,** Superintending Engineer, Dam Safety Organisation, Nashik.

6. Inspecting officers are requested to follow the suggestions given in Annexure -1 while carrying out forthcoming Pre/Post monsoon inspection of dam. In Annexure-1 general information viz. Time schedule of inspection, classification of dams, inspection authorities, preparation of AHSR for Class-I and Class-II dams, NRLD register updation, categorisation and standardisation of deficiencies, monitoring of deficiency removal programme is given, which will be helpful to field officer.

7. Standardization of the deficiencies for the category 1 to 3 has been made. This will facilitate proper classification of deficiencies, to decide the priorities and to plan the rectification measures accordingly. The targets can be decided according to no. of deficiencies, depending on availability of budget. Deficiencies standardization is given in Annexure-2

8. This report does not cover Class III dams and small dams. It is the responsibility of regional Chief Engineers to ensure inspection of such dams and publication of HSR of Class III and small dams under their control.

9. This report covers Dam Health Status of 1350 Class-I & II dams owned by WRD and also covers 48 private dams which are inspected by DSO.

10. In respect of Pre & Post monsoon inspection reports, 99.56% of the dams (1311 out of 1398) have been received in DSO. Both Pre & Post monsoon inspection reports of 16 Class I Dams and 08 Class-II Dams have not been received in DSO. (Please refer Table 2.2). Concerned Executive Director and Regional Chief Engineers are requested to ensure that every dam of Category –I & II is inspected every year by the competent authorities and inspection reports sent to DSO.

Statement showing total numbers of dams with deficiencies.

Sr. No	Region	Dam owner	Organisation	Year	Number of dams			Number of Class I Dams having deficiencies.			Number of Class II dams having deficiencies.		
					Class I	Class II	Total	Cat-1	Cat-2	Cat-3	Cat-1	Cat-2	Cat-3
1	Kokan	W.R.D	Civil	2018	39	110	149	00	20	39	00	52	110
				2019	39	111	150	00	32	39	00	49	111
			Mech	2018	15	00	15	00	15	15	00	00	00
				2019	15	00	15	01	15	15	00	00	00
		Local sector	Civil	2018	02	33	35	00	02	02	00	03	33
				2019	02	33	35	00	02	02	00	12	33
		Private	Civil	2018	09	06	15	00	07	09	00	02	06
				2019	09	06	15	00	07	09	00	03	06
			Mech	2018	08	00	08	00	08	08	00	00	00
				2019	08	00	08	00	07	07	00	00	00
	TOTAL Kokan	W.R.D		2018	39	110	149	00	20	39	00	52	110
				2019	39	111	150	00	32	39	00	49	111
		Local sector		2018	02	33	35	00	02	02	00	03	33
				2019	02	33	35	00	02	02	00	12	33
		Private		2018	09	06	15	00	07	09	00	02	06
				2019	09	06	15	00	07	09	00	03	06
2	Pune	W.R.D	Civil	2018	64	188	252	00	26	64	00	15	188
				2019	66	195	261	00	48	66	00	47	195
			Mech	2018	40	00	40	00	37	37	00	00	00
				2019	40	00	40	00	37	37	00	00	00
		Local sector	Civil	2018	00	31	31	00	00	00	00	10	31
				2019	00	38	38	00	00	00	00	16	38
		Private	Civil	2018	07	08	15	00	02	02	00	03	03
				2019	07	08	15	00	02	02	00	03	03
			Mech	2018	02	00	02	00	02	02	00	00	00
				2019	01	00	01	00	01	01	00	00	00
	TOTAL Pune	W.R.D		2018	64	188	252	00	26	64	00	15	188
				2019	66	195	261	0	48	66	0	47	195
		Local sector		2018	00	31	31	00	00	00	00	10	31
				2019	00	38	38	00	00	00	00	16	38
		Private		2018	07	08	15	00	02	07	00	03	03
				2019	07	08	15	00	02	02	00	03	08
3	NMR	W.R.D	Civil	2018	66	213	279	00	13	53	00	47	166
				2019	67	219	286	00	08	59	00	44	175
			Mech	2018	33	00	33	00	33	33	00	00	00
				2019	34	00	34	01	33	33	00	00	00
		Local sector	Civil	2018	00	11	11	00	00	00	00	04	07
				2019	00	11	11	00	00	00	00	03	08
		Private	Civil	2018	01	08	09	00	00	01	00	01	07
				2019	01	08	09	00	00	01	00	01	07
			Mech	2018	01	00	01	00	01	01	00	00	00
				2019	01	00	01	00	01	01	00	00	00
	TOTAL NMR	W.R.D		2018	66	213	279	00	13	53	00	47	166
				2019	67	219	286	00	08	59	00	44	175
		Local sector		2018	00	11	11	00	00	00	00	04	07
				2019	00	11	11	00	00	00	00	03	08
		Private		2018	01	08	09	00	00	01	00	01	07
				2019	01	08	09	00	00	01	00	01	07

Sr. No	Region	Dam owner	Organisation	Year	Class & Number of dams			Number of Class I Dams having deficiencies.			Number of Class II dams having deficiencies.		
					Class I	Class II	Total	Cat-1	Cat-2	Cat-3	Cat-1	Cat-2	Cat-3
4	Marathwada	W.R.D	Civil	2018	35	238	273	00	04	35	00	16	234
				2019	37	243	280	00	05	26	00	27	235
			Mech	2018	35	06	41	00	14	14	00	00	00
				2019	37	17	54	00	26	32	00	04	13
		Local sector	Civil	2018	00	01	01	00	00	00	00	00	01
				2019	00	02	02	00	00	00	00	00	02
		Private	Civil	2018	00	04	04	00	00	00	00	04	04
				2019	00	04	04	00	00	00	00	04	04
			Mech	2018	00	04	04	00	00	00	00	00	00
				2019	00	04	04	00	00	00	00	03	03
	TOTAL Marathwada	W.R.D		2018	35	238	273	00	04	35	00	16	234
				2019	37	243	280	00	05	26	00	27	235
		Local sector		2018	00	01	01	00	00	00	00	00	01
				2019	00	02	02	00	00	00	00	00	02
		Private		2018	00	04	04	00	00	00	00	04	04
				2019	00	04	04	00	00	00	00	04	04
5	Amaravati	W.R.D	Civil	2018	22	181	203	00	09	22	00	34	175
				2019	22	188	210	00	09	22	00	39	174
			Mech	2018	17	00	17	00	17	17	00	00	00
				2019	17	00	17	00	17	17	00	00	00
		Local sector	Civil	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private	Civil	2018	00	02	02	00	00	00	00	01	02
				2019	00	02	02	00	00	00	00	01	02
			Mech	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
	TOTAL Amaravati	W.R.D		2018	22	181	203	00	09	22	00	34	175
				2019	22	188	210	00	09	22	00	39	174
		Local sector		2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private		2018	00	02	02	00	00	00	00	01	02
				2019	00	02	02	00	00	00	00	01	02
6	Nagpur	W.R.D	Civil	2018	19	58	77	00	10	19	00	09	58
				2019	19	58	77	00	09	19	00	12	55
			Mech	2018	13	00	13	00	13	13	00	00	00
				2019	13	00	13	00	11	13	00	00	00
		Local sector	Civil	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private	Civil	2018	01	02	03	00	01	01	00	02	02
				2019	01	02	03	00	01	01	00	02	02
			Mech	2018	01	00	01	00	01	01	00	00	00
				2019	01	00	01	00	01	01	00	00	00
	TOTAL Nagpur	W.R.D		2018	19	58	77	00	10	19	00	09	58
				2019	19	58	77	00	09	19	00	12	55
		Local sector		2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private		2018	01	02	03	00	01	01	00	02	02
				2019	01	02	03	00	01	01	00	02	02
TOTAL		**W.R.D**		**2018**	245	988	1233	00	82	232	00	173	995
				2019	250	1014	1264	00	111	231	00	218	945
TOTAL		**Local sector**		**2018**	02	76	78	00	02	02	00	17	72
				2019	02	84	86	00	02	02	00	31	81
TOTAL		**Private**		**2018**	18	30	48	00	10	18	00	13	24
				2019	18	30	48	00	10	18	00	13	29
GRAND TOTAL (Civil)				**2018**	265	1094	1359	00	94	252	00	203	1091
				2019	270	1128	1398	00	123	251	00	263	1055

Statement showing total numbers of dams with deficiencies.
(As per data from Mechanical Organization)

Sr. No	Region	Dam owner	Organisation	Year	Class & Number of dams			Number of Class I Dams having deficiencies.			Number of Class II dams having deficiencies.		
					Class I	Class II	Total	Cat-1	Cat-2	Cat-3	Cat-1	Cat-2	Cat-3
TOTAL		W.R.D		2018	153	6	159	0	129	129	0	0	0
				2019	156	17	173	2	139	147	0	4	13
TOTAL		Private		2018	12	4	16	0	12	12	0	0	0
				2019	11	4	15	0	10	10	0	3	3
GRAND TOTAL (Mech)				2018	165	10	175	0	141	141	0	0	0
				2019	167	21	188	2	149	157	0	07	16

Statement showing total number of deficiencies

Sr. No.	Region	Dam Owner	Organisation	Year	Number of Deficiencies								
					Category-I			Category-II			Category-III		
					Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
1	**Konkan**	W.R.D	Civil	2018	0	0	0	60	100	160	305	344	649
				2019	00	00	00	110	96	206	315	361	676
			Mech	2018	00	00	00	259	00	259	459	00	459
				2019	01	00	01	392	00	392	900	00	900
		LS	Civil	2018	00	00	00	04	06	10	20	88	108
				2019	00	00	00	07	19	26	20	162	182
		Private	Civil	2018	00	00	00	39	08	47	64	57	121
				2019	00	00	00	38	09	47	65	55	120
			Mech	2018	00	00	00	44	00	44	135	00	135
				2019	00	00	00	87	00	87	255	00	255
	TOTAL **Konkan**	W.R.D		2018	00	00	00	319	100	419	764	344	1108
				2019	01	00	01	502	96	598	1215	361	1576
		Local sector		2018	00	00	00	04	06	10	20	88	108
				2019	00	00	00	07	19	26	20	162	182
		Private		2018	00	00	00	83	08	91	199	57	256
				2019	00	00	00	125	09	134	320	55	375
2	**Pune**	W.R.D	Civil	2018	00	00	00	98	22	120	465	1059	1524
				2019	00	00	00	270	58	328	848	1458	2306
			Mech	2018	00	00	00	712	00	712	1512	00	1512
				2019	00	00	00	700	00	700	1772	00	1772
		LS	Civil	2018	00	00	00	00	18	18	00	134	134
				2019	00	00	00	00	35	35	00	192	192
		Private	Civil	2018	00	00	00	00	17	17	40	41	81
				2019	00	00	00	00	17	17	34	36	70
			Mech	2018	00	00	00	07	00	07	06	00	06
				2019	00	00	00	02	00	02	09	00	09
	TOTAL **Pune**	W.R.D		2018	00	00	00	810	22	832	1977	1059	3036
				2019	00	00	00	970	58	1028	2620	1458	4078
		Local sector		2018	00	00	00	00	18	18	00	134	134
				2019	00	00	00	00	35	35	00	192	192
		Private		2018	00	00	00	07	17	24	46	41	87
				2019	00	00	00	02	17	19	43	36	79

Sr. No.	Region	Dam Owner	Organisation	Year	Number of Deficiencies								
					Category-I			Category-II			Category-III		
					Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
3	NMR	W.R.D	Civil	2018	00	00	00	52	196	248	244	610	854
				2019	00	00	00	32	173	205	509	788	1297
			Mech	2018	00	00	00	905	00	905	1203	00	1203
				2019	02	00	02	1077	00	1077	2860	00	2860
		LS	Civil	2018	00	00	00	00	22	22	00	35	35
				2019	00	00	00	00	19	19	00	43	43
		Private	Civil	2018	00	00	00	00	02	02	03	29	32
				2019	00	00	00	00	02	02	00	44	44
			Mech	2018	00	00	00	05	00	05	05	00	05
				2019	00	00	00	10	00	10	30	00	30
	TOTAL NMR	W.R.D		2018	00	00	00	957	196	1153	1447	610	2057
				2019	02	00	02	1109	173	1282	3369	788	4157
		Local sector		2018	00	00	00	00	22	22	00	35	35
				2019	00	00	00	00	19	19	00	43	43
		Private		2018	00	00	00	05	02	7	08	29	37
				2019	00	00	00	10	02	12	30	44	74
4	Marath wada	W.R.D	Civil	2018	00	00	00	14	56	70	199	929	1128
				2019	00	00	00	20	83	103	281	952	1233
			Mech	2018	00	00	00	405	00	405	987	00	987
				2019	00	00	00	422	68	490	2168	618	2786
		LS	Civil	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	11	11
		Private	Civil	2018	00	00	00	00	12	12	00	30	30
				2019	00	00	00	00	14	14	00	33	33
			Mech	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	81	81	00	64	64
	TOTAL Marathwada	W.R.D		2018	00	00	00	419	56	475	1186	929	2115
				2019	00	00	00	442	151	593	2449	1570	4019
		Local sector		2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	11	11
		Private		2018	00	00	00	00	12	12	00	30	30
				2019	00	00	00	00	95	95	00	97	97
5	Amravati	W.R.D	Civil	2018	00	00	00	30	111	141	122	689	811
				2019	00	00	00	29	120	149	132	725	857
			Mech	2018	00	00	00	390	00	390	802	00	802
				2019	00	00	00	284	00	284	1016	00	1016
		LS	Civil	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private	Civil	2018	00	00	00	00	02	02	00	15	15
				2019	00	00	00	00	02	02	00	15	15
			Mech	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
	TOTAL Amravati	W.R.D		2018	00	00	00	420	111	531	924	689	1613
				2019	00	00	00	313	120	433	1148	725	1873
		Local sector		2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private		2018	00	00	00	00	02	02	00	15	15
				2019	00	00	00	00	02	02	00	15	15

Sr. No.	Region	Dam Owner	Organisation	Year	Number of Deficiencies								
					Category-I			Category-II			Category-III		
					Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
6	Nagpur	W.R.D	Civil	2018	00	00	00	25	24	49	118	200	318
				2019	00	00	00	25	25	50	118	207	325
			Mech	2018	00	00	00	127	00	127	00	00	00
				2019	00	00	00	36	00	36	989	00	989
		LS	Civil	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private	Civil	2018	00	00	00	03	07	10	09	06	15
				2019	00	00	00	03	07	10	09	06	15
			Mech	2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	02	02	43	00	43
	TOTAL Nagpur	W.R.D		2018	00	00	00	152	24	176	118	200	318
				2019	00	00	00	61	25	86	1107	207	1314
		Local sector		2018	00	00	00	00	00	00	00	00	00
				2019	00	00	00	00	00	00	00	00	00
		Private		2018	00	00	00	03	07	10	09	06	15
				2019	00	00	00	03	09	12	52	06	58
TOTAL		WRD		2018	00	00	00	3077	509	3586	6416	3831	10247
				2019	03	00	03	3397	623	4020	11908	5109	17017
TOTAL		LS		2018	00	00	00	04	46	50	20	257	277
				2019	00	00	00	07	73	80	20	408	428
TOTAL		PRIVATE		2018	00	00	00	98	48	146	262	178	440
				2019	00	00	00	140	134	274	445	253	698
GRAND TOTAL				2018	00	00	00	3179	603	3782	6698	4266	10964
				2019	03	00	03	3544	830	4374	12373	5770	18143

Sr. No.	Region	Dam Owner	Organisation	Year	Number of Deficiencies (Civil)								
					Category-I			Category-II			Category-III		
					Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
TOTAL		WRD		2018	0	0	0	279	509	788	1453	3831	5284
				2019	0	0	0	486	555	1041	2203	4491	6694
TOTAL		LS		2018	0	0	0	4	46	50	20	257	277
				2019	0	0	0	7	73	80	20	408	428
TOTAL		PRIVATE		2018	0	0	0	42	48	90	116	178	294
				2019	0	0	0	41	51	92	108	189	297
GRAND TOTAL (Civil)				2018	0	0	0	325	603	928	1589	4266	5855
				2019	0	0	0	534	679	1213	2331	5088	7419

Statement showing total number of deficiencies in gated dams
(As per data from Mechanical Organization)

Sr. No.	Region	Dam Owner	Organisation	Year	Number of Deficiencies								
					Category-I			Category-II			Category-III		
					Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
TOTAL		WRD		2018	0	0	0	2798	0	2798	4963	0	4963
				2019	3	0	3	2911	68	2979	9705	618	10323
TOTAL		PRIVATE		2018	0	0	0	56	0	56	146	0	146
				2019	0	0	0	99	83	182	337	64	401
GRAND TOTAL (Mech)				2018	0	0	0	2854	0	2854	5109	0	5109
				2019	3	0	3	3010	151	3161	10042	682	10724

11. Observations / Findings in HSR – 2019

11.1 There is no dam having Category-I deficiency. (Civil Component). However, two mechanical components for two dams are found to be under Category -1 deficiency. It is observed that **123 Class I** dams (45.55%) and **263 Class II** (23.31%) are having major deficiencies of Category- II.

11.2 As per HSR 2018, out of 1360 dams (Class-I & II dams), in 297 dams (Class-I & Class-II), major deficiencies of category II were observed.

11.3 Regarding deficiencies in Mechanical components (Gates & Hoists etc.) two dams (Tillari Main & Sarangkheda Barrage) has noticed Category –I deficiency and 160 dams have been noticed with Category- 2 deficiencies and need attention of the project authorities.

11.4 The deficiencies shown in the present report are based on the pre/ post monsoon inspections of the dams carried out by the field officers and reports of them received by this organization. As such, the deficiencies and action taken thereof is the sole responsibility of the field officers.

12. Resposibilities of Field Officers

12.1 It is needless to over emphasize the fact that the owner / the officer in charge of a dam are primarily responsible for ensuring safety / sustainable health of that dam. It is expected that owner / officers in charge i.e. Executive Enginer and Superintending Engineer must initiate quick actions for removing the noticed deficiencies in order to improve health of dams.

12.2 Executive Directors of all Irrigation Development Corporations are requested to ensure that adequate funds are made available for removing deficiencies in dams. Also requested to monitor the progress of deficiencies removal program periodically. This will help in keeping the dam safe.

I hope this report will serve desired expectations expressed by Dam Safety Monitoring Directorate of C.W.C., New Delhi. I also hope this report would help dam owners/ in charge officers in their efforts towards maintaining and improving safety and sustained good health of their dams.

Any error, discrepancies omissions if any may please kindly by brought to the notice of this Organisation, so that it can be taken into consideration in the next report.

The efforts taken by the Superintending Engineer, Dam Safety Organisation, Nashik and his staff, in preparing and completion of this report are highly appreciated.

The efforts taken by field officers in inspecting the dams and submission of reports to this organisation are appreciated.

Place: Nashik-4
Date: 17 / 06 / 2020

(A. P. Kohirkar)
Director General
Design, Training, Hydrology.
Research and Safety,
MERI, Nashik-4.

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Annual Consolidated Health Status Report of Identified Large Dams In Maharashtra State 2019-20

PART – 1

Action Taken Report on Annual Health Status Report of Identified Large Dams for Year 2018-19

PART – 1
Action Taken Report on Annual Consolidated Health Status Report 2018-19 of Identified Large Dams in Maharashtra State

1.0 General

The Annual consolidated Health Status Report of Maharashtra State for the year 2018 was prepared and submitted to DSM of CWC, New Delhi vide letter No. DSO/DSD-3/300-A/2018-19 dated 06/06/2019 as well as to Government of Maharashtra. The Health Status Reports prepared region wise in the State was circulated to all field officers by the Dam Safety Organisation. Field officers were requested to carry out remedial measures to remove major deficiencies pointed out in HSR and send action taken report to DSO.

In most of the cases, response received from field officers is regarding information of initiation of administrative procedures, viz. estimate preparation, and reference to design organization or Mechanical organization. In some cases, even though remedial measures are taken no reports are sent to DSO. In such situation, the ATR part of this HSR doesn't give correct picture. Hence, it is necessary that ATR should be sent to DSO only after careful scrutiny at the Chief Engineer level. The region wise number of dams having major deficiencies as per HSR 2018-19 and status of compliance is given in Table 1.1

ACHSR 2018-19 was prepared for 1359 (Class-I 265 & Class-II 1094) large dams. Out of these dams, 297 dams (Class-I 94 & Class-II 203) have major deficiencies. Action taken reports of 106 dams are not received from field officers. Regionwise breakup of dams whose deficiencies are fully complied, partly complied & not complied is given in Table 1.2

The year wise (2008-2018) tabulation of compliance of deficiencies pointed out in previous years for class I and class II dams combined is given in Table 1.3. It is found that the trend of decrease in receipt of compliance report of deficiencies is changed (i.e. increased) in the year 2018-19.

1.1 Action Taken Report on Defeciencies of Large Dams Class I

1.1.1 Action Taken Report on Deficiency Category-1 of Large Dams Class I

No such dam under this category is reported.

1.1.2 Action Taken Report on Deficiency Category-2 of Large Dams Class I

There are 94 dams reported under this category. Regionwise no. of dams is given in Table 1.1

1.2 Action Taken Report on Defeciencies of Large Dams Class II

1.2.1 Action Taken Report on Deficiency Cat-1 of Large Dams Class II

No such dams under this category is reported.

1.2.2 Action Taken Report on Deficiency Cat-2 of Large Dams Class II

There are 203 dams reported under this category. Regionwise number of dams is given in Table 1.1

Part- 2 of this report gives the details of Annual Consolidated Health Status Report of identified large dams based on Pre & Post monsoon - 2019 inspection reports.

Table 1.1

Regionwise Position of compliance of deficiencies identified in HSR 2018 (MAHARASHTRA STATE)

Sr. No	Region	Major deficiencies reported in Large Dams			Status of Deficiencies removal as per compliance report received in DSO											
					Physically fully completed			Physically in progress			Administrative action initiated			Compliance report not received in DSO		
		Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Kokan`	22	55	77	00	04	04	03	10	13	19	40	59	00	01	01
2	Pune	26	25	51	00	02	02	05	01	06	19	18	37	02	04	06
3	NMR	13	51	64	00	01	01	00	02	02	01	06	07	12	42	54
4	Marathwada	04	16	20	00	00	00	00	03	03	04	08	12	00	05	05
5	Amravati	09	34	43	00	01	01	01	03	04	04	08	12	04	22	26
6	Nagpur	10	09	19	00	02	02	07	02	09	03	05	08	00	00	00
Govt.Total		**84**	**190**	**274**	**0**	**10**	**10**	**16**	**21**	**37**	**50**	**85**	**135**	**18**	**74**	**92**
Private																
1	Kokan	07	02	09	01	00	01	00	00	00	04	01	05	02	01	03
2	Pune	02	03	05	00	00	00	00	00	00	00	00	00	02	03	05
3	NMR	00	01	01	00	00	00	00	00	00	00	00	00	00	01	01
4	Marathwada	00	04	04	00	00	00	00	00	00	00	00	00	00	04	04
5	Amravati	00	01	01	00	00	00	00	00	00	00	00	00	00	01	01
6	Nagpur	01	02	03	00	00	00	00	00	00	01	02	03	00	00	00
Private Total		**10**	**13**	**23**	**1**	**0**	**1**	**0**	**0**	**0**	**5**	**3**	**8**	**4**	**10**	**14**
Grand Total		**94**	**203**	**297**	**1**	**10**	**11**	**16**	**21**	**37**	**55**	**88**	**143**	**22**	**84**	**106**

Table - 1.2
Regionwise status of compliance of deficiencies category 1, 2 & 3

Name of Region	Number of large Class-I & Class-II dams	Number of dams inspected by field officers	Number of Dams with Deficiencies Category			Number of dams of which deficiencies are fully complied	Number of dams of which deficiencies are partly complied	Number of dams whose complaince report awaited
			Cat 1	Cat 2	Cat 3			
Konkan	199	199	00	86	199	05	77	04
Pune	298	298	00	56	298	02	43	11
North Maharashtra	299	299	00	65	234	01	09	55
Marathwada	278	278	00	24	232	00	15	09
Amravati	205	205	00	44	205	01	16	27
Nagpur	80	80	00	22	80	02	20	00
Total	**1359**	**1359**	**0**	**297**	**1248**	**11**	**180**	**106**

Deficiency Category -1- Dams with major deficiencies which may lead to dam failure.

Deficiency Category -2- Dams with major rectifiable deficiencies needing immediate attention.

Deficiency Category -3- Dams having minor / nil deficiencies.

Table 1.3

Table showing year wise status of receipt of compliance report of deficiencies for last 10 Years

Sr. No	Year	Total Dams with yearwise Major Deficiencies noticed (Category 1 & 2)			No. of dams of which Compliance of Health Status Report Received	Compliance of Health Status Report yet to be received	Percentage of receipt of compliance of Health Status Report
		Class-I	Class-II	Total			
1	2008	126	457	583	71	512	12.2
2	2009	125	387	512	50	462	9.8
3	2010	114	412	526	101	425	19.2
4	2011	122	375	497	216	281	43.5
5	2012	109	327	436	202	234	46.3
6	2013	105	298	403	159	244	39.5
7	2014	93	272	365	119	246	32.6
8	2015	95	275	370	143	227	38.64
9	2016	91	222	313	90	223	28.75
10	2017	94	232	326	149	177	45.70
11	2018	94	203	297	191	106	64.31

Annual Consolidated Health Status Report

of Identified Large Dams In

Maharashtra State 2019-20

PART – 2

Annual Consolidated Health Status Report of Identified Large Dams
Based on Pre & Post Monsoon 2019-20
Inspection Report

PART – 2
Annual Consolidated Health Status Report of Identified Large Dams Based on Pre & Post Monsoon 2019 Inspection Reports

2.1 General

The "Annual Consolidated Health Status Report-2019" of state is based on pre & post monsoon inspection reports received from field officers. The dams included are under control of regular circles & Command Area Development Authorities. The pre and post monsoon inspections of dams owned by private & semi Govt. bodies are done by dam safety organization every year and Health Status of these dams is included in annual consolidated health status of large dams compiled every year.

The Government of Maharashtra has issued instructions for pre and post monsoon inspection of the dams. Dam Safety Organisation, Nashik has issued guidelines regarding questionnaire for inspecting dams by field officers vide letter (Marathi) DSO/DSD-III/128/47/dated 19-1-1998 and also conveyed discrepancies, errors & omissions noticed after the scrutiny of inspections reports time to time. It is again requested to issue orders to field officers to perform careful inspection according to the guidelines for proper monitoring of safety of dams.

The important information like time schedule of inspection, classification of dams, competent authority of dam inspection, preparation of health status report, categorization of deficiencies, monitoring of deficiency removal program, standard procedure for confirmation and removal of category – I deficiency and suggestions for inspection by field officers are given vide Annexure – 1.

Considering the various deficiencies observed over dams of Maharashtra over last few years , Dams Safety Organisation have Standardiized the categorywise deficiencies and these are given vide Annexure – 2.

2.2 Inspections of dams.

A systematic approach & working methodology is very essential to monitor the safety aspects of the dams. Maharashtra which is one of the pioneer states has established an elaborate set up for effective monitoring of dams. The periodical inspections of dams are completed by concerned field officers and the inspection reports are sent to Dam Safety Organisation for further action.

Dam Safety Organisation, Nashik carries out scrutiny of the inspection reports received from field officers for class-I & II dams, significant & serious deficiencies observed during scrutiny are immediately intimated to field officers to carry out remedial measures. To keep a check on the inspections carried out at field level, Test inspections are carried out by Dam Safety Organisation as a third party inspection. The annual dam inspection program of Dam Safety Organisation is prepared and is sanctioned by Director General, (D.T.H.R.S.) M.E.R.I., Nashik. The Dam Safety Organisation carries out pre and post monsoon inspections of private dams on consultancy basis.The reports of 48 private dams in Maharashtra, owned by Tata Power, Sahara India Pvt.Ltd.etc and by Urban Local bodies and Power generation companies, are considered in this report.

2.2.1 Dam inspection by field officers

There are 270 Class - I dams & 1128 Class – II dams in Maharashtra state. Both Pre & Post Monsoon Inspection Reports of 16 Class-I and 08 Class-II dams were not received in DSO and are not been incorporated in this status report. The region wise status of receipt of inspection reports is given in Table 2.1. List of dams of which both pre and post inspection reports were not received in DSO from field officers is given in table no. 2.2.

2.2.2 Dam Inspection by Dam Safety Organisation.

As per Annual inspection programme, DSO has inspected total 205 nos. of Class-I and Class-II dams including private dams. There are 18 Class- I and 30 Class-II private dams in Maharashtra state. Dam Safety Organisation carries out pre and post monsoon inspections of private dams. Regionwise nos. of dams inspected by field officers and Dam safety organisation are given in Table 2.3.

2.3 Overall health status of large dams

In this report, the Health Status of 254 Class-I & 1120 Class-II dams - total 1374 dams, for which inspection reports are received, is considered. Regionwise number of large dams in Maharashtra State where deficiencies are noticed are summarized and given in Table 2.4. Regionwise, Classwise and category wise number of deficiencies noticed are given in Table 2.5. Over all there are 1398 dams (including private dams) and there are 386 dams where category – 2 deficiencies are noticed.

2.4 Health status report of Class-I dams

2.4.1 Health status report of Class-I dams with Category-1 deficiency.

Two dams are reported under this category. Details of Class-I dams with category 1 deficiency are given in table 2.4.

2.4.2 Health status report of Class-I dams with Category-2 deficiency.

Out of 254 dams, 123 dams have been identified as having category- 2 deficiencies. Details of class – I dams, with category – 2 deficiencies are given in table 2.4.

2.4.3 Health status report of Class-I dams with Category-3 or NIL deficiency.

Out of 254dams, 251 dams have been identified as having category- 3 deficiencies. Details of class-I dams with category – 3 or Nil deficiency are given in table 2.4.

2.5 Health status report of Class-II dams

2.5.1 Health status report of Class--II dams with Category-1 deficiency.

Nil dams are reported under this category. Details of class-II dams, with category – 1 deficiency are given in table 2.4.

2.5.2 Health status report of Class-II dams with Category-2 deficiency.

Out of 1120 dams, 263 dams have been identified as having as having category- 2 deficiencies.Details of class – II dams, with category – 2 deficiencies are given in table 2.4.

2.5.3 Health status report of Class-II dams with Category-3 or NIL deficiency.

Out of 1120 dams, 1054 dams have been identified as having category- 3 deficiencies. Details of class – II dams, with category – 3 are given intable 2.4.

2.6 Health status report of Class-III dams

2.6.1 Criteria of Inspection of Class –III dams.

The Govt. of Maharashtra has restricted the scope of DSO in monitoring safety aspects to the extent of identified large dams, i.e. Class-I and Class-II dams only in view of large no. of dams and limited staff of DSO. The safety monitoring of other large dams (Class-III) including preparation of HSR rests with the respective regional Chief Engineers.

Hence every year for Class III dams, based on inspection report, HSR of Class – III dams need to be prepared by respective Chief Engineer and sent it to Dam Safety Organisation for record.

2.6.2 Region wise and classwise break up of number of dams

Classwise Number of dams in each region are given as below..

Class of Dam	Konkan		Pune		NMR		Marathwada		Amravati		Nagpur		Total		Grand Total
	GOV	PRIV	GOV	PRIV	GOV	PRIV	GOV	PRIV	GOV	PRIV	GOV	PRIV	GOV	PRIV	
I	41	9	66	7	67	1	37	0	22	0	19	1	252	18	270
II	144	6	233	8	230	8	245	4	188	2	58	2	1098	30	1128
III	5	1	100	0	147	0	283	0	135	0	78	0	748	1	749
Total	**190**	**16**	**399**	**15**	**444**	**9**	**565**	**4**	**345**	**2**	**155**	**3**	**2098**	**49**	**2147**

Graphical representation of Regionwise and Classwise dams in Maharashtra is shown in **Chart No-1**

2.7 Observations

Regionwise number of significant category II deficiencies observed in Class-1 and Class-2 dams is given in Table 2.6. Also graphical representation of significant category II deficiencies observed in Class-1 and Class-2 dams are shown in **Chart No-2 &3.**

In the state top five major deficiencies found in Class-I dams are as follows

1. B 5: Outlet gates not functioning properly. - 30 dams
2. A11 : Sweating / Seepage through downstream of masonry dam – 23 dams
3. A 12: Leaching - 23 dams
4. B 9: Instruments not in working condition. – 20 Dams
5. A 14 : EDA / Stilling basin damaged/Hydraulic performance not good.-19 Dams

In the state top five major deficiencies found in Class-II dams are as follows

1. B 7: Waste weir not in good condition – 77 dams
2. A 7: Retrogression /scouring in tail channel.- 61 Dams
3. B 1: Dam section is not as per design - 55 dams
4. A 1 & A 6: Boil leakage/ seepage/ wet patches/ slushiness, in Earthen Dam AND Outlet well damaged - 47 dams
5. A 4: Major leakages through outlet conduit/pipe joints/Gates – 40 Dams

The year wise (Period 2010-2019) tabulation of dams with deficiency category 1, 2 & 3 is given in table 2.7. As seen from that major deficiencies in class I & class II dams have reduced every year i. e. 46.38% in the year 2010 , has now reduced to 28.28% in the year 2019, during last 10 years.

The status report is compiled and brought out region wise of which the present report is merely a consolidated version i.e. Annual Consolidated Health Status Report identified Large Dams for Class I and Class II Dam for year 2019-20.

This consolidated report of identified large dams (class I and II) for year 2019-20 of comprising of region wise Health status report of Kokan, Pune, North Maharashtra Region, Marathwada, Amravati and Nagpur Region which are attached herewith as follows.

Annexure- 3 - a) Annual Consolidated Health Status Report of Indentified Large Dams in Kokan region year 2019-20

b) Annual Consolidated Health Status Report of Indentified Large Dams in Pune region year 2019-20

c) Annual Consolidated Health Status Report of Indentified Large Dams in Nortn Maharashtra region year 2019-20

d) Annual Consolidated Health Status Report of Indentified Large Dams in Marathwada region year 2019-20

e) Annual Consolidated Health Status Report of Indentified Large Dams in Amravathi region year 2019-20

f) Annual Annual Consolidated Health Status Report of Indentified Large Dams in Nagapur region year 2019-20

For implementation of deficiencies on priority basis a new concept of standardization of deficiencies is introduced in this ACHSR. Deficiencies are grouped as Category II A (Priority I) & Category II B (Priority II). It will help field officers in compliance of deficiencies in stages. A statement showing standard deficiencies & coding for it is given in Annexure-2.

Table 2.1
Regionwise Status of Receipt of Pre/Post Monsoon Inspection Reports (IR)

Sr No	Name of Office	Total dams			Both Pre & Post IR received			Either Pre or Post IR not received			Pre & Post both IR not received		
		Class -I	Class -II	Total	Class-I	Class -II	Total	Class-I	Class-II	Total	Class-I	Class-II	Total
1	**2**	**3**	**4**	**5**	**6**	**7**	8	**9**	**10**	**11**	**12**	**13**	**14**
1	Konkan	50	150	200	50	150	200	00 00	00 00	00	00	00	00
2	Pune	73	241	314	72	240	312	00 01	01 00	02	00	00	00
3	North Maharashtra Region	68	238	306	67	236	303	00 02	04 06	12	01	00	01
4	Marathwada	37	249	286	18	187	205	15 19	09 61	104	15	08	23
5	Amravati	22	190	212	22	190	212	00 00	00 00	00	00	00	00
6	Nagpur	20	60	80	20	60	80	00 00	00 00	00	00	00	00
	Grand Total	**270**	**1128**	**1398**	**249**	**1063**	**1312**	**37**	**81**	**118**	**16**	**8**	**24**

.

Table 2.2
List of Dams of which Pre & Post Both Inspection Reports were not received

Sr. No	Name of Region	Name of Dam of which inspection reports not received				
		Class-I		Class-II		Total Class-I & II
		Name of dams	No of Dams	Name of dams	No of Dams	
1	2	3	4	5	6	7
1	Konkan	--	--	--	--	--
2	Pune	--	--	--	--	--
3	North Maharashtra Region	Chehedi Bandhara	01	--	00	01
4	Marathwada	1.Apegaon HL Barrage 2.Mangrul HL Barrage 3.Rajatakli HL Barrage 4.Jogladevi HL Barrage 5.Loni Savangi HL Barrage 6.Khulgapur HL Barrage 7.Bindgihal LT Barrage 8.Sai HL Barrage 9.Takalgaon Devla HL Barrage 10.Shivni HL Barrage 11.Hosur Barrage 12.Gunjarga KT Weir 13.Rajegaon KT Weir 14.Dhanegaon HL Barrage 15.Karsa pohregaon Barrage	15	1. Bhilawani 2. Manyad 3.Tembhapuri 4.Tawarja 5.Kasarbalkund 6. Bhusni LL Barrage 7.Panharwadi MI (Shirur Anantphal) 8.Pimpaldari	08	23
5	Amravati	--	--	--	--	--
6	Nagpur	-	-	--	--	-
	Total		16		08	24

Table 2.3
Regionwise Number of dams inspected by Field officers & Dam Safety Organisation, Nashik

Name of Region	Total No. of Dams	No. of Dams inspected by Field Officers	Percentage of Dams Inspected by Field Officers	No. of Dams inspected by DSO	Percentage of Dams Inspected by DSO
Konkan	200	200	100%	33	16.50%
Pune	314	314	100%	40	12.73%
NMR	306	305	99.67%	41	13.40%
Marathwada	286	263	91.96%	41	14.34%
Amravati	212	212	100%	29	13.68%
Nagpur	80	80	100%	21	26.25%
Total	**1398**	**1374**	**98.28%**	**205**	**14.66%**

Note – Dams which are inspected at least once in (pre or post) year are also considered in above table.

Table 2.4

Regionwise and Classwise number of large dams where deficiencies are noticed

Sr. No.	Region of State	Number of Dams			Report taken in to Account			Number of Class I Dams having Deficiencies			Number of Class II Dams having Deficiencies			Remark
		Class I	Class II	Total	Class I	Class II	Total	Cat-1	Cat-2	Cat-3	Cat-1	Cat-2	Cat-3	
1	Konkan	50	150	200	50	150	200	1	41	50	0	64	150	----
2	Pune	73	241	314	73	241	314	0	50	73	0	66	241	----
3	North Maharashtra Region	68	238	306	67	238	305	1	08	60	0	48	190	----
4	Marathwada	37	249	286	22	241	263	0	05	26	0	31	240	----
5	Amravati	22	190	212	22	190	212	0	09	22	0	40	176	----
6	Nagpur	20	60	80	20	60	80	0	10	20	0	14	57	-----
	Total	**270**	**1128**	**1398**	**254**	**1120**	**1374**	**2**	**123**	**251**	**0**	**263**	**1054**	

Category I deficiency in Tillari Main Dam & Sarangkheda Barrage is of Spillway Gate (by Mechanical Organisation)

Deficiency Category No. 1- Dams with major deficiency, which may lead to failure.

Deficiency Category No. 2 - Dams with rectifiable deficiencies needing immediate attention.

Deficiency Category No. 3 - Dams with minor & nil deficiencies

Table 2.5

Region wise Number of deficiencies noticed (Civil)

Sr.No	Region	Class-I dams Number of deficiency noticed			Class-II dams Number of deficiency noticed		
		Cat-1	Cat-2	Cat-3	Cat-1	Cat-2	Cat-3
1	Konkan	0	155	400	0	124	578
2	Pune	0	270	882	0	110	1686
3	NMR	0	32	509	0	194	875
4	Marathwada	0	20	281	0	97	996
5	Amravati	0	29	132	0	122	740
6	Nagpur	0	28	127	0	32	213
	Total	**0**	**534**	**2331**	**0**	**679**	**5088**

Table 2.6

Regionwise significant Category 2 deficiencies noticed in number of Class-I & Class II dams

Name Of Major Deficiency	Konkan		Pune		NMR		Marathwada		Amravati		Nagpur		Total	
Category of Dam	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II
Deficiency Cat II (A)														
Earthen Dam														
A.1: Boil leakage/ seepage/ wet patches/ slushiness,in Earthen Dam.	05	15	03	09	01	12	01	06	00	05	00	00	10	47
A 2: Standing pool / Ponding / Water Logging / Slushy condition on D/S of Dam	02	03	05	08	02	06	01	04	00	04	01	07	11	32
A 3 : Leakages in vicinity of junction between earthen dam & masonry dam portion.	01	02	01	02	01	00	00	03	00	00	00	00	3	7
A 4 : Major leakages through outlet conduit/pipe joints/Gates.	03	06	07	03	01	23	01	00	02	06	01	02	15	40
A 5 ; Relief wells not functioning properly./ Abnormal rise in water level in wells.	00	00	04	01	00	00	01	01	03	01	02	00	10	3
A 6 : Outlet well is damaged/not in good condition /cracks observed/jets of water in well.	00	08	01	12	01	14	00	06	0	06	01	01	3	47
A 7 : Retrogression /scouring in tail channel.	00	04	09	04	01	24	01	08	00	18	02	03	13	61
Masonry / Concrete Dam														
A 8 : Drainage gallery inaccessible/No adequate lighting./ No dewatering arrangement or failure.	01	00	12	00	01	00	02	00	00	00	01	00	17	0
A 9 : Foundation drains / holes/ porous pipes/chocked/ no seepage through foundation drain holes.	00	00	13	00	00	00	00	00	02	00	03	00	18	0
A 10 : Heavy leakages through porous pipes/ through dam body in gallery /monolith joints.	02	00	10	00	02	00	01	00	00	00	00	00	15	0
A 11 : Sweating / seepages through D/S of masonry dam	03	00	16	00	01	00	02	00	00	00	01	01	23	1
A 12 : Excesssive considerable leaching from seepage water.	06	00	12	00	02	00	01	00	00	00	02	00	23	0

Name Of Major Deficiency	Konkan		Pune		NMR		Marathwada		Amravati		Nagpur		Total	
Category of Dam	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II
A 13 : Swelling / minor cracking observed on body of dam.	00	00	01	00	01	00	00	00	00	00	00	00	2	0
A 14 : EDA / Stilling basin damaged/Hydraulic performance not good.	02	01	13	00	02	05	00	04	01	07	01	03	19	20
A 15 : Leakages through spillway /piers//junction of flank wall.	03	00	06	01	00	06	01	00	00	00	01	01	11	8
A16: Damages / foundation erosion/ scour/undermining observed in vicinity of flank walls/ guide walls/ junction walls/return walls.	00	01	09	01	02	01	00	08	04	09	01	00	16	20
A 17 :End weir not in good condition / scouring noticed on immediate D/S.	00	00	11	01	00	00	00	00	03	11	02	00	16	12
Spillway gates.														
A 18 :Wire ropes of hoist not in good condition/hoisting structure damaged/cracked.	00	00	06	00	02	01	02	00	00	00	02	00	12	1
A 19 : Alternative power system Generator for gate operation not working properly.	00	00	01	00	01	00	00	00	00	00	01	00	3	0
A 20 : Operation of gates not smooth needs repair.	00	00	07	00	01	00	00	00	00	00	00	00	8	0
Deficiency Cat II (B)														
B 1 Dam section is not as per design	00	06	02	07	00	24	00	03	00	09	00	06	2	55
B 2 : Cross and toe drains not working properly/ drains silted or vegetated causing stagnant pool of water.	00	00	04	00	00	00	00	00	00	00	00	00	4	0
B 3 : Considerable settlement of embankment / Rock toe/Pitching/ U/S & D/S slops, bulging/concavity of slopes.	00	02	05	00	00	15	00	05	02	16	00	02	7	40

Name Of Major Deficiency	Konkan		Pune		NMR		Marathwada		Amravati		Nagpur		Total	
Category of Dam	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II	Class I	Class II
B 4: Longitudinal / Transverse cracks/ low area/sink holes/gully formation on top side slope of earthen dam.	00	00	03	01	00	01	00	01	00	03	00	00	3	6
B 5 : Outlet gates not functioning properly. Stem rod is bent(Service gate/Emergency gate/Stop log gate/sluice gate)	04	03	22	15	01	08	01	05	02	04	00	03	30	38
B 6 : Approach to dam through all weather road not constructed/maintained properly.	00	00	11	03	00	00	00	00	01	00	00	00	12	3
B 7: Waste weir/waste weir bar not in good condition/coping damaged/leakage through waste weir.	00	11	08	23	01	16	00	17	00	10	01	00	10	77
B 8 : Pointing on U/S face of dam not in good condition./deterioration spalling of concrete surface.	00	00	06	00	00	00	00	00	00	01	00	00	06	01
B 9: Instruments not in working condition.	00	00	19	00	00	00	00	00	00	00	01	00	20	00
B10 :Leakages through River sluice.	00	00	03	00	00	00	00	00	01	00	00	00	4	0
B 11: Surface paint/steel surface of spillway gates deteriorated.	00	00	07	00	00	00	00	00	00	00	00	01	7	1
B 12 : Damage to Rubber seals/ considerable Leakages through gates.	03	03	11	00	00	02	01	01	03	00	01	01	19	7
B 13 : Heavy vegetation/big trees on embankment top/slope making dam portion not accessible.	00	00	02	00	00	00	00	00	00	00	00	01	2	1
B 14 : Deck bridge slab/ pier / damaged cracked/ alignment disturbed.	00	00	02	00	00	00	00	00	00	00	00	00	2	0
B 15 :Major portion of Pitching damaged/washed away.	00	00	04	00	00	00	00	00	00	00	00	00	4	0

Table 2.7

Year Wise Deficiency Categorisation of Identified Large Dams (Class I & Class II) for last 10 Years

Sr. No.	Year of HSR	Number of Dams			Report taken in account	Class – I Dams			Class –II Dams			Total Class – I & II Dams			% of dam having major deficiencies (catogery I and II)
						Deficiency Category			Deficiency Category			Deficiency Category			
		Class-I	Class-II	Total		I	II	III	I	II	III	I	II	III	
1	2010	221	923	1144	1134	0	114	105	0	412	503	0	526	608	46.38
2	2011	229	942	1171	1155	0	122	102	0	375	556	0	497	658	43.03
3	2012	233	952	1185	1172	0	109	124	1	326	612	1	435	736	37.20
4	2013	233	998	1231	1226	0	105	128	3	295	695	3	400	823	32.87
5	2014	243	1009	1252	1237	0	93	148	1	271	724	1	364	872	29.50
6	2015	256	1053	1309	1301	0	95	161	1	278	768	1	373	929	28.74
7	2016	260	1072	1332	1325	0	91	169	0	222	843	0	313	1012	23.62
8	2017	263	1092	1355	1340	0	95	167	0	233	845	0	328	1012	24.47
9	2018	265	1093	1358	1352	0	94	204	0	203	962	0	297	1166	21.96
10	2019	270	1128	1398	1374	2	123	251	0	263	1054	2	386	1305	28.28

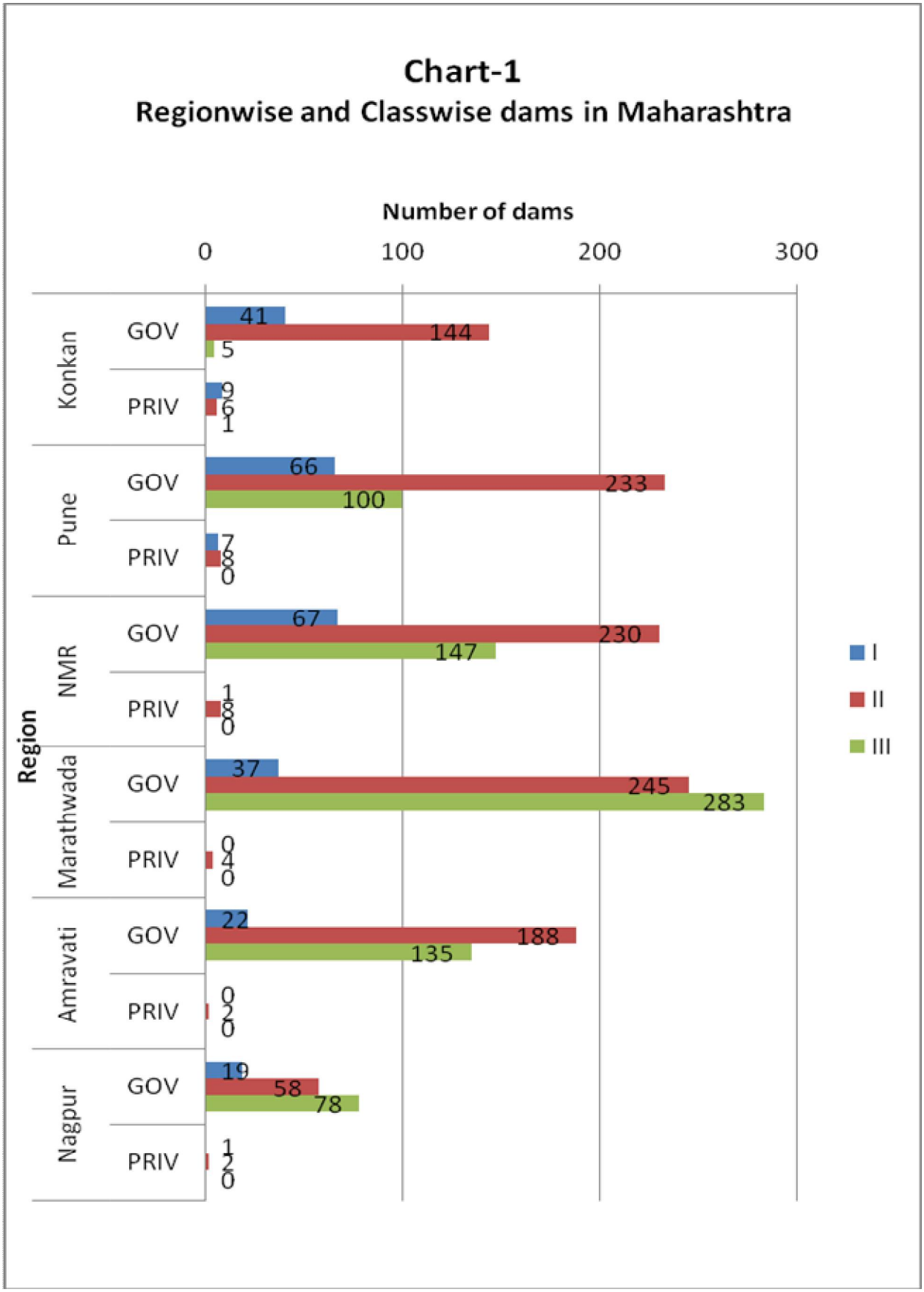


Chart-1
Regionwise and Classwise dams in Maharashtra
Number of dams
0
100
200
300
Region
Konkan
GOV
41
144
5
PRIV
9
6
1
Pune
GOV
66
233
100
PRIV
7
8
0
NMR
GOV
67
230
147
PRIV
1
8
0
Marathwada
GOV
37
245
283
PRIV
0
4
0
Amravati
GOV
22
188
135
PRIV
0
2
0
Nagpur
GOV
19
58
78
PRIV
1
2
0
I
II
III

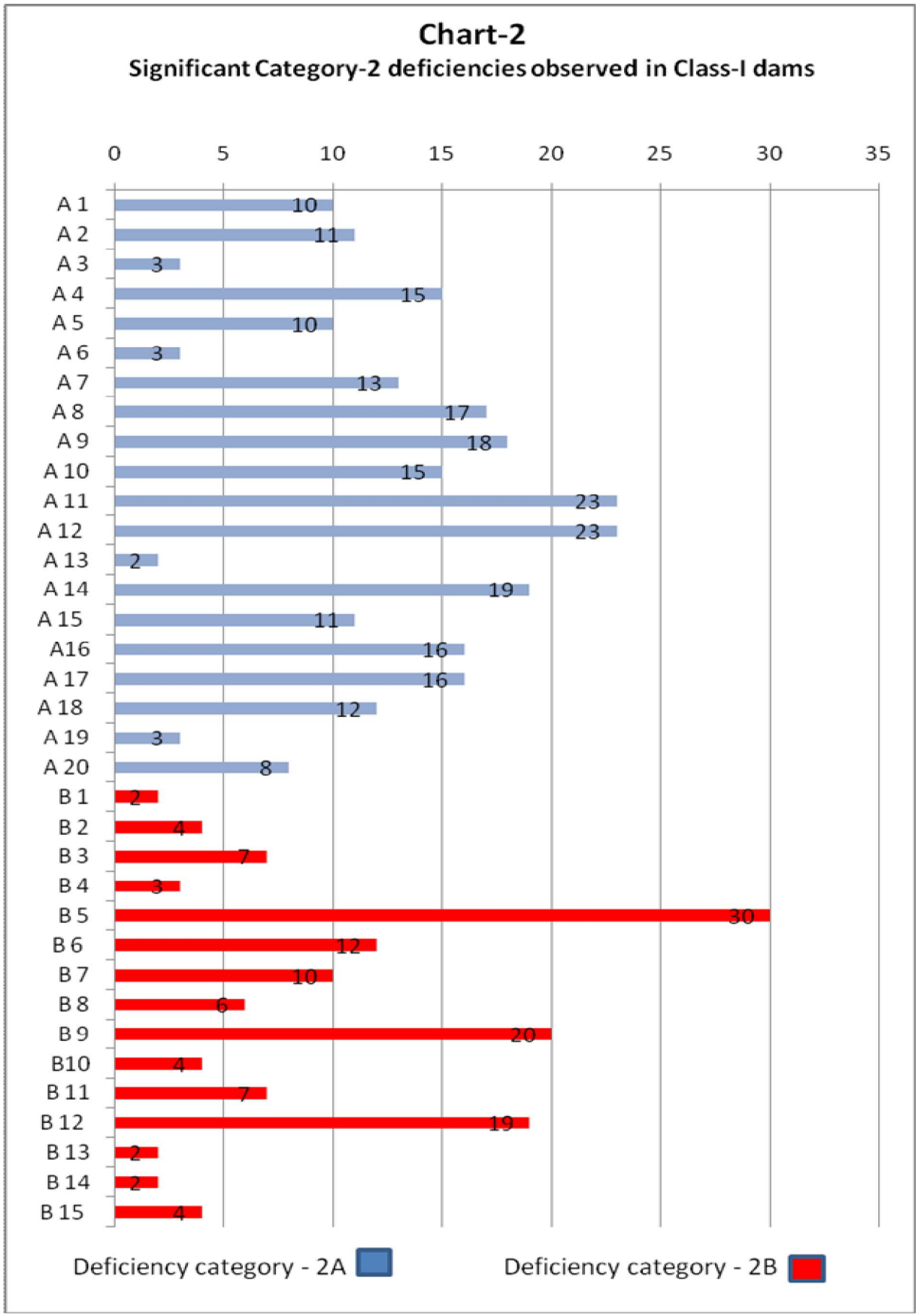


Chart-2
Significant Category-2 deficiencies observed in Class-I dams
0
5
10
15
20
25
30
35
A 1
10
A 2
11
A 3
3
A 4
15
A 5
10
A 6
3
A 7
13
A 8
17
A 9
18
A 10
15
A 11
23
A 12
23
A 13
2
A 14
19
A 15
11
A16
16
A 17
16
A 18
12
A 19
3
A 20
8
B 1
2
B 2
4
B 3
7
B 4
3
B 5
30
B 6
12
B 7
10
B 8
6
B 9
20
B10
4
B 11
7
B 12
19
B 13
2
B 14
2
B 15
4
Deficiency category - 2A
Deficiency category - 2B

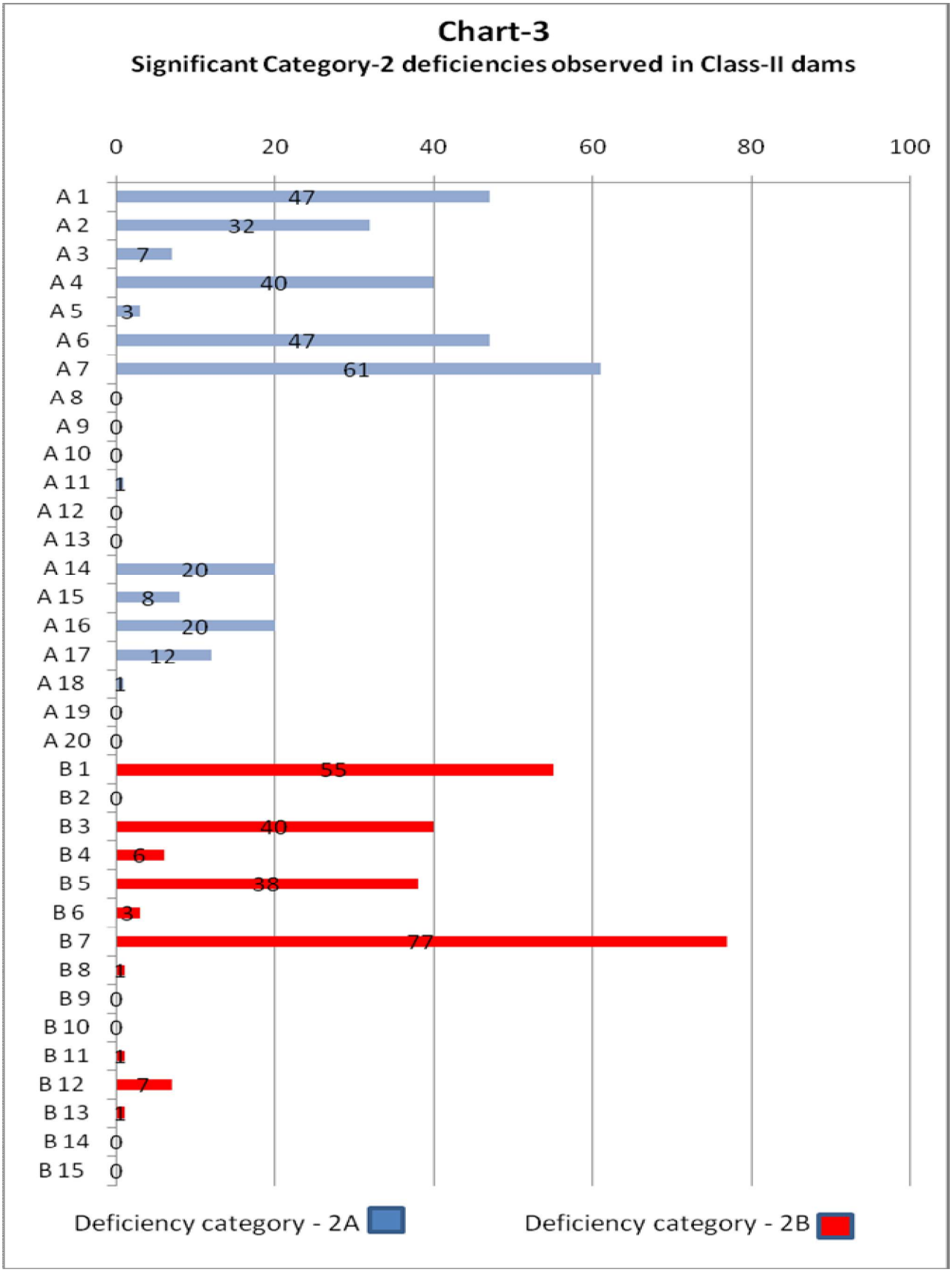


Chart-3
Significant Category-2 deficiencies observed in Class-II dams
0
20
40
60
80
100
A 1 47
A 2 32
A 3 7
A 4 40
A 5 3
A 6 47
A 7 61
A 8 0
A 9 0
A 10 0
A 11 1
A 12 0
A 13 0
A 14 20
A 15 8
A 16 20
A 17 12
A 18 1
A 19 0
A 20 0
B 1 55
B 2 0
B 3 40
B 4 6
B 5 38
B 6 3
B 7 77
B 8 1
B 9 0
B 10 0
B 11 1
B 12 7
B 13 1
B 14 0
B 15 0
Deficiency category - 2A
Deficiency category - 2B

Annual Consolidated Health Status Report of Identified Large Dams In Maharashtra State 2019-20

PART – 3

Annual performance Report of Instruments installed on Large Dams

PART – 3
Annual performance Report of Instruments installed on large dams

3.1 General.

The main purpose of instrumentation in dam is to monitor the safety of the dam and to warn of any changes that could in danger the safety of a dam, as well as to provide a confirmatory check in design assumptions and methods of computation.

Instruments embedded in or installed at the surface of the dam keeps a constant watch over the performance and indicate the distress spots for which remedial measures may be taken. Thus, instruments play an important role in checking the safety of dams and helps in monitoring and evaluating the performance of the dams during the construction as well as during the operation.

Instruments installed on dams are “Eyes and Ears” of dam’s performance vis-à-vis parameters adopted during its design. The field officers in charge of dams have not been able to upkeep and monitor/maintain instruments installed on dams. Efforts should be taken by all field officers to repair / replace instruments at the earliest. Monitoring of vital parameters like seepage, uplift, settlement and timely remedial measures will go long way in extending the life of the dam.

3.2 INSTRUMENTATION IN EARTHEN DAMS

Commonly used instrument in earthen dam are as below.

1) **Pore Pressure Meter**

They are installed in bore holes drilled below the foundation or through already completed embankment. Hence cannot be repaired or replaced.

2) **Casagrande/standpipe piezometers**

These are used for measuring pore water pressure in soil. These instruments can be installed at any time after completion of construction of the dam at desired location.

3) **Twin Tube Piezometers**

These are also used for measuring pore water pressure in earthen dam. These are installed in foundation and embankment during construction of dam. If PVC pipes are found chocked due to leached material then it can be cleaned with CuSo4. If pipes are cut / broken then it cannot be replaced as those are in body of dam. Outside measuring assembly can be repaired. Periodical maintenance, periodical reading and periodical calibration are utmost important.

4) Earth pressure cells

These are installed in the foundation. The cables which are outside the body can be replaced if damaged. The sensor cannot be repaired or replaced.

5) Settlement Gauges (surface settlement gauges/vertical cross arms)

These are used for measuring settlement in earth fill dam, rock fill dam and high embankment. Initially when the dam is under construction these instruments are installed. Settlement of dam is more in initial period, which gradually decreases and it is almost nil after certain period. As such these gauges also do not show settlement after few years.

6) Slope Indicator

This is installed in foundation with one end at bottom and other at top of the dam. It measures horizontal and vertical movement of the dam. This can be replaced.

3.3 INSTRUMENTATION IN CONCRETE/ MASONARY DAM

Commonly used instruments in concrete / masonry dams are as below.

1) Stress meters

The stress meters measure stresses inside the dam body. These instruments are embedded in concrete/masonry during construction stage hence cannot be repaired or replaced.

2) **Strain meter/ No stress strain meter**

The strain meters measures the deformation in the structure at the particular location due to strain, creep, temperature etc. The main purpose is to determine the stress distribution in the concrete dam during and after construction of dam. Since instrument is installed in the body of the dam it cannot be repaired or replaced.

3) **Uplift pressure cells**

The bowl type uplift pressure cells are provided in the foundation of dam. Uplift pressure cell is used for monitoring uplift pressure of water in the foundation of dam and concrete structure. The pressure cell pipes can be cleaned if choked. The pressure gauges can be repaired or replaced.

4) Plumb bob /Co-ordimeter

Conventional/inverted plumb bob is used to measure deflection of the dam body. It measures the horizontal displacement in dam's foundation and abutment. Plumb bob can be repaired or replaced.

5) Thermocouples/ Thermometers

These are used to measure the temperature variations in the body of concrete dam. These are installed in layers at various levels and can not be replaced or repaired after construction.

6) **Long gauge extensometer**

It is used to measure the deformation/displacement in the foundation of the concrete dam. Once it fails to function can not be repaired.

7) **Joint meters**

The joint meters measure the opening of the joints across which they are embedded. As such they are located near the joints.

3.4 STATUS OF DAM INSTRUMENTATION IN THE REGION.

Considering the fact that most of the instruments were non-functional from many years, Govt.of Maharashtra appointed a committee to study these instruments. The recommendations of the committee were accepted and incorporated in G.R. धसुसं २०१४ (६२१/१४)/ सिं.व्य. (कामे), dated 31/12/2015. Dam Safety Organisation has informed the project authorities to update the list of instruments at the dam site. In this report the updated details of instruments are considered.

The regionwise status of dam instrumentation in the state is given in table No.3.1. Similarly, the details of mortality of instruments are given in table No.3.2 and Regionwise comparison of mortality rate with respect to previous year is given in table no. 3.3.

3.5 OBSERVATIONS

1) There are 76 dams in the State where instruments are installed.
2) Various instruments numbering 4370 have been installed on these 76 dams. Out of which 1604 were working and 2766 were not working i.e. 63.30 % instruments are in non working condition.
3) In the state the instrument readings from Koyna, Kolkewadi and Upper Wardha dam were recived for analysis. Instrumentation data analysis report of these dams has been prepared and circulated.
4) The observations of the instruments should be taken regularly and need to be sent to D.S.O. Nashik for analysis.

Table -3.1

Regionwise status of dam instruments installed on large dams in State

Sr. No	Name of Region	Number of dams	Total Number of Instruments	Functional Status		Mortality (NF) (%)
				Functional	Non Functional	
1	Konkan	14	1562	1131	431	27.59
2	Pune	27	1576	381	1195	75.82
3	North Maharashtra	10	488	07	481	98.57
4	Marathwada	06	336	34	302	89.88
5	Amravati	10	296	46	250	84.46
6	Nagpur	9	112	05	107	95.53
	Total	**76**	**4370**	**1604**	**2766**	**63.30**

Table No.3.2

MORTALITY STATUS OF INSTRUMENTS INSTALLED ON LARGE DAMS IN MAHARASHTRA

Sr. No.	Type of Instruments	Status of Instruments			
		Total	Working	Non-Working	Mortality (%)
1	2	3	4	5	6
(A) Earthen Dams					
1	Casagrande/ Stand pipe piezometers(CG/SPP)	712	209	503	70.65
2	Twin tube piezometers (TTP)	1625	126	1499	92.25
3	Horizontal/Vertical device / Cross arm, surface settlement plug (SSP)	276	257	19	6.88
4	Earth pressure cells (EPC)	44	0	44	100.00
5	Slope indicator	2	0	2	100.00
Total		**2659**	**592**	**2067**	**77.74**
(B) Masonry Dams					
1	Pore pressure meters (PPM)	147	60	87	59.18
2	Stress meter (SM)	68	62	6	8.82
3	Strain meter/ No stress-strain meter (STM/NSSM)	90	84	6	6.67
4	Uplift pressure cells (UPC)	629	114	515	81.88
5	Plumb bob/ Inverted Plumb Bob / co-ordimeter (PLUMB LINES)	38	8	30	78.95
6	Long Gauge extensometer, Multiple Bore hole extensometer (EXTENSOMETERS)	8	6	2	25.00
7	Thermometers	660	628	32	4.85
8	Joint meters/Dial Gauge (JM/DG)	59	48	11	18.64
9	Tilt meter	2	2	0	0.00
Total		**1711**	**1012**	**699**	**40.85**
	Instruments in	**Total**	**Working**	**Non Working**	**Mortality**
(A)	**Earthen Dams**	**2659**	**592**	**2067**	**77.74**
(B)	**Masonry Dams**	**1711**	**1012**	**699**	**40.85**
	Grand Total	**4370**	**1604**	**2766**	**63.30**

Table No. 3.3

Regionwise comparison of mortality rate with respect to previous year

Year		HSR-2018-19					HSR-2019-20				
Sr. No.	Region	Total Dams	Total Instruments	Functioning	Not-Functioning	% Non functioning	Total Dams	Total Instruments	Functioning	Not-Functioning	% Non fuctioning
1	Konkan	14	1562	1176	386	24.71	14	1562	1131	431	27.59
2	Pune	27	1620	624	996	61.48	27	1576	381	1195	75.82
3	North Maharashtra	10	494	16	478	96.76	10	488	07	481	98.56
4	Marathwada	06	336	48	288	85.71	06	336	34	302	89.88
5	Amravati	10	296	46	250	84.46	10	296	46	250	84.46
6	Nagpur	9	93	21	72	77.42	9	112	05	107	95.54
	Total	**76**	**4401**	**1931**	**2470**	**56.12**	**76**	**4370**	**1604**	**2766**	**63.30**

Annual Consolidated Health Status Report

of Identified Large Dams In

Maharashtra State 2019-20

PART – 4

Annual performance Report of Meteorological instruments installed on dams

PART -4
Annual performances Report of Meteorological instruments installed on dams

4.1 General

Hazard potential of dam depends upon the possible hazard it poses to population on the downstream during flood. In case of gated spillways, generally flood is considered to impinge when reservoir is at F.R.L. If flood forecasting and warning systems are in place, flood impingement can be considered at lower when F.R.L. considering prior depletion.

The establishment of hydro-meteorological stations in the vicinity of every Class-I dam and rain gauge network in its catchments assumes vital importance due to its role in flood forecasting and warning. The hydro-meteorological station shall be capable of recording data relating to, among other parameters, rainfall, atmospheric pressure, maximum & minimum temperature and humidty,wind speed, wind direction, height of waves and reservoir water temperature. It is important that a representative proportion of the rain gauge network is linked to flood forecasting and warning control centre by telemetry.

Performance of the Meterological instruments dealt in this report is only the instruments operated and maintained by Dam authorities. In addition to these, there is vast network of the hydro meterological stations stack which is operated and maintained by Hydrology Project. Same is not dealt in this ACHSR.

4.2 Observations

CWC has issued new format for Pre / Post Monsoon Inspection of Dams from January 2018. It is expected that the information regarding various instruments installed on large dams shall be given in Annexure – I of this new revised format by field officers. As this status of instruments is submitted to C.W.C., New Delhi. Field authorities are expected to furnish correct information.

Table 4.1 gives the Regionwise status of the meteorological instruments and Table 4.2 gives the status of moratality of meteorological instruments installed in the region.

As per Pre / Post Monsoon reports of all regions in state it is seen that 949 various meteorological instruments installed on dams out of which 683 are functioning and 266 are non-functioning. The non-functioning should be repaired/replaced on priority.

As per the government circular CDA-1013/(207/13)/CAD(works)/ August-2013, it is mandatory to install Pan Evaporimeter to measure evaporation on all major and medium projects.

Efforts should be taken by field officers to establish automatic flood warning systems which will help in saving lives, livestock and property and will invariantly contribute to lessening of the overall impact of floods.

Table - 4.1
Regionwise Status of Meteorological Instruments Installed on Large Dams in Maharashtra State

Sr. No	Name of Region	Number of Dams	Total Number of Instruments	Functional Status		Mortality (NF) (%)
				Functional	Non Functional	
1	Konkan	109	189	113	76	40.21
2	Pune	82	216	176	40	18.52
3	North Maharashtra	60	194	147	47	25.26
4	Marathwada	47	131	97	34	34.09
5	Amravati	76	134	89	45	25.95
6	Nagpur	44	85	61	24	28.24
	Total	**418**	**949**	**683**	**266**	**28.03**

Table No. 4.2
Mortality status of Meteorological Instruments Installed on Dams in Maharashtra State

Sr. No.	Type of Instruments	Number Of Instruments			
		Total	Working	Non-Working	Mortality (%) (NF)
1	2	3	4	5	6
1	Rain gauge on dam (Ordinary)	409	329	80	19.56
2	Rain gauge on dam (Self Recorder)	72	34	38	52.78
3	Rain gauge in catchment (Ordinary)	150	126	24	16.00
4	Rain gauge in catchment (Self Recorder)	86	63	23	26.74
5	Pan Evaporimeter	109	62	47	43.12
6	Wind velocity recorder	27	14	13	48.15
7	Wind direction recorder	25	14	11	44.00
8	Wet/dry bulb thermometer	21	12	9	42.86
9	Thermometer for air jump	3	2	1	33.33
10	Thermometer for reservoir water temp	4	2	2	50.00
11	Water state recorder	16	12	4	25.00
12	Barometer	4	2	2	50.00
13	Sun shine recorder	3	2	1	33.33
14	Max & Min thermometer	2	2	0	0.00
15	Wave height recorder	2	0	2	100.00
16	Hydrometer	0	0	0	
17	Humidity Meter	0	0	0	
18	Automatic level controller	2	1	1	50.00
19	Stevenmeter	1	1	0	0.00
20	DWLL	2	0	2	100.00
21	Other Instruments	11	5	6	54.54
Total		**949**	**683**	**266**	**28.03**

Annual Consolidated Health Status Report of Identified Large Dams In Maharashtra 2019 – 20

PART – 5

Status of NCDS Documents Submitted to DSO

Part 5

National Committee on Dam Safety (NCDS) Documents

Importance of National Committee on Dam Safety (NCDS) Documents:

Central Water Commission (CWC) has laid down various guidelines covering the standardized dam safety practices-essentially guiding the dam owners in preparation of Emergency Action Plans, Periodical Dam Safety inspections, comprehensive dam Safety evaluation and appropriate institutional framework for dam safety. Their implementation is emphasized during the meetings of National Committee on Dam Safety (NCDS) and through the communications sent in this regard.

During the 34th meeting held at Chennai in March 2015, it was requested to all the Dam owners to take necessary steps for preparation of EAP, other documents & report to NCDS Secretariat.

The documents to be prepared as per National Committee on Dam Safety are as under & these shall be properly maintained and kept up to date by including latest information available.

1. EAP
2. R.O.S & G.O.S.
3. Data Book
4. O & M manual
5. Record Drawing & Completion Report,

1. EAP: Emergency Action Plan:

An Emergency action plan is a formal plan that identifies potential emergency conditions at a dam. It prescribes the procedures to be followed to minimize property damage and loss of life. The EAP contains procedures and information to assist the dam owner in taking necessary actions in time to moderate or alleviate the problems, in addition to issuing early warning & notification messages to responsible emergency management authorities,viz.,District Magistrate/Collector, Armed Forces, Paramilitary forces, Project Authorities & other Central/State Agencies. It also contains inundation maps to show the emergency management authorities of the critical areas for necessary relief and rescue actions in case of an emergency. In a nutshell, it outlines “who does, what, where, when and how” in an emergency situation or unusual occurrence affecting the Dams. The Emergency Action Plan has to be prepared as per Guidelines circulated by C.W.C., New Delhi’s vide letter no. 3/19/NCDS/Guidelines EAP/DSM/2004/233-67, Dtd. 17 May 2006.CWC Guidelines are available on http://www.cwc.gov.in/main/ downloads /cwc/EAP chapters.pdf

2. R.O.S. (Reservoir Operation Schedule) and G.O.S. (Gate Operation Schedule):

It is very necessary to lay down operating procedures of all storage reservoirs with the objective to limit the flood stages in the river downstream and with maximum feasible utilization of the flood capacity of the river channel downstream of reservoirs, consistent with the safety of the dam. A proper reservoir operation schedule should be in place.

For this purpose a schedule of opening and closing the gates to limit the reservoir levels to preset gauges should be laid down. Schedule for the dam as per operation & maintenance manual should be strictly adhered. The entire capacity of reservoir is used for active conservation. When the reservoir rises above active conservation, operation will be in accordance with the standing operation procedures. Inflow forecasting arrangement should be made for easy operation of gates. The Engineer in charge should inform immediately to the flood maintenance engineer downstream and flood –fighting center of the releases from the reservoir.

3. Data book:

Proper assessment of dam safety involves a thorough review of design, construction and performance records prior to conducting a field examination. The Data book is an unpublished document which is prepared before the initial safety inspection of each dam. This book is abbreviated. Convenient source of information, summarizing all pertinent records and history related to the safety of a dam and is a reference for the evaluation team. This Data book should answer most questions about the dam. A list of reference is included if additional information is needed. Continual updating of the Data book will be required as future inspections are made, new problems arise, new investigations are undertaken and remedial treatments performed. Documentation of all projects may be done in the Data book format which is the primary data base for the team evaluating the safety of a dam. (Guidelines on standardized Data book format are available at http://www.cwc.gov.in/ Dam_safety.html)

4. O & M Manual:

It is desirable that a separate manual is available with the officers .The officers Incharge of such works are requested to personally go through the manual and maintain the records from time to time in such a manner as to give their successors complete and correct idea of the state of each of the several storage works in their charge and the different standing orders on all matters concerning the works. This will enable them to tackle problems as they arise, by quickly referring to the manual as far as possible without having to depend on the office to give information. The complete set of manual for each of the storage works should be personally handed over to successor by each concerned officer.

Copies of the maintenance manual shall be maintained at all offices right from sectional office to Circle office.

It is also necessary that the manuals are inspected at the time of inspection by the superior officers. Record of handing over and inspection should be maintained.

5. Record Drawing and Completion Report:

The importance of record drawings and completion report as an archival data need not be emphasized. All efforts should be made by field engineers to prepare Record Drawing & Completion Report and store them for future reference.

Table 5.1
Regionwise Position of receipt in DSO of Emergency Action Plan (EAP)

Sr.No.	Name of Region	Total Dam	Received	Not received
1	Konkan	**50**	**14**	**36**
2	Pune	**73**	**29**	**44**
3	North Maharashtra	**68**	**34**	**34**
4	Marathwada	**37**	**09**	**28**
5	Amravati	**22**	**19**	**03**
6	Nagpur	**20**	**13**	**07**
	Total	**270**	**118**	**152**

Regionwise Position of receipt in DSO of Reservoir Opearation Schedule (ROS)

Sr.No.	Name of Region	Total Dam	Received	Not received
1	Konkan	**21**	**12**	**09**
2	Pune	**40**	**35**	**05**
3	North Maharashtra	**34**	**27**	**07**
4	Marathwada	**37**	**13**	**24**
5	Amravati	**17**	**17**	**00**
6	Nagpur	**14**	**13**	**01**
	Total	**163**	**117**	**46**

Regionwise Position of receipt in DSO of Gate Opearation Schedule (GOS)

Sr.No.	Name of Region	Total Dam	Received	Not received
1	Konkan	**21**	**11**	**10**
2	Pune	**40**	**35**	**05**
3	North Maharashtra	**34**	**27**	**07**
4	Marathwada	**37**	**11**	**26**
5	Amravati	**17**	**15**	**02**
6	Nagpur	**14**	**10**	**04**
	Total	**163**	**109**	**54**

Annual Consolidated Health Status Report of Identified Large Dams In Maharashtra 2019 – 20

PART – 6

Status of DHARMA: Dam Health and Rehabilitation Monitoring Application

Part – 6

DHARMA: Dam Health and Rehabilitation Monitoring Application

6.1 Introduction-

Dam health & Rehabilitation Monitoring application (DHARMA) is a web based asset management software to support the effective collection and management of authentic asset and health data for all large dams in India and address key dam safety challenges of-

i. Insuring Completeness of information.

ii. Bring stake holders together

iii. Effectively managing asset inventory.

iv. Assess soundness of dame health.

6.2 Design and Development-

DHARMA software consist of seven modules. -

i. Project features

ii. Project portfolio

iii. Engineering features.

iv. Asset health.

v. Asset rehabilitation.

vi. Stake holders and

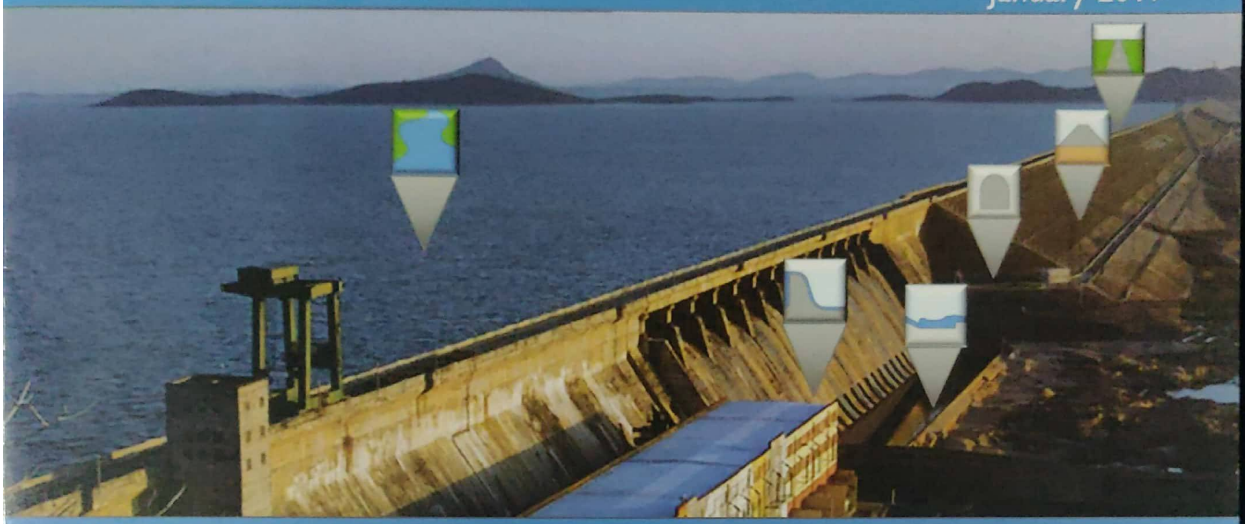
vii. Document library.

The first three modules (i to iii consist of mostly static data, to be enter once and rarely undergo a change where as modules iv) and v) will be dynamic and requires regular updating with information associated with inspections investigations, instrumentation and rehabilitation works. Modules VI) and vii) contain information useful for reference.

DHARMA

Integrated Approach for Asset Management of Dams in India

Information Bulletin No.4 January 2019



INSIDE

p.1 What is DHARMA?

p.2 The users of DHARMA

p.3 DHARMA Modules

p.4 Implementation

The Dam Health and Rehabilitation Monitoring Application (DHARMA)

is being developed as a part of the institutional strengthening component of the Dam Rehabilitation and Improvement Project (DRIP). DRIP is an initiative undertaken by the Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India with the financial assistance of The World Bank.

DHARMA has been designed and developed to enhance the capacity of individuals and organisations throughout India to manage their dam assets scientifically and professionally so as to sustain advantages of dams. This Information Bulletin No.4 has been prepared by the Central Project Management Unit (CPMU) to present an overview of the purpose and content of the software.

Project DRIP Dam Rehabilitation & Improvement Project

Financial Assistance THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Technical Assistance egis

What is DHARMA?

Introduction

There are 5264 large dams in operation in India and 437 are under construction. In addition, there are several thousand smaller dams. All these dams are vital for ensuring the water security of the country in a sustainable manner and regulating water during the rainy season to prevent floods.

Today, many of these dams are facing various structural deficiencies as well as shortcomings in the operation and monitoring facilities. There are also inefficiencies in the monitoring of real-time information regarding dam health and ongoing rehabilitation measures. These conditions affect the safety of the structures and pose risks to life and properties of people downstream of dam.

In April 2012, the six-year **Dam Rehabilitation and Improvement Project (DRIP)** was launched at an estimated cost of 2100 Crore INR for assisting dam-owning agencies in rehabilitating selected dams across selected states.

In 2017, the project has been extended by two years, until June 2020, to finish all of the programmed rehabilitation works on 223 dams in 7 states, with a revised cost of 3466 Crore INR.

In this context, the **Dam Health and Rehabilitation Monitoring Application (DHARMA)** has been designed and developed *to enhance the capacity of individuals and organisations throughout India to manage their dam assets* scientifically and professionally so as to sustain advantages of dams (irrigation and water supply, flood control, hydropower etc.) and prevent disasters.

Figure 1: DHARMA capturing information

Why is it needed ?

Managing the Dam Safety of over five thousand dams entails a number of obstacles to overcome. The prime challenge is to deliver the precious dam health information collected during the site inspection to the State and Central **Dam Safety Organisations (DSOs)** in a timely and secure manner. Improving this transmission of information thanks to data analysis will generate a more precise monitoring of the dams' health in DSOs as well as a more informed prioritization of rehabilitation works. To accomplish this goal, the four main challenges listed below must be overcome; it is DHARMA's goal to address these challenges.

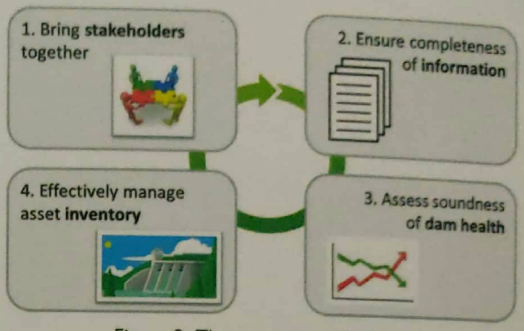


Figure 2: The purposes of DHARMA

1. Bring Stakeholders Together

DHARMA will ensure that details of all stakeholders are recorded and maintained. Such details may pertain to individuals as well as organisational entities associated with dam planning and design, construction, operation and maintenance, and rehabilitation.

2. Ensure Completeness of Information

DHARMA will enable gathering and updating of dam asset information in a centralised and structured manner so as to overcome limitations of multiplicity of agencies, wide geographical spread, voluminous data, varied terminologies and units, unknown and mismatched time reference and inconsistent formats.

3. Assess Soundness of Dam Health

DHARMA will ensure prompt capturing of inspection and investigation data directly by the 'Dam Health Engineers' and provide tools for correct analysis and interpretation of this time dependent data.

4. Effectively manage Asset Inventory

DHARMA will provide a complete data collection and management platform for assimilation of varied information for every dam component across all dam projects, also thereby benefiting from the insights and learning curves of a wider stakeholder spectrum.

The Users of DHARMA

DHARMA User Types

DHARMA has been designed for individuals and organisations at **Dam, State and Central level**. Owing to the large number of dams, several thousand individuals are expected to use the software; they will be assigned to seven main user roles across three tiers, as presented below:

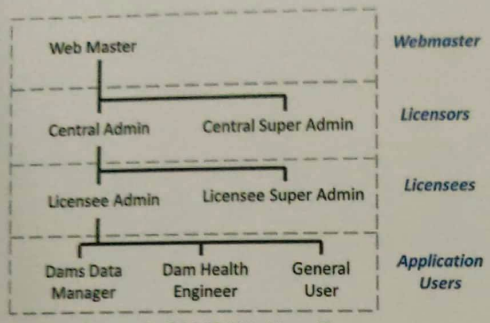
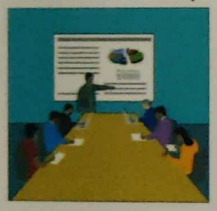


Figure 3: DHARMA User Types

The highest tier **'Licensors'** includes the 'Central Admin' and 'Central Super Admin' roles — these are based in the Central Dam Safety Organisation (in Central Water Commission) and are responsible for administrative control and distribution of the DHARMA software. One of the responsibilities of the 'Licensors' is to grant licenses to the second **'Licensees'** tier which includes the 'Licensee Admin' and 'Licensee Super Admin' roles. These are typically members of Central or State dam owning organisations (eg. State Water Resources Departments). Licensees, in turn, can add three types of **'Application Users'** namely 'Dams Data Manager', 'Dam Health Engineer' and 'General User' who are responsible for managing and updating the data in DHARMA.



A clear distinction is made between the 'Dams Data Manager' (DDM) and 'Dam Health Engineer' (DHE). The **Dams Data Manager**'s role is to manage the static information of dams, i.e. information that is entered once into the software and rarely changes (such as Spillway Capacity, Location of Dam, Access…). He/she is authorized to manage the data of the first three modules, presented in the next page. The **Dam Health Engineer**'s role is to manage dynamic data of a Dam, i.e. data that requires regular updates such as inspection report, investigations, instrumentation data…

DHEs are able to enter their inspection report directly on the software. A mobile application will also be developed for them to enter and upload their inspection report directly from dam site. An option to upload geo-referenced data and photos of each deficiency will be included so as to report deficiencies as precisely as possible.

	Dams Data Manager (DDM)	Dam Health Engineer (DHE)
Type of Data handled	**Static Data**	**Dynamic Data**
Modules	**Modules 1 to 3**: Project Features, Project Portfolio, Engineering Features	**Modules 4 to 7**: Asset Health, Asset Rehabilitation, Stakeholders, Document Library
Tasks assigned	• Entering **high level information** of the dam (Height, location, access, ...) • Creating the **Portfolio** of the Dam by assembling the different DHARMA **components** to match the physical layout of the dam • **Geo-referencing** of each component on Google Maps and adding **photos** • Entering the **technical details** of each **component** (Dam Block, Spillway, Gallery...)	• Entering the regular **pre** and **post monsoon inspection reports** • Entering and updating the **O&M, Investigations, Instrumentation, and EAP** data of the dam • Entering the details of **rehabilitation works** implemented at the dam • Entering the **contact** details of the dam's staff and suppliers in the **Stakeholders** Module • Uploading all important **dam documents** in pdf format into the Document Library Module

Figure 4: Distinction between DDM and DHE

DHARMA Modules

DHARMA consists of the **7** modules and **2** additional data analysis tools presented below:

Static Modules

1. Project Features

This module gives the static, high-level details of a dam project, such as the Dam's Height, Location, Access details… The General, Location and Financial information will be stored for all projects as well as the details of specific benefits provided by each dam: Irrigation, Hydropower, Navigation, Water Supply, Industrial, Tourism, Flood Control, Fishing, and Other Benefits.

2. Project Portfolio

It allows the Dams Data Manager to describe the make-up of his/her dam project using seventeen building blocks, the DHARMA components (Figure 6). Each component is added and organized in layers, similar to the MS Windows Explorer menu. For each component, the user can locate its exact position on Google Maps, upload pictures and schematics.

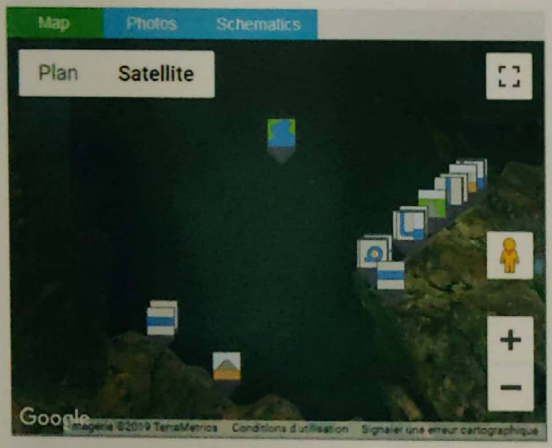


Figure 5: DHARMA Project Portfolio Map

3. Engineering Features

This module contains the technical details associated with each of the components entered in the Project Portfolio module. For example, whereas the name, location, photos and schematics of a storage reservoir would be entered in the Project Portfolio module, it is in Engineering Features that the volumes, elevations and dimensions are provided.

Dynamic Modules

4. Asset Health

This module supports the creation of regular pre and post-monsoon inspections and specific inspections. In this module, the Dam Health Engineers can also upload Instrumentation, Operation & Maintenance (O&M) and Emergency Action Plan (EAP) data, which is attached to the components from the Project Portfolio.

5. Asset Rehabilitation

Also to be administered by designated Dam Health Engineers, it captures the details of any rehabilitation works (minor or major) at the dam project. The need for future rehabilitation works should be identified in the inspection forms of the asset health module however, previous or historic rehabilitation works (pre-DHARMA) can also be entered into the module independently.

6. Stakeholders

The purpose of this module is to capture details of all individuals and organizations involved with each dam project including dam owners, operators, designers, consultants, contractors, and suppliers. Simple forms are provided explaining the nature and duration of involvement of each party and their contact details.

7. Document Library

The last module enables users to upload important designs and documents into a user-friendly database from where they can be easily retrieved using filters and other search criteria. An additional functionality will allow users to tag the documents such that they can be retrieved from other relevant sections of the software using hyperlinks.

Data Analysis Tools

The **Dashboard** enables Dam Safety Organisations to monitor the data-entry for each dam and to pinpoint dams with critical deficiencies.

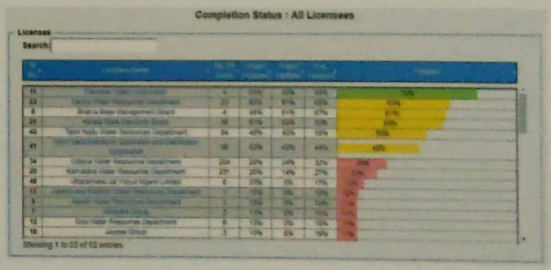


Figure 6: DHARMA Static Dashboard

The **Report Generator** creates lists of dams responding to selected criteria. (State, Purpose, Completion Year…)

Implementation of DHARMA

The success of DHARMA particularly depends on its uptake by Dam Data Managers and Dam Health Engineers around the country (cf. page 2, the users of DHARMA) as they will be in charge of entering all the data. The implementation of the DHARMA application is therefore as important as its design and development.

The first two modules were launched in May 2016 then, the team of designers, which gathers both software developing and civil engineering skills, started to perform training sessions around India in order to make the users familiar with the application.

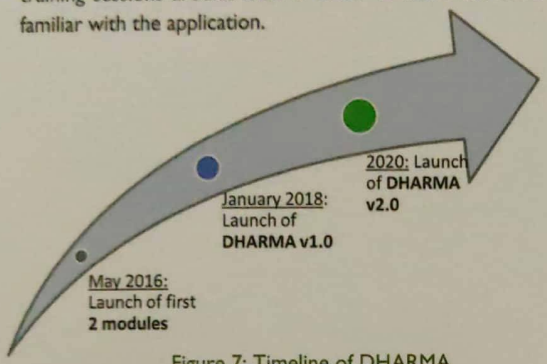


Figure 7: Timeline of DHARMA

DHARMA v1.0 was launched nationally in January 2018, during the previous International Dam Safety Conference in Trivandrum and following the successful migration of the National Register of Large Dams (NRLD) in 2017. Since then 24 trainings were held for 865 participants including 4 trainings in non-DRIP Sates (Rajasthan, Maharashtra & Gujarat). Thanks to these trainings sessions, today 600 people use DHARMA actively and 1546 dams are assigned (out of 5236 large dams in India).

The trainings take place in the State Capitals, they are arranged by the Implementing Agencies which are part of the Dam Rehabilitation and Improvement Project (DRIP). Participants of the trainings (ranging from 30 to 90 for each session) receive hands-on sessions for each module and tool, interactive quizzes and presentations on the purpose and benefits of DHARMA.

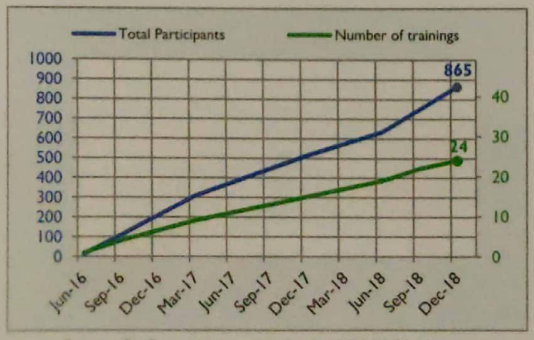


Figure 8: Cumulative number of DHARMA users

The **version 2.0** of DHARMA is to be implemented by December 2020. This version is currently under design and is likely to consist of 4 additional "sub-modules" and 3 additional tools.

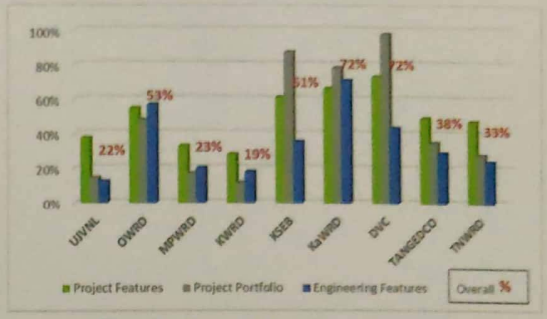


Figure 9: Status of data entry Agency-wise

Here is a list of all Implementing Agencies already using DHARMA:

	Implementing Agencies	Dams assigned to agency	Dams with entered data	Total Users
Agencies in DRIP	Odisha Water Resources Department	204	182	204
	Karnataka Water Resources Department	231	184	122
	Tamil Nadu Water Resources Department	84	84	91
	Madhya Pradesh Water Resources Dpt	887	42	85
	Kerala Water Resources Department	20	20	63
	Uttarakhand Jal Vidyut Nigam Limited	6	4	33
	Kerala State Electricity Board	36	36	25
	Tamil Nadu Elec Gen & Distrib Corp	38	38	15
	Damodar Valley Corporation	4	4	8
Agencies not in DRIP	Rajasthan Water Resources Department	211	131	90
	Maharashtra Water Resources Department	2354	60	49
	Gujarat Engineering Research Institute	631	21	31
	Punjab Water Resources Department	15	14	16
	Bhakra Beas Management Board	4	4	7
	Uttar Pradesh Irrigation and WRD	133	1	3
	National Hydroelectric Power Corporation	22	22	3
	Bihar Water Resources Department	26	1	3
	Meghalaya Power Gen Corp Limited	7	-	2
	Narmada Hydroelec Dvpt Corporation Ltd	-	-	2
	Telangana Irrigation and CAD Department	174	-	2
	Himachal Pradesh State Electricity Board	2	-	2
	Karnataka Engineering Research Station	-	-	2
	Chhattisgarh Water Resources Department	258	-	1
	Goa Water Resources Department	6	-	1
	Jammu and Kashmir Water Resources Dpt	1	-	1
	TOTAL	5354	848	861

Who can I contact to know more?

This is the fourth information bulletin on DHARMA. Development of updated versions of DHARMA and implementation of the software will continue to be taken up in a phased manner under the guidance of the **DHARMA Development Group (D3G)** and **DHARMA Implementation Group (DIG)**. All DRIP dams are expected to be incorporated into DHARMA before the completion of DRIP.

In the meantime, further information on the Dam Rehabilitation and Improvement Project (DRIP) can be found at www.damsafety.in. For further information on DHARMA, please also visit our dedicated website '**damsafety.in/dharma**.' where you can download the latest **User Manual**.

For any other queries, the DHARMA team can be contacted through the details provided below.

For further information please contact:

Project Director, DRIP and DSR Director, Central Water Commission

3rd Floor, New Library Building, R.K. Puram, New Delhi—110066

Telefax: +91-11-26192633

Email: dir-drip-cwc@nic.in Website: www.damsafety.in

DRIP

Dam Rehabilitation & Improvement Project

TABLE – 6.4

Data filling status on Dam Health and Rehabilitation Monitoring Application (DHARMA) portal (Class-1 Dams)

Sr. No	Name of Region	Number of Dam (Class I)	Average Dharma data filling status (%)
1	Konkan	**50**	**12.36**
2	Pune	**66**	**15.55**
3	North Maharashtra	**67**	**13.00**
4	Marathwada	**37**	**15.97**
5	Amravati	**21**	**23.43**
6	Nagpur	**41**	**17.56**

Annual Consolidated Health Status Report

of Identified Large Dams In

Maharashtra state 2019-20

PART – 7

Status Report of Gates of Various Gated Dams in Maharashtra state (Including Private Dams)

Part-7
Status report of Gates of Various gated dams in Maharashtra (Including Private Dams)

7.1 General

As per GR.NO.ID/1078/23/8/IMP/2 Dtd.10/09/1980, Dam Safety Organization has been established by Government of Maharashtra for effective monitoring the safety aspects of dam.

As per Maharashtra Government Guidelines and regulation, Chief Engineer (Mechanical), Water Resources Dept. Nashik assigned Dams gate Inspection work to Superintending Engineer, Mechanical Circle, Nashik to assure proper operation and maintenance of Dam gates As such the mechanical organization inspects all gate parts i. e. radial gates, outlet gates, vertical lift gates, sluice gates, power outlet gates and their hoisting mechanism and steel approach bridges.

Under Superintending Engineer, Mechanical Circle, Nashik Executive Engineer, Inspection unit, Aurangabad and Executive Engineer, Sluice Gate Mfg. Division, Dapodi , Pune are looking after all the inspection works.

Division offices Conduct all pre monsoon & Post Monsoon Gate Inspection work of Government, Semi Government, & Private Dams and send Reports to related authorities for same.

After Inspection work the observed points or deficiencies are classified into various categories as given below.

Def. Category 1	Dams with Major Deficiencies which may lead to dam failure	Very Serious Defects
Def. Category 2 (2 A) & (2B)	Dams with rectifiable Deficiencies needs immediate attention	Serious Defects (2A)
		Require immediate attention (2B)
Def. Category 3	General Defects	General Defects

In the year of 2019 pre and post monsoon inspection of total 173 gated dams have been carried out by Mechanical Organisation. It is to be noted that Chief engineer (Mechanical) W.R.D Nashik, prepares independently the detail Helth status Report of all the gated dams inspected by mechanical organisation.This report is published and submitted to WRD and circulated to all Concern Chief Engineers.

In this Health Status Report, only the damwise number of deficiencies noted by mechanical organisation is given in this part of ACHSR. For details regarding the actual deficiencies Health Status Report circulated by Mechanical Organisation shall be referred.

7.2 Overall Health Statues of Gated Dams

Mechanical Organisation has inspected 157 Class-I gated dams in the Maharashtra State. Out of these dams, 2 Class-I dams are having Category-1 deficiency & 149 Class-I dams are having Category-2 deficiency. Category - 3 deficiencies are observed on 157 Class-I dams. And in Class-2 dams.7 dams are having category II deficiency and 16 class II dams are having Category - 3 deficiencies. There are 3 numbers of Category-1 deficiency; 3161 numbers of Category -2 deficiencies and 10724 numbers of Category-3 deficiencies observed.

Table No. 7.1 shows the regionwise and categorywise number of deficiencies identified on gated dams in Maharashtra state

Table 7.1

Regionwise and categorywise number of deficiencies identified on gated dams in Maharashtra state

Sr. No	Region of State	Number of Dams	Report taken into Account	Number of Deficiencies		
				Cat-1	Cat-2	Cat-3
1	Konkan	23	21	01	479	1155
2	Pune	42	38	00	702	1781
3	North Maharashtra Region	35	34	02	1087	2890
4	Marathwada	57	49	00	571	2850
5	Amravati	17	17	00	284	1016
6	Nagpur	14	14	00	38	1032
	Total	**188**	**173**	**3**	**3161**	**10724**

Annexure- 1
General Information for Dam Safety Inspections

1.0 TIME SCHEDULE OF INSPECTIONS

The Government of Maharashtra has designed systematic approach for monitoring each and every dam. The periodical inspection of dams must be completed as per following schedule.

Type of Inspection	Last dates for	
	Completion of inspection	Sending of inspection reports to concerned authorities.
(1) Pre Monsoon	15th May	30th June
(2) Post Monsoon	30th November	31st December
(3) Special inspection before the first filling (Report need not be sent to Dam safety Organization)	30th April	31st May
(4) Special inspection after the first filling	Within one week after the lake attains the intended storage level.	Within one week from the date of inspection.
(5) Special inspection after a severe distressing event or accident or incident.	Immediately after the event is noted.	Within one week form the date of inspection?

2.0 CLASSIFICATION OF DAMS

The dams are categorized into three types based on their component and features as below.

Sr. No.	Type of Dam	Height from general level of deepest foundation in meter	Impounded gross storage capacity Up to FRL in MCum	Spillway Capacity	Type of Spillway
1	2	3	4	5	6
1	Large Dam (Class-I)	Above 30 m	Above 60 M Cum	Above 3,000 Cumecs	Gated Spillway
2	Large Dam (Class-II)	15 m to 30 m	15 MCum upto 60 MCum	2,000 to 3,000 Cumecs	Ungated Spillway
3	Large Dam (Class-III)	10 m.to15m	1.0 MCum upto 15 MCum	2,000 to 3,000 Cumecs	Ungated Spillway

3.0 FIELD INSPECTION AUTHORITIES

The designated inspection authority for periodical inspection of dam depending upon the classification of type of dam is as below:-

Sr. No	Type of Dam	Inspection authority	Inspection Reports to be sent to	Test Inspection
1	2	3	4	5
1	Large Dam (Class-I)	Superintending Engineer/ Administrator	1) Chief Engineer 2) Superintending Engineer, Dam Safety Organization.	Test Inspection by the Regional Chief Engineer / Chief Administrator for the dams having height more than 60 m or storage capacity more than 1000 MCum or spillway capacity 10000 Cumecs or more
2	Large Dam (Class-II)	Executive Engineer	1) Superintending Engineer / Administrator 2) Superintending Engineer, Dam Safety Organization	
3	Large Dam (Class-III)	Sub-Divisional Eng./Sub Divisional Officer	1) Superintending Engineer / Administrator 2) Executive Engineer	

4.0 PREPARATION OFANNUAL HEALTH STATUS REPORTS OF CLASS-I AND CLASS-II DAMS

Dam safety Organization takes over view of the periodical inspection reports of Class-I & Class-II dams received from field officers, and significant deficiencies are immediately reported to concern authorities to carry out remedial measures. Also based on all periodical inspection reports from field officers and test inspections by DSO officers, the Region wise Annual Health Status Report has been prepared and sent to government, CWC and all concerned Chief Engineers.

5.0 PREPARATION OF ANNUAL HEALTH STATUS REPORT OF CLASS-III DAMS

The responsibility of Health and Safety monitoring of class-III dams lies with the respective Chief Engineer. Hence for Class-III Dams based on periodical inspection reports, Annual Health Status Report of Class-III dams should be prepared by Chief Engineers and sent to DSO for record.

6.0 GUIDELINES REGARDING PREPARATION OF ANNUAL HEALTH STATUS REPORT OF IDENTIFIED LARGE DAMS

AHSR is prepared in DSO as per the guidelines received from Central Water Commission, New Delhi vide letter No. 3 / 19 / NCDS / HS / DSM / 2001 / 627-56, dated 28 August 2002. As per this letter the CWC has requested all states / organizations to send the AHSR for all large dams in prescribed proforma in the month of 'April' every year.

7.0 CATEGORIZATION OF DEFICIENCIES

The deficiencies observed are categorized as per CWC, New Delhi's letter no.3 /19/ NCDS/ HS/ DSM/ 2007 / 627-56, dated 28 August 2002, as below -

Deficiency Category -1- Dams with major deficiencies which may lead to dam failure.

Deficiency Category -2- Dams with major rectifiable deficiencies needing immediate attention.

Deficiency Category -3- Dams having minor/nil deficiencies.

For further detailing of deficiencies based on the nature and priority of deficiency, DSO has standardized all the three types of deficiencies. These standardized deficiencies are appended as the Annexure -2

8.0 NATIONAL REGISTER OF LARGE DAMS

NRLD is compilation of the large dams (Height above 10 meter) in the country as per information received from the owner of dams. In NRLD the definition of "Large Dams" has been adopted as per the norms of International Commission on Large Dams (ICOLD).

NRLD is the Proforma which consist of 20 columns giving information regarding salient features of Large Dams. Field officers need to submit the information of new dams to DSO every year upto December. The DSO compiles the information required for NRLD from field officer. The response regarding submission of NRLD information from field officer is very poor. After regular follow up / correspondence from DSO office, incomplete information receives from field officers. In every January the NRLD register is updated. As per NRLD Register-2017 Maharashtra State comprises of total 2354 dams (2069 completed dams and 285 under construction dams)

9.0 MONITORING OF DEFICIENCY REMOVAL PROGRAM AS PER ANNUAL HEALTH STATUS REPORT

As per Water Resources Department Marathi letter No.2014 dt.12/02/2015 Director General, Design, Training, Hydrology, Research and Safety MERI Nashik has been entrusted to monitor the deficiency removal program. For this a meeting has been held with all concern Chief Engineers and the program has been prepared for removal of deficiencies as per AHSR.

10.0 SUGGESTION FOR INSPECTION BY FIELD OFFICERS

1) Due care shall be taken while filling the salient features of dam and information regarding N.C.D.S. documents.
2) It is observed that the information regarding number of instruments installed does not tally for pre & post monsoon inspection report of the same dam. In some cases it is observed that the list of instruments given in previous year do not appears in the current year. These discrepancies should be avoided.
3) The periodical inspection reports of all the dams shall be sent in original instead of carbon or xerox copy.
4) Ambiguous or incomplete replies shall be avoided. It is necessary to check point wise replies, which should clear and self explanatory.
5) The deficiencies observed frequently since long shall be deleted only after rectification work is completed and reported to Dam Safety Organization, Nashik-4.
6) The inspecting officer is advised to write the word “special attention” in inspection report against all such items wherever immediate attention is necessary from concerned field officer in charge of dam from safety point of dams and life & property on the downstream & would be useful for identifying categorisation of deficiencies in Dam Safety Organization, Nashik- 4.
7) The extent of embankment settlement shall be furnished with its measurement & Reduced Distance (R.D.) and it shall be with compared designed cross section.
8) If the existing dam section is found under section as compared to the design section during inspection then the work of resectioning shall be carried out and opinion of inspecting officer shall be stated in inspection report.
9) The quantum of retrogression/scouring in tail channel shall be given in inspection report.
10) The monolith wise quantum of leaching in galleries and all type of leakages in dam shall be noted in inspection report.
11) The trial of spillway gates shall be carried out before monsoon every year & observed condition shall be mentioned in inspection report.
12) The information in Appendix II (Performance of meteorological instruments installed) and Appendix III (performance of taking observation of instruments installed in large dams) shall be filled properly and complete.
13) The compliance of rectification work of deficiencies of each dam mentioned in status report shall be communicated to Dam Safety Organization, Nashik every year so that this can be included in the Action Taken Report Part-I of status report.
14) Date of inspections is not mentioned in some pre / post inspection reports. This is mandatory since it will reflect in the Annual health status report.

11.0 STANDARD PROCEDURE FOR CONFIRMATION AND REMOVAL OF CATEGORY-I DEFICIENCY OF DAM

A systematic approach and working methodology is very essential to monitor the safety aspects of the dams. Hence in order to avoid any havoc among the stakeholders of dam, the standard procedure for confirmation of category-I deficiency has been circulated by DSO vide Marathi letter No.1491 dt.25/11/2014.

During the scrutiny of Pre and Post Monsoon report or during DSO test Inspection whenever it is found that the deficiency is of Category-I it will be immediately communicated to concern SE and CE. Concerned CE/SE should immediately visit the dam and should satisfied himself that the deficiency pointed out is a major deficiency which may lead to failure of dam, and should confirm to the DSO regarding the classification of deficiency as per his opinion. If it is confirmed then it will be finalised as Category-I deficiency and accordingly it will be appear in AHSR .

As per government directions, Category-I deficiency should be removed immediately on top priority and after completion of physical work of deficiency removal, Concern Chief Engineer should communicate this to DSO.

Annexure 2
Standardized Deficiencies
Standard Deficiencies Category- 1

1 E - Earthen Dam.

- **1E.1** Seepage water has created an open pathway or pipe through dam,which may lead to failure of dam by piping.
- **1E.2** Heavy seepage with muddy or turbid water is observed through any part of dam.
- **1E.3** Seepage water flooding from a boil in the foundation or from relief well on downstream side of dam.
- **1E.4** Outlet well / Head regulator well and hoisting structure is collapsed/completely damaged.
- **1E.5** Outlet pipe in the body of the dam is damaged/failed and uncontrolledoutlet-releases eroding Toe of dam.
- **1E.6** Debris stuck under gate or gate leaf is cracked / failed resulting uncontrolled flow through outlet.

1 M - Masonry Dam.

- **1M.1** Downstream movement or tilting of dam.
- **1M.2** Differential movement of dam blocks/monoliths.
- **1M.3** Vertical Displacement with visible cracking in the body of dam.
- **1 M.4** Spillway gate damaged / not working.

Annexure-2 (Cont...)
Standard Deficiencies Category – 2

Deficiency Cat II (A)	Deficiency Cat II (B)
Earthen Dam	
A.1: Boil leakage/ seepage/ wet patches/ slushiness,in Earthen Dam.	**B 1:** Dam section is not as per design
A 2: Standing pool / Ponding / Water Logging / Slushy condition on D/S of Dam	**B 2**: Cross and toe drains not working properly/ drains silted or vegetated causing stagnant pool of water.
A 3 : Leakages in vicinity of junction between earthen dam & masonry dam portion.	**B 3** : Considerable settlement of embankment / Rock toe/Pitching/ U/S & D/S slops, bulging/concavity of slopes.
A 4 : Major leakages through outlet conduit/pipe joints/Gates.	**B 4**: Longitudinal / Transverse cracks/ low area/sink holes/gully formation on top side slope of earthen dam.
A 5 ; Relief wells not functioning properly./ Abnormal rise in water level in wells.	**B 5 :** Outlet gates not functioning properly. Stem rod is bent(Service gate/Emergency gate/Stop log gate/sluice gate)
A 6 : Outlet well is damaged/not in good condition /cracks observed/jets of water in well.	**B 6** : Approach to dam through all weather road not constructed/maintained properly.
A 7 : Retrogression /scouring in tail channel.	**B 7**: Waste weir/waste weir bar not in good condition/coping damaged/leakage through waste weir.
Masonry / Concrete Dam	
A 8 : Drainage gallery inaccessible/No adequate lighting./ No dewatering arrangement or failure.	**B 8** : Pointing on U/S face of dam not in good condition./deterioration spalling of concrete surface.
A 9 : Foundation drains / holes/ porous pipes/chocked/ no seepage through foundation drain holes.	**B 9**: Instruments not in working condition.
A 10 : Heavy leakages through porous pipes/ through dam body in gallery /monolith joints.	**B 10** : Leakages through River sluice.
A 11 : Sweating / seepages through D/S of masonry dam	
A 12: Excesssive considerable leaching from seepage water.	
A 13: Swelling / minor cracking observed on body of dam.	
A 14: EDA / Stilling basin damaged/Hydraulic performance not good.	
A 15: Leakages through spillway /piers//junction of flank wall.	
A 16: Damages / foundation erosion/ scour/undermining observed in vicinity of flank walls/ guide walls/ junction walls/return walls.	
A 17 :End weir not in good condition / scouring noticed on immediate D/S.	
Spillway gates.	
A 18: Wire ropes of hoist not in good condition/hoisting structure damaged/cracked.	**B 11**: Surface paint/steel surface of spillway gates deteriorated.
A 19: Alternative power system Generator for gate operation not working properly.	**B 12** : Damage to Rubber seals/ considerable Leakages through gates.
A 20: Operation of gates not smooth needs repair.	
Other structures	
Deficiency Cat II (A)	**Deficiency Cat II (B)**
Masonry / Concrete Dam	
	B 13: Heavy vegetation/big trees on embankment top/slope making dam portion not accessible.
	B 14: Deck bridge slab/ pier / damaged cracked/ alignment disturbed.
	B 15: Major portion of Pitching damaged/washed away.

Annexure 2 (Cont..)
Standard Deficiencies Category – 3

3.1 Profuse growth of bushes and trees over dam portion.

3.2 Guard stones/ chainage stones and parapet wall not provided / damaged.

3.3 Growth of aquatic weeds in reservoir of dam is observed.

3.4 Ant hills or crab holes/holes made by rodents/animals**.**

3.5 Minor undulation/ settlement/slightly less top width/ Rain cuts / pot holes observed on dam top & slopes.

3.6 Access road**/**Dam top road surface/ slab joints damaged needs repair.

3.7 Pitching on embankment of dam is dislocated /disturbed at some places.

3.8 Breaching section is not accessible/ Instruction board showing operation of breaching section is not available.

3.9 Section of Toe drain/cross drain/ out fall drain/rock toe damaged at some places.Pitching of drains disturbed.Some weed,vegetation growth/ siltation in nalla/drains. Nalla needs regradation.

3.10 Surface drain/ Catch water drains for berms are silted /damaged.

3.11 Electric cable & wiring are damaged/not in good condition.

3.12 Minorleaching in the gallery/ body of dam.

3.13 V – notches/ measuring devices are not in working condition/ silted / damaged/ not provided.

3.14 Mosquito net door is to be provided to avoid entry of reptiles in the gallery.

3.15 Damage to natural slope protection works, guniting damaged / washed out / Wire mesh exposed.

3.16 Guide wall/Divide wall/Guide bund/End Sill wall damaged/ Pointing is not in good condition/weep holes not functioning. At some places w.w bar/coping is damaged.

3.17 Provision of access to stilling basin/ladder not provided.

3.18 EDA ponding with water not possible to Inspect.

3.19 Minor erosion / Scouring / Retrogression / pot holes in tail channel. Ponding / standing water in EDA / Tail channel.

3.20 Lubrication/painting/minor repairs required for parts of Gates / hoisting Structure /Rubber seal damaged/ replacement.

3.21 Approach bridge to intake well / spillway gates railing /flooring plates damaged / need repairs. Need of ladder for inspection well/EDA.

3.22 Minor leakages through river sluice/outlet/ gates.

3.23 Air vent not periodically cleaned / damaged / closed.

3.24 EAP / ROS /GOS /Record drawings/ not provided / not prepared at dam site.

3.25 The record of periodical measurements of leakage discharge from dam / relief well is not maintained.

3.26 Street light on dam top is not provided/not working.

3.27 Security / CC TV camera/entry gate not provided/not working.

3.28 Sufficient staff arrangement is not available for security, instrument readings and measurements and maintenance on dam site.

3.29 Fencing around dam is not provided/ damaged due to which unauthorized trespassers are seen.

3.30 Communication facilities like mobile wireless, warning devices, telephone is not available at dam site.

3.31 Sufficient stock of spares/stationary required is not available at dam site. Storage arrangement not provided at site.

3.32 Security cabin at dam entrance/Irrigation outlets not provided/damaged/needs repair.

3.33 Minor leakages through masonary/ concrete dam body/gallery of dam/outlet well

3.34 Approach channel silted.Trash rack need to be cleaned/ damaged/not provided.

3.35 Minor damages to spillway / masonary/ concrete portion of dam/outlet well.

3.36 Porous pipes/foundation drains / holes not periodically cleaned.

BHATSA DAM