

GATI INFRASTRUCTURE SADA MANGDER POWER PVT. LTD.
71 MW Sada-Mangder H.E.P. South & West Sikkim

“Six Monthly Compliance Report” for the period ending 30th September-2017

DATA SHEET

S No	Particulars	Remarks
1	Project Type	Run-of-the-River Scheme
2	Name of the Project	Gati Infrastructure Sada Mangder Power Private Ltd
3	Clearance Letter(s)/O.M.No. & Date	a) Environmental Clearance vide MOEF Letter No. J-12011/26/2007-1A-1 valid up to 2017
4	Location	
	a. District	South & West District
	b. State	Sikkim
	c. Latitude	27° 21' 50" N to 27° 24' 40" N
	Longitude	88° 19' 33" E to 88°21' 40" E
5	Address for Correspondence	
	a) Address of concerned project Chief Engineer (with Pin Code/ Tel. No./ Telex/ Fax No./ Email address)	Mr. Manoj Kumar Sen General Manager Gati Infrastructure Pvt Ltd House no _32, Development Area, J T Road, Gangtok_737101 Fax _03592_201213, Land line : 03592_201214 Cell No: 8170012388 E-mail: manoj.sen@gatiinfra.com
	b) Address of Executive Project Engineer/ Manager(With Pincode/ Tel. No/ Telex/ Fax No./ Email address)	Mr.Rakesh Kumar Poddar Head_Environment & Safety, Lower Bering Karabari, Post Office :Bering, Police station : Pakyong, East Sikkim PIN : 737106 Cell No: 81700-12383 Email: rakesh.poddar@gatiinfra.com
6	Salient Features	
	a) Of the Project	Enclosed Annexure-B
	b) Of the Environmental Management Plans	The Salient features of the environmental norms being adopted for the project are as follows
		a) Environment Management Plan (EMP): The EMP includes the following subheads:
		i) Compensation against private land.
		ii)Compensatory Afforestation Plan: Includes cost of Afforestation over double the forest land being diverted for the project, engineering measures as well as maintenance.
		iii) Provision of fuel to labourers.
		iv) Infrastructure Facilities: Includes proper water supply and sanitation, refuse disposal, health facilities, roads and colony for staff, muck disposal plans etc.
		v) Catchment Area Treatment plan: Includes measures for soil conservation including catchment afforestation, and civil engineering works.
		b) Environment Monitoring Plan: The environmental monitoring will be required during the pre-and post-commissioning phases of the project. This would allow for prompt implementation of effective corrective measures to problems arising at any time during the project implementation. This involves:
		i) Monitoring of water quality, soil conservation measures, public health facilities, Afforestation measures etc.
		ii) Establishment of an Environment division: To coordinate, supervise and monitor the environmental mitigatory measures.

S No	Particulars	Remarks
		c) Disaster Management Plan: No disaster is anticipated due to the failure of Sada & Mangder Dam as the project is designed with adequate and approved safety factors. In case of unforeseen natural or man-made causes, this plan proposes the set up of:
		i) Reporting procedures including surveillance,
		ii) Efficient & full proof communication system,
		iii) Emergency Action Committee to ensure coordinated action, emergency lighting, provision for fire prevention and control, etc.
7	Break up of the Project Area	
	a) Submergence area: Forest & Non-forest	Physical survey is under progress.
	b) Others	Not Applicable
8	Break up of Project-affected population with enumeration of those losing:	
	a) Houses/dwelling units only	-
	b) Agricultural land only	-
	c) Both dwelling units and Agricultural land	-
	d) Landless labourers/artisans	-
	e) SC/ST/Adivasis	-
	f) Others	-
9	Financial Details	
	a) Project cost as originally planned and subsequent revised estimates and the year of price reference:	Original planned cost as per DPR is Rs 335.90 crores.
	b) Allocations made for Environmental Management Plan with item-wise and year-wise break-up	Enclosed Annexure C
	C) Whether project cost includes the cost of environmental management as shown in (b) above.	Yes
	D) Actual expenditure incurred on the project so far:	Rs.16.59 crores
10	Forest land requirement	
	a) The status of approval for diversion of forest land for non-forestry use	Joint inspection with Forest and Land Revenue officials, Govt. of Sikkim has been completed in South district and the same is under process in West district.
	c) The status of compensatory Afforestation, if any	NA
	d) Comments on the viability and sustainability of compensatory Afforestation programme in the light of actual field experience so far.	NA
11	The status of clear felling in non-forest areas (such as submergence area of reservoir, approach road) if any, with quantitative information.	NA
12	Status of construction:	
	a) Date of Commencement (Actual and/or planned)	September, 2013
	b) Date of Completion (Actual and/or planned)	May, 2020
13	Reasons for the delay if the project is yet to start:	As per agreement, Government of Sikkim should construct two Access Roads which is still not done hence the delay in start of project.

CONDITIONS AND COMPLIANCES TOWARDS ENVIRONMENTAL CLEARANCE
MOEF Letter No. J-12011/26/2007-1A-1 dated 15.05.2007

No	Conditions	Status
	PART-A: Specific Conditions	
1	i) During lean season minimum water discharge from Rangit & Relli rivers should be 8.22 cusec & 9.17 Cusec respectively.	Noted - It will be adhered during the lean Season.
2	ii) Controlled blasting with very low charge and mild explosives should be used under close supervision. The quantity of explosive per delay to used should be informed within one month from the date of issue of this letter.	It will be complied with as per the guidelines.
3	iii) Catchment Area Treatment plan as has been proposed should be completed in three years and as proposed by Chief Wildlife Warden in his letter dt. 09.04.2007, Wildlife & Bio Diversity Conservation within the catchment area should be incorporated in consultation with him or his representative.	It will be adhered to once the CAT programme is taken up by the Forest Department.
4	iv) A Survey to be undertaken to find the extent of population and infrastructure that may be affected within the stipulated flood zone of 2.5m over & above the normal flow for rainfall run-off flood in the event of a dam break and the findings to be submitted within the three months-	Dam break analysis has already been done and submitted to the Ministry of Environments & Forests, New Delhi and State Forest Dept, Government of Sikkim.
5	v) Consolidation and compilation of the muck should be carried out in the muck dump sites and the dump sites should be above high flood level-	It will be complied with after start of construction works.
6	vi) Creation of a hatchery for fisheries development in Rangit and Ralli Rivers as proposed in the EMP for conservation of fishes should be implemented-	Will be complied in consultation with State Fisheries Department.
7	vii) Commitment made during public hearing should be fulfilled-	It will be complied during work execution.
8	viii) It is noted that the land required for the project will be acquired and registered in the name of Government of Sikkim through land Acquisition Act and then leased to the project proponent. Therefore much before submergence of land in question the land acquisition proceeding should be completed and possession of the land will be taken from Government of Sikkim –	Land acquisition is under process. The land will be acquired as per Land Acquisition Act prevalent in state of Sikkim.
	PART-B: General Conditions	
1	i) Adequate free fuel arrangement should be made for the labour force engaged in the construction work at project cost so that indiscriminate felling of trees is prevented-	Will be complied during execution of construction works.
2	ii) A fuel depot may be opened at site to provide the fuel (Kerosene Wood & LPG). Medical facilities as well as recreational facilities should also be provided to the labourers-	It will be complied during work execution.
3	iii) All the Labourers to be engaged for construction works should be thoroughly examined by health personal and adequately treated before issuing the work permit-	It will be complied during work execution.
4	iv) Restoration of construction area including dumping site of excavated material should be ensured by levelling, filling up of burrow pits, landscaping etc. The area should be properly treated with suitable plantation-	Will be complied after start of construction works.
5	v) Financial provision should be made in the total project budget of the project for implementation of the suggested safeguard measures-	Rs. 396.15 Lakhs has been allocated for implementation of suggested safeguard measures in Environment Management Plan.
6	vi) A multidisciplinary committee in consultation with the	It will be complied after obtaining Forest

No	Conditions	Status
	ministry should be constituted with ecologists, environmental scientists, various discipline of forestry, ecology, wildlife, soil conservation, NGO etc to oversee the effective implementation of suggested safeguard measures.	Clearance from State Forest Department.
7	vii) Six monthly monitoring reports should be submitted to the Ministry and its regional Offices, Shillong for review regularly-	Six Monthly Reports are being submitted regularly to MOEF New Delhi, Regional MOEF and State Forest Department.
8	Officials from Regional Office MOEF, Shillong who would be monitoring the implementation of environmental safeguards will be given full cooperation, facilities and documents/data by the project proponents during their inspection	Officials from Regional Office MOEF, Shillong who would be monitoring the implementation of environmental safeguards will be given full cooperation, facilities and documents/data during their inspection
9	The responsibility of implementation of Environmental safeguards rests fully with Gati and Government of Sikkim	It will be implemented with the help of Forest, Environment and Wildlife Department, Government of Sikkim.
10	In case of change in the scope of the project, project will require a fresh appraisal	Noted to be followed.
11	The Ministry reserves the right to add additional safeguards measures subsequently, if found necessary and to take action including revoking of the clearance under the provisions of the Environment(Protection) Act, 1986 to ensure effective implementation of the safeguards, measures in a time bound and satisfactory manner	All additional safeguard measures will be incorporated if any.
12	The clearance letter is valid for period of five years from the date of issue of this letter for commencement of construction work	Noted.
13	A copy of clearance letter will be marked to concerned Panchayat / local NGO, if any from whom any suggestion/ representation has been received while processing the proposal	A copy of the clearance letter has been given to all the concerned Panchayats / NGO.
14	State Pollution Control Board/committee should display a copy of the clearance letter at the regional office, District Industries Center, Collector's Office / Tehsildars Office for 30 days	A copy of clearance letter was displayed by State Pollution Control Board, Gangtok at the regional office, District Industries Center, District Collector(East) office as per the requirement.
15	The project proponent should be advertised at least in two local newspapers widely circulated in the region around the project one of the which shall be in the vernacular language of the locality concerned informing that project has been accorded environmental clearance and copies of clearance letters are available with State Pollution Control Board /Committee may also be seen at website of the Ministry of Environment and Forests at http://www.envfor.nic.in	We had advertised in two local newspapers widely circulated in the region around the project : <i>"HAMRO PRAJASHAKTI"</i> in Nepali & <i>"NOW"</i> in English, dated 01.06.2007 informing that project has been accorded environmental clearance and copies of clearance letters are available with State Pollution Control Board, Gangtok.

Salient Features

3.1 PROJECT LOCATION	
State	Sikkim
District	South-West District
Stream	Relli & Rangit
Vicinity	Ravangla
Latitude	27°21'50" – 27°24'40" N
Longitude	88°19'33" – 88°21'06" E

SADA INTAKE		
3.2 HYDROLOGY (Sada)		
Catchment area	km ²	117.55
Average annual inflow	106	356
Average discharge	m ³ /s	11.3
Specific average discharge	m ³ /s/km ²	0.1
Minimum ecological water release in Rangit River	m ³ /s	0.68
Flood discharge for river diversion (~Q10) Dry season	m ³ /s	115
Flood discharge for river diversion (~Q10) monsoon Season	m ³ /s	210
Design discharge for spillway arrangement (Q1000)	m ³ /s	450

3.3 RESERVOIR (SADA)		
Maximum normal reservoir level	m a.s.l.	1534.5
Average normal reservoir level (½ active storage)	m a.s.l.	1529.33
Minimum normal reservoir level	m a.s.l.	1521.5
Extreme maximum water level (max. flood level)	m a.s.l.	1539.7
Total storage volume	m ³	302100
Active storage volume	m ³	250300
Dead storage volume	m ³	51'800

3.4 DAM AND APPURTENANT STRUCTURES (SADA)		
Dam type --	Gravity	
Crest elevation	m a.s.l.	1540
Stream bed (talweg) level	m a.s.l.	1507
Dam foundation level	m a.s.l.	1494.1
Dam height from foundation level	m	45.9
Crest length	m	64.5
Dam volume	m ³	37000
Max depth of grout curtain	m	31
Diversion facilities		

Diversion Tunnel in the left abutment		
Design discharge	m ³ /s	115
Length	m	98
Diameter	m	3.9
Upstream Cofferdam		
Crest Elevation	m a.s.l.	1518.5
Length	m	37
Downstream Cofferdam		
Crest Elevation	m a.s.l.	1509.5
Length	m	37
Spillway type (incorporated into the dam) Ungated Ogee crest		
Crest elevation	m a.s.l.	1534.7
Crest length	m	19.5
Flip Bucket		
Bucket radius	m	5.5
Lip elevation	m a.s.l.	1518.86
Bottom Outlet (incorporated into the dam)		
Sill elevation	m a.s.l.	1507.3
Number of opening	--	1
Dimension of opening (h x w)	m	3.5 x 3.50
Gate type	Radial	
Max. Head	m	32.4
Capacity (by exceptional reservoir level), each opening	m ³ s	300

3.5 INTAKE STRUCTURE (SADA)		
Number of openings	--	1
Water inlet elevation	m a.s.l.	1516.6
Nominal discharge	m ³ /s	11.5
Dimension of trash rack opening (h x w)	m	3.60 x 3.60
Gate type at the tunnel entrance	Roller	
Sill elevation	m a.s.l.	1516
Dimensions (h x w)	m	2.9 x 2.7
Max. Head	m	23.7

3.6 HEADRACE TUNNEL (Sada)		
Shape	--	circular
Length	m	3558
Excavation Diameter	m	3.2 – 3.4
Internal Diameter	m	2.7
Velocity for nominal discharge	m/s	2
Slope	%	0.59
Nominal discharge	m ³ /s	11.5

Number of intermediate adits	--	0
Lining	100.00%	concrete
Surge Shaft (Sada)		
Vertical Shaft		
Top elevation	m.a.s.l	1549
Bottom Elevation	m.a.s.l	1495.1
Height	m	53.9
Max water level in surge shaft	m.a.s.l	1546.6
Minimum water level in surge shaft	m.a.s.l	1508.4
Excavation diameter	m	13.6
Internal Diameter	m	12
Lining	100.00%	concrete
Pressure shaft (Sada)		
Type		Inclined shaft
Nominal Discharge	m ³ /s	11.5
No. of intermediate adits		1
Lining	100.00%	steel line with concrete fillings
Upper Part		
Length	m	764
Slope	%	42.9
Excavation diameter	m	3
Internal Diameter	mm	1800
Velocity for nominal discharge	m/s	4.5
Lower Part		
Length	m	797
Slope	%	0.2
Excavation diameter	m	3.5
Internal Diameter	mm	1700
Velocity for nominal discharge	m ³ /s	5.1
Adit Tunnel		
Length	m	313
Excavation (h _{xw} ; D shaped)	m	4.5x4.5
Lining		Concrete invert

MANGDER INTAKE

3.7 HYDROLOGY (Ralli)

Catchment area	km ²	131
Average annual inflow	106 m ³	397
Average discharge	m ³ /s	12.6
Specific average discharge	m ³ /s/km ²	0.1
Minimum ecological water release in Ralli River	m ³ /s	0.74

Flood discharge for river diversion (~Q10) dry season	m ³ /s	120
Flood discharge for river diversion (~Q10) monsoon season	m ³ /s	220
Design discharge for spillway arrangement (Q1000)	m ³ /s	490

3.8 RESERVOIR (MANGDER)

Maximum normal reservoir level	m a.s.l.	1131
Average normal reservoir level (½ active storage)	m a.s.l.	1126.48
Minimum normal reservoir level	m a.s.l.	1120.5
Extreme maximum water level (max. flood level)	m a.s.l.	1136.55
Total water storage volume	m ³	391100
Active water storage volume	m ³	307500
Dead storage volume	m ³	83600

3.9 DAM AND APPURTENANT STRUCTURES (MANGDER)

Dam type	--	Gravity
Crest elevation	m a.s.l.	1136.75
Stream bed (talweg) level	m a.s.l.	1105
Dam foundation level	m a.s.l.	1089.45
Dam height from foundation level	m	47.3
Crest length	m	46.1
Dam volume	m ³	25'500
Max depth of grout curtain	m	32
Diversion facilities		
Diversion channel in left abutment		
Design discharge	m ³ /s	120
Length	m	66
Diameter	m	3.5
Upstream Cofferdam		
Crest Elevation	m a.s.l.	1115.5
Length	m	
Downstream Coffer dam		
Crest Elevation	m.a.s.l.	1106
Length	m	28.5
Spill way type (incorporated into the dam)		Ungated Ogee Crest
Bottom Outlet (incorporated into the dam)		
Crest Elevation	m.a.s.l.	1131.2
Crest Length	m	19.5
Flip Bucket		
Bucket radius	m	6.1
Lip Elevation	m.a.s.l.	1116.96
Bottom outlets (Incorporated into the dams)		
Sill elevation	m.a.s.l.	1105.3

No. of openings		1
Dimension of opening (hXw)	m ³	50X 3.50
Gate type		Radial
Maximum Head	m	31.25
Capacity (by exceptional reservoir level) each opening	m ³ /s	294

3.10 INTAKE STRUCTURE (MANGDER)		
Number of openings		1
Water inlet elevation	m.a.s.l	1,115,00
Nominal Discharge	m ³ /s	13.7
Dimension of trash rack opening (hXw)	m	3.90X3.90
Gate type at the tunnel entrance		Roller
Sill elevation	m.a.s.l	1115
Dimension (hxw)	m ³	3.1X3.0
Max. Head	m	21.55
Pressure shaft (Mangder)		
Type		Vertical shaft
Nominal Discharge	m ³ /s	13.7
No. of intermediate adits		0
Upper parts		
Length	m	121
Slope	%	1.5
Excavation diameter	m	3.5
Internal diameter	m	3
Velocity for nominal discharge	m/s	1.9
Lining		concrete
Length	m	139.5
Slope		Vertical
Excavation diameter	m	3.1
Internal Diameter	mm	1900
Velocity for nominal discharge	m/s	4.8
Lining		Steel line with concrete filling
Lower Part		
Length	m	34
Slope	%	1.5
Excavation diameter	m	3.5
Internal Diameter	m	1.9
Velocity for nominal discharge	m/s	4.8
Lining	100.00%	steel line with concrete filling

3.11 COMMON POWER PLANT AND OUTLETS WORKS, SADA MANGDER

Power House cavern		
Type		Underground
Cavern dimension (IXwXh)	m	44.5X16.5X30.4
Turbine "Sada" type		Francis vertical
Number of units		1
Turbine setting elevation	m.a.s.l	974.85
Rated Discharge	m ³ /s	11.5
Turbine speed	rpm	750
Min tail water level	m.a.s.l	981
Flood level (PMF)	m.a.s.l	986.5
Max/Min gross head	m	553.5/540.5
Average gross head	m	548.3
Installed capacity	MW	53.3
Average annul peaking energy production	GWh	176.5
Average annual based load energy production	GWh	90.8
Average annul operating time in peaking energy hours		3312
Average annual operating time in base load energy hours		1705
Plant load factor		0.57
Inlet valve "Sada"		
Type		Spherical valve
No.		1
Axis elevation	m.a.s.l	974.85
Diameter	m	1
Maximum Head	m	564.85
Generator "Sada" type		3-Phase
Number		1
Nominal Speed	rpm	750
Voltage/Frequency	Kv/Hz	11/01/50
Load Factor	cos Ø	0.9
Transformer "Sada" type		3-phase
Location		Inside
Number		1
Unit capacity	MVA	69.5
Voltage Ratio	Kv/Kv	132/11
Turbine "Mangder" type		Francis vertical
No. of units		1
Runner elevation	m.a.s.l	974.85
Rated discharge	m ³ /s	13.7
Turbine speed	rpm	600
Minimum tail water level	m.a.s.l	981

Flood level (PMF)	m.a.s.l	986.5
Max/Min gross head	m	150.0/139/5
Average gross head	m	145.48
Installed capacity	MW	16.9
Average annual peaking energy production	GWh	54.3
Average annual based load energy production	GWh	27.8
Average annual operating time in peaking energy hours		3203
Average annual operating time in base load energy hours		1641
Plant load factor		55
Inlet valve “Mangder”		
Type		Spherical valve
No.		1
Axis elevation	m.a.s.l	974.85
Diameter	m	1.3
Maximum Head	m	161.7
Generator “Mangder” type		3-Phase
Number		1
Nominal Speed	rpm	600
Voltage/Frequency	Kv/Hz	11/01/50
Load Factor	cos Ø	0.9
Transformer “Mangder” type		3-phase
Location		Inside
Number		1
Unit capacity	MVA	22.2
Voltage Ratio	Kv/Kv	132/11

3.12 MULTIPURPOSE ACCESS TUNNEL

Type		D-Shaped
Length	m	453
Dimension (h _x w)	m	5.5x5.5
Invert elevation at portal	m.a.s.l	1016
Slope	%	8.3
Lining		concrete invert + shotcrete where required
Transformer Gallery		
Type		Underground
Cavern Dimension (l _x h _x w)	m	20.3x9.0x11.0
Expansion chamber (Downstream surgeshaft)		
Type		Underground
Cavern Dimension (l _x h _x w)	m	23.0x25.9x9.8
Tale race tunnel		
Shape		Circular

Length	m	879.3
Excavation Diameter	m	5.2
Internal diameter	m	4.6
Velocity for nominal discharge	m/s	1.5
Nominal discharge	m ³ /s	25.2
Slope	%	0.5
Outlet sill elevation	m.a.s.l	982
River bed elevation (approx)	m.a.s.l	980.7
No. of intermediate adits		0
Lining	100.00%	concrete
SWITCH YARD 132 KV		
Type		Outdoor
Voltage/busbars	KV/	132/11
Area (lxw)	m	70x42

3.13 Estimated Cost		
Pre operative expenses	INR in Crores	20.81
Civil Works	INR in Crores	149.5
E&M Works	INR in Crores	85.12
Total Basic cost	INR in Crores	255.43
Escalated cost for civil and E&M works	INR in Crores	18.69
Interest during construction and fund management Expenses	INR in Crores	29.18
Total Generation works	INR in Crores	303.31
Cost per MW Installed	INR in Crores	4.27
Power benefits (for both plants)		
Energy generation in average year	GWh	349.4
Energy generation in dry year (Approx 90% dep)	GWh	314.6
Financial Aspects		
Cost of Generation (Avg. for first 15 years plan) per kWh at power house bus bars (including IDC) during 90% dependable year in Rs.		1.92
Construction Period		
Construction Period	Months	36

ANNEXURE- C

Total Cost Estimated for Implementation of EMP		
S No	Particulars	Amount (In Lakhs)
1	Compensatory Afforestation	3.00
2	Creation of Green Belt	3.24
3	Catchment Area Treatment	162.52
4	Biodiversity Conservation and Management Plan	39.50
5	Fisheries Development	9.95
6	Disaster Mitigation Plan for Geo Hazards	23.00
7	Health Delivery System	32.50
8	Muck Disposal	10.00
9	Solid Waste Management	12.44
10	Provision for Fuel Wood and Energy Conservation	20.00
11	Resettlement and Rehabilitation Plan	70.00
Total		386.15

ANNEXURE-D

Project Progress

Sada-Mangder Hydro Electric Power Project is falling in two districts i.e. South & West districts of Sikkim State and as per MoU signed between Government of Sikkim and Gati Infrastructure Ltd on dated 14.11.2003, the land required for the project is to be acquired by the Government in accordance with the provisions of Land Acquisition Act under the State Government. Accordingly the land acquisition has since been completed in the South District whereas the same is under process in the West District. No Objection Certificates have already been obtained from the private landowners and local panchayats. All the permissions/licenses have been obtained including Techno Economic Clearance from Govt of Sikkim.





Sada Dam Location



Sada Mangder Dam Location



Sada Mangder Power House Location



Sada Mangder Site Office

Social Welfare Activities

As a part of Corporate Social Responsibility Gati Infrastructure Sada Mangder Power Private Ltd organised a painting competition in Government Senior School, Borong, South Sikkim. The students were divided into two categories: Standard 1-5 & Standard 6-11. The students were thrilled as they had never participated in any painting competition and was a new experience for them. Total 125 students participated along with 15 teachers. After the competition, prizes were given to the students who made the best painting through the school principal in the presence of Local Panchayats and NGO.



Painting Competition in Government Senior School, Borong

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