Deedoke Hydropower Project

Environmental and Social Impact Assessment Report

Annexes

Author

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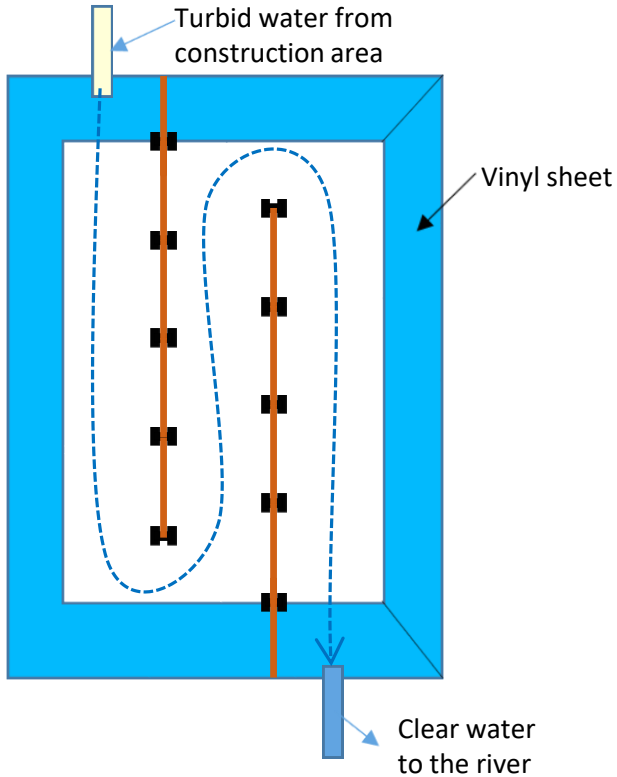
A N N E X 4 A - 1

EXAMPLE OF SETTLING POND FOR DEEDOKE HPP

Annex4A-1-Example of Settling pond for Deedoke HPP

Image of settling pond

[Plan]



[Photo]

- ❖ Waste water from construction area such as powerhouse, main dam excavations will be transferred into these settling pond to avoid the turbidity of river water by construction activities.
- ❖ The sedimentation plume will not occur because the power house and main dam excavations are cut off with the river by the cofferdams
- ❖ The design of this kind of settling pond will depend on the Contractor's plan

Wastewater Management at Base Camp and Worker Camp

Figure: Common Septic Tank

- A type of concrete septic tank commonly used in Myanmar will be utilized to collect the sewage waste from toilets in the Base and Worker Camps.

- The domestic wastewater (grey water) such as bathing water and kitchen water will be distributed into small drainage channels will be absorbed by the surrounding vegetation or discharged into the river through a side ditch drainage system in the compound.

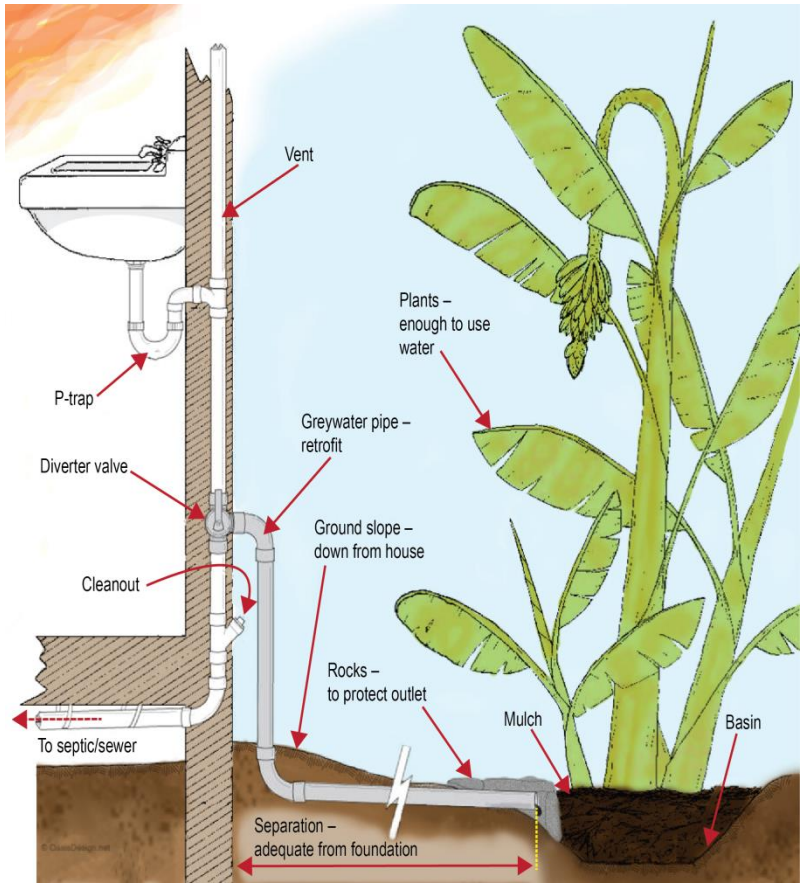


Figure: Greywater disposal plan

A N N E X 4 A - 2

LOCATION OF QUARRY SITE AND DISTANCE TO THE NEARTEST VILLAGE

Annex 4A-2 – Location of Quarry Sites and Distance to the Nearest Village

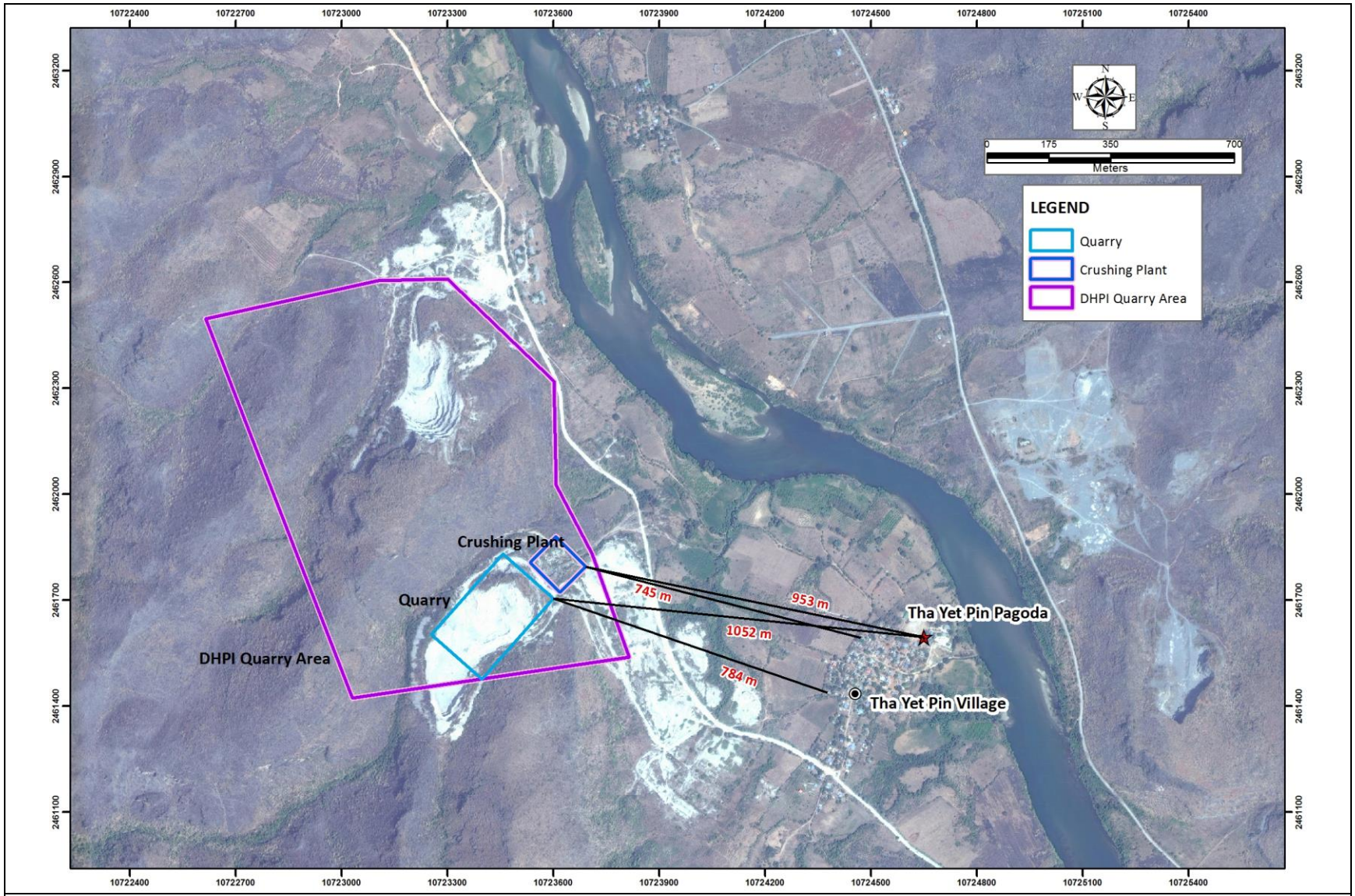


Figure 4A-2 - Location of Quarry Sites and Distance to the Nearest Village

A N N E X 4 A - 3

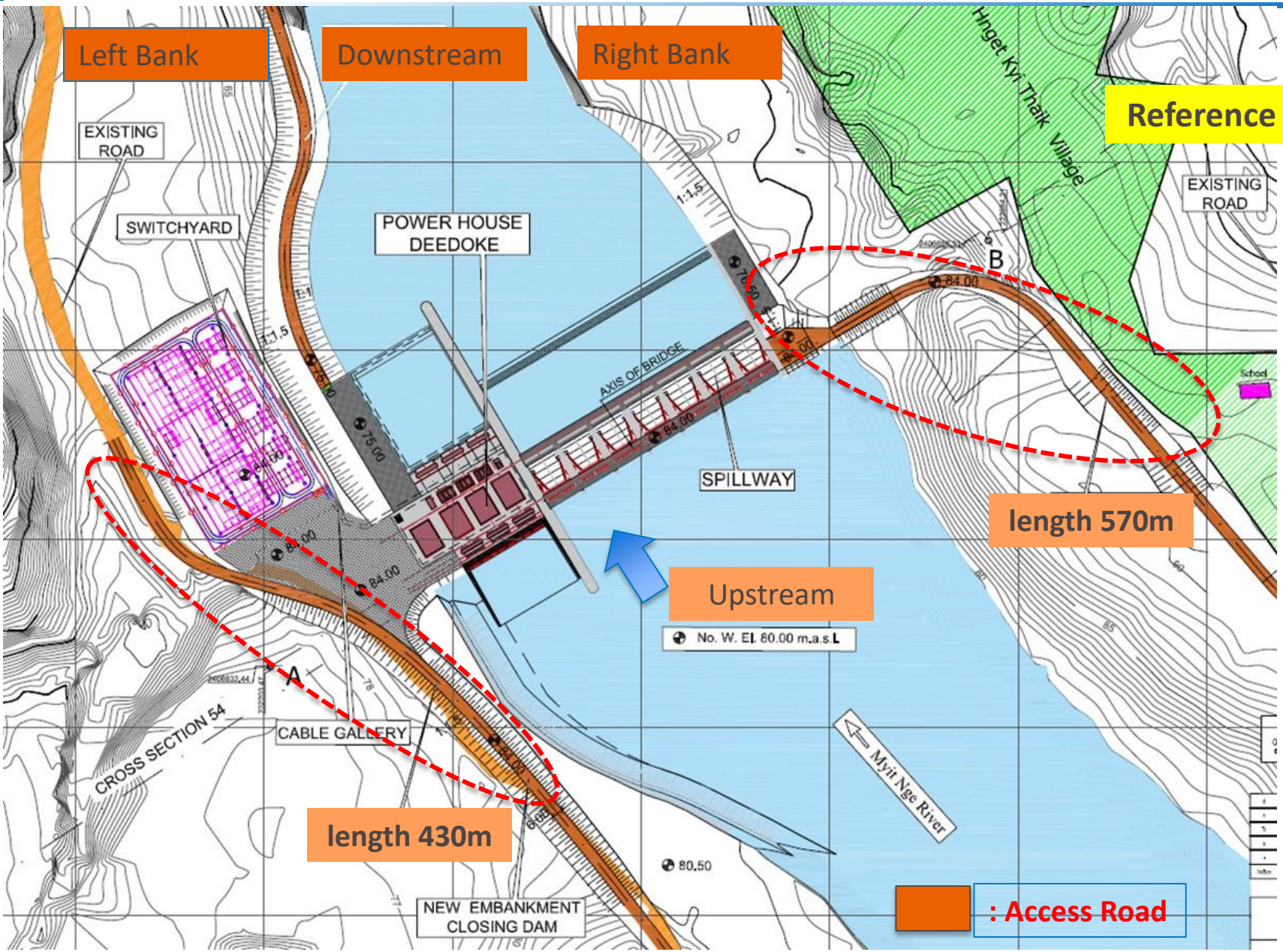
SAMPLES OF ACCESS ROADS FOR DEEDOKE HPP

Deedoke Hydropower Project Development

Access Road (Annex5A-5)

14th Jane 2018

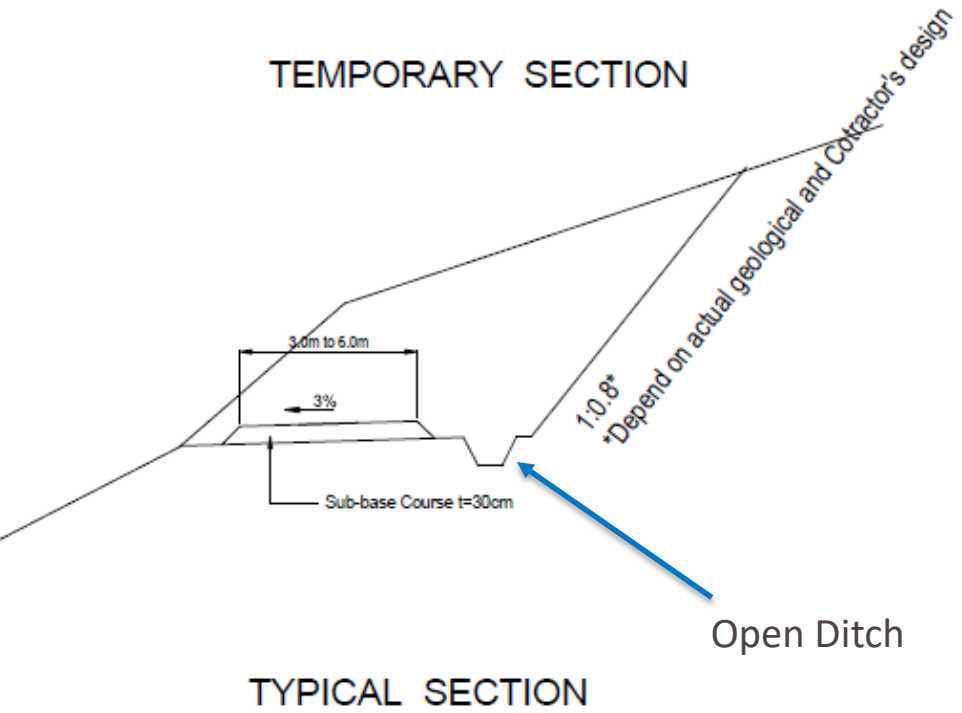
Access Road

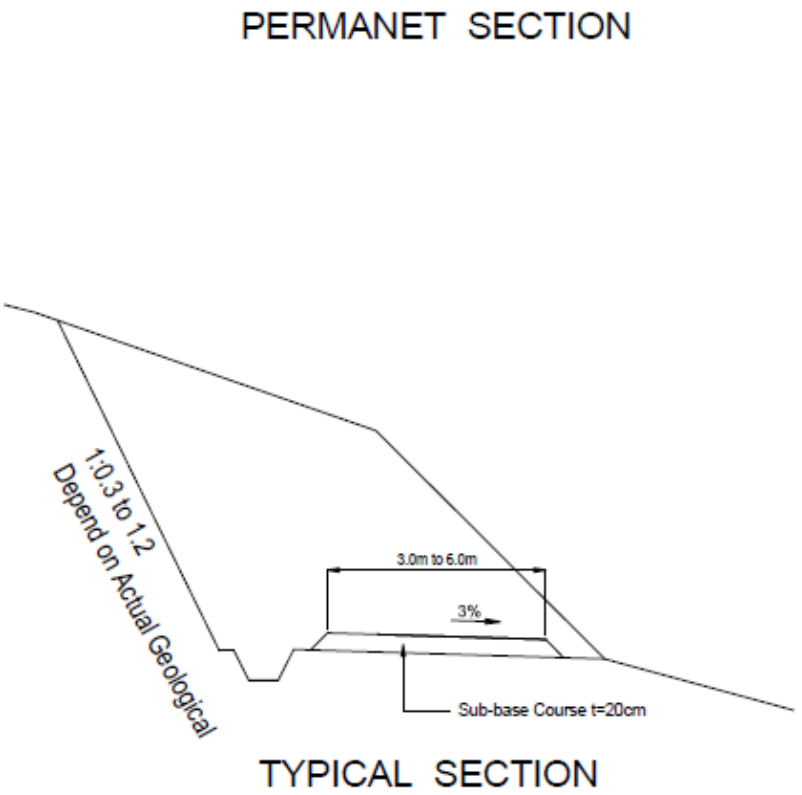

Left Bank
Downstream
Right Bank
Reference only
EXISTING ROAD
SWITCHYARD
POWER HOUSE DEEDOKE
AXIS OF BRIDGE
SPILLWAY
EXISTING ROAD
Hnget Kyi Thak Village
School
length 570m
Upstream
No. W. El. 80.00 m.a.s.l.
CABLE GALLERY
CROSS SECTION 54
length 430m
Myit Nge River
80.50
NEW EMBANKMENT CLOSING DAM
: Access Road

Access Road

Basic Design of Road

Reference only





Samples for Access Roads

Construction Roads

Permanent/ Main Roads

A N N E X 4 A - 4

IMPACT ASSESSMENT ON HYDROLOGY

Annex 4A-4-Impact Assessment on Hydrology

Assessment on Hydrology (based on available data) is described below,

A1. Concept of Deedoke Hydropower Plan

The Deedoke Hydropower Project ("Deedoke HPP") is planned on the Myitnge River approximately 20 km downstream of the Yeywa Hydropower Plant ("the Yeywa HPP) as shown in **Figure 1**. Since the Yeywa HPP has a large reservoir and regulates river inflow by the reservoir, the Deedoke HPP can enjoy the regulated inflow without its own reservoir. This means that the Deedoke HPP can efficiently generate power without a high dam and a reservoir, and it leads to good economic performance of power generation.

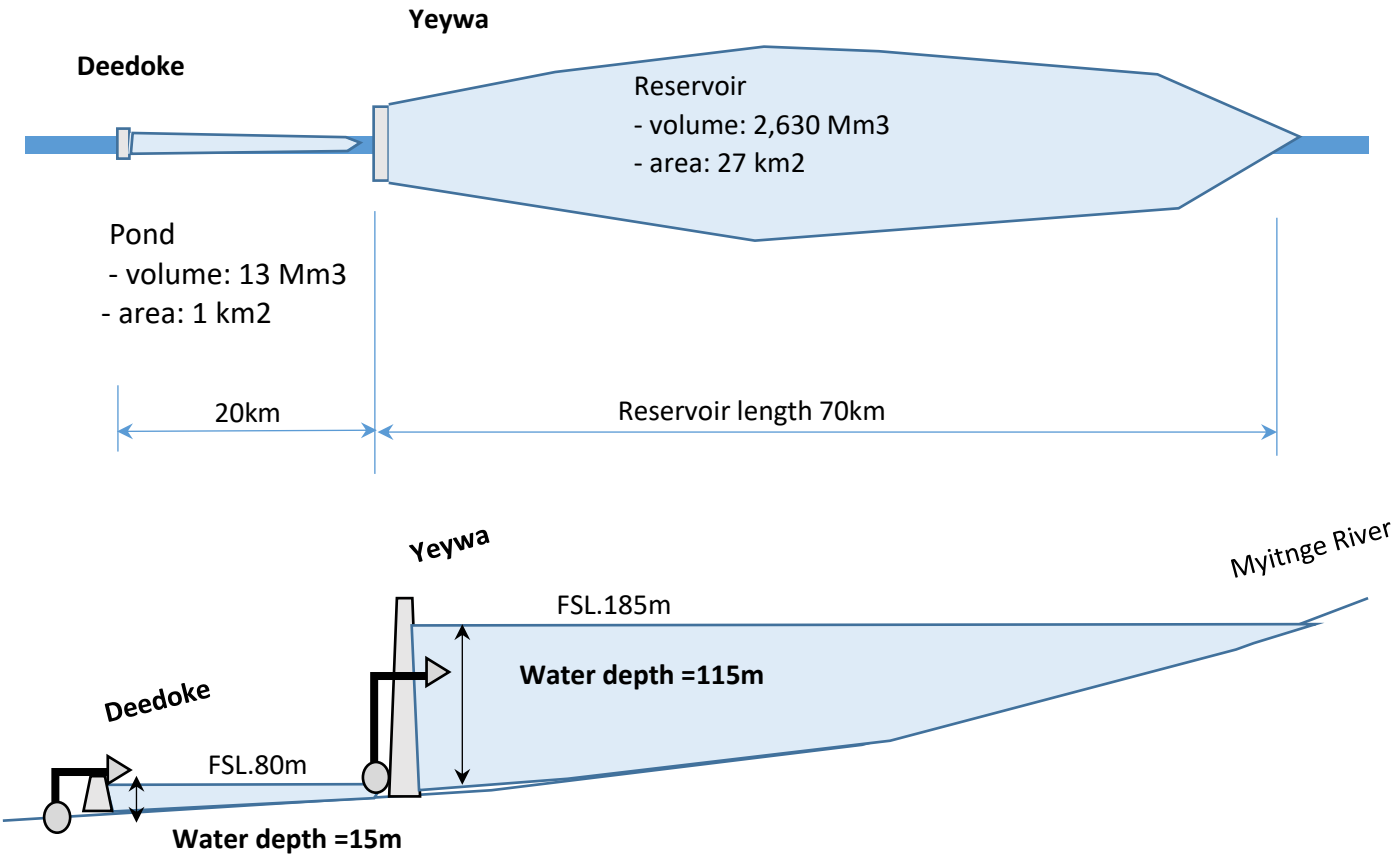


Figure 1 Location of Deedoke and Yeywa HPPs

A 2. Hydrology in Myitnge River

A 2.1 Construction Phase

In the construction period of the dam and spillways, the river flow would be diverted through the diversion channel. The hydrology of the Myitnge River would not be significantly changed. Impacts on the river regime during the construction would not be significant and limited in the diversion channel. The river will flow though the diversion channel during the spillway construction and finally coffer dams will be removed from the river.

A 3.2 Operation Phase

(1) Normal flow period

The Deedoke HPP is planned to be developed as a run of river type hydropower project and has only a pond. The storage water volume is too small to regulate river inflow compared to the river inflow volume, Thus, it is noted that, in general, the Deedoke HPP would not alter the present river flow regime. This means that the inflow at the Deedoke HPP would be similar to the outflow through year, as explained in **Figure 2**.

Namely,***Outflow (4) = Inflow(3) ≅ Outflow (2) .***

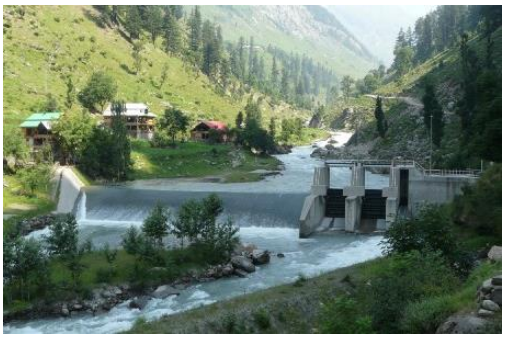


Photo- Example of ROR dam
48 MW run-of-river hydro-power project in Pakistan

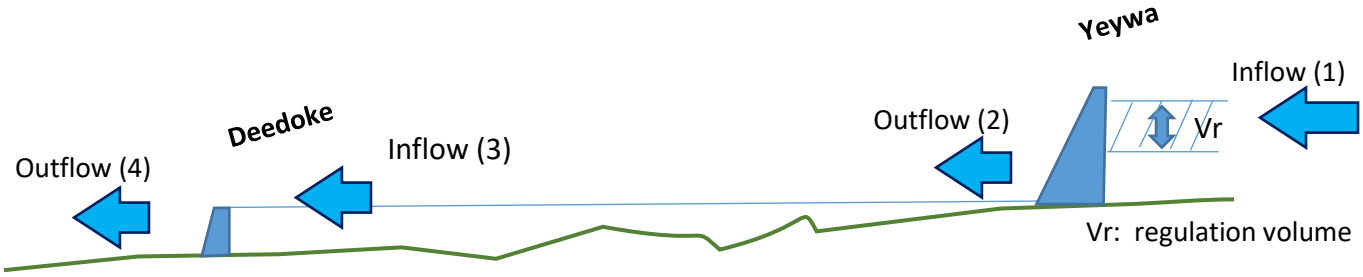


Figure 2-River Flow Condition in Normal Flow Period

(2) Flood flow period

The spillway is designed with the capacity to discharge the design flood water of 7,300 m3/ s (return period of 10,000 years) at the pond water level 82 m. However, in flood events, all the spillway gates will be fully opened in order to make the pond the original river as shown in **Figure 3**.

According to the past records at the Shwezayan Gauging Station, floods of 1,000 to 1,500 m3/s occur every year. In such flood events, the power generation of the Deedoke HPP will be continued with the spillway gate partially opened to keep the pond water level at Normal Water Level. In the next detailed design stage, the operation in the flood events will be carried out in order to mitigate backwater effects to the upstream area.

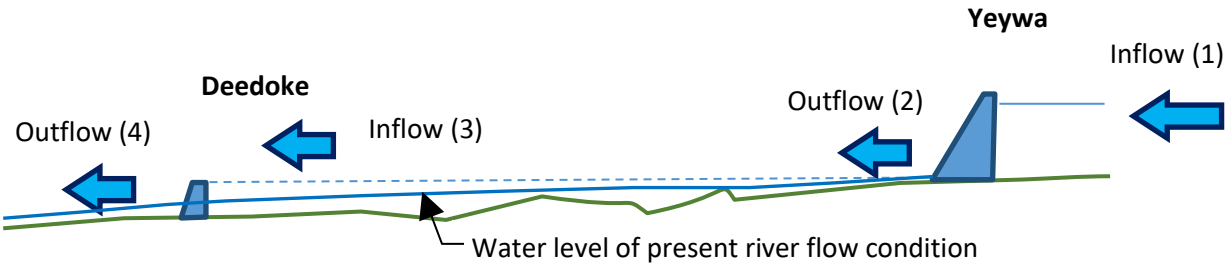


Figure 3-River Flow Condition in Flood Flow Period

(3) Residual Impacts

a. Predicted Level of Residual Impacts

In the normal flow period, generally, a run-of-river hydropower project will keep the pond water level at a normal water level (NWL) through year. However, in the flood period, spillway gate operation will be required for safety in the upstream regions as well as continuous power generation. Inflow of the Yeywa HPP and water level at the Deedoke HPP will be monitored continuously for rational and effective gate operation. Therefore, the Deedoke HPP will be operated in cooperation with the Yeywa HPP so as to minimize impacts to the upstream and downstream regions of the Deedoke HPP. The impacts should be acceptable to the affected households.

b. Evaluation of the Significance of impact from alteration of hydrology

The impact from alteration of hydrology in the flood period, especially on the upstream communities is evaluated as follows:

Impact category	Direct impact
Impact duration	Flood period
Impact extent	The section of Myitnge River between Yeywa and Deedoke
If no control – **Impact magnitude**	Alteration of flow elevation in Myitnge River especially upstream area from the Deedoke HPP
– **Severity**	Low to medium
Control priority	**Medium**

(4) Monitoring and Inspection

River flows and levels at the Deedoke HPP will be daily measured and recorded as part of the hydropower plant operations.

The spillway gates will be periodically inspected and maintained to ensure their function.

A N N E X 4 C

DESCRIPTION OF THE STRUCTURE OF PROJECT INFRASTRUCTURE AND PROCESS WHICH CAN RESIST THE SEISMIC

Annex – 4C Description of the structure of project infrastructure and process which can resist the seismic

According to seismic zonation map as shown in the following ***Figure 5C-1***, the project area is located in the Zone III to IV (high seismic risk).

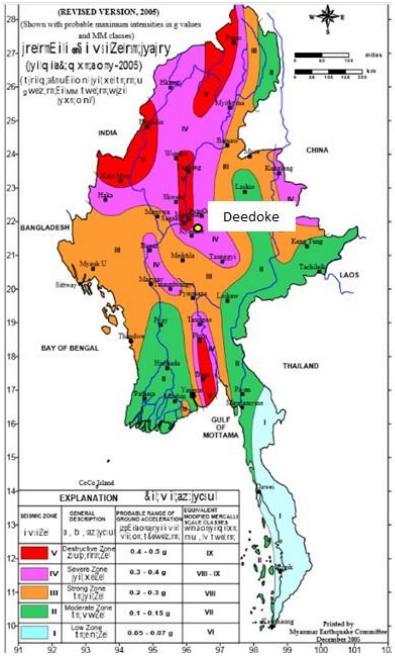


Table 1

Zone	MM Classes	Probable Damage	Examples of Damage
V	IX	Major damage	Considerable damage in specially designed structures Major damage in good RC buildings
IV	VIII – IX	Considerable damage	Considerable damage in good RC buildings Major damage in ordinary brick buildings
III	VIII	Moderate damage	Moderate damage in good RC buildings Considerable damage in ordinary brick buildings
II	VII	Minor damage	Minor damage in good RC buildings Moderate damage in ordinary brick buildings
I	VI	Slight damage	Minor damage in ordinary brick buildings

Source: SEISMIC ZONE MAP OF MYANMAR Revised by Dr. Maung Thein, U Tint Lwin Swe and Dr. Sone Han (December 2005)

Figure 5C-1: Seismic Zonation Map

A simplified extrapolation of the available hazard maps of the region of Mandalay has been carried out as shown in ***Figure 5C-2 to 4***.

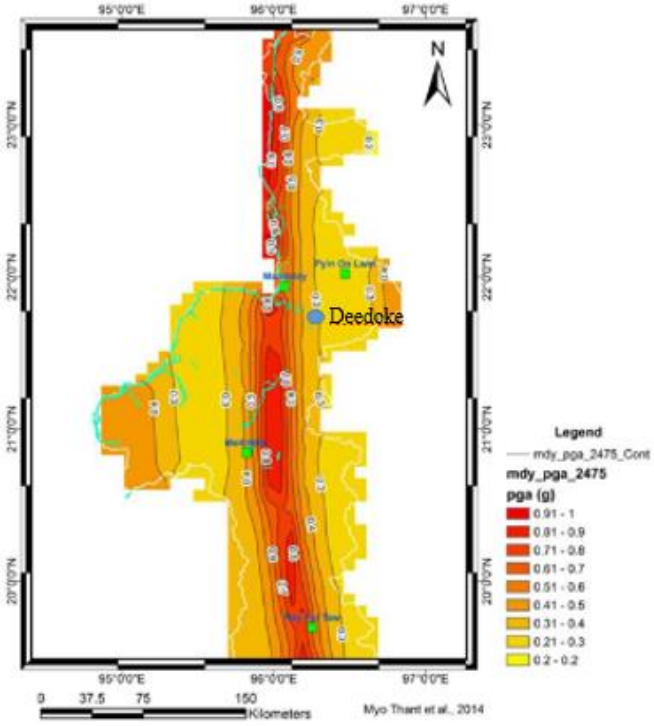


Figure 5C-2 Probabilistic seismic hazard map of the region of Mandalay -2% probability in 50 years.

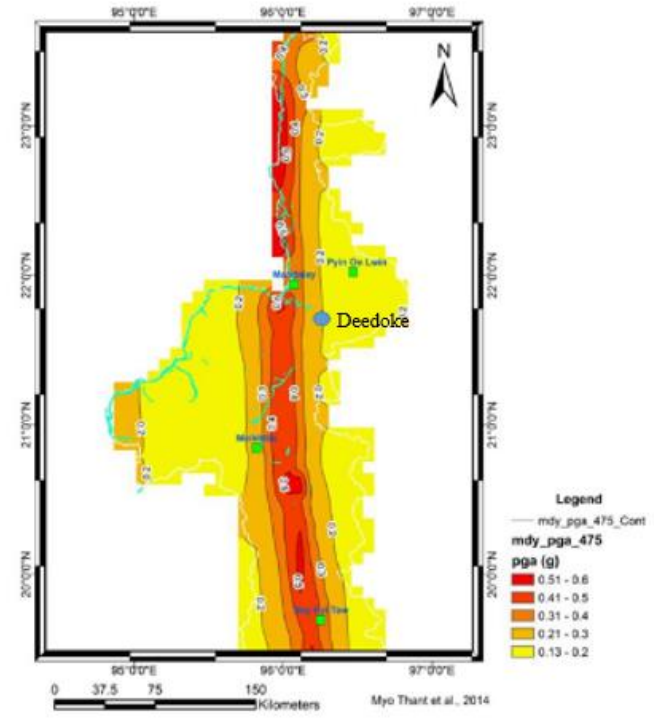


Figure 5C-3 Probabilistic seismic hazard map of the region of Mandalay - 10% probability in 50 years.

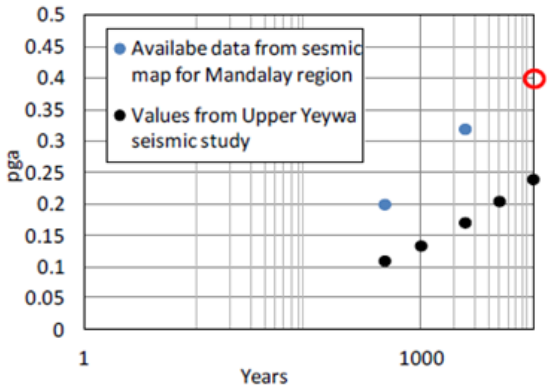


Figure 5C-4 Estimation of the PGA with a return period of 10'000 years by extrapolation of the available hazard maps of the region of Mandalay

Then Seismic hazard assessment shall be done by both Probabilistic Seismic Hazard Assessment (PSHA) and Deterministic Seismic Hazard Assessment (DSHA) methods are applied for the seismic hazard analysis of Deedoke Dam Project. PSHA is used for estimation of peak ground acceleration (PGA) and Spectral acceleration for MDE, DBE, OBE and CE together with the other suitable return periods, while
DSHA for MCE. Both PSHA and DSHA methods are explained briefly in the following sections.

Basically, the seismic load for the structures is shown as below.
For dams with small or limited damage potential shorter return periods can be specified. Due to the limited damage potential of Deedoke dam the SEE is taken as a PGA with a mean annual exceedance probability of 1/2'475.

Seismic load for the Structures

Features	PGA	Seismic load*
OBE (Operational Basis Earthquake)	0.2g (475 years)	0.13g
SEE1 (Safety Evaluation Earthquake)	0.32g (2’475 years)	0.21g

*To compensate the quasi-static application of the dynamic loads in the stability analyses, a correction factor of 2/3 is applied to the peak ground accelerations according to the international standard (USACE).

The result of dam stability is shown as the table.

It was found that all safety requirements are met for three scenarios.

Stability of Dam

	Case	Result	Safety factor (Based to USACE)	Judgement
Sliding	OBE	1.8	≥ 1.7	OK
	SEE	1.3	≥ 1.3	OK
Overturning	OBE	69% of Base length	middle 1/2 (25%-75%)	OK
	SEE	73% of Base length	within base (0%-100%)	OK
	Ultimate (kPa)	Allowable (kPa)	Maximum pressure (kPa)	
Bearing capacity	13,891	4,782	>250	OK

A N N E X 5 D

HYDROLOGY

5 Hydrology

5.1 Climate

The climate of Myanmar is governed by westerlies flowing in June to November and easterlies (trade wind) in March to May. Because of these monsoons, in general there are three seasons in Myanmar such as the cool season with less rainfall from November to February, the hot season with less rainfall from March to the beginning of May, and the rainy season from May to October. In terms of rainfall, the rainy season in the Myitnge River basin is from May to October and the dry season from November to April according to the rainfall record at the Shwesayan, Yeywa PS, Hsipaw and Mandalay.

The Myitnge River basin is located in the northeast Myanmar (Figure 5-1). Most of the Myitnge River basin is located in the Shan State, but the downstream reaches including the Yeywa PS and the Deedoke candidate dam sites are located in the Mandalay Division. The annual rainfall of the Deedoke HPP would be approximately 1'300 mm, which can be seen in the mean monthly rainfall record at the Shwesayan gaging stations and the Yeywa PS (Figure 5-2).

The climate in the basin may be influenced by the westerlies flowing in June to November and easterlies (trade wind) in March to May, since two peaks of the rainfall are observed in the rainfall record at the Yeywa PS and Mandalay.

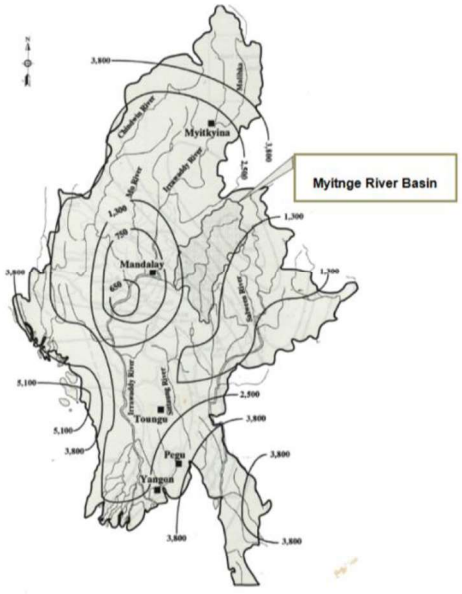


Figure 5-1. Isohyete map of Myanmar

The temperature recorded at Mandalay and Hsipaw shows the same tendency (Figure 5-2). Namely, rather large gaps between the maximum and minimum are seen in the period from November or December to April or May, which agrees with the period of dry season. The maximum gap of temperature is observed in April. In April, a gap of the maximum and minimum relative humidity becomes largest in a year. Corresponding to this tendency, a peak of evaporation can be seen in April.

Following figure present the monthly values of the rainfall, the temperature, the relative humidity and the evaporation in the project area

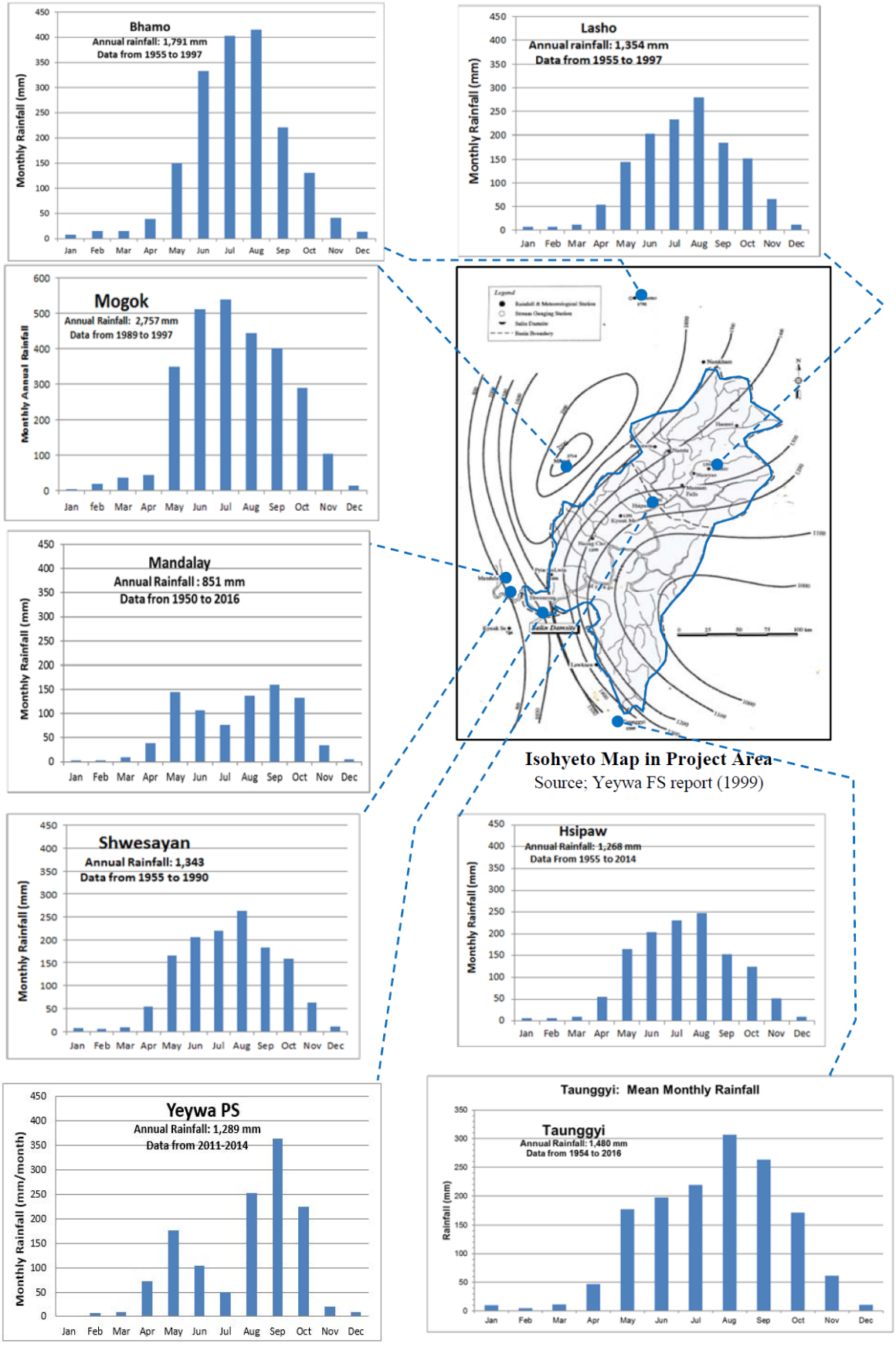


Figure 5-2. Mean Monthly Rainfall in Project Area

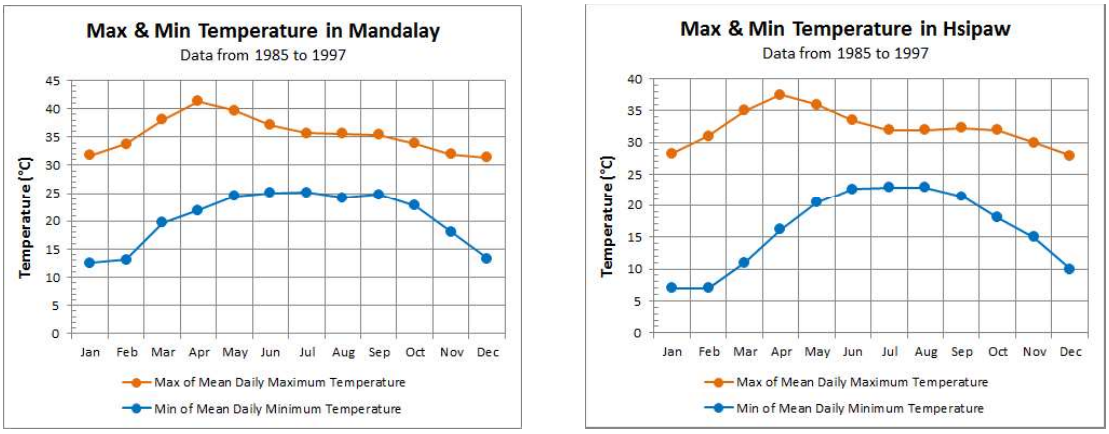


Figure 5-3. Temperature in Project Area

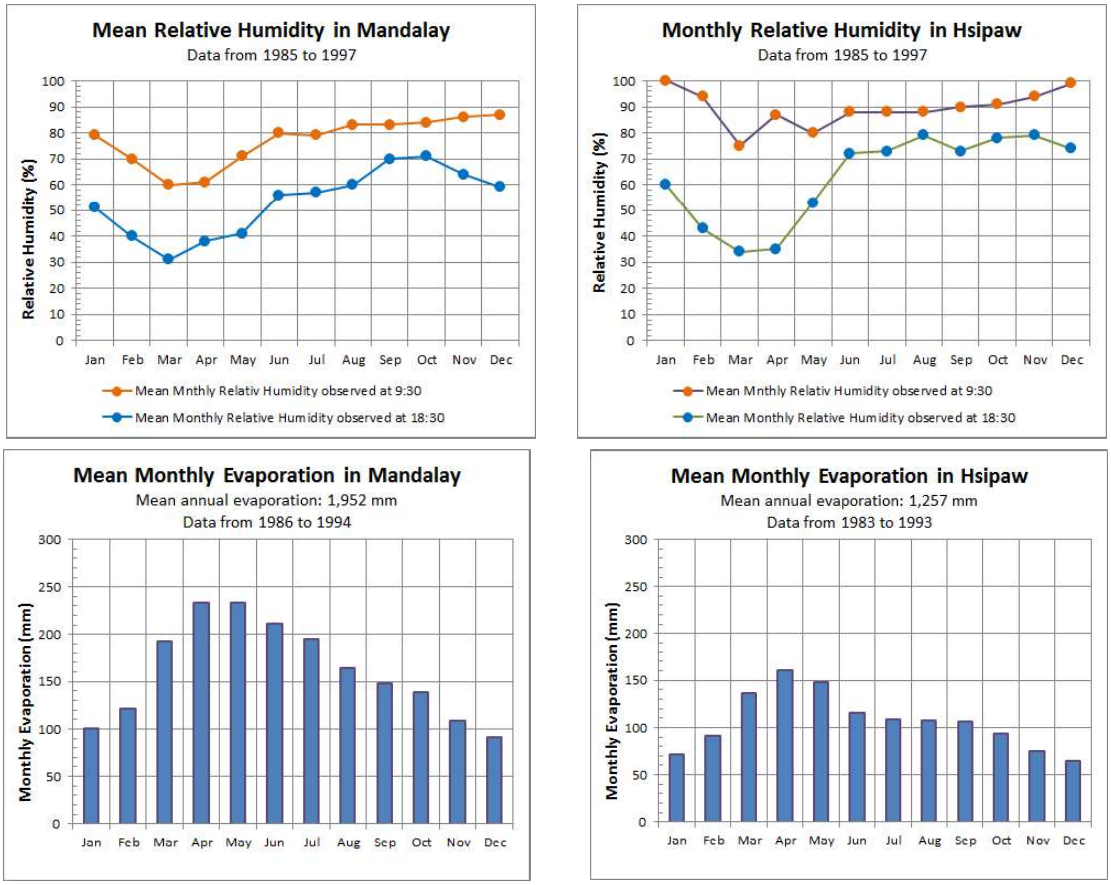


Figure 5-4. Relative humidity in project area (top) Evaporation in project area (bottom)

5.2 Design Flood

Since the distance between the Deedoke site and the Yeywa site is very small, the difference of catchment areas between the Deedoke HPP site and the Yeywa dam is only about 1% of the catchment area of the Yeywa dam and is therefore negligible. Hence, the flood statistics of the Yeywa dam are deemed to be applicable for the Deedoke HPP.

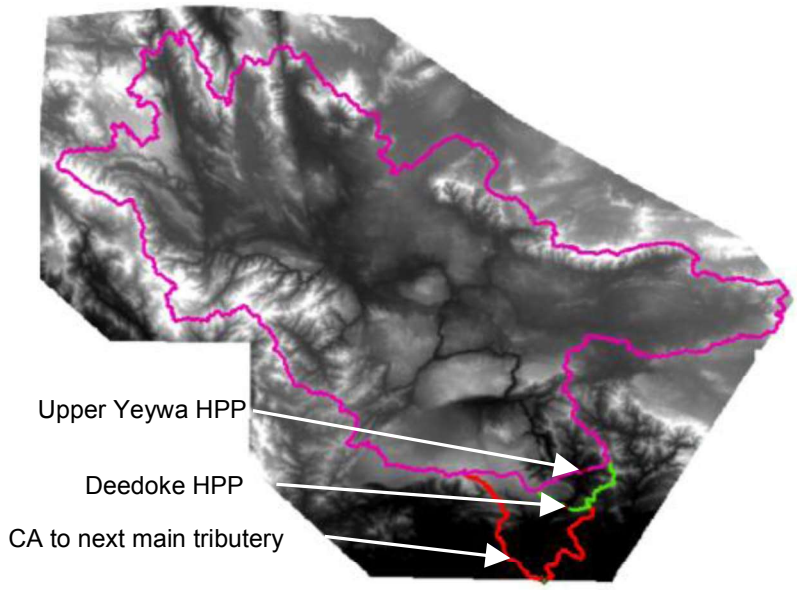


Figure 5-5. Calculated catchment area from the SRTM using ArcGIS

However, a new frequency analysis was carried because in the feasibility study in 1999 of Yeywa dam mean daily discharges are used as annual maximum discharges and not the maximum daily discharges.

Finally, the probable maximum flood (PMF) studied in the Yeywa FS report (1999) was reviewed and compared with other design floods in Myanmar.

5.2.1 Frequency Analysis

The table below shows the annual maximum flood data recorded at the Shwesayan GS, which is presented in the Yeywa FS report (1999) for frequency analysis. However, the data seems to be the mean daily discharge data, which can be confirmed by the attached data to the same FS report (1999). Although this data shows the discharge data after simulation, the data from 1972 to 1994 is the data recorded at the Shwesayan GS, by which the simulation model had been calibrated according to the Yeywa FS report (1999).

Therefore, the frequency analysis considers:

- the data from 1972 to 1994 is used, and
- the data is be converted to instantaneous peak discharges by formula.

There are basically two different approaches to estimate the instantaneous peak flow from mean daily flow data [4]. The first approach is to estimate a peak flow coefficient; a ratio of instantaneous peak flow and the corresponding mean daily flow with physiographic characteristics of the basin (Fuller 1914, Silva 1997, Silva and Tucci 1998). The second approach is that a sequence of mean daily flow data is used to estimate peak flow (Jarvis 1936, Langbein 1944, Linsley et al 1949, Sangal 1983, Fill 2003).

In this study, the method proposed by Sangal (1983) was applied.

In the table below the mean daily flow data and the instantaneous peak flow data converted by Sangal's method is presented. Fill's method is presented for reference only.

Sangal's equation is given as follows;

$$Qpp = \frac{4Q2 - Q1 - Q3}{2}$$

with,

Q_{pp}: instantaneous peak flow
Q_1: mean daily flow on the preceding day of the maximum
Q_2: the maximum mean daily flow
Q_3: mean daily flow on the succeeding day of the maximum

The frequency analysis of the converted peak flows from 1972 to 1994 was carried out by Gumbel and Log Pearson III. As a result, following design floods were obtained. Those are estimated by the Gumbel's probability density function because, as seen in Figure 5-6, Gumbel shows higher floods than those of Log Pearson III.

Table 5-1 Mean daily flow and converted peak flow at Shwezayan

	Year	Date	Q2 Mean Daily Discharge at Shwesayan (m3/s)	Q1 -1 day	Q3 +1 day	Sangal (1983)	Fill and Steiner (2003)			Remarks
						Qmax=(4Q2-Q1-Q3)/2	x	k	Qmax=(0.8Q2+0.25(Q1+Q3))/k	
1	1972	1-Sep	1,342	1,134	1,097	1,569	0.83	1.12	1,456	
2	1973	22-Aug	2,600	2,005	2,462	2,967	0.86	1.15	2,790	
3	1974	13-Aug	2,178	2,138	1,744	2,415	0.89	1.18	2,309	
4	1975	4-Sep	1,712	1,291	1,700	1,929	0.87	1.16	1,827	
5	1976	27-Sep	1,990	1,400	1,772	2,394	0.80	1.09	2,190	
6	1977	2-Sep	2,650	2,420	2,650	2,765	0.96	1.23	2,744	
7	1978	24-Jul	2,046	1,959	1,763	2,231	0.91	1.19	2,154	
8	1979	6-Aug	1,985	1,942	1,568	2,215	0.88	1.17	2,110	
9	1980	5-Oct	1,488	1,230	1,327	1,698	0.86	1.15	1,597	
10	1981	12-Sep	2,296	2,074	2,054	2,528	0.90	1.18	2,427	
11	1982	23-Aug	2,010	1,532	2,005	2,252	0.88	1.16	2,140	
12	1983	5-Aug	1,996	1,700	1,840	2,222	0.89	1.17	2,119	
13	1984	22-Oct	3,266	2,245	3,230	3,795	0.84	1.13	3,534	
14	1985	11-Sep	2,329	1,219	2,165	2,966	0.73	1.02	2,644	
15	1986	15-Oct	3,926	3,854	3,872	3,989	0.98	1.26	4,027	
16	1987	26-Aug	1,491	1,006	1,376	1,791	0.80	1.09	1,640	
17	1988	8-Aug	1,410	1,160	1,320	1,580	0.88	1.16	1,501	
18	1989	17-Aug	1,357	1,163	1,158	1,554	0.86	1.14	1,458	
19	1990	17-Aug	1,285	1,103	1,155	1,441	0.88	1.16	1,369	
20	1991	6-Nov	2,162	1,787	2,034	2,414	0.88	1.17	2,298	
21	1992	17-Oct	3,048	2,630	2,608	3,477	0.86	1.15	3,271	
22	1993	5-Sep	2,296	2,046	2,138	2,500	0.91	1.19	2,416	
23	1994	25-Aug	2,294	2,035	1,897	2,622	0.86	1.14	2,464	

Table 5-2 Flood discharges at Shwesayan gauging station and at the project are for various return periods

Return Period (year)	Shwesayan GS (28,717 km^2)	Deedoke HPP (28,695 km^2)
10,000	7,304	7,300
5,000	6,910	7,000
1,000	5,997	6,000
500	5,603	5,600
100	4,688	4,700
50	4,291	4,300
20	3,763	3,800
10	3,354	3,400
5	2,928	3,000
2	2,285	2,300
1	1,209	1,300

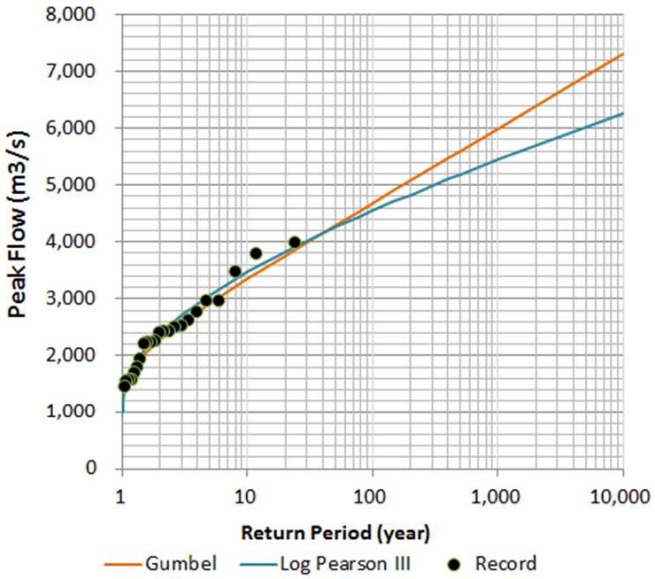


Figure 5-6. Frequency analysis at Shwesayan

An issue of importance for the designer is the dry season, this period allowing to complete works related to the river (diversion, cofferdams, excavations, etc.). A flood frequency analysis has been carried out for the period from December to June by using the approach by Gumbel.

Table 5-3 Mean daily flow and converted peak flow at Shwezayan in dry season

	Year	Date	Q2 Max. Q in dry season (Dec to May)	Q1 -1 day	Q3 +1 day	Sangal (1983) Qmax= (4Q2-Q1-Q3)/2	Fill and Steiner (2003) x	k	Qmax= {0.8Q2+0.25(Q1+Q3)}/k
1	1972	2-Dec-72	674	506	634	778	0.85	1.13	727
2	1973	1-Dec-73	845	776	820	892	0.94	1.22	879
3	1974	1-Dec-74	386	405	374	1) 396	1.01	1.28	393
4	1975	2-Dec-75	522	492	495	551	0.95	1.22	543
5	1976	1-Dec-76	794	624	763	895	0.87	1.16	847
6	1977	21-May-78	515	426	482	576	0.88	1.17	548
7	1978	1-Dec-78	358	364	356	1) 361	1.01	1.28	365
8	1979	3-Dec-79	678	592	640	740	0.91	1.19	714
9	1980	27-May-81	906	293	867	1,232	0.64	0.95	1,073
10	1981	1-Dec-81	616	616	608	620	0.99	1.27	630
11	1982	1-Dec-82	344	346	335	1) 345	0.99	1.27	352
12	1983	1-Dec-83	520	526	514	1) 523	1.00	1.27	530
13	1984	26-May-85	433	362	387	492	0.86	1.15	464
14	1985	1-Dec-85	512	512	511	513	1.00	1.27	522
15	1986	1-Dec-86	412	422	402	1) 417	1.00	1.27	420
16	1987	5-Dec-87	930	634	628	1,229	0.68	0.98	1,080
17	1988	17-May-89	319	310	182	392	0.77	1.07	355
18	1989	27-May-90	849	703	717	988	0.84	1.12	919
19	1990	2-Dec-90	310	310	308	311	1.00	1.27	317
20	1991	1-Dec-91	745	763	721	1) 754	1.00	1.27	761
21	1992	1-Dec-92	502	508	490	1) 505	0.99	1.27	513
22	1993	1-Dec-93	790	807	784	1) 799	1.01	1.28	804
23	1994	1-Dec-94	412	427	392	1) 420	0.99	1.27	421

1) Qmax=(Q1+Q2)/2

In the Table 5-4 below, several instantaneous peak flows on 1st December have been calculated as an average of Q1 and Q2. In such cases, Q1 on 30th November (the last day of rainy season)

is larger than Q2 on 1st December (the first day of dry season) and this would not be the case Sangal expected. Therefore, the possible highest discharge on 1st December is regarded as an average of Q1 and Q2.

As a result, the following design floods in dry season were obtained.

Table 5-4 Design floods in dry season (December to May)

Return Period (year)	Shwesayan GS (28,717 km^2)	Deedoke HPP (28,695 km^2)
50	1,429	1,500
25	1,271	1,300
10	1,058	1,100

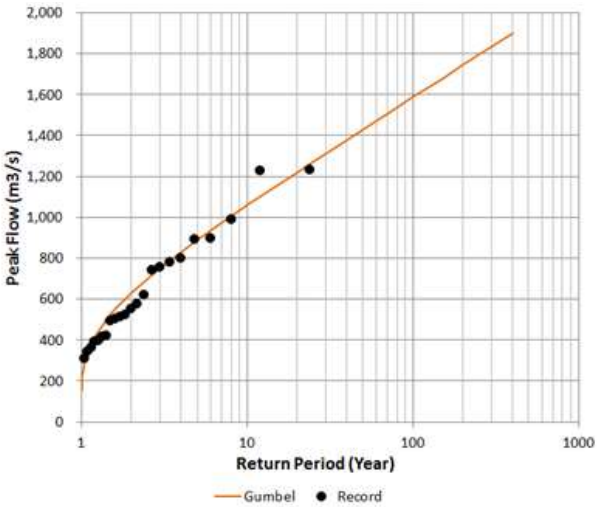


Figure 5-7. Frequency analysis at Shwesayan for dry season

5.2.2 Probable Maximum Flood (PMF)

The PMF (Probable Maximum Flood) of the Yeywa PS was estimated to 12'500 m^3/s in the FS report (1999) by the runoff simulation model i.e. a unit hydrograph introducing the PMP (Probable Maximum Precipitation) and observed floods at the Shwesayan GS. PMP was estimated by two approaches such as a statistical approach and a meteorological approach, and both led to the almost same PMP of 208.8 mm and 201.1 mm, respectively. The Figure 5-8 shows maximum flood record in Myanmar.

In principle, the flood statistics of Yeywa dam is valid for the Deedoke project since the additional catchment area between the two sites is negligible. Therefore no specific PMF study has been carried out for the Feasibility Study.

Nevertheless, the PMF discharge calculated for Yeywa dam seems very high. However, since the Deedoke weir has practically no important influence on the water level during such high, extreme discharges the effective value is less important for the design of Deedoke power plant.

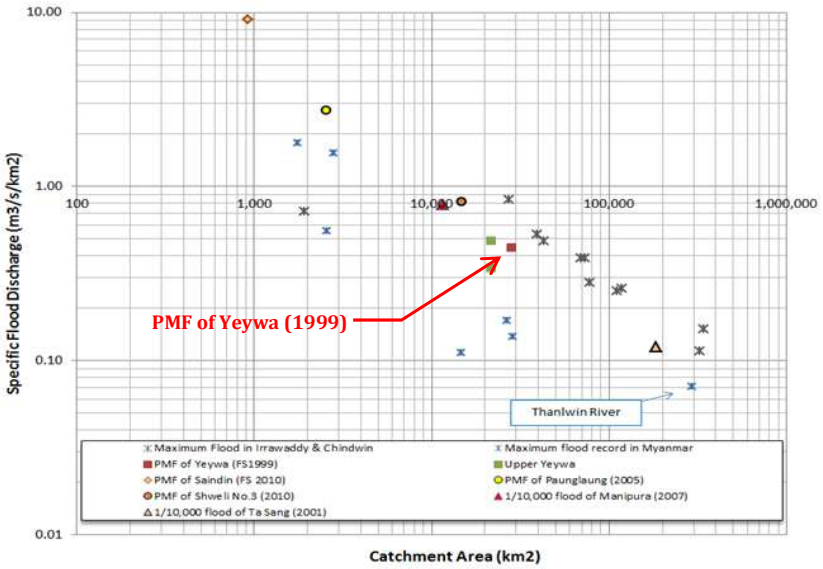


Figure 5-8. Maximum flood records in Myanmar

5.2.3 Sedimentation

As the Deedoke HPP is located just downstream of Yeywa reservoir with a large storage capacity and being designed as a run of river type, sedimentation will be no issue although countermeasures to avoid coarse sediment materials coming into the turbine should be foreseen.

Sediment Data in Myitnge River Basin

No data related to sedimentation is available in the Myitnge River basin although some suspended load samples have been taken according to the FS report (1999). The dead storage volume of the Yeywa reservoir is planned based on the annual sediment yield of 200 m^3/km^2/year, which was estimated on the basis of the sediment yield of 160 m^3/km^2/year in the Paunglaung River basin. In the FS report (1999), the horizontal sediment level of 131.5 m after 100 years was estimated assuming a trap efficiency of 90 % at the reservoir.

Generally, periodical monitoring of the reservoir by sounding gives us useful sediment data for planning of hydropower projects on the same basin or nearby. Such monitoring, however has not been carried out and there is no plan of the monitoring at present according to the monitoring team in the Yeywa PS. Furthermore, following verbal communication no water quality tests have been carried out so far.

Sediment Flushing at Yeywa Reservoir

There is no description of sand flushing concept in the Yeywa FS report (1999) and the Final Inception Report of Yeywa (2001). The Yeywa dam has a bottom outlet on the right bank mountain. However, the function of the bottom outlet is only to release water during impounding and in emergency, not to release sediment.

Following DHPI (Department of Hydropower Implementation, MOEP) (verbal communication during site visit in January 2015), no sediment flushing was planned so far.

A N N E X 5 E - 1

SEDIMENTATION AND EROSION STUDY

Annex 5E-1-Sedimentation and Erosion Study

Sedimentation

According to the "Yeywa HPP-Inception Report,2001", the MEPE performed 3 sediment sampling at the Yeywa dam site in 1998, and the AF-Consultant added 12 test results on suspended sediment concentration in 2001.

Despite a relatively wide variation of discharges at the measurements, the sediment concentrations of the Myitnge River basically ranged from 0.005g/l to 0.05g/l, and the maximum value was 0.2g/l.

The consultant evaluated 200m^3/year/km^2 would be reasonable as the specific sediment transportation of the river.

It is expected that 90% of the sediment yielded from the basin have been trapped in the Yeywa HPP and the rest of the sediment is wash load and/or suspended load which have passed through the Yeywa HPP or overflowed on the spillway. Those sediments would be transported by outflows of the Yeywa HPP including the spillway.

According to the information, the total sediment into the Deedoke project was calculated as follows.

Schematic diagram of sediment discharge in the Myitnge River Basin is shown in ***Figure1***. Left figure shows the natural condition for the Deedoke Reservoir without the Yeywa Reservoir. Middle figure shows the natural condition to the Yeywa reservoir. Right figure shows the future condition for the Deedoke Project.

Sediment inflow to Deedoke Reservoir can be calculated as follows:

$Qsinact(DDK) = Qsoutact(YYW) + Qsinact(RB)$

$Qsinact(RB) = Qsinnat(DDK) – Qsinnat(YYW)$

$Qsoutact(YYW) = Qsinact(YYW) - Qsinact(YYW) \times TE(YYW)$

$Qsinact(YYW) = Qsinnat(YYW)$

Where;

Qsinact(DKK)	:	Sediment Inflow to Deedoke in actual condition with Yeywa (m^3/year)
Qsoutact(YYW)	:	Sediment outflow from Yeywa in actual condition with Yeywa (m^3/year)
Qsinact(RB)	:	Sediment inflow from the residual basin between Yeywa and Deedoke (m^3/year)
Qsinnat(DDK)	:	Sediment inflow to Deedoke in natural condition (m^3/year)

Qsinnat(YYW) : Sediment inflow to Yeywa in natural condition (m^3/year)

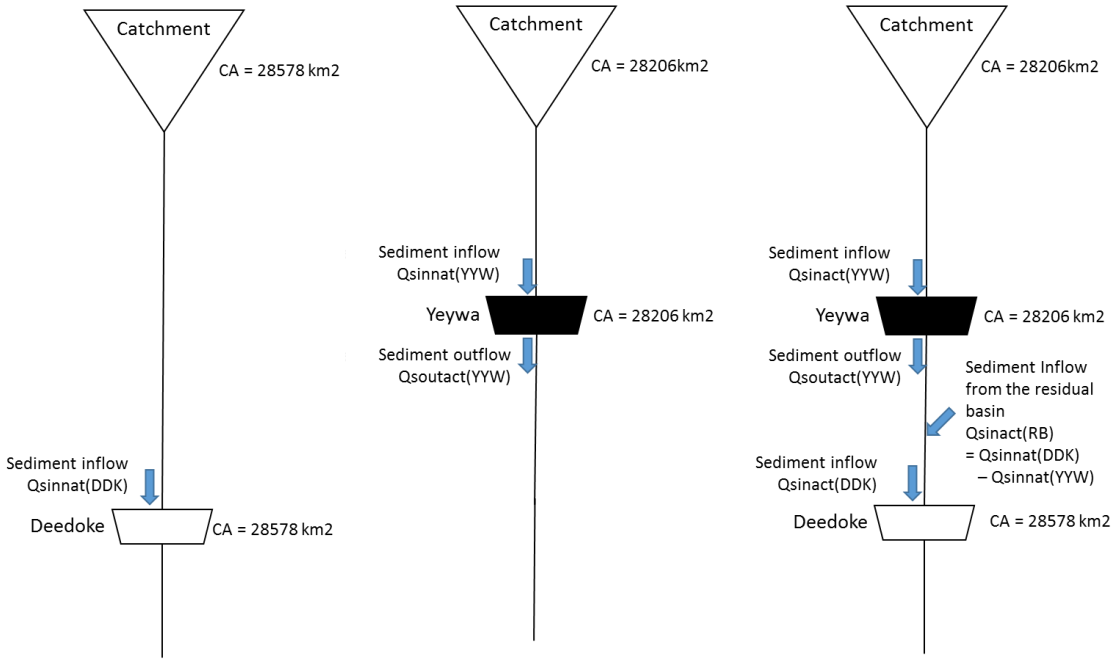
Qsinact(YYW) : Sediment inflow to Yeywa in actual condition with Yeywa (m^3/year)

As shown in ***Table 1***, the total sediment into the Deedoke reservoir per year is around 640,000 m^3/s.

As mentioned above, the sediment can be transported by river water from the dam site to the conference of the Irrawaddy River, distributed in the bottom of the river. The length of the river is around 80km and the width is assumed to be 100m. It is noted that the thickness of the sediment accumulated annually would be at large 8 centimeter (640,000m^3 / (80,000m x 100m), while most of the wash load will flow into the Irrawaddy River considering the nature of the wash load. It is concluded that the sedimentation downstream of the Deedoke spillway would be negligible for the safety.

Table-1 Estimation of the sediment

	A	B	C =A x B	D	E	F	G=C(DDK)−C(YYW)	H=F+G	
			Qsinnat	TE(YYW)		Qsoutact	Qsinact(RB)	Qsinact(DDK)	TE(DDK)
Reservoir	Catchment Area (km2)	Specific Sediment Yield (m3/km2/year)	Sediment Inflow (m3/year)	Trap Efficiency of Yeywa (%)	Trapped Sediment Inflow (m3/year)	Sediment outflow of Yeywa (m3/year)	Sediment inflow from residual basin (m3/year)	Sediment inflow of Deedoke =sediment outflow of Yeywa + sedimetnt inflow from residual basin (m3/year)	Trap Efficiency of Deedoke (%)
Yeywa	28,206	200	5,641,200	90	5,077,080	564,120			
Deedoke	28,578	200	5,715,600				74,400	638,520	0



Natural condition for Deedoke

Natural condition for Yeywa

Actual condition

Figure 1: Schematic Diagram of Sediment Discharge in the Myitnge River Basin

Erosion

According to the approved FS, in order to prevent erosion at the downstream of the spillway from occurring, the stilling basin was designed to be 50m long in consideration of the river hydraulics. Therefore, it is noted that the erosion which would give significant impacts on the downstream could not occur.

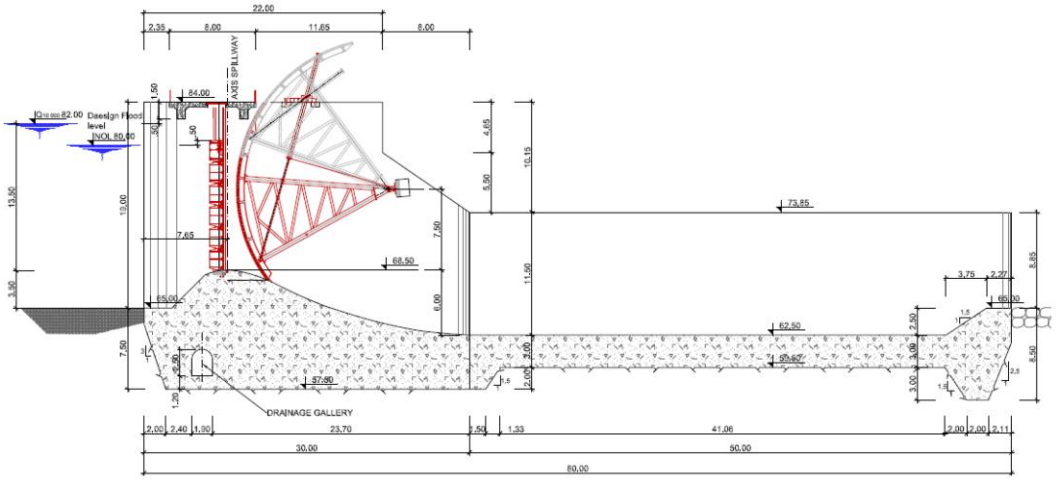


Figure 2 Stilling Basin

A N N E X 5 E - 2

INFORMATION ON STILLING BASIN

Annex – 5E-2 : Information on Stilling Basin

Stilling basin length is determined based on results of hydraulic model test described in the USACE as shown in ***Table-1***.
According to the table, the ratios of basin length (L2) and Tailwater level(d2) are about three (3).

L_2: Basin length
d_2: Tailwater level

Hydraulic Design Data from Physical Model Studies for Low-Head Navigation Dam Spillways
Based on Single-Gate Opening (Fully and/or Half) Criteria

Project Name	Item No.	Basin No.	Designed for What Gate Opening	Unit Discharge cfs/ft	Bay Width ft	Entering Froude No. F'*	d_2 ft	$\frac{TW}{d_2}$	$\frac{L_1}{d_2}$	$\frac{\text{Baffle Height}}{d_2}$	$\frac{L_2}{d_2}$	$\frac{\text{End Sill Height}}{d_2}$	d_{50}' ft
L&D 26	15	16	Full	775	110	2.5	44.5	0.81	1.08	0.27	2.6	0.25	3.8
Aliceville	13	6	Full	350	60	3.5	30.5	0.72	1.31	0.26	2.6	0.16	2.2
Columbus	16	5	Full	350	60	3.7	31.0	0.77	1.29	0.26	2.6	0.16	2.0
Red River No. 1	14	16	Full	484	50	3.9	39.6	0.81	1.26	0.25	2.8	0.43	1.7
Red River No. 2	10	13	Full	683	60	2.4	39.5	0.71	1.06	0.23	2.5	0.18	2.5
Red River No. 3	**	2	Full	817	60	2.75	47.9	0.79	1.15	0.21	3.0	0.15	2.6
L&D 26	15	30	Ice and Debris	382	110	3.7	32.8	0.91	1.58	0.24	3.0	0.15	2.6
Columbus	16	4	Half	242	60	4.4	26.2	0.84	1.53	0.31	3.1	0.19	1.7
Red River No. 1	14	9	Half	390	50	3.6	33.2	0.72	1.51	0.33	3.0	0.09	
Red River No. 1	14	17	Half	370	50	3.7	32.3	0.74	1.55	0.32	3.1	0.09	1.5
Red River No. 1	14	7	Half	370	50	4.1	33.7	0.71	1.48	0.34	2.7	0.27	1.1

Table-1 Hydraulic design data

Source: EM 110-2-1605 Hydraulic design, U.S. Army Corps of Engineers

Referring the above international standard, the ratio is adopted four (4) to determine the length of stilling basin. And stilling basin type for energy dissipation (to govern hydraulic jump) is selected Type IV by the USBR. As the result, stilling basin length is set to be 50m.

A N N E X 5 F

RESPONSE COMMENT ON SURFACE WATER SAMPLING

Annex 5F- Response Comment on Surface Water Sampling

Collecting of samples at each station was performed by composite sample. The sample from each station is obtained by combining of multiple grab from different depth at sampling station. This technique can improve temporal coverage of an area without increasing sampling number. The water samples at each station were poured into appropriate container prior completed and preserved immediately to prevent the change in constituent (*See Table below for preservation method*). The samples were store at low temperature ($\leq 6^{\circ}C$ but above freezing). Some parameters includes Conductivity, Dissolved oxygen, pH, Temperature and Salinity were measure *in situ.*

Surface water quality study was shown in ***Photo 6F-1***

Most parameter of surface water were analysed within appropriate interval time between collection and analysis but there are two parameters of BOD and turbidity which were not analysed within such time. The water sample for these two parameters are kept in opaque container and stored in cool condition in order to minimize microbiological activities which would probably degrade the sample. It is noted that only of those water samples which collected in April are sent to Thailand while water samples of July 2015 are sent to laboratory in Myanmar (ISO Tech, see ***Photo 6F-2***), these samples are analysed within three days after collection. Result of BOD analysis of this study in dry season (April) are relatively low (1.0 – 2.0 mg./L) compared with 6.0 – 22.0 mg./L during wet season, measured concentration of turbidity is coincident. This is proably caused by runoff during wet season.

	
1. Sampling of water from different depth at sampling station	2. Gathering of sampled water from each grab into plastic jar
	
3. Pouring of sampled water to containers and fixation prior store in cool container	4. In situ measurement of water quality at sampling station

Photo 6F-1 Surface water quality study at each station

Summary of Preservation, Analysis Methods, Detection Limit and container of water sample for Surface water quality study

Category	Parameter	Unit	Preservation Method [1/]	Analysis Method [1/]	Max. Period of Allowable Storage	Container
1.Physical	Depth	m.	Measure at Site		-	-
	Conductivity	µmho/cm.	Measure at Site	*In situ*/ Conductivity Meter	-	-
	Temperature	°c	Measure at Site	*In situ*/ Thermometer	-	-
	Transparency	m.	Measure at Site	Secchi disc		-
2.Chemical	pH	- -	Measure at Site	*In situ*/pH meter	-	-
	Salinity	ppt	Measure at Site	*In situ*/ Salino meter	-	-
	Dissolved oxygen	mg/L.	Measure at Site	*In situ*/ DO Meter	-	-
	BOD_5	mg/L.	Refrigerate in Cooling Container ≤ 6˚C	5120-B	**48 hr.**	PPE Bottle
	Turbidity	NTU	Refrigerate in Cooling Container ≤ 6˚C	2130-B	**48 hr.**	PPE Bottle
	Suspended Solids	mg/L.	Refrigerate in Cooling Container ≤ 6˚C	2540-D	7 days	PPE Bottle
	Total Dissolved Solids	mg/L.	Refrigerate in Cooling Container ≤ 6˚C	2540-C	7 days	PPE Bottle
	Total Solids	mg/L.	Refrigerate in Cooling Container ≤ 6˚C		7 days	PPE Bottle
	Oil and grease	mg/L.	Add H_2SO_4 to pH<2 and refrigerate to ≤ 6˚C	5520-D	28 days	Glass Bottle
	Total Hardness	mg $CaCO_3$/L.	Add H_2SO_4 to pH<2 and refrigerate	2340-C	6 months	PPE Bottle
	Carbonate Alkalinity	mg $CaCO_3$/L.	Refrigerate in Cooling Container ≤ 6˚C	2320-B	14 days	PPE Bottle
	Bicarbonate alkalinity	mg $CaCO_3$/L.	Refrigerate in Cooling Container ≤ 6˚C	2320-B	14 days	PPE Bottle
	Ammonia-Nitrogen	mg/L.	Add H_2SO_4 to pH<2 and refrigerate ≤ 6˚C	4500-NH_3-C	28 days	HDPE Bottle
	Nitrate-Nitrogen	mg/L.	Refrigerate in Cooling Container ≤ 6˚C	4500-NO_3^--B	14 days	HDPE Bottle
	Total Nitrogen	mg/L.		4500-Norg-B, 4500-NO_2-B 4500-NO_3^--B and calculate	28 days	HDPE Bottle
	Total Phosphorus	mg/L.	Add H_2SO_4 to pH<2 and refrigerate	4500-P-E	28 days	HDPE Bottle
	Potassium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Aluminium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Magnesium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Sodium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Total Chromium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Zinc	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle

Category	Parameter	Unit	Preservation Method [1/]	Analysis Method [1/]	Max. Period of Allowable Storage	Container
	Cadmium	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Copper	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Manganese	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Nickel	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Total Iron	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Arsenic	mg/L.	Add HNO_3 to pH<2 and refrigerate	3114-C	28 days	HDPE Bottle
	Lead	mg/L.	Add HNO_3 to pH<2 and refrigerate	3120-B	28 days	HDPE Bottle
	Mercury	mg/L.	Add HNO_3 to pH<2 and refrigerate	3112-B	28 days	HDPE Bottle
3.Biological	Total Coliform Bacteria	MPN/ 100 ml.	Refrigerate in Cooling Container ≤ 6˚C	9221-B		Glass Bottle, then completely wrap by Aluminium Foil

Remark: 1/ American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WEF). 2012. Standard Methods for the Examination of Water and Wastewater. 22nd Edition. Washington, DC: American Public Health Association.

Photo 6F-2 Result of water quality analysis by ISOTECH (St.SW1-SW7 and GW1 & GW2)

A N N E X 5 J

MAP OF FOREST SAMPLING PLOT WITHIN DEEDOKE HPP STUDY AREA

Annex 5J-Map of Forest Sampling Plot within Deedoke Project Study Area

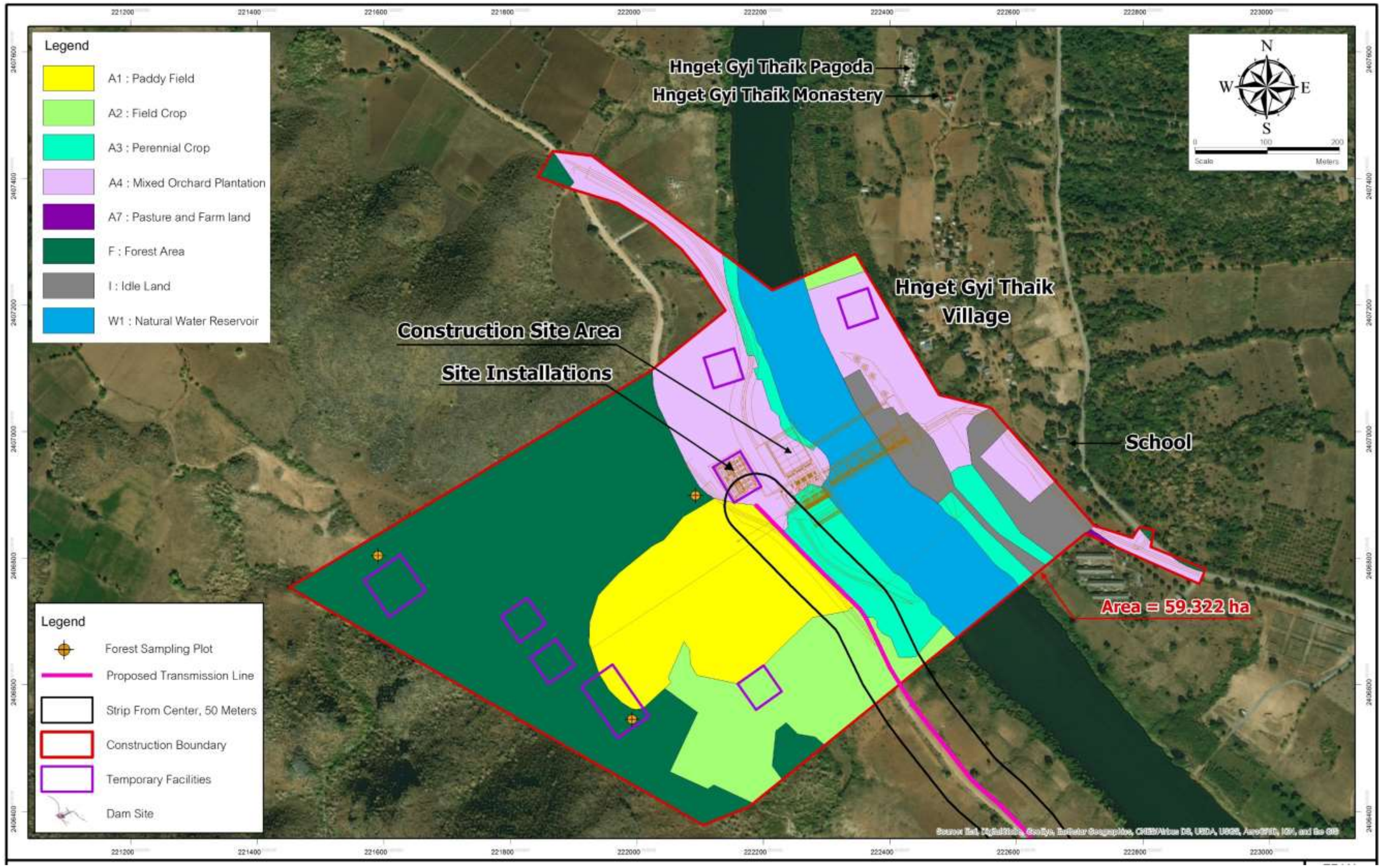


Figure 5J-Forest Sampling Plot Within Project Study Area

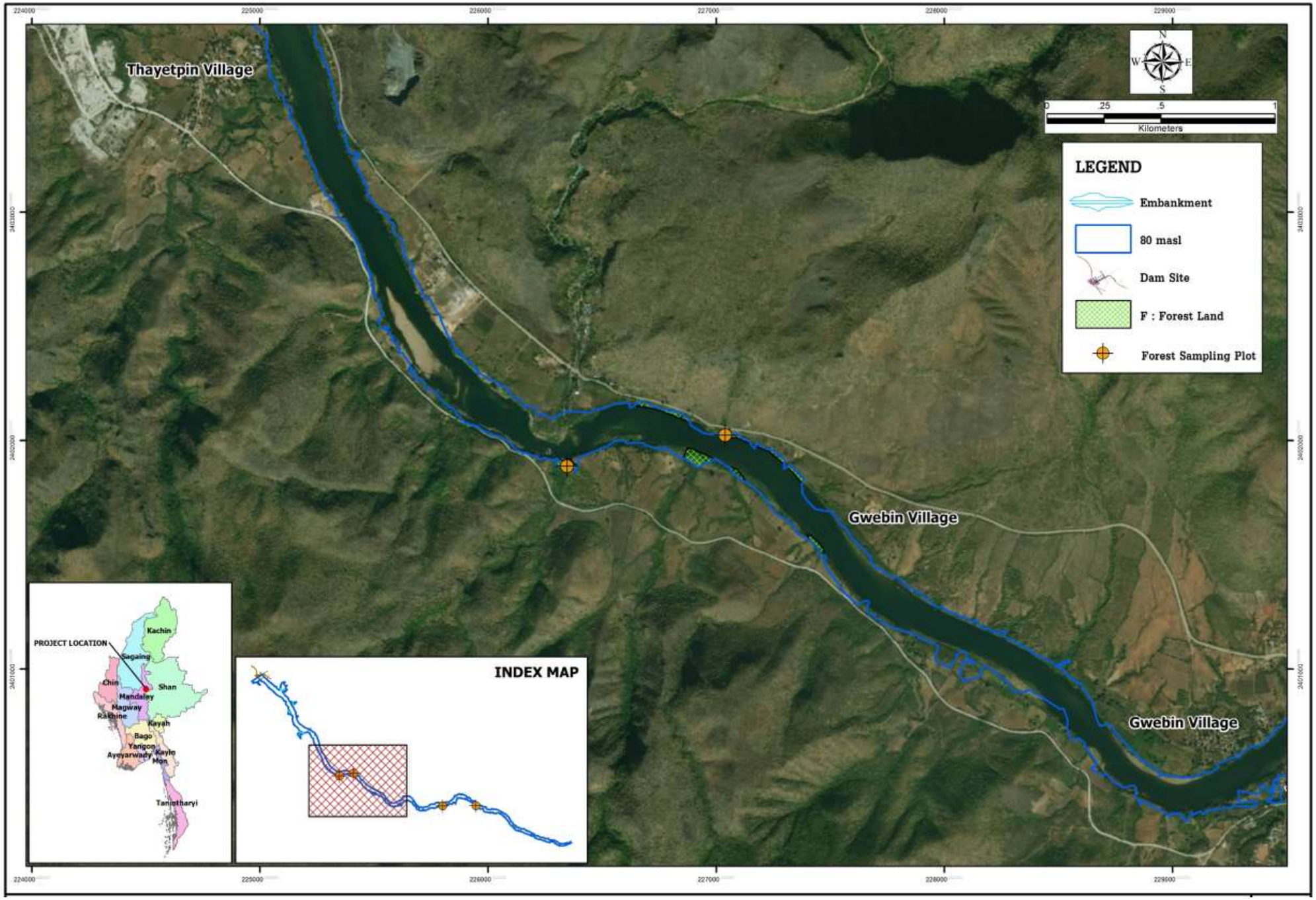


Figure 6J-Forest Sampling Plot Within Project Study Area (Cont'd)

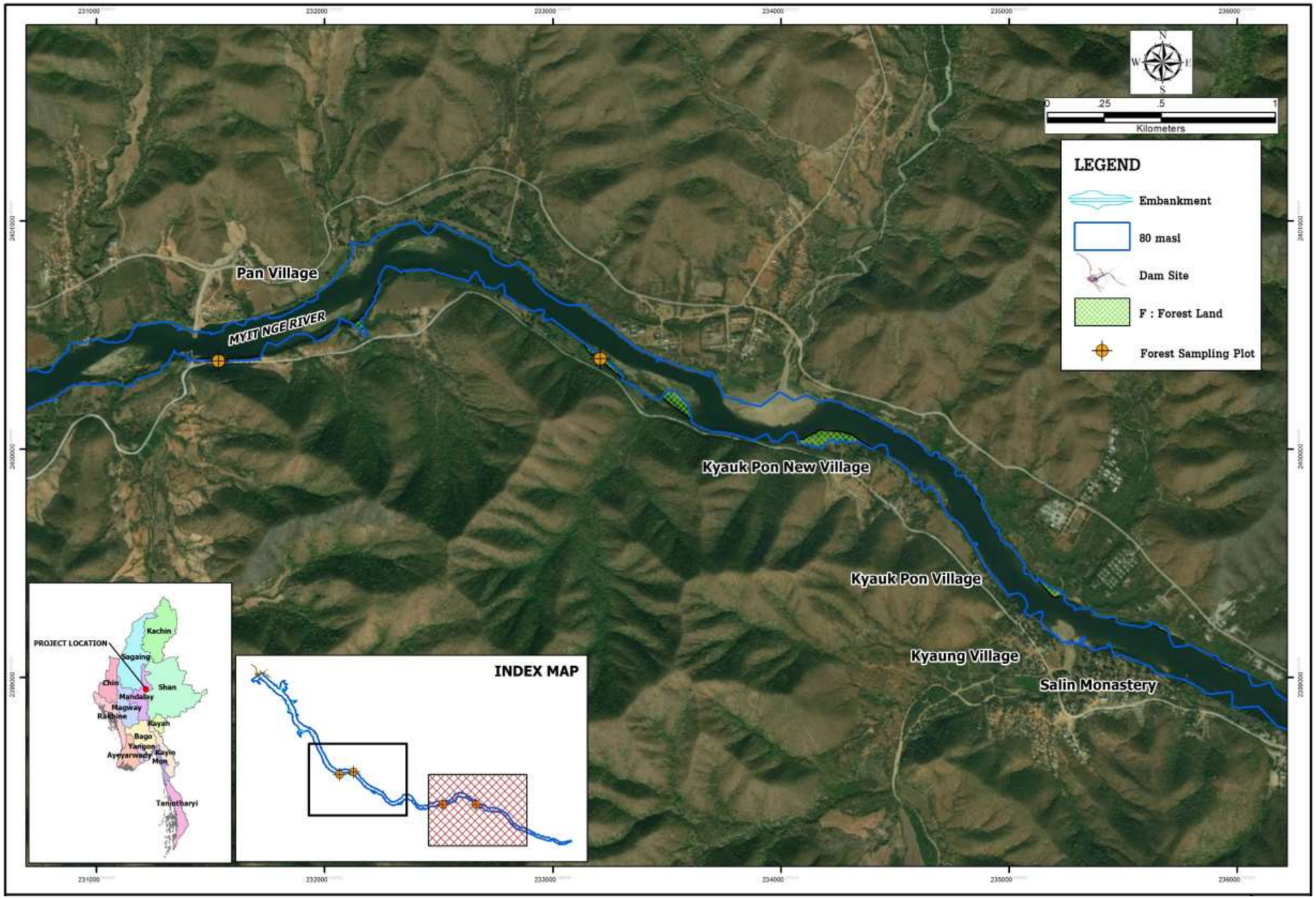


Figure 6J-Forest Sampling Plot Within Project Study Area (Cont'd)

A N N E X 5 K - 1

RESPONSE COMMENT ON AQUATIC FLORA, FAUNA & FISH SPECIES

Annex 5K-1-Response Comment on Aquatic Flora, Fauna and Fish Species

Fishes species found within the project location area

In final report, total 87 species of 27 families of freshwater fish had been listed within the project area. However, only 3 species were seen from 2 field surveys. In this supplement data 5 species of family Cyprinidae was suggested to be found within the purposed constructing area due to information on water quality and habitats availability. These species were the *Hypsibarbus myitkyinae*, *Osteobrama belengerii*, *Osteocheilus hasselti*, *Raiamas gatensis* and *Systomus orphoides*.

As the main channel of the Myitnge River in constructing area is under dam barrier, thence the daily change of water current was also highly fluctuated. During electric generating hours, water in main channel was clear, cold with swiftly current while non-operating period water become stagnant with shallowing depth. This highly fluctuation was not suitable for living of small species such as the minnows, spiny eels and also young of predator species such as snakehead (*Channa* spp.).The species that encounter this fluctuation would be the larger species such as Nga phe aung (*Osteobrama belengeri*) and the Nile tilapia (*Oreochromis niloticus*) while the smaller species such as Nga lay doun (*Osteobrama cunma*), Nga maw tawt (*Esomus* spp.) and probably other small species such as Snakehead and Croaking gourami cannot stand for strong current and move to live in tributaries.

Spawning time, spawning habitats and nursery area of fished in the project area was indicated in **Table 5K-1** It is obviously seen that peak of spawning time of fish is ranging between late of summer to early rainy season. Prefer spawning habitats and nursery area were flood area. Hence, available of upper dams had cut off supplying massive water volume to prevent flooding of downstream. This prevention along with alteration of water cycle would suffer most of downstream fish species in fewer of spawning and nursery area.

In conclusion, construction of the Dee Doke dam which is a smallest dam comparing to other upper dam would gave less effect to diversity of freshwater fish in project area. Seeming that the diversity of fish was threatened prior construction of this dam. The consultant still to keep on an idea of constructing of artificial wetland within dam area of enhancing fish production and diversity in new dam's reservoir.

Table 5K-1 Spawning time, Spawning habitats and Nursery Area of fishes in the project area

Family	Scientific name	Migratory	Peak of spawning	Type of spawning grounds	Nursery ground
Cyprinidae	*Hypsibarbus myitkyinae*	River	Late dry season	Gravels in headwater	Flood Area
	Systomus orphopides	Lateral	Late rainy season	Flood Area	Flood Area
	Osteobrama belangeri	Lateral	Late rainy season	Flood Area	Flood Area
	Barilius gatensis	Lateral	early rainy season	Open water	River
	Esomus danricus	Lateral	Late dry season	Flood Area	Flood Area
	Lepidocephalus thermalia	Lateral	Late rainy season	Flood Area	Flood Area
Clariidae	*Clarias batrachus*	Lateral	Late dry season	Flood Area	Flood Area
	Ophiocephalus striatus	Lateral	early rainy season	Flood Area	Flood Area
	Ophiocephalus gachua	Lateral	early rainy season	Flood Area	River
Cichlidae	*Oreochromis niloticus*	Lateral	All year	Flood Area	Flood Area
Anabantidae	*Anabas testudineus*	Lateral	Late dry season	Flood Area	Flood Area

Effect of sediments from constructing activities on fish and other aquatic organisms

As construction activities such opening of land surface, formation of dam's base for example would lead to leaking of some sediments into water. Basing on our survey, water in mainstream of Myitnge River was rather clear and probably high with nitrogen and phosphate due to a lot of water weed was found abundantly. Present of sediments would interfere photosynthesis of phytoplankton, delayed of hatching tine and sometime destroy eggs. Therefore, prevention of leaking of sediments would be the proper way to avoid these serious problems. Till now, exact calculation on sediments which will be produced from construction has not been released. Mitigation measure and monitoring plan for sediment should be proposed to cope with this issue to avoid further serious problem.

Fish migratory pattern and need of fish passage for the project

Data from **Table 6K-1** had shown that nearly all species within the project area were lateral migration which meaning of fish migrate to lateral of main channel for feeding, spawning and nursery purposes. Only one species of *Hypsibarbus* needs head water stream with rocky and gravel bottom for spawning. In addition, fish performs short migrate route to headwater stream of tributaries not the main river channel. As there were not any tributaries within the project area and only one found down the dam site. Therefore, construction of fish passage for this project could be skipped. According to previous report and interview of local fishermen, they expected that construction of dam would benefit their community by increasing of fish catching as the Yeywa dam. So instead of constructing of fish passage, the project should consider more on enhancing of fish productivity in newly established dam.

A N N E X 5 K - 2

ADDITIONAL ASSESSMENT ON EROSION

Annex 5K-2 Additional Assessment on Erosion

According to the approval FS, the volume of the coffer dam was 300,000m^3.

Basically, the surface of the coffer dam would be protected with rocks (riprap) or gabion so as to prevent erosion from occurring (see in ***Figure 1***).

In spite of the mitigation, the volume of the sediment which might be transported due to erosion would be assumed to be 10% of the coffer dam volume during the construction period of 5 years. 10% is the same assumption of the wash load and suspended load in the "Yeywa HPP-Inception Report, 2001".

Based on the assumption, the volume is calculated to be 30,000 [m^3/s]. The thickness of the accumulated sediment to the downstream in the Myitnge River is:

30,000m^3 / (80,000m x 100m) = around 4mm

Furthermore, the concentration of the sediment would be:

30,000[m^3] / 2.0[t/m^3] (Unit weight of soil) / (15 Billion m^3 (Annual inflow) x 5 years) = 0.0008[g/l] << 0.005[g/l] (Minimum value of the records of the Myitnge River in the "Yeywa HPP-Inception Report, 2001)

Those results has revealed that the possible erosion of the coffer dam would be negligible considering the large volume of inflows of the Myitnge River., even though the surface protection would basically be taken as the mitigation.


A


B

Figure 1 : Riprap (A) and Gabion (B)

Mitigation measure on erosion

- Plan construction activities that may accelerate soil erosion rate during dry season, where possible.
- Minimize area of land clearance and carefully monitor stripped soil from erosion.

A N N E X 5 K - 3

EROSION AND SEDIMENT MANAGEMENT PLAN

Annex 5K-3 Erosion and Sediment Management Plan

Table 1: Activities Generating Erosion and Sedimentation Impacts and Corresponding Mitigation Measures.

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
Clearing of vegetation	Erosion Sediment pollution of waterways	The extent of areas to be cleared will be minimized as far as practical. The use of existing cleared areas will be maximized. Clearing of sites will be undertaken in the sequence that sites are required for construction. Progressive revegetation of exposed areas will take place as soon as practical following completion of construction works in that area. Suitable species for revegetation will be used. If construction works are temporarily stopped in an exposed area (for longer than 14 days), temporary stabilization of exposed surfaces will be undertaken.
Exposed areas	Erosion Sediment pollution of waterways	All areas required to be disturbed will be clearly identified and the boundaries marked on the ground Areas not required to be disturbed will be retained in their original condition. 'Sensitive erosion areas', are defined as follows: i. Areas with slopes > 20% ii. Areas within 30m of a bank of a natural watercourse iii. Cut and fill slopes in areas of slope instability or erodible geology Where possible, works in sensitive erosion areas will be restricted to the dry season. All erosion and sediment controls will be designed to cater for a minimum of a 2 year ARI flood event Runoff velocities will be reduced by minimizing the length of flow paths, constructing any channels with gentle gradients and providing rough lining for steeper channels. Rip-rap, or similar, will be installed at the inlet and outlet of all culverts to prevent scour erosion. Retention of existing vegetation along

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
		watercourses will be maximized to reduce flow velocities and act as a sediment filter. 'Clean' runoff from undisturbed areas will be diverted away from the construction site and into established watercourses. Reference will be made to Appendix ….. to aid in the selection of the appropriate devices and for associated design specifications. Runoff from disturbed areas will be directed into sediment trapping or filtering devices. Reference will be made to Appendix ….. to aid in the selection of the appropriate devices and for associated design specifications. Silt fences or vegetative fences should be installed along the top of river banks to intercept any sediment migrating in runoff toward the river. Sediment trapping or filtering devices such as sediment fences, sediment basins or traps will be constructed to capture and treat sediment laden runoff from all disturbed areas. Reference will be made to Appendix … to aid in the selection of the appropriate devices and for associated design specifications. Sediment collection devices (including sediment basins, silt fences and sediment traps) will be cleared when basin capacity is reduced by a maximum of 50%. A marker will be installed in sediment collection basins to show when the basin is 50% full and requires emptying. Sediment collection devices will be sized to collect and treat run-off from the site as appropriate. Release of discharge will only occur after monitoring as required to meet the requirements of Sub-Plan No. … – Water Quality Monitoring. All discharge from sediment collection devices will pass through a vegetative or silt filter, prior to release to an established watercourse. Trash racks will be provided at the outlet of all main drainage points entering watercourses. Trash racks will be inspected

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
		and cleared daily and waste disposed off in accordance with the requirements of Attachment …. – Waste Management and Disposal Plan All erosion and sediment controls will be visually inspected at least once a week during the dry season and every 24 hours during the wet season to ensure their ongoing effectiveness. Any required remediative or replacement works will be undertaken within 24 hours of detection. The results of the inspections will be recorded and reported to the (to be advised once contracts are defined) At least one month prior to the anticipated commencement of the wet season, a review of the effectiveness and adequacy of the existing erosion and sediment controls will be made and any necessary modification and/or augmentation of controls carried out.
Spoil disposal area establishment	Erosion Sediment pollution of waterways	Long term spoil placement sites will be managed in accordance with the requirements of Plan B.
Temporary stockpile establishment	Erosion Sediment pollution of waterways	Temporary topsoil stockpiles will be developed in accordance with the following: i. Stockpiles will be constructed with smooth slopes and free draining patterns ii. Stockpiles will be located in existing cleared areas iii. Stockpiles will be located at least 50m from any watercourse or drainage line and not located in identified floodways iv. Stockpiles will be deep ripped to provide for moisture retention and re-growth v. Stockpiles will be located on land with a gradient of < 10% vi. Stockpile height should not exceed 3m and batter slopes will not exceed 1.5:1 vii. In windy conditions, watering of stockpiles will be carried out if excessive dust generation is evident viii. Diversion banks will be constructed uphill of stockpiles where there is a potential for run-off to erode the base of

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
		the stockpile Silt fences or vegetative fences will be constructed downstream of stockpiles to control runoff where necessary
Use of access roads by construction vehicles	Erosion and Sediment pollution of waterways	Access to and within construction sites will be limited to designated access roads and internal haul roads.
In-stream works	Sediment pollution of waterways	In-stream works will be carried out in low-flow conditions where possible. In small streams, when required and where flow conditions allow it, silt-curtains will be installed to protect against sediment transport during in-stream works. In large streams, in-stream work will be performed with sheet piles or conventional coffer dams depending on geological conditions of the stream. In any construction areas where permanent facilities for equipment maintenance and refueling exist, the following measures will be implemented: i. Construction of area with sealed floor, bunding and roof cover for all maintenance and refueling activities ii. Installation of grease trap for treatment of runoff prior to discharge Installation of hydrocarbon separation pit for treatment of runoff prior to discharge

Table 2: Guide to Selection of Erosion and Sediment Control Devices

DEVICE	PURPOSE
Check dam	To be used to minimize water velocity in flow corridors and channels to reduce erosive action. Typically constructed of clean rock fill, manufactured silt fence or straw bales.
Contour ditches	To be used to collect and convey water from a slope to a suitable outlet point.
Culvert protection	To be used to prevent scour erosion at the inlet and outlet of culverts. Typically constructed of clean rock/rip-rap.
Diversion dike	To be used to divert clean runoff away from the construction site or divert runoff around sensitive areas (eroded or bare soils, steep slopes etc.).
Interceptor drains	To be used to intercept and divert clean runoff away from the construction site or intercept and divert runoff around sensitive areas (eroded or bare soils, steep slopes etc.).
Perimeter bank / temporary berm	To be used to divert clean runoff away from construction areas.

DEVICE	PURPOSE
Sediment basin	To be used as a medium to long-term sediment trapping and storage facility. Located off-line of waterway. Must include an emergency spillway, dry and wet storage capacity and anchored riser pipe. Can be used for a large area than sediment traps.
Sediment trap	To be used as a short-term sediment trapping and storage facility. Typically to be used for discharge from areas less than 2 hectares. Can be constructed by excavation alone or with embankment.
Sediment/silt fence	To be used to reduce water velocities, divert flows and direct/divert runoff to sediment traps. Should be used in areas of sheet flow.
Slope drains	To be used to transport collected water down slopes during construction or prior to installation of permanent collection facilities. Typically constructed of stone, plastic or fibre mats.
Straw bale sediment filter	To be used as a temporary diversion structure or as an alternative to a silt fence for short periods (< 1 month).
Temporary revegetation	To be used to temporarily stabilize exposed surfaces, including stock-piles, prior to establishment of full vegetative cover, re-use of stockpiled materials or commencement of construction activities on exposed area.
Vegetated buffer strip / vegetative fence	To be used as a filter between runoff discharge point and drainage channel.

A N N E X 5 L

LAND COMPENSATION STATUS

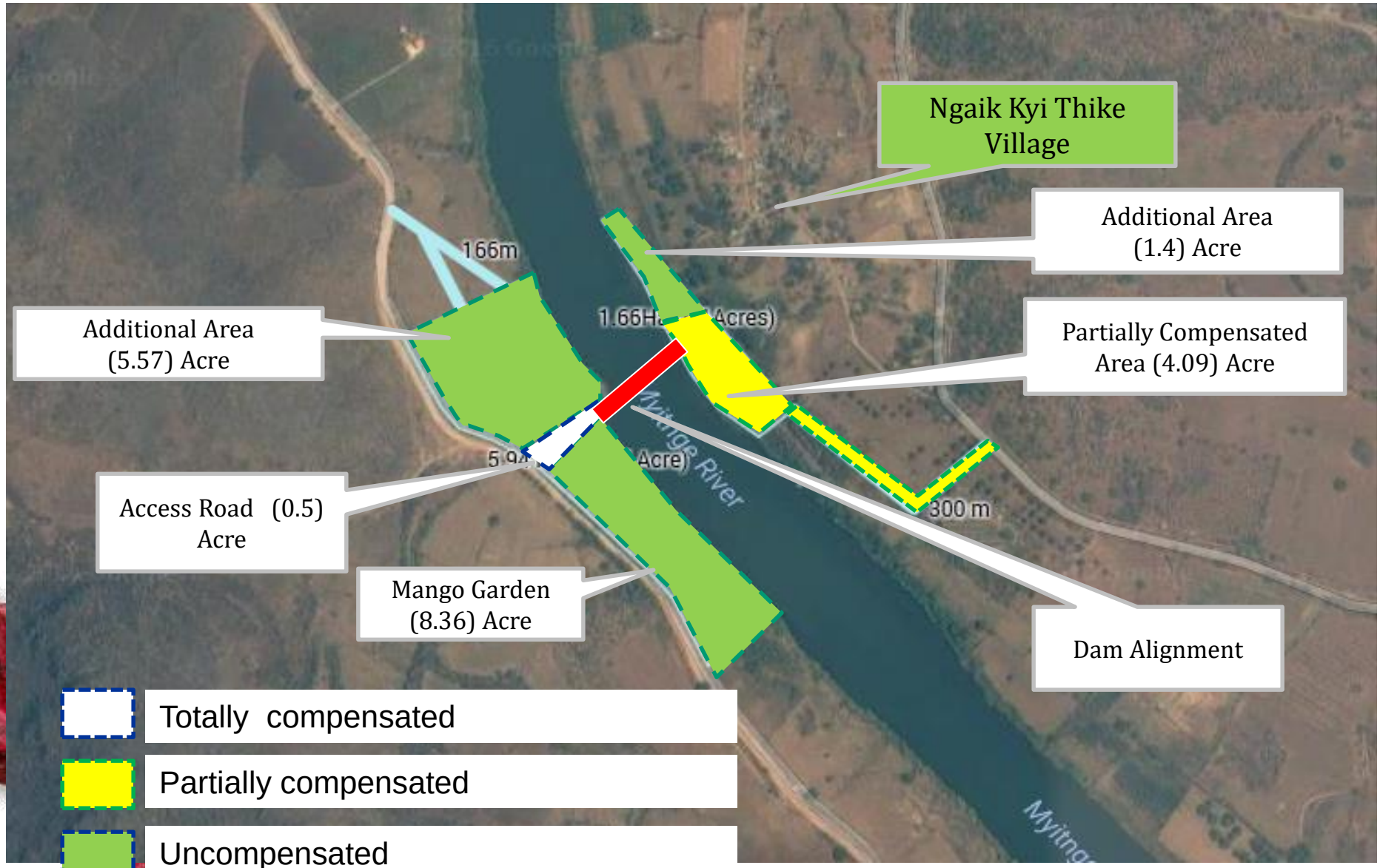
Ministry of Electricity and Energy
Department of Hydropower Implementation
Construction No.(2)

Deedoke Hydropower Project

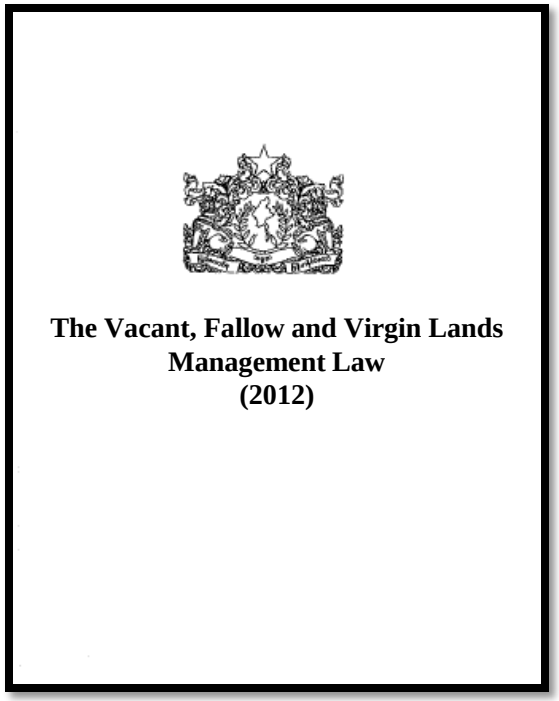
Current Status upon Compensation Cost

4th August, 2017

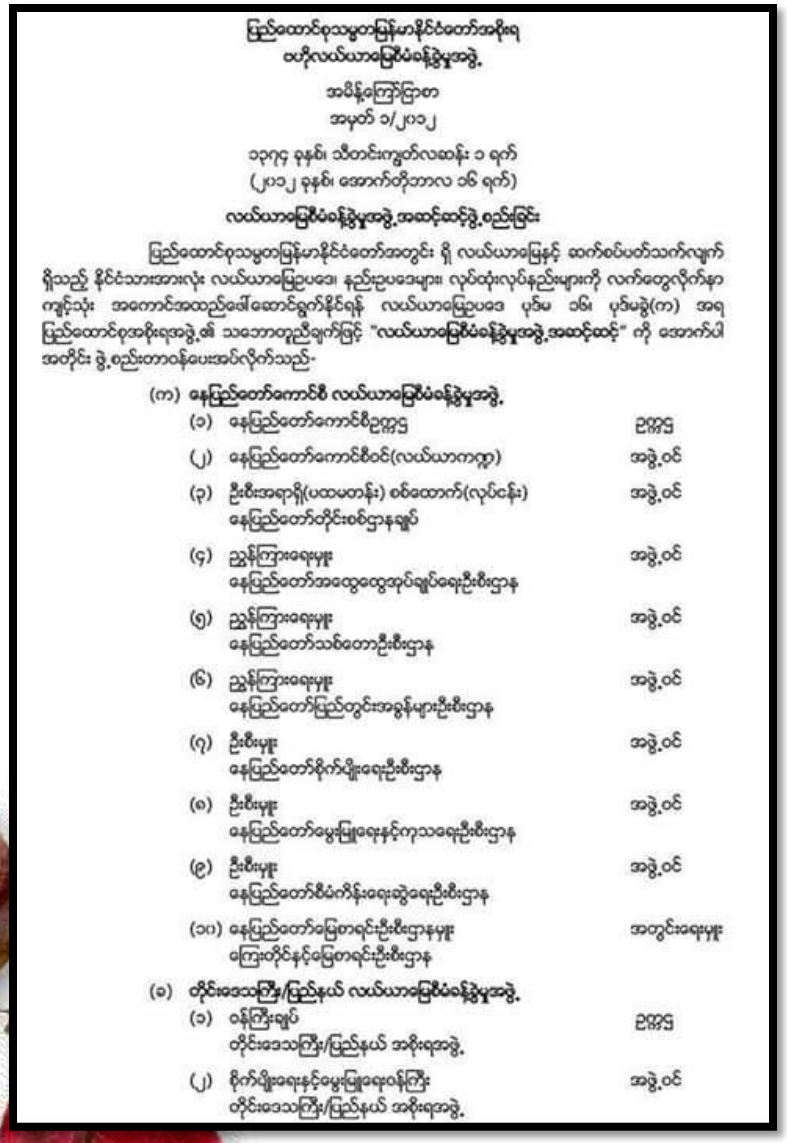
Location of Compensating Area



Laws Regarding to Land Compensation



Organization Chart of People Assigned to the Resettlement and Compensation Committee



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
ဓာတုလယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့

အမိန့်ကြော်ငြာစာ
အမှတ် ၁/၂၀၁၂

၁၃၇၄ ခုနှစ်၊ သီတင်းကျွတ်လဆန်း ၁ ရက်
(၂၀၁၂ ခုနှစ်၊ အောက်တိုဘာလ ၁၆ ရက်)

လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့အဆင့်ဆင့်ဖွဲ့စည်းခြင်း

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အတွင်း ရှိ လယ်ယာမြေနှင့် ဆက်စပ်ပတ်သက်လျက်ရှိသည့် နိုင်ငံသားအားလုံး လယ်ယာမြေပဒေ၊ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများကို လက်တွေ့လိုက်နာကျင့်သုံး အကောင်အထည်ဖော်ဆောင်ရွက်နိုင်ရန် လယ်ယာမြေပဒေ ပုဒ်မ ၁၆၊ ပုဒ်မခွဲ(က) အရ ပြည်ထောင်စုအစိုးရအဖွဲ့၏ သဘောတူညီချက်ဖြင့် "**လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့အဆင့်ဆင့်**" ကို အောက်ပါအတိုင်း ဖွဲ့စည်းတာဝန်ပေးအပ်လိုက်သည်-

(က) **နေပြည်တော်ကောင်စီ လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့.**

(၁)	နေပြည်တော်ကောင်စီဥက္ကဋ္ဌ	ဥက္ကဋ္ဌ
(၂)	နေပြည်တော်ကောင်စီဝင်(လယ်ယာကဏ္ဍ)	အဖွဲ့ဝင်
(၃)	ဦးစီးအရာရှိ(ပထမတန်း) စစ်ထောက်(လုပ်ငန်း) နေပြည်တော်တိုင်းစစ်ဌာနချုပ်	အဖွဲ့ဝင်
(၄)	ညွှန်ကြားရေးမှူး နေပြည်တော်အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၅)	ညွှန်ကြားရေးမှူး နေပြည်တော်သစ်တောဦးစီးဌာန	အဖွဲ့ဝင်
(၆)	ညွှန်ကြားရေးမှူး နေပြည်တော်ပြည်တွင်းအခွန်များဦးစီးဌာန	အဖွဲ့ဝင်
(၇)	ဦးစီးမှူး နေပြည်တော်စိုက်ပျိုးရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၈)	ဦးစီးမှူး နေပြည်တော်မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၉)	ဦးစီးမှူး နေပြည်တော်စီမံကိန်းရေးဆွဲရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၁၀)	နေပြည်တော်မြေစာရင်းဦးစီးဌာနမှူး ကြေးတိုင်နှင့်မြေစာရင်းဦးစီးဌာန	အတွင်းရေးမှူး

(ခ) **တိုင်းဒေသကြီး/ပြည်နယ် လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့.**

(၁)	ဝန်ကြီးချုပ် တိုင်းဒေသကြီး/ပြည်နယ် အစိုးရအဖွဲ့.	ဥက္ကဋ္ဌ
(၂)	စိုက်ပျိုးရေးနှင့်မွေးမြူရေးဝန်ကြီး တိုင်းဒေသကြီး/ပြည်နယ် အစိုးရအဖွဲ့.	အဖွဲ့ဝင်
(၃)	ဦးစီးအရာရှိ(ပထမတန်း) စစ်ထောက်(လုပ်ငန်း) တိုင်းစစ်ဌာနချုပ်	အဖွဲ့ဝင်
(၄)	တိုင်းဒေသကြီး/ပြည်နယ် အုပ်ချုပ်ရေးမှူး အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၅)	တိုင်းဒေသကြီး/ပြည်နယ် ဦးစီးမှူး စိုက်ပျိုးရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၆)	တိုင်းဒေသကြီး/ပြည်နယ် ဦးစီးမှူး မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၇)	တိုင်းဒေသကြီး/ပြည်နယ် ဦးစီးမှူး သစ်တောဦးစီးဌာန	အဖွဲ့ဝင်
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(၉)	တိုင်းဒေသကြီး/ပြည်နယ် ဦးစီးမှူး စီမံကိန်းရေးဆွဲရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၁၀)	တိုင်းဒေသကြီး/ပြည်နယ် မြေစာရင်းဦးစီးဌာနမှူး ကြေးတိုင်နှင့်မြေစာရင်းဦးစီးဌာန	အတွင်းရေးမှူး

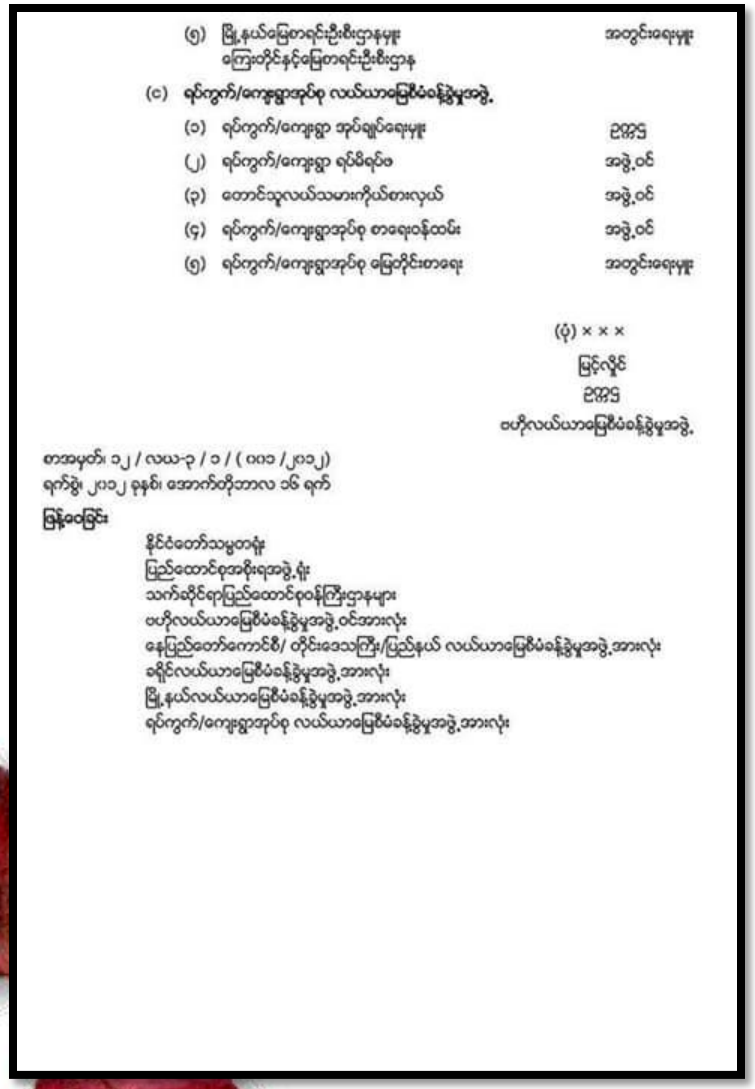
(ဂ) **ခရိုင်လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့.**

(၁)	ခရိုင်အုပ်ချုပ်ရေးမှူး အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန	ဥက္ကဋ္ဌ
(၂)	ခရိုင်ဦးစီးမှူး စိုက်ပျိုးရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၃)	ခရိုင်ဦးစီးမှူး မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၄)	ခရိုင်ဦးစီးမှူး စီမံကိန်းရေးဆွဲရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၅)	ခရိုင်မြေစာရင်းဦးစီးဌာနမှူး ကြေးတိုင်နှင့်မြေစာရင်းဦးစီးဌာန	အတွင်းရေးမှူး

(ဃ) **မြို့နယ်လယ်ယာမြေပဲမန်ဒေါ့မှုအဖွဲ့.**

(၁)	မြို့နယ်အုပ်ချုပ်ရေးမှူး အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန	ဥက္ကဋ္ဌ
(၂)	မြို့နယ်ဦးစီးမှူး စိုက်ပျိုးရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၃)	မြို့နယ်ဦးစီးမှူး မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန	အဖွဲ့ဝင်
(၄)	မြို့နယ်ဦးစီးမှူး စီမံကိန်းရေးဆွဲရေးဦးစီးဌာန	အဖွဲ့ဝင်

Organization Chart of People Assigned to the Resettlement and Compensation Committee



(၅) မြို့နယ်မြေတာရင်းဦးစီးဌာနမှူး — အတွင်းရေးမှူး
ကြေတိုင်နှင့်မြေတာရင်းဦးစီးဌာန

(ဃ) **ရပ်ကွက်/ကျေးရွာအုပ်စု လယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.**

(၁) ရပ်ကွက်/ကျေးရွာ အုပ်ချုပ်ရေးမှူး — ဥက္ကဋ္ဌ
(၂) ရပ်ကွက်/ကျေးရွာ ရပ်မိရပ်ဖ — အဖွဲ့ဝင်
(၃) တောင်သူလယ်သမားကိုယ်စားလှယ် — အဖွဲ့ဝင်
(၄) ရပ်ကွက်/ကျေးရွာအုပ်စု စာရေးဝန်ထမ်း — အဖွဲ့ဝင်
(၅) ရပ်ကွက်/ကျေးရွာအုပ်စု မြေတိုင်းစာရေး — အတွင်းရေးမှူး

(ပုံ) × × ×
မြင့်လှိုင်
ဥက္ကဋ္ဌ
ဗဟိုလယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.

စာအမှတ်၊ ၁၂ / လယ-၃ / ၁ / (၀၀၁ /၂၀၁၂)
ရက်စွဲ၊ ၂၀၁၂ ခုနှစ်၊ အောက်တိုဘာလ ၁၆ ရက်

ဖြန့်ဝေခြင်း

နိုင်ငံတော်သမ္မတရုံး
ပြည်ထောင်စုအစိုးရအဖွဲ့.ရုံး
သက်ဆိုင်ရာပြည်ထောင်စုဝန်ကြီးဌာနများ
ဗဟိုလယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.ဝင်အားလုံး
နေပြည်တော်ကောင်စီ/ တိုင်းဒေသကြီး/ပြည်နယ် လယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.အားလုံး
ခရိုင်လယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.အားလုံး
မြို့နယ်လယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.အားလုံး
ရပ်ကွက်/ကျေးရွာအုပ်စု လယ်ယာမြေပိမံခန့်ခွဲမှုအဖွဲ့.အားလုံး

Compensating Cost Table (Project Area-Right Bank)

Right Bank (Hnget Kyi Thaik Village)

Name of Farmer	Impacted Area (Acre)	Compensation Fee(Million Kyats)			Remark
		Total	Compensated	Remain to compensate	
U Myint Naing	1	70.3	30.3	40	
Daw Tin Kyi	1.39	97.3	41.7	55.6	
U Myint Oo	1.7	119	51	68	
Unmeasured	1.4	98	-	98	
Total	**5.49**	**384.6**	**123**	**261.6**	

Compensating Cost Table (Project Area-Left Bank)

Left Bank (Thayet Pin Village)

Name of Farmer	Impacte Area (Acre)	Compensation Fee(Million Kyats)			Remark
		Total	Compensated	Remain to compensate	
U Kyaw Hein	0.5	15	15	-	Access Road
U Nyan Shein	8.36	836	-	836	Mango Garden Area
Daw Tint Tint Soe	1.6	160	-	160	Cultivated Land Area
U Htun Aung	0.93	930	-	930	Cultivated Land Area
Village/Nat Sin Gone	2.5	250	-	250	Wild Land Area
Total	**13.89**	**2191**	**15**	**2176**	

Compensating Cost Table (Base Camp and Reservoir)

Other (Deedoke Camp)

Name of Farmer	Impacte Area (Acre)	Compensation Fee(Million Kyats)			Remark
		Total	Compensated	Remain to compensate	
Processing	13.27	1327	-	1327	This time
Reservoir Area	170	-	-	-	Nof available at 1
Total	**183.27**	**1327**	**-**	**1327**	

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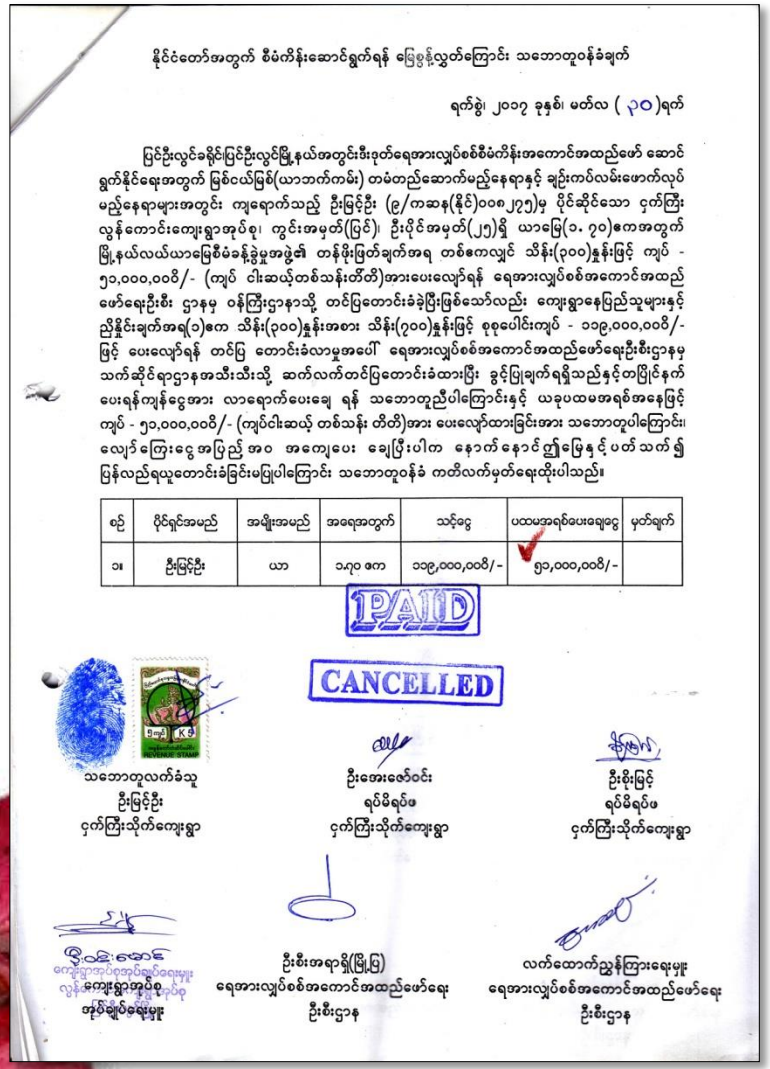

နိုင်ငံတော်အတွက် စီမံကိန်းဆောင်ရွက်ရန် မြေစွန့်လွှတ်ကြောင်း သဘောတူဝန်ခံချက်

ရက်စွဲ၊ ၂၀၁၇ ခုနှစ်၊ မတ်လ (၃၀)ရက်

ပြင်ဦးလွင်ခရိုင်ပြင်ဦးလွင်မြို့နယ်အတွင်းဒီးဒုတ်ရေအားလျှပ်စစ်စီမံကိန်းအကောင်အထည်ဖော် ဆောင်ရွက်နိုင်ရေးအတွက် မြစ်ငယ်မြစ်(ယာဘက်ကမ်း) တမဲတည်ဆောက်မည့်နေရာနှင့် ချဉ်းကပ်လမ်းဖောက်လုပ် မည့်နေရာများအတွင်း ကျရောက်သည့် ဦးမြင့်ဦး (၉/ကဆန(နိုင်)၀၀၈၂၇၅)မှ ပိုင်ဆိုင်သော ငှက်ကြီး လွန်ကောင်းကျေးရွာအုပ်စု၊ ကွင်းအမှတ်(ပြင်)၊ ဦးပိုင်အမှတ်(၂၅)ရှိ ယာမြေ(၁.၇၀)ကေအတွက် မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအဖွဲ့၏ တန်ဖိုးဖြတ်ချက်အရ တစ်ကေလျှင် သိန်း(၃၀၀)နှုန်းဖြင့် ကျပ် - ၅၁,၀၀၀,၀၀၀/- (ကျပ် ငါးဆယ့်တစ်သန်းတိတိ)အား ပေးလျော်ရန် ရေအားလျှပ်စစ်အကောင်အထည် ဖော်ရေးဦးဗိုလ်မှူး ဝန်ကြီးဌာနသို့ တင်ပြတောင်းခံခဲ့ပြီးဖြစ်သော်လည်း ကျေးရွာနေပြည်သူများနှင့် ညှိနှိုင်းချက်အရ(၁)ကေ သိန်း(၃၀၀)နှုန်းအစား သိန်း(၃၀၀)နှုန်းဖြင့် စုစုပေါင်းကျပ် - ၁၁၉,၀၀၀,၀၀၀/- ဖြင့် ပေးလျော်ရန် တင်ပြ တောင်းခံလာမှုအပေါ် ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေးဦးစီးဌာနမှ သက်ဆိုင်ရာဌာနအသီးသီးသို့ ဆက်လက်တင်ပြတောင်းခံထားပြီး ခွင့်ပြုချက်ရရှိသည်နှင့်တပြိုင်နက် ပေးရန်ကျန်ငွေအား လာရောက်ပေးချေ ရန် သဘောတူညီပါကြောင်းနှင့် ယခုပထမအရစ်အနေဖြင့် ကျပ် - ၅၁,၀၀၀,၀၀၀/- (ကျပ်ငါးဆယ့် တစ်သန်း တိတိ)အား ပေးလျော်ထားခြင်းအား သဘောတူပါကြောင်း၊ လျော်ကြေးငွေအပြည့် အဝ အကျေပေး ချေပြီးပါက နောက်နောင်ဤမြေနှင့်ပတ်သက်၍ မြန်လည်ရယူတောင်းခံခြင်းမပြုပါကြောင်း သဘောတူဝန်ခံ ကတိလက်မှတ်ရေးထိုးပါသည်။

စဉ်	ပိုင်ရှင်အမည်	အမျိုးအမည်	အရေအတွက်	သင့်ငွေ	ပထမအရစ်ပေးချေငွေ	မှတ်ချက်
၁။	ဦးမြင့်ဦး	ယာ	၁.၇၀ ဧက	၁၁၉,၀၀၀,၀၀၀/-	၅၁,၀၀၀,၀၀၀/-	

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သဘောတူလက်ခံသူ
ဦးမြင့်ဦး
ငှက်ကြီးသိုက်ကျေးရွာ

ဦးအေးဇော်ဝင်း
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ဦးစိုးမြင့်
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ဦးစီးအရာရှိ(မြို့မြ)
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးစီးဌာန

လက်ထောက်ညွှန်ကြားရေးမှူး
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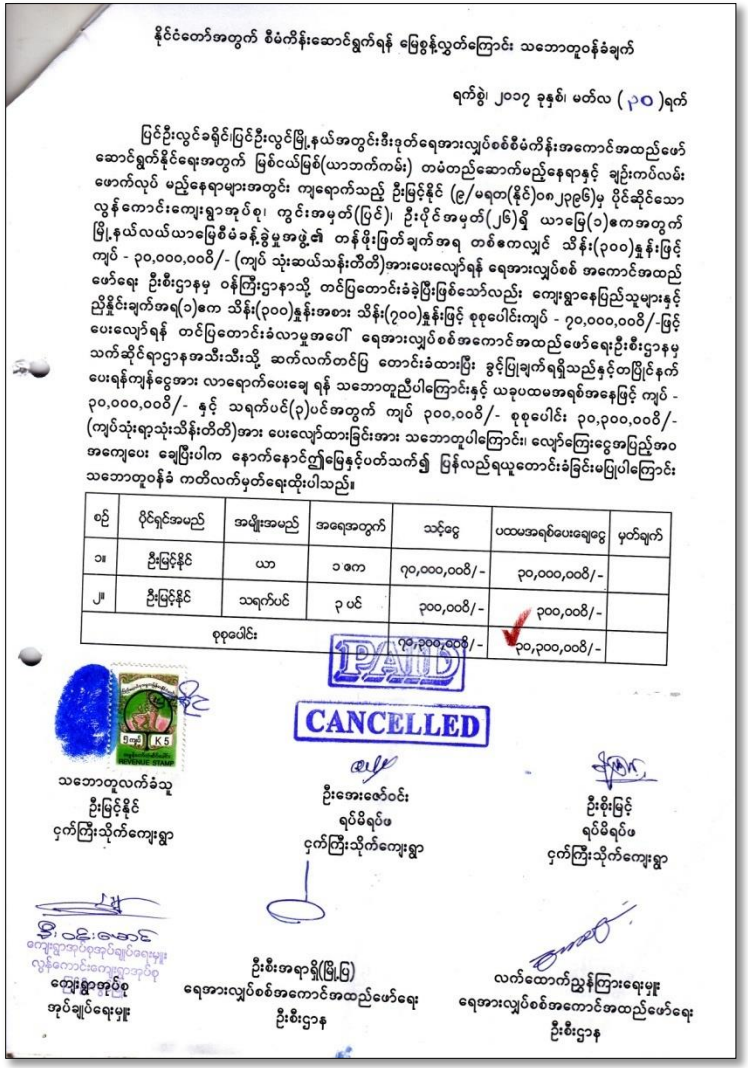

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ပြင်ဦးလွင်ခရိုင်ပြင်ဦးလွင်မြို့နယ်အတွင်းဒီးဒုတ်ရေအားလျှပ်စစ်စီမံကိန်းအကောင်အထည်ဖော် ဆောင်ရွက်နိုင်ရေးအတွက် မြစ်ငယ်မြစ်(ယာဘက်ကမ်း) တမဲတည်ဆောက်မည့်နေရာနှင့် ချဉ်းကပ်လမ်း ဖောက်လုပ် မည့်နေရာများအတွင်း ကျရောက်သည့် ဦးမြင့်နိုင် (၉/မရတ(နိုင်)၀၈၂၃၉၆)မှ ပိုင်ဆိုင်သော လွန်ကောင်းကျေးရွာအုပ်စု၊ ကွင်းအမှတ်(ပြင်)၊ ဦးပိုင်အမှတ်(၂၆)ရှိ ယာမြေ(၁)ကေအတွက် မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအဖွဲ့၏ တန်ဖိုးဖြတ်ချက်အရ တစ်ကေလျှင် သိန်း(၃၀၀)နှုန်းဖြင့် ကျပ် - ၃၀,၀၀၀,၀၀၀/- (ကျပ် သုံးဆယ်သန်းတိတိ)အား ပေးလျော်ရန် ရေအားလျှပ်စစ် အကောင်အထည် ဖော်ရေး ဦးဗိုလ်မှူး ဝန်ကြီးဌာနသို့ တင်ပြတောင်းခံခဲ့ပြီးဖြစ်သော်လည်း ကျေးရွာနေပြည်သူများနှင့် ညှိနှိုင်းချက်အရ(၁)ကေ သိန်း(၃၀၀)နှုန်းအစား သိန်း(၃၀၀)နှုန်းဖြင့် စုစုပေါင်းကျပ် - ၇၀,၀၀၀,၀၀၀/-ဖြင့် ပေးလျော်ရန် တင်ပြတောင်းခံလာမှုအပေါ် ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေးဦးစီးဌာနမှ သက်ဆိုင်ရာဌာနအသီးသီးသို့ ဆက်လက်တင်ပြ တောင်းခံထားပြီး ခွင့်ပြုချက်ရရှိသည်နှင့်တပြိုင်နက် ပေးရန်ကျန်ငွေအား လာရောက်ပေးချေ ရန် သဘောတူညီပါကြောင်းနှင့် ယခုပထမအရစ်အနေဖြင့် ကျပ် - ၃၀,၀၀၀,၀၀၀/- နှင့် သရက်ပင်(၃)ပင်အတွက် ကျပ် ၃၀၀,၀၀၀/- စုစုပေါင်း ၃၀,၃၀၀,၀၀၀/- (ကျပ်သုံးရာသုံးသိန်းတိတိ)အား ပေးလျော်ထားခြင်းအား သဘောတူပါကြောင်း၊ လျော်ကြေးငွေအပြည့်အဝ အကျေပေး ချေပြီးပါက နောက်နောင်ဤမြေနှင့်ပတ်သက်၍ မြန်လည်ရယူတောင်းခံခြင်းမပြုပါကြောင်း သဘောတူဝန်ခံ ကတိလက်မှတ်ရေးထိုးပါသည်။

စဉ်	ပိုင်ရှင်အမည်	အမျိုးအမည်	အရေအတွက်	သင့်ငွေ	ပထမအရစ်ပေးချေငွေ	မှတ်ချက်
၁။	ဦးမြင့်နိုင်	ယာ	၁ ဧက	၇၀,၀၀၀,၀၀၀/-	၃၀,၀၀၀,၀၀၀/-	
၂။	ဦးမြင့်နိုင်	သရက်ပင်	၃ ပင်	၃၀၀,၀၀၀/-	၃၀၀,၀၀၀/-	
စုစုပေါင်း				၇၀,၃၀၀,၀၀၀/-	၃၀,၃၀၀,၀၀၀/-	

PAID

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သဘောတူလက်ခံသူ
ဦးမြင့်နိုင်
ငှက်ကြီးသိုက်ကျေးရွာ

ဦးအေးဇော်ဝင်း
ရပ်မိရပ်ဖ
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ဦးစိုးမြင့်
ရပ်မိရပ်ဖ
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ဦးစီးအရာရှိ(မြို့မြ)
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးစီးဌာန

လက်ထောက်ညွှန်ကြားရေးမှူး
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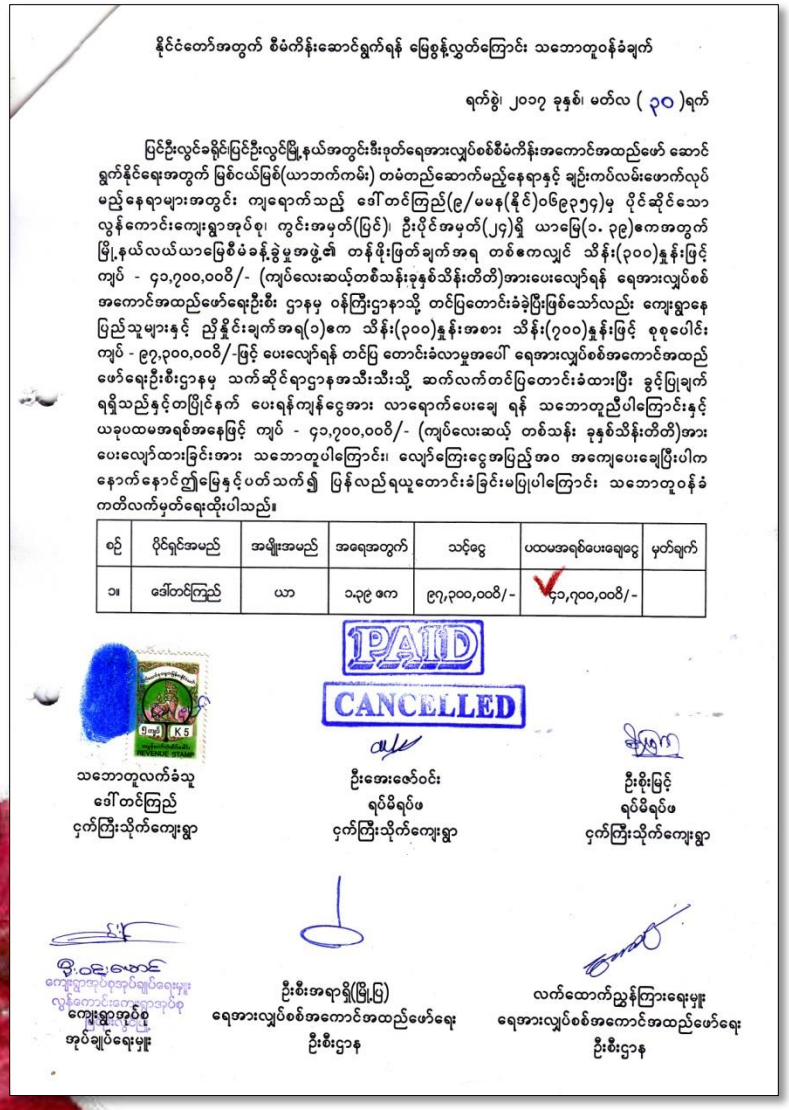
Paid Boucher



နိုင်ငံတော်အတွက် စီမံကိန်းဆောင်ရွက်ရန် မြေစွန့်လွှတ်ကြေငြာ သဘောတူဝန်ခံချက်

ရက်စွဲ၊ ၂၀၁၇ ခုနှစ်၊ မတ်လ (၃၀)ရက်

မြင်ဦးလွင်ခရိုင်မြင်ဦးလွင်မြို့နယ်အတွင်းဒီးဒုတ်ရေအားလျှပ်စစ်စီမံကိန်းအကောင်အထည်ဖော် ဆောင်ရွက်နိုင်ရေးအတွက် မြစ်ဝယ်မြစ်(ယာဘက်ကမ်း) တမဲတည်ဆောက်မည့်နေရာနှင့် ချဉ်းကပ်လမ်းဖောက်လုပ်မည့်နေရာများအတွင်း ကျရောက်သည့် ဒေါ်တင်ကြည်(၉/မမန(နိုင်)၀၆၉၃၄၄)မှ ပိုင်ဆိုင်သော လွန်ကောင်းကျေးရွာအုပ်စု၊ တွင်းအမှတ်(မြင်)၊ ဦးပိုင်အမှတ်(၂၄)ရှိ ယာမြေ(၁. ၃၉)ကေအတွက် မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအဖွဲ့၏ တန်ဖိုးဖြတ်ချက်အရ တစ်ကလျှင် သိန်း(၃၀၀)နှုန်းဖြင့် ကျပ် - ၄၁,၇၀၀,၀၀၀/- (ကျပ်လေးဆယ့်တစ်သန်းခုနှစ်သိန်းတိတိ)အားပေးလျော်ရန် ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေးဦးစီး ဌာနမှ ဝန်ကြီးဌာနသို့ တင်ပြတောင်းခံခဲ့ပြီးဖြစ်သော်လည်း ကျေးရွာနေပြည်သူများနှင့် ညှိနှိုင်းချက်အရ(၁)ကေ သိန်း(၃၀၀)နှုန်းအစား သိန်း(၇၀၀)နှုန်းဖြင့် စုစုပေါင်း ကျပ် - ၉၇,၃၀၀,၀၀၀/-ဖြင့် ပေးလျော်ရန် တင်ပြ တောင်းခံလာမှုအပေါ် ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေးဦးစီးဌာနမှ သက်ဆိုင်ရာဌာနအသီးသီးသို့ ဆက်လက်တင်ပြတောင်းခံထားပြီး ခွင့်ပြုချက်ရရှိသည်နှင့်တပြိုင်နက် ပေးရန်ကျန်ငွေအား လာရောက်ပေးချေ ရန် သဘောတူညီပါကြောင်းနှင့် ယခုပထမအရစ်အနေဖြင့် ကျပ် - ၄၁,၇၀၀,၀၀၀/- (ကျပ်လေးဆယ့် တစ်သန်း ခုနှစ်သိန်းတိတိ)အား ပေးလျော်ထားခြင်းအား သဘောတူပါကြောင်း၊ လျော်ကြေးငွေအပြည့်အဝ အကျေပေးချေပြီးပါက နောက်နောင်၌မြေနှင့်ပတ်သက်၍ ပြန်လည်ရယူတောင်းခံခြင်းမပြုပါကြောင်း သဘောတူဝန်ခံ ကတိလက်မှတ်ရေးထိုးပါသည်။

စဉ်	ပိုင်ရှင်အမည်	အဖျိုးအမည်	အရေအတွက်	သင့်ငွေ	ပထမအရစ်ပေးချေငွေ	မှတ်ချက်
၁။	ဒေါ်တင်ကြည်	ယာ	၁.၃၉ ဧက	၉၇,၃၀၀,၀၀၀/-	✓ ၄၁,၇၀၀,၀၀၀/-	

PAID
CANCELLED

သဘောတူလက်ခံသူ
ဒေါ်တင်ကြည်
ငှက်ကြီးသိုက်ကျေးရွာ

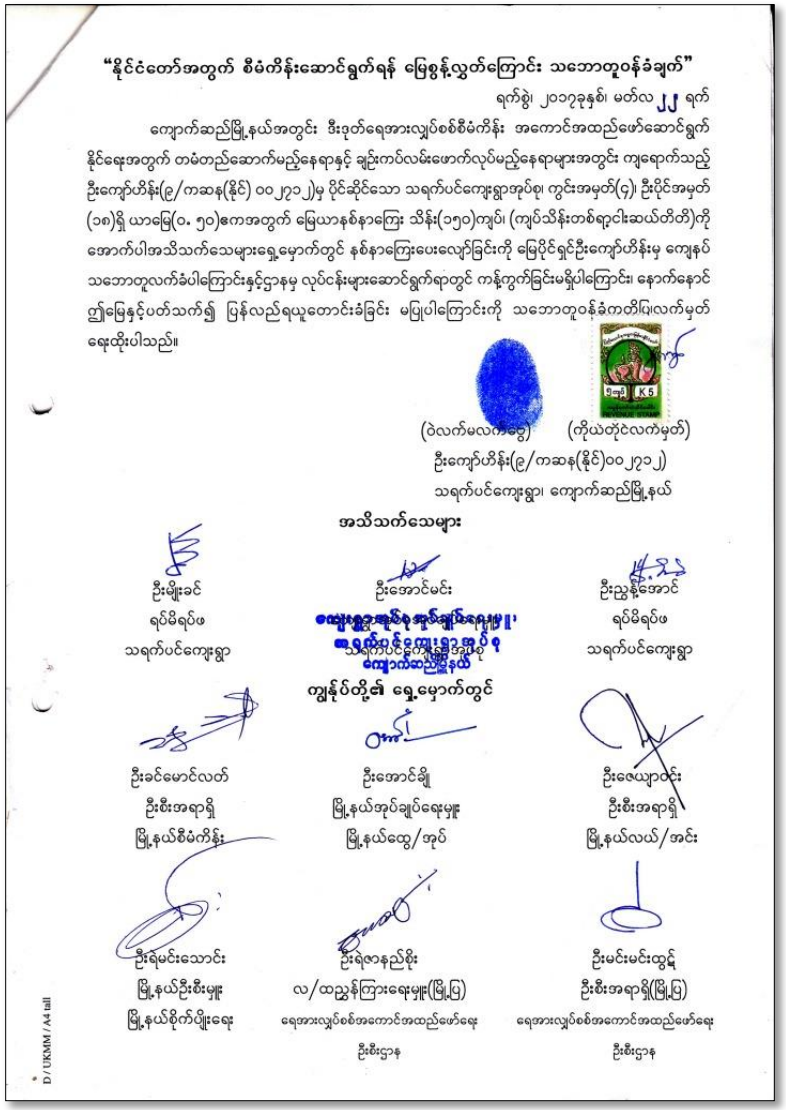
ဦးအေးထော်ဝင်း
ရပ်မိရပ်ဖ
ငှက်ကြီးသိုက်ကျေးရွာ

ဦးစိုးမြင့်
ရပ်မိရပ်ဖ
ငှက်ကြီးသိုက်ကျေးရွာ

ကျေးရွာအုပ်စုအုပ်ချုပ်ရေးမှူး
ကျေးရွာအုပ်စု
အုပ်ချုပ်ရေးမှူး

ဦးစီးအရာရှိ(မြို့ပြ)
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးစီးဌာန

လက်ထောက်ညွှန်ကြားရေးမှူး
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးစီးဌာန



"နိုင်ငံတော်အတွက် စီမံကိန်းဆောင်ရွက်ရန် မြေစွန့်လွှတ်ကြေငြာ သဘောတူဝန်ခံချက်"

ရက်စွဲ၊ ၂၀၁၇ခုနှစ်၊ မတ်လ ၂၂ ရက်

ကျောက်ဆည်မြို့နယ်အတွင်း ဒီးဒုတ်ရေအားလျှပ်စစ်စီမံကိန်း အကောင်အထည်ဖော်ဆောင်ရွက်နိုင်ရေးအတွက် တမဲတည်ဆောက်မည့်နေရာနှင့် ချဉ်းကပ်လမ်းဖောက်လုပ်မည့်နေရာများအတွင်း ကျရောက်သည့် ဦးကျော်ဟိန်း(၉/ကဆန(နိုင်) ၀၀၂၇၁၂)မှ ပိုင်ဆိုင်သော သရက်ပင်ကျေးရွာအုပ်စု၊ ကွင်းအမှတ်(၄)၊ ဦးပိုင်အမှတ်(၁၈)ရှိ ယာမြေ(၀. ၅၀)ကေအတွက် မြေယာနစ်နာကြေး သိန်း(၁၅၀)ကျပ်၊ (ကျပ်သိန်းတစ်ရာငါးဆယ်တိတိ)ကို အောက်ပါအသိသက်သေများရှေ့မှောက်တွင် နစ်နာကြေးပေးလျော်ခြင်းကို မြေပိုင်ရှင်ဦးကျော်ဟိန်းမှ ကျေနပ်သဘောတူလက်ခံပါကြောင်းနှင့်ဌာနမှ လုပ်ငန်းများဆောင်ရွက်ရာတွင် ကန့်ကွက်ခြင်းမရှိပါကြောင်း၊ နောက်နောင်၌မြေနှင့်ပတ်သက်၍ ပြန်လည်ရယူတောင်းခံခြင်း မပြုပါကြောင်းကို သဘောတူဝန်ခံကတိပြုလက်မှတ်ရေးထိုးပါသည်။

(ဝဲလက်မလက်ခွေ)
ဦးကျော်ဟိန်း(၉/ကဆန(နိုင်)၀၀၂၇၁၂)
သရက်ပင်ကျေးရွာ၊ ကျောက်ဆည်မြို့နယ်

(ကိုယ်တိုင်လက်မှတ်)

အသိသက်သေများ

ဦးမျိုးခင်
ရပ်မိရပ်ဖ
သရက်ပင်ကျေးရွာ

ဦးအောင်မင်း
ကျေးရွာအုပ်စုအုပ်ချုပ်ရေးမှူး၊
သရက်ပင်ကျေးရွာအုပ်စု
ကျောက်ဆည်မြို့နယ်

ဦးညွှန့်အောင်
ရပ်မိရပ်ဖ
သရက်ပင်ကျေးရွာ

ကျွန်ုပ်တို့၏ ရှေ့မှောက်တွင်

ဦးခင်မောင်လတ်
ဦးစီးအရာရှိ
မြို့နယ်စီမံကိန်း

ဦးအောင်ချို
မြို့နယ်အုပ်ချုပ်ရေးမှူး
မြို့နယ်ထွေ/အုပ်

ဦးဇေယျာထင်း
ဦးစီးအရာရှိ
မြို့နယ်လယ်/အင်း

ဦးရဲမင်းသောင်း
မြို့နယ်ဦးစီးမှူး
မြို့နယ်ပိုက်ပျိုးရေး

ဦးရဲဇာနည်စိုး
လ/ထည္ဆန်ကြားရေးမှူး(မြို့ပြ)
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးဌာန

ဦးမင်းမင်းထွဋ်
ဦးစီးအရာရှိ(မြို့ပြ)
ရေအားလျှပ်စစ်အကောင်အထည်ဖော်ရေး
ဦးဌာန

D / UKMM / A4 tail

Application and Approval for Quarry Site

2014 - 0347336

K 300

82	83	84	85	86	87	88	89

34, 33, 32, 31, 30

 လျှောက်ထားမြေနေရာ ၁၅၂.၈၈ ဧက

93 C/6	အခွန်စည်းကြပ်ခံရသူ/ ပိုင်ရှင်/ ဂရန်ရှင်/ အငှားဂရန်ရှင် အမည်	ပိုင်ဆိုင်ခွင့်	မြေမျိုးနှင့် အတန်း	ဧရိယာ (ဧက)	မှတ်ချက်
A-844336 B-849337 C-851337 D-854334 E-854331 F-855329 G-856326 H-848325	လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန	အစိုးရ	အခြားမြေ	၁၅၂.၈၈	

ရေးကူးပေးသည့်အကြောင်းအရာ — ဌာနပိုင်မြေအဖြစ်အသုံးပြုခွင့် လျှောက်ထားရန်

A N N E X 5 M - 2

PCR PLAN

ANNEX 5M-2 : PCR PLAN

1. Table 1: PCR Risk and Mitigation Matrix

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
Site disturbance works	Potential adverse impacts on previously unidentified items of cultural significance	Construction activities will create physical effect on the site. Construction personnel will be informed of the potential presence and the significance of relics and will not be permitted to enter the site before construction activities commence. Physical cultural resources will be defined as: i. remains left by previous human inhabitants (for example, artifacts, shrines, and battlegrounds) ii. unique and significant natural environmental features such as canyons and waterfalls and trees Table 2 contains guidance on the types of items that may constitute physical cultural resources. Construction workers will be trained to identify potential sites or items of cultural significance. Construction workers will be trained in the appropriate reporting and communication procedures to be followed if they identify any potential sites or items and the importance of implementing these procedures. The following steps will be implemented to protect any previously unidentified sites of potential cultural significance: i. If a construction worker identifies a potential site or item of cultural significance, he/she will immediately notify the construction supervisor on-site. ii. The construction supervisor will determine whether the site/item has potential significance iii. If the site/item is considered to have potential significance, the construction supervisor will immediately cease work within a 50m radius of the site iv. The construction supervisor will immediately notify the Officer in Charge v. The Officer in Charge will adapt and implement OWNER ENGINEER's '*PCR Chance Find Procedure*' as shown in Table 4 and follow communication process as indicated by the Owner Engineer vi. The reporting form contained in Table 3 will be

ACTIVITIES	POTENTIAL RISKS or IMPACTS	MITIGATION MEASURES
		completed within 24 hours of a potential site being identified.
		Temporary fencing or similar will be used to mark a 50m radius from the site. No work will be carried out within a 50m radius of a potential site until directed by Owner Engineer. Notification to Owner Engineer will be made 28 days prior to intended construction in the vicinity of identified objects or sites. Any directions or requirements from Owner Engineer in relation to measures to protect the site will be recorded on the form contained in Table 3 and communicated by the Officer in charge to the construction workforce. All such requirements will be strictly adhered to.

2. Table 2: List of Common Types of PCR

Buddhist images
Isolated artefacts, tools, implements
Pagodas, temples – complete or ruins
Sacred forests, caves , trees or other natural features having cultural significance
Shrines
Stupas – complete or ruins
Temples – complete or ruins
Unique natural features such as waterfalls
Village cemeteries or grave sites

3. Table 3 : PCR Notification Form

PART 1 – SITE IDENTIFICATION	
Date of Site Identification	
Description of Site Location (include name of construction area)	
Site Type	
General Description of Site	
Site identified by	
Time and date of ceasing work	
Time and date of notifying EFI/CEC	
Time and date of notifying EMU/EMO	
Form completed by	
Form verified by	
PART 2: DIRECTION FROM OWNER ENGINEER	
Date of receipt of OWNER ENGINEER requirements	
Summary of requirements from OWNER ENGINEER (refer to attachment if required)	
Date of training of workers	
Verification of implementation of OWNER ENGINEER requirements (Signature & date)	

A N N E X 5 M - 3

CHANCE FIND PROCEDURES FOR CULTURAL HERITAGE RESOURCES

Annex 5M-3 : Chance Find Procedures for Cultural Heritage Resources

(1) Principle and Rationale

Cultural heritage or previously unknown heritage resources may be exposed or found during construction of the project. In order to alleviate and mitigate the impacts on cultural heritage resources, chance find procedures shall be implemented.

(2) Chance Find Procedures

1) The person or group (identifier) who identified or exposed the burial ground must cease all activity in the immediate vicinity of the site;

2) The identifier must immediately inform his/her supervisor of the discovery;

3) The supervisor must ensure that the site is secured and control access; and

4) The supervisor must then inform the relevant personnel responsible included local and government cultural heritage administrative department.

5) Potential significance of the remains will be assessed and mitigate options will be identified.

6) If the significance of the remains is judged to be sufficient to warrant further action and they cannot be avoided, then the project archaeologist in consultation with the government cultural heritage administrative department and representatives of local communities will determine the appropriate course of action.

(3) Location

The area along the road alignment

(4) Period of Action

Throughout project construction period

(5) Budget Requirement

Included in construction cost

(6) Responsible Agencies

Contractor under supervision of project developer

(7) Governmental Agencies to Participate in the Monitoring Program

Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC).

A N N E X 6 L

MAP OF DEEDOKE HPP OVERLAID WITH MYANMAR NATIONAL PROTECTED AREA

Annex 6L-Map of Deedoke HPP overlaid with Myanmar National Protected Area

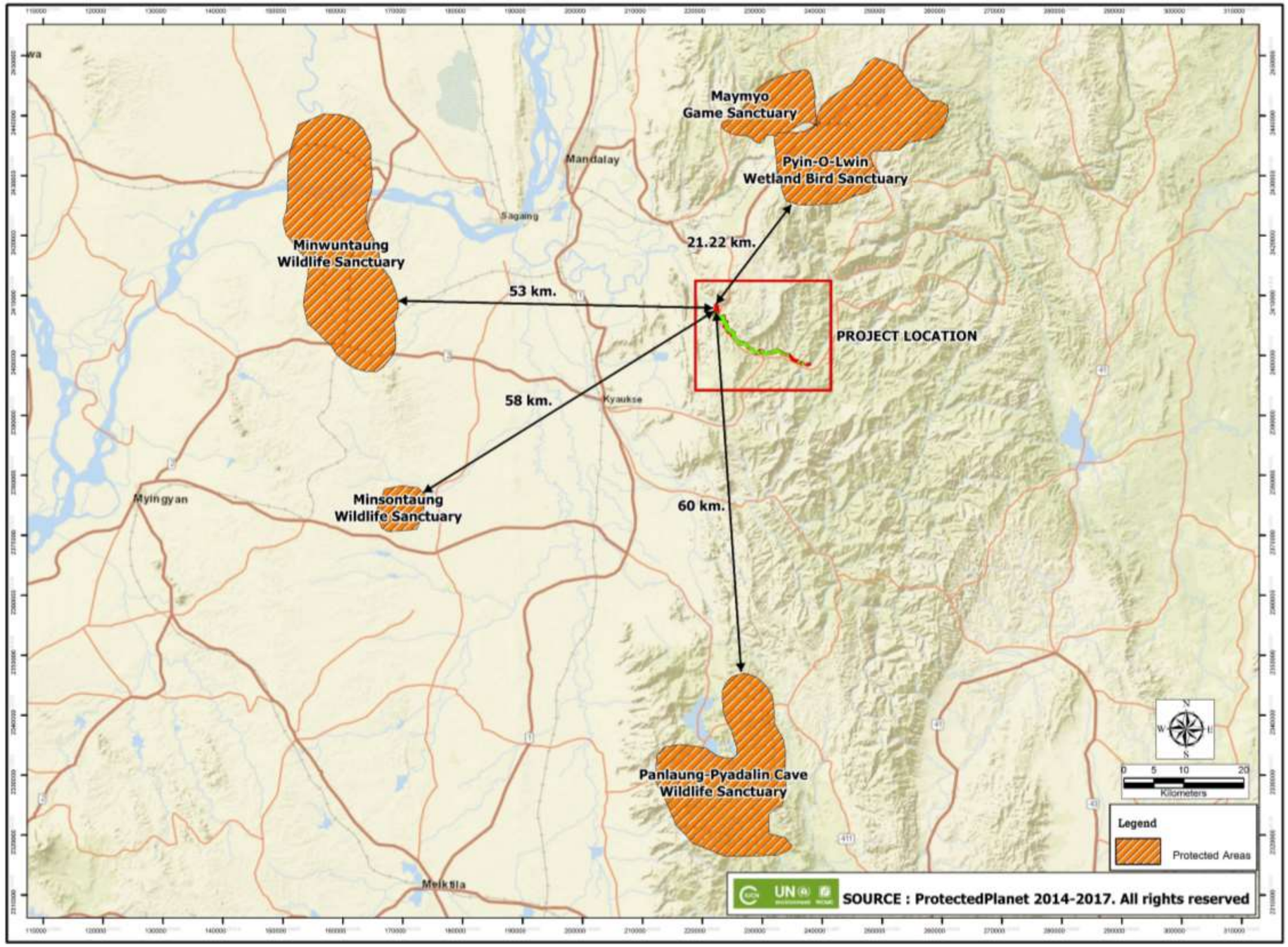


Figure 6L- Deedoke HPP overlaid with Myanmar National Protected Area

A N N E X 6 N

PUBLIC HEALTH AND SAFETY IMPACT ASSESSMENT

Annex 6N-Public Health and Safety Impact Assessment

1. Public Health

1) Construction Phase

A. Potential Impact

Construction Phase

The influx of 300 workers during the 4.5 years construction period could have both positive and negative impacts on the local communities as follows:

- **Creation of Demand for Local Goods and Services:** The influx of workers will create demands for local goods and services, such as foods, handicrafts, and personal services. These demands would be met locally and would create business opportunities to local people. This impact is therefore positive in nature.
- **Competing Use of Local Resources:** The influx of workers could compete with the locals for limited local resources such as foods, water, health service, and infrastructure services. This competition could have impacts on the locals such as increased food prices, and inconveniences in using infrastructure.
- **Health Risks:** Without proper management, the influx of workers could pose health risks to the communities. Communicable diseases such as sexually transmitted diseases, TB, hepatitis and pneumonia could be areas of concern. An increase of dengue fever, malaria, severe diarrhea is expected. Common cold and flu caused by probably new strains are very well possible, as well as respiratory tract diseases. Non-communicable diseases, among adults and the elders, stress and hypertension are common. Moreover, the construction activity will create noise and air pollution and will impact to villager which the major effects such as nuisance and stress, allergy, eye irrigation, respiratory tract infection and asthma;
- **Conflicts with Locals:** Workers from other areas, including foreign workers, could have conflicts with locals due to differences in culture, value and ways of life.
- **Accidents and Injuries:** An increase in the number of cars and motorcycles will cause the incidence of vehicle accidents and other injuries to rise, which will be a burden of health services and families.

The presence of Deedoke Hydroelectric Power Project will directly cause an influx of outside workers who will bring new diseases affecting community health and the community may also contract endemic diseases. The most serious threats to long-term health status in the project area are Sexual Transmitted Diseases (STD), malaria and dengue fever will occur. Moreover, influx of worker will create social tension to the community health such as violence and anxiety will be increased. The relatively low level of health services, limitation of medical and medical care unit will increase the risk.

B. Mitigation Measures

- Vigorous public relations and health education programs shall be launched. The programs should cover positive impacts such as economic benefit, better income, work opportunity, and improvement of standard of living. Local people shall be well informed about possible negative consequences like the possible spread of STD, dengue fever and malaria;
- Strengthening of health services. Local or village health stations, health centers or dispensaries shall be established particularly for drug kits distribution. Sufficient number of health personnel shall be employed, trained and supported to provide sufficient and effective health care. Besides, community health volunteers and traditional healers shall be recruited and trained and provide primary care for communities;
- Community efforts. Strong community efforts shall be organized with full support from local authorities and health facilities. Activities are to be focused on water supply and sanitation, environmental sanitation, solid waste disposal, sanitary toilet, fly and insect control and housing sanitation.
- Communicable diseases. There should be close surveillance on STD, dengue fever, malaria, influenza, diarrhea, dysentery and hepatitis. Case detection and distribution should be thoroughly studied and adequate treatment provided. Full course of immunization for infants and young children must be assured.
- Regular routine checks of vehicles, improvement of road conditions and traffic signs, and educating drivers and pedestrians will decrease the incidence of accidents and injuries. Traffic and drinking regulation with project staff should be strictly reinforced.

2) Operation Phase

A. Potential Impact

Accidents and Injuries: Generally, the economic status of the villagers will be better and many cars and other vehicles will be seen on the roads with undisciplined drivers. The ensuing wide range of injuries and disabilities will be a burden for the health services. Deaths from traffic accidents will increase.

B. Mitigation Measures

- Local district hospitals, local health stations should be adequately equipped and personnel trained to handle emerging health hazards and problems such as accidents. Collaboration with health facilities in Pyin Oo Lwin and Kyaukse Townships should be established and strengthened, an effective referral system should be established;
- Accidents and injuries. Many cars and motorcycles caused the incidence of vehicle accidents and other injuries will be on the rising trend and be the burden of health services and families. Regular routine checks of vehicles, improvement of road conditions and traffic signs, and educating drivers and pedestrians will decrease the incidence of accidents and injuries. Traffic and drinking laws should be strictly reinforced.

2. Occupational Health and Safety

This section, discussion turns to the specific issue of the work force employed in the dam and power house construction and operation. While some of these workers may be recruited locally, it is assumed that most will be temporary migrants from outside the community and that they will leave at the end of the construction phase.

1) Construction Phase

A. Potential Impact

The influx of 300 workers during the 4.5 years construction period could have the impacts as follows:

- **Health Risks:** Without proper management, Communicable diseases such as sexually transmitted diseases, TB and hepatitis could be areas of concern. Non-communicable diseases such as asthma and allergy can be founded.
- **Accidents and injuries:** Work accidents and injuries will be predominant especially among the untrained group. Injuries from blunt instruments (tools), cuts and wounds, falling, as well as eye irritation and burns are common. When protective devices are not adequately or properly used, the incidences will be high level. Beside unsafe vehicular transport, poor road conditions and inadequate traffic signs may be expected to a greater degree, which will in turn lead to more vehicle accidents and injuries.
- **Psycho-social disorder:** Being away from home and family, workers easily precipitate to more alcoholic drinking, smoking and substance abuse. Violence and social disturbances are frequently encountered.

B. Mitigation Measures

The contractor will need to design and implement an effective program for control of communicable diseases among the workers. Such program should include:

- Health screening of job applicants before employment;
- Periodic health examination or health surveillance program of workers for early detection of communicable diseases;
- Onsite health clinic and referral system;
- Survey, investigate and document all disease outbreaks within the workforce. Consultation should be available and should be followed the epidemiologic approach;
- Any suspected case of Sexually Transmitted Diseases (STD) should be adequately treated and followed up with practical health education;
- Provide appropriate information and health education to the workforce on prevention of diseases, including, malaria, diarrhea and food poisoning;
- Conduct safety training courses and rehearsals for the workers, to prevent and reduce work accidents;
- Provide adequate material and equipment used in construction activities in order to increase effective working and decrease the risk of causing accidents or injuries;
- Prepare and enforce the wearing of safety protection equipment or devices to prevent accidents or reduce their severity, such as eye glasses (goggles), safety shoes, ear muffs, safety belts, protective clothing and helmets with regular inspection;

• Implement regular surveillance and inspection on occupational hazard, equipment and protective devices;

• Regular routine checks of vehicles, improvement of road conditions and traffic signs, and educating drivers will decrease the incidence of accidents and injuries. Traffic and drinking regulation with project staff should be strictly reinforced.

2) Operation Phase

A. Potential Impact

Although the numbers of dam-related personnel during this period may be limited, the related health problems and work hazards still remain. The common problems are occupational hazards, injuries, accidents and ergonomic risks.

B. Mitigation Measures

• Health promotion and health education focusing on health behavior like smoking and alcohol drinking

• Regularly conduct health check-ups and analyses to forecast and prevent possible health problems and damages among particularly high-risk groups such as new workers, the elderly or diseased employees;

• Regular training, supervision, checking and support concerning protective device use and machine or equipment functioning and maintenance;

• Implementation of good and fair compensation plan and assurance.

3. Worker Camp Sanitation

1) Construction Phase

A. Potential Impact

The project construction will take about 4.5 years to complete and will use about 300 workers. The workers will be hired by the contractor and subcontractors. It is expected that most of the workers will be recruited from villages in the project area and beyond. Most skilled technicians and professionals would come from the country of origin of the contractor and subcontractors. It is expected that the workers will be accommodated in a camp. Inadequate space and facilities and inadequate management of the worker camp could have such impacts as: (i) unhygienic living conditions with implications on health of workers; (ii) pollution or contamination of the natural environment outside the worker camp, such as fly infestation, water pollution, and odor; and (iii) exposure of workers on accidental risks or worker safety.

B. Mitigation Measures

The design, operation, and management of worker camp is the responsibility of the main contractor and subcontractors. Therefore, the project proponent will ensure that the construction contract will cause the main contractor and subcontractors to meet all requirements of the design, operation, and management of the worker camp. The requirements for the worker camp should be as follows:

- Basic camp infrastructure will include:

– Power supply: The supply will be sufficient to ensure normal living and working supply for critical aspects.

– Water supply: The source of supply will be ground water taken from a deep well to be bored within the site. A water storage tank with 100 m^3 capacity will be provided as part of the water supply system.

– Drinking water: Clean drinking water will be provided in small tanks.

– Drainage: Drainage in the worker camp area will be adequate to ensure no water pools in the area.

– Sanitation: Wastewater will be drained separate from the storm drainage system to a wastewater treatment plant.

– Solid wastes: Solid wastes bins will be provided at various locations, such as canteen and sleeping quarter. A solid waste collection system will need to be established to ensure daily hauling of all domestic solid wastes to the disposal site.

- Set up waste collection system in the construction camps and coordinate with local authority to dispose such waste properly.
- Prepare garbage bins or containers with covers for garbage collection at the workers' camp sites and construction area. Also, inform concern local authorities or sub-contractor that gets permission from government section to collect and dispose garbage.
- Solid waste disposal procedures will comply with solid waste management regulations, as well as any additional disposal facility requirements.
- Separate each type of wastes and collected solid waste in appropriate and safety container for recycling where facilities are available. Any surplus to the recycling activity will be disposed of at an approved waste disposal site.
- Prohibit dumping waste in watercourse.
- Hazardous wastes will be collected and disposed of in accordance with the appropriate regulatory requirements.
- Prohibit burning waste in construction area and worker camp site
- The worker camps should be made of decent materials that could withstand heavy rains and storms. The worker camps should be adequately ventilated and lighted;
- Workers' camp site shall consist of living facilities with housing, canteen, sanitary facilities for all workers accommodated within the camp.
- Camp sanitation facilities should be provided and inspected.
- The number of toilets and baths should be 1 unit for 15 workers;
- A common canteen should be planned to accommodate for 300 persons and shall be equipped with mosquito nets and screens;
- Common areas for cloth washing and drying should be provided with adequate water supply and drainage;

- Fly, insect and rodent control needs to be strictly implemented in integration with solid waste collection;
- Ventilation of buildings within the camp areas shall be in accordance with Applicable Laws and Standards;
- Fire and safety plan for the camps should be prepared. Fire extinguishers need to be provided in each camp. Clear fire escape routes should be clearly marked with no obstructions. Workers will need to be informed on fire safety arrangements;
- Adequate measures for mosquito control, including dengue fever control;
- Health awareness training for the workers on hygiene and sanitation, good housekeeping practices, communicable and infectious diseases including an STD awareness program.
- Medical and first aid facilities shall be provided at camp site. Workers should be trained how to use them; and
- Providing emergency treatment and first aid for major accident/injuries and also emergency patient transfer.
- Train and educate staff in EMP/EIA requirements and conditions. Training is to be carried out in the three main areas;
- General environmental awareness, including rules and regulations to be followed on construction sites and workers' camp.
- Job-specific training for workers with responsibility for high risk activities that could have adverse impacts on the environment and humans.

2) Operation Phase

In the operation phase, the worker camp will be moved out from the project area since it is no activity and any impact for this phase.

A N N E X 6 P

TRAINING OF WOKERS PROGRAM

Annex 6P: Training of Workers Program

Table 1 : Description of typical measures

Description of Measures
All workers will complete the training programs contained in **Tables 2** and **3** below
Participants in job-specific training will be identified as required in Table 4 on the basis of their skills and capacity to undertake the training.
All training sessions will be conducted in Myanmar language for Myanmar personnel and as appropriate for foreign staff. All written materials will be provided in Myanmar language and other languages as appropriate.
A training register will be maintained that will contain details of the following: i. Name of training session ii. Date of training session iii. List of attendees and signatures iv. Name of trainer A sample format for the training register is contained in **Table 5.**
At completion of each relevant training course, each participant will be issued with a certificate of successful completion. A copy of the certificate will also be placed on each participant's employment file. A sample format for certificate to be developed.
The Owner Engineer will implement a rolling program of refresher courses in environmental and health and safety awareness issues through the use of 'tool-box' sessions at construction sites. The program will aim to visit every construction site for a 2-hour session at least one time within a 6-months period.
During audits of the construction areas, workers knowledge of environmental, health and safety issues will be examined.
Workers who have undergone job-specific training will be examined every 6 months in relation to their knowledge and skills and subject to re-training as required. Records of examination results and any re-training will be kept as part of the training register (refer **Table 5**).
All new employees will complete relevant training (in accordance with **Tables 2, 3 and 4**) prior to commencement of any activities on the construction site.
The key messages from the training sessions will be produced in poster and leaflet form in Myanmar language. Posters will be displayed prominently in construction work camps and construction areas and leaflets will be distributed to staff on a regular basis.

Table 2 : Training Program for Environmental Awareness Training

MODULE	TRAINING TOPICS	DURATION OF TRAINING
General Environmental Awareness for Construction Workers	• Introduction to environmental impacts related to construction activities and the need to protect the environment • Areas/issues of particular environmental sensitivity in or in the vicinity of the construction area (e.g. protected areas) • Description of EMMP and obligations/responsibilities of individual workers in terms of general environmental protection • Roles and responsibilities of Owner Engineer and construction supervisors, and lines of reporting in relation to environmental issues • Prohibitions on hunting, explosive and chemical fishing, logging, collection of non-timber forestry products, purchasing or trading in wildlife or wildlife meat, gathering and harvesting medicinal or valued plants or trees • Prohibition on possessing guns, snares, traps and other hunting equipment • Waste management practices in camps and on construction sites • Pollution control measures on construction sites • Vegetation clearing procedures • Cultural property issues (procedures to be followed for previously unidentified sites are located) • Issues in relation to resettlement communities • Penalties for violation of rules and regulations	½ day session on-site

Table 3 : Training Program for Health and Safety Awareness Training

MODULE	TRAINING TOPICS	DURATION OF TRAINING

MODULE	TRAINING TOPICS	DURATION OF TRAINING
General Health and Safety Awareness for Construction Workers	• Introduction to health and safety issues in construction camps and on construction sites including main areas of risk to workers and others. • Education on basic hygiene practices to minimize spread of typical tropical diseases. • HIV/AIDS and STD awareness, including information on methods of transmission and protection measures • Prohibition of drugs. • Prohibition of alcohol on construction sites. • Procedures for seeking medical assistance in emergency or non-emergency situations and procedures for seeking other health-related assistance (e.g. STD testing or counseling). • OH&S awareness including basic procedures for[1]: - Traffic and road safety - Electricity hazards - Explosives hazards - Fire and fire protection - Chemical use - Hazardous materials management - UXO • Use of Personal Protection Equipment (PPE) and processes for obtaining relevant PPE • Penalties for violation of rules and regulations	½ day session on-site

[1] *Note that workers with regular exposure to these issues or responsibility for these activities will receive specific training.*

Table 4 : Schedule of Job-Specific Training Requirements

ISSUE	TRAINING TOPICS	PARTICIPANTS[2]	APPROXIMATE DURATION
Emergency Response Teams	• Knowledge of hazardous materials located on-site • Potential for spills and releases • Environmental and human effects of spills/releases • Emergency response procedures including priorities of responses • Location and use of spill response equipment • Communication and reporting measures	[2] personnel at each construction site	1 day
Fire protection	• Causes of fire • Fire prevention measures • Fire fighting equipment use and maintenance • Fire fighting procedures and emergency response procedures • Emergency assistance contacts • Requirements for waste burning on-site • Methods to train other workers in fire protection methods	[1] Fire Protection Officer for each 50 workers	1 day
First Aid	• First Aid training in accordance with international accreditation	At least one First Aid Officer for each construction site and camp	1 day
Hazardous materials/waste management including explosives handling	• Correct handling and storage procedures including procedures in storage areas in terms of registering of materials • Correct use procedures including refueling procedures and calculating amounts to be used and ensuring effective equipment operation • Disposal of used storage containers • Hazardous waste storage procedures	All workers responsible for handling or transporting hazardous materials or explosives.	½ day

[2] Note that participants will receive this training and will carry out these functions in addition to their regular work tasks. These positions are not full-time designated positions but will be used on an 'as-needs' basis.

ISSUE	TRAINING TOPICS	PARTICIPANTS[2]	APPROXIMATE DURATION
	• Non-hazardous waste management • Medical issues associated with exposure to substances • Emergency response procedures		
Chemicals use	• Correct handling and storage procedures • Correct use procedures including calculating amounts to be used and ensuring effective equipment operation • Disposal of used storage containers • Medical issues associated with exposure • Emergency response procedures	All workers responsible for using, handling or transporting chemicals.	½ day
OH&S Inspection and Reporting Procedures	• OH&S Issues • OH&S obligations • How to carry out OH&S inspections • Processes for reporting / resolving issues	1 OH&S Officer for each 20 workers including at least one OH&S Officer for each construction site and camp	1 day
Traffic safety	• Traffic rules and regulations • Safe driving practices • Vehicle maintenance procedures • Refueling procedures • Emergency response procedures	All drivers of construction vehicles or equipment.	½ day
Water quality monitoring and analysis	• Use of equipment including calibration, testing methods, transport of samples, data quality control • Monitoring and reporting requirements	EFIs (as necessary)	1 day (as necessary)

Table 5 : Training Register Form For Recording Attendance At Training Course

TRAINING COURSE NAME	
TRAINING COURSE DATE	
TRAINING INSTRUCTOR	
LOCATION	

ATTENDEES		
Name	**Signature**	
	Course Opening	**Course Closing**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
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17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		
Signature of Training Instructor		

A N N E X 6 U - 1

RESPONSE COMMENT ABOUT IMPACTS OF WATER QUALITY FOR DECAYING OF SUBMERGED VEGETATION

Annex 6U-1 - Response Comment about Impacts of water quality from decaying of submerged vegetation

1. Impacts of water quality from decaying of submerged vegetation

Results from surface water quality survey during the study period in 2016, indicated that water of Yeywa river near proposed dam site of Deedoke HPP indicates very good water quality with high DO (6.1 – 8.0 mg/L in Apr. 2015 and 5.9 – 7.8 mg/L in Jul. 2015), low BOD and very low heavy metal concentrations. The water quality in pondage area will be altered, particularly during early stage of operation period due to decomposition of submerged vegetation and remaining biomass. Typically, this process would consume a huge amount of oxygen which will depend upon the remaining amount of carbon substances. Furthermore, excessive oxygen consumption may lead to anoxic conditions in such area.

The primary issue is related to the inundation of about 102 ha (*See* **Article 6.4.3.2** in **ESIA Report**) of the vegetation covered area. The biomass present in the area can be divided into two categories included (i) soft biomass, i.e. leaves, twig, herb, bush and grasses etc., and (ii) solid biomass, i.e. stems and large branches of trees. The decomposition of the solid parts is a very slow process and most of them will be removed from the project area therefore this portion can be neglected in the calculations. Biomass in tropical and equatorial regions is estimated between 200 and 400 tons/ha of dry materials (Ogawa, 1965[1]). In anticipated inundation area of Deedoke HPP, the lower estimate average case of 200 tons/ha biomass will be assumed because only portions of the vegetation remain in the reservoir. Soft biomass will be about 5% of total dry weight. Then soft biomass adopted for this calculation will be 10 t/ha. The calculation of oxygen demand for biomass decomposition in pondage area of Deedoke HPP is shown in ***Table 6U***. The percentage of soft biomass left in the reservoir is assumed at 2 levels, 50% and 20% of the vegetation covered area.

The calculations showed that the amount of oxygen available in the pondage at the first filling is 75.53 tons, which will not be sufficient by far for decomposing all soft biomass. To decompose all biomass in the reservoir, 545.7 tons of oxygen will be required (in case all 50% of soft biomass are left and coarse biomass are removed). In this case, decomposing the biomass would roughly require the amount of oxygen contained in 0.01 years of flow into Deedoke HPP. Therefore, the oxygen depletion can be alleviated in less than 1 week after operation.

[1] Ogawa, H., K. Yoda, K. Ogino and T. Kira. 1965. Comparative Ecological Studies on Three Main Type of Forest Vegetation in Thailand. II. Plant Biomass. Ibid. 4: 49-80.

TABLE 6U

OXYGEN REQUIREMENTS FOR BIOMASS DECOMPOSITION IN PONDAGE ARE OF DEEDOKE HPP

Parameter	Unit	PONDAGE AREA OF DEEDOKE HPP		
Percent soft biomass left and decomposed in the reservoir	%	100	50	20
Pondage area with vegetation covered (soft biomass remain)	ha	102.0	51.0	20.4
Biomass average	t/ha	10	10	10
Biomass total (soft only)	t	1,020.0	510.0	200.4
Oxygen in inflow water (from this study)	mg/l	5.81	5.81	5.81
Total volume of gross water storage in reservoir[1/]	MCM	13.5	13.5	13.5
Mean annual flow[2/]	MCM	10,000.0	10,000.0	10,000.0
Total oxygen at first filling	T	75.53	75.53	75.53
Total oxygen in annual inflow	t	58,100.0	58,100.0	58,100.0
Oxygen required per ton biomass	t	1.07	1.07	1.07
Total oxygen required for biomass decomposition	t	1,091.4	545.7	218.28
Oxygen balance	T	57,008.6	57,554.3	57881.72
Time for all soft biomass decomposition	year	0.02	0.01	0.005

Remark [1/] Article 14.2 in Deedoke HPP Feasibility Study Report, Nov.4, 2015

[2/] Article 6.1 in Deedoke HPP Feasibility Study Report, Nov.4, 2015

A N N E X 6 U - 2

SOLID WASTE MANAGEMENT PLAN

Annex 6U-2 - Solid Waste Management Plan

1) Objective

To manage the solid waste with appropriate methods to minimize the source of adverse effect to human health.

2) Context

Solid waste will be generated from activities associated with the Project, the main types of solid waste include; solid waste from the construction workers and solid waste from the pre-construction and construction activities. Solid waste from construction workers are domestic waste such as garbage, glass, and food waste, etc. For the solid waste from the project activities is biomass from site clearance activities during pre-construction phase, and wood, scrap steel and metals, and erosion control materials during construction phases. The management of solid waste is very important. If not properly controlled and disposed of, waste can be unsightly and cause human health and safety concerns.

3) Applicable Standard

Applicable guidelines and standards regarding the management and disposal of the three categories of wastes as prescribed by MONREC or enforced by the local government, whichever are more stringent.

4) Management Action or Mitigation Measures

Pre-construction phase

- Prepare garbage bins or containers with covers for garbage collection at the workers' campsites and inform concerned local authorities or agencies that get permission from government section to collect and dispose garbage
- Prohibit open burning wastes in worker campsite and project area.
- The biomass wastes should be separated into usable timber and woods
- The unusable wastes will be disposed of a disposal area or landfill site to be selected by the contractor with approval of the concerned authority.

Construction Phase

- For used oil and chemicals, they will collect at a temporary warehouse before sending back or disposed by contractors or inform concerned authorities to dispose used oil and chemicals.
- Prepare garbage bins or containers with covers for garbage collection at the workers' campsites and construction area. Also, inform concern local authorities or sub-contractor that gets permission from government section to collect and dispose garbage.
- Solid waste disposal procedures will comply with solid waste management regulations, as well as any additional disposal facility requirements.

- Separate each type of wastes and collected solid waste in appropriate and safety container for recycling where facilities are available. Any surplus to the recycling activity will be disposed of at an approved waste disposal site.
- Prohibit dumping waste in watercourse or wildlife habitat.
- No construction materials or debris are allowed to become waterborne. Any materials/debris that enters the aquatic environment must be removed immediately and disposed of in an approved manner.
- All temporary structures, piles, false works, debris, cofferdams etc. will be removed from the waterway upon completion of the work.
- Hazardous wastes will be collected and disposed of in accordance with the appropriate regulatory requirements.
- Prohibit burning waste in construction area and worker camp site.

5) Monitoring Programs

- Daily checking amount of Solid waste generated during pre-construction and construction phases and results will be include in monthly reports.

6) Performance Specifications

- Amount of Solid waste generated during pre-construction and construction phases
- Number of complaints related to Solid waste disposal.

7) Implementation Schedule

Throughout pre-construction and construction phases

8) Responsibilities

Developer and EPC Contractor

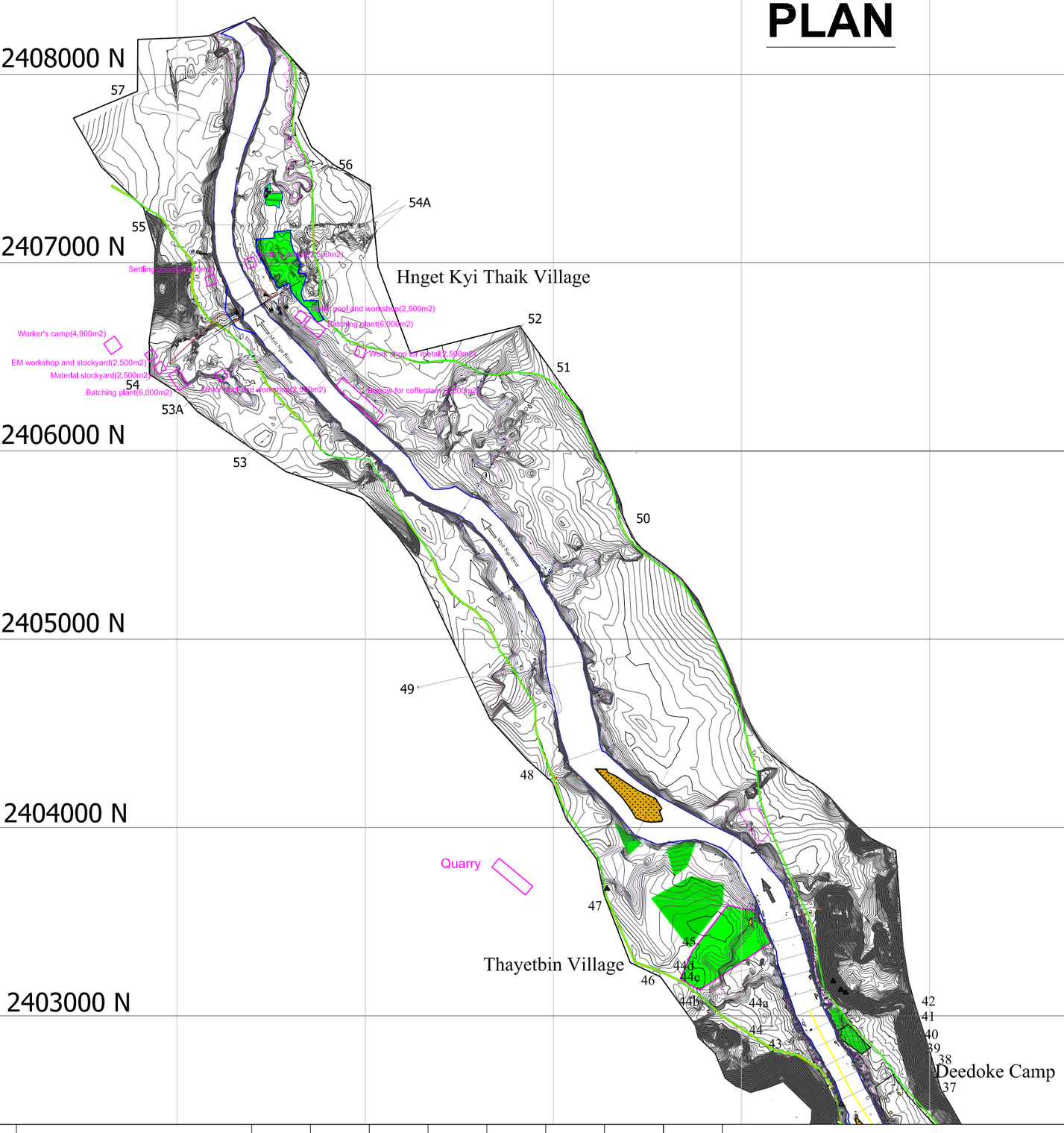
9) Budget

Mitigation Measures and Monitoring Program: Included in construction cost by Contractors.

A N N E X 8 A

PROJECT LAYOUT FOR DEEDOKE HPP

PLAN



500 250 0 500 1000 1500 2000 2500 3000 3500 Metres

Contour Interval = 1m

REV NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE

ANDRITZ Hydro HTCT Kansai Electric Power power with heart

DEEDOKE HYDROPOWER PROJECT

DRAWN	VALIDATED	DRAWING NAME
DESIGNED	RECOMMENDED	
VERIFIED	CONCURRED	TEMPORARY FACILITIES LAYOUT
APPROVED		SCALE: A3 1/25,000
DATE : Oct 2017		REPLACING DRAWING NO. / JOB NO.
		DWG NO.: DK-TF-001
		REV: 0

A N N E X 1 0 G

GRIEVANCE REDRESS MECHANISM

Annex 10G- Grievance Redress Mechanism

The Project Proponent should consider to establish a Community Participatory Committee (CPC) which will be represented by relevant parties such as government sectors, representatives of the affected villages and the Project Proponent. The committee should be established before commencing the construction.

The CPC will be a complaint center which is the representative of the Project Proponent to receive and consider comments or complaints. The CPC will be involved in public relation for the Project, building understandings and good relationship between the Project and the surrounding communities, participation in monitoring of the Project impacts and mitigation measures, receiving and addressing complaints arisen from the project impacts, and resolving conflicts between the Project and the locals.

Any person or organization may send comments, complaints and suggestions in person, by phone, via post or email using the contact information provided at the end of the document. The comments, complaints and suggestions will be responded to either verbally or in writing, in accordance with the preferred method of communication specified by the complainant, if contact details of the complainant are provided. The grievance redress process is shown in a diagram in ***Figure 1***.

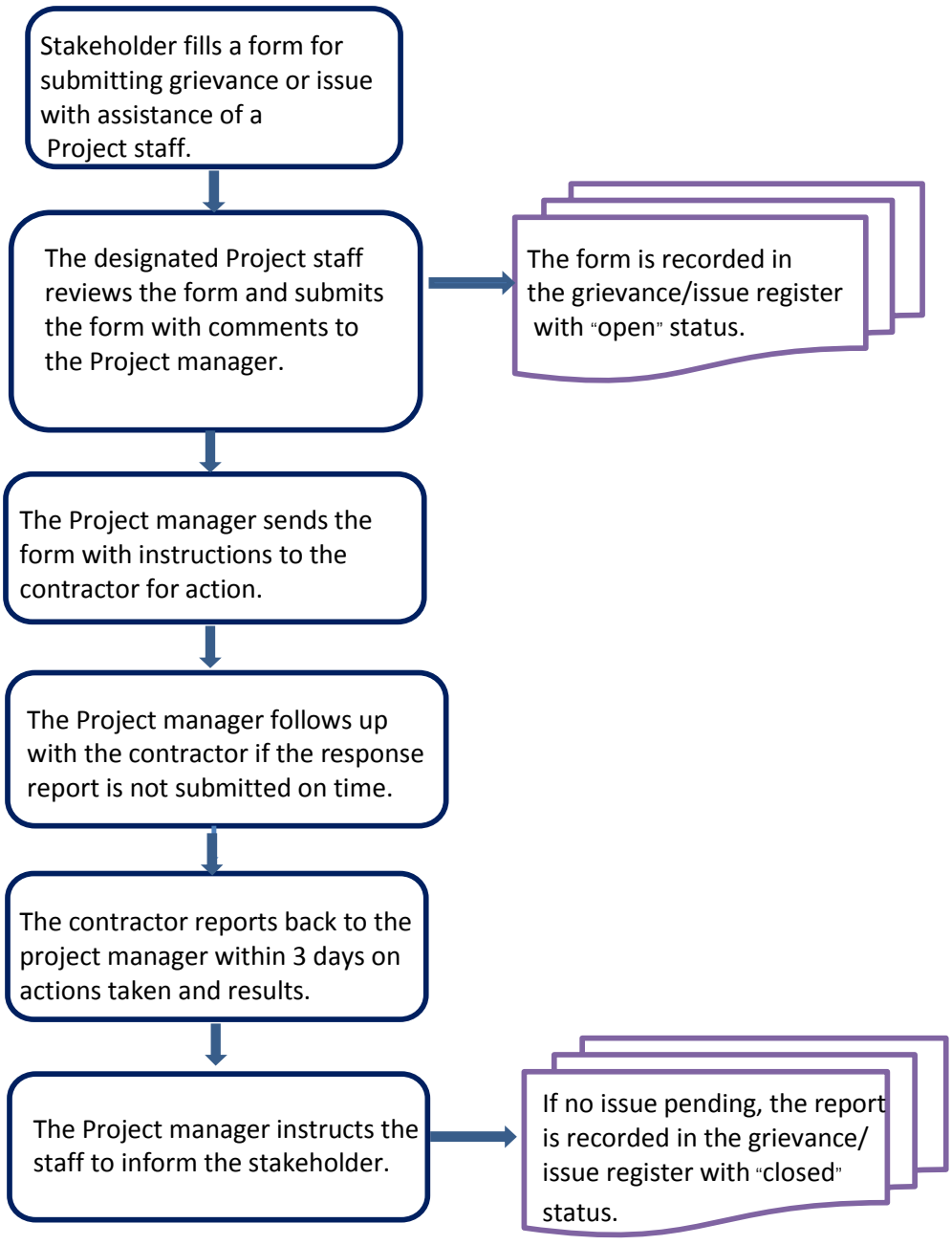


FIGURE 1 : GRIEVANCE REDRESS MECHANISM