

**LEVERAGING INTERNATIONAL LAW TO HELP ARSENIC
MITIGATION EFFORTS IN BANGLADESH**

TURHAN F. SARWAR*

TABLE OF CONTENTS

1.	INTRODUCTION.....	844
2.	SHORTCOMINGS IN CURRENT ARSENIC MITIGATION EFFORTS.....	849
	2.1. <i>High-Level Reasons for Lack of Progress</i>	850
	2.2. <i>Issues with the Government Response</i>	854
	2.2.1. <i>An Outdated Standard for Arsenic Contamination</i>	854
	2.2.2. <i>Plans, Policies, and Other Unenforced Suggestions</i>	855
	2.2.3. <i>Lack of a Unified Groundwater Act</i>	858
	2.2.4. <i>Complications in Implementing Alternative Water Sources</i>	861
	2.3. <i>The Ignored Problem: Soil</i>	867
3.	OBSTACLES TO RELYING ON SURFACE WATER.....	870
	3.1. <i>Difficulty of Securing Surface Water Through Treaty Negotiation</i>	871
	3.1.1. <i>Impact of the 1996 Ganges Treaty on Subsequent Treaties</i>	874
	3.1.2. <i>Oversights and Flaws in the 1996 Ganges Treaty</i>	876
	3.1.3. <i>Overwhelming Effects of Bargaining Inequity</i>	881
	3.1.4. <i>Insufficiency of Bilateral Treaties</i>	886
	3.2. <i>India's Inter-Basin Water Transfer Project and Upstream Dams</i>	889
4.	SECURING MORE SURFACE WATER.....	893
	4.1. <i>Stopping the IBWT Project</i>	894

* Production Editor, University of Pennsylvania Law School Journal of International Law, Vol. 32. J.D. Candidate, University of Pennsylvania Law School, 2011.

844	<i>U. Pa. J. Int'l L.</i>	[Vol. 32:3
	4.1.1. <i>Securing an International Forum</i>	894
	4.1.2. <i>Protections Under the 1996 Ganges Treaty</i>	895
	4.1.3. <i>Regulation of International Rivers and Recent Trends</i>	898
	4.2. <i>Independent Surface Water Augmentation Plans</i>	904
5.	CONCLUSION	907

1. INTRODUCTION

Bangladesh is a lower riparian nation located in the Ganges Delta of the Indian subcontinent. It faces staggering challenges in its attempts to provide a burgeoning population¹ with sanitary water for consumption and agriculture. Despite the abundance of freshwater in the region in the form of surface water² and groundwater, Bangladesh faces significant obstacles in leveraging these resources.³ Part of the reason is historical. British colonial rulers did little to develop water resources in East Bengal and this neglect has proved difficult to surmount.⁴

Due to its location at the mouth of a 1560-mile (2510-kilometer) river basin⁵ settled by over 350 million people,⁶ Bangladesh has

¹ In 2009, Bangladesh's population increased by 1.4% to over 162 million people. *Population, Total*, WORLD BANK, <http://data.worldbank.org/indicator/SP.POP.TOTL> (last visited Mar. 15, 2011); *Population Growth (Annual %)*, WORLD BANK, <http://data.worldbank.org/indicator/SP.POP.GROW> (last visited Mar. 15, 2011).

² Approximately 230 rivers are scattered throughout the country. FOOD & AGRIC. ORG. OF THE UNITED NATIONS, *IRRIGATION IN ASIA IN FIGURES 49* (1999). Bangladesh has an average annual surface water flow of about 1073 million acre feet; approximately 93% of this water comes from India via rivers, and the remaining 7% comes from rainfall. *Surface Water*, BANGLAPEDIA: NATIONAL ENCYCLOPEDIA OF BANGLADESH, http://bpedia.org/S_0614.php (last visited Mar. 15, 2011). See generally *Water Profile of Bangladesh*, ENCYCLOPEDIA OF EARTH (Mar. 30, 2007, 8:34 PM), http://www.eoearth.org/article/Water_profile_of_Bangladesh.

³ Bangladesh possesses natural resources in quantities that typically correlate to agricultural abundance and prosperity, but, as one observer puts it, this seems merely a "cruel paradox" in the face of the country's extreme poverty. Tauhidul A. Khan, *Management and Sharing of the Ganges*, 36 NAT. RESOURCES J. 455, 458 (1996).

⁴ See *id.* at 459 (noting, as an example, the failure of British colonial rulers to develop infrastructure enabling irrigation).

⁵ *Ganges River*, ENCYCLOPEDIA BRITANNICA, <http://www.britannica.com/EBchecked/topic/225359/Ganges-River> (last visited Mar. 15, 2011).

⁶ G. TYLER MILLER & SCOTT SPOOLMAN, *LIVING IN THE ENVIRONMENT: PRINCIPLES, CONNECTIONS, AND SOLUTIONS* 538 (16th ed. 2009) (discussing pollution

surface water that is teeming with harmful microorganisms and other pollutants. Floods are a major contributor to this pollution. Around 70% of Bangladesh's surface is underwater during the monsoon season, between June and September.⁷ The monsoons, aside from destroying crops and property, effectively render the country a "connected sewer."⁸ Because of limitations in Bangladesh's sanitation and healthcare infrastructures—as well as the sheer density of the population⁹—unsafe surface water conditions are not dealt with prior to public consumption, resulting in widespread illness and death. In the 1970s, nearly 250,000 children in Bangladesh died each year from waterborne diseases.¹⁰

Another major obstacle to delivering clean surface water is its inconsistent availability. There is a tremendous disparity between the amount of water available during the monsoon season and the dry season.¹¹ The water diversion practices of Bangladesh's upper riparian neighbor, India, are a partial cause; by controlling the flow of the Ganges at the Farakka Barrage, India allows—some claim—too much water to flow into Bangladesh during the monsoon season and too little during the dry season.¹² These practices

of the Ganges river basin in the context of India and stating "[a]bout 350 million people—almost one-third of [India's] population—live in the Ganges River basin. Very little of the sewage produced by these people and by the industries of 29 large cities in the basin is treated").

⁷ ANDREW A. MEHARG, *VENOMOUS EARTH: HOW ARSENIC CAUSED THE WORLD'S WORST MASS POISONING* 5 (2005).

⁸ *Id.* at 6.

⁹ See Khan, *supra* note 3, at 458 ("The population pressure in Bangladesh is greater and the occupation of the flood plains more intense than in India and Nepal in the Ganges basin. Thus, flood damage and distress is significantly higher in Bangladesh . . .").

¹⁰ *Statement on TVNZ Sunday Programme*, UNICEF N.Z. (Aug. 9, 2010), <http://www.unicef.org.nz/article/1528/StatementonTVNZSundayprogramme.html>; Andrew Buncombe, *How the West Poisoned Bangladesh*, INDEPENDENT (Mar. 21, 2010), <http://www.independent.co.uk/news/world/asia/how-the-west-poisoned-bangladesh-1924631.html>.

¹¹ Because of the flow disparity between the floods in the monsoon season and the drought during the dry season, Bangladesh's manageable surface water resources are thought to be 80% of the dependable flow in March during the pre-monsoon season. FOOD & AGRIC. ORG. OF THE UNITED NATIONS, *supra* note 2, at 49; see also *Bangladesh*, AQUASTAT, <http://www.fao.org/nr/water/aquastat/countries/bangladesh/index.stm> (last visited Mar. 15, 2011) (providing additional statistics about the impact seasonal change has on surface water resources in Bangladesh).

¹² See FOOD & AGRIC. ORG. OF THE UNITED NATIONS, *supra* note 2, at 49 (noting that the "dam was a source of tension between the two countries, with

adversely affect Bangladesh's attempts at effective water management. The practices do not simply deprive Bangladesh of surface water for agriculture; they also have significant ecological, economic, and health effects.¹³

The region's groundwater resources, unfortunately, provide little respite. The Bangladesh government, with the help of international organizations, attempted to alleviate water provision problems by introducing a solution which utilized its plentiful groundwater resources. In the early 1970s, the United Nations Children's Fund ("UNICEF") encouraged the Bangladesh government and NGOs to install approximately 900,000 groundwater-extracting devices called tube-wells throughout Bangladesh.¹⁴ Initially this program appeared successful: illness due to waterborne diseases dropped drastically and the infant mortality rate was halved from 1990 to 1996.¹⁵ The Bangladeshi people traded their dependence on water from upstream rivers and ponds to dependence, instead, on groundwater. Currently it is estimated that there are more than 10 million tube-wells in rural Bangladesh—one tube-well per 11 people.¹⁶

Unfortunately, it was discovered—first in 1978,¹⁷ then confirmed by scientists in 1983,¹⁸ and then brought to world attention in 1993 by the Bangladesh Department of Public Health and Engineering in Dhaka¹⁹—that groundwater from these tube-wells was tainted with geogenic (naturally occurring) arsenic.²⁰

Bangladesh asserting that the dam held back too much water during the dry season and released too much water during monsoon rains").

¹³ See generally Nahid Islam, *Indo-Bangladesh Common Rivers: The Impact on Bangladesh*, 1 CONTEMP. S. ASIA 203 (1992) (discussing, *inter alia*, the extensive effects of India's Farakka Barrage project on the environment and economy of Bangladesh).

¹⁴ *Statement on TVNZ Sunday Programme*, *supra* note 10.

¹⁵ MEHARG, *supra* note 7, at 7.

¹⁶ *Statement on TVNZ Sunday Programme*, *supra* note 10.

¹⁷ MEHARG, *supra* note 7, at 7.

¹⁸ *Id.*

¹⁹ *Id.* at 14.

²⁰ A lawsuit by a Bangladeshi man was filed in British High Court accusing the British Geological Survey ("BGS") of gross negligence when it conducted research for the UN tube-well drilling operation and failed to discover the arsenic contamination. Alastair Lawson, *Bangladesh Arsenic Case Begins*, BBC NEWS, Mar. 25, 2003, http://news.bbc.co.uk/2/hi/south_asia/2886079.stm (reporting on the commencement of legal proceedings). The court ultimately found in favor of BGS. *Bangladesh Man Loses Arsenic Case*, BBC NEWS, July 5, 2006, http://news.bbc.co.uk/2/hi/south_asia/5150210.stm. This outcome was likely positive for

This longstanding issue has drawn gradually increasing attention in the world arena.²¹

By drinking the groundwater—and by cooking and growing crops with it—Bangladesh suffers a slow, Napoleonic demise. Long-term exposure to arsenic “causes cancer of the skin, lungs, urinary bladder, and kidney, as well as other skin changes such as pigmentation changes and thickening (hyperkeratosis).”²² It is estimated that between 46²³ and 70²⁴ million people are currently drinking water that contains more than 10 micrograms per liter of arsenic, which is the provisional World Health Organization (“WHO”) guideline value of acceptable arsenic consumption.²⁵ Further, it is estimated that between 35 and 77 “million people in

Bangladesh; holding entities like the BGS liable for negligence in this type of situation probably serves as a disincentive for international organizations considering investment in Bangladesh water management.

²¹ Bangladesh Government and UN officials published a report on March 22, 2010 calling for “urgent action to tackle what remains a huge problem of contamination, both from drinking water and from crops such as rice that are irrigated with contaminated water.” Buncombe, *supra* note 10. Prior to this, the crisis had not been *ignored*, per se, but had received, at best, scattered (though impassioned) coverage. See, e.g., *Arsenic-Polluted Well Water Threatens Bangladesh Villagers*, N.Y. TIMES, Aug. 7, 1997, at A13, available at <http://www.nytimes.com/1997/08/07/world/arsenic-polluted-well-water-threatens-bangladesh-villagers.html> (revealing the havoc wreaked on individual families by the wells containing arsenic-contaminated water); Barry Bearak, *Bangladeshis Sipping Arsenic as Plan for Safe Water Stalls*, N. Y. TIMES, July 14, 2002, available at <http://www.nytimes.com/2002/07/14/world/bangladeshis-sipping-arsenic-as-plan-for-safe-water-stalls.html> (describing the lethal, unintended consequences of the tube-well plan); Barry Bearak, *Death by Arsenic: A Special Report; New Bangladesh Disaster: Wells that Pump Poison*, N.Y. TIMES, Nov. 10, 1998, at A1, available at <http://www.nytimes.com/1998/11/10/world/death-by-arsenic-a-special-report-new-bangladesh-disaster-wells-that-pump-poison.html> (reporting on the horrors caused by the poisonous wells); John Vidal, *Deadly Waters*, GUARDIAN, May 8, 2003, <http://www.guardian.co.uk/science/2003/may/08/science.highereducation> (detailing the circumstances surrounding the mass arsenic poisoning); David Rohde & Julfikar Ali Manik, *The Lethal Water Wells of Bangladesh*, N.Y. TIMES, July 17, 2005, <http://query.nytimes.com/gst/fullpage.html?res=9C04EFD9103CF934A25754C0A9639C8B63> (highlighting the perniciousness of the contaminated wells).

²² *Arsenic in Drinking Water, Fact Sheet N°210*, WORLD HEALTH ORG. (last revised May 2001), available at http://www.knowledgebank.irri.org/factsheetsPDFs/Health_and_Nutrition/whoFS_arsenic.pdf.

²³ Seth H. Frisbie et al., *The Concentrations of Arsenic and Other Toxic Elements in Bangladesh's Drinking Water*, 110 ENVTL. HEALTH PERSP. 1147, 1152 (2002).

²⁴ *An Interview with Mahmuder Rahman: Bangladesh's Arsenic Agony*, 86 BULL. WORLD HEALTH ORG. 11, 11 (2008) [hereinafter *Rahman Interview*].

²⁵ *Arsenic in Drinking Water, Fact Sheet N° 210*, *supra* note 22.

Bangladesh have been *chronically* exposed to increased concentrations of arsenic through drinking water” since the 1970s,²⁶ and that approximately 21% of the “all-cause” deaths in Bangladesh are associated with arsenic contamination.²⁷

Thus, Bangladesh is faced with a tremendous dilemma in its attempts to provide water to its population. It must decide upon some combination of relying on surface water and relying on groundwater. Neither type can be comfortably relied upon. Reliance on surface water is hampered by biohazards and pollutants deposited locally and upstream. It is also restricted by weeks of little to no water during drought seasons. Reliance on groundwater, meanwhile, has lethal implications due to arsenic.

This Article will not argue that either option is wholly better than the other. Nor will it attempt to decide what precise proportion of surface water and groundwater is ideal.²⁸ Instead, it will examine why Bangladesh cannot merely rely upon groundwater, and then consider the feasibility of ensuring a constant quantity of surface water for Bangladesh by utilizing international law.

Future attempts at ensuring sufficient and sanitary water delivery will fail unless—in conjunction with the policy articulated in Bangladesh’s 2004 National Policy for Arsenic Mitigation (specifically, a “preference to surface water over groundwater as source for water supply”²⁹)—Bangladesh leverages international law to limit the damming practices of its upper riparian neighbors and actively pursues an internal water augmentation plan to ensure a constant availability of surface water. This will ease the pressure on the dual goals of purifying arsenic-tainted groundwater and weaning the population off of groundwater in cases where a long-term purification solution cannot be implemented.

In Part 2, this Article will (1) examine the government’s attempts at arsenic mitigation and (2) note potential shortcomings

²⁶ Maria Argos et al., *Arsenic Exposure from Drinking Water, and All-Cause and Chronic-Disease Mortalities in Bangladesh (HEALS): A Prospective Cohort Study*, 376 LANCET 252, 252 (2010) (emphasis added).

²⁷ *Id.* at 255.

²⁸ In 1999, UNICEF published a report very reasonably stating that “[a] balanced package of interventions, that uses safe surface, ground and rain water sources as dictated by the local situation will ultimately be the most appropriate solution.” MEHARG, *supra* note 7, at 178 (quoting the 1999 UNICEF report).

²⁹ National Policy for Arsenic Mitigation, §5.2.2 (2004) (Bangl.).

in these efforts. This Article will establish that relying on the current methods to mitigate the arsenic problem—i.e. finding safe, often groundwater-based alternative water sources or espousing arsenic purification processes—are insufficient because they fail to address the looming issue of increasingly contaminated soil. Part 2 will discuss difficulties in improving water *quality* and argue that Bangladesh will need to take more active steps if it truly intends to reestablish the population's reliance on surface water.

Part 3 will explore the difficulties of transitioning back to surface water from the perspective of *quantity*. It will (1) highlight the difficulties of negotiating for more water from its upper riparian neighbors by reviewing how the 1996 Treaty on Sharing of the Ganges Waters at Farakka³⁰ ("Treaty" or "Ganges Treaty")—the region's sole river treaty—was secured and (2) identify the dangers of upper riparian plans such as the upcoming India Inter-Basin Water Transfer ("IBWT") Project, which will increase the burden on the already strained surface water resources in Bangladesh.

Section 4 will attempt to outline the ways in which Bangladesh might secure a larger and more constant flow of water. It will (1) examine the upper riparian obligations of India that arise from the Ganges Treaty, which limits India's ability to divert more water from the Ganges, (2) explore the ways broader international law concepts might help Bangladesh in its attempts to prevent more surface water loss, and (3) argue in favor of surface water augmentation projects like the stalled Ganga Barrage.

2. SHORTCOMINGS IN CURRENT ARSENIC MITIGATION EFFORTS

The response to the arsenic crisis by the national government and international aid organizations has been called, by one observer, "in the main, ineffective."³¹ It is difficult to argue otherwise, given the number of Bangladeshis still drinking, cooking with, and farming with arsenic-tainted water. This section will first attempt to identify high-level reasons for this lack of progress; then it will catalogue the Bangladesh government's response to the crisis.

³⁰ See generally Treaty Between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Sharing of the Ganga/Ganges Waters at Farakka, Bangl.-India, Dec. 12, 1996, 36 I.L.M. 519 (1997) [hereinafter 1996 Ganges Treaty].

³¹ MEHARG, *supra* note 7, at 21.

2.1. High-Level Reasons for Lack of Progress

Despite significant investment from outside entities, large-scale projects in Bangladesh seem to stagnate. Andrew Meharg points to spending patterns in borrowed money from the World Bank as an indicator of this phenomenon.³² In particular, he points to a \$34 million interest-free loan that was granted in 1998 to fight the arsenic crisis.³³ This was the Bangladesh Arsenic Mitigation Water Supply Project (“BAMWSP”),³⁴ a \$44 million project³⁵ whose development objective was to “reduce mortality and morbidity in rural and urban populations caused by arsenic contamination of groundwater using sustainable water supply, health, and water management strategies.”³⁶ By 2000, only \$2 million were spent, all on committees and consultants; by 2004, only \$6 million were spent.³⁷ While the failure to spend is hardly a definitive indicator of project failure (given that this does not take into account the actual accomplishment of the project’s goals), evidently *some* aspect of this massive project malfunctioned.

The World Bank’s own evaluation of this project also indicates a less than stellar performance, though it is not as grim in its

³² See *id.* (describing a representative stalled aid program in Bangladesh and its related spending).

³³ *Id.*

³⁴ See generally RURAL DEV. SECTOR UNIT, WORLD BANK, S. ASIA REGION, PROJECT APPRAISAL DOCUMENT FOR A PROPOSED CREDIT IN THE AMOUNT OF SDR 24.2 MILLION EQUIVALENT TO THE PEOPLE’S REPUBLIC OF BANGLADESH FOR A ARSENIC MITIGATION WATER SUPPLY PROJECT, Report No. 18252-BD (1998) (providing a detailed overview of the BAMWSP project, including a brief description of key interventions that the project will support, such as on-site mitigation, improved understanding of the arsenic problem, and strengthening of implementation capacity).

³⁵ This figure includes contributions from sources beyond the World Bank coffers, including the Bangladesh Government and foreign financiers. *Id.* at 3.

³⁶ ENV’T & WATER RES. UNIT, WORLD BANK, S. ASIA REGION, IMPLEMENTATION COMPLETION AND RESULTS REPORT ON A CREDIT IN THE AMOUNT OF SDR 24.2 MILLION (US\$ 44.4 MILLION EQUIVALENT) TO BANGLADESH FOR ARSENIC MITIGATION WATER SUPPLY, Report No. ICR000028, at iii (2007) [hereinafter BAMWSP RESULTS]. The project, among other things, was responsible for painting shallow tube-wells red, testing groundwater for arsenic for inclusion in a national database, and installing a variety of alternative water sources for villagers: 9,272 deep tube-wells, 300 rainwater harvesting systems, 393 dug wells, and 1 piped water supply system. *Id.* at iii-v.

³⁷ MEHARG, *supra* note 7, at 21.

evaluation. BAMWSP was deemed “moderately satisfactory” in a 2007 evaluation,³⁸ despite negative initial evaluations.³⁹

This positive grade might be appropriate; the project *did* experience a burst of successful spending activity in its later years.⁴⁰ However, critics might note that the project’s “success” included a considerable reframing of its objectives, which involved a removal of health activities to another World Bank project which never came to fruition, four extensions of the grant closing date, and two grant cancellations (due to slow performance and unutilized credit, respectively).⁴¹ In short, the “moderately” good grade seems predicated on changing the curve.

Other World Bank projects devoted to helping Bangladesh with water management have had even less luck than BAMWSP. One example is the 1996 Fourth Dhaka Water Supply Project (“FDWSP”),⁴² which was deemed “unsatisfactory” upon review⁴³ and prematurely cancelled after \$50.6 million of an \$80.3 million grant had already been spent.⁴⁴ Another example is the Bangladesh Water Supply Program Project (“BWSPP”), the 2004 follow-up project to BAMWSP, which involved a \$40 million dollar grant.⁴⁵ BWSPP, much like BAMWSP, stagnated in its early stages,

³⁸ BAMWSP RESULTS, *supra* note 36, at i.

³⁹ *Id.* at 8 (“Over a 2½-year period (December 1999 to December 2000; June 2002 to December 2003), the project was rated ‘unsatisfactory’ for implementation.”).

⁴⁰ *Id.* at vi.

⁴¹ *Id.* at 3–4.

⁴² WORLD BANK, S. ASIA REGION, IMPLEMENTATION COMPLETION REPORT ON A CREDIT IN THE AMOUNT OF SDRS 51.0 MILLION (US \$80.3 MILLION EQUIVALENT) TO THE PEOPLE’S REPUBLIC OF BANGLADESH FOR A FOURTH DHAKA WATER SUPPLY PROJECT, Report No. 25247, at 1 (2002) [hereinafter FDWSP IMPLEMENTATION] (describing project results and data from the Fourth Dhaka Water Supply Project).

⁴³ The \$175.8 million project was intended, among other things, “to start institutional reforms to enhance the efficiency of the water and sanitation sector in Dhaka by putting it on a commercial basis, and preparing a strategy for greater private sector participation.” *Id.* at 5. This objective was not met, “even though the project’s major physical works were completed satisfactorily, below budget and ahead of time, and a number of positive aspects concerning DWASA’s institutional development were achieved.” *Id.*

⁴⁴ *Id.* at 28–29.

⁴⁵ WORLD BANK, BANGLADESH WATER SUPPLY PROGRAM PROJECT PROPOSAL TO RESTRUCTURE, No. 45616, at 1 (2008) [hereinafter BWSPP RESTRUCTURE].

with only \$1 million of the credit disbursed during its first three years.⁴⁶

Examining these projects suggests that at least part of the problem arises from within the Bangladesh government itself.⁴⁷ A cynical explanation is that government officials in Bangladesh are corrupt, ineffective, or uncaring.⁴⁸ Alternatively, one may posit that the politicians have their hands tied as a result of political instability and rapid party-control turnover. Any attempt to counter this effect—via, for example, government measures that preserve project-related job security and provide funding resistant to political turmoil or via a results-based reward/job-security system that forces individual interests to coincide with project interests by disincentivizing funding misallocations, corruption, or blithe ineffectiveness—might be predicated on an unrealistic hope for non-partisan entities being effective in a highly partisan political climate.

Meharg also points to overwhelming health issues on the government's plate, such as AIDS, tuberculosis, malaria, diarrhea, and malnutrition, as a reason for the ineffectiveness of large-scale efforts; as he puts it, "arsenic is just another entry on a long list of killers."⁴⁹ The intrinsically challenging situation is further complicated by the Bangladesh government's need to rely on external aid to resolve *any* public health problems.⁵⁰ When one

⁴⁶ BAMWSP RESULTS, *supra* note 36, at 8 ("[BWSPP] is in the same position in which BAMWSP was in its early years, with extremely slow progress made thus far, and only US\$1 million of the credit disbursed after nearly three years."). In 2007, the project was ultimately swept away as a priority by two devastating floods and Cyclone "SIDR." BWSPP RESTRUCTURE, *supra* note 45, at 2. It has since been significantly restructured to include funding reallocation for building water supplies for flood and cyclone victims and less ambitious goals in the area of rural piped water supply and municipal water supply. *See id.* at 4-7 (describing changes in scope and ambition for the project components).

⁴⁷ FDWSP IMPLEMENTATION, *supra* note 42, at 6 ("[M]aybe because the program of change was never fully owned by the Bangladeshi agencies concerned, watered-down compromises were often the best that could be achieved during implementation.").

⁴⁸ *See* Asadullah Khan, *The Looming Water Crisis*, DAILY STAR (Bangl.), May 16, 2009, <http://www.thedailystar.net/newDesign/news-details.php?nid=88351> ("The past governments were largely to blame for their failure to assess the gravity of the situation and curb siphoning of groundwater. And the present Al-led government that came to power with some firm pledges must not indulge in lip-service but get into action.").

⁴⁹ MEHARG, *supra* note 7, at 19.

⁵⁰ *See* Allan H. Smith et al., *Contamination of Drinking-Water by Arsenic in Bangladesh: A Public Health Emergency*, 78 BULL. WORLD HEALTH ORG. 1093, 1096-97

combines these factors with logistical concerns not unique to Bangladesh (such as underdeveloped communication and transportation systems), it is perhaps not surprising that the government and established, oft-effective organizations such as the WHO find it difficult to educate the community,⁵¹ enact intervention programs,⁵² or act “at all levels.”⁵³ This is unfortunate given that, “in contrast to diseases like malaria, cholera and tuberculosis, which require a more complex public health response, the response to arsenic contamination is clear-cut: provide arsenic-free water.”⁵⁴

Mahmuder Rahman, a physician and expert on the arsenic crisis, who has spent considerable time helping the Bangladesh government tackle the problem,⁵⁵ points in frustration to the more general explanation of *systemic misdirection* in mitigation attempts. Too much effort, he notes, is being put into developing short-term alternative safe water sources.⁵⁶ Additionally, solutions are being implemented without a proper understanding of Bangladesh’s “geography, culture, and pattern of water use.”⁵⁷ He points to a failure to consider the total water resources of the country – among them, surface water:

Most of these experts come with the preconceived idea that dug wells and surface water are totally polluted with bacteria, but they forget that with simple and affordable technology these water supplies can be made safe and can play a major part in mitigation of this major problem.⁵⁸

(2000) (summarizing the panoply of challenges organizations in Bangladesh face in dealing with health crises and discussing short term strategies to address arsenic poisoning).

⁵¹ *Id.*

⁵² *Id.*

⁵³ See *Arsenic in Drinking Water, Fact Sheet No 210*, *supra* note 22 (“The poor availability of reliable information hinders action at all levels and may lead to panic, exacerbated if misleading reports are made. Effective information channels have yet to be established to those affected and concerned.”)

⁵⁴ Smith et al., *supra* note 50, at 1097.

⁵⁵ Rahman took a leading role in the formulation of Bangladesh’s National Arsenic Mitigation Policy. *Rahman Interview*, *supra* note 24, at 11.

⁵⁶ *Id.* at 11–12.

⁵⁷ *Id.*

⁵⁸ *Id.*

Given the immense number of contributing reasons, it is easy to come up with explanations of why efforts have been mired in setbacks. Unfortunately, good data on *which* contributing reasons have the most “miring” effects are sparse or non-existent. Thus, the question of how to speed up efforts is more difficult.

2.2. *Issues with the Government Response*

The Bangladesh government has generated internal policies attempting to consolidate and streamline the arsenic mitigation process. Given the stagnation established in the previous section, it is unclear whether these policies are working. This section will explore the ways in which Bangladesh’s policies might be ill-designed for the task of arsenic mitigation.

2.2.1. *An Outdated Standard for Arsenic Contamination*

First, many of the policies enacted in Bangladesh operate on the assumption that arsenic contamination should be prevented when it is above the Bangladesh National Standard⁵⁹ of 50 parts per billion (“ppb”).⁶⁰ This standard is mentioned in the 2004 National Policy for Arsenic Mitigation⁶¹ and the 2004 Implementation Plan for Arsenic Mitigation in Bangladesh (“IPAMB”).⁶²

This is an obsolete standard. The International Standards for Drinking-Water originally established 0.20 mg/L as an allowable concentration for arsenic in 1958.⁶³ In 1963, the standard was re-evaluated and reduced to 0.05 mg/L.⁶⁴ In 1984, this was used as WHO’s “Guideline Value,” spurring many countries to use this as a national standard or as an interim target.⁶⁵ Meharg suggests that the revised 0.05 mg/L standard arose from an early 1900s European measurement for survivable quantity of *acute* exposure to arsenic, not *chronic*.⁶⁶

⁵⁹ Environment Conservation Rules 1997, sched. 3 (Bangl.) (setting the national arsenic standard at .05 mg/L); *see also* Environment Conservation Act 1995 (Bangl.).

⁶⁰ National Policy for Arsenic Mitigation § 1.1 (2004) (Bangl.).

⁶¹ *Id.*

⁶² Implementation Plan for Arsenic Mitigation in Bangladesh § 1 (2004).

⁶³ *Arsenic in Drinking Water, Fact Sheet N^o 210*, *supra* note 22.

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ MEHARG, *supra* note 7, at 11.

The last edition of the WHO Guidelines for Drinking-Water Quality—established in 1993—changed the concentration to 0.01 mg/L or 10 ppb.⁶⁷

The Bangladesh government designs its processes for an estimated 30 million people who are drinking water that contains more than 50 mg/L arsenic.⁶⁸ As noted before, up to 70 million people—an additional 40 million, over double the government's target—are drinking water that contains more than the WHO guideline.⁶⁹

In order to properly address its arsenic crisis, Bangladesh should update its standard. It is currently directing the entirety of its arsenic mitigation projects to a fraction of those who are in danger of suffering from chronic arsenic poisoning.

2.2.2. *Plans, Policies, and Other Unenforced Suggestions*

Another potentially crippling characteristic of Bangladesh's water management policies is that they are nonbinding and, from a practical perspective, judicially unenforceable. The documents which direct Bangladesh's arsenic mitigation efforts—National Water Policy of 1999,⁷⁰ National Water Management Plan of 2001,⁷¹ National Policy for Arsenic Mitigation of 2004, and the IPAMB⁷²—are essentially *guidelines*. To date, there is no enforceable statute that imposes any consequences upon local governments—or other entities implementing arsenic mitigation technologies—for failing to follow them.⁷³ The policies primarily prescribe the formation of

⁶⁷ *Arsenic in Drinking Water, Fact Sheet N^o 210, supra* note 22.

⁶⁸ *Rahman Interview, supra* note 24, at 11.

⁶⁹ *Id.*

⁷⁰ Bangladesh's National Water Policy aims at providing direction to all agencies working with the water sector and sets for them objectives. It is not an Act and has no attached or specified form of enforcement. *See generally* National Water Policy (1999) (Bangl.).

⁷¹ The National Water Management Plan is a framework plan with the objective of "rationalising and decentralising management of the sector." 1 National Water Management Plan, at i (2001) (Bangl.). Line agencies and other organizations are expected to plan and implement their own activities in a coordinated manner "in line with" the plan. *Id.* at iii.

⁷² This document arises directly from the National Policy for Arsenic Mitigation. "An implementation plan shall be prepared which will provide the operational framework for arsenic mitigation activities in the country." National Policy for Arsenic Mitigation § 10.2 (2004) (Bangl.).

⁷³ ASIAN DEV. BANK & WATER RES. PLANNING ORG. (Bangl.), VOLUME 1: FINAL REPORT AND ROADMAP, ADB RETA PROJECT NO. 39199: PROCESS DEVELOPMENT FOR

committees,⁷⁴ “suitable” regulatory schemes,⁷⁵ or “appropriate” regulatory measures.⁷⁶ Occasionally, some provisions of these documents are worded strongly and imply actual consequences in the event of violation: Section 3.2.5 of the IPAMB, for example, prohibits the installation of unapproved arsenic purification technologies without first getting clearance from a government committee responsible for ensuring their safety.⁷⁷ The plan states:

[A]ll agencies/companies/manufacturers must be made liable for any kind of failure of the unit, adverse affect to any user and environmental damages caused by the technology used. An agreement ensuring consumer protection and legal liability of the proponent should be made between the proponent and the validating agency.⁷⁸

Note, however, that despite its seeming strength, the language does not indicate that private entities will actually be held liable—because the plan is not a binding law it appropriately pushes the private entity to include in its contract a provision which subsequently may be taken to Bangladeshi courts for enforcement. Again, the lack of such a contract provision would technically not be legally problematic for an agency, company, or manufacturer.

PREPARING AND IMPLEMENTING INTEGRATED WATER RESOURCES MANAGEMENT PLANS 18, para. 64 (2009) [hereinafter ADB REPORT] (noting that while these policies “appear to promote participatory and sustainable development of the water sector” they “are not judicially enforceable . . . although they may guide and influence concerned ministries and agencies”).

⁷⁴ National Policy for Arsenic Mitigation § 6.1 (2004) (Bangl.) (“The Government shall form a high level committee or designate any such existing committee to oversee all activities, implementation programmes in accordance with this policy.”).

⁷⁵ *Id.* § 6.6 (“Groundwater being a natural resource, a suitable regulatory mechanism shall be in place to regulate all activities in relation to groundwater such as exploration, exploitation and management.”).

⁷⁶ The government “[s]hall formulate appropriate regulatory measures to ensure that all research on arsenic in the country whether by local or expatriate organisations or individual researchers are undertaken in a co-ordinated way and the results are shared with the government of Bangladesh or its designated agency . . .” *Id.* § 7.2.

⁷⁷ See Implementation Plan for Arsenic Mitigation in Bangladesh § 3.2.5 (2004) (“While the marketing of the removal options should be through the private sector the government shall . . . not allow marketing of any such technology without proper testing and validation from Bangladesh Council for Scientific and Industrial Research(BCSIR) [sic].”).

⁷⁸ *Id.*

The issue is straightforward: because courts cannot and do not mandate adherence to these national policies, it is unclear to what extent local statutes or committees—formed from these policies—can exercise power over water management activities.

This “toothlessness” on the national legal level does not, of course, wholly deprive the policies of value. For one thing, their advisory flavor is part of their design⁷⁹—the Bangladesh government perhaps realized that a centralized statute for water management would be logistically nightmarish, given the plethora and variance of water sanitation problems across regions of Bangladesh.⁸⁰

Further, their existence is a significant boon to mitigation efforts due to their relatively advanced level of detail. The implementation plans, in particular, seem designed to be operations manuals, bulked up with technological annexes⁸¹ and similar components aimed at being practically useful to local government officials.

Additionally, there is evidence that individual sections of these plans and policies play a role in directing the activities of the Bangladesh government and NGOs. Note, again, section 5.2.2 of the National Policy for Arsenic Mitigation, which directs organizations to “[g]ive preference to surface water over groundwater as source for water supply”⁸²—in accordance to this provision, the World Bank limited the number of deep tube-wells it installed for BAMWSP.⁸³ The suggestions are being adhered to on some level.

⁷⁹ 1 National Water Management Plan, at i (2001) (Bangl.) (stating that “the Plan is a framework plan within which line agencies and other organisations are expected to plan and implement their own activities in a coordinated manner”).

⁸⁰ This is reflected in the National Policy for Arsenic Mitigation which calls for a “[m]ove towards decentralised planning and delivery of safe water options and health services through the grass root level local government institutions” National Policy for Arsenic Mitigation § 6.4 (2004) (Bangl.).

⁸¹ See, e.g., Implementation Plan for Arsenic Mitigation in Bangladesh, Annex A, Annex B, Annex C (2004) (providing, lists of arsenic-prone upazilas, and guides for dug well and pond sand filter construction).

⁸² National Policy for Arsenic Mitigation § 5.2.2 (2004) (Bangl.).

⁸³ See BAMWSP RESULTS, *supra* note 36, at 3–4 (“As surface water was recommended as the sole arsenic-safe source in the National Arsenic Mitigation Policy, implementation of the deep tubewell option was permitted, as an exception, only in coastal areas . . .”).

But perhaps not enough. As one observer has noted, “water use laws of South Asia are rarely followed or enforced.”⁸⁴ There has been some movement towards the passage of an enforceable Water Act,⁸⁵ one that would translate the National Water Policy into law and “thereby ensure integrated management, development, and equitable utilization of the countries [sic] water resources.”⁸⁶ Such an Act was slated for completion in 2010⁸⁷ (and as yet, is not law). In the pipeline as well is a National Water Code whose purpose is to “assemble all of the various pieces of legislation to ensure consistency and synergy in application.”⁸⁸ It is unclear, however, whether either of these will be passed or will be effective when passed.

2.2.3. *Lack of a Unified Groundwater Act*

Bangladesh lacks a Groundwater Act. Because groundwater is used extensively for both consumption and agriculture—despite being poisoned—*some* type of regulation is needed, given how much is used and how much poison is contained therein.

As noted before, it is estimated that the country operates more than 10 million tube-wells.⁸⁹ This is a drastic increase from the 1960s, when Bangladesh used almost no groundwater.⁹⁰ The percent of land irrigated by groundwater (total irrigated land) rose from 4% in 1972 to 70% in 1999.⁹¹ By 2010, Bangladesh was

⁸⁴ John C. Peck & Burke W. Griggs, *Groundwater Law and Management: The Asia (IWRM)-Kansas Program*, 41 CREIGHTON L. REV. 315, 348 (2008).

⁸⁵ See generally Draft Bangladesh Water Act, 2008, available at <http://www.warpo.gov.bd/RETA/Draft%20BWA.pdf>; Draft Bangladesh Water Act, 2010, available at http://www.warpo.gov.bd/PDFs/Draft_BWA.pdf.

⁸⁶ *Summary of Regional Technical Assistance (RETA) Supporting IWRM (Bangladesh)*, WATER RESOURCES PLANNING ORGANIZATION, <http://www.warpo.gov.bd/RETA/Reta.html> (last visited Mar. 15, 2011) [hereinafter WARPO REGIONAL TECHNICAL ASSISTANCE WEBSITE]. WARPO is a Government agency under the Ministry of Water Resources that forms an apex body in the water sector that acts as a macro-level planning organization for integrated water resources management. WATER RESOURCES PLANNING ORGANIZATION, <http://www.warpo.gov.bd/index.htm> (last visited Mar. 15, 2011).

⁸⁷ WARPO REGIONAL TECHNICAL ASSISTANCE WEBSITE, *supra* note 86.

⁸⁸ *Id.*

⁸⁹ See *Statement on TVNZ Sunday Programme*, *supra* note 10.

⁹⁰ See Tushaar Shah, *The Groundwater Economy of South Asia: An Assessment of Size, Significance, and Socio-Ecological Impacts*, 15 KAN. J.L. & PUB. POL'Y 407, 408 (2006).

⁹¹ *Id.*

expected to have withdrawn 70–75 cubic kilometers of groundwater annually.⁹² Up to 94% of these tube-wells are privately owned and sunk without regulation or monitoring.⁹³

Observers have called for a Groundwater Act that would control exploration, development, and management of groundwater utilization.⁹⁴ Such an Act should, at minimum, limit tube-well drilling—a priority, given the present overabundance of unmonitored groundwater use noted above. Observers have noted that an ideal Groundwater Act would also take into account conservation considerations, ensuring adequate replenishment of underground aquifers and thus protecting wetlands, forests, and open fields.⁹⁵ This is not off of the Bangladesh government’s radar—a Groundwater Act was contemplated by the National Policy for Arsenic Mitigation⁹⁶ and the IPAMB.⁹⁷ Terms regulating groundwater were also articulated in the Bangladesh Draft Water Act of 2008.⁹⁸

Unfortunately, the lack of a Groundwater Act has led to grim groundwater conditions that exacerbate the arsenic problem in Bangladesh.⁹⁹ Unfettered and unregulated tube-well placement has led to water losses in channels and fields, inadequate drainage, insufficient conjunctive use of tube-wells, and extensive pollution (from agriculture and industry); these have led, in turn, to a permanent depletion of static groundwater levels (as much as three feet per year in Dhaka), rampant waterlogging, resource salinization, a sinking water table, skyrocketing pumping and irrigation costs, and, in urban areas, severe land subsidence.¹⁰⁰

⁹² See *id.* at 415 fig.6.

⁹³ MEHARG, *supra* note 7, at 7.

⁹⁴ See AFIFA RAIHANA & DR. A Z M IFTIKHAR HUSSAIN, SILENT KILLER IN ACTION 110 (2004) (listing management recommendations for groundwater usage).

⁹⁵ *Id.*

⁹⁶ See National Policy for Arsenic Mitigation § 6.6 (2004) (Bangl.) (stating that a “regulatory mechanism” would be implemented in order to oversee groundwater utilization).

⁹⁷ See Implementation Plan for Arsenic Mitigation in Bangladesh § 6.2 (2004) (stating that a Groundwater Act should be enacted to regulate all groundwater related activities).

⁹⁸ Draft Bangladesh Water Act, 2008, ch. VI, § 47, available at <http://www.warpo.gov.bd/RETA/Draft%20BWA.pdf> (setting forth conditions for the control and protection of groundwater).

⁹⁹ See Peck & Griggs, *supra* note 84, at 337 (citing the overexploitation of groundwater as a reason for high levels of arsenic contamination in Bangladesh).

¹⁰⁰ *Id.* at 331.

Troublingly, the solutes finding their way into humans from groundwater are not restricted to arsenic: aluminum, iron, zinc, and copper are also present in Bangladeshi groundwater.¹⁰¹ One study has estimated that *tens of millions* of Bangladeshis are drinking water with unsafe levels of manganese, boron, barium, chromium, molybdenum, nickel, lead, or uranium.¹⁰² In Dhaka, “[g]eogenic mineralization, combined with groundwater depletion and industrial pollution” has created “alarmingly” high concentrations of chromium, aluminum, and iron in drinking water.¹⁰³ Given that it is unclear what these poisons will do at these quantities over time,¹⁰⁴ a Groundwater Act seems extremely important for slowing the systematic and myriad poisoning of the Bangladeshi population.

John Peck and Burke Griggs note that India’s lack of support of a Groundwater Act stems in part from the complexity of “enforc[ing] a centralized regulatory regime on millions of private well owners.”¹⁰⁵ The case is precisely the same with Bangladesh. It might be wise, thus, to look to India’s example¹⁰⁶ for some guidance on how to structure internal policies regarding groundwater management.¹⁰⁷ However, the challenges India faces

¹⁰¹ See *id.* at 337 (listing solutes found in the groundwater of Bangladesh).

¹⁰² Frisbie et al., *supra* note 23, at 1152.

¹⁰³ Peck & Griggs, *supra* note 84, at 337.

¹⁰⁴ When arguing against dependence on groundwater, Rahman notes: “We do not want to risk bringing up other toxic material of which we have very little knowledge, such as boron. It’s only arsenic today, but we do not know what will come next.” *Rahman Interview*, *supra* note 24, at 11.

¹⁰⁵ Peck & Griggs, *supra* note 84, at 349.

¹⁰⁶ India has a Central Ground Water Authority that monitors groundwater contamination, regulates agencies involved in the construction of wells, reviews and authorizes groundwater projects, and promotes conservation measures such as rainwater harvesting. Officials are preparing a zoning atlas for the appropriate use of water depending upon region, a plan by which states will regulate the private market in water, and a plan to use satellite imagery to map groundwater. Peck & Griggs, *supra* note 84, at 349–50.

¹⁰⁷ Bangladesh, in conjunction with the Government of Denmark, is currently engaged in various “sub-projects” through its Policy Support Unit. One such project is a groundwater map project, which is in its infancy stages. See generally PROJECT SUPPORT UNIT, BANGL. MINISTRY OF LOCAL GOV’T, RURAL DEV. & COOP., CONCEPT NOTE ON NATIONAL GROUNDWATER DATABASE FOR WATER SUPPLY AND SANITATION IN BANGLADESH 2 (2009), available at http://www.psu-wss.org/images/pdf/psuSubProject/GroundWaterMapping/Concept%20Paper_PSU_GWM.pdf. Note how this is differently structured (necessarily) from projects we might see in India as this project incorporates significant resources and financial aid of an additional nation, a measure India does not necessarily need to take.

in the implementation of its water management plans are in some ways different from those faced by Bangladesh. India, for example, does not have to deal with the unilateral water diversion actions of a militarily and economically mighty upper riparian neighbor.

2.2.4. *Complications in Implementing Alternative Water Sources*

Successfully implementing alternative water sources in Bangladesh has proven difficult. The first major problem is that Bangladeshis still use shallow tube-wells despite the steps that the Bangladesh government took to wean the population off of groundwater. The second major problem is that there are numerous technological and cultural wrinkles in implementing alternative water sources that make the entire endeavor, due to the lack of a reasonable monitoring system, prone to failure.

2.2.4.1. *Painting Oneself into a Corner*

In response to the arsenic crisis, Bangladesh's government came up with a straightforward solution to wean people off of tube-wells. In conjunction with the World Bank,¹⁰⁸ it tested tube-wells across the nation and painted them green or red depending on whether they were safe (green) or unsafe (red).

This solution, however, was not effective. The primary problem was that the *bad* wells were not sealed off; water can still be drawn from them. Rahman explains that after some time, because of a lack of clean alternatives, people start to drink and use the water again.¹⁰⁹ Because arsenic is undetectable and causes no immediate symptoms, people—especially children—return to the poison.¹¹⁰ Meharg, in response to this issue, advocates destroying the wells—“[i]f villagers have to travel distances of hundreds of metres or more to obtain ‘green’ water,” he reasons, “they can be tempted to use the red pumps.”¹¹¹

Others have noted that, “[s]ince most of the tube[-wells] are privately owned, people are *moving* their red tube[-wells] and sinking” them elsewhere.¹¹² This understandably creates

¹⁰⁸ BAMWSP RESULTS, *supra* note 36, at iii-v.

¹⁰⁹ Rahman Interview, *supra* note 24, at 11.

¹¹⁰ *Id.*

¹¹¹ MEHARG, *supra* note 7, at 176.

¹¹² RAIHANA & HUSSAIN, *supra* note 94, at 31-32 (emphasis added).

confusion, since some red tube-wells are occasionally safe.¹¹³ To compound the problem, green tube-wells may exhibit variability in their arsenic content—after testing as safe, these tube-wells may and have become contaminated with arsenic after operation.¹¹⁴

Finally, it is noteworthy that individuals living in Bangladesh villages may not be familiar with the red/green signal concept; it is a foreign, Western notion, one that is sometimes unnoticed in a clearing during a long-desired water break.¹¹⁵

2.2.4.2. *Sustainability and Acceptability of Alternative Water Sources.*

The main alternative water supplies approved for use by the Bangladesh government—and promoted by policymakers as long-term solutions¹¹⁶—are dug wells, pond sand filters, rainwater harvesters, deep tube-wells, and a limited number of piped water schemes (using groundwater and sometimes surface water).¹¹⁷

Each of these technologies has their advantages and disadvantages, from the technological perspective or from the perspective of ease of integration into Bangladeshi life. For the most part, however, they seem ill-fit to serve as long-term solutions.

The Arsenic Policy Support Unit (“APSU”) conducted a survey of the status of water supplies installed in arsenic-affected communities. In addition to the above technologies, the study took into account older installations, such as arsenic-iron removal plants or shallow shrouded tube-wells.¹¹⁸ The study looked to see whether the solutions were sustainable. Various alarming findings were published.

The survey found that approximately 8.4% of the installations were missing.¹¹⁹ The following reasons for their absence were

¹¹³ *Id.*

¹¹⁴ *Id.*

¹¹⁵ *Id.*

¹¹⁶ *Id.* at 47.

¹¹⁷ Implementation Plan for Arsenic Mitigation in Bangladesh § 3.2.1–3.2.6 (2004).

¹¹⁸ See AHAMMADUL KABIR & GUY HOWARD, ARSENIC POLICY SUPPORT UNIT, THE SUSTAINABILITY OF ARSENIC MITIGATION INTERVENTIONS: A SURVEY OF THE FUNCTIONAL STATUS OF WATER SUPPLIES 1 (2006) (summarizing the scope of the APSU water supply survey).

¹¹⁹ *Id.* at 9.

proposed: misappropriation of funds,¹²⁰ inaccurate details provided by stakeholders when the technology was installed,¹²¹ or removal of installations because the community deemed them ineffective.¹²²

All three of these reasons appear to be problems that might be solved by better designed local laws that actually impose liability for engaging in fund misappropriation, inaccurate reporting from stakeholders, or removal—the type of thing that local governments do not necessarily have any incentive to enact as a result of soft national guidance.¹²³

The last of these reasons is particularly distressing, as it suggests that some lack of community acceptance, for whatever reason,¹²⁴ has led to active “disappearance” of government-installed solutions. Aside from this being a glaring example of poor government oversight, lack of acceptance suggests a society-level barrier to successful implementation of arsenic mitigation plans. Researchers at Dhaka University conducted a study of technology acceptance in three areas of Bangladesh—with varying quantities of installed arsenic technology—to examine the issue of this very type of barrier.¹²⁵

Before delving into the findings of these studies, it is important to note that a *separate survey* by APSU was needed to determine that these “disappearances” were occurring in the first place. The Bangladesh government did not have a centralized monitoring system in place at the time of the study; and it is unclear whether an effective centralized monitoring system is currently operating. The APSU suggested, when publishing its results, that sponsoring agencies supply Global Positioning System (“GPS”) coordinates for each water supply installation for entry into a database¹²⁶ and that

¹²⁰ *Id.* at 27.

¹²¹ *Id.*

¹²² *Id.*

¹²³ See discussion *supra* Section 2.2.2. (Bangladesh’s water management policies are non-binding and judicially unenforceable).

¹²⁴ These reasons may include a perception that the technology does not work, knowledge that it does not work, or a general reluctance to use the technology for cultural reasons.

¹²⁵ RAIHANA & HUSSAIN, *supra* note 94, at 9 (identifying the three studied regions—Pubail, Tilchandripur, and Araihasar—and describing the extent to which each region has seen contamination, arsenic mitigation intervention, and education regarding the problem).

¹²⁶ KABIR & HOWARD, *supra* note 118, at 27.

the government undertake periodic monitoring efforts utilizing this database. Research gives no indication that these recommendations were incorporated into government policy. It is also unclear that any such policy, if codified, has been enforced. Without change in the government's monitoring efforts, arsenic mitigation plans are bound to fail.

In its study, APSU found worrisome figures. Of all the surveyed technologies, only 64% of the water supply installations were functioning.¹²⁷ For the most part, the malfunctioning installations were either providing insufficient quantities of water for the intended population—numbers that were perhaps unrealistically¹²⁸ defined in the IPAMB¹²⁹—or actually suffered from broken components.¹³⁰ This latter explanation is perhaps predictable for pond sand filters and dug wells, both of which, by virtue of their low-lying design and use of shallow groundwater aquifers, are vulnerable to regular Bangladeshi flooding.¹³¹

Rainwater harvesters also suffered significant implementation problems. Utilizing Bangladesh's rain resources has been recommended by various observers,¹³² to the point of being considered "the solution" due to the fact that it is plentiful and safe.¹³³ But rainwater harvesters, according to APSU, seem to malfunction *the most* of all the recommended technologies; while this was a surprising find, it was attributed to lack of training regarding their use.¹³⁴

Afifa Raihana and A. Hussain, however, attribute rainwater harvesters' poor performance to users' social reluctance to use

¹²⁷ *Id.* at 10.

¹²⁸ *Id.* at 33 (pointing out the need for a more "realistic estimate of the number of families served by individual options").

¹²⁹ Implementation Plan for Arsenic Mitigation in Bangladesh § 3.3.1 (2004) (recommending that at least one safe water source be available for every 50 families).

¹³⁰ KABIR & HOWARD, *supra* note 118, at 11-14 (providing data regarding the quantity of arsenic mitigation installations that suffer from malfunctioning components).

¹³¹ MEHARG, *supra* note 7, at 177-78.

¹³² *Id.* at 179 (noting that home purification of collected rainwater was "widely touted" as a short term solution, with foreign aid helping to develop and advertise the technology).

¹³³ *But see* RAIHANA & HUSSAIN, *supra* note 94, at 115 (disagreeing with researchers who call rainwater "the solution" because the option is not socially acceptable).

¹³⁴ KABIR & HOWARD, *supra* note 118, at 29.

rainwater. Their study found an unusually low acceptability of rainwater with Bangladeshis.¹³⁵ Thus, the feasibility of its implementation seems hampered by the fact that it is not “socially acceptable.”¹³⁶

This lack of acceptability might very well be overcome if the Bangladesh government was to take stronger measures incentivizing rainwater as a solution—India is a successful example of this. The Indian government recognized the need to harvest rainwater and amended its building laws and zoning codes.¹³⁷ This seems to have inspired states to change their laws. In at least ten Indian states, a method of rooftop rainwater harvesting is mandatory for buildings; additionally, the Indian government has installed such systems on government buildings in Delhi.¹³⁸

Internal Bangladeshi policy should also be updated to include more incentives and security for the *caretakers* of alternative water installations. APSU found that 59% of the installations in its survey had regular maintenance.¹³⁹ This is despite the fact that nearly all installations had a caretaker.¹⁴⁰ The study found a (predictable) trend between proper caretaking and long-term functionality of the alternative water source; thus APSU recommended “particular” government attention and development of caretakers of these technologies, through training and perhaps payment.¹⁴¹ It is unclear whether, without a stand on the issue from the national level, state governments or local governments will spontaneously enact such measures with any consistency.

APSU also suggested a shift towards using deep tube-wells to minimize microbial and arsenic contamination, and because deep tube-wells are commonly preferred by communities due to their

¹³⁵ RAIHANA & HUSSAIN, *supra* note 94, at 115.

¹³⁶ *Id.*

¹³⁷ Peck & Griggs, *supra* note 84, at 356 (explaining that rainwater can be channeled from rooftop gutters into a storage tank for eventual filtering and use and that these gutter installations are subject to regulation by the state).

¹³⁸ *Id.*

¹³⁹ KABIR & HOWARD, *supra* note 118, at 19 (noting, further, that 87% of the *working* water supplies were receiving regular maintenance).

¹⁴⁰ *Id.* (“All but 7 (0.7%) of the water supplies had a caretaker.”).

¹⁴¹ *Id.* at 32 (concluding that caretakers are “critical for the sustainability of the water supply” and “[e]nhancing [caretakers’] performance through support to water safety plans is likely to yield further benefits”).

comparative reliability.¹⁴² Raihana and Hussain had the same finding regarding the popularity of community deep tube-wells as a long-term solution.¹⁴³

However, APSU notes that it has yet to be determined whether these can be sunk safely.¹⁴⁴ Indeed, there are various obstacles: deep tube-wells are costlier to build than shallow tube-wells (by 45 times), result in longer carrying distances for women, and are mistrusted by Bangladeshis in some villages; furthermore, the full implications of drilling deep tube-wells are unknown.¹⁴⁵ As Meharg puts it, “[e]ven geologists and hydrologists do not want to give the go-ahead for a massive program to sink deep tube-wells. They fear that these too could eventually become tainted, creating even more problems down the line.”¹⁴⁶

In short, the optimal solution—and the solution that seems to have the best chance of long-term success—is difficult to pursue without significant government research. It will be necessary to create—or complete, as the case may be—groundwater maps to identify safe aquifers that are protected from the penetration of arsenic via clay barriers.¹⁴⁷ These objectives would be facilitated by an enforceable Groundwater Act, as argued for in Section 2.2.3.

Further policy recommendations by APSU include an update of the IPAMB with cost-sharing provisions for installations (including payment for the caretakers), a more realistic estimate of the number of families served by individual technology implementations, and updated recommendations on technology types given new data from various studies that have been conducted on their efficacy¹⁴⁸—all sensible suggestions which have not appeared in an updated Implementation Plan.

¹⁴² *Id.* at 29.

¹⁴³ RAIHANA & HUSSAIN, *supra* note 94, at 107 (“The villagers opted for deeper tube-well [sic] as a long-term solution.”).

¹⁴⁴ KABIR & HOWARD, *supra* note 118, at 33 (noting that “deeper, older and safer aquifers need to be identified”).

¹⁴⁵ MEHARG, *supra* note 7, at 179–80 (addressing the practical and social concerns of a large-scale deep tube-well implementation program).

¹⁴⁶ *Id.* at 180.

¹⁴⁷ KABIR & HOWARD, *supra* note 118, at 33.

¹⁴⁸ *Id.*

2.3. *The Ignored Problem: Soil*

In the 1990s, an analytical chemist named Dipankar Chakraborti¹⁴⁹ observed that arsenic content in toenails and hair were much higher than one would expect, given the supposed quantities of arsenic people were consuming through drinking water; people were being poisoned by some other source.¹⁵⁰

A large quantity of groundwater from shallow tube-wells is being used in fields for irrigation.¹⁵¹ Between 30% and 40% of the net cultivable area of Bangladesh is under irrigation and more than 60% of the irrigation need is met from groundwater.¹⁵² Groundwater use is particularly pronounced during the dry season, when vast quantities of water are pumped up to flood paddy fields; the arsenic in this water is left to collect atop the soil until, in the fortunate cases, monsoon floods wash away the contaminated sediment.¹⁵³ This irrigation practice was personally observed by Meharg, who stated: "The poison was being liberally poured onto the most precious of all the delta's natural resources: its soil. Not only has the miracle of clean water been turned sour — the agricultural revolution is slowly poisoning the land."¹⁵⁴ What is most alarming is that this problem seems to be largely ignored by both the Bangladeshi government and NGOs, despite the fact that arsenic in the food-chain may very well cause more serious long-term problems than arsenic in drinking-water¹⁵⁵ and arsenic in soil will inflict long-term damage on Bangladesh's chance for recovery.

A 2003 joint study conducted by the Bangladesh University of Engineering and the United Nations University on the subject of Bangladesh concluded that "[a]rsenic builds up in topsoil when

¹⁴⁹ MEHARG, *supra* note 7, at 18.

¹⁵⁰ See S. M. Imamul Huq & Ravi Naidu, *Arsenic in Groundwater of Bangladesh: Contamination in the Food Chain*, in ARSENIC CONTAMINATION: BANGLADESH PERSPECTIVE 203, 206-07 (M. Feroze Ahmed ed., 2003) (discussing the possible transfer of arsenic to humans from various forms of food, including water-soil-crops, which could account for the additional levels of arsenic contamination above what is found in the water supply).

¹⁵¹ See *Rahman Interview*, *supra* note 24, at 12 (citing studies regarding groundwater use in irrigation).

¹⁵² Huq & Naidu, *supra* note 150, at 204.

¹⁵³ See MEHARG, *supra* note 7, at 18.

¹⁵⁴ *Id.*

¹⁵⁵ *Rahman Interview*, *supra* note 24, at 12 (noting the looming but seemingly ignored danger of food chain contamination).

irrigated with arsenic contaminated water.”¹⁵⁶ Agricultural soils’ arsenic content “increases during irrigation with contaminated water but it is reduced during [the] post-irrigation period,” most likely due in part to leaching by flood or rainwater.¹⁵⁷ While the study concluded that “[a]rsenic content of soil does not build up to a critical level that affects growth of crops,”¹⁵⁸ there has been more recent concern that arsenic may reduce the *yield* of rice.¹⁵⁹

Arsenic collects in vegetables, particularly in leaves of low-growing leafy plants¹⁶⁰ like arum, gourd leaf, amaranthus, and ipomea¹⁶¹, as well as roots, like bitter gourd.¹⁶² Additionally, papaya, tomato, mayalu, green chili, jack fruit, and parwar contain significantly higher quantities of arsenic when irrigated by arsenic-contaminated water than when grown in unaffected areas.¹⁶³

Arsenic in wheat and rice is mostly concentrated in roots and straws.¹⁶⁴ As much as 1830 ppb arsenic has been found in rice grown in Bangladesh; 200 ppb is considered normal.¹⁶⁵ Presence of the element in rice grain varies according to the variety of rice being considered.¹⁶⁶ Arsenic is also found in grass used as fodder,¹⁶⁷ which is fed to livestock and potentially transferred to meat.¹⁶⁸

Bangladeshi cooking practices are also tainted: rice stalks used for cooking can have higher concentrations of arsenic than contaminated drinking water and people breathe in arsenic-tainted

¹⁵⁶ M. Feroze Ahmed, *Arsenic Contamination: Regional and Global Scenario*, in ARSENIC CONTAMINATION: BANGLADESH PERSPECTIVE, *supra* note 150, at 1, 4.

¹⁵⁷ *Id.*

¹⁵⁸ *Id.*

¹⁵⁹ RAIHANA & HOSSAIN, *supra* note 94, at 27 box 3.3.

¹⁶⁰ See Huq & Naidu, *supra* note 150, at 215.

¹⁶¹ See Indira Chakravarty et al., *Arsenic in Food Chain – A Study on Both Raw and Cooked Food*, in ARSENIC CONTAMINATION: BANGLADESH PERSPECTIVE, *supra* note 150, at 227, 236.

¹⁶² MEHARG, *supra* note 7, at 18.

¹⁶³ See Chakravarty et al., *supra* note 161, at 235 (providing data that supports the contention that vegetables contain higher levels of arsenic when irrigated with arsenic-contaminated water).

¹⁶⁴ *Id.* at 236.

¹⁶⁵ MEHARG, *supra* note 7, at 18.

¹⁶⁶ Chakravarty et al., *supra* note 161, at 236.

¹⁶⁷ *Id.*

¹⁶⁸ See Huq & Naidu, *supra* note 150, at 214 (speculating on the possibility of arsenic lingering in meat after livestock eats contaminated fodder).

fumes when they cook.¹⁶⁹ Contaminated rice can contribute as much or more arsenic to the diet as a tube-well—especially where it is cooked in contaminated water.¹⁷⁰

Indeed, many types of food retain arsenic through use of arsenic-contaminated water in cooking,¹⁷¹ including tea, diluted milk, dal, potato curry, and certain preparations of rice.¹⁷² Oddly enough, a separate study found that arsenic is not retained in lentil soup, one of the staple foods of rural Bangladesh cuisine.¹⁷³

The contaminated soil is perhaps the most urgent reason why Bangladesh needs to seriously pursue the drastic reduction of groundwater use. Getting people to stop drinking tube-well water is necessary but insufficient; the Bangladesh government must eliminate the use of tube-well water to irrigate rice paddies.

As Meharg notes, “[t]he quantities of water required for cultivation are so vast that it would be uneconomical to rid the water of arsenic.”¹⁷⁴ The solution, then, is to secure sufficient arsenic-free surface water—from river water and ponds—to halt the poisoning and destruction of Bangladesh’s agricultural foundations. As will be discussed in Section 4, this might be done through the use of international law and large-scale surface water augmentation projects.

Sadly, even this is only a partial solution—cessation of the use of tube-well water for irrigation would merely leave the poison where the food grows and arsenic present in the soil would remain.¹⁷⁵ Still, this problem cannot be solved merely through internal means. Surface water is needed. If Bangladesh is to rely more on surface water, it needs to turn to international law.

¹⁶⁹ Rahman Interview, *supra* note 24, at 12.

¹⁷⁰ MEHARG, *supra* note 7, at 18.

¹⁷¹ Huq & Naidu, *supra* note 150, at 222 (charting the arsenic levels in a variety of foods cooked with arsenic-contaminated water as opposed to grown with arsenic-contaminated water).

¹⁷² Chakravarty et al., *supra* note 161, at 237–38 (cataloguing heightened levels of arsenic in common Bangladeshi foods when prepared with arsenic-contaminated water).

¹⁷³ *Id.* at 239.

¹⁷⁴ MEHARG, *supra* note 7, at 18.

¹⁷⁵ *Id.* at 19.

3. OBSTACLES TO RELYING ON SURFACE WATER

The goal articulated by the Bangladeshi government of encouraging its population to again rely on surface water is not easy to accomplish. The logistical and social difficulties are explored in Section 2.2 which details the way in which the country's arsenic mitigation efforts—largely consisting of attempts to install temporary water provision alternatives—have encountered difficulties.

Additionally, as noted by UNICEF, reliance on surface water is only truly feasible after dealing with what is possibly a larger problem of waterborne microbial contaminants,¹⁷⁶ a threat Bangladesh faced in the past and hoped to resolve by turning to groundwater. A sudden switch to surface water would force Bangladesh to revisit early decades of mass sickness and death caused by drinking contaminated river water.

These problems are, however, in a sense, “luxury” problems. They are only addressed if there is water available in the first place. For a truly effective surface water solution, Bangladesh must first (or at the very least simultaneously) work to secure a sufficient *quantity* of surface water.

This is especially important because Bangladesh's agricultural reliance on groundwater must also be transferred elsewhere. The concern regarding biological waterborne disease, fortunately, is lessened in the context of water used for agriculture. Microbes in harvested food are dealt with at least partially through cooking, cleaning and processing crops. However, arsenic that has collected in the soil will continue to infiltrate the food chain. As discussed in Section 2.3, the poison has a tenacious tendency to linger. Arsenic is a long-term problem.

Given Bangladesh's consumption and agricultural needs, we can conclude that for arsenic mitigation practices to be effective, more surface water will be necessary for the population to use. If more surface water is not attained, the population, faced with the lack of surface water, will turn in its thirst to generously-provided and readily-available poisonous groundwater.

¹⁷⁶ See *id.* at 178 (quoting a 1999 UNICEF report, which noted that “[h]astily and indiscriminately switching back to surface water across the country without strong pollution control measures in place will most likely do more harm than good to the people of Bangladesh”).

In short, Bangladesh, must ensure that there is enough surface water upon which to apply newly designed sanitation technology and processes.

This is easier said than done. This section will examine the roadblocks Bangladesh faces in attempting to secure such water. It will (1) consider the difficulties of negotiating for more water through treaties, and (2) identify the dangers of upper riparian damming practices such as the upcoming Indian IBWT Project, which will exacerbate Bangladesh's plight.

3.1. Difficulty of Securing Surface Water Through Treaty Negotiation

There are many rivers that traverse between India and Bangladesh.¹⁷⁷ Despite this abundance, there is only one treaty¹⁷⁸

¹⁷⁷ There are fifty-seven transboundary rivers in Bangladesh; fifty-four are shared with India. *Bangladesh*, *supra* note 11. The remaining three are shared with Myanmar. *Id.*

¹⁷⁸ There seems to have been progress forging a second treaty that will govern the waters of the Teesta River, one of the transboundary rivers that Bangladesh and India share. See *Talks with B'desh on River Water Sharing*, HINDUSTAN TIMES (India), Jan. 10, 2011, <http://www.hindustantimes.com/Talks-with-B-desh-on-river-water-sharing/H1-Article1-648634.aspx> (reporting that talks from 2010 resumed between India and Bangladesh regarding sharing common rivers and noting the Bangladeshi expectation of a 15-year interim treaty on Teesta, as well as the likelihood of discussions on "a short-term treaty" for sharing the waters of the southern Feni river). Teesta has suffered from reduced flows during the last quarter century. *India, Bangladesh to Discuss Teesta River Water Sharing*, OUTLOOK INDIA, Jan. 4, 2010, <http://news.outlookindia.com/item.aspx?672113> ("[T]he flow of the river weakened significantly in the last 24 years for Gajoldoba barrage and some dams in the upstream Indian region. In February and March, it comes down to less than 1,000 cubic feet per second, from 5,000 cubic feet per second in December and January . . ."). As yet, no treaty on Teesta has been signed. Anisur Rahman, *India Dominates B'desh Political, Foreign Scene in 2010*, OUTLOOK INDIA, Dec. 23, 2010, <http://news.outlookindia.com/item.aspx?706099> ("[T]wo sides were yet to strike even an interim deal on the issue . . ."). This is despite signs of progress throughout 2010. In January 2010, India and Bangladesh held secretary-level talks to reach an agreement on the Teesta treaty, and Bangladesh indicated that it was amenable to a temporary deal to establish a foundation for the desired long-term deal. See *India, Bangladesh to Discuss Teesta River Water Sharing*, *supra* (describing both parties' commitment towards establishing an agreement, if not a treaty); see also *Govt Wants Deals On All Common Rivers*, BDNEWS24.COM (Bangl.), Jan. 23, 2010, <http://bdnews24.com/details.php?id=151790&cid=2> (noting that there was an express desire to reach an agreement on all rivers). In March 2010, the Joint Rivers Commission ("JRC") (see *infra* notes 216-22 and accompanying text for more information regarding the JRC) met after a years-long hiatus to discuss the Teesta river and exchange drafts of water sharing agreements, and the outlook was optimistic. See, e.g., *India, Bangladesh to Discuss Teesta Water-Sharing*, HINDU (India), Mar. 17, 2010, <http://beta.thehindu.com/news/national/article253918.ece> (discussing an

to date that governs one river system (at minimum¹⁷⁹). This leaves Bangladesh in a vulnerable position. India and upper riparians can argue—due to a lack of concretely governing international law¹⁸⁰—that they need not pay attention to lower riparian needs when determining what to do with rivers that are arguably unregulated by any treaty. The obvious solution for Bangladesh would be to enter into treaty negotiations for these rivers.

Unfortunately, as Meharg has observed, any goal to obtain water from transboundary rivers via political negotiations with India is complicated.¹⁸¹ For one thing, it seems difficult to bring upper riparians to the treaty bargaining table, because they have no incentive (by virtue of geographic or economic realities) to negotiate a water sharing treaty when they can choose to take as

upcoming JRC meeting to review Teesta water-sharing); *India, Bangladesh Exchange Drafts [Accords] on Teesta Water-Sharing*, TIMES OF INDIA, Mar. 20, 2010, <http://timesofindia.indiatimes.com/india/India-Bangladesh-exchange-draft-accords-on-Teesta-water-sharing/articleshow/5703608.cms> (reporting on the significant breakthrough in negotiations for the two nations when they exchanged draft water-sharing agreements); *India, Bangladesh Hold Talks on River Water*, SIFY NEWS (India), Mar. 18, 2010, <http://sify.com/news/india-bangladesh-hold-talks-on-river-water-news-national-kdsrkecdagb.html> (describing Teesta interim agreement talks between Bangladesh and India); *India-Bangladesh Water Sharing Agreement on Teesta Soon*, BOMBAYNEWS.NET (India), Mar. 20, 2010, <http://www.bombaynews.net/story/614333> (reporting that India and Bangladesh were moving closer to a Teesta water-sharing agreement); *Secys Asked to Examine Dhaka's Draft on Teesta*, DAILY STAR (Bangl.), Mar. 20, 2010, http://www.thedailystar.net/newDesign/latest_news.php?nid=22780 (noting that talks on the Teesta water treaty had intensified). However, something stalled the process, and Bangladesh ultimately expressed frustration at the lack of progress. See Anisur Rahman, *B'desh Wants to Expedite Water Cooperation with India*, OUTLOOK INDIA, Nov. 7, 2010, <http://news.outlookindia.com/item.aspx?700312> ("Peeved by the inordinate delay in reaching agreements on water sharing with India, Bangladesh Foreign Minister Dipu Moni has said that at this rate the two neighbours would need 'a millennium' to sign deals on 54 common rivers."); Kamran Reza Chowdhury, *Dhaka Presses for JRC Talks on Teesta Deal*, BDNEWS24.COM (Bangl.), Nov. 21, 2009, <http://bdnews24.com/details.php?id=147503&cid=2> (reporting the difficulties of arranging productive meetings with India on the matter of water sharing).

¹⁷⁹ It is possible that the 1996 Ganges Treaty governs, to some extent, the use and sharing agreements of other transboundary rivers. See generally discussion *infra* Section 4.1.2 discussing protection under the 1996 Ganges Treaty.

¹⁸⁰ International law might impose obligations upon upper riparian nations and India. See generally discussion *infra* Section 4.1.3 (discussing regulation of international rivers and recent trends).

¹⁸¹ See MEHARG, *supra* note 7, at 19 (observing that the construction of dams to divert water flowing from transnational rivers has been a source of political tension in Bangladesh's history).

much of the water as they need or want without significant negative consequences from the lower riparian. In theory, in the case of India, there is a legal obligation to come to the negotiating table imposed on both it and Bangladesh by the 1996 Ganges Treaty,¹⁸² though the extent or enforceability of this obligation is unclear. Thus far, it has seemed somewhat ineffectual: to date there has been limited success compelling India to adhere to this obligation, and lack of clarity as to whether Bangladesh has made sufficient effort to impose adherence to this term of the 1996 Treaty.¹⁸³ Some observers also claim an obligation to utilize the 1996 Treaty as a *template* of a “framework” for future treaties¹⁸⁴ — a contention that is arguably limited in its benefits.

¹⁸² See generally 1996 Ganges Treaty, *supra* note 30, art. IX (indicating that both governments agree to conclude water-sharing agreements with respect to *other rivers*).

¹⁸³ We can point to several pieces of evidence supporting this. First, the Joint Rivers Commission—an organization that is a focal point for negotiating efforts between India and Bangladesh (for more information regarding the JRC, see *infra* notes 216–22 and accompanying text)—meets inconsistently. While part of this is reluctance on India’s part, some note that the functionality of the group seems to be dictated by prevailing political mood in Bangladesh:

The JRC could not meet even once in three consecutive years during the late 80s because there was no political interest on the Indian side (the JRC is supposed to meet four or more times a year). When Awami League (AL) came into power in mid 1996, the JRC met several times and a 30-year Ganges Treaty could be drafted and signed within a few months of AL’s coming into power.

Shamim Ahsan, *India’s Giant River-Link Project: Will Bangladesh Dry Up?*, STAR MAG., Oct. 10, 2003, <http://www.thedailystar.net/magazine/2003/10/02/coverstory.htm>. Second, we can look at the markedly slow process of negotiating the Teesta River sharing agreement, which, as noted before, has been a longstanding concern. Despite apparent activity in 2010, negotiations have not culminated in a treaty or interim deal. Rahman, *India Dominates B’desh Political, Foreign Scene in 2010*, *supra* note 178. Note, however, that India has committed to working with Bangladesh to forge new treaties and agreements to ensure preservation of Bangladesh’s interests. See Khondkar A. Saleque, *Ice Melting in Indo-Bangla Relation*, ENERGY BANGLA, (Jan. 13, 2010, 1:21 AM), <http://www.energybangla.com/index.php?mod=article&cat=SomethingtoSay&article=2357> (describing the various commitments India made in January 2010 regarding water-sharing issues including and beyond the sharing of the Teesta River, such as: a promise of no harm from the Tipamiukh Dam; a commitment to working out issues related to the Feni, Muhuri, Khowai, Dharala and Dudkumar rivers; the dredging of the Ichamati river; and the protection of the Mahananda, Karotoa, Nagar, Kulik, Atrai, Dharala and Feni rivers).

¹⁸⁴ See, e.g., Surya P. Subedi, *Hydro-Diplomacy in South Asia: The Conclusion of the Mahakali and Ganges River Treaties*, 93 AM. J. INT’L L. 953, 960 (1999) (arguing that since the 1996 Treaty also “lays down the . . . principles . . . of future agreements

As further evidence of the difficulty of relying upon treaty negotiation, it is worthwhile to note that the 1996 Ganges Treaty – despite its benefits – is flawed in fundamental ways. The history of the formation of the 1996 Ganges Treaty highlights a potentially grim set of conclusions regarding these flaws: overwhelmingly negative effects of bargaining inequities between Bangladesh and its neighbors result in the absence of important water-sharing provisions, effective dispute resolution mechanisms, and perhaps necessitate the use of third-party arbitration.

3.1.1. *Impact of the 1996 Ganges Treaty on Subsequent Treaties*

Article IX of the Ganges Treaty directs the governments of India and Bangladesh to conclude water-sharing agreements for other common rivers.¹⁸⁵ It directs the two countries to conclude these treaties with “due consideration to the principles of equity, fairness and no harm.”¹⁸⁶

Unfortunately, this aspect of the Treaty has seen little enforcement. Note how the mandate of Article IX is remarkably vague; it gives no guidelines or structure to the obligation of creating new treaties. It does not indicate when or under what circumstances new water-sharing agreements for the numerous other rivers between India and Bangladesh should be forged. There seems to be nothing in the treaty’s text preventing India from delaying the process indefinitely, or from compelling an incompetent or distracted Bangladesh from neglecting its surface water interests.

Noting this conscious decision to include language whose scope lies *beyond* the technical matter of sharing water for just the Ganges, some observers—as mentioned before—argue that the treaty is a “framework” treaty that governs future water-sharing agreements between Bangladesh and India. This is a valuable observation, but might be of limited usefulness for several reasons.

First, the argument presumes that India will come to the bargaining table to form new treaties in the first place, which, as noted before, is not necessarily a reasonable given. Indeed, because India seems to have little to gain from such treaties, it is

on other common rivers;” it is a “framework treaty,” in addition to having a “technical character”).

¹⁸⁵ 1996 Ganges Treaty, *supra* note 30, art. IX.

¹⁸⁶ *Id.*

unclear how Bangladesh could even begin to make a “framework” treaty argument.

Second, it is unclear—given the Treaty’s shortcomings, which will be discussed in Section 3.1.2—whether the Ganges Treaty is a worthwhile framework to utilize. As observers have noted, there are some attractive aspects. One is the Treaty’s use and placement of the “no harm” principle. This principle—sometimes called the “obligation not to cause appreciable harm”—is an international custom¹⁸⁷ that limits a state’s right to act in a manner that impinges upon the rights of other states. In other words, the principle seems to imply that a lower riparian might assert rights in the event that an upper riparian is inflicting significant damage to it. The Ganges Treaty specifically includes mention of the “no harm” rule as well as the principle of equitable use,¹⁸⁸ and, rather unusually,¹⁸⁹

¹⁸⁷ Abu R. M. Khalid has suggested that the principle “receives wide recognition today as a general principle of international law,” having been articulated in the soft-law Stockholm Declaration on the Human Environment and applied in the *Trail Smelter* Arbitration between the United States and Canada. Abu R. M. Khalid, *The Interlinking of Rivers Project in India and International Water Law: An Overview*, 3 CHINESE J. INT’L L. 553, 563 (2004). The former’s articulation of the no harm rule can be found in Principle 21 of the Stockholm Declaration:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Report of the United Nations Conference on the Human Environment, Stockholm, Swed., June 5-16, 1972, *Action Taken by the Conference* 5, U.N. Doc. A/CONF.48/14/Rev.1 (1973). In the latter, meanwhile, the tribunal, considering damage caused to the United States—via air pollution—by a smelter in Canada, found that:

[U]nder the principles of international law . . . no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.

Trail Smelter Case (U.S. v. Can.), Decision, 3 R.I.A.A. 1905, 1965 (Apr. 1938).

¹⁸⁸ See *infra* notes 208–13, 297–303, and accompanying text.

¹⁸⁹ I characterize this as unusual only because the Treaty seems to explicitly buck the trend identified by some observers of favoring equitable use principles over the no harm rule. Subedi points to the (un-ratified) 1997 UN Watercourse Convention, which downplays the no harm rule and emphasizes the principle of reasonable and equitable use. Subedi, *supra* note 184, at 961. See also Convention on the Law of the Non-Navigational Uses of International Watercourses, arts. 5–7, May 21, 1997, 36 I.L.M. 700 (1997).

appears to favor neither.¹⁹⁰ Thus, if Bangladesh were able to bring India back to the table for new treaty negotiations regarding the many shared rivers that can currently be used with few international legal ramifications, it might have at its disposal the ability to incorporate the no harm rule into subsequent agreements. Again, as will be discussed in Section 3.1.2, given the Ganges Treaty's shortcomings, perhaps this advantage is an insufficient incentive to keep the Treaty as anything but a lessons-learned document.¹⁹¹ While the Treaty was indeed a breakthrough on many levels, it might do Bangladesh well to start fresh for other rivers.

Note, finally, the argument that the Ganges Treaty is a "framework" treaty—aside from potentially being moot—is also weakened by the final sentence in the preamble, which indicates provisions of the treaty are not meant to give rise "to any general principles of law or precedent."¹⁹² India would almost certainly utilize this clause to argue against allowing Bangladesh to use the Ganges Treaty for its benefit (and potentially to the detriment of India) in future treaty formation.

3.1.2. *Oversights and Flaws in the 1996 Ganges Treaty*

As Meharg notes, the construction of dams to divert and regulate the Ganges River has been a source of political tension between India and Bangladesh since Bangladesh gained independence.¹⁹³ The Ganges Treaty was a significant step in the relations between the two countries. It is a long-term solution to

¹⁹⁰ See 1996 Ganges Treaty, *supra* note 30, art. IX (stating that the parties are "guided by the principles of equity, fairness and no harm"). Subedi suggests that this means the two principles are given "equal footing," noting:

If the no-harm rule and equitable utilization are given equal weight, a lower riparian state in a parched region with fully utilized rivers might claim that any use of the watercourse by an upper riparian state would be harmful to it. This is one reason why an upper riparian state is likely to benefit more from adoption of the international law principle of equitable and reasonable utilization than from the principle of no harm.

Subedi, *supra* note 184, at 961.

¹⁹¹ Further, as Subedi notes, "[t]he parties' agreement to conclude other treaties, however, does not extend to such matters as the management, conservation and prevention of pollution of their common rivers." Subedi, *supra* note 184, at 960.

¹⁹² 1996 Ganges Treaty, *supra* note 30, at 523.

¹⁹³ See MEHARG, *supra* note 7, at 18-19.

what had been years of conflict: a thirty-year¹⁹⁴ agreement renewable by mutual consent,¹⁹⁵ and reviewed every five years (or as required by either party).¹⁹⁶ The arrangement basically attempts to ensure that Bangladesh is not *entirely* deprived of water during the region's dry seasons as a result of the Farakka Barrage, a structure that was built—without Bangladesh's consent—to allow India to divert flows from the Ganges River.¹⁹⁷

Some observers consider the treaty to be a breakthrough achievement, one that, as speculated by James Kraska, injected a “sense of fairness and equality into the diplomacy” between Bangladesh and India.¹⁹⁸ Like other water-sharing agreements in South Asia, the treaty potentially helped strengthen political ties, ameliorated regional tensions, and reduced the likelihood of war by inserting “new ingredients” into long-standing disputes: assurance, verification, institution-building, process-building, constituent building, and principle development.¹⁹⁹ It was, according to some, “a great achievement in the history of Indo-Bangladesh negotiations on the Ganges,” and removed a “major irritant” between the two nations.²⁰⁰

Despite these rather lofty benefits, the Ganges Treaty has its flaws.

For one thing, the agreement may assume that a higher level of water is available in the Ganges River during the dry season than actually is – an assumption that was revealed as seemingly false as

¹⁹⁴ 1996 Ganges Treaty, *supra* note 30, art. XII.

¹⁹⁵ *Id.*

¹⁹⁶ *See id.* art. X. A joint survey on Padma flow began on January 1, 2011 – to take place 6 days a week, until May 31 – pursuant to the Ganges Treaty. *See Joint survey on Padma flow*, BDNEWS24.COM (Bangl.), Jan. 1, 2011, <http://bdnews24.com/details.php?cid=2&id=183204>.

¹⁹⁷ *See Khan, supra* note 3, at 470 (noting that the aim of the Ganges Treaty is to ensure that Bangladesh receives water during the region's dry seasons). This water is diverted into the Bhagirathi-Hooghly river of West Bengal to flush silts and to improve navigability of the Port of Calcutta. *Id.* at 471.

¹⁹⁸ *See James Kraska, Sustainable Development is Security: The Role of Transboundary River Agreements as a Confidence Building Measure (CBM) in South Asia*, 28 YALE J. INT'L L. 465, 495 (2003).

¹⁹⁹ *Id.* at 492 (listing beneficial elements introduced into the South Asian geopolitical realm as a result of international river agreements).

²⁰⁰ *See Khan, supra* note 3, at 470.

early as 1997,²⁰¹ and which has not been adequately addressed due to shortcomings in the Treaty's dispute resolution provisions.²⁰²

The impact of this flaw is amplified by the Treaty's lack of a flow augmentation plan, which would have resulted in a collaborative project between the countries to increase the flow of the Ganges by leveraging other surface water resources.²⁰³ The Ganges Treaty quietly acknowledges the correction of this conceptual incompleteness as a worthy future goal.²⁰⁴ The lack of such a plan is particularly tragic because it was the subject of a protracted and consistent disagreement between India and Bangladesh, and resulted in a delay in the Treaty's formation.²⁰⁵

Additionally, some have noted that the Ganges Treaty is "overwhelmingly concerned" with sharing water during dry seasons and does not recognize the fact that the river floods severely in the monsoon season.²⁰⁶ India diverts water away from Bangladesh when the river runs low and then uses Farakka to allow the Ganges to flood Bangladesh when the river runs destructively high during the monsoon season.²⁰⁷

Note that attempts to fix these flaws are theoretically possible through the dispute resolution mechanisms contained within the Treaty. However, it can be argued that these mechanisms are also

²⁰¹ See Salman M.A. Salman & Kishor Uprety, *Hydro-Politics in South Asia: A Comparative Analysis of the Mahakali and the Ganges Treaties*, 39 NAT. RESOURCES J. 295, 327-28 (1999) (detailing Bangladesh's 1997 claims regarding the depleted flows of the Ganges, and India's reaction).

²⁰² See *id.* at 337 ("[W]hen the Ganges flow was below the thresholds specified in the Ganges Treaty, each of the countries . . . insisted on an interpretation of its relevant provisions in ways that suited them most. This obviously led to non-resolution and increased tension between the countries.").

²⁰³ See *id.* at 330.

²⁰⁴ See 1996 Ganges Treaty, *supra* note 30, art. IX ("The two Governments recognise the need to cooperate with each other in finding a solution to the long-term problem of augmenting the flows of the Ganga/Ganges during the dry season.").

²⁰⁵ See Khan, *supra* note 3, at 462-69 (detailing the role augmentation had in the discussions between Bangladesh and India, its delaying effect upon the proceedings, and its ultimate "delinking" from the issue of sharing).

²⁰⁶ See Khalid, *supra* note 187, at 560.

²⁰⁷ See *id.* (noting that India has "showed substantial efforts" to ensure its control on lean season flow but has "failed to demonstrate the same degree of enthusiasm to get its proportionate share of the devastating monsoon season water flow"); MEHARG, *supra* note 7, at 19 ("During the dry season India siphons off the precious Ganges waters; during the flood seasons it opens the gates, unleashing torrents of water into Bangladesh.").

the largest flaw built into the 1996 Ganges Treaty. Due to reliance on political negotiations, these mechanisms are stacked in favor of India.

The Ganges Treaty relies, in part, on an equitable utilization principle,²⁰⁸ which was articulated in the UN Convention on the Law of Non-navigational Uses of International Watercourses (“1997 Watercourse Convention”).²⁰⁹ It states that waters are to be “used and developed . . . taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse.”²¹⁰ As can be seen, the doctrine maintains seemingly purposeful vagueness and a lack of concrete rights to water use.²¹¹ It encourages, instead, that rights be assigned on a case-by-case basis. Some scholars have argued that this vagueness is in place in order to eliminate a sense of entitlement to water and encourage negotiations.²¹² Unfortunately for Bangladesh, while this does leave the door open for the country to negotiate its way to more rights and a fairer distribution of water based upon its needs, this door is not easily traversed, given the unevenness in bargaining power between India and Bangladesh.²¹³

We can see the embrace of negotiation as an equitable solution in the dispute resolution mechanisms of the Ganges Treaty: they ultimately fall back upon the respective country’s political powers. Article IV of the Treaty establishes a Joint Committee consisting of equal numbers of representatives nominated by each government for issues of dispute resolution.²¹⁴ Article VII dictates that disputes related to the operation of the Farakka Barrage or the Treaty that

²⁰⁸ Analysis of this principle—and suggestions regarding ways in which it can be used to Bangladesh’s advantage—are discussed *infra* Section 4.1.3.

²⁰⁹ See generally Convention on the Law of the Non-navigational Uses of International Watercourses, *supra* note 189.

²¹⁰ *Id.* art. 5, para. 1.

²¹¹ Michael Keene, *The Failings of the Tri-State Water Negotiations: Lessons to be Learned from International Law*, 32 GA. J. INT’L & COMP. L. 473, 495–96 (2004) (noting that the doctrine of equitable utilization lacks both specificity and permanent rights to water use).

²¹² See *id.* at 496 (“Parties to a discussion who believe that they possess inalienable rights are liable to be uncompromising. Concrete rights to water usage create a feeling of entitlement that can be stifling to negotiation.”).

²¹³ See generally *id.* at 496–97 (detailing how the vague parameters and flexible standards of rights under the doctrine of equitable utilization allow for equitable negotiations in cases in which the parties have relatively similar bargaining power).

²¹⁴ See 1996 Ganges Treaty, *supra* note 30, art. IV.

cannot be resolved by the Joint Committee float over to the Indo-Bangladesh Joint Rivers Commission ("JRC") for resolution.²¹⁵

The JRC is an older entity that was signed into existence in November 1972,²¹⁶ after Bangladesh's independence, and played a central role in the formation of the Ganges Treaty.²¹⁷ Its purpose is to work together "in harnessing the rivers common to both the countries for the benefit of the peoples of the two countries," and "to ensure the most effective joint efforts in maximizing the benefits of common river systems."²¹⁸ However, the JRC sits only occasionally – most recently, as noted before,²¹⁹ after a particularly prolonged delay²²⁰ to attempt to hash out a water sharing agreement for the sharing of the Teesta River²²¹ – and is considered by some as ineffective.²²² The Treaty perhaps contemplates this

²¹⁵ *Id.* art. VII.

²¹⁶ See generally Statute of the Indo-Bangladesh Joint Rivers Commission (1972), available at <http://www.internationalwaterlaw.org/documents/regionaldocs/indo-bangladesh.html> (providing the text of the Statute of the Indo-Banldadadesh Joint Rivers Commission, which was signed on November 24, 1972 in Dhaka).

²¹⁷ See generally Khan, *supra* note 3, at 462-70 (providing a detailed chronological account of the JRC's role in treaty negotiations between India and Bangladesh, including its dormancy and reactivation in the early 1990s).

²¹⁸ Statute of the Indo-Bangladesh Joint Rivers Commission (1972).

²¹⁹ See *supra* note 178.

²²⁰ See Chowdhury, *supra* note 178 (reporting that "the commission had failed to hold any talks for the last six years"). Note that this delay occurred despite the discussion of important matters during the previous meeting of the JRC. See Balaji Reddy, *India and Bangladesh Disagree on Teesta Water and Construction of Tipaimukh Dam – Source of Another Round of Confrontation?*, INDIA DAILY, Sept. 22, 2005, <http://www.indiadaily.com/editorial/4673.asp> (describing the discussions that took place during the September 2005 ministerial JRC meeting).

²²¹ See *supra* note 178 (noting progress forging a second treaty that will govern the Teesta River despite stalled attempts in the past).

²²² See Khalid, *supra* note 187, at 560 ("In actuality, the JRC has been almost ineffective for a long period and sits only occasionally."). This infrequency of meetings occurs reportedly despite protests from Bangladesh. See Hemayetuddin Ahmed, *Foreign Policy Conundrum: India Factor*, DAILY STAR (Bangl.), Oct. 31, 2009, <http://www.thedailystar.net/newDesign/news-details.php?nid=111986> ("There had been no meetings of the JRC at all for the last four years. Repeated reminders for the meetings and reportedly SOS from Bangladesh side had gone in vain."). See also Ahsan, *supra* note 183 (questioning the efficacy of the JRC and providing various suggestions to fulfill its conceptual potential: public dissemination of activities and functions, to increase accountability and credibility; regular collection and sharing of data on the quantity and quality of common waters; and remedial measures to make it a more forceful recommending body, including reducing the number of engineers as part of its required makeup, in order to move away from overly technical solutions).

and transfers the dispute settlement power—in the event that neither the Joint Committee nor the JRC can come to a resolution—to the political authority of the two countries.²²³ This is instead of opting for a more impartial dispute resolution framework such as independent arbitration—which, as Salman and Uprety note, maintains the advantages of negotiation and works quite well in the context of India and Nepal under the Mahakali Treaty, but does not leave the weaker country entirely vulnerable to the whims of the stronger.²²⁴

3.1.3. *Overwhelming Effects of Bargaining Inequity*

The discussion in Section 3.1.2 regarding ill-designed dispute resolution mechanisms in the 1996 Ganges Treaty brings to light a general concern that Bangladesh must deal with in any attempt to negotiate water sharing from upstream—bargaining inequities. This is perhaps particularly true when the negotiating parties are not similarly situated from an economic and military standpoint. The negotiation of the 1996 Ganges Treaty exemplifies how difficult such negotiations can be.

The story of the Treaty *begins* with an Indian structure that embodies the bargaining inequities between the nations: the Farakka Barrage. The Farakka Barrage represents the type of control India can exert by virtue of its comparative economic and military might and its position as an upper riparian. India was (and continues to be) in the position to drown or parch its neighbor as it wished (and wishes). Since the Ganges Treaty was a response to this type of power, it is reasonable to glean that the final product is somewhat lopsided.

The Farakka Barrage, a 1.4 mile (2,245 meter) irrigation dam,²²⁵ was built 11 miles above stream from the border of Bangladesh.²²⁶

²²³ The Treaty states that the dispute will be turned over “to the two Governments which shall meet urgently at the appropriate level to resolve it by mutual consent.” 1996 Ganges Treaty, *supra* note 30, art. VII. See *infra* Section 3.1.3 for a discussion regarding why relying upon political processes might not be ideal.

²²⁴ See generally Salman & Uprety, *supra* note 201, at 337–38 (comparing the presence of an arbitration mechanism in the Mahakali Treaty favorably to the lack of such a mechanism in the Ganges Treaty).

²²⁵ MINISTRY OF WATER RES., THE RIGHT TO INFORMATION BILL 2004 OF THE FARAKKA BARRAGE PROJECT, REPLY OF ITEM NO.4 OF CHAPTER-II 2 (India), available at http://wrmin.nic.in/writereaddata/linkimages/fb_rtia9734330785.pdf.

²²⁶ Khan, *supra* note 3, at 460–61.

It was designed to divert 40,000 cusecs of a river²²⁷ whose normal flow was, at the time, assumed to be as high as 50,000 to 55,000 cusecs during the dry season²²⁸ (an estimate shown to be potentially unrepresentative²²⁹). The intention was not sinister on the part of India—the primary purpose of Farakka was to divert water into the Hooghly River to improve the navigability of Calcutta port and prevent it from silting.²³⁰

Regardless of the efficacy of the dam and its purported goals,²³¹ Bangladesh suffered downstream of Farakka. In our limited

²²⁷ MINISTRY OF WATER RES., *supra* note 225, at 2.

²²⁸ Salman & Uprety, *supra* note 201, at 305.

²²⁹ *Id.* at 327 (indicating that actual water flow according to Bangladesh was considerably lower than the amount estimated as early as 1997).

²³⁰ This goal was confirmed by India's Ministry of Water Resources in response to an order to release information to the public pursuant to India's Right to Information Act. MINISTRY OF WATER RES., *supra* note 225, at 1. Other goals were to counteract high salinity in the water and to provide Calcutta with water for irrigation, domestic, and municipal purposes. Salman & Uprety, *supra* note 201, at 304.

²³¹ India's Ministry of Water Resources claims:

With the completion of the Farakka Barrage, silt free water now flows throughout the year in the river Hooghly. This has increased the navigable depth in the riverine approach of the port and it enables to receive large size ships and handle bigger volume of cargo, thereby improving the economy of the vast hinterland.

MINISTRY OF WATER RES., *supra* note 225, at 2. However, note that the project was pursued despite skepticism from various international experts—including those within India—who doubted that periodic diversions of 40,000 cusecs could indeed save Calcutta from silting. See Khan, *supra* note 3, at 470–72 (describing initial skepticism of the Farakka Barrage's likelihood of success). Farakka ultimately did not have the intended effect. Decades later, Calcutta port continues to silt. See Sankar Ray, *An Environmental Mistake in India*, ASIA SENTINEL, Sept. 12, 2008, http://asiacentinel.com/index.php?option=com_content&task=view&id=1429&Itemid=34 (“If ever there was a lesson in the unintended effects of damming rivers, [it is] the Farakka Barrage... threatening to wreak havoc on a series of downstream villages and ultimately silt up the Kolkata harbor, the condition it was partly designed to fix.”); Khan, *supra* note 3, at 470–72 (summarizing the subsequent evidence of Farakka's ultimate failure to achieve its goal of “flushing out” the Calcutta port). See also *Kolkata Port: Government Support Vital*, HINDU BUSINESS LINE, Nov. 19, 2001, available at <http://www.thehindubusinessline.com/businessline/logistic/2001/11/19/stories/0919c05s.htm> (noting the flow from Farakka's role on downstream silting). This is because the water from upstream brought its own massive silt deposits, all of which were dropped behind the dam, reducing the overall flow through Farakka. Julian Crandall Hollick, *Ganges Dam Leaves Devastating Legacy*, NAT'L PUB. RADIO, December 23, 2007, <http://www.npr.org/templates/story/story.php?storyId=17357750>. One observer has argued that India acknowledged this was happening by developing Haldia, a nearby deep sea port which is equipped for large oceangoing vessels and gradually

context, Farakka and its periodic reduction of water in Bangladesh during the dry season places immense pressure on the country's attempts to address its arsenic crisis. It provides a significant disincentive to encouraging true reliance on surface water and in turn provides a disincentive to developing long-term mechanisms for purifying and delivering surface water for consumption and agriculture.

In a broader context—one that informs our consideration of the bargaining inequities inherent between Bangladesh and India—Farakka's operation began to cause severe drought in Bangladesh. It reduced the flow of the Ganges drastically, a phenomenon which adversely affected (and continues to affect) the "hydrology, river morphology, agriculture, domestic and municipal water supply, fishery, forestry, industry, navigation, public health and biodiversity" of the country.²³² It was amidst the threat of these outcomes (as well as during the early stages of these outcomes) that Bangladesh attempted to work with India—for over two decades—to form the Treaty.

The first Farakka water-sharing agreement was a short-term, one-month arrangement in 1975, which shifted the longstanding controversy over *whether* Farakka should be built in the first place to determining the quantity of water to be shared during the dry season.²³³

This shift was, in essence, coerced. India had built the dam despite decades of objection from East Bengal (then Pakistan). Bangladesh—a young country in the awkward position of owing thanks to India for its help during Bangladesh's independence movement and the rebuilding period afterwards²³⁴—had little choice but to accept Farakka's existence. All the Bangladesh government could hope to do was secure an assurance that it

pushes Calcutta port to obsolescence. Khan, *supra* note 3, at 472. However, ironically, Haldia has *also* fallen prey to similar silting processes, due either to Farakka and other Indian damming practices upstream, or a generally lower-than-expected water availability from the Ganges. See, e.g., *Silt-Choked Haldia Port Shuts Down*, TIMES OF INDIA, Sept. 16, 2009, <http://timesofindia.indiatimes.com/india/Silt-choked-Haldia-port-shuts-down/articleshow/5015690.cms>; *Cargo Handling at Haldia Port to Drop by 9 MN Tonnes This Fiscal*, HINDU (India), <http://beta.thehindu.com/business/Industry/article201955.ece>.

²³² Khan, *supra* note 3, at 473.

²³³ Salman & Uprety, *supra* note 201, at 307.

²³⁴ Khalid, *supra* note 187, at 557–58.

would not be entirely deprived of water when India chose to begin its Ganges diversions.

The following thirsty, uncertain “era” involved a purportedly month-long test-run of the Barrage by India that continued for *two years*, intervention by the UN (at Bangladesh’s request) that resulted in a temporary sharing agreement lasting from 1977 to 1982,²³⁵ refusal on the part of India to renew the 1977 agreement despite Bangladesh’s repeated requests, two flimsier “Memoranda of Understanding” (in 1982 and 1985) that did not safeguard Bangladesh’s interests in the event of exceptionally low Ganges flows, and another dearth of sharing agreements for eight years between 1985 and late 1996.²³⁶ Throughout the pre-1996 years, on several occasions and for varying stretches of time, India withdrew significant quantities of water from upstream as needed, leaving Bangladesh dry.²³⁷

Over this period, the agreements were marked by a systematically reduced share of water for Bangladesh.²³⁸ While some of this might have been attributable to the equitable utilization principle—which, as noted before, partially guided the ultimate sharing arrangements in the Ganges Treaty and emphasized “distribution of resources in the manner that is most beneficial to all the parties involved,”²³⁹ or, phrased differently, “the comprehensive best interests of both parties”²⁴⁰—some compellingly speculate that the reduction found much of its source in India’s bargaining advantages: the country had size, military might, and upstream proximity in its favor.²⁴¹

²³⁵ See generally Agreement Between the Government of the People’s Republic of Bangladesh and the Government of the Republic of India on Sharing of the Ganges Waters at Farakka and on Augmenting its Flows, Bangl.-India, Nov. 5, 1977, 1066 U.N.T.S. 16 (detailing the terms of the Ganges water sharing agreement from 1977 to 1982).

²³⁶ See Khan, *supra* note 3, at 463–69, for an in-depth review of the sequence of events. See also Salman & Uprety, *supra* note 201, at 307–10, for a discussion of the early agreements on the Ganges River.

²³⁷ See Khan, *supra* note 3, at 467–69.

²³⁸ See Salman & Uprety, *supra* note 201, at 327 (stating that Bangladesh’s share of water decreased from about 59% under the 1977 Agreement to approximately 52% under the present Ganges Treaty).

²³⁹ Keene, *supra* note 211, at 485.

²⁴⁰ *Id.* at 488.

²⁴¹ *Id.* at 499–500.

Note, also, the sheer amount of time it took for a long-term treaty to be formed – twenty-one years, from 1975 to 1996.²⁴² Given that this lengthy period of time was primarily damaging to Bangladesh and less so (if at all) to India, it is reasonable to conclude that the gap was again due to the bargaining advantages that India possesses. India, after all, had little interest in forming a sharing agreement. In the absence of an agreement, it had free reign to use Farakka as it needed.

In sum, the Ganges Treaty, while beneficial to Bangladesh, was forged with significant compromises on the part of Bangladesh due to its bargaining disadvantages. The same problem will likely occur in any subsequent attempts to use solo treaty negotiations to secure surface water.²⁴³

Granted, it is unnecessarily and glumly fatalistic to dismiss *all* of Bangladesh's attempts to negotiate with India as doomed. There are ways of surmounting bargaining inequities. We can look to other treaties in the region for guidance – the Indus River Treaty between India and Pakistan, for example.²⁴⁴ While the bargaining disparities are obviously on a different scale (Pakistan is larger, more developed, and more militarily-advanced than Bangladesh), the Indus River Treaty did find success through the use of a third-party arbitration apparatus for the negotiation of treaty terms.

Indeed, much of the success of the Indus River Treaty – whose obligations have been met by both countries for the 50 years it has been in effect, despite strained political relations and full-out war – may be attributed to the fact that the treaty negotiations were managed by the World Bank, an independent, theoretically unbiased arbitrator.²⁴⁵ However, an arbitrator was not employed

²⁴² Communications between the countries during this more than two-decade gap indicate that the delay was largely due to disagreement on flow augmentation plans. See Khan, *supra* note 3, at 467. Some claim India was stalling negotiations by insisting on the linkage of the issues of flow augmentation and flow sharing and predicating any long-term treaty on an augmentation scheme of India's design. See *id.* at 469.

²⁴³ See *supra* note 178 and accompanying text (discussing recent, albeit tediously slow, attempts at drafting water sharing negotiations).

²⁴⁴ See generally Indus Waters Treaty 1960, India-Pak., Sept. 19, 1960, 419 U.N.T.S. 125 (defining the terms of current water sharing treaty between India and Pakistan).

²⁴⁵ See Subedi, *supra* note 184, at 953 (attributing the success of the Indus River Treaty to the "wisdom and far-sightedness of [India and Pakistan's] political leaders and the constructive role of mediation and conciliation played by the World Bank").

for the formation of the Ganges Treaty and the lesson from the Treaty's shortcomings is worthwhile. Bangladesh, in future "international" endeavors—such as agreements on the many transboundary rivers that flow from India—should avoid acting alone. It should instead call upon an impartial, credible, and influential arbitrator to help.

3.1.4. *Insufficiency of Bilateral Treaties*

There has been a consistent cry from some experts for multi-lateral, holistic, "catchment-based" water management treaties for entire hydrological systems rather than reliance on simple bilateral treaties. The Ganges-Brahmaputra-Meghna river system would benefit from such an agreement,²⁴⁶ and Bangladesh would do well to encourage its neighbors to enter into one. This, however, seems an unrealistic goal. Bangladesh may consider making a vigorous effort in international arenas by approaching organizations such as the United Nations to bring attention to its thirsty plight, and point to the untold efficiencies and benefits that might arise from having a better treaty for the region—but that is approximately the extent of what it is likely to accomplish.

The numbers support the lack of feasibility for such an arrangement: in 1997, 124 of the 145 water treaties in the world were bilateral.²⁴⁷ Twenty-one of the treaties were multilateral; two of these multilateral treaties were "unsigned agreements or drafts."²⁴⁸ Experts have attributed the lack of any real attempt to enter into a multilateral water management treaty to political and ideological differences, as well as the varying, and seemingly conflicting, immediate interests amongst riparian countries.²⁴⁹

²⁴⁶ Potential benefits include an increased provision of hydro-electric power, improved navigation routes, improved water quality, and increased cooperation in mitigating natural disasters. See ADB REPORT, *supra* note 73, at 6, para. 20.

²⁴⁷ See Jesse H. Hamner & Aaron T. Wolf, *Patterns in International Water Resource Treaties: The Transboundary Freshwater Dispute Database*, 9 COLO. J. INT'L ENVTL. L. & POL'Y 157, 160 (1997) (noting that the overwhelming percentage of modern international water resource treaties are bilateral, as opposed to multilateral).

²⁴⁸ *Id.*

²⁴⁹ See Salman & Uprety, *supra* note 201, at 299 (noting that in spite of the tremendous importance of the Ganges River to the livelihood of the four riparian countries—India, Nepal, Bangladesh, and China—they have never entered into a water-sharing agreement because of political and ideological differences).

Earlier, an example of this was mentioned briefly²⁵⁰—the flow augmentation disagreements during the twenty-one year delay before the 1996 Ganges Treaty. During this time, Bangladesh and India were exchanging large-scale construction proposals to augment the flow of the Ganges River. India's proposals centered on the construction of a link-canal through Bangladesh territory to connect the Brahmaputra River with the Ganges River at a point above the Farakka Barrage; Bangladesh disliked these proposals, concerned as they were with the environmental, social, political, and economic impact of such a project. More importantly, Bangladesh was concerned about the canal's potential to exacerbate flooding during the monsoon season.²⁵¹ Bangladesh instead wished to build storage reservoirs in the upper reaches of the Ganges in India *and Nepal* to "store water during the monsoon season for release during the dry season."²⁵² India refused this idea outright, because it involved Nepal, which it contended was outside the scope of the negotiations.

Indeed, during those two decades, whenever Bangladesh wanted to involve Nepal in the discussion of its proposal for augmentation through storage mechanisms, India avoided the issue by pleading bilateralism.²⁵³ One might interpret this refusal on the part of India to engage in multilateral negotiations as a strategic way to maintain its bargaining advantages. Bilateral negotiation was perhaps preferred by India because it: (a) prevented Nepal and Bangladesh from consolidating their transboundary river interests (thereby gaining more leverage against India); and (b) avoided the complications of articulating a non-contradictory, self-benefiting water sharing theory to both its upper and lower riparian neighbors at the same time. Imagine India attempting to reconcile its stance on the sharing of the Mahakali River with Nepal—defending, as a lower riparian country, its right to use the water in accordance with its need for the water, where the term "need" is interpreted to describe extensive socio-economic requirements—but denying Bangladesh,

²⁵⁰ See *supra* notes 205, 242 (noting the role of augmentation in the discussions between Bangladesh and India, and its delaying effect upon the proceedings).

²⁵¹ See Salman & Uprety, *supra* note 201, at 331 (discussing India and Bangladesh's proposed plans to augment the flow of the Ganges River during the dry season, and the concerns that arose out of these proposals).

²⁵² *Id.*

²⁵³ Khan, *supra* note 3, at 478.

as an upper riparian state, more generous access to the Ganges. This would be awkward at best; India, in short, had no immediate incentive to negotiate with more than one party at any given time (though it is worthwhile to note that recently India has seemed more amenable to the concept²⁵⁴).

Still, the arguments in favor of a multilateral treaty are compelling. International drainage basins link riparian states into a common and interdependent freshwater system that essentially connects the encompassed nations' respective agricultural, industrial, energy, and transportation sectors into an integrated regional unit—action by one riparian nation affects the quantity and quality of river water available to neighboring states, and imposes direct costs on other states in the basin; basin nations share not just a river, but also an entire ecosphere.²⁵⁵ While the potential for conflict is extremely high, so too is (as is submitted by some observers) the possibility and beneficial nature of compromise and cooperation.²⁵⁶

According to some water resource experts, ignoring the watershed as the fundamental planning unit—where the quality and quantity of surface water and groundwater are all interrelated—ignores hydrologic reality.²⁵⁷ Thus, any policy insisting upon bilateral negotiations is not ideal.²⁵⁸ Some observers claim that neither the Ganges-Brahmaputra nor the Indus River systems have ever been managed to their full efficiency due to mentalities that ignore the fundamental nature of the watershed.²⁵⁹ Another has predicted that a truly permanent solution to the Ganges-Brahmaputra-Meghna basin difficulties will only occur after the inclusion of all the affected watercourse states in treaty negotiations.²⁶⁰

²⁵⁴ *Bangladesh Seeks Tripartite Water Talks with Nepal, India*, BDNEWS24.COM (Bangl.), Mar. 20, 2010, <http://www.bdnews24.com/details.php?id=156324&cid=2> (“According to a press-release issued by the Bangladesh High Commission in Delhi, India was agreeable to the proposal of a tripartite discussion [regarding incorporating Nepal into potential augmentation schemes].”).

²⁵⁵ Kraska, *supra* note 198, at 481.

²⁵⁶ *Id.*

²⁵⁷ Hamner & Wolf, *supra* note 247, at 160.

²⁵⁸ *Id.*

²⁵⁹ *Id.*

²⁶⁰ Khalid, *supra* note 187, at 570.

3.2. India's Inter-Basin Water Transfer Project and Upstream Dams

Several planned actions²⁶¹ by India—through their manipulation of surface water flows—might be threats to Bangladesh's ultimate well-being. The largest of these is the Indian Inter-Basin Water Transfer Project.²⁶² The Indian Government is in the planning and design stages of a massive endeavor to rearrange its currently uneven distribution of water in the style of the Farakka Barrage, except on a far larger scale. The project, in addition to smaller Indian dam projects, such as the Tipaimukh Hydroelectric Dam on the Barak River,²⁶³ have the potential to

²⁶¹ See, e.g., *North Eastern Electric Power Map*, N.E. ELEC. POWER CORP., <http://www.neepco.gov.in/neepco/jsps/popupimg.html?neepco/images/needmapNew.jpg> (last visited Mar. 15, 2011) (depicting the locations of India's planned actions on a map); *Projects to be Taken Up*, N.E. ELEC. POWER CORP., <http://www.neepco.gov.in/neepco/index.jsp> (hover over "Projects" hyperlink; then follow "Future Projects" hyperlink) (last visited Feb. 27, 2011) (listing the current status of projects planned for states in the North Eastern region); *Projects Under Execution*, N.E. ELEC. POWER CORP., <http://www.neepco.gov.in/neepco/index.jsp> (hover over "Projects" hyperlink; then follow "Ongoing Projects" hyperlink) (last visited Mar. 15, 2011) (providing information on various gas and hydro electric based projects); see also *Projects List*, NAT'L HYDROELEC. POWER CORP., http://www.nhpcindia.com/Projects/Project_index.aspx (last visited Mar. 15, 2011) (listing National Hydroelectric Power Corporation's projects by type and then by name).

²⁶² See generally *Inter Basin Water Transfer: The Need*, NAT'L WATER DEV. AGENCY, <http://nwda.gov.in/index2.asp?slid=3&sublinkid=3&langid=1> (last visited Mar. 15, 2011) (stating the reasons the Indian Government plans to redistribute water from excess areas to shortage areas and the most effective ways of doing so).

²⁶³ See *Welcome to Tipaimukh Project*, NAT'L HYDROELEC. POWER CORP., http://www.nhpcindia.com/Projects/English/Scripts/Prj_Features.aspx?Vid=167 (last visited Mar. 15, 2011) (describing the project, as summarized by the implementation agency). See generally Syed Zain Al-Mahmood, *Muddying the Waters*, STAR WEEKEND MAG. (Bangl.), July 10, 2009, <http://www.thedailystar.net/magazine/2009/07/02/cover.htm> (describing India's Tipaimukh dam project and its potential dangerous effects on Bangladesh); Mohiuddin Alamgir, *Tipaimukh: Another Farakka in the Offing?*, NEW AGE XTRA (June 12, 2009), <http://media.causes.com/ribbon/502745> (drawing comparisons between the Tipaimukh Dam and the Farakka Barrage). Some have predicted that Tipaimukh will have devastating, irreversible effects in Bangladesh. See Mustafizur Rahman Tarafdar, *Tipaimukh Dam: An Alarming Venture*, DAILY STAR (Bangl.), Apr. 25, 2009, <http://www.thedailystar.net/story.php?nid=85451> (predicting environmental, economic, and agricultural havoc if the Tipaimukh dam is built); see also Syed Zain Al-Mahmood, *The Dam Documents*, STAR WEEKEND MAG. (Bangl.), July 24, 2009, <http://www.thedailystar.net/magazine/2009/07/04/followup.htm> (noting inadequacies and suspect items within the published portions of the feasibility and impact studies). Note, however, that India has assured Bangladesh that because the dam is a hydroelectric plant, it is not a danger to Bangladeshi interests

exacerbate Bangladesh's arsenic crisis by placing even more disincentives²⁶⁴ upon Bangladesh to rely on surface water. Bangladesh might, as a result, need to try leveraging international law to prevent or limit the effects of these unilateral Indian projects destined to affect Bangladesh's water supply.

IBWT involves the diversion of water from the Ganges and the Brahmaputra.²⁶⁵ Its construction was authorized by a decision of the Indian Supreme Court.²⁶⁶ The project has two components—a Himalayan component that will link fourteen rivers in northern India, and a Peninsular component that will link sixteen rivers in southern India.²⁶⁷

as it does not divert water away from the Barak River. *Tipaimukh Dam Won't Harm: India*, BANGL. NEWS, May 20, 2009, <http://www.independent-bangladesh.com/2009051910988/country/tipaimukh-dam-won-t-harm-india.html>.

²⁶⁴ See generally Sudha Ramachandran, *India, Bangladesh Fight Against the Current*, ASIA TIMES, June 8, 2006, http://www.atimes.com/atimes/South_Asia/HF08Df04.html (reporting non-arsenic related difficulties that have arisen from India's use of the Farakka Barrage, including the consistent diminution of the flow of water into Bangladesh, and resultant concerns arising from IBWT and Tipaimukh).

²⁶⁵ See generally *Inter Basin Water Transfer: The Need*, *supra* note 262 (describing potential ways to address water shortages and noting the excess of water in the Northern reaches of the Ganges and the Brahmaputra).

²⁶⁶ See Keya Acharya, *Scheme to Link Major Rivers Divides India*, ENV'T NEWS SERV., July 17, 2003, <http://www.ens-newswire.com/ens/jul2003/2003-07-17-01.html> ("The scheme has been given added weight by the Supreme Court of India which, on a public interest litigation filed by farmers from southern India asking the government to provide water to all, passed an Order requiring the project to be completed by 2016."); see also Ahsan, *supra* note 183 (relating news of minister-level talks between India and Bangladesh and conveying fear that India's river link project will harm Bangladesh's water supply). Manoj Mitta provides a narrative of the series of events that led to the court pronouncement: In August 2002, the Indian President Kalam made a "passing" observation in an address to the nation, listing problems that required urgent attention, including uneven water distribution across the nation. Manoj Mitta, *The River Sutra*, INDIAN EXPRESS, Mar. 2, 2003, <http://www.indianexpress.com/oldStory/19364/>. In August 2002, senior advocate Ranjit Kumar filed a copy of the speech along with other documents to the Supreme Court on a separate matter, the clean-up of Yamuna River. *Id.* Chief Justice of India Kirpal responded "so enthusiastically" that the Supreme Court converted Kumar's application into a writ petition and issued notices on the need to network rivers. *Id.*

²⁶⁷ NAT'L COUNCIL OF APPLIED ECON. RESEARCH, ECONOMIC IMPACT OF INTERLINKING OF RIVERS PROGRAMME 3 (2008) (India), available at <http://www.nwda.gov.in/writereaddata/mainlinkfile/File277.pdf>; see also *India's National River-Linking Project: India's River Linking Map*, INT'L WATER MGMT. INST., <http://nrlp.iwmi.org/main/maps.asp> (last visited Mar. 15, 2011) (mapping where rivers will be linked for the Peninsula and the Himalayan Components).

The Project's objectives, according to the Indian National Water Development Agency, are "to increase the irrigation potential for increasing the food grain production, mitigate floods and droughts and reduce regional imbalance in the availability of water," by transferring water from areas of surplus to deficit areas.²⁶⁸ The intention is to "build storage reservoirs on these rivers and connect them to other parts of the country," so that a "lot of benefits by way of additional irrigation, domestic and industrial water supply, hydropower generation, navigational facilities etc. [sic] would accrue."²⁶⁹

Using Farakka as a guide, it seems easy to surmise the adverse consequences that the Indian IBWT Project—a thorough, expensive redesign of natural water movement through the entire subcontinent—will likely have on the economy, ecology, biology, and sustainable development of Bangladesh.²⁷⁰ Among other projected ecological and economic effects (e.g. a crippling of Bangladesh's fishing industry²⁷¹), some contend that the intrusions of salinity caused by the IBWT Project "will render the ground water [further] contaminated and undrinkable, causing further scarcity in surface water."²⁷² Citing studies on the potential impacts of the Indian IBWT Project, Shawkat Alam warns:

The Indian River-Linking Project will irreparably alter natural ecosystems by an unnatural modification of the hydrological cycle through the use of canal systems, and it will seriously affect biological diversity by upsetting the natural equilibrium. Such extensive geomorphic changes

²⁶⁸ *Inter Basin Water Transfer: The Need*, *supra* note 262.

²⁶⁹ *Id.*

²⁷⁰ See Shawkat Alam, *An Examination of the International Environmental Law Governing the Proposed Indian River-Linking Project and an Appraisal of Its Ecological and Socio-Economic Implications for Lower Riparian Countries*, 19 *GEO. INT'L ENVTL. L. REV.* 209, 213 (2007) (discussing the impacts of the Indian River-Linking Project).

²⁷¹ See Khalid, *supra* note 187, at 555.

According to Jayanta Bandopadhyaya, of the Centre of Development and Environment Policy at the Indian Institute of Management in Kolkata, arresting the natural flow of rivers on a gigantic scale could sound "the death knell" for mangroves in the delta region of West Bengal and Bangladesh because mangroves require the steady rise and fall of the sea level so that their roots can breathe. Once this process is disrupted, the world could "lose the richest fisheries in South Asia". [sic]

Id.

²⁷² Alam, *supra* note 270, at 216.

will greatly increase the probability of microbial and infectious diseases because of the lack of water in areas where it was once present, thereby increasing the already inadequate levels of sanitation of the malnourished and poverty-stricken people who will become displaced.²⁷³

These types of conclusions are, of course, speculative. Indeed, there seems to be insufficient data regarding the project itself to make proper conclusions; the scale of destructiveness for Bangladesh largely depends on how much water India intends to divert. Some observers suggest that there are ways IBWT might actually *help* Bangladesh by preventing monsoon season flooding, provided that India draws water below a certain threshold.²⁷⁴

Still, barring a change in course from India herself—which, granted, is entirely possible because India is quite divided about whether or not to proceed with the project²⁷⁵—Bangladesh might find it beneficial to look to international law to stand between Bangladesh and the dire consequences of the IBWT Project and other Indian water manipulation projects.

²⁷³ *Id.*; see also ANIK BHADURI & B. K. ANAND, LINKING RIVERS IN THE GANGES-BRAHMAPUTRA BASIN: EXPLORING THE TRANSBOUNDARY EFFECTS AND POSSIBILITY OF A WIN-WIN SITUATION 2 (2008), available at http://nrlp.iwmi.org/PDocs/DReports/Phase_02/04.%20Linking%20Rivers%20in%20the%20Ganges-Brahmaputra%20River%20Basin-Anik%20bhaduri%20et%20al.pdf (stating that above a certain level, diversions of large amounts of water “could affect the ecology of the Brahmaputra River Basin in Bangladesh” and that “there is a chance of a huge environmental catastrophe in Bangladesh because of the salinity ingress that could arise from the depletion of water in the downstream Brahmaputra”).

²⁷⁴ See generally BHADURI & ANAND, *supra* note 273, at 5–6 (attempting to model a reasonable water sharing method between Bangladesh and India—utilizing altruism and a beneficent social planner for the entire Ganges basin—that would result in benefits for *both* parties, despite the reduction in water for Bangladesh). However, note that this suggestion is predicated on the amount of altruism India is willing to show to Bangladesh, given its own very extensive water needs.

²⁷⁵ See Tushaar Shah, Upali Amrasinghe & Peter McCornick, *India's River Linking Project: The State of the Debate*, in STRATEGIC ANALYSES OF THE NATIONAL RIVER LINKING PROJECT (NRLP) OF INDIA SERIES 2 at 1, 10–13 (Upali A. Amarasinghe & Bharat R. Sharma eds., 2008) (summarizing various Indian reservations to engaging in a project at the scale of the proposed IBWT, including concern over environmental and social costs, as well as fraying political ties with India's neighbors); see also Acharya, *supra* note 266 (describing the mixed reactions to India's river-linking plan); M. S. Menon, *A Case for Inter-Basin Transfer of Water*, HINDU (India), Nov. 19, 2002, <http://www.hinduonnet.com/thehindu/op/2002/11/19/stories/2002111900130200.htm> (objecting to the fears of those who reject the IBWT and claiming that these opponents “have conveniently forgotten the benefits reaped from the past water transfers”).

4. SECURING MORE SURFACE WATER

Section 3 identified Bangladesh's disadvantages in its negotiations with India, shortcomings inherent in the Ganges Treaty as a result of the Farakka Barrage (and other bargaining inequities), as well as threats to its surface water resources that are on the horizon due to upcoming water diversion projects being implemented by India. These issues were characterized as obstacles to Bangladesh's arsenic mitigation goal of having its population again rely on surface water as they effectively remove the most direct manner of securing more water: treaty negotiations.

Section 4 will attempt to take a brighter view on Bangladesh's plight by exploring other options. In general, to accomplish its goal of reestablishing reliance on surface water, Bangladesh will have to find a way to (1) prevent the further loss of surface water and (2) acquire more surface water.

Regarding this first objective—while, as established in Part 3, Bangladesh may have difficulty attempting to negotiate its way to more water, it *may* find success using international law as a defensive mechanism to prevent further surface water loss. This section will examine ways Bangladesh may use international law to *prevent* deprivation of more water from upstream due to India's damming practices. It will look to relief that Bangladesh might find under Ganges Treaty—despite its lack of an effective dispute resolution mechanism or its inclusion of ambiguous legal obligations upon both participating countries—and then turn to trends in international watercourse law that may help Bangladesh in preventing or curtailing the effects of India's actions, should the government choose to turn to the international arena for help.

Regarding the second objective—taking a page from India's own ambitious plans, Section 4 will also look to large-scale projects that Bangladesh might itself pursue to attempt to leverage currently inefficient surface water distributions. This section will advocate the benefits of such water augmentation projects and use India's example for their research and implementation, but will caution that their ecological and economic impact be carefully considered before implementation.²⁷⁶

²⁷⁶ Potential large-scale projects on Bangladesh's horizon will not have the same international watercourse law implications as those called upon by India's projects. Water diversion or storage attempts by Bangladesh will almost certainly have impacts on Bangladesh itself, but on some level will leave its neighbors

4.1. Stopping the IBWT Project

Bangladesh, in theory, is partially protected from unilateral upstream water diversions under both the current treaty between India and Bangladesh that governs transboundary rivers and under principles derived from the evolving body of international watercourse law. Such protections are discussed below. Note that this section will focus on legal protections against the IBWT project, though some of the arguments can be adapted to argue against any unilateral upstream diversions.

4.1.1. Securing an International Forum

First, to articulate these legal arguments and have them be heard, Bangladesh would need to compel India to consider whether it is violating its legal obligations to Bangladesh, listen and find merit in Bangladesh's legal arguments, and alter its actions or agree to amend water sharing treaties accordingly. As discussed previously, this will likely not occur through political means, given the bargaining inequities between the countries. A third-party judicial organ is likely necessary, regardless of Bangladesh's goals (whether they be the reinterpretation of the 1996 Treaty in light of emerging customary law, or the use of an international adjudicatory body to listen and mandate an outcome in a hypothetical water-sharing dispute between Bangladesh and India).

This goal, unfortunately, is not easily attainable. For example, Bangladesh might have considered attempting to voice its case before the International Court of Justice ("ICJ"). The ICJ serves a dispute settlement function for those nations declaring recognition of the ICJ's compulsory jurisdiction in relation to conflicts with any other State accepting the same obligation—which India has.²⁷⁷ Unfortunately, Bangladesh, for any conflict with India, would not

unscathed — this is a qualified blessing as a result of Bangladesh's status as a lower riparian nation.

²⁷⁷ Statute of the International Court of Justice, art. 36, para. 2, June 26, 1945, 59 Stat. 1055, T.S. 993 ("The states parties to the present Statute may . . . recognize as compulsory *ipso facto* and without special agreement, in relation to any other state accepting the same obligation . . ."); see also Declaration letter from Swaran Singh, Minister of External Affairs, India, to Int'l Court of Justice (Sept. 18, 1974), available at <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=3&code=IN&PHPSESSID=45955dcbbc3178264e1ea1a7790ba97d> (declaring India's recognition of the jurisdiction of the International Court of Justice as compulsory).

successfully gain an international venue by accepting compulsory ICJ jurisdiction because India's acceptance of ICJ jurisdiction specifically exempts itself for "disputes with the government of any State which is or has been a Member of the Commonwealth of Nations."²⁷⁸ This exemption might be one of many reasons Bangladesh has not itself recognized ICJ jurisdiction (aside from unpredictable Bangladeshi political considerations or a decision to preserve sovereignty).

4.1.2. *Protections Under the 1996 Ganges Treaty*

Section 3.1.1 discusses the limited utility of the 1996 Ganges Treaty as a tool to compel India to enter into treaty negotiations for the many transboundary rivers that the respective countries share. Still—in the spirit of taking a brighter view on Bangladesh's plight—it is safe to say that the Ganges Treaty does not solely concern the Ganges River. While, as Khalid notes, the framers of the Ganges Treaty likely did not have a project at the scale of the Indian IBWT Project in mind,²⁷⁹ at minimum it is arguable that the framers agreed to impose upon both countries *some* obligations that must be adhered to when undertaking projects that affect water-sharing, even if the precise extent of those obligations is unclear. It seems that, by pursuing the IBWT Project without pursuing a new treaty agreement with Bangladesh—and without, some say, even formally notifying Bangladesh²⁸⁰—India is willfully

²⁷⁸ Declaration letter from Swaran Singh, *supra* note 277, para. 2; *see also id.* para 5 (exempting India from "disputes with regard to which any other party to a dispute has accepted the compulsory jurisdiction of the International Court of Justice exclusively for or in relation to the purposes of such dispute . . .").

²⁷⁹ Khalid, *supra* note 187, at 561.

²⁸⁰ Khalid provides a narrative for Indian "double-speak" in 2003 on whether it is actually proceeding with the River-Linking project.

The Indian Prime Minister announced on 15 August 2003 that the project to link all major rivers of the country would start by the end of this year. A Joint River Commission Meeting was due on October 2003 and the Government of Bangladesh proposed to include the Project in the agenda. On 30 September 2003, the Water Resources Minister of India informed Bangladeshi officials that its proposal to link the rivers was only at a "conceptual stage". [sic] Yet, following insistence from the Bangladeshi side, India agreed to include the issue in the agenda, though only under the "miscellaneous" head. In that meeting, India only reiterated its position by saying that the Project is still at an amorphous stage.

ignoring the pro-treaty sentiments it espoused when creating Article IX.

Note how this type of argument—that is, the argument that India is in violation of Article IX—is not in conflict with the preamble’s caveat. Bangladesh would not be arguing a violation of a “general principle of law” that the Ganges Treaty established, but rather that India is violating a specific obligation that was bargained for and included plainly in the treaty. Similarly, Bangladesh would not be arguing that the Treaty somehow created some implicit legal “precedent” to which India did not specifically agree when signing the treaty; it instead would point to the clause as an explicit *present* requirement that was set forth and agreed to by both parties.

Khalid also suggests that the Treaty and the Indian IBWT Project cannot coexist because the IBWT Project intends to divert water from the Ganges *before* it reaches the point where water allocations are measured—thus, as he puts it, “proper implementation of the Treaty does not allow such a [water diversion] project[,] and the [Indian River-Linking] Project, if implemented, would make the Treaty completely irrelevant.”²⁸¹ While Khalid does not flesh out this argument, we can perhaps try to build one that stems from the “lucky” fact that India decided to locate the Farakka Barrage so close to the Bangladeshi border (“below” much of its hydrological system) and agreed that that point was where water allocations would be measured.²⁸²

Id. Since then, India has made rather grandiose assurances that IBWT, if implemented, will not harm Bangladesh.

Dasmunshi reiterated New Delhi’s assurance that India would not implement any project that might create any problems within India or for Bangladesh. “Before affecting Bangladesh, this project will affect West Bengal and Assam,” he said, adding, “it would not be implemented in 2000 years.”

Reddy, *supra* note 220.

²⁸¹ Khalid, *supra* note 187, at 561.

²⁸² 1996 Ganges Treaty, *supra* note 30, Annexure I. See the full “formula” below:

ANNEXURE-I

Availability at Farakka	Share of India	Share of Bangladesh
70,000 cusecs or less	50%	50%
70,000 - 75,000 cusecs	Balance of flow	35,000 cusecs
75,000 cusecs or more	40,000 cusecs	Balance of flow

First, note that for the period of March 1 to May 10 every year, the Treaty splits the Ganges flow not into *percentages* but respective *absolute* measures of water volume owed to each country.²⁸³ While it has already been discussed how these volumes might have been grossly underestimated, it is worthwhile to note that India, by not providing these volumes during these months under “natural” circumstances out of its control, would be in violation of the Treaty only because it is impossible to fulfill the conditions of the Treaty. The story changes, however, if India cannot fulfill the Treaty by *causing* the water to be unavailable to Bangladesh through upstream diversions. In this situation, it would be directly acting such that the terms of the Treaty – Article II(i) in conjunction with Annexures I and II²⁸⁴ – cannot be fulfilled. Therefore, it would be implicitly violating the 1996 Treaty.

Further, it could also be argued that India is *explicitly* violating Article II(ii) of the 1996 Treaty, which states in relevant part: “[e]very effort would be made by the upper riparian to protect flows of water at Farakka as in the 40-years average availability as mentioned above.”²⁸⁵ The Indian IBWT project actively shirks this responsibility. The language is admittedly broad; however, it is fairly clear on plain reading that the Indian IBWT project would hardly qualify as “every effort” to “protect flows” on the part of India.

Finally, Bangladesh can bolster its arguments with respect to violations of the 1996 Treaty by pointing to the repeated inclusions of a “no harm” principle alongside an “equitable use” principle,²⁸⁶ and using that repetition to suggest that India agreed – for, at minimum, the Ganges – to avoid engaging in watercourse practices harmful to its lower riparian neighbor. The benefits of equating these principles were discussed in Section 3.1.1 and the individual

Subject to the condition that India and Bangladesh each shall receive guaranteed 35,000 cusecs of water in alternate three 10-day periods during the period of March 1 to May 10.

Id.

²⁸³ *Id.* art. II.

²⁸⁴ *See id.* Annexure-II. Annexure II is an “indicative schedule” based on 40 years (1949-1988) of data of the average availability of water at Farakka for 10-day periods.

²⁸⁵ *Id.* art. II(ii).

²⁸⁶ *Id.* arts. II, IX, X.

principles and their legitimacy will be touched upon in Section 4.1.3.

4.1.3. *Regulation of International Rivers and Recent Trends*

Principles that attempt to tackle the problems of resolving conflicts between co-riparian water users have been developed over the course of centuries by lawmakers and scholars. As of this writing, no active convention or treaty applies directly to Bangladesh's plight in the face of India's upstream IBWT project (aside, potentially, from the 1996 Ganges Treaty itself, as discussed in Section 4.1.2).²⁸⁷ Thus, it might be useful to examine water regulation principles that have arisen over the centuries and glean the direction in which they flow with respect to acceptance by the international community. These principles—arising both from multilateral agreements and soft-law instruments—pertain to transboundary rivers and might prove useful to Bangladesh in crafting legal arguments in an international forum.

At minimum, it is clear that the old principle of *absolute territorial sovereignty* over rivers, a concept favoring upper riparian state rights and articulated by Grotius as “the property of the people through whose territory it flows” has been largely abandoned.²⁸⁸ As evidence of this, Alam points to the adoption of a more equitable distribution of rights in treaties entered into by various upper riparian nations such as the United States, Austria, and India.²⁸⁹ The principle's waning acceptance is also evident in decisions by international juridical bodies, which have rejected the position²⁹⁰ as evident in the 1941 *Trail Smelter Arbitration*²⁹¹ and the 1949 ICJ *Corfu Channel* case.²⁹²

²⁸⁷ Note, however, that Bangladesh can call upon *separate* obligations to which India has agreed—by virtue of India's various multilateral treaty memberships—and claim that India would violate *those* obligations if it proceeds with its upstream damming projects. These include obligations under the London Convention Related to the Preservation of Fauna and Flora in their Natural State, the Rome International Plant Protection Convention, the World Heritage Convention, and the Convention of Migratory Species. See Alam, *supra* note 270, at 230 (enumerating multilateral commitments made by India that the damming project would theoretically violate).

²⁸⁸ *Id.* at 220.

²⁸⁹ See Alam, *supra* note 270, at 220–21. (discussing changing customs and principles in international water law as reflected by treaty).

²⁹⁰ See Khalid, *supra* note 187, at 563 (noting a shift in customs and principles in international water law as defined by international judicial bodies).

It is also clear that the conceptual “opposite,” the *principle of absolute territorial integrity*—which requires upper riparian countries to utilize a river resource in such a manner so as not to affect the flow of the river to lower riparian countries—is similarly inapplicable, as it never took hold in the international realm.²⁹³

Two principles more readily embraced by modern international law are also embraced by the Ganges Treaty itself: the obligation not to inflict appreciable harm (or the “*no harm*” *principle* noted in Section 3.1.1) and the equitable use principle (noted in Section 3.1.2). The former imposes an obligation not to use, or to allow the use of, territory for acts contrary to the rights of other states and has appeared in various soft-law instruments.²⁹⁴ This doctrine is beneficial to Bangladesh as it obliges riparians to consider the effects their actions have on co-riparians, instead of ignoring them and pursuing projects under the theory of state sovereignty.²⁹⁵

The latter—the widely-held doctrine of reasonable and equitable use—establishes that states shall optimally, equitably,

²⁹¹ Trail Smelter Arbitration (U.S. v. Can.), Decision, 3 R.I.A.A. 1905 (Trial Smelter Arb. Trib 1938).

²⁹² Corfu Channel Case (U.K. v. Alb.), Judgment, 1949 I.C.J. 4, 22 (Apr. 9).

²⁹³ See Khalid, *supra* note 187, at 563 (“This principle states that lower riparian states have the right to the continuous or natural flow of a river flowing from upper riparian states.”).

²⁹⁴ See, e.g., Report of the United Nations Conference on the Human Environment, *supra* note 187, at 4. The Stockholm Declaration emphasized that although states are allowed to exploit their own resources pursuant to their own environmental policies, they have the responsibility to ensure that activities within their jurisdiction do not cause damage to other states; this concept has appeared in the 1992 Rio Declaration on Environment and Development, the 1992 Convention on Biological Diversity, and the 2002 Johannesburg Earth Summit. Alam, *supra* note 270, at 218. *But see* CHARLES B. BOURNE, *The International Law Commission’s Draft Articles on the Law of International Watercourses: Principles and Planned Measures*, in INTERNATIONAL WATER LAW: SELECTED WRITINGS OF PROFESSOR CHARLES B. BOURNE 83, 98–103 (Patricia Wouters ed., 1997) (describing how the principle of no harm directly contradicts the principle of equitable utilization and questioning the principle’s status as customary law by criticizing the use of the *Trail Smelter*, *Corfu Channel*, and *Lac Lanoux* cases as legitimate “precedent” for the no harm principle).

²⁹⁵ The old principle of state sovereignty has also been limited over the years. Alam points to the implicit restraints found within UN Charter itself, which requires participants to give due account to the well-being of its fellow nations in social, economic, and commercial matters. Alam, *supra* note 270, at 218; U.N. Charter art. 55.

and reasonably utilize the watercourse in their respective territories²⁹⁶; this principle merits some discussion.

The principle was articulated by the 1966 Helsinki Rules on the Uses of Waters of International Rivers,²⁹⁷ a document that was produced by the International Law Association and not bolstered by the weight of any intergovernmental body; it was revised and updated in the 2004 Berlin Rules on Water Resources.²⁹⁸ The principle was also incorporated into the 1997 Watercourse Convention.²⁹⁹

India, in some ways, leans on the principle of equitable use, which allows for the use of watercourses according to a country's need. This leaning is evident from India's negotiations during the formation of the Mahakali and Ganges Treaties, where it often used its need as a justification for its positions, defining "need" to

²⁹⁶ See *supra* notes 206-13 and accompanying text (discussing India's watercourse management in wet and dry seasons and its effect on Bangladesh, as well as the doctrine of equitable use generally).

²⁹⁷ See Int'l Law Ass'n, *Uses of the Waters of International Rivers*, 52 INT'L L. ASS'N REP. CONF. 447, 486 (1966) ("Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin.").

²⁹⁸ See Int'l Law Ass'n, *Berlin Conference on Water Resources Law: Fourth Report*, 71 INT'L LAW ASS'N REP. CONF. 334, 361 (2004). Interestingly, the principle of equitable utilization is prefaced by an articulation of the no harm principle noted before:

1. Basin States shall in their respective territories manage the waters of an international drainage basin in an equitable and reasonable manner having due regard for the obligation not to cause significant harm to other basin States.
2. In particular, basin States shall develop and use the waters of the basin in order to attain the optimal and sustainable use thereof and benefits therefrom, taking into account the interests of other basin States, consistent with adequate protection of the waters.

Id.

²⁹⁹ Convention on the Law of the Non-Navigational Uses of International Watercourses, arts. 5-7, *supra* note 189. The Convention requires 35 ratification documents to come into force. *Id.* art. 36(1). Note that Bangladesh voted for 1997 Watercourse Convention but India abstained from voting. Khalid, *supra* note 187, at 562. The convention has not yet accumulated 35 ratification documents. *Id.* This obviously reduces the applicability of the 1997 Watercourse Convention, especially given the following argument which one observer raises: because the Convention is looked upon with particular suspicion and given particular disregard in the South and East Asian regions, its applicable principles are rendered suspect. Erica J. Thorson, *Sharing Himalayan Glacial Meltwater: The Role of Territorial Sovereignty*, 19 DUKE J. COMP. & INT'L L. 487, 510-11 (2009).

include its population's significant "socio-economic requirements."³⁰⁰ This utilization of the doctrine has been decried by some observers as unreasonable and *contrary* to the doctrine's goal of efficiency.³⁰¹ As noted by Alam:

[India's] aggressive pursuit of economic prosperity while maintaining . . . unsustainable consumptive patterns, through the diversion and damming of environmental flows . . . requires even greater diversions of water to meet present needs. Hence, the traditional doctrine of equitable use actually results in increased waste, as the supposedly "optimal and reasonable use" for the further development of water resources has often been based on little more than the supply that is needed to prop up existing inefficiencies in water transmission and usage.³⁰²

Thus, under a sophisticated interpretation of the equitable use doctrine that takes into account the doctrine's goals, India's attempted justifications might ring hollow.³⁰³

The 1997 *Gabcikovo-Nagymaros* decision of the ICJ illustrates this in a way and might be of particular interest to Bangladesh because of its commentary relating to the equitable use of transboundary watercourses. The dispute was regarding the use of the Danube River.³⁰⁴ One of the parties in the case, Czechoslovakia, was attempting to build a dam, which had the possibility of wreaking environmental havoc on Hungary.³⁰⁵

³⁰⁰ Salman & Uprety, *supra* note 201, at 300.

³⁰¹ Alam, *supra* note 270, at 223.

³⁰² *Id.*

³⁰³ There is support for this contention in the soft-law instruments previously mentioned. The 1997 Watercourse Convention—which can be characterized as an advocate of the equitable use doctrine—takes pains to include in Article 7 the principle of "no significant harm." Convention on the Law of the Non-Navigational Uses of International Watercourses, *supra* note 189. Recall that this was also the case in the Berlin Rules. See Int'l Law Ass'n, *supra* note 298. This suggests that, on some level, "no harm" is increasingly being folded into the concept of "equitable utilization." Granted, as discussed in note 299, neither Bangladesh nor India are bound by the 1997 Watercourse Convention, but this at minimum is a persuasive indication that India's no-holds-barred interpretation of the equitable use doctrine that allows unfettered unilateral rearrangements of a complex water system is contrary to emerging international legal obligations.

³⁰⁴ *Gabcikovo-Nagymaros Project (Hung. v. Slov.)*, 1997 I.C.J. 7, para. 16 (Sept. 25).

³⁰⁵ *Id.* para. 53.

The ICJ affirmed that Hungary and Czechoslovakia each had an equal right to the benefits of the Danube's water resources, including the use of the water for hydropower, recreational enjoyment, fisheries, and other benefits.³⁰⁶ In arriving at this conclusion, the Court noted that both Hungary and Czechoslovakia enjoyed a customary right "to an equitable and reasonable sharing of the resources of an international watercourse."³⁰⁷

For Bangladesh's purposes, ICJ provided guidelines in relation to the use and ownership of shared water resources.³⁰⁸ It notably used the principle of equitable use *against* the violating riparian. In deciding the effect of the construction of the Gabčíkovo-Nagymaros dam project on the Danube, it held that Czechoslovakia, by unilaterally assuming jurisdiction over a shared watercourse, deprived Hungary of its right to an equitable and reasonable share of the natural resources and consequently failed to respect established principles of international law.³⁰⁹ Alam views the ICJ's judgment in *Gabčíkovo-Nagymaros* as strengthening the claims of downstream states such as Bangladesh.³¹⁰ Its holding strongly suggests that India's proposed solution to the issue of droughts and floods as it strives to attain economic growth—via assertion of ownership of the waters and reallocation of water unfettered by sufficient concern for the ecological integrity of the environment—is disallowed under international law,³¹¹ or at the very least, becoming less accepted under international law.

There are other fledgling doctrines that merit mention, as they might help Bangladesh argue regarding the emergence of trends in customary international law that militate against the legality of the Indian IBWT Project.

Generally speaking, there appears to be a trend in the international sphere towards recognizing the need for a "holistic" management of global environmental resources—a need which

³⁰⁶ *Id.* para. 85; Thorson, *supra* note 299, at 502.

³⁰⁷ Gabčíkovo-Nagymaros Project (Hung. v. Slov.), 1997 I.C.J. 7, para. 78 (Sept. 25).

³⁰⁸ See generally Alam, *supra* note 270, at 227.

³⁰⁹ Gabčíkovo-Nagymaros Project (Hung. v. Slov.), 1997 I.C.J. 7, para. 85 (Sept. 25).

³¹⁰ See generally Alam, *supra* note 270, at 227.

³¹¹ *Id.* at 229.

was articulated in the Rio Declaration.³¹² The Rio Declaration emphasizes long-term development of global freshwater resources with an understanding of the “interconnectedness of the elements related to freshwater and freshwater quality.”³¹³ The Declaration specifically notes that the organic unity of river systems “demands that freshwater management be holistic”³¹⁴—dealing with the entire river basin and not just the portions of the river within a country’s borders.³¹⁵ Bangladesh can leverage this type of trend to argue that the Indian IBWT Project fails to consider the harms that it will likely inflict on the rest of the Ganges River System.³¹⁶

This is similar to the “community of interest” theory, which is a modification of the equitable use doctrine that ignores national boundaries to treat an entire transboundary water resource as a single economic and geographic entity, and has found some traction in the slowly developing field of international groundwater law.³¹⁷ The ICJ, meanwhile, has articulated a vague and broad “precautionary principle” which holds states to the general obligation of ensuring that activities within their control respect the environments of other states.³¹⁸ The International Law Commission of the UN has drafted procedural obligations for states engaging in activities that create a risk of causing significant transboundary harm. This, in a sense, may be the beginning of a trend towards recognizing a duty to cooperate with other countries in mitigating transboundary risks.³¹⁹ If they develop further, all of these international law principles will likely aid Bangladesh in a hypothetical dispute or in the imposition of preventative legal obligations by the 1996 Ganges Treaty.

³¹² *Id.* at 219.

³¹³ *Id.* at 219 (citing United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 13-14, 1992, *Resolutions Adopted by the Conference*, 18.36, U.N. Doc A/CONF 151/26/Rev.1 (Vol. 1) (1993)).

³¹⁴ *Id.*

³¹⁵ *Id.* at 219-20.

³¹⁶ Bangladesh can *also* leverage this type of trend to argue the need of a multilateral treaty. See discussion *supra* Section 3.1.4.

³¹⁷ Khalid, *supra* note 187, at 564.

³¹⁸ *Id.*

³¹⁹ *Id.*

4.2. Independent Surface Water Augmentation Plans

The previous sections outline the obstacles Bangladesh faces in attempting to secure more surface water from its upper riparian neighbors. Bilateral negotiations feature crippling large bargaining inequities, which Bangladesh might minimize by insisting upon a third-party entity to help arbitrate discussions. There are, meanwhile, practical roadblocks to an ideal multi-lateral treaty and centuries might transpire while waiting for such pleas to come to fruition. If anything, Bangladesh might be able to leverage international law to *prevent* further deprivations of surface water as long as it manages to articulate its legal arguments before an independent juridical organ, though this too leaves an awful lot to chance and faith. Thus, in the meantime, Bangladesh might do better to look *within* for solutions to its water shortages. The final portion of this discussion will scrutinize Bangladesh's efforts at pursuing internal surface water augmentation plans, and examine why they have yet to garner any actual results.

The acquisition of more surface water requires a creative and concerted effort that is focused inward. Bangladesh will need to borrow ideas from its neighbors (such as India) who are facing similar (though not identical) challenges, in providing sufficient quantities of clean water for their populations, and adapt these solutions for its own plight.

Bangladesh can, for example, follow India's lead and incentivize installations of rainwater collectors on buildings in urban areas. It can research and develop its own barrages to try leveraging its monsoon season excesses for the benefit of its drought seasons. If Bangladesh is able to "get its act together" and take significant steps towards augmenting surface water sources on its own, it will have a considerably easier time addressing its arsenic problems.

Indeed, it is likely that Bangladesh will have a chance for success in addressing its arsenic mitigation woes *only* after it pursues internal surface water augmentation strategies. Only then can it design and implement purification mechanisms for surface water and lure its population away from the poisonous groundwater. Note that doing so would not likely violate any international obligations (Bangladesh is the "lowest" riparian in the Ganges basin, and thus would have minimal effect on its neighbors), and would constitute a positive trend towards self-reliance (which is necessary due to the bargaining inequities that

Bangladesh faces). Yet, it will also require, on the part of Bangladesh, (1) an earnest and vigorous solicitation of foreign aid coupled with (2) a good-faith effort to cut corrupt misallocation of funds and (3) the encouragement of long-term individual political commitment to whatever large-scale engineering projects it chooses. It can thereby earn foreign trust and, in turn, secure more funding.

This has not happened yet. Some of the reasons for this were examined in Section 2.1. The Government is not solely to blame, as it is consistently dealt a particularly difficult hand filled with natural disasters, continued poverty, and giant developing neighbors.

Still, the lack of progress on large-scale efforts at surface water augmentation is frustrating. "Since 1963, Bangladesh (then East Pakistan) has sought to build a barrage . . . to store the wet season flow of the Ganges for use during the dry season."³²⁰ While India initially opposed this plan—largely because of the barrage's proposed location and concerns over the effects on *India's* environment—it has since come around and approved its building.³²¹

Land was bought and a stone foundation built for the project as early as 1980.³²² However, the various governments since then have failed to act.³²³

A feasibility study was conducted in 1997, which enumerated the plan's potential positive effects (increased water flow, reduced saline intrusion, irrigation help in the southwest, and prevention of flooding in Bangladesh).³²⁴ Experts predicted that if the barrage were built, it would increase navigability of the rivers in the region and ultimately save the Sundarbans.³²⁵ The plan would essentially

³²⁰ See generally Salman & Uprety, *supra* note 201, at 333.

³²¹ See *id.* (discussing India's initial opposition to Bangladesh's water preservation plans).

³²² See *Dhaka May Build Barrage on Ganga*, TURKMENISTAN NEWS.NET, Feb. 25, 2009, <http://www.turkmenistannews.net/story/470913> (discussing the need for Bangladesh to complete the Ganga Barrage Project); Pinaki Roy, *Rivers Dying as Ganges Project Remains in Limbo*, DAILY STAR (Bangl.), Jan. 26, 2008, <http://www.thedailystar.net/story.php?nid=20633>.

³²³ See Roy, *supra* note 322 (highlighting the failure of the Bangladeshi Government by neither completing the Ganga Barrage Project nor making any significant progress toward its completion).

³²⁴ See Salman & Uprety, *supra* note 201, at 334 (discussing the optimization of water usage potentially realizable through completion of the Ganga Barrage).

³²⁵ See generally Roy, *supra* note 322.

leverage the flood-excesses and attempt to redistribute the water to the areas of Bangladesh suffering from consistent drought. In 1999, formal funding was requested for the project from the Asia Development Bank and other international organizations. Even India offered to help with the technical aspects of the barrage.³²⁶

Yet, the structure remains un-built. Six years later, following WARPO recommendations in 2005, the government took initiatives³²⁷ to appoint consultants for a new feasibility study.³²⁸ It is unclear whether this feasibility study took place and no action has followed from the government.

In 2009, there was a renewed flurry of activity regarding surface water augmentation plans. In April, the finance ministry committee approved the selection of a consulting firm to carry out a *new* "feasibility and detailed engineering model study" of the barrage.³²⁹ In May, the \$4 million dollar feasibility study was approved.³³⁰ In July, Bangladesh sought "\$1.4 billion to implement the Ganges Barrage Project, and \$88.12 million for restoration of the flow of the Buriganga River and for a project for prevention of river pollution" from China.³³¹

While these seem like steps in the direction of actual construction, it is unclear whether the project will actually come to fruition, or whether this is merely political posturing by the government that is currently in power.

³²⁶ Salman & Uprety, *supra* note 201, at 334.

³²⁷ See generally MINISTRY OF WATER RES., BANGL. WATER DEV. BD., TERMS OF REFERENCE FOR FEASIBILITY STUDY AND DETAILED ENGINEERING OF GANGES BARRAGE PROJECT (2005).

³²⁸ See Roy, *supra* note 322 (noting that the Bangladeshi Government has hired consultants for a feasibility study of the engineering planning and environmental impacts of a Ganges Barrage, and has even opened an office to examine the "Feasibility of Ganges Barrage Project").

³²⁹ See Mirza Ahsan, *Dhaka Firm Seeks 3 Nations' Help to Design Ganga Barrage*, A PAK. NEWS, Apr. 10, 2009, <http://www.apakistannews.com/dhaka-firm-seeks-3-nations-help-to-design-ganga-barrage-114144> (discussing the solicitation of design support from Australia, Pakistan, and China in completion of the Ganga Barrage Project).

³³⁰ See *Deal Signed for Feasibility Study on Ganges Barrage*, DAILY STAR (Bangl.), May 7, 2009, <http://www.thedailystar.net/newDesign/news-details.php?nid=87156> (discussing the finalization of a deal to conduct a feasibility study for the Ganga Barrage Project).

³³¹ See *Bangladesh to Seek \$4.68 Bn Assistance from China*, LIVEMINT.COM, July 27, 2009, <http://www.livemint.com/2009/07/27142527/Bangladesh-to-see-468-bn-as.html> (discussing the aid package solicited by Bangladesh from China in support of various infrastructure projects).

It is commendable that the Bangladesh government is acting with caution; perhaps the decades of effort—and delay—are to ensure that any surface water augmentation plan is safe for the environment and relatively free of long-term ecological and economic side effects. Bangladesh's fragile hydrology, after all, may not be able to survive too many more detrimental pressures. It is, however, doubtful that the decades of delay are the result of ecological trepidation. Publicity stunts and general political inaction in the absence of progressive vision might be at play.

Self-sufficient projects like the Ganga Barrage are the key to acquiring sufficient surface water and easing pressure on Bangladesh's arsenic mitigation attempts. Bangladesh will not lift itself out of its poisonous dilemma unless it takes decisive action to study the feasibility of the barrage, determines ways to minimize the negative effects that it might have on the country, acquires money for its construction—solicited from entities like the World Bank or the Asian Development Bank, both of which have shown considerable generosity in the past—and builds a solution to its surface water crisis.

Only then will it free itself from arsenic.

5. CONCLUSION

A thorough examination of Bangladesh's arsenic crisis reveals a multi-layered problem without an easy solution. Significant challenges arise from attempts to leverage theoretically ample groundwater and surface water resources.

Groundwater is easily available, but poisonous and difficult to purify for consumption. It is tempting for agricultural use, but the negative impact that this use has on the soil is a devastating and distant-seeming to unaware users. Surface water, meanwhile, is polluted and—due in part to upper riparian practices—inconstant; surface water drowns Bangladesh during monsoons and leaves Bangladesh parched during dry seasons. Addressing these challenges requires both reform of internal government policies and leveraging international law.

The Bangladeshi Government needs to address the stagnation of large-scale water management projects that fail to succeed despite significant investment from outside entities. It needs to enact policies that preserve project-related job security despite political turmoil; this type of action may also discourage funding

misallocations, corruption, and ineffectiveness, as it could force individual interests to coincide with the project's interests.

Part of this high-level stagnation can also be addressed by fixing the systemic misdirection that has plagued mitigation attempts. To refocus the mitigation process, the government should update its national standard for acceptable arsenic consumption; this will help reveal the scope of the country's true need for non-groundwater solutions. The Government should also update its Implementation Plan for Arsenic Mitigation with cost-sharing provisions for installations and payment for caretakers. It should include in this plan a more realistic estimate of the number of families that should be served by individual technology implementations, and update its recommendations on technology that should be used based on data that have been gathered regarding their efficacy.

Bangladesh should consolidate and codify its water management policies into a binding, enforceable water act that imposes negative consequences upon local governments, as well as implementing agencies, for failure to adhere to water laws. Bangladesh should also pass a groundwater act that limits tube-well drilling, ensures adequate replenishment of aquifers through the protection of wetlands, and encourages studies to determine the geologic feasibility of deep tube-well installations. The government needs to find ways to enforce its water laws by granting rewards for adherence and imposing penalties for derogations. To do so, it should borrow strategies applied by its neighbors, like India.

To improve its current arsenic mitigation efforts, the government should set up—or revamp—a centralized monitoring system that keeps track of technology implementations and their functional status. It should take stronger measures encouraging rainwater as a solution—and overcoming the cultural resistance to rainwater—by amending national building laws and zoning codes to require its use. It should also, on a national level, require incentives and job security for the caretakers of water installations. Without mandates on a national level, it is unlikely that state governments or local governments will spontaneously enact such measures.

In short, Bangladesh, from the perspective of policy reform and the correction of the current systemic misdirection, needs to, *on a national level*, discourage short-term alternative safe water sources

and encourage the development of long-term solutions that consider the total water resources of the country.

This is especially true due to the fact that the country's soil—and thus its agriculture—is being poisoned. Getting people to stop drinking tube-well water is necessary but insufficient; the government needs to find a way to stop them from using it to irrigate crops.

To do so, it will need to secure a more constant source of surface water so that entities can rely upon sufficient quantity to improve quality. Surface water is needed. If Bangladesh is to rely more on surface water, it needs to turn to international law. This is especially necessary given India's looming Indian Inter-Basin Water Transfer Project, which threatens to further deplete Bangladesh surface water resources.

Any goal to obtain water from transboundary rivers via political negotiations is unfortunately complicated. The Ganges Treaty's formation—as well as the impotence of its dispute resolution mechanisms—indicates that pure one-on-one negotiations are insufficient to protect Bangladesh's interests. The uneven bargaining positions of India and Bangladesh necessitate securing an unbiased, independent body to serve as mediator in any disputes that may arise. This type of body is likely necessary, not only for new treaty negotiations and resolving disputes arising from existent treaties, but also for situations in which Bangladesh actively seeks to prevent the further loss of water.

For non-treaty-negotiation and non-dispute-resolution purposes, Bangladesh would need to gain an independent venue for articulating its legal arguments; in such a venue, it can wield international law.

And in such a venue, it can find support to stop the Indian IBWT Project by using the Ganges Treaty. It can point to Indian obligations in the Ganges Treaty related to the preservation of the river flows. It can insist that the Ganges Treaty requires India and Bangladesh to treat the customary international "no harm rule" as importantly as the "reasonable and equitable use rule," and thus argue against future unilateral water diversion practices that harm Bangladesh. Bangladesh can also contend that projects like the Indian IBWT Project would illegally render the Ganges Treaty irrelevant by reducing the overall quantity of water bound for Bangladesh at a point above the Farakka Barrage.

Bangladesh can also argue that there are trends in international watercourse law that indicate that the principle of absolute state

sovereignty is subject to legal restraints and emerging legal principles, such as the need to manage and alter water resources through a consideration of hydrological systems as a whole. These trends in customary international law have been demonstrated by United Nations soft-law declarations and have cropped up—in limited magnitude—in international court decisions, like *Gabcikovo-Nagymaros*. These arguments can be leveraged against the many Indian upstream damming projects that are planned and currently underway.

In conjunction with these defensive measures to prevent projects like the Indian IBWT Project, Bangladesh should look to large-scale projects that attempt to leverage currently inefficient surface water distributions across the nation. Surface water augmentation projects like the Ganga Barrage should be pursued, with appropriate and careful consideration of their potential ecological and economic impacts. Bangladesh will need to study the feasibility of such barrages, determine ways to minimize the negative effects that they might have on the country, and acquire money for their construction by soliciting funding from the World Bank or the Asian Development Bank.

Once it manages that, it should go beyond merely painting the poisonous wells installed by UNICEF and other well-meaning entities—it should destroy them.

These steps and recommendations will not solve Bangladesh's arsenic problem. However, they may help.