MINUTES OF THE 10TH MEETING OF THE INDIA-NEPAL JOINT TEAM OF EXPERTS ON SAPTA KOSI HIGH DAM MULTIPURPOSE PROJECT AND SUN KOSI STORAGE-CUM-DIVERSION SCHEME HELD ON 22ND & 23RD AUGUST, 2011 AT NEW DELHI

The Tenth meeting of the Joint Team of Experts (JTE) between India and Nepal was held on 22nd & 23rd August, 2011 in New Delhi. The Indian Team was led by Mr. R.C. Jha, Member (RM), Central Water Commission (CWC) and Ex-Officio Additional Secretary to Government of India and the Nepalese Team was led by Mr M. B. Gurung, Director General, Department of Electricity Development, Government of Nepal (GoN). The composition of the Indian and Nepalese Teams is at Annex-I.

Mr R.C. Jha, the leader of the Indian Team, extended a warm welcome to the Nepalese Team and wished that their stay at New Delhi would be pleasant and comfortable. He mentioned the importance of Sapta Kosi High Dam Multi Purpose Project and Sun Kosi Storage-cum-Diversion Scheme, for the people of Nepal and India, in terms of irrigation, power generation, flood control, etc. He further informed that the Joint Project Office has already got extension till February, 2013, for carrying out the assigned activities for completing the Detailed Project Report (DPR). To achieve this objective it was necessary that the meetings of JTE are held frequently in future, at least every six months. This, he said, was necessary, for monitoring the progress in a time bound manner and guiding JPO-SKSKI in its works. He stated that such interactions would facilitate investigation & preparation of DPR within agreed time frame.

Mr. M. B. Gurung, the leader of the Nepalese Team expressed gratitude to the Government of India for the warm hospitality and excellent arrangements made for the meeting. He appreciated his Indian counterpart for the importance given to the multipurpose project, and put forward his assessment that despite various difficulties, investigation was making some progress. He informed that the Government of Nepal has taken measures for providing security in the project area. While expressing GoN's resolve to complete the DPR of the project, Mr. Gurung stated that the prepared project plan should not conflict with other projects identified and planned in the upstream Kosi basin.

The Nepalese Team Leader stressed that there is a need to expedite the pending fieldworks with priority. He appreciated that the Government of India has extended the time for the investigation and DPR preparation works till 28 February 2013 and allocated the requisite resources. He also laid stress on the necessity of mutual consultation on matters related to management of project investigation.

The proposed agenda of the meeting (Annex-II) was adopted.
10.1 Progress of Works

10.1.1 Topographical Survey

Project Managers informed JTE that Small Scale Maps have been prepared by the Survey Department, Nepal and provided to the JPO-SKSKI. Similarly, the Large Scale Maps for Sapta Kosi High Dam and Sun Kosi Dam sites, except that for Sun Kosi-Kamala diversion tunnel have also been prepared and provided to the JPO-SKSKI. The Topographical Survey for Sun Kosi-Kamala diversion tunnel will be taken up after the selection of Sun Kosi Dam Site and the diversion tunnel alignment by experts.

10.1.2 Geo-technical Investigations

10.1.2.1 Diamond Core Drilling at Sapta Kosi High Dam Multipurpose Project site

The Project Managers informed the JTE that the former contractors for drilling namely M/s Pratay Nivesh Pvt. Ltd., Asansol and M/s Mining Associates Pvt. Ltd., Asansol have once again requested for appointment of arbitrator by JPO-SKSKI, failing which they would move the court to appoint an arbitrator.

JPO-SKSKI on the direction of JTE had approached Nepal Electricity Authority (a Public Undertaking of GoN) for carrying out drilling, for a total length of 930 m at Sapta Kosi dam site. Representatives of NEA visited the project site on 12th July, 2011 to assess the work to be taken up and the field conditions and submitted a proposal to JPO-SKSKI for carrying out the drilling work.

The rates offered by NEA for drilling work were discussed in the meeting and found on higher side. JTE directed the Project Managers, JPO-SKSKI to negotiate the rates and submit their recommendation for acceptance to the competent authority within two weeks.

10.1.2.2 Geological Logging and Mapping

The Project Managers informed that the International Division of Geological Survey of India (GSI) has identified the Geologists from GSI and specified the time required to complete the balance geological mapping works at Sapta Kosi High Dam project. Four geologists would visit the site from 16th November 2011 till the completion of remaining geological mapping works at Sapta Kosi High Dam project.

10.1.3 Hydrological Studies

10.1.3.1 Hydrological Observations

Project Managers informed JTE that daily gauge observation at Sapta Kosi High Dam site and discharge observation at Chatara site, Kamala Dam site at Timnai, Kurule
Dam site, Sorungtar Dam site (both on River Sun Kosi) and Uttarayani Barrage site at River Kamala are continuing.

10.1.3.2 Flood benefit Studies

The Project Managers informed that Flood damage data for 15 years (up to 2009) for Indian Territory is being collected.

10.1.4 Seismological Studies

The Project Managers informed that the observations at all the eight seismological observatories are continuing.

10.1.5 Construction Material Survey

The Project Managers informed JTE that officers/experts of Central Soil & Materials Research Station (CSMRS), India visited the project area during 25th May - 3rd June 2011 and collected samples of coarse and fine aggregates from both the Sapta Kosi High Dam Multipurpose Project and Sunkosi Storage cum Diversion Project areas.

The Project Manager (Nepal) informed that collection of samples for rock-fill material would be carried out at the time of excavation of drift for Powerhouse as this would reduce the cost of security.

10.1.6 EIA Studies

10.1.6.1 EIA Studies- Nepalese Territory

The Project Managers informed that the Team Leaders of JTE, have approved the "Eligibility Criteria" and "Evaluation Methodology" for EIA studies.

JTE ratified the concurrence given by the Team Leaders.

The Project Managers further informed that technical and financial proposals for conducting "Environmental Impact Assessment Study of Sapta Kosi High Dam Multipurpose Project and Sunkosi Storage cum Diversion Scheme" were invited from Nepalese Consulting firms as per the approved eligibility criteria. In response, two Joint Venture of firms have submitted their proposals for EIA Studies in Nepalese Territory. The Tender Evaluation Committee (TEC) meeting for evaluation of technical proposal, which was proposed on 17-18 August 2011 is now rescheduled on 2-3 September 2011.

The Project Managers informed that as directed in the 9th JTE meeting, the Environmental studies are proposed for different dam height scenarios. All necessary data regarding socio-economic issues, submergence and other related matters such as forest land and conservation areas with respect to various dam heights, as required to
finalise the project parameters, are made available to the concerned offices within nine months of commencement of the Environmental Studies while continuing remaining works. In order to expedite the process of award of consulting service contract, JTE directed the project managers to use fastest means of communications for the concurrence of the Team Leaders on technical evaluation report subject to following the laid down procedures so that financial bids could be opened at the earliest.

10.1.6.2 EIA Studies- Indian Territory

JTE noted that the EIA study in Indian Territory for command area would be taken up after Irrigation studies are completed.

10.1.7 Power System Studies

The Project Managers informed that NEA was requested to submit the revised proposal for undertaking Power System Survey and Power Evacuation Studies in respect of Nepalese territory; which is yet to be received. JTE directed the Project Managers to expedite and send the proposal of NEA to Central Electricity Authority (CEA), GOI and thereafter, a meeting may be arranged immediately between NEA and CEA officials to firm up the studies.

10.1.8 Communication Survey

The Project Managers informed that JPO-SKSKI had finalised the scope of work for Communication Studies and sent the document of Expression of Interest (EOI) and Request for Proposal (RFP) to the members of TEC for confirmation; which has not been confirmed so far. JTE directed the Project Managers to obtain the recommendations of the TEC during their proposed TEC meeting in the first week of September 2011.

10.1.9 Irrigation Studies and Command Area Survey

10.1.9.1 Indian Territory

The Project Managers informed that field works for Irrigation studies in Indian Territory by M/s WAPCOS are progressing well but was likely to spill over further by three months beyond extended deadline of 31 December 2011.

10.1.9.2 Nepalese Territory

The Project Managers informed that about four months time would be required to award the remaining work of Irrigation Studies and Command Area Survey in Nepalese Territory to Nepalese Consultants. Thereafter, one year may be needed to complete the work. JTE noted that this work is becoming a critical activity and therefore directed JPO-SKSKI to initiate the process of procuring consulting services for remaining works of
irrigation studies in the Nepalese territory with priority so that collection of the field data is started in the winter season and completed latest by May 2012 positively.

10.1.10 Navigational Studies

The Project Managers informed that the Navigational Studies report prepared by M/s RITES was made available to concerned agencies in Nepal for detailed review. The comments of a multi agency Task Force constituted by Government of Nepal were received in JPO-SKSKI on 7th August, 2011. The Task Force viewed that the navigation component of the project has socio-economic value for Nepal, besides financial value and, therefore, needs to be included in the DPR. The task force has pointed out that the traffic volume was exceptionally low in the base year and the projected growth rate was also low.

The Project Managers explained that M/s RITES had analysed all the options viz. Sapta Kosi/ Kosi river (284 km), existing irrigation canal (197 km) and proposed new canal (191 km) and worked out capital cost and operating cost for all the three options in the Report. It is found that the project cost estimates of navigation by existing irrigation canal in Bihar is the least.

The Indian side pointed out that any allocation of water exclusively for maintaining draft for navigation will have trade off with other needs including power generation. This may even result in change of peaking power station to base load power station. This aspect needs to be kept in mind.

The above aspects would be considered while preparing DPR and the option for future development of inland navigation will be kept open.

10.2 JTE noted the progress of work. A detailed progress report on each item of investigation activities is attached at Annex-III.

10.3 Way Forward for Completion of the Investigation Work / DPR

10.3.1 After detailed discussion, JTE directed both the Project Managers to expedite the remaining field investigation and studies in a time bound manner. In order to meet various milestones set in C-PIB meeting, JTE directed the Project Managers as under:

(a) To arrange a field visit of Expert Team consisting of Geologists and Designers in the first week of November 2011, for finalization of location of Sun Kosi Dam and alignment of Sun Kosi-Kamala diversion tunnel so that the topographical survey of the diversion tunnel could be taken up by the Survey Department, GoN at the earliest and completed by June 2012.

(b) To ensure timely visits of GSI officers for completion of the remaining geological mapping of Sisauli Barrage, Kamala Dam and appurtenant works and all three alternative sites of Sun Kosi dam including right bank of Sapta Kosi dam, in the ensuing
working season starting from November 2011 and complete the mapping latest by February 2012.

(c) To negotiate the rates offered by NEA for drilling work and submit their recommendation for acceptance to the competent authority within two weeks.

(d) To estimate flood damage data and flood control benefits on Nepalese side on the basis of analysis and judgment of Bihar side as well as information that are likely to be gathered in the course of Environmental studies.

(e) For technical evaluation of two proposals for carrying out EIA studies in Nepalese side, TEC meeting may be held in the first week of September 2011. After obtaining the approval of the Team Leaders towards the technical proposals, the financial bids may be opened and examined.

(f) To expedite and send the revised proposal of NEA for undertaking Power System Survey and Power Evacuation Studies in respect of Nepalese territory to Central Electricity Authority (CEA), GOI and thereafter, a meeting may be arranged immediately between NEA and CEA officials to firm up the studies.

(g) For Communication surveys, the Project Managers may obtain the recommendations of the TEC members during their proposed TEC meeting in the first week of September 2011.

(h) The Project Managers were directed to initiate the process for awarding consulting services for remaining works of irrigation studies in the Nepalese territory on priority so that the field data is collected in the coming winter season and completed latest by May 2012 positively.

(i) The Project Managers would work out a detailed work plan for remaining works/studies required for preparation of DPR within three weeks from today with clear time lines and monitor the monthly progress of each activity vigorously so that the items which are on critical path are monitored closely and there is no further slippage in the targets set while extending the tenure of JPO-SKSKI up to 28 February 2013. Progress on each of the items as per the work plan would be presented by the Project Managers in the next JTE meeting.

10.4 Any other item

10.4.1 The Project Managers informed that hiring of three four-wheel drive inspection vehicles, each for Biratnagar, Dharan and Janakpur offices under JPO-SKSKI, Biratnagar, Nepal @ NRs. 57,000/- per vehicle per month amounting to NRs. 10,26,000/- for 6 months during 2011-12, was approved by the Team Leaders. JTE ratified the concurrence given by the Team Leaders.
10.4.2 The existing staff strength in JPO-SKSKI was discussed. The JTE directed that when field works would commence at full swing, the staff strength may be augmented. The Nepalese side agreed to post Engineers at the time of commencement of drilling works.

10.4.3 It was agreed to hold the next meeting of JTE in Nepal in January/ February 2012.

The meeting was held in a very cordial atmosphere.

Signed on August 23, 2011 at New Delhi.

(M. B. Gurung)
Director General
Department of Electricity Development
Government of Nepal

(R. C. Jha)
Member (RM), CWC
& Ex-Officio Additional Secretary to the Government of India
LIST OF PARTICIPANTS FROM NEPALESE SIDE

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<th>No.</th>
<th>Name</th>
<th>Designation</th>
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### LIST OF PARTICIPANTS FROM INDIAN SIDE

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<td>Shri R.C. Jha</td>
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AGENDA FOR THE 10th JTE MEETING

10.1 Review of progress of works

10.1.1 Topographical Survey
10.1.2 Geotechnical Investigations
10.1.3 Hydrological Studies
10.1.4 Seismological Studies
10.1.5 Construction Material Survey
10.1.6 EIA Studies
10.1.7 Power System Studies
10.1.8 Communication Studies
10.1.9 Irrigation Studies and Command area survey
10.1.10 Navigation Studies

10.2 Way forward for completion of the investigation work / DPR

10.3 Any other item
Progress of Investigation Works and other Studies

1. Topographical Surveys

Large Scale Maps

MOU for carrying out large scale mapping for the following major project components were signed with Survey Department, Nepal on 15th October, 2006:

- Sapta Kosi High Dam, spillway, underground power house and other appurtenant structures
- Kamala Dam, spillway, powerhouse and other appurtenant structures
- Sunkosi Diversion / Storage Dam
- Chatra/Sisauli barrage (downstream of Sapta Kosi Dam on river Sapta Kosi)
- Chisapani/Utrayani barrage (downstream of Kamala dam on river Kamala)
- Diversion tunnel (from Sunkosi Dam site to powerhouse site on a tributary of Kamala river near Khadikhop village)
- Diversion tunnel powerhouse at Khadikhop.

Topographical survey in respect of various components of Sapta Kosi High Dam Multipurpose Project including Chatra barrage has been completed. The final maps have also been printed and received in JPO-SKSKI.

The final maps for all the three alternate dam locations of Sun Kosi viz. Dam at Kuruleghat, Dam at Sourungtar and Diversion Dam at Sourungchhabisi have been printed and received in JPO-SKSKI.

The final maps of Kamala Dam, spillway, powerhouse and other appurtenant structures including Chisapani barrage have been printed and received in JPO-SKSKI.

The topographical survey of powerhouse at the tail end of Sun Kosi –Kamala diversion tunnel has also been completed.

The topographical survey of Diversion Tunnel could not be started due to non finalization of its alignment. The alignment can be fixed only after finalisation of the location of Sun Kosi Dam (from one of the three identified alternatives) in consultation with designers of CWC, geologists from GSI and related experts from Government of Nepal.

Small Scale Maps

MOU for carrying out topographical survey and preparation of following small scale maps was signed with Survey Department, Government of Nepal in March, 2008:

- Sapta Kosi High Dam reservoir
- Kamala Dam reservoir area
- Sun Kosi reservoir area
- Pond area of Sisauli barrage
- Pond area of Uttarayani barrage

The field work, digitization and mapping in respect of all above reservoir and pond areas have been completed and maps printed. The maps have been received in JPO-SKSKI.

2. Geological / Geo-technical Investigation

An interdisciplinary Team consisting of Designers and Geologists visited the Sapta Kosi High Dam Multipurpose Project in the 1st week of November, 2004 and recommended drilling of 400 m in 5 holes (3 vertical in the middle of the river and 2 inclined on either bank). Later, CWC Designers provided a tentative investigation stage layout of rock-fill dam alternative for Sapta Kosi High Dam to JPO-SKSKI for taking up the field investigations. After studying the aforesaid drawing and examination of geological investigation report carried out during 1946-52, GSI (in May-June, 2005) proposed 17 drill holes requiring total drilling of about 1920 m for rock-fill dam alternative. This included 5 Nos. drill holes recommended earlier (2A, 4A, 5A, 10A and 16A) by the expert team; however, the total drilling in these five holes was increased from 400 m to 720 m. Out of the 17 drill holes; 9 holes (1A, 2A, 3A, 9A, 10A,11A, 15A, 16A and 17A) totaling 1260 m, were to be drilled either on edge or in the middle of the river. 2 inclined holes (4A and 5A) of 150 m each were to be drilled on either banks and the remaining 6 holes (6A 7A, 8A, 12A, 13A and 14A) totaling 360 m were to be drilled on left and right abutments of the dam.

As the revised quantity of drilling in 5 drill holes increased from 400 m to 720 m, the work for increased quantity of drilling (320 m) in these holes was entrusted to the same contractor (under Package A) who was initially awarded the work for drilling 400 m at Sapta Kosi Dam.

Fresh tenders were invited for 1200 m drilling (1920 m -720 m) in 12 holes (17-5) under Package G. This drilling work could not be taken up as the lowest bidder did not respond for negotiation.

Till the suspension of drilling work in May, 2007 only 150 m drilling could be carried out in one inclined hole (5A) on the left bank of the river. The contractors for drilling at dam site M/s Pratay Nivesh P. Ltd, Asansol did not resume the work. Its security money was therefore forfeited.

During March, 2010 and June, 2010, the work of logging of drill holes and the geological mapping of the area in the vicinity of Sapta Kosi High dam site was taken up by GSI and as per their report, the abutments of the dam are strong, formed by predominantly hard and compact quartzite of high modulus and uniaxial compressive strength with steep upstream dipping beds, therefore ideal for high dam.

In the mean time GSI team which visited the dam site in 2010 informed that they are having old records of holes drilled in this area during 1946 to 1952 which can
be made use of, the drilling requirement was therefore revisited based upon earlier GSI logging report as well as the findings of the recently carried out geological mapping report; and in consultation with experts from GSI, 6 out of 17 drill holes viz. 1A, 3A, 9A, 11A, 15A and 17A were considered for deletion from the work of geological exploration, reducing the total drill quantity by 840 m.

As a result, the total drilling requirement has been re-assessed as 1080 m (720 m + (1200 m – 840 m)). Out of this, 150 m has already been drilled therefore, 930 m holes remain to be drilled at Sapta Kosi high dam. Although due diligence has been exercised in working out precise requirements, however, deviation to some extent cannot be ruled out. The exploration data supposed to be gathered from these 11 holes is proposed to be critically analyzed. This together with examination of river bed exploration already carried out earlier is considered sufficient for design studies and preparation of DPR.

Departmental estimate for drilling 930 m drill holes at Sapta Kosi High Dam Project, has been approved by the Competent Authority. As the private contractors are not confident of taking up the drilling works at Sapta Kosi Project, JTE in its 9th meeting had directed JPO-SKSKI to negotiate with M/s Nepal Electricity Authority (NEA) for carrying out drilling work. Accordingly, NEA has been approached to submit their offer for carrying out drilling at 10 no. of holes totaling 930 m at dam site location. In response NEA put forth certain conditions. NEA was once again requested to submit unconditional firm offer in the prescribed / provided format. Thereafter, on 12th July, 2011, the NEA representatives visited the project site to assess the field conditions and the quantum of work involved. After the visit NEA vide letter dated 17th July, 2011 proposed amendments viz. addition of 10% mobilization advance, change in penalty clause (0.05% per day instead of 1% per week), reimbursement of cost incurred on mobilization and demobilization of drilling equipment and accessories, in case NEA could not perform the work due to unavoidable circumstances, and payment of all the works till the date of sudden closure, if any, caused by local people. NEA has submitted their proposal for drilling which is on the higher side.

Altogether 11 nos. of drill holes totaling 865 m were to be drilled (under Package E) at Sapta Kosi Spillway site on the right bank of river Kosi at Barahkshetra. Out of this, by May 2007, 200.25 m of drilling was done in 4 holes, 2 fully (139 m) and 2 partially (61.25 m) by M/s RITES Ltd, Gurgaon. No drilling work at Spillway site could be carried out after May 2007 by M/s RITES Ltd, Gurgaon because of security concerns. The contractors for drilling at spillway site M/s RITES Ltd, Gurgaon did not resume the work. Its security money was therefore forfeited. The two partially drilled holes have collapsed in due course of time and as such have to be re-drilled.

Altogether 2000 m drilling was earlier envisaged to be done at Sapta Kosi Power house on the left bank on river Kosi. However, work of 1789 m in 10 holes was awarded earlier to M/s Mining Associates P. Ltd, Asansol under Package F and provision of 211 m was kept for some shallow holes in nearby Sonakumbi nallah. Out of this, by May 2007 when the work was stopped, partial drilling in two holes totalling 313 m (169 m out of 278 m in PDH-5 and 144 m out of 247 m in PDH-0) could only be carried out by M/s Mining Associates P. Ltd, Asansol.
These two incomplete holes which are in highly weathered and fractured strata have collapsed in period of more than 3 years after suspension of works. Therefore, these need to be abandoned. The contractors for drilling at dam site M/s Mining Associates P. Ltd, Asansol did not resume the work. Its security money was therefore forfeited. During the geological mapping work in the month of June, 2010 by GSI, presence of fault at the location at Sonakumbi nullah has been ascertained and as the fault is now well established, drilling for shallow holes, totaling 211 m, which otherwise would have only confirmed the fault, is not necessary. Moreover, logging of PDH-5 and PDH-6 coupled with geological mapping have given reasons to believe that location of machine hall and transformer cavern is not very encouraging and shifting location of the powerhouse cannot be ruled out. However, accurate idea in this regard can be obtained only after completion of geological mapping of right bank of the river. As it is not possible to reflect the firm requirement of drilling at powerhouse, the quantity of drilling has been kept limited to earlier awarded work of 1789 m. As such, the provision of balance drilling depth at the location of powerhouse complex works out to 2102 m (1789 + 313).

The CWC designers who were approached to ascertain the need for exploratory drift at Powerhouse site had opined to take up the same at the pre-construction stage. However, after carrying out geological mapping of the left abutment of dam site, GSI has indicated the necessity to explore the sub-surface through an exploratory drift reaching up to the end wall of major cavity of power house complex. As such, drift of 600 m at powerhouse site of Sapta Kosi High Dam Project is considered necessary.

In its 9th meeting JTE approved forfeiture of Security Deposit of M/s Pratyay Nivesh P. Ltd, Asansol for Package-'A' (Dam), M/s RITES Ltd, Gurgaon for Package-'E' (Spillway) and M/s Mining Associates P. Ltd, Asansol for Package-'F' (Power House) for the diamond core drilling at Sapta Kosi Project. During the meeting, it was informed that in June, 2010, the contractors for Package 'A' & 'F' have given notices for arbitration and have nominated an arbitrator from their side. They have also requested JPO-SKSI to nominate its arbitrator. Immediately thereafter in July, 2010, these two contractors were asked to specify the nature of dispute and also the clause of agreement under which the claim, if any, fell. In response in April, 2011, both of them have mentioned that all issues of dispute i.e. security cost, loss of interest in earnest money, remaining payment of idle cost and other ancillary costs, additional loss of income, harassment and non cooperation of the project to return back the equipment and price escalation of remaining works, loss of opportunity and other material loss, arise out of contract and have once again requested to appoint an arbitrator from JPO-SKSI side. Recently, on 14th June, 2011 M/s RITES Ltd, Gurgaon has also stated that the ground situation in Sapta Kosi project area was abnormal, and not under control of either party. Also that, as it was not a normal security problem, M/s RITES Ltd. could not have made necessary arrangements of its own. They have further mentioned that instead of compensating the loss, JPO-SKSI has forfeited the EMD and Security Deposit; which according to them needs to be released.

A barrage was proposed earlier at Chatra, 7.286 Km below Sapta Kosi High Dam axis. Altogether 218 m of drilling in 7 holes were completed at this site against
an earlier assessed quantity of 210 m. Logging of available drill cores of Sapta Kosi project has been carried out by geologists form GSI between 8th and 15th March, 2010. The results obtained from logging of cores and the in-situ permeability tests indicate that the barrage at Chatra has to be designed on permeable foundation. During course of investigation for Sapta Kosi Powerhouse, which is proposed to be considered for peaking operation, the tentative pondage requirement worked out to be 105 MCM. As this pondage was not available at the location of Chatra barrage identified during earlier investigation, alternative location for the same has been identified in consultation with experts from CWC and GSI. This new site is 12 Km downstream of Sapta Kosi High Dam Axis at Sisauli. At this location the river bed has further widened and intensity of braiding of the river bed has increased. The total width of river bed at this location is about 4 Km and river course flows in 2 to 3 branches of braided courses with intervening islands. Wide river terraces are also present on either side of the river course. Thick alluvium covers with boulders are present in the area. No hole has been drilled at this alignment, however, it appears that thick alluvium deposits are present and also that bed rock at this alignment is not likely to be available at reasonable depth; therefore, further geological investigation including permeability test is required at this alignment for which a token provision of 100 m drilling has been kept.

Preliminary diamond core drilling of 431.57 m in nine holes at three alternative dam locations of Sun Kosi Storage-cum-Diversion Scheme have been completed. Necessary desktop studies have been carried out and number of alternate tunnel alignments, joining Sun Kosi dam and Kamala River has been identified. Drilling at Kamala dam (403.15 m in ten holes, excluding additional drilling of 400 m as suggested by CWC designers), Chisapani Barrage (150 m in five holes) and Uttarayan Barrage (49 m in two holes) have been completed. Logging of drill cores of Kamala dam, Chisapani and Uttarayan barrages had been completed earlier. Logging of drill cores obtained from all three Sun Kosi dam sites has been carried out by geologist from GSI during 8th to 15th March, 2010.

Geological mapping of Sapta Kosi and Sun Kosi projects could not be taken up earlier due to non preparation of topographical survey maps and also due to security concerns. After preparation of topographical maps GSI was approached to take up geological mapping. A Team of GSI completed geological mapping along a part of left bank of the river Sapta Kosi at dam site between 13th and 27th June 2010 under security cover. For carrying out balance geological mapping works at Sapta Kosi project area, International Division of GSI was approached to identify the geologists from GSI and specify time required to complete the residual work. GSI vide their letter dated 12th May, 2011 communicated the names of 4 geologists and informed that 30 days would be required for the geological mapping work. Accordingly, a proposal for Geological Mapping from 6th June 2011 to 5th July, 2011 was framed and sent on 18th May 2011 for approval. Representative of GSI telephonically informed JPO-SKSKI on 7th June, 2011 that Ministry of Mines has agreed to the deputation of 4 identified geologists to Sapta Kosi Project, Nepal. However, approval of MoWR was not received till then. Now International Division of GSI has been requested to indicate fresh dates for geological mapping. So far GSI has not indicated fresh dates. JPO-
SKS has suggested 16th Nov. to 15th Dec. 2011 as tentative dates for the mapping work.

3. Hydrological Studies

As a part of hydrological investigation, following five gauge discharge and sediment sites have been established:

- Sapta Kosi High Dam Site (G&D)
- Chatra Kothu (GDS)
- Sun Kosi Dam Site at Kuruleghat (GDS)
- Kamala Dam Site (GDS)
- Utrayani Barrage Site at Chisapani (GDS),

Similarly, following three Meteorological stations have also been established:

- Barahkshetra for Sapta Kosi High Dam Project
- Kuruleghat for Sun Kosi Storage-cum-Diversion Project
- Belsot for Kamala Dam Project

Collection of gauge discharge and silt data at Kuruleghat dam site, Kamala Dam site and Chisapani barrage site is continuing. Hydrological observation at Barahkshetra (G) and Chatra (G&D) site have resumed from 4th April, 2010 after assurance of security by Government of Nepal.

Water availability studies and sedimentation studies in respect of Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage-cum-Diversion Scheme have been completed. The withdrawal data from Kamala (Bandipur) Barrage has been provided to CWC, New Delhi for carrying out the Water Availability Studies of Kamala Dam Project.

The work of Design Storm Studies has entrusted to India Meteorological Department (IMD) as per a decision taken in 9th meeting of JTE. Data required for Design Storm Studies has been provided to them. Additional data requested by them is being collected mainly from Department of Hydrology and Meteorology. IMD which has requested for full payment in advance has been requested to agree for 50% advance payment.

The requisite data for carrying out Glacier Lake Outburst Flood (GLOF) studies have already been made available to FE&SA Directorate of CWC, which has proposed restricted scope of work to Dam Break Modeling analysis (for making quantitative analysis of magnitude of GLOF Peak w.r.t. time arriving at the specified cross section(s), d/s of the Glacial Lake up to the proposed Dam site) and mentioned that for reasonable assessment of model parameters visit to project area will be necessary. They have submitted an estimate of Rs 28 lakh for carrying the GLOF Studies for approval.

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4. **Seismological Studies**

Revised report on 'Evaluation of Site Specific Seismic Design Parameters' has been approved by the National Committee on Seismic Design Parameters (NCSDP) in its meeting held on 8th September, 2009 at New Delhi.

Construction of seismological observatory buildings at Jhumka, Chatra, Dhankuta and Tumlingtar under Saptap Kosi High Dam Multipurpose Project and Gaighat, Dhalkebar, Kuruleghat and Rumjatar under Sun Kosi Storage-cum-Diversion Scheme were completed by July, 2009.

In September, 2009 seismological equipment (Digital Micro Earthquake Recording System and Digital Strong Motion Accelerograph with necessary accessories) and solar panels have been installed at these observatories.

The data is downloaded from these observatories with the help of two laptop computers, one each for Saptap Kosi and Sun Kosi projects. These data are being analysed by CWPRS, the consultants for seismological studies.

5. **Construction Materials Survey and Testing**

Probable quarry sites for coarse and fine aggregates for concrete were identified earlier by a Team of CSMRS Experts. However, collection of samples for Saptap Kosi Project could be done only in May, 2011 namely from Bagh Khola, Patnali Khola, 100 m d/s of new intake of Chatra Power House, Lyoti Khola and 50 m u/s of Chatra Ghat. Similarly collection of samples for Sun Kosi Project could be done only in May & June, 2011 namely from 500 m d/s of confluence of Jyamire Khola & Belsot Khola, 250 m u/s of Belsot Khola, confluence of Safi Khola & Panero Khola, 50 m, 300 m and 500 m u/s of proposed Dam axis of Kamala river, confluence of Kamala river & Chisapani Khola, 50 m u/s of Ratu Khola Bridge, 70 m u/s of Badari Khola Bridge, 20 m d/s of Aurahi River Bridge, 70 m d/s of Charnath Bridge. Investigation and testing of clay samples from borrow areas have been completed. Quarry sites for rock-fill material have been identified and inspected by a Team of CSMRS Experts in June-July, 2005; however, collection of samples and their testing could not be undertaken so far as blasting will be required to be done at some sites in Saptap Kosi project area for collection of sample. The Nepalese side has therefore advised to take up this work at the time of shifting for effective management and security of explosives. Water quality investigation of pre-monsoon, monsoon and post-monsoon river water samples of Saptap Kosi, Sun Kosi and Kamala rivers has been completed.

6. **Environment Impact Assessment Study**

Ministry of Water Resources has waived off of bid security from Nepalese Consultants in February, 2009. The Team Leaders of India and Nepal conveyed their approval to the "Eligibility Criteria" and "Evaluation Methodology" to be adopted for EIA Studies in Nepalese Territory vide Letter No: 1/1/JPO-SKSKI-
TECH/N&BC/2010/ 68-89 dated 11.04.2011 and letter No. 165-067/68 dated 18.05.2011, respectively. The highlights are as follows:

- The work of EIA Studies for both Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage-cum-Diversion Scheme has been combined as a single package.

- Technical and Financial proposals have been invited by prescribing the eligibility criteria.

- The Evaluation Methodology of technical proposal is as follows:
  - Technical and Financial Capability of the firm 15 %
  - Approach & Methodology, Work Plan and manning schedule 45 %
  - Suitability of key personnel 40 %

- The minimum mark for a firm to be technically qualified has been kept as 65%.

Immediately thereafter in May 2011, fresh technical and financial proposals from Nepalese Consulting Firms for conducting EIA Studies in respect of Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage-cum-Diversion Scheme in accordance with EPA 1997 and EPR 1997 was invited by JPO-SKSKI. Only two Nepalese Joint Venture Firms have submitted their technical and financial proposals, which are under examination.

As decided in the 9th JTE meeting the consulting firms applying for EIA study are to carry out environmental studies in such a manner that land and conservation areas with respect to various elevations, as required to finalise the project parameters, are made available to concerned offices within 9 months of commencement of the environmental studies; while continuing remaining works.

The draft ToR for conducting EIA studies of Command Area lying in Indian Territory (North Bihar) proposed to be brought under irrigation through Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage-cum-Diversion Scheme was considered by the Expert Appraisal Committee for River Valley and Hydro-electric Projects (constituted under the provisions of EIA notifications 2006) in its 18th meeting at New Delhi. The Committee approved the ToR with the following observations:

- The sampling in respect of soil and water in the proposed command area in India should be done on grid basis;

- As the command area is large, usual grid size suggested for other irrigation projects will lead to unmanageable extent of field works, (all of which may not be necessary), therefore areas under distinct soil series may be identified and data should be collected from three random locations from the area under each soil series;

- Salient features of the headworks should be given in the EIA report, even though they are located in Nepal.
Presently, the irrigation studies and command area survey in the Indian Territory is being carried out by M/s. WAPCOS Ltd. which is likely to complete the field related works by December, 2011. The process for procuring consulting services for EIA study in the Indian Territory will be initiated after completion of field survey in the command area and submission of draft report by M/s. WAPCOS Ltd.

7. Collection of Flood Damage Data

Flood damage data of 15 years in respect of districts in North Bihar falling in Kosi, Kamala and Bagmati river basins are being collected from Government of Bihar (GoB). Flood damage data for Nepal portion is not maintained. In absence of such data, flood control benefit on Nepalese side is proposed to be estimated on the basis of analysis and judgment of that on Bihar side and data as well as information that will be gathered in course of environmental studies. The modalities of carrying out Flood Control Benefit Studies for India and Nepal and the expert organization which can be entrusted these studies needs to be decided.

8. Power System Surveys

The preliminary power potential studies and finalization of installed capacity in respect of Sapta Kosi High Dam Multipurpose Project, purely from power generation point of view, have been carried out by Central Electricity Authority (CEA) based on data made available to them by JPO-SKISKI in January, 2007. However, CEA has sought data on downstream requirement in regard to irrigation, navigation and other uses for carrying out power potential studies. These data are being collected. Moreover, the data in this regard can be firm up after irrigation and navigation studies are completed by the consultants. Power System Survey and Power Evacuation Studies in respect of Nepalese Territory are to be got carried out through Nepal Electricity Authority (NEA). NEA officers were approached for an interactive meeting with CEA officers for firming up proposals for these studies. NEA has informed that the earlier proposal submitted by them needs revision. Also, that their officers earlier associated with preparation of the previous proposal have either left NEA or retired, and hence they may need some more time to reframe the fresh/revised proposal. Nepal Electricity Authority has suggested holding Interaction meeting only after the proposal for Power System Survey and Power Evacuation studies for Nepalese Territories is reframed by them.

9. Communication Surveys

Unit sizes, for which communication survey is required to be carried out, were finalized by JTE in its 7th Meeting held in March, 2006. ‘Request for Proposal’ and ‘Expression of Interest’ Documents have been formulated in July, 2010. The views of Members of Tender Evaluation Committee (TEC) have been sought, after which the tenders will be floated.

10. Irrigation Planning and Command Area Survey

Work of Irrigation Studies of Command Areas in Indian and Nepalese Territory was awarded to M/s WAPCOS Ltd and Joint Venture of M/s GEOCE- EAST-
AUTO CARTO Kathmandu, respectively on 3rd March, 2009. Both the consultants have submitted the respective macro planning reports in 3rd week of January, 2010. The contract of the Nepalese consultants was terminated as the agency had not applied for extension of time within the stipulated period as per contract agreement. In the 9th meeting of JTE held at Kathmandu on 1st and 2nd August, 2010, JPO-SKSKI was directed to initiate the process for procuring consultancy services for remaining works of irrigation studies in Nepalese territory. The quantum of residual work in Nepalese Territory is being reassessed. The work of micro irrigation planning in Indian Territory is under progress. M/s WAPCOS Ltd has also submitted the reports on Topographical Survey for micro irrigation planning on 1:10,000 scales for three patches viz. Patch-1 and Patch-2 in Burhi-Gandak-Bagmati Command and Patch-3 in Mahananda Command and micro planning of command area on 1:10,000 scale survey maps for all the aforementioned three patches up to minor level. Chaks of 40-50 ha area below the minors has also been carved out by them. The alignment survey of various canals spread in the above three patches is presently under progress. As a part of soil survey and soil mapping, sample ground checking and updating of soil land use and land capability in the entire command area of 10,00,000 ha has been completed. Semi detailed Soil Survey has been completed in two patches of Burhi Gandak-Bagmati command, however, the same for patch-3 in Mahananda command is in process. Interim Field Report has also been received in JPO-SKSKI.

11. Navigational Studies

After completing the field survey and model studies M/s RITES Ltd have made presentation on Navigation Studies on River Sapta Kosi / Kosi on 22nd -24th September, 2009. They have submitted the draft final report after incorporating the suggestions made by JPO-SKSKI in June, 2010. As per decision taken in the 9th meeting of JTE the report of Navigational studies prepared so far has been made available to concerned agencies in Nepal for detailed review before using them as inputs in DPR. The views of the multi disciplinary Task Force of GoN has been received on 7th August, 2011.

12. Design Studies

The following investigation stage layouts have been received so far:

- Investigation stage layouts of rock-fill dam, spillway and underground power house of Sapta Kosi High Dam Multipurpose Project
- Investigation stage layout of Concrete Dam alternative for Sapta Kosi High Dam Multipurpose Project
- Investigation stage layout of Kamala dam, spillway and power house complex on river Kamala
- Design of various components is to be taken up after receipt of geological/geotechnical reports, topographical maps and report on power potential studies