



NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

October 2020

A	18 November 2020	Hendra WINASTU Khamphone SAYSOMPHOU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BBS	Biodiversity Baseline Survey
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
CTA	Common Terms Agreement
DEB	Department of Energy Business, MEM
DEPP	Department of Energy Policy and Planning, MEM
DEQP	Department of Environment and Quality Promotion, MONRE
DESIA	Department of Environmental and Social Impact Assessment, MONRE
DFRM	Department of Forest Resources Management, MONRE
DLA	Department of Land Administration, MONRE
DSRP	Dam Safety Review Panel
EC	Electrolytic Conductivity
EC OCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGAT i	EGAT International Company Limited
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ERIC	Environmental Research Institute Chulalongkhorn University

ERM	Environmental Resource Management
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
FY	Fiscal Year
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HH	Household
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
M	million
m	metre
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
NTFP	Non-Timber Forest Products
NT2	Nam Theun 2 Hydropower Project

OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PAFO	Provincial Department of Agriculture and Forestry
PAP	Project Affected People
PD	Property Damage
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UXO	Unexploded Ordinance
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

EXECUTIVE SUMMARY

On 30 October 2020, Environmental Management Office (EMO) of NNP1PC completed the technical evaluation of the bids for the EMS Training and ISO14001 Certification Audit. After contract signing, the selected service provider will provide online training of relevant staff during Q4 2020 and Q1 2021. The NNP1PC's Environmental Policy and establishment of an ISO Committee are expected to be officially announced to all NNP1PC staff by the top management in early November 2020.

During the month, the EMO received one Detailed Work Program (DWP) and Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) for review and approval.

A total of 32 revegetation sites were monitored in October 2020, the percentage of vegetation cover has decreased compared with the previous month due to less rain.

EMO continued monitoring the effectiveness of the Wastewater Treatment Systems (WWTSs) in OSOV1, OSOV2, Main Dam and Re-Regulation Dam and discussed the results with the Consultant via VDO conference. A proposal for improving the Wastewater Treatment Systems (WWTSs) is being finalized and will be presented to the NNP1PC management for their consideration by the first week of November 2020. The proposal includes keeping the WWTSs in OSOV1 and the Re-regulation Dam as they are but improving the maintenance processes, installing a Sequencing Batching Reactor System for OSOV2, and adjusting the wastewater pumping and switching to automatic chlorination for the WWTS at the main dam.

During the month, Dissolved Oxygen (DO) levels at the surface of the main reservoir were generally between 5 and 10 mg/L. In the re-regulation reservoir, the DO levels were below 4 mg/L.

During October 2020, the discharge from the re-regulation dam mainly went through the turbine. The DO levels were less than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam and thus were non-compliant with the GoL Standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is in the process of collecting information to assist in developing measures to improve the DO levels downstream.

A total of 20 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 1.3 m³ compared with September 2020. A total of 12.6 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill. A total 273 kg out of 852.5 kg of poor condition cardboard stored in the community waste bank was segregated and disposed of at Houay Soup Landfill and a total of 28 kg of plastic bootless from the landfills was added to the waste bank making a new total amount of 2,947 kg recycle waste in the bank, a reduction of 245 kg comparing to the previous month. There was no trading of recyclable waste in the community waste bank in October 2020.

On 24 September 2020, NNP1PC transferred the funds for the watershed management activities of Bolikhamxay Provincial WRPO planned to be implemented during October to December 2020. The schedule of their activities was adjusted because of their internal meetings and postponement of the Water Safety Training. DOF-MAF submitted the fund disbursement request to NNP1PC for the implementation activity of Xayomsboun Provincial WRPO during October to December 2020. Their schedule will be further adjusted because the funds are expected to be transferred in the middle of November 2020 at the soonest.

Biodiversity offset related activities under the components of law enforcement and conservation linked livelihood continued in October 2020.

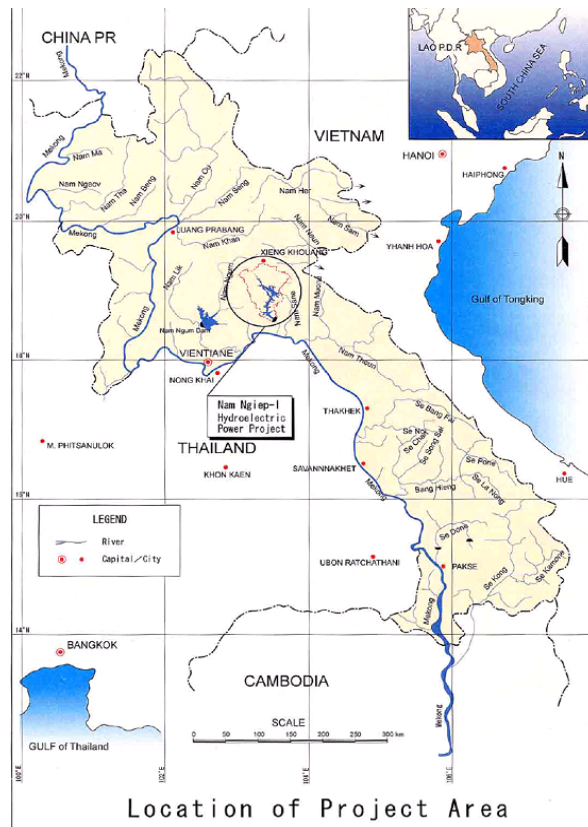
The fish catch monitoring for September 2020 in Nam Ngiep watershed was dominated by *Channa striata* and *Tor sinensis* and species groups of *Poropuntius*, *Sikukia gudgeri*, *Amblyrhynchichthys truncatus* and *Mastacembelus* and that are classified as Least Concern (LC) according to the IUCN Red List, except *Sikukia gudgeri* is classified as Data Deficient (DD) and *Tor sinensis* is classified as Vulnerable species (VU).

1. INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoum District into Thathom District of Xaysomboun Province, through Hom District and into Bolikham District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

FIGURE 1-1: LOCATION MAP

The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikham District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the project. From the main power station, a 230-kV line will run for 125 km to the Nabong outside Vientiane Capital. A 115-kV transmission line will be constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.



This Environmental Monthly Monitoring Report (EMMR) provides a summary of environmental monitoring activities and mitigation actions in January 2017. The EMMR was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Government of Lao PDR (GoL) related agencies.

The EMMR and other related reports including related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are publicly disclosed on the Project website in line with the ADB and GoL Public Disclosure Policies. Hard copies of the final reports will also be available upon requests at the Project's main office in Vientiane Capital and field office in Pakxan, Bolikhamxay Province.

2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction works for the Project have been carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-Mechanical Works and the 230 kV Transmission Line Works. Each Contract is in its Defects Notification Period all ending variously in 2020 or 2021 following the issue of Taking-over Certificates in 2018 and 2019.

2.1 OPERATION AND POWER GENERATION

2.1.1 Power Production

2.1.1.1 Main Power Station

Figure 2.1 and **Figure 2.2** shows the generation data at the main power station in October 2020. The generation was higher than the previous month.

FIGURE 2-1: UNIT GENERATED ENERGY (MAIN POWER STATION)

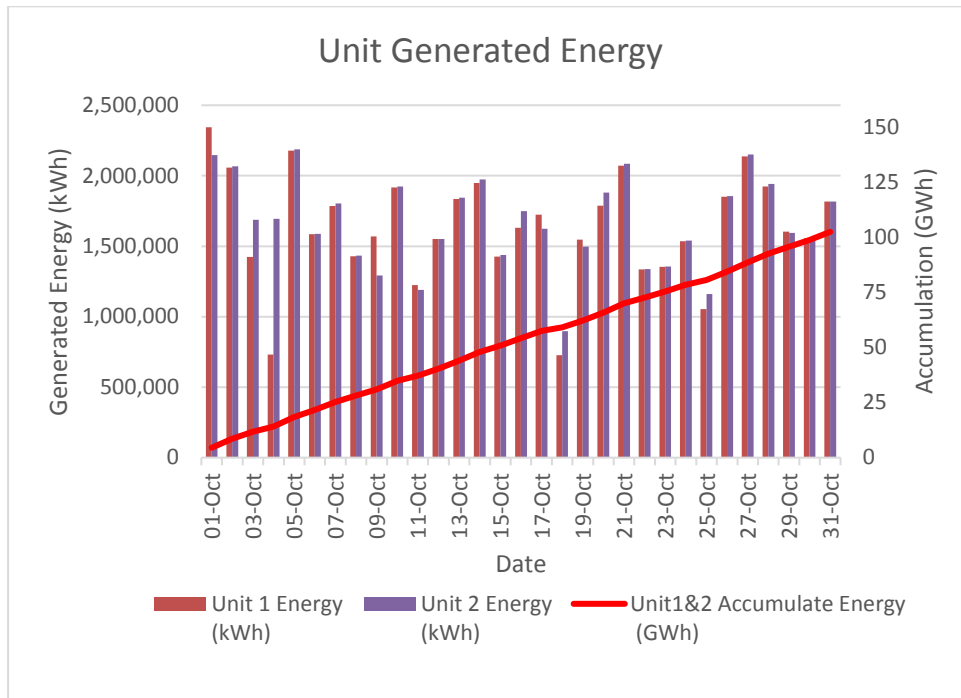


FIGURE 2-2: UNIT OPERATION HOURS (MAIN POWER STATION)

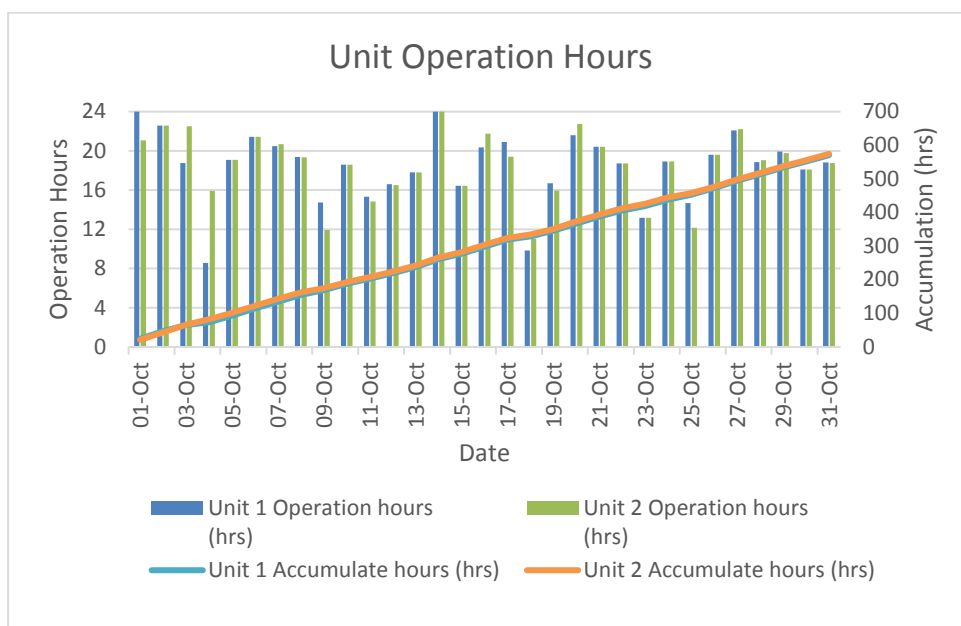


TABLE 2-1: SUMMARY OF THE MAIN DAM OPERATION IN OCTOBER 2020

Dam Data	Unit	Quantity
Main Dam water level at Beginning of the Month	m asl	314.73
Main Dam water level at End of the Month	m asl	315.10
Effective storage at Beginning of the Month	MCM	865.11
Effective storage at End of the Month	MCM	887.29
Inflow	MCM	356.26
Turbine discharge	MCM	327.20
Spillage (excluding riparian release)	MCM	0.0

Table 2-2, 2-3 and 2-4 shows the generation data at the main power station. In September 2020, the Actual Generation (118.73GWh) was higher than the Aggregate Declaration (114.6GWh).

TABLE 2-2 : SUMMARY OF MAIN POWER STATION IN OCTOBER 2020

Power Station Data	Unit	Quantity	
Generated Energy	GWh	102.85	
Delivery Energy at Delivery Point	GWh	100.79	
Station Service Energy	kWh	223,364	
		Unit 1	Unit 2
Period of Operation	Hours	570:30	574:29
Planned Outage	Hours	7:03	0:00
Unplanned Outage	Hours	14:51	15:21
Number of Unit Starts	No.	58	57

TABLE 2-3 : ENERGY AMOUNT IN OCTOBER 2020 (MAIN POWER STATION)

Month	Energy amount for the month (MWh)				Imported Energy (MWh)	Station Service Energy (MWh)
	Primary Energy	Secondary Energy	Excess Energy	Total		
January	104,444.6	0	0	104,444.6	182.5	146.0
February	92,536.8	0	0	93,536.8	174.6	157.3
March	61,790.7	0	0	61,790.7	224.5	172.0
April	44,676.9	0	0	44,676.9	131.9	148.6
May	51,541.1	0	0	51,541.1	212.9	187.4
June	51,227.3	0	0	51,227.3	202.2	180.7
July	109,358.1	100.7	0	109,458.8	94.6	226.6

Month	Energy amount for the month (MWh)				Imported Energy (MWh)	Station Service Energy (MWh)
	Primary Energy	Secondary Energy	Excess Energy	Total		
August	81,332.5	41,485.7	0	122,808.2	110.1	213.6
September	108,465.0	0	0	108,465.0	83.7	216.3
October	113,510.0	806.0	0	114,316.0	82.7	223.4

TABLE 2-4 : DECLARATION (MAIN POWER STATION)

Declaration	Unit	October 2020		November 2020 Aggregate Declaration
		Aggregate Declaration	Final Declaration	
Primary Energy	MWh	116,200	114,048	107,600
Secondary Energy	MWh	7,800	806	2,700
Total	MWh	124,000	114,854	110,300

2.1.1.2 Re-Regulation Power Station

Figures 2-3 and **2-4** shows the generation data at the Re-regulation Power Station in October 2020. The generation and operation time are affected by the operations of the main power station according to EGAT PPA. So, the amount of inflow is determined by the operation resulting at the main power station. Notwithstanding, even if the main power station is stopped, the specified 27 m³/sec water from Re-regulation Power Station must be discharged to downstream.

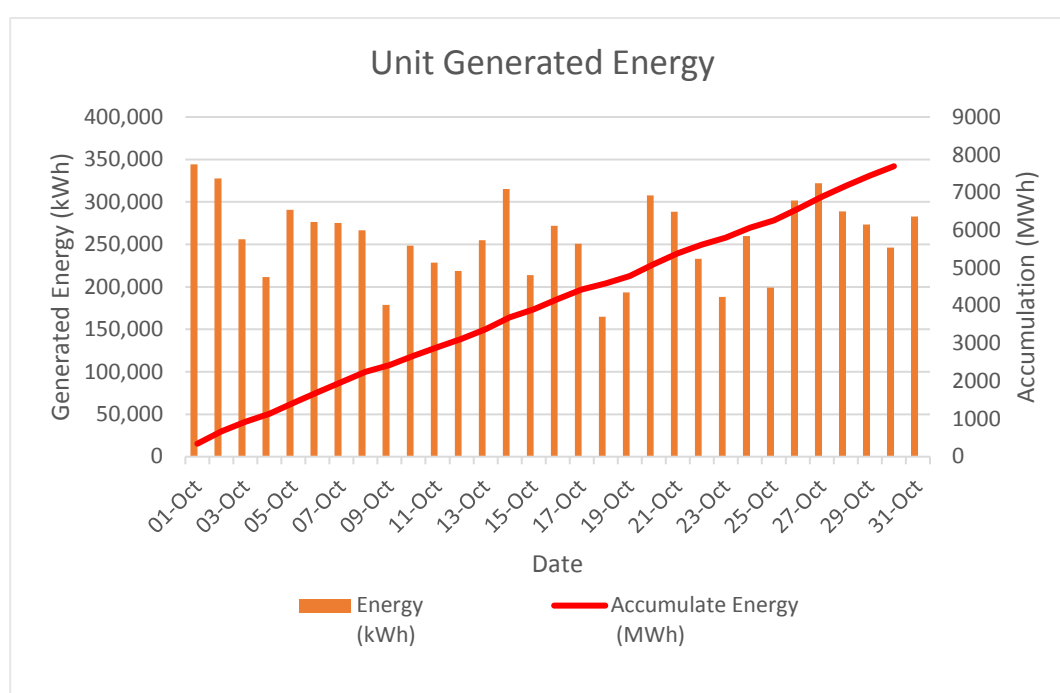
FIGURE 2-3: UNIT GENERATED ENERGY (RE-REGULATION POWER STATION)

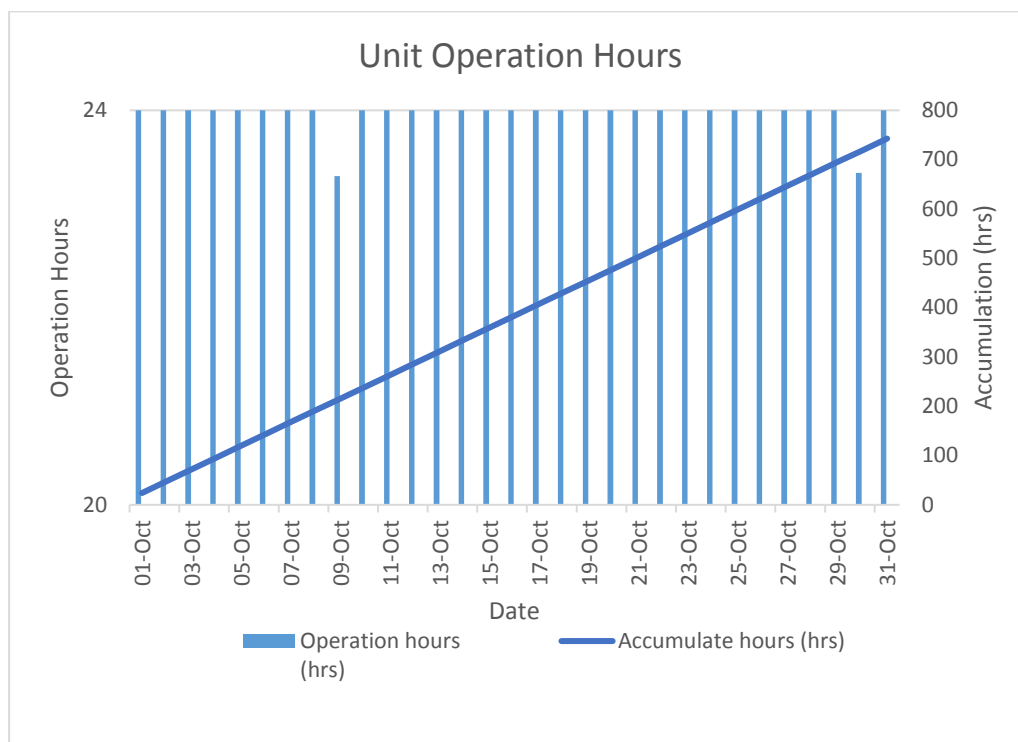
FIGURE 2-4: UNIT OPERATION HOURS (RE-REGULATION POWER STATION)

Table 2-5, 2-6 and 2-7 shows the dam data at the re-regulation dam and generation data at the re-regulation power station.

TABLE 2-5 : SUMMARY OF RE-REGULATION DAM IN OCTOBER 2020

Dam Data	Unit	Quantity
Dam Water Level at Beginning of the Month	m asl	178.55
Dam water Level at End of the Month	m asl	177.98
Inflow	MCM	326.46
Turbine Discharge	MCM	293.99
Spillage	MCM	36.40

TABLE 2-6: SUMMARY OF RE-REGULATION POWER STATION IN OCTOBER 2020

Power Station Data	Unit	Quantity
Generated energy	GWh	8.39
Delivery Energy at billing meter	GWh	7.97
Station service energy	kWh	78,547
Operation Hour	Hours	742:42
Planned outage	Hours	0
Unplanned outage	Hours	0:40
Number of unit start	No.	3

TABLE 2-7: ENERGY AMOUNT IN OCTOBER 2020 (RE-REGULATION POWER STATION)

Month	Energy Amount for the Period (MWh)	Imported Energy (MWh)	Station Service Energy (MWh)
January	4,573	18.8	67.8
February	5,179	11.0	66.2
March	4,764	37.5	64.2
April	4,801	61.1	59.8
May	6,681	10.7	75.7
June	6,497	30.5	70.7
July	9,376	2.9	77.9
August	8,684	1.7	77.5
September	8,543	8.1	75.6
October	7,977	0.5	78.5

2.1.1.3 Reservoir Operation

Figure 2-5 shows the dam water level compared with the rule curve. The dam was filled with water up to Full Supply Level at El. 320 m on 17 August 2019, but had slightly decreased because generating discharge was higher than the inflow.

The water level was recovered by heavy rainfall in August 2020; however, it was lower than what was expected at the end of October 2020.

FIGURE 2-5: DAM RESERVOIR LEVEL

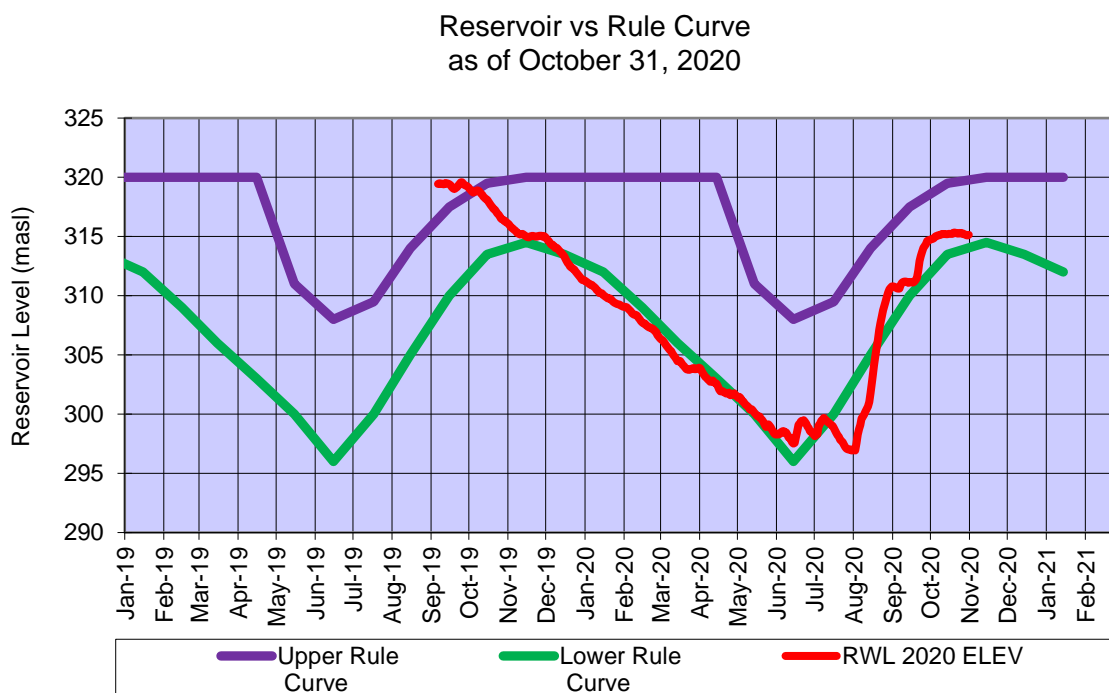
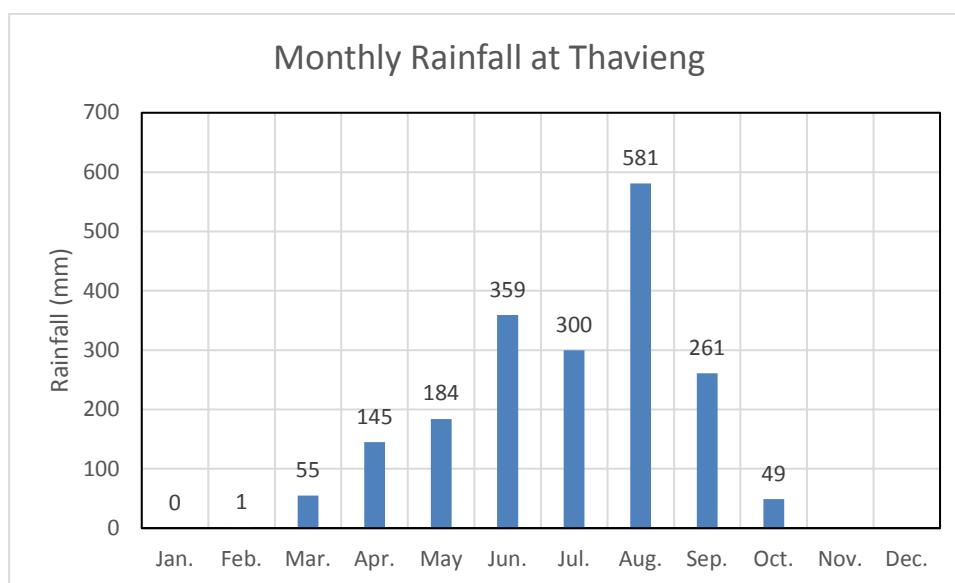


FIGURE 2-6: MONTHLY RAINFALL AT THAVIENG



2.1.2 Outage, Liquidated Damages and Unavailability

TABLE 2-8: UNAVAILABILITY AND SIGNIFICANT EVENT IN OCTOBER 2020 (MAIN POWER STATION)

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
1	4 Oct (08:00)	4 Oct (20:00)	Regular cleaning cooling water system	Short Notice Outage	12:00
	25 Oct (08:00)	25 Oct (15:03)	Monthly inspection	Planned Outage	7:03
	27 Oct (22:06)	27 Oct (22:24)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:18
	28 Oct (17:44)	28 Oct (18:01)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:17
	28 Oct (22:50)	28 Oct (23:06)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:16
	30 Oct (09:00)	30 Oct (11:00)	Maintenance for 22kV DL	Short Notice Outage	2:00
2	18 Oct (08:00)	18 Oct (17:00)	Regular cleaning cooling water system	Short Notice Outage	9:00
	25 Oct (09:50)	25 Oct (13:20)	Trimming under 22kV line	Short Notice Outage	3:30
2	27 Oct (22:06)	27 Oct (22:24)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:18
	28 Oct (17:44)	28 Oct (18:01)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:17
	28 Oct (22:50)	28 Oct (23:06)	Lost station service power due to 22kV DL ground fault	Forced Outage	0:16
	30 Oct (09:00)	30 Oct (11:00)	Maintenance for 22kV DL	Short Notice Outage	2:00

TABLE 2-9: LIQUIDATED DAMAGE IN OCTOBER 2020 (MAIN POWER STATION)

USD Portion	Baht Portion
715.46	75,754.21

*(Estimation)***TABLE 2-10: UNAVAILABILITY AND SIGNIFICANT EVENT IN OCTOBER 2020 (RE-REGULATION POWER STATION)**

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
1	9 Oct (14:00)	9 Oct (14:40)	Cleaning oil cooler and air cooler flow sensor	Forced Outage	0:40
	30 Oct (10:08)	30 Oct (10:11)	The circuit breaker didn't open in the process of stopping	Forced Outage	0:03

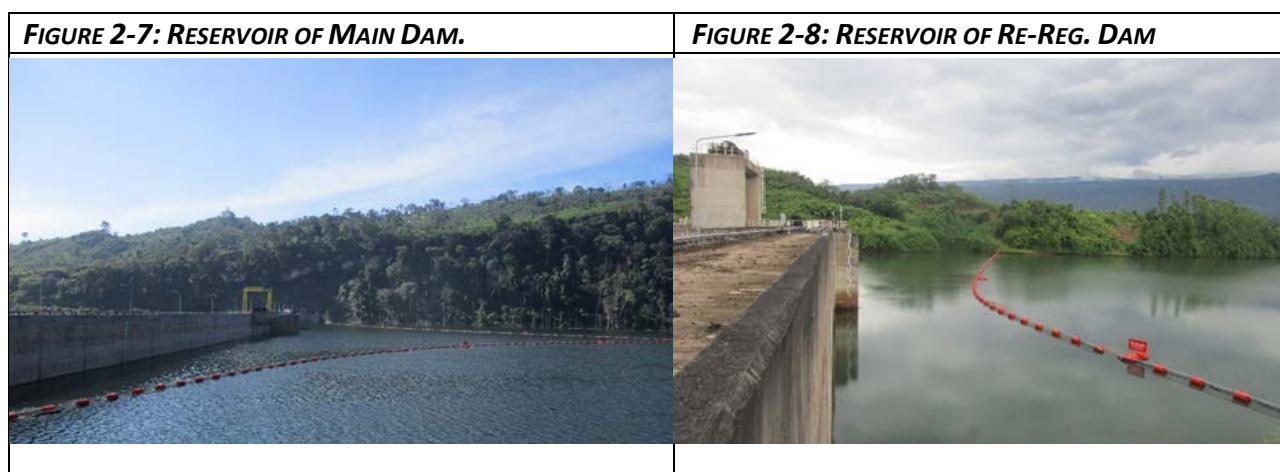
2.2 MAINTENANCE WORK (EGAT OM)

TABLE 2-11: MAINTENANCE ACTIVITY

Date	Activity
4 October 2020	Main Power Station: Flushing by high pressure for cooling pipes of Unit1
18 October 2020	Main Power Station: Flushing by high pressure for cooling pipes of Unit2

2.3 CIVIL AND APPURTENANT STRUCTURE

2.3.1 Reservoir

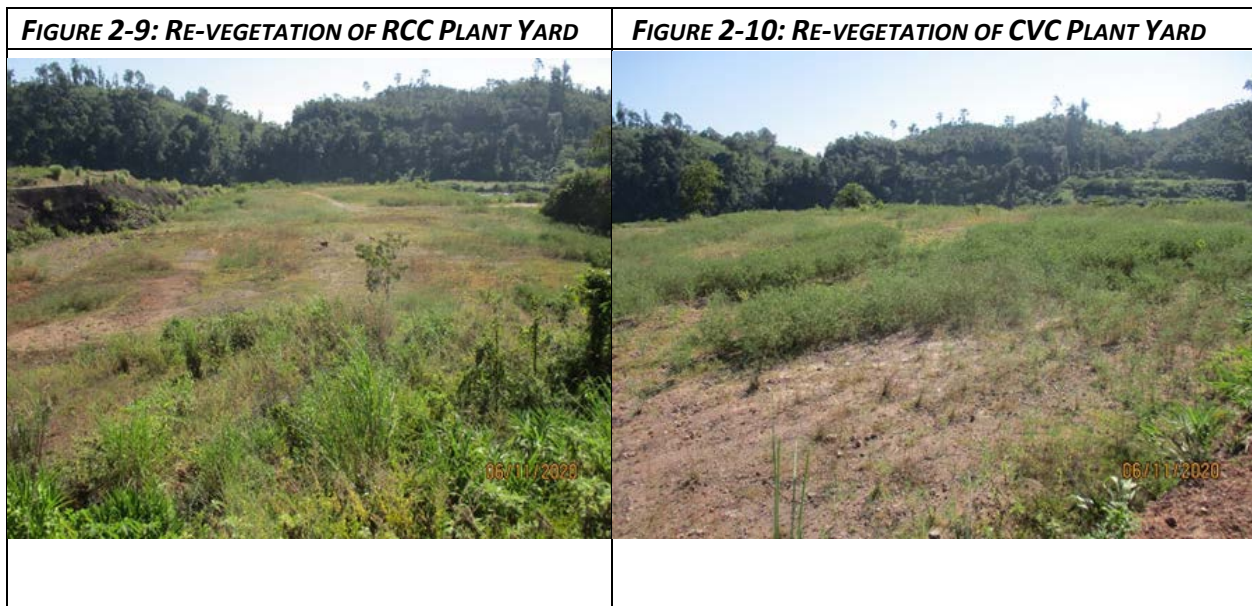


2.3.2 Dam and Power Plant

2.3.2.1 Rehabilitation works

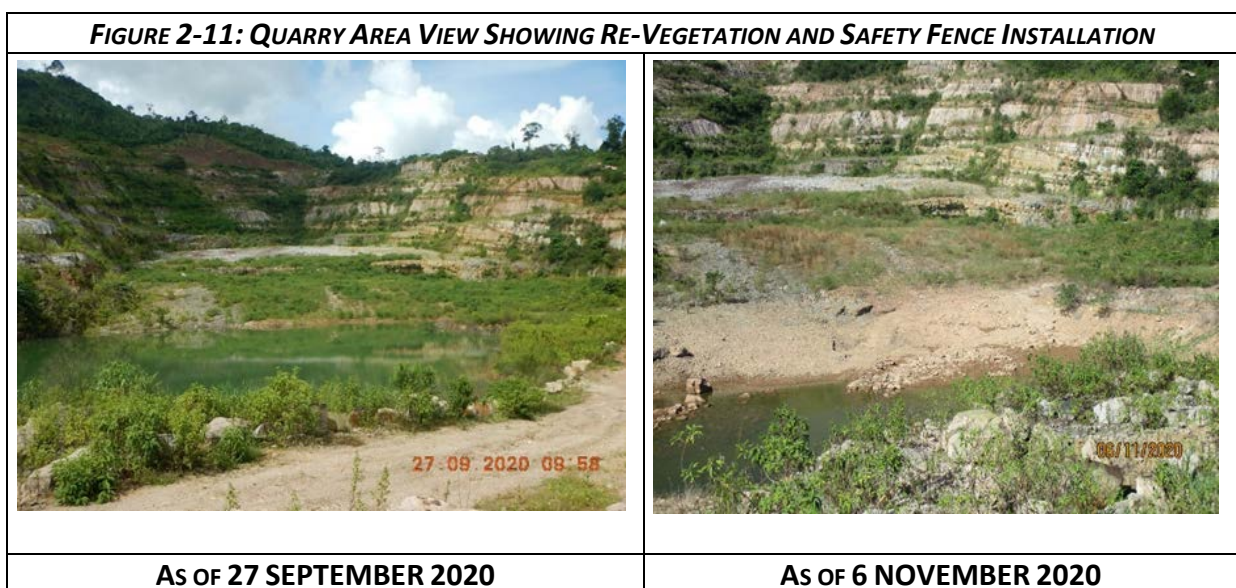
Plant Yards

Demobilization of plant facilities for both RCC and CVC plants was completed in December 2019. The vegetation improvement for rehabilitation of those areas is ongoing.



Quarry

The final blasting was carried out 27 March 2018. GOL have acknowledged that the quarry operation is complete. After several inspections by GOL and ADB for the Lenders, the quarry site has been improved by such as partial levelling, vegetation at the berms of slopes and large rock installation at top of slopes from an environmental and a safety point of view. Fence for safety was installed at top slope at right side. The grading at the quarry bottom and spreading of top soil was completed in January 2020.



2.3.2.2 Disposal Areas and Solid Waste Landfill Sites

The operation of both HSRA and Project landfills is ongoing with collection waste materials from Resettlement “Phouhomxay”, neighbour villages and the Owner Site Office and Village.

FIGURE 2-12: PHASE 2 OF PROJECT LANDFILL DEVELOPMENT ON 08 JUNE 2017

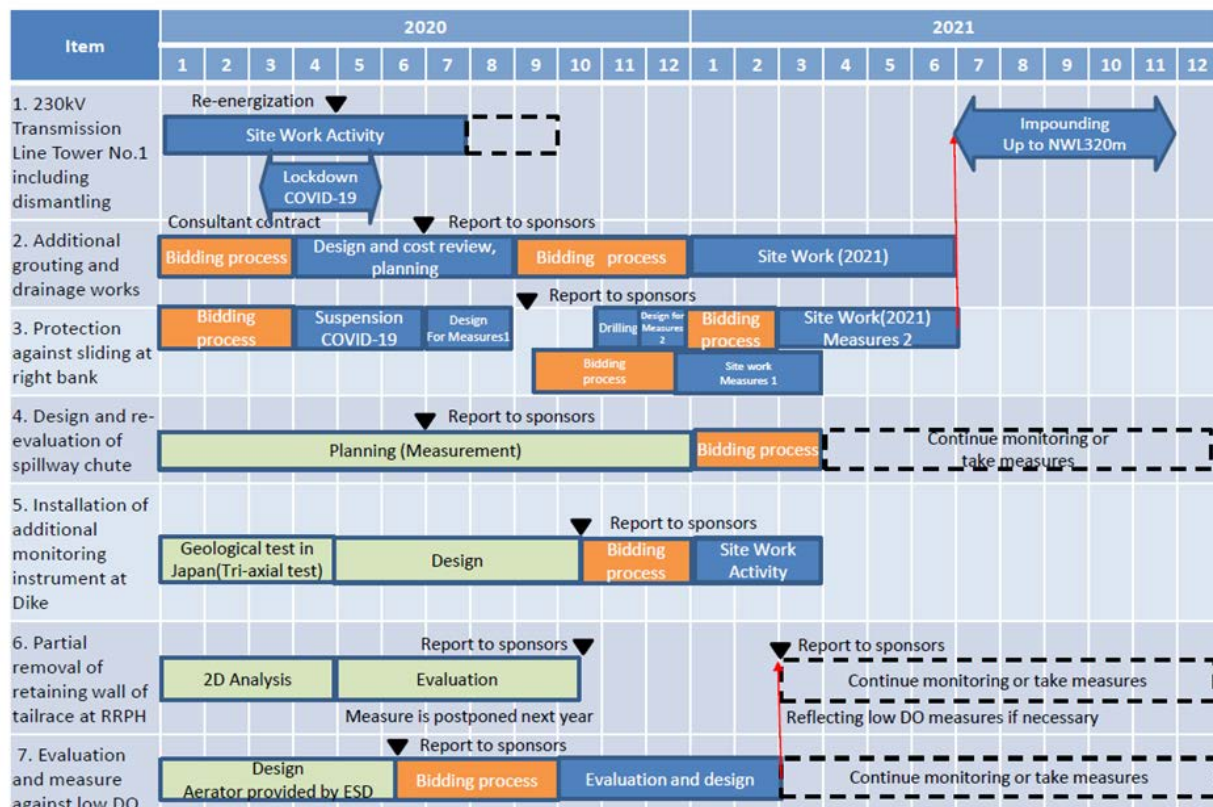
CURRENT CONDITION OF LANDFILL



2.3.2.3 Remaining Work

As shown in **Figure 2-13**, there remain seven items of significant works. Nos. 1, 2, 3, 4 are related to the main powerhouse and Nos. 5 and 6 are related to the re-regulation powerhouse. No. 7 is related to power operation and environmental issues.

FIGURE 2-13: SCHEDULE OF SIGNIFICANT REMAINING WORKS IN 2020



2.4 TRANSMISSION SYSTEM

2.4.1 Tower No.1 of 230 kV TL Replacement and Dismantling

The Tower No.1 was damaged due to the slope failure of approximately 150 m³ volume of material above and behind Tower No.1 that occurred overnight on 17 to 18 of August 2019. Some of the structural steel members of the Tower No.1 were deformed. Tower No.1 did not move significantly but remained an unsafe structure. Movement of the upper part of the steel structure of the tower was observed.

Therefore, a Temporary Tower No.1 was constructed and the transmission line was moved to this tower from the damaged tower over the period of 06 to 24 September 2019. The construction of the permanent Replacement Tower No.1 and disassembly of existing Tower No.1 was contracted in late December 2019. The foundation excavation for the legs of the new Tower No.1 started in the middle of January 2020 was completed on February 2020; the damaged Tower No.1 was almost dismantled in January 2020. The installation of gantry structure and new Tower No.1 was completed in the beginning of April 2020. Energization test was completed on 30 April 2020. The gabion mattress installation for slope protection of gantry structure was completed in September 2020. An additional slope protection work around the existing tower foundation started in October 2020 was completed in the middle of October 2020.

FIGURE 2-14: TOP VIEW OF GANTRY STRUCTURE _SLOPE PROTECTION AROUND FOUNDATION ONGOING



3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

On 30 October 2020, EMO completed the technical evaluation of the bids for the EMS Training and ISO14001 Certification Audit. A Committee Meeting to hear and discuss the evaluation result is expected to be arranged by PCD in early November 2020. After the contract signing, the selected service provider will provide online training on four ISO14001:2015 subjects (Requirement and Interpretation of ISO14001:2015, Organization Context and Risk Management for ISO14001, Documentation Information, and Internal Audit) to relevant staff during Q4 2020 and Q1 2021.

In addition, two memorandums for announcing NNP1PC's Environmental Policy and establishment of an ISO Committee have been prepared and are expected to be officially announced to all NNP1PC staff by the top management in early November 2020.

TABLE 3-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN

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

3.2 COMPLIANCE MANAGEMENT

In October 2020, EMO received one Detailed Work Program (DWP) and Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) for review and approval. The status is presented in **Table 3-2**.

TABLE 3-2: SS-ESMMP AND DOCUMENT REVIEW STATUS IN OCTOBER 2020

Title	Date Received	Status
DWP and SS-ESMMP for Geotechnical Investigation at the Main Dam Downstream Right Bank Slope Area	30 October 2020 (2 nd submission)	Under review

There were no Observations of Non-Compliance issued during October 2020. The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Table 3-3** and the status of the ONCs and NCRs that are unsolved exceeding deadlines are presented in **Table 3-4**.

TABLE 3-3: SUMMARY OF ONCs AND NCRs

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from September 2020	3	2	0	0
Newly Opened in October 2020	0	0	0	0
Total in October 2020	3	2	0	0
Resolved in October 2020	0	0	0	0
Carried over to November 2020	3	2	0	0
Unsolved Exceeding Deadlines	3	2	0	0

TABLE 3-4: SUMMARY OF THE ONCs AND NCRs THAT ARE UNSOLVED EXCEEDING DEADLINES

Document Number / Date of Issue	Subject Description	Current Status at the end of October 2020
ONC_AM-0003 / 28 Feb 2020	Issued to ADM to improve the second wetland pond similarly to the first wetland pond. (Based on the LTA's recommendation made during the mission in August 2019 to improve the OSOV's WWTS)	NNP1PC and the WWTS Consultant have checked and evaluated the treatment effectiveness of the existing WWTS and are preparing a proposal for improvement for management review/consideration by early November 2020.
ONC_OC-0349 / 24 Mar 2020	Issued to instruct the OC Contractor to use only the approved tree species for	The contractor is continuing routine inspection combined with revegetation and maintenance of perimeter fence as necessary.

Document Number / Date of Issue	Subject Description	Current Status at the end of October 2020
	revegetation and dead plant replacement.	<i>The ONC will be closed by the end of the contractor's liability period (Jan 2021).</i>
NNP1-ESD-EMO-NCR-VSP-0001 / 13 Jul 2020 (NCR Level 1)	Non-Compliance with site rehabilitation at the Spoil Disposal Area for the construction of the irrigation canal	The site was partially covered with a thin green of sown RUZI grass seed germination. <i>The NCR1 will be closed when the revegetation has been successfully completed.</i>
NNP1-ESD-EMO-NCR-HM-0007 / 06 Apr 2020 (NCR Level 1)	Non-Compliance with the site revegetation requirements at HM Hydro's Labour Camp No.2 (LILAMA10 Camp).	The corrective action was completed on 08 September 2020 by HM Hydro Contractor. This revegetated site will be monitored by NNP1-EMO until the end of the rainy season 2020. The first joint site inspection and evaluation of the revegetation will be conducted 3 months after the date of re-vegetation completion. <i>The NCR1 will be closed when the revegetation has been successfully completed.</i>
NNP1-ESD-EMO-SIR-OC-1014 / 23 September 2020	Ineffective corrective actions for site revegetation and soil stability.	The Contractor has made some minor progress such as proposed a corrective action plan and site preparation. However, the main corrective actions have progressed slowly and resulted in delaying the completion. <i>EMO will issue an NCR if no action commencement by the 1st week of November 2020.</i>

3.2.1 Site Inspection by Environment Management Unit

The monthly site visit by the Bolikhan District EMU (Bolikhamxay Province) and the quarterly mission of EMU Xaysomboun Province were not carried out in October 2020.

On 27 October 2020, EMO received the Minutes of Meeting (MoM) for the meetings held on 11 and 29 September 2020 between the Bolikhan DONRE and NNP1-EMO Environmental Compliance Monitoring Team, regarding the plan for environmental and social management inspection of NNP1PC's sites during Q4 2020 which includes the following activities:

- To organize a joint site inspection of the construction site decommissioning and rehabilitation within Q4 2020 prior to the handing over of the areas to GoL in Q1 2021;
- DONRE generally agreed on the plan that NNP1PC will continue to provide technical and budget support for the community solid waste management in the host villages (HatGniun and Thaheua) and Phouhomxay resettlement village in 2021. However, in order to increase the involvement of the communities in the waste management activities, DONRE proposed for NNP1PC's consideration to transfer the community waste management supporting funds to the GoL for management and operation after 2021 based on the Environmental Inspection and Monitoring MoM dated 10 June 2020 between the Department of Pollution Control and Monitoring (DPCM-MONRE) and NNP1PC.
- To conduct a joint community consultation meeting between EMU, EMO and the local authorities from Hat Gniun, Thaheua and Phouhomxay villages in Q4 2020 on the role of community involvement in the community waste management.

3.2.2 Site Decommissioning and Rehabilitation



During October 2020, EMO continually monitored the revegetated sites for grass seed germination and vegetation cover as well as site stability. The percentage of vegetation-cover has generally been maintained at 23 out of a total of 32 sites, but the green cover has decreased compared with the previous months due to less rain. The results of the evaluation are shown in **Table 3-5** and **Figure 3-1** below. The first nine sites were decommissioned after natural revegetation during the construction phase in 2018 and 2019. There was no structure set up in a 6-site, therefore decommissioning activities were not needed.

TABLE 3-5: SUMMARY THE GREEN COVER PERCENTAGE IN OCTOBER 2020

No	Site Name	Status of Decommissioning & Re-vegetation	Green cover evaluation Percentage
			Oct-2020
1	TCM & GFE Camp	Completed	90%
2	Spoil Disposal Area 7	Completed	98%
3	Spoil Disposal Area 9	Completed	75%
4	Spoil Disposal Area 10	Completed	95%
5	Borrow Pit P1	No need decommissioning	95%
6	Borrow Pit P1A	No need decommissioning	80%
7	TCM Mobile Crusher	Completed	90%
8	Dike Borrow Areas	No need decommissioning	75%
9	SECC camp	Completed	90%
10	KENBER Camp	Completed	95%
11	LiLaMa10 Camp	Completed	20%
12	Obayashi Camp	Completed	90%
13	Right Tunnelling Camp	Completed	90%
14	Songda5 Camp N#1	Completed	98%
15	Songda5 Camp N#2	Completed	95%

No	Site Name	Status of Decommissioning & Re-vegetation	Green cover evaluation Percentage
			Oct-2020
16	Sino Hydro Camp	Completed	95%
17	V&K Concrete Sole Camp	Completed	70%
18	Zhefu Camp	Completed	75%
19	Spoil Disposal Area 1	Completed	90%
20	Spoil No. 2 & main dam workshop	Completed	75%
21	Spoil Disposal Area 6	Completed	75%
22	Spoil Disposal Area 8	No need decommissioning	60%
23	Re-regulation dam workshop	Completed	85%
24	Main Quarry	Completed	70%
25	Aggregate Plant Yard	Completed	85%
26	CVC Plant	Completed	70%
27	IHI Field shop and contractor camp	Completed	85%
28	RCC Plant	Completed	70%
29	Songda5 Batching Plant & Stock yard	Completed	95%
30	Sino and Song Da's Magazine Area	Completed	80%
31	Sand Stock Yard	No need decommissioning	60%
32	Irrigation Canal Spoil Disposal Area Phouhomxay Village	No need decommissioning	5%

FIGURE 3-1: COMPARISON OF VEGETATION COVER PERCENTAGE IN SEPTEMBER AND OCTOBER 2020

RCC Plant yard 30 September 2020	RCC Plant yard 27 October 2020
	
Quarry 30 September 2020	Quarry 27 October 2020



3.3 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD5), Faecal Coliform, E. Coli Bacteria and Total Coliform 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/>

3.3.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the **Annex B** of this Report. The effluent camp monitoring results in October 2020 indicated non-compliances for some parameters in OSOV1 (EF01), OSOV2 (EF13) and the Main Powerhouse (EF19).

In October 2020, EMO continued monitoring the Wastewater Treatment Systems (WWTSs) effectiveness in OSOV1, OSOV2, Main Dam and Re-Regulation Dam and also discussed with the Consultant via VDO conference to conclude on the improvement options for NNP1PC management's consideration. A proposal for improving the wastewater treatment systems is being finalized for NNP1PC management's consideration. The proposal includes to maintain the WWTSs in OSOV1 and the Re-regulation Dam but improve the maintenance processes, to install a Sequencing Batching Reactor System for OSOV2, and for the WWTS at the Main Dam to adjust the wastewater pumping and switch to automatic chlorination.

In addition, on 22 October 2020, the Septic Biofilm Tank supplier visited OSOV1 under EMO's invitation to inspect the installed biofilm tanks and their specifications. The supplier provided recommendations to NNP1PC on how to operate and maintain the WWTS properly.

The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 3-6**.

TABLE 3-6: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSS IN OCTOBER 2020

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for Total Coliform in the first fortnightly sampling. However, fully compliance in the second fortnightly sampling.	A proposal for wastewater treatment system improvements is being finalized for NNP1PC management's consideration. The proposal includes to maintain the WWTSSs in OSOV1 and the Re-regulation Dam but improve the maintenance processes, to install a Sequencing Batching Reactor System for OSOV2, and adjusting the wastewater pumping and switching to automatic chlorination for the Main Dam.
OSOV2	EF13	Non-compliance for Total Nitrogen and Ammonia-Nitrogen in the second fortnightly sampling.	
Main Powerhouse	EF19	Non-compliance for TSS (second fortnightly sampling), Ammonia Nitrogen, Total Nitrogen and Total Phosphorus.	

3.3.2 Ambient Surface Water Quality Monitoring

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

In addition, weekly depth profile monitoring (pH, DO, conductivity, TDS and temperature) has been undertaken since 18 September 2018 for stations located in the re-regulation and main reservoirs. The locations of the monitoring stations are shown in **Figure 3-2**.

The monitoring results for key parameters (DO, TSS and BOD₅) during October 2020 are presented in **Table 3-7, Table 3-8 and Table 3-9**. The full set of data for October 2020 is attached in **Annex A**. In addition, the results for DO are presented as line graphs in **Figure 3-3**.

Main Reservoir

From 01 to 31 October 2020, the water level in the main reservoir increased from El. 314.75 m asl to El. 315.13 m asl.

Thermal stratification, oxycline and anoxic condition were observed in the main reservoir at some stations. The inflow during the wet season contributed to a higher DO level at the deeper layers in the main reservoir.

At R05, during October 2020, the thermocline depth lowered from about 8 m in the beginning of the month to a depth of 15 m at the end of the month. The oxycline depth deepened correspondingly with DO levels between 6 mg/L and 7 mg/L in the upper 6 m in the beginning of

October 2020, and over the course of the month these high DO levels extended down to a depth of 15.0 m corresponding to El. 300 m asl.

The same tendency to deepening of the oxycline over the course of the month can be seen in R4 and R3, but less so in R2.

At R04, the oxycline lowered from a depth of about 6 m to a depth of about 12 m over the course of the month with DO levels generally between 5 and 8 mg/L above the oxycline and DO levels less than 2 mg/L below the oxycline.

At R3, the oxycline lowered from a depth of about 5 m to a depth of about 9.5 m over the course of the month with DO levels generally between 6.5 mg/L and 9 mg/L above the oxycline and DO levels less than 2 mg/L below the oxycline.

At R02, the DO concentrations in the upper 3.5 m were between 5 and 10 mg/L and the oxycline deepened to a depth of about 9.5 m at the end of the month.

At R01, similar to previous months, the DO levels were generally between 5.6 and 9.8 mg/L in the entire water column.

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 to the high flow season means of about 100 – 250 mg/L and low flow season means of 20 - 50 mg/L.

The BOD₅ measurements at R03, R04 and R05 in the epilimnion were less than 1.12 mg/L, but in the hypolimnion, BOD₅ was recorded at 11.68, 11.62 and 12.8 mg/L respectively.

Re-regulation Reservoir

In October 2020, the turbine discharges from the main powerhouse varied between 61 and 163 m³/s usually interrupted by night-time periods with no discharge.

The DO measurements at R06 and R07 representing turbine discharges from the main dam generally had DO concentrations below 4 mg/L in the entire water column.

The BOD₅ concentrations in R06 and R07 were less than 1 mg/L.

Downstream

During October 2020, the discharge from the re-regulation dam mainly went through the turbine. The DO levels were less than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam and thus were non-compliant with the GoL Standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is in the process of collecting information to assist in developing measures to improve the DO levels downstream.

The BOD₅ in the downstream stations were below 1.0 mg/L (complied with national surface water quality standard).

FIGURE 3-2: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

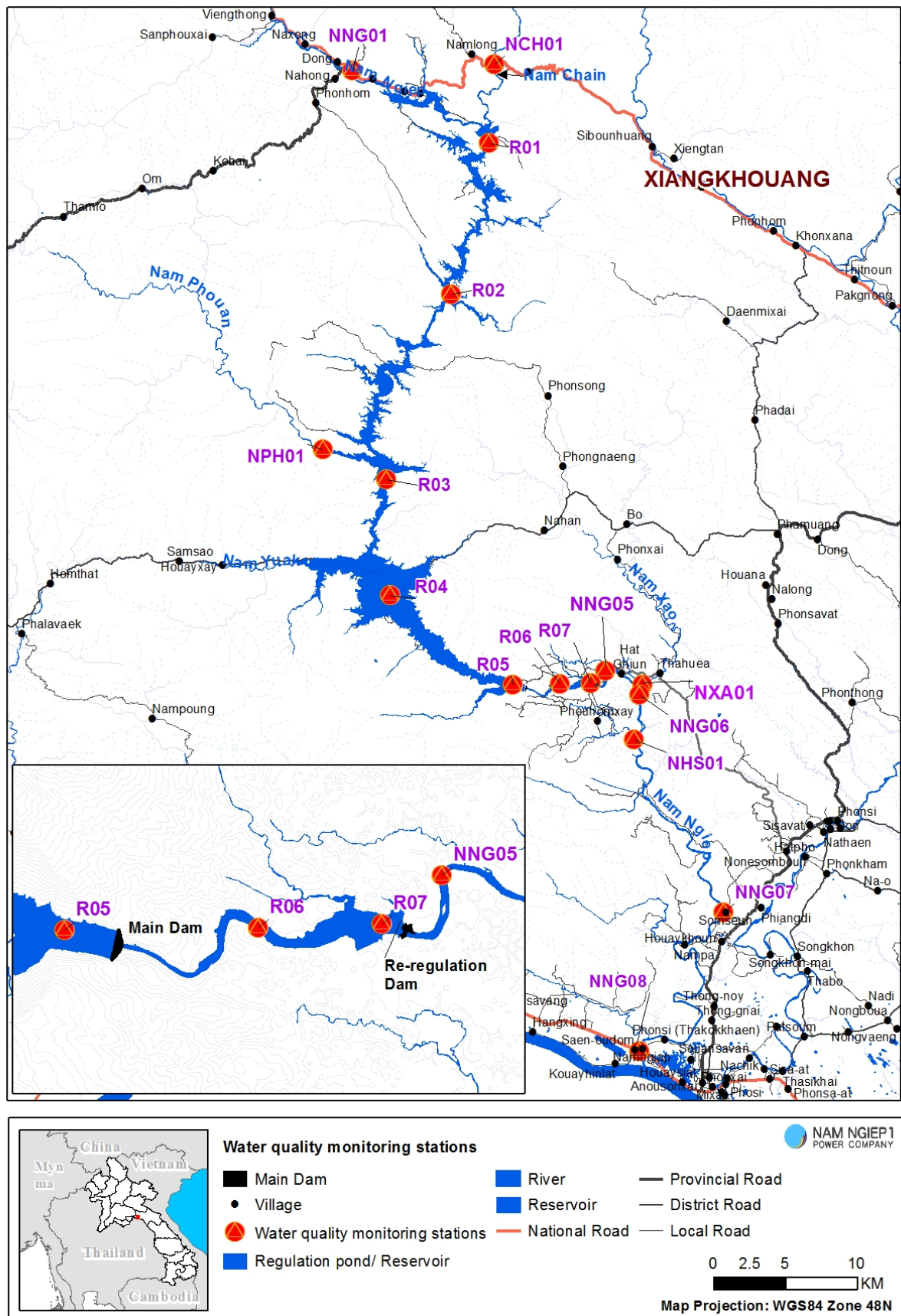


FIGURE 3-3: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE OCTOBER 2019 TO OCTOBER 2020

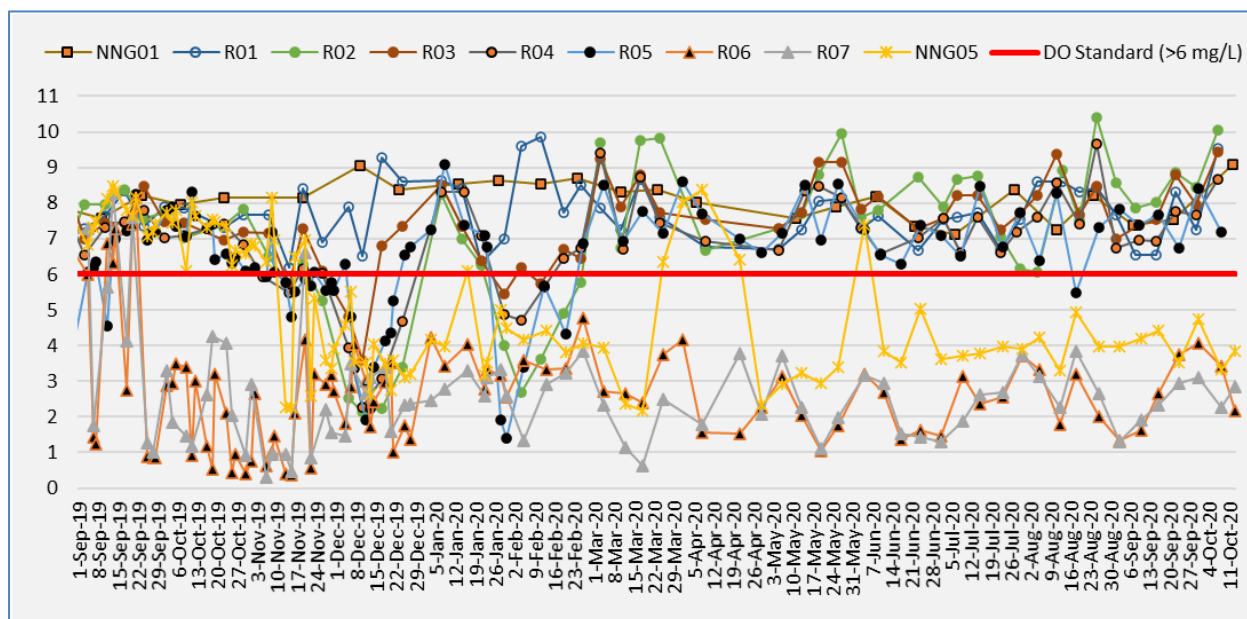


TABLE 3-7: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
7-Oct-20		9.54	10.06	9.45	8.66									10.12		
8-Oct-20						7.18	3.42	2.27	3.34	4.97	5.6	5.78			6.63	6.53
12-Oct-20	9.07												7.93			
13-Oct-20							2.16	2.85	3.83	4.43	5.52	6.34			6.65	6.63
15-Oct-20						7.26										
16-Oct-20		8.02	7.83	7.08	6.56									8.34		
20-Oct-20		9.35	7.95	6.91	5.73											
21-Oct-20						6.44	3.22	3.66	4.41	4.6	5.37	6.29			7.01	7.31
27-Oct-20		7.71	5.92	6.5	5.56											
28-Oct-20						6.93	3.61	2.62	3.69	4.16	6.66	6.59			7.51	7.54

TABLE 3-8: 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
12-Oct-20	6.45												6.2			
13-Oct-20							<5	<5	<5	<5	6.3	11			7.2	6.49
15-Oct-20						<5										
15-Oct-20 Hypolimnion						9.36										
16-Oct-20		<5		<5	<5									11		
16-Oct-20 Hypolimnion				31.89	28.11											

TABLE 3-9: 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
12-Oct-20	<1												<1			
13-Oct-20							<1	<1	<1	<1	<1	<1			<1	<1
15-Oct-20						<1										
15-Oct-20 Hypolimnion						12.4										
16-Oct-20		1.04		<1	1.12									<1		
16-Oct-20 Hypolimnion				11.68	11.62											

3.3.3 Groundwater Quality Monitoring

During October 2020, community groundwater quality analyses were carried out for six wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village.

The results indicate that two newly installed wells in Phouhomxay Village and one well in Pou Village comply fully with the groundwater quality standards.

Faecal Coliform and *E.coli* Bacteria are still present in the wells of Somseun, Nam Pa and ThongNoy villages. On 22 October 2020, EMO reported to SMO about findings from the investigation on the root causes of bacterial contamination in the groundwater supply system of Somseun, Nam Pa and Thong Noy Villages. The investigation revealed that irregular cleaning-up of water wells and water storage tanks and unrestricted livestock are likely to be the primary root causes of bacterial contamination. The SMO will communicate the findings and recommended improvements to the relevant authorities as well as report the progress of corrective action accordingly. The groundwater quality monitoring results are presented in **Table 3-10**.

TABLE 3-10: 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
	Guideline						
pH	6.5 - 9.2	8.43	8.5	7.64	7.83	7.08	7.73
Sat. DO (%)		41.1	38.8	69.6	77.2	31.6	91.6
DO (mg/L)		3.84	3.66	5.63	6.34	2.54	7.01
Conductivity (µS/cm)		430	470	328	415	383	26.3
Temperature (°C)		18.82	18.39	26.14	25.43	26.88	26.5
Turbidity (NTU)	<20	1.9	1.87	1.91	2.49	1.77	10.46
Fecal Coliform (MPN/100mL)	0	0	0	7.8	17	49	0
E.coli Bacteria (MPN/100mL)	0	0	0	7.8	9.3	22	0

3.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

Surface water from Houay Soup Stream is no longer used as water supply source for Phouhomxay Village since the two new groundwater boreholes (*GPHX01* and *GPHX02*) were connected to the existing water supply tanks on 21 October 2020.

The results of the water quality analyses are presented in **Table 3-11**. All parameters complied with the GoL Drinking Water Standards for Phouhomxay Village's water supply after the ground water source was connected.

Faecal Coliform and *E.coli* exceeded the standards in the water supply of Thaheua and Hat Gnuin Villages (WTHH02 and WHGN02). 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 pH value of GFWS at Hat Gnuin village also slightly exceeded the guideline. 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 3-11: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

		Site Name	Tha heau Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
26-Oct-20	pH	6.5 - 8.6	8.46	8.82	7.38	7.85
26-Oct-20	Sat. DO (%)		72.7	93.3	66.9	53.7
26-Oct-20	DO (mg/L)		5.94	7.76	5.48	4.47
26-Oct-20	Conductivity (µS/cm)	<1,000	47	62	385	380
26-Oct-20	Temperature (°C)	<35	25.8	24.7	25.5	24.5
26-Oct-20	Turbidity (NTU)	<10	2.15	2.62	2.63	1.85
26-Oct-20	Faecal Coliform (MPN/100 mL)	0	8	13	0	0
26-Oct-20	E.coli Bacteria (MPN/100 mL)	0	8	13	0	0

3.3.5 Landfill Leachate Monitoring

During October 2020, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond – LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that both NNP1 Project Landfill and Houay Soup Landfill fully complied with the standards. The landfill leachate monitoring results for October 2020 can be found in **Table 3-12**.

TABLE 3-12: RESULTS OF THE LANDFILL LEACHATE MONITORING

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
6-Oct-20	pH	6.0-9.0				8.94		8.86	
6-Oct-20	Sat. DO (%)					124.8		139.5	
6-Oct-20	DO (mg/L)					8.74		9.81	
6-Oct-20	Conductivity (µS/cm)					32.5		133	
6-Oct-20	Temperature (°C)					31.4		31.1	
6-Oct-20	Turbidity (NTU)					7.43		9.27	
6-Oct-20	BOD5 (mg/L)	<30				6.36		<6	

			Site Name	NNP1 Landfill Leachate					Houay Soup Landfill
			Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond
			Station	LL1	LL2	LL3	LL4	LL5	LL6
Date	Parameter (Unit)	Guideline							
6-Oct-20	COD (mg/L)	<125					29.4		33.4
6-Oct-20	Faecal Coliform (MPN/100mL)	<400					0		2
6-Oct-20	Total Coliform (MPN/100mL)	<400					33		79
6-Oct-20	Total nitrogen (mg/L)	<10					0.90		2.64
6-Oct-20	Lead (mg/L)	<0.2					<0.01		<0.01
6-Oct-20	Copper (mg/L)						<0.006		<0.006
6-Oct-20	Iron (mg/L)						0.202		0.169
6-Oct-20	Ammonia nitrogen (mg/L)	<10					<2		1.80
6-Oct-20	Oil & Grease (mg/L)	<10					<1		<1

3.3.6 Discharge Monitoring

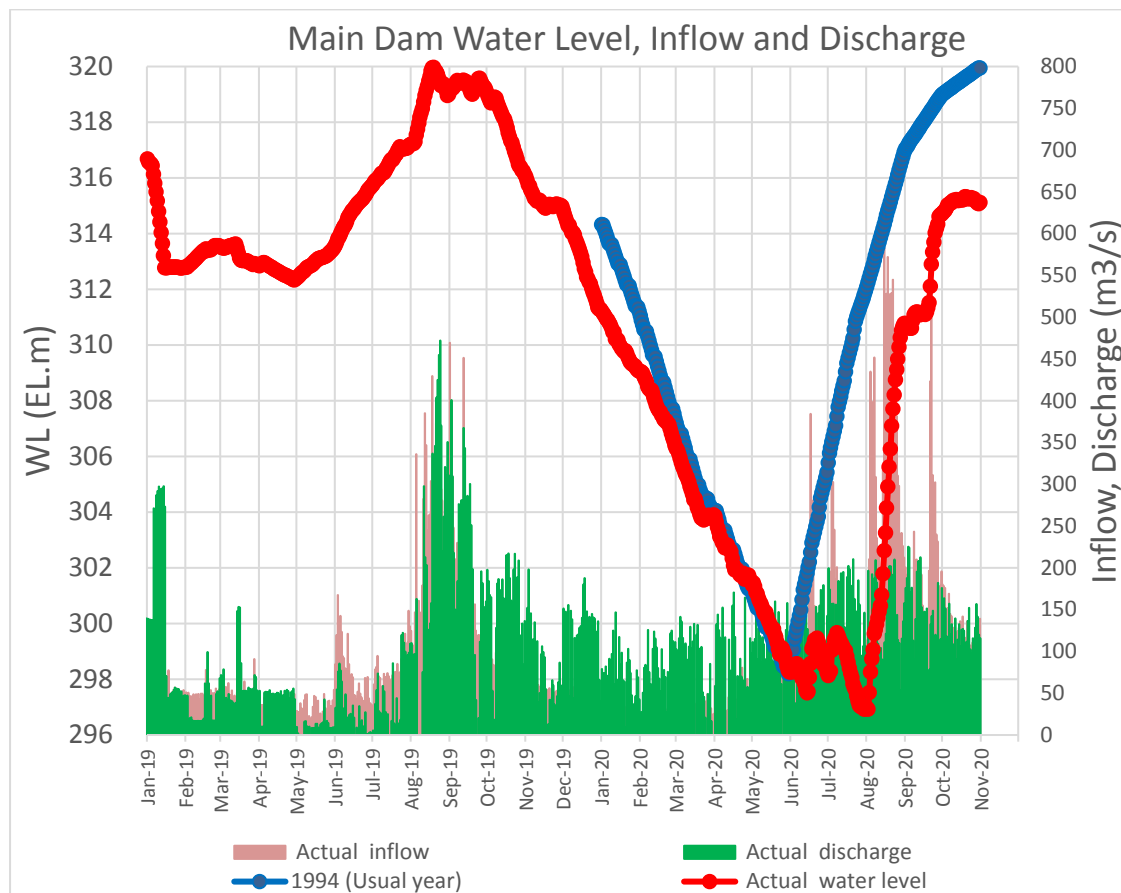
3.3.6.1 Main Reservoir – Water Level, Inflow and Discharge

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 3-4** presents the values recorded since 01 January 2019.

During October 2020, the mean inflow to the main reservoir was 145 m³/s during the first 2 weeks where after the inflow decreased to a mean of about 117 m³/s during the remaining part of October 2020 corresponding to almost the end of wet season. The minimum and maximum inflow were 96 (on 19 October 2020) and 180 m³/s (on 01 October 2020) respectively.

From 01 to 31 October 2020, the main reservoir was slightly filling-up and the water level increased by 0.38 m from El. 314.75 m asl to El. 315.13 m asl on 31 October 2020.

In October 2020, the turbine discharges from the main powerhouse varied between 61 and 164 m³/s usually interrupted by night-time periods with no discharge.

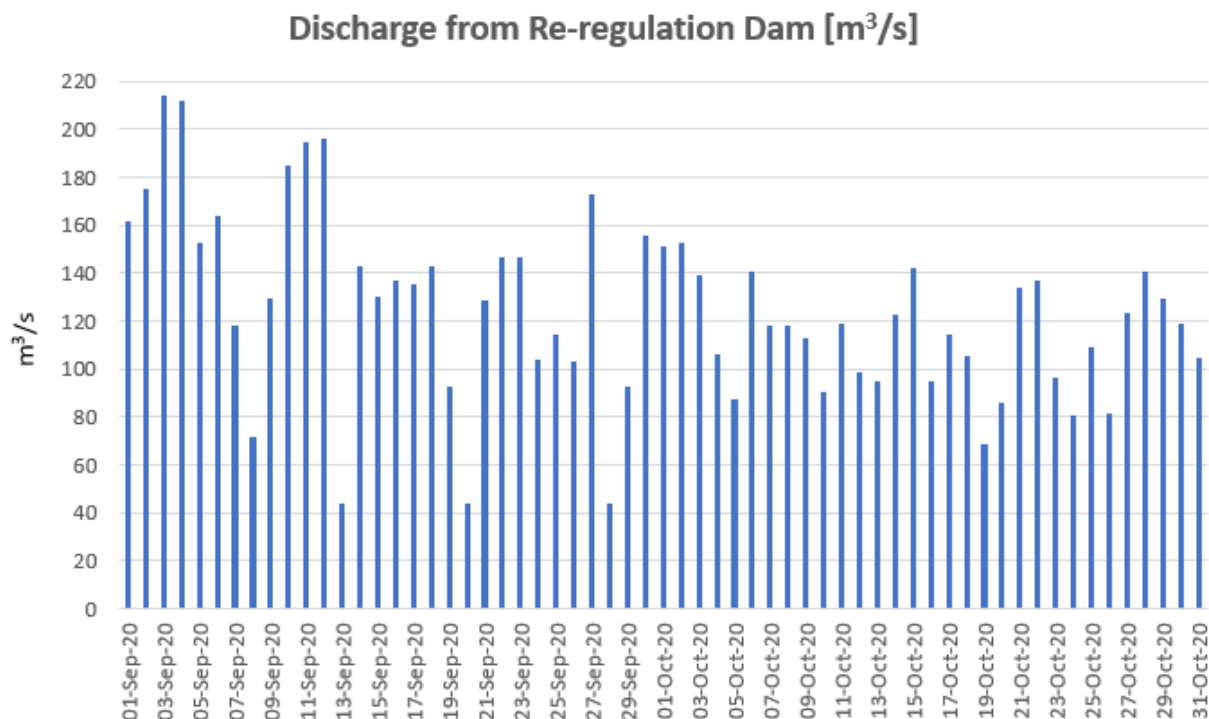
FIGURE 3-4: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR

3.3.6.2 Re-regulation Reservoir – Discharge

The discharge monitoring data for the re-regulation dam during September and October 2020 is presented in **Figure 3-5**.

During October 2020, the mean discharge from the re-regulation dam was about 135 m³/s with turbine discharges varying between 45 m³/s and 178 m³/s, combined with gate discharge varying between 28 m³/s and 144 m³/s. The discharge was kept above the minimum flow requirement of 27 m³/s at all times.

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

FIGURE 3-5: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN SEPTEMBER AND OCTOBER 2020

3.3.7 Nam Ngiep Downstream Water Depth Monitoring

In October 2020, EMO carried out four boat missions to monitor the water depth in the Nam Ngiep downstream of the re-regulation dam. A total of 19 sites have been identified with potential shallow water depths but none of them were found to be difficult to navigate.

3.4 PROJECT WASTE MANAGEMENT

3.4.1 Solid Waste Management

In October 2020, a total of 20 m³ of solid waste was disposed of at the NNP1 Project Landfill, an increase of 1.3 m³ compared in September 2020.

During October 2020, the local Waste Collection Contractor continued the routine operation and maintenance activities of both landfills which included waste separation, waste covering and waste inventory, and clean-up of vegetation and scattered waste, leachate ponds wastewater circulation and clean-up of Houay Soup Landfill's wetland pond with replacement of hyacinth plants. In addition, the Contractor also assisted on segregation of recyclable waste and clean up in the community waste bank.

No recyclable waste was sold this month. The cumulative amounts are presented in **Table 3-13**.

TABLE 3-13: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by October 2020
1	Plastic bottle	kg	0	89
2	Aluminium	kg	0	103
3	Paper/ Cardboard	kg	0	63
4	Glass	kg	0	64
Total		kg	0	319

The villagers from Phouhomxay Village collected a total of 796 kg of food waste from the OSOV1 canteen for animal feed in October 2020, an increase of 193 kg compared to the previous month.

3.4.2 Hazardous Materials and Waste Management

In October 2020, 100 out of a total 289 fluorescent bulbs were crushed by the fluorescent bulb crusher for further treatment by solidification method.

The types and amounts of hazardous material and hazardous waste stored on site in October 2020 are shown in **Table 3-14** and **Table 3-15**.

TABLE 3-14: RECORD OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in October 2020 (A)	Used (B)	Remaining (A – B)
1	Diesel	Litre	6,750	6,220	530
2	Gasoline	Litre	1,098	180	918
3	Lubricant (Turbine oil)	Litre	7,210	0	7,210
4	Colour Paint	Litre	266	0	266
5	Thinner	Litre	12	0	12
6	Grease Oil	Litre	725	0	725
7	Gear Oil	Litre	220	0	220
8	Chlorine Liquid	Litre	35	35	0
9	Chlorine Powder	Kg	65	0	65
10	SIKA	Litre	7	0	7

TABLE 3-15: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in October 2020 (A)	Disposed (B)	Remaining (A – B)
1	Used Oil (Hydraulic and Engine)	Litre	197	0	197
2	Empty 200L drum of used oil	Unit	3	0	3

No.	Hazardous Waste Type	Unit	Total in October 2020 (A)	Disposed (B)	Remaining (A - B)
3	Contaminated soil, sawdust and textile material	m ³	0.42	0	0.42
4	Used tires	Piece	9	0	9
5	Empty 20L chemical drum	Drum	4	0	4
6	Lead battery	Unit	3	0	3
7	Empty paint and spray cans	Can	125	0	125
8	Halogen/fluorescent bulbs	Unit	289	100	189
9	Empty cartridge (Ink)	Unit	151	0	151
10	Clinic Waste	Kg	5	0	5

3.5 COMMUNITY WASTE MANAGEMENT

3.5.1 Community Recycling Programme

In October 2020, there was no trading of recyclable waste at the community waste bank. Due to the COVID-19 measures, many local recycling businesses and vendors have stopped coming on site to trade recyclable waste, and 273 kg out of a total 852.5 kg of cardboard stored in the community waste bank had become unsellable and was segregated and disposed of at Houay Soup Landfill. A total of 28 kg of plastic bootless from the landfills was added to the waste bank making a new total amount of 2,947 kg recyclable waste in the bank.

TABLE 3-16: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in September 2020	Additional in October 2020	Sold/ dispose	Remaining in October 2020
Glass bottles	kg	2,304	0	0	2,304
Paper/cardboard	kg	852.5	0	273	579.5
Plastic bottles	kg	35.5	28	0	63.5
Aluminium cans	kg	0	0	0	0
Scrap metal	kg	0	0	0	0
Total	kg	3,192	0	0	2,947

3.5.2 Community Solid Waste Management

In October 2020, approximately 12.6 m³ of solid waste was collected from Phouhomxay Village and the host villages for disposal at Houay Soup landfill, a decrease of 4.5 m³ compared to the previous month.

FIGURE 3-6: WASTE MANAGEMENT ACTIVITIES DURING OCTOBER 2020

SOLID WASTE COLLECTION IN NNP1'S HOST VILLAGE (HAT NGIEN)	NNP1 LANDFILL'S PERIMETER FENCE MAINTENANCE
	
WASTE COLLECTION FROM THE VILLAGES	RECYCLE WASTE SEGREGATION IN THE COMMUNITY WASTE BANK
	

3.6 WATERSHED AND BIODIVERSITY MANAGEMENT

3.6.1 Watershed Management

3.6.1.1 Implementation of Annual Implementation Plan (AIP) 2019

The final draft of Fishery Co-Management Plan (FCMP) in English was submitted to ADB on 28 September 2020. ADB and BSP provided their comments on 20 October 2020 and NNP1PC-EMO provided the clarification to them on 28 October 2020. The final draft in Lao language was submitted to Xaysomboun PAFO on 27 October 2020 for their approval.

The final report in Lao language of the Assessment on Sustainable Livelihood Opportunities for NNP1 watershed communities was further reviewed and discussed with NNP1PC-EMO management at the end of October 2020. The report will be shared to Xaysomboun Provincial

WRPO for their reference to implement the activities under component 5 of NNP1 WMP – Livelihood Improvement.

On 24 September 2020, NNP1PC transferred the funds for the watershed management activities between October and December 2020 to Bolikhamxay Provincial WRPO. The WRPO updated the implementation schedule to start in the last week of October 2020 because of their internal meetings between the first and the third week of October 2020 as well as to accommodate recommendations from NNP1PC for them to have the Water Safety Training prior to continuing their reservoir patrol activity which was scheduled in the last week of October 2020. However, the water safety training was further postponed to first week of November 2020 because the trainer, Lao Red Cross, was urgently assigned by the GOL to assist on emergency measures in another province.

On 21 October 2020, DOF-MAF submitted an official request to NNP1PC for fund disbursement to Xaysomboun Provincial WRPO for the implementation of activities between October and December 2020. NNP1PC-EMO informed ADB and IAP on 25 October 2020 on the concern that some of the activities were excluded and postponed to 2021. These include: survey of villagers' land use and data collection in Hom district, installation of signboards of the village land-use and forest land area, and the land patrolling for forest and TPZ area. There was no clear justification on the exclusion of land use survey and signboard installation while the exclusion of patrol activity is related to a pending issue that NNP1PC have been dialoguing with Xaysomboun PAFO many times on the request for additional accommodation allowance for the field work which does not follow the GOL financial policy. ESD management and EMO proposed to have discussion with Xaysomboun Provincial Management in November 2020 or during the annual meeting on the commitment of Xaysomboun Provincial WRPO as the key implementation agency for NNP1 WMP and the compliance to nationwide GOL financial policy so that any delays in the preparation and implementation of AIP2021 could be avoided. NNP1PC-EMO team is preparing the document for the fund disbursement at the end of October 2020 and the fund is expected to be transferred to DOF-MAF by the second week of November 2020. In this regard, Xaysomboun Provincial WRPO have to adjust their implementation activities to start at the end of November 2020 at the soonest.

3.6.1.2 Preparation of Annual Implementation Plan (AIP) 2021

DOF-MAF advised Xaysomboun and Bolikhamxay Provincial WRPO to draft their AIP2021 and submit to NNP1PC in the first week of October 2020. Bolikhamxay Provincial WRPO submitted their budget plan on 14 October 2020 and it was internally reviewed by NNP1PC-EMO until end of October 2020. NNP1PC-EMO will share the comments and inputs to BSP in November 2020 prior to responding to Bolikhamxay Provincial WRPO. As of end of October 2020, Xaysomboun Provincial WRPO had not submitted their AIP2021. The discussion on draft AIP2021 between DOF-MAF, WRPOs, NNP1PC-EMO, and BSP is expected to be organized in November 2020 at the soonest.

3.6.2 Biodiversity Offset Management

3.6.2.1 Engagement of Biodiversity Service Provider (BSP)

The signing of the MOU between NNP1PC, ADB and WCS is pending agreement on some minor adjustments.

NNP1PC-EMO and the BSP continued to make progress on the preparation of a Law Enforcement Strategy (LES) document for NC-NX offset site, the overall biological monitoring program for NNP1 watershed and NC-NX offset site, community outreach program, and the conservation linked livelihood.

3.6.2.2 Implementation of BOMP Annual Implementation Plan (AIP) 2019 and 2020

Progresses on the implementation of key activities by Component in October 2020 are described below:

a. Component 1 - Spatial Planning and Regulation

The dissemination and outreach activity on the TPZ boundary were further postponed to November 2020 because of the impassable access after weeks of heavy rain in Viengthong and Xaychamphone District.

b. Component 2 – Law Enforcement

The four patrol teams continued the patrolling between 07 and 27 October 2020 with the focus on Nam Ma TPZ high priority area including Nam Houg, Nam Kha Gna and the tributaries of Nam Houg; TPZ Highest Priority including Nam San and Nam Chouan; Nam Ma TPZ High Priority Area including Nam Ma and Nam Pang; Xaychamphone District including Nam Chamhang and Nam Lak. The results of October 2020 patrolling will be presented and discussed in November 2020 Monthly Report.

The results of patrolling activity in September 2020 are as follow:

- *The first team* carried out patrolling at Nam Ma TPZ high priority area including Nam Ma, Nam Mong and Nam Pang. The team spent only 11 days covering a distance of 30 km on forest patrolling which is less than the original plan because of equipment malfunctioned as well as difficult mobility and access into the target area after weeks of heavy rain. The team made a total of nine direct observations and eight indirect observations of the following wildlife: macaques, Sambar, Large-toothed ferret badger, Otters, Phayre's Leaf Monkeys, White-cheeked gibbons, Eagles, Muntjac, Rufous-necked hornbill, White-cheeked gibbon, and wild pig.
- *The second team* carried out patrolling at at Xaychamphone District including Nam Kha Gni and Nam Chamhang. They spent 15 days covering a distance of 86 km on forest patrolling and 8 km on road patrolling. The team made a total of four direct observations and five indirect observations of the following wildlife: Great Hornbills, Macaques, Phayre's Leaf Monkeys, White-cheeked gibbons, Civet, Muntjac, Otter, and Wild pig. The team encountered 94 of small wire snares and destroyed on site.
- *The third team* carried out patrolling at Nam Ma TPZ high priority area and Nam Houg (Viengthong District) including Nam Sanga, Nam Kapa, Nam Kha Gna and Nam Sik. They spent 16 days covering a distance of 64 km on forest patrolling and 21 km on road patrol. The team made a total of seven direct observations and three indirect observations of the following wildlife: Black Giant Squirrel, Muntjac, Phayre's Leaf Monkeys, White-cheeked gibbons, Wild pigs, and Indochinese Serow. The team encountered and destroyed one inactive hunting camp at the southern part of Nam Sanga and one inactive hunting camp at Nam Kama upstream.
- *The fourth team* carried out patrolling at the TPZ highest priority area in Nam San, Nam Chang and Nam Sone. They spent 16 days covering a distance of 70 km on forest patrolling and 15

km on road patrolling. The team made a total of seven direct observations of the following wildlife: Black Giant Squirrels, Great Hornbills, Macaques, Phayre's Leaf Monkeys, White-cheeked gibbons, and Wild pigs. The team did not encounter any threats.

FIGURE 3-7: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN SEPTEMBER 2020

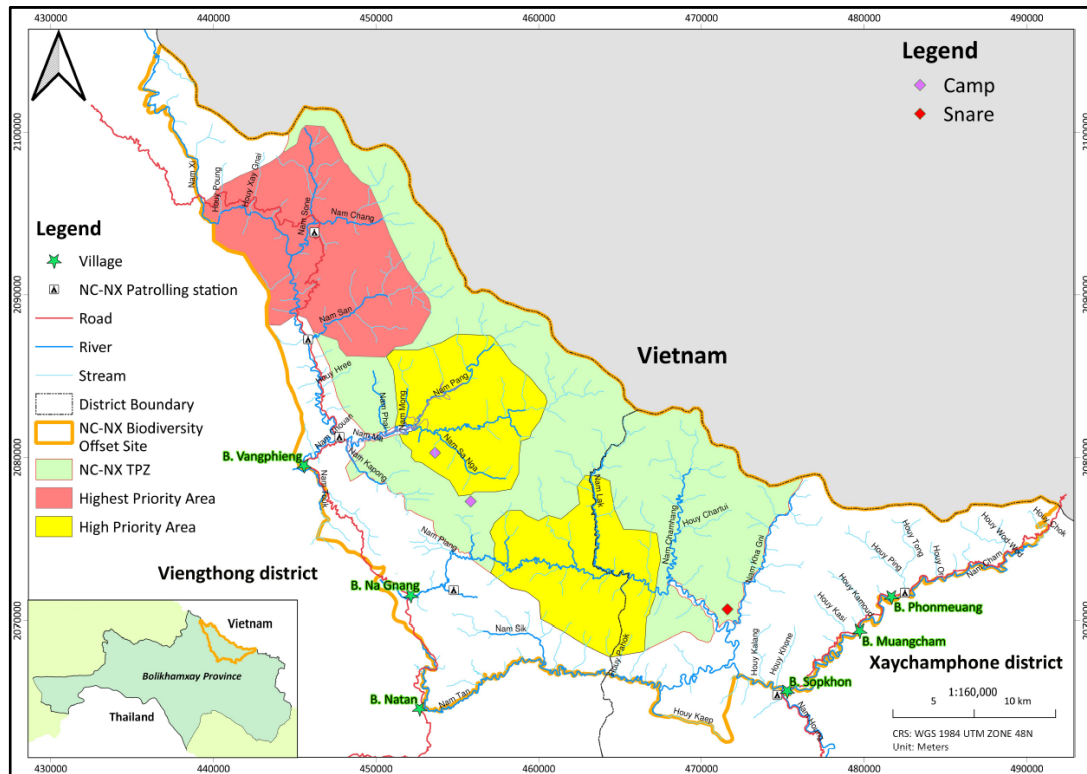


FIGURE 3-8: MAP OF WILDLIFE SIGNS RECORDED BY PATROLLING TEAMS IN SEPTEMBER 2020

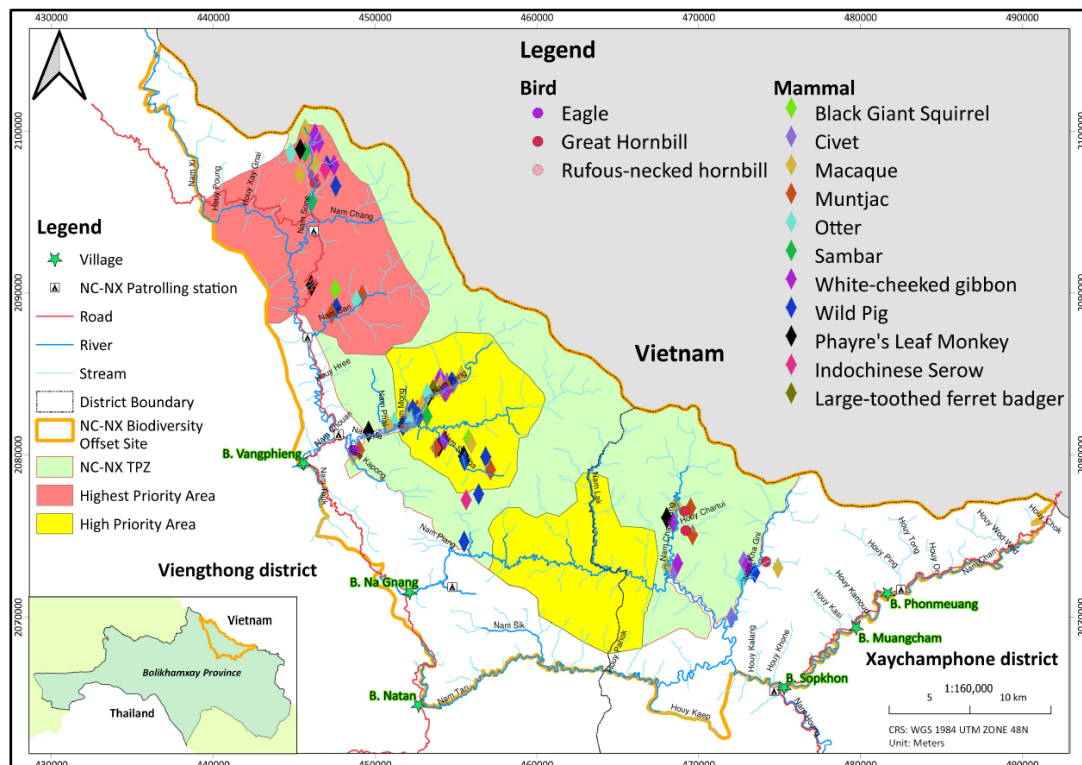
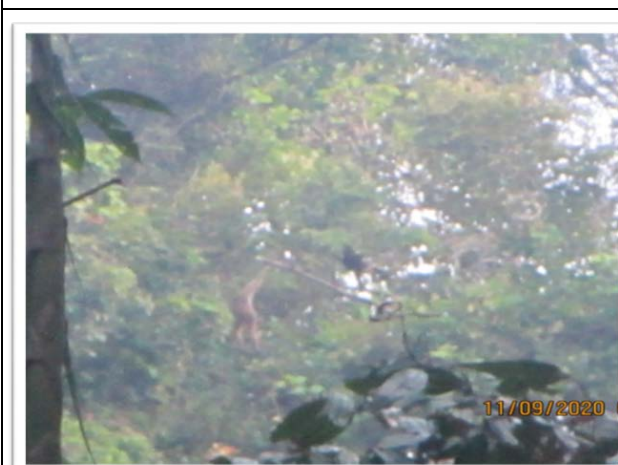
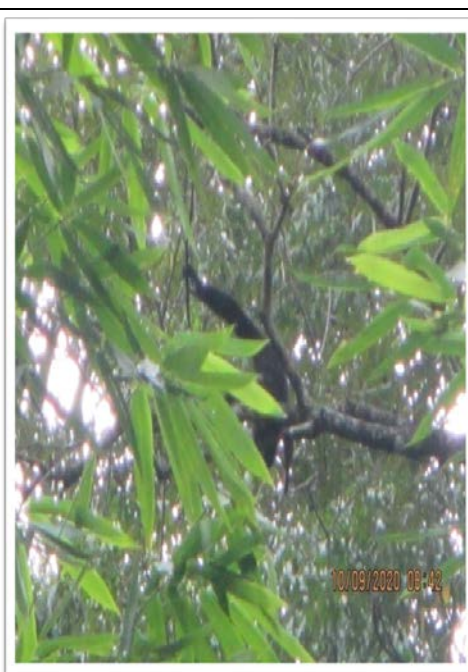


FIGURE 3-9: SMALL WIRE SNARE FOUND BY TEAM 2 AT NAM KHA GNI**FIGURE 3-10: INACTIVE HUNTING CAMP FOUND BY TEAM 3 AT SOUTHERN PART OF NAM SANGA****FIGURE 3-11: WHITE-CHEEKED GIBBON****FIGURE 3-12: PHAYRE'S LEAF MONKEY**

c. Component 3 – Conservation Outreach

The pre-assessment of the target communities and schools was scheduled at the end of October 2020 but due to impassable road access after weeks of heavy rains, the activity is postponed to November 2020.

d. Component 4 – Conservation linked livelihood development

The Consultant submitted a draft in English and Lao language to NNP1PC-EMO on 15 and 19 October 2020 respectively. The English version was reviewed by NNP1PC-EMO and BSP and then submitted to ADB and IAP on 19 October 2020. EMO received their comments on 27 October

2020. The comments will be addressed and elaborated together with the results of the final workshop with GOL that will be organized on 10 November 2020.

The Community Snare Removal Plan was further discussed during the technical meeting between NC-NX BOMU, NNP1PC-EMO, and BSP on 13 October 2020. It is expected that the revised plan will be finalized in November 2020. The team establishment and training will be further delayed to the end of November 2020 and the first snare removal is expected in December 2020.

e. Component 6 – Biological Monitoring

During October 2020, the BSP continued working on improving the biological monitoring matrix and so the sharing to ADB and IAP expected to be further delayed in November 2020.

The training on the camera trap installation by BSP was organized on 15-16 October 2020 with the participation of BOMU and DAFO staffs from Viengthong and Xaychamphone District as well as NNP1P-EMO. The installation was originally scheduled to start on 19 October 2020 but due to impassable road access into the target area after weeks of heavy rains, the activity was postponed to the last week of October 2020.

3.6.2.3 BOMP Annual Implementation Plan (AIP) 2021

Bolikhamxay Provincial NC-NX BOMU presented and discussed the initial activity plan for the AIP2021 during the monthly meeting between NC-NX BOMU, NNP1PC-EMO, and BSP on 03 September 2020. NNP1PC-EMO and BSP provided further inputs during 8 to 17 September 2020 for NC-NX BOMU to draft the budget plan. The draft budget was presented and discussed during the meeting between DOF-MAF, NC-NX BOMU, relevant GOL offices, NNP1PC-EMO, and BSP on 14 October 2020. NNP1PC-EMO and BSP provided further recommendation for improvement in the last week of October 2020. The follow up discussion was scheduled on 05 November 2020 for finalization prior to further submission to ADB and IAP for their review.

3.7 FLOATING DEBRIS REMOVAL

There was no field work carried out during this reporting period.

4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in September 2020 as listed in **Table 4-1**. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹, except *Sikukia gudgeri* is classified as Data Deficient (DD) and *Tor sinensis* is classified as Vulnerable species (VU).

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

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN SEPTEMBER 2020

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	171.1	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	119.9	DD, LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	101.1	LC
<i>Channa striata</i>	ປາຄໍ່	85.9	LC
<i>Tor sinensis</i>	ປາແດງ	75.1	VU

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in September 2020 is presented in **Table 4-2**. The list includes four species that are classified as Vulnerable species (VU) and four Near Threatened species (NT).

TABLE 4-2: THREATENED SPECIES OF SEPTEMBER 2020 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cirrhinus molitorella</i>	ປາແກງ	54	NT
<i>Cyprinus carpio</i>	ປາໄນ	18.5	VU
<i>Neolissochilus stracheyi</i>	ປາສອງ	2.1	NT
<i>Onychostoma gerlachi</i>	ປາຄົງ	1.4	NT
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປຽນ	17.8	VU
<i>Tor sinensis</i>	ປາແດງ	60	VU
<i>Wallago attu</i>	ປາຄ້າວ	1	NT

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to September 2020 is presented in **Figure 4-1**. Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017.

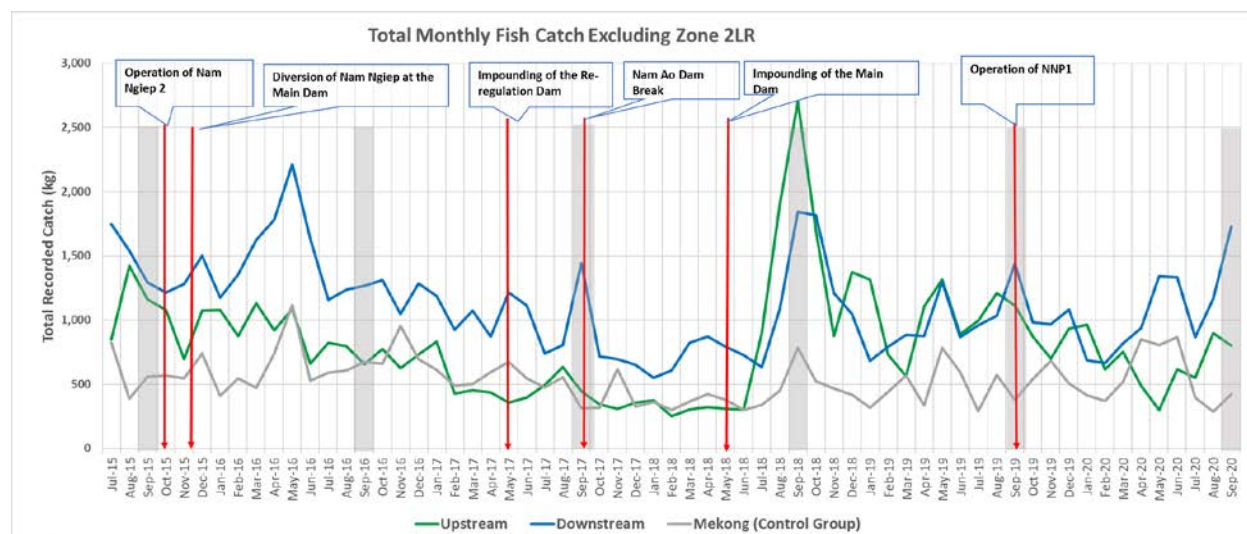
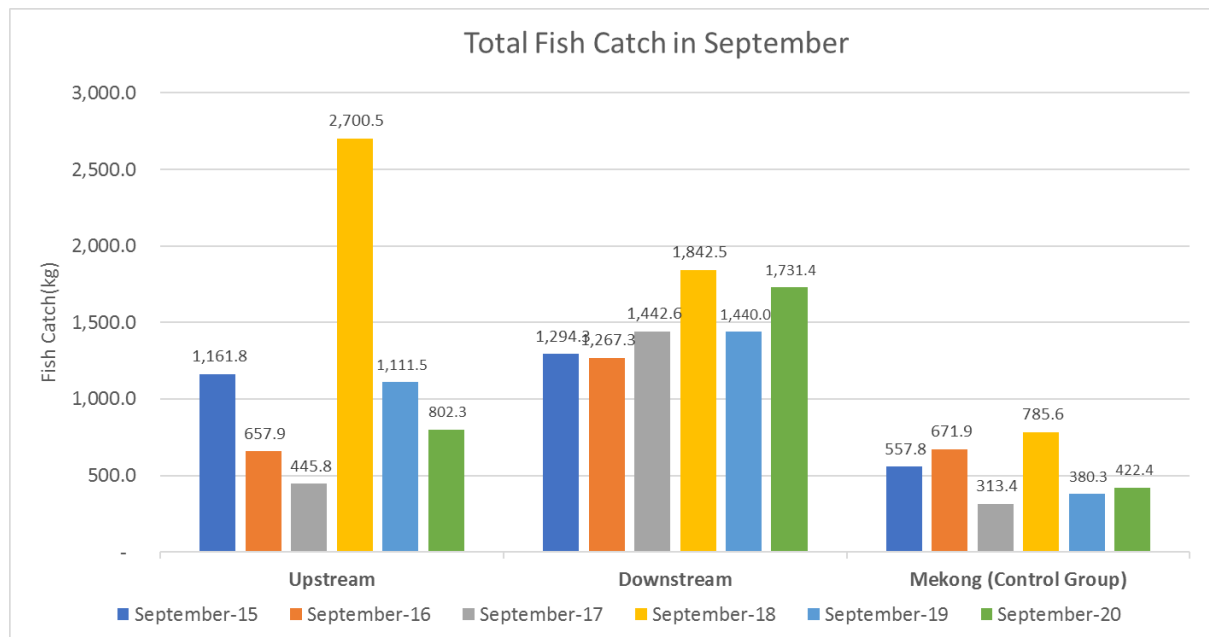
FIGURE 4-1: TOTAL MONTHLY FISH CATCH JULY 2015 – SEPTEMBER 2020

Table 4-3 and **Figure 4-2** show the total recorded fish catch for the month of September from 2015 to 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

TABLE 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF SEPTEMBER FROM 2015 TO 2020

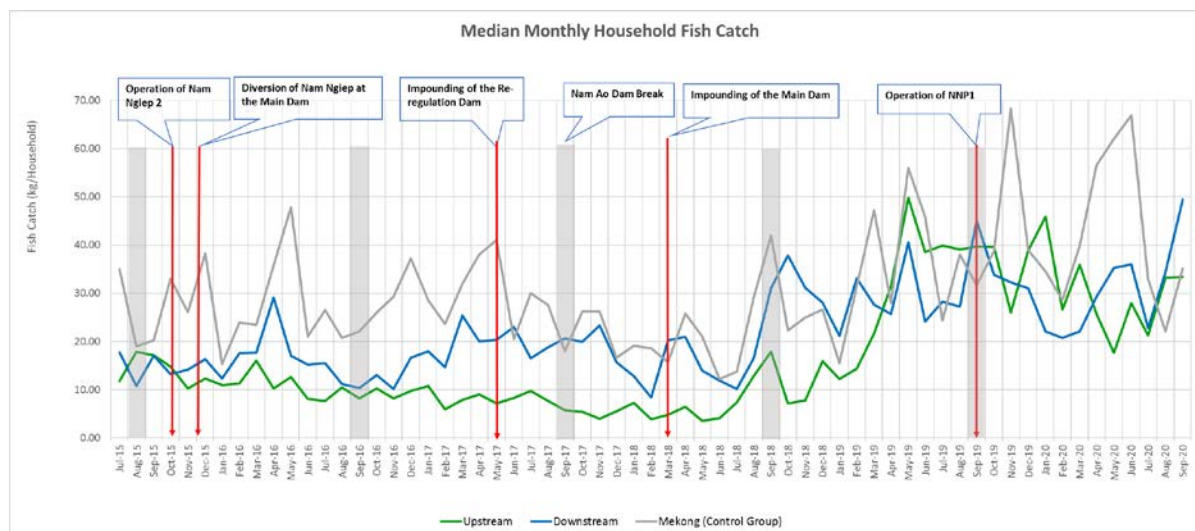
Fishing Zone	September 2015 (kg)	September 2016 (kg)	September 2017 (kg)	September 2018 (kg)	September 2019 (kg)	September 2020 (kg)
Upstream	1,161.8	657.9	445.8	2,700.5	1,111.5	802.3
Downstream	1,294.3	1,267.3	1,442.6	1,842.5	1,440.0	1,731.4
Mekong Control Group	557.8	671.9	313.4	785.6	380.3	422.4

FIGURE 2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF SEPTEMBER FROM 2015 TO 2020

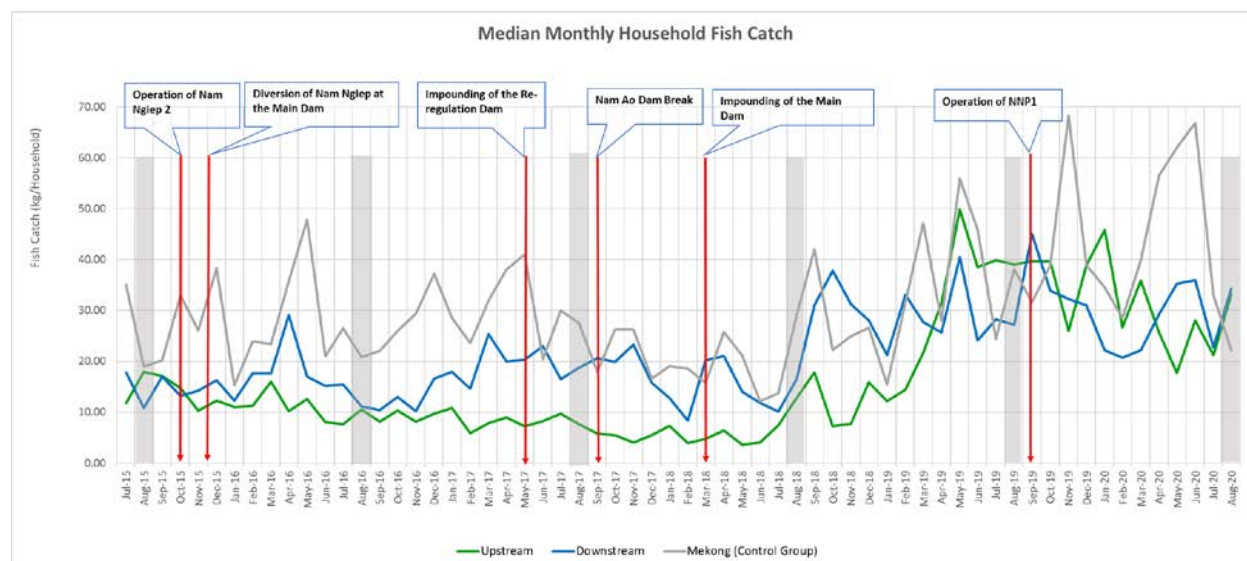


The numbers of fishing households involved in the fish catch monitoring programme are displayed in **Figure 4-3**.

FIGURE 4-3: NUMBER OF FISHING HOUSEHOLDS INVOLVED IN THE FISH CATCH MONITORING PROGRAMME



The median monthly household fish catch from July 2015 to August 2020 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in **Figure 4-4**.

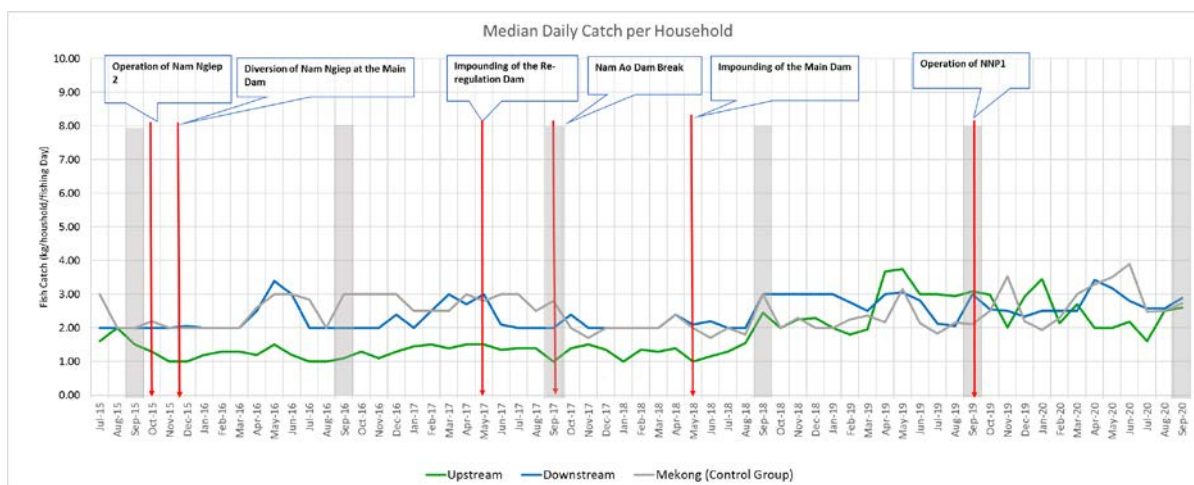
FIGURE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH WITHOUT ZONE 2LR

The median household fish catch for the month of September from 2015 to 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in **Table 4-4**.

TABLE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH IN THE UPSTREAM AND DOWNSTREAM COMMUNITIES EXCLUDING ZONE 2LR FOR THE MONTH OF SEPTEMBER FROM 2015 TO 2020

Fishing Zone	September 2015 (kg)	September 2016 (kg)	September 2017 (kg)	September 2018 (kg)	September 2019 (kg)	September 2020 (kg)
Upstream	17.2	8.2	5.8	17.9	39.7	33.4
Downstream	17.0	10.4	20.7	31.0	45.0	49.5
Mekong Control Group	20.2	22.1	18.0	42.0	31.7	35.2

The median daily fish catch per household are displayed in **Figure 4-5**, and the median fish catch per household per fishing day for the month of September from 2015 to 2020 are shown in **Table 4-5**.

FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD

TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF SEPTEMBER FROM 2015 TO 2020

Fishing Zone	September 2015 (kg)	September 2016 (kg)	September 2017 (kg)	September 2018 (kg)	September 2019 (kg)	September 2020 (kg)
Upstream	1.50	1.10	1.00	2.45	3.09	2.60
Downstream	2.00	2.00	2.00	3.00	3.00	2.89
Mekong Control Group	2.00	3.00	2.80	3.00	2.11	2.74

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

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

Date	Parameters (Unit)	River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Guideline														
7-Oct-20	pH	5.0 - 9.0		7.83	7.65	7.81	7.25							
8-Oct-20	pH	5.0 - 9.0						7.57	6.54	6.46	7.11	6.89	6.84	7.22
12-Oct-20	pH	5.0 - 9.0	7.44											
13-Oct-20	pH	5.0 - 9.0							6.98	6.86	6.74	7.19	7.11	7.08
15-Oct-20	pH	5.0 - 9.0						6.25						
16-Oct-20	pH	5.0 - 9.0		7.42	7.11	7.07	6.5							
20-Oct-20	pH	5.0 - 9.0		7.78	7.68	7.56	6.95							
21-Oct-20	pH	5.0 - 9.0						6.71	6.87	6.94	7.22	7.16	7.39	7.76
27-Oct-20	pH	5.0 - 9.0		6.72	6.97	6.79	7.2							
28-Oct-20	pH	5.0 - 9.0						6.44	6.68	6.73	6.97	7.1	6.67	6.78
29-Oct-20	pH	5.0 - 9.0												
7-Oct-20	Sat. DO (%)			128.5	136.4	126.1	114.7							
8-Oct-20	Sat. DO (%)							93.9	41.4	27.4	42.1	60.8	68.6	71
12-Oct-20	Sat. DO (%)		113.4											
13-Oct-20	Sat. DO (%)								26	35.3	46.8	53.9	68.6	78.4
15-Oct-20	Sat. DO (%)							93.1						
16-Oct-20	Sat. DO (%)			102.7	102	91.4	84.4							
20-Oct-20	Sat. DO (%)			118.6	100.9	87.6	72.2							
21-Oct-20	Sat. DO (%)							81.4	39.1	44.7	53.8	56.4	66.6	79.2
27-Oct-20	Sat. DO (%)			100	75.6	82.6	69.9							
28-Oct-20	Sat. DO (%)							85.7	43.7	31.6	44.7	50.4	82.1	81.1
29-Oct-20	Sat. DO (%)													
7-Oct-20	DO (mg/L)	>6.0		9.54	10.06	9.45	8.66							
8-Oct-20	DO (mg/L)	>6.0						7.18	3.42	2.27	3.34	4.97	5.6	5.78
12-Oct-20	DO (mg/L)	>6.0	9.07											
13-Oct-20	DO (mg/L)	>6.0							2.16	2.85	3.83	4.43	5.52	6.34
15-Oct-20	DO (mg/L)	>6.0						7.26						
16-Oct-20	DO (mg/L)	>6.0		8.02	7.83	7.08	6.56							
20-Oct-20	DO (mg/L)	>6.0		9.35	7.95	6.91	5.73							
21-Oct-20	DO (mg/L)	>6.0						6.44	3.22	3.66	4.41	4.6	5.37	6.29
27-Oct-20	DO (mg/L)	>6.0		7.71	5.92	6.5	5.56							
28-Oct-20	DO (mg/L)	>6.0						6.93	3.61	2.62	3.69	4.16	6.66	6.59
29-Oct-20	DO (mg/L)	>6.0												
7-Oct-20	Conductivity (µs/cm)			72	66	61	60							

Date	Parameters (Unit)	River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Guideline														
8-Oct-20	Conductivity (µs/cm)							59	64	64	63	65	68	68
12-Oct-20	Conductivity (µs/cm)		65											
13-Oct-20	Conductivity (µs/cm)								64	63	65	66	65	65
15-Oct-20	Conductivity (µs/cm)							58						
16-Oct-20	Conductivity (µs/cm)			76	68	62	60							
20-Oct-20	Conductivity (µs/cm)			76	72	63	61							
21-Oct-20	Conductivity (µs/cm)							57	64	63	65	66	65	64
27-Oct-20	Conductivity (µs/cm)			72	73	62	61							
28-Oct-20	Conductivity (µs/cm)							57	66	66	66	67	68	65
29-Oct-20	Conductivity (µs/cm)													
7-Oct-20	Temperature (°C)			31.02	31.44	30.46	29.87							
8-Oct-20	Temperature (°C)							29.28	24.94	24.94	25.14	25.46	25.64	25.72
12-Oct-20	Temperature (°C)		24.2											
13-Oct-20	Temperature (°C)								24.88	24.97	25.52	25.29	25.86	26.13
15-Oct-20	Temperature (°C)							28.2						
16-Oct-20	Temperature (°C)			28.38	28.96	28.72	28.3							
20-Oct-20	Temperature (°C)			27.64	27.81	27.56	27.26							
21-Oct-20	Temperature (°C)							27.37	25.18	25.39	25.29	25.66	26.31	26.52
27-Oct-20	Temperature (°C)			28.89	28.01	27.69	27.09							
28-Oct-20	Temperature (°C)							26.53	24.86	24.88	24.95	25.04	25.95	25.88
29-Oct-20	Temperature (°C)													
7-Oct-20	Turbidity (NTU)			2.1	2.4	2.38	2.31							
8-Oct-20	Turbidity (NTU)							2.12	2.81	2.34	2.98	3.45	3.42	4.42
12-Oct-20	Turbidity (NTU)		5.29											
13-Oct-20	Turbidity (NTU)								2.96	3.12	2.97	6.82	3.32	4.89
15-Oct-20	Turbidity (NTU)							2.8						
15-Oct-20	Turbidity (NTU)-Hypolimnion							2.44						
16-Oct-20	Turbidity (NTU)			2.47	3.56	3.54	3.01							
16-Oct-20	Turbidity (NTU)-Hypolimnion					3.5	2.07							
20-Oct-20	Turbidity (NTU)			2.29	2.52	2.55	2.28							
21-Oct-20	Turbidity (NTU)							2.32	2.6	2.61	2.71	2.97	3.16	4.09
27-Oct-20	Turbidity (NTU)			2.19	2.03	2.16	1.88							

Date	Parameters (Unit)	River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Guideline														
28-Oct-20	Turbidity (NTU)							2.2	2.75	2.65	2.81	3.35	2.32	4.82
29-Oct-20	Turbidity (NTU)													
12-Oct-20	TSS (mg/L)		6.45											
13-Oct-20	TSS (mg/L)								<5	<5	<5	<5	6.3	11
15-Oct-20	TSS (mg/L)							<5						
16-Oct-20	TSS (mg/L)			<5		<5	<5							
15-Oct-20	TSS (mg/L)-Hypolimnion							9.36						
16-Oct-20	TSS (mg/L)-Hypolimnion					31.89	28.11							
12-Oct-20	BOD ₅ (mg/L)	<1.5	<1											
13-Oct-20	BOD ₅ (mg/L)	<1.5							<1	<1	<1	<1	<1	<1
15-Oct-20	BOD ₅ (mg/L)	<1.5						<1						
15-Oct-20	BOD ₅ (mg/L)-Hypolimnion							12.4						
16-Oct-20	BOD ₅ (mg/L)	<1.5		1.04		<1	1.12							
16-Oct-20	BOD ₅ (mg/L)-Hypolimnion					11.68	11.62							
12-Oct-20	COD (mg/L)	<5.0	<5											
13-Oct-20	COD (mg/L)	<5.0							<5.0	<5.0	5.2	6	5.6	6.2
15-Oct-20	COD (mg/L)	<5.0												
12-Oct-20	NH ₃ -N (mg/L)	<0.2	<0.2											
15-Oct-20	NH ₃ -N (mg/L)	<0.2						<0.2						
15-Oct-20	NH ₃ -N (mg/L)-Hypolimnion							0.53						
16-Oct-20	NH ₃ -N (mg/L)	<0.2		<0.2		<0.2	<0.2							
16-Oct-20	NH ₃ -N (mg/L)-Hypolimnion					<0.2	0.99							
12-Oct-20	NO ₃ -N (mg/L)	<5.0	<0.02											
15-Oct-20	NO ₃ -N (mg/L)	<5.0						<0.02						
15-Oct-20	NO ₃ -N (mg/L)-Hypolimnion							<0.02						
16-Oct-20	NO ₃ -N (mg/L)	<5.0		<0.02		<0.02	<0.02							
16-Oct-20	NO ₃ -N (mg/L)-Hypolimnion					<0.02	<0.02							
12-Oct-20	Faecal coliform (MPN/100 mL)	<1,000	220											
13-Oct-20	Faecal coliform (MPN/100 mL)	<1,000							0	0	5	11	33	17
15-Oct-20	Faecal coliform (MPN/100 mL)	<1,000						0						
15-Oct-20	Faecal coliform (MPN/100 mL)-Hypolimnion							0						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guidelin e												
16-Oct-20	Faecal coliform (MPN/100 mL)	<1,000		5		920	220							
16-Oct-20	Faecal coliform (MPN/100 mL)-Hypolimnion					350	47							
12-Oct-20	Total Coliform (MPN/100 mL)	<5,000	920											
13-Oct-20	Total Coliform (MPN/100 mL)	<5,000						2	5	17	26	79	26	
15-Oct-20	Total Coliform (MPN/100 mL)	<5,000					2							
15-Oct-20	Total Coliform (MPN/100 mL)-Hypolimnion						0							
16-Oct-20	Total Coliform (MPN/100 mL)	<5,000		220		920	220							
16-Oct-20	Total Coliform (MPN/100 mL)-Hypolimnion					1600	540							
12-Oct-20	TKN		<1.5											
15-Oct-20	TKN						<1.5							
15-Oct-20	TKN-Hypolimnion						<1.5							
16-Oct-20	TKN			<1.5		<1.5	<1.5							
16-Oct-20	TKN-Hypolimnion					<1.5	<1.5							
12-Oct-20	TOC (mg/L)		0.78											
13-Oct-20	TOC (mg/L)							1.19	1.18	1.12	1.08	1.07	1.19	
15-Oct-20	TOC (mg/L)													
15-Oct-20	Phytoplankton Biomass (g dry wt/m³)						2.6							
15-Oct-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion						3.2							
16-Oct-20	Phytoplankton Biomass (g dry wt/m³)			3.6		2.8	2.2							
16-Oct-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion					1	1.2							
12-Oct-20	Total Phosphorus (mg/L)		0.02											
15-Oct-20	Total Phosphorus (mg/L)						0.08							

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
15-Oct-20	Total Phosphorus (mg/L)-Hypolimnion													
16-Oct-20	Total Phosphorus (mg/L)					<0.01	<0.01							
16-Oct-20	Total Phosphorus (mg/L)-Hypolimnion													
12-Oct-20	Total Dissolved Phosphorus (mg/L)		0.02											
15-Oct-20	Total Dissolved Phosphorus (mg/L)							<0.01						
15-Oct-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion							<0.01						
16-Oct-20	Total Dissolved Phosphorus (mg/L)			0.02		<0.01	<0.01							
16-Oct-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion					<0.01	<0.01							
16-Oct-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02	<0.02							

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

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
		Distance from Reg Dam (Km)				
Date	Parameters (Unit)	Guideline				
7-Oct-20	pH	5.0 - 9.0		7.94		
8-Oct-20	pH	5.0 - 9.0			7.59	7.84
12-Oct-20	pH	5.0 - 9.0	7.12			
13-Oct-20	pH	5.0 - 9.0			7.25	7.58
16-Oct-20	pH	5.0 - 9.0		8.39		
20-Oct-20	pH	5.0 - 9.0				
21-Oct-20	pH	5.0 - 9.0			7.78	7.8
27-Oct-20	pH	5.0 - 9.0				
28-Oct-20	pH	5.0 - 9.0			7.87	6.84
29-Oct-20	pH	5.0 - 9.0				
7-Oct-20	Sat. DO (%)			118.2		
8-Oct-20	Sat. DO (%)				83.4	81
12-Oct-20	Sat. DO (%)		100.2			
13-Oct-20	Sat. DO (%)				81.3	81.1
16-Oct-20	Sat. DO (%)			96.7		
20-Oct-20	Sat. DO (%)					
21-Oct-20	Sat. DO (%)				85.9	90.2
27-Oct-20	Sat. DO (%)					
28-Oct-20	Sat. DO (%)				90.6	91.6
29-Oct-20	Sat. DO (%)					
7-Oct-20	DO (mg/L)	>6.0		10.12		
8-Oct-20	DO (mg/L)	>6.0			6.63	6.53
12-Oct-20	DO (mg/L)	>6.0	7.93			
13-Oct-20	DO (mg/L)	>6.0			6.65	6.63
16-Oct-20	DO (mg/L)	>6.0		8.34		
20-Oct-20	DO (mg/L)	>6.0				
21-Oct-20	DO (mg/L)	>6.0			7.01	7.31
27-Oct-20	DO (mg/L)	>6.0				
28-Oct-20	DO (mg/L)	>6.0			7.51	7.54
29-Oct-20	DO (mg/L)	>6.0				
7-Oct-20	Conductivity (µs/cm)			66		
8-Oct-20	Conductivity (µs/cm)				83	21
12-Oct-20	Conductivity (µs/cm)		39.2			
13-Oct-20	Conductivity (µs/cm)				87	22
16-Oct-20	Conductivity (µs/cm)			62		
20-Oct-20	Conductivity (µs/cm)					
21-Oct-20	Conductivity (µs/cm)				94	24
27-Oct-20	Conductivity (µs/cm)					
28-Oct-20	Conductivity (µs/cm)				97	28

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
		Distance from Reg Dam (Km)				
Date	Parameters (Unit)	Guideline				
29-Oct-20	Conductivity (µs/cm)					
7-Oct-20	Temperature (°C)			23.27		
8-Oct-20	Temperature (°C)				27.04	26.3
12-Oct-20	Temperature (°C)		24.5			
13-Oct-20	Temperature (°C)				25.52	25.52
16-Oct-20	Temperature (°C)			22.67		
20-Oct-20	Temperature (°C)					
21-Oct-20	Temperature (°C)				25.62	26.1
27-Oct-20	Temperature (°C)					
28-Oct-20	Temperature (°C)				24.92	25.1
29-Oct-20	Temperature (°C)					
7-Oct-20	Turbidity (NTU)			5.35		
8-Oct-20	Turbidity (NTU)				7.1	3
12-Oct-20	Turbidity (NTU)		5.71			
13-Oct-20	Turbidity (NTU)				7.41	3.83
16-Oct-20	Turbidity (NTU)			4.51		
20-Oct-20	Turbidity (NTU)					
21-Oct-20	Turbidity (NTU)				5.44	3.05
27-Oct-20	Turbidity (NTU)					
28-Oct-20	Turbidity (NTU)				4.52	3.29
29-Oct-20	Turbidity (NTU)					
12-Oct-20	TSS (mg/L)		6.2			
13-Oct-20	TSS (mg/L)				7.2	6.49
16-Oct-20	TSS (mg/L)			11		
12-Oct-20	BOD ₅ (mg/L)	<1.5	<1			
13-Oct-20	BOD ₅ (mg/L)	<1.5			<1	<1
16-Oct-20	BOD ₅ (mg/L)	<1.5		<1		
12-Oct-20	COD (mg/L)	<5.0	6.6			
13-Oct-20	COD (mg/L)	<5.0			11.2	8.2
12-Oct-20	NH ₃ -N (mg/L)	<0.2	<0.2			
16-Oct-20	NH ₃ -N (mg/L)	<0.2		<0.2		
12-Oct-20	NO ₃ -N (mg/L)	<5.0	<0.02			
16-Oct-20	NO ₃ -N (mg/L)	<5.0		<0.02		
12-Oct-20	Faecal coliform (MPN/100 mL)	<1,000	34			
13-Oct-20	Faecal coliform (MPN/100 mL)	<1,000			220	220
16-Oct-20	Faecal coliform (MPN/100 mL)	<1,000		220		
12-Oct-20	Total Coliform (MPN/100 mL)	<5,000	350			
13-Oct-20	Total Coliform (MPN/100 mL)	<5,000			280	220

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
		Distance from Reg Dam (Km)				
Date	Parameters (Unit)	Guideline				
16-Oct-20	Total Coliform (MPN/100 mL)	<5,000		350		
12-Oct-20	TKN		<1.5			
16-Oct-20	TKN			<1.5		
12-Oct-20	TOC (mg/L)		1.22			
13-Oct-20	TOC (mg/L)				1.18	2.12
16-Oct-20	Phytoplankton Biomass (g dry wt/m³)					
12-Oct-20	Total Phosphorus (mg/L)		0.01			
16-Oct-20	Total Phosphorus (mg/L)			<0.01		
12-Oct-20	Total Dissolved Phosphorus (mg/L)		<0.01			
16-Oct-20	Total Dissolved Phosphorus (mg/L)			0.02		

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: RESULTS OF CAMP EFFLUENTS IN OCTOBER 2020

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	06-Oct-20	19-Oct-20	06-Oct-20	19-Oct-20	06-Oct-20	19-Oct-20
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.93	6.48	7.84	7.43	7.54	7.33
Sat. DO (%)		50	46	52.4	26.8	66.4	63.8
DO (mg/L)		3.62	3.6	3.84	3.75	4.91	5.04
Conductivity (µs/cm)		306	316	250	419	808	743
TDS (mg/L)		153	158	125	209.5	404	371.5
Temperature (°C)		30.5	26.3	29.7	25.7	29.4	25.9
Turbidity (NTU)		2.7	2.92	5.39	7.16	16.58	14.24
TSS (mg/L)	<50	<5	<5	7.1	10.5	43.2	53.6
BOD ₅ (mg/L)	<30	6.39	10.62	<6	<6	<6	<6
COD (mg/L)	<125	<25	<25	<25	60	117	102
NH ₃ -N (mg/L)	<10.0	5	2	5.1	11.3	24.1	21.5
Total Nitrogen (mg/L)	<10.0	7.39	5.41	6.2	12.8	53.6	22
Total Phosphorus (mg/L)	<2	1	1	0.54	1.21	5.64	6.59
Oil & Grease (mg/L)	<10.0	<1		<1		<1	
Total coliform (MPN/100 mL)	<400	540	240	0	0	0	0
Faecal Coliform (MPN/100 mL)	<400	27	14	0	0	0	0
Effluent Discharge Volume (L/mn)		6	6	3	4	1000	1900
Chlorination Dosing Rate (mL/mn)		n/a	n/a	32	28	225	475
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.42	0.88	1.10	1.28