

Executive Summary Report of Myagdi Khola Hydropower Project (57.3 MW)

Name of Developer Company:	M/s Hydro Village Private Limited
Date of Registration at Company Registrar:	25 th Bhadra, 2071
PAN:	602535357
Registered Address:	Subidhanagar, Kathmandu-32
Name of Project:	Myagdi Khola Hydropower Project (57.3 MW)

Project Background

Myagdi Khola Hydropower Project is a run-of-river type project with an installed capacity of 57.3 MW that will generate 335.99 GWh energy annually. The project is located at Jeltun village in Gandaki province of Nepal. The project has two headworks one is situated at the Myagdi river while another one is situated at the Kunaban river, and the powerhouse is located at Jeltun village. The project has a catchment area of 306 km² at headworks and has a design discharge of 12.5 m³/s.

Project Details:

1 Project Location

Province	Gandaki
District	Myagdi
Municipalities covered by project boundary	Dhawalagiri Rural Municipality
Project boundary	
Latitude	28°37'49" E to 28°34'18" N
Longitude	83°25'00" E to 83°21'50" E

2 General

Name of River	Kunaban Khola and Myagdi Khola
Nearest Town	Beni Bazar
Type of Scheme	Run-of-river
Gross Head	626.50 m
Rated Net Head	604.50 m

3 Hydrology

Catchment Area of both river combined	306 km ²
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Design Discharge of Myagdi Khola and Kunaban Khola Combined	12.50	m ³ /s
Design flood of Myagdi Khola at intake (1 in 100 Years)	496.54	m ³ /s
Design flood of Kunban Khola at intake (1 in 100 Years)	170.32	m ³ /s
Design flood of Myagdi Khola at tailrace (1 in 100 Years)	731.49	m ³ /s

4 Power and Energy

Design discharge	12.50	m ³ /s
Rated net head	604.68	m
Plant Capacity	57.30	MW
Dry Energy	103.11	GWh
Wet Energy	232.88	GWh
Annual total Energy	335.99	GWh

5 Weir

Myagdi Weir

Weir Type	Ogee Weir	
Weir Crest Length (excluding undersluice)	15	m
Weir Height (from U/S riverbed)	7.00	m
Weir Crest Elevation	2483.00	masl
Operation Platform Elevation	2490.80	masl
Stilling Basin		
Type	USBR Type II	
Stilling Basin Length	38	m

Kunban Weir

Weir Type	Boulder Weir	
Weir Crest Length (excluding undersluice)	18	m
Weir Height (from U/S riverbed)	4.5	m
Weir Crest Elevation	2479.50	masl
Operation Platform Elevation	2483.40	masl

6 Undersluice

Myagdi Undersluice

Size of Undersluice Opening (b x h)

Width (b)	1 st 4.00 and 2 nd 2.50	m
Height (h)	1 st 4.00 and 2 nd 2.50	m
No. of undersluice gates	2	Nos.
Invert Level	2474.50	masl

Kunban Undersluice

Size of Undersluice Opening (b x h)

Width (b)	2.50	m
Height (h)	2.70	m
No of undersluice gates	1	nos.
Invert Level	2471.50	masl

7 Intake

Myagdi Intake

Type of Intake Side Intake

Size of Intake Opening

Width (b)	3.60	m
Height (h)	2.70	m
Number of Openings	2	Nos.
Velocity of flow at intake trashrack	0.80	m/s

Kunban Intake

Type of Intake Side Intake

Size of Intake Opening

Width (b)	4.80	m
Height (h)	2.50	m
Number of Openings	2	nos.
Velocity of flow at intake trashrack	0.80	m/s

8 Gravel Trap and Flushing Culvert

Gravel Trap of Myagdi Khola

No. of Hopper	1	Nos.
Width of Hopper	8.20	m
Length of Gravel Trap at base	3	m
Total Length of Gravel Trap	5	m
Total Width of Gravel Trap at Top	8.20	m
Width of hopper at base	3.80	m

Flushing Culvert of Myagdi Khola

Number before flushing gates	1	Nos.
Size	1.2m (width) x 1 m (height)	
Length of Flushing Culvert	31	m

Gravel Trap of Kunban Khola

No of Hopper	1	Nos.
Width of Each Hopper	10.80	m
Length of Gravel Trap at base	4.75	m
Total Length of Gravel Trap	7.75	m
Total Width of Gravel Trap at Top	10.80	m
Width of hopper at base	3.55	m

Flushing Culvert of Kunban Khola

Number before flushing gates	2	
Size	1.20 m (width) x 1.20 m (height)	
Length of Flushing Culvert	51.50	m

9 Connecting Tunnel

Width of Tunnel	2.50	m
Height of Tunnel	2.50	
Bed Slope	1 in 500.0	

Length of Tunnel	387.14	m
Invert level at inlet	2481.15	masl
Invert level at outlet	2480.37	masl

10 Settling basin

Location	Near intake on the right bank of Kunaban River	
Sediment size to be settled	0.15	mm
Number of bays	2	Nos.
Length of Settling Basin (Main Section)	85.00	m
Width of Each Bay	11.00	m
Efficiency	90%	
Water Depth	8.5	m

Headrace Pipe

Length	400	m
Diameter	2.20	m

11 Headrace Tunnel and Rock Trap

Headrace Tunnel

Shape	Inverted D-Shaped	
Total length (inlet portal to surge shaft offset point)	6,127.00	m
Width of finished line (Shotcrete lined)	3.20	m
Height at finished line (Shotcrete lined)	3.50	m

Rock Trap

Length	28.00	m
Width	3.20	m
Depth below tunnel invert level	2.20	m

12 Surge Shaft

Type	Simple surge shaft
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Finished Diameter	8.00	m
Upsurge Level	2493.00	masl
Downsurge level	2458.23	masl
Top Level of Surge shaft including freeboard	2499.65	masl
Bottom level of Surge shaft	2450.95	masl
Total height including freeboard and submergence	44.70	m

13 Pressure shaft & Penstock Pipe

Tunnel from surge shaft to vertical drop shaft

Shape	D-shaped	
Finished diameter (shotcrete lined)	3.20	m
Finished height (shotcrete lined)	3.50	
Length upto center point	66.20	m

Vertical Drop shaft tunnel

Numbers of Vertical Drop	3	nos.
Shape	Circular	
Excavation diameter	3.2	m
Height of first drop shaft	190.48	m
Length of mild slope penstock tunnel after first drop shaft	257.16	m
Height of second drop shaft	215.88	m
Length of mild slope penstock tunnel after second drop shaft before to trifurcation point	202.16	m
Height of third drop shaft	85.69	m
Length of mild slope penstock tunnel after second drop shaft before to trifurcation point	168.09	m

Mild Slope Penstock Tunnel Size

Shape	D-shaped	
Finished diameter	3.20	m
Finished height	3.50	m

Penstock Pipe

Diameter of main penstock pipe	2.0	m
Length (From surge shaft to first bifurcation)	1207.45	m
Thickness	10mm to 45mm	mm
Penstock Steel Material specification	SALIMA	
Ultimate Tensile Stress steel	520	N/mm ²
Yield Stress of steel	450	N/mm ²

14 Powerhouse and Control Building

Type	Surface Powerhouse	
Powerhouse Size (L x B), outer dimensions excluding control building	49.60 x 15.20	m
Height from Machine floor	20.00	m
Control Building Size	41.75 x 9.0	m
Design Tailwater Level	1850.47	masl
No. of Units	3	
Turbine Center Line Level	1853.00	masl

15 Tailrace culvert

Tailrace Box culvert length	42	m
Shape	Rectangular	
Width	2.40	m
Height	2.00	m
Slope	1 in 600	

16 Turbine

Type	Vertical axis Pelton Turbine	
Number of units	3	
Efficiency	91.5%	

Speed	750	rpm
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17 Generator

Number of Units	3	
Efficiency	97.5%	
Voltage	11	kV
Power Factor	0.85	
Rated output per unit	22130	kW

18 Switchyard

Width (Including Access Road)	40	m
Length	20	m

19 Transmission Line

Length	17	km
Voltage	132	kV

20 Financial Indicators

Total Project Cost including VAT and Tax without IDC	10,742,904,008.32	NRs.
Cost per MW	187,485,235.75	NRs.
Dry energy rate	8.40	NRs/kWh
Wet energy rate	4.80	NRs/kWh
B/C ratio on Project	1.34	
IRR on Project	15.11%	
IRR on Equity	22.63%	
B/C ratio on Equity	1.34	

1 Technical Consultant

Hydro Village Private Limited had assigned M/s Hydro-Consults Engineering Ltd. as Owner's Engineer to carry out Tender Design, Construction Supervision and Contract Management for Myagdi Khola Hydropower Project. Hydro-Consult Engineering Ltd. is a renowned company in the hydropower field. It has provided engineering and consulting services to various small and large hydropower projects in Nepal and abroad.

2 Key Attractions of the project considering comparative study

- a) Myagdi River is a snow-fed river. It is a gauged river having data for more than 20 years. This means the data used for forecasting energy generation is more mature than the data used in other hydropower projects where hydrological prediction is mainly based on reference analysis.
- b) It is relatively a high head project with a gross head of 626.50 m. The structure in high head project tends to be much smaller compared to similar size project with low or medium head. For instance, the tunnel diameter of Trishuli 3 A HEP (60 MW) which has a gross head of 145 m is 5.4 m compared to 3.5 m of this project.
- c) Per MW cost of the project is around NPR. 19 crore compared to industry average of NPR. 20 crore. This is mainly due to high head nature of the project.
- d) Per MW revenue of the project is NPR 3.43 crore. Most of the hydropower projects in Nepal earn less than NPR. 3 crore per MW.
- e) The project has signed Take or Pay PPA in new tariff structure, i.e. six months dry and six months wet. Previously, the PPA for RoR projects were signed for eight months wet and four months dry. The PPA rates for dry and wet months are NPR. 8.40 and NPR. 4.80 per kWh respectively. Further, Take or Pay modality of PPA makes it more attractive as the Nepal Electricity Authority (NEA) is obliged to buy the contract energy.

3 Why the project is lucrative for equity investment?

Equity IRR of the project is 22.63% and project IRR is 15.11

4 Viability of project for debt investment:

The average DSCR of the project at 75:25 Debt: Equity ratio is 1.62 suggesting that it can easily service the debt liability.

5 Breakdown of total project cost

S.No.	Particulars	NPR. '000	Percent
1	Owner's Cost	200,000	1.86%
2	Land Acquisition/ Compensation/Development	257,357	2.40%
3	Site Office Building including Camp Facilities	647,600	6.03%
4	Vehicle	79,000	0.74%
5	Civil Works	3,571,722	33.25%
6	Electro-mechanical Works	1,547,960	14.41%
7	Hydro-mechanical Works	730,403	6.80%
8	Transmission line & Switchyard	330,000	3.07%
9	Project Supervision/Management and Engineering	546,000	5.08%
10	Insurance	46,351	0.43%
11	VAT	838,690	7.81%
12	Physical Contingency	619,736	5.77%
13	Price Escalation & Miscellaneous	256,837	2.39%
14	Financing Arrangement Cost	60,429	0.56%
15	Interest During Construction	1,010,820	9.41%
	Total	10,742,904	100%
	Per MW Cost	187,485	

6 Means of Finance

S. No.	Details	NPR. '000	%
1	Debt	8,057,257	75%
2	Equity	2,685,647	25%
	Total	10,742,904	100%

7 Proposed Equity Structure

S. No.	Details	NPR. '000	%
1	Existing Shareholders	805,718	30%
2	HIDCL	537,145	20%
3	Public Offering	537,145	20%
4	Other Financial Investors	805,718	30%
	Total	2,685,726	100%

8 Revenue

Annual Energy Generation	: 335.99 GWh
Wet	: 232.88 GWh (30.53%)
Dry	: 103.11 GWh (69.47%)
Wet PPA Rate	: NPR. 4.80 per kWh (for 6 months)
Dry PPA Rate	: NPR. 8.40 per kWh (for 6 months)
Number of escalations	: 8
Revenue in first year	: NPR. 1,959,852 thousands
Revenue in the ninth year	: NPR. 2,430,216 thousands
Annual Revenue at best scenario	: NPR 1,959,852 thousands
Annual Revenue at worst scenario	: NPR 1,665,874 thousands (15% Decline)

9 Construction Period

The actual construction is planned to start at the end of June, 2022. The construction period is estimated to be 30 months.

10 Debt Equity Volume and Ratio

Debt:Equity Ratio	75:25
Already Committed Equity:	NPR. 2,685,726 thousands (100%)
Already Received Equity :	NPR. 269,915.4 thousands (10.05%)

11 Upfront Equity

25% of the total equity will be the upfront equity before loan injection from Consortium of Banks.

12 Status of Regulatory Approvals and Physical Works -

a. Feasibility Study Report	Completed
b. Grid Connection Agreement	Signed
c. PPA (Take or Pay)	Signed
d. EIA	Approved
e. Geophysical Investigation	Completed
f. Generation License	Issued
g. DOI Registration	Approved
h. Transmission Line License	Issued
i. Forest Clearance and Government Land acquisition	At final stage of approval
j. Explosive Procurement permission	Approved
k. Bunker and Army Camp Construction	On process
l. Geotechnical Investigation	Ongoing
m. Sediment Sampling and Analysis	Completed
n. Transmission Line Survey	Completed
o. Transmission Line Detail Design	Ongoing
p. Boulder Suvery for Hydraulic Modelling	Completed
q. Crest Gague and Manual Gauge for Hydraulic Modelling	Established
r. Physical Hydraulic Modelling	Ongoing
s. Access Road Suvery	Completed
t. Access Road and Bridge Design	Ongoing
u. Access Road Construction	Ongoing (5km completed)
v. Automatic Water Level Recorder Station (2 Nos)	Established

- w. Continuous Discharge Measurement
- x. Construction Material Suvery

Ongoing
Completed

13 Time schedule

Construction Activities	Start	Finish
<i>Myagdi Khola Hydropower Project</i>	<i>01-June, 2022</i>	<i>10-January, 2025</i>
Infrastructure Works	01-June, 2022	30- July, 2022
Civil Construction Works	01-June, 2022	07-September, 2024
Hydro-mechanical Works	10-August, 2022	27-September, 2022
Electro-mechanical Works	26-July, 2022	14-September, 2024
Transmission Line	01-February, 2023	30-November, 2025

14 SWOT of the Project

● *Strength*

- a) High head project with 30.53% dry energy.
- b) 25% is proposed as the upfront equity.
- c) Promoted by reputed individuals having excellent business track record.
- d) Payback period is 6 years after COD.
- e) Comparative cost is lower than other projects.
- f) Almost all statutory approvals have been received.
- g) Project IRR is more than 15%.

● *Weakness*

- a) The total construction period is tight with little slack time.

● *Opportunity*

- a) Equity IRR is 22.63% and Average DSCR is 1.62
- b) Nepal is promoting hydro sector.
- c) PPA is already completed in Take or Pay modality with better tenor of 6:6 months dry and wet rate.
- d) The projected EPS is higher than other similar projects, which is very lucrative for equity investors.

● *Threat*

- a) The Dandakhet substation and transmission line being build by NEA. The delay in completion of substation and transmission line could hamper the power evacuation of the project.

15 Financials

Year After COD	1	2	3	4	5	6	7	8	9	10
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Income Statement (Amount in NPR Crore)

Revenue	197	203	209	215	220	226	232	244	244	244
EBITDA	174	179	185	190	195	200	206	211	216	216
PAT	49	58	68	79	89	101	113	126	139	148
Share Capital	269	269	269	269	269	269	269	269	269	269
EPS	18.19	21.71	25.40	29.26	33.31	37.57	42.08	46.84	51.91	55.18

Cash Flow Statement (Amount in NPR. Crore)

Total Receipt	197	203	209	215	220	226	232	244	244	244
Total Payment	116	188	196	204	212	220	229	239	248	259

Opening		81	96	108	119	128	134	138	137	133
Net	81	96	108	119	128	134	138	137	133	118

Balance Sheet (Amount in NPR Crore)

Equity	269	269	269	269	269	269	269	269	269	269
Reserve	12	27	44	63	86	111	139	171	206	23
Debt	799	756	708	656	598	535	465	388	303	212
	1079	1051	1021	988	953	915	873	827	777	723
Net FA	1038	1003	967	931	895	859	824	788	752	716
Net WC	41	48	54	57	58	55	49	39	25	7
	1079	1051	1021	988	953	915	873	827	777	723

Project IRR:- 15.11%
Equity IRR:- 24.63%