

Chapter 5

Environmental Flows : Concept and History

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EARLY CONCERNS

As discussed earlier, humans have interfered with river flows for millennia by diverting water for irrigation. Numerous reservoirs were constructed in cascades on small seasonal streams throughout the semi-arid regions of south Asia. In Sri Lanka, King Parakrama Bahu I (1123-1186 AD) is reported to have advocated “Let not even a drop of rain water go to the sea without benefiting man”. But large rivers remained untouched until the 19th century. The impacts of flow diversion into canals from rivers after their descent onto the plains such as the Ganga (at Bhimgoda just upstream of Haridwar, 1845-1854) and Yamuna (near Tajewala, by Ferozeshah Tughlaq in the early 14th century and redesigned in 1873 by the British), were too small for the impact on the main flows to be readily experienced and appreciated.

However, much before the scientific community started talking about the need to maintain certain flows in the river for benefits in the form of fisheries and other resources, the people in south Asia tried to ensure uninterrupted flow in the rivers for their socio-cultural needs. Rivers remain until today, an integral part of the cultural ethos of the region. When the British Government planned the construction of a permanent barrage about 3 km upstream of an earlier weir on River Ganga, despite an earlier assurance to the community in 1914, the Hindu community was greatly agitated by the proposal.. As the work on the barrage progressed, massive protests were made by the Ganga Mahasabha, under the leadership of Mahamana Madan Mohan Malaviya, and with the full support of many

Maharajas from different parts of the country. Finally in 1916, the British Government had to bow before the religious sentiments of the people, and signed an irrevocable agreement which provided for the uninterrupted flow of the Ganga into the channel passing along the holy sites at Haridwar (Government order No. 1002 dated 28th April 1917; <http://gangamahasabha.org/>, see also Parmanand 1987; and Annex 1). The agreement remains valid in perpetuity by the Indian Constitution, although significant amounts of flow have now been stored and diverted in the upstream reaches in the mountains, especially behind the Tehri Dam.

EMERGENCE OF ENVIRONMENTAL FLOWS CONCEPT

The development of large reservoirs started in the arid Western USA in the late 19th century, and many of them were constructed in the 1940s. As these projects had their greatest potential impacts on traditionally low summer streamflows, fish and wildlife biologists were concerned with the amounts of water to remain instream for the protection of fish and wildlife resources and related recreational opportunities. Therefore, during the 1950s and 1960s, numerous studies were made on the relationship of fisheries with a variety of stream variables, including channel morphology and river flows (Fausch et al. 1988) and the need for regulating low flows (e.g., Wood and Whelan 1962). During the 1970s and 1980s, the hydropower development projects in northwest USA came under the examination of regulatory agencies and fisheries management interests at state and federal level. One would have expected that regulatory agencies would put a cap on the amount of water that could be stored and diverted without affecting the fisheries and other downstream uses. However, all attention was directed at the needs or requirements of the fish and fish alone. Numerous studies were undertaken in different States to focus on 'in-stream flow needs' or 'in-stream flow requirements' of fish populations, mostly salmon and freshwater trout, for being in a reasonably good/acceptable condition. These studies were discussed at a landmark symposium organised by the American Fisheries Society in 1976 (Orsborn and Allman 1976). The most widely cited Tennant method was also presented at this Conference (Tennant 1976a). It was natural that such a narrow objective gave rise to the concept of 'minimum flow'. Stalnaker (1990) however adds another dimension by stating that, "The minimum flow concept rose from western water law as a mechanism to either reserve an amount of water from future appropriations or as a means of granting an instream water right for fishery purposes".

However, it is interesting to note that the concept of 'minimum flow' was criticised from the very beginning by Stalnaker (Stalnaker and Arnette 1976) who called it a myth (Stalnaker 1979, 1990). He pointed out that all instream uses for which flows may be needed had not been identified. "Most often overlooked are necessary periodic high flows that move bedload, flush sediments, rejuvenate the floodplain, and generally maintain the structural characteristics of a stream channel, which should be maintained in dynamic equilibrium with its watershed" (Stalnaker 1990). The discussions soon grew stronger to consider a wide range of issues including riverine habitats, geomorphology, other biota, and water quality. This led to the development of the concept of 'Instream Flow Requirement' and a

methodology to cover these aspects (Bovee 1982, Trihey and Stalnaker 1985). Since then, the concept has evolved and improved greatly, and is widely acknowledged within the United States. A number of State and Federal agencies concerned with fish and wildlife in the USA and Canada, joined hands to set up an Instream Flow Council which works to improve the effectiveness of instream flow programs and activities for conserving fish and wildlife and related aquatic resources (www.instreamflowcouncil.org/). The Council defines 'instream flows' as "*The amount of water flowing through a natural stream course that is needed to sustain, rehabilitate, or restore the ecological functions of a stream in terms of hydrology, geomorphology, biology, water quality, and connectivity at a particular level*" (Annear et al. 2004).

In the early 1990s, discussions on river flows extended to a larger issue of sustainable water resource management, and produced at least two other terms: ecological flow and environmental flow. The term Environmental Flow was extensively used in numerous scientific publications and widely accepted. The IUCN promoted the term through its publication where it was defined as: "... the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits" (Dyson et al. 2003). The term was endorsed at the International River Symposium and International Environmental Flows conference (Brisbane, Australia, 2007) by more than 750 delegates from 50 nations. It was incorporated in the Brisbane Declaration (2007) which defined it as: "*Environmental flow describes the quantity, quality and timing of water flows required to sustain freshwater ecosystems and the human livelihoods and well-being that depend on these ecosystems*".

Some still preferred the term 'Ecological Flows'. The New Zealand Ministry for the Environment (2008) adopted the term and defined it as: "*The flows and water levels required in a water body to provide for the ecological function of the flora and fauna present within that water body and its margins*". However, by this definition, ecological flows were considered to be a component of overall environmental flow (New Zealand Ministry for the Environment 2008).

The three terms - In-Stream Flows, Ecological Flows and Environmental Flows - together with other terms such as "environmental water requirements" (EWR), "environmental demand" and 'environmental flow needs' (Lankford 2002, Dyson et al. 2003, Smakhtin et al. 2004) are practically similar in their scope but are often interpreted differently. For example, a major criticism of the term 'instream flow' stems from the use of the word "instream" because it may be interpreted to exclude floodplains, which are critical to the form and function of riverine ecosystems through lateral connectivity. The Instream Flow Council emphasises that despite its earlier association with fisheries, the requirement to integrate water use needs among all stakeholders, and to include the ecosystem services provided to people living within the watershed, are key elements of instream flow. The Council considers it synonymous with 'environmental' and 'ecological' flow (Annear et al. 2004).

CURRENT STATE

Despite its widespread use and growing global acceptance, the term Environmental Flows continues to be interpreted variously. Often a distinction is sought to be made between the

Environmental Flow Requirement and Environmental Flow Releases. The latter refers to the amount of water that may be released from a reservoir for improving some ecological condition of the river and may not match the actual requirements. A distinction is also made between 'Flow' and 'Flows'. Whereas the word 'Flow' refers to a single value representing a proportion of the total annual flow, the word 'Flows' is preferred to reflect the temporal variability and all components of the flow regime as described earlier.

The focus of the studies on river flow has moved gradually from fisheries to include concerns beyond other instream uses (*sensu* Stalnaker 1976) and now covers habitat diversity, other components of biodiversity, water quality and ecosystem functions. After the Millennium Ecosystem Assessment drew attention to the 'goods and services' of ecosystems (MEA 2005), environmental flows discussions started considering the flow requirements for the livelihood and socio-cultural needs of downstream communities. Questions have been raised on the desirable and acceptable conditions of the riverine ecosystem, and relative benefits from allocating water for this. It has been argued that the acceptable condition of the river is 'a negotiated socio-political decision that is arrived at by consensus within the society'. Negotiation invariably means some tradeoffs between various uses and their impacts. It still requires political will to implement the environmental flows requirement arrived at by a consensus, through appropriate legislation.

It is important to note that despite these developments, water resource managers, policy makers and even researchers in most countries of South and Southeast Asia still continue to stress upon 'minimum flow' and its allocation for ecology or nature. Dr. Ramswamy Iyer, former Secretary of the Ministry of Water Resources, Government of India, questions the use of the term "minimum flow" as it clearly implies maximum abstraction (Iyer 2005). Iyer (2005) pointed out that expressions such as "environmental flows" or "water for nature" also imply that in allocating water for different uses, an allocation must be made "for nature as well". This is inappropriate in principle because "water itself is part of nature and one cannot presume to allocate water to nature".

An aspect of river ecosystems that has received until recently very little thought is the way we look at the problems caused by alteration of river flows (e.g., Bunn and Arthington 2002). The Environmental flows perspective is an attempt to find solution to problems, after their creation or planned to be created. Thinking of approaches to prevent the problems from arising is very rare. As Iyer (2005) puts it, we should ask the question, "how much water can be extracted/ diverted without affecting the ecology/ environment downstream?". In as early as 2000, the possibility of 'directly specifying a level of water development and protecting the remaining flows in the stream' was examined by Silk et al. (2000) who argued for legal recognition of 'upside-down instream flow water rights' especially to protect complex flow patterns. The South African approach to the protection of aquatic ecosystems by setting aside an 'Ecological Reserve' follows the same philosophy. Recently, in order to implement the European Freshwater Directive in the U.K., Acreman et al. (2008) have developed environmental standards that define the maximum abstraction thresholds for different ecological types of rivers. More recently, pointing out the need for placing constraints on abstraction, Richter (2010) has proposed a 'Sustainability Boundary

Approach' (SBA) which serves to set limits on the extent to which water withdrawals and discharges, water infrastructure operations and land uses, can alter natural variability in water flows and water chemistry, thereby sustaining the social benefits and biodiversity of freshwater ecosystems. It is hoped that such approaches to water resources management will soon gather momentum for the rivers which remain at present in pristine or only slightly degraded state.

The Environmental Flows discussion has so far been concerned largely with the requirements for sustaining or maintaining a desirable condition of the riverine system downstream of the point of intervention (where flow is to be stored at or diverted from). The environmental flow requirements of lower reaches of the rivers impacted by multiple diversion and storage projects upstream (on the same river and its tributaries) have yet to be considered. Further, these requirements are likely to differ significantly from those required for the restoration of degraded reaches, depending upon the nature and level of degradation. The social and environmental impacts on the areas upstream of the interventions such as large dams have been discussed for long (Goldsmith and Hildyard 1984, 1986, Bizer 2000, Scudder 2005), but have not been taken into account in environmental flows assessments. In this context, it is important to note that the amounts of water used by the natural and man-made ecosystems in the catchment are also sometimes considered within the purview of 'environmental flows'. For example, Mohile and Gupta (2005) suggested that "environmental water requirements should include the requirements of both terrestrial and aquatic ecosystems, and that the former would include direct evapotranspiration through forests, wetlands and other lands, all supporting distinct ecologies, while the latter would then be understood as environmental flow" (see also CPSP 2005, Gopalakrishnan 2006). Whereas such a distinction between EWR and EFlows will not only create greater confusion (see Smakhtin and Anputhas (2006), the misconceived approach to environmental flows will only result in further degradation of rivers and their ecosystem services.

Finally, it is necessary to add a word of caution, borrowed from O'Keefe and LeQesne (2009) who have pointed out the limitations of Environmental Flows. "It is important to recognise that environmental flows can only help to maintain or improve conditions in a river if the other non-flow related aspects are also looked after". The problems of river ecosystem degradation caused by improper management of land use, loss of floodplains due to embankments, clearing of riparian vegetation, discharge of domestic and industrial wastes without effective treatment, and introduced exotic species (plants or fish) cannot be overcome by ensuring adequate flows alone.

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Details of discussions regarding free flow of River Ganga at Haridwar for an agreement between the then British Government of India and Ganga Mahasabha (by permission from gangamahasabha.org)

No. 1002
GENERAL ADMINISTRATION DEPARTMENT
The 28th April 1917

PROCEEDINGS OF A CONFERENCE HELD AT HARDWAR ON THE 18th AND 19th DECEMBER 1916, REGARDING THE NEW GANGES CANAL WORKS HARIDWAR.

1. His honour arrived at Bhimgoda at 9 a.m. on the 18th December and was met by the following Chiefs, Officials and Private gentlemen:

A. Chiefs :

His Highness the Maharaja of Gwalior.
His Highness the Maharajahdiraj of Jaipur.
His Highness the Maharaja of Bikaner.
His Highness the Maharajahdiraj of Patiala.
His Highness the Maharaja of Alwar.
His Highness the Maharaja of Benaras.

B. Officials :

The Hon'ble Maharaja Bahadur of Darbhanga, Member of Council, Behar.
The Hon'ble MR. ROSE, Secretary of the Government of India, Public Works Department.
The Hon'ble MR. BARLOW, CLE. Chief Engineer, United Provinces.
MR. STANDLEY, Superintending Engineer, Irrigation Branch. U.P.
MR. COOPER, Executive Engineer, Irrigation Branch. United Provinces.
The Hon'ble MR. R. BURN, Chief Secretary to Government. U.P.

C. Private Gentlemen :

The Hon'ble Maharaja of Kasimbazar, President of Sabha
The Hon'ble LALA SUKHBIR SINGH, General Secretary Hindu Sabha.
The Hon'ble PANDIT MADAN MOHAN MALAVIYA.
The Hon'ble RAJA SIR RAMPAL SINGH, K.C.I.E., of Kurri, Sudauli, U.P
RAJ GIRRAJ SINGH of Kuchesar, United Provinces.
LALA RAM PRASAD. Hardwar, United Provinces.
SARDAR INDRAJ SINGH, Hardwar, United Provinces.
SURJI BABA, Hardwar, United Provinces.
RAI SALIG RAM THAKUR SAHIB, Hardwar and Lucknow, United Provinces.
MAHANT LACHHMAN DAS, DehraDun, United Provinces.
THAKUR MOHAN CHAND, Amritsar. Punjab.
RAI KANHAIYA LAL BAHADUR, Executive Engineer (Retired), Punjab.
The Hon'ble RAJ RAM SARAN DAS BAHADUR, Lahore.
BABU GOBARDHAN DAS, Deputy Magistrate, Karnal, Punjab.
MR. E. PURVES, Chief Engineer (Retired), Punjab, on behalf of the Ruling Chiefs.
PANDIT DINDAYAL SHARMA of Jhajjar, who had accepted the invitation to attend, was prevented from coming by sickness.
CHAUDHRI RAGHUBIR NARYAN SINGH of Asora was unable to come.
MR. ANTHONY, late Chief Engineer, Irrigation Branch United Provinces attended and gave valuable assistance.

2. In the first place, the model which had been prepared by the irrigation branch was inspected. The party then proceeded to the site of the actual works and made a thorough examination on the spot, all features being explained by the officers of the Irrigation Department. The conference then reassembled at Bhimgoda and the following discussion took place.

3. His Honour the Lieutenant- Governor opened the conference and said "your Highness, you have put me under a very great debt of obligation by coming to assist in the settlement today of a question which closely affects the Hindu religion. With your Highness permission, in order that we may come to a speedy understanding, I propose that each of the gentlemen who is here should be invited in turn to express his views; his dissatisfaction, if he has dissatisfaction, with the works now in progress; and then to make such suggestions as he has to remove any discontent in his mind or in the mind of the community he represents. After that your Highnesses will probably call me to place the whole matter before you and have the benefit of your advice."

4. Each of the Hindu representatives present then spoke in turn, in Hindustani –

The Hon'ble Maharaja of Kasim Bazar said that "the Ganga was the mother of all Hindus. Its water was used in all domestic purposes from Hardwar to Saugor Island. In Hardwar there were three channels. One channel washes the holy ghats; another channel serves the Mayapur canal and the third would now be closed up by the new works. We want a free channel so that pure water may flow through it. We have framed this memorial to the government asking that there should be only one channel to enable a free flow of water to Saugor Island. We want pure water but we are laymen and cannot say how this should be done."

His Honour enquired if he wanted the entire water of the Ganga to flow through or would he allow a part of it to be diverted into the canal; the Maharaja replied that he wanted the entire water of the Ganga to flow from the Himalayas to the sea. (He then made remarks about canals and malaria in Bengal which it was difficult to follow.)

5. The Hon'ble Maharaja of Darbhanga said that "he wanted the flow of the Ganges to be unfettered for the whole twelve months. If there was any secret difficulty in this, he would like to know."

6. The Hon'ble Madan Mohan Malviya began by saying that "those who were present at the Conference of 1914 misunderstood the decision that was come to then. There was no suspicion in their minds that Government was not carrying out its promises. The point simply was that they had misunderstood the decision. Two points had given cause for doubt. The first was that in the new channel to be opened there was to be no appearance of a canal. The canal went for a 1000 miles, but there were no ghats any where on it. People incurred large expenses in order to go to the Ganges. From the communiqué, that was issued by the Government he had understood that there would be an opening in the weir. He discovered that the opening will be in the shutter which itself be placed above the water. They did not object to the canal, they did not object to a little more water being taken for the canal but in the weir, there should be an opening to allow enough water to pass through unfettered for all their needs. He need not say how deep the feeling was all over India. People from Bikaner, Jaisalmer and all parts of the country come to Allahabad. They relied on the fact that the Ganges was free and pure. He said the opening should be a natural one and there should be no artificial embankments, etc from the discussion which appeared in the papers it is clear that people want a sufficient opening so that they can bath. It must be wide enough to let a sufficient stream through. Thousands of people bath along the course of the river. The opening must be so wide that all places below it receive pure water. People seem to be dissatisfied with the regulator. Possibly there was a misunderstanding both on the part of those who were present in 1914 and the outside public, it is important to remove this dissatisfaction in view of the holiness of the river. Even if some extra cost is incurred the feeling of the people should be soothed. It is said that the agriculturists will suffer if the volume of water that passes into the canal is reduced; but no Hindu would place his material prosperity above the dictates of his conscience and his religion. In his opinion a 5-foot opening was not enough. Five to 10 lakhs of bathers come to thiraths. They come from great distances and undergo great discomforts. But they will stand any trouble because it is a matter of faith. Even if the cost were 1 lakh or 2 lakhs that should not matter when it was a question of belief with the people. This must be borne in mind. They believe that the Ganges makes people pure and removes sin. He hoped that something would be done."

Questioned by His Honour about the regulator he said "he did not object to the regulator if it was open like a bridge built on piers. He did not want any gates or sluices and he would prefer not to have a farash."

7. The Hon'ble Lala Sukhbir Singh said that "he was present at the 1914 Conference and understood that "channel No. 1 would remain as at present. That had been done and was satisfactory. He said that through the weir enough water should flow to enable them to burn their dead and for their other religious requirements. He did not think an opening of 5 feet is enough. Moreover, he objected to the opening being no lower than the top of the weir. Further he had understood that the new supply channel should be so made that it would appear as a natural cut and would have no gates or sluices. As the head works were now constructed it would not be the water of the Ganges that would flow down to the sea but that of the canal. He also said that the people did not want canal water at the ghats."

His Honour interposed to ask "how much water he wanted to flow through unimpeded." Lala Sukhbir Singh replied that "he could not specify the volume in cubic feet. In the memorial submitted by the Hindu Sabha an opening of 30 feet was asked for."

His Honour enquired "if the 30 feet had been based on any calculation." Lala Sukhbir Singh admitted that "no calculation had been made. The figure was selected at random."

8. Thakur Monan Chand did not want the water to be held up. The masonry of the regulator should be level with the ground. He objected to the appearance of a canal which was caused by the regulator.

9. The Hon'ble Rai Ram Saran Das Bahadur wanted the decision arrived at the 1914 Conference to be carried out. He associated himself with what had been said by the Maharaja of Kasimbazar, the Hon'ble Pandit Madan Mohan Malviya and Thakur Mohan Chand. They seemed to have misunderstood the position in 1914; they make no complaint but rely on government to support their religion. He did not understand that there would be gates. He thought there would be a clear opening as provided in channel No. 1.

10. Rai Salig Ram Thakur Sahib said that "from the 1914 Conference he understood that there would be no restriction to the free flow of the water as in channel No.1. The people relied on the Government for protection of their religion."

11. The Hon'ble Raja Rampal Singh was not at the Conference of 1914 but saw the communiqué that was subsequently issued. He had forgotten what that communiqué said. He wanted the opening free and enough water to flow through, though with the other speakers he

could give no opinion as to what the volume of the flow should be. He did not object to a masonry foundation but it should be level with the ground. He did not want any gate.

12. Rai Girraj Singh said that "if less water was allowed into the canals the agriculturist would suffer. He could see no harm in the work."

13. Sardar Indraj Singh said that "the new channel should have a free opening. He had no objection to a farash of masonry flooring on bed level."

14. Surji Baba said there should be no gate or raised foundation. There should be no gate in No. 1 channel. Since the new headwords have been made, the whole river has become a canal and none of the Ghats between Bhimgoda and Hardwar were able to get the pure Ganges water. Wherever there is a gate, there must be a canal, call it by whatever name you wish: He quoted recent examples of people bringing bones from the Punjab and elsewhere to throw into the river when they saw the works at Hardwar Urey took them on to Rishikesh.

15. Lala Ram Prasad did not want the canal.

16. Mahant Lachhman Das wanted the Nildhara dam to be opened so as to ensure a sufficiently free flow of water. He could not say what he understood by a sufficient flow. He also understood that the new channel would be a free opening like channel No. 1.

17. Rai Kanhaiya Lai Bahadur said "he was prepared to answer any question Government might put. In 1914 none of the non-official gentlemen, who attended, asked him about the regulators. He knew there would be a regulator. He did not tell them. He recognized the sanctity of tiraths and of the Ganges water. He agreed that the channel had no appearance of a canal. He said we Hindus number crores and our feeling must be respected. He thought that wider opening could be left in the dam. He still thought so. The Ganges would adjust its own level. He then went into technical details and finished up by saying that there was no need to have gates or regulators. The bed would be 5 or 6 feet above the gap. The gap might be widened to 30 feet. He wound up by saying that Hindus were very anxious for their religious faith.

18. Rai Sri Ram Bahadur said "he had 40 years' government service. The Hindus did not want the Ganges to be stopped. They did not want gates or regulators and there was no need to have them. If there were no gates the Har-Ki-Pairi would not suffer from pollution. In the first place he would have only a bed of boulders below the regulators. If that cut up too much, he could see no objection to its being made pakka. He thought a 5-foot gap was not enough. Without calculations he could not say how wide the gap should be.

19. The Hon'ble Pandit Madan Mohan Malviya pointed out that "there was no water at the Daksh in Kankhal and people were distressed about that. He said that the original calculations for Mayapur escape were designed to give water at Kankhal and it had been found that a mistake was made. He hoped that in view of the possibility of error the engineers, to be on the safe side, would leave an ample margin."

20. The Hon'ble Lala Sukhbir Singh said "there were many ghats below Hardar and Kankhal and he hoped they would get sufficient water."

21. The Conference then entered into an informal discussion with the Engineers of the different suggestions that had been put forward, by 5 O'clock it seemed possible that an agreement would be arrived-at, and three alternative noted below were reduced to writing and communicated to those present :-

(1) That the new channel should be diverted so as to run parallel to the river from the new regulator down to Mayapur; at the same time a small supplementary channel would be taken out of the bund which could be closed by planks so as to avoid its silting up entirely. This channel would help to supply water to the Har-ki-pairi. It was pointed out in the agreement arrived at in 1914 that if No.1 channel is not regulated at, all as was agreed to, it would tend to shoal and might be without water for some time in every year.

(2) That some bays in the regulator should be closed permanently while others should be left open absolutely and permanently. "The floor would be level with the bed of the new channel which has been dug. In addition a new channel would be opened which could be controlled. The benefit of this alternative is that for the greater part of the year the amount of uncontrolled water in the channel running past Hardwar, would exceed the amount which had passed through a regulator.

(3) That the regulator should remain as designed but that some bays in it should be permanently opened, while some should have regulators. In addition to this, Kachcha bunk would be required annually to keep No. 1 channel open.

22. The Conference then adjourned till the next day; but private discussion between certain of the Chiefs, the Engineers, and a few of the Hindu representatives, continued until a late hour.

19th December 1916,

The gentlemen who had attended on the 18th were again present with the exception of Mr. Anthony and the Hon'ble Maharaja of Kasim Bazar who had been obliged to leave and Lai a Ram Prasad who was unwell.

The following five gentlemen were also present at the request of the General Secretary of the Sabha as they were signatories to the memorial:-

SWAMI MANUJ NATHJI of Rishikesh.
RAI BAHADUR LALA HARIMAL KHANNA of Peshawar.
RAI BAHADUR LALA HARI CHAND) of Multan.
RAI SAHIB LALA PANNA LAL of Ambala, and
DR. PARAS RAM SHARMA of Ferozpur.

23. The Conference re-assembled at Bhimgoda at 11 a.m. on the 19th and proceeded to discuss still further the alternatives which had been suggested and certain other which were now put forward.

24. His Honor arrived at 1 O'clock, the gentlemen who had attended on the 18th were again present with the exception of Mr. Anthony and the Hon'ble Maharaja of Kasimbazar who had been obliged to leave and Lala Ram Prasad who was unwell.

25. It then appeared that a fourth suggestion had been made, namely. (1) That the new regulator should remain permanently open and (2) That a Kachcha bund as at present constructed should be made at supply channel No.1 so as. to ensure the supply of 1,000 cusecs down it whenever the supply failed to reach that amount. This suggestion was discussed of great length and was finally put before the Conference by the Hon'ble Maharaja Bahadur of Darbhanga, at 4 p.m.

26. The Maharaja Bahadur said :-

"Your Honor. — We have considered the question very carefully and have decided to put the following proposals before your Honour's Government. They are as follows:-

A. (1) In order to guarantee the uninterrupted flow of the Ganges passing over the Har-Ki-Pairi and other ghats at Hardwar, a kachcha bund should be made every year as at present at the head channel No. 1 guaranteeing a minimum supply of 1,000 cusecs.

(2) Regulator under construction, the reinforced concrete face-wall below the road way and between the piers should be completely removed and there should be no regulation of the water in any way.

(3) The sill of the regulation also should be removed to the floor level of the sluices in order that the flow of the Ganges may remain unobstructed.

(4) The triangular portion of earth bank below the regulator on the upstream side of the supply channel should be removed in order that there may be no appearance of a canal below the bridge.

B. (1) The free opening left in die weir should go down to the top of foundation level.

(2) The opening of the weir should be sufficiently wide to ensure that the supply of water for places below Hardwar shall be sufficient in accordance with our Shastras.

(3) We have been advised that a minimum discharge of 1,000 cusecs would meet the requirement, but if this is considered impracticable, will the Government be pleased to state what amount will, in their opinion, meet the purpose.

(4) For this purpose a monthly discharge will have to be taken and kept on record.

C. (1) That suitable arrangements should be made for a free supply of water to Kankhal ghats.

D. (1) An opening corresponding to the one at Hardwar should be made in the weir at Narora also."

27. The meeting was adjourned to enable the Government Engineers to consider these proposals.

28. On the members of the Conference re-assembling His Honor said: - I am much obliged to those gentlemen of the sabha and their associates who have so clearly put before us the proposals that they have decided to recommend for the consideration of Government. I have in the interval put those proposals before our engineers who naturally wish to throw what they recommend to Government into a little more technical form. They have, accordingly, worded what they propose to advice in their own way and I will ask the Chief Engineer to read out his proposal. But I think I can assure you what he is going to read is for all practical purposes, not only on grounds of business but of sentiment identical with what you have put before us."

29. Mr. BARLOW then read out the following statement:-

(i) In order to guarantee an uninterrupted flow of the Ganges through the Har-Ki-Pairi and past the other ghats of Hardwar, a kachcha bund will be made at the head of channel No. 1 when necessary. A minimum supply of 1,000 cusecs in that channel being guaranteed, except at periods when clearing of the shoaling in channel No. 1 is in progress.

(ii) The irrigation branch, however, reserves to itself the right of reducing at any time and at any point the size of channel No.1 on the understanding that any reduction will be". Carried out in accordance with existing conditions. For instance, it may be found necessary to reduce the width of the entrance into the channel and in such a case a reduction will be carried out by means of masonry walls similar to the existing masonry walls. His irrigation branch also reserves to itself the right of lowering the bed of supply channel No. 1 at any point if it may be found advisable, but in all cases the continuous thread of the stream will not be interfered with.

(iii) The head of the new supply channel will not be fitted with gates. Some bays will be completely closed up with masonry and earth banks, some bays will be completely open. All bays, whether opened or closed will have a foot bridge. The floor on the Hardwar side

will be level with the sill and with the bed of the supply channel. The irrigation branch reserves to itself the right of keeping open or closed by masonry as many of the bays as experience from time to time shows may be necessary for the purpose of feeding the canal which stalls at Mayapur and also in the interest of the safety of the town of Hardwar and the existing canal works, but such bays as are kept open will be completely open as described above and whatever bays are closed will be kept completely closed with masonry and earth banks as mentioned above. The existing grooves will be left in what is now called the head or the supply channel, These grooves will never be used except in cases of some impending calamity or of actual accident to Hardwar or the existing canal works, when it is of vital importance to close completely the openings by means of wooden planks for a short period.

(iv) A free opening will be left in the weir which will go down to floor level. The opening will be so constructed that it will give, according to the calculations of the irrigation branch, a discharge of 400 cusecs at the cold weather low level of Matar.

(v) At the Mayapur regulator an opening will be made, calculated to provide a permanent flow of 200 cusecs for the services of the Kankhal ghats.

30. His Honour continued:—"Now, Gentlemen. I am very unwilling to take advantage of any apparent technicalities in these proposals, and if any gentlemen want to ask any question or to suggest any interpretation of any phrase, I should like to have his suggestions now."

31. A brief discussion then took place, followed by a short adjournment while the terms of settlement were finally drawn up.

32. On the members re-assembling, His Honour said :—"Your Highness and gentlemen.— I want to read to you what I now understand to be common ground both to the representatives of British India and to the engineers who are responsible for the conduct and maintenance of these works :—

(i) In order to guarantee an uninterrupted flow of the Ganges through the Har-Ki-Pairi and past the other ghats of Hardwar; a kachha bund will be made at the head of channel No.1 when necessary. A minimum supply of 1,000 cusecs in that channel being guaranteed except at periods when clearing of the shoaling in channel No. 1 is in progress; the irrigation branch undertaking that this work shall be carried through as expeditiously as possible in order to ensure a flow from this channel into the Har-Ki-Pairi.

(ii) The opening to supply channel No. 1 will be left for the present exactly as it is. Should experience show that this is dangerous, it may be necessary to curtail the width of the present opening and to take measures to prevent the retrogression of the bed. But no steps beyond those will be taken without prior consultation with the Hindu community.

(iii) The head of the new supply channel will not be fitted with gates. Some bays contiguous to each other will be completely closed up with masonry and earth banks, some bays will be completely open. All bays, whether opened or closed will have a foot bridge. The floor on the Hardwar side will be level with the sill and with the bed of the supply channel. The irrigation branch reserves to itself the right of keeping open or closed by masonry as many of the bays as experience from time to time shows may be necessary for the purpose of feeding the canal which starts at Mayapur and also in the interest of the safety of the town of Hardwar and the existing canal works, but such bays as are kept open will be completely open as described above and whatever bays are closed will be kept completely closed with masonry and earth banks as mentioned above. The existing grooves will be left in what is now called the head of the supply channel. These grooves will never be used except in cases of some impending calamity or of actual accident to Hardwar or the existing canal works, when it is of vital importance to close completely the openings by means of wooden planks for a short period."

(iv) A free opening will be left in the weir which will go down to floor level. The opening will be so constructed that it will give, according to the calculations of the irrigation branch, a minimum discharge of 400 cusecs at the cold weather low level of the river. For this purpose a record of gauges will be kept by the irrigation branch.

(v) At the Mayapur regulator a free opening, going down to the upstream bed level will be made calculated to provide a permanent flow of 200 cusecs for the service of the Kankhal ghats, which after leaving Kankhal will ultimately flow into the Ganges.

"Now before I take the last step and place this proposed settlement before Your Highness who have so kindly and patiently taken part in this conference, I want to explain only two small matters. I want to say that if your Highness are able to advise and if with your advice, I can accept this solution, I shall record formally and publicly that this understanding is to be taken as supplementary to the agreement of 1914,* which remains in force in so far as it is consistent with the provisions of today's settlement. I wish to bring to your notice that all reference to Narora has been omitted from this settlement, the reason being that the question of Narora has passed out of my hands and gone into those of the Government of India. But I will undertake that the wishes of the Sabha are placed before the Government of India for the consideration. And now Your Highness. I have to ask you whether, after all you have heard, you feel yourselves disclosed to say that this paper contains what you advise to be a reasonable settlement."

33. The Chiefs considered among themselves and gave an answer in affirmative.

34. His Honour then said:—"Gentlemen.- I have great pleasure in informing you that His Highness the Maharaja of Alwar gives a general acceptance and that all the other ruling Chiefs present accept these proposals and recommend them as a reasonable settlement in consonance with Hindu sentiment." "And now, gentlemen, before we part, I want to express my own deep indebtedness to everyone who has taken part in this conference:- in the first place to the representatives of the All-India Hindu Sabha and of British India generally, for the clear, full and intelligent manner in which they have discussed the whole of these complicated problems and for the temperate and definite method in which they have put their wishes before us. I wish next to express my very great indebtedness to the representatives of the Irrigation Branch, Mr. Barlow, the Chief Engineer, and his assistants, for the prompt and friendly manner in which they have dealt with the problems which came before them in somewhat unfamiliar term. To their unofficial colleague, Mr. Egerton Purvers, who has

come as technical adviser to the Ruling Chiefs, I tender my thanks for the sound advice and ready assistance that he has given to us all in these long technical discussions. I wish next in a very special manner to acknowledge our obligations to Mr. Rose, the Secretary to the Government of India in the Public Works Department, for his most admirable and valuable help and for the perfect temper and kindness with which he has received all the manifold propositions that were placed before him. And, lastly, it is difficult for me to find words to thank Your Highnesses for the great trouble you have taken, the time and comfort you have sacrificed and the perfect courtesy you have displayed, in advising me in this matter. I am perfectly sure that the lasting gratitude of the whole Hindu community will be your best reward."

35. The Hon'ble Maharaja of Darbhanga in proposing a vote of thanks to His Honour said:-

"We want to express our most heartfelt thanks to Sir James Meston for the very kind way in which he has listened to our grievances and for the very satisfactory settlement reached through his kindness and his care,"

36. His Highness the Maharaja of Bikaner in seconding the vote of thanks to His Honour said :-

"Your Honour and gentlemen, on behalf of their Highness the Ruling Princes present here as well as on my own, I rise to second the vote of thanks proposed by the Maharaja of Darbhanga to His Honour for the very satisfactory manner in which, considering the very great difficulties and the circumstances, a reasonable solution of the difficulties has been arrived at by which the legitimate fears, anxieties and even grievances of the Hindu Community of India are in a fair way of being removed. There has never been any question, I feel sure, on the part of any one in India of there being a breach of faith on the part of the Local Government or the Irrigation officers, but unfortunately through a series of circumstances some contretemps and misunderstandings had arisen, and the very tactful and patient way in which the settlement has gradually been arrived at is a matter for rejoicing. We, who come from outside the limits of British India Proper, have found it a very great pleasure not only to be associated with His Honour and his Government but with our brethren in British India, and to find how reasonable and earnest they have been in their desire to come to a satisfactory settlement. I feel therefore that I am voicing the feelings not only of my brother princes but also of the people of British India and especially of the representatives who are present here today when we convey at the same time our sincere thanks to the officers of the Irrigation Department and especially to MR. Barlow, for the manner in which they have tried to meet our requests and our demands. It has been a happy augury in the past that the relations between the United Provinces Irrigation Department and the people of Hardwar have been most cordial and I think that the settlement will help to maintain but will vastly increase those feelings of friendship between the people and the Irrigation Department. And finally on behalf of ourselves as well as the people of British India we wish to offer our special thanks to the Hon'ble Mr. Rose for the manner in which he has tried to assist us in coming to a satisfactory conclusion. I would again express our united thanks and second the vote with great pleasure."

37. The Hon'ble Lala Sukhbir Singh then on behalf of the All India Hindu Sabha expressed satisfaction at the agreement that had been come to.

38. His Highness the Maharaja of Alwar then said :-

Your Honour and friends, I will not tax your patience on this occasion at any length but I feel that I should be going away from Hardwar without having performed my duty if I did not add my own sentiments to those which have been already expressed generally by His Highness the Maharaja of Bikaner at the great pleasure we have had in being associated with our Hindu Brethren in an affair of so much importance and also in being associated with my old friend Mr. Barlow and the officers of the Public Works Department in the agreement which has been arrived at. I would also like above all things to add my personal thanks to His Honour, for the patience and tact with which he has managed the proceedings as a result of which a satisfactory conclusion has been arrived at today. The sacredness of our Mother Ganges is known throughout the world. Our object in assembling here was to advise a solution which would remove the difficulties that arose with regard to certain works that were started some time ago. There is no doubt that if the reasonability of those works had been considered before the actual construction was taken in hand, many of the difficulties that we have labored through today would have been avoided. But the works were started, even before Your Honour's period of office, and therefore it was our duty to come to a conclusion that would not only be acceptable to the gentlemen present but would satisfy the wants and the feelings of a much wider area throughout India. With that aim we have taken up Your Honour's time and we have admired your patience and tact, and the promptitude with which the various complicated and intricate questions have been dealt with by the officers of the Irrigation Department. It is our ultimate hope that the solutions we have arrived of the various questions at issue will in time justify themselves and satisfy the public mind as regards the uninterrupted flow of our Mother Ganges past the sacred ghats. This of course is a matter which can only be proved by time but our hopes at present are that the solutions may be found in keeping with the feelings and religious sentiments of the general Hindu Public. I have only to thank Your Honour once more for your kindness in inviting us to do our best service for our Mother Ganges. Our thanks are also due to his Excellency the Viceroy for having been good enough in suggesting and deciding on a Conference of Princes to be associated with our brethren of British India and we have every hope that the conclusion that Your Honour has read out will now meet with all requirements." 39. The Conference then dissolved, after the agreement in paragraph 32 above had been signed by the Hindu representatives present.

Sd. R. Burn

Chief Secretary.

Copy of a letter No. 2728 /III-495 Dated Naini Tal, the 26th September 1917, from the Hon'ble Mr. R. Burn, C.S.I., I.C.S., Chief Secretary to Government, United Provinces, to the Hon'ble Lala Sukhbir Singh, General Secretary, All India Hindu Sabha.

1. I am directed to acknowledge the receipt of your letter, dated the 5th, December, 1916, submitting the memorial of the council of the All India Hindu Sabha regarding the Ganges canal works at Hardwar. The council of the sabha ask the Lieutenant Governor - (a) to abandon the construction of the regulator, gates, masonry work and other accessories of the canal head works under construction at the head of the new supply above Har-ki-pairi : (b) to leave an opening of at least 30 feet in the weir at Hardwar which would go down to the natural bed of the river and to make a similar opening in the weir at Narora.

2. The question whether the works now under construction at Hardwar were likely to reduce the sanctity of that place and of the river Ganges in the eyes of Hindus was carefully considered by the Lieutenant Governor in 1914. On the 5th November in that year the Lieutenant Governor visited Hardwar and held a conference attended by His Highness the Maharaja of Jaipur and a number of gentlemen who were thoroughly representative of Hindu opinion. At that conference three requests were put forward on behalf of the Hindu community as representing the conditions necessary to secure that the virtue of the Ganges, would not be impaired by the new works- (1) that a free flow of water should be provided through what is known as the present supply channel No. (i) to the ghats at Hardwar; (2) that a free flow of water should be passed over the new weir into the main channel of the Ganges which flows towards the sacred places at Allahabad, Benares and elsewhere; (3) that the channel which leads water to the ghats at Hardwar should not be lined with masonry, so as to be regarded as a canal.

3. These points were thoroughly discussed both on the site of the works and at the conference, and after consultation with the canal officers the Lieutenant - Governor announced the following decisions:-

(i) The opening in supply channel No.1 was to be left for the present exactly as it is without constructing the regulator which had been designed. It was, however, pointed out that this might become dangerous and other measures might thus be required, but an undertaking was given that no steps beyond curtailment of the width and measures to prevent the retrogression of the bed will be taken without prior consultation with the Hindu community. The Irrigation Department undertook to provide a sufficient supply of water at the Hardwar ghats for the use of bathers but it was pointed out that the retention of a free opening in this channel would entail a considerable amount of shoaling as at present which a sluice would prevent and that pending the annual! Clearance of the channel the ghat might for a lime remain short of water as to present;

(ii) A free opening never to be closed and providing water sufficient for the use of the bathers was to be left in the weir;

(iii) The new supply channel was not to be lined with masonry but would be a natural cut through Laljiwala Island. These decisions were accepted by the gentlemen attending the conference as a satisfactory settlement of the difficulties of the Hindu community in regard to the effect of the new works.

4. No question has been raised regarding the first of the conclusions quoted above. But misconceptions appear to have arisen regarding the meaning of the other two. and I am to state for the information of the sabha what appears to the Lieutenant-Governor to be the clear meaning of those conclusions as judged by their origin and as understood by the officers of Government and by any one genuinely desirous of appreciating what was being done to meet the Hindu sentiment and at the same time to provide for the well-being of the great masses dependent on the efficient service of the canal. As regards the second decision the question as put to the Lieutenant Governor on the spot was the provision of constant flow of water over the weir sufficient for the use of bathers, which could not be controlled or stopped by human agency. The intention was that this should be provided by leaving an opening in the shutters which are to be erected along the crest of the remaining portion of weir. The supply thus left free and uncontrolled would also satisfy the feelings of Hindus regarding the supply of pure Ganges water to places below Hardwar. The decision was complied with by leaving an opening on the same level as the rest of the weir at a point where the crest of the weir is actually below the existing bed of the Ganges.

5. The third decision had also been complied with by refraining from lining with masonry the cut through Laljiwala Island opposite the regulator just above the Har-ki-pairi. The channel thus had a perfectly natural appearance and was actually on the same footing as the whole channel from Bhimgoda to Mayapur passing the ghat, which as explained in Sir Proby Cautley's report was also excavated.

6. As a fresh settlement has now been reached His Honour does not persue this phase of the question nor does he desire to indulge in controverting those passages in the memorial, which he can't accept as correct. The Hindu representative, who came to Hardwar on December the 18th and 19th 1916, specifically disclaimed my suggestion of bad faith by the Government or the Irrigation officers. The Lieutenant Governor in turn accepts their contention that the purport of the settlement arrived at in 1914 was not precisely understood by some of them. The necessity for further discussion has been averted by the result of the further conference held by his honour's invitation at Hardwar in December last. Attached to this letter is a list of the chiefs, officials and private gentlemen, who were present at Hardwar. It will be seen by a reference to that list that the gathering was thoroughly representative of Hindu opinion. It comprised a number of ruling chiefs and private gentlemen representative of the Hindu community, including the President and General Secretary of the All India Hindu Sabha and officials connected with the works. The ruling chiefs are advised by Mr. Egerton Purves, an engineer especially engaged by them on this behalf, and the Government of India were represented by the Secretary in the Public Works Department. The discussion of the committee was greatly facilitated by the preparation of a model of the river channel and the works. In addition to the study of this model which was explained in great deal by the engineers present the members of the conference visited the whole of the works which had by the reached a stage admitting of no further misconceptions.

7. I am now quote for your information the conclusions which were reached at that discussion:-

(i) In order to guarantee an uninterrupted flow of the Ganges through the Har-ki-pairi and past the other ghats of Hardwar, a Kachcha bund will be made at the head of channel necessary; a minimum supply of 1,000 cusecs in that channel being guaranteed, except at period when clearing of the shoaling in channel No.1 is in progress; the Irrigation Branch undertaken that this work shall be carried through as expeditiously as possible in order to ensure a flow from this channel into the Har-ki-Pairi.

(ii) The opening to supply channel No.1 will be left for the present exactly as it is should experience show that this is dangerous, it may be necessary to curtail the width of the present opening and to take measures to prevent the retrogression of the bed. But no steps beyond those will be taken without prior consultation with the Hindu community.

(iii) The head of the new supply channel will not be fitted with gates. Some bays contiguous to each other will be completely closed up with masonry and earth banks; some bays will be completely open. All bays, whether opened or closed, will have a foot-bridge. The floor on the Hardwar side will be level with the sill and with the bed of the supply channel. The Irrigation Branch reserves to itself the right of keeping open or closed by masonry as many of the bays as experience from time to time shows may be necessary for the purpose of feeding the canal which starts as Mayapur and also in the interests of the safety of the town of Hardwar and the existing canal works, but such bays as are kept open will be completely open as described above' and whatever bays are closed will be kept completely closed with masonry and earth banks as mentioned above. The existing grooves will be left in-what is now called the head of the supply channel. The grooves will never be used except in cases of commending calamity or of actual accident to Hardwar or the existing canal works when it is of vital importance to close completely the opening by means of wooden planks for a short period.

(iv) A free opening will be left in the weir which will go down to floor level. The opening will be constructed that it will give, according to the calculations of the Irrigation branch, a minimum discharge of 400 cusecs at the cold weather low level of the river. For this purpose a record of gauges will be kept by the Irrigation Branch.

(v) At the Mayapur regulator a free opening going down. to the upstream bed level will be made calculated to provide a permanent flow of 200 cusecs for the service of Kankhal ghats, which after leaving Kankhal will ultimately How into the Gangas.

8. I am to explain that the understanding quoted above is to be taken as supplementary to the agreement of 1914. This remains in force in so far as it is consistent with these provisions. I am also to point out that from an engineering point of view the arrangements are risky in their abrogation of control. The purpose of the gates in the new regulator was to prevent danger to Hardwar from floods. The absence of gates is also unsatisfactory through the danger of shoaling in the new supply channel. It is, thus, possible that during monsoon when the river is in flood the use of wooden planks for the purpose of adequately protecting Hardwar and preventing undue shoaling of the channel may have to be more freely resorted to than is indicated at the end of paragraph 7 (III) above or that open head of the new channel may have to be replaced by a regulator' discharged into a channel which will be taken down by a separate route to Mayapur and not allowed to mingle with the stream flowing past the Hardwar ghats and Government reserves to itself the option of adopting these alternatives in lieu of the air if agreements detailed in paragraph 7 above, should it in their opinion be considered necessary. This however would not in any way diminish the accepted liability of Government to provide an adequate supply of water at the ghats measured as nearly as may be by one thousand cusecs in No. 1 channel.

9. I am to add that question of Narora was expressly left out of consideration at the conference and will be settled later.

Note : Special attention is drawn to para 8 of the letter.

COPY OF THE AGREEMENT OF 5TH NOVEMBER, 1914 HARDWAR

1. The opening of supply channel No. 1 will be left for the present exactly as it is, should experience show that this is dangerous, it may be necessary to curtail the width of the present opening and to take measures to prevent the retrogression of the bed.

2. But no steps beyond those will be taken without prior consultation with the Hindu community. The Irrigation Department will undertake that sufficient supply of water will be provided at the Hardwar ghats for the use of bathers. It must be born in mind that the retention of the free opening in supply channel No.1, will entail a considerable amount of shoaling as at present, which a sluice would prevent. It will. Therefore, have to be under stood that it will, pending the annual clearance, for a time remain short of water as at present.

3. A free opening, which will never be closed and which will provide water sufficient for the use of bathers, will be left in the weir. According to the calculations of the Engineers this will mean a constant unfettered flow of water al all seasons of the year.

4. The new supply channel will not be lined with masonry. It will be a natural cut through Laljiwala Island. It is not expected that any extension of the lining of the supply channel No.1 will be necessary there will not be either the name or the appearance of a canal in either of the channels which feed the Hardwar ghats.