



NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

June 2023



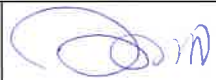
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EXECUTIVE SUMMARY

During June 2023, activities related to ISO14001:2015 implementation continued such as the implementation of the four (04) Environmental Management Plans (EMPs). The EMPs will be executed from April 2023 to March 2024 including 1) HSE awareness training for NNP1PC staff and contractors, 2) reducing the paper consumption in NNP1 offices, 3) minimizing the quantity of waste disposal at NNP1 project landfill, and 4) planting trees.

During this reporting period, two documents were submitted to the Environment Management Office (EMO) for review and approval.

On 22 June 2023, EMO, ADM and TD conducted a joint monthly site inspection of the wastewater treatment system operation and maintenance, waste management and NNP1 landfill operations. Waste compaction process at NNP1 landfill is still on hold waiting for ADM to finalize an arrangement for waste compaction.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 6.2 mg/L in the upper 6.0 m varying between 5.2 mg/L and 7.6 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths from 10 m to the bottom (08 June 2023), from 14 m to bottom (14 June 2023), from 18 m to bottom (21 June 2023) and from 12 to bottom (27 June 2023). At the water intake level, DO concentrations varied between 0.09 mg/L and 0.12 mg/L. In the Re-regulation Reservoir, the mean DO concentrations in the water column of the two monitoring stations were 2.6 mg/L.

The DO measurements downstream the Re-regulation Dam during turbine discharge was less than 6 mg/L in all stations.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed until a satisfactory situation has been reached. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the Re-regulation Dam.

A total of 8.09 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 0.9 m³ compared with May 2023. NNP1 EMO highlighted the efforts made in coordinating with the Bolikhan District Environment Management Unit or EMU for transferring the management of the communities' solid waste and Houay Soup Landfill to the local authorities. The EMU will initiate discussions involving NNP1, village, and district authorities after receiving the 2022 monitoring fund, which NNP1 transferred to MONRE on 11 May 2023 following the fund disbursement request by MONRE on 20 April 2023.

Bolikhamxay Watershed and Reservoir Protection Office (WRPO) received the first two-quarter funds under the approved Bolikhamxay Annual Implementation Plan (AIP) 2023 from the Forest Protection Fund (FPF) office of the Department of Forestry (DOF) – Ministry of Agriculture and Forestry (MAF) on 7 June 2023. Bolikhamxay WRPO organized a monthly meeting on 23 June 2023 to discuss the results of the May 2023 patrolling, the continuation of patrolling, and the plan for data collection of the land use in the villages adjacent to the NNP1 watershed.

There is still no further progress as per the agreement from the meeting in April 2023 including the follow-up with the Xaysomboun Provincial Department of Energy and Mines related to the mining exploration and hydropower project development in the NNP1 watershed Totally Protected Zone (TPZ), the internal discussion to review the patrol team establishment and the further implementation of fishery co-management, and the follow up with the contractor for the construction of two reservoir checkpoints.

The FPF DOF-MAF submitted an official fund disbursement request for the first two quarters of the approved Bolikhamxay Biodiversity Offset Management Unit (BOMU) AIP2023 on 16 June 2023. NNP1PC transferred the funds to FPF DOF-MAF at the end of June 2023. The implementation activities under the AIP2023 will be delayed until BOMU has received the funds.

The fish catch monitoring for May 2023 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and species groups of Hampala, Poropuntius, Mastacembelus and *Sikukia gudgeri*, *Amblyrhynchichthys truncatus*. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species except *Sikukia gudgeri* is classified as Data deficient (DD) and *Oreochromis niloticus* is an exotic species. The recorded catch of threatened species includes two Vulnerable species (VU): *Scaphognathops bandanensis* and *Tor sinensis*.

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During May June, activities related to ISO14001:2015 implementation continued such as the implementation of the four (04) Environmental Management Plans (EMPs). The EMPs will be executed from April 2023 to March 2024 including 1) HSE awareness training for NNP1PC staff and contractors, 2) reducing the paper consumption in NNP1 offices, 3) minimizing the quantity of waste disposal at NNP1 project landfill, and 4) planting tree. The details of EMPs 2023 implementation are shown in **Table 1.1-1**.

Table 1.1-1: The Details of EMPs 2023 implementation.

EMP No.	Activity Description	KPI	The EMP Evaluation Schedule	Implementation Result
01/2023*	Providing HSE awareness training to NNP1PC staff and contractors	80% of NNP1PC staff and the Contractors are trained on Health, Safety and Environmental awareness during April 2023 to March 2024	Oct 2023 – Feb 2024	
02/2023*	Reducing the paper consumption in NNP1 offices	Total use of A4 paper for printing in the NNP1PC's offices (VTE, OSOV1, OSOV2) is reduced by 10% during April 2023 to March 2024 compared with the previous 12 months	Oct 2023 – Dec 2024	
03/2023*	Reducing the quantity of waste disposal at NNP1 Project Landfill	Total use of A4 paper for printing in the NNP1PC's offices (VTE, OSOV1, OSOV2) is reduced by 10% during April 2023 to March 2024 compared with the previous 12 months	Sept 2023 – Mar 2024	
04/2023#	Planting tree	Percentage of plant survival, the potential plantation fields in contributing to the environmentally sustainability objectives (refer to Tree Planting Plan)	Feb 2024	

*EMP's implemented in 2022 will continue in 2023 for further success

New EMP suggested by the external ISO Auditor (SGS)

EMO is currently gathering data on the HSE awareness training records, A4 paper consumption, and waste quantity from the relevant departments in accordance with the EMP01, EMP02 and EMP03.

Preparations of the tree planting activity outlined in the EMP04 are in progress and are scheduled to commence in the mid-July 2023. This includes identifying suitable planting spots within OSOV1, OSOV2 and along the edge of the football field, and preparing around 60 local seedlings at the PHX-agricultural center and the rest 40 fruit trees will source through a campaign where staff members are encouraged to bring them along.

1.2 COMPLIANCE MANAGEMENT

In June 2023, EMO received two DWP & SS-ESMMPs from the contractor (PKCC) for review and approval. The status of the review is summarised in **Table 1.2-1**

TABLE 1.2-1: SUMMARY OF DOCUMENT REVIEW IN JUNE 2023

Document Title	Date Received	Reviewing Status
DWP & SS-ESMMP for monitoring works	07 June 2023	No objection and no comment
DWP & SS-ESMMP for maintenance and repairing works	09 June 2023	No objection with Comment

1.2.1 Joint Monthly Site Inspection

On 22 June 2023, EMO, ADM and TD conducted a joint monthly site inspection of the wastewater treatment system (WWTS) operation and maintenance, waste management and NNP1 landfill operations. The key findings are summarized in **Figure 1.2-1**

Figure 1.2-1: Joint Monthly Inspection in June 2023



Finding:

- The chlorine dosing system at the Main Powerhouse's WWTS fails to activate automatically when the wastewater pump is running.
- TD has been manually operating the wastewater pump and performing chlorine batch-dosing twice a week, as there is less wastewater being generated (04 staff on daily shifts);

Corrective Actions:

- EMO has discussed the WWTS operation with the contractor who installed the system and adjusted the timing of chlorine dosing accordingly (to be monitored).

	<p>Finding (Pending):</p> <p>The waste compaction at NNP1 landfill is still on hold, waiting for ADM to finalize an arrangement for waste compaction.</p> <p>Required Action:</p> <p>It was requested that ADM should finalize the arrangement for waste compaction with the local contractor (PKCC contractor).</p>
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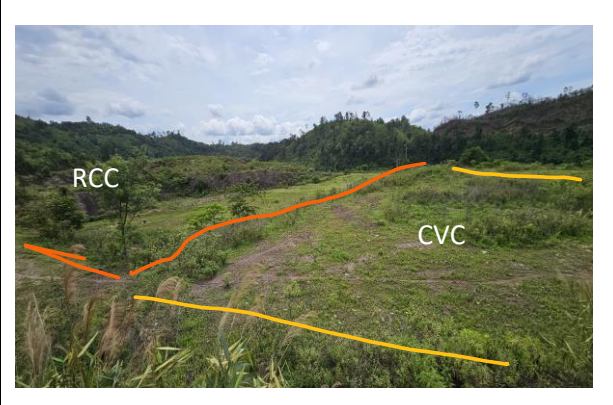
1.2.2 Site Inspection by the Environment Management Unit (EMU)

There was no site visit by the EMU of Bolikhan District, Bolikhamxay Province in June 2023. It is expected that their site visit will be in Q4 2023 after receiving the monitoring funds for 2022, which NNP1 transferred to MONRE on 11 May 2023, following the fund disbursement request by MONRE on 20 April 2023.

1.2.3 Site Decommissioning and Rehabilitation

During June 2023, a monthly monitoring of the rehabilitation sites was carried out at the main quarry, RCC plant, CVC plant, spoil disposal sites and camp areas. No evidence of erosion or instability were observed at any of the inspected sites, except for the remaining deep holes at the RCC plant, identified by the LTA during the mission in May 2023. TD has confirmed that these holes will be filled once the new Maintenance Works Contract of 2023 is executed.

Figure 1.2-2: Monthly Monitoring of Rehabilitated Sites in June 2023

	
<p>Inspection of site stability and vegetation cover at the former Main quarry site</p>	<p>Inspection of site stability and vegetation cover at the former RCC and CVC plants</p>

1.3 WATER QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD₅), Faecal Coliform Bacteria, Total Coliform Bacteria and *E.coli* have been carried out by NNP1PC's environmental laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) monthly, and quarterly to the ADB. The reports are also published on the Company's website at <https://namngiep1.com/resources/monitoring-reports/>.

1.3.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the *Error! Reference source not found.* of this Report. The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 1.3-1**

Table 1.3-1: Status of Corrective Actions for Non-Compliances at WWTSs in June 2023

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for fecal coliform (1 out of 2 samplings) and total coliform.	In June 2023, EMO, ADM and TD conducted a monthly joint inspection of the operation and maintenance of the WWTS. The inspection results are outlined in the above section 1.2.1 1) Closely monitor the residual chlorine content and chlorination dosage adjustment for the effluents of OSOV2 and the Main Powerhouse WWTS.;
OSOV2	EF13	Non-compliance for total phosphorus (1 out of 2 samplings), total coliform, fecal coliform, total nitrogen and ammonia-nitrogen.	
Main Powerhouse	EF19	Non-compliance for COD, total coliform, total nitrogen and ammonia-nitrogen in 1 out of 2 samplings, and total phosphorus in both samplings.	

1.3.2 Ambient Surface Water and Reservoir Water Quality Monitoring

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R01-R05), two stations in the Re-regulation Reservoir (R06 and R07), five stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and four stations in the main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

Weekly depth profile monitoring (pH, DO, conductivity and temperature) has been undertaken since 18 September 2018 for stations located in the Re-regulation reservoir and the main reservoir. The locations of the monitoring stations are shown in **Figure 1.3-1**.

The monitoring results for key parameters (DO, TSS and BOD₅) during June 2023 are presented in **Table 1.3-2**, **Table 1.3-3** and **Table 1.3-4**. The full set of data for June 2023 is attached in Annex A. In addition, the DO depth profile timeseries for R05 are shown in **Figure 1.3-2**, and the results for DO timeseries are presented as line graphs in **Figure 1.3-3** and DO Long Profile graphs **Figure 1.3-4**.

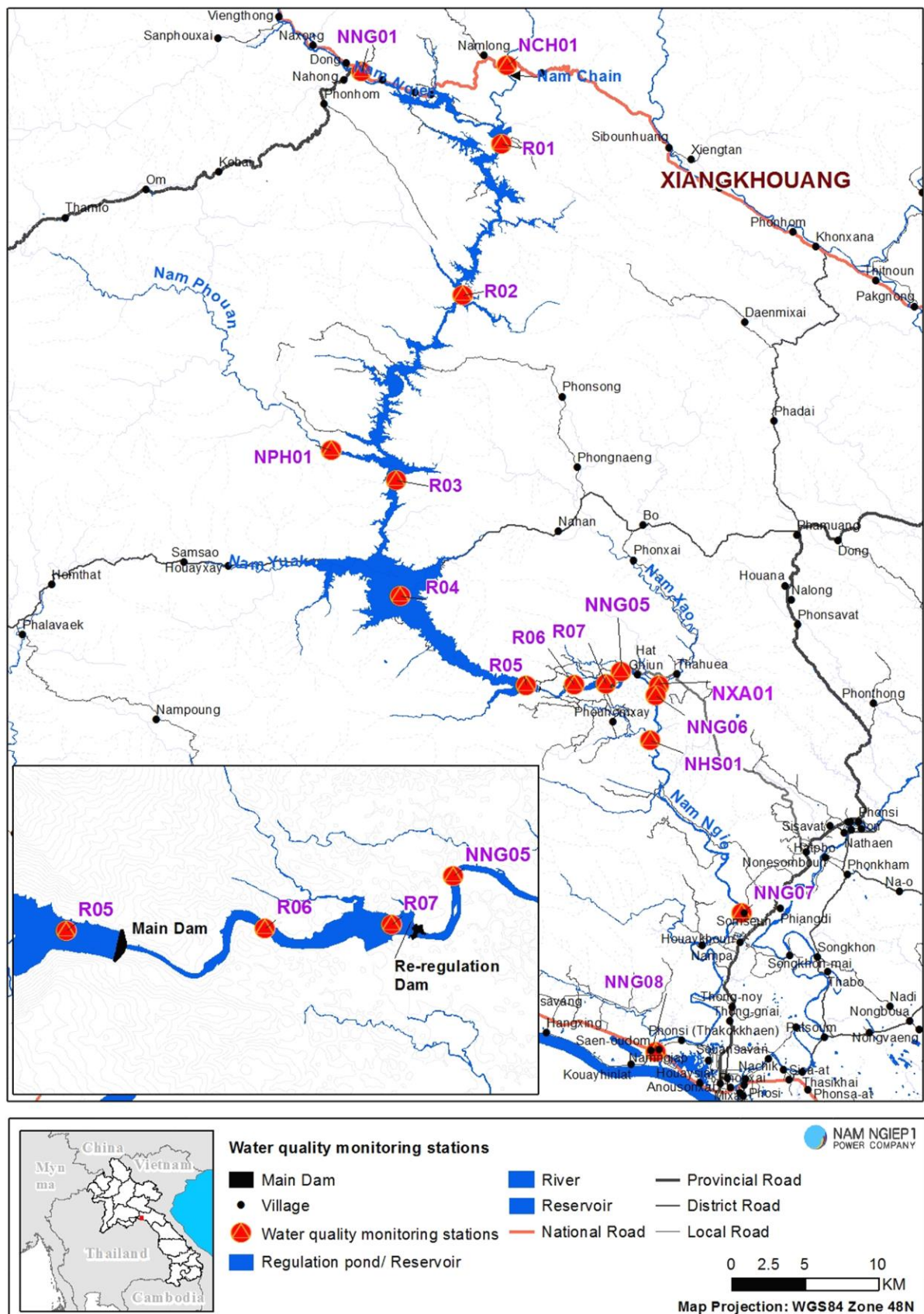


Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations

Main Reservoir

During first three week of June 2023, the water level in the main reservoir decreased from El. 298.80 m asl to El. 296.58 m asl. and from 23 June 2023, the water level in the main reservoir increased and reached El. 297.73 m by the end of the month.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 6.2 mg/L in the upper 6.0 m varying between 5.2 mg/L and 7.6 mg/L. Over the month the depth to the oxycline gradually increased from a depth of 7.5 m on 08 June 2023 to 11 m on 21 June 2023, other than that the oxycline was found at the depth of 6.5 m on 27 June 2023. Anoxic conditions (less than 0.5 mg/L) were found at depths from 10 m to the bottom (08 June 2023), from 14 m to bottom (14 June 2023), from 18 m to bottom (21 June 2023) and from 12 to bottom (27 June 2023). At the water intake level, DO concentrations varied between 0.09 mg/L and 0.12 mg/L.

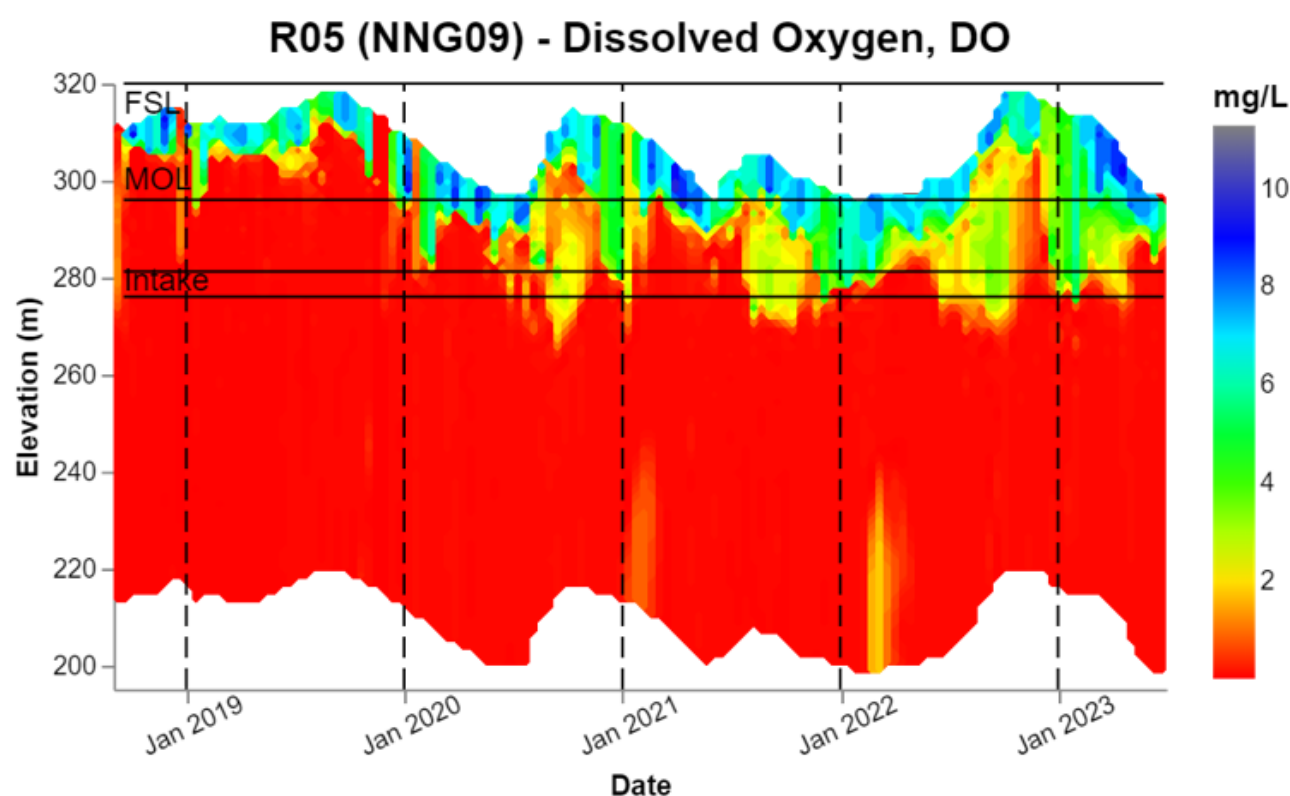


Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to June 2023)

At R04, the average DO concentration was 6.7 mg/L in the upper 8.0 m varying between 6.0 mg/L and 7.6 mg/L. From 9.5 m to the bottom, the DO concentrations varied between 0.1 mg/L and 1.8 mg/L with an average of 0.6 mg/L. Oxyclines were found at depths between 8.5 m and 9.0 m. Anoxic conditions (less than 0.5 mg/L) were found at depths from 9 m to the bottom (on 08 June 2023), at depths from 11 m to bottom (on 14 June 2023), at depths of 9 m, 10 m, 13 m and 14 m (21 June 2023) and at depths from 10 m to 11 m (on 27 June 2023).

At R03, the average DO concentration was 6.9 mg/L in the upper 5.0 m varying between 6.3 mg/L and 7.6 mg/L. Oxyclines were found at depths between 5.5 m and 7.0 m. From 5.5 m to bottom, DO concentration varied between 0.1 mg/L and 6.8 mg/L with an average of 1.5 mg/L. Anoxic conditions (less than 0.5 mg/L) were found at depths from 12 m to the bottom (07 June 2023), at the depths

from 9.5 m to 10 m and 17 m to bottom (13 June 2023), at the depths from 16 m to bottom (20 June 2023) and at the depths from 8.0 m to 8.5 m and 26 m to bottom (28 June 2023).

At R02, the average DO concentration was 5.5 mg/L in the upper 3.0 m varying between 4.0 mg/L and 7.0 mg/L. Oxycines were found at depth of 3.0 m (07 – 13 June 2023). No anoxic conditions occurred during the month. From 3.5 m to bottom, DO concentrations varied between 2.9 mg/L and 5.8 mg/L with an average of 4.4 mg/L.

At R01, the DO concentrations at the surface varied between 6.2 mg/L and 6.9 mg/L with an average of 6.4 mg/L.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean of 5 mg/L compared with the high flow season means of about 100 – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L prior to impounding.

The BOD₅ measurements in both epilimnion and hypolimnion at R01, R03, R04 and R05 were less than 1.0 mg/L, except in the hypolimnion at R03 (6.5 mg/L).

Re-regulation Reservoir

In June 2023, the turbine discharges from the Main Powerhouse varied between 13 and 231 m³/s usually interrupted by night-time periods with no discharge.

The mean DO concentrations in the water column of the both monitoring stations were 2.6 mg/L (R06 and R07).

The BOD₅ concentrations in both R06 and R07 were less than 1.0 mg/L.

Nam Ngiep Downstream

During June 2023, the monthly downstream water quality monitoring was carried out during a period of turbine discharge from the Re-regulation Dam, DO concentrations were less than 6 mg/L in all stations, thus, not complied with the surface water quality standard.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the re-regulation dam.

The BOD₅ in the downstream stations were less than 1 mg/L and complied with the national surface water quality standard.

Main Tributaries to Nam Ngiep

The monitored parameters in the main tributaries did not comply with the standards as detailed below:

- Nam Chiane (NCH01) and Nam Phouan (NPH01): COD, ammonia-nitrogen, faecal coliform.
- Nam Xao (NXA01): DO, COD.
- and Nam Houaysoup (NHS01): COD.

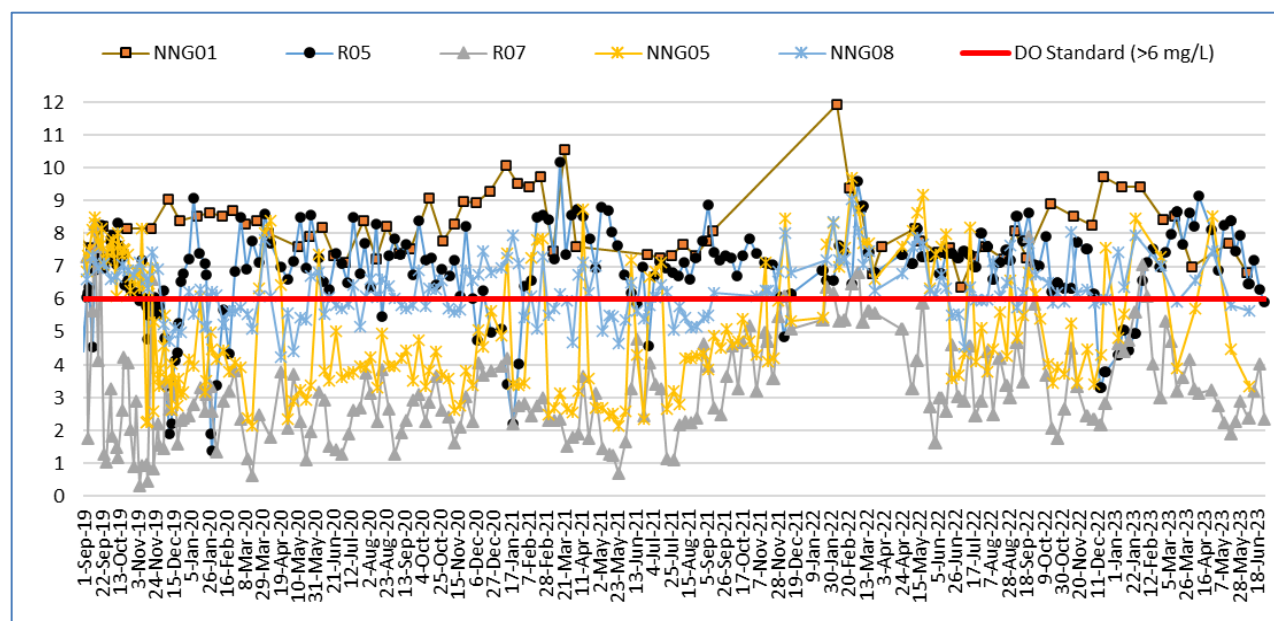


Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to June 2023

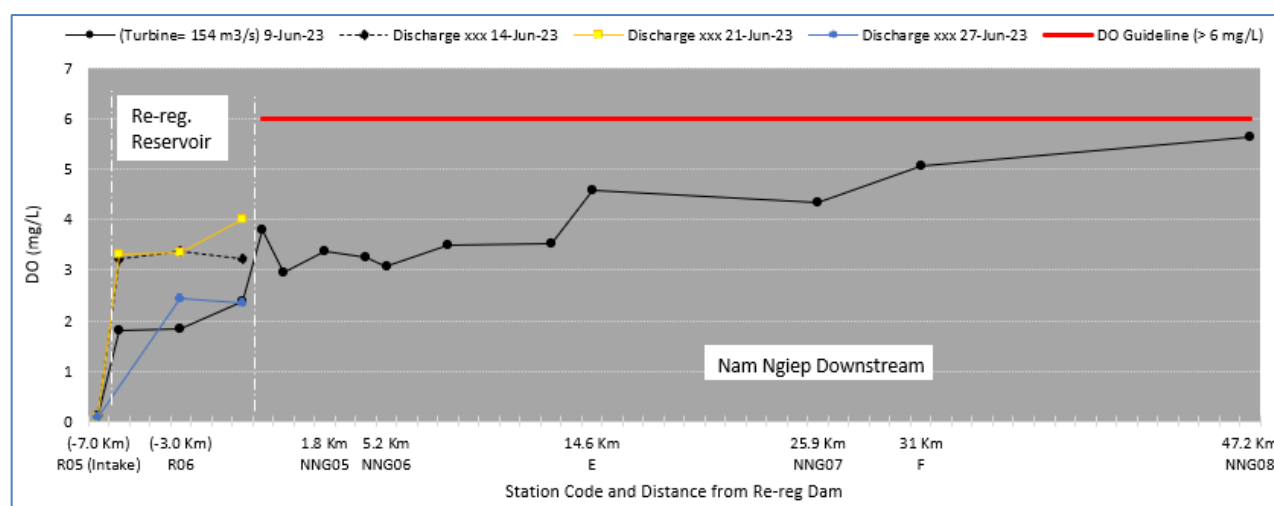


Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in June 2023 (from Immediately Upper Main Dam to Lower Nam Ngiep River)

Table 1.3-2: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.2 m, National Water Quality Standard: >6.0 mg/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jun-23	6.82												6.83			
7-Jun-23		6.24	6.99	7.55										7.51		
8-Jun-23					6.54	6.47	1.85	2.37								
9-Jun-23						6.47	1.85	2.37	3.36	3.07	4.34	5.64			5.45	6.48
13-Jun-23		6.16	6.06	6.79												
14-Jun-23					7.5	7.18	3.38	3.21								
20-Jun-23		6.89	6.14	6.58												

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
21-Jun-23					6.7	6.3	3.35	4.02								
27-Jun-23					6.52	5.92	2.45	2.35								
28-Jun-23		6.45	5.02	6.87												

Table 1.3-3: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L)

Total Suspended Solids (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jun-23	581												64.29			
7-Jun-23		802		26.52										196.32		
7-Jun-23 Bottom				29.1												
8-Jun-23					<5	<5	<5	<5								
8-Jun-23 Bottom					17.3	6.1										
9-Jun-23									<5	<5	16.06	<5			58.79	5

Table 1.3-4: Results of Surface Water Quality Monitoring for BOD₅ (mg/L) - Water Quality Standard: < 1.5 mg/L

BOD ₅ (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jun-23	<1												<1			
7-Jun-23		<1		<1										<1		
7-Jun-23 Bottom				6.5												
8-Jun-23					<1	<1	<1	<1								
8-Jun-23 Bottom					<1	<1										
9-Jun-23									<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During June 2023, community groundwater quality analyses were carried out for all seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village. The two damaged wells (GPHX01 and GPHX02) in Phouhomxay Village were repaired and have been operational since April 2023). The community groundwater samples were taken from household water taps.

The results indicate that:

- All parameters monitored from the two wells in Phouhomxay Village complied with the Standards.
- The wells in Somsuen and Nam Pa Villages fully complied with the Standards.

- The well in Thong Noy Village did not comply with the Standard for faecal coliform and *E. Coli* bacteria.
- One out of two wells (GPOU01) in Pou Village did not comply with the Standard for faecal coliform and *E. Coli* bacteria (however, at low concentrations)

The community groundwater quality monitoring results are presented in *Error! Reference source not found.*

The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and recommended to carry out the operation and maintenance improvement as well as were encouraged to boil water before drinking.

Table 1.3-5: Groundwater Quality Monitoring Results in Phouhomxay, Somsuen, Nam Pa, ThongNoy and Pou Villages

	Site Name	Phouhomxay		Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	22-Jun-23	22-Jun-23	19-Jun-23	19-Jun-23	19-Jun-23	06-Jun-23	06-Jun-23
pH	6.5 - 9.2	6.65	6.6	6.6	6.54	6.71	6.52	6.7
Sat. DO (%)		33	27.2	74.7	84.4	88	90.3	105.1
DO (mg/l)		2.58	2.19	5.42	6.54	6.91	7.11	8.34
Conductivity(μS/cm)		461	519	426	433	368	34	444
Temperature (°C)		28.25	26.23	28.13	28.4	27.74	27.69	27.13
Turbidity (NTU)	<20	23.9	8.01	0.66	0.52	7.07	11.8	4.04
Faecal coliform (MPN/100ml)	0	0	0	0	0	220	22	0
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	0	0	0	220	22	0

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The concentration of Faecal Coliform and *E.coli* did not comply with the standards in the water supply of Thaheua Village (WTHH02), Hat Gnuin Village (WHGN02) and Phouhomxay Village (WPHX02 – Primary School Water Tap and WPHX03 – Household Water Tap).

As observed in the field during water sampling, livestock are roaming around in the water intake areas which may contribute to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. The villagers were advised to boil water before drinking in accordance with the Law as mentioned in 1.3.3 as well as recommended to carry out the operation and maintenance improvement.

Table 1.3-6: Results of the Gravity Fed Water Supply Quality Monitoring

	Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	22-Jun-23	22-Jun-23	22-Jun-23	22-Jun-23
pH	6.5 - 8.5	6.9	6.85	7.02	6.98
Sat. DO (%)		89.2	89.9	95.2	88.3
DO (mg/L)		6.81	6.84	7.57	6.94
Conductivity (µS/cm)	<1,000	265	125	14	14
Temperature (°C)	<35	29.32	29.65	26.97	27.74
Turbidity (NTU)	<10	2.06	3.79	3.0	1.23
Faecal Coliform (MPN/100 mL)	0	14	70	170	46
<i>E.coli</i> Bacteria (MPN/100 mL)	0	14	49	110	33

1.3.5 Landfill Leachate Monitoring

During June 2023, the landfill leachate monitoring was not conducted at NNP1 Project Landfill (Last pond - LL4) because the leachate in the treatment ponds became disconnected from each other in the dry season. However, landfill leachate monitoring was carried out at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that Houay Soup Landfill Leachate fully complied with the Standard. EMO will continue to monitor the leachate and report the results in the next monthly progress report. The landfill leachate monitoring results for June 2023 can be found **Table 1.3-7**.

Table 1.3-7: Results of the Landfill Leachate Monitoring

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharge Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
5-Jun-23	pH	6.0-9.0						7.5	
5-Jun-23	Sat. DO (%)							110.4	
5-Jun-23	DO (mg/L)							7.8	
5-Jun-23	Conductivity (μS/cm)							161	
5-Jun-23	Temperature (°C)							33.95	
5-Jun-23	Turbidity (NTU)							22.3	
5-Jun-23	BOD5 (mg/L)	<30						8.58	
5-Jun-23	COD (mg/L)	<125						102	
5-Jun-23	Faecal Coliform (MPN/100mL)	<400						4	
5-Jun-23	Total Coliform (MPN/100mL)	<400						49	
5-Jun-23	Total Nitrogen (mg/L)	<10						1.04	
5-Jun-23	Ammonia nitrogen (mg/L)	<10						<2	
5-Jun-23	Oil & Grease (mg/L)	<10						1.1	

1.4 DISCHARGE MONITORING

1.4.1 Main Reservoir – Water Level, Inflow and Discharge

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir have been monitored since the start of the impounding on 15 May 2018. The graph in **Figure 1.4-1** and **Figure 1.4-2** presents the values recorded since January 2020.

During June 2023, the mean inflow to the main reservoir was 86 m³/s. The minimum and maximum inflows were 33 m³/s (on 05 June 2023) and 268 m³/s (on 28 June 2023) respectively.

In June 2023, during the first three weeks, the water level in the main reservoir decreased from El. 298.80 m asl to El. 296.58 m asl. And from 23 June 2023, the water level in the main reservoir increased and reached El. 297.73 m by the end of the month.

During June 2023, the hourly turbine discharges from the Main Powerhouse varied between 13 m³/s and 231 m³/s usually interrupted by night-time periods with no discharge.

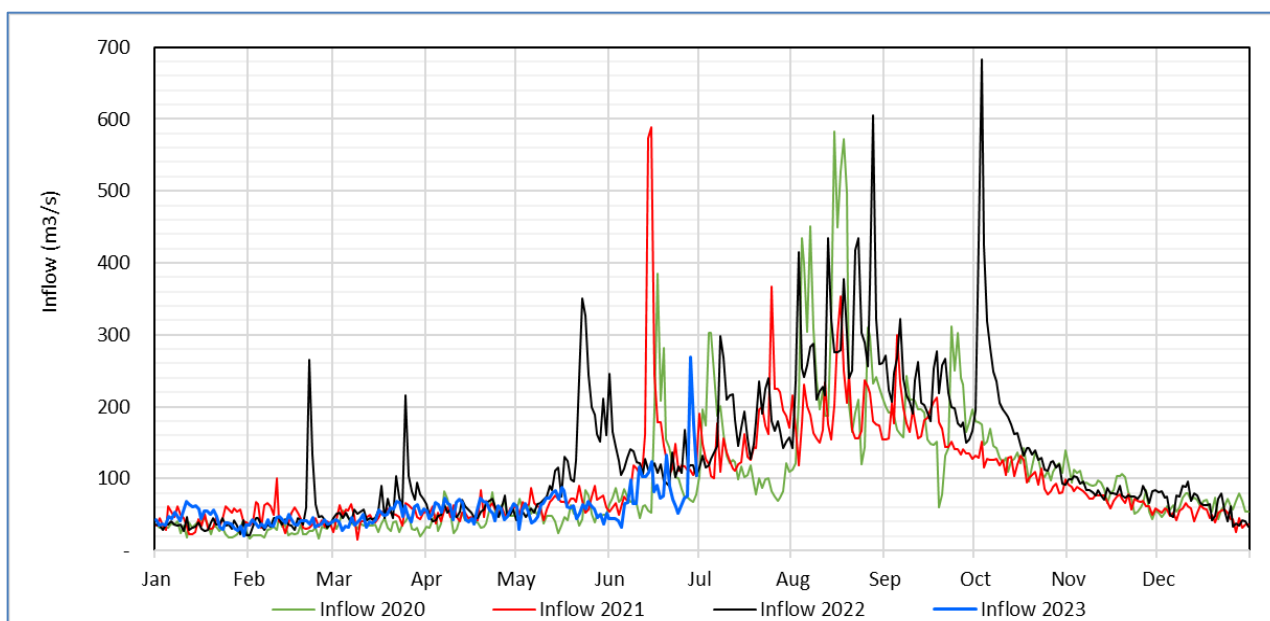


Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to June 2023

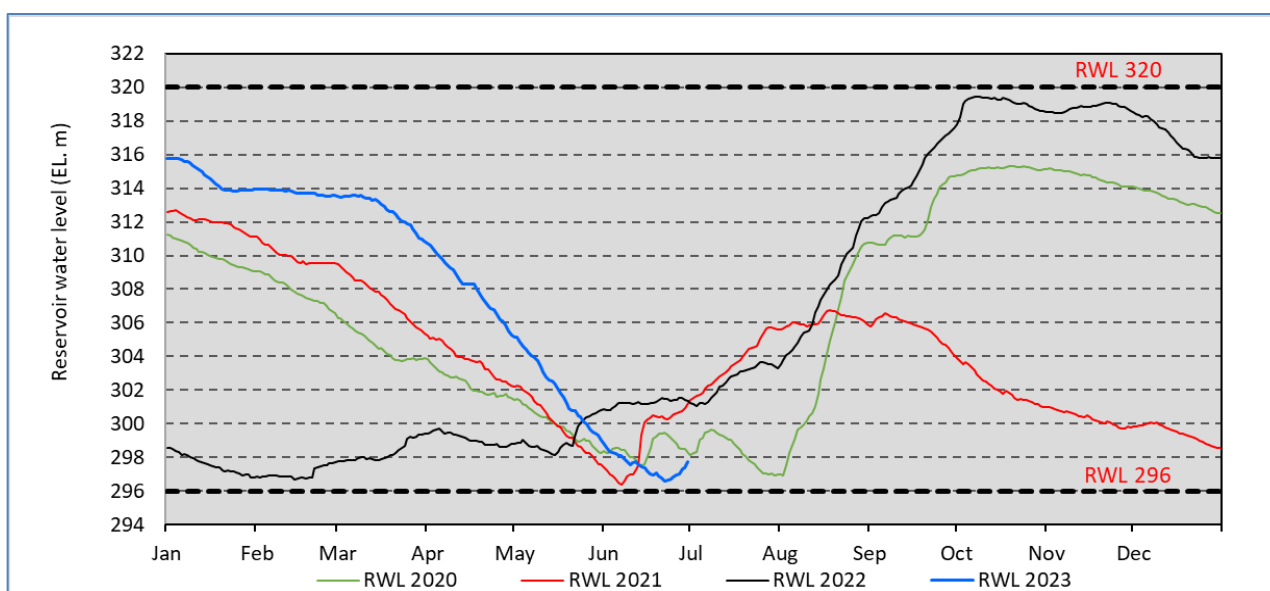


Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to June 2023

1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during April to June 2023 is presented in **Figure 1.4-3**.

During June 2023, the mean daily discharge from the Re-regulation Dam was about 104 m³/s, with hourly gate discharge varying between 27 m³/s and 59 m³/s, and hourly turbine discharge varying between 48 m³/s and 164 m³/s. The hourly total discharges (combined gate and turbine discharge) varied between 35 m³/s and 186 m³/s. The hourly discharge was kept above the minimum flow requirement of 27 m³/s at all times.

The changes in the discharge from the Re-regulation Dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems.

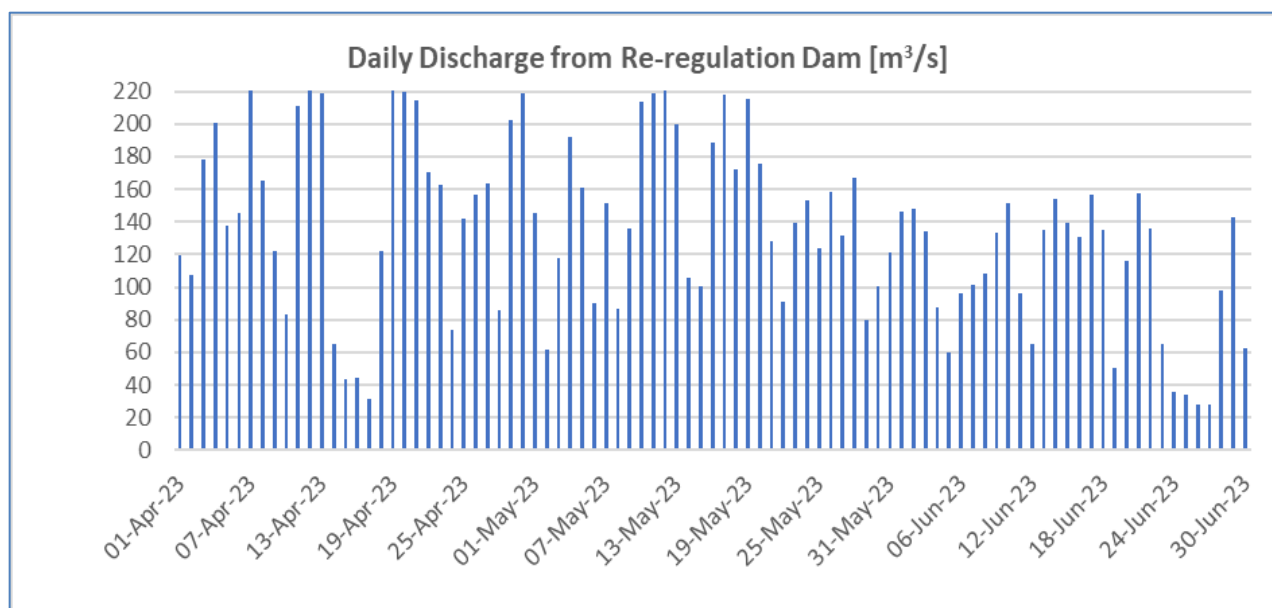


Figure 1.4-3: Discharge Monitoring at the Re-regulation Dam in February to June 2023

1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In June 2023, due to the discharge from Re-regulation Dam was greater than 30 m³/s, EMO did not carry out any boat missions to monitor the water depth in the Nam Ngiep downstream of the Re-regulation Dam.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

A total of 8.09 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 0.9 m³ compared with May 2023. The Contractor continued the regular waste collection from the NNP1PC's operation sites and operated the project landfill for three days per week. The work includes waste segregation and disposal, grass cutting and repairing of the perimeter fences. The waste compaction at NNP1 landfill is still on hold, waiting for ADM to finalize an arrangement for waste compaction.

The total amount of recyclable waste sold and collected this month is summarized in **Table 1.5-1**.

Table 1.5-1: Amounts of Recyclable Waste Sold and collection in June 2023

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total By June 2023
1	Plastic bottles	kg	0	55
2	Aluminium can	kg	0	0
3	Paper/Cardboard	kg	0	70
4	Glass	kg	0	74
5	Scrap Metal	Kg	0	0
Total		kg	0	199

In June 2023, the villagers from Phouhomxay Village collected a total of 284.2 kg of food waste from the OSOV1 canteen for feeding their animals.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in June 2023 are shown in **Table 1.5-2** and **Table 1.5-3** respectively.

Table 1.5-2: Record of Hazardous Material Inventory in June 2023

No.	Type of Hazardous Material	Unit	Total in June 2023(A)	Used (B)	Remaining at the end of June 2023 (A – B)
1	Diesel	Litre	2,775	2,345	430
2	Gasoline	Litre	724	163	561
3	Lubricant (Turbine oil)	Litre	91	6	85
4	Colour Paint	Litre	39	0	39
5	Thinner	Litre	1	0	1
6	Grease Oil	Litre	785	0	785
7	Gear Oil	Litre	17,25	0.75	16,5
8	Chlorine Liquid	Litre	150	60	90
09	HA Cut AF	Litre	3,925	0	3,925.0
10	HA Cut Cat AF	Litre	372.5	0	372.5

Table 1.5-3: Record of Hazardous Waste Inventory

No.	Hazardous Waste Type	Unit	Total in June 2023 (A)	Disposed (B)	Remaining at the end of June 2023 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	335.3	0	335.3
2	Empty used oil drum/container (drum 200L)	Unit	53	0	53
3	Contaminated soil, sawdust and textile material	m ³	0.8	0	0.8
4	Used tyre	Drum	5	0	5
5	Empty used chemical drum/container (drum 20L)	Unit	19	0	19
6	Lead acid batteries	Unit	6	0	6
7	Empty paint and spray cans	Unit	43	0	43
8	Halogen/fluorescent bulbs	kg	370	0	370

No.	Hazardous Waste Type	Unit	Total in June 2023 (A)	Disposed (B)	Remaining at the end of June 2023 (A - B)
9	Empty cartridge (Ink)	Unit	91	0	91
10	Clinic Waste	Kg	8,6	0	8.6
11	Expired Chlorine Powder	Kg	65	0	65

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Solid Waste Management and Recycling Programmes

NNP1 EMO has coordinated with the Bolikhan District Environment Management Unit or EMU for transferring the management of the communities' solid waste and Houay Soup Landfill to the local authorities. The EMU will initiate discussions involving NNP1, village, and district authorities after receiving the 2022 monitoring funds, which NNP1 transferred to MONRE on 11 May 2023 following the fund disbursement request by MONRE on 20 April 2023.

2 WATERSHED AND BIODIVERSITY MANAGEMENT

2.1 WATERSHED MANAGEMENT

2.1.1 Implementation of Annual Implementation Plan (AIP)

2.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)

The progress of the actions that were discussed and agreed upon during the meeting with the Head of Xaysomboun Province Agriculture and Forestry Office (PAFO) on 26 April 2023 are summarized below:

- The Xaysomboun PAFO agreed to provide updates about the mining exploration and Nam Phouan Hydropower Project development in the NNP1 watershed Totally Protected Zone (TPZ) 15 working days after the meeting. The Head of the Xaysomboun Watershed and Reservoir Protection Office (WRPO) informed the NNP1 EMO team that they still had not received any further information from the Xaysomboun Province Department of Energy and Mines as of the end of June 2023.
- The Xaysomboun PAFO agreed to update the NNP1 EMO team 15 working days after the meeting. The Head of Xaysomboun WRPO did not share a meeting agenda and confirmation of district availability as of the end of June 2023. He confirmed his unavailability because of other assignments within the forestry section of Xaysomboun PAFO.
- The Head of Xaysomboun PAFO agreed to review the patrol team establishment to have the district military personnel engaged in the patrolling work. A meeting should be organized among the NNP1 EMO, Xaysomboun WRPO, and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) before implementing the patrolling work, once the WRPO has received the AIP2022 funds. The Head of Xaysomboun PAFO assigned the Head of Xaysomboun WRPO to discuss further with the Xaysomboun WRPO about the arrangement but there was no further conclusion as of the end of June 2023.
- The Head of Xaysomboun WRPO finally agreed to check the readiness of the Xaysomboun WRPO sub-office at Vangkhiew in Hom District. He assigned the province and district WRPO team to

conduct the site visit together with the NNP1 EMO team on 20 June 2023. The Minutes of the Meeting (MOM) was signed on 23 June 2023 in which Xaysomboun WRPO to report the results of the inspection to the Head of Xaysomboun PAFO including the schedule and budget for fixing and purchasing some items. The plan will be submitted to and agreed upon with the EMO team no later than 14 July 2023. The Head of Xaysomboun WRPO has not yet prepared the official assignment for the staff to be based in the sub-office as of the end of June 2023. This means that the sub-office operation will be further delayed.

- The Head of Xaysomboun WRPO informed that Xaysomboun WRPO has sent out an invitation letter to the Contractor on 9 June 2023 for the discussion on 12 June 2023. But the Contractor was not available in June 2023. The construction is expected to be further delayed until the meeting is organized and a decision is made on the work.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO organized the Monthly Meeting on 21 June 2023 with participation of the NNP1 EMO and the BSP-WCS team. The key discussions are summarized below:

- The forest patrol found land conversion for grassland, wildlife tracks, and a wooden snare. The reservoir patrol observed forest fire around H. Xou, H. Hok, and H. Khai and land conversion but did not meet the offenders.
- Forest and reservoir patrolling will be resumed in which the reservoir patrol team will focus on H. Katha, H. Xou, and H. Hok, while the forest patrol team will focus on TPZ1 at Ban Phonsong. The patrolling is subject to the re-allocation within the first 6 months budgets of AIP 2023. Bolikhamxay WRPO will submit an official letter to NNP1 EMO for acknowledgment.
- Bolikhamxay WRPO also plans to collect the village land use information at Nahan, HatGnuin, Phonsong, and Phouhomxay in July 2023 and the results will be reported to the Bolikhamxay Watershed and Reservoir Protection Committee (WRPC) for further advice.
- BSP-WCS also presented the draft Law Enforcement Strategy (LES).
- Bolikhamxay WRPO received a call from the village authority of Phonsong and noted that the Kha E-Co Company is doing mining exploration in Ban Phonsong. Bolikhamxay WRPO will further coordinate and gather information from the relevant offices at the district and provincial level about this.

NNP1PC EMO

There was no activity implemented under the NNP1 EMO watershed livelihood program this month because the team's engagement with other assignments including the follow-up on the outstanding issues with the Xaysomboun WRPO, checking the Xaysomboun WRPO sub-office, and the follow-up on funds disbursement to Xaysomboun WRPO.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

The FPF DOF-MAF provided official comments to Xaysomboun WRPO on 2 June 2023 to separate the budget for operation and procurement and re-submit the official request afterward. The Xaysomboun WRPO did not re-submit the official request as of the end of June 2023 because of the unavailability of the head of the WRPO due to other assignments.

2.1.3 Preparation of Annual Implementation Plan (AIP) 2023

2.1.3.1 Xaysomboun WRPO

There is no further progress on the AIP2023 finalization as of the end of June 2023 which is related to the unavailability of the Head of Xaysomboun WRPO.

2.1.3.2 Bolikhamxay WRPO

Bolikhamxay WRPO received the funds for the two quarters of 2023 of the approved Bolikhamxay AIP2023 totalling 529,527,000 LAK from FPF DOF-MAF on 7 June 2023. They are preparing the request for the second two-quarter funds of the approved AIP2023 to avoid further delays in fund transfer and implementation of activities.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP)

The progress on the implementation of key activities by Component in June 2023 is described below:

a. Component 1 - Spatial Planning and Regulation

BSP-WCS is still reviewing and analysing the information collected from PLUP. The results will be further discussed among BOMU, NNP EMO, and BSP-WCS when they are ready. The results will be presented, discussed, and agreed upon with the community in September 2023 and the dissemination of the updated PLUP is scheduled for October 2023.

b. Component 2 – Law Enforcement

There was no field patrolling in June 2023 because the patrol teams has not receive the funds under the approved AIP2023 yet (see section 2.2.2). EMO has discussed with BOMU the non-compliance practice of not paying the patrolling team allowances for sub-station safeguarding. BOMU has further discussed with FPF DOF-MAF and noted that FPF DOF-MAF will speed up the fund disbursement of the first two-quarters of their AIP2023. **Component 3 – Conservation Outreach**

BSP-WCS is in progress of preparing the report for the outreach activity that was conducted in April 2023.

c. Component 4 – Conservation linked livelihood development

NNP1 EMO, BOMU, BSP-WCS, Bolikhamxay PAFO Agriculture and Livestock Sections, Viengthong and Xaychamphone DAFO had a discussion on 23 June 2023 about the implementation of CDP activities under the AIP2023. The meeting concluded that there is a need for Bolikhamxay PAFO Agriculture Section to train the District Trainers after BOMU receives the AIP2023 funds which is tentatively scheduled in July 2023. The implementation of the CDP activities is expected to be commenced from August 2023.

There was no snare removal activity in June 2023 because they did not receive the funds under the approved AIP2023 yet (see section 2.2.2).

2.2.2 Preparation of Annual Implementation Plan (AIP) 2023

The FPF DOF-MAF submitted an official fund disbursement request for the first two-quarters of the approved Bolikhamxay Biodiversity Offset Management Unit (BOMU) AIP2023 on 16 June 2023. NNP1PC transferred the funds to FPF DOF-MAF at the end of June 2023. The implementation activities under the AIP2023 will be delayed until BOMU has received the funds

FPF DOF-MAF agreed to circulate the soft file of the approved Financial Management to WRPOs and BOMU for their reference. The soft copy was circulated by NNP1 EMO on 16 June 2023. NNP1 also

agreed to provide financial support to print 50 copies of FMM through the NNP1 procurement department. The books are expected to be ready in July or August 2023 and will be circulated to relevant offices afterward.

2.3 FISHERY MONITORING

The fishery monitoring is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey of the month by covering the upstream, upper reservoir, lower reservoir, downstream and Mekong areas.

The fish species dominating the fish catch by weight in May 2023 as listed in **Table 2.3-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹, except *Sikukia gudgeri* is classified as Data deficient (DD) and *Oreochromis niloticus* is an exotic species.

Table 2.3-1: Fish Species dominating the Fish Catch in May 2023

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	239.4	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	158.9	LC
<i>Oreochromis niloticus</i>	ປານິນ	109.3	LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus faves</i>	ປາຫຼາດ	96.5	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	70.5	DD, LC

The recorded catch of Threatened species (IUCN Red List classification) in May 2023 are presented in **Table 2.3-2**. The list includes two species that are classified as Vulnerable species (VU).

Table 2.3-2: Threatened Species of May 2023 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	15.2	VU
<i>Tor sinensis</i>	ປາແດງ	16.6	VU

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in May 2023. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in May 2023 for above dam, below dam and Mekong area are presented in **Table 2.3-3**.

¹ The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not Evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

Table 2.3-3: Main Biodiversity Indicators for May 2023

Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	24	37	32
Single species	19	26	22
Species groups	5	11	10
Top 15 species (% total catch weight)	97.21%	83.63%	93.30%
Proportion for species groups	33.39%	61.14%	62.62%
Diversity index (Shannon)	1.9767	3.0335	2.4734

Figure 2.3-1 shows fish diversity index (Shannon) for above dam, below dam and Mekong area from July 2015 to May 2023. This diversity index (Shannon) explains that the high value means high diversity.

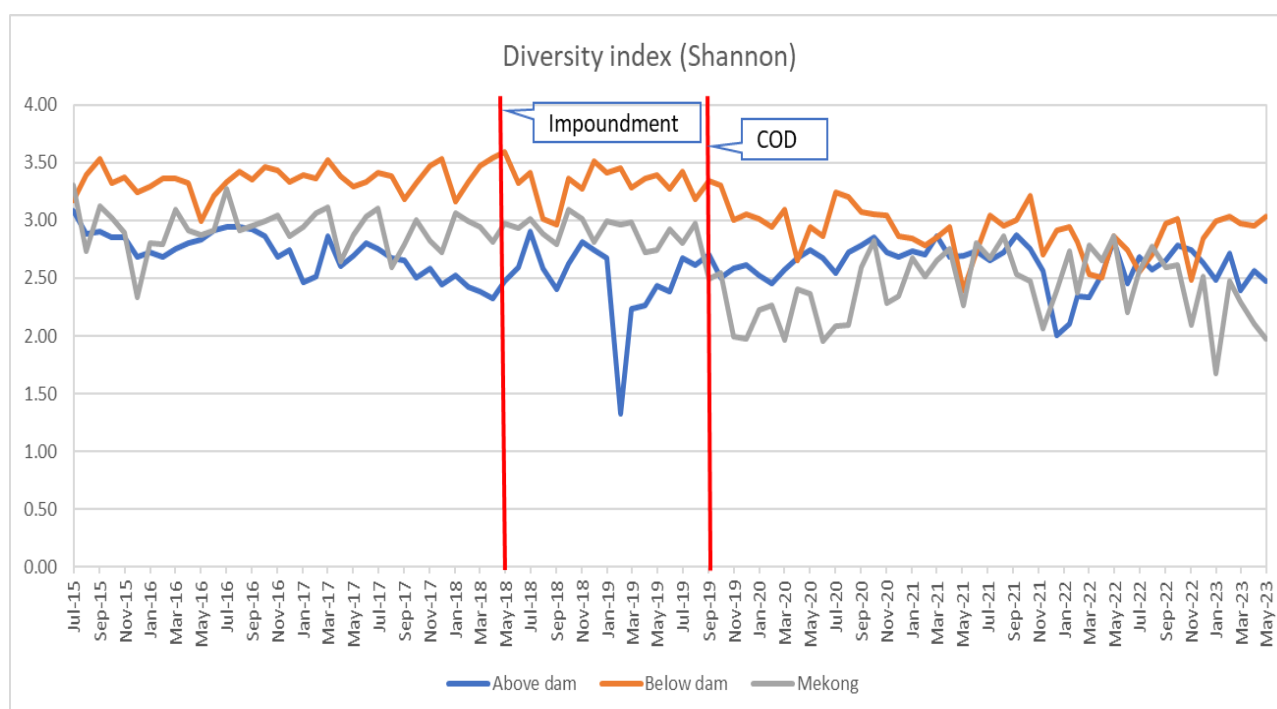
**Figure 2.3-1: Fish diversity index (Shannon) by fishing zone from July 2015 to May 2023**

Figure 2.3-2 shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 46% and 73% of active fishing households for all fishing zones in May 2023.

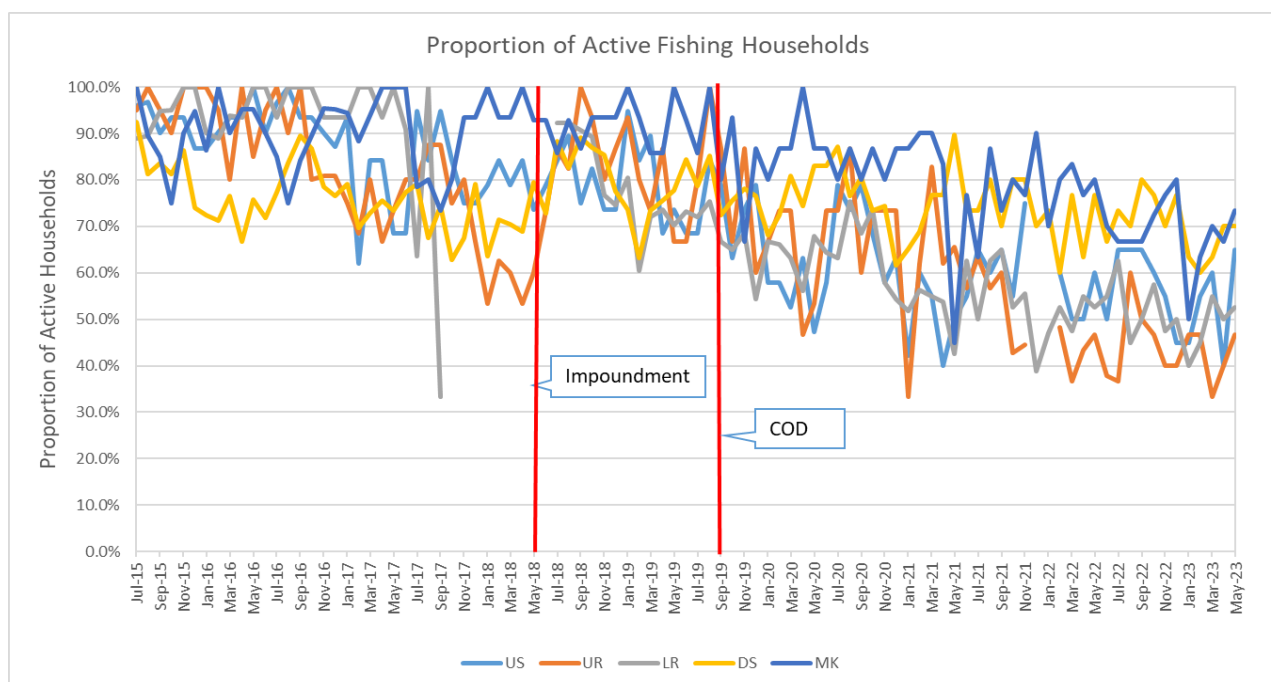


Figure 2.3-2: Proportion of total number of households actively fishing by fishing zone from July 2015 to May 2023

Note: Proportion of Active Fishing Households = (Active Fishing Households/Total Interviewed Households) x 100%.

Figure 2.3-3 shows the average (mean) of monthly household fishing days from July 2015 to May 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

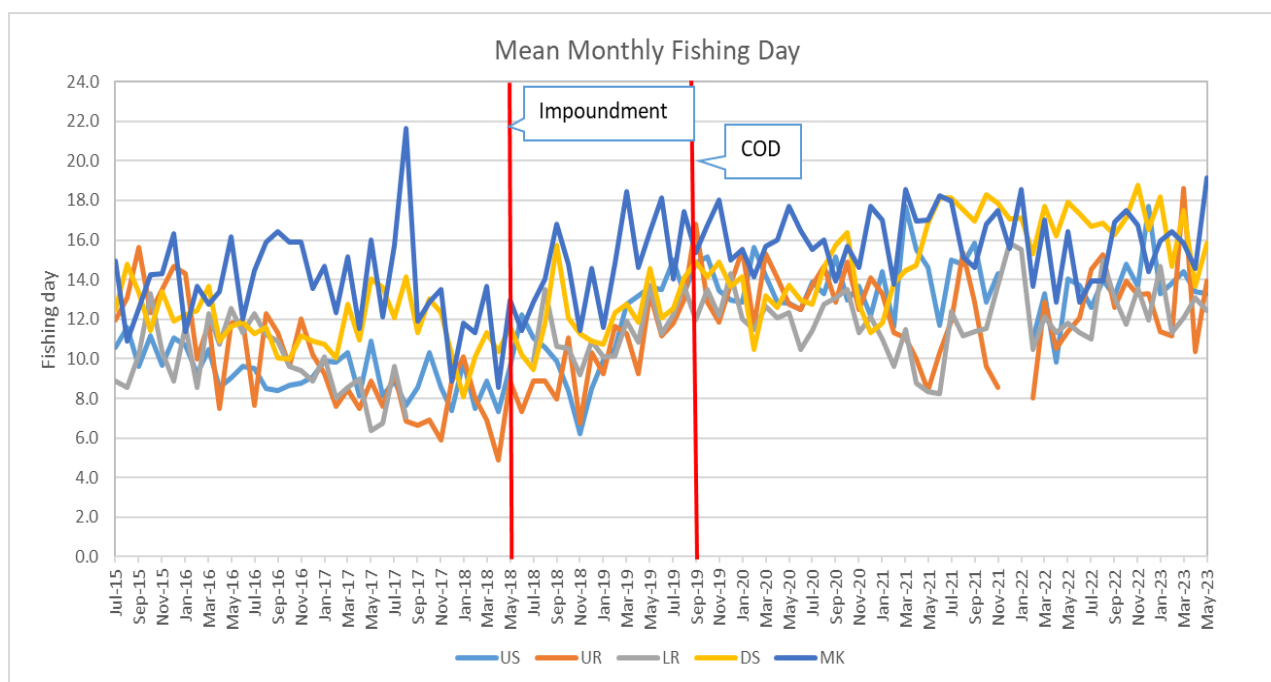


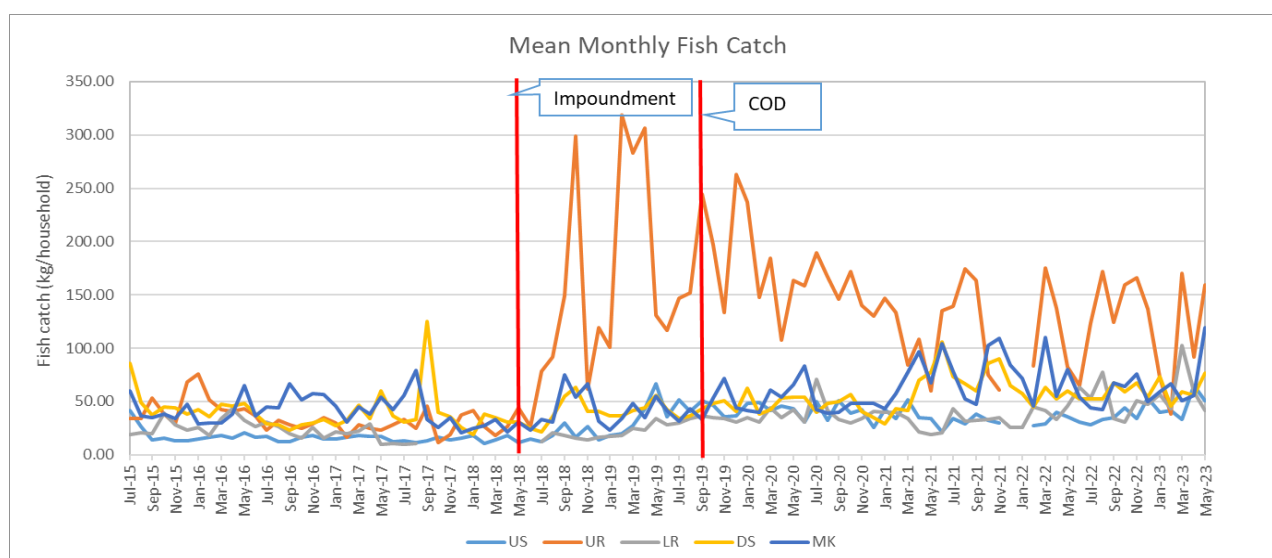
Figure 2.3-3: Mean of monthly fishing day from July 2015 to May 2023

The mean monthly number of fishing days for the month of May from 2016 to 2023 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-4**.

Table 2.3-4: Mean reported number of fishing days by fishing zone for the month of May from 2016 to 2023

Fishing Zone	May 2016 (day)	May 2017 (day)	May 2018 (day)	May 2019 (day)	May 2020 (day)	May 2021 (day)	May 2022 (day)	May 2023 (day)
Upstream	9.03	10.87	9.60	13.60	12.79	14.61	14.02	13.29
Upper reservoir	11.81	8.86	8.86	13.29	12.73	8.39	11.39	13.92
Lower reservoir	12.55	6.40	NA	13.73	12.35	8.34	11.81	12.44
Downstream	11.65	14.02	11.65	14.55	13.74	16.86	17.91	15.82
Mekong	16.15	16.01	12.95	16.45	17.71	17.03	16.42	19.12

The mean monthly household fish catch from July 2015 to May 2023 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 2.3-4**.

**Figure 2.3-4: Mean Monthly Household Fish Catch from July 2015 to May 2023**

The mean household fish catch for the month of May from 2016 to 2023 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-5**.

Table 2.3-5: Mean Monthly Household Fish Catch for the month of May from 2016 to 2023

Fishing Zone	May 2016 (kg)	May 2017 (kg)	May 2018 (kg)	May 2019 (kg)	May 2020 (kg)	May 2021 (kg)	May 2022 (kg)	May 2023 (kg)
Upstream	20.35	17.11	11.66	66.14	43.55	34.14	35.98	50.28
Upper reservoir	43.36	22.81	43.93	131.31	163.25	59.81	82.06	159.65
Lower reservoir	32.00	10.04	NA	34.12	42.62	18.96	46.04	41.54
Downstream	48.41	59.99	30.64	55.57	53.70	77.33	59.55	76.64
Mekong	65.23	53.65	30.93	54.44	66.12	67.62	79.97	119.25

The mean daily fish catch per household from July 2015 to May 2023 are displayed in **Figure 2.3-5** and the mean fish catch per household per fishing day for the month of May from 2016 to 2023 are shown in **Table 2.3-6**.

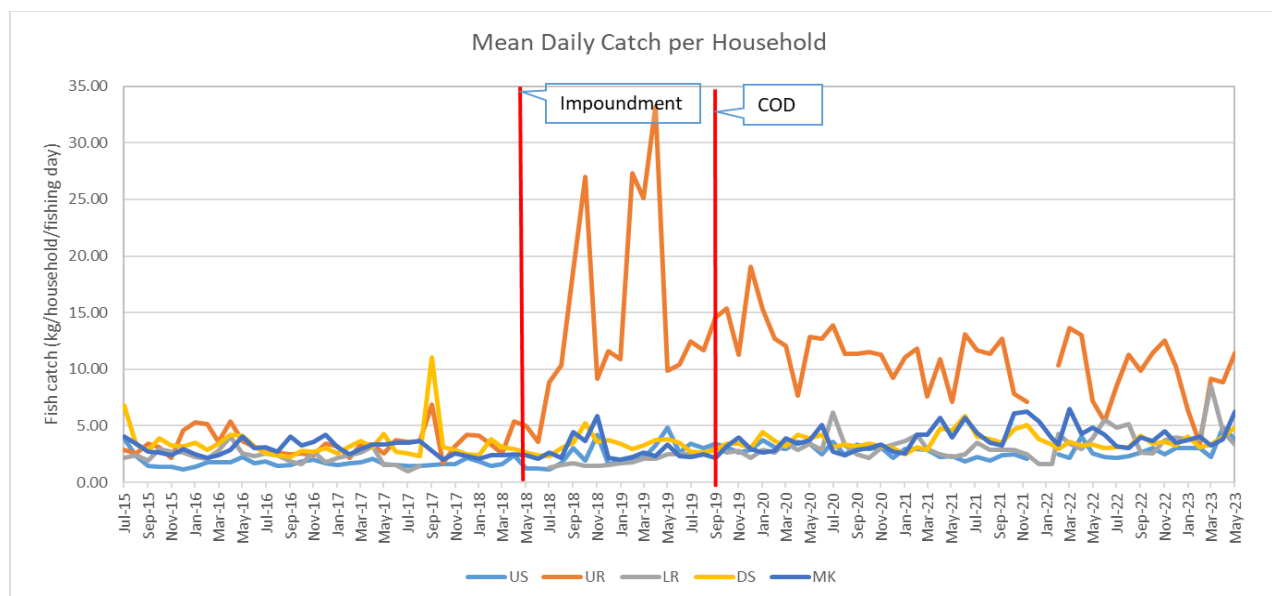


Figure 2.3-5: Mean Daily Fish Catch per Household from July 2015 to May 2023

Table 2.3-6: Mean Daily Fish Catch per Household for the month of May from 2016 to 2023

Fishing Zone	May 2016 (kg)	May 2017 (kg)	May 2018 (kg)	May 2019 (kg)	May 2020 (kg)	May 2021 (kg)	May 2022 (kg)	May 2023 (kg)
Upstream	2.25	1.57	1.22	4.86	3.40	2.34	2.57	3.78
Upper reservoir	3.67	2.58	4.96	9.88	12.82	7.13	7.21	11.47
Lower reservoir	2.55	1.57	NA	2.49	3.45	2.28	3.90	3.34
Downstream	4.15	4.28	2.63	3.82	3.91	4.59	3.33	4.85
Mekong	4.04	3.35	2.39	3.31	3.73	3.97	4.87	6.24

The survey results in May 2023 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zone, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are reservoir, tributaries and streams, and Mekong respectively. The proportion of fishing habitats in May 2023 are displayed in **Table 2.3-7**.

Table 2.3-7: Proportion of the catch reported by main habitats (%) in May 2023

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	9.4%	96.1%
Nam Ngiep	47.4%	8.6%	0.0%	51.9%	0.2%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	18.1%	87.2%	20.3%	0.0%	0.0%
Tributaries and streams	34.6%	2.8%	78.2%	28.8%	0.0%

Habitats	US	UR	LR	DS	MK
Wetlands	0.0%	1.4%	1.5%	9.9%	3.7%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total proportion of other aquatic animals (OAA) in the total reported catch of fish and OAA for the same 7-day period from July 2015 to May 2023 are presented in **Figure 2.3-6** and the proportion of OAA catch for the month of May from 2016 to 2023 are shown in **Table 2.3-8**.

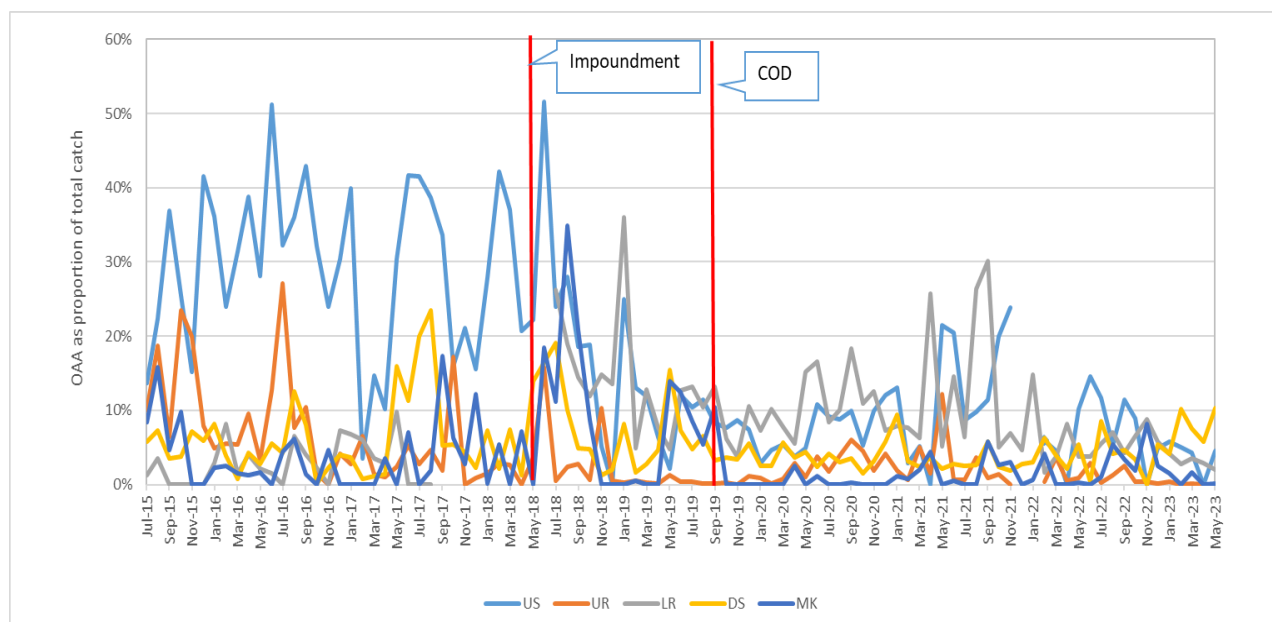


Figure 2.3-6: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to May 2023

Table 2.3-8: Proportion of OAA to the total reported number of fish and OAA for the month of May from 2016 to 2023

Fishing Zone	May 2016	May 2017	May 2018	May 2019	May 2020	May 2021	May 2022	May 2023
Upstream	28.14%	30.33%	22.17%	2.11%	4.84%	21.41%	10.22%	4.53%
Upper reservoir	3.21%	2.37%	3.69%	1.23%	1.04%	12.15%	0.88%	0.00%
Lower reservoir	2.14%	9.73%	NA	4.73%	15.23%	5.21%	3.75%	1.99%
Downstream	2.83%	15.89%	13.96%	15.41%	4.39%	2.09%	5.38%	10.32%
Mekong	1.61%	0.00%	0.00%	13.99%	0.00%	0.00%	0.23%	0.17%

3 EXTERNAL MISSIONS AND VISITS

There are no external missions and visits in June 2023.

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING**TABLE A-1: RESULTS OF MAIN RESERVOIR, RE-REGULATION RESERVOIR AND SURFACE WATER (NAM NGIEP RIVER, NAM PHOUAN, NAM CHIAN AND NAM XAO) QUALITY MONITORING**

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir					Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01
Date	Parameters (Unit)	Guideline															
6-Jun-23	pH	5.0 - 9.0	6.48											6.83			
7-Jun-23	pH	5.0 - 9.0		6.92	6.76	6.83									7.1		
8-Jun-23	pH	5.0 - 9.0					6.56	6.75	6.87	6.94							
9-Jun-23	pH	5.0 - 9.0									6.63	6.75	6.85	7.02			7.22 6.98
13-Jun-23	pH	5.0 - 9.0		6.91	6.85	6.74											
14-Jun-23	pH	5.0 - 9.0					6.55	6.45	6.77	6.83							
20-Jun-23	pH	5.0 - 9.0		7.3	6.65	6.6											
21-Jun-23	pH	5.0 - 9.0					6.4	6.45	6.3	6.35							
27-Jun-23	pH	5.0 - 9.0					6.65	6.6	6.7	6.76							
28-Jun-23	pH	5.0 - 9.0		6.95	6.5	6.55											
6-Jun-23	Sat. DO (%)		88.4											96			
7-Jun-23	Sat. DO (%)			79.5	95.5	102.2									93.6		
8-Jun-23	Sat. DO (%)						87.7	86.1	22.5	29.2							
9-Jun-23	Sat. DO (%)										40.7	36.7	52.5	69.6		70.3	80.6
13-Jun-23	Sat. DO (%)			75.5	79.9	90.6											
14-Jun-23	Sat. DO (%)						100.1	94.3	41.8	39.8							
20-Jun-23	Sat. DO (%)			90.8	80.8	86.8											
21-Jun-23	Sat. DO (%)						88.3	81	41.6	50.5							
27-Jun-23	Sat. DO (%)						85.6	76.8	30.4	29.4							
28-Jun-23	Sat. DO (%)			78.3	65.5	92.3											
6-Jun-23	DO (mg/L)	>6.0	6.82											6.83			
7-Jun-23	DO (mg/L)	>6.0		6.24	6.99	7.55									7.51		
8-Jun-23	DO (mg/L)	>6.0					6.54	6.47	1.85	2.37							
9-Jun-23	DO (mg/L)	>6.0									3.36	3.07	4.34	5.64			5.45 6.48

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houa y Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS 01
Date	Parameters (Unit)	Guideline																
13-Jun-23	DO (mg/L)	>6.0		6.16	6.06	6.79												
14-Jun-23	DO (mg/L)	>6.0					7.5	7.18	3.38	3.21								
20-Jun-23	DO (mg/L)	>6.0		6.89	6.14	6.58												
21-Jun-23	DO (mg/L)	>6.0					6.7	6.3	3.35	4.02								
27-Jun-23	DO (mg/L)	>6.0					6.52	5.92	2.45	2.35								
28-Jun-23	DO (mg/L)	>6.0		6.45	5.02	6.87												
6-Jun-23	Conductivity (µs/cm)		138											37				
7-Jun-23	Conductivity (µs/cm)			98	108	87									85			
8-Jun-23	Conductivity (µs/cm)						82	80	90	88								
9-Jun-23	Conductivity (µs/cm)										89	90	87	83		124	35	
13-Jun-23	Conductivity (µs/cm)			88	108	87												
14-Jun-23	Conductivity (µs/cm)						80	80	86	86								
20-Jun-23	Conductivity (µs/cm)			103	101	84												
21-Jun-23	Conductivity (µs/cm)						82	82	85	86								
27-Jun-23	Conductivity (µs/cm)						82	81	88	88								
28-Jun-23	Conductivity (µs/cm)			105	103	87												
6-Jun-23	Temperature (°C)		28.83											26.64				
7-Jun-23	Temperature (°C)			27.97	31.96	31.24									26.63			
8-Jun-23	Temperature (°C)						30.69	30.18	25.26	26.1								
9-Jun-23	Temperature (°C)										25.14	25.23	25.47	25.92		28.52	25.6	
13-Jun-23	Temperature (°C)			25.7	29.9	30.4												
14-Jun-23	Temperature (°C)						30.41	29.57	26.1	26.41								
20-Jun-23	Temperature (°C)			26.92	29.76	30.26												
21-Jun-23	Temperature (°C)						29.69	28.75	26.45	27.02								
27-Jun-23	Temperature (°C)						29.55	28.85	26.52	26.75								
28-Jun-23	Temperature (°C)			25.25	29.41	30.62												
6-Jun-23	Turbidity (NTU)		878											73.5				

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup	
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites				
			Upstream/Main Reservoir					Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream		
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS 01
Date	Parameters (Unit)	Guideline																
7-Jun-23	Turbidity (NTU)			710	4.36	3.5									134			
8-Jun-23	Turbidity (NTU)						4.21	2.28	1.72	2.5								
9-Jun-23	Turbidity (NTU)										2.4	6.98	9.13	17		115	8.63	
13-Jun-23	Turbidity (NTU)			554	9.03	3.06												
14-Jun-23	Turbidity (NTU)						3.42	1.89	1.95	5.88								
20-Jun-23	Turbidity (NTU)			260	3.84	3.56												
21-Jun-23	Turbidity (NTU)						3.5	1.89	2.65	2.74								
27-Jun-23	Turbidity (NTU)						3.98	2.35	1.89	2.96								
28-Jun-23	Turbidity (NTU)																	
6-Jun-23	TSS (mg/L)		581											64.29				
7-Jun-23	TSS (mg/L)			802.36		26.52									196.32			
8-Jun-23	TSS (mg/L)						<5	<5	<5	<5								
9-Jun-23	TSS (mg/L)										<5	<5	16.06	<5		58.79	5	
6-Jun-23	COD (mg/L)	<5.0	28.8												22.4			
7-Jun-23	COD (mg/L)	<5.0														35.2		
8-Jun-23	COD (mg/L)	<5.0							<5	6.7								
9-Jun-23	COD (mg/L)	<5.0									<5	<5	<5	<5		22.2	19.2	
6-Jun-23	NH ₃ -N (mg/L)	<0.2	0.3												0.2			
7-Jun-23	NH ₃ -N (mg/L)	<0.2		0.4		0.6										0.2		
8-Jun-23	NH ₃ -N (mg/L)	<0.2					0.3	<0.2										
6-Jun-23	NO ₃ -N (mg/L)	<5.0	0.17												0.13			
7-Jun-23	NO ₃ -N (mg/L)	<5.0		0.31		0.11										0.12		
8-Jun-23	NO ₃ -N (mg/L)	<5.0					0.1	<0.02										
6-Jun-23	Faecal coliform (MPN/100 mL)	<1,000	430												1,600			
7-Jun-23	Faecal coliform (MPN/100 mL)	<1,000														1,600		
9-Jun-23	Faecal coliform (MPN/100 mL)	<1,000									9	11	350	79			350	220

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS 01
Date	Parameters (Unit)	Guideline																
6-Jun-23	Total Coliform (MPN/100 mL)	<5,000	1,600											1,600				
7-Jun-23	Total Coliform (MPN/100 mL)	<5,000													1,600			
9-Jun-23	Total Coliform (MPN/100 mL)	<5,000								220	110	1,600	1,600			1,600	1,600	
6-Jun-23	TKN		5.5											<1.5				
7-Jun-23	TKN			6.2		<1.5									<1.5			
8-Jun-23	TKN						<1.5	<1.5										
6-Jun-23	TOC (mg/L)		11.62											5.9				
7-Jun-23	TOC (mg/L)														14.28			
8-Jun-23	TOC (mg/L)								1.03	1.05								
9-Jun-23	TOC (mg/L)										1.23	1.19	1.52	1.88		5.02	7.59	
6-Jun-23	Total Phosphorus (mg/L)		0.06											0.02				
7-Jun-23	Total Phosphorus (mg/L)			0.06		<0.01									0.05			
8-Jun-23	Total Phosphorus (mg/L)						0.04	<0.01										
6-Jun-23	Total Dissolved Phosphorus (mg/L)		0.02											0.01				
7-Jun-23	Total Dissolved Phosphorus (mg/L)			0.03		<0.01									0.01			
8-Jun-23	Total Dissolved Phosphorus (mg/L)						0.02	<0.01										
7-Jun-23	TSS (mg/L)-bottom					29.07												
8-Jun-23	TSS (mg/L)-bottom						17.27	6.1										
7-Jun-23	BOD ₅ (mg/L)-bottom					6.5									<1			
8-Jun-23	BOD ₅ (mg/L)-bottom						<1	<1										
7-Jun-23	NH ₃ -N (mg/L)-bottom					0.7												
8-Jun-23	NH ₃ -N (mg/L)-bottom						0.8	0.5										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS 01
Date	Parameters (Unit)	Guideline																
7-Jun-23	NO ₃ -N (mg/L)-bottom				0.12													
8-Jun-23	NO ₃ -N (mg/L)-bottom					<0.02	<0.02											
7-Jun-23	TKN-bottom				<1.5													
8-Jun-23	TKN-bottom					<1.5	<1.5											
7-Jun-23	Total Dissolved Phosphorus (mg/L)-bottom				<0.01													
8-Jun-23	Total Dissolved Phosphorus (mg/L)-bottom					0.05	0.03											
7-Jun-23	Total Phosphorus (mg/L)-bottom				0.02													
8-Jun-23	Total Phosphorus (mg/L)-bottom					0.08	0.06											
7-Jun-23	Chlorophyll-A				4.01													

TABLE A-2: RESULTS OF CAMP EFFLUENTS IN JUNE 2023

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	05-Jun-23	19-Jun-23	05-Jun-23	19-Jun-23	05-Jun-23	19-Jun-23
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.61	6.89	6.57	6.84	6.82	6.6
Sat. DO (%)		54.3	67.9	73.4	72.3	56.8	53.8
DO (mg/L)		4.14	5.39	5.53	5.62	4.25	4.12
Conductivity (µs/cm)		374	308	609	478	1,053	923
Temperature (°C)		29.43	21.17	30.21	28.19	31.59	29.26
Turbidity (NTU)		2.6	1.34	11.1	6.97	76.6	24.5
TSS (mg/L)	<50	<5	<5	11.71	7.46	116.0	35.3
BOD ₅ (mg/L)	<30	<6	<6	12.78	9.06	<6	<6
COD (mg/L)	<125	<25	<25	43	<25	162	38
NH ₃ -N (mg/L)	<10.0	<2	1.8	22.6	17.8	22.7	7.7
Total Nitrogen (mg/L)	<10.0	1.42	1.94	23.6	19.1	24.2	8.0
Total Phosphorus (mg/L)	<2	0.79	0.98	2.1	1.6	3.0	3.3
Oil & Grease (mg/L)	<10.0	<1		2		3	
Total coliform (MPN/100 mL)	<400	920	16,000	16,000	1,600	0	920
Faecal Coliform (MPN/100 mL)	<400	240	5,400	9,200	1,600	0	280
Residual Chlorine (mg/L)	<1.0			0.01	0.05	0.23	0.55