



*Supplement of*

## **Drastic decline of flood pulse in the Cambodian floodplains (Mekong River and Tonle Sap system)**

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## **Introduction**

Tables presented in this document are additional information that have been referenced in the main text. See main text for more information on their materials and methods.

**Table S1.** *Non-comprehensive list of irrigation schemes in Cambodia*

Project Name	Duration	Partner
Tonle Sap Lowlands Rural Development Project	2008-2015	
Uplands Irrigation and Water Resources Management Sector Project	2015-2019	ADB
Greater Mekong Subregion Flood and Drought Mitigation and Management Sector Project	2012-2017	
North West Irrigation Sector Project	2005-2014	ADB /AFD
Stung Chinit Irrigation and Rural Infrastructure Project	2000–2008	ADB/AFD
Water Resources Management Sector Development Program	2010–2016	ADB/DFAT
Cambodia Agricultural Value Chain Program (CAVAC) Phase 1 and 2	2010–2021	DFAT
Rehabilitation of Prey Nup Polders	1997–2008	
Water Resources Management & Agricultural Transition for Cambodia, Phase 1 and 2	2014–2025	AFD
Kanghot Irrigation Development, Phase 1 and 2	2010–2016	
Multi-purpose Dam Development	2012–2017	
Prek Stung Keo Water Resources Development	2011–2015	PRC
Stung Chikreng Water Resources Development, Phase 1	2014–2019	
Design and Build of Stung Pursat Dam	2011–2015	
Stung Sreng Water Resources Development 1 and 2	2011–2017	
Vaico Irrigation Development Phase 1	2012–2017	
Approximately 22 small-scale rehabilitation projects	2009–2016	
Technical Services Centre for Irrigation Systems, Phases 1 and 2	2001–2009	
River Basin Water Resources Utilization in Cambodia	2014–2019	JICA
Southwest Phnom Penh Irrigation and Drainage Rehabilitation and Improvement project	2014–2026	
West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project	2011–2016	
Dauntri Dam Development Project	2014–2019	
Krang Ponley River Basin development (multi-dams)	2006–2012	KOICA
Mongkol Borey Dam Project	2011–2015	
Sala Ta Orn Irrigation	2013–2017	
Mekong Integrated Water Resources Management Project	2017–2021	World Bank

Note: ADB = Asian Development Bank, AFD= Agence Française de Développement, DFAT = Government of Australia, JICA= Japan International Cooperation Agency, KOICA, Korean International Cooperation Agency, PRC, People’s Republic of China. Source: (Asian Development Bank, 2019)

**Table S2.** Floodpulse variables at Stung Treng, Kratie, Kompong Cham, Chaktomuk, Neak Luong and Prek Kdam from 1960-2019.

		Pre-dam 1960-1991	Growth 1992-2009	Change	Mega-dam 2010-2019	Change
Stung Treng	<i>MIN<sub>annual</sub>/m</i>	1.80	2.03	+0.23m *	2.40	+0.60m *
	<i>MAX<sub>annual</sub>/m</i>	10.23	10.47	+0.24m	10.43	+0.21m
	<i>AMPLITUDE/m</i>	8.42	8.44	+0.2%	8.03	-4.7%
	<i>START DATE</i>	6/6	3/6	-3 days	7/6	+1 day
	<i>PEAK DATE</i>	28/8	25/8	-3 days	5/9	+8 days
	<i>END DATE</i>	5/12	7/12	+2 days	30/11	-5 days
	<i>DURATION/days</i>	182	186	+4 days	182	No change
	<i>RISE RATE/mday<sup>-1</sup></i>	0.087	0.088	+1.8%	0.087	-0.04%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.071	0.077	+9.0%	0.083	+17.6%
Kratie	<i>MIN<sub>annual</sub>/m</i>	5.28	6.13	+0.85m *	6.83	+1.55m *
	<i>MAX<sub>annual</sub>/m</i>	20.87	21.23	+0.36m	21.19	+0.32m
	<i>AMPLITUDE/m</i>	15.59	15.10	-3.2%	14.36	-7.9% *
	<i>START DATE</i>	10/6	1/6	-9 days *	8/6	-2 days
	<i>PEAK DATE</i>	3/9	31/8	-3 days	6/9	+3 days
	<i>END DATE</i>	6/12	12/12	+6 days	10/12	+4 days
	<i>DURATION/days</i>	175	193	+18 days *	187	+12 days
	<i>RISE RATE/mday<sup>-1</sup></i>	0.163	0.146	-10.5%	0.150	-7.8%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.134	0.131	-1.9%	0.139	+3.9%
Kompong Cham	<i>MIN<sub>annual</sub>/m</i>	2.05	2.26	+0.22m *	2.65	+0.60m *
	<i>MAX<sub>annual</sub>/m</i>	14.72	14.94	+0.23m	14.61	-0.10m
	<i>AMPLITUDE/m</i>	12.67	12.68	+0.08%	11.96	-5.6%
	<i>START DATE</i>	12/6	19/6	+7 days	21/6	+9 days
	<i>PEAK DATE</i>	6/9	11/9	+5 days	6/9	No change
	<i>END DATE</i>	14/12	7/12	-7 days	26/11	-18 days
	<i>DURATION/days</i>	188	187	-1 day	162	-26 days *
	<i>RISE RATE/mday<sup>-1</sup></i>	0.117	0.121	+3.6%	0.143	+22.6%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.090	0.100	+10.8%	0.111	+23.8%
Neak Luong	<i>MIN<sub>annual</sub>/m</i>	1.04	1.00	-0.03m	1.14	+0.10m *
	<i>MAX<sub>annual</sub>/m</i>	7.22	7.14	-0.08m	6.67	-0.55m
	<i>AMPLITUDE/m</i>	6.19	6.13	-1.0%	5.53	-10.6% *
	<i>START DATE</i>	24/6	5/7	+11 days	9/7	+15 days *
	<i>PEAK DATE</i>	24/9	24/9	No change	19/9	-5 days
	<i>END DATE</i>	2/1	31/12	-2 days	15/12	-18 days*
	<i>DURATION/days</i>	191	188	-3 days	155	-36 days *
	<i>RISE RATE/mday<sup>-1</sup></i>	0.051	0.051	-1.0%	0.067	+31.0%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.044	0.044	+1.1%	0.046	+5.4%
Chaktomuk	<i>MIN<sub>annual</sub>/m</i>	1.79	1.74	-0.05m	1.74	-0.05m
	<i>MAX<sub>annual</sub>/m</i>	9.91	9.91	-0.00m	9.15	-0.76m
	<i>AMPLITUDE/m</i>	8.13	8.17	+0.5%	7.40	-8.9%
	<i>START DATE</i>	29/6	3/7	+4 days	10/7	+11 days *
	<i>PEAK DATE</i>	27/9	29/9	+2 days	18/9	-9 days
	<i>END DATE</i>	7/1	2/1	-5 days	13/12	-25 days *
	<i>DURATION/days</i>	193	192	-1 day	153	-40 days *
	<i>RISE RATE/mday<sup>-1</sup></i>	0.062	0.061	-2.1%	0.096	+53.8%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.060	0.061	+2.6%	0.063	+6.5%
Prek Kdam	<i>MIN<sub>annual</sub>/m</i>	0.65	0.81	+0.16m *	0.90	+0.25m *
	<i>MAX<sub>annual</sub>/m</i>	8.92	8.93	+0.01m	8.13	-0.79m
	<i>AMPLITUDE/m</i>	8.27	8.11	-2.0%	7.20	-12.9% *
	<i>START DATE</i>	25/6	5/7	+10 days	10/7	+15 days *
	<i>PEAK DATE</i>	28/9	1/10	+3 days	5/10	+7 days
	<i>END DATE</i>	30/12	9/1	+10 days	26/12	-4 days
	<i>DURATION/days</i>	183	199	+ 16 days *	163	-20 days
	<i>RISE RATE/mday<sup>-1</sup></i>	0.062	0.059	-4.6%	0.070	+13.3%
	<i>FALL RATE/mday<sup>-1</sup></i>	0.064	0.055	-14.2% *	0.057	-10.6%

(\*) denotes statistically significant changes (p<0.05)

**Table S3.** Reverse flow variables at Prek Kdam (Tonle Sap River) during 1962-1972 and 1995-2018.

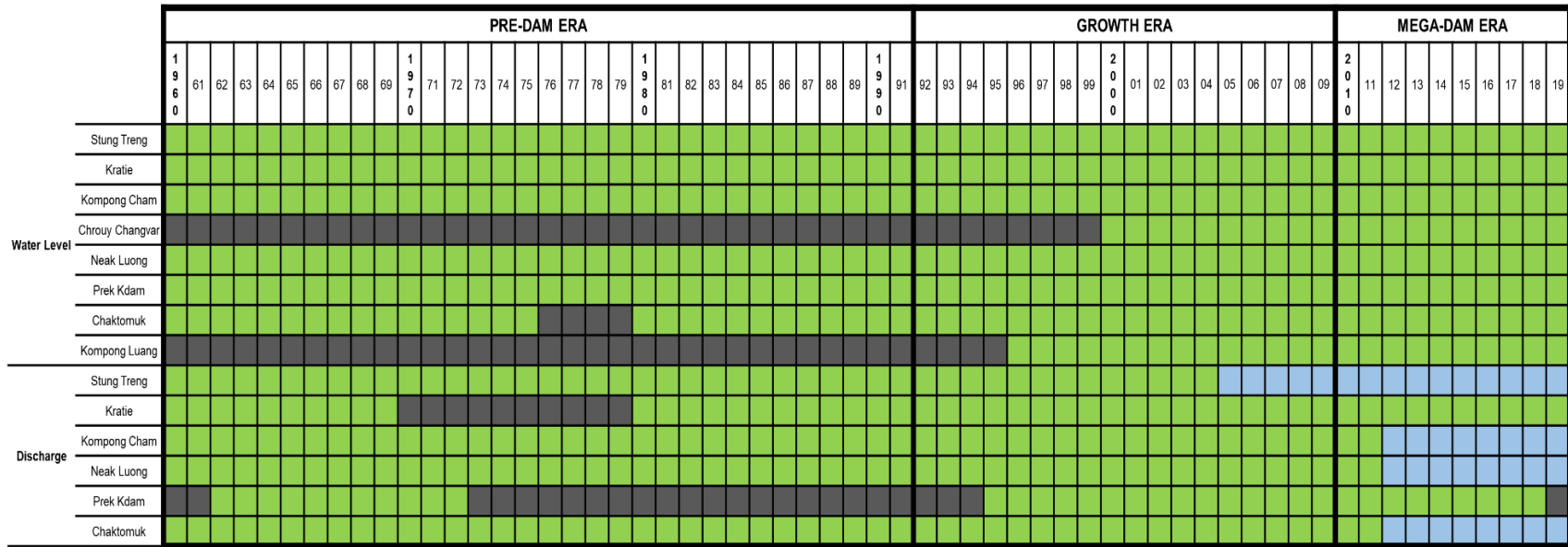
		Pre-dam 1962-1972	Growth 1995-2009	Change	Mega-dam 2010-2018	Change	
Prek Kdam	Reverse Flow (RF) Phase	ANNUAL RF/km <sup>3</sup>	49.67	37.75	-24.0% *	31.74	-56.5% *
		MAX <sub>RF</sub> /cms	9764	8393	-14.0% *	8312	-17.5 *
		START DATE	01/06	29/05	-3 days	23/05	-9 days
		PEAK DATE	16/08	16/08	No Change	09/08	-7 days
		END DATE	22/09	01/10	9 days	23/09	1 day
		DURATION/days	125	121	-4 days	112	-13 days
	Transition Phase	DURATION/days	41	6	-35 days	19	-23 days
	Normal Flow (NF) Phase	ANNUAL NF/km <sup>3</sup>	74.54	72.28	-3.0%	62.81	-18.7%

(\*) denotes statistically significant changes (p<0.05)

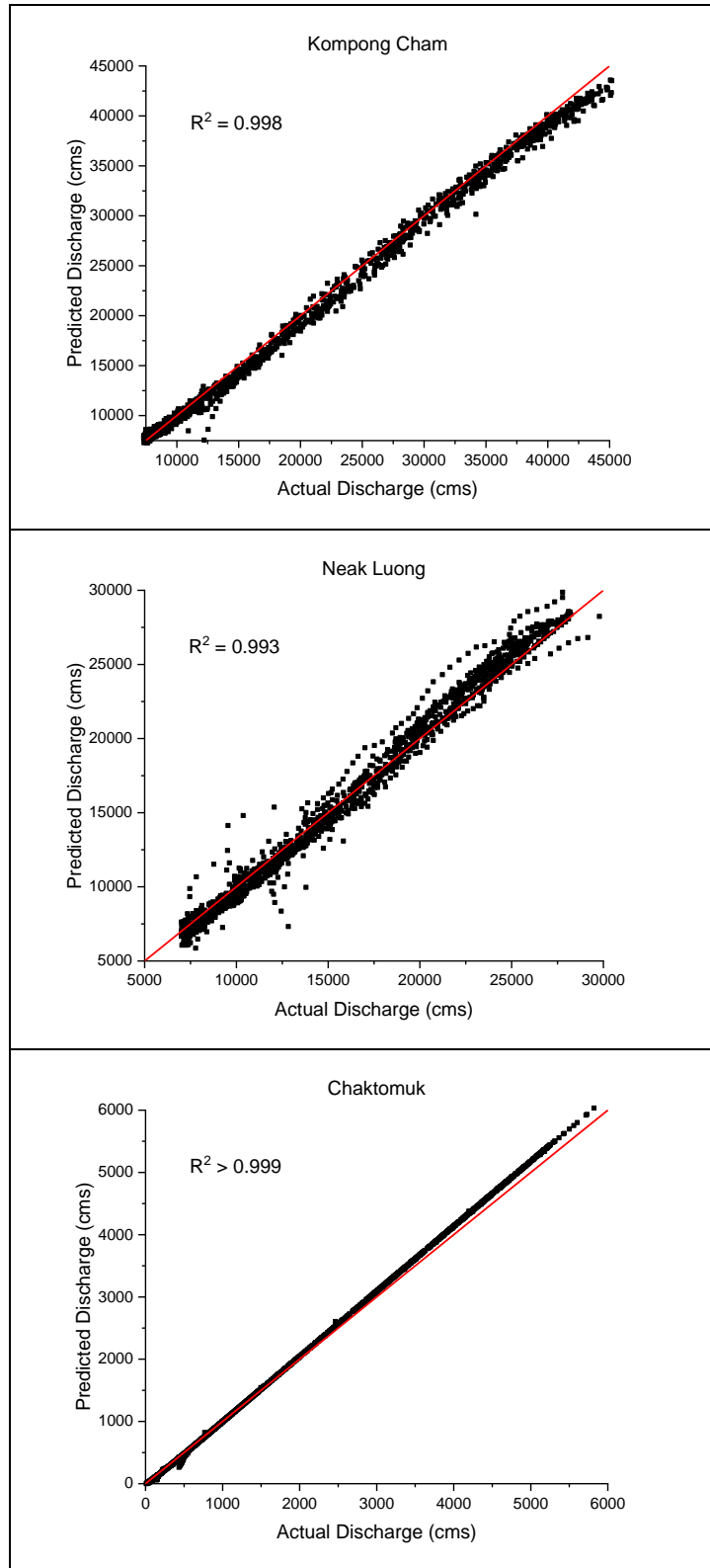
**Table S4.** Floodpulse variables at Kompong Luang (Tonle Sap Lake) from 1996-2019.

		Growth 1996-2009	Mega-dam 2010-2019	Change
Kompong Luang (Tonle Sap Lake)	<i>MIN<sub>annual</sub>/m</i>	0.70	0.60	-0.10m
	<i>MAX<sub>annual</sub>/m</i>	8.58	7.52	-1.05m*
	<i>AMPLITUDE/m</i>	7.91	6.93	-12.4%*
	<i>START DATE</i>	25/07	25/07	No change
	<i>PEAK DATE</i>	14/10	15/10	+1 day
	<i>END DATE</i>	31/01	18/01	-13 days *
	<i>DURATION/days</i>	198	163	-35 days*
	<i>RISE RATE/mday<sup>-1</sup></i>	0.06	0.06	-1.5%
	<i>FALL RATE/mday<sup>-1</sup></i>	-0.05	-0.05	-4.9%

(\*) denotes statistically significant changes (p<0.05)



**Figure S1.** Data obtained from various stations. Green cells: available data. Grey cells: missing data. Blue cells: missing but calibrated data.



**Figure S2.** Predicted against actual discharge values from 2003-2011 at Kompong Cham, Neak Luong and Chaktomuk.



**References for Supporting Information**

Asian Development Bank. (2019). *Irrigated Agriculture Improvement Project: Report and Recommendation of the President*.