My Ly - Nam Mo Hydropower JSC

Environmental and Social Impact Assessment

MY LY HYDROPOWER PROJECT

Volume II

Agreements, Approvals & Specialist Reports

29 September 2017

ENVIRO-DEV
With input from
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Volume II

Environmental and Social Impact Assessment
My Ly Hydropower Project

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CONTENTS of VOLUME II

1.1 Record of discussion – the 1st negotiation round agreement between the Government of the Lao People's Democratic Republic and the Government of the Socialist Republic of Vietnam

RECORD OF DISCUSSION

THE 1ST NEGOTIATION ROUND

AGREEMENT

BETWEEN

THE GOVERNMENT OF THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

AND

THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM

Today,March 11, 2016, at the headquarter of the Ministry of Industry and Trade of Vietnam, 54 Hai Ba Trung, Hanoi, the Delegation of the Socialist Republic of Vietnam and the Delegation of the Lao People's Democratic Republic held the first negotiation on Agreement between the two countries on cooperation for the project development for investment, construction and operation management of My Ly an Nam Mo hydropower plants.

H.E. Mr Hoang Quoc Vuong, Deputy Minister of the Ministry of Industry and Trade of Vietnam, led the Delegation of the Socialist Republic of Vietnam. Members of the Delegation are representatives of the Government Office and Ministries: Industry and Trade; Foreign Affairs; Justice; Finance; Public Security; National Defense; Natural Resources and Environment; Agriculture and Rural Development; and

H.E. Mr. Viraphonh Viravong, Deputy Minister of the Ministry of Energy and Mines of Laos, led the Delegation of the Lao People's Democratic Republic Members of the Delegation are representative of the Ministries: Energy and Mines; Foreign Affairs;Natural Resources and Environment; Agriculture and Rural Development.

*) The list of participants is in the attachment annex.

The negotiation proceeded as follows:

I. The general regulation

1. The two Parties confirmed that the two countries' traditional and friendly relationship will be enhanced by the signing of this Agreement.
2. The two Parties reaffirmed the significance and importance of the Agreement signing thatshall be the legal framework for the Investor (My Ly – Nam Mo hydropower joist stock company) to implement the Project.
3. The Project will relate to several crucial issues of the two countries such as society – economy, national security, mutual border, environment, immigration and resettlement. Thus, the signing of this Agreement is very necessary.

II. The specific contents

1. The two Parties agreed that the subjects of Agreement signing are the Governments of the two countries. However, the Governments may assign to suitable Ministries for signing. The two Parties proposed to report to the two Governments about the representative agencies of signing. For the Vietnamese side, the Ministry of Industry and Trade will be the representative and for the Laotian side, the Ministry of Energy and Mines will be the representative of Lao side for negotiation and signing of the Agreement(s).

1

2. Two Parties in principle agreed on the draft Agreement proposed by Vietnam Party. However, the Laotian Party proposed several issues to be carried out in the near future such as: i). Environmental and Social Impact Assessment including other mitigation plans as required by Lao PDR laws and procedure; ii). border issue is required to be elaborated in detail on the issues to be taking care and mitigation measure to avoid any illegal activities. Such border issues might be deal with in the draft Agreement and/or separated agreement between the two countries.The specific regulations will be stated in relevant Agreements (if needed) between the relevant Ministries of the two Parties. The two Parties assign the Investor to implement as soon as possible Environmental and Environmental and Social Impact Assessment (ESIA) in Lao territory in accordance with the current laws and regulation of Laos.

3. The Lao Party agreed that the Lao Government shall not issue permission for other new projects within the reservoirs of My Ly project with the full supply water level up to 300masl and Nam Mo 1 project with the full supply water level up to 235masl since the signing date of this Agreement.

4. The Lao Party agreed that the Ministry of Industry and Trade of Vietnam shall be responsible for the approval of design and technical specification of the Project because the whole site of the Project's construction locate in the territory of Vietnam.

5. The Vietnamese Party shall assign the Investor to implement the process of compensation and resettlement, design, construction in accordance with the current laws and regulations of Vietnam in Vietnamese territory.

6. The Vietnamese side shall update and amend the contents of the draft Agreement based on the contributing ideas of the Lao Party during the negotiation and submit the draft to relevant agencies of Vietnam for confirmation before sending to the Lao Party for consideration.

7. The Lao side will review and comment the draft provide by Vietnamese side as necessary to make sure that such agreement and following agreement will be in line with Lao laws and procedure.

8. The second round of negotiation will tentatively held in Nghe An Province, Viet Nam as soon as possible. The two Parties agreed to speed up the process of finalization and getting approval of the relevant agreements from both governments within the 2nd Quarter, 2016.

This Record of Discussion was signed in English in two versions in Hanoi, Vietnam on March 11, 2016.

For the Delegation of the Socialist Republic of Vietnam

Hoang Quoc Vuong
Deputy Minister
Ministry of Industry and Trade

For the Delegation of the Lao People's Democratic Republic

Viraphonh Viravong
Deputy Minister
Ministry of Energy and Mines

1.2 Document 209ML-TD assigning two consultants to conduct consultations during the preparation of the ESIAs for My Ly and Nam Mo 1 HPPs

CÔNG TY CP THỦY ĐIỆN
MỸ LÝ – NẬM MÔ

Số: 209 /ML-NM-TĐ
V/v: Tham vấn trong quá trình lập Báo cáo ĐTM của dự án: Thủy điện Mỹ Lý và Nậm Mô 1

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

Hà Nội, ngày 14 tháng 08 năm 2015

Kính gửi: UBND các xã Mỹ Lý, Keng Đu, Tà Cạ và Mường Típ.
BCH các Đồn biên phòng: Keng Đu, Mỹ Lý và Mường Típ

Căn cứ vào Thông báo kết luận số: 193/TB-UBND ngày 09/04/2015 của UBND tỉnh Nghệ An về việc kết luận của Chủ tịch UBND tỉnh Nguyễn Xuân Đường tại cuộc họp về Dự án thủy điện Mỹ Lý - Nậm Mô 1.

Căn cứ vào thông báo kết luận số: 14/TB-UBND huyện Kỳ Sơn ngày 17/4/2015 của đồng chí Bùi Trầm - Chủ tịch huyện tại cuộc họp về triển khai Dự án thủy điện Mỹ Lý -Nậm Mô 1.

Công ty CP thủy điện Mỹ Lý Nậm Mô cử hai chuyên viên là: Nguyễn Đức Thắng và Đoàn Ngọc Tân vào thực hiện công tác tham vấn trong quá trình lập báo cáo Đánh giá tác động môi trường ĐTM của dự án thủy điện Mỹ Lý và Nậm Mô 1.

Vậy, Công ty CP thủy điện Mỹ Lý Nậm Mô kính đề nghị các phòng ban chức năng, UBND các xã và BCH các đồn Biên phòng liên quan phối hợp, tạo điều kiện thuận lợi để Công ty CP thủy điện Mỹ Lý-Nậm Mô thực hiện nhiệm vụ đảm bảo chất lượng và tiến độ thời gian.

Trân trọng cảm ơn!

Nơi nhận:
- Như trên;
- Lưu VT, TĐ.

KT.TỔNG GIÁM ĐỐC
PHÓ TỔNG GIÁM ĐỐC

M.S.D.N: 2901444839 - C.T.C.P
CÔNG TY CP THỦY ĐIỆN MỸ LÝ-NẬM MÔ
TP.VINH-T.NGHỆ AN

NGUYỄN TIẾN PHONG

1.3 Decision approving the environmental impact assessment of My Ly HPP

BỘ TÀI NGUYÊN VÀ MÔI TRƯỜNG

Số: 2961 /QĐ - BTNMT

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM

Độc lập - Tự do - Hạnh phúc

Hà Nội, ngày 20 tháng 11 năm 2015

QUYẾT ĐỊNH

Về việc phê duyệt báo cáo đánh giá tác động môi trường của Dự án Công trình Thủy điện Mỹ Lý

BỘ TRƯỞNG BỘ TÀI NGUYÊN VÀ MÔI TRƯỜNG

Căn cứ Luật Bảo vệ môi trường ngày 23 tháng 6 năm 2014;

Căn cứ Nghị định số 21/2013/NĐ-CP ngày 04 tháng 3 năm 2013 của Chính phủ quy định chức năng, nhiệm vụ, quyền hạn và cơ cấu tổ chức của Bộ Tài nguyên và Môi trường;

Căn cứ Nghị định số 18/2015/NĐ-CP ngày 14 tháng 02 năm 2015 của Chính phủ quy định về quy hoạch bảo vệ môi trường, đánh giá môi trường chiến lược, đánh giá tác động môi trường và kế hoạch bảo vệ môi trường;

Căn cứ Thông tư số 26/2011/TT-BTNMT ngày 18 tháng 7 năm 2011 của Bộ Tài nguyên và Môi trường quy định chi tiết một số điều của Nghị định số 29/2011/NĐ-CP ngày 18 tháng 4 năm 2011 của Chính phủ quy định về đánh giá môi trường chiến lược, đánh giá tác động môi trường, cam kết bảo vệ môi trường;

Theo đề nghị của Hội đồng thẩm định báo cáo đánh giá tác động môi trường của Dự án Công trình Thủy điện Mỹ Lý thuộc xã Mỹ Lý và xã Keng Đu, huyện Kỳ Sơn, tỉnh Nghệ An họp ngày 29 tháng 7 năm 2015 tại Hà Nội;

Xét nội dung báo cáo đánh giá tác động môi trường của Dự án Công trình Thủy điện Mỹ Lý đã được chỉnh sửa, bổ sung kèm theo Văn bản giải trình số 265/PTĐ ngày 08 tháng 10 năm 2015 của Công ty Cổ phần Thủy điện Mỹ Lý - Nậm Mô;

Theo đề nghị của Tổng cục trưởng Tổng cục Môi trường,

QUYẾT ĐỊNH:

Điều 1. Phê duyệt báo cáo đánh giá tác động môi trường của Dự án Công trình Thủy điện Mỹ Lý (sau đây gọi là Dự án) thuộc phạm vi lãnh thổ Việt Nam (không bao gồm phần diện tích thuộc lãnh thổ Lào) của Công ty Cổ phần Thủy điện Mỹ Lý - Nậm Mô (sau đây gọi là Chủ dự án) với các nội dung chủ yếu sau đây:

1. Phạm vi, quy mô, công suất Dự án:

1.1. Phạm vi: Dự án nằm trên dòng chính sông Cả thuộc địa bàn các xã Mỹ Lý và xã Keng Đu, huyện Kỳ Sơn, tỉnh Nghệ An. Phần diện tích thuộc phạm vi lãnh thổ Việt Nam là 1017,47ha.

1.2. Quy mô, công suất các hạng mục công trình chính:

1.2.1. Hồ chứa nước có diện tích ngập phía Việt Nam 831,07ha ứng với mực nước dâng bình thường +330,0m.

1.2.2. Đập dâng bê tông trọng lực chiều dài 322,0 m; có cao trình đỉnh đập +338,5m; chiều rộng đỉnh đập 8,0m.

1.2.3. Đập tràn gồm 06 khoang, kích thước 10,0m x 12,0m; cao độ ngưỡng tràn +318,0m; tiêu năng bằng mũi phun.

1.2.4. Cửa lấy nước bê tông cốt thép đặt trong thân đập bờ phải; gồm 02 khoang kích thước 6,0 m x 6,0 m; tại mỗi khoang có bố trí cửa van sửa chữa và cửa van sự cố. Cao trình ngưỡng cửa lấy nước là +294,5m.

1.2.5. Đường hầm dẫn nước bọc bê tông cốt thép và bọc thép, chiều dài 349,38m; đường kính trong 6,0m.

1.2.6. Kênh xả sau nhà máy chiều dài 78,39m; độ dốc đáy kênh 0%; cao độ đáy kệnh 204,0m; chiều rộng đáy kênh 32,4m.

1.2.7. Nhà máy thủy điện kiểu hở gồm 02 tổ máy công suất nhà máy 250MW, cao trình lắp máy 211,4m; cao trình gian lắp ráp 228,75m; kích thước nhà máy phần hở 73,45m x 21,0m.

1.2.8. Trạm phân phối điện ngoài trời 220kV cao độ +228,75m; kích thước 95,0m x 50,0m; gồm thiết bị phân phối 220kV, thiết bị chống cháy, hệ thống rãnh cáp và đường đi nội bộ.

2. Yêu cầu bảo vệ môi trường đối với Dự án:

2.1. Phối hợp với các cơ quan chức năng liên quan, các chủ rừng bị chiếm dụng đất bởi Dự án thực hiện công tác kiểm kê, đánh giá trữ lượng và thỏa thuận phương án tận thu gỗ và lâm sản trong phạm vi diện tích chiếm dụng của Dự án. Phối hợp với cơ quan quản lý rừng phòng hộ trong quá trình triển khai thi công Dự án để phòng ngừa, kiểm soát triệt để các hành vi khai thác gỗ ngoài phạm vi Dự án và săn bắn động vật hoang dã trái phép.

2.2. Phối hợp với các cấp có thẩm quyền của địa phương thực hiện giải phóng mặt bằng, bồi thường tài sản, hoa màu, tái định cư theo quy định của Nghị định số 14/2014/NĐ-CP ngày 26 tháng 02 năm 2014 của Chính phủ quy định chi tiết thi hành Luật điện lực về an toàn điện và các quy định của pháp luật hiện hành về bồi thường, giải phóng mặt bằng trước khi khởi công xây dựng Dự án.

2.3. Thực hiện hoàn thổ và khôi phục cảnh quan các khu đất được giao làm mặt bằng phục vụ thi công; phối hợp với chính quyền địa phương xác định vị trí đổ bùn, đất đá thải phát sinh trong quá trình thi công và chỉ được phép đổ thải vào các vị trí khi được sự đồng ý của chính quyền địa phương.

2.4. Thông tin rộng rãi cho chính quyền địa phương và cộng đồng dân cư nơi thực hiện Dự án biết về các hoạt động thi công của Dự án.

2.5. Thực hiện các biện pháp giảm thiểu tác động đến môi trường đất, không khí, nước và tài nguyên sinh vật, các biện pháp phòng cháy nổ và các giải pháp quản lý, kỹ thuật khác trong quá trình thi công, vận hành đảm bảo các yêu cầu của quy trình vận hành hồ chứa; đảm bảo các quy định về vệ sinh môi trường, an toàn và phòng ngừa các sự cố môi trường cho người lao động và cộng đồng dân cư khu vực hạ lưu Dự án.

2.6. Xây dựng quy trình vận hành hồ chứa của Dự án và phối hợp với Công trình thủy điện Bản Vẽ trong quá trình vận hành đảm bảo duy trì dòng chảy tối thiểu đáp ứng các nhu cầu nước cho các đối tượng dùng nước phía hạ du; tuân thủ quy trình vận hành liên hồ chứa trên lưu vực sông Cả.

2.7. Thực hiện nghiêm túc chương trình giám sát môi trường như đã đề xuất trong báo cáo đánh giá tác động môi trường; cập nhật, lưu giữ số liệu giám sát để cơ quan quản lý nhà nước về bảo vệ môi trường kiểm tra khi cần thiết.

2.8. Tổ chức thu gom, vận chuyển và xử lý toàn bộ các loại chất thải rắn sinh hoạt, chất thải rắn thông thường và chất thải nguy hại phát sinh trong quá trình thực hiện Dự án theo đúng quy định tại Nghị định số 59/2007/NĐ-CP ngày 09 tháng 4 năm 2007 của Chính phủ về quản lý chất thải rắn, Nghị định số 38/2015/NĐ-CP ngày 24 tháng 4 năm 2015 của Chính phủ về quản lý chất thải và phế liệu, Thông tư số 36/2015/TT-BTNMT ngày 30 tháng 6 năm 2015 của Bộ Tài nguyên và Môi trường quy định về Quản lý chất thải nguy hại.

3. Các điều kiện kèm theo:

3.1. Chỉ được phép triển khai các hoạt động thi công xây dựng Dự án sau khi có Quyết định chuyển đổi mục đích sử dụng rừng của cơ quan nhà nước có thẩm quyền đối với phần diện tích thuộc phạm vi Dự án chiếm dụng và có báo cáo đánh giá tác động môi trường phần diện tích thuộc lãnh thổ nước Cộng hòa Dân chủ Nhân dân Lào được Chính phủ Lào chấp thuận.

3.2. Xây dựng phương án trồng bù rừng cho diện tích đất lâm nghiệp trình cấp có thẩm quyền thẩm định và phê duyệt theo quy định tại Thông tư số 24/2013/TT-BNNPTNT ngày 06 tháng 5 năm 2013 của Bộ Nông nghiệp và Phát triển nông thôn về trồng rừng thay thế khi chuyển mục đích sử dụng rừng sang mục đích khác.

Điều 2. Chủ dự án có các trách nhiệm sau đây:

1. Lập, phê duyệt và niêm yết công khai kế hoạch quản lý môi trường của Dự án trước khi triển khai thực hiện Dự án.

2. Thực hiện nghiêm túc các yêu cầu về bảo vệ môi trường quy định tại khoản 2 Điều 1 Quyết định này và các trách nhiệm khác theo quy định của pháp luật về bảo vệ môi trường.

3. Lập hồ sơ đề nghị kiểm tra, xác nhận việc thu dọn lòng hồ trước khi tích nước phục vụ giai đoạn vận hành của Dự án gửi cơ quan có thẩm quyền để kiểm tra, xác nhận.

Điều 3. Trong quá trình thực hiện nếu Dự án có những thay đổi so với các khoản 1 và 2 Điều 1 của Quyết định này, Chủ dự án phải có văn bản báo cáo và chỉ được thực hiện những thay đổi sau khi có văn bản chấp thuận của Bộ Tài nguyên và Môi trường.

Điều 4. Quyết định phê duyệt báo cáo đánh giá tác động môi trường của Dự án là căn cứ để quyết định việc đầu tư Dự án; là cơ sở để các cơ quan quản lý nhà nước có thẩm quyền kiểm tra, thanh tra việc thực hiện công tác bảo vệ môi trường của Dự án.

Điều 5. Giao Tổng cục Môi trường chủ trì, phối hợp với Sở Tài nguyên và Môi trường tỉnh Nghệ An cùng các đơn vị có liên quan thuộc Bộ Tài nguyên và Môi trường thực hiện việc kiểm tra, giám sát việc thực hiện các nội dung bảo vệ môi trường trong báo cáo đánh giá tác động môi trường đã được phê duyệt tại Quyết định này.

Điều 6. Quyết định này có hiệu lực thi hành kể từ ngày ký./.

Nơi nhận:
- Công ty Cổ phần Thủy điện Mỹ Lý - Nậm Mô;
- Bộ Công Thương;
- UBND tỉnh Nghệ An;
- Sở TN&MT tỉnh Nghệ An;
- Thanh tra Bộ;
- Lưu: VPMC, TCMT(2), Hoa (12).

BỘ TRƯỞNG

Nguyễn Minh Quang

ANNEX 2: TABLES, SPECIALIST REPORTS ON BIOLOGY AND WATER QUALITY

2.1 Appendices to chapter 7

Appendix 7.1 Forest vegetation in reservoir and construction area

No	Project area	Villages	Sampling plots[1]	Area (ha)	Land-use
1	**Reservoir area**				
		Keng Du	01, 02, 03	1,247.3	Secondary tropical grassland on uncultivated land; Secondary scrub vegetation on uncultivated land for 7-10 years; *Melia azedarach L. plantation* have regenerated.
		Hat Ta Ven	04		Predominant bamboo forest
		Huoi Xui	05		Secondary mixed evergreen rain forest after exploitation
		Cha Nga	06, 07, 08, 09		Secondary tropical grassland; Semi-deciduous forest after exploitation; Secondary scrub vegetation on uncultivated land for 7-10 years.
		Xop Duong	10, 11, 12		Semi-deciduous forest after exploitation; Mixed broadleaf and bamboo forest; Broadleaf forest after exploitation
2	**Construction areas**				
	Headworks	Xang Tren	13		Secondary mixed evergreen rain forest after exploitation
	Powerhouse		14, 15		Secondary forest on uncultivated land for 7-15 years
	Auxiliary area 2		16		Secondary forest on uncultivated land for 10-15 years
	Auxiliary area 3		17 - 19		Secondary forest on uncultivated land for 10-15 years
	Disposal area 1		20		Secondary forest on uncultivated land for 10-15 years

[1] Forest vegetation survey plots were established along the riverbanks which will be submerged and/or part of construction area.

Appendix 7.2 Vegetation in forest sample sites

Project Area/ Village	Plot No.	Forest type	Stage of forest growth	Regeneration	Species
Reservoir Area					
Keng Du	1	Secondary tropical grassland on cultivated land	Seedling stage	*Streblus ilicifolius, Clausena excavate; Trema orientalis*	Non woody species : *Eupatorium odoratum*, ferns, grass species
	2	Secondary scrub	Saw timber Planted earlier	None	Trees: *Melia azedarach* Non woody species: *Musa paradisiacal, Eupatorium odoratum*, ferns Grass: grass species
	3	Secondary tropical grassland	Seedling stage	*Streblus ilicifolius, Clausena excavate, Trema orientalis*	Herb:: Eupatorium odoratum, ferns Grass: grass species
Hat Ta Ven	4	Bamboo forest		None	*Schizostachyum dullooa*
Huoi Xui	5	Evergreen forest after exploitation	Pole size and some matured	*Aphanamixis polystachya, Dimocarpus fumatus*	Trees: *Celtis philippense, Aphanamixis polystachya, Polyanthia laui, Ilex rotunda, Ilex rotunda, Alstonia scholaris, Dimocarpus fumatus* Non woody species: *Leea indica, Musa balbisiana, Ferns, Poaceae*
Cha Nga	6	Secondary scrub on uncultivated land for 7-10 years	Pole size and some matured	*Lithocarpus corneus, Cratoxylum cochinchinensis, Canthium horridum* 250/ha	Trees: *Ilex rotunda, Lithocarpus corneus, Carallia brachiata, Cratoxylum cochinchinensis, Cratoxylum formosum, Lithocarpus corneus, Lagerstroemia tomentosa* Non woody species: *Schizostachyum dullooa, Psychotria* sp.
	7	*Semi-deciduous forest after exploitation*	*Pole size and some matured*	*Aphanamixis polystachya, Dimocarpus fumatus, Randia spinosa, Vitex tripinnata*	*Trees: Streblus asper, Lagerstroemia tomentosa, Pterocarpus indicus, Ormosia pinnata, Streblus asper, Ficus auriculata, Sumbabiopsis macrophylla* Non woody species*: Piper sp., Acacia sp., Harrisonia perforate, Pothos sp., Alpinia sp.,*
	8	Grassland on uncultivated land		*Streblus ilicifolius, Clausena excavate, Trema orientalis, Rinorea virgata, Schizostachyum dullooa, Cipadessa baccifera* Trees, shrub and bamboo)	Herbs: *Eupatorium odoratum, Urena lobata, Abutilon indicum*, ferns Grass species

Project Area/ Village	Plot No.	Forest type	Stage of forest growth	Regeneration	Species
	9	Grassland on uncultivated land		*Melia azedarach*	Herbs: *Eupatorium odoratum, Urena lobata,Cassia tora, Colocasia macrorhiza*, ferns, grasses
Xop Duong	10	Semi-deciduous forest after exploitation	Pole sized to matured forest	*Sumbabiopsis macrophylla, Dimocarpus fumatus, Streblus asper* (Tree species)	Trees: *Artocarpus rigidus, Dracuntomelon duperreanum, Knema conferta, Endospermum chinense, Sumbabiopsis macrophylla, Pterocarpus indicus, Aphanamixis polystachya, Celtis sinensis, Dimocarpus fumatus, Mangifera indica* *Herbs: Piper spp., Pothos spp.,Acassia spp., Croton spp., ferns, grass spp.*
	11	Mixed broadleaf and bamboo forest	Pole sized to matured forest	None	Trees: *Streblus asper, Pterocarpus indicus, Spondias lakoensis, Macaranga denticulate, Cordia grandis, Celtis sinensis,* *Schizostachyum dullooa* Non woody species*: Caryota mitis, Musa coccinea, ferns and grass spp*
	12	Evergreen forest after exploitation	Pole sized to matured forest	*Sterculia lanceolata, Mallotus hookerianus, Celtis philippense, Diospiros sp., Ficus spp., Sumbabiopsis macrophylla, Eurya spp.*	Trees: *Celtis philippense, Machilus odoratissimus, Mallotus hookerianus, Streblus asper, Streblus asper, Pterocarpus indicus* Non woody species: *Leea indica, Pothos, Tetrastigma sp., Accasia spp., ferns, grasses*
Construction Area (Xang Tren village)					
Headworks	13	Evergreen forest after exploitation	Pole sized to matured forest	*Sumbabiopsis macrophylla, Mallotus hookerianus, Celtis philippense, Machilus odoratissimus, Ficus spp*	Woody species: *Streblus asper, Celtis philippense, Machilus odoratissimus, Mallotus hookerianus,* Non-woody species: *Pothos, Tetrastigma spp., Accasia spp., ferns, grasses*
Powerhouse Area	14	Secondary forest on uncultivated land for 7-10 years	Pole sized	*Cratoxylum formosum, Dimocarpus fumatus, Streblus asper, Toxicodendron succedana*	Woody species: *Cratoxylum formosum, Cordia grandis, Dimocarpus fumatus, Lagerstroemia tomentosa, Macaranga denticulate, Toxicodendron succedana* **Non-woody species:** *Schizostachyum dullooa, Licuala spinosa, ferns an grasses*
	15	Secondary forest on uncultivated land for 10-15 years	Pole sized to matured	*Canthium horridum, Dimocarpus fumatus*	Woody species: *Cratoxylum formosum, Dimocarpus fumatus, Lagerstroemia tomentosa, Ormosia pinnata, Streblus asper, Toxicodendron succedana*

Project Area/ Village	Plot No.	Forest type	Stage of forest growth	Regeneration	Species
					Non-woody speicies: *Schizostachyum dullooa, Licuala spinosa, ferns and grasses*
Auxiliary area 2	16	Secondary forest on uncultivated land for 10-15 years	Pole sized	*Cratoxylum formosum, Dimocarpus fumatus, Streblus asper, Toxicodendron succedana*	Woody species: *Cordia grandis, Cratoxylum formosum, Dimocarpus fumatus, Lagerstroemia tomentosa, Macaranga denticulate, Ormosia pinnata, Streblus asper, Toxicodendron succedana* Non-woody species: *Schizostachyum dullooa, Licuala spinosa, ferns and grasses*
Auxiliary area 3	17	Evergreen forest after exploitation	Pole sized to matured	*Celtis philippense, Dimocarpus fumatus, Pterospermum truncatolobatum*	Woody species: *Aphanamixis polystachya, Archidendron lucidum, Celtis philippense, Glycomis pentaphylla, Pterospermum truncatolobatum, Streblus asper, Xylopia vielana* Non-woody species: *Ardisia spp., Colocasia macrorhiza, ferns, grasses*
	18	Secondary forest on uncultivated land for 10-15	Pole sized to matured	None	Woody species: *Albizia lucidior, Bauhinia sp., Canthium sp., Desmos chinensis, Engelhardtia roxburghiana, Grewia asiatica, Helicteres hirsute, Lagerstroemia tomentosa, Machilus odoratissimus, Micromelum minutum, Milletia spp., Rinorea virgata, Streblus aspe* Non-woody species: *Acacia sp., Harrisonia perforate, Lygodium sp., Tinospora crispa, ferns, grasses*
	19	Cultivated land	Matured	None	Pole sized to matured trees of *Melia azedarach* Non-woody species: *Ananas comomus, Eupatorium odoratum, Musa paradisiaca*
Disposal area 1		Secondary forest on uncultivated land for 10-15	Pole sized to matured	*Helicteres hirsute, Rinorea virgata, Streblus asper*	Woody species: *Albizia lucidior, Canthium sp., Desmos chinensis, Engelhardtia roxburghiana, Grewia asiatica, Helicteres hirsute, Lagerstroemia tomentosa, Machilus odoratissimus*, *Micromelum minutum* Non-woody species: *Acacia sp., Harrisonia perforate, Lygodium spp., ferns and grasses*

Note: Stage of growth: Saw timber / Matured trees (> 25 cm dbh), Poles (12.5-25 cm dbh), Saplings (10-12.5 cm dbh)

Appendix 7.3: Ethno-botanical characteristics of plants grown in project area

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
1	*Acampe ochracea (Lindl.) Hochr.*	*Xuệ lan vàng*				x		
2	*Acorus gramineus Ait. ex Soland.*	*Thạch xương bồ*	x					
3	*Acronychia pedunculata (L.) Miq.*	*Bưởi bung*	x					
4	*Adiantum caudatum L.*	*Tóc vệ nữ*	x					
5	*Ageratum conyzoides L.*	*Cỏ cứt lợn*	x					
6	*Aglaia edulis (Roxb.) Gray*	*Gội dịu*		x				
7	*Aglaia tomentosa T. & B.*	*Gội lông*		x				
8	*Alocasia macrorrhizos (L.) G. Don*	*Khoai ráp*						x
9	*Alseodaphne velutina Cher.*	*Vàng trắng lông*	x					
10	*Alstonia scholaris (L.) R. Br.*	*Sữa*	x	x				
11	*Ampelopsis cantoniensis (H. et A.) Planch.*	*Chè dây*	x					
12	*Ananas comomus (L.) Merr.*	*Dứa*			x			
13	*Antidesma bunius (L.) Spreng*	*Chòi mòi*			x			
14	*Aphanamixis polystachya (Wlall.) R. N. Parker*	*Gội nước*		x				
15	*Aralia armata (Wall. ex G. Don) Seem.*	*Dơn châu chấu*	x					
16	*Asplenium nidus L.*	*Tổ điểu*				x		
17	*Bambusa blumeana J. A. et J. H. Schult.*	*Tre gai*					x	
18	*Belamcanda chinensis (L.) DC.*	*Dẻ quạt*	x			x		

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
19	*Bidens pilosa L.*	*Đơn buốt*	x					
20	*Bischofia javanica Blume*	*Nhội*	x	x				
21	*Blumea balsamifera (L.) DC.*	*Đại bi*	x					x
22	*Bulbophyllum affine Lindl.*	*Lan cầu gần*				x		
23	*Calamus faberi Becc.*	*Mây thủ công*					x	
24	*Calamus rudentum Lour.*	*Song đá*					x	
25	*Calamus salicifolius Becc.*	*Mây lá liễu*					x	
26	*Calanthe clavata Lindl.*	*Lan hạc đỉnh*				x		
27	*Callipteris esculenta (Retz.) J. J. Sm.*	*Rau dớn*			x			
28	*Camellia sinensis (L.) Kuntze*	*Chè*						x
29	*Canarium album Raeusch*	*Trám trắng*	x	x	x			
30	*Carica papaya L.*	*Đu đủ*			x			
31	*Caryota mitis Lour.*	*Móc*					x	
32	*Castanopsis fissa (Champ.) Rehd. & Wild.*	*Dẻ gai*		x				
33	*Castanopsis indica (Roxb.) A. DC.*	*Dẻ gai*		x				
34	*Castanopsis tonkinensis Seem.*	*Dẻ gai*		x				
35	*Celtis philippense Blanco*	*Má tra*		x				
36	*Celtis sinensis Person*	*Sếu*		x				
37	*Chisocheton chinensis Merr.*	*Quếch*		x				
38	*Cinnamomum iners Reinw. ex Blume*	*Quế lợn*		x				x

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
39	*Colocasia esculenta (L.) Schott*	*Khoai nước*						x
40	*Commelina communis L.*	*Thài lài*						x
41	*Costus speciosus (Koenig) Smith*	*Mía dò*	x			x		
42	*Crateva magna (Lour.) DC. (C. nurvala Buch.-Ham.)*	*Bún*			x			
43	*Cratoxylum cochinchinensis (Lour.) Blume*	*Thành ngạnh*		x				
44	*Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer*	*Đỏ ngọn*		x				
45	*Croton tiglium L.*	*Bã đậu*	x	x				
46	*Curcuma longa L.*	*Nghệ*	x		x			
47	*Cymbidium aloifolium (L.) Sw.*	*Lan kiếm*				x		
48	*Cyperus rotundus L.*	*Củ gấu*	x					
49	*Derris elliptica (Roxb.) Benth.*	*Dây mật*	x					
50	*Dimocarpus fumatus (Blume) Leenh.*	*Nhãn rừng*		x				
51	*Dioscorea persimilis Prain & Burk.*	*Củ mài*	x					
52	*Dracaena cochinchinensis (Lour.) Merr.*	*Bồng bồng*	x					
53	*Dracuntomelon duperreanum Pierre*	*Sấu*		x	x			
54	*Drynaria fortunei (Kuntze ex Mett.) J. Sm.*	*Cốt toái bổ*	x					
55	*Duabanga grandiflora (DC.) Walp.*	*Phay*		x				
56	*Elephantopus scaber L.*	*Cúc chỉ thiên*	x					
57	*Embelia ribes Burm. f.*	*Chua ngút*	x					

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
58	*Endospermum chinense Benth.*	*Vạng trứng*		x				
59	*Engelhardtia roxburghiana Wall.*	*Chẹo*	x	x				
60	*Euodia lepta (Spreng) Merr.*	*Ba chạc*	x					
61	*Euphorbia hirta L.*	*Cỏ sữa*	x					
62	*Gelsemium elegans (Gardn. et Champ.) Benth.*	*Lá ngón*	x					
63	*Gironniera subaequalis Planch.*	*Ngát*		x				
64	*Gomphostemma leptodon Dunn.*	*Đinh hùng mảnh*	x					
65	*Hedyotis capitellata Wall. ex G. Don*	*Dạ cẩm*	x					
66	*Hedyotis diffusa Willd.*	*Lưỡi rắn trắng*	x					
67	*Helicia cochinchinensis Lour.*	*Cơm vàng*		x				
68	*Heliciopsis lobata (Merr.) Sleum.*	*Túng*		x				
69	*Homalomena occulta (Lour.) Schott*	*Thiên niên kiện*	x					
70	*Horsfieldia amygdalina (Wall.) Warb.*	*Săng máu*		x				
71	*Horsfieldia thorelii Lecomte*	*Săng máu*		x				
72	*Houttuynia cordata Thunb.*	*Diếp cá*	x		x			
73	*Ixora coccinea L.*	*Đơn đỏ*	x					x
74	*Kadsura coccinea (Lem.) A. C. Smith*	*Chua cùm đỏ*	x					
75	*Kibatalia anceps (Dunn & Williams) Woods*	*Thần linh*	x					
76	*Knema conferta Warb.*	*Máu chó lá nhỏ*		x				

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
77	Lagerstroemia calyculata Kurz	Bằng lăng		x				
78	Lagerstroemia tomentosa Presl	Săng lẻ		x				
79	Leucas aspera (De Wilde) Link	Bạch thiệt	x					
80	Lithocarpus annamensis (Hick. & A. Camus) Barn.	Dẻ		x				
81	Lithocarpus pseudosundaicus (Hick. & A. Camus) A. Camus	Dẻ		x				
82	Litsea cubeba (Lour.) Pers	Màng tang	x					x
83	Litsea glutinosa (Lour.) C. B. Robins	Bời lời nhớt	x					x
84	Lycopodiella cernua (L.) Franco & Vasc.	Thông đất	x					
85	Mallotus hookerianus Muell.-Arg.	Bụp		x				
86	Mangifera indica L.	Xoài			x			
87	Manglietia conifera Dandy	Mỡ		x				
88	Melia azedarach L.	Xoan		x				
89	Michelia foveolata Merr. ex Dandy (M. fulgens Dandy)	Giổi nhung		x				
90	Millettia pachyloba Drake	Dây mật	x					
91	Millettia reticulata Benth.	Kê huyết đằng	x					
92	Morinda umbellata L.	Mặt quỷ	x					
93	Musa balbisiana Colla	Chuối hột	x					
94	Musa paradisiaca	Chuối			x			
95	Neolamarkia cadamba (Roxb.) Bosser	Gáo		x				

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
96	*Ophiopogon japonicus (L. f.) Ker.-Gawl.*	*Cao cẳng*	x					
97	*Ophiopogon latifolius Rodr.*	*Cao cẳng*	x					
98	*Ophiopogon longifolius Dcne.*	*Cao cẳng*	x					
99	*Ormosia pinnata (Lour.) Merr.*	*Ràng ràng*		x				
100	*Oroxylum indicum (L.) Kurz*	*Núc nác*	x					
101	*Paederia scandens (Lour.) Merr.*	*Mơ leo*	x		x			
102	*Pandanus tectorius Parkinson*	*Dứa dại*	x					
103	*Passiflora foetida L.*	*Lạc tiên*	x					
104	*Paviesia annamensis Pierre*	*Trường mật*		x				
105	*Pentaphragma sinense Hemsl. & Wils.*	*Rau tai voi*			x			
106	*Peperomia pellucida (L.) H. B. K*	*Tiêu rận*			x			
107	*Phyllanthus embrica L.*	*Me rừng*	x					
108	*Phyllanthus reticulatus Poir.*	*Phèn đen*	x					
109	*Piper lolot C.DC.*	*Lá lốt*	x		x			
110	*Plantago asiatica L.*	*Mã đề*	x					
111	*Plantago major L.*	*Mã đề*	x					
112	*Polyanthia laui Merr.*	*Nhọc*		x				
113	*Polygonum multiflorum Thunb. ex Murray*	*Hà thủ ô*	x					
114	*Pometia pinnata Forst. & Forst. f.*	*Sâng*		x				
115	*Pouteria sapota (Jacq.) H. Moore & Stearn.*	*Trứng gà*			x			

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
116	Pouzolzia hirta Hassk.	Bọ mắm	x					
117	Prunus arborea (Blume) Kalkm.	Xoan đào		x				
118	Pteris ensiformis Burm. f.	Ráng seo gà	x					
119	Pterocarpus indicus Willd.	Giáng hương ấn		x				
120	Pterocarya stenoptera C. DC. var. tonkinensis Frach.	Cơi		x				
121	Quisqualis indica L.	Sử quân tử, Dây giun	x					
122	Rhapis gracilis Burret	Mật cật					x	
123	Rhodomyrtus tomentosa (Aiton) Hassk.	Sim	x					
124	Rubus alcaefolius Poir.	Ngấy	x					
125	Sapindus saponaria L.	Bồ hòn		x				
126	Schefflera heptaphylla (L.) Harms	Chân chim	x					
127	Schima wallichii (DC.) Korth.	Trín		x				
128	Shorea chinensis (Wang Hsie) H.Zhu	Chò chỉ		x				
129	Spondias lakoensis Pierre	Dâu gia xoan			x			
130	Sterculia lanceolata Cav.	Sảng		x				
131	Streblus asper Lour.	Ruối		x				
132	Streblus ilicifolius (Vidal) Corner	Mạy tèo		x				
133	Streptocaulon juventas (Lour.) Merr.	Hà thủ ô	x					
134	Strychnos axillaris Colebr.	Mã tiền	x					

No.	Plant species	Local name	Plant parts used for					
			Medicinal plants /Poisonous plants	Fuel-wood & timber trees	Edible plants	Ornamental plants	Rattan & bamboo	Others
135	*Syzygium cumini (L.) Druce*	*Trâm mốc*		x				
136	*Syzygium formosum (Wall.) Masam*	*Trâm đẹp*		x				
137	*Syzygium wightianum Wall et Arn.*	*Trâm oai*		x				
138	*Syzygium zeylanicum (L.) DC.*	*Trâm đỏ*			x			
139	*Tabernaemontana bovina Lour.*	*Lài trâu*	x					
140	*Tacca chantrieri Andre*	*Râu hùm*	x					
141	*Toxicodendron succedana (L.) Mold.*	*Sơn*	x					x
142	*Trevesia palmata (Roxb. & Lindl.) Vis.*	*Đu đủ rừng*	x					
143	*Vatica odorata (Griff.) Symington*	*Táu*		x				
144	*Vernicia montana Lour.*	*Trẩu*						x
145	*Vernonia arborea Buch.-Hams.*	*Cúc gỗ*		x				
146	*Vitex tripinnata (Lour.) Merr.*	*Bình linh*						x
147	*Wrightia annamensis Eberh. & Dub.*	*Thừng mức*		x				
148	*Zanthoxylum nitidum (Roxb.) DC.*	*Sẻn*	X		x			x
149	*Zingiber officinale Roscoe*	*Gừng*	X		x			x

Appendix 7.4 List of wildlife species recorded in My Ly HPP influence area

SN	Species	
	Family / Species	**Vietnamese Name**
Mammals		
	1. Soricidae Family	**Họ Chuột chù**
1	*Anourosorex squamipes*	Chuột chù cộc
2	*Suncus murinus*	Chuột chù
	2. Tupaiidae	Họ Đồi
3	*Tupaia belangeri*	Đồi
	3. Pteropodidae (bats)	Họ Dơi quả
4	*Cynopterus sphinx*	Dơi chó ấn
5	*Macroglossus minimus*	Dơi ăn mật hoa
	4. Emballonuridae	Họ Dơi bao
6	*Taphozous melanopogon*	Dơibao đuôinâu đen
	5. Megadermatidae	**Họ Dơi ma**
7	*Megaderma spasma*	Dơi ma Nam
	6. Hipposideridae (bats)	**Họ Dơi nếp mũi**
8	*Hipposideros armiger*	Dơi mũi quạ
9	*Hipposideros Pomona*	Dơi mũi xinh
10	*Hipposideros larvatus*	Dơi mũi xám
	7. Rhinolophidae (bats)	**Họ Dơi lá mũi**
11	*Rhinolophus affinis*	Dơi lá đuôi
12	*Rhinolophus pusillus*	Dơi lá mũi
	8. Vespertilionidae	**Họ Dơi muỗi**
13	*Murina cyclotis*	Dơi ống tai tròn
14	*Myotis muricola*	Dơi tai nhỏ
15	*Pipistrellus coromandra*	Dơi muỗi nâu
	9. Loricidae	**Họ Cu li**
16	*Nycticebus bengalensis*	Cu li lớn
	10. Cercopithecidae	**Họ Khỉ**
17	*Macaca mulatta*	Khỉ vàng
18	*Macaca fascicularis*	Khỉ đuôi dài
	11. Mustelidae	**Họ Chồn**
19	*Martes flavigula*	Chồn vàng
	12. Viverridae	**Họ Cầy**
20	*Paguma larvata*	Cầy vòi mốc
21	*Paradoxurus hermaphroditus*	Cầy vòi đốm
	13. Herpestidae	**Họ Cầy lỏn**
22	*Herpestes javanicus*	Cầy lỏn
23	*Herpestes urva*	Cầy móc cua
	14. Felidae	**Họ Mèo**
24	*Prionailurus bengalensis*	Mèo rừng
	15. Suidae	**Họ Lợn**
25	*Sus scrofa*	Lợn rừng
	16. Cervidae	Họ Hươu Nai
26	*Muntiacus muntjak*	Hoẵng
	17. Sciuridae	**Họ Sóc cây**

27	*Callosciurus erythraeus*	Sóc bụng đỏ
28	*Dremomys rufigenis*	Sóc mõm hung
	18. Rhizomyidae	Họ Dúi
29	*Rhizomys pruinosus*	Dúi mốc lớn
30	*Rhizomys sumatrensis*	Dúi má vàng
	19. Muridae	**Họ Chuột**
31	*Bandicota indica*	Chuột đất lớn
32	*Bandicota savilei*	Chuột đất bé
33	*Chiromyscus chiropus*	Chuột nhắt cây
34	*Rattus argentiventer*	Chuột bụng bạc
35	*Rattus bowersi*	Chuột mốc lớn
36	*Rattus bukit*	Chuột bukít
37	*Rattus edwardsi*	Chuột hươu lớn
38	*Rattus flavipectus*	Chuột nhà
39	*Rattus fulvescens*	Chuột hươu bé
40	*Rattus koratensis*	Chuột rừng
41	*Rattus losea*	Chuột đồng bé
42	*Rattus nitidus*	Chuột bóng
43	*Rattus norvegicus*	Chuột cống
44	*Rattus sabanus*	Chuột núi
45	*Rattus surifer*	Chuột xuri
Reptiles		
	Family / Species	**Vietnamese Name**
	1. Agamidae Family	**Họ Nhông**
1	*Calotes versicolor*	Nhông xanh
2	*Physignathus cocincinus*	Rồng đất
	2. Gekkonidae	**Họ Tắc kè**
3	*Gekko gecko*	Tắc kè
	3. Lacertidae	**Họ Thằn lằn chính thức**
4	*Takydromus kuhnei*	Liu điu kúc-ni
5	*Takydromus sexlineatus*	Liu điu chỉ
	4. Scincidae	**Họ Thằn lằn bóng**
6	*Mabuya multifasciata*	Thằn lằn bóng hoa
	5. Varanidae	**Họ Kỳ đà**
7	*Varanus nebulosus*	Kỳ đà vân
8	*Varanus salvator*	Kỳ đà hoa
	6. Typhlopidae	**Họ Rắn giun**
9	*Ramphotyphlops braminus*	Rắn giun thường
	7. Xenopeltidae	**Họ Rắn mống**
10	*Xenopeltis unicolor*	Rắn mống
	8. Colubridae	**Họ Rắn nước**
11	*Ahaetulla prasina*	Rắn roi thường
12	*Coelognathus radiatus*	Rắn sọc dưa
13	*Ptyas korros*	Rắn ráo thường
14	*Ptyas mucosus*	Rắn ráo trâu
15	*Enhydris plumbea*	Rắn bồng chì
16	*Amphiesma stolata*	Rắn sãi thường
17	*Rhabdophis chrysagos*	Rắn hoa cỏ vàng

18	*Xenochrophis piscator*	Rắn nước
	9. Elapidae	**Họ Rắn hổ**
19	*Bungarus fasciatus*	Rắn cạp nong
20	*Bungarus multicinctus*	Rắn cạp nia bắc
21	*Naja* cf. *atra*	Rắn hổ mang trung quốc
	10. Viperidae	**Họ Rắn lục**
22	*Trimeresurus albolabris*	Rắn lục mép trắng
23	*Trimeresurus stejnegeri*	Rắn lục xanh
	11. Geoemydidae	**Họ Rùa đầm**
24	*Cuora mouhotii*	Rùa sa nhân
Amphibians		
	1. Bufonidae	**1. Họ Cóc**
1	*Duttaphrynus melanostictus*	Cóc nhà
2	*Ingerophrynus galeatus*	Cóc rừng
	2. Megophryidae	**Họ Cóc bùn**
3	*Leptolalax pelodytoides*	Cóc mày bùn
4	*Xenophrys major*	Cóc mắt bên
	3. Microhylidae	**Họ Nhái bầu**
5	*Kaloula pulchra*	Ếnh ương thường
6	*Microhyla fissipes*	Nhái bầu hoa
7	*Microhyla heymonsi*	Nhái bầu hây-môn
8	*Microhyla pulchra*	Nhái bầu vân
	4. Dicroglossidae	**Họ Ếch nhái chính thức**
9	*Fejervarya limnocharis*	Ngoé
10	*Hoplobatrachus chinensis*	Ếch đồng
11	*Limnonectes kuhlii*	Ếch nhẽo
12	*Occidozyga lima*	Cóc nước sần
	5. Ranidae	**Họ Ếch nhái**
13	*Huia andersonii*	Chàng an-đéc-sơn
14	*Huia chloronota*	Ếch xanh
15	*Hylarana taipehensis*	Chàng đài bắc
16	*Rana johnsi*	Hiu hiu
17	*Sylvirana guentheri*	Chẫu
18	*Sylvirana nigrovittata*	Ếch suối
	6. Rhacophoridae	**Họ Ếch cây**
19	*Phylautus* sp.	Nhái cây
Birds		
	1. Ardeidae	
1	*Egretta garzetta*	Cò trắng
2	*Bubulcus ibis*	Cò ruồi
3	*Ardeola bacchus*	Cò bợ
4	*Butorides striatus*	Cò xanh
	2. Accipitridae	
5	*Ichthyophaga humilis*	Diều cá bé
6	*Spilornis cheela*	Diều hoa Miến Điện
	3. Falconidae	
7	*Falco severus*	Cắt bụng hung

	4. Phasianidae	
8	*Arborophila rufogularis*	Gà so họng hung
9	*Gallus gallus*	Gà rừng
	5. Turnicidae	
10	*Turnix tanki*	Cun cút lưng hung
	6. Rallidae	
11	*Rallus striatus*	Gà nước vằn
12	*Gallinula chloropus*	Kịch
	7. Charadriidae	
13	*Charadrius dubius*	Choi choi nhỏ
	8. Scolopacidae	
14	*Tringa ochropus*	Choắt bụng trắng
15	*Actitis hypoleucos*	Choắt nhỏ
	9. Columbidae	
16	*Streptopelia tranquebarica*	Cu ngói
17	*Streptopelia chinensis*	Cu gáy
	10. Psittacidae	
18	*Psittacula alexandri*	Vẹt ngực đỏ
	11. Cuculidae	
19	*Centropus sinensis*	Bìm bịp lớn
20	*Centropus bengalensis*	Bìm bịp nhỏ
	12. Strigidae	
21	*Glaucidium cuculoides*	Cú vọ
22	*Caprimulgus indicus*	Cú muỗi ấn Độ
	13. Trogonidae	
23	*Harpactes erythrocephalus*	Nuốc bụng đỏ
	14. Alcedinidae	
24	*Ceryle rudis*	Bói cá nhỏ
25	*Alcedo atthis*	Bồng chanh
	15. Coraciidae	
26	*Coracias benghalensis*	Sả rừng
	16. Capitonidae	
27	*Megalaima franklinii*	Cu rốc đầu vàng
	17. Eurylaimidae	
28	*Serilophus lunatus*	Mỏ rộng hung
	18. Pittidae	
29	*Pitta nipalensis*	Đuôi cụt gáy xanh
30	*Pitta soror*	Đuôi cụt đầu xám
	19. Hirundinidae	
31	*Hirundo concolor*	Nhạn nâu hung
32	*Hirundo rustica*	Nhạn bụng trắng
	20. Motacillidae	
33	*Motacilla flava*	Chìa vôi vàng
34	*Motacilla cinerea*	Chìa vôi núi
35	*Motacilla alba*	Chìa vôi trắng

	21. Campephagidae	
36	*Coracina melaschistos*	Phường chèo xám
37	*Hemipus picatus*	Phường chèo đen
38	*Tephrodornis gularis*	Phường chèo nâu
	22. Pycnonotidae	
39	*Pycnonotus jocosus*	Chào mào
40	*Pycnonotus aurigaster*	Bông lau tai trắng
41	*Pycnonotus finlaysoni*	Bông lau họng vạch
42	*Criniger pallidus*	Cành cạch lớn
43	*Hypsipetes propinquus*	Cành cạch nhỏ
	23. Irenidae	
44	*Aegithina tiphia*	Chim nghệ ngực vàng
45	*Chloropsis aurifrons*	Chim xanh trán vàng
46	*Chloropsis hardwickei*	Chim xanh hông vàng
47	*Irena puella*	Chim lam
	24. Laniidae	
48	*Lanius cristatus*	Bách thanh mày trắng
49	*Lanius collurioides*	Bách thanh nhỏ
50	*Lanius schach*	Bách thanh đầu đen
	25. Turdidae	
51	*Erithacus sibilans*	Oanh cổ trắng
52	*Erithacus cyane*	Oanh lưng xanh
53	*Copsychus saularis*	Chích chòe
54	*Copsychus malabaricus*	Chích chòe lửa
55	*Monticola solitarius*	Hoét đá
56	*Myophoneus caeruleus*	Hoét xanh
57	*Zoothera citrina*	Hoét vàng
58	*Zoothera dauma*	Sáo đất
59	*Zoothera marginata*	Sáo đất nâu
	26. Timaliidae	
60	*Pellorneum ruficeps*	Chuối tiêu ngực đốm
61	*Spelaeornis chocolatinus*	Khướu đất đuôi dài
62	*Stachyris rufifrons*	Khướu bụi trán hung
63	*Stachyris chrysaea*	Khướu bụi vàng
64	*Stachyris nigriceps*	Khướu bụi đầu đen
65	*Timalia pileata*	Họa mi nhỏ
66	*Chrysomma sinense*	Họa mi mỏ ngắn
67	*Yuhina diademata*	Khướu mào cổ trắng
68	*Yuhina nigrimenta*	Khướu mào đầu đen
	27. Sylviidae	
69	*Tesia olivea*	Chích đuôi cụt
70	*Megalurus palustris*	Chiền chiện lớn
71	*Locustella lanceolata*	Chích đầm lầy nhỏ
72	*Acrocephalus aedon*	Chích mỏ rộng
73	*Phylloscopus tenellipes*	Chích chân xám

74	*Phylloscopus coronatus*	Chích mày vàng
75	*Phylloscopus reguloides*	Chích đuôi xám
76	*Phylloscopus davisoni*	Chích đuôi trắng
	28. Muscicapidae	
77	*Muscicapa dauurica*	Đớp ruồi nâu
78	*Muscicapa thalassina*	Đớp ruồi xanh xám
79	*Niltava unicolor*	Đớp ruồi xanh nhạt
80	*Niltavas banyumas*	Đớp ruồi họng hung
	29. Monarchidae	
81	*Terpsiphone paradisi*	Thiên đường đuôi phướn
82	*Rhipidura albicollis*	Rẻ quạt họng trắng
	30. Paridae	**Họ Bạc má**
83	*Parus major*	Bạc má
84	*Parus spilonotus*	Bạc má mào
	31. Sittidae	
85	*Sitta castanea*	Trèo cây bụng hung
86	*Sitta frontalis*	Trèo cây trán đen
	32. Dicaeidae	**Họ Chim sâu**
87	*Dicaeum chrysorrheum*	Chim sâu bụng vạch
88	*Dicaeum concolor*	Chim sâu vàng lục
89	*Dicaeum ignipectus*	Chim sâu ngực đỏ
	33. Nectariniidae	
90	*Nectarinia sperata*	Hút mật họng hồng
91	*Aethopiga saturata*	Hút mật ngực đỏ
	34. Zosteropidae	
92	*Zosterops palpebrosa*	Vành khuyên họng vàng
	35. Emberizidae	
93	*Emberiza rutile*	Sẻ đồng hung
94	*Emberiza spodocephala*	Sẻ đồng mặt đen
	36. Estrildidae	
95	*Lonchura striata*	Di cam
96	*Lonchura punctulata*	Di đá
	37. Ploceidae	
97	*Passer montanus*	Sẻ nhà
	38. Sturnidae	
98	*Sturnus nigricollis*	Sáo sậu
99	*Sturnus sinensis*	Sáo đá Trung Quốc
100	*Acridotheres tristis*	Sáo nâu
101	*Acridotheres grandis*	Sáo mỏ vàng
	39. Oriolidae	
102	*Oriolus traillii*	Tử anh
	40. Dicruridae	
103	*Dicrurus macrocercus*	Chèo bẻo
104	*Dicrurus leucophaeus*	Chèo bẻo xám
105	*Dicrurus annectans*	Chèo bẻo mỏ quạ

106	*Dicrurus aeneus*	Chèo bẻo rừng
	41. Artamidae	
107	*Artamus fuscus*	Nhạn rừng
	42. Corvidae	**Họ Quạ**
108	*Urocissa erythrorhyncha*	Giẻ cùi
109	*Urocissa whiteheadi*	Giẻ cùi vàng
110	*Cissa chinensis*	Giẻ cùi xanh
111	*Corvus macrorhynchos*	Quạ đen

Appendix 7.5 : List of fish species in Ca river and stream, My Ly HPP

No.	Scientific name	Vietnamese name	Ca river	Stream	Vietnam Redbook
	1. Anguillidae Family	**Họ Cá chình**			
1	*Anguilla marmorata* (Quoy & Gaimard)	Cá lệch, cá chình hoa	+		VU
	2. Characidae Family	**Họ Cá Chép mỡ**	+		
2	*Cossoma brachypomum* (Cuvier)	Cá Chim trắng	+		
	3. Prochilodontidae Family	**Cá Vũn**			
3	*Prochilodus argenteus* (Spix & Agassiz)	Cá Vền nam mỹ	+		
	4. Cyprinidae Family	**Họ Cá Chép**			
4	*Danio laoensis* (Pellegrin & Fang)	Cá mại khe lào	+	+	
5	*Yaoshanicus kyphus* (Mai8)	Cá giao sơn		+	
6	*Spinibarbus denticulatus* (Oshima)	Cá bỗng	+		
7	*Puntius partipentazona (*Fowler)	Cá ngũ vân		+	
8	*Acheilognathus lamensis* (Nguyen)	Cá thè be sông lam	++	+	
9	*Acrossocheilus lamus* (Mai)	Cá chát sông lam	+		
10	*Acrossocheilus annamensis* (Pellegrin)	Cá trốc	+		VU
11	*Bangana lemassoni* (Pellegrin)	Cá Rầm xanh	+		VU
12	*Garra orientalis* Nichols, 1925	Cá bậu	+	+	
13	*Garra caudofasciata*	Cá sứt môi đuôi sọc	+		
14	*Garra poilanei*	Cá bậu	+		
15	*Cyprinus rubrofuscua* (Lacepede)	Cá Chép	+		
16	*Carassius auratus* (Linnaeus)	Cá Diếc	+		
17	*Carassioides acuminatus*	Cá Rưng	+		
18	*Onychostoma lepturus*	Cá mát	++		
19	*Onychostoma gerlachi*	Cá Sỉnh	+		
20	*Osteochilus salsburyi*	Cá Dầm đất	+	+	
21	*Cirrhinus molitorella* (Valenciennes)	Cá Trôi	+		
22	*Paraspinibarbus macracanthus*	Cá Cầy	+		
23	*Puntius ocellatus* (Mai)	Cá đong chấm	++	+	
24	*Puntius semifasciolatus* (Gunther)	Cá Đòng đong cân cấn	++	+	
25	*Opsarichthys bidens*	Cá Cháo	+	+	
26	*Metzialineata*	Cá Mại	+		
27	*Culter erythropterus*	Cá Thiểu	++		
28	*Culter flavipinnis*	Cá Ngão gù	+		
29	*Ancherythroculter daovantieni*	Cá Thiểu mắt to	+		
30	*Hemiculter leucisculus*	Cá Mương nổi	++		
31	*Megalobrama terminalis*	Cá Vền	+		

No.	Scientific name	Vietnamese name	Ca river	Stream	Vietnam Redbook
32	*Sinibrama affinis*	Cá Nhác	+		
33	*Squaliobarbus curriculus*	Cá Chày mắt đỏ	+		
34	*Hypophthalmichthys molitrix*	CáMè trắng trung quốc	+		
35	*Mylopharyngodon piceus*	Cá Trắm đen	+		
36	*Acheilognathus tonkinensis*	Cá Thè be	+		
37	*Saurogobio immaculatus*	Cá Đục đanh	+		
38	*Hemibarbus medius*	Cá Đục ngộ	+		
39	*Aristichthys nobilis*	Cá Mè hoa	+		
40	*Ctenopharyngodon idella*	Cá Trắm cỏ	+		
41	*Labeo rohita*	Cá Rô hu	+		
42	*Cirrhinus mrigala*	Cá Mrigan	+		
	5. Cobitidae Family	**Họ Cá Chạch**			
43	*Misgurnus tonkinensis*	Cá chạch bùn núi		+	
44	*Misgurnus anguillicaudatus*	Cá Chạch bùn	+	+	
	6. Namacheilidae Family	**Họ Cá Chạch suối**			
45	*Schistura orthocauda* (Mai)	Cá chạch đá đuôi bằng		+	
46	*Schistura incerta*	Cá chạch đá nâu		+	
47	*Schistura fasciolata*	Cá chạch đá sọc		++	
48	*Micronemacheilus taeniatus*	Cá chạch suối		+	
	7. Balitoridae Family	**Họ cá bám đá**			
49	*Balitora lancangjiangensis*	Cávây bằng vảy lan can	+	+	
50	*Beaufortia leveretti*	Cá Bám đá khuyết	+		
	8. Siluridae	**Họ Cá nheo**			
51	*Pteorocypris conchinchinensis*	Cá Thèo	+	+	
52	*Silurus asotus*	Cá Nheo	++		
	9. Bagridae	**Họ Cá lăng**			
53	*Pelteobagrus fulvidraco*	Cá Bò	+		
54	*Hemibagrus guttatus*	Cá Lăng	+		VU
55	*Pseudobagrus virgatus*	Cá Mịt	+	+	
	10. Cranogranidae	**Họ Cá ngạnh**			
56	*Cranoglanis henrici*	Cá Ngạnh	+		
	11. Claridae	**Họ Cá trê**			
57	*Clarius fuscus* Lacepede, 1803	Cá Trê	+		
58	*Clarias gariepinus* Burchell, 188	Cá Trê phi	+		
	12. Sisoridae	**Họ Cá chiên**			
59	*Bagarius rutilus* Ng.& Kottelat, 2000	Cá Chiên, cá ghé	+		VU
60	*Glyptothorax lampris* Fowler, 1934	Cá chiên suối		+	
61	*Glyptothorax quadriocellatus* (Mai, 1978)	Cá chiên suối		+	

No.	Scientific name	Vietnamese name	Ca river	Stream	Vietnam Redbook
62	*Pareuchiloglanis nebulifer*	Cá chiên bẹt	+		
	13. Monopteridae	**Họ Lươn**			
63	*Monopterus albus*	Lươn	+	+	
	14. Mastacembelidae	**Họ Cá chạch sông**			
64	*Mastacembelus armatus*	Cá Chạch sông	+		
65	*Sinobdella sinensis*	Cá Chạch	+		
	15. Anabantidae	**Họ Cá rô**			
66	*Anabas testudineus* Bloch, 1792	Cá Rô	+	+	
	16. Osphronemidae	**Họ Cá tai tượng**			
67	*17. Macropodus opercularis*	Cá Đuôi cờ		+	
68	*18. Trichogaster trichopterus*	Cá Sặc bướm		+	
	19. Eleotridae	**Họ cá bống đen**			
69	*Oxyeleotris marmorata*	Cá bống tượng	+		
	20. Gobiidae	**Họ Cá bống trắng**			
70	*Glossogobius giuris*	Cá Bống trắng	++		
71	*Rhinogobius duospilus*	Cá Bống suối		+	
72	*Rhinogobius giurinus*	Cá Bống đá		+	
	21. Cichlidae	**Họ Cá rô phi**			
73	*Oreochromis mosambicus*	Cá Rô phi thường	+++	+	
74	*Oreochromis niloticus*	Cá Rô phi vằn	++	+	
	22. Channidae	**Họ Cá quả**			
75	*Channa striata* Bloch, 1793	Cá Quả	+		
76	*Channa asiatica* (Linnaeus, 1758)	Cá trèo đồi		+	
77	*Channa gachua* (Hamilton, 1822)	Cá chuối suối	+	+	
		Total	**54**	**30**	**5**

NOTE: *(+): less common; (++): common; (+++) very common*
Main river: Ca river*;* **Streams***:* Tributaries of Ca River
Status classification by Red Data Book of Vietnam, 2007.

2.2 Specialist Report on Biology

EVN PECC1

POWER ENGINEERING CONSULTING

JOINT-STOCK COMPANY 1

Project:

MY LY HYDROPOWER PROJECT

FEASIBILITY STUDY

REPORT ON BIOLOGICAL BASELINE

FOR PREPARING ESIA REPORT OF MY LY - NAM MO 1 HPPs IN VIETNAM AND LAOS

VIETNAM ELECTRICITY
POWER ENGINEERING CONSULTING
JS COMPANY 1
FOR AND ON BEHALF OF GENERAL DIRECTOR
DEPUTY GENERAL DIRECTOR

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Q. THANH XUÂN - T.P HÀ NỘI

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INSTITUTE OF ECOLOGY
BIOLOGY RESOURCES
HEAD OF BIOLOGICAL TEAM

Le Hung Anh

Hanoi, May 2017

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Hanoi, May 2017

POWER ENGINEERING CONSULTING JOINT STOCK COMPANY 1

INSTITUTE OF ECOLOGY BIOLOGY RESOURCES

REPORT
ON
BIOLOGY SYSTEM

My Ly Hydropower Project

Ky Son district, Nghe An province, Vietnam

Ha Noi, 5/2017

TABLE OF CONTENT

LIST OF TABLES

CHAPTER 1. ECOLOGY OVERVIEW

1.1. Project description

1.1.1. Project location

My Ly Hydropower Project (My Ly HPP) is located on main course of Ca (Nam Non) river, laying in both territories of Socialist Republic of Viet Nam and Lao People Democratic Republic. Main civil works of My Ly HPP is located in My Ly commune, Ky Son district Nghe An province, Vietnam, some of 50km North West of Muong Xen town. Reservoir area spreads on a narrow river section where its two banks are sloping,river bed is also sloping with lots of water steps making navigation difficult to local resident. The reservoir is in territory of My Ly, Keng Du communes of Ky Son district Nghe An province (Vietnam); Kouan district, Houaphan province (Lao PDR).

Co-ordinates of design damsite is 19^{o}39'10.2" North latitude, 104^{o}19'27.3" East longitude. By co-ordinates system VN2000, the dam axis has point Đ1 (X= 2173953.287m; Y=454973.513m) and point Đ2 (X=2173814.790m; Y=455390.772m).

My Ly HPP location map is shown in following table:

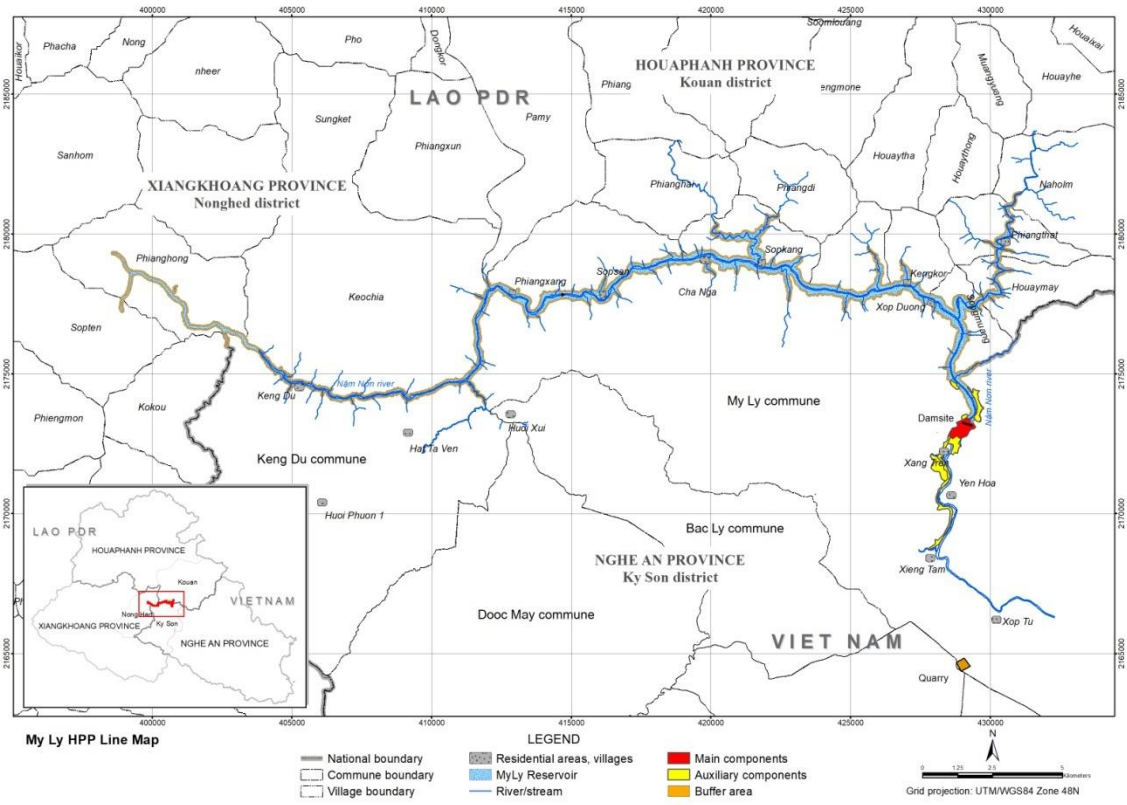


Figure 1: My Ly HPP location map

Figure 2: Plant, plot of plant and aquatic samples at Ca (Nam Non) river

1.1.2. Characteristics of project area

Project affected communes are remote and mountainous communes of two countries where technical infrastructure (transportation, power supply, water supply, communication) and social infrastructure (education, health care, environmental sanitation) are characterized with difficulty and limited. There is no industrial zone. Trading and services activities are negligible. Local resident in project area (both Vietnam and Laos) are mainly ethnic people of Thai, Kho Mu who live in small villages along Ca river. Economic life of local resident is difficult, main income source is from upland cultivation and forest exploitation.

1.2. Purposes of study

Evaluates present status of biological ecology in the catchment area, in submergence area and areas affected by My Ly HPP construction.

Forecasts possible and potential impacts to ecology by construction of My Ly HPP and recommends mitigation measures.

1.3. Methodologies

1.3.1. Flora and vegetation - methods in this study (June 2016 and March 2017)

To research plant community structure, we did standard plots research which has a size 20x20 m. Beside, in oder to study on species and plants community structure concerned, we did the points and routes research.

The species has determine by morphology method, base on morphology characteristics of reproductive and vegetative organs.

The List of species was based on the Checklist of plant species of Vietnam

Threatened species were based on Vietnam Red Data Book (2007) and The IUCN Red List of Threatened Species.

In each plot, all the data was measured and collected as: species, the number of individuals, the diameter and canopy of each individual.

The field measurements were used to calculate relative values such as relative frequency (RF), relative density (RD), relative of basal area (RBA), and Importance Value Index (IVI).

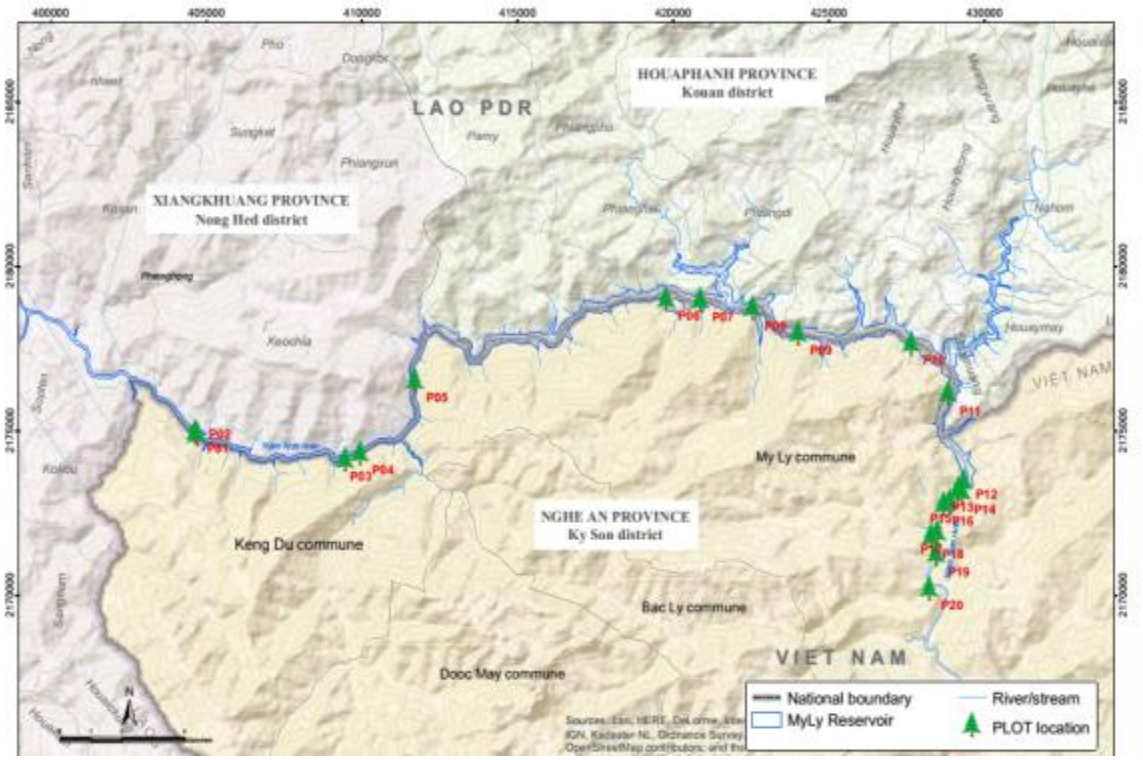


Figure 3: Location of vegetation plots of My Ly HPP

1.3.2. Fauna and wildlife

Used in the EIA report for approval MONRE, 2015 (PECI)

Birds: During the field surveys, community interviews were conducted, focusing on key bird species found in the Project area.

Mammals, Reptiles and Amphibians: During our field surveys, the occurrence of mammals, reptiles and amphibian species in the Project area was documented based on interview data collected from 20 local people in My Ly and Keng Du communes.

We used the following photographic guides and books with colour photos to support species identification:

- The mammals of the Indomalayan Region[1]
- Environment and Bio resources of Vietnam Present Situation and Solutions[2]
- Checklist of Mammals in Vietnam[3]
- An identification guide to the rodents of Vietnam[4]

Site investigation, interviews at surveyed location. Summarizes data from previous studies [1[5], 10[6], 9[7], 16[8],18[9], 20[10], 27[11]]

[1]Corbet G.B. & Hill J.E. 1992. The Mammals of the Indomalayan Region: A Systematic Review. Oxford: Oxford University Press. 488p.
[2]Cao, S.V. (ed.). 1998. Environment and Bioresources of Vietnam Present Situation and Solutions. Hanoi: The Gioi Publishers. 235p.
[3]Dang, H.H., Dao, T.V., Cao, S.V., Pham, A.T., and Hoang, K.M. 1994.Checklist of Mammals in Vietnam. Hanoi: Publishing House Science & Technics. 168p. [in Vietnamese].
[4]Lunde, D. and Nguyen, S.T. 2001. An identification Guide to the Rodents of Vietnam. Centre for Biodiversity and Conservation and the American Museum of National History, New York. 80p.
[5]Nguyễn Cử, Lê Trọng Trải, Karen Phillipps, 2000: Chim Việt Nam. Nxb Lao Động-Xã Hội, Hà Nội, 250tr.
[6]Đặng Huy Huỳnh (chủ biên), Đào Văn Tiến, Cao Văn Sung, Phạm Trọng ảnh, Hoàng Minh Khiên, 1994.Danh lục *các loài thú (Mammalia) Việt Nam. Nxb KH và KT, Hà Nội, 167 trang*
[7]Red Data Book of Vietnam, 2007. Section 1: Plant; Section 2: Wildlife.
[8]Dự án lâm nghiệp xã hội và bảo tồn thiên nhiên tỉnh Nghệ An (SFNC): ALA/VIE/94/24, 2001: Pù Mát: Điều tra đa dạng sinh học của một số khu bảo vệ ở Việt Nam. Nxb Lao động- Xã hội, 174 tr.
[9]Bryan Stuart (2000) in SFNC Project: Pù Mát - A biodiversity survey of a Vietnamese protected area, Chapter Five. Amphibians and Reptiles: 62-72
[10]Nguyễn Thanh Nhàn, 2001. Đa dạng sinh học ở khu BTTN Pù Mát – Nghệ An. Hội thảo quốc tế sinh học. International workshop on Biology.Hanoi - Vietnam 2-5 July 2001: 150 - 155.

1.3.3. Aquatic life

a. Collects aquatic life samples

Collects samples of phytoplankton, zooplankton using cone net (Juday type), diameter of the net mouth is 25cm, length 90cm. Bar-pitch of the net for phytoplankton size 75 (75 fiber/cm), cloth making net for zooplankton is of size 49. Phytoplankton sample collected from surface layer and deep layer between 5-0m. Net to take zoobenthos is manual net which horizontal edge of net mouth is 30cm, bar-pitch size 0.5mm. Besides, zoobenthos sample are also taken by hand from caves, hollow holes. Phytoplankton samples are fixed in formalin solution 5%, benthos is fixed in formalin solution 6-7%.

Net to take zoobenthos is manual handle net and net in triangle shape with bottom edge of net mouth of 25cm long, net bar-pitch is 0.5mm in size. Besides, zoobenthos samples are also taken by manual [11[12], 12[13]].

Fish samples are taken by various types of net and from buying from fishermen and from market (more information on nets and also show pictures of the net etc used bythe villagers/fishermen). Visuals the net after fishing, using photo, color picture of fish to interview fishermen and local resident. Samplesof unknown name fish at site are kept in formalin solution 10% [24[14]].

Interviews local residents

Fishing by net

[11]Vi Luu Binh, 2015.Biodiversity of western Nghe An and the sustainable development model of the Biosphere Reserve. Department of Agriculture and Rural Development.
[12]Đặng Ngọc Thanh, Hồ Thanh Hải, 2001.*Crustacean in fresh water.Animals in Vietnam, volume 5*.Science and Technique Publishing House, Ha Noi.
[13]Đặng Ngọc Thanh, Thái Trần Bái, Phạm Văn Miên, 1980.*Classification of invertebrate fauna in fresh water environment in North Vietnam*.Science and Technique Publishing House, Ha Noi.
[14]Nguyễn Thái Tự, 1994. Fish on Lam river (Msc Thesis on biology)

Figure 4: Field photos of fishing tools and fish ways of villagers

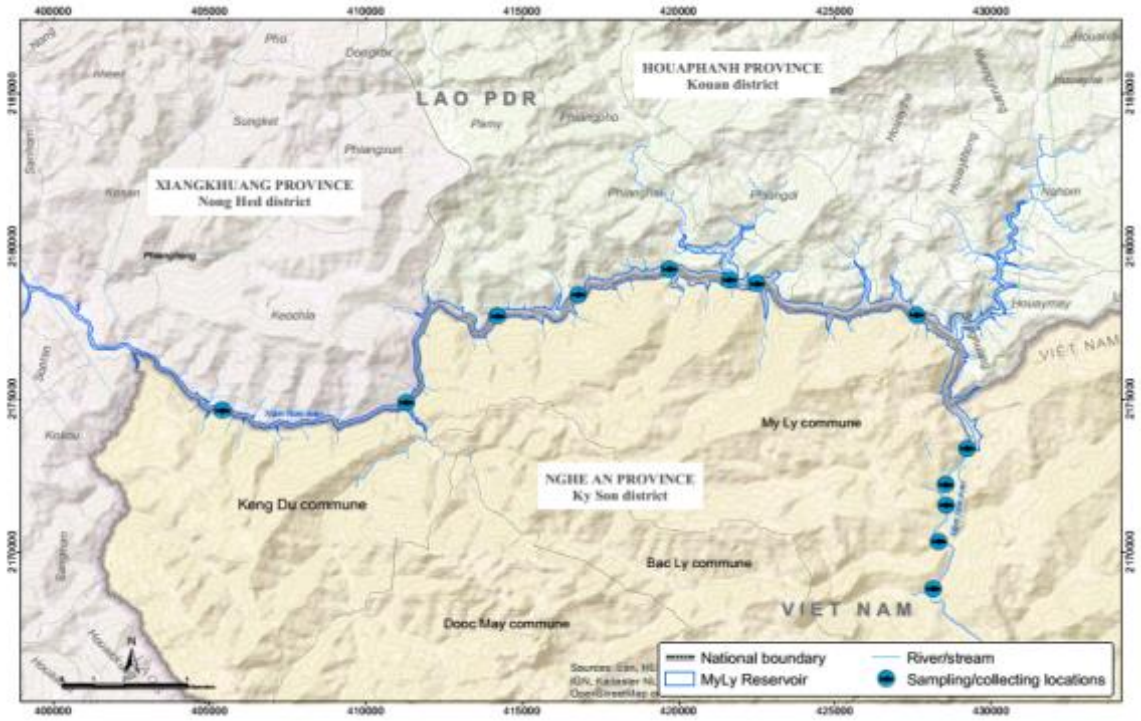


Figure 5: Location of fish samples

Qualitative analysis to samples of phytoplankton, zooplankton is done mainly according to classification manual by Vietnamese authors.

Quantitative analysis to **phytoplankton** is done using Goriaev counter, storage 0.0009 ml.

Quantitative analysis to **zooplankton** is done using Bogorov counter, storage10 ml.

Quantitative analysis to **zoobenthos** is done by counting quantity of individual collected per are of the surface where the net going through.

c .Reliability

Treats collected data, selects necessary data (empirical, experience, knowledge of experts in such sector). Estimates investigation and collected index using Excel software.

d. Route of survey

Performs survey in typical ecological area, approaches investigated location by navigation.

Co-ordinates of investigated location are listed below:

Table 1: Co-ordinates of aquaculture investigated sites

Symbol	Location	Co-ordinates
ML1	Xieng Tam village	19°36’46.72”N 104°18’53.41”E
ML2	Yen Hoa village	19°37'37.44"N 104°19'4.76"E
ML3	Mai stream confluence	19°40'1.81"N 104°19'12.81"E
ML4	Xop Duong village	19°41’37.45”N104°18’34.23”E
ML5	Sopsan village	19°41’36.37”N 104°18’33.91”E
ML6	Cha Nga village	19°41'34.69"N 104°12'3.15"E
ML7	Huoi Xui village	19°39'58.31"N 104° 9'9.67"E
ML8	Keng Du village	19°39’53.42” N104°5’51.44”E

Figure 6: Location of aquaculture investigation

Coordinates and record of the plots in the reservoir, dam and auxiliary areas is known in the following table:

Table 2: Coordinates and record of plots in the Resorvoir

Plots	Co-ordinates		Co-ordinates (VN 2000)		Record	Corresponding to Vegetation type in Vegetation map (*)
	Longitude (E)	Latitude (N)	X	Y		
P01	104.090167	19.668028	430617.57	2175641.446	Grassland on uncultivated land	VI
P02	104.090756	19.667216	430678.994	2175551.397	Melia azedarach L. plantation on uncultivated land for 7-10 years	VI
P03	104.136194	19.660639	435441.04	2174805.487	Grassland on uncultivated land	VI
P04	104.140778	19.662333	435922.334	2174991.325	The bamboo forest	II
P05	104.157306	19.682361	437663.191	2177202.148	The evergreen forest after exploitation	I
P06	104.234393	19.70525	445753.352	2179709.405	The secondary scrub on uncultivated land for 7-10 years	VI
P07	104.244861	19.704917	446850.653	2179669.249	The semi-deciduous forest after exploitation	III
P08	104.260944	19.702667	448535.997	2179415.259	Grassland on uncultivated land	VI
P09	104.274861	19.695778	449992.807	2178648.575	Grassland on uncultivated land after 1-2 years	VI
P10	104.309528	19.69325	453626.478	2178358.984	The semi-deciduous forest after exploitation	III
P11	104.320912	19.679422	454816.113	2176825.312	The mixed broadleaf and bamboo forest	II
P12	104.32579	19.655271	455320.903	2174150.721	The evergreen forest after exploitation	I

Table 3: Coordinates and record of plots at Damsite

Plots	Co-ordinates		Co-ordinates (VN 2000)		Record	Corresponding to Vegetation types in Vegetation map (*)
	Longitude (E)	Latitude (N)	X	Y		
P13	104.324059	19.653235	455138.813	2173925.747	The evergreen forest after exploitation	I
P14	104.325303	19.652579	455269.129	2173852.894	Secondary scrub on uncultivated land for 7-10 years	IV
P15	104.321556	19.649889	454875.383	2173556.073	Secondary forest on uncultivated land for 10-15 years	I

Table 4: Coordinates and record of plots at Auxiliary area

Plotsw	Co-ordinates		Co-ordinates (VN 2000)		Record	Corresponding to Vegetation types in Vegetation map (*)
	Longitude (E)	Latitude (N)	X	Y		
P16	104.31968	19.649063	454678.465	2173465.106	Secondary forest on uncultivated land for 10-15 years	I
P17	104.31779	19.641383	454478.153	2172615.542	The evergreen forest after exploitation	I
P18	104.31575	19.640278	454263.856	2172493.753	Secondary forest on uncultivated land for 10-15 years	I
P19	104.317391	19.63523	454434.583	2171934.528	Cultivated land	VI

P20	104.315371	19.626089	454220.109	2170923.241	Secondary forest on uncultivated land for 10-15 years	I

Table 5: Coordinates and record at Auxiliary area

No.	Name of items	Co-ordinates (VN 2000)		Record	Corresponding to Vegetation types in Vegetation map (*)
		X	Y		
1	Crushing facility for RCC and aggregate stockpile area	2165239.026	455182.239	The secondary scrub on uncultivated land for 10-12 years	IV
2	Crushing facility CVC 250t/h	2165107.245	454987.188	The secondary scrub on uncultivated land for 10-12 years	
3	RCC facility	2173292.909	454847.541	The cultivated land	VI
4	RCC conveyor system	2173446.426	454984.852	The secondary forest	I
5.1;	Concrete facility at dam, powerhouse areas			-	
	5.1 Main work area (MWA)	2173583.326	454759.237	The secondary scrub on uncultivated land for 10-12 years	IV
	5.1 Auxiliary area (AA)	2174129.256	455041.511	The secondary scrub on uncultivated land for 7-10 years	IV
5.2		2173155.498	454759.445	The secondary scrub on uncultivated land for 7-10 years	IV
6	Steel reinforcement facility at headworks, waterway areas	2173526.414	454728.892	The secondary scrub on uncultivated land for 10-12 years	IV
7	Steel formwork facility at headworks, waterway areas	2173486.075	454684.923	The secondary scrub on uncultivated land for 10-12 years	IV
8	Pre-casted concrete yard	2173444.423	454640.675	The secondary scrub on uncultivated land for 10-12 years	IV
9	Maintenance facility and parking area for construction equipment	2172583.527	454123.701	The secondary scrub on uncultivated land for 10-12 years	IV
10	Workshop for hydro-mechanic erection			-	
	10 right bank (RB)	2171936.962	454391.256	The cultivated land (near by village)	VI
	10 left bank (LB)	2172845.454	454663.571	The mixed shrubland and some small trees and fruit garden	VI
11	Workshop for electrical-mechanic erection of the powerhouse			-	
	11 upstream (Ups)	2173382.512	454734.080	The secondary scrub on uncultivated land for 10-12 years	IV
	11 downstream (Ds)	2172265.758	454304.500	The secondary scrub on uncultivated land for 10-12 years	IV
12	Laboratory of the headworks, waterway	2173196.299	454384.063	The mixed shrubland and cultivated land	VI

13	Explosive dynamite warehouse for headworks, waterway areas	2172942.055	454702.377	The cultivated land (near by village)	VI
14	Petroleum warehouse for dam, waterway areas	2173155.432	454367.558	The mixed shrubland and cultivated land	VI
15	Technical material warehouse (Project management Board's warehouse)	2173309.142	454564.433	The secondary scrub on uncultivated land for 10-12 years	IV
16	Water, power facilities for dam areas	2173530.426	454612.941	The secondary scrub on uncultivated land for 10-12 years	IV
17	Provision power	2173339.425	454599.777	The secondary scrub on uncultivated land for 10-12 years	IV
18	Sand stockpile area at headworks, waterway areas			-	
	18-MWA	2173608.024	454694.116	The secondary scrub on uncultivated land for 7-10 years	IV
	18-AA-RB	2174065.475	455023.029	The secondary scrub on uncultivated land for 10-12 years	IV
	18-AA-LB	2173112.203	454867.660	The secondary scrub on uncultivated land for 10-12 years	IV
19	Rubble stockpile area	2172952.368	454770.035	The cultivated land (near by village)	VI
20	Disposal area No.1	2170909.929	454225.344	The mixed shrubland and cultivated land	VI
21A	Disposal area No.2	2172056.145	454309.216	The evergreen forest after exploitation	I
21B	Disposal area No.3	2175255.347	454715.156	The mixed shrubland and cultivated land	VI
21C	Disposal area No.4	2174450.390	455598.891	The secondary scrub on uncultivated land for 7-10 years	IV
22	Substations			-	
	22_MWA_RB	2173562.884	454809.772	The mixed uncultivated land and bamboo	VI
	22_MWA_LB	2173660.929	455248.311	The secondary scrub on uncultivated land for 10-12 years	IV
	22_AA_RB	2172663.599	454071.201	The secondary scrub on uncultivated land for 10-12 years	IV
	22_AA_LB	2173159.820	454857.321	The secondary scrub on uncultivated land for 10-12 years	IV
23	Technical water treatment station at dam, powerhouse areas	2174161.051	455116.564	The secondary scrub on uncultivated land for 7-10 years	IV
	Technical water treatment station at auxiliary area			-	
24	*24_Ups*	2174201.803	455112.282	The secondary scrub on uncultivated land for 7-10 years	IV
	24_Ds	2173215.011	454630.194	Village	
25	Pump & treatment station of household waste water			Melia azedarach L. and bamboo plantation	VI

	25_high area	2172778.492	454026.622	The mixed shrubland and cultivated land	VI
	25-river area	2172599.784	454372.612	Sand and bare land	VII
26	Office of Contractor at the dam, wateray areas	2172674.624	453995.973	The secondary scrub on uncultivated land for 10-12 years	IV
27	Housing and office of PMB, specialists, Engineer				
	27 _ Ups	2173266.726	454584.552	The secondary scrub on uncultivated land for 10-12 years	IV
	27_ Ds	2172798.136	454220.823	The secondary scrub on uncultivated land for 10-12 years	IV
28	Housing area for dam, waterway workers	2172357.371	454038.961	The secondary scrub on uncultivated land for 10-12 years	IV
	Housing for CVC concrete batching plant workers				
	Housing for RCC concrete batching plant workers				
	Housing for 250T/h crushing plant workers				
	Housing for rock quarry workers				
29	Clinics at dam, waterway areas	2172473.773	454226.241	The secondary forest	I
30	Post Office	2172136.324	454417.929	The secondary scrub on uncultivated land for 10-12 years	IV
31	Police station			-	
	31_Ups	2172780.257	454169.962	The secondary scrub on uncultivated land for 10-12 years	IV
	31_Ds	2171873.397	454475.149	Grassland on uncultivated land	VI
32	Fire station	2172074.099	454424.122	The secondary scrub on uncultivated land for 10-12 years	IV

(*) Vegetation map consisting of the following main objects:

I. Secondary mixed evergreen rain forest
II. Mixed broadleaf and bamboo forest
III. Semi-deciduous forest after exploitation
IV. Secondary scrub on uncultivated land
V. Secondary tropical grass land
VI. Shrub/bamboo/cultivated/uncultivated land
VII. Other lands
VIII. River/stream

Table 6: Coordinates and record at Interviews locations for fauna wildlife

No.	Location	Coordinates		Record
		Longitude (E)	Latitude (N)	
1	Keng Du village	104.55144	19.395342	Interviews: Frequent encounters and hunts
2	Cha Nga village	104.142	19.4225	Interviews: Frequent encounters and hunts
3	Xop Duong village	104.183423	19.413745	Interviews: Frequent encounters and hunts
4	Xieng Tam village	104.185341	19.364672	Interviews: Frequent encounters and hunts
5	Sop Tu village	104.201357	19.353322	Interviews: Frequent encounters and hunts

Table 7: Coordinates and record at locations for aquatic

No.	Location	Coordinates		Mô tả
		Longitude (E)	Latitude (N)	
1	Keng Du village	104.55144	19.395342	Servey and collected samples
2	Under Keng Du village	104.105329	19.4135	Servey and collected samples
3	Phiangsang (Lao)	104.122218	19.415797	Servey and collected samples
4	Cha Nga village	104.142.00	19.4225	Servey and collected samples
5	Between Cha Nga Village and Sopsan village	104.153832	19.421043	Servey and collected samples
6	Xop Duong village	104.183423	19.413745	Servey and collected samples
7	My Ly dam foot	104.193043	19.39158	Servey and collected samples
8	Xieng Tam village	104.185341	19.364672	Servey and collected samples

Table 8: Coordinates and record at locations for fish

No.	Location	Coordinates		Record
		Longitude (E)	Latitude (N)	
1	Keng Du village, near river	104.55144	19.395342	Interviewed local people; Survey and collected samples
2	Under Keng Du village	104.91381	19.40173	Survey and collected samples
3	Under Keng Du village	104.105329	19.4135	Survey and collected samples
4	Phiangsang village (Laos)	104.122218	19.415797	Survey and collected samples
5	Cha Nga village	104.142.00	19.4225	Interviewed local people; Servey and collected samples
6	Stream coming to River, upstream Sopsan village	104.153832	19.421043	Survey and collected samples
7	Sopsan village	104.15852	19.421379	Survey and collected samples
8	Xop Duong village	104.183423	19.413745	Interviewed local people; Servey and collected samples
9	My Ly dam foot	104.193043	19.39158	Survey and collected samples
10	Downstream of Sercurity Post in Xang Tren village near My ly Commune People Committee	104.19687	19.383785	Survey and collected samples
11	Upstream and downstrean My ly CPC	104.1974	19.381581	Survey and collected samples
12	Xieng Tam village	104.185341	19.364672	Survey and collected samples
13	Sop Tu village	104.201357	19.353322	Interviewed local people; Servey and collected samples

CHAPTER 2. ECOLOGICAL STATUS

2.1. Biodiversity and its characteristics in My Ly reservoir area

In My Ly HPP project area, 20 plots were established to investigate the vegetation (the reservoir area: plots No. 1-12; both sides of the dam: plots No. 13-14 -15; the auxiliary area: plots No. 16 - 20. see the attached Annex). The vegetation in the plots represents mosts of vegetation types in the project area. Besides, the transect along the river from Keng Du commune to My Ly commune, the vegetation had been investigated.

Table 9: The coordinates of plotsof My Ly HPP project

No.	Plot numbers	Longitude (E)	Latitude (N)	Record
1.	P01	104.090167	19.668028	Grassland on uncultivated land
2.	P02	104.090756	19.667216	Melia azedarach L. plantation on uncultivated land for 7-10 years
3.	P03	104.136194	19.660639	Grassland on uncultivated land
4.	P04	104.140778	19.662333	The bamboo forest
5.	P05	104.157306	19.682361	The evergreen forest after exploitation
6.	P06	104.234393	19.70525	The secondary scrub on uncultivated land for 7-10 years
7.	P07	104.244861	19.704917	The semi-deciduous forest after exploitation
8.	P08	104.260944	19.702667	Grassland on uncultivated land
9.	P09	104.274861	19.695778	Grassland on uncultivated land after 1-2 years
10.	P10	104.309528	19.69325	The semi-deciduous forest after exploitation
11.	P11	104.320912	19.679422	The mixed broadleaf and bamboo forest
12.	P12	104.32579	19.655271	The evergreen forest after exploitation
13.	P13	104.324059	19.653235	The evergreen forest after exploitation
14.	P14	104.325303	19.652579	Secondary scrub on uncultivated land for 7-10 years
15.	P15	104.321556	19.649889	Secondary forest on uncultivated land for 10-15 years
16.	P16	104.31968	19.649063	Secondary forest on uncultivated land for 10-15 years
17.	P17	104.31779	19.641383	The evergreen forest after exploitation
18.	P18	104.31575	19.640278	Secondary forest on uncultivated land for 10-15 years
19.	P19	104.317391	19.63523	Cultivated land
20.	P20	104.315371	19.626089	Secondary forest on uncultivated land for 10-15 years

And the vegetation in auxiliary items of My Ly HPP project area were investigated.

Table 10: Vegetation in auxiliary items of My Ly HPP

No.	Name of items	Co-ordinates (VN 2000)		Record
		X	Y	
1	Crushing facility for RCC and aggregate stockpile area	2165239.026	455182.239	The secondary scrub on uncultivated land for 10-12 years
2	Crushing facility CVC 250t/h	2165107.245	454987.188	The secondary scrub on uncultivated land for 10-12 years
3	RCC facility	2173292.909	454847.541	The cultivated land
4	RCC conveyor system	2173446.426	454984.852	The secondary forest
5.1;	Concrete facility at dam, powerhouse areas			
	5.1 Main work area (MWA)	2173583.326	454759.237	The secondary scrub on uncultivated land for 10-12 years
	5.1 Auxiliary area (AA)	2174129.256	455041.511	The secondary scrub on uncultivated land for 7-10 years
5.2		2173155.498	454759.445	The secondary scrub on uncultivated land for 7-10 years
6	Steel reinforcement facility at headworks, waterway areas	2173526.414	454728.892	The secondary scrub on uncultivated land for 10-12 years
7	Steel formwork facility at headworks, waterway areas	2173486.075	454684.923	The secondary scrub on uncultivated land for 10-12 years
8	Pre-casted concrete yard	2173444.423	454640.675	The secondary scrub on uncultivated land for 10-12 years
9	Maintenance facility and parking area for construction equipment	2172583.527	454123.701	The secondary scrub on uncultivated land for 10-12 years
10	Workshop for hydro-mechanic erection			-
	10 right bank (RB)	2171936.962	454391.256	The cultivated land (near by village)
	10 left bank (LB)	2172845.454	454663.571	The mixed shrubland and some small trees and fruit garden
11	Workshop for electrical-mechanic erection of the powerhouse			-
	11 upstream (Ups)	2173382.512	454734.080	The secondary scrub on uncultivated land for 10-12 years
	11 downstream (Ds)	2172265.758	454304.500	The secondary scrub on uncultivated land for 10-12 years
12	Laboratory of the headworks, waterway	2173196.299	454384.063	The mixed shrubland and cultivated land
13	Explosive dynamite warehouse for headworks, waterway areas	2172942.055	454702.377	The cultivated land (near by village)
14	Petroleum warehouse for dam, waterway areas	2173155.432	454367.558	The mixed shrubland and cultivated land
15	Technical material warehouse (Project management Board's	2173309.142	454564.433	The secondary scrub on uncultivated land for 10-12 years

	warehouse)			
16	Water, power facilities for dam areas	2173530.426	454612.941	The secondary scrub on uncultivated land for 10-12 years
17	Provision power	2173339.425	454599.777	The secondary scrub on uncultivated land for 10-12 years
18	Sand stockpile area at headworks, waterway areas			
	18-MWA	2173608.024	454694.116	The secondary scrub on uncultivated land for 7-10 years
	18-AA-RB	2174065.475	455023.029	The secondary scrub on uncultivated land for 10-12 years
	18-AA-LB	2173112.203	454867.660	The secondary scrub on uncultivated land for 10-12 years
19	Rubble stockpile area	2172952.368	454770.035	The cultivated land (near by village)
20	Disposal area No.1	2170909.929	454225.344	The mixed shrubland and cultivated land
21A	Disposal area No.2	2172056.145	454309.216	The evergreen forest after exploitation
21B	Disposal area No.3	2175255.347	454715.156	The mixed shrubland and cultivated land
21C	Disposal area No.4	2174450.390	455598.891	The secondary scrub on uncultivated land for 7-10 years
22	Substations			
	22_MWA_RB	2173562.884	454809.772	The mixed uncultivated land and bamboo
	22_MWA_LB	2173660.929	455248.311	The secondary scrub on uncultivated land for 10-12 years
	22_AA_RB	2172663.599	454071.201	The secondary scrub on uncultivated land for 10-12 years
	22_AA_LB	2173159.820	454857.321	The secondary scrub on uncultivated land for 10-12 years
23	Technical water treatment station at dam, powerhouse areas	2174161.051	455116.564	The secondary scrub on uncultivated land for 7-10 years
	Technical water treatment station at auxiliary area			
24	*24_Ups*	2174201.803	455112.282	The secondary scrub on uncultivated land for 7-10 years
	24_Ds	2173215.011	454630.194	Village
25	Pump & treatment station of household waste water			Melia azedarach L. and bamboo plantation
	25_high area	2172778.492	454026.622	The mixed shrubland and cultivated land
	25-river area	2172599.784	454372.612	Sand and bare land
26	Office of Contractor at the dam,	2172674.624	453995.973	The secondary scrub on uncultivated land for 10-12 years

	wateray areas			
27	Housing and office of PMB, specialists, Engineer			-
	27 _ Ups	2173266.726	454584.552	The secondary scrub on uncultivated land for 10-12 years
	27_ Ds	2172798.136	454220.823	The secondary scrub on uncultivated land for 10-12 years
28	Housing area for dam, waterway workers	2172357.371	454038.961	The secondary scrub on uncultivated land for 10-12 years
	Housing for CVC concrete batching plant workers			
	Housing for RCC concrete batching plant workers			
	Housing for 250T/h crushing plant workers			
	Housing for rock quarry workers			
29	Clinics at dam, waterway areas	2172473.773	454226.241	The secondary forest
30	Post Office	2172136.324	454417.929	The secondary scrub on uncultivated land for 10-12 years
31	Police station			-
	31_Ups	2172780.257	454169.962	The secondary scrub on uncultivated land for 10-12 years
	31_Ds	2171873.397	454475.149	Grassland on uncultivated land
32	Fire station	2172074.099	454424.122	The secondary scrub on uncultivated land for 10-12 years

2.1.1. Biodiversity of various forest vegetation in My Ly HPP project area

In proposed area of My Ly reservoir, there are some typical vegetations, as herein description.

a. The secondary mixed evergreen rain forest after exploitation

The vegetation is resulted from human impact on the natural forest causing exploitive succession and then progressive succession. The composition of timber tree species was high diversity. However, these forests were not much within the area.

Plate 1.i The secondary mixed evergreen rain forest after exploitation.

Photo by Nguyen The Cuong in My Ly commune (N:19.641383/E:104.31779)

The dominant layer includes broadleaf trees. These are species left after selected exploitation which are less value or premature timber trees, 15-25 m tall includes: Sếu - *Celtis philippense* Blanco, Gội nước - *Aphanamixis polystachya*, Ruối -*Streblus asper* Lour., Kháo - *Machilus odoratissimus* Nees, Gạo - *Bombax malabaricum* DC., Sấu – *Dracontomelon duperreanum* Pierre, Săng lẻ - *Lagerstroemia tomentosa* Presl, Ngát – *Gironiera subaequalis*, Chẹo – *Engelhardtia roxburghiana*, Vạng Trứng – *Endospermum chinense*, Nhãn rừng – *Dimocarpus fumatus* (Blume) Leenh., Máu chó – *Knema conferta* Warb, species of Dẻ - *Lithocarpus* spp., species of Dẻ gai – *Castanopsis* spp., Gội – *Aglaia* sp.., Táu - *Vatica odorata* (Griff.) Symington, Sao – *Shorea chinensis* (Wang Hsie) H.Zhu, Giổi – *Manglietia* sp., species of Trâm *Syzygium* spp., Sến – *Madhuca* sp, Re – *Cinnamomum* sp.... Close to river edge are species of *Sung* - *Ficus racemosa* L., Cơi - *Pterocarya stenoptera* C. DC., Vàng anh - *Sacara dives*Pierre ...

Table 11: 10 common woody species in some plots

No	Scientific name	Local name	RD	RF	RBA	IVI
1	Celtis philippense Blanco	Sếu	30	16.67	48.82	95.50
2	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	6.67	11.11	18.33	36.11
3	Streblus asper Lour.	Ruối	16.67	11.11	4.81	32.59
4	Machilus odoratissimus Nees	Kháo	13.33	5.56	2.72	21.61
5	Archidendron lucidum (Benth.) I. Niels.	Mán đỉa trâu	3.33	5.56	11.39	20.28
6	Polyanthia laui Merr.	Nhọc	3.33	5.56	5.72	14.61
7	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	3.33	5.56	3.09	11.98
8	Ilex rotunda Thunb.	Bùi	3.33	5.56	2.26	11.15
9	Pterocarpus indicus Willd.	Đinh hương	3.33	5.56	1.46	10.35
10	Mallotus hookerianus Muell.-Arg.	Bụp hooker	3.33	5.56	0.74	9.63

The subdominant layer includes small trees, scattering, less than15 m tall which includes: Dâu gia đất – *Baccaurea racemosa*, species of Súm – *Eurya* spp., species of Trâm – *Syzygium* spp., species of Bứa – *Garcinia* spp., species of Bời lời – *Litsea* spp., Quế rừng – *Cinnamomum* spp., Sảng – *Sterculia* sp., Trám – *Canarium album*...

Scrub layer includes species of Chòi mòi *Antidesma bunius*, Ớt rừng – *Tabernaemontana bovina*Lour., Mua – *Melastoma septemnervium*, species of Khôi – *Ardisia* spp., Bổ béo – *Gomphandra mollis* Merr. , Kích nhũ -*Polygala tonkinensis* Chodat, Móc – *Pinnaga* spp. Lá nón – *Licuala* spp. and regenerated premature trees.

Shrub layer is mainly species of Fern, species in family of Gừng – Zingiberaceae, family Hòa Thảo – Poaceae, Family Cói Cyperaceae... Limb layer is mainly species of Fern, species of creeper in family Gắm – *Gnetumsp*., Đậu – *Fabaceae*, family Khoai lang – *Convolvulaceae*, Song mây – *Calamus* spp....

b.The semi-deciduous forest after exploitation

The dominant layer includes semi-deciduous trees. These are timber trees, 15-25 m tall includes: Săng lẻ - *Lagerstroemia tomentosa* Presl, Đinh hương - *Pterocarpus indicus*Willd., Ruối - Streblus asper Lour., Mít rừng - Artocarpus rigidus Blume, Vạng trứng -

Endospermum chinense Benth., Sấu - *Dracuntomelon duperreanum* Pierre, Nàng nàng - *Sumbabiopsis macrophylla* Muell.-Arg….

Scrub layer includes species of Găng - *Randia spinosa* Blume, Bình linh - *Vitex tripinnata* (Lour.) Merr., Nhãn rừng - *Dimocarpus fumatus* (Blume) Leenh….

Shrub layer is mainly species of Fern, species in family of Gừng – Zingiberaceae, family Hòa Thảo – Poaceae, Family Cói Cyperaceae... Limb layer is mainly species of Fern, species of creeper in family Đậu – *Fabaceae*, family Khoai lang – *Convolvulaceae*....

Plate 1.ii. The semi-deciduous forest after exploitation

Photo by Nguyen The Cuong in My Ly commune (N:19.7049169999999/E:104.244861)

Table 12: 10 common woody species in some plots

No.	Scientific name	Local name	RD	RF	RBA	IVI
1	Lagerstroemia tomentosa Presl	Săng lẻ	17.86	5.88	20.15	43.89
2	Pterocarpus indicus Willd.	Đinh hương	14.29	11.76	12.55	38.60
3	Streblus asper Lour.	Ruối	17.86	5.88	7.05	30.79
4	Artocarpus rigidus Blume	Mít rừng	7.14	5.88	13.53	26.55
5	Endospermum chinense Benth.	Vạng trứng	3.57	5.88	14.79	24.24
6	Dracuntomelon duperreanum Pierre	Sấu	3.57	5.88	13.86	23.31
7	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	7.14	11.76	0.65	19.55
8	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	3.57	5.88	8.32	17.77
9	Ormosia pinnata (Lour.) Merr.	Ràng ràng	3.57	5.88	2.16	11.61
10	Celtis sinensis Person	Sếu	3.57	5.88	2.02	11.47

c. The vegetation after burn-over lands

This type of vegetation occupies all most of area, it was the product of cultivated activities. In the studied area, this type of vegetation is roughly divided into 3 types of vegetation after burn-over lands as follows:

The secondary scrub on uncultivated land for 3-5 years:

The communities are progressive succession on uncultivated land for 5-10 years, presently in recovery process. Vegetative structure is relatively simple. Timber trees are mainly planted species left behind such as Xoan (*Melia azedarach* L.) or some species growing in abandoned slash and burn land area such as Thừng mức – *Wightia pubescens*, Ràng ràng – *Ormosia pinnata,* Hu lá hẹp – *Trema angustifolia*, ...

Dominated by scrub mixed with herbaceous species as: species of Cứt lợn - *Ageratum conyzoides L.,* Chuối – *Musa balbisiana Colla,* Chuối rừng – *Musacoccinea Andr*....

Predominant by scrub layer mixed with species of herbaceous species, main species of shrub layer are species of Cỏ lào - *Eupatorium odoratum L*., species of family Cúc – *Asteraceae*, family Đậu – *Fabaceae*, family Hòa thảo – *Poaceae*, family Cói – *Cyperaceae*... and species of fern.

Limb layer are species of creeper in families of Cúc – Asteraceae, Bầu bí – *Cucurbitaceae*, Khoai lang – *Convolvulaceae*, Bòng bong – *Lygopodiaceae* ...

Plate 1.iii. The secondary scrub on uncultivated land for 3-5 years

Photo by Nguyen The Cuong in Keng Du commune

The secondary scrub on uncultivated land for 5-10 years:

The plant communities are progressive succession on uncultivated land for 5-10 years, presently in recovery process. Vegetative structure is relatively simple. There are very few trees, mostly are priority species such as Xoan - *Melia azedarach* L., Muối – *Rhus chinensis*, Thàu táu – *Apurosa dioca*, Me rừng – *Phyllanthus embrica,* Mã rạng – *Macaranga denticulata*, Thừng mức – *Wightia pubescens*, Ràng ràng – *Ormosia pinnata,* Hu lá hẹp – *Trema angustifolia*, ...

Dominated by scrub mixed herbaceous species as: Bồ cu vẽ - *Breynia fruticosa,* Cơm rượu – *Glycomis pentaphylla,* Găng gai – *Randia spinosa,* Trang – *Ixora coccinea,* Lấu – *Psychotria* spp.*,* Mắt trâu – *Micromelum hirsutum*, Đơn nem – *Maesa* spp... Locally appearing with Nứa - *Neohouzeaua dulloa (Gamble) A. Camus*.

Shrub layer are species of family Đậu – Fabaceae, family Cúc – Asteraceae, family Hòa thảo – Poaceae, family Cói – Cyperaceae... and species of fern. Limb layer are species of creeper in family of Cúc – Asteraceae, Bầu bí – Cucurbitaceae, Khoai lang – Convolvulaceae, Bòng bong – Lygopodiaceae...

Plate 1.iv. The secondary scrub on uncultivated land for 5-10 years

Photo by Nguyen The Cuong in My Ly commune

Secondary forest on uncultivated land for 10-15 years:

The vegetation pattern is relatively simple, which includes vegetation communities of 2-3 timber trees layers. The dominant layer is the priority trees, of 5-6 m tall as: Mã rạng – *Macaranga denticulata*, Thàu tau – *Apurosa dioca*, Me rừng – *Phyllanthus embrica,* Muối – *Rhus chinensis*, Thừng mức – *Wightia pubescens*, Ràng ràng – *Ormosia pinnata,* Hu đay – *Tremna orrientalis*, Bời lời – *Litsea* spp., Sung – *Ficus* spp., Hoắc quang – *Wendlandia paniculata*,... Inserting with some other timber trees such as: Dẻ gai – *Castanopsisannamensis*, Lòng mang – *Pterospermumheterophyllum*, Sảng – *Sterculia hymenocalys*, Ngát - *Gironiera subaequalis*, Lọng bàng - *Dillenia* spp ... and with appearance of some timber trees which are normally seen in secondary forest such as Săng lẻ - *Lagerstroemia tomentosa* Presl, Chẹo - *Engelhardtia roxburghiana* Wall.

The scrub layer mainly includes species in families of Thầu dầu – *Euphorbiaceae*, Cà phê – *Rubiaceae*, Đơn nem – *Myrsinaceae*, Trúc đào – *Apocynaceae*, Mua – *Melastomataceae*... In this vegetation, shrub layer are species of Fern, family Gừng – *Zingiberaceae*, Hòa Thảo – *Poaceae*, Cói *Cyperaceae*, Đậu - *Fabaceae*... and with appearance of many Nứa - *Neohouzeaua dulloa* (Gamble) A. Camus

In this vegetation, limb layer of creeper species such as those in family Khoai lang - Convolvulaceae are strongly developed.

Plate 1.v. The secondary forest on uncultivated land for 10-15 years

Photo by Nguyen The Cuong in My Ly commune

The secondary forest on uncultivated land for more 15 years:

The vegetation is characterized as tropical monsoon forest with evergreen rain forest in low hills, broadleaf trees. The upper layer, trees are 15-20 m tall, including species as: Săng lẻ - *Lagerstroemia tomentosa* Presl, Chẹo - *Engelhardtia roxburghiana* Wall., Lim vang – *Peltrophorum dasyrrhachis*, Xoan nhừ - *Choerospondias axillaris*, Táu – *Vatica* spp, Dâu da xoan - *Spondias lakoensis* Pierre....

Foliage layer is species of broadleaf evergreen tree, of some 10-15 m high, including species of Dẻ - *Lithocarpus* spp., De núi – *Cinnamomum* spp., Bời lời – *Litsea* spp., Cà đuối – *Cryptocarya* spp., Gội – *Aglaia* spp....

The scrub layer is secondary tree and species of scrub such as Ba chạc – *Euodia lepta*, Lấu – *Psychotria* spp., Ớt rừng – *Tabernaemontana* spp., Gang – *Randia* spp., Trang – *Ixora* spp., Thần linh – *Kibatalia* sp., Thừng mức – *Wightia* sp... These are low scrub bushes, growable in shadow but slowly growing.

The shrub layer is species of family Hòa thảo – Poaceae, family of Cói – Cyperaceae, Gừng gió – *Ammomum* spp., Riềng gió – *Alpinia* spp., Ráy dại – *Alocasia* sp., Thiên niên kiện – *Homalomena oculta* and species of Fern.

The sub layer includes ferns, wild pepper species - *Piper spp*. , Má đào - *Aschynanthus* spp.... creeper species of sweet potato family Khoai lang - *Convolvulaceae*, family Đậu - *Fabaceae*, family Tiết dê - *Menispermaceae*... and creeping timber species or running species in family Na - *Annonaceae* (Bù dẻ - *Desmos* spp., *Uvaria* spp., *Fissistigma* spp., Tứ thư - *Tetrastigma* spp...

Plate 1.vi. The secondary forest on uncultivated land for more 15 years

Photo by Nguyen The Cuong in My Ly commune

c. The mixed broadleaf and bamboo forest

This type of forest is not many within the area. This is also what resulted of secondary forest after being impacted and now is under recovery. Some broadleaf timber species, as high as 10-15 m as Re núi – *Cinnamomum* spp., Gội - *Aglaia* spp., Dẻ - *Lithocarpus* spp., Bứa – *Garcinia* spp., Trám – *Canarium* sp., Táu – *Vatica* spp., Bụp – *Mallotus* spp., Hu đay – *Tremna* spp.... grow intercalated with Nứa – *Neohouzeaua dulloa*.

Plate 1.vii. *The mixed broadleaf and bamboo forest*

Photo by Nguyen The Cuong in My Ly commune

d. The predominant bamboo forest

Bamboo forest in the studied area is mainly formed after timber forest has been overexploited, destroyed under burning or left uncultivated after slash and burn activities. Pattern of bamboo forest is close forest with only one predominant species to be bamboo Nứa **-** *Neohouzeaua dulloa* (Gamble) A. Camus*,* locally appear with some other species but of negligible quantity. The shrub layer is quite simple, comprising some few species of fern, some species in family Hòa thảo - *Poaceae* or family Cói - *Cyperaceae*.

Plate 1.viii. *The predominant bamboo forest*

Photo by Nguyen The Cuong in My Ly commune

e. The vegetation on rock along streams

The flows in upstream area are normally characterized as rapid flows. However, right at the flow and two banks are normally exposed rock terrains running long together with small sand lanes. This creates conditions for some vegetation to grow, creating a different vegetation. Along rivers, the vegetation includes some plants as: Thạch xương bồ - *Acorus gramineus*, Côm hải nam - *Elaeocarpus hainanensis*, Rù rì - *Momonia riparia*, Rù rì bãi - *Ficus subpyriformis*, Gáo nước - *Aidia pilulifera*, Trâm lá hẹp - *Syzygium linneatum*... Along river banks, the vegetation includes some typical species as Cơi - *Pterocarya tonkinensis*, Sung - *Ficus* spp. Trâm - *Syzygium* spp... Along small streams are habitats of species as Thiên niên kiện - *Homalonema oculta*, Râu hùm - *Tacca chantrieri*, Cao cẳng - *Ophiopogon* spp., Thu hải đường - *Begonia* spp., some species in family Cói - Cyperaceae...

Plate 1.ix. *The vegetation on rock along streams*

Photo by Nguyen The Cuong in Keng Du commune

f. The secondary tropical grass land

The secondary tropical grass lands are results of uncultivated land for 3-5 years. They occupy most of area in the region. On lands where degradation has not happened much usually are high or medium grass species as: Cỏ tranh - *Imperata cylindrical*, Sậy - *Phragmites karka*, Lách - *Saccharum spontaneum*, Chít - *Thysanolaena maxima*, Chè vè - *Miscanthus sinensis*...

On land areas where soil has been much degraded, normally exist with low grass, poor recovery with main species such as Dị thảo- *Heteropogon conturtus*, Cỏ công viên - *Paspalum conjugatum*, Sả hôi-*Cymbopogon caesius*, Trúc thảo - *Arundinella nepalense*, Cỏ phao - *Themeda triandra*...

On lands subject to regular stepping on, exists low grass with predominant species such as Cỏ may - *Chrysopogon aciculatus*, Cỏ gà - *Cynodon dactylon*, Cỏ cát vĩ - *Eulalia monostachya*, Cỏ đuôi voi - *Paspalum conjugatum*...

Plate 1.x. *The secondary tropical grass land*

Photo by Nguyen The Cuong in My Ly commune

On land area where soil is quite good or bordering with forest ecology is normally grass land with predominant species such as Cỏ cứt lợn - *Ageratum conyzoides*, Cỏ lào -*Eupatorium odoratum*. Growing together with species of herbaceous are some timber species, bushes, creeper, jumper which are recently regenerated with species component almost similar to bush vegetation in surrounding.

g. Vegetation on slash and burn land

This type of vegetation is popular seen along river banks. This vegetation is suffered to deforestation, burning and replaced with foodstuff crops as corn and rice. Annually, the vegetation is burned and cultivated. Along slash and burn area appears with very few timber tree, mainly is China-tree.

Plate 1.xi. *Vegetation on slash and burn land*

Photo by Nguyen The Cuong in My Ly commune

2.1.2. Forest ecology with economic-ecology-environment values and preservation characteristics in reservoir area of My Ly HPP

In our study, in reservoir area of My Ly HPP, forest ecologies have economic-ecology-environment meaning (on viewpoint of flora and botany). This is watershed forest in upstream most of Ca river, therefore forest ecology here plays important role in protecting upstream area. Forest ecologies in this region are sources of timber for construction demand of all ethnic minority communities, besides it is where supplying sub-product from forest, an important income sources of local resident. This is evergreen mixed rain forest after exploitation, evergreen mixed rain forest after slash and burn activities, mixed forest of broadleaf and bamboo forest and bamboo predominant forest.

Ecology of the evergreen mixed rain forest after exploitation is of medium biodiversity while other forest ecologies including evergreen mixed rain forest after slash and burn activities, mixed forest of broadleaf and bamboo forest and bamboo predominant forest are of low biodiversity. Among the said ecologies, growing 2 species listed in Red Data Book of Vietnam (2007).

2.1.3. Ethno Botanical Description

Local communities have always used forest resources for fuel-wood, timber, fodder and forage, medicines, food and rituals. There are several medicinal plants of high value at the same time there are poisonous plants naturally growing in the forest like Crotontiglium spp. (Ba đậu), Millettia pachyloba (Dây mật), Engelhardtia roxburghiana (Chẹo) and other species. Plant species with their uses are described below.

Medicinal & Poisonous plants: 64 species; Fuel-wood & Timber trees: 56 species; Eatable plants: 28 species;Ornamental plants: 10 species; Rattan & bamboo: 6 species; Forages: 3; Fiber crops: 2 species; Dyes plant: 2 species; Essential oil & Fat: 2 species; Resin plant: 1 species

Table 13: Ethno-botanical Characterists of plants grown in project area

Plant Species	Local name	Plant parts used for					
		Medicinal & Poisonous plants	Fuel-wood & Timber trees	Eatable plants	Ornamental plants	Rattan & bamboo	Others
Acampe ochracea (Lindl.) Hochr.	Xuệ lan vàng				x		
Acorus gramineus Ait. ex Soland.	Thạch xương bồ	x					
Acronychia pedunculata (L.) Miq.	Bưởi bung	x					
Adiantum caudatum L.	Tóc vệ nữ	x					
Ageratum conyzoides L.	Cỏ cứt lợn	x					
Aglaia edulis (Roxb.) Gray	Gội dịu		x				
Aglaia tomentosa T. & B.	Gội lông		x				
Alocasia macrorrhizos (L.) G. Don	Khoai ráp						x
Alseodaphne velutina Cher.	Vàng trắng lông	x					
Alstonia scholaris (L.) R. Br.	Sữa	x	x				
Ampelopsis cantoniensis (H. et A.) Planch.	Chè dây	x					
Ananas comomus (L.) Merr.	Dứa			x			
Antidesma bunius (L.) Spreng	Chòi mòi			x			
Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước		x				
Aralia armata (Wall. ex G. Don) Seem.	Dơn châu chấu	x					
Asplenium nidus L.	Tổ điểu				x		
Bambusa blumeana J. A. et J. H. Schult.	Tre gai					x	
Belamcanda chinensis (L.) DC.	Dẻ quạt	x			x		
Bidens pilosa L.	Đơn buốt	x					
Bischofia javanica Blume	Nhội	x	x				
Blumea balsamifera (L.) DC.	Đại bi	x					x
Bulbophyllum affine Lindl.	Lan cầu gần				x		
Calamus faberi Becc.	Mây thủ công					x	
Calamus rudentum Lour.	Song đá					x	
Calamus salicifolius Becc.	Mây lá liễu					x	
Calanthe clavata Lindl.	Lan hạc đỉnh				x		
Callipteris esculenta (Retz.) J. J. Sm.	Rau dớn			x			
Camellia sinensis (L.) Kuntze	Chè						x
Canarium album Raeusch	Trám trắng	x	x	x			
Carica papaya L.	Đu đủ			x			
Caryota mitis Lour.	Móc					x	
Castanopsis fissa (Champ.) Rehd. & Wild.	Dẻ gai		x				
Castanopsis indica (Roxb.) A. DC.	Dẻ gai		x				
Castanopsis tonkinensis Seem.	Dẻ gai		x				
Celtis philippense Blanco	Má tra		x				
Celtis sinensis Person	Sếu		x				
Chisocheton chinensis Merr.	Quếch		x				

Plant Species	Local name	Plant parts used for					
		Medicinal & Poisonous plants	Fuel-wood & Timber trees	Eatable plants	Ornamental plants	Rattan & bamboo	Others
Cinnamomum iners Reinw. ex Blume	Quế lợn		x				x
Colocasia esculenta (L.) Schott	Khoai nước						X
Commelina communis L.	Thài lài						x
Costus speciosus (Koenig) Smith	Mía dò	x			x		
Crateva magna (Lour.) DC. (C. nurvala Buch.-Ham.)	Bún			x			
Cratoxylum cochinchinensis (Lour.) Blume	Thành ngạnh		x				
Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn		x				
Croton tiglium L.	Bã đậu	x	x				
Curcuma longa L.	Nghệ	x		x			
Cymbidium aloifolium (L.) Sw.	Lan kiếm				x		
Cyperus rotundus L.	Củ gấu	x					
Derris elliptica (Roxb.) Benth.	Dây mật	x					
Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng		x				
Dioscorea persimilis Prain & Burk.	Củ mài	x					
Dracaena cochinchinensis (Lour.) Merr.	Bồng bồng	x					
Dracuntomelon duperreanum Pierre	Sấu		x	x			
Drynaria fortunei (Kuntze ex Mett.) J. Sm.	Cốt toái bổ	x					
Duabanga grandiflora (DC.) Walp.	Phay		x				
Elephantopus scaber L.	Cúc chỉ thiên	x					
Embelia ribes Burm. f.	Chua ngút	x					
Endospermum chinense Benth.	Vạng trứng		x				
Engelhardtia roxburghiana Wall.	Chẹo	x	x				
Euodia lepta (Spreng) Merr.	Ba chạc	x					
Euphorbia hirta L.	Cỏ sữa	x					
Gelsemium elegans (Gardn. et Champ.) Benth.	Lá ngón	x					
Gironniera subaequalis Planch.	Ngát		x				
Gomphostemma leptodon Dunn.	Đinh hùng mảnh	x					
Hedyotis capitellata Wall. ex G. Don	Dạ cẩm	x					
Hedyotis diffusa Willd.	Lưỡi rắn trắng	x					
Helicia cochinchinensis Lour.	Cơm vàng		x				
Heliciopsis lobata (Merr.) Sleum.	Túng		x				
Homalomena occulta (Lour.) Schott	Thiên niên kiện	x					
Horsfieldia amygdalina (Wall.) Warb.	Săng máu		x				

Plant Species	Local name	Plant parts used for					
		Medicinal & Poisonous plants	Fuel-wood & Timber trees	Eatable plants	Ornamental plants	Rattan & bamboo	Others
Horsfieldia thorelii Lecomte	Săng máu		x				
Houttuynia cordata Thunb.	Diếp cá	x		x			
Ixora coccinea L.	Đơn đỏ	x					x
Kadsura coccinea (Lem.) A. C. Smith	Chua cùm đỏ	x					
Kibatalia anceps (Dunn & Williams) Woods	Thần linh	x					
Knema conferta Warb.	Máu chó lá nhỏ		x				
Lagerstroemia calyculata Kurz	Bằng lăng		x				
Lagerstroemia tomentosa Presl	Săng lẻ		x				
Leucas aspera (De Wilde) Link	Bạch thiệt	x					
Lithocarpus annamensis (Hick. & A. Camus) Barn.	Dẻ		x				
Lithocarpus pseudosundaicus (Hick. & A. Camus) A. Camus	Dẻ		x				
Litsea cubeba (Lour.) Pers	Màng tang	x					x
Litsea glutinosa (Lour.) C. B. Robins	Bời lời nhớt	x					x
Lycopodiella cernua (L.) Franco & Vasc.	Thông đất	x					
Mallotus hookerianus Muell.-Arg.	Bụp		x				
Mangifera indica L.	Xoài			x			
Manglietia conifera Dandy	Mỡ		x				
Melia azedarach L.	Xoan		x				
Michelia foveolata Merr. ex Dandy (M. fulgens Dandy)	Giổi nhung		x				
Millettia pachyloba Drake	Dây mật	x					
Millettia reticulata Benth.	Kê huyết đằng	x					
Morinda umbellata L.	Mặt quỷ	x					
Musa balbisiana Colla	Chuối hột	x					
Musa paradisiaca	Chuối			x			
Neolamarkia cadamba (Roxb.) Bosser	Gáo		x				
Ophiopogon japonicus (L. f.) Ker.-Gawl.	Cao cẳng	x					
Ophiopogon latifolius Rodr.	Cao cẳng	x					
Ophiopogon longifolius Dcne.	Cao cẳng	x					
Ormosia pinnata (Lour.) Merr.	Ràng ràng		x				
Oroxylum indicum (L.) Kurz	Núc nác	x					
Paederia scandens (Lour.) Merr.	Mơ leo	x		x			
Pandanus tectorius Parkinson	Dứa dại	x					
Passiflora foetida L.	Lạc tiên	x					
Paviesia annamensis Pierre	Trường mật		x				
Pentaphragma sinense Hemsl. & Wils.	Rau tai voi			x			
Peperomia pellucida (L.) H. B. K	Tiêu rận			x			
Phyllanthus embrica L.	Me rừng	x					

Plant Species	Local name	Plant parts used for					
		Medicinal & Poisonous plants	Fuel-wood & Timber trees	Eatable plants	Ornamental plants	Rattan & bamboo	Others
Phyllanthus reticulatus Poir.	Phèn đen	x					
Piper lolot C.DC.	Lá lốt	x		x			
Plantago asiatica L.	Mã đề	x					
Plantago major L.	Mã đề	x					
Polyanthia laui Merr.	Nhọc		x				
Polygonum multiflorum Thunb. ex Murray	Hà thủ ô	x					
Pometia pinnata Forst. & Forst. f.	Sâng		x				
Pouteria sapota (Jacq.) H. Moore & Stearn.	Trứng gà			x			
Pouzolzia hirta Hassk.	Bọ mắm	x					
Prunus arborea (Blume) Kalkm.	Xoan đào		x				
Pteris ensiformis Burm. f.	Ráng seo gà	x					
Pterocarpus indicus Willd.	Giáng hương ấn		x				
Pterocarya stenoptera C. DC. var. tonkinensis Frach.	Cơi		x				
Quisqualis indica L.	Sử quân tử, Dây giun	x					
Rhapis gracilis Burret	Mật cật					x	
Rhodomyrtus tomentosa (Aiton) Hassk.	Sim	x					
Rubus alcaefolius Poir.	Ngấy	x					
Sapindus saponaria L.	Bồ hòn		x				
Schefflera heptaphylla (L.) Harms	Chân chim	x					
Schima wallichii (DC.) Korth.	Trín		x				
Shorea chinensis (Wang Hsie) H.Zhu	Chò chỉ		x				
Spondias lakoensis Pierre	Dâu gia xoan			x			
Sterculia lanceolata Cav.	Sảng		x				
Streblus asper Lour.	Ruối		x				
Streblus ilicifolius (Vidal) Corner	Mạy tèo		x				
Streptocaulon juventas (Lour.) Merr.	Hà thủ ô	x					
Strychnos axillaris Colebr.	Mã tiền	x					
Syzygium cumini (L.) Druce	Trâm mốc		x				
Syzygium formosum (Wall.) Masam	Trâm đẹp		x				
Syzygium wightianum Wall et Arn.	Trâm oai		x				
Syzygium zeylanicum (L.) DC.	Trâm đỏ			x			
Tabernaemontana bovina Lour.	Lài trâu	x					
Tacca chantrieri Andre	Râu hùm	x					
Toxicodendron succedana (L.) Mold.	Sơn	x					x
Trevesia palmata (Roxb. & Lindl.) Vis.	Đu đủ rừng	x					
Vatica odorata (Griff.) Symington	Táu		x				
Vernicia montana Lour.	Trẩu						x

Plant Species	Local name	Plant parts used for					
		Medicinal & Poisonous plants	Fuel-wood & Timber trees	Eatable plants	Ornamental plants	Rattan & bamboo	Others
Vernonia arborea Buch.-Hams.	Cúc gỗ		x				
Vitex tripinnata (Lour.) Merr.	Bình linh						x
Wrightia annamensis Eberh. & Dub.	Thừng mức		x				
Zanthoxylum nitidum (Roxb.) DC.	Sẻn	x		x			x
Zingiber officinale Roscoe	Gừng	x		x			x
Schizostachyum dullooa (Gamble) R. B. Majumdar -	Măng nứa			x			
Bambusa blumeana J. A. et J. H. Schult	Tre					x	
Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa					x	

a) Ecosystem Services

Terrestrial ecosystems, mainly forests and grasslands, in the project area provide tangible products such as food, construction materials, medicinal plants and less tangible items like tourism and recreation. As per the Millennium Ecosystem Assessment[15]*Ecosystem services* are benefits people obtain from ecosystems.

Provisional ecosystem services include i) food, crops, wild foods, and spices, ii) raw materials such as fuel wood, organic matter, fodder, iii) water, iv) medicinal resources, v) ornamental resources like handicraft materials, furs, feathers, etc. Whereas cultural services include are spiritual and religious value.

Table 14: Forest and grassland ecosystem services in project area

Ecosystem services	Species	Availability	Duration
Food, crops, wild foods (leaves, stem, seeds/fruits/ root crops, and spices	Houttuynia cordata Thunb. - Rau diếp cá Pentaphragma sinense Hemsl. & Wils. – Rau tai voi Canarium album Raeusch - Trám Piper lolot C. DC. - Lá lốt Dioscorea persimilis Prain & Burk. – Củ Mài Curcuma longa L. - Nghệ Bischofia javanica Blume - Nhội Callipteris esculenta (Retz.) J. J. Sm. – Rau dớn Schizostachyum dullooa (Gamble) R. B. Majumdar - Măng nứa	x	Rainny season: From July to October (lunar calendar)
Wood	Aglaia edulis (Roxb.) Gray - Gội Aglaia tomentosa T. & B. - Gội Aphanamixis polystachya (Wlall.)	x	Year around

[15]Millennium Ecosystem Assessment (MA). 2005. Ecosystems and Human Well-Being: Synthesis [1]. Island Press, Washington. 155pp.

	R. N. Parker - Gội nước Castanopsis fissa (Champ.) Rehd. & Wild. - Dẻ gai Celtis philippense Blanco - Má tra Endospermum chinense Benth. - Vạng trứng Lithocarpus pseudosundaicus (Hick. & A. Camus) A. Camus - Dẻ Lithocarpus annamensis (Hick. & A. Camus) Barn. - Dẻ Melia azedarach L. Paviesia annamensis Pierre - Trường mật		
Construction materials	Duabanga grandiflora (DC.) Walp. - Phay Hopea mollissima C. Y. Hu - Táu Lagerstroemia calyculata Kurz - Bằng lăng Lagerstroemia tomentosa Presl - Săng lẻ Michelia foveolata Merr. ex Dandy (M. fulgens Dandy) – Giổi Pometia pinnata Forst. & Forst. f. - Sâng Shorea chinensis (Wang Hsie) H.Zhu – Chò chỉ Vatica odorata (Griff.) Symington – Táu Pterocarpus indicus – Giáng hương	x	Year around
Fodder/Forage	Alocasia macrorrhizos (L.) G. Don – Khoa ráp Colocasia esculenta (L.) Schott – Khoai nước Commelina communis L. – Thài lài	x	Year around
Medicine	Acorus gramineus Ait. ex Soland. Ampelopsis cantoniensis (H. et A.) Planch. – Chè dây Costus speciosus (Koenig) Smith – Mía dò Curcuma longa L. – Nghệ Drynaria fortunei (Kuntze ex Mett.) J. Sm. – Cốt toái bổ Homalomena occulta (Lour.) Schott – Thiên niên kiện Morinda umbellata L. – Dây ruột gà Musa coccinea Andr. – Chuối hột Ophiopogon latifolius Rodr. – Cao cẳng Ophiopogon longifolius Dcne. – Cao cẳng Pandanus tectorius Parkinson – Dứa dại Passiflora foetida L. Lạc tiên Plantago major L. – Mã đề Polygonum multiflorum Thunb.	x	Year around

	ex Murray – Hà Thủ ô Streptocaulon juventas (Lour.) Merr. – Hà thủ ô Tacca chantrieri Andre – Râu hùm		
Fibrers and handicraft materials	Calamus faberi Becc. - Mây Calamus rudentum Lour. -Mây Calamus salicifolius Becc. - Mây	x	Year around

Religious and spiritual sites:

2.2. Main features of flora and vegetation in My Ly HPP basin area

2.2.1. Biodiversity of flora and vegetation in the basin area

What resulted from our study shows that, flora and vegetation in My Ly HPP project area comprised of at least 447 vascular plant species, 341 genus, 124 families belonging 4 botanical phylum namely: *Licopodiophyta*, *Polypodiophyta*, *Pinophyta* and *Magnoliophyta* (see the attached Annex, the botanical list).

Table 15: Taxa components in flora of My Ly HPP project area

Phylum	No. of family	No. of genus	No. of species
Lycopodiophyta (Ngành Thông đất)	3	3	3
Polypodiophyta (Ngành Dương xỉ)	9	12	14
Pinophyta (Ngành Thông)	1	1	1
Magnoliophyta (Ngành Mộc lan)	111	325	429
- Magnoliopsida (Lớp Mộc lan)	91	255	332
- Liliopsida (Lớp Hành)	20	70	97
Total	**124**	**341**	**447**

2.2.2. Rare species in the area

As according to Red Data Book of Vietnam – Botanical Section (2007) and IUCN red list, the threatened plant species in My Ly HPP project area comprised of 2 species:

Table 16. List of threatened species in My Ly project area

No.	Scientific name	Vietnamese name	Botanical family	Red Data Book of Vietnam 2007	IUCN
1.	Drynaria fortunei (Kuntze ex Mett.) J. Sm.	Cốt toái bổ	Polypodiaceae	EN A1,c,d	
2.	Pterocarpus indicus Willd.	Dáng hương ấn	Fabaceae		Vulnerable A1d ver 2.3

2.3. Preliminary data on situation and characteristics of flora biodiversity in My Ly reservoir area

Presently, the flora biodiversity characteristic in reservoir area is identified basing on what gained from site survey combining with Map classifying forest vegetation types (supplied by Management Board of Protection Forest of Ky Son district), Map covering land area occupied by the project, satellite photos.

Results gained from the study show that, vegetation in reservoir area of My Ly HPP (in the

designed alternative) comprises of almost all vegetation types existed in this catchment area, such as:

a. The vegetation on rock along the streams

Botanical component in this vegetation type is simple, species in this plant community comprise of species such as Thạch xương bồ - *Acorus gramineus*, Côm hải nam – *Elaeocarpus hainanensis*, Rù rì – *Momonia riparia*, Rù rì bãi – *Ficus subpyriformis*, Gáo nước – *Aidia pilulifera*, Trâm lá hẹp – *Syzygium linneatum*... Growing along river bank are some typical species such as Cơi – *Pterocarya tonkinensis*, Sung – *Ficus* spp. Trâm – *Syzygium* spp... Along smaller stream where humidity is existed is habitats of species of as: Thiên niên kiện – *Homalonema oculta*, Râu hùm – *Tacca chantrieri*, Cao cẳng – *Ophiopogon* spp., Thu hải đường – *Begonia* spp., some species of family Cói - Cyperaceae...

b. Grass land

Grass develops mainly on abandoned slash and burn land. On lands where degradation has not happened much usually are high or medium grass species as: Cỏ tranh – *Imperata cylindrical*, Sậy – *Phragmites karka*, Lách – *Saccharum spontaneum*, Chít – *Thysanolaena maxima*, Chè vè – *Miscanthus sinensis*... On land areas where soil has been much degraded, normally exist with low grass, poor recovery with main species such as Dị thảo – *Heteropogon conturtus*, Cỏ công viên – *Paspalum conjugatum*, Sả hôi – *Cymbopogon caesius*, Trúc thảo – *Arundinella nepalense*, Cỏ phao – *Themeda triandra*... On lands subject to regular stepping on, exists low grass with predominant species such as Cỏ may – *Chrysopogon aciculatus*, Cỏ gà – *Cynodon dactylon*, Cỏ cát vĩ – *Eulalia monostachya*, Cỏ đuôi voi – *Paspalum conjugatum*... On land area where soil is quite good or bordering with forest ecology is normally grass land with predominant species such as Cỏ cứt lợn – *Ageratum conyzoides*, Cỏ lào – *Eupatorium odoratum*. Growing together with grass species are some timber species, bushes, creeper, jumper which are recently regenerated with species component almost similar to bush vegetation in surrounding.

c. Secondary scrub on abandoned cultivated land

The vegetation has quite simple structure. Timber trees take few percentage, mainly are species of priority tree such as Muối – *Rhus chinensis*, Thàu tau – *Apurosa dioca*, Me rừng – *Phyllanthus embrica,* Mã rạng – *Macaranga denticulata*, Thừng mức – *Wightia pubescens*, Ràng ràng – *Ormosia pinnata,* Hu lá hẹp – *Trema angustifolia*... Predominant by the scrub layer mixing with herbaceous species, mainly are species of Bồ cu vẽ - *Breynia fruticosa,* Cơm rượu – *Glycomis pentaphylla,* Găng gai – *Randia spinosa,* Trang – *Ixora coccinea,* Lấu – *Psychotria* spp.*,* Mắt trâu – *Micromelum hirsutum*, Đơn nem – *Maesa* spp. The shrub layer is species of family Đậu – Fabaceae, family Cúc – Asteraceae, family Hòa thảo – Poaceae, family Cói – Cyperaceae... and species of Fern.

d. Secondary forest on abandoned cultivated land

This vegetation is also of simple structure, comprising of plant communities with 2-3 timber tree layers. Predominant layer comprises of some timber tree species as high as 5-6m, they are priority species also, such as Mã rạng – *Macaranga denticulata*, Thàu tau – *Apurosa dioca*, Me rừng – *Phyllanthus embrica,* Muối – *Rhus chinensis*, Thừng mức – *Wightia pubescens*, Ràng ràng – *Ormosia pinnata,* Hu đay – *Tremna orrientalis*, Bời lời – *Litsea* spp., Sung – *Ficus* spp., Hoắc quang – *Wendlandia paniculata*,... inserting with few of other timber trees such as Dẻ gai – *Castanopsisannamensis*, Lòng mang – *Pterospermumheterophyllum*, Sảng – *Sterculia hymenocalys*, Ngát - *Gironiera subaequalis*, Lọng bàng - *Dillenia* spp...

The scrub layer is mainly species of family Thầu dầu – *Euphorbiaceae*, Cà phê – *Rubiaceae*, Đơn nem – *Myrsinaceae*, Trúc đào – *Apocynaceae*, Mua – *Melastomataceae*... The shrub layer is species of Fern, of family Gừng – *Zingiberaceae*, Hòa Thảo – *Poaceae*, Cói *Cyperaceae*, Đậu - *Fabaceae*... In this vegetation, limb layer with species of creeper in family Khoai lang – *Convolvulaceae* is strongly developed.

e. Young forest recovered on scrub land*:*

Timber tree species comprise of some species such as Lim vang – *Peltrophorum dasyrrhachis*, Xoan nhừ - *Choerospondias axillaris*, Dẻ - *Lithocarpus* spp., De núi – *Cinnamomum* spp., Bời lời – *Litsea* spp., Cà đuối – *Cryptocarya* spp..... The scrub layer are regenerated trees and scrub species such as Ba chạc – *Euodia lepta*, Lấu – *Psychotria* spp., Ớt rừng – *Tabernaemontana* spp., Gang – *Randia* spp., Trang – *Ixora* spp., Thần linh – *Kibatalia* sp., Thừng mức – *Wightia* sp... These are low scrub species, slowly growable in shadow. The shrub layer are species of family Hòa thảo – Poaceae, family Cói – Cyperaceae, Gừng gió – *Ammomum* spp., Riềng gió – *Alpinia* spp., Ráy dại – *Alocasia* sp., Thiên niên kiện – *Homalomena oculta* and species of Fern. The sub-layer comprises of skin developed botanical species such as fern, species of Tiêu dại – *Piper spp*. , Má đào – *Aschynanthus* spp.... species of creeper in family Khoai lang – Convolvulaceae, family Đậu – Fabaceae, family Tiết dê – Menispermaceae... and species of creeping timber of family Na – Annonaceae (Bù dẻ - *Desmos* spp., *Uvaria* spp., *Fissistigma* spp., Tứ thư – *Tetrastigma* spp...

f. Dominant bamboo forest

Bamboo forest is a close forest with only one dominant species to be Nứa **-** *Chizostachyum dullooa,* sometimes appearing with some other species but of negligible quantity. The shrub layer is also simple, comprising some species of fern, some species in family Hòa thảo – *Poaceae* or family Cói – *Cyperaceae*.

g. The secondary mixed evergreen seasonal rainy forest

The dominant layer includes broadleaf trees species such as Dẻ - *Lithocarpus* spp., species of Dẻ gai – *Castanopsis* spp., Ngát – *Gironiera subaequalis*, Chẹo – *Engelhardtia roxburghiana*, Vạng Trứng – *Endospermum chinense*, species of Trâm *Syzygium* spp., Máu chó – *Knema conferta* Warb, *Horsfieldia* spp., Nhãn rừng – *Dimocarpus fumatus* (Blume) Leenh. Under foliage layer is species of Dâu gia đất – *Baccaurea racemosa*, species of Súm – *Eurya* spp., species of Trâm – *Syzygium* spp., species of Bứa – *Garcinia* spp., species of Bời lời – *Litsea* spp., Quế rừng – *Cinnamomum* spp., Sảng – *Sterculia* sp., Trám – *Canarium album*... The scrub layer is species of Chòi mòi *Antidesmabunius*, Ớt rừng – *Tabernaemontana bovina* Lour. , Mua – *Melastoma septemnervium*, species of Khôi – *Ardisia* spp., Bổ béo – *Gomphandra mollis* Merr., Kích nhũ - *Polygala tonkinensis* Chodat, Móc – *Pinnaga* spp. Lá nón – *Licuala* spp. and regenerated young trees. The shrub layer mainly is species of fern, species in family of Gừng – *Zingiberaceae*, family Hòa Thảo – *Poaceae*, family Cói *Cyperaceae*... Limb layer is mainly species of fern, species of creeper in family Đậu – *Fabaceae*, family Khoai lang – *Convolvulaceae*, Song mây – *Calamus* spp....

Comparison on biodiversity of various vegetation types in the studied region with surrounding, see table below:

Table 17: Comparison on biodiversity of various vegetation in studied area and surrounding

Studied region / **Vegetation**	**My Ly directly impacted area area (reservoir and construction work areas)**	**Basin area controlled by My Ly HPP**	**Pu Mat National Park**

Close evergreen rain forest which is suffered negligible impact at high elevation	NA (*)	NA	Comprises of sub-classification: Close evergreen rain broadleaf forest on low land Close evergreen rain broadleaf-coniferous forest Close evergreen rain coniferous forest Low forest
Evergreen rain forest which is suffered impact at high elevation	NA	NA	Comprises of sub-classification: Secondary evergreen rain broadleaf mixed forest
Evergreen rain forest which is suffered negligible impact at low elevation	NA	NA	Comprises of sub-classification: Evergreen rain forest on upland Evergreen rain forest on limestone
Evergreen rain forest which is suffered strong impact at low elevation	Comprises of sub-classification: Mixed evergreen rain broadleaf forest on low land after exploitation Broadleaf – bamboo mixed forest Single predominant bamboo forest Rock sticking vegetation along river and stream	Comprises of sub-classification: Mixed evergreen rain broadleaf forest on low land after exploitation Broadleaf – bamboo mixed forest Single predominant bamboo forest Rock sticking vegetation along river and stream	Comprises of sub-classification: Mixed evergreen rain broadleaf forest on low land after exploitation Broadleaf – bamboo mixed forest Single predominant bamboo forest Single predominant Bục bạc forest Vegetation on wet land (swamp and rock sticking along stream)
Evergreen tropical vegetation at low elevation	Comprises of sub-classification: Secondary scrub land on uncultivated land for 5-10 years Secondary forest land on uncultivated land for 10-15 years Young forest recovered on scrub land	Comprises of sub-classification: Secondary scrub land on uncultivated land for 5-10 years Secondary forest land on uncultivated land for 10-15 years Young forest recovered on scrub land	Comprises of sub-classification: Secondary scrub land on uncultivated land for 5-10 years Secondary forest land on uncultivated land for 10-15 years Young forest recovered on scrub land
Secondary tropical vegetation	Yes	Yes	Yes

(*) Not available

Generally, biodiversity of vegetation in the project area is limited, coinciding with that in Pu Mat National Park in 3 types: evergreen rain forest on low land which suffers strong impact; tropical evergreen vegetation on low land and secondary tropical grass land.

h. Density of Forest Vegetation

Describe density of forest vegetation in the project area are shown in following table:

Table 18: Density of forest vegetation in reservoir, headwork and auxiliary and area

No.	Vegetation types	Number of species/tree in the area					
		Reservoir		Main work		Auxiliary	
		species	trees	species	trees	species	trees
		(1)	(2)	(3)	(4)	(5)	(6)
A	**Vegetation layer**	**58**	**3,660,356**	**18**	**114,143**	**39**	**186,405**
1	Tree (woody)	29	218,533	11	6,505	19	9,092
2	Generation of trees (woody)	(*) 11 new /19 total	499,638	(*) 3new /6 total	16,234	(*) 6 new /12 total	22,383
3	Shrub (woody)	12	2,482,942	3	79,936	8	137,546
4	Herb (non-woody)	6	466,618	2	11,469	6	17,384
B	**Density**						
1	No. of tree/ha	175		200		197	

<u>Explaination:</u> example in colume (1): (*) 11 new/19 total: this mean that out of 19 species of generation of tree, there are 11 identified as new species and 07 remaining species identified coincide with the species of tree.

Example: in column 1 total number of species is the reservoir is 29+11+12+6 = 58 species

Similar for column 3 and 5 the total number of species in Headwork is 11+3+3+2 = 19 species, and 19+6+8+6 = 39 species.

2.4. Summary on Forest Management and Protection

<u>Protection forest</u>

Protection forest management and Protection are specified in Protection Forest Regulation issued together with Decision No. 17/2015/QĐ-TTg dated 09/06/2015 of Prime Minister..

Content: Protection and Management of Forest protection (FP)

The Province sets up a Forest Protection Board including Forest Protection Unit (700ha/1person)

Protecting Protection forest: Protecting forest ecosystem and vegetation; preventing and fighting forest fire; preventing hamful organisms to the protection forest.

Arranging Protection Forest: Protection Forest Management Board (PFMB), people who hired/contracted Protection Forest; Local Forest Protection Division; Commune People Committe support for the forest owner, protect the forest area that not allocated/contracted in the locality.

Protection forest contracting, co-management and benefit-sharing: protection forest management boards are responsible for organization of forest contracting, implementation of forest co-management with households, individuals, and village communities.

The rate for protecting of protection forest is 200,000VND/ha.

Using protection forest and benefit sharing mechanism: Exploiting forest products; utilizing wood in Protection forest for natural forest; Exploiting wood in planted forest (<20% & <3 ha..); Exproiting forest bamboo and forest products (<30% of reserves); Eco-tourism, scientific research, education; intergrated agro-fishery (for area without forest, planted forest has not yet closed capyno, water surface);

Productive forest

Protective forest protection and management is provided in Productive forest regulation issued together with Decision No. 49/2016/QĐ-TTg dated 01/11/2016 the Pirme Minister.

Content: Protecting and deleloping Productive forest

Productive forest owner has to develop the forest protection plans and organize forest protection by themselves, prevent and fight forest fire; and organize and conduct to contract/hire and protect for households, individuals, local communities or forest cooperatives.

Local Forest Protection Offices and Commune people's Committees coordinate and support for forest development, prevent and fight forest fire according to the National Law. Inspect and supervise the forest owners in implementing the responsibility of forest protection, prevent and fight forest.

Forest owner have to develop sustainable forest management plans under the guidance of the Ministry of Agriculture and Rural Development and submit Department of Agriculture and Rural Development for appraisal and approval and organize in managing, protecting, developing, using forest, inspect and monitoring under plans of sustainable forest management.

Details:

Improvement of productive forest categorized as natural forests in accordance with the approved plan;

Timber exploitation in natural productive forest; timber exploitation in natural productive forests to serve the essential demands on the spot of households, individuals, and village communities (district-level approval & <10m^3/time); Utilization of timber in natural production forest areas when changing the forest use purpose (with the list of forest products to track/monitor their origins when they are circulated and consumed); utilization of timber when implementing silvicultural measures and scientific research; recovery of timber in natural production forests; exploitation of non-timber forest products in production forests; utilization and recovery of timber in concentrated planted forests; other activities in production forests (forest environmental services, development of non-timber forest products, agricultural and fishery production combined with less than 30% of the area, scientific research and technological application activities, management of other forest categories and land categories in productive forests (protection forests, agricultural land…).

2.5. Vegetation map of My Ly HPP

Remote sensing and GIS methods was used to establish vegetation map of My Ly HPP. The data used for the study included:

VNRedSAT satellite image 2014 with 2.5m resolution.

Topo map 1/10.000, VN2000 coordinates system.

GPS photos (taken during field surveys at My Ly HPP area).

Other reference data.

Satellite imagery needs to be pre-processed and geometric correction based on topo map and cut off boundaries of the study area. The information on the image is extracted using supervised classification method (Maximum likelihood), combined with visual interpretation to correct and add information layers. This is the process of separating the qualitative and quantitative information from the image by direct signals (image signals) and indirect signals (non-image signals and indicators) such as size; shape; shadow; lightness; color; structure;

relevance ... create layers of thematic information from satellite imagery. To assist in the sorting and verification of results, we used field survey data and other reference materials for comparison.

Finally, the images are classified and vectorized to construct thematic maps on GIS software. From this result we can actually print or build derivative products, extract data for computing, statistics area for each object.

Vegetation map is shown following figure:

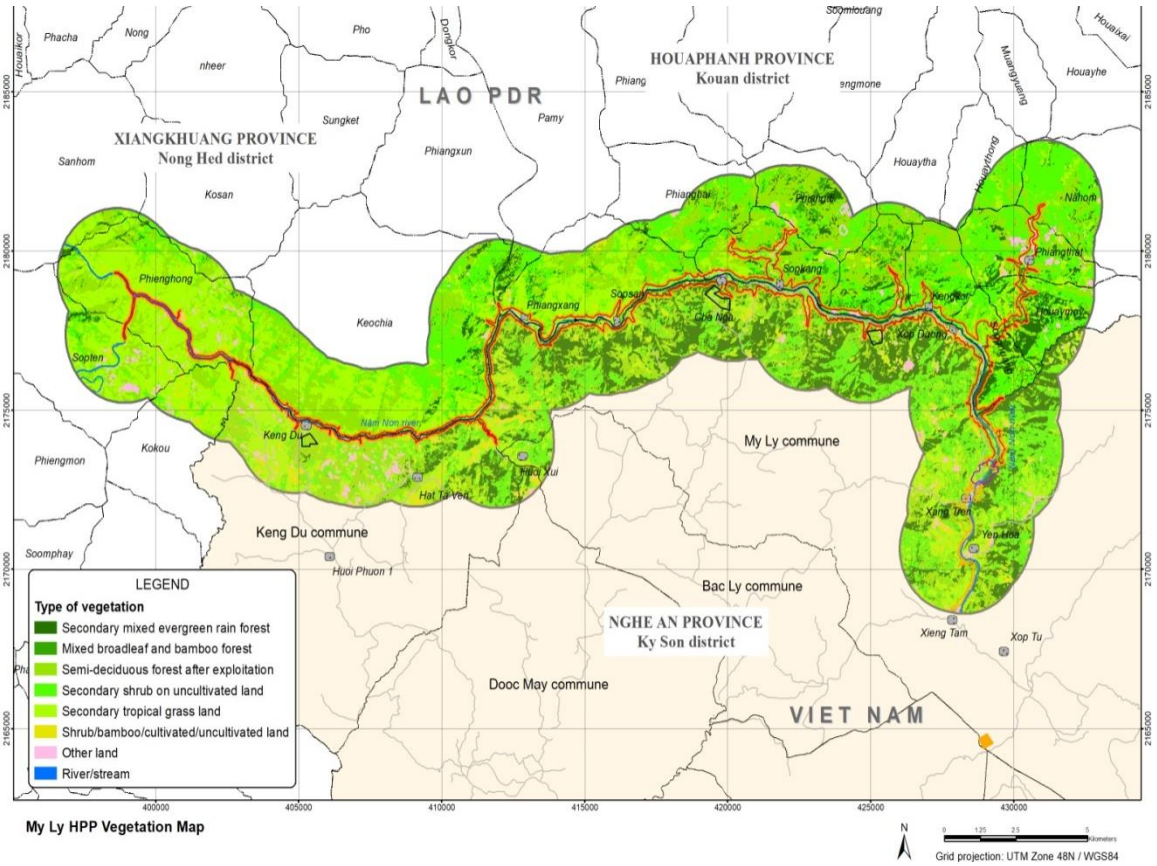


Figure 7: Vegetation map of My Ly HPP

Figure 7 isvegetation map consisting of the following main objects:

I. Secondary mixed evergreen rain forest
II. Mixed broadleaf and bamboo forest
III. Semi-deciduous forest after exploitation
IV. Secondary scrub on uncultivated land
V. Secondary tropical grass land
VI. Shrub/bamboo/cultivated/uncultivated land
VII. Other lands
VIII. River/stream

2.6. Estimation of submerged biomass due to construction of My Ly HPP

The area of 7 vegetation types was calculated based on the vegetation map.

Biomass calculation was based on Do Huu Thu (2015), Pham Tuan Anh (2007), Tran Binh Da (2012), Vu Tan Phuong et al. (2012), andNguyen Thanh Tien (2012)

The results of vegetation area and biomass are shown in the table follows:

Table 19. Area of vegetation types (ha)/Total dry biomass of both ground and underground (roots) of vegetation typea (Ton)

No.	Occupied area	Total area (ha)	Occupied area of each vegetation type (ha)/ total dry biomass (vegetation types according to Vegetation map)							
			I	II	III	IV	V	VI	VII	VIII
A	**Permannent area**									
1	**Submerged area**	**1247.3**	259/15,540	98.3/2,949	272/13,600	166/1,992	161/644	32/160	51	208
2	**Buffer area**	**707.69**	150/9,000	45/1,350	230/11,500	102/1,224	149/596	17/85	12	2.8
3	**Main works area**	**34.15**	11.6/690	2.1/63	3.8/190	8.2/98.4	5.2/20.4	0.3/1.5	0.2	2.7
B	**Temtorary area**	**52.61**								
1	Disposal No.1	1.2	**0**	**0**	**0**	**0.2/2.4**	**0.1/0.4**	**0.3/1.5**	**0.6**	**0**
2	Disposal No.3	0.21	**0**	**0**	**0**	**0**	**0.10.4**	**0**	**0.1**	**0**
3	Disposal No. 4	3.09	**0**	**0**	**0**	**3.09/37.08**	**0**	**0**	**0**	**0**
4	Auxiliary area No.1	1.16	**0**	**0.2/6**	**0.2/10**	**0.5/6**	**0.1/0.4**	**0**	**0.1**	**0**
5	Auxiliary area No. 2	16.9	**3.2/192**	**0.8/24**	**0.1/5**	**3.4/40.8**	**1.9/7.6**	**5.4/27**	**0.1**	**2**
6	Auxiliary area No.3 (Disposal area No.2)	26.86	**8.4/504**	**3/90**	**6.6/330**	**3.7/44.4**	**3.8/15.2**	**1.2/6**	**0.2**	**0**
7	Other items in road	0.94	0	0	0	0.64/7.68	0	0.3/1.5	0	0
8	Construction road	2.25	0	0	0	0	0	0	2.25	0
C	**Quarry**	**11**								
	Items No. 1 and No. 2	2.76	**0**	**0**	**0**	**2.76/33.12**	**0**	**0**	**0**	**0**

Note:

I. ***Secondary mixed evergreen rain forest:*** *Total dry biomass of both ground and underground (root) was60 tons/1ha*

II. ***Mixed broadleaf and bamboo forest: T****otal dry biomass of both ground and underground (root) was 30 tons/1ha*

III. ***Semi-deciduous forest after exploitation:*** *Total dry biomass of both ground and underground (root) was 50 tons/1ha*

IV. ***Secondary scrub on uncultivated land:*** *Total dry biomass of both ground and underground (root) was 12 tons/1ha*

V. ***Secondary tropical grass land:*** *Total dry biomass of both ground and underground (root) was 4 tons/1ha*

VI. ***Shrub/bamboo/cultivated/uncultivated land:*** *Total dry biomass of both ground and underground (root)was.5 tons/1ha.*

VII. ***Other lands***

VIII. ***River/stream***

On the numerator is area (ha), the denominator is total biomass of both the ground and underground (roots) of whole vegetion types(tons)

2.6. Fauna

Vietnam has recorded total 402[16] mammal species of 93 families, 25 orders, 5 classes (Dang H.H. et all, 1994). However, In area of My Ly commune, Keng Du commune, Ky Son district, Nghe An province, including 45 mammal species. In addition, the project area has recorded 111 bird species, 24 reptile species, 19 amphibian species and 203 insect species (Table 18).

Table 20: Component of mammal, bird, reptile, amphibian, fish and insects in My Ly HPP basin

No.	Wildlife	No. of order	No. of family	No. of species	
				2012	2017
1	Mammal	7	19	45	41
2	Bird	14	43	111	107
3	Reptile	2	11	24	23
4	Amphibian	1	6	19	17
5	Insect	2	14	203	210
6	Fish	6	17	69	76
	Total	**32**	**110**	**471**	**474**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.

2.6.1. Mammal

Biodiversity of wildlife in the region is high. There have been listed with 45 species (13.9% total number of known species in Vietnam), belonging to 19 families, 7 orders. The animals are mainly distributed in area where forest is in good condition, above 500masl.

According to statistical data, *Rodentia* has the most species with 19 species, 3 families; then to *Chiroptera* 12 species, 6 families, the *Carnivora* has 6 species, 4 families; *Primates* has 3 species, 2 families, orders having two species are *Scandenta* and *Artiodactyla* orders.

[16]Dang, H.H., Dao, T.V., Cao, S.V., Pham, A.T., and Hoang, K.M. 1994.Checklist of Mammals in Vietnam. Hanoi: Publishing House Science & Technics. 168p. [in Vietnamese].

Table 21: Mammal composition in My Ly HPP basin

No.	Vietnamese name/local name	Scientific name Order	No. of family	No. of species
1	Bộ ăn côn trùng	Insectivora	1	2
2	Bộ nhiều răng	Scandenta	1	1
3	Bộ dơi	Chiroptera	6	12
4	Bộ linh trưởng	Primates	2	3
5	Bộ ăn thịt	Carnivora	4	6
6	Bộ móng guốc ngón chẵn	Artiodactyla	2	2
7	Bộ gặm nhấm	Rodentia	3	19
	Total		19	45

Table 22: Catergories showing the 10-15 most commonly seen species

No.	Vietnamese name/ Local language names	Scientific name
1	Chuột chù cộc	*Anourosorex squamipes*
2	Chuột chù	*Suncus murinus*
3	Dơi ăn mật hoa	*Macroglossus minimus*
4	Dơi bao đuôi nâu đen	*Taphozous melanopogon*
5	Dơi mũi quạ	*Hipposideros armiger*
6	Dơi mũi xinh	*Hipposideros pomona*
7	Dơi mũi xám	*Hipposideros larvatus*
8	Dơi lá đuôi	*Rhinolophus affinis*
9	Dơi lá mũi	*Rhinolophus pusillus*
10	Dơi ống tai tròn	*Murina cyclotis*
11	Dơi muỗi nâu	*Pipistrellus coromandra*
12	Chuột đất lớn	*Bandicota indica*
13	Chuột đất bé	*Bandicota savilei*
14	Chuột nhà	*Rattus flavipectus*
15	Chuột cống	*Rattus norvegicus*

Site surveys and studies show in the proposed project damsite area mostly are small animal, widely distributed species such as mice, bat... It shall be noted that the number of individuals of most mammals species have been seriously impaired due to overexploitation and habitat destruction.

2.6.2. Bird

A total of 111 species recorded in the area belonging to 43 families, 14 orders. There are about 60 species identified through visual or listening to singing. The remaining species were identified based on body parts such as skin, hair, mine kept in the locals and by interviewing.

Generally, bird in this area is poor in biodiversity, taking 12.22% of total number of bird species in Vietnam.

Orders havinglots of species such as: *Passeriformes* has 26 families 84 species; *Coraciiformes*, *Falconiformes*, *Gruiformes*, *Charadriiformes* have 2 families 3 species; the

Galliformes, *Cuculiformes*, *Columbiformes* have 1 families, 6 species. There are orders having one family, one species.

Table 23: Bird species in My Ly HPP basin

No.	Vietnamese name	Scientific name Order	No. of family	No. of species	
				2012	2017
1	Bộ hạc	Ciconiiformes	1	4	3
2	Bộ Cắt	Falconiformes	2	3	3
3	Bộ Gà	Galliformes	1	2	2
4	Bộ Sếu	Gruiformes	2	3	2
5	Bộ Rẽ	Charadriiformes	2	3	3
6	Bộ Bồ câu	Columbiformes	1	2	2
7	Bộ vẹt	Psittaciformes	1	1	1
8	Bộ Cu cu	Cuculiformes	1	2	2
9	Bộ Cú	Strigiformes	1	1	1
10	Bộ Cú muỗi	Caprimulgiform	1	1	1
11	Bộ Nuốc	Trogoniformes	1	1	1
12	Bộ Sả	Coraciiformes	2	3	3
13	Bộ Gõ kiến	Piciformes	1	1	1
14	Bộ Sẻ	Passeriformes	26	84	82
	Total		**43**	**111**	**107**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.

2.6.3. Reptile

Biodiversity of reptile species is low. It has been determined 24 reptile species belong to 11 families, 2 orders. The *Squamata* has 10 families with 23 species and *Testudines* has 1 family, 1 species. Reptile species distribute mainly in high mountain area above elevation 500masl, in area of evergreen forest along rivers and streams.

Table 24: Reptile species in My Ly HPP basin

No.	Vietnamese name	Scientific name Order	No. of family	No. of species	
				2012	2017
1	Bộ có vảy	Squamata	10	23	22
2	Bộ rùa	Testudinata	1	1	1
	Total		**11**	**24**	**23**

2.6.4. Amphibian

The number of amphibian species is low. It has identified 19 amphibian species of 6 families, of *Anura* order. Families such as *Ranidae* has 6 species, *Microhylidae*and *Dicroglossidae* have 4 species, *Bufonidae* and *Megophryidae* have 2 species, the *Rhacophoridae* has 1 species. Amphibian species distributes in forest area along streams which are flowing to Ca (Nam Non) river and in population areas.

Table 25: Amphibian species in My Ly HPP basin

No.	Vietnamese name	Scientific name Order	No. of species	
			2012	2017
1	Bộ không đuôi	Anura		
2	HọCóc	Bufonidae	2	2
3	HọCóc bùn	Megophryidae	2	1
4	HọNhái bầu	Microhylidae	4	4
5	HọẾch nhái chính thức	Dicroglossidae	4	4
6	HọẾch nhái	Ranidae	6	5
7	HọẾch cây	Rhacophoridae	1	1
	Total		**19**	**17**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.

2.6.5. Insect

It has preliminarily determined 203 insect species belonging to 14 families, 2 orders. They are: *Coleoptera* and *Lepidoptera*.

Table 26: Insect component in My Ly HPP basin

No.	Vietnamese name	Scientific name	No. of family	No. of species	
				2012	2017
1	Bộ Cánh cứng	COLEOPTERA	1	1	2
2	Bộ Cánh vảy	LEPIDOPTERA	13	202	208
	Total		**14**	**203**	**210**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.

2.6.6. Fish and aquatic

a. Fish

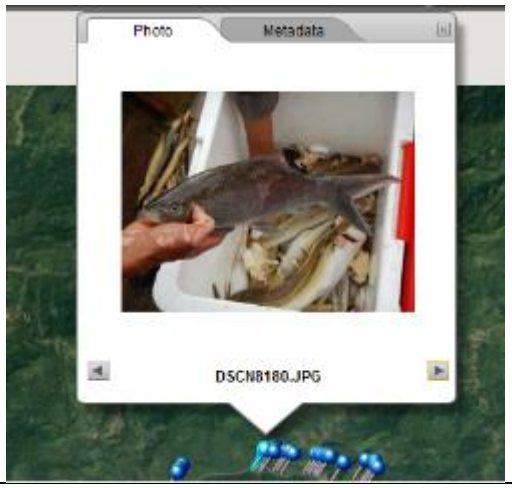
Diversity. The number of fish in water bodies in the region are quite diversity, distinctly distribution in the two types of water bodies as rivers and streams. . Through the survey and interview process at Ca (Nam Non) River, 77 species of fish have been recorded: in 2012has identified 69 species belonging to 17 families, 6 orders. , in 2016 it was 76 fish species belonging to 17 families, 6 orders. And in March 2017, identify 77 fish species.The *Cypriniformes* order has 2 families 47species, *Perciformes* has 5 families 12 species, *Siluriformes* has 5 families 12species. There is great difference between fish species component between main riverwith smaller streams. In main river basin (this is only sampling in the river stretch affected by the MY Ly HPP not the whole basin, there are 51 fish species recorded, while in smaller streams in surround, there are only 29 species. There are 10 fish species distributing in both main river basin and smaller tributaries.

Fisheries. Interviewing fishermen in project area shows that the species exploited mainly are zebra tilapia*Oreochromis niloticus*, black tilapia, eel, snakehead fish, goby, catfish and a some other small fish species with not high economic value. Caught fish used for personal and family only. Fishing productivity is low, varying between some of 1-2kg/capita/day. Villagers take day off to go fishing in small streams for their own demand on daily meal. Means and tools are simple and manual. Mostly are handy net or hand. Sometime local resident stop the flow on stream, dewatering and fishing. Some villagers use poison leave in a stream section for fishing. Also according to resident, there is still phenomenon of using electric shock to fishing in streams though this has been prohibited.

.

Capture fish in Ca river

Capture fish in stream



Cá Rầm xanh, *Bangana lemassoni* (Pellegrin & Chevey, 1936)

Cá lăng chấm, *Hemibagrus guttatus* Lacepede, 1803

Figure 7: Some pituresof fishing ways, fish survey and fish types

On main river course, some fishermen also perform fishing and other aquatic species such as crab, shrimp, etc. Tools are mainly fishing net, and other simple tools. Fishing yield on river is higher than on streams and component of fishes caught is more diversify. Sometime fishermen still catch some big size fish of high value such as eel fish, goby, catfish, etc…Generally, fishing yield in this region is low and there is no more resident living regularly on fishing.

Aquaculturally, in area of My Ly HPP, fishing farm area is not many, mainly are small ponds or pens lying areas to keep water, not high yield. Generally speaking, fishery in this area is un-developed and for self demand only. Local resident in villages along river, stream has not yet in custom and fish farming. It could be because present water level is low, unstable,water surface area is limited causing un-development to aquaculture activities.

Table 27: Fish orders and number of famiies and species in studies of the in the Ca river stretch of the planned My ly HPP

No.	Vietnamese name	Scientific name	No. of family	No. of species		
				2012	2016	2017
1	Bộ cá Chép Mỡ	Characiformes	1	2	2	2
2	Bộ Cá Chép	Cypriniformes	3	41	47	47
3	Bộ Cá Nheo	Siluriformes	5	11	11	12

4	Bộ Cá Vược	Perciformes	5	12	12	12
5	Bộ cá Chình	Anguilliformes	1	1	1	1
6	Bộ Mang liền	Synbranchiformes	2	2	3	3
	Total		**17**	**69**	**76**	**77**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.
Source for 2016: Scoping report, My Ly HPP, 2016, PECC1.

Table 28: The most fish common species caught in Ca (Nam Non) river and stream

No.	Vietnamese name/local name	Scientific name	Ca (Nam Non) river	stream
1	Cá thè be sông lam	Acheilognathus lamensis (Nguyen, 1983)	++	+
2	Cá mát	Onychostoma lepturus	++	
3	Cá đong chấm	Puntius ocellatus (Mai,1978)	++	+
4	Cá Đòng đong cân cấn	Puntius semifasciolatus Gunther, 1868	++	+
5	Cá Thiểu	Culter erythropterus Basilewsky, 1855	++	
6	Cá Rô phi thường	Oreochromis mosambicus Peters, 1852	+++	+
7	Cá Rô phi vằn	Oreochromis niloticus Linnaeus, 1758	++	+
8	Cá Mương nổi	Hemiculter leucisculus Basilewsky, 1855	++	
9	Cá mại khe lào	Danio laoensis (Pellegrin & Fang, 1940)	+	+
10	Lươn	Monopterus albus Zuiew, 1793	+	+

Rare fish species of high economic value are shown in following table:

Table 29: The most fish species of high economicvalue in Ca (Nam Non) river

No.	Vietnamese name/local name	Scientific name
1	Cá lệch, cá chình hoa	Anguilla marmorata Quoy & Gaimard, 1824
2	Cá bỗng	Spinibarbus denticulatus Oshima, 1926
3	Cá Chép	Cyprinus rubrofuscua Lacepede, 1803
4	Cá mát	Onychostoma lepturus
5	Cá Lăng	Hemibagrus guttatus Lacepede, 1803
6	Cá Ngạnh	Cranoglanis henrici Vaillant, 1893
7	Cá Chiên, cá ghé	Bagarius rutilus Ng.& Kottelat, 2000
8	Cá Quả	Channa striata Bloch, 1793

According to the survey results, it has found that, in the studied basin there are 4 rare fish species listed in Vietnam Red Data Book (2007) as Vulnerable VU, including: *Anguilla mamorata*, *Acrossocheilus annamensis*, *Hemibagrus guttatus*, *Bagarius rutilus*. These fishes are large in size, of high economic value. They are over-hunted, fishing, and increasingly decreased in numbers. The *Anguilla mamorata* fish is a migration species between river-sea, there should be suitable mitigation measures applied to migration species when constructing the dam.

Fish species distribute in river, stream in the catchment

Site survey shows 54 species of fish living in main river course, 30 species living in tributaries, of which 10 species distribute both in river and stream such as zebra tilapia*Oreochromis niloticus*, black tilapia, *Misgurnus anguillicaudatus Cantor*, anabas, eel,...Species living in streams are normally small fish species, preferring rapid water and high oxygen content. Typical stream fish species are those such as *Schistura*, *Rhinogobius,* particularly zebra tilapia*Oreochromis niloticus*. They distribute, grow and adapt strongly in such small streams. At the time of site survey, there were lots of young tilapia, in group, seen finding food in static water in streams. Parent tilapia are big, strong, hardly to catch even with net and electric shock.

Fish migrations: As in other rivers in Vietnam, Ca (Nam Non) river fish migrate to spawning, migrant wintering, migrant populations, or migratory water.

Fisheries on the Ca (Nam Non) river: Fishing is not the main occupation of the majority of the local population in the Ca (Nam Non) river basin. However, households use their free time to fish for daily food. They use simple fishing net and fishing nets. Normally, every day, we go fishing all night with 1-3 kg of fish up to 5-10 kg. Usually the species they catch are: Cá mát- *Onychostoma lepturus;* cá ghé- *Bagarius rutilus;* Cá Lăng- *Hemibagrus guttatus;* Cá Chép- *Cyprinus rubrofuscua;* Cá Rô phi thường- *Oreochromis mosambicus;*Cá mại khe lào- *Danio laoensis;* Cá bậu- *Garra orientalis.*

Table 30: List of fish species in Ca (Nam Non)river, stream (Vietnam, Lao and IUCN) of My Ly HPP area

No.	Vietnamese name/local name	Scientific name	Ca (Nam Non) river	stream	IUCN
I	**BỘ CÁ CHÌNH**	**ANGUILLIFORMES**			
	Họ Cá chình	**Anguillidae**			
1	Cá lệch, cá chình hoa	*Anguilla marmorata* Quoy & Gaimard, 1824	+		VU
II	**BỘ CÁ CHÉP MỠ**	**CHARACIFORMES**			
	Họ Cá Chép mỡ	**Characidae**	+		
2	Cá Chim trắng	*Cossoma brachypomum* (Cuvier, 1818)	+		
	Cá Vũn family	**Prochilodontidae**			
3	Cá Vền nam mỹ	*Prochilodus argenteus* Spix & Agassiz, 1829	+		
III	**BỘ CÁ CHÉP**	**CYPRINIFORMES**			
	Họ Cá Chép	**Cyprinidae**			
4	Cá mại khe lào	*Danio laoensis* (Pellegrin & Fang, 1940)	+	+	
5	Cá giao sơn	*Yaoshanicus kyphus* (Mai, 1978)		+	
6	Cá bỗng	*Spinibarbus denticulatus* (Oshima, 1926)	+		
7	Cá ngũ vân	*Puntius partipentazona (*Fowler, 1934)		+	
8	Cá thè be sông lam	*Acheilognathus lamensis* (Nguyen, 1983)	++	+	
9	Cá chát sông lam	*Acrossocheilus lamus* (Mai, 1978)	+		
10	Cá trốc	*Acrossocheilus annamensis* (Pellegrin & Chevey, 1936)	+		VU
11	Cá Rầm xanh	*Bangana lemassoni* (Pellegrin & Chevey, 1936)	+		VU

12	Cá bậu	*Garra orientalis* Nichols, 1925	+	+	
13	Cá sứt môi đuôi sọc	*Garra caudofasciata*	+		
14	Cá bậu	*Garra poilanei*	+		
15	Cá Chép	*Cyprinus rubrofuscua* Lacepede, 1803	+		
16	Cá Diếc	*Carassius auratus* Linnaeus, 1758	+		
17	Cá Rưng	*Carassioides acuminatus* Richardson, 1846	+		
18	Cá mát	*Onychostoma lepturus*	++		
19	Cá Sỉnh	*Onychostoma gerlachi*	+		
20	Cá Dầm đất	*Osteochilus salsburyi* Nichol & Pope, 1927	+	+	
21	Cá Trôi	*Cirrhinus molitorella* Valenciennes,1844	+		
22	Cá Cầy	*Paraspinibarbus macracanthus* Pellegrin & Chevey, 1936	+		
23	Cá đong chấm	*Puntius ocellatus* (Mai,1978)	++	+	
24	Cá Đòng đong cân cấn	*Puntius semifasciolatus* Gunther, 1868	++	+	
25	Cá Cháo	*Opsarichthys bidens* Gunther, 1873	+	+	
26	Cá Mại	*Metzialineata* Pellegrin, 1907	+		
27	Cá Thiểu	*Culter erythropterus* Basilewsky, 1855	++		
28	Cá Ngão gù	*Culter flavipinnis* Tirant, 1883	+		
29	Cá Thiểu mắt to	*Ancherythroculter daovantieni*Banarescu, 1967,	+		
30	Cá Mương nổi	*Hemiculter leucisculus* Basilewsky, 1855	++		
31	Cá Vền	*Megalobrama terminalis* Richardson, 1946	+		
32	Cá Nhác	*Sinibrama affinis* Vaillant, 1892	+		
33	Cá Chày mắt đỏ	*Squaliobarbus curriculus* Richardson, 1846	+		
34	Cá Mè trắng trung quốc	*Hypophthalmichthys molitrix* Valenciennes, 1844	+		
35	Cá Trắm đen	*Mylopharyngodon piceus* Richardson, 1846	+		
36	Cá Thè be	*Acheilognathus tonkinensis* Vaillant, 1892	+		
37	Cá Đục đanh	*Saurogobio immaculatus* Koller, 1927	+		
38	Cá Đục ngộ	*Hemibarbus medius* Yue	+		
39	Cá Mè hoa	*Aristichthys nobilis* Richardson, 1844	+		
40	Cá Trắm cỏ	*Ctenopharyngodon idella* Valenciennes, 1842	+		
41	Cá Rô hu	*Labeo rohita* Hamilton, 1822	+		
42	Cá Mrigan	*Cirrhinus mrigala* Hamilton, 1822	+		
	Họ Cá Chạch	**Cobitidae**			

1	Cá chạch bùn núi	*Misgurnus tonkinensis* Rendahl,1937		+	
2	Cá Chạch bùn	*Misgurnus anguillicaudatus* Cantor, 1842	+	+	
	Họ Cá Chạch suối	**Namacheilidae**			
1	Cá chạch đá đuôi bằng	*Schistura orthocauda* (Mai, 1978)		+	
2	Cá chạch đá nâu	*Schistura incerta* Nichols, 1931		+	
3	Cá chạch đá sọc	*Schistura fasciolata (*Nichols & Pope, 1927)		++	
4	Cá chạch suối	*Micronemacheilus taeniatus*		+	
	Họ cá bám đá	**Balitoridae**			
1	Cá vây bằng vảy lan can	*Balitora lancangjiangensis* (Zheng, 1980)	+	+	
2	Cá Bám đá khuyết	*Beaufortia leveretti* Nichol & Pope, 1927	+		
IV	**BỘ CÁ NHEO**	**SILURIFORMES**			
	Họ Cá nheo	**Siluridae**			
1	Cá Thèo	*Pteorocypris conchinchinensis* (Valenciennes, 1839)	+	+	
2	Cá Nheo	*Silurus asotus* Linnaeus, 1758	++		
	Họ Cá lăng	**Bagridae**			
3	Cá Bò	*Pelteobagrus fulvidraco* Richardson, 1846	+		
4	Cá Lăng	*Hemibagrus guttatus* Lacepede, 1803	+		VU
5	Cá Mịt	*Pseudobagrus virgatus* Oshima, 1926	+	+	
	Họ Cá ngạnh	**Cranogranidae**			
1	Cá Ngạnh	*Cranoglanis henrici* Vaillant, 1893	+		
	Họ Cá trê	**Claridae**			
1	Cá Trê	*Clarius fuscus* Lacepede, 1803	+		
2	Cá Trê phi	*Clarias gariepinus* Burchell, 188	+		
	Họ Cá chiên	**Sisoridae**			
1	Cá Chiên, cá ghé	*Bagarius rutilus* Ng.& Kottelat, 2000	+		VU
2	Cá chiên suối	*Glyptothorax lampris* Fowler, 1934		+	
3	Cá chiên suối	*Glyptothorax quadriocellatus* (Mai, 1978)		+	
4	Cá chiên bẹt	*Pareuchiloglanis nebulifer*	+		
V	**BỘ MANG LIỀN**	**SYNBRANCHIFORMES**			
	Họ Lươn	**Monopteridae**			
1	Lươn	*Monopterus albus* Zuiew, 1793	+	+	
	Họ Cá chạch sông	**Mastacembelidae**			
2	Cá Chạch sông	*Mastacembelus armatus* Lacepede, 1800	+		

3	Cá Chạch	*Sinobdella sinensis*	+		
VI	**BỘ CÁ VƯỢC**	**PERCIFORMES**			
	Họ Cá rô	**Anabantidae**			
1	Cá Rô	*Anabas testudineus* Bloch, 1792	+	+	
	Họ Cá tai tượng	**Osphronemidae**			
2	Cá Đuôi cờ	*Macropodus opercularis* Linneaus, 1758		+	
3	Cá Sặc bướm	*Trichogaster trichopterus* Pallas, 1770		+	
	Họ cá bống đen	**Eleotridae**			
4	Cá bống tượng	*Oxyeleotris marmorata*	+		
	Họ Cá bống trắng	**Gobiidae**			
5	Cá Bống trắng	*Glossogobius giuris* Hamilton, 1822	++		
6	Cá Bống suối	*Rhinogobius duospilus* Herre, 1935		+	
7	Cá Bống đá	*Rhinogobius giurinus* Rutter, 1897		+	
	Họ Cá rô phi	**Cichlidae**			
1	Cá Rô phi thường	*Oreochromis mosambicus* Peters, 1852	+++	+	
2	Cá Rô phi vằn	*Oreochromis niloticus* Linnaeus, 1758	++	+	
	Họ Cá quả	**Channidae**			
1	Cá Quả	*Channa striata* Bloch, 1793	+		
2	Cá trèo đồi	*Channa asiatica* (Linnaeus, 1758)		+	
3	Cá chuối suối	*Channa gachua* (Hamilton, 1822)	+	+	
	Total		**54**	**30**	**5**

(+): less common; (++): common; (+++) met a lot

Notes: 1: Main river, in My Ly and Keng Du commune territory

2: Streams flows into Nam non river

3: Status classification by Red Data Book of Vietnam, 2007.

b. Phytoplankton

Results gained from analyzing phytoplankton samples taken during site survey have identified 37 species belonging to 4 algae phylum. They are silica algae *Bacillariophyta*; blue algae *Cyanophyta*; green algae *Chlorophyta* and eye algae *Euglenophyta*.

Species composition as said is lower than the river waters forms, this could possibly due to number of samples taken which is not many and therefore not yet reflecting all number of actual species existing in this area. However, the results from investigation have assessed somehow biodiversity of phytoplankton in the region. Among its composition, the silica algae *Bacillariophyta* is dominated with 19 species accounted for 51.4 percent and 12 species of green algae *Chlorophyta* 32.4%; 4 species of blue algae *Cyanophyta* (10.8%) and eye algae *Euglenophyta* 2 species, accounting for 5.4%. Appearance of commonspecies in genus of *Navicula (Navicula placentula; N. gastrum)*, *Nitzschia (Nitzschia recta; Nitzschia nyanensis)*, *Diatoma* (*Bacillariophyta* algae), *Oscillatoria* (*Oscilllatoria limosa*) and *Spirogyra* (*Spirogyra ionia;*) has shown predominant in species composition belongs to algae groups preferring rapid water in mountainous watershed where organic contamination is still less (see table 1, Annex). These are species preferring clean water, normally occur in natural rivers, streams, lakes in mountainous area. Evaluation of water quality is done by means of

species indicating the flowing water habitat.

Table 31: Lists of species of Phytoplankton

No.	Phyla	No. of species		Percentage (%)
		2012	2016-2017	
1	*Cyanophyta*	4	4	10.8
2	*Bacillariophyta*	18	19	51.4
3	*Chlorophyta*	11	12	32.4
4	*Euglenophyta*	2	2	5.4
	Total	**35**	**37**	**100**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.
Source for 2016: Scoping report, My Ly HPP, 2016, PECC1.

Investigated locations on Ca (Nam Non)river show a low density of phytoplankton, between 1.82×106 to 5.03×106 tb/m^3. Within the composition, species predominant in density are silica algae *Bacillariophyta*, while group of green algae *Chlorophyta*and blue algae *Cyanophyta*has low density, the eye algae *Euglenophyta* group does not appear in quantitative sample. The results prove that, during investigation time which was in rainy season, the water flows rapidly, has somehow limited the development in quantity of phytoplankton particularly the green algae *Chlorophyta*and eye algae*Euglenophyta*.

Density of phytoplankton found in site survey 2016 was low too, varying between 2.36×10^6 and 4.82×10^6 tb/m^3 as found at investigated locations on Ca (Nam Non) river. Density rate between groups changes not so much from results gained in 2012.

Table 32: Density of phytoplankton at investigated locations on Ca (Nam Non) river

in 9/2012

Investigation location	No. of species	Caculate average density of phytoplankton (x 10^6 cell/m^3)				
		Total	Bacillariophyta	Cyanophyta	Chlorophyta	Euglenophyta
ML1	15	2.80	2.14	0.16	0.50	0.0
ML2	14	4.56	1.48	1.70	1.38	0.0
ML3	15	4.57	2.12	1.60	0.85	0.0
ML4	12	5.03	2.16	1.85	1.02	0.0
ML5	13	3.69	1.50	1.64	0.55	0.0
ML6	13	2.28	0.96	0.95	0.37	0.0
ML7	10	1.82	0.88	0.52	0.42	0.0
ML8	11	2.63	1.02	0.75	0.86	0.0
Average		3.42	1.53	1.15	0.74	0.0

in 7/2016

Investigation location	No. of species	Caculate average density of phytoplankton (x 10^6 cell/m^3)				
		Total	Bacillariophyta	Cyanophyta	Chlorophyta	Euglenophyta
ML1	13	2.98	2.12	0.16	0.5	0.2
ML2	15	4.72	1.48	1.86	1.38	0
ML3	14	4.72	2.12	1.75	0.85	0
ML4	13	4.82	2.08	1.52	1.02	0.2
ML5	12	3.21	1.02	1.64	0.55	0
ML6	13	2.84	1.52	0.95	0.37	0

ML7	11	2.36	0.88	0.52	0.96	0
ML8	11	3.57	1.96	0.75	0.86	0
Average		3.65	1.64	1.14	0.81	0.05

In 3/2017

Investigation location	**No. of species**	**Caculate average density of phytoplankton (x 10^6 cell/m^3)**				
		Total	**Bacillariophyta**	**Cyanophyta**	**Chlorophyta**	**Euglenophyta**
ML1	15	3.95	3.01	0.34	0.47	0.13
ML2	14	5.03	2.16	1.67	1.15	0.05
ML3	15	4.66	2.34	1.58	0.74	0
ML4	16	5.68	2.65	1.69	1.16	0.18
ML5	13	5.39	3.11	1.71	0.57	0
ML6	15	3.45	2.14	0.88	0.43	0
ML7	12	3.62	1.92	0.91	0.79	0
ML8	13	3.76	2.23	0.82	0.65	0.06
Average		4.44	2.45	1.2	0.75	0.05

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.
Source for 2016: Scoping report, My Ly HPP, 2016, PECC1.

c. Zooplankton

Results gained from analyzing samples taken from 8 location in the investigated site have helped identifying 24 species of zooplankton in groups of *Copepoda* (6 species, taking 25.0%), *Cladocera*(12 species; 50.0%), *Rotatoria* (3 species; 12,5%), *insect larva* 3 species 12.5%). Found species are common species, widely distributed and typically for flowingwater environment where nutrient content is low. Popular species in such type of water bodies include *Diplois daviesiae* (Rotatoria)*, Macrothrix spp., Ilyocryptus halyi* (Cladocera)*, Biapertura, Paracyclops, Paracyclops fimbriatus, Ectocyclops phaleratus* (Copepoda). Besides are groups of species widely distributed, adapting both flow water condition and stand-still watershed where organic matter is rich such as *Moina dubia, Moinodaphnia macleayi, Bosmina longirostris* (Cladocera), *Thermocyclops hyalinus* (Copepoda).....

Table 33: List of species of zooplankton

No.	**Phylum**	**No. of species 2012**[17]	**No. of species 2016-2017**[18]	**Percentage of total number of species 2016-2017**
1	*Copepoda*	6	6	25 %
2	*Cladocera*	11	12	50 %
3	*Rotatoria*	3	3	12.5 %
4	*Insect larva*	2	3	12.5 %
	Total	**22**	**24**	**100**

Source for 2012: Environmental Impact Assessment report, My Ly HPP, 2012, PECI.
Source for 2016: Scoping report, My Ly HPP, 2016, PECC1.

[17] *My Ly Environmental Impact Assessment report, 2012, PECI*
[18] *The results of survey in 2016: Scoping report, 2016, PECC1*

Density of zooplankton in investigated locations on Ca (Nam Non) river is low, varying between 164 - 468 ind./m^3 (resulted gained in 2012 site survey) and between 204 – 443 individual/m^3 (resulted gained in 2016 site survey). Composition of predominant species, density of dominant species in communities is not clearly shown. Some species adapting to flowing water environment appear mainly in quantitative sample but of small quantity. Within component it is mainly small crustaceans (Cladocera, Copepoda), groups of species eat filter (Rotatoria) usually have very low density. Typically for water bodies in upstream of mountainous rivers, in investigated samples, it has shown quite high density of water insect group in orders of Diptera, Odonata and Ephemeroptera (varying between 32-135 individual/m^3). Density of zooplankton tends to increase following the flow direction, but difference between locations is not much. Features on number and variation in zooplankton reflect characteristics of flowing water environment in the mountain river waters which are generally lower in nutrient and high in flow velocity.

Table 34: Density of zooplankton at investigated locations on Ca (Nam Non)river

in 09/2012

Name	Density (ind./m^3)								
	ML1	**ML2**	**ML3**	**ML4**	**ML5**	**ML6**	**ML7**	**ML8**	**Average**
No. of identified species	14	9	11	12	11	10	11	12	
Copepoda	170	128	252	98	122	56	45	76	118
Cladocera	126	115	61	75	66	112	85	82	90
Rotatoria	21	16	20	0	12	14	0	0	10
Others	32	40	135	54	47	76	34	44	58
Total	**349**	**299**	**468**	**227**	**247**	**258**	**164**	**212**	**278**

in 07/2016

Name	Density (individual/m^3)								
	ML1		**ML3**	**ML4**	**ML5**	**ML6**	**ML7**	**ML8**	**Average**
No. of identified species	13	129	12	12	12	11	12	12	
Copepoda	158	101	205	131	140	69	80	72	129
Cladocera	122	18	142	98	54	108	74	75	101
Rotatoria	30	42	25	15	16	20	12	5	18
Others	25	**289**	71	46	38	63	38	26	42
Total	**335**	**358**	**443**	**290**	**248**	**260**	**204**	**178**	**289**

In 3/2017

Name	Density (individual/m^3)								Average
	ML1	**ML2**	**ML3**	**ML4**	**ML5**	**ML6**	**ML7**	**ML8**	
No. of identified species	14	12	13	13	14	10	11	12	
Copepoda	268	287	235	202	162	81	90	83	176
Cladocera	134	121	142	114	66	113	68	62	103
Rotatoria	45	34	25	21	20	35	11	9	25
Others	57	18	71	37	26	59	24	19	39
Total	**518**	**472**	**486**	**387**	**288**	**298**	**204**	**185**	**355**

d. Zoobenthos

Results gained from site survey at 8 locations on rivers, streams, ponds within My Ly HPP area in Ky Son district, Nghe An province have helped identifying 19 species of benthos in groups *Bivalvia* (2 species, taking 10.5%), *Gastropoda* (10 species; 52.6%), *Crustacea* (4 species; 21.1%) and *Insecta* larva (3 species; 15.8%). These identified species must be less than the actual species available in the region, however it reflects in some extent characteristic of aquatic lives in mountainous watershed. In species composition we found families of Pachychilidae, Thiaridae (*Brotia siamensis*, *Tarebia granifera*, *Thiara scabra*, etc.) which often distribute predominately in mountainous areas and appear in most of investigated locations. The species in families of Corbiculidae, Unionidae often seen in river and with very few species. The species of insect larvae quite diversify in the survey, though have not mentioned to species typically characterized for water bodies in mountainous area. The identified species are widely distributed, some of them typically characterized for mountainous regions, in flowing water bodies where organic nutrient content is low.

Density of zoo benthos varies between 49 - 102 individual/m^2 (resulted gained in 2012 site survey) and between 57 – 95 individual/m^2 (resulted gained in 2016 site survey), among composition, predominating is snail (Gastropoda) and group of insect larva (Insecta). Insect larva in families Chironomidae and Baetidae is normally of the highest density in most of investigated locations, then to snail groups popular in mountainous water bodies, which lives sticking on rock or aquatic vegetation, in families Pachychilidae, Bithyniidae, Thiaridae. However, most of zoo benthos species are identified belong in to small size species therefore biomass will not high. Benefits from zoo benthos generally unremarkable, some species can be used as food for local resident such as crabs, mussel but not many in quantity and very few exploited.

Table 35: Density of zoobenthos at investigated locations on Ca (Nam Non)river

in 09/2012

No.	Name	Density of zoo benthos (individual/m^2)								
		ML1	ML2	ML3	ML4	ML5	ML6	ML7	ML8	Average
1	Bivalvia	11	4	0	8	0	0	0	0	3
2	Gastropoda	15	12	8	18	21	26	14	16	16
3	Crustacea	6	1	12	3	7	10	15	4	7
4	Insecta	47	32	32	28	74	53	28	32	41
	Total	**79**	**49**	**52**	**57**	**102**	**89**	**57**	**52**	**67**

in 07/2016

No.	Name	Density of zoo benthos (individual/m^2)								
		ML1	ML2	ML3	ML4	ML5	ML6	ML7	ML8	Average
1	Bivalvia	9	6	2	7	0	0	1	0	3
2	Gastropoda	6	10	11	15	24	31	20	18	17
3	Crustacea	8	5	6	2	4	5	8	6	6
4	Insecta	52	48	39	33	67	62	35	41	47
	Total	**75**	**69**	**58**	**57**	**95**	**98**	**64**	**65**	**73**

In 3/2017

No.	Name	Density of zoo benthos (individual/m^2)								
		ML1	ML2	ML3	ML4	ML5	ML6	ML7	ML8	Average
1	Bivalvia	5	4	0	4	0	0	3	0	2
2	Gastropoda	16	10	18	21	18	42	22	13	20

3	Crustacea	12	5	9	13	10	11	16	12	11
4	Insecta	18	48	25	24	39	53	27	52	36
	Total	**51**	**67**	**52**	**62**	**67**	**106**	**68**	**77**	**67**

2.6.7. Rare wildlife

a.Mammal

Among 45 mammal species recorded in the region, there are 4 rare species (taking 8.9% total number of mammal species in the surveyed area). Of which, there is one species recorded in Red List of IUCN (2015) as VU; 3 species listed in Red Data Book of Vietnam (2007) including 1 VU species and 2 LR species and 4 species listed in Decree 32/2006/NĐ-CP including 2 species in category IB and 2 species in category IIB.

Table 36: List of rare mammal species in My Ly HPP basin

No.	Vietnamese name	Scientific name	Data sources	Red Data Book of Vietnam 2007	IUCN 2015	Decree 32/2006 NĐ-CP
1	Cu li lớn	Nycticebus bengalensis	i	VU	VU	IB
2	Khỉ vàng	Macaca mulatta	i	LR		IIB
3	Khỉ đuôi dài	Macaca fascicularis	i	LR		IIB
4	Mèo rừng	Felis bengalensis	i			IB

Notes:
(o) = obseved; (i)-interviewed
IUCN (2016) (The IUCN Red List of Threatened Species (2016): (VU) = Vulnerable;
VNRB (2007) (Vietnam Red Data Book, 2007): (VU) = Vulnerable;(LR) = Lower Risk;

Decree 32/2006/ND-CP(The Governmental Decree No. 32/2006/ND-CP (2006): (IB) = Prohibit of collection and use for commercial purposes;(IIB) = Restricting exploitation and use for commercial purposes.

b. Bird

There are 3 rare bird species (taking 2.7% total number of species) identified in surveyed area, including species listed in Decree 32/2006/NĐ-CP(2006) category IIB.

Table 37: List of rare bird species in My Ly HPP basin

No.	Vietnamese name	Scientific name	Data sources	Red Data Book of Vietnam 2007	IUCN 2015	Decree 32/2006 NĐ-CP
1	Cắt bụng hung	Falco severus	i			IIB
2	Vẹt ngực đỏ	Psittacula alexandri	i			IIB
3	Chích chòe lửa	Copsychus malabaricus	i			IIB

Notes:
(o) = obseved; (i)-interviewed

c. Reptile

Among 24 identified reptile species, there are 8 rare species taking 33.33% total number of reptile species in the investigated region. There are 8 species listed in Red Data Book of Vietnam (2007), including 6 EN species and 2 VU species; and 6 species listed in Decree 328/2006/NĐ-CP (2006) including 1 species of category IB, 5 species of categoryIIB.

Table 38: List of rare reptile species in My Ly HPP basin

No.	Vietnamese name	Scientific name	Data sources	Red Data Book of Vietnam 2007	IUCN 2016	Decree 32/2006 NĐ-CP
1	Tắc kè	*Gekko gecko*	O; i	VU		
2	Rồng đất	*Physignatus coccincinus*	O; i	VU		
3	Kỳ đà vân	*Varanus nebulosus*	I	EN		IIB
4	Kỳ đà hoa	*Varanus sanvator*	I	EN		IIB
5	Rắn ráo thường	*Ptyas korros*	o; i	EN		IIB
6	Rắn ráo trâu	*Ptyas mucosus*	I	EN		IB
7	Rắn cạp nong	*Bungarus fasciatus*	I	EN		IIB
8	Rắn hổ mang	*Naja naja*	I	EN		IIB

Notes:
(o) = obseved; (i)-interviewed

d. Amphibian

This is no species listed in Red Data Book of Vietnam 2007 and Red List of IUCN 2016 or Decree 32/2006 of the Government.

e. Insect

Though species quantity is quite lot but in the region there are no species recorded in Vietnam Red Book 2007, Red list IUCN 2011 and Decree 32/2006 by the Government

f. Fish

Table 39: List of rare fish species in My Ly HPP basin (2012-2017)

No.	Vietnamese name	Scientific name	Data sources	Red Data Book of Vietnam 2007	IUCN 2016
1	Cá Chiên	*Bagarius rutilus*	O, p	VU	DD
2	Cá Trốc	*Acrossocheilus annamensis*	i	VU	
3	Cá Rầm xanh	*Bangana lemassoni*	O, p	VU	DD
4	Cá Lăng	*Hemibagrus guttatus*	O, p	VU	DD
5	Cá Lệch, cá Chình hoa	*Anguilla marmorata*	i	VU	LC

Notes:
(O) = obseved; (i)-interviewed; (p) = Photo specimens in the field

VU: Vulnerable; DD: Data deficient; LC: Least concern

	
Hemibagrus guttatus	*Bagarius rutilus*
	
Bagarius rutilus	*Bangana lemassoni*

Among 76 indentified fish species, there are 5 rare species listed in Red Data Book of Vietnam 2007 with 5 species of which are VU species.

On 13/9/2016, Mr.Vi Van Toan, resident of Hoa Ly village, My Ly commune (Ky Son district, Nghe An province) caught a fish *Anguilla marmorata* of 16kg from Ca (Nam Non) river

(source: www.http://hoahau.tienphong.vn/xa-hoi/nong-dan-nghe-an-bat-duoc-ca-chinh-khung-1049798.tpo)

2.6.8. Distribution of wildlife by main habitats

These animals, recorded through interviews, have not obseved.

a. Mixed evergreen rain forest after exploitation

Mammals: Main species in broadleaf forest habitat are: yellow monkey *Macaca mulatta*, wild cat *Felis bengalensis*, wild pig *Sus scrofa*, muntjac *Muntiacus muntjak*, big bamboo rat *Bandicota indica*.

Bird: this is habitat for species of families of drongo, crow, fly eating bird, honey eating bird, Chinese laughing-thrush, cock, turtle bird etc…

Reptile, amphibian: Typical species of this habitat are: *Physignathus cocincinus*, *Varanus nebulosus*, cobra *Naja naja*, *Trimeresurus albalabris*, species of family tortoise*Emydidae*, gecko*Gekko gecko* live in this habitat.

b. Secondary forest on abandoned cultivated land

Mammal: this habitat is where concentrating lots of small animal of orders of rodent, bat....

Bird: this type of habitat concentrates quite lots species, is living space and food finding space of lots wild birds....

Reptile, amphibian: mainly are species of *Physignathus cocincinus*, *Ptyas mucosus*, *Bungarus fasciatus*, *Bungarus candidus*, (*Naja naja*), etc...

c. Habitat along river, stream, swidden plot and population area

These habitats locate along river, stream in communes, slash and burn land areas, population area all along road alignment.

Animal: Species typically for this habitat are: black tail rat *Crocidura attennata*, mosquito eat bat *Java Pipistrellus javanicus*, mice *Rattus flavipectus*, rat *R. norvegicus*, etc...

Bird: representatives of this habitat are species such as milky stork *Egretta garzetta*, fly stork *Bubulcus ibis*, Milky necked stork *Amaurornis phoenicurus*, big kingfisher *Megaceryle lugubris*, small kingfisher *Ceryle rudis*, wolly necked stork *Halcyon chloris*, *Alcedo atthis*, etc...

Reptile, amphibian: typically for this habitat are species of: gecko, water snake and most of species belongs to family of amphibian (Ranidae), family of tree frog (Rhacophoridae), family of small frog (Microhylidae), etc...

Insect: Most species of butterfly are distributed in this habitat.

2.6.9. Wildlife exploitation situation

Local resident normally exploits wildlife for various purposes. Value in using of wildlife mainly are[19],[20].

Statistical data shows that 38 species are used as food including 10 animal species (mainly is civet, squirrel, wild pig); 12 bird species (mainly is doves family *Columbidae*, red-whiskered bulbul *Pycnonotus jocosus*, sparrow order *passeriformes*); 10 species of reptile (ground dragon *Physignathus cocincinus*, spotted gecko *Varanus salvator*, species of snake) and 6 species amphibian (field frog *Hoplobatrachus chinensis*, big frog *Sylvirana guentheri*, *Limnonectes kuhlii*, stream frog *Sylvirana nigrovittata*, tree frog *Rhacophoridae*).

[19]*Policy brief: on controlling wildlife trade and consumption in Vietnam. The Asian Program actions against trafficking in endangered species. Biodiversity conservation Agency.*

[20]*Đặng Huy Huỳnh, Cao Văn Sung, Lê Xuân Cảnh, Phạm Trọng Ánh, Nguyễn Xuân Đặng, Hoàng Minh Khiên, Nguyễn Minh Tâm, 2008. Fauna of Vietnam, volume 25. Science and Technique Publishing House, Ha Noi.*

There are 25 species used as drug including 10 mammals species (mainly are loris *Loricidae*, monkey *Cercopithecidae*, species of cat family *Felidae*..), 4 bird species (group of boucal *Centropus sinensis*, bird of dove family *Columbidae*,..), 10 reptile species (gecko *Gekko gecko*, species of varan *Varanidae*, species of snake *Serpentes*, species of tortoise *Testudines*,...) and 1 amphibian species (home toad *Duttaphrynus melanostictus*).

There are 45 species of animal exploited for commercial purposes including 20 animal species (species of loris *Loricidae*, species of monkey *Cercopithecidae*, species of civet *Viverridae*, species of squirrel *Sciuridae*); 13 species of birds (blue dove, spotted dove, parrot *Psittacidae*, dollarbird, mynah*Timaliidae*, Chinese laughing-thrush *Sturnidae*); 12 species of reptile (gecko *Gekko gecko*, ground dragon *Physignathus cocincinus*, species of varan *Varanidae*, species of snake *Serpentes*, species of tortoise *Testudines*). Those species are exploited, trading between regions all over the country, even to abroad. Some species with food value are sold to restaurant to be special dishes.

Besides, there are some species exploited as fur in household or their remains are decoration.

2.6.10. Characteristics of fauna in reservoir area

Site survey shows that: the reservoir area comprises mainly poor forest, bamboo forest, scrub land and grass land... Therefore wildlife is not so abundant as in areas where forest is still in good condition. Species in reservoir area is missing with large size and rare species and instead seen with small size animal of family civet *Viverridae*, weasel *Mustelidae*, some species of tree squirrel *Sciuridae*, rat family *Muridae*, bamboo rat *Rhizomyidae*; bird comprises of wild chicken *Gallus gallus*, some species of woodpecker family *Piciformes*, *Coraciidae*, kingfisher family *Alcedinidae*, boucal, some species of cock, drongo, *Muscicapidae* etc; reptile and amphibian have some species of agama *Agamidae*, ground dragon *Physignathus cocincinus*, gecko *Gekko gecko*, varan *Varanidae*, snake *Coelognathus radiatus*, cobra *Elapidae*, species of frog, etc... No special species found in reservoir area.

2.7. Natural reserves, national forest, protective forest

Biosphere Reserve of Western Nghe An (http://sinhquyennghean.vn/?n=11/da-dang-sinh-hoc); Environmental Impact Assessment for Ban Ve hydropower project on Ca river, Nghe An province, 2006.

Table 40: List of species in national reserves andpark surrounding My Ly HPP

Project / reserve	Distance from the Planned My Ly HPP	Flora	Mammal	Bird	Reptile and amphibian	Insect	Fish
My Ly Dam	0	447	45	111	43	203	76
Ban Ve Dam	60	686	63	176	51	NA	105
Pu Huong Natural reserve	50	665	291	265	NA (*)	NA	NA
Pu Hoat Natural reserve	40			142	NA	NA	NA
Pu Mat national park	60	2,494	132	361	86	1084	119

(*) NA: Not Available

In project area and distance 5km from the project area, there is no special forest such as National Park, Natural reserve.

In Vietnam, Pu Mat, Pu Hoat and Pu Huong Natural Reserves are all located in 30-60km in distance to the project area (Figure 8).

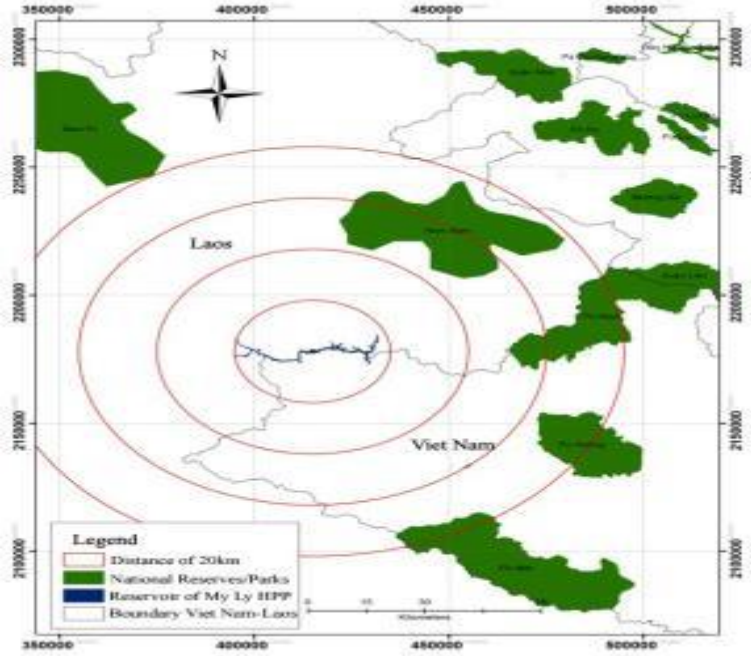


Figure 8: My Ly HPP and National Reserves/ Park

CHAPTER 3. IMPACTS BY HYDROPOWER PROJECT TO ECOLOGY

To assess possible and potential impacts caused by construction and development of My Ly hydropower project to natural environment, the report divides potential impacted area in to two sub-regions, as below:

The upper including area to construct main dam, where reservoir will be formed, along reservoir area and the basin upstream of the reservoir down to My Ly damsite, borrow areas, appurtenant work area, access road system for project construction, etc.

The lower from the damsite to downstream of damsite, including area of penstock, powerhouse, switchyard, tailrace channel and transmission line alignment, etc, together with other project components such as appurtenant work, worker camp, access road for construction, access road to powerhouse and downstream of the dam.

3.1. Sources of impacts

My Ly HPP is proposed to be constructed in 5 year, including oneyear forpreparation. The project construction will happen on an area of some 2052.75 ha in My Ly, Keng Du communes of Ky Son district, Nghe An province, including reservoir area, buffer area, headwork component, appurtenant work, access road, quarry etc.

Detail see in following table:

Table 41: Total occupied area of My Ly HPP

No.	Affected areas	Total occupied area (ha)
A	**Permanent affected area**	**1989.14**
1	Submerged area	1247.30
2	Buffer area	707.69
3	Main work area	34.15
B	**Temporary affected area**	**52.61**
C	**Quarry area**	**11.00**
	In which: Crushing facilitys (Items 1 and 2)	2.76
	Total	**2052.75**

3.1.1. Waste related impacts

a. During preparation period

Cutting, leveling ground to prepare layout in project construction site, appurtenant work, worker camp, stockpile, disposal site.

Constructs works such as access road, power supply system, water supply system, worker camp, office for project management board, worker camp for contractor, appurtenant work serving construction.

b. During construction period

Operation of vehicles serving hauling and transportation and construction of the project.

Constructs project components such as dam, powerhouse, waterway.

Operation of production bases, mechanical workshop where repairing, maintaining vehicles.

Operation of workers on site.

Wastes resulted and generated during construction period, including:

+ Solid wastes: mainly are rock, soil, wastes from construction activities such as cement bag, abundant material, wood boxes containing equipment and domestic wastes.

+ Liquid wastes: oil, lubrication, wasted water from construction activities, from domestic activities.

+ Exhausted gas: mainly are dust and some poison gas resulted from exploitation and hauling of construction material, equipment to the project.

c. During operation period

Operation of powerhouse will almost cause no wastes, except a certain volume of petroleum which could possibly leakage to soil and water environment and thus causing pollution during operation. Living activities by Project Management Board and workers at powerhouse will generate a volume of wastes and wasted water from domestic activities. However, this volume of waste is forecasted not so much.

3.1.2. Non-waste related impacts

a. During construction period

Compensation, land acquisition for access road and project construction site.

Constructs access road, appurtenant works.

Constructs dam and powerhouse.

Fills reservoir.

Concentrates workers, labor force and population.

b. During operation period

Forms a reservoir covering an area of some1247.3 ha.

Operation regime of reservoir.

Living activities of staff, workers at the power plant.

3.1.3. Objective of impacts

Impacts to geology, geomorphology and foundation.

Impacts to ambient air environment.

Impacts to water quality.

Impacts to hydrological regime.

Impacts to land using pattern.

Impacts to ecology (fauna, flora, aquatic).

3.2 . Impacts to ecology during construction period

The section should have sections like: type of expected impacts (positive and negative)

Impact level: low, medium or low

Rational for the impact: the reason

Key mitigation: if any or not, explain. Many impcts are permanent even on temporary areas (like for vegetation and fauna)

3.2.1. Impact to flora and vegetation during construction period

Negative impacts to flora, botanical resources during construction period of My Ly HPP can happen, as following describes:

Loosing a vegetation area in reservoir area: when reservoir is filling, it will cause submergence to some of 956.3 ha poor forestry land area in My Ly, Keng Du communes of Ky Son district, Nghe An province and a limited area of agricultural and residential land.

Submergence to a limited cultivated land and forestry land as mentioned above is negative impacts to productive activities of local resident as well as to ecology in the region. However, this impact is unremarkable, thanks to following reasons:

There is some of 5% in total of submerged cultivated land is slash and burn land area and one crop paddy rice area where productivity is not so high. Moreover, this land area will be reasonably compensated in resettlement site so as to ensure livelihood and living standard of Project Affected People (PAP) will be better than before.

There are up to 90% of submerged forestry land is poor forest of small storage. Submergence to such forestry land area will cause not much impact to biodiversity in the region.

Some individual rare plant species to be submerged are all those of widely distributed characteristics, existed in many un-submerged areas. In future these plants will still have conditions to grow, no gene source will be lost.

Within submergence area, there is no natural ecology of preservative value or protective value (as special forest or natural reserve area, etc).

*Loosing some vegetation area for construction of access road and appurtenant works:*to serve the construction, appurtenant work, access road shall be constructed first. By estimation, this appurtenant work will occupy an area less than 10 ha. However, because the project site is quite close to existing access road, natural land area required for access road connecting the project site will be unremarkable. This area is mainly covered by secondary forest, agriculture and scrub land, therefore this impact is assessed as unremarkable.

Effects forestry resources: particularly during construction of the dam and other components, there will be a large number (some of 1000-1500) of workers concentrating at the site. It will be a great challenge to meet demands on accommodation, food and other activities for this number of people in the local. Only firewood has been a tough issue already. By estimation, in average each individual will consume some of $0.5m^3$ to $0.7m^3$firewood in a year. That means every year the construction site must explore at least $10,000m^3$firewood for every day demand. This will be a great threat to forest and other natural vegetation in the region. Extent of impact will depend largely on awareness of worker as well as immigrants. Biodiversity in the region will therefore not be affected largely.

Besides, fire can happen too if happening petroleum fire, explosion or careless in domestic activities by workers.

In shorts, during land acquisition process, construction of project component, there will be negative impacts to environment in general and to biodiversity in particular as mentioned above. Buts they are instantaneous impacts, in small extent and unavoidable in any hydropower project development. Extent of impacts will be within the construction site and some of surrounding forest. After construction period of 4-5 years a new ecology will go in stable. Negative impacts will be mitigated if mitigation measures proposed in next sections are properly applied and implemented.

3.2.2. Impact to fauna and wildlife during construction period

a. Impacts to habitats, distribution of wildlife

Even if the hydropower is not constructed, fauna and wildlife in the region still subject to human impact which are, losing habitat due to cultivation activities which approaches to forest land, construction of rural access road, forest fire, exploitation of forest resource (firewood, timber, non-timber products) and particularly wildlife hunting. All of these make a great contribution to reduced number of wildlife in the region.

When hydropower project is construction, landscape will be altered not only on the reservoir basin but also in downstream of powerhouse in many aspects: climate, hydrology, fauna, flora as well as socio-economic activities in the region, including the fauna (mammal, bird, reptile, amphibian) in project construction site both in the basin and downstream of powerhouse.

However the dam is construct at what elevation, the reservoir will anyway causes submergence to a certain land area where forest is existed and therefore narrowing habitat of wildlife. Interrupted habitat, some forest land on mountain, in reservoir area will be isolated or fully submerged. Due to the reservoir formation, population in reservoir area must move higher to resettle. New population area will cause demands on cultivate land, land for housing, timber for construction and every day duel. Besides, it shall take in to consideration a number of workers, construction vehicles and machine which will cause noise pollution. All of such will impact to wildlife in the region. Many species will displace far from the project site but in different directions.

Large size animal whose living area is large, moving fast, sensitive to disturbance (noises, population), distributed nearby the project such as bear, panther, bull, monkey, etc… will displace to further calm forest in high mountain to live. In the region there are Pu Mat National Park, Pu Huong, Pu Hoat Natural Reserves and some protective watershed forests which are in good conditions and good preserved and will be new habitats of those species. As said, in reservoir area, large size animal is not many left therefore this impact is assessed as negligible.

Species live near population area such as deer, muntjac, wild boar, etc will move far from project site, normally to forest in valley or low mountain, but then back to forest, slash and burn area close to project site looking for food. Small size wildlife, bird, reptile will only move out of submergence area or spreading far from project site for new habitat. If they can not make it when the reservoir is filling, some individual of rat and species living in cave, hole in project site could be death. Species living on water such as otter, water bird (heron families, kingfisher family, duck family), species of varan, water snake and amphibian will only move to coastal area to live on. Because wildlife will not move so far from project site, it will be cause illegal hunting by local resident living nearby. But when the powerhouse is under operation, when noises caused by construction activities are reduced, wildlife will gradually get back to live in the region.

Though My Ly HPP is not located in any national park or natural preserve but pressure from using of natural reserves during construction period, if not well and properly managed will cause impact to wildlife in surrounding area. During construction period, thousand of worker will focus at this location, demand on food, drug will remarkably increase. Local resident will have market for wildlife and their products (restaurants, rare drug from wildlife such as bear gall, monkey bone glue, gecko and fur). To satisfy this market, there will appear hunter going to forest to hunt, catch illegally wildlife, bird and other wildlife if possible. Hunting and trapping wildlife may be popular in the region, particularly where bordering with protective watershed forest of Ky Son (in My Ly commune, Ky Son district). When the source in surrounding area is limited, they will enter and approach to natural reserves, national park where rare species of high gene preservation value are living.

b. Impact to food finding and resting

Noises will cause changes and reaction of wildlife, especially bird and animal. Intensive acting habit of animal is finding food, which normally happens at night, between 19:00 in the evening to the next 6:00. From 10:00 to 16:00, animal normally rests and less activities. The busiest times for bird species to find food are in two intervals: early morning (5:00 to 9:00) and evening (16:00 to 18:00). Resting time of bird, besides night time is also mid day time (11:00 to 15:00).

Along rivers and streams there are sand lanes or gravel areas where some small size wildlife goes to find food, hunting in night time. Therefore, during food finding time as biological habit, it means in night time, noises caused by construction activities near their places of food finding will cause panic, scare them away. In contrary, in day time animal usually finds deep forest, far from where human normally passing such as access road, population for resting. At construction site, activities will be done mainly in day time, except when schedule requires high intensity then will be done also in night time.Therefore construction activities though affecting to food finding and resting activities of wildlife in the region but in unremarkable extent.

3.2.3. Impact to aquatic and fishery during construction period

During construction period, aquatic and fishery will be affected as below:

Due to a retaining dam stopping water, drainage system serving construction of technical infrastructures, habitat of fish species as well as other aquatic life will be changed and altered. Interruption of the flow will create barrier to fish migration. Altered habitat will make it hard to small size fishes to reproduce and therefore resulting in quantity reduction. Some species of stream fish, when water is drained up, they will focus living in plashes and caves. Some species can not get up with changes will die.

Besides, during preparation and construction periods of My Ly HPP, and these periods may as long as 5-6 years, there will be continuously a certain volume of oil, lubrication from means of transport, fuel from machine, cement, etc…discharged in to water environment. All of these will cause impacts to aquatic system in the future reservoir area and downstream area.

Turbidity in river will be increased thus reducing light in various water layers and therefore affecting to development of plants (of photosynthetic ability) such as phytoplankton, periphyton. This will result in possibility of reducing primary productivity of the watershed. In the watershed, plant is the first and important in the natural food chain of material and energy alternation in the ecology. When primary productivity of watershed is reduces, secondary productivity including eating creatures such as phytoplankton, zooplankton, zoobenthos and fish eating vegetation will be reduced since food source is lost. Species of meat eating fish will be reduced since lower graded animal is reduced already. Species of fish preferring clean water habitat and oxygen rich habitat will be reduced too and could disappear. Instead will be fish species of high bearing ability, widely adaption, livable in pollution habitat such as zebra tilapia, black tilapia, anabas, catfish, etc…

Increases of soil, rock volume from construction could lead to increasing of nutrient in soil adding to the watershed. This nutrient sources is mineralized and could be adding to water in downstream of the project.

Volume of oil, lubrication and other wastes from project will poison sources to water environment, affecting to aquatic communities: resulting in reduction of species component and also number of individual. Generally, during this phase the aquatic system in the watershed will be altered both in reducing of species component and number of individual. Biodiversity will be less, fish species of migration habit along river and oxygen loving fish species, clean habitat loving fish species will be gradually replaced by small size fish species which can bear and deal with alternative and polluted environment.

3.3.Impact to ecology during operation period

3.3.1. Impact to flora and vegetation during operation period

It can be said straight away that, when the project is constructed and under operation, My Ly will cause negligible negative impacts to ecology in the region and its impacts to biodiversity will be mainly positive impacts.

One positive impact which is distinguishly seen after formation of reservoir is local climate which is improved, underground water table will be raised up, air humidity and soil humidity will be also improved. These will be positive impacts to biodiversity. Resettlement of plant will be much easier, their growing and development will be more favorable and if it is properly utilized, these will be good conditions for covering bare hill, enhancing coverage of forest vegetation along reservoir and in the catchment.

In downstream of My Ly dam, besides some forest areas along river, the remaining is cultivate land, mainly is corn, potato, cassava, paddy rice. When the project is under operation, there will be an additional water sources satisfying irrigation, domestic water demands in downstream. This is a positive impact to ecology in the region.

3.3.2. Impact to wildlife and fauna

When the project is completed, the reservoir is impounded, climate in the region will be gentler, and to ensure water resources inflowing to the reservoir, forest and watershed forest will be paid with more attention. This will be helpful to fauna here to maintain and growing. Such as:

Due to existence of hydropower plant, population distribution in the region will be changed. Exchanges between regions will be more and more increasing. Thanks to regulation of water in reservoir area as well as in downstream, agriculture will be more developed than before, this will of course result in appearance of some species as well as number of individual, alternation on distribution of species preferring to live closely to human, seed eating species such as mouse *Rattus flavipectus*, rat *Chiromyscus chiropus*, sparrow *Passer montanus*, home toad *Duttaphrynus melanostictus*, etc…

There is possibility to attract migration bird species: the reservoir in a large area will be a great factor to attract migration bird during winter time flying from the North looking for shelter in cold period.

Formation of reservoir will attract wildlife species in the basin. Some animal species will go on living in this new habitat. Wild pig, civet, wild dog and monkey species will consider this is their new habitat and food sources from water will be used more properly. Species of otter will feel comfortable in new habitat.

Upstream forest will be protected, reforestation will be performed and forest will be more and more developed. Under calm environment, it will be positive factor to attract species, both small and medium size wildlife, and bird to live here.

In short, construction of My Ly HPP will cause impacts to fauna in the region by affecting to habitat, and cause direct impacts to some species. However, during operation, the reservoir formation will cause positive impacts to some species living near water. Living standard of local resident will be surely enhanced and improved. This will be a permanent condition helping protection and development of fauna and wildlife in the region.

3.3.3. Impact to aquatic and fishery after project completion

The reservoir created by My Ly HPP is a small component covering an area of some 1247.3ha. After impoundment, the reservoir will change basically terrestrial ecology as well as various watersheds in submergence area. New reservoir ecology together with aquatic system typically for this watershed will be formed.

In first years after filling, aquatic system in My Ly reservoir is basically reservoir aquatic system. Plants, vegetation after submergence will be disintegrated in organic and nutrient making rich to food sources of aquatic life living in the reservoir, increasing primary reproduction, increasing development of zooplankton and therefore making rich food source to fish. Phytoplankton will develop fast, zoobenthos species will be less developed due to deep water and deposition causing damages to previous bed, creation of new bed. Species of fish preferring egg laying in rapid water environment, gravel bed shall have to displace to upstream of tributaries or be reduced in quantity.

Plant communities represent reservoir environment in Vietnam such as blue algae *Microcystis*, silica algae *Melosira,* in upstream is yellow algae *Dinobryon* spp. (phytoplankton), *Bosmina, Diaphanasoma* (Crustacean), *Mongolodiaptomus birulai, Vietodiaptomus hatinhensis, Allodiaptomus* spp*., Dentodiaptomus javanicus, Mesocyclops leukartii, Thermocyclops* spp. (Gastropoda) will appear in predominant density within phytoplankton biology in the reservoir. Density and biomass of phytoplankton, in first duration will be high (density of zooplankton) will reach to tens of thousand individual per /m^3, density of phytoplankton reaches to hundred of thousand to million tb/l), even happening phytoplankton blossom. Within the composition, yellow algae *Dinobryon* will develop. Characteristics, distribution, composition as well as quantity of phytoplankton in reservoir in general and in My Ly reservoir in particular relate to distribution characteristics of nutrient salt and some other environmental factors. Generally, quantitative and qualitative distribution of

phytoplankton tends to vary distinguishly by hydrological season. In case of a reservoir, density of phytoplankton in general will be much higher than that in stream, river bodies as at present. There will be forming a density gradient of phytoplankton along the reservoir. In dry season, density of phytoplankton is the least in upstream, the highest focuses in middle part near upstream, and getting lower in downstream. In flood season, density of phytoplankton is the least in upstream, getting higher to downstream and the highest is near damsite location. Besides the difference in distribution which is in surface area, phytoplankton has characteristics of distributing in quantity in vertical direction, the highest on surface layer, getting lower in deeper water layers.

Also during first time after impoundment, soft body species will reduce in number of species as well as in quantity due to unstable reservoir bed. However, shrimp of family *Atyidae* will develop in quite high quantity in areas along banks.

Vegetation eating fish species and organic mud eating fish species adapt with stand still water environment will develop, fish species adopts with flowing water environment will reduce both in number of species and quantity. Fishery on reservoir will be formed, during first period productivities of natural fish will be high, with lots of individual of larger size than present such as goby fish *Cyprinus rubrofuscua*, *Aristichthys nobilis*. In first years after impoundment, quantity of phytoplankton and organic matters in water is abundant, to be important food source to fish species. Fish species in stand still water environment will grow and strongly develop. Small fish community will be gradually replaced by large fish communities and less movement. Stable water level and higher water level as well as large water surface, the bed is getting to deposit mud and sediment from upstream, making it favorable for catfish and meat eating fish species to strongly develop. Large water surface area will also make it more difficult to fishing, this is great conditions for catfish species such as *Silurus asotus*, *Clarius fuscus,Hemibagrus guttatus*, *Bagarius rutilus*, *Cranoglanis henrici*and *Mylopharyngodon piceus*to develop and get to their larger size.

In watershed of My Ly HPP, it has recorded one fish species *Anguilla mamorata* to be the one migrating between river and the sea for breeding. So, *Anguilla mamorata* individual in upstream of the dam will be stopped to get to the sea for reproduction while young babies *Anguilla mamorata* individual are stopped in downstream of the dam, unable to get to the upstream to live and grow.

Water impoundment upstream of My Ly HPP will be chance and conditions to develop aquaculture and fishery. In our opinions, after the reservoir is filling, the water surface in reservoir shall be assigned to some enterprises to perform aquaculture farming and tourism services. Fish species grown in reservoir shall include of *Ctenopharyngodon idella*, *Mylopharyngodon piceus*, *Cirrhinus molitorella*, *Aristichthys nobilis*, *Cyprinus rubrofuscua*, *Hemibagrus guttatus*. Those are fish species well adopting to stand still water environment and rich in nutrient. They are also fish species grow fast, easy to catch. Besides, the hydropower plant shall allow some households or enterprise to do fish cage farming on reservoir. The hydropower plant shall also expand tourism service and fishing for entertainment.

Impact to aquatic life in downstream of the dam

+ Flood control in seasons will cause negative impacts to some aquatic species and wildlife living nearby the water environment. Flood intervals are considered as festival of aquatic communities and various wildlife communities, focusing on flooding delta along Ca (Nam Non) river. My Ly HPP will help reducing peak flood in downstream, it means it narrower the said flooding delta and therefore resulting in reduction of some species as well as number of individual, particularly species with habit of laying egg in flood season. In the same time wildlife living nearby water bodies will be subject to impacts due to a reduced food volume.

3.3.4. Forecast on reservoir ecology pattern and behavior

During using, most of reservoirs will pass 4 periods, including:

Disturbance period: this period happens right after reservoir formation, and might lasts in 10 years. This period has 2 succeed phases which are high nutrient phase and reduced nutrient phase.

Stable period: this is period follows the disturbance period.

Eutrophication: follows the stable period.

And swampy period: this is the final period of any reservoir, starting when sediment mud reaches to Minimum Operating Level.

Each periodhas typical characteristics in pattern, structure, composition and quantity of creatures, under direct impacts of water environment.

In the view of watershed nutrient, the nutrient volume supplies regularly to reservoir will be from two main sources, which are:

External nutrient source, this source comes from main inflow and from catchment area through erosion process.

Nutrient source created inside reservoir itself (internal source), due to disintegration process from bed sediment layer (grain nutrient in to dissolved nutrient).

So the external nutrient adding to reservoir will depends partially on erosion process, and on the other hand depends on soil type, mode of land using, extent of cultivation and type of vegetation covering the basin. Besides, it shall consider also possibility of industrialization and new population area in basin which are factors increasing nutrient to the reservoir too. Such things show that impacts by human in the basin will be the most important factor affecting to quality of reservoir ecology.

In short, after formation of My Ly reservoir, aquatic species structure and composition will change both in quantity and in quality, reflecting typical characteristics of aquatic communities in reservoir. Distribution in composition and density of phytoplankton shows differences between upstream and downstream areas of reservoir, between surface and bed layers. In first years after impoundment, density of aquatic biomass in general and phytoplankton in particular will develop strongly. It can forecast that after the reservoir in upstream is formed, there will be great possibility that reservoir in downstream will be richer in nutrient with higher density, biomass of aquatic comparing to upstream cascade. The formation of reservoir will be great and favorable conditions for fishery to develop on reservoir.

The Ban Ve Hydropower Dam Hydropower are located downstream of the My Ly Hydroelectricity so migratory species such as Anguilla mamonata found in the My Ly area are remnants on the upstream of the Nam Nam River. When people catch this species, there are often individuals of a much larger size than other individuals. For example, the individual collected in the Ca (Nam Non) River weighs 16 kg (www.http://hoahau.tienphong.vn/xa-hoi/nong-dan-nghe-an-bat-duoc-ca-chinh-khung-1049798.tpo

MITIGATION MEASURES

Outline mitigation measures for forestry, wildlife and fish and fisheris:

I. Preventive measures

II. Compensatory measures

III. Corrective measures

- Limit grading and filling activities to what is necessary;

- Ensure to monitor all activities to prevent malfunction in the Dam area by workforce employed during construction phase;

- Adequate sanitation facilities will be provided to prevent pollution due to sewage and garbage;

The Project owner shall conduct the necessary training and provide instruction for works in Dam area to prevent such issue of contamination.

CONCLUSIONS

In regards to impacts caused by the project to environment, by means of assessment, following conclusions can be drawn:

Positive impacts

The project has high socio-economic benefit, to be additional power supply source to regional power system, in both countries and will help changing the situation in mountainous rural area of Ky Son district, Nghe An province. The project is supported by various authorities and local resident.

The project will help controlling flood, increasing water supply in dry season to cultivate area, supplying domestic water to population areas in downstream.

Forms up a quite comprehensive infrastructure system to local area living in project area.

By means of resettlement and compensation program during project implementation, local resident will have chance to contact with labor force, favorable trading with other developed regions in the provinces, improving spirit and cultural living life. Project affected people in particular and Ky Son district in general will be benefited from better social benefit, changing economic conditions, reducing number of poor households in the local.

The hydropower project after completion will create a good climate area, better landscape making it good for tourism to develop.

Formation of My Ly reservoir will help developing fishery, improving nutrient condition to local resident and raising up economic benefit in the local.

Negative impacts

The reservoir will cause submergence to some of 1247.3 ha which is mainly secondary poor forest, bamboo forest, scrub land area where timber resources is not high, impact to vegetation is unavoidable.

Causes pollution to ambient air, noise will be temporarily impact during construction period and can be mitigated. This impact is negligible.

Water pollution: after treating sources of wastes and performing methods of reservoir clearance, this impact will only effect during first period.

To the natural environment, during preparation period and construction period, the ecology will be hurt. But such impacts will be in short term (3- 5years of construction).

If mitigation measures are properly applied, negative impacts caused by the project development will be minimized. Long-term positive impacts by the project still be predominant.

RECOMMENDATIONS

Construction of My Ly HPP will cause unremarkable impacts to natural environment in the project area, however, there are some unavoidable impacts to ecology and the flow. To overcome and mitigate impacts listed above, the Project Owner must commit to apply fully and properly solutions on prevention, control, mitigation as mentioned in the above sections.

It is recommending local authority of Ky Son district, Nghe An province and environmental management agencies of various levels (Ministry of Natural Resources and Environment, Department of Natural Resources and Environment, Department of Forestry Guard, Department of Agriculture and Rural Development) shall co-operate to perform mitigation measures and environmental monitoring program in the project area.

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APPENDIXES

Table 1.Phytoplankton species at investigated locations on Ca (Nam Non) river

No.	Scientific name	2012	2016	2017
	Algae SILIC : BACILLARIOPHYTA			
	Centridae class			
	Discinales order			
	Coscinodiscaceae family			
1	*Melosira granulata* Ralfs	*X*	*X*	*X*
2	*M. granulata var angutissima*		*X*	*X*
	Pennatae class			
	Araphinales order			
	Fragilariaceae family			
3	*Synedra ulna* (Nitzsch) Ehr.	*X*	*X*	*X*
4	*Fragillaria virescens Ralfs.*	*X*	*X*	
	Naviculaceae family			
5	*Navicula placentula* Grun	*X*	*X*	*X*
6	*N. cuspidata*	*X*	*X*	*X*
7	*N. gastrum Husted*	*X*	*X*	*X*
8	*Gyrosigma attenuatum*	*X*	*X*	
9	*Cymbella turgida* Clever	*X*	*X*	
10	*C. ventricosa* Kutz	*X*	*X*	
11	*C. cistula*	*X*	*X*	
12	*Gomphonema sphaerophorum* Her.	*X*	*X*	*X*
	Nitzschiaceae family			
13	*Nitzschia recta* Hantsch	*X*	*X*	*X*
14	*Nitzschia philippinarum Ehr*	*X*	*X*	*X*
15	*Nitzschia nyanensis*	*X*	*X*	*X*
	Surirellaceae family			
16	*Surirella robusta* Ehr	*X*	*X*	
17	*S. robusta var. splendida*	*X*	*X*	
	Tabelariaceae family			
18	*Diatoma elongatum Ehr*	*X*	*X*	*X*
19	*Tabeleria fenestrata Kutz*	*X*	*X*	
	GREEN ALGAE: CHLOROPHYTA			
	Chlorophyceae Class			
	Chlorococcales Order			
	Oocystaceae family			
20	*Ankistrodesmus falcatus* Ralfs (Corda)	*X*	*X*	
	Scenedesmaceae family			

21	*Scenedesmus quadricauda var spinosus* Dedus	*X*	*X*	
22	*Scenedesmus ellipsoideus Chodat*		*X*	
23	*Crucigenia rectanguilaris*(Nag.) Gay	*X*	*X*	
	Order: Zygnematales			
	Zygnemataceae family			
24	*Spirogyra ionia*	*X*	*X*	*X*
25	*S. prolifica*	*X*	*X*	
26	*Zygnemopsis americana*Transeau	*X*	*X*	
	Desmidisceae family			
27	*Neitrium digitus* (Ehr.) Roy & Bis	*X*	*X*	
28	*Closterium moniliferum* (Bory) Ehr.	*X*	*X*	*X*
29	*Desmidium aptogomun* De Breb.	*X*	*X*	
30	*Micrasterias foliacea* Bail	*X*	*X*	
31	*Euastrum spinosum* Lenorm.	*X*	*X*	*X*
	BLE ALGAE : CYANOPHYTA			
	Class Chroococcaceae			
	Order Chroococcales			
	Family Oscillatoriaceae			
32	*Oscilllatoria limosa* Ag	*X*	*X*	*X*
33	*Lyngbya birgei*	*X*	*X*	*X*
	Family Anabaennaceae			
34	*Anabaena vigueri*	*X*	*X*	*X*
	Family Nostocaceae			
35	*Nostochopsis lobatus Wood*	*X*	*X*	*X*
	EYE ALGAE: EUGLENOPHYTA			
	Class Euglenophyceae			
	Order Euglenales			
	Family Euglenaceae			
36	*Euglena acus* Ehr	*X*	*X*	*X*
37	*Euglena granulata*	*X*	*X*	*X*
	Total	**35**	**37**	

Table 2.Zooplankton species at investigated locations on Ca (Nam Non) river

No.	Taxon name	2012	2016	2017
	ROTATORIA			
	1. Family Asplanchnidae			
1	*Asplanchna sieboldi* Laydig	*X*	*X*	*X*
	2. Family Mytilinidae			
2	*Mytilina ventralis* Ehrenberg	*X*	*X*	*X*
	3. Family Euchlanidae			
3	*Diplois daviesiae* Gosse	*X*	*X*	*X*
	CLADOCERA			
	4. Family Bosminidae			
4	*Bosmina longirostris* Muller	*X*	*X*	*X*
5	*Bosminopsis deitersi* Richard	*X*	*X*	*X*
	5. Family Sididae			
6	*Macrothrix triserialis* Brady	*X*	*X*	*X*
7	*Macrothrix spinosa* King	*X*	*X*	*X*
8	*Ilyocryptus halyi* Brady	*X*	*X*	*X*
	6. Family Daphniidae			
9	*Moina dubia* de Guerne et Richard	*X*	*X*	*X*
10	*Moinodaphnia macleayi*(King)	*X*	*X*	*X*
	7. Family Chydoridae			
11	*Chydorus sphaesicus sphaesicus*(Muller)	*X*	*X*	*X*
12	*Disparalona rostrata* Koch	*X*	*X*	*X*
13	*Alona eximia* Kiser		*X*	*X*
14	*A. rectangula* Sars	*X*	*X*	*X*
15	*Biapertura intermedia* Sars	*X*	*X*	*X*
	COPEPODA			
	SUB-ORDER CALANOIDA			
	SUB-ORDER CYCLOPOIDA			
	8. Family Cyclopidae			
16	*Eucyclop serrulatus* (Fischer)	*X*	*X*	*X*
17	*Eucyclop speratus* (Lilljeborg)	*X*	*X*	*X*
18	*Paracyclops fimbriatus* (Fischer)	*X*	*X*	*X*
19	*Ectocyclops phaleratus* Koch	*X*	*X*	*X*
20	*Thermocyclops hyalinus* (Rehberg)	*X*	*X*	*X*
	SUB-ORDER HARPACTICOIDA			

	9. Family Canthocamptidae			
21	*Elaphoidella coronata* (Sars)	*X*	*X*	
	INSECTA LARVA			
	10. Chironomidae			
22	*Chironomus* sp.	*X*	*X*	*X*
	11. Ephydridae			
23	*Brachydeutera* sp.		*X*	
	12. Coenagrionidae			
24	*Agriocnemis* sp.	*X*	*X*	*X*
	Total	**22**	**24**	**22**

Table 3. Zoobenthos species at investigated locations on Ca (Nam Non) river

No.	Species	2012	2016	2017
	I. MOLLUSCA			
	I.1. BIVALVIA			
	1. Corbiculidae			
1	*Corbicula messageri* Bavey et Dautzenberg	*X*	*X*	*X*
	2. Unionidae			
2	*Nodularia douglasiae crassidens* Hass	*X*	*X*	*X*
3	*Lanceolaria fruhstorferi* (Bavay & Dautzenberg, 1901)			*X*
4	*Pseudodon* sp.			*X*
	I.2. GASTROPODA			
	3. Ampullariidae			
5	*Pomacea canaliculata* (Lamarck)	*X*	*X*	*X*
	4. Lymnaeidae			
6	*Lymnaea viridis* Quoy et Gaimard	*X*	*X*	*X*
7	*Lymnaea swinhoei*Adams	*X*	*X*	
	5. Pachychilidae			
8	*Brotia siamensis* (Brot)	*X*	*X*	*X*
9	*Adamietta reevei* (Brot, 1862)	*X*	*X*	*X*
	6. Stenothyridae			
10	*Stenothyra messageri* Bavey et Dautzenberg	*X*	*X*	
	7. Thiaridae			
11	*Sermyla tornatella* (Lea)	*X*	*X*	*X*
12	*Tarebia granifera* (Lamarck)	*X*	*X*	*X*
13	*Thiara scabra* (Muller)	*X*	*X*	*X*
14	*Melanoides tuberculatus* (Muller)	*X*	*X*	*X*
15	*Plotia scabra*(Muller)			*X*
	II. ARTHROPODA			
	II.1. CRUSTACEA			
	8. Palaemonidae			
16	*Macrobrachium hainanense* Parisi	*X*	*X*	*X*
17	*Macrobrachium nipponense* (De Haan)	*X*	*X*	*X*
	9. Parathelphusidae			
18	*Somaniathelphusa dugasti* (Rathbun)	*X*	*X*	*X*
19	*Somanniathelphusa sinensis*(Stimpson, 1907)	*X*	*X*	*X*

	10. Atyidae			
20	*Caridina flavilineata*			*X*
	III. INSECTA			
	11. Chironomidae			
21	*Chironomus sp.*	*X*	*X*	*X*
	12. Coenagrionidae			
22	*Agriocnemis* sp.	*X*	*X*	*X*
	13. Baetidae			
23	*Acentrella* sp.		*X*	*X*
	Total No. of species	**18**	**19**	**21**

Table 4.Terrestrial vertebrate species (mammal)

No.	Vietnamese name	Scientific name & English name
	I. Bộ Ăn sâu bọ	**Insectivora**
	1. Họ Chuột chù	**Soricidae**
16	Chuột chù cộc	*Anourosorex squamipes*
17	Chuột chù	*Suncus murinus*
	II. Bộ Nhiều răng	**Scandenta**
	2. Họ Đồi	**Tupaiidae**
18	Đồi	*Tupaia belangeri*
	III. Bộ Dơi	**Chiroptera**
	3. Họ Dơi quả	**Pteropodidae**
19	Dơi chó ấn	*Cynopterus sphinx*
20	Dơi ăn mật hoa	*Macroglossus minimus*
	4. Họ Dơi bao	**Emballonuridae**
21	Dơi bao đuôi nâu đen	*Taphozous melanopogon*
	5. Họ Dơi ma	**Megadermatidae**
22	Dơi ma Nam	*Megaderma spasma*
	6. Họ Dơi nếp mũi	**Hipposideridae**
23	Dơi mũi quạ	*Hipposideros armiger*
24	Dơi mũi xinh	*Hipposideros pomona*
25	Dơi mũi xám	*Hipposideros larvatus*
	7. Họ Dơi lá mũi	**Rhinolophidae**
26	Dơi lá đuôi	*Rhinolophus affinis*
27	Dơi lá mũi	*Rhinolophus pusillus*
	8. Họ Dơi muỗi	**Vespertilionidae**
28	Dơi ống tai tròn	*Murina cyclotis*
29	Dơi tai nhỏ	*Myotis muricola*
30	Dơi muỗi nâu	*Pipistrellus coromandra*
	IV. Bộ Linh trưởng	**Primates**

No.	Vietnamese name	Scientific name & English name
	9. Họ Cu li	**Loricidae**
31	Cu li lớn	*Nycticebus bengalensis*
	10. Họ Khỉ	**Cercopithecidae**
32	Khỉ vàng	*Macaca mulatta*
33	Khỉ đuôi dài	*Macaca fascicularis*
	V. Bộ Ăn thịt	**Carnivora**
	11. Họ Chồn	**Mustelidae**
34	Chồn vàng	*Martes flavigula*
	12. Họ Cầy	**Viverridae**
35	Cầy vòi mốc	*Paguma larvata*
36	Cầy vòi đốm	*Paradoxurus hermaphroditus*
	13 Họ Cầy lỏn	**Herpestidae**
37	Cầy lỏn	*Herpestes javanicus*
38	Cầy móc cua	*Herpestes urva*
	14 Họ Mèo	**Felidae**
39	Mèo rừng	*Prionailurus bengalensis*
	VI. Bộ guốc - chẵn	**Artiodactyla**
	15. Họ Lợn	**Suidae**
40	Lợn rừng	*Sus scrofa*
	16. Họ Hươu Nai	**Cervidae**
41	Hoẵng	*Muntiacus muntjak*
	VII. Bộ Gặm nhấm	**Rodentia**
	17. Họ Sóc cây	**Sciuridae**
42	Sóc bụng đỏ	*Callosciurus erythraeus*
43	Sóc mõm hung	*Dremomys rufigenis*
	18. Họ Dúi	**Rhizomyidae**
44	Dúi mốc lớn	*Rhizomys pruinosus*
45	Dúi má vàng	*Rhizomys sumatrensis*
	19. Họ Chuột	***Muridae***
46	Chuột đất lớn	*Bandicota indica*
47	Chuột đất bé	*Bandicota savilei*
48	Chuột nhắt cây	*Chiromyscus chiropus*
49	Chuột bụng bạc	*Rattus argentiventer*
50	Chuột mốc lớn	*Rattus bowersi*
51	Chuột bukít	*Rattus bukit*
52	Chuột hươu lớn	*Rattus edwardsi*
53	Chuột nhà	*Rattus flavipectus*
54	Chuột hươu bé	*Rattus fulvescens*
55	Chuột rừng	*Rattus koratensis*

No.	Vietnamese name	Scientific name & English name
56	Chuột đồng bé	*Rattus losea*
57	Chuột bóng	*Rattus nitidus*
58	Chuột cống	*Rattus norvegicus*
59	Chuột núi	*Rattus sabanus*
60	Chuột xuri	*Rattus surifer*

Table 5.Terrestrial vertebrate species (bird)

No.	Vietnamese name	Scientific name & English name
	I. Bộ Hạc	**CICONIIFORMES**
	1. Họ Diệc	**Ardeidae**
1.	Cò trắng	*Egretta garzetta*
2.	Cò ruồi	*Bubulcus ibis*
3.	Cò bợ	*Ardeola bacchus*
4.	Cò xanh	*Butorides striatus*
	II. Bộ CắT	**FALCONIFORMES**
	2. Họ Ưng	**Accipitridae**
5.	Diều cá bé	*Ichthyophaga humilis*
6.	Diều hoa Miến Điện	*Spilornis cheela*
	3. Họ Cắt	**Falconidae**
7.	Cắt bụng hung	*Falco severus*
	III. Bộ Gà	**GALLIFORMES**
	4. Họ Trĩ	**Phasianidae**
8.	Gà so họng hung	*Arborophila rufogularis*
9.	Gà rừng	*Gallus gallus*
	IV. Bộ Sếu	**GRUIFORMES**
	5. Họ Cun cút	**Turnicidae**
10.	Cun cút lưng hung	*Turnix tanki*
	6. Họ Gà nước	**Rallidae**
11.	Gà nước vằn	*Rallus striatus*
12.	Kịch	*Gallinula chloropus*
	V. Bộ Rẽ	**CHARADRIIFORMES**
	7. Họ Choi choi	**Charadriidae**
13.	Choi choi nhỏ	*Charadrius dubius*
	8. Họ Rẽ	**Scolopacidae**
14.	Choắt bụng trắng	*Tringa ochropus*
15.	Choắt nhỏ	*Actitis hypoleucos*
	VI. Bộ Bồ câu	**COLUMBIFORMES**
	9. Họ Bồ câu	**Columbidae**
16.	Cu ngói	*Streptopelia tranquebarica*
17.	Cu gáy	*Streptopelia chinensis*
	VII. Bộ vẹt	**psittaciformes**
	10. Họ Vẹt	**Psittacidae**
18.	Vẹt ngực đỏ	*Psittacula alexandri*
	VIII. Bộ Cu cu	**CUCULIFORMES**
	11. Họ Cu cu	**Cuculidae**
19.	Bìm bịp lớn	*Centropus sinensis*

No.	Vietnamese name	Scientific name & English name
20.	Bìm bịp nhỏ	*Centropus bengalensis*
	IX. Bộ Cú	**STRIGIFORMES**
	12. Họ Cú mèo	**Strigidae**
21.	Cú vọ	*Glaucidium cuculoides*
	X. Bộ Cú muỗi	**CAPRIMULGIFORMES**
	13. Họ Cú muỗi	**Caprimulgidae**
22.	Cú muỗi ấn Độ	*Caprimulgus indicus*
	XI. Bộ Nuốc	**TROGONIFORMES**
	14. Họ Nuốc	**Trogonidae**
23.	Nuốc bụng đỏ	*Harpactes erythrocephalus*
	XII. Bộ Sả	**CORACIIFORMES**
	15. Họ Bói cá	**Alcedinidae**
24.	Bói cá nhỏ	*Ceryle rudis*
25.	Bồng chanh	*Alcedo atthis*
	16. Họ Sả rừng	**Coraciidae**
26.	Sả rừng	*Coracias benghalensis*
	XIII. Bộ Gõ kiến	**PICIFORMES**
	17. Họ Cu rốc	**Capitonidae**
27.	Cu rốc đầu vàng	*Megalaima franklinii*
	XIV. Bộ Sẻ	**PASSERIFORMES**
	18. Họ Mỏ rộng	**Eurylaimidae**
28.	Mỏ rộng hung	*Serilophus lunatus*
	19. Họ Đuôi cụt	**Pittidae**
29.	Đuôi cụt gáy xanh	*Pitta nipalensis*
30.	Đuôi cụt đầu xám	*Pitta soror*
	20. Họ Nhạn	**Hirundinidae**
31.	Nhạn nâu hung	*Hirundo concolor*
32.	Nhạn bụng trắng	*Hirundo rustica*
	21. Họ Chìa vôi	**Motacillidae**
33.	Chìa vôi vàng	*Motacilla flava*
34.	Chìa vôi núi	*Motacilla cinerea*
35.	Chìa vôi trắng	*Motacilla alba*
	22. Họ Phường chèo	**Campephagidae**
36.	Phường chèo xám	*Coracina melaschistos*
37.	Phường chèo đen	*Hemipus picatus*
38.	Phường chèo nâu	*Tephrodornis gularis*
	23. Họ Chào mào	**Pycnonotidae**
39.	Chào mào	*Pycnonotus jocosus*
40.	Bông lau tai trắng	*Pycnonotus aurigaster*

No.	Vietnamese name	Scientific name & English name
41.	Bông lau họng vạch	*Pycnonotus finlaysoni*
42.	Cành cạch lớn	*Criniger pallidus*
43.	Cành cạch nhỏ	*Hypsipetes propinquus*
	24. Họ Chim xanh	**Irenidae**
44.	Chim nghệ ngực vàng	*Aegithina tiphia*
45.	Chim xanh trán vàng	*Chloropsis aurifrons*
46.	Chim xanh hông vàng	*Chloropsis hardwickei*
47.	Chim lam	*Irena puella*
	25. Họ Bách thanh	**Laniidae**
48.	Bách thanh mày trắng	*Lanius cristatus*
49.	Bách thanh nhỏ	*Lanius collurioides*
50.	Bách thanh đầu đen	*Lanius schach*
	26. Họ Chích chòe	**Turdidae**
51.	Oanh cổ trắng	*Erithacus sibilans*
52.	Oanh lưng xanh	*Erithacus cyane*
53.	Chích chòe	*Copsychus saularis*
54.	Chích chòe lửa	*Copsychus malabaricus*
55.	Hoét đá	*Monticola solitarius*
56.	Hoét xanh	*Myophoneus caeruleus*
57.	Hoét vàng	*Zoothera citrina*
58.	Sáo đất	*Zoothera dauma*
59.	Sáo đất nâu	*Zoothera marginata*
	27. Họ Khướu	**Timaliidae**
60.	Chuối tiêu ngực đốm	*Pellorneum ruficeps*
61.	Khướu đất đuôi dài	*Spelaeornis chocolatinus*
62.	Khướu bụi trán hung	*Stachyris rufifrons*
63.	Khướu bụi vàng	*Stachyris chrysaea*
64.	Khướu bụi đầu đen	*Stachyris nigriceps*
65.	Họa mi nhỏ	*Timalia pileata*
66.	Họa mi mỏ ngắn	*Chrysomma sinense*
67.	Khướu mào cổ trắng	*Yuhina diademata*
68.	Khướu mào đầu đen	*Yuhina nigrimenta*
	28. Họ Chim Chích	**Sylviidae**
69.	Chích đuôi cụt	*Tesia olivea*
70.	Chiền chiện lớn	*Megalurus palustris*
71.	Chích đầm lầy nhỏ	*Locustella lanceolata*
72.	Chích mỏ rộng	*Acrocephalus aedon*
73.	Chích chân xám	*Phylloscopus tenellipes*
74.	Chích mày vàng	*Phylloscopus coronatus*

No.	Vietnamese name	Scientific name & English name
75.	Chích đuôi xám	*Phylloscopus reguloides*
76.	Chích đuôi trắng	*Phylloscopus davisoni*
	29. Họ Đớp ruồi	**Muscicapidae**
77.	Đớp ruồi nâu	*Muscicapa dauurica*
78.	Đớp ruồi xanh xám	*Muscicapa thalassina*
79.	Đớp ruồi xanh nhạt	*Niltava unicolor*
80.	Đớp ruồi họng hung	*Niltavas banyumas*
	30. Họ Rẻ quạt	**Monarchidae**
81.	Thiên đường đuôi phướn	*Terpsiphone paradisi*
82.	Rẻ quạt họng trắng	*Rhipidura albicollis*
	31. Họ Bạc má	**Paridae**
83.	Bạc má	*Parus major*
84.	Bạc má mào	*Parus spilonotus*
	32. Họ Trèo cây	**Sittidae**
85.	Trèo cây bụng hung	*Sitta castanea*
86.	Trèo cây trán đen	*Sitta frontalis*
	33. Họ Chim sâu	**Dicaeidae**
87.	Chim sâu bụng vạch	*Dicaeum chrysorrheum*
88.	Chim sâu vàng lục	*Dicaeum concolor*
89.	Chim sâu ngực đỏ	*Dicaeum ignipectus*
	34. Họ Hút mật	**Nectariniidae**
90.	Hút mật họng hồng	*Nectarinia sperata*
91.	Hút mật ngực đỏ	*Aethopiga saturata*
	35. Họ Vành khuyên	**Zosteropidae**
92.	Vành khuyên họng vàng	*Zosterops palpebrosa*
	36. Họ Sẻ đồng	**Emberizidae**
93.	Sẻ đồng hung	*Emberiza rutila*
94.	Sẻ đồng mặt đen	*Emberiza spodocephala*
	37. Họ Chim di	**Estrildidae**
95.	Di cam	*Lonchura striata*
96.	Di đá	*Lonchura punctulata*
	38. Họ Sẻ	**Ploceidae**
97.	Sẻ nhà	*Passer montanus*
	39. Họ Sáo	**Sturnidae**
98.	Sáo sậu	*Sturnus nigricollis*
99.	Sáo đá Trung Quốc	*Sturnus sinensis*
100.	Sáo nâu	*Acridotheres tristis*
101.	Sáo mỏ vàng	*Acridotheres grandis*
	40. Họ Vàng anh	**Oriolidae**

No.	Vietnamese name	Scientific name & English name
102.	Tử anh	*Oriolus traillii*
	41. Họ Chèo bẻo	**Dicruridae**
103.	Chèo bẻo	*Dicrurus macrocercus*
104.	Chèo bẻo xám	*Dicrurus leucophaeus*
105.	Chèo bẻo mỏ quạ	*Dicrurus annectans*
106.	Chèo bẻo rừng	*Dicrurus aeneus*
	42. Họ Nhạn rừng	**Artamidae**
107.	Nhạn rừng	*Artamus fuscus*
	43. Họ Quạ	**Corvidae**
108.	Giẻ cùi	*Urocissa erythrorhyncha*
109.	Giẻ cùi vàng	*Urocissa whiteheadi*
110.	Giẻ cùi xanh	*Cissa chinensis*
111.	Quạ đen	*Corvus macrorhynchos*

Table 6.Terrestrial vertebrate species (reptile-amphibian)

No.	Vietnamese name	Scientific name
	Lớp Bò sát	**Reptilia**
	I. Bộ Có vảy	**Squamata**
	Thằn lằn	**Sauria**
	1. Họ Nhông	**Agamidae**
1.	Nhông xanh	*Calotes versicolor*
2.	Rồng đất	*Physignathus cocincinus*
	2. Họ Tắc kè	**Gekkonidae**
3.	Tắc kè	*Gekko gecko*
	3. Họ Thằn lằn chính thức	**Lacertidae**
4.	Liu điu kúc-ni	*Takydromus kuhnei*
5.	Liu điu chỉ	*Takydromus sexlineatus*
	4. Họ Thằn lằn bóng	**Scincidae**
6.	Thằn lằn bóng hoa	*Mabuya multifasciata*
	5. Họ Kỳ đà	**Varanidae**
7.	Kỳ đà vân	*Varanus nebulosus*
8.	Kỳ đà hoa	*Varanus salvator*
	Rắn	**Serpentes**
	6. Họ Rắn giun	**Typhlopidae**
9.	Rắn giun thường	*Ramphotyphlops braminus*
	7. Họ Rắn mống	**Xenopeltidae**
10.	Rắn mống	*Xenopeltis unicolor*
	8. Họ Rắn nước	**Colubridae**
11.	Rắn roi thường	*Ahaetulla prasina*

No.	Vietnamese name	Scientific name
12.	Rắn sọc dưa	*Coelognathus radiatus*
13.	Rắn ráo thường	*Ptyas korros*
14.	Rắn ráo trâu	*Ptyas mucosus*
15.	Rắn bồng chì	*Enhydris plumbea*
16.	Rắn sãi thường	*Amphiesma stolata*
17.	Rắn hoa cỏ vàng	*Rhabdophis chrysagos*
18.	Rắn nước	*Xenochrophis piscator*
	9. Họ Rắn hổ	**Elapidae**
19.	Rắn cạp nong	*Bungarus fasciatus*
20.	Rắn cạp nia bắc	*Bungarus multicinctus*
21.	Rắn hổ mang trung quốc	*Naja* cf. *atra*
	10. Họ Rắn lục	**Viperidae**
22.	Rắn lục mép trắng	*Trimeresurus albolabris*
23.	Rắn lục xanh	*Trimeresurus stejnegeri*
	II. Bộ Rùa	**Testudines**
	11. Họ Rùa đầm	**Geoemydidae**
24.	Rùa sa nhân	*Cuora mouhotii*
	Lớp Ếch nhái	**Amphibia**
	I. Bộ Không đuôi	**Anura**
	1. Họ Cóc	**Bufonidae**
1.	Cóc nhà	*Duttaphrynus melanostictus*
2.	Cóc rừng	*Ingerophrynus galeatus*
	2. Họ Cóc bùn	**Megophryidae**
3.	Cóc mày bùn	*Leptolalax pelodytoides*
4.	Cóc mắt bên	*Xenophrys major*
	3. Họ Nhái bầu	**Microhylidae**
5.	Ễnh ương thường	*Kaloula pulchra*
6.	Nhái bầu hoa	*Microhyla fissipes*
7.	Nhái bầu hây-môn	*Microhyla heymonsi*
8.	Nhái bầu vân	*Microhyla pulchra*
	4. Họ Ếch nhái chính thức	**Dicroglossidae**
9.	Ngoé	*Fejervarya limnocharis*
10.	Ếch đồng	*Hoplobatrachus chinensis*
11.	Ếch nhẽo	*Limnonectes kuhlii*
12.	Cóc nước sần	*Occidozyga lima*
	5. Họ Ếch nhái	**Ranidae**
13.	Chàng an-đéc-sơn	*Huia andersonii*
14.	Ếch xanh	*Huia chloronota*
15.	Chàng đài bắc	*Hylarana taipehensis*

No.	Vietnamese name	Scientific name
16.	Hiu hiu	*Rana johnsi*
17.	Chẫu	*Sylvirana guentheri*
18.	Ếch suối	*Sylvirana nigrovittata*
	6. Họ Ếch cây	**Rhacophoridae**
19.	Nhái cây	*Phylautus* sp.

Table 7.Terrestrial wildlife species (insect)

No.	Vietnamese name	Scientific name
	I. Bộ Cánh cứng	**COLEOPTERA**
	1. Họ Bọ hung	**Scarabaeidae**
1.		*Peltonotus morio* Burm.
	II. Bộ Cánh vảy	**LEPIDOPTERA**
	2. Họ Bướm phượng	**Papilionidae**
2.		*Chilasa paradosa* (Hewitson)
3.		*Chilasa slateri* (Hewitson)
4.		*Graphium agamemnon* (Linn.)
5.		*Lamproptera meges* (Butler)
6.		*Meandrusa payeni* (Fruhstorfer)
7.		*Pachliopa aristolochiae* (Fabricius)
8.		*Papilio atcnenor* Westwood
9.		*Papilio bianor* Fruhstofer
10.		*Papilio demoleus* Linn.
11.		*Papilio dialis doddsi* Janet
12.		*Papilio helenus* Linn.
13.		*Papilio memnon* Linn.
14.		*Papilio nephelus* Westwood
15.		*Papilio noblei noblei* de Niceville
16.		*Papilio paris* Linn.
	3. Họ Bướm phấn	**Pieridae**
17.		*Eurema andersoni* Shisozu et Yata
18.		*Eurema blanda* (Wallace)
19.		*Eurema hecabe* (Linn.)
20.		*Gandaca harina burmana* Moore
21.		*Hebomoia glaucippe* (Linn.)
22.		*Ixias pyrene* (Linn.)
23.		*Leptosia nina nina* (Fabricius)
24.		*Prioneris philomome* (Boidusval)
25.		*Prioneris thestylis* (Doubleday)
	4. Họ Bướm giáp	**Nymphalidae**
26.		*Argyreus hyperbius* (Linn.)
27.		*Ariadne ariadne* (Linn.)
28.		*Ariadne merione* Cramer
29.		*Ariadne isaeus* Wallace
30.		*Athyma asura*Moore
31.		*Athyma kanwa*Moore
32.		*Charaxes kahruba* Moore

No.	Vietnamese name	Scientific name
33.		*Charaxes marmax* Westwood
34.		*Chersonesia risa* Doubleday
35.		*Cirrochoroa aoris* de Niceville
36.		*Cirrochoroa tyche* (C. et R. Felder)
37.		*Hypolymnas bolina* (Linn.)
38.		*Junonia almana* (Linn.)
39.		*Junonia hierta* Fabricius
40.		*Junonia lemonias* (Linn.)
41.		*Moduza procris* (Cramer)
42.		*Neptis clinia*Moore
43.		*Neptis harita harita* Moore
44.		*Neptis hordonia* Stoll
45.		*Neptis ilira* Kheil
46.		*Neptis hylas* (Linn.)
47.		*Neptis leucoporos* Fruhstorfer
48.		*Neptis miah*Moore
49.		*Neptis nata* (Moore)
50.		*Neptis sankara* Kollar
51.		*Neptis soma*Moore
52.		*Pantoporia aurelia* Stau.
53.		*Pantoporia hordontia* (Stoll)
54.		*Stibochiona nicea* (Gray)
55.		*Symbrenthia hypselis* (Godart)
56.		*Symbrenthia lilaea* Hewitson
57.		*Tanaecia cocytus* (Fabricius)
58.		*Vagrans egista* (Cramer)
59.		*Vindula erota* (Fabricius)
	5. Họ Bướm đốm	**Danaidae**
60.		*Danaus genutia* (Cramer)
61.		*Euploea aglea* Godart
62.		*Euploea camaralzeman* Butler
63.		*Euploea coregodarti* Lucas
64.		*Parantica aglea* (Moore)
65.		*Parantica melaneus* (Cramer)
66.		*Parantica sita* (Kollar)
67.		*Tirumala limniasce* (Cramer)
68.		*Tirumala septentrionis* (Butler)
	6. Họ Bướm mắt rắn	**Satyridae**
69.		*Coelites nothis* Fruhstorfer

No.	Vietnamese name	Scientific name
70.		*Elymnias casiphone* Distant
71.		*Erites medura* Horsfield
72.		*Lethe chandica* (Moore)
73.		*Lethe confusa* (Auriv.)
74.		*Lethe europa* (Fabricius)
75.		*Lethe naga* Doherty
76.		*Mycalesis mnasides* Hewitson
77.		*Mycalesis perseoides* (Moore)
78.		*Ypthima baldus* (Fabricius)
79.		*Ypthima huebneri* Kirby
80.		*Ypthima imitans* Elwes et Edwards
81.		*Ypthima savana* Smith
82.		*Zipaetis unipupilata* Lee
	7. Họ Bướm tro	**Lycaenidae**
83.		*Acytolepis puspa* (Horsfield)
84.		*Ancema ctesia* Hewitson
85.		*Anthene emolus emolus* (Godart)
86.		*Anthene lycaenina* (Hewitson)
87.		*Arhopala perimuta* Moore
88.		*Caleta elna* Hewitson
89.		*Caleta roxus* Godart
90.		*Catochrysops strabo* (Fabricius)
91.		*Jamides alecto alocina* Swinhoe
92.		*Jamides bochus* Stoll
93.		*Jamides celeno* Cramer
94.		*Jamides pura pura* Moore
95.		*Jamides virulatus* Druke
96.		*Loxura atymnus* Fruhstorfer
97.		*Megisba malaya sikkima* Moore
98.		*Nacaduba kurava* Fruhstorfer
99.		*Neocherita fabronia* Hewitson
100.		*Neomyrina nivea* God. Et Sal.
101.		*Poritia erycinoides* Evans
102.		*Poritia hewitsoni*Moore
103.		*Spindasis lohita* Horsfield
104.		*Spindasis syana* (Horsfield)
105.		*Yasoda tripunctata* (Hewitson)
106.		*Zeltus amasa amasa* (Hewitson)
	8. Họ Bướm tro vạch	**Riodinidae**

No.	Vietnamese name	Scientific name
107.		*Abisara burnii* (Fruhstorfer)
108.		*Abisara echerius* (Stoll)
109.		*Abisara fylla* (Fruhstorfer)
110.		*Abisara neophron* (Fruhstorfer)
111.		*Dodona deodata* Hewitson
112.		*Laxita thuisto* Hewitson
113.		*Paralaxita dora* Fruhstorfer
114.		*Stiboges nymphidia*Butler
115.		*Taxila dora* (Fruhstorfer)
116.		*Zemeros flegyas* (Cramer)
	9. Họ Bướm rừng	**Amathusiidae**
117.		*Amathuxidia amythaon* Talbot
118.		*Discophora deo* de Niceville
119.		*Discophora sondaica* Boisduval
120.		*Enispe eurymius* Doubleday
121.		*Faunis caneus* Stichel
122.		*Faunis eumeus* (Staudinger)
123.		*Stichophthalma fruhstorferi* Rober
124.		*Stichopthalma louisa* Janet
125.		*Thaumantis diores* Doubleday
126.		*Thauria aliris lathyi* Fruhstorfer
127.		*Zeuxidia anethysa* Butler
	10. Họ Bướm nhảy	**Hesperidae**
128.		*Astictopterus jama* Moore
129.		*Badamia exclamationis* (Fabricius)
130.		*Baoris farri* (Moore)
131.		*Bibasis amara* (Moore)
132.		*Bibasis oedipodea belesis* (Mabille)
133.		*Bibasis sena sena* (Moore)
134.		*Celaenorrhinus asmara*Butler
135.		*Cephrenas acalle* Hopffer
136.		*Cupitha purea* (Moore)
137.		*Halpe zola zola* Evans
138.		*Hasora badra badra* (Moore)
139.		*Iambrix salsala salata* (Moore)
140.		*Isoteinon lamprospilus* Felder
141.		*Koruthaialos rubecula hector* Watson
142.		*Notocrypta paralysos* W-M
143.		*Ochus subvittatus* Moore

No.	Vietnamese name	Scientific name
144.		*Seseria affinis* Druce
145.		*Tagiades gana sangarava* Fruhstorfer
146.		*Tagiades menaka* (Moore)
147.		*Thoressa cerata* Hewitson
148.		*Thoressa mansoni* Moore
149.		*Thoressa submaculata* (Leech)
	11. Họ Bướm mỏ chim	**Libytheidae**
150.		*Libythea myrrha* Godart
151.		*Libythea celtis* Laich.
152.		*Libythea geoffroyi* Godart
	12. Họ Bướm ngọc	**Acraeidae**
153.		*Acraea viola* Godart
	13. Họ Ngài chim	**Sphingidae**
154.		*Agrius convulvuli* (Linn.)
155.		*Megacorma obliqua obliqua* (Walker)
156.		*Acherontia lachensis* (Fabricius)
157.		*Meganoton analis* (Felder)
158.		*Meganoton yunanfuana* Clark
159.		*Psilogramma inrecta* (Walker)
160.		*Psilogramma menephron* (Cramer)
161.		*Dolbina inexacta* (Walker)
162.		*Amplypterus masoni mansoni* (Clark)
163.		*Barbourion lemaii* (Moult)
164.		*Ambulyx sericeipennis* Butler
165.		*Parum colligata* (Walker)
166.		*Craspedortha porphyria* (Butler)
167.		*Cypa decolor* (Walker)
168.		*Smerinthulus pervesa* (Roth.)
169.		*Smerinthulus quadripunctatus* Huwe
170.		*Ampelophaga khasiana* Roth.
171.		*Ampelophaga dolichoides* (Felder)
172.		*Elibia dolichus* (Westwood)
173.		*Acosmeryx shervillii* Boisduval
174.		*Acosmeryx anceus* Roth. et Jordan
175.		*Acosmeryx naga* (Moore)
176.		*Eupanacra variolosa* (Walker)
177.		*Eupanacra busiris* (Walker)
178.		*Eupanacra mydon* (Walker)
179.		*Eupinanga assamensis* (Walker)

No.	Vietnamese name	Scientific name
180.		*Angonix testacea* (Walker)
181.		*Eupteryx bhaga* (Moore)
182.		*Macroglosum belis* (Linn.)
183.		*Macroglosum fritzei* Roth. et Jordan
184.		*Macroglosum corythus* Walker
185.		*Macroglosum hemichroma* Butler
186.		*Macroglosum faro* (Cramer)
187.		*Hippotion boerhoviae* (Cramer)
188.		*Pegesa acteus* (Cramer)
189.		*Theretra boisduvali* (Bugnion)
190.		*Theretra silhetensis* (Walker)
191.		*Rhagastis confusa* Roth. et Jordan
192.		*Rhagastis abdomarginatus* (Roth.)
193.		*Cechenena aegrota* (Butler)
194.		*Cechenena helops* (Walker)
195.		*Cechenena minor* (Butler)
196.		*Cechenena lineosa* (Walker)
197.		*Cechenena subangustata* Roth.
	14. Họ Ngài tằm trời	**Saturnidae**
198.		*Archaeoattacus edwardsii* White
199.		*Samia cynthia* Drury
200.		*Actias selene* Hubner
201.		*Antheraea assamensis* Helfer
202.		*Loepa katina* Westwood
203.		*Salassa thepis* Leech

Table 8 List of flora species in My Ly HPP basin

No.	Vietnamese name	Scientific name	Use	Red Data Book Of Vietnam (2007)
	Ngành Thông đất	**Lycopodiophyta**		
	Họ Thông đất	**Lycopodiaceae**		
1.	Thông đất	Huperzia serrata (Thunb.) Trevis		
2.	Thông đất	Lycopodiella cernua (L.) Franco & Vasc.	41	
	Họ Quyển bá	**Selaginellaceae**		
3.	Quyển bá oa-lích	Selaginella wallichii (Wall. ex Hook. & Grev.) Spring		
	Ngành Dương xỉ	**Polypodiophyta**		
	Họ Tóc thần vệ nữ	**Adiantaceae**		

4.	Tóc thần vệ nữ đuôi	Adiantum caudatum L.	39	
	Họ Rau dớn	**Athyriaceae**		
5.	Rau dớn	Callipteris esculenta (Retz.) J. J. Sm.	42	R
	Họ Tổ chim	**Aspleniaceae**		
6.	Tổ điều	Asplenium colaniae Tardieu		
7.	Tổ điều	Asplenium nidus L.	41	
	Họ Ráng lá dừa	**Blechnaceae**		
8.	Ráng lá dừa	Blechnum orientale L.		
9.	Quyết	Tectaria stenosemioides C. Chr. & Tard.		
	Họ Guột	**Gleicheniaceae**		
10.	Guột	Dicranopteris linearis (Burm.) Underew.		
	Họ Ráng nhiều chân	**Polypodiaceae**		
11.	Cốt toái bổ	Drynaria fortunei (Kuntze ex Mett.) J. Sm.	39	**EN** A1,c,d
12.	Ráng	Microsorum brachylepis (Bak.) Nak.		
13.	Thạch vĩ lưỡi mác	Pyrrosia lanceolata (L.) Farw.		
	Họ Ráng seo gà	**Pteridaceae**		
14.	Ráng seo gà thường	Pteris ensiformis Burm. f.	41	
15.	Ráng seo gà nửa lông chim	Pteris semipinnata L.		
	Họ Bòng bong	**Schizeaceae**		
16.	Bòng bong to	Lygodium conforme C. Chr.		
	Họ Ráng lỡi beo	**Vittariaceae**		
17.	Ráng tô tần dàu	Vittaria elongata Sw.		
	Ngành thông	**Pinophyta**		
	Họ Gắm	**Gnetaceae**		
18.	Gắm núi	Gnetum montanum Markgraf		
	Ngành Mộc lan	**Magnoliophyta**		
	Class Mộc lan	**Magnoliopsida**		
	Họ Ô rô	**Acanthaceae**		
19.	Mảnh cộng	Clinacanthus nutans (Burm. f.) Lindau		
20.	Cát đằng thơm	Thunbergia eberhardtii R. Ben.		
	Họ Dương đào	**Actinidiaceae**		
21.	Nóng	Saurauia roxburghii Wall.		
	Họ Rau dền	**Amaranthaceae**		

22.	Rau dệu	Alternanthera sessilis (L.) A. DC.		
23.	Dền gai	Amaranthus spinosus L.		
24.	Mào gà hoa trắng	Celosia argentea L.		
	Alangiaceae	**Family Thôi ba**		
25.	Quăng lâm	Alangium barbatum (R. Br.) Baill.		
	Họ Xoài	**Anacardiaceae**		
26.	Sấu	Dracuntomelon duperreanum Pierre	33,42	
27.	Xoài	Mangifera indica L.	33,39	
28.	Sơn ta	Toxicodendron succedana (L.) Mold.	37	
29.	Dâu da xoan	Spondias lakoensis Pierre	42	
30.	Muối	Rhus chinensis Muell.		
	Họ Na	**Annonaceae**		
31.	Dây công chúa	Desmos chinensis Lour.		
32.	Cách có lông	Fissistigma villossium (Ast.) Merr.		
33.	Nhọc lá to	Polyanthia laui Merr.	33	
34.	Bồ quả	Uvaria micrantha Hook. f. & Thoms		
35.	Giền đỏ	Xylopia vielana Pierre ex Fin. & Gagnep		
	Họ Trúc đào	**Apocynaceae**		
36.	Sữa	Alstonia scholaris (L.) R. Br.	33,39	
37.	Thần linh lá to	Kibatalia anceps (Dunn & Williams) Woods	39	
38.	Lài trâu	Tabernaemontana bovina Lour.	39	
39.	Răng bừa hồng	Urceola rosea Hook. & Arn.		
40.	Lòng mức trung Bộ	Wrightia annamensis Eberh. & Dub.	33	
	Họ Bùi	**Aquifoliaceae**		
41.	Bùi tròn	Ilex rotunda Thunb.		
	Họ Nhân sâm	**Araliaceae**		
42.	Đơn châu chấu	Aralia armata (Wall. ex G. Don) Seem.	39,42	
43.	Chân chim tám lá	Schefflera heptaphylla (L.) Harms	39,42	
44.	Thầu dầu núi	Trevesia palmata (Roxb. & Lindl.) Vis.	39	

	Họ Thiên lý	**Asclepiadaceae**		
45.	Hà thủ ô nam	Streptocaulon juventas (Lour.) Merr.	39	
	Họ Cúc	**Asteraceae**		
46.	Cứt lợn	Ageratum conyzoides L.	39	
47.	Đơn buốt	Bidens pilosa L.	39,42	
48.	Đại bi	Blumea balsamifera (L.) DC.	35,39	
49.	Cúc chỉ thiên	Elephantopus scaber L.	39	
50.	Cỏ lào	Eupatorium odoratum L.		
51.	Rau tàu bay	Gynura crepidioides Benth.		
52.	Cúc gỗ	Vernonia arborea Buch.-Hams.	33,39	
	Họ Thu hải đường	**Begoniaceae**		
53.	Thu hải đường bon	Begonia bonii Gagnep.		
	Họ Núc nác	**Bignoniaceae**		
54.	Núc nác	Oroxylum indicum (L.) Kurz	39,42	
55.	Quao	Radermachera stellata Steen.		
	Họ Gạo	**Bombacaceae**		
56.	Gạo	Bombax malabaricum DC.		
	Họ Vòi voi	**Boraginaceae**		
57.	Tâm mộc	Cordia grandis Roxb.		
	Họ Bọ chó	**Buddlejaceae**		
58.	Bọ chó, Cây chìa vôi	Buddleja asiatica Lour.		
	Họ Trám	**Burseraceae**		
59.	Trám trắng	Canarium album Raeusch	33,39,42	
	Họ Vang	**Caesalpiniaceae**		
60.	Móng bò	Bauhinia viridescens Desv.		
61.	Móc mèo núi	Caesalpinia bonduc (L.) Roxb.		
62.	Muồng lá khế	Cassia occidentalis L.		
63.	Thảo quyết minh	Cassia tora L.		
64.	Vàng anh	Sacara dives Pierre		

	Họ Màn màn	**Capparaceae**		
65.	Cáp hoa nhỏ	Capparis micrantha DC.		
66.	Màn màn hoa vàng	Cleome viscosa L.		
67.	Cây bún	Crateva magna (Lour.) DC. (C. nurvala Buch.-Ham.)	42	
68.	Trứng cuốc	Stixis scandens Lour.		
	Họ Kim ngân	**Caprifoliaceae**		
69.	Cơm cháy	Sambucus hookeri Rehd.		
70.	Vót vàng	Viburnum lutescens Blume		
	Họ Đu đủ	**Caricaceae**		
71.	Đu đủ	Carica papaya L.	39,42	
	Họ Rum	**Cecropiaceae**		
72.	Rum thơm	Poikilospermum suaveolens (Blume) Merr.		
	Họ Bứa	**Clusiaceae**		
73.	Sơn vé	Garcinia merguensis Wight		
74.	Bứa nam Bộ	Garcinia cochinchinensis (Lour.) Chóiy		
	Họ Bàng	**Combretaceae**		
75.	Sử quân tử	Quisqualis indica L.	39	
	Họ Dây khế	**Connaraceae**		
76.	Lốp bốp	Connarus paniculatus Roxb.		
	Họ Khoai lang	**Convolvulaceae**		
77.	Bạc thau	Argyreia acuta Lour.		
78.	Dây lang rừng	Ipompoea cyrosa Roem. & Schult.		
79.	Bìm bìm lam	Ipomoea nil (L.) Roth.		
80.	Bìm bìm vàng	Merremia boisiana (Gagnep.) Van Ooststn.		
	Họ Bầu bí	**Cucurbitaceae**		
81.	Đại hái	Hodgsonia macrocarpa (Blume) Cogn.		
	Họ Tơ hồng	**Cuscutaceae**		
82.	Tơ hồng	Cuscuta chinensis Lam		
	Họ Dầu	**Dipterocarpaceae**		
83.	Chò chỉ	Shorea chinensis (Wang Hsie) H.Zhu	**33**	

84.	Táu	Vatica odorata (Griff.) Symington	**33**	
	Họ Sổ	**Dilleniaceae**		
85.	Lọng bàng	Dillenia turbipinnata Fin. & Ggnep.		
86.	Chạc chìu	Tetracera scandens (L.) Merr.		
	Họ Nhót	**Elaeagnaceae**		
87.	Nhót lá rộng	Elaeagnus latifolia L.		
	Họ Côm	**Elaeocarpus**		
88.	Côm hải nam	Elaeocarpus hainamensis		
89.	Côm trâu	Elaeocarpus sylvestris (Lour.) Poir		
	Họ Thầu dầu	**Euphorbiaceae**		
90.	Chòi mòi bun	Antidesma bunius (L.) Spreng	42	
91.	Ngăm	Aporusa dioica (Roxb.) Muell.-Arg.		
92.	Dâu gia đất	Baccaurea racemosa Lour.		
93.	Nhội	Bischofia javanica Blume	33,39	
94.	Bồ cu vẽ	Breynia fruticosa Hook. f.		
95.	Ba đậu, Mần để	Croton tiglium L.	39	
96.	Vạng trứng	Endospermum chinense Benth.	33	
97.	Cỏ sữa	Euphorbia hirta L.	39	
98.	Bòn bọt	Glochidion eriocarpum Champ.		
99.	Rù rì	Homonoia riparia Lour.		
100.	Lá nến, Ba soi	Macaranga denticulata (Blume) Muell.-Arg.		
101.	Bục bục	Mallotus barbatus (Wall.) Muell.-Arg.		
102.	Bụp hooker	Mallotus hookerianus MueII.-Arg.	33	
103.	Bục bạc	Mallotus paniculatus (Lam.) Muell-Arg.		
104.	Me rừng	Phyllanthus embrica L.	42	
105.	Phèn đen	Phyllanthus reticulatus Poir.	39,40	
106.	Nàng nàng	Sumbabiopsis macrophylla Muell.-Arg.		
107.	Trẩu	Vernicia montana Lour.	34,36	

	Họ Đậu	**Fabaceae**		
108.	Đậu săng	Cajanus indicus Spreng		
109.	Lục lạc trắng xanh	Crotalaria pallida Aiton		
110.	Dây mật	Derris elliptica (Roxb.) Benth.	39	
111.	Hàn the dị phiến	Desmodium heterophyllum (Willd) DC.		
112.	Dây mật	Millettia pachyloba Drake	39	
113.	Kè huyết đằng	Millettia reticulata Benth.	39	
114.	Ràng ràng	Ormosia pinnata (Lour.) Merr.	33	
115.	Giáng hương ấn	Pterocarpus indicus Willd.	33	
	Fagaceae	**Family Dẻ**		
116.	Dẻ gai phảng	Castanopsis fissa (Champ.) Rehd. & Wild.	33	
117.	Dẻ gai ấn độ	Castanopsis indica (Roxb.) A. DC.	33	
118.	Dẻ gai bắc Bộ	Castanopsis tonkinensis Seem.	33	
119.	Dẻ trung Bộ	Lithocarpus annamensis (Hick. & A. Camus) Barn.	33	
120.	Sồi ghẻ	Lithocarpus corneus (Lour.) Rehd.		
121.	Dẻ xanh	Lithocarpus pseudosundaicus (Hick. & A. Camus) A. Camus	33	
	Họ Bồ quân	**Flacourtiaceae**		
122.	Nang trứng lá ô rô	Hydnocarpus ilicifolia King		
	Họ Tai voi	**Gesneriaceae**		
123.	Hai hùng nhám	Didissandra aspera Drake		
	Họ Liên đằng	**Hernandiaceae**		
124.	Liên đằng	Illigera celebica Miq.		
	Họ Thường sơn	**Hydrangeaceae**		
125.	Thường sơn	Dichroa febrifuga Lour.		
	Họ Ban	**Hypericacaceae**		
126.	Thành ngạnh	Cratoxylum cochinchinensis (Lour.) Blume	33	
127.	Đỏ ngọn	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	33	
	Họ Thụ đào	**Icacinaceae**		
128.	Mao hùm mềm	Gomphandra mollis Merr.		

129.	Mộc thông, Tử quả	Iodes cirrhoza Turz		
	Họ Hồ đào	**Juglandaceae**		
130.	Chẹo	Engelhardtia roxburghiana Wall.	33, 39	
131.	Cơi bắc Bộ	Pterocarya stenoptera C. DC. var. tonkinensis Frach.	33	
	Họ Hoa môi	**Lamiaceae**		
132.	Đinh hùng mảnh	Gomphostemma leptodon Dunn.	39	
133.	Bạch thiệt	Leucas aspera (De Wilde) Link	39	
134.	Lá men	Mosla dianthera (Benth. et Hook.) Maxim.		
	Họ Long não	**Lauraceae**		
135.	Vàng trắng lông	Alseodaphne velutina Cher.	33	
136.	Tơ xanh	Cassytha filiformis L.		
137.	Quế lợn	Cinnamomum iners Reinw. ex Blume	33	
138.	Re chay	Cinnamomum tamala (Buch.-Ham.) Nees et Eberm		
139.	Mò trung hoa	Cryptocarya chinensis (Hance) Hemsl.		
140.	Mò lá tù, ẩn hạch, Cà đuối nhuộm	Cryptocarya infectoria (Blume) Miq. (C. obtusifolia Merr.)		
141.	Liên đàng thờng	Lindera communis Hemsl.		
142.	Màng tang	Litsea cubeba (Lour.) Pers	39	
143.	Bời lời nhớt	Litsea glutinosa (Lour.) C. B. Robins	39,42	
144.	Kháo thơm	Machilus odoratissimus Nees		
145.	Bài nhài tích-lan	Neolitsea zeylanica (C. & T. Nees) Merr.		
146.	Sụ lá to	Phoebe tavoyana (Meissn.) Hook. f.		
	Họ Gối hạc	**Leeaceae**		
147.	Gối hạc đen	Leea indica (Burm. f.) Merr.		
	Họ Mã tiền	**Loganiaceae**		
148.	Trai tích lan	Fagraea ceilanica Thunb.		
149.	Lá ngón, Ngón	Gelsemium elegans (Gardn. et Champ.) Benth.	39	
150.	Mã tiền	Strychnos axillaris Colebr.	39	
	Họ Tầm gửi	**Loranthaceae**		
151.	Đại cán lá bắc hai	Macrosolen bibracteolatus (Hance) Dans.		

152.	Tầm gửi sét	Scurrula ferruginea (Jack) Danser		
153.	Mộc vệ ký sinh	Scurrula parasitica L.		
	Họ Bằng lăng	**Lythraceae**		
154.	Bằng lăng	Lagerstroemia calyculata Kurz	33	
155.	Săng lẻ	Lagerstroemia tomentosa Presl	33	
	Họ Bần	**Soneratiaceae**		
156.	Phay	Duabanga grandiflora (DC.) Walp.	33	
	Họ Mộc lan	**Magnoliaceae**		
157.	Mộc lan lông	Magnolia albosericea C. H. Tsoong		
158.	Mỡ	Manglietia conifera Dandy	33	
159.	Giổi nhung	Michelia foveolata Merr. ex Dandy (M. fulgens Dandy)	33	
	Họ Bông	**Malvaceae**		
160.	Cối xay	Abutilon indicum (L.) Sweet.		
161.	Bò ké, Ong bù	Kydia calycina Roxb.		
162.	Ké hoa vàng	Sida acuta Burm.		
163.	Bái bò	Sida cordata (Burm. f.) Boiss		
164.	Ké hoa vàng	Sida rhombifolia L.		
165.	Ké hoa đào	Urena lobata L.		
	Họ Mua	**Melastomataceae**		
166.	Mua rừng	Blastus cochinchinensis Lour.		
167.	Mua không tuyến	Blastus eglandulosus Staf. ex Spare		
168.	Mua thờng	Melastoma normale D. Don		
169.	Mua máu	Melastoma sanguinea Sims.		
170.	Sầm bù	Memecylon edule Roxb.		
171.	Mua đỏ chùm	Oxyspora paniculata (D. Don) DC.		
172.	Cẩm hơng bò cạp	Phyllagathis scorpiothyrsioides C. Hans		
173.	Cẩm hơng nằm ngang	Phyllagathis prostrata C. Hans		
	Sơn linh fi-nê	Sonerila finetii Guillaumin		
	Họ Xoan	**Meliaceae**		

174.	Gội dịu	Aglaia edulis (Roxb.) Gray	33	
175.	Gội lông	Aglaia tomentosa T. & B.	33	
176.	Gội nước	Aphanamixis polystachya (Wlall.) R. N. Parker	33	
177.	Quếch trung hoa	Chisocheton chinensis Merr.	33	
178.	Cà muối quả mọng	Cipadessa baccifera (Roxb.) Miq.		
179.	Xoan	Melia azedarach L.	33	
	Họ Tiết dê	**Menispermaceae**		
180.	Tiết dê	Cissampelos pareira L.		
181.	Dây xanh	Cocculus trilobus (Thunb.) DC.		
182.	Lõi tiềm lam	Pericampilus glaucus (Lam.) Merr.		
183.	Phải đằng	Pycnarrhena poilanei (Gagnep.) Forman		
184.	Dây cóc	Tinospora crispa (L.) Miers		
	Họ Trinh nữ	**Mimosaceae**		
185.	Sống rắn dày	Acacia pennata (L.) Willd.		
186.	Sống rắn sừng nhỏ	Albizia corniculata (Lour.) Druce		
187.	Dái bò, Bản xe	Albizia lucidior (Steud.) I. Niels.		
188.	Lim bình hành, mán đỉa	Archidendron clypearia (Jack.) I. Niels.		
189.	Mán đỉa trâu	Archidendron lucidum (Benth.) I. Niels.		
190.	Trinh nữ	Mimosa diplotricha C. Wright ex Sauvalle		
191.	Trinh nữ gỗ, Ma Dơng	Mimosa pigra L.		
192.	Trinh nữ thẹn	Mimosa pudica L.		
	Họ Dâu tằm	**Moraceae**		
193.	Mít nài	Artocarpus rigidus Blume		
194.	Mỏ quạ ba mũi	Cudrania tricuspidata (Carr.) Bur. ex Lav.		
195.	Vả	Ficus auriculata Lour.		
196.	Ngái lông	Ficus hirta Vahl		
197.	Ngái	Ficus hispida L. f.		
198.	Sung táo	Ficus oligodon Miq.		

199.	Sung bán tâm	Ficus semicordata Griff.		
200.	Rù rì quả lê	Ficus subpyriformis Hook. &Arg.		
201.	Sung biến diệp	Ficus variolosa Lindl. ex Benth.		
202.	Mỏ quạ nam Bộ	Maclura cochinchinensis (Lour.) Corner		
203.	Duối leo	Malaisia scandens (Lour.) Blume		
204.	Ruối	Streblus asper Lour.	33	
205.	Ruối ô rô	Streblus ilicifolius (Vidal) Corner	33	
	Họ Máu chó	**Myristicaceae**		
206.	Săng máu quả đào	Horsfieldia amygdalina (Wall.) Warb.	33	
207.	Săng máu tô-ren	Horsfieldia thorelii Lecomte	33	
208.	Máu chó lá nhỏ	Knema conferta Warb.	33	
	Họ Đơn nem	**Myrsinaceae**		
209.	Trọng đũa sóng giả	Ardisia pseudocrispa Pit.		
210.	Trọng đũa xỉn	Ardisia quinquegona Blume		
211.	Thùn mũn, Vón vén	Embelia ribes Burm. f.	39	
212.	Đơn nem núi	Maesa balansae Mez		
213.	Đơn nem màng	Maesa membranacea A.DC.		
	Họ Sim	**Myrtaceae**		
214.	Trâm lục hoa nhỏ	Decaspermum parviflorum (Lam.) Scott.		
215.	Sim	Rhodomyrtus tomentosa (Aiton) Hassk.	40,42	
216.	Trâm mốc	Syzygium cumini (L.) Druce	33	
217.	Trâm đẹp	Syzygium formosum (Wall.) Masam	33	
218.	Trâm lá hẹp	Syzygium linneatum		
219.	Trâm oai	Syzygium wightianum Wall et Arn.	33	
220.	Trâm vỏ đỏ	Syzygium zeylanicum (L.) DC.	42	
	Họ Nhài	**Oleaceae**		
221.	Lài ba gân	Jasminum triplinerve Vahl		
222.	Nhài dạng sóng	Jasminum undulatum Ker.-Gawl.		

223.	Lí lãm đầu nhụy nhỏ	Linociera insignis C. B. Clarker		
	Họ Rau mương	**Onagraceae**		
224.	Rau mơng đứng	Ludwigia octovalvis (Jack.) Raven		
225.	Rau mơng đất	Ludwigia prostrata Roxb.		
	Họ Chua me	**Oxalidaceae**		
226.	Chua me đất	Biophytum sensitivum (Lour.) DC.		
227.	Chua me đất vàng	Oxalis corniculata L.		
	Họ Lạc tiên	**Passifloraceae**		
228.	Vòng kỷ	Adenia heterophylla (Blume) Koord		
229.	Lạc tiên, Nhãn lồng	Passiflora foetida L.	39	
	Họ Rau tai voi	**Pentaphragmataceae**		
230.	Rau tai voi	Pentaphragma sinense Hemsl. & Wils.	42	
	Họ Hồ tiêu	**Piperaceae**		
231.	Rau càng cua	Peperomia pellucida (L.) H. B. K	42	
232.	Tiêu lông	Piper bonii C.DC.		
233.	Tiêu dày	Piper densum Blume		
234.	Lá lốt	Piper lolot C.DC.	39,42	
235.	Tiêu dài	Piper longum L.		
236.	Thảo hồ tiêu	Zippelia begoniifolia Blume ex Schult. & Schult.		
	Họ Hải đồng	**Pittosporaceae**		
237.	Hải đồng lá mác	Pittosporum aff. baileyanum Gowda		
	Họ Mã đề	**Plantaginaceae**		
238.	Mã đề châu á	Plantago asiatica L.	39	
239.	Mã đề	Plantago major L.	39	
	Họ Viễn chí	**Polygalaceae**		
240.	Viễn chí bắc Bộ	Polygala tonkinensis Chodat		
	Họ Rau răm	**Polygonaceae**		
241.	Nghể râu	Polygonum barbatum L.		
242.	Thồm lồm	Polygonum chinense L.		
243.	Hà thủ ô	Polygonum multiflorum Thunb. ex Murray	39	

244.	Thồm lồm gai	Polygonum perfoliatum L.		
	Họ Quắn hoa	**Proteaceae**		
245.	Cơm vàng	Helicia cochinchinensis Lour.	33	
246.	Túng, Đáng	Heliciopsis lobata (Merr.) Sleum.	33	
	Ranunculaceae	**Family Mao lương**		
247.	Vằng kim cang	Clematis smilacifolia Wall.		
248.	Bạch tụ tích lan	Naravelia zeylanica (L.) DC.		
	Họ Táo ta	**Rhamnaceae**		
249.	Dây đòn gánh	Gouania leptostachya DC.		
250.	Táo hoang	Ziziphus oenoplia (L.) Mill.		
	Họ Đước	**Rhizophoraceae**		
251.	Trúc tiết cành doãng	Carallia brachiata (Lour.) Merr.		
	Họ Hoa hồng	**Rosaceae**		
252.	Xoan đào	Prunus arborea (Blume) Kalkm.	33	
253.	Mâm xôi	Rubus alcaefolius Poir.	39	
254.	Ngấy hơng	Rubus cochinchinensis Tratt.		
	Họ Cà phê	**Rubiaceae**		
255.	Gáo nước	Adina pilulifera (Wall. ex Don) Benth.		
256.	Gáo hoa dày	Aidia pycnantha (Drake) Tirv.		
257.	Đoản ngạc xỉ oa-lích	Brachytome wallichii Hook. f.		
258.	Găng gai	Canthium horridum Blume		
259.	Dạ cẩm	Hedyotis capitellata Wall. ex G. Don	39	
260.	Lỡi rắn trắng	Hedyotis diffusa Willd.	39	
261.	Đơn đỏ	Ixora coccinea L.	41	
262.	Mẫu đơn lá đại sa	Ixora pavettaefolia Craib		
263.	Xú hơng trung Bộ	Lasianthus annamicus Pit.		
264.	Xú hơng phiến mác	Lasianthus lancilimbus Merr.		
265.	Mặt quỉ	Morinda umbellata L.	39	
266.	Bướm cam-pu-chia	Mussaenda cambodiana Pierre		

267.	Bướm bạc lông mềm	Mussaenda pubescens Ait.		
268.	Tuyến ngạc ba-lăng-xa	Mycetia balansae Drake		
269.	Vạn kính tàn	Myrioneuron effusum (Drake) Merr.		
270.	Gáo, Săng tàn	Neolamarkia cadamba (Roxb.) Bosser	33	
271.	Xà căn lá to	Ophiorrhiza amplifolia Drake		
272.	Mơ leo	Paederia scandens (Lour.) Merr.	42	
273.	Dọt sành hoa	Pavetta graciliflora Wall.		
274.	Lấu núi	Psychotria montana Blume		
275.	Lấu gân ít	Psychotria oligoneura Pierre ex Pit.		
276.	Lấu bò	Psychotria repens L.		
277.	Lấu đỏ, Lấu	Psychotria rubra (Lour.) Poit.		
278.	Găng trâu, Găng mài	Randia spinosa Blume		
279.	Trèn lá to	Tarenna latifolia Pit.		
280.	Câu đằng lá to	Uncaria macrophylla DC.		
281.	Câu đằng lá nhọn	Uncaria rhynchophylla (Miq.) Hail		
282.	Chà hươu lào	Wendlandia laotica Pit.		
283.	Chà hươu chuỳ	Wendlandia paniculata (Roxb.) DC.		
284.	Chà hươu nhuộm	Wendlandia tinctoria (Roxb.) DC.		
	Họ Cam	**Rutaceae**		
285.	Bai bái, Bởi bung	Acronychia pedunculata (L.) Miq.	39	
286.	Hồng bì lõm	Clausena excavata Burm. f.		
287.	Chè cỏ, Ba chạc	Euodia lepta (Spreng) Merr.	39	
288.	Cơm rượu	Glycomis pentaphylla Retz.		
289.	Tiêu vân lông, Mắt trâu	Micromelum hirsutum Oliv.		
290.	Tiểu vân nhỏ, Kim s-ơng lá nhỏ	Micromelum minutum (Forst. f.) Wight & Arn. (M. falcatum Tanaka)		
291.	Sơn tiêu, Truống	Zanthoxylum avicenniae (Lam.) DC.		
292.	Trng, Sng	Zanthoxylum nitidum (Roxb.) DC.	39,42	
	Họ Bồ hòn	**Sapindaceae**		

293.	Ngoại mộc lục	Allophylus viridis Radlk		
294.	Dây tầm phong	Cardiospermum halicacabum L.		
295.	Nhãn rừng	Dimocarpus fumatus (Blume) Leenh.	33	
296.	Trường mật trung Bộ	Paviesia annamensis Pierre	33	
297.	Sâng	Pometia pinnata Forst. & Forst. f.	33	
298.	Bồ hòn	Sapindus saponaria L.	33	
	Họ Hồng xiêm	**Sapotaceae**		
299.	Cồng sữa vàng	Eberhardtia aurata (Dub.) Lecomte		
300.	Trứng gà	Pouteria sapota (Jacq.) H. Moore & Stearn.	42	
301.	Nhục tử hẹp	Sacrosperma angustifolium Gagnep.		
302.	Hồng đạt	Sarcosperma kachinense (King & Prain) Excell		
303.	Sến đất trung hoa	Sinosideroxylon aff. wightianum Hook. & Arn.		
	Họ Diếp cá	**Saururaceae**		
304.	Diếp cá	Houttuynia cordata Thunb.	42	
	Họ Ngũ vị	**Schisandraceae**		
305.	Chua cùm đỏ	Kadsura coccinea (Lem.) A. C. Smith	39	
	Họ Hoa mõm chó	**Scrophulariaceae**		
306.	Tuyến hơng lam	Adenosma caerulea R. Br.		
307.	Cam thảo đất	Scoparia dulcis L.		
308.	Tô liên hoa tím	Torenia violacea (Azaola ex Blanco) Penn.		
	Họ Thanh thất	**Simaroubaceae**		
309.	Sầu đâu cứt chuột	Brucea javanica (L.) Merr.		
310.	Hải sơn	Harrisonia perforata (Blumea) Merr.		
	Họ Cà	**Solanaceae**		
311.	La	Solanum erianthum D. Don		
	Họ Côi	**Staphyleaceae**		
312.	Turpinia montana (Blume) Kurz	Côi núi		
	Họ Trôm	**Sterculiaceae**		
313.	Tai mèo bông vàng, Nga khoai	Abroma angusta (L.) L. f.		

314.	Trôm leo	Byttneria aspera Colebr.		
315.	Thung	Commersonia bartramia (L.) Merr.		
316.	Con chuột	Helicteres hirsuta Lour.		
317.	Lòng mang	Pterospermum heterophyllum Hance		
318.	Mang lá cụt	Pterospermum truncatolobatum Gagnep.		
319.	Sảng	Sterculia hymenocalys K. Schum		
320.	Sảng	Sterculia lanceolata Cav.	33	
	Họ Dung	**Symplocaceae**		
321.	Dung nam Bộ	Symplocos cochinchinensis (Lour.) Moore. [S. laurina Wall. ex G. Don]		
322.	Dung lá súm	Symplocos euryoides Hand.-Mazz.		
323.	Dung lông	Symplocos glomerata subsp. adenopus (Hance) Nooteb.		
	Họ Chè	**Theaceae**		
324.	Chè	Camellia sinensis (L.) Kuntze	42	
325.	Súm trơn	Eurya nitida Korth.		
326.	Súm có lông	Eurya trichocarpa Korth.		
327.	Trín	Schima wallichii (DC.) Korth.	33	
	Họ Trầm	**Thymelaeaceae**		
328.	Niệt gió	Wikstroemia indica (L.) C. A. Mey		
	Họ Đay	**Tiliaceae**		
329.	Lò bo lọng	Brownlowia denysiana Pierre		
330.	Bồ an dạng tai	Colona auriculata (Desf.) Craib		
331.	Cò ke châu á	Grewia asiatica L.		
332.	Cò ke lá sếu	Grewia ericocarpa Juss. (G. celtidifolia Juss.)		
333.	Cò ke	Grewia paniculata Roxb.		
334.	Ké đay vàng	Triumfetta rhomboidea Jack.		
	Họ Du	**Ulmaceae**		
335.	Ma trá oai	Celtis philippense Blanco	33	
336.	Sếu	Celtis sinensis Person	33	
337.	Ngát vàng	Gironniera subaequalis Planch.	33	

338.	Hu	*Tremna orrientalis* (L.) Blume		
	Họ Gai	**Urticaceae**		
339.	Gai	Boehmeria nivea (L.) Gaudich.		
340.	Lâu khê	Elatostema balansae Gagnep.		
341.	Cao hùng da	Elatostema rupestre Wedd.		
342.	Han đài hai	Laportea disepala (Gagnep.) Chew.		
343.	Han lá dài	Laportea thorelii Gagnep.		
344.	Han lá nguyên	Oreocnide integrifolia (Gaud.) C. J. Chen		
345.	Sam đá	Pellionia repens (Lour.) Merr.		
346.	Pí lè ba vì, Nan ông ba vì	Pilea boniana Gagnep. (P. baviensis Gagnep.)		
347.	Bọ mắm lông	Pouzolzia hirta Hassk.	39	
348.	Bọ mắm	Pouzolzia zeylanica (L.) Benn.		
	Họ Cỏ roi ngựa	**Verbenaceae**		
349.	Tu hú thân gỗ	Callicarpa arborea Roxb.		
350.	Tu hú hồng	Callicarpa rubella Lindl.		
351.	Bọ mẩy, Đắng cẩy	Clerodendrum cyrtophyllum Turcz.		
352.	Lõi tHọ châu á	Gmelina asiatica L.		
353.	Bông ổi	Lantana camara L.		
354.	Cách ba-lăng-xa	Premna balansae Dop.		
355.	Cỏ roi ngựa	Verbena officinalis L.		
356.	Đẻn ba lá	Vitex trifolia L.		
357.	Bình linh cọng mảnh	Vitex tripinnata (Lour.) Merr.	41	
	Họ Hoa tím	**Violaceae**		
358.	Tam giác xa	Rinorea virgata (Thw.) Kuntze		
359.	Cải gừng tía	Viola inconspicua Blume		
	Họ Nho	**Vitaceae**		
360.	Chè dây	Ampelopsis cantoniensis (H. et A.) Planch.	39	
361.	Ô liễm ba lá	Cayratia trifolia (L.) Domino		

362.	Bạch phấn bốn cạnh	Cissus subtetragona Planch.		
363.	Tứ th thân dẹt	Tetrastigma planicaule (Hook. f.) Gagnep.		
	Class Loa kèn	**Liliopsida**		
	Họ Thạch Xơng bồ	**Acoraceae**		
364.	Thạch xương bồ	Acorus gramineus Ait. ex Soland.	39	
	Họ Ráy	**Araceae**		
365.	Khoai ráp	Alocasia macrorrhizos (L.) G. Don	43	
366.	Khoai nước	Colocasia esculenta (L.) Schott	43	
367.	Ráy	Colocasia macrorhiza (L.) G. Don		
368.	Sơn thục	Homalomena occulta (Lour.) Schott	39	
369.	Cơm lênh bò	Pothos repens (Lour.) Druce		
370.	Ráy leo chân rết	Pothos scandens L.		
371.	Đuôi phợng men xuống	Raphidophora decursiva (Roxb.) Schott		
	Họ Cau	**Arecaceae**		
372.	Mây thủ công	Calamus faberi Becc.	44	
373.	Song đá	Calamus rudentum Lour.	44	
374.	Mây lá liễu	Calamus salicifolius Becc.	44	
375.	Đùng đình	Caryota mitis Lour.	44	
376.	Đùng đình bông đơn	Caryota monostachya Becc.		
377.	Lá nón	Licuala spinosa Wurm.		
378.	Cau rừng	Pinanga dupperreana Pierre ex Gagnep.		
379.	Lụi mảnh	Rhapis gracilis Burret	44	
	Họ Măng tây	**Asparagaceae**		
380.	Thiên môn đông	Asparagus cochinchinensis (Lour.) Merr.		
	Họ Thài lài	**Commelinaceae**		
381.	Thài lài	Commelina communis L.	43	
382.	Pôn nhật	Pollia japonica Thunb.		
383.	Thài lài tía	Tradescantia zebrina Hort. ex Loudon		
384.	Đầu rìu	Floscopa scandens Lour.		

385.	Loã trai ngọt	Murdannia edulis (Stokes) Faden.		
386.	Bôn dãy	Pollia thyrsiflora (Blume) Endl. & Hassk.		
	Họ Tỏi đá	**Convallariaceae**		
387.	Mạch môn đông	Ophiopogon japonicus (L. f.) Ker.-Gawl.	39	
388.	Cao cẳng lá rộng	Ophiopogon latifolius Rodr.	39	
389.	Cao cẳng lá dài	Ophiopogon longifolius Dcne.	39	
	Họ Mía dò	**Costaceae**		
390.	Mía dò	Costus speciosus (Koenig) Smith	39,41	
	Họ Cói	**Cyperaceae**		
391.	Cói hoa xoè	Cyperus diffusus Vahl		
392.	Cói bông cách	Cyperus distans L. f.		
393.	Cói cao	Cyperus exaltatus Retz.		
394.	Cỏ gấu	Cyperus rotundus L.	39	
395.	Năn dẹt	Fimbristylis complanata (Retz.) Link.		
396.	Năn hai ngả	Fimbristylis dichotoma (L.) Vahl		
397.	Bạc đầu	Kyllinga nemoralis (J. R. & G. Forst) Dandy ex Hutch. & Dalz.		
398.	Cơng tản phòng	Scleria corymbifera Hook. & Thoms.		
	Họ Dứa thơm	**Bromeliaceae**		
399.	Dứa	Ananas comomus (L.) Merr.	42	
	Họ Củ nâu	**Dioscoreaceae**		
400.	Củ nâu	Dioscorea cirrhosa Lour.		
401.	Khoai mài	Dioscorea depauperata Prain et Burk.		
402.	Củ mài, Hoài sơn	Dioscorea persimilis Prain & Burk.	42	
403.	Từ lá lê	Dioscorea pyrifolia Kunth		
404.	Từ ba lá	Dioscorea triphylla L.		
	Họ Bồng bồng	**Dracaenaceae**		
405.	Huyết giác nam Bộ	Dracaena cochinchinensis (Lour.) Merr.	39	
	Họ Sâm cau	**Hypoxidaceae**		
406.	Cồ nốc mảnh	Curculigo gracilis Wall.		

407.	Sâm cau lá rộng	Curculigo latifolia Dryand. ex Ait.		
	Họ La dơn	**Iridaceae**		
408.	Rẻ quạt	Belamcanda chinensis (L.) DC.	39,41	
	Họ Dong ta	**Marantaceae**		
409.	Dong dạng đầu	Phrynium capitatum Willd		
	Họ Chuối	**Musaceae**		
410.	Chuối hột	Musa balbisiana Colla	39	
411.	Chuối rừng	Musa coccinea Andr.		
412.	Chuối	Musa paradisiaca	42	
	Họ Phong lan	**Orchidaceae**		
413.	Xuệ lan vàng đỏ	Acampe ochracea (Lindl.) Hochr.		
414.	Lan cầu gần	Bulbophyllum affine Lindl.		
415.	Kiều lan đỉnh	Calanthe clavata Lindl.		
416.	Lan lô hội, Đoản kiếm lô hội	Cymbidium aloifolium (L.) Sw.		
417.	Lan phích lá hợp	Flickengeria angustifolia (Blume) Hawekes		
418.	Phiên thân lan	Hetaeria rubens (Lindl.) Benth. ex Hook. f.		
419.	Lan nhẫn diệp ba-lăng-xa	Liparis balansae Gagnep.		
	Họ Dứa dại	**Pandanaceae**		
420.	Dứa gỗ	Pandanus tectorius Parkinson	39	
	Họ Lúa	**Poaceae**		
421.	Cỏ lá tre	Acroceras munroanum (Balansa) Henr.		
422.	Tre gai	Bambusa blumeana J. A. et J. H. Schult.	44	
423.	Cỏ may	Chrysopogon aciculatus (Retz.) Trin.		
424.	Sả	Cymbopogon citratus (DC) Stapf.		
425.	Cỏ gà	Cynodon dactylon (L.) Pers		
426.	Cỏ mần trầu	Eleusine indica (L.) Gaertn.		
427.	Cỏ tranh	Imperata cylindrica L.		
428.	Chè vè	Miscanthus sinensis Anderson		
429.	Sậy khô	Neyraudia reynaudina (Kunth) Keng		

430.	Cỏ kê	Panicum miliaceum L.		
431.	Sậy núi	Phragmites karka (Retz.) Trin. ex Steud.		
432.	Lau	Saccharum arundinaceum Retz.		
433.	Lách	Saccharum spontaneum L.		
434.	Nứa	Schizostachyum dullooa (Gamble) R. B. Majumdar		
435.	Cỏ phao	Themeda triandra		
436.	Chít	Thysanolaena maxima (Roxb.) Kuntze		
	Họ Kim cang	**Smilacaceae**		
437.	Kim cang	Heterosmilax chinensis Wang		
438.	Khúc khắc trung hoa	Smilax china L.		
439.	Kim cang bạc	Smilax corbularia Kunth		
440.	Khu đóng	Smilax perfoliata Lour.		
	Họ Râu hùm	**Tacaceae**		
441.	Râu hùm	Tacca chantrieri Andre	39	
	Họ Gừng	**Zingiberaceae**		
442.	Riềng đài tua	Alpinia blepharocalyx K. Schum.		
443.	Riêng lá bắc to	Alpinia malaccense Burm.		
444.	Sa nhân	Amomum villosum Lour.		
445.	Nghệ, Nghệ trồng	Curcuma longa L.	39,42	
446.	Gừng	Zingiber officinale Roscoe	39,42	
447.	Riềng dại, Gừng gió	Zingiber zerumbet Sm.		

Use, numbered as follows: 33. Fuel-wood &Timber trees; 39. Medicinal & poisonous plants; 41. Ornamental plants; 42. Eatable plants; 43. Forages; 44. Rattan & bamboo.

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 01 Side: 20 x 20 m

GPS points (N/E): $19^0$40'04,9"/$104^0$05'24,6' Altitude (m):

Ecosystem type (coding): Grassland on uncultivated land

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	Diameter (cm)	Counts (total number)	Remark
	Scientific name	Local name				
1						

2. Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
2	Eupatorium odoratum L.	Cỏ lào	1-2 m	3-4 clusters/m^2	6-7 stems/cluster
3	Ferns				
4	Grass				

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	
	Scientific name	Local name			
1.	Streblus ilicifolius (Vidal) Corner	Ruối ô rô	< 1	6	
2.	Clausena excavata Burm. f.	Hổng bì dại	1-1,5	3	
3.	Trema orientalis (L.) Blume	Hu	< 2	4	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):
Lead surveyor: NGUYEN THE CUONG
Other surveyor: TRINH XUAN THANH
Date: March, 2017
Location:
Site name: Village: Keng Du District: Ky Son
Plot No.: 02 Side: 20 x 20 m
GPS points (N/E): 19.667216/104.090756 Altitude (m):
Ecosystem type (coding): Melia azedarach L. plantation on uncultivated land for 5-10 years
Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter
	Scientific name	Local name				
1	Melia azedarach L.	Xoan	13.0	62.5	1	7.5
2	Melia azedarach L.	Xoan	10.5	54.5	1	5.5
3	Melia azedarach L.	Xoan	9.5	50.3	1	5.0
4	Melia azedarach L.	Xoan	12.5	61.0	1	6.0
5	Melia azedarach L.	Xoan	9.5	42.1	1	4.5
6	Melia azedarach L.	Xoan	10.0	56.7	1	6.5
7	Melia azedarach L.	Xoan	8.0	40.3	1	4.0
8	Melia azedarach L.	Xoan	9.0	48.7	1	6.0
9	Melia azedarach L.	Xoan	10.0	58.3	1	6.8

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Musa paradisiaca	Chuối	3,0	03	
2	Eupatorium odoratum L.	Cỏ lào	1-2 m	18-20 individuals/m^2	
3	Ferns				
4	Grass				

(3) Regeneration of trees:NONE

(4) Vegetations in Laos side:
The secondary, semi-deciduous forest after exploitation, dominanat by *Lagerstroemia tomentosa* Presl and Pterocarpus indicus Willd.

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):
Lead surveyor: NGUYEN THE CUONG
Other surveyor: TRINH XUAN THANH
Date: March, 2017
Location:
Site name: Village: Keng Du District: Ky Son
Plot No.: 03 Side: 20 x 20 m
GPS points (N/E): $19^0$40'04,9"/$104^0$05'24,6' Altitude (m):
Ecosystem type (coding): Grassland on uncultivated land
Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	Diameter (cm)	Counts (total number)	Remark
	Scientific name	Local name				

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Eupatorium odoratum L.	Cỏ lào	1-2 m	3-4 clusters/m^2	6-7 stems/cluster
2.	Ferns				
3.	Grass				

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
4.	Streblus ilicifolius (Vidal) Corner	Ruối ô rô	< 1	6	
5.	Clausena excavata Burm. f.	Hổng bì dại	1-1.5	3	
6.	Trema orientalis (L.) Blume	Hu	< 2	4	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):
Lead surveyor: NGUYEN THE CUONG
Other surveyor: TRINH XUAN THANH
Date: March, 2017
Location:
Site name: Village: District: Ky Son
Plot No.: 04 Side: 20 x 20 m
GPS points (N/E): 19.662333/104.140778 Altitude (m): 255 m
Ecosystem type (coding): The bamboo forest
Overall conditions of forest (encircle the suitable option): None

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	26 stems/cluster
2	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	30 stems/cluster
3	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	16 stems/cluster
4	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	23 stems/cluster
5	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	33 stems/cluster
6	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	56 stems/cluster
7	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	42 stems/cluster
8	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	9 stems/cluster
9	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	14 stems/cluster
10	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	21stems/cluster
11	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	4 stems/cluster
12	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	26 stems/cluster
13	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	74 stems/cluster
14	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	81 stems/cluster
15	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	63 stems/cluster
16	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	37 stems/cluster
17	Schizostachyum dullooa (Gamble)	Nứa	6-7	01	27 stems/cluster

	R. B. Majumdar				
18	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	56 stems/cluster
19	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	21 stems/cluster
20	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	63 stems/cluster
21	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	29 stems/cluster
22	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	12 stems/cluster
23	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6-7	01	37 stems/cluster

(2) Non-woody vegetation: None
(3) Regeneration of trees: None

(4) Vegetations in Laos side:
The evergreen forest after exploitation

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 05 Side: 20 x 20 m

GPS points (N/E): 19.682361/104.157306 Altitude (m): 240 m

Ecosystem type (coding): The evergreen forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Celtis philippense Blanco	Sếu	25.0	210	01	6,5
2.	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	28.0	241	01	12
3.	Polyanthia laui Merr.	Nhọc	18.5	170	01	15
4.	Ilex rotunda Thunb.	Bùi	12	107	01	7
5.	Alstonia scholaris (L.) R. Br.	Sữa	16	230	01	6
6.	Celtis philippense Blanco	Sếu	10.5	160	01	7
7.	Celtis philippense Blanco	Sếu	15	110	01	7
8.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	10.5	125	01	6

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
	Leea indica (Burm. f.) Merr.	Gối hạc	1-2	13	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Musa balbisiana Colla	Chuối rừng	4-5	5	
2.	Ferns				5-7 individuals/m^2
3.	Poaceae				6-8 individuals/m^2

(3) Regeneration of trees

No	Species	Height	Counts	Remark

	Scientific name	Local name	(m)	(total number)	
1.	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	< 1,5	04	
2.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	1-2	26	

(4)Vegetations in Laos side:

The evergreen forest after exploitation

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 06 Side: 20 x 20 m

GPS points (N/E): 19.7052499999999/104.234393 Altitude (m): 301

Ecosystem type (coding): The secondary scrub on uncultivated land for 7-10 years

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter
	Scientific name	Local name				
1.	Ilex rotunda Thunb.	Bùi tròn	5	38.0	1	2.1
2.	Lithocarpus corneus (Lour.) Rehder	Dẻ bán cầu	4.5	15.5	1	2.3
3.	Carallia brachiata (Lour.) Merr.	Xăng mả	4.5	27.5	1	2.8
4.	Carallia brachiata (Lour.) Merr.	Xăng mả	6.0	38.0	1	3.5
5.	Cratoxylum cochinchinensis (Lour.) Blume	Thành ngạnh	4.0	42.5	1	2.5
6.	Cratoxylum cochinchinensis (Lour.) Blume	Thành ngạnh	6.5	32	1	1.8
7.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	6.0	23	1	1.5
8.	Lithocarpus corneus (Lour.) Rehder	Dẻ bán cầu	5.5	20	1	1.7
9.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	6.0	23.5	1	1.7
10.	Lagerstroemia tomentosa Presl	Săng lẻ	12.5	150	1	6.0
11.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	10.5	106	1	4.2
12.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	6.5	96	1	3.4
13.	Lagerstroemia tomentosa Presl	Săng lẻ	6.0	29.5	1	2.5
14.	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	3-4		3 clusters	

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
	Psychotria sp.	Lấu	< 1 m	13	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Ferns				
2.	Grass				

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Lithocarpus corneus (Lour.) Rehder	Dẻ bán cầu	1-2	03	
2	Cratoxylum cochinchinensis (Lour.) Blume	Thành ngạnh	1-2	06	
3	Canthium horridum Blume	Găng	1.5	01	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 07 Side: 20 x 20 m

GPS points (N/E): 19.7049169999999/104.244861 Altitude (m): 227 m

Ecosystem type (coding): The semi-deciduous forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Streblus asper Lour.	Ruối	8.5	83.0	01	4.5
2.	Lagerstroemia tomentosa Presl	Săng lẻ	20.0	150.0	01	6.5
3.	Pterocarpus indicus Willd.	Đinh hương	21.0	102.0	01	8.5
4.	Lagerstroemia tomentosa Presl	Săng lẻ	8.0	55.0	01	3.5
5.	Lagerstroemia tomentosa Presl	Săng lẻ	15.0	87.0	01	5.5
6.	Ormosia pinnata (Lour.) Merr.	Ràng ràng	18.0	107.0	01	5.0
7.	Streblus asper Lour.	Ruối	12.0	91.0	01	6.0
8.	Lagerstroemia tomentosa Presl	Săng lẻ	25.0	245.0	01	8.5
9.	Pterocarpus indicus Willd.	Đinh hương	18.0	139	01	6.5
10.	Ficus auriculata Lour.	Vả	8.0	62.5	01	8.5
11.	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	15.0	53.0	01	5.5
12.	Lagerstroemia tomentosa Presl	Săng lẻ	17.0	117.0	01	6.5
13.	Streblus asper Lour.	Ruối	5.5	45.5	01	3.0
14.	Streblus asper Lour.	Ruối	6.0	49.5	01	3.0
15.	Streblus asper Lour.	Ruối	9.0	133.0	01	6.0
16.	Sacara dives Pierre	Vàng anh	6.0	67	01	5.5

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Acacia sp.			9	
2	Harrisonia perforata (Blumea) Merr.	Hải sơn		4	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Alpinia sp.	Riềng núi		13 clusters	
2.	Piper sp.	Tiêu dại		11	
3.	Pothos sp.	Ráy leo		6	
4.	Ferns				3-4 individuals/m^2
5.	Grass				6-8 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	< 2	02	
2	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	<2	3	
3	Randia spinosa Blume	Găng	< 2	2	
4	Vitex tripinnata (Lour.) Merr.	Bình linh	<2	4	

(4) Vegetations in Laos side:

The semi-deciduous forest after exploitation, dominant by Lagerstroemia tomentosa Presl and Pterocarpus indicus Willd.

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 08 Side: 20 x 20 m

GPS points (N/E): 19.702667/104.260943999999 19.702667/104.260943999999

Altitude (m): 217

Ecosystem type (coding): Grassland on uncultivated land

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	Diameter (cm)	Counts (total number)	Remark
	Scientific name	Local name				

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Urena lobata L.	Ké hoa đào	< 1	15	
2	Cassia tora L.	Muồng	< 1	12	
3	Abutilon indicum (L.) Sweet	Cối xay	< 1	17	
4	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	< 1.5	8	
5	Cipadessa baccifera (Roxb.) Miq.	Cà muối	< 1	3	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Eupatorium odoratum L.	Cỏ lào	< 1	8-10 stems/m^2	
2.	Ferns				
3.	Grass				

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			

1	Streblus ilicifolius (Vidal) Corner	Ruối ô rô	< 1	6	
2	Clausena excavata Burm. f.	Hổng bì dại	1-1.5	3	
3	Trema orientalis (L.) Blume	Hu	< 2	4	
4	Rinorea virgata (Thw.) Kuntze	Tam giác xa	< 1	5	

(4) Vegetations in Laos side:
The semi-deciduous forest after exploitation

PLANT SURVEY FIELD FORM

1. Woody vegetation (forest/shrub):
Lead surveyor: NGUYEN THE CUONG
Other surveyor: TRINH XUAN THANH
Date: March, 2017
Location:
Site name: Village: District:Kỳ Sơn
Plot No.: 09 Side: 20 x 20 m
GPS points (N/E): 19.695778/104.274861 Altitude (m): 205
Ecosystem type (coding): Grassland on uncultivated land after 1-2 years
Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	Diameter (cm)	Counts (total number)	Remark
	Scientific name	Local name				
5						

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Urena lobata L.	Ké hoa đào	< 1	1-2 stems/m^2	
2	Cassia tora L.	Muồng	< 1	1-2 stems/m^2	

2. Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Eupatorium odoratum L.	Cỏ lào	< 1	9-10 stems/m^2	
2	Colocasia macrorhiza (L.) G. Don	Ráy	< 1	1-2 stems/m^2	
3	Ferns				
4	Grass				

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Melia azedarach L.	Xoan	2-3	31	

(4) Vegetations in Laos side:
The secondary forest after exploitation and cultivated land

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 10 Side: 20 x 20 m

GPS points (N/E): 19.6932499999999/104.309528 Altitude (m): 217 m

Ecosystem type (coding): The semi-deciduous forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Artocarpus rigidus Blume	Mít rừng	12.0	64.0	01	6.5
2.	Dracuntomelon duperreanum Pierre	Sấu	28.0	271.0	01	12.0
3.	Knema conferta Warb.	Máu chó	7.5	51.0	01	3.5
4.	Pterocarpus indicus Willd.	Đinh hương	10.5	155.0	01	8.5
5.	Artocarpus rigidus Blume	Mít rừng	25.0	260.0	01	15.0
6.	Endospermum chinense Benth.	Vạng trứng	30.0	280.0	01	15.0
7.	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	5.5	25.0	01	3.5
8.	Pterocarpus indicus Willd.	Đinh hương	20.0	113.0	01	8.0
9.	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	25.0	210.0	01	15
10.	Celtis sinensis Person	Sếu	15.0	103.5	01	8.0
11.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	7.5	103.5	01	8.0
12.	Mangifera indica L.	Xoài	8.0	65.5	01	5.0

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
	Acacia sp.			11	
	Croton sp.			3	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Piper sp.	Tiêu dại		5	
2.	Pothos sp.	Ráy leo		3	
3.	Ferns				2-3 individuals/m^2
4.	Grass				2-3 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	< 2	26	
2	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	<2	7	
3	Streblus asper Lour.	Ruối	< 2	6	
4	Vitex tripinnata (Lour.) Merr.	Bình linh	<2	9	

(4) Vegetations in Laos side:

The mixed broadleaf and bamboo forest

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 11 Side: 20 x 20 m

GPS points (N/E): 19.6794219999999/104.320912 Altitude (m): 218 m

Ecosystem type (coding): The mixed broadleaf and bamboo forest

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Streblus asper Lour.	Ruối	7.0	35.0	01	4.5
2.	Pterocarpus indicus Willd.	Đinh hương	25.0	120.5	01	8.5
3.	Spondias lakoensis Pierre	Dâu gia xoan	20.0	132.0	01	10.5
4.	Macaranga denticulata (Blume) Muell.-Arg.	Lá nến	8.0	41.5	01	4.5
5.	Cordia grandis Roxb.	Tâm mộc	5.5	46.0	01	5.5
6.	Celtis sinensis Person	Sếu	20.0	107.0	01	7.5
7.	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	6.0-7.5		8 clusters	50-60 stems/cluster

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Caryota mitis Lour.	Đùng đình		6	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
2	Musa coccinea Andr.	Chuối rừng		11	
3	Ferns				5-7 individuals/m^2
4	Grass				5-6 individuals/m^2

(3) **Regeneration of trees:** NONE
(4) Vegetations in Laos side:

The mixed broadleaf and bamboo forest

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 12 Side: 20 x 20 m

GPS points (N/E): 19.6552709999999/104.32579 Altitude (m): 191 m

Ecosystem type (coding): The evergreen forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1	Celtis philippense Blanco	Sếu	17.0	96.0	01	6.0
2	Machilus odoratissimus Nees	Kháo	12.0	72.5	01	4.5
3	Machilus odoratissimus Nees	Kháo	6.0	56.0	01	3.0
4	Machilus odoratissimus Nees	Kháo	6.5	47.0	01	03
5	Mallotus hookerianus Muell.-Arg.	Bụp hooker	10.0	61.0	01	6.0
6	Machilus odoratissimus Nees	Kháo	9.5	56.0	01	5.5
7	Streblus asper Lour.	Ruối	8.0	72.0	01	6.0
8	Celtis philippense Blanco	Sếu	25.0	243.0	01	12.0
9	Celtis philippense Blanco	Sếu	27.0	241.0	01	12.5
10	Pterocarpus indicus Willd.	Đinh hương	15.0	86.0	01	6.0

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Leea indica (Burm. f.) Merr.	Gối hạc	1-2	6	
4	Acacia sp.	Sống rắn		7	
5	Quisqualis indica L.	Sử quân tử		2	

(2) **Non-woody vegetation**

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
2	Pothos	Ráy leo		5	
3	Tetrastigma sp.	Tứ thư		3	
6	Ferns				5-6 individuals/m^2

7	Grass				4-5 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
8	Sterculia lanceolata Cav.	Sảng	< 2.0	13	
9	Mallotus hookerianus Muell.-Arg.	Bụp	< 2.0	17	
10	Celtis philippense Blanco	Sếu	< 2.0	9	
11	Ficus sp.	Sung	< 2.0	4	
12	Diospiros sp.	Thị rừng	< 2.0	3	
13	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	< 2.0	9	
14	Eurya sp.	Chè rừng	< 2.0	8	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location: Dam site

Site name: Village: District: Ky Son

Plot No.: 13 Side: 20 x 20 m

GPS points (N/E): /19.6532349999999104.324059 Altitude (m):

Ecosystem type (coding): The evergreen forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Streblus asper Lour.	Ruối	8.5	75	01	6.5
2.	Celtis philippense Blanco	Sếu	12	88	01	6
3.	Celtis philippense Blanco	Sếu	25	235	01	12
4.	Machilus odoratissimus Nees	Kháo	7	49	01	05
5.	Mallotus hookerianus Muell.-Arg.	Bụp hooker	12	77	01	5.5
6.	Celtis philippense Blanco	Sếu	20	95	01	6,0
7.	Mallotus hookerianus Muell.-Arg.	Bụp hooker	9	57	01	4.5
8.	Celtis philippense Blanco	Sếu	25	247	01	9
9.	Celtis philippense Blanco	Sếu	25	235	01	9

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Acacia sp.	Sống rắn		12	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Pothos	Ráy leo		9	
2	Tetrastigma sp.	Tứ thư		2	
3	Ferns				3-4 individuals/m^2
4	Grass				4-5 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Sumbabiopsis macrophylla Muell.-Arg.	Nàng nàng	< 2.5	5	
2	Mallotus hookerianus Muell.-Arg.	Bụp	< 2.5	4	
3	Celtis philippense Blanco	Sếu	< 2.5	7	
4	Ficus sp.	Sung	< 2.0	5	
5	Machilus odoratissimus Nees	Kháo	< 2.0	6	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: My Ly District: Ky Son

Plot No.: 14 Side: 20 x 20 m

GPS points (N/E): 19.6525789999999/104.325303 Altitude (m):

Ecosystem type (coding): Secondary forest on uncultivated land for 7-10 years

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	5.5	32	01	3
2.	Macaranga denticulata (Blume) Muell.-Arg.	Lá nến	5	28	01	3.5
3.	Lagerstroemia tomentosa Presl	Săng lẻ	5	42	01	3
4.	Cordia grandis Roxb.	Tâm mộc	4.5	27	01	2,5
5.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	6	31	01	3
6.	Toxicodendron succedana (L.) Mold.	Sơn ta	6.5	44	01	3
7.	Streblus asper Lour.	Ruối	5	55	02	3.5
8.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	4	34	01	4
9.	Toxicodendron succedana (L.) Mold.	Sơn ta	9.5	67	01	4.5

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	5-7	9 clusters	18-20 stems/cluster
2	Licuala spinosa Wurm.	Lá nón	1-1.5	4 clusters	4-6 stems/cluster

(2) Non-woody vegetation (forest/shrub)

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Ferns				3-4 individuals/m^2

2.	Grass				6-8 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Streblus asper Lour.	Găng	<2	12	
2	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	<2	5	
3	Toxicodendron succedana (L.) Mold.	Sơn ta	<2	3	
4	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	<2	5	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 15 Side: 20 x 20 m

GPS points (N/E): 104.321556/19.649889 Altitude (m): 198 m

Ecosystem type (coding): Secondary forest on uncultivated land for 10-15 years

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Streblus asper Lour.	Ruối	7.5	62	01	3.2
2.	Streblus asper Lour.	Ruối	4.5	62	02	3.0
3.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	6.0	37.5	01	4.0
4.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	7.0	39	01	6.0
5.	Toxicodendron succedana (L.) Mold.	Sơn ta	13.5	86.5	01	6.5
6.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	14.0	91.5	01	6.5
7.	Streblus asper Lour.	Ruối	6.0	82.0	01	4.5
8.	Lagerstroemia tomentosa Presl	Săng lẻ	16.0	89.0	01	6.0
9.	Ormosia pinnata (Lour.) Merr.	Ràng ràng	12.0	67.0	01	4.5
10.	Toxicodendron succedana (L.) Mold.	Sơn ta	13.0	85.0	01	6.0

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	4-5	13 clusters	15-20 stems/cluster
	Licuala spinosa Wurm.	Lá nón	1-1.5	03 clusters	4-6 stems/cluster

(2) Non-woody vegetation

No	Species	Height	Counts	Remark

	Scientific name	Local name	(m)	(total number)	
1.	Ferns				5-7 individuals/m^2
2.	Poaceae				6-8 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Canthium horridum Blume	Găng	1.5	02	
2	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	1-2	04	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):
Lead surveyor: NGUYEN THE CUONG
Other surveyor: TRINH XUAN THANH
Date: March, 2017
Location: near items No.7 andNo. 8
Site name: Village: District: Ky Son
Plot No.: 16 Side: 20 x 20 m
GPS points (N/E): 19.649063/104.31968 Altitude (m):
Ecosystem type (coding): Secondary forest on uncultivated land for 10-15 years
Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1.	Macaranga denticulata (Blume) Muell.-Arg.	Lá nến	6.5	33	01	4.5
2.	Cordia grandis Roxb.	Tâm mộc	5.5	33	01	5
3.	Streblus asper Lour.	Ruối	4.5	62	02	3.5
4.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	6	32	01	4
5.	Toxicodendron succedana (L.) Mold.	Sơn ta	9.5	67	01	4.5
6.	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	9.5	77	01	6
7.	Lagerstroemia tomentosa Presl	Săng lẻ	10	60	01	5.0
8.	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	7	39	01	6.0
9.	Ormosia pinnata (Lour.) Merr.	Ràng ràng	8	58	01	4.5
10.	Toxicodendron succedana (L.) Mold.	Sơn ta	6	47	01	3.5

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
	Schizostachyum dullooa (Gamble) R. B. Majumdar	Nứa	5-7	6 clusters	15-20 stems/cluster
	Licuala spinosa Wurm.	Lá nón	1-1.5	06 clusters	4-6 stems/cluster

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Ferns				3-4 individuals/m^2
2.	Grass				6-8 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Streblus asper Lour.	Găng	<2	7	
2	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	<2	4	
3	Toxicodendron succedana (L.) Mold.	Sơn ta	<2	1	
4	Cratoxylum formosum (Jack.) Benth. et Hook. f. ex Dyer	Đỏ ngọn	<2	3	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 17 Side: 20 x 20 m

GPS points (N/E): 19.641383/104.31779 Altitude (m): 184 m

Ecosystem type (coding): The evergreen forest after exploitation

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter (m)
	Scientific name	Local name				
1	Streblus asper Lour.	Ruối	8.5	42.0	01	3.5
2	Celtis philippense Blanco	Sếu	22.0	141.0	01	8.0
3	Streblus asper Lour.	Ruối	15.0	80.0	01	6.0
4	Streblus asper Lour.	Ruối	13.0	76.0	01	6.0
5	Streblus asper Lour.	Ruối	13.0	72.0	01	6.5
6	Celtis philippense Blanco	Sếu	25.0	72.0	01	10.5
7	Xylopia vielana Pierre ex Fin. & Gagnep	Giền đỏ	6.0	25.0	03	3.0
8	Glycomis pentaphylla Retz.	Cơm rượu	8.0	41.0	02	4.5
9	Pterospermum truncatolobatum Gagnep.	Mang cụt	4.0	23.0	01	2.5
10	Aphanamixis polystachya (Wlall.) R. N. Parker	Gội nước	25.0	186.0	01	10
11	Celtis philippense Blanco	Sếu	20.0	117.0	03	8.0
12	Archidendron lucidum (Benth.) I. Niels.	Mán đỉa trâu	5.5	24.0	01	4.0

Shrubs:

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Ardisia sp.	Cơm nguội	<1,5	13	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			

1.	Colocasia macrorhiza (L.) G. Don	Ráy		5	
2.	Ferns				1-2 individuals/m^2
3.	Grass				3-4 individuals/m^2

(3) Regeneration of trees

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Celtis philippense Blanco	Sếu	< 2,0	4	
2	Pterospermum truncatolobatum Gagnep.	Mang cụt	< 2,0	6	
3	Dimocarpus fumatus (Blume) Leenh.	Nhãn rừng	< 2,0	7	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location:

Site name: Village: District: Ky Son

Plot No.: 18 Side: 20 x 20 m

GPS points (N/E): 19.6402779999999/104.315749999999 Altitude (m): 253

Ecosystem type (coding): Secondary forest on uncultivated land for 10-15 years

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter
	Scientific name	Local name				
1.	Lagerstroemia tomentosa Presl	Săng lẻ	6	93.0	01	3.5
2.	Milletia sp.		5.5	27.5	03	2.0
3.	Albizia lucidior (Steud.) I. Niels.	Bản xe	9.0	82.0	01	7.0
4.	Machilus odoratissimus Nees	Kháo	8.0	81.5	02	6.0
5.	Grewia asiatica L.	Cò ke	6.0	26.0	01	3.5
6.	Engelhardtia roxburghiana Wall.	Chẹo	12.5	140.0	01	6.0

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Acacia sp.			11	
2	Harrisonia perforata (Blumea) Merr.	Hải sơn		3	
3	Desmos chinensis Lour.		<2.0	13	
4	Helicteres hirsuta Lour.		< 2.0	20	
5	Bauhinia sp.		2.5	07	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Lygodium sp.	Bòng bong		13	
2.	Tinospora crispa (L.) Miers	Dây cóc		3	
3.	Ferns				
4.	Grass				

(3) Regeneration of trees:

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Bauhinia sp.		2.5	07	
2	Canthium sp.		2.5	07	
3	Streblus asper Lour.	Ruối	< 2.5	21	
4	Rinorea virgata (Thw.) Kuntze		<1.5	06	
5	Micromelum minutum (Forst. f.) Wight & Arn.		<1.5	21	

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location: Near by site of items No.10

Site name: Village: District: Ky Son

Plot No.: 19 Side: 20 x 20 m

GPS points (N/E): 19.63523/104.317391 Altitude (m):

Ecosystem type (coding): Cultivated land

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	Diameter (cm)	Counts (total number)	Canopy diameter
	Scientific name	Local name				
1.	Melia azedarach L.	Xoan	9	60	1	7.5
2.	Melia azedarach L.	Xoan	10	55	1	7
3.	Melia azedarach L.	Xoan	9.5	52	1	5.0
4.	Melia azedarach L.	Xoan	11	63	1	6.5
5.	Melia azedarach L.	Xoan	11	55	1	6

Shrubs: None

(2) **Non-woody vegetation**

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Ananas comomus (L.) Merr.	Dứa			2 clusters/m2
2.	Musa paradisiaca	Chuối		4	
3.	Eupatorium odoratum L.	Cỏ lào			4-5 plants/m2

(3) Regeneration of trees: None

PLANT SURVEY FIELD FORM

(1) Woody vegetation (forest/shrub):

Lead surveyor: NGUYEN THE CUONG

Other surveyor: TRINH XUAN THANH

Date: March, 2017

Location: near site of items No. 30

Site name: Village: District: Ky Son

Plot No.: 20 Side: 20 x 20 m

GPS points (N/E): 19.626089/104.315371 Altitude (m):

Ecosystem type (coding): Secondary forest on uncultivated land for 10-15 years

Overall conditions of forest (encircle the suitable option):

No	Species		Height (m)	DBH (cm)	Counts (total number)	Canopy diameter
	Scientific name	Local name				
1.	Lagerstroemia tomentosa Presl	Săng lẻ	8	102	01	5.5
2.	Engelhardtia roxburghiana Wall.	Chẹo	8	112	01	6
3.	Machilus odoratissimus Nees	Kháo	6	67	01	4
4.	Machilus odoratissimus Nees	Kháo	7.5	69	01	4.5
5.	Grewia asiatica L.	Cò ke	7	42	01	4.5
6.	Engelhardtia roxburghiana Wall.	Chẹo	14	143	01	6
7.	Albizia lucidior (Steud.) I. Niels.	Bản xe	7	71	01	5.5

Shrubs

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1	Acacia sp.			7	
2	Harrisonia perforata (Blumea) Merr.	Hải sơn		5	
3	Helicteres hirsuta Lour.		< 2	13	
	Desmos chinensis Lour.		<2	7	

(2) Non-woody vegetation

No	Species		Height (m)	Counts (total number)	Remark
	Scientific name	Local name			
1.	Lygodium spp.	Bòng bong		21	
2.	Ferns				3-4 stems/m^2

3.	Grass				5-6 stems/m^2

(3) Regeneration of trees:

No	Species	Local name	Height (m)	Counts (total number)	Remark
1.	Streblus asper Lour.	Ruối	< 2.5	5	
2.	Helicteres hirsuta Lour.		< 2	13	
3.	Rinorea virgata (Thw.) Kuntze		<3	3	
4.	Micromelum minutum (Forst. f.) Wight & Arn.		<3	7	
5.	Canthium sp.		<3	04	

2.3 Specialist Report on Water Quality

EVN PECC1

POWER ENGINEERING CONSULTING

JOINT-STOCK COMPANY 1

Project:

MY LY HYDROPOWER PROJECT

FEASIBILITY STUDY

RESULTS OF SURFACE WATER SAMPLING

FOR PREPARING ESIA REPORT OF MY LY - NAM MO 1 HPPs IN VIETNAM AND LAOS

VIETNAM ELECTRICITY
POWER ENGINEERING CONSULTING
JS COMPANY 1
FOR AND ON BEHALF OF GENERAL DIRECTOR
DEPUTY GENERAL DIRECTOR

M.S.D.N: 0100100953 - C.T.C.P
CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG ĐIỆN 1
Q. THANH XUÂN - T.P HÀ NỘI

Pham Nguyen Hung

VIETNAM INSTITUTE OF INDUSTRIAL CHEMISTRY
DIRECTOR OF ANALYSING CENTER

Nguyen Doan Huy

Hanoi, March 2017

TABLE OF CONTENT

List of table

LIST OF PARTICIPANT

Person in charge: MBA. Nguyen Doan Huy, Director of laboratory - Vietnam Institute of Industrial Chemistry

List of out-door team:

1. Nguyen Doan Huy Vietnam Institute of Industrial Chemistry
2. Cao Van Nam Vietnam Institute of Industrial Chemistry
3. Pham Thanh Hien Vietnam Institute of Industrial Chemistry

List of in-door team:

4. Nguyen Thu Hien Vietnam Institute of Industrial Chemistry
5. Nguyen Thanh Binh Vietnam Institute of Industrial Chemistry
6. Nguyen Thi Cuc Vietnam Institute of Industrial Chemistry
7. Pham Thi Thu Hoai Vietnam Institute of Industrial Chemistry
8. Nguyen Thi Thuy Vietnam Institute of Industrial Chemistry
9. Tran Thi Hong Hien Vietnam Institute of Industrial Chemistry
10. Nguyen Thi Thu Van Vietnam Institute of Industrial Chemistry
11. Ngo Thi Tuyen Yen Vietnam Institute of Industrial Chemistry
12. Trinh Thi Nhu Vietnam Institute of Industrial Chemistry
13. Dam Thuy Hang Vietnam Institute of Industrial Chemistry

CHAPTER I. FOREWORD

I.1. Legal background

Environmental monitoring is done on the basis of law on environment, including:

Environmental protection law dated 23/6/2014;

Decree No. 18/2015/ND-CP dated 14/02/2015 regulating in detail how to implement some provision of Environmental protection law.

Contract No. 371/VHH-PT signed on 29/12/2016 between Power Engineering Consulting Joint Stock Company 1 (Party A) and Vietnam Institute of Industrial Chemistry (party B);

Decision No. 1271/QĐ-BTNMT dated 28/5/2015 by Ministry of Natural Resources and Environment certifying conditions for performing environmental monitoring services to Vietnam Institute of Industrial Chemistry, Chemistry of Vietnam.

I.2. Summary on client

1. **Company**: Power Engineering Consulting Joint Stock Company 1 (PECC1)

2. **Address**: Km 9+200, Nguyen Trai Road, Thanh Xuan Nam ward, Thanh Xuan district, Ha Noi city, Vietnam.

I.3. Summary on contractor

Agency: Vietnam Institute of Industrial Chemistry

Address: No.2 Pham Ngu Lao street, Phan Chu Trinh ward, Hoan Kiem district, Ha Noi city of Vietnam.

Decision of establishment: No. 232/QĐ-CNNg-TCNS dated 10/7/1990 by Heavy industry ministry (now is Ministry of Industry and Trade)

Register Number: A-695 dated 07/01/2008 (renew)

Account number: 115000001386 at Joint Stock Bank of Industry and Commercial of Vietnam, Ha Noi branch.

Enterprise code/tax code: 0100101121

BỘ TÀI NGUYÊN VÀ MÔI TRƯỜNG

CHỨNG NHẬN

ĐỦ ĐIỀU KIỆN HOẠT ĐỘNG DỊCH VỤ QUAN TRẮC MÔI TRƯỜNG

Số hiệu: VIMCERTS 087

Tên tổ chức:

Viện Hóa học Công nghiệp Việt Nam,
Tập đoàn Hóa chất Việt Nam

Trụ sở chính:

Số 2 Phạm Ngũ Lão, quận Hoàn Kiếm, Thành phố Hà Nội

Quyết định số: 1271 /QĐ-BTNMT ngày 28 tháng 5 năm 2015 của Bộ trưởng Bộ Tài nguyên và Môi trường về việc chứng nhận đủ điều kiện hoạt động dịch vụ quan trắc môi trường.

Người đứng đầu tổ chức:

Họ và tên: Hoàng Văn Hoan Chức vụ: Viện trưởng

CMND số: 010566192 do Công an Thành phố Hà Nội

Cấp ngày 28 tháng 3 năm 2007

Thời hạn của Giấy chứng nhận: 03 năm

Từ ngày 28 tháng 5 năm 2015

Đến ngày 27 tháng 5 năm 2018

LĨNH VỰC VÀ PHẠM VI ĐƯỢC CẤP GIẤY CHỨNG NHẬN

I. QUAN TRẮC HIỆN TRƯỜNG

1. Nước:		
- Nước mặt	☒	Số thông số: 06
- Nước thải	☒	Số thông số: 04
- Nước dưới đất	☒	Số thông số: 06
- Nước biển	☒	Số thông số: 07
- Nước mưa	☒	Số thông số: 04
2. Khí:		
- Không khí xung quanh và môi trường lao động	☒	Số thông số: 14
3. Đất:	☒	Số thông số: 01
4. Trầm tích:	☒	Số thông số: 01
5. Chất thải:	☒	Số thông số: 01

II. PHÂN TÍCH MÔI TRƯỜNG

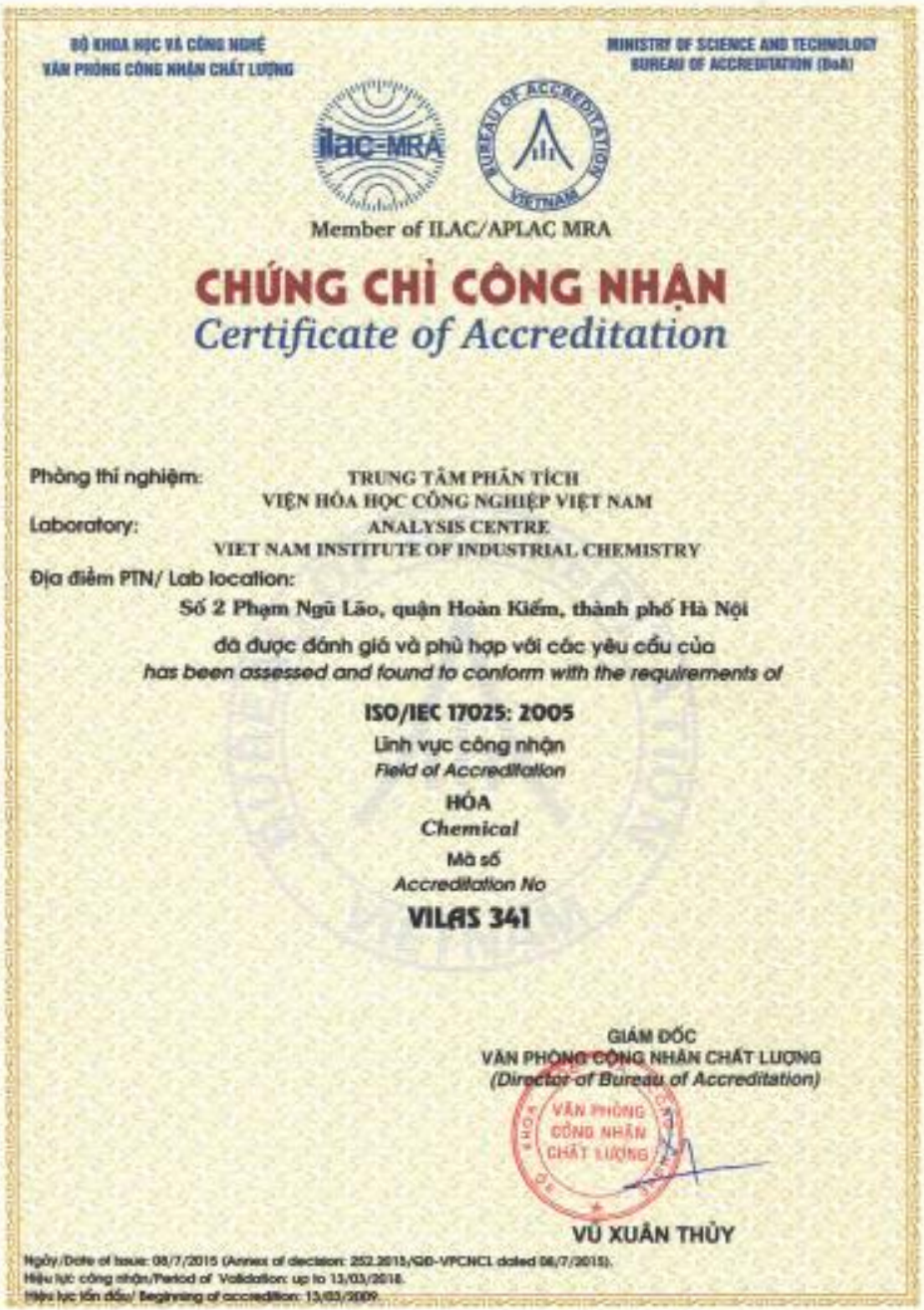
1. Nước:		
- Nước mặt	☒	Số thông số: 32
- Nước thải	☒	Số thông số: 28
- Nước dưới đất	☒	Số thông số: 31
- Nước biển	☒	Số thông số: 22
- Nước mưa	☒	Số thông số: 11
2. Khí:		
- Không khí xung quanh và môi trường lao động	☒	Số thông số: 08
3. Đất:	☒	Số thông số: 16
4. Trầm tích:	☒	Số thông số: 07
5. Chất thải:	☒	Số thông số: 10

(Chi tiết phương pháp thử, giới hạn phát hiện của các Thông số được chứng nhận kèm theo Quyết định số: 1271 /QĐ-BTNMT của Bộ trưởng Bộ Tài nguyên và Môi trường).

Hà Nội, ngày 28 tháng 5 năm 2015

KT. BỘ TRƯỞNG
THỨ TRƯỞNG

Bùi Cách Tuyến



BỘ KHOA HỌC VÀ CÔNG NGHỆ
VĂN PHÒNG CÔNG NHẬN CHẤT LƯỢNG

MINISTRY OF SCIENCE AND TECHNOLOGY
BUREAU OF ACCREDITATION (BoA)

Member of ILAC/APLAC MRA

CHỨNG CHỈ CÔNG NHẬN
Certificate of Accreditation

Phòng thí nghiệm: TRUNG TÂM PHÂN TÍCH
VIỆN HÓA HỌC CÔNG NGHIỆP VIỆT NAM
Laboratory: ANALYSIS CENTRE
VIET NAM INSTITUTE OF INDUSTRIAL CHEMISTRY

Địa điểm PTN/ Lab location:
Số 2 Phạm Ngũ Lão, quận Hoàn Kiếm, thành phố Hà Nội

đã được đánh giá và phù hợp với các yêu cầu của
has been assessed and found to conform with the requirements of

ISO/IEC 17025: 2005

Lĩnh vực công nhận
Field of Accreditation
HÓA
Chemical

Mã số
Accreditation No
VILAS 341

GIÁM ĐỐC
VĂN PHÒNG CÔNG NHẬN CHẤT LƯỢNG
(Director of Bureau of Accreditation)

VĂN PHÒNG CÔNG NHẬN CHẤT LƯỢNG

VŨ XUÂN THỦY

Ngày/Date of issue: 08/7/2015 (Annex of decision: 252.2015/QĐ-VPCNCL dated 08/7/2015).
Hiệu lực công nhận/Period of Validation: up to 13/03/2018.
Hiệu lực lần đầu/ Beginning of accredition: 13/03/2009.

CHAPTER II: SUMMARY ON MONITORING PROGRAM

II.1. General on monitoring locations

II.1.1. Scope of work

The monitoring, sampling water surface sample for preparation of ESIA report of My Ly – Nam Mo 1 HPP under WB/IFC standard was done under contract No. 371/VHH-PT dated 29/12/2016 signed between PECC1 and Vietnam Institute of Industrial Chemistry.

II.1.2. Type of monitoring

This is monitoring, sampling program for surface water environment to be done at 5 locations downstream of population areas along Ca river (Nam Non river) starting from Phiangxang village in Kouan district, Lao PDR, the most upstream location, to Yen Hoa village in My Ly commune, Ky Son district, Nghe An province of Vietnam, the ending location downstream of the project damsite.

II.1.3. Project location

My Ly Hydropower Project (My Ly HPP) is located on main course of Ca river/Nam Non river, in territories of SR Vietnam and Lao PDR. Main civil works of My Ly HPP is located in My Ly commune, Ky Son district, Nghe An province of Vietnam, some of 50km North West of Muong Xen town. Reservoir component will be formed on a narrow river section where two banks are steep. The river bed sloping is high and existing with many waterfall, water step which cause trouble and difficulties to navigation, in territories of My Ly, Keng Du communes of Ky Son district, Nghe An province (Vietnam), and Kouan district, Huaphan province, Lao PDR.

Co-ordinates of the designed damsite is 19º39’10,2” North latitude, 104º19’27,3” East longitude, by co-ordinates system VN2000, the dam axis Đ1 (X= 2173953.287m; Y=454973.513m) and Đ2 (X=2173814.790m; Y=455390.772m).

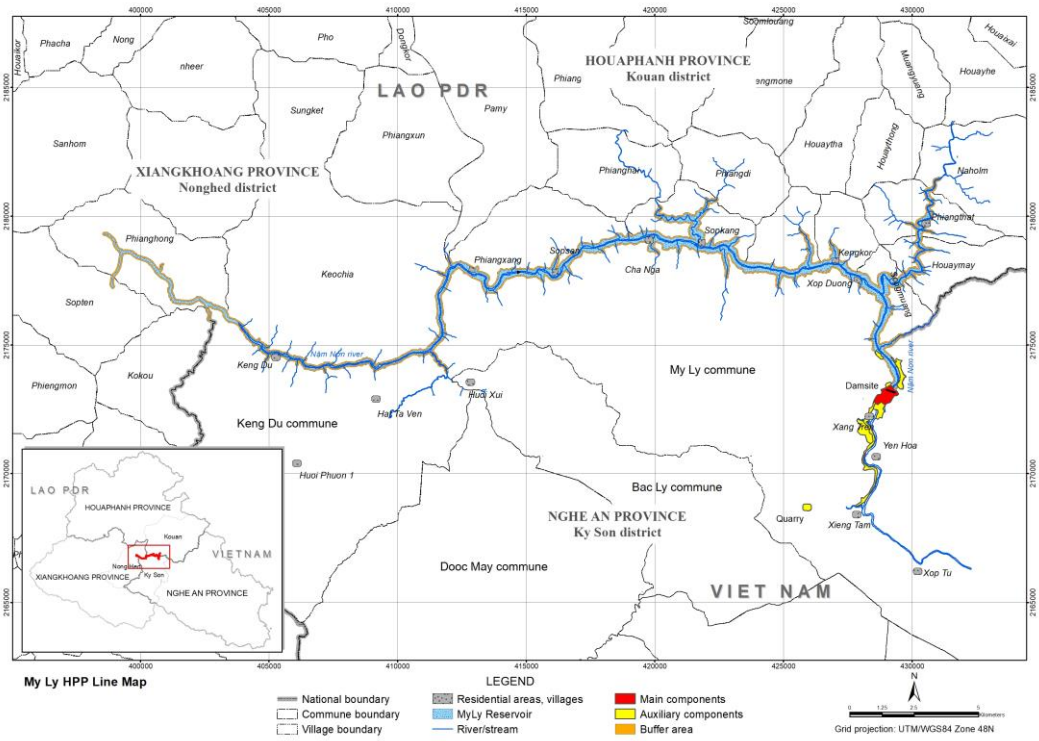
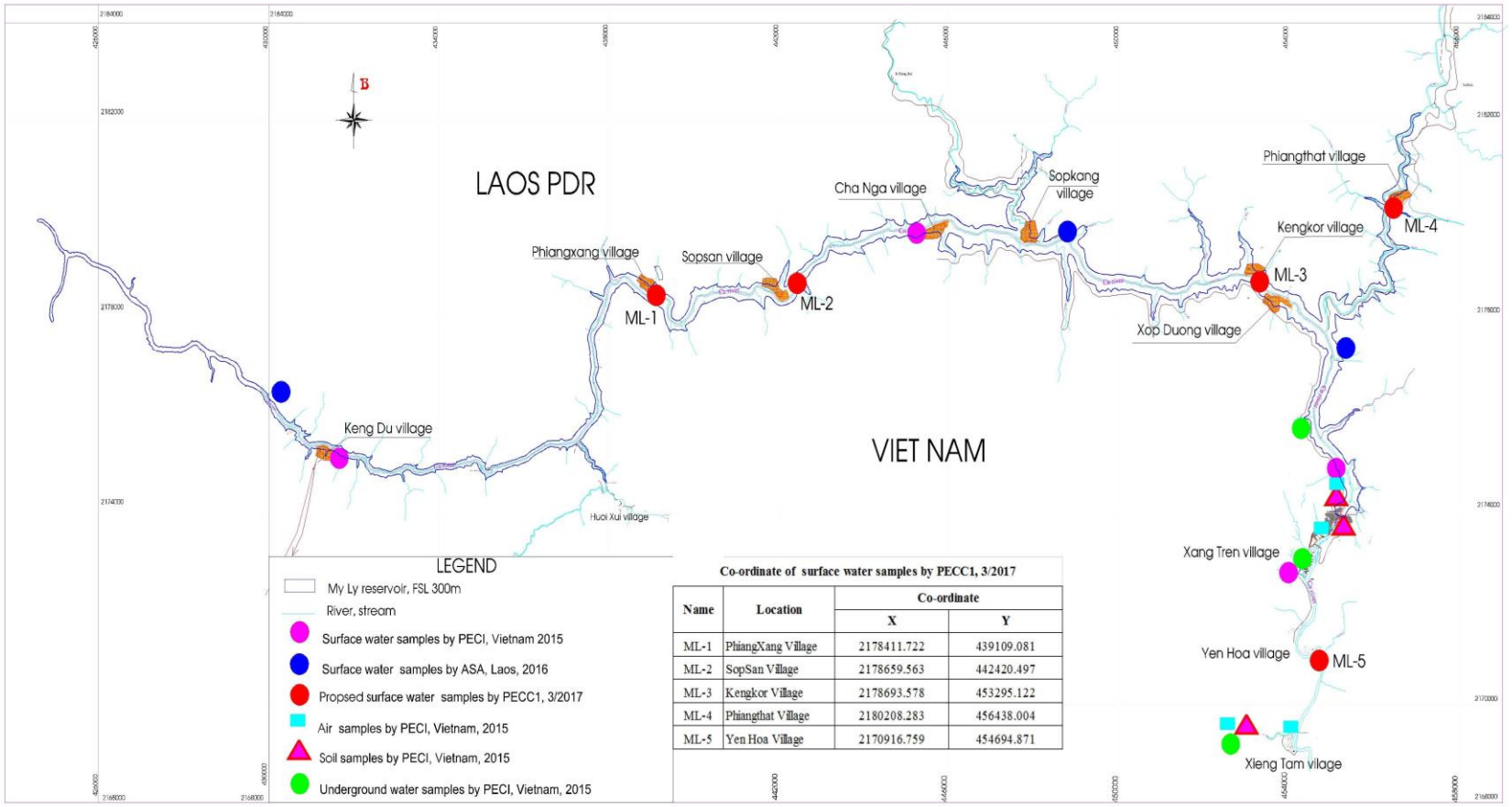


Figure 1: Location map of My Ly HPP

Location of investigation, sampling is shown in the below figure:



Co-ordinate of surface water samples by PECC1, 3/2017

Name	Location	Co-ordinate	
		X	Y
ML-1	PhiangXang Village	2178411.722	439109.081
ML-2	SopSan Village	2178659.563	442420.497
ML-3	Kengkor Village	2178693.578	453295.122
ML-4	Phiangthat Village	2180208.283	456438.004
ML-5	Yen Hoa Village	2170916.759	454694.871

II.2. List of monitoring parameters

Table 1. List of monitoring component and indicators

No.	Monitoring location	Monitored parameter
	05 locations - Water surface sample at Phiangsang village, Kouan district, Lao PDR - Water surface sample at Sopsan village, Kouan district, Lao PDR - Water surface sample at Kengkor village, Kouan district, Lao PDR - Water surface sample at Phiangthat village, Kouan district, Lao PDR - Water surface sample at Yen Hoa village, My Ly commune, Ky Son district Nghe An province, Vietnam	20 indicators: pH, BOD_5, COD, dissolved oxygen, total suspended solid, Ammonite, Chloride, Fluoride, Nitrite, Nitrate, Phosphate, Xyanua, Arsenic, zinc, Mangan, mercury, iron, total oil, grease, Coliform, E.coli.

II.3. List of monitoring apparatus and Lab equipment

Table 2. Monitoring apparatus and lab equipment

No.	List of equipment	Code	Made in	Inspection	Calibration	Calibration by
1	Taking water sample by incline method		Vietnam			
2	Measure multi-properties of water	P/N 5465000	HACH		Before using	The Lab
3	Rod to take water sample	-	Vietnam			
4	Wire to take water sample	-	Vietnam			
5	Sample keeping box	-	Vietnam			
6	Analysis weight 5 numbers	OHUAS	USA		once a year	TTQT
7	Analysis weight 4 numbers	Satorius-TE214S	Germany		once a year	TTQT
8	Technical weight	JY	China	When using		
9	Nuclear absorber at heater regime, graphite burner, FIAS unit, radiation	Perkin elmer AA 800	USA	When using	once a year	Perkinelmer
10	Molecule spectrum absorber	Agilent 8453	USA		once a year	TTQT
11		LaMotte	USA		once a year	
12	Heater	Ecocell	Germany		once a year	TTQT

No.	List of equipment	Code	Made in	Inspection	Calibration	Calibration by
13	pH measuring apparatus	Hanna	EUROPE	When using	once a year	The Lab
14	Temperature keeping cubicle	FOC-VELP	Italia	Before using	once a year	TTQT
15	Sample keeping cubicle	Towashi	Japan			
16	COD distill tools		USSR			
17	DO measuring apparatus	51302954	HACH	Before using		The Lab
18	Vacuum rotational apparatus	SN 10702315	Japan			
19	Double water distilling apparatus	Hamilton	England			
20	Moisture absorber					
21	Glass distil set		Germany			
22	Sample extracting apparatus		Vietnam			

II.4. Methodology of sampling, storing and transporting sample

The monitoring sample is taken under national technical standards which have been issued.

Table 3. Method of taking sample at the site

No.	Parameters	Method of sample taking
I	Sampling	- TCVN 6663-1:2011, Water quality – taking sample – Part 1: Guidance on sample taking technique. - TCVN 666-3:2008, Water quality – Taking sample – Part 3: Guidance on sample storing and treatment. - TCVN 6663-6:2008, Water quality – Taking sample – Part 6: Guidance on sample taking from river and stream.

II.5. List of measurement methods for out-door and in-door works

Table 4. Measurement method in out-door work

No.	Parameters	Method of sample taking
1	pH	TCVN 6492-2011
2	Dissolved oxygen (DO)	TCVN 7325:2004

Table 5. Analysis method in laboratory

No.	Parameters	Standard
1	BOD_5 (20°C)	TCVN 6001-1:2008
2	COD	SMEWW 5220B:2012
3	Total Suspended Solid (TSS)	TCVN 6625:2000
4	Ammonite (NH4+ estimated according to N)	TCVN 6179-1:1996
5	Chloride (Cl^-)	TCVN 6194:1996
6	Fluoride (F^-)	SMEWW 4500B&D:2012
7	Nitrite (NO^{2-} estimated according to N)	TCVN 6178:1996
8	Nitrate (NO^{3-} estimated according to N)	TCVN 6180:1996
9	Phosphate (PO_4^{3-} estimated according to P)	TCVN 6202:2008
10	Xyanua (CN^-)	TCVN 6181:1996
11	Arsenic (As)	ISO 15586:2003
12	Zinc (Zn)	TCVN 6193:1996
13	Mangan (Mn)	TCVN 6002:1995
14	Mercury (Hg)	TCVN 7877:2008
15	Iron (Fe)	TCVN 6177:1996
16	Total oils & grease	SMEWW 5520B:2012
17	Coliform	TCVN 6182-2:1996
18	E.coli	TCVN 6182-2:1996

II.6. Monitoring location

Table 6. List of monitoring locations

No.	Location	Symbol	Co-ordinates of taking sample
1	Water surface sample at Phiangsang village, Kouan district, Lao PDR	ML-1	X = 2178411.722; Y = 439109.081
2	Water surface sample at Sopsan village, Kouan district, Lao PDR	ML-2	X = 2178659.563; Y = 442420.497
3	Water surface sample at Kengkor	ML-3	X = 2178693.578; Y = 453295.122

	village, Kouan district, Lao PDR		
4	Water surface sample at Phiangthat village, Kouan district, Lao PDR	ML-4	X = 2180208.283; Y = 456438.004
5	Water surface sample at Yen Hoa village, My Ly commune, Ky Son district Nghe An province, Vietnam	ML-5	X = 2170916.759; Y = 454694.871

II.7. Weather condition when taking sample

Samples were taken under good weather condition, cloudy, no rain.

CHAPTER III. COMMENTS ON MONITORING RESULTS

Table 7. Results gained from monitoring water surface samples

No.	Indicators	Unit	Results and analysis					Max. allowable limit (*)
			ML1	ML2	ML3	ML4	ML5	
1	pH	mg/l	6.86	6.89	6.76	7.52	7.57	6 to 8.5
2	BOD_5 (20°C)	mg/l	0.96	0.96	1.16	1.04	0.88	6
3	COD	mg/l	1.42	1.38	1.72	1.41	1.25	15
4	Dissolved oxygen (DO)	mg/l	6.3	6.4	6.0	6.4	6.3	≥ 5
5	Total suspended solid (TSS)	mg/l	18	15	14	14	12	30
6	Ammonite (NH4+ estimated according to N)	mg/l	<0.01	0.03	0.08	0.16	0.11	0.3
7	Chloride (Cl^-)	mg/l	1.62	1.62	1.45	1.62	1.45	350
8	Fluoride (F^-)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	0.04	0.03	0.10	<0.01	<0.01	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2
12	Xyanua (CN^-)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
13	Arsenic (As)	mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.02
14	Zinc (Zn)	mg/l	0.003	0.004	0.006	0.005	0.005	1.0
15	Mangan (Mn)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2
16	Mercury (Hg)	mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.001
17	Iron (Fe)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	1

No.	Indicators	Unit	Results and analysis					Max. allowable limit (*)
			ML1	ML2	ML3	ML4	ML5	
18	Total oils & grease	mg/l	<0.1	<0.1	<0.1	0.2	0.2	0.5
19	Coliform	mg/l	180	210	240	360	420	5000
20	E.coli	mg/l	2	5	4	18	14	50

Notes:

- (*) Maximum allowable limit regulated by National Technical Standard on quality of surface water (QCVN 08-MT:2015/BTNMT)- column A2: applying to surface water resources used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes.
- ML-1: Water surface sample at Phiangsang village, Kouan district, Lao PDR .
- ML-2: Water surface sample at Sopsan village, Kouan district, Lao PDR .
- ML-3: Water surface sample at Kengkor village, Kouan district, Lao PDR
- ML-4: Water surface sample at Phiangthat village, Kouan district, Lao PDR .
- ML-5: Water surface sample at Yen Hoa village, My Ly commune, Ky Son district Nghe An province, Vietnam.

Comments:

Generally, quality of surface water at all monitored locations reflects no sign of pollution beyond corresponding regulation and standard in column A2 in National Standard on water surface QCVN 08-MT:2015/BTNMT, corresponding with quality of surface water used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes. This shows that activities by population along the river section cause unremarkable pollution to surface water quality in corresponding investigated locations.

VIII. CONCLUSIONS

Monitoring results show that quality of surface water environment in investigated locations and in location where samples were took in My Ly HPP territory is good, no sign of pollution.

ANNEX
(Sheets of analyzed results)

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ANALYSIS LABORATORY CENTER
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SHEET OF ANALYZED RESULTS OF WATER SAMPLE

Client : Power Engineering Consulting Joint Stock Company 1 (PECC1)
Project : ESIA for My Ly – Nam Mo 1 HPP
Sample name : Surface water sample at Phiangxang village, Kouan district, Lao PDR
Sample code : ML-1
Sample co-ordinates : X = 2178411.722; Y = 439109.081
Date of sampling : 05/03/2017

No.	Indicator	Unit	Method	Results	Max allowable limit(*)
1	pH		TCVN 6492:2011	6.86	6 to 8.5
2	BOD_5 (20°C)	mg/l	TCVN 6001-1:2008	0.96	6
3	COD	mg/l	SMEWW 5220B:2012	1.42	15
4	Dissolved Oxygen (DO)	mg/l	TCVN 7325:2004	6.3	≥ 5
5	Total Suspended Solid (TSS)	mg/l	TCVN 6625:2000	18	30
6	Ammonite (NH4+ estimated according to N)	mg/l	TCVN 6179-1:1996	<0.01	0.3
7	Chloride (Cl^-)	mg/l	TCVN 6194:1996	1.62	350
8	Fluoride (F^-)	mg/l	SMEWW 4500B&D:2012	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	TCVN 6178:1996	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	TCVN 6180:1996	0.04	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	TCVN 6202:2008	<0.01	0.2
12	Xyanua (CN^-)	mg/l	TCVN 6181:1996	<0.01	0.05
13	Arsenic (As)	mg/l	ISO 15586:2003	<0.0001	0.02
14	Zinc (Zn)	mg/l	TCVN 6193:1996	0.003	1.0

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No.	Indicator	Unit	Method	Results	Max allowable limit(*)
15	Mangan (Mn)	mg/l	TCVN 6002:1995	<0.01	0.2
16	Mercury (Hg)	mg/l	TCVN 7877:2008	<0.0001	0.001
17	Iron (Fe)	mg/l	TCVN 6177:1996	<0.01	1
18	Total oils & grease	mg/l	SMEWW 5520B:2012	<0.1	0.5
19	Coliform	MPN/100ml	TCVN 6182-2:1996	180	5000
20	E.coli	MPN/100ml	TCVN 6182-2:1996	2	50

Notes: Maximum allowable limit regulated by National Technical Standard on quality of surface water (QCVN 08-MT:2015/BTNMT)- column A2: applying to surface water resources used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes..

Ha Noi, March 20th 2017.

Analyzed by **Checked by**

For and on behalf of
Director of Institute
DIRECTOR OF LABORATORY

Nguyen Thi Cuc **MBA. Nguyen Thu Hien** **MBA. Nguyen Doan Huy**

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SHEET OF ANALYZED RESULTS OF WATER SAMPLE

Client : Power Engineering Consulting Joint Stock Company 1 (PECC1)
Project : ESIA for My Ly – Nam Mo 1 HPP
Sample name : Surface water sample at Sop San village, Kouan district, Lao PDR
Sample code : ML-2
Sample co-ordinates : X = 2178659.563; Y = 442420.497
Date of sampling : 05/03/2017

No.	Indicator	Unit	Method	Results	Max allowable limit(*)
1	pH		TCVN 6492:2011	6.89	6 to 8.5
2	BOD_5 (20°C)	mg/l	TCVN 6001-1:2008	0.96	6
3	COD	mg/l	SMEWW 5220B:2012	1.38	15
4	Dissolved Oxygen (DO)	mg/l	TCVN 7325:2004	6.4	≥ 5
5	Total Suspended Solid (TSS)	mg/l	TCVN 6625:2000	15	30
6	Ammonite (NH4+ estimated according to N)	mg/l	TCVN 6179-1:1996	0.03	0.3
7	Chloride (Cl^-)	mg/l	TCVN 6194:1996	1.62	350
8	Fluoride (F^-)	mg/l	SMEWW 4500B&D:2012	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	TCVN 6178:1996	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	TCVN 6180:1996	0.03	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	TCVN 6202:2008	<0.01	0.2
12	Xyanua (CN^-)	mg/l	TCVN 6181:1996	<0.01	0.05
13	Arsenic (As)	mg/l	ISO 15586:2003	<0.0001	0.02
14	Zinc (Zn)	mg/l	TCVN 6193:1996	0.004	1.0

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No.	Indicator	Unit	Method	Results	Max allowable limit(*)
15	Mangan (Mn)	mg/l	TCVN 6002:1995	<0.01	0.2
16	Mercury (Hg)	mg/l	TCVN 7877:2008	<0.0001	0.001
17	Iron (Fe)	mg/l	TCVN 6177:1996	<0.01	1
18	Total oils & grease	mg/l	SMEWW 5520B:2012	<0.1	0.5
19	Coliform	MPN/100ml	TCVN 6182-2:1996	210	5000
20	E.coli	MPN/100ml	TCVN 6182-2:1996	5	50

Notes: Maximum allowable limit regulated by National Technical Standard on quality of surface water (QCVN 08-MT:2015/BTNMT)- column A2: applying to surface water resources used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes..

Ha Noi, March 20th 2017

Analyzed by	Checked by	For and on behalf of Director of Institute **DIRECTOR OF LABORATORY**
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SHEET OF ANALYZED RESULTS OF WATER SAMPLE

Client : Power Engineering Consulting Joint Stock Company 1 (PECC1)
Project : ESIA for My Ly – Nam Mo 1 HPP
Sample name : Surface water sample at Kengkor village, Kouan district, Lao PDR
Sample code : ML-3
Sample co-ordinates : X = 2178693.578; Y = 453295.122
Date of sampling : 06/03/2017

No.	Indicator	Unit	Method	Results	Max allowable limit(*)
1	pH		TCVN 6492:2011	6.76	6 to 8.5
2	BOD_5 (20°C)	mg/l	TCVN 6001-1:2008	1.16	6
3	COD	mg/l	SMEWW 5220B:2012	1.72	15
4	Dissolved Oxygen (DO)	mg/l	TCVN 7325:2004	6.0	≥ 5
5	Total Suspended Solid (TSS)	mg/l	TCVN 6625:2000	14	30
6	Ammonite (NH4+ estimated according to N)	mg/l	TCVN 6179-1:1996	0.08	0.3
7	Chloride (Cl^-)	mg/l	TCVN 6194:1996	1.45	350
8	Fluoride (F^-)	mg/l	SMEWW 4500B&D:2012	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	TCVN 6178:1996	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	TCVN 6180:1996	0.10	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	TCVN 6202:2008	<0.01	0.2
12	Xyanua (CN^-)	mg/l	TCVN 6181:1996	<0.01	0.05
13	Arsenic (As)	mg/l	ISO 15586:2003	<0.0001	0.02
14	Zinc (Zn)	mg/l	TCVN 6193:1996	0.006	1.0

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No.	Indicator	Unit	Method	Results	Max allowable limit(*)
15	Mangan (Mn)	mg/l	TCVN 6002:1995	<0.01	0.2
16	Mercury (Hg)	mg/l	TCVN 7877:2008	<0.0001	0.001
17	Iron (Fe)	mg/l	TCVN 6177:1996	<0.01	1
18	Total oils & grease	mg/l	SMEWW 5520B:2012	<0.1	0.5
19	Coliform	MPN/100ml	TCVN 6182-2:1996	240	5000
20	E.coli	MPN/100ml	TCVN 6182-2:1996	4	50

Notes: Maximum allowable limit regulated by National Technical Standard on quality of surface water (QCVN 08-MT:2015/BTNMT)- column A2: applying to surface water resources used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes..

Ha Noi, March 20th 2017.

Analyzed by **Checked by**

For and on behalf of
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Nguyen Thi Cuc **MBA. Nguyen Thu Hien** **MBA. Nguyen Doan Huy**

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SHEET OF ANALYZED RESULTS OF WATER SAMPLE

Client : Power Engineering Consulting Joint Stock Company 1 (PECC1)
Project : ESIA for My Ly – Nam Mo 1 HPP
Sample name : Surface water sample at Phiangthat village, Kouan district, Lao PDR
Sample code : ML-4
Sample co-ordinates : X = 2180208.283; Y = 456438.004
Date of sampling : 06/03/2017

No.	Indicator	Unit	Method	Results	Max allowable limit(*)
1	pH		TCVN 6492:2011	7.52	6 to 8.5
2	BOD_5 (20°C)	mg/l	TCVN 6001-1:2008	1.04	6
3	COD	mg/l	SMEWW 5220B:2012	1.41	15
4	Dissolved Oxygen (DO)	mg/l	TCVN 7325:2004	6.4	≥ 5
5	Total Suspended Solid (TSS)	mg/l	TCVN 6625:2000	14	30
6	Ammonite (NH4+ estimated according to N)	mg/l	TCVN 6179-1:1996	0.16	0.3
7	Chloride (Cl^-)	mg/l	TCVN 6194:1996	1.62	350
8	Fluoride (F^-)	mg/l	SMEWW 4500B&D:2012	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	TCVN 6178:1996	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	TCVN 6180:1996	<0.01	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	TCVN 6202:2008	<0.01	0.2
12	Xyanua (CN^-)	mg/l	TCVN 6181:1996	<0.01	0.05
13	Arsenic (As)	mg/l	ISO 15586:2003	<0.0001	0.02
14	Zinc (Zn)	mg/l	TCVN 6193:1996	0.005	1.0

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No.	Indicator	Unit	Method	Results	Max allowable limit(*)
15	Mangan (Mn)	mg/l	TCVN 6002:1995	<0.01	0.2
16	Mercury (Hg)	mg/l	TCVN 7877:2008	<0.0001	0.001
17	Iron (Fe)	mg/l	TCVN 6177:1996	<0.01	1
18	Total oils & grease	mg/l	SMEWW 5520B:2012	0.2	0.5
19	Coliform	MPN/100ml	TCVN 6182-2:1996	360	5000
20	E.coli	MPN/100ml	TCVN 6182-2:1996	18	50

Notes: Maximum allowable limit regulated by National Technical Standard on quality of surface water (QCVN 08-MT:2015/BTNMT)- column A2: applying to surface water resources used for domestic water supply purpose but it shall be applied with suitable treatment method, for irrigation, navigation and other similar purposes..

Ha Noi, March 20th 2017.

Analyzed by **Checked by**

For and on behalf of
Director of Institute
DIRECTOR OF LABORATORY

Nguyen Thi Cuc **MBA. Nguyen Thu Hien** **MBA. Nguyen Doan Huy**

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SHEET OF ANALYZED RESULTS OF WATER SAMPLE

Client : Power Engineering Consulting Joint Stock Company 1 (PECC1)
Project : ESIA for My Ly – Nam Mo 1 HPP
Sample name : Surface water sample at Yen Hoa village, My Ly commune, Ky Son district, Nghe An province, SR Viet Nam
Sample code : ML-5
Sample co-ordinates : X = 2170916.759; Y = 454694.871
Date of sampling : 06/03/2017

No.	Indicator	Unit	Method	Results	Max allowable limit(*)
1	pH		TCVN 6492:2011	7.57	6 to 8.5
2	BOD_5 (20°C)	mg/l	TCVN 6001-1:2008	0.88	6
3	COD	mg/l	SMEWW 5220B:2012	1.25	15
4	Dissolved Oxygen (DO)	mg/l	TCVN 7325:2004	6.3	≥ 5
5	Total Suspended Solid (TSS)	mg/l	TCVN 6625:2000	12	30
6	Ammonite (NH4+ estimated according to N)	mg/l	TCVN 6179-1:1996	0.11	0.3
7	Chloride (Cl^-)	mg/l	TCVN 6194:1996	1.45	350
8	Fluoride (F^-)	mg/l	SMEWW 4500B&D:2012	<0.05	1.5
9	Nitrite (NO^{2-} estimated according to N)	mg/l	TCVN 6178:1996	<0.01	0.05
10	Nitrate (NO^{3-} estimated according to N)	mg/l	TCVN 6180:1996	<0.01	5
11	Phosphate (PO_4^{3-} estimated according to P)	mg/l	TCVN 6202:2008	<0.01	0.2
12	Xyanua (CN^-)	mg/l	TCVN 6181:1996	<0.01	0.05
13	Arsenic (As)	mg/l	ISO 15586:2003	<0.0001	0.02
14	Zinc (Zn)	mg/l	TCVN 6193:1996	0.005	1.0

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No.	Indicator	Unit	Method	Results	Max allowable limit(*)
15	Mangan (Mn)	mg/l	TCVN 6002:1995	<0.01	0.2
16	Mercury (Hg)	mg/l	TCVN 7877:2008	<0.0001	0.001
17	Iron (Fe)	mg/l	TCVN 6177:1996	<0.01	1
18	Total oils & grease	mg/l	SMEWW 5520B:2012	0.2	0.5
19	Coliform	MPN/100ml	TCVN 6182-2:1996	420	5000
20	E.coli	MPN/100ml	TCVN 6182-2:1996	14	50

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