

PCA Case No. 2023-01
IN THE MATTER OF AN ARBITRATION

-before-

THE COURT OF ARBITRATION CONSTITUTED
IN ACCORDANCE WITH THE INDUS WATERS TREATY 1960

-between-

THE ISLAMIC REPUBLIC OF PAKISTAN

-and-

THE REPUBLIC OF INDIA

SECOND PHASE ON THE MERITS

MEMORIAL

VOLUME II (APPENDICES)

19 JANUARY 2026

APPENDICES

Volume II of Pakistan's Memorial on the Second Phase of the Merits

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APPENDIX A

**DATA COMMUNICATED TO
PAKISTAN BY INDIA PURSUANT TO
PARAGRAPH 9 AND APPENDIX II,
AND PARAGRAPH 19 AND
APPENDIX III, OF ANNEXURE D**

APPENDIX A

Data communicated to Pakistan by India pursuant to Paragraph 9 and Appendix II, and Paragraph 19 and Appendix III, of Annexure D

By Paragraph 2.3.3(a) of Procedural Order No. 17, the Court of Arbitration requested Pakistan to address “the data India has shared with Pakistan in respect of the capacity and load of Annexure D, Part 3 HEPs, as well as India’s calculations for the maximum Pondage for such HEPs”. Pursuant to Paragraph 9 and Appendix II (new Run-of-River Plants) and Paragraph 19 and Appendix III (new Small Plants) of Annexure D to the Indus Waters Treaty, India is obliged to communicate to Pakistan certain specified information relating to such Plants in advance of construction. The specified information includes information relevant to the capacity and load of such Plants.

This **Appendix A** sets out the data provided by India to Pakistan specified in Appendices II and III of Annexure D to the Treaty relating to the “capacity”, “load”, and India’s “calculations for the maximum Pondage” in the design of each Annexure D, Part 3 HEP notified to Pakistan since the Treaty entered into force. The table is organised chronologically by Notification Date (Column D). Column C identifies the exhibit number of the corresponding notification letter already on the record of the proceedings, noting that all of the data contained in this Appendix have already been submitted into the record in these proceedings.¹

¹ Upon review of the Pondage-related record of these proceedings, Pakistan discovered that four exhibits, **P-0077**, **P-0649.0781 (resubmitted)**, **P-0649.1337**, and **P-0649.1390**, relating to the Ratle, Thirot, Miyar, and Thusgam Sankoo HEPs respectively, inadvertently omitted certain pages. Pakistan is accordingly resubmitting the complete version of these documents with this submission.

Memorial of Pakistan on the Second Phase on the Merits (Appendix A)
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19 January 2026

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
No.	HEP	Exhibit No.	Notification Date	Capacity (MW) <i>App. II, ¶ 4(i)</i> <i>App. III, ¶ 4(g)</i>	Load (cumecs) <i>App. II, ¶ 4(h)</i>	Volume of Operating Pool (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>	Maximum Permissible Pondage (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>
1.	Billing	P-0649.0013	6 March 1962	0.1 (Firm Power = 0.1) (Secondary Power = nil)	N/A	No Pondage proposed.	
2.	Shansha	P-0649.0052	23 December 1963	0.2 (Firm Power = 0.1) (Secondary Power = 0.01)	N/A	No Pondage proposed.	
3.	Sissu	P-0649.0063	9 July 1964	0.1 (Firm Power = 0.05) (Secondary Power = 0.05)	N/A	No Pondage proposed.	
4.	Khardung	P-0649.0076 (resubmitted)	26 April 1965	0.3 (Firm Power = 0.1) (Secondary Power = 0.2)	N/A	No Pondage proposed.	
5.	Dras	P-0649.0074	26 April 1965	0.075 (Firm Power = 0.075) (Secondary Power = nil)	N/A	No Pondage proposed.	

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6.	Stakna	P-0649.1730	9 September 1968	3.24 ² (6 units of 540 KW each, where Firm Power = 4 to 5 units, and Secondary Power = 1 to 2 units)	Daily variation of 300 to 660 cumecs (summer) and 224 to 500 cumecs (winter)	135,806 CM or 110.10 acre-feet	No maximum Pondage calculation provided.
7.	Sumbal	P-0649.1731	11 September 1968	22	Daily variation of 0 to 615 cumecs	200,046 CM or 162.2 acre-feet	No maximum Pondage calculation provided.
8.	Salal-I&II	P-0649.0169 (resubmitted)	30 April 1970	270 (3 x 90 MW units) ³	No variation given Plant to operate at base load without interfering with river regime.	No Pondage proposed.	
9.	Lower Jhelum	P-0649.0268	21 November 1974	105	Daily variation of 0 to 7,000 cumecs	961,499 CM or 779.5 acre-feet ⁴	1,677 acre-feet Enclosure 14 (p. 29)

² The installed capacity of the Stakna HEP subsequently increased from 3.24 MW to 4 MW. *See* General Issues Award, ¶ 186, Figure 4: Summary of completed Run-of-River HEPs with Operating Pool Storage.

³ The installed capacity of the Salal-I&II HEP was subsequently increased from 270 MW to 690 MW. *See* General Issues Award, ¶ 167.

⁴ This figure comprises 252 acre-feet (diversion weir), 479.50 acre-feet (balancing reservoir), and 48 acre-feet (forebay). *See* Letter No. F.4(1)/62-IC(IT) from the ICIW to the PCIW, dated 21 November 1974, **P-0649.0268**, p. 2.

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10.	Chinani-I	P-0649.0403 (resubmitted)	14 March 1978	Not provided.	Not provided.	49,339 CM or 40 acre-feet	236 acre-feet Enclosure VI (p. 9)
11.	Dul Hasti	P-0649.0408 (resubmitted)	3 July 1978	780	Weekly variation of 0 to 426 cumecs	8,000,000 CM or 6,500 acre-feet	13,756 acre-feet Appendix II (p. 8) ⁵
12.	Upper Sind-II	P-0649.0500 (resubmitted)	18 May 1984	105	Daily variation of 0 to 52.4 cumecs	404,290 CM ⁶ or 328 acre-feet	359 acre-feet Enclosure 20 (p. 42)
13.	Uri-I	P-0649.0523 (resubmitted)	19 September 1985	480	No variation given Plant to operate at base load without interfering with the river regime.	No Pondage proposed.	
14.	Kargil	P-0649.0534 (resubmitted)	30 January 1986	3.75	Daily variation of 0 to 28.32 cumecs	Not provided.	190 acre-feet Enclosure VII (p. 8)

⁵ The calculations for the maximum permissible Pondage for the Dul Hasti HEP accompanying its design notification do not explicitly state the figure for the maximum permissible Pondage, although it is clear from the calculation itself, by doubling the figure for the highest cumulative storage in the week (6878 x 2 = 13,756 ac-ft). This figure is confirmed by the ICIW in a subsequent letter. See Letter No. F.16(4)/62-I.T./78 from the ICIW to the PCIW dated 8 November 1983, **P-0649.1733**, p. 5.

⁶ This figure comprises 2,300 CM (weir on Sindh Nallah), 1,590 CM (weir on Wangath Nallah), 270,000 CM (balancing reservoir on Sumbal Link), 121,000 (balancing reservoir on Wangath Link), and 9,400 CM (forebay). See Letter No. F.11(2)/82-I.T./135 from the ICIW to the PCIW, dated 18 May 1984, **P-0649.0500 (resubmitted)**, p. 32.

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15.	Killar	P-0649.0537 (resubmitted)	12 March 1986	0.3	N/A	Negligible	No maximum Pondage calculation provided.
16.	Karnah	P-0649.0541 (resubmitted)	9 April 1986	2	N/A	No Pondage proposed.	
17.	Thirot	P-0649.0569 (resubmitted)	28 October 1986	3 (3 units of 1 MW each)	N/A	8,100 CM ⁷ or 6.5 acre-feet	No maximum Pondage calculation provided.
18.	Haftal-I&II	P-0649.0600	31 May 1988	2	N/A	No Pondage proposed.	
19.	Shaker Chicktan (Sanjak)	P-0649.0601 (resubmitted)	31 May 1988	0.84 (2 units of 0.42 MW each)	N/A	No Pondage proposed.	
20.	Matayin	P-0649.0602 (resubmitted)	31 May 1988	0.12	N/A	No Pondage proposed.	
21.	Matchil	P-0649.0604 (resubmitted)	29 June 1988	0.35	N/A	No Pondage proposed.	
22.	Keran	P-0649.0626 (resubmitted)	5 September 1988	0.7	N/A	No Pondage proposed.	

⁷ The Operating Pool of the Thirot HEP was subsequently decreased to 6,622 CM (or 5.4 acre-feet). *See* Letter No. 4(9)/83-I.T./640 from the ICIW to the PCIW, dated 24 March 1993, **P-0649.0781 (re-resubmitted)**, p. 2.

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No.	HEP	Exhibit No.	Notification Date	Capacity (MW) <i>App. II, ¶ 4(i)</i> <i>App. III, ¶ 4(g)</i>	Load (cumecs) <i>App. II, ¶ 4(h)</i>	Volume of Operating Pool (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>	Maximum Permissible Pondage (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>
23.	Asthan Nallah	P-0649.0628	29 September 1988	0.75	N/A	9,735 CM or 7.9 acre-feet	9,951 CM Annex V (p. 8)
24.	Pahalgam	P-0649.0636 (resubmitted)	30 November 1988	4.5	No variation as the “Plant is designed purely as a Run of River plant utilising the river flows as available” (p. 6)	No Pondage proposed.	
25.	Chinani-II	P-0649.0648 (resubmitted)	9 February 1989	2 (2 units of 1 MW each)	N/A	No Pondage proposed.	
26.	Bhadarwah	P-0649.1737 (resubmitted)	29 July 1989	1.5 (Firm Power = 1) (Secondary Power = 0.5)	N/A	1,555.6 CM or 1.26 acre-feet	No maximum Pondage calculation provided.
27.	Parnai	P-0649.0695	15 January 1990	37.5	Daily variation of 12.03 cumecs	67,680 CM or 54.8 acre-feet	178,308 CM (Ann. VIII, p. 23)
28.	Rajouri	P-0649.1738 (resubmitted)	31 August 1990	3 (3 units of 1 MW each)	N/A	16,800 CM or 13.62 acre-feet	24,408 CM (Ann. V)

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29.	Bazgo	P-0649.0749 (resubmitted)	4 July 1991	0.3	N/A	Negligible	No maximum Pondage calculation provided.
30.	Sumoor Nobra	P-0649.0748 (resubmitted)	4 July 1991	0.1	N/A	Negligible	4,205 CM (Ann. IV)
31.	Hunder Nobra	P-0649.0750	8 July 1991	0.4	N/A	Negligible	No maximum Pondage calculation provided.
32.	Baglihar-I&II	P-0585	20 May 1992	450 (Stage I) ⁸ (3 units of 1.5 MW)	Weekly variation of is 0 to 438.15 cumecs	37,500,000 CM or 30,400 acre-feet	37,722,000 CM (Ann. III, p. 41)
33.	Kishenganga	P-0055	19 June 2006	330	Weekly variation of 0 to 58.4 cumecs	7,550,000 CM or 6,120 acre-feet	8,870,000 CM (Ann. A, p. 6)
34.	Uri-II	P-0649.1018	27 December 2005	240 (4 units of 60 MW)	“No variations in the discharge expected due to load fluctuations, being a run off river scheme with no storage” (p. 4)	No Pondage proposed.	

⁸ The ultimate installed capacity of the Baglihar HEP is 900 MW. See General Issues Award, ¶ 186, Figure 4: Summary of completed Run-of-River HEPs with Operating Pool Storage.

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35.	Nimo Bazgo	P-0649.1065	27 December 2006	45 (3 units of 15 MW)	Weekly variation of 48.7 to 146.1 cumecs.	9,720,000 CM or 7,880 acre-feet	16,440,000 CM (Ann. VII, p. 35)
36.	Chutak	P-0649.1103	2 November 2007	44 (4 units of 11 MW)	24.05 to 96.20 cumecs. Letter does not specify whether daily or weekly variation.	No Pondage proposed.	
37.	Athawatto	P-0649.1194	13 May 2009	10 (2 units of 5 MW)	N/A	1215 cumecs in the forebay (p. 2).	No maximum Pondage calculation provided.
38.	Tangmarg	P-0649.1201	26 August 2009	10 (2 units of 5 MW)	N/A	1284 cumecs in the forebay (p. 2).	No maximum Pondage calculation provided.
39.	Brenwar	P-0649.1202	1 October 2009	7.5 (3 units of 2.5 MW)	N/A	725 cumecs in the forebay (p. 2)	No maximum Pondage calculation provided.
40.	Ranja-Ala-Dunadi	P-0649.1236	31 May 2010	15 (2 units of 7.5 MW)	N/A	2065 cumecs in the forebay (p. 2)	No maximum Pondage calculation provided.
41.	Dumkhar	P-0649.1258	30 September 2010	0.5 (2 units of 0.25 MW)	N/A	No Pondage proposed.	
42.	Marpachoo	P-0649.1263	10 November 2010	0.75 (3 units of 0.25 MW)	N/A	No Pondage proposed.	

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43.	Kehmil	P-0649.1273	7 March 2011	4 (2 units of 2 MW)	N/A	No Pondage proposed. Volume between FPL and DSL in forebay is to meet “hydraulic transients” arising from operation of the plant (p. 2).	
44.	Dah	P-0649.1289	18 July 2011	6 (2 units of 3 MW)	N/A	No Pondage proposed. Volume of 360 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).	
45.	Hanu	P-0649.1288	18 July 2011	5 (2 units of 2.5 MW)	N/A	No Pondage proposed. Volume of 360 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).	
46.	Boniyar	P-0649.1296	21 September 2011	8 (2 units of 4 MW)	N/A	No Pondage proposed. Volume of 1480 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).	
47.	Miyar	P-0649.1337 (resubmitted)	27 April 2012	120 (3 units of 40 MW)	Weekly variation of 0 to 61.35 cumecs.	900,000 CM or 730 acre-feet	1,986,000 CM (Ann. VII, p. 13)
48.	Lower Kalnai	P-0649.1340	22 June 2012	48 (2 units of 24 MW)	Weekly variation 0 to 29.55 cumecs.	760,000 CM or	2,760,000 CM (Ann. II, p. 37)

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						616 acre-feet	
49.	Ratle	P-0077 (resubmitted)	16 August 2012	850 (4 units of 205 MW)	Weekly variation of 33.43 to 961.53 cumecs.	23,860,000 CM or 19,350 acre-feet	24,100,000 CM (Ann. VII, p. 23)
50.	Chulunkha	P-0649.1362	14 December 2012	0.8 (2 units of 0.4 MW)	N/A	No Pondage proposed.	
51.	Turtuk-I	P-0649.1363	27 December 2012	0.5 (2 units of 0.25 MW)	N/A	No Pondage proposed. Volume of 116.88 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
52.	Waris-III	P-0649.1367 (resubmitted)	10 January 2013	1.2 (2 units of 0.6 MW)	N/A	No Pondage proposed. Volume of 106.68 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
53.	Bogdang	P-0649.1369	23 January 2013	0.8 (2 units of 0.4 MW)	N/A	No Pondage proposed. Volume of 75.46 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
54.	Durbuk-II	P-0649.1370	29 January 2013	0.35 (2 units of 0.175 MW)	N/A	No Pondage proposed.	

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						Volume of 64.14 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
55.	Shayok	P-0649.1371	6 February 2013	0.6 (2 units of 0.3 MW)	Variation of 0 to 7.5 cumecs. Unclear whether daily or weekly.	No Pondage proposed.	
56.	New Ganderbal	P-0649.1372	26 February 2013	93 (3 units of 31 MW)	Weekly variation of 0 to 72.38 cumecs.	100,000 CM or 81.1 acre-feet	3,580,000 CM (Ann. VII, p. 24)
57.	Tsati	P-0649.1375	13 March 2013	0.5 (2 units of 0.5 MW)	N/A	No Pondage proposed. Volume of 36.84 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
58.	Henache	P-0649.1377	9 April 2013	0.6 (2 units of 0.3 MW)	N/A	No Pondage proposed. Volume of 73.88 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
59.	Chamshen	P-0649.1376	9 April 2013	0.45 (2 units of 0.225 MW)	N/A	No Pondage proposed. Volume of 79.65 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	

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60.	Sumda-Dho	P-0649.1378	9 April 2013	0.3 (2 units of 0.15 MW)	N/A	No Pondage proposed. Volume of 39.74 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
61.	Zunkur	P-0649.1384	9 July 2013	2.5 (2 units of 1.25 MW)	N/A	No Pondage proposed. Volume of 420 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
62.	Raru	P-0649.1387	9 July 2013	2 (2 units of 1 MW)	N/A	No Pondage proposed. Volume of 300 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
63.	Bairas	P-0649.1385	9 July 2013	1.5 (2 units of 0.75 MW)	N/A	No Pondage proposed. Volume of 540 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
64.	Chilong	P-0649.1386	9 July 2013	1 (2 units of 0.5 MW)	N/A	No Pondage proposed. Volume of 250 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
65.	Umbulung	P-0649.1388	9 July 2013	1 (2 units of 0.5 MW)	N/A	No Pondage proposed.	

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						Volume of 345 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
66.	Thusgam Sankoo	P-0649.1390 (resubmitted)	10 July 2013	0.5	N/A	No Pondage proposed. Volume of 391.5 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
67.	Sangarh	P-0649.1391	11 July 2013	1.5 (2 units of 0.75 MW)	N/A	No Pondage proposed. Volume of 210 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
68.	Thusgam Drass	P-0649.1393	11 July 2013	0.5 (2 units of 0.25 MW)	N/A	No Pondage proposed. Volume of 84 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
69.	Tambis	P-0649.1392	11 July 2013	0.2 (2 units of 0.1 MW)	N/A	No Pondage proposed. Volume of 102 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
70.	Khandi	P-0649.1398	16 July 2013	1.5 (2 units of 0.75 MW)	N/A	No Pondage proposed.	

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
No.	HEP	Exhibit No.	Notification Date	Capacity (MW) <i>App. II, ¶ 4(i)</i> <i>App. III, ¶ 4(g)</i>	Load (cumecs) <i>App. II, ¶ 4(h)</i>	Volume of Operating Pool (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>	Maximum Permissible Pondage (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>
						Volume of 240 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
71.	Matayeen	P-0649.1397	16 July 2013	1 (2 units of 0.5 MW)	N/A	No Pondage proposed. Volume of 370 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).	
72.	Khari-I	P-0649.1426	17 August 2015	2	N/A	No Pondage proposed.	
73.	Tamasha	P-0649.1479	4 February 2019	12 (3 units of 4 MW)	N/A	No Pondage proposed.	
74.	Baltikulan	P-0649.1477	4 February 2019	5 (2 units of 2.5 MW)	N/A	No Pondage proposed.	
75.	Kalaroos-II	P-0649.1478	4 February 2019	10.5 (3 units of 3.5 MW)	N/A	No Pondage proposed.	
76.	Nimu Chilling	P-0649.1515	24 December 2020	24 (3 units of 8 MW)	Variation of 58.64 to 64.50 cumecs. Does not specify whether daily or weekly.	No Pondage proposed.	
77.	Durbuk Shyok	P-0649.1514	24 December 2020	19 (2 units of 9.5 MW)	Variation of 9.65 to 10.615 cumecs. Does not specify	No Pondage proposed.	

Memorial of Pakistan on the Second Phase on the Merits (Appendix A)
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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
No.	HEP	Exhibit No.	Notification Date	Capacity (MW) <i>App. II, ¶ 4(i)</i> <i>App. III, ¶ 4(g)</i>	Load (cumecs) <i>App. II, ¶ 4(h)</i>	Volume of Operating Pool (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>	Maximum Permissible Pondage (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>
					whether daily or weekly.		
78.	Kiru	P-0546 (resubmitted)	1 June 2021	624 (4 units of 156 MW)	Weekly variation of 146.5 to 586 cumecs.	10,500,000 CM or 8,516 acre-feet	20,220,000 CM (Ann. VII, p. 51)
79.	Kargil Hunderman	P-0649.1587	7 July 2021	25 (2 units of 12.5 MW)	Variation of 26.60 to 53.19 cumecs. Does not specify whether daily or weekly.	40,689 CM or 32.99 acre-feet	No maximum Pondage calculation provided.
80.	Kulan Ramwari	P-0649.1588	7 July 2021	25	N/A	Nil	No maximum Pondage calculation provided.
81.	Phagla	P-0649.1589	7 July 2021	14.10	Variation in discharge from 3.49 to 10.47 cumecs. Does not specify whether daily or weekly.	Nil	No maximum Pondage calculation provided.
82.	Mandi	P-0649.1603	10 August 2021	15 (3 units of 5 MW)	Variation of 5.7 to 17.1 cumecs. Does not specify whether daily or weekly.	2,202 cumecs	No maximum Pondage calculation provided.

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(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
No.	HEP	Exhibit No.	Notification Date	Capacity (MW) <i>App. II, ¶ 4(i)</i> <i>App. III, ¶ 4(g)</i>	Load (cumecs) <i>App. II, ¶ 4(h)</i>	Volume of Operating Pool (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>	Maximum Permissible Pondage (CM / acre-feet) <i>App. II, ¶ 3(b)</i> <i>App. III, ¶ 3(b)</i>
83.	Mangdum Sangra	P-0649.1634	9 October 2021	19 (2 units of 9.5 MW)	Variation of 13.85 to 27.70 cumecs. Does not specify whether daily or weekly.	Nil	No maximum Pondage calculation provided.
84.	Sankoo	P-0649.1634	9 October 2021	18.5 (2 units of 9.25 MW)	Variation of 17.98 to 35.97 cumecs. Does not specify whether daily or weekly.	Nil	No maximum Pondage calculation provided.
85.	Ans-II	P-0649.1634	9 October 2021	23 (2 units of 11.5 MW)	Variation of 17.37 to 34.75 cumecs. Does not specify whether daily or weekly.	22,600 CM or 18.3 acre-feet	No maximum Pondage calculation provided.
86.	Kwar	P-0649.1718	20 June 2023	540 (4 units of 135 MW)	Weekly variation of 145.07 to 580.28 cumecs.	9,160,000 CM or 7,429 acre-feet	20,170,000 CM (Ann. VIII)

* * *

APPENDIX B

HISTORICAL DISCUSSIONS BETWEEN THE PARTIES CONCERNING “LOAD”, “CAPACITY” AND “CALCULATIONS FOR THE MAXIMUM PONDAGE”

APPENDIX B

Historical discussions between the Parties concerning “load”, “capacity” and “calculations for the maximum Pondage”

By Paragraphs 2.3.3(b) of Procedural Order No. 17, the Court of Arbitration requested Pakistan to address “discussions of the capacity and load of proposed Annexure D, Part 3 HEPs, as well as calculations of the maximum Pondage for such HEPs found in: (i) all correspondence between the Parties’ respective Commissioners for Indus Waters, (ii) all correspondence between other officials, and (iii) records of the Permanent Indus Commission”.

This **Appendix B** provides a description of all relevant communications between the Parties concerning Pondage for each Annexure D, Part 3 HEP notified to Pakistan since the Treaty entered into force, with specific exchanges concerning “load”, “capacity”, and “calculations for the maximum Pondage” excerpted. The table is arranged chronologically by reference to the date of the communication in question (Column C).

The Appendix includes “correspondence between the Parties’ respective Commissioners for Indus Waters” and “records of the Permanent Indus Commission”. It does not, however, include the third category identified by the Court (“correspondence between other officials”) as Pakistan has not located any such correspondence relevant to the question of Pondage. It does contain one entry for discussions between the Parties at Secretary-level meetings for the Baglihar HEP. The communications are grouped according to the Annexure D, Part 3 HEP to which they relate. Additionally, certain general correspondence relating to Pondage, but which is not specific to a particular Annexure D, Part 3 HEP, is set out at the end of the table. All the exhibits referenced herein have already been submitted into the record in these proceedings.¹

¹ Upon review of the Pondage-related record of these proceedings, Pakistan discovered that four exhibits, **P-0077**, **P-0649.0781 (resubmitted)**, **P-0649.1337**, and **P-0649.1390**, relating to the Ratle, Thiro, Miyar, and Thusgam Sankoo HEPs respectively, inadvertently omitted certain pages. Pakistan is accordingly resubmitting complete versions of these documents with this submission.

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
BILLING			
P-0649.0013	Letter No. F4(28)/61-IC	6 March 1962	Notification of HEP design. No Pondage proposed.
SHANSHA			
P-0649.0052	Letter No. F.4(28)61-I.C	23 December 1963	Notification of HEP design. No Pondage proposed.
SISSU			
P-0649.0063	Letter No. F.4(28)61-I.C	9 July 1964	Notification of HEP design. No Pondage proposed.
KHARDUNG			
P-0649.0076 (resubmitted)	Letter No. F.4(6)/65-IC/I	26 April 1965	Notification of HEP design. No Pondage proposed.
DRAS			
P-0649.0074	Letter No. F.4(28)/61-I.C	26 April 1965	Notification of HEP design. No Pondage proposed.

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
STAKNA			
P-0649.1730	Letter No. F.4(1)/66-IC	9 September 1968	Notification of HEP design. Operating Pool: 110.10 acre-feet (Annexure V, p. 13). No calculation provided for maximum Pondage. Load: daily variation of 300 to 660 cusecs (Summer) and 224 to 500 cusecs (Winter) (p.5). Installed Capacity: 6 units of 540 KW each – 4 to 5 units for firm power, 1 to 2 units for secondary power (p.5).
P-0649.0137	Letter No. WT(16)/(2201-A)/PCIW	5 November 1968	Response to ICIW letter above. PCIW requests details of the “exact value of Firm Power” and calculations “for the Operating Pool allowed under the Treaty [maximum Pondage]” (p. 1). PCIW requests details of “variations in the discharge on account of weekly load fluctuations” (p. 4).
P-0649.0163 / P-0649.1940	Letter No. F.4(1)/66-IC	24 December 1969	Response to PCIW letter above. ICIW provides calculation for maximum Pondage “based on daily load pattern for a typical day” (p. 5), with detailed calculations at Enclosure IX (p. 19). On load variations, ICIW states that “variation of discharge are on the basis of daily load fluctuations and these have already been intimated. It is anticipated that there will not be any variation of weekly load fluctuations than those worked out on daily load fluctuations” (p. 9). On firm power, ICIW states that “concrete figures for Firm and Secondary Power are not required to be supplied under [the Treaty]. Nevertheless these are given below as requested:

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			1. Firm Power 2450 KW (4 to 5 units) at 60% Load Factor. 2. Secondary Power 790 KW (1 to 2 units) subject to availability of river flows.” (p. 9).
SUMBAL			
P-0649.1731	Letter No. 4(13)/65-IC	11 September 1968	Notification of HEP design. Operating Pool: 162.18 acre-feet (Enclosures 8 and 9, pp. 21-22). No calculation provided for maximum Pondage. Load: daily variation of zero to 615 cusecs (p. 7). Installed Capacity: ICIW states that “[f]or Firm Power 22000 KW at about 30% load factor. For secondary power. The generating capacity would be utilised for secondary power generation also when the river flows are higher than that required for Firm Power” (p. 7).
P-0649.0136	Letter No. WT(16)/(2202-A)/PCIW	5 November 1968	Response to ICIW letter above. PCIW notes that the “information received with [the above] letter [...] is incomplete and Pakistan is, therefore, unable to satisfy itself that the design of the Plant conforms to the criteria laid down in the Treaty”; PCIW specifically requests “the calculations for the Operating Pool allowed under the Treaty” (p. 1). PCIW also requests confirmation that “total capacity of power units to be installed is 22,000 KW and that the capacity for Firm Power is also 22,000 KW. This means that there will be no power unit installed for Secondary Power” (p. 4).
P-0649.0140 (resubmitted)	Letter No. 4(13)/65-IC	10 February 1969	Response to PCIW letter above. ICIW disagrees that information previously supplied was not sufficient or inadequate in terms of what the Treaty required India to share. ICIW notes that “with information already supplied under Item 4(1) of Appendix II to Annexure ‘D’ to the Treaty, it can be

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
			seen as explained in the enclosures, that the capacity of the Operating Pool does not exceed twice the Pondage required for the Firm Power” (p. 1). ICIW notes that “[t]he calculations for the operating pool as defined under para 2(f) have already been furnished under item 3(b) of Appendix II to Annexure ‘D’ of the Treaty. Moreover, with the data already supplied under item 3(f) [designated range of operation] and 4(i) [maximum aggregate capacity of power units] of Appendix II and the simple calculations as done below, it is quite easy to see that the maximum pondage in the Operating Pool does not exceed twice the Pondage required for Firm Power” (p. 4). The calculation is as follows: “From the generating capacity of 22,000 KW and load factor of 30% (as supplied under item 4(i) of Appendix II, the Firm Power works out to $22,000 \times 0.3 = 6600$ KW (continuous). The corresponding discharge against an average head of 503 ft. (from the designated range of operation given under item 3(f) of Appendix II as 499 ft. to 507 ft.) works out to $15 \times 6600 / 503 = 196$, say 200 cusecs. According to standard norms for a load factor of 30% about $\pm 33\%$ of daily requirements are necessary as pondage for Firm Power which works out to $1/3 \times 2 \times 200 = 133$ A. ft. We are entitled, under Para 8(c) of Annexure ‘D’ to the Indus Waters Treaty, to twice the pondage required for Firm Power i.e. 266 Acre ft. against which the total Pondage provided in both the Balancing Reservoirs is about 162 acre. ft. only. This does not include the insignificant, incidental pondage in the Hydel Channel” (pp. 4-5). Detailed calculations “in the manner desired by [PCIW]” were shared as Encl. XIII (p. 23). ICIW notes that “according to this [calculation] the Pondage required for Firm Power works out to 151 Acre ft., twice of which is 302 Acre ft” (p. 5). ICIW also confirms that “maximum installed capacity of the power units is 22,000 KW, which can be used both for Firm as well as Secondary Power generation depending upon the river flows available” (p. 8).

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
P-0649.0114 / P-0649.0143	Letter No. WT(16)/(2295-A)/PCIW	9 May 1969	Response to ICIW letter above PCIW notes that “I am glad that you were able to supply most of the information that I had sought, which, in my view, India was required to supply in the very first instance”. [This information included, <i>inter alia</i>, “calculations for the Operating Pool allowed under the Treaty” and confirmation on Pakistan’s assessment of the totally capacity of the power units, and the values for Firm Power and Secondary Power”] However, PCIW notes that further information is required, including “pondage in the hydel channel” so that Pakistan can confirm that the design conforms to Paragraph 8(c) (p. 1). PCIW also states in the annexure that: “[t]he Live Storage needed for meeting the water requirements of a Plant during the period of the minimum mean discharge would naturally depend on the load curve. To see that the maximum Pondage being provided did not exceed twice the Pondage required for Firm Power, the magnitude of the Live Storage has to be determined from the actual load curve worked out for the proposed Plant and not from any hypothetical load curve. It would be appreciated that the Live Storage required for a plant having a load factor of 30% could vary considerably with the shape of the load curve. According to my calculations the ‘Pondage required for Firm Power’, on the basis of the minimum mean discharge of 258 cusecs and the load pattern indicated in your letter under reference, comes to 42.6 cusec days. Thus the total maximum Pondage on this Plant is not to exceed 85.2 cusec days. To enable Pakistan to satisfy itself the maximum Pondage provided on this Plant will not exceed the above figure, it is requested that the quantum of Pondage provided in the hydel channel may kindly be intimated alongwith the necessary details.” (p. 5).
P-0647.32	Record of the 32nd Meeting of the Permanent	8 January 1970	ICIW commits to supply information requested by PCIW and to “re-calculate the minimum mean discharge at the site of the plant by taking into account the discharges

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
	Indus Commission, 2-8 January 1970		observed at both Gund and Kulan and modifying the data of Gund discharge site for the increase in discharge in the reach Kulan to Gund” (p. 3).
P-0649.0166 (resubmitted)	Letter No. F.4(13)/65-IC	9 April 1970	This letter follows from the Commissioners’ discussion at the 32nd PIC meeting above. ICIW shares information as agreed at the meeting, including “Pondage in the Hydel Channel” (p. 4), MMD calculations (p. 6), and permissible Operating Pool calculations given modified MMD (p. 7). The revised Operating Pool calculations follow the same formulation as the one presented by India in P-0649.0140, with necessary modifications to account for new MMD.
P-0649.0171	Letter No. WT (16)/(2488-A)/PCIW	30 May 1970	Response to ICIW letter dated 9 May 1969 (P-0649.0114 / P-0649.0143). PCIW notes the revised MMD calculation provided by ICIW on 9 April 1970, and noted “the method adopted for estimating the discharge at the off-take of the power channel [...] will not be considered as a precedent for the future” (p. 1). PCIW also notes the revised figures for the permissible capacity of the Operating Pool (pp. 1-2).
P-0649.0174	Letter No. 4/13/65-IC	28 September 1970	Response to PCIW letter above. ICIW notes that “[a]s regards the calculations for the minimum mean discharge you would agree that the method in question, was adopted, as suggested by you in your letter dated 9th May 1969 and [...] was to satisfy you that the pondage even if worked out according to your method would still remain within the permissible limits” (p. 1). No comment provided on the revised figures for the permissible capacity of the Operating Pool.

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
P-0649.0180	Letter No. WT(16)/(2529-A)/PCIW	12 November 1970	Response to ICIW letter above. PCIW writes to disagree with the narrative regarding the minimum mean discharge set out in ICIW's letter of 28 September 1970.
P-0649.0204	Letter No. F. 4(13)/65-IC/IT	31 May 1971	Response to PCIW letter above. ICIW writes to, <i>inter alia</i> , reiterate his position on the minimum mean discharge, as per his previous letters.
P-0649.0215	Letter No. WT(16)/(2726-A)/PCIW	20 August 1971	Response to ICIW letter above. With respect to the MMD, PCIW states that "the Treaty does not allow the adoption of any assumed figure for the 'minimum mean discharge' and it has be worked out in accordance with the provisions of Paragraph 2(i) of Annexure D to the Treaty " (p. 1). PCIW further notes that "[y]our predecessor has agreed to rework out the figure of the 'minimum mean discharge' after a detailed discussion of the provisions of the Treaty and fully appreciating the Pakistan Commissioner's views on the subject. I request you to kindly review the matter and in case you still feel that the design of the plant is to be based on the assumed minimum mean discharge of 200 cusecs then the matter shall have to be resolved under the provisions of Article IX of the Treaty" (p. 1). <i>Note: No response found to this letter on the record, despite reminder letters from PCIW, with last reminder letter sent on 30 April 1997 (P-0649.0862).</i>
P-0649.0566	Letter No. WT(16)/(4818-A)/PCIW	4 September 1986	Response to ICIW letter dated 18 April 1986 (P-0649.0542). PCIW invites ICIW's attention to his previous observations "concerning the outstanding issues like the figures of Minimum Mean Discharge and the permissible pondage" (p. 4). <i>Note: No response found to this letter on the record.</i>

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
SALAL-I&II			
P-0649.0169 (resubmitted)	Letter No. F.4(10)/63-IC	30 April 1970	Notification of HEP design. No Pondage proposed.
LOWER JHELUM			
P-0649.0268	Letter No. F.4(1)/62-IC(IT)	21 November 1974	Notification of HEP design. Operating Pool: 779.50 acre-feet (p. 2). Calculations for maximum Pondage provided at Enclosure 14 (p. 29). Load: daily variation of zero to 7,000 cusecs (p. 5). Installed Capacity: 105 MW (3 sets of 35 MW each), plus one standby set of 35 MW for firm as well as Secondary Power (p. 5).
P-0649.0283	Letter No. WT(85)/(3264-A)/PCIW	20 February 1975	Response to ICIW letter above. PCIW notes that “[f]rom the information supplied it is not possible to ascertain the minimum mean discharge at the site of the plant” and requests further information (p. 1).
P-0649.0315	Letter No. WT(35)/(3403-A)/PCIW	16 October 1975	Follow-up letter from PCIW in relation to its letter above. PCIW notes the ICIW’s lack of response to the PCIW’s multiple letters objecting to the HEP’s design.
P-0649.0319	Letter No. F.4(1)/62-IC-(IT)	25 October 1975	Response to PCIW dated 25 September 1975 (P-0649.0312). The ICIW presents a calculation of Pondage that is linked to a load curve, stating that “[t]o the extent that the pondage that could be provided at site falls short of the

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
			requirement of the load curve, there will no doubt be a constraint of the peaking capability of the Plant” (p. 3).
P-0649.0342	Letter No. WT(85)/(3487-A)/PCIW	28 January 1976	Response to ICIW letter above. In the annexure to the letter, PCIW notes that “[t]he calculation for the Operating Pool [...] do not depict the actual variations through the turbines which are proposed to be met with the pondage provided, and, therefore, appear to be hypothetical. It may please be appreciated that the capacity of the Operating Pool is to correspond to the Firm Power which can be actually generated at a time when the river is carrying the minimum mean discharge ” (pp. 5-6).
P-0649.0356 (resubmitted)	Letter No. F.4/1/62-IC(IT)	12 May 1976	Response to PCIW letter above. ICIW presents a calculation of Pondage that is linked to a load curve, stating that “[t]o the extent that the pondage that could be provided at site falls short of the requirement of the load curve, there will no doubt be a constraint of the peaking capability of the Plant ” (p. 3).
P-0649.0361	Letter No. WT(85)/(3567)/PCIW	26 July 1976	Response to ICIW letter above. PCIW reiterates his earlier objection, noting that the ICIW’s observations “imply that the calculations for the operating pool are to be based on a daily load curve which can not be met with the pondage provided at a time when the river is carrying the minimum mean discharge. I do not agree with the view and reiterate my earlier observation” (p. 3).
P-0649.0381 (resubmitted)	Letter No. WT(85)/(3703-A)/PCIW	25 March 1977	Response to ICIW letter dated 20 January 1977 (P-0649.0379). PCIW notes that “pondage required for firm power is to be worked out on the basis of the minimum mean discharge to be calculated as laid down in Paragraph 2(i) of Annexure D to the Treaty ” (p. 2) and disagrees with the MMD figure used by India.

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
P-0649.0429	Letter No. WT(85)/(4067-A)/PCIW	6 January 1980	Response to ICIW letter dated 23 May 1979 (P-0649.0423). PCIW requests information regarding the calculations for MMD at the site (p. 2).
P-0649.0435	Letter No. F.4(1)/62-IC(IT)	19 September 1980	Response to PCIW letter above. ICIW responds to PCIW's request regarding MMD calculations by stating that "minimum mean discharge was calculated as per para 2(i) of Annexure D of the Treaty " (p. 1).
CHINANI-I			
P-0649.0403 (resubmitted)	Letter No. F.4(7)/64-IC(IT)	14 March 1978	This letter follows the record of the 45th Meeting of the PIC from 24-29 September 1977. Notification of HEP design. Operating Pool: 40 acre-feet. Calculation for maximum permissible Pondage based on weekly loading provided at Enclosure VI (p. 9).
P-0649.0425	Letter No. WT(14)/(4023-A)/PCIW	4 August 1979	Response to ICIW letter dated 13 November 1978 (P-0649.1994). PCIW notes the discrepancy in the value of Firm Power for the plant, in India's calculations for the Operating Pool and India's notification of the "installed capacity of the Plant for firm Power" (p. 1). PCIW also states that "the generation pattern has to be related to the Operating Pool provided at the site of the Plant. But in case of the Plant under reference calculations for the Operating Pool do not depict the actual variations through the turbines, which are proposed to be met with the pondage provided, and, therefore, appear to be hypothetical. The permissible capacity of the Operating Pool is to correspond to the Firm Power which can be actually generated at a time the river is carrying the Minimum Mean Discharge " (p. 1).

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(A) Exhibit No.	(B) Document	(C) Date	(D) Comments
P-0649.0504	Letter No. F.4(7)/64-IC/IT/157	3 September 1984	Response to PCIW letter dated 13 May 1984 (P-0649.0497). ICIW agrees with PCIW that “as required under Paragraph 8(c) of Annexure D, the permissible (maximum) Pondage in the Operating Pool is to correspond to the Firm Power which can be actually generated a time the river carrying the Minimum Mean Discharge” and further states that “the Firm Power corresponding to the MMD will require generation up to 20 MW as the system Load Factor ” (p. 2).
DUL HASTI			
P-0649.0408 (resubmitted)	Letter No. F16(4)/62-IT	3 July 1978	Notification of HEP design. Operating Pool: 8 million cumecs (6500 acre-feet). Detailed calculations for maximum Pondage provided in Appendix II (p. 8). Load: Initial weekly variations in discharge of 213 cumecs maximum to zero cumecs minimum, and ultimate (in future) weekly variations in discharge of 426 cumecs to zero cumecs minimum. Installed Capacity: 390 MW (initial) and 780 MW (ultimate – in future).
P-0649.0411	Letter No. WT(104)/(3926-A)/PCIW	21 September 1978	Response to ICIW letter above. PCIW requests information regarding the MMD calculations relied on by India (p. 6).
P-0649.1733	Letter No. F.16(4)/62-I.T./78	8 November 1983	Response to ICIW letter dated 25 May 1983 (P-0649.047) (referring to PCIW letter above). ICIW notes that “[w]ith the figure of [the] Operating Pool given under item 3(b) of Appendix II and calculations for permissible Pondage supplied with [ICIW’s letter of 3 July 1978, P-0649.0408 (resubmitted)], Pakistan can satisfy itself that the Pondage provided is well within the permissible limits. Verification of Pondage at different levels is not relevant in the above context.” (p. 1).

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P-0649.0493	Letter No. WT(104)/(4565-A)/PCIW	11 February 1984	Response to ICIW letter above. PCIW notes that “figure of minimum mean discharge used for calculating the Operating Pool should have been indicated” and that India’s calculations of the Operating Pool “ are hypothetical [and therefore] the same be revised and calculations of actual operation of the Plant be supplied so that Pakistan know the actual variations in the supplies ” (p. 4).
P-0649.0513	Letter No. 16(4)62-I.T/179	26 December 1984	Response to PCIW letter above. ICIW notes that “Firm Power corresponds to the power generated when the river is carrying the minimum mean discharge” and that India’s calculations are “not hypothetical. This plant would be required to be operated in the gride and has to provide necessary peaking capacity under the varying conditions of Hydro-thermal mix and system operating conditions at different points of time” (pp. 5-6).
P-0649.0514	Letter No. WT(104)/(4661-A)/PCIW	3 March 1985	Response to ICIW letter above. PCIW notes that he does not “agree with [ICIW’s] contention that no provision exists in the Treaty for supply of calculations of minimum mean discharge” as this is “the first step for calculating the Operating Pool and is part of the calculation and is to be supplied”. PCIW also states that “in view of what has been stated by you more details are required to see that the load curve is realistic and not hypothetical ” (p. 4).
P-0649.0535	Letter No. F.16(4)/62-I.T/234	28 February 1986	Response to PCIW letter dated 8 December 1985 (P-0649.0527). ICIW notes that “Firm Power corresponds to the power generated when the river is carrying the minimum mean discharge” and that India’s calculations comply with that requirement of the Treaty (p. 3).
P-0649.0638	Letter No. 16(4)/62-I.T/407	6 December 1988	Response to PCIW letter dated 19 January 1987 (P-0649.0576).

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			No discussion of Pondage calculations except for ICIW's remark that the "Treaty does not provide for supply of calculations of the minimum mean discharge" (p. 5).
P-0649.0773	Letter No. WT(104)/(5304-A)/PCIW	14 September 1992	Response to ICIW letter dated 16 July 1992 (P-0649.0768 (resubmitted)). PCIW notes that "in the absence of calculations for the Minimum Mean Discharge, it is not possible to ascertain whether the criterion (c) laid down in Paragraph (8) of Annexure D to the Treaty is met" (p. 3). Further, the PCIW notes that in "Paragraph 2(i) of Annexure D to the Treaty, Firm Power is defined as [...] 'the hydro-electric power corresponding to the minimum mean discharge at the site of a plant'" (p. 3). However, the calculations for the 'Pondage' supplied previously was based on a very hypothetical load curve, which provided for a "Firm Power", which did not correspond to the Minimum Mean Discharge intimated by India" (p. 3). PCIW requested updating calculations for India's entitlement to Pondage at the site, stating that "the revised [...] Operating Pool together with calculations for the Operating Pool may also be supplied. It was requested to be supplied previously along with a realistic load curve, as the load curve supplied earlier was a hypothetical one and provided for a Firm Power, which did not correspond to the Minimum Mean Discharge" (p. 7).
P-0649.0795	Letter No. 16(4)/62-I.T./660	26 August 1993	Response to PCIW letter above. ICIW responds to Pakistan's objection to the approach to calculating permissible Pondage by stating: "the allowable Pondage accordingly worked out to be 13756 acre ft whereas the Pondage provides is of 7595 acre ft only, which is well within the Treaty requirements [...] Further, your contention 'the calculations for the Pondage supplied previously was based on a very hypothetical load curve' is not clear. However, it may be mentioned that the power station has to operate in the grid and provide necessary peaking capacity under varying conditions of hydrothermal mix and system operating conditions at different points of time" (p. 2).

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P-0649.0833	Letter No. WT(104)/(5511-A)/PCIW	8 October 1995	Response to ICIW letter dated 5 May 1994 (P-0649.0816). PCIW reiterates his earlier objection that “calculations for the pondage supplied previously has been based on a hypothetical load curve which did not take into consideration the Firm Power corresponding to the Minimum Mean Discharge ” (p. 2), and that “the load curve supplied for the calculation of pondage was a hypothetical one and has not been based on the actual operation of the Plant which would be grided nationwide ” (p. 4).
UPPER SIND-II			
P-0649.0500 (resubmitted)	Letter No. F.11(2)/82-I.T/135	18 May 1984	Notification of HEP design. Operating Pool: 404,290 cumecs (328 acre-feet) (p. 32). Detailed calculations of maximum Pondage provided in Enclosure 20 (p. 54) based on daily loading (and not weekly). Load: expected daily variation in the discharge from maximum 52.40 cumecs to minimum of zero (p. 36). Installed Capacity: Firm Power and Secondary Power is 105 MW. Initially it is proposed to install 2 sets of 35 MW each and the third set of 35 MW will be installed in future (p. 36).
P-0649.0503	Letter No. WT(16)/(4618-A)/PCIW	18 August 1984	Response to ICIW letter above. PCIW requests further information regarding the MMD and other particulars to determine Pondage. PCIW notes that “figure for minimum mean discharge used for calculating the Operating Pool has not been indicated” (p.9) and that “it is not clear as to how the releases from and extraction for pondage provided in the case of Sumbal [HEP] has been accounted for” (p.10).

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			PCIW notes that “it has been stated that the variations in load would be from maximum of 52.40 cumecs to minimum of zero cumecs. This is in conflict with the information given in Enclosure 20” (p. 17). PCIW also requests Firm Power and Secondary Power as defined in the Treaty (p. 17). <i>Note: No response found to this letter on the record.</i>
URI-I			
P-0649.0523 (resubmitted)	Letter No. 3(26)/72-I.T/209	19 September 1985	Notification of HEP design. Operating Pool: Nil – no calculations provided.
P-0649.0528	Letter No. WT(103)/(4731-A)/PCIW	12 December 1985	Response to ICIW letter above. PCIW requests further information on Pondage, because although Operating Pool has been reported as “Nil”, there would be “some Pondage available in the head-race channel and in the reservoir behind the barrage” (p. 8).
P-0649.0645 (resubmitted)	Letter No. 3(26)/72-I.T./1	16 January 1989	Response to PCIW letter dated 22 November 1988 (P-0649.1736). ICIW states that there is no Pondage provided and no Pondage would be available in the open channel or in the reservoir behind the barrage (p. 2).
P-0649.0656	Letter No. WT(103)/(5052-A)/PCIW	8 June 1989	Response to ICIW letter dated 9 March 1989 (P-0649.0654). PCIW notes that while the volume of the Operating Pool has been provided as nil, this is not correct as the “Power Tunnel could be effectively fed by considerably lowering the Full Pondage Level of the barrage [] and the hydel channel” and further that “from the

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			discharge data supplied it is not possible to ascertain the minimum mean discharge at the proposed site of the barrage of the plant” (p. 3).
P-0649.0669	Letter No. 3(26)/72-I.T./450	11 August 1989	Response to PCIW letter above. Calculations for the Operating Pool are provided at p. 7. According to ICIW, India is permitted to provide Pondage to “meet the fluctuations in the discharge of the turbines from variations in the daily loads of the plant” (p. 3).
P-0649.0677	Letter No. WT(103)/(5082-A)/PCIW	7 September 1989	Response to ICIW letter above. In support of his contention that the plant has Pondage (contrary to India’s stated position), PCIW notes that “ the load curve [daily loading] enclosed with your letter [of 11 August 1989], is that of a peaking Plant having a Pondage”, and requests that calculations for the Operating Pool be supplied” (p. 2-3).
P-0649.0687	Letter No. 3(26)/72-I.T./470	27 November 1989	Response to PCIW letter above. ICIW states that “the calculations attached to my letter dated 11 th August 1989 shows a typical load curve data for calculating the permissible Pondage which is based on the condition that the river would be carrying the minimum mean discharge ” (p. 3). ICIW also clarifies that no Pondage has been provided in the plant, and calculations for Pondage were based on MMD of 2778 cusec, and that the “calculations of permissible pondage supplied are based on the assumption that the river carries a discharge equal to the MMD and a Pondage as permitted would be provided. Since due to topographical constraints no pondage has been provided, the actual operation of the plant will only take advantage of the pondage of about 780 acre ft provided on the Lower Jhelum HEP and will provide peaking to that extent” (p. 8).

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KARGIL			
P-0649.0534 (resubmitted)	Letter No. F.3(5)/83-I.T/227	30 January 1986	Notification of HEP design. Operating Pool: Not provided. Detailed calculations for Pondage provided at Enclosure VII (p. 10) and include a load factor. Load: daily variation of zero to 28.32 cumecs (p. 6). Installed Capacity: 3.75 MW (3 units of 1.25 MW for Summer, 1 unit of 1.25 MW for Winter).
P-0649.0543	Letter No. WT(124)/(4774-A)/PCIW	20 April 1986	Response to ICIW letter above. PCIW requests that “details of [] calculations” of minimum mean discharge “may please be supplied” (p. 5).
KILLAR			
P-0649.0537 (resubmitted)	Letter No. F.4(10)/85-I.T/236	12 March 1986	Notification of HEP design. No Pondage proposed (p. 2).
P-0649.0550	Letter No. WT(15)/(4782-A)/PCIW	10 May 1986	Response to ICIW letter above. PCIW requests calculations of Operating Pool as “some Pondage is also available in the head-race channel itself” (p. 3).
KARNAH			
P-0649.0541 (resubmitted)	Letter No. F.3(8)/83-I.T/240	9 April 1986	Notification of HEP design.

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			No Pondage proposed.
P-0649.0557	Letter No. WT(15)/(4792-A)/PCIW	5 June 1986	Response to ICIW letter above. PCIW requests calculations for Pondage as there is “sufficient ‘Pondage’ provided in the forebay and hydel channel”, despite India stating no live storage has been provided in the HEP. PCIW also draws attention to Paragraph 2(i) of Annexure D in connection with “check[ing] the criterion laid down in Paragraph 18(b) of Annexure D” (p. 3).
THIROT			
P-0649.0569 (resubmitted)	Letter No. F. No. 4(9)/83-I.T./272	28 October 1986	Notification of HEP design. Operating Pool: 8100 CM (p. 2). No calculation for maximum Pondage provided. Installed Capacity: Firm Power and Secondary Power = 3 MW (3 units of 1 MW each) (p. 5).
P-0649.0781 (resubmitted)	Letter No. 4(9)/83-I.T./640	24 March 1993	Response to ICIW letter above. The letter concerns changes in design particulars of Thirot HEP. India reduces the volume of its Operating Pool to 6,622 CM and provides updated calculations at Appendix 3(b)-IXB (p. 16).
P-0649.0787	Letter No. WT(125)/(5350-A)/PCIW	24 May 1993	Response to ICIW letter above. PCIW notes that MMD calculations have not been supplied and that calculations for the Operating Pool are not in accordance with the requirements of the Treaty. PCIW also offers more detail on Pakistan’s appreciation of the correct approach to calculating Pondage: “In [India’s] statement of calculations for Operating Pool [], Pondage has been calculated as Pondage required for maximum aggregate capacity of power units for Firm Power and Secondary Power. It should be limited to the extent

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			required for Firm Power only, as per scheme of things incorporated in the Treaty” (p. 5). PCIW explains that because of the requirements of the Treaty, “design of the Plants on the Western Rivers has to be different from those located on rivers other than Western Rivers” (p. 5) and requests a revised calculation for Pondage required for Firm Power.
P-0649.0817 (resubmitted)	Letter No. 4(9)/83-I.T./704	16 May 1994	Response to PCIW letter above. ICIW responds to Pakistan’s objection to India’s approach to calculating Pondage. ICIW states that “the Operating Pool calculations have been made for firm power only based on available minimum mean discharge in accordance with the Treaty” (p. 2).
HAFTAL-I&II			
P-0649.0600	Letter No. 3(8)/87-I.T./364	31 May 1988	Notification of HEP design. No Pondage proposed (p. 2).
P-0649.0613	Letter No. WT(15)/(4986-A)/PCIW	7 August 1988	Response to ICIW letter above. PCIW requests further information as “some Pondage has been provided behind the 4.05m high rock full-cum-Gabio Weir, in the desilting Tank and the head-race itself” and so “required details along with the calculations for Pondage may please be supplied so as to know that the design fulfils the criterion laid down in Paragraph 18(b) of Annexure D” (p. 3).
P-0649.0641	Letter No. F.3(8)/87-I.T./411	21 December 1988	Response to PCIW letter above. ICIW confirms that no Pondage has been provided.

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SHAKER CHICKTAN (SANJAK)			
P-0649.0601 (resubmitted)	Letter No. 3(9)/87- I.T./363	31 May 1988	Notification of HEP design. No Pondage proposed (p. 2).
P-0649.0614	Letter No. WT(15)/(4985-A)/PCIW	7 August 1988	Response to ICIW letter above. PCIW requests confirmation that “no Pondage has been provided in the design of the Plant” and notes that “Trench Weir, supply channel, desilting tank and forebay will act as operating pool”, so information should be supplied to “ascertain whether the criterion specified in Paragraph 18(b) of Annexure D is fulfilled or not” (pp. 3-4).
P-0649.0632 (resubmitted)	Letter No. 3(9)87- I.T./399	28 October 1988	Response to PCIW letter above. ICIW confirms that “no pondage will be provided” and that “trench weir, supply channel, desilting tank and forebay are structures meant purely for diversion, conveyance and desilting purposes and not for pondage to meet fluctuations in the discharge of the turbines arising from the daily and weekly loads of the plant” (p. 2).
MATAYIN			
P-0649.0602 (resubmitted)	Letter No. 3(10)/87- I.T./362	31 May 1988	Notification of HEP design. No Pondage proposed (p. 2).
P-0649.0615	Letter No. WT(15)/(4984-A)/PCIW	7 August 1988	Response to ICIW letter above. PCIW requests confirmation that “no Pondage has been provided” and notes that “Trench Weir and head-race duct are acting as operating pool”, so information should be supplied to “check[] criterion of Paragraph 18(b) of Annexure D” (p. 3).

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P-0649.0642 (resubmitted)	Letter No. 3(10)/87- I.T./413	23 December 1988	Response to PCIW letter above. ICIW confirms that no Pondage has been provided and that trench weird is meant for diversion and head race duct for conveyance and neither will act as Operating Pool (p. 2).
MATCHIL			
P-0649.0604 (resubmitted)	Letter No. 3(7)/87- I.T./368	29 June 1988	Notification of HEP design. No Pondage proposed (p. 3).
P-0649.0624	Letter No. WT(15)/(4989-A)/PCIW	29 August 1988	Response to ICIW letter above. PCIW requests confirmation that “no Pondage has been provided”, as the idea of no Pondage is “not supported from the drawings of forebay” (p. 2), and notes that “Trench weir, supply channel, desilting tank and power canal, all are acting as operating pool” (p. 3), so “calculations for operating pool may please be therefore supplied for checking criterion of Paragraph 18(b) of Annexure D” (p. 3).
P-0649.0660	Letter No. 3(7)/87- I.T./427	12 April 1989	Response to PCIW letter above. ICIW states that no Pondage has been provided and that the “trench weird, supply channel, desilting tank and power canal” are not for Pondage (p. 2).
KERAN			
P-0649.0626 (resubmitted)	Letter No. 3(5)/87- I.T./385	5 September 1988	Notification of HEP design. No Pondage proposed (p. 3).
P-0649.1735 / P-0649.2035	Letter No. WT(15)/(5002-A)/PCIW	5 November 1988	Response to ICIW letter above.

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			PCIW raises concerns that “enough pondage has been provide[d] in the supply channel, silting tank, head-race and the Forebay. In addition to this there appears to be enough free board (0.5 M + height of Side Walls) which will add to the Operating Pool. Calculations for the same may please be supplied. In its absence it is not possible for Pakistan to satisfy itself whether criterion (b) of Paragraph 18 of Annexure D is met or not” (p. 3).
P-0649.0672	Letter No. 3(5)87-IT/455	1 September 1989	Response to PCIW letter above. ICIW states that “supply channel, desilting tank, head-race” are not meant for Pondage as defined in the Treaty and the “forebay also does not act as balancing reservoir and does not provided for any pondage” (p. 3).
ASTHAN NALLAH			
P-0649.0628	Letter No. 3(6)/87-I.T./392	29 September 1988	Notification of HEP design. Operating Pool: 9,735 CM. Detailed calculations provided at Annex V (p. 8). Installed Capacity: 0.75 MW (p. 6).
P-0649.0637	Letter No. WT(15)/(5021-A)/PCIW	5 December 1988	Response to ICIW letter above. PCIW requests calculations of minimum mean discharge and notes that “calculation for the Operating Pool is just hypothetical. The capacity of Operating Pool has to be calculated on the actual load curve. The required calculations and the load curve may please be supplied ” (p. 3).
P-0649.0803	Letter No. 3(6)/87-I.T./681	11 January 1994	Response to PCIW letter dated 1 November 1993 (P-0649.2049). ICIW presents an updated calculation for the Operating Pool as Annexure VR (p. 6), that is “based on load curve” (p. 2).

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PAHALGAM			
P-0649.0636 (resubmitted)	Letter No. 3(1)/85- I.T./404	30 November 1988	Notification of HEP design. No Pondage proposed (p. 3).
P-0649.0649	Letter No. WT(129)/(5033-A)/PCIW	28 February 1989	Response to ICIW letter above. PCIW requests confirmation that no Pondage will be provided and for the supply of information regarding the Operating Pool of the forebay and reservoirs behind the two weirs (p. 4).
CHINANI-II			
P-0649.0648 (resubmitted)	Letter No. 4(7)/64- I.C.(I.T.)/420	9 February 1989	Notification of HEP design. No Pondage proposed (p. 3).
P-0649.0655	Letter No. WT(130)/(5043- A)/PCIW	8 April 1989	Response to ICIW letter above. PCIW notes that “it is not understood as to how it has been stated that ‘No pondage proposed’, particularly when Full Pondage Level and Dead Storage Level of the Forebay are not the same”, which means there is Pondage in the forebay in addition to pondage in the water conductor (p. 3). PCIW requests calculations for Operating Pool.
P-0649.0707 (resubmitted)	Letter No. 4(7)/64-IC (IT)/503	21 June 1990	Response to PCIW letter above. ICIW states that Pondage is defined as “live storage of only sufficient magnitude to meet fluctuations...” and that “no such pondage has been provided in this Plant” (p. 2).

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BHADARWAH			
P-0649.1737 (resubmitted)	Letter No. F.3(8)/88-I.T./447	29 July 1989	Notification of HEP design. Operating Pool: 1.26 acre-feet. No calculation of maximum Pondage provided (p. 2). Installed Capacity: Firm Power of 1 MW and Secondary Power of 500 KW (p. 2).
PARNAI			
P-0649.0695	Letter No. 4(1)/86-I.T./485	15 January 1990	Notification of HEP design. Operating Pool: 66,340 CM (reservoir) and 1,340 CM (forebay) (p. 3). Detailed calculations enclosed as Annex VIII (p. 23) based on a daily load. Load: 12.03 cumecs (p. 6). Installed Capacity: 37.5 MW (p. 6).
P-0649.0703	Letter No. WT(16)/(5138-A)/PCIW	14 April 1990	Response to ICIW letter above. PCIW notes that “design of [an Annexure D, Part 3] plant is to conform to the criteria specified in Paragraph 8 of Annexure D” but that “the works connected with such a Plant are to be operated as per provisions of Paragraph 15 of the said Annexure ” (p. 1). PCIW also sets out Pakistan’s understanding of Paragraph 15, based on “a close examination of the operation criteria of a Plant mentioned in Paragraph 15” (p. 2). PCIW also objects to the calculations for the Operating Pool, stating that “calculations for Operating Pool [...] are hypothetical one; it may be reviewed based on the actual load curve or vice versa ” (p. 10).

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RAJOURI			
P-0649.1738	Letter No. 3(4)/88-IT/511	31 August 1990	Notification of HEP design. Operating Pool: 16,800 CM (p. 3). Calculation of maximum Pondage provided as Annex V (p. 16) based on a daily load. Installed Capacity: 3 MW (p. 7).
P-0649.0722	Letter No. WT(15)/(5183-A)/PCIW	29 October 1990	Response to ICIW letter above. PCIW raises objections regarding the volume of Pondage being provided and requests for information for further particulars (pp. 3-4). PCIW requests calculations for the MMD and clarification of “whether the operation of the Plant as proposed in Annexure V to your letter is a hypothetical one or it will be followed as proposed. In the past you have termed such operation (load curve) as hypothetical when those plants like LJHP came into operation. In case it is hypothetical one, a load curve to be actually followed may be given. ” (p. 5). <i>Note: No response found to this letter on the record.</i>
BAZGO			
P-0649.0749 (resubmitted)	Letter No. 3(7)/88-I.T./556	4 July 1991	Notification of HEP design. Operating Pool: negligible (p. 3).
P-0649.0756	Letter No. WT(15)/(5239-A)/PCIW	31 August 1991	Response to ICIW letter above. PCIW objects to the absence of the “minimum mean discharge along with its calculations and calculations of ‘Pondage’ (Operating Pool)”, and notes that the “plant has been designed for a discharge of 22 cusecs as compared to Minimum Discharge of about 11.22

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			cusecs [...] [which] shows that enough Pondage is required to run the Plant at the designed discharge at peak hours” (p. 4).
SUMOOR NOBRA			
P-0649.0748 (resubmitted)	Letter No. 3(6)/88-I.T./557	4 July 1991	Notification of HEP design. Operating Pool: negligible (p. 3). Calculation enclosed as Annexure IV (p. 8).
P-0649.0755	Letter No. WT(15)/(5240-A)/PCIW	31 August 1991	Response to ICIW letter above. PCIW objects to India’s calculations for total Pondage, and states “India’s entitlement for pondage has been worked out as 4,205 cubic Meters as compared to 1,932 cubic Meters reported to have been actually provided. This shows that either the load curve adopted is a hypothetical one or more pondage has been made available behind the weird and the water conductor system. This may be clarified” (p. 2).
HUNDER NOBRA			
P-0649.0750	Letter No. 3(1)/88-I.T./558	8 July 1991	Notification of HEP design. Operating Pool: negligible (p. 3).
P-0649.0758	Letter No. WT(15)/(5242-A)/PCIW	7 September 1991	Response to ICIW letter above. PCIW requests further information to determine the total amount of Pondage provided in the design (p. 2).
BAGLIHAR-I&II			
P-0585	Letter No. 3/1/84-I.T/597	20 May 1992	Notification of HEP design.

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			Operating Pool: 37.5 MCM. Calculations for maximum Pondage provided at Annex III (p. 41). Calculation based on weekly loading. Load: expected variations in the discharge on account of daily and weekly load fluctuations is 0 to 438.15 cumec in the first stage (p. 6). Installed Capacity: 3 x 150 MW = 450 MW (Stage-I) (p. 6).
P-0649.2047	Letter No. WT(127)/(5293-A)/PCIW	12 August 1992	Response to ICIW letter above. PCIW notes that “[i]n the absence of calculations of the Minimum Mean Discharge, it is not possible to ascertain whether the criterion (c) laid down in Paragraph (8) of Annexure D to the Treaty is met. Moreover, Firm Power defined in Paragraph 2(i) of Annexure D to the Treaty means: “Firm Power” means the hydro-electric power corresponding to the minimum mean discharge at the site of a plant....” However, the calculations for the “Pondage” supplied vide Annexure III to your letter under reference is based on a very hypothetical load curve, which provides for a Firm Power, which does not correspond to the Minimum Mean Discharge intimated by you. The Pondage provided in the design of the Plant is therefore, more than twice the Pondage required for Firm Power” (p. 2).
P-0649.0786 (resubmitted)	Letter No. 3(1)/84-I.T./646	7 May 1993	Response to PCIW letter above. ICIW again states that the Treaty does not require sharing of MMD calculations (pp. 1, 5).
P-0649.0797	Letter No. WT(127)/(5377-A)/PCIW	11 October 1993	Response to ICIW letter above. PCIW objects to the approach to calculation of permissible Pondage, noting the absence of MMD calculations and that the calculations for Pondage “was based on a very hypothetical load curve, which provided for a Firm Power, which does not correspond to the Minimum Mean Discharge intimated by [ICIW]” (p. 2), and requests a recalculation of Pondage in accordance with Paragraph 8(c) (p. 5).

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P-0649.0814	Letter No. 3(1)/84-I.T./690	11 March 1994	Response to PCIW letter above. ICIW reiterates that the Treaty does not require supply of MMD calculations, but that Pakistan could work that out “from the data already supplied” (p. 2). ICIW also disagrees with Pakistan’s view that calculations for Pondage were based on a “very hypothetical load curve”, stating that “in a grid of hydro-thermal mix, the load demand curve may assume any pattern which cannot be predicted unlike in case of an isolated distribution system” and that in the pondage calculation, the provision of ‘firm power’ “has been based on Minimum Mean Discharge only” (p. 2).
P-0649.0822	Letter No. WT(127)/5452-A)/PCIW	13 October 1994	Response to ICIW letter above. PCIW continues the objection to India’s Pondage calculation, stating that “permissible pondage worked out by India has not been based on the Firm Power corresponding to the Minimum Mean Discharge and thus is on higher side. The method to work out the pondage while running the plant at the installed capacity for certain period of time and keeping it closed for some time is not understandable.” (pp. 1-2). PCIW responds to India’s argument that “in a grid of hydro-thermal mix, the load demand curve may assume any pattern which cannot be predicted”, by saying that it is “irrelevant in the context of design criteria laid down in Paragraph 8 of Annexure D [...]the load demand curve supplied is hypothetical. This has been drawn only to achieve the maximum pondage. As per our calculations the pondage required for firm power is much lower than what has been worked out and actually provided in the design of the plant” (p. 2).
P-0649.0850	Letter No. 3(1)/84-IT/784	2 May 1996	Response to PCIW letter above. ICIW reiterates his earlier response to Pakistan’s “hypothetical load curve” objection, stating again that “in a grid of hydro-thermal mix, the load demand curve may assume any pattern which cannot be predicted [...] [and that] it may also be seen from the

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			pondage calculation that the provision, of ‘firm power’ has been based on Minimum Mean Discharge only” (p. 2).
P-0649.0866	Letter No. WT(127)/(6014-A)/PCIW	13 August 1997	Response to ICIW letter above. PCIW again objects to Pondage based on a hypothetical load demand curve, Pondage required for firm power not being based on MMD, and requests MMD calculations.
P-0649.0881	Letter No. 3(1)/98-IT/905	21 May 1999	Response to PCIW letter above. ICIW reiterates his earlier response that the Pondage calculation is based on MMD (calculated as per the Treaty) and that the Treaty does not require supply of MMD calculations, but that Pakistan can work it out based on data already shared.
P-0647.82	Record of the 84th Meeting of the Permanent Indus Commission, 29-30 March 2000	30 March 2000	PCIW requests further data from the ICIW, including: “14. Value of Firm and Secondary Power and efficiency of the Plant 15. Magnitude of existing load and its load factor 16. Size and shape of load duration curve over previous years 17. Extent of unconnected load 18. Probable growth of load over next few years 19. Present power supply system, location, size of interconnection and characteristics of existing power plants” (p. 3).
P-0587	Letter No. WT(127)/(6333-A)/PCIW	13 July 2002	Response to ICIW letter dated 24 May 2002 (P-0649.0930). PCIW notes that the “maximum design flood level has been lowered from EL 841.5 m to EL 840.0 m” which “leave a free board of 4.50 m as compared to the previous free board of 3.0m. A further increase of 1.50 m provides an additional storage capacity of 11.25 MCM. The pondage provided in the revised design of the plant is, therefore, more than

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			twice the Pondage required for Firm Power, unless and until the dam height is reduced” (pp. 1-2). The PCIW further notes that “[i]n the absence of calculations of the Minimum Mean Discharge, it is not possible to ascertain whether the criterion (c) laid down in Paragraph (8) of Annexure D to the Treaty is met” (p. 1).
P-0649.0986	Letter No. 3/1/84-IT/1115	22 March 2004	Response to PCIW letter dated 30 January 2004 (P-0649.0982). ICIW notes that MMD “has been computed on the basis of river discharge data which has already been supplied and that the actual Pondage works out to be within the permissible value”. ICIW then requests that “in case the values of MMD/Pondage computed at your end are different”, to communicate those to India (p. 1). He further states that “the Plant is envisaged to be operated as a Peaking Station, the operation of which in any case shall be governed by the daily & weekly releases as per Paragraph 15 of Annexure D” (p. 1).
P-0647.88	Record of the 91st Meeting of the Permanent Indus Commission, 26-27 May 2004	29 May 2004	Discussion of Kishenganga and Baglihar projects. Pondage issues only discussed in context of Baglihar, where it is noted that: “The Indian Commissioner reiterated that in reference to [...] Criterion (c), the Minimum mean Discharge has been computed on the basis of the flow data already supplied to Pakistan and if any deviation from the computer figure is pointed out, the Indian side is open for further discussions and review, if required” (p. 6). PCIW responded that technical discussions on Baglihar had taken place, and were unsuccessful, at the 83rd, 84th, 85th, 86th and 88th meetings, and Pakistan had been ultimately pushed to filing a Neutral Expert reference. PCIW noted that Pakistan was “willing to resolve the differences bilaterally provided India stop all construction work at the Plant site” (p. 7).

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P-0650.1	Minutes of Secretary Level Meeting on Baglihar Hydroelectric Project held in New Delhi, 3-6 January 2005	7 January 2005	ICIW notes that: “The value of Firm Power corresponding to Minimum Mean Discharge can be deduced from the details covering calculations for the Pondage. In respect of IWT, firm power means the hydroelectric power corresponding to minimum mean discharge. For computing firm power, the necessary data as specified in the treaty under Appendix-II of Annexure D can be utilized. The Firm Power is an indicator of the hydro power generation potential at the site which could reliably be integrated in the power system to meet the requirements of the consumers on firm basis. The project is designed to (i) optimally harness the hydroelectric power potential at the site and at the same time to (ii) cater to the power system requirements based on the assured energy available from the station. The hydroelectric stations are amenable to quick start and stop and respond almost instantaneously to load variations which make them most suitable to cater to least variations and provide peaking power. The Treaty stipulates provisions for Pondage to meet the fluctuations in the discharge of the turbines arising from the variations in the daily and weekly loads of the plant. The Treaty also specifies that permissible maximum storage to meet above variations be based on the Firm Power. For the designed operation/role of the station in the grid, the , Pondage has been worked out and supplied. The operation ensures the releases of waters downstream of the station as per the provisions of the Treaty.” (p. 20). PCIW notes that: “While flagging the issue of low level weir for further discussions without prejudice to the position taken by the two sides, it was decided to examine the calculations done by India for the design of the proposed plant. It was accepted by India that based on the minimum mean discharge of 125.89 cumecs and the project designed by them, the Firm Power. Is 130 MW. However, they have designed the plant for 450 MW to meet the peaking requirement. Pakistan side held the view that the Treaty allows

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			for Firm Power to be determined on the basis of mean minimum discharge and the Pondage is meant only to cater for the daily and the weekly loads (in accordance with Annexure D, Part 1, Para 2(b)). The daily and weekly fluctuations cannot be construed to be 3.5 times of the Firm Power. As such 450 MW capacity being operated intermittently, cannot be taken as Firm Power for calculation of Pondage.” (p. 27). India further notes that: “When the calculations of Pondage provided to Pakistan in May 1992 and a copy given during the meeting was discussed, Secretary (WP), GOP, indicated that zero or negligible pondage is permissible under the provisions of the Treaty and that the power installation should have been kept at around 150 MW. They further indicated that India have by way of their planning process generated self created problems including those relating to submergence. The Secretary (WR), GOI, informed that the so called problems are common to all hydroelectric projects and India is capable to handle the same. What is important was to carry out the development within the frame work of the treaty.” (p. 37). PCIW responds that: “The pondage requirement depends on the load curve and Firm Power. The load curve should show fluctuations over continuous Firm Power. In our view the fluctuation can be + -10% over the continuous Firm Power. The load curve provided by India provides 450 MW generation of electricity for a few hours in a day and periods of zero generation in the remaining part of the day. This in our view does not correspond to the concept of Firm Power and fluctuations in continuous flow of Power over it. When the realistic load curve corresponding to the requirement of the Treaty showing Firm Power and fluctuation is provided by India maximum Pondage can be calculated accordingly.” (p. 41). PCIW also notes that: “Pakistan has not objected to Power Generation capacity of the plant but has objected to the way Pondage has been computed. It has been explained in the preceding sections that maximum Pondage is related to Firm Power and fluctuations in daily and weekly loads of the plant. It has been explained in Annexure III that the load curve provided by India has abrupt variations in power generating capacity

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			and not fluctuations in Firm Power which in our view is wrong interpretation of the Treaty.” (p. 42).
KISHENGANGA			
P-0055	Letter No. 3/7/82-IT/1228 (with enclosures)	19 June 2006	Follow-up letter of ICIW letter dated 20 April 2006 (P-0054). Notification of HEP design. Operating Pool: 7.55 MCM. Calculations for maximum permissible Pondage of 8.87 MCM included as Annexure A (p. 6), based on weekly load. Load: expected variations in the discharge on account of the daily and the weekly load fluctuations provided as “0 to 58.4 cumec”. Installed Capacity: 330 MW (p. 4).
P-0056	Letter No. WT(132)/(6713-A)/PCIW (with enclosures)	24 August 2006	Response to ICIW letter above. Response to KHEP design notification, including request for further information as required under Annexure D, rather than Annexure E. On Pondage, PCIW notes that “Paragraph 8(c) of Annexure D to the Treaty provides that ‘The maximum Pondage in the Operating Pool shall not exceed twice the Pondage required for Firm Power.’ Notwithstanding the clear mandate of the Treaty, it seems that the “Pondage required for Firm Power” has been computed by India with reference to an arbitrarily determined set of peaking requirements. In Pakistan’s opinion, this method of calculation is incorrect and is not in conformity with the provisions of the Treaty. Instead, the “Pondage required for Firm Power” must be calculated as the Pondage necessary to ensure the continuous production of Firm Power during a week when the average inflow is equal to the Minimum Mean Discharge. Twice such Pondage would then equal the maximum Pondage. permissible under the Treaty. [...]

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			Without prejudice to Pakistan’s position regarding the correct way of calculating Pondage required for Firm Power, even if it be assumed that India was entitled to calculate the “Pondage required for Firm Power” with reference to the expected power output of the Kishenganga Plant, the expected power output must not be arbitrarily assumed but must bear some reasonable relationship to the actual expected output of the Kishenganga Plant. In the instant case, the peaking timings noted by India. are completely arbitrary in that no peaking has been done on the mornings of Saturday, Sunday and Monday. The pondage of 7.55 MCM provided by India in its design of the Kishenganga Plant is therefore excessive and unjustifiable. In this respect too, the design of the Kishenganga Plant is in violation of Paragraph 8(c) of Annexure D to the Treaty.” (pp. 5-6). In response to the specific information provided on the calculations for the Operating Pool, PCIW noted that “In the calculation of Pondage at Annexure certain timings of operation on various days of a week have been given. How have these timings been selected? Similarly, the basis for depletion of stored water has also not been given. All this appears to be hypothetical and to have been used to achieve the maximum figure of Pondage. Such method is not relevant to the Treaty provisions to calculate the Pondage. Kindly refer to my accompanying letter in this regard.” (p. 12). No comment on the figure for variation in discharge due to load fluctuations.
P-0057	Letter No. 3/7/82-IT/1369 (with enclosure)	25 May 2007	Response to PCIW letter above, rejecting general point that India has notified the wrong information and maintains that KHEP is an Annexure E project despite being a run-of-river plant. On Pondage, ICIW notes that “Pakistan’s contention that the “Pondage required for Firm Power must be calculated as the Pondage necessary to ensure the continuous production of Firm Power” is not based on the Provisions of the Treaty (p. 5). The Treaty provides in Annexure D, the definition of Pondage in Paragraph 2 (c): “Pondage” means Live Storage of only sufficient magnitude to meet the fluctuations in

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			the discharge of the turbines arising from variations in the daily and the weekly loads of the plant” (p. 5). With the above provision, the Pondage volume should be sufficient to satisfy daily or weekly load variations of the plant and the consequent variations in the turbine discharge necessary to cater to this variable demand of power. Accordingly the Pondage calculation has been done by India as provided under Paragraph 2(c) of Annexure D to the Treaty strictly ensuring the volume of daily discharge through the turbines within the permissible limit of 30% and 130% daily inflow volume and releasing the total inflow volume within the same week as specified under Para 15 of Annexure D to the Treaty. For attaining the most complete and satisfactory utilisation of the waters of Kishanganga river (a Tributary of The Jhelum) within the provisions of the Treaty, Pondage volume has been provided sufficient to meet the system load variations. Due to relatively lower demand on Saturday & Sunday, the number of peak load hours has been kept small. The water stored in the operating pool in these two days has been carried forward to the working days of the week to meet peak load requirements, which is permissible in view of the very definition of “Pondage” in Paragraph 2(c).” (pp. 5-6).
P-0059	Letter No. WT(132)/(6839-A)/PCIW	4 February 2008	Response to ICIW letter above. On Pondage, PCIW notes that “Paragraph 8(c) of Annexure D states clearly that ‘the maximum pondage in the Operating Pool shall not exceed twice the pondage required for. Firm Power’. It therefore follows that notwithstanding the definition of Pondage contained in paragraph 2(c) of Annexure D, the quantum of Maximum Pondage is to be determined by doubling the quantum of pondage necessary to ensure the continuous production of Firm Power during a week when the average inflow is equal to the minimum mean discharge. Maximum Pondage determined in this manner comes to 1

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			mcm and the maximum pondage provided by India of 7.5 mcm at the Kishenganga Project is therefore in violation of the Treaty. Without prejudice to the foregoing, the maximum pondage provided by India is excessive, even if it is assumed that pondage is to be calculated with reference to a peaking schedule. India’s pondage calculations therefore are based on an entirely arbitrary peaking schedule which bears no resemblance to the peak load which would actually be expected on a reasonable or objective basis. For example, the peaking schedule includes peaking on Monday from 20:51 pm till 08:00 am (that is, all night long) as well as peaking on Friday for a continuous period of 11 hours (from 09:00 am till 20:20 pm). If the peaking schedule assumed is rationally determined, the maximum pondage which results is not more than 3 mcm. The pondage provided by India is therefore not in conformity with the provisions of the Treaty.” (pp. 11-12).
P-0070	Record of the 108th Meeting of the Permanent Indus Commission, 24-25 March 2013	24 September 2013	On Pondage, ICIW notes that “The maximum Pondage India can provide is already limited, being a function of MMD. The benefit of Pondage is unquestionably flexibility in operation. But there are also instances when India has provided less Pondage than permissible due to site conditions. As defined in the Treaty, and acknowledged by the NE in Baglihar case, the purpose of Pondage is to meet load fluctuations. It has however been Pakistan’s view to design Pondage to meet flow variations which is nowhere stated in the Treaty. Such a view also renders Paragraph 15 of Annexure D unnecessary.” (p. 7) PCIW notes that “the NE left the definition of the Firm Power given in the Treaty and picked up a definition from outside of the Treaty which was markedly different from the definition of Firm Power given in the Treaty. With such a big flaw in application of the Treaty, Pakistan, did not consider the interpretation provided by the NE in Baglihar case as a valid interpretation of the Treaty.” (p. 9) ICIW notes that “with respect to Pondage he said that given the positions of India and Pakistan on the issue, the two sides appear to be left only to bargain on the magnitude of

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			the Pondage, setting aside the Treaty provisions, in order to achieve resolution at the Commission level” – the PCIW replied that “Pakistan was open to this option and requested a fast response on the design issues of the three hydropower plants discussed in the meeting” (pp. 9-10) ICIW further notes that “irrespective of the views held by PCIW on NE’s interpretations in Baglihar case, Pondage is governed by the provisions of the Treaty to meet variations in the discharge through the turbines arising from daily/ weekly load variations. The Treaty nowhere provides for determination of Pondage to meet flow variations around MMD.” (p. 10)
P-0074	Letter No. WT(132)/(7411-A)/PCIW (with enclosure)	31 March 2014	Response to ICIW letter dated 6 February 2014 (P-0075). PCIW provides the “technical basis and supporting calculations” for Pakistan’s objections to the Kishenganga HEP design. On Pondage, the PCIW notes that: “India’s calculation of maximum Pondage essentially ignores the exclusive design criterion stipulated for conformance in Paragraph 8(c) of Annexure D to the Treaty for estimation of the maximum Pondage in the Operating Pool of any new Run-of-River Hydroelectric Plant. Instead of using the Treaty’s restricted criterion India’s Pondage calculations are based on: a. Inflow used as a fixed value of Minimum Mean Discharge (MMD) instead of a natural river flow pattern b. The outflow pattern for purposes of Paragraph 2(c) of Annexure D to the Treaty c. The time period which is weekly as per Paragraph 15 of Annexure D to the Treaty, in this case along with daily volume restriction i.e. 30% (minimum) to 130% (maximum) It can be noted that none of the above three points being followed by India for Pondage calculation observe the exclusive criterion of Paragraph 8(c) stipulated - in Annexure D to the Treaty - for a mandatory and statutory conformance of the design of any new Run-

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			of-River Plants. On the above basis Pakistan strongly considers that India's Pondage calculations being supplied to Pakistan remain non-conforming to the mandatory and statutory restrictions applied by the Treaty in this particular context. [...] India has provided Pondage of 7.55 Mm3 for operating the KHEP at installed capacity during the peak demand hours during winter. The adopted method of calculation, based on following the fluctuations of load curve, resulted in maximum permissible Pondage of 8.77 Mm3 while India adopted Pondage of 7.55 Mm3 in the design of the Plant. Pakistan's computed maximum Pondage value comes out as 0.8 Mm3 or say 1.0 Mm3 by following the procedure defined in Paragraph 8(c) of the Treaty and using the revised MMD determined in the light of the recent decision of the Court of Arbitration concerning the release of minimum environmental flow of 9m3/s for avoiding material damage to the environment of Kishenganga/Neelum River downstream of Kishenganga Dam and Line of Control. As discussed above India is ignoring Paragraph 8 (being the only paragraph that provides design criteria for new run-of-river power plants) and using Paragraph 15 of Annexure D to the Treaty in computation of Pondage which is incorrect as Paragraph 15 enunciates the rules for operation of the plant after it has been constructed and put in operation. In use of Paragraph 8(c) India interprets Firm Power as Energy corresponding to Firm Power which leads India to carry out peaking operation in the computation process of maximum Pondage instead of generating power throughout the week at the sustained rate of Firm Power as required by Paragraph 8(c). India's calculation of pondage is based on the generating power equal to installed capacity of the Plant (330 MW) instead of Firm Power (57.7 MW) as required by Paragraph 8(c) of Annexure D to the Treaty. Pakistan, therefore, does not accept the India's interpretations and method as described above.

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			In view of the above, Pakistan considers that Paragraph 8(c) is the only relevant design clause for computation of Pondage and the storage required to produce Firm Power (not the Installed Capacity) is “Pondage for Firm Power” as Firm Power is defined in the Treaty under Paragraph 2(i) of Annexure D to the Treaty “Firm Power means the hydro-electric power corresponding to minimum mean discharge (...)” (pp. 4-6).
P-0012	Letter No. Y-20014/1/2015-16/2152	16 July 2015	Response to PCIW letter dated 3 July 2015, requesting reference of points of difference to Neutral Expert (P-0010). ICIW notes that “it was pointed out by my side during the 111th meeting that the Treaty nowhere provides for determination of pondage to meet flow variations around MMD which is assumed by Pakistan side. Such an assumption will render Paragraph 15 of Annexure D redundant. Pondage is provided to meet fluctuations in the discharge of the turbines arising from variations in the daily and weekly loads of the plant as provided at para 2(a) of Annexure D of the Treaty. Moreover, the approach of Pakistan side in this regard had already been rejected by Neutral Expert appointed under the provisions of the Treaty in respect of Balighar HEP. India has followed the same procedure as used by Neutral Expert for arriving at the permissible pondage values in case of Balighar HEP [...] Therefore, the Commission may deliberate pondage provided for above projects as per the guidelines/views of Neutral Expert in the case of Baglihar HEP.” (p. 2).
P-0014	Letter No. WT(132)/(7496-A)/PCIW	24 July 2015	Response to ICIW letter above. PCIW notes that “[y]ou keep on relying on Neutral Expert’s (NE) determination in Baglihar case wherein to support his interpretation the NE had to disregard the definition of the term “Firm Power” given in the Treaty and adopt the definition of the term given by American Society of Civil Engineers (Paragraph 9 & 10 of the Record of 110th meeting and Paragraph 31 of 111st meeting of PIC)” (p. 3).

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P-0016	Letter No. Y-11017/2/2015-IT/2155	21 August 2015	Response to PCIW letter above. ICIW notes that “Rejecting the approach suggested by your side in respect of Pondage, NE has also viewed that ‘in the context of the Treaty, the pondage volume should be calculated taking into account only the variations in load i.e. of the turbine discharge, and this, in accordance with the value of firm power fixed by the Treaty’ [...] Further it has been brought out by my side that the Treaty nowhere provides for determination of Pondage to meet flow variations around MMD as wrongly assumed by your side and such an assumption will render Paragraph 15 of Annexure D redundant [...] the approach suggested by Pakistan is highly subjective because your approach leads to weeks for which the Pondage comes out nearly zero and some weeks give as high as 20 MCM.” (p. 3).
P-0018	Letter No. WT(132)/(7505-A)/PCIW	11 September 2015	Response to ICIW letter above. PCIW notes that “You are aware that we have been discussing and having difference on the method of computation of pondage since many years and I find from your letter that you are still arguing for your point of view without showing any accommodation or appreciation of our point of view [...] we find major faults in the methodology used by the NE in Baglihar case. The first one being that he left the definition of Firm Power given in the Treaty [...] and the second being that he did not differentiate between the purpose of the pondage and the method of computation of the ‘maximum pondage’ and substituted the definition of pondage in place of paragraph 8(c) of Annexure D to the Treaty which defines the method of computation of ‘maximum pondage’. [...] You have also been repeatedly saying in the meetings ‘An important matter to be stressed is that the Treaty does not say that “Pondage” means live storage of only sufficient magnitude to meet the fluctuations of the daily and weekly inflow of the river’. This phrase was first used by NE in his Determination, and is being repeatedly mentioned by

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			your side as argument for replacing Paragraph 8(c) with definition of the Pondage. In response we repeatedly mentioned in our meetings that definition of the pondage given in the Treaty relates it to the purpose of the pondage on which we do not have any difference but what Paragraph 8(c) of Annexure D is specifying, is the method for computation of ‘maximum Pondage’ that can be provided in the design of the plants, which involves generation of Firm Power according to its definition given in the Treaty. It is important to understand that, if we pass MMD through the turbines constantly (for generation of Firm Power as per Treaty definition) for a week, i.e. constant outflow, while the inflow has the natural variations arising from variation in climatic parameters within a day and from day to day, i.e. variable inflow, we would see that this method of computation involves using the pondage provided in the Operating Pool for meeting the daily and weekly inflow fluctuations, as inflow is variable throughout the week but the outflow is fixed, being equal to MMD; the resulting value of pondage from this analysis is to be made twice to come to value of ‘maximum Pondage’ that can be provided in the Operating Pool of the Plant. Thus, first part of the method suggested by the Treaty does involve meeting the daily and weekly inflow fluctuations as opposed to the impression created by the above-mentioned statement of NE. [...] As regards your objection that Paragraph 15 of Annexure D to the Treaty would become redundant if the maximum pondage value following the method suggested by us is adopted, it is submitted that the analysis shows that such is not the case. In case of Ratle HEP we computed the value of maximum Pondage as 8.09 Mm³ and if we work with value of MMD of 106.51 m³/s (though there will be many days in the data set in which the inflow would be less than MMD) the pondage of 8.09 Mm³ will be able to store 88 % of the flow during a day and only 12% of the flow will be released through the turbines during a day, thus violating the minimum release criteria specified by Paragraph 15 of Annexure D; this shows that we are in need of operational constraints of Paragraph 15 for

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			ensuring the minimum releases specified by it (Paragraph 15) and that Paragraph 15 of Annexure D does not become redundant as mentioned in your letter. In case of Kishenganga the maximum Pondage value computed by our side is 0.77 Mm³ while the MMD is 18.5 m³/s; using the discharge data set estimated by India in Kishenganga Arbitration Case. it is also clear that MMD is ‘minimum mean discharge’ implying there are values higher and lower than it in the discharge data set. if we study, these lower values we generally encounter many 10-day average values of the order of 12 m³/s (the individual day corresponding to this average value would have lower values than the average value). Working with this value we find that the maximum pondage value of 0.77 Mm³ can store 76% of the inflow volume of the day and only 24% would be released during a day; again showing the need of operational constraints of Paragraph 15 of Annexure D for relatively uniform supply of water for the downstream riparian. Thus, even in this case it is established that the operational constraints imposed by Paragraph 15 of Annexure D do not become redundant in case Pakistan’s computed value of ‘maximum Pondage’ are adopted.” (pp. 2-4).
P-0019	Letter No. Y-11017/2/2015-IT/2162	13 October 2015	Response to PCIW letter above. ICIW notes that “[a]s already pointed out by my side, the Treaty does not require MMD to be continuously passed through turbine as asserted by you. However, your side continue to stick to the position to the extent of diluting the views of an eminent neutral expert appointed by the World Bank, ignoring the fact that the approach advocated by you gives a wide range of pondage values starting from zero to even exceeding the value provided by India. I am still looking forward to your response to this anomaly in your approach to discuss the same in the next meeting of PIC” (p. 1).
P-0020	Letter No. WT(132)/(7513-A)/PCIW	4 November 2015	Response to ICIW letter above.

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			“First, my response to your observations on pondage; how good is an interpretation that abandons the definition of ‘Firm Power’ given in the Treaty and adopts another definition from outside the Treaty with entirely different meaning? Please also keep in view Paragraph 6(b) of Annexure F to the Treaty, which states that the provisions of this Treaty “shall govern” the Neutral Expert while making his decisions. You are aware that Paragraph 8(c) of Annexure D to the Treaty relates the value of ‘maximum Pondage’ or the permissible pondage to “Firm Power”, according to the definition given in the Treaty, which defines it as the hydroelectric Power corresponding to MMD at the site of the Plant. You assert in your letter that the Treaty does not require MMD to be continuously passed through turbines, but you would agree that the Treaty does require Firm Power to be produced for estimation of maximum Pondage and as per definition of the Firm Power given in the Treaty it will be only generated if MMD is continuously passed through the turbines - proving beyond doubt that while computing ‘maximum Pondage’ it is required that MMD is continuously passed through the turbines. It is only possible to justify the position you are taking if in place of the definition of Firm Power given in the Treaty another definition of the term is adopted that would allow different values of power generated be attributed as Firm Power. This was primarily the reason for the Neutral Expert in Baglihar Case for abandonment of the definition of Firm Power given in the Treaty and adoption of a definition from an outside source with entirely different meaning. In doing so, however, he did not realize that he was proceeding against the directions of the Treaty that the provisions of this Treaty shall govern the Neutral Expert while making his decisions. When I mentioned that your side never contested the faults pointed out by our side in the method of computation of ‘maximum Pondage’ adopted by the Neutral Expert in Baglihar Case, I meant that you did not respond to the faults as mentioned above and as explained in my letter of September 11, 2015. For example how would you respond to the question in the first sentence of second paragraph of this letter.

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			Also that I pointed out in my letter of 11 September 2015 that replacing Paragraph 8(c) with definition of pondage as given in Paragraph 2(c) of Annexure D was also not acceptable for Pakistan, as it would change the real intent of Paragraph 8(c) of Annexure D to the Treaty. I note from your above referred letter that you continue to support the method adopted by Neutral Expert, to which our side continues to object, on the basis that it was founded on a faulty interpretation of a clearly defined procedure of the Treaty. The above explains the basis of the difference on the procedure of computation and resulting values of ‘maximum Pondage’ between us and we have not been able to resolve it in so many years. As regards other objections mentioned in your letter on the implications of using the method suggested by us it is submitted that all of these have been adequately replied by Pakistan side in various meetings of PIC; please see Paragraphs 26 to 31 of the Record of 109th meeting, Paragraphs 8 to 12 and 28 of the Record of 110th meeting and Paragraph 31 of the Record of 111th meeting of PIC.” (pp. 1-2).
P-0021	Letter No. Y-11017/2/2015-IT/2169	27 November 2015	Response to PCIW letter above. “You have mentioned that implications of method suggested by Pakistan side regarding calculation of pondage have been adequately replied to by Pakistan side in various meetings (Para 26 to 31 of Record of 109th meeting, Para 8 to 12 and 28 of Record of 110th meeting and Paragraph 31 of the Record of 111th meeting of PIC). In this regard please refer to Para 45 of Record of 109th meeting, para 11 and 29 of Record of 110th meeting and para 32 of record of 111th meeting of PIC where ICIW has deliberated the issues related to pondage. The flaws in Pakistan side’s approach were also pointed out. Further, I have pointed out these flaws vide my letters dated 21.10.15 (para 10) and 13.10.15 (para 4) and requested for your response to such anomaly in the approach of Pakistan side, which is missing in your correspondence so far. I am still looking forward to the same so that we are able to resolve the issue amicably.” (p. 1).

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P-0022	Letter No. WT(132)/(7523-A)/PCIW	5 February 2016	Response to ICIW letter above. PCIW recaps the exchanges on Pondage so far, with references to specific letters and PIC meeting minutes.
P-0095	Letter No. Y-11017/2/2015-IT/2177	1 March 2016	Response to PCIW letter above. ICIW notes that the “Indian side has never contended the definition of firm power as defined in para 2(i) but the interpretation of the same by your side. India side has been repeatedly drawing your attention that the purpose of pondage is to meet the load fluctuations. It is your own interpretation that the pondage is required to meet the flow variation and the MMD should flow through the turbines, which is nowhere provided in the Treaty. We have also brought out that such a view also renders para 15 of Annexure D as redundant. You may appreciate that it is not possible that an unambiguous treaty (IWT) will provide for a provision that will lead to a wide band of values subject to selective interpretations as per approach suggested by you. Pakistan side has so far not responded to this anomaly in their approach ever since it was pointed out in 108 th Meeting”. (p. 1).
URI-II			
P-0649.1018	Letter No. 2/1/2002-IT/1200	27 December 2005	Notification of HEP design. Operating Pool: nil (p. 2).
P-0649.1029	Letter No. WT(145)/(6669-A)/PCIW	1 April 2006	PCIW notes that the design for the project provides for Pondage in the power channel and reservoir, and requests India to present a calculation of that storage and a calculation for the Operating Pool (p. 8).
P-0649.1045	Letter No. 2/1/02-IT/1230	23 June 2006	ICIW states that the project has no Pondage, including in the power channel and desilting basin, where the water storage will form part of the “dead storage” (p. 1).

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P-0649.1052	Letter No. WT(145)/(6717-A)/PCIW	31 August 2006	PCIW reiterates his objection that India has provided for Pondage in the project design, and requests further particulars.
P-0649.1069	Letter No. 2/1/02-IT/1353	23 January 2007	ICIW insists that there “is no Pondage in the Operating Pool”.
NIMOO BAZGO			
P-0649.1065	Letter No. 3/1/2003-IT/1349	27 December 2006	Notification of HEP design. Operating Pool: 9.72 MCM (p. 2). Calculations for maximum Pondage provided at Annexure VII (p. 35), which include a consideration of Para 15 operational parameters. Calculations based on weekly load variations. Load: 48.7 to 146.1 cumecs (p. 3). Installed Capacity: 45 MW (p. 3).
P-0649.1072	Letter No. WT(159)/(6767-A)/PCIW	30 March 2007	Response to ICIW letter above. PCIW objects to India’s calculation of Pondage, stating that “the calculations for ‘Pondage’ [...] are based on a very hypothetical load curve, which has no supporting basis and also does not correspond to a Firm Power (13.3 MW). The perusal of the computation method provided as Annexure VII shows that Pondage has been estimated using provisions of Paragraph 15 only. It may be noted that Paragraph 15 refers to operation only i.e. operation criteria which must be met after the plant has been designed and built. ” (p. 2). PCIW requests an updated calculation, “estimated according to Paragraph 8(c) of Annexure D” (p. 2).
P-0649.1235	Letter No. WT(51)/(7088-A)/PCIW	13 May 2010	The letter encloses the draft record of the 104 th PIC meeting for finalisation by ICIW.

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			For the Nimoo-Bazgo Plant, the draft record notes Pakistan’s objection that that Paragraph 8(c) “states that Maximum Pondage shall be calculated in such a way that it shall not exceed the Pondage required for Firm Power and not as the energy equivalent of Firm Power. The writers of the Treaty being of a high calibre would never have written Firm Power when they meant power generation according to a load patter with energy equivalent of Firm Power. Therefore, for computation of maximum Pondage the outflow from the Turbines should correspond to Firm Power and not the outflow required for peaking operation” (p. 4). PCIW also made observations regarding the load curve supplied by India (pp. 4-5). In response, the draft minutes record the ICIW as saying that “India has calculated Pondage value of 16.44 MCM taking into accounts Paragraphs 8(c), 2(c) and 15 of Annexure D to the Treaty which are interrelated. Pondage is to be used for operational purpose and accordingly paragraph 15 of Annexure D to the Treaty comes into the picture”, and citing the Baglihar determination as support for India’s position (p. 5).
P-0330	Record of 104th Meeting of the Permanent Indus Commission, 27-31 March 2010	31 May 2010	PCIW notes that “PCIW stated that the Pondage of 9.72 MCM provided by India in Nimoo-Bazgo Plant has not been computed according to the design criterion provided under Paragraph 8(c) of Annexure D to the Treaty for computation of Maximum Pondage. This criterion explicitly states that Maximum Pondage shall be calculated in such a way that it shall not exceed the Pondage required for Firm Power and not as the energy equivalent of Firm Power. The writer of the Treaty being of high calibre would never have written Firm Power when they meant power generation with energy equivalent of Firm Power according to a load pattern. Therefore, for computation of maximum Pondage the outflow from the Turbines should correspond to Firm Power and not the outflow required for peaking operation” (pp. 4-5) PCIW further notes that “India’s Pondage calculation is based on an arbitrary load pattern which is oriented towards maximization of the Pondage. The load pattern

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			used by India for Pondage calculation has been devised in such a way that the Plant has not been operated during the morning hours of Saturday, Sunday and Monday and evening time generation is of only 2.5 hours for Saturday and Sunday. This feature of load pattern leads to building up of Pondage during the initial part of the week. It may be seen from the load curve provided by India that during the subsequent days the plant has been operated at installed capacity for six hours during 1700 hrs to 2300 hrs and three and half (3.5) hours during 0430 hrs to 0800 hours till Friday morning (i.e. 8 A.M.). To make the weekly balance of inflow volume equal to the outflow volume towards the end of the week, the Plant has been operated continuously for 11 hours in the morning (from the last hour of Thursday up to 1107 hrs on Friday) and in the evening it was further operated for continuous six hours unlike the other weekdays. Moreover, subsequent to India's above mentioned Plant operation, the calculated Pondage has been made twice to which Pakistan objects strictly on the basis that making the Pondage twice to arrive at the Maximum Pondage is only allowed under Paragraph 8 (c), where it is required that the Plant is operated to produce the Firm Power and not the Installed Power. Therefore India's calculation procedure is in violation of Treaty design criteria of Paragraph 8(c) of the Annexure D to the Treaty. It was further stated by the PCIW that according to the Paragraph 8(c) of Annexure D to the Treaty Maximum Pondage comes to about 3 MCM which is sufficient to generate peak power for $45.32/146 \times 168 = 52.15$ hours in a week during the lean period. By adopting the above maximum Pondage value of 3 MCM computed by Pakistan, DSL would be fixed at El. 3092 m i.e. 2 meter above DSL. PCIW substantiated the sufficiency of the Maximum Pondage value of 3 MCM by referring to the realistic load pattern which duly incorporates the two peaks during the weekdays and only the evening peak during weekend holidays" (p. 5). In response, ICIW notes that "India has calculated the Pondage value of 16.44 MCM taking into account Paragraphs 8(c), 2(c) and 15 of Annexure D to the Treaty which are inter-related. Pondage is to be used for operational purpose and accordingly Paragraph 15 of Annexure D to the Treaty comes into the picture as per which daily volume is restricted to not less than 30% and not more than 130% with entire

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			volume of water received in a week is to be delivered downstream within the same week [...] India's calculations are in line with the procedure adopted by the Neutral Expert in his decision of Baglihar Hydroelectric Plant. The Neutral Expert had observed <i>'This leads the Neutral Expert to consider that in the context of the Treaty, Pondage should be calculated taking into account only the variations in load i.e. of the turbine discharge and it is in accordance with the Firm Power fixed by the Treaty.'</i> He has further observed <i>'in this context, the Pondage should be as large as possible with the condition, naturally that the provisions of the Treaty are respected.'</i> Accordingly [...] India has every right to maximize the Pondage value within the provisions of the Treaty. ICIW further pointed out that though as per the calculations, Pondage works out to 16.44 MCM, but a lesser value of 9. 72 MCM has been kept to address submergence concerns." (pp. 5-6). The Commissioners continue to disagree about the proper approach, as follows: "PCIW read the opening statement of Paragraph 8 of Annexure D to the Treaty and asserted that maximum Pondage computation is to be done using the criterion mentioned in Paragraph 8 and not Paragraph 15 of Annexure D to the Treaty. PCIW invited ICIW to review the computations done by Pakistan to firm up the sufficiency of the Pondage of about 3 MCM to meet the genuine peaking needs of India in the low flow season to which ICIW did not respond positively as in ICIW's view, India's Pondage calculations are consistent with the methodology adopted by NE and the provisions of the Treaty. ICIW reiterated that the provision of 9.72 MCM by India is in compliance of the Treaty and any reduction of the same is not warranted. He further stated that in future, Ladakh region would be inter-connected to the Northern Regional Grid of India. Ladakh region has acute shortage of power and alternative power sources are also very limited. With winter temperatures reaching as low as -35 C, there is an immense necessity of power for the region." (p. 6).

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P-0649.1292	Letter No. 3/1/2003-IT/1877	8 August 2011	Response to PCIW letter dated 27 July 2011 (P-0649.1291). ICIW notes that “India has already pointed out the relevance of applying Paragraphs 2(c), 8(c) and 15 of Annexure D [...] it is necessary to treat the Treaty as a whole. Design is integral with operation, as the design provides wherewithal for operations. As per the definition of Pondage in Paragraph 2(c), the purpose of Pondage is to meet load variations and this has also been affirmed by the Neutral Expert [in Baglihar]. Accordingly the Neutral Expert had applied load variations as the basis for computing the maximum permissible Pondage under Paragraph 8(c)” (p. 3).
CHUTAK			
P-0649.1103	Letter No. 3/2/2003-IT/1684	2 November 2007	Notification of HEP design. No Pondage proposed.
P-0649.1117	Letter No. WT(168)/(6840-A)/PCIW	4 February 2008	Response to ICIW letter above. PCIW argues that while the design indicates the Operating Pool as nil, there will be a quantum of Pondage available in the reservoir behind the barrage and headrace tunnel (p. 2).
ATHAWATTO			
P-0649.1194	Letter No. 3/9/2006-IT/1758	13 May 2009	Notification of HEP design. Operating Pool: 1215 cumecs in the forebay (p. 2). No calculations for maximum Pondage provided.
P-0649.1199	Letter No. WT(186)/(7021-A)/PCIW	11 July 2009	Response to ICIW letter above.

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			PCIW objects to design as providing Pondage, whereas ICIW indicates that there is no Pondage. PCIW requests calculations regarding Pondage and firm power and the calculations for the Operating Pool (p. 8).
TANGMARG			
P-0649.1201	Letter No. 3/9/2006-IT/1766	26 August 2009	Notification of HEP design. Operating Pool: 1284 cumecs in the forebay (p. 2). No calculations for maximum Pondage provided.
P-0649.1206	Letter No. WT(188)/(7038-A)/PCIW	24 October 2009	Response to ICIW letter above. PCIW requests calculations for Pondage, firm power and Operating Pool (p. 8).
BRENNAR			
P-0649.1202	Letter No. 3/9/2006-IT/1772	1 October 2009	Notification of HEP design. Operating Pool: 725 cumecs in the forebay (p. 2). No calculations for maximum Pondage provided.
P-0649.1210	Letter No. WT(189)/(7045-A)/PCIW	26 November 2009	Response to ICIW letter above. PCIW requests clarification of Operating Pool calculation, as “the reported operating pool of 725 m ³ does not match with 2.5 minutes retention volume corresponding to reported 3 x 1.5m ³ /s flow” (p. 3).
RANJA-ALA-DUNADI			
P-0649.1236	Letter No. 3/9/2006-IT/1793	31 May 2010	Notification of HEP design.

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			Operating Pool: 2065 cumecs in the forebay (p. 2). No calculations for maximum Pondage provided.
P-0649.1256	Letter No. WT(194)/(7116-A)/PCIW	14 September 2010	Response to ICIW letter above. PCIW requests calculations for Operating Pool (p. 2).
P-0649.1320	Letter No. 3/9/2006-IT/1904	20 December 2011	Response to PCIW letter above. ICIW reiterates that “the trench weir is not amenable to provision of any Pondage” and the Operating Pool in the forebay is to “meet the fluctuations due to hydraulic transients” (p. 2).
DUMKHAR			
P-0649.1258	Letter No. 3/5/2010-IT/1823	30 September 2010	Notification of HEP design. No Pondage proposed.
P-0649.1267	Letter No. WT(185)/(7136-A)/PCIW	11 December 2010	Response to ICIW letter above. PCIW requests information on Pondage (p. 4).
P-0649.1274	Letter No. 3/5/2010-IT/1846	25 March 2011	Response to PCIW letter above. No information on Pondage provided (p. 1).
MARPACHOO			
P-0649.1263	Letter No. 3/6/2010-IT/1827	10 November 2010	Notification of HEP design. No Pondage proposed.

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P-0649.1270	Letter No. WT(198)/(7142-A)/PCIW	21 January 2011	Response to ICIW letter above. PCIW requests information on Pondage (p. 2). <i>Note: No response found to this letter on the record.</i>
KEHMIL			
P-0649.1273	Letter No. 3/7/2010-IT/1843	7 March 2011	Notification of HEP design. No Pondage proposed. Volume between FPL and DSL in forebay is to meet “hydraulic transients” arising from operation of the plant (p. 2).
P-0649.1280	Letter No. WT(201)/(7166-A)/PCIW	6 May 2011	Response to ICIW letter above. PCIW requests MMD figure and calculations (p. 2).
P-0649.1321	Letter No. 3/7/2010-IT/1905	21 December 2011	Response to PCIW letter above. ICIW reiterates that no Pondage has been provided and so MMD calculations are not relevant (p. 2).
DAH			
P-0649.1289	Letter No. 3/4/2011-IT/1872	18 July 2011	Notification of HEP design. No Pondage proposed. Volume of 360 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).
P-0649.1339	Letter No. 3/4/2011-IT/1932	30 April 2012	Following above ICIW letter. The letter concerns changes in design particulars of Dah Small HEP.

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			Volume between FPL and DSL increased from 360 to 440 CM, but no calculations for Operating Pool provided.
HANU			
P-0649.1288	Letter No. 3/3/2011-IT/1871	18 July 2011	Notification of HEP design. No Pondage proposed. Volume of 360 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).
BONIYAR			
P-0649.1296	Letter No. 3/4/2010-IT/1883	21 September 2011	Notification of HEP design. No Pondage proposed. Volume of 1480 CM between DSL and FPL of forebay is to “stabilize the hydraulic transients” (p. 2).
MIYAR			
P-0649.1337 (resubmitted)	Letter No. 3/2/2011-IT/1930	27 April 2012	Notification of HEP design. Operating Pool: 900,000 CM (p. 2). Calculations for maximum Pondage provided at Annexure VII (p. 13), based on weekly variation in load. Load: zero to 61.35 cumecs (p. 3). Installed Capacity: 120 MW (p. 13).
P-0649.1343	Letter No. WT(209)/(7292-A)/PCIW	7 August 2012	Response to ICIW letter above. PCIW notes that “according to our calculations, the Pondage computed by India is excessive by 0.7 MCM” (p. 2).

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P-0081	Letter No. WT(51)/(7337-A)/PCIW (with enclosures)	25 March 2013	The letter attaches the PCIW's calculations for maximum Pondage for multiple projects, including Miyar. Calculations for maximum Pondage at Miyar provided at p. 7.
LOWER KALNAI			
P-0649.1340	Letter No. 3/4/2009-IT/1939	22 June 2012	Notification of HEP design. Operating Pool: 760,000 CM (p. 2). Calculations for maximum Pondage provided at Annexure VII (p. 37), based on weekly variation in load. Load: zero to 29.55 cumecs (p. 5). Installed Capacity: 48 MW (p. 5).
P-0649.1350	Letter No. WT(211)/(7302-A)/PCIW	8 October 2012	Response to ICIW letter above. PCIW objects to India's calculation for Pondage, stating that "the requirement is that discharge corresponding to Firm Power that is Minimum Mean Discharge (MD) is passed through the turbines continuously for the analysis period. The storage requirement would result from the difference of constant value of outflow (equal to MMD) and inflow values exhibiting natural variations with average over the analysis period equal to MMD . The method adopted by India does the opposite, i.e. keeps inflow constant and varies the outflow according to variation in load, does not produce Firm Power but generates power equal to the installed capacity of the plant for specified durations in a day " (p. 2).
P-0649.1364	Letter No. 3/4/2009-IT/1971	8 January 2013	Response to PCIW letter above. ICIW requests the PCIW to provide Treaty provisions to support the PCIW's statements that "discharge corresponding to Firm Power that is Minimum Mean Discharge (MMD) is passed through the turbines continuously for the analysis period" and "the storage

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			requirement would result from the difference of constant value of outflow (equal to MMD) and the inflow values exhibiting natural variations with average over the analysis period equal to MMD”. ICIW reiterated that “purpose of Pondage is [...] to meet fluctuations in the discharge of the turbines arising from variations in the daily and weekly <u>loads</u> of the Plant. In other words, turbine discharges will fluctuate with load variations and there is no mention that turbine discharge is to be kept constant against natural variations in river flow. An earlier neutral view is also available to this effect ” (p. 2).
P-0081	Letter No. WT(51)/(7337-A)/PCIW (with enclosures)	25 March 2013	The letter attaches Pakistan’s calculations for maximum Pondage for multiple projects, including Lower Kalnai. Calculations for maximum Pondage at Lower Kalnai provided at p. 11.
P-0083	Record of the 109th Meeting of the Permanent Indus Commission, 22-25 September 2013	14 July 2014	ICIW notes that “considering the MMD of 11.21 cumec, India has worked out the permissible Pondage as 2.74 MCM. However, the Pondage has been kept as 0.76 MCM. It was pointed out that the Pondage of 0.38 MCM proposed by Pakistan was grossly inadequate even for daily operation of Plant.” (pp. 17-18).
P-0103	Record of the 113th Meeting of the Permanent Indus Commission, 20-21 March 2017	29 March 2018	The Commissioners disagree on the calculation of Pondage due to a disagreement on the proper Minimum Mean Discharge of the river (pp. 17-18).
P-0180	Record of the 114th Meeting of the Permanent Indus Commission, 29-30 March 2018	31 March 2018	The Commissioners disagree on the calculation of Pondage due to a disagreement on the proper Minimum Mean Discharge of the river (pp. 7-8).
P-0188	Record of the 115th Meeting of the Permanent	30 August 2018	The Commissioners reiterate their position on Pondage as elaborated in the 114 th meeting of the PIC, and “technical experts from both sides exchanged their respective views,

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	Indus Commission, 29-30 August 2018		appreciated each other's position and agreed that there is scope for convergence on the matter. Both sides agreed to discuss the issue further to achieve convergence." (p. 3)
P-0215	Record of the 116th Meeting of the Permanent Indus Commission, 23–24 March 2021	3 March 2022	PCIW reiterates the objection to Pondage in the context of intakes, noting that he "also raised objections on the varying/mutually-inconsistent river flow series of Kalnai River which give rise Pakistan's objections on the Pondage". (p. 10).
RATLE			
P-0077 (resubmitted)	Letter No. 3/5/2007-IT/1947 (with enclosures)	16 August 2012	Notification of HEP design. Operating Pool: 23.86 MCM (p. 2). Calculations for maximum Pondage provided at Annexure VII (p. 23), based on weekly variation in load. Load: expected variation in the discharge of 33.43 to 961.53 cumecs (p. 5). Installed Capacity: 4 x 205 MW + 1 x 30 MW = 850 MW (p. 5).
P-0078	Letter No. WT(150)/(7314-A)/PCIW (with enclosures)	26 November 2012	PCIW sets out objections to Ratle design. "According to our calculations, pondage provided exceeds the value of maximum pondage permitted under the Treaty. You will be aware that "Firm Power" means the hydro-electric power corresponding to the minimum mean discharge at the site of a plant. However, the calculations for the "Pondage" supplied vide Annexure III to your letter under reference are based on the Plants operation which generates peak power by releasing turbine's rated discharge following a hypothetical load curve. Paragraph 8(c) restricts the maximum Pondage to twice the Pondage required to generate Firm Power, therefore, releasing turbine's rated discharge during the hypothetical peak demand hours (instead of continuous release of the Minimum Mean Discharge (MMD)) is a clear violation of an express provision of the Treaty." (p. 1).

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P-0079	Letter No. 3/5/2007-IT/1974 (with enclosure)	11 January 2013	Response to PCIW letter above. On Pondage, ICIW states: “I fail to understand your objection under Paragraph 8(c). The requirement of continuous release of Minimum Mean Discharge (MMD), as proposed by you, is nowhere stated in the Treaty. There can be no objection to the Plant generating power in any pattern, including peaking, so long as it releases the same quantum of water that it is obliged to deliver into the river below the Plant during any period of seven consecutive days or any one period of 24 hours within that seven day period. Further a continuous release of MMD would imply no scope for fluctuations in the discharge of the turbines arising from variations in the daily and weekly loads of the Plant, rendering the definition of Pondage in Paragraph 2(c) as well as Paragraph 15 (ii) of Annexure D purposeless. The Commission has the benefit of a neutral view on Pondage and may be guided by the same.” (p. 1).
P-0081	Letter No. WT(51)/(7337-A)/PCIW (with enclosures)	25 March 2013	The letter attaches Pakistan’s calculations for maximum Pondage for multiple projects, including Ratle. Calculations for maximum Pondage at Ratle provided at p. 4.
P-0082	Letter No. 3/5/1007-IT/2043 (with enclosures)	11 September 2013	Response to PCIW letter dated 26 November 2012 (P-0078). ICIW notes that Pakistan’s objection to the Pondage at Ratle “once again rests on Pakistan’s view of the determination of Pondage to meet fluctuations in the inflows of the river Chenab over a period of consecutive seven days in which the mean flow is close to MMD. To the contrary, as per Paragraph 2(c), ‘Pondage’ means <i>‘Live storage of only sufficient magnitude to meet the fluctuations in the discharge of the turbines arising due to variations in daily and weekly loads of the ‘Plant’.</i> The requirement of continuous release of Minimum Mean Discharge (MMD) through the turbine, as you state, is nowhere stated in the Treaty as the basis for the determination of Pondage. Further, the operation rules in Paragraph 15, allow India to hold or release water within a band of 50% to 130% within a period of seven days. Therefore, there can be

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			no objection to the Plant generating power in any pattern, including peaking, so long as it releases water in accordance with Paragraph 15." ICIW also notes specific issues with Pakistan's then-approach to Pondage calculation and reproduces excerpts from the Baglihar determination to criticise Pakistan's approach (pp. 3-4). ICIW finally noted that "India's approach is in harmony with the purpose of Pondage in Paragraph 2(c) to meet variations in turbine discharge due to load variations and the provision in Paragraph 15 to hold or release water but limiting it in terms of MMD that corresponds to Firm Power for determination of Pondage under Paragraph 8(c). Pondage is a function of MMD and operational restrictions, and they are already quite restrictive. The procedure adopted by India just gives a unique maximum Pondage which is possible under these restrictions and is consistent with the provisions of the Treaty. The Pondage actually provided by India is generally even less than this unique maximum Pondage." (p. 5).
P-0083	Record of the 109th Meeting of the Permanent Indus Commission, 22-25 September 2013	14 July 2014	PCIW notes that "Indian Commissioner in his letter of 11 September 2013 brought out certain excerpts from the determination of Neutral Expert (NE) on Baglihar case to which he wanted to respond. PCIVV said that NE's observation 'An important matter to be stressed is that the Treaty does not say that Pondage means Live Storage of only sufficient magnitude to meet the fluctuations of the daily and weekly inflows of the Chenab River' was strange as the purpose of Pondage cannot be 'to meet fluctuations of the daily and weekly inflows of Chenab River'. He said that Pakistan had never said that it had any difference on the purpose of the Pondage as described in Paragraph 2(c) of Annexure D. Pakistan fully accepts the purpose of Pondage as given in the definition of the Pondage in the Treaty. The difference is on the method of computation of Pondage which according to Pakistan should be computed following the method given in Paragraph 8(c) of Annexure D to the Treaty, which states, 'The maximum Pondage in the Operating Pool shall not exceed twice the Pondage required for Firm Power.'" and Firm Power has been defined in the Treaty as the hydro-electric power corresponding to the minimum mean discharge (MMD). Thus, the method for computation of maximum Pondage given by the Treaty specifies that MMD should be passed through the turbines continuously and the

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			Pondage that would result from the variations in inflows should be multiplied by two to come to the value of maximum Pondage for the Plant. The method India has chosen does not pass MMD through the turbines but the discharge equal to the design discharge of the turbines and the power generated in this manner is not Firm Power but peak power or power equal to installed capacity of the Plant. As Firm Power and Design Capacity of the Plant are wide apart and two entirely different things the method adopted by India cannot be accepted as that conforming to the requirements of Paragraph 8 (c) of Annexure D. [...] Regarding the Pondage of Ratle HEP, PCIW said that without prejudice to the principled position of Pakistan on the matter and for seeking resolution in view of the discussions held in the 108th meeting, he was of the view that Pondage of 12 Mm³ would suffice for Peaking operations of the Plant. PCIW hoped that India should evaluate this figure with a realistic load pattern and should not use the load pattern in which the water is carried over to the next day for each day of the first half of the week and then released in the latter half of the week. If evaluated with a realistic load pattern, Pakistan considers that this value will be sufficient to meet the peaking needs of the Plant.” (pp. 8-9, 10) In response, the ICIW observed that “The Treaty does not provide for fixing the Pondage on the basis of variation in river inflows. The Para 8(c) of Annexure D only limits the permissible Pondage to twice the Pondage required for firm power. The firm power, however, could be peak power or base load power as per the requirements of the consumers. This approach has also been supported by the Neutral Expert in his determination on Baglihar as <i>‘It is important to highlight that firm power, according to the requirements of consumers, can be peak load or base load’</i>. [...] On Pakistan's suggestion of 12 MCM of the quantum of Pondage without prejudice to each other's position, ICIW stated that India's approach and the pondage provided is

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			consistent with the various provisions of the Treaty as brought in earlier discussions and correspondence. The Neutral Expert's approach in case of Baglihar HE Project also coincides with India's approach. Even though he had marginally reduced the Pondage provided by India, his opinion is not to the satisfaction of Pakistan. There can be no end to dissatisfaction with the views of the third party. Further, Ratle HE project is the first tariff based hydroelectric plant in India. The developer decides the load pattern on which he decides the Pondage keeping in view the Treaty provisions. Being already tightly budgeted, it may be extremely difficult to reduce it further. " (pp. 12-13).
CHULUNKHA			
P-0649.1362	Letter No. 3/4/2012-IT/1965	14 December 2012	Notification of HEP design. No Pondage proposed.
TURTUK-I			
P-0649.1363	Letter No. 3/10/2012-IT/1966	27 December 2012	Notification of HEP design. No Pondage proposed. Volume of 116.88 CM between FPL and DSL at forebay is to "stabilize the hydraulic transients" (p. 2).
WARIS-III			
P-0649.1367 (resubmitted)	Letter No. 3/11/2012-IT/1973	10 January 2013	Notification of HEP design. No Pondage proposed. Volume of 106.68 CM between FPL and DSL at forebay is to "stabilize the hydraulic transients" (p. 2).

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BOGDANG			
P-0649.1369	Letter No. 3/5/2012-IT/1976	23 January 2013	Notification of HEP design. No Pondage proposed. Volume of 75.46 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
DURBUK-II			
P-0649.1370	Letter No. 3/13/2012-IT/1977	29 January 2013	Notification of HEP design. No Pondage proposed. Volume of 64.14 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
SHAYOK			
P-0649.1371	Letter No. 3/7/2012-IT/1981	6 February 2013	Notification of HEP design. No Pondage proposed.
NEW GANDERBAL			
P-0649.1372	Letter No. 3/1/1990-IT/1984	26 February 2013	Notification of HEP design. Operating Pool: 100,000 CM. Calculations for maximum Pondage provided at Annexure VII (p. 21), based on weekly load variations. Load: zero to 72.38 cumecs (p. 4). Installed Capacity: 93 MW (p. 4)

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TSATI			
P-0649.1375	Letter No. 3/16/2012-IT/1988	13 March 2013	Notification of HEP design. No Pondage proposed. Volume of 36.84 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
HENACHE			
P-0649.1377	Letter No. 3/14/2012-IT/1997	9 April 2013	Notification of HEP design. No Pondage proposed. Volume of 73.88 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
CHAMSHEN			
P-0649.1376	Letter No. 3/15/2012-IT/1998	9 April 2013	Notification of HEP design. No Pondage proposed. Volume of 79.65 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
SUMDA-DHO			
P-0649.1378	Letter No. 3/9/2012-IT/1996	9 April 2013	Notification of HEP design. No Pondage proposed. Volume of 39.74 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
ZUNKUR			
P-0649.1384 / P-0649.1389	Letter No. 3/2/2013-IT/2020	9 July 2013	Notification of HEP design.

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			No Pondage proposed. Volume of 420 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
RARU			
P-0649.1387	Letter No. 3/5/2013-IT/2024	9 July 2013	Notification of HEP design. No Pondage proposed. Volume of 300 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
BAIRAS			
P-0649.1385	Letter No. 3/11/2013-IT/2021	9 July 2013	Notification of HEP design. No Pondage proposed. Volume of 540 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
CHILONG			
P-0649.1386	Letter No. 3/3/2013-IT/2022	9 July 2013	Notification of HEP design. No Pondage proposed. Volume of 250 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
UMBULUNG			
P-0649.1388	Letter No. 3/6/2013-IT/2023	9 July 2013	Notification of HEP design. No Pondage proposed. Volume of 345 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).

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THUSGAM SANKOO			
P-0649.1390 (resubmitted)	Letter No. 3/9/2013-IT/2025	10 July 2013	Notification of HEP design. No Pondage proposed. Volume of 391.5 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
SANGARH			
P-0649.1391	Letter No. 3/4/2013-IT/2026	11 July 2013	Notification of HEP design. No Pondage proposed. Volume of 210 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
THUSGAM DRASS			
P-0649.1393	Letter No. 3/10/2013-IT/2028	11 July 2013	Notification of HEP design. No Pondage proposed. Volume of 84 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
TAMBIS			
P-0649.1392	Letter No. 3/7/2013-IT/2027	11 July 2013	Notification of HEP design. No Pondage proposed. Volume of 102 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
KHANDI			
P-0649.1398	Letter No. 3/8/2013-IT/2030	16 July 2013	Notification of HEP design.

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			No Pondage proposed. Volume of 240 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
MATAYEEN			
P-0649.1397	Letter No. 3/12/2013-IT/2029	16 July 2013	Notification of HEP design. No Pondage proposed. Volume of 370 CM between FPL and DSL at forebay is to “stabilize the hydraulic transients” (p. 2).
KHARI-I			
P-0649.1426	Letter No. Y-19011/3/2015-IT/2154-A	17 August 2015	Notification of HEP design. No Pondage proposed.
TAMASHA			
P-0649.1479	Letter No. Y-19011/3/2018/2302	4 February 2019	Notification of HEP design. No Pondage proposed.
BALTIKULAN			
P-0649/1477	Letter No. Y-19011/1/2018/2301	4 February 2019	Notification of HEP design. No Pondage proposed.
KALAROOS-II			
P-0649.1478	Letter No. Y-19011/5/2018/2303	4 February 2019	Notification of HEP design. No Pondage proposed.

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NIMU CHILLING			
P-0649.1515	Letter No. 19011/9/2019-IT/2361	24 December 2020	Notification of HEP design. No Pondage proposed.
DURBUK SHYOK			
P-0649.1514	Letter No. 19011/10/2019-IT/2360	24 December 2020	Notification of HEP design. No Pondage proposed.
KIRU			
P-0546 (resubmitted)	Letter No. 3/6/2007-IT/2371 (with enclosure)	1 June 2021	Notification of HEP design. Operating Pool: 10.5 MCM (p. 2). Calculations for maximum Pondage provided in Annexure VII (p. 51), based on weekly loading. Load: expected variation in discharge from 146.5 cumecs to 586 cumecs (p. 5). Installed Capacity: 4 x 156 MW, Total: 624 MW (p. 5).
P-0216	Record of the 117th Meeting of the Permanent Indus Commission, 1–3 March 2022	3 March 2022	PCIW notes that “the Pondage of 10.50 MCM as provided by India is almost twice when compared with the Pondage duly calculated by using the sole design criterion of the Indus Waters Treaty stipulated in Paragraph 8(c) of Annexure D to the Treaty. In this regard he highlighted that India must adhere to the design criteria of the Treaty while designing various components of its new projects on Western Rivers as putting reliance to the other provisions related to operation of the works or definition clauses would dilute the primacy of the design criteria which tantamount to committing violation of the Treaty. He added that Pakistan’s corresponding computation using the Paragraph 8(c) shows the Maximum Pondage of 5.7 MCM, which needs to be adopted to make the design of the Plant compliant with the Treaty. By so doing, the Dead Storage Level (DSL)

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			must also be raised by 4.9 m and to be fixed at El. 1508.9 m or say 1509.0 m. In case the justification in this respect is available with India, the same would be required to be shared so as to see whether further review by Pakistan would be needed or not.” (p. 10). In response, ICIW “requested PCIW to furnish Pondage calculations made by them for better understanding. He further held Pondage needs to be so fixed that its objective, as defined in the para 2(c) are fulfilled and at the same time the operating flexibility given to India under para (15) of Annexure D is ensured. For this project, the Pondage of 10.5 MCM has been provided for Kiru HEP project is considered to be very well within the Treaty Provisions.” (pp. 10-11).
KARGIL HUNDERMAN			
P-0649.1587	Letter No. Y-19011/5/2019-IT/2374	7 July 2021	Notification of HEP design. Operating Pool: 40,689 CM (p. 2). No calculations provided for maximum Pondage. Load: variation in discharge from 26.60 to 53.19 cumecs (p. 3). Does not specify whether variation is daily or weekly calculations. Installed Capacity: 25 MW (p. 4).
P-0649.1633	Letter No. WT(259)/(7974-A)/PCIW	29 September 2021	Response to ICIW letter above. PCIW objects that there is potential for Pondage in reservoir behind barrage and headrace tunnel and requests calculations for the Operating Pool (p. 2).
P-0649.1671	Letter No. Y-19011/5/2019-IT/2397	24 February 2022	ICIW responds and states that “information already supplied through my above letter [P-0649.1587] is complete and sufficient” (p. 1).
P-0649.1683	Letter No. WT(47)/(8047-A)/PCIW	14 March 2022	PCIW writes to remind ICIW of unresolved information requests for multiple HEPs, including for calculations of maximum Pondage for Kargil Hunderman HEP.

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P-0649.1713	Letter No. WT(47)/(8118-A)/PCIW	9 January 2023	PCIW writes to remind ICIW of unresolved information requests for multiple HEPs, including for calculations of maximum Pondage for Kargil Hunderman HEP.
KULAN RAMWARI			
P-0649.1588	Letter No. Y-19011/6/2019-IT/2376	7 July 2021	Notification of HEP design. Operating Pool: Nil (p. 2) – no calculations provided. Installed Capacity: 25 MW (p. 4).
P-0649.1631	Letter No. WT(275)/(7976-A)/PCIW	29 September 2021	PCIW objects that there is potential for Pondage in the reservoir behind the spillway and in the power channel and requested India to provide calculations for the Operating Pool (p. 4). <i>Note: No response found to this letter on the record.</i>
PHAGLA			
P-0649.1589	Letter No. Y-19011/3/2019-IT/2375	7 July 2021	Notification of HEP design. Operating Pool: Nil (p. 2) – no calculations provided. Installed Capacity: 14.10 MW (p. 4).
P-0649.1632	Letter No. WT(273)/(7975-A)/PCIW	29 September 2021	PCIW objects that there was potential for Pondage in reservoir behind spillway and headrace pipe (p. 1). <i>Note: No response found to this letter on the record.</i>

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MANDI			
P-0649.1603	Letter No. Y-19011/2/2018/2378	10 August 2021	Notification of HEP design. Operating Pool: 2,202 cumecs (p. 2). No calculations for maximum Pondage provided. Installed Capacity: 15 MW (3 x 5 MW) (p. 4).
P-0649.1636	Letter No. WT(152)/(7986-A)/PCIW	9 November 2021	PCIW objects that while a nominal value for Operating Pool has been indicated, no supporting calculations have been provided for maximum Pondage (pp. 1, 4). <i>Note: No response found to this letter on the record.</i>
MANGDUM SANGRA			
P-0649.1634	Letter No. Y-19011/10/2019-IT/2382	9 October 2021	Notification of HEP design. Operating Pool: Nil (p. 28) – no calculations provided. Load: expected variation in the discharge of 13.85 to 27.70 cumecs (p. 30). Installed Capacity: 19 MW (2 x 9.5 MW) (p. 30).
P-0649.1668	Letter No. WT(260)/(8027-A)/PCIW	6 January 2022	PCIW objects that while “nil” Operating Pool is indicated in design, there is potential for Pondage in reservoir behind barrage (p. 2).
SANKOO			
P-0649.1634	Letter No. Y-19011/10/2019-IT/2382	9 October 2021	Notification of HEP design. Operating Pool: Nil (p. 51) – no calculations provided. Load: expected variations in discharge of 17.98 to 35.97 cumecs (p. 53).

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			Installed Capacity: 18.5 MW (2 x 9.25 MW) (p. 53).
P-0649.1669	Letter No. W(256)/(8026-A)/PCIW	6 January 2022	PCIW objects that while “nil” Operating Pool is indicated in design, there is potential for Pondage in reservoir behind barrage (p. 2).
ANS-II			
P-0649.1634	Letter No. Y-19011/10/2019-IT/2382	9 October 2021	Notification of HEP design. Operating Pool: 0.0225 MCM (p. 2). No calculation for maximum Pondage provided. Load: expected variation in the discharge of 17.37 to 34.75 cumec (p. 4). Installed Capacity: 23 MW (2 x 11.5 MW) (p. 4).
P-0649.1670	Letter No. WT(276)/(8028-A)/PCIW	6 January 2022	PCIW requests supporting calculations for the nominal value of the Operating Pool indicated in the design (p. 1).
KWAR			
P-0649.1718	Letter No. 3/7/2007-IT/	20 June 2023	Notification of HEP design. Operating Pool: 9,160,000 CM (p. 2). Calculations for maximum Pondage provided at Annexure VIII (p. 51). The calculation accounts for Paragraph 15 operational parameters, and is based on weekly variations in load. Load: 145.07 to 580.28 cumecs (p. 4). Installed Capacity: 540 MW (4 x 135 MW) (p. 4).
P-0649.1723	Letter No. WT(149)/(8147-A)/PCIW	20 September 2023	PCIW objects that the design provides for an excessive maximum Pondage (p. 2) and that the Pondage should be fixed at the lower, Treaty-acceptable volume.

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GENERAL			
P-0072	Letter No. WT(150)/(7335-A)/PCIW	20 March 2013	This letter concerns Pakistan’s objections on the design of multiple HEPs, including Miyar, Lower Kalnai and Ratle. PCIW notes that he “appreciate[s] that the purpose of Pondage - defined by the Treaty in Paragraph 2(c) of Annexure D to the Treaty - is to meet the fluctuations in the discharge of the turbines arising from variations in the daily and the weekly loads of the plant. However, Paragraph 8 of Annexure D stipulates the design criteria and therefore provides under sub-paragraph (c) that the maximum Pondage in the Operating Pool shall not exceed twice the Pondage required for Firm Power. To check whether or not the maximum Pondage in the Operating Pool exceeds twice the Pondage required for Firm Power, there is no other way except to simulate the operation of the facility in a manner that the power generation is restricted to the Firm Power - as defined in Paragraph 2(i) of Annexure D to the Treaty. Such an operation would require passing of the Minimum Mean Discharge (MMD) through the turbines while receiving the natural river flow in the reservoir. The natural flow pattern in the rivers inherently exhibits variation within a day and the week. In order to maintain the sustained water supply to generate the Firm Power, a cushion is required to absorb the sudden impulses during the day and/or the week i.e. flows greater than MMD, and to supplement the discharge during the instances when the flow falls below MMD. The volume of aforementioned cushion is thus technically adequate for the purposes of ensuring the generation of Firm Power. Given the uncertainty of natural flow patterns and to ensure meeting the fluctuations in the discharge of the turbines arising from variations in the daily and the weekly loads of the plant Treaty duly allows to make twice the Pondage required for Firm Power, which is known as maximum Pondage.” (p. 2)

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P-0103	Record of the 113th Meeting of the Permanent Indus Commission, 20-21 March 2017	29 March 2018	The meeting started with a general discussion on Pakistan’s consistent objections to India’s Pondage methodology. ICIW notes that “On Pondage, ICIW emphasized that India has been taking into account all the relevant provisions in the Treaty like paragraph 2(c), 8(c) and 15 of Annexure D while estimating pondage requirements and therefore is as per Treaty provisions. The same methodology has been used by Neutral Expert in Baglihar case. However, even the methodology of a Neutral Expert who has been appointed and delivered his determination under the provisions of the Treaty is not acceptable to Pakistan. Indian side could not find a single provision in the Treaty which required that firm power need to be generated continuously. It had earlier been brought out by Indian side that the Pakistan’s approach is very subjective and yields pondage ranging from very trivial to more than what India has provided. In the meticulously drafted Treaty, such subjectivity is beyond comprehension. The PCIW suggestion as given in 109th meeting to ignore the very high and very low fluctuations and to take the sample representative of the general fluctuation pattern tantamount to tweaking the Treaty provisions to suit his assertion. Further, with the Pakistan’s interpretation, the Pondage value would be very small and in the absence of drawdown flushing facility the reservoir will be filled with sediments in shorter duration making the scheme unviable. This certainly is not the intention of the Treaty” (p. 9). In response, “PCIW rebutted by stating that India’s interpretation for Pondage computation may be used for the hydropower projects that are not under the domain of the Indus Waters Treaty but cannot be used for the India’s projects on the Western Rivers of the Indus Basin. He stated that for the hydropower projects on the Western Rivers the Treaty explicitly defines the criterion for pondage computation under Paragraph 8(c). PCIW asserted that Para 15 of Annexure Dis only for operational purposes and cannot be applied for design as stated at the head of Para 8 of Annexure D [...] PCIW elaborated that the words ‘shall conform to the following criteria’ put restrictions on India that nothing else but Paragraph 8 can be used for the parameters dealt with in

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			this paragraph for hydropower scheme design on the Western Rivers. Pondage is associated with Firm Power. Contrary to Pakistan’s perspective, India is not basing her calculations of permissible Pondage on generating Firm Power, rather, India computes Pondage with generation of peak power. Pakistan side also recorded their reservations on the approach adopted for Pondage computation by Neutral Expert (NE) in Baglihar case. It was explained that NE went beyond his mandate as defined in the Treaty and incorrectly used the definition of ASCE for Firm Power leaving aside the definition of Firm Power given in the Treaty.” (pp. 9-10). On the subject of “load”, PCIW notes that “it was observed in India’s Pondage computation that it was so much oriented towards maximizing pondage that even the load curve was not followed in true sense. No hydropower was generated for hours to maximize the difference between cumulative inflow and outflow then plant was operated at peak capacity for many hours to fulfil the criteria of Paragraph 15, and the real load curve of the area i.e. Northern Grid, was compromised. PCIW emphasized that this approach was not consistent with the provisions of the Treaty. Pakistan side explained that value of Permissible Pondage computed as per Pakistan’s perspective was sufficient for regular operation of the plant. It had also been estimated that Pondage value greater than Pakistan’s estimation provided no extra benefits in terms of total energy and revenue. India might carry out its own analysis in this regard. Then both the countries might sit to discuss the results, in case of any significant differences in their estimates.” (p. 10). In response, ICIW “stated the Treaty does not specify Pondage to be Live Storage of only sufficient magnitude to meet the fluctuations of the daily and weekly inflow of the river, as interpreted by Pakistan. In fact, the Treaty defines the Pondage to be Live Storage of only sufficient magnitude to meet the fluctuations of the discharge of the turbines arising from variations in daily and weekly loads on the Plant. Further, the consumption of energy by industrial or domestic consumers in an interconnected grid can vary could vary from day to day, season to season and from time to time throughout the life of the plant and with the development can assume

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			different pattern in the time to come. With more and more capacity additions envisaged from renewable energy sources which supply variable and intermittent power, the need for balancing power for stabilizing the grid and for successful integration of the renewables, the role of hydro power is increasingly becoming important. As such, operation of hydro projects need more flexibility in operation in order to cater to the varying load demands. Indian side stated that moreover, there is nothing in the Treaty which says that load variations have to be stable throughout the life of the Plant and the concept of load curve, too, is not explicitly provided in the Treaty. The Treaty, however, fixes the limitation of India's control of water from the Western Rivers through Paragraph 15 of Annexure D. India is free to design the Pondage of its Plant within that limitations taking care of possible future scenarios." (p. 10)

* * *

APPENDIX C

**THE *TRAVAUX PRÉPARATOIRES* OF
THE TREATY RELATING TO THE
TERMS “CAPACITY” AND “LOAD”**

APPENDIX C

The *travaux préparatoires* of the Treaty relating to the terms “capacity” and “load”

C.1. In Procedural Order No. 17, the Court requested Pakistan to address “[t]he meaning of the terms ‘capacity’ and ‘load’ as used in the Treaty, including in Annexure D, Part 3.” In its General Issues Award, the Court confirmed that the general rules on treaty interpretation expressed in the Vienna Convention on the Law of Treaties (“VCLT”) are applicable in interpreting the Treaty.¹ These rules include resort to “supplementary means of interpretation”, pursuant to the principle in Article 32 of the VCLT, including the “preparatory work” of the Treaty (its *travaux préparatoires*), to confirm the meaning, or to determine the meaning when application of the other elements of interpretation leaves the meaning ambiguous, obscure, or manifestly absurd or unreasonable. This **Appendix C** addresses the *travaux préparatoires* (“*travaux*”) of the Treaty insofar as it may shed light on the meaning of the terms “capacity” and “load” as used in the Treaty.

C.2. In its General Issues Award, the Court set out a comprehensive analysis of the relevance of the *travaux* of the Treaty in interpreting the provisions of the Treaty at issue in the First Phase on the Merits. In relation to the calculation of maximum Pondage, the Court concluded that “the preparatory work of the Treaty provides limited guidance [on the interpretation of Paragraph 8(c) of Annexure D], but what guidance exists confirms an interpretation of Paragraph 8(c) that calls for calculating maximum Pondage based on, *inter alia*, the HEP’s installed capacity and anticipated load.”² The Court observed that the significance of loading in calculating maximum Pondage was consolidated, from different provisions for Run-of-River HEPs and Small Plants in the Heads of Agreement 1959, “into a single text [from the April 1960 Heads of Agreement onwards], [...] as a definition, with that definition serving as a basis for the calculation of Pondage for both regular Plants and Small Plants.”³

C.3. Pakistan has reviewed the preparatory work of the Treaty once again for the purposes of this Second Phase on the Merits. It has sought to identify anything that may be gleaned from it relevant to the Court’s task of resolving the basis upon which India must determine the

¹ General Issues Award, ¶¶ 270-272.

² *Id.*, ¶ 736.

³ *Id.*, ¶ 735.

installed capacity and anticipated load of a proposed Annexure D, Part 3 HEP, and, once determined, how these elements are to be taken into account for purposes of the calculation of maximum Pondage.

C.4. As Pakistan observes in this Memorial,⁴ the specific terms used by the Court in its General Issues Award – “installed capacity” and “anticipated load” – are not mentioned in the Treaty. As a result, in consulting the preparatory work of the Treaty, Pakistan has sought to identify anything in the *travaux* that may “confirm” or “determine” the meaning of the terms “capacity” and “load” as used in the Treaty (and referred to in the Court’s PO17), including in Annexure D, Part 3, pursuant to Article 32 of the VCLT.

C.5. First, Pakistan considers the use of the terms “capacity” and “load” in draft versions of the Treaty (**Section A**). Second, Pakistan analyses the evolution in draft versions of the Treaty of the provisions that the Court identified in its General Issues Award as “relevant context” for the interpretation of Annexure D, Paragraph 8(c), namely: Annexure D, Paragraph 15 (water delivery requirements); Paragraph 9 and Appendix II of Annexure D (notification requirements); and Annexure E (storage of waters) (**Section B**). Third, Pakistan has returned to the preparatory work of the Treaty to confirm the existence and nature of discussions between the Parties (or with the World Bank) during the negotiations of the concepts of “capacity” and “load” (**Section C**).

A. Use of the terms “capacity” and “load” in draft versions of the Treaty

C.6. In this Section, Pakistan considers the use of the terms “capacity” and “load” in draft versions of the Treaty. The preparatory works yield little additional guidance in this respect, beyond lending support to the conclusion already drawn by the Court in its General Issues Award that the projection of an Annexure D, Part 3 HEP’s anticipated load must be “realistic, well-founded, and defensible”.⁵

C.7. Annex B of the Heads of Agreement 1959, as the forerunner of Annexure D, does not use the term “capacity” in its main terms.⁶ The first appearance of the term is in Appendix I (that is, the information India would be required to communicate to Pakistan in advance of the

⁴ Pakistan’s Second Phase Memorial, ¶¶ 3.16-3.17.

⁵ General Issues Award, ¶ 747(b).

⁶ Indus Waters, Heads of Agreement, 15 September 1959 (“**Heads of Agreement 1959**”), Exhibit P-0136, pp. 18-21.

beginning of construction of river works connected with a plant).⁷ The evolution of the notification requirements under the Treaty are considered further below.

C.8. The term “load” first appears in the definition of “run-of-river” plants in Paragraph 2 of Annex B of the Heads of Agreement 1959. Its deployment there is used in a way comparable to its final incarnation in the definition of “Run-of-River Plant” in the Treaty:

“A ‘Run-of-River’ plant is a hydro-electric plant at which power is developed without live storage as an integral part of the plant, except for the storage in the operating pool, that is to say, the pondage required to meet fluctuations in the discharge of the turbines arising from variations in the daily or weekly load of the power plant.”⁸

C.9. The definition of “Run-of-River Plant” (Paragraph 2(g)) in the final Treaty likewise refers, indirectly, to the “fluctuations in the discharge of the turbines arising from variations in the daily and the weekly loads of the plant” through its use of the defined term “Pondage”.

C.10. The term “load” also appears in the design criterion set out in Paragraph 3(b) of Annex B of the Heads of Agreement 1959 (the progenitor of Paragraphs 8(c) and 2(c) of Annexure D).⁹ As Pakistan explained in Appendix A to its Memorial in the First Phase on the Merits (“**First Phase Memorial**”),¹⁰ Pakistan appears to have proposed this amendment, and India accepted it.¹¹ The Minutes of the Meeting at which this amendment was proposed do not, however, shed any light on what the Parties intended the word “load” to mean, or how it would be calculated.¹² The word “load” is also used in the corresponding provision relating to Small Plants (Paragraph 14(b)), but again, without explanation.¹³ The next appearance of the term “load” is in Appendix I (notification requirements), as more fully explained below.

C.11. As Pakistan explained in Appendix A to its First Phase Memorial, the fact that Pakistan proposed the inclusion of Paragraph 3(b), with its reference to “daily or weekly load fluctuations”, “suggests that the provision was intended to have a limiting, rather than an

⁷ *Id.*, p. 22.

⁸ *Id.*, p. 18.

⁹ “The volume between the maximum and minimum levels of the operating pool shall not exceed that required to meet the daily or weekly load fluctuations as the case may require.” *Id.*

¹⁰ First Phase Memorial, 22 March 2024, Appendix A, ¶¶ 48, 132.

¹¹ World Bank, Minutes of Meeting, 8 September 1959, **Exhibit P-0474**, ¶ B.1. In its First Phase Memorial, Pakistan expressed the view that the fact that Pakistan proposed the inclusion of this language “suggests that the provision was intended to have a limiting, rather than an enlarging, effect on India’s allowable Pondage.” (Appendix A, ¶ 48).

¹² World Bank, Minutes of Meeting, 8 September 1959, **Exhibit P-0474**.

¹³ Indus Waters, Heads of Agreement, 15 September 1959, **Exhibit P-0136**, p. 20.

enlarging, effect on India’s allowable Pondage.”¹⁴ The same logic lends support to the conclusion, already drawn by the Court, that India’s projection of the proposed Annexure D, Part 3 HEP’s anticipated load, reflecting fluctuations in the discharge of the turbines arising from variations in the daily or weekly loads of the plant, must be “realistic, well-founded, and defensible”¹⁵ – as opposed to hypothetical. Pakistan’s proposed inclusion of reference to a limit on the “volume between the maximum and minimum levels of the operating pool” of “that required to meet the daily or weekly load fluctuations as the case may require” would have been pointless if India’s calculation of “load fluctuations” was to be wholly unconstrained by practical realities. Beyond this, however, an analysis of the use of the terms “capacity” and “load” in draft versions of the Treaty provides no further guidance on how precisely such “realistic, well-founded, and defensible” projection of the anticipated load should be calculated.

B. The evolution in draft versions of the Treaty of provisions that provide “relevant context”

C.12. In this Section, Pakistan analyses the evolution in draft versions of the Treaty of the provisions that the Court identified in its General Issues Award as “relevant context” for the interpretation of Annexure D, Paragraph 8(c), namely: Annexure D, Paragraph 15 (water delivery requirements); Paragraph 9 and Appendix II of Annexure D (notification requirements); and Annexure E (storage of waters). As explained further below, certain aspects of the evolution of the drafting of the notification requirements in Appendix II of Annexure D lend support to the Court’s conclusion that India’s projection of a proposed Annexure D, Part 3 HEP’s anticipated load must be based on something concrete – “realistic, well-founded, and defensible” – rather than hypothetical.¹⁶ Similarly, the negotiating history of Annexure E also supports the Court’s existing conclusion that India’s projection of a proposed HEP’s installed capacity and anticipated load must be “realistic, well-founded, and defensible”.¹⁷ However, beyond this, an analysis of the evolution in draft versions of the Treaty of provisions that provide “relevant context” does not provide further guidance on how precisely such “realistic, well-founded, and defensible” projection of the anticipated load should be calculated.

¹⁴ First Phase Memorial, Appendix A, ¶ 48.

¹⁵ General Issues Award, ¶ 747(b).

¹⁶ *Id.*

¹⁷ *Id.*

C.13. **Paragraph 15 of Annexure D (water delivery requirements).** In its General Issues Award, the Court expressed the view that Paragraph 15 of Annexure D “is a vital element for the methodology for calculating ‘maximum Pondage’”.¹⁸ Pakistan addressed the evolution of Paragraph 15 in the preparatory works of the Treaty in Appendix A to its First Phase Memorial. As Pakistan there observed,¹⁹ paragraphs 10 and 11 of Annex B of the Heads of Agreement 1959²⁰ bear close resemblance to what became Paragraph 15 of Annexure D of the final Treaty. Certain numerical amendments and minor drafting amendments were made to these provisions (at what became Paragraph 15 of Annexure D) in the April 1960 draft of Annexure D²¹: in particular, it reduced “the volume [to be] delivered into the river below the Plant” to “not less than 30%” and “not more than 130%”, from the 50% and 150%, respectively, envisaged in Annex B of the Heads of Agreement 1959. The drafting of this provision in the April 1960 draft of Annexure D was maintained materially unchanged into the final text.²²

C.14. **Paragraph 9 and Appendix II of Annexure D (notification requirements).** The Court observed in its General Issues Award that the notification requirements under the Treaty provide “[f]urther relevant context for interpreting Paragraph 8(c) of Annexure D”.²³ It referred, in particular to the following requirements: (a) Hydraulic Data (paragraph (b)); and Particulars of Design (paragraphs (h) and (i)).²⁴ In the paragraphs that follow, Pakistan tracks the evolution of those specific notification requirements from their inception in Appendix I of Annex B to the Heads of Agreement 1959 to their final incarnation in the Treaty.

C.15. Hydraulic Data: The progenitor of paragraph 3(b) of Appendix II to Annexure D, is paragraph 3(b) of Appendix I of Annex B of the Heads of Agreement 1959:

“Maximum and minimum operating pool levels and pondage in the operating pool between these two levels, along with calculations showing the pondage required to meet the fluctuations due to the weekly or daily loads.”²⁵

¹⁸ General Issues Award, ¶ 681.

¹⁹ First Phase Memorial, Appendix A, ¶ 57.

²⁰ Heads of Agreement 1959, **Exhibit P-0136**, pp. 19-20.

²¹ Annexure D, Generation of Hydro-Electric Power by India on the Western Rivers, draft of 23 April 1960 (“**April 1960 draft of Annexure D**”), **Exhibit P-0476**, ¶ 14.

²² The final Treaty adopted 30% / 130% (Paragraph 15, Annexure D) (other than where a Plant is located at a site on the Chenab Main below Ramban).

²³ General Issues Award, ¶ 686.

²⁴ *Id.*, ¶ 687.

²⁵ Heads of Agreement 1959, **Exhibit P-0136**, p. 22.

C.16. In paragraph 3(b) Appendix II of the April 1960 draft of Annexure D, this became:

“Full Pondage Level, Dead Storage Level and Pondage together with the calculations for the Pondage.”²⁶

C.17. Replacing these provisions with their definitions, would read:

“The level of the Operating Pool corresponding to the maximum Pondage specified in Paragraph 7 (c)”, the “level corresponding to” “that portion of the storage which is not used for operational purposes”, and “storage of only sufficient magnitude to meet fluctuations in the discharge of the turbines arising from variations in the daily and the weekly load of the plant” together with the calculations for the Pondage.”

C.18. In the final version in the Treaty, this became:

“Full Pondage Level, Dead Storage Level and Operating Pool, together with the calculations for the Operating Pool”.

C.19. The language clearly evolved – the original form of paragraph 3(b) of Appendix II to Annexure D referring directly to the “pondage required to meet the fluctuations due to the weekly or daily loads”, while the final form maintained the link to “loads” only indirectly, through its reference to the “calculations for the Operating Pool”. The evolution, however, sheds no light on the meaning of the term “load” (nor on the term “capacity”) as used in the Treaty. Rather, the substance of the notification requirement remained broadly stable throughout the evolution of the draft terms. That said, the fact that this type of data was envisaged to be provided by India from the outset of the Parties’ negotiations of the final text of the Treaty, at the same time as reference to “load” was included (on Pakistan’s initiative) in the design criteria of run-of-river HEPs, lends further support to the Court’s conclusion that India’s projection of a proposed Annexure D, Part 3 HEP’s anticipated load must be based on something concrete – “realistic, well-founded, and defensible”.²⁷

C.20. Particulars of Design: The progenitor of paragraph 4(h) of Appendix II to Annexure D is paragraph 4(h) of Appendix I of Annex B of the Heads of Agreement 1959:

“Mean discharge proposed to be passed through the plant, initially and ultimately, and variations in the discharge on account of daily and weekly load fluctuations.”²⁸

C.21. In paragraph 4(h) of Appendix II of the April 1960 draft of Annexure D, this became

²⁶ April 1960 draft of Annexure D, **Exhibit P-0476**, p. 7.

²⁷ General Issues Award, ¶ 747(b).

²⁸ Heads of Agreement 1959, **Exhibit P-0136**, p. 23.

(with amendments shown underlined):

“Mean discharge proposed to be passed through the plant, initially and ultimately, and expected variations in the discharge on account of daily and weekly load fluctuations.”²⁹

C.22. The only change as between the Heads of Agreement 1959 and the final Treaty was thus the addition of “expected”, before variations, presumably to reflect the fact that the information captured was inherently forward-looking but nonetheless required to be “realistic, well-founded, and defensible”.

C.23. In the final version in the Treaty, this became:

“Discharge proposed to be passed through the Plant, initially and ultimately, and expected variations in the discharge on account of the daily and the weekly load fluctuations.”

C.24. Here, there are only minor drafting changes (including the capitalisation of “Plant”, to reflect the inclusion of a defined term) as compared to draft versions. This evolution – in particular, the addition in April 1960 of the word “expected” before “variations in the discharge on account of daily and weekly load fluctuations” – again lends support to the Court’s conclusion that India’s projection of a proposed Annexure D, Part 3 HEP’s anticipated load must be based on something concrete – “realistic, well-founded, and defensible” – rather than hypothetical.³⁰

C.25. The progenitor of paragraph 4(i) of Appendix II to Annexure D is paragraph 4(i) of Appendix I of Annex B of the Heads of Agreement 1959:

“Proposed maximum installed capacity of power plant (exclusive of standby units) both firm and secondary.”³¹

C.26. In Appendix II of the April 1960 draft of Annexure D, this became:

“Proposed maximum installed capacity of plant (exclusive of standby units) both firm and secondary.”³²

C.27. The only change here is therefore the omission of “power” before “plant”. The

²⁹ April 1960 draft of Annexure D, **Exhibit P-0476**, p. 8 (emphasis added).

³⁰ General Issues Award, ¶ 747(b).

³¹ Heads of Agreement 1959, **Exhibit P-0136**, p. 23.

³² April 1960 draft of Annexure D, **Exhibit P-0476**, p. 8.

provision then underwent two more material changes in the June 1960 draft of Annexure D (paragraph 3(d)), as follows (underlined):

“Maximum aggregate capacity of power units (exclusive of standby units) both firm and secondary.”³³

C.28. It is difficult to discern precisely the intentions that lay behind the evolution in language from “Proposed maximum installed capacity of plant” to “Maximum aggregate capacity of power units.” The archives do not contain any documents which identify the genesis of these changes.

C.29. The changes subsequently made in the final version in the Treaty were primarily to introduce (further to amendments proposed by India³⁴) defined terms explaining the concepts of “Firm Power” and “Secondary Power” (shown below underlined):

“Maximum aggregate capacity of power units (exclusive of standby units) for Firm Power and Secondary Power.”

C.30. India proposed a corresponding change in Paragraph 4(g)(v) of the Appendix to Annexure E, including with a specific reference to Annexure D.³⁵ However, the final version of Annexure E of the Treaty referred to “firm power and secondary power”, without using the defined terms and without reference to Annexure D, as follows: “Maximum aggregate capacity of power units (exclusive of standby units) for firm power and secondary power.” That Annexure E did not capitalise these terms, notwithstanding India’s proposal to do so, indicates that the negotiating Parties reached agreement that the terms as employed in Annexure E would have meanings distinct from those employed in Annexure D. Whatever the case may be, there are no clear implications of this decision for confirming the meaning of the terms “capacity” and “load” as used in Annexure D of the Treaty.

C.31. **Annexure E (storage of waters).** In its General Issues Award, the Court identified as “relevant context” for the interpretation of Paragraph 8(c) of Annexure D the following specific provisions of Annexure E: Paragraph 7 (aggregate storage capacity for Storage Works); and

³³ Indus Waters Treaty 1960, Annexure D: Generation of Hydro-Electric Power by India on the Western Rivers (Article III(2)(d)), draft of 6th June 1960, **Exhibit P-0478**, p. 11.

³⁴ Indus Waters Treaty 1960, Annexure D (Draft dated 6th June, 1960), Amendments proposed by India, **Exhibit P-0379**, pp. 1-2, 4.

³⁵ Indus Waters Treaty 1960, Annexure E (Draft dated 6th June, 1960), Amendments proposed by India, **Exhibit P-0493**, p. 3.

Paragraph 21 (limits on maximum Pondage incorporated in a Storage work).³⁶

C.32. In the first draft of Annexure E, from April 1960,³⁷ the progenitor of Paragraph 7 of the final version of Annexure E appears at paragraph 4. Draft paragraph 4 is broadly similar to final Paragraph 7, in that it provides a table dividing up the different types of “Storage Capacity” that India may construct on each relevant river system. The storage capacities not described as “nil” had not yet been agreed, and instead appeared simply as “-”.³⁸

C.33. Where the April 1960 draft of Annexure E differs materially from its final version is in relation to the carve-outs from the figures specified in the table set out at paragraph 4. In particular, paragraph 5 of the draft carves out “Pondage, as defined in Annexure D” from “[t]he figures specified in Paragraph 4”, but – unlike the final version of Annexure E – has no separate carve-out for any pondage in a “hydro-electric power plant [...] incorporated in a Storage Work” (Paragraph 8(e), referring to Paragraph 21(a)). As Pakistan explained in its First Phase Memorial, at this point in time, storage for India’s hydro-electric uses of the Western Rivers was left to be dealt with exclusively by the detailed design, operation and construction constraints in Annexure D.³⁹ Indeed, a formal memorandum from Pakistan’s Ambassador to the United States, Ambassador Aziz Ahmed, to the President of the Bank dated 12 April 1960, sets out important context about the approach taken in the April 1960 draft of Annexure E:

“Pakistan has recognised that the area in question may have needs for hydro-electric development and for flood control. Accordingly, it has agreed to meet these needs by permitting India *as much power development as it desires from run-of-the-river plants*. In addition, as noted above, Pakistan is prepared to agree to 0.5 MAF of storage for irrigation. This can be used for hydro-electric power as well.

[...]

It is suggested that such proposals as the Bank puts forward with respect to storage should keep in view (a) that it is *politically essential for Pakistan’s irrigation system to be as independent as possible and works that could cause interference should be minimal*; (b) that *to a large extent hydro-electric and flood control requirements in the*

³⁶ General Issues Award, ¶¶ 692-699.

³⁷ Annexure E, Construction of Storage Works by India on the Western Rivers, draft of 23 April 1960, **Exhibit P-0489**.

³⁸ See, for the negotiating Parties’ starting positions on these figures, Office Memorandum from Mr Iliff to Files, 16 April 1960, **Exhibit P-0486**.

³⁹ First Phase Memorial, Appendix A, ¶ 165.

area under Indian control can be met by works so designed as to preserve this independence.”⁴⁰

C.34. As explained in Pakistan’s First Phase Memorial, the storage capacities India would be permitted to make on the Western Rivers, above and beyond that required for hydro-electric power production by run-of-river plants, was a new and particularly contentious issue during the period leading up to the finalisation of the April 1960 drafts of Annexures D and E.⁴¹ Pakistan objected that India’s demand for storages “undermined the very concept of ‘independence’” from interference by India in the Western Rivers, which had been at the heart of the Bank’s original 1954 Proposal.⁴²

C.35. The storage capacities India would be permitted to construct on each river system were not agreed until the June 1960 draft of Annexure E.⁴³ At the same time, the progenitor of Paragraph 21 (i.e., provision for a hydro-electric power plant incorporated in a Storage Work) first appeared at draft paragraph 18.⁴⁴ Draft paragraph 18(a) is identical to the final Paragraph 21(a) of Annexure E.

C.36. Like the final version of Annexure E, neither the April or June 1960 drafts of Annexure E directly define the concepts of “installed capacity” or “load”, nor do the preparatory works relating to the drafts directly address these terms. However, the surrounding negotiations strongly indicate that the detailed formula set out in Annexure D – including the components of “capacity” and “load” – was designed to ensure that any storage by India pursuant to that Annexure (D) remained minimal and strictly for power generation. Again, this lends support to the Court’s existing conclusion that India’s projection of a proposed Annexure D, Part 3 HEP’s installed capacity and anticipated load must be based on something concrete – “realistic,

⁴⁰ Memorandum from Iliff to Files, 13 April 1960 (with enclosure), **Exhibit P-0483**, enclosure: Memorandum by Ambassador Aziz Ahmed of Pakistan (Secret), 12 April 1960, pp. 5-6 (emphasis added).

⁴¹ See First Phase Memorial, Appendix A, ¶¶ 158-171, setting out the evolution of negotiations of Annexures D and E during the first half of 1960.

⁴² Cable from Ambassador Aziz Ahmed to Finance Minister Shoaib (with enclosure [incomplete]), 14 April 1960, **Exhibit P-0484**, Annexure ‘A’, p. 4.

⁴³ Indus Waters Treaty 1960, Annexure E: Construction of Storage Works by India on the Western Rivers (Article III(4)) (Draft dated 6th June, 1960), **Exhibit P-0491**. As explained in Pakistan’s First Phase Memorial, the process by which agreement was ultimately reached in this respect is not clear from the preparatory works (Memorial, Appendix A, ¶ 170).

⁴⁴ Indus Waters Treaty 1960, Annexure E: Construction of Storage Works by India on the Western Rivers (Article III(4)) (Draft dated 6th June, 1960), **Exhibit P-0491**. This is likely to have been a contentious issue between the negotiating parties, see First Phase Memorial, Appendix A, ¶¶ 158-171.

well-founded, and defensible”⁴⁵ – as opposed to being hypothetical or artificial.

C. Discussion between the Parties during the negotiations of the concepts of “capacity” and “load”

C.37. In this Section, Pakistan provides an outline of what (limited) detail the preparatory works reveal about the discussions between the Parties (or with the World Bank) during the negotiations of the concepts of “capacity” and “load”. While there is reference to both terms in certain meeting minutes, the *travaux* in this respect provide no assistance in elucidating the meaning of those terms.

C.38. As Pakistan explained in its First Phase Memorial (Appendix A, paragraph 47), the first indication in the *travaux* of any discussion of the concept of “load” is at a meeting between the World Bank and India on 13 August 1959.⁴⁶ The subject matter of the meeting was stated as follows:

“To discuss Indian draft of clause covering hydel uses by [India on the Western] Rivers.”⁴⁷

C.39. The minutes continued to report the discussion as follows:

“1. Gulhati submitted his draft. It was discussed [and] minor alterations were discussed and [agreed upon].

- (a) temporary retention [due to surcharge storage].
- (b) a reference to the weekly load factor in relation to the peak.
- (c) filling period
- (d) fore-bay capacity.”⁴⁸

C.40. The following day, the Bank met with Pakistan’s representatives. There was no detailed discussion of the draft, but rather Mr Mueenuddin expressed Pakistan’s concern regarding “the extent of the harm that India could do should she operate the structures malevolently.”⁴⁹ On 15 August 1959, the Bank and Pakistan’s representatives met again. Pakistan submitted a draft

⁴⁵ General Issues Award, ¶ 747(b).

⁴⁶ World Bank, Minutes of Meeting (Indian representatives), 13 August 1959, **Exhibit P-0456**, ¶ 1(b).

⁴⁷ Words contained in square brackets are only faintly legible.

⁴⁸ World Bank, Minutes of Meeting (Indian representatives), 13 August 1959, **Exhibit P-0456**, ¶ 1. Words contained in square brackets are only faintly legible.

⁴⁹ World Bank, Minutes of Meeting (Pakistan representatives), 14 August 1959, **Exhibit P-0457**, ¶ 1.

“for the hydel uses”. The definition of a run-of-river plant was “discussed in some detail”, and “agreement was reached on the general principles”.⁵⁰ The draft referred to the term “pondage”, which in turn made reference to the term “load”: “the intake to the power house shall be fixed at such a level that the pondage above that level is adequate only to cater for the weekly load factor of the power plant (daily load factor in the case of a power house involving the construction of a dam on the main stem of the Chenab river).”⁵¹

C.41. As explained above, Pakistan appears to have proposed, and India accepted, the amendment which led to the inclusion of the term “load” in the Design criterion set out in Paragraph 3(b) of Annex B of the Heads of Agreement 1959.⁵² The Minutes of the Meeting at which this amendment was proposed do not, however, shed any light on what the Parties intended the word “load” to mean, or how it would be calculated.⁵³

D. Concluding observations

C.42. As will have been evident from the preceding review the *travaux* of the Treaty provide only limited guidance on the meaning of the terms “capacity” and “load”. What limited guidance they do provide supports the Court’s finding that the projection of an Annexure D, Part 3 HEP’s installed capacity and anticipated load must be “realistic, well-founded, and defensible”. Beyond this, however, the *travaux* provide no further guidance on how precisely such “realistic, well-founded, and defensible” projections fall to be assessed.

C.43. Pakistan has found no further material in the preparatory work of the Treaty that might confirm the Court’s interpretation of, or determine the meaning of, the terms “capacity” and “load” as used in the Treaty, including in Annexure D, Part 3. In sum, the record of discussions between the Parties of the concepts of “capacity” and “load” provide no assistance in elucidating the meaning of those terms.

* * *

⁵⁰ World Bank, Minutes of Meeting (Pakistan representatives), 15 August 1959, **Exhibit P-0458** ¶ 2-3.

⁵¹ Letter from Mr Mueenuddin to Mr W. A. Sheikh (with enclosures), 17 August 1959, **Exhibit P-0365**, Enclosure II – Draft given by Pakistan on Hydel formula on 15.8.59, ¶ 2(b).

⁵² World Bank, Minutes of Meeting, 8 September 1959, **Exhibit P-0474**, ¶ B.1.

⁵³ World Bank, Minutes of Meeting, 8 September 1959, **Exhibit P-0474**.

APPENDIX D

ENGINEERING ANALYSIS FOR DETERMINATION OF ANTICIPATED LOAD, INSTALLED CAPACITY AND MAXIMUM PONDAGE AS PER THE COURT'S GENERAL ISSUES AWARD AND PO17

APPENDIX D

Engineering analysis for determination of anticipated load, installed capacity and maximum Pondage as per the Court’s General Issues Award and PO17

D.1 INTRODUCTION

1. In its General Issues Award, the Court interprets Paragraph 8(c) of Annexure D to the Treaty as meaning that “the Treaty’s method for calculating maximum Pondage [...] includes, as elements, the HEP’s installed capacity and anticipated load”.¹ To reach this conclusion, the Court has referred to engineering practices at the time of the Treaty.² The installed capacity of a Plant would be available to supply the local power demand with the Firm Power and firm energy³ being the amounts that could be guaranteed.
2. However, in the modern context, the reference to anticipated load must consider that India’s Annexure D, Part 3 HEPs are connected to a large power system that is linked across Northern India and not just the vicinity of the power plant. Plants connected to the grid can supply their power and energy outputs to optimise the overall cost of supplying the grid system load, rather than the local load as may have been the case in the early 1960s. This appreciation affects the determination of the installed capacity for the anticipated load of a given Plant, and the potential utilisation of the Pondage at a Run-of River power station.
3. It is appropriate then to consider the power demand to understand how projects on the Western Rivers can be expected to operate within India’s modern, integrated power system and the meaning of the criteria for design of the Plants in Paragraph 8 of Annexure D to the Treaty. Further, given the Court’s direction that installed capacity

¹ General Issues Award, ¶ 737.

² W.P. Creager & J.D. Justin (eds.), *Hydroelectric Handbook* (2nd Edition: John Wiley & Sons 1950), **Exhibit P-0309 (resubmitted)**, Chapter 10.

³ In the context of hydroengineering, the term “firm power” is understood to mean the “[p]ower intended to have assured availability to the customer” or in this case, the power system, “to meet all or any agreed upon portion of the [load] requirements”, see United States Army Corps of Engineers, “Engineer Manual 1110-2-1701”) Hydropower dated 31 December 1985 (“USACE, *Hydropower*”), **Exhibit P-0302 (resubmitted)**, S-12, p. 302; “firm energy” is counterpart to “firm power” and is understood to mean “[e]lectric energy which is intended to have assured availability to the customer to meet any or all agreed upon portion of his load requirements”, see *id.*, S-5, p. 295.

and anticipated load are to be considered in calculations of maximum Pondage under Paragraph 8(c), it is important to review how these parameters affect the calculation, given the context of the Plants on the Western Rivers within the overall Northern India power system.

4. This **Appendix D** sets out Pakistan’s analysis of the Court’s chosen methodology for the calculation of maximum Pondage, by including the parameters identified and the context of the Plants in the power system. The Appendix discusses the expected operation of power stations within the power system, including how the plant may actually be operated, in line with the Court’s direction in its General Issues Award.⁴ The Appendix also provides background information to illustrate how a Run-of-River power station can be expected to be dispatched within a power system, with the actual dispatch affecting both the timing of the energy generation at the Plant and the maximum capacity utilised in some parts of the year. Both factors affect the determination of the Pondage, along with the installed capacity and the anticipated load.

D.2 POWER SYSTEM IN NORTHERN REGION OF INDIA

D.2.1 SYSTEM DESCRIPTION

5. The power system in India comprises five interconnected regional power grids.⁵ India’s Annexure D, Part 3 HEPs on the Western Rivers of the Indus Basin connect to the grid for the Northern Region of India (“**NRG**”), which, as of 2025, had a total installed capacity of approximately 137,000 MW.⁶
6. As with any power system, power and energy are delivered to customers in real time, with the output from many individual power stations being aggregated through the power system. The energy delivered varies seasonally with the seasonal variation of the hydrology and the peak power tends to grow from year to year in line with the

⁴ General Issues Award, ¶ 743 (“As a general matter, the plant’s installed capacity and anticipated load must correspond to how the plant will actually be operated; it cannot be hypothesized in a manner that serves to inflate the amount of maximum Pondage”).

⁵ See Pakistan’s Memorial in the First Phase on the Merits, 22 March 2024, ¶ 11.114, Figure 11.5.

⁶ National Power Portal (India), “Location wise Northern Region state-wise installed capacity as on 30/11/2025”, available at: <https://npp.gov.in/public-reports/cea/monthly/installcap/2025/NOV/capacity2-Northern-2025-11.pdf>, **Exhibit P-0714**.

economic development of the country.⁷

7. Power demand is recorded through the Grid Controller of India Limited (“**Grid-India**”), which is a division of the Ministry of Power.⁸ Grid-India monitors and ensures round-the-clock integrated operation of the Indian power system. Grid-India consists of five Regional Load Despatch Centres (“**RLDCs**”) and the National Load Despatch Centre (“**NLDC**”). Hourly load data is reported to users in India with access to the Grid-India system. The NRG is one part of the system monitored by Grid-India.
8. For the purposes of this analysis, hourly data were obtained from the India Climate & Energy Dashboard,⁹ which provides a selection of data from Grid-India. Hourly load data for the NRG was obtained for the period from 1 January 2024 to 30 June 2025, by accessing the available data sets.¹⁰ More information is available to users in India with access to the Grid-India database. For present purposes, however, the publicly available information is sufficient to illustrate for the Court the operation of the NRG, i.e., the power system relevant to the development of India’s Run-of-River HEPs in the Indus Basin.
9. The NRG comprises a variety of power generating technologies including thermal power stations using coal, oil and gas, photovoltaic solar facilities, wind turbines, and hydropower plants (both storage and Run-of-River hydropower).¹¹

D.2.2 SEASONAL POWER DEMAND

10. As highlighted above, hourly data was obtained for the period from 1 January 2024 to 30 June 2025, which period covers two winter seasons and parts of two monsoon

⁷ See generally, USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, Chapter 3, p. 398.

⁸ Press Information Bureau, Ministry of Power, Government of India, “Power System Operation Corporation Limited is now Grid Controller of India Limited”, 14 November 2022, available at: <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1875864>, **Exhibit P-0715**.

⁹ Hourly data from Grid-India available at: <https://iced.niti.gov.in/energy/electricity/distribution/national-level-consumption/load-curve>.

¹⁰ Hourly demand data for the Northern Region of India from 1 January 2024 to 30 June 2025, **Exhibit P-0717**. This exhibit compiles data obtained from the India Climate & Energy dashboard, and is presented in native Excel format, comprising 13,128 separate hourly demand values. The hourly demand data for 2024 and 2025 were obtained separately from the India Climate & Energy dashboard, and have been consolidated in the same Excel file for ease of reference.

¹¹ National Power Portal (India), “Location wise Northern Region state-wise installed capacity as on 30/11/2025”, available at: <https://npp.gov.in/public-reports/cea/monthly/installcap/2025/NOV/capacity2-Northern-2025-11.pdf>, **Exhibit P-0714**.

seasons. This data range is sufficient to illustrate the seasonal variability of the power demand and the effect of the monsoon.

11. **Figure 1** shows the variation of the hourly power demand through the relevant period in the NRG. The demand varies each day, and the plot illustrates the range of the demand by the width of the zone showing the plotted points, as annotated in the figure. As can be expected, the demand varies seasonally, with the highest demand occurring during the monsoon period when air temperatures are highest, requiring widespread use of air conditioning. The winter seasons have lower demand but there is a greater variability within each day, as evidenced by the variation illustrated in the figure. This pattern is consistent with variations in loads for heating and cooling being a large part of the total demand.

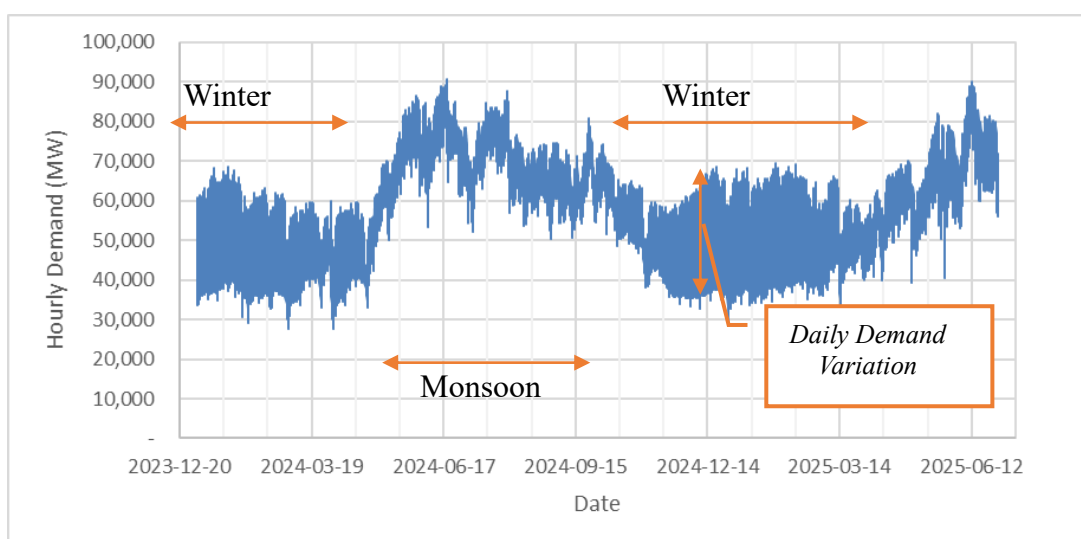


Figure 1 - Seasonal Power Demand in the NRG (Jan 2024-Jun 2025)¹²

12. Run-of-River hydropower projects will normally operate continuously at their full installed capacity during the monsoon season (i.e., as baseload plants) when high flow conditions equal or exceed the installed capacity of the Plant, i.e., if the flow rate is higher than the capacity of the Plant, then the Plant will operate at the full load with surplus water being released through a spillway. Pondage will not be used in this season because the high flow rate does not leave surplus capacity available for daily peaking and because the reservoir should be lowered to the Dead Storage Level for sediment

¹² Based on hourly demand data for the Northern Region of India from 1 January 2024 to 30 June 2025, **Exhibit P-0717**.

management via sluicing. If the Plant is at full capacity, then there is no possibility to reduce output to store water in Pondage and release subsequently at a Plant discharge higher than the capacity.

13. Run-of-River hydropower projects can provide some load following (i.e., daily peaking) during the dry season because the available inflow will often be less than the capacity of the power station.¹³ Pondage will only be used during the period of the year when the flow rate is less than the capacity of the Plant.
14. By contrast, storage hydropower projects can provide peaking during the monsoon season while the reservoir is being refilled by the surplus inflow, but the available storage can still provide some daily peaking capability. Storage reservoir peaking is used year-round to supply power and meet energy demands in the power system.
15. The overall power system must be capable of providing power and energy year-round. The limitation on the ability of Run-of-River Plants to provide daily peaking in the wet season means that other Plants must be added to the generation system to serve this role. The availability of these plants will usually limit the required peaking operation of Run-of-River plants during the dry season.

D.2.3 WEEKLY DEMAND

16. The hourly demand data for the winter (dry) season periods in the NRG were extracted from the larger data set to assess the variability of the demand during the period when Pondage is likely to be used.
17. Data for the dry seasons was plotted as illustrated in **Figure 2** for early 2024, and **Figure 3** for the 2024-2025 dry season. As illustrated, the largest daily range in demand variability is during the December to mid-February periods in the selected years of 2024 and 2025. These circumstances demand larger Pondage because of the need to regulate generation from the Plant to match the power demand.
18. The data set was reduced by selecting data for December to mid-February for further analysis. The period selected was for weeks from 6 January 2024 to 24 February 2204,

¹³ See generally, USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, Chapter 2, p. 336.

and 7 December 2024 to 8 February 2024, comprising the weeks with the largest daily variability seen in **Figure 1**, for a total span of 18 weeks. A comparison of the figures for the two dry season periods demonstrates that the load curves are substantially similar.

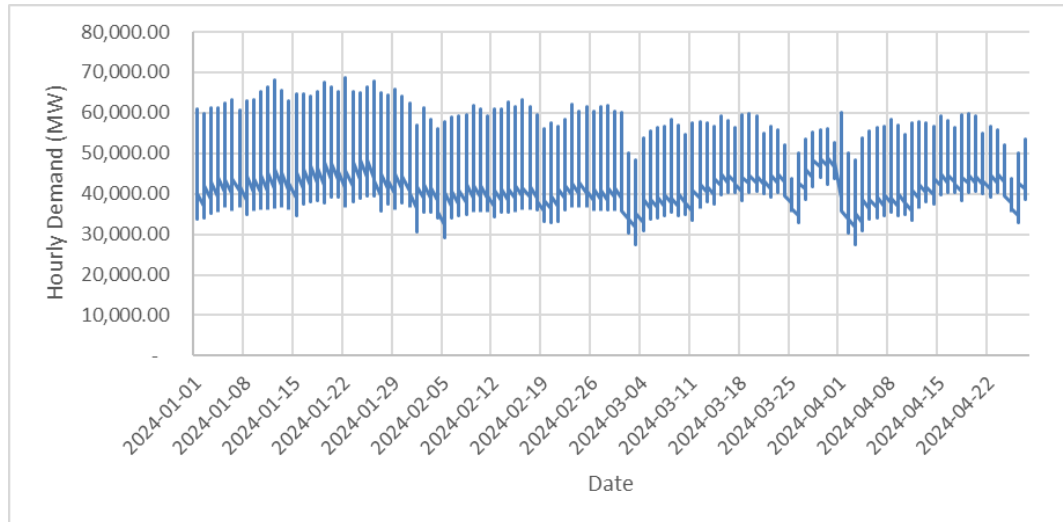


Figure 2 - Hourly Power Demand in the NRG (Jan-Apr 2024)¹⁴

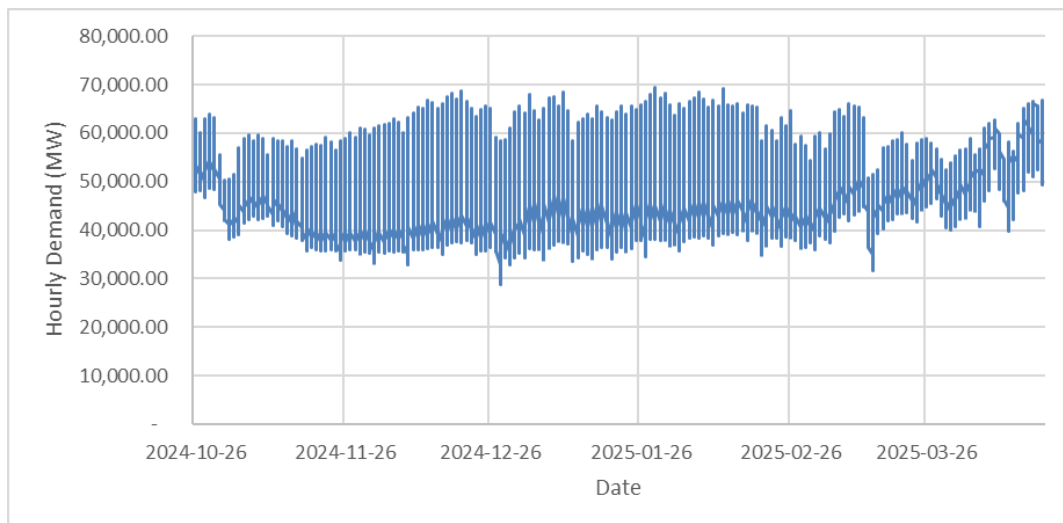


Figure 3 - Hourly Power Demand in the NRG (Nov 2024-Mar 2025)¹⁵

19. From the selected data, a typical hourly load curve for a seven-day period was computed as the average of the hourly load in the selected 18-week period. The resulting average weekly load curve is given as **Figure 4** and shows load variation between about 35,000

¹⁴ Based on hourly demand data for the Northern Region of India from 1 January 2024 to 30 June 2025, **Exhibit P-0717**.

¹⁵ *Id.*

MW and 65,000 MW with two daily peak periods occurring at about 11:00 and 20:00. The overnight low period is short at about three to four hours of base load, and the daily peak period exceeds the average load for about 15 to 16 hours per day.

20. Load curves from selected weeks within the data selection are similar, including the daily peaks and the moderate differences between days. The weekly load curves for the selected period are shown in **Figures 4A-4E** below.
21. The energy being generated for any day within the week can be computed by adding the hourly power values in MW to give the energy in MWh. The MWh values are converted to GWh by dividing by 1,000. **Figure 5** shows the energy produced per day during the week. When averaged over the period selected for the analysis, the weekend day energy is about 99% of the average for the week whereas the weekday energy is about 101% of the average for the week.
22. However, the weekend energy was not consistently lower than the weekday energy and higher average weekend energy was observed in five of the eighteen weeks. The small weekend-weekday variability is attributed to the natural variability of the demand within the region. The averaged load curve gives the weekend energy as 98.7% of the average weekly energy, and the weekday energy as 100.5% of the average weekly energy. The weekend energy values for the period selected ranged from 93 to 103% of the average weekly energy. The weekday energy values ranged from 99 to 103% of the average weekly energy. The weekend and weekday values are combined so that the overall weekly energy is equal to the average energy. The resulting average load curve was, therefore, adopted as being representative of the weekly load.
23. The available power stations must be capable of meeting demand on weekends as well as weekdays. The power demand for the NRG does not show a significant differentiation from weekend to weekday.

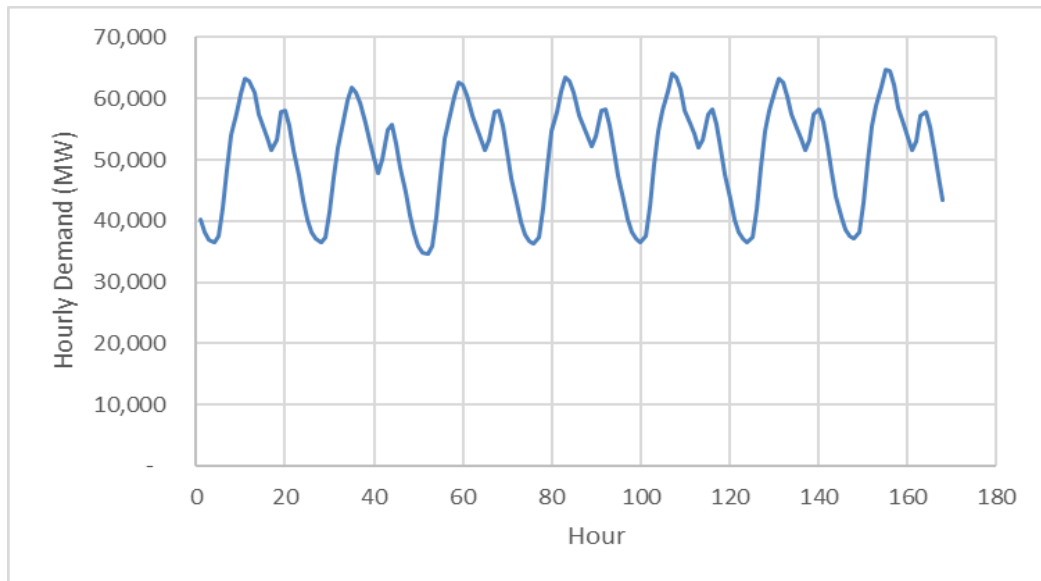


Figure 4 - Average Weekly Load Curve for the NRG (Jan 2024-Jun 2025)¹⁶

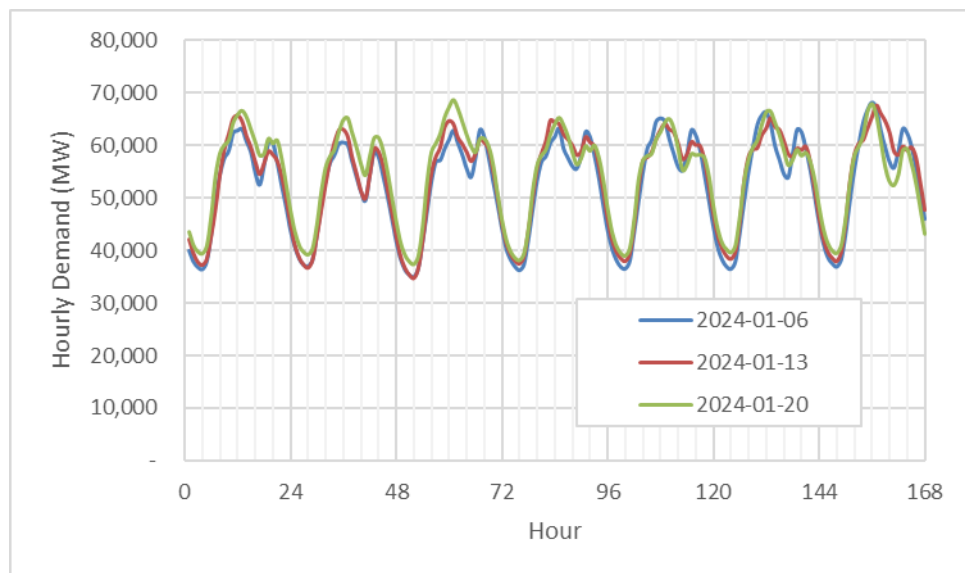


Figure 4A – Actual weekly load curves for the NRG (Jan 2024)¹⁷

¹⁶ *Id.*

¹⁷ *Id.*

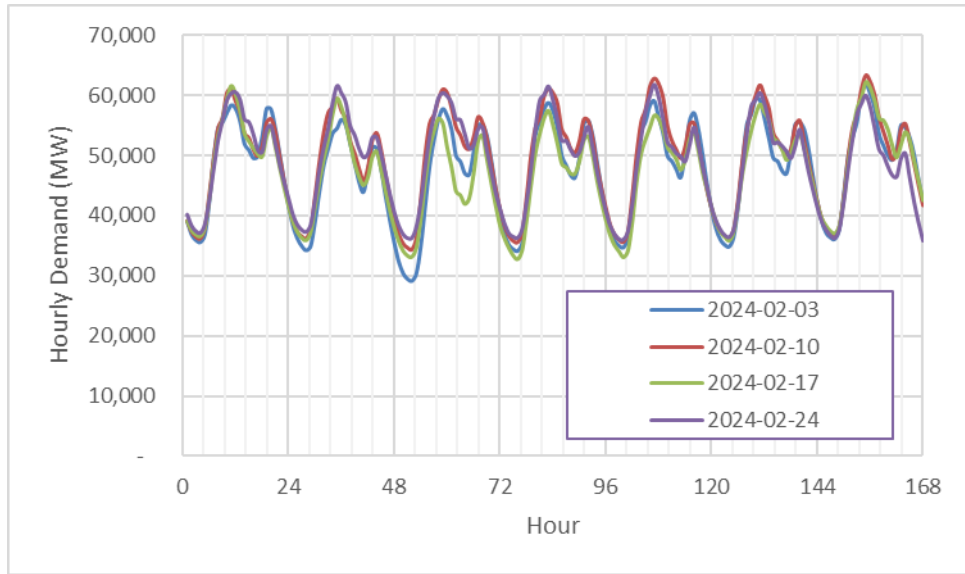


Figure 4B - Actual weekly load curves for the NRG (Feb 2024)¹⁸

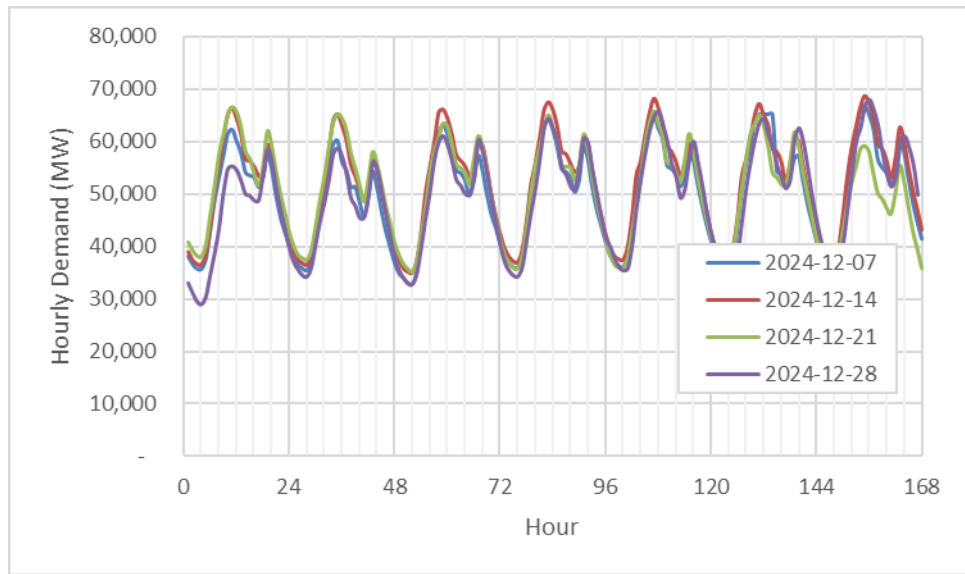


Figure 4C - Actual weekly load curves for the NRG (Dec 2024)¹⁹

¹⁸ *Id.*

¹⁹ *Id.*

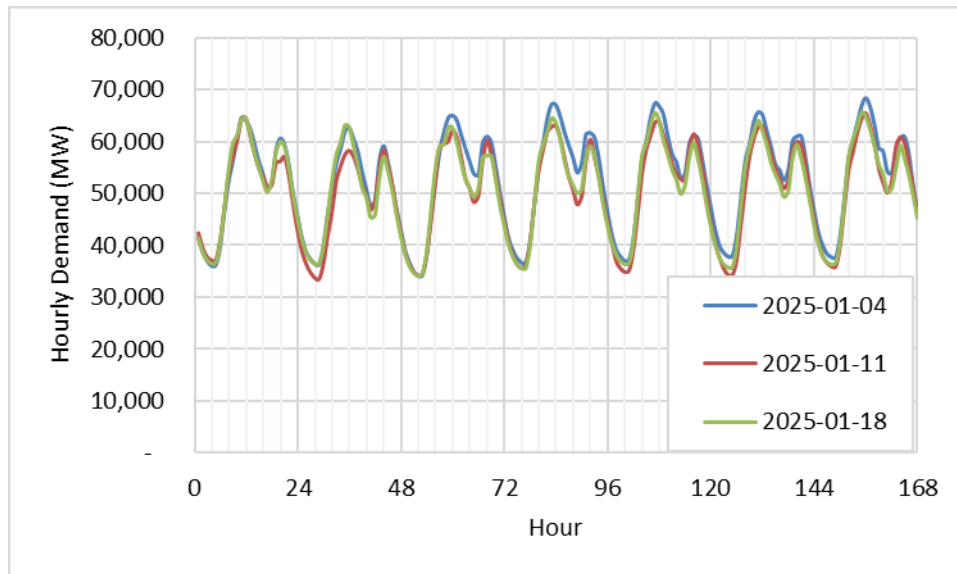


Figure 4D - Actual weekly load curves for the NRG (Jan 2025)²⁰

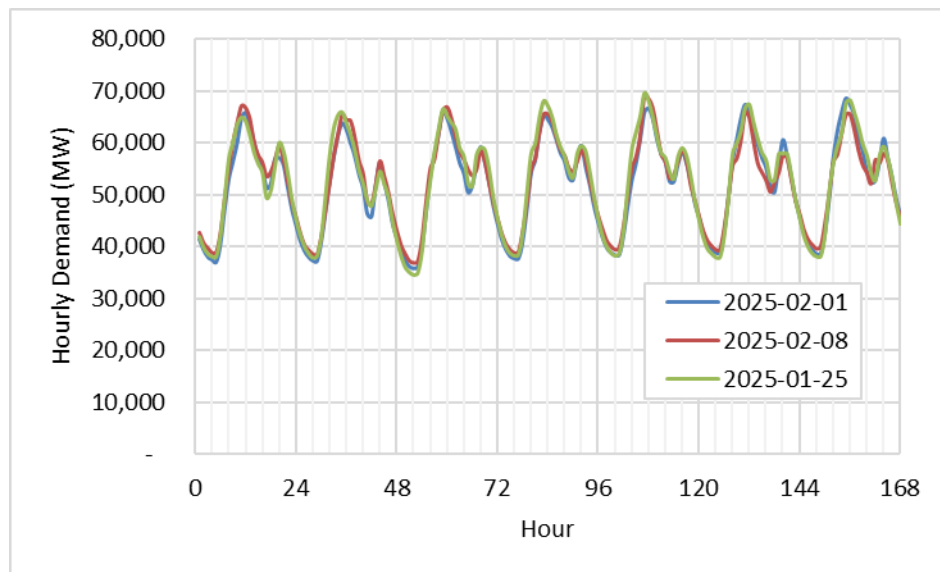


Figure 4E - Actual weekly load curves for the NRG (Feb 2025)²¹

²⁰ *Id.*

²¹ *Id.*

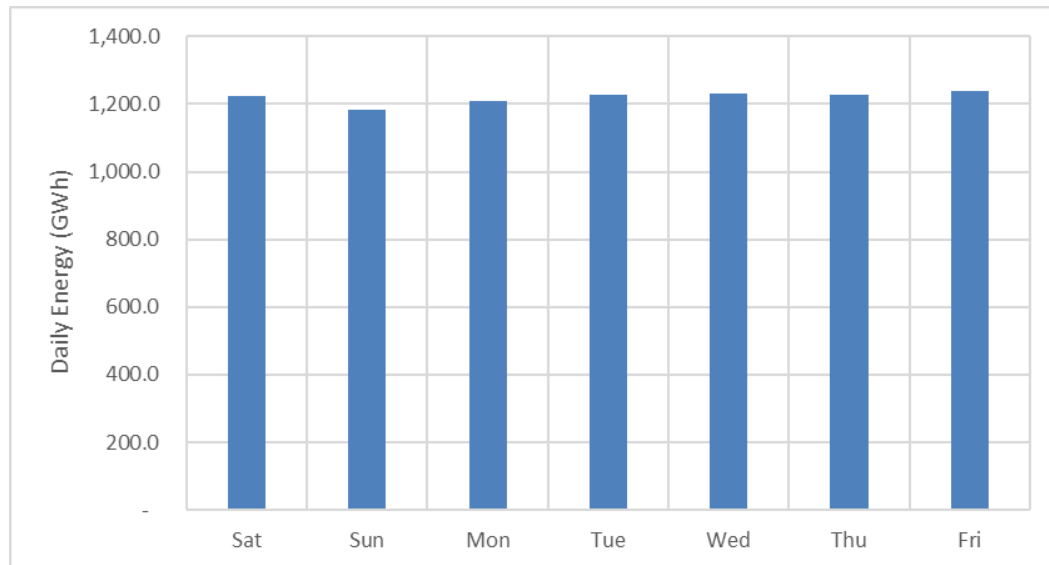


Figure 5 - Daily Energy Production per average week (Jan 2024-Jun 2025)

24. The above analysis confirms that there is very limited variation in load, on average, from weekend to weekday in the NRG. When individual weeks are examined, the weekend-weekday relationship similarly shows very small differences. The weekly variation determined from the actual power system demand can be used to assess the weekly Pondage requirements.
25. The conclusion from the load data accessed from Grid-India for the NRG is that weekly load demand is generally consistent throughout the week with no significant reduction in weekend load. The reduction that does occur is attributable to the natural variability of the demand rather than a systemic condition. This has implications for how a Plant in such a grid would be operated. Pondage computations should consider the variation based on the actual demand of the power system.
26. A rational plant operator for the NRG would seek to dispatch the Plant every day and not reduce or limit the Plant's operations to allow for storage over the weekend other than that determined from the actual demand.
27. The hourly demand analysis was for a typical operating period spanning two recent dry seasons. The demand in the power system will increase as the general level of economic activity increases, as expected for load forecasting.²² The hourly variability of load can

²² See generally, USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, Chapter 3, p. 398

be shown using load duration curves, which show the percentage of time that the load is exceeded. A load duration curve presents the same information as available in the weekly load curves in a different form.

28. Consistency of the load duration curve with time gives an indication of whether the character of the load is changing along with the economic growth. Detailed forecasting of load is beyond the scope of this Appendix and is not necessary to confirm the Pondage for a given power station. However, an indication of the variation is available by considering historical load duration curves available for the NRG, as shown in **Figure 6**.
29. The available load duration curves are reasonably consistent with some variability occurring between years as expected given variable weather and other influences. The curves show a similar shape indicating that the load factor will be reasonably consistent. The comparison suggests that the weekly load curves selected for the NRG will be representative of the load curves that can be expected in the future, i.e., the system does not show dramatic changes in the distribution of the load.

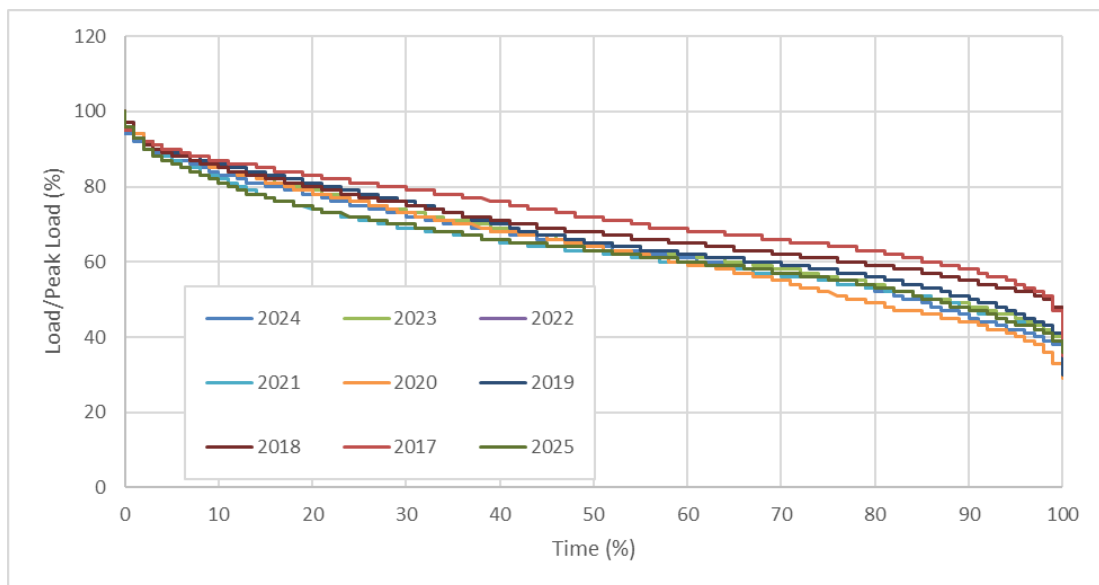


Figure 6 – Historical load duration curves for the NRG (2017-2025)²³

²³ Based on historical load duration curves for the Northern Region of India for 2017-2025, available at: <https://iced.niti.gov.in/energy/electricity/distribution/national-level-consumption/load-curve>, **Exhibit P-0718**. This exhibit compiles data obtained from the India Climate & Energy dashboard, and is presented in native Excel format. The load duration curve data for each year was obtained as individual files from the India Climate & Energy dashboard, and have been consolidated in the same Excel file for ease of reference.

30. The curves were analysed further to derive an average load duration curve for the period, as shown in **Figure 6A**.

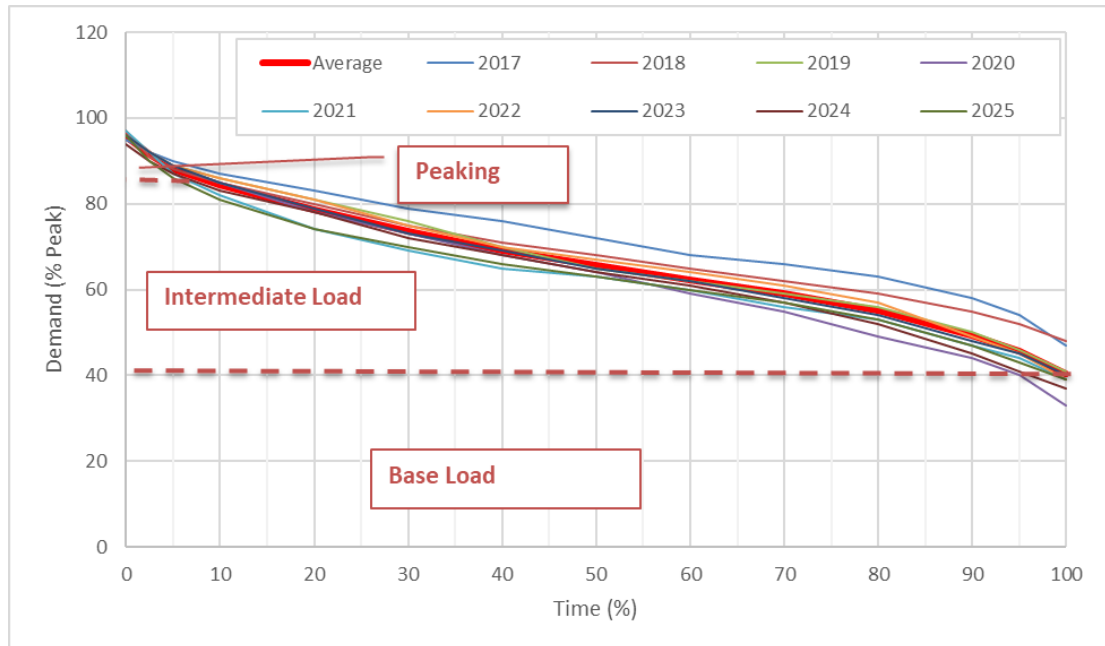


Figure 6A – Average load duration curve for the NRG (2017-2025)

31. The curves for the individual years vary around the average curve, with no trend indicating a change. Base load is consistently about 40% of the total, with the level of the base fluctuating among the years as illustrated in **Figure 6B**.

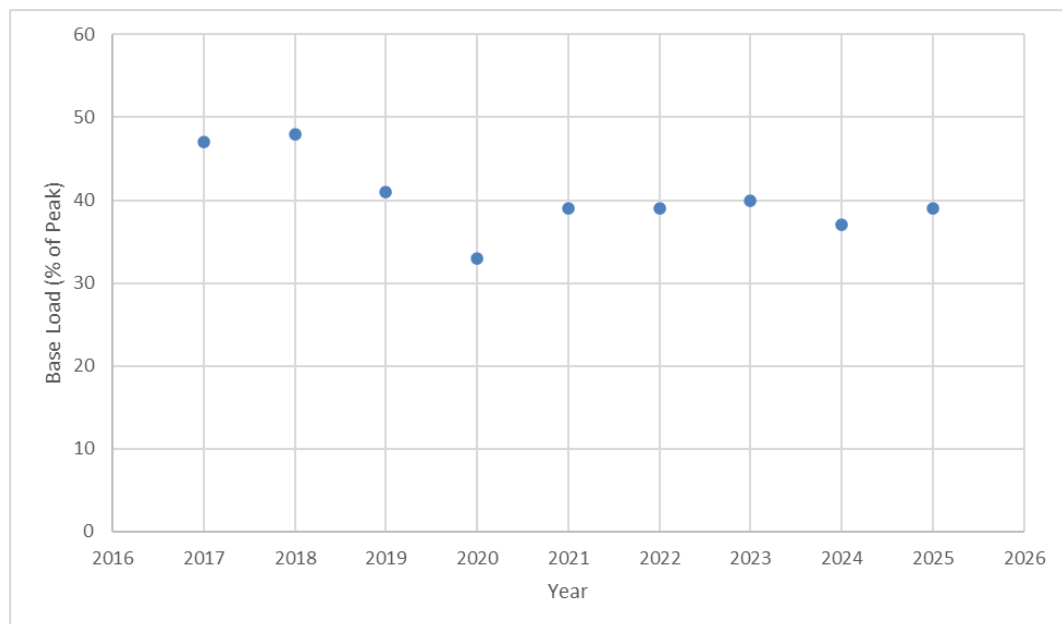


Figure 6B – Fluctuations in base load of the NRG (2017-2025)

32. The slope of the intermediate load part of the load duration curve is also consistent with some variation among years, but with no significant trend, as seen in **Figure 6C**.

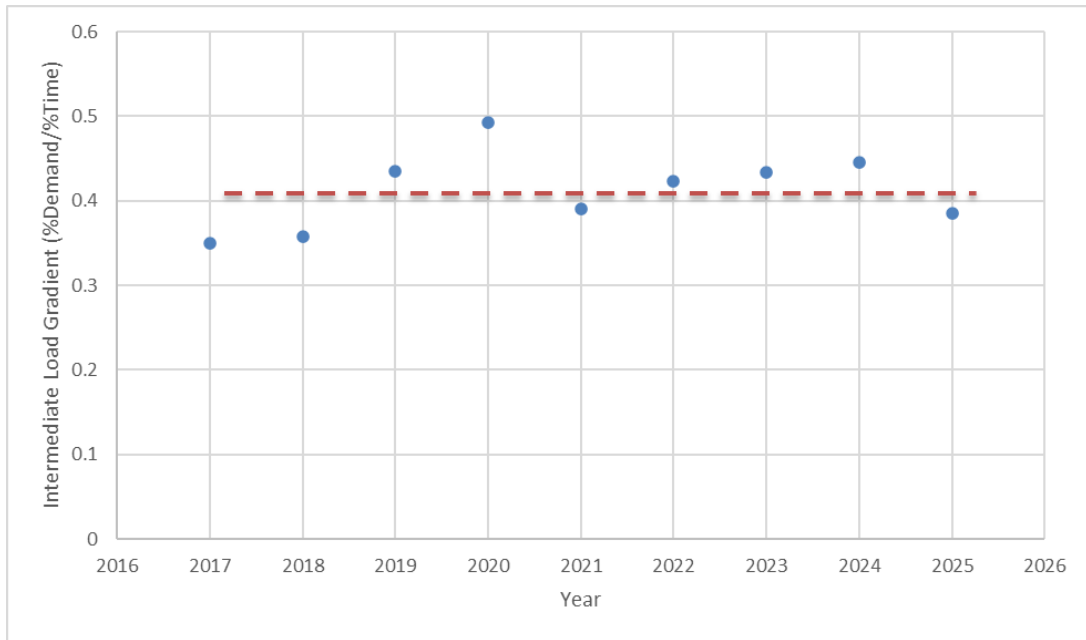


Figure 6C – Fluctuations in intermediate load in NRG (2017-2025)

33. The peak period apparent in the load duration curves is short, amounting to less than 10% of the time, as shown by the minor upturn of the load duration curve near the vertical axis in **Figure 6A**.
34. Generation expansion planning considers what Plants must be added to a power system to allow the overall system to continue to supply power and energy with the selected level of reliability. Any analysis considers the capability of the existing system of Plants and determines what must be added to enable the expanded system to supply the forecast loads. As such, generation expansion planning considers marginal generation additions to supply marginal load increases.
35. This is important in that any Plant being planned can be optimised for the anticipated load at the time of installation knowing that it will continue to provide similar benefits for the life of the Plant. Any future evolution in the character of the power system will be accommodated by future power plants that can be optimised along with the existing generation resources to supply the future load.

D.3 LOAD DURATION ANALYSIS

36. A load (or power) duration curve shows the relationship between generating capacity requirements and capacity utilisation.²⁴ The hourly demand data are organised to show the percentage of time that each load level is exceeded. The load duration curve can be used to show how a given power station would be used in supplying the overall weekly power and energy demand in the power system.
37. **Figure 7** shows the load duration curve derived for the selected hourly demand period of 1 January 2024 to 30 June 2025. The curve is computed for the weeks when Pondage use will be at a maximum in the NRG. The vertical axis shows the ratio of the load to peak load during the week, and the horizontal axis shows the percentage of time that this load is exceeded.

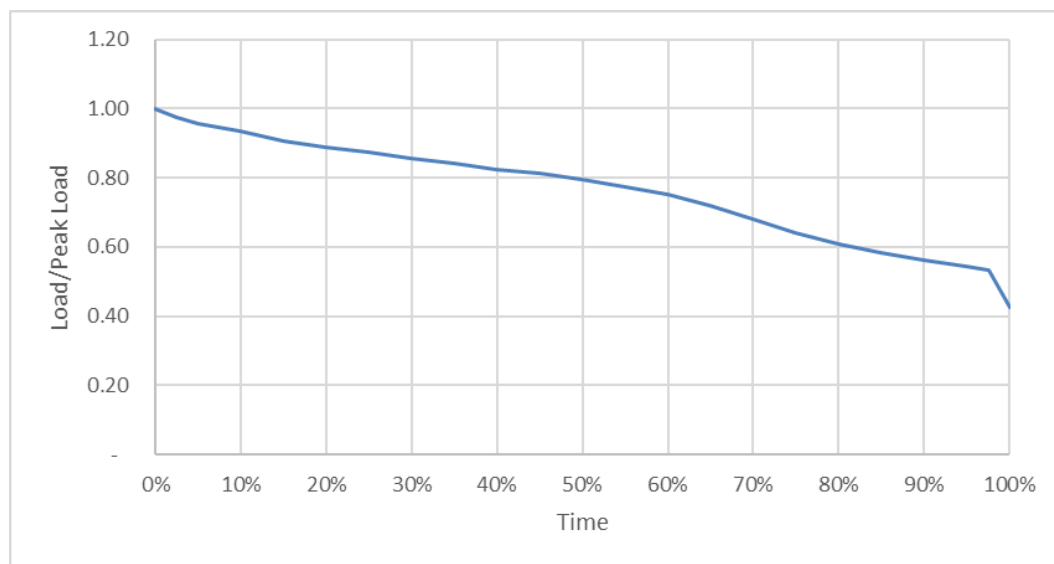


Figure 7 - Hourly Load Duration Curve for maximum Pondage use period²⁵

38. As noted above, the peak hourly demand on the power system is approximately 66,400 MW (**Figure 4**) – which becomes 1.00 (or 100% of demand) on the vertical axis. The curve shows that demand on the power system never drops below approximately 40% of peak load, and that for half of the week the power system is operating at 80% of peak load or above. There is no distinct peak period with an upturn

²⁴ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, 5-6 – 5-10, pp. 451-455.

²⁵ Based on hourly demand data for the Northern Region of India from 1 January 2024 to 30 June 2025, **Exhibit P-0717**.

of the curve near the vertical axis. This reflects a general lack of variability in demand within the power system in question and demonstrates that Plants must be able to supply a large base load, substantial intermediate load, and a relatively small part of energy reserved for peaking.

39. The area of a horizontal slice through the load duration curve, whose height equals to the installed capacity of the plant power, represents the energy available from that Plant. This relationship is used to place the Plant in the load duration curve at the location where the installed capacity is plotted at the vertical axis and the area of the curve within the horizontal slice is equal to the energy available. The position of the Plant on the load duration curve will then show the number of hours that the Plant is to be used during the week and provides some guidance on the variability of load during the operating period. This procedure is referred to as “load stacking” and is used for power generation planning purposes.²⁶
40. For generation planning²⁷ using Run-of-River projects, the stacking position is determined by the Plant’s Firm Power and firm energy.²⁸ The position of the Plant in the curve must consider all other Plants available in the power system. Accordingly, if there are other Plants providing most of the peaking, then a Run-of-River Plant may be relegated to a lower position in the load duration curve where energy is used but the Plant’s full installed capacity may not be utilised.
41. This is consistent with the typical optimisation of the installed capacity for Run-of-River Plants, where the capacity is determined through economic optimisation of the firm energy and secondary energy²⁹ available during periods of high flow. Larger installed capacity is often used for Run-of-River plants to generate secondary energy in the wet season of the year rather than for providing only for the Firm Power/energy.

²⁶ For an example of load stacking, see S. W. Hadley, J. W. Van Dyke, and T. K. Stovall, “The Effect of Distributed Energy Resource Competition with Central Generation”, Engineering Science and Technology Division, Oak Ridge National Laboratory, U. S. Department of Energy, October 2023, **Exhibit P-0719**.

²⁷ Generation planning here refers to the process of determining which power stations should be added to a growing power system to enable the system to guarantee the supply of future demands. The firm energy and firm power are used to represent what each Plant, or combination of Plants, can add to the power system. The resulting generation plan shows the optimum investment plan for the system.

²⁸ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, pp. 584-586, 589-595, 746-748.

²⁹ Secondary energy being “all hydroelectric energy other than primary energy. Secondary energy is generally marketed as non-firm energy”, *id.*, S-5, p. 295.

firm energy is valued at the cost of the capital investment plus the value of any displaced energy from alternative sources, such as thermal plant fuel. Secondary energy has a lower value in a power system and is typically valued at just the cost of energy displaced (typically fuel cost), rather than at the full cost of generation comprising fuel and capital investments in the power stations.

42. The Kiru HEP has an installed capacity of 624 MW and a Firm Power of 57.65 MW, as cited in Pakistan's Memorial in the First Phase on the Merits.³⁰ The Firm Power is determined with a Minimum Mean Discharge ("MMD") of 65 m³/s minus the allocation of 16.33 m³/s assigned as environmental flow. Firm Power is 51.8 MW after deduction of the environmental flow. The Plant's turbines have a combined discharge of 586 m³/s. With the discharge reduced by the amount of the environmental flow, then the available Plant capacity is 606.6 MW.
43. The corresponding weekly energy, adopting the Court's analysis, is 8,707 MWh (i.e., 51.8 MW x 168 hours). The Plant may be stacked in the load duration curve by finding a horizontal slice where the available capacity and firm energy (i.e., 606 MW and 8,707 GWh) can both be positioned. The position of the Kiru HEP in the load duration curve is shown in **Figure 8**. The energy available from environmental flow will stack at the base of the load duration curve as baseload available continuously for 168 hours per week. This would appear in **Figure 8** as a small slice across the full width at the base of the diagram.

³⁰ Pakistan's Memorial in the First Phase on the Merits, 22 March 2024, ¶ 11.53.

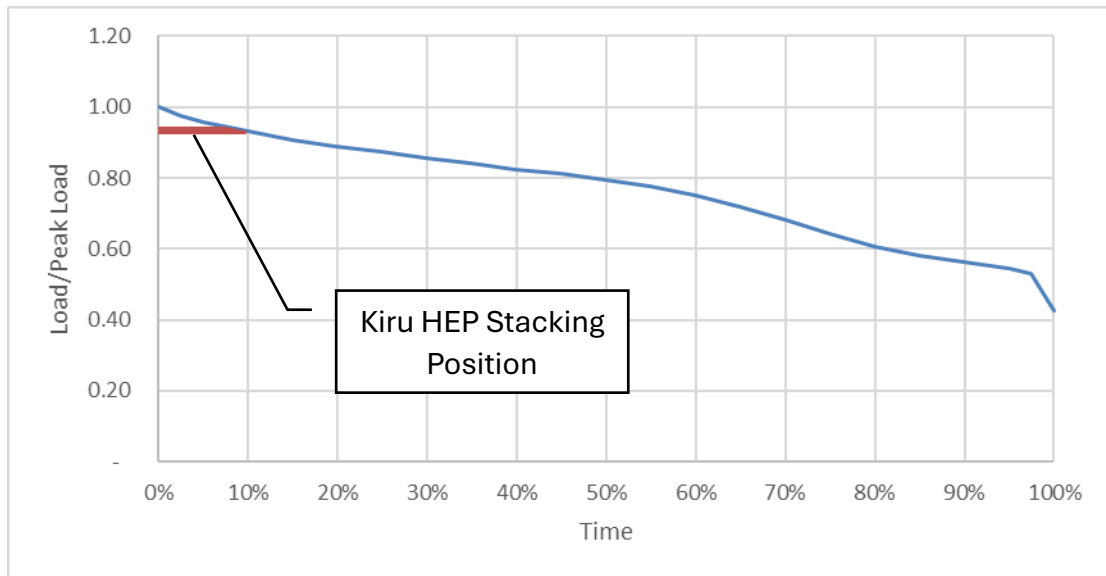


Figure 8 - Kiru HEP Plant Stacking

44. With the conditions available for the Kiru HEP, the Plant would supply load with a position on the load duration curve from 61,687 MW to 62,294 MW, corresponding to the Plant operating for 16.1 hours per week, including 12.58 hours at peak load. The daily generation is accordingly 2.3 hours. The load on the plant will vary from zero to the capacity within the generating time.
45. The stacking position would be lower if the capacity were adjusted to account for operation at the best efficiency point and outage of generating units for maintenance.
46. The plant factor³¹ for this idealised position is 8.5%, which is outside the range normally associated with Run-of-River hydropower. For reference, plant factors typical for hydropower plants are as follows:³²

Plant Type	Plant Factor
Peaking	5 to 17%
Intermediate	17 to 40%
Base Load	Over 50%

³¹ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, S-6, p. 296: “Plant Factor. The ratio of the average load on the plant for the period of time considered to the aggregate rating of all the generating equipment installed in the plant.”

³² *Id.*, 6-8 – 6-9, pp. 591-592.

47. A peaking plant may have a plant factor up to about 17% and may be required to operate 4 to 8 hours per day during high demand periods, or for shorter periods or at reduced output for the remainder of the time.³³
48. The Kiru HEP, as defined by India, would fall within the pure peaking type of project, which typically requires unconstrained reservoir storage that allows for plant dispatch as needed.³⁴ A Run-of-River Plant with Pondage designed to displace thermal power plants in the generation expansion plan would have a plant factor of approximately 17 to 40%.
49. The installed capacity can be increased if the Plant is intended to primarily generate secondary energy that would displace other more expensive generation at existing power stations. The plant factor in this case would be in the range of 10 to 40%. The actual plant factor depends on annual production and can only be determined based on an economic analysis that optimises the value of Firm and secondary energy with the cost of providing larger installed capacity.
50. With the short generating time provided for the Kiru HEP in India's calculation of maximum Pondage,³⁵ Pakistan's understanding is that the installed capacity of the HEP was selected based on the ability of the Plant to generate secondary energy during the wet season, rather than providing peaking value during the dry season. The secondary energy will displace more expensive energy from other existing generating plants in the power system. However, capacity costs (i.e., capital investment costs) of the alternative plants are not affected by the full installed capacity of the Kiru HEP. The number of peaking hours in the dry season should, therefore, be adjusted based on the actual operation in the power system rather than the Secondary Power selected for economic optimisation.
51. Intermediate load plants typically serve that part of the load that occurs nine to 14 hours per day.³⁶ A HEP intended for an intermediate load operation would be expected to have a plant factor in the 17 to 40% range. The HEP might operate for 14, 20, or even

³³ *Id.*

³⁴ *Id.*

³⁵ Letter No. 3/6/2007-IT/2371 from the ICIW to the PCIW dated 1 June 2021 (with enclosure), **Exhibit P-0546 (resubmitted)**, p. 51 (Annexure VII).

³⁶ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, 6-8, p. 591.

24 hours a day at full output during high load periods, and a fewer number of hours (often at reduced output), at other times. Water availability has a major effect on the type of load the project can carry at any given time. Daily or weekly Pondage is needed to permit shaping of flows to meet the hourly power demand pattern.³⁷

52. Pondage is used for an intermediate load plant to enable the turbines to operate above their minimum load during low flow periods, and to increase the efficiency by operating close to the best efficiency point.

D.4 DAILY PONDAGE AND INSTALLED CAPACITY

53. The preceding sections have dealt with the anticipated load on the Plant, demonstrating that there is an hourly load variation within each day and a smaller variation between days for the NRG. The second factor identified for the analysis is the installed capacity of the Plant, which is related to the plant factor described in **Section D.3**.
54. The Pondage required on each day depends on the actual flow available and the capacity of the Plant that will be used, as explained in the following paragraphs.
55. The inflow volume can be computed as the product of the flow rate (Q) on a given day and the number of hours in the day. The number of hours of operation at the plant capacity (Q_P) within the day can then be computed as follows (where t_P is the number of hours the HEP would operate at the plant capacity to discharge the available inflow volume):

$$t_P = \frac{Q \times 24}{Q_P}$$

56. Flow rate and power (capacity), or flow volume and energy, are analogous for purposes of the principles set out in this section.
57. The Pondage volume (V_P) required for the selected capacity and energy is computed from the balance of inflow and outflow in the day by recognizing that there must be a daily equivalence. If the HEP provides peaking for part of the day, then water is stored for the other part of the day and released during the peaking period. For daily peaking,

³⁷ *Id.*

the volume of water inflow over the 24 hours of the day must equal the volume of water discharged during the peaking period.

58. This Pondage will combine with any weekly variation in storage, which will be discussed in a subsequent section.
59. The volume (V_P) that must be stored to be used during the peak period can be computed as:

$$V_P = Q \times (24 - t_p) \times 0.0036$$

60. These two equations combine to give the Pondage required assuming equal daily peaking at flow rate Q_P . The inflow rate (Q) is adjusted to deduct the environmental flow (Q_e), giving the volume available for peaking with the eco-flow being used for base load.

$$V_P = \left(24(Q - Q_e) - \frac{(24)(Q - Q_e)^2}{Q_P} \right) \times 0.0036$$

61. The above relationship gives the same Pondage as determined using the Excel table provided by the Court, and is attached to this Memorial as **Appendix E**.
62. Pondage computed for the installed capacity, with the flow equal to the MMD will depend on assumed installed capacity, with the variation for the Kiru HEP shown in **Figure 9**. The daily peaking time for this calculation is in the range from 1 hour to twenty-four hours, depending on the ratio of the Rated Flow to the MMD.

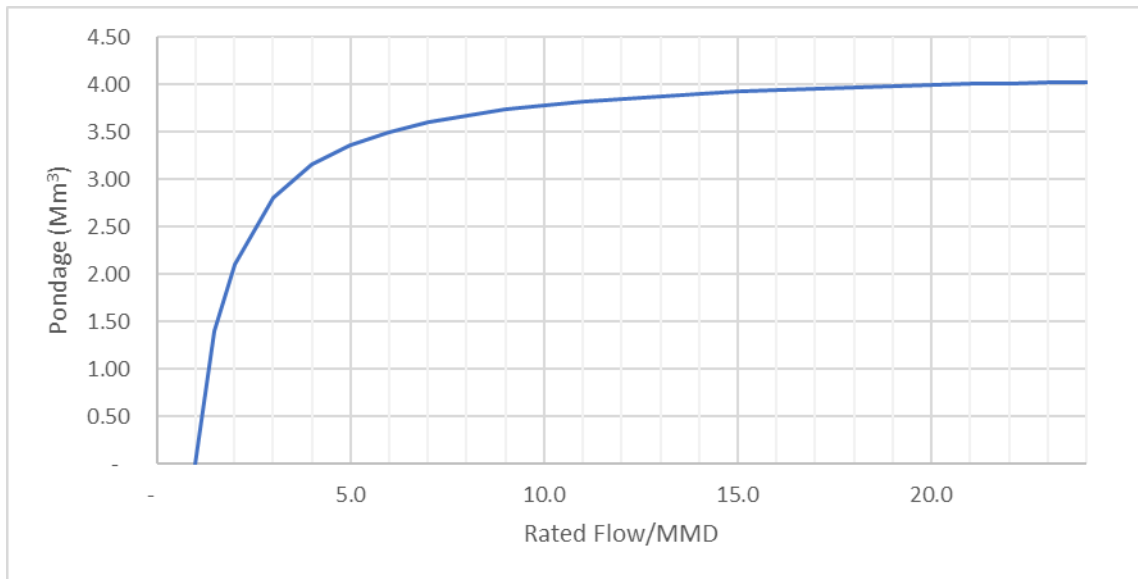


Figure 9 - Variation of Kiru HEP Daily Pondage with Installed Capacity

63. The daily Pondage in this analysis, therefore, depends on the MMD and the selected installed capacity for the Plant. The amount allocated for environmental flow is deducted from the MMD, giving a peaking volume based on 48.67 m³/s in place of the MMD computed according to the Treaty.
64. The Treaty does not specify what installed capacity would be used for computation of Firm Power according to Paragraph 8(c) of Annexure D. The Court, in its General Issues Award has determined, however, that the installed capacity chosen by India for an Annexure D, Part 3 HEP should be “realistic, well-founded, and defensible”.³⁸ Firm Power itself is computed for the MMD.
65. It should be noted that the capacity used for calculations of the required Pondage does not necessarily equal the full installed capacity of the Plant. Accordingly, selection of the capacity to be used for the calculation of required Pondage should consider how the Plant will be operated.
66. Hydro turbine efficiency varies as a function of the generating head and flow rate.³⁹ The best efficiency point is typically at a flow rate of 75 to 90% of the maximum flow

³⁸ General Issues Award, ¶ 743 (“As a general matter, the plant’s installed capacity and anticipated load must correspond to how the plant will actually be operated; it cannot be hypothesized in a manner that serves to inflate the amount of maximum Pondage”).

³⁹ U. S. Department of the Interior, Bureau of Reclamation, “Selecting Hydraulic Reaction Turbines”, Engineering Monograph No. 20, 1976, **Exhibit P-0720**.

rate at the Plant's installed capacity for Francis turbines, 60 to 90% for Kaplan turbines, or 30 to 90% for Pelton turbines.⁴⁰ The turbine design can be optimised to select the flow and head conditions with the best efficiency point

67. When installed capacity is increased for secondary energy generation, the best efficiency point will be selected closer to the lower end of the range to account for the frequent operation during the dry months of the year with lower flows.⁴¹ Accordingly, the capacity used for computation of Pondage during the dry season months should be approximately 85%, or lower, of the rated capacity, when considering Francis turbines, which are the turbines specified in the Kiru HEP design by India.
68. Operation at the best efficiency point increases energy production and is a normal optimisation undertaken by the plant operator.⁴² The number of generating hours are increased with the same flow volume available to achieve a net increase in the energy produced.
69. The Plant flow rate will typically vary from minimum power with the Plant start up to the peak power with operation at the best efficiency point. The minimum power will depend on the turbine type and the specific turbine design. However, the minimum for a Francis turbine might be about 50 to 60% of the rated power whereas the minimum for a Kaplan turbine might be about 20 to 30% of the rated power.⁴³
70. The minimum power (and its associated discharge) may affect the daily timing of the peaking if the flow volume is low. Minimum power will impose a maximum limit on the number of generating hours for the Plant, i.e., for the available inflow volume the turbines cannot operate at less than the minimum power, which then gives the maximum number of hours available for generation.
71. While simple block loading can be assumed for preliminary studies, the actual turbine discharge must vary from the minimum load to the selected daily peak following the daily demand curve while considering the hydraulic conditions and turbine design. The

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, 5-11 – 5-18, pp. 456-463.

⁴³ U. S. Department of the Interior, Bureau of Reclamation, "Selecting Hydraulic Reaction Turbines", Engineering Monograph No. 20, 1976, **Exhibit P-0720**.

variation in power will also depend on power system demand with the demand increasing from the time the turbine starts at the minimum power up to the planned power during the peak. The load variation is illustrated by the load curves shown previously. The Plant will never achieve an abrupt block operation when the load increases from zero to the daily maximum instantaneously.

72. The capacity available for peaking should also be adjusted to account for turbines being out of service for annual maintenance. Maintenance typically requires two to four weeks annually for each turbine giving an availability of 95% or less.⁴⁴ The maintenance plan will reduce the effective capacity available during the dry season because units will be taken off-line during the period when capacity is not required for energy generation. Rivers with high sediment load will typically require maintenance at the upper end of the range because of the need for annual sediment abrasion inspections or repairs.
73. The daily peaking period can be adjusted by accounting for operation at best efficiency, the minimum turbine loading, and daily ramp up and ramp down. Adjusting for the best efficiency point and the MMD less environmental flow, the operation time for the Kiru HEP increases from 2 hours at installed capacity to 2.4 hours at best efficiency discharge, using India's assumptions.
74. Operation of a Run-of-River HEP for only 2.4 hours per day is considered to be abnormal, with peaking periods in the range of four to eight hours being typical.⁴⁵ The Plant should be expected to operate and provide generation during the daily load period, typically from about 8:00 through to 22:00 by reference to the NRG load curve. Even if the Plant were providing energy to complement solar generation, the operating time would be from about 17:00 to 22:00, when there is higher demand after the solar radiation ends with sunset.
75. The operation should, therefore, adjust to allow for approximately five to 14 hours of daily generation with load varying throughout the day according to the system demand.

⁴⁴ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, 2-11, p. 346; ASME, "The Guide to Hydropower Mechanical Design", Prepared by the ASME Hydro Power Technical Committee, HCI Publications, 1996 (Extract), **Exhibit P-0716**.

⁴⁵ USACE, *Hydropower*, **Exhibit P-0302 (resubmitted)**, 6-9, p. 592.

This would be consistent with an intermediate peaking plant or a Run-of-River plant (see paragraph 51 above).

76. A constraint on the minimum number of operating hours daily is consistent with the expected operation in a large, interconnected power system where the system dispatcher must coordinate the start up and shut down of a large number of power stations to correspond to load variations. System operation would be simplified if plants could be scheduled for dispatch during the full peaking period at a suitable capacity to avoid multiple on-off adjustments through the system.
77. In the case of the Kiru HEP, the required Pondage, computed using the MMD less environmental flow, and assuming 85% of the installed capacity, is estimated at 3.8 Mm³ based on a daily operation of 2.4 hours. If the operation time is increased to a more reasonable six hours, then the Pondage would be 3.2 Mm³.
78. The relationship of the daily peaking flow rate with the Pondage and daily generating hours is shown in the **Figure 10**. The figure is computed using the equation provided above by varying the flowrate assumed to be available for peaking. The resulting Pondage and the number of generating hours are determined explicitly from the relationships. The curves can be used to find the Pondage required for any assumed daily peaking time and the associated daily peak period flow rate. For example, as shown by the arrows in the figure, eight hours of peaking gives a peak period flow rate of 146 m³/s and a Pondage of 2.8 Mm³. The peak period flow rate is greater than the minimum for turbine operation.

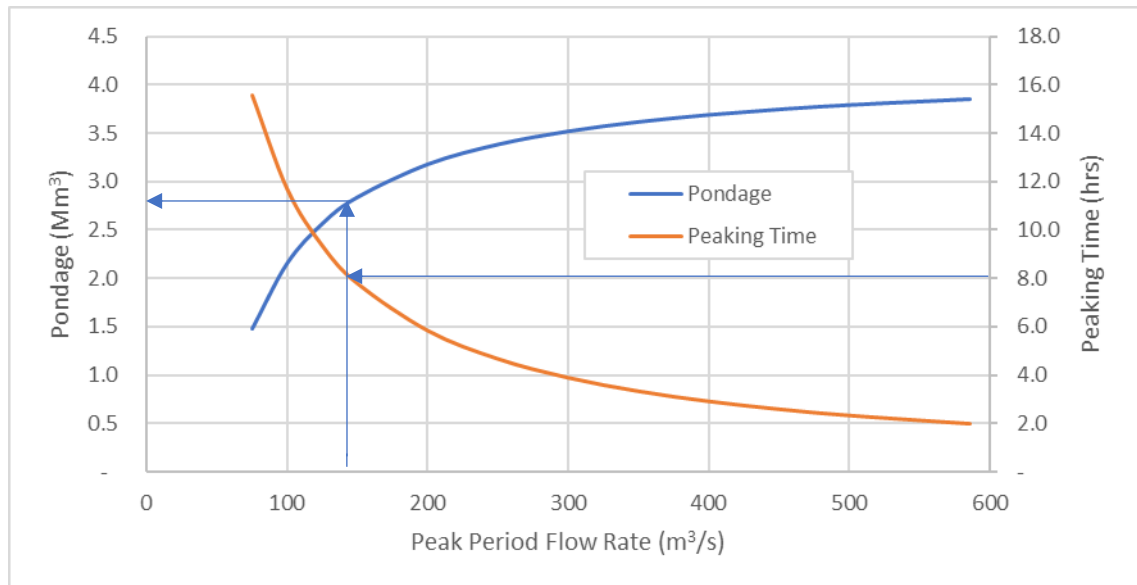


Figure 10 - Variation of Kiru HEP Daily Pondage with Peaking Capacity

79. The analysis shows that Pondage varies as a function of the peaking period capacity assumed in the computation. However, because the operation must reflect realistic operating conditions, the MMD used in the computation must be decreased by the environmental flow, the capacity must be reduced to operate near the best efficiency point, outage of units for annual maintenance should be considered, and the resulting daily operating time must fall within the range typically expected for a Run-of-River plant in a large interconnected power system.
80. With a daily generation time of about four hours, the Pondage is limited to approximately 3.5 Mm³, whereas an increase to eight hours of generation time gives Pondage of about 2.8 Mm³. The Pondage illustrated in **Figure 10** is sufficient for the Firm Power assuming that the daily load is uniform through the week, as indicated by the NRG system data discussed above.

D.5 WEEKLY PONDAGE AND INSTALLED CAPACITY

81. Weekly operation of the Plant is implied by the provisions of Paragraph 15 of Annexure D to the Treaty, which sets out daily and weekly limitations on the outflow rate as compared to the inflow rate of each day. Paragraph 15 does not include any reference to computation of the Pondage and similarly Paragraph 8(c) does not refer to Paragraph 15. Accordingly, Paragraph 15 is read as a constraint that must be respected when Pondage is determined based on the MMD, and anticipated load and installed

capacity. Paragraph 15 operates as a limit on the results obtained from the computation under Paragraph 8(c).

82. In keeping with the findings in the Court’s General Issues Award – i.e., that Pondage must be determined based on the actual operation of the Plant⁴⁶ – the actual weekly load for the Plant should be used for the computation of the Pondage. **Section D.2** above presented the weekly load for the dry season months, illustrated in **Figure 4**.
83. Firm Power is computed from the MMD less the environmental flow, which amounts to 51.8 MW for the Kiru HEP. The weekly variation of the load on the Plant can then be determined from the load curve shown in **Figure 4**, after adjustment so that the mean load is equal to Firm Power. The resulting load curve is shown in **Figure 11**.

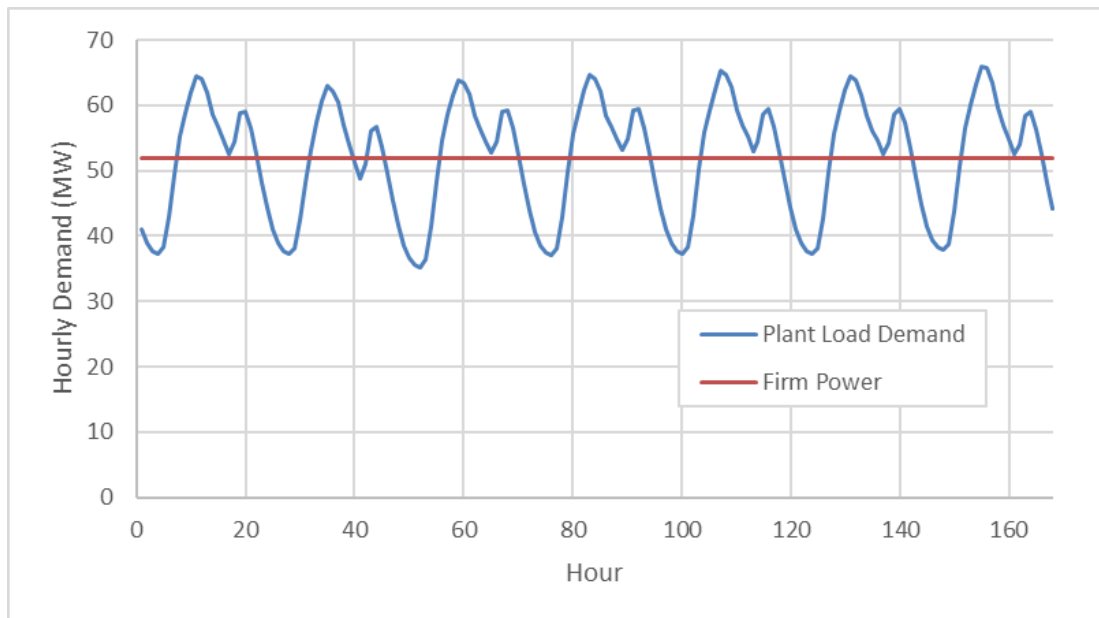


Figure 11 - Weekly Load for Firm Power for the NRG (Jan 2025-Jun 2025)

84. As illustrated, the weekly load varies hourly but will provide the same energy over the week as would be available with Firm Power. Pondage can be computed from this curve by determining the volume required to regulate the Plant’s power to match the load demand.
85. The analysis compares the cumulative load with the cumulative Firm Power throughout

⁴⁶ General Issues Award, ¶ 743 (“As a general matter, the plant’s installed capacity and anticipated load must correspond to how the plant will actually be operated; it cannot be hypothesized in a manner that serves to inflate the amount of maximum Pondage.”)

the week. The difference between the two cumulative amounts at any hour is the Pondage required. The maximum Pondage for the week is then found as the largest amount in any of the 168 hours of the week. This accounts for daily fluctuations as well as variability from weekend to weekday.

86. **Figure 12** shows the resulting cumulative power curves for the Kiru HEP. The maximum Pondage is 131 MWh, which converts to 0.47 Mm³. The environmental flow will be released continuously and will not affect the Pondage. The low value of Pondage determined from the load curve is because the power station operates continuously with the load varying to match the power system load curve. There is a very small difference in the load between the weekends and the weekdays so there is very limited storage required to regulate within the seven days.

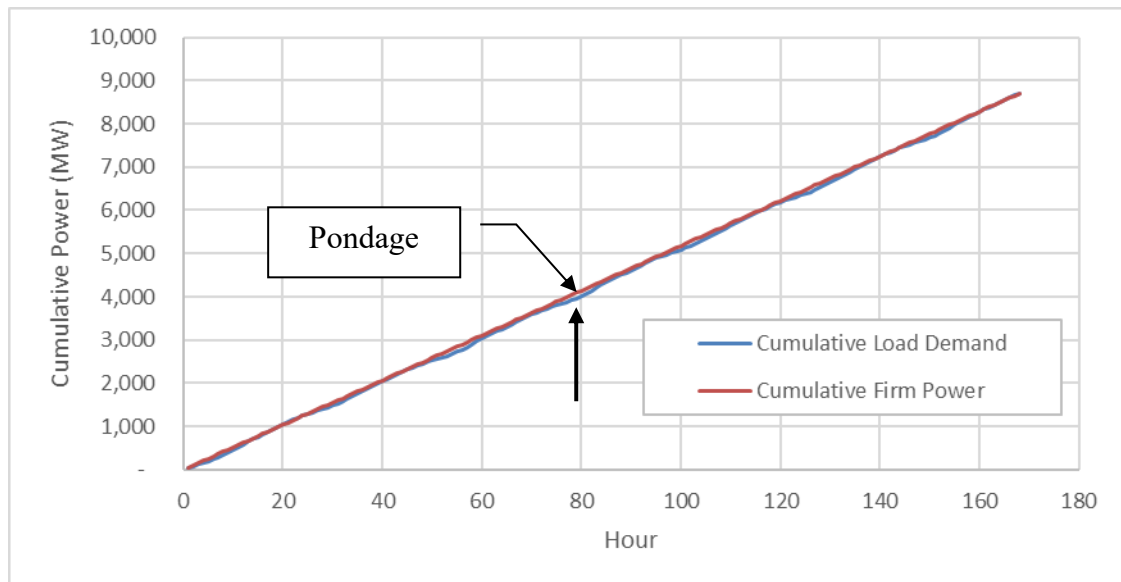


Figure 12 - Kiru HEP Weekly Pondage Analysis

87. The actual weekly load demand requires generation on the weekends at a level very close to the weekday generation. Operation of the Plant will, therefore, be required during the weekends. An operation with the Plant largely shut down through the weekend would not be optimal because other generating facilities would be required to provide the generation not supplied from the Plant. This would increase the capital costs for investment in plant capacity.
88. The actual load for the NRG system shows a much lower weekend to weekday variation

than what is permissible in accordance with Paragraph 15. However, as the Court determined, Paragraph 15 is a limitation on the range of flow rates rather than a design criterion. Therefore, application of Paragraph 15 limits for selection of Pondage would not be consistent with the actual load of the power system over a week.

89. The weekly load variation will produce Plant loads that fall below the minimum acceptable turbine load. Accordingly, some Pondage should be used to allow for daily peaking to keep the turbines operating between their minimum load and the selected peak period load, as described in the following paragraphs.

D.6 COMBINED WEEKLY AND DAILY PONDAGE

90. The maximum Pondage will be a combination of the weekly amount computed in **Section D.5**, and a daily amount assuming the Plant can operate for some daily peaking, as discussed in **Section D.4**. Pondage would be required daily to ensure that the Plant would operate above the minimum flow limit for the turbines.
91. Given the modest amount of Pondage required for weekly power regulation, the total Pondage can be estimated as the sum of the weekly and daily amounts computed.
92. In the case of the Kiru HEP, the total Pondage would be 0.47 Mm³ for weekly regulation combined with perhaps 3.2 Mm³ for the daily peaking operation.⁴⁷ The total Pondage required for Firm Power is accordingly 3.67 Mm³ and doubling that arrives at a maximum permissible Pondage of 7.34 Mm³. The weekly variation in flow rates to regulate Firm Power to supply the load demand will be within the constraints imposed by Paragraph 15. The result computed here abides with the requirements of Paragraph 15, as required by the General Issues Award.⁴⁸ Pakistan has also illustrated the results of this computation in **Appendix E, Scenario 5** as further explained below.

D.7 ALTERNATIVE CALCULATIONS OF MAXIMUM PONDAGE AT THE KIRU HEP USING THE COA EXCEL TABLE

93. The Excel table provided by the Court (“**COA Excel Table**”) provides a dispatch

⁴⁷ Assuming 6 hours daily generation.

⁴⁸ General Issues Award, ¶ 747(c) (“Pondage required for Firm Power shall be calculated in a manner that abides by the daily and weekly release requirements set forth in Paragraph 15 of Annexure D.”)

schedule for the Kiru HEP which is used to determine the Pondage. The COA Excel Table does not include the rationale (since India does not provide one) used to select the allocation of operating hours through the week. The resulting Pondage in the COA Excel Table was also obtained assuming block loading of the generating units at either zero load or at the installed capacity.

94. As noted in the preceding sections of this Appendix, the maximum load during the peak period should be reduced to account for operation of generating units ideally at their best efficiency point and the fact that units will be off-line for maintenance outage for part of the dry season. These two factors alone would reduce the Pondage computed using the COA Excel Table. The capacity should also be reduced to provide for a more reasonable daily dispatch schedule.
95. The COA Excel Table also assumes a weekend to weekday difference in flow volume, presumably using the limits in Paragraph 15 as constraints. The COA Excel Table does not provide any information as to how the available flow volume was distributed between weekend and weekday (as India does not provide this information), but the results in the table indicate that it is akin to using Paragraph 15 as a design criterion, rather than an operational restraint as provided for in the Treaty.
96. To assist with the Court's analysis, Pakistan has prepared five alternative scenarios for the calculation of maximum Pondage at the Kiru HEP, using the COA Excel Table format, and illustrated in **Appendix E**. The five scenarios, and the adjustments made in each, are as follows:
- (a) **Scenario 1:** India allowed for a total power production of 13.95 hours of generation per week for the Kiru HEP.⁴⁹ In this scenario, Pakistan has only adjusted one element of the calculation—dividing the total power production evenly through every day of the week, for 1.99 hours of production per day. The even division of power across the week corresponds to the average weekly load curve for the NRG, which shows very little weekday to weekday variation in demand (see paragraphs 19 to 25 above). The results in the scenario do not

⁴⁹ Letter No. 3/6/2007-IT/2371 from the ICIW to the PCIW dated 1 June 2021 (with enclosure), **Exhibit P-0546 (resubmitted)**, p. 51 (Annexure VII).

exceed the daily and weekly inflow and outflow limits of Paragraph 15. Accounting for environmental flow, the Pondage required for Firm Power is calculated as 3.86 Mm³, which, when doubled in accordance with Paragraph 8(c) of Annexure D, provides for a maximum Pondage of **7.71 Mm³**.

- (b) **Scenario 2:** India's calculations for the maximum Pondage for the Kiru HEP resulted in a total energy production of 8,706.4 MWh (see **Appendix E, Energy Comparisons**). In this scenario, Pakistan has adjusted the equal daily generation time so that it corresponds to a more practical period of 3.21 hours of generation time per day, for a total of 22.49 hours of generation time per week, which results in the same total energy production (see **Appendix E, Energy Comparisons**). Further, Pakistan has reduced the "turbine discharge" from a maximum of 586 m³/s, as provided by India (that assumes all four turbines are running at their full installed capacity), to 363.61 m³/s, to account for at least one turbine being offline for maintenance, and the remaining three turbines being run at their best efficiency point of 85% of their rated capacity. The results in the scenario do not exceed the daily and weekly inflow and outflow limits of Paragraph 15. Accounting for environmental flow, the Pondage required for Firm is calculated as 3.64 Mm³, which, when doubled in accordance with Paragraph 8(c) of Annexure D, provides for a maximum Pondage of **7.29 Mm³**.
- (c) **Scenario 3:** In this scenario, Pakistan has adjusted the equal daily generation time to achieve a period of eight hours of generation time per day, to correspond to the higher end of the range of the typical generation time for peaking plants (see paragraph 74 above), for a total of 56 hours of generation time per week, which also results in the same total energy production (see **Appendix E, Energy Comparisons**). Given the amount of water available is fixed at the HEP site, there is a further adjustment made to the "turbine discharge", with a reduction to 146.01 m³/s, with the load being shouldered by a single turbine running at nearly 100% of its rated capacity. The same turbine discharge could be achieved by two turbines running at 50% of their rated capacity, but this would be a less efficient approach. The results in the scenario do not exceed the daily and weekly inflow and outflow limits of Paragraph 15. Accounting for

environmental flow, the Pondage required for Firm is calculated as 2.80 Mm³, which, when doubled in accordance with Paragraph 8(c) of Annexure D, provides for a maximum Pondage of **5.61 Mm³**.

- (d) **Scenario 4:** In this scenario, Pakistan has further adjusted the equal daily generation time to achieve a period of 12 hours of generation time per day, corresponding to the profile of an intermediate Plant (see paragraph 51 above), for a total of 84 hours of generation time per week, which also results in the same total energy production (see **Appendix E, Energy Comparisons**). Again, to account for the fixed volume of available water, the turbine discharge is reduced to 97.34 m³/s, with the load being shouldered by a single turbine running at 66% of its rated capacity. The results in the scenario do not exceed the daily and weekly inflow and outflow limits of Paragraph 15. Accounting for environmental flow, the Pondage required for Firm is calculated as 2.10 Mm³, which, when doubled in accordance with Paragraph 8(c) of Annexure D, provides for a maximum Pondage of **4.20 Mm³**.
- (e) **Scenario 5:** In this scenario, Pakistan provides a methodology for the calculation of maximum Pondage set out in **Sections D.3-D.6** above, i.e., based on Pakistan's understanding of the Court's interpretation of Paragraph 8(c) in its General Issues Award. **Figure 10** above can be used to compute the peak flow rate for any required number of daily operating hours; Pakistan had adjusted the relevant parameters in this scenario, so that the value for maximum Pondage is similar to the value calculated in paragraph 92 above. The adjustments made by Pakistan are as follows:
- i. Daily generating time is set to six hours.
 - ii. The weekday energy is set to 101% of the average weekly energy with the resulting weekend daily energy being 97.5% of the average weekly energy. These values are consistent with the NRG load curve shown previously in **Figure 4**.
 - iii. One unit is assumed to be offline for maintenance, and the maximum capacity is equal to 85% assuming operation at best efficiency.

However, these parameters do not actually affect the result when a daily generating time of six hours is specified.

- iv. The weekday peaking flow rate is $196.6 \text{ m}^3/\text{s}$ and the weekend peaking flow rate is $189.8 \text{ m}^3/\text{s}$.
- v. The peak period is assumed to end at 23:00. The load is assigned equally through the six-hour generating period.

The results in the scenario do not exceed the daily and weekly inflow and outflow limits of Paragraph 15. Accounting for environmental flow, the Pondage required for Firm Power is calculated as 3.36 Mm^3 , which, when doubled in accordance with Paragraph 8(c) of Annexure D, provide for a maximum Pondage of **7.72 Mm^3** . The weekly energy generated by this scenario is the same as any of the other scenarios considered except that slightly more is delivered during weekdays than on weekends. The Pondage required for Firm Power would be 3.15 Mm^3 if the energy were distributed equally rather than using the weekly load curve. The difference of 0.21 Mm^3 is the amount attributable to the weekly load variation. This value is slightly less than the approximate value given in paragraph 92 above and reflects the result when all parameters are considered concurrently. A similar adjustment would be attributable to any of the other assumed daily generation time scenarios.

D.8 SUMMARY

- 97. The Pondage computed from the load curve accords to the needs of the power system in which the Plant will operate, including the weekly variation in load. The installed capacity is accounted for in the computation but subject to limitations based on a realistic and reasonable number of daily operating hours, plant maintenance requirements, and operation at reasonable efficiency levels. The computation provides for the Firm Power being delivered during the week with some block loading during days within the week. Any weekend to weekday demand variation is accounted for in the computation by provision of a weekly Pondage amount based on the actual load curve for the NRG.

98. The daily generation periods are reasonable and practical for dispatch within an integrated power system. The Plant would start generation at a selected load as load increases and would continue in operation until the load diminishes after the peak.
99. The calculation presented in this Appendix complies with the Court’s General Issues Award in that it uses the *actual* load demand in India (NRG), the installed capacity, and the Firm Power to determine the Pondage. Pondage is the sum of a weekly volume required to regulate the weekly load demand and an assumed block loading using the number of generating hours obtained from the load duration curve for the Plant and adjusted for actual operation.
100. The resulting flow variations implied by the Plant operation abides by the constraints given in Paragraph 15. However, that the NRG load demand has very modest variation between weekends and weekdays with the result that the large flow variation limits in Paragraph 15 are not needed to serve the power system demands. While such limits may have been required at the time of the Treaty’s drafting – where, as noted, a Plant could be required on its own to service a local power system with far greater variation in daily and weekly demand – with respect to the Kiru HEP at least, the relative stability of the NRG means that adequate Pondage can be provided within the constraints of Paragraph 15.

* * *

APPENDIX E

Adjustable Operating Pool Calculations
Table developed by Pakistan

Adjustable Operating Pool Calculations Table (populated with data and inputs as requested by India for the River HEP)									
Minimum Mean Discharge (MMD)			=	05	cumec				
Permissible (all 4 units) discharge			=	16.13	cumec				
Minimum environmental flow			=	2743	cumec-hr (per week)				
Daily inflow >= 24 h X MMD			=	780	cumec-hr (per day)				
Minimum outflow to be released in a day-X% daily inflow			=	130% MIN	cumec-hr (per day)				
Minimum outflow to be released in a day-X% daily inflow			=	2028	cumec-hr (per day)				
Total			=	624.0	MW				
Peak power (assuming 3% efficiency) (MW)			=	92.2800% EFF (w)					
Day	Time	Inflow	Peaking & Release	Storage	Cumulative Storage	Power Generation			
Start Period	End Period	OS/OT	No. of hrs	(cumec-hr)	(cumec-hr)	No. of hrs	Hrs remaining	MW	
Opening balance = - 2%									
Sat-Sun									
Daily inflow (%)									
62.7%									
Min. Condition									
OK									
Max. Condition									
OK									
Total									
17:00 17:57									
17:57 18:00									
18:00 19:00									
19:00 20:00									
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21:00 22:00									
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06:00 07:00									
07:00 08:00									
Sun-Mon									
Daily inflow (%)									
62.7%									
Min. Condition									
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Max. Condition									
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05:00 06:00									
06:00 07:00									
07:00 08:00									
Mon-Tue									
Daily inflow (%)									
62.7%									
Min. Condition									
OK									
Max. Condition									
OK									
Total									
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05:00 06:00									
06:00 07:00									
07:00 08:00									
Tue-Wed									
Daily inflow (%)									
128.4%									
Min. Condition									
OK									
Max. Condition									
OK									
Total									
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06:00 07:00									
07:00 08:00									
Wed-Thur									
Daily inflow (%)									
128.4%									
Min. Condition									
OK									
Max. Condition									
OK									
Total									
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06:00 07:00									
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Thu-Fri									
Daily inflow (%)									
128.4%									
Min. Condition									
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Max. Condition									
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Daily inflow (%)									
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04:00 05:00									
05:00 06:00									
06:00 07:00									
07:00 08:00									
Total									
10000 100									

Adjustable Operating Pool Calculations Table											
Populated with data and inputs as proposed by India for the Kien Reef											
Minimum Mean Discharge (MMB)	-	-	-	-	-	-	-	-	-	-	comes
Surface discharge	-	-	-	-	-	-	-	-	-	-	262.613 comes
Minimum environmental flow	-	-	-	-	-	-	-	-	-	-	16.13 comes
Daily inflow ~ 24 h X MAMD	-	-	-	-	-	-	-	-	-	-	2743 comes (per week)
Minimum outflow to be released in a day-X% daily inflow	-	-	-	-	-	-	-	-	-	-	1580 comes (per day)
Minimum outflow to be released in a day-X% daily inflow	-	-	-	-	-	-	-	-	-	-	780 comes (per day)
Head	-	-	-	-	-	-	-	-	-	-	117.8 comes (per day)
Peak power (assuming 3% efficiency) (MW)	-	-	-	-	-	-	-	-	-	-	387.2 MW
Day	Time	Start Period	End Period	On/Off	No. of hrs	Inflow (cusec-hr)	Releases (cusec-hr)	Storage (cusec-hr)	Committed Storage (cusec-hr)	Power Generation (MW)	Net of Loss (MW)
Operating balance ~											
P/W											
P/W											
P/W											
P/W											
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Adjustable Operating Point Calculations Table (populated with data and inputs as requested by India for the King HPF)									
Minimum Mean Discharge (MMD)	=		65	cm/sec					
Turbine discharge	=		97.34	cm/sec					
Minimum environmental flow	=		2743	cm/sec (per week)					
Daily inflow = 24H X MMD	=		16.33	cm/sec-hr (per day)					
Minimum outflow to be released in a day-X% daily inflow	=		80% MIN	cm/sec-hr (per day)					
Minimum outflow to be released in a day-X% daily inflow	=		130% MAX	cm/sec-hr (per day)					
Total	=		92.2000%	EFF (m)					
Peak power (assuming X% efficiency) (MW)	=		163.7	MW					
Day	Time	Inflow (cm/sec-hr)	Releasing (cm/sec-hr)	Storage (cm/sec-hr)	Cumulative Storage (cm/sec-hr)	Power Generation Hrs	MW		
Start Period	End Period	ON/OFF	No. of hrs						
Opening balance = -438									
Sat-Sun									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Sun-Sat									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Mon-Fri									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Tue-Wed									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Wed-Thu									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Thu-Fri									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Fri-Sat									
Daily inflow (Q)									
100.0%									
Min. Condition									
OK									
Max. Condition									
OK									
Total									
Closing balance (= Opening balance) = 438									
Minimum weekly balance = 0									
Pondage required = 584.83 cm/sec-hr									
Pondage allowed as per India Water Treaty = 2 x Req. Pondage = 4.20 Mm									
Includes Discharge for environmental flow									

Note: For a detailed explanation of the adjustments made by Pakistan in Scenario 4, please see Memorandum 5.190(Q) and Appendix B.5.190(Q).

Day

Energy

Total Inflow

Excess Volume

Peak Volume

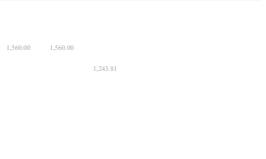
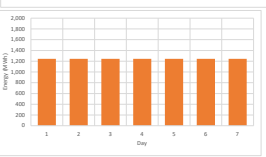
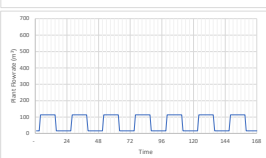
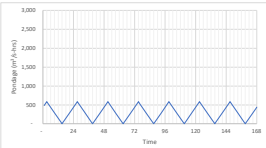
Weekly Peak Hours

Daily Peak Hours

Mean

Seconds

Peak Discharge



Note: This worksheet presents a comparison of the energy production per day, and per week, for the five alternative scenarios in this Appendix E with the same values for India's calculation of maximum Pondage at the Kiru HEP.

Energy	India	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
1	594.5	1,243.8	1,243.8	1,243.8	1,243.8	1,228.3
2	624.0	1,243.8	1,243.8	1,243.8	1,243.8	1,228.3
3	624.0	1,243.8	1,243.8	1,243.8	1,243.8	1,250.0
4	1,716.0	1,243.8	1,243.8	1,243.8	1,243.8	1,250.0
5	1,716.0	1,243.8	1,243.8	1,243.8	1,243.8	1,250.0
6	1,716.0	1,243.8	1,243.8	1,243.8	1,243.8	1,250.0
7	1,716.0	1,243.8	1,243.8	1,243.8	1,243.8	1,250.0
Total	8,706.4	8,706.6	8,706.6	8,706.6	8,706.6	8,706.6