Flooding and Inundation in Nepal Terai: Issues and Concerns

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Abstract: During the monsoon months from June to September, all the rivers in Terai are in spate with bank-full discharges and cause flooding and inundation. The problems of flooding and inundation in the Terai are more critical due to change in climate in general and change in rainfall pattern/intensity in particular. This article tries to highlight the issues and concerns of flooding and inundation in the Terai and suggests measures to mitigate these issues in light of climate change adaptation.

Key words: Flooding, inundation, River Training Works, Terai, Nepal

Introduction

The Terai region of Nepal occupies about 17 percent of the land area (25,000 km^2) and forms the northern edge of the Indo-Gangetic plain. The Terai area is popularly known as the granary of the nation. The topography of the Terai is almost flat with gentle slope towards the south. The elevation of the Terai ranges from 65m to 300m from mean sea level with varying width of 20 km to 45 km. The climate of the Terai is subtropical with average temperature of 25^{o}C. The rainfall of the Terai varies from 1,200 mm to 3,000 mm per annum with occasional showers and cloudbursts. All the rivers of Nepal debouch into the Terai plain at the foot hills of the Churia and Siwalik ranges and provide water for livelihood of the Terai. During the monsoon months from June to September, all these rivers are in spate with bank-full discharges and cause flooding and inundation in several parts of the Terai. The problems of flooding and inundation in the Terai are more critical due to change in climate in general and change in the rainfall pattern/intensity in particular. This article tries to highlight the issues and concerns of flooding and inundation in the Terai and suggests measures to mitigate these issues in light of climate change adaptation.

River Systems of Nepal

According to the origin, size and nature of the flow, Nepal's rivers are grouped into three categories:

- Large rivers originating from the Higher Himalayas,
- Medium rivers originating from the Mahabharat Hills, and
- Small rivers originating from the Siwalik and Churia Hills.

The largest four rivers of Nepal, i.e. the Koshi, the Gandaki, the Karnali and the Mahakali originate from the high Himalayas and carry large discharges. These rivers are incised in the hills and mountains and are comparatively less vulnerable until they debouch into the Terai plain. The average discharge of the Koshi, Gandaki and Karnali range between 1,350 m^3/s to 1,600 m^3/s while the average discharge of the Mahakali River is 726 m^3/s. In the Terai these rivers often cause flooding and inundation over large stretches of land adjoining their banks.

The medium rivers that originate from the Mahabharat hills experience monsoon discharge of 2,000 m^3/s to 8,000 m^3/s and create havoc of flooding and inundation in the Terai. These rivers transport significant amounts of sediment while flowing through the Churia range and exhibit lateral shifting. These rivers are wide as they enter into the Terai plain and start meandering after the Bhabar zone. These rivers are the Kankai in Jhapa, Kamala in Siraha and Dhanusha, Bagmati in Sarlahi and Rautahat, Tinau in Rupandehi, West Rapti in Dang and Banke, and Babai in Bardiya districts.

The small rivers originating from the southern slope of the Churia hills are named as Churia rivers. The length of these rivers up to the Nepal-India border ranges between 25 km to 85 km. These rivers are numerous and cause local erosion and deposition in the Terai belt. These rivers have special morphological characteristics that aggravate the flooding and inundation in the Terai of Nepal. The most vulnerable Churia Rivers are the Biring and Ratuwa in Jhapa, Bakraha and Lohendra in Morang, Sunsari in Sunsari, Khando in Saptari, Balan and Gagan in Siraha, Rato in Mahottari, Jhim and Lakhandehi in Sarlahi, Lal Bakaiya in Rautahat, Pashaha in Bara, Rohini in Rupandehi, Banganga in Kapilvastu, Khutiya in Kailali and Dhondha in Kanchanpur districts. These Churia rivers have special characteristics that are described in their proper context below.

River Morphology in the Terai

The river morphology in the Terai depends upon the origin, flow magnitude and sediment load of the river. The rivers originating from the Churia hills are characterized as flashy with negligible or low flow during the dry season. In addition, the large rivers also change their morphology as they debouch into the Terai plain with flatter slopes and wide widths. The morphological characteristics of the rivers flowing through the Terai are briefly described hereunder:

Severe Erosion in the Hill Slopes: The Churia hills are the youngest hills in the Himalayas formed about 2 million years ago (Neocene period). Their composition is made of sedimentary rocks such as mud-stones, sand-stones, and conglomerates. The Terai areas of

Nepal experience relatively higher rainfall intensity (Carson 1985) which contributes to higher soil erosion in the slopes of the Churia hills. The rivers that originate from the Churia hills bring a lot of sediment thereby eroding the hill slopes as well as river banks (Photo 1).

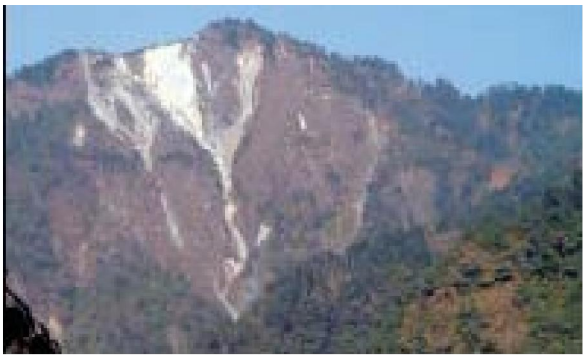

Photo 1. Degradation of Catchment in the Churia Hills.

Excessive Sediment Load: The Churia range contributes maximum sediment load to the rivers originating from the southern face (Sharma 1977). According to a JICA study, the annual sediment yield of the Lakhandehi river is estimated as high as 178,000 m^3 per year. In some stretches of the Churia rivers, almost two meters of sediment has been deposited in the last 45 years (Dixit 1995). Due to the higher sediment load, the bed level of several rivers are rising significantly. The case of the Lothar river in Chitwan District is typical of this phenomenon (Photo 2).

Photo 2. Sediment Accumulation under the Lother High Bridge.

Wide and Braided Channels: Most rivers in the Terai are braided at the Bhabar zone and prone to change their course frequently. In many cases, these rivers find a new path and enter into the cultivated lands leaving the old course. This is also evident in some medium sized rivers. For example, the bifurcation of the Tinau River into the Tinau and Dano rivers just downstream of the East-West Highway Bridge after 1978 flood is a typical example of the Terai river characteristics.

High Peak Floods: Runoff in Churia Rivers concentrates only in the monsoon months from June to September. Factors like short steep slope, overgrazing, deforestation, and short time of concentration produce high peak flood during the monsoon. In general, the runoff duration is less than one day and the flood hydrograph is very sharp with high peak discharge.

Photo 3. Flood in Mahakali River in 2009.

Narrow Width at Nepal-India Border: Most of the Churia Rivers have relatively narrow width at the Nepal-India border. During heavy rainfall these rivers spill over the banks and flooding and inundation occur for some time depending on the topography, slope of the river and the waterway. A typical example of a narrowing river width is the Rato River in Mahottari District. The Rato and Jangha rivers in Mahottari District lie 6 km apart at the East-West Highway. The span of the Highway Bridge at the Rato River is 204m. After joining the Jangha and Ankushi rivers, the span of the bridge over the Rato River at the Bardibas-Jaleshwor road narrows down to about 100m. Further downstream near the Nepal-India border at the Jaleshwor-Bhirttamod road, the span of the bridge is narrowed again to only 30m.

Topographical Depressions: Some of the Churia Rivers form topographical depressions such as marshy lands, swampy lands and oxbow lakes in the lower reaches of the Terai. These depressions have formed due to excessive meandering, abandoning of the old course, and avulsion of the rivers or their part. The Sunsari River at Maria Dhar, old course of the Kankai River are some of such examples. The medium sized river Babai in Bardiya District had also changed its course and formed topographical depressions in the west of Gularia some 80 years ago.

Rainfall-Runoff Process in the Terai

Past experience shows that flooding and inundation occur following high intensity rainfall in the Churia hills and Terai. A rainfall intensity of 350 mm for consecutive 48 hours is considered as high intensity rainfall (Sharma 1988). In addition, rainfall exceeding 70 mm per hour is considered as cloudburst rainfall (Gyawali 2011) which disrupts both the slopes and channel equilibrium at the local as well as regional scales. Precipitation

events exceeding 375 mm in 24 hours have been recorded in different parts of the Terai between 1959-1993 and maximum rainfall data is shown in Table 1.

S. No.	Station Code	Station Name	District	Mean Annual Rainfall (mm)	Max Mean Monthly Rainfall (mm)	
1	0215	Godavari	Kailali	2,279	700	July
2	0416	Nepalgunj	Banke	1,338	426	July
3	0705	Bhairahawa	Rupandehi	1,609	509	July
4	0906	Hetauda	Makwanpur	2,283	566	Aug
5	1121	Karmaiya	Sarlahi	1,718	443	Aug
6	1421	Gainde	Jhapa	2,853	683	Aug

Table 1. Maximum Rainfall Records in the Terai.
Source: Department of Hydrology and Meteorology (DHM) Data

Past Flood Events in the Terai

Historical evidence shows that the floods of 1785, 1787, 1793, 1806, 1867, and 1871 in the 19th century were major ones. During the 1871 floods, rainfall of 483 mm in 36 hours was recorded causing heavy loss of lives and property in Nepal's Terai and India. In 1883, about 2,300 km^2 of area situated at the northern part of the railway line in India was flooded severely. Thousands of houses collapsed and crops of some 1,000 villages were almost ruined.

In 1902, excessive rainfall along the lower reaches of the Himalaya had caused heavy floods in the Nepal Terai. In 1926, heavy floods occurred in the Bagmati River in the Terai and 75 percent of Bhadai (harvested at mid September) crops and 50 percent of Aghani (harvested in late November) crops were damaged completely in the Terai and adjoining Indian Territory. In 1934, the floods of the Bagmati River had caused it to shift its course towards the right in India. In 1935, severe floods and inundation again occurred in the Terai and India. The Sitamani railway embankment in India was breached by flood. In recent times, heavy floods were observed in the Nepal Terai and northern India. The floods of 1954, 1956, 1958, 1960, 1962, 1981, 1987, 1993, 1998, 2002, 2004, and 2008 are vividly imprinted in the memories of the people. The details of some flood events are briefed hereunder:

Floods of 1978 in Butwal: With the intense rainfall in the Churia hills, a landslide occurred in the Butwal area in September 1978. The landslide had blocked the river Tinau, and upon burst of the landslide dam, the high surge of water had washed away the newly constructed bridge over the river along the East-West highway, diversion weir of the Tinau Irrigation Project and other public property. This flood had not only damaged the infrastructure and property adjacent to the river bank but also had changed the flow pattern of the river. A rainfall of 125 mm within a few hours had been experienced in Butwal (Sharma 1988).

Floods of 1987 in the Eastern region: In August 1987, an intense rainfall of 200 mm had caused flooding and inundation in the Eastern Terai. The East-West Highway was damaged in several places. In some locations, 50 cm deep water was flowing over the road pavement causing submergence of agricultural lands adjacent to the highway (Sharma 1988). The most flood affected districts then were Jhapa, Morang, Sunsari, Saptari and Udayapur.

Floods of 1993 in Central Nepal: The floods of 1993 were one of the worst in the history of Nepal which had resulted in the deaths of 1,336 persons. The maximum daily rainfall of 540 mm was recorded in Tistung of Makawanpur District on 19 July 1993. This was the highest daily maximum rainfall ever recorded in Nepal. The floods had also inundated sixty thousand ha of agricultural land in the Terai and washed way 67 irrigation systems. The peak flood of the Bagmati River is a typical example of a highly disastrous flood in the history of the country, which had washed away part of the Bagmati Barrage and inundated vast areas in Sarlahi and Rautahat districts.

Koshi Flood of 2008: The devastating Koshi flood disaster occurred on 18th August, 2008 near Kushaha village of Sunsari District due to a breach of the eastern embankment of the Koshi barrage. The barrage and embankments were constructed in the 1960s under the Nepal-India Koshi Project Agreement. Four VDCs of West Kushaha, Haripur, Shripur and Narsingha of Sunsari district were severely affected from the flood disaster. At the time of the breach, the Koshi river had only 4,700 m^3/s of water flowing through the barrage. The flood flow was minimal of August flow against the highest flood of 26,990 m^3/s (Dixit 2008) recorded in 1968.

Photo 5. Forced Migration due to Flood.

Photo 6. Koshi Flood 2008.

Photo 7. Damage of Crops in Far-West Flood, 2008.

Far-West Flood of 2008: One month after the devastating flood of the Koshi, downpour generated by cloudbursts occurred in the Far-western region. Most of the mountain districts were affected by a series of landslides while the Terai districts were affected by floods. All the rivers that originate from the Churia hills swelled with bankful discharges, spilled over their banks, eroded adjacent agricultural lands, deposited sands and silt on nearby houses, and inundated settlements for days. The East-West highway was eroded in two-three places in Kailali and Kanchanpur districts along with damages to irrigation projects, transmission lines, and other public and private infrastructure.

Barriers as Drainage Congestion in Terai

Drainage congestion is one of the reasons causing flooding and inundation in the Terai. Some of the examples of drainage congestion are briefed hereunder:

East-West Highway: The East-West highway connects all Terai districts by a single strategic road network and is considered as a backbone of national economic development. It traverses mostly along the foot hills of the Churia range and acts as a barrier embankment especially for rivers and streams that originate from the Churia hills. In 2007 September, a small culvert near Chormara in Nawalparasi district was washed out by flood water due to drainage congestion.

Bridges and Culverts: The waterway opening of the bridges and culverts constructed in the Terai area seem to be on the non conservative side to address the floods from upstream catchments. There are several examples of damages to the bridges and culverts due to drainage congestion. In 2007 September, a highway bridge over the Dhanshar River in Rautahat District collapsed by flooding, and traffic movement was interrupted for days. Two causeways needed to be replaced in Nawalparasi district on the Danda Khola and Janga Khola. The over flanking of the East-Rapti river from its left bank upstream of the highway bridge near Hetauda by the flood of 2007 had also interrupted traffic for many days.

Urban Settlements: Most of the urban settlements in the Terai are prone to inundation after intense rainfall events due to improper drainage provisions. The inundation of Nepalgunj in 2007 July is an example of drainage congestion owing to deficient urban planning and management. The inundation lasted for a week in most of the city centers including New Road, Gharbari Tole, and Surkhet Road. A maximum rainfall of 205 mm was recorded in Nepalgunj on July 27, 2007 which caused flooding and inundation in Nepalgunj (KC 2008). Similarly, Biratnagar, Bhairahawa, Narayanghat and Janakpur are also prone to inundation time and again due to drainage congestion. The inundation of Gaur Bazar is a different case as it becomes inundated due to congestion of sheet flow over the entire area from the Lalbakeya River on the West and Bagmati River on the East. The main cause of this inundation is the construction of the Bargenia Ring Bund in Indian Territory which blocks the flow path of natural drainage from Gaur Bazar.

Hulaki Sadak: The cross-country postal road or *Hulaki Sadak* is being implemented under Indian assistance in the Nepal Terai. The proposed length of the road is

Photo 8. Mahali Sagar of Kapilvastu District.

1,446 km which is aligned mostly within 10 km of the Nepal-India border from Mechi to Mahakali. It passes through flat Terai terrain and acts a barrier to sheet flow. The confinement of the road at the location of bridges

S. No.	Name of river	Span of bridges (m)		Remarks
		E-W Highway	Hulaki Sadak	
1	Gagan	128	46	In Siraha district
2	Rato	204	102	In Mahottari district
3	Lakhandehi	250	100	In Sarlahi district
4	Lalbakeya	361	120	In Rautahat district
5	Aurahi	319	50	Aurahi and Basai form Bighi river in Dhanusha district

Table 2. Typical Bridge-spans in E-W Highway and *Hulaki Sadak*.
Source: Field Survey, 2009

may aggravate the drainage congestion. The alignment of the postal road starts from Chandragadi, Jhapa to Dewanganj, Sunsari through Rangeli in Morang District and joins the E-W highway to cross the Koshi river. In Siraha District, the *Hulaki Sadak* is just a few hundred meters north of the Nepal-India border where the Gagan River crosses it. In Nawalparasi and Rupandehi districts, it joins Bhairahawa town with Parasi and after Bhairahawa follows the Lumbini Road up to Taulihawa. The waterways provided to pass the flood under the bridges of the *Hulaki Sadak* are significantly narrow and cause flooding and inundation in several locations. In addition, the comparison of waterways of the bridges along the E-W Highway and *Hulaki Sadak* shows significant deviation (Table 2) in respect to the same river.

Inundation at Southern Border Points: All the rivers of Nepal drain to the Ganges basin crossing the Nepal- India border in the Terai plain. The total length of the border with India is estimated as 1,808 km, of which rivers act as the border between Nepal and India for about 595 km of length (Shrestha 2009). The infrastructures constructed just downstream of the border across the contour have congested the drainage passage of the natural water bodies and have caused inundation in upstream areas adjacent to the border. India has constructed dozens of the embankments, dams water control structures just at the boarder inundating Nepalese territory/farmland. Nepal's request to alleviate the problems have not been considered by India. The major structures constructed at the border points in India that cause flooding and inundation in Nepalese territory are:

- Girijapuri barrage on the Karnali river (Ghaghra in India),
- Saryu barrage on the Babai river (Saryu in India),
- Laxmanpur barrage on the Rapti river,
- Banganga barrage on the Banganga river,
- Goabari weir on the Lalbakaiya river, and
- Dheng bridge on the Bagmati river

The main canals that pass along the contour under the Koshi and Gandak Project agreements between Nepal and India have also created drainage congestions time and again. The Gandak Western Main Canal and associated structures are causing flooding and inundation in Nawalparasi District due to drainage congestion of these structures. Similarly, the Koshi Western Main Canal also adversely affects the area in Saptari District of Nepal. In addition, embankments constructed in India near the Nepal-India border block the sheet flow as well as natural drainage passage causing flooding and inundation in Nepalese territory. The major embankments constructed in India adjacent to the border are:

- Kalkalawa Bund in the Rapti river (right afflux bund of Laxmanpur barrage),
- Khurd-Rasiwal Bund (K-G Bund) in the Danav river (Kunha in India),
- Bargenia Ring Bund near Gaur Bazar in Rautahat District,
- Kunauli embankment in the Khando river near Trilathe in Rajbiraj District, and
- Mechi embankment in the Mechi river near Kakarbitta in Jhapa District

Furthermore, the implications of these embankment bunds are many. Lack of proper maintenance of drainage flow paths under the cross-drainage structures of irrigation canals in India also aggravates the flooding and inundation in the Nepal Terai. Drainage congestions on the Ghorasain branch canal of Gandak Project are the typical examples in this respect.

In addition, there are several isolated irrigation projects and small embankments in India near the Nepal-India border that cause flooding and inundation in the Nepal Terai. Some of the minor irrigation structures are:

- Mahali Sagar, Bajha Sagar, Siswa Sagar and Marthi Sagar in Kapilvastu District,
- Danda Barrage on the Danda river near Sunauli in Rupandehi District,
- Masauliya barrage on the Rohini river in Rupandehi District and,
- Kantawa Irrigation in the Maraha river in Siraha District

The Sagars in Kapilvastu District are the typical examples of pond irrigation. These Sagars provide irrigation to the bordering area of India at the cost of inundation in Nepal territories. More than 60 percent of the reservoir area of these Sagars lies in Nepal at normal water level. The situation aggravates during the heavy monsoon rainfall and delay in gate operation by the Indian authority who live far away from the location of these gates.

Initiatives to Cope with Floods and Inundation

People of the Terai area have been compelled to live with floods and inundation since time immemorial. People have adopted indigenous local coping measures to survive the floods and inundation. The Government has also been implementing several flood protection and rehabilitation measures. In addition to the humanitarian support to the victims of the floods, there are institutional efforts of the Government towards mitigating flooding and inundation in the Terai, which are briefed hereunder:

Department of Water Induced Disaster Prevention (DWIDP): The DWIDP is the leading Government agency to deal with the water induced disasters in general and floods in particular. In 1991, the Disaster Prevention Technical Center (DPTC) was established to address the water induced disasters in a coordinated way under JICA assistance. Considering the positive impacts of DPTC, the Government has converted it into the DWIDP since 2000. To cope with ever increasing demands of disaster mitigation at the local level, the GON has expanded the DWIDP through divisions and sub-divisions along with the inclusion of River Training Projects known as Peoples embankment. In addition to the structural measures of river training, the DWIDP also imparts awareness and training activities to the concerned persons and institutions. The river training works carried out so far are in the Bakra River in Morang, East-Rapti River in Chitwan, and Mahakali River in Kanchanpur districts.

JICA Study on Flood Mitigation Plan: In 1999, JICA carried out the study on flood mitigation plan for selected rivers in the Terai plain. These rivers are the Khutiya in Kailali, Babai in Bardiya, West Rapti in Banke and Dang, Tinau in Rupandehi, Narayani in Chitwan and Nawalparasi, Lakhandehi in Sarlahi, Lohendra in Morang and Ratuwa in Jhapa. The study also carried out the detailed feasibility of two most vulnerable rivers, Babai and Lakhandehi, on a priority basis and suggested to implement the flood mitigation plan as soon as possible. The flood mitigation plan suggests three components for its sustainability: watershed management, river control measures and community development activities.

Extension of Embankments and Indian Cooperation

Realizing the seriousness of the flooding and inundation problems in the vicinity of the Nepal- India border, it was agreed to extend the embankments from the border along both banks of the vulnerable rivers. Since 2002, embankment constructions are being carried out in the Bagmati, Lalbakeya and Kamala rivers with grant assistance from the Government of India. Adjoining areas of these rivers in Rautahat, Sarlahi, Dhanusha and Siraha districts have been protected from the recurrent floods and inundations. However, many trans-boundary rivers are awaiting a positive response from the Indian side towards mitigating floods and inundation along the southern border.

Apart from the Governmental initiatives, there are several Non-Governmental Organizations (NGOs) working in the field of floods and inundation in the Terai.

Suggestions to Mitigate Flooding and Inundation in the Terai

Floods are natural process and we can only reduce the impacts of the floods. Following are some of the issues and concerns to be addressed to reduce the floods impacts.

- **Discourage the Tendency to Encroach Upon Marginal Lands at the River Banks:** Many poor people take shelter at the banks of the river due to the availability of jobs and free fertile land in the river valley. Many marginal people are maintaining their livelihoods through cultivation of steep sloppy lands and river banks which are susceptible to flooding and inundation. This tendency is increasing day by day. The case of settlements along the Tinau River is an example.

- **Manage River Bed Mining:** The increasing trend of river bed mining and its un-planned management is one of the most notorious activities responsible for flooding and inundation. On the one hand, thousands of people do find their jobs in collecting, screening and transporting river bed materials, and on the other hand, severe environmental consequences arise due to the extraction of boulders and gravel from the river bed thereby lowering its level. The problem has been aggravated due to issuance of export permits to the neighboring country by the District Development Committees (DDCs). Almost all Terai DDCs are generating revenues by exporting the river bed material and consequently inviting flooding and inundation at the homes of poor people. It is very high time to manage river bed mining in a planned, judicious and limited manner so as to sustain the environment and reduce the vulnerability to flooding and inundation.

- **Enforce Land Use Rules and Regulations:** Proper land use based on topographic and agronomic considerations is key to a planned development approach. The settlement area should be at a higher elevation than the cultivation area. Due to absence of land use regulations, several houses are constructed in the most fertile lands of the Terai. Hence, proper land use regulation and its enforcement are essential to reduce the vulnerability to flooding and inundation in the Nepal Terai.

- **Provide Adequate Drainage Passage in Road and Embankment Construction:** As mentioned earlier, development activities, mainly construction of physical infrastructure, are the major barriers to the passage of flood water. Roads in urban areas have less drainage passage way to allow the escape of incoming sheet flow. In addition, due to lack of sufficient information on hydrology, several bridges and culverts are constructed with constricted water-ways. It is necessary to provide adequate drainage passage to safely allow the the flood flows to pass.

- **Conserve the Churia Hills:** The Churia hills are the major source of sediments in the Terai Rivers. Due to degraded catchment, these hills are susceptible to erosion, landslides and mass wasting. The Churia conservation activities are

being implemented on project basis since the 1990s. However, the process of degradation of catchment is not prevented. Hence, emphasis must be given to conserve the Churia hills in the long term with watershed management with peoples participation.

Conclusion

The Terai is the bread basket of the country which needs to be well safeguarded from flooding and inundation impacts. Several development initiatives need to be coordinated properly so as to provide adequate waterways for the floods. An integrated water resources management approach is the key tool to address the flood and inundation problems. Apart from watershed management in the Churia hills, land use regulations need to be promulgated and enforced to dovetail with integrated water resources management interventions.

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CALENDAR OF EVENTS - WATER RESOURCES

12-14 February, 2013: WATECHASIA: International Exhibition and Conference on Water Technologies. Location: Mumbai, India. Contact Email: watechasia@radeecal.com. More info: http://www.biztradeshows.com/trade-events/watechasia-expo-mumbai.html

12-14 February, 2013: Second International Conference on Water Resources and Environmental Management (ICWRE 2013): Water, Food, Energy Security and Climate Change. Location: Marrakesh, Morocco. Contact Email: info@icwre.com. More info: http://www.icwre.com/index.php

19-21 February, 2013: WEX 2013: The Water and Energy Exchange. Location: Lisbon, Portugal. Contact Email: info@w-e-x.com. More info: http://www.w-e-x.com/index/articles.php?id=44&navi_cat=47&page=HOME

24-25 February, 2013: 5th International Conference on Water Resources and Sustainable Development. Location: Algeries, Algeria. Contact Email: ciredd2013@ensh.dz. More info: http://www.water.tallyfox.com/event/5th-international-conference-water-resources-and-sustainable-development-2013

28 February-2 March, 2013: 10th Everything about Water Expo 2013: International Exhibition & Conference on Water & Wastewater Management. Location: Chennai, India. Contact Email: intlenquiry@eawater.com. More info: http://www.eawater.com/expo/

6-7 March, 2013: 2nd World Water-Tech Investment Summit. Location: London. Contact Email: abigail.ryder@rethinkevents.com. More info: http://www.worldwater.rethinkevents.com

11 March, 2013: CGIAR Research Program on Water, Land and Ecosystems Management Committee Meeting. Location: Colombo, Sri Lanka. More info: http://wle.cgiar.org/events/wle-management-committee-meeting-colombo/

13-15 March, 2013: Asia Water Week 2013. Location: ADB headquarters, Manila, Philippines. More info: http://www.adb.org/news/events/asia-water-week-2013

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