

Nam Ngiep 1 Hydropower Project

Environment Monitoring Report Third Quarter of 2018

July to September 2018

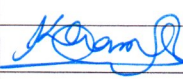
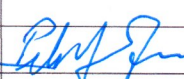
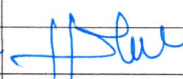
A	4 April 2019				Final
A1	15 January 2019				To ADB for review
A0	December 2018	Khamlar PHONSAVAT	Peter G JENSEN	Vilayhak SOMSOUVONG	To LTA for Review
REV	DATE	PREPARED	REVIEWED	APPROVED	MODIFICATION DETAILS
Accessibility		<div>Document No.</div> <div>NNP1-C-J0905-RP-015-A</div>			
<input checked="" type="checkbox"/>	Public				
<input type="checkbox"/>	Internal				
<input type="checkbox"/>	Confidential				
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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
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
EC	Electrolytic Conductivity
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
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
GOL	Government of Lao PDR
GIS	Geographic Information Systems
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
kV	kilo-Volt
LTA	Lender's Technical Advisor
MAF	Ministry of Agriculture and Forestry

MEM	Ministry of Energy and Mines, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry
PONRE	Provincial Department of Natural Resource and Environment, MONRE
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
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

1 EXECUTIVE SUMMARY

The quarterly environment monitoring reports of Nam Ngiep 1 Hydropower Project provide information and analysis of compliance with the environmental and social obligations of the Project stipulated in the Concession Agreement between the Nam Ngiep 1 Power Company (NNP1PC) and the Government of Lao PDR (GOL), and as required by environmental legislation of the Lao PDR, the ADB Safeguard Policy Statement and IFC Performance Standards. The Company ensures compliance with these requirements through implementation of project specific sub-plans, programmes and activities prepared as part of the Environmental and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP).

During Q3 2018, the Environmental Management Office (EMO) of NNP1PC reviewed and approved four Site Specific ESMMPs and one Site Decommissioning Plan whilst one site Decommissioning Plan review will be carried over to next quarter. A total of 13 Observations of Non-Compliance (ONCs), one Non-Compliance Level-1 (NCR1) and two Non-Compliance Level-2 (NCR2) were opened and resolved during the reported period.

During Q3 2018, a total of 430.7 m³ of solid waste was disposed at the NNP1 Project Landfill, a decrease of 103.3 m³ compared to Q2 2018. A total of 15,218 kg of recyclable waste (mostly scrap metal) was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing and final disposal.

The Environmental Management Unit (EMU) of Bolikhamxay Province conducted site inspection during 26 - 27 September 2018. During this inspection, the EMU was concerned about demolition of heavy concrete foundations at the aggregate crushing plant and the RCC Plant which was addressed by EMO in the Project's Site Decommissioning and Rehabilitation Plan discussed with the principal Contractors in September 2018.

The quarterly site inspection by the Environmental Management Unit (EMU) of Xaysomboun Province was carried on 25 September 2018. This visit focused mainly on the reservoir water quality monitoring. The Xaysomboun Provincial EMU did not raise any concerns during their mission.

NNP1PC received comments on the final NNP1 Watershed Management Plan (WMP) from ADB, LTA, and Xaysomboun and Bolikhamxay Watershed and Reservoir Protection Offices (WRPO) in September 2018. The final plan is being improved to address these comments and will be re-submitted to ADB for final review and approval prior to submitting the plan to the Chairman of Watershed and Reservoir Protection Committee (WRPC).

Xaysomboun PONRE presented the draft watershed management regulations to the Provincial Assembly on 16 August 2018. The Assembly members gave their consent to the regulations with some comments that need to be addressed before re-submission to the chair of the Provincial Assembly. However, The Xaysomboun Provincial Assembly will need to have further discussions on objections raised by Xaysomboun PAFO at the end of September 2018. As soon as these matters are resolved, the Chairperson of the Provincial Assembly will issue a certification of acceptance prior to submitting the regulations to Xaysomboun Provincial Governor for signing.

The initial first draft of the NNP1 Biodiversity Offset Management Plan for NCNX was submitted to NNP1PC on 29 June 2018. The EMO and its biodiversity expert have further improved the draft and submitted this to ADB in September 2018.

The Biodiversity Offset Management Regulations were presented to the Bolikhamxay Provincial Assembly on 17 August 2018. The regulations were unanimously endorsed by Bolikhamxay

Provincial Assembly. These Regulations were submitted to the Bolikhamxay Provincial Governor for signing on 24 September 2018. The regulations will be effective once the Provincial Governor has signed the document.

The five species that dominated the fish catch by weight in Q3 2018 are all species that are categorized as Least Concern except *Hemibagrus filamentus* that are Data Deficient according to the IUCN Red List. The recorded catch included one Critically Endangered species (CR), two Endangered (EN) species, four Vulnerable species (VU), and six Near Threatened species (NT).

2 INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khuang 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.

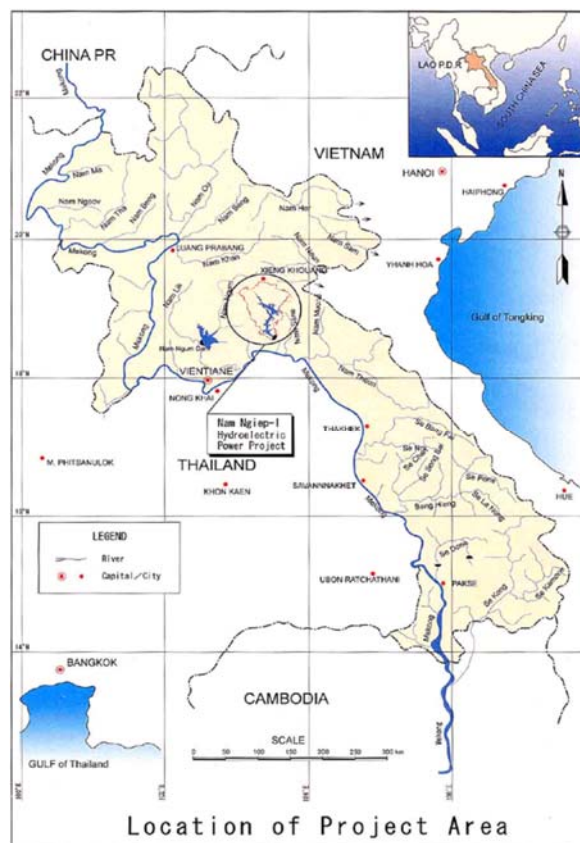
The project consists of two dams. The main dam which is located 9.0 km upstream of Hat Gniun Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At 167 m high, the main dam will be the second largest in Lao PDR. The Power 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 Substation 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 Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during Q3 2018. The report is published on the Company website (<https://namngiep1.com/>).

Related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are also publicly disclosed on the Company website as required under the Concession Agreement.

3 CONSTRUCTION PROGRESS

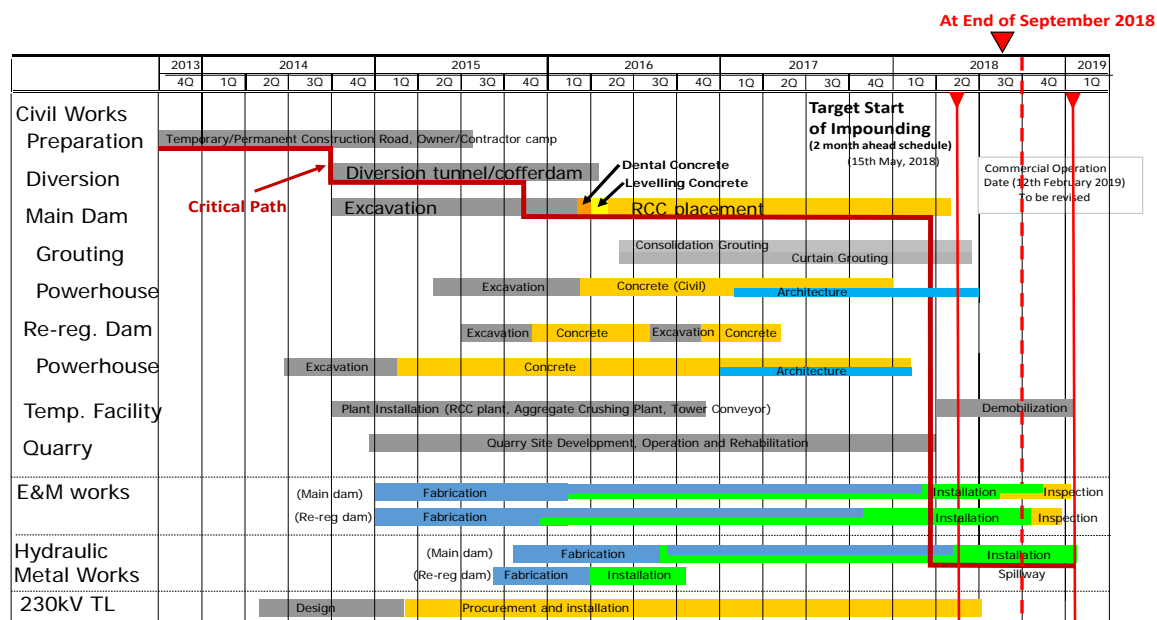
Construction Works for the Project are being carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-mechanical Works and the 230 kV Transmission Line Works. Actual overall cumulative



work progress until the end of September 2018 was 97.5%¹ (compared to planned progress of 98.2%).

The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in **Figure 3-1**.

FIGURE 3-1: OVERALL CONSTRUCTION SCHEDULE



3.1 CIVIL WORK

The actual overall cumulative work progress until the end of September 2018 was 97.5 % (compared to planned progress of 98.2 %). This progress is correctly stated but takes no account of the unforeseen circumstances that have arisen on Site during July 2018 with regard to the installation tolerances of the turbine generating units already installed which will probably lead to their dis-assembly and re-installation.

3.2 MAIN DAM AND POWERHOUSE

Since the impounding of the Main Dam started 15 May 2018, monitoring has been done to confirm the dam stability, especially to the right abutment where some anomalous results had been noted. Many of the original concerns have been explained or are better understood. However, the monitoring revealed unforeseen consequences, which began unfolding with events in August and September 2018 when loading of the dam toe appeared to have caused a rotation and settlement of the main powerhouse to upstream and towards the old river bed

¹ The progress to-date is calculated as (Cumulative Amount of Achieved Interim Milestone Payments) / (Total Agreed Original Price of Construction Contracts) and expressed as a percentage. These totals exclude varied works and other adjustments allowed under each Contract.

² The progress to-date is calculated as (Cumulative Value Achieved for Completed Work by Variation Order or Other Adjustment) / (Total Budget Contingency Amount)

such that the setting and fixing vertically of both turbine generating units within the required tolerances was not possible. This movement of the powerhouse also affected associated structures such as the penstocks and the intake valve. Monitoring of the instruments initially installed continues, more instruments have been installed or are planned to be installed, further drainage drilling has been carried out and more will be undertaken. However, it is important to note that this is not a dam safety issue and there is no risk to the stability or integrity of the dam or the powerhouse structures. As related above, all current information and opinion is contained in the separate September Monthly Report on Main Dam Instrumentation and Monitoring. This Report has been sent to the Dam Safety Review Panel and the RCC Dam Expert for review and comment.

3.2.1 Re-regulation dam and powerhouse

The re-regulation dam and powerhouse are 100% completed with various auxiliary equipment being installed during Q3 2018.

FIGURE 3-2: COMPLETED RE-REGULATION DAM AND POWERHOUSE, AS THE END OF SEPTEMBER 2018



3.3 QUARRY

The quarry operations were completed in March 2018 and the final blasting was carried out on 27 March 2018.

The materials excavated from the plunge pool have been hauled to the quarry and deposited there. A draft decommissioning and rehabilitation plan has been developed and government notification of this practice is under arrangement.

3.4 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 September 2018 was 98.8 % as planned and on schedule both for the main dam powerhouse

and the re-regulation dam powerhouse. However, due to the inclination of the turbine shafts, the EMW Contractor has suspended its installation works of Unit 2 and wet test work for Unit 1 until a plan for recovery of the situation has been developed.



Figure 4.2-1: Main shaft levelling check for Unit 1



Figure 4.2-2: Turbine shaft inclination check for Unit 1



Figure 4.2-3: Adjustment of platform inside turbine pit for Unit 1



Figure 4.2-4: Main shaft levelling check for Unit 2

3.5 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 September 2018 was 83 % and on schedule.

During Q3 2018 the following work was undertaken:

- Completed erection of the guide frame for the spillway gate Nos. 1, 2, 3 and 4.
- Erection of the gate leaf for the spillway gate for Nos. 1 to 4 at the main dam is 37 % complete.
- Completed setting stoplogs for spillway gate Nos 1, 2, 3 and 4.
- Operation of spillway gate No 4.
- Carried out the third wet test of the riparian release conduit.
- Completed wet tests and commissioning of the two intake gates.

3.6 230 kV 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 September 2018 was 100 % and on schedule with energization test completed successfully in September 2018.

3.7 115-kV TRANSMISSION LINE

The 115-kV Transmission Line from the re-regulation powerhouse to Pakxan substation is an associated facility to NNP1, owned and being constructed by Électricité Du Laos (EDL).

The 115-kV transmission line will pass through Phouhomxay Village and EDL and NNP1PC has executed a lease agreement in April 2018, whereby NNP1PC will lease the right of way to EDL under certain conditions. The construction of tower foundations was started in December 2017 and has reached 57 completed out of a total of 86 towers with 49 No. towers erected and all tower materials already delivered to Site. The contractor suspended construction work in May 2018 and will resume work after the rainy season. The remaining work is unlikely to be completed before the end of November 2018.

4 ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental management and monitoring activities reported in this section document implementation of the relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Construction Phase during Q3 2018.

4.1 Contractor SS-ESMMPs

During Q3 2018, four Site Specific Environmental and Social Management Plans (SS-ESMMPs) and two Site Decommissioning and Rehabilitation Plans were submitted for review and approval by the Environmental Management Office (EMO). Out of these, four SS-SEMMPs and one Site Decommissioning Plan were cleared, one site Decommissioning Plan will be reviewed and cleared in the next quarter.

The status of the SS-ESMMPs received in Q3 2018 is shown in **Table 4-1**. More details can be found in **Appendix 1**.

TABLE 4-1: SS-ESMMP AND WORKING DRAWINGS REVIEWED DURING Q3 2018

Name of SS-ESMMP Document/ Working Drawings	Rev. 1	Rev. 2	Rev. 3	Approved
Reply to owner’s comment for SS-ESMMP for closing of the dyke at borrow pit No.7 (1 st submission)	√	Closed, the final mitigation measures were implemented and the Contractor agreed to prepare and submit site specific decommissioning and rehabilitation plan for further review and approval.		
Reply to owner’s comment for SS-ESMMP–RRPS for closing of a borrow pit at the corner of road P1 &P1A (1 st submission)	√	Closed. As above		
SS-ESMMP for Construction of Quarry Site (version A6)	Closed. As above			
TCM subcontractor’s Camp Decommissioning Plan (2 nd submission)	√	√	NA	√

Name of SS-ESMMP Document/ Working Drawings	Rev. 1	Rev. 2	Rev. 3	Approved
SS-ESMMP for HSRA's Irrigation Canal Rock Excavation	√	NA	NA	√
Sino Hydro Camp, Aggregate Plant and Facilities Decommissioning and Rehabilitation Plan	√	Under Review		

4.2 Results of Compliance Inspections at Construction Sites

During Q3 2018, the EMO conducted bi-weekly and weekly follow-up inspections at 30 construction sites and camps of the main civil works, the 230 kV Transmission Line, the 115 kV Transmission Line and construction sites in Phouhomxay Village and Zone 2UR. The total number of inspected sites has decreased this Quarter from 31 to 30 monitoring sites because the PKC Contractor at Phouhomxay Village completed their work and the camp and facilities were demobilised from the site.

A total of 13 Observations of Non-Compliance (ONCs), one Non-Compliance Level-1 (NCR1) and two Non-Compliance Level-2 (NCR2) were opened and resolved during the reported period. The status of these non-compliance reports is summarized in **Table 4-2** and **Figure 4-1**. The progress of corrective actions is presented in **Appendix 2**.

TABLE 4-2: STATUS OF NON-COMPLIANCE REPORT DURING Q3 2018

Status	ONC	NCR- Level 1	NCR- Level 2	NCR- Level 3	Incident Report
Carried over ONC/NCR	7	0	1	0	0
Newly opened ONC/NCR	6	1	1	0	0
Total No. of ONC/NCR	13	1	2	0	0
Resolved ONC/NCR	13	1	2	0	0
Unresolved ONC/NCR carried forward to the next Quarter	0	0	0	0	0

FIGURE 4-1: STATUS OF ONC DURING Q3 2018

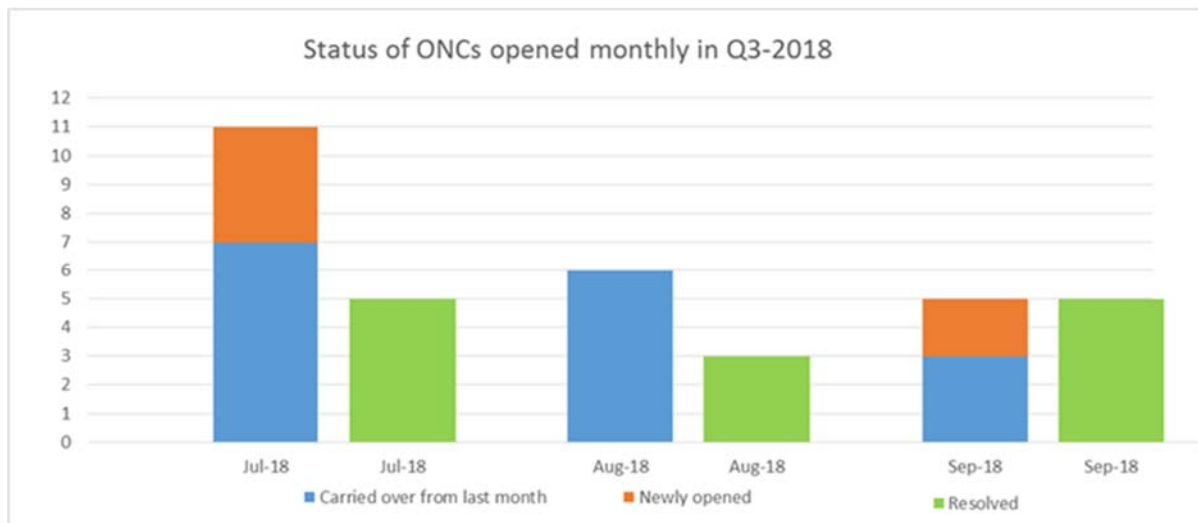
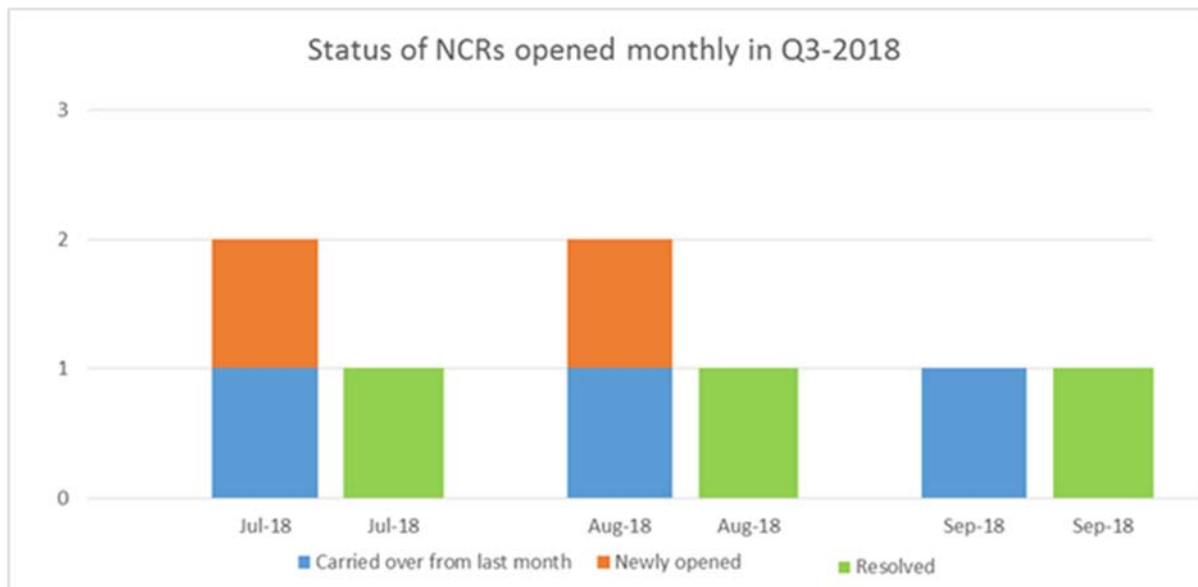


FIGURE 4-2: STATUS OF NCR DURING Q3 2018



PHOTOGRAPH 1: BI-WEEKLY JOINT INSPECTION BETWEEN NNP1PC AND CONTRACTORS



PHOTOGRAPH 2: JOINT INSPECTION ON SITE DECOMMISSIONING AT SINO HYDRO WORKSHOP OF THE AGGREGATE CRUSHING PLANT YARD



PHOTOGRAPH 3: SITE INSPECTION OF 115 kV TRANSMISSION LINE AT TOWER NO. 3



PHOTOGRAPH 4: JOINT INSPECTION ON THE CONTRACTOR'S WASTEWATER TREATMENT SYSTEM OPERATION AND MAINTENANCE



4.3 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

4.3.1 General Waste Management

During Q3 2018, a total of 430.7 m³ of solid waste was disposed at the NNP1 Project Landfill, a decrease of 103.3 m³ compared to Q2 2018. EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the camps. EMO noted that waste separation from the construction sites and the camps of the main Contractors (HM-Hydro and IHI) and subcontractors (LILAMA 10, Zhefu, Song Da 5 and 276) has generally improved.

A total of 300 kg of compost was produced from grass, cow dung, rice husks, molasses, bio-extracts (a liquid substance derived from the fermentation of vegetables and fruits with sugar and used as a natural liquid fertiliser) and vegetable and fruit waste from the canteens. A total of 15,218 kg of recyclable waste was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing as shown in **Table 4-3**.

TABLE 4-3: AMOUNTS OF RECYCLABLE WASTE SOLD DURING Q3 2018

Source and Type of Recyclables		Unit	Total in Q3 of 2018 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	68,239	13,272	54,967
Sub-Total 1		kg	68,239	13,272	54,967
Operation camp					
2	Glass bottles	kg	1,687	1,530	157
3	Plastic bottles	kg	280	214.5	65.5
4	Aluminium cans	kg	73.2	47.7	25.5
5	Paper/Cardboard	kg	248.5	153.5	95
Sub-Total 2		kg	2,288.7	1,945.7	343
Grand Total 1+2		kg	70,527.7	15,217.7	55,310

4.3.2 Hazardous Waste Management

During Q3 2018, joint hazardous materials and waste inventories was carried out at the main construction sites and the contractors' camps. The amounts of hazardous waste collected, stored and disposed during Q3 2018 are shown in **Table 4-4**. The treatment and final disposal of hazardous waste including used hydraulic oil and engine oil are outsourced to Khounmixay Processing Factory. Khounmixay will collect and treat/dispose the remaining used hydraulic oil and engine oil in connection with the decommissioning of the relevant facilities due in 2019.

TABLE 4-4: HAZARDOUS WASTE RECORDED DURING Q3 2018

No.	Hazardous Waste Type	Unit	Total in Q3 2018	Disposal	Remaining
1	Used hydraulic and engine oil	litre (l)	11,620	3,800	7,820
2	Contaminated soil, sawdust and concrete	kg	1,260	0	1,260
3	Used oil filters	No.	489	0	489
4	Used tyre	No.	329	0	329
5	Empty paint and spray cans	can	224	0	224
6	Ink cartridge	No.	204	0	204
7	Empty used chemical drum/container	Drum (20 l)	180	10	170
8	Halogen/fluorescent bulbs	No.	123	0	123
9	Empty used oil drum/container	drum (20 l)	149	47	102
10	Empty used chemical drum/container	drum (200 l)	140	40	100
11	Contaminated textile and material	kg	42	0	42
12	Empty contaminated bitumen drum/container	drum (200 l)	52	10	42

No.	Hazardous Waste Type	Unit	Total in Q3 2018	Disposal	Remaining
13	Lead acid batteries	No.	22	0	22
14	Lithium-ion batteries	No.	7	0	7
15	Clinical waste	kg	4	0	4
16	Empty used oil drum/container	drum (200 l)	40	39	1

In addition, a total of 46 m³ of sewage sludge from Sino Hydro and V&K subcontractors was transported and disposed of at Spoil Disposal Area No. 6 by following NNP1PC's Standard Operating Procedure (SOP) on Sewage/Black Water Disposal.

4.4 COMMUNITY WASTE MANAGEMENT SUPPORT

4.4.1 Animal Fodder (Pig Feed) Collection Programme

During Q3 2018, local villagers collected a total of 17,370 kg of food waste from the Owner's Site Office and Village (OSO) and Contractors' camps for feeding their animals. This is a decrease of 1,055 kg compared to Q2 2018, details are shown in **Table 4-5** below.

TABLE 4-5: AMOUNT OF FOOD WASTE COLLECTED BY LOCAL VILLAGERS FOR USE AS PIG FEED DURING Q3 2018

NO.	SITE NAME	UNIT	TOTAL
1	Song Da5 Camp No. 2	kg	5,490
2	Song Da5 Camp No. 1	kg	3,159
3	Obayashi Corporation Camp	kg	2,223
4	Owner's Site Office and Village (OSO)	kg	2,408
5	LILAMA 10 Camp	kg	3,692
6	Kenber Camp	kg	398
Total		kg	17,370

4.4.2 Community Recycling Programme

The Community Recycle Waste Bank collected a total of 4,676 kg of recyclables from villagers and 1,562 kg was sold to Khounmixay Processing Factory as presented in **Table 4-6** below.

TABLE 4-6: AMOUNTS OF RECYCLABLES SOLD AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Purchased Amount During the Third Quarter of 2018 (A)	Sold (B)	Remaining Amount (A - B)
Scrap metal	kg	28	0	28
Glass	kg	2,657	805	1,852
Paper/cardboards	kg	1,345	501	844
Plastic bottles	kg	598.5	256	342.5
Aluminium	kg	47.5	0	47.5
Total	kg	4,676	1,562	3,114

In addition, EMO conducted a community consultation on waste management for host villages (Thaheau & Hat Gnuin village) and Phouhomxay village during 19 September 2018 to improve their awareness on proper waste separation and disposal.

4.4.3 Houay Soup Landfill

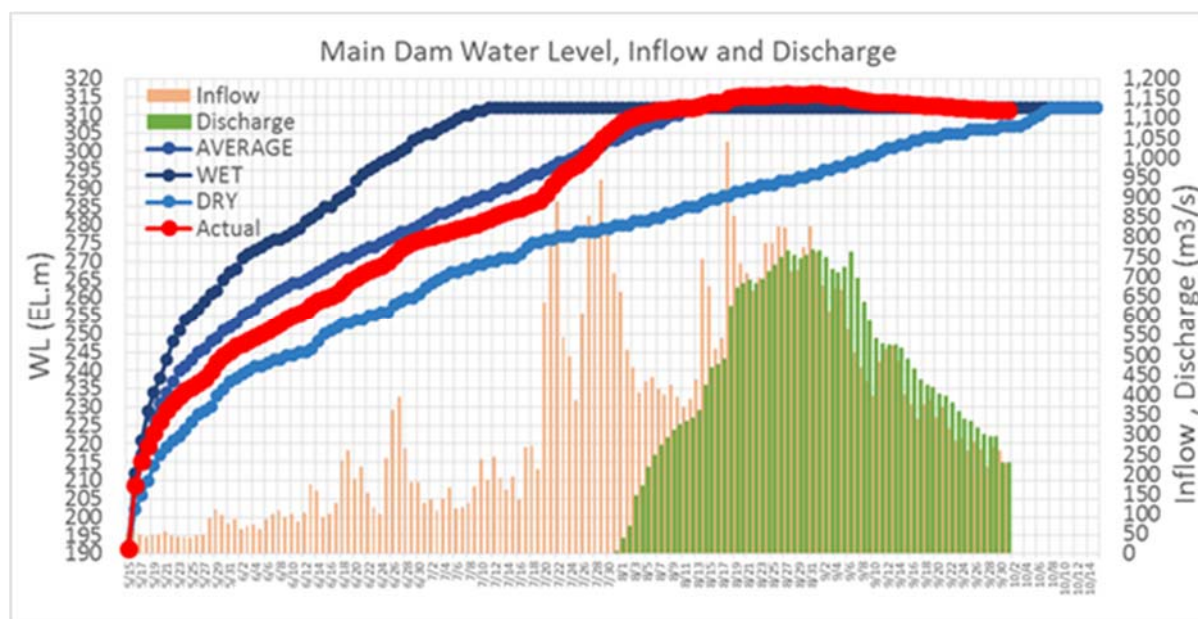
A local contractor started the operation of the Houay Soup landfill in December 2017. The work includes solid waste collection and transportation from Phouhomxay, Thahuea and Hat Gnuin villages to Houay Soup landfill three days a week (Monday, Wednesday and Friday), waste segregation, waste compaction and daily waste cover at the landfill.

During Q3 2018, approximately 92.4 m³ of solid waste was collected from the Thaheau, Hat Gnuin and Phouhomxay villages.

4.5 MAIN RESERVOIR IMPOUNDING

The impounding of the main reservoir started on 15 May 2018 and until 31 July 2018 when the water level in the reservoir reached 306.5 masl (the sill level of the spillways), the discharge from the re-regulation dam was reduced to a minimum² of 5.5 m³/s. The average discharge from the re-regulation dam during this initial period was 8.3 m³/s. The progress of impounding is illustrated in **Figure 4-3**.

FIGURE 4-3 IMPOUNDING PROGRESS OF THE MAIN RESERVOIR



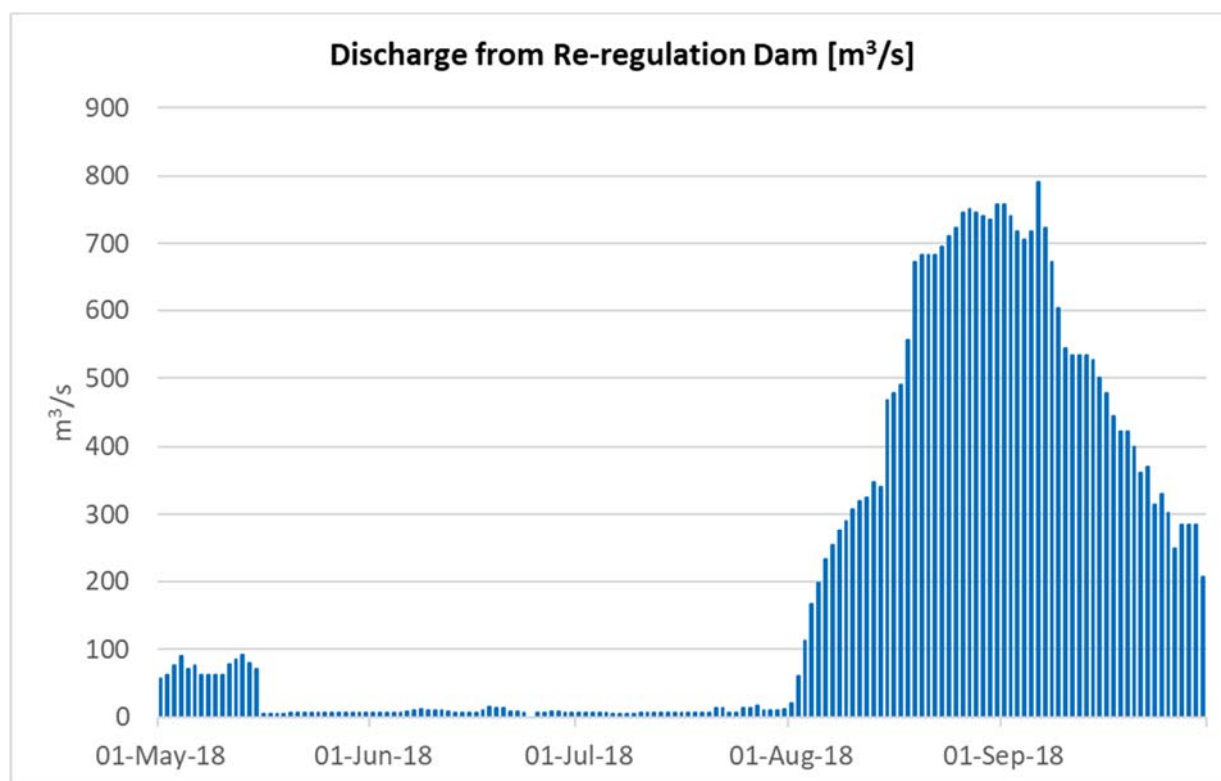
Over the course of August 2018, the discharge from the main dam and the re-regulation dam was gradually increased to about 50 m³/s - 100 m³/s lower than the inflow gradually raising the water level in the reservoir from about to 306 masl to a maximum of 315.8 masl where

² Minimum flow requirements during impounding as stipulated in the Concession Agreement, Annex C

after the discharge was increased exceeding the inflow using both spillway No. 4 and spillway No.1 (over the stoplogs) and by the end of September 2018 the water level was reduced to 311.5 masl.

NNP1PC monitors the discharge from the re-regulation dam to ensure compliance with the minimum flow requirements and the results are presented in **Figure 4-4**. The discharge from the re-regulation dam has been above the required minimum flow since the start of impounding.

FIGURE 4-4: DISCHARGE FROM THE RE-REGULATION DAM AFTER START OF IMPOUNDING



Since 18 July 2018, NNP1PC has carried out weekly monitoring of river depths at 16 locations downstream the re-regulation dam as shown on **Figure 4-5**. These locations represent cross-sections with possible shallow water depths at low discharge rates.

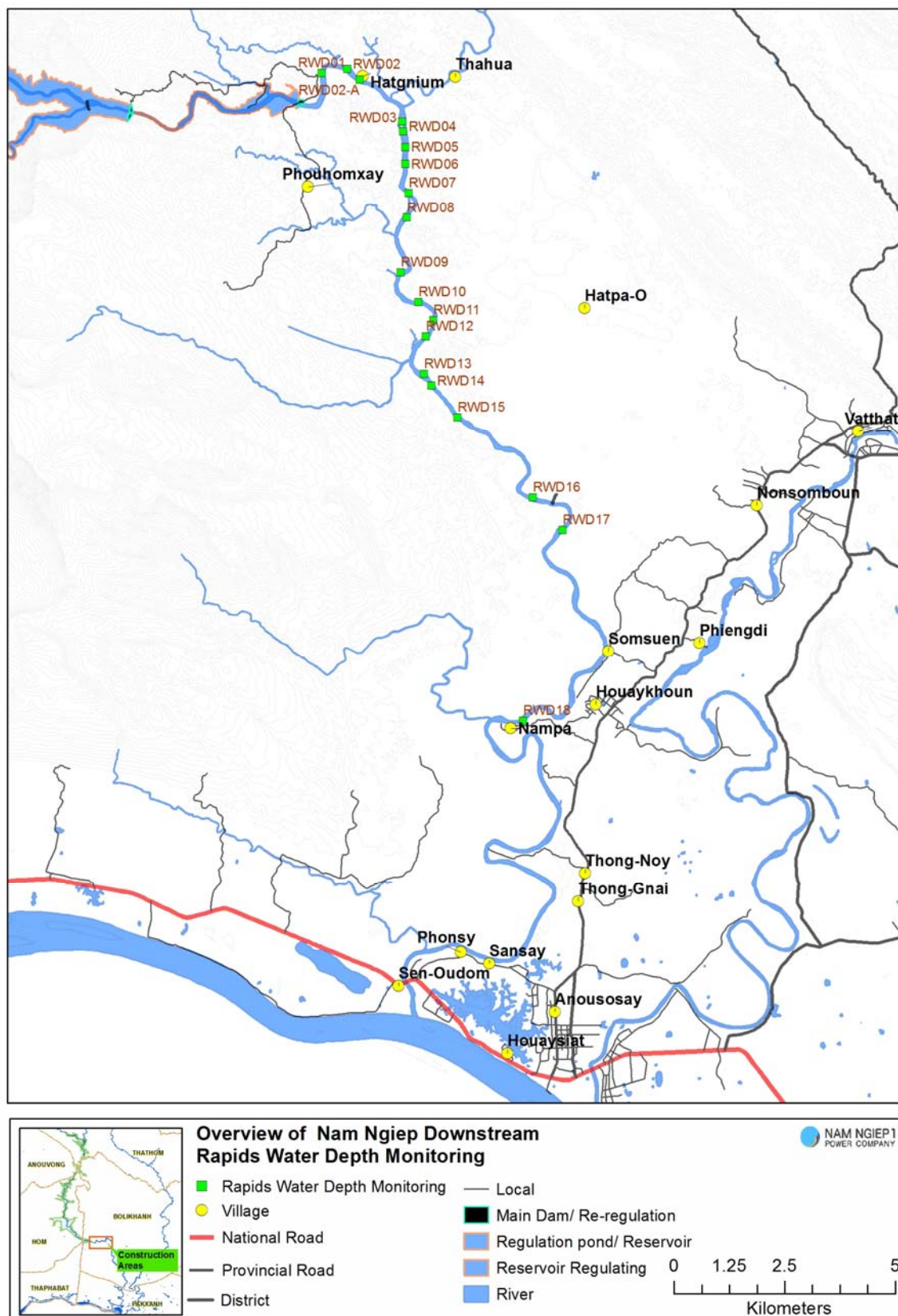
The monitoring is undertaken to confirm compliance with the water depth requirements in the Concession Agreement, Annex C (at least 0.5 m measured immediately downstream the re-regulation dam).

The results of the monitoring are presented in **Table 4-7**. During the period with low discharge rates in July 2018, the results show water depths of about 0.4 m at station RWD01 1.55 km downstream from the re-regulation dam. The monitoring team did not experience any difficulties navigating their boat due to shallow water during any of their missions.

TABLE 4-7 RIVER DEPTH MEASUREMENTS IN NAM NGIEP DOWNSTREAM THE RE-REGULATION DAM

	Station ID	RWD 01	RWD 02	RWD 03	RWD 04	RWD 05	RWD 06	RWD 07	RWD 08	RWD 09	RWD 10	RWD 11	RWD 12	RWD 13	RWD 14	RWD 15	RWD 16
Distance from re-regulation dam (km)		1.55	2.43	4.9	5.2	5.66	6.16	7.13	8.01	9.97	11.31	12.08	12.62	14.1	14.49	15.77	19.76
Date	Discharge (m3/s)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)
18-Jul-18	7.0	0.4	0.58	0.9	0.92	0.75	0.63	0.9	0.73	1	0.58	1	1.1	1.2	1.5	2	1.1
25-Jul-18	14.5	0.42	0.63	0.94	1	0.84	0.77	1.05	0.85	1.15	0.78	1.1	1.2	1.42	1.8	2.5	1.32
01-Aug-18	20.9	0.5	0.67	1.04	1.18	1.05	1.1	1.3	1.1	1.35	0.95	1.4	1.5	1.65	2	2.8	1.6
08-Aug-18	276.3	2.1	1.9	2.5	2.72	2.63	2.7	2.86	2.52	2.9	2.45	2.97	3	3.13	3.54	4.4	3.2
15-Aug-18	467.2	2.6	2.4	3.15	3.45	3.31	3.4	3.55	3.18	3.6	3.16	3.66	3.8	3.95	4.7	5.52	4.98
22-Aug-18	683.2	3.5	3.35	4.1	4.42	4.26	4.35	4.5	4.13	4.46	4.12	4.6	4.75	5	6.2	6.8	6.5
29-Aug-18	740.1	3.72	3.56	4.25	4.7	4.64	4.75	4.87	4.5	4.86	4.55	4.97	5.1	5.4	6.62	7.22	6.85
05-Sep-18	717.3	3.6	3.43	4.14	4.6	4.53	4.62	4.79	4.43	4.78	4.48	4.89	5.04	5.38	6.58	7.19	6.82
12-Sep-18	533.4	2.96	2.82	3.5	3.72	3.81	4	4.12	3.8	4.15	3.7	4.06	4.33	4.65	5.87	6.5	6
20-Sep-18	399.0	2.24	2.1	2.82	3.05	3.17	3.15	3.4	3	3.4	2.89	3.27	3.5	3.7	4.8	5.4	4.9
27-Sep-18	285.4	1.82	1.9	2.45	2.67	2.74	2.7	2.96	2.6	2.95	2.3	2.73	2.92	3.16	4.2	4.4	3.91

FIGURE 4-5 LOCATION OF RIVER DEPTH MONITORING POINTS



4.6 ENVIRONMENTAL MONITORING

The environmental monitoring activities followed the programmes presented in the ESMMP-CP Volume III. The programmes consist of the following components:

- a) Effluent discharge from camps and construction sites
- b) Ambient surface water quality monitoring
- c) Groundwater quality monitoring
- d) Reservoir water quality monitoring
- e) Landfill leachate quality monitoring
- f) Ambient air quality monitoring (particulate matter of less than 10 microns)
- g) Ambient noise and noise emission monitoring.

The monitoring results are assessed against the relevant National Environmental Standards and Effluent Standards specified in the Concession Agreement Annex C³ as applicable. This Section focuses on the key results that did not meet the Standards. All monitoring results can be found in **Appendix 5**.

The NNP1PC Environmental Laboratory carries out water quality analyses for TSS, BOD₅, total coliform, faecal coliform and E. Coli bacteria. All other laboratory water quality analyses are performed by United Analysis and Engineering Consultant Company Ltd (UAE).

4.6.1 Surface Water (River) Quality

The regular surface water quality monitoring programme was adjusted in May 2018 due to the impounding of the main reservoir, which started on 15 May 2018. The revised programme comprises:

- 5 monitoring stations in the main reservoir: R1-R5, where R1 and R2 are new stations and R3, R4 and R5 correspond to the location of the previous Nam Ngiep main stem stations NNG02, NNG03 and NNG09 respectively,
- 2 stations in the re-regulation reservoir: R6 and R7 where R6 corresponds to the location of the previous Nam Ngiep main stem station NNG04,
- 5 stations in the Nam Ngiep main stem (NNG01, and NNG05-NNG08) and
- 4 stations in the main tributaries to Nam Ngiep (NCH01 in Nam Chiane, NPH01 in Nam Phouan, NXA in Nam Xao and NHS01 in Nam Houay Soup).
- NPH01 in Nam Phouan has been moved upstream in the Nam Phouane as the previous location is now in the reservoir.

³ The Effluent Standards in Annex C are **the stricter of** the indicative guideline values applicable to sanitary wastewater in IFC Environmental Health and Safety Guideline, General Guidelines: Wastewater and Ambient Water Quality – and the applicable values in the Lao National Environmental Standards. Note also that the indicative guideline values in the IFC EHS Guideline are meant to apply in the absence of national values

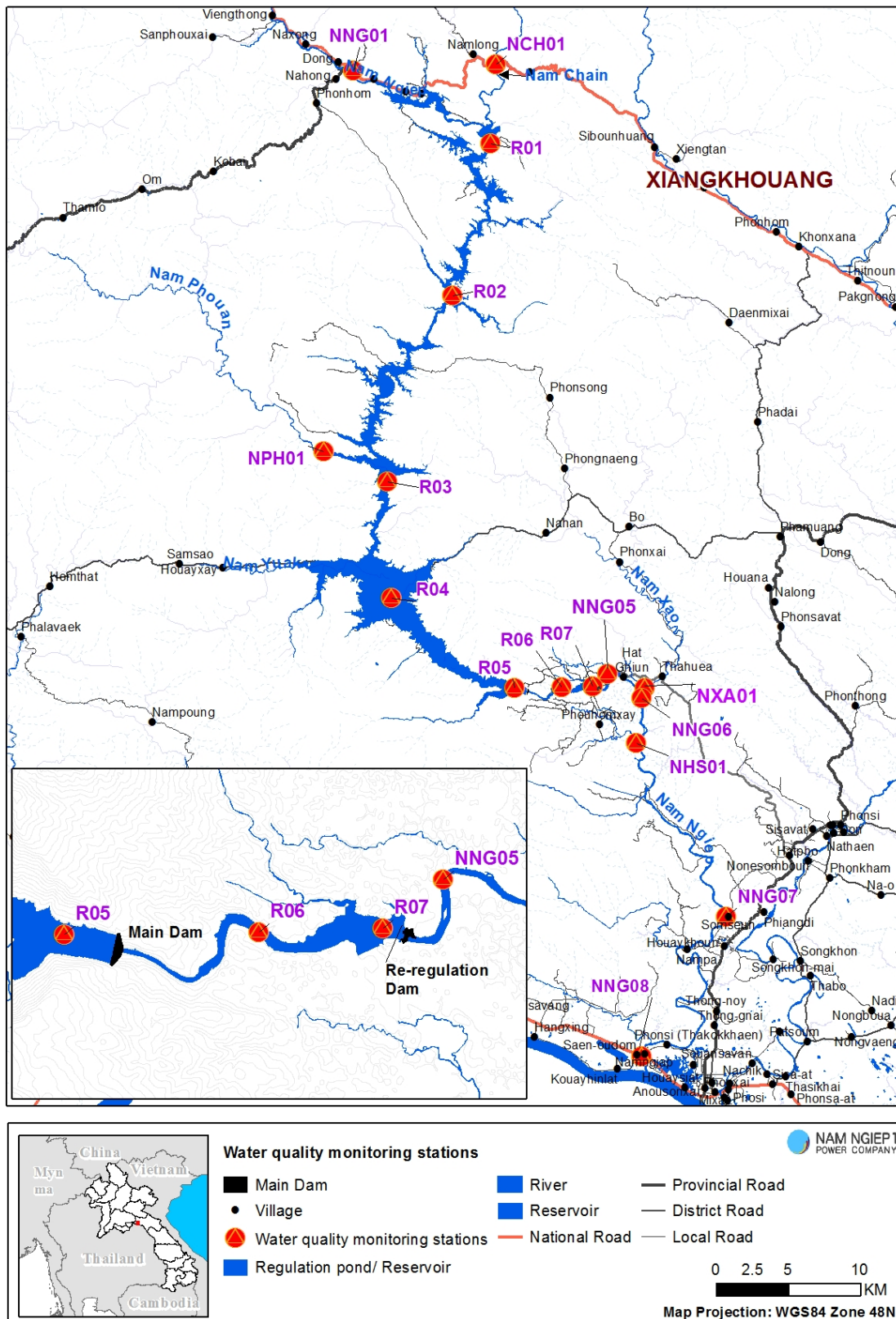
The measurements of depth profiles in the main reservoir and re-regulation reservoir ((dissolved oxygen, temperature, conductivity, pH, and total dissolved solids)) started in mid-September 2018.

The monitoring programme is presented in the **Table 4-8** and the locations of monitoring stations are shown in **Figure 4-6**.

TABLE 4-8: MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Tuesdays and Saturdays	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{s}/\text{cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$) and Turbidity (NTU)	- R5NNG05
Weekly	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{s}/\text{cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$), Turbidity (NTU), TSS (mg/l),	- NPH01 - R3 - R4/NNG03 - R5 - R6 - R7NNG05
Weekly	BOD ₅ (mg/l), Faecal coliform (MPN/100 ml) and Total coliform (MPN/100 ml)	- R5 - R6 - R7 - NNG05
Fortnightly	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{s}/\text{cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$), 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
Quarterly	Total iron (mg/l), Manganese (mg/l), total phosphorus (mg/l), total dissolved phosphorus (mg/l), phytoplankton biomass (g dry weight/m ³), TOC (mg/l)	All stations

FIGURE 4-6: SURFACE WATER QUALITY MONITORING LOCATIONS

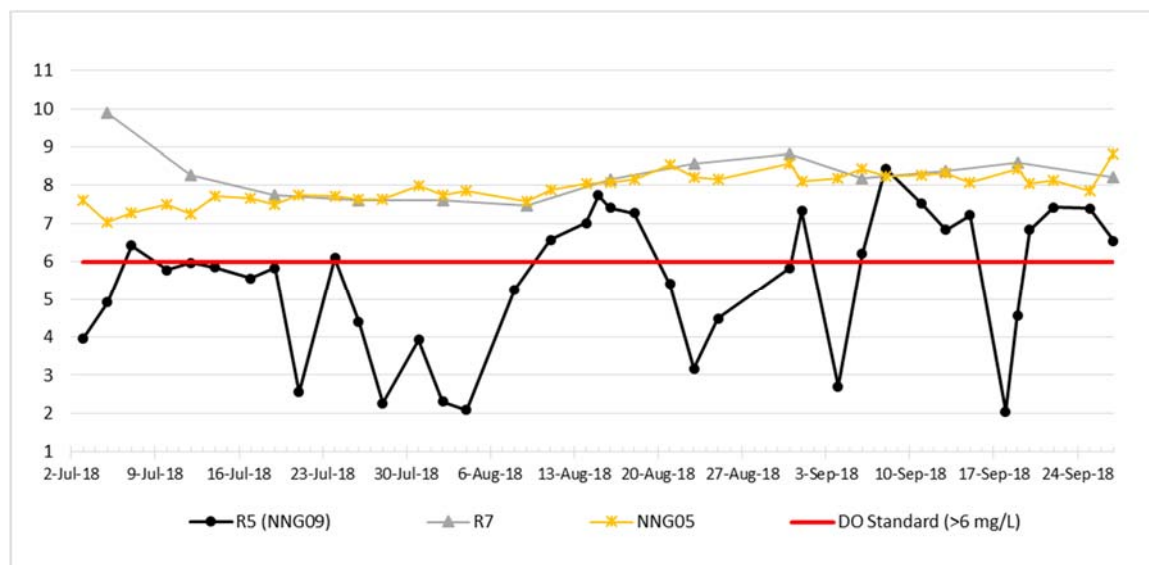


Descriptions of each monitoring station and surface water quality monitoring parameters can be found in **Appendix 3** and all surface water quality data for Q3 2018 are listed in **Appendix 5.1**

Dissolved Oxygen (DO)

The results of dissolved oxygen measurements for the stations immediately upstream and downstream the Project are presented in the line graph in **Figure 4-7**, and the full set of surface water data are shown in **Table 4-9**.

FIGURE 4-7: DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE PROJECT



During the Q3 2018, the concentration of dissolved oxygen in the surface water of R5 (Main Reservoir) which is located immediately upstream of the main dam, fluctuated between 2.05 - 8.44 mg/L. Most of the results recorded at R5 were below 6 mg/L (the surface water quality standard). This is likely due to decomposing vegetation. In July 2018, a total of 31 dead fish was found, and specimens were collected at R5 for fish species identification. The dead fish species were a *Papuligobius* sp., 6 *Scaphiodonichthys acanthopterus* (IUCN Red List Status: Least Concern), 3 *Devario* sp., a *Pao* sp., 2 *Poropuntius* sp., and 18 *Mystacoleucus marginatus* (IUCN Red List Status: Least Concern). EMO has not observed any other incidents of fish kill during Q3 2018.

The dissolved oxygen concentrations in the re-regulation reservoir and in the downstream stations have remained well above 6 mg/L and within normal (pre-impounding) ranges. In addition, the Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01), Nam Phouan (NPH01) and Main Reservoir (R1-R4) were above 6 mg/L, except R2 on 15 August 2018.

The depth profile monitoring indicates formation of oxyclines in the main reservoir (R2-R5, except R1) at levels between 1.5 – 3.0 m. There are no indications of neither an oxycline nor a thermocline in R6 and R7 in the re-regulation reservoir.

The temperature profiles indicate that thermoclines are forming in R2, R3, R4 and R5 at rather shallow but varying depths over time about 1.5-4 m below surface.

The dissolved oxygen levels in the main reservoir and in the re-regulation reservoir at the end of Q3 2018 is summarized in **Figure 4-8**.

FIGURE 4-8 MAIN RESERVOIR DISSOLVED OXYGEN END OF Q3 2018

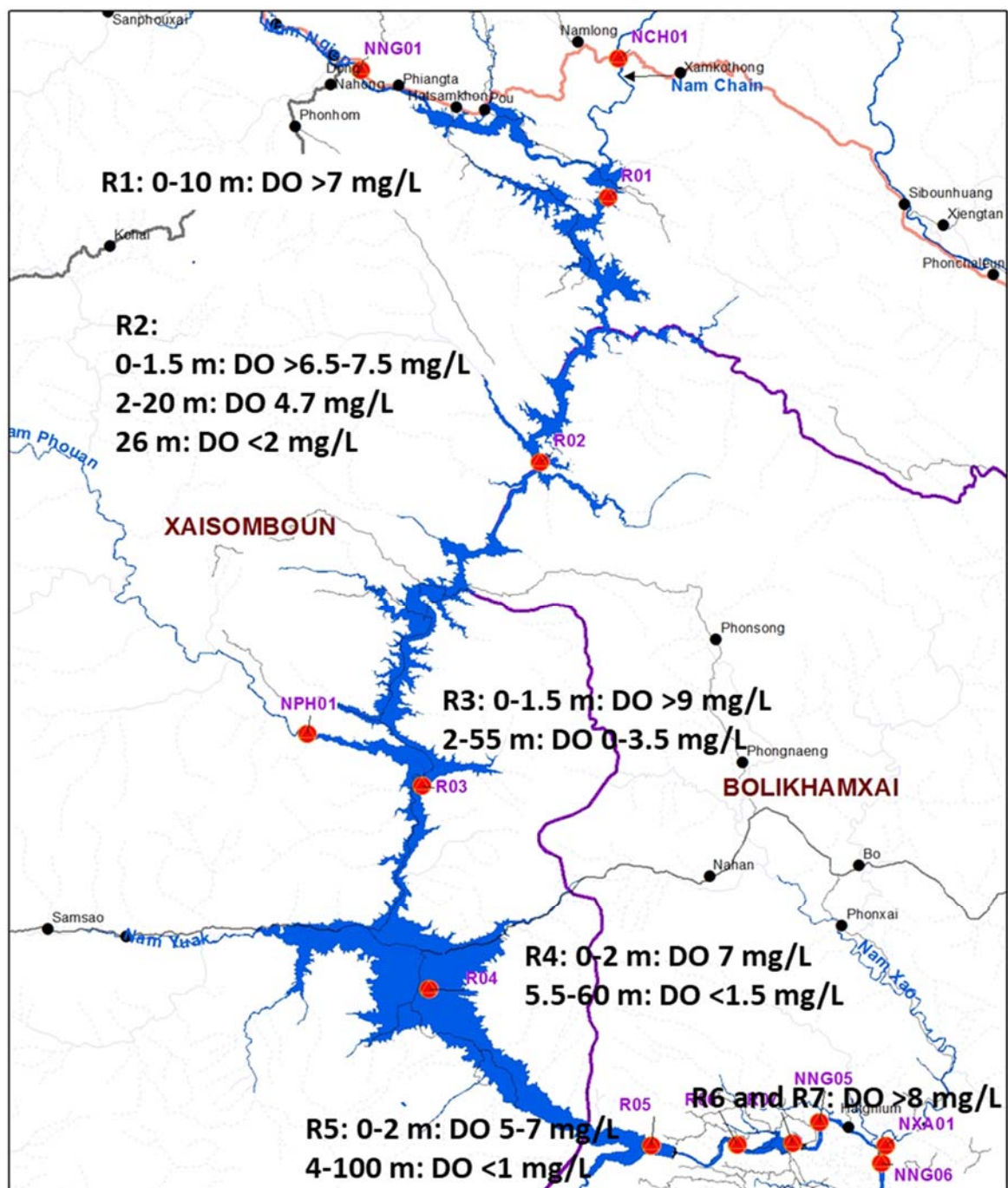
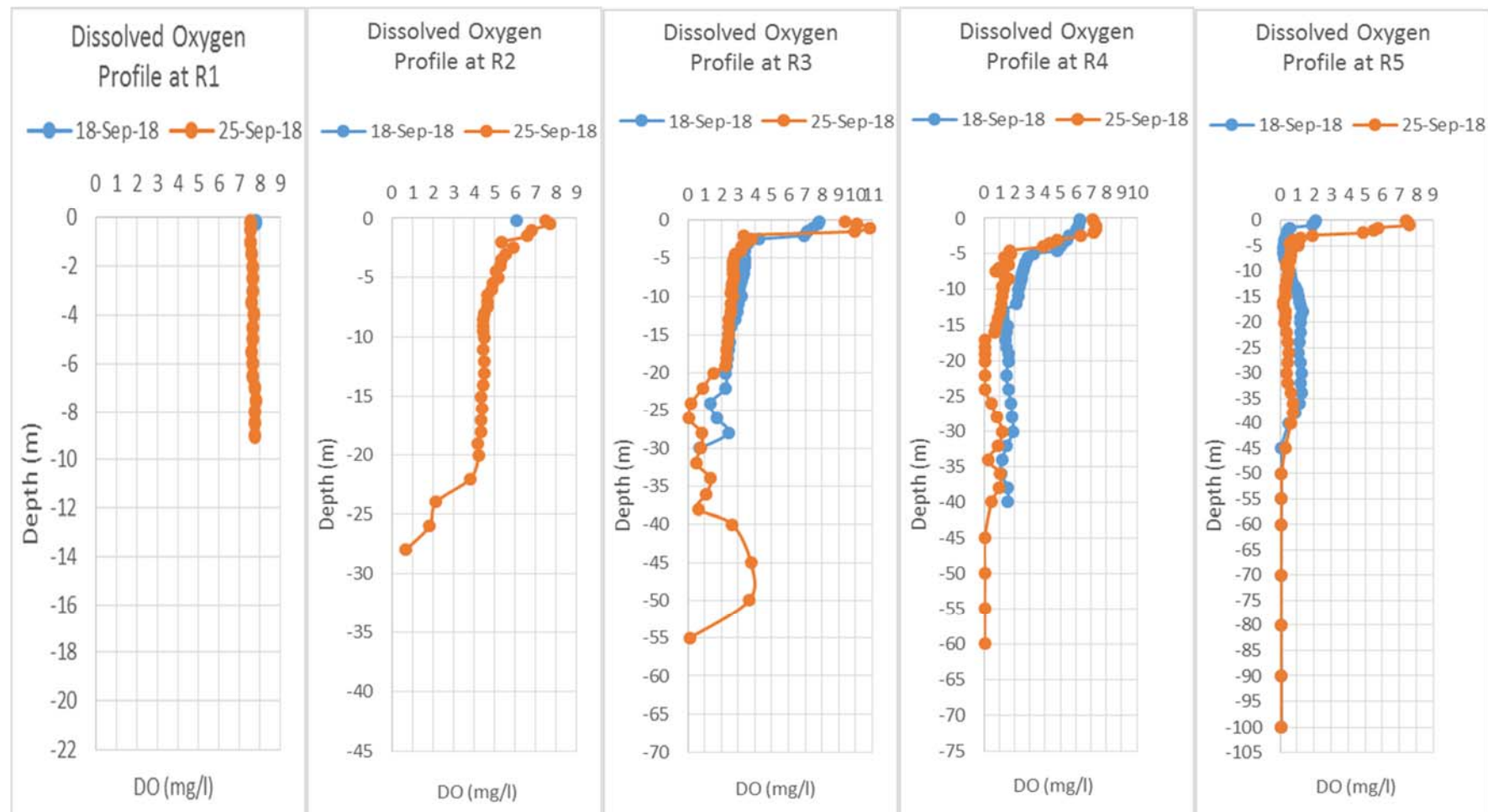


FIGURE 4-9: DISSOLVED OXYGEN – DEPTH PROFILE IN MAIN RESERVOIR AND RE-REGULATION RESERVOIR



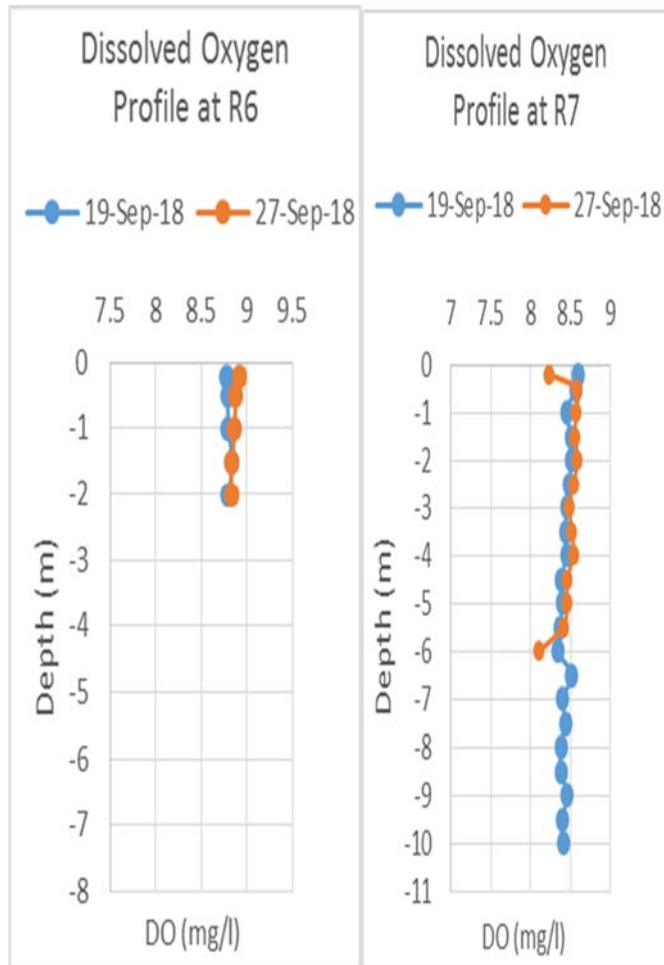


TABLE 4-9: DO RESULTS OF SURFACE WATER IN MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM JULY TO SEPTEMBER 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR DO: >6.0 MG/L)

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	7.68			8.98	8.29	3.96			7.62				7.93	7.39		
5-Jul-18						4.91	6.55	9.89	7.03	7.03	6.64	6.95			7.05	6.95
7-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							
2-Aug-18						2.3	7.63	7.61	7.75							
4-Aug-18						2.09			7.86							
7-Aug-18	7.95	7.46											8.21			
8-Aug-18						5.26										
9-Aug-18							7.6	7.47	7.58	7.53	7.32	7.24			7.38	6.88
11-Aug-18						6.57			7.9							
14-Aug-18						7.02			8.04							
15-Aug-18			5.66	9.08	8.47	7.74										
16-Aug-18						7.41	8.31	8.17	8.09							
18-Aug-18						7.27			8.16							
21-Aug-18						5.41			8.55							
22-Aug-18		7.67	6.43	9.79	7.3											
23-Aug-18						3.17	8.73	8.58	8.23							
25-Aug-18						4.49			8.17							
28-Aug-18	7.79	7.42											8.06			
29-Aug-18			7.23	10.1	9.52											
31-Aug-18						5.84	8.67	8.81	8.58	8.56	8.09	6.83			8.46	7.1

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Sep-18						7.33			8.1							
4-Sep-18	8.08	7.84				2.7			8.2				8.22			
5-Sep-18				10.1	8.18											
6-Sep-18						6.21	8.44	8.2	8.45	8.19	7.61	6.54			7.49	6.3
8-Sep-18						8.44			8.25							
11-Sep-18						7.53			8.26							
12-Sep-18		7.5	6.59	10.9	9.68											
13-Sep-18						6.83	8.8	8.37	8.34							
15-Sep-18						7.22			8.07							
18-Sep-18	7.84	7.25	6.09	7.84	6.24	2.05							8.17			
19-Sep-18						4.57	8.78	8.6	8.43	7.98	7.87	7.37			7.53	6.8
20-Sep-18						6.84			8.05							
22-Sep-18						7.43			8.14							
25-Sep-18		7.58	7.53	9.35	7.12	7.4			7.86							
27-Sep-18						6.55	8.92	8.23	8.81							

Ammonia Nitrogen

Prior to reservoir impounding, the Ammonia Nitrogen levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (<0.2 mg/L). In July and August 2018, Ammonia Nitrogen exceeded the National Surface Water Quality Standard of <0.2 mg/L in some stations with levels as high as 0.63 – 1.66 mg/L ammonia nitrogen in the July 2018 samples, which is similar to levels measured in May 2018 (before impounding) and in June 2018, but otherwise highly unusual. The elevated levels of ammonia nitrogen observed in July 2018 in the main reservoir and immediately downstream could be explained by decomposing biomass due to the impounding of the reservoir, but cannot explain the elevated levels upstream in NNG01, in the tributaries nor in the further downstream stations NNG07 and NNG08. Therefore, the elevated Ammonia Nitrogen results appear to be unrelated to NNP1 activities.

TABLE 4-10: AMMONIA NITROGEN RESULTS OF SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM JULY TO SEPTEMBER 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR DO: <0.2 MG/L)

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	0.93			<0.2	<0.2								<0.2	<0.2		
5-Jul-18						0.89	1.04	0.89	1.66	1.22	1.28	<0.2			0.77	<0.2
7-Aug-18	<0.2												<0.2			
8-Aug-18						<0.2										
9-Aug-18							<0.2	<0.2	<0.2	0.63	1.37	0.89			0.8	<0.2
15-Aug-18			<0.2	0.9	<0.2											
4-Sep-18	<0.2	<0.2											<0.2			
6-Sep-18						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2

Biochemical Oxygen Demand (BOD₅)

Since 2014, the Biochemical Oxygen Demand (BOD₅) levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L) with only occasional minor exceedances of the National Surface Water Quality Standard of < 1.5 mg/L. The results for this quarter are within the normal ranges previously measured except in R3, R4 and R5. Elevated levels of BOD₅ as measured in R3, R4 and R5 in Q3 2018 after start of impounding would be expected as a result of the ongoing decay of biomass in the water column.

TABLE 4-11: BOD₅ RESULTS OF SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM JULY TO SEPTEMBER 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD₅: <1.5 MG/L)

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	<1.0			3.28	2.15								<1.0	<1.0		
5-Jul-18						1.5	<1.0	1.23	1.03	<1.0	<1.0	<1.0			<1.0	<1.0
19-Jul-18						1.8	1.07	1.43	<1							
12-Jul-18						<1	<1	<1	<1							
26-Jul-18						1.2	1.13	1.9	<1							
2-Aug-18						2.5	1.43	1.17	1.12							
7-Aug-18	<1.0	<1.0														
8-Aug-18						1.2							<1.0			

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
9-Aug-18							1.28	<1.0	<1.0	<1.0	<1.0	<1.0			<1.0	<1.0
15-Aug-18			<1.0	1.7	1.67											
16-Aug-18						1.6	1.18	<1.0	<1.0							
23-Aug-18						2.4	<1.0	<1.0	<1.0							
4-Sep-18	<1.0	<1.0											<1.0			
5-Sep-18				4.85	3.37											
6-Sep-18						1.5	<1.0	<1.0	<1.0	<1.0	<1.0	1.13			<1.0	<1.0
13-Sep-18						1.9	<1.0	<1.0	<1.0							
19-Sep-18						1.7	<1.0	<1.0	<1.0							
27-Sep-18						2.8	<1.0	<1.0	<1.0							

Chemical Oxygen Demand (COD)

The COD measurements in Q3 2018 are presented in **Table 4-12**. Elevated COD was detected at all but two monitored locations.

TABLE 4-12: COD RESULTS FOR SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES DURING Q3 2018
(NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	<5.0			12.9	7.4								5.3	<5.0		
5-Jul-18						7.2	17	7.4	14.1	8.2	7.2	15.6			<5.0	7.6
7-Aug-18	<5.0												<5.0			
8-Aug-18						8										
9-Aug-18							11.7	7.2	7.4	11.1	12.5	14			7.8	<5.0
15-Aug-18			<5.0	8.3	6.3											
4-Sep-18	9.6	18.1		19.1	12.2								14			
6-Sep-18						12.8	<5.0	<5.0	7.9	8.7	13.8	19.3			<5.0	6.9

Baseline monitoring since 2014 has shown elevated COD of >5.0 mg/L across much of the year, with highest COD levels associated with seasonal high flows between June and November as indicated in (**Table 4-13**).

In Q3 2018, 30 out of 40 COD measurements (75%) were >5 mg/L and the mean value was 9.1 mg/L close to previous high-flow season means.

TABLE 4-13 MEAN VALUES OF COD MEASUREMENTS

Mean ⁴ COD Values	Upstream High Flow Season Mean (Jun-Nov) (mg/L)	Upstream Low Flow Season Mean (Dec-May) (mg/L)	Downstream High Flow Season Mean (Jun-Nov) (mg/L)	Downstream Low Flow Season Mean (Dec-May) (mg/L)
Hydrological Year ⁵ 2015	15.3	6.7	22.0	5.9
Hydrological Year 2016	10.8	5.6	10.6	5.4
Hydrological Year 2017	13.9	7.0	12.4	4.7
Hydrological Year 2018	14.8	5.0	7.1	5.7

Faecal Coliforms

The results of the faecal coliform analyses in Q3 of 2018 are presented in

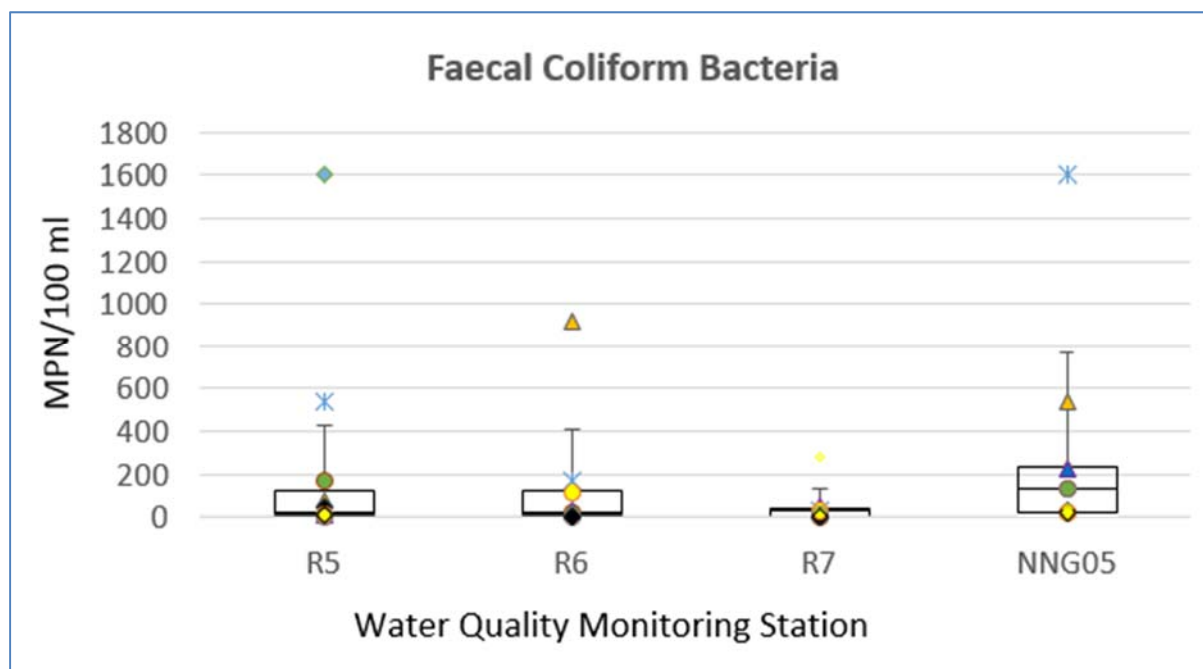
Table 4-14.

The basic statistics of the faecal coliform measurements in Q3 2018 are displayed in the box and whisker diagrams in **Figure 4-10**. The R5 (main reservoir immediately upstream main dam) has the same median and mean as R6 and R7 in the re-regulation reservoir and lower median and mean than NNG05 (downstream at Hat Gniun village) and the data shows outliers in R5, R6 and NNG05.

A statistical hypothesis test using Excel's TTEST function (unpaired, two-tailed, different variances, level of significance: 0.05) comparing the upstream sample (R5) for Q3-2018 with the downstream sample (NNG05) for Q3-2018 gives a p-value of 0.83, which indicates that the observed data are compatible with the null hypothesis that the true faecal coliform means of the two samples are identical.

⁴ If the measurement is below the Limit of Detection, then the value is determined as the Limit of Detection divided by the square root of 2

⁵ The hydrological year is from start of the wet season in June to the end of the dry season in May the following year. The year denotes the year of the end of the hydrological year. For the hydrological year 2015 the high flow season data only includes September-November 2014, and for the hydrological year 2018 the low flow season data only until March 2018

FIGURE 4-10: BOX AND WHISKER DIAGRAMS OF FAECAL COLIFORM MEASUREMENTS DURING Q3 2018 IN SELECTED STATIONS**TABLE 4-14: RESULTS OF FAECAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES FROM JULY TO SEPTEMBER 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)**

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG0 7	NNG0 8	NCH01	NPH0 1	NXA01	NHS0 1
3-Jul-18	1,600			240	33								240	240		
5-Jul-18						170	22	4.5	130	27	170	23			11	34
12-Jul-18						79	920	33	540							
19-Jul-18						540	170	27	1,600							
26-Jul-18						17	22	46	240							
2-Aug-18						7	33	49	220							
7-Aug-18	920	1,600											920			
8-Aug-18						1,600										
9-Aug-18							11	7	22	540	540	49			1,600	920
15-Aug-18			240	0	2											
16-Aug-18						48	5	4	26							
23-Aug-18						8	110	33	23							
4-Sep-18	1,600	1,600											920			
5-Sep-18				2	0											
6-Sep-18						5	0	8	130	130	17	17			220	40
13-Sep-18						9	2	2	17							
19-Sep-18						8	130	280	39							

Table 4-15 presents seasonal (high flow season and low flow season) means of faecal coliform bacteria upstream of the main dam, in the re-regulation reservoir and downstream of the re-regulation dam. The data indicates that there is a tendency towards higher values in the high flow season. However, the means for Q3 2018 (high-flow months) are significantly lower than the previous high-flow season means. It is still too early to assess if this is linked to the relocation of the villages in the main reservoir area and the subsequent impounding of the reservoir.

TABLE 4-15: SEASONAL MEANS FOR FAECAL COLIFORMS UPSTREAM THE MAIN DAM, IN THE RE-REGULATION RESERVOIR AND DOWNSTREAM THE RE-REGULATION DAM

	Upstream		Re-regulation Reservoir		Downstream	
	High Flow Season Mean	Low Flow Season Mean	High Flow Season Mean	Low Flow Season Mean	High Flow Season Mean	Low Flow Season Mean
	(MPN/100 ml)	(MPN/100 ml)	(MPN/100 ml)	(MPN/100 ml)	(MPN/100 ml)	(MPN/100 ml)
Hydrological Year ⁶ 2015		659		372		399 ⁷
Hydrological Year 2016	2,971	529	2,630	629	2,092	570
Hydrological Year 2017	1,286	452	3,710	197	939	171
Hydrological Year 2018	2,055	318	1,249	109	1,157	247
Q3 2018	431	-	81	-	215	-

Total Coliforms

The results of measurements for total coliform bacteria are presented in **Table 4-16**. The results indicate a similar pattern and same tendency as for faecal coliform bacteria.

TABLE 4-16: RESULTS OF TOTAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES FROM JULY TO SEPTEMBER 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	1,600			350	33								1,600	920		
5-Jul-18						350	240	49.0	350	350	540	240			920	240
12-Jul-18						350	1,600	110	540							
19-Jul-18						920	350	79	1,600							
26-Jul-18						170	39	170	540							
2-Aug-18						1,600	350	1,600	1,600							
7-Aug-18	1,600	1,600											1,600			
8-Aug-18						1,600										
9-Aug-18							540	920	920	920	1,600	920			1,700	920

⁶ The hydrological year is from start of the high flow season in June to the end of the low flow season in May the following year. The year denotes the year of the end of the hydrological year.

⁷ This mean excludes an anomaly of 92,000 MPN/100 ml reported for NNG07 in January 2015

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXAO1	NHS01
15-Aug-18			350	33	34											
16-Aug-18						1,600	33	70	540							
23-Aug-18						350	110	33	130							
4-Sep-18	1,600	1,600											1,600			
5-Sep-18				49	5											
6-Sep-18						23	0	23	220	130	170	350			540	280
13-Sep-18						920	110	350	350							
19-Sep-18						280	920	1,600	540							

4.6.2 Compliance Monitoring of Effluents from Camps

A total of 12 camps including OSOV were in use during Q3-2018 and the effluents were monitored in 11 camps (11 sampling sites) as indicated in **Figure 4-11**. The Wastewater Treatment Plant (WWTP) at the TCM camp has no discharge due to small number of workers and was therefore not sampled.

The results are described in **Table 4-17** and the full data set is in **Appendix 5.2**.

The status of compliance as of 29 September 2018 can be summarized as follows:

- Non-compliance with total coliform bacteria for six camps (EF01, EF02, EF07, EF09, EF13 and EF17);
- The HM Main camp (EF13) has the worst record of compliance with instances of non-compliance with all parameters;
- All camps have experienced varied degree of non-compliance with ammonia and total nitrogen;

The results indicate that there is inadequate residence time in the waste water treatment ponds due to the limited space available at the camp area and inadequate manual disinfection with chlorine in the waste water treatment ponds by the Contractors. Additional aeration which was used previously at the camps will be reapplied and may help to resolve the elevated nitrogen and ammonia. Review of chlorine dosing methodologies would be beneficial.

FIGURE 4-11: MAP OF EFFLUENT MONITORING LOCATIONS DURING THE THIRD QUARTER OF 2018

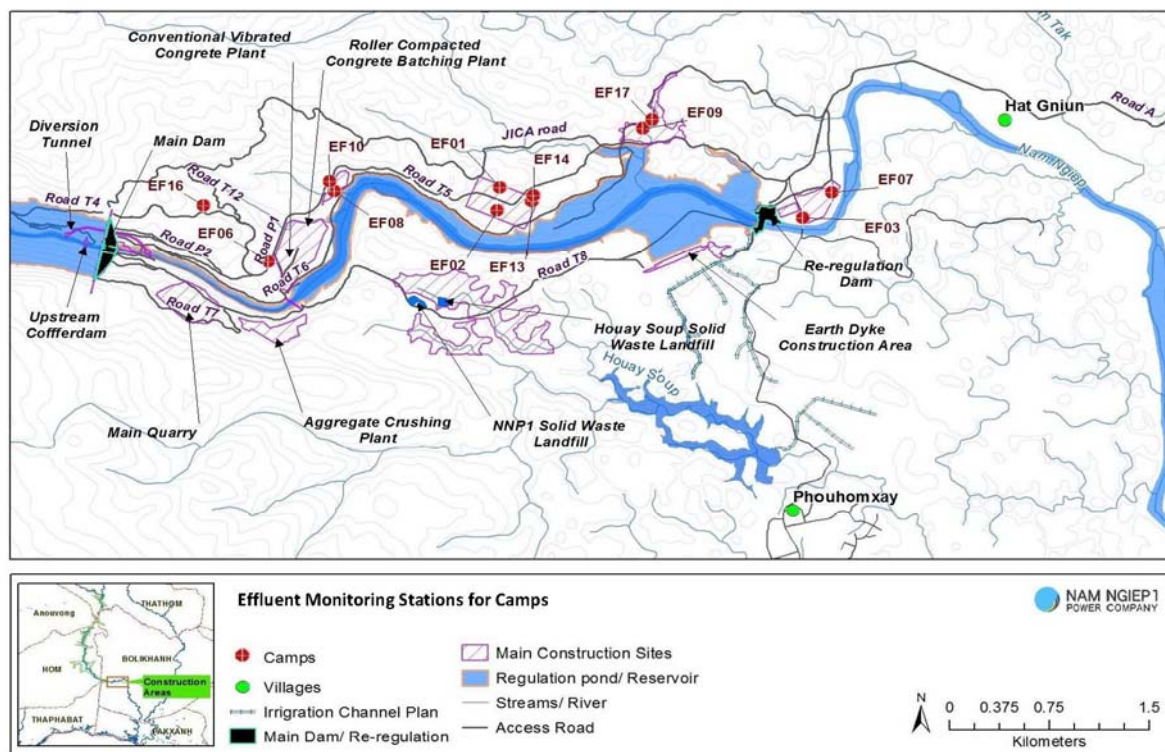


TABLE 4-17: RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS FROM JULY TO SEPTEMBER 2018

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
02-Jul-18	pH	6.0-9.0	7.21	7.57		7.55	7.4	7.49	7.35	7.28	7.35	7.13	7.09
16-Jul-18	pH	6.0-9.0	7.53	7.58	7.57	7.51	7.52	7.7	7.57	7.35	7.12	7.55	7.05
13-Aug-18	pH	6.0-9.0	7.02	7.63	7.51	7.17	7.36	6.77	7.36	7.8	7.19	7.82	6.85
27-Aug-18	pH	6.0-9.0	6.87	7.6	7.51	7.27	7.5	7.29	7.56	7.29	6.91	7.3	7.68
03-Sep-18	pH	6.0-9.0	7.09	7.31	7.44	7.4	7.28	6.92	7.53	7.47	7.09	7.32	7.23
17-Sep-18	pH	6.0-9.0	6.91	7.29		7.5	7.25	6.98	7.18	7.29	7.69		6.82
02-Jul-18	TSS (mg/l)	<50	<5	5.26		20.54	15.24	18.77	11.49	26.07	18.41	6.31	52.68
16-Jul-18	TSS (mg/l)	<50	<5	6.46	0.19	25.7	17.75	28.79	8.94	33.58	136.73	19.33	20.83
13-Aug-18	TSS (mg/l)	<50	<5	5.38	8.92	18.49	12.6	30.08	9.21	47.49	36.03	16.9	17.92
27-Aug-18	TSS (mg/l)	<50	<5	8.81	<5	20.83	12.12	41.05	13.64	42.42	42.86	10.1	15.46
03-Sep-18	TSS (mg/l)	<50	<5	8.03	12.53	25.68	13.26	32.65	13.57	40.54	28.62	6.84	10.34
17-Sep-18	TSS (mg/l)	<50	<5	10.58		16.24	11.76	47.3	7.3	89.74	12.94		7.52
02-Jul-18	BOD5 (mg/l)	<30	18.66	<6		<6	<6	<6	10.98	112.2	89.93	<6	<6
16-Jul-18	BOD5 (mg/l)	<30	9.39	<6	6.03	<6	<6	<6	<6	198.3	<6	<6	29.76
13-Aug-18	BOD5 (mg/l)	<30	10.74	<6	<6	32.64	<6	45	<6	64.84	<6	<6	21.9
27-Aug-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6	<6	<6	128.1	78.9	<6	<6
03-Sep-18	BOD5 (mg/l)	<30	6.12	<6	<6	<6	<6	22.32	<6	<6	<6	<6	<6
17-Sep-18	BOD5 (mg/l)	<30	6.81	24.42		<6	<6	<6	<6	<6	<6		<6
02-Jul-18	COD (mg/l)	<125	<25	37.6		93.6	54.6	29.4	<25	221	114	<25	106
16-Jul-18	COD (mg/l)	<125	<25	43.1	<25	53.8	61.6	67.5	32.8	316	374	39.1	26.6
13-Aug-18	COD (mg/l)	<125	<25	40	26.8	70.9	59.2	76	37.2	254	196	32.2	<25
27-Aug-18	COD (mg/l)	<125	<25	32.9	<25	55.4	47.2	91.9	<25	224	187	<25	<25
03-Sep-18	COD (mg/l)	<125	<25	42.8	<25	62.5	45.4	66.3	32.4	282	142	<25	<25

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
17-Sep-18	COD (mg/l)	<125	<25	46.6		64.2	51	73	29.4	302	63.4		<25
02-Jul-18	NH3-N (mg/l)	<10	6.9	20.3		24.8	24.4	10.3	3.7	28	16.8	4.9	34.2
16-Jul-18	NH3-N (mg/l)	<10	8.4	21.2	5.2	11.2	28.5	30.2	8.7	25.1	14.4	6.1	9.5
13-Aug-18	NH3-N (mg/l)	<10	11.7	16.8	6.3	21.1	19.7	25.2	7.8	18.2	12.8	2	7.6
27-Aug-18	NH3-N (mg/l)	<10	5.3	14.1	5.5	10.5	16.1	20	2.1	12.2	6.9	<0.2	2.9
03-Sep-18	NH3-N (mg/l)	<10	3.9	12.7	2.3	15	10.4	21.3	3.9	18.1	6.8	<0.2	2.3
17-Sep-18	NH3-N (mg/l)	<10	9.2	19.3		19.7	23.7	26	8	11.8	25.4		1.6
02-Jul-18	Total Nitrogen (mg/l)	<10	10.4	20.6		27.6	28.1	14.8	9.79	28.4	17	6.31	34.9
16-Jul-18	Total Nitrogen (mg/l)	<10	9.36	21.8	19.7	25.7	29.1	30.8	17.3	25.3	15	6.25	9.87
13-Aug-18	Total Nitrogen (mg/l)	<10	16.2	17.3	10.3	23.1	23.7	26.4	13.3	18.7	13.1	4.88	7.9
27-Aug-18	Total Nitrogen (mg/l)	<10	11.1	17.3	25.4	14.2	19.9	20.2	39.4	16	28.2	8.7	42.2
03-Sep-18	Total Nitrogen (mg/l)	<10	8.91	15.8	8.27	16.7	14.9	21.7	4.29	21.4	9.19	1.42	2.91
17-Sep-18	Total Nitrogen (mg/l)	<10	13.8	20		20.7	24.3	27.7	8.6	12.1	26.2		2.6
02-Jul-18	Faecal Coliform (MPN/100 ml)	<400	23	0		0	0	920	23	540	170	0	0
16-Jul-18	Faecal Coliform (MPN/100 ml)	<400	13	0	0	0	0	0	0	920	0	0	27
13-Aug-18	Faecal Coliform (MPN/100 ml)	<400	170	0	0	1600	0	220	0	23	0	0	540
27-Aug-18	Faecal Coliform (MPN/100 ml)	<400	22	0	0	0	2	2	2	1600	0	0	0
03-Sep-18	Faecal Coliform (MPN/100 ml)	<400	23	0	79	0	0	240	0	0	0	0	2
17-Sep-18	Faecal Coliform (MPN/100 ml)	<400	1600	1600		0	0	0	0	0	0		0
02-Jul-18	Total Coliform (MPN/100 ml)	<400	920	540		0	0	1600	240	16000	540	0	0
16-Jul-18	Total Coliform (MPN/100 ml)	<400	1600	0	0	0	0	0	0	1600	0	0	920
13-Aug-18	Total Coliform (MPN/100 ml)	<400	280	0	240	1600	0	220	0	23	0	0	1600
27-Aug-18	Total Coliform (MPN/100 ml)	<400	140	0	17	0	2	2	7.8	3500	0	2	0
03-Sep-18	Total Coliform (MPN/100 ml)	<400	130	0	170	0	0	240	0	0	2	0	4.5
17-Sep-18	Total Coliform (MPN/100 ml)	<400	1600	1600		0	0	0	0	0	0		0

TABLE 4-18: COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q3 2018

Site	ID	WWTS	Key Non-Compliance Issues ⁸ in Q2-2018	Corrective Actions
Owner's Site Office and Village (NNP1PC)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m ³ /day	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 4 out of 6. Q3 mean 11.63 mg/L. - Ammonia (<10 mg/L): Non-compliance in 1 out of 6. Q3 mean 7.57 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 308.5 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6. Q3 mean 778.33 MPN/100 mL. 	<ul style="list-style-type: none"> - EMO continues to monitor, share effluent monitoring results with the Admin team for their WWTP improvement and corrective action were implemented. - A discussion meeting was held in August and September 2018 to agree on the required improvement of the WWTS operation and maintenance. This included cleaning up the vegetation in the wetland, reinstalling the piping system, replacing the filter material(sand, gravel, etc.) and planting of new reeds. - EMO will follow up and report the progress in Q4 report.

⁸ The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues ⁸ in Q2-2018	Corrective Actions
OC Camp – WWTS01	EF02	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Ammonia (<10 mg/L): Q2 mean 17.4 mg/L. - Total nitrogen (<10 mg/L): Q2 mean 18.8 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 266.67 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6. Q3 mean 356.67 MPN/100 mL. 	<ul style="list-style-type: none"> - EMO will continue to monitor this issue and issue an observation of non-compliance for contractor's corrective actions if EMO finds that the issue is yet resolved in Q4.
TCM Camp	EF03	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	NA	<ul style="list-style-type: none"> - There was no discharge of wastewater for sampling during Q3 2018. - Note: this facility was handed over to GFE subcontractor who will stay for another year (the property handing over paper is available).
Sino Hydro Camp	EF06	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 1 out of 4. Q3 mean 15.91 mg/L. 	<ul style="list-style-type: none"> - This site will be decommissioned during October 2018 by following the site decommissioning and rehabilitation plan
Zhefu Camp (HMH Worker Camp No.1)	EF09	Septic tank (kitchen and black water), sediment ponds (grey water)	<ul style="list-style-type: none"> - BOD₅ (<30 mg/L): Non-compliance in 1 out of 6. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q3 mean 21.17 mg/L. - Total nitrogen (<10 mg/L): Q3 mean 23.6 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 230.33 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 343.67 MPN/100 mL. 	<ul style="list-style-type: none"> - EMO will continue to monitor this issue and issue an observation of non-compliance for contractor's corrective actions if EMO finds that the issue is yet resolved in Q4.

Site	ID	WWTS	Key Non-Compliance Issues ⁸ in Q2-2018	Corrective Actions
V&K Camp	EF10	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Total nitrogen (<10 mg/L): Non-compliance in 3 out of 6. Q3 mean 15.44 mg/L.	- As above
HMH Main Camp – WWTS01	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - TSS (<50 mg/L): Non-compliance in 1 out of 6. Q3 means 46.64 mg/L. - BOD₅ (<30 mg/L): Non-compliance in 5 out of 6. Q3 mean 84.72 mg/L. - COD (<125 mg/L): Non-compliance in 6 out of 6. Q2 mean 266.5 mg/L. - Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q2 mean 18.9 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 20.32 mg/L. - Total phosphorus (<2.0 mg/L): Non-compliance in 1 out of 6. Q3 mean 1.36 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6. Q3 mean 513.83 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6. Q3 mean 3,520.5 MPN/100 mL. 	- EMO will discuss with the Contractor on the corrective actions during the Monthly Progress Report to be held in October 2018.
IHI Camp	EF14	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - TSS (<50 mg/L): Non-compliance in 1 out of 6. Q3 means 45.93 mg/L. - BOD₅ (<30 mg/L): Non-compliance in 2 out of 6. Q3 mean 29.74 mg/L. - COD (<125 mg/L): Non-compliance in 4 out of 6. Q3 mean 179.4 mg/L. - Ammonia (<10 mg/L): Non-compliance in 4 out of 6. Q3 mean 13.85 mg/L. 	- As above

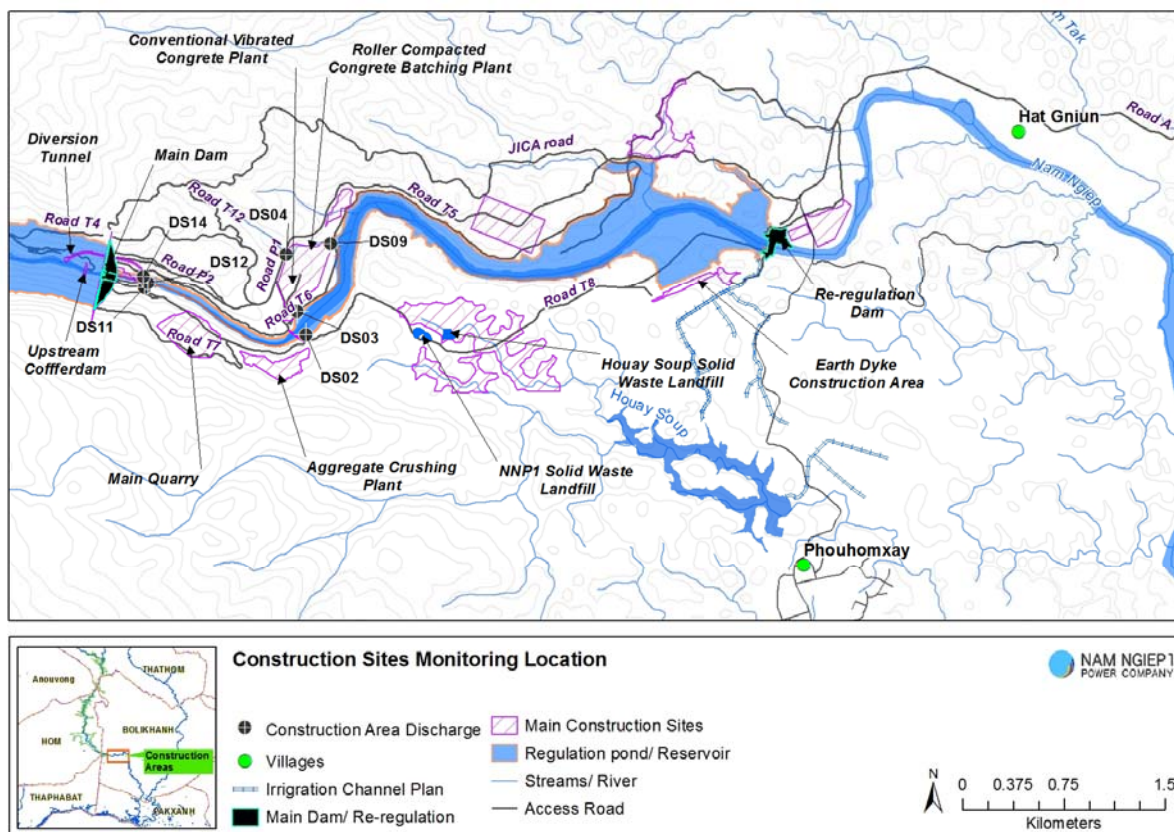
Site	ID	WWTS	Key Non-Compliance Issues ⁸ in Q2-2018	Corrective Actions
			<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 5 out of 6. Q3 mean 18.12 mg/L. - Total phosphorus (<2.0 mg/L): Non-compliance in 1 out of 6. Q3 mean 1.18 mg/L. 	
Song Da 5 Camp No. 1	EF07	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q3 mean 17.05 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q2 mean 21.33 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 266.67 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 266.67 MPN/100 mL. 	- The issue of non-compliances for faecal and total coliforms will be monitored and non-compliance reports will be issued if continues in the next quarter.
Song Da 5 Camp No. 2	EF08	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q3 mean 20.47 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q3 mean 23.33 mg/L. - Total phosphorus (<30 mg/L): Non-compliance in 1 out of 6. Q3 mean 1.30 mg/L. 	- As above
Kenber Camp	EF16	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Fully compliance.	
Lilama10 Camp	EF17	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 2 out of 6. Q3 mean 16.73 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 1 out of 6. Q3 mean 9.68 mg/L. 	- The contractor was instructed to improve oil/grease traps to prevent food waste being discharged and accumulated in the wetland pond, the key staff

Site	ID	WWTS	Key Non-Compliance Issues ⁸ in Q2-2018	Corrective Actions
			<ul style="list-style-type: none">- Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q3 mean 94.83 MPN/100 mL.- Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6. Q3 mean 420.75 MPN/100 mL.- TSS (<50 mg/L): Non-compliance in 1 out of 6. Q3 mean 20.79 mg/L.	was assigned for chlorine treatment.

4.6.3 Compliance Monitoring of Discharges from Construction Sites

Discharges from the key construction sites (see **Figure 4-12**) were monitored during the reported period. The results are presented in **Table 4-19**. Results that are above the prescribed standards are highlighted in yellow. The full set of data is in **Appendix 5.3**.

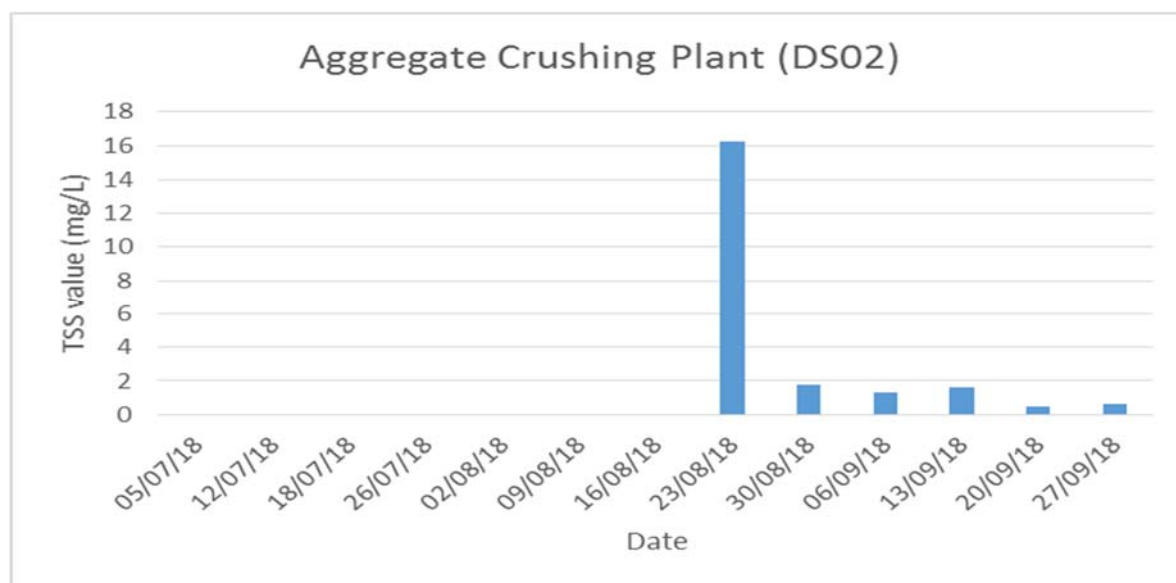
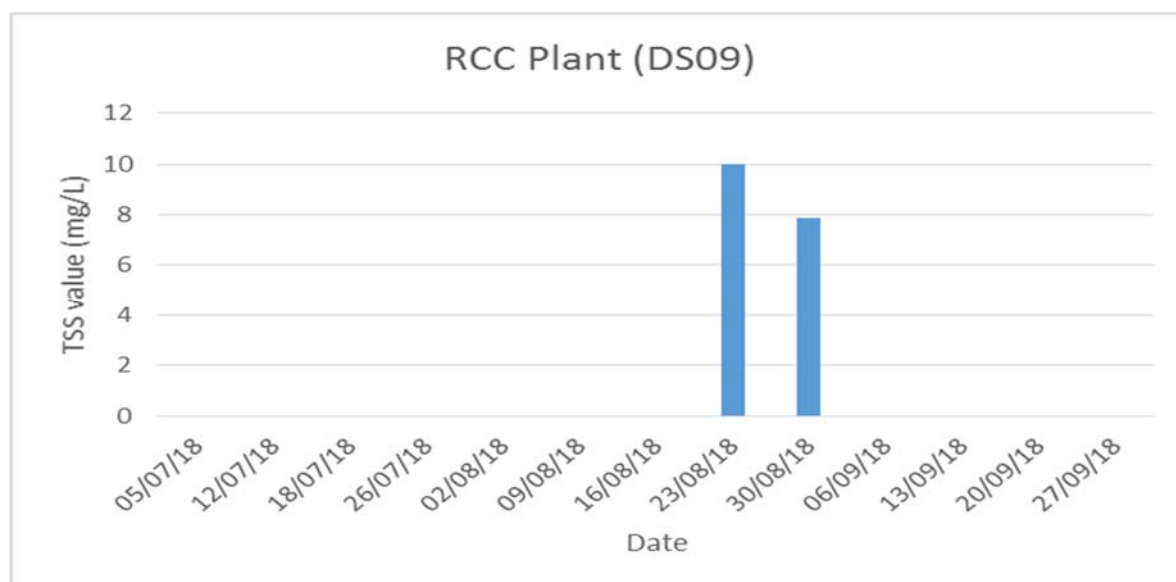
FIGURE 4-12 LOCATION OF DISCHARGE POINTS OF KEY CONSTRUCTION SITES



Construction site discharge measurement continues to ensure that the discharges from the construction sites are in compliance with the standard for Total Suspended Solids (50 mg/L). Following the completion of the RCC placement work at the main dam on 29 April 2018, the production of aggregate and RCC has stopped resulting in no discharge of water from the sedimentation ponds of the Aggregate Crushing Plant and the RCC Plant.

The results of the discharge measurements at the the Aggregate Crushing Plant and the RCC Plant are presented in **Figure 4-13**.

The compliance status for each of the key construction sites is summarized in **Table 4-18**

FIGURE 4-13: TOTAL SUSPENDED SOLIDS IN THE DISCHARGE FROM THE AGGREGATE CRUSHING PLANT**FIGURE 4-14: TOTAL SUSPENDED SOLIDS IN THE DISCHARGE FROM THE RCC BATCHING PLANT**

Note that the Main Dam Treatment Plant No.1 (DS11) and the Main Dam Treatment Plant No.2 (DS12) have both been decommissioned and have therefore not been sampled.

TABLE 4-19 RESULTS OF THE CONSTRUCTION AREA DISCHARGE MONITORING IN Q3 2018

Date	Parameter (Unit)	Site Name (Code)	Aggregate Crushing Plant (DS02)	Spoil Disposal Area No.2	RCC Plant (DS09)	Main Dam Treatment Plant No.3 (DS14)
		Effluent Standard				
05-Jul-18	TSS (mg/l)	<50		136.61		6.77
12-Jul-18	TSS (mg/l)	<50		58.72		7.39
18-Jul-18	TSS (mg/l)	<50		151.69		154.14
26-Jul-18	TSS (mg/l)	<50		2,833		29.75
02-Aug-18	TSS (mg/l)	<50		39.04		50.78
09-Aug-18	TSS (mg/l)	<50		13.15		3.55
16-Aug-18	TSS (mg/l)	<50		7.4		Decommissioned
23-Aug-18	TSS (mg/l)	<50	16.25	14.6	10	
30-Aug-18	TSS (mg/l)	<50	1.76	8.82	7.89	
06-Sep-18	TSS (mg/l)	<50	1.29	9.79		
13-Sep-18	TSS (mg/l)	<50	1.64	14.87		
20-Sep-18	TSS (mg/l)	<50	0.5	9.79		
27-Sep-18	TSS (mg/l)	<50	0.66	8.38		

TABLE 4-20: COMPLIANCE STATUS OF EFFLUENT DISCHARGE AND CORRECTIVE ACTION DURING THE THIRD QUARTER OF 2018

Site	ID	Treatment System	Key Non-Compliance Issues ⁹ in Q2-2018	Corrective Actions
Aggregate Crushing Plant	DS02	Sediment ponds	- Full compliance.	- No corrective action is required. However, EMO will continue to monitor this site and share the results with the Contractor for their improvement.
CVC Plant	DS03	Sediment ponds	- No discharge during Q3 2018	NA
Spoil Disposal No.2	DS04	Sediment pond	- TSS (<50 mg/L): Q3 mean 254.29 mg/L. Non-compliance in 4 out of 13 measurements.	- As above - The exceedances of TSS at Spoil disposal no. 2 was due to inappropriate

⁹ The values in brackets indicate the applicable standard

Site	ID	Treatment System	Key Non-Compliance Issues ⁹ in Q2-2018	Corrective Actions
				maintenance of vehicle washing facility locate at Spoil disposal no. 2. The Site Inspection Report ref no. <i>ONC_OC-0286</i> was issued to the contractor on 10 July 2018 to improve the car washing facility.
RCC Plant (at Lower Ponds)	DS09	Sediment ponds	- Full compliance.	- No corrective action is required. However, EMO will continue to monitor this site and share the results with the Contractor for their improvement.
Main Dam Construction Area (Treatment Plant No.3)	DS14	pH adjustment and chemical flocculation	- TSS (<50 mg/L): Q3 mean 42.06 mg/L. Non-compliance in 2 out of 6 measurements.	- The facility has been decommissioned.

4.6.1 Special Surface Water Quality Monitoring

Following the failure of the Nam Ao dam located on the Nam Ao in Phaxai District, Xieng Khuang Province on 11 September 2017, NNP1PC has continued to monitor and observe changes in water quality in Nam Ngiep. The last monitoring of the Nam Ao was conducted in Q2 2018. No monitoring of the Nam Ao was conducted in Q3 2018.

4.6.2 Groundwater Quality Monitoring

During the Q3 2018, two boreholes at Somseun, one borehole at Nam Pa, one borehole at Thong Noy and one borehole at Pou villages have been monitored for the following parameters:

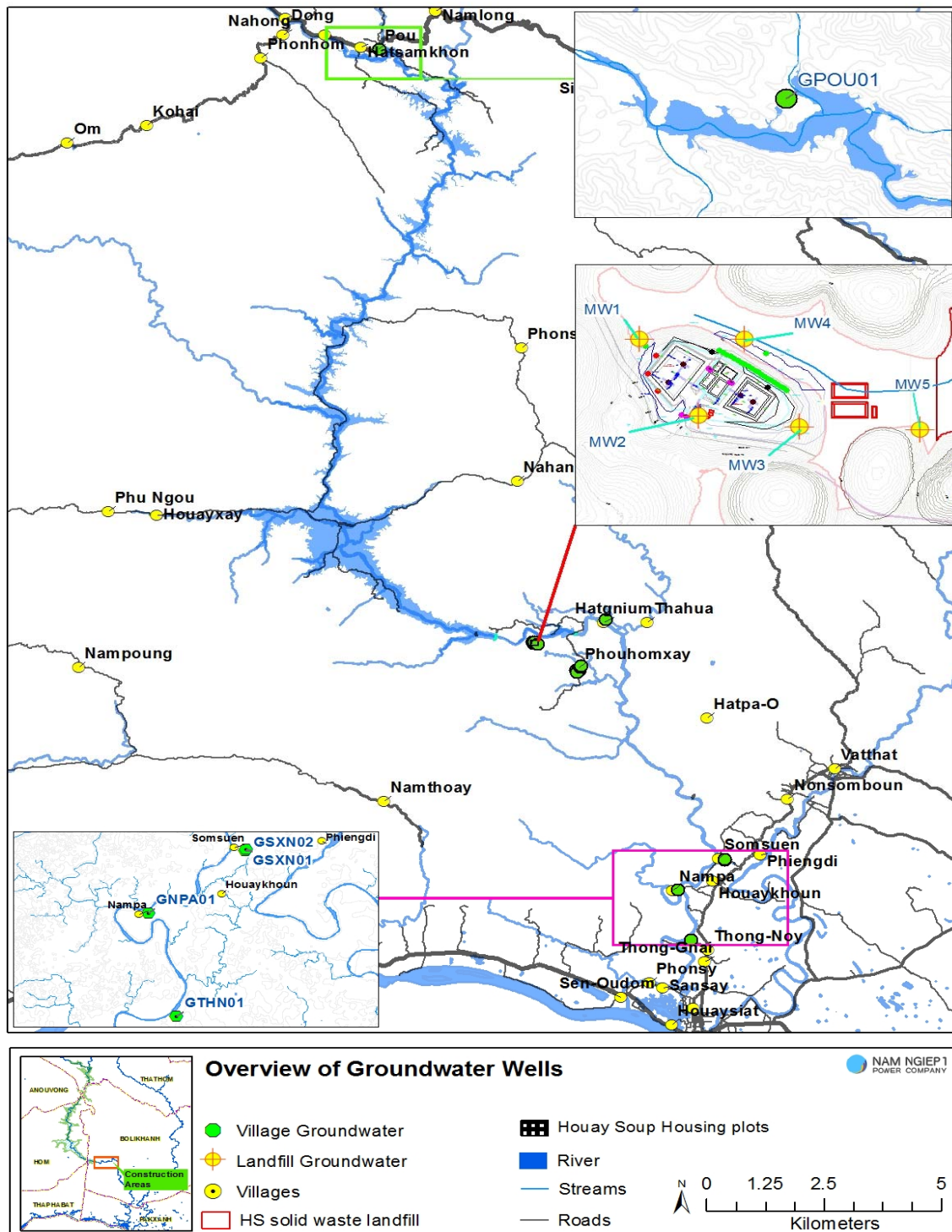
- Monthly:* pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), Faecal Coliform (MPN/100 ml) and E. coli (MPN/100 ml);
- Quarterly:* Arsenic (mg/l), Cadmium (mg/l), Iron (mg/l), Magnesium (mg/l), Manganese (mg/l), Fluoride (mg/l), Nitrate (mg/l), Nitrite (mg/l), Total Hardness (mg/l) Lead (mg/l).

Note that the six boreholes at Phouhomxay Village have been taken out of use and have therefore not been monitored. The water supply has been permanently replaced with gravity fed water supply system.

The groundwater quality in the four monitoring wells located at the NNP1 Project Landfill and the monitoring well at Houay Soup Landfill was monitored.

The groundwater sampling locations are displayed in **Figure 4-15** and the groundwater monitoring data is presented in **Appendix 5.4 and 5.7**

FIGURE 4-15: GROUNDWATER SAMPLING LOCATIONS



Key findings from the groundwater quality monitoring are summarized as the follows:

Somsuen: All monitored parameters complied with the standard except for faecal coliform and E.coli bacteria in the July 2018 sample.

Pou villages: All monitored parameters complied with the standard except for faecal coliform and E.coli bacteria in the July and September 2018 and for pH in measurements in July and August 2018.

Nam Pa Village and Thong Noy Village: All of monitored parameters complied with the relevant National Standard during the reported period.

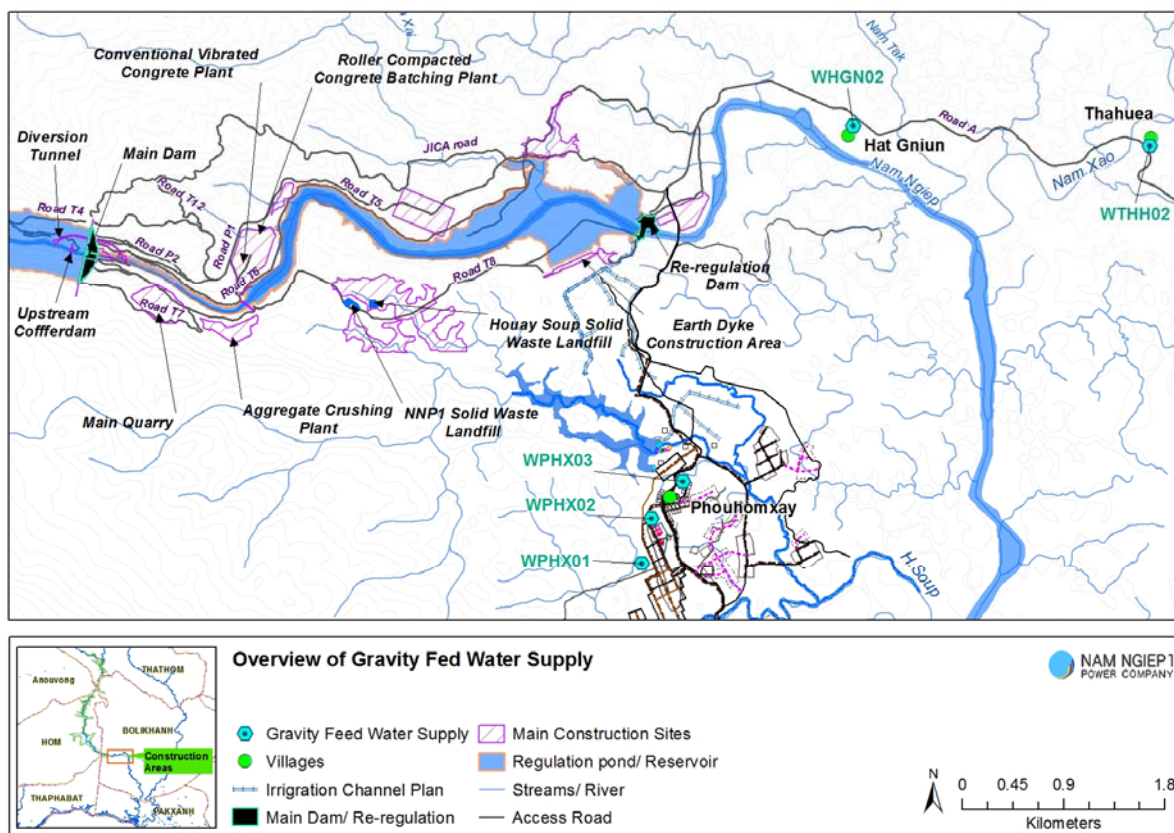
The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

NNP1 Landfill and Houay Soup Landfill: All parameters monitored complied with the standard except for lead. Elevated levels of lead have been detected in all monitoring wells from time to time since they were established in July 2016 and it is assessed that these levels represent natural background levels.

4.6.3 Gravity Fed Water Supply (GFWS) Monitoring

The monitoring of the GFWS aims to assess the quality of water that is being used for bathing and washing by villagers at Hat Gniun, Thahuea and Phouhomxay villages. The use of gravity fed water supply at Phouhomxay Village was commenced in December 2017.

FIGURE 4-16: OVERVIEW OF GRAVITY FED WATER SUPPLY



Water samples were taken from the taps for analysis during the reported period and selected results are shown in **Table 4-21**. The full set of data is presented in **Appendix 5.5**

TABLE 4-21: THE GFWS MONITORING RESULT IN Q3 2018

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
11-Jul-18	E. Coli Bacteria (MPN/100 ml)	0	49	240	33	17	6.8
01-Aug-18		0	23	23	7.8	0	0
11-Sep-18		0	920	220	79	6.8	0
11-Jul-18	Faecal coliform (MPN/100 ml)	0	49	240	140	49	6.8
01-Aug-18		0	33	23	7.8	0	0
11-Sep-18		0	920	220	79	6.8	0

Thahuea Village (WTHH02): all parameters complied with the National Drinking Water Standards, except for faecal coliform and E.Coli bacteria and one exceedance for TSS.

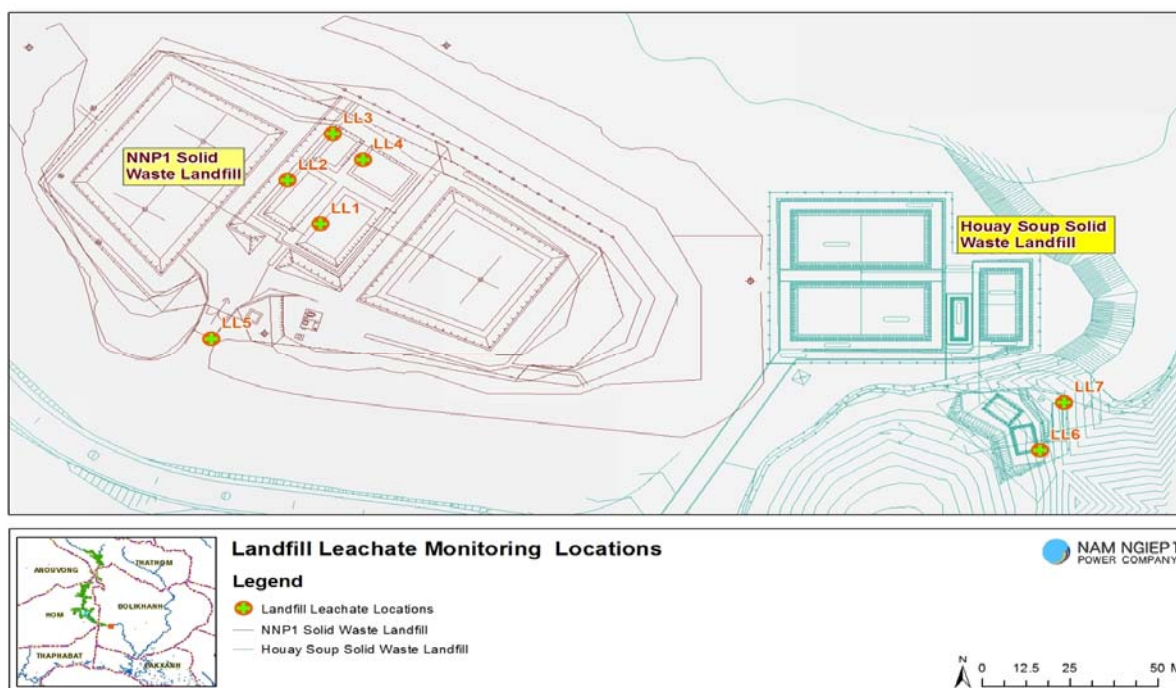
Hat Gnuin Village (WHGN02): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

Phouhomxay Village (WPHX01 -raw water in the head tank before filtration, WPHX02 - tap water at primary school & WPHX03-tap water at the villager's house): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

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.

4.6.4 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. The monitoring locations are presented in the **Figure 4-17**.

FIGURE 4-17: LANDFILL LEACHATE MONITORING LOCATION

The monitoring results for Q3 2018 indicate compliance with the applicable standards for all monitored parameters except total coliform at the last pond of NNP1 Landfill and the discharge point of Houay Soup Landfill in July 2018. No measures were undertaken as there was no discharge of leachate from the last pond of NNP1 Landfill to the environment, and because the results from August and September 2018 for both landfills show full compliance. It should also be noted that the faecal coliform counts in the July 2018 samples from both landfills were <100 MPN/ml indicating low levels of faecal contamination, possibly from cows or other wildlife. The monitoring data can be found in **Appendix 5.6**

4.6.5 Air Quality (Dust) Monitoring

4.6.5.1 Ambient Air Quality in the Host Villages

The ambient air quality monitoring for dust (measured as PM₁₀ – particulate matter with diameter of 10 micrometre or smaller) was carried out for 72 consecutive hours at Hat Gniun and Phouhomxay villages. The main purpose of the dust monitoring at Hat Gniun and Phouhomxay villages is to assess if the project construction works may have caused significant dust levels in the ambient air.

The monitoring stations are displayed in **Figure 4-18** and the results are summarized in **Table 4-22**. The measured concentrations of PM₁₀ in the ambient air complied with the standard during the monitored periods.

FIGURE 4-18: NOISE AND DUST MONITORING LOCATIONS AT THE CONSTRUCTION SITES AND NEARBY VILLAGES

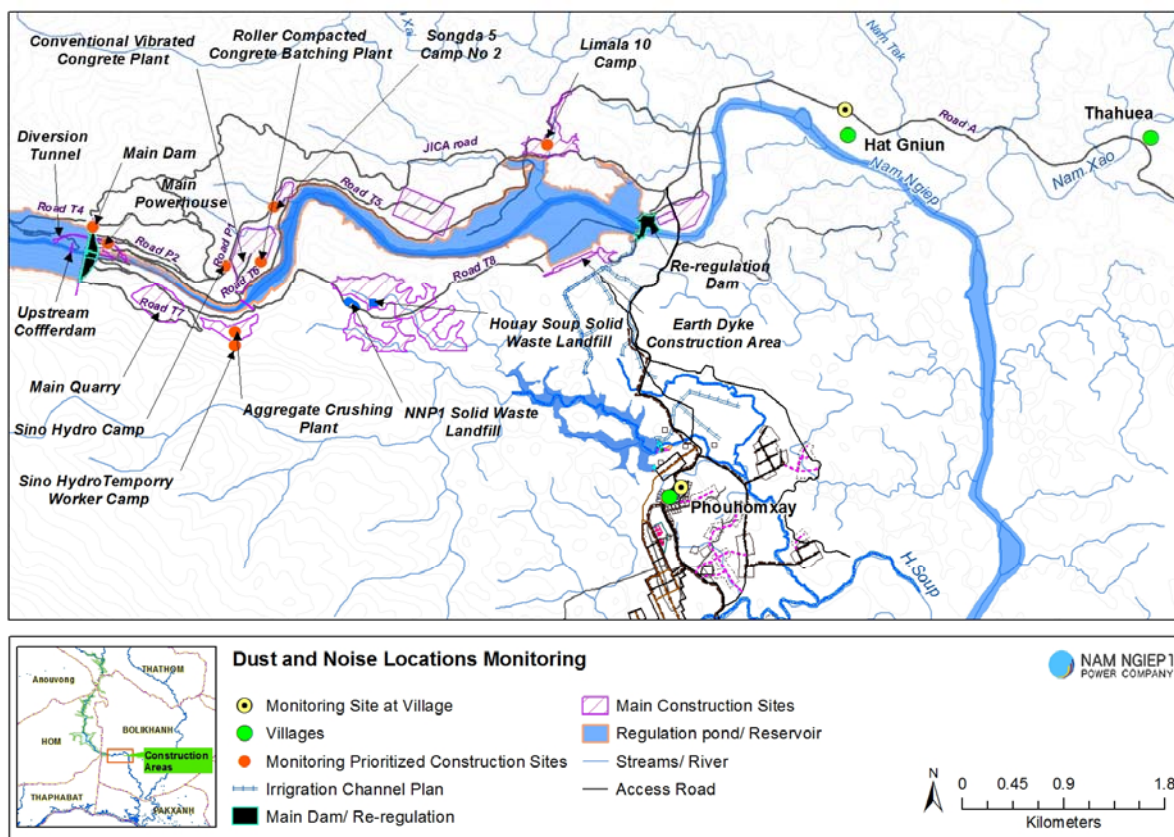


TABLE 4-22: RESULTS OF AIR QUALITY (DUST) MONITORING AT THE VILLAGES NEAR THE PROJECT CONSTRUCTION SITES DURING JULY TO SEPTEMBER 2018

Site Name	Hat Gniun Village								
Start Time	17/Jul/18 18:30	18/Jul/18 18:01	19/Jul/18 18:01	06/Aug/18 18:01	07/Aug/18 18:01	08/Aug/18 18:00	17/Sep/18 18:00	18/Sep/18 18:00	19/Sep/18 18:00
End Time	18/Jul/18 18:00	19/Jul/18 18:00	20/Jul/18 18:00	07/Aug/18 18:01	08/Aug/18 18:00	09/Aug/18 18:00	18/Sep/18 18:00	19/Sep/18 18:00	20/Sep/18 18:00
Average Data Record - 24 hours	0.016	0.022	0.012	0.027	0.028	0.020	0.030	0.041	0.053
Guideline ¹⁰	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

Site Name	Phouhomxay								
Start Time	02/Jul/18 18:00	03/Jul/18 18:00	04/Jul/18 18:00	20/Aug/18 18:00	21/Aug/18 18:00	22/Aug/18 18:00	25/Sep/18 18:30	26/Sep/18 18:31	27/Sep/18 18:31
End Time	03/Jul/18 18:00	04/Jul/18 18:00	05/Jul/18 18:00	21/Aug/18 18:00	22/Aug/18 18:00	23/Aug/18 18:00	26/Sep/18 18:30	27/Sep/18 18:30	28/Sep/18 18:00

¹⁰ National Environment Standard No2734 /PMO.WREA: Ambient Air Quality Standard 24-hour average

Average Data Record - 24 hours	0.021	0.024	0.032	0.017	0.020	0.020	0.029	0.043	0.050
Guideline	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

4.6.5.2 Project Construction Sites

During Q3 2018, dust (PM₁₀) monitoring was carried out monthly for periods of 24 consecutive hours at eight priority construction sites and camps to assess possible impact on workers' health. The results summarized in **Table 4-23** indicate compliance with the standard (0.12 mg/m³ PM₁₀) for most of construction sites, except for one elevated reading at the Main Powerhouse (for July 2018). All staff were advised to wear dust masks while working in these areas.

TABLE 4-23: DUST MONITORING RESULTS AT THE CONSTRUCTION SITES DURING JULY TO SEPTEMBER 2018

Site Name	Aggregate Crushing Plant		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	25/Jul/18 18:00	23/Aug/18 18:00	04/Sep/18 18:30
End Time	26/Jul/18 18:00	24/Aug/18 18:00	05/Sep/18 18:00
Average Data Record -24h	0.013	0.018	0.021
Guideline ¹¹	0.12	0.12	0.12

Site Name	RCC Plant		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	11/Jul/18 18:30	16/Aug/18 18:00	07/Sep/18 18:00
End Time	12/Jul/18 18:00	17/Aug/18 18:00	08/Sep/18 18:00
Average Data Record -24h	0.008	0.016	0.023
Guideline	0.12	0.12	0.12

Site Name	Main Dam		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	27/Jul/18 18:30	01/Aug/18 18:00	11/Sep/18 18:30
End Time	28/Jul/18 18:00	02/Aug/18 18:00	12/Sep/18 18:00
Average Data Record -24h	0.015	0.023	0.094

^{11 11} National Environment Standard No2734 /PMO.WREA: Ambient Air Quality Standard 24-hour average

Site Name	Main Dam		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	27/Jul/18 18:30	01/Aug/18 18:00	11/Sep/18 18:30
End Time	28/Jul/18 18:00	02/Aug/18 18:00	12/Sep/18 18:00
Guideline	0.12	0.12	0.12

Site Name	Sino Hydro Temporary Worker Camp		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	26/Jul/18 18:30	27/Aug/18 18:00	03/Sep/18 18:00
End Time	27/Jul/18 18:00	28/Aug/18 18:00	04/Sep/18 18:00
Average Data Record -24h	0.015	0.023	0.018
Guideline	0.12	0.12	0.12

Site Name	Song Da 5 Camp No.2		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	10/Jul/18 18:30	09/Aug/18 18:30	10/Sep/18 18:00
End Time	11/Jul/18 18:00	10/Aug/18 18:00	11/Sep/18 18:00
Average Data Record -24h	0.012	0.022	0.024
Guideline	0.12	0.12	0.12

Site Name	Lilama 10 Camp		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	09/Jul/18 18:00	02/Aug/18 18:30	13/Sep/18 18:00
End Time	10/Jul/18 18:00	03/Aug/18 18:00	14/Sep/18 18:00
Average Data Record -24h	0.009	0.025	0.043
Guideline	0.12	0.12	0.12

Site Name	Main Powerhouse		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	05/Jul/18 18:30	29/Aug/18 18:00	24/Sep/18 18:00
End Time	06/Jul/18 18:00	30/Aug/18 18:00	25/Sep/18 18:00
Average Data Record -24h	0.213	0.057	0.055
Guideline	0.12	0.12	0.12

Site Name	Sino Hydro Camp		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	12/Jul/18 18:30	14/Aug/18 18:00	05/Sep/18 18:30
End Time	13/Jul/18 18:00	15/Aug/18 18:00	06/Sep/18 18:00
Average Data Record -24h	0.021	0.018	0.025
Guideline	0.12	0.12	0.12

4.6.6 Noise Monitoring

4.6.6.1 Nearby Communities

Noise monitoring was carried out in Hat Gniun Village and Phouhomxay Village for 72 consecutive hours. The recorded values were measured against the standards, including maximum average noise levels for daytime during 06:00-18:00, evening time during 18:00-22:00 and night time during 22:00-06:00.

The results (see **Table 4-24**) show that the noise levels at the villages were within the allowable maximum peak value at 115 dB(A), and some of the night-time average noise levels were slightly higher than the standard in Hat Gniun and Phouhomxay villages due to rain during these periods.

TABLE 4-24: NOISE MONITORING RESULTS AT THE HOST VILLAGES IN Q3 2018

Ban Hat Gnuin -Noise Monitoring 72 consecutive hours-July 2018									
Noise Level (dB)	17-18/July/18			18-19/July/18			19-20/July/18		
	18:30-22:00	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
Ban Hat Gnuin -Noise Monitoring 72 consecutive hours-August 2018									
Noise Level (dB)	06-07/August/18			07-08/August/18			08-09/August/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	74.10	71.00	69.40	69.10	70.70	76.50	79.60	64.50	71.00
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	49.58	60.99	52.42	49.40	63.65	55.26	50.78	55.38	52.13
Guideline Averaged	55	45	55	55	45	55	55	45	55
Ban Hat Gnuin -Noise Monitoring 72 consecutive hours-September 2018									
Noise Level (dB)	17-18/September/18			18-19/September/18			19-20/September/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	72.40	70.70	80.00	63.60	67.00	71.80	74.90	69.70	97.50
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	53.87	57.74	56.94	55.51	57.01	48.54	57.29	60.66	49.56
Guideline Averaged	55	45	55	55	45	55	55	45	55

Phouhomxay Village -Noise Monitoring 72 consecutive hours-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
Phouhomxay Village -Noise Monitoring 72 consecutive hours-August 2018									
Noise Level (dB)	20-21/August/18			21-22/August/18			22-23/August/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	57.30	61.80	72.20	64.00	61.20	75.30	54.90	63.40	63.40
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	43.25	53.54	41.16	51.33	51.89	47.51	46.26	50.67	49.30
Guideline Averaged	55	45	55	55	45	55	55	45	55
Phouhomxay Village -Noise Monitoring 72 consecutive hours-September 2018									
Noise Level (dB)	25-26/September/18			26-27/September/18			27-28/September/18		
	18:30-22:00	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	59.70	68.70	74.90	69.80	70.60	82.50	60.70	66.50	78.00
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	52.49	48.58	47.79	54.83	52.35	54.13	53.10	50.81	48.97
Guideline Averaged	55	45	55	55	45	55	55	45	55

4.6.6.2 Project Camps and Construction Sites

During Q3 2018, noise monitoring was conducted at the Aggregate Crushing Plant, RCC Plant, Sino Hydro camp and Song Da 5 camp No.2, Main Dam, Sino Hydro temporary worker camp, Lilama10 camp and Main Powerhouse to assess possible impacts on workers' health as well as to estimate any potential impact on the ambient noise levels in nearby communities.

The result shown that all maximum peak noise levels were within the National Standard. However, the average noise level during 22:01-06:00 at Sino Hydro Temporary Worker Camp (August and September 2018), Song Da 5 Camp No.2 (August and September 2018), Lilama10 Camp (August and September 2018) and Sino Hydro Camp (September 2018) were higher than the National standard. In addition, the average noise level during 18:00-06:00 (August 2018) and 18:00-17:59 (September 2018) at Main Powerhouse were higher than the National Standard. The elevated noise levels at the main powerhouse is most likely caused by the diving water discharged over the spillway. All staff were advised to wear ear mugs while working in these areas.

TABLE 4-25: NOISE MONITORING RESULTS FOR PROJECT CONSTRUCTION SITES IN Q3 2018

Site Name	Aggregate Crushing Plant - Noise Monitoring (dB (A))								
Noise Level (dB)	25-26/July/18		26/July/18	23-24/August/18		24/Aug/18	04-05/September/18		05/Septem ber/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	18:30 - 22:00	22:01 - 06:00	06:01 - 18:00
Maximum Value Recorded	46.1	65.5	73	73.7	69.8	78.2	45.9	58.3	77.7
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	40.64	53.38	50.52	46.00	53.33	47.25	41.10	41.75	38.56
Guideline Averaged	70	70	70	70	70	70	70	70	70
Site Name	RCC Plant								
Noise Level (dB)	11-12/July/18		12/July/18	16-17/Aug/18		17/Aug/18	07-08/Sept/18		08/Sept/18
	18:30 - 22:00	22:01 - 06:00	06:01 - 18:00	18:00 - 22:00	22:01 - 06:00	06:01 - 17:59	18:00 - 22:00	22:01 - 06:00	06:01 - 18:00

Maximum Value Recorded	74.9	62.1	71.2	59.1	64.8	65.2	77.8	66.3	64.4
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	53.21	50.54	39.92	47.02	54.28	52.67	49.67	49.63	49.38
Guideline Averaged	70	70	70	70	70	70	70	70	70
Site Name	Main Dam								
Noise Level (dB)	27-28/July/18		28/July/18	01-02/Aug/18		02/Aug/18	11-12/Sept/18		12/Sept/18
	18:30 - 22:00	22:01 - 06:00	06:01-18:00	18:00 - 22:00	22:01 - 06:00	06:01-18:00	18:30 - 22:01	22:01 - 06:01	06:01 - 18:01
Maximum Value Recorded	62.2	56	74.4	69.8	86.5	75.9	65.7	74.9	68.7
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	50.20	46.47	49.99	60.92	61.07	61.31	58.49	58.81	61.80
Guideline Average	70	70	70	70	70	70	70	70	70
Site Name	Sino Hydro Temporary Worker Camp								
Noise Level (dB)	26-27/July/18		27/July/18	27-28/Aug/18		28/Aug/18	03-04/Sept/18		04/Sept/18
	18:30 - 22:01	22:01 - 06:01	06:01 - 18:01	18:00 - 22:02	22:01 - 06:02	06:01-18:01	18:00 - 22:03	22:01 - 06:00	06:01 - 18:01
Maximum Value Recorded	52.9	53	63	59.9	66.2	74.5	62.4	70.2	87.2
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	47.32	45.64	46.40	48.86	52.27	40.28	48.48	56.53	50.55
Guideline Average	70	50	70	70	50	70	70	50	70
Site Name	Song Da5 Camp No.2								
Noise Level (dB)	10-11/July/18		11/July/18	09-10/Aug/18		10/Aug/18	10-11/Sept/18		11/Sept/18
	18:30 - 22:00	22:01 - 06:00	06:01 - 18:00	18:30 - 22:00	22:01 - 06:00	06:01 - 18:00	18:00 - 22:01	22:01 - 06:01	06:01 - 18:01
Maximum Value Recorded	49.6	54.4	44.9	63.4	63	60.9	63.1	70.2	66.8
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	43.30	45.72	35.84	49.29	50.74	42.62	50.84	55.07	42.41
Guideline Averaged	70	50	70	70	50	70	70	50	70
Site Name	Lilama 10 Camp								
Noise Level (dB)	09-10/July/18		10/July/18	02-03/Aug/18		03/Aug/18	13-14/Sept/18		14/Sept/18
	18:00 - 22:01	22:01 - 06:01	06:01 - 17:31	18:30 - 22:02	22:01 - 06:02	06:01 - 18:00	18:00 - 22:03	22:01 - 06:03	06:01 - 18:01
Maximum Value Recorded	61.6	69.8	61	69.4	61.4	71.2	71.4	67.6	74.5
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	46.56	47.44	42.01	56.93	52.74	52.16	52.74	63.42	47.09
Guideline Averaged	70	50	70	70	50	70	70	50	70
Site Name	Main Powerhouse								
Noise Level (dB)	05-06/July/18		06/July/18	29-30/Aug/18		30/Aug/18	24-25/Sept/18		25/Sept/18
	18:30 - 22:01	22:01 - 06:01	06:01 - 17:59	18:00 - 22:02	22:01 - 06:02	06:01 - 18:00	18:00 - 22:03	22:01 - 06:03	06:01 - 18:01

Maximum Value Recorded	58.8	69.4	82.1	81.5	72.6	95.6	72.6	72.6	84.1
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	52.62	49.51	60.82	71.81	71.05	67.98	71.32	71.36	73.55
Guideline Averaged	70	70	70	70	70	70	70	70	70
Site Name	Sino Hydro Camp								
Noise Level (dB)	12-13/July/18		13/July/18	14-15/Aug/18		15/Aug/18	05-06/Sept/18		06/Sept/18
	18:30 - 22:01	22:01 - 06:01	06:01 - 17:31	18:00 - 22:02	22:01 - 06:02	06:01 - 18:00	18:30 - 22:03	22:01 - 06:03	06:01 - 18:01
Maximum Value Recorded	55.2	51.3	80.7	56.2	57.7	73.6	71.4	72.9	88
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	41.17	39.56	41.55	48.46	46.93	44.40	50.34	53.05	48.95
Guideline Averaged	70	50	70	70	50	70	70	50	70

4.6.7 Vibration

The construction work during Q3 2018 is unlikely to generate vibrations that would impact the human health and surrounded environment. Quarry operations were completed in March 2018 and the final blasting was carried out on 27 March 2018. Therefore, no blasting occurred during this this quarter.

5 WATERSHED AND BIODIVERSITY MANAGEMENT

5.1 WATERSHED MANAGEMENT

5.1.1 Preparation of 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.

NNP1PC received comments on the final NNP1 Watershed Management Plan (WMP) from ADB, LTA, and Xaysomboun and Bolikhamxay Watershed and Reservoir Protection Offices (WRPO) in September 2018. The final plan is being improved to address the comments and will be re-submitted to ADB for final review and approval prior to submitting to the Chairman of Watershed and Reservoir Protection Committee (WRPC).

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.

Bolikhamxay WRPO is preparing the Annual Implementation Plan for watershed management 2019 in September 2018 and will submit the draft plan to NNP1PC for further review in October 2018. Xaysomboun WRPO have settled the nomination of members of Xaysomboun WRPO in September 2018 and will start the preparation of the Annual Implementation Plan in October 2018.

Xaysomboun Provincial Authorities and NNP1PC conducted joint monitoring mission at the main reservoir on 7 August 2018. The mission made the following observations:

- The team observed cattle raising, farming, wildlife hunting, and fishing within the TPZ 1 (Phou Samsao) and the main reservoir. The Chairman of WRPC advised NNP1PC and Xaysomboun WRPO team to collect field data and report to WRPC for further actions. In addition, Xaysomboun WRPO team in collaboration with NNP1PC should expedite the preparation of TPZ management activities as part as the Annual Implementation Plan for the watershed management.
- WRPC advised to move the current check point in Ban Houaxay closer to the edge of the main reservoir and upgrad to be a Xaysomboun WRPO sub-office that will serve multiple purposes such as WRPO coordination, boat registration, CUZ land patrolling check point and reservoir patrolling check point.
- WRPC advised NNP1PC to continue removing floating log/debris in accordance with relevant guidelines.

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.

In August 2018, the checkpoints made 857 records of people accessing the main reservoir, out of these, 239 records are from Houayxay (Hom District, Xaysomboun Province), 139 records are from Pou (Thathom District, Xaysomboun Province) and 479 records are from Nahanh (Bolikhhan District, Bolikhamxay Province). Fishing (298 records) and agriculture (197 records) related activities are amongst the main reasons why people access the reservoir.

In September 2018, the checkpoints made 788 records of people accessing the main reservoir which is smaller than the previous month, out of these, 365 records are from Houayxay (Hom District, Xaysomboun Province), 187 records are from Pou (Thathom District, Xaysomboun Province) and 236 records are from Nahanh (Bolikhhan District, Bolikhamxay Province). Household consumption including fishing and hunting (328 records), agriculture (227 records) and livestock raising (158 records) are amongst the main reasons why people access the reservoir.

In addition, a total of 917 cattle was found inside the NNP1 watershed area and known to belong to 77 households from eight villages namely Nahanh, Nam Kian, Bor, Palaveak, Pamueang, Phoungou, Huay Xay and Homtath were recorded. The company's concern on livestock raising related activities was presented to Xaysomboun WRPO for consideration to remove the cattle and further notify the villagers not to enter their former grazing lands that have been compensated by the Project.

5.1.2 Preparation of Provincial Regulation for the Watershed Management

Xaysomboun PONRE presented the draft watershed management regulations to the Provincial Assembly on 16 August 2018. The Assembly members gave their consent to the regulations with some comments that need to be addressed before re-submission to the chair of the Provincial Assembly.

The Xaysomboun Provincial Assembly will have further discussions on the objection raised by Xaysomboun PAFO at the end of September 2018 related to ownership of the regulation and future enforcement by PONRE and PAFO. The Chairperson of Provincial Assembly will issue the certification of acceptance afterward prior to submission to Xaysomboun Provincial Governor for signing.

5.2 BIODIVERSITY OFFSET MANAGEMENT

5.2.1 Preparation of Biodiversity Offset Management Plan

The initial first draft of the NNP1 Biodiversity Offset Management Plan for NCNX was submitted to NNP1PC-EMO on 29 June 2018. The EMO and its biodiversity expert have further improved the draft until August 2018. The improved draft was submitted to ADB in September 2018 for further review after discussion on institutional arrangement with Bolikhamxay Province Agriculture and Forestry Office (PAFO).

5.2.2 Preparation of Provincial Regulations for Biodiversity Offset Management in NCNX

Following consultations on 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.

The regulation was presented to the Bolikhamxay Provincial Assembly on 17 August 2018. The regulation was unanimously endorsed by Bolikhamxay Provincial Assembly. The Biodiversity Offset Management Regulation was then submitted to the Bolikhamxay Provincial Governor for signing on 24 September 2018.

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 Q3 2018. Detailed information is being recorded in the SMART database and is regularly reported and discussed during the monthly patrolling meeting with the BOMC Secretariat.

In July 2018, two patrolling 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 storms were the main reason for the limited number of patrolling days. The patrolling covered seven key areas within 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. A total of 789 small wire snares were collected and recorded by Viengthong patrolling team. The rainy season is known to be the peak time for wildlife hunting. The patrolling 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.

In August 2018, two patrolling teams with a total of 18 people conducted forest patrolling for 13 days in Viengthong District (including 9 forest patrolling days with the distance of 43 km and 4 road/village patrolling days with the distance of 29 km) and 14 days in Xaychamphone District (including 12 forest patrolling days with the distance of 41 km and 2 road/village patrolling days with a distance of 43 km). Heavy rain and storms limited the mobilization of patrolling team especially in the forest areas. The patrolling covered 12 key areas within the NCNX offset site. The main threats found in these areas are hunting and fence wire snares. Approximately 76 large wire snares were collected by Viengthong team and 168 small wire snares were collected by Xaychamphone team.

Based on the results of the patrolling team evaluation, training was conducted in the last week of August 2018 involving five BOMC secretariat members, four patrolling team

members, six border militaries officials, NNP1 EMO staff and trainers from Bolikhamxay PAFO, district hospital and head of BOMC secretariat. The training covered the main topics: 1) general principle of conservation, wildlife list base on Lao Law and the provincial regulation for NC-NX Biodiversity Offset; 2) usage of map, compass and GPS; 3) SMART forms, recognizing threats and field practice and; 4) first aid provision in the field.

In September 2018, two patrolling teams with a total of 18 people conducted patrolling for 16 days in Viengthong District and. The patrolling covered 7 key areas within the NCNX offset site. The main threats found in the areas are wildlife hunting and fence wire snares by local villagers. A total of 34 small wire snares, 13 temporary hunting camps and 4 plots of land being cleared were collected and recorded by Viengthong patrolling team whilst a total of 85 small wire snares and 7 temporary hunting camps were collected/recorded by Xaychamphone patrolling team. One offender was encountered with one cap gun and 13 kg of deer meat confiscated and written warning was given to the person..

FIGURE 19: OVERALL PATROLLING TRACK RECORD FROM SEPTEMBER 2017 UNTIL END OF 3RD QUARTER 2018

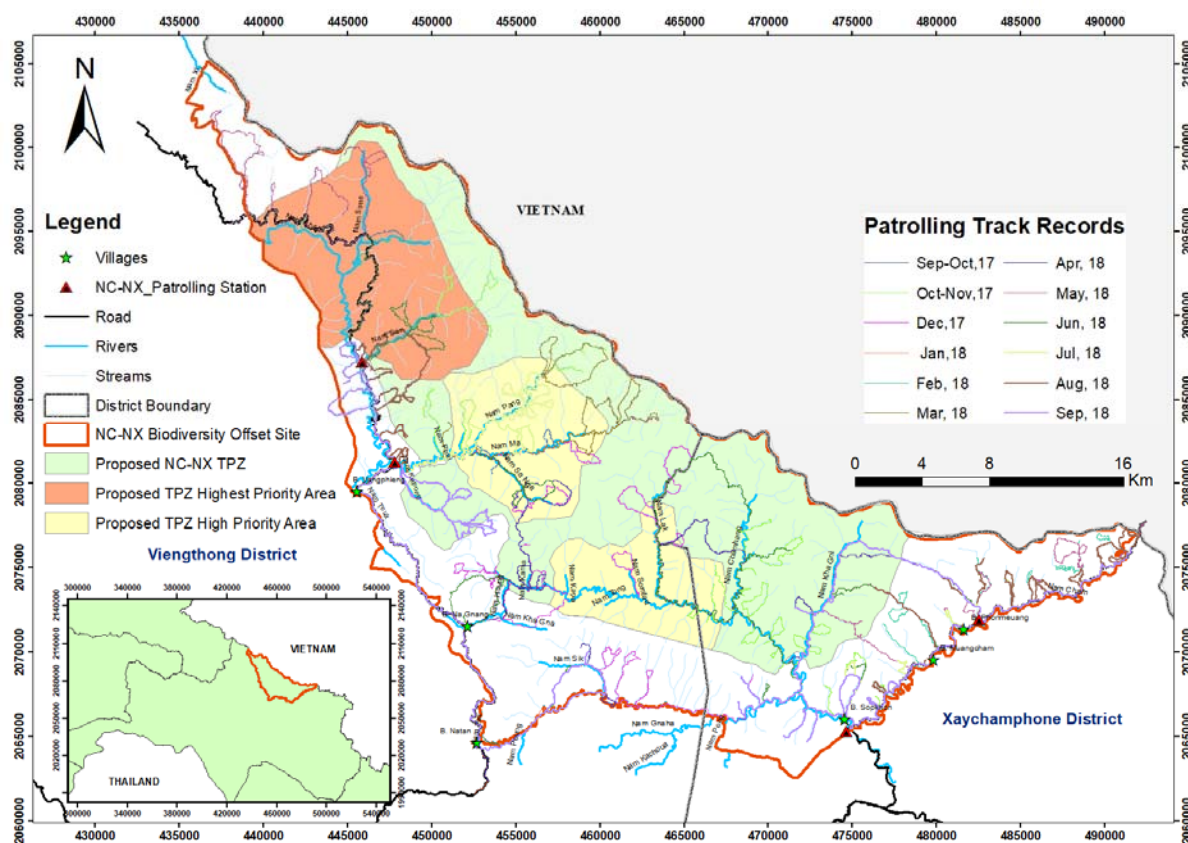


FIGURE 20: OVERALL THREATS RECORDED UNTIL END OF 3RD QUARTER 2018 IN VIENGTHONG DISTRICT

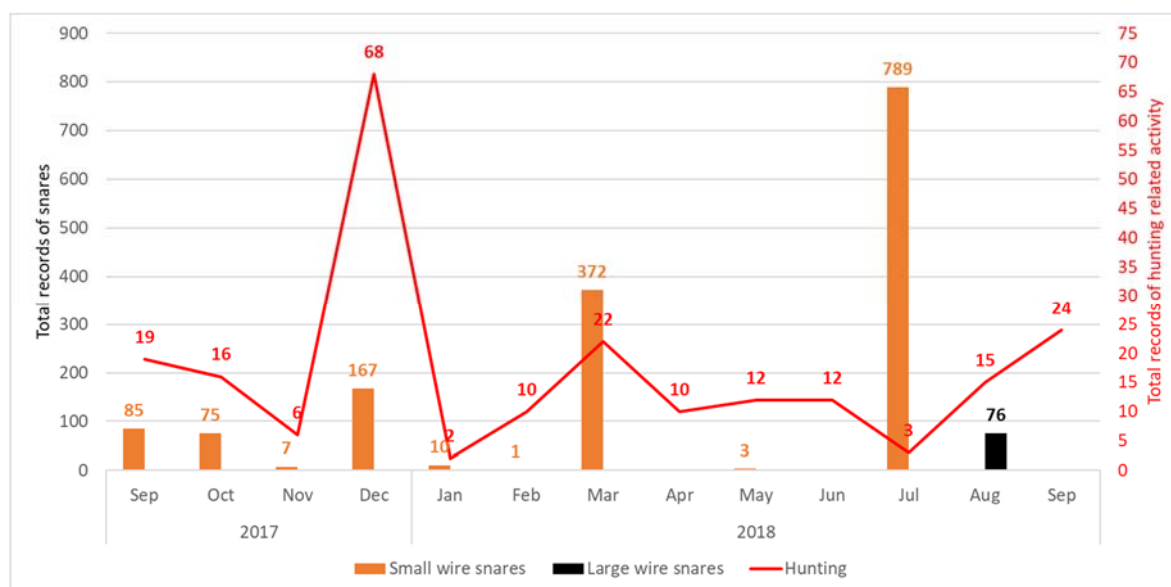
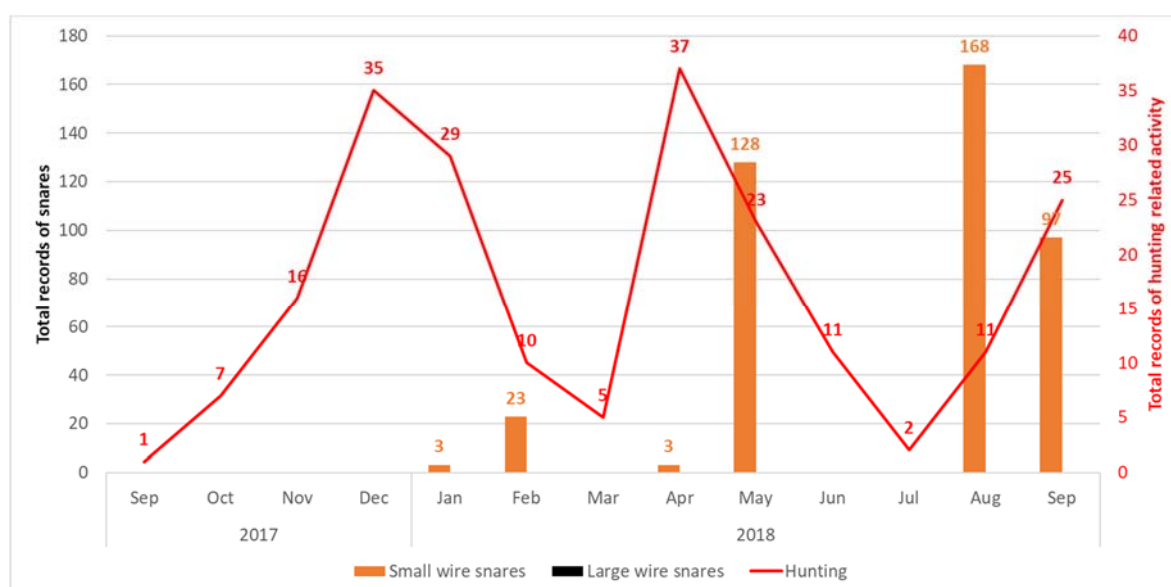


FIGURE 21: OVERALL THREATS RECORDED UNTIL END OF 3RD QUARTER 2018 IN XAYCHAMPHONE DISTRICT



Pre-BOMP2 proposal was approved by ADB and agreed by BOMC at the end of September 2018. The fund disbursement is being processed for the continuation of the project activities especially the patrolling.

6 BIOMASS CLEARANCE / FLOATING DEBRIS REMOVAL

As of 30 April 2018, the biomass clearance work was completed. A total of 1,640.75 ha was accepted as fully cleared and the completion work was inspected and accepted by Department of Natural Resources and Environmental Monitoring (DNREM) of the Ministry of Natural Resource and Environment (MONRE) after a join inspection was conducted with NNP1PC in April 2018. On 09 May 2018, DNREM issued a letter to the Department of Energy Business (DEB) of the Ministry of Energy and Mine (MEM) certifying the completion of the biomass removal.

NNP1PC has contracted a local Contractor to carry out removal of floating debris in the main reservoir. This Contractor started the work on 15 August 2018 with the focus on removal of

floating debris and logs trapped at log boom of the main dam and another lower reservoir area in order to minimise decaying biomass and prevent damage to dam infrastructure.

The Contractor team removed the floating log/debris to the landing site near the river bank in Zone 2. Burning wood/debris piles in Zone 2 will commence during the first week of October 2018. The team also started the progress in Zone 5 at the end of September 2018.

FIGURE 6-1: Representative photographs of floating debris and logs removal operation in August 2018



FIGURE 6-2: Representative photographs of floating debris and logs removal operation in Zone 2 in September 2018

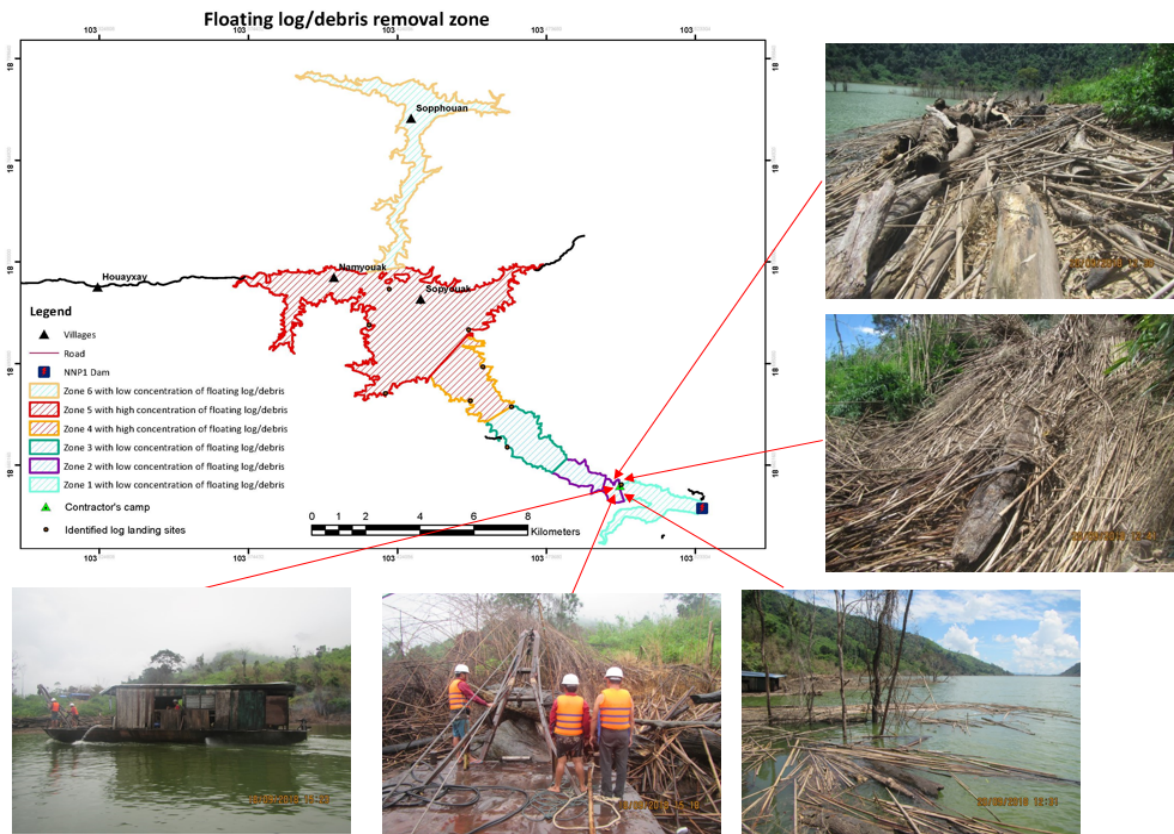
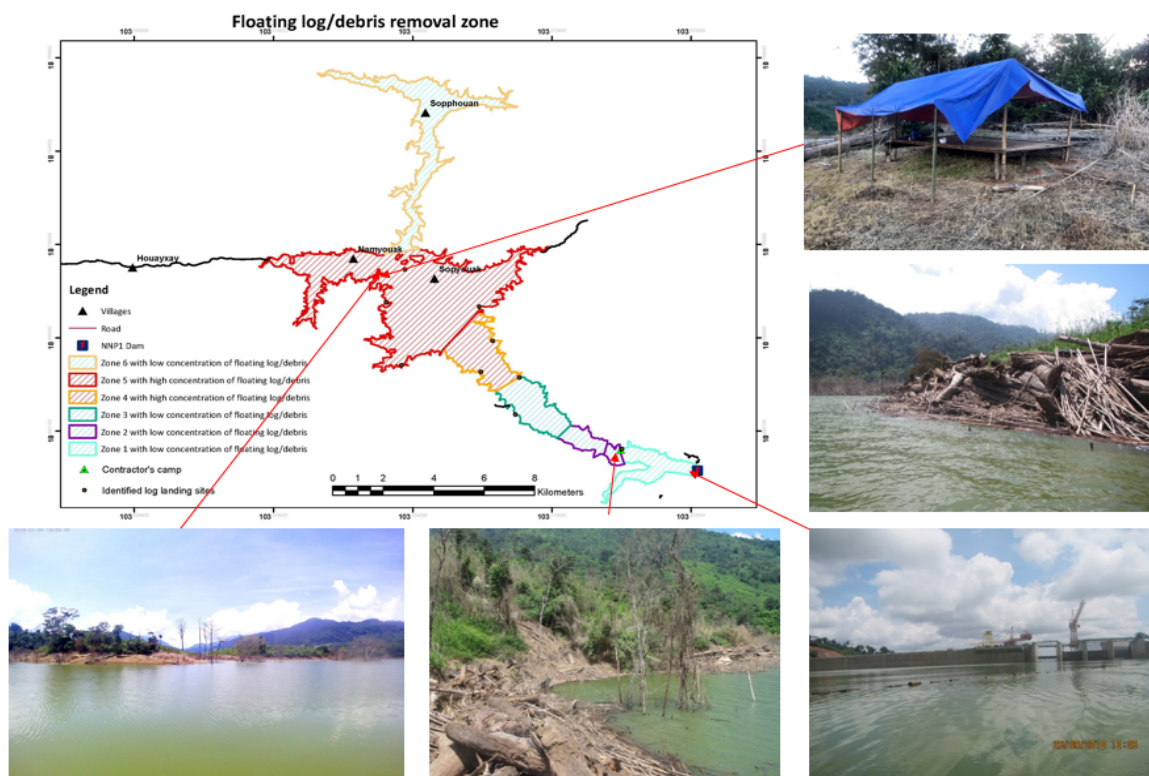


FIGURE 6-3: Representative photographs of floating debris and logs removal operation in Zone 5 in September 2018



7 FISHERY MONITORING

The 5 species that dominated the fish catch by weight in Q3 2018 are listed in **Table 7-1**. This includes three species and 2 species groups that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species¹², except *Hemibagrus filamentus* that are Data Deficient.

TABLE 7-1: FISH SPECIES DOMINATING THE FISH CATCH IN Q3 2018

Species	Fish Catch in Q3 2018 (kg)	IUCN Red List Classification
<i>Hemibagrus nemurus</i> , <i>Hemibagrus filamentus</i>	1779.2	LC, DD
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i>	1663.3	LC
<i>Clarias batrachus</i>	800.6	LC
<i>Channa striata</i>	735.5	LC
<i>Anabas testudineus</i>	560.9	LC

The recorded catch of threatened species (IUCN Red List classification) in the Q3 2018 fish catch is presented in **Table 7-2**. The list includes one Endangered (EN), four Vulnerable species (VU), and six Near Threatened species (NT).

TABLE 7-2: THREATENED AND NEAR THREATENED SPECIES OF THE Q3 2018 FISH CATCH

Species	Fish Catch ¹³ in Q3 2018 (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	91.6	Vulnerable
<i>Bangana behri</i>	55.3	Vulnerable
<i>Cirrhinus molitorella</i>	49.2	Near Threatened
<i>Wallago attu</i>	20	Near Threatened
<i>Onychostoma gerlachi</i>	30.3	Near Threatened
<i>Ompok bimaculatus</i>	22.1	Near Threatened
<i>Bagarius bagarius</i>	10.2	Near Threatened
<i>Cyprinus carpio</i>	2.4	Vulnerable (introduced in Lao PDR)

¹² 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.

¹³ The list only includes species caught in Nam Ngiep basin – not fish caught by the Mekong Control Group

Species	Fish Catch ¹³ in Q3 2018 (kg)	IUCN Red List Classification
<i>Cirrhinus cirrhosis</i>	3.7	Vulnerable (introduced in Lao PDR)
<i>Luciocyprinus striolatus</i>	2.7	Endangered
<i>Mekongina erythrospila</i>	1	Near Threatened

The occurrence of Threatened and Near Threatened species in the fish catch by Quarter since the start of species identification in Q3 2015 is displayed in **Table 7-3**.

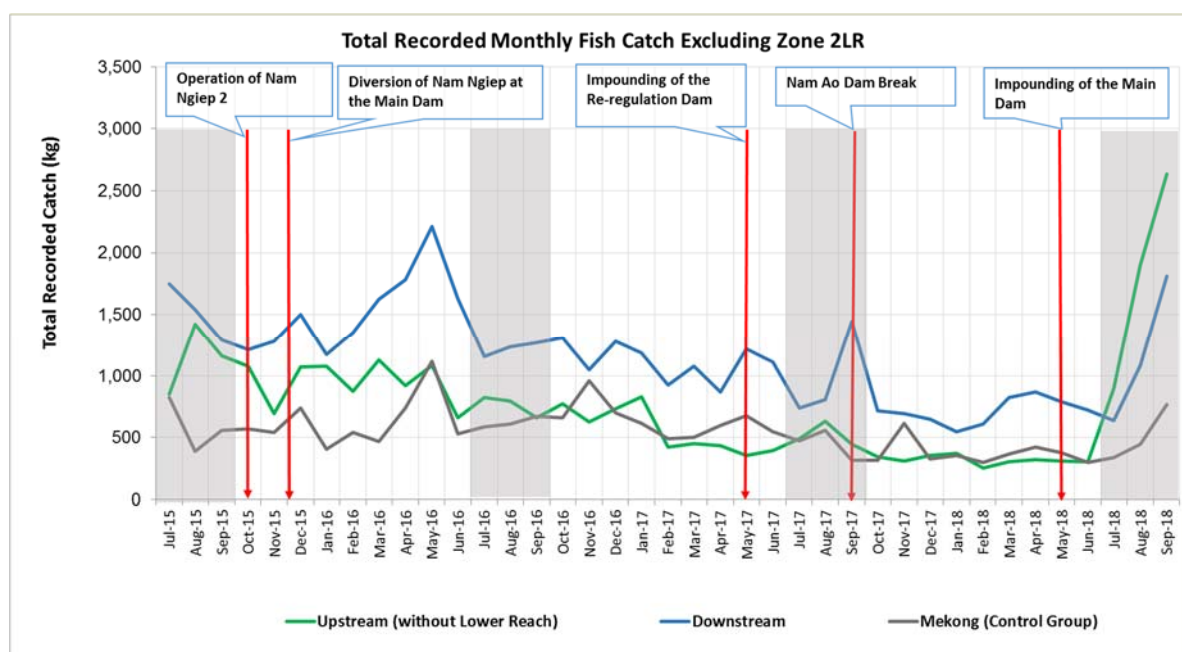
TABLE 7-3 OCCURRENCE OF THREATENED AND NEAR THREATENED SPECIES IN THE FISH CATCH

Species	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018
<i>Bagarius bagarius</i> (NT)			+	+	+	+	+	+	+	+	+	+	+
<i>Bagarius yarrelli</i> (NT)	+			+					+				
<i>Bangana behri</i> (VU)	+	+	+	+	+	+	+	+	+			+	+
<i>Cirrhinus cirrhosus</i> (VU)	+	+	+	+	+	+	+	+	+		+	+	+
<i>Cirrhinus molitorella</i> (NT)	+	+										+	+
<i>Cyprinus carpio</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Epalzeorhynchus munense</i> (VU)												+	
<i>Hypophthalmichthys molitrix</i> (NT)	+				+								
<i>Luciocyprinus striolatus</i> (EN)	+	+	+	+			+	+	+	+			+
<i>Mekongina erythrospila</i> (NT)	+	+	+	+	+	+	+	+	+			+	+
<i>Ompok bimaculatus</i> (NT)	+	+	+	+	+	+	+	+		+	+	+	+
<i>Onychostoma gerlachi</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pangasianodon hypophthalmus</i> (EN)	+												
<i>Probarbus jullieni</i> (EN)	+	+	+			+		+	+	+		+	
<i>Probarbus labeamajor</i> (EN)				+	+			+					
<i>Scaphognathops bandanensis</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Syncrossus beauforti</i> (NT)		+	+	+	+	+					+		
<i>Wallago attu</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+

The total recorded monthly fish catch from July 2015 to September 2018 for the downstream, upstream and Mekong control group fishing households involved in the monitoring programme is presented in **Figure 7-1**. 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 7-1 TOTAL RECORDED FISH CATCH 2015-2018



Error! Reference source not found. **Table 7-4** and **Figure 7-2** show the total recorded fish catch for Q3 2015, Q3 2016, Q3 2017 and Q3 2018 by the upstream (excluding Zone 2LR), downstream and the Mekong control group fishing households. Both the monthly data (**Figure 7-1**) and the quarterly data in (**Table 7-4** and **Figure 7-2**) indicate an increasing total amount of fish caught in the upstream areas including in the main reservoir in Q3 2018. For the downstream and the Mekong Control Group there does not seem to be a clear difference. The total fish catch was higher within the reservoir (upstream) in Q3 2018 compared to the pre-construction and construction phases. Further statistical analysis will be carried out when longer time series become available.

TABLE 7-4: TOTAL RECORDED FISH CATCH IN Q3 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND BY THE MEKONG CONTROL GROUP FISHING HOUSEHOLDS

	Q3 2015 (kg)	Q3 2016 (kg)	Q3 2017 (kg)	Q3 2018 (kg)
Upstream	3,434	2,275	1,573	5,433
Downstream	4,584	3,664	2,989	3,527
Mekong Control Group	1,767	1,868	1,346	1,556

FIGURE 7-2: TOTAL RECORDED FISH CATCH IN Q3 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS

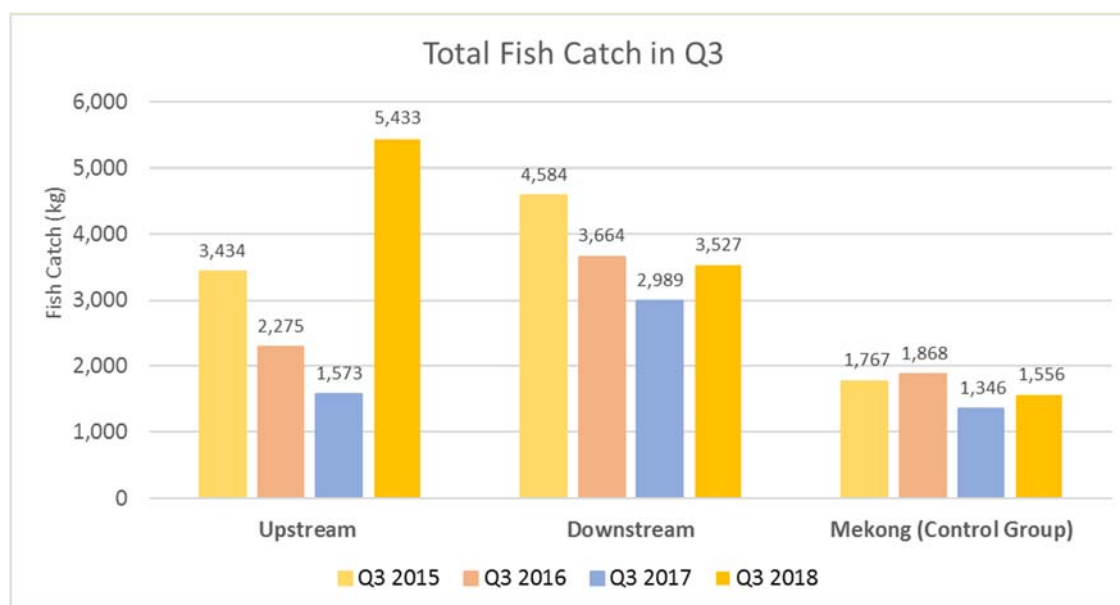
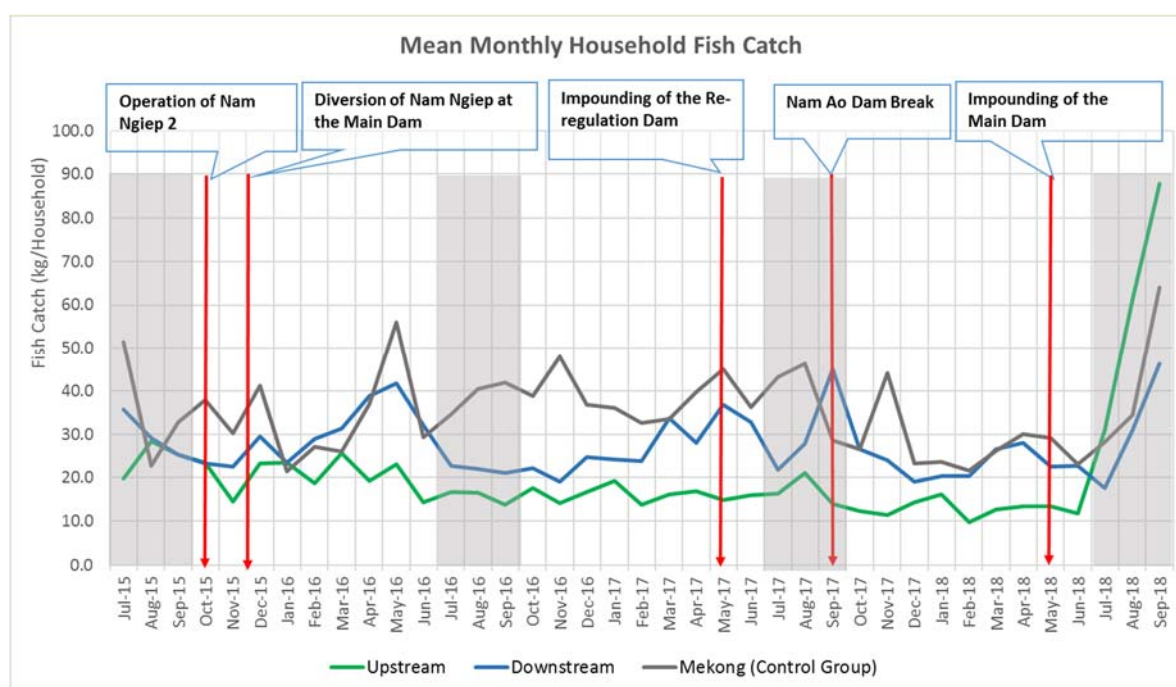


Table 7-5 presents the mean household fish catch per fishing day for Q3 2015, Q3 2016, Q3 2017 and Q3 2018 in the upstream (excluding Zone 2LR), downstream and the Mekong Control Group, and **Figure 7-3** shows the mean monthly household fish catch per fishing day from July 2015 to September 2018.

TABLE 7-5: MEAN HOUSEHOLD FISH CATCH PER FISHING DAY IN Q3 2015, Q3 2016, Q3 2017 AND Q3 2018

Fishing Zone	Q3 2015 (kg)	Q3 2016 (kg)	Q3 2017 (kg)	Q3 2018 (kg)
Upstream (Excluding Zone 2LR)	2.61	2.11	2.67	8.27
Downstream	3.30	2.66	3.48	3.45
Mekong (Control Group)	3.15	3.41	3.38	3.00

FIGURE 7-3 MEAN MONTHLY HOUSEHOLD FISH CATCH PER FISHING DAY (EXCLUDING ZONE 2LR)

To test whether there are any significant differences among the quarterly mean household fish catch per fishing day for each fishing zone, one-way ANOVA (analysis of variance) statistical tests have been performed on the data from each fishing zone. The null-hypothesis is that the sample means are equal, and the alternative hypothesis is that at least one of the means is statistically different. The level of significance is set to 0.05 (5%). The results of the one-way ANOVA tests are presented in Table 7-6.

TABLE 7-6 RESULTS OF ONE-WAY ANOVA TESTS ON MEAN HOUSEHOLD FISH CATCH IN Q3

Fishing Zone	F-Statistic	P-value	F-Critical	Significance
Upstream	8.992	8.48×10^{-6}	2.624	Highly Significant
Downstream	1.649	0.177	2.622	Not Significant
Mekong Control Group	0.231	0.875	2.659	Not Significant

The rule for interpreting the results of an ANOVA test is that if the F-statistic is lower than the F-Critical value then this supports that the null-hypothesis cannot be rejected (same if the p-value is greater than the significance level). The results of the ANOVA tests in **Table 7-6** indicates that neither the downstream means nor the Mekong Control Group means are significantly different, while the upstream means are significantly different. This indicates that in Q3 2018 mean household fish catch was significantly higher within the reservoir (upstream) than compared to downstream in Nam Ngiep and in the Mekong River.

Further statistical analyses will be carried out when longer time series become available and the data and information from the monitoring programme will be studied to identify the possible reasons for the decrease in fishing households and fishing days.

8 EXTERNAL MONITORING

8.1 INDEPENDENT ADVISORY PANEL

No Independent Advisory Panel (IAP) Mission was conducted in Q3 2018.

Results of 11th IAP Mission from 20-27 May 2018 was presented in the Q2 2018 report.

8.2 GOL ENVIRONMENTAL MANAGEMENT UNIT

The monthly inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was conducted during 26 - 27 September 2018. During this inspection, the EMU was concerned about demolition of heavy concrete foundations at the aggregate crushing plant and the RCC Plant. EMO addressed EMU's comments in the Project's Site Decommissioning and Rehabilitation Plan that was discussed with the principal Contractors in September 2018 and will be followed up by EMO in the Q4.

The quarterly site inspection by the Environmental Management Unit (EMU) of Xaysomboun Province was carried out on 25 September 2018. This visit focused mainly on the reservoir water quality monitoring. The EMU did not raise any concerns during their mission.

APPENDICES

APPENDIX 1: STATUS OF SS-ESMMPs AND WORKING DRAWINGS OF THE CAMPS' WASTE WATER TREATMENT SYSTEMS REVIEW AND APPROVAL DURING Q3 2018

No	Site name	List of ESMMP and SS-ESMMP	Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status
1	Earth Dyke (Saddle Dam)	SS-ESMMP for Closing Dike's Borrow Pit No.:7 (Reply owner's comments)	PKCC	Closed. The final solution was made and the contractor agreed to prepare and submit site specific decommissioning and rehabilitation for review and approval.	Dike construction /embankment	Completed. The submission of site-specific decommissioning and rehabilitation is no longer valid because this site closure will be included in the overall NNP1 Project Site Decommissioning and Rehabilitation Plan.
2	Re-regulating Dam	SS-ESMMP for Closing borrow pits at the corner of road P1, P1A.	Songda5	As above	Re-regulation power station embankment	Completed
3	Main Quarry	SS-ESMMP for Quarry site management	Sino Hydro	As above	Aggregate production for Dam RCC and CVC works	Completed

4	TCM Camp	Site Decommissioning and rehabilitation 2 nd submission	TCM	No objection with comment	Camp facility decommissioning	The first stage of building structures demobilisation and removal are completed. The remaining concrete foundation/concrete slab was handed over to GFE subcontractor for use and final site cleaning up based on their internal arrangement of site usage
5	HSRA Irrigation canal	SS-ESMMP for HSRA's irrigation canal rock excavation	VSP Co., Ltd	No objection with comment	Rock excavation at intake of irrigation canal	On-going
6	Sino Hydro Camp and Aggregate Plant facilities	Site Decommissioning and Rehabilitation	Sino Hydro	Under Review	Camp, Aggregate Plant and facilities decommissioning and rehabilitation	On-going

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q3-2018

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
ONC_OC-0232	30.08.2016	Re-regulation Dam Borrow Pit (Borrow Pit Area at Corner of P1 & P1A Road)	The borrow pit was operated without adequate environmental management actions: <ul style="list-style-type: none"> - The slope of the cut had no berm and cut-off drains; - Lack of closure plan for the borrow pit. 	A Response to Owner's comment was on 03 March 2018 is under review, it is expected to be cleared in July 2018.	27.09.2016	27.09.2018	Closed
ONC_OC-0272	13.02.2018	Main quarry site	Waste rock had been pushed down the slope towards Nam Ngiep. The operation has damaged riparian vegetation.	The loose rocks were removed and no more quarry blasting since the end of May 2018.	27.02.2018	26.06.2018	Closed
ONC_HM-0015	15.05.2018	HM Hydro Worker Camp N#2	A food waste trap/ oil trap at the canteen were damaged without maintenance. As a result, food waste was flushed and accumulated in the wetland pond. <ul style="list-style-type: none"> - Wastewater was discharging from the wetland pond without chlorination. 	<ol style="list-style-type: none"> 1. Repair/ replace the food waste trap/oil trap; 2. Clean up food waste regularly, collect into plastic bag and dispose in NNP1 Landfill; 3. Treat effluent from the wetland pond with chlorine (immediately). 	18.05.2018	12.07.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
ONC_OC-0279	29.05.2018	Aggregate Plant Yard	Indicative timeframe of site removal and rehabilitation provided by CWC's contractors (Camps and Facilities Decommissioning ref: rev.0, 16 March 2018) was not consistent with the actual work on site. Given that: - Work completion date: 31 August 2018, and - Removal date: 30 November 2018. However, this bi-weekly joint site inspection observed some decommissioning of conveyor belts and crusher had commenced and ongoing.	Revise the site removal and rehabilitation timeframes to be consistent with the actual work - Sino Hydro main camp & office and Sino hydro magazine (at spoil No.6), need to be added onto the list.	07.06.2018	04.07.2018	Resolved
NCR_HM-0004	27.04.2018	HM Hydro Worker Camp #2	No corrective action done for the pending environmental and health issues identified during EMO, EMU and IAP-ADM inspections. During the EMU-EMO inspection in April 2018, it was found that- Hazardous material (oil drums) was stored in unsecure storage (no proper bund, floor). Some oil drums and containers were stored on the bare ground;- Poultry was raised in the LILAMA10 camp. During this inspection, HM-Hydro and LILAMA	The Contractor is required to take the following actions by 30 June 2018: - Improve the existing oil storage facility; - Display procedures and poster for the correct practice of oil handling at the storage facility; - Provide steel tray and oil spill response kit (dry sand) at this oil storage facility;	30.06.2018	06.07.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			<p>10 were instructed to resolve those findings within 15 days.</p> <p>On 20-27 May 2018, IAP-ADB identifies similar issues as above and recommendation through NNP1PC for the improvement has been provided. On 07 June 2018 during NNP1PC-HM Hydro monthly progress meeting, EMO discussed and recommended to improve the above pending issues. At the end of this meeting, the discussion note was distributed to all participants for references and actions. On 13 June 2016, EMO sent an example "Best Practice and Best Available Technic as per the requirement in ESMMP-CP" to HM Hydro contractor for the improvement of LILAMA10's hazardous material storage. On 20 June 2018, EMO conducted site inspection to follow up the agreed corrective actions, it was confirmed that LILAMA10 subcontractor did not take any action to resolve those pending environmental and health risk issues.</p> <p>Note: NNP1PC-EMO is not satisfied with the contractor's cooperation and effort as no progress has been</p>	<ul style="list-style-type: none"> - Carry out a complete clean-up and disposal of oil contaminated soil/waste by referring to related measures (SP05: Hazardous material management; - Provide training on hazardous material and waste handling to LILAMA10's workers who operate the oil storage facility; - Stop raising of any poultry and dismantle chicken coop; - HM Hydro should follow-up the implementation of their subcontractor's corrective action and report the progress to NNP1PC in a timely manner. 			

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			made to resolve their environmental issues after various recommendations provided by EMO, EMU, and IAP-ADB.				
ONC_OC-0282	26.06.2018	Songda5 Camp #1	Water pump transporting wastewater from the second to next wetland pond was not operated (power line was unplugged), as a result, wastewater was nearly overflow from the pond prior to chlorination. The wastewater pipe line connecting between camp's washing area and WWTS was not properly connected. This caused in wastewater releasing to the open ditches and following to the outside.	1 Re-install the water pump and ensure these wastewater been transported to the designated chlorination tanks for treatment prior discharge, 2 Repair and well connect the wastewater pipe line to ensure no release and leakage of wastewater to the outside.	28.06.2018	13.07.2018	Resolved
ONC_OC-0283	26.06.2018	Songda5 Camp #1	Poor operation and housekeeping of workshop and hazardous storage areas. Oily equipment and machines were stored on the bare ground without spillage protection facilities/devices. This resulted in oil spillage and caused soil contamination next to workshop and stock yard.	Provide steel trays to collect oil dripping from the old machine; - Provide plastic sheet cover for oily equipment and machines to prevent from rain wash.	27.06.2018	13.07.2018	Resolved
ONC_OC-0285	26.06.2018	RCC Plant Yard	Septic tanks next to the RCC plant laboratory was full and there was an evidence of black water releasing from the septic tank.	Immediately block the septic tank hole to stop black water leaking; - Empty the septic tank and	05.07.2018	04.09.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
				dispose black water by following NNP1PC's Standard Operating Procedure (SOP) for black water/sewage sludge disposal.			
ONC_OC-0286	10.07.2018	Main Dam Workshop	No maintenance and cleanup of sediment from the oil traps serving car washing area and temporary hazardous material storages: An evidence of storm run-off through hazardous material storage without a provision of mitigation measures and / or control devices. Whilst the oil traps are not functioning. -The oil trap was full of sediment, the elbows pipes are broken which allowed oil film releasing off-site directly,	The Contractor is required to take the following corrective action: 1 Clean up sediment from the oil traps 2 Repair / replace the elbow pipes in the oil traps to ensure any oil film can be trapped. 3 Provide appropriate measures/devices to prevent the run-off through the hazardous material storage areas.	20.07.2018	17.07.2018	Resolved
ONC_OC-0287	10.07.2018	Sino Hydro Worker Camp	Poor management of hazardous material causing untidy and oily storage. No clean-up of oil spillage and contaminated sand in the storage. In addition, some pieces of roof were removed without repairing or replacement. This resulted in rain water interring and stagnant into the hazardous material storage area. Oil dripping from a backhoe causing contaminated soil without a	The Contractor is required to: - Clean up the hazardous material storage with dry sand and clean up oily sand properly after a complete oil absorption. The contaminated soil shall be collected and stored inside hazardous storage area at Sino Hydro main camp for proper elimination; - Repair the roof of hazardous storage area to prevent rain	20.07.2018	15.08.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			provision of steel trays and cleanup of contaminated ground was observed.	water interring and stagnant; - Provide steel tray to collect the dripping oil from the backhoe and clean up the contaminated soil properly.			
ONC_OC-0288	24.07.2018	V&K Camp	There was an evidence of black water leaking from the underground septic tanks which flew along the open ditch to the environment without maintenance and / or control measures. Without appropriate control measures. This sanitary carelessness presents high potential health and environmental risks.	1. Check the source of leakage and repair the broken septic system and leakage point; 2. Empty the septic tanks and dispose of sewage by following the SOP for Sewage/black water disposal.	31.07.2018	15.08.2018	Resolved
ONC_OC-0289	24.07.2018	V&K Camp	Ineffective of oil traps provided at the hazardous material storage resulting in: - Oil leakage from the storage facility creating oil contaminated ground. - The elevation of inlet pipe of the oil traps is higher than the outlet pipe that caused stagnant water which will be back-flowed into the oil storage area.	The Contractor is required to: - Clean up the contaminated ground at outside of storage for proper disposal, - Clean up oil-water mixture in the oil traps and modify the oil trap piping system.	31.07.2018	07.08.2018	Resolved
NCR_OC-0024	24.07.2018	KENBER Camp	A total of 1,600 liters of used oil disappeared from Kenber contractor's storage area without any notification to the NNP1PC-	1. Investigate and provide record and information of transportation destination and disposal method of the	03.08.2018	XX 20/09/2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			<p>EMO.</p> <p>The EMO conducts a monthly monitoring and inventory of hazardous material and waste storage at every construction sites and workshops. In June 2018, a total of 1,800 liters used oil from Kenber's workshop were inventoried, but during July 2018 inspection it was found that only 200 liters used oil remained in the hazardous waste storage area.</p> <p>EMO requested OC's environmental team to work with Kenber contractor to investigate and provide record and information of transportation destination and disposal method of the disappeared 1,600 liters used oil.</p> <p>However, during the latest bi-weekly joint site inspection on 24 July 2018, the contractor could not provide the requested information and no any clarification to the mentioned issue. This is confirmed a non-compliance on the disposal of hazardous waste in stipulated in the Project's ESMMP-CP 2016 (SP05 and SP06).</p>	<p>disappeared 1,600 liters used oil;</p> <p>2. Provide training and instruction to the Kenber contractor for their attention and obligation on environmental management matters;</p> <p>3. Provide a corrective action and prevention plan to prevent the similar and repeating issue;</p> <p>4. Address NNP1PC-EMO's comments in part 2 of this NCR1.</p>			
ONC_OC-0025	24.08.2018	KENBER Camp	No corrective actions done for the pending Non-Compliance Report	1. Address NNP1PC-EMO's comments in the NCR ref no.	31.08.2018	20.09.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			<p>(NCR) ref no. NNP1-ESD-EMO-NCR-OC-0024 for a Non-Compliance disposal of hazardous waste by Kenber contractor.</p> <p>The said NCR level 1 was issued to Obayashi Corporation (OC) (ref no NNP1/0440-018/OBA/EPC-CE dated 02 August 2018- attached) instructing OC to investigate the disappearance of 1,600 liters of used oil from Kenber's workshop, and to report the result of the investigation together with preventative measures to NNP1 to avoid any similar incidents. So far, the contractor has not taken any action or provided any response to the issued environmental Non-Compliance.</p> <p>Furthermore, during the latest joint bi-weekly inspection on 21 August 2018, a total of 222 kg oil contaminated sand and 10 units of used oil filters, as referred to the hazardous waste inventory are unaccounted for at the same hazardous waste storage of Kenber contractor</p>	<p>NNP1-ESD-EMO-NCR-OC-0024, letter ref no. NNP1/0440-018/OBA/EPC-CE dated 02 August 2018.</p> <p>2. Investigate and provide record and information of transportation, destination and disposal method of the newly disappeared 222 kg oil contaminated sand and 10 unit used oil filters.</p> <p>3. Provide training and instructions to the personnel of Kenber Geotechnics about their obligations with respect to hazardous waste management;</p> <p>4. Provide a corrective action and prevention plan to prevent occurrence of any similar incidents;</p> <p>5. Address NNP1PC-EMO's comments in part 2 of this NCR2.</p>			
ONC_OC-0290	04.09.2018	Sino Hydro Workshop	Improperly deconditioning procedure was conducted by Sino	The Contractor is required to take immediate clean up the oily	07.09.2018	18.09.2018	Resolved

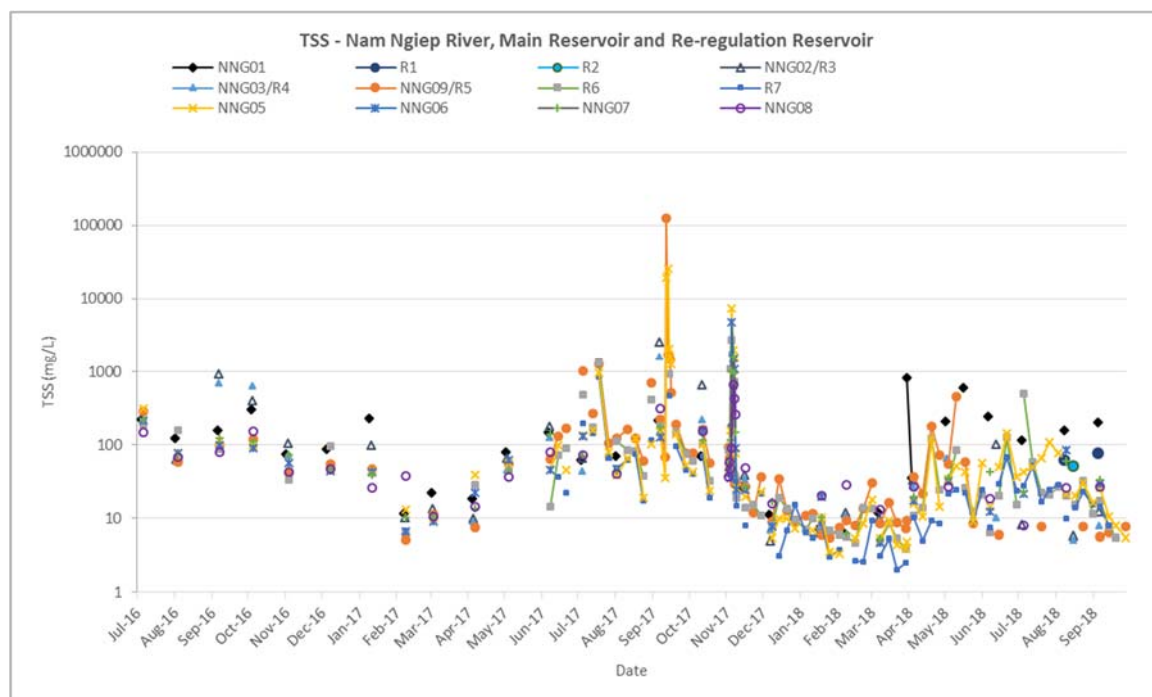
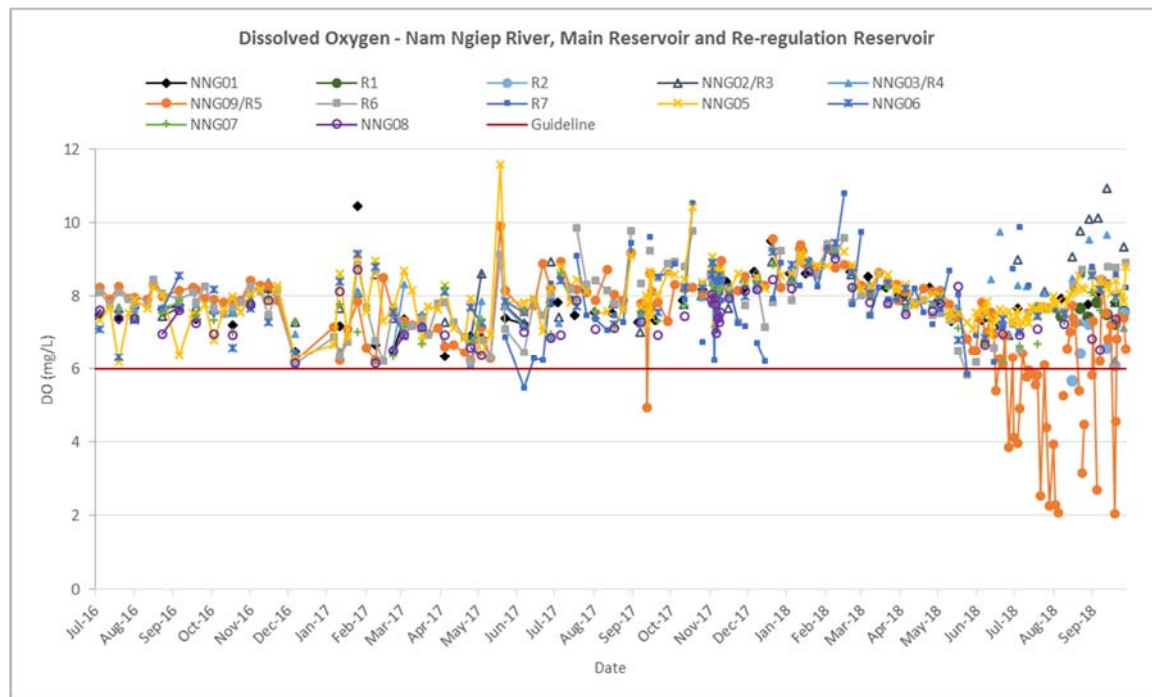
Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			Hydro Contractor. Hazardous material storage facility (roof and structures) has been demolished without cleanup of contaminated soil and oily rages. As a result, oily floor, oily rages and contaminated soil being flushed by rain water to the ground and adjacent open ditch.	dirt, oil rages from the platform for proper disposal. Note: The action shall be done within specified deadline. Otherwise a NCR will be issued.			
ONC_HM-017	04.09.2018	HM Hydro Worker Camp #2	Two opened drums with a 200L capacity each containing some turbine oil were stored outside the workshop. Theses drums were not properly covered causing oil-rainwater mixture.	1. Immediately repair and provide proper cover to protect rainwater entering; 2. Separate turbine oil from rainwater; 3. If there is too much oil-water mixture and cannot be separated, please remove the two drums to a designated hazardous material storage area for further environmentally disposal / elimination. Note: Any open drum / container which contains hazardous material is not allowed to store on a temporary hazardous material storage without control devices, bund and proper cover.	10.09.2018	20.09.2018	Resolved

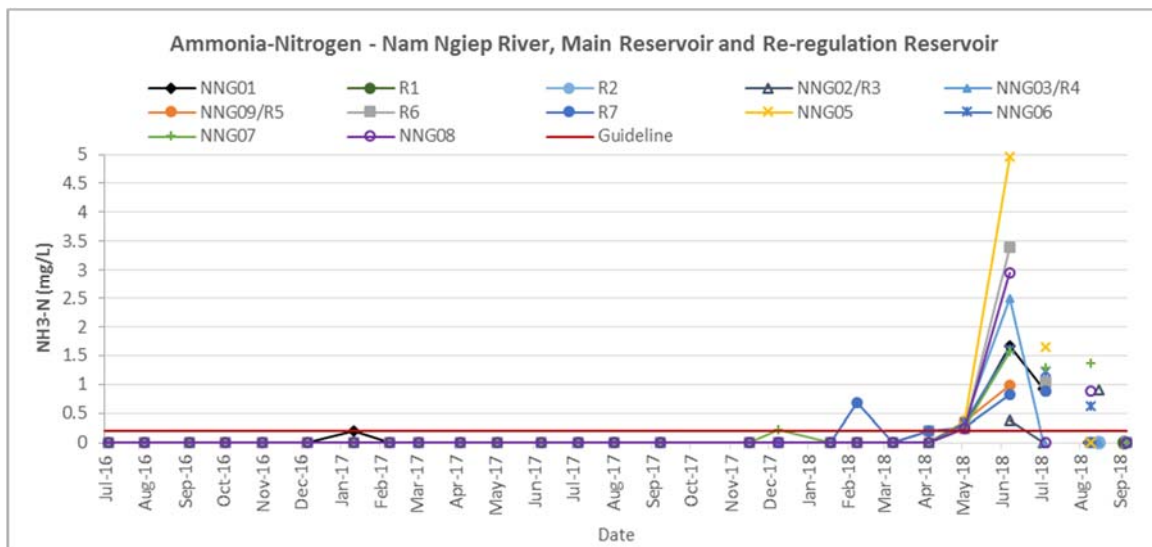
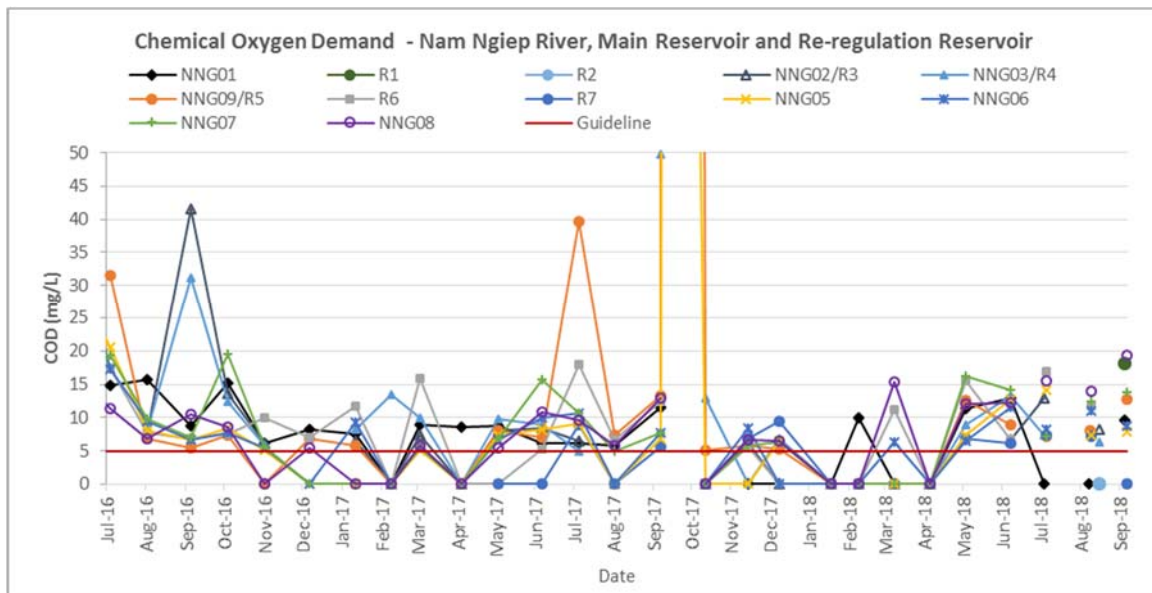
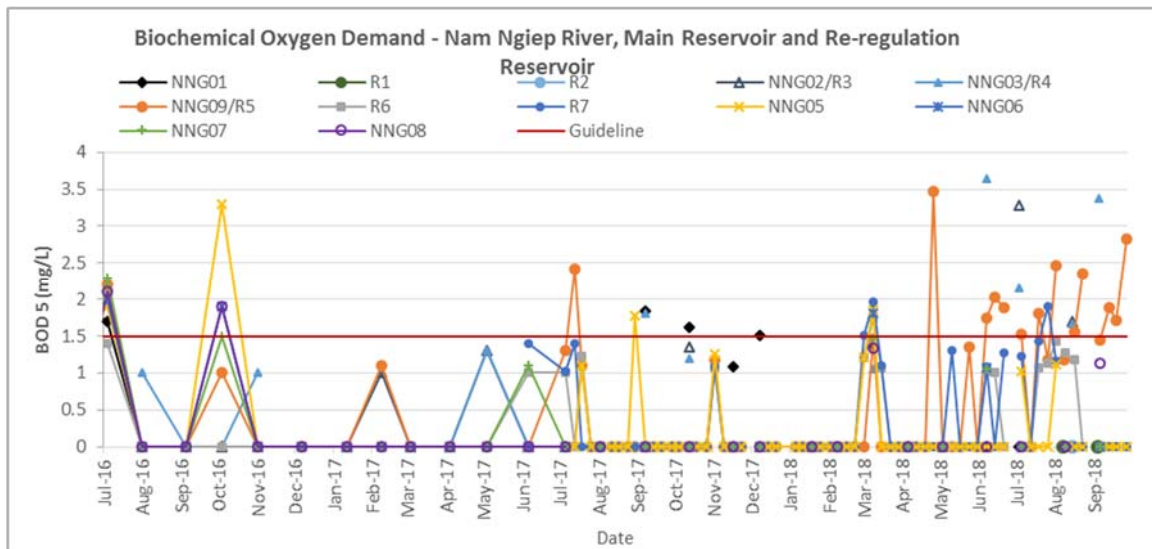
APPENDIX 3: CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS

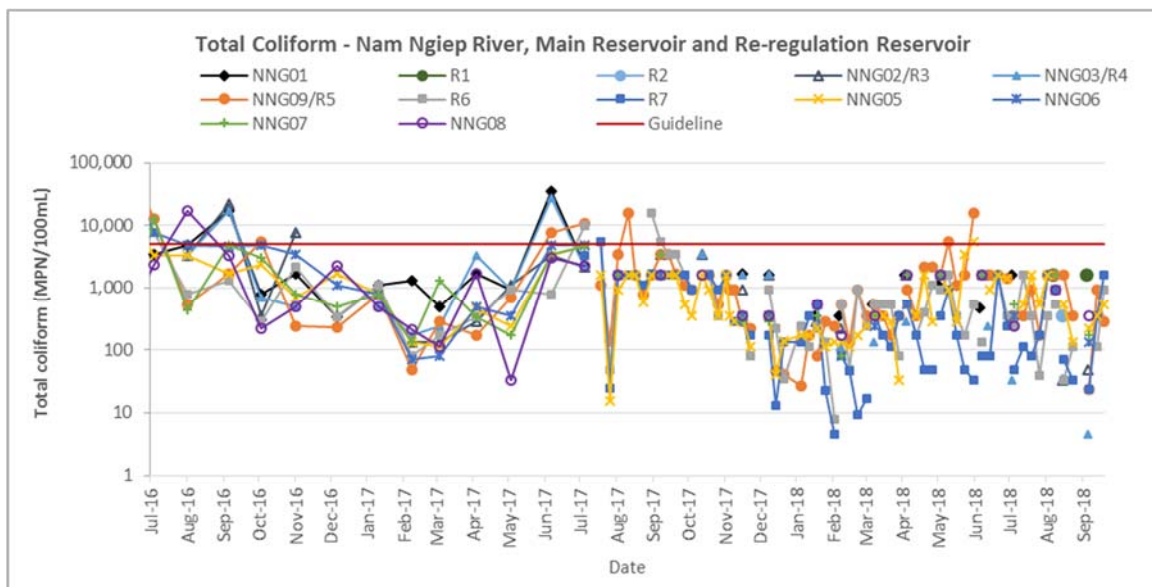
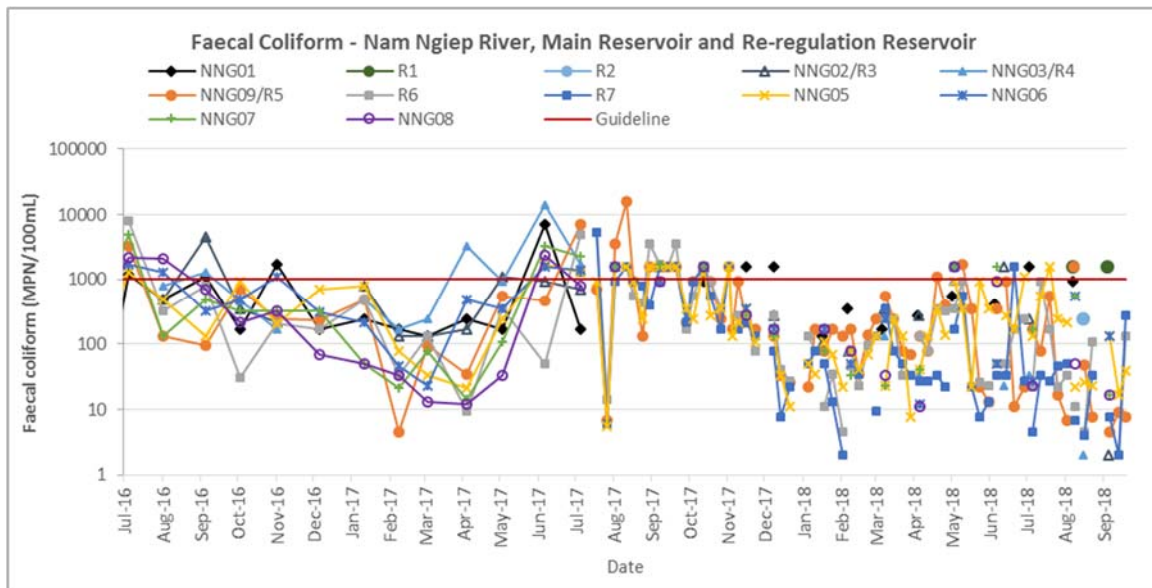
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
R1	Main reservoir upstream main dam approx. 50 Km.	
R2	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R3	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R4	Nam Ngiep Downstream of Ban Sop-Yuak / Main reservoir upstream main dam approx. 13 Km.	
NNG09/R5	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	
NNG04 / R6	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	Within Project Construction Site
R7	Reservoir Upstream Re-Regulation Dam	
NNG05	Nam Ngiep Upstream of Ban Hat Gniun	Downstream Project Construction Site
NNG06	Nam Ngiep Downstream of Nam Xao Confluence	
NNG07	Nam Ngiep at Ban Somsuen	
NNG08	Nam Ngiep at the Bridge of Road 13	
NCH01	Nam Chiane at the Bridge of Road 1D	Tributaries Upstream of Project Construction Site
NPH01	Nam Phouan Upstream of Nam Ngiep Confluence	
NXA01	Nam Xao Upstream of Nam Ngiep Confluence	Tributaries Downstream of Project Construction Site
NSH01	Nam Houay Soup Upstream Nam Ngiep Confluence	

APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JULY 2016 TO END OF SEPTEMBER 2018 (ONLY PARAMETERS THAT EXCEEDED GUIDELINE STANDARDS)

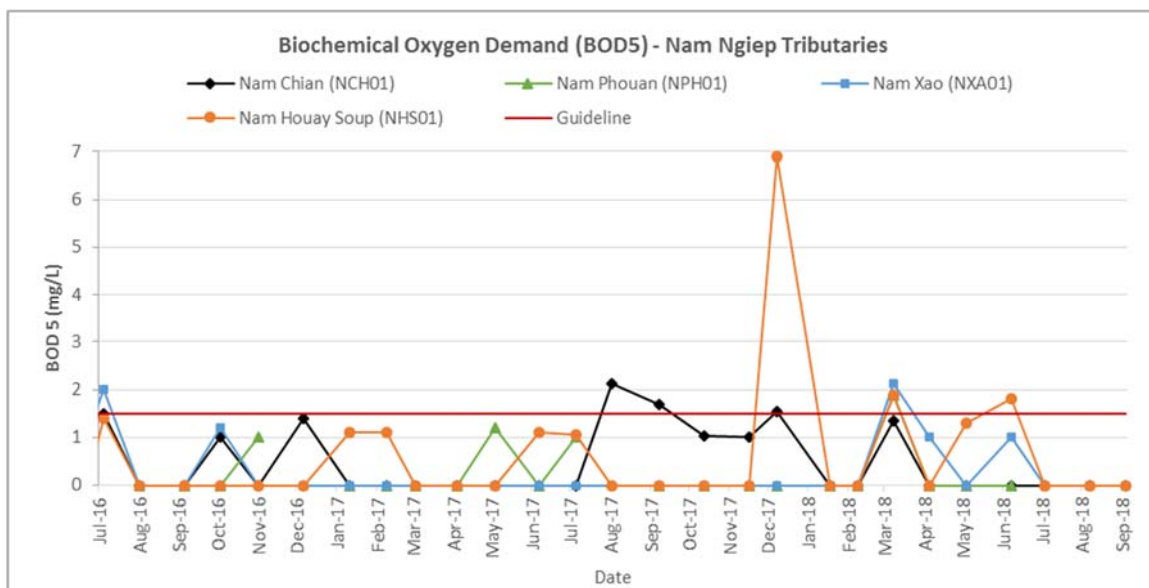
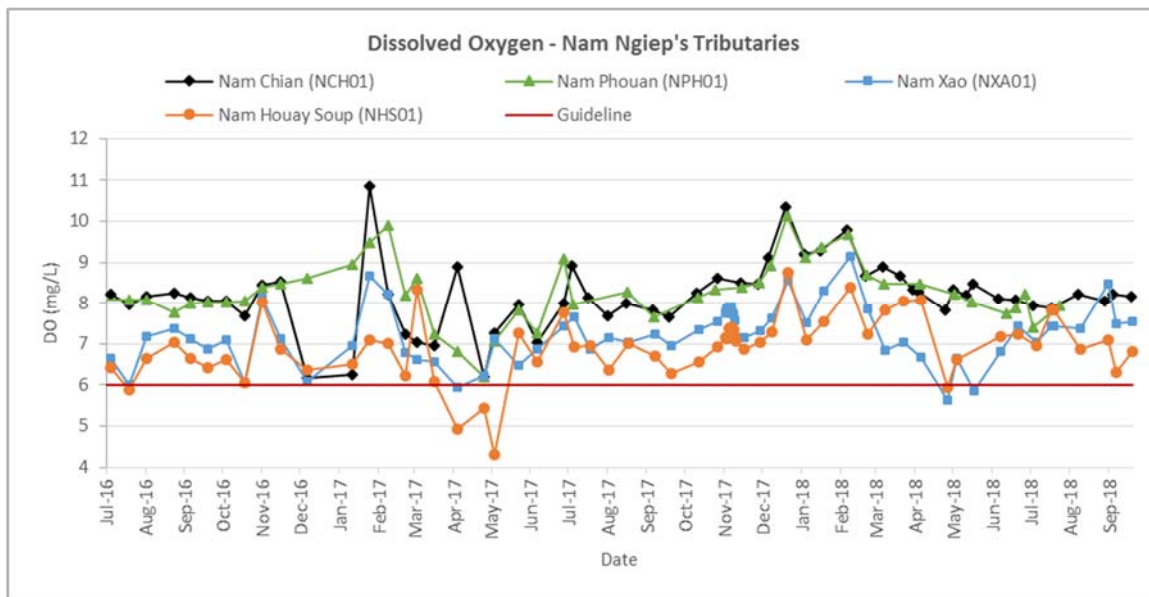
Nam Ngiep Surface Water

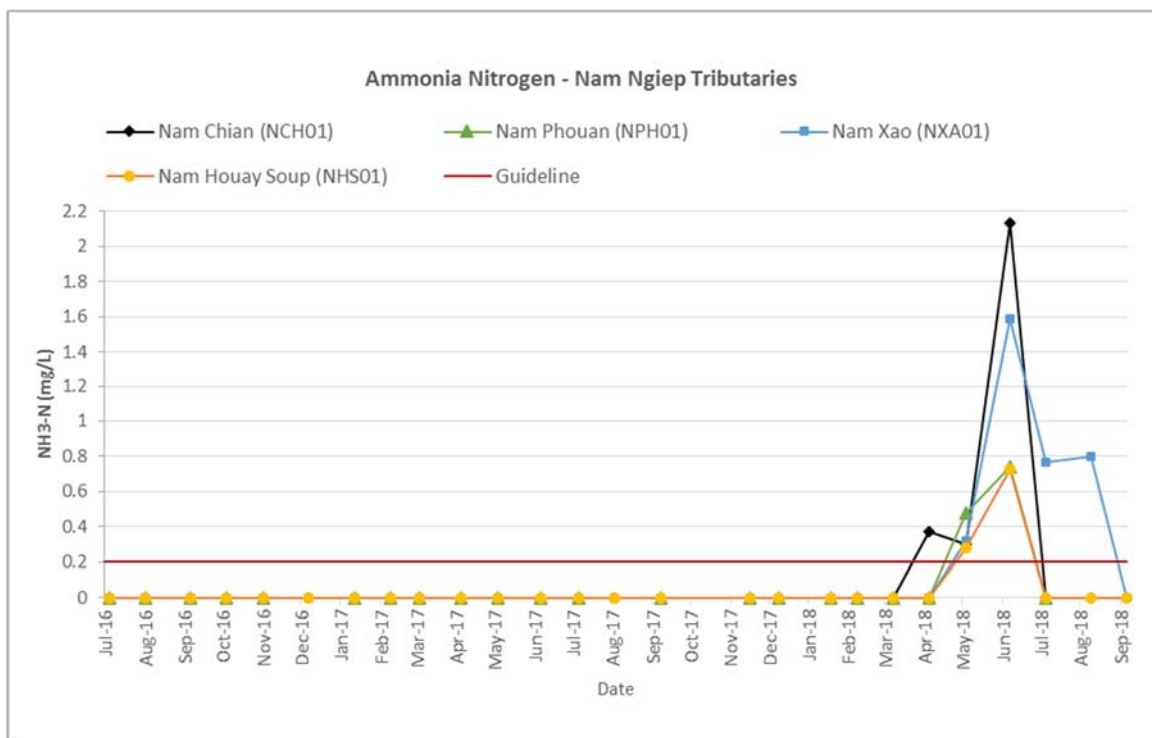
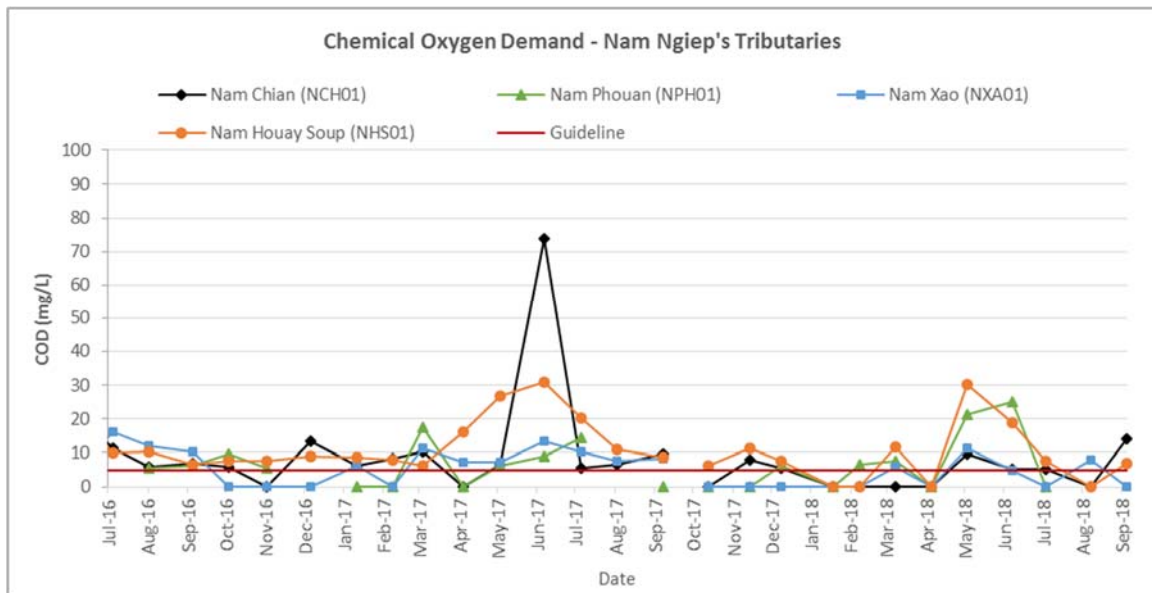




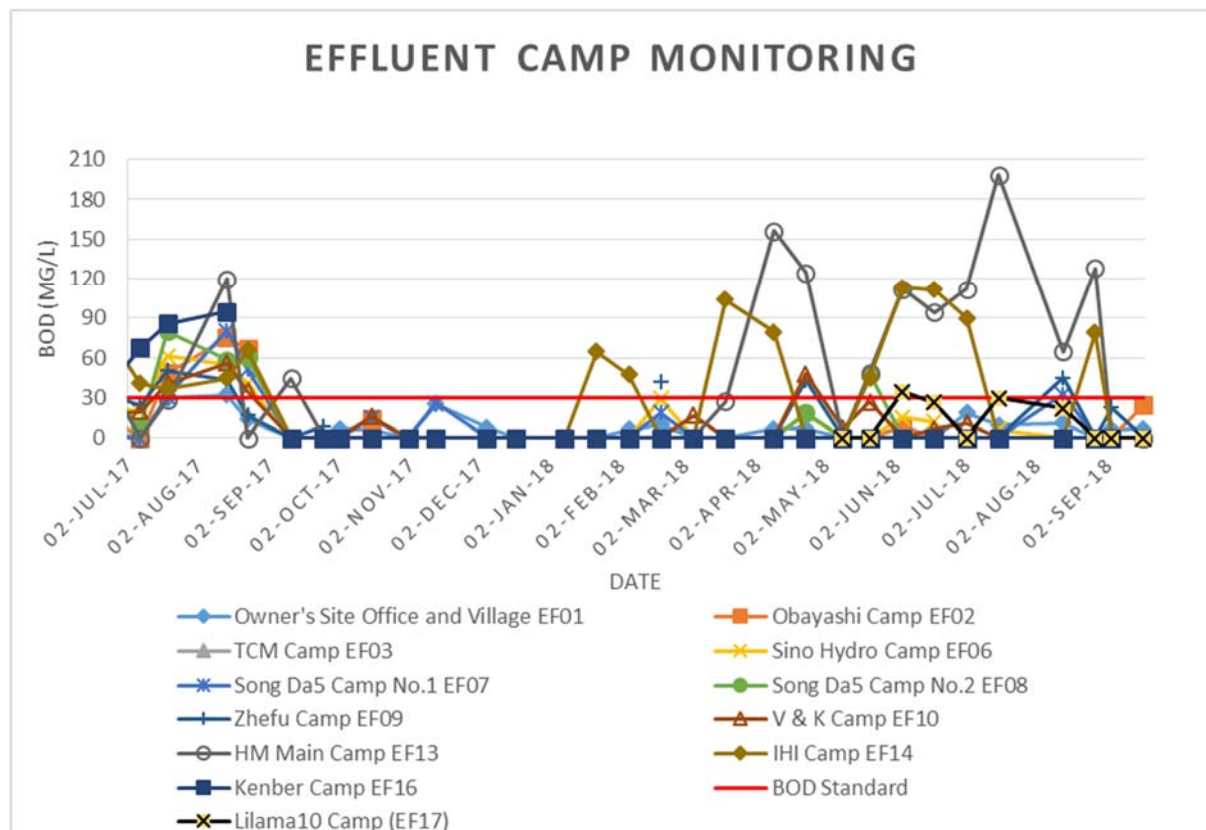
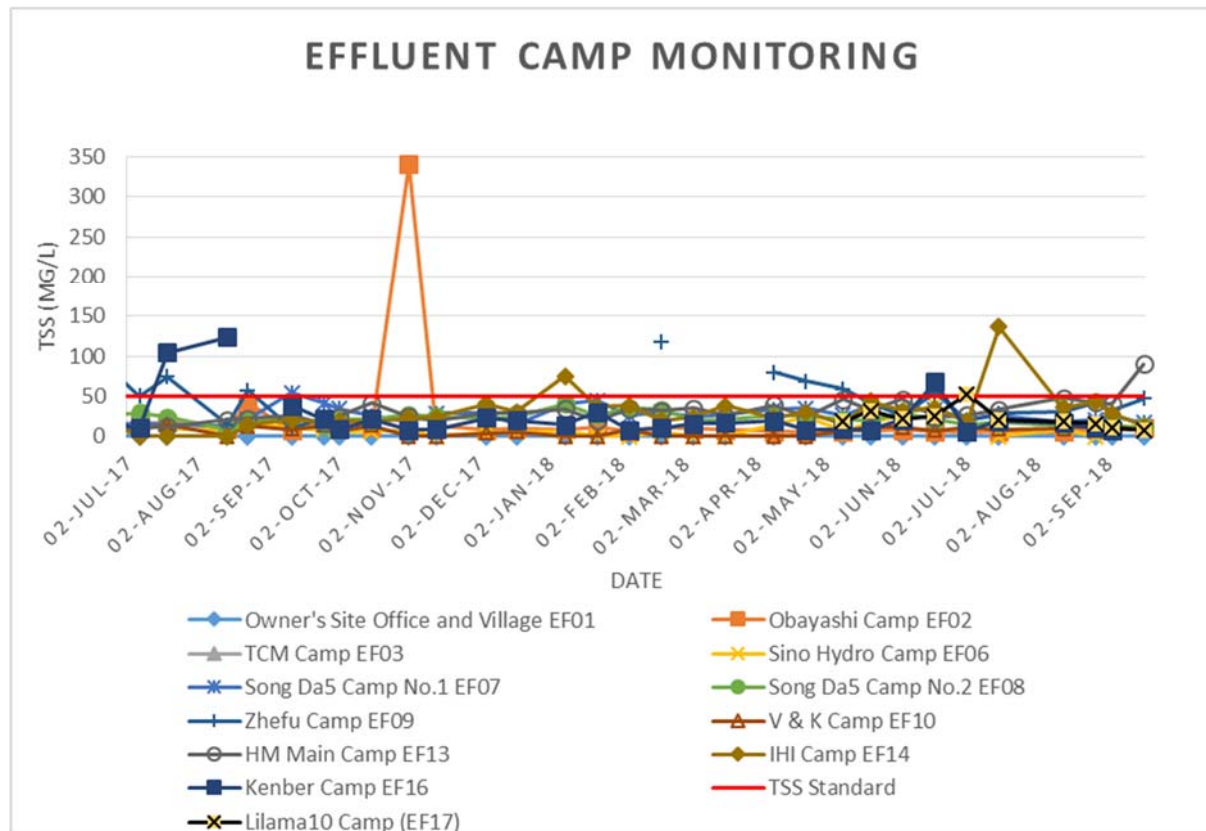


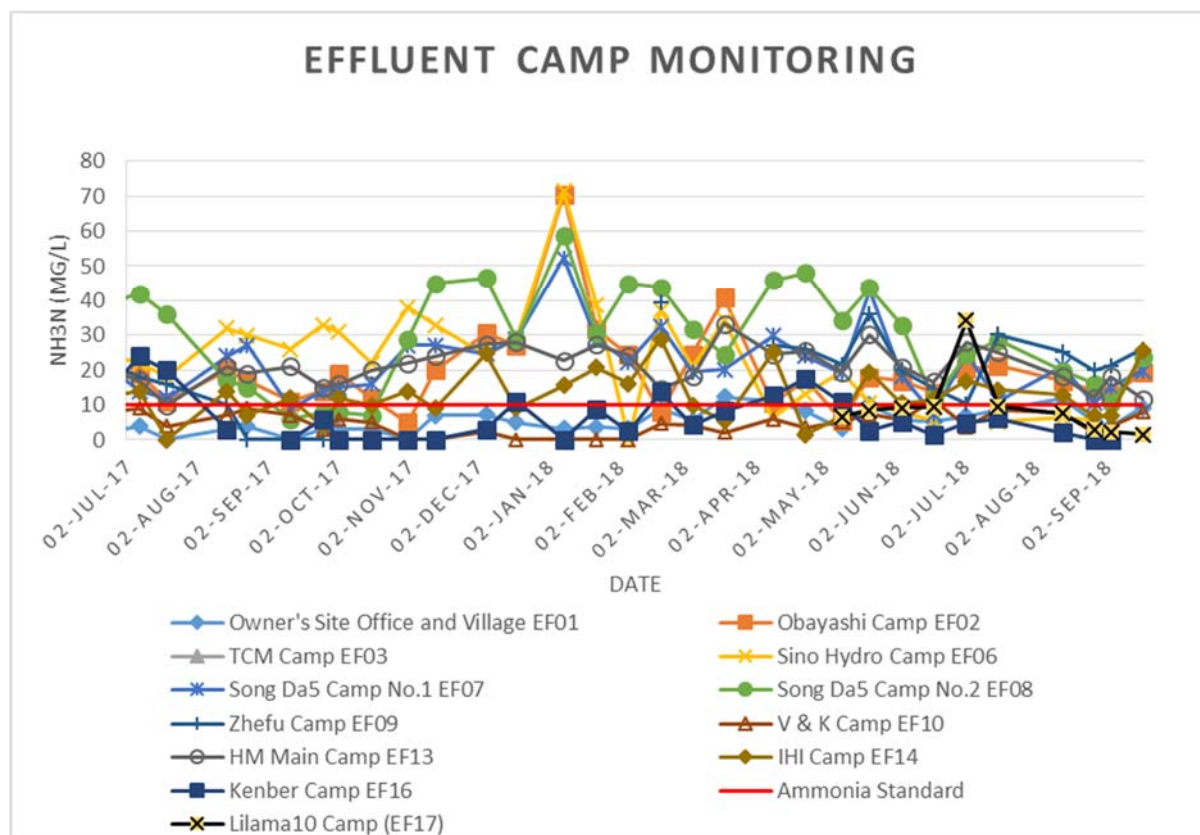
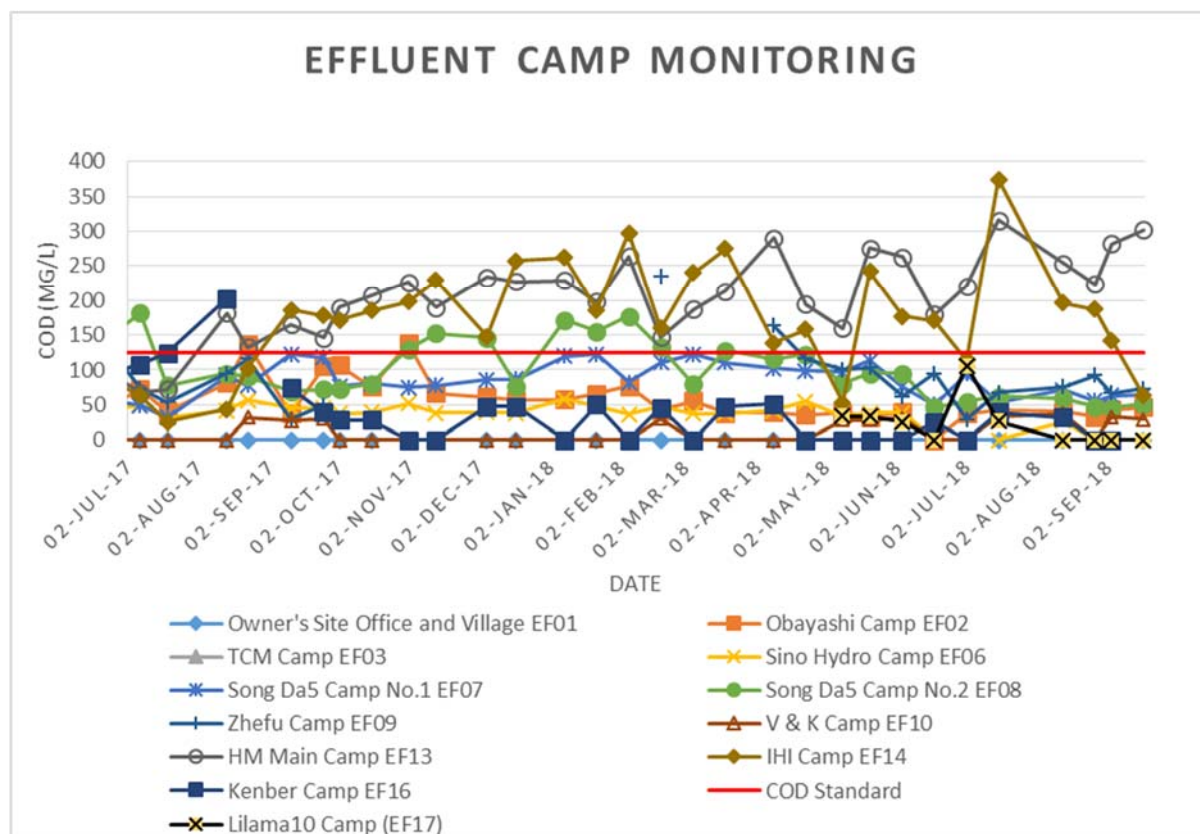
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

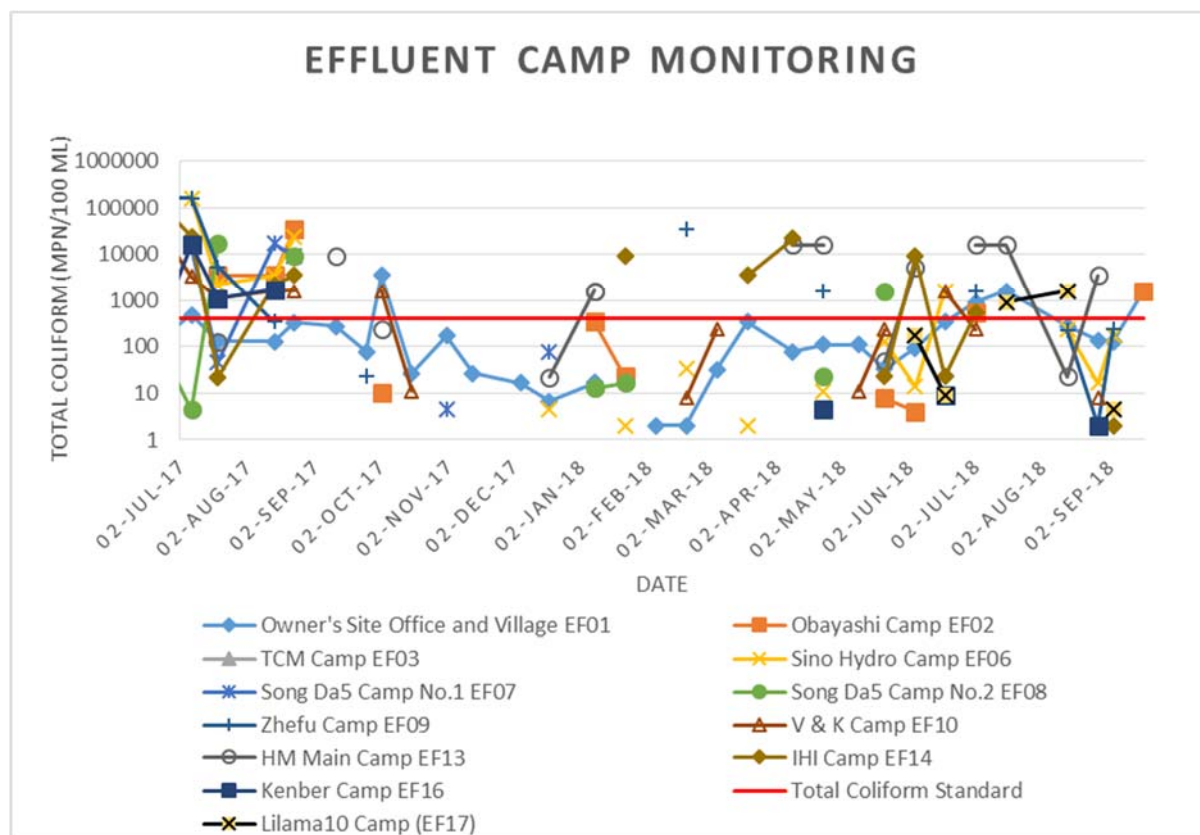
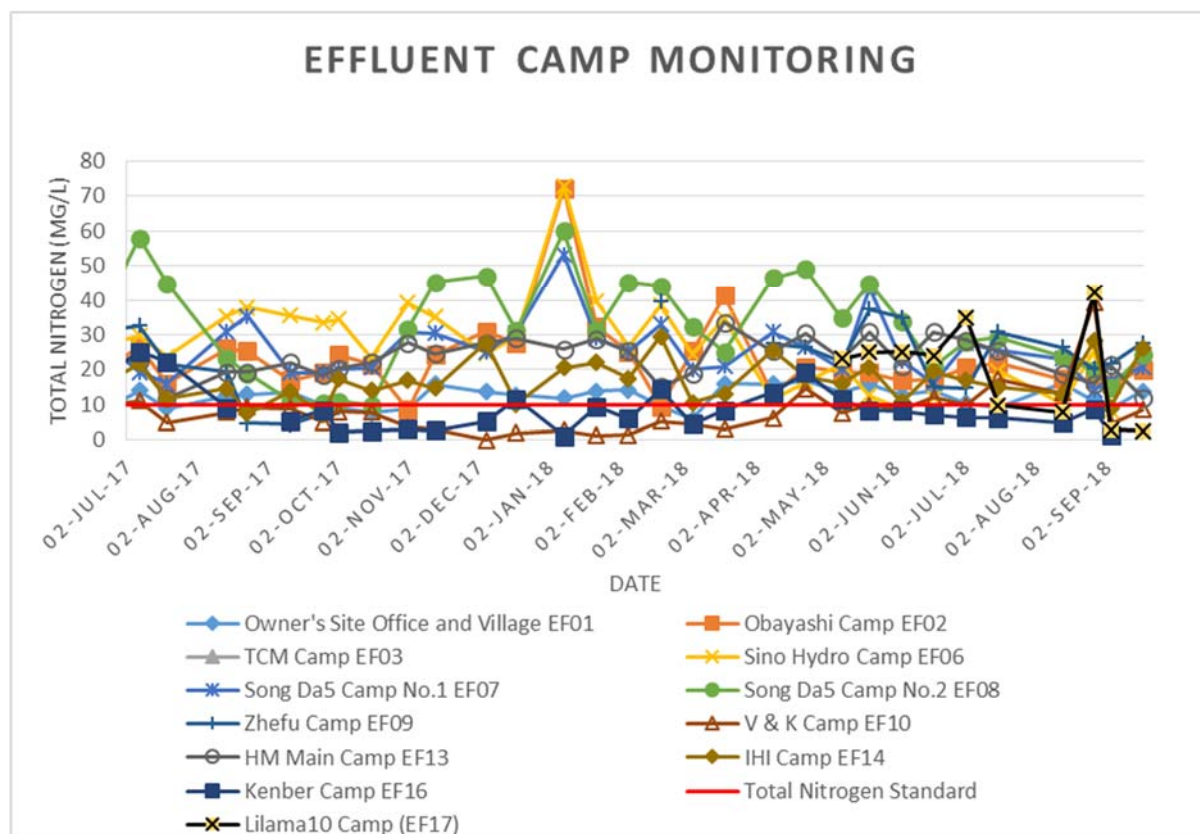




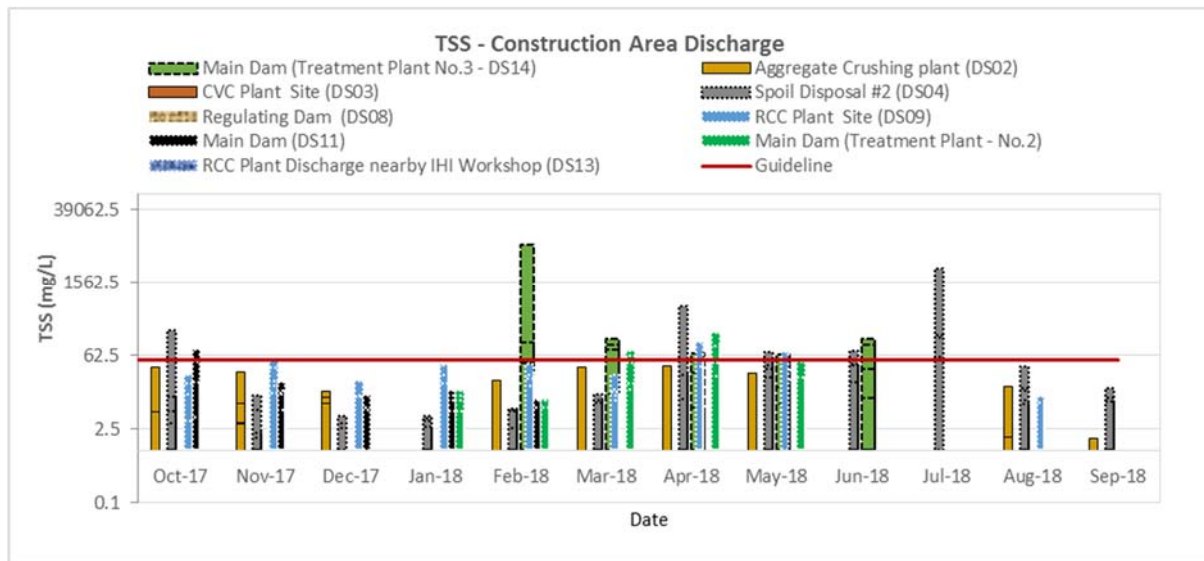
Camps' Effluent Water Quality Trends (Since July 2017 – September 2018)







Construction Area Discharge Water Quality (Since October 2017 to September 2018)



APPENDIX 5: WATER QUALITY MONITORING DATA**APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q3 2018**

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	pH	5.0 - 9.0	8.06			8.26	8.29	7.29			7.69				8.38	8.32		
5-Jul-18	pH	5.0 - 9.0						7.77	7.56	7.44	7.61	7.34	8.33	7.76			7.46	7.44
7-Jul-18	pH	5.0 - 9.0						7.42			7.59							
10-Jul-18	pH	5.0 - 9.0					7.96	7.83			7.7							
12-Jul-18	pH	5.0 - 9.0						7.82	7.97	7.49	7.95							
14-Jul-18	pH	5.0 - 9.0						7.69			7.73							
17-Jul-18	pH	5.0 - 9.0	7.97					7.79			7.51				8.13			
19-Jul-18	pH	5.0 - 9.0						7.92	6.76	6.62	6.69	6.75	7.83	7.85			7.51	6.89
21-Jul-18	pH	5.0 - 9.0						7.43			7.32							
24-Jul-18	pH	5.0 - 9.0				7.57	7.59	7.67			7.85					7.86		
26-Jul-18	pH	5.0 - 9.0						7.55	7.76	7.81	7.77							
28-Jul-18	pH	5.0 - 9.0						7.56			7.43							
31-Jul-18	pH	5.0 - 9.0						6.78			7.55							
2-Aug-18	pH	5.0 - 9.0						7.5	7.75	7.64	7.34							
4-Aug-18	pH	5.0 - 9.0						7.38			7.99							
7-Aug-18	pH	5.0 - 9.0	7.96	7.92											7.66			
8-Aug-18	pH	5.0 - 9.0						7.24										

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
9-Aug-18	pH	5.0 - 9.0							7.9 4	7.86	7.94	7.73	7.93	7.88			7.97	7.87
11-Aug-18	pH	5.0 - 9.0						7.86			7.64							
14-Aug-18	pH	5.0 - 9.0						7.8			7.88							
15-Aug-18	pH	5.0 - 9.0			7.42	8.07	7.95	7.93										
16-Aug-18	pH	5.0 - 9.0						7.86	7.7 9	7.26	7.86							
18-Aug-18	pH	5.0 - 9.0						7.69			7.78							
21-Aug-18	pH	5.0 - 9.0						7.2			7.25							
22-Aug-18	pH	5.0 - 9.0		6.61	6.58	6.65	6.52											
23-Aug-18	pH	5.0 - 9.0						7.23	7.0 3	6.96	7.18							
25-Aug-18	pH	5.0 - 9.0						7.67			7.87							
28-Aug-18	pH	5.0 - 9.0	8.15	8.16											8.01			
29-Aug-18	pH	5.0 - 9.0			8.12	8.54	8.47											
31-Aug-18	pH	5.0 - 9.0						7.56	8.0 6	7.47	7.68	7.74	7.87	7.81			7.47	7.29
1-Sep-18	pH	5.0 - 9.0						7.55			7.55							
4-Sep-18	pH	5.0 - 9.0	7.02	8.1				7.7			7.8				8.15			
5-Sep-18	pH	5.0 - 9.0				8.59	7.99											
6-Sep-18	pH	5.0 - 9.0						7.15	7.9 4	7.69	7.56	8.01	7.95	7.69			7.57	7.41
8-Sep-18	pH	5.0 - 9.0						7.81			7.75							
11-Sep-18	pH	5.0 - 9.0						7.77			8.44							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
12-Sep-18	pH	5.0 - 9.0		7.98	7.89	7.97	7.87											
13-Sep-18	pH	5.0 - 9.0						7.51	7.81	7.74	7.53							
15-Sep-18	pH	5.0 - 9.0						7.58			7.72							
18-Sep-18	pH	5.0 - 9.0	7.92	7.68	7.17	8.6	7.7	7							7.94			
19-Sep-18	pH	5.0 - 9.0						7.64	7.62	7.35	7.15	7.95	7.89	7.93			7.29	7.34
20-Sep-18	pH	5.0 - 9.0						7.19			7.79							
22-Sep-18	pH	5.0 - 9.0						7.85			7.98							
25-Sep-18	pH	5.0 - 9.0		7.83	7.63	8.7	7.84	7.71			7.59							
27-Sep-18	pH	5.0 - 9.0						7.17	7.45	7.18	7.19							
3-Jul-18	Sat. DO (%)		97.5			133.9	118.7	56.9			99.8				99.5	100.4		
5-Jul-18	Sat. DO (%)							66.6	89.2	142.6	96.4	95.8	86.3	91.8			96.2	94.8
7-Jul-18	Sat. DO (%)							84.9			95							
10-Jul-18	Sat. DO (%)						117.5	82.2			95.6							
12-Jul-18	Sat. DO (%)							80.6	99	113.9	93.2							
14-Jul-18	Sat. DO (%)							79.3			100.1							
17-Jul-18	Sat. DO (%)		96					73.5			95.6				99.3			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Jul-18	Sat. DO (%)							76.4	99.7	100.3	95.2	94.9	85.5	90.7			95.1	98.2
21-Jul-18	Sat. DO (%)							26.5			95.5							
24-Jul-18	Sat. DO (%)					104.6	105.2	79.1			97.4					103.2		
26-Jul-18	Sat. DO (%)							26.6	99.3	98.9	96							
28-Jul-18	Sat. DO (%)							29.3			94.5							
31-Jul-18	Sat. DO (%)							48.8			98.3							
2-Aug-18	Sat. DO (%)							29.8	98	97.6	99.3							
4-Aug-18	Sat. DO (%)							27.4			100.2							
7-Aug-18	Sat. DO (%)		97.6	95.4											101.4			
8-Aug-18	Sat. DO (%)							72.5										
9-Aug-18	Sat. DO (%)								100.6	98.8	99.6	98.1	93.4	92.6			96.2	89.4
11-Aug-18	Sat. DO (%)							89.3			101							
14-Aug-18	Sat. DO (%)							95.4			102.7							
15-Aug-18	Sat. DO (%)				73.8	126.7	116.2	105.9										
16-Aug-18	Sat. DO (%)							97.1	104.7	103.1	102.9							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
18-Aug-18	Sat. DO (%)							98.6			104							
21-Aug-18	Sat. DO (%)							71.1			107.1							
22-Aug-18	Sat. DO (%)			96.8	81.5	131.1	97.4											
23-Aug-18	Sat. DO (%)							41	100.8	100.6	100.4							
25-Aug-18	Sat. DO (%)							58.4			104							
28-Aug-18	Sat. DO (%)		97.2	93.7											100.2			
29-Aug-18	Sat. DO (%)				97.4	135.5	127.3											
31-Aug-18	Sat. DO (%)							75.9	108.2	109.4	108.2	106.1	100.4	85.5			105.2	89.8
1-Sep-18	Sat. DO (%)							98.5			103.2							
4-Sep-18	Sat. DO (%)		97.2	96				35.3			104.7				101			
5-Sep-18	Sat. DO (%)					136.4	109.1											
6-Sep-18	Sat. DO (%)							83.2	103.2	99.2	109.2							
8-Sep-18	Sat. DO (%)							111.8			105.3							
11-Sep-18	Sat. DO (%)							107.1			106.3							
12-Sep-18	Sat. DO (%)			97.6	87.8	154.1	132.4											

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
13-Sep-18	Sat. DO (%)							88	106.5	102	106.8							
15-Sep-18	Sat. DO (%)							98.8			105.2							
18-Sep-18	Sat. DO (%)		95.8	85.3	76.3	100.7	80.2	25.1							101.4			
19-Sep-18	Sat. DO (%)							58.9	106.2	103.6	105	102	100.6	94			95.1	86.3
20-Sep-18	Sat. DO (%)							97.5			104.6							
22-Sep-18	Sat. DO (%)							104.1			103.8							
25-Sep-18	Sat. DO (%)			90.8	99.4	129	94.5	98.2			101.2							
27-Sep-18	Sat. DO (%)							85.1	109.1	100.6	107.8							
3-Jul-18	DO (mg/l)	>6.0	7.68			8.98	8.29	3.96			7.62				7.93	7.39		
5-Jul-18	DO (mg/l)	>6.0						4.91	6.55	9.89	7.03	7.03	6.64	6.95			7.05	6.95
7-Jul-18	DO (mg/l)	>6.0						6.42			7.28							
10-Jul-18	DO (mg/l)	>6.0					8.27	5.78			7.51							
12-Jul-18	DO (mg/l)	>6.0						5.97	7.55	8.28	7.26							
14-Jul-18	DO (mg/l)	>6.0						5.85			7.71							
17-Jul-18	DO (mg/l)	>6.0	7.7					5.56			7.66				7.89		7.42	7.82

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Jul-18	DO (mg/l)	>6.0						5.83	7.7 3	7.74	7.5	7.45	6.69	7.1			7.42	7.82
21-Jul-18	DO (mg/l)	>6.0						2.55			7.74							
24-Jul-18	DO (mg/l)	>6.0				8.12	8.08	6.1			7.72					7.94		
26-Jul-18	DO (mg/l)	>6.0						4.4	7.7 1	7.62	7.63							
28-Jul-18	DO (mg/l)	>6.0						2.26			7.65							
31-Jul-18	DO (mg/l)	>6.0						3.93			8.00							
2-Aug-18	DO (mg/l)	>6.0						2.3	7.6 3	7.61	7.75							
4-Aug-18	DO (mg/l)	>6.0						2.09			7.86							
7-Aug-18	DO (mg/l)	>6.0	7.95	7.46											8.21			
8-Aug-18	DO (mg/l)	>6.0						5.26										
9-Aug-18	DO (mg/l)	>6.0							7.6	7.47	7.58	7.53	7.32	7.24			7.38	6.88
11-Aug-18	DO (mg/l)	>6.0						6.57			7.9							
14-Aug-18	DO (mg/l)	>6.0						7.02			8.04							
15-Aug-18	DO (mg/l)	>6.0			5.66	9.08	8.47	7.74										
16-Aug-18	DO (mg/l)	>6.0						7.41	8.3 1	8.17	8.09							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
18-Aug-18	DO (mg/l)	>6.0						7.27			8.16							
21-Aug-18	DO (mg/l)	>6.0						5.41			8.55							
22-Aug-18	DO (mg/l)	>6.0		7.67	6.43	9.79	7.3											
23-Aug-18	DO (mg/l)	>6.0						3.17	8.73	8.58	8.23							
25-Aug-18	DO (mg/l)	>6.0						4.49			8.17							
28-Aug-18	DO (mg/l)	>6.0	7.79	7.42											8.06			
29-Aug-18	DO (mg/l)	>6.0			7.23	10.09	9.52											
31-Aug-18	DO (mg/l)	>6.0						5.84	8.67	8.81	8.58	8.56	8.09	6.83			8.46	7.1
1-Sep-18	DO (mg/l)	>6.0						7.33			8.1							
4-Sep-18	DO (mg/l)	>6.0	8.08	7.84				2.7			8.2				8.22			
5-Sep-18	DO (mg/l)	>6.0				10.13	8.18											
6-Sep-18	DO (mg/l)	>6.0						6.21	8.44	8.2	8.45	8.19	7.61	6.54			7.49	6.3
8-Sep-18	DO (mg/l)	>6.0						8.44			8.25							
11-Sep-18	DO (mg/l)	>6.0						7.53			8.26							
12-Sep-18	DO (mg/l)	>6.0		7.5	6.59	10.94	9.68											

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
13-Sep-18	DO (mg/l)	>6.0						6.83	8.8	8.37	8.34							
15-Sep-18	DO (mg/l)	>6.0						7.22			8.07							
18-Sep-18	DO (mg/l)	>6.0	7.84	7.25	6.09	7.84	6.24	2.05							8.17			
19-Sep-18	DO (mg/l)	>6.0						4.57	8.78	8.6	8.43	7.98	7.87	7.37			7.53	6.8
20-Sep-18	DO (mg/l)	>6.0						6.84			8.05							
22-Sep-18	DO (mg/l)	>6.0						7.43			8.14							
25-Sep-18	DO (mg/l)	>6.0		7.58	7.53	9.35	7.12	7.4			7.86							
27-Sep-18	DO (mg/l)	>6.0						6.55	8.92	8.23	8.81							
3-Jul-18	Conductivity (µs/cm)		78.6			67.4	66.4	65.2			40.4				24.2	60.5		
5-Jul-18	Conductivity (µs/cm)							67.6	62.7	44.1	47.8	68.3	49.5	39.7			89.9	17.9
7-Jul-18	Conductivity (µs/cm)							68.2			57.8							
10-Jul-18	Conductivity						66.3	65.5			57.6							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	(µs/cm)																	
12-Jul-18	Conductivity (µs/cm)							63.2	50.4	55.4	40.4							
14-Jul-18	Conductivity (µs/cm)							63.1			124.2							
17-Jul-18	Conductivity (µs/cm)		64.4					63.8			39.2				25.5			
19-Jul-18	Conductivity (µs/cm)							62	53.6	50.2	35.3	52.5	30	29.6			59.6	51.1
21-Jul-18	Conductivity (µs/cm)							61.8			39.8							
24-Jul-18	Conductivity (µs/cm)					60.2	61.9	60.9			31.1					62.4		
26-Jul-18	Conductivity (µs/cm)							61.5	42.1	41	25.1							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
28-Jul-18	Conductivity (µs/cm)							65.2			25							
31-Jul-18	Conductivity (µs/cm)							66.1			27.1							
2-Aug-18	Conductivity (µs/cm)							59	51.2	51	45.4							
4-Aug-18	Conductivity (µs/cm)							58.9			62.6							
7-Aug-18	Conductivity (µs/cm)		65.3	50.6											21.23			
8-Aug-18	Conductivity (µs/cm)							57.1										
9-Aug-18	Conductivity (µs/cm)								52.8	53.1	48.9	54.4	47.9	45.6			60.4	14.23
11-Aug-18	Conductivity							58.3			54.8							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	(µs/cm)																	
14-Aug-18	Conductivity (µs/cm)							59.2			55.4							
15-Aug-18	Conductivity (µs/cm)				48.1	56.5	58.8	58.9										
16-Aug-18	Conductivity (µs/cm)							58.9	58	57.5	57.4							
18-Aug-18	Conductivity (µs/cm)							57.7			55.2							
21-Aug-18	Conductivity (µs/cm)							57			54.5							
22-Aug-18	Conductivity (µs/cm)			48	52.3	55.5	56.8											
23-Aug-18	Conductivity (µs/cm)							57.4	56.3	54.9	53							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
25-Aug-18	Conductivity (µs/cm)							56.7			56.3							
28-Aug-18	Conductivity (µs/cm)		65.1	50.8											33			
29-Aug-18	Conductivity (µs/cm)				53.4	50.4	57.4											
31-Aug-18	Conductivity (µs/cm)							53.7	53.6	53	53.6	52.7	49.9	44.6			48.1	12.5
1-Sep-18	Conductivity (µs/cm)							53.4			82.2							
4-Sep-18	Conductivity (µs/cm)		63.4	51.5				54.1			51.3				23.1			
5-Sep-18	Conductivity (µs/cm)					54.2	52.6											
6-Sep-18	Conductivity							50.9	64	64	49.5	50.3	48.7	58.1			53.4	11.79

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	(µs/cm)																	
8-Sep-18	Conductivity (µs/cm)							52			50.4							
11-Sep-18	Conductivity (µs/cm)							52			49.4							
12-Sep-18	Conductivity (µs/cm)			54.6	52.8	54.5	53.6											
13-Sep-18	Conductivity (µs/cm)							61	64	63	51.1							
15-Sep-18	Conductivity (µs/cm)							53.7			51.8							
18-Sep-18	Conductivity (µs/cm)		66.3	68	65	60	61	59							19.69			
19-Sep-18	Conductivity (µs/cm)							49.8	64	63	50.5	52.3	49.9	49			64.4	12.47

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
20-Sep-18	Conductivity (µs/cm)							50.7			49							
22-Sep-18	Conductivity (µs/cm)							49.6			49.1							
25-Sep-18	Conductivity (µs/cm)			77	72	65	61	60			100.8							
27-Sep-18	Conductivity (µs/cm)							60	64	63	64							
3-Jul-18	TDS (mg/l)		39.3			33.7	33.2	32.6			20.2				12.1	30.25		
5-Jul-18	TDS (mg/l)							33	31.35	22.05	24	34	24.75	19.85			45	9
7-Jul-18	TDS (mg/l)							34			28							
10-Jul-18	TDS (mg/l)						33.1	32.5			28.8							
12-Jul-18	TDS (mg/l)							31.5	25.2	27.5	20.2							
14-Jul-18	TDS (mg/l)							31.55			62.1							
17-Jul-18	TDS (mg/l)		32.2					31.5			19.1				12.5			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Jul-18	TDS (mg/l)							31	26.8	25.1	17.5	26.2	15	14.8			29.5	25
21-Jul-18	TDS (mg/l)							30.5			17.8							
24-Jul-18	TDS (mg/l)					30	31	30.45			15.55					31		
26-Jul-18	TDS (mg/l)							30.8	21	20.5	12.5							
28-Jul-18	TDS (mg/l)							34			14							
31-Jul-18	TDS (mg/l)							33			13							
2-Aug-18	TDS (mg/l)							29.1	25.5	25.5	22.7							
4-Aug-18	TDS (mg/l)							29.59			31.3							
7-Aug-18	TDS (mg/l)		32.5	25.3											10.5			
8-Aug-18	TDS (mg/l)							28.5										
9-Aug-18	TDS (mg/l)								26.4	26.8	24.45	27	23.9	22.8			30.2	7
11-Aug-18	TDS (mg/l)							29.15			27.4							
14-Aug-18	TDS (mg/l)							30			27							
15-Aug-18	TDS (mg/l)				24	28	29	29										
16-Aug-18	TDS (mg/l)							29	29	28	28							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
18-Aug-18	TDS (mg/l)							28.85			27.6							
21-Aug-18	TDS (mg/l)							29			27.25							
22-Aug-18	TDS (mg/l)			24	26.15	27.75	28.4											
23-Aug-18	TDS (mg/l)							28.5	28.1	27.4	26.5							
25-Aug-18	TDS (mg/l)							28.3			26.5							
28-Aug-18	TDS (mg/l)		32.55	25.4											16.5			
29-Aug-18	TDS (mg/l)				26.5	25.2	27.7											
31-Aug-18	TDS (mg/l)							26.5	26.8	26.5	26.6	26.3	24.95	22.3			24	6.2
1-Sep-18	TDS (mg/l)							26.7			41.1							
4-Sep-18	TDS (mg/l)		31.5	25.5				27			25.5				11.5			
5-Sep-18	TDS (mg/l)					27	26											
6-Sep-18	TDS (mg/l)							25.4	32	32	24.75	25	24.3	29			26.7	5.89
8-Sep-18	TDS (mg/l)							26			25							
11-Sep-18	TDS (mg/l)							26			24.7							
12-Sep-18	TDS (mg/l)			27.3	26.4	27.25	26.8											

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
13-Sep-18	TDS (mg/l)							30.5	32	31.5	25.55							
15-Sep-18	TDS (mg/l)							25.9			26.85							
18-Sep-18	TDS (mg/l)		33	34	32.5	30	30.5	29.5							10			
19-Sep-18	TDS (mg/l)							25	32	31.5	25.25	26.15	25	24			32.2	6.23
20-Sep-18	TDS (mg/l)							25.3			24.5							
22-Sep-18	TDS (mg/l)							24.8			24.5							
25-Sep-18	TDS (mg/l)			38.5	36	32.5	30.5	30			50.4							
27-Sep-18	TDS (mg/l)							30	32	31.5	32							
3-Jul-18	Temperature (°C)		25.1			34.2	31.7	32			27.3				24.1	28.7		
5-Jul-18	Temperature (°C)							28.9	29.8	33	29.8	29.4	27.3	28.3			29.05	28.5
7-Jul-18	Temperature (°C)							27.2			27.4							
10-Jul-18	Temperature (°C)						30.4	30.3			26.1							
12-Jul-18	Temperature (°C)							28.6	27.6	29.8	26.5							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
14-Jul-18	Temperature (°C)							28.7			26.8							
17-Jul-18	Temperature (°C)		23.9					27.2			24.9				24			
19-Jul-18	Temperature (°C)							27.2	26.5	26.8	25.7	25.9	26.1	26.1			26.2	26
21-Jul-18	Temperature (°C)							26.5			25.4							
24-Jul-18	Temperature (°C)					25.7	26.3	26.7			25.1					26.2		
26-Jul-18	Temperature (°C)							26.4	26.8	26.6	25.6							
28-Jul-18	Temperature (°C)							26.3			24.7							
31-Jul-18	Temperature (°C)							24.8			24.3							
2-Aug-18	Temperature (°C)							26.2	25.8	26.1	26.6							
4-Aug-18	Temperature (°C)							26.6			26.1							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
7-Aug-18	Temperature (°C)		23.3	25.6											23.4			
8-Aug-18	Temperature (°C)							29.5										
9-Aug-18	Temperature (°C)								28	28.1	28	27.5	26.4	26.5			27.6	27.4
11-Aug-18	Temperature (°C)							28.8			26.3							
14-Aug-18	Temperature (°C)							28.6			26.2							
15-Aug-18	Temperature (°C)				26.3	30.2	29.3	29.3										
16-Aug-18	Temperature (°C)							27.3	25.4	25.4	25.8							
18-Aug-18	Temperature (°C)							28.5			26							
21-Aug-18	Temperature (°C)							27			25.3							
22-Aug-18	Temperature (°C)			24.6	24.8		27.6											

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
23-Aug-18	Temperature (°C)							26.2	25	25.3	25.4							
25-Aug-18	Temperature (°C)							26.6			25.4							
28-Aug-18	Temperature (°C)		24.2	24.9											23.7			
29-Aug-18	Temperature (°C)				24.7	28	27.7											
31-Aug-18	Temperature (°C)							25.9	25.2	25	25.8	25.5	24.9	25.4			25.6	25.9
1-Sep-18	Temperature (°C)							28.5			27.7							
4-Sep-18	Temperature (°C)		22.8	23.5				27			26.3				23.2			
5-Sep-18	Temperature (°C)					28.3	27.7											
6-Sep-18	Temperature (°C)							28	24.87	24.94	27	26.5	27	25.9			26.4	29.6
8-Sep-18	Temperature (°C)							27.5			26.4							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-Sep-18	Temperature (°C)							31.5			26.8							
12-Sep-18	Temperature (°C)			25.2	27.7	30.8	26.6											
13-Sep-18	Temperature (°C)							28.41	24.98	25.39	26.4							
15-Sep-18	Temperature (°C)							29.5			26.8							
18-Sep-18	Temperature (°C)			23.62	26.65	28.44	28.41	25.66							23.7			
19-Sep-18	Temperature (°C)							26.4	24.88	24.89	25.5	26.8	26.6	26.6			26.2	26.5
20-Sep-18	Temperature (°C)							30.7			27.2							
22-Sep-18	Temperature (°C)							31			27.8							
25-Sep-18	Temperature (°C)			24.45	29.94	32.85	30.01	30.03			26.7							
27-Sep-18	Temperature (°C)							29.07	25.71	25.73	25.4							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	Turbidity (NTU)		49.01			3.45	2.53	1.45			32.56				8.71	22.61		
5-Jul-18	Turbidity (NTU)							1.61	259	36.74	45.41	26.93	20.74	12.28			16.9	22.65
7-Jul-18	Turbidity (NTU)							3.33			64.52							
10-Jul-18	Turbidity (NTU)						1.77	1.76			63.48							
12-Jul-18	Turbidity (NTU)							2.17	73.06	46.47	59.28							
14-Jul-18	Turbidity (NTU)							2.91			53.35							
17-Jul-18	Turbidity (NTU)		1,335					2.87			38.7				30.38			
19-Jul-18	Turbidity (NTU)							2.63	29.78	24.35	47.35	25.75	24.72	20.04			23.72	24.74
21-Jul-18	Turbidity (NTU)							2.36			48.69							
24-Jul-18	Turbidity (NTU)					5.23	3.14	1.84			39.24					29.46		

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
26-Jul-18	Turbidity (NTU)							2.69	32.77	35.59	69.09							
28-Jul-18	Turbidity (NTU)							1.8			36.76							
31-Jul-18	Turbidity (NTU)							4.15			46.54							
2-Aug-18	Turbidity (NTU)							2.49	18.2	38.01	53.02							
4-Aug-18	Turbidity (NTU)							3.56			24.71							
7-Aug-18	Turbidity (NTU)		62.02	53.12											26.76			
8-Aug-18	Turbidity (NTU)							5.86										
9-Aug-18	Turbidity (NTU)								15.96	16.32	16.6	40.08	23.99	18.53			87.48	5.82
11-Aug-18	Turbidity (NTU)							1.75			18.82							
14-Aug-18	Turbidity (NTU)							1.66			29.85							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
15-Aug-18	Turbidity (NTU)				89.66	3.86	3.1	1.46										
16-Aug-18	Turbidity (NTU)							2.51	16.73	17.33	20.72							
18-Aug-18	Turbidity (NTU)							3.8			29.6							
21-Aug-18	Turbidity (NTU)							3.4			21.2							
22-Aug-18	Turbidity (NTU)			95.22	59.2	7.47	4.58											
23-Aug-18	Turbidity (NTU)							3.04	19.25	18.16	19.6							
25-Aug-18	Turbidity (NTU)							3.74			54.59							
28-Aug-18	Turbidity (NTU)		183	242											33.95			
29-Aug-18	Turbidity (NTU)				57.94	13.13	9.29											
31-Aug-18	Turbidity (NTU)							3.51	15.18	18.4	16.53	16.38	18.46	15.24			22.41	5.51

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Sep-18	Turbidity (NTU)							3.98			16.18							
4-Sep-18	Turbidity (NTU)		89.21	56.68				4.27			19.77				78.77			
5-Sep-18	Turbidity (NTU)					11.45	7.3											
6-Sep-18	Turbidity (NTU)							4.76	15.69	15.61	19.62	21.19	17.97	23.2			90	4.27
8-Sep-18	Turbidity (NTU)							9.54			14.07							
11-Sep-18	Turbidity (NTU)							8.36			12.05							
12-Sep-18	Turbidity (NTU)			42.8	25.77	11.14	8.27											
13-Sep-18	Turbidity (NTU)							6.8	11.05	11.09	11.17							
15-Sep-18	Turbidity (NTU)							8.79			12.25							
18-Sep-18	Turbidity (NTU)		32.9	63.59	13.29	9.25	7.05	2.31							33.9			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Sep-18	Turbidity (NTU)							2.74	5.07	4.8	8.39	8.79	9.47	9.53			11.71	5.64
20-Sep-18	Turbidity (NTU)							5.72			9.7							
22-Sep-18	Turbidity (NTU)							7.15			7.39							
25-Sep-18	Turbidity (NTU)			24.3	7.87	6.79	7.11	6.69			3.91							
27-Sep-18	Turbidity (NTU)							6.98	6.3	5.67	6.69							
3-Jul-18	TSS (mg/l)		115.84			8.25	<5								13.6	26.47		
5-Jul-18	TSS (mg/l)							<5	500.76	27.61	42.33	21.37	22.76	7.88			11.31	17.59
12-Jul-18	TSS (mg/l)							<5	59.07	51.63	50.26							
19-Jul-18	TSS (mg/l)							7.67	22.34	16.84	65.05							
26-Jul-18	TSS (mg/l)							<5	21	24.33	108.37							
2-Aug-18	TSS (mg/l)							<5	26.86	28.91	76.08							
7-Aug-18	TSS (mg/l)		156.22	61.94											54.68			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
8-Aug-18	TSS (mg/l)							<5										
9-Aug-18	TSS (mg/l)								20.43	10.02	21.8	84.62	60.66	26.13			194.02	<5
15-Aug-18	TSS (mg/l)				51	5.85	5.2											
16-Aug-18	TSS (mg/l)							<5	15.5	14	20.33							
23-Aug-18	TSS (mg/l)							7.66	32.8	23	30							
31-Aug-18	TSS (mg/l)							<5	11.4	15.13	16.1							
4-Sep-18	TSS (mg/l)		204.71	77.45											208.56			
5-Sep-18	TSS (mg/l)					12.29	7.98											
6-Sep-18	TSS (mg/l)							5.64	17.26	14.32	25.64	29.01	33	26.95			28.35	<5
13-Sep-18	TSS (mg/l)							6.34	7.66	8.04	10.51							
19-Sep-18	TSS (mg/l)							<5	5.47	<5	7.92							
27-Sep-18	TSS (mg/l)							7.77	<5.0	<5.0	5.49							
3-Jul-18	BOD5 (mg/l)	<1.5	<1.0			3.28	2.15								<1.0	<1.0		
5-Jul-18	BOD5 (mg/l)	<1.5						1.53	<1.0	1.23	1.03	<1.0	<1.0	<1.0			<1.0	<1.0
19-Jul-18	BOD5 (mg/l)	<1.5						1.81	1.07	1.43	<1							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
12-Jul-18	BOD5 (mg/l)	<1.5						<1	<1	<1	<1							
26-Jul-18	BOD5 (mg/l)	<1.5						1.18	1.13	1.9	<1							
2-Aug-18	BOD5 (mg/l)	<1.5						2.47	1.43	1.17	1.12							
7-Aug-18	BOD5 (mg/l)	<1.5	<1.0	<1.0														
8-Aug-18	BOD5 (mg/l)	<1.5						1.18							<1.0			
9-Aug-18	BOD5 (mg/l)	<1.5							1.28	<1.0	<1.0	<1.0	<1.0	<1.0			<1.0	<1.0
15-Aug-18	BOD5 (mg/l)	<1.5			<1.0	1.7	1.67											
16-Aug-18	BOD5 (mg/l)	<1.5						1.55	1.18	<1.0	<1.0							
23-Aug-18	BOD5 (mg/l)	<1.5						2.35	<1.0	<1.0	<1.0							
4-Sep-18	BOD5 (mg/l)	<1.5	<1.0	<1.0											<1.0			
5-Sep-18	BOD5 (mg/l)	<1.5				4.85	3.37											
6-Sep-18	BOD5 (mg/l)	<1.5						1.45	<1.0	<1.0	<1.0	<1.0	<1.0	1.13			<1.0	<1.0
13-Sep-18	BOD5 (mg/l)	<1.5						1.88	<1.0	<1.0	<1.0							
19-Sep-18	BOD5 (mg/l)	<1.5						1.72	<1.0	<1.0	<1.0							
27-Sep-18	BOD5 (mg/l)	<1.5						2.82	<1.0	<1.0	<1.0							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jul-18	COD (mg/l)	<5	<5.0			12.9	7.4								5.3	<5.0		
5-Jul-18	COD (mg/l)	<5						7.2	17	7.4	14.1	8.2	7.2	15.6			<5.0	7.6
7-Aug-18	COD (mg/l)	<5	<5.0												<5.0			
8-Aug-18	COD (mg/l)	<5						8										
9-Aug-18	COD (mg/l)	<5							11.7	7.2	7.4	11.1	12.5	14			7.8	<5
15-Aug-18	COD (mg/l)	<5			<5.0	8.3	6.3											
4-Sep-18	COD (mg/l)	<5	9.6	18.1											14			
6-Sep-18	COD (mg/l)	<5						12.8	<5.0	<5.0	7.9	8.7	13.8	19.3			<5.0	6.9
3-Jul-18	NH3-N (mg/l)	<0.2	0.93			<0.2	<0.2								<0.2	<0.2		
5-Jul-18	NH3-N (mg/l)	<0.2						0.89	1.04	0.89	1.66	1.22	1.28	<0.2			0.77	<0.2
7-Aug-18	NH3-N (mg/l)	<0.2	<0.2												<0.2			
8-Aug-18	NH3-N (mg/l)	<0.2						<0.2										
9-Aug-18	NH3-N (mg/l)	<0.2						<0.2	<0.2	<0.2	<0.2	0.63	1.37	0.89			0.8	<0.2
15-Aug-18	NH3-N (mg/l)	<0.2			<0.2	0.9	<0.2											
4-Sep-18	NH3-N (mg/l)	<0.2	<0.2	<0.2											<0.2			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Sep-18	NH3-N (mg/l)	<0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
3-Jul-18	NO3-N (mg/l)	<5	0.14			<0.02	<0.02								0.11	0.08		
5-Jul-18	NO3-N (mg/l)	<5						0.07	0.23	0.18	0.25	0.19	0.19	0.16			0.18	0.15
7-Aug-18	NO3-N (mg/l)	<5	0.13												0.08			
8-Aug-18	NO3-N (mg/l)	<5						<0.02										
9-Aug-18	NO3-N (mg/l)	<5							<0.02	0.13	0.05	0.05	<0.02	<0.02			0.05	<0.05
15-Aug-18	NO3-N (mg/l)	<5			0.06	<0.02	<0.02											
4-Sep-18	NO3-N (mg/l)	<5	0.1	0.15											0.11			
6-Sep-18	NO3-N (mg/l)	<5						0.06	0.09	0.1	0.05	0.1	0.1	0.11			0.1	0.15
3-Jul-18	Faecal coliform (MPN/100 ml)	<1,000	1,600			240	33								240	240		
5-Jul-18	Faecal coliform (MPN/100 ml)	<1,000						170	22	4.5	130	27	170	23			11	34
12-Jul-18	Faecal coliform (MPN/100 ml)	<1,000						79	920	33	540							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Jul-18	Faecal coliform (MPN/100 ml)	<1,000						540	170	27	1,600							
26-Jul-18	Faecal coliform (MPN/100 ml)	<1,000						17	22	46	240							
2-Aug-18	Faecal coliform (MPN/100 ml)	<1,000						7	33	49	220							
7-Aug-18	Faecal coliform (MPN/100 ml)	<1,000	920	1,600											920			
8-Aug-18	Faecal coliform (MPN/100 ml)	<1,000						1,600										
9-Aug-18	Faecal coliform (MPN/100 ml)	<1,000							11	7	22	540	540	49			1,600	920
15-Aug-18	Faecal coliform (MPN/100 ml)	<1,000			240	0	2											
16-Aug-18	Faecal coliform	<1,000						48	5	4	26							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	(MPN/100 ml)																	
23-Aug-18	Faecal coliform (MPN/100 ml)	<1,000						8	110	33	23							
4-Sep-18	Faecal coliform (MPN/100 ml)	<1,000	1,600	1,600											920			
5-Sep-18	Faecal coliform (MPN/100 ml)	<1,000				2	0											
6-Sep-18	Faecal coliform (MPN/100 ml)	<1,000						5	0	8	130	130	17	17			220	40
13-Sep-18	Faecal coliform (MPN/100 ml)	<1,000						9	2	2	17							
19-Sep-18	Faecal coliform (MPN/100 ml)	<1,000						8	130	280	39							
3-Jul-18	Total Coliform (MPN/100 ml)	<5,000	1,600			350	33								1,600	920		

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-Jul-18	Total Coliform (MPN/100 ml)	<5,000						350	240	49.0	350	350	540	240			920	240
12-Jul-18	Total Coliform (MPN/100 ml)	<5,000						350	1,600	110	540							
19-Jul-18	Total Coliform (MPN/100 ml)	<5,000						920	350	79	1,600							
26-Jul-18	Total Coliform (MPN/100ml)	<5,000						170	39	170	540							
2-Aug-18	Total Coliform (MPN/100 ml)	<5,000						1,600	350	1,600	1,600							
7-Aug-18	Total Coliform (MPN/100 ml)	<5,000	1,600	1,600											1,600			
8-Aug-18	Total Coliform (MPN/100 ml)	<5,000						1,600										
9-Aug-18	Total Coliform	<5,000							540	920	920	920	1,600	920			1,700	920

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	(MPN/100 ml)																	
15-Aug-18	Total Coliform (MPN/100 ml)	<5,000			350	33	34											
16-Aug-18	Total Coliform (MPN/100 ml)	<5,000						1,600	33	70	540							
23-Aug-18	Total Coliform (MPN/100 ml)	<5,000						350	110	33	130							
4-Sep-18	Total Coliform (MPN/100 ml)	<5,000	1,600	1,600											1,600			
5-Sep-18	Total Coliform (MPN/100 ml)	<5,000				49	5											
6-Sep-18	Total Coliform (MPN/100 ml)	<5,000						23	0	23	220	130	170	350			540	280
13-Sep-18	Total Coliform (MPN/100 ml)	<5,000						920	110	350	350							

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
19-Sep-18	Total Coliform (MPN/100 ml)	<5,000						280	920	1,600	540							
4-Sep-18	Arsenic (mg/l)	<0.01	0.0009	0.0005											<0.0003			
6-Sep-18	Arsenic (mg/l)	<0.01						<0.0003	<0.0003	0.0004	<0.0003	<0.0003	0.0004	0.0005			<0.0003	<0.0003
4-Sep-18	Total Iron (mg/l)		6.54	3.18											5.92			
6-Sep-18	Total Iron (mg/l)							0.154	0.8	0.762	0.945	1.08	1.1	1.35			1.44	0.906
7-Aug-18	Phytoplankton Biomass (g dry wt/m ³)		154												42.5			
8-Aug-18	Phytoplankton Biomass (g dry wt/m ³)							3.5										

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
15-Aug-18	Phytoplankton Biomass (g dry wt/m ³)				121	5.6	4											
7-Aug-18	Total Phosphorus (mg/l)		0.02												0.02			
8-Aug-18	Total Phosphorus (mg/l)							<0.01										
15-Aug-18	Total Phosphorus (mg/l)				0.03	0.01	<0.01											
6-Sep-18	Total Phosphorus (mg/l)		<0.01	0.01											<0.01			
06-Sep	Total Phosphorus (mg/l)							<0.01			<0.01							
7-Aug-18	Total Dissolved Phosph		<0.01												<0.01			

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
	horus (mg/l)																	
8-Aug-18	Total Dissolved Phosphorus (mg/l)							<0.01										
15-Aug-18	Total Dissolved Phosphorus (mg/l)				<0.01	<0.01	<0.01											
4-Sep-18	Total Dissolved Phosphorus (mg/l)		<0.01	<0.01											<0.01			
06-Sep	Total Dissolved Phosphorus (mg/l)							<0.01			<0.01							
07-Aug-18	TOC (mg/l)		1.3												1.06			
08-Aug-18	TOC (mg/l)							2.43										

Date	Parameters (Unit)	National Surface Water Quality Standard	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
15-Aug-18	TOC (mg/l)				1.86	2.57	2.46											
04-Sep-18	TOC (mg/l)		1.26	1.16											1.28			
06-Sep-18	TOC (mg/l)							2.23			1.17							
16-Aug-18	Hydrogen Sulfide (mg/l)							<0.02	0.02	0.02	0.03							
23-Aug-18	Hydrogen Sulfide (mg/l)							<0.02	0.02	0.02	0.03							
06-Sep-18	Hydrogen Sulfide (mg/l)							<0.02		0.02	0.02							
20-Sep-18	Hydrogen Sulfide (mg/l)							<0.02		<0.02	<0.02							
04-Sep-18	Dry Weight Biomass/m3		224	76.8											181			
06-Sep-18	Dry Weight Biomass/m3							3.5			19.5							

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q3 2018

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
02-Jul-18	pH	6.0-9.0	7.21	7.57		7.55	7.4	7.49	7.35	7.28	7.35	7.13	7.09
16-Jul-18	pH	6.0-9.0	7.53	7.58	7.57	7.51	7.52	7.7	7.57	7.35	7.12	7.55	7.05
13-Aug-18	pH	6.0-9.0	7.02	7.63	7.51	7.17	7.36	6.77	7.36	7.8	7.19	7.82	6.85
27-Aug-18	pH	6.0-9.0	6.87	7.6	7.51	7.27	7.5	7.29	7.56	7.29	6.91	7.3	7.68
03-Sep-18	pH	6.0-9.0	7.09	7.31	7.44	7.4	7.28	6.92	7.53	7.47	7.09	7.32	7.23
17-Sep-18	pH	6.0-9.0	6.91	7.29		7.5	7.25	6.98	7.18	7.29	7.69		6.82
02-Jul-18	Sat. DO (%)		55.3	90.6		68.1	46.7	39.5	85.2	54	23.9	92.5	64.6
16-Jul-18	Sat. DO (%)		59.8	77.4	74.5	66.6	44.4	30	53	59.1	11	98.7	33.4
13-Aug-18	Sat. DO (%)		73.9	98.3	102.1	55.2	44.8	36.9	93.6	42.4	77.2	155.4	61.4
27-Aug-18	Sat. DO (%)		55.4	95.1	56.8	59	26.8	44.7	95.8	68.9	55.5	123	68.3
03-Sep-18	Sat. DO (%)		69.2	67.7	89.4	36.8	47.1	29.5	77.4	61.3	15.3	106.6	71.3
17-Sep-18	Sat. DO (%)		59.2	53.7		72.3	32.6	30.6	35.2	69.2	42.1		77
08-Aug-18	DO (mg/l)		4.16	5.63	3.87	4.71	5.05		5.73	5.22	3.39	7.38	
02-Jul-18	DO (mg/l)		4.08	6.48		4.81	3.38	2.7	6.14	3.92	1.7	6.74	4.56

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
16-Jul-18	DO (mg/l)		4.55	5.74	5.59	5.01	3.38	2.62	4.04	4.47	0.8	6.7	2.5
13-Aug-18	DO (mg/l)		5.68	7.31	7.67	4.1	3.38	2.77	7.08	3.22	5.88	11.41	4.64
27-Aug-18	DO (mg/l)		4.17	6.61	4.19	4.14	1.99	3.16	7.03	5.05	4.03	8.79	4.87
03-Sep-18	DO (mg/l)		5.33	5.17	6.99	2.84	3.69	2.25	5.95	4.78	1.15	8.23	5.32
17-Sep-18	DO (mg/l)		4.57	4.04		5.5	2.46	2.29	2.67	5.19	3.14		5.78
02-Jul-18	Conductivity (μS/cm)		333	578		1,164	674	523	185.1	936	657	154.1	333
16-Jul-18	Conductivity (μS/cm)		322	549	289	843	568	475	350	866	476	195.5	328
13-Aug-18	Conductivity (μS/cm)		385	483	294	919	651	394	382	1023	835	163.2	324
27-Aug-18	Conductivity (μS/cm)		269	412	245	903	396	534	208.2	1.101	704	154	293
03-Sep-18	Conductivity (μS/cm)		296	435	142.2	776	654	432	309	947	643	134.8	366
17-Sep-18	Conductivity (μS/cm)		385	501		940	506	736	338	1343	1,236		439
02-Jul-18	Temperature (°C)		29.1	31.1		32	30.7	33.7	30.8	30.1	31.4	29.5	29.1
16-Jul-18	Temperature (°C)		27.3	28.7	27.9	28.2	27.8	28.4	27.6	27.8	27.9	27.3	28.6

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
13-Aug-18	Temperature (°C)		26.9	28.7	28.1	29.3	28.1	28.4	28	27.7	27.5	28.9	28
27-Aug-18	Temperature (°C)		28.1	32.8	25.3	32.2	30.5	31.6	29.7	29.6	30.3	31	31.3
03-Sep-18	Temperature (°C)		26.2	27.3	26.2	27.1	26.9	27.7	27.2	27.4	28.1	26.4	26.8
17-Sep-18	Temperature (°C)		27	28.2		27.9	28.2	28.2	27.9	28.5	28.6		28.4
02-Jul-18	Turbidity (NTU)		0.73	20.26		54.82	62.1	26.38	4.68	58.09	25.04	6.18	32
16-Jul-18	Turbidity (NTU)		2.01	33.28	25.52	29.6	65.17	20.72	8.1	37.88	35.85	15.42	35.4
13-Aug-18	Turbidity (NTU)		1.59	27.06	8.03	32.39	38.2	19.56	7.64	71.69	37.43	10.91	46.87
27-Aug-18	Turbidity (NTU)		1.29	10.5	3.97	30.79	16.13	34.58	3.33	38.95	31.28	6.38	25.99
03-Sep-18	Turbidity (NTU)		1.57	14.94	13.36	14.66	27.14	23.48	4.95	34.66	34	6.85	23.89
17-Sep-18	Turbidity (NTU)		1.42	21.1		22.48	8.8	28.33	4.34	49.83	16.11		9.17
02-Jul-18	TSS (mg/l)	<50	<5	5.26		20.54	15.24	18.77	11.49	26.07	18.41	6.31	52.68
16-Jul-18	TSS (mg/l)	<50	<5	6.46	0.19	25.7	17.75	28.79	8.94	33.58	136.73	19.33	20.83
13-Aug-18	TSS (mg/l)	<50	<5	5.38	8.92	18.49	12.6	30.08	9.21	47.49	36.03	16.9	17.92
27-Aug-18	TSS (mg/l)	<50	<5	8.81	<5	20.83	12.12	41.05	13.64	42.42	42.86	10.1	15.46
03-Sep-18	TSS (mg/l)	<50	<5	8.03	12.53	25.68	13.26	32.65	13.57	40.54	28.62	6.84	10.34
17-Sep-18	TSS (mg/l)	<50	<5	10.58		16.24	11.76	47.3	7.3	89.74	12.94		7.52
02-Jul-18	BOD5 (mg/l)	<30	18.66	<6		<6	<6	<6	10.98	112.2	89.93	<6	<6

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
16-Jul-18	BOD5 (mg/l)	<30	9.39	<6	6.03	<6	<6	<6	<6	198.3	<6	<6	29.76
13-Aug-18	BOD5 (mg/l)	<30	10.74	<6	<6	32.64	<6	45	<6	64.84	<6	<6	21.9
27-Aug-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6	<6	<6	128.1	78.9	<6	<6
03-Sep-18	BOD5 (mg/l)	<30	6.12	<6	<6	<6	<6	22.32	<6	<6	<6	<6	<6
17-Sep-18	BOD5 (mg/l)	<30	6.81	24.42		<6	<6	<6	<6	<6	<6		<6
02-Jul-18	COD (mg/l)	<125	<25	37.6		93.6	54.6	29.4	<25	221	114	<25	106
16-Jul-18	COD (mg/l)	<125	<25	43.1	<25	53.8	61.6	67.5	32.8	316	374	39.1	26.6
13-Aug-18	COD (mg/l)	<125	<25	40	26.8	70.9	59.2	76	37.2	254	196	32.2	<25
27-Aug-18	COD (mg/l)	<125	<25	32.9	<25	55.4	47.2	91.9	<25	224	187	<25	<25
03-Sep-18	COD (mg/l)	<125	<25	42.8	<25	62.5	45.4	66.3	32.4	282	142	<25	<25
17-Sep-18	COD (mg/l)	<125	<25	46.6		64.2	51	73	29.4	302	63.4		<25
02-Jul-18	NH3-N (mg/l)	<10	6.9	20.3		24.8	24.4	10.3	3.7	28	16.8	4.9	34.2
16-Jul-18	NH3-N (mg/l)	<10	8.4	21.2	5.2	11.2	28.5	30.2	8.7	25.1	14.4	6.1	9.5
13-Aug-18	NH3-N (mg/l)	<10	11.7	16.8	6.3	21.1	19.7	25.2	7.8	18.2	12.8	2	7.6
27-Aug-18	NH3-N (mg/l)	<10	5.3	14.1	5.5	10.5	16.1	20	2.1	12.2	6.9	<0.2	2.9
03-Sep-18	NH3-N (mg/l)	<10	3.9	12.7	2.3	15	10.4	21.3	3.9	18.1	6.8	<0.2	2.3
17-Sep-18	NH3-N (mg/l)	<10	9.2	19.3		19.7	23.7	26	8	11.8	25.4		1.6

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
02-Jul-18	Total Nitrogen (mg/l)	<10	10.4	20.6		27.6	28.1	14.8	9.79	28.4	17	6.31	34.9
16-Jul-18	Total Nitrogen (mg/l)	<10	9.36	21.8	19.7	25.7	29.1	30.8	17.3	25.3	15	6.25	9.87
13-Aug-18	Total Nitrogen (mg/l)	<10	16.2	17.3	10.3	23.1	23.7	26.4	13.3	18.7	13.1	4.88	7.9
27-Aug-18	Total Nitrogen (mg/l)	<10	11.1	17.3	25.4	14.2	19.9	20.2	39.4	16	28.2	8.7	42.2
03-Sep-18	Total Nitrogen (mg/l)	<10	8.91	15.8	8.27	16.7	14.9	21.7	4.29	21.4	9.19	1.42	2.91
17-Sep-18	Total Nitrogen (mg/l)	<10	13.8	20		20.7	24.3	27.7	8.6	12.1	26.2		2.6
02-Jul-18	Total Phosphorus (mg/l)	<2.0	0.69	0.8		0.68	0.83	0.23	0.34	0.95	0.61	0.39	0.48
16-Jul-18	Total Phosphorus (mg/l)	<2.0	1.94	1.82	1.09	0.77	2.25	1.04	0.95	2.37	2.53	0.69	0.28
13-Aug-18	Total Phosphorus (mg/l)	<2.0	1.19	1.07	0.84	0.91	1.15	1.36	0.73	1.26	1.1	0.3	0.12
27-Aug-18	Total Phosphorus (mg/l)	<2.0	1.08	1.11	0.8	0.62	1.26	1.2	0.32	1.11	0.89	0.27	0.12

			Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
			Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA												
03-Sep-18	Total Phosphorus (mg/l)	<2.0	0.97	0.98	0.31	0.68	1.13	1.07	0.53	1.31	0.76	0.16	0.04	
17-Sep-18	Total Phosphorus (mg/l)	<2.0	0.86	1.13		1.07	1.19	1.09	0.73	1.15	1.17		0.03	
02-Jul-18	Faecal Coliform (MPN/100 ml)	<400	23	0		0	0	920	23	540	170	0	0	
16-Jul-18	Faecal Coliform (MPN/100 ml)	<400	13	0	0	0	0	0	0	920	0	0	27	
13-Aug-18	Faecal Coliform (MPN/100 ml)	<400	170	0	0	1600	0	220	0	23	0	0	540	
27-Aug-18	Faecal Coliform (MPN/100 ml)	<400	22	0	0	0	2	2	2	1600	0	0	0	
03-Sep-18	Faecal Coliform (MPN/100 ml)	<400	23	0	79	0	0	240	0	0	0	0	2	
17-Sep-18	Faecal Coliform (MPN/100 ml)	<400	1600	1600		0	0	0	0	0	0		0	
02-Jul-18	Total Coliform (MPN/100 ml)	<400	920	540		0	0	1600	240	16000	540	0	0	
16-Jul-18	Total Coliform (MPN/100 ml)	<400	1600	0	0	0	0	0	0	16000	0	0	920	

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
13-Aug-18	Total Coliform (MPN/100 ml)	<400	280	0	240	1600	0	220	0	23	0	0	1600
27-Aug-18	Total Coliform (MPN/100 ml)	<400	140	0	17	0	2	2	7.8	3500	0	2	0
03-Sep-18	Total Coliform (MPN/100 ml)	<400	130	0	170	0	0	240	0	0	2	0	4.5
17-Sep-18	Total Coliform (MPN/100 ml)	<400	1600	1600		0	0	0	0	0	0		0
02-Jul-18	Oil & Grease (mg/l)	<10	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
16-Jul-18	Oil & Grease (mg/l)	<10											
13-Aug-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1	<1	<1	6	8	<1	<1
27-Aug-18	Oil & Grease (mg/l)	<10											
03-Sep-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1	<1	<1	<1	6	<1	<1
17-Sep-18	Oil & Grease (mg/l)	<10											

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
02-Jul-18	Residual Chlorine (mg/l)	<1.0		0.48		0.89	1.49	2.09	0.19	1.16	0.51	0.83	0.72
16-Jul-18	Residual Chlorine (mg/l)	<1.0		0.24	0.19	1.43	0.43	0.48	0.18	0.07	0.68	0.41	0.02
13-Aug-18	Residual Chlorine (mg/l)	<1.0		0.37	0.14	0.04	1.23	0.03	0.46	0.86	1.1	0.19	0.07
27-Aug-18	Residual Chlorine (mg/l)	<1.0		1.09	0.22	1.27	0.94	1.1	0.14	0.08	0.83	0.35	0.93
03-Sep-18	Residual Chlorine (mg/l)	<1.0		0.6	0.09	0.94	1.12	0.53	0.33	0.98	0.49	0.24	0.37
17-Sep-18	Residual Chlorine (mg/l)	<1.0		0.1		0.54	0.61	0.77	0.22	1.48	1.93		1
02-Jul-18	Chlorination Dosing Rate (ml/mn)			217		47	240	3.1	20	3.1		58	3.1
16-Jul-18	Chlorination Dosing Rate (ml/mn)			840	152	385	842	3.1	21	3.1		16	
13-Aug-18	Chlorination Dosing Rate (ml/mn)			95	12	20	85	3.1	50	3.1	38	9	3.1

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	(EF17)
Date	Parameter (Unit)	Guideline in the CA											
27-Aug-18	Chlorination Dosing Rate (ml/mn)			290	38	300		3.1	148	3.1		160	3.1
03-Sep-18	Chlorination Dosing Rate (ml/mn)			615	38	152	503	3.1	70	3.1	3.1	43	3.1
17-Sep-18	Chlorination Dosing Rate (ml/mn)			500		256	880	3.1	170	3.1	3.1		3.1
02-Jul-18	Effluent Discharge Volume (L/mn)		12	6		12	20	4.2	3.33	4.2	2.4	3	4.2
16-Jul-18	Effluent Discharge Volume (L/mn)		20	12	6	60	12	4.2	3.15	4.2	6	3	
13-Aug-18	Effluent Discharge Volume (L/mn)		20	6	3	60	30	4.2	6	4.2	3	3	4.2
27-Aug-18	Effluent Discharge Volume (L/mn)			20		60		4.2	12	4.2			4.2
03-Sep-18	Effluent Discharge Volume (L/mn)		6	30	8.5	60	30	4.2	6	4.2	4.2	0	4.2
17-Sep-18	Effluent Discharge Volume (L/mn)			20		4	30	4.2	6	4.2	4.2		4.2

APPENDIX 5-3: EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q3 2018

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (µS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		CA Effluent Standard	6.0 - 9.0							<50	<10
05-Jul-18	RCC Plant Discharged at lower ponds	DS09									
12-Jul-18	RCC Plant Discharged at lower ponds	DS09									
18-Jul-18	RCC Plant Discharged at lower ponds	DS09									
26-Jul-18	RCC Plant Discharged at lower ponds	DS09									
02-Aug-18	RCC Plant Discharged at lower ponds	DS09									
09-Aug-18	RCC Plant Discharged at lower ponds	DS09									
16-Aug-18	RCC Plant Discharged at lower ponds	DS09									
23-Aug-18	RCC Plant Discharged at lower ponds	DS09	6.86	98.3	7.46	233	116.5	27.9	10.97	10	
30-Aug-18	RCC Plant Discharged at lower ponds	DS09	7.97	99.4	7.73	202.3	101	26.2	17.8	7.89	
06-Sep-18	RCC Plant Discharged at lower ponds	DS09									

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (μS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		CA Effluent Standard	6.0 - 9.0							<50	<10
13-Sep-18	RCC Plant Discharged at lower ponds	DS09									
20-Sep-18	RCC Plant Discharged at lower ponds	DS09									
27-Sep-18	RCC Plant Discharged at lower ponds	DS09									
05-Jul-18	CVC Plant	DS03									
12-Jul-18	CVC Plant	DS03									
18-Jul-18	CVC Plant	DS03									
26-Jul-18	CVC Plant	DS03									
02-Aug-18	CVC Plant	DS03									
09-Aug-18	CVC Plant	DS03									
16-Aug-18	CVC Plant	DS03									
23-Aug-18	CVC Plant	DS03									
30-Aug-18	CVC Plant	DS03									
06-Sep-18	CVC Plant	DS03									
13-Sep-18	CVC Plant	DS03									
20-Sep-18	CVC Plant	DS03									
27-Sep-18	CVC Plant	DS03									
05-Jul-18	Aggregate Crushing Plant	DS02									

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (μS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		CA Effluent Standard	6.0 - 9.0							<50	<10
12-Jul-18	Aggregate Crushing Plant	DS02									
18-Jul-18	Aggregate Crushing Plant	DS02									
26-Jul-18	Aggregate Crushing Plant	DS02									
02-Aug-18	Aggregate Crushing Plant	DS02									
09-Aug-18	Aggregate Crushing Plant	DS02									
16-Aug-18	Aggregate Crushing Plant	DS02									
23-Aug-18	Aggregate Crushing Plant	DS02	7.81	101.1	8.21	46.4	23.2	25.7	17.36	16.25	
30-Aug-18	Aggregate Crushing Plant	DS02	7.98	98.6	7.81	43.4	21.5	25.3	7.59	1.76	
06-Sep-18	Aggregate Crushing Plant	DS02	6.27	98.8	7.48	32.1	16	28	3.28	1.29	
13-Sep-18	Aggregate Crushing Plant	DS02	7.36	96.8	7.35	34.8	17.4	27.8	4.94	1.64	<1
20-Sep-18	Aggregate Crushing Plant	DS02	6.28	94.1	7.52	29.4	14.5	25.6	2.29	0.5	
27-Sep-18	Aggregate Crushing Plant	DS02	7.46	108.5	8.25	34	17	27.6	2	0.66	
05-Jul-18	Spoil Disposal No.2	DS04	6.9	69.9	5.29	22.7	11	27.8	147.68	136.61	<1
12-Jul-18	Spoil Disposal No.2	DS04	7.73	78.6	6.11	20.4	10	26.1	90	58.72	
18-Jul-18	Spoil Disposal No.2	DS04	6.42	97.4	7.71	23.3	11.5	25.5	183	151.69	
26-Jul-18	Spoil Disposal No.2	DS04	6.35	88.8	7.08	55.4	27.5	25	2,765	2,833	
02-Aug-18	Spoil Disposal No.2	DS04	6.45	81.8	6.55	15.6	7.8	25.4	51.34	39.04	
09-Aug-18	Spoil Disposal No.2	DS04	7.86	67.7	6.17	17.62	8.8	24.6	19.73	13.15	<1
16-Aug-18	Spoil Disposal No.2	DS04	7.05	74.2	5.82	15.25	7	25.8	13.71	7.4	

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (μS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		CA Effluent Standard	6.0 - 9.0							<50	<10
23-Aug-18	Spoil Disposal No.2	DS04	7.52	79.8	6.3	16.02	8	25.5	20.76	14.6	
30-Aug-18	Spoil Disposal No.2	DS04	6.68	89.3	6.91	12.64	6.3	25.4	19.45	8.82	
06-Sep-18	Spoil Disposal No.2	DS04	7.32	78.8	6.12	12.26	6	28.6	12.22	9.79	
13-Sep-18	Spoil Disposal No.2	DS04	7.33	79.9	5.93	16.55	8.27	29.1	22.33	14.87	<1
20-Sep-18	Spoil Disposal No.2	DS04	6.82	83.2	6.18	14.42	7.2	25.9	14.34	9.79	
27-Sep-18	Spoil Disposal No.2	DS04	7.61	88.8	6.78	16.98	8.49	27.4	6.53	8.38	
05-Jul-18	Main Dam's Treatment Plant No.3	DS14	7.16	107.8	7.29	295	147.5	30.7	3.8	6.77	<1
12-Jul-18	Main Dam's Treatment Plant No.3	DS14	7.9	101.3	7.03	128.7	64.3	32.8	7.88	7.39	
18-Jul-18	Main Dam's Treatment Plant No.3	DS14	8.3	98.7	7.78	75.2	37.5	25.5	58.41	154.14	
26-Jul-18	Main Dam's Treatment Plant No.3	DS14	7.72	97.1	7.5	787	393	26.8	25.93	29.75	
02-Aug-18	Main Dam's Treatment Plant No.3	DS14	7.81	98.3	7.78	121.9	60.5	25.8	49.87	50.78	
09-Aug-18	Main Dam's Treatment Plant No.3	DS14	6.68	119.1	8.69	142.8	71.4	29.8	4.64	3.55	<1
16-Aug-18	Main Dam's Treatment Plant No.3	DS14									
23-Aug-18	Main Dam's Treatment Plant No.3	DS14									

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (μ S/cm)	TDS (mg/L)	Temperature ($^{\circ}$ C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		CA Effluent Standard	6.0 - 9.0							<50	<10
30-Aug-18	Main Dam's Treatment Plant No.3	DS14									
06-Sep-18	Main Dam's Treatment Plant No.3	DS14									
13-Sep-18	Main Dam's Treatment Plant No.3	DS14									
20-Sep-18	Main Dam's Treatment Plant No.3	DS14									
27-Sep-18	Main Dam's Treatment Plant No.3	DS14									

APPENDIX 5-4: GROUNDWATER QUALITY MONITORING RESULTS – Q3 2018

Month Year	Parameter (Unit)	Site Name	Somseun Village		NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GSXN02	GNPA01	GTHN01	GPOU01
		National Groundwater Standard					
11-Jul-18	pH	6.5 - 9.2	6.94		7.02	6.91	
17-Jul-18	pH	6.5 - 9.2					6.31
01-Aug-18	pH	6.5 - 9.2	7.6		7.54	7.45	
07-Aug-18	pH	6.5 - 9.2					6.37
04-Sep-18	pH	6.5 - 9.2					7.02
11-Sep-18	pH	6.5 - 9.2	7.48		7.43	7.51	
11-Jul-18	Sat. DO (%)		80.9		82.2	77.2	
17-Jul-18	Sat. DO (%)						78.2
01-Aug-18	Sat. DO (%)		95.8		90.5	81.4	
07-Aug-18	Sat. DO (%)						80.3
04-Sep-18	Sat. DO (%)						84.9
11-Sep-18	Sat. DO (%)		82.6		91.5	94.9	
11-Jul-18	DO (mg/l)		6.15		6.28	5.81	
17-Jul-18	DO (mg/l)						6.07
01-Aug-18	DO (mg/l)		7.24		6.87	6.08	
07-Aug-18	DO (mg/l)						6.16
04-Sep-18	DO (mg/l)						6.76
11-Sep-18	DO (mg/l)		6.07		6.76	6.94	
11-Jul-18	Conductivity (µS/cm)		344		292	308	
17-Jul-18	Conductivity (µS/cm)						15.78
01-Aug-18	Conductivity (µS/cm)		347		331	288	
07-Aug-18	Conductivity (µS/cm)						14.72
04-Sep-18	Conductivity (µS/cm)						18.72
11-Sep-18	Conductivity (µS/cm)		301		347	299	
11-Jul-18	TDS (mg/l)		172		146	154	
17-Jul-18	TDS (mg/l)						7.5
01-Aug-18	TDS (mg/l)		173		165	144	
07-Aug-18	TDS (mg/l)						7.3
04-Sep-18	TDS (mg/l)						9.3
11-Sep-18	TDS (mg/l)		150.5		173.5	149.5	
11-Jul-18	Temperature (°C)		28		27.7	28.5	
17-Jul-18	Temperature (°C)						25.7
01-Aug-18	Temperature (°C)		28.4		28	28.8	

Month Year	Parameter (Unit)	Site Name	Somseun Village		NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GSXN02	GNPA01	GTHN01	GPOU01
		National Groundwater Standard					
07-Aug-18	Temperature (°C)						25.6
04-Sep-18	Temperature (°C)						24.7
11-Sep-18	Temperature (°C)		30.1		29.8	30.4	
11-Jul-18	Turbidity (NTU)	<20	0.66		1.61	1.79	
17-Jul-18	Turbidity (NTU)	<20					14.14
01-Aug-18	Turbidity (NTU)	<20	3.29		0.65	2.2	
07-Aug-18	Turbidity (NTU)	<20					3.8
04-Sep-18	Turbidity (NTU)	<20					2.98
11-Sep-18	Turbidity (NTU)	<20	1.57		1.42	1.22	
11-Jul-18	Fecal coliform (MPN/100 ml)	0	2		0	0	
17-Jul-18	Fecal coliform (MPN/100 ml)	0					9.3
01-Aug-18	Fecal coliform (MPN/100 ml)	0	0		0	0	
07-Aug-18	Fecal coliform (MPN/100 ml)	0					0
04-Sep-18	Fecal coliform (MPN/100 ml)	0					4.5
11-Sep-18	Fecal coliform (MPN/100 ml)	0	0		0	0	
11-Jul-18	E.coli Bacteria (MPN/100 ml)	0	2		0	0	
17-Jul-18	E.coli Bacteria (MPN/100 ml)	0					9.3
01-Aug-18	E.coli Bacteria (MPN/100 ml)	0	0		0	0	
07-Aug-18	E.coli Bacteria (MPN/100 ml)	0					0
04-Sep-18	E.coli Bacteria (MPN/100 ml)	0					4.5
11-Sep-18	E.coli Bacteria (MPN/100 ml)	0	0		0	0	
11-Jul-18	Arsenic (mg/l)	<0.05	0.0005		<0.0003	<0.0003	
17-Jul-18	Arsenic (mg/l)	<0.05					<0.0003
11-Jul-18	Total Iron (mg/l)	<1	<0.010		<0.010	0.98	
17-Jul-18	Total Iron (mg/l)	<1					0.308
11-Jul-18	Magnesium (mg/l)		4.26		2.47	4.35	
17-Jul-18	Magnesium (mg/l)						0.242
11-Jul-18	Manganese (mg/l)	<0.5	<0.005		<0.005	<0.005	

Month Year	Parameter (Unit)	Site Name	Somseun Village		NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GSXN02	GNPA01	GTHN01	GPOU01
		National Groundwater Standard					
17-Jul-18	Manganese (mg/l)	<0.5					<0.005
11-Jul-18	Fluoride (mg/l)	<1					
17-Jul-18	Fluoride (mg/l)	<1					0.65
11-Jul-18	Total hardness (mg/l)	<500	203		152	171	
17-Jul-18	Total hardness (mg/l)	<500					14.6
11-Jul-18	Nitrate (mg/l)	<45	0.66		1.64	1.68	
17-Jul-18	Nitrate (mg/l)	<45					0.66
11-Jul-18	Nitrite (mg/l)	<3	<0.02		<0.02	<0.02	
17-Jul-18	Nitrite (mg/l)	<3					
11-Jul-18	Lead (mg/l)	<0.05	<0.008		<0.008	<0.008	
17-Jul-18	Lead (mg/l)	<0.05					<0.008

APPENDIX 5-5: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q3 2018

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
Date	Parameter (Unit)	National Drinking Water Standard	WTHH02	WHGN02	WPHX0 1	WPHX0 2	WPHX0 3
11-Jul-18	pH	6.5 - 8.6	6.69	6.93	8.43	7.59	6.85
01-Aug-18	pH	6.5 - 8.6	7.88	7.72	7.75	7.74	7.52
11-Sep-18	pH	6.5 - 8.6	7.88	7.96	7.92	7.63	7.52
11-Jul-18	Sat. DO (%)		95.3	96.1	98.3	95.5	91.7
01-Aug-18	Sat. DO (%)		98.5	76.6	100.2	92.4	85.8
11-Sep-18	Sat. DO (%)		94.5	96.9	100	99.2	98.8
11-Jul-18	DO (mg/l)		7.11	7.3	7.61	7.3	6.93
01-Aug-18	DO (mg/l)		7.41	5.53	8.04	7.08	6.54
11-Sep-18	DO (mg/l)		6.86	7.22	7.72	7.7	7.4
11-Jul-18	Conductivity (µS/cm)	<1,000	43.2	65.2	14.94	8.66	8.34
01-Aug-18	Conductivity (µS/cm)	<1,000	24	36.6	14.81	10.87	10
11-Sep-18	Conductivity (µS/cm)	<1,000	26.6	38.3	6.55	6.24	5.49
11-Jul-18	TDS (mg/l)	<600	21.5	32.5	7.4	4.33	4.1
01-Aug-18	TDS (mg/l)	<600	12	18	7.4	5.43	5
11-Sep-18	TDS (mg/l)	<600	13.3	19.15	3.27	3.12	2.74
11-Jul-18	Temperature (°C)	<35	28	27.9	26.7	27.5	27.9
01-Aug-18	Temperature (°C)	<35	28.7	28.8	24.9	27.7	27.8

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
Date	Parameter (Unit)	National Drinking Water Standard	WTHH02	WHGN02	WPHX0 1	WPHX0 2	WPHX0 3
11-Sep-18	Temperature (°C)	<35	30	29.7	27.5	27.2	28.9
11-Jul-18	Turbidity (NTU)	<10	2.46	2.6	0.62	1.89	2.01
01-Aug-18	Turbidity (NTU)	<10	5.56	6.06	0.71	2.75	2.58
11-Sep-18	Turbidity (NTU)	<10	19.91	6.2	1.96	1.98	1.81
11-Jul-18	Faecal Coliform (MPN/100ml)	0	49	240	140	49	6.8
01-Aug-18	Faecal Coliform (MPN/100ml)	0	33	23	7.8	0	0
11-Sep-18	Faecal Coliform (MPN/100ml)	0	920	220	79	6.8	0
11-Jul-18	E.coli Bacteria (MPN/100ml)	0	49	240	33	17	6.8
01-Aug-18	E.coli Bacteria (MPN/100ml)	0	23	23	7.8	0	0
11-Sep-18	E.coli Bacteria (MPN/100ml)	0	920	220	79	6.8	0

APPENDIX 5-6: LANDFILL LEACHATE MONITORING RESULTS – Q3 2018

		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	Discharge Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
16-Jul-18	pH	6.0-9.0				8.39	No discharge		7.48
13-Aug-18	pH	6.0-9.0				8.9		8.26	
3-Sep-18	pH	6.0-9.0				8.87			7.77
16-Jul-18	Sat. DO (%)					120.1			70.7
13-Aug-18	Sat. DO (%)					103		103.5	
3-Sep-18	Sat. DO (%)					133.2			51.3
16-Jul-18	DO (mg/l)					8.82			5.23
13-Aug-18	DO (mg/l)					7.79		7.91	
3-Sep-18	DO (mg/l)					10.41			3.9
16-Jul-18	Conductivity (µS/cm)					169.7			154.8
13-Aug-18	Conductivity (µS/cm)					152.9		171	
3-Sep-18	Conductivity (µS/cm)					93.8			191.2
16-Jul-18	TDS (mg/l)					84.3			77.4
13-Aug-18	TDS (mg/l)					76.45		85.8	
3-Sep-18	TDS (mg/l)					46.5			99.5
16-Jul-18	Temperature (°C)					29.2			28.9
13-Aug-18	Temperature (°C)					27.8		27.4	

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
			Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharge Point
			LL1	LL2	LL3	LL4	LL5	LL6	LL7
			Guideline						
Date	Parameter (Unit)	Guideline							
3-Sep-18	Temperature (°C)					28.2			27.7
16-Jul-18	Turbidity (NTU)					83.86			2.22
13-Aug-18	Turbidity (NTU)					13.65		4.38	
3-Sep-18	Turbidity (NTU)					12.46			3.77
16-Jul-18	BOD (mg/l)	<30				17.4			1.58
13-Aug-18	BOD (mg/l)	<30				5.74		2.18	
3-Sep-18	BOD (mg/l)	<30				6.87			<6
16-Jul-18	COD (mg/l)	<125				91.9			<25
13-Aug-18	COD (mg/l)	<125				46.4		33.4	
3-Sep-18	COD (mg/l)					35.7			<25
16-Jul-18	Faecal Coliform (MPN/100 ml)					79			7.8
13-Aug-18	Faecal Coliform (MPN/100 ml)					4		0	
3-Sep-18	Faecal Coliform (MPN/100 ml)					7.8			0
16-Jul-18	Total Coliform (MPN/100 ml)	<400				1,600			1,600
13-Aug-18	Total Coliform (MPN/100 ml)	<400				350		39	
3-Sep-18	Total Coliform (MPN/100 ml)	<400				79			8
3-Sep-18	Mercury (mg/l)					<0.0005			<0.0005
3-Sep-18	Total nitrogen (mg/l)	<10				1			1
3-Sep-18	Arsenic (mg/l)					0.0006			0.001
3-Sep-18	Manganese (mg/l)					0.116			0.35
3-Sep-18	Lead (mg/l)	<0.2				<0.010			<0.010
3-Sep-18	Iron (mg/l)					0.666			
3-Sep-18	Total Petroleum Hydrocarbons (mg/l)					<1			<1

APPENDIX 5-7: LANDFILL GROUNDWATER QUALITY MONITORING RESULTS – Q3 2018

Parameter (Unit)	Site Name	NNP1 Project Landfill				Houay Soup Landfill
	Station	MW1	MW2	MW3	MW4	MW5
	Date	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18
	Guideline					
pH		6.34	7.06	6.34	6.07	6.69
Sat. DO (%)		63.5	72.3	66.7	67.4	64.7
DO (mg/l)		4.89	5.38	5.02	5.04	4.76

Parameter (Unit)	Site Name	NNP1 Project Landfill				Houay Soup Landfill
	Station	MW1	MW2	MW3	MW4	MW5
	Date	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18
	Guideline					
Conductivity ($\mu\text{S}/\text{cm}$)		199	20.39	230	139	98.1
TDS (mg/l)		99.5	10.19	115	69.5	49.05
Temperature ($^{\circ}\text{C}$)		27.1	29.0	28.5	28.7	29.7
Turbidity (NTU)		3.03	1.61	1.95	1.8	4.69
Total Nitrogen (mg/l)		0.77	0.64	0.88	0.51	0.52
Lead (mg/l)	<0.01	0.213	<0.01	0.108	0.108	0.241
Total Phosphorus (mg/l)		0.02	0.01	0.04	0.02	0.02
Faecal Coliform (MPN/100 ml)		0	0	0	0	0
Total Coliform (MPN/100 ml)		0	0	0	0	0
NH ₃ -N (mg/l)		0.5	0.4	0.8	0.4	0.4
Copper (mg/l)		<0.003	<0.003	<0.003	<0.003	<0.003
Total Petroleum (mg/l)		<1.0	<1.0	<1.0	<1.0	<1.0
Water level (m)		21.2	31.2	18.97	16.67	6.8