

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

August 2021




					
A	15 September 2021	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
REV	DATE	AUTHOR	CHECKED	APPROVED	MODIFICATION DETAILS
<u>Accessibility</u>		Document No. NNP1-O-J0904-RP-008-A			
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EXECUTIVE SUMMARY

The ISO14001:2015 Internal Audit for all 38 areas has been accomplished, and the preparation of the audit reports and summaries of results are progressing. The Organization's Context, the needs and expectation of interested parties, the evaluation of environmental obligations, the environmental aspects identification and assessment, and the risks and opportunities assessment according to the ISO14001:2015 requirements have been reviewed and finalized. Two Environmental Objectives and their action plans have been approved by MD and are expected to be announced to all relevant parties by early of September 2021. Another three action plans are under preparation by the relevant divisions for MD consideration and approval. The Management Review is scheduled to be conducted by 01 September 2021 and the first stage of the External Audit by SGS will be held on 07 September 2021 via Microsoft Team.

During July 2021, EMO received one document (Detail Work Program or DWP; and Site Specific Environmental and Social Monitoring and Management Plan or SS-ESMMP) for review and approval. EMO did not issue any Site Inspection Report (SIR) or Observation of Non-Compliance to the Contractor during August 2021.

Due to the COVID-19 pandemic and the measures announced by the GOL, the regular joint site inspections were suspended at some restricted areas such as villages and Zone 2UR during the reporting period. However, the joint site inspections around the Dam sites and NNP1PC's operation sites were conducted as normal.

The construction of the wastewater treatment system modification and improvement at OSOV1 and OSOV2 were completed by the Soulignet Choummanitham Construction Sole Co., Ltd. (SCC). The final inspection of work completion is planned to be conducted in early September 2021. The three systems are in full operation and the effluents are monitored closely for system adjustment during the first stage of operation.

In August 2021, water quality depth profile measurements at R01, R02 and R03 (main reservoir) and NPH01 were suspended due to security concerns. At R05, close to the dam, the Dissolved Oxygen (DO) levels at the surface were generally between 6 mg/L and 7 mg/L and the oxycline was generally found at a depth of 7.0 to 11.0 m – slightly less than July 2021. In the re-regulation reservoir, the mean DO levels over the entire water column was 2.1 mg/L in both R06 and R07.

The discharge from the Re-regulation Dam mainly went through the turbine and combination of gate and turbine discharge. At the stations in Nam Ngiep immediately downstream of the Re-regulation Dam, the DO concentrations were less than 6 mg/L for all monitoring missions, all of which were carried out during periods with turbine discharge. No dead fish was observed in Nam Ngiep downstream in this monitoring period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

In August 2021, the local waste collection contractors continued collecting waste from the NNP1PC's operation sites and the nearby villages, and operating the NNP1 Project Landfill and Houy Soup Landfill. The work included waste segregation and disposal, waste cover, grass cutting and repairing perimeter fences.

A total of 24.8 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 19.2 m³ compared with July 2021. A total of 32.7 m³ of solid waste from Phouhomxay, Thahuea and Hat

Gniun Villages was disposed of at Houay Soup Landfill, a decrease of 11.2 m³ compared with July 2021. Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. There was no trading of recyclable waste at the community recycle waste bank during the period of reporting.

Xaysomboun Watershed and Reservoir Protection Office (WRPO) did not carry out any field activity during the reporting period. The construction of Xaysomboun WRPO sub-office at Ban Houaxay continues to progress in August 2021. The field activities by Bolikhamxay WRPO and Nam Chouane - Nam Xang Biodiversity Offset Management Unit (NC-NX BOMU) will be continued after receiving the fund under the approved AIP2021.

The fish catch monitoring for July 2021 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Channa striata*, and the species groups of Hampala, *Barbonymus gonionotus* and *Hypsibarbus* and *Mastacembelus*. They are classified as Least Concern (LC) according to the IUCN Red List.

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The ISO14001:2015 Internal Audit for all 38 areas has been accomplished, the preparation of the audit reports and summaries of results are progressing. The Organization's Context, the needs and expectation of interested parties, the evaluation of environmental obligations, the environmental aspects identification and assessment, and the risks and opportunities assessment according to the ISO14001:2015 requirements have been reviewed and finalized. Two Environmental Objectives and their action plans have been approved by MD and are expected to be announced to all relevant parties by early of September 2021. Another three action plans are under preparation by the relevant divisions for MD consideration and approval. The Management Review is scheduled to be conducted by 01 September 2021. The mandatory documents will be shared with the external auditor (SGS) per their request on 02 September 2021 and the first stage of the External Audit by SGS will be held on 07 September 2021 via Microsoft Team.

TABLE 1-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN-REVISED IN AUGUST 2021

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents (8 Standard Operating Procedures are completed)						
2	NNP1PC Environmental Policy announcement						
3	NNP1PC ISO Committee establishment						
4	Training relevant staff on: - Requirement and Interpretation of ISO14001:2015 - Organization Context and Risk Management for ISO14001 - ISO14001:2015 Document Information - ISO14001:2015 Internal Audit						
5	Implement the EMS procedures and processes						
6	ISO14001:2015 Internal Audit						
7	Implement the corrective actions and preventive actions according to the Internal Audit						
8	Management Review by NNP1PC Management						
9	ISO 14001:2015 Assessment and Certification Audit – 1st Stage (<i>remote audit</i> on the documentation review)						
10	Implement the corrective actions and preventive actions according to the 1 st Stage Audit						
11	ISO 14001:2015 Assessment and Certification Audit – 2nd Stage (on-site audit)						
12	Implement the corrective actions and preventive actions according to the 2 nd Stage Audit						
13	Certify of ISO14001:2015 upon successful completion of the audit						

	Completed activities
	Delayed activities and re-scheduled
	Original plan activities

1.2 COMPLIANCE MANAGEMENT

In August 2021, EMO received one Detail Work Program (DWP) and Site Specific Environmental and Social Monitoring and Management Plan (SS-ESMMP) for review and approval. The status of the document review is presented in **Table 1-2**.

TABLE 1-2: SS-ESMMP AND DOCUMENT REVIEW STATUS IN JULY 2021

Title	Date Received	Status
DWP & SS-ESMMP for the construction of Biofilm septic tanks replacement at OSOV1	19 August 2021 (1 st submission)	No objection with no comments on 23 August 2021

Due to the Corvid-19 situation and the GOL's lockdown measures continue to be in place in the area surrounding the project and its activities, the suspension of the regular joint site inspections has continued at some areas such as at villages and in Zone 2UR during the reporting period. However, the Compliance team conducted joint site inspections at the construction sites for the wastewater treatment system improvement and modification at OSOV1 and OSOV2, the Main Dam's grouting work and the NNP1PC operation sites. No Site Inspection Report (SIR) was issued to the contractor during the period of reporting.

On 19 August 2021, a joint site inspection was conducted between EMO, TD and the Kenber contractor to follow up on the progress of corrective actions for the pending issues related to waste management and grey water discharge at the temporary camp (rental houses) and the spill response, waste management and turbid water discharge at the main dam grouting work areas. Some of the issues were resolved and some are in progress. The status of issues is summarized in **Table 1-3** below.

The construction of the wastewater treatment system modification and improvement at OSOV1 and OSOV2 were completed by the Soulignet Choummanitham Construction Sole Co., Ltd. (SCC). The final inspection of work completion is planned to be conducted in early September 2021. The three systems are in full operation and the effluents are monitored closely for system adjustment during the first stage of operation.

The overall status can be seen in **Figure 1-1** below.

FIGURE 1-1: PHOTOS OF SITE INSPECTION ON THE PROGRESS OF WASTEWATER TREATMENT SYSTEMS IMPROVEMENT AND MODIFICATION AT OSOV1, OSOV2 AND THE MAIN POWERHOUSE



EMO has issued 06 Observations of Non-Compliance (ONC) during August 2021. The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 1-3**.

TABLE 1-3: SUMMARY OF ONCs AND NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from July 2021	6	0	0	0
Newly Opened in August 2021	0	0	0	0
Total in July 2021	6	0	0	0
Resolved in August 2021	2	0	0	0
Carried over to September 2021	4	0	0	0
Unsolved Exceeding Deadlines	4	0	0	0

1.2.1 Site Inspection by Environment Management Unit (EMU)

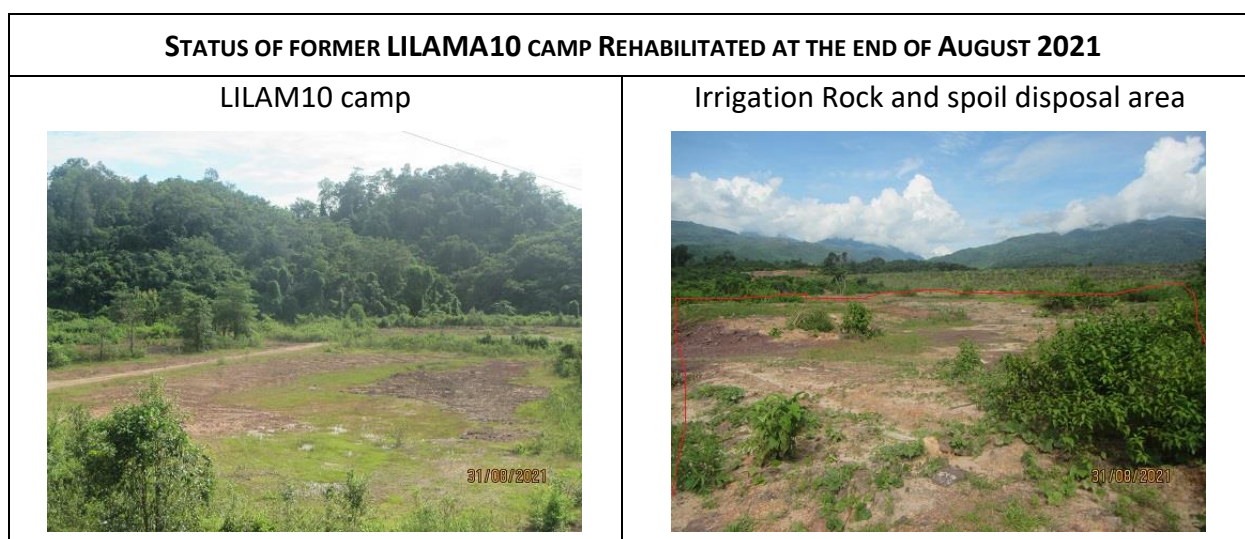
The monthly site visits by the EMU of Bolikhan District and the quarterly site visit by the EMU of Xaysomboun Province were not carried out in August 2021.

1.2.2 Site Decommissioning and Rehabilitation

During the reporting period of August 2021, EMO continued to monitor the progress of rehabilitation for two sites (Phouhomxay Village's Irrigation canal rock and spoil disposal area and the former LILAMA10 camp).

NNP1PC-TD completed covering with topsoil and planting of local grass on some areas where natural growth of vegetation has been limited. The status of the two sites at the end of August 2021 are shown below.

Figure 1-2: Photos status of former LILAMA10 camp and Phouhomxay Village's Irrigation canal's rock and spoil disposal area at the end of August 2021.



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/>

Due to the COVID-19 preventative measures imposed by the Thai Governments since middle of July 2021, some water samples were analysed at the NNP1 Project Environmental Laboratory only for TSS, BOD₅, *E.coli* bacteria, faecal coliform and total coliform and no water samples were shipped to the UAE Laboratory in Thailand. Therefore, there are no results for COD, ammonia-nitrogen, total nitrogen, TKN, TOC, phytoplankton biomass, total phosphorus, and oil and grease since the second half of July 2021.

In addition, there is also no turbidity measurement data reported since July 2021 due to the turbidity meter was broken. The turbidimeter purchase order is under process and is expected to obtain it by Q4 of 2021.

1.3.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the **Annex B** of this Report. The effluent camp monitoring results in August 2021 indicated non-compliances for some parameters in OSOV1 (EF01), OSOV2 (EF13) and the Main Powerhouse (EF19).

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 AUGUST 2021

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for faecal coliform and total coliform in first fortnightly sample. However, all parameters monitored in second fortnightly was complied with the standard.	Soulignet Choummanitham Construction Sole Company Limited Co., Ltd. (SCC) commenced the wastewater treatment systems improvement work on 26 April 2021 and completed the work by the end of August 2021. The wastewater treatment system improvement output will be included in the September 2021 Monthly Report.
OSOV2	EF13	Non-compliance for TSS in the first fortnightly sampling. Faecal coliform and total coliform in the second fortnightly sampling	

Site	Sampling ID	Status	Corrective Actions
		were not complied with the standard.	
Main Powerhouse	EF19	Non-compliance for TSS in the first fortnightly sampling. All parameters monitored in second fortnightly sampling were fully complied with the standard.	

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]).

In addition, weekly depth profile monitoring (pH, DO, conductivity and temperature) has been undertaken since 18 September 2018 for stations located in the Re-regulation and main reservoirs. The locations of the monitoring stations are shown in **Figure 1-3**.

The monitoring results for key parameters (DO, TSS and BOD₅) during August 2021 are presented in **Table 1-5, Table 1-6 and Table 1-7**. The full set of data for August 2021 is attached in **Annex A**. In addition, the results for DO are presented as line graphs in **Figure 1-4**.

Main Reservoir

From 01 to 31 August 2021, the water level in the main reservoir was relatively stable and only decrease with 0.19 m from El. 305.83 m asl to El. 305.64 m.

Depth profile measurements and sampling at R01, R02 and R03 were suspended due to security concerns during August 2021.

At R05, the average DO concentration was 6.8 mg/L in the upper 7.0 m varying between 6.0 mg/L and 7.5 mg/L, and the oxycline was generally found at a depth of 7.0 – 11.0 m with DO concentrations between about 1 mg/L and 3 mg/L – slightly lower than July 2021. DO concentrations less than 0.5 mg/L (anoxic condition) were recorded at depths below 30 m corresponding to 0.3 m below the centre line of the Intake in early August 2021 to 4.4 m below the centre line by the end of the month, taking into consideration the fluctuated water level in the reservoir over the period.

At R04, the DO levels in the upper 7.0 m varied between 5.0 mg/L and 7.4 mg/L. The DO concentrations dropped to below 0.5 mg/L at a depth of about 34 m.

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.

The BOD₅ measurements at R04 and R05 in both epilimnion and hypolimnion were less than 1.0 mg/L.

Re-regulation Reservoir

In August 2021, the turbine discharges from the Main Powerhouse varied between 60 and 259 m³/s usually interrupted by night-time periods with no discharge.

The mean DO levels over the entire water column were 2.1 mg/L in both R06 and R07 during August 2021.

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

Nam Ngiep Downstream

During August 2021, the discharge from the Re-regulation Dam mainly went through the turbine and combination of gate and turbine discharge.

During periods with turbine discharge and combination of gate and turbine discharge, the DO concentrations at NNG05 about 1.8 km downstream of the Re-regulation Dam varied between 2.8 mg/L and 4.2 mg/L and gradually increased to 4.4 mg/L at a distance of 5.2 km from the dam and to about 4.8 mg/L at NNG07 (25.9 km distance from the dam). At NNG08 close to the confluence with the Mekong River (47.2 km from the dam), the DO levels varied between 5.1 mg/L and 5.8 mg/L.

No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

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

No water quality monitoring for Nam Phouan during August 2021.

All monitored parameters in the Nam Chian (NCH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards, except DO and faecal coliform (11 August 2021) at NXA01 and DO (25 August 2021) and faecal coliform (11 August 2021) at NHS01.

FIGURE 1-3: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

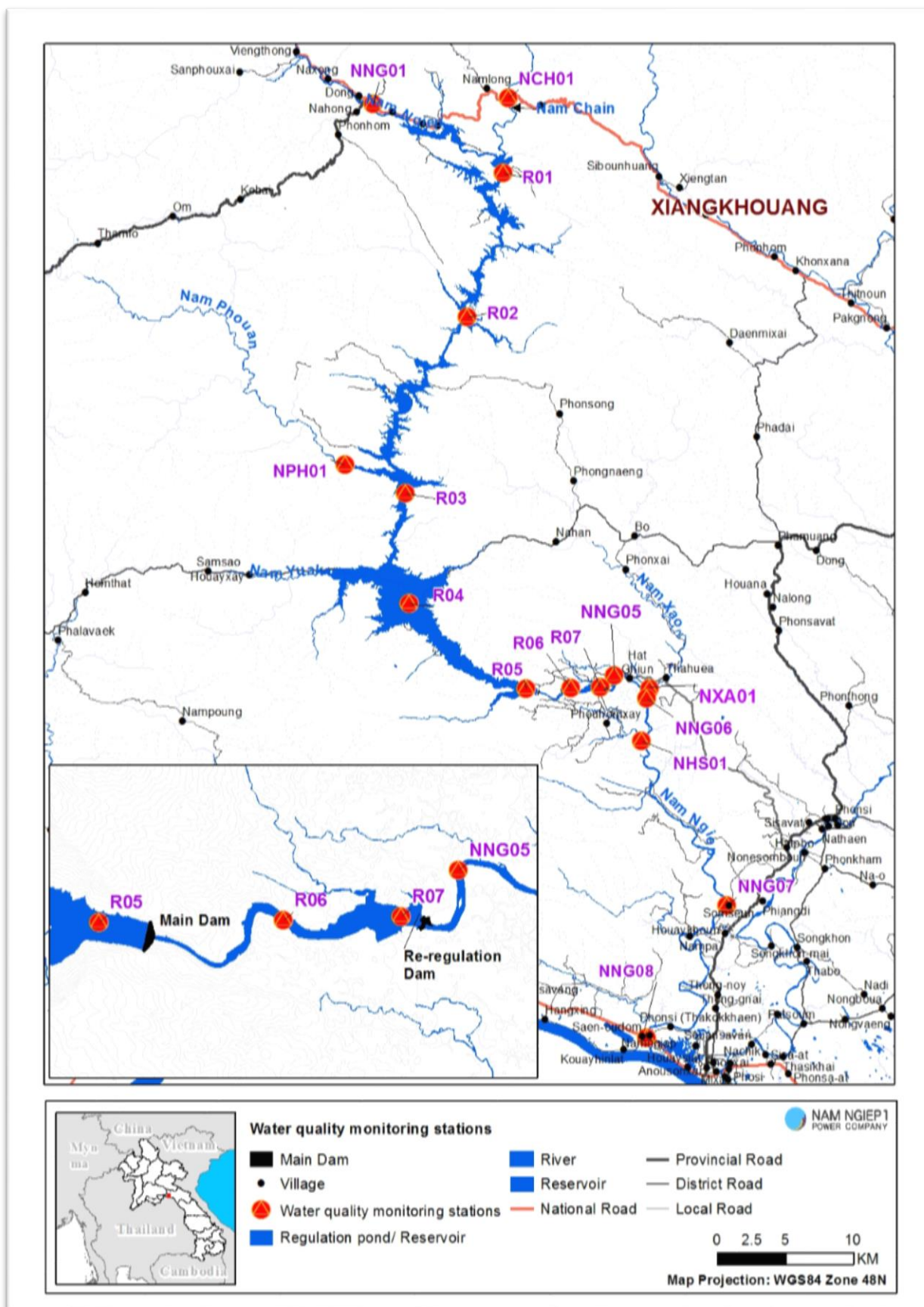


FIGURE 1-4: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO AUGUST 2021

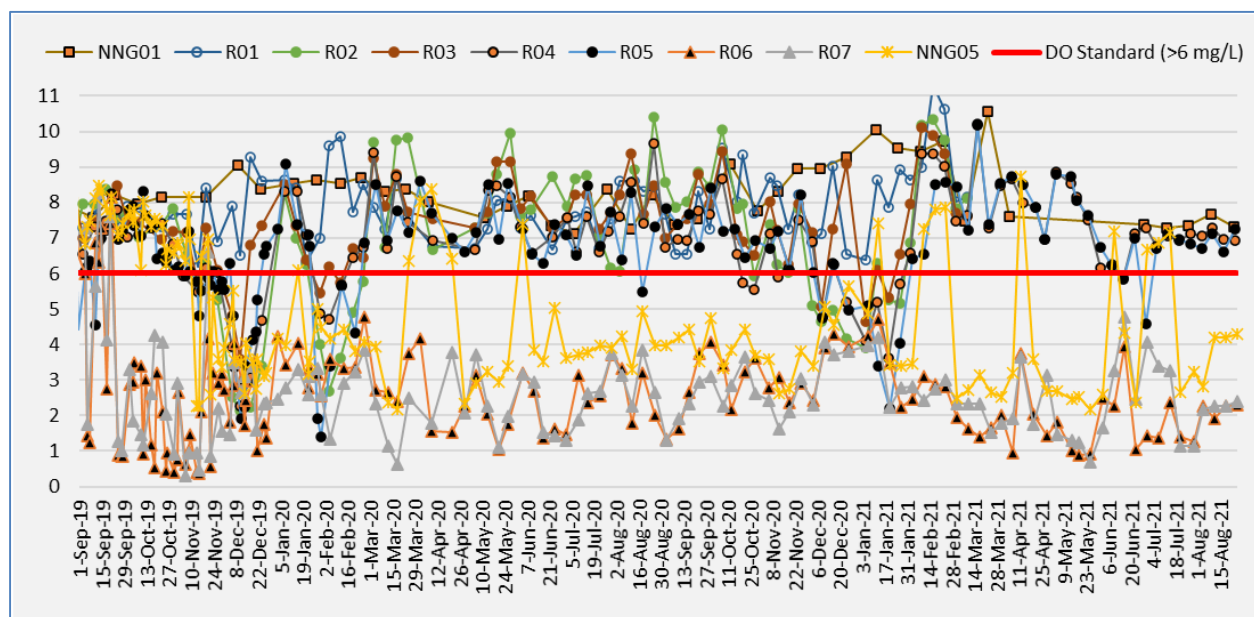


TABLE 1-5: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Aug-21					7.05	6.72										
4-Aug-21							2.26	2.17	2.81	3.83	5.28	5.8			6.21	6.52
9-Aug-21	7.66												8.08			
10-Aug-21					7.28	7.11										
11-Aug-21							1.91	2.28	4.21	4.41	6.06	5.45			5.17	6.87
17-Aug-21					6.96	6.6										
18-Aug-21							2.28	2.26	4.21	4.81	5.01	5.13			6.19	6.07
23-Aug-21	7.32												7.54			
24-Aug-21					6.92	7.25										
25-Aug-21							2.3	2.4	4.28	4.57	4.82	5.17			6.1	5.71

TABLE 1-6: 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
9-Aug-21	20.8												5.8			
10-Aug-21					2.5	2.24										
10-Aug-21 Bottom					8.27	<5										
11-Aug-21							2.8	3.01	3.02	15.2	14.08	25.41			54.59	67.1

TABLE 1-7: 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
9-Aug-21	<1												<1			
10-Aug-21					<1	<1										
10-Aug-21 Bottom					<1	<1										
11-Aug-21							<1	<1	<1	<1	<1	<1			<1	<1

1.3.3 Groundwater Quality Monitoring

During August 2021, community groundwater quality analyses were carried out for six wells located in Phouhomxay Village, Somseun Village, Nam Pa Village, Thong Noy Village and Pou Village. The community groundwater samples were taken from household water taps, except in Phouhomxay Village where the groundwater samples were taken at sampling points before entering into the water storage tank.

The results indicate that:

- Two wells in Phouhomxay Village (GPHX01 and GPHX02) fully complied with the groundwater quality standards for all parameters monitored.
- The well in Thong Noy Village and one well in Nam Pa Village did not comply with the standard for *E.coli* bacteria.
- The well in Pou Village did not comply with the standard for pH parameter.
- The well in Somsuen Village complies with the standard.

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, THONG NOY AND PHOUHOMXAY VILLAGES

	Site Name	Phouhomxay Village		Somseun Village	Nampa Village	Thong Noy Village	Pou Village
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline*						
pH	6.5 - 9.2	6.56	7.00	7.17	7.19	7.15	6.05
Sat. DO (%)		32.8	26.7	73.7	81.9	54.3	84.7
DO (mg/L)		2.7	2.16	5.71	6.46	4.18	6.28
Conductivity (µS/cm)		231	463	346	399	402	17
Temperature (°C)		26.32	26.52	28.55	27.58	29.04	29.17
Faecal coliform (MPN/100mL)		0	0	0	23	240	0
<i>E.coli</i> Bacteria (MPN/100mL)	0	0	0	0	23	79	0

*These are groundwater quality standards for drinking purposes attached in the concession agreement.

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

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

Faecal Coliform and *E.coli* exceeded the drinking water quality 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). Note here that during sampling of tap water in Phouhomxay Village, surface water from Houay Soup Stream was still supplied into the system and the samples likely represent a mixture of surface water and groundwater from the boreholes, where, as mentioned in **Section 1.3.3** and as shown in **Table 1-8**, *E.coli* bacteria were not detected in the two wells.

As observed in the field during water sampling, livestock are roaming around the water intake areas and feces from birds may also contribute to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. 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 were encouraged to boil water before drinking.

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*				
pH	6.5 - 8.6	7.06	7.07	6.97	7.07
Sat. DO (%)		83.5	93.3	91.8	90.3
DO (mg/L)		6.45	7.21	7.18	7.08
Conductivity (µS/cm)	<1,000	70	93	10	11
Temperature (°C)	<35	28.75	28.7	28.02	28.15
Faecal Coliform (MPN/100 mL)	0	79	79	49	33
<i>E.coli</i> Bacteria (MPN/100 mL)	0	79	79	49	23

*These are drinking water quality standards attached in the concession agreement.

1.3.5 Landfill Leachate Monitoring

During August 2021, 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 both NNP1 Project and Houay Soup Landfill leachates did not comply with the standard for pH and total coliform. However, the leachate is still contained in the leachate ponds without discharging 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 August 2021 can be found in **Table 1-10**.

The high pH and super saturation with dissolved oxygen indicate high algae growth with photosynthetic production of O₂ and consumption of CO₂ resulting in rising pH during the day.

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							
2-Aug-21	pH	6.0-9.0				9.51		9.54	
2-Aug-21	Sat. DO (%)					113.7		163.8	
2-Aug-21	DO (mg/L)					8.12		11.95	
2-Aug-21	Conductivity (µS/cm)					122		165	
2-Aug-21	Temperature (°C)					33.08		32.16	
2-Aug-21	BOD5 (mg/L)	<30				5.15		4.35	

2-Aug-21	Faecal Coliform (MPN/100mL)	<400				33		79	
2-Aug-21	Total Coliform (MPN/100mL)	<400				920		1,600	

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 May 2018.

During August 2021, the mean inflow to the main reservoir was 195 m³/s. The minimum and maximum inflows were 118 m³/s (on 03 August 2021) and 352 m³/s (on 17 August 2021) respectively.

From 01 to 31 August 2021, the water level of the main reservoir decreased by 0.19 m from El. 305.83 m and El. 305.64 m asl.

In August 2021, the hourly turbine discharges from the Main Powerhouse varied between 60 and 259 m³/s usually interrupted by night-time periods with no discharge.

FIGURE 1-5: INFLOW TO THE MAIN RESERVOIR

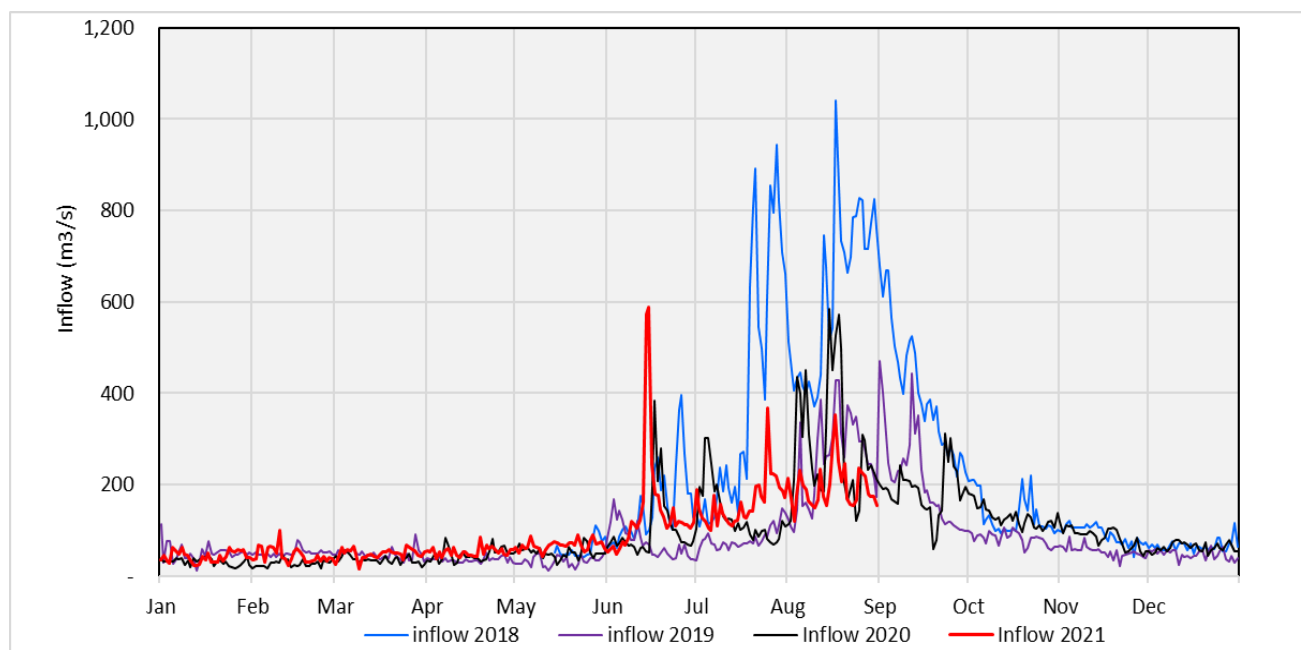
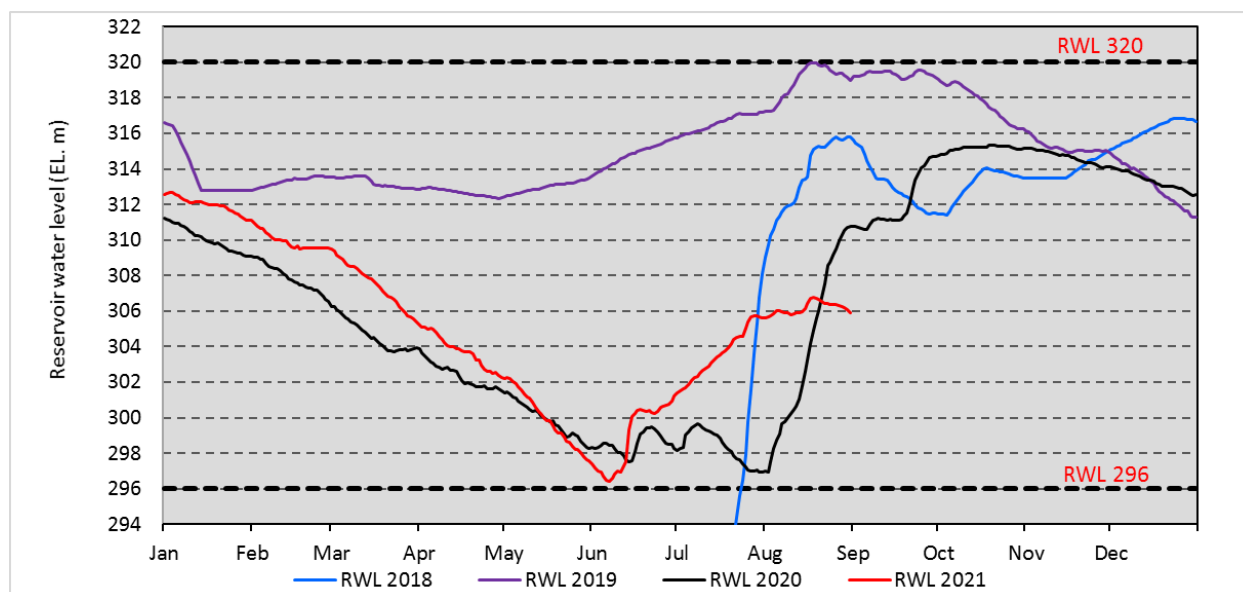


FIGURE 1-6: WATER LEVEL FOR THE MAIN RESERVOIR


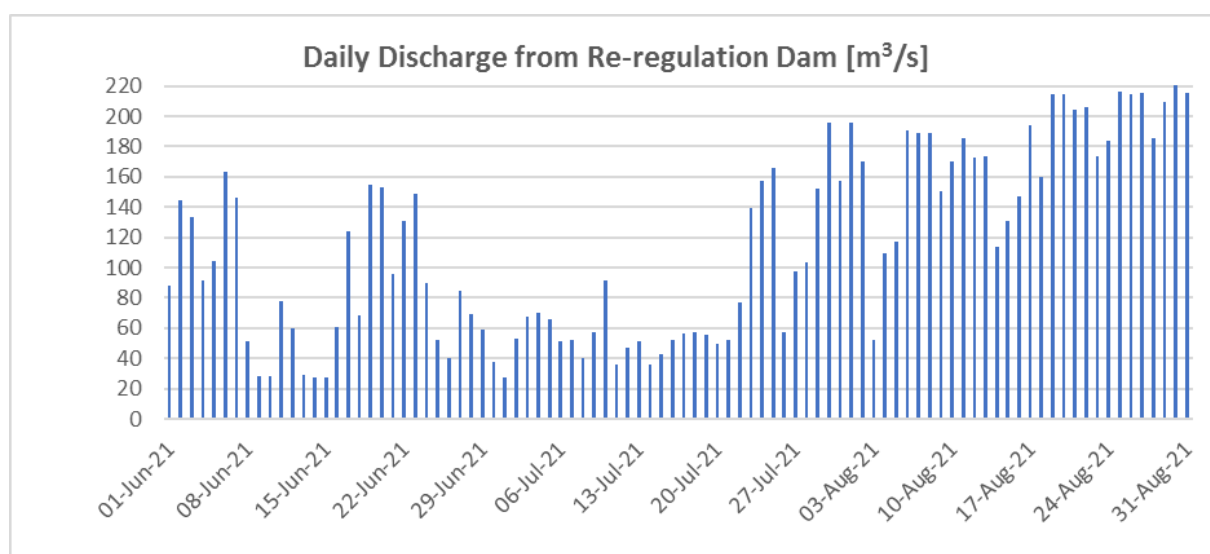
Note: The 2018 and 2019 Reservoir Water Level represent the reservoir before the COD (05 September 2019)

1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during May to July 2021 is presented in **Figure 1-7**.

During August 2021, the mean hourly discharge from the Re-regulation Dam was about 175 m³/s with hourly turbine discharges varying between 50 m³/s and 191 m³/s, hourly gate discharge varied between 27 m³/s and 218 m³/s, and hourly total discharge varying between 27 m³/s and 246 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 JUNE TO AUGUST 2021


1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In August 2021, 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. The thalweg water depth monitoring results showed full compliance with the CA requirement (greater than 0.5 m).

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

In August 2021, a total of 24.8 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 19.2 m³ compared with July 2021.

During this reporting period, 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, grass cutting and repairing the perimeter fence.

FIGURE 1-8: WASTE MANAGEMENT ACTIVITIES AT NNP1 LANDFILL DURING AUGUST 2021

WEEKLY WASTE COVER	WEEKLY LANDFILL MAINTENANCE (CLEANUP SEDIMENT FROM THE OPEN DITCH)
	

There is no recyclable waste selling this month and collection of recyclable waste is summarized in **Table 1-11**.

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

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by August 2021
1	Plastic bottles	kg	0	25
2	Aluminium	kg	0	13
3	Paper/Cardboard	kg	0	9
4	Glass	kg	0	15
5	Scrap Metal	Kg	0	0
Total		kg	0	62

During August 2021 villagers from host villages and Phouhomxay resettlement village collected 508 kg of food waste from the OSOV1 canteen for feed animals.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in August 2021 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 August 2021 (A)	Used (B)	Remaining at the end of August 2021 (A – B)
1	Diesel	Litre	9,048	4,600	4,448
2	Gasoline	Litre	845	180	665
3	Lubricant (Turbine oil)	Litre	7,335	3	7,332
4	Colour Paint	Litre	244	2	242
5	Thinner	Litre	10	1	9
6	Grease Oil	Litre	220	0	220
7	Gear Oil	Litre	468	0	468
8	Chlorine Liquid	Litre	83	83	0
9	Chlorine Powder	kg	65	0	65
10	SIKA	Litre	7	0	7

TABLE 1-13: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in August 2021 (A)	Disposed (B)	Remaining at the end of August 2021 (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	190	20	170
2	Used oil mixed with water	Litre	3200	0	3200
3	Empty 200L drum of used oil	Unit	22	16	6
4	Contaminated soil, sawdust and textile material	M ³	0.53	0	0.53
5	Used tires	Piece	0	0	0
6	Empty 20L chemical drum	Drum	10	0	10
7	Lead battery	Unit	7	0	7
8	Empty paint and spray cans	Can	0	0	0
9	Halogen/fluorescent bulbs	Unit	317	0	317
10	Empty cartridge (Ink)	Unit	8	0	8
11	Clinic Waste	kg	4.5	0	4.5

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme



Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. There was no trading of recycle waste at the community recycle waste bank during the period of reporting.

1.6.2 Community Solid Waste Management

In August 2021, a total of 32.7 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill, a decrease of 11.2 m³ compared with July 2021.

During this reporting period, the local waste collection contractor conducted regular waste collection from the three villages and operated the Houy Soup landfill for two days per week. The work included waste collection, segregation and disposal, waste cover, grass cutting and repairing the perimeter fence. In addition, the local contractor also conducted a quarterly site inspection and provided training on health, safety and environmental as well as the waste covering and segregation for the local workers.

FIGURE 1-9: WASTE MANAGEMENT ACTIVITIES DURING AUGUST 2021

WASTE DUMP AT HSL	LANDFILL MAINTENANCE AT HSL (GRASS CUTTING)
	

2. WATERSHED AND BIODIVERSITY MANAGEMENT

2.1 WATERSHED MANAGEMENT

2.1.1 Implementation of Annual Implementation Plan (AIP) 2020

The construction of the sub-office for Xaysomboun Watershed and Reservoir Protection Office (WRPO) at Huayxay Village, Hom District under the approved AIP2020 continued to progress in August 2021. Xaysomboun WRPO also shared the design of patrolling sub-station in the third week of August 2021 and NNP1 EMO provided recommendations on the design and budget for revision. There was no reservoir patrolling carried by Xaysomboun WRPO in August 2021 because some of the team members were occupied with other assignments.

NNP1 EMO and the Consultant finalized the assessment report on sustainable livelihood opportunities that include an action plan to strengthening local production and market access for local producers. The consultation meeting with Hom District on the action plan was organized on 25 August 2021. The meeting was chaired by Mr. Lucy Yorloryialong, Head of XSB Provincial Agriculture and Forestry Office (PAFO)/Vice Chairperson of Xaysomboun Watershed and Reservoir Protection Committee (WRPC) and co-chaired by Mr. Kongkham Southammavong, Vice District Governor of Hom/WRPC Member. There were 16 participants comprising representatives from XSB WRPO, Hom District Agriculture and Forestry Office (DAFO), District Commerce Office, District Lao Women Union, NNP1PC (EMO), village authorities and representatives of local producers of Ban Phou Ngou and Huayxay. The key notes from the meeting:

- The meeting participants principally agreed on the assessment and the proposed 5-year action plan. The action plan will contribute to the achievement of the district goals, objectives and plan

of increasing agricultural production and the program of Hom District called “one district one product”.

- Close and regular monitoring and support from relevant offices at district level is important to enable a smooth and effective implementation of the action plan. The meeting agreed that the implementation of the action plan should be monitored and supervised by WRPC and WRPO members at district level. Xaysomboun WRPO will request the district authorities to appoint WRPO members at district level as focal points.
- Land use zoning and agricultural land allocation for land access equity and land rights are essential. Improvement of the PLUP for Phou Ngou and Huayxay under the approved AIP 2020 of Xaysomboun WRPO needs to be carried out as soon as possible.

NNP1 EMO had discussion with DAFO of Hom and Thathom about the agriculture extension services on 02 and 05 August 2021, respectively. The key notes from discussion are as follow:

- Pineapple, orange and upland rice farming are priorities for agricultural extension service in Hom district. However, Hom DAFO confirmed that they have limited resources and capacity to provide agricultural extension services to the watershed communities in Hom District;
- Thathom DAFO agreed and is willing to provide extension services in Ban Nanhong and Phonhome. The extension services will focus on: 1) improving the technical and managerial skills of Kai Noi rice farmers; and 2) introducing and promoting the year-round organic vegetable garden in Ban Nanhong and Phonhome including improving the technical skills. Knowledge, information and farming techniques will be disseminated to all interested farmers. Thathom DAFO will prepare a budget proposal for these activities and submit it to NNP1 EMO for consideration.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2021

The Bolikhamxay WM AIP2021 was approved on 29 July 2021 and an official request for fund disbursement by DOF-MAF was submitted to NNP1PC on 10 August 2021. However, NNP1 EMO team found that there was a miss match in the official letter and the approved plan. NNP1 EMO has communicated with Bolikhamxay WRPO and Department of Forestry, Ministry of Agriculture and Forestry (DOF-MAF) for revision and re-submission. The fund disbursement is being processed and the field activities will be continued after receiving the fund for Q3 2021.

Xaysomboun WRPO is still finalizing their AIP2021 until the end of August 2021.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP) 2020

The progress on the implementation of key activities by Component in August 2021 are described below:

a. Component 1 - Spatial Planning and Regulation

The representatives of Nam Chouane - Nam Xang Biodiversity Offset Management Committee (NC-NX BOMC) and Biodiversity Offset Management Unit (BOMU) confirmed their availability to commence the site visit to settle the issue on the TPZ boundary demarcation in the remaining village, Vangphieng Village of Viengthong District. However, the road access was inaccessible after the long heavy rain in the middle of the month and so the visit was still postponed.

The land use plans of three NC-NX villages (Natan, Na Gngang, Vangphieng Villages) in Viengthong district is being reviewed by NC-NX BOMU in August 2021. The activity is scheduled in September 2021 after receiving the fund under the approved AIP2021.

b. Component 2 – Law Enforcement

The fund disbursement for the approved AIP2021 is still being processed in August 2021 and so there was no patrolling work carried out. Some of the patrol team members were assigned in the patrol sub-station to safeguard the facility and make the observation nearby the sub-station.

The results of patrolling activity in July 2021 are as follows:

Team	Patrolling Area/distance	Observations/Actions Taken
1	TPZ highest priority area including Houy Payang and north of Nam San Mountain ridges. (14 days covering 43.93 km distance of forest and 18.78 km distance of road patrol)	The team found a bullet close to Houy Payang, observed two hunting dogs at Nam San (inside TPZ) and heard the gunshots (Home-made gun) in two locations close to Nam Chouan (Inside TPZ highest priority area).
2	Nam Houg TPZ high priority area including Nam Houg, Nam Kha Gna, Nam Tong, Houy Yateng and ridges. (13 days covering 50.84 km distance of forest patrol)	The team encountered and destroyed a fresh fishing camp located at Nam Houg and observed five buffalos at the upstream of Nam Kha Gna (inside CUZ).
3	TPZ high priority area including Nam Ma, Nam Sa Nga and Nam Kapong. (13 days covering 64.39 km distance of forest patrol)	The team destroyed an old fishing camp located at Nam Ma and a fresh hunting camp at Nam Kapong. They also observed three buffalos at Nam Ma (inside CUZ).
4	TPZ highest priority area including Nam Sone, Houy Poug and mountain ridges. (13 days covering 35.21 km distance of forest patrol and 12.72 km distance of road patrol)	The team did not encounter any threats during patrolling.

FIGURE 2-1: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN JULY 2021

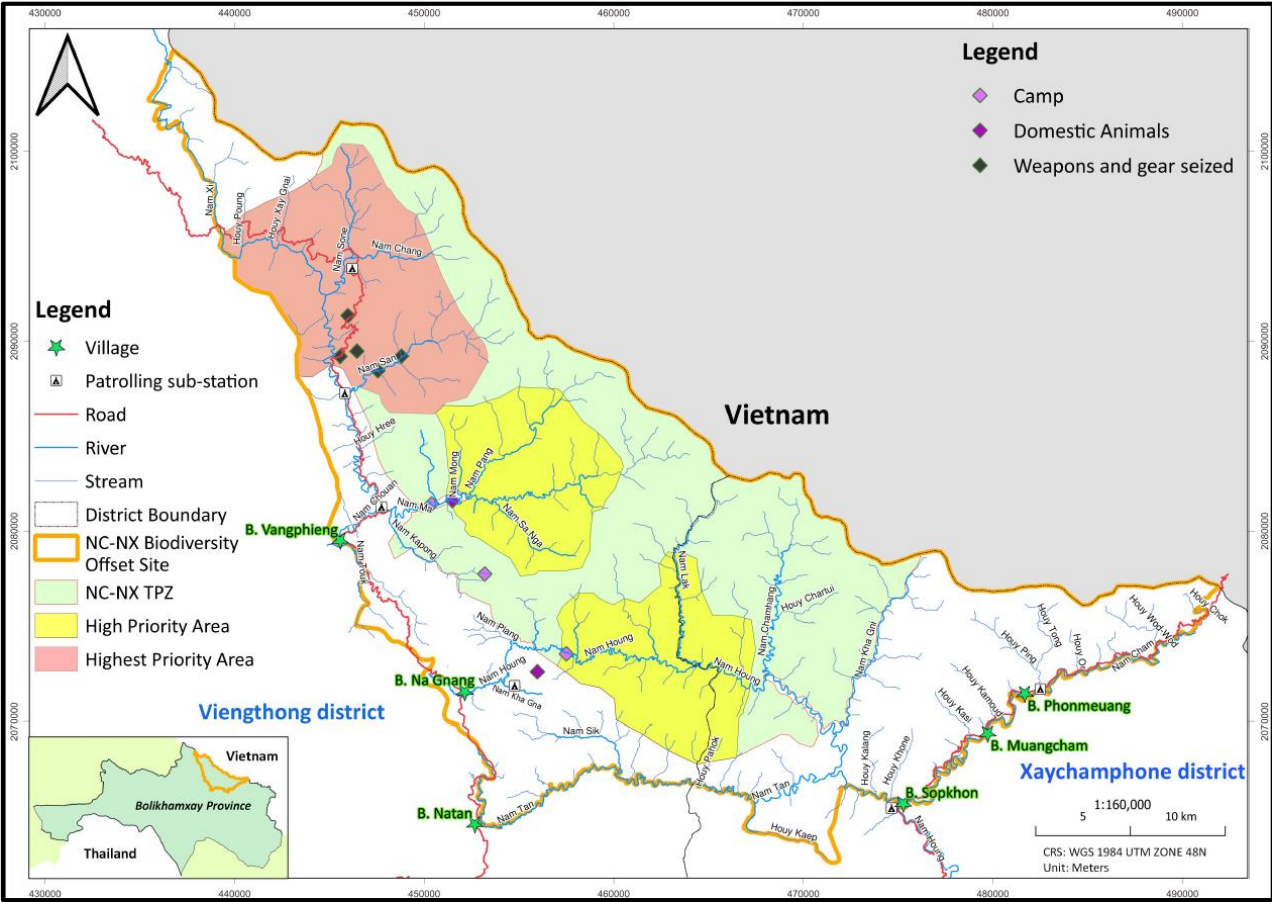


FIGURE 2-2: FRESH FISHING CAMP FOUND BY TEAM 2 AT NAM HOUNG



FIGURE 2-3: OLD FISHING CAMP FOUND BY TEAM 3 AT NAM MA



c. Component 3 – Conservation Outreach

Biodiversity Service Provider (BSP) - Wildlife Conservation Society (WCS) presented the schedule of the outreach activities in 2021 and the strategy outline during the monthly meeting on 19 August 2021. The draft strategy will be circulated to NNP1 EMO and NC-NX BOMU in September 2021. The outreach activity will be implemented according to the schedule after receiving the fund under the approved AIP2021.

d. Component 4 – Conservation linked livelihood development

The finalization of the Lao version of the CDP is subject to further discussions with Bolikhamxay PAFO but some of the CDP activities have already been incorporated into the NC-NX BOM AIP2021.

The third snare removal for July 2021 was commenced between 23 July to 07 August 2021. No snares were detected during the field activity. The snare removal program was discussed during the monthly meeting on 19 August 2021 for improvement. The activity will be continued after receiving the fund under the approved AIP2021.

e. Component 6 – Biological Monitoring

NNP1 provided comments to ADB about the TORs and expert engagement approach on 03 August 2021 and some of it were clarified by BSP-WCS on 04 August 2021. There was no comment received yet from ADB until end of August 2021. BSP-WCS and NNP1 provided comments on the draft TOR of NNL auditor on 28 July and 03 August 2021 respectively. ADB provided clarification on 18 August 2021.

NNP1, ADB, and BSP-WCS expect to have further discussions about the TORs and expert engagement during the 2nd MOU meeting between NNP1, ADB, and BSP-WCS on 08 September 2021.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2021

The Bolikhamxay NC-NX Biodiversity Offset Management (BOM) AIP2021 was approved on 03 August 2021 and an official request for fund disbursement by DOF-MAF was submitted to NNP1PC on 10 August 2021. However, NNP1 EMO found there was a miss-match in the official letter and the approved plan. NNP1 EMO have communicated with Bolikhamxay NC-NX BOMU and DOF-MAF for revision and re-submission. NNP1PC transferred the Q3, 2021 fund to DOF-MAF account on 26 August 2021 and NC-NX BOMU expects to receive the fund in the first week of September 2021 as soonest.

3. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in July 2021 as listed in **Table 3-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹.

Table 3-1: Fish Species dominating the Fish Catch in July 2021

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	149.4	LC
<i>Oreochromis niloticus</i>	ປານິນ	119.2	LC
<i>Barbonymus gonionotus</i> , <i>Hypsibarbus malcomi</i> , <i>Hypsibarbus vernayi</i> , <i>Hypsibarbus wetmorei</i>	ປາປາກ	124.7	LC
<i>Channa striata</i>	ປາຄໍ້າ	112.6	LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	101.7	LC

The recorded catch of Threatened species (IUCN Red List classification) in July 2021 are presented in **Table 3-2**. The list includes four species that are classified as Vulnerable species (VU).

TABLE 3-2: THREATENED SPECIES OF JULY 2021 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	13	VU
<i>Cyprinus carpio</i>	ປາໄນ	62.4	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປຽນ	18.6	VU
<i>Tor sinensis</i>	ປາແດງ	65.9	VU

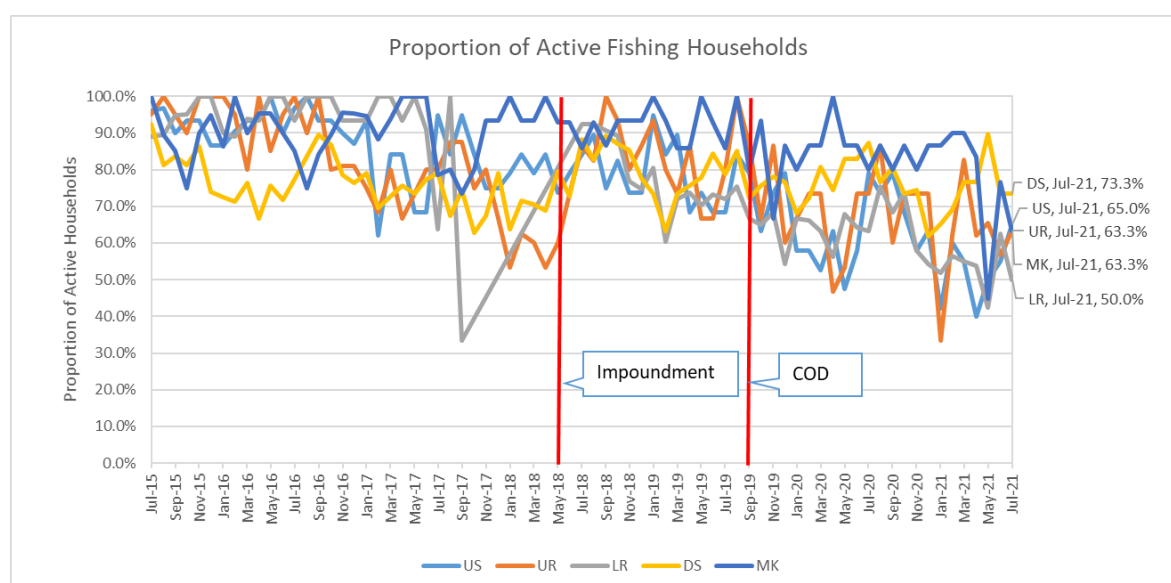
Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in July 2021. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in July 2021 for above dam, below dam and Mekong area are presented in **Table 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 3-3: MAIN BIODIVERSITY INDICATORS FOR JULY 2021

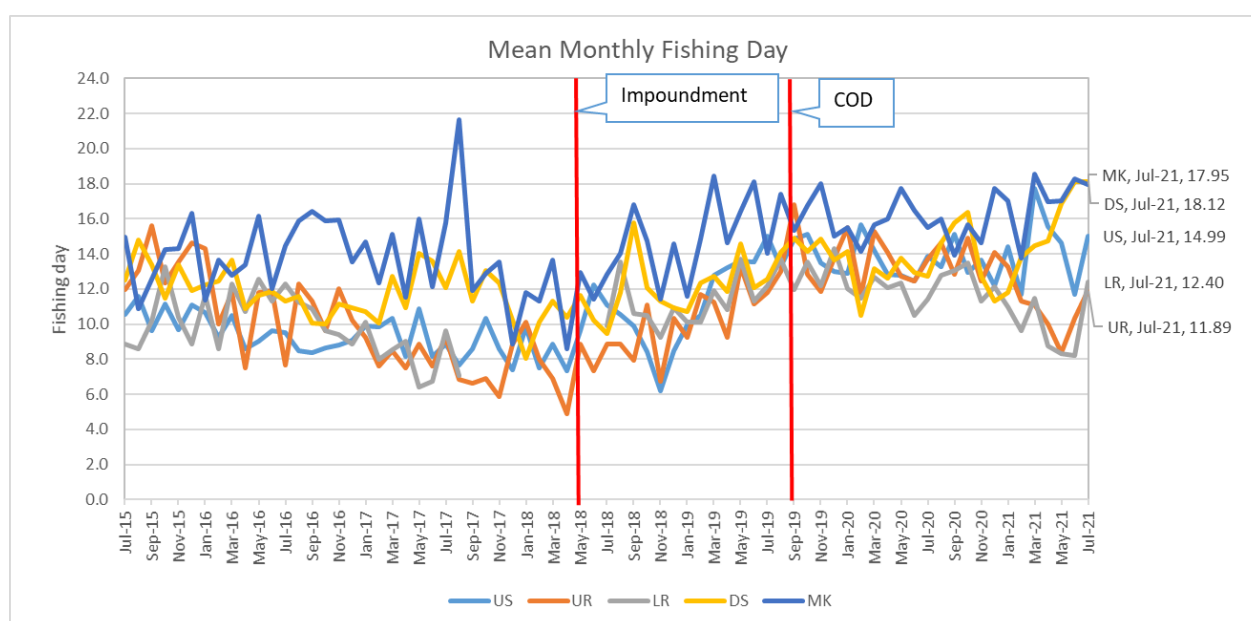
Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	27	38	36
Single species	24	27	22
Species groups	3	11	14
Top 15 species (% total catch weight)	92.26%	80.93%	93.66%
Proportion for species groups	15.81%	57.48%	47.48%
Diversity index (Shannon)	2.6448	3.0406	2.6791

Figure 3-1 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 50% and 73% of active fishing households for all fishing zones in July 2021.

FIGURE 3-1: PROPORTION OF TOTAL NUMBER OF HOUSEHOLDS ACTIVELY FISHING BY FISHING ZONE FROM JULY 2015 TO JULY 2021**Note:**

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

Figure 3-2 shows the average (mean) of monthly fishing day from July 2015 to July 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

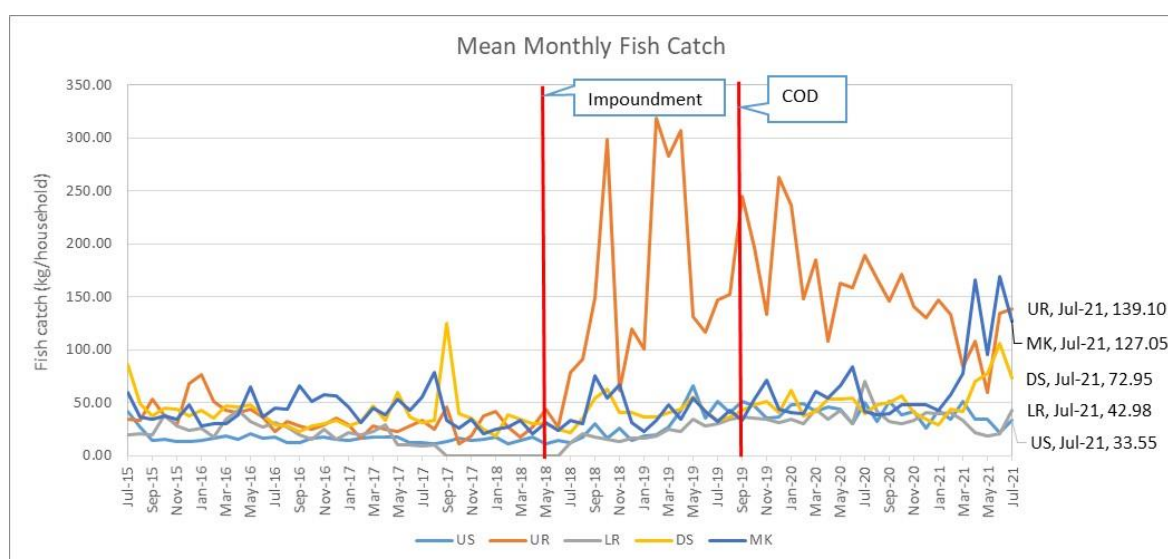
FIGURE 3-2: MEAN OF MONTHLY FISHING DAY FROM JULY 2015 TO JULY 2021

The mean monthly number of fishing day for the month of July from 2015 to 2021 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 3-4**.

TABLE 3-4: MEAN REPORTED NUMBER OF FISHING DAYS BY FISHING ZONE FOR THE MONTH OF JULY FROM 2015 TO 2021

Fishing Zone	July 2015 (day)	July 2016 (day)	July 2017 (day)	July 2018 (day)	July 2019 (day)	July 2020 (day)	July 2021 (day)
Upstream	10.56	9.64	8.86	11.07	14.99	13.88	14.99
Upper reservoir	11.98	11.90	9.26	8.86	11.81	13.69	11.89
Lower reservoir	8.86	11.33	9.60	9.88	12.21	11.44	12.40
Downstream	12.50	11.87	12.05	9.46	12.57	12.75	18.12
Mekong	14.95	12.00	15.75	12.84	14.02	15.50	17.95

The mean monthly household fish catch from July 2015 to July 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 3-3**.

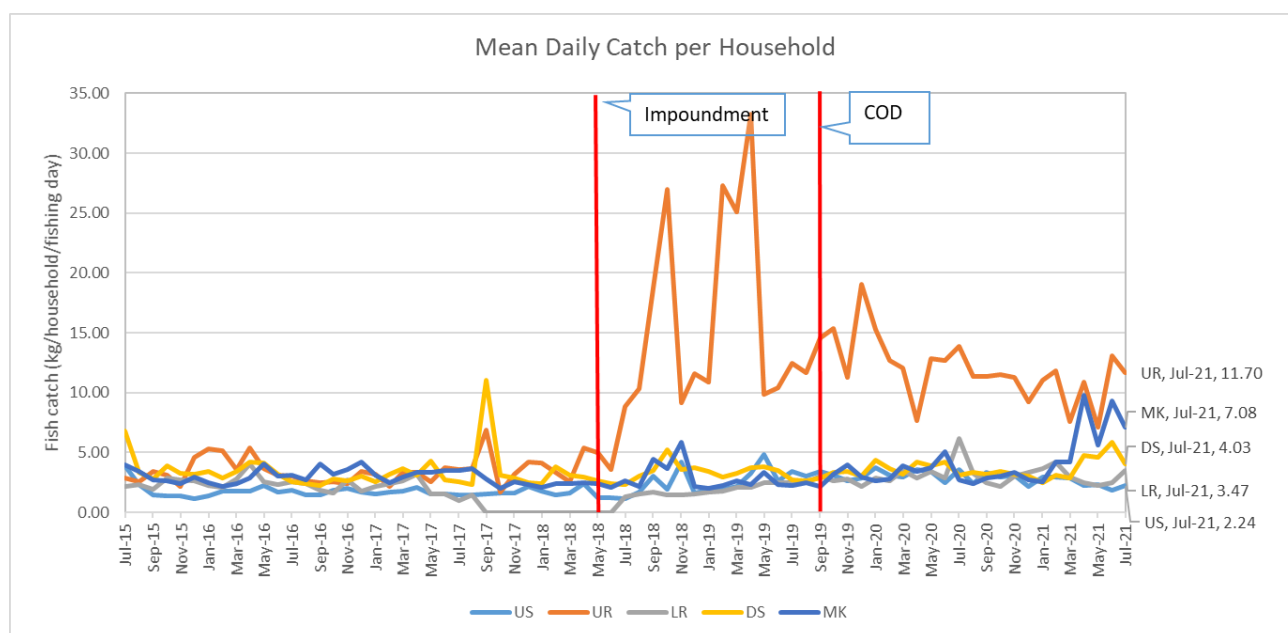
FIGURE 3-3: MEAN MONTHLY HOUSEHOLD FISH CATCH FROM JULY 2015 TO JULY 2021

The mean household fish catch for the month of July from 2015 to 2021 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 3-5**.

TABLE 3-5: MEAN MONTHLY HOUSEHOLD FISH CATCH FOR THE MONTH OF JULY FROM 2015 TO 2021

Fishing Zone	July 2015 (kg)	July 2016 (kg)	July 2017 (kg)	July 2018 (kg)	July 2019 (kg)	July 2020 (kg)	July 2021 (kg)
Upstream	41.36	17.49	12.74	12.29	51.71	49.81	33.55
Upper reservoir	33.97	22.91	33.17	78.19	146.88	189.46	139.10
Lower reservoir	19.19	31.00	9.45	12.58	30.00	70.40	42.98
Downstream	85.46	28.76	30.88	21.66	33.66	39.85	72.95
Mekong	59.95	44.96	55.36	33.39	31.85	42.11	127.05

The mean daily fish catch per household from July 2015 to July 2021 are displayed in **Figure 3-4** and the mean fish catch per household per fishing day for the month of July from 2015 to 2021 are shown in **Table 3-6**.

FIGURE 3-4: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JULY 2021**TABLE 3-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF JULY FROM 2015 TO 2021**

Fishing Zone	July 2015 (kg)	July 2016 (kg)	July 2017 (kg)	July 2018 (kg)	July 2019 (kg)	July 2020 (kg)	July 2021 (kg)
Upstream	3.92	1.84	1.44	1.11	3.45	3.59	2.24
Upper reservoir	2.83	2.99	3.58	8.83	12.44	13.84	11.70
Lower reservoir	2.17	2.53	0.98	1.27	2.46	6.15	3.47
Downstream	6.83	2.55	2.56	2.29	2.68	3.13	4.03
Mekong	4.01	3.11	3.52	2.60	2.27	2.72	7.08

The survey results in July 2021 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zones, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are the reservoir, tributaries and streams, and Mekong respectively. The proportion of fishing habitats in July 2021 are displayed in **Table 3-7**.

TABLE 3-7: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) IN JULY 2021

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	9.93%	86.17%
Nam Ngiep	51.27%	14.33%	0.00%	56.68%	3.56%
Nam Xan	0.00%	0.00%	0.00%	0.00%	0.00%
Reservoir	0.00%	80.97%	32.25%	0.00%	0.00%
Tributary and stream	41.62%	3.20%	48.63%	32.84%	0.00%
Wetland	7.11%	1.51%	19.11%	0.55%	10.27%
Others	0.00%	0.00%	0.00%	0.00%	0.00%

Total reported fish and OAA catch (proportion of OAA) for the same 7-day period from July 2015 to July 2021 are presented in **Figure 3-5** and the proportion of OAA catch for the month of July from 2015 to 2021 are shown in **Table 3-8**.

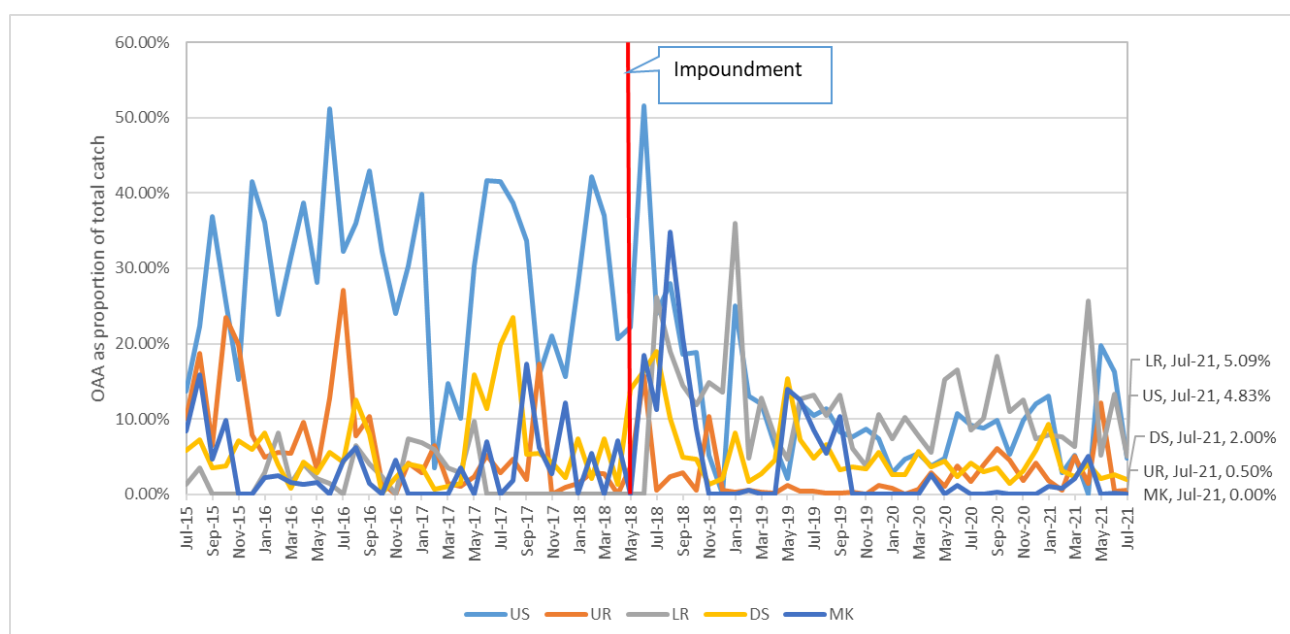
FIGURE 3-5: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR A 7-DAY PERIOD BY FISHING ZONE FROM JULY 2015 TO JULY 2021

TABLE 3-8: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR THE MONTH OF JULY FROM 2015 TO 2021

Fishing Zone	July 2015	July 2016	July 2017	July 2018	July 2019	July 2020	July 2021
Upstream	13.66%	32.31%	41.47%	23.97%	10.44%	9.20%	4.83%
Upper reservoir	10.07%	27.05%	2.83%	0.50%	0.43%	1.73%	0.50%
Lower reservoir	1.27%	0.00%	0.00%	26.23%	13.14%	8.48%	5.09%
Downstream	5.81%	4.27%	19.90%	19.04%	4.74%	4.18%	2.00%
Mekong	8.38%	4.45%	0.00%	11.19%	8.48%	0.00%	0.00%

ANNEXES

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

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
3-Aug-21	pH	5.0 - 9.0					6.82	7.36						
4-Aug-21	pH	5.0 - 9.0							6.66	6.82	6.87	7.06	7.04	7.1
9-Aug-21	pH	5.0 - 9.0	6.92											
10-Aug-21	pH	5.0 - 9.0					7.83	7.56						
11-Aug-21	pH	5.0 - 9.0							6.67	6.88	6.87	7.17	7.13	7.2
17-Aug-21	pH	5.0 - 9.0					7.08	7.28						
18-Aug-21	pH	5.0 - 9.0							7.02	7.03	7.06	7.11	7.15	7.2
23-Aug-21	pH	5.0 - 9.0	7.14											
24-Aug-21	pH	5.0 - 9.0					6.74	7.05						
25-Aug-21	pH	5.0 - 9.0							6.85	6.86	6.94	7.11	6.94	7.03
3-Aug-21	Sat. DO (%)						92.6	87.7						
4-Aug-21	Sat. DO (%)								27.5	26.7	34.4	47.1	64.9	71.5
9-Aug-21	Sat. DO (%)		96.7											
10-Aug-21	Sat. DO (%)						97.3	94.2						
11-Aug-21	Sat. DO (%)								23.5	27.9	51.4	53.7	74.2	67.4
17-Aug-21	Sat. DO (%)						91.7	85.7						
18-Aug-21	Sat. DO (%)								27.9	27.7	51.5	58.3	62.1	63.9
23-Aug-21	Sat. DO (%)		88.2											
24-Aug-21	Sat. DO (%)						92.2	95.8						
25-Aug-21	Sat. DO (%)								28.3	29.2	52.3	56.3	59.7	64.6
3-Aug-21	DO (mg/L)	>6.0					7.05	6.72						
4-Aug-21	DO (mg/L)	>6.0							2.26	2.17	2.81	3.83	5.28	5.8
9-Aug-21	DO (mg/L)	>6.0	7.66											
10-Aug-21	DO (mg/L)	>6.0					7.28	7.11						
11-Aug-21	DO (mg/L)	>6.0							1.91	2.28	4.21	4.41	6.06	5.45
17-Aug-21	DO (mg/L)	>6.0					6.96	6.6						
18-Aug-21	DO (mg/L)	>6.0							2.28	2.26	4.21	4.81	5.01	5.13
23-Aug-21	DO (mg/L)	>6.0	7.32											
24-Aug-21	DO (mg/L)	>6.0					6.92	7.25						
25-Aug-21	DO (mg/L)	>6.0							2.3	2.4	4.28	4.57	4.82	5.17
3-Aug-21	Conductivity (µs/cm)						71	68						
4-Aug-21	Conductivity (µs/cm)								76	76	74	78	74	50
9-Aug-21	Conductivity (µs/cm)		89											

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
10-Aug-21	Conductivity (µs/cm)						71	70						
11-Aug-21	Conductivity (µs/cm)								76	75	73	75	71	60
17-Aug-21	Conductivity (µs/cm)						69	69						
18-Aug-21	Conductivity (µs/cm)								73	71	69	72	65	59
23-Aug-21	Conductivity (µs/cm)		99											
24-Aug-21	Conductivity (µs/cm)						69	69						
25-Aug-21	Conductivity (µs/cm)								73	71	72	73	69	61
3-Aug-21	Temperature (°C)						29.85	29.14						
4-Aug-21	Temperature (°C)								25.6	25.85	25.59	26.01	25.96	26.03
9-Aug-21	Temperature (°C)		27.34											
10-Aug-21	Temperature (°C)						30.58	30.08						
11-Aug-21	Temperature (°C)								25.76	25.59	25.54	25.72	25.69	26.21
17-Aug-21	Temperature (°C)						29.75	28.95						
18-Aug-21	Temperature (°C)								25.75	25.65	25.65	25.85	26.25	26.74
23-Aug-21	Temperature (°C)		26.45											
24-Aug-21	Temperature (°C)						30.37	29.9						
25-Aug-21	Temperature (°C)								25.77	25.66	25.8	26.02	26.33	26.71
9-Aug-21	TSS (mg/L)		20.8											
10-Aug-21	TSS (mg/L)						2.5	2.24						
10-Aug-21	TSS (mg/L)-bottom						8.27	<5						
11-Aug-21	TSS (mg/L)								2.8	3.01	3.02	15.2	14.08	25.41
9-Aug-21	BOD ₅ (mg/L)	<1.5	<1											
10-Aug-21	BOD ₅ (mg/L)	<1.5					<1	<1						
10-Aug-21	BOD ₅ (mg/L)-bottom						<1	<1						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
11-Aug-21	BOD ₅ (mg/L)	<1.5							<1	<1	<1	<1	<1	<1
9-Aug-21	Faecal coliform (MPN/100 mL)	<1,000	350											
10-Aug-21	Faecal coliform (MPN/100 mL)	<1,000					2	5						
10-Aug-21	Faecal coliform (MPN/100 mL)-bottom						0	2						
11-Aug-21	Faecal coliform (MPN/100 mL)	<1,000							17	49	21	140	1,600	350
9-Aug-21	Total Coliform (MPN/100 mL)	<5,000	1,600											
10-Aug-21	Total Coliform (MPN/100 mL)	<5,000					5	14						
10-Aug-21	Total Coliform (MPN/100 mL)-bottom						2	4						
11-Aug-21	Total Coliform (MPN/100 mL)	<5,000							79	140	26	220	1,600	540

TABLE A-2: RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP

			River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
			Zone	Location Refer to Construction Sites			
				Tributaries Upstream		Tributaries Downstream	
			Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline					
4-Aug-21	pH	5.0 - 9.0				7.02	7.13
9-Aug-21	pH	5.0 - 9.0		6.87			
11-Aug-21	pH	5.0 - 9.0				7.12	7.31
18-Aug-21	pH	5.0 - 9.0				7.13	7.24
23-Aug-21	pH	5.0 - 9.0		7.22			
25-Aug-21	pH	5.0 - 9.0				7.12	7.2
4-Aug-21	Sat. DO (%)					79.2	80.1
9-Aug-21	Sat. DO (%)			97.6			
11-Aug-21	Sat. DO (%)					65.2	83.9
18-Aug-21	Sat. DO (%)					78.3	75.2
23-Aug-21	Sat. DO (%)			90.3			
25-Aug-21	Sat. DO (%)					76.8	72.2
4-Aug-21	DO (mg/L)	>6.0				6.21	6.52
9-Aug-21	DO (mg/L)	>6.0		8.08			
11-Aug-21	DO (mg/L)	>6.0				5.17	6.87
18-Aug-21	DO (mg/L)	>6.0				6.19	6.07
23-Aug-21	DO (mg/L)	>6.0		7.54			
25-Aug-21	DO (mg/L)	>6.0				6.1	5.71
4-Aug-21	Conductivity (µs/cm)					114	20
9-Aug-21	Conductivity (µs/cm)			30			
11-Aug-21	Conductivity (µs/cm)					103	15
18-Aug-21	Conductivity (µs/cm)					91	18
23-Aug-21	Conductivity (µs/cm)			30			
25-Aug-21	Conductivity (µs/cm)					85	25
4-Aug-21	Temperature (°C)					27.81	25.9
9-Aug-21	Temperature (°C)			24.89			
11-Aug-21	Temperature (°C)					27.73	25.53
18-Aug-21	Temperature (°C)					27.9	26.15
23-Aug-21	Temperature (°C)			24.76			
25-Aug-21	Temperature (°C)					28.21	27.37
9-Aug-21	TSS (mg/L)			5.8			
11-Aug-21	TSS (mg/L)					54.59	67.1
9-Aug-21	BOD ₅ (mg/L)	<1.5		<1			
11-Aug-21	BOD ₅ (mg/L)	<1.5				<1	<1
9-Aug-21	Faecal coliform (MPN/100 mL)	<1,000		170			
11-Aug-21	Faecal coliform (MPN/100 mL)	<1,000				1,600	1,600
9-Aug-21	Total Coliform (MPN/100 mL)	<5,000		920			
11-Aug-21	Total Coliform (MPN/100 mL)	<5,000				1,600	1,600

TABLE A-3: RESULTS OF CAMP EFFLUENTS IN AUGUST 2021

	Site Name	OSOVI (Owner's Site Office and Village)		OSOVI (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	02-Aug-21	16-Aug-21	02-Aug-21	16-Aug-21	02-Aug-21	16-Aug-21
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.91	7.04	6.83	7.35	7.69	7.82
Sat. DO (%)		44.3	70.9	17.8	46.5	34	83.3
DO (mg/L)		3.4	5.54	1.36	3.63	2.58	6.37
Conductivity (µs/cm)		445	329	1,278	362	1,064	864
TDS (mg/L)		222.5	164.5	639	181	532	432
Temperature (°C)		29.13	28.23	29.04	28.14	29.95	29.14
Turbidity (NTU)		n/a	n/a	n/a	n/a	n/a	n/a
TSS (mg/L)	<50	<5	<5	137.5	13.1	58.1	15.8
BOD ₅ (mg/L)	<30	13.98	<6	<6	11.28	<6	<6
COD (mg/L)	<125	n/a	n/a	n/a	n/a	n/a	n/a
NH ₃ -N (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a
Total Nitrogen (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a
Total Phosphorus (mg/L)	<2	n/a	n/a	n/a	n/a	n/a	n/a
Oil & Grease (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a
Total coliform (MPN/100 mL)	<400	1,600	110	0	2,200	0	0
Faecal Coliform (MPN/100 mL)	<400	1,600	49	0	1,400	0	0
Effluent Discharge Volume (L/mn)		7.5	6		0	1200	
Chlorination Dosing Rate (mL/mn)		n/a	n/a	30		300	2
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.88	0.03	0.43	0.54