Lowering of Ground Water Table Around River Ravi in Lahore: Aggravated by Indus Water Treaty

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ABSTRACT

River Ravi was major source of recharging ground water table around Lahore City. But scenario has totally been changed after Indus Water Treaty (IWT) between India and Pakistan. In dry season almost 60 K.M long reach of river (Ravi siphon to Baloki Headwork) passing nearby the Lahore city is converted into drain. The ground water table which is being recharged from untreated urban as well as industrial sewage is becoming highly contaminated. IWT was signed without carrying out any kind of Environmental Impact Assessment (EIA) study. Due to this low flow condition many other environmental parameters are being affected; e.g. drastically lowering of ground water table, contamination of ground as well as surface water, degradation of aesthetic value of river, endangered aquatic flora and fauna, usage of contaminated water for irrigation, degradation of human health, increased water borne diseases. These all problems have been associated with low flow in River Ravi. In this research the effect of low flow condition on the lowering of ground water table is studied in detail, in which ground water table data of last 60 years is analysed. Very obviously it can be concluded that there is drastic change in ground water table depth before and after IWT. As a compensation and mitigation measure very essential recommendations is suggested that extra amount of water should be added at Ravi Siphon. This will not only mitigate sewage dilution problem rather it will also enhance recharging capability of River Ravi.

Keywords: Adverse Effects, EIA, Ground Water, Indus Water Treaty, Low Flow Condition, River Ravi

INTRODUCTION

India and Pakistan have fought more than three wars; relation between two countries remained hostile even before creation of both countries (AKHTAR; U. Alam, 1997; U. Z. Alam, 2002; Aslam, 2006; M. Y. Khan, 1990; Mirza, 2008; Racine, 2002; Starr, 1991; R. Wirsing, 1998; R. G. Wirsing, 2007). India has influenced the process of partition by recognizing well in advance the importance of sweet water for both countries; being agriculture based economies. Injustice with Pakistan started when district of Gurdaspur was given to India, which was the only passage to Kashmir. If Gurdaspur district would have been given to Pakistan; then India could not have occupied Kashmir and most importantly could not have regulated water through Madhopur and Feorozpur head works. Above all then Pakistan would not have been compelled to sign treaty with India to share its legitimate water of Indus river basin and its tributaries. Nowadays the most famous slogan and dream advertised in leading media of Pakistan and India is "Aman ki Asha (wish for peace)" between India and Pakistan. This is a wonderful slogan and dream indeed, the need of the hour and demanded by the citizens of both countries (Behuria, 2010; Bolognani, 2010; Cheema, 2006; Manjunath, Sridhar, & Anand, 2006). Its earliest fulfillment will create room for poverty alleviation and will provide opportunity for both the governments to focus on their lean economy. If this dream can come true it will reduce tension and throwing lot of money in purchasing arsenals. Second most desired wish of India is getting declared its trade status as Most Favoured Nation (MFN) through confidence building measures and track-2 diplomacy (Cheema, 2006; S. R. Khan, Yusuf, Bokhari, & Aziz, 2005; Qamar, 2005; Yusuf, 2011). But can both countries move forward without resolving long outstanding issue of Kashmir and above all the main source of tension/conflict between both countries is the right on the use of water of six common rivers (Ammad, 2011; Gazdar, 2005; Gleick, 2010; Hilali, 2005; Hodges, 1995; Iyer, 1999, 2005; R. W. A. Khan, Khan, & Chaudhary, 2011; Kilgour & Dinar, 2001; Pappas, 2011; Yamin, Sinkovics, & Hadjielias, 2007). If we say all the wars which were fought among two nations was water would not be wrong statement. Moreover if we say the potential cause of any of the future wars is also water would not be wrong. In this study we will try to evaluate all possible adverse impacts on Pakistan's river's morphology, Irrigation and agriculture system caused by Indian violation of Indus Water Treaty 1960.

BACKGROUND

One of the important river systems in the world is making up by the river Indus along with its six tributaries. During the British colonial era this basin was developed extensively into a cultivated area, with millions of acres were irrigated by large canals system. At the time of partition in 1947 Pakistan's and India's, boundaries were outlined without first considering the realisms of the region. The west portion of the Punjab becomes a portion of Pakistan, while the remaining eastern portion was amalgamated into India. The immediate result of this division was that the Indus Basin became distributed and conflicts consequently arose concerning the two countries over the distribution of water resources. In 1948, when India took control of the head works and ceased the water flow into Pakistan, at that time this clash gained international attention. World Bank in 1960, after years of negotiations and consultations brokered the Indus Water Treaty (IWT). This treaty proposed a framework for the use and regulation water for the Indus Basin Rivers. The World Bank's Mr. W. A.B Iliff, Prime Minister of India Jawaharlal Nehru and President of Pakistan Ayub Khan signed the agreement on September 19, 1960 (Paul, 2005). This kind of treaty i.e. IWT is unique in which one of upper riparian country has been given full right of usage of complete water and lower riparian has been deprived off its due share of water. Contrary to this IWT there are numbers of other treaties in which water of other major rivers are shared, but none of treaty gives full right to any one country (Ashton, 2002; Dellapenna, 1994; Fischhendler, 2008; Galvin & Haller, 2008; Kirmani, 1990; Lindemann, 2006; Paul, 2005; Swain, 1997, 2004; Treaty, 1960; Wolf, 1998; Wolf, Hamner, Lowi, & Shaw, 2000).

The IWT comprises of three parts, preamble, twelve articles and annexure A to H. The primary topics covered in the annexures of treaty are, the interchange of minutes between the governments of India and Pakistan as well as India's agricultural usage of certain tributaries of the river Ravi. India's agricultural usage of the up side reaches of the western rivers. Some quantity of water from the three eastern rivers was allocated to Pakistan during the period of transition. It is explained in traty that how India could use the water of western rivers to generate hydroelectric power; from the western rivers. A forum to resolve disputes is provided in treaty through a commission or through a neutral court of arbitration (Paul, 2005). As per the Treaty full right has been given to India for use of the Beas, Ravi and Sutlej rivers. Pakistan was also awarded with full right of use to the western rivers water i.e. the Jhelum, Indus and Chenab. According to the treaty, India has to allow these rivers to flow of these rivers into Pakistan without any interruption or interference. This consists of the usage of water for domestic purposes besides other non-consumptive commitments, as well as the hydroelectric power generation. However, the treaty prohibits India on the construction of any structure for the storage of water from the river's water allocated to Pakistan. Even if India wants to generate hydroelectric power from water of these rivers; it could only use water by building run of the river hydro-electric power projects, which should not form any kind of storage. Permanent Indus Water Commission has been established as per the treaty a, led by two eminent engineers, one from each country. The job of this commission is to monitor that no country violates the treaty, and smooth down any differences that may rise. Commission can refer the dispute to either the World Bank or to the Court of Arbitration.

RESEARCH PROBLEM STATEMENT RESEARCH QUESTION

India Although the IWT has survived conflicts between Pakistan and India over the decades, but recent developments has threaten to undermine this treaty. Historical and second most populous city of Pakistan the Lahore was built on the bank of River Ravi. The city has witness the glory of the great River Ravi; which remained main source of income, recursion and domestic water supply. As per IWT complete right of three eastern rivers has been given to India. The problem is aggravated during dry spell period means from October to May when almost river is totally dry; as India discharges almost zero water in the River Ravi. The blackish water flowing in the narrowest strip in these days is none other than untreated sewage effluent from the city of Lahore. This low flow condition leads to many environmental problems (Ahmed & Ali, 2000; Haider, 2010; Khalid, 2004; M. Khan, Khan, & Aslam, 2003; Paul, 2005; Zawahri, 2008). Among these all problems, the most serious problem is drastically lowering of ground water table around River Ravi around metropolitan city of Lahore.

As per treaty India has been given the right of limited storage for generate Hydropower. But India has misused this right and exploited the right beyond its objectives. India by constructing many disputed Projects on Western Rivers whose complete right of using water has been awarded to Pakistan as per treaty. India has constructed many dams on western rivers like Wuler barrage, Slal Dam, Baglihar projects. Construction of these dams has not only deprived Pakistan from its legitimate quantum of water as well as has given India water regulation capability, which has potential to desertification of Pakistan's cultivatable fertile land. More importantly India's water regulation capability has serious implications on Pakistan defense system, which are based on canal system fed from western rivers. Pakistan objected not only on the design of these dams, height of dam, height of spillways, height of inlet level, freeboard etc, but also on the timings of the filling of these dams. India violated

IWT while filling of Salal dam, by kept on filling of dam beyond specified limit, but at that India agreed to compensate and released same amount of water in River Ravi. This time in case of filling of Baglihar dam again India violated the treaty and filled up dam beyond specified time, by which depriving Pakistan with 30 million acre feet of water. India this time still not has compensated the lost water, rather India this time denying the claim. To add to the list of the disputes India has started constructing the Kishanganga dam on River Nelum by diverting its tributary from River Nelum to River Jehlum. This diversion of River water will have serious implication on Pakistan.

RESEARCH QUESTION

- What was the lowest amount water in River Ravi in dry spell season?
- What are the adverse effects, due to low flow condition; on ground water table depth around river Ravi, especially surrounding Lahore?

RESEARCH DESIGN/METHODOLOGY

We have analyzed river Ravi discharge data of last 35 years so that we can generalize that how badly low flow condition in eastern rivers are effecting Pakistan after IWT. We have also analyzed ground table depth data starting from 1955 till 2015 so that pre and post IWT scenarios can be compared and deductions can be drawn from results. We have gathered data from different sources like WASA LHR, S.M.O WAPADA regarding tube well's ground water table depth data at different locations near river Ravi. Few tube well ground water table depth data were selected inside Lahore city. Deductions are made conclusions are drawn from analysis of the results.

RESULTS AND DISCUSSIONS

After gathering and compiling of last 35 years river Ravi discharge data; it is analyzed in a manner that minimum daily discharge (cusecs) data has been recorded for seven consecutive days. Secondly minimum monthly average daily flow in cusecs has also been recorded, accordingly data have been grouped in two columns and have been tabulated in Table 1 as well as presented in Chart 1 in the form of graph.

1985 was the year in which Minimum daily discharge (for seven consecutive days) in particular year remained lowest mean 138 Cusecs and Minimum monthly average flow as 254 cusecs. Analysis of River Ravi data reveals that discharge remains mostly very low from Oct to May which usually remained so low that it does not have the ability to dilute or transport the sewage water which is being added through drain from Lahore city. So there is need to augment River Ravi water.

According to international treaties and pacts division of surface water between countries (which are sharing water of same river), are made in a way that lower riparian country should at least have sufficient amount of water to meet the domestic demands and aquatic life of flora and fauna should not be disturbed. Discharge at tail should not be so low that it leads to environmental problems. Environmental problems in Rivers Ravi and Sutlej rivers are aggravated due to low flow condition after signing Indus Basin Treaty with India. There is no example where full right of any river has been given to one country. This is the biggest flaw in this treaty that this treaty was signed without conducting Environmental Impact Assessment and without providing compensation to those parameters which are affected due to low flow conditions. This treaty is wrong,

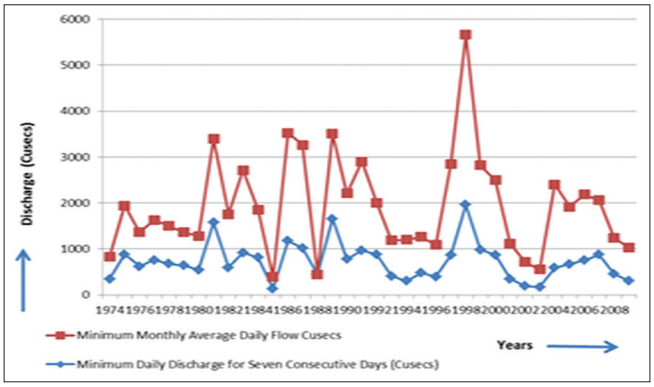

Figure 1: Graph of minimum River Ravi discharge at Shahdara near Lahore

Table 1: Minimum River Ravi discharge results recorded at Shahdara near Lahore

Year	Minimum daily discharge for seven consecutive days (cusecs)	Minimum monthly average daily flow cusecs
1955	8883	12062
1956	7622	9742
1957	8761	11869
1958	7681	9819
1959	7640	10725
1960	7545	10738
1981	1578	1818
1982	600	1155
1983	924	1793
1984	813	1043
1985	138	254
1986	1180	2347
1987	1020	2247
1988	450	2468
1989	1656	1849
1990	780	1430
1991	970	1930
1992	880	1122
1993	412	780
1994	305	895
1995	479	785
1996	401	690
1997	866	1980
1998	1961	3700
1999	982	1838
2005	872	1625
2006	348	768
2007	194	520
2008	174	380
2009	592	1813
2010	675	1245
2011	754	1432
2012	876	1187
2013	453	789
2014	314	721
2015	1876	1233

according to environmental engineering and management point of view. During dry season the major portion of discharge in the River Ravi is wastewater reaching it through various point and non-point sources. River Ravi is the major source of the recharging groundwater for Lahore city. Due to low flow in River Ravi after IWT, water table is lowering very rapidly. In Table 2 ground water table depth data is presented along River Ravi near Lahore, if we carry out analysis of this data critically, it would be easy to infer that there is huge difference in ground water depth till 1960 and just after IWT the ground water depth is lowering exponentially.

The biggest problem is that Pakistan government has till now not asked for Regional Environmental Impact Assessment report from India regarding River Ravi which is facing acute scarcity of water problem. One more issue is that India is not providing technical details of any proposed\ongoing dam's project and tries to gain time so that she can complete dam before the case is referred to Neutral Expert or Court of Arbitration on even for those river which directly falls under Pakistani domain. This

Table 2: Sample table ground water table depth along River Ravi near Lahore (ft)

Sr	Address of tube well	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
1	WASA Tube Well near Mehmood Booti Bund Road Lahore	8.5	9	16	18	21	25	30	36	42	50	58	65	75
2	Shahdara Town Sheikhupura	9.5	10	17	19	22	24	29	36	45	56	65	72	80
3	Sanda Town Bund Road Lahore	10.5	11	18	21	24	26	31	40	52	64	71	80	89
4	Ghulshan-e- Ravi Bund Road Lahore	10.5	11	18	20	23.5	26	32	42	52	60	67	77	86
5	Shera Kot Bund Road Lahore	10	11	17	19	23	25	30	40	51	61	71	82	92
6	Village Niaz Beg near Tokar Niaz Beg Lahore	9.5	10.5	16.5	19	22	24	28	32	42	53	63	73	84
7	Military Farm Multan Road Grain Mandi Jangla Village Lahore	9.5	10.5	17	19	22	24	26	30	40	51	62	72	83
8	Village Takia Tali Per near Multan Road Lahore	9.8	11	18	20	22	23	26	31	40	50	59	67	78
9	Well Mosque Wala of Village Khizarabad Multan Road Lahore	8.9	10	17	19	21	24	27	30	39	51	5	63	74
10	Tube Well Tuffail Road Saddar Bazar Lahore Cantt	14	15	25	30	36	43	50	60	72	85	100	114	125
11	Gurumanget Tube Well Gulberg – III Lahore	14	15.5	27	32	40	48	53	63	73	83	97	113	130

perception in common Indian's mind that Neutral Expert can't award decision against India & even if decision comes against India's interest then they will not act upon the decision just like they are not obeying United Nations (U.N) resolutions of plebiscite on Kashmir.

CONCLUSIONS

a) Pakistan interests vis-a-vis treaty must be safe guarded.
b) To compensate low flow in River Ravi, water should be augmented from River Chenab to River Ravi up stream of city of Lahore, Rather than via upper Chenab canal. As a result it would be possible to increase flow condition in River Ravi which will help in recharging of ground water table.
c) To safe guard River Ravi from environmental problems it is strongly recommended that IWT should be reconsider and India should be bound to release at least that much amount of water which should not leave adverse impacts on environment.
d) Regional Environmental Impact Assessment of River Ravi and Sutlej should be conducted under the supervision of international organization like World Bank. Objective of this study should be broad in which problems which are caused due to low flow should be highlighted, so that consequently environmental problems be reduced which Pakistan is facing due to low flow condition.
e) Arrangements should be made to re-charge ground water aquifer beneath city of Lahore. For which artificial ground water recharge arrangements can be made in which inundation can be made towards North and Western sides of Lahore from water of BRBL Canal and upper Chenab Canal.
f) Flow should be increased and sewage should be treated so that dilution ratio should be 1:10. This will promote recreational activities and give rise to esthetic look of River Ravi.
g) Improved water flow condition will give rise to many fields e.g:-
    - It will promote fish production.
    - It will improve health conditions.
    - It will promote swimming in fresh water.
    - It will increase agriculture production.

- It will improve ground and surface water quality.
- It will decrease water borne diseases.

h) There is no example in World where full right of any river has been given to one country. This is the biggest flaw in this treaty that this treaty was signed without conducting Environmental Impact Assessment and without providing compensation to those parameters which are affected due to low flow conditions. This treaty is flawed, according to environmental engineering \management point of view.

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