NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

July 2018

A	21 August 2018		Peter G JENSEN	Vilayhak SOMSOULIVONG	
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TABLE OF CONTENTS

BBREVIATIONS / 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
ECOCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGATi	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
PvPA	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

The Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) reviewed and cleared two Site Specific Environmental and Social Management and Monitoring Plans (SS-ESMMPs) in July 2018.

The monthly inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was rescheduled to August 2018, and the quarterly site visit by the EMU of Xaysomboun Province will be carried out in August 2018 as planned.

The July 2018 effluent monitoring results of the wastewater treatment plants at the camps confirmed that BOD5 and COD comply with the relevant effluent standards, except at two camps. The results also show that six out of 11 camps did not comply with the standard for total coliform bacteria. Most of the camps except Kenber struggle with compliance with total nitrogen and ammonia nitrogen. With the completion of the RCC placement work at the Man Dam, the production at the Aggregate Crushing Plant and the RCC plant has ended resulting in no water discharge from these plants in July 2018.

The surface water quality monitoring for July 2018 indicates that the level of dissolved oxygen in the station at the main dam has decreased due to decay of biomass after the impounding of the main reservoir, which was started on 15 May 2018.

In July 2018, a total of 181 m3 solid waste was disposed of at the NNP1 Project Landfill, an increase of 21 m3 compared to June 2018; and a total of 1,426 kg of recyclable waste was sold to Khounmixay Processing Factory. Only 35 m3 of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill.

NNP1PC submitted a revised Lao translation of the NNP1 Watershed Management Plan to Xaysomboun and Bolikhamxay Watershed and Reservoir Protection Offices (WRPOs) at the end of July 2018 for final review. It is expected that the plan will be approved by the Chairman of the Watershed and Reservoir Protection Committee and ADB in August 2018.

The EMO and its biodiversity expert continued to further improve the draft NNP1 Biodiversity Offset Management Plan for Nam Chouane-Nam Xang biodiversity offset site before submission of the plan to the Biodiversity Offset Management Committee (BOMC) and ADB. The Bolikhamxay Provincial Department of Justice has reviewed the draft provincial biodiversity management regulations and after addressing the comments of the department, the regulations were submitted to the Provincial Administration Office and the Provincial Assembly for approval.

NNP1PC has contracted a contractor to carry out removal of floating debris in the main reservoir. The work is expected to start by the middle of August 2018.

The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in Nam Ngiep River was 1.6 kg/household/day in June 2018. Around 35 % of the catch was sold, 56 % was consumed fresh, 7 % was processed and approximately 2 % was used for other purposes.

1. INTRODUCTION

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

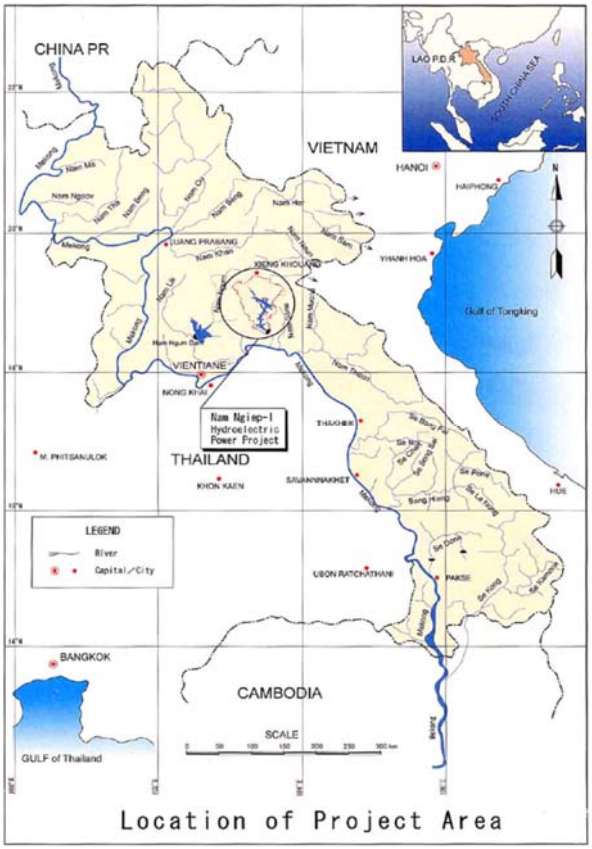


Figure 1-1: Location Map

The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikhan 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.

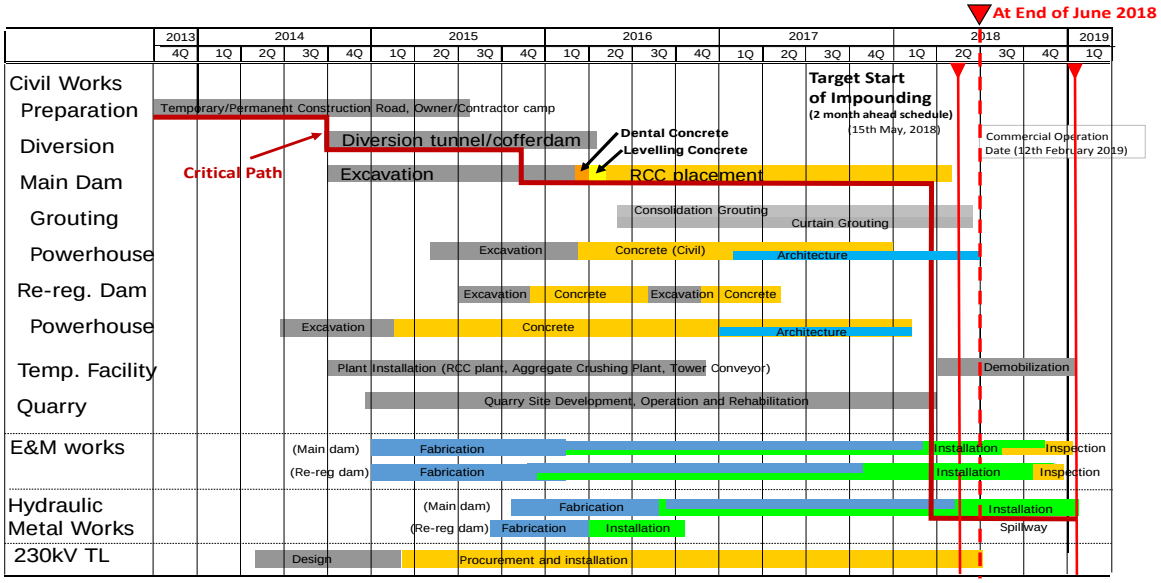
2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction Works for the Project are being 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. Actual overall cumulative work progress until the end of June 2018 was 96.2 % (compared to planned progress of 97.5 %), based on achieved Interim Milestone Payments for all Contracts

excluding the value of Advance Payments, varied works and other adjustments allowed under each Contract. In terms of the value of actual work done the percentage is understated since work completed, but not paid, is not included.

The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in *Error! Reference source not found.*.

Figure 2-1: Overall Construction Schedule



2.1 Civil Work

The Civil Works Contract was executed between Obayashi Corporation and the Nam Ngiep 1 Power Company on 30 September 2013 and the NTP was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam were commenced in October 2014 and completed in February 2016, following which the concreting works were commenced.

The cumulative actual work progress of the Civil Works until the end of June 2018 was 97.9 % (compared to planned progress of 98.7 %) calculated in the same manner as described above for the value of achieved Interim Milestone Payments excluding advance payment.

2.1.1 Main dam and power house

After starting the main dam excavation works in October 2014 on the left bank, the works were about one month advanced when diversion of the Nam Ngiep River was achieved at the end of October 2015. However, excavated volumes were 20% greater than expected and part of this additional work is necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following the efforts on Site, the additional excavation work was completed at the end of February 2016.

Figure 2-2: Main Dam and Powerhouse from Overhead Looking Upstream

The consolidation drilling and grouting for the main dam started in May 2016 and was completed in June 2018.

Table 2-1: Progress of consolidation and curtain drilling for grouting at the end of June 2018

Item	Description	Total Drilling (m)	Completed (m)	Progress (%)
Consolidation Grouting	Anticipated Quantity	17,769	17,769	100
Curtain Grouting	Original Design Quantity	27,945	58,400	209
	Anticipated Final Quantity	58,400	58,400	100

*The linear metres 'completed' are drilled and grouted.

Main powerhouse sub-structure excavation works were completed in January 2016 and levelling concrete works were started in coordination with installation of the grounding system and the penstock concrete encasement. Major concrete of the main powerhouse was substantially completed in December 2017 and Progress of the powerhouse concreting works is shown in ***Table 2-2*** below. Dam control centre works and oil pit works are ongoing in June 2018.

Table 2-2: Progress of Main Powerhouse Sub-Structure Concrete Works to as of the end of June 2018.

Location	Total Anticipated Volume (m^3)	Completed (m^3)	Progress (%)
Main Powerhouse	34,800	34,650	99
Penstock Embedment	11,885	11,885	100
Spillway	35,500	29,500	83

2.1.2 Re-regulation dam and powerhouse

The re-regulation powerhouse excavation and cofferdam works for river diversion were commenced in early October 2014. The excavation works for the powerhouse on the left bank were fully completed down to El. 146.7 m at the end of February 2015.

Structural concrete works were commenced in March 2015, in coordination with installation of the grounding system. The progress of structural concrete works is shown in ***Figure 2-3*** below

Figure 2-3: Completed Re-regulation Dam and Powerhouse at the End of June 2018

2.1.3 Temporary work facility

2.1.3.1 DIVERSION TUNNEL INLET AND OUTLET

The diversion tunnel works which is over 600 m in length and 10 m in diameter were commenced in October 2014 by drill and blast techniques and completed in late September

2015. The river diversion took place on 31 October 2015 together with construction of earth-fill cofferdams upstream and downstream.

2.1.3.2 SECONDARY UPSTREAM COFFERDAM

The concrete placement works in both conventional and roller compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed ahead of construction schedule in the middle of February 2016. The grout curtain works were completed on 02 April 2016.

2.1.3.3 PLANT YARDS

These comprise the Aggregate Crushing Plant, the CVC Batching Plant and the RCC Batching Plant.
Foundation work and installation of equipment were completed at all the plant yards and the belt conveyor system from the RCC plant to the main dam was completed in early April 2016.

2.1.3.4 QUARRY

After removal of overburden the excavation of raw materials for aggregate crushing were started in July 2015. The nature and type of the rock being exploited is acceptable though unsuitable soil layers are removed to spoil disposal areas, and good quarry management continues.

2.1.3.5 DISPOSAL AREAS

The disposal area on the right bank has been available for operation since January 2015, as was the adjacent waste disposal area. The Disposal Area No.9 along Road P1 near the entrance of Road T5 started operation in April 2015. Unsuitable material from the quarry continues to be hauled to Disposal Area No.6 and Disposal Area No.9 is being developed by the E&M Contractor as stated above.

2.2 Electrical and Mechanical Works

The EMWC was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the NTP was issued on 03 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of June 2018 was 98.3 % (compared to planned progress of 98.3 %).

Figure 4.2-7: Lowering and Installing Lower Cooling Coil for Unit 2

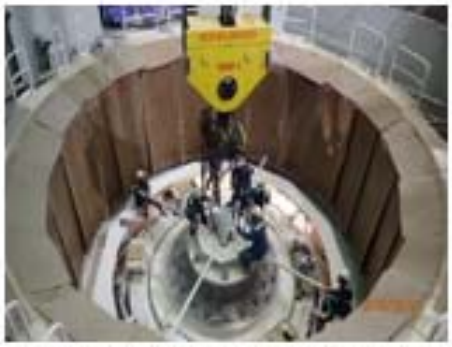


Figure 4.2-8: Run-out Check for Coupling Main Shaft and Lower Shaft for Unit 2

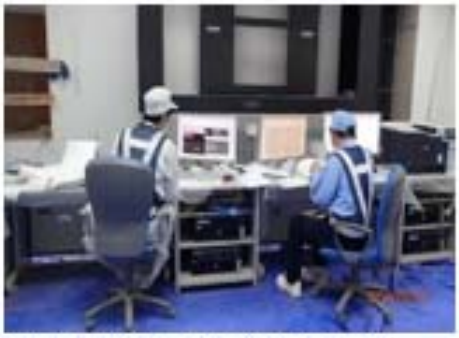


Figure 4.2-9: Commissioning Tests of SCADA System Interface to Remote Control Panels

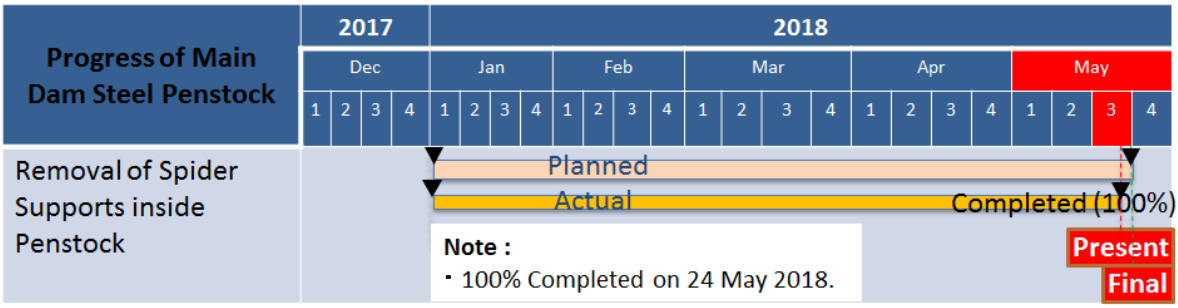
Figure 4.2-10: Dielectric Strength Test for 16.5 kV Disconnecting Switch for Unit 1 & 2

Figure 4.2-11: Installation of Generator Main Lead along Access Shaft

Figure 4.2-12: Inspection of Generator Air Gap between Rotor and Stator

2.3 Hydro-Mechanical Works

The HMWC was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 03 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of June 2018 was 68.8 % (compared to planned progress of 79.1 %). The main activities carried out during this month are described below:



2.4 230kV Transmission Line Works

The TLW Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Contractor on 03 October 2014. The cumulative work progress of the Transmission Line Works until the end of June 2018 was 100 % (compared to planned progress of 100 %).

In respect of the delay to commencement of most works the Contractor is studying its programme to ensure that sufficient resources are committed as the works progress to ensure that completion is achieved in good time. Onset of daily rains has made access to all areas difficult but the Contractor follows its revised acceleration schedule, after the progress for the construction of tower foundations slowed after May, 2016 (See ***Figure 2-4*** below)

Figure 2-4: Cumulative Work Progress of Tower Foundation (Original, Revised Planned and Actual)

Figure 2-5: Revised Cumulative Work Progress of Tower Erection (Planned and Actual)

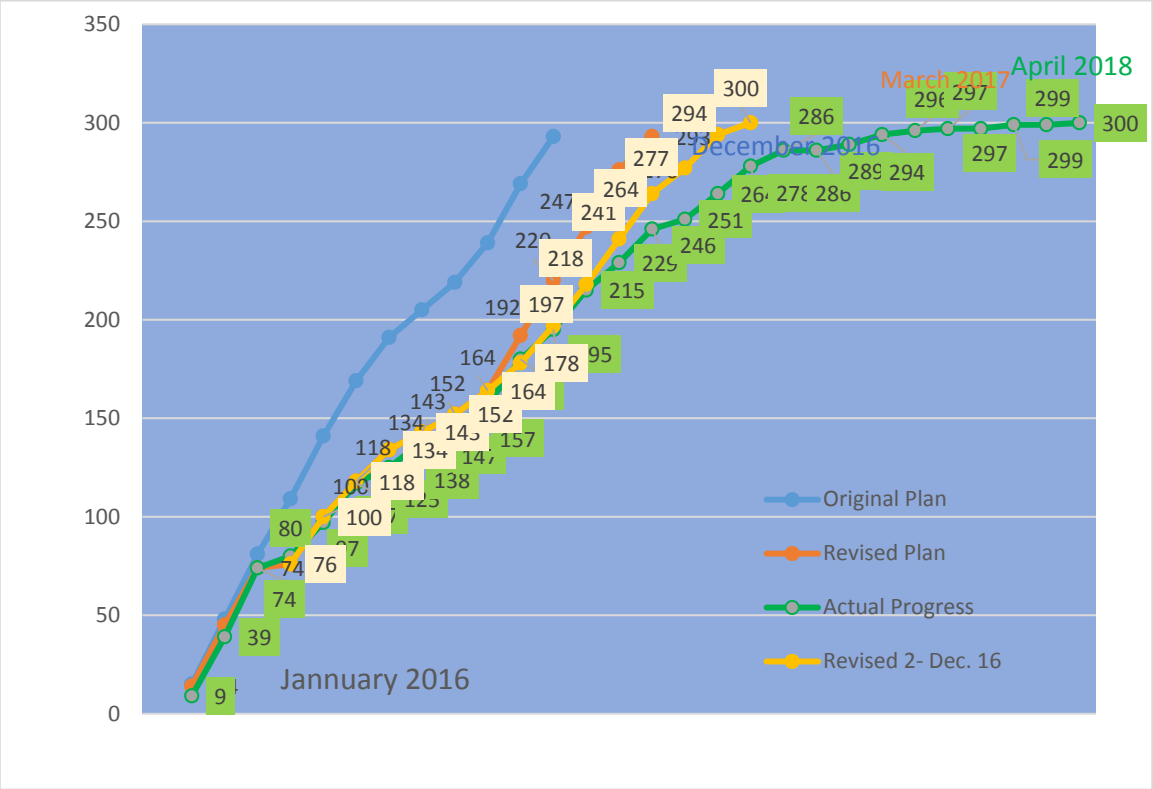


Figure 2-6: Cumulative Progress of Stringing Works (Planned & Actual)

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 Compliance Management

3.1.1 Site Specific Environmental and Social Management and Monitoring Plans

Three SS-ESMMPs carried over from February and March 2018 were under review, and EMO cleared the Site Decommissioning Plan (2nd revision) for the TCM camp and the SS-ESMMP for rock excavation of the irrigation canal at Phouhomxay Village.

Table 3-1: SS-ESMMP review status in July 2018

Title	Date Received	Status
Site Decommissioning Plan (TCM Camp)	27 June 2018 (2nd submission)	No objection with comments on 12 July 2018
SS-ESMMP for Rock Excavation for irrigation canal at Phouhomxay Village	13 July 2018 (1st submission)	No objection with comments on 25 July 2018
SS-ESMMP for Closing of Borrow Pit No. 7	03 February 2018 (Reply to Owner's comment)	Under review
SS-ESMMP for Closing of Borrow Pit at the Corner of Road P1 and P1A	03 February 2018 (Reply to Owner's comment)	Under review
SS-ESMMP for the Quarry	17 March 2018 (Version A6)	Under review

3.1.2 Compliance Report

The status of compliance reports (Observation of Non-Compliance, ONC, Non-Compliance Report, NCR) issued by NNP1PC to the contractors is summarized in ***Table 3-2***, ***Table 3-3*** and ***Table 3-3*** below.

Table 3-2: Summary of ONC and NCR

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from June 2018	07	0	01	0
Newly Opened in July 2018	04	01	0	0
Total in July 2018	**11**	**01**	**01**	**0**
Resolved in Julye 2018	05	0	01	0
Carried over to August 2018	06	01	0	0
Unsolved Exceeding Deadlines	**04**	**0**	**0**	**0**

Table 3-3: Carried-Over ONC and NCR from July 2018 into August 2018

Site ID	Issues	Reporting	Actions
Re-regulation Dam (Borrow Pit Area at Corner of P1 & P1A Road)	The borrow pit slopes had no berm and cut-off drains. Lack of closure plan for the borrow pit (ONC_OC-0232). First inspection: 30 August 2016 Latest inspection: 15 February 2018	ONC (Closure Pending)	Under review and expected to be cleared in August 2018
Main Quarry Site	The revised DWP & SSESMMP submitted on 16 March 2018 did not fully address EMO's comments on erosion control and site decommissioning (ONC_OC-0273). First inspection: 13 February 2018 Latest inspection: 05 May 2018	ONC (Closure Pending)	Under review and expected to be cleared in August 2018.
RCC Plant Yard	Septic tanks next to the RCC plant's laboratory was full causing overflow of black water (ONC_OC-0285). First inspection: 26 June 2018	ONC (Closure pending)	The contractor was instructed to Immediately stop the release of black water and empty the septic tanks and dispose the content by following NNP1PC's Standard Operating Procedure
Sino Hydro Workers' Camp at the Aggregate Crushing Plant	- Poor storage of hazardous material; - No clean-up of oil spillage:(ONC_OC-0287). First inspection: 10 July 2018 Latest Inspection: 24 July 2018	ONC (New)	The contractor was instructed to implement the following actions by 07 August 2018: - Clean up oil spills with dry sand and arrange for proper storage and disposal of the contaminated material. stored inside hazardous storage area at Sino Hydro main camp for proper elimination; - Repair the roof of hazardous storage area; - Provide trays to collect oil drips from machinery

Site ID	Issues	Reporting	Actions
V&K Camp	Leakage of black water leaking from the underground septic tanks (ONC_OC-0288). First inspection: 24 July 2018	ONC (New)	The contractor was instructed to take the following actions by 01 August 2018: - Repair the septic system stop the leakage; - Empty the septic tanks and dispose the sewage by following the procedures for sewage disposal.
V&K Camp	Ineffective oil trap at the storage facility resulting in oil leakage to the ground; First inspection: 24 July 2018	ONC (New)	The contractor was required to clean-up the contaminated soil and arrange for proper disposal; and to clean-up oil-water mixture in the oil trap and modify the oil trap piping system. Deadline 01 August 2018
KENBER Camp (Workshop)	A total of 1,600 litres of used oil unaccounted for at the Kenber contractor's storage area without notifying NNP1PC-EMO (NCR_OC-0024). First inspection: 10 July 2018	NCR-1 (New)	The contractor was required to document transportation and disposal of the unaccounted waste oil; and to train and instruct the staff on proper management of hazardous waste. Deadline 03 August 2018

Figure 3-1: Site Inspection Locations

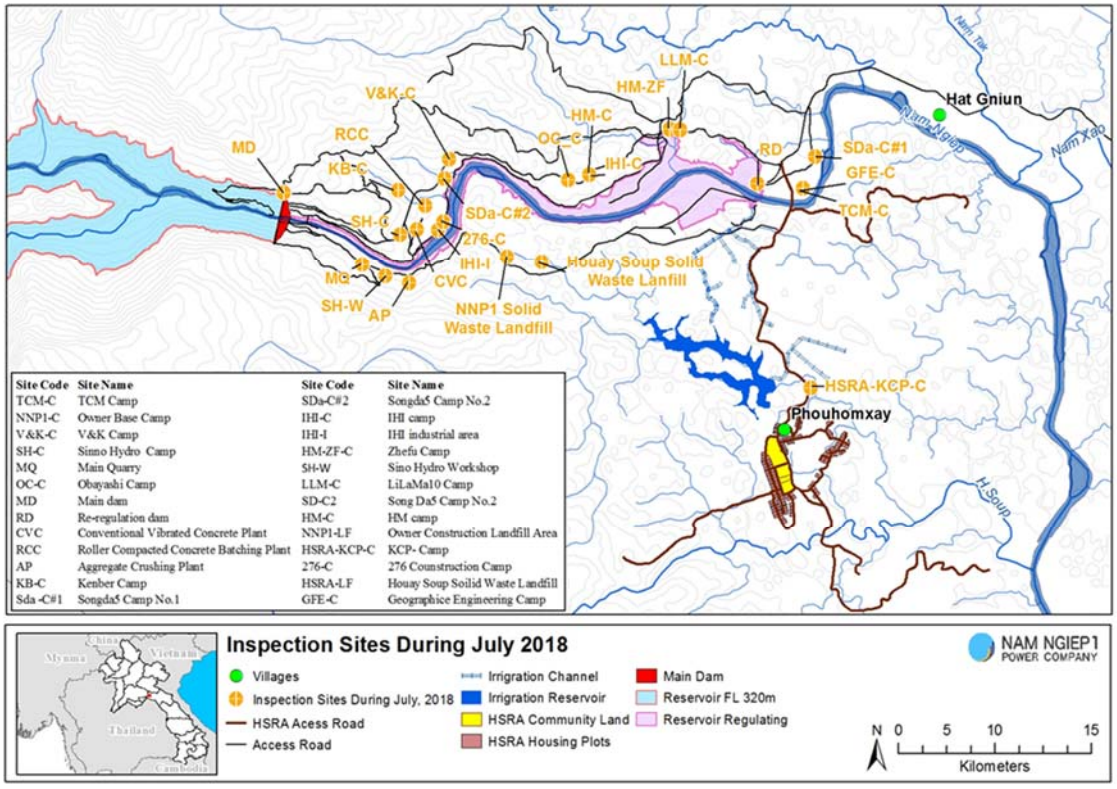
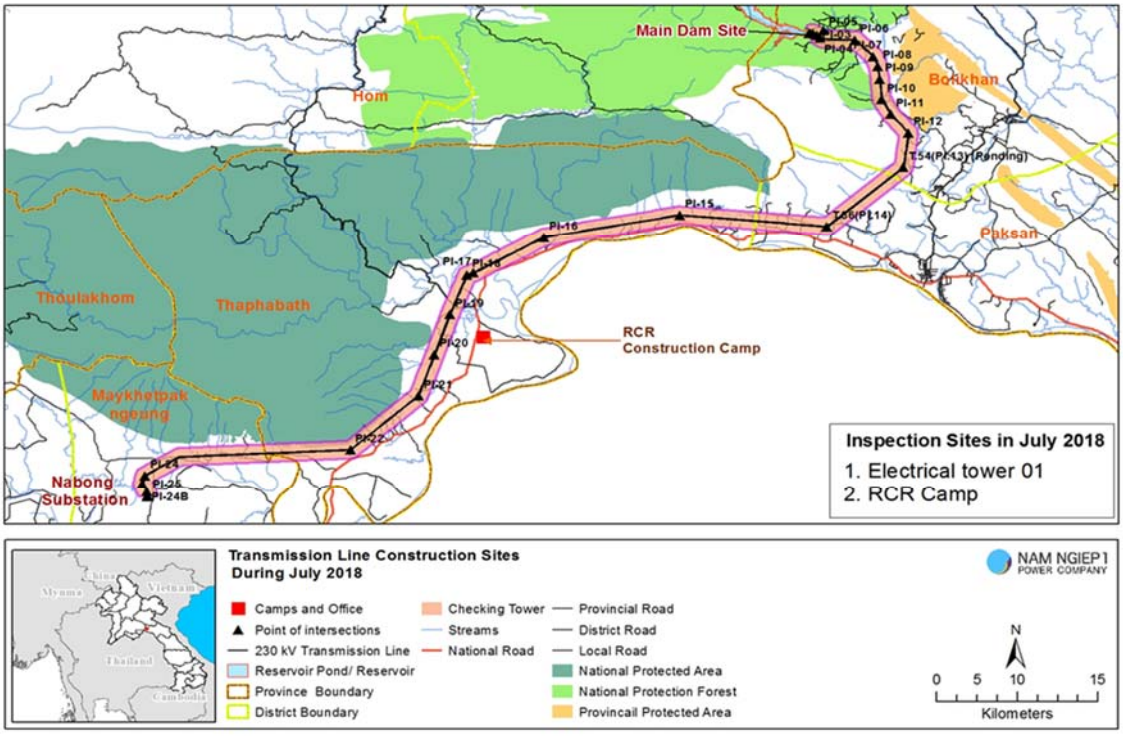


Figure 3-2: 230 kV Transmission Line Construction Monitoring



3.1.3 Inspection by Environment Management Unit

The monthly inspection from the Environmental Management Unit (EMU) of Bolikhamxay Province was rescheduled to August 2018. The quarterly site visit by the EMU of Xatsomboun Province will be carried out in August 2018.

3.2 Environmental Quality Monitoring

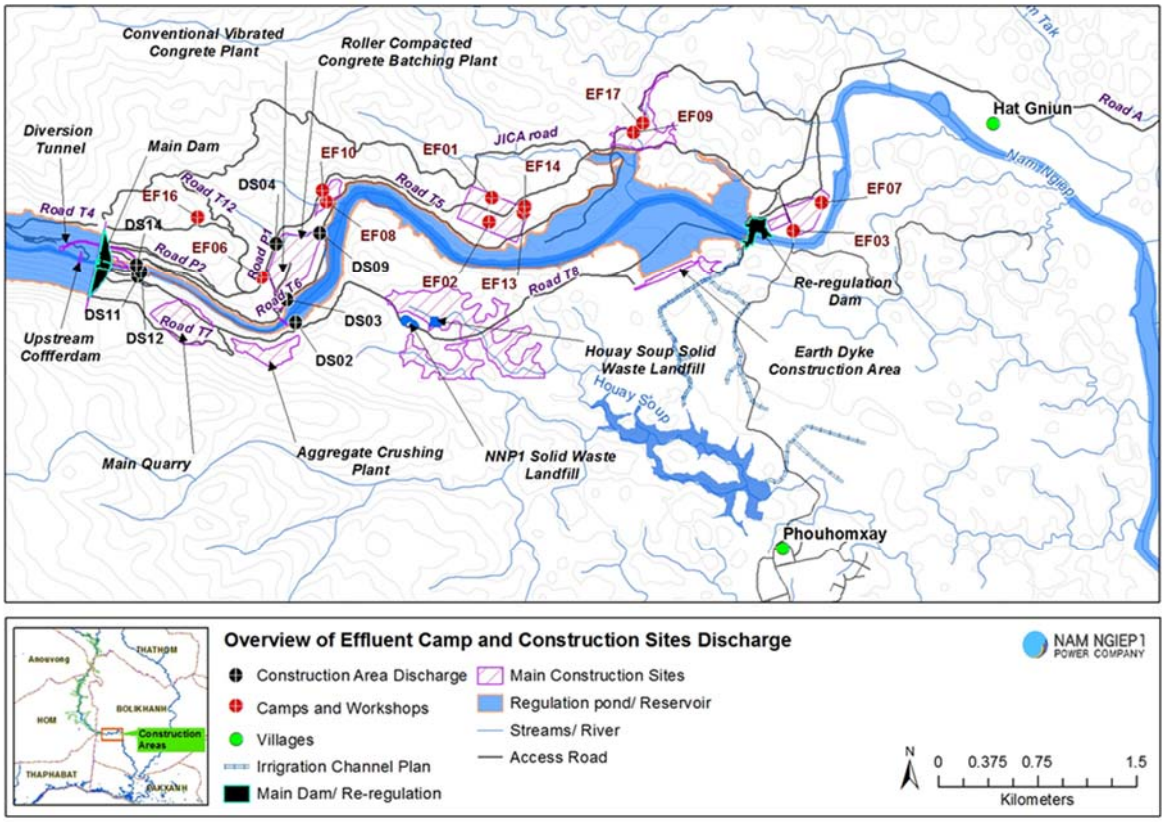
The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD5), faecal coliform, E. Coli bacteria and total coliform have been carried out by NNP1PC Environmental Laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) and the Project Lenders on a monthly and quarterly basis and published on the Company website https://namngiep1.com/resources/monitoring-reports/.

3.2.1 Effluent Discharge from Camps and Construction Sites

The results of effluent monitoring of the camps and the construction sites are presented in ***Table 3-4*** and the monitoring locations are displayed in ***Figure 3-3***.

Figure 3-3: Map of Effluent Discharge Monitoring Locations



Detailed monitoring results are provided in Annex B of this Report. The effluent monitoring results for the camps in July 2018 indicate that the measurements of BOD5 and COD comply with the relevant effluent standards, except at HMH Main camp and IHI camps (for 02 and 16 July 2018). The total coliform counts have exceeded the standard in six out of 11 camps (Owner's Site Office and Village, Obayashi, Zhefu, HM Hydro, IHI and Lilama10). Most of the camps except Kenber struggle with compliance with total nitrogen and ammonia nitrogen.

Following the completion of the RCC placement work at the Main Dam, the production at the aggregate crushing plant and the RCC plant has stopped and the associated sediment retention ponds are therefore no longer in operation.

Table 3-4: Status of Corrective Actions at Camps and Construction Sites

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Non-compliance for total nitrogen and total coliform	The effluent monitoring result is being shared with TD to improve the operation of the WWTS
Obayashi Corporation Camp	EF02	Non-compliance for ammonia nitrogen (NH_3-N), total nitrogen and total coliform. However, the total coliform was back to compliant with the standard on 16 July 2018	The effluent monitoring result is being shared with TD and the contractors to improve the operation of the WWTS
Sino Hydro Camp	EF06	Non-compliance for total nitrogen on 16 July 2018	As above
Song Da 5 Camp No. 1	EF07	Non-compliance for ammonia nitrogen (NH_3-N) and total nitrogen	As above
Song Da 5 Camp No. 2	EF08	Non-compliance for ammonia nitrogen, total nitrogen and total phosphorus	As above
Zhefu Camp (Subcontractor of Hitachi-Mitsubishi Hydro)	EF09	Non-compliance for total coliform, NH_3-N and total nitrogen. However, total coliform was back in c compliance on 16 July 2018	As above
V&K Camp	EF10	Non-compliances for total nitrogen on 16 July 2018	As above
HMH Main Camp (WWTS)	EF13	Non-compliance for BOD_5, COD, NH_3-N, total nitrogen, total coliform and total phosphorus	As above
IHI Main Camp	EF14	Non-compliance for TSS, BOD_5, COD, NH_3-N, total nitrogen, total coliform and total phosphorus. However, total coliform was back in compliance on 16 July 2018	As above
Kenber Camp	EF16	Full compliance with the standards	As above
Lilama10 Camp	EF17	Non-compliances for ammonia nitrogen, total nitrogen and total	As above

Site	Sampling ID	Status	Corrective Actions
		coliform. However, ammonia nitrogen and total nitrogen were back in compliance on 16 July 2018.	
Main Dam Construction Area (Waste Water Treatment Plant No.1)	DS11	No discharge during the missions.	The Treatment plant has been decommissioned
Main Dam Construction Area (Waste Water Treatment Plant No.2)	DS12	No discharge during the missions	The Treatment plant has been decommissioned
Main Dam Construction Area (Waste Water Treatment Plant No.3)	DS14	Non-compliance for TSS on 18 July 2018.	The Treatment plant has been decommissioned
Spoil Disposal Area No.2 (Song Da 5 Workshop)	DS04	Non-compliance for TSS in July 2018.	
CVC Plant	DS03	No discharge during the missions	The site will be monitored until site rehabilitation is completed
RCC Plant (discharge point at the weirs)	DS09	No discharge during the missions	The site will be monitored until site rehabilitation is completed
Aggregate Crushing Plant	DS02	No discharge during the missions	The site will be monitored until site rehabilitation is completed

3.2.2 Ambient Surface Water Quality Monitoring

The ambient surface water quality monitoring programme comprises 5 monitoring stations in the main reservoir (R1-R5), 2 stations in the re-regulation reservoir (R6 and R7), 5 stations in the main stream Nam Ngiep (NNG01, and NNG05-NNG08) and 4 stations in the main tributaries to Nam Ngiep (Nam Chiane, Nam Phouan, Nam Xao and Nam Houay Soup).

Table 3-5: Monitoring Frequency for Surface Water Quality Parameters

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Tuesdays and Saturdays	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C) and Turbidity (NTU)	- R5, main reservoir immediately upstream the main dam; - NNG05, Nam Ngiep downstream the re-regulation dam at Hat Gniun Village
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS (mg/l), BOD_5 (mg/l), Faecal coliform (MPN/100 ml) and Total coliform (MPN/100 ml)	- Main Reservoir: R3, R4, R5 - Re-regulation Reservoir: R6, R7 - Nam Ngiep downstream: NNG05 - Tributaries: NPH01, Nam Phouan
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/l), BOD_5 (mg/l), COD (mg/l), NH_3-N (mg/l), NO_3-N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All stations

The monitoring results for key parameters (dissolved oxygen, Total Suspended Solids and BOD) since the start of impounding are presented in ***Table 3-6, Table 3-7, and Table 3-8*** and the full set of data for July 2018 is attached in Annex A. In addition, the results for dissolved oxygen are presented as line graphs in ***Figure 3-4***.

The surface water quality data for July 2018 indicates that the levels of dissolved oxygen (DO) at R5 immediately upstream the main dam is affected by decay of biomass following the impounding of the main reservoir, which started on 15 May 2018. After the start of impounding, the DO levels in R5 have fluctuated between 2.26 mg/L and 6.42 mg/L. DO concentrations in R3 and R4 (upstream main dam 13 km and 21 km respectively) were above 8 mg/L over the same period. The DO measurements in R6 and R7 (re-regulation reservoir) have shown values from 6.55 mg/L to 9.89 mg/L and the DO in NNG05 downstream the re-regulation dam has remained above 7 mg/L.

A more in-depth analysis of the data will be included in the quarterly environment monitoring reports.

Figure 3-4: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations

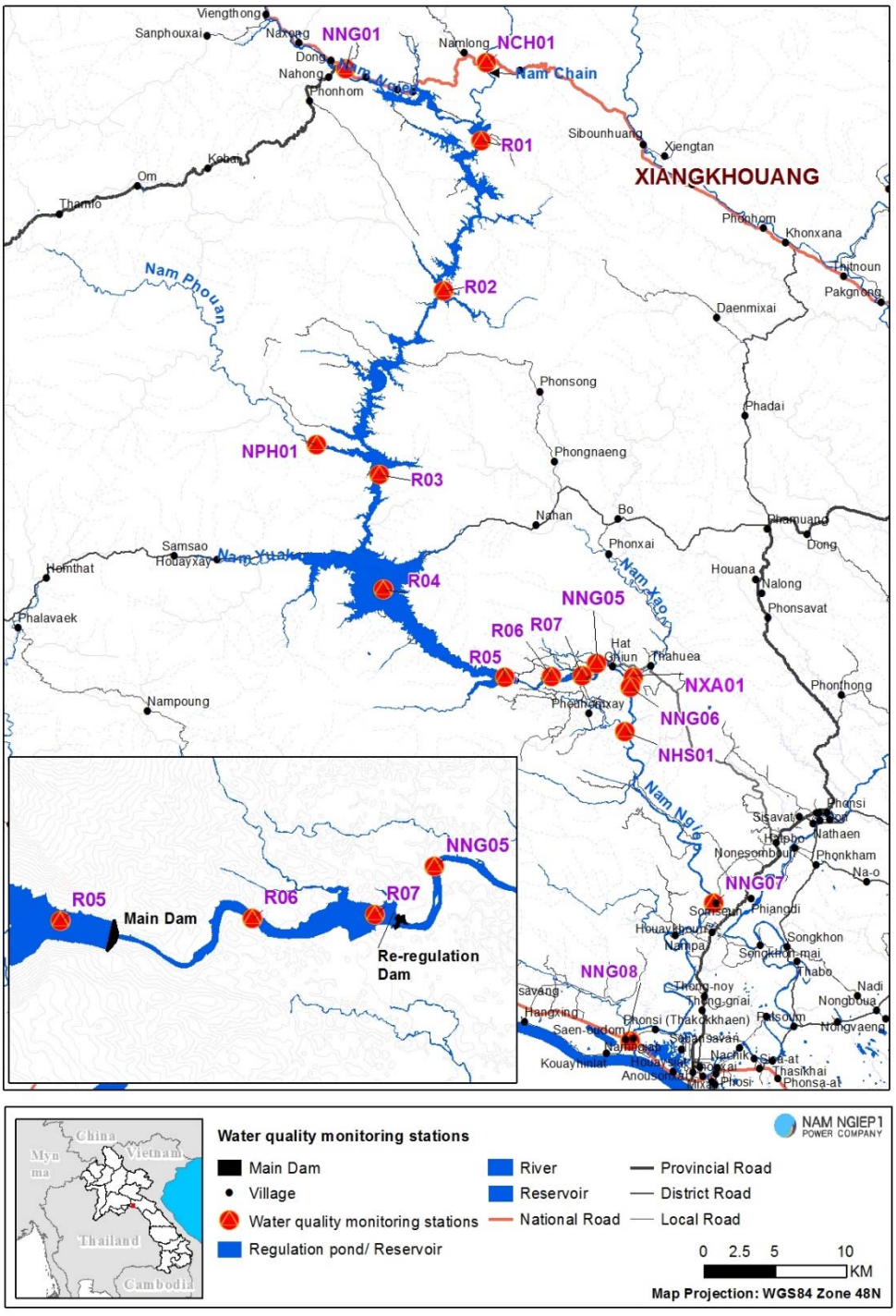


Figure 3-5: Concentration of Dissolved Oxygen since the Start of Impounding

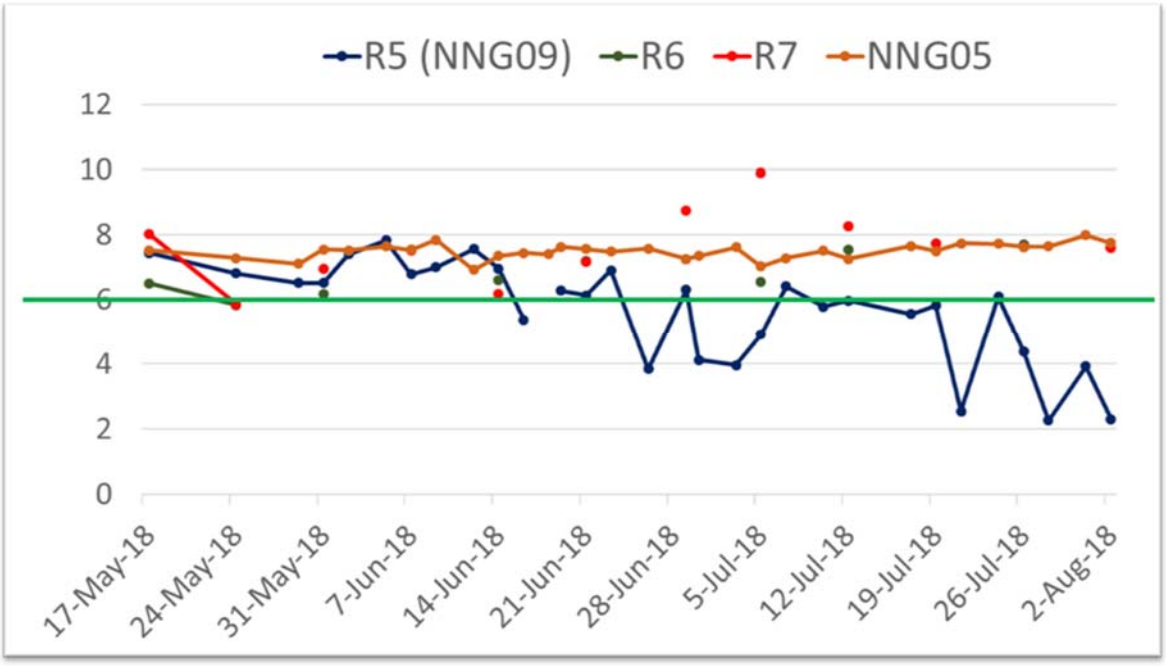


Table 3-6: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) - Water Quality Standard: > 6.0 mg/L

Dissolved Oxygen (mg/L)	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
15-May-18		7.64	7.69									8.01		
16-May-18	7.43										8.47			
17-May-18				7.44	6.51	8.04	7.53	6.81	7.13	8.26			5.85	
24-May-18				6.82	5.84	5.87	7.29							
29-May-18				6.52			7.11							
31-May-18				6.52	6.18	6.95	7.55							
02-Jun-18				7.41			7.52							
05-Jun-18	7.35			7.83			7.64				8.11			
07-Jun-18				6.79	7.54	7.53	7.54	6.86	6.65	6.67			6.82	7.18
09-Jun-18				7.01			7.85							
12-Jun-18		7.43	8.45	7.57			6.92					7.74		
14-Jun-18				6.97	6.6	6.19	7.35							
16-Jun-18				5.39			7.44							
19-Jun-18	7.21	7.22	9.75	6.28			7.63				8.07	7.87		
21-Jun-18				6.14	7.21	7.18	7.57	7.37	6.21	6.98			7.42	7.22
23-Jun-18				6.91			7.49							
26-Jun-18		6.93	6.98	3.85			7.58					8.22		
29-Jun-18				6.31	7.24	8.74	7.26							
30-Jun-18				4.13			7.35							
03-Jul-18	7.68	8.98	8.29	3.96			7.62				7.93	7.39		

Dissolved Oxygen (mg/L)	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
05-Jul-18				4.91	6.55	9.89	7.03	7.03	6.64	6.95			7.05	6.95
07-Jul-18				6.42			7.28							
10-Jul-18			8.27	5.78			7.51							
12-Jul-18				5.97	7.55	8.28	7.26							
14-Jul-18				5.85			7.71							
17-Jul-18	7.7			5.56			7.66				7.89		7.42	7.82
19-Jul-18				5.83	7.73	7.74	7.5	7.45	6.69	7.1			7.42	7.82
21-Jul-18				2.55			7.74							
24-Jul-18		8.12	8.08	6.1			7.72					7.94		
26-Jul-18				4.4	7.71	7.62	7.63							
28-Jul-18				2.26			7.65							
31-Jul-18				3.93			8.00							

Table 3-7: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L) - Water Quality Standard: No Standard

Total Suspended Solids (mg/L)	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
16-05-18	601.0										50.6			
17-05-18				58.4	25.9	22.1	43.2							
24-05-18				8.5	12.4	9.0	9.0							
31-05-18				3.5	20.9	24.1	56.6							
05-06-18	242.5										26.7			
07-06-18				3.5	6.4	7.5	14.2	12.2	43.0	18.4			7.1	14.1
12-06-18		102.8	10.3									282.3		
14-06-18				6.1	20.1	29.1	49.3							
21-06-18				3.5	127.3	68.3	143.5							
29-06-18				3.5	15.5	23.4	36.1							
03-07-18	115.8	8.3	3.5								13.6	26.5		
05-07-18				3.5	500.8	27.6	42.3	21.4	22.8	7.9			11.3	17.6
12-07-18				3.4	59.1	51.6	50.3							
19-07-18				7.7	22.3	16.8	65.1							
26-07-18				2.5	21.0	24.3	108.4							

Table 3-8 ***Results of Surface Water Quality Monitoring for BOD5 (mg/L) - Water Quality Standard: < 1.5 mg/L***

BOD_5 (mg/L)	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
10-May-18				<1.0	<1.0	1.31	<1.0							
17-May-18				<1.0	<1.0	<1.0	<1.0							
24-May-18				1.36	<1.0	<1.0	<1.0							
31-May-18				<1.0	<1.0	<1.0	<1.0							
05-Jun-18	<1.0										<1.0			
07-Jun-18				1.75	1.02	1.08	<1.0	1.07	1.06	<1.0			1.01	1.8
12-Jun-18		<1.0	3.64									<1.0		
14-Jun-18				2.03	1.01	<1.0	<1.0							
21-Jun-18				1.89	<1.0	1.27	<1.0							
03-Jul-18	<1.0	3.28	2.15								<1.0	<1.0		
05-Jul-18				1.53	<1.0	1.23	1.03	<1.0	<1.0	<1.0			<1.0	<1.0
19-Jul-18				1.81	1.07	1.43	<1.0							

3.2.3 Groundwater Quality Monitoring

During July 2018, groundwater quality analyses were carried out for four water-wells located in Somseun Village, Nam Pa Village, Thong Noi Village and Pou Village. The six-community water-wells at Phouhomxay Village have been permanently replaced with a gravity fed water supply system and have therefore not been monitored.

All results complied with the groundwater quality standards for water supply purposes except for two wells (GSXN01 in Somseun Village and GPOU01 in Pou Village), which exceeded the standard with respect to faecal coliform and Ecoli bacteria. The monitoring results were shared with ESD-SMO as part of NNP1PC public health programme.

Figure 3-6: Groundwater Quality Monitoring Locations

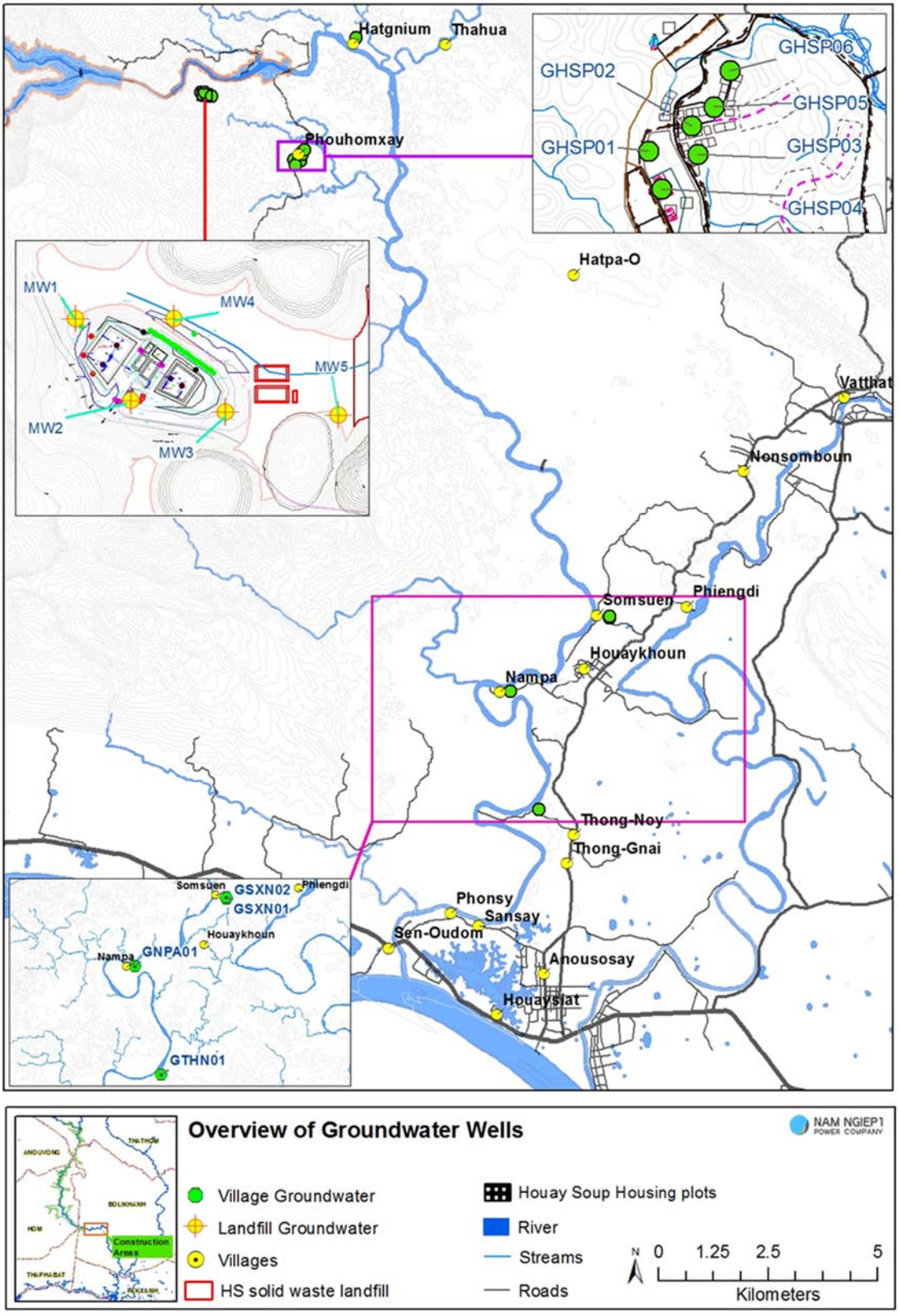


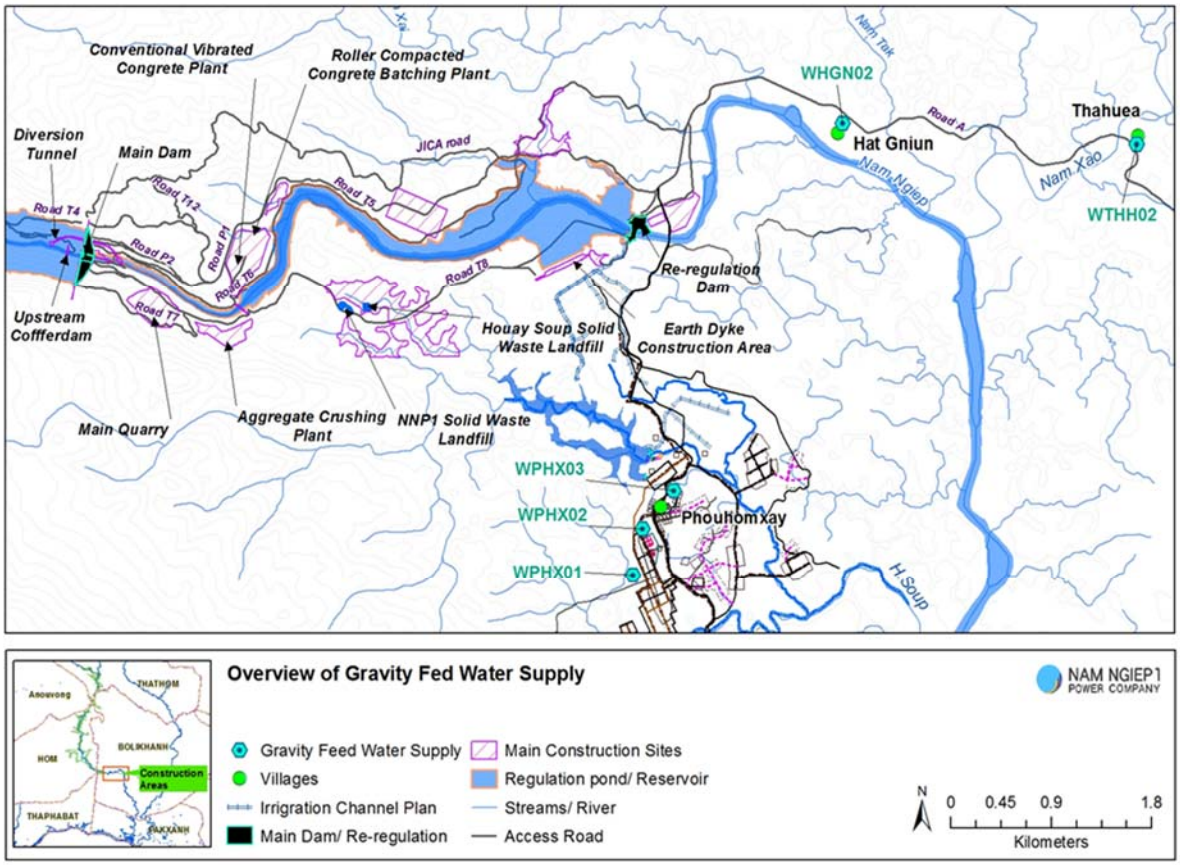
Table 3-9: Groundwater Quality Monitoring Results, Somsuen, Nam Pa, Thongnoi and Pou Villages

	Site Name	Somseun Village		NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GSXN02	GNPA01	GTHN01	GPOU01
Parameter (Unit)	Guideline					
pH	6.5 - 9.2	6.94	This borehole was connected with GSXN01 since June 2018	7.02	6.91	6.31
Sat. DO (%)		80.9		82.2	77.2	78.2
DO (mg/l)		6.15		6.28	5.81	6.07
Conductivity (µS/cm)		344		292	308	15.78
TDS (mg/l)		172		146	154	7.5
Temperature (°C)		28		27.7	28.5	25.7
Turbidity (NTU)	<20	0.66		1.61	1.79	14.14
Fecal coliform (MPN/100ml)	0	2		0	0	9.3
E.coli Bacteria (MPN/100ml)	0	2		0	0	9.3
Arsenic (mg/)	<0.05	0.0005		<0.0003	<0.0003	<0.0003
Total Iron (mg/l)	<1	<0.010		<0.010	0.98	0.308
Magnesium (mg/l)		4.26		2.47	4.35	0.242
Manganese (mg/l)	<0.5	<0.005		<0.005	<0.005	<0.005
Fluoride (mg/l)	<1					0.65
Total hardness (mg/l)	<500	203		152	171	14.6
Nitrate (mg/l)	<45	0.66		1.64	1.68	0.66
Nitrite (mg/l)	<3	<0.02		<0.02	<0.02	<0.02
Lead (mg/l)	<0.05	<0.008		<0.008	<0.008	<0.008

3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During July 2018, water samples from water taps at Thahuea Village, Hat Gniun Village and Phouhomxay Village were analysed.

Figure 3-7 Gravity Fed Monitoring Locations



The results of the water quality analyses are presented**.** All parameters complied with the National Drinking Water Standards except for faecal coliforms and E.Coli. According to the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, domestic water supply for daily use should be boiled or otherwise treated before drinking. The villagers were informed about the results and encouraged to boil the water before drinking.

Table 3-10: Result Gravity Fed Water Supply (GFWS) Quality Monitoring

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
11-Jul-18	pH	6.5 - 8.6	6.69	6.93	8.43	7.59	6.85
11-Jul-18	Sat. DO (%)		95.3	96.1	98.3	95.5	91.7
11-Jul-18	DO (mg/l)		7.11	7.3	7.61	7.3	6.93
11-Jul-18	Conductivity (µS/cm)	<1,000	43.2	65.2	14.94	8.66	8.34
11-Jul-18	TDS (mg/l)	<600	21.5	32.5	7.4	4.33	4.1
11-Jul-18	Temperature (°C)	<35	28	27.9	26.7	27.5	27.9
11-Jul-18	Turbidity (NTU)	<10	2.46	2.6	0.62	1.89	2.01
11-Jul-18	Faecal Coliform (MPN/100ml)	0	49	240	140	49	6.8

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
11-Jul-18	E.coli Bacteria (MPN/100ml)	0	49	240	33	17	6.8

3.2.5 Landfill Leachate Monitoring

During June 2018, the landfill leachate monitoring was conducted at NNP1 Project Landfill (last pond – LL4) and at Houay Soup Solid Waste Landfill (discharge point – LL7).

The results indicate that the treated leachate comply with the relevant effluent standards except total coliform for both landfills.

Figure 3-8: Landfill Leachate Monitoring Location

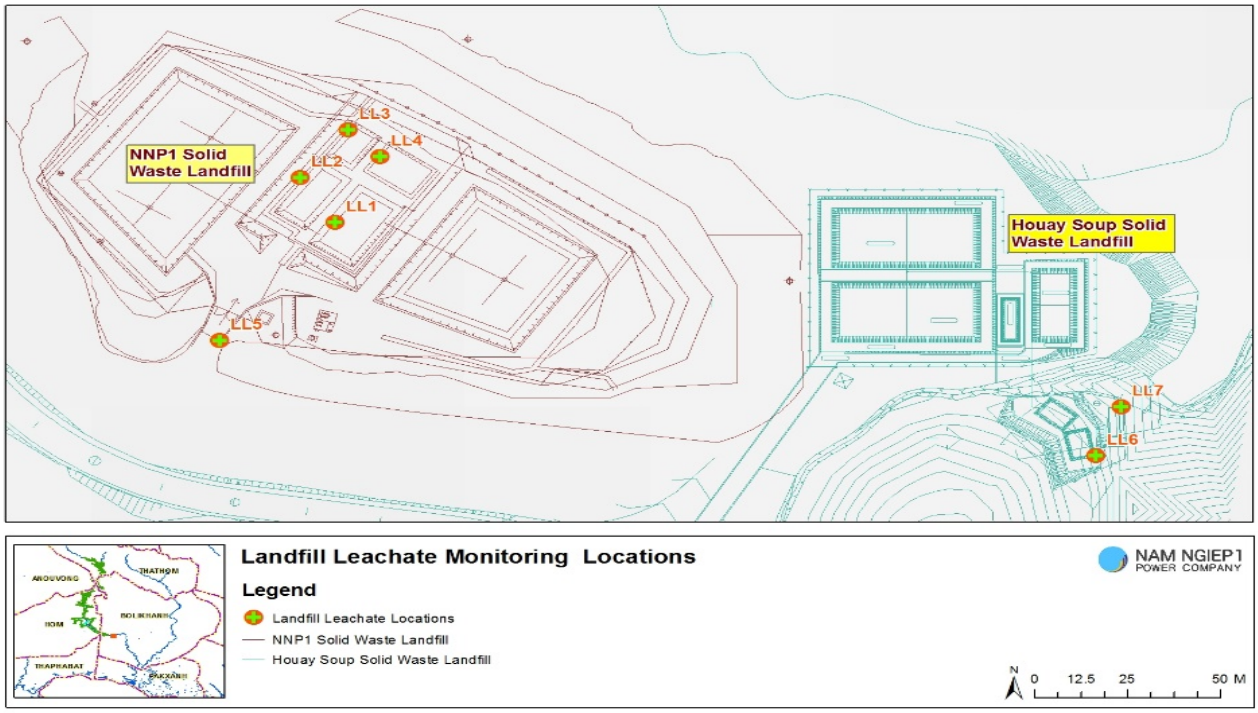


Table 3-11: *Landfill Leachate Monitoring Results*

	Site Name	NNP1 Landfill Leachate	Houay Soup Landfill
	Location	Pond No.04	Discharged Point
	Station	LL4	LL7
	Date	16-July-18	16-July-18
Parameter (Unit)	Guideline		
pH	6.0-9.0	8.39	7.48
Sat. DO (%)		120.1	70.7
DO (mg/l)		8.82	5.23
Conductivity (µS/cm)		169.7	154.8
TDS (mg/l)		84.3	77.4

	Site Name	NNP1 Landfill Leachate	Houay Soup Landfill
	Location	Pond No.04	Discharged Point
	Station	LL4	LL7
	Date	16-July-18	16-July-18
Parameter (Unit)	**Guideline**		
Temperature (°C)		29.2	28.9
Turbidity (NTU)		83.86	2.22
BOD (mg/l)	<30	17.4	1.58
COD (mg/l)	<125	91.9	<25
Faecal Coliform (MPN/100ml)		79	7.8
Total Coliform (MPN/100ml)	<400	1,600	1,600

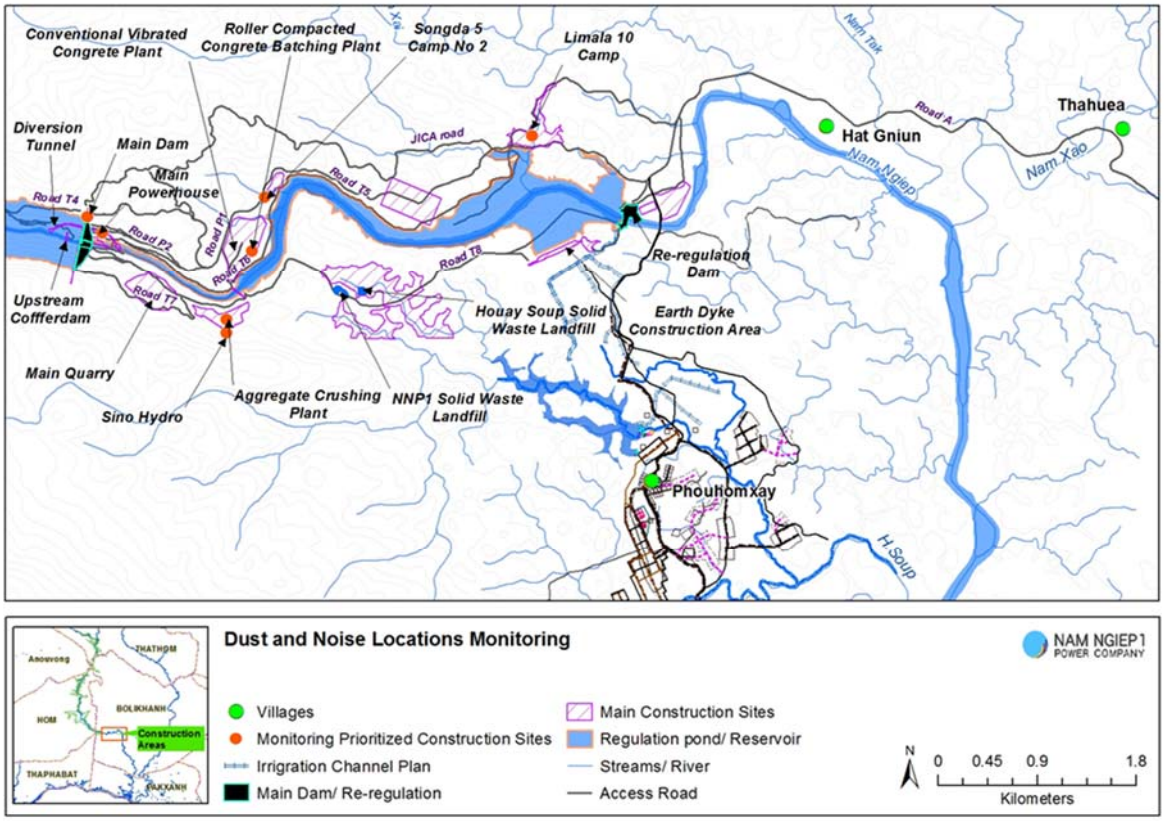
3.2.6 Dust Monitoring

The results indicated non-compliance with the National Standard at the main powerhouse. The results were shared with EMO-compliance and TD-safety teams as a reference for inspection to ensure proper establishment of health & safety procedures (traffic access restriction, wear proper personal protective equipment including masks, eye protection).

3.2.7 Noise Monitoring

During July 2018, noise monitoring was conducted for 72 consecutive hours at Hat Gniun Village and Phouhomxay Village, and for 24 consecutive hours at the Aggregate Crushing Plant, RCC Plant, Sino Hydro Main Camp, Sino Hydro Temporary Worker Camp, Main Dam, Lilama10 Camp, and the main powerhouse.

Figure 3-9: Noise and Dust Emission Monitoring Locations

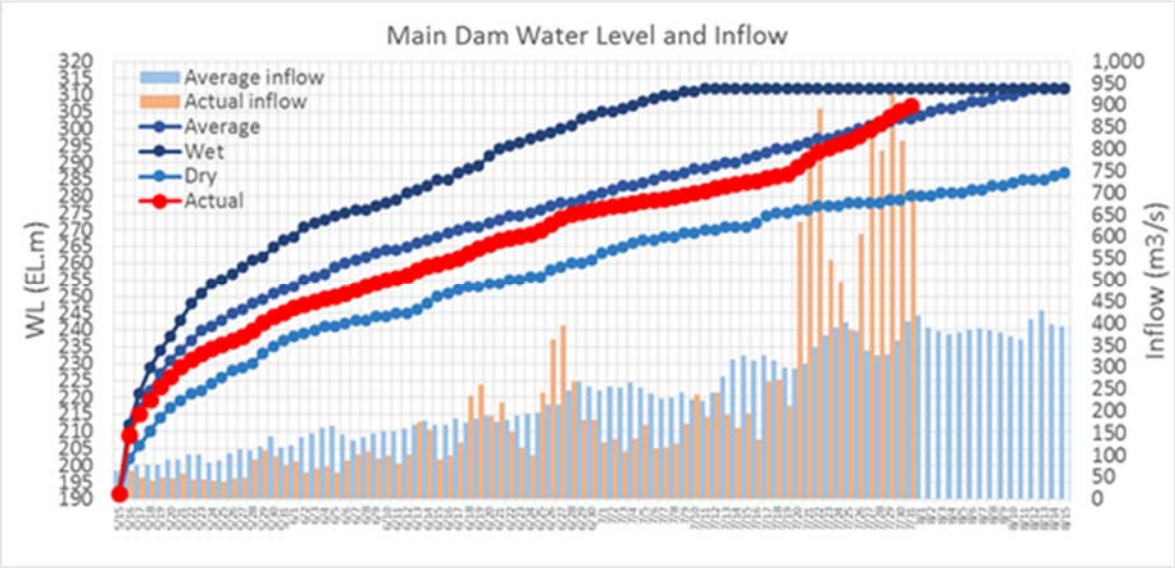


3.2.8 Discharge Monitoring

The impounding of the main reservoir started on 15 May 2018 and until the water level in the reservoir reaches 306.5 masl, the discharge from the re-regulation dam will be reduced to a minimum of 5.5 m3/s (Concession Agreement, Annex C: Minimum flow requirements during impounding).

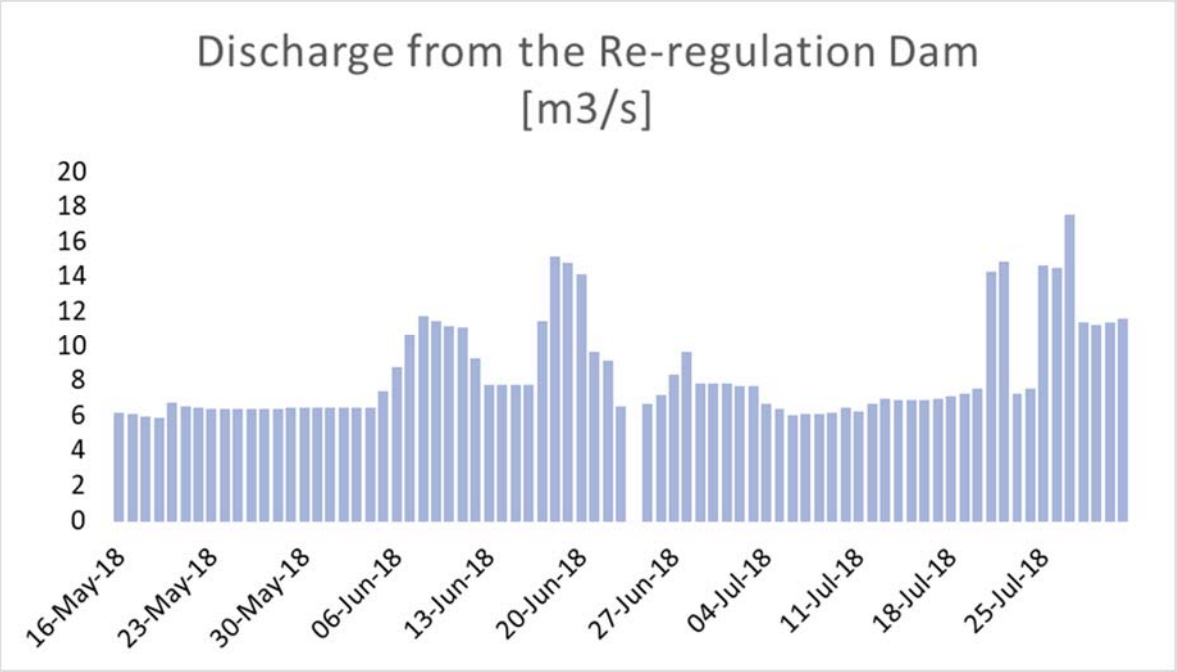
The progress of impounding from 15 May 2018 to 31 July 2018. On 31 July 2018 the water level had reached 306.8 masl.

Figure 3-10: *Progress of Impounding the Main Reservoir*



NNP1PC monitors the discharge from the re-regulation dam to ensure compliance with the minimum flow requirements. The discharge from the re-regulation dam has been above the required minimum flow throughout the period of impounding.

Figure 3-11: Discharge Monitoring at the Re-regulation Dam



3.2.9 Nam Ngiep Downstream Water Depth Monitoring

EMO carried out two water depth monitoring missions by boat in Nam Ngiep downstream of the re-regulation dam in July 2018. EMO has identified 17 riffles and a summary of monitoring results. EMO did not experience any difficulties navigating the river during the missions.

Figure 3-12: Nam Ngiep Downstream Water Depth Monitoring Locations

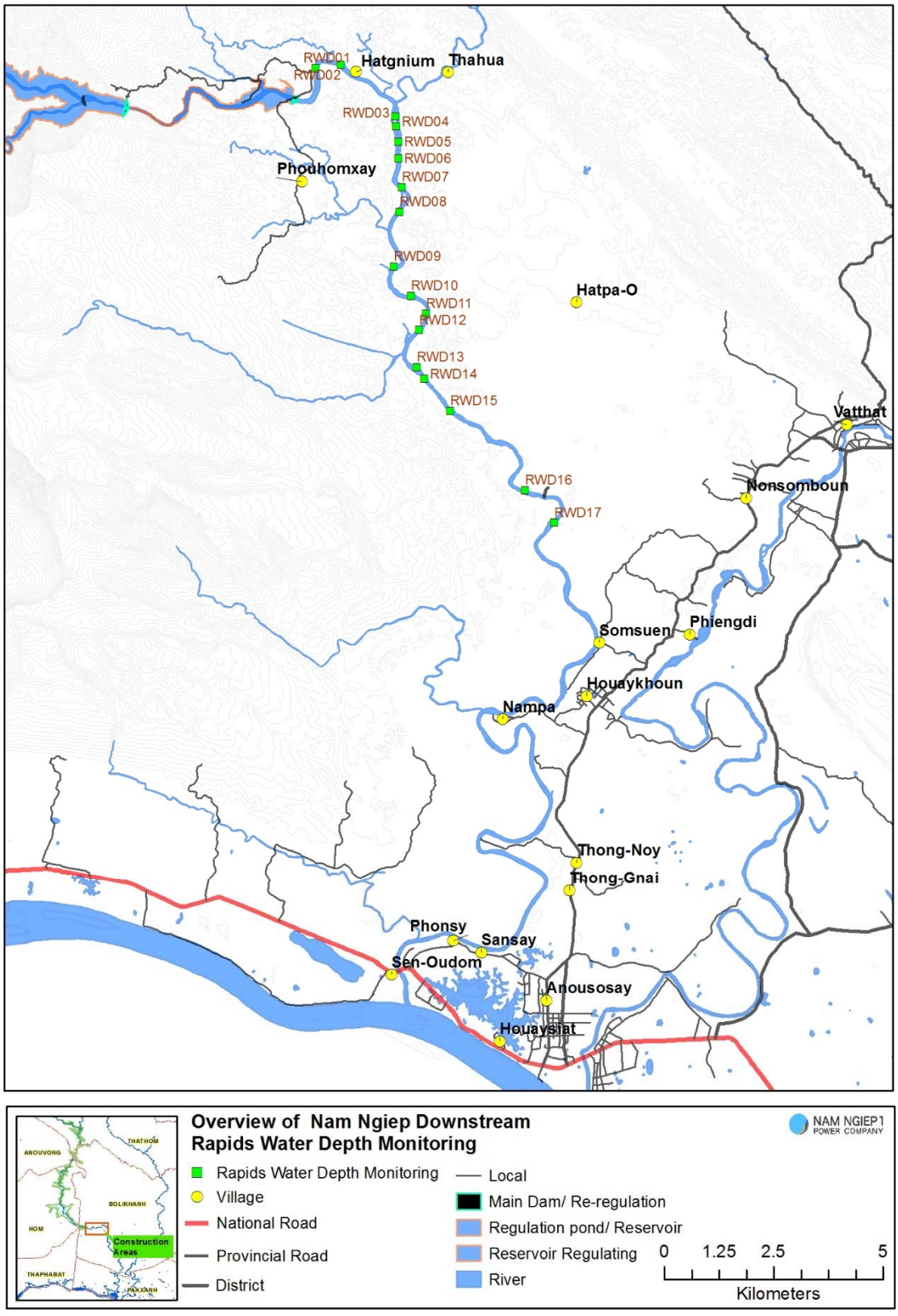


Table 3-12: Nam Ngiep Water Depth Monitoring Results Downstream of Rapids

Date	Rapid	Water Level	Remark
18 July 2018	17 locations (Water depth between 0.40 m - 2.00 m)	▪ 0.15 m at Hat Gniun Station ▪ 2.5 m at Somsuen Station	Boat can pass all rapids along Nam Ngiep downstream
25 July 2018	17 locations (Water depth between 0.42 m - 2.50 m)	▪ 0.30 m at Hat Gniun Station ▪ 3.65 m at Somsuen Station	As above

3.3 PROJECT WASTE MANAGEMENT

3.3.1 Solid Waste Management

In July 2018, a total of 181 m3 solid waste was disposed at the NNP1 Project Landfill, an increase of 21 m3 compared to June 2018. During July 2018, EMO conducted two waste spot checks at the NNP1 Project Landfill and the camps. Waste from LILAMA 10, Zhefu, Songda 5, Kenber, Sino-Hydro and GFE subcontractors was not separated properly before transporting to the landfill, and the contractors were instructed to segregate the waste properly before disposal. A monthly waste cover and compaction was not conduct due to a continuation of rain. On 18 July 2018, the Phoukhamchanvong contractor (PKC) submitted a closure plan for NNP1 Project Landfill waste pit no. 1 for NNP1PC's review and approval prior to carrying out the final cover of the first waste pit by August 2018.

A total of 1,426 kg of recyclable waste was sold to Khounmixay Processing Factory by the Contractors.

Table 3-13: Amounts of Recyclable Waste Sold

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by 31 July 2018
Construction activity				
1	Scrap metal	kg	204	43,858
	Sub-Total 1	**kg**	**204**	**43,858**
Operation camp				
2	Glass bottles	kg	1,071	581
3	Plastic bottles	kg	90	144
4	Paper/Cardboard	kg	51	140.5
5	Aluminium can	kg	9.5	59.2
	Sub-Total 2	**kg**	**1,221.5**	**924.7**
	Grand Total 1+2	**kg**	**1,425.5**	**44,782.7**

The villagers of Phouhomxay Village collected a total of 6,802 kg (an increase of 2,352 kg compared to June 2018) food waste from selected camps for animal feeding in July 2018.

Table 3-14 Amounts of Food Waste Collected by Villagers

NO.	SITE NAME	UNIT	TOTAL
1	Song Da 5 Camp No. 2	kg	2,136
2	Song Da 5 Camp No. 1	kg	1,219
3	Obayashi Corporation Camp	kg	872
4	Owner's Village and Site Office (OSOV)	kg	889
5	LILAMA 10 Camp	kg	1,389
6	Kenber Camp	kg	297
Total		**kg**	**6,802**

3.3.2 Hazardous Materials and Waste Management

The types and amounts of hazardous waste collected and transported for offsite treatment and final disposed at Khounmixay processing factory in July 2018.

Table 3-15: Results of Hazardous Material Inventory

No.	Hazardous Waste Type	Unit	Total in July 2018 (A)	Disposed (B)	Remainder (A - B)
1	Used hydraulic and engine oil	litre (l)	8,690	2,000	6,690
2	Contaminated soil, sawdust and concrete	kg	1,163	0	1,163
3	Used oil filters	No.	482	0	482
4	Used tire	No.	325	0	325
5	Empty paint and spray cans	can	189	0	189
6	Empty used chemical drum/container	Drum (20 litter)	180	10	170
7	Ink cartridge	No.	142	0	142
8	Halogen/fluorescent bulbs	No.	109	0	109
9	Empty used oil drum/container	drum (20 l)	109	8	101
10	Empty used chemical drum/container	drum (200 l)	91	9	82
11	Empty contaminated bitumen drum/container	drum (200 l)	52	0	52
12	Contaminated textile and material	kg	42	0	42
13	Empty used oil drum/container	drum (200 l)	40	7	33
14	Lead acid batteries	No.	22	0	22
15	Lithium-ion batteries	No.	7	0	7
16	Clinical waste	kg	1	0	1
17	Acid and caustic cleaners	Bottle	0	0	0
18	Cement bag	bag	0	0	0
19	Used oil mixed with water	litre (l)	0	0	0

3.4 Community Waste Management

3.4.1 Community Recycling Programme

In July 2018, approximate of 40 m3 of solid waste was collected from Phouhomxay, Thahuea and Hat Gniun villages. The solid waste was transported at Houay Soup Landfill where recyclable materials were segregated before disposal of the waste at the landfill.

Table 3-16: Types and Amounts of Recyclable Waste Traded at the Community Waste Bank

Types of Waste	Unit	Remaining in Jun 2018	Additions in Jul 2018	Sold	Remaining in Jul 2018
Scrap metal	kg	16	2	0	18
Glass bottles	kg	1,899.5	240.5	0	2,140
Paper/cardboard	kg	655	166	501	320
Aluminium cans	kg	0	2.2	0	2.2
Plastic bottles	kg	151.5	108	256	3.5
Total	**kg**	**2,722**	**518.7**	**757**	**2,483.7**

3.4.2 Community Solid Waste Management

In July 2018, approximate of 40 m3 of solid waste was collected from Phouhomxay, Thahuea and Hat Gniun villages. The solid waste was transported at Houay Soup Landfill where recyclable materials were segregated before disposal of the waste at the landfill.

3.5 Watershed and Biodiversity Management

3.5.1 Watershed Management

3.5.1.1 Preparation of the Watershed Management Plan

NNP1PC submitted the final NNP1 Watershed Management Plan (WMP) to ADB for final review and approval at the end of June 2018, and in parallel, NNP1PC submitted a revised Lao translation of the plan to Xaysomboun and Bolikhamxay Watershed and Reservoir Protection Offices (WRPO) for their final review. It is expected that the plan will be approved by the chair of the Watershed and Reservoir Protection Committee (WRPC) and ADB in August 2018.

The Xaysomboun Provincial Governor issued Agreement No. 718 dated 16 July 2018 on the appointment of the chair, vice chair, and committee members of the WRPC, and a new structure of the Xaysomboun WRPO. The WRPO and NNP1PC will start the preparation of the Annual Implementation Plan for watershed management 2018-2019 in August 2018.

Based on observations made by the staff of the checkpoints and NNP1PC's own routine reservoir monitoring, it appears that people continue to access the reservoir and the watershed area for fishing, livestock raising/grazing, and agricultural activities. There are more boats in the reservoir for fishing and transport. There appears to be an increase in floating logs and debris in the reservoir including logs from the salvage logging operations, and to ensure that the commercial logs are collected, the GOL has allowed the salvage logging contractors to use boats for removing the remaining logs from the reservoir. The deadline for the contractors to remove the remaining logs in the reservoir area, especially

within the TPZ area will be discussed at the upcoming meeting of the salvage logging committee.

Xaysomboun Provincial Authorities and NNP1PC plan to undertake a joint monitoring mission of the reservoir in August 2018 to better understand how to deal with the issues (fishing, boating, and access control).

3.5.1.2 PREPARATION OF PROVINCIAL REGULATION FOR THE WATERSHED MANAGEMENT

The final draft watershed management regulations were certified by Xaysomboun Provincial Justice Department and submitted to the Provincial Assembly for final review in June 2018. Xaysomboun PONRE will present the regulations at the Provincial Assembly Meeting, which is scheduled to be held in August 2018.

3.5.2 Biodiversity Offset Management

3.5.2.1 PREPARATION OF BIODIVERSITY OFFSET MANAGEMENT PLAN

The EMO and its biodiversity expert continued to further improve the draft NNP1 Biodiversity Offset Management Plan for Nam Chouane-Nam Xang Biodiversity Offset Site before submission of the plan to the Biodiversity Offset Management Committee (BOMC) and ADB.

3.5.2.2 PREPARATION OF PROVINCIAL REGULATION FOR BIODIVERSITY OFFSET MANAGEMENT IN NC-NX

Following consultations of the draft provincial regulations for biodiversity offset management in Nam Chouan – Nam Xang with six villages adjacent to the offset site in June 2018, the Provincial Regulation Development Committee submitted the draft regulations to the Provincial Justice Department. The department added their comments and the committee then further improved the draft and submitted it to the Provincial Administrative Office and the Provincial Assembly Office for final review at the end of July 2018.

3.5.2.3 Implementation of pre-Biodiversity Offset Management Plan

NNP1PC has disbursed funds on 16 March 2018 for the implementation of the second pre-BOMP. Patrolling activities have continued in July 2018. Two patroling teams with a total of 18 people conducted forest patrolling for 13 days in Viengthong District and 10 days in Xaychamphone District. The heavy rain and storm was the main reason for the limitted number of patrolling days. The patroling covered seven key areas wihtin the NCNX offset site: Nam Pang, Nam Mar in Viengthong zone, Nam Votvot, Nam Bang, Nam Ping, Huay Kamout and Huay Kone in Xaychamphone zone. The main threats found in the areas are hunting camps and fence wire snares. The rainy season is the peak time for wildlife hunting. The patroling team was able to predict the next potential areas for hunting which is helpful for the development of the patrolling plan for the coming months. Detailed information is being recorded in the SMART database and will be presented to BOMC Secretariat.

NNP1PC further worked with BOMC to improve pre-BOMP2 proposal based on the comments from ADB. The proposal is expected to be re-submitted for ADB approval in early August 2018.

3.6 FLOATING DEBRIS REMOVAL

NNP1PC has contracted a contractor to carry out removal of floating debris in the main reservoir. The work is expected to start by the middle of August 2018.

FISHERY MONITORING

The fishery monitoring programme is progressing in June as planned with the daily catch logbook, gillnet survey, and sampling household interview. The gathered information is being put into the database system.

The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in Nam Ngiep River was 1.7 kg/household/day in May 2018. The estimated total fish catch in Nam Ngiep basin for May 2018 is 33,800 kg. Around 40 % of the catch was sold, 51% was consumed fresh, 6% processed and approximately 3% was used for other purposes.

Detail activity of fishery monitoring program comprises of daily fish catch monitoring, re-sampling HH, gillnet survey, and fish monitoring during reservoir impoundment could be summarized as below table.

Table 3-17: ***Summary of Fishery Monitoring Program in July 2018***

Activities in July 2018	Results
Daily Catch Logbook survey	• Completed daily catch logbook survey in all 93 targeted 93 households • Conducted the training for new target households for daily catch survey in Lower Reservoir Area with a target of 32 households in Bolikhan District of Bolikhamxay Province and 28 households in Hom District of Xaysomboun Province. • The average daily household catch for Nam Ngiep in June 2018 is 1.6 kg/household/day.
Gillnet Survey	• The next round of the survey will be scheduled during 13-28 August 2018
Fish Monitoring for Impounding period	• No dead fish observed in the Upper Reservoir, Lower Reservoir and Downstream during the impounding period (May-July2018).

ANNEXES

ANNEX A: Results of Surface Water Quality Analyses

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08
	Date	03-Jul-18	03-Jul-18	03-Jul-18	05-Jul-18	05-Jul-18	05-Jul-18	05-Jul-18	05-Jul-18	05-Jul-18	05-Jul-18
Parameters (Unit)	**Standard**										
pH	5.0 - 9.0	8.06	8.26	8.29	7.77	7.56	7.44	7.61	7.34	8.33	7.76
Sat. DO (%)		97.5	133.9	118.7	66.6	89.2	142.6	96.4	95.8	86.3	91.8
DO (mg/L)	>6.0	7.68	8.98	8.29	4.91	6.55	9.89	7.03	7.03	6.64	6.95
Conductivity (µs/cm)		78.6	67.4	66.4	67.6	62.7	44.1	47.8	68.3	49.5	39.7
TDS (mg/L)		39.3	33.7	33.2	33	31.35	22.05	24	34	24.75	19.85
Temperature (°C)		25.1	34.2	31.7	28.9	29.8	33	29.8	29.4	27.3	28.3
Turbidity (NTU)		49.01	3.45	2.53	1.61	259	36.74	45.41	26.93	20.74	12.28
TSS (mg/L)		115.84	8.25	<5	<5	500.76	27.61	42.33	21.37	22.76	7.88
BOD_5 (mg/l)	<1.5	<1.0	3.28	2.15	1.53	<1.0	1.23	1.03	<1.0	<1.0	<1.0
COD (mg/L)	<5	<5.0	12.9	7.4	7.2	17	7.4	14.1	8.2	7.2	15.6
NH_3-N (mg/L)	<0.2	0.93	<0.2	<0.2	0.89	1.04	0.89	1.66	1.22	1.28	<0.2
NO3-N (mg/l)	<5	0.14	<0.02	<0.02	0.07	0.23	0.18	0.25	0.19	0.19	0.16
Faecal coliform (MPN/100 ml)	<1,000	1,600	240	33	170	22	4.5	130	27	170	23
Total Coliform (MPN/100 ml)	<5,000	1,600	350	33	350	240	49.0	350	350	540	240

	Station Code	NNG 01	R3 (NNG02)	R4 (NNG 03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08
	Date				19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18
Parameters (Unit)	**Guideline**										
pH	5.0 - 9.0				7.92	6.76	6.62	6.69	6.75	7.83	7.85
Sat. DO (%)					76.4	99.7	100.3	95.2	94.9	85.5	90.7
DO (mg/l)	>6.0				5.83	7.73	7.74	7.5	7.45	6.69	7.1
Conductivity (µs/cm)					62	53.6	50.2	35.3	52.5	30	29.6
TDS (mg/l)					31	26.8	25.1	17.5	26.2	15	14.8
Temperature (°C)					27.2	26.5	26.8	25.7	25.9	26.1	26.1
Turbidity (NTU)					2.63	29.78	24.35	47.35	25.75	24.72	20.04
TSS (mg/l)					7.67	22.34	16.84	65.05			
BOD_5 (mg/l)	<1.5				1.81	1.07	1.43	<1			
Faecal coliform (MPN/100ml)	<1,000				540	170	27	1,600			

	Station Code	NNG 01	R3 (NNG02)	R4 (NNG 03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08
	Date				19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18	19-Jul-18
Parameters (Unit)	Guideline										
Total Coliform (MPN/100ml)	<5,000				920	350	79	1,600			

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				03-Jul-18			03-Jul-18
Parameters (Unit)	Guideline							
pH	5.0 - 9.0				7.29			7.69
Sat. DO (%)					56.9			99.8
DO (mg/l)	>6.0				3.96			7.62
Conductivity (µs/cm)					65.2			40.4
TDS (mg/l)					32.6			20.2
Temperature (°C)					32			27.3
Turbidity (NTU)					1.45			32.56

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				07-Jul-18			07-Jul-18
Parameters (Unit)	Guideline							
pH	5.0 - 9.0				7.42			7.59
Sat. DO (%)					84.9			95
DO (mg/l)	>6.0				6.42			7.28
Conductivity (µs/cm)					68.2			57.8
TDS (mg/l)					34			28
Temperature (°C)					27.2			27.4
Turbidity (NTU)					3.33			64.52

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date			10-Jul-18	10-Jul-18			10-Jul-18
Parameters (Unit)	Guideline							
pH	5.0 - 9.0			7.96	7.83			7.7
Sat. DO (%)				117.5	82.2			95.6
DO (mg/l)	>6.0			8.27	5.78			7.51
Conductivity (µs/cm)				66.3	65.5			57.6
TDS (mg/l)				33.1	32.5			28.8
Temperature (°C)				30.4	30.3			26.1
Turbidity (NTU)				1.77	1.76			63.48

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				12-Jul-18	12-Jul-18	12-Jul-18	12-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				7.82	7.97	7.49	7.95
Sat. DO (%)					80.6	99	113.9	93.2
DO (mg/l)	>6.0				5.97	7.55	8.28	7.26
Conductivity (µs/cm)					63.2	50.4	55.4	40.4
TDS (mg/l)					31.5	25.2	27.5	20.2
Temperature (°C)					28.6	27.6	29.8	26.5
Turbidity (NTU)					2.17	73.06	46.47	59.28
TSS (mg/l)					3.36	59.07	51.63	50.26
BOD_5 (mg/l)	<1.5				<1	<1	<1	<1
Faecal coliform (MPN/100ml)	<1,000				79	920	33	540
Total Coliform (MPN/100ml)	<5,000				350	1,600	110	540

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				14-Jul-18			14-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				7.69			7.73
Sat. DO (%)					79.3			100.1
DO (mg/l)	>6.0				5.85			7.71
Conductivity (µs/cm)					63.1			124.2
TDS (mg/l)					31.55			62.1
Temperature (°C)					28.7			26.8
Turbidity (NTU)					2.91			53.35

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date	17-Jul-18			17-Jul-18			17-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0	7.97			7.79			7.51
Sat. DO (%)		96			73.5			95.6
DO (mg/l)	>6.0	7.7			5.56			7.66
Conductivity (µs/cm)		64.4			63.8			39.2
TDS (mg/l)		32.2			31.5			19.1
Temperature (°C)		23.9			27.2			24.9
Turbidity (NTU)		1,335			2.87			38.7

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				21-Jul-18			21-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				7.43			7.32
Sat. DO (%)					26.5			95.5
DO (mg/l)	>6.0				2.55			7.74
Conductivity (µs/cm)					61.8			39.8
TDS (mg/l)					30.5			17.8
Temperature (°C)					26.5			25.4
Turbidity (NTU)					2.36			48.69

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date		24-Jul-18	24-Jul-18	24-Jul-18			24-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0		7.57	7.59	7.67			7.85
Sat. DO (%)			104.6	105.2	79.1			97.4
DO (mg/l)	>6.0		8.12	8.08	6.1			7.72
Conductivity (µs/cm)			60.2	61.9	60.9			31.1
TDS (mg/l)			30	31	30.45			15.55
Temperature (°C)			25.7	26.3	26.7			25.1
Turbidity (NTU)			5.23	3.14	1.84			39.24

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				26-Jul-18	26-Jul-18	26-Jul-18	26-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				7.55	7.76	7.81	7.77
Sat. DO (%)					26.6	99.3	98.9	96
DO (mg/l)	>6.0				4.4	7.71	7.62	7.63
Conductivity (µs/cm)					61.5	42.1	41	25.1
TDS (mg/l)					30.8	21	20.5	12.5
Temperature (°C)					26.4	26.8	26.6	25.6
Turbidity (NTU)					2.69	32.77	35.59	69.09
TSS (mg/l)					2.5	21	24.33	108.37
BOD_5 (mg/l)	<1.5				1.18	1.13	1.9	<1
Faecal coliform (MPN/100ml)	<1,000				17	22	46	240
Total Coliform (MPN/100ml)	<5,000				170	39	170	540

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				28-Jul-18			28-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				7.56			7.43
Sat. DO (%)					29.3			94.5
DO (mg/l)	>6.0				2.26			7.65
Conductivity (µs/cm)					65.2			25
TDS (mg/l)					34			14
Temperature (°C)					26.3			24.7
Turbidity (NTU)					1.8			36.76

	Station Code	NNG01	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05
	Date				31-Jul-18			31-Jul-18
Parameters (Unit)	**Guideline**							
pH	5.0 - 9.0				6.78			7.55
Sat. DO (%)					48.8			98.3
DO (mg/l)	>6.0				3.93			8.00
Conductivity (µs/cm)					66.1			27.1
TDS (mg/l)					33			13
Temperature (°C)					24.8			24.3
Turbidity (NTU)					4.15			46.54

	Station Code	NCH01	NPH01	NXA01	NHS01
	Date	03-Jul-18	03-Jul-18	05-Jul-18	05-Jul-18
Parameters (Unit)	**Standard**				
pH	5.0 - 9.0	8.38	8.32	7.46	7.44
Sat. DO (%)		99.5	100.4	96.2	94.8
DO (mg/l)	>6.0	7.93	7.39	7.05	6.95
Conductivity (µs/cm)		24.2	60.5	89.9	17.9
TDS (mg/l)		12.1	30.25	45	9
Temperature (°C)		24.1	28.7	29.05	28.5
Turbidity (NTU)		8.71	22.61	16.9	22.65
TSS (mg/l)		13.6	26.47	11.31	17.59
BOD_5 (mg/l)	<1.5	<1.0	<1.0	<1.0	<1.0
COD (mg/l)	<5	5.3	<5.0	<5.0	7.6
NH_3-N (mg/l)	<0.2	<0.2	<0.2	0.77	<0.2
NO3-N (mg/l)	<5	0.11	0.08	0.18	0.15
Faecal coliform (MPN/100ml)	<1,000	240	240	11	34
Total Coliform (MPN/100ml)	<5,000	1,600	920	920	240

Table A- 1: Results of Surface Water Quality Monitoring in Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup

	Station Code	NCH01	NPH01	NXA01	NHS01
	Date	17-Jul-18	24-Jul-18	19-Jul-18	19-Jul-18
Parameters (Unit)	**Standard**				
pH	5.0 - 9.0	8.13	7.86	7.51	6.89
Sat. DO (%)		99.3	103.2	95.1	98.2
DO (mg/l)	>6.0	7.89	7.94	7.42	7.82
Conductivity (µs/cm)		25.5	62.4	59.6	51.1
TDS (mg/l)		12.5	31	29.5	25
Temperature (°C)		24	26.2	26.2	26
Turbidity (NTU)		30.38	29.46	23.72	24.74

ANNEX B: Results of Effluent Analyses

Table B- 1: Results of Camp Effluents in July 2018

	Site Name	Owner's Site Office and Village		Obayashi Camp		Sino Hydro Camp	
	Station Code	EF01		EF02		EF06	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.21	7.53	7.57	7.58		7.57
Sat. DO (%)		55.3	59.8	90.6	77.4		74.5
DO (mg/L)		4.08	4.55	6.48	5.74		5.59
Conductivity (µs/cm)		333	322	578	549		289
TDS (mg/L)		166.5	161	289	274.5		143.5
Temperature (°C)		29.1	27.3	31.1	28.7		27.9
Turbidity (NTU)		0.73	2.01	20.26	33.28		25.52
TSS (mg/L)	<50	<5	<5	5.26	6.46		<5
BOD (mg/L)	<30	18.66	9.39	<6	<6		6.03
COD (mg/L)	<125	<25	<25	37.6	43.1		<25
NH3-N (mg/L)	<10.0	6.9	8.4	20.3	21.2		5.2
Total Nitrogen (mg/L)	<10.0	10.4	9.36	20.6	21.8		19.7
Total Phosphorus (mg/L)	<2	0.69	1.94	0.8	1.82		1.09
Oil & Grease (mg/L)	<10.0	<1		<1			
Total coliform (MPN/100mL)	<400	920	1,600	540	0		0
Faecal Coliform (MPN/100mL)		23	13	0	0		0
Effluent Discharge Volume (L/mn)		12	20	6	12		6
Chlorination Dosing Rate (mL/mn)				217	840		152
Residual Chlorine (mg/L)	<1.0			0.48	0.24		0.19

	Site Name	Song Da 5 Camp No.1		Song Da 5 Camp No.2		Zhefu Camp	
	Station Code	EF07		EF08		EF09	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.55	7.51	7.4	7.52	7.49	7.7
Sat. DO (%)		68.1	66.6	46.7	44.4	39.5	30
DO (mg/L)		4.81	5.01	3.38	3.38	2.7	2.62
Conductivity (µs/cm)		1,164	843	674	568	523	475
TDS (mg/L)		582	421	337	284	261.5	239
Temperature (°C)		32	28.2	30.7	27.8	33.7	28.4
Turbidity (NTU)		54.82	29.6	62.1	65.17	26.38	20.72

Final- **21 August 2018**

	Site Name	Song Da 5 Camp No.1		Song Da 5 Camp No.2		Zhefu Camp	
	Station Code	EF07		EF08		EF09	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline						
TSS (mg/L)	<50	20.54	25.7	15.24	17.75	18.77	28.79
BOD (mg/L)	<30	<6	<6	<6	<6	<6	<6
COD (mg/L)	<125	93.6	53.8	54.6	61.6	29.4	67.5
NH3-N (mg/L)	<10.0	24.8	11.2	24.4	28.5	10.3	30.2
Total Nitrogen (mg/L)	<10.0	27.6	25.7	28.1	29.1	14.8	30.8
Total Phosphorus (mg/L)	<2	0.68	0.77	0.83	2.25	0.23	1.04
Oil & Grease (mg/L)	<10.0	<1		<1		<1	
Total coliform (MPN/100mL)	<400	0	0	0	0	1,600	0
Faecal Coliform (MPN/100mL)		0	0	0	0	920	0
Effluent Discharge Volume (L/mn)		12	60	20	12	4.2	4.2
Chlorination Dosing Rate (mL/mn)		47	385	240	842	3.1	3.1
Residual Chlorine (mg/L)	<1.0	0.89	1.43	1.49	0.43	2.09	0.48

	Site Name	V & K Camp		HM Main Camp		IHI Camp	
	Station Code	EF10		EF13		EF14	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.35	7.57	7.28	7.35	7.35	7.12
Sat. DO (%)		85.2	53	54	59.1	23.9	11
DO (mg/L)		6.14	4.04	3.92	4.47	1.7	0.8
Conductivity (µs/cm)		185.1	350	936	866	657	476
TDS (mg/L)		92.55	175	468	433	328.5	238
Temperature (°C)		30.8	27.6	30.1	27.8	31.4	27.9
Turbidity (NTU)		4.68	8.1	58.09	37.88	25.04	35.85
TSS (mg/L)	<50	11.49	8.94	26.07	33.58	18.41	136.73
BOD (mg/L)	<30	10.98	<6	112.2	198.3	89.93	<6
COD (mg/L)	<125	<25	32.8	221	316	114	374
NH3-N (mg/L)	<10.0	3.7	8.7	28	25.1	16.8	14.4
Total Nitrogen (mg/L)	<10.0	9.79	17.3	28.4	25.3	17	15
Total Phosphorus (mg/L)	<2	0.34	0.95	0.95	2.37	0.61	2.53
Oil & Grease (mg/L)	<10.0	<1		<1		<1	
Total coliform (MPN/100mL)	<400	240	0	16,000	16,000	540	0
Faecal Coliform (MPN/100mL)		23	0	540	920	170	0

Final- **21 August 2018**

	Site Name	V & K Camp		HM Main Camp		IHI Camp	
	Station Code	EF10		EF13		EF14	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline						
Effluent Discharge Volume (L/mn)		3.33	3.15	4.2	4.2	2.4	6
Chlorination Dosing Rate (mL/mn)		20	21	3.1	3.1		
Residual Chlorine (mg/L)	<1.0	0.19	0.18	1.16	0.07	0.51	0.68

	Site Name	Kenber Camp		Lilama10 Camp	
	Station Code	EF16		EF17	
	Date	02-Jul-18	16-Jul-18	02-Jul-18	16-Jul-18
Parameters (Unit)	Guideline				
pH	6.0 - 9.0	7.13	7.55	7.09	7.05
Sat. DO (%)		92.5	98.7	64.6	33.4
DO (mg/L)		6.74	6.7	4.56	2.5
Conductivity (µs/cm)		154.1	195.5	333	328
TDS (mg/L)		77.05	97.5	166.5	164
Temperature (°C)		29.5	27.3	29.1	28.6
Turbidity (NTU)		6.18	15.42	32	35.4
TSS (mg/L)	<50	6.31	19.33	52.7	20.8
BOD (mg/L)	<30	<6	<6	<6	29.76
COD (mg/L)	<125	<25	39.1	106	26.6
NH3-N (mg/L)	<10.0	4.9	6.1	34.2	9.5
Total Nitrogen (mg/L)	<10.0	6.31	6.25	34.9	9.87
Total Phosphorus (mg/L)	<2	0.39	0.69	0.48	0.28
Oil & Grease (mg/L)	<10.0	<1		<1	
Total coliform (MPN/100mL)	<400	0	0	0	920
Faecal Coliform (MPN/100mL)		0	0	0	27
Effluent Discharge Volume (L/mn)		3	3	4.2	
Chlorination Dosing Rate (mL/mn)		58	16	3.1	
Residual Chlorine (mg/L)	<1.0	0.83	0.41	0.72	0.02

Table B- 2: Results of the Construction Area Discharge in July 2018

	Site Name	Spoil Disposal No.2			
	Station Code	DS04			
	Date	05-Jul-18	12-Jul-18	18-Jul-18	26-Jul-18
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.9	7.73	6.42	6.35
Sat. DO (%)		69.9	78.6	97.4	88.8
DO (mg/l)		5.29	6.11	7.71	7.08
Conductivity (µs/cm)		22.7	20.4	23.3	55.4
TDS (mg/l)		11	10	11.5	27.5
Temperature (°C)		27.8	26.1	25.5	25
Turbidity (NTU)		147.68	90	183	2,765
TSS (mg/l)	<50	136.61	58.72	151.69	2,833
Oil & Grease (mg/l)	<10	<1			

	Site Name	RCC Plant Discharge at lower ponds			
	Station Code	DS09			
	Date	05-Jul-18	12-Jul-18	18-Jul-18	26-Jul-18
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	No water discharge			
Sat. DO (%)					
DO (mg/l)					
Conductivity (µs/cm)					
TDS (mg/l)					
Temperature (°C)					
Turbidity (NTU)					
TSS (mg/l)	<50				
Oil & Grease (mg/l)	<10				

	Site Name	Aggregate Crushing Plant			
	Station Code	DS02			
	Date	05-Jul-18	12-Jul-18	18-Jul-18	26-Jul-18
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	No water discharge			
Sat. DO (%)					
DO (mg/l)					
Conductivity (µs/cm)					
TDS (mg/l)					
Temperature (°C)					
Turbidity (NTU)					
TSS (mg/l)	<50				
Oil & Grease (mg/l)	<10				

	Site Name	Main Dam Treatment Plant No.2 (DS12)			
	Station Code	DS12			
	Date	05-Jul-18	12-Jul-18	18-Jul-18	26-Jul-18
Parameter (Unit)	**Guideline**				
pH	6.0 - 9.0	No water discharge			
Sat. DO (%)					
DO (mg/l)					
Conductivity (µs/cm)					
TDS (mg/l)					
Temperature (°C)					
Turbidity (NTU)					
TSS (mg/l)	<50				
Oil & Grease (mg/l)	<10				

	Site Name	Main Dam's Waste Water Treatment Plant No.3			
	Station Code	DS14			
	Date	05-Jul-18	12-Jul-18	18-Jul-18	26-Jul-18
Parameter (Unit)	**Guideline**				
pH	6.0 - 9.0	7.16	7.9	8.3	7.72
Sat. DO (%)		107.8	101.3	98.7	97.1
DO (mg/l)		7.29	7.03	7.78	7.5
Conductivity (µs/cm)		295	128.7	75.2	787
TDS (mg/l)		147.5	64.3	37.5	393
Temperature (°C)		30.7	32.8	25.5	26.8
Turbidity (NTU)		3.8	7.88	58.41	25.93
TSS (mg/l)	<50	6.77	7.39	154.14	29.75
Oil & Grease (mg/l)	<10	<1			

ANNEX C: Ambient Dust Quality

Table C- 1: 24-hour Average Dust Concentrations Measured in Hat Gniun Village

Hat Gniun Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	17-Jul-18 18:30	18-Jul-18 18:00	19-Jul-18 18:00
End Time	18-Jul-18 18:00	19-Jul-18 18:00	20-Jul-18 18:00
Average Data Record in 24h (mg/m3)	0.016	0.022	0.012
Guideline Average in 24h (mg/m3)	***0.12***	***0.12***	***0.12***

Figure C- 1: Dust Monitoring Results at Hat Gniun Village in July 2018

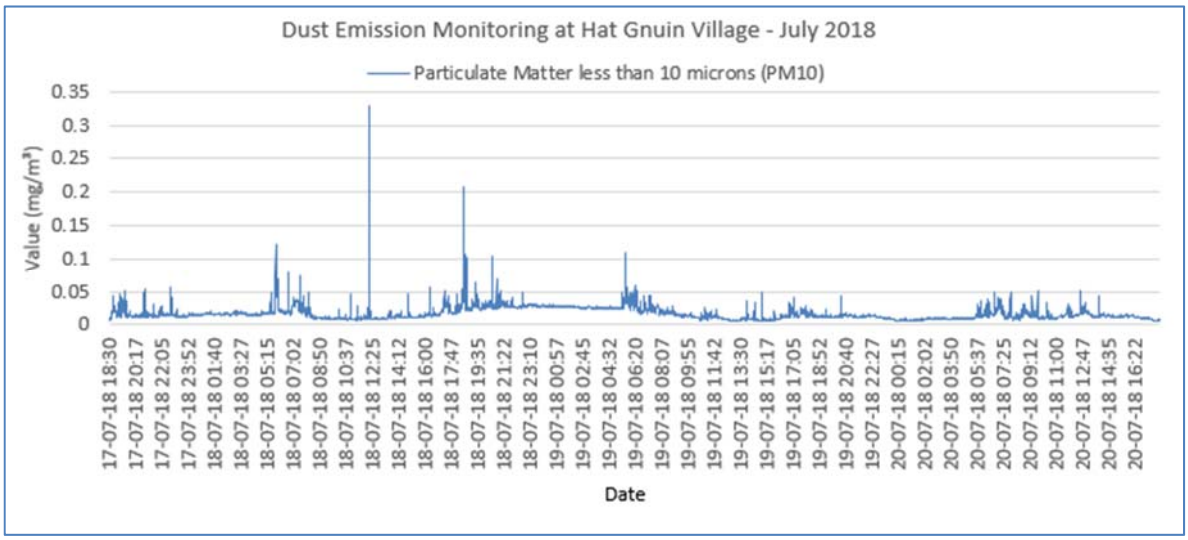


Table C- 2 24-hour Average Dust Concentrations Measured in Phouhomxay Village

Phouhomxay Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	02-Jul-18 18:00	03-Jul-18 18:00	04-Jul-18 18:01
End Time	03-Jul-18 18:00	04-Jul-18 18:00	05-Jul-18 18:00
Average Data Record in 24h (mg/m3)	0.021	0.024	0.032
Guideline Average in 24h (mg/m3)	***0.12***	***0.12***	***0.12***

Figure C- 2: Dust Monitoring Results at Phouhomxay Village in July 2018

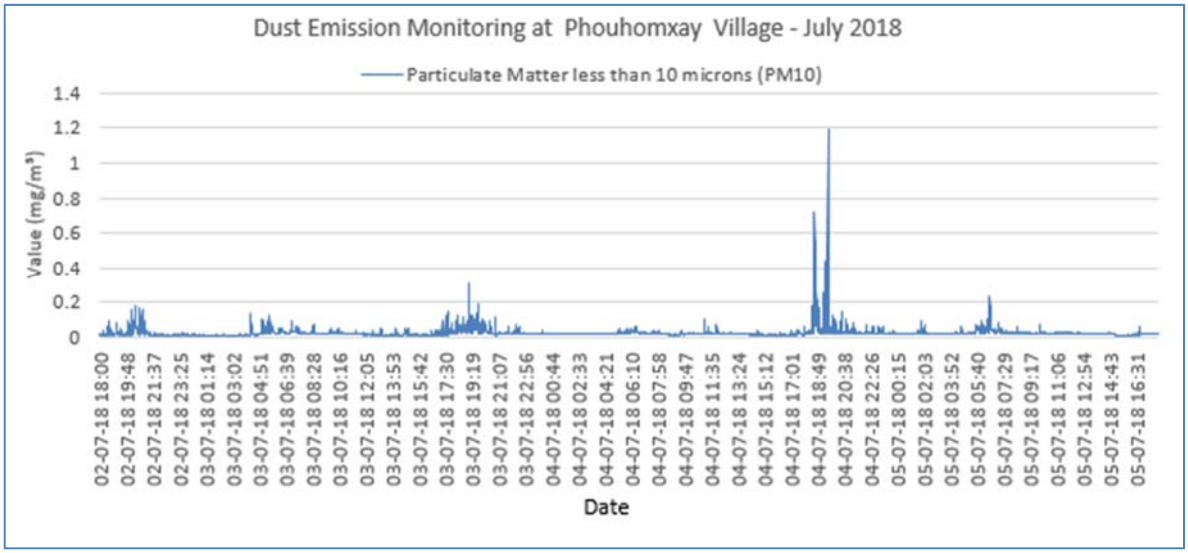


Figure C- *3*: Dust Monitoring Results at the Aggregate Crushing Plant in July 2018

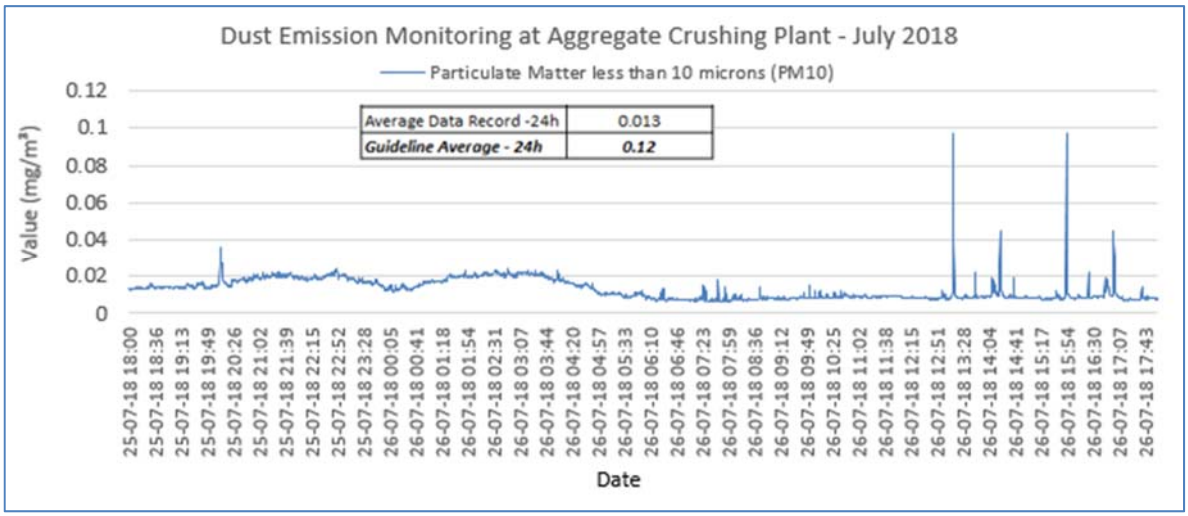


Figure C- *4*: Dust Monitoring Results at the RCC Plant in July 2018

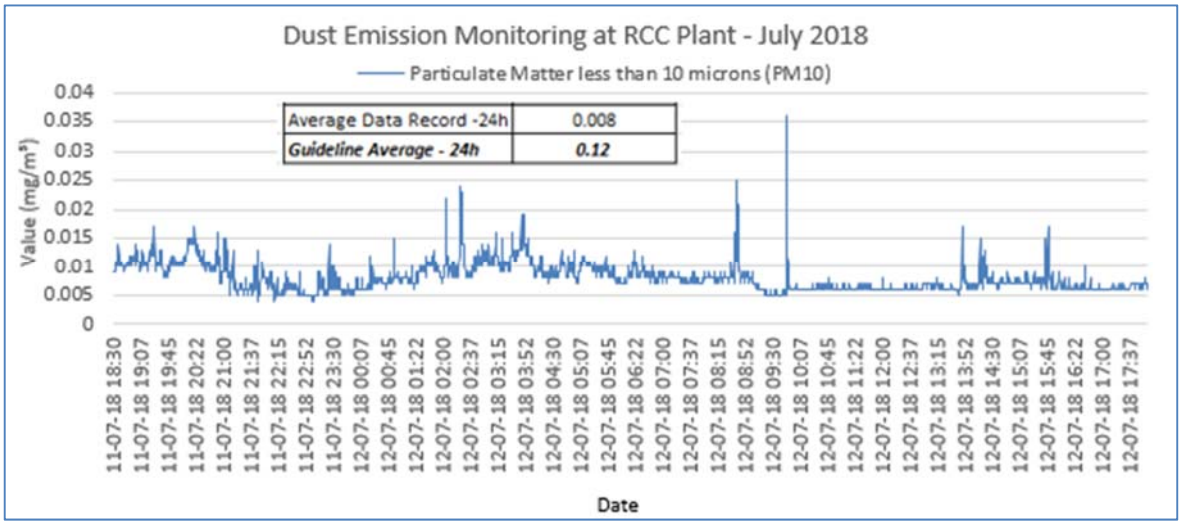


Figure C- 5: Dust Monitoring Results at the Sino Hydro Temporary Camp in July 2018

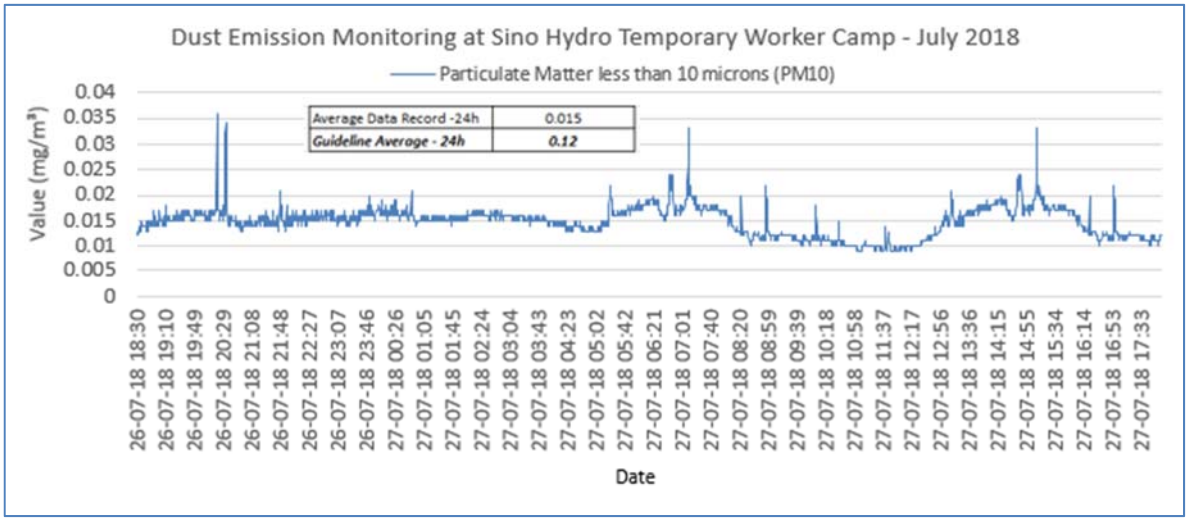


Figure C- 6: Dust Monitoring Results at the Song Da5 No.2 Camp in July 2018

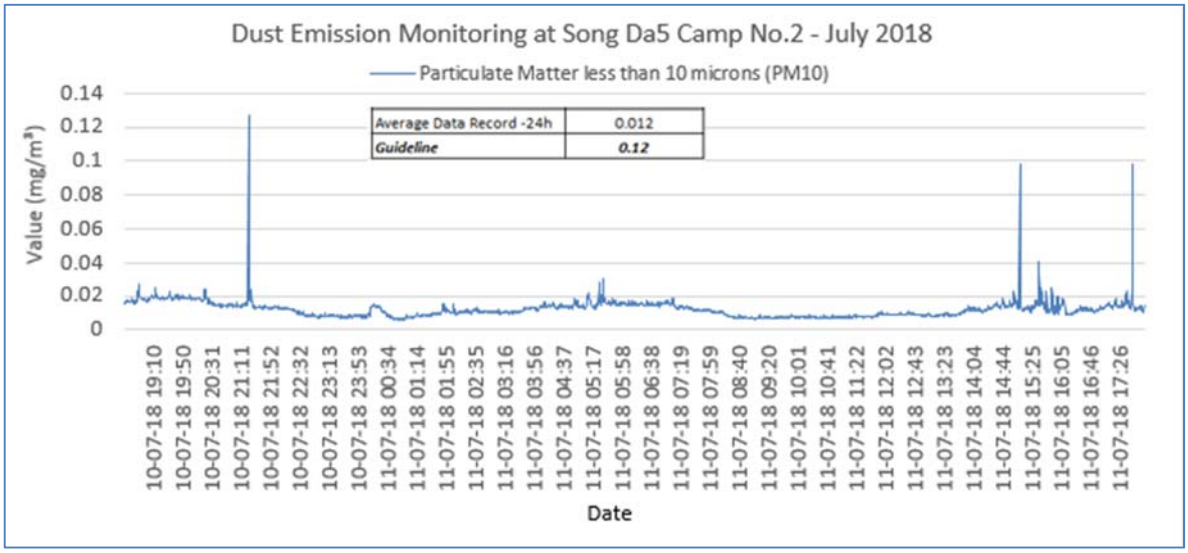


Figure C-7: **Dust Monitoring Results at the Main Dam (Top View Left Bank) in July 2018**

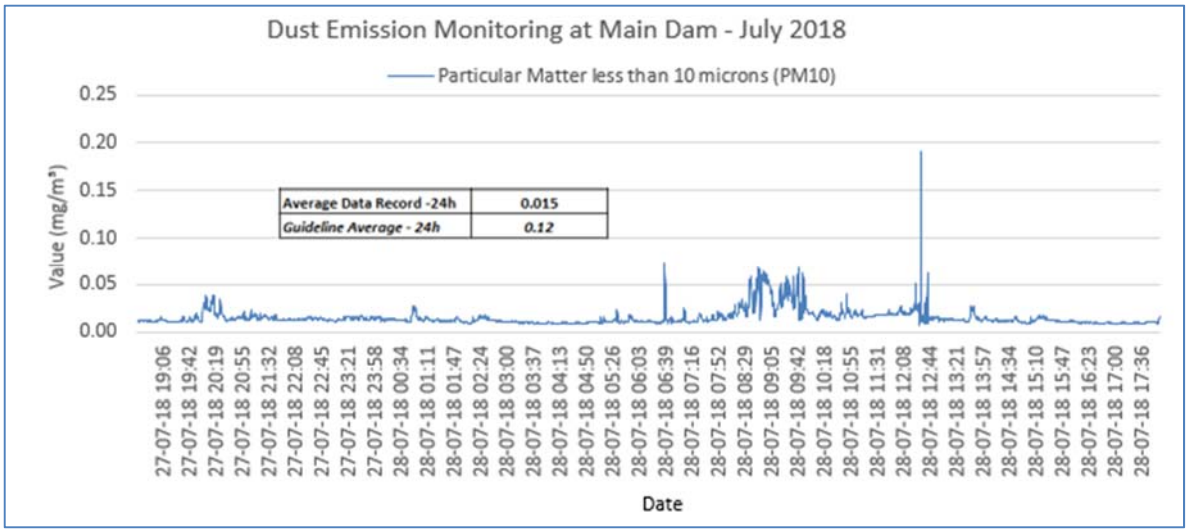


Figure C- 8: **Dust Monitoring Results at the Lilama 10 Camp in July 2018**

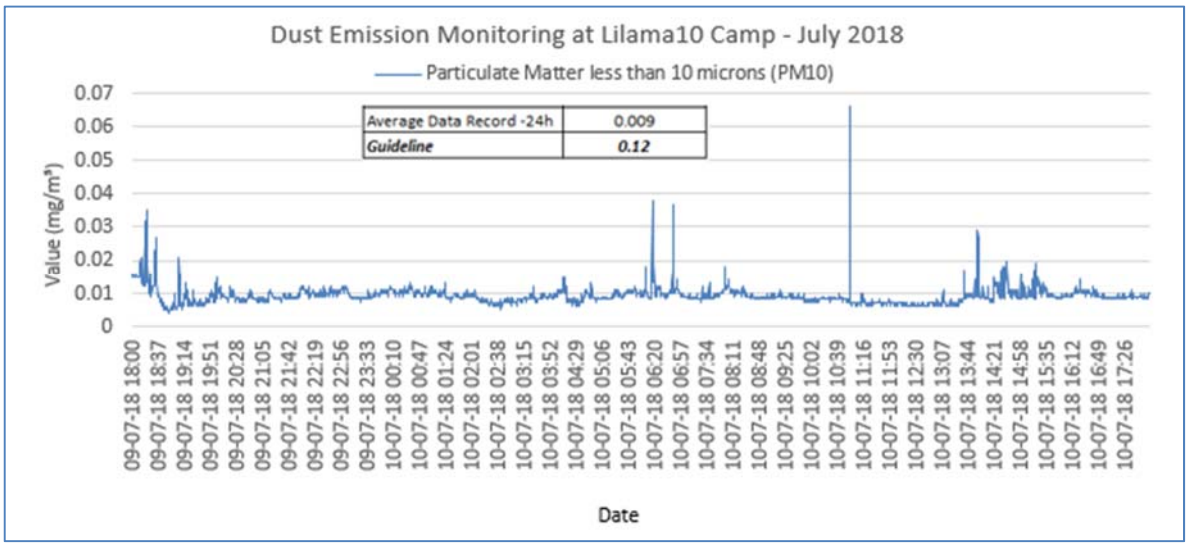


Figure C- 9: Dust Monitoring Results at the Main Powerhouse in July 2018

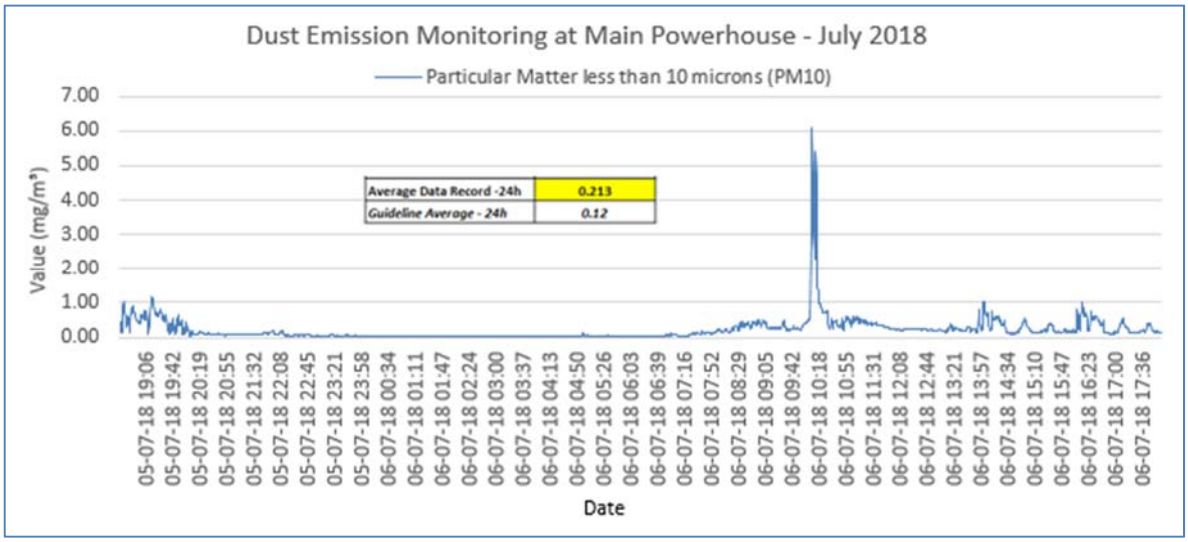
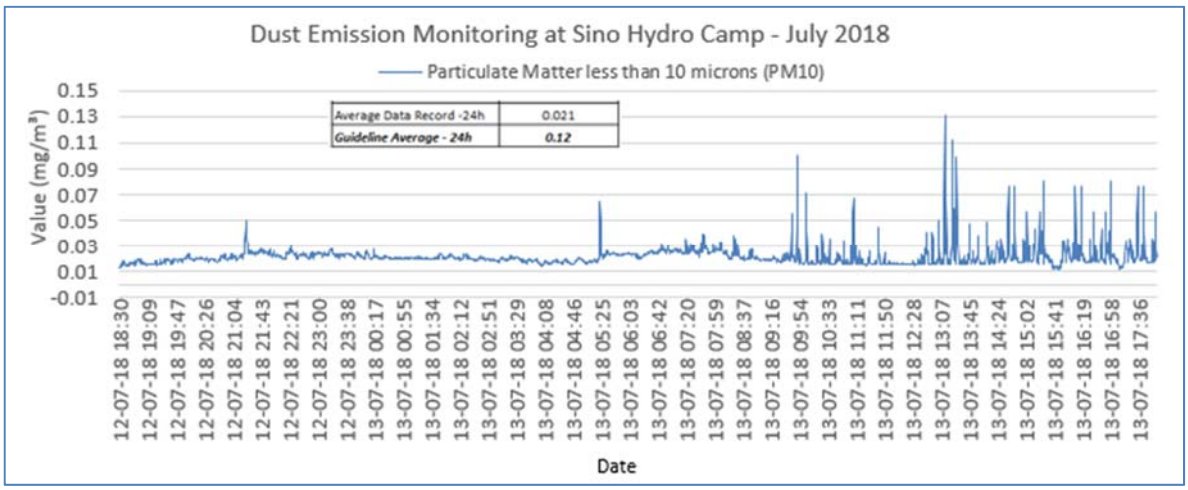


Figure C-10: Dust Monitoring Results at the Sino Hydro Camp in July 2018



ANNEX D: AMBIENT NOISE DATA

Table D- 1: Average Results of Noise Monitoring at Ban Hat Gniun in July 2018

Noise Level (dB)	17-18/July/18			18-19/July/18			19-20/July/18		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	67.60	67.40	61.40	58.40	68.70	71.20	57.50	65.20	71.70
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	41.94	44.16	39.26	44.06	42.62	44.69	43.31	42.14	43.67
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Figure D- 1: Result of Noise Level Monitoring at Ban Hat Gniun in July 2018

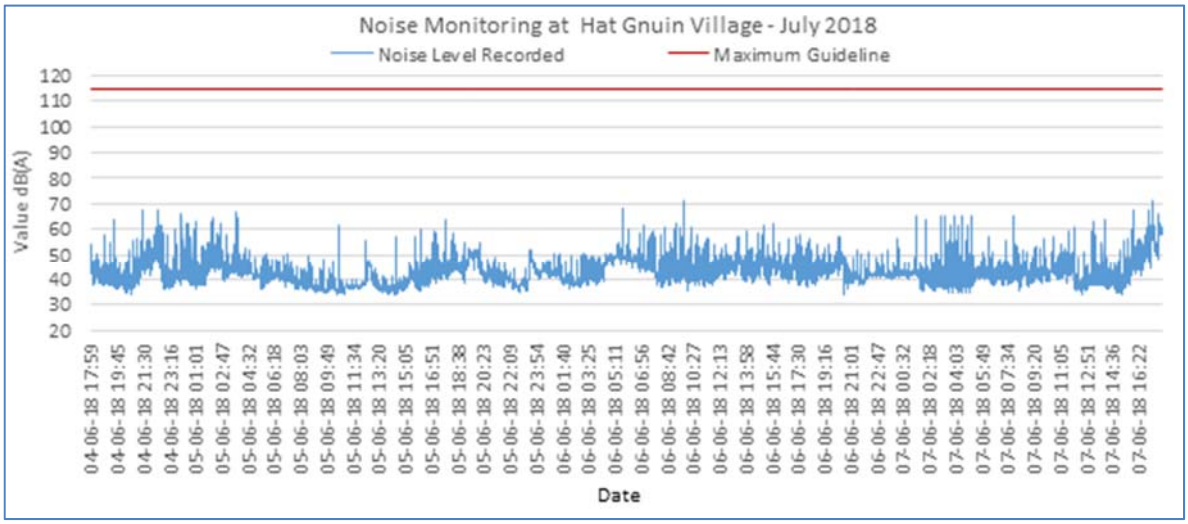


Table D- 2: Average Results of Noise Monitoring at Phouhomxay Village in July 2018

Noise Level (dB)	02-03/July/18			03-04/July/18			04-05/July/18		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	63.80	59.00	64.30	62.40	68.70	62.80	67.90	67.90	74.90
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	39.95	39.41	38.51	40.23	39.37	37.30	41.25	41.33	40.27
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Figure D- 2: Result of Noise Level Monitoring at Phouhomxay Village in July 2018

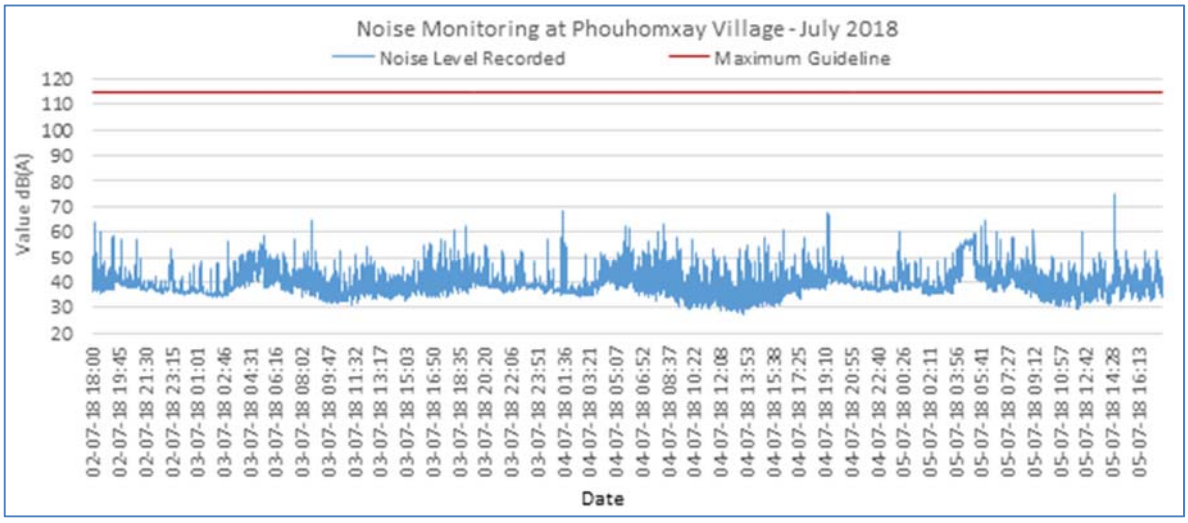


Table D-3 and Table D-4: Average Results of Noise Monitoring at Aggregate Crushing Plant and RCC Plant in July 2018

Aggregate Crushing Plant

Noise Level (dB)	25-26/July/18		26/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	46.1	65.5	73
Guideline Max	***115***	***115***	***115***
Average Data Recorded	40.64	53.38	50.52
Guideline Averaged	***70***	***70***	***70***

RCC Plant

Noise Level (dB)	11-12/July/18		12/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	74.9	62.1	71.2
Guideline Max	***115***	***115***	***115***
Average Data Recorded	53.21	50.54	39.92
Guideline Averaged	***70***	***70***	***70***

Figure D-*3*: Results of Noise Level Monitoring at the Aggregate Crushing Plant in July 2018

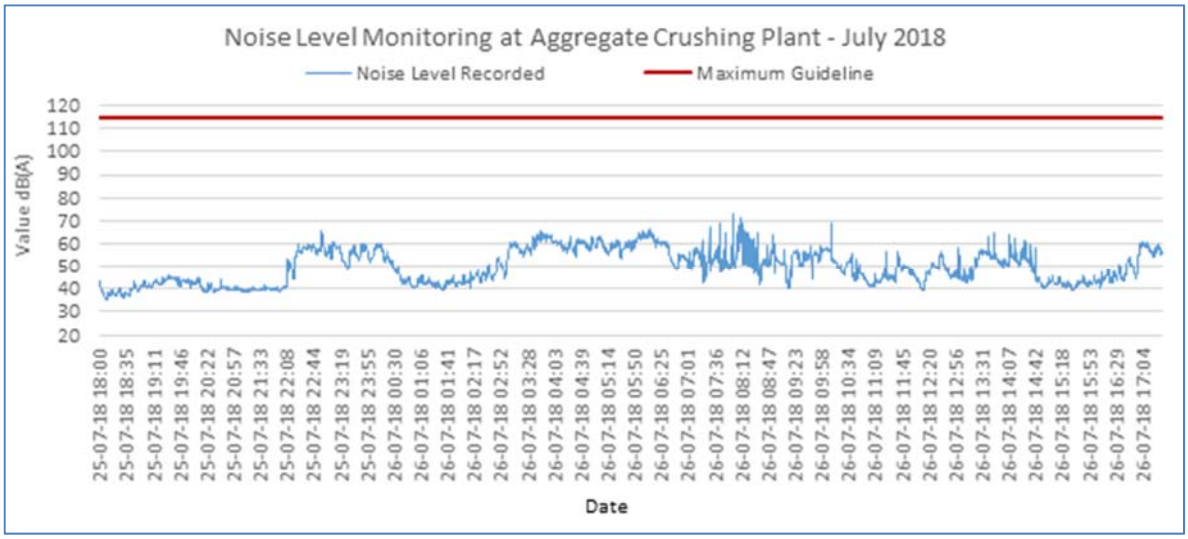


Figure D-*4*: Results of Noise Level Monitoring at the RCC Plant in July 2018

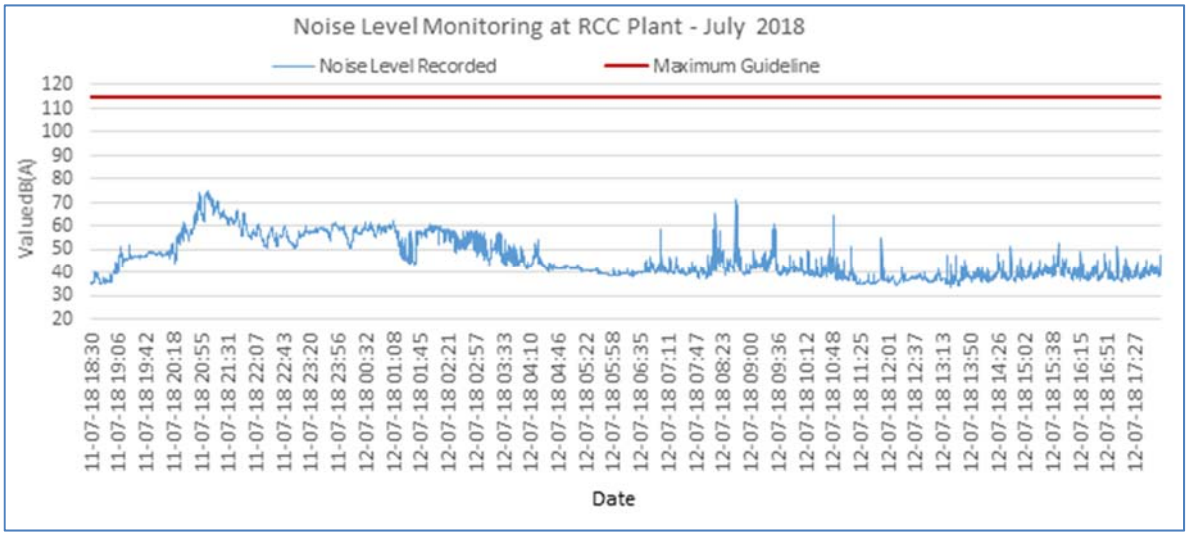


Table D- 5 and Table D- 6: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Sino Hydro Camp in July 2018

Song Da5 Camp No.2

Noise Level (dB)	10-11/July/18		11/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	49.6	54.4	44.9
Guideline Max	***115***	***115***	***115***
Average Data Recorded	43.30	45.72	35.84
Guideline Averaged	***70***	***50***	***70***

Sino Hydro Temporary Worker Camp

Noise Level (dB)	26-27/July/18		27/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	52.9	53	63
Guideline Max	***115***	***115***	***115***
Average Data Recorded	47.32	45.64	46.40
Guideline Averaged	***70***	***50***	***70***

Figure D- 5: Results of Noise Level Monitoring at Song Da5 Camp No.2 in July 2018

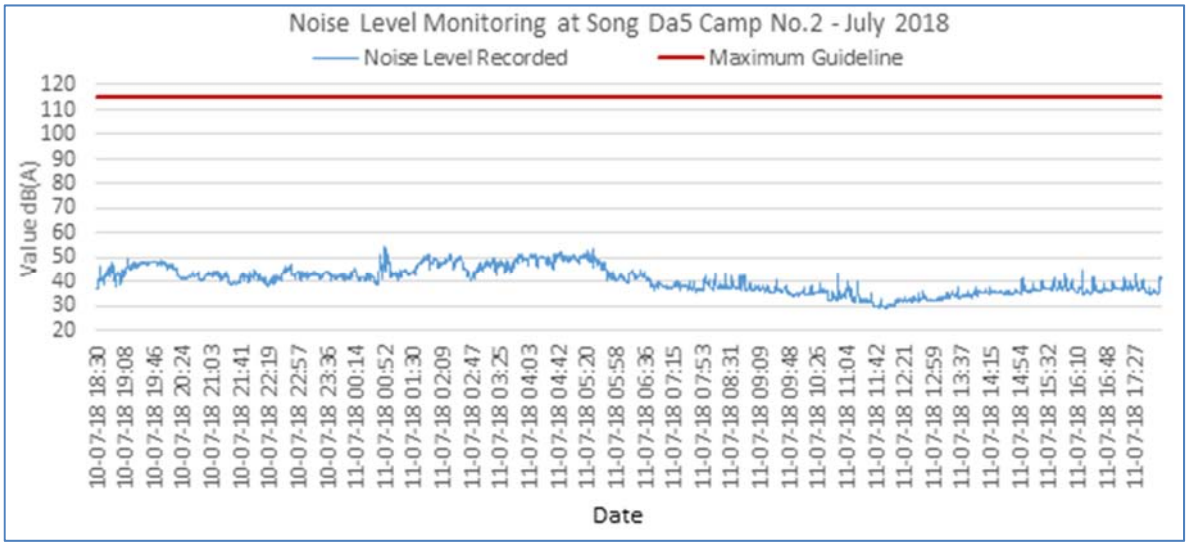


Figure D- 6: Results of Noise Level Monitoring at Sino Hydro Temporary Worker Camp in July 2018

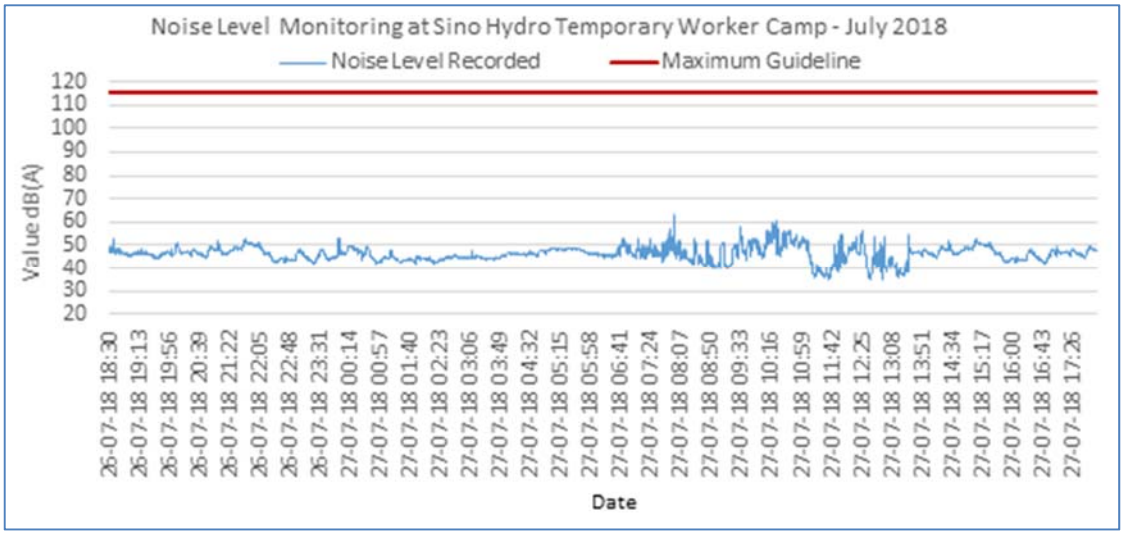


Table D- 7 and Table D- 8: Average Results of Noise Monitoring at Main Dam, and Lilama 10 Camp in July 2018

Main Dam

Noise Level (dB)	27-28/July/18		28/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	62.2	56	74.4
Guideline Max	***115***	***115***	***115***
Data Record Average	50.20	46.47	49.99
Guideline Averaged	***70***	***70***	***70***

Lilama 10 Camp

Noise Level (dB)	09-10/July/2018		10/July/2018
	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	61.6	69.8	61
Guideline Max	***115***	***115***	***115***
Average Data Recorded	46.56	47.44	42.01
Guideline Averaged	***70***	***50***	***70***

Figure D- 7: Results of Noise Level Monitoring at Main Dam (Top View Left Bank) in July 2018

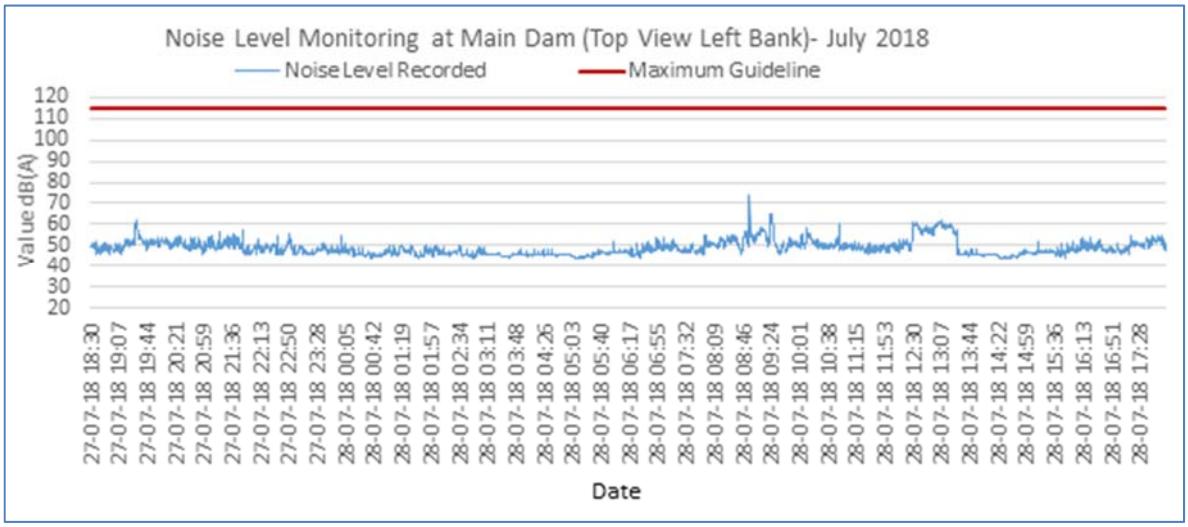


Figure C- 8: Results of Noise Level Monitoring at Lilama 10 Camp in July 2018

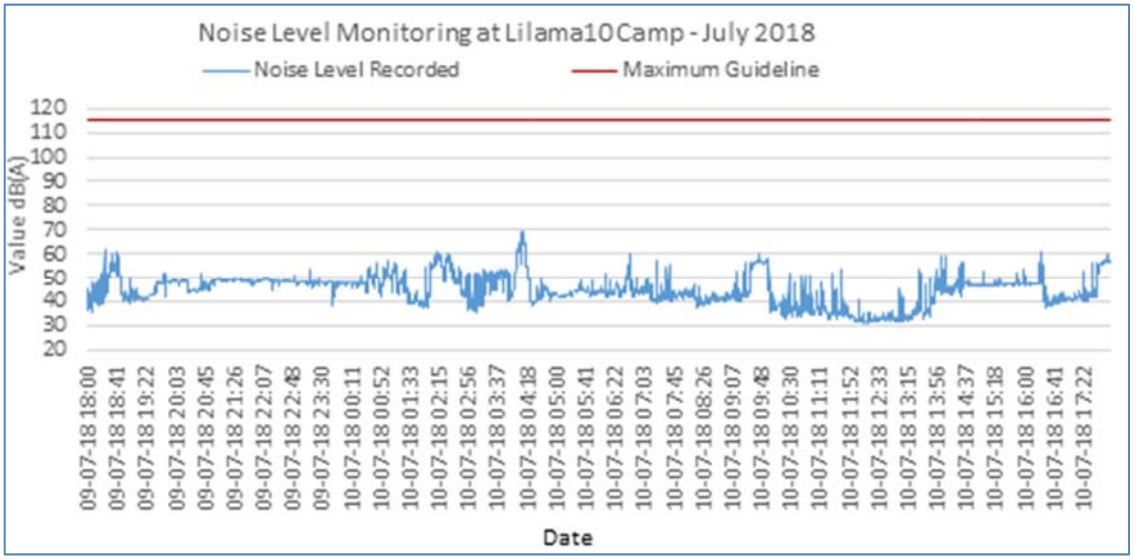


Table D-9 and Table D-10: Average Results of Noise Monitoring at Main Powerhouse, and Sino Hydro Camp in July 2018

Main Powerhouse

Noise Level (dB)	05-06/July/18		06/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	58.8	69.4	82.1
Guideline Max	***115***	***115***	***115***
Data Record Average	52.62	49.51	60.82
Guideline Averaged	***70***	***70***	***70***

Sino Hydro Camp

Noise Level (dB)	12-13/July/18		13/July/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	55.2	51.3	80.7
Guideline Max	***115***	***115***	***115***
Average Data Recorded	41.17	39.56	41.55
Guideline Averaged	***70***	***50***	***70***

Figure C- 9: Results of Noise Level Monitoring at Main Powerhouse in July 2018

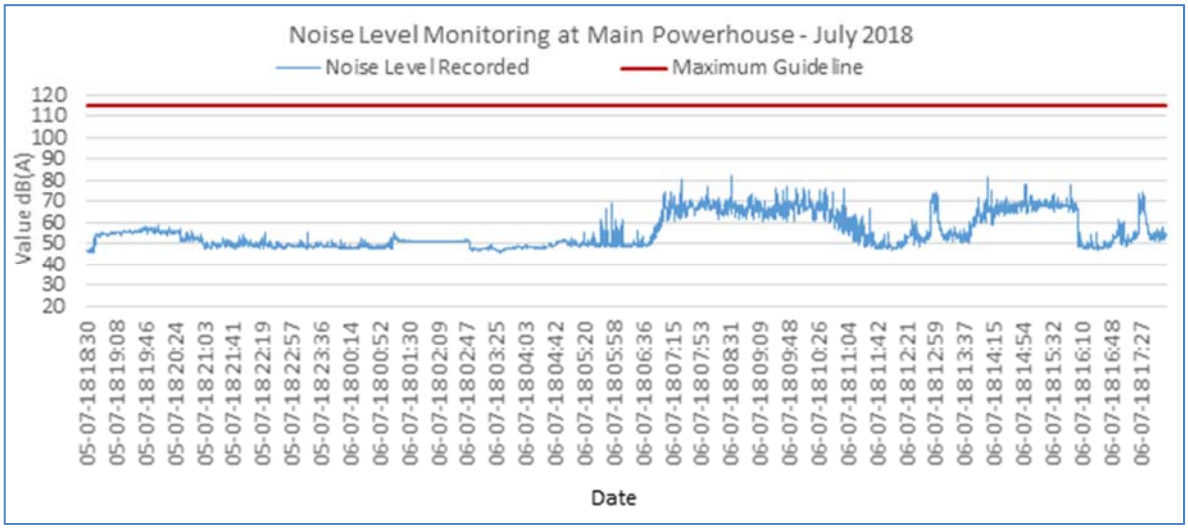


Figure C-10: Results of Noise Level Monitoring at Sino Hydro Camp in July 2018