

Environmental Monitoring Report

Third Quarterly Report March to May 2016
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BHU: Second Green Power Development Project (118 MW Nikacchu Hydropower Project)

Prepared by the Tangsibji Hydro Energy Limited for the Asian Development Bank.

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Table of Contents

Executive Summary	3
1.0. Introduction.....	3
1.1. Brief Project Description.....	4
1.2. Project Progress Status and Implementation Schedule.....	4
2.0. Compliance to National Regulations	6
2.1. Terms and Conditions of Environmental Clearance	6
3.0. Compliance to Environmental Covenants from the ADB Loan Agreement.....	8
3.1. Schedule 5 Environment (prepare a matrix to show how compliance was achieved) ..	8
4.0. Compliance to Environmental Management Plan.....	10
4.1. Access Road Management.....	10
4.2. Biodiversity Management Committee	10
4.3. Biodiversity Conservation Programme	11
4.4. Botanical garden for conservation of rescued floral species	11
4.5. Human-Wildlife Conflict Management	12
4.6. Augmentation of Baseline Surveys	13
4.7. Compensatory Afforestation	13
4.8. Catchment Management	13
4.9. Panel of Expert.....	14
4.10. Aquatic Specialist	14
4.11. E-flow	15
4.12. Private Land	15
4.13. Government Reserve Forest Land.....	17
4.14. Community Development Programme	18
4.15. Income of Affected Persons (APs).....	18
5.0. Safeguards Monitoring Results and Unanticipated Impacts	18
6.0. Implementation of Grievance Redress Mechanism and Complaints Received from	

Stakeholders.....18

7.0. Conclusion and Recommendations19

List of Tables

Table 1.1 Project Progress Status.....	4
Table 2.1 Compliance with Environment Clearance.....	6
Table 3.1 Compliance to Environmental Covenants.....	8
Table 4.1 Details of floral survey and rescue.....	11
Table 5.1 Additional Affected Persons	15
Table 6.1 Private land for construction facilities	16
Table 7.1 newly affected household by access road to Power House	17
Table 8.1 Private household whose lands are affected	17

List of Figures

Figure 1.1 Green House funded by THyE for conservation of rescued floral species	12
Figure 2.1 Stations for fish sampling	14
Figure 3.1 Fish species recorded and method adopted	15

List of Annexes

Annexure-I	1 st Report from College of Natural Resource
Annexure-II	Land Details
Annexure-III	Access road land detail

Executive Summary

The Environmental Clearance for 118 MW Nikachhu Hydropower Project was accorded on July 01, 2015. With the receipt of clearance construction of access roads were awarded in November 2015 pre-construction works including access road construction was awarded in November 2014 followed by water supply arrangement, construction power supply arrangement and contractor construction facilities.

The main package works have been awarded to M/s Hindustan Construction Company and Contract Agreement signed on 20 March, 2016. Since then all site were handed over to the contractor mobilization going on at site. Since, the construction works are not in full swing the environmental impact is minimum. However, THyE has been monitoring all aspects of Environment and Social well being in line with the EMP and RP approved by ADB.

Environmental Management Plan (EMP) is based on the analysis of project activity interactions with the baseline features in the project area. The EMP reflects all identified impacts and required mitigation measures, as well as monitoring programs, in conformity with the requirements of the Royal Government of Bhutan, while also being compliant with the Environmental Safeguard Policies of ADB. The Environment Management Plan for following items, during pre-construction phase was proposed:

- Land Acquisition (temporary and permanent);
- Mobilization of equipment;
- Influx of workers;
- Fuel storage;
- Biodiversity and Wildlife management;
- Solid waste management;
- Project water supply system;
- Construction work management;
- Fisheries development plan;
- Catchment Management Plan;
- Transmission line alignment.

Some of the items like mobilization of equipment, influx of workers and fuel storage are not highlighted at this stage since the main package contractor has not yet fully mobilized. All the management plans that are to be implemented at site were complied and some plans such as Biodiversity Management and Catchment Management involving government counter-parts are being initiated.

1.0. Introduction

1.1. Brief Project Description

Tangsibji Hydro Energy Ltd (THyE) fully owned by Druk Green Power Corporation Limited was incorporated, on April 25, 2014, as a Special Purpose Vehicle to develop 118 MW Nikachhu Hydropower Project. The 118 MW Nikachhu Hydro Power Project was identified in the updated Power System Master Plan (PSMP) of Bhutan (2004). The Pre-Feasibility Study (PFS) that was completed on 31 December, 2011 followed by Feasibility Study in September 2012. The Detailed Project Report was completed in September 2013.

Bhutan Consultants & Research (BHUCORE) carried out Environmental and Social Impact Assessment (ESIA) of the Nikachhu project on June 1, 2012, and revisions to the ESIA report have been made by PWC India consultants under the technical assistance of Asian Development Bank (ADB). The report constitutes three parts comprising ESIA, Environment Management Plan (EMP) and Resettlement Plan (RP)

With an estimated energy generation of 491.52 MU, 85 % shall be exported which will not only enable revenue generation for the nation but reduces Green House Gas emission in the neighbouring country by replacement of fuel by clean and renewable energy, hydropower. Further, the outflow of Nikachhu into Mangechhu reservoir provides additional 323.77 MU to Mangdechhu Hydro Electric Project

Nikachhu Hydropower Project is located in Trongsa and stretches over 25 km from Dam, at Lorim, to Power House, at Norbuodi with 12.14 km Head race Tunnel (HRT) having five intermediated tunnels, ADITs. With the construction of 38 m high dam, 12.28 acres of land will be impounded by 810 m water back-flow.

1.2. Project Progress Status and Implementation Schedule

During this pre-construction stage, infrastructure facilities such as access road of 17.411 km, about 8 km construction power line, water supply arrangement, residential, labour camps and offices were constructed. The detail is as provided below in the Table 1.1.

Table 1.1 Project Progress Status

Sl. No	Facility	Details	Status
1	Access road to Dam and Bailey bridge	<ul style="list-style-type: none"> ✓ Contractor: Construction Development Corporation Limited, Thimphu ✓ Contract Amount: <ul style="list-style-type: none"> • Construction of 30 m span 24R Bailey Bridge: BTN 14,812,670.43 • Construction of 2.10 km Access Road : BTN 34,791,955.00 ✓ Contract Agreement signed on 15th October, 2014 	<ul style="list-style-type: none"> ✓ Road Handed over on 12th November, 2015 ✓ Camp demobilized on 1st December,

		✓ Formation cutting started on 28 th November, 2014	2015
2	Access road to Adit-I	✓ Contractor: M/s Gayjur Construction Private Limited, Mongar ✓ Contract Amount: BTN 18,760,650.00 ✓ Letter of award issued on 19 th October, 2014 ✓ Contract Agreement signed on 1 st November, 2014 ✓ Formation Cutting started on 23 rd November, 2014	Taken over 15 th December, 2015.
3	Access road to Adit-II and Adit-III	✓ Contractor: M/s Lamnekha Construction Private Limited, Thimphu ✓ Contract Amount: BTN 50,626,000.00 ✓ Letter of award issued on 19 th October, 2014 ✓ Contract Agreement signed on 3 rd November, 2014	Road taken over on 2 nd November, 2015
4	Access road to Adit-IV, V, and Surge Shaft	✓ Contractor: M/s Gyalcon Infrastructure Private Limited, Thimphu ✓ Contract Amount: BTN 22,678,100.00 ✓ Contract Agreement signed on 1 st November, 2014	Road taken over on 2 nd November, 2015
5	Access road to Power House	✓ Contractor: M/s Tshering Construction Private Limited, Bumthang ✓ Contract Amount: BTN 60,158,750.00 ✓ Contract Agreement signed on 1 st November, 2014	Completed
6	Water supply arrangement to Dam and Adit I	✓ Contractor: M/s TGD Construction, Trongsa ✓ BTN 2,838,862.50 ✓ Letter of Award issued on 27 th December, 2014. ✓ Contract Signed on 12 th January, 2015	Completed
7	Water supply arrangement to Adit II,III &IV	✓ Contractor: M/s L.S. Construction, Trongsa ✓ Contract Amount: BTN 1,820,936.10 ✓ Letter of Award issued on 27 th December, 2014. ✓ Contract Signed on 12 th January, 2015	Completed
8	Water supply arrangement to Adit V, Surge Shaft & Power House	✓ Contractor: M/s Karma Tshering Construction, Bumthang ✓ Contract Amount: BTN 3,356,028.78 ✓ Letter of Award issued on 27 th December, 2014. ✓ Contract Signed on 12 th January, 2015	Completed
9	Contractor facility at Dam, Adit-I	✓ Contractor: M/s Gayjur Construction Private Limited, Lingmithang ✓ Contract Amount: BTN 28,477,299.24	Completed

	&Adit-II	✓ Contract Agreement signed on 5 th May, 2015	
10	Contractor facility at Adit-III, Adit-V, Surge Shaft & Power House	✓ Work Awarded to M/s Z&K Construction Private Limited, Thimphu on 7 th April, 2015 ✓ Contract Agreement signed on 22 nd April, 2015 ✓ Contract Amount: BTN 31,843,544.50 ✓ Letter of commencement of work issued on 1 st July, 2015	Completed
11	Client facility at Dam	✓ Contractor: M/s Lamnekha Construction Private Limited, Thimphu ✓ Letter of Award: 5 th June, 2015 ✓ Contract Agreement signed on 20 th June, 2015 ✓ Contract Amount: BTN 18,558,838.10 ✓ Contract Duration: 4.50 months	Completed
12	Client facility at Power House	✓ Letter of Award: 18 th June, 2015 ✓ Contract Agreement signed on 3 rd July, 2015 ✓ Awarded to M/s Gyalcon Infrastructure Private Limited, Thimphu ✓ Contract Amount: BTN 18,247,704.75 ✓ Contract Duration: 4.50 months	Completed
13	Construction power arrangement	✓ MoU signed with BPC on 15 August, 2014. ✓ Contract duration: 9 months ✓ Completion date: May, 2015	Completed in June, 2015

2.0. Compliance to National Regulations

2.1. Terms and Conditions of Environmental Clearance

Table 2.1 compliance with Environment Clearance

Sl.no	Reference Environmental Clearance to	Relevant Condition	Compliance
1	Clause 9	The holder shall ensure that the implementation of the proposed project is strictly confined within the allocated area.	Complied.
2	Clause 15	The holder shall ensure that local residents, households, communities, public, private parties and religious, cultural, historical and ecologically important site are not adversely affected by the construction of proposed project.	Complied, except for the household below the access road of Adit-III, which has been damaged by falling rock. However, a new house had

			been constructed with better facilities and handed over to the owner.
3	Clause 18	The holder shall ensure that the implementation of the proposed project, except the Dam, does not lead to blockage, storage or diversion of river, stream, irrigation channel, waterfall and underground water source.	Complied.
4	Clause 19	The holder shall ensure that a buffer of at-least 100 ft is maintained between the project activities and water streams.	Maintaining buffer from streams were not practical where the road alignment has to cut the water body. However, mitigation measures, for elimination of impact on water, such as causeways, and hume pipes were constructed.
5	Clause 21	The holder shall ensure Biodiversity Management Plan and Compensatory Afforestation Program are implemented in co ordination with the DoFPS to minimize biodiversity impacts.	Complied.
6	Clause 22	The holder shall ensure that the construction works at Adit-II are not carried out from 10 pm to 6 am.	Complied.
7	Clause 24	The holder shall ensure that felling of trees if required are done only upon obtaining approval from DoFPS and as per the conditions of the approval.	Complied.
8	Clause 28	The holder shall ensure that Environment Friendly Road Construction techniques are adopted for construction of access roads.	Complied.
9	Clause 29	The holder shall ensure that the bio engineering practices are adopted on all road side slopes.	Complied.
10	Clause 30	The holder shall ensure construction of side drains, cross drains, causeways, and other supporting structures are required to prevent soil erosion, improve usability and sustainability of road .	Complied.
11	Clause 36	The holder shall ensure that no raw materials of any kind, machineries, plants and equipments and excavated materials are staked along the	Not Complied due to space constraint at the access road side.

		highway.	
12	Clause 37	The holder shall ensure safe and smooth flow of traffic along the highway.	Complied.
13	Clause 40	The holder shall ensure dusts are suppressed.	Complied.
14	Clause 46	The holder shall ensure that dump sites are stabilized with appropriate protection measures	Complied.
15	Clause 52	The holder shall ensure that waste generated from the labour camps and work sites are managed as required under WPMA of Bhutan.	Complied.
16	Clause 59	The holder shall ensure that safety gadgets are provided to all workers and any person entering the worksite.	Complied.
17	Clause 66	Ensure that signboard are erected at the starting point of the project area	Complied

3.0. Compliance to Environmental Covenants from the ADB Loan Agreement

3.1. Schedule 5 Environment (prepare a matrix to show how compliance was achieved)

Table 3.1 Compliance to Environmental Covenants

SI.No	Relevant Condition	Reference	Compliance status
1	The Beneficiary shall ensure, or cause DGPC and THyE to ensure, that the preparation, design, construction, implementation, operation of the Project and all Project facilities comply with (a) all applicable laws and regulations of the Beneficiary relating to environment, health, and safety; (b) the Environmental Safeguards; (c) the EIAs; and (d) all measures and requirements set forth in each EIA and EMP, and any corrective or preventative actions set forth in a Safeguards Monitoring Report.	Financing Agreement, Schedule 5, Paragraph 3	Complied.
2	The Beneficiary shall ensure, and cause DGPC and THyE to ensure, that (a) there are no measurable adverse impacts on critical habitat that could impair its ability to function; (b) there is no reduction in the population of any recognized endangered or critically endangered species; and (c) any lesser impacts are mitigated. Without limiting the generality of the foregoing, the Beneficiary shall cause DGPC and THyE to establish a biodiversity management committee acceptable to ADB that (a) shall be responsible for implementation monitoring and evaluation of the biodiversity conservation and	Financing Agreement, Schedule 5, Paragraph 4	Complied.

	biodiversity management plan as outlined in the relevant EMP and (b) shall ensure that the Project facilities are constructed and operated in a manner consistent with the JSW National Park Management Plan		
3	The Beneficiary shall cause DGPC and THyE to (a) assess on a continuous basis, in accordance with the relevant EMP, the minimum environmental water flow requirements during the operation of the Project facilities; and (b) ensure a minimum water flow, at a level acceptable to ADB, so as to minimize downstream impacts and make sure there is no net loss of downstream aquatic biodiversity arising from the operation of hydropower facilities in the Mangdechu river basin, including from the Project facilities and the Mangdechu Hydroelectric project. The Beneficiary shall cause DGPC to establish a funding mechanism or internal resources to ensure integrated water resources management for the Mangdechu river basin, including compliance with the minimum environmental water flow requirements as set out in the preceding sentence	Financing Agreement, Schedule 5, Paragraph 5	Not relevant at this stage of project phase.
4	The Beneficiary shall ensure, or cause DGPC and THyE to ensure, that all land and all rights-of-way required for the Project, and all Project facilities are made available to the Works contractor in accordance with the schedule agreed under the related Works contract and all land acquisition and resettlement activities are implemented in compliance with (a) all applicable laws and regulations of the Beneficiary relating to land acquisition and involuntary resettlement; (b) the Involuntary Resettlement Safeguards; and (c) all measures and requirements set forth in the RP, and any corrective or preventative actions set forth in a	Financing Agreement, Schedule 5, Paragraph 6	Complied.
5	Without limiting the application of the Involuntary Resettlement Safeguards, and the RP, the Beneficiary shall ensure or cause DGPC and THyE to ensure that no physical or economic displacement takes place in connection with the Project until (a) compensation and other entitlements have been provided to affected people in accordance with the RP; and (b) a comprehensive income and livelihood restoration program has been established in accordance with the RP	Financing Agreement, Schedule 5, Paragraph 7	Complied.
6	Submit quarterly Environmental Safeguards Monitoring Reports and semi-annual Involuntary Resettlement Safeguards Monitoring Reports to ADB during construction of the Project annual Environmental Safeguards Monitoring Reports during operation of the Project facilities, and	Financing Agreement, Schedule 5, Paragraph	complied,

	disclose relevant information from such reports to affected persons promptly upon submission;		
7	If any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the relevant EIA, EMP or the RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan;	Financing Agreement, Schedule 5, Paragraph 11, bullet 'b'	Complied.
8	No later than 31 March, 2015 engage a panel of experts to monitor and report upon Project implementation, and facilitate the carrying out of any monitoring activities by such panel; and	Financing Agreement, Schedule 5, Paragraph	Complied.
9	Report any actual or potential breach of compliance with the measures and requirements set forth in the relevant EIA, EMP or the RP promptly after becoming aware of the breach.	Financing Agreement, Schedule 5, Paragraph	Complied.

4.0. Compliance to Environmental Management Plan

4.1. Access Road Management

The access road construction was completed and to complement the grass seed broadcasted last year, 100 kgs of grass mixture seeds were broadcasted this year from 17-22 May, 2016. The seeds were broadcasted at the slopes of access road to Power House, Surge Shaft, Adit-V, Adit-III, Adit-II, Adit-I and Dam.

4.2. Biodiversity Management Committee

Biodiversity Management Committee (BMC) was constituted for effective implementation of Biodiversity Conservation Programme enlisted in EMP, with members the following members:

1. Dr. Sangay Wangchuk, WCD, DoFPS as chairman;
2. Mr. Ugyen Tenzin, Chief Forest Officer, Forest Territorial Division, Zhemgang;
3. Mr. Phankey Drukpa, Chief Forest Officer, JSWNP;
4. Ms. Sangay Dema, National Biodiversity Center;
5. Ms. Rebicca Pradhan, Royal Society for Protection of Nature;

6. Mr. Sherab Tenzin, Department of Livestock;
7. Mr. Ugyen Tenzin, Dzongkhag Forest Officer, Trongsa;
8. Ms. Thinley, Tangsibji Hydro Energy Limited.

After the constitution of committee, the first committee meeting was held from 2-4 February, 2016. The next meeting has been scheduled in August, 2016.

4.3. Biodiversity Conservation Programme

A Memorandum of Understanding (MoU) was signed between NBC and THyE for rescue of rare endangered species, from Nikachhu project site, on December 08, 2014. Till date survey and rescue was carried out thrice as detailed below:

Table 4.1 Details of floral survey and rescue

Survey/Rescue	Date	Remarks
1 st survey and rescue	February 26-March 06, 2015	Documentation of existing floral diversity of the Nikachu hydropower project sites.
2 nd survey and rescue	April 09- 13, 2015	Rescued 14 species of Orchids.
3 rd survey and rescue	August 19-30, 2015	18 plant species were collected and rescued.

The MoU was signed to augment baseline floral data in the project area and to rescue threatened species, if any, to prevent being destroyed during the main project construction. In December 2015 a hands-on workshop was provided by NBC to forest officials and field officers of various government agencies to impart knowledge on seed collection from wild plants and its long term conservation. Since, NBC being busy engaged in national priority works could not precede with their first phase of rescue scheduled from December 2015-January 2016. The Centre requested for extension of conservation project for six more months which was approved. The project shall now extended till December 2016.

THyE has approved contribution of Nu. 3.6 million to Forest Territorial Division, Zhemgang, for Botanical Garden construction at Tingtibi during the 15th Board Meeting on October 30, 2015. The Memorandum of Understanding could not be signed till date due to inter-department issues with the agency. During the meeting with DoFPS on 15 March, 2016, it was decided that Social Forestry and Extension Division (SFED) shall take lead role in initiating the signing of MoU for compensatory afforestation and Land management. The SFED shall also review the EMP budget allocated for Biodiversity Conservation and prioritize their activity with proportionate fund.

4.4. Botanical garden for conservation of rescued floral species

For conservation of rescued floral species from Nikachhu project site, Nu.3.6 million was approved for establishment of Botanical Garden at Bermoo, Zhemgang. Since, the

Department is at the moment working on appropriation of Biodiversity Conservation budget of THyE, the MoU could not be signed. However, under the project tied up with NBC, a green house has been constructed.



Figure 1.1 Green House funded by THyE for conservation of rescued floral species

4.5. Human-Wildlife Conflict Management

Wild bores are the main predator to the crops of farmers. In view of the difficulty faced by the farmer, THyE had discussion with the Geog Administration on electric fencing agriculture lands. During a meeting on October 27, 2015 it was mutually agreed between the Forest Territorial Division, Dzongkhag and Geog Administration that electric fencing system shall be implemented by Department of Forest and Park Services for which Nu.1.5 million was approved. The JSWNP has also proposed for electric fencing at two villages, Kela and Chendebji, falling under park. Since, the same activity in Chendebji area was covered by the proposal of Zhemgang Forest Division, it was decided during the Biodiversity Committee Meeting that the issue shall be discussed within their department. The whole set of proposal submitted by JSWNP was asked to route through proper channel before submitting directly to THyE.

To reduce poaching and educate local residents on Biodiversity protection, an awareness program was conducted in collaboration with DoFPS on forestry rules and management from 18-19 April, 2016.

4.6. Augmentation of Baseline Surveys

To augment baseline data of fish survey carried out in 2012, THyE has approved the proposal for aquatic survey by the College of Natural Resource, Lobesa. The proposal covers fish, butterfly and micro-invertebrate survey during the lean season. The preliminary survey and site selection was shall conducted from 27 December, 2015 to 20 January, 2016. Two stretches of site were selected; one stretch from dam till Chendebji Chorten and another between Tsheringmai Drupchhu and confluence. The team has carried out survey on fishes, micro-invertebrates and butterfly from 02-10 March, 2016. The team recorded presence of Brown trout and Snow trout in designated stretches of river. The preliminary report has been submitted to THyE and attached as Annexure-I. The detail report shall be submitted after identifying all samples collected from site.

The floral survey covered under project with National Biodiversity Center has also been augmenting the baseline vegetation data. 201 species of plant additional to the baseline was recorded from the project site during the second phase survey conducted in August, 2016.

4.7. Compensatory Afforestation

Although THyE has approved contribution of Nu. 7.5 million to Department of Forest and Park Services for compensatory afforestation, due to inter-departmental issue the MoU could not be signed. The MoU shall be signed after thorough discussion within the Department. Compensatory afforestation works are anticipated to carry out from the next season. Although the EMP has provisioned over Nu.26 million for compensatory afforestation of 624.34 acres, the impacted land for access roads have decreased from expected 43.940 acres to 19.652 acres. Therefore, compensatory afforestation shall be carried out only double the area impacted.

4.8. Catchment Management

The EMP requires various catchment management program comprising rapid classification of micro-watershed, assessment of critical micro-watershed and implementation of management plans. To implement the plan, THyE had discussion with Watershed Management Division (WMD) under DoFPS and found out that World Wildlife Fund (WWF) has already signed a project with the Department to carry out catchment management along Nikachhu, which also includes the project area of Nikachhu Hydro Power Project. WMD has been carrying out rapid assessment of watershed along Nikachhu from September 2015. After the completion of watershed assessment three micro-watersheds were found critical by function. Two (Nimdro khang chhu and Sangchu chhu) are in Sehup Geog under Wangdue Dzonkhag while one (Tshering mai Drupchhu) is in the Project area. The WMD is preparing management plan for the two micro-watersheds under Sephu and shall not cover Tsheringmai Drupchhu since it does not fall in the area of WWF project. However, during the meeting with WMD and other stakeholders from Forest and health office on 15-16 January, 2016, it was made clear that THyE in collaboration with the Division shall take up management plan preparation and implementation soon after the completion of their current project. As a part of catchment activity, a team from THyE has visited Nikachhu watershed from 24-27 April, 2016, to assess the criticality through visual inspection. It was found that the watershed is pristine

and the only concern is waste management. The issue shall be addressed in coordination with WMD and Forest Territorial Division during the preparation of management plan of watershed.

4.9. Panel of Expert

To monitor implementation of EMP an Environmental Expert and Social Development Expert was appointed. They serve as an independent consultant to THyE and back up Environment Unit for any environmental and social issues. The Panel of Experts (PoEs) visited site from February 26-28, 2015 for familiarization of site and from April 19-25, 2015 for consultation and monitoring project sites. The Experts also visited from November 15-22, 2015. The next visit is scheduled tentatively in mid-August, 2016.

4.10. Aquatic Specialist

National Centre for Riverine and Lake Fisheries (NCRLF), Haa, under the DoL was approved to be appointed as the aquatic specialist to THyE due their expertise and availability of required equipments and man-power. An MoU was signed between Gross National Happiness Commission (GNHC), DoL and THyE for implementation of 'Conservation and Monitoring of Fishery in Nikachhu' on 24 December, 2015. The team from NCRLF carried out preliminary site selection from 06-17 February. Four zones were identified within which stretch the monitoring shall be carried out as give in the picture below:



Figure 2.1 Stations for fish sampling

The fish survey was conducted from 21 March-01 April, 2016. During the survey only two fish species were recorded; Snow trout at the confluence and all other zones are dominated by Brown Trout. Flow data were also measured at sites depending on the nature of river flow.



Figure 3.1 Fish species recorded and method adopted

4.11. E-flow

As per the Environment Clearance issued by National Environment Commission, 10% of average lean flow (5.554 cumec) which is 0.554 cumecs was set as minimum flow to be released from Dam for sustenance of aquatic lives downstream. To determine the adequacy of E-flow, studies are being carried out with NCRLF for aquatic life and flow data to be collected in co-ordination with Department of Hydro-Met Services (DHMS). Flow of few tributaries was measured with float method, however, due to inaccessibility tributaries at the right bank could not be assessed. To determine cumulative discharge contribution from tributaries, flow measurement shall be done at confluence with assistance from DHMS.

4.12. Private Land

Most of private lands acquired for project construction are under Tsangkha Chiwog. Although only 3.577 acres of private land belonging to 11 households and One Community Primary School were indentified during the project planning stage, eight additional households were affected during the actual construction works as detailed below:

Table 5.1 Additional Affected Persons

Sl.No.	Name	Plot No.	Location	Area affected (ac)
1	Kinley Zangmo	TAN-1906	Dragitsawa, Tsangkha	0.362
2	Tshering Norbu	TAN-2872	Dragitsawa, Tsangkha	0.196

3	Pelden	TAN-1907	Dragitsawa, Tsangkha	0.362
Total				0.920

A total of 0.920 acres were affected by access road to Adit-V. Consultations with the additional affected household were carried out and meeting done with them in presence of Geog administration to brief them on the type of compensation they are entitled to. Since the access roads are temporary, it was agreed to provide their land on lease for duration of project completion at the rate, Nu.0.1/Sqft/annum, prescribed in the Land Lease Rule of Bhutan, 2009. However, later THyE was approached by the PAPs to increase the lease rate. Therefore, THyE approved a lease rate of Nu.1.0/Sqft/annum taking the baseline from Punatsangchhu HEP and Mangdechhu HEP. The lease agreement was then signed on 18 February, 2016 and lease charges disbursed on 28 March, 2016.

While construction of Construction facilities, private lands of two household were also taken on lease as agreed by the owners. The detail is as provided below:

Table 6.1 Private land for construction facilities

Sl. No.		Name	Thram No.	Plot No.	Land Name	Land Type	Existing Area (Ac)	Actual Affected Area (Ac)
1	Power House colony	Dorji Dema	258	TAN-1880	Laychu	Kamzhing	0.872	0.268
2	Power House colony	Tshewang Norbu		TAN-1881	Laychhu	Kamzhing	0.300	0.300
TOTAL								0.568

The lease agreement was signed with the two household on 18 February, 2016, and lease charges disbursed on 28 March, 2016.

To determine the actual impact of access road construction of private land and also GRFL, Cadastral surveys are being carried out from 05-17 October, 2015. Accordingly, after receipt of final report from Dzongkhag Land Record on 24 March, 2016, THyE requested Geog and Dzongkhag Administration to process compensation. As per the report, land of three new households was also affected due to construction of access road to Power House. The total land affected is 0.894 acres as detailed below:

Table 7.1 newly affected household by access road to Power House

Sl. No.	Thram No.	Name	Plot No.	Land Name	Land Type	Thram Area	Actual Area to be/ already acquired
1	510	Sumchokmo	TAN-3253	Nyala	Kamzhing	0.406	0.406
2	268	Tshewang Gyeltshen	TAN-1875		Kamzhing	0.577	0.116
3	254	Rinzin Wangmo	TAN-1876	Leaychu	Kamzhing	0.372	0.372
Total							0.894

THyE have received request for compensation from the PAPs in which 8 households opted for land-for-land compensation and one opted for lease. THyE did not receive letter from two affected households. The total land affected is now 8.836 acres including those leased. The detail of affected land is provided as Annexure-II.

As identified in the Environment Impact Assessment Report, the 132 kV transmission line shall require acquiring 0.6 acres of private land at Drakten and Langthil. Since the work is scheduled to commence in June 2016, cadastral survey for private land of the identified six households were carried out from 25-28 January, 2016. As per the report, only five household shall be affected against the identified six households during planning stage as detailed below:

Table 8.1 Private household whose lands are affected

Sl.no.	Thram no.	Name	Plot no.	Thram area	Area to be acquired	
1	360	Tshering Dema	DRT-2692	0.624	0.050	For Tower
2			DRT-2691	0.821	0.050	For Tower
3	361	Tsheringmo	DRT-2626	1.391	0.100	For Tower
4	1007	Yeshey	DRT-733	0.990	0.100	For Tower
5	689	Sangay Wangdi	DRT-3110	1.198	0.100	

Although the affected area is less than 0.10 acre, during the public consultation meeting it was decided that at least 0.10 acre shall be acquired to allow PAPs eligible for land-for-land compensation. As per the Land Act of Bhutan, only cash compensation is entitled for PAPs whose land affected is less than 0.10 acre. The compensation process is being kept on halt due to ongoing survey carried out by Royal Government of Bhutan (RGoB) to provide Kidu (grant) lands which are measured from GRFL. THyE anticipate more households to be affected therefore compensation process shall be carried out once the government issue land ownership for Kidu land.

4.13. Government Reserve Forest Land

THyE has leased 195.262 acres of GRF land from the National Land Commission (NLC) with lease agreement signed on May 01, 2015. The leased land does not include access roads which was agreed to be leased only after completion. The cadastral survey carried out from 05-17 October, 2015, also included the GRFL affected by access roads. A total of

19.652 acres of land were affected by access road construction of which 1.69 acres fall in private land and 4.08 acres fall in already area. Further, 5.049 acres affected by access road to power house need not have to be leased as directed by National Land Commission. Therefore, only 8.836 acres have to be leased for which application was submitted to Dzongkhag Land Lease Committee (DLLC) on 25 May, 2016. The detail of land affected and to be leased is attached as Annexure-III.

4.14. Community Development Programme

Community Development Programmes (CDP) were enlisted in the Resettlement Plan (RP) in consultation with PAP and Geog and approved by ADB, DGPC and the Royal Government of Bhutan amounting Nu. 16.40million, excluding 10% contingencies. The programme includes blacktopping of Tangsibji Farm road from national highway till NamgayChholing CPS, which has been completed as part of infrastructure work.

Geog Administration has proposed for additional development programme, amounting Nu. 27.00 million which was revised by THyE and was approved in the 15th Board Meeting amounting Nu. 15.15 million. The additional development programmes includes Blacktopping of additional 2.55 km Tangsibji farm road, construction of Temple, study tour for geog officials involved in project service, an ambulance and establishment of Tsogpas' offices. THyE disbursed the approved amount of Nu. 1.4 million for construction of Temple and two vegetable outlets for which a Letter of Understanding was signed. A copy is attached as Annexure-IV. The blacktopping of additional 2.55 km farm road at Tangsibji was awarded in December 2015 to M/s Bikay Construction.

4.15. Income of Affected Persons (APs)

Although there has not been much income to the PAPs directly, their income has increased significantly through increased business such as livestock products, vegetables and, grocery to employee of THyE. Some of the PAPs were also provided with contract to cut trees by the contactors of THyE.

5.0. Safeguards Monitoring Results and Unanticipated Impacts

All the parameters of Environment Management Plan were complied. Besides THyE, the parameters are also monitored by DoFPS and National Environment Commission (NEC).

Unanticipated impacts have not occurred except at Adit-III access road construction. A boulder has damaged a two stored house at Tangsibji However, the house has been rebuilt with better facilities and improved condition. Household items were provided to the house owner. The new house has toilet, kitchen and water supply inside the house and also approached with an access road and handed over to the owner.

6.0. Implementation of Grievance Redress Mechanism and Complaints Received from Stakeholders

The Grievance Redress Committee with members from Dzongkhag Administration, THyE and Geog Administration was formed to address Grievance Redress Mechanism. Till date the committee did not receive any complaints from the stakeholders.

7.0. Conclusion and Recommendations

THyE has initiated most of the Environment Management Plans and Resettlement Plan and doing more for Biodiversity Conservation. The environment aspects are also strictly monitored by Forest Territorial Division and National Environment Commission.

For all social aspects, people do not have any grievance towards the project and indeed happy for the land development cost freedom to choose substitute land provided to them in addition to land replacement. The project has benefited Tangsibji community in terms of development, income (through rents and livestock product) and employment.

Back To Office Report for environmental studies along Nika Chhu

Introduction

First phase of field survey and other necessary environmental studies along the Nika Chhu funded by THyE was conducted from 27th Dec 2015 to till 20th Jan 2016. During the period of 27 days, various field works was covered and the data were collected for further analysis and reference. This report comprises of four sections. Section I deals about preliminary survey. Section II describes about the field survey and various methodologies adopted during the data collection for different objectives. Section III informs about the direct observations obtained from the field. Section IV contains some annexure to support the report.

Section I: Preliminary survey for ground truthing

Prior to going in field survey, five days preliminary survey was conducted from 27th Dec 2015 to till 31st Dec 2015. During this five days survey, the team has covered following activities

1. Visited various offices to cover research protocols such as informing about the forth coming environmental studies
2. Zonation of Nika chhu into three zone
3. Collected coordinate for every subplot
4. Identified areas for temporary stream diversion
5. PRA technique with open ending questions were asked among the villagers about Nika chhu
6. Identified camping areas

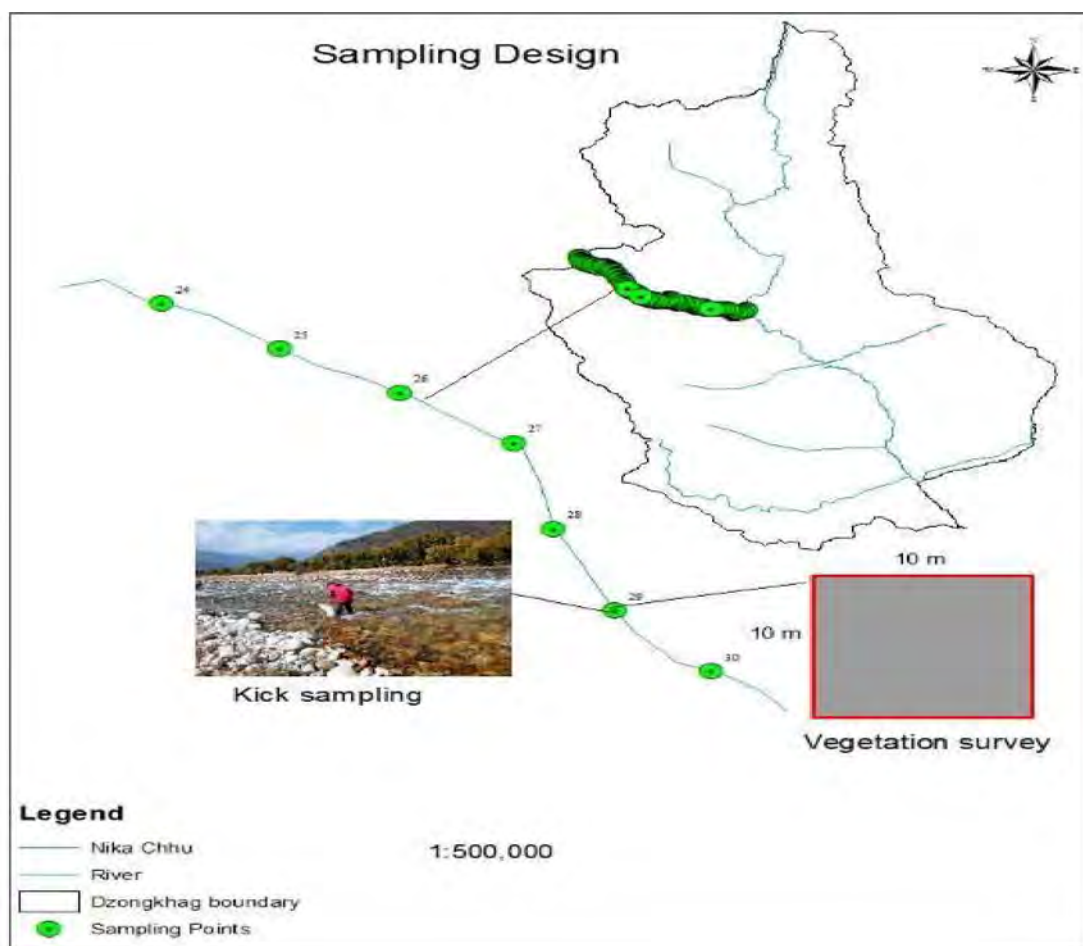
Back To Office Report for environmental studies along Nika Chhu

Section II: Field survey

The phase I field survey was conducted from 3rd Jan 2016 to till 20th Jan 2016. In this survey, the team has collected the data for fishes, Vegetation and Macro invertebrates

Sampling Design

Nika Chhu was divided into three Zones, Mangde Chhu confluence to Tsheringma Drupchu confluence (Zone I), THyE Dam site to Chendipjee chorten (Zone II), and Chendipjee village to till Busa village (Zone III). Within the zones, the river was systematically divided into subplots at every 200 meter distance (Map 1).



Back To Office Report for environmental studies along Nika Chhu

Objective 1: Assess the baseline status of fish diversity and its distribution along Nika Chhu.

To assess the diversity and distribution of fishes, cast net, river diversions, electric shocking, and stone flipping techniques were used. Catch and release method was followed as it is widely used.

Cast net method

Using the local fishermen, cast net was used for catching the fishes along Nika Chhu basin. In every plot, cast nets are thrown for five times. The fish caught per throw are recorded for examining their population dynamics. Other information like total length (TL), standard length



(SL) and weight are measured

Back To Office Report for environmental studies along Nika Chhu

River diversion method

River diversion and flipping of stone was carried out in those sites where temporary stream diversion was identified during preliminary survey. The basic rationale to carry out such method is to obtain the complete information about diversity of fish in Nika Chhu and its tributaries.

Electric shocking method

Further, Low voltage electric shocking was also carried out. This method is used in habitat of river, where earlier methods are impossible to carry out.



Objective 2: Identify different riparian habitats of fishes along Nika Chhu.

Riparian habitats of Nika Chhu were assessed based on water quality (temperature, P^H), macro invertebrates and vegetation along river sides.

Water Quality assessment

In every sub plot, the temperature and P^H of the river was measured using thermometer and P^H measurement kits. Along with the physical parameters, stream width and stream depth was also measured.

Vegetation Survey

At each subplot, on either side of bank, the plot was laid of 10 x 10m (outer layer) 2 x 2m and 1 x 1m sub plot for three vegetation surveys, that is tree layer ($> 1.3m$), sapling layers ($< 1.3m$) and

Back To Office Report for environmental studies along Nika Chhu

seedling layers (0.5m) respectively. All trees, shrubs, saplings are recorded to know the vegetation dominance, crown density, and relation of fish population with vegetation type.

Macro-invertebrate

Kick & flipping stone method was used to sample the macro-invertebrates. In every sub plot, the method was followed after collecting the data for fish.



Specimen preservation

Unidentified specimens of fishes and macro-invertebrates were preserved in formalin and alcohol spirit with proper labeling. The specimens are further transported to College of Natural Resources laboratory for identification and longer preservation

Back To Office Report for environmental studies along Nika Chhu

Section III: Observations

Fishes

Two species of fish, seven orders and 17 families of macro-invertebrates were found in Nika Chhu till date. Brown trout dominates Zone II and III, whereas, Snow Trout in zone I.



Brown Trout (Salmo trutta)



Snow trout (Schizothorax spp)

Back To Office Report for environmental studies along Nika Chhu

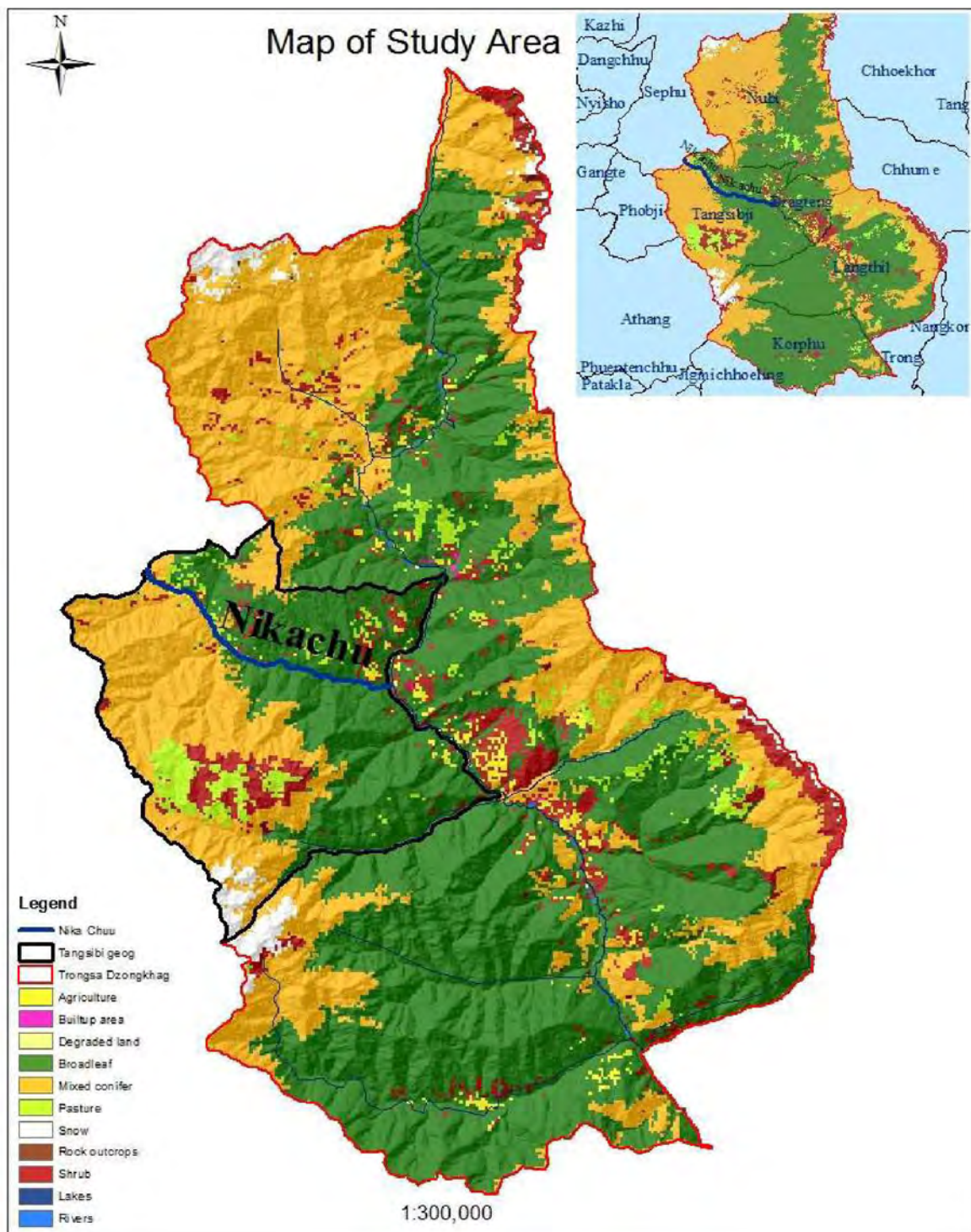
Macro-invertebrates in Nika Chhu River Basin

Sl.no	Orders	Family	Remarks
1	Trichoptera	Rhyacophilidae	Hydropsychidae, Scirtidae, Planariidae dominates the NikaChhu River followed by Perlidae, Perlinae, Periodidae, Ephemerellidae, and Heptageniidae. Epiophlebiidae and Gomphidae are found in upper region of the River.
		Psychomyiidae	
		Hydropsychidae	
2	Plecoptera	Perlidae	
		Perlinae	
		Periodidae	
3	Diptera	Tipulinae	
		Psychodidae	
		Limniidae	
		Ceratopogonidae	
4	Ephemeroptera	Ephemerellidae	
		Heptageniidae	
5	Odonata	Epiophlebiidae	
		Gomphidae	
6	Coleoptera	Scirtidae	
7	Planarian	Planariidae	

Back To Office Report for environmental studies along Nika Chhu

Section IV

Annexure 1: GIS projected map of the study area



Back To Office Report for environmental studies along Nika Chhu

Annexure II: Data collection sheet

Data collection format I- Fish

Name of the river: Nika Chu

DD/MM/Year:

Plot number:

Recorder:

Cordinates (E)

(N)

Altitude:

Stream reache: Cascade

Pool

Riffle

Run

Name of fish spp	Frequency	Standard length (Range)
		Standard weight (Range)

Sl.#

Back To Office Report for environmental studies along Nika Chhu

Annexure III: Data collection format II -Vegetation habitat

Name of the river: Nika Chu

DD/MM/Year:

Plot number:

Plot size:

Recorder:

Cordinates (E)

(N)

Altitude:

Slope:

A. Tree Vegetation(DBH > 1.3 m)

Sl.#	Species name	DBH (cm)	Tree Height (m)	Tally

B. Sapling Vegetation (DBH < 1.3 m)

Sl.#	Species name	DBH (cm)	Tree Height (m)	Tally

C. Regeneration (DBH < 0.5 m)

Sl.#	Species name	DBH (cm)	Tree Height (m)	Tally

Back To Office Report for environmental studies along Nika Chhu

Annexure IV: Data collection format III- Macro-invertebrates

Name of the river: Nika Chu

DD/MM/Year:

Plot number:

Recorder:

Cordinates (E)

(N)

Altitude:

Stream reache: Cascade

Pool

Riffle

Run

Sl.#	Order	<u>Family</u>	Count

Annexure-II- Land Details

Sl. No.	Thram No.	Name	Plot No.	Land Name	Land Type	Thram Area	Affeted Area	Actual Area to be/ already acquired	Compensated area (Ac)	Additional Land to be compensated
1	510	Sumchokmo	TAN-3253	Nyala	Kamzhing	0.406	0.406	0.406	0.000	0.406
2	56	Dorji	TAN-1843	Lorim	Kamzhing	2.150	0.840	0.840	0.480	0.360
3	58	Ugyen Zangmo	TAN-1842	Lorim	Kamzhing	0.880	0.213	0.213	0.107	0.106
4	255	Sonam Wangchen	TAN-1889	Dorteng	Kamzhing	0.699	0.699	0.699	0.210	0.489
5	255	Sonam Wangchen	TAN-1873		Kamzhing	1.047	0.132	0.132	0.132	0.051
6	181	Kunzang Wangmo	TAN-1909	Draktsawa	Kamzhing	0.372	0.372	0.372	0.165	0.207
7	258	Dorji Dema	TAN-1863	Dragitsawa	Kamzhing	0.460	0.460	0.460	0.126	0.334
8	272	Tshewang Lhamo	TAN-1865	Samrang Gongwog	Kamzhing	0.888	0.658	0.658	0.469	0.189
9	268	Tshewang Gyeltshen	TAN-1875		Kamzhing	0.577	0.116	0.116	0.000	0.116
10	254	Rinzin Wangmo	TAN-1876	Leaychu	Kamzhing	0.372	0.152	0.372	0.000	0.372
11	269	Tshang Tshang Dorji	TAN-1878	Tangseydragchun	Kamzhing	0.526	0.215	0.526	0.197	0.329
12	269	Tshang Tshang Dorji	TAN-1879	Tangseydragchun	Kamzhing	0.527	0.203	0.527	0.155	0.372
TOTAL							4.466	5.321	2.041	3.331

No additional affected

Sl.no.	Thram No	Project Component	Name		Land Type	Thram Area	Acquired	Land affected by
1	527	Adit 3	Namgay Chholing CPS		Institutional Land	2.819	0.423	Road
2	270	Power House	Dorji Zangmo		Kamzhing	1.2	0.183	Road
3	262		Ugyen Tshomo		Kamzhing	1.12	0.28	Road
4	240		Sonam Pelmo		Kamzhing	0.765	0.142	Road
Total Area (Acres)							1.028	

Annexure-II- Land Details

Area Leased

Project Component	Thram No	Name	Plot No	Land Type	Thram Area (Ac)	Area affected (Ac)	Already compens ated	Area to be and/leased (Ac)	Land affected by
Adit-V	246	Palden	TAN-1907	Kamzhing	0.480	0.480	0.000	0.480	Access road-V
	243	Kinley Zangmo	TAN-1906	Kamzhing	0.648	0.362	0.000	0.362	
	274	Tshering Norbu	TAN-2872	Kamzhing	0.777	0.196	0.000	0.196	
Power House									Access road to Power House
	257	Phub Zangmo	TAN-1855	Kamzhing	0.563	0.563	0.241	0.322	Contractor Constructi on Facility at Power House
	258	Dorji Dema	TAN-1880	Kamzhing	0.872	0.604	0.267	0.268	
		Tshewang Norbu	TAN-1881	Kamzhing	0.300	0.300	0.000	0.300	
Total									1.928

Details of land area affected by access road of 118 MW Nikachhu Hydropower Project

Sl. No.	Access Road to	Area (Ac)	area already in leased area (CCF/MD/BP) (Ac)	Area in Pvt. Land (Ac)	Total area to be leased (Ac)
1	Power House	5.049			NA
2	Surge Shaft	1.900	0.36	0.10	1.440
3	Adit-V	1.270		0.78	0.490
4	Adit-IV	0.802	0.25		0.552
5	Adit-III	2.559	1.24	0.46	0.859
6	Adit-II	3.684	0.70		2.984
7	Adit-I	2.017	0.40	0.13	1.487
8	Dam	2.371	0.65	0.22	1.024
			0.35		
			0.13		
TOTAL		19.652	4.08	1.69	8.836

