



NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

July 2022


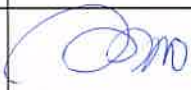

					
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EXECUTIVE SUMMARY

During July 2022, activities related to ISO14001:2015 implementation were continued such as following up on the implementation of the Environmental Management Plan and its achievements and on preparation and review of the internal audit plan for the coming session in August 2022.

During this reporting period, no new document was submitted to EMO for review and approval. However, EMO reviewed and approved a Site Decommissioning Plan submitted by the Contractor in late June 2022. EMO issued one Non-Compliance Report (NCR level 2) to a Contractor related to tree cutting (danger trees) outside the right of way (ROW) of the 22 kV Distribution Line (DL) without obtaining approval by the relevant authorities.

The operation and adjustment of the constructed wastewater treatment systems including the trial of bacteria seeding for the Sequencing Batch Reactor (SBR) system at OSOV2 continued in July 2022. The results of the effluent analyses after the trial indicated that the reduction of nitrogen and phosphorus had improved. However, it was also observed that the trial use of bacteria seeds could not generate sludge to meet the designed specifications. In this regard, EMO plans to apply sludge into the SBR system at OSOV2 within August 2022. It is expected that the operation of the system can be adjusted to meet the effluent standards by Q3 2022.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.2 mg/L in the upper 8.5 m varying between 5.02 mg/L and 8.07 mg/L, and the oxycline was generally found at depths between 8.5 m and 9.5 m with DO concentrations decreasing from about 7 mg/L to 4 mg/L. In the Re-regulation Reservoir, the DO concentrations were about 1 mg/L to 4 mg/L with a mean of 2.9 mg/L.

The DO measurements downstream the Re-regulation Dam during turbine discharges were less than 6 mg/L in all downstream stations. This is due to oxygen depletion in the deeper layers of the main reservoir, caused by decomposing submerged biomass which was left in the reservoir.

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 process of handing over the community solid waste management including the operation of Houay Soup Landfill to the local authorities (Bolikhan Environment Management Unit or EMU) has continued in July 2022. The report on the community consultations is still under review and consideration by the Bolikhan District Governor. EMO expects the solid waste management to be fully handed over and resume the community solid waste management by the local authority within Q3 2022.

A total of 10.71 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.42 m³ compared with June 2022.

The progress on the actions from the previous monthly meeting in May 2022 was discussed among EMO, Xaysomboun Watershed and Reservoir Protection Office (WRPO), and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) during the monthly meeting on 5 July 2022. Some activities have progressed but behind the expected target and schedule. EMO management has informed the situation to DOF-MAF for their support. The SMART refresher and new standard operation procedure (SOP) training for Bolikhamxay WRPO rangers in collaboration with BSP-WCS under NNP1 No Net Loss (NNL) fund was postponed due to unavailability of Bolikhamxay WRPO team. NC-NX BOMU safeguarding the three patrol sub-stations in July 2022 and preparing the material for the meeting with relevant village, district, and provincial authority for the NC-NX and TPZ boundary recognition with the technical support from EMO.

The fish catch monitoring for June 2022 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Channa striata*, and species groups of *Hampala*, *Poropuntius*, and *Sikukia gudgeri* and *Amblyrhynchichthys truncates*. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Sikukia gudgeri* which is classified as Data Deficient species (DD).

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During July 2022, activities related to ISO14001:2015 implementation were continued such as following up on the progress of implementing the Environmental Management Plan and its achievements and on preparation and review of the internal audit plan for the coming session in August 2022.

1.2 COMPLIANCE MANAGEMENT

In July 2022, EMO did not receive any document for review and approval. However, EMO reviewed and approved a Site Decommissioning Plan submitted by the Contractor in late June 2022. The status of the review is summarised in **Table 1-1**.

TABLE 1-1: SUMMARY OF DOCUMENT PENDING REVISION AND RESUBMISSION FOR REVIEW IN JULY 2022

Title	Date Received	Latest Status of documents which are pending to be submitted after revising
Site Decommissioning Plan	28 June 2022 (3 rd submission)	No objection with no further comment on 01 July 2022

The operation and adjustment of the constructed wastewater treatment systems including the trial of bacteria seeding for the Sequencing Batch Reactor (SBR) system at OSOV2 continued in July 2022. The results of the effluent analyses after the trial indicated that the reduction of nitrogen and phosphorus had improved. However, it was also observed that the trial use of bacteria seeds could not generate sludge to meet the designed specification. In this regard, EMO plans to apply sludge into the SBR system at OSOV2 within August 2022. It is expected that the operation of the system can be adjusted to meet the effluent standards by Q3 2022.

EMO issued one Non-Compliance Report (NCR level 2) to a Contractor related to tree cutting (danger trees) outside the right of way (ROW) of the 22 kV Distribution Line (DL) without obtaining approval by the relevant authorities. The status of compliance reports (Observation of Non-Compliance or ONC; and Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 1-2** and **Table 1-3** below.

TABLE 1-2: SUMMARY OF ONCs AND NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from June 2022	0	1	0	0
Newly Opened in July 2022	0	0	1	0
Total in July 2022	0	1	1	0
Resolved in July 2022	0	0	0	0

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over to August 2022	0	1	1	0
Unsolved Exceeding Deadlines	0	1	0	0

TABLE 1-3: SUMMARY OF THE *ONC* AND *NCR* ISSUED TO THE CONTRACTOR

Document Number / Date of Issue	Subject Description	Current Status at the end of July 2022
NC No. 01/22 Issued Date: 13-02-22 (NCR Level 1)	Some effluent parameters continue to exceed the standards for almost 5 months following the completion of the improvement and modification in September 2021	<ul style="list-style-type: none"> Conducted case study to confirm the efficiency of filter material of the wetland ponds; Conducted case study to identify the volume and sourcing of sludge to be applied for the SBR system at OSOV2; Maintenance of the damaged air blower piping system of WWTS at the Main Powerhouse. Monitoring of the influent and the effluent to check the treatment effectiveness will continue.
NC No. 02/22 Issued Date: 01-07-22 (NCR Level 2)	<p>1) The Contractor proposed “trimming of 6 trees” for the preventive and maintenance of ROW for 22 kV DL but in fact, they used the “cut” method for the three trees. This change in method without prior notification and revision of SS-ESMMP submitted to NNP1PC-TD. It has resulted in significant impacts on biodiversity especially when these are protected species listed in category II and III of the Forestry Law and IUCN as endangered or vulnerable (EIA of NNP1 Project prepared by ERM dated 2014).</p> <p>2) Most of these valuable trees are located outside the ROW of the 22 kV DL of 5 m from each side so cutting shall be</p>	<ul style="list-style-type: none"> Suspended the tree cutting and logs removal process; Submitted a letter to the relevant GOL authorities requested for site inspection and consideration as well as provided recommendations and approval for the trees cutting and logs removal. The inspection was done by district agriculture and forestry office. Requested the experts from the Faculty of Forestry Science of National University of Laos (NUOL) to identify and confirm the tree species. The tree species was identified and confirmed by the experts. ESMMP-OP dissemination was provided for NNP1PC’s relevant staff.

Document Number / Date of Issue	Subject Description	Current Status at the end of July 2022
	minimized to the extent possible. The contractor did not assess the risks nor propose any alternative options, but went ahead with cutting the trees without prior approval by EMO and the relevant GOL parties.	The preventive and corrective actions are still in progress and this NCR could be Closed Out within August 2022.

1.2.1 Site Inspection by Environment Management Unit (EMU)

The monthly site visit by the EMU of Bolikhan District and the quarterly site visit by the EMU of Xaysomboun Province were not carried out in July 2022.

1.2.2 Site Decommissioning and Rehabilitation

NNP1PC received the signed memo of land use handover from the District Office of Energy and Mines confirming their acceptance of the land use handover to GOL. The handover is currently being reviewed and considered by the higher government at provincial level.

The overall rehabilitation status of the construction sites and percentage of vegetation cover have remained the same as in the previous month of June 2022.

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 **Annex A** 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 1-4**.

TABLE 1-4: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSs IN JULY 2022

Site	Sampling ID	Status	Corrective Actions (Expected Completion Date)
OSOV1	EF01	Non-compliance for faecal coliform and total coliform.	1) Completed proper fence installation to prevent cattle from accessing the OSOV1 wetland ponds (31 March 2022). 2) Completed additional planting of reeds in the OSOV1 wetland ponds (31 March 2022). 3) Added the proper sludge/seeds into the Aeration Tank at OSOV2 WWTS and the Biofilm Septic Tank at the Main Powerhouse System – the effluent testing results after adding will be reported in Q3 of 2022. 4) Closely monitor the Residual Chlorine content in the effluents of OSOV2 and the Main Powerhouse WWTS and Chlorination dosage adjustment was successful by June 2022. 5) Closely monitor the Influent to compare with the effluent for the specific parameters to check the treatment effectiveness (Q2 of 2022).
OSOV2	EF13	Non-compliance for total phosphorus (one out of two), total nitrogen and ammonia-nitrogen.	
Main Powerhouse	EF19	Non-compliance for faecal coliform (one out of two), total coliform, total phosphorus, total nitrogen and ammonia-nitrogen.	

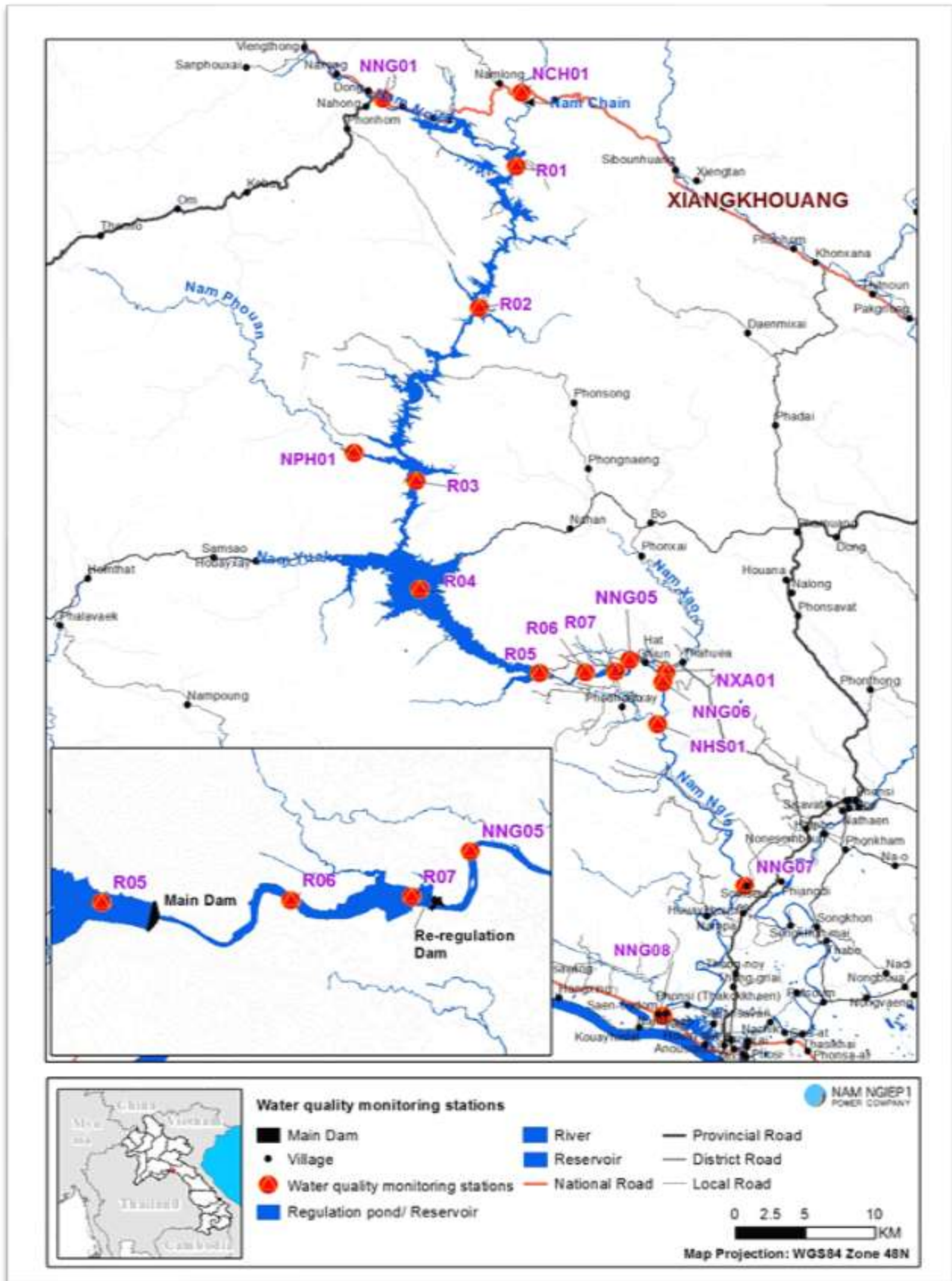
1.3.2 Ambient Surface Water and Reservoir Water Quality Monitoring

The ambient surface water and reservoir 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 1-1**.

The monitoring results for key parameters (DO, TSS and BOD₅) during July 2022 are presented in **Table 1-5, Table 1-6 and Table 1-7**. The full set of July 2022 is attached in **Annex A**. In addition, the trends of DO depth profile timeseries measurement graph for R05 station is shown in **Figure 1-2**, the results for DO timeseries are presented as line graphs in **Figure 1-3** and DO Long Profile graphs in **Figure 1-4**.

FIGURE 1-1: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

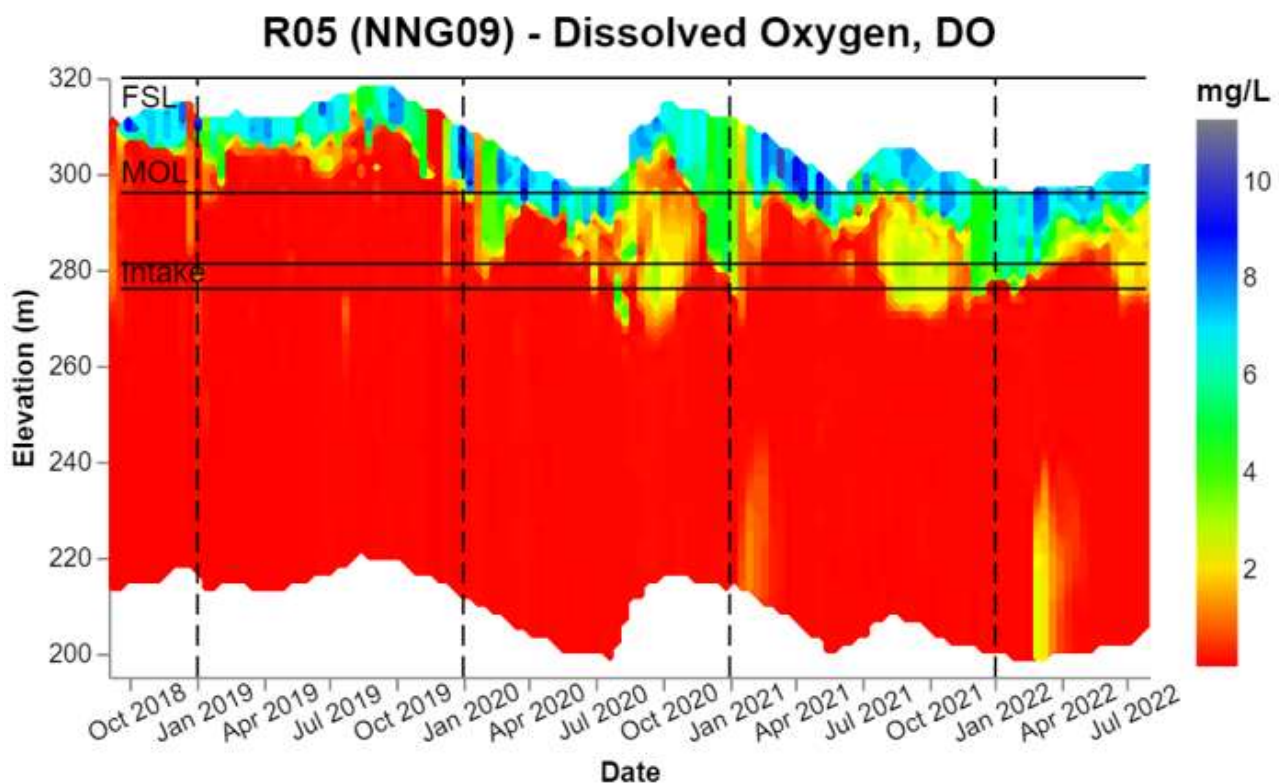


Main Reservoir

From 01 to 31 July 2022, the water level in the main reservoir increased from from El. 301.07 m asl to El. 303.32 m asl.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 7.2 mg/L in the upper 8.5 m varying between 5.02 mg/L and 8.07 mg/L, and the oxycline was generally found at the depths between 8.5 m and 9.5 m with DO concentrations decreasing from about 7 mg/L to 4 mg/L. DO concentrations below 0.5 mg/L (anoxic condition) were recorded at depths of 28 m to 30 m to the bottom which correspond to 2.8 m below the intake sill on 06 July 2022, 3.5 m below the intake sill on 13 July 2022, 2.8 m below the intake sill on 20 July 2022 and 2.5 m below the intake sill on 27 July 2022.

FIGURE 1-2: DO DEPTH PROFILES TIME SERIES IN R05 (SINCE SEPTEMBER 2018 TO JULY 2022)



At R04, the DO levels in the upper 6.0 m varied between 6.7 mg/L and 8.3 mg/L with oxycline at depths between 6.5 and 7.5 m below surface, DO concentrations in the depth interval from 6.5 m to 24.0 varied between 2 and 7 mg/L, and anoxic condition (0.5 mg/L) occurred at depths below 30 m.

At R03, the DO levels in the upper 5.5 m varied between 5.2 mg/L and 9.3 mg/L. DO concentrations decreased in the depth interval from 22 m to 28 m with a range between 2 mg/L and 7 mg/L. Anoxic condition (less than 0.5 mg/L) occurred at depths below 32 m.

At R02, the DO levels in the entire water column varied between 5.1 mg/L and 9.4 mg/L with a mean of 6.4 mg/L.

At R01, the DO level at the water surface were about 7 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 at R01, R02, R03, R04 and R05 in epilimnion were less than 1.0 mg/L. The BOD₅ measurements at R03, R04 and R05 in hypolimnion were 4.6 mg/L, 4.1 mg/L and less than 1 mg/L respectively.

Re-regulation Reservoir

In July 2022, the turbine discharges from the Main Powerhouse varied between 58 and 242 m³/s usually interrupted by night-time periods with no discharge.

The mean DO concentration in the water column were 2.9 mg/L in both R06 and R07.

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

Nam Ngiep Downstream

During July 2022, the downstream water quality monitoring was carried out during gate discharge (14 July 2022), turbine discharge and combination of turbine and gate/labyrinth discharges from the Re-regulation Dam. When the DO measurements downstream the Re-regulation Dam were carried out during turbine and combination of turbine and gate/labyrinth discharges, the DO concentrations were less than 6 mg/L in all downstream stations thus not complying with the surface water quality standard. This is due to oxygen depletion in the deeper layers of the main reservoir, caused by decomposing submerged biomass which was left in the reservoir.

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 station (NNG05) was less than 1 mg/L and complied with the national surface water quality standard.

Main Tributaries to Nam Ngiep

The monitored parameters in the Nam Phouan (NPH01), Nam Chiane (NCH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards, except COD at NSH01 and faecal coliform in NCH01.

FIGURE 1-3: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO JULY 2022

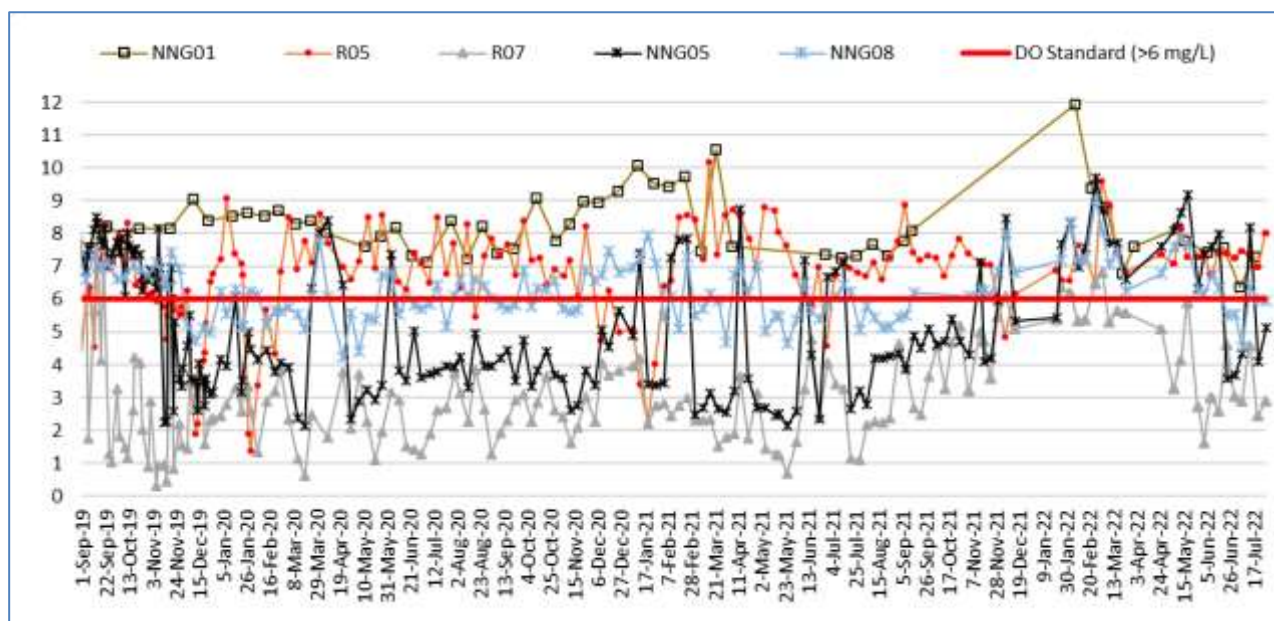


FIGURE 1-4: DISSOLVED OXYGEN (MG/L) LONG PROFILE IN JULY 2022 (FROM IMMEDIATELY UPPER MAIN DAM TO LOWER NAM NGIEP RIVER)

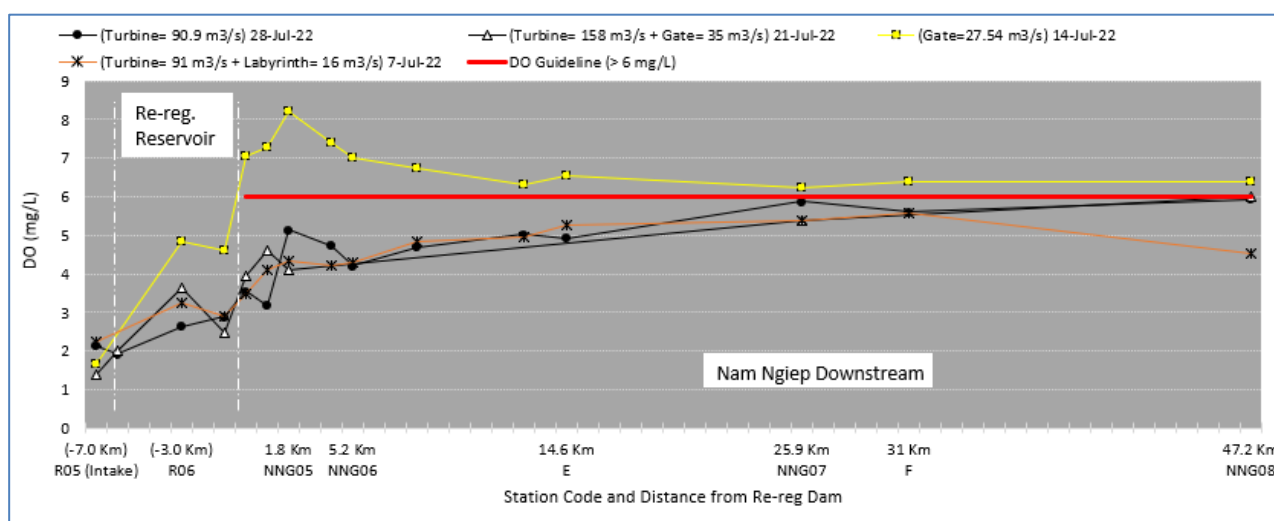


TABLE 1-5: RESULTS OF RESERVOIR AND SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL SURFACE WATER QUALITY STANDARD: >6.0 MG/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Jul-22	6.36												6.75			
5-Jul-22		8.03	6.88	7.56										7.55		
6-Jul-22					7.68	7.46	3.27	2.91								

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
7-Jul-22									4.33	4.3	5.37	4.54			6.31	6.25
12-Jul-22		8.28	8.31	8.08												
13-Jul-22					7.34	7.37	4.83	4.59								
14-Jul-22									8.2	7.01	6.25	6.38			6.82	6.52
18-Jul-22	7.3												7.73			
19-Jul-22		8.85	9.44	8.88										9.39		
20-Jul-22					6.72	6.98	3.63	2.47								
21-Jul-22									4.09		5.38	5.99			7.36	7.3
26-Jul-22		7.15	7.4	7.55										7.47		
27-Jul-22					7.93	8.01	2.65	2.9								
28-Jul-22									5.14	4.21	5.88	5.94			6.36	6.41

TABLE 1-6: RESULTS OF RESERVOIR AND 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
4-Jul-22	43.06												12.55			
5-Jul-22		43.38		<5										23.37		
5-Jul-22 Bottom				83.3												
6-Jul-22					<5	<5	<5	<5								
6-Jul-22 Bottom					<5	<5										
7-Jul-22									<5	<5	18.4	28.66			35	21.2

TABLE 1-7: RESULTS OF RESERVOIR AND SURFACE WATER QUALITY MONITORING FOR BOD₅ (MG/L) – SURFACE 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
4-Jul-22	<1												<1			
5-Jul-22		<1		<1										<1		
5-Jul-22				4.46												
6-Jul-22					<1	<1	<1	<1								

BOD ₅ (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jul-22					4.16											
7-Jul-22									<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During July 2022, community groundwater quality analyses were carried out for only five out of seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village due to the water pumps in two wells of Phouhomxay Village were broken. The community groundwater samples were taken from household water taps.

The results indicate that:

- The well in Somsuen Village complied with the National Standards.
- The well in Nam Pa Village and 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 pH, faecal coliform and *E. Coli* bacteria.

The community groundwater quality monitoring results are presented in **Table 1-8**.

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 1-8: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES

	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	25-Jul-22	25-Jul-22	25-Jul-22	04-Jul-22	04-Jul-22
pH	6.5 - 9.2	7.58	7.88	7.79	6.38	6.66
Sat. DO (%)		73.2	78.2	74.5	68.5	64
DO (mg/L)		5.41	5.99	5.61	5.27	5.11
Conductivity (µS/cm)		355	422	350	21	265
Temperature (°C)		31.45	29.22	29.71	28.93	26.96
Turbidity (NTU)	<20	1.58	0.59	2.18	2.31	1.8
Faecal coliform (MPN/100ml)	0	0	1.8	49	2	0
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	1.8	49	2	0

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of the water quality analyses are presented in **Table 1-9**.

Faecal Coliform and *E.coli* exceeded the standards in the water supply of Thaheua Village (WTHH02), Hat Gniun 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 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 1-9: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

	Site Name	Thaheua Village	Hat Gniun Village	Phouhomxay Village	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	25-July-22	25-July-22	25-July-22	25-July-22
pH	6.5 - 8.5	7.74	7.95	8.31	8.46
Sat. DO (%)		90	91.3	100.4	103
DO (mg/L)		6.05	6.84	7.54	7.92
Conductivity (µS/cm)	<1,000	47	104	9	10
Temperature (°C)	<35	30.15	30.5	30.38	29.04
Turbidity (NTU)	<10	6.34	5.03	1.13	1.04
Faecal Coliform (MPN/100 mL)	0	94	49	17	26
<i>E.coli</i> Bacteria (MPN/100 mL)	0	94	49	17	17

1.3.5 Landfill Leachate Monitoring

During July 2022, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that NNP1 Project Landfill leachate fully complied with the standards, but the Houay Soup Landfill Leachate did not comply with the standard for total coliform parameter. However, the concentration of faecal coliform bacteria was rather low. The leachate is still contained in the leachate ponds without being discharged to the environment. EMO will continue to monitor the leachate and report the results in the next monthly progress report. The landfill leachate monitoring results for July 2022 can be found in **Table 1-10**.

TABLE 1-10: 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	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
1-Jul-22	pH	6.0-9.0				8.08		8.1	
1-Jul-22	Sat. DO (%)					80.9		126.7	
1-Jul-22	DO (mg/L)					6.02		9.36	
1-Jul-22	Conductivity (µS/cm)					73		160	
1-Jul-22	Temperature (°C)					31.44		31.21	
1-Jul-22	Turbidity (NTU)					34.9		8.29	
1-Jul-22	COD (mg/L)	<125				52.8		25	
1-Jul-22	Faecal Coliform (MPN/100mL)	<400				13		17	
1-Jul-22	Total Coliform (MPN/100mL)	<400				350		920	
1-Jul-22	Total Nitrogen (mg/L)	<10				1.66		2.8	
1-Jul-22	Ammonia nitrogen (mg/L)	<10				<2		2.20	
1-Jul-22	Oil & Grease (mg/L)	<10				4		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 1-5** and **Figure 1-6** presents the values recorded since January 2020.

During July 2022, the mean inflow to the main reservoir was 171 m³/s. The minimum and maximum inflows were 115 m³/s (on 01 July 2022) and 268 m³/s (on 09 July 2022) respectively.

From 01 to 31 July 2022, the water level in the main reservoir increased from El. 301.07 m asl to El. 303.32 m asl.

In July 2022, the hourly turbine discharges from the Main Powerhouse varied between 58 m³/s and 242 m³/s usually interrupted by night-time periods with no discharge.

FIGURE 1-5: INFLOW TO THE MAIN RESERVOIR DURING JANUARY 2020 TO JULY 2022

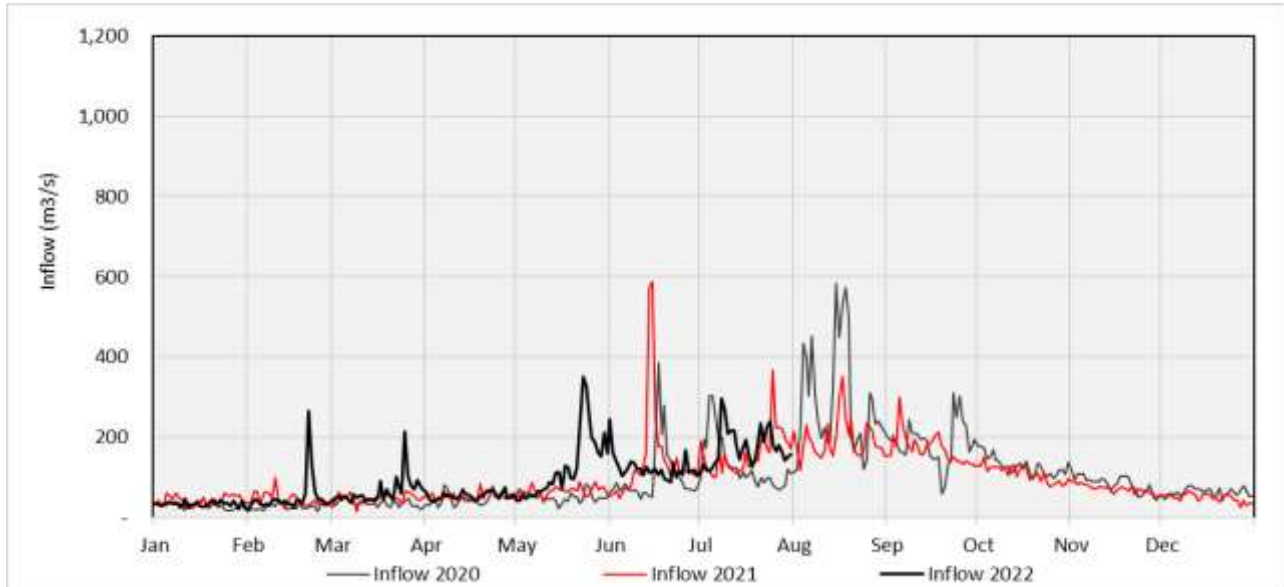
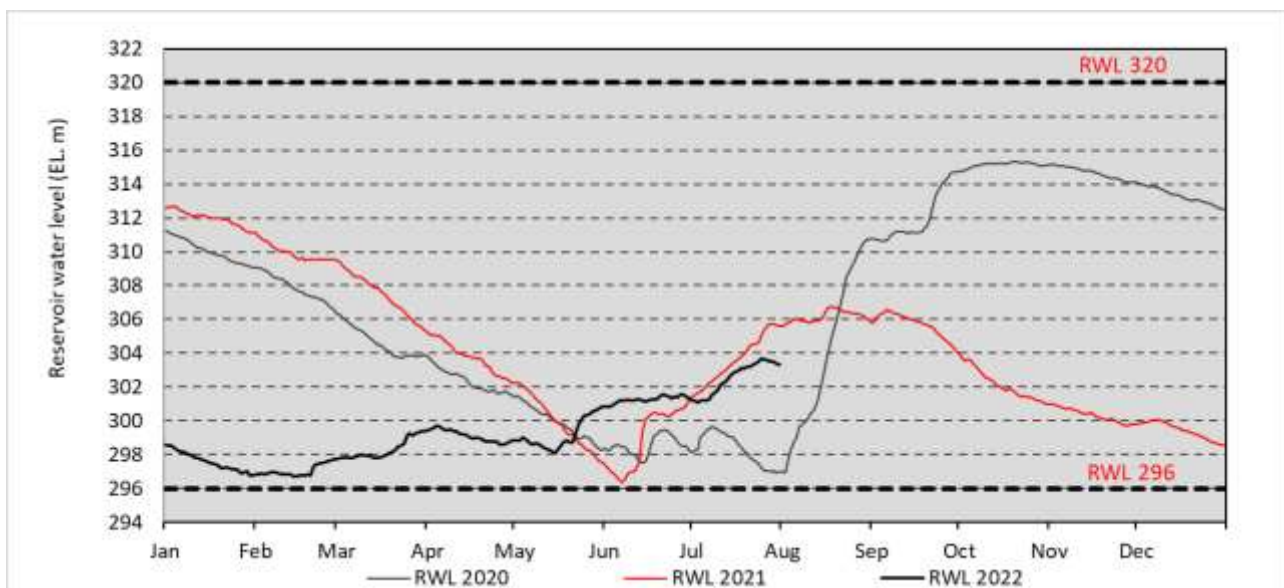


FIGURE 1-6: WATER LEVEL FOR THE MAIN RESERVOIR DURING JANUARY 2020 TO JULY 2022



1.4.2 Re-regulation Reservoir – Discharge

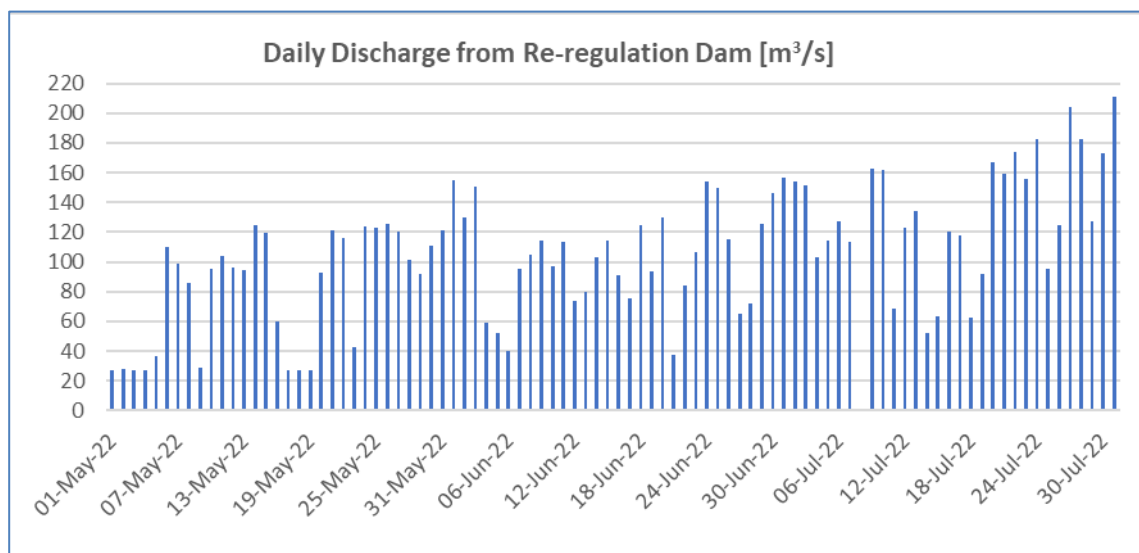
The daily discharge monitoring data for the Re-regulation Dam during May to July 2022 is presented in **Figure 1-7**.

During July 2022, the mean daily discharge from the Re-regulation Dam was about 134 m³/s, hourly gate discharge varied between 27 m³/s and 190 m³/s, hourly labyrinth discharge varied between 1

m³/s and 57 m³/s, and hourly turbine discharge varied between 49 m³/s and 161 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 1-7: DAILY DISCHARGE MONITORING AT THE RE-REGULATION DAM IN MAY TO JULY 2022



1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In July 2022, EMO carried out four boat missions to monitor the water depth in the Nam Ngiep downstream of the Re-regulation Dam. A total of 19 sites have been identified with potential shallow water depths and during the boat missions, the thalweg water depth was less than 0.5 m at one site (at 5.6 km from the Re-regulation Dam) during a discharge of about 27 m³/s on 14 July 2022 but the team did not have any difficulties with boat navigation.

NNP1PC TD and EMO team conducted a joint survey during low discharge (about 27 m³/s) on 28 May 2022 to determine the need for minor excavations in the thalweg riverbed to ensure compliance with the water depth requirement of at least 0.5 m and one site was observed the water depth less than 0.5 m during the mission. In June 2022, NNP1PC TD conducted a mission to move the rock in the riverbed by using the local manpower but it was not successful. EMO and TD agreed to consider another try to resolve this issue during the next dry season.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

A total of 10.71 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 0.42 m³ compared with June 2022.

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 included waste segregation and disposal, waste cover and compaction, grass cutting and repairing of perimeter fences.

FIGURE 1-8: WASTE MANAGEMENT ACTIVITIES AT NNP1 LANDFILL DURING JULY 2022



The total amount of recyclable waste selling and collection this month is summarized in **Table 1-11**.

TABLE 1-11: AMOUNTS OF RECYCLABLE WASTE SOLD AND COLLECTION IN JULY 2022

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by July 2022
1	Plastic bottles	kg	0	65
2	Aluminium can	kg	0	0
3	Paper/Cardboard	kg	0	40
4	Glass	kg	0	78
5	Scrap Metal	Kg	0	0
Total		kg	0	183

In July 2022, the villagers collected 271 kg food wastes 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 July 2022 are shown in **Table 1-12** and **Table 1-13**.

TABLE 1-12: RECORD OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in July 2022 (A)	Used (B)	Remaining at the end of July 2022 (A – B)
1	Diesel	Litre	10,380	5,498	4,882
2	Gasoline	Litre	708	523	185
3	Lubricant (Turbine oil)	Litre	5,080	0	5,080
4	Colour Paint	Litre	299	0	299
5	Thinner	Litre	10	0	10
6	Grease Oil	Litre	153	3	150
7	Gear Oil	Litre	435	0	435
8	Chlorine Liquid	Litre	70	10	60
9	Chlorine Powder	kg	70	67	3
10	HA Cut AF	Litre	3,925	0	3,925
11	HA Cut Cat AF	Litre	372.5	0	372.5

TABLE 1-13: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in July 2022 (A)	Disposed (B)	Remaining at the end of July 2022 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	326	0	326
2	Empty used oil drum/container (drum 200L)	Unit	53	3	50
3	Contaminated soil, sawdust and textile material	m ³	0.5	0	0.5
4	Used tyre	Drum	14	0	14
5	Empty used chemical drum/container (drum 20L)	Unit	19	2	17
6	Lead acid batteries	Unit	9	3	6
7	Empty paint and spray cans	Unit	182	10	172
8	Halogen/fluorescent bulbs	kg	74	5	69
9	Empty cartridge (Ink)	Unit	181	0	181
10	Clinic Waste	Kg	3	0	3
11	Expired Chlorine Powder	Kg	65	0	65

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme

The process of handing over the community waste bank to the Bolikhan District EMU has continued in July 2022. There was no recycle waste trade activities in the community recycle waste bank in July 2022.

1.6.2 Community Solid Waste Management

In July 2022, the communities' general waste collection and the Houay Soup Landfill operation are still under handover process to be managed by the local authorities (Bolikhan Environment Management Unit or EMU). There was no waste collection from communities to dispose of at Houay Soup Landfill during the reporting period. The report on community consultations is under consideration by the District Governor. It's expected that the waste management will be fully handed over to the local authority and that the community solid waste management will resume in Q3 2022.

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)

A monthly technical meeting between Xaysomboun Provincial Agriculture Forestry Office (PAFO)-WRPO, EMO, and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) was organized on 5 July 2022 at Xaysomboun PAFO office in Anouvong District to follow up on the progress and pending issues as discussed in the previous meeting. Some key discussion points and the relevant progresses until end of July 2022 are summarized below:

- Xaysomboun WRPO will work with the technical staff of Provincial Department of Home Affairs to draft the Agreement on establishment of provincial task force for addressing the forest encroachment and occupation in the watershed Total Protected Zones (TPZs). At the end of July 2022, the GOL team is still drafting the agreement.
- Xaysomboun WRPO confirmed their disagreement with the revised budget for the site inspection of mineral exploration of Boualay Mangkonthong Company in the watershed TPZ1 that was discussed before the meeting. They requested the site inspection be postponed until the agreement on accommodation allowance is made. EMO management have informed the situation and requested the support from Department of Forestry (DOF)-Ministry of Agriculture and Forestry (MAF). The matter is also related with the finalization of Financial Management Manual (FMM) and so DOF-MAF recommended NNP1PC to submit an official letter to Ministry of Finance (MoF) office for the clarification and guidance related with the interpretation of MoF Agreement, No.4000/MoF to be applied in the development project like the case of NNP1PC. NNP1PC has submitted an official letter to MoF office on 6 July 2022 and received the response from MoF on 26 July 2022 with the confirmation for NNP1PC to follow the Minister's Agreement No.4000/MoF particularly Section 4.1.1 under Article 4 about meal and accommodation for the

business trip allowance within the country. NNP1PC has no objection to provide the allowances following Minister's Agreement No.4000/MoF but will propose further discussion among NNP1, ADB, GOL, Independent Advisory Panel (IAP), Lender's Technical Advisor (LTA) and BSP-WCS after the budget evaluation by BSP-WCS.

- Xaysomboun WRPO confirmed that the consultation meeting on the role and responsibilities of reservoir fishery management for Hom and Thathom District was scheduled during 18-22 July 2022. However, the respective District Agriculture and Forestry Offices (DAFOs) did not confirm the actual date of the meeting until end of July 2022.
- The Hom District Governor Agreement on the establishment of District Watershed and Reservoir Protection Committee (WRPC), WRPO and staff assignment for WRPO sub-office, No. 0202/DG.HOM, dated 23 April 2022, does not specify the roles and responsibilities of the District WRPC, WRPO and appointed officials in detail. EMO team requested the representatives of Hom DAFO to further consult with their Management to include detailed roles and responsibilities within the agreement and include clarification on the assignment of only military staffs to be based in the sub-office. At the end of July 2022, the Hom DAFO is still discussing internally about the matter.
- The meeting also highlighted the information from SMART database of Xaysomboun WRPO. There are 345 cases recorded during the reservoir patrols from August 2021 – March 2022 that comprises of 242 cases of forest encroachment for agriculture purpose, 31 cases of wildlife hunting, 44 cases of illegal fishing, 15 cases of illegal logging, 6 cases of illegal NFTP collection, and 7 cases of forest fire. These cases warrant actions from the Xaysomboun WRPO as continuously being followed up by EMO and BSP-WCS. Xaysomboun WRPO with the support from BSP-WCS team will also prepare a list of repeated offenders to be further discussed during the next meeting in terms of what actions need to be taken.
- BSP-WCS team also emphasized that the mineral exploration within watershed TPZ1 does not comply with Xaysomboun Provincial Governor Agreement of NNP1 Watershed Management that was issued in 2019 and most importantly it poses a challenge in achieving the No Net Loss (NNL) for biodiversity. An action must be taken as soon as possible to avoid further destruction. EMO management has asked support from DOF-MAF and NNP1PC noted that the Deputy Director General (DDG) of DOF-MAF will communicate with Vice Minister of MAF accordingly.
- Xaysomboun WRPO shared a draft Agreement on the establishment of four TPZ Patrolling Teams and one forest patrol team. The draft is still being reviewed as of end of July 2022.
- Xaysomboun WRPO will discuss and have a written agreement with the fishermen how to manage their boats until the reservoir checkpoint is built or until the assigned staff relocated to the sub-office.
- Xaysomboun WRPO clarified that the contract for building the two ranger stations and two reservoir checkpoints was signed between the PAFO and the Contractor with the contract duration of six months. EMO team has requested Xaysomboun WRPO to provide an update on the progress of work, but as of end of July 2022, the Contractor had not yet mobilized due to difficult access at the start of the rainy season.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

The SMART refresher training and training on new standard operation procedures (SOP) for Bolikhamxay rangers in collaboration with BSP-WCS under NNP1 No Net Loss (NNL) was postponed

to August 2022 because of the unavailability of Bolikhamxay WRPO team. The patrolling will be resumed after this training.

2.1.1.3 NNP1PC EMO

Implementation of the agriculture extension service plan for improving home gardening and Kai Noi rice production continued in July 2022. Thathom DAFO submitted a monitoring report of Kai Noi rice farming for the month of July 2022 and it is being reviewed by EMO Team at the end of July 2022. Thathom DAFO also completed building the last greenhouse at Ban Phonhome at the end of July 2022.

Hom Women's Union prepared a training plan on the processing of pineapples for pineapple farmers at Ban Phoungou and Houayxai in Hom District which is part of activity promoting processed cash crop products of the 5-year action plan for strengthening local production and market linkages. The training aims to build basic knowledge and skills in adding value for pineapple cultivation. The farmers will learn making pineapple jam, dried pineapple and dishwashing liquid from waste pineapple waste. The training was scheduled for the third week of July 2022 but the document was not internally approved until the end of July 2022 and so the training was postponed to August 2022.

The trainers who are professors from Faculty of Agriculture of National University of Laos (NUOL) finalized the training and budget plan for cattle farming program at the end of June 2022. A training on beef cattle farming management for farmers at four villages: PhouNgou and Houayxai in Hom District and Phonhom and Nahong in Thathom District was tentatively scheduled for July 2022 but postponed. A meeting on the readiness and preparation of available local materials with the village authorities and producer groups of 2 respective villages in Thathom District was organized on 20 July 2022. The producer groups confirmed training can be organized during first week of August 2022. EMO also organized a meeting with the producer groups of 2 respective villages in Hom District at the end of July 2022 and the training can be organized after Thathom District.

The trainers further refined the training plan of pineapple and orange farming for farmers at Ban PhouNgou and Houayxai. The training is tentatively scheduled in August 2022.

EMO had a meeting with Thathom DAFO on 21 July 2022 for the work arrangement in connection with establishing the local producer groups at Nahong and Phonhome Village. The kick off meeting was scheduled for early August 2022 depending on the availability of assigned DAFO staffs.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

EMO team has reviewed the budget plan of Xaysomboun AIP2022 and submitted it to ADB and the Independent Advisory Panel (IAP) on 10 May 2022 for their review. IAP and ADB provided confirmation of no objection on 7 and 30 June 2022 respectively. EMO has further revised the budget plan 2022 considering the remaining period for the implementation activity. The revised budget was sent to Xaysomboun WRPO on 19 July 2022 and noted that Xaysomboun WRPO requested a further discussion with EMO team after their internal review.

2.1.2.2 Bolikhamxay WRPO

Bolikhamxay WRPO AIP2022 was finalized in February 2022 and the WRPO received their quarterly funds (Q1 and Q2) under their approved AIP 2022 in the first week of May 2022.

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 July 2022 are described below:

a. Component 1 - Spatial Planning and Regulation

Nam Chouane-Nam Xan (NC-NX) Biodiversity Offset Management Unit (BOMU), EMO and BSP-WCS organized a technical discussion/meeting on 30 June 2022 to clarify and agree on data and mapping for the recognition of NC-NX and TPZ boundary. It was noted that per further discussion and recommendation from Bolikhamxay PAFO management then a meeting with relevant provincial, district and village authorities will be organized to present the final boundaries to be officially recognized. The presentation material and relevant documents were prepared by NC-NX BOMU with the support from EMO in the third week of July 2022. The meeting will be organized after the confirmation of availability of participants.

b. Component 2 – Law Enforcement

The remaining budget from other activities under the previous AIP was only sufficient to mobilize two patrol teams within the TPZ highest priority area in June 2022 and to safe-guarding the three patrol sub-stations (Na Gngang, Nam Ma, and Nam San) in June and July 2022. It is noted that the law enforcement activity cannot be continued in the following months unless NC-NX BOMU agrees to proceed further with their AIP2022 finalization and approval then requesting for the fund disbursement from the Company.

The results of patrolling activity in June 2022 are as follows:

Team	Patrolling Area/distance	Observations/Actions Taken
1	TPZ highest priority area including Nam San and Nam San Mountain ridges. (16 days covering a distance of 69 km on forest patrolling)	The team did not encounter any threats during patrolling.
2	TPZ highest priority area including Nam Xi, Houay Xai Gnai and Houay Pong. (14 days covering a distance of 48.23 km on forest patrolling)	The team found and destroyed one old hunting camp located outside the TPZ and one old fishing camp inside the TPZ at Nam Xi. The team also found and removed an old hunting camp inside the TPZ at Houay Xay Gnai.

FIGURE 2-1: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN JUNE 2022

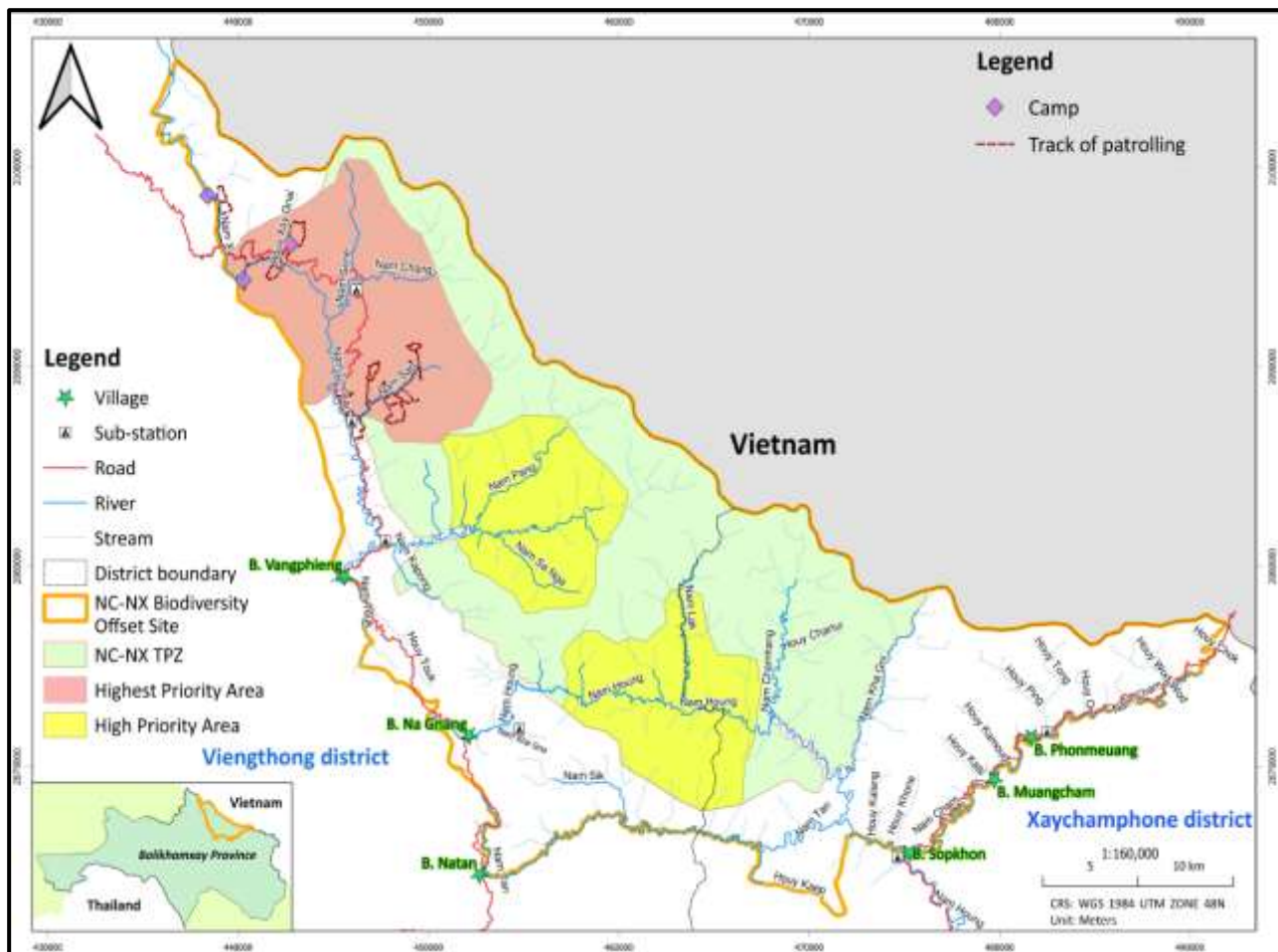


FIGURE 2-2: REPRESENTATIVE PHOTOS FOR MONTHLY PATROLLING IN JUNE 2022



c. Component 3 – Conservation Outreach

BSP-WCS shared the improved draft NC-NX outreach strategy to EMO on 23 June 2022. EMO reviewed and agreed with proposed revision by BSP-WCS and on the timeframe that will now cover

the period between 2022 to 2026 with additional minor comments on the draft. The reviewed draft was returned to BSP-WCS on 29 June 2022 and BSP is currently working on the improvements. The radio-broadcast outreach continued to be implemented in July 2022.

d. Component 4 – Conservation linked livelihood development

BSP-WCS continued improving the Lao version of the draft Community Conservation Agreement (CCA) for BOMU review and comments.

It had earlier been discussed and agreed among EMO, NC-NX BOMU, and BSP-WCS that an annual meeting for snare removal activity as well as the basic first aid training for snare removal team following the recommendation for the assessment of snare removal team performance should be conducted in July 2022. However, due to lack of sufficient remaining budget from other activities under the previous AIP, then only the annual meeting could be held (it was organized on 27 July 2022). The meeting was participated by the Viengthong DAFO, Viengthong Administration office, NC-NX BOMU, Chouan Village cluster police, BSP-WCS, EMO, Vangphieng village authorities and snare removal team. It was noted from the meeting that three of the snare removal team members voluntarily withdrew from the team due to their own family matters and health issues. In regards to the withdrawal of the team members, three new members were selected and agreed by the committee. It was also noted that the team still have weak capacity in terms of the technical skills, so refresher and first aid trainings are needed.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2022

EMO submitted an official response to the compiled comments from GOL committees on the final draft Financial Management Manual (FMM) to Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF) on 20 May 2022. A meeting on this matter will be organized after the review by DOF-MAF. However, there was no responses from GOL team until end of June 2022 and per discussion between DoF-MAF and NNP1 management then it was recommended that NNP1PC should submit an official letter to the Ministry of Finance to seek the clarification and guidance on the accommodation allowance issues. The letter was submitted on 6 July 2022 and MoF responded on 26 July 2022 with the confirmation for NNP1PC to follow the Minister's Agreement No.4000/MoF particularly Section 4.1.1 under Article 4 about meal and accommodation for the business trip allowance within the country. NNP1PC has no objection to provide the allowances following Minister's Agreement No.4000/MoF but will propose further discussions among NNP1, ADB, GOL, Independent Advisory Panel (IAP), Lender's Technical Advisor (LTA) and BSP-WCS after the budget evaluation by BSP-WCS.

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 June 2022 as listed in **Table 2-1**.

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 species (DD).

TABLE 2-1: FISH SPECIES DOMINATING THE FISH CATCH IN JUNE 2022

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	133.7	LC
<i>Oreochromis niloticus</i>	ປານິນ	89.5	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	90	LC
<i>Channa striata</i>	ປາຄໍ້	68.6	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	73.2	DD, LC

The recorded catch of Threatened species (IUCN Red List classification) in June 2022 are presented in **Table 2-2**. The list includes two species that are classified as Vulnerable species (VU).

TABLE 2-2: THREATENED SPECIES OF JUNE 2022 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	7.2	VU
<i>Tor sinensis</i>	ປາແດງ	43.3	VU

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in June 2022. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in June 2022 for above dam, below dam and Mekong area are presented in **Table 2-3**.

TABLE 2-3: MAIN BIODIVERSITY INDICATORS FOR JUNE 2022

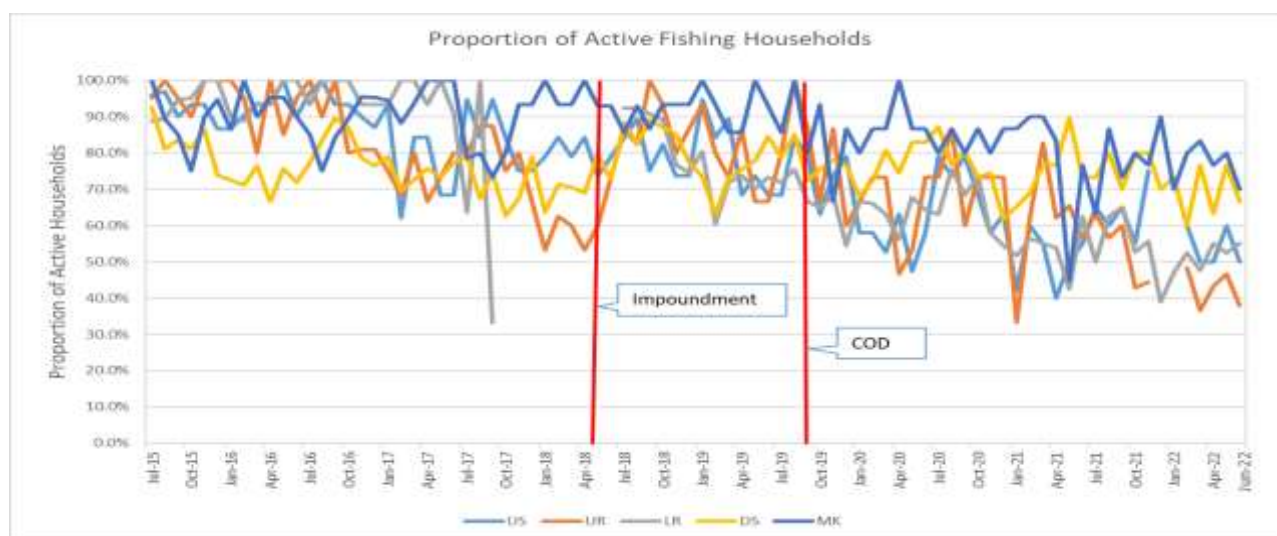
Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	19	36	28
Single species	15	23	17
Species groups	4	13	11
Top 15 species (% total catch weight)	97.65%	85.07%	95.64%
Proportion for species groups	14.03%	59.31%	42.59%

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.

Biodiversity Indicators	Mekong	Below dam	Above dam
Diversity index (Shannon)	2.2021	2.7588	2.4958

Figure 2-3 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 38% and 70% of active fishing households for all fishing zones in June 2022.

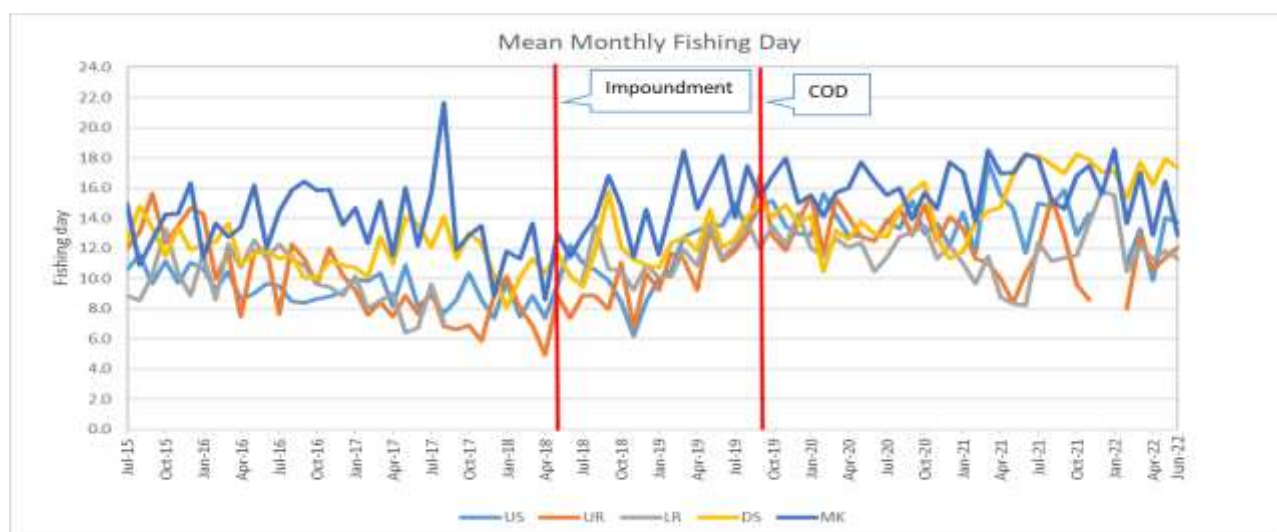
FIGURE 2-3: PROPORTION OF TOTAL NUMBER OF HOUSEHOLDS ACTIVELY FISHING BY FISHING ZONE FROM JULY 2015 TO JUNE 2022



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

Figure 2-4 shows the average (mean) of monthly household fishing days from July 2015 to June 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

FIGURE 2-4: MEAN OF MONTHLY HOUSEHOLD FISHING DAY FROM JULY 2015 TO JUNE 2022



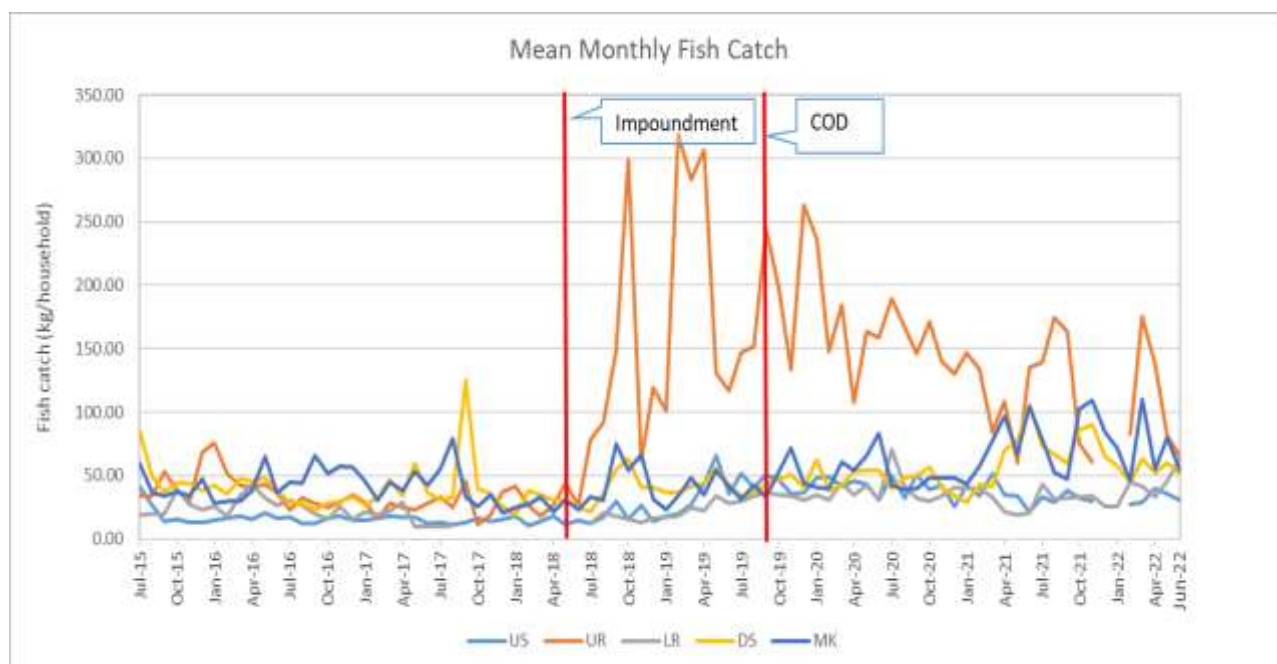
The mean monthly number of fishing day for the month of June from 2016 to 2022 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2-4**.

TABLE 2-4: MEAN REPORTED NUMBER OF FISHING DAYS BY FISHING ZONE FOR THE MONTH OF JUNE FROM 2016 TO 2022

Fishing Zone	June 2016 (day)	June 2017 (day)	June 2018 (day)	June 2019 (day)	June 2020 (day)	June 2021 (day)	June 2022 (day)
Upstream	9.64	8.14	12.24	13.52	12.47	11.69	13.71
Upper reservoir	11.90	7.62	7.35	11.14	12.47	10.34	12.08
Lower reservoir	11.33	6.73	NA	11.29	10.48	8.23	11.30
Downstream	11.87	13.60	10.22	12.07	12.97	18.12	17.36
Mekong	12.00	12.14	11.43	18.13	16.48	18.26	12.86

The mean monthly household fish catch from July 2015 to June 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 2-5**.

FIGURE 2-5: MEAN MONTHLY HOUSEHOLD FISH CATCH FROM JULY 2015 TO JUNE 2022

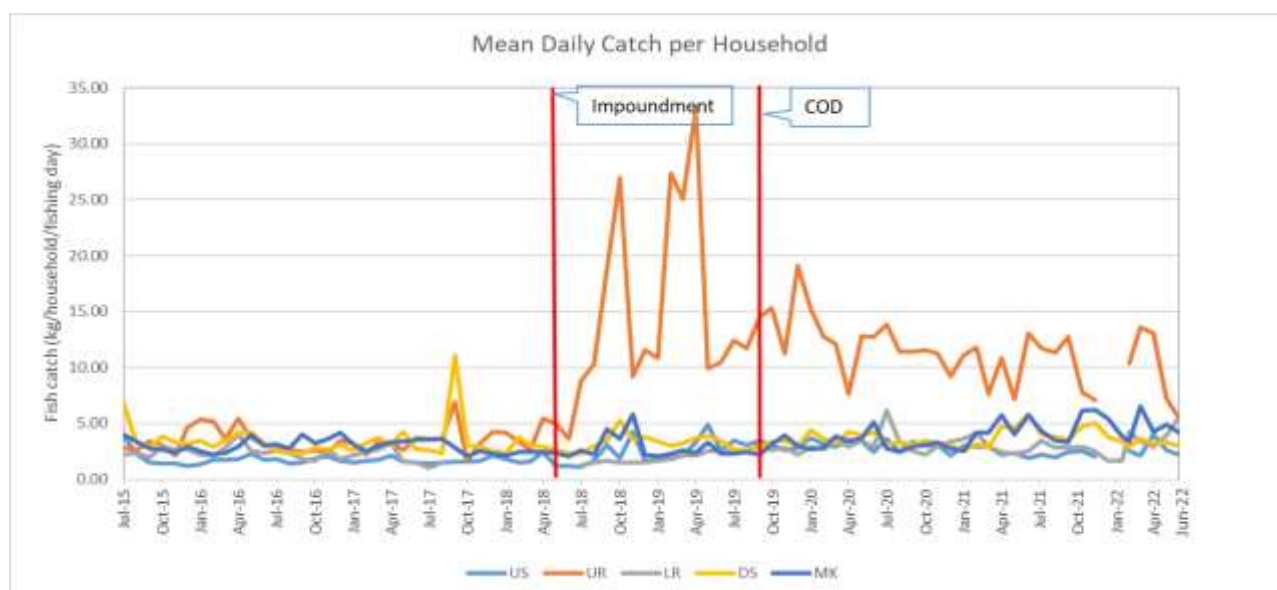


The mean household fish catch for the month of June from 2016 to 2022 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2-5**.

TABLE 2-5: MEAN MONTHLY HOUSEHOLD FISH CATCH FOR THE MONTH OF JUNE FROM 2016 TO 2022

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)	June 2021 (kg)	June 2022 (kg)
Upstream	16.53	12.34	14.57	35.47	30.62	21.66	30.30
Upper reservoir	36.57	28.43	26.51	116.40	158.49	134.87	65.30
Lower reservoir	26.66	10.16	NA	28.39	30.44	20.59	62.98
Downstream	38.16	36.61	24.45	41.97	54.11	105.99	51.99
Mekong	36.29	42.50	23.43	41.60	83.64	104.22	53.84

The mean daily fish catch per household from July 2015 to June 2022 are displayed in **Figure 2-6** and the mean fish catch per household per fishing day for the month of June from 2016 to 2022 are shown in **Table 2-6**.

FIGURE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JUNE 2022**TABLE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF JUNE FROM 2016 TO 2022**

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)	June 2021 (kg)	June 2022 (kg)
Upstream	1.71	1.52	1.19	2.62	2.46	1.85	2.21
Upper reservoir	3.07	3.73	3.61	10.45	12.71	13.05	5.41
Lower reservoir	2.35	1.51	NA	2.51	2.91	2.50	5.57

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)	June 2021 (kg)	June 2022 (kg)
Downstream	3.22	2.69	2.39	3.48	4.17	5.85	3.00
Mekong	3.02	3.50	2.05	2.29	5.07	5.71	4.19

The survey results in June 2022 indicate that Nam Ngiep is the main fishing habitat for the downstream zone, reservoir is the main fishing habitat for upper reservoir and lower reservoir zones, while the main fishing habitat for the upstream and Mekong zones are tributaries and streams and Mekong respectively. The proportion of fishing habitats in June 2022 are displayed in **Table 2-7**.

TABLE 2-7: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN JUNE 2022

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	8.9%	82.9%
Nam Ngiep	40.7%	19.6%	0.0%	56.5%	7.8%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	60.6%	53.5%	0.0%	0.0%
Tributaries and streams	57.9%	18.1%	41.5%	31.3%	0.0%
Wetlands	1.4%	1.8%	4.9%	3.3%	9.3%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total reported fish and other aquatic animals (OAA) catch (proportion of OAA) for the same 7-day period from July 2015 to June 2022 are presented in **Figure 2-7** and the proportion of OAA catch for the month of June from 2016 to 2022 are shown in **Table 2-8**.

FIGURE 2-7: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE FROM JULY 2015 TO JUNE 2022

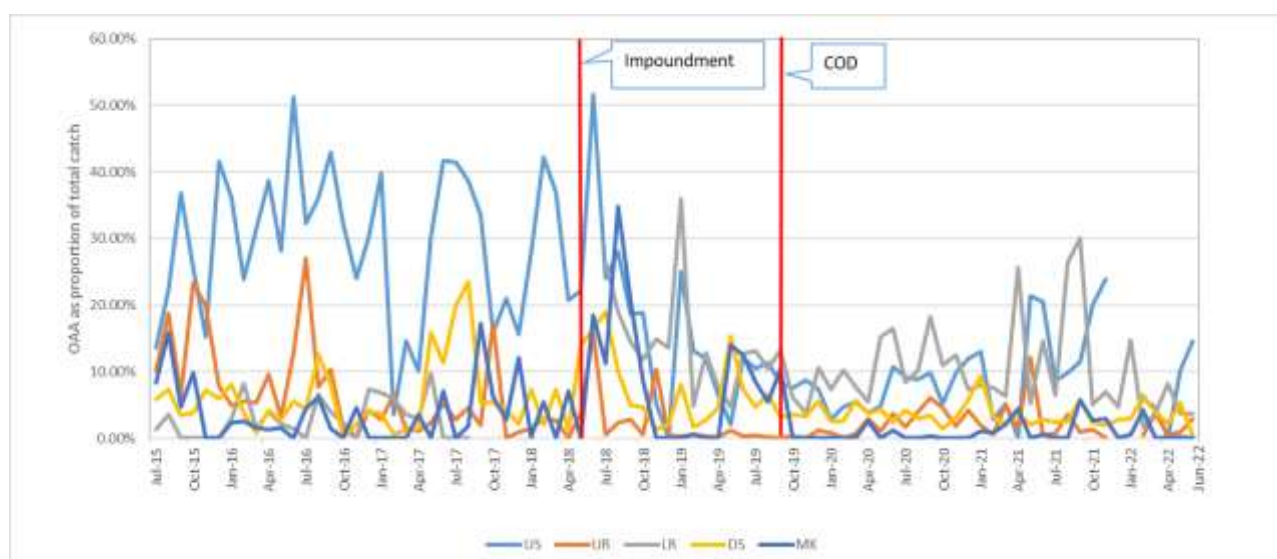


TABLE 2-8: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR THE MONTH OF JUNE FROM 2016 TO 2022

Fishing Zone	June 2016	June 2017	June 2018	June 2019	June 2020	June 2021	June 2022
Upstream	51.23%	41.70%	51.63%	12.09%	10.78%	20.46%	14.61%
Upper reservoir	12.73%	5.24%	15.76%	0.37%	3.74%	0.59%	2.90%
Lower reservoir	1.47%	0.00%	NA	12.70%	16.52%	14.58%	3.75%
Downstream	5.52%	11.31%	16.40%	7.30%	2.40%	2.82%	0.41%
Mekong	0.00%	7.03%	18.51%	12.48%	1.17%	0.53%	0.00%

3. EXTERNAL MISSIONS AND VISITS

There was no external mission and visit during the month of reporting.

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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
4-Jul-22	pH	5.0 - 9.0	6.62											6.72				
5-Jul-22	pH	5.0 - 9.0		6.89	6.86	7.2									6.85			
6-Jul-22	pH	5.0 - 9.0					7.16	7.24	7.04	6.93								
7-Jul-22	pH	5.0 - 9.0									7.14	7.08	7.08	6.95			7.19	7.03
12-Jul-22	pH	5.0 - 9.0		6.79	7.27	7.3												
13-Jul-22	pH	5.0 - 9.0					7.42	7.24										
14-Jul-22	pH	5.0 - 9.0							7.35	7.21	7.36	7.05	7.89	8.09			7.1	7.85
18-Jul-22	pH	5.0 - 9.0	7.78												7.81			
19-Jul-22	pH	5.0 - 9.0		7.91	7.99	7.62										8.05		
20-Jul-22	pH	5.0 - 9.0					7.62	6.98	7.69	7.67								
21-Jul-22	pH	5.0 - 9.0									7.63		8.1	8.19			7.8	8.59
26-Jul-22	pH	5.0 - 9.0		8.19	8.6	8.08										8.55		
27-Jul-22	pH	5.0 - 9.0					7.41	7.16	7.09	7.92								
28-Jul-22	pH	5.0 - 9.0									7.58	6.64	7.71	7.6			6.49	7.26
4-Jul-22	Sat. DO (%)		80.4												82.7			
5-Jul-22	Sat. DO (%)			98.9	91.1	101.5										92.1		
6-Jul-22	Sat. DO (%)						101.8	96.8	40.7	35.9								
7-Jul-22	Sat. DO (%)										52.3	52.2	65.4	54.4			78.6	75.9
12-Jul-22	Sat. DO (%)			99.3	109.5	109.4												
13-Jul-22	Sat. DO (%)						97.3	97	61.3	61.8								

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
14-Jul-22	Sat. DO (%)									101.7	88.2	78.3	80			87.5	80.9	
18-Jul-22	Sat. DO (%)		93.4											94.2				
19-Jul-22	Sat. DO (%)			108.8	129.3	120.1									114.4			
20-Jul-22	Sat. DO (%)						90.3	92.3	44.3	31.3								
21-Jul-22	Sat. DO (%)										49.8		65.9	74.2			95.1	87.1
26-Jul-22	Sat. DO (%)			88.2	102.3	105.7										94.5		
27-Jul-22	Sat. DO (%)						107.6	107.1	32.5	36.2								
28-Jul-22	Sat. DO (%)										63.7	52.4	74	76.8			83.9	81.9
4-Jul-22	DO (mg/L)	>6.0	6.36												6.75			
5-Jul-22	DO (mg/L)	>6.0		8.03	6.88	7.56										7.55		
6-Jul-22	DO (mg/L)	>6.0					7.68	7.46	3.27	2.91								
7-Jul-22	DO (mg/L)	>6.0									4.33	4.3	5.37	4.54			6.31	6.25
12-Jul-22	DO (mg/L)	>6.0		8.28	8.31	8.08												
13-Jul-22	DO (mg/L)	>6.0					7.34	7.37	4.83	4.59								
14-Jul-22	DO (mg/L)	>6.0									8.2	7.01	6.25	6.38			6.82	6.52
18-Jul-22	DO (mg/L)	>6.0	7.3												7.73			
19-Jul-22	DO (mg/L)	>6.0		8.85	9.44	8.88										9.39		
20-Jul-22	DO (mg/L)	>6.0					6.72	6.98	3.63	2.47								
21-Jul-22	DO (mg/L)	>6.0									4.09		5.38	5.99			7.36	7.3
26-Jul-22	DO (mg/L)	>6.0		7.15	7.4	7.55										7.47		
27-Jul-22	DO (mg/L)	>6.0					7.93	8.01	2.65	2.9								
28-Jul-22	DO (mg/L)	>6.0									5.14	4.21	5.88	5.94			6.36	6.41
4-Jul-22	Conductivity (µs/cm)		99												37			
5-Jul-22	Conductivity (µs/cm)			87	79	73										90		
6-Jul-22	Conductivity (µs/cm)						70	69	79	80								

19 August 2022

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
7-Jul-22	Conductivity (µs/cm)									79	81	61	48			102	15	
12-Jul-22	Conductivity (µs/cm)			80	77	73												
13-Jul-22	Conductivity (µs/cm)						69	68	77	73								
14-Jul-22	Conductivity (µs/cm)									69	78	74	64			97	18	
18-Jul-22	Conductivity (µs/cm)		107											33				
19-Jul-22	Conductivity (µs/cm)			78	78	71									93			
20-Jul-22	Conductivity (µs/cm)						63	63	75	74								
21-Jul-22	Conductivity (µs/cm)										77		74	54		100	15	
26-Jul-22	Conductivity (µs/cm)			79	73	68									82			
27-Jul-22	Conductivity (µs/cm)						64	64	74	73								
28-Jul-22	Conductivity (µs/cm)										76	77	75	65		102	20	
4-Jul-22	Temperature (°C)		26.62												25.57			
5-Jul-22	Temperature (°C)			25.9	29.98	30.87										25.39		
6-Jul-22	Temperature (°C)						30.06	28.95	26.4	26.06								
7-Jul-22	Temperature (°C)										25.03	25.21	25.36	25.47			26.89	25.31
12-Jul-22	Temperature (°C)			24.57	29.88	31.22												
13-Jul-22	Temperature (°C)						30.05	29.73	27.23	30.54								
14-Jul-22	Temperature (°C)										26.41	26.96	26.92	28.09			28.22	26.37
18-Jul-22	Temperature (°C)		22.5												9.78			
19-Jul-22	Temperature (°C)			25.72	31.93	31.21										25.37		
20-Jul-22	Temperature (°C)						30.95	29.89	25.91	27.37								
21-Jul-22	Temperature (°C)										25.41		25.54	26.3			28.55	24.28
26-Jul-22	Temperature (°C)			26.13	32.62	33.3										27.42		
27-Jul-22	Temperature (°C)						31.39	30.58	25.96	26.94								
28-Jul-22	Temperature (°C)										26.28	26.48	27.03	27.08			29.65	28.01

19 August 2022

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
4-Jul-22	Turbidity (NTU)		49.5											19				
5-Jul-22	Turbidity (NTU)			59.3	3.02	1.68									18			
6-Jul-22	Turbidity (NTU)						3.11	1.6	1.9	2.31								
7-Jul-22	Turbidity (NTU)										3.17	4.56	20.2	33.9			60.3	40
12-Jul-22	Turbidity (NTU)			39.8	3.08	1.05												
13-Jul-22	Turbidity (NTU)						1.33	1.32	1.83	1.58								
14-Jul-22	Turbidity (NTU)										2.54	13.9	13.4	12.6			36	9.49
19-Jul-22	Turbidity (NTU)			64.8	2.07	1.54										13.1		
20-Jul-22	Turbidity (NTU)						1.71	1.13	1.35	1.31								
21-Jul-22	Turbidity (NTU)										2.22		16.7	29.9			137	2.49
26-Jul-22	Turbidity (NTU)			68.8	2.13	1.16										18.4		
27-Jul-22	Turbidity (NTU)						1.59	1.34										
28-Jul-22	Turbidity (NTU)																	
4-Jul-22	TSS (mg/L)		43.06											12.55				
5-Jul-22	TSS (mg/L)			43.38		<5									23.37			
6-Jul-22	TSS (mg/L)						<5	<5	<5	<5								
7-Jul-22	TSS (mg/L)										<5	<5	18.4	28.66			35	21.2
4-Jul-22	BOD ₅ (mg/L)	<1.5	<1												<1			
5-Jul-22	BOD ₅ (mg/L)	<1.5		<1		<1										<1		
6-Jul-22	BOD ₅ (mg/L)	<1.5					<1	<1	<1	<1								
7-Jul-22	BOD ₅ (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
4-Jul-22	COD (mg/L)	<5.0	6.4												<5			
5-Jul-22	COD (mg/L)	<5.0														<5		
6-Jul-22	COD (mg/L)	<5.0							<5	<5								
7-Jul-22	COD (mg/L)	<5.0									<5	9.6	<5	10				6.8

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
4-Jul-22	NH ₃ -N (mg/L)	<0.2	<0.2											<0.2				
5-Jul-22	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2									<0.2			
6-Jul-22	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
4-Jul-22	NO ₃ -N (mg/L)	<5.0	0.07											0.07				
5-Jul-22	NO ₃ -N (mg/L)	<5.0		0.06		0.07									0.06			
6-Jul-22	NO ₃ -N (mg/L)	<5.0					<0.02	0.06										
4-Jul-22	Faecal coliform (MPN/100 mL)	<1,000	1,600											1,600				
5-Jul-22	Faecal coliform (MPN/100 mL)	<1,000												220				
6-Jul-22	Faecal coliform (MPN/100 mL)	<1,000						5	5									
7-Jul-22	Faecal coliform (MPN/100 mL)	<1,000								17	170	220	540			920	350	
4-Jul-22	Total Coliform (MPN/100 mL)	<5,000	1,600											1,600				
5-Jul-22	Total Coliform (MPN/100 mL)	<5,000													250			
6-Jul-22	Total Coliform (MPN/100 mL)	<5,000						27	22									
7-Jul-22	Total Coliform (MPN/100 mL)	<5,000								22	220	280	920			1,600	920	
4-Jul-22	TKN		<1.5											<1.5				
5-Jul-22	TKN			<1.5		<1.5									<1.5			
6-Jul-22	TKN						<1.5	<1.5										
5-Jul-22	Secchi Disk (m)				2	3												
6-Jul-22	Secchi Disk (m)						2.75	3	3.5	3								
12-Jul-22	Secchi Disk (m)				1.75	3.5												
13-Jul-22	Secchi Disk (m)						3.25	3.3	3.5	3.3								
19-Jul-22	Secchi Disk (m)				2.1	3												
20-Jul-22	Secchi Disk (m)						2.75	3	3.6	4								
26-Jul-22	Secchi Disk (m)				2.2	3												
27-Jul-22	Secchi Disk (m)						3	3.2	3.4	3								

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
4-Jul-22	TOC (mg/L)		2.34											2.07				
5-Jul-22	TOC (mg/L)														2.42			
6-Jul-22	TOC (mg/L)							2.01	1.87									
7-Jul-22	TOC (mg/L)									2	1.97	2.9	3.16				7.56	
5-Jul-22	Phytoplankton Biomass (g dry wt/m³)			43.2		1												
6-Jul-22	Phytoplankton Biomass (g dry wt/m³)						0.6	0.4										
4-Jul-22	Total Phosphorus (mg/L)		0.03											0.01				
5-Jul-22	Total Phosphorus (mg/L)			0.02		0.01									0.02			
6-Jul-22	Total Phosphorus (mg/L)						<0.01	<0.01										
4-Jul-22	Total Dissolved Phosphorus (mg/L)		0.02											<0.01				
5-Jul-22	Total Dissolved Phosphorus (mg/L)			0.01		0.01									0.02			
6-Jul-22	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
5-Jul-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
6-Jul-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
5-Jul-22	Turbidity (NTU)-bottom					73.9												
6-Jul-22	Turbidity (NTU)-bottom						1	2										
5-Jul-22	TSS (mg/L)-bottom					83.33												
6-Jul-22	TSS (mg/L)-bottom						<5	<5										
5-Jul-22	BOD ₅ (mg/L)-bottom					4.46												
6-Jul-22	BOD ₅ (mg/L)-bottom						4.16	<1										
5-Jul-22	NH ₃ -N (mg/L)-bottom					0.51												
6-Jul-22	NH ₃ -N (mg/L)-bottom						0.3	<0.2										
5-Jul-22	NO ₃ -N (mg/L)-bottom					0.06												

		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	NXA0 1	NHS01
Date	Parameters (Unit)	Guideline																
6-Jul-22	NO ₃ -N (mg/L)-bottom					0.07	0.07											
5-Jul-22	TKN-bottom				<1.5													
6-Jul-22	TKN-bottom					<1.5	<1.5											
5-Jul-22	Total Dissolved Phosphorus (mg/L)-bottom				0.01													
6-Jul-22	Total Dissolved Phosphorus (mg/L)-bottom					0.13	<0.01											
5-Jul-22	Total Phosphorus (mg/L)-bottom				0.02													
6-Jul-22	Total Phosphorus (mg/L)-bottom					0.16	0.01											
5-Jul-22	Hydrogen Sulfide (mg/L)-bottom				<0.02													
6-Jul-22	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02											
5-Jul-22	Phytoplankton Biomass (g dry wt/m³)-bottom				11.6													
6-Jul-22	Phytoplankton Biomass (g dry wt/m³)-bottom					11.7	1.6											

TABLE A-2: RESULTS OF CAMP EFFLUENTS IN JULY 2022

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	01-July-22	15-July-22	01-July-22	14-July-22	01-July-22	15-July-22
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.27	7.27	7.39	7.02	7.3	7.55
Sat. DO (%)		66.9	78.5	66.9	82.6	10.8	67.4
DO (mg/L)		5.22	6	5.14	6.34	0.81	5.11
Conductivity (µs/cm)		275	312	552	522	1,520	1,409
Temperature (°C)		27.67	29.26	28.63	29.02	29.74	29.58
Turbidity (NTU)		1.31	0.92	9.74	9.81	26.3	34.9
TSS (mg/L)	<50	<5	<5	11.2	5.82	19.6	35.86
BOD ₅ (mg/L)	<30		<6		<6		<6
COD (mg/L)	<125	<25	<25	36.5	30.0	91.9	116.0
NH ₃ -N (mg/L)	<10.0	<2	<2	22.1	18.9	91.40	76.60
Total Nitrogen (mg/L)	<10.0	0.58	0.37	24.0	20.4	96.40	82.60
Total Phosphorus (mg/L)	<2	1.13	1.17	2.4	1.6	8.23	6.68
Oil & Grease (mg/L)	<10.0	<1		1		2	
Total coliform (MPN/100 mL)	<400	9,200	5,400	13	0	1,600	1,600
Faecal Coliform (MPN/100 mL)	<400	2,400	5,400	0	0	240	1,600
Residual Chlorine (mg/L)	<1.0			0.40	0.23	0.02	0.66