

Environmental and Social Monitoring Report

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ENVIRONMENT AND SOCIAL ANNUAL PROGRESS REPORT 2020

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ACRONYMS

ADB	Asian Development Bank
AEL	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.
G3 Group of Three Elephant
NP National Park
NNT-NP Nakai-Nam Theun National Park
PMLs Pond Mineral Licks
NTFPs Non-Timber Forest Products
WCA Wildlife Conservation Association

GENERAL INTRODUCTION

NTPC is subject to environment monitoring obligations under the CA until the end of the CA Period.

The Environmental and Social annual progress report follows the AIP 2020 Ver.1 NTPC-S-B1002-0016.

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 December 2020, referring to the key tasks of AIP 2020, 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 15 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 an 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) 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), 2 replenishments have been organised in 2020 before and after 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.

- (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, Government 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:

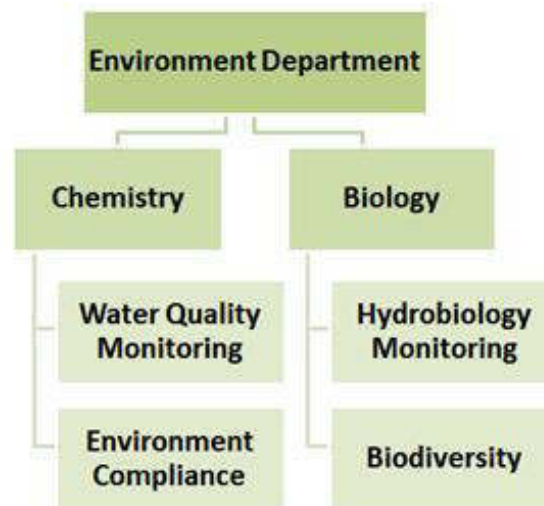


Figure 1 – Environment Department Organization

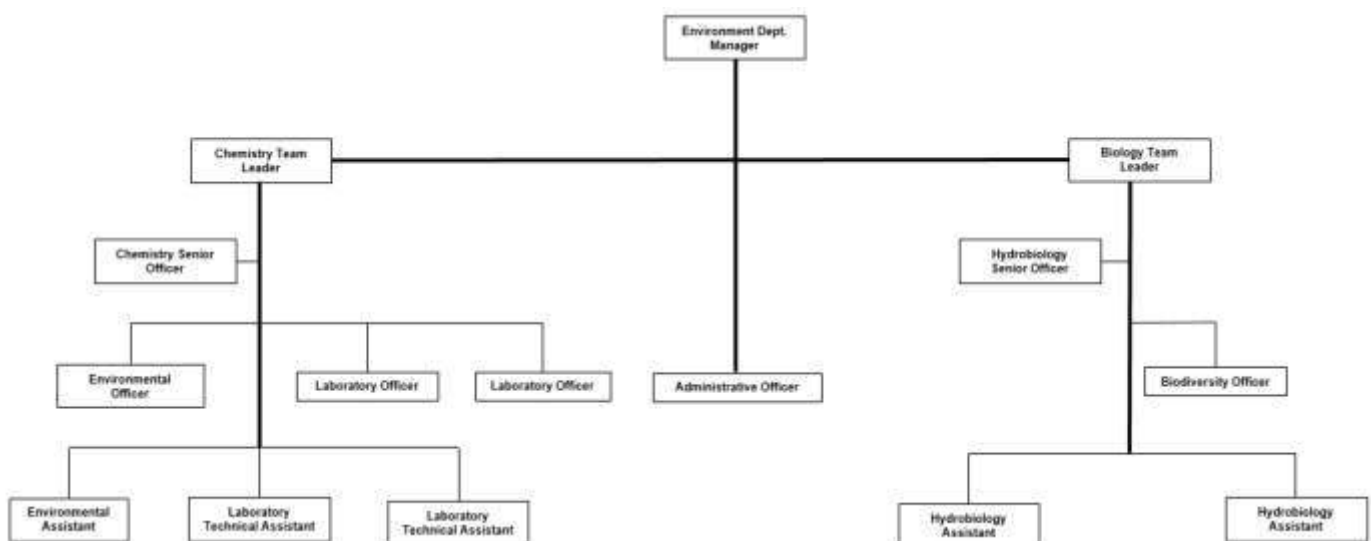


Figure 2 – Detailed Organization Chart of the Environment Department

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 (AEL), 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 DECEMBER 2020

3.1 The Aquatic Environment Laboratory (AEL)

After twelve years of operation of NT2 Aquatic Environment Laboratory (AEL), 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 AEL 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.
- 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 December 2020, **28 scientific articles** relating to Nam Theun 2 Project have been published in peer reviewed journals and are accessible online (**Annex1**)

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 December 2020

Reservoir and Downstream Water Quality

After ten(10) years operating of Nam Theun2(NT2) Project, a critical weather condition in wet season of 2020(delay of rain events). The NT2 reservoir has faced its record of lowest water storage or minimum operation level(525.5m ASL in 14th July). During this exceptional period, low concentration of dissolved oxygen(DO) has been observed in the whole reservoir, a high sediment concentration in the water has influenced to the functioning of facilities in the Powerhouse and aquatic life living either on the reservoir and in the rivers downstream.

Two environmental events occurred in July and end of September that resulted in dead fish in the Regulating Pond. Approximately 3,192 kg of dead fish had been collected from the area (1,289 kg and 1,903 kg respectively). The root cause analysis of both environmental incidents for defining preventive and corrective action is a high priority. Additional monitoring of water quality and hydrobiology (specific analysis of the fish sample by an external laboratory (Faculty of Agriculture, NUOL) has been performed, and it has confirmed that there is no significant issue associated with water quality.

7 routine sampling missions in December were cancelled due to tightened sampling schedule because of the Laboratory building renovation work plan.

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 (>5mg/L) at the surface water were always observed in all stations, except in Water Intake in July where the DO dropped to 1.8 mg/L and in NT2 Thalweg (RES01) in October, the decreasing of DO could be 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 ~5mg/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 (3 to 12 m) from February to September. The summary of Water Quality in the Reservoir January to December 2020 are respectively presented in **Annex 6**.

Rivers

Key WQ results related to Project releases during the January to December 2020:

- **Dissolved Oxygen (DO)** remained above the surface water Guideline for Nam Theun, Nam Kathang and Xe Bangfai Rivers throughout the whole year.
- **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*).

* Water quality standard guideline of surface water, Decision on National Environmental Quality Standard, Prime Minister's Office, No.81/PMO. 2 Feb 2017, MoNRE, Vientiane Capital.

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. The water temperature at both stations became similar during wet season as well as high conductivity at Xe Bangfai downstream was observed during that period.

Despite issues of low DO concentration in Reservoir in July, the water quality of the water released to downstream of Nakai Dam; Nam Kathang river; and Xe Bangfai river are still in the standard guideline of the Government of Laos (more than 5mg/L).

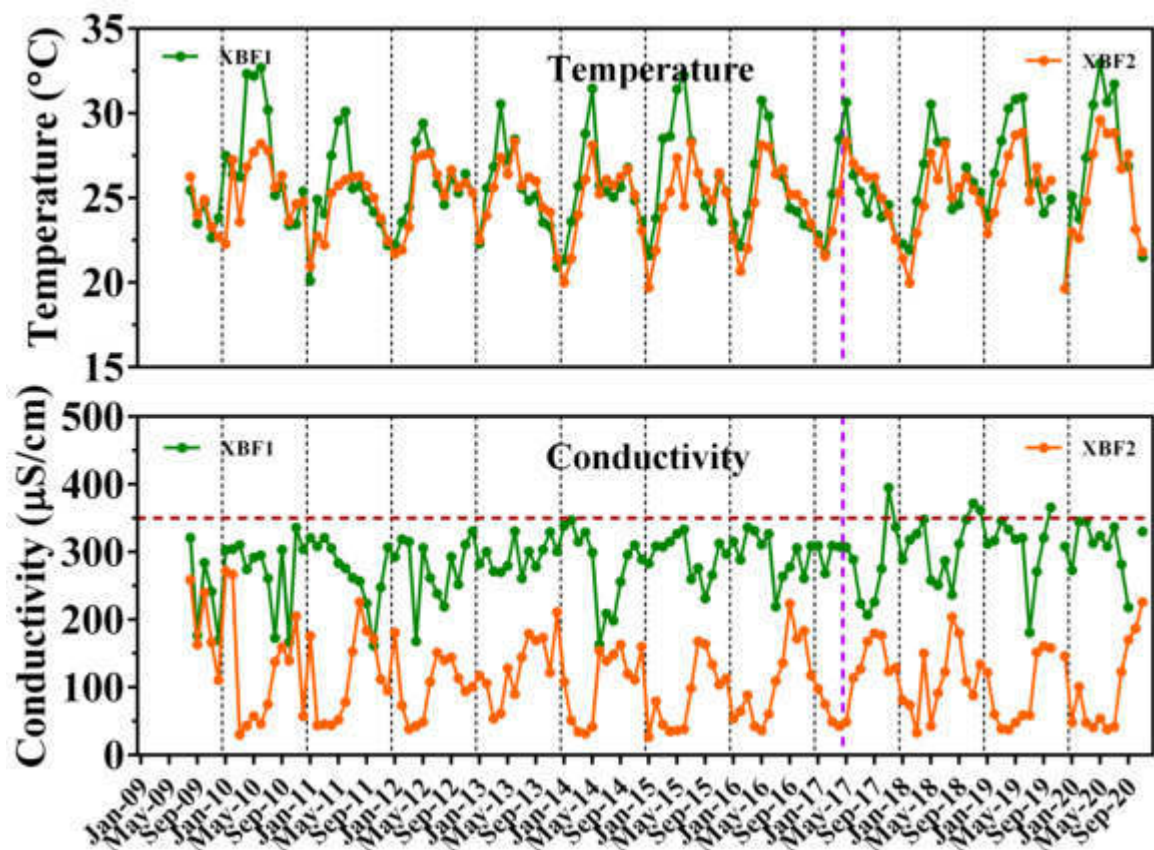


Figure 3 – Measurement of Temperature and Conductivity in Xe Bangfai river

Greenhouse Gas (GHG) Monitoring

GHG emission monitoring continues in routinely basis in Reservoir, Tributaries, Downstream rivers and civil work areas, the monitoring frequency is set as same as Reservoir and Downstream Water Quality Monitoring. **Six scientific articles** relating to GHG emission in NT2 project are published.

Village Water Supply and Water Quality

Up to December 2020, a total of 383 of 827 boreholes (46%) of total in-use boreholes installed by NTPC since construction period are monitored. Monitoring results of groundwater for Village Water Supply in 2020 are:

- i) Q1_2020: 86 boreholes (including 16 fixed boreholes, see **Annex 7**) were monitored, 44 BH in Nakai Resettlement area and 42 BH in Downstream Program area.
- ii) Q2_2020: due to Covid-19 outbreak, in April and May, only 29 BH in Downstream Program area (including 8 fixed boreholes, see **Annex 7**) were monitored by end of June.
- iii) Q3_2020: 86 boreholes (including 16 fixed boreholes, see **Annex 7**) were monitored, 44 BH in Nakai Resettlement area and 42 BH in Downstream Program area.
- iv) Q4_2020: 29 boreholes in Downstream Project area (including 8 fixed boreholes, see **Annex 7**) were monitored.

Monitoring period	Guideline* exceedances	Actions
Q1_2020	-	-
Q2_2020	- Nitrate exceedance at 1BH at Nongbok	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.
Q3_2020	- Nitrate exceedance at 2BH (1 BH at Mahaxai and 1 BH at Xaybouly).	
Q4_2020	Some analysis is pending due to technical issue of Ions analyzer	

* Water quality standard guideline of groundwater for drinking purpose, Decision on National Environmental Quality Standard, Prime Minister's Office, No.81/PMO. 2 Feb 2017, MoNRE, Vientiane Capital.

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 December 2020, AE Lab staff participated to the blind samples' analysis for Total Suspended Solid, Total Phosphorus, Total Nitrogen, Chemical Oxygen Demand (COD), Dissolved Iron Dissolved Silica. All testing results were in the acceptance range.

3.3 Hydrobiology monitoring

3.3.1 Obligations

Reference related to CA obligation-Volume 2A, Schedule 4, Part 2, Subject 9: 1, 7, 13 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 December 2020

Routine monitoring conducted according to the CA and in the framework of the 4th Service, hydrobiology program realized for 2020 as following:

- (i) Routine monitoring for Chlorophyll *a* for reservoir in monthly basis.
- (ii) Fish Population Monitoring (FPM) was conducted all sites (Upstream of NT2 reservoir and downstream of Nakai Dam and Xe Bangfai Watershed).
- (iii) Yearly monitoring for aquatic macro-invertebrate for river habitat of upstream and downstream.

Fish Population Monitoring

Typical year for NT2 project since COD, the pandemic of COVID-19 caused some cancellations of monitoring mission and a minimum operating level (MOL) of Nakai reservoir impacted to accessibility of sampling sites.

Nam Theun Downstream of Nakai Dam

The fish population monitoring (FPM) is continued to monitor by seasonally basis in the area. Monitoring result for 2020 showed **Figure 4**:

- The mission for end Warm-Dry season 2020 for NTH6 was not conducted.
- Fish population follows seasonal dynamic with an increase in term of abundance and it reached the highest peak in May 2019. The value of abundance in 2020 was generally lower compared to previous year but it was still in same range as of 2013 – 2018.
- Taxonomic richness and biomass are more stable since 2013 and around 10 species per catch since then.
- Since 2011 to 2020, biomass fluctuated around 2 kg per catch with peak in end of Warm-Dry season.

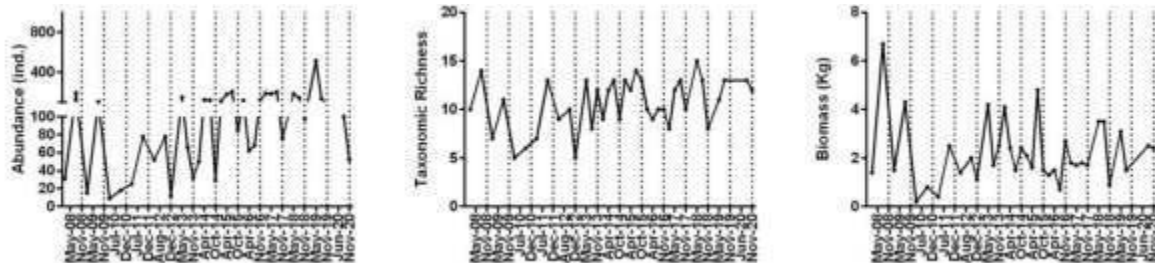


Figure 4 – Fish population parameters (Abundance, biomass & taxonomic richness) at NTH6

Fish Population in the Xe Bangfai

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

- A trend of an increase in abundance, biomass and taxonomic richness since the COD for a same fishing effort and same station.
- All indicators (abundance, biomass and taxonomic richness) reached low values end of 2018 and then slightly increased in 2019 and 2020.
- Biomass and taxonomic richness showed seasonal peak at the end of the Dry season and at the beginning of the rainy (Wet) season.
- After the COD, the biomass is fluctuated at around 1.5 Kg per catch and it reached 10 kg/catch for the first time in June 2020.

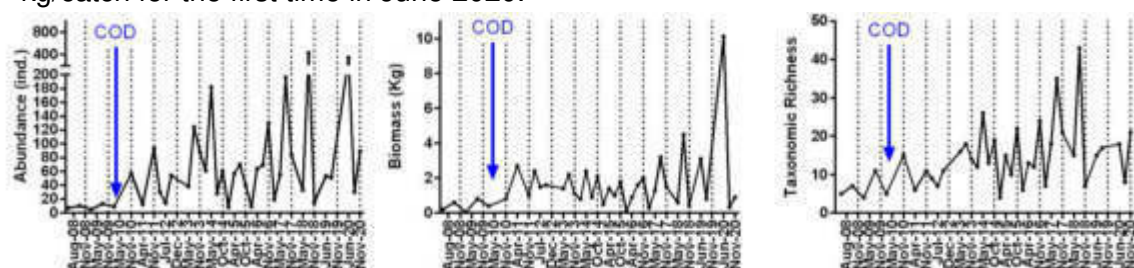


Figure 5 – Fish population parameters (abundance, biomass & taxonomic richness) at Ban Mahaxai

Chlorophyll a [Chl a]

Chlorophyll a concentration showed the same pattern since 2011 (**Figure 6**). 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 season (June) and second weaker peak in end of the Warm-Wet season (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 was the main factor for Chlorophyll a concentration. During 2020, [Chl a] showed the same trend with gradual increasing from January to reach the peak in June.

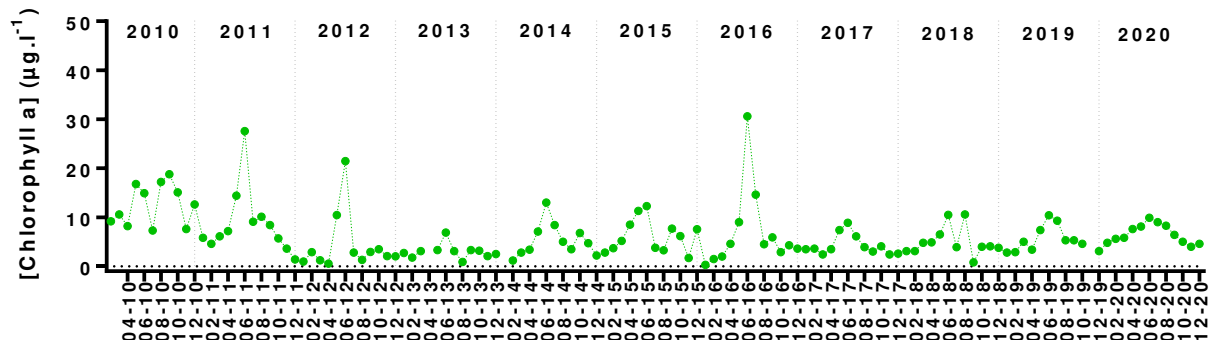


Figure 6 – Monthly average (of all stations) of [Chl a] ($\mu\text{g.L}^{-1}$) in NT2 reservoir from 2010 to 2020

Aquatic Macroinvertebrate Monitoring

Due to the pandemic of covid-19 the sampling for downstream area of Nakai Dam (NTH6) was not conducted. Annex 10.

Nam Theun Area

In 2020, biological indices of NTH1 showed lower value since the beginning of monitoring ($\text{BMWP}_{\text{thai}}=13$ and $\text{ASPT}=3.3$). Low biological indices were linked to the absence of highly sensitive species of aquatic macroinvertebrate. However, the moderate sensitive species (e.g. Corixidae, Gerridae...) were still observed and this can confirm moderate range of water quality level for the area. Stable equability (J) value is 0.3 and it indicated that the area was dominated by one or two species (e.g. Tubicidae, Oligochaeta...).

Nam Kathang / Gnom Area

In 2020, the biological indices $\text{BMWP}_{\text{thai}}$ is ranged between 131 – 244 and ASPT is ranged between 5.5 – 6.3, these values can confirm moderate to good water level for the area. Stable equability (J) is range between 0.3 – 0.7 which indicated aquatic invertebrate communities in this area is dominated by few families e.g. Chironomidae, Baetidae, Oligochaeta...

Xe Bangfai Area

The biological indices values are bit different between stations in upstream (XBF0) and downstream (XBF1 & XBF2) of confluence ($\text{BMWP}_{\text{thai}}$: XBF0=232 vs XBF1=30, XBF2=22 and ASPT: XBF0=6.5 vs XBF1=4.3, XBF2=3.7). The low value of biological indices for downstream area is linked to accessibility to the sampling sites (fast-moving flow and deep-water), the sampling methodology cannot conduct properly. However, stable equability (J) is ranged between 0.5 – 0.7 which indicated Xe Bangfai area is dominated by a few families e.g. Chironomidae, Baetidae, Hydrobiidae... In addition, biological indices confirm moderate to good water level for this area.

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 December 2020

Elephant Program

Human Elephant Conflict (HEC) Monitoring and Mitigation

In 2020, a total of 199 HEC incidents occurred. 155 incidents are related to the Group of Three; 39 incidents related to Thalang group; and 5 incidents are related to elephants inside NNT-NP (Error! Reference source not found.). 45 incidents were crops damaged; 59 incidents were properties damaged; and 95 incidents were crops and properties damaged. Main damages were 101 huts, 4 houses, 4 rice barns, 3,768 m² of paddy rice field, 5,281 kg of rice, 4,569 mature banana trees and 3,360 matured cassava plants.

A lethal incidents occurred on 22nd August 2020 inside Nakai-Nam Theun Nation Park (in area of AML zone I), a 70 year-old man from Ban Nakai Tai was encountered with elephants and killed while he was searching for NTFPs.

On 17th December 2020, a dead juvenile elephant found near Ya Long River by villager(at UTM E: 494427; N: 1975895). After the investigation, there was not evidence found related to hunting and it was expected relating to accidentally sinking while the group was crossing reservoir shore.

In addition, the HEC awareness raising was conducted in May and October 2020 for 11 villages in 3 districts (Bualapha, Mahaxai and Xaibuathong). A total of 549 participants attended the activities.

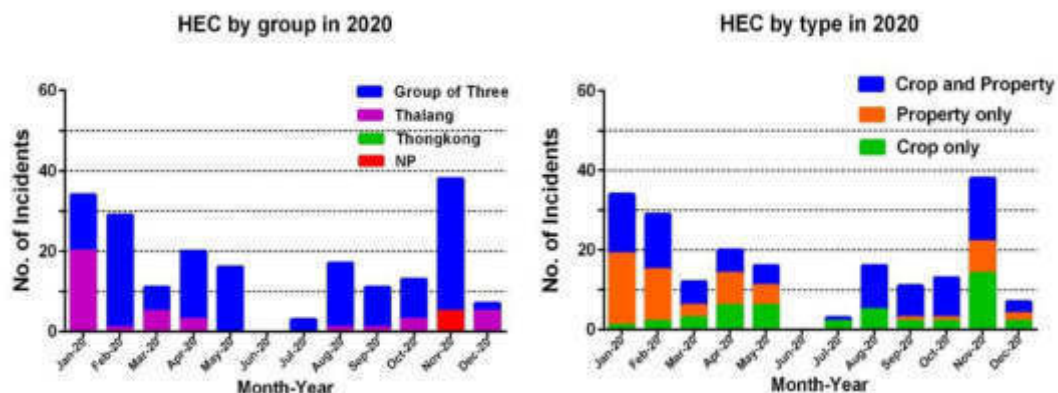


Figure 7 – Annual HEC incidents in 2020 (by group and by type)

Solutions for the Group of Three Elephant (G3)

Through the collaring mission in last 2019 and it was found that the member of this elephant group was increased from 3 to 6 individuals as well they have caused a lot problem to local villagers. To ensure the long management of this elephant group, on 24th August 2020 a meeting was held at Nakai District and hosted by Forestry Department in Wildlife and Aquatic Division of Ministry of Agriculture and Forestry (**Annex 12**). A total of 39 participants from various stakeholders such as authorities from 7 districts in Khammouane and Savannakhet Province, WCA, WMPA, Savannakhet and Khammouane PAFO. The meeting outputs are: (i) short term solution: raising HEC awareness for impacted communities; (ii) long term management: Forestry Department will be the lead of drafting a management plan for HEC monitoring and mitigation; and (iii) Forestry Department will be the centre to establish a committee to figure out the solution of HEC occurred by the Group of Three.

Artificial Mineral Lick Replenishment (AML) and its monitoring for 2020

The AML replenishments were completed for both dry and wet seasons (February and October). Total of 2,912 kg of mineral salts (1,632 kg of NaCl, 880 kg of NaH₂PO₄, 281 kg of CaCO₃ and 119 kg of KCl) were refilled to all 8 pond mineral licks (PMLs) in 3 AML zones. The monitoring was conducted as schedule for both methods (observation and camera trapping). Through its monitoring, elephants and wild ungulates found using all PMLs (**Annex13, Annex14**) Cattle found using all PMLs in zone II and III. Human act evidences found in all PML sites. In consequence, PML2/7 was invaded by local people.

Invasive species survey and destruction

The survey and destruction of *Mimosa pigra* was conducted for 4 rounds in 2020. From the survey and destruction, approximately of 338,660 mature trees were found and destroyed. The destruction was focus at Headrace channel of water intake, Regulation pond, and resettlement villages (**Annex 15**).

Chinese Swamp Cypress conservation program

Seed germination was conducted in late November 2019 which led 6 seedlings were planted in May 2020. The monitoring shows 4 saplings are in well growth and other 2 saplings are slightly growing up and they are all in good condition. The biggest sapling is about 105 cm tall and smallest sapling is only 16 cm. To achieve the goal for planting of trees in nature(50 mature trees), the seed collecting was conducted in mid-November 2020 and allow to collect approximately 37,000 seeds from 3 mother trees in Dtung cluster(Khoun Houy Heo and Thong Na Dtueng) and germination process was started in late December 2020 (**Annex 16**).

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 December 2020

NTPC Waste management facility

A sub-contractor (PKC Co., Ltd) is performed the management of the NTPC landfill since 2018, the wastes coming from all NTPC premises to the site are well separated as per classification (general waste, composite waste, recyclable waste and hazardous waste). The recyclable wastes are sold to the local traders. The food wastes are used for producing of fertilizer (Effective Micro-organism (EM)). 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 December 2020, about 45% of in-use waste cell was filled (waste cell No. 7).

Landfill observation borewell

Groundwater quality monitoring in the 9 monitoring wells installing) 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 from heavy metals at those 9 wells (**Annex 17**). The groundwater quality monitoring at Landfill will continue until end of the CA.

NTPC Wastewater Treatment Management (Black and Grey Wastewater)

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 on a monthly basis. The effluent guideline exceedances have been observed sometime in some parameters (BOD, COD, TSS, Ammonia-Nitrogen, Residual Chlorine, Oil & Grease and Faecal Coliform Bacteria) (**Annex 18** and **Annex 19**).

- ***Environment site inspections and monitoring***

As part of Environment Department, the Environmental Compliance team continues 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 167 environmental inspections at all NTPC sites were conducted from January to December 2020. Total special environmental inspections for 2020 was 43 missions (**Annex 20**).

- ***Environment incident management***

There are 6 environmental incidents were reported in 2020 as shown in **Figure 8** 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

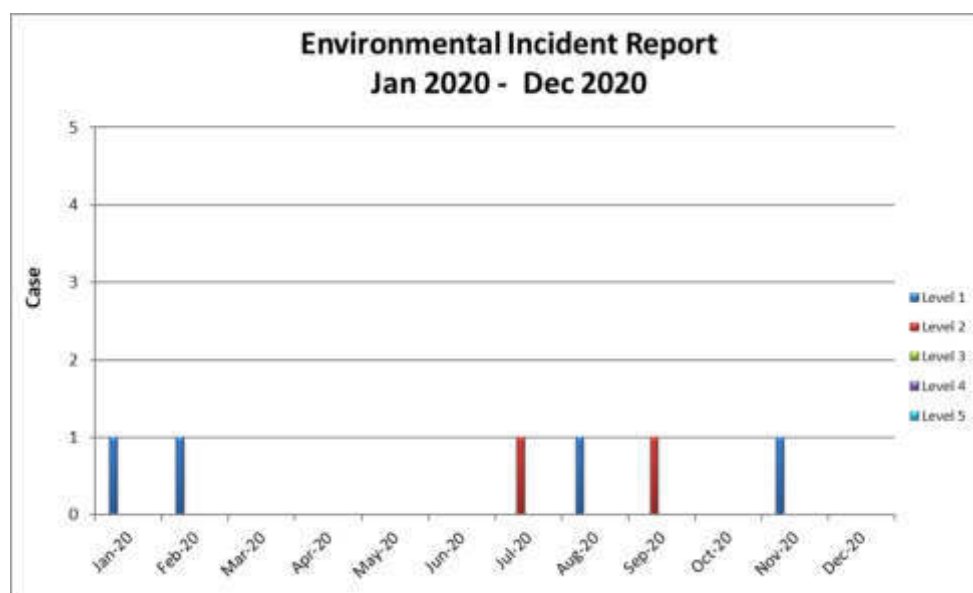


Figure 8 - Environment Incident Reports during January to December 2020

Corrective and preventive actions for the reported environment incidents are clarified in **Annex 21**

- **Environment awareness programs**

Awareness training

The environmental training was conducted for both NTPC staff and contractors, the number is described in **Annex 22**.

- NTPC Staff, Fresh Graduate and Trainee: 51 persons for induction training and 231 persons for yearly refresh training.
- NTPC staff housewives: 40 persons for yearly refresh training.
- NTPC's Contractor: 323 persons for induction training and 242 persons for refresh training.

The training assessment was performed via quiz, question, game, and real practice on environment activities with all 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 2020, two main camps (RNT and WGH) were included to the plastic bag usage reduction campaign (HSE 11/2020, **Annex 23**). The yearly reduction percentage of 2020 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). In 2020, the total consumption at RNT and WGH are 2,969 packs, represents about 7.11% of increasing consumption compared to the record in 2019 (2,772 packs) (**Figure 9** Error! Reference source not found.):

- **RNT:** The total consumption is increased compared to the previous year (2,692 packs in 2020 and 2,468 in 2019). The trend of changes are shown in **Figure 10**.
- **WGH:** The total consumption is decreased compared to the previous year (277 packs in 2020 and 304 packs in 2019) The trend of changes are shown in **Figure 10**.

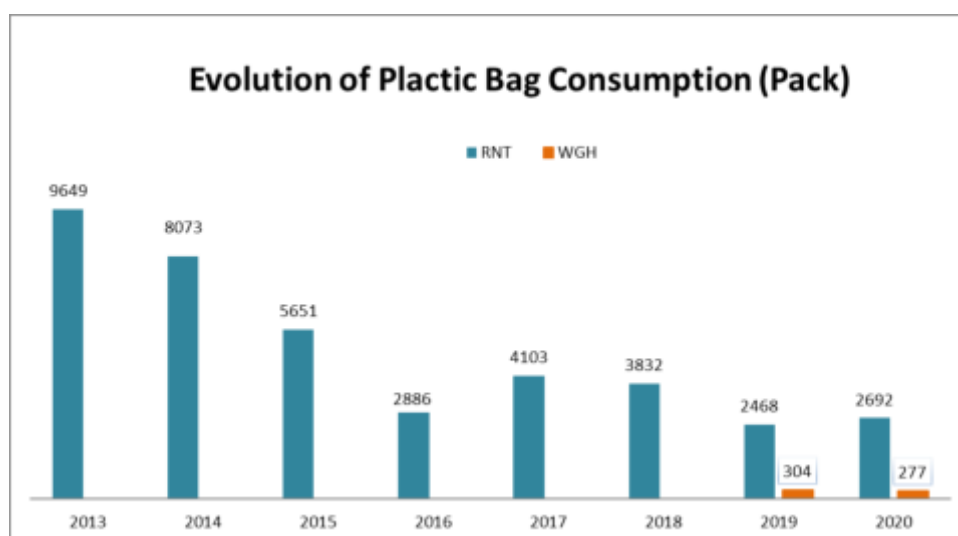


Figure 9 - Yearly Plastic Bag consumption (2013 – 2020)

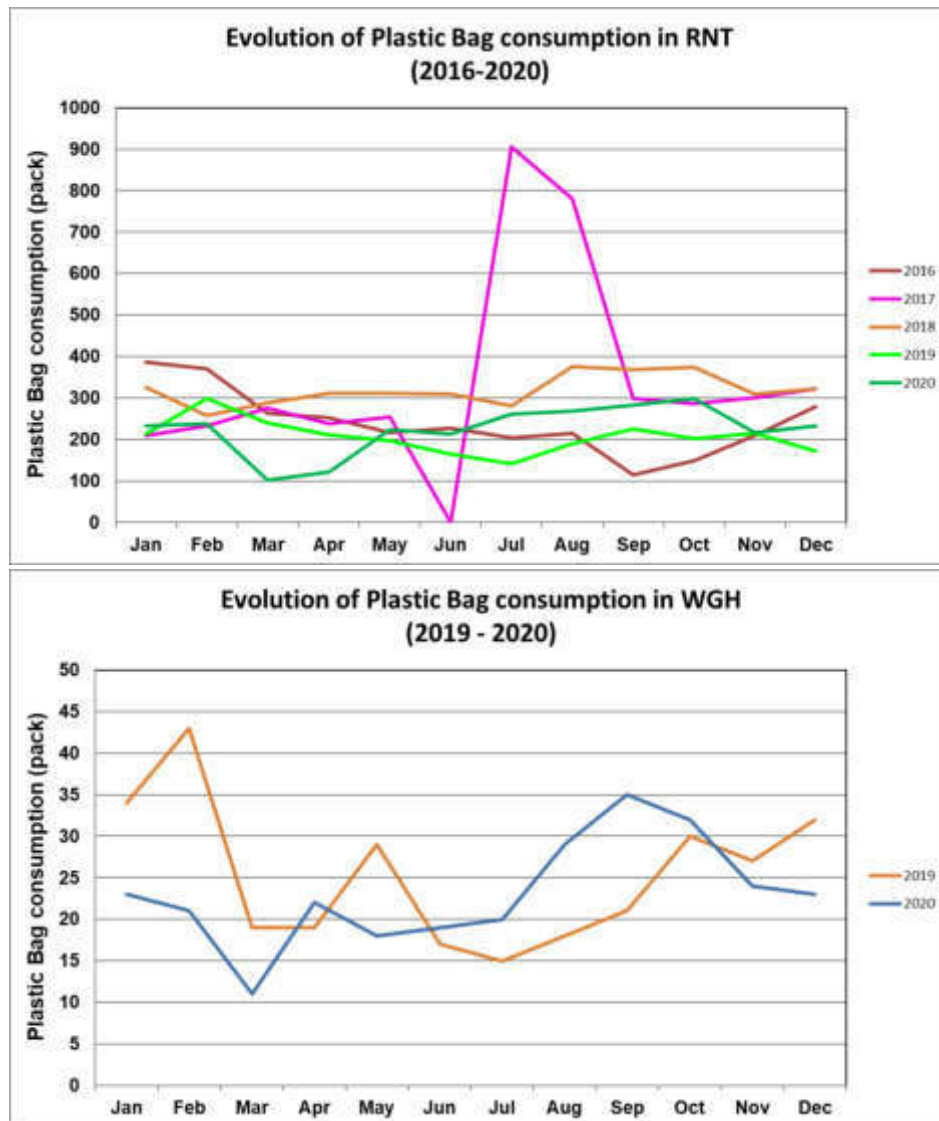


Figure 10 – Monthly Plastic Bag consumption in RNT (2013-2020) and WGH (2019-2020)

Environment awareness program - Paper usage reduction

In 2020, the target of paper usage reduction is set at 5% compared to year 2019. Based on the data collected, the paper usage depends on the needs of users (the A4 type was used regularly report and documents printing). Belowed graph demonstrated the evolution of A4 consumption, the total usage in 2020 reduced by 31.6% compared to data of 2019 (158 boxes vs 231 boxes, **Figure 11**).

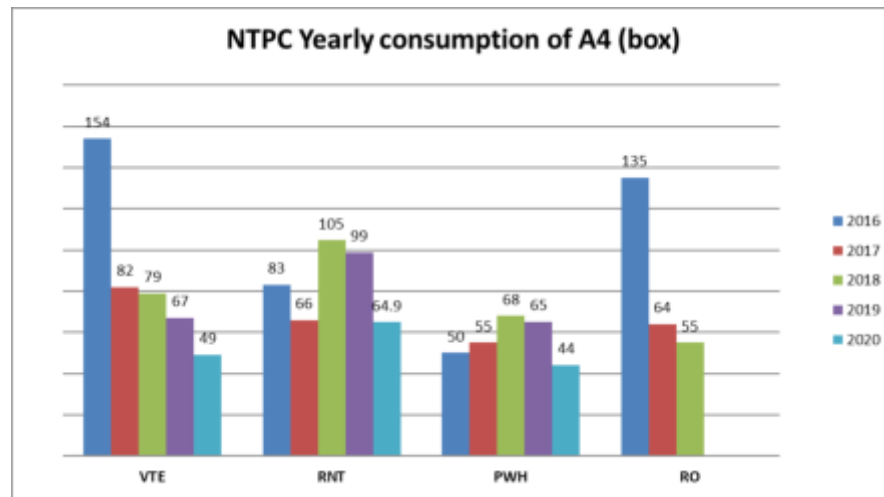


Figure 11 – Yearly consumption of A4 paper at 4 offices

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

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 until December 2020, he has also segregated the waste and to guide other people who come to dump their waste at landfill.

Regarding the district waste management plan, NTPC is working with GRET, an NGO experienced in community waste management, to conduct the feasibility study on district waste management. The 1st phase of this study was organized in August and focused on the waste collection experiment to estimate the waste production in targets villages and the villager's interview to understand their current practice of waste disposal. Thereafter, GRET organized a workshop with DoNRE and Head of villages to present their study results of 1st phase and to get the suggestion from them to establish the action plan for sustainable waste management in this area. The final report of 1st phase study will be submitted in early 2021.

- **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 completed in June 2020. It was officially handed to Nakai DoNRE for management. Furthermore, in order to sustain the landfill management of district together with their service contractor, Environment team organized a basic training on waste management in January for 5 members of contractor working for Nakai waste collection team and Nakai DoNRE, the training agenda also included the site visit at NTPC landfill to see the real practice of NTPC regarding waste management.

In regards of waste management, NTPC has also working with GRET and Nakai DoNRE to establish the feasibility study on district waste management. Their mission was conducted in the same sequence as of the Gnommalath district.

By end of November, Environment department together with CSR-GolCom department and Zero Waste Lao organized the Zero waste camping at Nongbouakham center to encourage local youth to support the zero-waste lifestyle. In December, NTPC accompanied 15 volunteers from Nongbouakham Center and Gnommalath to attend the “**Youth for Sustainable Development Goals (SDGs)**” event in Vientiane.

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 December 2020

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

The latest Xe Bangfai riverbank survey (the 28th mission) was conducted by the Environment team on 8th – 9th June 2020. 737 locations including 27 indicator sites were monitored: (i) 1 indicator site (Ban Bouakhai) and 3 non-indicator sites (2 at Ban Natai and 1 at Ban Phakpheuatai) showed a slight erosion expansion and; (ii) found 1 new erosion site (Ban Nasang) comparing to the mission of December 2019. 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 2nd mission of the year, after wet season, was expected to conduct in December. However, due to the workload of team and some inconvenience (temporary office relocation due to the Lab building renovation work), the mission was postponed to January 2021.

In addition, two special missions of eroded riverbank were conducted in some villages of Xaybuly and Nongbok district where a significant erosion have been observed (Thakham, Thadoua, Dan and Navang Gnai village) in August and October respectively. The survey result showed that phenomenon occurred by influence of Mekong water level (sudden change) and after flood event in Xe Bangfai river. Preliminary summary report also shared to Lao authorities.

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 24**).

3.7.2 Main outputs until December 2020

To maintain and continue improvement of Environmental Management System (EMS or ISO 14001), a re-certification audit of the system was conducted by Certified Body (SGS,

Thailand) on 9th September 2020, and there is only one observation which was related to the control document of EMS aspect.

4. VISITS, MEETINGS AND CONSULTANCIES

- **Lab visit by:**
 - (i) delegation from MoNRE, PoNRE of Khammouan and Bolikhamxay, DoNRE of Gnommalath, Nakai and Khamkeut in January.
 - (ii) representative from National Mekong Secretary, MoNRE in September.
 - (iii) country director of French National Research institut for Sustainable Development, IRD Laos) in November.
- **Site visit by Faculty of Environment, NUOL** - A visit of bachelor's degree students (in February) and master's degree students (in March). The general information regarding environment department such as the monitoring program on water quality, hydrobiology as well as biodiversity activities were presented.
- In February, discussion with GHG specialist from IRD on:
 - (i) validation of the data of N₂O for 2018 EDF annual report, data of GHG monitoring for 2019 and resume work for writing of the article on N₂O emission from NT2 reservoir,
 - (ii) tentative schedule for 2020 campaigns of IRD research program; and
 - (iii) status of Gas chromatography and the comparison of testing results of samples between old technique vs new sampling method.
- Participation in LTA audit 2020 via video conference in April, main highlight was focused on solid waste management within NTPC, Gnommalath and Nakai district.
- In May, meeting with GHG specialist from IRD on the GHG monitoring results and technical support on current work, the discussion has included:
 - (i) Comparison result of the GHG analysis by two different sampling collection techniques.
 - (ii) Estimation of Greenhouse gas emitted from NT2 project in 2019.
 - (iii) Setting parameters and process prior to commissioning of new Gas Chromatography.
- **Special Adaptive Management Committee (AMC) meeting** was organized on 24th July. Representatives from DEB, Khammouane PoNRE, DoNRE of concerned district (Xaibuly, Xe Bangfai, Mahaxay, Gnommalath and Nakai), TB-Operation, Environment and CSR-GolCom were attended. The meeting aims to disseminate the information of water management during the reservoir water level reaches Minimum Operation Level (MOL) and prepare the action plans to prevent all potential risks that could happen during the raise of reservoir water level in wet season.
- Elephant program: meeting about solution for Elephant Group of Three was held at Nakai District on 24th August 2020 at Nakai which were involved by all concerned parties (Forestry Department of Ministry of Agriculture and Forestry (MAF), PAFO and DAFO from Savannakhet and Khammouane, National Park and NTPC). The middle and long term action plan on HEC program have been discussed. In parallel to the current activity, the participants agreed to increase number of HEC awareness campaign at impacted villages.

- **AEL's Scientific Advisory Committee (SAC) meeting** was organised on 23th September 2020 via Microsoft Team conference(NTPC and EDF-CIH). The discussed topics were mainly focused on GHG monitoring program which are included: (i) equipment availability; (ii) updated progress of samples analysis results; (iii) installation of new hydro-meteo station sensors at Thalang bridge and (iv) GHG data interpretation and pending GHG net emission calculation.
- First cooperation meeting with Nakai Nam Theun National Park (NNT NP) was held on 17th Dec 2020 at RNT, the discussion was focused on:
 - (i) Share information of NTPC and NNT NP on Biodiversity monitoring program
 - (ii) Review area of our current cooperation and lesson learnt
 - (iii) Explore potential area of additional cooperation and agree on role and responsibility.

Both parties are agreed to enhance more bilateral cooperation on data sharing, support research programs and organize regular meeting to update the work progress.

- Meeting with IUCN-Laos, Department of Forestry and Nakai Nam Theun National Park (NNT NP) in December to discuss on the Monitoring the Illegal Killing of Elephant and Law Enforcement Capacity Assessment. The current implementation work of NNT NP has been assessed and overall of result showed a satisfaction rank, all information will be submitted to CITES.
- Meeting with CSR and Government affaire team in December to discuss on the current cooperation with GML DoNRE, action plan for coming year (2021) have been set which will be targeted to increase a capacity and autonomy of GML on environment management in district level. The discussion has also talked on the possible contribution and support to implement the activities such as awareness campaign of Law enforcement to disseminate information a regulation on wildlife protection, waste management

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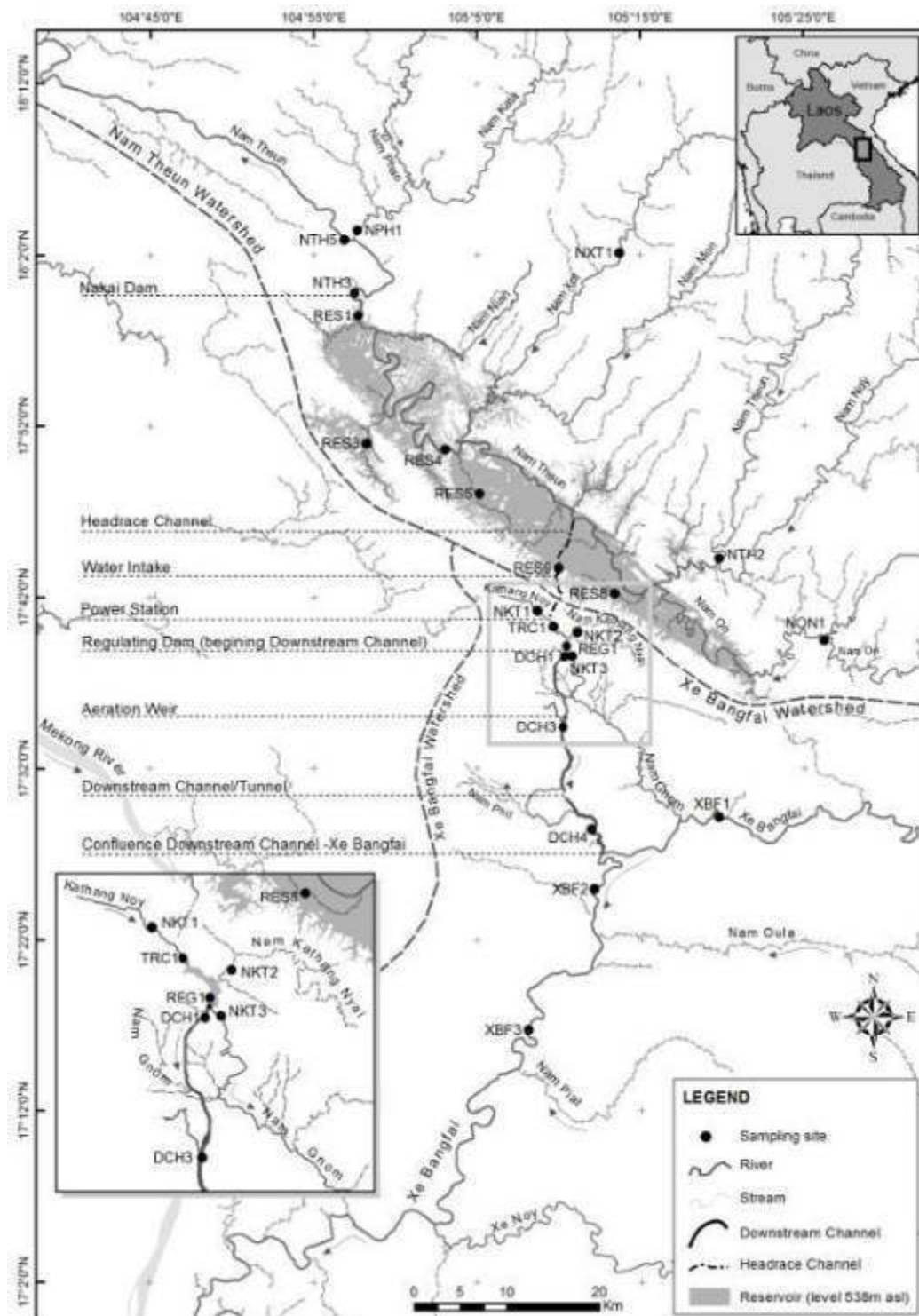
Annex 1 - List of scientific articles relating to Nam Theun 2 Project

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			√

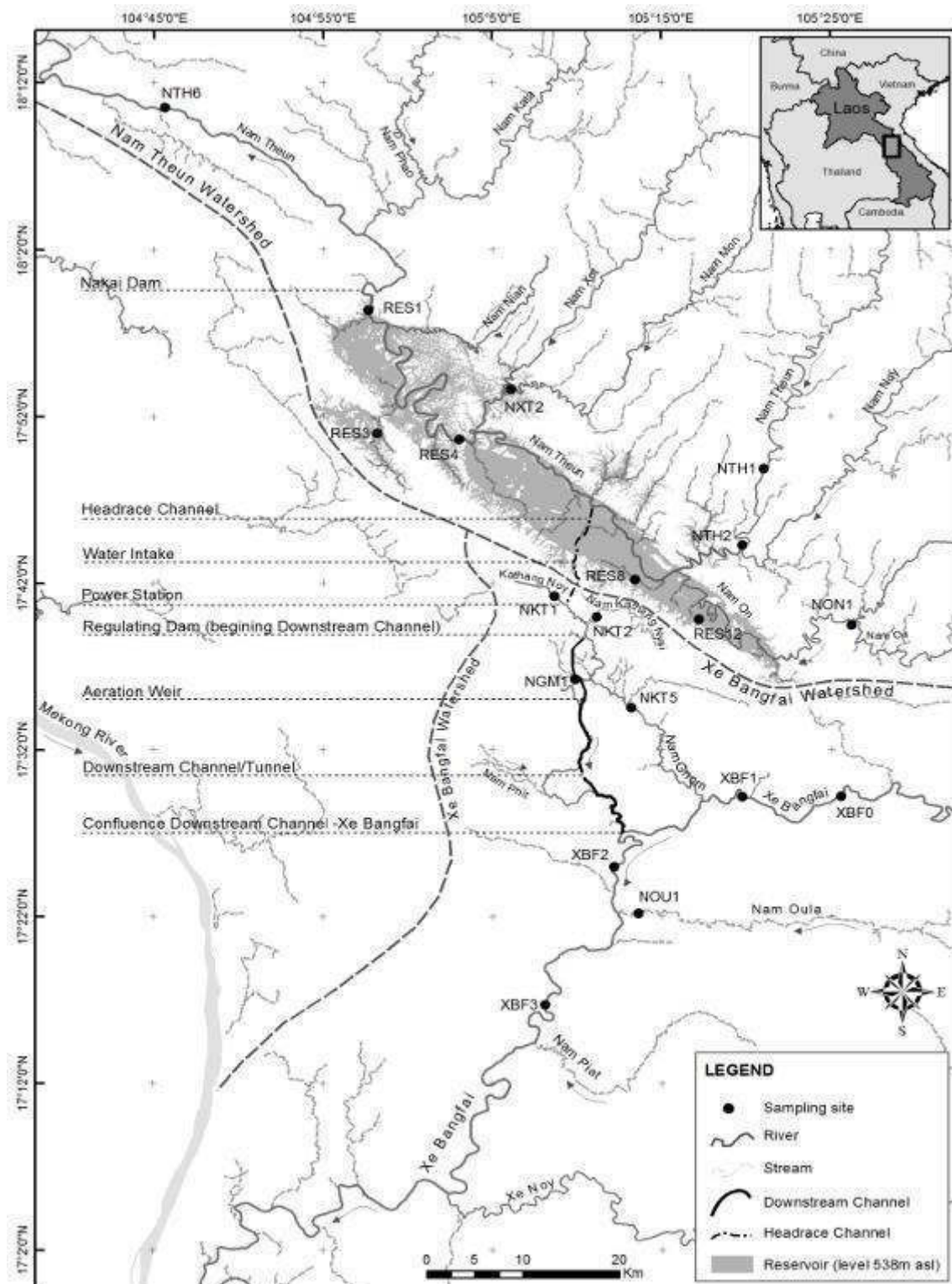
Articles	Under review	Approved	Published and online
Descoux & Cottet. 5 years of monitoring of zooplankton community dynamics in a newly impounded sub-tropical reservoir in Southeast Asia (Nam Theun 2, Lao PDR). Hydroeco. appl., 2015			√
D. Serça et al. Nam Theun 2 Reservoir four years after commissioning: 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., Vongkhamso, 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. Vongkhamso, 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 et 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

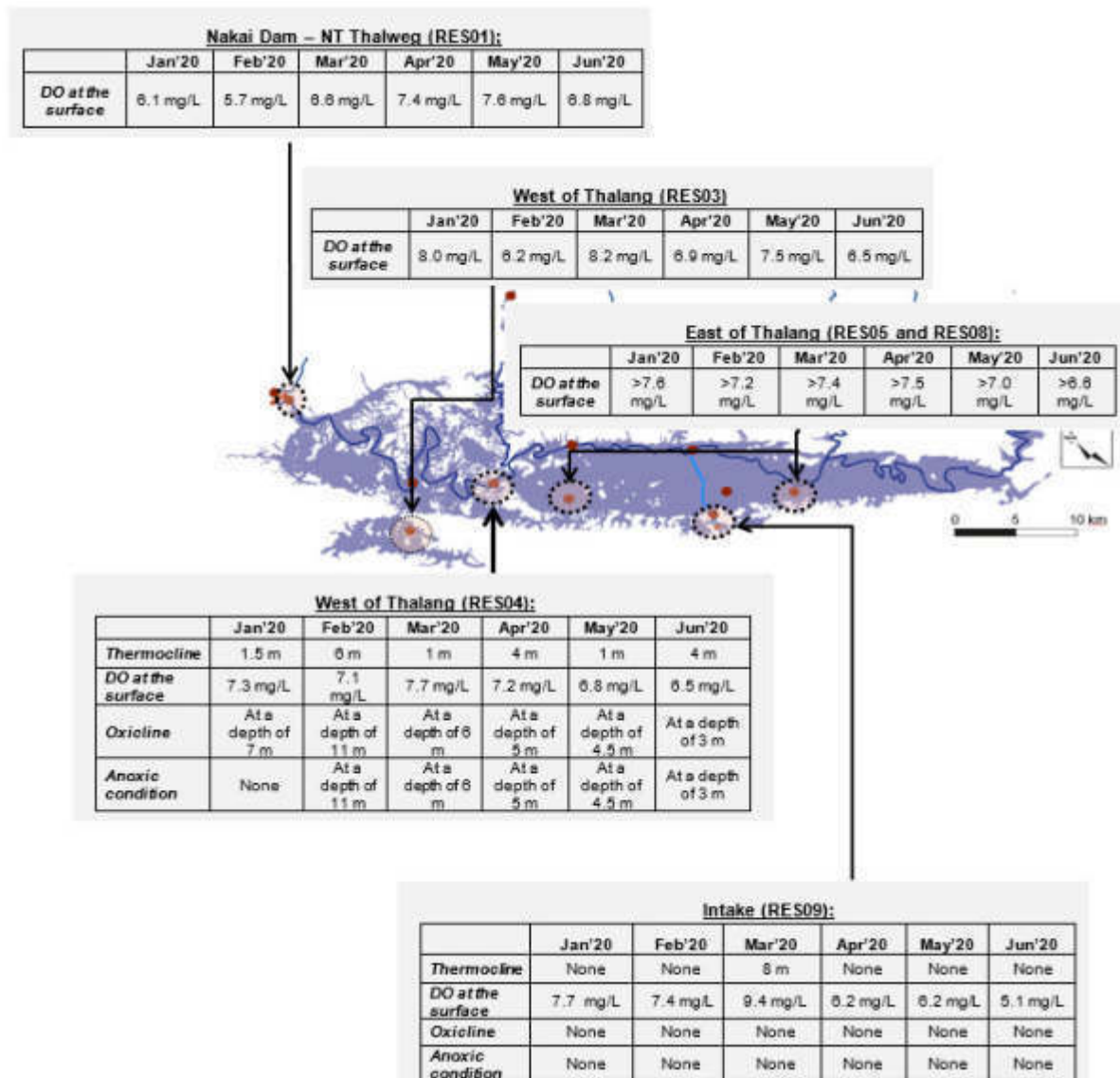
Number	Group	Parameters
1	In situ	Total Depth, Temperature, pH, Dissolved Oxygen, Turbidity, Conductivity, Transparency
2	Carbon budget	Dissolved CH ₄ , Dissolved CO ₂ , Total Organic Carbon, Total Carbon, Total Inorganic Carbon (Calculation), Total Alkalinity
3a	Other major parameters	BOD, TSS, Total 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

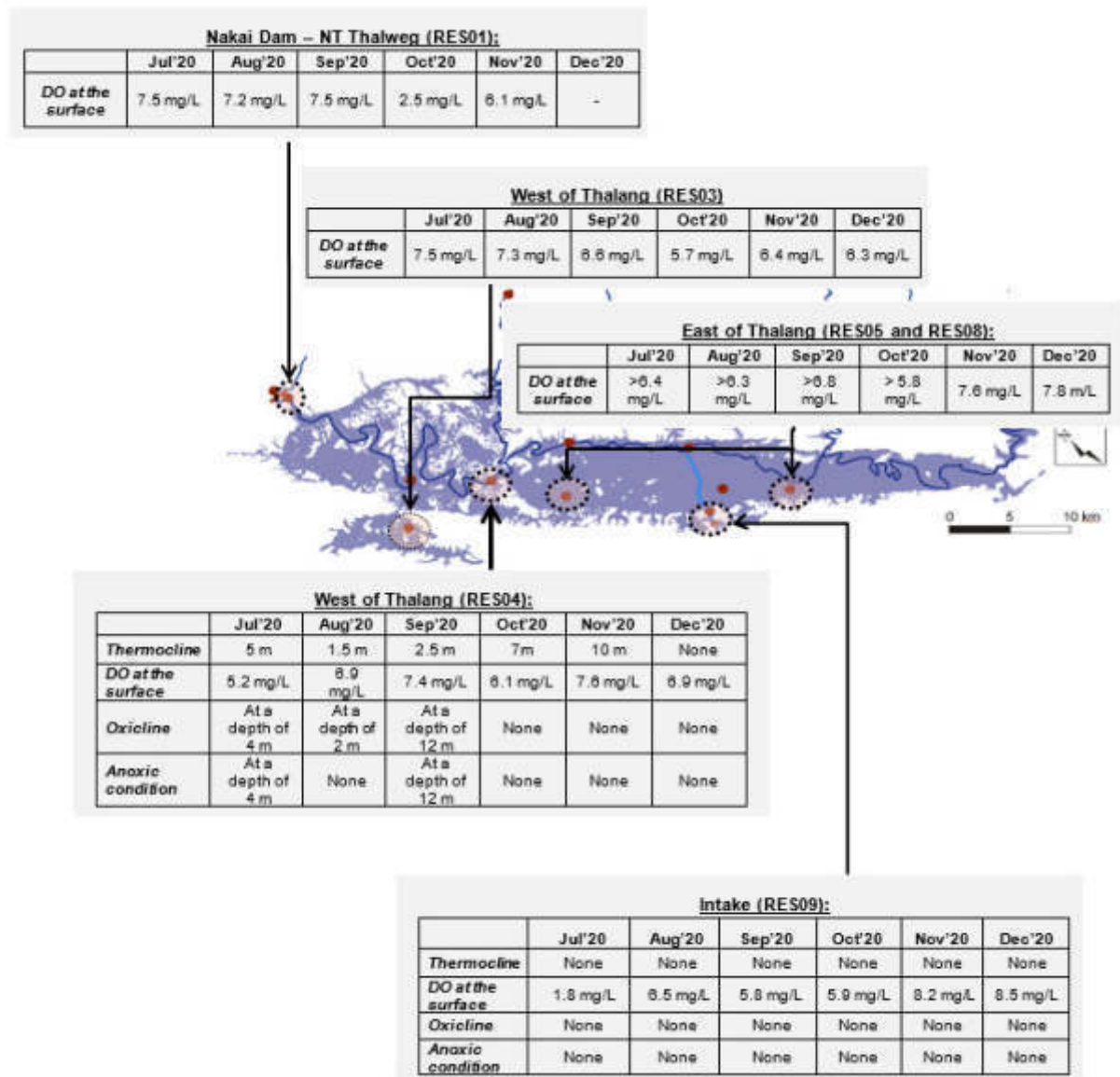
Annex 5 – Frequencies and stations of the measurements in May 2017 to April 2023

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 Dec 2020



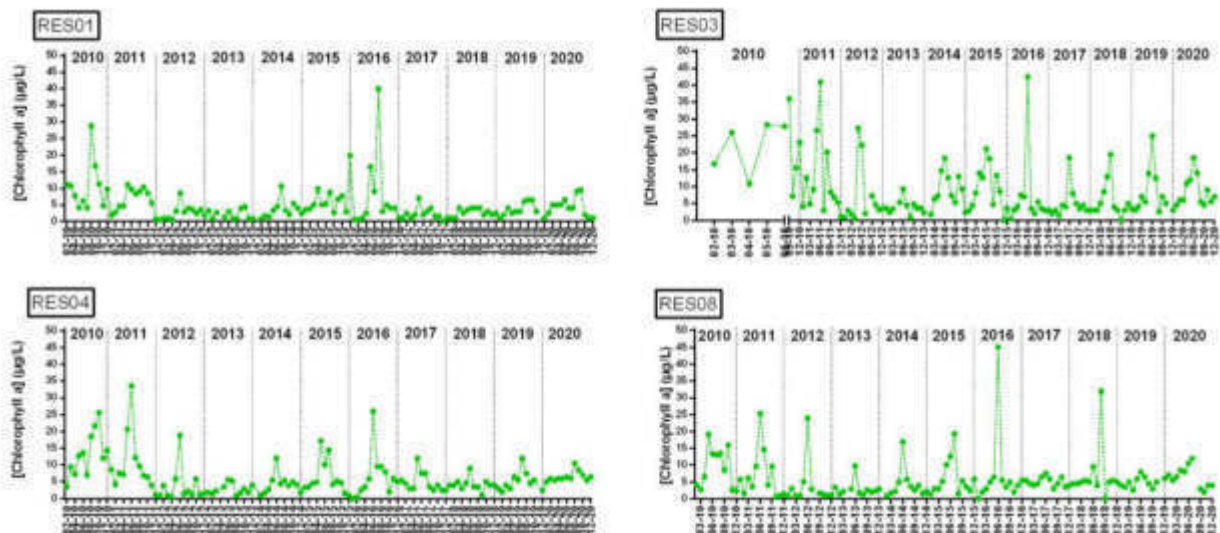


Annex 7 – The 16 fixed boreholes are the most frequently used by villagers in 6 districts

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

Nongbok	Ban Thaphoxai	XBL07802	Thaphoxai BH2
	Ban Thakharm	XBL07902	Thakharm BH2
	Ban Sorkbor	NBK05307	Sorkbor BH7
	Ban Hatxiengdee	NBK05902	Hatxiengdee BH2

Annex 8 – Chlorophyll a concentration by station

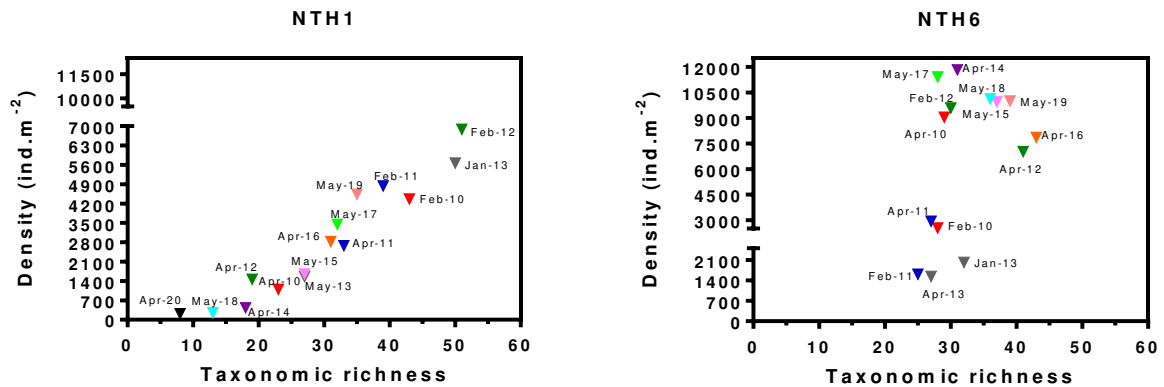


Annex 9 – Reference of Chl a result at RES08

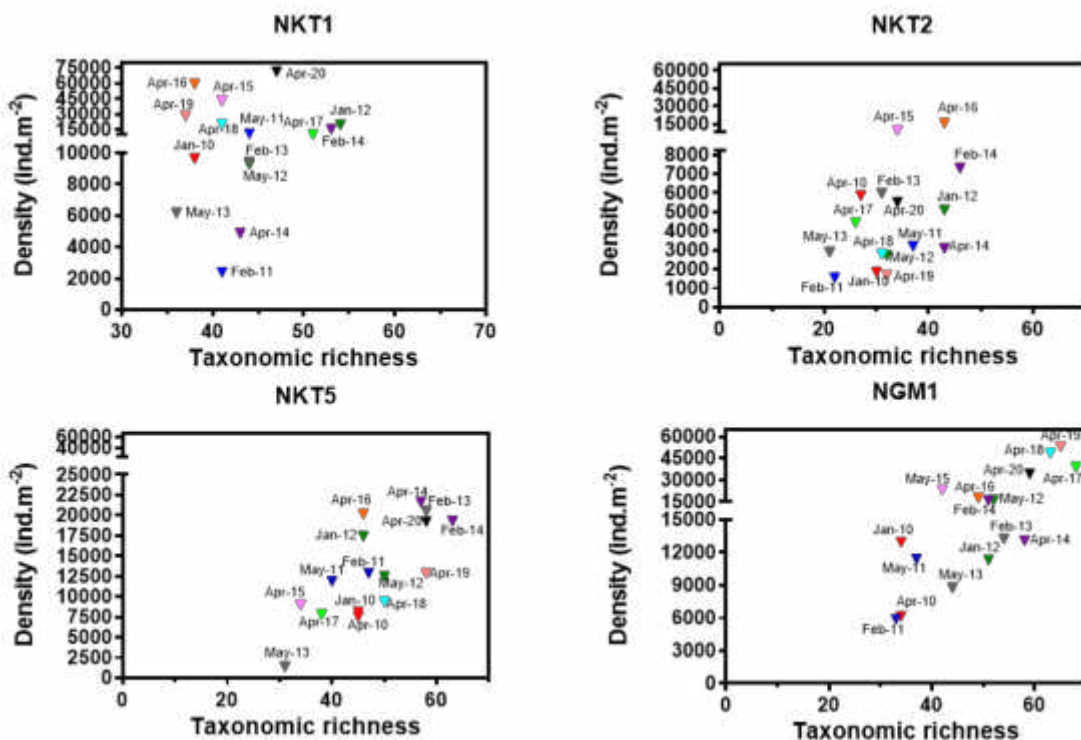
- (i) Normally in August (high water level in NT2 reservoir) the concentration of Phosphorus is ranged between 0.01-0.036 mg.L⁻¹ since 2012, but in August 2018 Phosphorus' concentration could reached 0.041 mg.L⁻¹
- (ii) BZ. Pan *et al.* Factors Influencing Chlorophyll a Centration in the Yangtze-Connected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

Annex 10 – Monitoring result of aquatic invertebrate for 2020

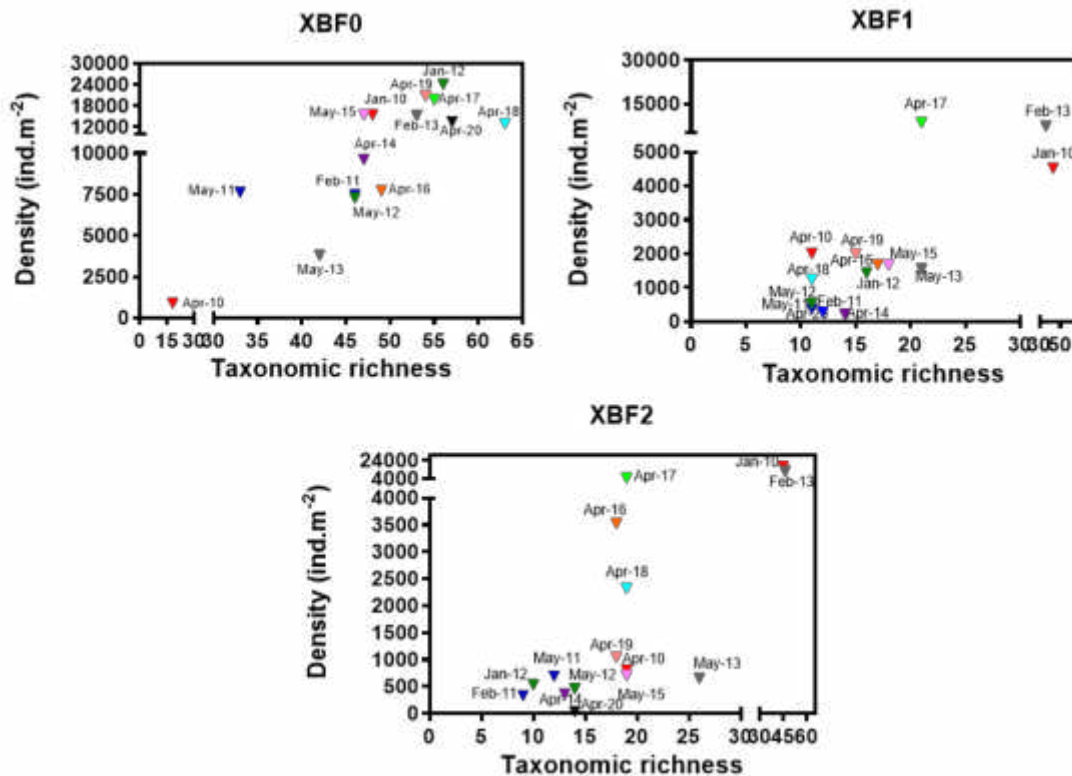
1. Density and taxonomic richness of aquatic invertebrates in the Nam Theun River upstream (NTH1) and Downstream (NTH6) (2010-2020)



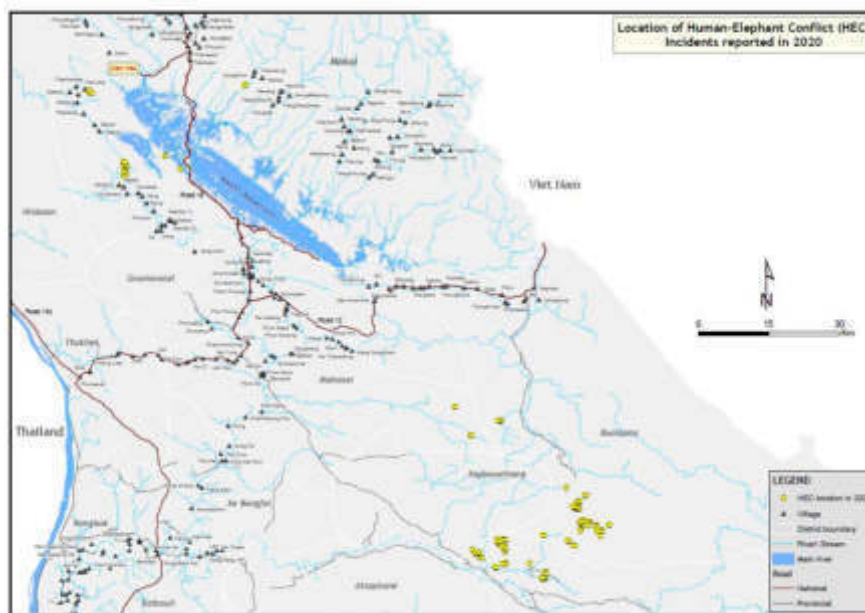
2. Density and taxonomic richness of aquatic invertebrates in Nam Kathang/Nam Gnom area from 2010 to 2020



3. Density and taxonomic richness of aquatic invertebrates in the Xe Bangfai area between 2010 and 2020



Annex 11 – Location of HEC incidents in 2020



Annex 12 – The meeting of G3 solution held on 24th August 2020 at Nakai District

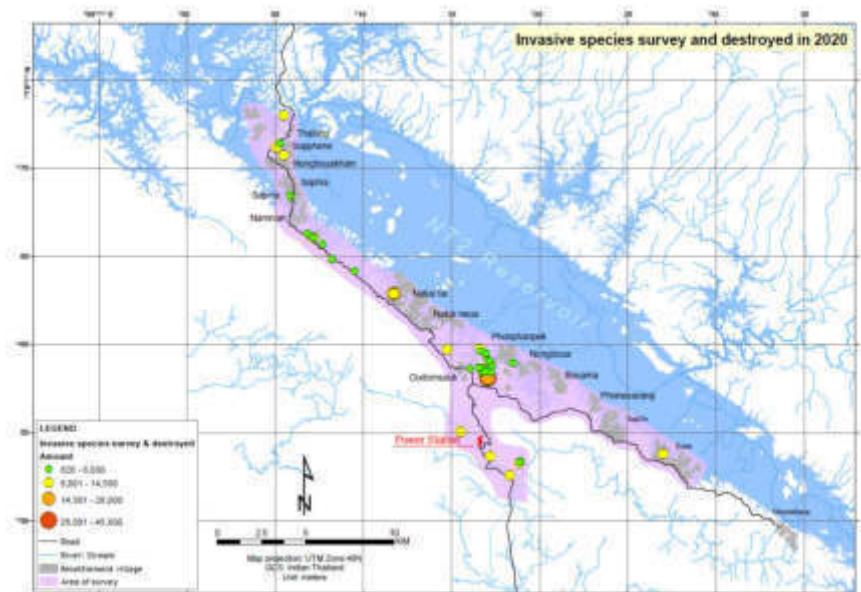


Annex 13 – Picture of AMLs monitoring result by camera trap



Annex 14 – AMLs' monitoring result during January to December 2020

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 15 – Locations of *Mimosa pigra* found and destroyed for 2020

Annex 16 – Activities of Chinese Swamp Cypress restoration in 2020

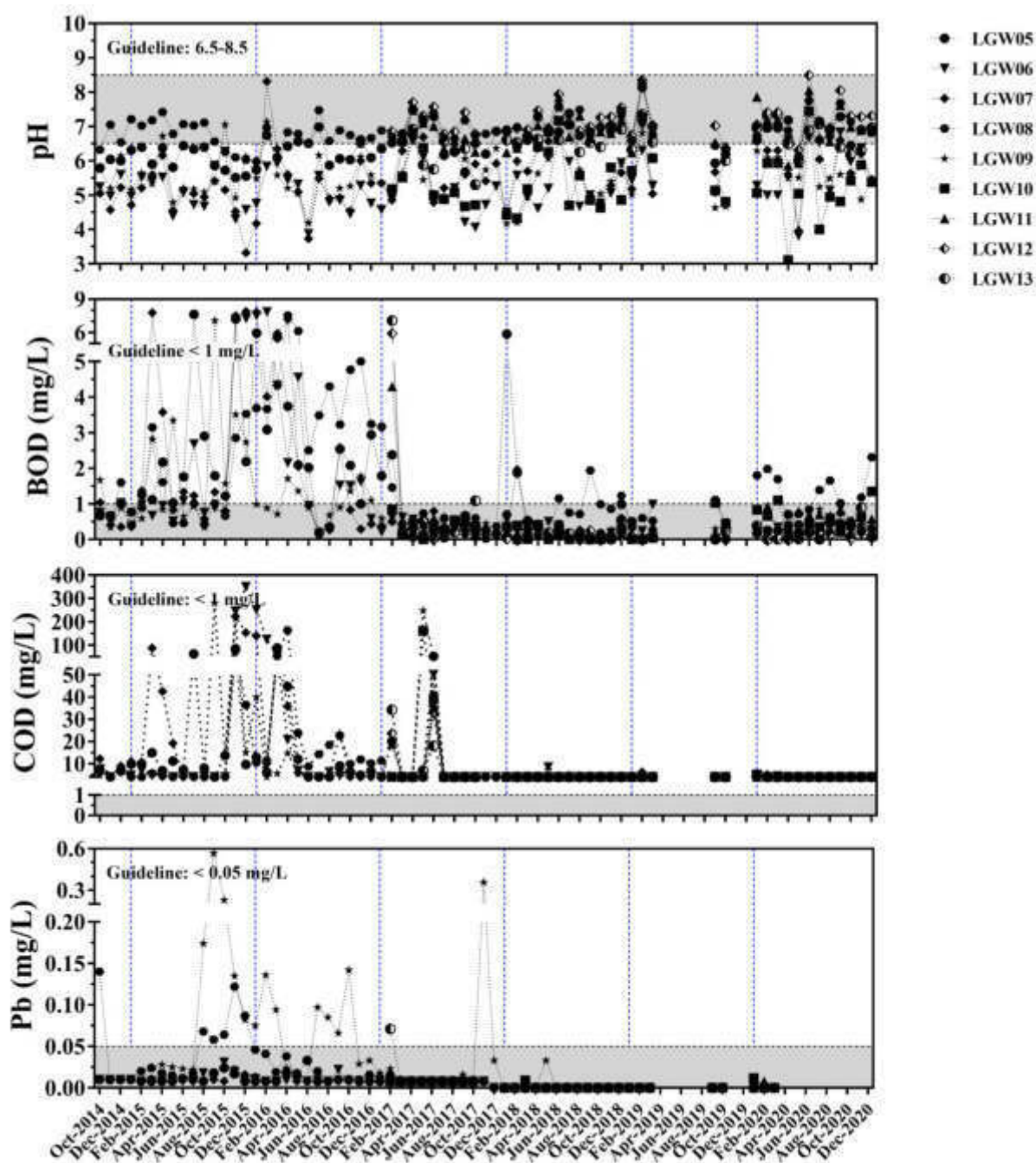


Measuring the planted saplings

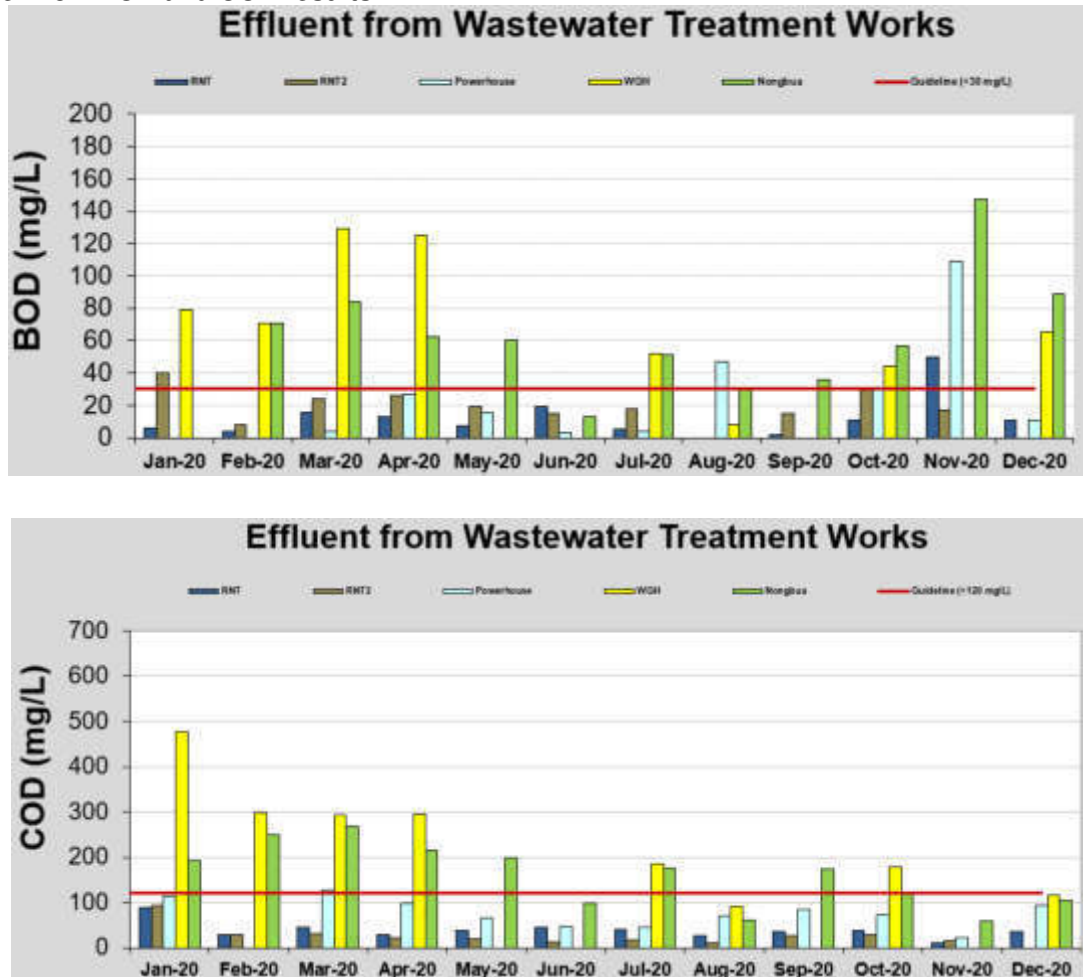


Germination activities: sowing seeds of Chinese Swamp Cypress

Annex 17 - Landfill observation borewells testing results January to December 2020



Annex 18 – BOD and COD results



Annex 19 – NTPC wastewater treatment facilities monitoring results

Parameter	Guideline values*	Exceedance revealed (at least a month) from January to December 2020				
		RNT1	RNT2	Powerhouse (PWH)	Wooden Guesthouse (WGH)	Nongbua Boat camp
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		
Ammonia-nitrogen (NH ₃ -N)	< 4 mg/L			X		
Oil & Grease	< 5 mg/L				X	

Note: No effluent discharged during the sampling day: (i) at PWH in February, (ii) at WGH in May and June, (iii) at WGH in September and November and (iv) at RNT2 in December.

* Water quality standard guideline of effluent discharged, Decision on National Environmental Quality Standard, Prime Minister's Office, No.81/PMO. 2 Feb 2017, MoNRE, Vientiane Capital

Annex 20 - Environment inspection and monitoring

NTPC sites	Number of Inspection
	January to December
Nakai Dam Site	9
Wooden Guesthouse	16
PWH & Switchyard	9
RNT Complex	29
Gnommalath Landfill	63
Surge Shaft/Access Adit	9
Intake and Headrace Channel and Tunnel	9
Nong Boua Boat area	16
Regulating Dam	7
Total	167

There were 62 environmental issue raised from the industrial site inspection and workplace inspection (non-industrial site) during January to December 2020, the current status is reported in table below:

Period	Inspection area	Number of issues	Status		Remark
			Closed	Pending	
January to December 2020	Industrial site	33	30	3	Action follow up is going on
	Non-Industrial site	29	21	8	

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 43 special missions of environmental inspection in January - December 2020 as follows:

- 1 mission of Daily managerial patrol during the 2020 Major Overhaul (January to March)
- 2 missions of Workplace inspection at RNT organized by RSU (February and March)
- 3 mission of Workplace inspection at Vientiane office (February, September and December)
- 15 mission of Managerial patrol with TB-QHSE (2 in March, 1 in May, 1 in June, 1 in July, 3 in August, 1 in September, 2 in October, 3 in November and 1 in December)
- 6 missions of inspection at Gnommalath district landfill (January, February, July, August, September and November)
- 4 missions of inspection at Nakai district landfill (January, June, July and November)
- 7 missions of joining final inspection:
 - (i) in January: stainless door-cover sand tanks-Nam Kathang bridge door, toilet-generator house
 - (ii) in October: the improvement the kitchen at F3 houses, the new bus shelter at Newrest parking area.
 - (iii) in November: the drilling the borehole at NTPC Landfill, the improvement residence fence at RNT

(iv) In December: the improvement of quality for water supply and wastewater treatment system at WGH.

- 1 mission to follow up the field work of GRET in August.
- 1 mission to inspect the death fish case at regulating dam in September.
- 1 mission to count the obsolete equipment with AB-Site management in October.
- 2 missions of yearly site visit at Xai Long Lao steel factory and VTE landfill.

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 21 - Corrective and preventive action for incident reports January to December 2020

No	Incident Date	Level	Description of Incident	Corrective Action Plan	Status	ID Ref.
01	23-1-2020	1	The styrofoam was used for packaging in Newrest mini-mart which not complied to NTPC environmental care policy.	The Newrest must be informed not to use the styrofoam, the biodegradable container is acceptable to use.	Closed	2,544
02	9-2-2020	1	Found the oil leakage from junction box 111MTB204BD and cable pipe in junction box 111MTB402BT.	TB-Mechanical to perform Root Cause Failure Analysis (RCFA) and implement.	CAP Completed	2,568
03	13-7-2020	2	Found several death fish at the log boom of Regulating dam, the root cause may occur by low dissolved oxygen (DO) in the water which was due to low water level of Nakai reservoir.	Buried all the death fish at NTPC landfill and disinfected the area by lime powder.	Closed	2682
04	10-8-2020	1	Found the oil spill from vehicle on the access road around RNT camp	TB-Environment and AB-Site controlled the damaged and clean the spill with sand, collected them in red plastic bag with proper label, and sent to NTPC Landfill.	Closed	2700
05	23-9-20	1	Found death fish in regulating pond	Buried all the death fish at NTPC landfill and disinfected the area by lime powder.	CAP required	2783
06	24-11-2020	1	Found the waste and cigarette butts are littering on the ground at motorcycle parking.	Clean the area by NEWREST and increase the awareness of contractors by TB-Environment.	CAP Follow up	2834

Annex 22 - Environment awareness training January to December 2020

- **For NTPC staff and family**

No.	Description of group	#Trained Persons	Remarks
1	NTPC new staff	13	
2	NTPC new interns	33	
3	Others (Consultants, students and volunteers)	5	
4	Housewives of NTPC staff	40	Refresh training
5	NTPC staff	231	Refresh training

- **For Contractors**

No.	Company name of contractors/providers	#Trained Persons	Remarks
1	NEWREST	6	
2	English Teacher	1	
3	Koncept furniture	3	
4	SSV Education	6	
5	KSSSE	4	
6	KGS	12	
7	SOS medic	2	
8	Automation service	2	
9	BK	77	
10	SCC	13	
11	SSS	5	
12	GM	29	
13	TSV	7	
14	KSSC	16	
15	NTC Nilan	13	
16	BPC	18	
17	KSC	5	
18	IMDC and NTCC (National Tuberculosis Control Center)	18	
19	PBC	5	
20	PK underworld water	5	
21	TDS (Thongsangnang Driving School)	4	
22	XSN (Xaysana construction)	66	
23	OCG Learning Center and Consulting	4	
24	TAF	2	
25	KGS	43	Refresh training
26	SSSE	2	Refresh training
27	SSV Education	22	Refresh training
28	KSC	114	Refresh training
29	NEWREST	61	Refresh training

Annex 23 – 2020 Health, Safety and Environment Improvement Program (HSEIP)

Objective & Target Reference	Objectives	Targets
HSE 08/2020	Saving Energy and Water Program	<ul style="list-style-type: none"> -Install the meters to record water and electricity consumption -Organize at least 2 events to promote the program -Implement "Earth Hour" event (turn off the light and other electrical appliance together about 1 hour, doing outdoor activity together)
HSE 09/2020	Environmental <ul style="list-style-type: none"> - To prevent major environment accident. - To comply with the local law and other requirements (LTA, IMA and POE), Project: waste cell, wastewater treatment. 	Zero major environment accident
HSE 10/2020	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, and 100% report is submitted
HSE 11/2020	Promotion and implementation of Environment Awareness Programs in NTPC community <ul style="list-style-type: none"> - To reduce the usage of plastic bag in RNT campus - To reduce the usage of paper in NTPC's offices 	<ul style="list-style-type: none"> - 5% reduction of plastic bag usage compare to 2019 - 5% reduction of paper usage compare to 2019
HSE 12/2020	To promote the Chemical awareness to all staff	<ul style="list-style-type: none"> -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 13/2020	To start the Laboratory waste disposal	<ul style="list-style-type: none"> - Conduct the trial disposal process of Acid and Base waste by evaporation (to reduce at least 10% of existing chemical waste amount).

Objective & Target Reference	Objectives	Targets
		- Record and write a procedure
HSE 14/2020	Supporting of Nakai and Gnommalath solid waste management and providing technical assistance	- Provide training on waste management to DoNRE staff and other related parties. - Prepare and Provide the landfill operation manual applied at the district landfill
HSE 15/2020	Feasibility study on community waste management at Nakai and Gnommalath districts	- Complete the first phase of the project for site survey, data collection and set up an action plan for further steps.
HSE 16/2020	Study on recycle waste compaction process and its recycling market (to reduce storage volume)	- Finding recycling factory in lao who accept the compacted recycle waste (paper, plastic bottle, can) - Finding appropriate compacting machine
HSE 17/2020	Control and manage special waste (obsolete furniture, obsolete equipment, printer toners...) from other departments to be disposed to NTPC landfill	- 80% of real generated waste must be disposed to landfill (only 20% of waste to be stored at temporary waste storage)

Annex 24 – 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)