SIX-MONTHLY COMPLIANCE
(1-1-2013 to 30-6-2013)

of

ENVIRONMENTAL CLEARANCE
(J.13012/86/2010-IA.II (T) dated 21-3-2011

ISSUED TO

225 MW GAS BASED COMBINED CYCLE POWER PLANT

GAMA INFRAPROP PVT LTD
Mahuakheraganj, Kashipur,
Uttarakhand

CONTENTS

A. Specific Conditions:

	EC Conditions	Compliance
1.	Vision Document specifying prospective plan for the site shall be formulated and submitted to the Ministry **within six months.**	**Attached as A-1**
2.	In case of fuel for running the power plant is proposed to be changed from natural gas to other fuel (liquid or solid) the project proponent shall apply for such a change in environmental clearance along with necessary documents as required under EIA notification, 2006 (and its amendments). In such a case the necessity for holding public hearing again or otherwise will be determined by the Ministry in consultation with the Expert Appraisal Committee (Thermal Power).	The fuel for running the power plant is Natural Gas.
3.	The project proponent shall submit within three months to the Ministry a certificate / confirmation from the office of the chief of migratory Warden to the effect that area does not fall in the corridor of migratory route of elephants.	**Attached as A-2**
4.	The project proponent shall in association with other Gas Based Thermal Power Plants coming up in the District, initiate a study through a reputed institution to assess the cumulative impact of the power plants on the AAQ of the area and submit its report to the Ministry within two years. The study shall in particular assess the impact of emission of the gas power plant on the chemistry of upper troposphere and stratosphere of the atmosphere and the impact on radiation budget. It shall be ensured that the study takes into account the worst seasonal atmospheric conditions. The project proponent shall ensure that the Ministry is informed of the Commissioning of the study and shall submit status report every quarterly. The report of the study shall be submitted to the Ministry for further action as may be necessary.	The study will be initiated after commissioning of the plant
5.	Local employable youth shall be trained in skills relevant to the project for eventual employment in the project itself. The action taken report and details thereof to this effect shall be submitted to the Regional Office of the Ministry and the state Govt. Dept. concerned from time to time.	Local employable youth has been trained and absorbed in the project. **Details are given in A-3**

6.	Additional soil for leveling of the proposed site shall be generated within the sites (to the extent possible) so that natural drainage system of the area is protected and improved.	Complied. No soil was brought from outside the premises
7.	Hydro geological study of the area shall be reviewed annually and report submitted to the Ministry. No water bodies including natural drainage system in the area shall be disturbed due to activities associated with the setting up / operation of the power plant.	We have done regular groundwater and surface water monitoring of the area. We have not disturbed any water body or natural drainage of the area. **Results are attached as A-4.**
8.	COC of 5.0 shall be adopted.	We have installed Air Cooled Condensers.
9.	A well designed rainwater harvesting shall be constructed. Central Groundwater Authority/ Board shall be consulted for finalization of appropriate rainwater harvesting technology within **a period of three months** from the date of issue of clearance and details shall be furnished to the Regional Office of the Ministry. Subsequently water requirement for running the plant shall be met from harvested rain water and use ground water shall be dispensed with thereafter.	The rainwater harvesting design has been prepared and is in the process of implementation in consultation with Central Groundwater Board. **The same is placed at A-5**
10.	Regular monitoring of ground water level shall be carried out by establishing a network of existing wells and constructing new piezometers. Monitoring shall also be carried out particularly for heavy metals (Cr, As,Pb) and records maintained and submitted to the Regional Office of this Ministry. The data so obtained should be compared with the baseline data so as to ensure that the ground water quality is not adversely affected due to the project.	Complied.
11.	Monitoring surface water quantity and quality (if any nearby) shall also be regularly conducted and records maintained. The monitored data shall be submitted to the Ministry regularly. Further, monitoring points shall be located between the plant and drainage in the direction of flow of ground water and records maintained. Monitoring for heavy metals in ground water shall be undertaken.	Complied
12.	The treated effluents confirming to the prescribed standards only shall be re-circulated and reused within the plant. There shall be no discharge outside the plant boundary except during monsoon. Arrangements shall be made that effluents and storm water do not get mixed.	Complied. Air cooled condenser has been installed to reduce almost 95% water consumption.

13.	A sewage treatment plant shall be provided (as applicable) and the treated sewage shall be used for raising greenbelt/plantation.	Complied
14.	The project proponent shall set up permanent monitoring stations measurement of PAN, NHMC besides criteria pollutants.	Shall be complied after plant commissioning
15.	Dry Low NOx Burners shall be installed.	Complied. Dry LNB is built-in the Gas Turbine.
16.	A stack of 40 m height shall be provided with continuous online monitoring equipments for ambient air quality parameters notified by the Ministry including NOx. Exit velocity of flue gases shall not be less than 22 m/sec	Complied
17.	Green Belt consisting of three tiers of plantations of native species arround plant constituting 33% of total area. Tree density shall not less than 2500 per ha with survival rate not less than 80%.	Greenbelt development started.
18.	In additon to development of green belt, social forestry measures shall be taken up in close consultation with the District Forests Department. The project proponent shall accordingly identify blocks of degraded forests and generation of degraded forests shall be undertaken at a large scale. In pursuance to this the project proponent shall formulate time bound action plan along with financial allocation and shall submit status of implementation to the Ministry every six months.	Matter taken up with DFO, response awaited.
19.	The project proponent shall also adequately contribute in the development of the neighbouring villages. Special package with implementation schedule for free potable drinking water suplly in the nearby villages and schools shall be undertaken in a time bound manner.	Complied
20.	An amount of Rs 3.4 Crores shall be earnmarked as one time capital cost for CSR programme. Subsequently a recurring expenditure of Rs 0.68 Crores per annum shall be earnmarked as recurring expenditure for CSR activities. Details of the activities to be undertaken shall be submitted **within three month** along with road map for implementation.	Budget earmarked for CSR activities. Details of CSR activities present in EIA report. CSR activity will start after plant commissioning.
21.	While identifying CSR programme the company shall conduct need based assessment for the nearby villages to study economic measures with action plan which can help in upliftment of poor section of society. Income generating projects	Complied. Details of CSR activities present in EIA report.

	consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. Company shall provide separate budget for community development activities and income generating programmes. This will be in addition to vocational training for individuals imparted to take up self employement and jobs.	
22.	It shall be ensured that in-built monitoring mechanism for the schemes identified is in place and annual social audit shall be got done from the nearest government institute of repute in the region. The project proponent shall also submit the status of implementation of the scheme from time to time.	Audit of CSR activities shall be done after plant commissioning.

B. General Conditions

	Point wise Compliance	
1.	Adequate safety measures shall be provided in the plant area check/minimize fires and other hazards. Copy of these measures with full details along with location plant layout shall be submitted to the Ministry as well as to the Regional Office of the Ministry.	Complied. EIA Report separately submitted to RO-MOEF Lucknow.
2.	Storage facilities for auxiliary liquid fuel such as LDO and/ HFO/ LSHS (if any) shall be made in the plant area in consultation with Department of Explosives, Nagpur. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.	No Liquid fuel shall be handled or stored inside the plant premises
3.	First Aid and Sanitation arrangements shall be made for the drivers and other contract workers during contract workers during construction phase.	Complied. First aid box placed and septic tanks provided in toilets.
4.	Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 75 dBA. For people working in the high noise area, requisite personal protective equipment like earplugs/ ear muffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc shall be periodically examined to maintain audiometric record and for treatment for any hearing loss including shifting to non noisy / less noisy areas.	Complied. The GT is inbuilt with noise reduction system and acoustic enclosure. We have kept Ear Plugs which shall be provided to workers who are operating and maintaining the GT and Air Compressors.

5.	Regular monitoring of ground level concentration of NOx& PM_{10} shall be carried out in the impact zone and records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations and frequency of monitoring shall be submitted to the Regional Office of this Ministry. The data shall also be put on the website of the company.	This will be done after plant commissioning
6.	Provision shall be made for the housing of construction labour (as applicable) within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Complied.
7.	The project proponent shall advertise in at least 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 within seven days from the date of this clearance letter, informing that the project has been accorded environmental clearance and copies of clearance letter are available with the State Pollution Control Board/Committee and may also be seen at website of the Ministry of Environment and Forests at http://envfor.nic.in.	Complied
8.	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, ZilaParishad / Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.	Complied.
9.	An Environmental Cell shall be created at the project site itself and shall be headed by an officer of appropriate seniority and qualification. It shall be ensured that the Head of the Cell shall directly report to the Head of the Organisation. The status report on the functioning of the Cell shall be submitted to the Regional Office of the Ministry periodically.	The Environment Cell is headed by GM (Mr. Sudhir Gupta) who directly reports to the Managing Director (Mr. Rahul Goyal)
10.	The proponent shall upload the status of compliance	Shall be Complied.

	of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional office of MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely RSPM, SO_2, NOx (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.	Stack emission results shall be generated after plant commissioning
11.	The environment statement for each financial year ending 31st March in Form-V as in mandated to be submitted by the project proponent to the concerned State Pollution Control Board as Prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Offices of the Ministry by e-mail.	Environment Statement (Form V) shall be generated after plant commissioning
12.	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment and Forests, its Regional Office, Central Pollution Control Board and State Pollution Control Board. The project proponent shall upload the status of compliance of the environment of the environmental clearance conditions on their website and update the same periodically and simultaneously send the same by e-mail to the Regional Office, Ministry of Environment and Forests.	Complied
13.	Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report and Environmental Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring. Project proponent will up-load the compliance status in their website and up-date the same from time to time at least six monthly basis. Criteria pollutants level including NOx (from stack & ambient air) shall be displayed at the main gate of the power plant.	EIA – EMP Report separately submitted to RO-MOEF Lucknow.
14.	Separate funds shall be allocated for implementation	Funds allocated for implementation of environmental protection measures

	of environmental protection measures along with item-wise break-up. These cost shall be included as part of the project cost. The funds earmarked for the environment protection measures shall not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.	along with item-wise break-up provided in EIA Report.
15.	The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure and final approval of the project by the concerned authorities and the dates of start of land development work and commissioning of plant.	The plant commissioning will be done once gas is made available and the date will be informed to RO-MOEF and MOEF.
16.	Full Cooperation shall be extended to the Scientist / Officers from the Ministry / Regional Office of the Ministry at Bangalore/CPCB/SPCB who would be Monitoring the compliance of Environmental status.	Complied

Annexure – 1

VISION STATEMENT - GAMA INFRAPROP (PVT) LTD

- We have envisages to contribute towards growth of our nation with the prime notion of providing benefit to the people of India by **providing adequate power to agricultural sector and varied industries**.
- It is only our conviction that we have put the most efficient and environment friendly power resource. The project is a 225 MW Gas based Combined Cycle Power Project, which is based on Natural Gas as fuel and one third of the total power is generated from the byepass product (steam).
- **Provide electricity to the state of Uttarakhandas per the terms and conditions stated by UERC.**
- We have planned to lay our **green belt of 8 acres instead of 7.5 acres** out of the measure that shows our dedication and conviction for environment protection.
- The green belt would consist **of high oxygen emitting trees such as Neem&Ficusreligiosa (Peepal)** as a maximum environment benefit measure.
- We have put in provisions of **building Inland concrete roads with systematic drainage system**.
- We also have also planned for **Beautification of the ambit of the project**.
- With an aim to preserve water we have also planned for **Rain Water Harvesting** so as to preserve the maximum water resources which can be utilized for the plant.
- To ensure the maximum preservation we have planned for a **Water Treatment Plant** so as the maximum water can be treated for in house consumption.
- Stack Emissions will be reduced as the project is equipped with state of the art technology of **Dry Low Nox burners on the project stacks**. A provision of **regular online monitoring system** is also installed as a measure to keep a regular check on emissions.
- For sewer/sewage water and plant wash water with other contents shall be treated with state of the art **Sewage Treatment Plan**t within the plant. A provision is kept of utilizing the water in our green belt.
- Provisions for **regular environmental monitoring measures** are put in place as we have hired **registered consultants for regular environment monitoring at the site**.
- **Ambient air quality shall be measured by installing monitoring stations at site**.
- As for noise protecting measure all the **equipments have been balanced with noise level within 85 decible (db)**. Turbine, Generators and other related equipments are placed in acoustic enclosure to have noise level maintained within 85 db. This exercise shall be carried out at every six months.
- We have also planned to conduct regular sessions with the locals so as to educate and train them for various environment protection and preservation methods.
- **A provision is made for setting up an environment protection and preservation fund wherein Gama Infraprop (P) Ltd. will provide financial assistance for environment protection and preservation activities carried out in the state**.

ANNEXURE 2 : NOC FROM CHIEF WILD LIFE WARDED

कार्यालय, प्रभागीय वनाधिकारी तराई पश्चिमी वन प्रभाग, रामनगर (नैनीताल)

पत्र संख्या 3201 / 12-1 दिनांक , रामनगर , जून 27 2011

सेवा में

Gama Infraprop (P) LTD
M-3 (First floor) Aurbindo marg, Hauz Khas,
New Delhi-110016

विषयः– No "Migratory Route of Elephants" Certificate

सन्दर्भ :– आपका पत्रांक– GIPL/NEC/2011/001 Date 14.06.2011

महोदय,

उपरोक्त विषयक सन्दर्भित पत्र के अनुक्रम में उक्त प्रकरण पर वन क्षेत्राधिकारी काशीपुर से आख्या मॉगी गयी , वन क्षेत्राधिकारी काशीपुर ने अवगत कराया है कि महुवाखेड़ागंज औद्योगिक आस्थान है तथा यह क्षेत्र हाथी कोरिडोर के अर्न्तगत नही आता है तथा यहॉ पर हाथियों की उपलब्धता भी नही है। अतः सूचना प्रेषित।

भवदीय

(निशान्त वर्मा)
प्रभागीय वनाधिकारी
तराई पश्चिमी वन प्रभाग, रामनगर

प्रभागीय वनाधिकारी
तराई पश्चिमी वन प्रभाग
रामनगर (नैनीताल)

Annexure 3

LIST OF LOCAL YOUTH WHO HAS BEEN EMPLOYED AFTER TRAINING AT GAMA INFRAPROP PRIVATE LIMITED, KASHIPUR

Sl No.	Name	Rank	Address
1	Ankit Sharma	Sr. Engineer (Mech)	Subhash Nagar, AvasVikas Colony, Kashipur
2	Akash Sharma	Accounts In-charge	Durga Colony, Kashipur
3	Raju Kumar	Store In-charge	Court Road, Kashipur
4	Ram Briksh Yadav	Store In-charge	Court Road, Kashipur
5	Dushyant Kumar	Electrician	New SabziMandi, Shakti Nagar, Kashipur
6	Rajeev Bhatnagar	Office Boy	KalashMandap Road, Kashipur
7	Usman	Office Boy	Bathuakhera, Kashipur
8	Nanhe	Gardener	Bathuakhera, Kashipur

Annexure 4: AIR AND WATER QUALITY RESULTS

EMTRC LAB

(EMTRC CONSULTANTS PRIVATE LIMITED)

F-66, Road No.2, Phase-I, UPSIDC Industrial Area
Masuri Gulawathi Road, Ghaziabad (UP)-201009
Recognized by Ministry of Environment & Forest, GOI
Vide Notification N0. S.O.592 (E) 08.03.2013 to 07.03.2018

---TEST REPORT---

Issued To : GAMA INFRAPROP PVT. LTD.
Khasara No. 948 (UIP), Vill-Mahua Khera Ganj,
Kashipur, U.S. Nagar, Uttarakhand.
Party Code No. : GIPL/15/1
Nature of Sample : Ambient Air Quality Monitoring (24-h avg)
Sampling Date : 04-05-2013 to 05-05-2013
Sample Collected By : Scientist of EMTRC

AMBIENT AIR QUALITY TEST RESULTS

	Parameter	Location					
		Unit	Test Methods	Project Site	Mahuakhera Village	Aharpura Village	National Standard
1	PM_{10}	$\mu g/m^3$	IS-5182-P-23-2006	82	70	76	100 (24-hours average)
2	$PM_{2.5}$	$\mu g/m^3$	40 CFR USEPA Chapter 1-Part 50 AP-L	46	38	40	60 (24-hours average)
3	Sulphur dioxide (SO_2)	$\mu g/m^3$	IS-5182-P-2-2001	<4.0	<4.0	<4.0	80 (24-hours average)
4	Nitrogen dioxide (NO_2)	$\mu g/m^3$	IS-5182-P-6-2006	9.6	8.6	8.3	80 (24-hours average)

Date: 30-5-2013

Authorized Signatory

Registered Office: P-501, Anupam Apartment East Arjun Nagar, Delhi 110032
Phone: 011-22301172, 9810032481

EMTRC LAB

(EMTRC CONSULTANTS PRIVATE LIMITED)

F-66, Road No.2, Phase-I, UPSIDC Industrial Area
Masuri Gulawathi Road, Ghaziabad (UP)-201009
Recognized by Ministry of Environment & Forest, GOI
Vide Notification N0. S.O.592 (E) 08.03.2013 to 07.03.2018

---TEST REPORT---

Issued To : GAMA INFRAPROP PVT. LTD.
Khasara No. 948 (UIP), Vill-Mahua Khera Ganj,
Kashipur, U.S. Nagar, Uttarakhand.
Party Code No. : GIPL/15/2
Nature of Sample : Surface Water Quality
Sampling Date : 05-05-2013
Sample Collected By : Scientist of EMTRC

TEST RESULTS

	Parameters (Designated-Best-Use)	Unit	Test Methods	Dhela River	Bahalla River U/S	Bahalla River D/S
1	pH	-	APHA-4500	7.71	7.14	7.50
2	DO	mg/l	APHA-4500C	4.0	4.1	4.1
3	BOD (3 days 27°C)	mg/l	APHA-5210B	5.4	4.5	4.6
4	Total coliform	MPN/100ml	APHA-9230B	65	56	58

Date: 30-5-2013

Authorized Signatory

Registered Office: P-501, Anupam Apartment East Arjun Nagar, Delhi 110032
Phone: 011-22301172, 9810032481

EMTRC LAB

(EMTRC CONSULTANTS PRIVATE LIMITED)

F-66, Road No.2, Phase-I, UPSIDC Industrial Area
Masuri Gulawathi Road, Ghaziabad (UP)-201009

Recognized by Ministry of Environment & Forest, GOI
Vide Notification N0. S.O.592 (E) 08.03.2013 to 07.03.2018

----------TEST REPORT----------

Issued To : GAMA INFRAPROP PVT. LTD.
Khasara No. 948 (UIP), Vill-Mahua Khera Ganj,
Kashipur, U.S. Nagar, Uttarakhand.
Party Code No. : GIPL/15/3
Nature of Sample : Groundwater
Sampling Date : 05-05-2013
Sample Collected By : Scientist of EMTRC

TEST RESULTS

	Parameters	Unit	Test Methods	Project Site	Aharpura Village	Permissible limit IS:10500:1991
1	pH	-	APHA-4500	7.80	7.30	6.5 to 8.5
2	Colour	Hazen Unit	APHA 2120B	Colourless	Colourless	25
3	Turbidity	NTU	APHA-2030B	3	2	10
4	Total Dissolved Solids	mg/l	APHA-2540B	430	440	2000
5	Total Hardness as $CaCO_3$	mg/l	APHA-2340C	200	190	600
6	Calcium as Ca	mg/l	APHA-4500B	48	52	200
7	Magnesium as Mg	mg/l	APHA-4500B	19.5	14.5	100
8	Chlorides as Cl	mg/l	APHA-4500B	30	34	1000
9	Sulphate as SO_4	mg/l	APHA-4500E	10	12	400
10	Nitrates as NO_3	mg/l	APHA-4500	8	10	100
11	Fluoride as F	mg/l	APHA-4500D	0.7	0.7	1.5
12	Arsenic as As	mg/l	APHA-3114	<0.025	<0.025	0.05
13	Mercury as Hg	mg/l	APHA-3112	<0.01	<0.01	0.05
14	Cadmium as Cd	mg/l	APHA-3111B	<0.01	<0.01	0.01
15	T. Chromium as Cr	mg/l	APHA-3111B	<0.005	<0.005	0.05
16	Iron as Fe	mg/l	APHA-3111B	0.022	0.028	1.0
17	Copper as Cu	mg/l	APHA-3111B	<0.02	<0.02	1.5
18	Lead as Pb	mg/l	APHA-3111B	<0.01	<0.01	0.05
19	Manganese as Mn	mg/l	APHA-3111B	<0.05	<0.05	0.3
20	Zinc as Zn	mg/l	APHA-3111B	0.6	0.6	15.0
21	Oil and Grease	mg/l	APHA-4500D	Nil	Nil	0.03
22	Total Coliform	MPN/100ml	APHA-9230B	Nil	Nil	Nil

Date: 30-5-2013

Authorized Signatory

Registered Office: P-501, Anupam Apartment East Arjun Nagar, Delhi 110032
Phone: 011-22301172, 9810032481

EMTRC LAB

(EMTRC CONSULTANTS PRIVATE LIMITED)

F-66, Road No.2, Phase-I, UPSIDC Industrial Area
Masuri Gulawathi Road, Ghaziabad (UP)-201009

Recognized by Ministry of Environment & Forest, GOI
Vide Notification N0. S.O.592 (E) 08.03.2013 to 07.03.2018

----------TEST REPORT----------

Issued To : GAMA INFRAPROP PVT. LTD.
Khasara No. 948 (UIP), Vill-Mahua Khera Ganj,
Kashipur, U.S. Nagar, Uttarakhand.
Party Code No. : GIPL/15/3
Nature of Sample : Groundwater
Sampling Date : 05-05-2013
Sample Collected By : Scientist of EMTRC

TEST RESULTS

	Parameters	Unit	Test Methods	Mahuakhera Village	Katiyar Village	Permissible limit IS:10500:1991
	pH	-	APHA-4500	7.58	7.98	6.5 to 8.5
	Colour	Hazen Unit	APHA-2120B	Colourless	Colourless	25
	Turbidity	NTU	APHA-2030B	3	3	10
	Total Dissolved Solids	mg/l	APHA-2540B	445	480	2000
	Total Hardness as $CaCO_3$	mg/l	APHA-2340C	200	220	600
	Calcium as Ca	mg/l	APHA-4500B	52	60	200
	Magnesium as Mg	mg/l	APHA-4500B	17	17	100
	Chlorides as Cl	mg/l	APHA-4500B	25	35	1000
	Sulphate as SO_4	mg/l	APHA-4500E	12	28	400
)	Nitrates as NO_3	mg/l	APHA-4500	8	10	100
l	Fluoride as F	mg/l	APHA-4500D	0.7	0.7	1.5
2	Arsenic as As	mg/l	APHA-3114	<0.025	<0.025	0.05
3	Mercury as Hg	mg/l	APHA-3112	<0.01	<0.01	0.05
4	Cadmium as Cd	mg/l	APHA-3111B	<0.01	<0.01	0.01
5	T. Chromium as Cr	mg/l	APHA-3111B	<0.005	<0.005	0.05
6	Iron as Fe	mg/l	APHA-3111B	0.022	0.028	1.0
7	Copper as Cu	mg/l	APHA-3111B	<0.02	<0.02	1.5
8	Lead as Pb	mg/l	APHA-3111B	<0.01	<0.01	0.05
9	Manganese as Mn	mg/l	APHA-3111B	<0.05	<0.05	0.3
)	Zinc as Zn	mg/l	APHA-3111B	0.7	0.9	15.0
l	Oil and Grease	mg/l	APHA-4500D	Nil	Nil	0.03
2	Total Coliform	MPN/100ml	APHA-9230B	Nil	Nil	Nil

Date: 30-5-2013

Authorized Signatory

ANNEXURE 5

RAIN WATER HARVESTING PLAN

1.1 Need for artificial recharge of ground water

The water requirement of the power plant has been estimated as 45 m^3/hr or 1100 m^3/day (0.40 mcm/year) for 500 MW power plant.The water will be obtained by sinking two tube wells, each tube well is expected to yield 50 m^3/hour if drilled up to depth of 120 meters. With a view to recharge the ground water storage of the plant area, it is proposed that whatever rain water is harnessable in the plant area, would be recharged artificially in to the groundwater storage. Accordingly, rainwater harvesting program is being proposed so as to utilize the roof water rain water from different power plant buildings and open area.

As indicated earlier, hydro geologically the plant area is composed of alluvium having unconsolidated sequence of sand, fine to medium with boulders with occasional bands of silty sand. The depth to water is shallow during post monsoon period, ranging from 3.50 to 4.50 meters below the land surface. The sub-surface geological section reveals the presence of unconsolidated sand and boulders from surface to water table with occasional presence of loose gravel. These sands have moderate to good infiltration rate. The area therefore has ideal conditions for rain water harvesting through a permeable strata from land surface to the water table.

1.2 Basic requirement for artificial recharge project

There are two basic requirements for taking up any artificial ground water recharge project and these are:

a) Availability of non-committed surplus monsoon runoff and

b) Identification of suitable hydrogeological environment and sites for creating sub-surface reservoir through cost effective artificial recharge techniques.

While considering these two aspects in special reference to power plant, Kashipur, it is observed that there is a definite availability of surplus monsoon water from the roof top buildings covering an area of 0.742 hectares. Roof tops have sufficient area producing adequate quantity of water which could be collected and recharged to a central point where a suitable recharge structure could be constructed to store the roof top rain water duly filtered.

Another important aspect is to evaluate the storage potential of sub-surface reservoir having maximum unsaturated zone with maximum specific yield and hydraulic conductivity during the period when water is available for recharge. Artificial ground water recharge cannot be undertaken where water level is within 3 meters below the land surface during the monsoon period. Fortunately, the water table in alluvium in the power plant area, which is at the higher elevation, during the post monsoon period remains at the depth of 3.50 to 4.50 meters below the ground level indicating that 0.5 to 1.50 meters of unsaturated horizon is available for ground water storage.

This unsaturated zone of average thickness of 1 meter can store additional 1500 m^3 of water in the power plant area of 10 hectares taking the specific yield of 15%.

1.3 Main considerations for selection of recharge structures

Although there are many recharge structures in practice for artificial recharge of ground water, only those recharge structures are being proposed which are cost effective and most suitable for hydrogeological and hydrological setting of plant area. The following considerations have been kept in mind while designing the recharge structures for the power plant.

1. Only those recharge structures are being proposed which are cost effective and provide immediate ground water recharge. Generally, it is most economical to recharge directly existing open wells and tubewells but as there are no existing wells and tubewells in the plant area, new recharge trenches and contour bunds are being proposed.
2. Accordingly, depending upon the source of water from roof top rain water from the power plant buildings, suitable recharge trenches are being designed and proposed.
3. The recharge structures should be easy to maintain and do not have high recurring cost of annual maintenance.
4. Only such materials required for construction of recharge trenches are being proposed which are available in the nearby river beds and hills and can be procured easily.

Keeping these considerations in view, the following recharge structures are being proposed based on roof top rain water.

1.4 Design of recharge structures

While selecting a cost effective recharge structure, it is necessary that under the existing hydrogeological setting, the structure should be able to store the available roof top rain water which may percolate down to join the zone of saturation. The recharge structure should be such that its filter media could be easily taken out, washed so that clays deposited during filtration are removed to regain the original infiltration rate and reinstalled conveniently without much expenditure. Keeping this in view, a recharge pits and recharge trenches are being proposed for this plant area.

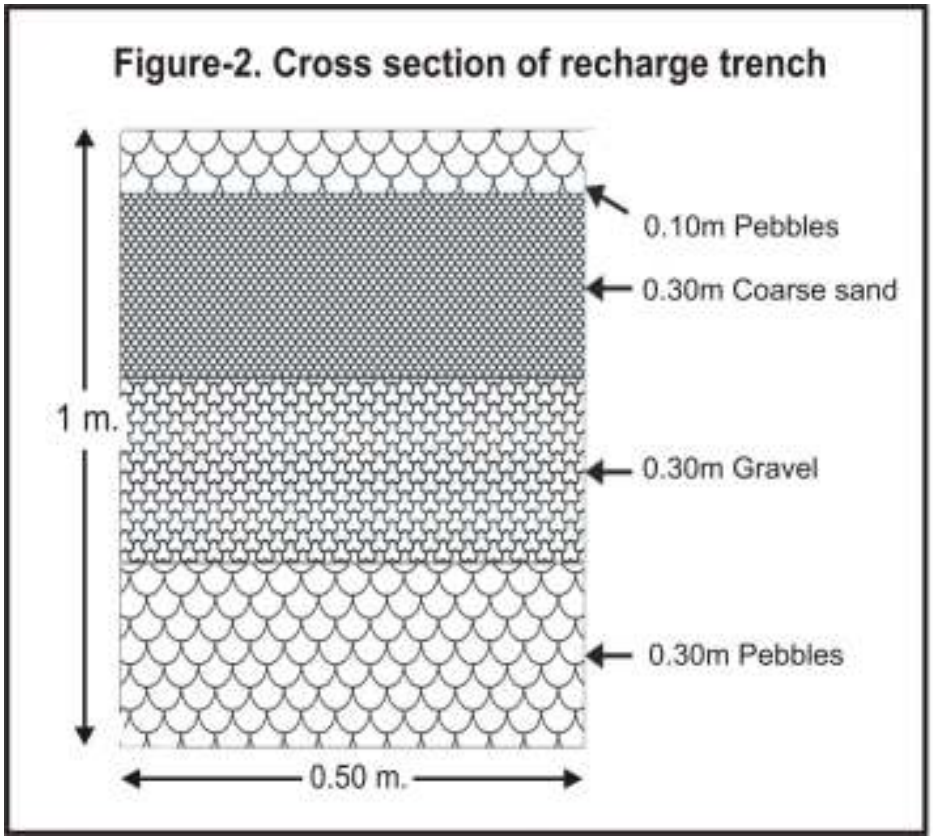
Hydrogeologically, alluvium are considered a favorable formation for rain water harvesting as it has lofty storing capacity due to high hydraulic conductivity and high porosity.

Depth to water table in the plant area during pre – monsoon period(May - June) is around 5.00 to 6.00 meters below the land surface while during the post monsoon period (Sept- Oct.) is between 3.50 to 4.50 meters below the land surface. By natural ground water recharge, there is increment of about 1.5 to 2.0 meters due to rains in the area. The same increment has been found in the entire buffer zone (10 km radius area) of power plant while carrying out hydrogeological assessment studies.

1.5 Roof top rain water utilization program

Based on the above consideration, recharge trenches are proposed, in front of each building and shed. Under a normal construction of any building or industrial shed, roof top rain water is collected through drain pipes which join a cemented drain, just at the base of the building and drain is later taken to either a percolation pond or to a plantation. It is proposed that the cemented drains, as usual may be constructed but it may be used as recharge trench having naked/unlined bottom and having filter media. All the roof top rain water will be collected from properly spaced PVC drain pipes of 50 mm dia and water brought to recharge trench of 0.5 m width and 1 meter depth. The trench will lined with cement except the bottom portion which will allow percolation of filtered water to the alluvium. Filter media as shown in Figure-2 will be filled in the recharge trench with top layer of well rounded, quartz pebbles so that coarse sand laid below the pebbles is not disturbed by water. The filter media of 1 meter thickness will retain all the suspended solids, coming along with roof top rain water and only filtered water will percolate to the zone of saturation through alluviumexposed in the bottom of the recharge trench.

Only those buildings and sheds are being considered for the recharge which have roof top area more than 300 m^2 so that adequate quantity of rain water is available for recharge. It is therefore suggested that wherever the Civil Division has originally proposed a cemented drain for disposal of roof top rain water, it may be constructed as recharge trench by providing unlined bottom and filling it by filter media.



The following recharge system is proposed for different type buildings being constructed in the plant area.

STG Building

It is proposed to construct a STG building having total RCC flat roof top area of 1,058 m^2. All the roof top rain water will be collected through drain pipes and brought to two recharge trenches to be constructed at the front and back side of the building as shown in **Figure -3**.

The availability of roof top water and the peak runoff from the roof top of the main office having total roof top area of 1,058 m^2 has been estimated as under, taking annual average rainfall as 1,184 mm, 0.85 as runoff coefficient

for cemented roof and rainfall intensity which is 60 mm/hour (15 mm/15 minutes) as peak rainfall for Kashipur area.

Availability of roof top rain water 1,058 x 0.85x 1.184 = 1065 m^3

Peak availability of water during 15mins 1,058 x 0.85x 0.015= 13 m^3

It is proposed that roof top rain water from the main office (having total roof top area of around 1,058 m^2) may be collected through 50 mm PVC drain pipes and brought to the recharge trench which will be constructed in front and side of the buildings and will have minimum length of 45 metres in front and back of the building.

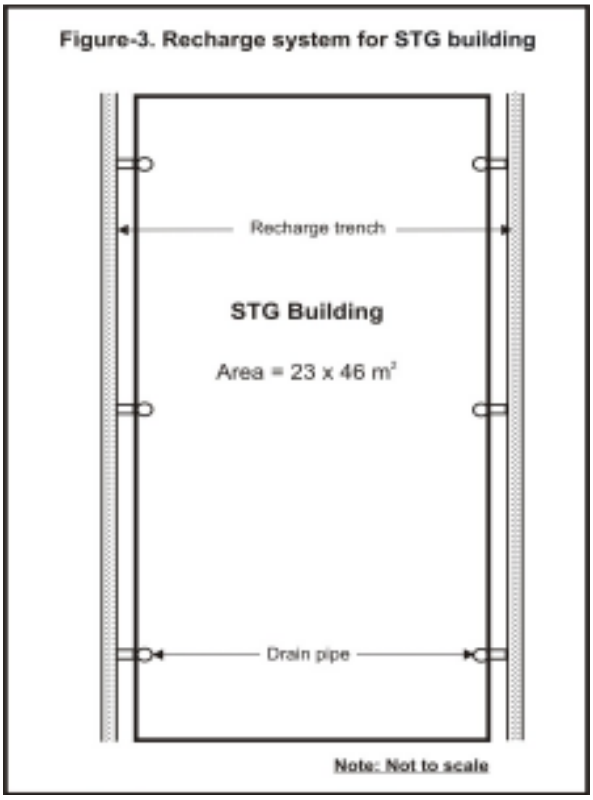
The capacity of the recharge trench is sufficient to accommodate the peak rainfall of 15 minutes taking 50% as void ratio.

0.5 x 1 x 90 x 0.5 = 23 m^3

W x D x L x void ratio = capacity

Any surplus water (during any cloud burst or slow infiltration rate of the trench) tank may be taken as overflow to another recharge trench to be constructed around the open area of the STG building of the similar design. The width and depth of the trench may be kept as half metre and one metre respectively. The trench will be cemented by the sides but remain unlined at the bottom. The trench will be filled at the bottom with 30 cm thick layer of pebbles, 30 cm. thick layer of gravel, 30 cm. thick layer of coarse sand and 10 cm. thick layer of pebbles or of boulders. The water in the trench will gradually percolate and join the water table in due course of time. The length

of trench may be decided depending upon the area available around the building.



Electrical and Control Building

It is proposed to construct an electrical and control room having total RCC flat roof top area of 852 m^2. All the roof top rain water will be collected through drain pipes and brought to one recharge trench to be constructed at the front and back side of the buildings as shown in **Figure -4**.

The availability of roof top water and the peak runoff from the roof top of the a electrical and control room having total roof top area of 852 m^2 has been estimated as under, taking annual average rainfall as 1,184 mm, 0.85 as runoff coefficient for cemented roof and rainfall intensity which is 60 mm/hour (15 mm/15 minutes) as peak rainfall for Kashipur area.

Availability of roof top rain water 852 x 0.85x 1.184 = 857 m^3

Peak availability of water during 15 minutes852 x 0.85x 0.015= 11 m^3

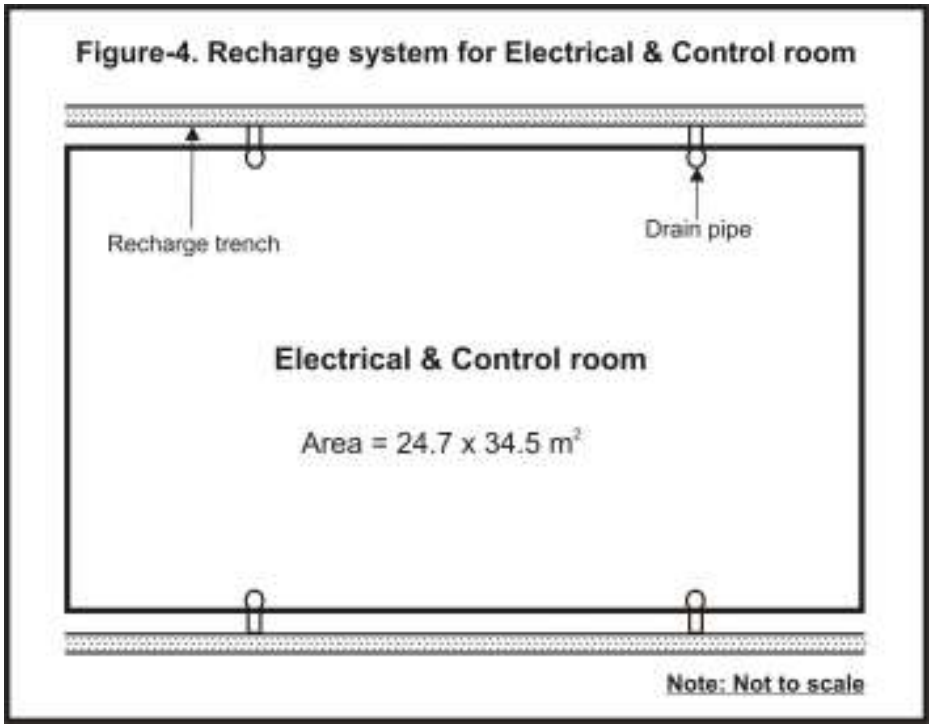
It is proposed that roof top rain water from the an Electrical and Control room (having total roof top area of around 852 m^2) may be collected through 50 mm PVC drain pipes and brought to the recharge trench which will be constructed in front and back of the buildings and will have minimum length of 34 m in front of the building.

The capacity of the recharge trench is sufficient to accommodate the peak rainfall of 15 minutes taking 50% as void ratio

0.5 x 1 x 68 x 0.5 = 17 m^3

W x D x L x void ratio = capacity

Any surplus water (during any cloud burst or slow infiltration rate of the trench) tank may be taken as overflow to another recharge trench to be constructed around the open area of the electrical and control room of the similar design. The width and depth of the trench may be kept as half meter and one meter respectively. The trench will be cemented by the sides but remain unlined at the bottom. The trench will be filled at the bottom with 30 cm thick layer of pebbles, 30 cm. thick layer of gravel, 30 cm. thick layer of coarse sand and 10 cm. thick layer of pebbles or of boulders. The water in the trench will gradually percolate and join the water table in due course of time. The length of trench may be decided depending upon the area available around the buildings.



Administration Building and Canteen

It is proposed to construct aadministration building and canteenhaving total RCC flat roof top area of 1362 (1000+362) m^2. All the roof top rain water will be collected through drain pipes and brought to two recharge trenches to be constructed at the front and back side of the building as shown in **Figure -5**.

The availability of roof top water and the peak runoff from the roof top of the administration building and canteenhaving total roof top area of 1362 m^2 has been estimated as under, taking annual average rainfall as 1,184 mm, 0.85 as runoff coefficient for cemented roof and rainfall intensity which is 60 mm/hour (15 mm/15 minutes) as peak rainfall for Kashipur area.

Availability of roof top rain water 1362 x 0.85x 1.184 = 1371 m^3

Peak availability of water during 15 mins1362 x 0.85x 0.015= 17 m^3

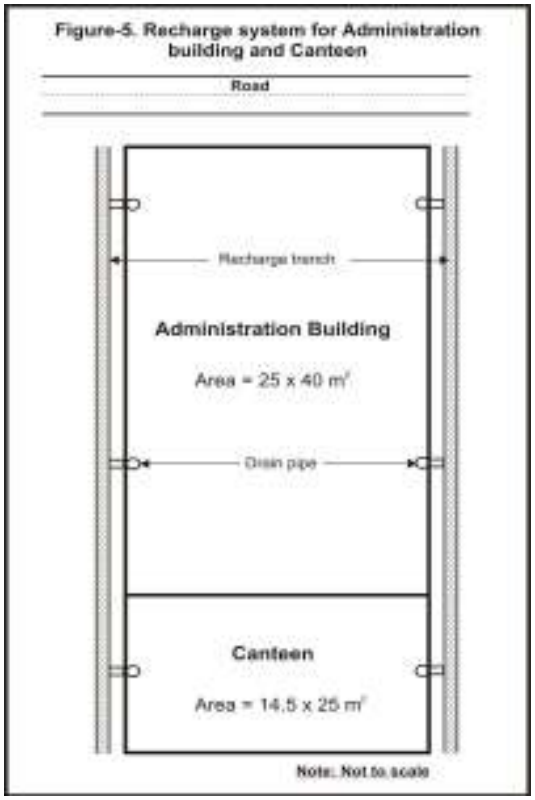
It is proposed that roof top rain water from the Administration Building and Canteen(having total roof top area of around 1362 m^2) may be collected through 50 mm PVC drain pipes and brought to the recharge trench which will be constructed in front and side of the building and will have minimum length of 65 (40+25) meters in front and side of the building.

The capacity of the recharge trench is sufficient to accommodate the peak rainfall of 15 minutes taking 50% as void ratio.

0.5 x 1 x 130 x 0.5 = 32 m^3

W x D x L x void ratio = capacity

Any surplus water (during any cloud burst or slow infiltration rate of the trench) tank may be taken as overflow to another recharge trench to be constructed around the open area of the administration building and canteenof the similar design. The width and depth of the trench may be kept as half meter and one meter respectively. The trench will be cemented by the sides but remain unlined at the bottom. The trench will be filled at the bottom with 30 cm thick layer of pebbles, 30 cm. thick layer of gravel, 30 cm. thick layer of coarse sand and 10 cm. thick layer of pebbles or of boulders. The water in the trench will gradually percolate and join the water table in due course of time. The length of trench may be decided depending upon the area available around the building.



Stores

It is proposed to construct a Store building total RCC flat roof top area of 600 m^2. All the roof top rain water will be collected through drain pipes and brought to two recharge trenches to be constructed at the front and back side of the building as shown in **Figure -6**.

The availability of roof top water and the peak runoff from the roof top of the chemical store having total roof top area of 600 m^2 has been estimated as under, taking annual average rainfall as 1,184 mm, 0.85 as runoff coefficient for cemented roof and rainfall intensity which is 60 mm/hour (15 mm/15 minutes) as peak rainfall for Kashipur area.

Availability of roof top rain water 600 x 0.85x 1.184 = 604 m^3

Peak availability of water during 15 mins600 x 0.85x 0.015= 8 m^3

It is proposed that roof top rain water from the store building (having total roof top area of around 600 m^2) may be collected through 50 mm PVC drain pipes and brought to the recharge trench which will be constructed in front and back of the building and will have minimum length of 50 meters in front and back of the building.

The capacity of the recharge trench is sufficient to accommodate the peak rainfall of 15 minutes taking 50% as void ratio.

0.5 x 1 x 100 x 0.5 = 25 m^3

W x D x L x void ratio = capacity

Any surplus water (during any cloud burst or slow infiltration rate of the trench) tank may be taken as overflow to another recharge trench to be constructed around the open area of the store building of the similar design. The width and depth of the trench may be kept as half meter and one meter respectively. The trench will be cemented by the sides but remain unlined at the bottom. The trench will be filled at the bottom with 30 cm thick layer of pebbles, 30 cm. thick layer of gravel, 30 cm. thick layer of coarse sand and 10 cm. thick layer of pebbles or of boulders. The water in the trench will gradually percolate and join the water table in due course of time. The length of trench may be decided depending upon the area available around the building.

Figure-6. Recharge system for Store