

Environmental and Social Monitoring Report

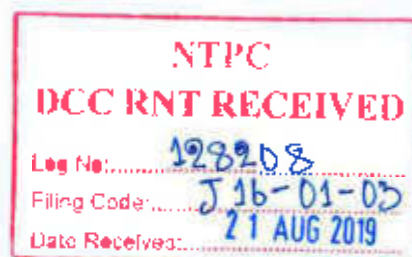
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NAM THEUN 2 POWER COMPANY LTD

ENVIRONMENT AND SOCIAL SEMI-ANNUAL PROGRESS REPORT 2019

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ACRONYMS

ADB	Asian Development Bank
AE Lab	Aquatic Environment Laboratory
AIP	Annual Implementation Plan
AMLs	Artificial Mineral Licks
BH	Borehole
CA	Concession Agreement
CEMMP	Company's Environmental Monitoring and Management Plan
Chl a	Chlorophyll a
CIH	Hydro- Engineering Center of EDF
COD	Commercial Operations Date
CSR	Corporate Social Responsibility
DAFO	District Agriculture and Forestry Office
DEB	Department of Energy Business (Ministry of Energy & Mines)
DOI	Lao Department of Irrigation Analytical Chemistry Laboratory
DONRE	District Of Natural Resources and Environment
E&S	Environmental and Social
EAMP	Environmental Assessment and Management Plan
EDF	Electricité de France
EDFI	Electricité de France International
EGAT	Electricity Generating Authority of Thailand
EGCO	Electricity Generating Public Company Limited
ESMP	Environmental and Social Management Plan
GHG	Greenhouse Gas
GoL	Government of Lao PDR
GPS	Global Positioning System
HH	Household
HEC	Human Elephant Conflict
HSE	Health Safety and Environment
IUCN	International Union for Conservation of Nature
LTA	Lenders Technical Advisor
MONRE	Ministry Of Natural Resources and Environment
NBCA	National Biodiversity Conservation Area
NGO	Non-Government Organisation
NN-NP	Nakai Nam Theun National Park
NPA	National Protected Area
NPLAF	Nakai Plateau Livestock, Agriculture and Fishery
NRO	Nakai Resettlement Office (formerly known as Resettlement Monitoring Office)
NT2	Nam Theun 2 Project
NTPC	Nam Theun 2 Power Company Limited
PAFO	Provincial Agriculture and Forestry Office
POE	Panel of Experts
PONRE	Province Of Natural Resources and Environment
RC	Resettlement Committee
SERF	Social and Environment Remediation Fund
RFA	Reservoir Fisheries Association
RIP	Resettlement Implementation Period
RMU	Resettlement Management Unit
RNT	Residence Nam Theun
SGS	Société Générale de Surveillance
UAE	United Analyst and Engineering Consultant Co., Ltd.
UXO	Unexploded Ordnance
VFG	Village Fisheries Group
VTE	NTPC - Vientiane Office

WB World Bank
WCS Wildlife Conservation Society
WGH Wooden guesthouse
WMPA Watershed Management & Protection Authority
WMPP Wildlife Management and Protection Program
WQB Water Quality and Biodiversity Department
WQMAP Water Quality Monitoring and Assessment Program
XBF Xe Bangfai.

GENERAL INTRODUCTION

NTPC is subject to environment monitoring obligations under the CA until the end of the CA Period. The Environmental and Social bi - annual progress report follows the AIP 2019 Ver.1 NTPC-S-B1002-0015.

Since the obligation on reporting on social activities has ended with the closing of the Resettlement Implementation Period last July 2018, the current report only focuses on environment activities.

ENVIRONMENTAL ACTIVITIES

1. INTRODUCTION-KEY MILESTONES

There are key milestones of Environment Program during January to June 2019, referring to the key tasks of AIP 2019, as follow:

- **Water quality monitoring**

- (i) Monitor and understand the evolution of the whole NT2 hydro system in relation to Project operations, as required by the Concession Agreement;
- (ii) Provide data for predictive models of the reservoir's water quality and GHG emissions. This model developed by EDF-CIH will help in assessing scenarios of water quality evolution in the medium-term period (30 years). Greenhouse Gases are also taken into consideration in this model in order to refine the estimation of the carbon footprint of the hydropower plant within its entire concession period.

- **Hydrobiology monitoring**

- (i) As part of the concession agreement and the 4th Service Agreement of NTPC-EDF (May 2017 to April 2023), the hydrobiology monitoring includes the routine monitoring of main aquatic groups e.g. Chlorophyll a (as production indicator in the Reservoir), aquatic invertebrates in the rivers upstream and downstream of the reservoir.
- (ii) To continue of Fish Population Monitoring in the rivers and reservoir with a total of 20 sampling stations in order to monitor the fish biomass in the project area.

Additional activities will lead to support the end of research programs by providing assistance of data analysis and interpretation.

- **Biodiversity Program**

- (i) Follow up the Nakai Elephant Program with Nakai DAFO.
- (ii) Education and outreach on HEC: provide the necessary support and follow up the effectiveness of HEC mitigation and awareness activities by the HEC outreach team from Nakai DoNRE.
- (iii) GPS collars replacement for the Group of three elephants at the end of 2019.
- (iv) Chinese Swamp Cypress germination program: (i) Environment team plan to continue the joining with the experts from IUCN Conifer Redlist Authority to collect Swamp Cypress seed; (ii) organise germination, (iii) plant seedlings in the NPA.
- (v) Continue invasive species monitoring and control; and
- (vi) Mineral lick replenishment: as advised by an Elephant Specialist (WCS), one replenishment has been organised in 2019 before the wet season.

- **Environment Compliance Program**

- (i) To undertake periodic inspection of all activities by NTPC or its contractors to ensure the compliance with CEMMP.
- (ii) Manage and arrange the facility for a closure of the 6th NTPC waste cell while ensuring no environmental issues.

- (iii) Organize and manage the waste disposal in appropriate methodologies for the wastes stored in NTPC Landfill (hazardous wastes, laboratory wastes, recyclable wastes, used fluorescents, electronic wastes).
- (iv) Regularly organize the landfill observation borewells water quality monitoring for NTPC landfill by using the appropriate methodologies and suitable frequency to ensure that potential of contamination leached from waste cells and/or its leachate ponds are captured and corrective action to avoid further contamination into the local groundwater system will be taken properly.
- (v) Continue to follow up with NTPC-Site management on taking a proper action for wastewater treatment modification and its maintenance to ensure that the effluent water discharged from NTPC facilities are under the GoL effluent standard guidelines and no environmental impact to the local discharged areas.
- (vi) Progress work of the Nakai Landfill construction project and its associated activities; and
- (vii) Continue to support and promote the environmental awareness program in both districts (Gnommalath and Nakai).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Historical background

The Environment Management Office was divided into two separate departments in 2010. The role of ensuring compliance with NTPC's environmental commitments was transferred to the Health, Safety and Environment Department and is under NTPC's Integrated Management System Division. In June 2015 this unit has been renamed Risk & Strategy Unit, along with this organisational change, all tasks related to biodiversity monitoring and management; water quality monitoring and analysis (chemistry, hydrobiology); and erosion monitoring have been maintained within E&S Division's Water Quality and Biodiversity Department. Since January 2016, the Environment Compliance team under the Risk & Strategy Unit was transferred to Water Quality and Biodiversity Department and the name of department has been changed to Environment Department since August 2016. Since October 2018, as the social activities were completed, the E&S unit was split into 2 parts: Environment Department is integrated in Technical branch and Social team is re-named to CSR Department which is merged with CSR, GoL affairs and Communication Unit.

The Forth Service Agreement between EDF and NTPC to support the Laboratory started in May 2017 and will last till April 2023.

2.2 Current organization and responsibilities

The department is organized as below:

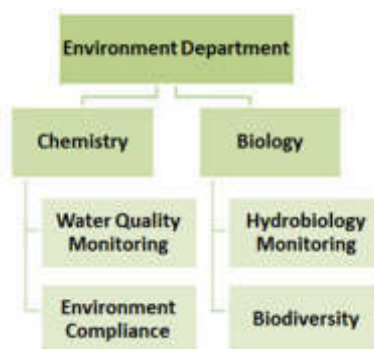


Figure 1 – Environment Department Organization

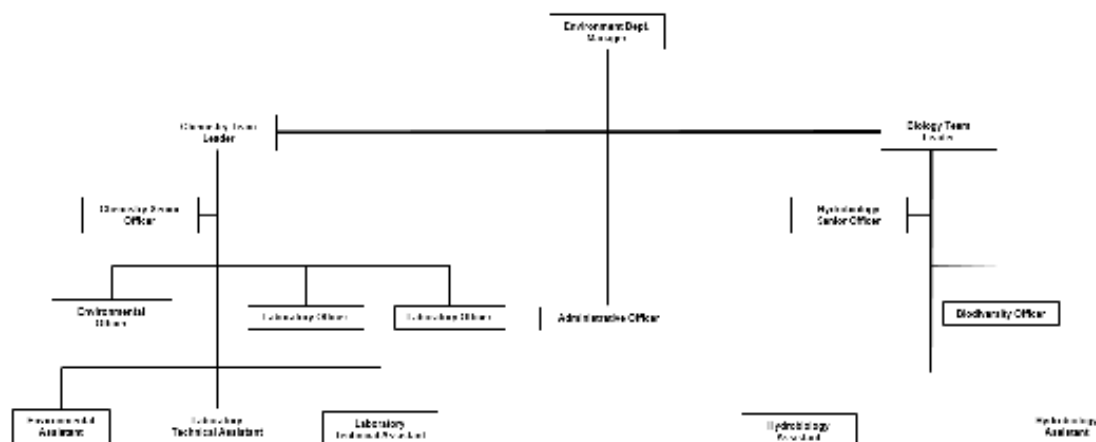


Figure 2 – Detailed Organization Chart of the Environment Department

The Environment Department is in charge of design, implementation and monitoring of activities and achievement of objectives of Environmental (including all water quality and biodiversity) contractual obligations of NTPC during the Operational Phase.

The Aquatic Environment Laboratory (AE Lab), within the Environment Department to monitors water quality, hydrobiology and greenhouse gas emissions in the reservoir, upstream and downstream areas under funding agreement between NTPC and EDF starting from April 2011 for 3 years period and is extended to April 2017. Another 6 years (May 2017 to April 2023) of funding agreement with a lightened scope of monitoring is accepted by EDF. The team also conducts the riverbank erosion monitoring along the Xe Bangfai. Furthermore, a fish catch monitoring in the Nakai Reservoir will end when the RIP will be closed (end of CA obligations). However, a handing over to the Nakai district was realized to ensure their capacity to perform the monitoring upon the needs and important information and document were shared with the NPLAF team.

The environment compliance team monitors, inspects and manages all environmental internal issues and supports the solid waste management in the 2 local districts (Gnommalath and Nakai). The mission ensures that there is no negative impact by the project to the local environment in a short term and on a long run. The corrective and preventive actions are taken for any environment incident and follow up by the team.

The elephant program, the invasive species program and swamp cypress program are under the biodiversity section of the Environment Department.

3. ENVIRONMENT PROGRAMS STATUS AS PER JUNE 2019

3.1 The Aquatic Environment Laboratory (AE Lab)

After eleven years of operation of NT2 Aquatic Environment Laboratory (AE Lab), the *Service Agreement* between NTPC and EDF for water quality will end as of April 30, 2023. Since 2008 four contracts were signed with EDF-CIH.

The AE Lab was set up in order to develop two kinds of in-house capacities:

- Perform the analysis of most water quality parameters to be monitored by NTPC to fulfil its obligations under the **Concession Agreement** (only analysis such as oil and grease are still being sent for analysis to UAE, a Thai laboratory based in Bangkok).
- Support various **research programs**: Greenhouse Gas (GHG) emissions measurements and related studies, Dynamic of Mercury content in fish flesh, Fish stock assessment in the reservoir, and Effects of a reservoir on fish composition using a tropic approach.

The main outputs for the AEL are the following:

- Maintained the quality of Laboratory and staff performance by continuing to conduct the internal QA/QC for laboratory by performing the tests of method blank analysis, blind samples analysis and Quality Control Standards by CRM.
- The proficiency testing (PT) program for the external QA/QC could not be applied to participate with the accredited provider in USA due to the new Import regulation of Lao PDR by Air Freight against the amount of Chemical product. The PT providers in Thailand was contacted for proficiency testing program in 2019.
- Support of the Scientific researches:
 - Greenhouse gas (GHG) emission monitoring: the monitoring continues in routinely basis but the sampling sites, as well as frequencies are decreased according to the 4th Service Agreement of NTPC and EDF-CIH. The monitoring result is on progress of review by the researchers (Toulouse University, IRD etc.).

As of June 2019, **27 scientific articles** relating to Nam Theun 2 Project have been published in peer reviewed journals and are accessible online (**Annex 1**).

3.2 Water quality monitoring

3.2.1 Obligations

References related to CA Obligations - Volume 2A, Schedule 4, Part 2, Subject 9: 1 to 4.

The Concession Agreement (Volume 2A, Schedule 4, Part 2) details the obligations of NTPC in regard to water quality monitoring during the whole Concession Period. In the CA, it is specified that NTPC has to provide a detailed program to cover the three different phases to check that the Project meets environmental standards (i) prior to inundation, (ii) during the reservoir impounding throughout the construction period and (iii) during operation. A Water Quality monitoring program has to ensure an accurate assessment of water quality and biological parameters relating to the Project (rivers, domestic water supply, groundwater in the Project Land, effluent discharge, livestock drinking and irrigation water). Monitoring of variations and trends exceeding specified trigger levels are as well clearly specified. The water quality monitoring program has to be regularly reviewed and evaluated to assess its effectiveness.

Reference related to the 4th Service Agreement between NTPC and EDF (period of May 2017 to April 2023). The maps of the monitoring stations for the 4th Service Agreement are presented in **Annex 2, Annex 3, Annex 4 and Annex 5**.

3.2.2 Main outputs until June 2019

Reservoir and Downstream Water Quality

Reservoir

- NT2 reservoir still showed clear thermal stratification cycles following natural seasons (December to January: mixing stage, March to July: stable stratification, and August to October: weak stratification due to the disturbance of water current from the rainy runoff). Influence of stratification sequences remains the key driving factor for reservoir chemistry: (i) maximum of

nutrients/gas release was recorded at the end of the stratified period, (ii) nutrients/dissolved gas decrease from annual flooded and reached minimum consecutive to the mixing event.

- High value of Dissolved oxygen ($>5\text{mg/L}$) at the surface water were always observed in all stations, except in Water Intake in June where the DO dropped to 3.23mg/L , the decreasing of DO could associated to the high demand of oxygen during low water level in reservoir and the atmospheric temperature was high. However, it would not induce to a critical state of water quality as there was not an oxygen depletion.
- DO at the bottom level tend to increase during mixing period from 4mg/L at Thalang (RES04) and around 8mg/L at Intake (RES09). When the stratification appeared, the anoxic condition was observed at RES04 at various layers (4.5 to 23 m) from February to June. The summary of Water Quality in the Reservoir January to June 2019 are respectively presented in **Annex 6**.

Rivers

Key WQ results related to Project releases during the January to June 2019:

- **Dissolved Oxygen (DO)** remained above the surface water Guideline for Nam Theun, Nam Kathang and Xe Bangfai Rivers throughout the 6 months.
- **Biological Oxygen Demand (BOD)**, all measured values in the surface water meet the guideline.
- **Chemical Oxygen Demand (COD)** slightly exceeded the guideline for few months in Xe Bangfai downstream of the downstream channel (DSC) confluence, in Nam Kathang downstream of the Regulating Dam and in Nam Theun downstream of Nakai Dam (If the uncertainty of measurement is considered on the reported results, values may remain under the guideline or slightly exceed the guideline).

The water discharged to Xe Bangfai still show seasonal effects on temperature and conductivity parameters due to the cooler water and low conductivity of water from the reservoir.

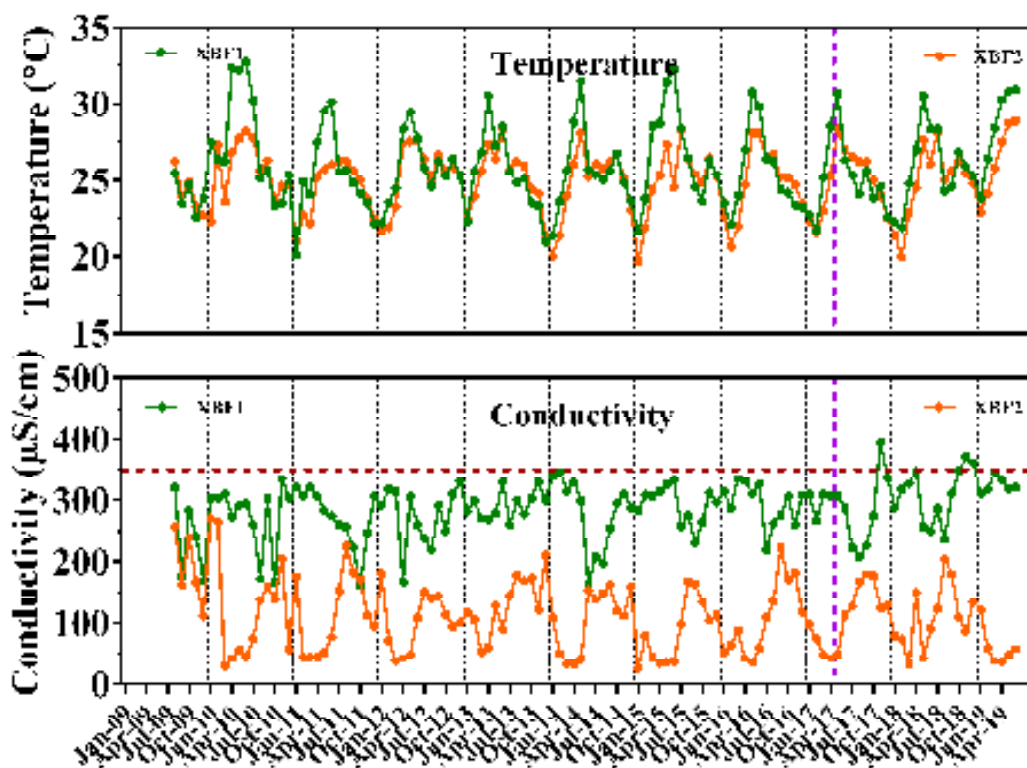


Figure 3 – Measurement of Temperature and Conductivity in Xe Bangfai river

Greenhouse Gas (GHG) Monitoring

GHG emission monitoring continue in routinely basis in reservoir, tributaries, downstream rivers and civil work area, the monitoring frequency is set as same as Reservoir and Downstream Water Quality Monitoring. **Five scientific articles** relating to GHG emission in NT2 project are published.

Village Water Supply and Water Quality

New cycle of borehole monitoring started in 2018. Up to June 2019, a total of 315 of 827 boreholes (38%) of total in-use boreholes installed by NTPC since construction period are monitored. Monitoring results of groundwater for Village Water Supply in 2019 are:

- i) Q1_2018: 90 boreholes (including 16 fixed boreholes, see **Annex 7**) were monitored, 34 BH in Nakai Resettlement area and 56BH in Downstream Program area.
- ii) Q2_2018: 85 boreholes (including 16 fixed boreholes, see **Annex 7**) were monitored, 37 BH in Nakai Resettlement area and 48BH in Downstream Program area.

Monitoring period	Exceedances	Actions
Q1_2019	-Nitrate exceedance at 1BH at Xebangfai	The monitoring results have shared with Nam Saat of concerned district by issuing an official notification letters and the Nam Saat has responsibility for communicating to local consumers regarding the recommendation of this exceedance.
Q2_2019	-Nitrate exceedance at 2BH at Nongbok	

Laboratory QA/QC for Water Quality Testing

To maintain the quality of laboratory and staff, AE Lab continued to conduct the QA/QC plan for internal QA/QC (method blank analysis, blind samples analysis, Quality Control Chart and method comparison) and external QA/QC laboratory.

From January to June 2019, AE Lab staff participated to the blind samples' analysis for Total Suspended Solid and Total Phosphorus. All testing results were in the acceptance range.

3.3 Hydrobiology monitoring**3.3.1 Obligations**

Reference related to CA obligation and the 4th Service Agreement between NTPC and EDF, the monitoring are conducting for biological production parameters in reservoir ([Chl a] and fish) and rivers (aquatic invertebrate and fish).

3.3.2 Main outputs until June 2019

Routine monitoring conducted according to the CA and in the framework of the 4th Service, hydrobiology program realized in first semester of 2019 as following:

- (i) Routine monitoring for main Aquatic Group ([Chl a] in reservoir);
- (ii) Field sampling for Aquatic Invertebrate monitoring for 2019 in April; and
- (iii) Fish Population Monitoring was conducted for end of Warm-Dry Season (WDS) 2019.

Fish Population Monitoring

Nam Theun Downstream of Nakai Dam

The fish population monitoring (FPM) is continued to monitor by seasonally basis in the area. During the first semester of 2019, only one mission was conducted for WDS 2019 and its result of the monitoring showed (**Figure 4**):

- Fish population follows seasonal dynamic with an increase in term of abundance and it reached the higher peak in May 2019 compared to previous mission since started the monitoring.
- Taxonomic richness and biomass are more stable since 2013.
- Since 2011 to mid of 2019, biomass fluctuated around 2 kg per catch and taxonomic around 10 species.

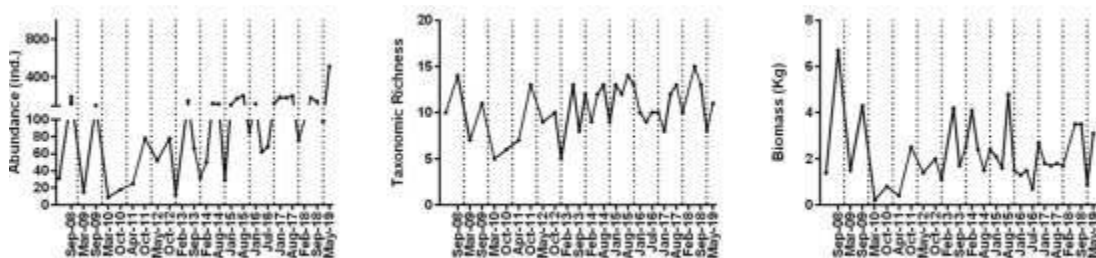


Figure 4 – Fish population parameters (Abundance, biomass & taxonomic richness) at NTH6

Fish Population in the Xe Bangfai

The result of the monitoring at Ban Mahaxai (XBF2) showed (**Figure 5**):

- A trend of an increase in abundance, biomass and taxonomic richness since the COD for a same fishing effort and same station.
- Abundance, biomass and taxonomic richness reached low value in end of 2018 and then slightly increased June 2019.
- Biomass and taxonomic richness showed seasonal peak at the end of the dry season and at the beginning of the rainy season.
- After the COD, the biomass is fluctuated at around 1.5 Kg per catch.

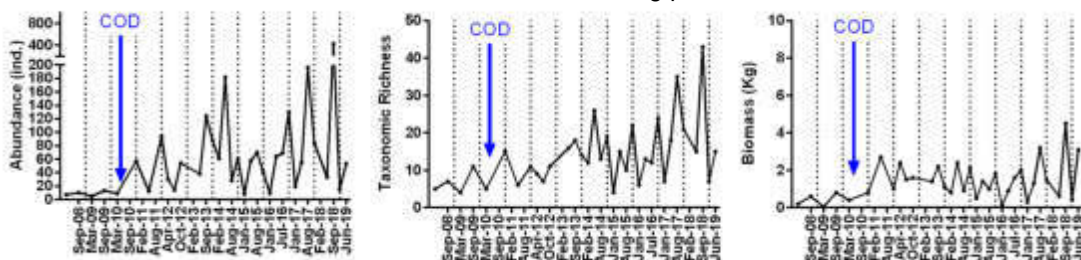


Figure 5 – Fish population parameters (abundance, biomass & taxonomic richness) at Ban Mahaxai

Chlorophyll a [Chl a]

Chlorophyll a concentration showed the same pattern since 2011 (Figure 1. After a higher production in 2010 (trophic upsurge), concentration decreased to reach a stable level in 2011. Concentration showed an annual production peak observed at the end of Warm-Dry (June) and second weaker peak in end of the warm-wet (October). In general, the low concentration of [Chl a] underlined the oligo-mesotrophic level of NT2 Reservoir. In 2018, a high peak observed in August and this was observed at RES08 (**Annex 8 and Annex 9**) and this could be linked to the higher amount of total Phosphorus (0.041mgL^{-1}) which is the main factor for Chlorophyll a concentration. During the first

semester of 2019, [Chl a] showed the same trend with gradual increasing from January to reach the peak in June 2019.

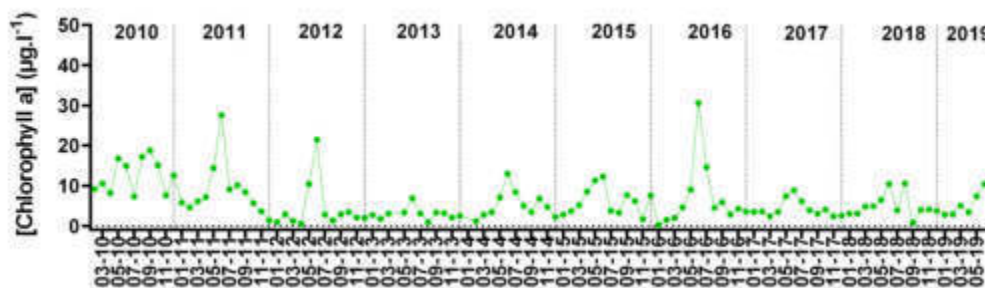


Figure 6 – Monthly average (of all stations) of [Chlo a] ($\mu\text{g.L}^{-1}$) in NT2 reservoir from 2010 to mid of 2019

Aquatic Macroinvertebrate Monitoring

Pictures and maps of the monitoring stations in

Annex 10.

Nam Theun Area

The station on upstream of reservoir (NTH1) and downstream of Nakai Dam (NTH6) composed by the water velocity between 5 – 75 cm/s. The habitat of NTH1 was mainly composed by fine sediment and silt with size less than 2.5 mm while habitat of NTH6 was composed by bed rock. However, both stations' habitat was composed by large size of rock.

Nam Kathang/Gnom Area

The water velocity of monitoring stations in this area was dominated between 5 – 75 cm/s. Their habitats were composed mainly by sand, silt and rock of small size to large size. Some stations present emerged spermatophyte.

Xe Bangfai Area

This area is rapid water velocity and at the river body the water current could be higher than 150 cm/s. However, the water velocity of sampling points is ranged between 5 – 75 cm/s. The substrate was mainly dominated by sand and silt. The station in the upstream of confluence of Xe Bangfai river and downstream channel presented the development of algae.

3.4 Biodiversity Program

3.4.1 Obligations

References related to CA Obligations - Volume 2A, Schedule 4, Part 2, Subject 9: 4, 9, 12, 14, 15, 16, 18, 19, 20.

3.4.2 Main outputs until June 2019

Elephant Program

Human Elephant Conflict (HEC) Monitoring and Mitigation

5 HEC incidents occurred during January to June 2019. All incidents are related to property only. 3 incidents related to Thalang Group and 2 incidents related to Dtong Group (**Figure 7**). Unfortunately, during the first semester of 2019 there were two dead elephants found in area of NN-NP. The first case was found in February at the border of NN-NP and PHP-NPA (UTM 0482988 E; 1992185 N). Through the investigation, the dead elephant was caused by hunting and the second time was found in April at Kalo Stream (UTM 535569 E; 1962236 N), approximately to 600m far from Nam Theun River. After the investigation of concerned parties, the dead elephant was a juvenile of the age between 2 – 3 years old and it was naturally dead. As a result, in order to prevent the illegal wildlife hunting, including the elephant inside the protected area, the Nakai DAFO will increase a frequency of field mission to conduct a patrolling every two months.

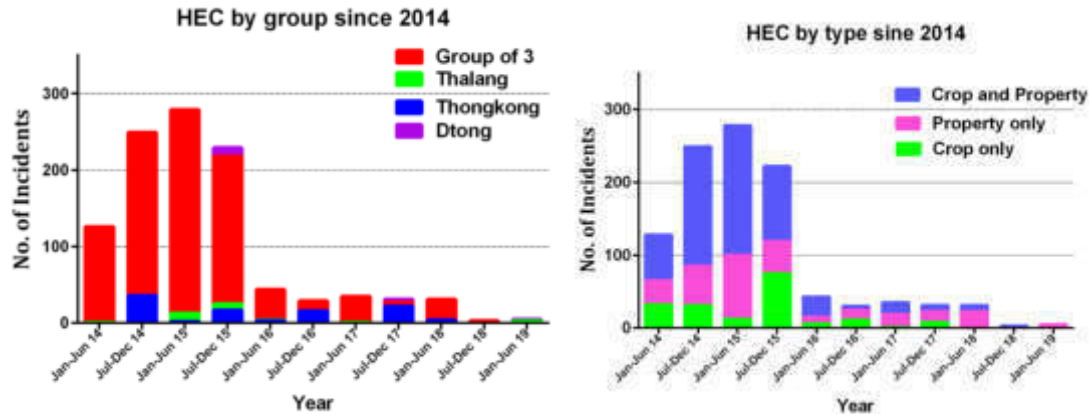


Figure 7 – HEC incidents in bi-annual since 2014 (by group and by type)

Solutions for the Group of Three Elephant at Vilabouly District, Savannakhet Province

In early 2018, the GPS collar was installed to a sub-adult of wild elephant from Phou Xang Hair NPA which is travelled together with the Group of Three elephant, since then a movement of elephant could be followed up by a satellite, the GPS collar has stopped uploading information in August 2018 until February 2019. To find out the root cause of missing the information from the GPS collar, the camera traps were installed in Phou Xang Hair area to observe the target group of elephants. Recent picture captured by camera shown that GPS receiver and its antenna were damaged. A collar replacement was requested and planned to be conducted in November-December 2019, the mission will be involved by all concerned parties (central level, provincial and district authorities, including NTPC staff). Up to end of June, all necessities authorize documents as well as budget cost for conducting the mission are on processing.



Figure 8 – Collared elephant captured by camera trap in February 2019

Artificial Mineral Lick Replenishment (AMLs) and its monitoring for Jan-Jun 2019

The mission was set to be conducted two times per year (before and after wet season). The first mission (Dry season) was performed in February. The mineral salts, including of NaCl: 902 kg, NaH₂PO₄: 459 kg, CaCO₃: 154 kg and KCl: 65 kg were used for refilling the mineral licks. Two types of monitoring activities were put in place to monitor of the wildlife visitation to all mineral licks.

- (i) the camera traps were set one time from January to June 2019 for a duration of one month; and
- (ii) the site observations were done in every two months. Through the monitoring, it was found that elephant visited all AMLs in zone 3. Furthermore, wild ungulate found using AMLs, except AML 3/18. The human acts still found in all AMLs and cattle found using all AMLs in zone 2 and zone 3 (**Annex 11** and **Annex 12**).

Invasive species survey and destruction

Two rounds were conducted for first semester of 2019 (in February and April 2019). Through the survey and destruction, approximately to 46,507 of adult trees and 132,110 seedlings were found and destroyed. The activities were still focused on resettled villages and agriculture area (**Annex 13**).

Chinese Swamp Cypress conservation program

Since the end of 2017, there were more than 1,300 seedlings of Swamp Cypress were successfully germinated. In May 2019, a total of 279 seedlings have been planted in 3 locations in Nakai Plateau and NN-NP (**Annex 14**).

- (i) 136 seedlings were planted in reservation area in Oudomsouk village;
- (ii) 37 seedlings were planted at Phonsa-ard village, Khamkeut district; and
- (iii) 106 seedlings were planted at Khoun Houy Heo, Dteung Cluster (inside NN-NP).

3.5 Environment Compliance Program

3.5.1 Obligations

References related to CA Obligations - Volume 2A, Schedule 4, Part 2, Subject 9: 35, 39 and Volume 2A, Schedule 4, Part 1, 15.1(b): (i), 2.2.

3.5.2 Main outputs until June 2019

NTPC Waste management facility

Since January 2018, The NTPC solid waste facility in Gnommalath district is performed by a new sub-contractor (PKC Co., Ltd) under a strictly management by NTPC. The solids wastes are still well-separated at source into the 4 separated bins (general waste, composite waste, recyclable waste and hazardous waste). The solid wastes from all NTPC working/accommodation areas (RNT, Powerhouse, NRC, WGH, Nongboua boat camp and Dam Site) were then transported to landfill for the further process. The recyclable wastes are sold to the local traders. The food wastes are used for fertilizer (Effective Micro-organism (EM)) and it is on trial process. The hazardous wastes are well stored in the close building where the access is restricted, and the general wastes go into the waste cell. As of June 2019, about 25% of in-use waste cell (waste cell No. 7) was filled.

Landfill observation borewell

Groundwater quality monitoring in the 9 monitoring wells (5 of the existing ones and 4 of the new installation) around the NTPC landfill is performed on monthly basis. Guideline exceedances in some parameters (pH, BOD, COD and Lead) can be observed sometime. In 2019, no contamination of Lead was revealed at those 9 wells (**Annex 15**). However, the Bennett pump was out of service since April due to the technical issue and it was sent to the assembly factory in USA for maintenance since then. The monitoring will be continued until end of December 2019; however, the groundwater quality monitoring at Landfill will continue until end of the CA.

NTPC Wastewater Treatment Management (Black and Grey Wastewater)

Since January 2019, the NRC camp has been handed over to Nakai district and the monitoring of effluent discharged from this camp was terminated. Furthermore, the additional wastewater treatment at RNT was constructed which has used the same design as the existing one (loading capacity of 120 m³/day), the construction work and its system test was completed at the end of 2018 and it started to operate in early 2019, in parallel with first plant the new treatment unit at RNT, so the monitoring of the effluent discharged from plant also started since then.

Up to date, effluent from all 5 wastewater treatment plants (3 Black wastewater treatment at RNT and Powerhouse and 2 Grey wastewater treatments at Wooden Guesthouse and Nongboua) are routinely monitored in monthly basis. The effluent guideline exceedances have been observed sometime in some parameters (BOD, COD, TSS and Faecal Coliform Bacteria) (**Annex 16** and **Annex 17**).

- **Environment site inspections and monitoring**

As part of Environment Department, the Environmental Compliance team continue to fulfil its role of undertaking the audits, inspections and monitoring of all facilities to ensure compliance with NTPC environmental guidelines and Lao PDR law.

Total of 79 environmental inspections at all NTPC sites were conducted from January to June 2019. The number of environmental inspections for special missions from January to June 2019 was 18 missions (**Annex 18**)

- **Environment incident management**

There are 6 Environmental incidents were reported during January to June 2019 as shown in **Figure 9** by level classifying:

- Level 1 – Minor Environmental Pollution
- Level 2 – Significant Environmental Pollution
- Level 3 – Serious Environmental Pollution
- Level 4 – Major Environmental Pollution
- Level 5 – Catastrophic Environmental Pollution

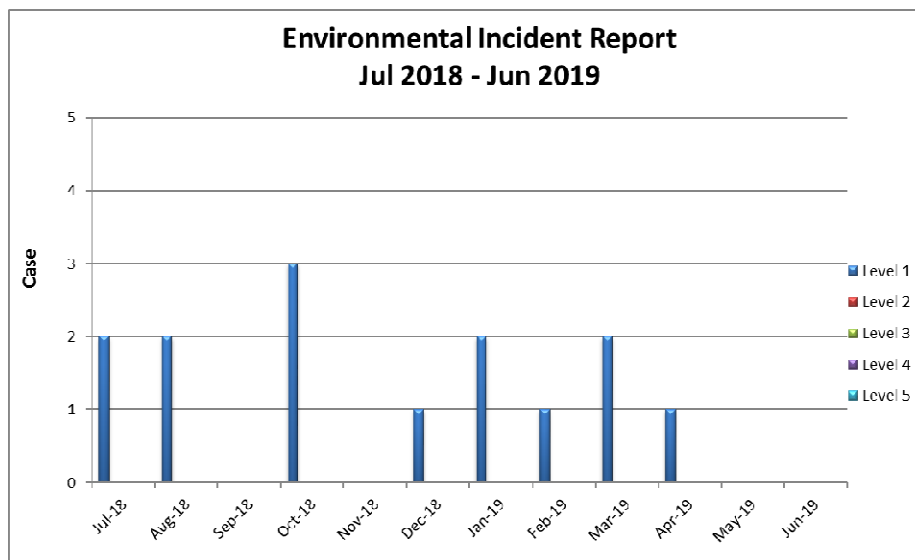


Figure 9 - Environment Incident Reports during July 2018 to June 2019

Corrective and preventive actions for the reported environment incidents are clarified in **Annex 19**

- **Environment awareness programs**

Awareness training

The environmental training was conducted for both NTPC staff and contractor from January - June 2019 (**Annex 20**).

- NTPC Staff: 49 persons for induction training
- NTPC staff housewives: 19 persons for yearly refresh training.
- NTPC's Contractor: 267 persons for induction training and 85 persons for refresh training.

The training assessment was performed via quiz, question, game and real practice on waste management with good participation from participants.

Environment awareness program - Plastic bag usage reduction

Since 2013, the program has included into a yearly implementation of Health, Safety and Environmental Improvement Programs(HSEIP). In 2019, two main camps (RNT and WGH) were included to the plastic bag usage reduction campaign (HSEIP#13 of NTPC-M-B150303-0020) (**Annex 21**).The yearly reduction percentage of 2019 was set at 5% (this number is based on the limitation of reduction, the plastic bag are needed in some case such as waste collection and waste delivery).Below are the current situation of the program:

- **RNT:** The total consumption is decreased compared to the previous year (1,322 packs in January to June 2019 and 1,802 packs in January to June 2018). The trend of changes are shown in Figure 10.

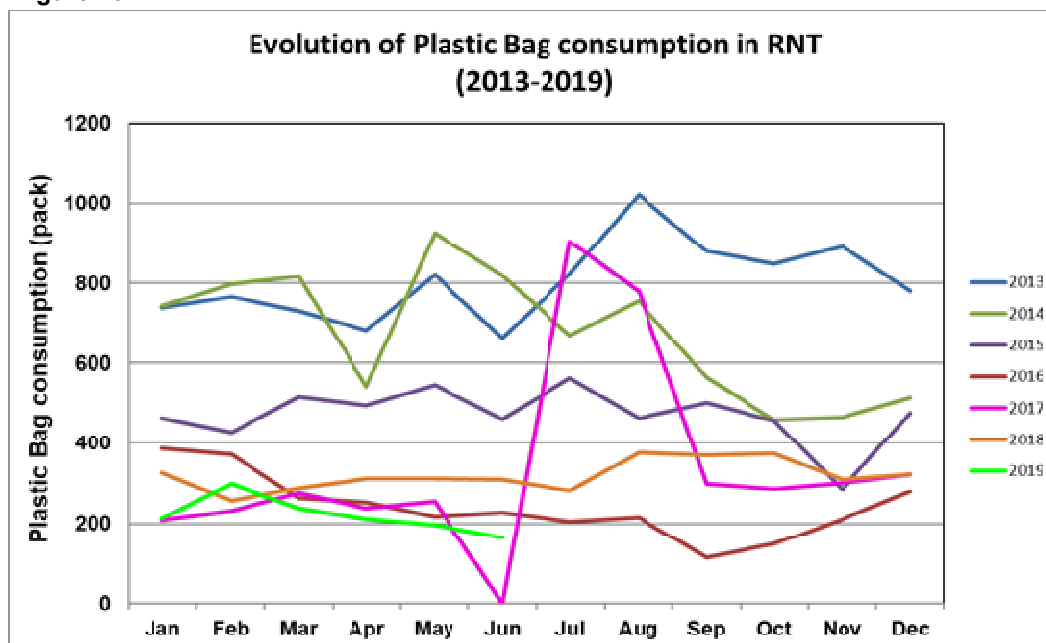


Figure 10 – Monthly Plastic Bag consumption in RNT (2013-2019)

- **WGH:** the Wooden guesthouse are opened for permanent residents of company (interns, consultants and staffs) since January 2019 (after the closure of NRO camp), the monthly record from WGH has started and there are about 161 packs of plastic bag used in WGH up to June 2019 (Figure 11)

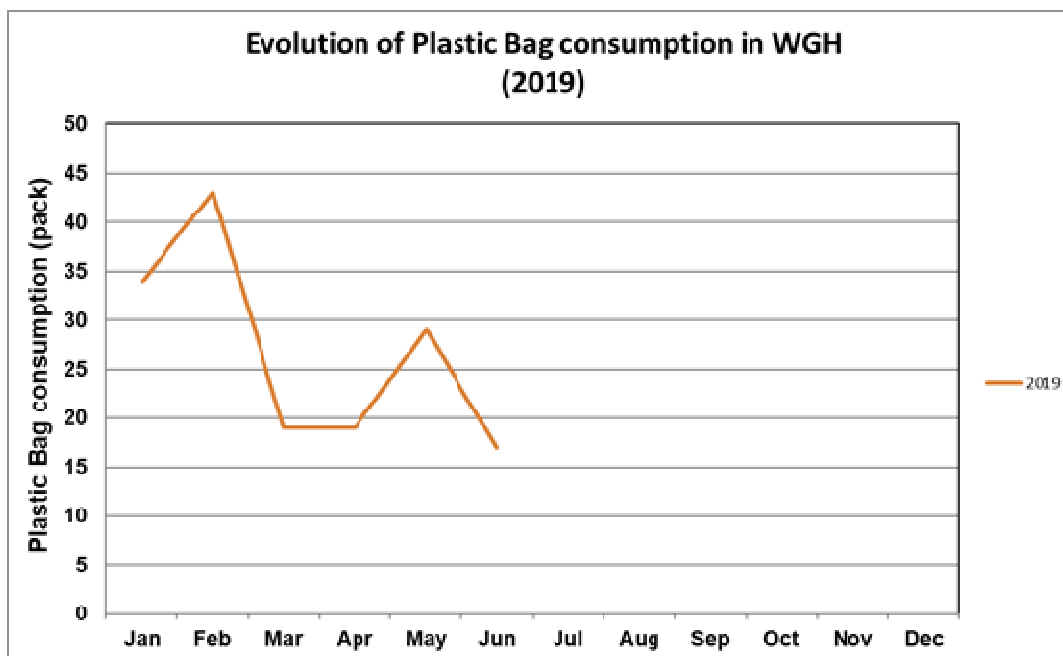
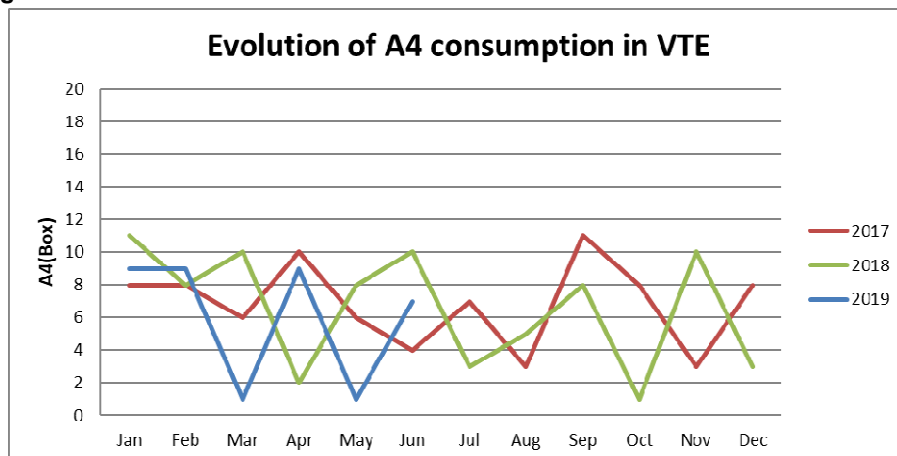


Figure 11 - Monthly Plastic Bag consumption in WGH (2019)

Environment awareness program - Paper usage reduction

This program was launched since 2017 to record the paper consumption from all offices. In 2018, the yearly target was set 15% compared to data collecting in 2017.

In 2019, the target of paper usage reduction is set at 5% compared to year 2018. Based on the data collected, the paper usage depends on the needs of users and only the A4 type was used regularly and easy make comparison each period. The graph below showed the evolution of A4 consumption, the most common paper type regularly used. The usage trends for each offices (VTE, RNT and Powerhouse; no data for NRO after the RIP closure) illustrated the same range of consumption during 2.5 years of monitoring(2017 to June of 2019) Figure 12.



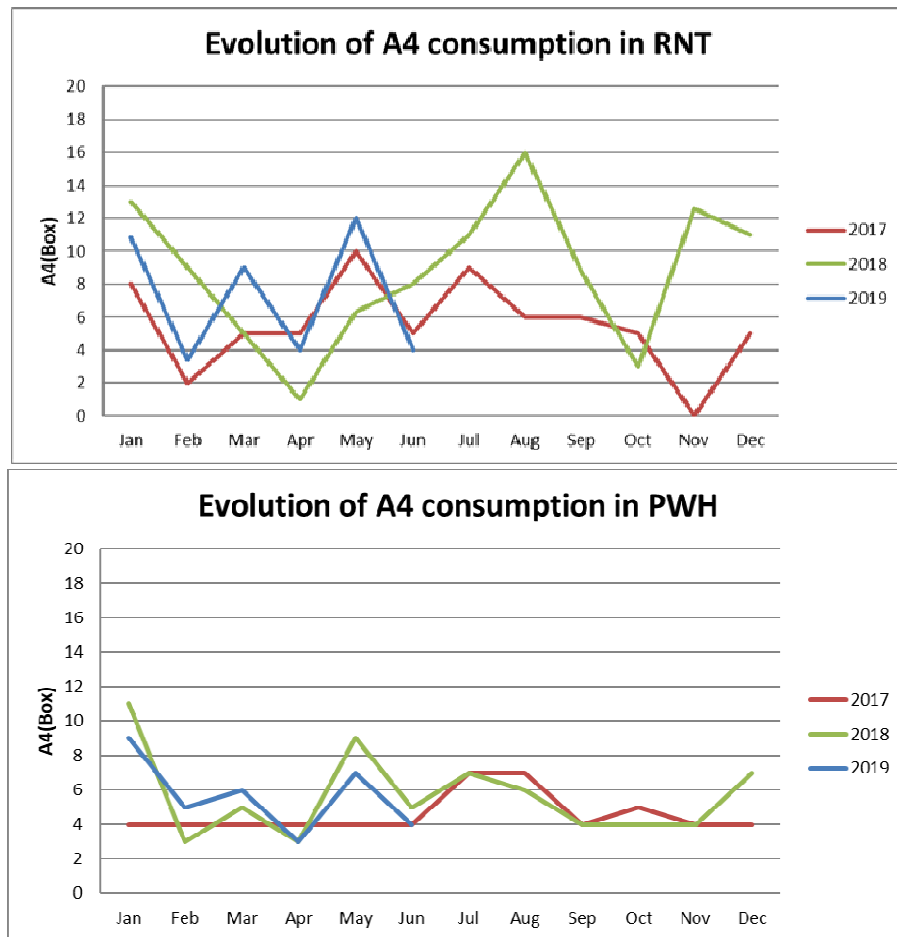


Figure 12 – The evolution of A4 paper usage at 3 offices

- **Supporting of Gnommalath District Solid Waste Management**

In February, NTPC has co-operated with Gnommalath DoNRE to organize a big cleaning day at district landfill. The company also supported a budget for repairing of HDPE liner of the waste cell which was damaged by villagers. About 70 m² was re-sealed in May as well as all the waste left outside (by local people) has properly been moved into the waste cell. To increase the efficiency of the waste segregation and secure the area, a guard was hired by Gnommalath DoNRE to work at the landfill with financial support of NTPC for 6 months(May – October 2019), he has also segregated the waste and to guide other people who come to dump their waste at landfill.

Regarding the implementation of district waste collection, due to the business interest issue, Panidtha Import-Export and Development Environment Sole Co., Ltd denied the proposal of DoNRE. Currently, NTPC is working with GRET, an NGO experienced in community waste management, to conduct the feasibility study on district waste management. This project will also undertake the same study in Nakai district.

- **Supporting of Nakai District Solid Waste Management**

Referred to Company ambitions “For our Communities and Environment”, NTPC has decided to participate in regular education programs regarding waste management plans and service in Nakai Resettlement villages in order to development initiative with the district.

The project of new Nakai Landfill construction started in January 2019. Up to June, about 80% of work is done, under a supervise of Lao Consulting Group (LCG) engineer.

NTPC has been also working with Nakai DoNRE for the Environment Awareness Campaign in 16 resettlement villages (the target groups were: villagers, business owners and students). The 1st event was conducted in January and the program ended in May with 37 campaigns organized in total. Furthermore, company also has contributed a budget to Nakai DoNRE for installing of Environmental Awareness signs in different locations around the district and the work was done in June.

3.6 Erosion Monitoring Program

3.6.1 Obligations

References related NTPC Obligations - Volume 2A, Schedule 4, Part 2, clause 9, Item 11_(e)).

3.6.2 Main outputs until June 2019

Photograph survey is still being conducted, as part of on-going erosion monitoring in the Xe Bangfai (including Total Suspended Solids measurements and Cross Section Survey). This survey also gathers data on erosions in sensitive areas (i.e. temples, school).

The latest Xe Bangfai riverbank survey (the 26th mission) was conducted by the Environment team on 20th and 21st May 2019. 692 locations including 27 indicator sites were monitored: (i) 3 non-indicator sites (at Ban Kengsavang, Ban Yangkham and Ban Natai) showed a slight erosion expansion and; (ii) found 3 new erosion sites (Ban Hatkhamhieng, ban Hatsaisoungneua and Ban Sakong) comparing to the mission of November 2018. The indicator sites were where (i) erosion has been significant; (ii) the site has potential for further erosion; and (iii) the site is located near infrastructure such as bridges, houses, temples or irrigation pumps.

The Cross-Section Survey was implemented in early 2019 by Asean Builder Construction (ABC) company, started by surveying the Bench Mark (BM) points, UXO clearance work and BM points installation. The work was done in May and the survey report is under preparation.

3.7 Implementation of the Environmental Management System

3.7.1 Obligations

Referred to the HSE Legal and Other - Requirements Register (Ref: NTPC M B150302) in the Company's Environmental Management and Monitoring Plan (CEMMP – **Annex 22**).

3.7.2 Main outputs until June 2019

In 28 March 2014, NTPC has been certified on Environmental Management System (ISO 14001) by SGS (Thailand) as Certifying Body under UKAS. On 28th March 2019, a surveillance audit of the system was conducted by Certified Body. In total, 7 Opportunities for Improvement (OFI) were raised with no observation on environmental activities.

4. VISITS AND CONSULTANCIES

During the 1st semester of 2019, there were main activities of visits, audits and consultancies as follows:

- **Environment Management system** – Environment department participated to Surveillance Audit for ISO14001:2015, ISO9001:2015 and OHSAS18001:2007 on 28th March. All the activities of the AE lab, as well as Environment department routine work were audited.
- **Site visit by Faculty of Environment, NUOL** - in February, ~125 students and teachers from Department of Environmental Science and Environment Management (NUOL) visited AE Lab. All

activities related to Environment Department were briefly presented. The visitors are interested in waste management process at Landfill and analytical activities at the AE Laboratory.

- **University of Science and Technology of Hanoi (USTH) mission** - participation of Chemistry team in the field and laboratory work with students and teachers on 24th February to 6th March, the staff participated on:
 - (i) Demonstrating water sampling and profile measurement on reservoir;
 - (ii) Demonstrating laboratory analysis work; and
 - (iii) Students practiced of GHG analysis by using Gas Chromatography for dissolved and ebullition samples.
- **Lab visit:**
 - (i) In January by: Kowepo-Lao International (KLIC) from Xe Pian-Xe Nam Noy Hydropower project, the delegation from MoNRE and the delegation from EGCO Engineering and Service Co.,Ltd (ESCO),Thailand.
 - (ii) In February by Madame Florence Jeanblanc-Risley, the French Ambassador to Lao PDR.
 - (iii) In April by Executive Vice President, Deputy Director of Sustainable Development Division and Chief Financial Officer of the International Division, EDF.
 - (iv)
- **Meeting** with CEO assistant and Mr Arnaud from GRET in May to discuss on action plan to support the feasibility study on the waste management at Gnommalath and Nakai districts.

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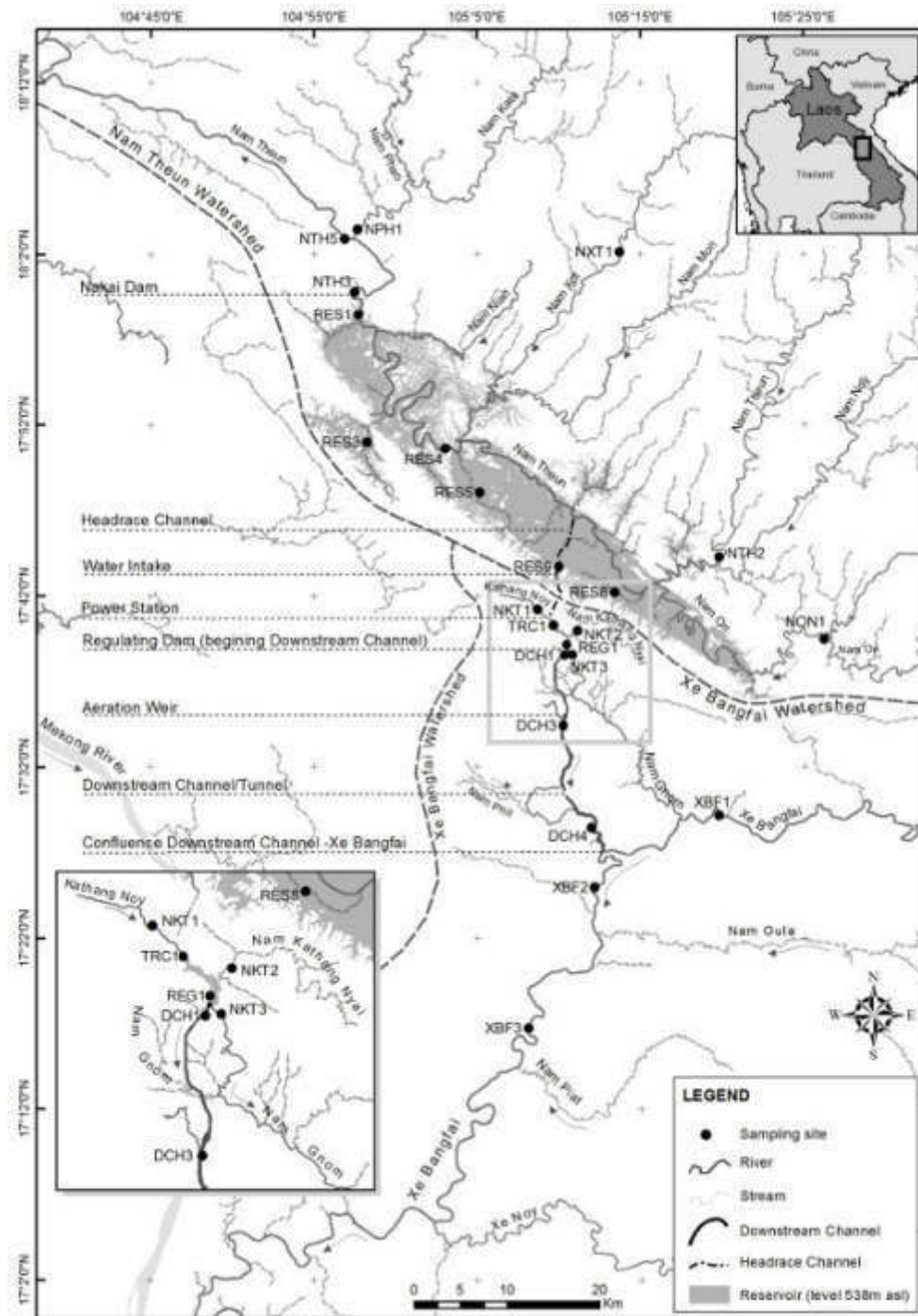
Annex 1 - List of scientific articles relating to Nam Theun 2 Project

Articles	Under review	Approved	Published and online
HYDROECOLOGIE APPLIQUEE – NAM THEUN 2 SPECIAL ISSUE			
Descoux et al. Main features of the Nam Theun 2 hydroelectric project (Lao PDR) and the associated environmental monitoring programme. Hydroeco. appl., 2014			√
Chanudet et al. Evolution of the physico-chemical water quality in the Nam Theun 2 Reservoir for the first 5 years after impoundment. Hydroeco. appl., 2014			√
Chanudet et al. Hydrodynamic and water quality 3D modelling of the Nam Theun 2 Reservoir (Lao PDR): results of simulations of some scenarios. Hydroeco. appl., 2014			√
Martinet et al. Phytoplankton community and trophic status assessment of a newly impounded sub-tropical reservoir: case study of the Nam Theun 2 Reservoir (Lao PDR, Southeast Asia). Hydroeco. appl., 2014			√
Descoux et al. Efficiency of the Nam Theun 2 hydraulic structures on water aeration and degassing. Hydroeco. appl., 2014			√
Cottet et al. Fish Population dynamic in the newly impounded Nam Theun 2 Reservoir (Lao PDR). Hydroeco. appl., 2015			√
Pécastaings et al. Biofilm colonizing the Nam Theun 2 Power Plant Penstock (Lao PDR) - mechanism and potential evolution. Hydroeco. appl., 2014			√
Visser et al. Developing approaches for establishing a fisheries baseline: case-study for Xe Bangfai basin (Lao PDR). Hydroeco. appl., 2014			√
Attwood & Cottet. Malacological and parasitological surveys along the Xe Bangfai and its tributaries in Khammouane Province, Lao PDR. Hydroeco. appl., 2015			√
Streicher U. The Wildlife Rescue Programme of the Nam Theun 2 Hydropower Project (Lao PDR). Hydroeco. appl., 2014			√
Som & Cottet. Turtle and tortoise rescue and monitoring programme in the Nam Theun 2 Reservoir (Laos). Hydroeco. appl., 2015			√
Kottelat. The fishes of the Nam Theun and Xe Bangfai drainage, Laos. Hydroeco. appl., 2015			√
Clavier et al. Spatial and temporal variation of benthic macroinvertebrates in the Nam Gnom Basin receiving discharged waters from the Nam Theun 2 Reservoir (Laos). Hydroeco. appl., 2015			√

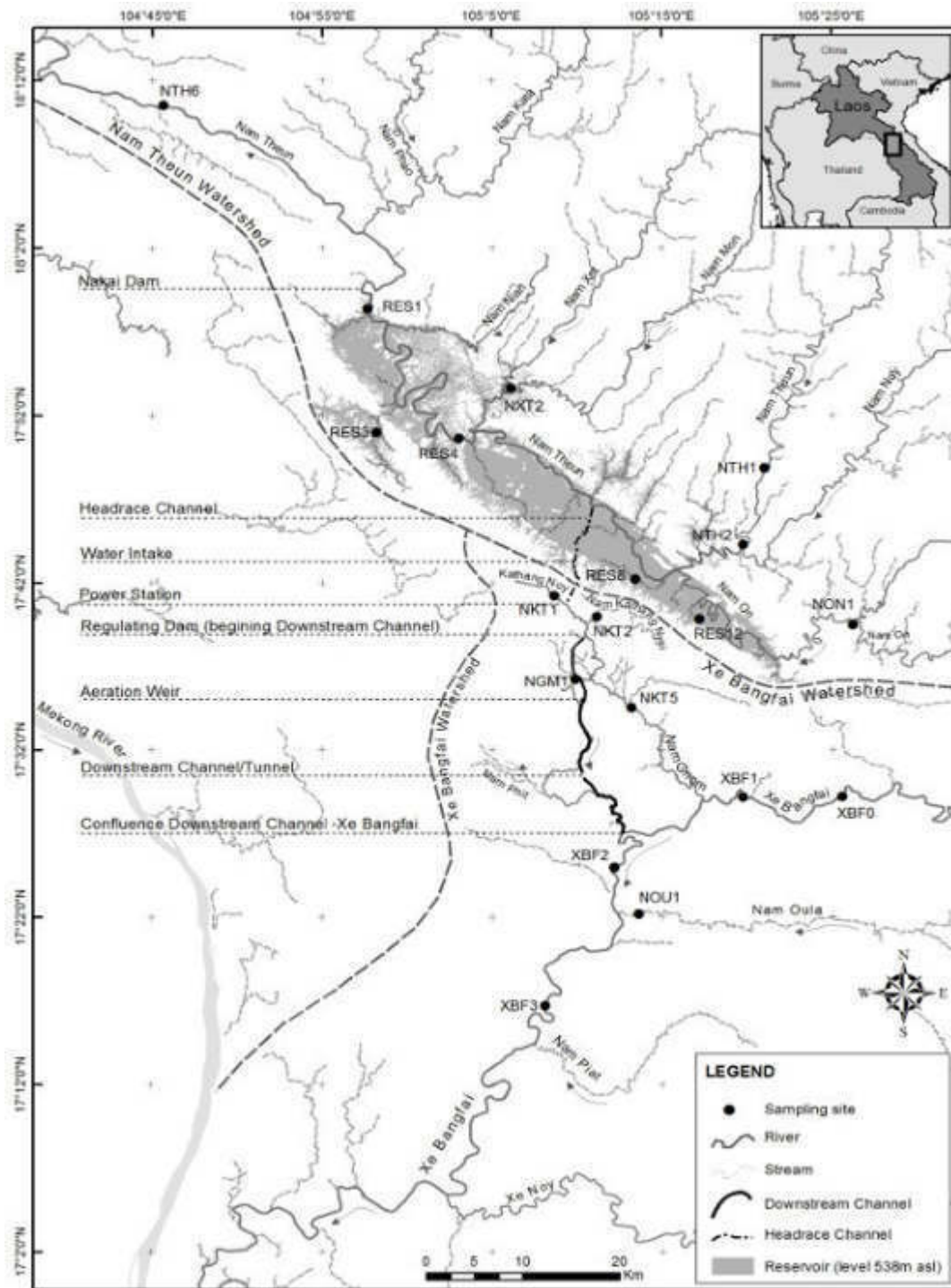
Articles	Under review	Approved	Published and online
Descoux & Cottet. 5 years of monitoring of zooplankton community dynamics in a newly impounded sub-tropical reservoir in Southeast Asia (Nam Theun 2, Lao PDR). Hydroeco. appl., 2015			√
D. Serça et al. Nam Theun 2 Reservoir four years after commissioning: significance of drawdown methane emissions and other pathways, Hydroécol. Appl., 19, 119-146, 2016.			√
GREENHOUSE GAS			
Deshmukh et al. Physical controls on CH ₄ emissions from a newly flooded subtropical freshwater hydroelectric reservoir: Nam Theun 2 Biogeosciences Discuss., 11, 3271-3317, doi:10.5194/bgd-11-3271-2014, 2014.			√
Deshmukh, C., Guérin, F., Labat, D., Pighini, S., Vongkhamsoo, A., Guédant, P., Rode, W., Godon, A., Chanudet, V., Descoux, S., and Serça, D.: Low methane (CH ₄) emissions downstream of a monomictic subtropical hydroelectric reservoir (Nam Theun 2, Lao PDR), Biogeosciences, 13, 1919-1932, 2016.			√
F. Guérin et al., Effect of sporadic destratification, seasonal overturn and artificial mixing on CH ₄ emissions at the surface of a subtropical hydroelectric reservoir (Nam Theun 2 Reservoir, Lao PDR). Biogeosciences. 22 June 2016			√
M. Adon, C. Galy-Lacaux, D. Serça, P. Guedant, A. Vongkhamsoo, W. Rode, Y. Meyerfeld, F. Guérin: First assessment of nitrogen deposition budget following the impoundment of a subtropical hydroelectric reservoir (Nam Theun 2, Lao PDR). Atmospheric Chemistry and Physics			√
C. Deshmukh et al., Carbon Dioxide emissions from the bottom and shallow Nam Theun 2 Reservoir: drawdown area as a neglected pathway to the atmosphere. Biogeosciences		√	
LIMNOLOGY			
Martinet et al. Phytoplankton functional groups for ecological assessment in young sub-tropical reservoirs: case study of the Nam-Theun 2 Reservoir, Laos, South-East Asia. Journal of Limnology, doi:10.4081/jlimnol.2014.958, 2014.			√
Pedrono et al. Seasonal algal community succession in epixylic biofilms in a tropical meso-oligotrophic shallow reservoir, Nam Theun 2 (Lao PDR). Journal of Limnological		√	
FISH and FISHERIES			
Cottet et al. Total iron concentrations in waters and fish tissues in the Nam Theun 2 Reservoir area (Lao PDR). Environmental			√

Articles	Under review	Approved	Published and online
and Monitoring Assessment.			
Tessier et al. Fish assemblages in large tropical reservoirs: overview of fish population monitoring methods. Journal of Fisheries Sciences and Aquaculture.			√
A. Tessier, J. Guillard, V. Chanudet & M. Cottet: Length-weight relationships of 8 Asian freshwater fish species from Nam Theun 2 Reservoir (Lao PDR)			√
M Cottet & T. Visser: Fish catch and fishing practices in the Nam Theun 2 Reservoir and watershed (Lao PDR)			√
Hughes et al. Combination of direct fishing and indirect e DNA metabarcoding monitoring during a 3 years survey significantly improves the fish biodiversity report around a South East Asian reservoir.			√
A.Tessier et al., Low input of the pelagic zone of a large tropical neo-reservoir to fisheries		√	
Tessier, et al. Life history traits of the exploited Nile Tilapia (<i>Oreochromis niloticus</i>) in a subtropical reservoir (Lao PDR)			√
A.Tessier, et al. Life history and exploitation of <i>Hampala macrolepidota</i> in the Nam Theun 2 reservoir, Lao PDR	√		
D. Beaune, et al. Population dynamics of the Nile Tilapia in a large Asian reservoir: Length-at-age versus length frequency distribution growth analyses	√		
E. Baran et al. Developing a fishery in a subtropical reservoir-experience from Nam Theun 2 Dam in Lao PDR	√		
GENERAL ENVIRONMENT			
Descoux at al., 2011: Co-assessment of biomass and soil organic carbon stocks in a future reservoir area located in Southeast Asia. Environmental Monitoring and Assessment			√

Annex 2 – Water quality monitoring stations from May 2017 to April 2023



Annex 3 – Hydrobiology monitoring stations from May 2017 to April 2023



Annex 4 – Parameters to be monitored from May 2017 to April 2023

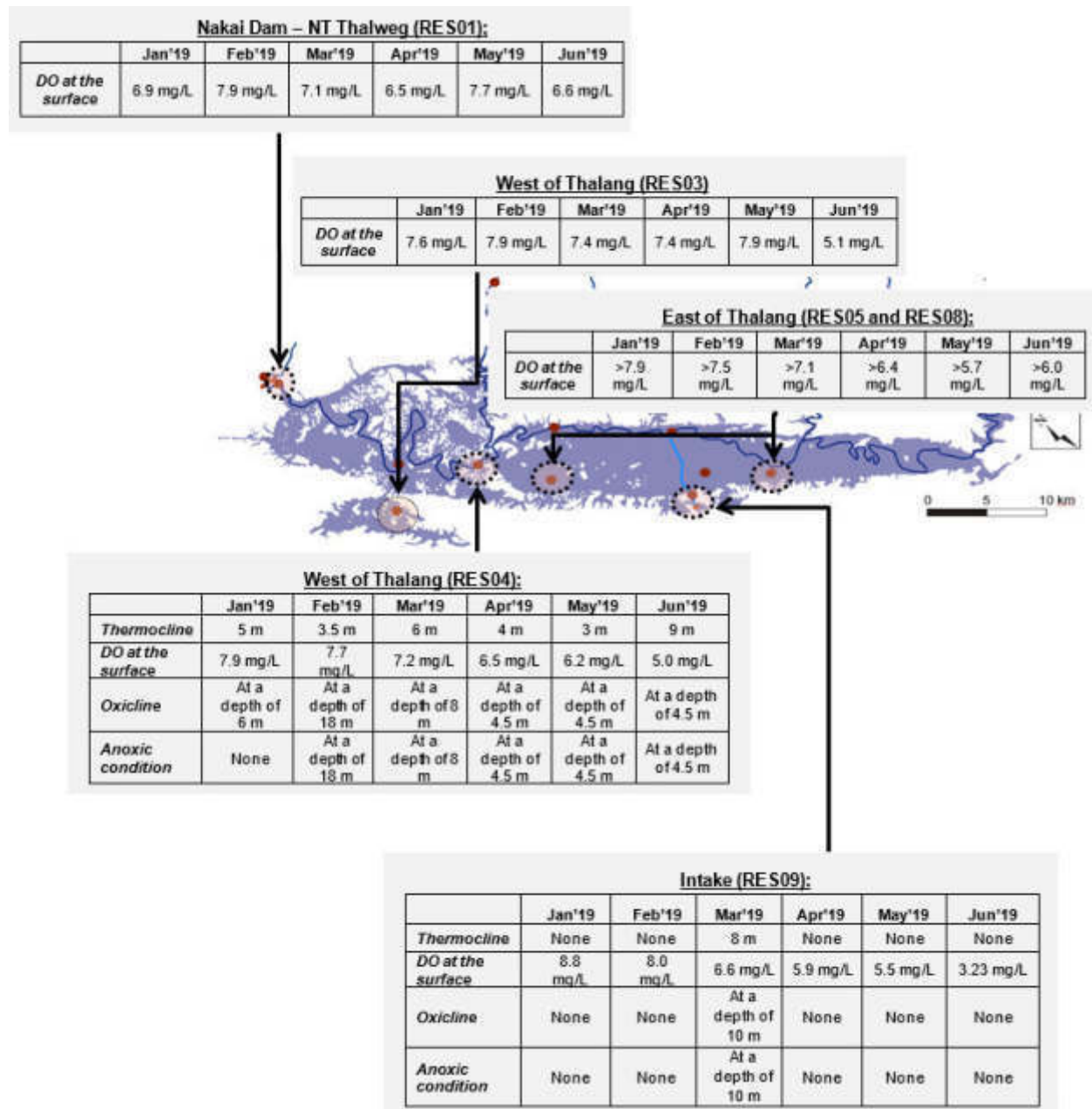
Number	Group	Parameters
1	In situ	Total Depth, Temperature, pH, Dissolved Oxygen, Turbidity, Conductivity, Transparency
2	Carbon budget	Dissolved CH ₄ , Dissolved CO ₂ , Total Organic Carbon, Total Carbon, Total Inorganic Carbon (Calculation), Total Alkalinity
3a	Other major parameters	BOD, TSS, Total N, Total P, Fe II, Fe III, Total Dissolved Iron, Dissolved Silica
3b	COD	COD
4	Anions and Cations	Potassium, Sodium, Calcium, Magnesium, Ammonium, Phosphate, Sulfate, Chloride, Nitrite, Nitrate, Fluoride
5	N₂O	Dissolved N ₂ O
6	Gas fluxes (bubbling)	Bubbling CH ₄ , CO ₂
7	Chlorophyll a	Chlorophyll a
8	Benthic macroinvertebrates	Number and identification of specimen per family (per genus or species whenever possible)
9	Fish	Number, identification, size, weight, sex and maturity of specimens per net, species and stomach content
10	Fish flesh for Hg	Mercury (Hg) measurement

Annex 5 – Frequencies and stations of the measurements in May 2017 to April 2023

Group of Stations		Frequencies			
		Monthly	By 3 seasons	Biannual	Annual
Nam Theun River and Tributaries	NTH3	1, 2, 3a, 3b, 4, 5	-	-	-
	NTH5	1, 3a, 4	-	-	-
	NTH6	-	9	10	8
	NPH1	1, 3a, 4	-	-	-
	NXT1	1, 2, 3a, 4, 5	-	-	-
	NXT2	-	9	-	-
	NTH2	1, 2, 3a, 4, 5	9	10	-
	NON1	1, 2, 3a, 4, 5	9	10	-
	NTH1	-	9	10	8
Reservoir	RES1 (1)	1, 2, 3a, 3b, 4, 5, 7	9	10	-
	RES3 (1)	1, 2, 3a, 4, 5, 7	9	10	-
	RES4 (6)	1, 2, 3a, 4, 5, 7,	9	10	-
	RES5 (1)	1, 2, 3a, 4, 5	-	-	-
	RES8 (1)	1, 2, 3a, 4, 5, 7,	9	10	-
	RES9 (3)	1, 2, 3a, 3b (3), 4, 5	-	-	-
	RES12	-	9	10	-
	3 bubbling stations	6(6 missions /year)			
Civil Works	TRC1	1, 2, 3a, 4, 5	-	-	-
	REG1 (3)	1, 2, 3a, 3b (1), 4, 5	-	-	-

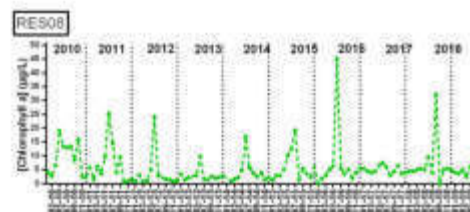
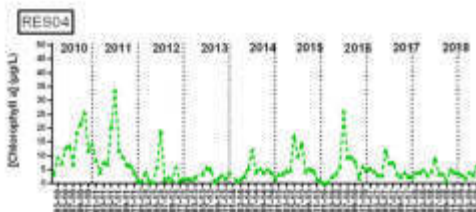
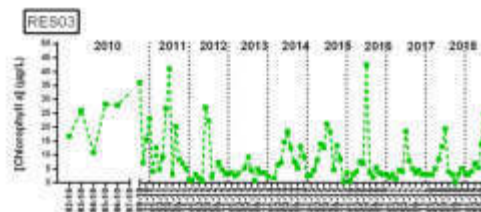
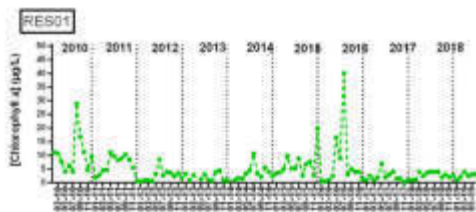
Group of Stations		Frequencies			
		Monthly	By 3 seasons	Biannual	Annual
	DCH1	1, 2, 3a, 3b, 4, 5	-	-	-
	DCH3	1, 2, 3a, 4, 5	-	-	-
	DCH4	1, 2, 3a, 3b, 4, 5	-	-	-
Nam Kathang	NKT1	1, 2, 3a, 4, 5	-	-	8
	NKT2	1, 2, 3a, 3b, 4, 5	-	-	8
	NKT3	1, 2, 3a, 3b, 4, 5	-	-	-
	NKT5	-	-	-	8
	NGM1	-	-	-	8
Xe Bang Fai	XBF0	-	9	-	8
	XBF1	1, 2, 3a, 3b, 4, 5	9	10	8
	XBF2	1, 2, 3a, 3b, 4, 5	9	10	8
	XBF3	1, 2, 3a, 4, 5	9	-	-
	NOU1	-	9	-	-

Annex 6 – Water Quality in the Reservoir January to June 2019



Annex 7 – The 16 fixed boreholes are the most frequently used by villagers in 6 districts

District	Village	Site Code	Village & Borehole No
Gnommalath	Ban Nongping	GML01003	Nongping BH3
	Ban Khoksavang	GML13105	Khoksavang BH5
Nakai	Ban Nakai Neua	NAK0113	Nakai Neua BH13
	Ban Nong Boua Kham	NAK0911	Nong Boua Kham BH11
	Ban Thalang	NAK1310	Thalang BH10
	Ban Nong Boua	NAK1606	Nongboua BH6
	Ban Sop On	NAK1915	Sop On BH15
Mahaxai	Ban Mahaxai	MHX02410	Mahaxaitai BH10
	Ban Pova	MHX02609	Povatai BH9
Xebangfai	Ban Kuase	XBF03708	Kuase BH8
	Ban Dangtha	XBF04204	Dangtha BH4
Xaiboulee	Ban Khamsavang	XBL03901	Khamsavang BH1
	Ban Thaphoxai	XBL07802	Thaphoxai BH2
	Ban Thakharm	XBL07902	Thakharm BH2
Nongbok	Ban Sorkbor	NBK05307	Sorkbor BH7
	Ban Hatxiengdee	NBK05902	Hatxiengdee BH2

Annex 8 – Chlorophyll a concentration by station

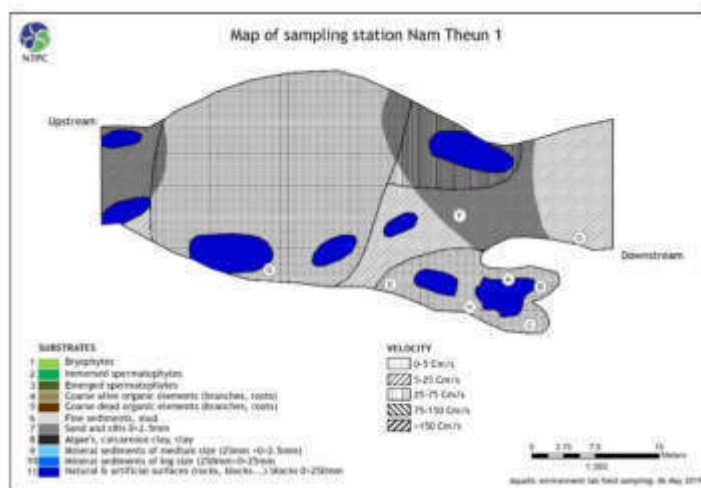
Annex 9 – Reference of Chl a result at RES08

- (i) Normally in August (high water level in NT2 reservoir) the concentration of Phosphorus is ranged between 0.01-0.036 mg.L-1 since 2012, but in August 2018 Phosphorus' concentration could reached 0.041 mg.L-1
- (ii) BZ. Pan *et al.* Factors Influencing Chlorophyll a Centration in the Yangtze-Connected Lake Fresenius Environmental Bulletin, PSP Volume 18 – No 10.2009

Annex 10 – Maps and pictures of Aquatic Invertebrate monitoring stations

Nam Theun Area

Nam Theun (NTH1)

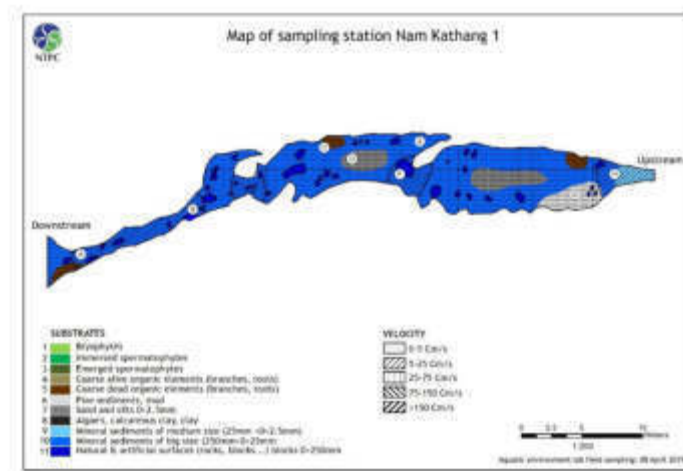


Nam Theun (NTH6)

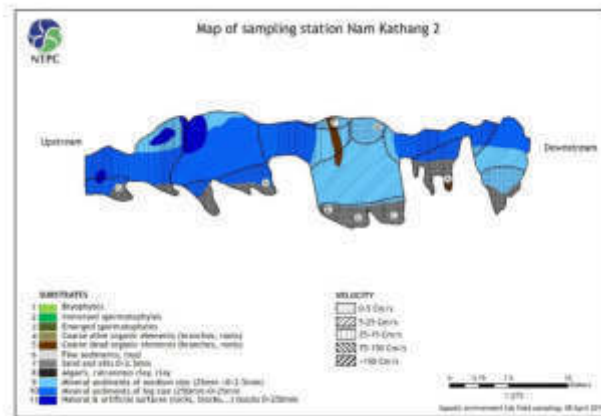


Nam Kathang/Gnom Area

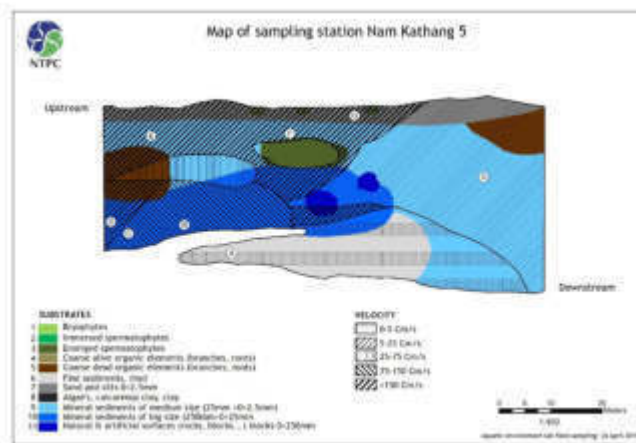
Nam Kathang (NKT1)



Nam Kathang (NKT2)

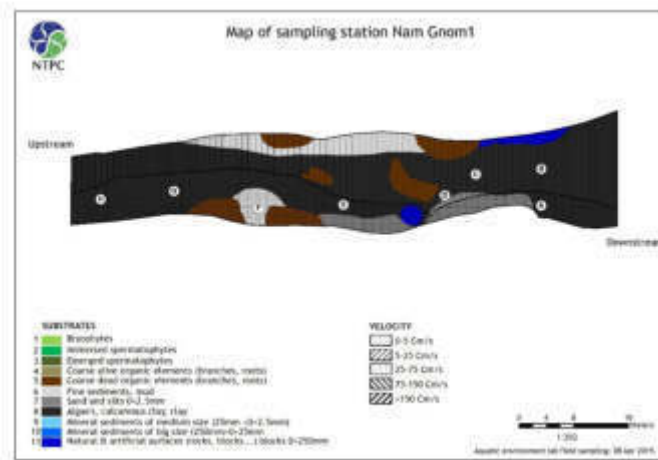


Nam Kathang (NKT5)





Nam Gnom (NGM1)



Xe Bangfai Area

Xe Bangfai (XBF0)



Xe Bangfai (XBF1)



Xe Bangfai (XBF1)

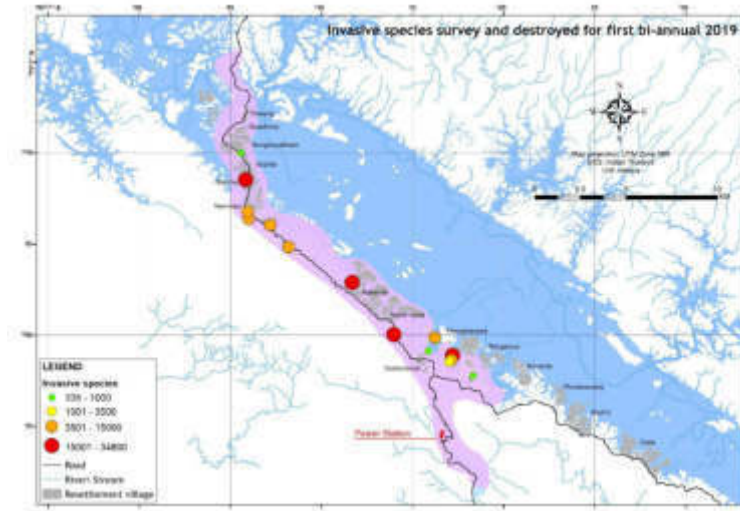


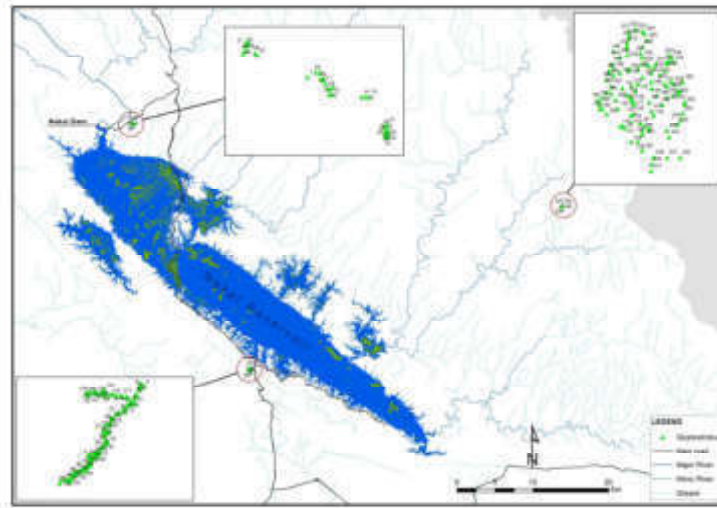
Annex 11 – Picture of AMLs monitoring result by camera trap



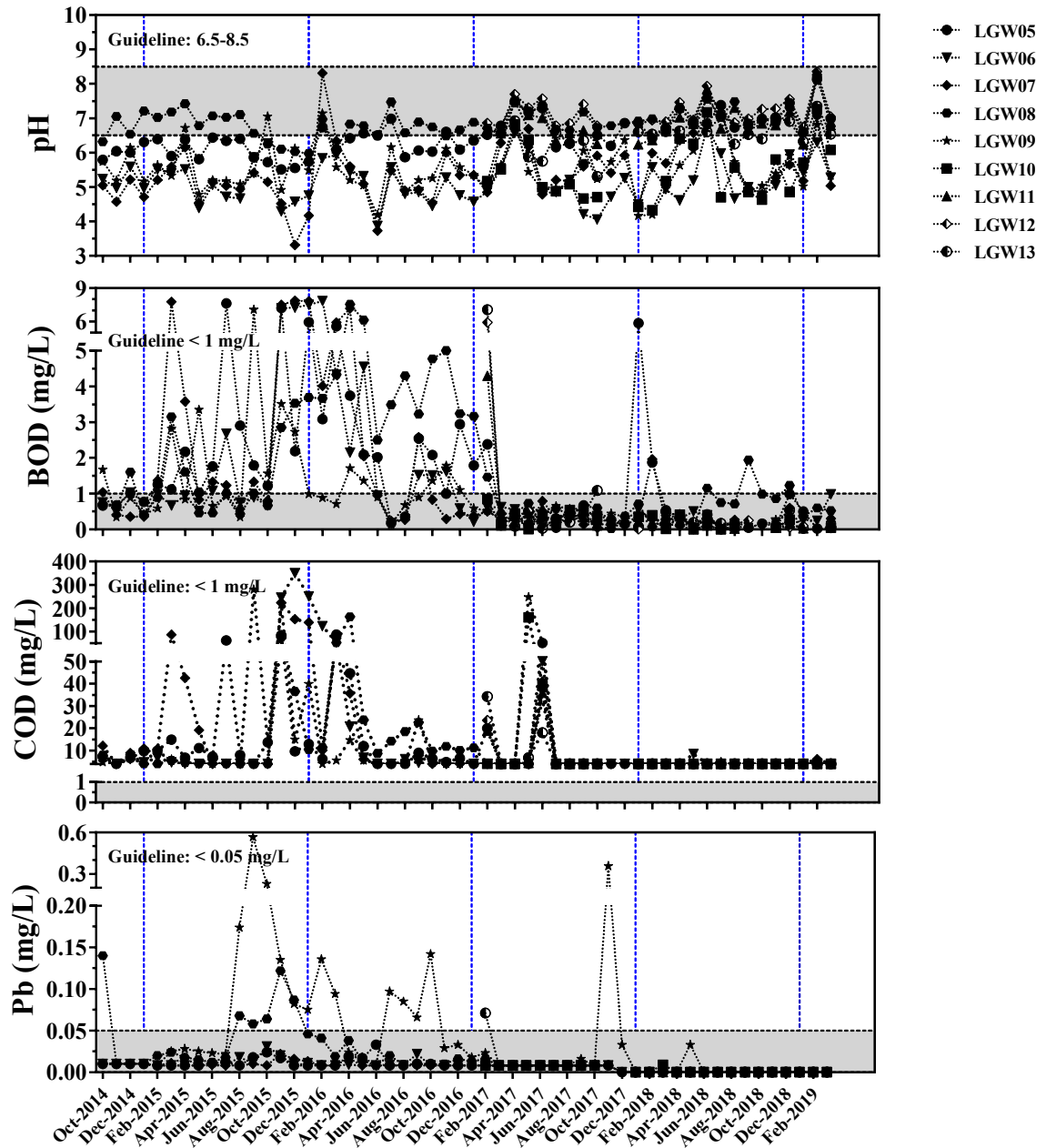
Human
act
evidences**Annex 12 – AMLs' monitoring result during January to June 2019**

Sites (zone/No. of AML)	EPE	HAE	CE	OUE	
1/5	0	1	0	1	AML: Artificial Mineral Lick EPE: Elephant Evidence HAE: Human Activities Evidence CE: Cattle Evidence OUE: Other Wild Ungulate Evidence 0 = No evidence of animal visitation 1 = Evidence of animal visitation
1/9	0	1	0	1	
1/19	0	1	0	1	
2/7	0	1	1	1	
2/16	0	1	1	1	
3/18	1	1	1	0	
3/19	1	1	1	1	
3/23	1	1	1	1	

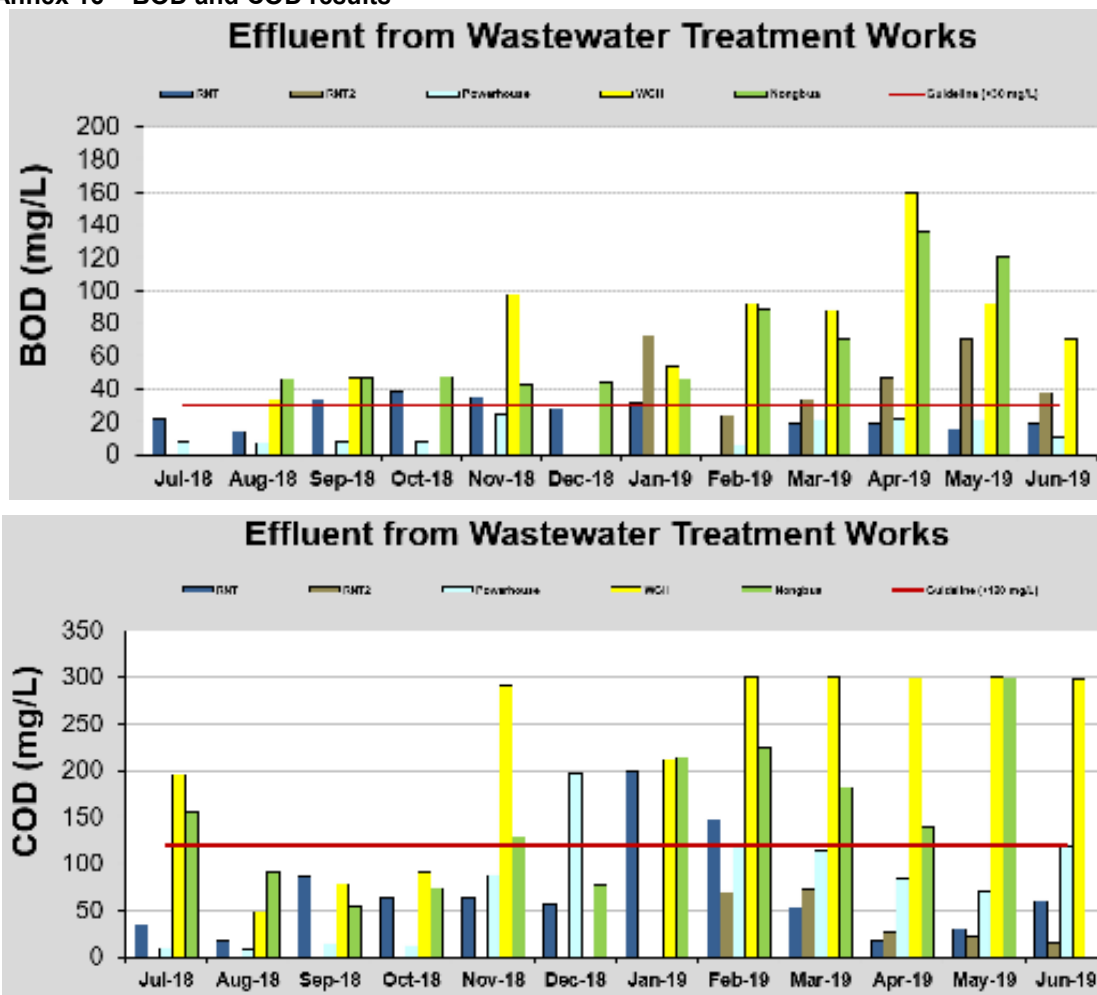
Annex 13 – Locations of *Mimosa pigra* found and destroyed in first half of 2019

Annex 14 – Planting locations of Chinese Swamp Cypress on Nakai Plateau and NN-NP

Annex 15 - Landfill observation borewells testing results January to June 2019



Annex 16 – BOD and COD results



Annex 17 – NTPC wastewater treatment facilities monitoring results

Parameter	Guideline values	Exceedance revealed (at least a month) from January to June 2019				
		RNT1	RNT2	Powerhouse (PWH)	Wooden Guesthouse (WGH)	Nongboua Boathouse
Biological Oxygen Demand (BOD)	<30mg/L	X	X		X	X
Chemical Oxygen Demand (COD)	<120 mg/L	X			X	X
Total Suspended Solids (TSS)	<40mg/L	X		X	X	X
Thermotolerant (Faecal) Coliform	<1000 CFU/100mL	X	X	X		
Conductivity	< 3500 μ S/cm				X	X
Ammonia-nitrogen	< 4 mg/L			X		
Oil & Grease	< 5 mg/L				X	
Residual Chlorine	< 1mg/L			X		

Note: No effluent discharged at PWH during the sampling day in January.

Below are the highlighted issues from each plant and their improvement action:

Wastewater treatment plant	Issue	Improvement Action	Remark
RNT1	There is no big maintenance since the beginning of operation.	The old plant must be whole cleaned after new plant installed. The cleaning process has been included in AB site-management action plan. Environment will closely follow up the process with them.	In process
RNT2	High BOD in the effluent	The new plant is still under warranty period and the WQ results are under follow up.	In process
PWH	There is no big maintenance/cleaning in 2019	The big cleaning should be performed once-twice a year.	
WGH	The increase number of residents at WGH cause overloading of the plant.	The memo of plant modification proposal was sent to AB-site management for the plant improvement.	In process
Nongboua Boathouse	The outlet pipe could not flow well and it causes some waste/graywater stuck in the wetland for long time.	The yearly maintenance should be performed in Q3 2019.	

Annex 18 - Environment inspection and monitoring

NTPC sites	Number of Inspection
	January to June
Nakai Dam Site	4
Wooden Guesthouse	12
PWH & Switchyard	3
RNT Complex	3
Gnommalath Landfill	35
Surge Shaft/Access Adit	3
Intake and Headrace Channel and Tunnel	4
Nong Boua Boat area	12
Regulating Dam	3
Total	79

There were 71 environmental issue raised from the industrial site inspection and workplace inspection (non-industrial site) during January to June 2019, the current status is reported in table below:

Period	Inspection area	Number of issues	Status		Remark
			Closed	Pending	
January to June 2019	Industrial site	31	30	1	Action follow up is going on
	Non-Industrial site	40	39	1	

The issues raised from these inspections were informed, via the joint inspection checklist or email, to concerned parties such as AB-site management, AB-security, TB-QHSE, KGS contractor or the area owner for improvement.

The Environment team participated in 18 special missions of environmental inspection in January - June 2019 as follows:

- 1 mission of Daily managerial patrol during the 2010 Minor Overhaul.
- 3 missions of Workplace inspection at RNT organized by RSU (in January, March and May)
- 4 missions of workplace inspection at Wooden Guest House, Nongbua and PIC (in February, April, May and June).
- 2 missions of Workplace inspection at Vientiane office (in February and April).
- 1 mission of Management patrol at AE Lab (in May)
- 2 missions of inspection at Gnommalath district landfill (in May and June)
- 5 missions of joining final inspection in January and February: new Sala at RNT, motorbike parking at RNT, Wooden guesthouse improvement project, new potable water treatment system, new UV treatment unit at F6 extension

The issues observed during each inspection/patrol were mainly related to waste segregation and waste disposal. All issues were immediately informed to concerned parties such as a site engineer, contractor, AB-site management or TB-QHSE for improvement.

Annex 19 - Corrective and preventive action for incident reports January to June 2019

No	Incident Date	Level	Description of Incident	Corrective Action Plan	Status	ID Ref.
01	8-1-2019	1	The bad odour from waste water leaked (2 points) at RNT accommodation (Mr Laong'house and Phouvong's houses)	AB-Site checked with CES to fix the problem and to clean if necessary	CAP Follow up	2,003
02	29-1-2019	1	The SCO observed the flash light alarm detecting the chemical leakage (~ 40L of Sodium Hypochloride) in chemical storage room	On call Team and SCO responded by replacing a new 1000L container and clean the area.	CAP Follow up	2,067
03	18-2-2019	1	ABC contractor burned their solid waste in front of their camp cause air pollution to neighbourhood.	The contractor was informed to do not repeat this act during final inspection meanwhile the environment team should follow up the contractor when they finish work and clean their camp. This contractor moved out of the camp due to work completion.	CAP required	2,115

04	13-3-2019	1	Found the 5L of Engine oil leakage from oil filter of Portable generator due to O-ring seal was damaged at Nakai Damsite	TB staffs responded the spill by using spill kit and sand then put the contaminated stuff in red waste bin, and TB-ME team will repair, replace and damage part.	Closed	2,147
05	22-3-2019	1	Found waste from local people under the transmission line between tower No. 000/1-000/2 beside 500/115kV substation	In priory, KGS was informed to clean up the area and dispose the waste properly.	CAP Follow up	2,155
06	24-4-2019	1	Waste scattering along 500kv transmission line at #063/1 and #063/2	The incident was first reported to environment team then it should be also reported to the Xebangfai district to inform the villagers not to throw their waste in this area.	CAP Follow up	2,184

Annex 20 - Environment awareness training January to June 2019

- For NTPC staff and family**

No.	Description of group	#Trained Persons	Remarks
1	NTPC new staff	2	
2	NTPC new interns	25	
3	Others (Consultants and students)	22	
4	Housewives of NTPC staff	19	Refresh training

- For Contractors**

No.	Company name of contractors/providers	#Trained Persons	Remarks
1	SSV education Group	2	
2	CES	10	
3	Newrest	7	
4	TPA	2	
5	LCG	7	
6	SSSE	1	
7	KGS	2	
8	ABC	19	
9	KSSSE	41	
10	ISOS	2	

No.	Company name of contractors/providers	#Trained Persons	Remarks
11	Automation service	2	
12	Wisky	1	
13	Nilan	9	
14	BK	31	
15	Noum Phuthai	15	
16	Phouvieng Contruction	3	
17	MCM	3	
18	Mil Search	26	
19	VDC	57	
20	World Wide Trade	3	
21	DSV	5	
22	SCC	8	
23	ISUZU	4	
24	Vieng Chan Fitness	1	
25	VTE office park	6	
26	NEWREST	85	Refresh training

Annex 21 – 2019 Health, Safety and Environment Improvement Program (HSEIP)

Objective & Target Reference	Objectives	Targets
HSE 08/2019	Environmental - To prevent major environment accident. - To comply with the local law and other requirements (LTA, IMA and POE), Project: waste cell, waste water treatment.	Zero major environment accident
HSE 09/2019	To ensure that the wastewater treatment plant relating to NTPC activities are well-managed and water quality of the discharged effluent is	1) Effluent water quality report in Monthly basis and proper actions are taken; 2) Set up the monitoring plan for the new treatment system that will be installed at RNT at the end of

Objective & Target Reference	Objectives	Targets
	closely monitored.	the year.
HSE 10/2019	To ensure that the Solid Waste Management relating to NTPC activities are well-managed and regularly follow-up	1) 100% Weekly inspection; 2) Reporting the progress of recycle waste removal/trading in Monthly basis (12 reports per year); and 3) Start implement of the food waste to produce organic fertilizer.
HSE 11/2019	To ensure that the HazMat Management is always under the environment standard	1) The HazMat storage at both industrial and non-industrial site are monitored in monthly basis and actions taken are followed-up; 2) 100% of HazMat report is submitted to GoL (Bi-annual basis).
HSE 12/2019	To ensure that the emergency cases for chemical spills will be well-handled in a good manner	Implementation the drill once a year in AE Lab, Oil storage at RNT Powerhouse and Dam Site, 100% report is submitted.
HSE 13/2019	Promotion and implementation of Environment Awareness Programs in NTPC community - To reduce the usage of plastic bag in RNT campus - To reduce the usage of paper in NTPC's offices	1) 5% reduction of plastic bag usage compare to 2018 2) 5% reduction of paper usage compare to 2018
HSE 14/2019	To promote the Environment Awareness to local communities	1) Promoting the Environment Awareness Programs in NTPC School, at least 2 missions a year and covering all classes in NTPC School. 2) Joining the awareness training together with Gol-Com site visit activities, at least 3 missions a year and covering 3 impacted areas (Nakai, Gnommalath and Mahaxay).

Objective & Target Reference	Objectives	Targets
HSE 15/2019	Landfill observation borewells water quality monitoring	100% of monthly monitoring done as planned and reporting in monthly basis
HSE 16/2019	To promote the Chemical awareness to all staff	<ul style="list-style-type: none"> - Revise and add the chemical awareness knowledge into the induction/yearly refresh training content. - Organize at least 2 campaigns Chemical awareness for concerned staff (who work closely with chemicals)
HSE 17/2019	To re-arrange the Chemical storage at Powerhouse	100% of Haz Mat storage rooms at Powerhouse are re-arranged to prevent chemical hazard.

Annex 22 – List of Documents in CEMMP

- Quality Health Safety and Environment Policy (POLQSE)
- Job Hazard and Environmental aspect Assessment Instruction (PR B15 01)
- Legal and Other Requirements Procedure (PR B15 02)
- HSE Objectives Targets and Programs (PR B15 03)
- NTPC Health, Safety and Environmental Objectives and Targets (NTPC M B 15 0303 17)
- Health, Safety and Environmental Improvement Programs (NTPC M B 15 03 03 0018)
- Waste Management Plan (NTPC M B 15 03 04 0016)
- Hazardous Materials and Contamination Control Management Plan (NTPC M B 15 03 04 0012)
- Water Management Plan (NTPC M B 15 03 04 0015)
- Water Quality Monitoring Plan (NTPC M B 15 05 01 0001)
- Biodiversity Management Plan (NTPC M B 15 03 04 0017)
- Health, Safety and Environmental Training Procedure (PR B15 04)
- Training Procedure (PR 1410)
- NTPC Health, Safety and Environmental Training Needs Matrix
- HSE Communication Participation and Consultation Procedure (PR B15-05)
- Documents and Records Control Procedure (PR B15 06)

- Chemical Management Procedure (PR B14 04)
- Waste Segregation Work Instruction (WI B14 04)
- Waste Management at Gnommalath Landfill Work Instruction (WI B14 07)
- Clinical Waste Management Work Instruction (WI B14 07)
- HSE Specifications for Contracts and Bidding Documents (NTPC M B 15 04 06 0004)
- Crisis and Emergency Management Plan (NTPC M B0501 0001)
- Hydrocarbon and Chemical spill Response Procedure (NTPC O P0602 13 0002)
- OMD-Natural Disaster Management Procedure (NTPC O P1004 17 0001)
- OMD-Emergency Contingency Plan for Powerhouse (NTPC O P10 04 13 0001)
- Emergency and Preparedness and Response Procedure (PR B14 05)
- HSE Performance Monitoring and Measurement Procedure (PR B15-07)
- Reporting and Incident Management Procedure (PR B15 10)
- Nonconformity Corrective and Preventive Action Procedure (PR B15-08)
- Internal Audit Procedure (PRB15 09)
- NTPC Senior Management Review (NTPC M B 15 06 01 0001)