



Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

February 2022

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EXECUTIVE SUMMARY

During February 2022, some activities related to the preparation of ISO14001:2015 accreditation audit were completed such as two emergency drills, training session on Environmental, Health and Safety, review and finalizing of the Emergency Preparedness and Response Plan (EPRP) and Development and Maintenance of the Quality Management System Documentation (QMS) as well as the mandatory manuals and standard operating procedures (SOPs). The Stage 2 ISO14001:2015 Audit was conducted by an accreditation company (SGS (Lao) Sole Co., Ltd.) on 21 – 24 February 2022 (remote audit). The audit was successfully completed with no Major and no Minor Critical Findings, but six observations were recommended for further improvement. The certification process will take 4-6 weeks before a hard copy of the ISO14001:2015 Certificate. The certificate will be valid for three years until February 2025 subject to satisfactions of the first and second Surveillance Audit in year 1 and 2 after this Certification. The first Surveillance Audit by SGS (Lao) Sole Co., Ltd. is tentatively scheduled to be conducted in February 2023.

During February 2022, EMO received one document for review and approval. EMO did not issue any Site Inspection Report of Observation of Non-Compliance (ONC) to the Contractor but one Non-Compliance Reports (NCR) was issued to the Administrative Division relating to the Wastewater Treatment System and the corrective action plans are in progress.

Due to the COVID-19 pandemic and the measures announced by the GOL, as well as cases of infected project personnel, the regular joint site inspections were completely suspended at all restricted areas such as nearby villages and in Zone 2UR as well as at NNP1PC's operation sites during the reporting period. However, the EMO undertook their own site inspections of the Dam sites and NNP1PC's operation sites as normal.

The operation and adjustment of the newly constructed wastewater treatment systems were still ongoing in February 2022. EMO will need more time in Q1 2022 to analyse the results and the sampling schedule is now adjusted from fortnightly to weekly to get a better understanding of the wastewater treatment conditions.

The water quality monitoring in February 2022 included the other pending parameters analysed in UAE Lab during January 2022 as well.

At R05, the average DO concentration was 6.7 mg/L in the upper 14 m varying between 5.0 mg/L and 7.7 mg/L, and the oxycline was generally found at a depth between 16.0 and 20.0 m with DO concentrations abruptly decreasing from about 6 mg/L to below 1 mg/L. In the Re-regulation Reservoir, the mean DO concentrations over the entire water column were 5.2 mg/L and 4.8 mg/L in R06 and R07 respectively.

The rather high DO concentrations at the upper half of the intake to the Main Powerhouse provided similar or slightly higher DO concentrations in the Re-regulation Reservoir. DO concentrations immediately downstream of the Re-regulation Dam from the gate generally were between 7 mg/L and 9 mg/L. Further downstream the DO levels were above 7 mg/L thus complying with the surface water quality standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. 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.

In February 2022, 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 Houay Soup Landfill. The work included waste segregation and disposal, waste cover, grass cutting and repairing perimeter fences.

A total of 23.1 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 1.1 m³ compared with January 2022. A total of 20.0 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at Houay Soup Landfill, a decrease of 3.8 m³ compared with January 2022. There was no trading of recyclable waste at the community recycle waste bank during the period of reporting.

The Watershed and Reservoir Protection Offices (WRPOs) carried out activities in February 2022 including the reservoir patrolling by Xaysomboun WRPO and the forest and the reservoir patrolling by Bolikhamxay WRPO. Bolikhamxay Nam Chouane-Nam Xang Biodiversity Offset Management Unit (NC-NX BOMU) carried out activities in February 2022 including the patrolling and snare removal and the community outreach through radio broadcast at NC-NX districts and villages.

The fish catch monitoring for September 2021 to January 2022 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus*, *Channa striata*, *Tor sinensis* and *Clarias batrachus* respectively, while the species groups of Mastacembelus, Poropuntius, Hampala, Mystacoleucus, *Sikukia gudgeri* and *Amblyrhynchichthys truncates*, and *Barbonymus gonionotus* and *Hypsibarbus* dominated September 2021 to January 2022. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Tor sinensis* is classified as Vulnerable species (VU) and *Sikukia gudgeri* is classified as Data Deficient species (DD).

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During February 2022, some activities related to the preparation of ISO14001:2015 accreditation audit were completed as follows:

- Two emergency drills were conducted:
 - Hazardous Material/Chemical Spill Drill in the Storage Area; and
 - Fire Fighting and Evacuation Drill in the Owner's Site Office and Village 1 (OSOV1) accommodation.
- One training session on Environmental, Health and Safety Awareness was conducted for the NNP1 staff on site (face-to-face and online).
- Documents relating to the Environmental Management System (EMS) were reviewed, revised and approved by relevant divisions:
 - Emergency Preparedness and Response Plan (EPRP) by TD and Administrative (ADM) team;
 - Development and Maintenance of the Quality Management System Documentation (QMS) by ADM-Documents Control Centre (DCC) team;
 - Operation Manual for NNP1 Wastewater Treatment System; and
 - Necessary Standard Operating Procedures (SOP) and Forms by all relevant parties.
- Followed-up/summarized the progress of the five Environmental Management Plans (EMPs) that were announced by the top management and which have been implemented by all NNP1PC staff and the Contractors.
 - **EMP01:** To reduce the paper consumption in the NNP1 Office works by 10% within one year (August 2021 – July 2022);
 - **EMP02:** To reduce the quantity of waste disposed at the NNP1 Project Landfill by 10% during the September 2021 to August 2022 as compared with the previous 12 months;
 - **EMP03:** To improve DO at the Re-regulation Dam downstream station to comply with the Concession Agreement with GoL (not less than 6 mg/L);
 - **EMP04:** Staff and Contractors have better knowledge and awareness on the Project's Environment, Social, Occupational and Safety measures;
 - **EMP05:** To replace the fluorescence lighting bulbs in OSOV1 accommodation to be LED bulbs for at least 60% of total light bulbs by the end of December 2022.

The Stage 2 ISO14001:2015 Audit was conducted by an accreditation company (SGS (Lao) Sole Co., Ltd.) on 21 – 24 Feb 2022 (remote audit). The audit was successfully completed with no Major and no Minor Critical Findings, but six observations were recommended for further improvement. The necessary actions according to the six observations will be detailed by Environment Management Office (EMO) then share to all relevant divisions for further actions and to be ready for the next Internal Audit.

The audit report and next visit plan from SGS will be submitted to NNP1PC within seven days after completion of the audit. The certification process will take 4-6 weeks before a hard copy of the ISO14001:2015 Certificate is received. The certificate will be valid for three years until February 2025 subject to satisfactions of the first and second Surveillance Audits in year 1 and 2 after this Certification.

The next steps to maintain the certified ISO14001:2015 are:

- All relevant divisions complete the required actions per auditor's recommendations and/or provide the concrete plans as necessary;
- The progress of the five EMPs to be regularly followed-up and reported;
- The second ISO14001:2015 Internal Audit to be conducted during August – September 2022;
- The third Management Review Meeting to be conducted right after the Internal Audit (within September - October 2022);
- The first Surveillance Audit by SGS (Lao) Sole Co., Ltd. is tentatively scheduled to be conducted in February 2023 (one year after the certification).

TABLE 1-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN-REVISED IN FEBRUARY 2022

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021				Year 2022	
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	Continue to prepare EMS documents								
2	NNP1PC Environmental Policy announcement								
3	NNP1PC ISO Committee establishment								
4	Training relevant staff on: <ul style="list-style-type: none"> - 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 – Stage 1 (remote audit on the documentation review)								
10	Implement the corrective actions and preventive actions according to the Stage 1 Audit								
11	ISO 14001:2015 Assessment and Certification Audit – Stage 2 (remote audit, 4 man-days)								
12	Implement the corrective actions and preventive actions according to the Stage 2 Audit – No Corrective Action Request raised during the Stage 2 Audit								
13	Certify of ISO14001:2015 with a successful completion of the audit								
	Completed activities per the plan								
	Plan to achieve the activities								

1.2 COMPLIANCE MANAGEMENT

In February 2022, EMO received one document for review and approval. The status of the document review is shown in **Table 1-2** below.

TABLE 1-2: SUMMARY STATUS OF DOCUMENT REVIEW IN FEBRUARY 2022

Title	Date Received	Status
DWP SS-ESMMP for Repairing of damaged irrigation canal and leveling the Access Roads in PHX Resettlement Village	10 February 2022 (2 nd submission)	No objection with comments on 21 February 2022

Due to the COVID-19 pandemic, the suspension of the regular joint site inspections has continued at all areas such as at nearby villages, in Zone 2UR and at NNP1PC's operation sites during the reporting period. However, the EMO undertook their own site inspections of the Dam sites and NNP1PC's operation sites as normal including at OSOV1, OSOV2, at the Main Dam grouting work and the Main dam right bank abutment remedial work.

The operation and adjustment of the newly constructed wastewater treatment systems were still ongoing in February 2022. EMO will need more time in Q1 2022 to analyse the results and the sampling schedule is now adjusted from fortnightly to weekly to get a better understanding of the wastewater treatment conditions.

EMO issued one Non-Compliance Reports (NCR) to the Administrative Division relating to the Wastewater Treatment System in February 2022. The status of compliance reports (Observation of Non-Compliance or ONC; and Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 1-3** and **Table 1-4** below.

TABLE 1-3: SUMMARY OF ONCs AND NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from January 2022	2	1	0	0
Newly Opened in February 2022	0	1	0	0
Total in February 2022	2	2	0	0
Resolved in February 2022	0	0	0	0
Carried over to March 2022	2	2	0	0
Unsolved Exceeding Deadlines	2	1	0	0

TABLE 1-4: SUMMARY OF THE NCR AND ONC ISSUED TO THE CONTRACTOR

Document Number / Date of Issue	Subject Description	Current Status at the end of February 2021
NC No. 04/21 Issued Date: 09-11-21 (NCR Level 1)	<p>Lack of spill control at the KENBER's temporary camp and workshop (rental house) at Hat Gniun Village.</p> <ul style="list-style-type: none"> - No clean-up of the contaminated soil/sand on the ground that EMO previously instructed on NC No. 02/2021. - The contaminated sand and spilt oil inside of the bunding area of fuel station was cleaned up and disposed/dumped directly on the ground outside the bunding area without containing/storing properly. - New additional spillages on the ground were observed. 	<p>After EMO inspected and verified the status of corrective actions for the NC No. 02/21, EMO found that not all of required actions had been fully addressed and that oil spillage had occurred repeatedly.</p> <p>However, the NC No. 02/21 was closed with some unsolved issues transferred to the new NC No. 04/21 with a shorter deadline and enforcement.</p> <p>Latest inspection and follow-up on 20 February 2022, some actions have been completed and some actions were in progress.</p>
ONC_KENBER-0007	<p>The contractor has a lack of spill response and control on site.</p> <ul style="list-style-type: none"> - Black oil and hydrocarbon spills from the generator and water pump to the ground and open ditch without appropriate countermeasures; - No cleaning up of absorbent sand/contaminated sand for a proper storage. 	<p>EMO followed up on 20 February 2022, no actions have been taken. EMO instructed the contractor with a deadline extension to be completed by 28 February 2022.</p> <p>EMO will follow up and update the status of corrective action in next monthly progress report.</p>
ONC_KENBER-0008	<p>Reference to previous NCR (NC No. 03/2021) pursuant the poor waste management at the temporary camp (rental houses).</p> <p>The scattered waste was collected and burned in the area surrounding the rental houses in contravention of EMO's repeated instructions that no burning of solid waste is allowed</p>	<p>EMO followed up on 20 February 2022, no actions have been taken. EMO instructed the contractor with a deadline extension to be completed by 28 February 2022.</p> <p>EMO will follow up and update the status of</p>

Document Number / Date of Issue	Subject Description	Current Status at the end of February 2021
		corrective action in next monthly progress report.
NC No. 01/22 Issued Date: 13-02-22 (NCR Level 1)	Some parameters of effluent discharge are continued exceeded standard guideline for almost 5 months since a significant improvement and modification completed in September 2021.	The correction action plans are identified and in process (detailed can be found in Table 1-5)

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 February 2022.

1.2.2 Site Decommissioning and Rehabilitation

Considering that the EMU of Bolikhan District had no comments to the ongoing rehabilitation of the construction sites during their mission in January 2022, the frequency of the regular site inspections has been reduced from monthly to quarterly until the sites have been successfully handed over to the GOL. The next inspection and monitoring will be carried out in March 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 results of COD, Ammonia-Nitrogen, Total Nitrogen, Total Phosphorus and Oil & Grease of January and February 2022 were included for the report period.

The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 1-5**.

TABLE 1-5: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSs IN JANUARY AND FEBRUARY 2022

Site	Sampling ID	Status	Corrective Actions (Expected Completion Date)
OSOV1	EF01	Non-compliance for total faecal coliform and total coliform in all five samplings.	1) Proper fencing installation to prevent the cattle's encroachment in the OSOV1 wetlands' ponds (31 March 2022).
OSOV2	EF13	Non-compliance for ammonia-nitrogen and total nitrogen in all five samplings, total phosphorus in three out of five samplings, total coliform in three out of five samplings and faecal coliform in two out of five samplings.	2) Additional planting of reeds in the OSOV1 wetlands' ponds (31 March 2022). 3) Adding the proper sludges/seeds into the Aeration Tank at OSOV2 WWTS and the Biofilm Septic Tank at the Main Powerhouse System (31 March 2022). 4) Replacing the detergent materials in the Main Powerhouse by using lower Phosphate detergent (30 April 2022).
Main Powerhouse	EF19	Non-compliance for total phosphorus in all five samplings, ammonia nitrogen and total nitrogen in one out of five samplings, and faecal coliform and total coliform in three out of five samplings.	5) Closely monitor the Residual Chlorine content in the effluents of OSOV2 and the Main Powerhouse WWTS and adjust as necessary (30 April 2022). 6) Closely monitor the Influent to compare with the Effluent for the specific parameters to check their treatment effectiveness (Q2 of 2022).

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 1-2**.

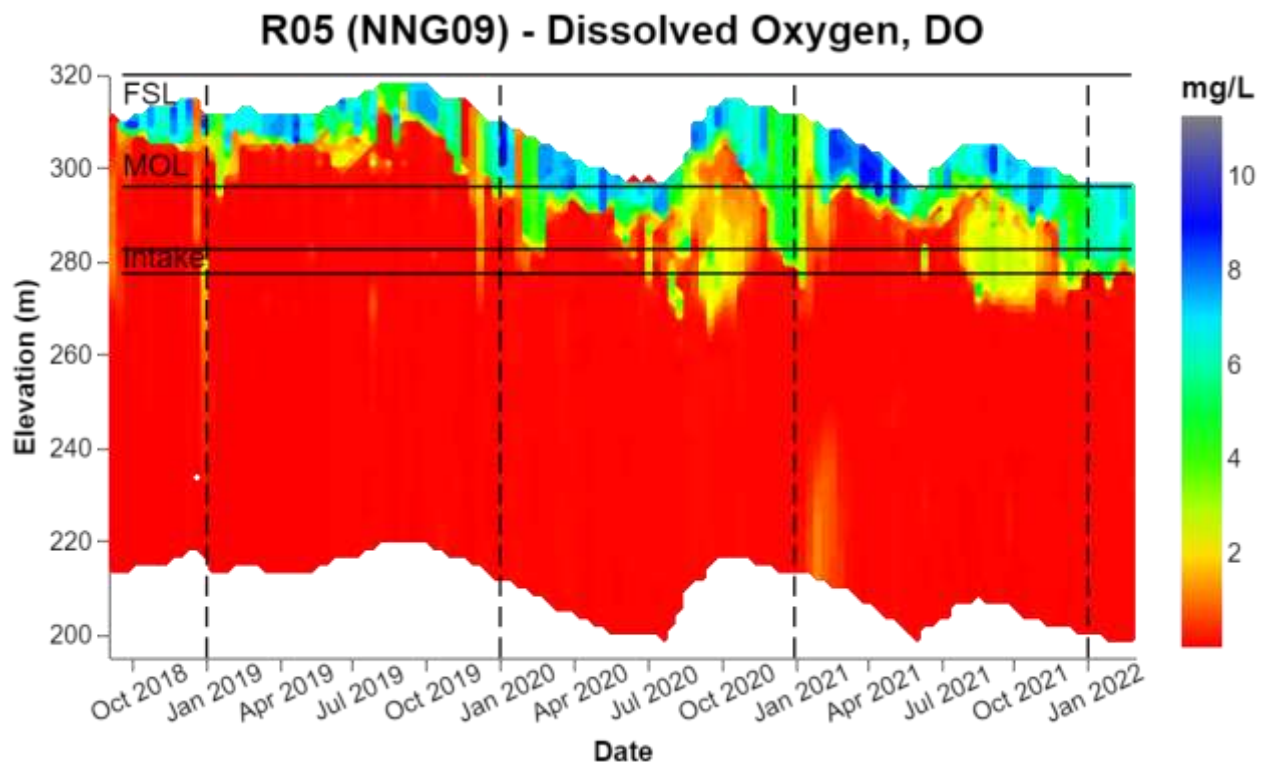
The monitoring results for key parameters (DO, TSS and BOD₅) during February 2022 are presented in **Table 1-6**, **Table 1-7** and **Table 1-8**. The full set of data for February 2022 is attached in **Annex A**. In addition, the results for DO timeseries are presented as line graphs in **Figure 1-3** and DO Long Profile graphs in **Figure 1-4**.

Main Reservoir

From 01 to 28 February 2022, the main reservoir water level increased with 1.02 m from El. 296.96 m asl to El. 297.71 m.

At R05, the average DO concentration was 6.7 mg/L in the upper 14 m varying between 5.0 mg/L and 7.7 mg/L, and the oxycline was generally found at the depth between 16.0 and 20.0 m with DO concentrations abruptly decreasing from about 6 mg/L to less than 1 mg/L. DO concentrations below 0.5 mg/L (anoxic condition) were recorded at depths of 18 - 22 m which is just after the intake.

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



At R04, the DO levels in the upper 12.0 m varied between 5.3 mg/L and 7.8 mg/L with oxycline at depths of 14 m and 18 m below surface and DO concentrations generally less than 2 mg/L at depths below 24 m.

At R03, the DO levels in the upper 11.0 m varied between 5.1 mg/L and 8.9 mg/L, and below 12 m to the bottom, the DO concentrations were generally between 2 mg/L to 5 mg/L with a mean of 4 mg/L.

At R02, the DO levels in the entire water column varied between 4.3 mg/L and 8.9 mg/L with a mean of 6.3 mg/L.

At R01, the DO level at the water surface was between 9.4 mg/L and 11.9 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.

The BOD₅ measurements at R01, R02, R03, R04 and R05 in epilimnion were less than 1.0 mg/L and BOD₅ measurements in the hypolimnion at R03 and R04 were less than 1.0 mg/L and at R05 was 7.2 mg/L.

Re-regulation Reservoir

In February 2022, the turbine discharges from the Main Powerhouse varied between 13 and 226 m³/s usually interrupted by night-time periods with no discharge.

The mean DO concentration in the water column were 5.2 mg/L and 4.8 mg/L in R06 and R07 respectively.

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

Nam Ngiep Downstream

During February 2022, the discharge from the Re-regulation Dam was mainly gate discharge and occasionally turbine discharge.

Considering that the DO measurements in R05 are representative of the DO levels at the intake to the main dam, it is likely that the DO concentrations at the upper half of the intake to the Main Powerhouse have generally been rather high (about 6 mg/L) with concentrations dropping to below 1 mg/L at the lower part of the intake. This has provided similar or slightly higher DO concentrations in the Re-regulation Reservoir and therefore also generally high DO levels immediately downstream of the Re-regulation Dam with concentrations between 7 mg/L and 9 mg/L. Further downstream the DO levels were above 7 mg/L thus complying with the surface water quality standard.

No dead fish was observed in Nam Ngiep downstream during this monitoring period. 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.

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

All monitored parameters in the Nam Phouan (NPH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards.

FIGURE 1-2: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

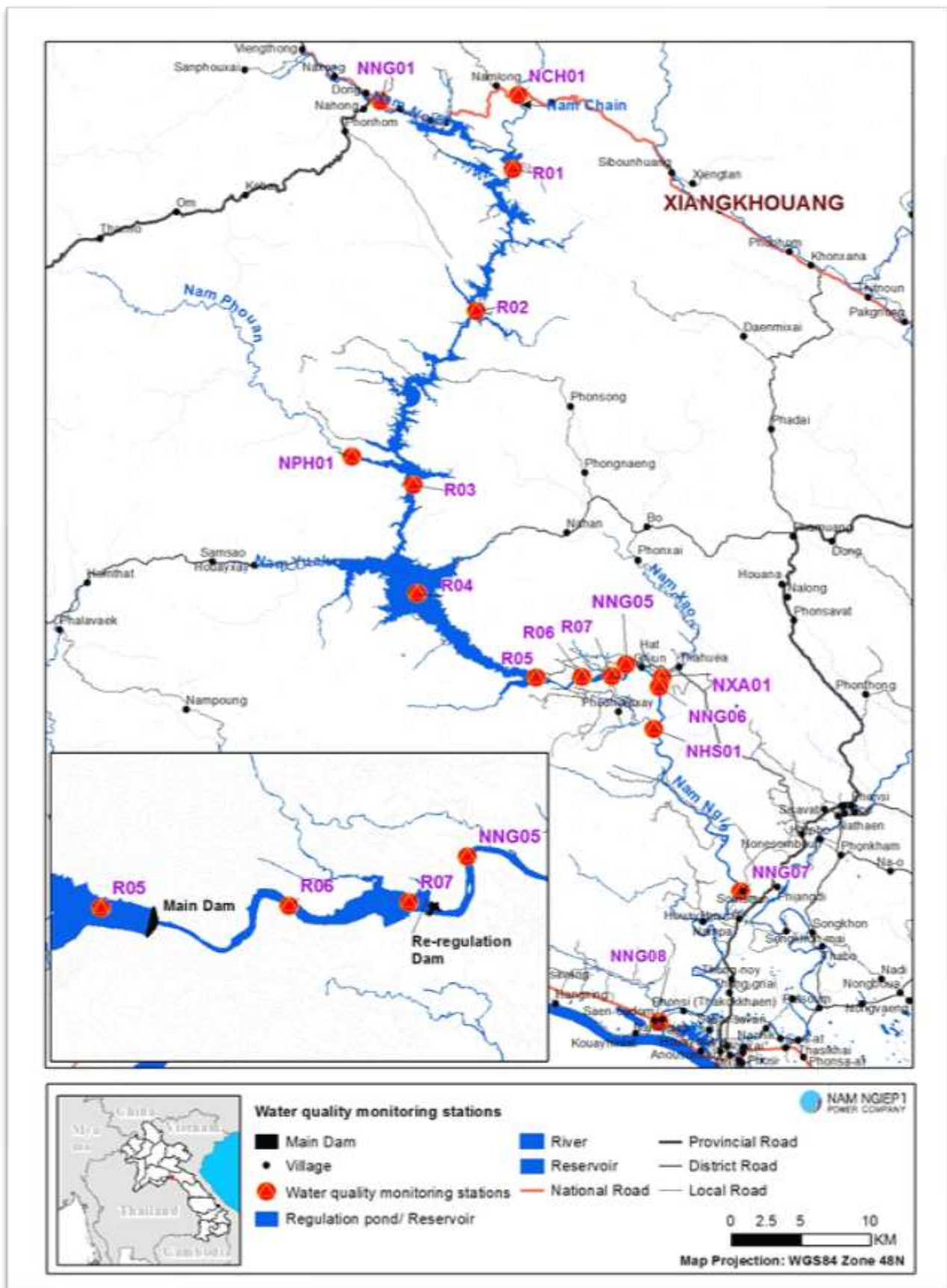
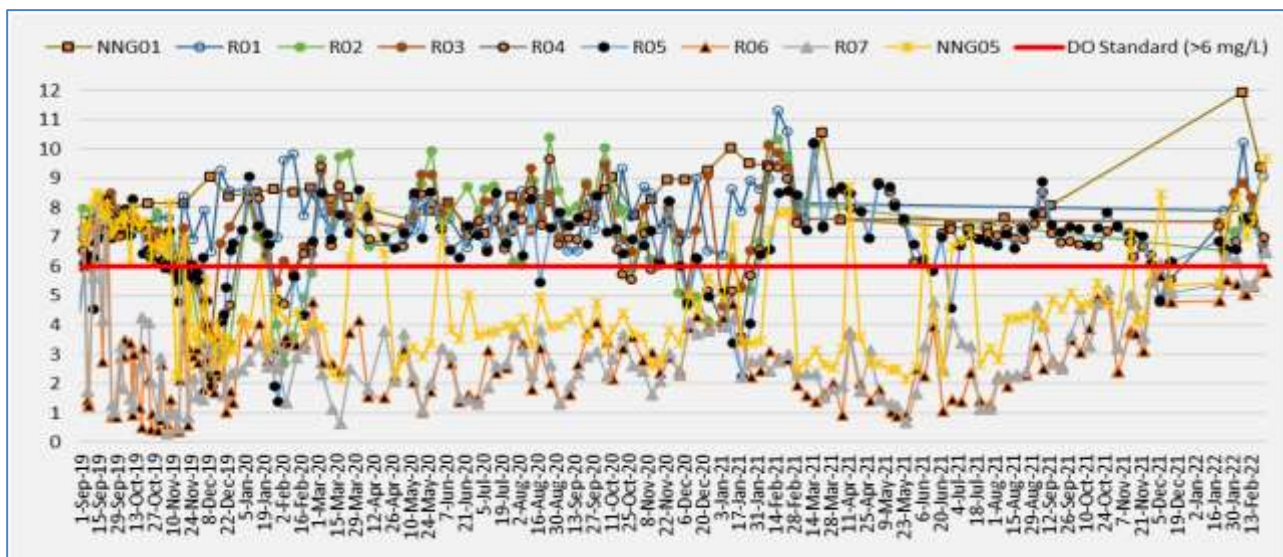
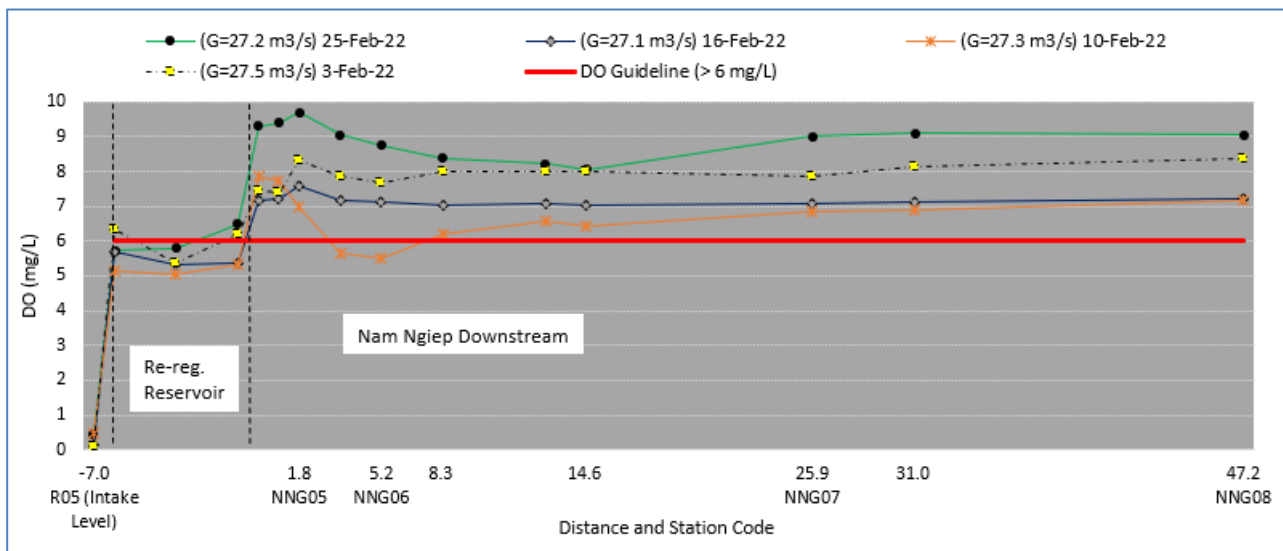


FIGURE 1-3: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO FEBRUARY 2022**FIGURE 1-4: DISSOLVED OXYGEN (MG/L) LONG PROFILE IN FEBRUARY 2022 (FROM IMMEDIATELY UPPER MAIN DAM TO LOWER NAM NGIEP RIVER)****TABLE 1-6: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED 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
1-Feb-22		8.02	7.19	8.49										9.21		
2-Feb-22					6.84	6.57	5.37	6.18								
3-Feb-22							5.37	6.18	8.32	7.7	7.85	8.37			6.84	7.08
7-Feb-22	11.93												11.83			
8-Feb-22		10.23	7.44	8.87										10.86		

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
9-Feb-22					7.64	7.65	5.03	5.34								
10-Feb-22							5.03	5.34	7.0	5.52	6.83	7.18			7.73	6.43
14-Feb-22		7.81	7.84	8.36										8.48		
15-Feb-22					7.68	7.48	5.3	5.37								
16-Feb-22							5.3	5.37	7.57	7.12	7.07	7.21			6.32	6.78
21-Feb-22	9.39												9.95			
23-Feb-22		9.05	6.72	6.74										9.64		
24-Feb-22					7.01	6.46	5.8	6.48								
25-Feb-22							5.8	6.48	9.7	8.76	9.01	9.06			8.61	9.86

TABLE 1-7: 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
7-Feb-22	<5												<5			
8-Feb-22		66.8		<5										14.22		
8-Feb-22 Bottom				<5												
9-Feb-22					<5	<5										
9-Feb-22 Bottom					<5	<5										
10-Feb-22							<5	<5	<5	<5	5.45	<5			<5	<5

TABLE 1-8: 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
7-Feb-22	<1												<1			
8-Feb-22		<1		<1												
8-Feb-22 Bottom				<1												
9-Feb-22					<1	<1	<1	<1						<1		
9-Feb-22 Bottom					<1	7.2										
10-Feb-22									<1	<1	<1	<1			<1	1.2

1.3.3 Groundwater Quality Monitoring

During February 2022, community groundwater quality analyses were carried out for seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village. The community groundwater samples were taken from household's water tap (except in Phouhomxay Village).

The results indicate that:

- Both wells in Phouhomxay Village (GPHX01 and GPHX02) complied with the National Standard.
- The well in Somsuen Village, the well in Nam Pa Village and the well in Thong Noy Village fully complied with the Standard.
- Two out of three wells (GPOU02 and GPOU03 – new wells) in Pou Village did not comply with faecal coliform and *E. coli* bacteria parameters.

The community groundwater quality monitoring results are presented in **Table 1-9**.

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 1-9: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES

	Site Name	Phouhomxay Village		Somseun Village	NamPa Village	ThongNoy Village	Pou Village		
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02	GPOU03
	Guideline	17-Feb-22	17-Feb-22	17-Feb-22	17-Feb-22	17-Feb-22	07-Feb-22	21-Feb-22	21-Feb-22
pH	6.5 - 9.2	6.87	6.81	6.99	7.13	7.06	6.78	7.84	6.92
Sat. DO (%)		34.3	24.6	61.9	88	55.5	105.2	47.9	45.5
DO (mg/L)		2.81	2.03	5.02	7.2	4.55	8.76	4.04	3.81
Conductivity (µS/cm)		421	423	130	418	421	27	355	224
Temperature (°C)		25.79	25.26	26.03	25.47	25.64	24.57	24.09	25.67
Turbidity (NTU)	<20	2.03	2.42	0.19	0.28	0.32	2.55	1.11	12.5
Fecal coliform (MPN/100ml)	0	0	0	0	0	0	0	49	240
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	0	0	0	0	0	49	240
Arsenic (mg/L)	<0.05	0.001	0.0012	0.0015	0.0014	0.0027	<0.0003	0.0015	N/A
Cadmium (mg/L)	<0.01	<0.003	<0.003	<0.003	<0.003	<0.003	0.002	Pending	N/A
Total Iron (mg/L)	<1	0.018	<0.01	0.032	<0.01	0.01	0.071	0.032	N/A
Total hardness (mg/L)	<300	210	230	174	194	202	8.1	186	N/A
Lead (mg/L)	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	N/A
Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	Pending	N/A

In addition, during February 2022, NNP1PC carried out landfill groundwater monitoring at NNP1 Solid Waste Landfill (only three monitoring wells due to water sampling equipment was stuck in monitoring well MW2) and at Houay Soup Solids Waste Landfill (one monitoring well). Similar to previous monitoring results, the concentration of lead in the monitoring wells MW1, MW3, MW4 and MW5 exceeded the relevant groundwater quality standard. This is most likely the (natural) background level and is not attributed to the landfill. Lead has been detected in all wells from time to time both upstream and downstream the landfill. Furthermore, lead has not been detected in the leachate from the landfill treatment ponds and the waste pits and all ponds of both landfills are lined with a HDPE liner protecting the groundwater against infiltration of leachate. These boreholes are more than 50 m deep and not used by staff or villagers.

TABLE 1-10: LANDFILL GROUNDWATER QUALITY MONITORING RESULTS IN NNP1 AND HOUAY SOUP LANDFILLS

		Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline					
22/02/2020	pH		6.75	-	6.28	6.1	6.17
22/02/2020	Sat. DO (%)		39.6	-	28.8	21.6	36.7
22/02/2020	DO (mg/L)		3.31	-	2.41	1.82	3
22/02/2020	Conductivity (µS/cm)		186	-	131	56	107
22/02/2020	Temperature (°C)		24.22	-	24.71	24.7	27.7
22/02/2020	Turbidity		23	-	2.23	2.77	13.3
22/02/2020	Total Nitrogen (mg/L)		2.23	-	1.25	1.04	2.10
22/02/2020	Lead (mg/L)	<0.01	0.407	-	2.20	0.491	0.518
22/02/2020	Faecal Coliform (MPN/100ml)		4.5	-	2	0	0
22/02/2020	E. coli (MPN/100ml)		4.5	-	2	0	0
22/02/2020	NH ₃ -N (mg/L)		0.09	-	0.07	0.10	0.22
22/02/2020	Copper (mg/L)	<1	<0.003	-	0.007	0.003	<0.003
22/02/2020	Total Petroleum (mg/L)		<3	-	<3	<3	<3
22/02/2020	Water level (m)		29.5	-	26.7	25.1	14.9

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of the water quality analyses are presented in **Table 1-11**.

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). 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 1-9**, the groundwater samples from the two wells in Phouhomxay Village both complied with the GOL Drinking Water Standards for *E.coli* and faecal coliform bacteria.

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. 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 1-11: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

	Site Name	Thaheau Village	Hat Gniun Village	Phouhomxay Village	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline	17-Feb-22	17-Feb-22	17-Feb-22	17-Feb-22
pH	6.5 - 8.5	7.05	7.15	7.02	6.97
Sat. DO (%)		105.6	94.1	90.4	82.5
DO (mg/L)		8.9	7.92	7.47	6.88
Conductivity (µS/cm)	<1,000	81	114	139	130
Temperature (°C)	<35	23.44	23.89	24.93	24.38
Turbidity (NTU)	<10	1.14	1.61	0.88	0.49
Faecal Coliform (MPN/100 mL)	0	13	79	220	540
<i>E.coli</i> Bacteria (MPN/100 mL)	0	13	49	130	240
Arsenic (mg/L)	<0.05	<0.0003	<0.0003	<0.0003	<0.0003
Cadmium (mg/L)	<0.003	<0.002	<0.002	<0.002	<0.002
Iron (mg/L)		0.058	<0.01	0.106	0.048
Lead (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01
Total hardness (mg/L)	<300	42	57.4	67.1	61.5
Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002

1.3.5 Landfill Leachate Monitoring

During February 2022, there was no landfill leachate monitoring at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6) due to the ponds dried out.

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 February 2022, the mean inflow to the main reservoir was 51 m³/s. The minimum and maximum inflows were 21 m³/s (on 01 February 2022) and 265 m³/s (on 21 February 2022) respectively.

From 01 to 14 February 2022, the water level in the main reservoir fluctuated from El. 296.94 m asl to El. 296.69 m asl. And from 15 to 28 February, water level in main reservoir increased from El. 296.73 m asl to El. 297.71 m asl.

In February 2022, the hourly turbine discharges from the Main Powerhouse varied between 13 and 226 m³/s usually interrupted by night-time periods with no discharge.

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

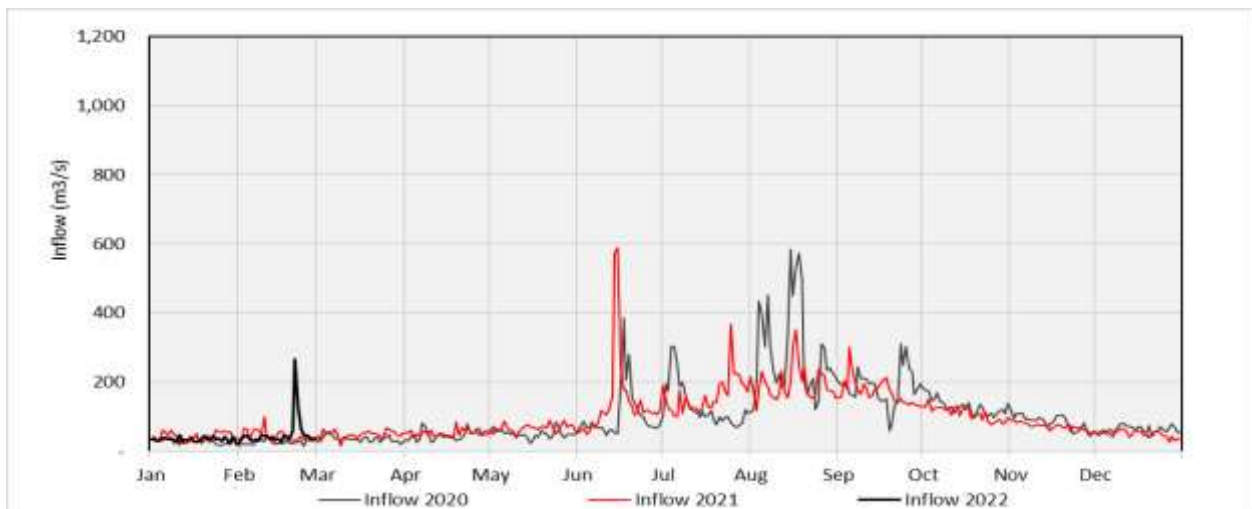
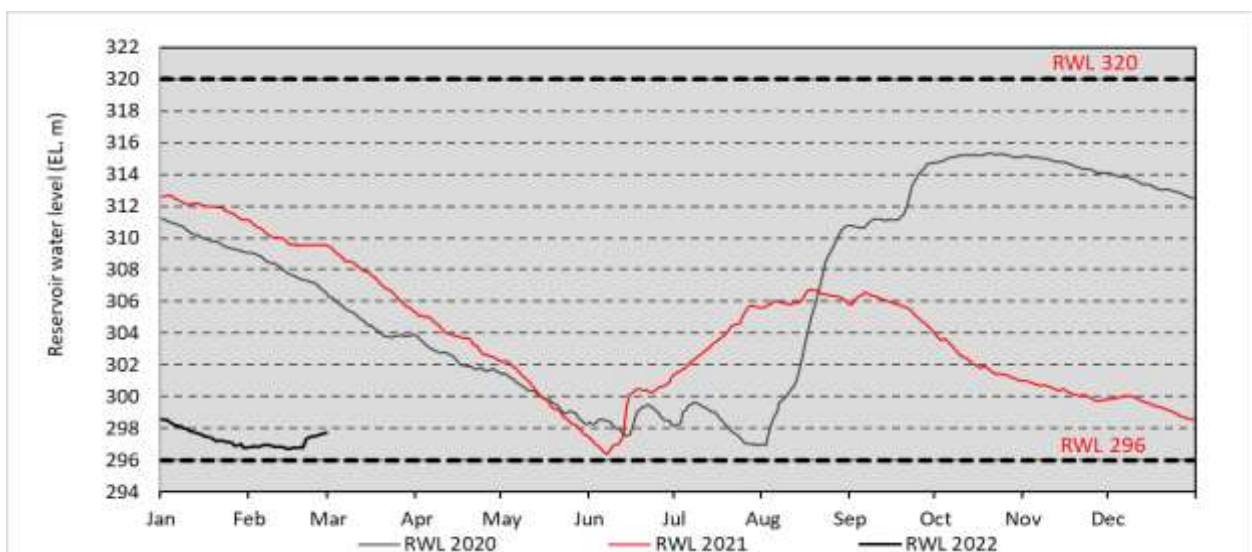


FIGURE 1-6: WATER LEVEL FOR THE MAIN RESERVOIR DURING JANUARY 2020 TO FEBRUARY 2022



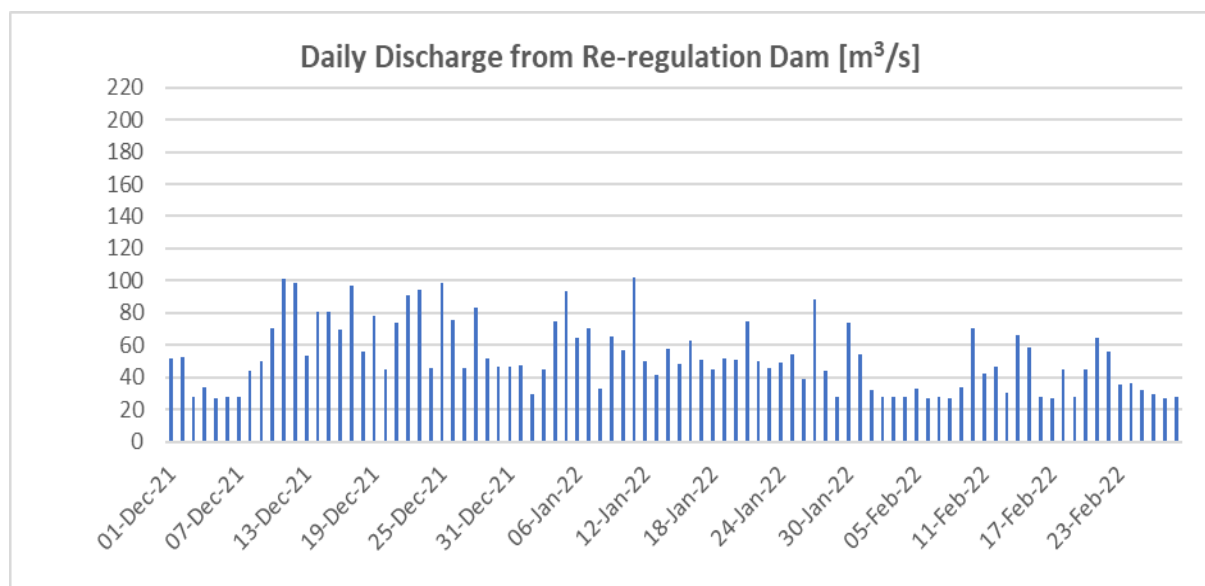
1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during December 2021 to February 2022 is presented in **Figure 1-7**.

During February 2022, the mean daily discharge from the Re-regulation Dam was about 38 m³/s with hourly turbine discharges varying between 49 m³/s and 176 m³/s, hourly gate discharge varied between 26 m³/s and 30 m³/s, and hourly total discharge varying between 26 m³/s and 176 m³/s. The hourly discharge was kept above the minimum flow requirement of 27 m³/s at most of the times, except 5 hours on 19 February 2022 and 4 hours on 28 February 2022 with discharge about 26 m³/s.

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 DECEMBER 2021 TO FEBRUARY 2022



1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In February 2022, EMO carried out only four boat mission 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 in all four boat missions, the thalweg water depth was less than 0.5 m at four of the sites (distance between 1.5 and 5.6 km from the Re-regulation Dam) and the EMO experienced difficulties with boat navigation at 5.6 km during the discharge about 27 m³/s on 03, 10, 16 and 25 February 2022. A joint monitoring with TD and EMO of the four sites to resolve the navigation issues will be conducted in March 2022.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

In February 2022, a total of 23.1 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 1.1 m³ compared with January 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 and compaction, grass cutting and repairing of perimeter fences.

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



The total amount of recyclable waste selling and collection this month is summarized in **Table 1-12**.

TABLE 1-12: AMOUNTS OF RECYCLABLE WASTE SOLD AND COLLECTION

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by February 2022
1	Plastic bottles	kg	0	20
2	Aluminium can	kg	14	23
3	Paper/Cardboard	kg	0	33
4	Glass	kg	0	28
5	Scrap Metal	Kg	0	0
Total		kg	0	104

In February 2022, the access to OSOV1 continued to be restricted and the villagers collected 81 kg food wastes from the OSOV1 canteen.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in February 2022 are shown in **Table 1-13** and **Table 1-14**.

TABLE 1-13: RECORD OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in February 2022 (A)	Used (B)	Remaining at the end of February 2022 (A – B)
1	Diesel	Litre	6,435	2,721	3,714
2	Gasoline	Litre	982	386	596
3	Lubricant (Turbine oil)	Litre	12,115	0	12,115
4	Colour Paint	Litre	242	0	242
5	Thinner	Litre	7	0	7
6	Grease Oil	Litre	785	0	785
7	Gear Oil	Litre	166	0	166
8	Chlorine Liquid	Litre	105	0	105
9	Chlorine Powder	kg	65	0	65
10	SIKA	Litre	7	0	7

TABLE 1-14: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in February 2022 (A)	Disposed (B)	Remaining at the end of February 2022 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	272.3	0	272.3
2	Used oil mixed with water	Litre	920	0	920
3	Empty used oil drum/container (drum 200L)	Unit	3	0	3
4	Contaminated soil, sawdust and textile material	m ³	0.48	0	0.48
5	Used tyre	Drum	12	0	12
6	Empty used chemical drum/container (drum 20L)	Unit	8	0	8
7	Lead acid batteries	Unit	9	0	9
8	Empty paint and spray cans	Unit	138	0	138
9	Halogen/fluorescent bulbs	kg	233	0	233
10	Empty cartridge (Ink)	Unit	176	0	176
11	Clinic Waste	Kg	15.7	0	15.7

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 in the community area. No recycle waste trade activities in the community recycle waste bank in February 2022.

1.6.2 Community Solid Waste Management

In February 2022, a total of 20.0 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill, a decrease of 3.8 m³ compared with January 2021.

During this reporting period, the local waste collection contractor conducted regular waste collection from the three villages and operated the Houay Soup Landfill for two days per week. The work included waste collection, segregation and disposal, waste cover and compaction, grass cutting and repairing the perimeter fences. The contractor also assisted on the big cleaning in the Phouhomxay Resettlement village.

FIGURE 1-9: WASTE MANAGEMENT ACTIVITIES DURING FEBRUARY 2022

DAILY WASTE COLLECTION FROM VILLAGE	DAILY WASTE DUMP AT HOUAY SOUP LANDFILL
 <p>2022/2/11 08:17</p>	 <p>11/02/2022</p>
SUPPORT WASTE BIG CLENGING ACTIVITY IN THE VILLAGE	
 <p>2022/2/11 08:21</p>	 <p>25/02/2022</p>

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)

Xaysomboun WRPO conducted reservoir patrol between 11-18 February 2022 and the report will be communicated with Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) for SMART data analysis and future planning. However, there are no progress for other pending activities such as the Participatory Land Use Plan (PLUP) training and PLUP improvement for Phonhom Village, construction of reservoir access checkpoint at WRPO sub-office, construction of 2 ranger stations and 2 reservoir TPZ checkpoints, producing TPZs protection handbook, installation of signs and poles for TPZs, as well as the organization of meeting on role and responsibilities on the reservoir fishery management and the annual meeting. These activities might be progressed after the new Agreement on the establishment of Xaysomboun WRPC and WRPO is issued per the recommendation of Xaysomboun Provincial Governor during the meeting on 07 February 2022.

2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)

Bolikhamxay WRPO organized the annual meeting on 03 February 2022 at Bolikhan Administration Office using the remaining budget from AIP2021. There were 34 attendees comprising representative from Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF), Xaysomboun PAFO, Provincial Forestry Section, District Agriculture and Forestry Office (DAFO), village authorities, and NNP1PC EMO. The meeting presented and discussed the lessons learned of implementation activities in 2021 and the status of the AIP2022. The key points summarized from the meeting:

1. The land use, forest encroachment and illegal wildlife trading are not in line with existing laws and regulations and these pending issues need to be solved as soon as possible through the coordination among parties.
2. The pending issue on the law enforcement should be solved by the relevant sectors soon.
3. NNP1PC to finalize the fishery co-management plan in line with relevant regulations on wildlife management within the NNP1 watershed soon.
4. The budget to be timely provided to GOL in quarterly basis to solve the issues within the NNP1 watershed.
5. Livelihood improvement program for the external watershed villages should be considered to solve the forest encroachment issue in the NNP1 watershed.

Bolikhamxay WRPO also conducted internal monthly meeting on 14 February 2022 with the participation of EMO. It was noted that they will focus on forest patrolling in February 2022 to deal with the threats around Phonesong Village with encroachment nearby the NNP1 watershed totally protection zone (TPZ) and they will also form a joint effort with Xaysomboun WRPO for the reservoir patrolling. They conducted forest patrolling between 15-24 February 2022 and reservoir patrol between 17-26 February 2022. The report will be shared with EMO and BSP-WCS for SMART data analysis and future planning.

2.1.1.3 NNP1PC EMO

A meeting with NNP1 Provincial Resettlement and Livelihood Restoration Committee (PRLRC) and Watershed and Reservoir Protection Committee (WRPC) took place on 07 February 2022 at 01.30 p.m. at the Provincial Administration Office of Xaysomboun Province. The meeting was chaired by

H.E. Mr. Phoikham Hounbounnuang, Provincial Governor and Leader of the Provincial Revolutionary Party and was attended by 23 participants (included 3 women) comprising of Deputy Head from relevant provincial departments, Vice District Governors of Hom and Thathom, Head of District Agriculture and Forestry of Hom and Thathom, Head of Xaysomboun Provincial Resettlement Management Unit (RMU), Head of Xaysomboun WRPO, Mr. Masahiko Umesaki (Managing Director of NNP1PC), Deputy Managing Director of NNP1PC (ESD), and staffs of NNP1PC.

Two presentations on the overall implementation progress of NNP1 watershed management and social development were presented by representatives from NNP1PC. A summary of the discussion and agreement related with NNP1 watershed and reservoir management:

- The Maj. Gen. Vongsone Inpanphim, Provincial Vice Governor is appointed as new Chairperson of Xaysomboun PRLRC and WRPC replacing Mr. Bounphanh Phommachanh, Former Chairperson of Xaysomboun PRLRC and WRPC. The Provincial Home Affairs Department in coordination with PAFO is assigned to review and improve the existing Agreement for the appointment of the new Chairperson of Xaysomboun PRLRC and WRPC for the Provincial Governor review and approval.
- The proposed two ranger stations and two reservoir checkpoints should be compatible to the patrolling strategies on protecting the conservation areas. Xaysomboun WRPO (Watershed and Reservoir Protection Office) is advised to continue preparing documents for building the two ranger stations and two reservoir checkpoints as well as reviewing the plan if one additional ranger station in TPZ is needed.
- WRPO to draft an Agreement on the appointment of staff to be stationed at the new sub-office, patrolling programs and reservoir checkpoints for the Provincial Governor review and approval.
- WRPO to draft an Instruction Letter to be signed by the Provincial Governor on the prohibition/restriction of land occupation and utilization inside the forest land, TPZs and compensated land by clearly mentioning the deadline for moving out from these areas for his prior review and approval.
- Draft an Agreement on the establishment of a Government Special Task Force to inform villagers who illegally encroached and occupied forest land, TPZs and compensated land to move out from these areas. (The Task Force should consist of staff from relevant GoL agencies at provincial and district levels)
- The NNP1 reservoir fishery management should focus on the benefits and engagement of the Project Affected People. NNP1PC in collaboration with Xaysomboun PAFO to organize another consultation meeting on roles and responsibilities of reservoir fishery management with relevant parties and start implementing fishery management plan as soon as possible.
- The clearance of compensated rubber plantation must be carried out in accordance with the recommendations during the last PRLRC meeting held on 07 August 2019 in Bolikhamxay Province. Xaysomboun PAFO in collaboration with NNP1PC to develop a plan for removal of compensated rubber plantation.
- Allowance for field work shall be paid in accordance with the Ministry of Finance's Agreement No.4000/MoF.

EMO also organized a meeting with the Head of Lao Woman Union of Hom District on the possibility of collaboration for providing training on pineapple and orange processing for producers at Phou Ngou and Houayxai Villages at Lao Woman Union Office on 01 February 2022. A summary of the discussion is as follow:

- Hom District Lao Woman Union confirmed their full support to NNP1PC and local producers in building capacity for producing local products and distribution to the market.

- Producers from PhouNgou and Houayxai Villages can participate in any exhibition where Hom Lao Woman Union is invited.
- Lao Woman Union and NNP1PC will work together on improving processed pineapple products in terms of quality and packaging.
- Lao Woman Union will assist pineapple and orange production groups in obtaining approval of Food and Drug Authority (FDA) for their processed products.

EMO had a meeting with Dr. Viengsakoun, a Professor at Faculty of Agriculture, National University of Laos on 18 February 2022 to discuss the collaboration on providing capacity building for cattle fattening to the farmers at PhouNgou, Houayxai, Phonhom and Nahong Villages. Dr. Viengsakoun confirmed his interest and support. The meeting with Dr. Phouthasone, Pineapple/Orange Expert is postponed to March 2022 because of his unavailability.

The Lao Newt and Gecko survey as well as camera trap survey were started according to the schedule on 14 February and 27 February 2022 respectively.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2022

2.1.2.1 Xaysomboun WRPO

Xaysomboun WRPO organized another round of discussions with EMO and the BSP-WCS between 1-3 February 2022. They further work on the detail budget plan after that and proposed for the draft to be submitted on 25 February 2022. However, Head of Xaysomboun PAFO informed that the draft plan need to be further discussed with Xaysomboun PAFO management prior to submission to NNP1PC and DOF-MAF. Therefore, the planned submission will be further delayed because the Head of Xaysomboun PAFO has been out of the office since the first week of February 2022 and expected to return to the office in March 2022.

2.1.2.2 Bolikhamxay WRPO and DOF-MAF

The Independent Advisory Panel (IAP) and ADB confirmed acceptance on the plan of DOF-MAF and Bolikhamxay WRPO on 07 and 10 February 2022 respectively. The team has refined the Lao version of the plan and shared the plans to DOF-MAF and Bolikhamxay WRPO on 11 February 2022. Bolikhamxay WRPO is still working on their internal document process until end of February 2022 before submitting the fund disbursement request to DOF-MAF and NNP1PC. DOF-MAF submitted the fund disbursement request on 25 February 2022 and EMO is processing the request internally. It is noted that their fund disbursement request will cover the implementation activity during Q1 and Q2 2022 anticipating their internal document processes and NNP1PC management has no objection on it.

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 February 2022 are described below:

a. Component 1 - Spatial Planning and Regulation

Biodiversity Offset Management Unit (BOMU) continues to process in the recognition of District authorities of Viengthong and Xaychamphone. The discussion among EMO, BOMU, and BSP-WCS for updating village land use plans still could not be organized because of the unavailability of BOMU team.

b. Component 2 – Law Enforcement

The patrolling in February 2022 was implemented between 08 to 27 February 2022 focussing on TPZ highest priority area including Nam Chouan, Houay Kokhai and mountain ridges, Nam Chang, downstream of Nam Sone and mountain ridges, Nam San and its northern tributaries as well as TPZ high priority area including Nam Mong, Nam Pang and mountain ridges. The results of the patrolling in February 2022 will be presented in March 2022 Monthly Report.

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

Team	Patrolling Area/distance	Observations/Actions Taken
1	TPZ highest priority area including Nam Sone, Nam Chouan, Houay Xay Gnai, Houay Xay Noi, and Houay Pong. (14 days covering a distance of 81 km on forest patrolling)	The team found and destroyed one old fishing camp at Nam Chouan, one hunting camp close to Nam Chouan. The team also observed a small-scale of inactive forest fire close to Houay Pong suspected as the work of hunter and Non-Timber Forest Product (NTFP) collector.
2	TPZ highest priority area including Houay Phalai, Nam San and southern Nam San tributaries (14 days covering a distance of 57 km on forest patrolling)	The team found and destroyed a small hunting camp which including 17 bird traps and some trashes at Houay Phalai.
3	TPZ highest priority area including Nam Sone, Houay Pong and mountain ridges. (14 days covering a distance of 73 km on forest patrolling)	The team found and destroyed a hunting camp upstream of Nam Sone. They also collected some litter potentially from hunters upstream of Houay Pong.
4	Nam Ma TPZ high priority area including Nam Sa Nga, and mountain ridges. (14 days covering a distance of 77 km on forest patrolling)	The team found and destroyed a recent fishing camp with some garbage at Nam Ma and a recent hunting camp with a used cartridge located close to Nam Sa Nga.

Notes: Each patrol team spent two working days (5-6 January 2022) to help with road and bridge maintenance from Vangphieng village to Nam San sub-station and so the forest patrolling only included 14 working days (7-20 January 2022).

[illegible]

Evidence of small-scale forest fire observed by team 1 close to Houay Pong	Fishing camp found and destroyed by team 1 at Nam Chouan
	
Hunting camp found and destroyed by team 1 close to Nam Chouan	Bird traps found and collected by team 2 at Houay Phalai
	
Hunting camp found and destroyed by team 3 at the mountain ridge of Nam Sone	The litters found by team 3 close to Nam Chang
	
Used cartridge found and collected by team 4 at mountain ridge of Nam Sa Nga.	Drying rack found and destroyed by team 4 at mountain ridge of Nam Sa Nga

c. Component 3 – Conservation Outreach

BSP-WCS shared the third draft of outreach strategy on 04 February 2022. EMO provided comments on the draft particularly to elaborate on the budget estimation for the proposed activities. BSP-WCS is working to further improve the draft.

The scripts for radio-broadcast were distributed to the six Nam Chouane-Nam Xang (NC-NX) villages on 03 February 2022. The broadcasting is being implemented from February to July 2022.

d. Component 4 – Conservation linked livelihood development

The activity under the approved Community Development Plan (CDP) still could not be commenced due to unavailability of BOMU and DAFO.

BSP-WCS shared the draft English version of Conservation Contract Agreement (CCA) to EMO on 15 February 2022. They are also improving the Lao version of the draft which will then be shared to BOMU for their review and comments.

The results of January 2022 monthly snare removal were encoded into SMART database. The February 2022 snare removal was implemented between 10 to 24 February 2022 focussing on the TPZ highest priority area including Nam Xi, Houay Pong and Houay Xay Gnai. The data is being reviewed and summarized by BOMU team.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2022

EMO and BOMU organized an online discussion on 09 February 2022 to discuss and agree on the key issues for the draft AIP2022 such as field allowance, subsistence allowance, phone cards and etc. The activity schedule was further detailed and communicated with BSP-WCS on 16 February 2022 for their inputs. BSP also recommended to include additional training budget for the patrolling and snare removal team and so the plan was further updated accordingly. The draft was submitted to ADB and IAP on 23 February 2022 for their review and approval.

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.

Fish species dominated the fish catch by weight from September 2021 to January 2022 ¹as listed in **Table 2-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species², except *Tor sinensis* is classified as Vulnerable species (VU) and *Sikukia gudgeri* is classified as Data Deficient species (DD).

¹ Data is calculated based on available data due to COVID-19 lockdown.

² The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not Evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

TABLE 2-1: FISH SPECIES DOMINATING THE FISH CATCH IN SEPTEMBER 2021 TO JANUARY 2022

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
September 2021			
<i>Mastacembelus armatus, Mastacembelus favus</i>	ປາຫຼາດ	155	LC
<i>Hampala dispar, Hampala macrolepidota</i>	ປາສຸດ	129.7	LC
<i>Oreochromis niloticus</i>	ປານິນ	109.5	LC
<i>Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus</i>	ປາຈາດ	104.1	LC
<i>Tor sinensis</i>	ປາແດງ	93	VU
October 2021			
<i>Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei</i>	ປາປາກ	102.8	LC
<i>Sikukia gudgeri, Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	96.6	DD, LC
<i>Mastacembelus armatus, Mastacembelus favus</i>	ປາຫຼາດ	61.4	LC
<i>Hampala dispar, Hampala macrolepidota</i>	ປາສຸດ	46.3	LC
<i>Channa striata</i>	ປາຄໍ້	45.1	LC
November 2021			
<i>Sikukia gudgeri, Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	174.8	DD, LC
<i>Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei</i>	ປາປາກ	73.8	LC
<i>Channa striata</i>	ປາຄໍ້	61.4	LC
<i>Clarias batrachus</i>	ປາດູກ	57.6	LC
<i>Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus</i>	ປາຈາດ	50	LC
December 2021			
<i>Sikukia gudgeri, Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	78.5	DD, LC
<i>Clarias batrachus</i>	ປາດູກ	42.2	LC
<i>Channa striata</i>	ປາຄໍ້	27	LC
<i>Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei</i>	ປາປາກ	29	LC
<i>Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus</i>	ປາຈາດ	28.5	LC
January 2022			
<i>Sikukia gudgeri, Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	85.7	DD, LC
<i>Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus</i>	ປາຈາດ	40.5	LC
<i>Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei</i>	ປາປາກ	24.7	LC
<i>Mystacoleucus atridorsalis, Mystacoleucus marginatus</i>	ປາຫຼັງໜາມ	19.2	LC
<i>Clarias batrachus</i>	ປາດູກ	17	LC

The recorded catch of Threatened species (IUCN Red List classification) in September 2021 to January 2022 are presented in **Table 2-2**. The list includes three species that are classified as Vulnerable species (VU) and one Endangered species (EN).

TABLE 2-2: THREATENED SPECIES OF SEPTEMBER 2021 TO JANUARY 2022 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
September 2021			
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	9.6	VU
<i>Tor sinensis</i>	ປາແດງ	87	VU
October 2021			
<i>Probarbus jullieni</i>	ປາເອີນ	17	EN
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	12.8	VU
<i>Tor sinensis</i>	ປາແດງ	29.3	VU
November 2021			
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	0.9	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	9.1	VU
<i>Tor sinensis</i>	ປາແດງ	13.4	VU
December 2021			
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	0.8	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	6.6	VU
<i>Tor sinensis</i>	ປາແດງ	3.5	VU
January 2022			
<i>Cirrhinus cirrhosus</i>	ປາແກງ/ປານວນຈັນ	1	VU
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ້ຽນ	8.3	VU
<i>Tor sinensis</i>	ປາແດງ	5.3	VU

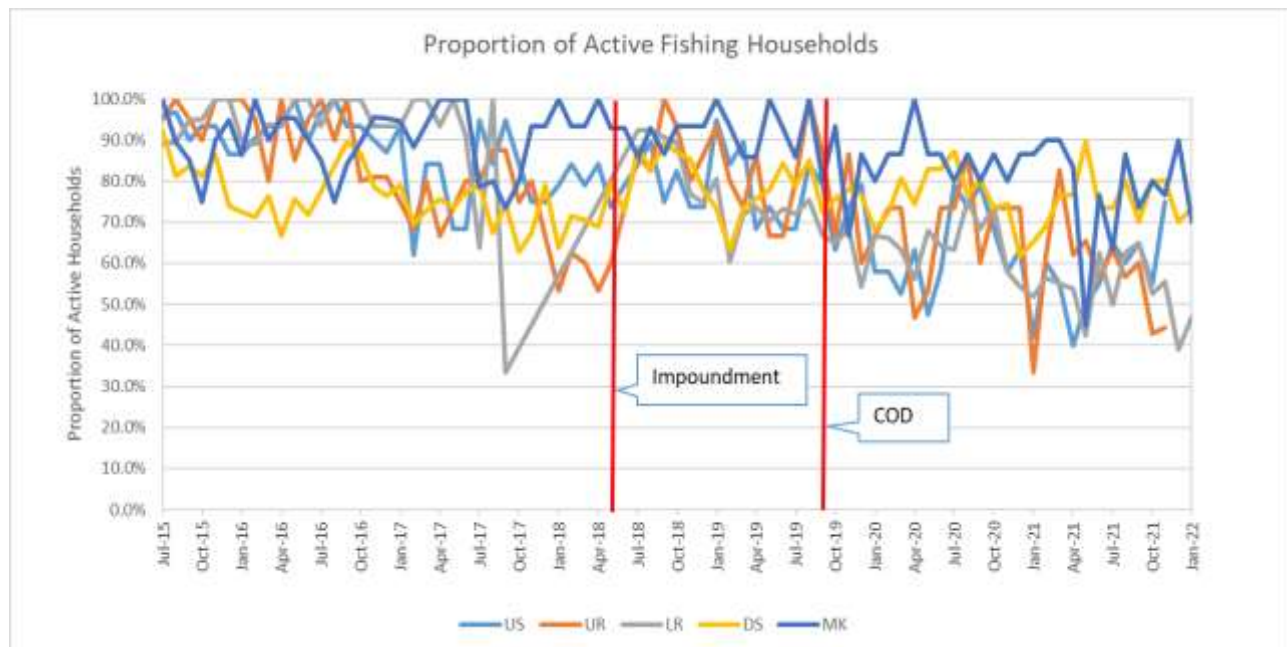
Species abundance and occurrence are based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey from September 2021 to January 2022. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators from September 2021 to January 2022 for above dam, below dam and Mekong area are presented in **Table 2-3**.

TABLE 2-3: MAIN BIODIVERSITY INDICATORS FOR SEPTEMBER 2021 TO JANUARY 2022 (5 MONTHS)

Biodiversity Indicators	Mekong	Below dam	Above dam
Total species and groups	45	58	47
Single species	37	40	32
Species groups	8	18	15
Top 15 species (% total catch weight)	88.82%	76.28%	85.85%
Proportion for species groups	13.44%	57.63%	46.36%
Diversity index (Shannon)	2.7233	3.1216	2.9695

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 39% and 90% of active fishing households for all fishing zones from September 2021 to January 2022.

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

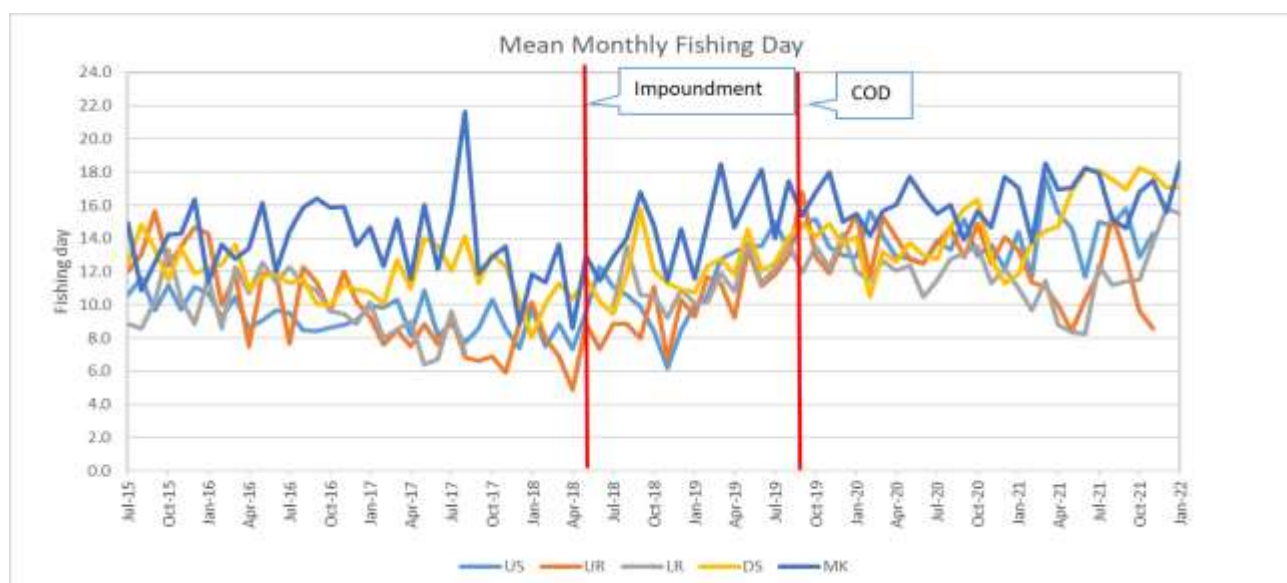


Note:

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

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

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



The mean monthly number of fishing days for the month of September to December from 2015 to 2021 and for the month of January from 2016 to 2022 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2-4**.

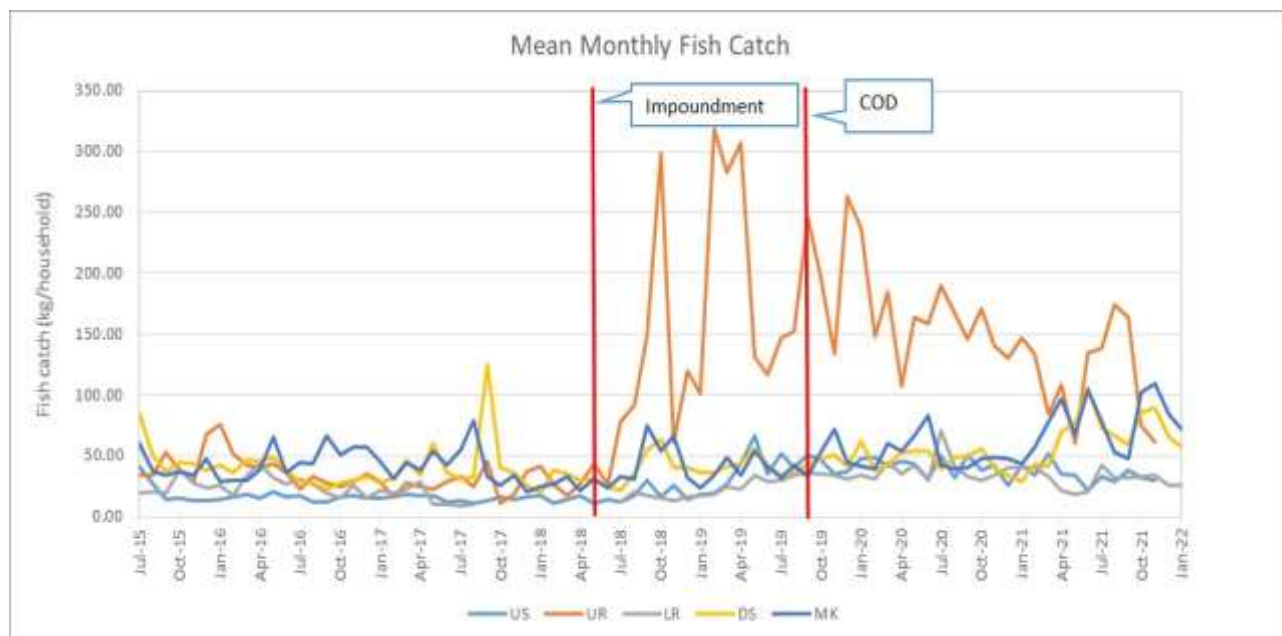
TABLE 2-4: MEAN REPORTED NUMBER OF FISHING DAYS BY FISHING ZONE FOR THE MONTH OF SEPTEMBER TO DECEMBER FROM 2015 TO 2021 AND FOR THE MONTH OF JANUARY FROM 2016 TO 2022

Fishing Zone	September 2015 (day)	September 2016 (day)	September 2017 (day)	September 2018 (day)	September 2019 (day)	September 2020 (day)	September 2021 (day)
Upstream	9.64	8.39	8.57	9.89	14.86	15.14	15.82
Upper reservoir	15.63	11.33	6.62	7.96	16.81	12.86	12.86
Lower reservoir	10.18	10.88	0.00	10.61	11.95	13.08	11.37
Downstream	13.37	10.03	11.31	15.76	14.87	15.75	16.94
Mekong	12.55	16.43	11.90	16.79	15.36	13.93	14.61
Fishing Zone	October 2015 (day)	October 2016 (day)	October 2017 (day)	October 2018 (day)	October 2019 (day)	October 2020 (day)	October 2021 (day)
Upstream	11.17	8.65	10.33	8.41	15.13	12.95	12.88
Upper reservoir	12.34	9.60	6.89	11.07	12.84	14.90	9.60
Lower reservoir	13.29	9.60	0.00	10.52	13.53	13.50	11.51
Downstream	11.45	10.01	13.04	12.06	14.14	16.37	18.27
Mekong	14.23	15.87	12.88	14.76	16.77	15.67	16.79
Fishing Zone	November 2015 (day)	November 2016 (day)	November 2017 (day)	November 2018 (day)	November 2019 (day)	November 2020 (day)	November 2021 (day)
Upstream	9.69	8.79	8.57	6.19	13.47	13.64	14.29
Upper reservoir	13.52	12.00	5.89	6.73	11.87	12.47	8.57
Lower reservoir	10.36	9.43	0.00	9.22	12.20	11.30	13.71
Downstream	13.39	11.17	12.32	11.29	14.87	12.73	17.86
Mekong	14.29	15.92	13.52	11.43	18.00	14.64	17.52
Fishing Zone	December 2015 (day)	December 2016 (day)	December 2017 (day)	December 2018 (day)	December 2019 (day)	December 2020 (day)	December 2021 (day)
Upstream	11.07	9.08	7.38	8.49	12.99	NA	NA

Upper reservoir	14.65	10.22	8.86	10.33	13.78	NA	NA
Lower reservoir	8.86	8.86	0.00	10.90	14.29	12.14	15.82
Downstream	11.88	10.90	10.20	10.91	13.65	11.30	17.08
Mekong	16.33	13.56	8.86	14.55	14.99	17.71	15.58
Fishing Zone	January 2016 (day)	January 2017 (day)	January 2018 (day)	January 2019 (day)	January 2020 (day)	January 2021 (day)	January 2022 (day)
Upstream	10.67	9.91	9.84	9.96	12.88	NA	NA
Upper reservoir	14.31	9.23	10.12	9.26	15.50	NA	NA
Lower reservoir	11.63	10.12	0.00	10.10	12.00	11.00	15.50
Downstream	12.24	10.72	8.05	10.72	14.12	11.81	17.11
Mekong	11.35	14.67	11.81	11.58	15.50	17.03	18.56

The mean monthly household fish catch from July 2015 to January 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 JANUARY 2022



The mean household fish catch for the month of September to December from 2015 to 2021 and for the month of January 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 SEPTEMBER TO DECEMBER FROM 2015 TO 2021 AND FOR THE MONTH OF JANUARY FROM 2016 TO 2022

Fishing Zone	September 2015 (kg)	September 2016 (kg)	September 2017 (kg)	September 2018 (kg)	September 2019 (kg)	September 2020 (kg)	September 2021 (kg)
Upstream	14.25	12.54	13.23	29.93	51.03	50.94	38.37
Upper reservoir	53.32	27.98	45.62	149.39	244.95	146.29	163.38
Lower reservoir	19.82	19.85	0.00	17.73	36.67	32.71	32.23
Downstream	37.55	22.81	124.99	54.86	42.97	49.86	59.61
Mekong	34.41	66.14	33.24	75.11	33.54	40.00	47.75
Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)	October 2019 (kg)	October 2020 (kg)	October 2021 (kg)
Upstream	15.73	16.13	16.39	15.99	46.54	38.63	32.21
Upper reservoir	38.02	24.62	11.56	298.71	196.94	171.51	75.03
Lower reservoir	38.68	15.54	0.00	15.57	35.17	29.69	33.17
Downstream	44.43	28.27	40.18	63.06	47.81	56.22	85.56
Mekong	37.74	51.19	25.93	53.92	53.33	47.90	102.41
Fishing Zone	November 2015 (kg)	November 2016 (kg)	November 2017 (kg)	November 2018 (kg)	November 2019 (kg)	November 2020 (kg)	November 2021 (kg)
Upstream	13.38	17.94	14.03	26.24	35.45	42.27	29.64
Upper reservoir	29.01	28.76	18.86	61.71	133.55	140.45	60.86
Lower reservoir	27.75	25.33	0.00	13.52	34.20	33.86	34.41
Downstream	43.90	29.88	35.80	40.31	50.95	40.76	89.98
Mekong	33.95	57.09	34.52	66.82	71.31	48.50	108.88
Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)	December 2020 (kg)	December 2021 (kg)
Upstream	12.95	15.15	15.94	13.99	36.82	NA	NA
Upper reservoir	67.93	35.12	37.29	119.47	263.01	NA	NA
Lower reservoir	23.47	15.68	0.00	16.44	30.93	40.79	25.69
Downstream	37.80	33.23	25.36	40.89	41.03	34.42	65.10
Mekong	47.61	56.93	20.47	31.54	44.22	48.07	84.26

Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)	January 2020 (kg)	January 2021 (kg)	January 2022 (kg)
Upstream	14.57	14.87	17.81	18.24	47.99	NA	NA
Upper reservoir	76.04	29.41	41.82	100.49	236.71	NA	NA
Lower reservoir	25.74	21.57	0.00	16.90	34.47	39.93	25.58
Downstream	42.37	27.67	19.06	36.36	62.14	29.29	57.29
Mekong	28.54	46.00	24.87	23.27	41.08	43.09	71.74

The mean daily fish catch per household from July 2015 to January 2022 are displayed in **Figure 2-6** and the mean fish catch per household per fishing day for the month of September to December from 2015 to 2021 and for the month of January from 2016 to 2022 are shown in **Table 2-6**.

FIGURE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FROM JULY 2015 TO JANUARY 2022

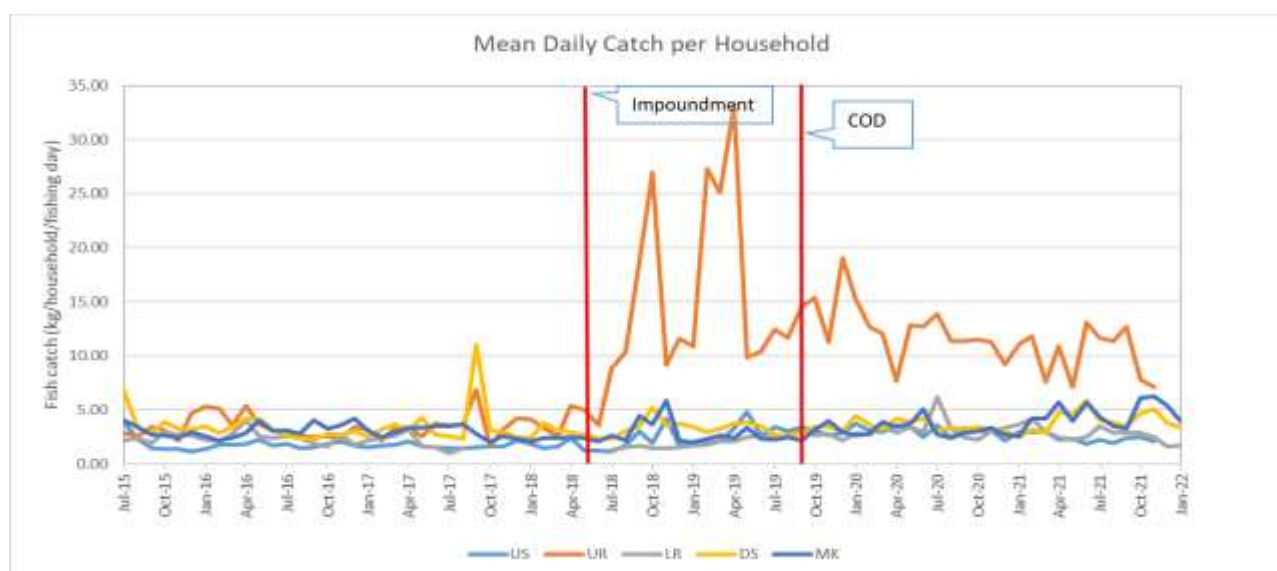


TABLE 2-6: MEAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF SEPTEMBER TO DECEMBER FROM 2015 TO 2021 AND FOR THE MONTH OF JANUARY FROM 2016 TO 2022

Fishing Zone	September 2015 (kg)	September 2016 (kg)	September 2017 (kg)	September 2018 (kg)	September 2019 (kg)	September 2020 (kg)	September 2021 (kg)
Upstream	1.48	1.50	1.54	3.03	3.43	3.36	2.43
Upper reservoir	3.41	2.47	6.89	18.77	14.57	11.38	12.71
Lower reservoir	1.95	1.82	0.00	1.67	3.07	2.50	2.83
Downstream	2.81	2.27	11.05	3.48	2.89	3.17	3.52
Mekong	2.74	4.03	2.79	4.47	2.18	2.87	3.27

Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)	October 2019 (kg)	October 2020 (kg)	October 2021 (kg)
Upstream	1.41	1.87	1.59	1.90	3.08	2.98	2.50
Upper reservoir	3.08	2.57	1.68	26.98	15.33	11.51	7.82
Lower reservoir	2.91	1.62	0.00	1.48	2.60	2.20	2.88
Downstream	3.88	2.82	3.08	5.23	3.38	3.43	4.68
Mekong	2.65	3.23	2.01	3.65	3.18	3.06	6.10
Fishing Zone	November 2015 (kg)	November 2016 (kg)	November 2017 (kg)	November 2018 (kg)	November 2019 (kg)	November 2020 (kg)	November 2021 (kg)
Upstream	1.38	2.04	1.64	4.24	2.63	3.10	2.08
Upper reservoir	2.15	2.40	3.20	9.16	11.25	11.27	7.10
Lower reservoir	2.68	2.69	0.00	1.47	2.80	3.00	2.51
Downstream	3.28	2.68	2.91	3.57	3.43	3.20	5.04
Mekong	2.38	3.59	2.55	5.85	3.96	3.31	6.22
Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)	December 2020 (kg)	December 2021 (kg)
Upstream	1.17	1.67	2.16	1.65	2.83	NA	NA
Upper reservoir	4.64	3.44	4.21	11.56	19.09	NA	NA
Lower reservoir	2.65	1.77	0.00	1.51	2.17	3.36	1.62
Downstream	3.18	3.05	2.48	3.75	3.00	3.05	3.81
Mekong	2.92	4.20	2.31	2.17	2.95	2.71	5.41
Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)	January 2020 (kg)	January 2021 (kg)	January 2022 (kg)
Upstream	1.37	1.50	1.81	1.83	3.73	NA	NA
Upper reservoir	5.31	3.19	4.13	10.85	15.27	NA	NA
Lower reservoir	2.21	2.13	0.00	1.67	2.87	3.63	1.65
Downstream	3.46	2.58	2.37	3.39	4.40	2.48	3.35
Mekong	2.51	3.14	2.11	2.01	2.65	2.53	3.87

The survey results from September 2021 to January 2022 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 from September 2021 to January 2022 are displayed in **Table 2-7**.

TABLE 2-7: PROPORTION OF THE CATCH REPORTED BY MAIN HABITATS (%) FROM SEPTEMBER 2021 TO JANUARY 2022

Habitats	US	UR	LR	DS	MK
Mekong	0.00%	0.00%	0.00%	11.67%	84.43%
Nam Ngiep	67.11%	27.00%	0.00%	43.69%	0.94%
Nam Xan	0.00%	0.00%	0.00%	0.22%	0.00%
Reservoir	0.00%	64.09%	4.33%	0.00%	0.00%
Tributary and stream	26.56%	7.89%	80.58%	35.36%	0.25%
Wetland	6.33%	1.01%	15.09%	9.07%	14.38%
Others	0.00%	0.00%	0.00%	0.00%	0.00%

The total reported fish and other aquatic animals (OAA) catch (proportion of OAA) for the same 7-day period from July 2015 to January 2022 are presented in **Figure 2-7** and the proportion of OAA catch for the month of September to December from 2015 to 2021 and for the month of January 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 JANUARY 2022

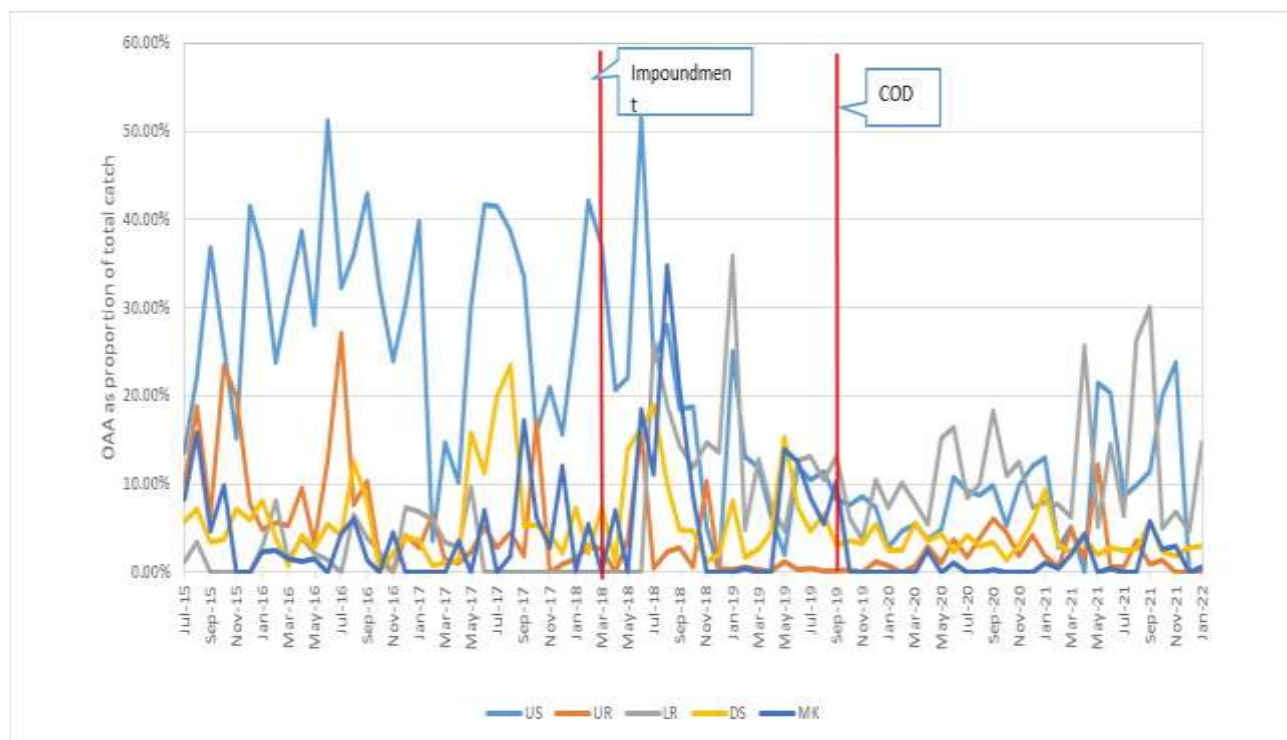


TABLE 2-8: PROPORTION OF OAA TO THE TOTAL REPORTED NUMBER OF FISH AND OAA FOR THE MONTH OF SEPTEMBER TO DECEMBER FROM 2015 TO 2021 AND FOR THE MONTH OF JANUARY FROM 2016 TO 2022

Fishing Zone	September 2015	September 2016	September 2017	September 2018	September 2019	September 2020	September 2021
Upstream	36.85%	42.97%	33.60%	18.57%	8.32%	9.86%	11.42%
Upper reservoir	6.42%	10.39%	1.93%	2.83%	0.11%	6.08%	0.88%
Lower reservoir	0.00%	3.99%	0.00%	14.43%	13.19%	18.30%	30.08%
Downstream	3.49%	8.05%	5.34%	4.92%	3.21%	3.50%	5.83%
Mekong	4.66%	1.44%	17.30%	20.79%	10.40%	0.27%	5.77%
Fishing Zone	October 2015	October 2016	October 2017	October 2018	October 2019	October 2020	October 2021
Upstream	25.52%	32.18%	15.91%	18.88%	7.62%	5.26%	20.00%
Upper reservoir	23.44%	1.48%	17.25%	0.59%	0.29%	4.57%	1.36%
Lower reservoir	0.00%	2.32%	0.00%	11.90%	6.10%	10.94%	5.07%
Downstream	3.81%	0.13%	5.39%	4.72%	3.63%	1.46%	2.38%
Mekong	9.83%	0.00%	6.26%	8.69%	0.00%	0.00%	2.63%
Fishing Zone	November 2015	November 2016	November 2017	November 2018	November 2019	November 2020	November 2021
Upstream	15.23%	23.98%	21.05%	5.16%	8.68%	9.88%	23.85%
Upper reservoir	19.93%	0.00%	0.00%	10.32%	0.05%	1.88%	0.00%
Lower reservoir	0.00%	0.00%	0.00%	14.81%	3.83%	12.52%	6.95%
Downstream	7.18%	2.21%	4.34%	1.29%	3.35%	3.11%	1.95%
Mekong	0.00%	4.60%	2.79%	0.00%	0.00%	0.00%	2.99%
Fishing Zone	December 2015	December 2016	December 2017	December 2018	December 2019	December 2020	December 2021
Upstream	41.56%	30.35%	15.63%	0.00%	7.36%	12.00%	NA
Upper reservoir	7.86%	4.18%	0.94%	0.49%	1.18%	4.18%	NA
Lower reservoir	0.00%	7.33%	0.00%	13.61%	10.57%	7.34%	4.69%
Downstream	5.94%	4.07%	2.23%	2.05%	5.52%	5.81%	2.77%
Mekong	0.00%	0.00%	12.13%	0.00%	0.00%	0.00%	0.00%
Fishing Zone	January 2016	January 2017	January 2018	January 2019	January 2020	January 2021	January 2022

Upstream	36.16%	39.85%	27.89%	25.03%	2.85%	13.02%	NA
Upper reservoir	4.90%	2.80%	1.49%	0.32%	0.85%	1.89%	NA
Lower reservoir	2.92%	6.83%	0.00%	35.97%	7.33%	7.92%	14.76%
Downstream	8.11%	3.65%	7.34%	8.13%	2.56%	9.37%	3.00%
Mekong	2.27%	0.00%	0.15%	0.00%	0.00%	1.09%	0.58%

3. EXTERNAL MISSIONS AND VISITS

There was a Stage 2 ISO14001:2015 Assessment and Accreditation Audit (remote) by SGS (Lao) Sole Co., Ltd. (a Thai auditor) for four days (21 – 24 February 2022). The audit findings and observations are presented in section 1.1 in this report.

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 CHIANE 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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NING01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
20-Jan-22	pH	5.0 - 9.0				6.88	7.13	6.97	6.79	6.89								
21-Jan-22	pH	5.0 - 9.0									6.84							
24-Jan-22	pH	5.0 - 9.0		6.82	7.24	7									7.03			
25-Jan-22	pH	5.0 - 9.0					7.05	7	6.62	6.68								
26-Jan-22	pH	5.0 - 9.0									6.9	7.07	6.74	6.62			6.98	6.82
1-Feb-22	pH	5.0 - 9.0		7.18	7.35	7.19										7.4		
2-Feb-22	pH	5.0 - 9.0					7.26	6.97	6.85	6.78								
3-Feb-22	pH	5.0 - 9.0									6.95	6.95	7.22	7.24			6.94	6.96
7-Feb-22	pH	5.0 - 9.0	7.25												7.85			
8-Feb-22	pH	5.0 - 9.0		7.06	7.06	7.41										7.12		
9-Feb-22	pH	5.0 - 9.0					7.59	6.99	6.8	6.9								
10-Feb-22	pH	5.0 - 9.0									7.22	7.04	7.01	7.14			7.11	6.88
14-Feb-22	pH	5.0 - 9.0		7.13	7.82	7.43										7.82		
15-Feb-22	pH	5.0 - 9.0					7.26	7.08	7.83	7.66								
16-Feb-22	pH	5.0 - 9.0									7.01	7.11	7.47	7.28			7.38	7.03
21-Feb-22	pH	5.0 - 9.0	7.89												8.06			
23-Feb-22	pH	5.0 - 9.0		8.32	8.27	8.21										8.09		

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
24-Feb-22	pH	5.0 - 9.0					7.4	7.1	6.88	6.92								
25-Feb-22	pH	5.0 - 9.0									7.62	7.48	7.61	7.49			7.58	7.47
20-Jan-22	Sat. DO (%)					90.3	88.7	82.2	59.3	66.8								
21-Jan-22	Sat. DO (%)										64.1							
24-Jan-22	Sat. DO (%)			92.9	79.2	78.4										97.7		
25-Jan-22	Sat. DO (%)						75.6	78.4	66.2	80.4								
26-Jan-22	Sat. DO (%)										90.3	81.1	86.2	85.5			81.3	72.6
1-Feb-22	Sat. DO (%)			92.3	86.4	102.3										101.3		
2-Feb-22	Sat. DO (%)						81.4	77.8	62.9	73.7								
3-Feb-22	Sat. DO (%)										97.8	89.2	91.4	97.9			78.9	79.8
7-Feb-22	Sat. DO (%)		135												130.4			
8-Feb-22	Sat. DO (%)			118.6	89.4	105.5										121.5		
9-Feb-22	Sat. DO (%)						91	92.4	59.5	63.8								
10-Feb-22	Sat. DO (%)										83.1	65.7	80.9	86.1			92.6	72.7
14-Feb-22	Sat. DO (%)			91.7	94.7	101.2										95.9		
15-Feb-22	Sat. DO (%)						92.9	90.7	64.6	67.1								
16-Feb-22	Sat. DO (%)										90.2	84.2	84.5	85.9			76	77.1
21-Feb-22	Sat. DO (%)		96.8												101.1			
23-Feb-22	Sat. DO (%)			101.5	81.3	79.4										103.9		
24-Feb-22	Sat. DO (%)						82.6	75.6	68.7	79.6								
25-Feb-22	Sat. DO (%)										113.5	101.1	104.5	105.2			97.2	107.2
20-Jan-22	DO (mg/L)	>6.0				7.52	7.39	6.87	4.82	5.38								

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
21-Jan-22	DO (mg/L)	>6.0						6.87	4.82	5.38	5.45							
24-Jan-22	DO (mg/L)	>6.0		7.9	6.55	6.57									9.1			
25-Jan-22	DO (mg/L)	>6.0					6.36	6.59	5.54	6.36								
26-Jan-22	DO (mg/L)	>6.0						6.59	5.54	6.36	7.68	7.06	7.31	7.18		7.07	6.41	
1-Feb-22	DO (mg/L)	>6.0		8.02	7.19	8.49									9.21			
2-Feb-22	DO (mg/L)	>6.0					6.84	6.57	5.37	6.18								
3-Feb-22	DO (mg/L)	>6.0							5.37	6.18	8.32	7.7	7.85	8.37		6.84	7.08	
7-Feb-22	DO (mg/L)	>6.0	11.93												11.83			
8-Feb-22	DO (mg/L)	>6.0		10.23	7.44	8.87										10.86		
9-Feb-22	DO (mg/L)	>6.0					7.64	7.65	5.03	5.34								
10-Feb-22	DO (mg/L)	>6.0							5.03	5.34	7.0	5.52	6.83	7.18		7.73	6.43	
14-Feb-22	DO (mg/L)	>6.0		7.81	7.84	8.36									8.48			
15-Feb-22	DO (mg/L)	>6.0					7.68	7.48	5.3	5.37								
16-Feb-22	DO (mg/L)	>6.0							5.3	5.37	7.57	7.12	7.07	7.21		6.32	6.78	
21-Feb-22	DO (mg/L)	>6.0	9.39												9.95			
23-Feb-22	DO (mg/L)	>6.0		9.05	6.72	6.74										9.64		
24-Feb-22	DO (mg/L)	>6.0					7.01	6.46	5.8	6.48								
25-Feb-22	DO (mg/L)	>6.0							5.8	6.48	9.7	8.76	9.01	9.06		8.61	9.86	
20-Jan-22	Conductivity (µs/cm)					74	72	73	78	80								
21-Jan-22	Conductivity (µs/cm)										79							
24-Jan-22	Conductivity (µs/cm)			84	80	74									75			
25-Jan-22	Conductivity (µs/cm)						73	73	82	77								

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
26-Jan-22	Conductivity (µs/cm)									75	78	77	80			162	59	
1-Feb-22	Conductivity (µs/cm)			88	78	74									76			
2-Feb-22	Conductivity (µs/cm)						73	73	81	78								
3-Feb-22	Conductivity (µs/cm)										77	80	81	84			126	76
7-Feb-22	Conductivity (µs/cm)		116												36			
8-Feb-22	Conductivity (µs/cm)			69	80	73										76		
9-Feb-22	Conductivity (µs/cm)						73	73	79	77								
10-Feb-22	Conductivity (µs/cm)										76	84	78	78			163	95
14-Feb-22	Conductivity (µs/cm)			89	80	74										78		
15-Feb-22	Conductivity (µs/cm)						73	73	79	78								
16-Feb-22	Conductivity (µs/cm)										78	79	79	80			163	58
21-Feb-22	Conductivity (µs/cm)		82												33			
23-Feb-22	Conductivity (µs/cm)			76	82	73										96		
24-Feb-22	Conductivity (µs/cm)						72	73	80	77								
25-Feb-22	Conductivity (µs/cm)										79	83	78	79			128	41
20-Jan-22	Temperature (°C)					24.6	24.5 2	24.28	26.08	26.53								
21-Jan-22	Temperature (°C)										23.47							
24-Jan-22	Temperature (°C)			23.41	24.89	24.24										18.61		
25-Jan-22	Temperature (°C)						23.9 7	23.91	24.47	24.6								
26-Jan-22	Temperature (°C)										23.26	23.02	23.53	24.18			22.33	21.77
1-Feb-22	Temperature (°C)			22.39	24.6	24.69										19.96		

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
2-Feb-22	Temperature (°C)					24.08	23.84	23.25	24.21									
3-Feb-22	Temperature (°C)									23.24	22.7	22.95	23.15			22.75	21.29	
7-Feb-22	Temperature (°C)		21.35											19.97				
8-Feb-22	Temperature (°C)			22.65	24.65	24.35									20.97			
9-Feb-22	Temperature (°C)					24.06	24.86	23.76	24.43									
10-Feb-22	Temperature (°C)									23.9	23.74	23.76	24.52			24.37	21.34	
14-Feb-22	Temperature (°C)			23.2	24.99	25.06									21.46			
15-Feb-22	Temperature (°C)					24.83	25.04	25.56	26.71									
16-Feb-22	Temperature (°C)									24.05	23.77	24.41	24.26			24.74	22.75	
21-Feb-22	Temperature (°C)		16.82											16.11				
23-Feb-22	Temperature (°C)			21.06	24.84	23.74									18.68			
24-Feb-22	Temperature (°C)					23.63	23.32	23.78	25.9									
25-Feb-22	Temperature (°C)									23.05	22.37	22.83	23.41			21.44	19.43	
1-Feb-22	Turbidity (NTU)			42.4	3.3	1.22									15			
2-Feb-22	Turbidity (NTU)					1.8	1.23	4.21	10.4									
3-Feb-22	Turbidity (NTU)									2.77	2.51	3.69	8.35			2.89	2.38	
7-Feb-22	Turbidity (NTU)		4.93											2.97				
8-Feb-22	Turbidity (NTU)			34.9	2.67	0.97									10.3			
9-Feb-22	Turbidity (NTU)					1.12	0.53	1.18	1.67									
10-Feb-22	Turbidity (NTU)									1.52	1.85	2.2	3.92			3.28	2.25	

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
14-Feb-22	Turbidity (NTU)			47.8	3.76	1.07									14.2			
15-Feb-22	Turbidity (NTU)						0.64	0.43	2.14	2.15								
16-Feb-22	Turbidity (NTU)										1.72	1.73	2	4.34			3.43	2.68
21-Feb-22	Turbidity (NTU)		149												22.5			
23-Feb-22	Turbidity (NTU)			71.1	4.93	1.33									7.33			
24-Feb-22	Turbidity (NTU)						0.86	0.95	2.61	2.13								
25-Feb-22	Turbidity (NTU)										2.62	2.78	3.75	6.14			8.06	4.36
24-Jan-22	TSS (mg/L)			159.3 3		<5										14.56		
25-Jan-22	TSS (mg/L)						<5	<5	<5	5.2								
26-Jan-22	TSS (mg/L)										<5	<5	<5	<5			<5	<5
7-Feb-22	TSS (mg/L)		<5												<5			
8-Feb-22	TSS (mg/L)			66.82		<5										14.22		
9-Feb-22	TSS (mg/L)						<5	<5										
10-Feb-22	TSS (mg/L)								<5	<5	<5	<5	5.45	<5			<5	<5
24-Jan-22	BOD ₅ (mg/L)	<1.5		<1		<1										<1		
25-Jan-22	BOD ₅ (mg/L)	<1.5					<1	<1	<	<1								
26-Jan-22	BOD ₅ (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
7-Feb-22	BOD ₅ (mg/L)	<1.5	<1												<1			
8-Feb-22	BOD ₅ (mg/L)	<1.5		<1		<1												
9-Feb-22	BOD ₅ (mg/L)	<1.5					<1	<1	<1	<1						<1		
10-Feb-22	BOD ₅ (mg/L)	<1.5									<1	<1	<1	<1			<1	1.2
24-Jan-22	COD (mg/L)	<5.0														<5		

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir												Tributaries Upstream		Tributaries Downstream	
		Station Code	NING01	R01	R02	R03	R04	R05	R06	R07	NING05	NING06	NING07	NING08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
25-Jan-22	COD (mg/L)	<5.0							<5	<5								
26-Jan-22	COD (mg/L)	<5.0									<5	<5	<5	<5			<5	<5
7-Feb-22	COD (mg/L)	<5.0	<5												<5			
8-Feb-22	COD (mg/L)	<5.0														<5		
9-Feb-22	COD (mg/L)	<5.0							6.4	<5								
10-Feb-22	COD (mg/L)	<5.0									<5	<5	<5	<5			<5	<5
24-Jan-22	NH ₃ -N (mg/L)	<0.2		<0.2		0.2										<0.2		
25-Jan-22	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
7-Feb-22	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
8-Feb-22	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2										<0.2		
9-Feb-22	NH ₃ -N (mg/L)	<0.2					<0.2	<0.2										
24-Jan-22	NO ₃ -N (mg/L)	<5.0		0.14		0.08										0.09		
25-Jan-22	NO ₃ -N (mg/L)	<5.0					0.05	0.02										
7-Feb-22	NO ₃ -N (mg/L)	<5.0	0.13												0.1			
8-Feb-22	NO ₃ -N (mg/L)	<5.0		0.17		0.11										0.1		
9-Feb-22	NO ₃ -N (mg/L)	<5.0					0.09	0.09										
24-Jan-22	Faecal coliform (MPN/100 mL)	<1,000														130		
25-Jan-22	Faecal coliform (MPN/100 mL)	<1,000							14	49								
26-Jan-22	Faecal coliform (MPN/100 mL)	<1,000									5	2	8	17			33	27
7-Feb-22	Faecal coliform (MPN/100 mL)	<1,000	540												79			

		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											Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01
Date	Parameters (Unit)	Guideline															
8-Feb-22	Faecal coliform (MPN/100 mL)	<1,000													17		
9-Feb-22	Faecal coliform (MPN/100 mL)	<1,000						8	11								
10-Feb-22	Faecal coliform (MPN/100 mL)	<1,000								49	240	79	350			350	240
24-Jan-22	Total Coliform (MPN/100 mL)	<5,000													920		
25-Jan-22	Total Coliform (MPN/100 mL)	<5,000						49	70								
26-Jan-22	Total Coliform (MPN/100 mL)	<5,000								49	79	49	350			240	920
7-Feb-22	Total Coliform (MPN/100 mL)	<5,000	1,600											540			
8-Feb-22	Total Coliform (MPN/100 mL)	<5,000													140		
9-Feb-22	Total Coliform (MPN/100 mL)	<5,000						13	33								
10-Feb-22	Total Coliform (MPN/100 mL)	<5,000								70	240	170	920			1,600	540
24-Jan-22	TKN			<1.5		<1.5									<1.5		
25-Jan-22	TKN						<1.5	<1.5									
7-Feb-22	TKN		<1.5											<1.5			
8-Feb-22	TKN			<1.5		<1.5									<1.5		
9-Feb-22	TKN						<1.5	<1.5									
20-Jan-22	Secchi Disk (m)					3.4	4	4.2									
24-Jan-22	Secchi Disk (m)				2.5	4											
25-Jan-22	Secchi Disk (m)						3.8	4									

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
1-Feb-22	Secchi Disk (m)				2.8	3.2												
2-Feb-22	Secchi Disk (m)							3.5										
8-Feb-22	Secchi Disk (m)				2.1	4.5												
9-Feb-22	Secchi Disk (m)						4	4.2	3.5	2.25								
24-Jan-22	TOC (mg/L)														2.78			
25-Jan-22	TOC (mg/L)								2.02	2.41								
26-Jan-22	TOC (mg/L)										1.84	1.98	1.87	1.72			2.23 2.39	
7-Feb-22	TOC (mg/L)		1.86											1.26				
8-Feb-22	TOC (mg/L)														1.87			
9-Feb-22	TOC (mg/L)								1.45	1.28								
10-Feb-22	TOC (mg/L)										1.12	1.28	1.13	1.18			1.93 1.86	
24-Jan-22	Phytoplankton Biomass (g dry wt/m³)			167		3.6												
25-Jan-22	Phytoplankton Biomass (g dry wt/m³)						1.6	1.2										
8-Feb-22	Phytoplankton Biomass (g dry wt/m³)			60.2		1.6												
9-Feb-22	Phytoplankton Biomass (g dry wt/m³)						0.6	0.6										
24-Jan-22	Total Phosphorus (mg/L)			0.19		0.01									0.03			
25-Jan-22	Total Phosphorus (mg/L)						<0.01	0.03										
7-Feb-22	Total Phosphorus (mg/L)		0.02											0.01				
8-Feb-22	Total Phosphorus (mg/L)			0.09		0.01									0.04			
9-Feb-22	Total Phosphorus (mg/L)						0.01	0.01										

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
24-Jan-22	Total Dissolved Phosphorus (mg/L)			0.11		<0.01									0.01			
25-Jan-22	Total Dissolved Phosphorus (mg/L)						<0.01	0.01										
7-Feb-22	Total Dissolved Phosphorus (mg/L)		<0.01											<0.01				
8-Feb-22	Total Dissolved Phosphorus (mg/L)			0.05		<0.01									0.02			
9-Feb-22	Total Dissolved Phosphorus (mg/L)						<0.02	<0.01										
24-Jan-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
25-Jan-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
8-Feb-22	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
9-Feb-22	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
8-Feb-22	Turbidity (NTU)-bottom					4.63												
9-Feb-22	Turbidity (NTU)-bottom						7.34	0.79										
24-Jan-22	TSS (mg/L)-bottom					<5												
25-Jan-22	TSS (mg/L)-bottom							<5										
8-Feb-22	TSS (mg/L)-bottom					<5												
9-Feb-22	TSS (mg/L)-bottom						<5	<5										
24-Jan-22	BOD ₅ (mg/L)-bottom					<1												
25-Jan-22	BOD ₅ (mg/L)-bottom						<1	6.54										
8-Feb-22	BOD ₅ (mg/L)-bottom					<1												
9-Feb-22	BOD ₅ (mg/L)-bottom						<1	7.22										
24-Jan-22	NH ₃ -N (mg/L)-bottom					<0.2												

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
25-Jan-22	NH ₃ -N (mg/L)-bottom					<0.2	0.2											
8-Feb-22	NH ₃ -N (mg/L)-bottom				<0.2													
9-Feb-22	NH ₃ -N (mg/L)-bottom					<0.2	0.3											
24-Jan-22	NO ₃ -N (mg/L)-bottom				0.12													
25-Jan-22	NO ₃ -N (mg/L)-bottom					<0.02	<0.02											
8-Feb-22	NO ₃ -N (mg/L)-bottom				0.12													
9-Feb-22	NO ₃ -N (mg/L)-bottom					0.14	0.11											
24-Jan-22	TKN-bottom				<1.5													
25-Jan-22	TKN-bottom					<1.5	<1.5											
8-Feb-22	TKN-bottom				<1.5													
9-Feb-22	TKN-bottom					<1.5	<1.5											
24-Jan-22	Total Dissolved Phosphorus (mg/L)-bottom				<0.01													
25-Jan-22	Total Dissolved Phosphorus (mg/L)-bottom					<0.01	0.03											
8-Feb-22	Total Dissolved Phosphorus (mg/L)-bottom				0.01													
9-Feb-22	Total Dissolved Phosphorus (mg/L)-bottom					0.01	0.03											
24-Jan-22	Total Phosphorus (mg/L)-bottom				<0.01													
25-Jan-22	Total Phosphorus (mg/L)-bottom					<0.01	0.04											
8-Feb-22	Total Phosphorus (mg/L)-bottom				0.02													

		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												Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Feb-22	Total Phosphorus (mg/L)-bottom					0.01	0.05											
24-Jan-22	Hydrogen Sulfide (mg/L)-bottom				<0.02													
25-Jan-22	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02											
8-Feb-22	Hydrogen Sulfide (mg/L)-bottom				<0.02													
9-Feb-22	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02											
24-Jan-22	Phytoplankton Biomass (g dry wt/m³)-bottom				2.6													
25-Jan-22	Phytoplankton Biomass (g dry wt/m³)-bottom					4.6	2.4											
8-Feb-22	Phytoplankton Biomass (g dry wt/m³)-bottom				2.6													
9-Feb-22	Phytoplankton Biomass (g dry wt/m³)-bottom					2.8	3.2											

TABLE A-2: RESULTS OF CAMP EFFLUENTS IN JANUARY AND FEBRUARY 2022

	Site Name	OSOVI (Owner's Site Office and Village)				
	Station Code	EF01				
	Date	27-Jan-22	04-Feb-22	11-Feb-22	18-Feb-22	22-Feb-22
Parameters (Unit)	Guideline					
pH	6.0 - 9.0	6.75	6.82	6.59	7.32	7.17
Sat. DO (%)		44.7	49.2	39.9	53	47.2
DO (mg/L)		3.77	4.07	3.24	4.28	4.05
Conductivity (µs/cm)		429	488	410	412	276
Temperature (°C)		23.81	24.88	25.86	25.8	22.68
Turbidity (NTU)			0.61	0.57	1.53	2.16
TSS (mg/L)	<50	<5	<5	<5	<5	<5
BOD ₅ (mg/L)	<30	<6	6.03	<6	7.38	<6
COD (mg/L)	<125	<25	<25	<25	<25	<25
NH ₃ -N (mg/L)	<10.0	6.2	7.1	6.6	4.7	2.9
Total Nitrogen (mg/L)	<10.0	7.11	8.18	8.73	5.41	3.76
Total Phosphorus (mg/L)	<2	1.53	1.55	1.63	1.64	1.01
Oil & Grease (mg/L)	<10.0	<1	<1			
Total coliform (MPN/100 mL)	<400	1,600	1,600	5,400	3,500	1,600
Faecal Coliform (MPN/100 mL)	<400	1,600	1,600	3,500	3,500	1,600
Residual Chlorine (mg/L)	<1.0					

		Site Name	OSOVS2 (ESD Camp)				
		Station Code	EF13				
		Date	27-Jan-22	04-Feb-22	11-Feb-22	17-Feb-22	22-Feb-22
Parameters (Unit)	Guideline						
pH	6.0 - 9.0		7.73	7.93	7.41	7.47	7.59
Sat. DO (%)			70.4	86.2	73.6	78.1	96.3
DO (mg/L)			6.06	7.15	6.02	6.36	8.26
Conductivity (µs/cm)			610	663	618	573	430
Temperature (°C)			22.86	24.64	25.45	25.65	23.02
Turbidity (NTU)				12.1	15.2	10.9	7.45
TSS (mg/L)	<50		10.08	11	15.09	14.26	5.71
BOD ₅ (mg/L)	<30		6.18	6.96	8.79	10.83	<6
COD (mg/L)	<125		40	44	41	60	<25
NH ₃ -N (mg/L)	<10.0		30.1	34.0	27.5	27.6	17.1
Total Nitrogen (mg/L)	<10.0		40.6	35.9	29.6	28.4	19.3
Total Phosphorus (mg/L)	<2		1.95	2.52	2.14	2.86	1.49
Oil & Grease (mg/L)	<10.0		1	1			
Total coliform (MPN/100 mL)	<400		1,600	1,600	23	1,600	240
Faecal Coliform (MPN/100 mL)	<400		1,600	540	0	170	0
Residual Chlorine (mg/L)	<1.0		0.08	0.21	0.13	0.18	0.18

		Site Name	Main Powerhouse				
		Station Code	EF19				
		Date	27-Jan-22	04-Feb-22	11-Feb-22	18-Feb-22	22-Feb-22
Parameters (Unit)	Guideline						
pH	6.0 - 9.0		6.97	7.81	7.2	7.22	7.59
Sat. DO (%)			86.1	73.4	78.8	89.9	87.2
DO (mg/L)			6.89	5.81	6.11	7.01	7.1
Conductivity (µs/cm)			981	980	999	989	907
Temperature (°C)			26.58	27.31	28.33	27.95	25.73
Turbidity (NTU)				8.28	6.59	9.15	17.20
TSS (mg/L)	<50		14	20	<5	13	16
BOD ₅ (mg/L)	<30		8.34	10.65	6.18	7.35	7.05
COD (mg/L)	<125		44	42	46	40	45
NH ₃ -N (mg/L)	<10.0		8.1	11.5	7.8	9.5	4.9
Total Nitrogen (mg/L)	<10.0		9.2	12.0	8.5	10.9	5.2
Total Phosphorus (mg/L)	<2		6.8	8.1	3.3	8.4	3.2
Oil & Grease (mg/L)	<10.0		<1	2			
Total coliform (MPN/100 mL)	<400		2	3,500	2	16,000	1,600
Faecal Coliform (MPN/100 mL)	<400		0	3,500	2	16,000	1,600
Residual Chlorine (mg/L)	<1.0		0.27	0.08	0.32	0.28	0.16