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Crafting Legal and Institutional Frameworks for Groundwater Resources of Bangladesh: From Overexploitation to Sustainable Abstraction

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Doctor of Philosophy

Abstract

Economic activities in Bangladesh are heavily dependent on groundwater resources, which contribute to approximately 79% of total annual water withdrawal. Indeed, Bangladesh has achieved near self-sufficiency in food through irrigated agriculture, and thriving on groundwater, it has become the world's second-largest garments exporter. This achievement, however, continues to cause significant damage to its invaluable groundwater resources. In short, a growing population, ever-increasing agricultural, industrial, and domestic water demands, and the impact of climate change are all exerting unprecedented stress on Bangladesh's groundwater systems and supplies. These combined effects result in the depletion of the water table to an extent where it cannot be naturally replenished.

Declining water tables, therefore, continue to challenge groundwater sustainability in Bangladesh. Instead of groundwater governance and management, the country has focused on resource development for a considerable period of time. Against this backdrop, drawing on in-depth interviews conducted with the responsible government officials, judges, scholars, and groundwater users, this thesis examines the viability of the existing legal and institutional frameworks in tackling the mounting challenges stemming from groundwater over-extraction.

The thesis finds that the existing legal framework is ineffective and inefficient in controlling unsustainable groundwater extraction. Though requiring a permit for the installation of a well, for instance, is a substantial legislative improvement, without an associated water metering obligation, it fails to control indiscriminate groundwater pumping. Additionally, the sustainability of this resource is threatened by the lack of a legislative requirement for capping extractions to prevent unrestrained groundwater withdrawal in the industrial sector. Moreover, conflicts and overlaps between water laws; an absence of community and expert involvement in the lawmaking process; and persistent legislative ambiguities in relation to the delineation of appropriate responsibilities among water institutions undermine the noble vision of groundwater sustainability. Beyond these fatal gaps in groundwater laws themselves, compliance and enforcement remain a perennial problem in Bangladesh. A lack of knowledge of groundwater laws among the regulators and the regulatees, and a historic lack of groundwater regulation, among other things, stand in the way of achieving sustainable extraction of groundwater resources in Bangladesh.

The thesis further finds that water institutions that are responsible for governing groundwater withdrawal are poorly designed, resulting in their consistent failure to arrest the declining water table. The presence of an excessive and unnecessary number of water institutions creates substantial uncertainty in establishing robust coordination among these institutions, which is further exacerbated by resource and data shortages. This, in turn, significantly limits their capacity to undertake a sustained collective response to overcome the daunting challenges posed by growing groundwater depletion. In the face of these overwhelming

institutional limitations, however, the thesis demonstrates the promise of the Barind Multipurpose Development Authority, which has significantly reduced groundwater pumping for irrigation in the Barind Tract through the introduction of a prepaid smart metering system.

Beyond the legal and institutional frameworks, the thesis also considers whether the judicial intervention could offer some respite to this rampant crisis. The thesis finds that there remains considerable scope for the Court to facilitate groundwater sustainability through its balanced and targeted judicial action. Finally, the thesis identifies lessons for both policymakers and the literature on how these challenges may be overcome.

Declaration Page

I declare that:

- the thesis comprises only my original work towards the Doctor of Philosophy;
- due acknowledgement has been made in the text to all other material used; and
- the thesis is fewer than 100,000 words (the maximum word limit) in length, exclusive of tables, maps, bibliographies, and appendices.

Mohammad Sohidul Islam, Student ID 880252

23 December 2020

Preface

Three articles associated with or derived from this thesis have been published:

1. Mohammad Sohidul Islam, 'Judicial Activism: A Catalyst to Facilitate Sustainable Abstraction of Groundwater Resources of Bangladesh? (2018) 211 *Advances in Social Science, Education and Humanities Research* 179 (arguing that a balanced and enlightened judicial action could significantly promote groundwater sustainability in Bangladesh; this paper builds on chapter 5).
2. Mohammad Sohidul Islam, 'Crafting a Regulatory Framework for Groundwater Irrigation in Bangladesh: From Regression to Innovation' *Australian Journal of Asian Law* (accepted on 10 July 2020, forthcoming 2020) (arguing that the current groundwater irrigation laws and regulations are ineffective, inefficient, and inappropriate, and eventually, making recommendations for law reforms, enhancing education and community involvement, and for monitoring and management strategies; the article draws elements from chapters 3, 4 and 6).
3. Mohammad Sohidul Islam and Erin O'Donnell, 'Legal Rights for the Turag: Rivers as Living Entities in Bangladesh' (2020) 23(2) *Asia Pacific Journal of Environmental Law* 160 (exploring the implications of the *Bangladesh Rivers* case (where the Bangladeshi rivers have been recognised as living entities with legal personality) within Bangladesh, where it is reshaping water law and management, including the responsibilities of the state, as well as the penalties which may apply to individuals whose actions impact river health; this paper benefits from chapters 3 and 4).

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It has been a wonderful PhD journey that has been replete with love, care, support, and inspiration of so many people.

To start with, Prof Lee Godden and Assoc Prof Rebecca Nelson have been brilliant supervisors. I express my heartfelt gratitude to them both, for their excellent guidance, support, and feedback throughout my candidature. It is they who have taught me how to remain stalwart and steadfast in confronting research challenges, how to conduct research effectively in an area characterised by scarce research materials, and most importantly, how to become an independent researcher. I am also immensely grateful to Prof Tim Lindsey, not only for his acting as Chair of my Academic Advisory Committee but also for providing me with outstanding academic support. By offering me a rare and invaluable opportunity to act as a *Guest Editor* of the Australian Journal of Asian Law, Prof Tim Lindsey has tremendously assisted me in advancing and honing my research aptitude. I gratefully acknowledge the insightful comments and feedback of Prof Christine Parker and Dr Anita Foerster on my thesis. Additionally, I am thankful to Prof Cameron Holley, Assoc Prof Jenny Beard, Dr Erin O'Donnell, Assoc Prof Saiful Karim, Prof Jason Varuhas, Prof Sundhya Pahuja, Prof Farrah Ahmed, Prof Ridwanul Hoque, and Dr Fabia Fernandes for their kind suggestions and advice at various points of my candidature. I am also grateful to the interviewees for their generosity in time and feedback.

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Beyond Australia, there are so many people whose love, care, and inspiration have greatly facilitated me to sail through this grueling journey. My parents have played a key role in finishing this arduous job; my mom has never failed to encourage and support me through her unfailing love, care, thoughts, and prayers. My brothers and sisters have always been

there to cheer me up when difficult times cropped up. My wife and my only son have sacrificed a lot to let my dreams come true. My son was one-month-old when I started my PhD in February 2017, and I left them both in Bangladesh. And for practical difficulties, they could not join me in Australia. I have deprived my son of fatherly love, affection, and caresses — the greatest sacrifice by a son and a dad on earth.

Finally, my friends have been a constant source of support throughout this journey. My cousin Shohel — my best friend — has made his presence clearly visible at every step of this journey and has transformed it into a joyful experience. He has always stood by me with might and main at crucial junctures. My friends Delawar Hossain, Abdullah, Abdur Rahman, Muajjem Hussain, Hossain Reza, Mostafa Mahmud, Delowar Khokon, Shamim Ahmed, Azad Jewel, Shahidul Noman, Ismail Hossain, and Azami Millat have all poured in their strongest care and support on me in diverse ways.

Contents

CHAPTER 1 1

GROUNDWATER DEPLETION IN BANGLADESH: EMERGING LEGAL AND INSTITUTIONAL CHALLENGES 1

I INTRODUCTION 1

II RESEARCH QUESTIONS, RESEARCH METHODOLOGY AND SCOPE OF THE THESIS 5

A Research Question *5*

B Methodology *8*

C Scope of the Research *8*

III OVERVIEW OF THE THESIS 9

IV CONTRIBUTION TO SCHOLARSHIP 12

CHAPTER 2 14

RESEARCH METHODOLOGY AND SETTING THE CONTEXT 14

I INTRODUCTION 14

II RESEARCH METHODOLOGY 16

A Doctrinal Analysis *16*

B Empirical Investigation *18*

1 Empirical Research in Law and the Role of Qualitative Research *18*

C Interviews and Content Analysis *20*

1 Selection of Participants *20*

2 Ethics and Interviewee Privacy *22*

3 Conducting the Interviews *22*

4 Conflict of Interest *23*

5 Coding the Interviews in the Research *24*

6 Content Analysis *24*

7 Using the Data *24*

III DEFINING THE KEY TERMS 25

A Groundwater *25*

B Aquifer *26*

C (Groundwater) Sustainability *27*

D Groundwater Governance/Regulation *30*

E Groundwater Management *31*

IV UNDERSTANDING THE NEXUS BETWEEN ENVIRONMENTAL PROTECTION AND GROUNDWATER SUSTAINABILITY 32

V LEGAL AND INSTITUTIONAL FRAMEWORKS FOR GROUNDWATER SUSTAINABILITY: UNPACKING THEIR ROLES AND SIGNIFICANCE 35

A Role of Legal Framework *35*

1 Issues to be Addressed by an Ideal Legal Framework *35*

2 Global Practice of Regulatory Mechanism *37*

B Significance of Water Institutions *41*

1 Attributes of an Ideal Water Institution *42*

VI INTERNATIONAL RESPONSE TO THE PROTECTION OF GROUNDWATER RESOURCES 46

VII AN OVERVIEW OF BANGLADESH 48

VIII SIGNIFICANCE OF GROUNDWATER AND ITS OVEREXPLOITATION IN BANGLADESH 50

IX CONCLUSION 54

CHAPTER 3 ..... **57**

LEGAL FRAMEWORK OF BANGLADESH TO ENSURE SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES: EXAMINING ITS EFFICACY AND VIABILITY **57**

I INTRODUCTION 57

II RIGHTS OVER GROUNDWATER IN BANGLADESH: A LEGAL ANALYSIS **59**

A *A Brief Account on the Evolution of Groundwater Rights in Bangladesh: From Unrestricted Rights to Controlled Rights* 60

B *Land-based Groundwater Rights: A Blow to the Human Right to Water?* 62

III EXPLORING THE GROUNDWATER REGULATION IN BANGLADESH 64

A The History of Water Law in Bangladesh *64*

1 Precolonial Water Law ***64***

2 Colonial Water Law ***65***

3 Post Colonial Water Law ***65***

B Legal Vacuum in the Regulation of Groundwater Abstraction *67*

IV A CRITICAL EXAMINATION OF THE LAWS GOVERNING GROUNDWATER ABSTRACTION IN BANGLADESH 67

A Constitutional Approach *67*

B National Water Policy 1999: A Significant Step? *69*

C Groundwater Management Ordinance 1985 ..... *71*

D Groundwater Irrigation Management Act 2018: Old Wine in a New Bottle? *74*

1 A Critical Analysis of the Groundwater Act ***75***

E A Close Look at the Bangladesh Water Act 2013 ..... *77*

V AN EMPIRICAL INVESTIGATION INTO THE GAPS OF THE EXISTING LEGAL FRAMEWORK 85

A Groundwater Cursorily Addressed *86*

B Absence of Metering Mandate *87*

C Legislative Vacuum for Capping *88*

D Sectoral Responsibilities Not Delineated *90*

E Conflicting Provisions of Law *91*

VI AN EMPIRICAL INSIGHT INTO THE (IN)ACTION OF GROUNDWATER LAW 93

A Poor Processes for Adopting Groundwater Law *93*
B Lack of Knowledge of Groundwater Law *95*
C Absence of Effective Monitoring *96*
D Absence of Effective Coordination *97*
E Historic Lack of Groundwater Regulation *97*
Summary: Compliance and Enforcement *99*
VII CONCLUSION 100
CHAPTER 4 ..... **102**
INSTITUTIONAL FRAMEWORK OF BANGLADESH TO ENSURE GROUNDWATER SUSTAINABILITY: INVESTIGATING ITS EFFICIENCY AND DEFICIENCY **102**
I INTRODUCTION 102
II INSTITUTIONAL ARRANGEMENTS TO ENSURE GROUNDWATER SUSTAINABILITY: A CONUNDRUM? 105
A Water Resources Planning Organisation: Exploring Its Strengths and Weaknesses in Ensuring Groundwater Sustainability *106*
1 The Creation of the WARPO ***106***
2 Functions of the WARPO ***107***
3 Strengths of the WARPO ***108***
4 Weaknesses of the WARPO ***109***
B Other Water Institutions *111*
1 Central Government Agencies ***111***
2 Local Government Institutions ***116***
C Persistent Conflicts and Overlaps: A Major Blow to Groundwater Regulation *118*
III IDENTIFYING THE WEAKNESSES OF THE WATER INSTITUTIONS 120
A Resource Shortage *120*
B Lack of Coordination among the Water Institutions *122*
C Lack of Monitoring and Groundwater Data *123*
D Insufficient Research *124*
E Lack of Regional and Local Offices *126*
F Absence of Leadership *127*
G Other Factors *128*
IV BARIND MULTIPURPOSE DEVELOPMENT AUTHORITY: UNPACKING ITS POTENTIAL FOR SUSTAINABLE GROUNDWATER IRRIGATION 129
A About the Barind Tract *130*
B Initiatives Adopted by the BMDA for Groundwater Irrigation *131*
C Prepaid Smart Metering System in the Barind Tract: A Promising Initiative? *132*
1 Prepaid Smart Metering System: How It Works ***133***
(a) Prepaid Meter 133

(b) User Card 133
(c) Checking Card and Large Capability Card 134
2 Advantages of the Prepaid Smart Metering System (PSMS) *134*
3 Limitations of the PSMS *135*
V CONCLUSION 137
CHAPTER 5 140
THE ROLE OF THE COURT IN PROMOTING SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES IN BANGLADESH: EXPLORING ITS POTENTIAL 140
I INTRODUCTION 140
II EXPLORING MULTIDIMENSIONAL ASPECTS OF JUDICIAL ACTION IN BANGLADESH 143
A Locating the Legal Basis of Judicial Action in Bangladesh *143*
B Judicial Action in Bangladesh *144*
1 Judicial Action in Relation to Administrative Measures *145*
2 Judicial Action in the Legislative Domain *145*
3 Judicial Action in Shaping Public Policy *146*
C Judicial Action in Relation to the Protection of the Environment *148*
D Public Interest Litigation and Judicial Action *149*
E Suo Motu (Self-Initiated) Judicial Intervention *151*
III THE ROLE OF THE JUDICIARY IN DRIVING WATER GOVERNANCE REFORM 153
IV JUDICIAL ACTION IN PROMOTING GROUNDWATER SUSTAINABILITY: A JUDICIAL BLINDNESS? 156
A Dr Mohiuddin Farooque v Bangladesh and Others: Connecting Pollution-free Water with Right to Life *157*
B Rabia Bhuiya, MP Case: A Step forward to the Protection of Groundwater Quality? *159*
V BARRIERS TO JUDICIAL ACTION IN PROMOTING SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES 160
A Judges' Lack of Scientific Knowledge *161*
B Inertia of Lawyers and NGOs *162*
C Non-availability of Data *162*
D Powerful Respondent: A Barrier? *163*
VI SIGNIFICANCE OF JUDICIAL ACTION IN THE CONTEXT OF GROUNDWATER SUSTAINABILITY 163
VII CONCLUSION 168
CHAPTER 6 171
FORMULATING RECOMMENDATIONS 171
I INTRODUCTION 171
II REFORMING GROUNDWATER LAWS 174
A Removing the Conflicts and Overlaps among Water Laws *174*

B Introducing Water Metering Requirement *175*
1 Mandatory Water Metering for Agricultural Groundwater Use ***176***
2 Mandatory Water Metering for Industrial Groundwater Use ***179***
3 Limited Water Metering for Domestic Use ***181***
(a) Urban Areas 181
(b) Rural Areas 183
C Introducing Limited Capping *184*
D Enacting Groundwater Laws Efficiently *186*
E Delineating the Responsibilities of the Water Institutions *188*
III REFORMING WATER INSTITUTIONS 190
A The Need for Regional and Local Offices of the Water Institutions *190*
B Reducing Water Institutions *191*
C Promoting Groundwater Users' Associations *193*
D Strengthening the National Water Resources Database *196*
E Addressing Resource Constraints *198*
IV INVOKING LIMITED JUDICIAL ACTION 200
A Establishing a Specialist High Court Bench *201*
B Suo Motu (self-initiated) Jurisdiction/Proceedings: Cautious Application Warranted *204*
C The Need for Active NGOs *205*
D Technical-Expert Lawyers Needed *206*
V INTRODUCING MANAGEMENT STRATEGIES 208
VI IMPLEMENTING RECOMMENDATIONS 210
VII CONCLUSION 212
CHAPTER 7 ..... **214**
CONCLUSION **214**
I INTRODUCTION 214
II THESIS QUESTIONS AND KEY FINDINGS 216
III PRIORITISING RECOMMENDATIONS MADE IN CHAPTER 6 225
IV AREAS FOR FUTURE RESEARCH 229
V CONCLUSION 232
BIBLIOGRAPHY **234**
A ***Articles/Books/Reports*** 234
B ***Cases*** 258
C ***Legislation/Policy Documents*** 260
D ***Treaties*** 262
E ***Other*** 263
APPENDICES **270**

A ***Table of Acronyms*** 270

B ***Tables*** 272

1 Summary Functions, Interactions and Overlaps of Major Water Institutions *272*

2 Summary Functions, Overlaps, and Conflicts of Bodies and Committees Formed under Water Legislation *273*

C ***Groundwater Glossary*** 275

D ***Interviewees*** 279

E ***Interview Documents*** 281

1 Schedule of Interview Questions *281*

2 Plain Language Statement for Interviews (sample text) *287*

3 Consent Form for Interviews (sample text) *291*

F ***Ethics Approval*** 293

CHAPTER 1

GROUNDWATER DEPLETION IN BANGLADESH: EMERGING LEGAL AND INSTITUTIONAL CHALLENGES

I INTRODUCTION

Groundwater depletion is an acknowledged problem in Bangladesh,[1] — and a lack of clear, effective, and efficient legal and institutional frameworks lies at the heart of this fast-growing crisis.[2] Legal and policy responses to tackle the unsustainable groundwater extraction in Bangladesh have been both slow and ineffective. Indeed, unmindful of groundwater management and governance, the country has for a quite long time been predominantly concerned with resource development.[3]

After decades of inaction, Bangladesh has only recently developed laws and institutions to regulate uncontrolled groundwater withdrawal. As a result, the century-old common law concept of landowners' unrestricted rights over groundwater has now been qualified. Public control over groundwater resources through statutory enactments, and through the development of public institutions for governing groundwater is gradually taking hold. The *Bangladesh Water Act 2013* and the *Groundwater Irrigation Management Act 2018* are now in place to address the urgent issue of groundwater decline, but both have, however, more weaknesses than strengths. Regulatory mechanisms — like licensing bores — are proving ineffective in curbing the unsustainable withdrawal of groundwater.[4] The problem is further deepened by the fragmented and patchy water institutions that remain dysfunctional owing to, among other reasons, their vague and undelineated responsibilities, resulting in persistent gaps and overlaps. In particular, the existence of an astounding number of water institutions triggers a perennial coordination crisis.[5] Developing a viable regulatory framework to ensure sustainable abstraction of groundwater resources remains, as it seems, one of the biggest legal and policy challenges for Bangladesh today. While groundwater problems entail both quality and quantity, this thesis focuses on extraction and declining groundwater.

However, the significance and accompanying challenges of managing groundwater resources are also internationally documented. Of all the available freshwater on earth, for instance,

---

[1] See generally World Bank, *Bangladesh—Country Water Resources Assistance Strategy* (Report No 32312-BD, 2005); *National Water Policy 1999* (Bangladesh) *('Water Policy')*; *National Water Management Plan 2001* (Approved in 2004) (Bangladesh).

[2] Shubhra Bhattacharjee et al, 'Groundwater Governance in Bangladesh: Established Practices and Recent Trends' (2019) 8 *Groundwater for Sustainable Development* 69, 75.

[3] Asad S Qureshi, Zia Uddin Ahmad and Timothy J Krupnik, 'Moving from Resource Development to Resource Management: Problems, Prospects and Policy Recommendations for Sustainable Groundwater Management in Bangladesh' (2015) 29(12) *Water Resources Management* 4269, 4281.

[4] See chapter 3(IVB-E)(V).

[5] See chapter 4(II)(III).

almost 99% is stored in the subsurface.[6] Globally, groundwater provides nearly 50% of drinking water, over 40% of agricultural water, and almost 34% of industrial water.[7] About one-third of humanity is exclusively dependent on this invaluable resource to meet its daily needs.[8] Additionally, it sustains ecosystems, maintains the baseflow of rivers, and prevents land subsidence and seawater intrusion.[9]

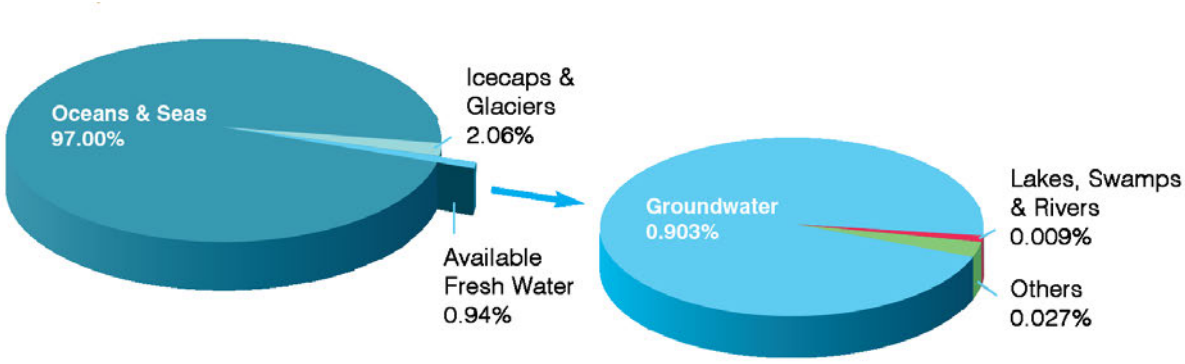

Fig 1 shows the different water sources; source: International Groundwater Resources Assessment Centre.

Obviously, in this age of the Anthropocene, local and global pressures have been mounting on groundwater resources.[10] This hidden resource is overexploited across the globe causing its persistent depletion.[11] A recent report reveals that worldwide groundwater exploitation has increased by more than 300% over the last fifty years (1960-2010).[12] In the future, groundwater use will continue to increase, even at a higher rate than before to meet the escalating demands exerted by the agricultural, industrial, and domestic sectors and also by the ecosystems.[13] Declining groundwater causes land subsidence, high pumping costs, water

[6] Sarah Shalsi et al, 'Can Collective Action Address the "Tragedy of the Commons" in Groundwater Management? Insights from an Australian Case Study' (2019) 27(7) *Hydrogeology Journal* 2471; Food and Agriculture Organisation (FAO), *Shared global vision for Groundwater Governance 2030 and A call-for-action - Groundwater Governance A Global Framework for Action* (FAO, 2015 (revised in 2016)) vi.

[7] UN Water, *Groundwater Overview: Making the Invisible Visible* (IGRAC, 2018) 1 ('UN Water'); globally 1,000 km³ groundwater is abstracted per year of which 67% is used for irrigation, 22% is used to meet domestic needs (drinking water and sanitation) and 11% is used for industry; International Groundwater Resources Assessment Centre, *What is Groundwater?* <https://www.un-igrac.org/what-groundwater>; S Siebert et al, 'Groundwater Use for Irrigation – a Global Inventory' (2010) 14(10) *Hydrology and Earth System Sciences* 1863.

[8] Ali Akbar Barati, Hossein Azadi and Jürgen Scheffran, 'A System Dynamics Model of Smart Groundwater Governance' (2019) 221 *Agricultural Water Management* 502, 502.

[9] UN Water (n 7).

[10] UN High Level Panel on Water Outcome Report, *Making Every Drop Count — An Agenda for Water Act ion* (March 2018) 7.

[11] Inge EM de Graaf et al, 'Environmental Flow Limits to Global Groundwater Pumping' (2019) 574(7776) *Nature* 90.

[12] Barati, Azadi and Scheffran (n 8); Stéphanie Leyronas et al, 'Toward an Analytical Framework for the Governance of Natural Resources — The Case of Groundwater' (AFD Research Paper, 2016) 3.

[13] Barati, Azadi and Scheffran (n 8).

quality deterioration, hydrological drought, sea-level change, and saline intrusion.[14] In short, population growth, rapid urbanisation, industrialisation, economic development, food security, and climate change are all placing tremendous pressures on global groundwater systems and supplies.[15] It is then no surprise that since 2012 water[16] crises have been invariably placed at top global risks,[17] and there is a growing voice internationally to pay increased attention to water sustainability.

For instance, the latest Sustainable Development Goals (SDG) adopted by the United Nations in September 2015, which are to be realised by 2030, call for ensuring availability and sustainable management of water and sanitation for all (SDG 6) that includes groundwater.[18] Though the SDGs are non-binding, as significant United Nations policy positions, they are strongly aspirational and influential in framing discourse around sustainability. Nations such as Bangladesh are urged to work towards these goals in environmental and resource management. Groundwater could also play a critical role in achieving other SDGs such as poverty eradication (Goal 1), food security (Goal 2), gender equality (Goal 5), the sustainability of cities and human settlement (Goal 11), combating climate change (Goal 13), and protecting ecosystems (Goal 15).[19] More recently, the UN World Water Development Report also acknowledges the value and importance of groundwater in realising the SDG 6.[20]

In response to challenges posed by the declining groundwater resources, traditionally, however, technological and infrastructure 'fixes' have been adopted.[21] In contrast, law, governance, and regulation have often been sidestepped.[22] The UN High Level Panel on Water identified water as being 'often left out of budgeting, legislation, and human resources mobilisation decisions and discussions'.[23] This vacuum in legal and governance leadership has triggered a fragile and tenuous legal approach to confront the growing pressure on water

[14] Marc FP Bierkens and Yoshihide Wada, 'Non-Renewable Groundwater Use and Groundwater Depletion: A Review' (2019) 14(6) *Environmental Research Letters* 1, 21-5; Graaf et al (n 11).
[15] Barati, Azadi and Scheffran (n 8) 514.
[16] In this thesis 'water' includes 'groundwater'.
[17] World Economic Forum, *The Global Risks Report 2020* (Report, 2020).
[18] Kirstin I Conti and Joyeeta Gupta, 'Global Governance Principles for the Sustainable Development of Groundwater Resources' (2016) 16(6) *International Environmental Agreements: Politics, Law and Economics* 849, 853; *Transforming Our World: The 2030 Agenda for Sustainable Development,* GA Res 70/1, UN Doc A/RES/70/1 (25 September 2015).
[19] UN Water (n 7).
[20] UNESCO, UN-Water, *The United Nations World Water Development Report 2020: Water and Climate Change* (UNESCO, 2020).
[21] WA Jury and H Vaux, 'The Role of Science in Solving the World's Emerging Water Problems' (2005) 102(44) *Proceedings of the National Academy of Sciences* 15715; Robert G Varady et al, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper No 5: Groundwater Policy and Governance* (Rome, April 2013) 9.
[22] See generally Janice Gray, Cameron Holley and Rosemary Gail Rayfuse, *Trans-Jurisdictional Water Law and Governance* (Routledge, 2016); Michael Kidd et al (eds), *Water and the Law: Towards Sustainability* (Edward Elgar Publishing, 2014); Claudia Pahl-Wostl, *Water Governance in the Face of Global Change : From Understanding to Transformation* (Springer, 2015).
[23] UN High Level Panel on Water, *Action Plan* (September 2016) 6.

resources.[24] Hence, a governance crisis often triggers a water crisis.[25] Substantial water crisis, it is argued, could be overcome if the resource is governed effectively and efficiently.[26] While struggles to govern and manage groundwater widely differ from region to region, a common element in these struggles is that they are hydrological as well as socio-legal in nature.[27]

A close look at the global literature reveals that mostly developing countries are confronting the challenge of designing and implementing broader legal regimes to ensure sustainable abstraction of groundwater.[28] The challenge developing nations are facing, includes how to regulate groundwater effectively and efficiently, and in particular, how legal rules can promote and ensure groundwater sustainability. Asia, especially South Asia, is the most densely populated area of the world where about a quarter of the global population lives — which has less than 5% of the world's renewable water resources.[29] This region has emerged as one of the most water stressed areas of the world mainly due to low groundwater recharge and high abstraction of the resource, especially for irrigation.[30] More precisely, almost one-third of the global groundwater irrigated land is in South Asia,[31] causing significant depletion to the water table in this region, which Shah has termed as 'groundwater anarchy'.[32] India, Pakistan, and Bangladesh are the dominant actors in this 'anarchy game'.[33] Among these three countries, Bangladesh is relatively small but heavily dependent on groundwater for its development activities.[34]

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[24] Joyeeta Gupta and Claudia Pahl-Wostl, 'Editorial on Global Water Governance' (2013) 18(4) *Ecology and Society;* Animesh K Gain and Carlo Giupponi, 'A Dynamic Assessment of Water Scarcity Risk in the Lower Brahmaputra River Basin: An Integrated Approach' (2015) 48 *Ecological Indicators* 120.

[25] Global Water Partnership (GWP), *Towards Water Security: A Framework for Action* (GWP, March 2000); Aditi Mukherji and Tushaar Shah, 'Groundwater Socio-Ecology and Governance: A Review of Institutions and Policies in Selected Countries' (2005) 13(1) *Hydrogeology Journal* 328, 339; Asit K Biswas and Cecilia Tortajada (2011) 'Future water governance – Problems and perspectives' in Asit K Biswas and Cecilia Tortajada (eds), *Improving Water Policy and Governance* (Routledge, 2011).

[26] Karen G Villholth and Kirstin I Conti, 'Groundwater Governance: Rationale, Definition, Current State and Heuristic Framework' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 4.

[27] Alida Cantor and Jacque Emel, 'New Water Regimes: An Editorial' (2018) 7(2) *Resources* 25.

[28] See generally Tushaar Shah, *Taming the Anarchy: Groundwater Governance in South Asia* (Resources for the Future, 2009); Mark Giordano and Karen G Villholth (eds), *The Agricultural Groundwater Revolution: Opportunities and Threats to Development* (CABI, 2007); Syed Mohammad Khair, Shahbaz Mushtaq and Kathryn Reardon-Smith, 'Groundwater Governance in a Water-Starved Country: Public Policy, Farmers' Perceptions, and Drivers of Tubewell Adoption in Balochistan, Pakistan' (2015) 53(4) *Groundwater* 626.

[29] Pradip K Sikdar, 'Problems and Challenges for Groundwater Management in South Asia' in Pradip K Sikdar (ed), *Groundwater Development and Management: Issues and Challenges in South Asia* (Springer, 2018) 9.

[30] Ibid.

[31] Shah (n 28) 1; out of 300 million ha groundwater irrigated land more than 90 million ha was in India, Pakistan and Bangladesh.

[32] Ibid 1-4.

[33] Ibid.

[34] Bangladesh Agricultural Development Corporation, *Minor Irrigation Survey Report 2016-17 (Rabi Season)* (Report, 2018) 5. The total irrigated land across the country is 5,527,266 ha out of which 4,170,005 ha is irrigated through the utilisation of groundwater.

To put it mildly, the life of Bangladeshi people is written on the water — the single-most important resource for their well-being.[35] While there are abundant surface waters in the country, groundwater tells a different story. This invaluable resource contributes approximately 79% of the total water withdrawal in Bangladesh.[36] A growing population, ever-increasing agricultural, industrial, and domestic water demands, and the impact of climate change are all placing unprecedented stress on Bangladesh's groundwater systems and supplies. These combined effects result in the depletion of the water table to an extent where it cannot be naturally replenished.[37] Indeed, the current trend of groundwater extraction in Bangladesh is largely unsustainable — a position, which has recently emerged as a serious legal and policy issue.

Of course, ensuring groundwater sustainability is crucial not only for achieving the SDG 6 and other connected goals but also for the overall development of Bangladesh. However, the ongoing overexploitation occurring in Bangladesh stands in the way of realising the stated SDG goals. Therefore, significant attention needs to be directed towards the improvement of the existing legal and institutional frameworks governing groundwater withdrawal in Bangladesh. The decline in groundwater resources makes it imperative to reform existing groundwater laws and institutions.[38]

This introductory chapter aims to frame the research problem and provide an overview of the thesis. A detailed background of the thesis is depicted in chapter 2. Part II outlines the research questions, research methodology, and scope of this thesis. Part III provides an overview of the thesis. Finally, Part IV explains the contribution of this thesis to scholarship.

II RESEARCH QUESTIONS, RESEARCH METHODOLOGY AND SCOPE OF THE THESIS

A *Research Question*

As noted above, agricultural, industrial, and domestic sectors are exerting tremendous pressure on Bangladesh's groundwater systems and supplies. Climate change has further deepened the crisis. The result has been the fast depletion of the water table across the country.[39] As seen, legal and institutional responses to address the overexploitation of groundwater resources of Bangladesh have been both slow and ineffective. Breaking the

[35] *Water Policy* (n 1) s 1.

[36] Food and Agriculture Organisation (FAO), *AQUASTAT Country Profile – Bangladesh* (FAO, 2014) 7.
[37] Nepal C Dey et al, 'Sustainability of Groundwater Use for Irrigation of Dry-Season Crops in Northwest Bangladesh' (2017) 4 *Groundwater for Sustainable Development* 66, 75.
[38] Mohammad Sohidul Islam, 'A Human Right to Water: Challenges and Opportunities for Ensuring This Right in Bangladesh' (2014) 15(2) *Australian Journal of Asian Law* 1, 13-14.
[39] See chapter 2(VIII).

inordinate inaction, the country endeavoured to undertake legal and institutional initiatives to prevent groundwater depletion, thereby attempting to shift from the groundwater development phase to management and governance. These legal arrangements, however, suffer significant drawbacks. As such, current groundwater laws are required to be tailored to the specific context of Bangladesh. Again, the mere existence of robust laws cannot themselves prevent groundwater depletion unless their strict implementation is secured. Groundwater sustainability in Bangladesh, therefore, faces two-pronged challenges — developing a robust groundwater law, and ensuring its implementation. The human environment, food security, and economy of Bangladesh will be seriously threatened if the country continues on its current trajectory of groundwater withdrawals.[40]

Consequently, it is both timely and urgent to examine and explore the gaps and deficiencies of the existing legal and institutional frameworks meant to prevent the over-extraction of groundwater resources in Bangladesh, with a view to offering sustainable solutions to this growing crisis. This legal examination is particularly significant given that albeit considerable engineering and scientific studies have been undertaken pertaining to Bangladesh's groundwater resources,[41] legal aspects of this valuable resource thus far have remained underexamined.

Against this backdrop, the thesis frames the following central question and sub-questions.

Central question:

> In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources?

Sub-questions:

> To answer this question, this thesis addresses the following sub-questions:
>
> > a) To what extent do the current legal and institutional frameworks ensure the sustainable abstraction of groundwater resources?
> >
> > b) What deficiencies presently exist in the legal and institutional settings?
> >
> > c) Can judicial action promote the sustainable abstraction of this resource?

[40] Md Bayzidul Islam et al, 'A Regional Groundwater-Flow Model for Sustainable Groundwater-Resource Management in the South Asian Megacity of Dhaka, Bangladesh' (2017) 25(3) *Hydrogeology Journal* 617, 617; Bhattacharjee et al (n 2) 70.

[41] Shofiqul Islam et al, 'Geographical Variation and Age-Related Dietary Exposure to Arsenic in Rice from Bangladesh' (2017) 601 *Science of The Total Environment* 122; ATM Sakiur Rahman et al, 'Long-Term Trend Analysis of Water Table Using "MAKESENS"Model and Sustainability of Groundwater Resources in Drought Prone Barind Area, NW Bangladesh' (2016) 87(2) *Journal of the Geological Society of India* 179; MR Hasan et al, 'Groundwater Depletion and Its Sustainable Management in Barind Tract of Bangladesh' (2018) 12(5) *Research Journal of Environmental Sciences* 247; Ratan Kumar Majumder, Jun Shimada and Makoto Taniguchi, 'Groundwater Flow Systems in the Bengal Delta, Bangladesh, Inferred from Subsurface Temperature Readings' (2013) 35(1) *Songklanakarin Journal of Science and Technology* 99; Dey et al (n 37).

d) What specific changes in the current legal and institutional frameworks are needed to make them more effective and operational?

Among the sub-questions outlined above, a unique and important sub-question has been the role of courts in promoting groundwater sustainability. This question is rather context-specific given that the Supreme Court of Bangladesh continues to make a significant contribution to the improvement of the environmental regime of the country including water governance.[42]

The goal of this thesis, therefore, has been to achieve groundwater sustainability. This targeted sustainability ultimately paves the way for more equitable access to groundwater by the poor, marginalised and vulnerable people of Bangladeshi society in that the rich will not be allowed to extract groundwater at their pleasure. The constitutional base of these legal and social goals has been enshrined in article 18A of the *Bangladesh Constitution* that stresses the need to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens. Based on this constitutional mandate, groundwater and its regulation are important components of environmental regulations and environmental goals that can also seek to achieve social equity.

To achieve the goal stated above, the thesis proceeds from the premise that to address groundwater depletion immediately, at least a short-term solution is needed. A committed judiciary could try to bring some relief by playing a proactive role. For the long-term solutions, however, the existing legal and institutional frameworks must undergo significant reforms, with proposed measures informed by the best available science and policy including interview data from the thesis. The thesis, therefore, looks at law through a regulatory lens that explains on-the-ground implementation of the law.

The thesis argues that the current legal and institutional frameworks designed for governing groundwater withdrawal are ineffective and inefficient. The continual groundwater depletion (detailed in chapter 2(VIII)) bears testimony to the fact that the current legal regimes are ill-equipped to ensure groundwater sustainability. The legal rules, for instance, are themselves defective insofar as the core functions of groundwater law such as setting the groundwater extraction limits are missing in the current legislative instruments.[43] Moreover, the problems are exacerbated by poor compliance and enforcement that undermines the presence of groundwater laws. As a result, significant reforms are needed to transform the existing fragile legal and institutional frameworks into effective, efficient, and innovative ones.

[42] See chapter 5(IIC)(III).
[43] See chapter 3(IVE)(VC).

B *Methodology*

This thesis uses a combination of doctrinal and empirical legal research to answer the key thesis question — In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? — by addressing each of the sub-questions framed. Doctrinal research, as defined by Hutchinson and Duncan, is 'research into the law and legal concepts'.[44] For doctrinal analysis, this thesis depends on a range of primary and secondary legal materials that include legislation, policies, and case laws. In recent years, alongside the doctrinal research, there is a growing application of empirical research as part of legal scholarship,[45] and an empirical approach is more relevant for broader environmental law since it is goal-oriented, and scientific evidence plays a crucial role in the realisation of its goals.[46] More generally, a realist engagement is needed to understand the intentions and effects of environmental law by asking: what does the law do, to and for people?[47] As part of the empirical investigation, the researcher interviewed 43 people including judges, policymakers, and groundwater users. A detailed discussion on the methodology can be found in chapter 2(II).

C *Scope of the Research*

In respect of groundwater law and policy, the major scope of the thesis is directed to considering the regulation of groundwater quantity, as opposed to groundwater quality. The thesis acknowledges the vital importance of addressing groundwater quality, but it has chosen to concentrate attention on the most urgent issue of groundwater quantity. The rate of groundwater depletion in recent years has transformed into a serious crisis for Bangladesh requiring immediate attention. In particular, drinking water is fundamentally threatened by declining groundwater levels. The thesis, however, recognises that groundwater quantity is heavily impacted by its quality, and the converse is equally true.[48] Keeping these interactions in mind, the thesis makes a strong case for future research on the laws and regulations pertaining to groundwater quality in chapter 7(IV). The thesis also does not extend to examining the regulation of surface water, while acknowledging that surface water use may

[44] Terry Hutchinson and Nigel Duncan, 'Defining and Describing What We Do' (2012) 17(1) *Deakin Law Review* 83, 85, 101.
[45] Robert J Landry III, 'Empirical Scientific Research and Legal Studies Research—A Missing Link' (2016) 33(1) *Journal of Legal Studies Education* 165.
[46] See generally Lee Godden and Jacqueline Peel, *Environmental Law: Scientific, Policy and Regulatory Dimensions* (Oxford University Press, 2010); DE Fisher, *Australian Environmental Law: Norms, Principles and Rules* (Lawbook, 3rd ed, 2014).
[47] Karl N Llewellyn, 'Some Realism about Realism: Responding to Dean Pound' (1931) 44 *Harvard Law Review* 1222, 1244.
[48] RN Gejl et al, 'Understanding the Impacts of Groundwater Abstraction through Long-Term Trends in Water Quality' (2019) 156 *Water Research* 241; Larry W Mays, 'Groundwater Resources Sustainability: Past, Present, and Future' (2013) 27(13) *Water Resources Management* 4409, 4410 .

indeed put a strain on groundwater regulation.[49] In particular, conjunctive use of surface and groundwater is being increasingly recognised as one of the effective ways of tackling the groundwater crisis;[50] and accordingly, more scholarly attention is being paid to address the issues around conjunctive use. Further, the thesis does not aim to examine the transboundary water issues that could have a bearing on the quantity of groundwater resources in Bangladesh.[51] Finally, the thesis is focused on public water institutions that require immediate reforms to prevent groundwater over-extraction. Private water institutions, however, the thesis acknowledges, are also playing an increasingly significant role in promoting groundwater sustainability. Hence, targeted in-depth research is needed — which is beyond the scope of this thesis — to explore and understand the challenges and opportunities of Bangladeshi private water institutions in relation to declining groundwater levels. While all these issues are important, nonetheless, as the first substantial work on groundwater laws and institutions in Bangladesh, the thesis focuses on the most foundational ones.

III OVERVIEW OF THE THESIS

Chapter 2 begins with a discussion on the methodology of the study, paying particular attention to the need for empirical investigation in this project. The chapter then defines the key terms that are used throughout the thesis. Further, it unpacks the nexus between environmental protection and groundwater sustainability. The chapter argues that achieving groundwater sustainability is one of the strong environmental outcomes that mandates concrete action to be undertaken by the state. Thereafter this chapter explores the role of groundwater laws and institutions generally in tackling groundwater overexploitation. The chapter illustrates the widespread regulatory mechanisms that are applied in many parts of the world to prevent groundwater over-extraction. Currently, licensing, water metering including charging fees and to a lesser extent, cap-and-trade are in place across the globe to control groundwater extraction. The chapter also briefly discusses the international legal response to the protection of groundwater resources. It then moves to show the significance

[49] See generally Daud Hassan and BK Saha, 'Regulatory Frameworks for Protecting Inland Waters from Pollution: Challenges and Opportunities' (2016) 46(3/4) *Environmental Policy and Law* 270; Sudip Pal et al, 'Evaluation of the Effectiveness of Water Management Policies in Bangladesh' (2011) 27(2) *International Journal of Water Resources Development* 401; Chan, Ngai, Ranjan Roy and Brian Chaffin, 'Water Governance in Bangladesh: An Evaluation of Institutional and Political Context' (2016) 8(9) *Water* 403; Biplob Kumar Saha, 'Inland Water Pollution in Bangladesh: The Need for Regulatory Reform' (PhD Thesis, University of Western Sydney, 2014).

[50] Xin Wu et al, 'Optimizing Conjunctive Use of Surface Water and Groundwater for Irrigation to Address Human-Nature Water Conflicts: A Surrogate Modeling Approach' (2016) 163 *Agricultural Water Management* 380, 380-1, 389-91.

[51] Md Mahbubur Rahman and Muhammad Mizanur Rahaman, 'Impacts of Farakka Barrage on Hydrological Flow of Ganges River and Environment in Bangladesh' (2018) 4(4) *Sustainable Water Resources Management* 767; Animesh Gain and Carlo Giupponi, 'Impact of the Farakka Dam on Thresholds of the Hydrologic Flow Regime in the Lower Ganges River Basin (Bangladesh)' (2014) 6(8) *Water* 2501.

of groundwater in the economic development of Bangladesh and what triggers the overexploitation of this precious resource.

Chapter 3 critically examines the viability of the existing Bangladeshi laws governing groundwater withdrawal, thereby answering sub-questions (a) and (b) pertaining to the legal framework. It argues that the existing groundwater laws are rather fragmented, ineffective, and inefficient in arresting groundwater depletion caused by its over-extraction. A legislative requirement of licensing for the installation of any tubewell other than those exempted under the legislation, the chapter notes, is a considerable improvement that shows a new horizon for groundwater governance in Bangladesh. Moreover, the declaration of water stress area and the determination of the lowest safe yield of aquifers under the authority of law are undoubtedly commendable initiatives to try to curb the overexploitation of groundwater. The chapter, however, demonstrates that these positive features of groundwater laws are undermined by their obvious weaknesses. The mere introduction of licensing without metering requirements, for instance, undercuts the legislative goal of groundwater sustainability. Additionally, the law creates two conflicting systems for licensing irrigation wells, hindering effective groundwater governance. Reflecting on interview data, this chapter flags the general gaps in the existing legal framework, and it also identifies and explains the bottlenecks in the implementation of groundwater laws. The chapter concludes that significant legal reforms are needed to address the groundwater depletion issues effectively and efficiently.

Chapter 4 aims to answer sub-questions (a) and (b) in relation to the institutional framework. This chapter argues that the present water institutions are poorly designed which has rendered the groundwater regulation more complex and challenging, thereby allowing constant unsustainable groundwater extraction. It illustrates that central and local level water agencies offer opportunities for action to prevent the declining groundwater table. The existing institutional arrangements, however, fail to seize these opportunities to work in collaboration to overcome the unrelenting challenges posed by the depleting groundwater resources. In particular, it is quite unclear what would be the relation among these agencies of different levels, and in the absence of any legislative clarity, they (water agencies) remain unlinked and uncoordinated with each other, raising more questions than answers. The chapter also shows that the presence of a staggering number of water agencies and organisations generates significant conflicts and overlaps in institutional responsibilities that have exacerbated the difficulties of the groundwater governance regime. Drawing on in-depth interviews, the chapter charts that resource shortage; poor research activities; a lack of decentralisation and proper monitoring; a dearth of groundwater data; and a lack of integration and coordination have rendered the water institutions, notably the Water Resources Planning Organisation (‘WARPO’) almost dysfunctional. Despite these institutional limitations, a case study conducted on the Barind Multipurpose Development Authority — a promising institution revealed in the interviews — discloses optimistic findings in relation to the regulation of

groundwater irrigation in the northwest region of the country. Remarkably, the introduction and functioning of a prepaid smart metering system have rendered this institution a unique one that offers lessons for other Bangladeshi water institutions. The chapter concludes that the WARPO and other connected water institutions need to undergo substantial reforms for tackling the uphill challenges stemming from the declining groundwater resources.

Chapter 5 investigates whether judicial action could be one of the avenues to promote groundwater sustainability in Bangladesh that in turn, responds to sub-question (c). This chapter argues that a balanced and enlightened judicial action could potentially help shape groundwater laws and institutions, thereby promoting sustainable groundwater extraction. It explores the contributions that the Court has made in solving different societal and environmental issues of Bangladesh including water resources. It shows that the Supreme Court of Bangladesh could declare laws as well as promote compliance and enforcement by invoking its constitutionally mandated extraordinary writ jurisdictions. In particular, the chapter highlights that judicial intervention has the potential to ensure public accountability of the responsible water institutions and accelerate targeted executive action to prevent groundwater depletion. A Supreme Court ruling, the chapter notes, triggered the establishment of the National River Protection Commission, and a more recent judicial ruling has conferred legal personality upon all Bangladeshi rivers. It further demonstrates that in the absence of regular lawsuits in urgent and appropriate cases, the Court may apply *suo motu* (self-initiated) judicial intervention to stop indiscriminate groundwater exploitation that is most likely to cause devastating and irreversible damage to this invaluable resource. The chapter concludes that there remains a window of opportunity for the Court to harness its judicial power for promoting groundwater sustainability.

Drawing on interview findings, chapter 6 seeks to formulate recommendations for Bangladeshi policymakers to better ensure the sustainable abstraction of groundwater resources of the country, and it seeks to inform more generally the groundwater literature — thereby answering sub-question (d) and ultimately the central thesis question. Building on chapter 3, this chapter first outlines reforms to fill the gaps of the existing legal framework that would, in turn, make the current legal settings well-tailored to the specific situations of Bangladesh in order to control the unsustainable extraction of groundwater resources. Referring to chapter 4 and drawing on interview findings, it then proposes reforms for the existing Bangladeshi water institutions such that they could address issues around falling groundwater resources more effectively and efficiently. Thereafter, reflecting on chapter 5, this chapter proceeds to formulate certain recommendations such that balanced and targeted judicial action could be applied effectively, efficiently, and legitimately to accelerate legal reforms proposed in this thesis, thereby facilitating sustainable groundwater extraction. Going beyond the legal issues, the chapter takes the discussion further by devising some management options alongside the regulation that have the effect of promoting groundwater sustainability.

Chapter 7 presents a summary of the key findings of the thesis. The thesis finds that there is considerable scope to improve the existing legal and institutional frameworks to overcome the increasingly daunting challenges posed by the declining groundwater resources of Bangladesh. To that end, legal and institutional frameworks need to undergo substantial reforms as proposed in chapter 6. Based on the interview data, this chapter prioritises some reforms for immediate implementation. The chapter warns that declining groundwater challenges are not static, but rather evolving with time, and as such, groundwater laws and institutions need to be constantly tested, explored, and refined to make them dynamic, innovative, and better responsive. Finally, this chapter identifies areas for future research.

IV CONTRIBUTION TO SCHOLARSHIP

This thesis meaningfully contributes to scholarship in three ways. First, very scant literature exists in Bangladesh in relation to groundwater sustainability. This limited scholarship has, however, tended to examine the sociological and technical aspects of groundwater resources, so legal issues have mostly remained unaddressed from both doctrinal and empirical perspectives.[52] Further, the key legislation in Bangladesh pertaining to groundwater resources — the *Bangladesh Water Act 2013* and the *Groundwater Irrigation Management Act 2018* — is fairly new and therefore, has seen very limited scholarly attention. More importantly, the *Bangladesh Water Rules 2018* made under the *Bangladesh Water Act*, the *Groundwater Irrigation Management Act* and the 2019 Rules made thereunder, have been adopted officially in Bangla, and no authenticated English translations of these laws exist. This thesis, therefore, makes a unique contribution to English-language scholarship by analysing and translating elements of these laws from Bangla to English, thus making them available to a wider range of audiences and researchers.

Second, this thesis advances broader water law, governance, and management literature by adopting an approach undertaking an examination of water sustainability through the lens of a country that is heavily dependent on water resources for its development activities. Of course, Bangladesh is not alone in the category of developing countries that strongly depend on water resources for economic advancement. The country has, however, some factors such as high population growth, and ever-increasing use of water resources by competing actors (described in chapter 2(VII)(VIII)) that make it unique for study. Be that as it may, unaware of the impact of unsustainable water withdrawal many more countries like Bangladesh

[52] See, eg, Sushmita Sengupta, Amandeep Kang and Nitya Jacob, 'A Briefing Paper on the State of Groundwater Management in Bangladesh' (Water Wealth, September 2012) (focusing on urban groundwater management); Farhana Sultana, 'Community and Participation in Water Resources Management: Gendering and Naturing Development Debates from Bangladesh' (2009) 34(3) *Transactions of the Institute of British Geographers* 346 (examining the mobilisation and outcomes of participation in water provision and arsenic mitigation); Golam Saleh Ahmed Salem et al, 'Optimum Abstraction of Groundwater for Sustaining Groundwater Level and Reducing Irrigation Cost' (2017) 31(6) *Water Resources Management* 1947 (estimating optimum groundwater extraction for irrigation).

continue to stress water development instead of regulations, governance, and management. While much has been written on water governance and sustainability generally,[53] little attention has been paid to explore, understand, and evaluate issues around groundwater governance and sustainability in Bangladesh — a country that is characterised by a historic lack of water governance and regulations in general, and for groundwater in particular. Instead of looking at the law and regulation across the entire of water cycle, the thesis has focused on declining groundwater tables since they represent an impending disaster for Bangladesh warranting immediate policy attention. Taking Bangladesh as an example this thesis, therefore, provides insights into challenges and opportunities for broader water governance that may be relevant to other countries such as Iran, Pakistan, Yemen, Somalia, Sudan, and Egypt — where similar issues are prevalent or expected to emerge in the future.[54]

Third, beyond broad water scholarship, this thesis also contributes to resource governance and more broadly public administration insofar as it identifies and discusses issues of the gap between law and implementation on-the-ground, the difficulties of coordinating institutions, and the potential for judicial intervention in resource governance. More generally, the thesis highlights the factors that separate the 'Law on Books' and 'Law in Practice', and outlines the barriers that stymie smooth institutional functioning; and eventually, the thesis shows how to overcome these obstacles that may significantly help other natural resource managers and public administrators in undertaking their day-to-day work.

[53] See, eg, Alejandro Jiménez et al, 'Unpacking Water Governance: A Framework for Practitioners' (2020) 12(3) *Water* 827; Alvar Closas and Karen G Villholth, 'Groundwater Governance: Addressing Core Concepts and Challenges' (2020) 7(1) *Wiley Interdisciplinary Reviews: Water* e1392; David E McNabb, *Global Pathways to Water Sustainability* (Palgrave Macmillan US, 2019); Mark Smith et al (eds), *Spring: Managing Groundwater Sustainably* (IUCN, 2016); Paul D Raskin, Evan Hansen and Robert M Margolis, 'Water and Sustainability' (1996) 20(1) *Natural Resources Forum* 1.

[54] See, eg, Ehsan Nabavi, '(Ground)Water Governance and Legal Development in Iran, 1906–2016' (2017) 9(1) *Middle East Law and Governance* 43; Ahmed AM Almas and Miklas Scholz, 'Agriculture and Water Resources Crisis in Yemen: Need for Sustainable Agriculture' (2006) 28(3) *Journal of Sustainable Agriculture* 55; Jauad El Kharraz et al, 'Water Scarcity and Drought in WANA Countries' (2012) 33 *Procedia Engineering* 14; World Bank, *Beyond Scarcity: Water Security in the Middle East and North Africa* (World Bank, 2017).

CHAPTER 2

RESEARCH METHODOLOGY AND SETTING THE CONTEXT

I INTRODUCTION

Bangladesh is a unique country characterised by high population density, *de facto* open access to groundwater, little information about the characteristics of aquifers, and multitudes of tiny private groundwater users.[1] Therefore, approaches to tackle groundwater depletion that work in certain jurisdictions characterised by small numbers of large users and low population density may fail in Bangladesh.[2] Hence, a context-specific approach is needed for tackling issues around groundwater resources. Chapter 1 showed that groundwater depletion has emerged as an urgent legal and policy issue in Bangladesh. There is a growing recognition that groundwater sustainability is closely linked to environmental protection.

Crucially, a legal framework is critical to ensure the sustainability of aquifers. This legal framework may be of two types: the first one is concerned with specific sector activities that impact groundwater, while the second one deals with the groundwater resource itself.[3] Under the first type of legal framework, irrigation, industrial groundwater use, mining, oil/gas drilling, waste disposal, etc may be covered, while the second type would handle the groundwater quality and quantity itself.[4] Ultimately, the legislation establishes water agencies with program missions to set rules and monitor groundwater quality and quantity.[5] In Bangladesh, however, the first type of legal framework is almost absent. While legal and institutional frameworks in relation to groundwater extraction exist in Bangladesh, they like other developing countries, are fragmented, poorly funded, and characterised by the capacity of the government agencies that lack the horizontal link with other sectors or vertical link to local institutions.[6]

However, to understand in what ways legal and institutional frameworks could better ensure the sustainable extraction of groundwater resources in Bangladesh, it is necessary to undertake a nuanced examination of the general role that laws and institutions can play in preventing groundwater over-extraction. More clearly, to conduct an effective assessment of the legal and institutional frameworks of Bangladesh in relation to the prevention of

[1] See generally Asad Sarwar Qureshi, Zia Uddin Ahmed and Timothy J Krupnik, *Groundwater Management in Bangladesh: An Analysis of Problems and Opportunities* (CSISA-MI Project, Research Report No 2, 2014).
[2] Kerstin Mechlem, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper 6: Legal and Institutional Frameworks* (Rome, June 2012) 38.
[3] Alfred M Duda, 'Leadership and Political Will for Groundwater Governance: Indispensable for Meeting the New Sustainable Development Goals (SDGs)' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 101.
[4] Ibid 101-102.
[5] Ibid 102.
[6] See chapters 3(IV)(V)(VI), 4(II)(III); see also Food and Agriculture Organisation (FAO), *Global Diagnostic on Groundwater Governance* (FAO, 2016) 123, 131-2.

groundwater overexploitation, it is imperative to learn what issues should be addressed by an ideal legal framework of this kind, and what would be the attributes of an ideal water institution in the context of groundwater regulation. Much of the characteristics of this ideal framework will underpin the critical examination conducted in chapters 3 and 4 in relation to the Bangladeshi laws and institutions that govern groundwater extraction.

Additionally, initiatives adopted at the international level towards the protection of groundwater resources often promote domestic actions in this regard. For instance, the latest Sustainable Development Goals encourage national governments to undertake appropriate measures to ensure sustainable management of water resources. Therefore, as a member of the international community, Bangladesh is strongly expected to adopt effective legal measures to ensure groundwater sustainability. However, this legal study on groundwater sustainability requires background knowledge of Bangladesh. In particular, it is necessary to know what value and significance groundwater resources bear for Bangladesh and who are the drivers behind groundwater over-extraction. Agricultural and industrial sectors are exerting unprecedented stress on groundwater systems and supplies that warrant immediate effective legal response before turning it into an irreversible crisis in Bangladesh.

Of course, the examination of legal rules requires appropriate research methods. This chapter, therefore, also sets out the methods used to examine the existing legal and institutional frameworks in sufficient detail to identify and understand their strengths and gaps in tackling the declining groundwater resources of Bangladesh. Investigating the relevant groundwater laws and institutions requires research methods that can engage with factors triggering the action and inaction of the legal arrangements. Understanding when and how legal rules contribute to groundwater sustainability requires a deeper engagement with the specific context of these rules. To do so, the thesis uses two distinct methods: a legal analysis of the statute and other legal instruments, and a method drawing on in-depth interviews with groundwater users, policymakers, judges, and scholars on groundwater issues.[7] These interviews are a significant contribution to this research, and provide myriad insights into the role of legal rules and institutions in tackling groundwater over-extraction that enable us to go beyond the 'law on books', shedding light on how laws and institutions work in practice. 'Normative, theoretical, or doctrinal' research dominates the legal scholarship,[8] but empirical research is increasingly recognised as important, and is undertaken by legal scholars.[9]

[7] Gary Thomas, *How to Do Your Case Study: A Guide for Students and Researchers* (SAGE Publications, 2011), see particularly the discussion of the interpretative approach, 124-129.
[8] Robert J Landry III, 'Empirical Scientific Research and Legal Studies Research—A Missing Link' (2016) 33(1) *Journal of Legal Studies Education* 165, 169; Tom R Tyler, 'Methodology in Legal Research' (2017) 13(3) *Utrecht Law Review* 130.
[9] DR Cahoy, 'Editor's Corner: Considerations in the Rise of Empirical Legal Scholarship' (2010) (3) *American Business Law Journal* v; Michael Heise, 'The Importance of Being Empirical' (1999) 26 *Pepperdine Law Review* 807; Frans L Leeuw and Hans Schmeet, *Empirical Legal Research: A Guidance Book for Lawyers, Legislators and Regulators* (Edward Elgar Publishing, 2016); Tyler (n 8).

This chapter proceeds in nine parts. Part II explains the methodology of the study justifying the need for empirical research. Part III defines the key terms used throughout the thesis. Part IV then explains the nexus between groundwater sustainability and environmental protection. Part V moves to discuss what role legal and institutional frameworks can generally play in tackling the groundwater over-extraction. In particular, this Part explores the widespread regulatory practices that are applied globally to control groundwater extraction. In Part VI, the chapter briefly looks at the international response to the protection of groundwater resources. Part VII provides an overview of Bangladesh while Part VIII illustrates the significance of groundwater and its overexploitation in Bangladesh. Finally, Part IX summarises this chapter.

II RESEARCH METHODOLOGY

This thesis is based on doctrinal as well as empirical analysis.

A *Doctrinal Analysis*

Doctrinal research provides a systematic exposition of the rules governing a particular legal category, analyses the relationship between rules, explains areas of difficulty, and, eventually, predicts future developments.[10] In other words, this type of research is concerned with the identification, interpretation, and application of relevant rules to practical human experience, and is broadly characterised by an exhaustive literature review and close reading of case law and legislation.[11] This technique allows undertaking a systematic review of the existing knowledge[12] with respect to groundwater regulation in general and the Bangladeshi context in particular, and this systematic review generates a more precise and more generalisable study by accumulating data and context from multiple studies.[13]

Interpretation of legislation and legal instruments, however, still forms the backbone of this thesis. Doctrinal analysis has been conducted in the following ways:

First, global literature related to the sustainable abstraction of groundwater resources has been extensively consulted to gain a global picture with respect to this issue. This wide-ranging global literature review helps the researcher gain a clear understanding how legal frameworks are concerned with groundwater governance, and how groundwater resources are managed through the application of responsibility, participation, information availability, transparency, custom, and rule of law.[14] In particular, the literature that has been developed

[10] Terry Hutchinson and Nigel Duncan, 'Defining and Describing What We Do' (2012) 17(1) *Deakin Law Review* 83, 85, 101.
[11] Brendon Murphy and Jeffrey McGee, 'Phronetic Legal Inquiry: An Effective Design for Law and Society Research?' (2015) 24(2) *Griffith Law Review* 288, 297.
[12] William Baude, Adam S Chilton and Anup Malani, 'Making Doctrinal Work More Rigorous: Lessons from Systematic Reviews' (2017) 84(1) *The University of Chicago Law Review* 37, 44-45.
[13] Ibid.
[14] Mechlem (n 2).

that centres on Australian and Indian groundwater regulation has been reviewed with a view to gaining knowledge as to what tools have been devised in those jurisdictions to tackle the groundwater depletion issues. There are two-fold reasons for doing this:

a. in Bangladesh very scant amount of literature has developed in the area under research rendering doctrinal analyses themselves insufficient and incomplete;
b. orientation with the literature developed globally helps the researcher formulate appropriate recommendations for Bangladesh.

Second, in recent years the interaction between science, law, and technology has increasingly been recognised,[15] and this is highly relevant with respect to groundwater law and regulation.[16] As such, scientific literature in relation to groundwater has been consulted to build a firm understanding of the hydrological and hydrogeological aspects of this resource.

Third, a detailed reading of legal instruments of Bangladesh in relation to groundwater extraction such as the Acts of Parliament, policies, regulations, orders, and case law has been conducted to identify how the current legal and institutional frameworks respond to issues around groundwater depletion and what deficiencies exist in the current settings. Poorly designed groundwater law followed by its poor implementation disclosed by empirical investigation indicates the deficiency in the current setting.

Fourth, literature developed in Bangladesh related to the groundwater depletion issue, though very limited, has been systematically reviewed to be apprised of the current legal scholarship.

Finally, literature developed in relation to the role of the court in general and the Bangladeshi context in particular with regard to the protection of groundwater resources has been consulted to see whether the Bangladeshi Court could contribute in one way or another to groundwater sustainability. Given the unique opportunity of the Supreme Court of Bangladesh is offered under the constitution and the commendable proactive role that it has played and continues to play in shaping a robust environmental regulation broadly (detailed out in chapter 5), this thesis has chosen to consider this legal area that has to date remained unexplored.

These reviews of laws and policies and academic scholarship have been used as the basis of determining how the existing legal instruments respond to the challenge or problem of

[15] See, eg, W Keith Robinson and Joshua T Smith, 'Emerging Technologies Challenging Current Legal Paradigms' (2018) 19 *Minnesota Journal of Law, Science and Technology* 355; VS Mani, 'Law, Science and Technology: Some Reflections' (2013) 2(1) *INROADS- An International Journal of Jaipur National University* 48; National Research Council, *A Convergence of Science and Law: A Summary Report of the First Meeting of the Science, Technology, and Law Panel* (National Academy Press, 2001).

[16] See, eg, Devin L Galloway and Geological Survey (US) (eds), *Evolving Issues and Practices in Managing Ground-Water Resources: Case Studies on the Role of Science* (US Geological Survey, 2003); Bharat R Sharma et al (eds), *Groundwater Research and Management: Integrating Science into Management Decisions* (International Water Management Institute, 2006); Marios Sophocleous, 'Interactions between Groundwater and Surface Water: The State of the Science' (2002) 10(1) *Hydrogeology Journal* 52.

reaching sustainable abstraction of groundwater resources in Bangladesh, what deficiencies currently exist in the legal and institutional frameworks, and what role, if any, the Court could play to promote the groundwater sustainability. These findings have then been supplemented with an empirical investigation.

B *Empirical Investigation*

1 *Empirical Research in Law and the Role of Qualitative Research*

Law has traditionally been viewed as a closed system, and doctrinal research has been a dominating tool in legal research.[17] Over the past few decades, however, empirical legal research has been conducted, albeit on a limited scale in relation to Bangladesh, to look at the differences between 'law on books' and 'law in action'.[18] Empirical legal research is more concerned with a realistic view on what the law is, what it does, and how it can be improved than the one that presents law with a specific style of interpretation.[19] This type of research is especially needed to correctly comprehend and explicate the natural and social scientific knowledge, to understand and interpret the behavior of legal actors, and to observe how law on-the-ground changes society.[20] Additionally, this approach demonstrates why certain legal rules fail to achieve the intended objective, what barriers these legal rules encounter in their implementation, and how they could be overcome.[21] Empirical research, therefore, has the enriching potential to inform, underpin, and complement the doctrinal research with deeper and more informed findings for the readers.

Methodologically, empirical research is 'the systematic collection of information ('data') and its analysis according to some generally accepted method'.[22] Empirical research can be undertaken using quantitative or qualitative methods. But these are considered to be distinct from each other in that 'qualitative observation' identifies the presence or absence of something, whereas 'quantitative observation' involves measuring the degree to which some feature is present.[23] As a result, qualitative research instead of depending on statistical quantification, attempts to capture and categorise social phenomenon and their meanings.[24]

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[17] Kylie Burns and Terry Hutchinson, 'The Impact of "Empirical Facts" on Legal Scholarship and Legal Research Training' (2009) 43(2) *The Law Teacher* 153; Heise (n 9).
[18] Burns and Hutchinson (n 17) 159.
[19] WH van Boom, Pieter Desmet and Peter Mascini, 'Empirical Legal Research: Charting the Terrain' in WH van Boom, Pieter MA Desmet and Peter Mascini (eds), *Empirical Legal Research in Action: Reflections on Methods and Their Applications* (Edward Elgar Publishing, 2018) 2.
[20] Ibid 3.
[21] Ibid 6.
[22] Peter Cane and Herbert M Kritzer, 'Introduction' in Peter Cane and Herbert M Kritzer (eds), *The Oxford Handbook of Empirical Legal Research* (Oxford University Press, 2010) 4-5; Robert M Lawless, Jennifer K Robbennolt and Thomas Ulen, *Empirical Methods in Law* (Aspen Publishers, 2010) 7.
[23] Jerome Kirk and Marc L Miller, *Reliability and Validity in Qualitative Research* (SAGE Publications, 1986) 9.
[24] Lisa Webley, 'Qualitative Approaches to Empirical Legal Research' in Peter Cane and Herbert M Kritzer (eds), *The Oxford Handbook of Empirical Legal Research* (Oxford University Press, 2010) 928-9.

Further, quantitative methods generate 'objective, generalisable and, by implication, value-free' results, whereas qualitative methods are typically seen as 'soft and subjective'.[25] Whilst this historical conflation of quantitative methods with 'hard' data and qualitative with 'soft' is no longer generally accepted, the qualitative and quantitative methods are indeed better suited to particular types of research questions. Quantitative methods lend themselves to deductive methods of inquiry, particularly in experimental settings, to test hypotheses,[26] and qualitative methods, on the other hand, offer insight into how and why a phenomenon of interest is occurring in context, and typically rely on a more holistic, inductive approach to data gathering and analysis.[27]

As this thesis seeks to make the legal and institutional frameworks focusing on implementation strategies more effective and efficient in relation to the sustainable abstraction of groundwater resources, the empirical qualitative approach fits in.[28] Groundwater law is particularly well-matched to a qualitative approach given that its success and failure often depend on crafting robust legislation coupled with its implementation.[29] More importantly, given the absence of previous literature in the area under research, this study is more exploratory in nature, that is, no well-established hypotheses exist to test, and as such, the study is reform-oriented in terms of basic legal mechanisms. Furthermore, the question about the role of the Court is hypothetical in the sense that it has not yet been used extensively on-the-ground, hence there is no possibility of measuring on-ground effectiveness in a quantitative way. This type of research evidence can identify gaps in current legal provisions, or weaknesses in the ways in which current law works.[30] It can also help adopt new strategies to tackle the crisis. This type of qualitative research could better answer: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? To what extent do the current legal and institutional frameworks ensure sustainable groundwater extraction? What deficiencies presently exist in the legal and institutional settings? Can judicial action promote the sustainable abstraction of this resource? What specific changes in the current legal and institutional frameworks are needed to make them more effective and operational?[31]

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[25] Hilary PM Winchester, 'Qualitative Research and its Place in Human Geography' in Iain Hay (ed), *Qualitative Research Methods in Human Geography* (Oxford University Press, 2nd ed, 2005) 3, 10.
[26] Kevin Laws and Robert McLeod, 'Case Study and Grounded Theory: Sharing Some Alternative Qualitative Research Methodologies with Systems Professionals' (Conference Paper, International Conference of the Systems Dynamics Society, 25-29 July 2004); RY Cavana, Uma Sekaran and Brian L Delahaye, *Applied Business Research: Qualitative and Quantitative Methods* (John Wiley and Sons, 2001).
[27] David Silverman, 'The Logics of Qualitative Research' in Gale Miller and Robert Dingwall (eds), *Context and Method in Qualitative Research* (SAGE Publications, 1997) 13-25; Winchester (n 25).
[28] Silverman (n 27).
[29] Cameron Holley and Darren Sinclair, 'Compliance and Enforcement of Water Licences in NSW: Limitations in Law, Policy and Institutions' (2012) 15(2) *Australasian Journal of Natural Resources Law and Policy* 149, 151-2.
[30] Cane and Kritzer (n 22); Webley (n 24).
[31] Martin Partington, 'Empirical Legal Research and Policy-making' in Peter Cane and Herbert M Kritzer (eds), *The Oxford Handbook of Empirical Legal Research* (Oxford University Press, 2010) 1006.

Thus, qualitative legal research can assist policymakers in defining changes needed in law and policy. Therefore, in order to understand the efficiency and effectiveness of the current legal and institutional frameworks of Bangladesh in ensuring groundwater sustainability through the lens of different actors, an empirical investigation using the qualitative method is adopted.

C *Interviews and Content Analysis*

Before embarking on the detailed interview process, it is worth noting that since there is no published work on groundwater regulation in Bangladesh, these interviews are a major original contribution to scholarship. A rigorous literature review has failed to trace any recorded qualitative data such as interviews in relation to this area. Interviews that were conducted in Bangla and later translated to English, provide an avenue for other researchers who had no access to Bangla to undertake future research, thereby filling a gap in the literature that has long been ignored.

1 *Selection of Participants*

A total of forty-three in-depth, face-to-face, one-on-one interviews were conducted by the researcher, totaling around forty hours. The idea was as pointed out by Johnson and Rowlands, to develop and build on intimacy that resembles friendship and subsequently to seek deep information and knowledge regarding the study area.[32] Broadly four categories of people were interviewed. Category 1 consisted of eight government officials. Among these government officials four worked with the Ministry of Water Resources, one with the Law Commission-Bangladesh, and the remaining three with the Ministry of Agriculture, the Ministry of Industries, and the Legislative and Parliamentary Affairs Division under the Ministry of Law, Justice and Parliamentary Affairs, respectively. All these government officials were involved with policymaking in one way or another and had been in their current role (or a very similar one) for several years. Category 2 consisted of 11 Scholars comprising of five academics, four advocates, one water specialist, and one environmental activist. Given their practical experiences these interviewees were selected as they could offer a specific 'information-rich' perspective.[33] However, given the small size of the sample random sampling could not be conducted.

Category 3 was comprised of three judges of the Supreme Court of Bangladesh, and three judges of the Environment Courts. Selected judges of the Supreme Court previously dealt with a significant number of cases related to the environment. Currently, three Environment Courts and one Environment Appellate Court operate in Bangladesh, and given their practical

[32] John M Johnson and Timothy Rowlands, 'The Interpersonal Dynamics of In-depth Interviewing' in Jaber Gubrium et al (eds), *The SAGE Handbook of Interview Research: The Complexity of the Craft* (SAGE Publications, 2nd ed, 2012) 99.

[33] Michael Quinn Patton, *Qualitative Research and Evaluation Methods* (SAGE Publications, 3rd ed, 2002) 45; Tim Rapley, 'Sampling Strategies in Qualitative Research' in Uwe Flick, Katie Metzler and Wendy Scott (eds), *The SAGE Handbook of Qualitative Data Analysis* (SAGE Publications, 2014) 49-63.

expertise and experiences, three judges of these Courts were selected to participate in the interview. Hence, the sample of this category 'drew from' almost all courts that typically deal with groundwater.

Category 4 consisted of eighteen groundwater irrigators and domestic users. Among them, thirteen were farmers as well as domestic groundwater users and five were exclusively domestic groundwater users. They were selected as described below from the northwest, southwest, southeast, and eastern hill regions of the country. These regions were chosen because the nature of the groundwater crisis in these areas differs from one place to another. For instance, the northwest regions experience groundwater overexploitation and suffer severe water scarcity[34] whereas the southwest, southeast, and eastern hill regions are relatively water abundant, but the former one (southwest) region is exposed to salinity and arsenic,[35] and the latter two regions are susceptible to arsenic causing different types of water crises. Interviewees of these four different regions generally gave responses that were understandable given the specific contexts.

The small sample size, however, means that there may be experiences and views held by others that fall into the study categories that interview data collected for this project do not capture, but nonetheless, these interview data provide rich and valuable information. In particular, the involvement of an exceptional range of actors such as the government officials and the judges of different courts including the Supreme Court of Bangladesh, has rendered these interviews highly valuable. In other words, it is typically hard for other researchers to access and interview the high government officials and judges that this researcher, by virtue of his affiliation with the government,[36] has undertaken smoothly, thereby facilitating other researchers by making this rare data available to them. It is pertinent to note here that for the sake of brevity and convenience interviewees from Category 1, 2, and 3 — in appropriate cases — will be collectively referred to as 'professional respondents'.

Contact details of the most of interviewees of Category 1 were found on the publicly accessible websites. In addition, thanks to his affiliation with judicial service, the researcher knew several interviewees in Category 1 and 3. The personal knowledge of the researcher, however, does not represent a conflict of interest here as is made clear below. Thus, interviewees were initially sourced on the contacts of the author and a snowball sampling technique (a referral-based technique) was adopted to source the further interviewees including those in Category 2. As far as Category 4 was concerned, judicial colleagues of the

[34] CSIRO, WARPO, BWDB, IWM, BIDS, CEGIS, *Bangladesh Integrated Water Resources Assessment* (Final Report, May 2014) 65 ('CSIRO Report'); also see generally Nepal C Dey et al, 'Sustainability of Groundwater Use for Irrigation of Dry-Season Crops in Northwest Bangladesh' (2017) 4 *Groundwater for Sustainable Development* 66; JM Kirby et al, 'The Impact of Irrigation Development on Regional Groundwater Resources in Bangladesh' (2015) 159 *Agricultural Water Management* 264.
[35] CSIRO Report (n 34).
[36] The researcher has been working with the government of the People's Republic of Bangladesh in the justice sector since 22 May 2008; he is still in his service but now on secondment to undertake the current project.

researcher working in the selected locations — northwest (Rajshahi division), southwest (Khulna division), southeast and eastern hill (Chattogram division) — assisted him in identifying these interviewees.[37]

2 *Ethics and Interviewee Privacy*

Conducting these interviews ethically required an assessment of the potential risks of the research. Hence, an ethics application was lodged with the Melbourne Law School Human Ethics Advisory Group seeking an ethics approval. Having reviewed the application, the Human Ethics Advisory Group issued their approvals on 22 December 2017.

The value of these interviews lies in the ability of the interviewees to discuss their perspectives and opinions honestly, so the risk mitigation strategies[38] emphasised the anonymity of the interviewees and the protection of their interview data. It was made clear to all interviewees in the initial contact that participation in the interview was voluntary and they (interviewees) were also given the option to choose how they would be identified in the resulting research material (including this thesis and any related reports or academic publications). As most of the interviewees requested that their identity remains confidential, all interviewees are only identified with a code to be known to the researcher only. All interviewees were, nevertheless, cautioned that given the small number of the respondents it might be possible to identify them based on their remarks in the interview.

3 *Conducting the Interviews*

The interviews were semi-structured, and each interview lasted between 30-60 minutes depending on the participant's level of interest and comfort. All interviews except those related to Category 4 were conducted at the interviewees' office/workplace (Dhaka and Chattogram). Interviews for Category 4 were conducted either at their house or on agricultural lands as suggested by them. The interview questions were designed to demonstrate the capacity of the interviewees to discuss their views on, experiences with, and knowledge of the strengths and weaknesses of the current legal and institutional frameworks with respect to the groundwater abstraction. Interviews in relation to Category 4 were conducted with a view to ascertaining their levels of knowledge, and compliance with the relevant laws. Interview questions slightly differed from category to category depending on their involvement with the groundwater resources in their daily and professional lives. All interviews were conducted in such a way as to allow for a natural conversation flow. As a result, some interview responses were not directly related to the central thesis question, and

[37] All interviewees were adult, and they were contacted by the researcher personally. All interviewees received a plain language statement outlining the aims of the research, how the data from their interview would be captured and stored and their capacity to consent to the interview. Additionally, they were provided with details of who to contact if further information was required, or if the interviewee had any concerns at any point during the interview process. All interviewees had the opportunity to decline to participate at any point, even after the interview was conducted. All interview transcripts were stored on a password-protected computer.

[38] Robert K Yin, *Case Study Research: Design and Methods* (SAGE Publications, 4th ed, 2009) 73.

ultimately, they were not incorporated into the thesis. All but four interviews were conducted in Bangla, and these four interviews were conducted in English.

All but seven interviews were audio-recorded as well as transcribed during the interview discussion. Some follow-up interviews were conducted. The transcription was checked against the recording for accuracy after the interview was conducted. Most interview transcripts were read over to the participants after the interview was over and some were also returned to them for confirmation of accuracy. In most cases, very few alterations were requested. The analysis of the interviews is based on these written documents, which remain on file. It is, however, necessary to note that while reporting the speech of the interviewees in English the researcher employed the highest caution, faithfulness, and honesty to retain and exhibit the tone and the way interviewees expressed an idea in Bangla. Yet, as it is most likely to happen in all translations, an idea translated from Bangla to English risks some deviations from the original expressions of the interviewees. It is, therefore, acknowledged that despite the best efforts employed English translated speech of the interviewees may incur slight deviations from their original Bangla expressions.

4 *Conflict of Interest*

There was a small chance of a perceived conflict of interest between the researcher's former role and the interview participants. As stated earlier, the researcher is a member of the Bangladesh Judiciary. There might be some perceived conflict of interest between the researcher and the participants of Category 3 — who were the judges of different courts. As far as the judges of the Supreme Court were concerned, these judicial officers were senior officials, and only in a general way they would oversee the researcher's judicial role; although not so directly as his immediate controlling authorities like the District Judge and the Chief Judicial Magistrate. Therefore, he was not in a position to influence these senior judicial officers and it was at their discretion whether they would consent to be interviewed. In relation to the judges of the Environment Courts, they were fully independent in forming their opinions in relation to any matter including the questions that the researcher put forward them.

In respect of the participants of Category 1 and 2, these participants held high positions in their respective fields who were quite independent in their views. Therefore, it was highly unlikely that these participants were influenced by the researcher. As far as Category 4 was concerned, the researcher did not disclose his official identity to them, and it was explained to them that their involvement in the project was voluntary and they were at liberty to withdraw from the project at any time. Moreover, no prior relationship existed between these participants and the researcher, and the participants were not offered any reward for their participation in the project. Furthermore, the researcher advised participants of all categories that the data provided by them would be retained with utmost secrecy and confidentiality, and he would protect their anonymity to the fullest possible extent. Therefore, there was a

very small chance of the fact that the participants, especially from Category 4, responded in a way to make the researcher happy.

5 *Coding the Interviews in the Research*

Throughout the thesis government officials (Category 1) are identified as GO 1, GO 2, GO 3, and so on while scholars (Category 2) are identified as S 1, S 2, S 3, and so on. Judges (Category 3) are marked as J 1, J 2, J 3, and so on, while groundwater users (Category 4) are identified as GU 1, GU 2, GU 3, and so on.

6 *Content Analysis*

The interviews give valuable insight into the way the legal and institutional frameworks of Bangladesh work in practice to control groundwater withdrawal, in particular, interviews give a sense as to why legal regulations fail to prevent groundwater depletion. Further, interviews demonstrate issues around compliance and enforcement, that is, what factors drive people for compliance or non-compliance with groundwater regulation, what gaps prevail with respect to enforcement strategies, and how they could be better suited to the peculiar conditions of Bangladesh. The objective of collecting interview data was to provide a richer, deeper, and more nuanced interpretation of the findings that emerged from the review of legal rules, academic literature, and other related materials.

The interview transcripts were entered into NVivo12 for the purpose of content analysis. The themes for this analysis were generated using an iterative approach, so that initial themes of interest were identified based on the legal analysis, and thereafter with further deeper look and analysis, they were condensed into a full set of themes. This follows Berg's requirement that 'the development of categories in content analysis must derive from inductive reference…. concerning patterns that emerge from the data',[39] and ensures that the themes are 'grounded in the data' from which they have emerged. As described by Berg, the list of themes was refined until saturation point was reached, when the interview data was able to be coded quickly.[40]

7 *Using the Data*

Interviews were undertaken using an inductive, interpretative approach based on qualitative data. This method is rooted in the interpretation of the law to identify and describe:

a. the extent to which the current groundwater laws and institutions act in ensuring the sustainable abstraction of groundwater resources;

b. the deficiencies exist in the current legal and institutional settings;

[39] Bruce L Berg, *Qualitative Research Methods for the Social Sciences* (Allyn and Bacon, 3rd ed, 1998) 234.
[40] Ibid 236-238.

c. the possibility of judicial action to promote the sustainable abstraction of this resource; and
d. specific reforms in the current legal and institutional frameworks that are needed to be undertaken.

Using the interviews in this way requires what Alvesson called a 'mixed position' on interview interpretation.[41] On the other hand, the structured nature of the interviews, with their reliance on short questions and long answers, the content analysis with its emphasis on detailed coding and large quantities of material, and the capacity of interviewees to provide feedback on the interview transcripts indicates an 'interactive rationalist' approach to the interview data. The interviews are considered to 'accurately reflect the experiences and/or observations of interviewees', at least from the perspectives of the interviewees.[42] However, the interview data is primarily relied on to understand the 'ideas, values [and] understandings of practices'[43] of the groundwater actors, and the interviews were conducted using a conversational style, diverging from the set interview questions as needed to ensure the natural flow of the conversation. This 'romantic' approach yields 'deeper, fuller conceptualisations'[44] and greater understanding than the interactive rationalist approach. The interviews were all conducted by the researcher, who is known to some of the interviewees as a professional colleague, and relied on the building and maintaining of trust, further aligning with the romantic approach. Despite the fact that the authenticity of interview data should always be scrutinised,[45] they can be relied on as a source of each individual interviewee's description of their understanding of events, processes, and values.

III DEFINING THE KEY TERMS

Throughout this thesis, certain key terms are used. Therefore, it is useful to shed light on the precise definition of these selected terms.[46]

A *Groundwater*

It is pertinent to mention here that legal (as distinct from hydrogeological) definitions of groundwater and aquifer vary across the world.[47] Different legislations define it differently. The following definition represents the most commonly held characteristics of groundwater.

[41] Mats Alvesson, *Interpreting Interviews* (SAGE Publications, 2011) 21.
[42] Ibid 13.
[43] Ibid 14.
[44] J Miller and B Glassner, 'The "Inside" and the "Outside": Finding Realities in Interviews' in David Silverman (ed), *Qualitative Research* (SAGE Publications, 1997) 99, 103.
[45] David Silverman, *Interpreting Qualitative Data: Methods for Analyzing Talk, Text and Interaction* (SAGE Publications, 3rd ed, 2006) 109-148.
[46] A groundwater glossary appears in Appendices (C).
[47] Rebecca Nelson and Philippe Quevauviller, 'Groundwater Law' in Anthony J Jakeman et al (eds), *Integrated Groundwater Management* (Springer International Publishing, 2016) 173-196.

All water below the ground is called subsurface or underground water.[48] This underground water lies in both saturated and unsaturated states in strata and soils.[49] All underground water, however, is not groundwater; groundwater is water that fully saturates the ground, filling all available spaces[50] — pores and cracks of the earth's subsurface geology.[51] The ground that contains groundwater is known as the 'saturated zone'.[52] The upper surface of the groundwater is called the 'water table' from where water can be pumped through drilling. Generally, groundwater moves slowly;[53] however, it often moves faster when it comes close to the surface water.[54] There is a significant variation of flow rate depending on the permeability or porosity of sedimentary material. Nevertheless, while thirty meters a year is a typical figure, ten to fifteen meters per day is very rapid.[55]

Groundwater is naturally recharged by rainwater and snowmelt or water leaked from water bodies such as lakes and rivers. Recharging can also occur through the leakage of water supply systems and crops irrigated with more water than required.[56] Groundwater can also be artificially recharged, thereby increasing the amount of water in the aquifer.[57]

The *Bangladesh Water Act 2013* in section 2(26) defines groundwater as 'any water underneath the soil which flows through aquifers and is abstractable onto the surface by natural or artificial process'. This definition embraces the above discussed characteristics of groundwater. Having regard to the foregoing discussions, this thesis adopts a mixed but comprehensive definition of groundwater such that broader aspects of this resource are covered in this thesis. Accordingly, in this thesis, groundwater refers to water that fully saturates the pores and cracks of the earth's subsurface geology.

B *Aquifer*

An aquifer is a body of rock or sediment that stores/yields significant quantities of water and serves as an underground reservoir.[58] The International Law Commission's *Draft Articles on Transboundary Aquifers 2008* defines aquifer in article 2(a) as 'a permeable water-bearing geological formation underlain by a less permeable layer and the water contained in the

[48] Kuniaki Sato and Yoshiaki Iwasa, *Groundwater Hydraulics* (Springer, 2003) 1.
[49] Ibid.
[50] Nora R Pincus, 'Groundwater and International Law: The Need for Specific Regulation' (2008) 11(2) *University of Denver Water Law Review* 313, 316.
[51] Kirstin I Conti and Joyeeta Gupta, 'Global Governance Principles for the Sustainable Development of Groundwater Resources' (2016) 16(6) *International Environmental Agreements: Politics, Law and Economics* 849, 851; Charles R Fitts, *Groundwater Science* (Academic Press, 2002).
[52] International Groundwater Resources Assessment Centre (IGRAC), *What is Groundwater?* <https://www.un-igrac.org/what-groundwater> ('IGRAC').
[53] Sato and Iwasa (n 48).
[54] Pincus (n 50).
[55] Ibid.
[56] IGRAC (n 52).
[57] See generally Robert G Maliva, *Anthropogenic Aquifer Recharge: WSP Methods in Water Resources Evaluation Series No 5* (Springer, 2020).
[58] Pincus (n 50); IGRAC (n 52).

saturated zone of the formation'. Aquifers can be composed of different materials that include unconsolidated sands and gravels, permeable sedimentary rocks such as sandstones or limestones, fractured volcanic and crystalline rocks.[59] Aquifers differ significantly in terms of size and capacity. Additionally, they may be either confined or unconfined. In an unconfined aquifer, a water table occurs within the aquifer layer and the groundwater comes in direct contact with the atmosphere through soil pores.[60] In contrast, a confined aquifer is over and underlain by a semi-permeable or impermeable layer[61] that prevents the aquifer from interacting directly with the atmosphere and with surface water bodies.[62]

An aquifer is defined in section 2(18) of the *Bangladesh Water Act 2013* as 'a layer lying in-between the saturated soil or rock layer beneath the ground surface which can store and transmit water and from where water can be pumped'. In the same way, the *Groundwater Irrigation Management Act 2018* defines an aquifer in section 2(7) as 'a subsurface rock or any level of underground soil that can store and transmit sufficient quantity of water and from where water can be lifted'. These two definitions contain key features of an aquifer. Since the definitions of an aquifer outlined above do not see any significant variations from each other, hence, for the purpose of this thesis a condensed definition is adopted. Accordingly, in this thesis aquifer refers to a permeable layer of underground rock that is saturated with, and capable of yielding exploitable quantities of water.

C *(Groundwater) Sustainability*

The issue of sustainability[63] or perhaps, efforts to achieve sustainability is central to groundwater governance and management.[64] In the groundwater literature, the term 'safe yield' has been used for nearly a century. Lee, for example, first defined this term as the quantity of water that can be withdrawn 'regularly and permanently without dangerous depletion of the storage reserve'.[65] This notion of safe yield has, since then, been gradually tested, explored, and refined to cope with the emerging issues around groundwater resources.[66] Todd, for instance, concisely defined the safe yield as 'the amount of water

[59] IGRAC (n 52).
[60] Conti and Gupta (n 51) 852; Jean F Margat and Jac van der Gun, *Groundwater around the World: A Geographic Synopsis* (CRC Press, 2013) 1-30.
[61] Conti and Gupta (n 51) 852.
[62] Pincus (n 50).
[63] For better understanding of the word 'sustainable' see generally Gro Harlem Brundtland, *Report of the World Commission on Environment and Development: Our Common Future,* 42nd sess, UN Doc A/42/25 (16 June 1987); Iris Borowy, *Defining Sustainable Development for Our Common Future: A History of the World Commission on Environment and Development (Brundtland Commission)* (Routledge, 2013); Susan Baker, *Sustainable Development* (Routledge, 2016).
[64] Larry W Mays, 'Groundwater Resources Sustainability: Past, Present, and Future' (2013) 27(13) *Water Resources Management* 4409, 4412.
[65] Charles H Lee, 'The Determination of Safe Yield of Underground Reservoirs of the Closed-Basin Type' (Paper No 1315, American Society of Civil Engineers, 1915) 213.
[66] See, eg, William M Alley and Stanley A Leake, 'The Journey from Safe Yield to Sustainability' (2004) 42(1) *Ground Water* 12.

which can be withdrawn from it annually without producing an undesired result.'[67] In determining safe yield Todd considered issues around water supply, economics, water quality, and water rights.[68] The concept of safe yield has, however, been criticised on various grounds including its ignorance of discharges to streams, springs, and seeps;[69] its vagueness and dependence on the particular location of wells.[70] Hence, in the past few decades, the term sustainability began to emerge in the water literature with the notion of environmental sustainability.

The simple definition of 'sustainable development' as proposed by the World Commission on Environment and Development (1987), briefly and popularly known as the 'Brundtland Commission', is 'development that meets the needs of the present without compromising the ability of future generation to meet their own needs'.[71] This concept of sustainability has been progressively integrated into groundwater management and governance regimes. For example, the concept of sustainability is often invoked to understand the economic value of groundwater with a view to imposing appropriate water price that ultimately leads to devise effective groundwater management. Additionally, this concept is used to develop a modelling framework for the groundwater sustainability of aquifers that defines the relations between water uses and their long-term consequences.[72] More specifically, since humanity is substantially dependent on groundwater resources for their well-being, there is a strong case for intra-generational and inter-generational equity that enjoins groundwater depletion that would disregard the needs of future generations.

Groundwater sustainability like the safe yield concept is considered as 'development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.[73] To Llamas et al groundwater sustainability bears manifold concepts consisting of nine dimensions namely hydrological, ecological, economic, social, legal, institutional, political, inter and intra-generational.[74] In the groundwater discourse sustainable development is more concerned with artificial recharge, conjunctive use of surface and groundwater, use of recycled water,

[67] DK Todd, *Groundwater Hydrology* (John Wiley and Sons, 1959) 336; for historical background of sustainability also see Paul Seward, Yongxin Xu and Luc Brendonck, 'Sustainable Groundwater Use, the Capture Principle, and Adaptive Management' (2007) 32(4) *Water SA* 473.
[68] Todd (n 67); Seward, Xu and Brendonck (n 67).
[69] Marios Sophocleous, 'Managing Water Resource Systems: Why 'Safe Yield' is not sustainable' (1997) 35 (4) *Ground Water* 561, 561.
[70] Alley and Leake (n 66) 12, 14.
[71] Brundtland (n 63) Part I(2)(I).
[72] Mays (n 64) 4416-19.
[73] William M Alley, Thomas E Reilly and O Lehn Franke, *Sustainability of Ground-Water Resources* (US Geological Survey Circular 1186, 1999) 2.
[74] MR Llamas, P Martinez-Santos and A de la Hera, 'The Manifold Dimensions of Groundwater Sustainability: An Overview' in Stephen Ragone, A de la Hera and Nuria Hernandez-Mora (eds), *Proceedings of the International Symposium on Groundwater Sustainability* (National Ground Water Association Press, 2006) 105–116.

all of which can significantly contribute to the development that can be sustained.[75] More recently, (groundwater) sustainability is defined to avoid six specific undesirable results — lowering of groundwater levels; reduction in groundwater storage; seawater intrusion; water quality degradation; land subsidence; and impacts on beneficial uses of interconnected surface waters,[76] and all these seriously impact the environment. Achieving broader environmental protection is, therefore, impossible without ensuring groundwater sustainability.

Sustainability is, however, an evolving issue that is continuously confronted with the changing technology, knowledge of ecology, uncertain demands of the future generations, and the social and political infrastructure of the society.[77] It is then, perhaps, not possible to outline, in a universally applicable way, what is sustainable and what is not in terms of groundwater extraction, but it is certainly possible to develop some pre-emptive measures with diverse options to address the issue. In other words, countries could undertake a number of different initiatives to tackle issues around sustainability.

In the context of developing countries like Bangladesh, the sustainability concept is, however, even more uncertain due to limited information on the country's aquifer systems.[78] Moreover, the key legislation of Bangladesh that concerns groundwater (*Bangladesh Water Act 2013* and *Groundwater Irrigation Management Act 2018*) has failed to define 'sustainability' in the context of (ground)water. Instead, it has used the term 'safe yield',[79] but again, this legislation has not provided any detailed definition of this term. In the absence of such a legislative definition, for the purpose of this thesis, a targeted outcome-based and groundwater focused definition of 'sustainability' that is more carefully aligned to measure broader sustainable development, is adopted.Accordingly, the term will be used to indicate that groundwater abstraction, as well as natural discharge to rivers, springs and supporting forests, does not exceed the recharge so as to arrest significant declines in groundwater levels. Two points stand out from this definition: first, groundwater would be measured to ensure that extraction does not outstrip recharge; and second, groundwater-dependent ecosystem is not impacted by groundwater withdrawal. However, the emphasis here is on a broad volumetric measure of sustainability, which would be expected to have some benefits for groundwater-dependent ecosystems. Since the struggle to achieve groundwater sustainability is a starting point for Bangladesh, this thesis is using the most basic and foundational elements of sustainability that may be inappropriate for other developing countries.

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[75] Alley and Leake (n 66) 13.
[76] Michael Kiparsky, 'Unanswered Questions for Implementation of the Sustainable Groundwater Management Act' (2016) 70(4) *California Agriculture* 165, 165.
[77] Daniel P Loucks, 'Sustainable Water Resources Management' (2000) 25(1) *Water International* 3, 8; Daniel P Loucks and John S Gladwell (eds), *Sustainability Criteria for Water Resource Systems* (Cambridge University Press, 1999) 9.
[78] CSIRO Report (n 34) 62.
[79] *Bangladesh Water Act 2013* (Bangladesh) s 19.

Other issues around sustainability stemming from the literature outlined above that include water quality degradation, land subsidence, salinity intrusion are consciously avoided given that these diverse issues cannot be covered in this single thesis. Therefore, the most foundational one around groundwater sustainability that concerns the declining groundwater table is chosen for this thesis. Indeed, by focusing on the risks of declining groundwater levels, the thesis also indirectly addresses threats to the realisation of the human right to water.

D *Groundwater Governance/Regulation*

The concept of groundwater governance first emerged in the late 2000s. In 2009, Foster et al defined groundwater governance as 'the exercise of appropriate authority and promotion of responsible collective action to ensure sustainable and efficient utilisation of groundwater resources for the benefit of humankind and dependent ecosystems'.[80] In 2013, the fifth thematic paper on groundwater policy and governance for the Global Environment Facilities' Groundwater Governance project defined groundwater governance as 'the process by which groundwater is managed through the application of responsibility, participation, information availability, transparency, custom, and rule of law. It is the art of coordinating administrative actions and decision making between and among different jurisdictional levels – one of which may be global'.[81] However, the authors of the digest of the fifth thematic paper elaborated the definition of FAO by providing 'In practice, groundwater governance is the complex and overarching framework that determines the management of groundwater resources and the use of the aquifers. The local, regional or national governance framework establishes 'who' participates in formulating strategies and is responsible for their execution and 'how' the different actors (governmental, public sector, non-governmental, private sector, and civil society) interact.'[82] Indeed, this is a comprehensive definition of groundwater governance that covers elements from definitions of 'governance' (governance as a process and a framework), 'good governance' (responsibility, participation, etc), 'environmental governance' (governance as multi-level), and 'water governance' (the relationships and rules in practice).[83]

In 2015, Megdal et al refined the definition of groundwater governance to be 'the overarching framework of groundwater use laws, regulations, and customs, as well as the processes of

[80] Stephen Foster et al, *Groundwater Governance* (Strategic Overview Series No 1, 2009) 3.
[81] Robert G Varady et al, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper No 5: Groundwater Policy and Governance* (Rome, April 2013) 7.
[82] Karen G Villholth and Kirstin I Conti, 'Groundwater Governance: Rationale, Definition, Current State and Heuristic Framework' in Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 9-11.
[83] For a nuanced discussion on water and groundwater governance see, eg, ibid 3-27.

engaging the public sector, the private sector, and civil society' that 'shapes how groundwater resources are managed and how aquifers are used.'[84]

More recently Villholth and Conti proposed a definition of groundwater governance by providing 'Groundwater governance is the framework encompassing the processes, interactions, and institutions, in which actors (ie government, private sector, civil society, academia, etc) participate and decide on management of groundwater within and across multiple geographic — sub-national, national, transboundary, and global — and institutional/sectoral levels, as applicable'.[85]

In essence, many regulatory processes and their interaction[86] are embedded in groundwater governance.[87] In simple words, regulation is concerned with formal legal mechanisms, enforcement processes, and associated rules to ensure that stakeholders perform their obligations, and that standards, obligations, and mandates are maintained. The capacity to enforce arranged standards such as setting water abstraction limits, and impose sanctions for non-compliance are also covered by the regulation.[88]

In this thesis groundwater governance and groundwater regulation are used interchangeably. Throughout the thesis, groundwater governance/regulation refers to the combined operation of groundwater laws and institutions. The phenomena of groundwater governance/regulation enumerated above such as participation, the role of civil society and academia, coordination, and information provision are addressed in overview in this thesis across chapters 3, 4, 5, and 6. Other elements of groundwater governance such as engagement of the private sector and the general community in the groundwater governance system are broader issues warranting lengthier works that fall outside the scope of this thesis.

E *Groundwater Management*

Groundwater management is concerned with keeping the state of the resource within desirable bounds by undertaking activities of analysing and monitoring, developing, and implementing certain measures.[89] Grigg defines water resource management as 'the application of structural and non-structural measures to control natural and man-made water

[84] Sharon B Megdal et al, 'Groundwater Governance in the United States: Common Priorities and Challenges' (2015) 53(5) *Groundwater* 677, 678.
[85] Villholth and Conti (n 82) 14.
[86] For broader understanding of regulation see, eg, Robert Baldwin, Martin Cave and Martin Lodge, *Understanding Regulation: Theory, Strategy, and Practice* (Oxford University Press, 2nd ed, 2012); Bronwen Morgan and Karen Yeung (eds), *An Introduction to Law and Regulation: Text and Materials* (Cambridge University Press, 2007)16-76; Peter Drahos (ed), *Regulatory Theory: Foundations and Applications* (ANU Press, 2017).
[87] Claudia Pahl-Wostl, 'A Conceptual Framework for Analysing Adaptive Capacity and Multi-Level Learning Processes in Resource Governance Regimes' (2009) 19(3) *Global Environmental Change* 354, 355.
[88] Alejandro Jiménez et al, 'Unpacking Water Governance: A Framework for Practitioners' (2020) 12(3) *Water* 827, 833, 836.
[89] Pahl-Wostl (n 87).

resources systems for beneficial human and environmental purposes'.[90] More generally, it involves the study, planning, monitoring, and application of various control and development techniques for long-term, multiple uses of the diverse forms of water resources.[91]

Thus, groundwater management differs from groundwater governance. Lautze et al differentiate between water management and water governance as 'whereas water governance is the set of processes and institutions through which management goals are identified, water management is charged with implementing the practical measures to achieve those goals'.[92] Put differently, groundwater governance determines actors and their interactions; drives decision-making with information, knowledge, and science; and makes policies and plans that define when and why activities are needed. Groundwater management, on the other hand, relates to activities that are undertaken by the actors within the governance framework concerning the development and protection of groundwater.[93] In this thesis, groundwater management refers to the measures and strategies that are to be applied to facilitate sustainable groundwater extraction which instead of emerging from legislative instruments emanate from non-binding policy documents. This definition embraces the characteristics of groundwater management discussed above in that policy measures ultimately advance groundwater governance.

The foregoing definitional discussions, especially discussions around groundwater sustainability bring forth whether groundwater sustainability comes within the purview of broader environmental protection, and as such, whether groundwater sustainability is an environmental outcome. This issue deserves consideration to understand what connection, if any, exists between groundwater and the environment. Accordingly, the next Part moves to explore the connection between environmental protection and groundwater sustainability.

IV UNDERSTANDING THE NEXUS BETWEEN ENVIRONMENTAL PROTECTION AND GROUNDWATER SUSTAINABILITY

Environmental laws and policies are driven by objectives that they aim to achieve.[94] International environmental law has evolved around issues concerning acid rain, ozone depletion, climate change, loss of biodiversity, toxic and hazardous products and wastes,

[90] Neil S Grigg, *Water Resources Management: Principles, Regulations, and Cases* (McGraw-Hill, 1996); Jonathan Lautze et al, 'Putting the Cart before the Horse: Water Governance and IWRM' (2011) 35(1) *Natural Resources Forum* 1, 4.
[91] World Health Organisation (WHO), *Water Management; Official WHO Definition* (WHO, 2009).
[92] Lautze et al (n 90).
[93] Food and Agriculture Organisation (FAO), *Global Diagnostic on Groundwater Governance* (FAO, 2016) 38.
[94] Jonas Ebbesson, 'Introduction: Dimensions of Justice in Environmental Law' in Jonas Ebbesson and Phoebe Okowa (eds), *Environmental Law and Justice in Context* (Cambridge University Press, 2009) 1.

pollution of rivers and depletion of freshwater resources.[95] Among these environmental concerns, in recent years groundwater depletion — a grave issue pertaining to freshwater resources — poses a daunting challenge both nationally and internationally. As noted in chapter 1, globally groundwater extraction has increased by over 300% that necessitates global and domestic action. Crucially, sustainable development — an important environmental goal — requires conserving and enhancing the resource base.[96] In other words, one of the indicators of sustainable development is groundwater sustainability. This groundwater sustainability, however, is fundamentally threatened by diverse human actions.

Indeed, unsustainable groundwater withdrawal — both globally and domestically — continues to undermine the broader environmental sustainability.[97] No man can claim the absolute right to indulge in activities that result in environmental degradation in the land owned by him.[98] The value of groundwater to the non-human environment as briefly mentioned in the definition of sustainability (protecting natural discharge), is as enormous as to that of humans. Dealing with groundwater depletion will not be a complete way to achieve groundwater sustainability in the environmental protection sense, but it will be a necessary component. That is, building a legal and institutional system that better responds to threats of groundwater depletion will form a valuable and necessary foundation for broader future legal action that further promotes the non-human aspects of environmentally protecting groundwater.

There is an increasing recognition that environmental law principles such as sustainable development, precautionary principle, polluter pays principle, environmental impact assessment and intra-generational and inter-generational equity, public trust doctrine and common heritage require groundwater sustainability for broader environmental outcomes.[99] These principles mandate that the government takes effective measures to prevent over-extraction of groundwater resources or any action by the landowners that may adversely affect the quality and quantity of groundwater.[100]

In fact, the precautionary principle lies at the heart of effective groundwater regulation.[101] There can hardly be any dispute that overexploitation of groundwater by a private person or company is most likely to trigger depletion as well as pollution of groundwater in other

[95] Philippe Sands et al, *Principles of International Environmental Law* (Cambridge University Press, 3rd ed, 2012) 3.
[96] Ibid 9.
[97] Sujith Koonan, 'Groundwater Legal Regime in India: Towards Ensuring Equity and Human Rights' (SOAS Law Working Papers No 1, 2013) 11.
[98] *Thilakan v Circle Inspector of Police* (2008) 48 AIR Ker [11].
[99] Phillippe Cullet, 'Groundwater Law in India: Towards a Framework Ensuring Equitable Access and Aquifer Protection' (2014) 26 Journal of Environmental Law 55, 72; Philippe Cullet, 'Model Groundwater (Sustainable Management) Bill, 2017: A New Paradigm for Groundwater Regulation' (2018) 2(3) *Indian Law Review* 263, 271-2; Philippe Cullet, Lovleen Bhullar and Sujith Koonan, 'Regulating the Interactions between Climate Change and Groundwater: Lessons from India' (2017) 42(6) *Water International* 646, 652, 656.
[100] Koonan (n 97) 12.
[101] Cullet (n 99) 72.

areas[102] triggering an environmental crisis. This precautionary principle, therefore, obliges the government to undertake effective measures to control groundwater over-extracting within its territory. Moreover, climate change — a constant looming threat to the planet's environment — makes it imperative that groundwater protection and conservation should be viewed through the lens of environmental concerns.[103]

Additionally, the public trust doctrine — further expanded in chapter 5(III)(VI) — is increasingly recognised as an effective tool to prevent overexploitation of environmentally critical resources. This doctrine is grounded on the idea that some natural resources are so important and so essential to human life that private interests cannot take control over them, and the state must guard them against any private capture.[104] Groundwater is such an important resource that has turned out almost a sole source of drinking water and a major source of freshwater including irrigation in Bangladesh and internationally.[105] The public importance of groundwater has, therefore, been well manifested that speaks volumes about its protection for the present and future generations. Further, the idea of common heritage emanating from environmental jurisprudence stresses the need for ensuring equitable and sustainable groundwater extraction. By disregarding the idea of individual control and appropriation, the common heritage concept necessitates the use and conservation of natural resources for the benefit of all.[106] In the context of groundwater, the strong equity goal of this common heritage notion requires state control over the groundwater extraction by landowners such that the landless and the poor get access to this important natural resource.

In summary, broader environmental protection requires effective groundwater protection that is underpinned by groundwater sustainability. Achieving groundwater sustainability, therefore, is an environmental outcome. A recent study estimates that only a few meters decline in groundwater levels will render 6 to 20% of wells inoperative across the globe.[107] Hence, declining groundwater levels are so serious and so urgent that merit immediate attention which this thesis has chosen to address.

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[102] Koonan (n 97) 12.
[103] Philippe Cullet and Raya Marina Stephan, 'Introduction to "Groundwater and Climate Change: Multi-Level Law and Policy Perspectives"' (2017) 42(6) *Water International* 641, 642.
[104] Joseph L Sax, 'The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention' (1970) 68(3) *Michigan Law Review* 471, 475, 484-5; David Takacs, 'The Public Trust Doctrine, Environmental Human Rights, and the Future of Private Property Student Essay Competition Winner' (2008) 16(3) *New York University Environmental Law Journal* 711, 718.
[105] UN Water, *Groundwater Overview: Making the Invisible Visible* (IGRAC, 2018) 1; S Siebert et al, 'Groundwater Use for Irrigation – a Global Inventory' (2010) 14(10) *Hydrology and Earth System Sciences* 1863, 1863.
[106] Philippe Cullet, *Water Law, Poverty, and Development: Water Sector Reforms in India* (Oxford University Press, 2009) 188.
[107] Scott Jasechko and Debra Perrone, 'Global Groundwater Wells at Risk of Running Dry' (2021) 372(6540) *Science* 418, 418.

V LEGAL AND INSTITUTIONAL FRAMEWORKS FOR GROUNDWATER SUSTAINABILITY: UNPACKING THEIR ROLES AND SIGNIFICANCE

A *Role of Legal Framework*

While technological and infrastructure 'fixes' have been employed for quite some time to tackle the groundwater challenges,[108] over the past decades the necessity of developing legal frameworks has increasingly been felt at the global and domestic level.[109] As examined below, a well-tailored and well-crafted legal framework could play a significant role in protecting this scarce resource. Accordingly, the following section sheds light on the role of a legal framework in protecting groundwater resources.

1 *Issues to be Addressed by an Ideal Legal Framework*

Quantification, planning, allocation, water abstraction, use rights, and more broadly conservation of groundwater resources are all matters dealt with by groundwater legislation.[110] A legal framework is also typically designed to provide cooperative interaction between water administrators and water users.[111] More narrowly, groundwater legislation is concerned with addressing or remediating groundwater overexploitation and pollution.[112] Essentially, policy development is grounded on a legal framework that turns policy decisions into specific rights and obligations.[113] Indeed, proper regulation, control and development, and efficient management of this resource are almost impossible in this age of Anthropocene without legislation.[114] The contemporary literature has set some criteria against which to test this legislation, such as whether the mechanisms developed under the law are accountable, transparent, and participatory; whether the issue around sustainability is addressed and given priority; and whether water resources are dealt with in an integrated manner.[115]

Single water legislation may encompass both surface and groundwater; sometimes two or more pieces of legislation are dedicated to dealing with them. However, recently, one water

[108] WA Jury and H Vaux, 'The Role of Science in Solving the World's Emerging Water Problems' (2005) 102(44) *Proceedings of the National Academy of Sciences* 15715, 15715-20; Varady et al (n 81) 9.
[109] Cameron Holley and Darren Sinclair, 'Replenishing Australia's Water Future: From Stagnation to Innovation' in Cameron Holley and Darren Sinclair (eds), *Reforming Water Law and Governance: From Stagnation to Innovation in Australia* (Springer, 2018) 2-3.
[110] Pradip K Sikdar, 'Problems and Challenges for Groundwater Management in South Asia' in Pradip K Sikdar (ed), *Groundwater Development and Management: Issues and Challenges in South Asia* (Springer, 2018) 14; Nelson and Quevauviller (n 47) 177-8; Varady et al (n 81) 6; HP Patra, Shyamal Kumar Adhikari and Subrata Kunar, *Groundwater Prospecting and Management* (Springer, 2016) 198-99.
[111] Sikdar (n 110); Nelson and Quevauviller (n 47) 177-8.
[112] Patra, Adhikari and Kunar (n 110) 198.
[113] Mechlam (n 2) 5; Nelson and Quevauviller (n 47) 182-3.
[114] Patra, Adhikari and Kunar (n 110) 198.
[115] Mechlam (n 2) 6; Asit K Biswas, 'Water Policies in the Developing World' (2001) 17(4) *International Journal of Water Resources Development* 489, 493-4.

statute complemented by subsidiary legislation is tailored to govern both surface water and groundwater resources.[116] Legislation with regard to land-use planning, agriculture and irrigation, environment and mining, health and sanitary issues, to some extent contains provisions relating to groundwater management.[117] Ideal water legislation clearly defines and delineates the duties, powers, functions, and degree of centralisation, decentralisation, and deconcentration of water institutions including the water users' associations.[118]

Ideally, groundwater legislation imposes obligations upon the licence holders to produce data that informs the volume of water pumped which eventually facilitates water managers in identifying water stressed areas, and accordingly, they can adopt suitable management strategies for tackling groundwater crisis.[119] More broadly, to achieve groundwater sustainability groundwater laws need to clearly state the overall responsibilities of (groundwater) users such that they can undertake specific actions to further sustainability.[120] Additionally, modern groundwater legislation attaches special importance to environmental law principles that include the precautionary principle, the polluter pays principle, and the environmental impact assessment, and accordingly, these principles are subsumed in such a legislative instrument.[121] Ideal groundwater laws lay out clear mechanisms how disputes arising between water users are to be resolved effectively,[122] which indeed, bolsters groundwater governance.[123]

To be effective, however, groundwater legislation requires public participation in its enactment process. Indeed, public participation underpins the efficiency of law in terms of its contents, implementation, and achieving policy goals.[124] Public hearings make a significant contribution to narrowing the drafting instruction which makes the formulation stage more efficient.[125] In essence, public participation helps shape better legislation[126] taking into account the on-the-ground reality of the social need[127] and the implementation strategy of the legislation. Local stakeholders can provide more inputs in adopting appropriate

[116] Mechlam (n 2) 7; Cullet (n 99) 68-70.
[117] Mechlam (n 2) 7; Biswas (n 115) 490.
[118] Dante Augusto Caponera and Marcella Nanni, *Principles of Water Law and Administration* (Taylor and Francis, 2007) 177, 180; here deconcentration entails the delegation of powers by one institution to its branch offices spread across the country with a view to facilitating water resources management.
[119] Mechlam (n 2) 13.
[120] Cullet (n 99) 274.
[121] Cullet (n 99) 72; Cullet (n 99) 271-2; Cullet, Bhullar and Koonan (n 99).
[122] Cullet (n 99) 274-5.
[123] Insa Theesfeld, 'Institutional Challenges for National Groundwater Governance: Policies and Issues' (2010) 48(1) *Ground Water* 131, 138.
[124] Ekawestri Prajwalita Widiati, 'Efficient Public Participation in the Local Law-Making Process' (2018) 33(3) *Yuridika* 389, 393, 397-400.
[125] GC Thornton, *Legislative Drafting* (Butterworths, 4th ed, 1996) 129.
[126] Karen Syma Czapanskiy and Rashida Manjoo, 'The Right of Public Participation in the Law-Making Process and the Role of Legislature in the Promotion of This Right' (2008) 19 *Duke Journal of Comparative and International Law* 1, 4; Suzanne Hanchett, 'Participation and Policy Development: The Case of the Bangladesh Flood Action Plan' (1997) 15(3) *Development Policy Review* 277, 277.
[127] Hanchett (n 126).

legislation based on their local knowledge in relation to constraints, utilisation and potential of water resources.[128] It makes people more willing to accept decisions that promote the common interests of the society even when individual interest is disserved.[129]

Additionally, stakeholders' combined knowledge, experiences, perspectives, values, and capacities facilitate smooth understanding and addressing shared challenges and potential options which in other words leads to social learning.[130] Legislation fulfils the democratic values if it results from a fair and open participatory process where citizens, instead of merely complying with the law, may continue to cooperate in deliberation.[131] Even when literacy levels are low, stakeholder participation cannot be ignored, rather their participation needs to be tailored to deal with specific situations.[132] True, mere social norms alone cannot protect groundwater resources, and equally true legislation enacted ignoring existing social norms does not work in practice. In fact, social norms embedded in groundwater legislation work better in managing and protecting groundwater resources. Hence, social norms and groundwater legislation need to supplement each other.[133] Here lies the importance of stakeholder participation.

Whatever form a groundwater legal instrument may take, the literature suggests that it must meet some fundamental requirements by answering these key questions: Who, when, and under which conditions can access groundwater? What mechanism is to be used to safeguard an aquifer against depletion and pollution? Which criteria are to be followed for the allocation and protection of finite non-recharging aquifers? Which kind of monitoring and planning tools are to be applied? How are stakeholders to be involved in decision-making and management processes?[134]

2 *Global Practice of Regulatory Mechanism*

The vast majority of the countries of the world have placed groundwater under the stewardship of the State removing it from the exclusive ownership and control of landowners,[135] and thereby the long-drawn highly conflictive, and potentially destructive

[128] *Guidelines for Participatory Water Management 2000* (Bangladesh) 11.
[129] Czapanskiy and Manjoo (n 126) 15-16.
[130] Margaret A Shannon, 'Participation as Social Inquiry and Social Learning (Reviewed Paper)' (2006) 157(10) *Schweizerische Zeitschrift fur Forstwesen* 430, 432.
[131] James Bohman, *Public Deliberation: Pluralism, Complexity, and Democracy* (MIT Press, 1996) 187; Czapanskiy and Manjoo (n 126) 19.
[132] Joyeeta Gupta and Joseph W Dellapenna, 'The Challenges for the Twenty-First Century: A Critical Approach' in Joseph W Dellapenna and Joyeeta Gupta (eds), *The Evolution of the Law and Politics of Water* (Springer, 2009) 404.
[133] Ayan Biswas, 'Catalyzing Peoples' Participation for Groundwater Management' in Pradip K Sikdar (ed), *Groundwater Development and Management: Issues and Challenges in South Asia* (Springer, 2018) 509.
[134] Mechlam (n 2) 5; Stefano Burchi, 'Legal Principles and Legal Frameworks Related to Groundwater' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 119-20.
[135] Mechlam (n 2) 8; S Burchi and M Nanni, 'How Groundwater Ownership and Rights Influence Groundwater Intensive Use Management' in M Ramon Llamas and E Custodio (eds), *Intensive Use of Groundwater: Challenges and Opportunities* (Balkema, 2003) 227-239.

situation in relation to groundwater ownership has significantly been resolved.[136] Contemporary water legislation embraces this shift from private ownership to State stewardship, though in a handful of countries, notably, India, Pakistan, and the State of Texas (USA) groundwater is still treated by law to be the property of the over-lying landowner.[137] The registering and/or licensing of groundwater abstraction is considered as a 'best practice' to establish control over groundwater use.[138] There is a widespread practice of such an administrative permit system across the globe in a bid to limit water extraction triggered by advanced technology, rapid population growth, and economic development.[139] Annual or seasonal volumetric allocations are typically granted by permits. Permits also, among other things, stipulate conditions for the usage of water, spell out the measures to be adopted for the protection of water, and set obligations to pay fees or charges.[140]

Pumping wells are generally metered to ensure, and monitor compliance with volumetric limits attached to a permit — the most important element of the licence.[141] More broadly, water metering is used, among other functions, for monitoring water extraction through the application of a purpose-fitted flow measuring device that has been rated and fitted according to standards specified by the manufacturer.[142] Globally, this metering system is applied to bring about water use efficiency.[143] Indeed, a legislative requirement of water metering offers significant assistance in determining the rights and obligations of water users,[144] thereby allowing the water managers to regulate groundwater extraction more effectively and efficiently. A host of countries have adopted water metering systems to achieve sustainability in groundwater irrigation, while a relatively small number of countries have resorted to this mechanism to control the industrial groundwater over-extraction. Australia,[145] Oman,[146] and China[147] are some countries to name that apply water metering systems in their own jurisdictions to try to overcome ever-increasing groundwater scarcity challenges.

Additionally, in some parts of the world, notably Australia, metering systems are in place to bring about domestic water use efficiency. In the Australian Capital Territory, for instance,

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[136] Burchi (n 134) 120; Mechlam (n 2) 8.
[137] Burchi (n 134) 120.
[138] François Molle and Alvar Closas, 'Groundwater Licensing and Its Challenges' (2020) 28 *Hydrogeology Journal* 1961, 1961.
[139] Mechlam (n 2) 8-9; Patra, Adhikari and Kunar (n 110) 199-200.
[140] Mechlam (n 2) 9.
[141] Ibid.
[142] Sinclair Knight Merz, *Assessment of Groundwater Licensing, Metering and Extraction Estimation Arrangements and Techniques in Australia* (Waterlines Report, National Water Commission, 2012) 36.
[143] Xiaowei Wang et al, 'Implementing the Prepaid Smart Meter System for Irrigated Groundwater Production in Northern China: Status and Problems' (2017) 9(6) *Water* 379, 393.
[144] Kerstin Mechlem, 'Groundwater Governance: The Role of Legal Frameworks at the Local and National Level—Established Practice and Emerging Trends' (2016) 8(8) *Water* 347, 350-1.
[145] Merz (n 142) viii.
[146] Slim Zekri et al, 'Feasibility of Adopting Smart Water Meters in Aquifer Management: An Integrated Hydro-Economic Analysis' (2017) 181 *Agricultural Water Management* 85, 86.
[147] Wang et al (n 143).

under the *Water Resources Act 2007* (ACT) a licence is required for pumping groundwater for commercial as well as stock and domestic purposes. Furthermore, as per the terms of a licence, licence holders are obliged to record the meter's reading on monthly basis, and the licensing agency can collect this information from licence holders.[148] Namibia, an African country, introduced a block tariff structure to control water consumption in its capital Windhoek. This system was premised on the notion of increasing water prices with the volume consumed. By influencing the consumers' water use habits, this system dramatically reduced water consumption resulting in over 30% of water savings.[149] In Spain where water scarcity engulfs most of its territory[150] pricing mechanisms are frequently used to achieve water use efficiency.[151]

Another regulatory mechanism applied in some jurisdictions notably Australia, United States, Chile, Spain, and South Africa to achieve groundwater sustainability is a cap-and-trade model.[152] This economic instrument places an aggregate cap on resource extraction; allocates shares among users; and finally makes these shares tradable.[153] Users who use water below their set allowance can sell their surplus resources to those who need more water than their permitted volume. Thus, cap-and-trade consists of three distinct but inseparable processes — capping, allocation, and trading. Indeed, achieving sustainability and economic efficiency are among the policy goals of the cap-and-trade instrument. More specifically, a cap is concerned with sustainability, and trade is concerned with economic efficiency.[154] By encouraging the stakeholders and regulators to limit aggregate resource use to a level of sustainability, a cap drives them to preserve the resource for future use[155] which is concerned with aquifer level protection. That said, for a nuanced understanding, it is necessary to flesh out briefly the relationship between concepts of licensing, metering, and capping.

[148] Merz (n 142) 24.
[149] Earl W Lewis, Chad Staddon and Johannes Sirunda, 'Urban Water Management Challenges and Achievements in Windhoek, Namibia' (2019) 14(3) *Water Practice and Technology* 703, 710.
[150] Miguel A García-Rubio, Alberto Ruiz-Villaverde and Francisco González-Gómez, 'Urban Water Tariffs in Spain: What Needs to Be Done?' (2015) 7(4) *Water* 1456, 1457.
[151] Ibid 1461.
[152] Cameron Holley and Darren Sinclair, 'Governing Water Markets: Achievements, Limitations and the Need for Regulatory Reform' (2016) 33(4) *Environmental and Planning Law Journal* 301, 301-2; María E Milanés Murcia, 'International Comparative Analysis of Regulations for Water Markets and Water Banks' in Edson de Oliveira Vieira et al (eds), *Integrated Water Resource Management: Cases from Africa, Asia, Australia, Latin America and USA* (Springer, 2020) 45-57; Doreen Burdack, Anne Biewald and Hermann Lotze-Campen, 'Cap-and-Trade of Water Rights: A Sustainable Way Out of Australia's Rural Water Problems?' (2014) 23(4) *GAIA Ecological Perspectives for Science and Society* 318; Dustin Garrick, Stuart Whitten and Anthea Coggan, 'Understanding the Evolution and Performance of Water Markets and Allocation Policy: A Transaction Costs Analysis Framework' (2013) 88 *Ecological Economics* 195; Andrew Ross, 'Groundwater Governance in Australia, the European Union and the Western USA' in Anthony J Jakeman et al (eds), *Integrated Groundwater Management* (Springer, 2016) 156.
[153] B Timothy Heinmiller, 'The Politics of Cap and Trade Policies' (2007) 47(2) *Natural Resources Journal* 445, 445.
[154] Ibid 447.
[155] Ibid.

Licensing/permit/entitlement is a right to abstract water for uses specified therein.[156] In Australia, for instance, under the *National Water Initiative 2004*, water entitlements are clearly defined, legally severed from land wherever possible, specified in registers, monitored, and enforced.[157] More broadly, licensing prescribes the conditions on which wells can be dug or drilled, and the volume of water that can be extracted.[158] Hence, as seen above, in most cases terms of a water licence include the installation of a water meter, and licence holders are obliged to record the meter's reading on monthly basis. Globally, this metering system is resorted to try to ensure optimal water use.[159] On the other hand, capping places an aggregate cap on resource extraction — the maximum water withdrawal limit in a region per season/year. Connected with capping is the trade that is known in the literature as cap-and-trade.

In short, licensing is needed for water abstraction; water metering is used for monitoring compliance with withdrawal limits and also for collecting data on water extraction. In most jurisdictions, notably Australia, licensing and metering go hand in hand, and standard conditions of licensing include the installation of water metering. Capping is the allowable amount of water that can be extracted under a licence. Therefore, licensing, metering, and capping are interrelated, and the trio is needed for effective control of groundwater withdrawal. In Bangladesh a licence is required only for the installation of a well — with certain exceptions provided under the *Bangladesh Water Act* — that does not concern volumetric water withdrawal. Water metering and capping are foreign to the water legislation and policy of Bangladesh.[160]

Like many other countries, declining groundwater levels affect every groundwater use in Bangladesh, including drinking water which is a priority in terms of human needs. Indeed, the poor, marginal and vulnerable people in Bangladesh are more affected by the falling water tables since they are unable to install deeper tubewells to extract the water to meet their basic needs including irrigation for food. In contrast, large-scale farmers and industry owners can comfortably dig deeper to pump water to satisfy their water needs. Hence, sustainability, which is the focus of this thesis, supports and promotes the rights of various groundwater users, especially the poor and the vulnerable who are hard hit by depleting groundwater resources.

Additionally, the water policy priority of Bangladesh has been potable water and water for hygiene and sanitation followed by water for households and agriculture. Therefore, ensuring groundwater sustainability is vital to achieving these policy objectives. Hence, the restrictions in relation to groundwater extraction that this thesis proposes in chapter 6 will

[156] Nelson and Quevauviller (n 47) 182.
[157] Ross (152).
[158] Molle and Closas (n 138) 1971.
[159] Wang et al (n 143).
[160] See chapter 3(IVCDE)(VBC).

not inhibit access to water for the vulnerable; these restrictions will rather promote sustainability, and the sustainability condition will support and facilitate everyone's right to water.

In a bid to achieve groundwater sustainability the mechanisms which the thesis will be looking at in chapter 3, are licensing, metering, and capping that are essentially key elements of the best practice groundwater law. As such, these measures are widely applied for tackling groundwater depletion across the globe. In addition, in assessing the effectiveness of groundwater laws, the thesis will highlight issues around compliance and enforcement that include public participation in the lawmaking process. The feasibility of the recommendations has been informed by extensive interviews undertaken in Bangladesh, and are therefore sensitive to Bangladesh's unique circumstances. Further, the approach to recommendations is expressed as a staged approach, recognising Bangladesh's unique circumstances.

Nevertheless, Bangladesh has a number of similarities with other countries as there is an imposed government framework, it has considerable exposure to aid money which often requires the adoption of comparative regulatory practices as well as exposure to international law around sustainability.

That said, the mere adoption of groundwater laws and policies does not *ipso facto* protect the groundwater resources unless guarded by a competent water institution and associated regulation. Accordingly, the following section illustrates the role of water institutions generally in the protection of groundwater resources.

B *Significance of Water Institutions*

Groundwater abstraction has increased significantly over the last few decades,[161] in many places though only recently have the adverse effects of overexploitation been felt. As such, institutional responses to protect the groundwater resources have been slow.[162] A water institution is a public agency[163] that governs the water resources of a country under law and policy which outline the framework and define the capacity of such an agency that is charged with the implementation of the legal and policy provisions on-the-ground.[164] In other words, water governance is the core responsibility of a water institution that is typically underpinned by the organisational, financial, and managerial structures including the regulatory

[161] Varady et al (n 81) 11.
[162] Mechlam (n 2) 15.
[163] Sarah Hendry, 'Ownership Models for Water Services: Implications for Regulation' in Aileen McHarg et al (eds), *Property and the Law in Energy and Natural Resources* (Oxford University Press, 2010) 261-62; Alex Gardner et al, *Water Resources Law* (LexisNexis Butterworths, 2nd ed, 2018) 125-9.
[164] In that sense water laws and policies are considered as the software component of the water institution whereas water administrations are its hardware; see R Maria Saleth and Ariel Dinar, *The Institutional Economics of Water: A Cross-Country Analysis of Institutions and Performance* (Edward Elgar Publishing, 2004) 101, 102.

arrangements and dispute resolution mechanisms.[165] Transparency, public participation, and accountability are the three objectives of improving institutional governance.[166] To be effective a water institution should have clear objectives, meaningful relationships with other formal and informal institutions such as social norms, customs, and social networks, compliance capacity, adaptiveness, and appropriate spatial and administrative scales.[167]

1 *Attributes of an Ideal Water Institution*

Typical objectives and functions of an ideal water institution include the formulation of overall water resources policies, plans, and strategies; [168] the storage of all data relating to water quality and quantity; the determination of respective rights and obligations of users — individuals, public institutions, corporations or states — in relation to the use, conservation, and protection of the resources and the regulation of pollution activities.[169] Additionally, a water institution ideally should organise stakeholder fora.[170] A water institution also should conduct a rigorous study before approving a water project or plan in order to assess the possible effects of that project or plan on water resources.[171] An ideal water institution effectively administers the resources at the central and decentralised levels by involving informed and participating groundwater users in the management system.[172]

Another important function of an ideal water institution is monitoring. Groundwater monitoring refers to the practice of observing changes in relation to, among other things, groundwater levels, spring discharge, water quality, and abstraction volumes.[173] Groundwater monitoring furnishes information for a better understanding of the resource including processes affecting it such as the effects of human interaction and policies.[174] Additionally, it ensures the proper use of institutional resources through accountability.[175] More broadly, improved decision-making, enhanced resource allocation, and increased

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[165] R Maria Saleth 'Water Institutions in India: Structure, Performance, and Change' in Chennat Gopalakrishnan, Cecilia Tortajada and Asit K Biswas (eds), *Water Institutions: Policies, Performance and Prospects* (Springer, 2005) 61.
[166] Hendry (n 163) 267.
[167] Phillip Pagan, 'Laws, Customs and Rules: Identifying the Characteristics of Successful Water Institutions' in Lin Crase and Vasant P Gandhi (eds), *Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development* (Routledge, 2009) 20, 26-34.
[168] Marcella Nanni et al, 'Legal and Institutional Considerations' in Stephen Foster and Daniel P Loucks (eds), *Non-Renewable Groundwater Resources: A Guidebook on Socially-sustainable Management for Water-Policy Makers* (UNESCO, 2006) 52.
[169] Caponera and Nanni (n 118).
[170] Mechlam (n 2) 16.
[171] Caponera and Nanni (n 118).
[172] Nanni et al (n 168).
[173] Marguerite de Chaisemartin et al, 'Addressing the Groundwater Governance Challenge' in Eiman Karar (ed), *Freshwater Governance for the 21st Century* (Springer, 2017) 211; Sophie Vermooten and Neno Kukuric, 'Collecting Aggregated Groundwater Data to Identify Highly Stressed Aquifers Worldwide' (2009) 329 *IAHS Publication* 277, 277-8.
[174] Chaisemartin et al (n 173).
[175] Aziza Akhmouch and Delphine Clavreul, 'Assessing and Monitoring Groundwater Governance' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 249.

accountability all depend on functional monitoring apparatus.[176] Further, a lack of effective monitoring encourages users to extract groundwater indiscriminately.[177] Eventually, an absence of robust monitoring mechanisms can significantly limit the effectiveness of policymaking and groundwater management.[178]

Connected with monitoring is groundwater data. Two types of groundwater data are needed for effective groundwater governance: the first one concerns the 'static condition' of the groundwater systems (aquifers and aquitards); and the second type pertains to time-dependent features of groundwater resources that can be obtained through monitoring activities.[179] Information, in other words, data forms a critical element in the performance of any water institution, not least properly collected and interpreted data propels water managers to take right and timely decisions in managing this precious resource more effectively and efficiently.[180] In particular, data can alert managers to the need to address aquifer stress.[181] Additionally, the generation of information and its management guide the water managers in adopting appropriate enforcement mechanisms.[182] Crucially, data drives the groundwater users to limit their abstraction to a sustainable limit.[183] Given that groundwater is an invisible resource, data is even more indispensable for its effective management than surface water.[184] In other words, the identification of groundwater-related potentials and problems hinges heavily on the availability of data.[185]

Indeed, the successful implementation of groundwater laws, policies, and planning significantly depends on the robustness of water institutions,[186] and as such, for the enforcement of legal rules, a water authority applies various methods that include imposing fines for non-compliance with legal obligations.[187] More broadly, a water institution typically exercises political, executive, technical, and judicial powers.[188] A single water resources

[176] Ibid.
[177] In Chile, for example, due to the lack of enforcement and monitoring of water abstraction from groundwater source, water users often overexploit the resource; ibid 258.
[178] Chaisemartin et al (n 173) 212.
[179] Food and Agriculture Organisation (FAO), *Global Framework for Action to Achieve the Vision on Groundwater Governance* (FAO, March 2016) 40 ('Global Framework').
[180] William K Jaeger, 'Institutions and Water' in Ariel Dinar and Kurt Schwabe (eds), *Handbook of Water Economics* (Edward Elgar Publishing, 2015) 29.
[181] Karin Erika Kemper, 'Instruments and Institutions for Groundwater Management' in Mark Giordano and Karen G Villholth (eds), *The Agricultural Groundwater Revolution: Opportunities and Threats to Development* (CABI, 2007) 157-8.
[182] Ibid 163.
[183] Ibid 167.
[184] Jac AM Van Der Gun, 'Sharing Groundwater Information, Knowledge and Experience on a Worldwide Scale' in Mark Giordano and Karen G Villholth (eds), *The Agricultural Groundwater Revolution: Opportunities and Threats to Development* (CABI, 2007) 363
[185] Ibid.
[186] Caponera and Nanni (n 118) 171; Nanni et al (n 168); Chennat Gopalakrishnan, Cecilia Tortajada and Asit K Biswas (eds), *Water Institutions: Policies, Performance and Prospects* (Springer, 2005) v.
[187] Stephen Hodgson, *Modern Water Rights, Theory and Practice* (FAO, 2006) 43; Mechlam (n 2) 16.
[188] Caponera and Nanni (n 118) 171.

institution ideally should be invested with the entire range of water management issues (both surface and groundwater) to ensure effective and efficient groundwater governance.[189] In practice, however, this ideal single institution often does not exist and instead, there are some dedicated councils, commissions or committees created typically to coordinate among ministries and agencies involved in the water sector.[190] Yet, tenuous coordination among the ministries, departments, or other autonomous responsible authorities is generally observed that upends the integrated approach resulting in the unplanned and inconsistent water resources policy.[191] Hence, an ideal water institution pays utmost importance to establish robust and meaningful coordination among related water institutions.

Additionally, in most jurisdictions, water users' associations also exist to promote and facilitate, among other things, the more effective implementation of water legislation through the active participation of water users in the planning and management of water resources. Water legislation should encourage the formation and establishment of this type of association to secure better compliance, enforcement, and implementation of water laws, policies, and planning.[192]

Ideally, a water institution is run by good and accomplished leaders.[193] Such a leader must have both vision and the ability to deliver on that vision. This type of leadership requires the leader to have clear knowledge on groundwater, a vision on its prospects and problems, and possible means to address these.[194] Further, to translate the vision, leaders need to have the capability to put groundwater management onto the agenda, to understand and flag the main issues to be addressed, and to engage the actors in the overall groundwater management process.[195] Thus, strong leadership is a driving force not only for effective groundwater governance but also for achieving multiple goals of the new Sustainable Development Goals adopted by Heads of States in 2015.[196]

The thesis will test the effectiveness of Bangladeshi water institutions in chapter 4 against the most foundational elements of an ideal water institution that include coordination, monitoring, groundwater data, leadership, and decentralised functioning.

Beyond groundwater laws and institutions, in some jurisdictions notably India and Bangladesh the role of the judiciary is being increasingly recognised in facilitating the protection of water resources, and more broadly the environment. For instance, the Supreme Court of India has been instrumental in incorporating the concept of sustainable development,

[189] Nanni et al (n 168).
[190] Ibid.
[191] Caponera and Nanni (n 118) 172, 176-7.
[192] Ibid 175-6.
[193] Asit K Biswas and Cecilia Tortajada, 'Future Water Governance: Problems and Perspectives' (2010) 26(2) *International Journal of Water Resources Development* 129, 136-7.
[194] Global Framework (n 179) 36.
[195] Ibid.
[196] Duda (n 3) 114.

the precautionary principle, the polluter-pays principle, and the public trust doctrine into domestic environmental jurisprudence.[197] The Court has often taken a resort to the flexible interpretation of fundamental rights and duties for the protection of people's health as well as that of the environment.[198] Additionally, the Courts put the government under pressure to implement appropriate measures to protect the environment, and that includes water resources.[199] The Indian judiciary continues to play a significant role in shaping, designing, and crafting sustainable groundwater regulation. The Central Groundwater Authority (CGWA), for instance, is the product of the activist Indian judiciary.[200] Alarming water table depletion by 4-8 m around New Delhi prompted the Supreme Court to pass an order directing the central government to constitute the CGWA under section 3(3) of the *Environment (Protection) Act 1986*.[201] Eventually, the CGWA was constituted 'to regulate and control management and development of groundwater in the country and to issue necessary regulatory directions for this purpose'.[202]

Following the model of the Indian judiciary, the Supreme Court of Bangladesh continues to flex its muscles when it comes to the environment in general and water resources in particular. The Court has exerted its significant influence in designing and reforming water governance in Bangladesh. It is the Court that triggered the enactment of the *National River Protection Commission Act 2013* and the establishment of the National River Protection Commission to improve river protection and management.[203] The Court has often interpreted fundamental rights provided under the *Bangladesh Constitution* in such a way that cast obligations upon the executive government to undertake effective measures for the protection of the environment that includes water resources.[204] At times the Court engages in making law — filling gaps and legislative vacuums — as well as laying down new policy.[205] This being the case it is pertinent to explore what role the Court can play in promoting groundwater sustainability in the context of Bangladesh. Although this thesis focuses on legal issues around groundwater sustainability in Bangladesh, it is, nevertheless, useful for gaining a nuanced understanding of groundwater protection generally, to briefly shed light on the international response to the protection and preservation of this vital but seemingly under-valued resource. Accordingly, the next Part turns to briefly discuss the legal response of the international community towards the protection of this scarce resource.

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[197] *MC Mehta v Kamal Nath* (1997) 1 SCC 388 (Supreme Court of India); Cullet, Bhullar and Koonan (n 99) 656.
[198] Jenny T Grönwall, 'Access to Water Rights, Obligations and the Bangalore Situation' (PhD Thesis, Linköping University, 2008) 164.
[199] Ibid 169.
[200] *MC Mehta v Union of India* (1997) 11 SCC 312 (Supreme Court of India); Cullet (n 99) 270.
[201] Patra, Adhikari and Kunar (n 110) 202.
[202] Cullet (n 99) 270.
[203] See chapter 5(III).
[204] See chapter 5(IIC)(III)(IV).
[205] See chapter 5(IIB).

VI INTERNATIONAL RESPONSE TO THE PROTECTION OF GROUNDWATER RESOURCES

This Part seeks to demonstrate the evolution of legal initiatives at the global level to protect groundwater resources internationally that in turn, underscores the role of law in protecting this resource at the national level. As briefly seen in chapter 1, the importance of, and threats to, groundwater resources have been internationally documented. Yet, globally groundwater has long been absent in the discourse of the international community when compared to surface water and other environmental challenges,[206] and indeed until recently, it was treated as the neglected stepchild of international water law.[207] For instance, while numerous treaties have been adopted for the 263 river basins, to date, only five agreements have been concluded in relation to five of the 273 transboundary aquifers.[208] To be specific, the *1966 Helsinki Rules*[209] that marked the era of the codification of modern water law, did not concern the specific challenges encountered by a shared aquifer.[210] The world's first environmental conference held in 1972 in Stockholm addressed poorly and insufficiently human-environment interactions and water resources.[211]

Fortunately, the first international conference on water held in Mar del Plata in 1977[212] formulated certain recommendations, albeit superficially, for groundwater management, placing emphasis on the utilisation of aquifers and on enhancing aquifer-related knowledge.[213] Almost a decade later in 1986, the International Law Association adopted the *Seoul Rules* on international groundwater.[214] The *Seoul Rules* filled the gap in the *Helsinki Rules* by providing substantive provisions on groundwater. It contained provisions for the protection of groundwater through the practice of consultation and exchange of data and information between and among states.[215] The *Seoul Rules* also asked the basin states to

[206] Tim Stephens, 'Remaining International Water Law' (2011) 71 *Maryland Law Review Endnotes* 20, 26; for a broader discussion on the evolution of international groundwater law see, eg, Kerstin Mechlem, 'Past, Present and Future of the International Law of Transboundary Aquifers' (2011) 13(3) *International Community Law Review* 209; Coalter G Lathrop, 'Finding the Right Fit: One Design Element in the International Groundwater Resource Regime' (2008) 19 *Duke Journal of Comparative and International Law* 413; Pincus (n 50) 313.
[207] Gabriel E Eckstein, 'Managing Buried Treasure across Frontiers: The International Law of Transboundary Aquifers' (2011) 36(5) *Water International* 573, 573; Gabriel E Eckstein, 'Commentary on the UN International Law Commission's Draft Articles on the Law of Transboundary Aquifers' (2007) 18(3) *Colorado Journal of International Environmental Law and Policy* 537, 537, 609, 610.
[208] Mechlem (n 206) 210.
[209] International Law Association (ILA), *The Helsinki Rules on the Uses of Waters of International Rivers 1966* (ILA Report, 1967) 484.
[210] Mechlem (n 206) 210.
[211] *United Nations Conference on the Human Environment*, UN Doc A/CONF.48/14/REV.1 (5-16 June 1972) (Stockholm Declaration on the Human Environment) principle 2; Conti and Gupta (n 51) 852.
[212] *United Nations Water Conference*, UN Doc. E/Conf.70/29 (14-25 March 1977).
[213] Ibid *Resolutions I Assessment of Water Resources*; Conti and Gupta (n 51) 852; Mechlem (n 206) 210.
[214] International Law Association (ILA), *The Seoul Rules on International Groundwaters 1986* (ILA Report, 1987) 251 ('*The Seoul Rules'*).
[215] *The Seoul Rules* art III.

consider integrated water management, including conjunctive use.[216] Surprisingly, however, the UN Watercourses Convention — although it includes groundwater in the definition of a watercourse — completely bypasses the specific management challenges posed by groundwater.[217] Indeed, an opportunity was missed to adopt a comprehensive legal regime for all freshwater resources in one instrument.

Notwithstanding, in the early part of this century, the international community began to pay increased attention to the protection of this hitherto neglected resource.[218] For instance, at the regional level, countries have concluded various agreements to coordinate, promote, and facilitate the rational management of water resources with regard to their transboundary aquifers.[219]

Similarly, at the global level, countries started taking collective action to protect and preserve this invisible resource. In 2004 the International Law Association adopted its *Berlin Rules* on water resources covering all types of aquifers and applying the same general principles to all freshwater resources.[220] The *Berlin Rules* focus, among others, on the precautionary management of aquifers; information required to manage groundwater and aquifers; sustainability; and protection.[221]

Obviously, the most significant development has been the adoption of the International Law Commission's *Draft Articles on Transboundary Aquifers* in 2008,[222] addressing the utilisation of transboundary aquifers; activities that may have an impact on such aquifers; and measures for the protection, preservation, and management of those aquifers.[223] Unfortunately, the *Draft Articles* have not explicitly referred to sustainable use or sustainability.[224] Nonetheless, the *Draft Articles* — albeit not transformed into a convention and as such, having no binding force[225] — make a significant contribution to the development

[216] *The Seoul Rules* art IV.
[217] Kerstin Mechlem, 'International Groundwater Law: Towards Closing the Gaps? (2003) 14 *Yearbook of International Environmental Law* 47, 57–62; Pincus (n 50) 315, 319.
[218] Eckstein (n 207) 573-4.
[219] Notable aquifers in relation to which agreements have been concluded include North-Western Sahara Aquifer System, Iullemedan Aquifer System, and Guarani Aquifer System; see Mechlem (n 206) 216; Francesco Sindico, Ricardo Hirata and Alberto Manganelli, 'The Guarani Aquifer System: From a Beacon of Hope to a Question Mark in the Governance of Transboundary Aquifers' (2018) 20 *Journal of Hydrology: Regional Studies* 49, 53.
[220] International Law Association (ILA), *The Berlin Rules on Water Resources 2004* (ILA Report, 2004) 337 ('*The Berlin Rules'*).
[221] *The Berlin Rules* arts 38, 39, 40, 41.
[222] Following a six-year intense research and debate the United Nations General Assembly (UNGA) adopted a Resolution containing 19 *Draft Articles* on transboundary aquifer. *The Law of Transboundary Aquifers,* 63rd sess, GA Res 63/124, UN Doc A/RES/63/124 (15 January 2009, adopted 11 December 2008) ('*The Draft Articles'*).
[223] *The Draft Articles* art 1.
[224] Mechlem (n 206) 216.
[225] Gabriel Eckstein and Francesco Sindico, 'The Law of Transboundary Aquifers: Many Ways of Going Forward, but Only One Way of Standing Still' (2014) 23(1) *Review of European, Comparative and International Environmental Law* 32, 32.

of international groundwater law. Notably, these Articles contain substantive provisions in relation to the protection, preservation, and management of aquifers that certainly encourage states to adopt bilateral and multilateral agreements to manage their transboundary aquifers.[226] Further, resolutions adopted by the UN Human Rights Commission and the UN General Assembly in 2010 declaring a human right to water and sanitation have implications for the use and development of all groundwater resources.[227] More importantly, as seen in chapter 1, the latest Sustainable Development Goals (SDG) by placing emphasis on the sustainable management of water resources (SDG 6) draws the attention of the domestic governments to adopt appropriate measures for the protection and preservation of groundwater resources that are crucial for the realisation of at least half a dozen of the SDGs.

That said, in order to understand, examine, and explore the legal response of a particular country in relation to the protection of its groundwater resources, it is necessary to learn the background information of that country. Since Bangladesh is the focus of this thesis, the next Part moves to provide an overview of the country.

VII AN OVERVIEW OF BANGLADESH

Bangladesh stands between 20°34′ and 26°38′ north latitude and between 88°01′ and 92°41′ east longitude, and is bounded by India in the east, west, and north and by the Bay of Bengal in the south.[228] It is a densely populated country with 164.6 million people living in a relatively small area of 147,570 sq km.[229] Furthermore, it has a high population growth rate of 1.33% per annum,[230] and the total population will be around 233 million by 2050 if the current trajectory of population growth continues.[231] The country is divided into eight divisions, each division consists of several districts and each district comprises Upazilas (sub-districts) which are further characterised by unions. Currently, Bangladesh has eight divisions, 64 districts, 492 Upazilas, and 4,571 unions.[232]

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[226] See *the Drat Articles* (n 222). Bilateral or regional agreements among states would be better response to protect groundwater resources in which those pools are located, see, eg, Lathrop (n 206); Eckstein and Sindico (n 225) 40-41-2.

[227] Human Rights Council, *Human Rights and Access to Safe Drinking Water and Sanitation*, HRC 15th sess, UN Doc A/HRC/RES/15/9 (6 October 2010, adopted 30 September 2010); *The Human Right to Water and Sanitation*, 64th sess, GA Res 64/292, UN Doc A/RES/64/292 (3 August 2010, adopted 28 July 2010); Conti and Gupta (n 51) 853.

[228] Banglapedia, National Encyclopedia of Bangladesh, *Bangladesh* <http://en.banglapedia.org/index.php?title=Bangladesh>.

[229] Bangladesh Bureau of Statistics (BBS), *Monthly Statistical Bulletin-Bangladesh* (BBS, August 2019) ix.

[230] Ibid.

[231] Mohammad H Mondal, 'Crop Agriculture of Bangladesh: Challenges and Opportunities' (2010) 35(2) *Bangladesh Journal of Agricultural Research* 235, 236.

[232] Bangladesh Bureau of Statistics (BBS), *Bangladesh Statistics 2018* (BBS, 2018) 4.

Bangladesh is one of the largest deltas of the world crisscrossed by more than 230 rivers.[233] Fifty-seven international rivers cross the country.[234] The topography of Bangladesh is formed by the three largest river systems in the world: the Ganges-Brahmaputra-Meghna.[235] Eighty percent of the land of the country consists of floodplains while terraces and hills account for about 8% and 12% respectively.[236] Being a lower riparian country, Bangladesh itself makes up only 7% of the watershed[237] and around 93% of the surface water of the river systems comes from outside the country which is mainly controlled by India.[238] This creates uncertainty in the quantity of surface water and significantly affects the availability of groundwater.[239]

Three major aquifers — composite or shallow, main or intermediate and deep — store the groundwater resources of the country.[240] In the northern part of Bangladesh, the groundwater level is generally high while in the southern part it is usually low.[241] Groundwater is mostly recharged through rain, flooding, streamflow in rivers, and to a lesser extent through irrigation return flow.[242] However, only 11% of the total rainfall recharges the aquifer whereas some of the remaining water evaporate and the rest make their way to the nearest water bodies.[243] Being a subtropical country, Bangladesh experiences intense rainfall in a limited time.[244] The average annual rainfall of the country is 2,320 mm[245] which varies from 1,100 mm in the extreme northwest to 5,690 mm in the northeast.[246] As much as 80% of rainfall occurs during the monsoon extending from June to September and only 10% of rainfall takes place during the post-monsoon (October-November) and winter periods

[233] Shubhra Bhattacharjee et al, 'Groundwater Governance in Bangladesh: Established Practices and Recent Trends' (2019) 8 *Groundwater for Sustainable Development* 69, 70.
[234] Punam Pandey, 'Water Management in Bangladesh: Policy Interventions' in Amit Ranjan (ed), *Water Issues in Himalayan South Asia: Internal Challenges, Disputes and Transboundary Tensions* (Springer, 2020) 30.
[235] Ratan Kumar Majumder, Jun Shimada and Makoto Taniguchi, 'Groundwater Flow Systems in the Bengal Delta, Bangladesh, Inferred from Subsurface Temperature Readings' (2013) 35(1) *Songklanakarin Journal of Science and Technology* 99, 100.
[236] Nasima Tanveer Chowdhury, 'Water Management in Bangladesh: An Analytical Review' (2010) 12(1) *Water Policy* 32, 35.
[237] Pandey (n 234).
[238] Food and Agriculture Organisation (FAO), *AQUASTAT Country Profile — Bangladesh* (FAO, 2014) 3 ('FAO').
[239] Pandey (n 234) 34-5.
[240] Anwar Zahid and Syed Reaz Uddin Ahmed, 'Groundwater Resources Development in Bangladesh: Contribution to Irrigation for Food Security and Constraints to Sustainability' in Bharat R. Sharma, Karen G Villholth, Kapil D Sharma (eds), *Groundwater Research and Management: Integrating Science into Management Decisions* (International Water Management Institute, 2006) 32-3. The depth of the shallow aquifer ranges between few to 60 meters; that of the main aquifer is between 5 to 140 meters, and the depth of deep aquifer stretches between 190 to 1500 meters.
[241] Bhattacharjee et al (n 233) 69-70.
[242] Mohammad Shamsudduha, 'Impacts of Human Development and Climate Change on Groundwater Resources in Bangladesh' in Abhijit Mukherjee (ed), *Groundwater of South Asia* (Springer, 2018) 536.
[243] Bhattacharjee et al (n 233) 69-70.
[244] Pandey (n 234) 31.
[245] FAO (n 238).
[246] Ibid.

(December-February) and the other 10% befalls in the pre-monsoon (March-May).[247] While the country grapples with flood and drainage issues caused by heavy rainfall during the monsoon, it faces tremendous water scarcity during winter.[248] Therefore, depending on the season, water is both scarce and abundant in Bangladesh.[249]

Whilst seasonal abundance and shortage characterise the overall water resources of Bangladesh, groundwater continues to play a significant role in the development of the country. Despite its documented importance, groundwater is over-extracted in Bangladesh resulting in its fast depletion that ultimately threatens food security, socio-economic development, and the human environment. The next Part turns to chart the importance of groundwater and factors that trigger its over-extraction in Bangladesh.

VIII SIGNIFICANCE OF GROUNDWATER AND ITS OVEREXPLOITATION IN BANGLADESH

Groundwater provides almost 97% of drinking water[250] and around 90% of irrigation water in Bangladesh.[251] About 76% of the total land is currently irrigated through groundwater.[252] Prior to the 1970s, surface water and monsoon rainfall were the main sources of irrigation in Bangladesh.[253] However, in the mid-1970s and throughout the 1980s, millions of drinking water (hand tubewells) and shallow irrigation wells were installed by the government and the private sector across the country,[254] to enhance small-scale irrigation,[255] and also to provide safe drinking water in the face of widespread surface water contamination.[256] Extensive groundwater exploitation has led to a dramatic increase in *boro*[257] (dry season crop) production that consumes the lion's share of all extracted groundwater.[258] At present, 37,175 deep tubewells and 1.4 million shallow tubewells operate across the country to pump groundwater for irrigation, thereby posing a significant threat to groundwater

[247] Chowdhury (n 236) 33.
[248] Ibid 50.
[249] Pandey (n 234) 37-8.
[250] Shamsudduha (n 242) 536.
[251] Nazmoon Nahar Sumiya and Hafiza Khatun, 'Groundwater Variability in Bangladesh: Assessment Based on Rainfall Variation and Use of Water in Irrigation' (2016) 42(2) *Journal of Asiatic Society of Bangladesh, Science* 177, 178.
[252] Bangladesh Agricultural Development Corporation, *Minor Irrigation Survey Report 2016-17 (Rabi Season)* (Report, 2018) 5 ('*Irrigation Report'*).
[253] Mohammad Shamsudduha et al, 'The Impact of Intensive Groundwater Abstraction on Recharge to a Shallow Regional Aquifer System: Evidence from Bangladesh' (2011) 19(4) *Hydrogeology Journal* 901, 903.
[254] Ibid 903-5.
[255] Sudip Pal et al, 'Evaluation of the Effectiveness of Water Management Policies in Bangladesh' (2011) 27(2) *International Journal of Water Resources Development* 401, 404.
[256] Shamsudduha (n 242) 525.
[257] *Boro* rice is rice that is grown during the dry winter season and requires irrigation.

[258] Of all abstracted groundwater, 80% is used for irrigation, of which 70% is exclusively used for boro production, see Qureshi, Ahmed and Krupnik (n 1) 10.

sustainability.[259] Growing more rice for the ever-increasing population means putting more pressure on groundwater resources. Additionally, financial incentives provided by the government encourage farmers to extract more groundwater to augment their agricultural productivity.[260] Indeed, the current groundwater irrigation of Bangladesh is largely unsustainable.[261]

Apart from agriculture, the industrial sector is also exerting increasing pressure on groundwater resources. In Dhaka and other parts of Bangladesh, industries are growing exponentially in an unplanned way.[262] Currently, 4,296 manufacturing industries and 113 tanneries are operating across the country,[263] placing enormous pressure on the groundwater resources of Bangladesh.[264] Textile and leather industries' 98% water comes from a groundwater source.[265] For dyeing and washing the cotton and clothes of the garment industry, for instance, every year 1,500 billion of water is used, which is enough to meet the water demands of 0.8 million people for a whole year.[266] Around 250 to 300 litres of water is used to wash apparel weighing one kg, whereas the global standard is 60 to 70 litres for the same amount of fabric.[267] Achieving the ambitious target of reaching USD$ 50 billion of exports by 2021 and USD$ 82.5 billion by 2030 set by the Bangladesh Garment Manufacturers and Exporters Association would require more groundwater than before.[268] Moreover, green technologies and techniques are rarely applied in the industrial manufacturing process.[269] The current trend of groundwater withdrawal in the industrial sector is, therefore, unsustainable.[270]

Domestic groundwater use, albeit still low, nevertheless, puts pressure on groundwater. Cities like Dhaka, Khulna, Chattogram, and Barishal depend heavily on groundwater.[271] In Dhaka, for instance, about 78% of the city supply depends on groundwater.[272] In addition to 827 deep tubewells of the Dhaka Water Supply and Sewerage Authority,[273] several hundred

[259] *Irrigation Report* (n 252) 2.
[260] MA Sattar Mandal, *A Synthesis of Agricultural Policies in Bangladesh: Agriculture Sector Review* (Ministry of Agriculture, 2006) 27–31.
[261] Dey et al (n 34) 67.
[262] Thomas Sagris and Justin Abbott, 'An Analysis of Industrial Water Use in Bangladesh with a Focus on the Textile and Leather Industries' (2030 Water Resources Group, May 2015) v.
[263] Ahaduzzaman et al, 'Overview of Major Industries in Bangladesh' (2017) 30(1) *Journal of Chemical Engineering* 51, 52, 54.
[264] Sagris and Abbott (n 262) 4, 7.
[265] Ibid 9.
[266] Inam Ahmed and Refayet Ullah Mirdha, 'Water: Garments' invisible price', *The Daily Star* (online, 22 September 2017) <http://www.thedailystar net/frontpage/water-garments-invisible-price-1465762>.
[267] Ibid; Sagris and Abbott (n 262) 5.
[268] Sagris and Abbott (n 262) v; see another similar report made by ARUP.
[269] Bhattacharjee et al (n 233) 75; World Bank, *Bangladesh – Country Water Resources Assistance Strategy* (Report No. 32312-BD, 2005) 25-32.
[270] Sagris and Abbott (n 262) vii.
[271] Shamsudduha (n 242) 526.
[272] Dhaka Water Supply and Sewerage Authority, *Annual Report 2017-2018* (Report, 2018) 3.
[273] Ibid 9.

to a thousand unlicensed boreholes withdraw groundwater continuously in the capital city.[274] Moreover, municipalities across the country principally rely on groundwater for their water supplies.[275]

Further, Bangladesh's water resources are impacted by the upper-basin riparian countries like India and China that intervene in and control transboundary flows into Bangladesh.[276] Approximately 93% of the surface water of Bangladesh comes from international rivers controlled mostly by the neighbouring country of India. The Farakka Barrage and the Teesta Barrage constructed by India, and the so-called ongoing hydroelectric dam project undertaken by India on the river Barak at Tipaimukh point to a significant impact on the overall availability of water resources to Bangladesh.[277] The interconnection between surface and groundwater of the deltaic plain suggests that changes in the rate of the rivers' water flow — though transboundary water is another issue — affect directly the availability of groundwater. Indeed, the water flows of these rivers contribute significantly to the aquifer recharge in Bangladesh.[278]

Additionally, climatic change continues to wreak havoc on Bangladesh's groundwater resources by causing the following: changes to the monsoon pattern, unpredictable rainfall distribution, a fall in water quality, and an increase in temperature.[279] Bangladesh is amongst the worst victims of climate change due to its low-lying topography, high population density, and widespread poverty.[280]

Data with respect to the total groundwater withdrawal in Bangladesh is very scarce. However, in 2008, the total estimated water withdrawal was 35.87 km³ of which 31.50 km³ (88%) was consumed by the agricultural sector, 3.60 km³ (10%) by the domestic sector, and 0.77 km³

[274] Shamsudduha (n 242) 526.
[275] Ibid.
[276] Muhammad Mizanur Rahaman, 'Integrated Ganges Basin Management: Conflict and Hope for Regional Development' (2009) 11(2) *Water Policy* 168; Animesh Gain and Carlo Giupponi, 'Impact of the Farakka Dam on Thresholds of the Hydrologic Flow Regime in the Lower Ganges River Basin (Bangladesh)' (2014) 6(8) *Water* 2501.
[277] M Monirul Qader Mirza, 'The Ganges Water Diversion: Environmental Effects and Implications - An Introduction' in M Monirul Qader Mirza (ed), *The Ganges Water Diversion: Environmental Effects and Implications* (Springer Netherlands, 2004) 1-12; MN Islam, MA Azam and QR Islam, 'Teesta River Water Sharing: A Case Study in Teesta Barrage Project.' (Conference Paper, Asian Regional Conference on Irrigation and Drainage, 14-17 March 2004) 36; M Anowar Hossain, 'Tipaimukh Dam of India: Probable Disaster for Bangladesh' (undated) 1-23.
[278] Islam, Azam and Islam (n 277).
[279] Tahmina Hadi, 'An Analysis of Water Policies and Strategies of Bangladesh in the Context of Climate Change' (2019) 29(1) *Asia-Pacific Journal of Rural Development* 111, 111.
[280] Behrooz Hassani-Mahmooei and Brett W Parris, 'Climate Change and Internal Migration Patterns in Bangladesh: An Agent-Based Model' (2012) 17(6) *Environment and Development Economics* 763, 763; K Maudood Elahi, 'Climate Change and Health Impacts in Bangladesh' in Rais Akhtar (ed), *Climate Change and Human Health Scenario in South and Southeast Asia* (Springer, 2016) 207.

(2%) by the industrial sector.[281] Of total water withdrawal, groundwater provides approximately 28.48 km³ (79%) and the rest 7.39 km³ (21%) comes from surface water.[282]

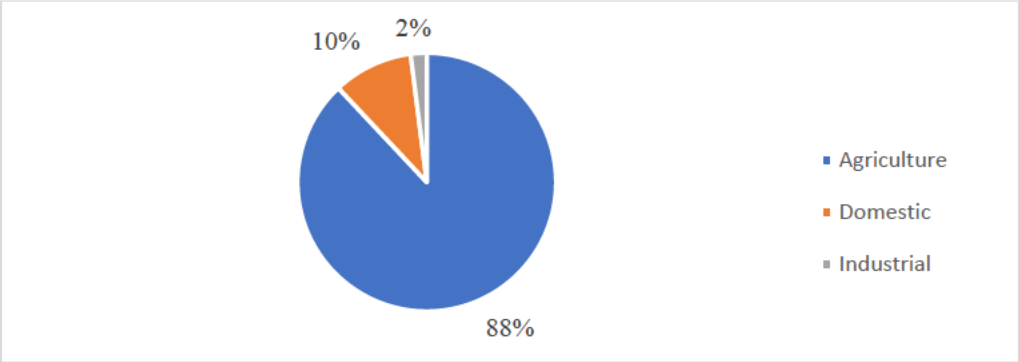

Fig 1 Water withdrawal by sector in Bangladesh.

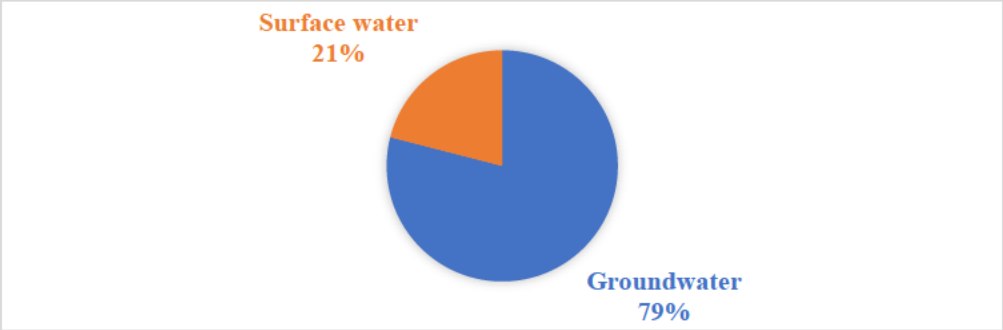

Fig 2 Water withdrawal by source.

The combined effects of indiscriminate groundwater extraction by different users have led the water table to decline by almost one meter per year across the country.[283] In metropolitan cities like Dhaka, this declining rate is two-three meters per year.[284] A more recent study suggests that Bangladesh's water table dropped drastically by 32% in a decade (2003-2013).[285] More specifically, uncontrolled groundwater extraction has caused the groundwater level in and around Dhaka to plummet 170 feet below sea level, thereby accelerating salinity intrusion to the groundwater of the central region of the country. Aquifers of the northern part of Bangladesh also are exposed to saltwater intrusion due to excessive groundwater withdrawal for irrigation. Indeed, the groundwater table of Rajshahi, the northwest

[281] FAO (n 238) 6.
[282] Ibid 7.
[283] Sumiya and Khatun (n 251) 181-3, 186; Shamsudduha (n 242) 528-33.
[284] Afia Jahin and Md Yasin, 'Smart and Sustainable Water Management Using GIS (A Case Study in District Metering Area of Bangladesh)' (2019) 4(1) *International Journal of Recent Engineering Research and Development* 26, 26.
[285] M Khaki et al, 'A Study of Bangladesh's Sub-Surface Water Storages Using Satellite Products and Data Assimilation Scheme' (2018) 625 *Science of the Total Environment* 963, 963.

metropolitan city, has dropped 18 to 20 feet below sea level.[286] This declining water table demonstrates that the current trend of groundwater extraction far exceeds the recharge rate, and hence, as per the definition of sustainability adopted above for this thesis, groundwater withdrawal in Bangladesh is unsustainable.

To sum up, groundwater depletion has transformed into a serious crisis in Bangladesh for multiple reasons. First, Bangladesh is excessively dependent on groundwater for its socio-economic development. Second, though the average rainfall of the country is 2,320 mm/year, it is much less in the northwest region. Third, Bangladesh's population is projected to reach 233 million over the next three decades, putting more stress on groundwater resources. Fourth, climate change and periodic droughts significantly exacerbate the water quantity and quality.[287] Finally, and most importantly, fragile legal and institutional frameworks for groundwater governance are rooted in all these causes.

IX CONCLUSION

In addition to describing and analysing the processes that underpin social realities, qualitative research discusses and explains the social relationships through which people are linked to one another. It is these processes and relationships that lead to the emergence and durability of organisations, institutions, culture, and society.[288]

This chapter has detailed the methods that combine extensive legal analysis with in-depth interviews with government officials, judges, scholars, and groundwater users to provide a nuanced understanding of the gaps and strengths of groundwater laws and institutions in Bangladesh. The interviews are a significant contribution to the analysis of legal instruments pertaining to groundwater sustainability. In particular, in the face of the limited availability of published work in relation to Bangladesh's groundwater laws and institutions, these interviews fill this significant gap in the literature. In these interviews, the aim was to understand what stakeholders perceived as the problems with the current regulation of groundwater extraction and to identify lessons for designing more effective and efficient regulatory regimes for groundwater withdrawal across the country. A qualitative approach was undertaken to analysing the interview data. This reveals several themes that inform the critical analysis of the Bangladesh water laws and institutions that appear in this thesis. Indeed, the interviews substantially deepen the knowledge of the gaps in the implementation of the laws and provide insights not available through the published literature.

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[286] 'Dhaka under Salinity Threat', *The Daily Star* (online, 29 September 2012) <https://www.thedailystar.net/news-detail-251717>.

[287] See, eg, JM Kirby et al, 'The Impact of Climate Change on Regional Water Balances in Bangladesh' (2016) 135(3/4) *Climatic Change* 481.

[288] Gale Miller and Robert Dingwall (eds), *Context and Method in Qualitative Research* (SAGE Publications, 1997) 3.

Additionally, this chapter has explored the more specific role and significance of legal and institutional frameworks in advancing groundwater sustainability. The chapter has outlined what issues should be addressed by an ideal legal framework for groundwater sustainability. Essentially, quantification, allocation, water abstraction, and use rights should be clearly articulated in groundwater legislation. The chapter has also fleshed out the global regulatory practices in relation to groundwater pumping. Water licensing and metering, water market, and environmental tools such as environmental impact assessments are widely practiced in a bid to ensure groundwater use efficiency.

Connected with groundwater laws are the water institutions. The chapter has briefly explained their significance in relation to groundwater sustainability. Compliance and enforcement of groundwater rules are heavily dependent on the capacity of a responsible water institution. In particular, ensuring monitoring that underpins the groundwater governance and regulatory framework remains a far cry without an able and dedicated water institution.

Beyond the role of groundwater laws and institutions, the chapter has also briefly discussed the relevance and significance of judicial action in relation to groundwater sustainability, notably in India and Bangladesh. Following its counterpart in India, the Supreme Court of Bangladesh has expressed its willingness to actively engage in the water governance reform and more broadly the environmental governance. It is, therefore, timely to drill down into the potential role of the Bangladesh judiciary that can be played in facilitating groundwater sustainability. Accordingly, this thesis will consider this issue in chapter 5.

Of course, an examination of domestic response to groundwater protection requires some discussion on international initiatives in this regard. Hence, this chapter has shed light on the international legal response to the protection and preservation of groundwater resources. While initially, the international community paid no or little attention to the sustainable management of this resource, since the beginning of this century they started focusing on the need for targeted collective action to protect this hidden resource. The latest SDGs (SDG 6) underscored the importance of water sustainability and accordingly, it urged the domestic governments to undertake specific measures to achieve the SDGs that include sustainable water management.

Therefore, as a member of the international community, Bangladesh is strongly encouraged to adopt effective legal measures to ensure groundwater sustainability. This chapter has shown that the agricultural sector — the major user of groundwater resources — is indiscriminately extracting groundwater, thereby posing a significant threat to its long-term sustainability. This groundwater overexploitation is further intensified by the burgeoning industrial sector that continues to mindlessly pump this scarce resource. To a lesser extent, urban households are also placing stress on groundwater systems and supplies. This crisis is

further compounded by climate change. Thus, groundwater is being quickly depleted in Bangladesh in a manner that cannot be naturally replenished.

As demonstrated in chapter 1, a lack of effective legal arrangements goes to the root of the declining groundwater resources in Bangladesh. Accordingly, the next chapter turns to conduct an in-depth examination of the efficacy of the existing legal framework in relation to the prevention of groundwater depletion.

CHAPTER 3

LEGAL FRAMEWORK OF BANGLADESH TO ENSURE SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES: EXAMINING ITS EFFICACY AND VIABILITY

I INTRODUCTION

Chapter 2(VIII) showed that groundwater has turned out to be the lifeline for most people of Bangladesh, not least their food security heavily hinges on this resource. Like elsewhere in the world because of its easy availability, accessibility, and reliability,[1] groundwater is widely abstracted across Bangladesh to meet the increasing water demands emanating from domestic, agricultural, and industrial sectors. Historically, the country was more concerned with feeding the growing population, and with the policy focus on food security, it began to extract groundwater indiscriminately.[2] This wholesale groundwater withdrawal has enabled Bangladesh to grow the targeted food through irrigated agriculture[3] and also to earn a sizable foreign currency by exporting readymade garments.[4]

These achievements, however, continue to cause significant damage to Bangladesh's groundwater systems and supplies.[5] Structural solutions through a centralised approach by professional engineers have frequently been invoked to resolve the water problems of Bangladesh[6] where laws and regulations have often been ignored or sidestepped.[7] Comprehensive water legislation provides a legal basis for the effective and sustainable management of groundwater by, among other things, incorporating provisions for the quantification, planning, allocation, and conservation of groundwater resources.[8] It also defines the rights and duties of groundwater users, lays down requirements for the registration and qualification of well drillers, and provides provisions for cooperative

[1] Tapan K Ray, 'Legislation for Effective Groundwater Management in South Asian Countries' in Pradip K Sikdar (ed), *Groundwater Development and Management* (Springer, 2019) 489.
[2] Asad S Qureshi, Zia Uddin Ahmad and Timothy J Krupnik, 'Moving from Resource Development to Resource Management: Problems, Prospects and Policy Recommendations for Sustainable Groundwater Management in Bangladesh' (2015) 29(12) *Water Resources Management* 4269, 4270, 4281; see also Asad Sarwar Qureshi, Zia Uddin Ahmed and Timothy J Krupnik, *Groundwater management in Bangladesh: An Analysis of Problems and Opportunities* (CSISA-MI Project, Research Report No 2, 2014) *('Research Report')*.
[3] Qureshi, Ahmed and Krupnik (n 2) 10 *('Research Report')*.
[4] Inam Ahmed and Refayet Ullah Mirdha, 'Water: Garments' invisible price', *The Daily Star* (online, 22 September 2017) <http://www.thedailystar net/frontpage/water-garments-invisible-price-1465762>.

[5] ARM Towfiqul Islam et al, 'Assessing Recent Impacts of Climate Change on Design Water Requirement of Boro Rice Season in Bangladesh' (2019) 138(1-2) *Theoretical and Applied Climatology* 97, 98.
[6] AKM Jahir Chowdhury and Golam Rasul, 'Equity and Social Justice in Water Resource Governance: The Case of Bangladesh' (2011) 2(2) *South Asian Water Studies* 44, 54.
[7] Geof Wood, 'Contesting Water in Bangladesh: Knowledge, Rights and Governance' (1999) 11(5) *Journal of International Development* 731, 748-9.
[8] See chapter 2(VA1).

interaction between water regulators and water users.[9] Indeed, legal frameworks lay the foundations for policy development and they (legal frameworks) ultimately turn policy decisions into rights and obligations.[10] These rights and obligations determine who, when, where, and how can access groundwater and spell out the measures for the protection of aquifers against depletion and pollution.[11] Ensuring sustainable abstraction of groundwater resources, therefore, largely depends on the adoption of effective and efficient groundwater law.[12]

Caught by the shortcomings of the mere engineering solutions and inspired by the increasingly visible role of laws and regulations in solving complex issues around groundwater, Bangladesh has only recently adopted laws to govern groundwater extraction. These laws, however, often fail to reflect the need and importance of groundwater protection. Indeed, most water laws are preoccupied with surface water. Further, the basic statutory frameworks fail to consider the growing multifaceted challenges stemming from the overexploitation of groundwater caused by different users. For instance, the existing legal framework has — albeit introduced a licensing system for the installation of wells — failed to require water metering as part of the well approvals process. Additionally, the major defect of the current framework has been its failure to set the maximum limit of groundwater withdrawal, thereby missing the core elements of ideal groundwater law.[13]

Furthermore, the legal instruments governing groundwater extraction in Bangladesh apply to specific sectors that in turn, generate obvious overlaps and/or contrasts among the existing laws seriously undermining the entire edifice of the legal framework. In other words, different areas such as the environment, agriculture, industry, and households have often dealt with water from their own perspectives, and accordingly, they have developed water laws in a parochial way that have been devoid of collective vision. Moreover, the existing legal framework has not clearly articulated how the permit system is to be invoked and implemented to prevent the overexploitation of groundwater. In particular, the current laws are in sharp clash with each other in relation to the requisite permit issuing authority. The absence of water metering and capping remains a major gap in the current regulatory framework. The prevailing legal framework has also largely ignored the issues around monitoring, training, learning, stakeholders' participation, and the formation of users'

[9] Marcella Nanni et al, *Groundwater Legislation and Regulatory Provision: From Customary Rules to Integrated Catchment Planning* (World Bank, 2004) 1.
[10] Kerstin Mechlem, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper 6: Legal and Institutional Frameworks* (Rome, June 2012) 5; Marguerite de Chaisemartin et al, 'Addressing the Groundwater Governance Challenge' in Eiman Karar (ed), *Freshwater Governance for the 21st Century* (Springer, 2017) 221.
[11] See chapter 2(VA).
[12] Cameron Holley, 'Future Water: Improving Planning, Markets, Enforcement and Learning' in Ron Levy et al, *New Directions for Law in Australia: Essays in Contemporary Law Reform* (ANU Press, 2017) 253.
[13] Rebecca Nelson and Philippe Quevauviller, 'Groundwater Law' in Anthony J Jakeman et al (eds), *Integrated Groundwater Management* (Springer, 2016) 177-8; HP Patra, Shyamal Kumar Adhikari and Subrata Kunar, *Groundwater Prospecting and Management* (Springer, 2016) 198-99.

associations. Hence, in the context of Bangladesh water laws are discrete, and their implementation is even more challenging.

Against this backdrop, this chapter argues that the current legal framework for groundwater regulation in Bangladesh is insufficient, inefficient, and limited. It also argues that current laws are preoccupied with surface water as groundwater is cursorily addressed. As a result, the existing legal framework has largely failed to curb unsustainable groundwater withdrawal in Bangladesh. The chapter concludes that significant reform is needed to transform the existing ineffective legal framework into a more responsive one to tackle the mounting challenges stemming from the declining groundwater.

This chapter answers sub-questions (a) and (b) pertaining to groundwater laws: To what extent does the current legal framework ensure the sustainable abstraction of groundwater resources? What deficiencies presently exist in legal settings? To answer these questions and also to establish the argument stated above the chapter is organised in the following way. Part II illustrates the legal position prevailing in Bangladesh in relation to rights over groundwater. It shows that land and groundwater rights are bundled together in Bangladesh; these rights are, however, subject to significant restrictions imposed by groundwater laws. Part III sheds light on the history of groundwater regulation in Bangladesh. It then moves, in Part IV, to examine and critically analyse the laws and policies separately developed in Bangladesh to govern groundwater resources, especially to ensure their sustainable abstraction. Drawing on interview data and building on an individual analysis of groundwater laws made in the preceding Part (IV), Part V casts the net further by flagging the general deficiencies of the existing legal framework. This Part is distinct from Part IV in that it identifies the overall shortcomings of the legal response to prevent groundwater depletion which eventually needs to be addressed. While the enactment of proper laws is the first step to solve the groundwater depletion problem, the success ultimately lies upon its implementation. Therefore, reflecting on in-depth interviews Part VI explores the much under-researched and largely uncharted groundwater governance area of compliance and enforcement issues. Finally, the main features of the chapter are summarised in Part VII.

II RIGHTS OVER GROUNDWATER IN BANGLADESH: A LEGAL ANALYSIS

Before turning to the substantive discussion on groundwater regulation, it is useful to analyse how groundwater rights have evolved over time in Bangladesh. The intention has been to understand groundwater from rights perspectives. Understanding groundwater rights in Bangladesh, however, is a complex issue that warrants careful examination. Laws governing rights over groundwater are silent on some basic issues that should be addressed by ideal legislation that deals with such rights. For instance, the *Bangladesh Water Act 2013* – principal water legislation in Bangladesh – has not explicitly stated what arrangements

should be there to meet the basic water needs of the poor and vulnerable group of people, notably those who do not own land. Likewise, poor and marginal farmers who substantially depend on groundwater for their livelihoods deserve special treatment from the law that addresses issues around groundwater irrigation. Unfortunately, however, these concerns are largely overlooked by the existing groundwater laws. Thus, issues around equitable access to groundwater are almost sidestepped by the current legal instruments that concern water rights.

A *A Brief Account on the Evolution of Groundwater Rights in Bangladesh: From Unrestricted Rights to Controlled Rights*

Groundwater rights in Bangladesh are tied to landownership. The century-old *Easements Act 1882* safeguards the right of every owner of land to collect and dispose within his own limits of all water under the land which does not pass in a defined channel.[14] This unfettered right of a landowner is further confirmed by section 17(d) of the *Easements Act* that declares that 'a right to groundwater not passing in a defined channel cannot be acquired by prescription'. To be more specific, the *Easements Act* seemingly made a distinction between percolating groundwater and groundwater flowing in defined channels. While the owner of the land has unrestricted right and control over percolating groundwater, his right and control over the groundwater flowing in defined channels are to some extent limited to use and consumption for household and drinking purposes, and irrigation or other purposes of manufacture.[15]

This groundwater right of a landholder was largely informed and shaped by early British cases. In 1843 a British court, for example, ruled that a landowner owned groundwater beneath his land, and he was free to abstract it at his will. The court further held that no legal action could be brought against a landowner whose unfettered exercise of water extraction right caused a decline in groundwater of his neighbour's well.[16] This position was reaffirmed by the House of Lords in 1859 when it stated,

> 'The general rule is that the owner of a land has got a natural right to all the water that percolates or flows in undefined channels within his land and that even if his object in digging a well or a pond be to cause damage to his neighbour by abstracting water from his field or land it does not matter in the least because it is the act and not the motive which must be regarded. No action lies for the obstruction or diversion of percolating water even if the result of such abstraction be to diminish or take away the water from a neighbouring well in an adjoining land.'[17]

This legal position has, however, been altered in Bangladesh with the enactment of the *Groundwater Management Ordinance 1985* (now replaced by the *Groundwater Irrigation*

[14] *Easements Act 1882* (Bangladesh) s 7 ('*Easements Act*').
[15] Philippe Cullet, 'Groundwater Law in India: Towards a Framework Ensuring Equitable Access and Aquifer Protection' (2014) 26(1) *Journal of Environmental Law* 55, 58-9.
[16] *Acton v Blundell* (1843) 12 Meeson and Welsby 324 (Court of Exchequer Chamber).
[17] *George Chasemore v Henry Richards* (1859) VII House of Lords Cases 349 (House of Lords).

Management Act 2018[18]) and the *Bangladesh Water Act 2013*.[19] Recognising the interface between landownership and groundwater rights, each legislation imposes restrictions on landowners in extracting groundwater beneath their lands. As described below, a license is required under both legislations to extract groundwater unless an exemption is provided.

More importantly, under the existing water law all rights over water resources that include groundwater within the state territory vest in the State.[20] This in effect overrides the provisions of the *Easements Act* that assert the unrestricted groundwater rights of landowners over percolating groundwater resources. This legislative development also has severely limited the rights of landowners over groundwater that passes in a defined channel beneath their lands. In other words, the latest *Water Act* unlike the *Easements Act* has not made a distinction between percolating groundwater and groundwater that flows in a defined channel. Therefore, landowners' rights over groundwater within their lands are subjected to the restrictions imposed by the *Water Act* and the *Groundwater Act*. The *Easements Act* also acknowledges the right of the government to regulate water resources, and it leaves any law regulating water resources of the country unaffected.[21] Aligned with this legislative recognition of the *Easements Act*, the *Water Act* and the *Groundwater Act* have declared their overriding effects on all other laws that may have limited their operation.[22] As seen further below (Part IVE), still, however, there are some rights over groundwater such as right to extract water by hand-pumped tubewells to meet household needs including drinking water that landowners can enjoy without any lawful restrictions.

Interview data also reveals that the application, operation, and relevance of the *Easements Act* in relation to the rights over groundwater have been significantly modified with the enactment of the *Water Act* and the *Groundwater Act*. As one of the interviewed policymakers commented, 'The legal position of Bangladesh concerning groundwater rights of a landowner is much clear. Section 7 of the *Easements Act* that conferred unrestricted rights upon a landowner to extract groundwater beneath his land has now been qualified. A landowner unless accorded an exemption under the law must have a permit to abstract groundwater underneath his land'.[23] Echoing the view of this respondent an interviewed judge stated, 'Section 7 of the *Easements Act* does no more hold good; a landholder can no longer enjoy unrestricted rights over groundwater below his land. Law requires him to have a license for extracting groundwater.'[24] Another respondent explained this issue —

> '……rights over groundwater are still land-based in Bangladesh. Only a landowner can apply for an extraction licence, and a landless cannot enjoy this right as groundwater is tied to the land. Law is now in place to regulate once unrestricted groundwater extraction rights. A landowner can, however, still

[18] *Groundwater Irrigation Management 2018* (Bangladesh) ('*Groundwater Act'*).
[19] *Bangladesh Water Act 2013* (Bangladesh) ('*Water Act'*).
[20] Ibid s 3(a).
[21] *Easements Act* (n 14) s 2(a).
[22] *Water Act* (n 19) s 3(a); *Groundwater Act* (n 18) s 3.
[23] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).
[24] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).

> exercise his unbridled rights over groundwater that are intentionally kept outside the hook of law, for instance, the right to withdraw water by hand-pumped tubewell to meet the drinking water and other household needs.'[25]

To sum up, rights over groundwater in Bangladesh are no longer unhindered, and landholders' rights over groundwater beneath their lands recognised under section 7 of the *Easements Act* are now subject to the restrictions slapped by the subsequent *Water Act* and the *Groundwater Act*. These rights are, however, still tagged to landownership that impacts the basic water needs of the poor and vulnerable group of people.

B *Land-based Groundwater Rights: A Blow to the Human Right to Water?*

As seen above, rights over groundwater are grounded on landownership, and essentially only a landholder can apply for an extraction permit. The current groundwater law does not heed the need of a significant portion of the population who do not own land.

To illustrate, an agricultural census carried out in 1999 estimated that 53 percent of households across the country were landless.[26] A survey conducted in 2001 revealed that 68.8% of people in Bangladesh did not have lands of their own.[27] Reversing the previous trend the preliminary findings of the latest agricultural census undertaken in 2019, however, suggest that 11.33% of households across the country do not own land.[28] These varying figures of landless population send out a strong message that a considerable number of people of Bangladesh do not have their own lands, and as such, their rights over groundwater are significantly impacted. Additionally, 20.5% and 10.5% of people live below the poverty and extreme poverty line respectively[29] further limiting the access to groundwater for this group of people. These poor and landless people can access groundwater through village-owned communal pump, or perhaps, in the case of a tenant farmer this access can be obtained through a pump used for irrigation.

Indeed, the growing importance of groundwater as a major source of domestic and agricultural water highlights the need for social equity to be considered in recalibrating groundwater rights. Interview respondents also expressed their concern that the basic rights to groundwater of the landless, marginalised and poor people will continue to be denied. In particular, the human right to water for these landless and poor people is being increasingly threatened. A right to water as defined by the United Nations Committee on Economic, Social and Cultural Rights entitles everyone to sufficient, safe, acceptable, physically accessible and

[25] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[26] Md Abul Quasem, 'Landlessness in Bangladesh: A Case Study in the Coastal Region of Bangladesh' (2001) 27(1) *The Bangladesh Development Studies* 105, 106.
[27] Mahbuba Nasreen, Khondokar Mokaddem Hossain and Debasish Kumar Kundu, 'The Interrelationship between Poverty, Environment and Sustainable Development in Bangladesh: An Overview' (2006) 3(2) *Bangladesh e-Journal of Sociology* 59, 62.
[28] Bangladesh Bureau of Statistics (BBS), *Preliminary Report on Agriculture Census 2019* (BBS, 2019) 5.
[29] Bangladesh Bureau of Statistics (BBS), *Poverty and Extreme Poverty 2019* (BBS, 2019).

affordable water for personal and domestic uses.[30] But the prevailing land-based groundwater rights stand in the way of realising a human right to water in a country like Bangladesh where 97% of drinking water comes from groundwater sources.

In the face of this legal shortcoming, the Supreme Court of Bangladesh continues to show its willingness to find other avenues to ensure a human right to water. Right to life as enshrined under articles 31 and 32 of the *Bangladesh Constitution*, for instance, has repeatedly been interpreted by the Court to ensure this emerging right[31] in Bangladesh. In the case of *Dr Mohiuddin Farooque v Bangladesh and others*,[32] the High Court Division of the Supreme Court invoked its writ jurisdiction conferred under article 102 of the *Bangladesh Constitution* to ensure pollution-free water. The Court broadened the meaning of the right to life so as to cover the right to a safe environment and pollution-free water.[33] In the case of Rabia Bhuiyan, MP, the Appellate Division of the Supreme Court of Bangladesh went further by explicitly and forcefully ruling that failure to ensure access to safe and potable water constitutes a violation of the right to life as guaranteed by articles 31[34] and 32[35] of the Bangladesh Constitution read with articles 15[36] and 18[37].[38]

In essence, the judicial intervention led the government to adopt a *National Policy for Safe Water Supply and Sanitation* in 1998 and a *National Policy for Arsenic Mitigation* in 2004. More recently the government has undertaken a project to ensure safe water in the country's rural areas. The project is expected to be completed by January 2025. Under this project, the government will install 297,300 shallow tubewells and 294,099 deep tubewells at government primary schools and community clinics across the rural areas of the country.[39] Currently, around 105 people on average use a tubewell in Bangladesh's rural areas, and the government is targeting to bring it down to 50.[40] Interview data also underscores the need to take more meaningful and tangible actions towards the realisation of the human to water for Bangladeshi people, especially the poor and vulnerable ones.

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[30] Committee on Economic, Social and Cultural Rights, *General Comment No 15 (2002): The Right to Water (Articles 11 and 12 of the International Covenant on Economic, Social and Cultural Rights)*, UN ESCOR, 29th sess, Agenda Item 3, UN Doc E/C.12/2002/11 (20 January 2003) para 2. For better understanding on a human right to water see generally Rhett B Larson, 'The New Right in Water' (2013) 70 *Washington and Lee Law Review* 2181.

[31] Mohammad Sohidul Islam, 'A Human Right to Water: Challenges and Opportunities for Ensuring This Right in Bangladesh' (2014) 15(2) *Australian Journal of Asian Law* 1-18.

[32] Dr Mohiuddin Farooque filed many PIL cases for the advancement of human rights in Bangladesh; *Dr Mohiuddin Farooque v Bangladesh and Others* (2003) 55 DLR (HCD) 69 [53].

[33] *Dr Mohiuddin Farooque v Bangladesh and Others* (2003) 55 DLR (HCD) 69 [47].

[34] Right to Protection of Law.

[35] Right to Life and Personal Liberty.

[36] Provision of Basic Necessities.

[37] Public Health and Morality.

[38] *Rabia Bhuiyan, MP v Ministry of LGRD and Others* (2007) 59 DLR (AD) 176 [29].

[39] 'Tk 8,850cr Project for Safe Water in Rural Areas', *The Daily Star* (online, 8 January 2020) <https://www.thedailystar.net/business/news/tk-8850cr-project-safe-water-rural-areas-1851022>.

[40] Ibid.

Any damage, therefore, caused to groundwater — both in terms of quality and quantity – severely impacts the realisation of the human right to water of the present as well as future generations.[41] The human right to water casts a strong duty upon the government to prevent the overexploitation and pollution of groundwater by landowners.[42] To speak differently, unsustainable groundwater extraction stands in the way of ensuring a human right to water, and it impacts other uses of groundwater such as other domestic use and agricultural and industrial uses. Declining groundwater levels pose a constant threat to the realisation of a human right to water and equitable access to groundwater that need to be addressed on a broader scale which this thesis is focusing on.

Along this line of groundwater rights, groundwater regulation has trodden a lengthy path to take its present form in Bangladesh. As will be seen below, groundwater did not witness any regulations until recently prompted by the multiple adverse effects of mindless groundwater pumping. Accordingly, the next Part turns to drill down into the groundwater regulation in Bangladesh.

III EXPLORING THE GROUNDWATER REGULATION IN BANGLADESH

Historically, the water regulation of Bangladesh in general, and groundwater in particular, was chaotic and uncoordinated. As will be seen in Chapter 4, a considerable number of ministries and government agencies are directly or indirectly involved in the groundwater regulation, but their plans and implementations have neither been integrated nor been harmonised. However, as seen below increasing demand exerted by domestic, agricultural, and industrial sectors pushed the government to adopt some regulatory measures to prevent the falling water table.

A *The History of Water Law in Bangladesh*

1 *Precolonial Water Law*

During the period of the Indus Valley Civilisation which flourished around 2500 BCE, water was primarily used to meet human personal needs and irrigation.[43] This early civilisation witnessed deforestation and changes in land use for agricultural development.[44] People would

[41] Sujith Koonan, 'Groundwater Legal Regime in India: Towards Ensuring Equity and Human Rights' (SOAS Law Working Papers No 1, 2013) 11.
[42] John Scanlon, Angela Cassar and Noemi Nemes, (2004) 'Water as a Human Right?' (IUCN Environmental Policy and Law Paper No 51, 2004) 21-2.
[43] Philippe Cullet and Joyeeta Gupta, 'India: Evolution of Water Law and Policy' in Joseph W Dellapenna and Joyeeta Gupta (eds), *The Evolution of the Law and Politics of Water* (Springer, 2009) 158.
[44] Madhav Gadgil and Ramachandra Guha, *The Use and Abuse of Nature* (Oxford University Press, 1992) 79.

collect drinking water from rivers, springs, and artificial wells.[45] Thereafter, the birth of Jainism and Buddhism promoted the conservation of natural resources.[46] Hinduism, however, played a more vital role in the conservation of water resources. Under the Hindu religious law, water was considered indivisible and diversion or obstruction of natural water flow or its pollution was punishable.[47] Water could be used for irrigation and transportation. Notwithstanding, particular caution was to be taken in undertaking irrigation such that possible harm to others should be avoided.[48] However, under Hinduism, the King was the owner of all waters and people had to pay a water tax for the agricultural use of water.[49] During Islamic rule, water was considered as a gift of God, and it belonged neither to the ruler nor to the ruled. Yet, everyone could use water to meet his or her needs.[50]

2 *Colonial Water Law*

During British rule, the concept of state control over surface waters was introduced.[51] British colonial water law had notably two main features. First, common law principles, emphasising the rights of landowners to access water, which were progressively applied to regulate water. In relation to groundwater, landowners enjoyed unrestricted right to use water under their holdings.[52] Second, a number of statutes were adopted mainly to protect and maintain embankments, to regulate canals used for navigation, irrigation, drainage, and fisheries.[53] Despite these rules and regulations, the water sector did not witness any planned development during the British period, perhaps due to the local land tenure and revenue system introduced by the British colonial rules.[54]

3 *Post Colonial Water Law*

Following the partition of the Indian sub-continent,[55] for the first time in 1964, a 20-year Water Master Plan was formulated that marked the beginning of water management of

[45] Ramesh Chandra Majumdar, HC Raychaudhuri and Kalikinkar Datta, *An Advanced History of India* (Macmillan, 4th ed, 1978) 30.
[46] Cullet and Gupta (n 43) 159.
[47] Ibid.
[48] Ibid 160.
[49] Ibid.
[50] Thomas Naff and Joseph Dellapenna, 'Can There Be Confluence? A Comparative Consideration of Western and Islamic Fresh Water Law' (2002) 4(6) *Water Policy* 465, 477.
[51] Cullet and Gupta (n 43) 161.
[52] Ibid.
[53] *Embankment Regulation 1829* (India); *Bengal Embankment Act 1855* (India); *Northern India Canal and Drainage Act 1873* (India) Preamble; Cullet and Gupta (n 43) 161.
[54] Sudip K Pal et al, 'Evaluation of the Effectiveness of Water Management Policies in Bangladesh' (2011) 27(2) *International Journal of Water Resources Development* 401, 403.
[55] For better knowledge on the partition of Indian sub-continent see, eg, Yasmin Khan, *The Great Partition: The Making of India and Pakistan* (Yale University Press, 2017).

present Bangladesh.[56] This Master Plan was, however, concerned with surface water for the augmentation of agricultural production. Accordingly, it specifically dealt with issues around flood control, irrigation canals, and drainage,[57] whereby groundwater was completely overlooked.[58] However, in a drastic effort to augment small-scale irrigation facilitated by the swarm of inexpensive shallow tubewell, Bangladesh experienced massive groundwater extraction between the 1970s and early 1980s.[59] This indiscriminate groundwater irrigation triggered the rapid depletion of the groundwater table that in turn, led the government — for the first time — to adopt the *Groundwater Management Ordinance* in 1985. During the period between 1983-1991, a *National Water Plan* was undertaken.[60] During the period stretching from 1947 to 1988, a sectoral approach dominated the water development of the country, and cross-sectoral communication was almost absent.[61] In other words, in the past water management was tilted to food production where the role of water in domestic supply, fisheries, navigation, industrial and ecological sectors was often ignored.[62]

The devastating floods that occurred in 1987 and 1988 prompted the country to formulate a comprehensive Flood Action Plan towards the end of 1989 with the aim of stabilising food production and maintaining the country's capacity to feed an increasing population.[63] During the period between 1989-1999, diagnosis of the poor operation of different water projects revealed the lack of public participation that then provoked the government to formulate the 'Guidelines for People's Participation in Water Development Projects'.[64] The first *National Water Policy* that emerged in 1999 marked a watershed in the realm of water governance in Bangladesh. In 2001 the Water Resources Planning Organisation developed a *National Water Management Plan* — which was approved in 2004 — to supplement the *National Water Policy* with the aim of implementing the policy within the next 25 years.[65] Thereafter, the

[56] AK Gain and M Schwab, 'An Assessment of Water Governance Trends: The Case of Bangladesh' (2012) 14(5) *Water Policy* 821, 825; Daud Hassan and BK Saha, 'Regulatory Frameworks for Protecting Inland Waters from Pollution: Challenges and Opportunities' (2016) 46(3/4) *Environmental Policy and Law* 270, 270.
[57] Pal et al (n 54).
[58] World Bank, *Bangladesh—Country Water Resources Assistance Strategy* (Report No 32312-BD, 2005) 22 *('World Bank Report')*.
[59] See chapter 2(VIII).
[60] Gain and Schwab (n 56) 826. During this period, the entire country was divided into 173 catchments under 60 planning areas that fell under five major hydrologic regions — northeast, northwest, southeast, southwest and south-central. National Water Plan (Phase I) was completed in 1986 and Phase II was completed in 1991; see Matthew Chadwick and Anjan Datta 'Water Resource Management in Bangladesh: A Policy Review' (Livelihood-Policy Relationships in South Asia, Working Paper No 1, 2003) 3-4.
[61] Gain and Schwab (n 56) 826.
[62] QK Ahmad, 'Towards Poverty Alleviation: The Water Sector Perspectives' (2003) 19(2) *International Journal of Water Resources Development* 263, 273.
[63] Gain and Schwab (n 56) 826; see also Suzanne Hanchett, 'Participation and Policy Development: The Case of the Bangladesh Flood Action Plan' (1997) 15(3) *Development Policy Review* 277.
[64] *Guidelines for People's Participation in Water Development Projects 1995* (Bangladesh).
[65] Sushmita Sengupta, Amandeep Kang and Nitya Jacob, *A Briefing Paper on the State of Groundwater Management in Bangladesh* (Water Wealth, 2012) 15.

Bangladesh Water Act 2013 and the *Groundwater Irrigation Management Act 2018* were enacted.

B *Legal Vacuum in the Regulation of Groundwater Abstraction*

Clearly, early water resources management of Bangladesh was heavily concerned with flood control, drainage, and irrigation with a view to enhancing food grain[66] and protecting riverbank or dredging rivers.[67] Indeed, the legal framework of the country was predominantly preoccupied with surface water, and groundwater was not in the mind of the policymakers. Though the *Groundwater Management Ordinance* attempted to regulate groundwater irrigation, its operation was halted soon after its introduction. More broadly, ignoring the governance and regulation the government focused on groundwater development for increased irrigation.[68] Only recently, has the government employed efforts to undertake some regulatory framework to control the groundwater abstraction that is also replete with flaws and fraught with difficulties. For instance, groundwater laws fail to impose a volumetric limit on groundwater withdrawal, thereby frustrating the overarching purpose of the law,[69] which is further muddied by poor compliance and enforcement.

IV A CRITICAL EXAMINATION OF THE LAWS GOVERNING GROUNDWATER ABSTRACTION IN BANGLADESH

A *Constitutional Approach*

A bundle of fundamental principles of state policy[70] and fundamental rights[71] has been enumerated in Part II and Part III respectively of the *Constitution of the People's Republic of Bangladesh* (the '*Constitution'*). However, nowhere in the *Constitution* unlike that of South

[66] Chowdhury and Rasul (n 6); *World Bank Report* (n 58) 26.
[67] *World Bank Report* (n 58) 26.
[68] See generally *National Water Policy 1999* (Bangladesh); *National Water Management Plan 2001* (approved in 2004) (Bangladesh); General Economics Division, Planning Commission, *Bangladesh: Unlocking the Potential-National Strategy for Accelerated Poverty Reduction* (Planning Commission, 16 October 2005) 87-91; *World Bank Report* (n 58) 48.
[69] Nelson and Quevauviller (n 13) 177-8; Patra, Adhikari and Kunar (n 13).
[70] See the *Constitution of the People's Republic of Bangladesh 1972* (Bangladesh) *(*the *'Constitution'*) arts 8-25. These are 'principles' as distinguished from 'laws' and as such, they are not judicially enforceable, see Mahmudul Islam, *Constitutional Law of Bangladesh* (Mullick Brothers, 2nd ed, 2002) 54. However, these principles have special value as they are fundamental to the governance of Bangladesh; are applied in the making of laws; are taken as a guide in interpreting the Constitution and other laws of the country; and they form the basis of the work of the State and of its citizens, see the *Constitution* art 8(2).
[71] See the *Constitution* (n 70) arts 26-47A. These rights are judicially enforceable, see the *Constitution* arts (n 41) 44, 102(1).

Africa, has a right to water been recognised.[72] Even initially the *Constitution* that was adopted in 1972 was not concerned with the protection and preservation of the environment and biodiversity. The judiciary has, however, endeavoured on different occasions to interpret the right to life in a way so as to include the protection and preservation of the ecology and the right to a pollution-free environment.[73] The Court has consistently interpreted various constitutional provisions to give a legal colour and enforceable strength to the right to a clean environment that essentially covers water resources.[74] At last, in 2011 the *Constitution* was amended giving formal recognition of the need for protection and improvement of the environment and biodiversity.[75] This national state policy enshrined in the *Constitution* reinforces the need to preserve and safeguard, among others, the natural resources and wetlands that have long been pressed by the Court.

Even so, considerable constitutional uncertainty persists in relation to the preservation of water resources inasmuch as this is a mere recognition of the need to take steps to protect this natural resource that is not judicially enforceable.[76] Indeed, this constitutional vacuum leaves room for the Bangladesh judiciary to trigger the government to take appropriate legislative measures for the protection of groundwater resources by way of issuing suitable directives,[77] which the Court has been doing sparingly for quite some time to improve the diverse areas of the environment.[78] Accordingly, chapter 5 expands this issue of judicial action with the aim of assessing the scope and potential of the Court in relation to groundwater sustainability in Bangladesh.

Despite this constitutional uncertainty, there has been a progressive introduction of the *Groundwater Management Ordinance 1985*, the *Bangladesh Water Act 2013* and the *Groundwater Irrigation Management Act 2018* as the key legislative instruments in Bangladesh regulating groundwater withdrawal. The *National Water Policy*, however, as noted sets the guiding principles for groundwater laws and regulations. Accordingly, any

[72] See the *Constitution of Republic of South Africa 1996* (South Africa) ch 2 s 27 that has explicitly recognised a right to have access to sufficient water. Constitutions of other jurisdictions like India also encourages the State to undertake appropriate policy to preserve the material resources of the community; see the *Constitution of India 1950* (India) art 39(b). The *Constitution of the Federal Democratic Republic of Ethiopia* in art 40(3) specifically mentions that all natural resources including water, are 'a common property of the Nations, Nationalities, and People's of Ethiopia'; see also Reta Hailu, Degefa Tolossa and Getnet Alemu, 'Water Institutions in the Awash Basin of Ethiopia: The Discrepancies between Rhetoric and Realities' (2018) 16(1) *International Journal of River Basin Management* 107, 112.
[73] See chapter 5(IIC).
[74] Hassan and Saha (n 56) 271.
[75] Article 18A was incorporated in the *Constitution* in 2011 which reads 'The State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wildlife for the present and future citizens.' Though this article is included in Part II under the banner of 'Fundamental Principles of State Policy', which is not judicially enforceable, it, nevertheless, presses the government to take effective steps to protect natural resources and it further gets the judiciary armed with jurisdiction to pass more effective environment-protective orders.
[76] The *Constitution* (n 70) art 8(2).
[77] Ibid 102(2).
[78] See chapter 5(IIC)(III).

analysis of the effectiveness of the legislative instruments must also take into account the overarching policy objectives.

B *National Water Policy 1999: A Significant Step?*

The *National Water Policy*[79] is considered here as it is the foundation or at least aspires to be the foundation of the legal framework. In evaluating the merits of the framework, it is also necessary to consider how the legal framework matches up to the *Water Policy*. The adoption of the *Water Policy* marked a new era for the water sector of Bangladesh. The absence of a clear national water policy caused significant damage to the water resources of the country.[80] Realisation of the finite nature of the resource prompted the government to adopt this policy for its exploration, development, and use to satisfy the needs of all users.[81]

One of the main objectives addressed in the *Water Policy* relating to the management of groundwater is the use and development of groundwater in an efficient and equitable way.[82] The *Water Policy* emphasises the conjunctive use of groundwater and surface water for irrigation and urban water supply[83] that has the potential to play a significant role in protecting groundwater quantity.[84] It also underscores the development and dissemination of technologies for the conjunctive use of rainwater, groundwater, and surface water.[85] The *Water Policy* also highlights the preservation of natural depressions and water bodies in major urban areas for recharging underground aquifers.[86] Given that Bangladesh is a riverine country,[87] to mitigate pressure on groundwater resources the *Water Policy* suggests the development of water resources of the major rivers for multipurpose use such as irrigation, fisheries, forestry, and aquatic wildlife.[88] The government can regulate the extraction of water in the identified scarcity zones to protect the rechargeable shallow groundwater aquifers.[89]

More importantly, the *Water Policy* underscores the adoption of measures to increase water efficiency in irrigation, including drainage-water recycling, rotational irrigation, use of water-conserving crop technology, and conjunctive use of surface and groundwater.[90] It also prescribes crop diversification programmes across the country to ensure efficient water

[79] *National Water Policy 1999* (Bangladesh) (*'Water Policy'*)
[80] Ibid Forward.
[81] Ibid Preface.
[82] Ibid s 3.
[83] Ibid s 4.7.
[84] Insa Theesfeld, 'Institutional Challenges for National Groundwater Governance: Policies and Issues' (2010) 48(1) *Ground Water* 131, 135.
[85] *Water Policy* (n 79) s 4.15.
[86] Ibid s 4.6.
[87] Bangladesh is one of the largest deltas of the world crisscrossed by more than 230 rivers, see chapter 2(VII).
[88] *Water Policy* (n 79) s 4.2.
[89] Ibid s 4.3.
[90] Ibid s 4.7.

utilisation.[91] Additionally, the *Water Policy* proposes to introduce appropriate financial incentives for water re-use and conservation, responsible use of groundwater, and for preventing overexploitation and pollution.[92] Another significant strength of the *Water Policy* relates to the recommendation for developing a central database and management information system to accumulate better data on the existing hydrological systems, supply and use of national water resources, water quality, and the eco-system.[93]

With respect to institutional settings, the *Water Policy* underlines the importance of robust coordination among the existing institutions and the need for reform and the creation of new community-based institutions.[94] It further considers the adoption of a framework for institutional reforms that needs to be reviewed periodically for the refinement of institutional roles with changing needs and priorities.[95] The *Water Policy* names the National Water Resources Council, the Executive Committee of the National Water Resources Council, and the Water Resources Planning Organisation as the principal bodies for developing and implementing appropriate policies and plans for improved water management of the country.[96] In relation to the legislative framework, the *Water Policy* acknowledges the need for appropriate law to implement the water policy. Additionally, to tackle the contemporary challenges it stresses the required changes and amendments of related laws and regulations.[97]

Despite the positive features of the *Water Policy* outlined above, it suffers significant weaknesses. It has, for instance, failed to consider climate change as a threat to the water sector of Bangladesh.[98] Climate change has the potential to adversely affect the hydrological cycle, and it is most likely to alter the timing, magnitude, and duration of precipitation events — which could significantly shake the sustainability of the water supply.[99] Though the *Water Policy* has considered water as an economic resource and has proposed the imposition of water pricing to convey its scarcity value,[100] in the absence of concrete principles this scarcity value may find difficulty at the implementation level.[101] Albeit the *Water Policy* has acknowledged the importance of its periodical review and revision, this commitment has to date been rhetorical. Since its introduction in 1999, the *Water Policy* has not seen any review or revision whereas a country like India has revised its national water policy three times since its introduction in 1987, with the latest one being in 2012.[102]

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[91] Ibid.
[92] Ibid s 4.14.
[93] Ibid s 4.15.
[94] Ibid s 5.
[95] Ibid.
[96] Ibid.
[97] Ibid s 6.
[98] Hassan and Saha (n 56) 273.
[99] Ibid 281.
[100] *Water Policy* (n 79) s 4.14.
[101] Chadwick and Datta (n 60) 9.
[102] Philippe Cullet and Sujith Koonan, *Water Law in India: An Introduction to Legal Instruments* (Oxford University Press, 2017) 92-3.

Further, the *Water Policy* has not drawn a clear map as to how the compartmentalisation of the water sector will be unified. More strikingly, it has failed to underscore the need for water resource assessment to be undertaken scientifically and reviewed at a periodic interval. In particular, the *Water Policy* has not adequately addressed problems associated with groundwater resources such as mapping the aquifers to determine the quantum and quality of the resource, undertaking artificial recharging projects, and community-based management of aquifers. The *Water Policy* is also silent in relation to the importance of the Water Users' Associations. Moreover, it does not recognise and encourage the promotion of customary laws that form part of traditional wisdom and practices on water management.[103] More importantly, it does not explain how industrial and agricultural groundwater use would be substantively regulated, that is, by metering and/or the setting of quotas (volumetric limit on a licence) or by other regulatory measures.

In summary, the *Water Policy* has both strengths and weaknesses in relation to groundwater extraction. It recognises the value of groundwater as well as the need for its protection. In particular, it acknowledges the vital role of law and institutions in solving groundwater issues along with the structural solutions that have hitherto been the dominant approach of Bangladesh.[104] The *Water Policy* has, nonetheless, failed to provide a clear map for the effective regulation of this precious invisible resource, thereby leaving the legal framework without any substantial guidelines to achieve groundwater sustainability.

C *Groundwater Management Ordinance 1985*

The *Groundwater Management Ordinance*[105] was replaced by the *Groundwater Irrigation Management Act 2018* that essentially reproduced the earlier Ordinance with very minor changes. The following analysis of the *Groundwater Ordinance*, therefore, also represents an examination of the strengths and weaknesses of the *Groundwater Irrigation Management Act 2018.* Generally speaking, the *Groundwater Ordinance* was a welcome initiative by the government in recognising and seeking to address a perceived problem before it turned into a deep crisis. At the same time, it also miserably failed to address some of the most crucial problems identified, not least compliance and enforcement remained a stumbling block with the *Ordinance*.

The two central substantive legal provisions introduced in the *Groundwater Ordinance* were the requirement for a groundwater licence and the introduction of a sub-district level committee to approve the licences. Under the *Groundwater Ordinance*, a licence was

[103] Donna Craig and Elizabeth Gachenga, 'The Recognition of Indigenous Customary Law in Water Resource Management' (2010) 20(5/6) *Water Law* 278, 279.
[104] Chadwick and Datta (n 60) 9.
[105] *Groundwater Management Ordinance 1985* (Bangladesh) *('Groundwater Ordinance')*.

required for the installation of an irrigation well.[106] An application for a licence was required to be made to the Upazila Parishad (Sub-district Council) in a prescribed form along with the required fee.[107]

Under the *Groundwater Irrigation Management Act 2018* (further discussed below), the application fees for the licence of the irrigation wells that are to be deposited at the time of application are as follows: BDT 500 (approximately USD$ 5.90) for 2-cusec capacity deep tubewell; BDT 400 (approximately USD$ 4.72) for 1.5-cusec capacity deep tubewell; BDT 300 (approximately USD$ 3.54) for 1-cusec capacity deep tubewell; BDT 200 (approximately USD$ 2.36) for both 0.5-cusec deep tubewell and all types of shallow tubewells.[108] Under the same 2018 Act, upon approval of his licence application, an applicant requires to pay licence fee — BDT 3000 (approximately USD$ 35.41) for deep tubewell and BDT 1000 (approximately USD$ 11.80) for shallow tubewell.[109] A licence so granted remains valid for three years from the date of granting unless previously cancelled,[110] and the same can be renewed through an application with fees prescribed for an original licence application.[111]

The application was to be accompanied by documents showing, *inter alia*: the location of tubewells (both shallow and deep) around the command area of the proposed tubewell; the exact location of the installation site of the tubewell applied for; and the area to be irrigated by the proposed tubewell.[112]

An institutional innovation adopted in the *Groundwater Ordinance* was the formation of the Upazila (sub-district) Irrigation Committee (the 'Committee') consisting of four members: the Upazila Agricultural Officer; the Upazila Engineer; the Upazila Rural Development Officer; and a responsible Officer of the Bangladesh Agricultural Development Corporation who would act as secretary of the Committee.[113]

In relation to a licence application, the Committee was required to submit a report to the Upazila Parishad for its consideration after holding a local enquiry. The report had to state: the aquifer condition of the soil where the tubewell was to be installed; the area likely to be benefited by the tubewell; and the possible effect on the existing tubewells, including tubewells used for domestic purposes.[114] Finally, the Upazila Parishad had to be satisfied that the installation of the proposed tubewell would be beneficial to the areas for which it was to

[106] Ibid s 5(1).
[107] Ibid s 5(2)(3).
[108] *Groundwater Irrigation Management Rules 2019* (Bangladesh) r 4(3) ('*Groundwater Rules'*).
[109] Ibid r 6(2).
[110] Ibid r 9(1).
[111] Ibid r 9(2).
[112] *Groundwater Management Rules 1987* (Bangladesh) r 4(2)(a) *('Groundwater Rules 1987')*.

[113] *Groundwater Ordinance* (n 105) s 4; *Groundwater Rules 1987* (n 79) r 3(1).

[114] *Groundwater Ordinance* (n 105) s 5(4).

be installed and would not have any adverse effect upon the surrounding area. If these elements were satisfied then the Upazila Parishad had powers to grant the licence applied for, subject to such conditions and for such time, as would be specified.[115] This licence, however, was only required to construct wells, and it was not concerned with the volumetric withdrawal of groundwater. Another feature of the *Groundwater Ordinance* was that all existing unlicensed tubewells were required to be licensed[116] within six months from the commencement of the Ordinance.[117] The licence was liable to be suspended[118] or cancelled[119] if conditions were violated by the licensee.

Another unique feature of the *Groundwater Ordinance* was that public or private agencies or individuals dealing with tubewells were prohibited from providing wells to a person who did not have a valid licence under the *Ordinance*.[120] The *Groundwater Management Rules 1987* made under the *Groundwater Ordinance* went further by setting the spacing criteria between tubewells. The Rules prescribed tubewell distances: 2500 feet (762 meters) between two deep tubewells; 1700 feet (518.16 meters) between a deep tubewell and a shallow tubewell; and 800 feet (243.84 meters) between two shallow tubewells.[121]

While the *Groundwater Ordinance* introduced a groundwater licence and approvals system, these positive features of the Ordinance were undermined by its failure to provide for a metering regime to control groundwater pumping. The mere introduction of a permit system without a metering requirement — that did not regulate volumetric withdrawal and was concerned with the construction of well only — did little to advance sustainable groundwater irrigation. Indeed, under such a legal arrangement, a licence holder can extract as much water as s/he can. Legislative recognition of water metering could better sensitise the water users about their rights and obligations, thereby encouraging them to perform their respective obligations under the law.[122] In addition, the *Groundwater Ordinance* did not oblige the licensee to furnish a report, on an annual basis or otherwise, that states the amount of water that is extracted. This type of information is needed to facilitate the effective monitoring of groundwater quantity.[123] In particular, such reporting by the licensee has the potential to allow the water managers to recognise critical situations, and undertake the appropriate intervention.[124] Indeed, this legislative gap substantially weakens the effort of the government to achieve an important policy goal — establishing a robust central database on the use of national water resources.

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[115] Ibid s 5(5).
[116] Ibid s 6.
[117] *Groundwater Rules 1987* (n 112) r 12.
[118] *Groundwater Ordinance* (n 105) s 7.
[119] Ibid s 8.
[120] Ibid s 9.
[121] *Groundwater Rules 1987* (n 112) sch 1.
[122] See chapters 2(VA2), 6(IIB).
[123] See chapter 2(VA).
[124] See chapter 2(VA1).

Further, the *Groundwater Ordinance* ignored the involvement of farmers in regulating groundwater irrigation. Given the localised nature of groundwater access, community bodies like a Water User Association or Local Farmers' Association could make a significant contribution to the improvement of groundwater conservation.[125] More importantly, the *Groundwater Ordinance* failed to enumerate the duties and liabilities of farmers in relation to groundwater use for agriculture, that is, for example, penalties for non-compliance with the licence. Ideal groundwater legislation tends to comprehensively address the responsibilities of groundwater users to ensure they are aware of what can and cannot be done under the law and specifies actions to protect this precious resource.[126]

Given the abundant rainfall in Bangladesh, the *Groundwater Ordinance* should have incorporated provisions with respect to rainwater harvesting to support conjunctive water use. Thus, one of the policy objectives articulated in the *Water Policy* — conjunctive use of rainwater, groundwater, and surface water — remains on paper only without being reflected in the legislative instrument.

On the whole, the *Groundwater Ordinance* was the first legislative step in regulating groundwater irrigation more effectively. Yet, due to its inability to address the underlying issues such as water metering for controlling volumetric water withdrawal, community involvement, and well interference, the *Groundwater Ordinance* largely failed to curb unsustainable groundwater irrigation.

D *Groundwater Irrigation Management Act 2018: Old Wine in a New Bottle?*

The *Groundwater Irrigation Management Act*[127] was passed on 28 January 2018 following a judgment delivered by the Appellate Division of the Supreme Court of Bangladesh declaring the martial law regime unconstitutional. As a result, the *Constitution (7th Amendment) Act 1986* was repealed, which meant that the *Groundwater Ordinance* lost its legal efficacy. Following these constitutional upheavals, a vacuum prevailed in relation to the regulation of groundwater irrigation in Bangladesh. Hence, the previous statute was re-enacted with negligible changes.[128] The *Groundwater Irrigation Management Rules 2019*[129]

[125] Y Jadeja et al, 'Managing Aquifer Recharge and Sustaining Groundwater Use: Developing a Capacity Building Program for Creating Local Groundwater Champions' (2018) 4(2) *Sustainable Water Resources Management* 317, 317-8; Bryan Bruns, 'Community Priorities for Water Rights: Some Conjectures on Assumptions, Principles and Programmes' in BCP van Koppen, Mark Giordano and John Butterworth (eds), *Community-Based Water Law and Water Resource Management Reform in Developing Countries* (CABI, 2007) 28-29.
[126] See chapter 2(VA1).
[127] *Groundwater Act* (n 18).
[128] Ibid Preamble.

[129] *Groundwater Rules* (n 108).

made under the 2018 Act also reproduced the equivalent *Groundwater Rules 1987* provisions with only very minor changes.

The *Groundwater Rules* has made a series of minor improvements to the composition and functions of the Upazila Irrigation Committee. The Committee would now comprise eight Upazila level officers and includes an innovation — a representative of the local farmers' association.[130] Further, three technical members were to be included; this is an improvement given that issues around groundwater irrigation involve substantial technical matters that need to be dealt with by technically skilled individuals.[131] The *Groundwater Rules* has also marginally increased the spacing distance between tubewells — prescribing the following distances: 800-meters between 2 cusec capacity tubewells; 690-meters between 1.5 cusec capacity tubewells; 600-meters between 1 cusec capacity tubewells; and 500-meters between 0.5 cusec tubewells.[132]

1 *A Critical Analysis of the Groundwater Act*

The *Groundwater Act* was only passed in 2018 and, indeed, there has been only very limited implementation of its provisions in practice. As there is very little commentary on the legislation, the views expressed in this section are based on a primary analysis of the legislative provisions themselves.

It is acknowledged that the emerging groundwater irrigation problems are much more complicated than they were a few decades ago, and the factors that led to the adoption of groundwater regulation have evolved significantly since 1985. Even so, the government in 2018 has still failed to come up with comprehensive legislation for effective and efficient regulation of groundwater irrigation in Bangladesh to address contemporary challenges. Essentially, the *Groundwater Act* still has at its core the establishment of the State's control over the use of groundwater by requiring the registration of existing tubewells.[133] However, by only requiring the registration of existing tubewells, without further local inquiry, the *Groundwater Act* has grandfathered the prevailing over-extraction of groundwater and thus has not effectively addressed the unsustainable groundwater irrigation. Put differently, the *Groundwater Act* has not taken stock of situations where there is already severe water scarcity — and accordingly, it has failed to lay out effective measures to tackle the existing over-extraction of groundwater.

One weakness of the *Groundwater Act* with very direct impacts relates to the spacing settings of the wells. These spacings have proved to be inappropriate based on the recent research

[130] *Groundwater Act* (n 18) s 4; *Groundwater Rules* (n 108) r 3.

[131] For instance, making a proper assessment on the aquifer condition of the soil requires technical skills; see *Groundwater Act* (n 18) s 5(5)(a).

[132] *Groundwater Rules* (n 108) sch 1.
[133] *Groundwater Act* (n 18) s 6.

conducted in relation to tubewell distance. A new study suggests that in floodplains the distance between wells should be in the range of 2.5-2.95 km and in the Barind Tract — an agriculturally important arid region in the northwest of the country — the same should be between 1.4-2 km.[134] Floodplain areas are adjacent to a stream or river and are characterised by shallow depressions and small ridges that are almost entirely flooded during the monsoon. In contrast, the Barind is dissected and undulating land which represents a series of fault blocks at the basement with low infiltration capacity.[135]

Further, the *Groundwater Act* has failed to name or create a single institution with a general mandate to control and regulate groundwater irrigation across the country. In addition, it does not provide an effective mechanism to ensure coordination between the different institutions dealing with groundwater irrigation. Although the *Groundwater Act* has established the Upazila Irrigation Committee to perform specified functions, neither the *Groundwater Act* nor the *Groundwater Rules* has detailed the central or regional authority to which this committee is responsible for its decision-making. This legislative omission stands in the way of establishing meaningful coordination between the central and local water agencies that seriously impacts the achievement of common goals in relation to sustainable groundwater irrigation. Issues around responsibility, accountability, and transparency are generally unaddressed in the latest *Act*. Additionally, public participation — as examined in chapter 2(VA1) — is a *sine qua non* for enacting robust groundwater legislation. While Constitutions of some countries notably South Africa require public involvement in the lawmaking process[136] no such requirement is in place in the *Bangladesh Constitution*. The first legislative instruments for water — the *Groundwater Ordinance* and subsequently the *Groundwater Act* — ignored the importance of public participation in managing groundwater irrigation.

Despite all these shortcomings, the *Groundwater Act* could be a starting point for the stronger regulation of groundwater irrigation in Bangladesh. In particular, the formation of the Upazila Irrigation Committees is a step forward towards substantive regulation of groundwater irrigation, and more broadly for ensuring groundwater sustainability. The spacing settings prescribed by the *Groundwater Act*, if enforced, could, to some extent, control indiscriminate groundwater irrigation.[137] It has, however, failed to introduce a metering regime to regulate the groundwater irrigation of the country.

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[134] GS Sattar et al, 'Interference and Inefficiency of Water Wells: A Constrain of Water Conservation in Bangladesh' (2017) 23(2) *ISH Journal of Hydraulic Engineering* 220, 224.
[135] Ibid 221.
[136] Karen Syma Czapanskiy and Rashida Manjoo, 'The Right of Public Participation in the Law-Making Process and the Role of Legislature in the Promotion of This Right' (2008) 19 *Duke Journal of Comparative and International Law* 1, 1-2. In the case of *Doctors for Life International v Speaker of the National Assembly and Others* (2006) 12 BCLR 1399 the South African Constitutional Court held that the South African Constitution requires public participation in the legislative process.
[137] Sattar et al (n 134) 220.

E *A Close Look at the Bangladesh Water Act 2013*

Although the *Water Policy* articulated the urgent necessity of comprehensive water legislation, it took more than a decade for the *Bangladesh Water Act*[138] to emerge. The *Water Act*, grounded on the *Water Policy*, was enacted for the integrated development, management, extraction, distribution, usage, protection, and conservation of water resources in Bangladesh.[139] After five years of silence, the government adopted the *Bangladesh Water Rules*[140] in 2018, with the objective of providing detailed provisions for the implementation of the *Water Act*.[141] Noteworthy strengths of the *Water Act* in relation to groundwater sustainability include the introduction of licensing system, safe yield determination for aquifers, the formation of various local level water committees, and the declaration of water stress areas. In contrast, telling weaknesses of the *Act* include its failure to set a volumetric limit of groundwater withdrawal, centralised functioning of the apex water bodies, and a lack of specific obligations of groundwater users in relation to the protection of groundwater resources, that in turn, significantly limit the capacity of the legal framework to address depletion issues.

As stated, the positive features of the *Water Act* include introducing an approvals system for the installation of tubewells for pumping groundwater.[142] A licence application must be accompanied by a fee prescribed by the Water Resources Planning Organisation.[143] This fee is yet to be fixed. A licence granted under this Act is valid for two years from the date of issuance, and in the water stressed area this validity period is reduced to one year.[144] In appropriate cases a tubewell licence may be suspended or cancelled.[145] It remains unclear whether a licence granted under the *Water Act* is renewable. Some exceptions, however, are accorded to this licensing system. Hand-pumped tubewells — be it shallow or deep — used for abstracting groundwater to meet the drinking water and other household demands do not require a licence to operate. In the same vein, shallow tubewells within the range of 0.5 cusec capacity that are used for groundwater irrigation, are put outside the purview of the licence approvals system.[146] Moreover, all existing tubewells that are not accorded exemptions are required to be licensed for extracting groundwater.[147] Again, however, like the *Groundwater Act*, this permit system controls only the construction of wells and does not extend to regulate the amount of water to be extracted under a licence.

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[138] *Water Act* (n 19).
[139] Ibid Preamble.
[140] *Bangladesh Water Rules 2018* (Bangladesh) ('*Water Rules'*).
[141] Henceforth the term '*Water Act*' will also include the '*Water Rules*' in appropriate cases.
[142] *Water Rules* (n 140) r 30.
[143] Ibid r 31(3).
[144] Ibid schedule (Forms 7-7.4).
[145] Ibid r 31(8)(11).
[146] Ibid r 29.
[147] Ibid r 32.

The *Water Act* prioritises the use of water for drinking and sanitation over all other uses.[148] Indeed, this legislative water use priority paves the way to the realisation of a new emerging human right to water in Bangladesh.[149] This approach will rapidly move Bangladesh along the path toward sustainable development since human rights and sustainable development are interwoven.[150] Ultimately, this unique legislative development would encourage the country to adopt appropriate measures to ensure groundwater sustainability such that a right to water is guaranteed for all. A further strength of the *Water Act* relates to vesting all rights over groundwater resources, on behalf of the people, in the State.[151] This legislative provision can be interpreted in light of the public trust doctrine.[152] That doctrine implies that groundwater resources are held by the State in trust, and are not amenable to ownership either by the State or communities or individuals.[153] Additionally, the *Water Act* prohibits any person or organisation from undertaking any activities that may stop or obstruct the natural flow of any watercourse or divert the direction thereof.[154] This is a substantial legislative initiative since the natural flow of any watercourse makes a significant contribution to the replenishment of groundwater resources, and thus can play a vital role in its sustainability.[155]

Interestingly, a high-powered National Water Resources Council ('NWRC') has been formed under the *Act* to ensure integrated, equitable, and sustainable management, development, and utilisation of water resources.[156] More than a dozen ministers and state-ministers, together with other important functionaries of the Republic, are members of the NWRC under the leadership of the prime minister.[157] On all accounts, this suggests that the government is finally giving due importance to the management of this precious resource. Management of all water resources has been entrusted to the Executive Committee of the NWRC ('ECNWRC'),[158] — formed under section 9 of the *Water Act* — that would invoke the public trust doctrine. The ECNWRC has powers of investigation and examination to fix the lowest safe yield level of any aquifer.[159] This safe yield determination could potentially ensure the

[148] *Water Act* (n 19) s 3(2); *Water Rules* (n 140) r 3.
[149] See generally Islam (n 31) 1-18.
[150] Waseem Ahmad Qureshi, 'The Emerging Human Right to Water in International and Domestic Law' (2017) 21 *University of Denver Water Law Review* 137, 142-4.
[151] *Water Act* (n 19) s 3(1).
[152] For a broader discussion on 'Public Trust Doctrine' see, eg, Joseph L Sax, 'The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention' (1970) 68(3) *Michigan Law Review* 471.
[153] Ibid 484.
[154] *Water Act* (n 19) s 20.
[155] David Walker et al, 'Insights From a Multi-Method Recharge Estimation Comparison Study' (2019) 57(2) *Groundwater* 245, 246; Marios Sophocleous, 'Interactions between Groundwater and Surface Water: The State of the Science' (2002) 10(1) *Hydrogeology Journal* 52, 53-4.
[156] *Water Act* (n 19) ss 4, 5.
[157] Ibid s 4.
[158] Ibid ss 9, 10, 12, 13, 15, 16, 17, 19, 20.
[159] Ibid s 19(1).

withdrawal of water from an aquifer without producing undesired results[160] that include groundwater depletion, quality damage, and the contravention of existing water rights.[161] To ensure the safe extraction of water from aquifers, the ECNWRC may impose necessary restrictions by issuing a protection order[162] that clearly states what activities can and cannot be undertaken in relation to an aquifer.[163] Compliance with such a promulgated protection order is mandatory. A violator runs the risks of imprisonment and compensation for causing any damage to an aquifer.[164] However, the *Water Act* has not explained how this safe yield would be determined.

More importantly, the District Integrated Water Resources Management Committee,[165] the Upazila (sub-district) Integrated Water Resources Management Committee,[166] the Union Integrated Water Resources Management Committee,[167] and the Technical Committee[168] constituted under the *Act* could play a significant role in improving the overall groundwater regulation. Figure 1 below shows summarily the bodies and committees constituted under the *Groundwater Act* and the *Water Act.* It highlights the main functions of each piece of legislation in relation to the protection of groundwater resources. A table encapsulating the functions, overlaps, and conflicts of these bodies and committees appears in Appendices (B2). The strength of these committees lies in the fact they are represented by a considerable number of technical people. For instance, the District Committee includes 12 technical

[160] DK Todd, *Groundwater Hydrology* (John Wiley and Sons, 1959) 336; Paul Seward, Yongxin Xu and Luc Brendonck, 'Sustainable Groundwater Use, the Capture Principle, and Adaptive Management' (2007) 32(4) *Water SA* 473, 473; Larry W Mays, 'Groundwater Resources Sustainability: Past, Present, and Future' (2013) 27(13) *Water Resources Management* 4409, 4414.

[161] Yangxiao Zhou, 'A Critical Review of Groundwater Budget Myth, Safe Yield and Sustainability' (2009) 370(1–4) *Journal of Hydrology* 207, 209; however, as seen in chapter 2(IIIC), this safe yield concept has been criticised for its limited scope. For example, it ignores the discharge of groundwater from the aquifer into a stream, spring, or seep.

[162] *Water Act* (n 19) s 19(4).

[163] *Water Rules* (n 140) r 38(2).

[164] *Water Act* (n 19) s 27(3).

[165] *Water Rules* (n 140) r 14; functions of the District Water Management Committee include identifying challenges and opportunities for sustainable management of district water resources; developing a water resources database; and ensuring the integrated development of water resources.

[166] *Water Rules* (n 140) r 15; functions of the Upazila Water Management Committee include identifying challenges and opportunities for sustainable management of Upazila water resources; developing a water resources database; maintaining communication with the Distract Committee and the Water Resources Planning Organisation (WARPO); and ensuring the integrated development of water resources.

[167] *Water Rules* (n 140) r 16; functions of the Union Water Management Committee include identifying challenges and opportunities for sustainable management of union water resources; developing a water resources database; maintaining communication with Upazila and District Committees and the WARPO; and ensuring the integrated development of water resources.

[168] *Water Rules* (n 140) r 21; functions of the Technical Committee include preparing technical reports in relation to water resources development projects upon the assessment of, among other things, their potential impact on flowing rivers or canals or water bodies.

members,[169] and in the same vein, the Upazila Committee and the Union Committee include 10 and six technical members respectively.[170]

Indeed, local level committees formed under the *Water Act* in association with the local government bodies could undertake necessary measures for the protection of groundwater resources at the aquifer level. Given the localised nature of groundwater resources, their protection measures should be initiated locally by the local government bodies.[171] An aquifer, for instance, located entirely within a union — the lowest tier of the local government — is under the direct control of the Union Water Management Committee. Accordingly, the Committee is well placed to adopt necessary steps to protect an aquifer. If an aquifer, on the other hand, happens to fall within the jurisdiction of two unions, the Upazila Water Management Committee could facilitate the coordination of the planning process between two unions sharing the aquifer. By bringing together water related local bodies, aquifer level protection measures indeed advance integrated water resources management and planning in that this type of protection promotes the coordinated development and management of water.

In a substantial move, the *Water Act* requires holding a public hearing to elicit opinions of the communities and organisations concerned with water resources in order to formulate an effective and efficient National Water Policy.[172] Indeed, these legal provisions highlight and recognise the relevance, significance, and necessity of community-engagement in groundwater governance which has been well documented in groundwater literature.[173]

Another point of importance is that on the basis of the result of an enquiry, scrutiny, or survey the ECNWRC may issue a compliance order with a view to protecting, among other things, the groundwater resources.[174] Further, the ECNWRC is empowered to issue a removal order for infrastructure, or landfilling materials or elements which obstruct the normal flow of the watercourse.[175] The ECNWRC is also empowered to impose any restriction with a view to ensuring the natural flow of any watercourse.[176] This provision could significantly contribute to the protection of groundwater resources given that the unobstructed flow of the

[169] *Water Rules* (n 140) r 14(2).
[170] Ibid rr 15(2), 16(2).
[171] Cullet (n 15) 75.
[172] *Water Act* (n 19) s 8 (2).
[173] See, eg, Taha M Taher, 'Groundwater Abstraction Management in Sana'a Basin, Yemen: A Local Community Approach' (2016) 24(6) *Hydrogeology Journal* 1593; Taha Taher et al, 'Local Groundwater Governance in Yemen: Building on Traditions and Enabling Communities to Craft New Rules' (2012) 20(6) *Hydrogeology Journal* 1177; Cameron Holley and Darren Sinclair, 'A New Water Policy Option for Australia?: Collaborative Water Governance, Compliance and Enforcement and Audited Self-Management' (2014) 17(2) *Australasian Journal of Natural Resources Law and Policy* 189.
[174] *Water Act* (n 19) s 12.
[175] Ibid s 13.
[176] Ibid s 20 (2).

watercourse offers substantial help in recharging groundwater,[177] promoting groundwater sustainability.[178]

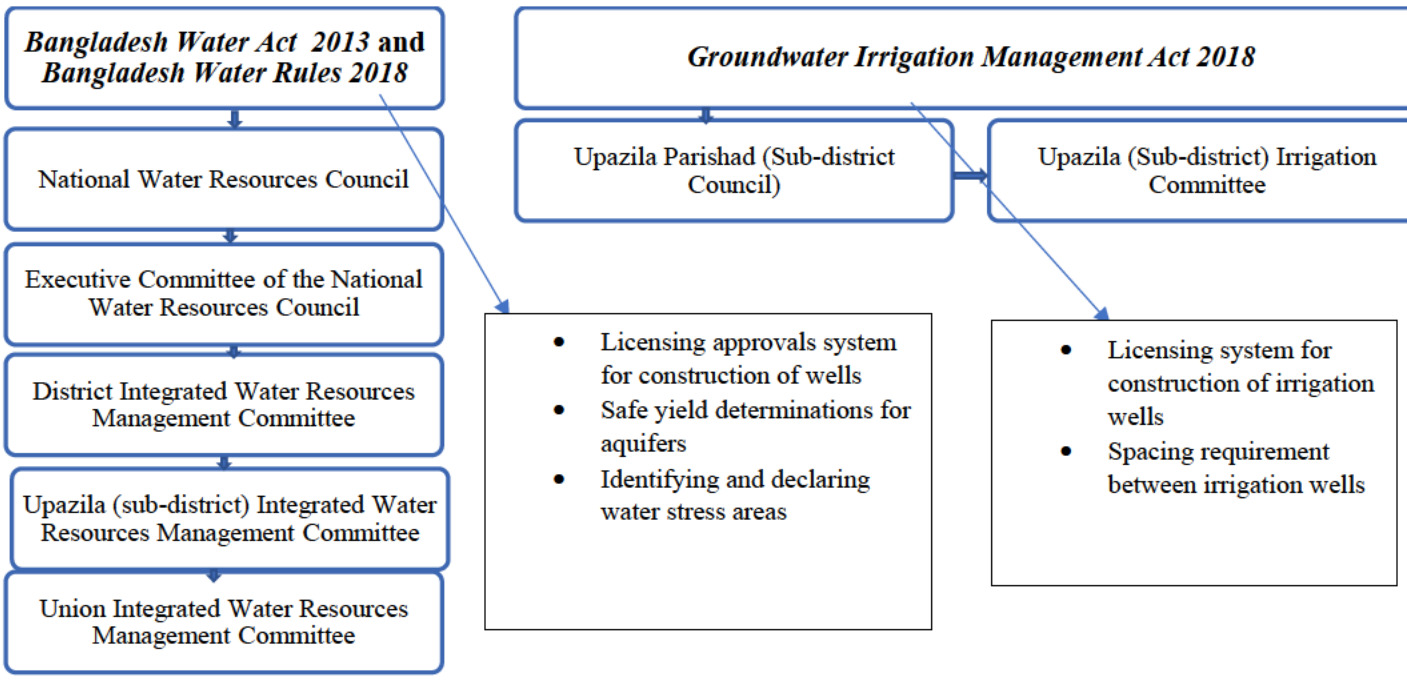

Figure 1 shows different water bodies and committees constituted under the *Water Act* and the *Groundwater Act*.

Another unique feature of the *Water Act* is that on the basis of necessary enquiry, scrutiny, or survey, to protect any water source or an aquifer, the Government may declare any area or any part thereof or any land connected thereto with water resources as a Water Stress Area for a certain period.[179] Accordingly, appropriate management strategies could be undertaken to protect the aquifers of those areas.[180] In addition to the formulation of short-term and long-term management options, the *Water Act* encourages collaborative action — based on consultation with the local people — to identify the possible pathways to overcome water stress.[181] Further, the ECNWRC is empowered to pass any protection order directed to any

[177] Thomas C Winter, 'Relation of Streams, Lakes, and Wetlands to Groundwater Flow Systems' (1999) 7(1) *Hydrogeology Journal* 28, 29.

[178] Nepal C Dey et al, 'Sustainability of Groundwater Use for Irrigation of Dry-Season Crops in Northwest Bangladesh' (2017) 4 *Groundwater for Sustainable Development* 66, 67, 75; Z Zomlot et al, 'Spatial Distribution of Groundwater Recharge and Base Flow: Assessment of Controlling Factors' (2015) 4 *Journal of Hydrology: Regional Studies* 349, 349.

[179] *Water Act* (n 19) s 17(1).

[180] *Water Rules* (n 140) rr 26, 27.

[181] Ibid r 27. In literature balancing water supply-demand, water infrastructure development, demand side management and numerical groundwater modelling measures have been suggested to manage water stress; see, eg, Soojun Kim et al, 'Sustainable Development of Water Resources: Spatio-Temporal Analysis of Water Stress in South Korea' (2018) 10(10) *Sustainability* 3795; Salvador del Saz-Salazar et al, 'Managing Water Resources Under Conditions of Scarcity: On Consumers' Willingness to Pay for Improving Water Supply Infrastructure' (2016) 30(5) *Water Resources Management* 1723; Simon Guy, 'Managing Water Stress: The Logic of Demand

individual or appropriate authority for the conservation of any dighi (large-sized pond), pond, or any other similar water source as a source of potable water or for the conservation of a haor,[182] baor,[183] or any other similar water source for seasonal birds to stay or move safely and to keep their sanctuary safe.[184] This legislative provision acknowledges the obvious connection between groundwater and surface water and their resulting influence on each other — a fact which is now clearly discernible thanks to the advancement of science and technology.[185]

Additionally, the *Water Act* in line with the *Water Policy* requires the development of a reliable water resources database.[186] This would further improve and strengthen the National Water Resources Data, which is to be maintained and updated by the Water Resources Planning Organisation ('WARPO') — principal water institution.[187] Indeed, properly collected water data is the foundation for compliance, enforcement, and sustainable water management.[188]

Notwithstanding these positive features, the centralised functioning of the NWRC and the ECNWRC constituted under the *Water Act* significantly limits the effectiveness of these committees. Albeit, some local level committees have been formed under the *Water Act*, these committees are neither linked to the NWRC nor the ECNWRC nor the WARPO.[189] Consequently, the *Water Act* has taken a heavily top-down approach to regulate the water resources of the country, and the committees formed under the *Water Act* are quite disconnected, with the central water institutions ignoring the need for coordination across water agencies. Such an approach, indeed, belies the policy objective articulated in the *Water Policy* that underscores the need for community engagement and meaningful coordination among the water institutions.

Even so, the *Water Policy* and the *Water Act* have stressed community engagement in developing water policy and other related instruments.[190] In advancing and securing people's participation in the water management of Bangladesh, the government has embarked on a milestone by adopting '*Guidelines for Participatory Water Management'*.[191] The objectives

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Side Infrastructure Planning' (1996) 39(1) *Journal of Environmental Planning and Management* 123; Mohamed El Alfy, 'Numerical Groundwater Modelling as an Effective Tool for Management of Water Resources in Arid Areas' (2014) 59(6) *Hydrological Sciences Journal* 1259.

[182] 'Haor' means any saucer shaped large shallow depression created naturally in-between two separate rivers; see *Water Act* (n 19) s 2(35).

[183] 'Baor' means any kind of ox-bow shaped lake where water course has become stagnant in course of time; see *Water Act* (n 19) s 2(22).

[184] *Water Act* (n 19) s 22.

[185] Winter (n 177).

[186] *Water Rules* (n 140) r 52 (1).

[187] Ibid r 4.

[188] See chapter 2(VB1).

[189] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018). A detailed account of interviews has been provided in Appendices (DE).

[190] *Water Policy* (n 79) ss 4.4, 4.16; *Water Rules* (n 140) s r 6(5).

[191] *Guidelines for Participatory Water Management 2000* (Bangladesh).

of the Guidelines include an increase/improvement of stakeholder participation in water management and conferment of decisive voice upon the local stakeholders at all stages of water management.[192] Despite this promising policy development, the policymakers of Bangladesh often sidestep public participation on the ground of poor literacy. There is a tendency among the policymakers that uneducated rural people have nothing to contribute to the development of law and policy.[193] Additionally, they are often unwilling to share their authority with the public.[194] Further, interview data (discussed in Part VIA) reveals that this requirement of public participation[195] largely remains on paper and is hardly followed as a matter of practice. As a result, community involvement is largely absent in groundwater regulation in Bangladesh.

Like the *Groundwater Act*, the *Water Act* has failed to enumerate the duties and liabilities of water users in general and groundwater users in particular. For example, large-scale users could be obliged to ensure the conservation of the resource, take measures for recharge, practice recycling, and reuse, etc.[196] Apart from agricultural irrigation, industrial sectors are exerting increasing pressure on groundwater resources.[197] Instead of taking any step towards the sustainable use of groundwater resources this sector has hitherto treated water as an infinite resource.[198] Poor or almost absent regulation has worsened the situation.[199] Therefore, the *Water Act* at least should have laid down the duties and liabilities of industrial owners, commercial, agricultural, or other bulk groundwater users. In addition to an authorisation requirement for the abstraction of groundwater for industrial, commercial and other bulk uses, there should be provisions for appropriate groundwater pricing.[200] Additionally, water legislation in many countries is increasingly recognising the need for groundwater recharging through, among others, rainwater harvesting and water body preservation.[201] In many parts of the world, significant policy attention is being paid to artificial aquifer recharge to keep groundwater systems healthy and sustainable.[202] But this aquifer recharging issue is missing in the *Water Act*.

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[192] Ibid 2-3.
[193] Suzanne Hanchett, 'Participation and Policy Development: The Case of the Bangladesh Flood Action Plan' (1997) 15(3) *Development Policy Review* 277, 286. The current literacy of Bangladesh is recorded as 72.9%; see Bangladesh Bureau of Statistics (BBS), *Monthly Statistical Bulletin-Bangladesh* (BBS, October 2018).
[194] Hanchett (n 193) 280.
[195] See chapter 2(VA1) for how public participation influences groundwater sustainability.
[196] Philippe Cullet, 'Model Groundwater (Sustainable Management) Bill, 2017: A New Paradigm for Groundwater Regulation' (2018) 2(3) *Indian Law Review* 263, 274; see also *Model Groundwater (Sustainable Management) Bill 2017* (India) ch VII *('Indian Groundwater Bill')*.
[197] See chapter 2(VIII).
[198] Thomas Sagris and Justin Abbott, 'An Analysis of Industrial Water Use in Bangladesh with a Focus on the Textile and Leather Industries' (2030 Water Resources Group, May 2015) v.
[199] Ibid.
[200] Cullet (n 196).
[201] Ibid; see also *Indian Groundwater Bill* (n 196) ch VII.
[202] See, eg, Robert G Maliva, *Anthropogenic Aquifer Recharge: WSP Methods in Water Resources Evaluation Series No 5* (Springer, 2020); David Walker et al, 'Insights From a Multi-Method Recharge Estimation

Another significant weakness of the *Water Act* relates to its failure to create groundwater protection zones and adopt groundwater-specific security plans. By creating such protection zones and undertaking such security plans short-term and long-term aquifer-protection measures could be taken.[203] While protection zones are set up to protect aquifers — especially recharge zones — from specific threats and foster groundwater sustainability, security plans concern the sufficient quantity of safe water for life and livelihoods.[204] While it is heartening to note that the *Water Act* contains provisions for the declaration of water stress areas and management thereof,[205] these provisions are not clear as to how aquifers would be protected, and what security plans are in place to ensure the sufficient quantity of water to meet domestic needs. Comprehensive provisions with respect to groundwater protection zones and security plans are needed.

Further substantial weakness of the *Water Act* relates to permitting the unlimited abstraction of privately-owned water sources,[206] which could significantly affect the groundwater regulation across the country by reducing the amount of water available for recharge. More strikingly, the *Water Act* fails to set a maximum limit of groundwater withdrawal either at the catchment or regional level. Without setting an overall limit, many of the other measures will not be effective. Thus, one of the core functions of groundwater law is to manage groundwater quantity by setting limits on total extraction to achieve certain objectives,[207] and it is missing in the *Water Act*. Another noticeable shortcoming concerns the lack of transparency and accountability provisions in relation to the public servants working in this sector. While modern water legislation underscores the need for transparency and accountability in the water sector,[208] such requirements remain to be resolved in the water sector of Bangladesh.[209] Transparency provisions encourage public officials to take more effective measures towards the protection of resources.[210] A final weakness of the *Water Act* relates to the absence of provisions for dispute resolution. Ideally, water legislation should deal with the resolution of disputes among competing users, as much as possible at the local

Comparison Study' (2019) 57(2) *Groundwater* 245; Adriana Palma Nava, Fernando J González Villarreal and Angélica Mendoza Mata, 'The Development of a Managed Aquifer Recharge Project with Recycled Water for Chihuahua, Mexico' (2018) 4(2) *Sustainable Water Resources Management* 371; Jadeja et al (n 125).

[203] Theesfeld (n 84) 135; Cullet (n 196) 273; *Indian Groundwater Bill* (n 196) ch V.

[204] Cullet (n 196) 273; *Indian Groundwater Bill* (n 196) ch V.

[205] *Water Act* (n 19) s 17; *Water Rules* (n 140) rr 26, 27.

[206] *Water Act* (n 19) ss 3(3), 26. The *Water Act* makes an exception that rights over the surface water on any private land remain with the owner of such land. This exception, however, runs counter to the assertion of state ownership of all water resources.

[207] Nelson and Quevauviller (n 13) 177.

[208] See chapter 2(VA1).

[209] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).

[210] Ibid.

level through mediation and conciliation.[211] Indeed, suitable dispute resolution mechanisms are critical for water regulation.[212]

In summary, the enactment of the *Water Act* was a groundbreaking legislative step for managing groundwater resources in Bangladesh. By vesting the ownership of groundwater resources in the State on behalf of all citizens, the *Act* obliges the government to undertake appropriate measures for the protection of this finite resource. The formation of the National Water Resources Council and different local level committees demonstrates that, if made functional, these council and committees could significantly resolve the groundwater crisis the country is confronting today. Legal provisions concerning the declaration of water stress areas and the determination of the lowest safe yield of aquifers are certainly a breakthrough in trying to prevent further groundwater depletion. A range of measures such as issuing protection orders, compliance orders, removal orders, and prohibitive orders to address particular situations are obviously promising to limit activities that may pose threats to groundwater resources. These positive features of the *Water Act* are, however, blurred by its telling weaknesses. Centralised functioning of the National Water Resources Council; a missing connection between national level and local level water agencies; and a failure to prescribe the core obligations of the groundwater users significantly limit the capacity of the *Water Act* to curb unsustainable groundwater extraction. More importantly, the *Water Act* has failed to address issues around the sustainable limit of groundwater extraction, thereby permitting different users to pump groundwater indiscriminately. Indeed, these shortcomings undermine the core objective of the *Water Policy* that concerns the development of groundwater in an efficient and equitable way, thereby creating significant barriers to achieve groundwater sustainability.

V AN EMPIRICAL INVESTIGATION INTO THE GAPS OF THE EXISTING LEGAL FRAMEWORK

The preceding sections reveal that laws were absent in Bangladesh to regulate groundwater abstraction until 1985. With the adoption of the *Groundwater Ordinance* in 1985 for the first time 'law on books' surfaced. However, this paper law had some palpable weaknesses, not least it did not envisage any metering regime to control groundwater withdrawal. The *Water Policy*, the *Water Act,* and the latest *Groundwater Act* all have remarkable deficiencies in regulating groundwater pumping. As seen below, compliance and enforcement pose a daunting challenge in the groundwater regulation of Bangladesh. This section aims to combine the preceding legislative analysis with the empirical data obtained from the interviews to identify general deficiencies of the current legal framework in governing groundwater extraction.

[211] See chapter 2(VA1).
[212] Theesfeld (n 84) 138.

A *Groundwater Cursorily Addressed*

Part IV reveals that the *Water Act* — the principal legislative instrument — has not paid due attention toward the conservation of groundwater resources. Only one section ie 19 is dedicated to dealing with the groundwater resources. A significant failure of the current laws is that they do not obligate landowners to take appropriate protection measures at the aquifer level. This is ascribed to the fact that landowners are not legally required to participate at broader aquifer-level measures that address both groundwater quality and quantity concerns. Thus, the legal framework remains unclear as to how to bring the landowners sharing an aquifer under the same platform for cooperation or to provide a foundation for local government agencies to take effective measures for the protection of the common resource and its multiple shared benefits.[213]

Aligned with this legislative analysis the vast majority of the interview respondents (80%) also noted that groundwater issues were poorly addressed by the legal rules. They observed that legal tools were rather more concerned with surface water than groundwater. Interviewed judges (100%), however, had the clearest majority taking this view, followed by the interviewed policymakers (86%) and scholars (67%). Perhaps, this gap was more noticeable to judges owing to the role they played every day — trying similar types of cases in an environmental jurisdiction. Interestingly, respondents from policymakers significantly agreed that the legal framework largely sidestepped the issues around groundwater resources. As one interviewed policymaker noted, 'I think we are having some laws in relation to the water resources; but my impression is that those laws have rather focused on surface water.'[214] A similar view was expressed by an interviewed scholar who stated, '…..I mean we are more concerned about surface water, obviously, groundwater is not in our minds, that is very clear….'.[215] Respondents also noted that compared to other types of water, groundwater was used more, yet it received less policy attention.[216] In the result, they suggested incorporating a separate chapter on groundwater resources in the *Water Act* detailing, among other things, how its sustainable abstraction could be ensured.[217]

As far as the *Water Policy* was concerned, the general observation of the respondents was that it did not draw a clear map as to how sustainable abstraction of groundwater could be ensured. Over half of the respondents (52%) noted that the policy emphasised the conjunctive use of surface and groundwater, but it did not lay out any plan for achieving this stated goal. They also pointed out that no implementation mechanism was tailored to protect groundwater resources. As one respondent commented, '…...you see good statements/good thoughts are included in the policy as much as possible, but nothing is planned for their

[213] Cullet (n 196) 263.
[214] Interview with GO 2, Government Official (Mohammad, Dhaka, 30 January 2018).
[215] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[216] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[217] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018.

implementation….'. He further explained, 'We know that the mere good law and policy don't work and solve your problem unless you have good implementation mechanism in hand…'. And eventually, he concluded that these laws and policies were not so much valuable as they should have been.[218]

B *Absence of Metering Mandate*

Analysis of the existing laws reveals that currently there is no metering mechanism to regulate groundwater abstraction. A metering instrument is one generally applied across the globe to regulate groundwater abstraction, especially for industrial and agricultural use.[219] In the Barind region of Bangladesh a prepaid (pay-as-you-go) smart metering system has been introduced to regulate groundwater irrigation,[220] — a system that has largely been acclaimed in the water literature.[221] However, there is no legislative recognition of this metering arrangement in Bangladesh.

Having noted that the legal instruments including the latest *Groundwater Act* and the *Water Act* did not mandate water metering, interview respondents in principle, advocated for a metering regime to ensure economical and rational use of groundwater, thereby achieving more sustainable extraction thereof. To be precise, 88% of professional respondents supported metering regimes in groundwater irrigation while 56% of groundwater users advocated for it. Respondents were almost unanimous (96%) in supporting a metering regime to regulate industrial groundwater use. One interviewed policymaker noted, '…..to be honest, we don't know how much groundwater is used by the industries across the country; there is no accounting, there is no accurate data….'.[222] Another respondent termed this unaccounted groundwater use by the industries as 'outrageous'.[223]

Respondents, however, significantly differed on the feasibility of metering regimes for household/domestic groundwater use. In principle, they agreed with metering in all metropolitan areas; and referring to the success of the metering regime in the capital city one respondent asked for the immediate introduction of it in all other metropolitan cities.[224] In principle, respondents opposed the use of a metering tool in the rural areas largely on the ground that domestic groundwater use was very low compared to other uses, and the country was not equipped with technology to introduce and monitor metering in the remote areas of the country.[225] A vast majority of groundwater users (around 80%) rejected the metering regime as a means to control rural domestic groundwater use arguing, among other reasons,

[218] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[219] See chapter 2(VA2); the rationale for the need of water metering is discussed in detail in chapter 6(IIB).
[220] See Chapter 4(IVC).
[221] Xiaowei Wang et al, 'Implementing the Prepaid Smart Meter System for Irrigated Groundwater Production in Northern China: Status and Problems' (2017) 9(6) *Water* 379, 380.
[222] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).
[223] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).
[224] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[225] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).

that they installed tubewells by themselves without government aid, and they were paying electricity bills to run their pump for abstracting groundwater. These findings suggested the introduction of metering regimes for industrial, agricultural, and domestic groundwater use in metropolitan areas, and accordingly, respondents recommended the incorporation of comprehensive legal provisions in the existing laws governing groundwater withdrawal.

C *Legislative Vacuum for Capping*

In simple terms, a cap is the maximum ceiling of water that can be withdrawn within a region per year.[226] More broadly, greater efficiency, innovation, and public outcomes are intended to be achieved through this cap-and-trade scheme.[227] In the context of Bangladesh, water trading may not be feasible right now[228] (further explained in chapter 6(IIC)), but setting the maximum groundwater withdrawal limit should be considered at least to reign in the groundwater pumping by the industries. As one respondent commented, 'We are still 50 years behind, so at the moment we cannot think of it (water trading). Because still, the concept in vogue in Bangladesh is that water is a free good, water is abundant; it's not true, so slowly society goes for it'.[229]

In Dhaka and other parts of Bangladesh, the number of industries is increasing exponentially in an unplanned way.[230] Increased water demand from industrial sectors especially from textiles puts this precious resource at substantial risks of depletion. The indiscriminate use of groundwater has the potential to trigger land subsidence as well as to lower the water table.[231] A lack of any significant metering and/or any effective regulatory mechanism encourages the industrial sector to use groundwater in such a lavish and reckless manner.[232] Capping in association with metering, therefore, could bring in new practices and behaviors around water use and water efficiency in industrial sectors.[233]

Consistent with these concerns, there was a general agreement among the respondents that a cap was needed to regulate industrial groundwater use. Indeed, an overwhelming 96% of professional respondents suggested that strict capping regimes were to be introduced to control industrial groundwater use. Additionally, respondents proposed higher water prices

[226] Gordon Mitchell and Adrian McDonald, 'Developing Resilience to England's Future Droughts: Time for Cap and Trade?' (2015) 149 *Journal of Environmental Management* 97, 100.
[227] Cameron Holley and Darren Sinclair, 'Governing Water Markets: Achievements, Limitations and the Need for Regulatory Reform' (2016) 33(4) *Environmental and Planning Law Journal* 301, 303; Erik Gómez-Baggethun and Roldan Muradian, 'In Markets We Trust? Setting the Boundaries of Market-Based Instruments in Ecosystem Services Governance' (2015) 117 *Ecological Economics* 217, 217.
[228] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).
[229] Interview with S 3, Academic (Mohammad, Dhaka, 7 February 2018).
[230] See chapter 2(VIII).
[231] 'Massive waste of water in RMG sector, Adopt water efficiency measures', *The Daily Star* (online, 23 September 2017) <http://www.thedailystar net/editorial/massive-waste-water-rmg-sector-1466182> *('The Daily Star')*.
[232] Sagris and Abbott (n 198).
[233] Ibid vii.

for industries compared to those of agricultural and domestic use. Currently, industries pay a mere BDT 0.0326 (USD$ 0.00038) for a litre of water.[234] Further, they recommended the decentralisation of industries to mitigate pressure on the groundwater of any particular region. Some respondents suggested putting industries under an obligation to arrange at least 50% of their total water demand from a surface source.[235] Notably, all policymakers strongly agreed on the introduction of capping in the industrial sector. Putting it mildly, a policymaker stated, '……we don't exactly know how much water is being used by the industrial sector. I guess there is no data, accounting with respect to water consumption in this sector…..'.[236]

However, respondents considerably differed in relation to capping for groundwater irrigation. The majority of interviewed judges (67%) supported capping for groundwater irrigation arguing that irrigation became heavily groundwater-dependent, and this valuable resource was needed to be used sustainably. Therefore, capping could be one of the effective ways to ensure the sustainable abstraction of this precious resource. On the other hand, a handful of interviewed judges (33%) opposed the capping system as part of groundwater regulation in the irrigation sector. Their main concern with this system was grounded on the notion that it would take away the morale of the poor farmers. Consequently, they would be unwilling to grow crops, and eventually, the agriculture across the country would collapse threatening food security.[237] Of policymakers, 60% opposed the capping system to regulate groundwater irrigation. They reasoned that agriculture being the backbone of the country's economy provided food security for the entire nation which was most likely to be adversely affected if this system was ever introduced. Additionally, these respondents felt the adoption of licensing and metering regimes would drive the farmers to use groundwater more wisely and cautiously. Most importantly, the country was not equipped with sophisticated technology to introduce and monitor capping mechanisms across the country.[238] In contrast, 40% of policymakers favoured the capping regime for groundwater irrigation showing the same reasons advanced by the judges who supported it.

Scholars were equally divided on the capping issue in relation to groundwater irrigation. Scholars opposing the capping system put forward the same grounds advanced by the interviewed judges and policymakers standing against this system for groundwater irrigation. One of the respondents termed this capping for irrigation as 'politically impossible' and 'practically ridiculous' given that millions of farmers dispersed across the country and politics was actively connected with it.[239] In the same vein, scholars advocating for the capping system to be introduced in the agricultural sector echoed similar reasons articulated by the judges and policymakers who supported capping in this sector.

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[234] *The Daily Star* (n 231).
[235] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).
[236] Interview with GO 2, Government Official (Mohammad, Dhaka, 30 January 2018).
[237] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).
[238] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).
[239] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).

Interestingly, all interviewed farmers vehemently opposed the capping tool in relation to groundwater irrigation. They argued that they were paying for groundwater, and they did not waste water in any way. They further explained that they wanted to use surface water, but due to its unavailability, they were obliged to pump groundwater. They suggested that the government should create more water bodies to make surface water available round the year for their irrigation.

In summary, the majority of the respondents stood against the capping tool in relation to groundwater irrigation. Given that millions of farmers are scattered across the country, the introduction of a capping tool appears to be unrealistic. Moreover, around 70% of the total population are dependent on agriculture for their livelihood,[240] and agriculture makes a significant contribution to the national gross domestic product.[241] Presumably, capping will adversely affect the mental strength of the poor farmers, thereby discouraging them from farming crops. Ultimately, this will cause a severe blow to the country's food security. Perhaps, all these concerns influence the policymakers not to embark on the initiation of this tool. Rather one of the respondents from this category preferred to go slowly when embracing this system.[242] It is not surprising then that all respondents from the farmer group stood firmly against the introduction of this mechanism. Respondents, in principle, suggested comprehensive legal provisions pertaining to capping to effectively regulate industrial groundwater use across the country. Respondents were, however, unanimous that a capping regime was not relevant at all for domestic groundwater use given that less than 10% of groundwater was used to meet the domestic needs.[243]

D *Sectoral Responsibilities Not Delineated*

Thirty-five public organisations under 13 different ministries are directly or indirectly responsible for the implementation of water policy.[244] This section, in contrast to chapter 4(II) — which discusses institutional practice in relation to groundwater protection which is not directly linked to groundwater laws — highlights the fact that the law does not clearly delineate responsibilities among water institutions. It is imperative that water legislation clearly allocates duties, powers, and functions among water institutions.[245] Indeed, successful implementation of groundwater laws requires that connected water institutions must have clearly defined responsibilities that are well-matched with the aquifer system.[246] Sectoral

[240] Animesh K Gain, Carlo Giupponi and David Benson, 'The Water–Energy–Food (WEF) Security Nexus: The Policy Perspective of Bangladesh' (2015) 40(5/6) *Water International* 895, 897.
[241] Sumaiya Jarin Ahammed et al, 'Assessment of Changing Pattern of Crop Water Stress in Bangladesh' [2019] *Environment, Development and Sustainability* 1, 2.
[242] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).
[243] Shubhra Bhattacharjee et al, 'Groundwater Governance in Bangladesh: Established Practices and Recent Trends' (2019) 8 *Groundwater for Sustainable Development* 69, 73.
[244] See chapter 4(II).
[245] See chapter 2(VB).
[246] Theesfeld (n 84) 138.

responsibilities often remain vague and polysemic where different authorities are required to work together,[247] leading to the implementation deficits that ultimately undermine the legal framework.

Respondents identified the weakness of the laws in delineating responsibilities for Bangladeshi water institutions. One respondent termed these responsibilities as 'segmented and fragmented'.[248] Referring to the *Water Act* adopted by the Ministry of Water Resources and the *Groundwater Act* developed by the Ministry of Agriculture, respondents pointed out the double statutes on the same subject matter (groundwater) that had the effect of debilitating groundwater management in the country.[249] Alluding to the fragmented responsibilities of the agencies another respondent noted that the Water Resources Planning Organisation looked at the water quantity whereas the Department of Environment was responsible for water quality, the Ministry of Agriculture was regulating groundwater irrigation and the Ministry of Industries and the Ministry of Jute and Textiles were using groundwater on their own. There was no collaboration among them which was completely messy.[250] These isolated and uncoordinated responsibilities of the water institutions created more problems than solutions. As one respondent commented, '…I do not understand what the exact responsibilities of water ministry, environment ministry, agriculture ministry, and ministry of industries are in relation to the management of groundwater resources….'.[251] A small portion of respondents (24%) noted that the *Act* and *Policy* were rather silent with respect to the responsibilities of the relevant agencies in relation to groundwater regulation. Interestingly, a significant number of policymakers (71%) acknowledged this vagueness of the law and suggested clarification. One policymaker, however, argued that delineation of responsibilities was not possible beforehand, rather he underscored the concerted efforts of all agencies for the implementation of water law.[252]

E *Conflicting Provisions of Law*

The existing water laws have stark clashes with each other in relation to the groundwater regulation of the country. For instance, definitions of deep tubewell and shallow tubewell provided by the *Groundwater Act* and the *Water Act* significantly differ from each other. While the *Groundwater Act* sets the seven-meter vertical distance between the centrifugal pump and the pumped water level as a distinguishing mark for deep tubewell and shallow tubewell, the *Water Act* has not recognised such a number as the determining factor for these

[247] Ibid.
[248] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[249] Interview with GO 8, Government Official (Mohammad, Dhaka, 29 February 2018).
[250] Interview with J 4, Judge (Mohammad, Dhaka, 19 February 2018).
[251] Interview with J 2, Justice (Mohammad, Dhaka, 1 March 2018).
[252] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).

two types of wells.[253] Another potential clash relates to the licence requirement and exemption. While the *Groundwater Act* requires a licence for the installation of irrigation tubewell (be it deep tubewell or shallow tubewell)**,**[254] the *Water Act* accords an exemption to 0.5 cusec capacity shallow tubewell to have 'no objection' from the appropriate authorities to extract groundwater.[255] Furthermore, under the *Groundwater Act,* the Upazila Parishad is the competent authority to issue a licence for the installation of irrigation tubewell,[256] whereas under the *Water Act* the 'no objection' issuing authority is either the Upazila Committee or the Zila Committee or the WARPO depending on the capacity of the wells.[257] As a result, this legal framework has set up a dual administration for the self-same matter that stands in the way of effective regulation of groundwater irrigation.

Interviewees also stressed these obvious conflicts of laws. As one interviewed policymaker somberly said, '….when you have a parallel licence issuing authority, you wait to witness disaster in the water sector……who will control water extraction? Law is enacted to solve a problem, but here the law is enacted to create a problem….'.[258] Another respondent directly stated, '….even we don't have a uniform definition of a well. How poor, haphazard, and inconsistent our water laws are! How will our laws solve water problems when they cannot solve as simple matter as a well definition…'.[259] In the end, interviewees suggested immediate resolutions of these obvious gaps in laws.

Indeed, clashes and overlaps among water laws have devastating effects on groundwater sustainability in various ways. First, these provisions leave the responsible water institutions confused as to their exact responsibilities — what, when, and how to act in ensuring sustainable abstraction of groundwater resources. Second, and equally, conflicts and overlaps among water laws create confusion and uncertainty among the groundwater users in relation to appropriate steps to be taken by them in furtherance of groundwater sustainability. Finally, these legislative anomalies place a significant barrier on setting a common goal in relation to groundwater sustainability, thereby impeding the implementation of targeted plans and strategies.

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[253] According to the *Groundwater Act* 'shallow tubewell' means a tubewell that is operated by a centrifugal pump coupled with a prime mover but only capable of pumping water when the vertical distance between the centrifugal pump and the pumped water level depth is within 7 metres; 'deep tube well' means a tubewell that is operated by a submersible pump set or turbine pump coupled with a prime mover capable of pumping ground water when the pumped water level depth is more than 7 metres; see *Groundwater Act* (n 18) s 2(a)(d). On the other hand, according to the *Water Rules* 'shallow tubewell' means such a tube-well which by a centrifugal pump coupled with a prime mover can pump water from underground water layer in suction mode; 'deep tubewell' means such a tubewell which by a submersible pump set or turbine pump coupled with a prime mover can pump water in force mode; see *Water Rules* (n 140) r 19(a)(b).

[254] *Groundwater Act* (n 18) s 5.

[255] *Water Rules* (n 140) r 29(1)(a).

[256] *Groundwater Act* (n 18) s 5.

[257] *Water Rules* (n 140) r 30.

[258] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).

[259] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).

In short, a legislative vacuum in relation to water metering and capping requirements, failure to delineate institutional responsibilities, and conflicting provisions between the *Water Act* and the *Groundwater Act* are the major deficiencies in the prevailing legal framework that significantly limit its capacity to curb unsustainable groundwater withdrawal. Beyond these defects of groundwater law themselves, there are other challenges that concern the implementation of these laws. Drawing on interview data the following Part turns to identify the barriers to the implementation of laws governing groundwater extraction.

VI AN EMPIRICAL INSIGHT INTO THE (IN)ACTION OF GROUNDWATER LAW

Fragmented water law systems are prevalent in most developing countries where they do not make any visible difference to the situation that they are governing.[260] Domestically implementing groundwater laws is challenging — enforcement is often fraught with difficulties or it becomes nearly impossible if the laws and regulations do not appreciate the on-the-ground scenario. Additionally, implementation remains elusive where implementing agencies lack the capacity to monitor and enforce compliance with the law or where the incident of non-compliance has been ingrained into the social culture of tolerance.[261] Many of the forty-three policymakers, scholars, judges, and groundwater users interviewed about groundwater laws in Bangladesh for this thesis, viewed the adoption of the *Water Act* and the *Groundwater Act* as a step forward towards more effective groundwater regulation. However, they remained concerned about the substance of these laws as well as their implementation. They argued that the mere adoption of the law would not change the situation unless it was effectively and comprehensively implemented. Adoption of the law is the first step to solve a problem, but the major challenges lie in its implementation.[262] Interviewees identified the following barriers to successful implementation.

A *Poor Processes for Adopting Groundwater Law*

Respondents generally considered the ambiguity in laws and the manner of their adoption in Bangladesh as a barrier to compliance and enforcement. Judges were, however, more vociferous about this issue. All interviewed judges noted that the law was required to be clear and understandable for effective compliance and enforcement. As one respondent commented, ‘Being a judge I sometimes falter to understand the core message of the

[260] Gupta and Dellapenna, ‘The Challenges for the Twenty-First Century: A Critical Approach’ in Joseph W Dellapenna and Joyeeta Gupta (eds), *The Evolution of the Law and Politics of Water* (Springer, 2009) 390-408.
[261] Chaisemartin et al (n 10) 218.
[262] Cullet (n 196) 276.

provisions of law. Then think what general people would do? You need to present the contents of law in a very simple way so that everyone understands it'.[263]

A significant body of respondents (88%) identified the absence of public participation as a core factor producing inefficient laws, and consequently, poor compliance. Again, judges (100%) topped all other groups concerning public participation. They commented that public participation remained absent in framing laws in general, and water law in particular. They cautioned that the mere adoption of the law would not protect groundwater unless people were engaged in the lawmaking process.[264] The vast majority of scholars (92%) also noted that public participation in making water law was virtually absent rendering a law of this category ineffective and inefficient. As one respondent directly stated, '….in our country laws are made behind closed doors, nobody knows when a law is initiated and adopted. I mean, the stakeholders are not consulted before making a law; their interests are not considered rather the interests of the authorities are actively considered….'.[265] Another respondent termed the law as the 'sweet will' of the authorities where public concerns were largely ignored.[266] A considerable body of policymakers interviewed (71%) reflected the concerns of these two respondents by conceding that stakeholders were not consulted before enacting water laws. As one respondent in this category commented, 'To be honest, stakeholders are not consulted in letter and spirit before enacting a law'.[267] Acknowledging public participation as a condition precedent for the successful implementation of water law, one respondent termed the state of public participation 'very poor and hopeless'.[268] These concerns expressed by this group of professional respondents were confirmed by the groundwater users, who all bluntly stated that they were never consulted before a water law was enacted. As one respondent claimed, 'We never know when a water law is adopted by the government….this is the first time I am hearing about it...'.[269] Another respondent angrily said, '…….some people sitting in the air-conditioned room are making laws to regulate agriculture who have no involvement with irrigation at all; how will this law be effective?'[270]

In short, public participation is very limited in Bangladesh with respect to the lawmaking process in general, and water law in particular. A large number of respondents doubted if public opinions were reflected at all in the law. Compared to judges, more scholars (67%) raised concern if people's expressed views were incorporated in the final publication of the law. All policymakers except one, however, remained silent on this issue understandably given the role they were playing in shaping the water law and policy of the country. Claiming that some NGOs and others were invited to express their opinions in relation to a draft law,

[263] Interview with J 6, Judge (Mohammad, Chattogram, 7 March 2018).
[264] Interview with J 1, Justice (Mohammad, Dhaka, 28 February 2018).
[265] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[266] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[267] Interview with GO 8, Government Official (Mohammad, Dhaka, 29 February 2018).
[268] Interview with GO 4, Government Official (Mohammad, Dhaka, 12 February 2018).
[269] Interview with GU 8, Groundwater User (Mohammad, Rajshahi, 23 March 2018).
[270] Interview with GU 10, Groundwater User (Mohammad, Khulna, 2 April 2018).

the dissenting respondent from this group was not sure if their opinions were taken into consideration during the finalisation of laws like water law.[271]

In addition, some respondents also identified the lack of required fieldwork, ignorance of local customs, absence of multidisciplinary experts in the lawmaking process, and a failure to recognise the connection between law and science as major reasons for dysfunctional regulation. Highlighting the importance of science in adopting water law a respondent explained, 'You need to have proper sufficient scientific data before the enactment of a water law…. science is a must for water regulation. If the law/policy is not backed by science people would ignore it…'. [272]

B *Lack of Knowledge of Groundwater Law*

One group of interview respondents identified knowledge of the law as a vital factor for compliance and enforcement. They differentiated knowledge of law among the responsible government officials from that of the general population, with judges regarded as being in the top category with respect to requisite knowledge. Indeed, all judges pointed out ignorance and knowledge of the law as the strongest reason for non-compliance and it posed a significant barrier to the on-the-ground implementation of water law. As one interviewed judge noted, '…. most of the people break laws because of their ignorance……they don't know what to be and not to be done under a particular law….'.[273] Moreover, a significant portion of policymakers (86%) considered ignorance of law among the general population as one of the strongest setbacks to securing compliance with water law while 58% of scholars interviewed held a similar view.

Surprisingly, all groundwater users that were interviewed revealed that they were totally ignorant of groundwater law. This common response among groundwater users suggests that community awareness programs are hardly ever undertaken by the responsible authorities. Given the sorry state of knowledge of the groundwater users, respondents across all groups recommended holding workshops/seminars/awareness programs to build knowledge of the laws. They wanted the print and electronic media to take the lead and become involved in building community awareness of the problem. Some respondents suggested that research findings pertaining to the groundwater crisis should be presented to the Bangladesh community, and groundwater users in particular, to make them aware that a water crisis loomed large and, as such, the groundwater law was adopted for their betterment. In addition, an equal portion of (67%) of the interviewed judges and policymakers believed that responsible officers that were not well-acquainted with water law were slowing the compliance rate, while only 34% of interviewed scholars held the same view. These

[271] Interview with GO 5, Government Official (Mohammad, Dhaka, 26 February 2018).
[272] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[273] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).

responses indicate that responsible officers need to be trained and motivated to ensure they are well placed to implement compliance with the laws.

C *Absence of Effective Monitoring*

This section complements chapter 4(IIIC) that charts more broadly why a lack of monitoring is damaging for overall groundwater sustainability.[274] Many interview respondents identified monitoring as a vital element for effective implementation of groundwater laws, especially where measures such as regulatory controls are being adopted. But the interview data revealed that the current state of monitoring was very shaky and precarious. All interviewed judges and the vast majority of interviewed scholars (92%) attributed the lack of implementation of the laws by government officials to the poor monitoring system. Unsurprisingly, all groundwater users blamed the inertia of government officers for the poor adoption of a monitoring system. As one interviewed groundwater user bluntly stated, '……...we don't even know if any licence is required for the installation of this tube-well, and no government officials ever asked us to seek a licence in this regard. To date, no government official has visited our tube-wells….'.[275] Some respondents from groundwater users also raised the integrity of the responsible officers in relation to monitoring activities.[276]

Aligned with the view of these respondents, a large majority of the interviewed policymakers (86%) also noted that the negligence of the government officials led to a fragile monitoring system across the country with respect to compliance and enforcement. Respondents also identified the need for the general availability of data to support effective and efficient monitoring mechanisms. There was widespread agreement among the respondents (64%) that the availability of data with respect to groundwater resources was very poor and unsatisfactory, again contributing to the failure of compliance and enforcement. In particular, all interviewed policymakers acknowledged this problem, terming it a 'great setback' to regulating groundwater extraction across the country. Professional respondents also identified the centralised functioning of water institutions as an obstruction to effective monitoring. Around 50% of respondents suggested the decentralisation of water institutions like the Water Resources Planning Organisation was needed. Additionally, respondents considered resource constraints as a major obstruction to effective monitoring.

A significant body of respondents (68%) considered that lack of effective monitoring made the water law to function more as 'law on books' than 'law in action'. In particular, respondents noted that Bangladesh had some excellent pieces of legislation with respect to groundwater, but they were rarely implemented due to ineffective monitoring.[277] As one of

[274] Precisely this section is concerned with the role of monitoring in the implementation of groundwater law only.
[275] Interview with GU 4, Groundwater User (Mohammad, Rajshahi, 19 March 2018).
[276] Interviews with GU 1, GU 2, GU 8, Groundwater Users (Mohammad, Bangladesh, March 2018).
[277] Interview with GO 2, Government Official (Mohammad, Dhaka, 30 January 2018).

the interviewed policymakers explained, 'There is a plethora of laws in Bangladesh, but the problem is that law is hardly implemented on-the-ground. We are having some excellent pieces of legislation in relation to the water resources of the country, but unfortunately, these laws do not get implemented satisfactorily due to a lack of required oversight. I could tell you that the *Groundwater Management Ordinance 1985* (now repealed) was good law in relation to groundwater irrigation; but this law was hardly acted upon'.[278]

This implementation gap means that although groundwater is legally state property, practically it belongs to anyone who can put up a tubewell and pump it.[279]

D *Absence of Effective Coordination*

Coordination between institutions is further discussed in chapter 4(IIIB) focusing on the WARPO — a chief coordinating agency in Bangladesh.[280] Many respondents agreed that a lack of coordination among different water-related organisations was also an obstacle to effective compliance and enforcement. All interviewed judges reported that the state of coordination among responsible institutions was very poor. Some of them attributed the 'anarchy' in the water sector to tenuous coordination.[281] A majority of interviewed scholars (67%) considered this an obstruction to achieving the targeted compliance. Some of the interviewees commented that agencies involved in the water sector worked in an 'isolated' manner, while others noted that problems associated with groundwater resources would be substantially resolved if a strong coordination mechanism was developed. A smaller portion of policymakers (43%) commented on this issue, and while they acknowledged the problem, they felt precluded from offering further detail. As one respondent said, '…. unfortunately, the current coordination is not up to the mark. But being an official of the government, I am unwilling to share with you the level of non-coordination…'.[282]

E *Historic Lack of Groundwater Regulation*

Respondents identified the historical lack of groundwater regulation as a major blow to current compliance with, and enforcement of, groundwater law. Despite the legal recognition of groundwater as being a public good, users persist in treating it as being a private resource undermining the legal regulation.[283] The notion of private property right in groundwater often leads to overexploitation of the resource.[284] The majority of respondents among policymakers (57%) considered people's historical free access to water as a bar to secure compliance, while

[278] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).
[279] Interview with S 3, Academic (Mohammad, Dhaka, 7 February 2018).
[280] This section briefly integrates interview responses to show that a lack of coordination is a real barrier to compliance and enforcement.
[281] Interviews with J 1, J 3, Justices (Mohammad, Dhaka, February 2018).
[282] Interview with GO 5, Government Official (Mohammad, Dhaka, 26 February 2018).
[283] Mechlem (n 10) 27.
[284] Ibid.

42% of respondents from the category of scholars and 33% of interviewed judges held similar views. These respondents explained that Bangladeshi people had free access to groundwater from time immemorial and had never previously faced regulatory restrictions on its use, whether direct or indirect. This can be interpreted in terms of the historical context in which Bangladesh was depicted as a water-abundant country and, as such, no necessity existed to regulate groundwater extraction. Popular impressions that groundwater resources were plentiful — a view now understood to be wrong — also led them not to comply with water regulation. To illustrate this, 34% of groundwater user respondents viewed groundwater as infinite and, as such, declared that it would never be depleted. On the other hand, 66% of interviewed groundwater users, drawing on their life experiences, held the opposite view. These opposing responses suggest that compliance with the groundwater laws is considerably influenced by perceptions held about the sustainability of the resource.

Another factor of importance pointed out by the respondents is a 'compliance-habit'. Around 33% of each group of scholars and judges noted that the 'compliance-habit' of the people of Bangladesh was very poor, that is, people are not law-abiding by nature — they tend to break the law instead of respecting it. As one respondent commented, 'Some societies are compliant with the law, and some are not. Ours is not a law-compliant one. Here people generally tend to break the law…'.[285] Only 29% of policymakers that were interviewed raised this issue, they, however, explained it in another way, terming the water regulation as a 'new phenomenon' for Bangladesh. This group looked to an improvement in the people's participation in the entire water governance system and pinned their hope on the realisation of the importance and value of this scarce resource.[286]

Beyond these factors, other issues having a bearing on the implementation of groundwater laws, albeit less articulated, were also identified by the interviewees. A smaller portion of respondents (20%) mostly scholars, for example, blamed the ongoing political culture for non-compliance. As one respondent somberly stated, '….our country is dominated by vicious politics, bad governance and bad politics….people who are to enforce laws and people who are to set examples of compliance with the law themselves breach the law with impunity. This bad practice makes general people unwilling to comply with water law.'[287] A significant number of respondents (68%), mostly judges (83%) and scholars (67%), identified the 'uneven application of the law' as a major setback to compliance and enforcement. They reported that rich and politically influential people generally did not comply with water law as they faced no consequence for breach — people were treated differently under the law.[288] To another respondent, insufficient punishment triggered non-compliance. He explained that the incentives of groundwater overexploitation were higher than the fine/punishment, and a

[285] Interview with S 2, Academic (Mohammad, Dhaka, 4 February 2018).
[286] Interviews with GO 5, GO 7, Government Officials (Mohammad, Dhaka, February 2018).
[287] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[288] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).

non-compliant got a higher economic advantage at the end of the day vis-à-vis the consequences he faced for breach — a fine does not act as a deterrent.[289] Respondents (mostly judges 67%) also agreed that the compliance rate would dramatically rise if people could be made understand about the beneficial effect of the law on them — water law was adopted for their benefit. Realising this beneficial aspect of law one of the groundwater users put, 'If people are sensitised about the beneficial effect of law, I think they will comply with it despite the difficulties they might face in doing that'.[290]

Summary: Compliance and Enforcement

In summary, the interview data obtained in this study reveals that groundwater extraction is poorly regulated in Bangladesh. The related legislation has some major flaws, and groundwater users are ignorant of the existence of relevant laws and regulations. Ineffective monitoring worsens the situation, which is further compounded by the lack of coordination among the responsible institutions. Groundwater users' attitudes to law, together with a lack of a 'compliance-habit', add to the problems of inadequate implementation of groundwater law.

However, there are many ways to approach and understand these problems of compliance and enforcement of groundwater laws in Bangladesh. Of course, the identified problems of ignorance of the law, and a lack of monitoring and coordination do not exist in a vacuum. These challenges are embedded in a society where the legitimacy of groundwater regulations and authorities is arguably at a low ebb. As interview data reveals, the regulations are fairly recent in Bangladesh, and they are being applied to uses of groundwater that historically have been widely accepted. Most groundwater users believe that they are within their rights, they are farming their land, and they are abstracting their own groundwater. Thus, groundwater users challenge the legitimacy of the regulations. Additionally, economic pressure pushes agricultural and industrial groundwater users to generally flout laws. Social obligations within this community to encourage self-monitoring are largely absent. Moreover, power politics, political culture, and the capacity of interest groups to influence administrations are perennial in Bangladesh, and can significantly obstruct legislative and policy initiatives,[291] including groundwater regulations. Solving these problems will require further work to better understand groundwater as a social issue, including adopting hydro-social, behavioural, political, and other lenses for research, although this wider analysis is beyond the scope of this thesis.

[289] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[290] Interview with GU 11, Groundwater User (Mohammad, Khulna, 3 April 2018).
[291] Ferdous Arfina Osman, 'Bangladesh Politics: Confrontation, Monopoly and Crisis in Governance' (2010) 18(3) *Asian Journal of Political Science* 310, 310.

VII CONCLUSION

This chapter has answered the thesis sub-questions (a) and (b) pertaining to the viability of the current legal framework in ensuring sustainable abstraction of groundwater resources in Bangladesh. In doing so, the chapter has demonstrated that laws governing groundwater withdrawal in Bangladesh are characterised by both weaknesses and strengths where the downside, however, outweighs the positive counts. Indeed, groundwater has received very limited dedicated focus in Bangladesh's legal framework.

Of course, a legislative requirement of licensing for the installation of any tubewell with some exceptions is a considerable improvement that shows a new horizon for groundwater governance in Bangladesh. This permit system, it is hoped, would put the brakes on the indiscriminate construction of wells, thereby slowing groundwater pumping that in turn, would mitigate stress on groundwater supplies and systems. Additionally, the constitution of central and local level water council and committees can certainly strengthen the existing groundwater governance. In particular, the local water committees can potentially enhance community engagement in establishing inclusive groundwater governance and management across the country that would be more legitimate and sustainable. Finally, declaring water stress area and determining the safe yield of aquifers under the authority of law are undoubtedly groundbreaking legal development that allows the government to tighten its control on groundwater extraction. In essence, this legislative breakthrough facilitates the targeted executive action to curb overexploitation in an area that requires urgent attention.

These positive legislative features are, however, seriously jolted by the brazen weaknesses embedded in the existing legal framework governing groundwater abstraction. The chapter has shown that the permit system introduced by the legal rules, albeit promising, is still haphazard, vague, and unclear, not least dual administrations exist to regulate groundwater irrigation through the self-same licensing approvals system. In such a situation, irrigation farmers may get confused as to who is the appropriate licensing authority, and consequently, they are most likely to feel discouraged to apply for a well licence. Thus, this conflictive legal arrangement poses a significant threat to the effectuation of a licensing approvals system that aims to stop the wanton installation of irrigation wells. Moreover, the prevalent licensing system — the chapter has revealed — does not oblige a groundwater user to install water metering as part of licensing conditions. This legislative deficiency flies in the face of efforts directed at ensuring sustainable extraction of groundwater resources. To be specific, controlling volumetric withdrawal and collecting groundwater data that are prerequisites for effective groundwater governance are almost impossible without a metering regime. Hence, a permit system that ignores water metering is destined to fail to achieve groundwater sustainability. Finally, legislative failure to set the maximum limit of groundwater extraction especially for industrial sectors is a major blow to groundwater sustainability. In the absence of an appropriate capping, Bangladeshi industries especially leather and textiles, continue to deplete water tables at an alarming rate, thereby proving the groundwater laws a toothless

tiger. This significant legal lacuna allows the users to pump groundwater until the wells run dry.

Beyond these fatal gaps in groundwater laws themselves, drawing on interview data, the chapter has charted factors that inhibit compliance and enforcement, thereby rendering groundwater laws even more ineffective. A lack of legal knowledge pertaining to groundwater among the regulators and the regulatees, and a historic lack of groundwater regulation, *inter alia*, have been identified as major barriers to the successful implementation of legal rules governing groundwater pumping.

Inevitably, the legislative analyses conducted in this chapter lead to the conclusion that the prevailing groundwater laws are far from controlling unsustainable groundwater extraction in Bangladesh that warrants sweeping legal reforms. That said, the mere adoption of appropriate law will not change the situation unless their compliance and enforcement are secured. This groundwater implementation issue is largely dependent on the capacity and soundness of responsible water institutions.[292] Accordingly, the next chapter turns to examine the effectiveness of water institutions in relation to the sustainable abstraction of groundwater resources of the country.

[292] Dante Augusto Caponera and Marcella Nanni, *Principles of Water Law and Administration* (Taylor and Francis, 2007) 171.

CHAPTER 4

INSTITUTIONAL FRAMEWORK OF BANGLADESH TO ENSURE GROUNDWATER SUSTAINABILITY: INVESTIGATING ITS EFFICIENCY AND DEFICIENCY

I INTRODUCTION

Chapter 3 demonstrated that despite their obvious weaknesses, the *Bangladesh Water Act*[1] and the *Groundwater Irrigation Management Act*[2] were groundbreaking legislative initiatives directed at groundwater sustainability. Signaling a major reform for the existing legal framework the chapter, however, noted that implementation of these laws is conditional on the robustness of water institutions that strengthen groundwater governance. Hence, a groundwater crisis is often viewed as a governance crisis,[3] and there could be a substantial solution to this crisis once effective groundwater governance is established.[4] Pertinently, this thesis, as noted in chapter 1(IIC), concerns public water institutions to understand whether, when and how these institutions can meaningfully contribute to promote groundwater sustainability in Bangladesh. In other words, the focus of the thesis is public law as opposed to private law. The discussions made in this chapter, therefore, relate to the public institutions only — whether central or local.

Crucially, a sound institutional framework plays a pivotal role in adopting appropriate groundwater laws, policies, and suitable strategic management planning.[5] Additionally, the institutional environment determines the implementation, enforcement, and credibility of laws and policies.[6] A robust water institution, therefore, is a *sine qua non* for the effective and efficient development, management, and governance of a nation's water resources.[7] Water quality and quantity can be better monitored by a water institution that involves informed and participating water users in the resource management system. Institutional

[1] *Bangladesh Water Act 2013* (Bangladesh) *('Water Act').*
[2] *Groundwater Irrigation Management Act 2018* (Bangladesh) *('Groundwater Act').*
[3] Asit K Biswas and Cecilia Tortajada, 'Future Water Governance: Problems and Perspectives' (2010) 26(2) *International Journal of Water Resources Development* 129, 131; R Maria Saleth and Ariel Dinar, *The Institutional Economics of Water: A Cross-Country Analysis of Institutions and Performance*' (Edward Elgar Publishing, 2004) 1, 11.
[4] Karen G Villholth and Kirstin I Conti, 'Groundwater Governance: Rationale, Definition, Current State and Heuristic Framework' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 4.
[5] See chapter 2(VB1).
[6] Thomas Bolognesi and Christian Bréthaut, 'An Institutionalist Perspective on the Use of International Water Law: Crafting Institutions in a Multi-Level Setting' in Mara Tignino and Christian Bréthaut (eds), *Research Handbook on Freshwater Law and International Relations* (Edward Elgar Publishing, 2018) 418.
[7] See chapter 2(VB).

deficiencies, therefore, stand in the way of accomplishing groundwater governance.[8] Hence, groundwater institutions need to be innovative for effectively tackling the problems around the resource.[9] Proper understanding of past weaknesses and existing arrangements can assist in the adoption of viable water institutions to ensure the sustainable use of water.[10]

In Bangladesh, achieving the nationally set six goals[11] that include the preservation of the environment requires safeguarding the sustainability and productivity of the country's water resources.[12] To ensure this water sustainability the *National Water Policy*[13] underscored the need for sound institutional settings alongside an enduring legal framework.[14] The more recent strategic document entitled, the *Bangladesh Delta Plan 2100*[15] has also highlighted the need for sustainable management of water resources to achieve the targeted development goals.[16] More clearly, the *Delta Plan* has set up a specific goal concerning water security and water use efficiency,[17] and it reinforces the idea articulated in the *Water Policy* of placing an emphasis on developing robust institutions for water resources management.[18]

In an effort to undertake planned development of water resources the Water Resources Planning Organisation ('WARPO') under the Ministry of Water Resources has delineated eight hydrological regions across the country. These defined regions are: the northwest, the north-central, the northeast, the southeast, the south-central, the southwest, the eastern hills, and the active floodplains and charlands[19] of the main rivers and estuaries.[20] Thus, over the years Bangladesh has been trying to bring about a discipline in the water sector of the country.[21] However, while much has been written on paper, less has been done in practice.

This theory-practice gap is well illustrated by the existing institutional arrangements that are characterised by the redundant water institutions that function differently in the

[8] Lin Crase and Vasant Gandhi, 'The Effectiveness of Water Institutions' in Lin Crase and Vasant P Gandhi (eds), *Reforming Institutions in Water Resource Management: Policy and Performance for Sustainable Development* (Earthscan, 2009) 5.
[9] Ibid; see also A Vaidyanthan, *Water Resource Management: Institutions and Irrigation Development in India* (Oxford University Press, 1999).
[10] Crase and Gandhi (n 8).
[11] These goals are economic development; poverty alleviation; food security; public health and safety; decent standard of living for the people; and protection of the natural environment; see *National Water Policy 1999* (Bangladesh) s 2.
[12] *National Water Management Plan 2001* (Approved in 2004) (Bangladesh) vol 2, 82 *('Water Plan')*.
[13] *National Water Policy 1999* (Bangladesh) *('Water Policy').*
[14] See chapter 3(IVB).
[15] The *Bangladesh Delta Plan 2100* (Bangladesh) *('Delta Plan')*. The *Delta Plan* was adopted on 4 September 2018 with the aim of achieving 'safe, climate resilient and prosperous Delta' by 2100.
[16] *Delta Plan* (Bangladesh Planning Commission, Abridged Version, 2018) 4.
[17] Ibid 14.
[18] Ibid.
[19] Charland is any accreted land in a river course or estuary, see Banglapedia, National Encyclopedia of Bangladesh, *Char* <http://en.banglapedia.org/index.php?title=Char>.
[20] *Water Plan* (n 12) 15.
[21] Ibid 40.

implementation of water law and policy,[22] making the groundwater governance more complex, compound, and convoluted. Figure 1 (diagram) drawn below hierarchically presents the major water institutions (without recording their functions/interactions/overlaps) engaged in the groundwater regulation. Summary functions, interactions, and overlaps of prominent water institutions involved in the groundwater regulation appear in Appendices (B1). Isolated response to sectoral needs at various levels and times triggered the creation of excessive water institutions and their fragmented responsibilities.[23] However, no effective mechanisms have been developed to integrate and coordinate functions spread across various agencies and organisations. The current legal framework falls short of delineating the responsibilities of the existing water institutions. Conflicting, overlapping, vague, and fragmented institutional responsibilities have rendered the water institutions nearly dysfunctional.[24] For instance, parallel administrations distinctly set up by the *Bangladesh Water Development Board Act*,[25] the *Water Act*, and the *Groundwater Act* are operational in relation to the licensing and enforcement of groundwater regulations[26] that in effect inhibit sound groundwater governance. Opacity also exists in the area of control and monitoring of the flow of the groundwater where the prevailing laws allow the Bangladesh Water Development Board and the WARPO to work concurrently without requiring coordination.[27]

Of course, under the law, the WARPO is designated as the main implementing body of the overall water sector.[28] Data derived from interviews, however, reveals that limited research; the absence of regional and local offices; poor data; fragile coordination; leadership crisis; and weak monitoring system have rather rendered the WARPO paralysed. Additionally, the attitude of rivalry by the Bangladesh Water Development Board further weakens the WARPO.[29] In the face of the WARPO's underperformance in the water sector, the Barind Multipurpose Development Authority — which is tasked with providing irrigation facilities and ensuring water use efficiency in the Barind Tract that is notorious for its aridity and groundwater overexploitation — shows a ray of hope toward the sustainable groundwater

[22] Water Resources Planning Organisation (WARPO), Ministry of Water Resources, *National Policies and Legislations* <http://old.warpo.gov.bd/index.php/home/project_details/43>.
[23] See chapter 3(I)(III); see also Madar Samad, 'Water Institutional Reforms in Sri Lanka' (2005) 7(1) *Water Policy* 125, 131.
[24] See chapter 3(VE); Insa Theesfeld, 'Institutional Challenges for National Groundwater Governance: Policies and Issues' (2010) 48(1) *Ground Water* 131, 138.
[25] *Bangladesh Water Development Board Act 2000* (Bangladesh) *('Water Board Act').*
[26] Ibid s 5(2)(a); *Bangladesh Water Rules 2018* (Bangladesh) r 29(1)(a) (*'Water Rules'*); *Groundwater Act* (n 2) s 5.
[27] *Water Board Act* (n 25) s 5(2)(a); Water Resources Planning Organisation (WARPO), *Mandate*<http://www.warpo.gov.bd/site/page/768472b5-c801-4e81-9f7c-2ce18bdd2bbf/->.
[28] World Wide Fund for Nature (WWF), *Water Governance in Bangladesh: Challenges and Opportunities around Policy, Institutional Function and Implementation for a Sustainable Water Future* (WWF Report, 2015) 16.
[29] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).

irrigation in the northwest region of the country. It has, however, some obvious limitations such as over installation of deep tubewells in the relatively small region.[30]

This chapter argues that the existing water institutions that are responsible to ensure groundwater sustainability are poorly designed and as such, they are ineffective in controlling unsustainable groundwater withdrawal. Albeit there remain ample opportunities for coordinated action, the present institutional settings continue to miss these opportunities to work in partnership to tame the daunting challenges exerted by the declining groundwater resources. Conflicts and overlaps among water institutions have worsened the regime. Consequently, coordination and interaction among the water institutions have reached at the lowest ebb creating substantial risks of governance vacuum.

Against this background, this chapter answers thesis sub-questions (a) and (b) pertaining to institutional settings: To what extent does the current institutional framework ensure the sustainable abstraction of groundwater resources? What deficiencies presently exist in the institutional settings? Accordingly, this chapter is organised as follows: Identifying the WARPO as the leading water institution of the country, Part II critically examines and analyses its efficiency and deficiency in relation to groundwater regulation of the country. It then explores other water institutions of Bangladesh designed and involved, in one way or another, to facilitate or at least have a bearing on groundwater sustainability. Reflecting on the interview data, the chapter proceeds, in Part III, to outline and discuss the weaknesses of the existing water institutions focusing on the WARPO. Thereafter, Part IV turns to investigate, assess, and test the capacity of the Barind Multipurpose Development Authority in relation to the regulation of groundwater irrigation in the northwest region of the country. In particular, it evaluates the effectiveness of the prepaid smart metering system introduced in the Barind Tract to ensure sustainable groundwater irrigation. Finally, Part V summarises the main findings.

II INSTITUTIONAL ARRANGEMENTS TO ENSURE GROUNDWATER SUSTAINABILITY: A CONUNDRUM?

Over 40 different agencies and organisations, of which 35 are public, take part in the water sector of Bangladesh[31] — figure 1 below presents the water institutions that are closely related to the groundwater governance in Bangladesh. Among these public agencies, seven ministries are directly involved in the country's water management with the Ministry of Water Resources acting as the principal water regulator and the Department of Environment under the Ministry of Environment, Forest and Climate Change playing the role of principal

[30] Md Ferozur Rahaman, Chowdhury Sarwar Jahan and Quamrul Hasan Mazumder, 'Rainwater Harvesting to Alleviate Water Scarcity in Drought-Prone Barind Tract, NW, Bangladesh: A Case Study' (2019) 5(4) *Sustainable Water Resources Management* 1567, 1569.
[31] WARPO (n 22).

water monitor with authority to take legal action against the water polluters, mostly industries. The rest of the ministries — Ministry of Agriculture; Ministry of Local Government, Rural Development and Cooperatives; Ministry of Industries; Ministry of Textiles and Jute; and Ministry of Disaster Management and Relief — represent the principal water consumers of the country.[32] Organisations in other areas that have interlinkages with this sector are the Department of Public Health Engineering, the Local Government Engineering Department, the Water Supply and Sewerage Authority, the Department of Fisheries, the Bangladesh Inland Water Transport Authority, the Roads and Highways Department, and their respective municipal authorities.[33]

However, the WARPO is the principal coordinating water institution. This institution coupled with the National Water Resources Council and the Executive Committee of the National Water Resources Council is entrusted with the adoption and implementation of required water policies and plans. By virtue of its functions and responsibilities, the WARPO has been transformed into the central water institution in Bangladesh. Groundwater regulation, therefore, significantly depends on the capacity of this institution, which in turn determines the success or failure of groundwater governance in Bangladesh.

A *Water Resources Planning Organisation: Exploring Its Strengths and Weaknesses in Ensuring Groundwater Sustainability*

1 *The Creation of the WARPO*

The water resources management of Bangladesh dates back to 1964 when a 20-year Master Plan was adopted. Thereafter, various studies were conducted to evaluate and update that Plan. Following a recommendation by the World Bank in 1970, the government of Bangladesh established the Master Plan Organisation under the Ministry of Water Resources in 1983 to prepare a comprehensive National Water Plan.[34] Accordingly, the Master Plan Organisation undertook the preparation of a perspective plan (1985-2005) for water resources development. The National Water Plan was completed in 1987 and later updated in 1991.[35] The National Water Plan recommended, among others, to institutionalise the process of water planning and to undertake long-term water resource management that triggered the creation of the WARPO in 1992 replacing the erstwhile Master Plan Organisation. Severe floods of 1987 and 1988 pushed the government to undertake the Flood Action Plan that necessitated the establishment of the Flood Plan Coordination Organisation

[32] WWF (n 28).
[33] Nasima Tanveer Chowdhury, 'Water Management in Bangladesh: An Analytical Review' (2010) 12(1) *Water Policy* 32, 47.
[34] Matthew Chadwick and Anjan Datta 'Water Resource Management in Bangladesh: A Policy Review' (Livelihood-Policy Relationships in South Asia, Working Paper No 1, 2003) 1-4.
[35] Water Resources Planning Organisation (WARPO), *Background*, <http://www.warpo.gov.bd/site/page/3ee10cbe-3fb6-41a6-bde8-5a8c8d8f16b7/->.

under the Ministry of Water Resources to coordinate the activities of the Flood Action Plan. In 1996 Flood Plan Coordination Organisation was merged with the WARPO. The *Water Resources Planning Act 1992*[36] provides the legal framework for the WARPO[37] that emerges as a multi-disciplinary public organisation in Bangladesh.[38]

2 *Functions of the WARPO*

The WARPO is the principal organisation dealing with the countrywide macro-level water resources planning and management.[39] It works as the central coordinating body for all relevant activities in the water sector. It also acts as the custodian of National and Regional Water Resources Databases and Information systems.[40] The *Water Planning Act*, the *Water Policy*, the *Water Act*, and the *Water Rules* have all mandated the WARPO to perform important responsibilities in relation to water resources.[41] These mandated responsibilities transformed the WARPO into an apex planning body in the water sector of the country.[42] Under these laws, the main responsibilities of the WARPO include delineating the hydrological regions of the country to undertake effective planning for the development of water resources;[43] providing administrative, technical, and legal support to the Executive Council of National Water Resources Council ('ECNWRC').[44] Additionally, the WARPO requires to advise the ECNWRC on policy, planning, and regulatory matters of water resources,[45] and prepare the National Water Management Plan that needs to be periodically reviewed.[46] Further responsibilities of this water institution extend to making, updating, and consolidating water laws that govern ownership, development, appropriation, utilisation, conservation, and protection of water resources.[47] More importantly, the WARPO acts as a 'clearing house' for all water sector projects and reports to the ECNWRC on their conformity to the *National Water Management Plan*.[48] Additional obligations of the WARPO include developing national strategy and policy for scientific utilisation and conservation of water resources;[49] advising other related organisations in relation to the development, utilisation

[36] *Water Resources Planning Act 1992* (Bangladesh) *('Water Planning Act').*
[37] Ibid.
[38] Water Resources Planning Organisation (WARPO), *About WARPO* <http://www.warpo.gov.bd/>.
[39] Md Masud Alam, 'An Evaluation of Water Resources Planning Organization, an Apex Planning Organization in Water Sector Bangladesh' (2014) 3(1) *Asian Journal of Applied Science and Engineering* 66, 67.
[40] Water Resources Planning Organisation (WARPO), *Vision and Mission*, <http://www.warpo.gov.bd/site/page/ce7cac5b-d589-4d2a-a1de-268b4a5b499c/->.
[41] WARPO (n 35).
[42] Ibid.
[43] *Water Policy* (n 13) s 4.2.
[44] Ibid s 5(d)(i).
[45] Ibid s 5(d)(ii).
[46] Ibid ss 4.2, 5(d)(iii).
[47] Ibid.
[48] Ibid s 5(d)(v).
[49] *Water Planning Act* (n 36) s 7(b).

and conservation of water resources;[50] and collecting and analysing information with regard to the utilisation of water resources and to disseminate them.[51]

Further, under the *Water Act,* the WARPO requires to implement and apply the policies and strategies adopted by the National Water Resources Council and the ECNWRC.[52] The *Water Act* also obliges the WARPO to take necessary steps to build public awareness in respect to this *Act,*[53] and prepare National Water Resources Plan and place the same for the approval of the National Water Resources Council.[54] Finally, under this *Act* the WARPO is responsible to periodically assess the country's water resources and their use and to identify water stress area and safe yield of aquifers;[55] provide permit/licences of water abstraction for projects, industrial and commercial purposes;[56] and monitor and evaluate the implementation of the *Water Act*.[57]

Overall, the responsibilities of the WARPO in relation to groundwater resources are comprehensive; questions, however, remain whether this important water institution is equipped enough to function effectively to tackle daunting challenges around this resource.

3 *Strengths of the WARPO*

The WARPO has the potential to protect the groundwater resources of the country. This is the only institution in Bangladesh that coordinates among an astounding number of organisations with respect to the management of water resources in general and groundwater in particular.[58] It is this institution that is lawfully authorised to take necessary steps for the implementation of water laws across the country. It enjoys the force of law to make a difference in the water sector of Bangladesh by promoting training, education, professionalism, and engaging stakeholders in groundwater management activities.[59] The WARPO established the National Water Resources Database in 2001 and maintains it regularly. Despite its limitations described below, the National Water Resources Database is by far the largest geo-spatial database in Bangladesh.[60] It integrates science into law and vice versa. By presenting the scenario of the country's water resources it has immensely assisted the government in adopting, among other things, the *National Water Plan 1983-1987* (I and II), *Water Policy, National Water Management Plan 2001* (approved in 2004), *Water Act*

[50] Ibid s 7(c).
[51] Ibid s 7(g).
[52] Ibid s 14(2)(a).
[53] Ibid s 14(2)(d).
[54] Ibid s 15(1).
[55] *Water Rules* (n 26) rr 26, 28.
[56] Ibid rr 30(3), 33.
[57] WARPO (n 27).
[58] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[59] *Water Planning Act* (n 36) s 7(f).
[60] Md Masud Alam, Md Ataur Rahman and Md Shahabul Alam, 'An Investigation of National Water Resources Database, Bangladesh' (2014) 3(2) *Asian Journal of Applied Science and Engineering* 129, 141.

and *Water Rules*.[61] Of note, the WARPO is made Secretariat to the ECNWRC[62] which opens the window for it to play a more active role in the groundwater regulation of the country. Moreover, the existing legal framework obliges all water-related agencies — be it public or private — to render necessary cooperation to the WARPO in performing its mandated functions effectively and efficiently.[63] Additionally, one of the WARPO officials reported that initiatives were underway to establish WARPO's regional office in a district of each division, and on that count, the WARPO would have eight regional offices across the country.[64] Once this regional plan is implemented the monitoring capacity of the WARPO would be significantly strengthened.

4 *Weaknesses of the WARPO*

Notwithstanding its positive features, the WARPO suffers considerable shortcomings. A significant weakness relates to the lack of water experts within the institution,[65] and that stands in its way of adopting viable water law, policy, planning, and strategy. In the *Water Act*, several provisions prescribe measures such as compliance orders,[66] removal orders,[67] and protection orders,[68] etc to be enforced by the ECNWRC through the WARPO. However, it is not clear how the WARPO will implement these orders — the *Water Policy* does not provide any guidelines on the institutional setup of the WARPO either. Moreover, this institution needs financial assistance for the implementation of the *Water Act*, but this issue remains unaddressed in the *Act*.[69]

Undeniably, on paper the WARPO is a significant water institution, in practice, however, it receives very insignificant attention from policymakers. Policymakers either intentionally ignore the research findings of the WARPO or fail to understand the research findings. Be that as it may, a lack of policy attention causes a telling dent in the WARPO's capacity in relation to the management of groundwater resources of the country. The interview respondents highlighted this gap between the WARPO and the policymakers. Moreover, while people appreciate the role of the Bangladesh Water Development Board — which often undertakes big (surface)water projects — as its outputs are more visible, they often ignore the success of the WARPO — which typically deals with water data, research, coordination, etc — as its outputs are less visible.[70] Another obvious weakness of this institution concerns its potential conflict with the Planning Commission. One of the respondents explained this conflict, '….usually the Planning Commission does not agree with the plan developed by the

[61] Alam (n 39) 73.
[62] *Water Act* (n 1) s 14(1); *Water Policy* (n 13) s 5(d).
[63] *Water Act* (n 1) s 41.
[64] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).
[65] WWF (n 28) 26-7.
[66] *Water Act* (n 1) s 12.
[67] Ibid s 13.
[68] Ibid s17.
[69] WWF (n 28) 16.
[70] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).

WARPO as it thinks that it's the sole duty of the Commission to make a plan for coordination, and why it should pay heed to the WARPO's plan, and the Commission holds such type of notion….for this reason the National Water Management Plan was not implemented….'.[71]

Added to this, albeit the WARPO is entrusted with water resources planning, coordination, and implementation of water laws and policies, it is undermined by other water-related institutions, and the worst is that other agencies often ignore any decision taken by it. Interview data also illustrates this significant point of institutional incapacity. In the result, one of the core functions of the WARPO called 'coordination among the water institutions', remains as a paper mandate only without being implemented. As a consequence, a lack of effective cooperation and coordination from other related agencies considerably limits the WARPO's activities in relation to the update and maintenance of the National Water Resources Database. For example, the Water Development Board hardly shares water-related data especially that of groundwater with the WARPO. In the same vein, the Department of Public Health Engineering, the Institute of Water Modelling, and the Bangladesh Agricultural Development Corporation collect substantial groundwater data, but they too share little data with the WARPO, rendering the National Water Resources Database insufficient and ineffective in serving its purpose.[72] An instance exemplifying the stagnancy of the National Water Resources Database relates to the fact that between 2001 to 2007 the WARPO requested 11 sectoral government agencies to provide their respective water data, but only two responded over this long period of time.[73]

Optimistically, however, since the passing of the *Water Act*, all water-related agencies, both public and private, are legally bound to cooperate with the WARPO in carrying its functions. It is hoped that this legislative compulsion will significantly improve the situation in the coming days. Finally, interview data revealed that the WARPO could not exercise its power independently. A lack of explicit enforcement power of the WARPO creates substantial confusion about whether the WARPO is a regulatory body in relation to the water resources of the country. Further weaknesses of the WARPO are identified and discussed in Part III.

In short, the WARPO is the central water institution that is entrusted with countrywide macro-level water resources planning and management. It makes a significant contribution to the development of water-related laws, policies, planning, and strategies. The National Water Resources Database developed by it has the potential to propel water-related agencies to adopt appropriate groundwater planning and strategies. It can play a crucial role in promoting education, training, communication, and building public awareness in relation to groundwater sustainability. However, its effectiveness in ensuring sustainable abstraction of groundwater resources is limited by a lack of water experts, insufficient policy attention, and non-cooperation from other water institutions.

[71] Ibid.
[72] Ibid.
[73] Alam, Rahman and Shahabul Alam (n 60) 132.

B *Other Water Institutions*

The other water institutions in relation to groundwater resources are discussed below.

1 *Central Government Agencies*

The National Water Resources Council ('NWRC') constituted under section 4 of the *Water Act* is the highest body responsible for making policies, giving instructions for integrated development, safe abstraction, and protection of water resources.[74] It is also responsible for giving instructions in respect of adopting the *National Water Resources Plan* with a view to ensuring the integrated development of water resources.[75] The Executive Committee of the NWRC ('ECNWRC') consisting of 23 members[76] requires to publicise, monitor, and evaluate the *National Water Policy* and the *National Water Resources Plan*.[77] However, interview data (further discussed in Part III) suggested that the NWRC was rather ineffective and inoperative on-the-ground. Some respondents pointed out that the NWRC and the ECNWRC are composed predominantly of bureaucrats; while technical people, scholars, and academics are almost absent in these bodies. They noted that these large committees hardly worked towards the protection of groundwater resources. As one of the respondents explained —

> 'You see secretaries are incredibly busy with their routine works……Besides, you need to do homework, prepare yourself with materials to contribute to a meeting like this. But the bureaucrats cannot do it. Ultimately, what happens is that these bureaucrats remain absent in the meeting of this type of committee, and eventually, this type of committee does not work effectively and efficiently'.[78]

Another respondent noted, '…….to my knowledge this council hardly holds meetings, and there is no meeting, no follow up of any issue, and as a result, the problem persists…….'.[79] Eventually, respondents suggested that the size of this type of committee should be significantly reduced and be predominantly represented by technical people, academics, and subject-oriented people.

Most worryingly some water-related institutions are neither included in the NWRC nor the ECNWRC. The Ministry of Industries, for instance, controls and regulates the industrial sector of the country that impacts both surface water and groundwater quality and quantity. Being ill-informed about water issues, these industrial actors are unaware of their vulnerability to the water risks created by themselves. The Ministry of Industries, therefore,

[74] *Water Act* (n 1) s 5(a).
[75] Ibid s 5(b).
[76] Ibid s 9.
[77] Ibid s 10.
[78] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018).
[79] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).

could play a vital role in the protection of groundwater resources by reigning in the culprit industries. But this ministry is not included in the aforementioned bodies.[80]

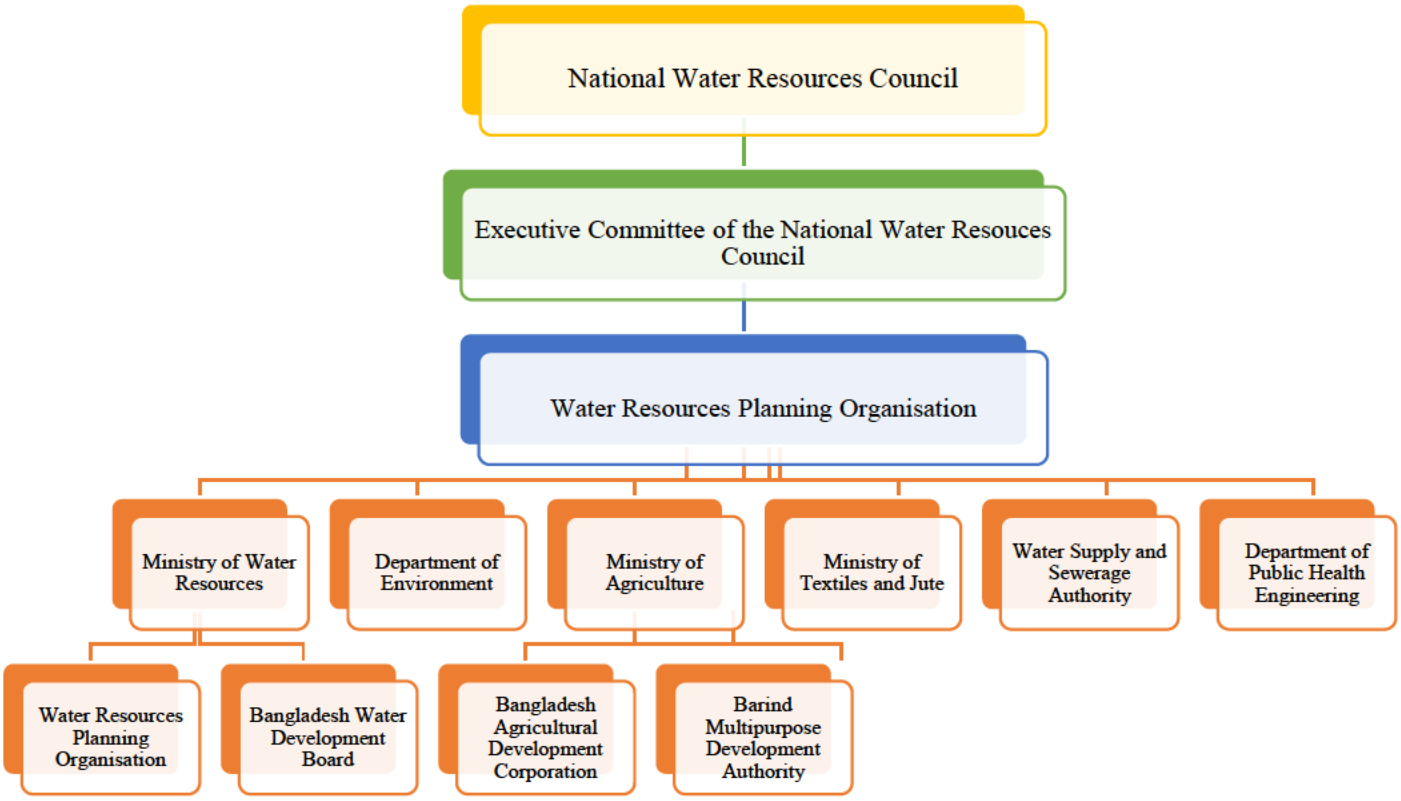

Figure 1 shows the major water institutions involved in groundwater governance in Bangladesh.

The Ministry of Water Resources — the highest authority in the water sector of Bangladesh — leads on policy formulation and its monitoring and implementation through its five supporting organisations that include the WARPO and the Bangladesh Water Development Board.[81] In particular, the WARPO plays a vital role in shaping and formulating water law, policy, planning, and strategies — albeit this institution, as indicated above and further outlined below, confronts significant barriers in discharging its mandated functions, not least other water institutions often ignore the need of coordinated action to be taken under the auspices of the WARPO.

The Bangladesh Water Development Board is responsible to develop and manage water resources projects ranging from flood control, drainage, and irrigation to rainwater harvesting. In addition to promoting food production by surface water irrigation, it carries

[80] *Water Act* (n 1) ss 4, 9.
[81] Ministry of Water Resources, *Brief History* <https://mowr.gov.bd/site/page/328c56b4-a102-48bc-be1c-bbc6a99c902d/Brief-History>.

surveys and collects data.[82] It is also responsible for the establishment and training of water users' associations and other stakeholder organisations.[83] Additionally, it strives to develop and disseminate appropriate technologies for the conjunctive use of rainwater, groundwater, and surface water. For monitoring and forecasting the hydrological conditions, it regularly maintains and updates water models and programs.[84] As a major collector of water resources information, this water institution can potentially make a significant contribution to the improvement of the National Water Resources Database in tandem with the WARPO.[85]

The Institute of Water Modelling ('IWM') is an organisation under the Ministry of Water Resources — created under a trust — that is concerned with water modelling, computational hydraulics, and allied sciences for improved integrated water resources management. The IWM models provide a significant contribution to the study of, among other things, groundwater flow processes.[86] This institute is particularly relevant for groundwater regulation given that it offers a wide range of specialist services in the fields of water resources planning and management, as well as hydrometric measurements, hydrographic, bathymetric, and topographic surveys and monitoring.[87] Groundwater monitoring, aquifer vulnerability, and groundwater quality assessment can be undertaken through the state-of-art mathematical modelling developed by this institute.[88] Significant uncertainty, however, remains how this and other relevant research organisations' scientific advice/findings feed into water legislation. Unfortunately, the current water legislation — the *Water Act* and the *Groundwater Act* — turns a blind eye to this issue.

The Department of Environment under the Ministry of Environment, Forest and Climate Change sets rules and guidelines to be observed in all water projects. Responsibilities of the WARPO and the Department of Environment in relation to setting standards, compliance and enforcement, data acquisition, and storage mostly overlap. Hence, enhanced coordination between these agencies is needed such that effective guidelines focusing on water sustainability are developed that would be followed by the actors.[89]

The Ministry of Agriculture is directly involved in the groundwater governance notably, through its two agencies — the Bangladesh Agricultural Development Corporation, and the Barind Multipurpose Development Authority. The primary functions of the Bangladesh

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[82] Bangladesh Water Development Board, Ministry of Water Resources, *Function* <https://www.bwdb.gov.bd/en/page/13>; Chowdhury (n 33).
[83] Ashim Das Gupta et al, 'Water Sector of Bangladesh in the Context of Integrated Water Resources Management: A Review' (2005) 21(2) *International Journal of Water Resources Development* 385, 392.
[84] Bangladesh Water Development Board, Ministry of Water Resources, *Hydrology, Mission of Hydrology* <http://www.hydrology.bwdb.gov.bd/index.php?pagetitle=mission_of_hydrology&sub2=156&_subid=79&id=82>.
[85] Chowdhury (n 33).
[86] Institute of Water Modelling, *Brief on IWM* <https://www.iwmbd.org/brifeoniwm.php>.
[87] Institute of Water Modelling, *Annual Report 2018* (Report, 2018) 1.
[88] Institute of Water Modelling, *Annual Report 2016* (Report, 2016) 17.
[89] Chowdhury (n 33) 48.

Agricultural Development Corporation include providing irrigation facilities through utilisation of surface and groundwater to the farmers.[90] In doing so, it strives to bring about efficiency in irrigation by, among other things, ensuring the best use of surface water.[91] Further, it conducts surveys in relation to water resources for the development of minor irrigation.[92] With a view to ensuring water use efficiency, it endeavours to introduce drip irrigation, sprinkler irrigation, and mobile irrigation pump across the country.[93]

The Barind Multipurpose Development Authority, on the other hand, works for the promotion of agricultural development in the Barind area — northwest region of the country. The Barind Tract — the driest part of the country — is notorious for groundwater overexploitation, a situation that led to the creation of this Authority to regulate groundwater irrigation as well as promote agricultural productivity in the region. A critical examination of this institution is conducted in Part IV.

The Ministry of Textiles and Jute deals with, among other things, the promotion of jute, ready-made garments, and primary textiles including allied textile processing industries.[94] The *Textile Policy 2017* encourages the industries, *inter alia*, to produce environment-friendly products through removing, mitigating, and recycling effluents and to take effective measures to install effluent treatment plants (ETP) to keep the environment free from pollution.[95] Despite the continual over-extraction of groundwater resources by the textile industries,[96] the policy has overlooked issues around the sustainable use of water in general and groundwater in particular, that is used in producing textiles. Likewise, the *National Jute Policy 2018* has not addressed issues concerning the sustainable use of water in this sector.

The Ministry of Industries is concerned with the development of new policies and strategies for promotion, expansion, and sustainable development of the industrial sector.[97] Notwithstanding the overexploitation of groundwater resources by industries across the country,[98] the *National Industrial Policy 2016* has failed to address this urgent issue. Since the WARPO issues licenses for commercial and industrial water abstraction (seen in Part IIA2), perhaps, this ministry and the preceding ministry (Ministry of Textiles and Jute) in

[90] Bangladesh Agricultural Development Corporation, Ministry of Agriculture, *Background of the BADC* <http://www.badc.gov.bd/site/page/ae79e137-6170-4212-b208-e44042272917/->.
[91] Bangladesh Agricultural Development Corporation, Ministry of Agriculture, *Vision and Mission* <http://www.badc.gov.bd/site/page/1643c1ee-3ea5-4485-8202-40139a094a47/->.
[92] Bangladesh Agricultural Development Corporation, Ministry of Agriculture, *Terms of Reference* <http://www.badc.gov.bd/site/page/1e0a2104-9a50-4b99-8ed2-734b9dbaca96/->.
[93] Bangladesh Agricultural Development Corporation, *Annual Report 17-18* (Report, 2018) 7.
[94] Ministry of Textiles and Jute, *Functions* <https://motj.portal.gov.bd/site/page/bcc3874a-d90b-4aee-9ad7-7ab32a05f896/Functions>.
[95] *Textile Policy 2017* (Bangladesh) ch 3.
[96] See chapter 2(VIII).
[97] Ministry of Industries, *Welcome Message* <https://moind.gov.bd/>.
[98] See chapter 2(VIII).

collaboration with the WARPO could develop comprehensive codes for themselves that would address issues around sustainable groundwater use.

The Water Supply and Sewerage Authority ('WASA') was created in four metropolitan cities namely Dhaka, Chattogram, Khulna, and Rajshahi with the prime objective of supplying water and providing sanitation and drainage facilities at affordable costs.[99] Dhaka WASA, for example, currently produces 2,500 million litres of water per day to serve more than 17 million people.[100] At present 78% of this institution's water supply comes from groundwater sources.[101] Dhaka WASA is, however, targeting to manage 70% of its required water from surface sources, thereby reducing its reliance on groundwater.[102] Likewise, the Chattogram WASA provides water services to the residents of the city. Currently, it produces 350 million litres of water per day to serve more than four million people.[103] In contrast to Dhaka WASA, its (Chattogram WASA) 80% water comes from surface sources while only 20% comes from groundwater sources.[104]

In summary, the National Water Resources Council, the WARPO, the Bangladesh Water Development Board, and the Barind Multipurpose Development Authority are directly involved in the groundwater regulation of Bangladesh, while the agencies such as the Bangladesh Agricultural Development Corporation, the Ministry of Textiles and Jute, and the Ministry of Industries have a strong influence in, and bearing on, the groundwater governance of the country. However, the apex national body National Water Resources Council seems to be ineffective in discharging its functions. It is not clear how the Bangladesh Water Development Board and the WARPO interact in relation to groundwater governance, especially in data sharing. The Bangladesh Agricultural Development Corporation is mandated to ensure water use efficiency in irrigation. However, as revealed by interview data, it cannot discharge its functions effectively due to resource shortage.[105] While the Bangladesh Multipurpose Development Authority kindles some hope in relation to the regulation of groundwater irrigation, it has some clear limitations too. The textile sector is extracting groundwater heavily where 98% of its water comes from groundwater sources.[106] This massive unregulated water extraction depletes the water tables alarmingly.[107] Yet, the Ministry of Textiles and Jute and the Ministry of Industries have sidestepped this urgent issue. The policies adopted by these organisations do not address the issues around the (ab)use of this scarce resource. However, the Institute of Water Modelling, given its

[99] *Water Supply and Sewerage Authority Act 1996* (Bangladesh) s 17.
[100] Dhaka WASA, *Annual Report* 2017-2018 (Report, 2018) 7, 11.
[101] Ibid 6.
[102] Ibid 4.
[103] Chattogram WASA <http://ctg-wasa.org.bd/>.
[104] Chattogram WASA, *Annual Report 2017-2018* (Report, 2018) 3.
[105] Interview with GO 7, Government Official (Mohammad, Dhaka, 14 February 2018).
[106] See chapter 2(VIII).
[107] Ibid.

capacity to develop tools, methods and modelling, has the potential to make a significant contribution in shaping groundwater planning and management.

2 *Local Government Institutions*

In line with the State Policy different tiers of local government are in place in Bangladesh. All local government institutions come under the administrative responsibility of the Local Government Division of the Ministry of Local Government, Rural Development and Cooperatives. Functions of the Local Government Division include managing all matters relating to drinking water, developing water supply, sanitation, and sewerage facilities in rural and urban areas, and developing, maintaining, and managing small-scale water resource infrastructures within the limit determined by the government.[108] Figure 2 below paints hierarchically different local government institutions that along with the Department of Public Health Engineering take part in water resources management, mostly in relation to drinking and sanitation.

Two distinct kinds of local government institutions exist in Bangladesh: one kind for rural areas and another kind for urban areas. While the rural local governments have three tiers of hierarchy: Zila Parishad (District Council), Upazila Parishad (Sub-district Council), and Union Parishad; the urban local governments have a hierarchical system composing of two tiers: City Corporations and Pourashava (municipalities).[109] Under the *City Corporation Act 2009* 12 city corporations have been established in major cities of the country. Currently, 330 Pourashava (municipalities), established under the *Local Government (Pourashava) Act 2009*, 61 Zila Parishad (District Council), established under the *Local Government (Zila Parishad) Act 2000*, 492 Upazila Parishad (sub-district council), established under the *Upazila Parishad Act 1998*, and 4,571 Union Parishad, established under the *Local Government (Union Parishad) Act 2009* operate across the country.[110] In association with these local government institutions, the Department of Public Health Engineering is responsible for the provision of drinking water supply and waste management across the country excepting the cities where Water Supply and Sewerage Authorities operate. It also deals with arsenic problems and adopts appropriate planning for its mitigation.[111] The Local Government Engineering Department is concerned with the development and management of small-scale (1000 ha and less) projects in flood control, drainage, irrigation, water supply,

[108] Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, *Mission and Vision* <https://lgd.gov.bd/site/page/d802d485-cb9f-442f-a8c2-c94cac324a05/->.
[109] Ishtiaq Jamil and Pranab Panday, 'Inter-Organizational Coordination and Corruption in Urban Policy Implementation in Bangladesh: A Case of Rajshahi City Corporation' (2012) 35(5) *International Journal of Public Administration* 352, 353.
[110] Ibid; Bangladesh Bureau of Statistics (BBS), *Statistical Pocketbook 2019* (BBS, 2019) 4.
[111] Department of Public Health Engineering, *History of DPHE* <http://www.dphe.gov.bd/site/page/8d5a20ca-9d3c-47e4-ba5e-e6134ab23ef1/->.

and sanitation.[112] It, however, places heavy emphasis on local public participation in water-related projects.[113]

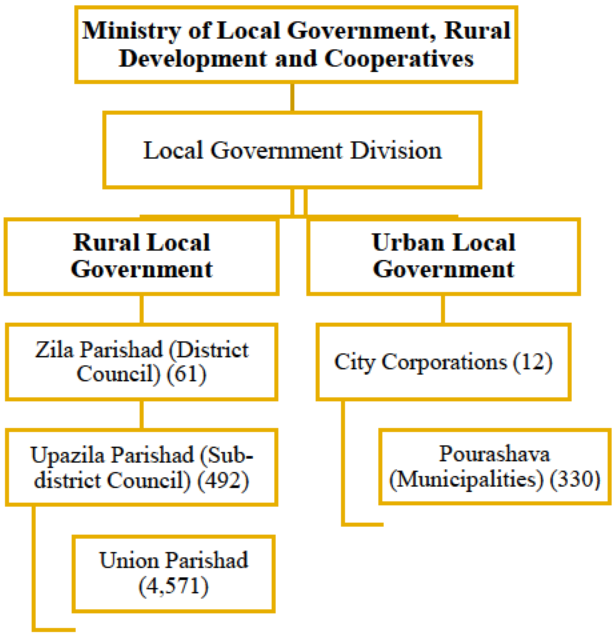

Figure 2 shows the existing structure of the Local Government in Bangladesh.

To sum up, the local government institutions have been created with the aim of implementing the subsidiarity principle that is concerned with decentralisation, devolution, and participation.[114] The *Water Act*, however, established some local level committees — the District Integrated Water Resources Management Committee, Upazila (sub-district) Integrated Water Resources Management Committee, Union Integrated Water Resources Management Committee, and Technical Committee.[115] Additionally, under the *Groundwater Act* Upazila Parishad and Upazila Irrigation Committee are in place to deal with licensing issues around irrigation wells.[116] But it is not clear what are the relationships among these local government institutions, central water institutions, and the local Committees established under these two Acts in relation to the management and regulation of groundwater.

[112] Josselin J Rouillard, David Benson and Animesh K Gain, 'Evaluating IWRM Implementation Success: Are Water Policies in Bangladesh Enhancing Adaptive Capacity to Climate Change Impacts?' (2014) 30(3) *International Journal of Water Resources Development* 515, 519-20.
[113] Gupta et al (n 83) 393.
[114] *Water Plan* (n 12) 77.
[115] See chapter 3(IVE).
[116] See chapter 3(IVCD).

C *Persistent Conflicts and Overlaps: A Major Blow to Groundwater Regulation*

The preceding two sections make it clear that issues around water resources in general and groundwater in particular, are cross-cutting, and a considerable number of agencies take part in the management of this resource. Responsibility for managing water resources of towns and rural areas, for instance, lies with the Rural Local Governments, the Department of Public Health Engineering, and the Bangladesh Water Development Board whereas that of major cities stays with the Urban Local Governments, the Water Supply and Sewerage Authorities, the Department of Public Health Engineering, and the Bangladesh Water Development Board. In the same vein, responsibility for managing agricultural water vests in the Bangladesh Water Development Board, the Local Government Engineering Department, the Bangladesh Agricultural Development Corporation, and the Barind Multipurpose Development Authority whereas the Department of Environment, the Department of Fisheries, the Department of Forest and the Local Governments are engaged in the management of the environment and aquatic water resources.[117] Further, the National Water Resources Council, the Executive Council of the National Water Resources Council, and the WARPO are engaged in formulating water policy whereas the responsibility in relation to national and regional water planning and coordination rests with the WARPO and the Planning Commission. Additionally, framing water rules, regulations, guidelines, and legislations fall within the purview of the National Water Resources Council, the Executive Council of the National Water Resources Council, the WARPO, the Department of Environment, the Ministry of Land, and the Ministry of Industries. The Bangladesh Water Development Board, the Bangladesh Agricultural Development Corporation, and the Department of Agricultural Extension partake in managing minor irrigation.[118] Responsibility in relation to environmental assessment rests with the WARPO and the Department of Environment.[119] Monitoring and management of water quality are shared between the Bangladesh Water Development Board and the Department of Environment.

These complex and vague institutional responses to the groundwater problems led one interviewee to directly state, 'Unfortunately, all these agencies do not have a common vision in relation to the management of water resources…..each agency is treating water from its angles/perspectives…..in the result, you see, conflicts and overlaps engulf the entire regime….'.[120] Ultimately this respondent suggested that the WARPO should be entrusted with the whole gamut of groundwater governance to dispel institutional opaqueness.

[117] *Water Plan* (n 12) 17.
[118] Ibid 19.
[119] Ibid 62.
[120] Interview with S 4, Academic (Mohammad, Dhaka, 5 February 2018).

Moreover, there is significant uncertainty pertaining to the abstraction licensing and enforcement of surface and groundwater regulations as these simultaneously fall within the ambit of the *Water Board Act*, the *Water Act*, and the *Groundwater Act*. Laws and rules are quite unclear in relation to these areas.[121] Considerable ambiguity also persists in relation to the control and monitoring of the flow of groundwater. While the *Water Board Act* obliges the Bangladesh Water Development Board to control and monitor the flow of groundwater aquifers,[122] the WARPO has also the mandate to monitor and evaluate the state of groundwater resources across the country.[123]

Additionally, it is quite unclear what would be the relationship of the WARPO as a central water institution with the local government institutions and the different committees formed under the two key statutes — the *Water Act* and the *Groundwater Act*. Terming this huge agencies' involvement in the water sector as 'too many cooks spoil the broth' a respondent commented, '….to do things effectively and to reach a goal, you need to know your tasks, your recipe of actions; our water institutions are beating around the bush, are shooting in the dark to kill a bird without knowing where the bird has sat on…'.[124] Another respondent bluntly stated, 'We tried to dissuade the ministry of agriculture from legislating the *Groundwater Act* where there is an existing legislation (*Water Act*) dealing with, among other things, irrigation issues, but they enacted the *Groundwater Act* creating more problems than solutions…….what is our common vision and what are we working for?'[125] This speaks volumes about how the gaps and overlaps hold back the water institutions in setting and implementing a common goal of groundwater sustainability.

Overall, this complex web of institutional arrangements seems to be rather confusing — who does what to whom, why, and at which level? Segmentation and fragmentation characterises the overall institutional framework where gaps and overlaps dominate.[126] As a result, water agencies often undertake initiatives that stymie the path of groundwater sustainability. An instance of this type of obstruction was explored in chapter 3(VE) that showed how legislative tools adopted by the two agencies — Ministry of Water Resources and the Ministry of Agriculture — in an uncoordinated way complicated the licensing system for groundwater irrigation. These legal instruments (*Water Act* and the *Groundwater Act*) set up parallel administration for licensing approvals processes.

Additionally, going beyond the legal mandates outlined above, these water institutions are expected to promote the social dimensions of groundwater use such as enhancing drinking

[121] *Groundwater Act* (n 2) s 5; *Water Rules* (n 26) r 29(1)(a); *Water Plan* (12) 61.
[122] *Water Board Act* (n 25) 5(2)(a).
[123] WARPO (n 27).
[124] Interview with J 4, Judge (Mohammad, Dhaka, 19 February 2018).
[125] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).
[126] Punam Pandey, 'Water Management in Bangladesh: Policy Interventions' in Amit Ranjan (ed), *Water Issues in Himalayan South Asia: Internal Challenges, Disputes and Transboundary Tensions* (Springer, 2020) 44-47.

water facilities and facilitating basic livelihood subsistence activities that include irrigation. Unfortunately, currently, water institutions are far from effectively performing these social mandates. Interview data suggested that water institutions hardly took any noticeable initiatives toward the realisation of social mandates of groundwater use. As one of the respondents bluntly stated, 'In addition to legal mandates, a water institution has some social mandates that it should take seriously for the broader well-being of the community. Regrettably, we have not heard any story of this kind occurring in any corner of the country.'[127]

Beyond these institutional overlaps and uncertainty, interview data more specifically identifies the telling weaknesses of the Bangladeshi water institutions notably the WARPO that significantly limit their capacity in tackling groundwater overexploitation occurring across the country. Accordingly, the next Part turns to provide further insights from the interviews.

III IDENTIFYING THE WEAKNESSES OF THE WATER INSTITUTIONS

Clearly, a considerable number of institutions are engaged in the water sector of Bangladesh. The achievement of legislative objectives heavily hinges on the capacity, soundness, and level of completeness of institutions — which cover diverse functions that are comprehensive in scope.[128] However, interview data demonstrated that the water institutions of Bangladesh were far from exhibiting soundness and completeness. A dearth of resources; a lack of coordination and cooperation; want of monitoring and groundwater data; a lack of proper research; centralised water management approach; and an absence of leadership render these water institutions dysfunctional. These disturbing elements significantly weaken the institutional capacity, and eventually, though Bangladesh had enacted some laws in relation to groundwater, they hardly got implemented on-the-ground. Drawing on the interview data the following weaknesses of the Bangladeshi water institutions are identified and discussed.

A *Resource Shortage*

Resource strength is central to the effective functioning of water institutions,[129] and as such, resource constraints paralyse this type of institution.[130] In many cases, it is observed that the dearth of legislation is not the biggest problem, but insufficient resources, a lack of political

[127] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[128] See chapter 2(VB); Bolognesi and Bréthaut (n 6).
[129] V Ratna Reddy and P Prudhvikar Reddy, 'Water Institutions: Is Formalisation the Answer? (A Study of Water User Associations in Andhra Pradesh)' (2002) 57(3) *Indian Journal of Agricultural Economics* 519, 533.
[130] Stephen Foster and Héctor Garduño, 'Groundwater-Resource Governance: Are Governments and Stakeholders Responding to the Challenge?' (2013) 21(2) *Hydrogeology Journal* 317, 319.

will, and the means to implement existing legislation pose the real threat in solving problems.[131] Indeed, groundwater management requires significant investments for designing, implementing, monitoring, and enforcing groundwater laws and policies.[132] Thus, well-intentioned efforts to implement groundwater laws and policies are destined to be frustrated due to the lack of required financial and human resources.[133]

Consistent with the findings from the literature, respondents identified the lack of resources as a stumbling block to the effective and efficient functioning of the responsible water institutions of Bangladesh. They identified the WARPO as a principal institution for groundwater regulation across the country. This institution, however, could not function properly due to resource shortages. Compared to other groups (judges and scholars) interviewed policymakers (86%) were more concerned with this issue and noted that staff crisis and resource constraints stood in the way of discharging its duties properly. Perhaps, government officials face resource shortages every day, and as such, they raised this issue more compared to other groups. A significant number of interviewed judges (67%) also raised this issue while only 33% of interviewed scholars talked about it. Having compared the WARPO with the Water Development Board and the Department of Forest, one respondent concluded that the former is weaker than the latter in terms of resources.[134] As one of the respondents from the WARPO somberly explained, '….under laws we have a host of responsibilities ranging from delineating hydrological regions to implementing and applying policies and strategies, but our resources both human and financial are insufficient to carry out these responsibilities…'.[135] Another respondent from the Bangladesh Agricultural Development Corporation reported, '…we don't have sufficient officers at Upazila level, one officer is charged with 3-4 Upazilas, there are lots of vacancies across the country….'.[136] Additionally, very insufficient funds are approved for the WARPO to undertake necessary research.[137]

More generally, many respondents noted that the Ministry of Water Resources as the principal water agency was rather one of the weakest ministries in Bangladesh, and its budget allocation was very low compared to other ministries, and as such, it could not take the lead in managing water resources. Its capability and acceptance were always questionable.[138] Yet,

[131] Marcus Moench, Himanshu Kulkarni and Jacob Burke, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper No 7: Trends in local groundwater management institutions* (Rome, January 2013) 21.
[132] Aziza Akhmouch and Delphine Clavreul, 'Assessing and Monitoring Groundwater Governance' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 257.
[133] Ryan Stoa, 'Subsidiarity in Principle: Decentralization of Water Resources Management' (2014) 10(2) *Utrecht Law Review* 31, 38.
[134] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[135] Interview with GO 2, Government Official (Mohammad, Dhaka, 30 January 2018).
[136] Interview with GO 7, Government Official (Mohammad, Dhaka, 14 February 2018).
[137] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[138] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).

even with this limited resource, one respondent tended to comment that the water institutions notably the WARPO should have performed much better than it was doing.[139]

In short, resource constraints undermine the efficacy of water institutions. Even a well-designed and well-crafted water institution fails to achieve its targeted goal if it is under-resourced. Interview data highlighted that resource shortage constricted the performance of water institutions especially the WARPO, and as such, groundwater overexploitation remains unaddressed risking irreversible degradation of the resources and their aquifer systems.

B *Lack of Coordination among the Water Institutions*

A lack of coordination among water institutions often leads to inconsistent water resources policy. An integrated and coordinated approach is needed for effectively planning the development, protection, and conservation of water resources.[140] A lack of coordination among water institutions creates a significant barrier to effective compliance and enforcement.[141] As noted, a lack of proper coordination led to the creation of dual water authorities in relation to groundwater irrigation that inhibits smooth groundwater governance. One respondent stated, '…unilateral decision or work of one water agency is adversely affecting the functions of other agencies…..two statutes on groundwater irrigation are the direct outcome of non-coordination…'.[142] Another respondent termed this non-coordination as the 'basic problem' of Bangladeshi water institutions.[143] A respondent directly stated, 'You cannot stop the indiscriminate groundwater withdrawal occurring across the country unless you bring the responsible water institutions under one umbrella and a strong coordination mechanism is established'.[144]

Consequently, this coordination crisis poses significant uncertainty as to which agency should issue a licence for groundwater irrigation — since two parallel agencies are empowered to perform this task — and at times an agency may refuse to issue a licence on the supposition that another agency would issue it. Clearly, this duplication that is further compounded by fragile coordination triggers waste of resources, and more frustratingly, this confusing nature of licensing system could discourage groundwater users to apply for licences that they are obliged to do under the law. As one interviewee stated, '…. absence of coordination or poor coordination means water institutions don't know which institution does what…'.[145]

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[139] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[140] Dante Augusto Caponera and Marcella Nanni, *Principles of Water Law and Administration* (Taylor and Francis, 2007) 176-7.
[141] See chapter 3(VID).
[142] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[143] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[144] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[145] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).

The WARPO — the principal coordinating agency — has some inherent weaknesses in discharging its core duty relating to coordination. One such weakness articulated by many interviewees is the positioning of the WARPO that is not correct. They suggested that the WARPO should have been placed under the Planning Commission or under the Office of the Prime Minister. Different studies conducted in relation to the capacity building of the WARPO also suggest the repositioning of the WARPO.[146]

Additionally, respondents pointed out that the WARPO was undermined by the Ministry of Water Resources itself and other ministries, and that no one heeded the decision taken by this responsible agency. As one respondent flatly stated, '……Water Board under the Ministry of Water Resources is a strong agency compared to other wings of that ministry. Water Ministry does not respect the WARPO and does not treat it to be an important wing……here money is important, the water board is the weightiest wing as it deals with big water projects where a big amount of money is involved; everyone looks at money……'.[147]

Further, interview data suggested that the WARPO was the weakest wing of the Ministry of Water Resources, and the Bangladesh Water Development Board intentionally kept the WARPO weak and handicapped to support its own interest. One of the respondents explained this point, 'Any project proposed by the Water Board is required to go through the WARPO, hence, the Board does not want the WARPO to be strengthened. You see, for this reason, the DG of the WARPO is always picked up from the Water Board such that he (DG of the WARPO) does not object to any project proposed by the Water Board. To be honest, WARPO is now virtually dysfunctional'.[148] These all limit the WARPO's capacity to establish robust coordination among water institutions that remains an ongoing challenge in Bangladesh.

C *Lack of Monitoring and Groundwater Data*

Monitoring is one of the core functions of an effective water institution.[149] A water institution must fail in achieving groundwater sustainability if it does not have a sustained monitoring mechanism. Implementation of groundwater legislation, proper knowledge on the availability of groundwater resources and their extraction, recharge, discharge, and quality all depend on the robustness of monitoring. However, establishing effective monitoring is heavily dependent on the availability of solid groundwater data.[150] Monitoring and groundwater data are, therefore, intertwined.

Despite the documented importance of monitoring and data in relation to groundwater governance, the state of these two foundational elements has been very deplorable.

[146] Alam (n 39) 75.
[147] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[148] Ibid.
[149] See chapter 2(VB).
[150] Ibid.

Interviewees identified monitoring as a major challenge for the groundwater regulation in Bangladesh. Resource constraints, the centralised functioning of the water institutions, and a lack of integrity of the responsible government officials were identified within the empirical data as factors limiting, constricting, and impeding the robust monitoring activities.[151] Perhaps, groundwater is alarmingly depleted in Bangladesh due to, among other things, this fragile monitoring system since people do not realise that water levels are declining as much as they are due to insufficient monitoring.

Aligned with the importance of data, a significant proportion of respondents (64%) considered the lack of data as standing in the way of discharging responsibilities of water-related institutions. All policymaker respondents acknowledged that related water institutions were confronted with the dearth of required data that eventually limited the effective groundwater governance across the country. They marked this data shortage as a 'great setback' to take timely steps towards the protection of groundwater resources.[152] As one respondent of this category directly stated, 'I don't know how much groundwater is extracted by the industries; we don't have any specific data with respect to this issue and that is simply outrageous……'.[153] Terming the groundwater regulation as a new concept in Bangladesh one respondent commented that very limited research was conducted in this area resulting in the scant data that consequently posed a big challenge for institutions to regulate groundwater effectively and efficiently.[154]

In a nutshell, the lack of proper groundwater data significantly impedes the smooth and effective functioning of a water institution. Interview data demonstrated that Bangladeshi water institutions were plagued with data scarcity, and perhaps due to this data shortage groundwater laws, policies, and planning hardly make any difference on-the-ground. Certainly, better data would enable the water managers to undertake targeted compliance and enforcement efforts, declare water stress areas, and fix the lowest safe yield level of aquifers.

D *Insufficient Research*

Research plays a key role in securing data, information, and information management. The need for in-depth research for devising effective groundwater governance can hardly be overemphasised. Indeed, dedicated and targeted research offers significant help in solving problems, developing priorities, defining management options, and establishing decision criteria around water resources.[155]

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[151] See chapter 3(VIC).
[152] Ibid.
[153] Interview with GO 5, Government Official (Mohammad, Dhaka, 26 February 2018).
[154] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).
[155] Ralf B Ibisch, Janos J Bogardi and Dietrich Borchardt, 'Integrated Water Resources Management: Concept, Research and Implementation' in Ralf B Ibisch, Janos J Bogardi and Dietrich Borchardt (eds), *Integrated Water Resources Management: Concept, Research and Implementation* (Springer, 2016) 23.

Mindful of the significance of research in relation to groundwater governance, professional respondents (64%) largely agreed that an ideal water institution should have a dedicated research team to continuously conduct research on groundwater resources with a view to assisting the water institution in adopting timely water laws and policies. Uncertainty surrounding the groundwater resource itself poses a significant challenge in managing this hidden treasure trove.[156] Hence, as suggested by many respondents, this type of research should focus on, among other things, gaps, flaws, and lags in the present governance, the current state of groundwater resources and their expected trends, identification of the water stress areas where groundwater is being depleted faster, improvements in terms of data, actors (capacity, leadership, awareness, etc), and legal frameworks. These respondents, however, estimated that responsible water institutions like the WARPO lacked a dedicated research team, and as such, no tangible actions were taken to protect the groundwater resources of the country.

The necessity of having a research team like this was felt more by the policymakers (86%) followed by the judges (83%) and the scholars (42%). Given that groundwater is closely connected with scientific aspects the need for having such a research team is obvious. As one respondent commented that proper scientific data was needed before the enactment of water law and this type of law and policy were required to be supported by science.[157] He further explained, '……if you impose restriction in a given area that more than 50 tubewells cannot be installed there, this imposition should be justifiable through the proper scientific data; otherwise, if anyone could prove the contrast this restriction on the installation of tubewells would not hold water, and people would break this regulation. Science is a must for water regulation. If the law/policy is not backed by science people would ignore it'.[158] The benefits of this research include the presentation of the real scenario of the resource before the public at large who would then be aware of the dire groundwater crisis of the country. Ultimately, general people would be motivated to comply with water law and policy. One respondent suggested that this type of research should be conducted in collaboration with different academic institutions. He, however, deplored that the outcomes of privately run researches were often ignored by the policymakers.[159]

In principle, respondents agreed that this type of research team was badly needed for Bangladesh. They underscored the desirability of the multidisciplinary nature of this team — it would be formed of people like geologists, hydrologists, lawyers, policy and planning experts, etc.

[156] François Molle and Alvar Closas, 'Why Is State-Centered Groundwater Governance Largely Ineffective? A Review' (2019) 7(1) *Wiley Interdisciplinary Reviews: Water* e1395, 1397.
[157] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[158] Ibid.
[159] Ibid.

E *Lack of Regional and Local Offices*

The localised nature of groundwater resources warrants that they should be administered locally within the larger national structure.[160] Centralised functioning stymies effective groundwater regulation. In contrast, decentralised offices of water institutions offer several advantages such as the collection of local groundwater data, effective monitoring of compliance and enforcement, better communication with local people to gain local customs, practice, and knowledge, and facilitating stakeholder participation. Local knowledge of ecological processes and human behavior is better known to the local people[161] who could, in turn, make a significant contribution in adopting national rules and regulations reflecting local realities. In particular, rules and regulations that build on community voices are more legitimate — since they are well accepted by the community — and as such, they are more likely to be complied with.[162] In other words, a decentralised office offers significant assistance in determining issues around groundwater sustainability locally. Moreover, decentralised office could make a significant contribution to the promotion of groundwater users' associations/local farmers' associations/community-based associations by providing them technical and all other support. Local level institutions in association with regional and local offices of central water institutions can play a major role in advancing community engagement to manage groundwater resources in a collaborative way.

Mindful of the advantages of a decentralised office of the national water institutions, the vast majority of respondents (72%) identified the centralised functioning of the water institution as a stumbling block to effective groundwater regulation. They strongly recommended decentralisation of the water institution like the WARPO — they suggested setting up regional and local offices. Policymakers (86%) and judges (83%) were more supportive of the decentralised offices for the water institutions than the other group (scholars 58%). These respondents, however, commonly noted that for effective monitoring and gathering groundwater-related data there was no alternative to having field-level offices. Having compared the groundwater data with the collection of news items one respondent argued that real data could not be gathered without having a local representative like a news report. This respondent attributed mismanagement in the water sector to the lack of field-level/local offices.[163]

Some policymakers advised that the government was considering setting up eight regional offices for the WARPO for better management and oversight of groundwater resources across the country and to that end, work was in progress. Many respondents suggested that the related existing Upazila (sub-district) officers like the agricultural officer, fisheries officer, Public Health Engineering officer, Agricultural Development Corporation officer,

[160] See chapter 3(IVC).
[161] Stoa (n 133) 34.
[162] Ibid.
[163] Interview with J 2, Justice (Mohammad, Dhaka, 1 March 2018).

the Department of Agricultural Extension Officer, etc could be deputed to work as a field-level officer for the purpose of groundwater regulation. It was also suggested that the offshoots of local government like Upazila Parishad (Sub-district Council), Pourashava (Municipality), Union Parishad (Union Council) could be charged to work as a local office for the responsible water institution.[164] To assist the local committee, a respondent suggested setting up a scientific cell in the center that would analyse data and dispatch them to the local committee.[165]

In summary, the centralised functioning of water institutions has proved ineffective in regulating groundwater resources, and this centralised notion has long been decried in the water literature.[166] Bangladeshi water institutions especially the WARPO still function centrally undermining the notion of decentralisation that has largely been advocated in the water planning documents of Bangladesh.[167]

F *Absence of Leadership*

Leadership plays a crucial role in governing groundwater resources including ensuring their sustainability. The absence of leadership, therefore, causes a significant dent in the entire governance regime.[168] As revealed by interview data, the WARPO rarely sees a competent leader at its helm, and in the result, it suffers a leadership crisis perennially. As a matter of fact, the Director General (DG) of this organisation is picked from the Bangladesh Water Development Board for a short period of time, and as such, a DG cannot demonstrate his/her capability in this short tenure.[169]

In tune with the literature,[170] empirical data derived from interviews has also identified the leadership void as one of the obstacles to the effective functioning of Bangladeshi water institutions. Around 50% of respondents reported that responsible water institutions like the WARPO lacked a competent leader who would propel the institution in the right direction. Interestingly, policymakers (71%) raised this issue more compared to judges (50%) and scholars (33%). Perhaps, the policymakers that were interviewed wanted to bring about a change in nominating a competent leader for the WARPO, but they encountered internal resistance. One respondent noted that the WARPO was headed by non-technical people which he termed 'very damaging' for the overall development of the country in general and groundwater resources in particular. He further bluntly stated, '……bureaucrats and

[164] Interview with S 3, Academic (Mohammad, Dhaka, 7 February 2018).
[165] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[166] See generally Magnus Moglia et al, 'Assessing Decentralised Water Solutions: Towards a Framework for Adaptive Learning' (2011) 25(1) *Water Resources Management* 217; Floriane Clement, 'Analysing Decentralised Natural Resource Governance: Proposition for a "Politicised" Institutional Analysis and Development Framework' (2010) 43(2) *Policy Sciences* 129.
[167] *Water Plan* (n 12) 76-7; *Water Policy* (n 13) s 5.
[168] See chapter 2(VB).
[169] Alam (n 39) 78.
[170] Broadly discussed in chapter 2(VB).

politicians are enough to destroy these institutions. Then my question is- "why we study?" — we could solve all problems through our common knowledge!!!……'.[171]

Highlighting the importance of a competent leader for a water institution like the WARPO another respondent explained, '…..the WARPO is required to have a DG who would be a man of high stature and great qualities and eventually, who would be respected by all at large and would be able to command all agencies related in the water sector…'. He, however, deplored that the WARPO was used to serve the interest of some people, and accordingly, the DG of this institution was picked up from the Water Development Board.[172] A technically and administratively sound leader should have solid knowledge with respect to (ground)water resources and should set up a clear achievable vision and mission.

In brief, Bangladeshi water institutions notably the WARPO have been confronting a chronic leadership crisis. Perhaps due in part to this crisis Bangladeshi water institutions continues to fail to set up clear achievable objectives[173] in relation to sustainable groundwater abstraction. What is precisely learnt from the interview data is that vested interests rather than popular interests are actively considered in choosing a leader for a water institution like the WARPO undermining the noble goal of a dedicated water institution.

G *Other Factors*

Respondents underscored the need for sufficient power for water institutions and enforcement mechanisms. They highlighted that merely conferring power upon the institution would not save the groundwater resources of the country unless it was equipped with the means to exercise that power. While recognising the significance of requisite power for water institutions, respondents equally emphasised the need for accountability among the agencies. They suggested deleting the indemnity clause[174] from the law and incorporating an accountability clause therein. One respondent claimed that a lack of accountability among the responsible agencies put the water resources at perils.[175] Indeed, increased accountability among decision-makers can bring about mainstream integrity and transparency practices across water institutions and water governance frameworks.[176] In the face of citizens'

[171] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[172] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018). Responses made by this interviewee suggested that policy decisions of the WARPO were significantly influenced by people from the Water Development Board, and there was a growing concern among all other water agencies that any plan developed by the WARPO was biased toward the Water Development Board.
[173] Setting up clear objectives is one of the characteristics of an effective water resource institution, see Vasant P Gandhi and Lin Crase, 'New Institutional Economics, Governance and the Performance of Water Institutions in India' (Conference Paper, International Association of Agricultural Economists Conference, 16-22 August 2009).
[174] An indemnity clause typically provides safeguard to a public official for an act of commission or omission done in good faith even though it causes harm to the public — in such an event a public official does not incur any liability.
[175] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[176] Akhmouch and Clavreul (n 132) 260.

suspicion and a low level of trust in institutions, the relevance of accountability and transparency is being increasingly felt at the government level.[177]

In summary, the above discussion grounded on the data derived from the interview responses demonstrates that the Bangladeshi water institutions are not equipped to tackle groundwater over-extraction occurring across the country. Resource shortage, lack of coordination, absence of effective monitoring, lack of required groundwater data, leadership crisis, inadequate research, and centralised functioning are significantly limiting the capacity of the Bangladeshi water institutions notably the WARPO. Given the sorry state of, and prevailing anarchy in the groundwater sector some respondents dubbed the institutional framework as a 'failed' one.

In the face of this institutional incapacity, the Barind Multipurpose Development Authority resuscitates, at least to some extent, the moribund water institutions. It offers some lessons for other institutions, albeit it has weaknesses too. By introducing the prepaid smart metering system, it has brought about a small revolution in groundwater irrigation. Accordingly, the next Part moves to examine the strengths and weaknesses of this institution in relation to the regulation of groundwater irrigation.

IV BARIND MULTIPURPOSE DEVELOPMENT AUTHORITY: UNPACKING ITS POTENTIAL FOR SUSTAINABLE GROUNDWATER IRRIGATION

The Barind Multipurpose Development Authority (BMDA) was created on 15 January 1992 under the Ministry of Agriculture to promote agricultural development in the Barind Tract.[178] The development priorities of the Barind Tract include increasing irrigation facilities by using groundwater through the installation of deep tubewells, augmenting surface water resources and their use, excavating and re-excavating ponds and canals for irrigation.[179] Currently, the BMDA pumps groundwater through 15,553 deep tubewells for irrigating around 0.6 million hectares of land,[180] that is 20% of agricultural land of the Barind Tract is covered by the BMDA.[181] However, this groundwater irrigation has been brought under the regulation by obliging farmers to pay for groundwater use.

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[177] Ibid 263.
[178] A separate section is incorporated below about the Barind Tract.
[179] Barind Multipurpose Development Authority, Ministry of Agriculture, *About Us, Background, Activities of BMDA* <http://www.bmda.gov.bd/>, <http://www.bmda.gov.bd/site/page/cc476d52-3552-4192-901d-efb7aac2e8af/Background>,<http://www.bmda.gov.bd/site/page/db57511d-2cd1-4ce3-8678-a7d83423b991/->.
[180] Asaduz Zaman, 'Participatory Irrigation Management: Barind Model a New Sustainable Initiative' (2019) 7(6) *Universal Journal of Management* 220.
[181] Barind Multipurpose Development Authority, Ministry of Agriculture, *Annual Report 2016-2017* (Report, 2017) ('BMDA Report, 2017').

This is the only institution that works at a regional level in Bangladesh to augment agricultural productivity as well as to ensure water use efficiency. Notably, the region contributes 34% of the country's total rice, 60% of the total wheat, and over two-thirds of the total potato and maize that have transformed the area into the food basket of Bangladesh.[182] The Barind Tract saw a significant development before 1947 when it was linked to Kolkata — the city of West Bengal — through an improved communication system. However, since the partition of the Indian sub-continent, the Tract lost its importance triggering the sufferings of the inhabitants that ultimately led the government to create this institution to improve the socio-economic condition of the area.[183] In recent years the region yields huge *boro* rice in the dry season through the extensive use of groundwater that has raised serious concerns about the sustainability of groundwater irrigation.

A *About the Barind Tract*

The Barind Tract consists of 16 districts of Rajshahi and Rangpur divisions (northwest region of the country) covering an area of 7,770 sq km.[184] The Tract is a terrace landscape formed during the Pleistocene age.[185] Two distinct landforms — the Barind which is dissected and undulating, and the floodplains — characterise the Barind Tract.[186] The western part of the Tract is tilted up while the southern part is tilted down.[187] The soil of the Tract is generally reddish and yellowish.[188] It is comparatively at a higher elevation than the surrounding floodplains.[189] The Tract is composed of highland, medium highland, and lowland representing 47%, 41%, and 12% respectively.[190] The groundwater of this region is mainly recharged through rainwater.[191] However, the thick sticky clay surface of the Tract significantly impedes groundwater recharging causing more runoff.[192] As a result, with the increased withdrawal of water for irrigation groundwater is quickly depleting in this part of

[182] Mohammed Mainuddin et al, *Irrigated agriculture in the northwest region of Bangladesh* (CSIRO, June 2019)14.
[183] Barind Multipurpose Development Authority, Ministry of Agriculture, *Background* <http://www.bmda.gov.bd/site/page/cc476d52-3552-4192-901d-efb7aac2e8af/Background>.
[184] Banglapedia, National Encyclopedia of Bangladesh, *Barind Tract* <http://en.banglapedia.org/index.php?title=Barind_Tract> ('Banglapedia'); ME Haque et al, 'Life Cycle Cost and Energy Consumption Behavior of Submersible Pumps Using in the Barind Area of Bangladesh' (2017) 110 *Energy Procedia* 479, 80.
[185] Md Saiful Islam, Md Zakir Hossain and Md Bahuddin Sikder, 'Drought Adaptation Measures and Their Effectiveness at Barind Tract in Northwest Bangladesh: A Perception Study' (2019) 97(3) *Natural Hazards* 1253, 1257.
[186] CS Jahan et al, 'Impact of Irrigation in Barind Area, NW Bangladesh — An Evaluation Based on the Meteorological Parameters and Fluctuation Trend in Groundwater Table' (2010) 76(2) *Journal of the Geological Society of India* 134, 134.
[187] Banglapedia (n 184).
[188] Islam, Hossain and Sikder (n 185).
[189] Ibid.
[190] Banglapedia (n 184).
[191] Ibid.
[192] Md Marufur Rahman and AQM Mahbub, 'Groundwater Depletion with Expansion of Irrigation in Barind Tract: A Case Study of Tanore Upazila' (2012) 4(8) *Journal of Water Resource and Protection* 567, 568-9.

the country.[193] The climate of the region is generally warm and humid. It receives comparatively little rainfall, the average being about 1,971 mm[194] which is much less than the national average of 2,320 mm.[195] The average temperature of the region fluctuates between 35'C and 25'C during summer and 9'C to 15'C during winter.[196] The region usually experiences hot weather and is considered semi-arid.[197]

B *Initiatives Adopted by the BMDA for Groundwater Irrigation*

Irrigated agriculture makes a significant contribution to the growth of crop production in Bangladesh,[198] and thanks especially to the existence of the BMAD, the once barren Barind Tract has now been transformed into a fertile agricultural land through groundwater irrigation.[199] As noted, the BMDA focuses on increasing irrigation facilities by using, among others, groundwater through the installation of deep tubewells. Accordingly, it undertook projects in relation to deep tubewells, underground irrigation pipelines, prepaid irrigation meters, and dug well. Additionally, to mitigate pressure on groundwater, it also carried out projects with respect to the re-excavation of ponds, cross dams, and construction of water reservoirs (locally known as *Khari*).[200] The installation of deep tubewells is the major work undertaken by the BMDA for groundwater withdrawal to augment agricultural productivity. Initially, the BMDA used to supply the exploited groundwater through open canals to farmlands which were found rather ineffective, since a considerable amount of water was lost by evaporation.[201] However, the most innovative work undertaken by the BMDA is the installation of digital meters replacing the manual token system. In addition to ensuring transparency, this prepaid metering system reduces significant water wastage.[202] These two approaches — installation of underground irrigation pipelines and prepaid irrigation meters — have been proven to be highly effective to ensure sustainable groundwater use.[203]

Another noteworthy approach adopted by the BMDA is crop diversification. It encourages farmers to cultivate less water-demanding crops in *rabi* season (dry winter season) such as wheat, potato, mustard, pulse, etc instead of more water consumptive *boro* rice.[204] This crop

[193] Ibid 569.
[194] Banglapedia (n 184).
[195] Food and Agriculture Organisation, *AQUASTAT Country Profile — Bangladesh* (FAO, 2014) 3.

[196] Banglapedia (n 184).
[197] Ibid.
[198] Md Mosiur Rahman et al, 'Study on the Irrigation Water Distribution System Developed by Barind Multipurpose Development Authority' (2011) 1(2) *Journal of the Bangladesh Association of Young Researchers* 63, 63.
[199] Jahan et al (n 186) 141.
[200] Islam, Hossain and Sikder (n 185) 1264.
[201] Ibid.
[202] Ibid.
[203] Ibid 1264-5.
[204] Ibid 1266.

diversification approach saves around 20% of irrigation water.[205] Additionally, to improve the irrigation efficiency in the Barind Tract the BMDA introduced various water distribution systems such as Poly Vinyl Chloride buried pipe, cement concrete rectangular, and rectangular earth drain.[206] Studies suggest that the water distribution system developed by the BMDA is a sustainable means to increase the productivity of irrigation systems in the country.[207]

As noted, the introduction of the prepaid smart metering system is the most innovative and significant initiative undertaken by the BMDA with a view to ensuring irrigation efficiency, thereby promoting sustainable abstraction of groundwater. It is, therefore, pertinent to examine how this metering system works, what are its advantages and limitations. Accordingly, the following section turns to shed light on this smart metering system.

C *Prepaid Smart Metering System in the Barind Tract: A Promising Initiative?*

Prior to the introduction of the prepaid smart metering system in the Barind Tract, the BMDA would collect an irrigation charge through the Prepaid Coupon System. To that end, the entire Barind area was divided into several zones, and every zonal office was equipped with staff like an assistant engineer, sub-assistant engineer, electrician, etc.[208] Pump users had to buy coupons issued by the BMDA either from the Upazila offices of the BMDA or the dealers appointed by the BMDA. Every coupon had three parts — one was for the farmer, one was for the operator and one was kept at the office.[209] An operator appointed by the BMDA would run the pump. When a farmer needed water for his agricultural land, he would go to the pump station and place his demand to the pump operator. The value was calculated based on the prescribed rate for a particular pump.[210]

There were, however, palpable problems associated with the Prepaid Coupon System such as the hassle of the preservation of the coupon, and financial deception practiced on the farmers.[211] Additionally, the collection of irrigation charges through the coupon system largely remained at the operators' will. Sometimes farmers did not get water to meet their irrigation necessity, and often groundwater was overused by the operators; meter tampering

[205] Barind Multipurpose Development Authority, Ministry of Agriculture, *Annual Report 2015-2016* (Report, 2016).
[206] Rahman et al (n 198) 64.
[207] Ibid 63.
[208] Barind Multipurpose Development Authority, Ministry of Agriculture, *Food Security and the Role of BMDA in Irrigation* (BMDA, Undated) ('Food Security').
[209] Abdur Rashid and Iquebal Hossain, 'Irrigation Management System of BMDA: An Innovative Approach' (Conference Paper, International Conference on Planning, Architecture and Civil Engineering, 2019) 8-9.
[210] Barind Multipurpose Development Authority, Ministry of Agriculture, *Irrigation Charge Collection System of the BMDA* (BMDA, Undated) ('Irrigation Charge').
[211] Barind Multipurpose Development Authority, Ministry of Agriculture, *Prepaid Meter — Innovation* <http://www.bmda.gov.bd/site/page/2ec1dbe2-c407-42e4-a541-a01971a0c0bf/->.

efforts were also reported — which led to the introduction of the smartcard-based prepaid metering system in 2005.[212]

1 *Prepaid Smart Metering System: How It Works*

Every pump is run through a divisional procedure, and to that end, as was done with the Prepaid Coupon System, the entire Barind area is divided into several zones. The prepaid smart metering system has several components. Figure 3 below exhibits the components of a smart meter.

(a) Prepaid Meter

The prepaid meter is the control unit of the pump. It operates to make the pump turn off and on according to the set rules. Additionally, it measures, among other things, energy usage, the total time of pump use, total money consumption by the pump. This meter also displays the hourly rate of the irrigation charge, and a farmer can see that before pumping water. As such, a pump operator cannot claim extra money from a farmer, nor can he practice fraud upon a farmer. When a farmer inserts his card, the prepaid meter checks if any credit is left over in the card. It displays the amount of credit and duration of operation time with the available credit. The unit asks for confirmation for pump usage, and once the user's confirmation is received, the prepaid meter turns the pump on. The pump remains on until the credit is finished, or the user stops the motor. In the latter case, the remaining credit is shown to the user who can use it later. By virtue of this meter, the irrigation charge is paid upfront by a farmer, and hence, there is no possibility for irrigation charges to remain due.[213]

(b) User Card

A farmer is required to collect a smart card from the BMDA office at the cost of BDT 152 (USD$ 1.79).[214] On this card, his photograph and identity number are printed. He uses this card for supplying water to his agricultural land. This card is rechargeable and may be recharged about 50,000 times.[215] Once a card can be recharged up to BDT 2800 (USD$ 33.05). This limit is, however, changed by the authorities from time to time.[216] A farmer is able to recharge an amount of money of his choice from the local BMDA offices or from a recognised dealer.[217]

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[212] Ibid.
[213] Zaman (n 180) 224.
[214] Food Security and the Role of BMDA in Irrigation, undated
[215] BMDA, *Irrigation Charge Collection System of the BMDA*; Asaduz Zaman, 'Participatory Irrigation Management: Barind Model a New Sustainable Initiative' (2019) 7(6) *Universal Journal of Management* 220, 224.
[216] Food Security (n 208).
[217] Irrigation Charge (n 210).

(c) Checking Card and Large Capability Card

While a checking card is used to collect data from the meter pertaining to time consumption, power consumption, etc, a large capability card keeps a more detailed meter record, which can detect, among other things, the names of ten thousand farmers who last used the deep tubewells. All these data are uploaded to the local vending stations located at zonal level offices that send them directly to the system master station which is installed at the head office of the BMDA.[218]

Figure 3 shows the components of a prepaid smart meter (source: Asaduz Zaman, 'Participatory Irrigation Management: Barind Model a New Sustainable Initiative' (2019) 7(6) *Universal Journal of Management* 220, 224).

2 *Advantages of the Prepaid Smart Metering System (PSMS)*

A prepaid meter is a well-equipped and distinctly displayable database meter that can record water usage data accurately.[219] Operating hours, unit consumption per hour, and total money against total operation can be seen at a glance.[220] Real time or near real time water usage data can be automatically and electronically captured, collected, and communicated through this

[218] Zaman (n 180) 224.
[219] Thulo Ram Gurung et al, 'Smart Meters for Enhanced Water Supply Network Modelling and Infrastructure Planning' (2014) 90 *Resources, Conservation and Recycling* 34, 35-6.
[220] Ibid.

device.[221] One is required to insert a charged prepaid card to run a pump, and as such, there is no scope of irrigation without a valid card, and eventually, no irrigation charge remains unpaid. As the meter is well-protected through a computerised system, it cannot be bypassed. Close monitoring of a meter is established through the checking card.[222] Relatively less manpower is needed to run the pumps across the area. Data with respect to the everyday irrigation charge of every Upazila could be known from the Head Office instantly, and ultimately, anomalies, if any, could be detected and sorted out.[223] Additionally, the PSMS can be used for measuring hydraulic pressure and flow, water quality, and head losses.[224] With the help of the PSMS, water managers can effectively monitor, assess, and forecast the availability, condition, and use of water.[225] Farmers are no longer harassed by the operators as they (farmers) can run the pump with their cards without the intervention of an operator and can accurately learn their water consumption rate.[226] Finally, optimal use of groundwater is ensured as farmers need to pay for every drop of water.[227]

3 *Limitations of the PSMS*

Undoubtedly, the PSMS has brought about a groundwater irrigation revolution in the Barind area. There are, however, some profound challenges and limitations too. The system is highly expensive and requires hefty investment for its operation.[228] Moreover, production components of wells dispersed in different physical locations that require assembly pose significant challenges to effectively maintain the system. Additionally, the terminal facilities installed on the wells face substantial natural and man-made damages under poor working conditions.[229] Apart from these general drawbacks of the system, the PSMS introduced by the BMDA regulates only 20% of the groundwater withdrawal for irrigation in that area, whereas 80% of groundwater irrigation remains fully unregulated.[230] There is no accounting and accurate data for this unregulated groundwater withdrawal. Most worryingly, around 15,000 deep tubewells and around 725,000 shallow tubewells pump groundwater in that area without any restriction which poses a significant threat to the groundwater resources of the region, and in the result, sustainable groundwater irrigation is threatened. More specifically,

[221] Ibid; Rodney A Stewart et al, 'Web-Based Knowledge Management System: Linking Smart Metering to the Future of Urban Water Planning' (2010) 47(2) *Australian Planner* 66, 67-8; Graham Cole and Rodney A Stewart, 'Smart Meter Enabled Disaggregation of Urban Peak Water Demand: Precursor to Effective Urban Water Planning' (2013) 10(3) *Urban Water Journal* 174, 174.
[222] Stewart et al (n 221) 68; Zaman (n 180) 224.
[223] Gurung et al (n 219) 34.
[224] Muhammad Qumrul Hassan et al, 'An Overview of Smartwater Management System: Strategic Potential in Bangladesh' (Conference Paper, GSA Annual Meeting, 2018).
[225] Ibid.
[226] Xiaowei Wang et al, 'Implementing the Prepaid Smart Meter System for Irrigated Groundwater Production in Northern China: Status and Problems' (2017) 9(6) *Water* 379, 380.
[227] Ibid.
[228] Ibid.
[229] Ibid.
[230] BMDA Report 2017 (n 181).

the area can accommodate around 8,728 deep tube wells of 02-cusec capacity to pump groundwater, but presently more than 23,000 deep tubewells operate there.[231] Additionally, no capping system is in place there to limit the total groundwater extraction. Perhaps, this region could be a starting point for a capping tool to be applied in the agricultural sector of Bangladesh.

In summary, the establishment of the BMDA marked remarkable strides in irrigating groundwater in the Barind Tract. A significant number of farmers enjoy the irrigation facilities in the dry season provided by the BMDA. Prior to the establishment of this institution, farmers could cultivate crops only once a year, but now they can harvest their agricultural lands twice or thrice.[232] Alongside the goals related to irrigation efficiency, the BMDA and other water institutions must direct their attention to addressing equity concerns in relation to access to groundwater by all farmers, notably poor and the marginalised — who are predominantly tenants, having little or no agricultural land of their own — who can ill afford to pay water price imposed by the government. The government must ensure that the special needs of the farmers who are disadvantaged by the regulations are properly identified and redressed. In identifying this equity issue interviewed farmers advocated that such regulations should not impose hardship upon them, and that they should not be compelled to pay irrigation fees like the rich farmers.[233]

That said, groundwater is a finite resource, which is rather, as a recent study reveals, non-renewable with only 6% of the total volume of groundwater around the world has renewed within a period of 50 years.[234] The current trajectory of groundwater extraction in the Barind Tract is not sustainable, and severe water scarcity will loom large if groundwater continues to be withdrawn at the current rate or even higher.[235] Also, there is a substantial risk of land subsidence in the future.[236] Moreover, the annual rainfall of the area is very low and it is progressively declining[237] triggering low groundwater rechargeability. In fact, 85% of the land of the Barind Tract has a low groundwater recharge potentiality, and only 8.6% of yearly precipitation percolates into an aquifer.[238]

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[231] Rahaman, Jahan and Mazumder (n 30).
[232] Islam, Hossain and Sikder (n 185) 1269.
[233] This equity issue is broadened in chapter 6(IIB1).
[234] Ibid; Tom Gleeson et al, 'The Global Volume and Distribution of Modern Groundwater' (2016) 9(2) *Nature Geoscience* 161.
[235] Islam, Hossain and Sikder (n 185) 1270.
[236] HM Rasel et al, 'Assessment of Ground Water Fluctuation and Recharge Due to Rainfall in Barind Area under Greater Rajshahi District (North Western Part of Bangladesh)' (2013) 13(2) *International Journal of Civil and Environmental Engineering* 47, 53.
[237] Md Rashidul Hasan, Md Nuruzzaman and Abdullah Al Mamun, 'Contribution of Rainwater to the Irrigation Requirement for Paddy Cultivation at Tanore Upazila in Rajshahi, Bangladesh' (2019) 12 *Air, Soil and Water Research* 1, 1.
[238] MI Adham et al, 'Study on Groundwater Recharge Potentiality of Barind Tract, Rajshahi District, Bangladesh Using GIS and Remote Sensing Technique' (2010) 75(2) *Journal of the Geological Society of India* 432.

In the face of these complex and multifaceted challenges, the introduction of the PSMS is a step forward initiative to control indiscriminate groundwater irrigation. Other options, however, need to be explored. In particular, surface water irrigation needs to be enhanced, and to that end, more water bodies such as ponds, cross dams, and *kahri* (water reservoirs) need to be created.[239] Drip irrigation methods may be applied to decrease water usage by more than 50%.[240] Other options include crop diversification, artificial recharging, increasing irrigation efficiency by applying, among others, the Alternate Wetting and Drying method, rainwater harvesting.[241] Despite all these limitations of the BMDA, other regions of the country could draw some lessons from the model, especially in relation to the application and operation of the prepaid smart metering system in order to bring efficiency in groundwater irrigation.

Beyond this promising technical innovation, the BMDA itself has turned out to be a model water institution. One of the dynamic features of this institution has been the inclusion of three representatives from the farmers in the Board that manages the BMDA — farmers' participation in the irrigation management is guaranteed — which provides a lesson for other water institutions.[242] Further, the irrigation management system introduced by this Authority seems to be a self-sustained model. In other words, the BMDA can meet its expenditure by its internal earnings without seeking further funds from the government.[243] Thus, it averts the notorious typical problem of resource shortage as identified by interview data that every water institution invariably faces in its day-to-day work. Additionally, by virtue of the operation of the prepaid smart metering system the BMDA has established a robust monitoring network in the region it covers that in turn, helps it collect significant groundwater data including volumetric information. Eventually, the BMDA possesses some key elements of an ideal water institution outlined in chapter 2(VB1) — promoting the participation of groundwater users in the implementation of legislation; collecting data in relation to groundwater quality and quantity; administering the resources with the participation of groundwater users on board; and establishing monitoring network.

V CONCLUSION

This chapter has answered the sub-questions (a) and (b) in relation to the viability of the current institutional settings in ensuring groundwater sustainability in Bangladesh. It has explored how the central and local government water agencies, and the local level

[239] Islam, Hossain and Sikder (n 185) 1271; ATM Sakiur Rahman et al, 'Long-Term Trend Analysis of Water Table Using 'MAKESENS'Model and Sustainability of Groundwater Resources in Drought Prone Barind Area, NW Bangladesh' (2016) 87(2) *Journal of the Geological Society of India* 179, 192.
[240] Mevlut Uyan and Tayfun Cay, 'Spatial Analyses of Groundwater Level Differences Using Geostatistical Modeling' (2013) 20(4) *Environmental and Ecological Statistics* 633, 642.
[241] Rahman and Mahbub (n 192) 575.
[242] Zaman (n 180) 223.
[243] Ibid.

committees formed under the *Water Act* and the *Groundwater Act* could offer opportunities for coordinated action to arrest the declining groundwater table. The existing institutional arrangements are, however, rather poorly designed such that they fail to seize these opportunities to work in collaboration for tackling the formidable challenges emanating from the depleting groundwater resources. Consequently, the existence of an excessive number of agencies and organisations in the water sector results in poor service outcomes, thereby rendering the groundwater regulation more complex, daunting, and challenging. More clearly, conflicting and overlapping responsibilities among water institutions have exacerbated the problems characterising the regime.

Nevertheless, the WARPO that has emerged as a dedicated and leading water institution, offers some ray of hope. As a principal water institution, it has some clear mandates from the prevailing water laws to undertake necessary steps toward the protection of the country's groundwater resources. Notably, it has the authority to develop a National Water Resources Plan, periodically assess and evaluate the country's water resource and its use, and accordingly, identify water stress areas and determine safe yield. It is the custodian of national and regional water resources databases and information systems that play a vital role in undertaking a targeted plan and strategy to facilitate groundwater sustainability. Obviously, the WARPO represents the only institution in Bangladesh that coordinates among 35 public agencies in relation to the management of water resources in general and groundwater in particular.

Notwithstanding these optimistic features of the WARPO, it suffers significant weaknesses that limit its effectiveness in overcoming the daunting challenges emerging from groundwater overexploitation. One such weakness concerns the positioning of the WARPO that undermines its status as a central water institution which needs to be addressed to make it an ideal water institution. Additionally, data based on interviews has identified some core shortcomings of the WARPO that include resource shortage; a lack of coordination, decentralisation, monitoring, and groundwater data; poor research activities; and leadership crisis. These identified institutional flaws — notably resource constraints; coordination, monitoring, and data crisis — typically shake the foundations of a water institution and so do the WARPO. Of note, coordination among the water institutions is virtually absent creating substantial risks and uncertainty in operationalising sustained groundwater governance. Additionally, insufficient resources, fragile monitoring, and a clear lack of groundwater data put the final nail to the WARPO's coffin in its capacity to tackle the groundwater crisis. Eventually, the dysfunctional state of the WARPO and other related water institutions have rendered the groundwater laws non-functional and inoperative on-the-ground. Hence, the WARPO and other connected water institutions need to undergo significant reforms for tackling the daunting challenges stemming from the declining groundwater resources. These reforms will be discussed in chapter 6 and some reform areas will be prioritised in chapter 7(III).

Despite these recorded limitations of the WARPO and other related water institutions, the creation and operation of the BMDA in relation to groundwater irrigation indicate some light at the far end of the tunnel. In particular, even with its limitations, the introduction of the prepaid smart metering system in the Barind Tract shows how water use efficiency in irrigation can be achieved in a water scarce region. Farmers have to pay upfront for every drop of water that in turn, encourages them to be economical in pumping groundwater for irrigating their agricultural lands. Moreover, this metering system enables the water managers to access the water data instantly, and accordingly, they can take a timely decision in response to any urgent groundwater crisis. The prepaid smart metering system, however, is not free from flaws. Robust funding is needed to ensure the proper functioning of this system. Moreover, meter tampering within this system is a widespread problem that limits its efficiency and effectiveness.[244]

That said, between the legal and institutional frameworks, in the context of Bangladesh, there lies another influential actor called the 'Higher Judiciary' — the Supreme Court of Bangladesh. Over the years this actor has made significant contributions and continues to do so in shaping laws, policies, and institutions in various aspects of society. In particular, it continues to make laudable contributions in shaping and dynamising the laws and institutions around the environment. It has begun to flex its muscle when it comes to the environment in general and water in particular. It has, therefore, the potential to make a greater contribution in the arena of groundwater laws and institutions. Accordingly, the following chapter is dedicated to investigating what role the Court can play in promoting and facilitating groundwater sustainability.

[244] See, eg, Iñigo Monedero et al, 'Detection of Water Meter Under-Registration Using Statistical Algorithms' (2016) 142(1) *Journal of Water Resources Planning and Management* 1; Anil Gantala et al, 'Public Water Supply Monitoring to Avoid Tampering and Waterman Fraudusing Smart Water Meter System' (2017) 8(8) *International Journal of Mechanical Engineering and Technology* 1194.

CHAPTER 5

THE ROLE OF THE COURT IN PROMOTING SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES IN BANGLADESH: EXPLORING ITS POTENTIAL

I INTRODUCTION

As seen in chapter 2IV, groundwater falls within the ambit of the environment, and achieving groundwater sustainability is, therefore, a strong environmental outcome. The thesis is directed at examining mechanisms — legal, institutional and judicial — that by preventing declining groundwater levels attempt to promote groundwater sustainability. This chapter now turns to investigate whether, when, and how judicial action can facilitate groundwater sustainability in Bangladesh. While the Bangladesh judiciary has been instrumental in protecting the environment in general and surface water in particular, it has yet to extend its judicial powers to try to protect Bangladesh's groundwater resources. This is the specific gap that this thesis has identified. Accordingly, this chapter is devoted to exploring the opportunities that the judiciary could seize on to make a greater contribution toward groundwater sustainability, informed by a preliminary analysis of the judiciary's existing approach in the broader environmental sphere.

Bangladeshi laws that govern groundwater extraction are themselves defective and deficient — problems that are exacerbated by poor compliance and enforcement.[1] Faced with serious shortcomings, institutions that are tasked with groundwater administration have proven ineffective in controlling unsustainable groundwater pumping.[2] The Supreme Court of Bangladesh could be a catalyst in facilitating, though not ensuring, the sustainable abstraction of groundwater resources, not least it could declare laws[3] as well as promote compliance and enforcement[4] by applying its constitutionally conferred extraordinary jurisdiction.[5] Eventually, this chapter answers sub-question (c) that asks: Can judicial action promote the sustainable abstraction of groundwater resources? Since the latest *Bangladesh Water Act 2013*[6] has not established any court to which people could approach to seek relief to direct the government or other organisations to stop overexploitation of groundwater resources, the role of the Supreme Court, therefore, remains vital to address activities done, or omitted to

[1] See chapter 3(IV)(V)(VI).
[2] See chapter 4(II)(III).
[3] The *Constitution of the People's Republic of Bangladesh 1972* (Bangladesh) (the '*Constitution*') art 111*;* art 111 reads 'the law declared by the Appellate Division shall be binding on the High Court Division and the law declared by either division of the Supreme Court shall be binding on all Courts subordinate to it'.
[4] Ibid 104, 108, 112.
[5] Ibid art 102.
[6] *Bangladesh Water Act 2013* (Bangladesh) *('Water Act').*

be done, by the government or any individuals or organisations concerning this issue.[7] This chapter argues that balanced and enlightened judicial action can make a significant contribution in shaping groundwater laws and institutions of Bangladesh, thereby facilitating groundwater sustainability. In particular, judicial vigilance has the potential to ensure public accountability of the relevant public institutions and stimulate executive action toward the prevention of groundwater depletion. It also argues that in appropriate cases *suo motu* (self-initiated) judicial intervention could be applied to stop indiscriminate groundwater withdrawal.

Before embarking on the discussion, it needs to be acknowledged that judicial action in relation to the overexploitation of groundwater resources is a short-term solution. A more long-term solution ultimately rests with the government — issues which are explored across chapters 3, 4, and 6. Given that this thesis aims to devise effective and efficient legal and institutional frameworks for Bangladesh to ensure sustainable extraction of its groundwater resources, an examination of the role of the Court[8] complements well other examinations of these legal and institutional frameworks.

The role of the judiciary in changing society has invited both criticism and accolades from scholars. Some have vehemently opposed the court's rise while others have highlighted its role in achieving social justice.[9] Despite a rich vein of criticism,[10] the proactive role of the court, most notably in South Asia, has gained momentum in changing society possibly due to the failure of representative institutions.[11] Arguably, in addition to the interpretation of the law, judges of the highest court of a country should make a law to meet changing situations.[12]

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[7] Mohammad Sohidul Islam, 'A Human Right to Water: Challenges and Opportunities for Ensuring This Right in Bangladesh' (2014) 15(2) *Australian Journal of Asian Law* 1, 13.

[8] All instances of the term the 'Court' refer to the Supreme Court of Bangladesh unless otherwise indicated.

[9] Madhav Khosla, 'Addressing Judicial Activism in the Indian Supreme Court: Towards an Evolved Debate' (2009) 32 *Hastings International and Comparative Law Review* 55, 55-6; Pratap Bhanu Metha, 'The Rise of Judicial Sovereignty' (2007) 18 (2) *Journal of Democracy* 70, 72, 79; also see generally Vijayashri Spipati, 'Human Rights in India - Fifty Years after Independence' (1997) 26 *Denver Journal of International Law and Policy* 93; Jeremy Cooper, 'Poverty and Constitutional Justice: The Indian Experience' (1992) 44 *Mercer Law Review* 611.

[10] See, eg, Armin Rosencranz and Michael Jackson, 'The Delhi Pollution Case: The Supreme Court of India and the Limits of Judicial Power' (2003) 28 *Columbia Journal of Environmental Law* 223 (analysing how the Delhi Pollution Case has not resulted in providing long-term environmental protection); Lavanya Rajamani, 'Public Interest Environmental Litigation in India: Exploring Issues of Access, Participation, Equity, Effectiveness and Sustainability' (2007) 19(3) *Journal of Environmental Law* 293 (examining the limitations that arise and concerns that emerge by studying two major public interest environmental cases of the Indian Supreme Court); Gerald N Rosenberg, *The Hollow Hope: Can Courts Bring about Social Change?* (University of Chicago Press, 2nd ed, 2008) (discussing limitations of judicial power in general).

[11] Ridwanul Hoque and MD Morshed Mahmud Khan, 'Judicial Activism and Islamic Family Law: A Socio-Legal Evaluation of Recent Trends in Bangladesh' (2007) 14(2) *Islamic Law and Society* 204, 204-5; Jamie Cassels, 'Judicial Activism and Public Interest Litigation in India: Attempting the Impossible?' (1989) 37(3) *The American Journal of Comparative Law* 495, 497; Khosla (n 9) 64-6.

[12] Upendra Baxi, *Courage, Craft, and Contention: The Indian Supreme Court in the Eighties* (NM Tripathi, 1985)2-3.

This type of judicial action is needed to make the Constitutional Court more effective and operational.[13] Though a court lacks 'sword and purse', in the context of South Asia, the court is no longer conceived as the weakest organ of the State. In this region, over the years the court has provided a strong voice for the disadvantaged people, it has placed itself as the bulwark against oppression and tyranny, it has demonstrated itself to be impartial, principled, and capable of achieving results.[14]

Mindful of the potential of the modern judiciary, the framers of the Bangladesh *Constitution* contemplated a robust judiciary with a view to realising a socialist society.[15] The *Constitution* contemplates two types of the judiciary — the Higher Judiciary and the Subordinate Judiciary. The Higher Judiciary refers to the Supreme Court of Bangladesh while the Subordinate Judiciary denotes the District Courts.[16] Constitutionally, the Supreme Court of Bangladesh[17] is the guardian of the *Constitution* and is fully independent in discharging its duties.[18] It has the authority to command compliance with its decisions and orders.[19] The Court is given the power of judicial review[20] by virtue of which it could not only review the State actions to ensure that it has not transgressed any provisions of the *Constitution* or the laws of the land but also could declare any law null and void for being inconsistent with any provisions of the *Constitution*. In other words, the Court has considerable scope to apply its judicial action to try to dispel injustices from society.

Initially, the Court displayed a conservative attitude by pursuing a quite restricted jurisprudential path and refused to look beyond the texts of the law.[21] However, with the advent of the concept of human rights, fundamental human rights, social justice, environmental justice, etc the Court rose with the aim of curbing anarchy and injustice from society. The Court began to realise its onerous duty to bring about social change by applying its constitutionally mandated judicial power. As explored below, the Court has made a

[13] SP Sathe, 'Judicial Activism: The Indian Experience' (2001) 6 *Washington University Journal of Law and Policy* 29, 106.
[14] Ibid 50.
[15] The *Constitution* (n 3) Preamble.
[16] Pranab Kumar Panday and Awal Hossain Mollah, 'The Judicial System of Bangladesh: An Overview from Historical Viewpoint' (2011) 53(1) *International Journal of Law and Management* 6, 7.
[17] The Supreme Court of Bangladesh, the highest Court of the country, consists of the Appellate Division and the High Court Division. The Chief Justice, and the Judges appointed to the Appellate Division, sit only in that division, and the other Judges sit only in the High Court Division. The Appellate Division is higher in rank and therefore, decisions of this Court are final; see the *Constitution* arts 94, 111; for detailed discussion on the constitution, powers, and jurisdiction of the Supreme Court see the *Constitution* arts 94-113.
[18] The *Constitution* (n 3) arts 94 (4), 96, 109.
[19] It is empowered to commit anyone for contempt, and the 'authorities' (executive and judicial) are obliged to act in its aid; see the *Constitution* (n 3) arts 108, 112.
[20] Judicial review refers to the power of the court to test any legislation passed by the Parliament or the action or inaction of the executive in relation to people's rights; see, eg, Joseph M Isanga, 'African Judicial Review, the Use of Comparative African Jurisprudence, and the Judicialization of Politics' (2017) 49(4) *George Washington International Law Review* 749, 749-53.
[21] Ridwanul Hoque, 'Taking Justice Seriously: Judicial Public Interest and Constitutional Activism in Bangladesh' (2006) 15(4) *Contemporary South Asia* 399, 400.

significant contribution to the protection of the environment. It continues to play an influential role in driving (surface) water governance reform. In fact, the Court's rulings have been crucial in undertaking necessary steps to try to protect rivers' health of the country. In particular, the adoption of the *National River Protection Commission Act 2013* and the establishment of the National River Protection Commission have been the outcome of the Court's intervention.[22] The Court has, however, failed to extend its judicial power to try to promote groundwater sustainability. Interviews identified the judges' lack of scientific knowledge, the inertia of lawyers and NGOs, and scarcity of groundwater data as the factors standing in the way of effective judicial action in relation to groundwater over-extraction. Indeed, the Court can profitably apply its constitutionally mandated judicial power in a targeted way — water stress areas could be prioritised for planned judicial intervention. As such, it is useful to shed light on the challenges and opportunities of judicial action in facilitating the sustainable extraction of groundwater resources of Bangladesh.

This chapter consists of seven parts. Part II explores how judicial action has been an influence in reshaping the vast array of administrative, legislative, and policy domains in Bangladesh. In particular, it considers the judicial contribution to environmental protection which in turn, helps develop a richer environmental jurisprudence in the country. This Part takes the discussion further by examining the rationale of public interest litigation and s*uo motu* judicial intervention in the context of groundwater sustainability. Part III then turns to investigate the role of the Court in driving water governance reform in Bangladesh. It highlights the judicial action that compelled the government to pass specific legislation and to constitute a dedicated commission for the protection of Bangladeshi rivers. In Part IV referring to two cases concerned with groundwater quality, this chapter discusses and explains how judicial action could make a meaningful contribution to groundwater sustainability. Drawing on interview data Part V identifies barriers to the telling judicial action in the promotion of sustainable groundwater extraction. Part VI underscores the relevance and significance of the judicial role in the context of groundwater sustainability. Finally, Part VII summarises the findings of this chapter.

II EXPLORING MULTIDIMENSIONAL ASPECTS OF JUDICIAL ACTION IN BANGLADESH

A *Locating the Legal Basis of Judicial Action in Bangladesh*

The Supreme Court of Bangladesh can invoke and apply judicial action under the *Constitution*. More specifically, article 102 of the *Constitution* has conferred extraordinary writ jurisdiction upon the High Court Division of the Supreme Court of Bangladesh by virtue

[22] *Human Rights and Peace for Bangladesh v Bangladesh and Others* [2009] HCD (Writ Petition No 3503 of 2009) *('Rivers Protection Case')*.

of which it continues to play a significant role in addressing diverse issues including broader environmental concerns. The High Court Division, on the application of any person aggrieved, may give necessary directions to any person or authority for the enforcement of any fundamental rights conferred by Part III of the *Constitution*.[23] The High Court Division, may on the application of any person aggrieved, make an order directing a person performing any functions in connection with the affairs of the Republic or of a local authority, to refrain from doing that which he is not permitted by law to do or to do that which he is required by law to do.[24] In the same way, the High Court Division may also declare any proceeding taken by a person performing functions in connection with the affairs of the Republic or of a local authority to be without lawful authority, and thus is of no legal effect.[25] In the same vein, the High Court Division may make an order requiring a person holding or purporting to hold a public office to show under what authority he claims to hold that office.[26] Indeed, without using the nomenclature 'writ', article 102 (2) of the *Constitution* empowers the High Court Division to exercise five kinds of writs, namely, *mandamus, prohibition, certiorari, quo warranto, and habeas corpus* against state and local authorities.[27] Furthermore, under article 104 of the *Constitution*, the Appellate Division of the Supreme Court of Bangladesh has the power to issue such directions, orders, decrees, or writs as may be necessary for doing complete justice in any cause or matter pending before it.

B *Judicial Action in Bangladesh*

This section explores the general trends of judicial action in Bangladesh. It illustrates what prompted the development of this legal jurisprudence in Bangladesh by reference to relevant cases, which are cited and analysed. In particular, this section shows that the proactive role of the Court is gradually expanding in Bangladesh, and the Court has started playing its proactive role when it comes to the arbitrary and irrational governmental actions and its inactions that are detrimental to the public interest or individuals' rights.[28] This general discussion on judicial action demonstrates that the Court can potentially exercise judicial power to curb groundwater depletion in Bangladesh. The Court applies this extraordinary jurisdiction either by way of judicial review of administrative actions, or by testing the

[23] The *Constitution* (n 3) art 102(1).
[24] Ibid art 102 (2)(a)(i).
[25] Ibid art 102 (2)(a)(ii). Further, the High Court Division, on the application of any person, is also empowered to make an order for the production of a person kept in the custody to get itself satisfied that the person is not being held in custody without lawful authority or in an unlawful manner; see the *Constitution* (n 3) art 102 (2)(b)(i).
[26] Ibid art 102 (2)(b)(ii).
[27] Ibid art 102 (2); see also Md Abdul Halim, *Constitution, Constitutional Law, and Politics: Bangladesh Perspective: A Comparative Study of Problems of Constitutionalism in Bangladesh* (CCB Foundation, 2006); AKM Shamsul Huda, *The Constitution of Bangladesh* (Rita Court, 1997).
[28] In *Abdul Gafur v Secretary, Ministry of Foreign Affairs* (1997) 17 BLD (HCD) 453, the Court, in pursuance of the right to life and legal protection of a girl-victim of human trafficking interned in Kolkata, directed diplomatic assistance for her rescue. It also directed actions to bring back other women victims of human trafficking.

constitutionality of statutes, or by participating in the design of the public policy. Accordingly, the following discussion on judicial action extends to these three areas.

1 *Judicial Action in Relation to Administrative Measures*

On different occasions, the Court has remained vigilant to ensure that administrative actions did not cause public harm. Invoking the doctrine of public trust, for instance, the Court persistently reminded the duty-bearers of the State that the powers they exercise are a trust reposed by the general public on them.[29] The Court took seriously the wanton misuses of arresting power by the police and other forms of police brutalities and exaggerations.[30] The Court has turned down countless preventive detention orders and sought to develop robust interpretations of the *Special Powers Act 1974*.[31] The Court has repeatedly observed that it is more concerned with the betterment of the whole nation than that with the financial loss of individuals.[32] Thus, the Court upheld the government ban on the manufacturing of polythene bags rejecting the plea of some businessmen that their right to legal protection was denied due to the government's failure to notify them beforehand.[33]

2 *Judicial Action in the Legislative Domain*

The Court tested and subsequently annulled several pieces of legislation by applying its extraordinary jurisdiction. For example, the Court struck down the *Contempt of Court Ordinance 2008* as it undermined judicial independence.[34] Similarly, the *Supreme Judicial Commission Ordinance 2008* was declared unconstitutional by the Court as it ran counter to the constitutional principle of judicial independence by providing for a Commission the majority of whose members happened to be outside the judiciary.[35] The Court declared the fifth, seventh, eighth, 13th, and 16th amendments to the *Constitution* unconstitutional.[36] In the

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[29] *BLAST v Bangladesh* (2008) 60 DLR (HCD) 176; this doctrine was applied in *M Saleem Ullah v Bangladesh* (2005) 57 DLR (HCD) 171; *Motiar Rahman v Govt of Bangladesh* (2005) 57 DLR (HCD) 327.

[30] See, eg, *Alhaj Md Yousuf Ali v The State* (2002) 22 BLD (HCD) 231; *Saifuzzaman v State* (2004) 56 DLR (HCD) 324 (cautioning the police against using arresting power under section 54 of the *Code of Criminal Procedure 1898* 'capriciously and fancifully', and against resorting to torture). In Saifuzzaman, the Court also framed guidelines to regulate arrest, detention and police custody. See also the most prominent case of this genre, *BLAST v Bangladesh* (2003) 55 DLR (HCD) 363; the Appellate Division affirmed the judgment and order of the High Court Division in the *Bangladesh v Bangladesh Legal Aid and Services Trust (BLAST)* [2004] AD (Civil Appeal No 53 of 2004) *('Remand Case')*.

[31] *The Special Powers Act 1974* (Bangladesh); this *Act* allows preventive detention and it is a notorious weapon for police to detain anyone capriciously; see ss 3-6.

[32] *KM Asadul Bari v Bangladesh* (2002) 22 BLD (HCD) 129, 131; see also *Sirajul Islam v The State* (2004) 56 DLR (HCD) 236 (environment-consciousness led to a broader legal interpretation).

[33] *KM Asadul Bari v Bangladesh* (2002) 22 BLD (HCD) 129, 131.

[34] *Md Shamsul Hoque and Another v Bangladesh* [2008] HCD.

[35] *Md Idrisur Rhaman v Bangladesh* [2008] HCD (Writ Petition No 3228 of 2008).

[36] *Khondker Delwar Hossain, Secretary, BNP Party (Civil Petition No 1044/09), and Munshi Ahsan Kabir and Others (Civil Petition No 1045/09) v Bangladesh Italian Marble Works Ltd, Dhaka and Others* [2009] AD (both cases)*; Siddique Ahmed v Government of Bangladesh and Others* [2011] AD (Civil Appeal No 48 of 2011);

eighth amendment case, the Court authoritatively developed the 'basic structural pillars of the Constitution' principle which was held to be inviolable in all circumstances, and it decisively concluded that the Parliament in no way could change the basic structure of the Constitution by applying its legislative power whatsoever. In this case, the Court by majority decision struck down the amended article 100 of the *Constitution* and restored the original one.[37]

More recently, in the 16th amendment case[38] in response to an argument advanced by the Attorney General of Bangladesh[39] that the policy decision was beyond the judicial review, and as such, the Court should not 'poke its nose' into such kinds of decision, the Court aptly replied that it would not roll back its judicial hands and would not remain as a silent spectator when the policy decision was violative of the fundamental rights, or of any of the provisions of the *Constitution*.[40] The Court kept saying that as the ultimate guardian of the rights of the people of this land, this Court had placed itself at the helm of the affairs in dealing with State machinery.[41] The Court forcefully asserted that the judicial review conferred upon the High Court Division under article 102 of the *Constitution* protects the rights of the people from parliamentary and executive encroachment, and it is the bulwark against the joint invasion by the Parliament and the Executive.[42] Indeed, the independent judiciary is a citadel that safeguards the rights and the liberty of the citizens, and the judges are the impregnable wall of that citadel.[43]

3 *Judicial Action in Shaping Public Policy*

The Court continues to play a significant role in shaping public policy. Soon after the nation's independence, the nascent judiciary established the judicial reviewability of policy issues by reference to the greater public interest.[44] Having observed the non-existence of law to effectively and efficiently prevent and punish sexual harassment of women, the Court came

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Anwar Hossain Chowdhury v Bangladesh (1989) 18 CLC (AD) *('8th Amendment Case'); Abdul Mannan Khan v Government of Bangladesh and Others* [2005] AD (Civil Appeal No 139 of 2005)*; Government of Bangladesh and Others v Advocate Asaduzzaman Siddiqui and Others* [2017] AD (Civil Appeal No 6 of 2017) *('16th Amendment Case')*; the government has filed a review petition with the Appellate Division against the judgment and order confirmed by this Division upholding the earlier judgment and order handed down by the High Court Division declaring the 16th constitutional amendment unconstitutional. By this amendment, the Chief Justice-led Supreme Judicial Council, which was responsible for holding inquiry into the alleged misconduct and incapacity of a judge of the Supreme Court, was abolished and the removal power was vested with the Parliament.

[37] *8th Amendment Case* (n 36) [293, 295, 297, 419-20, 496, 523, 529, 673].

[38] *16th Amendment Case* (n 36).

[39] Attorney General is the highest law officer of the Republic who is appointed by the President. To be appointed as the Attorney General of Bangladesh one must be qualified to be appointed as a Judge of the Supreme Court of Bangladesh; see the *Constitution* (n 3) art 64.

[40] *16th Amendment Case* (n 36) 339-40.

[41] Ibid 338-41.

[42] Ibid.

[43] Ibid 480-5.

[44] *Kazi Mukhlesur Rahman v Bangladesh* (1974) 26 DLR (AD) 44 ('*Berubari Case')*.

up with clear guidelines in the 'nature of law' to be followed by the employers and educational institutions in preventing and suppressing sexual harassment of women until 'effective legislation' was adopted.[45] In *BLAST and others v Bangladesh*[46] the Court developed legal safeguards against misuses of arresting power of the police and of the discretion of the magistrates to remand (send back) the arrestees to the police custody. The decision was, on an appeal, substantially reaffirmed by the Appellate Division, and it resulted in setting out specific guidelines for magistrates and judges and also responsibilities and guidelines for police.[47]

The Court's proactive and assertive judicial action was perhaps, most well demonstrated in the case of *Secretary, Ministry of Finance v Md Masdar Hossain and Others*.[48] In this case, the Appellate Division largely agreeing with the High Court Division issued some laudable directives to be implemented forthwith by the executive for ensuring judicial independence. Following the Court's directives, finally, the subordinate judiciary was formally separated from the executive and started its new journey from 1 November 2007.[49] In this case, responding to an argument made by the Attorney-General of Bangladesh that the Court lacked an authority to direct Parliament to enact laws or to direct the President to frame rules, the Court boldly and eloquently asserted that if in any case a course of constitutional deviation was found to be engineered and pursued either by Parliament or the executive, the higher judiciary could exercise its jurisdiction to bring them back to the constitutional path by giving necessary directions.[50]

The foregoing discussions reveal that judicial action has not only been used to check administrative and legislative actions in Bangladesh, it has been extended to shape public policy. This potential of the Court could be invoked to promote a viable policy to ensure sustainable abstraction of groundwater resources.

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[45] *BNWLA v Bangladesh* (2009) 14 BLC (HCD) 694.

[46] *Bangladesh Legal Aid and Services Trust (BLAST) and Others v Bangladesh and Others* (2005) 25 BLD (HCD) 83; in *Korban v Bangladesh* (2003) 55 DLR (HCD) 363, where the petitioner was re-detained from the jail gate following Court's release order, the HCD awarded against the detaining authority compensatory cost of BDT 5000. The Court also exercised its assertive judicial activism in the area of women's legal rights. The Court did not hesitate to strike down both blatant and ingenious gender-based discriminatory actions against women and has employed commendable efforts to advance and establish the concept of equitable and substantive equality; see, eg, *Rabia Bashri Irene v Bangladesh Biman* (2000) 52 DLR (HCD) 308, declaring unconstitutional a public body's fixation of different ages of retirement for flight stewards and stewardesses. This was affirmed in *Bangladesh Biman v Rabia Bashri Irene* (2003) 55 DLR (AD) 132.

[47] *Remand Case* (n 30).

[48] *Secretary, Ministry of Finance v Md Masdar Hossain and Others* (2000) 52 DLR (AD) 82 *('Masdar Hossain Case').*

[49] Awal Hossain Mollah, 'Independence of Judiciary in Bangladesh: An Overview' (2012) 54(1) *International Journal of Law and Management* 61, 66, 72-3.

[50] *Masdar Hossain Case* (n 48) 108.

C *Judicial Action in Relation to the Protection of the Environment*

As (ground)water is one of the important components of the environment, it is useful to flesh out the Court's action in relation to the protection of the environment. This section also demonstrates that the Court has taken environmental issues seriously, and that issues around groundwater depletion now remain ripe for the Court to apply its action therein.

The Court has extensively exercised its judicial power in the protection and preservation of the environment. In the first case of its kind, the Court asserted that the right to live in a decent environment was inclusive in the right to life under articles 31[51] and 32[52] of the *Constitution*. Thus, the Court decisively held that the State was bound to protect the health and longevity of the people living in the country as the right to life guaranteed under articles 31 and 32 of the *Constitution* that include protection of the health and normal longevity of a man free from threats of man-made hazards unless the threat is justified by law.[53] In a writ petition filed by the Bangladesh Environmental Lawyers Association (BELA) with a prayer to stop pollution from ultra-hazardous industries, the Court held that life means a 'qualitative life among others, free from environmental hazard'.[54] Recognising the connection between environmental pollution and the violation of the right to life, the Appellate Division stressed the necessity to improve the natural and man-made environment with a view to protecting this right to a healthy environment.[55] Relying on an Indian case[56] the Court observed that a hygienic environment is an integral facet to a healthy life, and it will be impossible to live with human dignity without a humane and healthy environment.[57] In dealing with this environmental issue, the Court applied the *intergenerational equity*[58] principle and observed that the right to have open space, parks, water bodies, etc are rights accruing to Nature and the Environment, which it is the duty of the State to preserve for the sake of future

[51] The *Constitution* (n 3) art 31 guarantees right to protection of law.
[52] Ibid art 32 guarantees protection of right to life and personal liberty.
[53] *Dr Mohiuddin Farooque v Bangladesh and Others* (1996) 48 DLR (HCD) 438 ('*Radiated Milk Case')*.
[54] *Dr Mohiuddin Farooque v Bangladesh and Others* (2003) 55 DLR (HCD) 69 [53] ('*Industrial Pollution Case'*).
[55] *Rabia Bhuiyan, MP v Ministry of LGRD and Others* (2007) 59 DLR (AD) 176 ('*Arsenic case'*).
[56] *Virender Gaur v State of Haryana* (1995) 2 SCC 577 [7].
[57] *Arsenic Case* (n 55) [25].
[58] Equity refers to procedural and substantive fairness and justice. In the international environmental law, equity includes both intra-generational equity and inter-generational equity. The former aims to ensure justice among existing human beings while the latter requires each generation to maintain the environment and pass it on in no worse condition that it was received; for detailed discussion on this issue see, eg, Daniel Bodansky, Jutta Brunnée and Ellen Hey (eds), *The Oxford Handbook of International Environmental Law* (Oxford University Press, 2008) 640-61; Philippe Sands and Jacqueline Peel, *Principles of International Environmental Law* (Cambridge University Press, 2012) 187-237; Zena Hadjiargyrou, 'A Conceptual and Practical Evaluation of Intergenerational Equity in International Environmental Law' (2016) 18(3/4) *International Community Law Review* 248; Edith Brown Weiss, 'Climate Change, Intergenerational Equity, and International Law' (2007) 9 *Vermont Journal of Environmental Law* 615.

generations.[59] The Court applied the *precautionary principle*[60] in relation to the hazardous ship-breaking industry and categorically directed the government to frame necessary rules and regulations with a view to preventing the entrance of hazardous ships into the territorial waters of Bangladesh for dismantling purposes.[61]

Additionally, the Court's intervention largely prevented air pollution emitting from two-stroke three-wheeler vehicles. In response to a writ petition filed by the BELA, the Court directed the government to, among other things, phase out all existing two-stroke three-wheeler vehicles, which notoriously polluted Dhaka's air, from the capital city by December 2002.[62] Despite palpable hardships accruing to certain citizens, the government implemented the Court's direction.[63]

The preceding discussions make it abundantly clear that judicial action is, in one way or another, contributing to the change of Bangladesh society. Having said that, it is to be recognised that this judicial action is largely dependent on the public interest litigation which deserves a short discussion. As such, the following section examines the interplay between public interest litigation and judicial action.

D *Public Interest Litigation and Judicial Action*

There is a growing recognition that public interest considerations are intrinsically connected with groundwater resources.[64] Given that groundwater is immensely contributing to the rise of the economy by promoting mining, manufacturing, irrigated agriculture, hydropower generation, and meeting domestic needs, public interest becomes more plausible in this resource.[65] Additionally, public values such as aesthetics, public recreation, and public health are also connected with the development of (ground)water resources.[66] Public interest issues are relevant to the groundwater resources of Bangladesh given that groundwater contributes almost 97% of drinking water and 90% of irrigation water.[67] The *Water Act* explicitly

[59] *Bangladesh Paribesh Andolon and Another v Bangladesh and Others* (2006) 58 DLR (HCD) 441 [28].
[60] The precautionary principle is applied to prevent serious or irreversible environmental damage where there is scientific uncertainty; for broader discussion on this subject see, eg, Sands and Peel (n 58); Bodansky, Brunnée and Hey (n 58); Jacqueline Peel, *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (Federation Press, 2005); James Cameron and Juli Abouchar, 'The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment' (1991) 14 *Boston College International and Comparative Law Review* 1.
[61] *Bangladesh Environmental Lawyers Association (BELA) v Bangladesh and Others* (2006) HCD (Writ Petition No 3916 of 2006) [4].
[62] *Dr Mohiuddin Farooque v Bangladesh and Others* (2003) 55 DLR (HCD) 613 *('Vehicular Pollution Case')*.
[63] Md Saiful Karim, Okechukwu Benjamin Vincents and Mia Mahmudur Rahim, 'Legal Activism for Ensuring Environmental Justice' (2012) 7(1) *Asian Journal of Comparative Law* 1, 32.
[64] See generally Janet M Howe, 'Arizona Water Law: A Parched Public Interest' (2016) 58(2) *Arizona Law Review* 541.
[65] Ibid 554.
[66] Ibid.
[67] See chapter 2(VIII).

recognises that rights in relation to groundwater shall, on behalf of the people, vest in the State.[68] As such, public interest litigation is very pertinent to exploring the applicability of such principles in relation to groundwater depletion.

Public interest litigation implies litigation for the protection of the interest of the society at large.[69] However, matters of standing in public interest litigation have long been a subject of judicial discourse in Bangladesh, and instead of being instrumental in advancing public interest litigation through judicial action, Bangladeshi judges have pursued an inward-looking jurisprudential path for quite some time, refusing to go beyond the texts of law.[70] Indeed, rigid interpretation of the term 'person aggrieved' mentioned in article 102 of the *Constitution* clogged the path of public interest litigation in Bangladesh for a considerable period of time.[71] Overwhelmingly strong pressure from the established legal quarters, however, eventually forced Bangladeshi judges to move beyond restricted legal formalism. Public interest litigation formally won out in 1996 in *Dr Mohiuddin Farooque v Bangladesh* case.[72] In this case, the BELA, an environmental organisation, was granted standing to challenge an ongoing 'flood control' megaproject, Flood Action Plan 20, on the ground of rights violation and breach of the law. Earlier the High Court Division refused standing to the BELA in *Dr Mohiuddin Farooque v Bangladesh*,[73] and on an appeal, the Appellate Division opened standing to any person with 'sufficient interest' and wishing to litigate people's rights or seeking enforcement of public legal-constitutional duties.[74] In this groundbreaking case, Kamal, J made the following statements:

> 'In so far as it concerns public wrong or public injury or invasion of fundamental rights of an indeterminate number of people, any member of the public, being a citizen, suffering the common injury or common invasion in common with others or any citizen or an indigenous association, as distinguished from a local component of a foreign organisation, espousing that particular cause is a person aggrieved and has the right to invoke the jurisdiction under Article 102'.[75]

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[68] *Water Act* (n 6) s 3.

[69] For detailed discussion on public interest litigation see, eg, Cassels (n 11); Rajamani (n 10); Jona Razzaque, *Public Interest Environmental Litigation in India, Pakistan and Bangladesh* (Kluwer Law International, 2004); Naim Ahmed, *Public Interest Litigation: Constitutional Issues and Remedies* (Bangladesh Legal Aid and Services Trust, 1999).

[70] Hoque (n 21).

[71] Ridwanul Hoque, *Judicial Activism in Bangladesh: A Golden Mean Approach* (Cambridge Scholars Publishing, 2011) 141-2.

[72] *Dr Mohiuddin Farooque v Bangladesh and Others* (1997) 49 DLR (AD) 1 (popularly known as '*FAP20 Case'*); *Dr Mohiuddin Farooque v Bangladesh and Others* (1998) 50 DLR (HCD) 84.

[73] *Dr Mohiuddin Farooque v Bangladesh* [1994] HCD (Writ Petition No 998 of 1994).

[74] *FAP20 Case* (n 72).

[75] Ibid. His Lordship further held that 'interpreting the word "any person aggrieved" meaning only and exclusively individuals and excluding the consideration of people as a collective and consolidated personality will be a stand taken against the Constitution' [47]. His Lordship BB Roy Choudhury, J, went further and held that 'The expression "person aggrieved" means not only any person who is personally aggrieved but also one

This new paradigm has incorporated an affirmative, proactive role of the Court to meet the needs of those who are incapable, on account of poverty or otherwise, of seeking the assistance of the Court.[76] Eventually, the Court is empowered to ensure that rule of law is observed by citizens ranging from the poor to the rich, as well as by the rulers. Since this judgment, many NGOs such as the BELA, the Bangladesh Legal Aid and Services Trust, the Bangladesh Poribesh Andolon have run many successful public interest litigation cases.[77] However, most of these public interest litigation cases involved environmental justice, and continued judicial environmental activism has been one of the significant features of Bangladeshi public interest litigation jurisprudence. The sustainability of natural resources such as groundwater is an integral part of environmental protection that requires judicial attention.

However, public interest litigation does have some obvious constraints in stimulating judicial action. Certain situations require that judicial intervention be made instantaneously to prevent wanton damage to any critical public property, including natural resources. Filling a natural water body with earth, for instance, may necessitate immediate intervention from the Court. In such a case it may be too late to initiate judicial action based on litigation and as such, justice may be obstructed. *Suo motu* jurisprudence may usher in justice in such an urgent circumstance. Most importantly, *suo motu* intervention — which seeks to halt actions that may cause irreparable damage to the environment — is more relevant concerning the protection of groundwater resources given that damage caused to this precious resource by human activities is devastating and almost irreversible.[78] Quick judicial response to prevent groundwater depletion, therefore, warrants and justifies this unique power of the Court. Hence, the following section turns to examine the successes and limitations of *suo motu* jurisprudence in Bangladesh.

E *Suo Motu (Self-Initiated) Judicial Intervention*

Suo motu (self-initiated) judicial intervention by the Supreme Court, albeit few in number, has added a new horizon to the justice sector of Bangladesh. Such a proceeding is initiated by the Court either completely on its own motion or following news reports or in response to

whose heart bleeds for his less fortunate fellow beings for a wrong done by the Government or a local authority in not fulfilling its constitutional or statutory obligations' [97]. For further discussion on how *locus standi* issue evolved in Bangladesh see generally *Berubari Case* (n 44); *Dada Match Workers Union v Bangladesh* (1977) 29 DLR (HCD) 188; *Bangladesh Sangbadpatra Parishad (BSP) v Bangladesh* (1991) 43 DLR (AD) 126; *Bangladesh Retired Government Employees Welfare Association v Bangladesh* (1994) 46 DLR (HCD) 426.

[76] Islam (n 7) 9; Sathe (n 13) 70-72.

[77] See *Industrial Pollution Case* (n 54); *Vehicular Pollution Case* (n 62); *Bangladesh Environmental Lawyers Association (BELA) and Thengamara Mohila Sabuj Sangha (TMSS) v Bangladesh and Others* [2004] HCD (Writ Petition No 4244 of 2004) *('Illegal Sand Extraction from River Korotoa').*

[78] See, eg, Werner Aeschbach-Hertig and Tom Gleeson, 'Regional Strategies for the Accelerating Global Problem of Groundwater Depletion' (2012) 5(12) *Nature Geoscience* 853; Yoshihide Wada et al, 'Global Depletion of Groundwater Resources' (2010) 37(20) *Geophysical Research Letters* 1.

letters addressed to it.[79] Courts usually tend to apply this jurisdiction when gross executive negligence or police excesses affecting people's life and liberty are found. In the *State v Deputy Commissioner, Sathkhira*,[80] the first reported *suo motu* intervention, MM Hoque, J having read the newspaper came to learn the miserable story of a hapless boy named Nazrul Islam and based on the report he issued a *rule nisi* asking the authorities to free the illegally detained person.[81] With this case, the jurisprudence of *suo motu* intervention started its journey in the judiciary of Bangladesh, and *suo motu* interventions were applied by the Bangladeshi judges on several occasions.[82] The High Court Division prompted by a newspaper report that under-trial children prisoners had been languishing with adult prisoners, directed the Inspector General of Prisons to submit a detailed report followed by an extensive inquiry. Having heard the matter in length, the Court issued prescriptions, guidelines, and some mandatory directives that included orders to shift the children to the correction centres, to separate the juvenile offenders from the adult prisoners, and to discharge the children under the age of 12 from the charges.[83] By applying the *suo motu* interventions the Court quashed several proceedings illegally initiated against some under-aged children who did not legally possess *mens rea* to commit offences.[84]

This *suo motu* jurisprudence has been extended to the protection of the environment. By invoking this unique tool, the Court has ordered the demolition of a skyscraper building illegally constructed on the natural water bodies.[85] The Bangladesh Garment Manufacturers and Exporters Association erected this 15-story building in 2006, which the Court termed as a 'cancerous growth' choking the capital's landmark Hatirjheel lake. Since the final order to demolish the building passed by the Appellate Division on 2 June 2016, the Bangladesh Garment Manufacturers and Exporters Association took several extensions from the Court that finally expired on 12 April 2019. Only on 22 January 2020, following the conclusive order of the Court, did the government start demolishing the building, and indicated that it would take six months to complete the demolition.[86]

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[79] Hoque (n 71) 152.

[80] *State v Deputy Commissioner, Sathkhira* (1993) 45 DLR (HCD) 643.

[81] This dictum (*suo mto*) was reaffirmed in *Shiplu and Another v The State* (1997) 49 DLR (HCD) 53.

[82] In the *State v Md Zillur Rahman and Others* (1999) 19 BLD (HCD) 303, Rabbani, J, in a *suo motu* intervention, held that forceful opposition to, and compelling others to observe hartal (strike) were criminal offences under the *Penal Code 1860* (Bangladesh) ss 141-160. In the *Editor, the Daily Bangla Bazar v District Magistrate, Naogaon* (2001) 21 BLD (HCD) 45, the same judge, acting on a newspaper report, issued a directive banning unauthorised fatwas involving Muslim personal law matters now governed by the *Muslim Family Laws Ordinance 1961* (Bangladesh).

[83] *Editor, the Daily Prothom Alo v Bangladesh* (2003) 11 BLT (HCD) 281.

[84] *Labu Mia v State* (2001) 53 DLR (HCD) 218 (a charge of a crime was formally brought against a minor boy of four). As per the *Penal Code 1860* (Bangladesh) (as amended in 2004) ss 82-83, minimum age of criminal responsibility is nine (earlier this age was seven).

[85] *President, Bangladesh Garment Manufacturers and Exporters Association (BGMEA) v Government of Bangladesh and Others* [2013] AD (Civil Petition for Leave to Appeal No 1162 of 2013).

[86] Abdullah Alif, 'Rajuk Starts Demolishing BGMEA Building', *Dhaka Tribune* (online, 22 January 2020) <https://www.dhakatribune.com/bangladesh/dhaka/2020/01/22/rajuk-starts-demolishing-bgmea-building>.

However, *suo motu* jurisprudence suffers legal uncertainty.[87] *Suo motu* intervention, it is argued, can only be exercised in a case of palpable gross criminal injustice, and the Court is not empowered to initiate judicial review actions *suo motu* under article 102 of the *Constitution*.[88] To remove this legal uncertainty the Court may follow the trail of its Indian counterpart — the Indian Supreme Court — to authoritatively pronounce on its authority to issue writs *suo motu*.[89] Some people also tend to term the *suo motu* judicial actions as non-judicial and violative of natural justice and judicial impartiality since the self-intervening judge allegedly is the complainant and the adjudicator at the same time.[90] However, in *suo motu* judicial actions, formal processes of hearing are maintained adhering to the principles of natural justice, and such *suo motu* actions are directed only to protect public/social interests.[91] Most importantly, constitutional objectives of the rule of law, justice, and human dignity, protection of the environment, and natural resources like groundwater, it may be argued, certainly, justify the *suo motu* jurisdiction.[92] Therefore, judges' functional responsibility to dispel injustices and legal wrongs offer constitutionally-sustained moral justifications for their *suo motu* actions. The environmental degradation ranging from water pollution to air pollution to the river 'grabbing' to the forest destruction has induced the Court to initiate judicial intervention on its own motion. In particular, the inertia of the environmental lawyers, groups and more generally, public institutions and the government necessitates the *suo motu* intervention of the Court to prevent irreversible damage to the groundwater resources.

III THE ROLE OF THE JUDICIARY IN DRIVING WATER GOVERNANCE REFORM

The Court has been attempting to strengthen water governance in Bangladesh for over two decades — by relying on the constitutional right to seek enforcement of fundamental rights, and the capacity to seek a writ petition for the purposes of remedying damages to public property. In the case of *Dr Mohiduddin Farooque v Bangladesh and Others*,[93] the Court for the first time, albeit without elaboration, made a direct connection between a decent environment (in this case, referring to water quality) and the right to life. Having expressed its grave concern over the quality of water being contaminated by the untreated effluents discharged by the huge number of industries and factories,[94] the Court issued directives to

[87] Ridwanul Hoque, 'Suo Motu Jurisdiction as a Tool of Activist Judging: A Survey of Relevant Issues and Constructing a Sensible Defence' (2003) 8 *Chattogram University Journal of Law* 1.
[88] Mahmudul Islam, *Constitutional Law of Bangladesh* (Mullick Brothers, 2nd ed, 2002) 451.
[89] See, eg, *Sunil Batra (I) v Delhi Administration* (1978) 4 SCC 494.
[90] Asif SK Khosa, 'Suo Motu Exercise of Writ Jurisdiction' [1993] *All Pakistan Legal Decision 1993 Journal Section* 79, 87-96.
[91] Ahmed (n 69) 148; Hoque (n 71) 156.
[92] Hoque (n 71) 156.
[93] *FAP20 Case* (n 72).
[94] *Industrial Pollution Case* (n 54) [18].

the government that included the mandatory obligation for industrial units to adopt adequate and sufficient measures to control pollution.[95]

In 2009, the Court ruled to protect four specific rivers around Dhaka — the Buriganga, the Shitalakkhya, the Turag, and the Balu — by requiring the government to establish the National River Protection Commission (NRPC).[96] In response, the government passed the *National River Protection Commission Act 2013*, which included the establishment of the NRPC and a new raft of governance arrangements specifically designed to improve river protection and management. In order to protect the rivers Piani, Dawki, and Dhala, the Court upheld a ban on the mechanised extraction of stones from the said rivers imposed by the Department of Environment.[97] That same year, the Court halted a development project on the Sandhya/Krishnakati River, and found that the right to water was intimately and legally connected to the right to life,[98] and directed the government to protect rivers as principal sources of natural water.[99]

In 2010, the Court castigated the Bangladesh Inland Water Transport Authority for encroaching upon the Buriganga River and eventually asked the authority to demolish, dismantle, and remove the structure erected on the river.[100] The Court tasked the government with forming a committee to cease dumping of human and industrial waste in the Buriganga, as well as launching a monthly mass awareness campaign on the need to keep the river clean.[101] In 2011, the Court released specific directives to protect the Jaflong-Dawki River from erosion, encroachment, and uncontrolled extraction of stones (which included the removal of unauthorised bailey bridge constructed over the Jaflong-Dawki), as well as the declaration of the river as an 'Ecologically Critical Area', and formulation of the environmental guidelines.[102] More recently, in 2016, the Court relied explicitly on the public trust doctrine to require the government to remove illegal installations, buildings, and constructed establishments from the banks of the Karnaphuli River.[103]

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[95] Ibid [47].
[96] *Rivers Protection Case* (n 22).
[97] *Bangladesh Environmental Lawyers Association (BELA) v Government of Bangladesh and Others* [2009] HCD (Writ Petition No 4958 of 2009).
[98] The *Constitution* (n 3) art 32.
[99] *Human Rights and Peace for Bangladesh v Bangladesh and Others* [2009] HCD (Writ Petition No 4242 of 2009).
[100] *Human Rights and Peace for Bangladesh v Bangladesh and Others* [2010] HCD (Writ Petition No 4027 of 2010).
[101] *Human Rights and Peace for Bangladesh v Bangladesh and Others* [2010] HCD (Writ Petition No 3676 of 2010).
[102] *Bangladesh Environmental Lawyers Association (BELA) and Abdul Hafiz v Bangladesh and Others* [2011] HCD (Writ Petition Nos 10703 of 2011 and 10947 of 2011).
[103] *Human Rights and Peace for Bangladesh v Bangladesh and Others* [2010] HCD (Writ Petition No 6306 of 2010).

The latest in a series of rulings on water law has been the *Bangladesh Rivers Case*[104] which granted legal personhood to the Turag river and all other rivers flowing in and through the territory of Bangladesh.[105] The Court recognised all Bangladeshi rivers as living entities as well as legal persons. The Court appointed the NRPC as the legal guardian (in *loco parentis*) for the protection and conservation of all rivers including the Turag, and articulated a new obligation on the NRPC to 'free all rivers of pollution and encroachment and ensure their natural navigability along with their protection, conservation, beautification, and associated developments'.[106] The reasons given by the Court relied primarily on two internationally recognised principles of environmental law: (1) the public trust doctrine; and (2) constitutional human rights, including the right to a healthy environment. However, in doing so, the Court relied on an unusual reading of the *Constitution*. The Court identified a novel basis for the public trust doctrine within the *Constitution*. While Part II of the *Constitution* (Fundamental Principles of State Policy) explicitly includes the public trust doctrine and the right to a healthy environment,[107] these articles are not 'judicially enforceable', but rather serve as a guide to constitutional interpretation and State lawmaking.[108]

To overcome this hurdle, in this case, the Court in an innovative way considered Part II alongside the specific, judicially enforceable rights articulated in Part III of the *Constitution*.[109] In particular, articles 31 (the right to the protection of law) and 32 (the protection of the right to life and personal liberty) create broad human rights to legal protection, and the right to seek enforcement of fundamental rights is itself a fundamental right guaranteed by the *Constitution*,[110] and a writ petition is maintainable for the purposes of remedying damage caused to public property.[111] The Court held that when articles 31 and 32 are read in combination with articles 18A and 21 in Part II, it means that 'if any damage is caused to any public property (such as natural resources), any individual as owner of that property can resort to law for the violation of a fundamental right guaranteed by the *Constitution*'.[112] Consequently, the Court opined that people's fundamental rights over the public trust property (including natural resources and the environment) are well established, and that depriving any person of that right constitutes a violation of articles 31 and 32 of the *Constitution* (which are judicially enforceable). As a result, whilst the principles underpinning this decision are indeed widely recognised, the ruling may well set an important precedent for constitutional interpretation as well as environmental protection.

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[104] *Human Rights and Peace for Bangladesh v Government of Bangladesh and Others* [2016] HCD (Writ Petition No 13989 of 2016) judgement declared on 3 February 2019 *('Bangladesh Rivers Case').*
[105] Ibid 278 (Directive No 2).
[106] Ibid 278-9. This obligation is shared by all other river related agencies, directorates and ministries, who are directed to aid the NRPC in achieving this goal.
[107] The *Constitution* (n 3) arts 18A, 21.
[108] Ibid art 8(2).
[109] Ibid arts 44(1), 102(1).
[110] Ibid art 44(1).
[111] Ibid art 102 (1).
[112] *Bangladesh Rivers Case* (n 104) 270-71.

The Court ruling, in addition to its decision regarding the legal status of the rivers of Bangladesh, also included a 17-point directive to the executive government of Bangladesh. This directive included amendments to the powers of the NRPC; specific amendments to the *National River Protection Commission Act 2013* to make river encroachment and pollution a criminal offence with stricter punishment (including fines); substantial new punishments for people or companies accused of river encroachment or pollution; and extensive public education and awareness raising campaign.[113] It is worth noting that the case has already been appealed to the Appellate Division of the Supreme Court, which largely upheld the case (subject to constraints on some of the specific directives made by the High Court Division).[114]

Water management has been challenging in Bangladesh for decades, and the Court has shown increasing willingness to make specific and targeted recommendations for government action to improve the water resources of Bangladesh. Whilst some of these decisions have indeed led to regulatory and legal reform, the Court has also evinced its growing frustration with the slow pace of change. The above judicial actions, however, concerned the surface water resources of the country, and the Court to date has done very little to protect the country's groundwater resources. The next Part moves to explore the role of the Court in protecting groundwater resources.

IV JUDICIAL ACTION IN PROMOTING GROUNDWATER SUSTAINABILITY: A JUDICIAL BLINDNESS?

The discussions developed above, have explored the role of the Supreme Court of Bangladesh played to dispel injustices from society ranging from the protection of fundamental rights to the protection of the environment, to the protection of surface water, especially rivers. The Court has tended to interpret 'environment' widely to include pollution-free water in its components. Further, the Court on different occasions has extended the meaning of the right to life so as to cover a right to enjoy a decent environment,[115] and the Court's role in protecting the environment as a whole is encouraging. Despite the intrinsic connectivity of water (both surface and ground) with the environment,[116] the Court's record of action concerning this resource is very poor, and this is more true in relation to the

[113] Ibid 278-81.

[114] *Nishat Jute Mills Limited v Human Rights and Peace for Bangladesh (HRPB) and Others* [2019] AD (Civil Petition No 3039 of 2019) 37; judgement declared on 17 February 2020; the Appellate Division modified these directives by declaring that the Court has no power to direct the executive government to enact new legislation, thus reducing directive number 7 (which required new legislation to make 'river encroachment' (unlawful development) a criminal offence to the mere expression of opinion (or suggestion) by the court.

[115] See *Radiated Milk Case* (n 53); *Industrial Pollution Case* (n 54); *Arsenic Case* (n 55).

[116] See chapter 2(IV); also see generally VK Gupta and I Ali, *Environmental Water: Advances in Treatment, Remediation and Recycling* (Elsevier, 2013); Alfred M Duda and Mohamed T El-Ashry, 'Addressing the Global Water and Environment Crises through Integrated Approaches to the Management of Land, Water and Ecological Resources' (2000) 25(1) *Water International* 115-16.

protection of groundwater resources. Indeed, to date, the Court has not explicitly dealt with the groundwater depletion issue. Perhaps, the Court has failed to problematise this important but overlooked arena of natural resources.[117] More specifically, since groundwater is hidden and invisible, it remains out of sight of the judiciary, and as such, judicial action has not found its way to tackle this growing crisis.

The Court has, however, expressed its concern over groundwater quality, and it has issued directives to protect this element of groundwater. Though this thesis does not extend to groundwater quality, it is useful to discuss the leading cases on this aspect of groundwater to understand the approach of the Court about this issue, as an indicator for issues around groundwater quantity. For example, directing the concerned agency/organisation to produce a report of compliance could be a good strategy to enforce the Court's order in relation to groundwater depletion, and treating a case as continuous *mandamus* is also a sound strategy for the Court to continually monitor the implementation progress of its orders.

A *Dr Mohiuddin Farooque v Bangladesh and Others: Connecting Pollution-free Water with Right to Life*

Perhaps, *Dr Mohiuddin Farooque v Bangladesh and Others*[118] is the first case where the Court expressed its grave concern over the quality of water being contaminated by the untreated effluents and wastes discharged by the huge number of industries and factories. In this case, the Court explained the expression 'life' enshrined in article 32 of the *Constitution*[119] by providing that it included everything necessary to make it meaningful and a 'life' worth living. Among other elements, the maintenance of health is of utmost importance for a meaningful life that is significantly dependent on a decent environment. Indeed, a lack of sound and healthy environment may put the 'life' of the citizen at nought.[120] The Court noted that the government appeared to be unresponsive to the constitutional mandates in relation to curbing the industrial pollutions, which significantly affect the water bodies, among others.[121] The Court further stated that in the face of government inaction it would issue necessary orders and directions to implement a law.[122]

In this case, ABM Khairul Hoque and Md Joynal Abedin JJ noted that industrial units continued to pollute the waters, the rivers, the air, and the environment as a whole, recklessly ignoring constitutional mandates and the legislation on this vital aspect of national

[117] Interview with S 2, Academic (Mohammad, Dhaka, 4 February 2018).
[118] *Industrial Pollution Case* (n 54) 69.
[119] The *Constitution* (n 3) art 32 reads 'No person shall be deprived of life or personal liberty save in accordance with law'.
[120] *Industrial Pollution Case* (n 54) [18].
[121] Ibid [41].
[122] Ibid [33].

importance and interest. The Court issued the following directives to the government to ensure that-

- the industrial units and the factories that were marked as 'Red' under the Environment Conservation Rules 1997 adopted effective measures to control pollution within one year from this order and reported compliance to the Court within six weeks thereafter;
- other industrial units and the factories adopted similar measures to control pollution within a period of two years from this order and reported compliance to the Court as soon as possible; and
- no new industrial units and factories were set up in Bangladesh without first arranging adequate measures to control pollution as required under the Environment Law.[123]

Interestingly, the petitioner BELA was put at liberty to bring incidents of violation of any of the provisions of the aforesaid Act and Rules made thereunder to the notice of the Court.[124]

Despite the specific directives by the Court, the situation in relation to industrial pollution did not change, and as such, the Court reopened this case and delivered further directives on 23 June 2009. The Court disconcertedly observed that the condition of two rivers around Dhaka — the Buriganga and the Shitalakkhya — since 2001 deteriorated much and beyond recognition, and the Buriganga was no longer a river but had become a large drain.[125] In relation to groundwater, the Court observed that the groundwater level in and around the city went down by 9 feet per year, and polluted waters percolated into the subsurface, even so, the authorities turned a blind eye to this obvious crisis.[126] The Court laid emphasis on the need to act and act quickly to implement the provisions of environmental laws meticulously in its letters and spirit, and it warned that otherwise there would be no river, no water in and around Dhaka, and it would be a dead-city very soon.[127]

The Court then issued some specific directives to curb industrial pollution which included the following:

- All industries belonging to *Red* category must install the Effluent Treatment Plant (ETP) by 30 June 2010. In case of non-compliance, these industries would face legal sanctions.
- The tanneries that fell into *Red* category would require to be relocated from Hazaribagh by 28 February 2010. A breach of this order would result in the closure of these tanneries. Relocated tannery industries would operate only when they had functional ETPs and other appropriate pollution preventive devices.

[123] Ibid [47]; the industrial units and projects which have very little pollution impact on the environment is classified as Green while those are environmentally hazardous are classified Orange ka, Orange kha, and the dangerous ones are classified Red; see the *Environment Conservation Rules 1997* (Bangladesh) r 7, sch I.
[124] Ibid.
[125] *Industrial Pollution Case* (n 54) [1994] HCD (Writ Petition No 891 of 1994) (Reopened in 2009) 2.
[126] Ibid 3.
[127] Ibid 4.

- All kinds of industries would strictly comply with the provisions of environmental laws. The Department of Environment would take necessary actions against the flouting industries in accordance with the provisions of laws.[128]

Interestingly, to ensure compliance with the Court's order the Director General, Department of Environment was directed to produce reports of compliance in this respect by 30 July 2010. It is also interesting to note that for the purposes of continuous monitoring by the Court, the writ petition was treated as continuous mandamus. On an appeal by the industry owners against this judgment and order, the Appellate Division upheld the verdict of the High Court Division.[129]

B *Rabia Bhuiya, MP Case: A Step forward to the Protection of Groundwater Quality?*

In *Rabia Bhuiya, MP* case[130] the Appellate Division issued directives to the government to ensure groundwater quality by taking necessary steps so that it was safe for drinking. The Appellate Division recognised the gravity of the arsenic contamination in Bangladesh and directed the government and other public authorities to comply with the existing laws of the country — which at that time did not include the *Water Act*.[131] It observed that the government was under an obligation to provide arsenic-free safe drinking water to the citizens, as per the *National Policy for Arsenic Mitigation 2004* and the *Implementation Plan for Arsenic Mitigation 2004*.[132] In a first for Bangladesh, the Court also relied on *General Comment No 14* issued by the UN Committee on Economic, Social and Cultural Rights to link access to safe and potable water to the right to health.[133] Referring to a decision of an Indian Court,[134] the Court observed that failure to ensure access to safe and potable water constituted a violation of the right to life as guaranteed by articles 31 and 32 of the *Constitution*, as read with articles 15[135] and 18.[136]

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[128] Ibid 7.
[129] 'SC Upholds Order to Close Hazaribagh Tanneries', *The Daily Star* (online, 12 March 2017) <http://www.thedailystar.net/city/sc-upholds-order-close-hazaribagh-tanneries-1374694>.
[130] *Arsenic Case* (n 55).
[131] *The Environment Conservation Act 1995* (Bangladesh) and *the Environment Conservation Rules 1997* (Bangladesh) to some extent deal with water issues. The Department of Environment is duty-bound to take measures and to give necessary directions to any person to conduct drinking water quality surveillance programs and submit report and advice or, in appropriate cases, direct every person to follow the standard of drinking water; see the *Environment Conservation Act 1995* s 4(2)(h).
[132] *The National Policy for Arsenic Mitigation 2004* (Bangladesh) was adopted to ensure safe water for cooking and drinking through implementation of water supply options in all arsenic affected areas.
[133] *Arsenic Case* (n 55) [18-21].
[134] *Virendar Gaur v State of Haryana* (1995) 2 SCC 577 (Supreme Court of India).
[135] The *Constitution* (n 3) art 15 deals with the provision of basic necessities.
[136] The *Constitution* (n 3) art 18 deals with public health and morality.

The Court then issued specific directives that were to be followed by the responsible government bodies to ensure access to safe drinking water for people at large, free from arsenic. These included:

- taking necessary and effective steps to implement the *National Arsenic Mitigation Policy 2004* and the *National Action Plan for Arsenic Mitigation*;
- framing rules for groundwater management in accordance with *National Arsenic Mitigation Policy 2004*;
- raising mass awareness of the dangers of drinking water from arsenic contaminated tubewells;
- expediting the testing of tubewells across the country for arsenic; and
- providing a yearly report to the Court regarding steps taken to implement the Arsenic Policy 2004.[137]

This is a leading example of how the Court could play a proactive role in the protection of groundwater quality. It is interesting that in this case, the Court ordered the relevant authorities to furnish a yearly report regarding the implementation of the relevant law and policy. However, there is a tendency on the part of the government not to comply with such directives in totality, commonly pleading that it suffers financial constraints. It has, therefore, continually sought more time from the Court to implement the Court's order.[138]

In summary, these cases suggest that the judiciary has significant potential to promote groundwater sustainability by applying its judicial power in appropriate cases. True, the judiciary's powers are limited — they cannot make a fence to protect a water body or aquifer — but they can reduce groundwater scarcity by ensuring the public accountability of those in power.[139] Judicial action yields not only direct results in terms of court-ordered relief, but also encourages social movement strategies towards the sustainable abstraction of groundwater resources.[140]

V BARRIERS TO JUDICIAL ACTION IN PROMOTING SUSTAINABLE ABSTRACTION OF GROUNDWATER RESOURCES

The proactive judicial action of the Supreme Court of Bangladesh, however, encounters certain constraints that stem, among other things, from political conditions as well as internal judicial ideologies.[141] Politicians often try to influence the decisions of the Court by exerting their political powers and this is possible due to the faulty appointment system of the judges. The appointment of a judge solely depends on the discretion of the government.[142] Indeed,

[137] *Arsenic Case* (n 55) [29].
[138] The *FAP20 Case* (n 72) judgment was, in fact, inappropriately implemented defying the directives of the Court; see Karim, Vincents and Rahim (n 63) 33.
[139] Hoque (n 21) 406.
[140] Islam (n 7).
[141] Hoque (n 71) 138.
[142] See the *Constitution* (n 3) arts 95, 98, 48(3).

over the years political consideration has been dominant in appointing a Supreme Court judge that sometimes hinders in nominating a man with required intellectual capacities and personal qualities.[143] Moreover, in addition to criticising the judiciary for passing orders against the perceived interest of the government,[144] the executive often delays implementation of the Court's orders on the grounds of insufficient financial and other logistic support. Additionally, although civil society that offered considerable support to the judiciary in applying targeted judicial action to purge the society of disturbing elements,[145] when it comes to protecting groundwater resources, this same civil society seems weak, unorganised, and less rights-centric. Moreover, individual lawyers often overlook the importance of public interest litigation and its pro-people ramifications.[146] These all significantly obstruct the path of the judiciary in the realm of groundwater resources.

Apart from these general limitations, interview data more specifically identified the following barriers to judicial action in relation to the groundwater resources of Bangladesh.

A *Judges' Lack of Scientific Knowledge*

The judges that were interviewed identified judges' lack of scientific knowledge as a significant barrier to engaging with groundwater related cases. They generally noted that the Court was often reluctant to deal with this category of the case given the knowledge gap around the technical issues of groundwater resources. As one respondent of this category reported, '…. groundwater is a scientific issue, and we as judges don't have sufficient knowledge in relation to this resource. Sometimes we do not show our interest to take up this type of case that involves highly technical issues….'.[147] Another respondent from the group of scholars expressing a similar view stated, '…maybe the Court is not interested to take up groundwater issues as they warrant some scientific study…...'.[148] One interviewed judge considered the insufficient scope of training as a potential barrier to improving their skills to deal with cases pertaining to highly technical issues like groundwater.[149] Another respondent

[143] International Crisis Group, *Political Conflict, Extremism and Criminal Justice in Bangladesh* (Brussels, 2016) 19-20 ('Crisis Group').
[144] 'Verdict on 16th Amendment: Lawmakers Tear into Higher Courts', *The Daily Star* (online, 10 July 2017) <http://www.thedailystar.net/frontpage/verdict-16th-amendment-lawmakers-tear-higher-courts-1430734>.
[145] With the overwhelming support from the civil society the Court declared punishment on the basis of fatwa as extrajudicial, see *Mohammad Tayeeb and Moulana Abul Kalam Azad v Government of the People's Republic of Bangladesh* (2015) 4 LNJ (AD) 48; it made illegal to compel students or workers in public schools or offices to wear religious clothing, see E Bock, 'Bangladesh Court Rules against Mandatory Religious Clothing', *The Jurist* (online, 22 August 2010) <http://jurist.org/paperchase/2010/08/bangladesh-court-rules-against-mandatoryreligious-clothing.php>; and it banned Islamic political parties, see Adeeba Aziz Khan, 'NGOs, the Judiciary and Rights in Bangladesh: Just Another Face of Partisan Politics?' (2012) 1(3) *Cambridge Journal of International and Comparative Law* 254, 265.
[146] Hoque (n 71) 175; Marc Galanter, 'Why the "Haves" Come out Ahead: Speculations on the Limits of Legal Change' (1974) 9(1) *Law and Society Review* 95, 97.
[147] Interview with J 2, Justice (Mohammad, Dhaka, 1 March 2018).
[148] Interview with S 2, Academic (Mohammad, Dhaka, 4 February 2018).
[149] Interview with J 2, Justice (Mohammad, Dhaka, 1 March 2018).

from the group of scholars echoed this view; he, however, added that High Court judges were usually reluctant to attend any training related to their professional skills.[150]

B *Inertia of Lawyers and NGOs*

Respondents identified the indifference of NGOs to groundwater matters as a substantial obstruction to judicial action in relation to issues around groundwater resources. As one interviewed judge pointed out, 'Perhaps, NGOs, rights groups, and other related organisations are less concerned with groundwater. You see we are having some excellent cases in relation to the surface water, for example, river filling, lake filling and so on and so forth…'.[151] Another respondent put it as 'Either NGOs could not identify this groundwater depletion problem, or they could identify this problem but for lack of incentives they did not bring it before the court'.[152] Some respondents, however, identified the resource constraints of NGOs as a barrier to bringing these types of cases before the Court. As one respondent reported, '…… we lack sufficient technical and financial resources……To file a case in relation to groundwater you need to have sufficient technical and financial resources.…'.[153] Given all these aspects one respondent commented that NGOs were unaware of looming disasters in relation to groundwater resources.[154]

In addition, respondents also identified the inertia of individual lawyers and mass ignorance in the community of the value of the resources as a significant obstacle to judicial action. As one respondent said, '…..lawyers including masses are not aware of the hazards encountered by groundwater resources……'.[155] Individual lawyers often fail to understand the significance of public interest litigations and their effect on the wellbeing of people's lives.[156]

C *Non-availability of Data*

Respondents also identified the non-availability of data as a major setback to effective judicial action in relation to the protection of groundwater resources. As one interviewed judge reported, '…..the Court does depend on particular data/reports to deal with this type of case, but required data/reports are not available at all……'.[157] Echoing the concern of this judge, another respondent noted, '……and at every forum, this issue has gained momentum. I personally tried to file a case in relation to this issue, but in the end, I could not for want of proper information and data……'.[158] These findings suggested that this issue had received

[150] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[151] Interview with J 3, Justice (Mohammad, 26 February 2018).
[152] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[153] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[154] Interview with S 2, Academic (Mohammad, Dhaka, 4 February 2018).
[155] Interview with J 3, Justice (Mohammad, 26 February 2018).
[156] Hoque (n 71) 175; Galanter (n 146).
[157] Interview with J 1, Justice (Mohammad, Dhaka, 28 February 2018).
[158] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).

very little attention from academics, environmental groups, and other associated agencies and entities. As a result, very negligible studies have been undertaken in this area, further clogging the path of judicial action. Beyond the scant research, respondents also reported the indifference and non-cooperation of the government agencies in advancing this issue. As one respondent bluntly stated, '…relevant authorities and public functionaries are not cooperative, to be clear, they don't provide us with the required data'.[159]

D *Powerful Respondent: A Barrier?*

Respondents largely agreed that elite and politically influential people were involved in indiscriminately exploiting the groundwater resources in Bangladesh, and it was always tough to wage a legal battle against them in the court. As one interviewed judge pointed out, '…usually elite and politically influential people are involved in breaking environmental laws, and it is always tough in Bangladesh to encounter such people in the court. They manage the case before it is lawfully disposed of…'.[160] Another respondent directly stated, '….our country is dominated by vicious politics, bad governance, and bad politics. Financially and politically powerful people are involved in massive water pollution and overexploitation of groundwater resources, and they get off the hook of law easily; people who are to enforce laws and people who are to set examples of compliance with the law themselves breach the law with impunity'.[161] These statements can be interpreted to the effect that elite groups in society are able to silence the voices of the weaker segment of the community, and they even silence the administration by virtue of their undue power and influence.[162]

For the effective realisation of judicial action, these barriers need to be removed. To address some of these problems, interviewees suggested, *inter alia*, the establishment of a Specialist High Court Bench. Drawing on interviews more discussion is developed in chapter 6(IV) in the form of recommendations to overcome these barriers. Having said that, it is necessary to flesh out a bit of why judicial action is particularly relevant for groundwater sustainability.

VI SIGNIFICANCE OF JUDICIAL ACTION IN THE CONTEXT OF GROUNDWATER SUSTAINABILITY

Questions arise as to whether the court's decision-making could bring about a change in society, especially the attitude of the government and people to groundwater resources. Rosenberg doubts the capability of the court to change the social scenario.[163] His findings

[159] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[160] Interview with J 3, Justice (Mohammad, 26 February 2018).
[161] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[162] Crisis Group (n 143) 17-18.
[163] Rosenberg (n 10) 420-29.

are that court decisions have had no significant direct or indirect effect on social change. Political oppositions often undercut court contributions, and a lack of the court's implementation capacity has transformed it into a virtually powerless entity that is unable to produce the desired change in society.[164] Problems that are not seriously taken by the executive government remain unsolvable in the courtroom.[165] He argued that factors like political efforts wholly separate from the court system could trigger considerable changes in society.[166] A study conducted by Rajamani revealed that legal activism generated some social changes in India. He, however, raises concerns over the access, participation, effectiveness, and sustainability of the public interest environmental jurisdiction.[167]

Nevertheless, court decisions remain important as they put the government under public and legal pressure to comply with court orders in furtherance of protecting natural resources like groundwater.[168] In this way, judicial action can produce long-term social change and yield results for the community.[169] Despite its obvious limitations, public interest litigation has contributed to the development of environmental laws and policies in Bangladesh, and it has been attracting some measure of legislative-executive activism.[170] The prevailing scenario of social deprivation of general people, bad governance, and the violation of constitutional norms in administering state functions, and more specifically the unsustainable withdrawal of groundwater resources is, more or less, an outcome of the lack of public accountability.[171] Public institutions have not been made truly institutionalised even after forty-six years of independence — there are no checks and balances, there is no watch-dog mechanism at work — people holding public offices remain almost unaccountable for their act of commission or omission.[172]

These forms of executive and legislative apathy led the Court to be proactive in addressing some public-interested issues. In addition to the examples cited above (Part II, III), judicial

[164] Ibid 420.
[165] Ibid 422.
[166] Ibid; see also Gerald N Rosenberg, 'Hollow Hopes and Other Aspirations: A Reply to Feeley and McCann' (1992) 17(4) *Law and Social Inquiry* 761; Rosenberg's argument was criticised by Feeley; see Malcolm M Feeley, 'Hollow Hopes, Flypaper, and Metaphors' (1992) 17(4) *Law and Social Inquiry* 745; for an extended argument of Rosenburg see Shenita Brazelton, 'A Hollow Hope? Social Change, the US Supreme Court and Affirmative Action' (2016) 12(2) *Journal of Race and Policy* 84.
[167] Rajamani (n 10) 296.
[168] Upendra Baxi, 'Judicial Discourse: Dialectics of the Face and the Mask' (1993) 35(1-2) *Journal of the Indian Law Institute* 1, 10-12.
[169] Karim, Vincents and Rahim (n 63) 37-39.
[170] For example, following the Court ruling, the government gradually withdrew petrol-run two-stroke scooters, and introduced CNG-run vehicles in Dhaka city. A complete ban on the plying of two-stoke scooters in Dhaka city became effective on 31 December 2002; see *Vehicular Pollution Case* (n 62).
[171] Hoque (n 21) 409.
[172] *16th Amendment Case* (n 36) 227-8; Ahmed Shafiqul Huque, 'Accountability and Governance: Strengthening Extra-bureaucratic Mechanisms in Bangladesh' (2011) 60(1) *International Journal of Productivity and Performance Management* 59, 59; Abu Elias Sarker, 'The New Mode of Public Governance and Public Accountability in Developing Countries: An Analysis with Particular Reference to Bangladesh' (2009) 32(13) *International Journal of Public Administration* 1101, 1108-10.

intervention stimulated the government to bring about an amendment to the *Environment Conservation Act 1995* to stop encroachment over water bodies. Following the Court's directives, the government added the *Wetland Protection Act 2000* in the statute book and declared the Gulshan-Baridhara lake an ecologically critical area.[173] The Court played its proactive role in eradicating corporal punishment from all educational institutions across the country.[174] In the 16th amendment case, the Court arduously framed a 39-point code of conduct to be observed by the judges of the Supreme Court.[175] These all demonstrate that the Court has the power to issue directives to bring a particular change in society.

The Court, therefore, could play a significant role in promoting groundwater sustainability. The current groundwater laws and institutions fall far short of addressing important issues around groundwater.[176] The *Water Act*, for example, has not fixed the maximum amount of water that could be withdrawn by any individual or organisation.[177] Further, it does not impose any restriction on the abstraction of water from any privately-owned water source,[178] and free-style abstraction of water from privately owned water sources has the potential to significantly affect the overall water resources of the country. Additionally, institutional anomalies such as gaps and overlaps in relation to their responsibilities limit the effectiveness of water institutions.[179]

Hence, judicial action from the Supreme Court remains important, and perhaps, these legal uncertainties could be pointed out to the government through judicial action — the Court could formulate recommendations that the government would follow until identified gaps are filled through legislative action. For instance, the Court could ask the government to declare an area as water stress under the *Water Act* — an urgent arrangement that the government continues to ignore despite the depletion of groundwater tables at an alarming rate in some parts of the country, notably Dhaka and its precincts — where a cap on the groundwater withdrawal would be imposed. Further, the Court can direct the government to form a committee that would include groundwater experts to assess and monitor the state of groundwater resources. In particular, to mitigate stress on groundwater the Court may ask the government to direct its attention to exploring more options to use surface water.

In the same vein, as it did in relation to the NRPC for the protection of Bangladeshi rivers, the Court could direct the government to enhance the powers and status of the Water Resources Planning Organisation — a point that was strongly supported by the interviewees and which has also been a long overdue — such that it could emerge as a more capable water

[173] *Omar Sadat and Another v Bangladesh* [2006] HCD (Writ Petition No 11003 of 2006).
[174] *Bangladesh Legal Aid and Services Trust (BLAST) and Another v Secretary, Ministry of Education, Bangladesh Secretariat, Dhaka and Others* [2010] HCD (Writ Petition No 5684 of 2010).
[175] *16th Amendment Case* (n 36) 385-94.
[176] See chapters 3(IV)(V), 4(II)(III).
[177] See chapter 3(IVE).
[178] Ibid.
[179] See chapter 4(IIC).

institution to arrest the declining water resources more effectively and efficiently. Indeed, a cautious but activist judiciary can profitably use its judicial power to try to make the executive more answerable for actions and inactions in relation to the protection of groundwater resources.[180]

The public trust doctrine has already been applied in Bangladesh, where it has been explicitly articulated in the *Constitution*.[181] In the latest ruling — the *Bangladesh Rivers Case* — the Court quoted extensively from Sax's influential 1970 article on the capacity of the public trust doctrine to provide a sound legal basis for environmental protection. In this article, Sax argued that the public trust doctrine 'must contain some concept of a legal right in the general public; it must be enforceable against the government; and it must be capable of an interpretation consistent with contemporary concerns for environmental quality'.[182] More specifically, Sax argued that this doctrine imposed three types of restrictions on governmental authority: 'first, the property subject to the trust must not only be used for a public purpose, but must be held available for use by the general public; second, the property may not be sold, even for a fair cash equivalent; and third, the property must be maintained for particular types of uses'.[183] As seen above (Part III), natural resources that include groundwater have been recognised as public trust property under the *Constitution.* The *Water Act* has also impliedly recognised this doctrine in relation to water resources.[184] The Court, therefore, could invoke this doctrine to protect groundwater resources which would give the judiciary a technique to address the lack of action by the legislative and administrative processes.[185]

That said, however, the implementation of the Court's judgments significantly depends on the will of the executive. If the executive turns a blind eye to the Court's rulings, they may remain unrealised.[186] Even so, over the years the Court has invoked its contempt power in the case of violations of its orders.[187] Typically, the Court directs any potential violator of the Court's order to appear before it in person, and explain his/her conduct in relation to the

[180] Hoque (n 21) 409.
[181] The *Constitution* (n 3) art 21.
[182] Joseph L Sax, 'The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention', (1970) 68(3) *Michigan Law Review* 471, 474.
[183] Ibid 477.
[184] See chapter 3(IVE).
[185] Sax (n 182) 509, 518, 556.
[186] Nizam Ahmed, 'Executive-Judiciary Relations in Bangladesh' (2006) 33(2) *Asian Affairs: An American Review* 103, 106.
[187] The *Constitution* (n 3) art 108.

order of the Court.[188] Additionally, designating an implementation committee,[189] and requiring compliance reports at regular intervals[190] are some other ways of enforcing judicial rulings that are often invoked by the Court. In a substantial move, the Court set very high penalties in the *Bangladesh Rivers Case* as part of its 17-point directive.[191]

Alongside these implementation mechanisms for its orders, the Court also should explore opportunities to expand its role in supervising the implementation of the existing water laws. The Environment Courts that are functional across the country may be tasked, as suggested by interviews, with monitoring the enforcement of water laws. Perhaps, if they are adopted and implemented, the regional branches of the Water Resources Planning Organisation, the regional offices of the Department of Environment and other water related local bodies could be placed under the general supervision of these environment courts. These water agencies would require reporting to the courts from time to time in relation to the implementation of water laws. The Supreme Court — or the specialist High Court Bench if constituted following the recommendation put forward in chapter 6(IVA) — would be in charge of general supervision of these implementation efforts across the country. One of the effective ways of performing this supervisory role would be to install a monitoring cell at the administrative level of the Supreme Court or the specialist High Court Bench, as the case may be.

Of course, proactive judicial action is not free from criticism. Judicial action may generate judicial overstepping resulting in injustices itself if it goes unrestrained.[192] It is argued that intervention by the Courts in a field that exclusively belongs either to the executive or the legislature may also run counter to the principle of separation of powers; that judges are not elected, and as such, they are not accountable to the public.[193] Judicial action is essential to offer appropriate remedies for the violation of collective and individual rights and to rein in the unconstitutional exercise of state powers by the executive.[194] It is also needed for upholding public ethics in the government.[195] Legislation and policy decisions need to be

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[188] See, eg, 'Delay in River Protection Commission, Contempt Charge against Govt', *The Daily Star* (online, 3 January 2010) <http://www.thedailystar net/news-detail-120234>; 'HC Asks Moulvibazar DC to Appear in Court Apr 26', *The Daily Star* (online, 16 April 2010) <http://www.thedailystar net/news-detail-134470>; 'HC Issues Warrant against DC', *bdnews24.com* (online, 22 August 2010) <https://bdnews24.com/bangladesh/2010/08/22/hc-issues-warrant-against-dc>.

[189] 'High Court Upholds Order on Banning 34 Pharmaceutical Companies from Producing Medicines', *Daily Sun* (online, 13 February 2017) <http://www.daily-sun.com/post/205401/High-Court-upholds-order-on-banning-34-pharmaceutical-companies-from-producing-medicines>.

[190] See *Human Rights and Peace for Bangladesh v Bangladesh* (2009) 14 BLC (HCD) 759 (affirmed in *City Sugar Industries v HRPB* (2010) 62 DLR (AD) 428); see also Ridwanul Hoque, 'Constitutionalism and the Judiciary in Bangladesh' in Sunil Khilnani, Vikram Raghavan and Arun K Thiruvengadam (eds), *Comparative Constitutionalism in South Asia* (Oxford University Press, 2013) 326.

[191] *Bangladesh River Case* (n 104) 278-81.

[192] Hoque (n 71) 5.

[193] Zeev Segal, 'Judicial Activism Vis-a-Vis Judicial Restraint: An Israeli Viewpoint' (2011) 47 *Tulsa Law Review* 319, 322.

[194] Hoque (n 71) 228-37.

[195] Segal (n 193) 328.

examined by the Court to ensure constitutionalism and sound democracy in a country, and as such, the principle of separation of powers is not undermined by proactive judicial action.[196] Moreover, a meaningful democracy requires a strong, independent, and effective judiciary.[197] Where the executive and the legislature slumber over the depletion and degradation of the groundwater resources, when they fail to adopt timely legislation, and when they make inordinate delay to respond to the crises, the judiciary is legitimately expected to come forward to prod the executive.

Moreover, constitutionally, the judiciary is entrusted with the onerous tasks of resolving disputes as well as balancing the conflicting interests of different groups in the society, and eventually, it is answerable to the people at large.[198] This accountability to the society requires the Court to remain alive with the changing needs and challenges.[199] Balanced and enlightened judicial action[200] indeed is needed to protect important natural resources like groundwater.

VII CONCLUSION

Ronald Dworkin once remarked that 'the Courts are the capitals of law's empire, and judges are its princes, not its seers and prophets'.[201] With their wisdom, the judges should respond to the social needs evolving with time. The Constitutional Court should not be restricted by the original intentions of the founding fathers of the legislation, rather it should interpret the laws having regard to the circumstances that exist at the time of such interpretation.[202] Indeed, proactive judicial action is not an aberration, but a normal judicial function.[203] In a country where poverty dominates, ignorance of rights and duties among the citizens is pervasive, it requires the Court to be proactive in appropriate cases.

As seen above, the Supreme Court of Bangladesh is empowered to issue directions, orders, and writs by virtue of which it could meet the peculiar requirements of this country. In essence, the Court is empowered to review a constitutional amendment and annul it, if it runs counter to the basic structure of the Constitution. The Court even can declare laws to fill any vacuum in the legal arena. This unique power of the Court has frequently been invoked to protect the environment of the country. The Court in a very limited way has also applied its

[196] Ibid 323.
[197] Redson Edward Kapindu, 'Reclaiming the Frontier of Constitutional Deference: Mazibuko v City of Johannesburg – a Jurisprudential Setback' (2010) 25(2) *Southern African Public Law* 471, 490.
[198] Afroza Begum, 'Judicial Activism versus Judicial Restraint: Bangladesh's Experience with Women's Rights with Reference to the Indian Supreme Court' (2005) 14(4) *Journal of Judicial Administration* 220, 225.
[199] Andrew Byrnes, Jane Connors and Lum Bik (eds), *Advancing the Human Rights of Women: Using International Human Rights Standards in Domestic Litigation* (Commonwealth Secretariat, 1997) 26.
[200] Hoque (n 71) 253.
[201] Ronald M Dworkin, *Law's Empire* (Belknap Press, 1986) 407.
[202] Sathe (n 13) 31.
[203] Ibid.

mandated judicial role to protect mainly the quality of groundwater. The Court has, however, yet to apply its judicial action in relation to the depletion of this precious resource. Given the enormity of this issue,[204] such judicial passivity is not desirable.

Crucially, public interest litigation could be an effective tool to invoke targeted judicial action. However, the prospects for effective public interest litigation are largely dependent on the capacity and willingness of the civil rights groups, and environmental groups/organisations. Hence, the concerned groups need to be more active in bringing suitable suits/cases of this nature.[205] The government should execute the Court's order expeditiously without taking recourse to any dilatory tactics. The Court also must remain vigilant over the proper implementation of its directives. Additionally, the *suo motu* jurisdiction of the Court could be a promising tool in this regard. The Court needs to apply this unique tool in appropriate cases to stop unsustainable groundwater extraction (further elaborated in chapter 6(IVB)). Judicial action, however, should not be construed to be governance by the judiciary, rather it is meant, for all intents and purposes, to perform within the limits of the judicial process.[206]

More importantly, in order to gain the maximum benefit of judicial action, a judge is to be a person of character and integrity. He is required to be independent, fearless, and impartial.[207] As seen above, the current appointment system is faulty, and in appointing a judge of the Supreme Court, political considerations may prevail over other relevant considerations. Hence, an independent Commission like the Judicial Appointments Commission of the UK or like the Collegiums consisting of the Chief Justice and four to five senior most-most judges of the Supreme Court prevailing in India may be introduced in Bangladesh for the appointment of Supreme Court Judges.[208] Judicial action, however, is not a permanent solution to the ever-increasing crisis of groundwater depletion. The executive and the legislature ultimately will have to wake up to respond to this crisis. Essentially the Court can encourage them to adopt a permanent solution by their proper executive and legislative actions. In short, an active judiciary manned with courageous judges assisted by the environmental groups and rights organisations, obviously, can meaningfully contribute to groundwater sustainability in Bangladesh. In the result, this chapter answers sub-question (c) in the affirmative that targeted judicial action can, indeed, promote the sustainable extraction of groundwater resources in Bangladesh.

[204] See chapter 2(VIII).
[205] This issue is further discussed in chapter 6(IVC).
[206] Sathe (n 13) 106.
[207] Ibid 100.
[208] Sarkar Ali Akkas, 'Appointment of Judges: A Key Issue of Judicial Independence' (2004) 16 *Bond Law Review* 201, 201-10; Barrister Moyeen Firozee, 'Appointment of Judges in the Supreme Court: Needs a Fresh Approach' (2008) *Dhaka Law Reports (DLR)- February Issue* 9, 9-12.

Chapters 3 and 4 showed that while the adoption of groundwater laws and institutions was a welcome initiative to address issues around declining groundwater, these legal apparatuses evinced substantial weaknesses warranting significant reforms. Additionally, this chapter has demonstrated that without undermining the principle of separation of powers, the Supreme Court of Bangladesh can potentially facilitate groundwater sustainability through its targeted judicial action. Despite this optimistic conclusion, interview data has also revealed some factors that largely limit the capacity of the Court in promoting sustainable groundwater extraction. Accordingly, the next chapter turns to formulate recommendations to strengthen the present legal and institutional frameworks as well as the judicial capacity for tackling uphill challenges posed by the declining groundwater resources of Bangladesh.

CHAPTER 6

FORMULATING RECOMMENDATIONS

I INTRODUCTION

The central research question framed for this thesis was: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? To answer this question four sub-questions were then framed: (a) To what extent do the current legal and institutional frameworks ensure the sustainable abstraction of groundwater resources? (b) What deficiencies presently exist in the legal and institutional settings? (c) Can judicial action promote the sustainable abstraction of this resource? (d) What specific changes in the current legal and institutional frameworks are needed to make them more effective and operational? Chapters 3 and 4 answered sub-questions (a) and (b) while chapter 5 answered sub-question (c). By answering sub-question (d), this chapter attempts to answer the central thesis question.

A well-drafted law solves half of the problem while the rest remains with the implementation. As Menard aptly stated nearly 70 years ago, 'Poorly drafted statutes are a burden upon the entire state…attorneys find it difficult to base any sure advice upon them, the citizen with an earnest desire to conform is confused. Often, lack of draftsmanship results in failure of the statute to achieve its desired result…'.[1] Hence, the law is ineffective if it is not properly drafted. Again, mere placing rights, duties, or formulas in the body of legislation does not necessarily solve a particular problem[2] unless responsible institutions operate effectively, efficiently, and ably. Here lie the interface and interplay between legal and institutional frameworks.

In answering the central thesis question, broadly three issues stood out from chapters 3, 4, and 5. In addition to issues around legal and institutional frameworks, a context-specific third issue emerged concerning the role of the Court in Bangladesh. To speak differently, legal rules, institutions, and the Court can collectively contribute to groundwater sustainability in Bangladesh. Legislating water laws is a step forward toward the protection of groundwater resources.[3] In particular, the adoption of water law is viewed as a recognition of a water crisis in general and groundwater in particular. Notwithstanding, there are significant weaknesses, gaps, and overlaps in the existing legal framework, not least unsustainable groundwater withdrawal by the industrial and agricultural sectors remains unaddressed.[4] Despite water metering, for instance, being globally treated as a necessary tool to ensure sustainable

[1] Albert R Menard, 'Legislative Bill Drafting' (1953) 26(4) *Rocky Mountain Law Review* 368, 368.
[2] Mark A Graber, 'The Constitution as a Whole: A Partial Political Science Perspective Commentaries' (1999) 33(2) *University of Richmond Law Review* 343, 361.
[3] See chapter 3(III)(IV).
[4] See chapter 3(IV)(V).

abstraction of groundwater resources, there is no legislative obligation for adopting this tool in Bangladesh, it even remains unrecognised in the policy documents, especially in the *National Water Policy*[5].

Additionally, a quota system — volumetric control at the level of an individual licence — or more broadly capping — volumetric control at the level of an entire sector — of groundwater is also absent in the current legal framework.[6] A quota system is widely applied in different jurisdictions to limit groundwater withdrawal notably in the agricultural and industrial sectors, thereby promoting sustainable extraction of this precious resource.[7] In the context of Bangladesh, while capping in the agricultural sector may sound impracticable, it is certainly feasible in the industrial sector. In recent years, industries especially leather and textile, are posing an impending threat to the overall groundwater resources of the country which needs to be tackled with a better legal response.[8]

Another major defect in relation to the legal framework concerns the lawmaking process itself that deserves serious consideration for improved regulation. Interview data revealed that stakeholders were largely absent in the water lawmaking process threatening their (water laws) sustainability and durability. To make things worse, water experts across disciplines were hardly consulted in adopting a technical law like groundwater, rendering the legislation virtually ineffective, inefficient, and ill-equipped to overcome the increasingly notorious challenges stemming from groundwater depletion.[9] The interface of law and science around groundwater makes it imperative that multidisciplinary experts are actively engaged in the lawmaking process to get it tailored to solving complex groundwater issues.

A legal framework, howsoever sophisticated it is, nevertheless fails to achieve the targeted goals unless water institutions are equally improved. Successful implementation of groundwater laws and policies depends on the capacity, ability, and robustness of institutional arrangements.[10] A diagnosis of the institutional framework carried out in chapter 4(II)(III) revealed substantial weaknesses in the current settings that require significant improvement in order to effectively deal with issues around groundwater sustainability. The presence of a considerable number of water institutions and their centralised functioning; a lack of integration and coordination; a lack of monitoring and groundwater data; an absence

[5] *National Water Policy 1999* (Bangladesh) *('Water Policy').*
[6] See chapter 3(VC).
[7] Gordon Mitchell and Adrian McDonald, 'Developing Resilience to England's Future Droughts: Time for Cap and Trade?' (2015) 149 *Journal of Environmental Management* 97, 99, 103; Doreen Burdack, Anne Biewald and Hermann Lotze-Campen, 'Cap-and-Trade of Water Rights: A Sustainable Way out of Australia's Rural Water Problems?' (2014) 23(4) *GAIA - Ecological Perspectives for Science and Society* 318, 323-5; Qian Ke and Tianbin Qin, 'Investigation of Water Right System with Tradable Water Quotas—Case Study in Zhangye City, the Middle Reaches of Heihe River' (Seminar Paper, International Symposium on Water Resource and Environmental Protection, May 2011) 819-21.
[8] See chapter 2(VIII).
[9] See chapter 3(VIA).
[10] See chapter 2(VB).

of groundwater users' associations; and resource constraints were identified as the major factors limiting the effectiveness of the Bangladeshi water institutions.

Between legal and institutional frameworks lies the judicial action in promoting the sustainable abstraction of groundwater resources. The role of the court is rather context-specific given the unique power and potential of the Bangladeshi Court. The higher judiciary of Bangladesh has been constantly contributing to the improvement of environmental jurisprudence and (surface) water governance.[11] However, the Court has barely dealt with issues around groundwater resources. While judicial overstepping is not desirable, judicial silence is not tolerable either. Rather a balanced and enlightened judicial action[12] is needed to improve the groundwater situation. Some factors, however, obstruct the path of the Court's action that need to be addressed. In particular, the lack of judges' technical and scientific knowledge, and the inertia of the environmental NGOs and the lawyers have contributed to the judicial passivity in the realm of groundwater sustainability.[13]

Beyond these legal issues, some management strategies also need to be explored and applied to secure the sustainable extraction of groundwater resources. Interview data also suggested that groundwater regulation needed to be supplemented by some tighter management strategies. Respondents largely identified the conjunctive use of surface and groundwater; rainwater harvesting; alternate wetting and drying; and changing crop patterns as the best management strategies to ensure sustainable abstraction of groundwater resources of Bangladesh.

Against this backdrop, heavily drawing on interview data, this chapter proceeds to formulate recommendations for Bangladeshi policymakers on how to better ensure the sustainable abstraction of groundwater resources of the country, thereby answering sub-question (d) and the central thesis question. These suggested reforms also offer lessons for the literature on how to overcome the challenges emanating from the declining groundwater resources. Following this introduction, and building on chapter 3, Part II seeks to formulate recommendations to fill the gaps of the existing legal framework, thereby making the current legal settings well-tailored to the specific situations of Bangladesh to rein in the unsustainable extraction of groundwater resources. Part III, by reference to chapter 4, aims to reform the existing water institutions with a view to transforming them into able, efficient, and sustainable ones. Thereafter, reflecting on chapter 5, Part IV moves to target the judicial action to the specific needs of groundwater resources with suggestions to remove the factors that stymie the path of the Court's action. Going beyond legal issues, Part V takes the discussion further by devising some management strategies that can promote groundwater sustainability. Part VI exemplifies what changes are needed for the implementation of a

[11] See chapter 5(IIC)(III).
[12] Ridwanul Hoque, *Judicial Activism in Bangladesh: A Golden Mean Approach* (Cambridge Scholars Publishing, 2011) 252-270.
[13] See chapter 5(VAB).

recommendation proposed in this chapter. Finally, Part VII summarises the findings of this chapter.

II REFORMING GROUNDWATER LAWS

A *Removing the Conflicts and Overlaps among Water Laws*

The existing water laws have conflicting and overlapping provisions. To recap, the *Bangladesh Water Act*[14] *and* the *Groundwater Irrigation Management Act*[15] provided differing definitions of the terms 'deep tubewell' and 'shallow tubewell'.[16] This definitional tension impacts groundwater sustainability in various ways including that water managers fail to properly comprehend and consider sustainability issues in allowing or refusing the installation of a deep tubewell and a shallow tubewell.[17] Hence, this definitional anomaly needs to be resolved by bringing forth uniform definitions of deep tubewell and shallow tubewell across water laws. Further clashes between water laws concern the licensing requirement and licensing exemption.[18] Using the exemption provisions of the *Water Act* an irrigation farmer can legally avoid licensing requirements prescribed by the *Groundwater Act*. Thus, these legal loopholes could encourage groundwater users to thrive on unsustainable groundwater extraction, thereby frustrating the ultimate objective of water law — groundwater sustainability. In the result, these antithetical laws create substantial risks in undertaking a cohesive and consistent groundwater plan and strategy toward groundwater sustainability.

Moreover, the existing well spacing settings suggested by the *Groundwater Act* prove inappropriate.[19] A more recent study concludes that the distance between wells should be in the range of 2.5-2.9 km and 1.4-2 km in floodplains and the Barind Tract, respectively.[20] In addition to causing a significant drawdown to the water table, well interference triggers a reduction in the discharge of tubewells.[21] If well space is carefully determined, tubewell discharge would be sufficiently robust to meet the irrigation and other demands.[22] Hence, the *Groundwater Act* needs to be amended providing appropriate spacing settings.

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[14] *Bangladesh Water Act 2013* (Bangladesh) *('Water Act'); Bangladesh Water Rules 2018* (Bangladesh) *('Water Rules').*
[15] *Groundwater Irrigation Management Act 2018* (Bangladesh) *('Groundwater Act').*
[16] See chapter 3(VE).
[17] Ibid.
[18] Ibid.
[19] See chapter 3(IVD).
[20] Ibid.
[21] Jaskaran Dhiman, MP Kaushal and Sunil Garg, 'Well Spacing in Central Indian Punjab: A Case Study' (2011) 25(2) *Journal of Crop Improvement* 151, 154-9.
[22] RS Patode and BC Mal, 'Optimal Spacing of Tubewells in Relation to Channel Losses and Lining for Multicropping System' (1996) 29(2) *Agricultural Water Management* 163, 164.

Additionally, two distinct licence issuing authorities exist in relation to the installation of irrigation wells setting up a parallel administration over the self-same issue.[23] To avoid all these clashes and overlaps, perhaps, the best option is to integrate the *Groundwater Act* into the *Water Act*. In order to effectuate this integration, a couple of legislative actions need to be undertaken; first, the *Groundwater Act* should be repealed; second, an amendment to the *Water Act* needs to be adopted. Interview findings also highlighted this integration. Many interviewees suggested that in the *Water Act* a separate chapter on groundwater could be incorporated detailing, among other reforms, how sustainable abstraction of groundwater could be ensured across different groundwater users.[24] Perhaps, in this chapter, separate sections focusing on domestic, agricultural, industrial, and environmental groundwater use could be inserted dealing with issues around sustainability.

B *Introducing Water Metering Requirement*

Presently, there is no legal requirement for water metering across Bangladesh.[25] It is often said 'you cannot manage what you cannot measure',[26] and water metering plays a paramount role in gaining this measurement. Indeed, water metering systems provide a foundation for ensuring water use efficiency.[27] By providing reliable and accurate extraction data, water meters augment water accounting, deliver efficiency gains, and enhance compliance and enforcement which otherwise significantly assists the regulators in managing groundwater resources more effectively, efficiently, and sustainably.[28] In addition to controlling groundwater extraction, metering plays a significant role in the implementation of pricing, quotas, and other policies.[29] Moreover, illegal water extraction could be detected and eventually prevented through the use of improved metering.[30] Monks et al identified seventy-five benefits of digital water metering — of these, fifty-seven benefit the water utility, and forty benefit the customers while twenty-two benefit both.[31] Notably, water metering

[23] See chapter 3(VE).
[24] Interviews with GO 1, S 1 (Mohammad, Dhaka, February-March 2018).
[25] See chapter 3(VB).
[26] The director of Stanford University's Water in the West program commented on California's situation by saying: 'If everyone had a meter on their well and you knew how much everyone was using, you could sort of calculate everyone's contribution to aquifer depletion. But if you don't know any of those things, they just become things to fight about'; see Tom Elias, 'Big Gaps in Our Knowledge of Groundwater Supplies', *The Davis Enterprise* (23 April 2017); François Molle and Alvar Closas, *Groundwater Governance: A Synthesis; Groundwater Governance in the Arab World* (IWMI Project, Report No 6, April 2017) 54.
[27] See chapter 2(VA2).
[28] Cameron Holley and Darren Sinclair, 'Non-Urban Water Metering Policy: Water Users' Views on Metering and Metering Upgrades in NSW' (2013) 16(2) *The Australasian Journal of Natural Resources Law and Policy* 101, 125-6; see also Jean-Daniel Rinaudo, Steve Barnett and Cameron Holley, 'Changing from Unrestricted Access to Sustainable Abstraction Management Regimes: Lessons Learnt from France and Australia' in Jean-Daniel Rinaudo et al (eds), *Sustainable Groundwater Management: A Comparative Analysis of French and Australian Policies and Implications to Other Countries* (Springer, 2020) 537-60.
[29] Molle and Closas (n 26).
[30] Holley and Sinclair (n 28) 126.
[31] Ian Monks et al, 'Revealing Unreported Benefits of Digital Water Metering: Literature Review and Expert Opinions' (2019) 11(4) *Water* 838, 838.

significantly improves water regulation through, among other things, recording consumption that ultimately informs the regulators if consumers abide by water usage regulations.[32] More broadly, water monitoring can measure not only volume but also water quality, pressure, and asset condition.[33] In other words, water metering is crucial for collecting data and information on groundwater use, imposing charges, and most importantly, ensuring compliance with, and enforcement of, obligations arising out of a licence that includes a volumetric limit. Hence, the ultimate goal of a groundwater permit system, supported by metering, is to achieve sustainability that is directed at preventing declining groundwater levels, thereby reducing social and environmental harms.[34]

Thus, going back to the central thesis question: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? An answer to this question is the introduction of water metering as part of the licensing conditions that could be a viable legislative response to ensure a more sustainable abstraction of groundwater resources. That said, notwithstanding, in the context of Bangladesh it requires careful deliberation and attention to see when, how, and to what extent this metering system can be introduced. In Bangladesh, groundwater use falls into three broad categories — agricultural use, industrial use, and domestic use. Accordingly, the following discussions consider each category centring on the central theme of groundwater sustainability. In line with the discussion made in chapters 2(VA2) and 3(VB), in this part metering refers to monitoring and collecting data on groundwater use and also using that to impose charges and controls.

1 *Mandatory Water Metering for Agricultural Groundwater Use*

In the context of Bangladesh, water metering is particularly relevant to promote sustainable groundwater irrigation given that 90% of irrigation water comes from groundwater sources and huge numbers of irrigation equipment are in use to pump groundwater.[35] The vast majority of professional interviewees (88%) registered their support for introducing metering regimes in groundwater irrigation while 62% of interviewed farmers advocated for it.[36] Of note, a significant portion of interviewed policymakers (86%) felt the necessity to introduce a metering system in order to have direct control over groundwater irrigation. Referring to

[32] Ibid 859 (22).
[33] Ibid.
[34] For licensing regimes operating in developing countries see, eg, Molle and Closas (n 26); Xiaowei Wang et al, 'Implementing the Prepaid Smart Meter System for Irrigated Groundwater Production in Northern China: Status and Problems' (2017) 9(6) *Water* 379; Reta Hailu, Degefa Tolossa and Getnet Alemu, 'Water Institutions in the Awash Basin of Ethiopia: The Discrepancies between Rhetoric and Realities' (2018) 16(1) *International Journal of River Basin Management* 107; François Molle and Alvar Closas, 'Groundwater Metering: Revisiting a Ubiquitous "Best Practice"' [2021] *Hydrogeology Journal* 1; François Molle and Alvar Closas, 'Groundwater Licensing and Its Challenges' (2021) 28 *Hydrogeology Journal* 1961.
[35] Currently 37,175 deep tube-wells and around 1.4 million shallow tube-wells operate across the country to abstract groundwater for irrigation; see chapter 2(VIII).
[36] See chapter 3(VB).

the success of the prepaid smart metering system introduced in the Barind Tract, they underscored the early initiation of this regime across the country. Even with its certain limitations, the prepaid smart metering system has made a significant improvement in the Barind Tract in terms of groundwater sustainability.[37] This system, indeed, rekindles hope for effective regulation of groundwater irrigation across the country.

Despite these optimistic interview findings, it needs to be noted that millions of farmers across the country depend on groundwater irrigation for their survival.[38] Furthermore, agriculture contributes around 15% of gross domestic product,[39] and hence, a balance needs to be struck between a metering regime on the one hand, and food security, livelihood, and economic development on the other hand. However, the intimate connectivity between irrigation and food security brings forth the notion of intergenerational equity[40] that reinforces the need for effective groundwater laws and institutions to ensure groundwater sustainability in Bangladesh.

Overall, metering is practicable in the context of Bangladesh given that some farmers are already paying for groundwater use in one way or another. Farmers of the Barind Tract, for instance, spend BDT 145 (USD$ 1.75) to pump groundwater for an hour. Local level government institutions, different committees constituted under the *Water Act* and the *Groundwater Act*, and the Water Resources Planning Organisation ('WARPO') with its potential regional and district level offices through sustained and robust coordination could implement this suggested prepaid smart metering system across the country. In this advanced age of satellite and internet technology, groundwater use can be monitored and controlled remotely from centralised stations.[41] This technology is especially useful for Bangladesh given that irrigation wells abound, and the high costs are associated with visiting wells and meter reading.[42] Interviewees across the groups recommended that the installation costs of meters should be incurred by the government. In the Barind Tract where water metering is already in operation, all meters were installed by the government. In fact, this demonstrates that the government is also willing to bear the costs associated with the installation of meters for groundwater irrigation. Notably, the vast majority of the interviewed policymakers (70%) also opined that the government should bear the meter installation costs since Bangladeshi farmers are generally poor. Indeed, other groundwater uses notably drinking water substantially benefit from sustainable groundwater irrigation since irrigation is the principal and major groundwater user in Bangladesh. Preventing unsustainable groundwater irrigation,

[37] See chapter 4(IVC).
[38] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[39] MS Islam et al, 'Agricultural Scenario and Solar Irrigation System of Bangladesh' (Conference Paper, International Conference on Mechanical, Industrial and Energy Engineering, 23-24 December 2018) 1.
[40] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[41] M Dinesh Kumar, 'Raising Agricultural Productivity, Reducing Groundwater Use and Mitigating Carbon Emissions: Role of Energy Pricing in Farm Sector' (2013) 68(3) *Indian Journal of Agricultural Economics* 275, 289.
[42] Ibid 290.

therefore, promotes healthy aquifers that can help to ensure groundwater for all other uses, including drinking purposes.

The notion of introducing water metering to achieve sustainable groundwater irrigation is not new. Rather, as illustrated in chapter 2(VA2), a considerable number of countries across the globe including Australia, Oman, and China have embraced metering systems to achieve sustainability in groundwater irrigation. In Northern China, the prepaid smart metering system as a management tool has significantly influenced the habits of water users, thereby substantially reducing groundwater overexploitation in that region. Eventually, the groundwater level saw remarkable improvement in that area.[43] Thus, the literature demonstrates that a metering mechanism is quite an effective way of promoting sustainable groundwater irrigation.

A final consideration related to the practicability of metering in Bangladesh relates to the situation of marginal irrigation farmers. Over 76% of Bangladesh's farmers are small and marginal, with around 36% of such farmers being tenants, having no arable land of their own.[44] Further, in the rural areas of the country among all households, 63.11% are farm and 36.89% are non-farm. Of the farm households, 57.60% are small, 5.17% are medium and only 0.34% are large.[45] Given that most of the farmers are poor and marginalised, equitable access to groundwater irrigation remains a nagging issue in Bangladesh.

Hence, caution should be taken to ensure that the interests of poor and marginal farmers are protected, and these marginal groups are not adversely affected by regulations. While medium and large-scale farmers enjoy more benefits from the government, small and marginal farmers have only limited access to government services.[46] This concern was raised in interviews, suggesting that policymakers should pay special attention to the needs of this vulnerable group of farmers. As some interviewed irrigation farmers pointed out, their financial viability and economic futures should be taken into consideration before a metering system is introduced on a large scale. More specifically, some of them suggested that the government should provide a subsidy if a meter system was introduced, and they should be charged with a lesser amount for the use of government-arranged irrigation.[47] As one of the respondents explained —

[43] Xiaowei Wang et al, 'Implementing the Prepaid Smart Meter System for Irrigated Groundwater Production in Northern China: Status and Problems' (2017) 9(6) *Water* 379, 390.
[44] Reaz Ahmad, 'Marginal Farmers Have Least Access', *The Daily Star* (online, 5 October 2017) <www.thedailystar.net/frontpage/marginal-farmers-have-least-access-1471696>.
[45] Bangladesh Bureau of Statistics (BBS), *Report on Agriculture and Rural Statistics 2018* (BBS 2018) 39.
[46] For example, small-scale farmers have 7.15 per cent and 10 per cent access to farm credit and agriculture extension services respectively, as opposed to 13.35 per cent and 21.5 per cent access to these services by the large and medium-scale farmers; see Ahmad (n 44).

[47] Interviews with GU 3, GU 4, Groundwater Users (Mohammad, Bangladesh, March 2018).

'… I think the government should provide subsidies in this sector so that we could pay less for water. The government may install a deep tubewell for 15/20 farmers, we could manage that by ourselves. We should be charged for electricity … and a lump [sum] for water having regard to our ability …'.[48]

More importantly, interview data suggested that onerous regulations would damage the morale of poor farmers, and consequently, they would be unwilling to keep farming, thereby threatening the food security of the entire country. Policymakers should keep in mind that smallholders will need support from the state, and regulations applicable to the big farmers may not be appropriate for the small ones. In addition to the introduction of reduced water pricing for these groups, more credit and financing schemes should be undertaken to promote the welfare of smallholders.[49]

2 *Mandatory Water Metering for Industrial Groundwater Use*

The industrial sector of Bangladesh has been putting tremendous stress on groundwater supplies and systems.[50] The textile industry, notably the ready-made garment sector, is notorious for its intensive water use and high pollution load.[51] Almost all the industries including the textile one pump unmetered and unpriced self-supply groundwater from the boreholes.[52] An absence of regulation encourages industries to use a huge amount of water, for instance, 250-300 liters of water is used for washing every kg of apparel — which is four times higher than the global standard. Thus, this unaccounted groundwater withdrawal alarmingly depletes the country's water table, notably in Dhaka.[53]

Respondents strongly supported the strict metering regime for industrial groundwater use.[54] Most importantly, acknowledging the existing policy gap, all interviewed policymakers supported the immediate introduction of this regime. Terming the industrial sector as an impending 'real threat' to the groundwater resources of the country, one respondent warned that domestic groundwater would be adversely affected should the industrial sector not be strictly regulated by introducing metering and capping.[55] Respondents also noted that there was no accurate accounting of the number of deep tubewells used to pump groundwater for industries, and these deep tubewells were not properly registered, posing significant risks to the groundwater resources of the country.[56]

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[48] Interview with GU 4, Groundwater User (Mohammad, Rajshahi, 19 March 2018).
[49] Karen G Villholth, 'Groundwater Irrigation for Smallholders in Sub-Saharan Africa – A Synthesis of Current Knowledge to Guide Sustainable Outcomes' (2013) 38(4) *Water International* 369, 386.
[50] See chapter 2(VIII).
[51] Linda Greer et al, 'The Textile Industry Leaps forward with Clean by Design: Less Environmental Impact with Bigger Profits' (Natural Resources Defense Council, 2015) 4.
[52] Mostafiz Uddin, 'Is It Time for a Water Tax in the Apparel Sector?', *The Daily Star* (online, 14 July 2019) <https://www.thedailystar.net/opinion/environment/news/it-time-water-tax-the-apparel-sector-1770919>.
[53] Ibid; see chapter 2(VIII).
[54] See chapter 3(VB).
[55] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[56] Interviews with GO 4, GO 5, Government Officials (Mohammad, Dhaka, February 2018).

Water metering for industrial groundwater efficiency seems to be promising and practicable in Bangladesh. The Partnership for Cleaner Textile (PaCT), for instance, having experimented with metering in Aboni Textiles Ltd found that metering significantly reduced the water use of the industry, and eventually brought economic, environmental, and social benefits. Metering enabled the industry to identify resource savings opportunities by using reliable water data procured through the meter.[57]

The principal water legislation (*Water Act*) should bind the industry owners to install water meters as part of the licence obligations. These obligations should be articulated in detail in the Rules — when and how to install these meters; what would be the standard of the meters; when to replace these meters. The owners of the industries should shoulder the cost for the installation of water meters that would control groundwater extraction and help impose proper charges. There was a strong agreement among the interview respondents that the industry owners, not the government, should pay for meter installation. Interview data suggested that the industry owners were most likely to accept a metering requirement; but what is needed on the part of the government is to establish a close link with the Bangladesh Garment Manufacturers and Exporters Association — a representative organisation of the industry owners — and work in partnership to ensure that industrial groundwater use is metered. Further, as suggested by interviewees, the price of groundwater for industrial use should be much higher than that for agricultural and domestic use. Currently, industries are using groundwater almost without any charges.[58]

Water metering as a way of achieving sustainable industrial groundwater use receives wide attention in the literature. For instance, Greer et al identified ten best practices to reduce the environmental footprint of textiles, notably energy and water use,[59] where metering was identified as one of the best practices to reduce water use, thereby promoting sustainable abstraction of groundwater. For regulating industrial groundwater use in Metro Manila, Philippines, Ebarvia suggested the strict application of licensing, metering, and water pricing.[60] Investigating the industrial groundwater overexploitation of West Java, Indonesia, Braadbaart and Braadbaart proposed the introduction of tariff-and-quota regimes around groundwater drawn from boreholes.[61]

Summing up, both the literature and interview data suggest that metering is a viable option for Bangladesh to control the indiscriminate groundwater withdrawal in the industrial sector. This will drive the industry owners to reduce consumption and improve water use efficiency.

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[57] Partnership for Cleaner Textile (PaCT), *Cleaner Production Case Study, Metering Resource Usage* (PaCT, Undated).
[58] Industries are charged a negligible BDT 0.0326 (USD$ 0.00038) for a litre of water; see chapter 3(VC).
[59] Greer et al (n 51) 7.
[60] Maria CM Ebarvia, *Pricing for Groundwater Use of Industries in Metro Manila, Philippines* (Research Report, November 1997) 36-9.
[61] Okke Braadbaart and Frederick Braadbaart, 'Policing the Urban Pumping Race: Industrial Groundwater Overexploitation in Indonesia' (1997) 25(2) *World Development* 199, 207.

Moreover, water usage data gleaned from the meter would assist them in developing appropriate water use strategies for economic, social, and environmental benefits.

3 *Limited Water Metering for Domestic Use*

The possibility of introducing water metering for domestic groundwater use in Bangladesh can profitably be discussed under the headings of urban and rural areas given their distinct demographic and topographic settings.

(a) Urban Areas

In the context of Bangladesh, water metering could be introduced to regulate urban domestic groundwater use. More specifically, water metering could bring forth a promising solution to the indiscriminate withdrawal of groundwater in metropolitan cities, district, and sub-district urban areas. The Water Supply and Sewerage Authorities would administer and implement this metering in metropolitan cities while the Department of Public Health Engineering in conjunction with the local government institutions would implement it in district and sub-district urban areas.[62]

In principle, interview respondents agreed on the need for metering in all metropolitan areas.[63] Inspired by the success of a metering regime in the capital city, the majority of respondents recommended the immediate application of it in all other metropolitan cities.[64] Beyond metropolitan areas, a significant portion of respondents (68%) suggested the extension of this regulation (metering regime) to district and Upazila (sub-district) headquarters. They suggested that private tubewells could be installed upon a license to be issued by the responsible body like the Department of Public Health Engineering, municipalities, and city corporations; there should be an installation fee and a yearly fee for the abstraction of water. They also recommended a fixed monthly charge for water consumption if water metering could not be implemented in the district and Upazila areas immediately. Water metering, however, may be progressively implemented in district and Upazila towns.

Indeed, the introduction of metering in metropolitan areas, as well as district and Upazila towns is plausible. Residents of four metropolitan cities — Dhaka, Chattogram, Khulna, and Rajshahi — for instance, already pay for water consumption. In a substantial step forward, the Dhaka Water Supply and Sewerage Authority and the Chattogram Water Supply and Sewerage Authority introduced meters to collect water tariffs from the users.[65] However, the

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[62] See chapter 4(IIB).
[63] See chapter 3(VB).
[64] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[65] Afia Jahin and Md Yasin, 'Smart and Sustainable Water Management Using GIS (A Case Study in District Metering Area of Bangladesh)' (2019) 4(1) *International Journal of Recent Engineering Research and Development* 26, 26; Dhaka Water Supply and Sewerage Authority (DWASA) <http://dwasa.org.bd/>; Chattogram Water Supply and Sewerage Authority, *Tariff/Fees* <http://ctg-wasa.org.bd/?page_id=122>.

water tariff imposed by these city corporations rather seems to be insufficient vis-à-vis the real value of water.[66] Furthermore, there is no provision of a block tariff system — an incremental increase of tariff with the increase of water consumption. Water use is significantly impacted by pricing. Researchers advocate for an increased price to bring about water use efficiency,[67] which needs to be actively considered in Bangladesh. However, the special needs of the vulnerable and marginalised sections of the people should be taken into consideration before applying this metering instrument. Perhaps, the concept of 'free basic water' policy as prevalent in South Africa may be introduced in Bangladesh. Under this policy, a certain quantum of water could be supplied to the disadvantaged community to meet their basic household needs such as drinking, food preparation, bathing, and toilet flushing.[68]

Beyond metropolitan areas, people living in district towns also pay for water consumption between BDT 150 to 500 (USD$ 1.78-5.92) per month depending on consumption.[69] In addition to four Water Supply and Sewerage Authorities in Dhaka, Chattogram, Rajshahi, and Khulna, local government institutions exist at all local tiers which could significantly facilitate the introduction of a metering regime in all metropolitan cities as well as district and Upazila towns.[70] However, implementation of the installation of water meters and their proper functioning require hefty investments, and as is the case with all developing countries, this financial requirement poses a significant challenge in the implementation of a metering regime in Bangladesh. As discussed below, to overcome financial hardships, Bangladesh will need to explore different funding options within domestic and international sources.

To achieve groundwater sustainability in urban areas, water metering is applied in some parts of the world. The Australian Capital Territory (ACT), Australia, Namibia, and Spain, are some countries to name where water metering is in place to ensure water use efficiency in the urban areas.[71] Additionally, Vugt and Samuelson showed that metering would greatly

[66] For instance, DWASA charges BDT 11.57 (USD$ 0.14) for every 1000 litres; see Dhaka Water Supply and Sewerage Authority, *Water Tariff* <http://dwasa.org.bd/site/page/224276b5-882c-4f19-b761-ee1bcbd3cee4/Water-Tariff> .

[67] Ronglin Sun et al, 'Urban and Rural Groundwater Use in Zhengzhou, China: Challenges in Joint Management' (2009) 17(6) *Hydrogeology Journal* 1495, 1504.

[68] In the Mazibuko case the Johannesburg High Court fixed 50 litres of water per person per day that would require to meet the basic household needs which was reduced to 42 litres by the Supreme Court of Appeal. The Constitutional Court, however, declined to determine the minimum quantified amount of water arguing that it should be primarily left in the hands of the legislative and executive branches; see Jackie Dugard and Sandra Liebenberg, 'Muddying the Waters: The Supreme Court of Appeal's Judgment in the Mazibuko Case' (2009) 10(2) *ESR Review: Economic and Social Rights in South Africa* 11, 11-17; M Wesson, 'Reasonableness in Retreat? The Judgment of the South African Constitutional Court in Mazibuko v City of Johnnesburg' (2011) 11(2) *Human Rights Law Review* 390, 398-399.

[69] Tanuja Barua, Sujit Kumar Roy and Mehedi Hasan Munna, 'Status of Drinking Water Quality and Sanitation Facilities in Subarnachar and Maijdee in Noakhali, Bangladesh' (2019) 5(1) *Asian Journal of Medical and Biological Research* 37, 41.

[70] See chapter 4(IIB).

[71] See chapter 2(VA2).

promote resource conservation, especially during a period of scarcity.[72] They argued that metering provided people with direct financial incentives to conserve the resource. Since the conservation becomes noticeable in the size of the bill, metered households are more interested to preserve the resource vis-à-vis the unmetered ones.[73] Thus, the literature lends support to water metering proposed to be introduced to promote urban groundwater sustainability in Bangladesh.

(b) Rural Areas

Rural areas cover 90% of the total topography of Bangladesh (out of the total land area of 147,570 sq km, 132,813 sq km forms rural Bangladesh).[74] Around 75% of the people of Bangladesh live in rural areas,[75] and the density of population per sq km is 1,103.[76] Given that rural areas form the major part of the vast landmass of Bangladesh and that a significant number of people live in the rural areas, in the context of Bangladesh metering sounds unrealistic to regulate domestic groundwater use. Moreover, a monitoring network across this vast landmass is absent. Although local government institutions are in place, they are rather dysfunctional.[77] Further, the government has no water distribution networks in the rural areas, rather as revealed by the interview data, water users pump groundwater out of their own costs to meet their domestic needs. Consequently, an overwhelming majority of groundwater users strongly disapproved of the notion of water metering to regulate domestic groundwater use. Understandably, the sheer number of domestic groundwater users spreading across the country renders it impracticable for the regulators to monitor and enforce groundwater withdrawal.[78] Clearly, Bangladesh is lagging behind the technological advancement that prevents it from embarking on a metering regime across the remote areas of the country. These practical limitations were also flagged and well-articulated by the interviewees.[79] Therefore, water metering is neither feasible nor necessary to control domestic groundwater use in rural settings of Bangladesh.

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[72] Mark Van Vugt and Charles D Samuelson, 'The Impact of Personal Metering in the Management of a Natural Resource Crisis: A Social Dilemma Analysis' (1999) 25(6) *Personality and Social Psychology Bulletin* 735, 735.
[73] Ibid 737.
[74] Bangladesh Bureau of Statistics (BBS), *Monthly Statistical Bulletin-Bangladesh* (BBS, August 2019) ix.
[75] Bangladesh Bureau of Statistics (BBS), *Report on Agriculture and Rural Statistics* (Report, May 2019) 3.
[76] Bangladesh Bureau of Statistics (BBS), *Monthly Statistical Bulletin-Bangladesh* (BBS, April 2019) ix.
[77] See chapter 4(IIB2)(IIC).
[78] Given the involvement of sheer number of groundwater users especially in developing countries Mechlem proposes 'user self-organisation' to manage groundwater resources at local level; see Kerstin Mechlem, *Groundwater Governance: A Global Framework for Country Action — Thematic Paper 6: Legal and Institutional Frameworks* (Rome, June 2012) 29.
[79] See chapter 3(VB).

C *Introducing Limited Capping*

The current legal framework is silent in relation to the introduction of a capping regime.[80] A cap refers to the highest amount of water that can be extracted within a hydrological area per year.[81] Connected with a cap is a trade that is otherwise known as 'water trading' or 'water market'. The elements required for a water market[82] are clearly absent in the current legal framework of Bangladesh.[83] Moreover, in addition to a sound legal framework, a water market requires an able and effective institutional framework to support water transactions among different users. The existing water institutions of Bangladesh are far from soundness and completeness, and as such, they are incapable of running a functional water market in Bangladesh.[84] For a major cap-and-trade system to be introduced in Bangladesh, significant improvement in legal and institutional frameworks is required. In the absence of a legally defined groundwater rights system, however, informal groundwater markets swarm over the Bangladeshi agrarian landscape with about 88% of pump owners reporting trading water in Bangladesh.[85]

Nevertheless, a capping system — that imposes a maximum withdrawal limit — could be considered to control the unbridled groundwater pumping in the industrial sector of Bangladesh. Indeed, this capping instrument, in other words, a regional cap, is feasible to be introduced in the industrial sector given that 70% of washing, dying, and finishing industries are located in the greater Dhaka area and the remaining are located in Mymensingh and Chattogram.[86] That is, the clustering of industries in these areas facilitates the introduction of capping of groundwater. Moreover, groundwater irrigation does not occur in these clustered industrial areas so that would make this selective capping ineffective. Additionally, domestic groundwater use in these areas — which is still very insignificant — is highly unlikely to undercut the effectiveness of the proposed capping tool. However, before 'slapping the capping', a rigorous scientific survey is needed to determine the availability of resources. Then having considered the actual needs of this sector, an appropriate capping could be imposed, which could differ from region to region.[87] In fact, this capping determination highlights the need for developing a strong water resources database as discussed in detail in Part IIID of this chapter. Perhaps, the treatment of wastewater for reuse

[80] See chapter 3(IV)(VC).
[81] See chapter 3(VC).
[82] These elements are: clearly defined individual water rights distinguishable from land title, capping, allocation and trading; see chapter 2(VA2).
[83] See chapter 3(IV)(V).
[84] See chapter 4(II)(III).
[85] Aditi Mukherji and Tushaar Shah, 'Groundwater Socio-Ecology and Governance: A Review of Institutions and Policies in Selected Countries' (2005) 13(1) *Hydrogeology Journal* 328, 328; Jayanath Ananda and Mohamed Aheeyar, 'An Evaluation of Groundwater Institutions in India: A Property Rights Perspective' (2020) 22(6) *Environment, Development and Sustainability* 5731, 5736.
[86] Thomas Sagris and Justin Abbott, 'An Analysis of Industrial Water Use in Bangladesh with a Focus on the Textile and Leather Industries' (2030 Water Resources Group, May 2015) 5.
[87] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018).

could be a better option for Bangladeshi industries to comply with capping. Waste-water treatment and reuse are considered as viable options to mitigate pressure on groundwater resources.[88] If thoroughly processed around 90% of textile wastewater could be reused.[89] It is projected that by 2021 the textile industries of Bangladesh will generate around 349 million m^3 of wastewater which if properly treated for reuse, will significantly reduce water extraction and water stress.[90]

Interview data also advocated for capping regimes in the industrial sector. Given the high annual rainfall,[91] rainwater harvesting could significantly alleviate the industrial groundwater water crisis.[92] Perhaps, as also suggested by interview findings, industries should be put under legislative obligations to arrange at least 50% of their total water demand from surface water, which would ultimately encourage the industry owners to pay more attention to try to explore the possibility of rainwater harvesting. The other option to encourage the industries to pump less groundwater is to impose an increased water price that would, in turn, encourage water users to reduce their water demand and adopt water-saving technologies.[93] In other words, the combined operation of metering, capping, and pricing would significantly limit groundwater withdrawal in the industrial sectors, thereby advancing groundwater sustainability.

For more effective control over industrial groundwater abstraction, the country may profitably be divided into several industrial zones, and no industry should be allowed to be established outside the designated zones. Moreover, *Water Policy* has placed emphasis on zoning regulations for new industrial establishments.[94] This industrial zone could substantially help the water managers to introduce capping in every zone which would ultimately facilitate compliance with, and enforcement of, individual licences issued under the cap. In so doing, however, groundwater laws need to be aligned with other laws notably land laws and industrial laws. This will require strong and meaningful coordination among the WARPO, Ministry of Land, Ministry of Industries, and Ministry of Textiles and Jute.

[88] Tanveer Hussain and Abdul Wahab, 'A Critical Review of the Current Water Conservation Practices in Textile Wet Processing' (2018) 198 *Journal of Cleaner Production* 806, 808-10; Laila Hossain, Sumit Kanti Sarker and Mohidus Samad Khan, 'Evaluation of Present and Future Wastewater Impacts of Textile Dyeing Industries in Bangladesh' (2018) 26 *Environmental Development* 23, 23, 28, 31.
[89] Hussain and Wahab (n 88) 808.
[90] Hossain, Sarker and Khan (n 88).
[91] The annual rainfall of Bangladesh is recorded 2,320 mm; see chapter 2(VII).
[92] Maharam Dakua et al, 'Potential of Rainwater Harvesting in Buildings to Reduce Over Extraction of Groundwater in Urban Areas of Bangladesh' (2014) 9(10) *European Scientific Journal* 68, 68-9.
[93] Amine Oulmane, Aymen Frija and Fatima Brabez, 'Modelling Farmers' Responses to Irrigation Water Policies in Algeria: An Economic Assessment of Volumetric Irrigation Prices and Quotas in the Jijel–Taher Irrigated Perimeter' (2019) 68(3) *Irrigation and Drainage* 507, 508, 509; various pricing methods such as fixed pricing, volumetric pricing, binomial pricing and block tariff, freely settled price, and marginal cost pricing are applied to control groundwater extraction.
[94] *Water Policy* (n 5) s 4.8.

Hence, effective coordination among related agencies is crucial for the successful implementation of capping and other recommendations laid down in this chapter.[95]

That said, this type of regulation, however, has not been experimented with, and tested before which remains an uncharted terrain for Bangladesh. Hence, it is not known what response would come from the industry owners. Despite this uncertainty, many interviewees kept their fingers crossed for a capping tool to succeed in Bangladesh. For instance, an interviewee who happened to be a former policymaker drawing on his personal engagement with industries reported that industry owners were willing to comply with any regulation, but the government was indifferent to take any effective measures in this regard.[96] This suggested that any sort of regulation to control industrial groundwater withdrawal including capping could be welcomed by the industry owners, and eventually, it is most likely to work. Additionally, industries have started realising the need to be more water-efficient. For instance, by adopting water-saving technologies Fakir Apparels Ltd and Mondol Fabrics — two textile industries of Bangladesh — saved 70% and 27% of water respectively.[97] This reinforces the interview findings that industry owners are most likely to embrace capping regulation. Capping, however, is not feasible to be introduced in the agricultural and domestic sectors, and as such, the thesis does not recommend the introduction of capping in those sectors.[98]

D *Enacting Groundwater Laws Efficiently*

Groundwater laws are adopted in a very cursory manner in Bangladesh.[99] People often violate laws due to their ignorance of the law, and this ignorance could largely be addressed through enhanced public participation in the lawmaking process. The benefits of public participation include making people willing to abide by the law.[100] Additionally, substantive public participation may advance social equity in that stakeholders can raise their concerns directly during the consultation which can be reflected in law[101] that would ultimately act to dispel inequality among groundwater users. Even so, there remain concerns about whether public participation is seriously considered by the policymakers to achieve social equity, and participation that is considered by decision-makers to have only a token role is arguably unlikely to make a difference on-the-ground. Perhaps, in this regard judicial intervention — discussed in chapter 5III — might sharpen policymakers' attention.

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[95] See chapters 3(VID), 4(IIIB).
[96] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[97] Inam Ahmed and Refayet Ullah Mirdha, 'Water: Garments' Invisible Price', *The Daily Star* (online, 22 September 2017) <http://www.thedailystar net/frontpage/water-garments-invisible-price-1465762>.
[98] See chapter 3(VC).
[99] See chapter 3(VIA).
[100] Karen Syma Czapanskiy and Rashida Manjoo, 'The Right of Public Participation in the Law-Making Process and the Role of Legislature in the Promotion of This Right' (2008) 19 *Duke Journal of Comparative & International Law* 1, 15-16; see also chapter 2(VA1).
[101] Suzanne Hanchett, 'Participation and Policy Development: The Case of the Bangladesh Flood Action Plan' (1997) 15(3) *Development Policy Review* 277, 277.

Three issues stood out from the interview data — first, stakeholders were rarely engaged in the groundwater lawmaking process; second, multidisciplinary experts were hardly involved in the lawmaking process; and third, elicited public and expert opinions were hardly reflected in the final draft of the law. Thus, local practice and knowledge, notwithstanding their highly-valued significance, are often ignored by the Bangladeshi law and policymakers resulting in limited compliance with laws and regulations.[102] Hence, stakeholders' participation needs to be enhanced in the lawmaking process.

One way of enhancing stakeholder participation is to use local government institutions.[103] Since local government institutions are responsible to coordinate stakeholder participation at all stages of water sector projects,[104] they are better placed to engage general people in the lawmaking process. Additionally, (see Part IIIC), local farmers' associations/groundwater users' associations should be formed and allowed to operate at the local level to maximise the benefit of public participation. Interview data also highlighted the need for the existence of this type of association. Interview findings also suggested that the legislative introduction of this type of association would assist in making the groundwater users aware of the consequences of over-extraction of the resources leading to their more sustainable use.

Another option of enacting more solid and sustainable groundwater laws suggested by the interview findings is to conduct fieldwork to establish a repository of information about groundwater conditions in the country. Such fieldwork should involve multidisciplinary experts such as scientists, hydrologists, engineers, and lawyers in the lawmaking process, given that issues around groundwater extend across all these disciplines.[105] Scientists, hydrologists, and water engineers can offer significant help in determining what is sustainable and what is not in relation to groundwater withdrawal. On the other hand, lawyers and law experts help shape the law efficiently, clearly, and precisely. But they depend on each other for crafting a workable water law.[106] Therefore, a combination of these two groups of experts is needed in adopting a sustainable groundwater law. One of the ways of involving water scientists and engineers in the groundwater lawmaking process is to include academics and researchers in the early draft process of a bill.[107] For instance, the Department of Water Resources Engineering under the Bangladesh University of Engineering and Technology could make a significant contribution in enacting a timely groundwater law.[108]

That said, however, the government needs to be willing and sincere when engaging water scientists and engineers in the lawmaking process, and accordingly, it should take appropriate

[102] Sarah Shalsi et al, 'Can Collective Action Address the "Tragedy of the Commons" in Groundwater Management? Insights from an Australian Case Study' (2019) 27(7) *Hydrogeology Journal* 2471, 2474
[103] See chapter 4(IIB2).
[104] *Water Policy* (n 5) s 4.2.
[105] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[106] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[107] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018).
[108] Interviews with S 4, S 5, Academics (Mohammad, Dhaka, February 2018).

executive steps. Equally, these scientific people should also be willing to contribute to the crafting of this type of law. One of the ways of engaging scientists and water engineers is to hire them on short-term or long-term contracts depending on the subject of law and policy. In the same vein, lawyers and law experts can be engaged in the lawmaking process. For instance, lawyers from the Bangladesh Environmental Lawyers Association or other similar NGOs who focus on environmental issues could be actively involved through their legal consultancy in undertaking this type of law.[109] Likewise, law experts such as researchers and academics across the universities and institutes could be engaged in the lawmaking process. Indeed, the combined efforts of all these people can generate a sustained groundwater law. Potentially, the Law Commission- Bangladesh — the functions of which include formulating recommendations in relation to any legal matters referred to it by the government — could also make a significant contribution in enacting a solid and sustained groundwater law.[110]

The above arguments find support from the literature. For instance, Brooks argues that scientific evidence once properly explained to and understood by policymakers produces better decision-making.[111] However, an effective science-policy interface requires effective communication between scientists and policymakers.[112] The mere existence of scientific information without being communicated would compound the problems associated with groundwater appropriation. Hence, scientists and policy analysts need to effectively explain, communicate, and educate water managers and decision-makers with regard to scientific findings related to the sustainability of water resources.[113]

E *Delineating the Responsibilities of the Water Institutions*

An unusual number of public agencies in many ways influence the implementation of water law and policy in Bangladesh.[114] Ideal groundwater legislation specifies the duties, powers, and functions of responsible water institutions.[115] However, the existing laws are rather nebulous in laying down the specific responsibilities of the water institutions, thereby risking the sustainable abstraction of groundwater resources.[116] The responsibilities of water

[109] Interviews with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[110] Law Commission- Bangladesh, *About Law Commission* <http://www.lc.gov.bd/about htm>; *The Law Commission Act 1996* (Bangladesh) s 6.
[111] H Brooks 'The Scientific Adviser' in Robert Gilpin and Christopher Wright (eds), *Scientists and National Policy-Making* (Columbia University Press, 1964) 74-8, 84-7; Namrata Chindarkar and R Quentin Grafton, 'India's Depleting Groundwater: When Science Meets Policy' (2019) 6(1) *Asia and the Pacific Policy Studies* 108, 112.
[112] See generally Roger A Pielke Jr, *The Honest Broker: Making Sense of Science in Policy and Politics* (Cambridge University Press, 2007).
[113] WA Jury and H Vaux, 'The Role of Science in Solving the World's Emerging Water Problems' (2005) 102(44) *Proceedings of the National Academy of Sciences* 15715, 15719.
[114] See chapter 4(II).
[115] See chapters 2(VA1), 3(VD).
[116] See chapter 3(VD).

institutions need to be clearly defined and delineated to let them know what, when, how, and to what extent they should act to achieve the common goal of groundwater sustainability.

Interview findings suggested that the responsibilities of water institutions were fragmented. Indeed, the existence of two parallel licensing authorities,[117] discrete enforcement of groundwater regulations,[118] and vague responsibilities of the National Water Resources Council, Executive Committee of the National Water Resources Council, and the WARPO in relation to groundwater extraction[119] are all seriously impacting groundwater sustainability.[120]

To address these problems, provisions in relation to the duties and liabilities of the water institutions are required to be incorporated in the existing law that governs groundwater by clearly specifying what institutions should do what, how, and when, and to what extent. Surface and groundwater should be dealt with by one institution, and in this case, perhaps, the WARPO could be invested with this responsibility. Likewise, water quality and quantity should also be handled by one institution — currently, the Department of Environment is concerned with groundwater quality, and the WARPO deals with groundwater quantity. As recommended earlier, the *Groundwater Act* should be integrated into the *Water Act*, and general duties of water institutions should be laid down in the principal legislation while more detailed responsibilities should be spelt out in the Rules made thereunder. The preponderance of water institutions paralyses the groundwater governance in Bangladesh.[121] Hence, the government should direct its attention to reducing the number of water institutions (see Part IIIB below). There are threefold benefits of a smaller number of water institutions; first, the chance of having overlapping and conflicting responsibilities among water institutions is significantly reduced; second, more resources can be allocated among water institutions to discharge their responsibilities more effectively and efficiently; and third, the duties and responsibilities of each water institutions can be clearly defined in relation to the protection of groundwater resources. To implement this proposed change the *Water Act* and the *Groundwater Act* and their associated Rules would need to be reformed.

In summary, despite some positive improvements made in the current Bangladeshi groundwater laws such as the legislative requirement of a license for the installation of a well, significant reforms need to be undertaken to transform them into innovative, dynamic, and sustainable ones to prevent the falling groundwater table. In particular, inclusive participation should be ensured in groundwater lawmaking processes so as to make the legal rules more comprehensive, challenge-tolerant, and context-tailored. Particular attention needs to be paid to the legislative incorporation of water metering requirements as part of licensing conditions

[117] See chapter 3(VE).
[118] See chapter 4(IIC).
[119] Ibid.
[120] Ibid.
[121] Ibid.

that would place a volumetric limit on groundwater withdrawal notably, in the industrial sector. However, the implementation of legal rules is largely dependent on the capacity and robustness of responsible water institutions. Hence, alongside the improvement of the legal framework, water institutions also need to be reformed to address the increasingly daunting issues around groundwater sustainability. Accordingly, the next Part turns to formulate series of recommendations to improve the performance of responsible water institutions.

III REFORMING WATER INSTITUTIONS

A *The Need for Regional and Local Offices of the Water Institutions*

Decentralised offices of water institutions facilitate significantly in, among other things, ensuring compliance and enforcement, gleaning groundwater data, and promoting public participation in water resource management.[122] Even so, Bangladeshi water institutions like the WARPO are highly centralised. The WARPO does not have regional and local offices.

Therefore, the WARPO and other responsible water institutions need to have regional and local offices to advance groundwater sustainability. Interviewees also underscored the need for decentralised offices of the water institutions notably the WARPO.[123] Regional offices of the WARPO could profitably be established at the eight hydrological regions identified by the WARPO.[124] Optimistically, during the fieldwork one of the policymakers informed the researcher that the government was mulling over the establishment of regional offices at each hydrological region. Setting up of these regional offices needs to be accelerated and made functional as quickly as possible. Thereafter, offices of the WARPO could be established at every district which can further be extended to every Upazila. The regional, district, and Upazila level offices of the WARPO would allow it to establish close links with all other local government institutions and local level water committees established under the *Water Act* and the *Groundwater Act*,[125] thereby strengthening the local and coordinated management of groundwater resources.

Hence, under the existing legislative framework, considerable scope remains to promote groundwater sustainability locally with the establishment of decentralised offices of the WARPO across the country. Effectuating this recommendation, however, will require resources that the government, (see Part IIIE), may mobilise by exploring both internal and external funding options.

[122] See chapter 4(IIIE).
[123] Ibid.
[124] See chapter 4(I); the WARPO has divided the entire country into eight hydrological regions.
[125] For discussion on local water committees constituted under the *Water Act* and *Groundwater Act* see chapter 3(IVCDE) and Appendices (B2), and for local government institutions see chapter 4(IIB2).

A direct benefit of regional and local offices of the WARPO would be to educate irrigators and water users across the country by holding workshops/training/awareness programs. Interview data demonstrated that ignorance contributed to the non-compliance.[126] This issue of ignorance could substantially be addressed through the targeted programs undertaken by the decentralised offices of the WARPO in association with the existing local government institutions.

B *Reducing Water Institutions*

In Bangladesh, the implementation of groundwater laws and policies are dependent, in different ways, on an unconscionable number of water institutions.[127] But too many cooks spoil the broth. The preponderance of water institutions creates more problems and confusion in addressing groundwater depletion issues. Precisely, under the present institutional arrangements, responsibilities pertaining to monitoring of groundwater, formulation of groundwater rules, and issuance of abstraction licence fall under multiple water institutions that in turn, debilitate groundwater sustainability.[128] This is in part due to the existence of excessive water institutions coupled with a lack of effective coordination, and in part due to the silence of the law. This silo and overlap problem, however, is also prevalent in many jurisdictions, and it is an impetus for water institutions to work in coordination in order to achieve the targeted goal.[129]

To overcome this situation perhaps, the best option is to reduce the number of water institutions — functions in relation to groundwater resources that include extraction rights dispersed across various institutions would be concentrated to a fewer number of water institutions. Given the uncertainties prevailing in the water institutions, some respondents suggested the establishment of a single agency to take over groundwater-related responsibilities. Some respondents, however, disagreed with this notion of a single agency arguing that water was a cross-cutting issue and many ministries and agencies had stakes over it making it unrealistic to be dealt with by a sole ministry or agency. They rather suggested enhanced coordination and cooperation among the water-related institutions.[130] As one respondent commented, '…the more agencies are involved in the water sector, the more disorder will appear…'.[131] Given the cross-cutting nature of water issues, the notion of a single agency seems to be unrealistic. What seems to be plausible as articulated by many interviewees, is that the WARPO should take the lead in groundwater regulation, and other core agencies such as the Bangladesh Water Development Board, the Barind Multipurpose

[126] See chapter 3(VIB).
[127] See chapter 4(II).
[128] See chapter 4(IIC).
[129] Ndodana Nleya, 'Institutional Overlaps in Water Management in the Eerste River Catchment' (Master's Thesis, University of the Western Cape, 2005) iii, 1-3; Lyla Mehta et al, 'The Politics of IWRM in Southern Africa' (2014) 30(3) *International Journal of Water Resources Development* 528, 532.
[130] Interviews with S 1, GO 4, GO 5 (Mohammad, Dhaka, February-March 2018).
[131] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018).

Development Authority, and the Agricultural Development Corporation should actively assist it, but should not legislate any law or take any policy decision in relation to the water resources. The WARPO would be entrusted with critical issues around licensing including metering and capping to avoid potential conflicts and overlaps.

More generally, to avoid conflicting, overlapping, and nebulous responsibilities among water institutions, the WARPO with active cooperation from all other related agencies would lead operational decisions in relation to groundwater resources. It seems practicable given that under the *Water Act* the WARPO has already been made Secretariat to the Executive Committee of the National Water Resources Council[132] and all water-related public and private agencies are legally obliged to offer necessary assistance to the WARPO for enabling it to perform its functions effectively and efficiently.[133] The responsibilities of the Bangladesh Water Development Board and the Bangladesh Agricultural Development Corporation insofar as they relate to the groundwater regulation should be shifted to the WARPO. Though this thesis does not concern itself with issues of groundwater quality, it is pertinent to suggest that water quality should also be regulated by the WARPO instead of the Department of Environment to avoid fragmented responsibilities.[134] Perhaps, there could be mandatory consultative committees between water agencies with the WARPO taking the lead. These committees would meet on a regular basis to discuss, analyse, and review the prevailing challenges and opportunities around the country's groundwater resources.

Beyond the reduction of water institutions themselves, the breadth of the National Water Resources Council and the Executive Committee of the National Water Resources Council needs to be reduced. At present, the National Water Resources Council and the Executive Committee of the National Water Resources Council are composed of 34 and 23 members respectively most of whom are bureaucrats where technical people and scholars are largely ignored.[135] Water resources in general and groundwater in particular are closely associated with science (see Part IVA below). As transpired from interview findings that these oversized council and committees are inoperative. One of the best ways of making these bodies operational is to truncate their size as well as to include the technical and expert people.[136]

The reduced water institutions will facilitate the WARPO — the chief coordinating agency — to establish robust coordination among all water-related institutions. However, for more meaningful coordination as indicated by interview data, the status of the WARPO needs to be upgraded.[137] As suggested by many interviewees the WARPO could profitably be put under the Office of the Prime Minister. Alternatively, it could be put under the Planning

[132] *Water Act* (n 14) s 14(1); *Water Policy* (n 5) s 5(d).
[133] See chapter 4(IIA3).
[134] Interview with GO 1, Government Official (Mohammad, Dhaka, 14 February 2018).
[135] See chapter 4(IIB1).
[136] Interviews with GO 1, S 5 (Mohammad, Dhaka, February 2018).
[137] See chapter 4(IIIB).

Division. This heightened position of this coordinating institution will attract more attention from policymakers rendering the water policy and plan developed by it, more likely to be implemented. Additionally, the WARPO needs to be spearheaded by a technically sound and administratively capable person which it has been missing perennially.[138] The government should select the leader from among water engineers, water scientists, hydrologists, and hydrogeologists. Further, academics and scholars may also be targeted and approached to be a leader. Under the prevailing laws, the government may appoint this type of person as the head of the WARPO.[139]

Another pertinent issue for this reform theme relates to integrated water resources management. Given that groundwater problems in Bangladesh are multidimensional and multisectoral, and characterised by multi-interests and multi-causes, contemporary approaches to water governance including integrated water resources management should be taken into consideration in future water regulation.[140] This integrated water resources management tool aims to achieve three strategic targets: water use efficiency; equitable water allocation; and socio-economic, and environmental sustainability to protect water resources and related ecosystems.[141] All of these aspects are crucial in ensuring groundwater sustainability in Bangladesh. Further, integrated water resources management underscores the need for participation and decentralisation[142] which this thesis considers necessary for effective groundwater regulation in Bangladesh.

C *Promoting Groundwater Users' Associations*

The localised nature of groundwater requires active and functional groundwater users' associations (GUA) that could make a significant contribution to groundwater sustainability.[143] Interview data highlighted the need for this type of association. The existence of such an association would help water users solve, among other things, their groundwater problem collectively and also assist in raising their common concerns before the responsible government officials. In particular, users may limit their groundwater extraction collectively to prevent groundwater depletion, thereby facilitating compliance and

[138] See chapter 4(IIIF).
[139] *Water Resources Planning Act 1992* (Bangladesh) s 8.
[140] Asit K Biswas, 'Integrated Water Resources Management: A Reassessment: A Water Forum Contribution' (2004) 29(2) *Water International* 248-56; Integrated water resources management has been defined by the Global Water Partnership as 'a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'; see Global Water Partnership (GWP), 'Towards Water Security: A Framework for Action' (GWP, March 2000). For a nuanced understanding of integrated water resources management see, eg, Edson de Oliveira Vieira, 'Integrated Water Resources Management: Theoretical Concepts, Basis, Responsibilities, and Challenges of IWRM' in Edson de Oliveira Vieira et al (eds), *Integrated Water Resource Management: Cases from Africa, Asia, Australia, Latin America and USA* (Springer International Publishing, 2020) 1-12.
[141] Vieira (n 140) 4.
[142] Ibid 5.
[143] See chapter 3(IVC).

enforcement.[144] Such an association is particularly well-placed to have the relevant information and come up with innovative solutions through negotiations.[145] More importantly, an association of this kind injects a sense of belongingness, solidarity, and social esteem which promote networking, building relationships, and advancing negotiation and collective action.[146]

Hence, Bangladesh needs functional GUAs across the country for groundwater sustainability. Without detailing the formation and operation of the farmers' association, the *Groundwater Act* has made a provision for the inclusion of a representative of the local farmers' association in the Upazila Irrigation Committee.[147] However, depending on the size of the project or scheme the *Guidelines for Participatory Water Management 2000* have prescribed different types of water management organisations such as Water Management Group, Water Management Association and Water Management Federation. While a Water Management Group is designed to operate at the lowest level for each smallest hydrological unit or social point, a Water Management Association is meant to run at the mid-level for each sub-system of the project, sub-project or scheme. A Water Management Federation, on the other hand, is proposed to function at the apex level of the project, sub-project or scheme.[148] One of the unique features of these water management organisations has been the fact that membership is open to landless people and destitute women,[149] thereby promoting the participation of the poor. While these elements of the Guidelines sound promising, the interviews revealed that they were hardly followed on-the-ground since they did not have any binding force. Perhaps, to ensure compliance, these matters should be incorporated in the water legislation.

More broadly, the *Groundwater Act* — if it is integrated into the *Water Act* as suggested then the *Water Act* — should comprehensively address issues around the formation, operation, and responsibilities of the local farmers' associations/groundwater users' associations.[150] The principal legislation should generally lay out the structure of this type of association while the Rules made thereunder should discuss in detail matters such as the membership and responsibilities of the association; its relationship with water-related local and central agencies. Special attention, however, needs to be paid to the poor and marginalised farmers such that their participation is ensured in the associations, and their voices are heard. Perhaps,

[144] See chapter 2(VB).
[145] N Faysse, 'Challenges For Fruitful Participation of Smallholders in Large-Scale Water Resource Management Organisations: Selected Case Studies in South Africa' (2004) 43(1) *Agrekon* 52, 55; Edella Schlager, 'Community Management of Groundwater' in Mark Giordano and Karen G Villholth (eds), *The agricultural groundwater revolution: Opportunities and threats to development* (CABI, 2007) 149.
[146] Patricia Kefilwe Madigele, 'Efficiency of Common-Pool Resource Institutions: Focusing on Water Users Associations in South Africa' (2018) 20(2) *Environment, Development and Sustainability* 825, 827.
[147] *Groundwater Act* (n 15) s 4; *Groundwater Irrigation Management Rules 2019* (Bangladesh) r 3.
[148] *Guidelines for Participatory Water Management 2000* (Bangladesh) s 5.1.
[149] Ibid s 5.2.
[150] See chapter 2(VB1).

the statute concerned should have provisions that mandate mandatory representation of such groups on governing bodies or councils.

In the context of Bangladesh, the intended function of the GUA would be raising awareness among groundwater users and assisting the water institutions in implementing water legislation. The Bangladesh Water Development Board — whose current responsibilities extend to the formation and training of water users' associations[151] — should work together with the WARPO, the Barind Multipurpose Development Authority, and the Agricultural Development Corporation to make these types of local associations effective and functional on-the-ground. Additionally, the Union Parishad[152] — a local government institution — and the Union Integrated Water Resources Management Committee (the 'Union Committee')[153] could play an active role in promoting such an association given that these legal bodies are predominantly composed of, and run by, local people. These local bodies have the potential to undertake more comprehensive awareness and capacity building activities to sensitise and strengthen the GUA to use groundwater more efficiently. More broadly, this awareness and capacity building activities could propel the GUA to advise on seasonal, innovative, culturally sensitive, and conservation-oriented groundwater management practices for the users generally.[154] Properly constituted and sufficiently equipped GUA could even monitor water abstractions, thereby facilitating the regulatory functions of water managers.[155] Further, the Technical Committee that operates at the local level could also significantly assist these local associations in managing groundwater locally.[156]

Indeed, ample opportunity remains within the existing framework to take action toward the formation and effectuation of a GUA at the local level. In the Barind Tract though farmers have not formed formal water users' associations, instead they act like the members of similar associations. Interview data revealed that in that Tract farmers between 100 to 150 were usually organised under the operator of a pump.[157] They collectively spend money on repairing the pump and other related issues. Beyond the Barind Tract, interview data also disclosed that (informal) water users' associations existed in some parts of the country. The typical functions of these associations include acquiring lands for the installation of deep tubewells, creating channels/drains to flesh out water to the cultivated lands, and mending water pumps.[158] These associations are informal, and therefore are not bound to consider the

[151] See chapter 4(IIB1).
[152] Union Parishad consists of a chairman and 12 members. Among 12 seats, three seats are exclusively reserved for women; see the *Local Government (Union Parishad) Act 2009* (Bangladesh) s 10 (*'Union Parishad Act'*).
[153] The Union Committee comprises the Chairman of the concerned Union Parishad and 12 other members including an NGO representative; see the *Water Rules* (n 14) r 16.
[154] Nathalie Richards, 'Water Users Associations in Tanzania: Local Governance for Whom?' (2019) 11(10) *Water* 2178, 2191.
[155] Ibid 2186.
[156] See chapter 3(IVE).
[157] Interview with GU 5, Groundwater User (Mohammad, Rajshahi, 20 March 2018).
[158] Interview with GO 7, Government Official (Mohammad, Dhaka, 14 February 2018).

sustainable use of groundwater. These informal associations may be transformed into formal ones to reap the benefits of a more clear focus on sustainability and equity as discussed above.

The literature on groundwater research also underscores the need for the formation of local bodies for the effective management of groundwater resources.[159] For instance, a study conducted on a Korean irrigation association and on the Angas Bremer irrigation district in South Australia showed how local collective action could substantially improve the groundwater resources.[160] Literature across economics, sociology, anthropology as well as environmental and political sciences have highlighted the need for a bottom-up approach to water resource management for desirable management and conservation outcomes.[161]

D *Strengthening the National Water Resources Database*

Reliable, credible, and accessible data lays the foundation for effective and efficient groundwater management and governance (see Part IIB above). Data enables water institutions to adopt targeted policies, programs, and planning to ensure sustainable abstraction of groundwater resources. Data leads to the generation of information and the development of knowledge on groundwater systems.[162] Available data can guide both the water managers and users to achieve the goal of groundwater sustainability.[163] Moreover, the lack of data stymies effective judicial action — since judges, lawyers, and environmental agencies heavily rely on groundwater data for initiating a case pertaining to groundwater resources.[164] By virtue of this data, politicians can understand what is at stake and what would be the alternative options for decision-making. The information gained from data makes the groundwater users aware of their current or potential impacts on groundwater, what is at stake, and why certain measures are needed. Eventually, it could educate them to act judiciously in relation to groundwater use.[165]

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[159] See, eg, Tushaar Shah, *Groundwater Governance and Irrigated Agriculture* (Global Water Partnership, 2014) 28-30; Taha M Taher, 'Groundwater Abstraction Management in Sana'a Basin, Yemen: A Local Community Approach' (2016) 24(6) *Hydrogeology Journal* 1593, 1593-1604; Taha Taher et al, 'Local Groundwater Governance in Yemen: Building on Traditions and Enabling Communities to Craft New Rules' (2012) 20(6) *Hydrogeology Journal* 1177, 1177-87.

[160] Madigele (n 146); Shalsi et al (n 102) 2471.

[161] Zoe Wilson and Sylvain R Perret, 'Participation in Water Resources and Services Governance in South Africa: Caught in the Acts' in Kate A Berry and Eric Mollard (eds), *Social Participation in Water Governance and Management: Critical and Global Perspectives* (Earthscan, 2010) 183-200; Julia Brown, 'Can Participation Change the Geography of Water? Lessons from South Africa' (2013) 103(2) *Annals of the Association of American Geographers* 271, 271-83.

[162] Jac van der Gun, 'Data, Information, Knowledge and Diagnostics on Groundwater' in Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 205.

[163] See chapter 2(VB).

[164] See chapter 5(VC).

[165] Gun (n 162) 195-6.

The WARPO, in line with the mandate of the *Water Policy*, established the National Water Resources Database (NWRD).[166] The *Water Act* reinforces the development of a reliable water resources database.[167] Encouragingly, all public and private water-related agencies are obliged, if requested, to transmit water data to the WARPO.[168] Despite this legislative improvement, a remarkable change is yet to emerge. Dishearteningly, the Bangladesh Water Development Board and other water-related institutions share little data with the WARPO.[169] Additionally, the lack of technology and resources impact the effectiveness of the NWRD.[170]

One of the ways of strengthening the NWRD suggested by interview data is to establish monitoring networks at different levels. For example, the WARPO should maintain national, regional, and local groundwater quality and quantity monitoring networks. Regional groundwater quality and abstraction should be monitored by the proposed regional offices of the WARPO to be established across the country.[171] In addition, local government institutions such as the City Corporations, Zila Parishad, Upazila Parishad, Paurashavas, and Union Council in conjunction with the Department of Public Health Engineering and local level committees formed under the *Water Act* could amass local groundwater data.[172] Further, the Water Supply and Sewerage Authorities should implement networks in metropolitan cities where they operate, to monitor water abstraction and quality. Thereafter, these regional and local level institutions should input their groundwater data into the NWRD. Thus, a countrywide water monitoring network could be established without making any legislative changes. Indeed, improved data allows water managers and water users to know where aquifer boundaries are, thereby promoting and strengthening coordinated action between relevant entities at the aquifer level. In addition to assessing long term trends in groundwater quality and quantity, robust groundwater monitoring networks help determine the major drivers causing the changes eg rainfall or extraction.[173]

In the same vein, as suggested by many interviewees other water institutions like the Bangladesh Water Development Board, the Department of Environment, and the Bangladesh Agricultural Development Corporation should input their respective groundwater data into the NWRD. In particular, given the comprehensive computerised database it maintains, the Institute of Water Modelling should upload its water data to the NWRD.[174] Perhaps, an amendment to the *Water Act* should be undertaken that would require all water-related agencies to input water data within their domain into the NWRD. Further, interview data suggested that NGOs working with the environment in general and water in particular, would

[166] *Water Policy* (n 5) s 4.15; see chapter 4(IIA3).
[167] *Water Rules* (n 14) r 52.
[168] *Water Act* (n 14) s 41.
[169] See chapter 4(IIA4).
[170] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[171] Interviews with S 5, S 6, GO 1 (Mohammad, Dhaka, February-March 2018).
[172] See chapters 3(IVE), 4(IIB2).
[173] Rinaudo, Barnett and Holley (n 28) 542.
[174] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).

be encouraged to share their research findings and water-related data with the government that would in turn, improve the NWRD. To that end, however, the government should encourage, supervise, and promote the NGOs and private sector in undertaking more research and development activities in this area.[175] The advancement of this type of research and development largely depends on the goodwill and sincerity of the government, and of course, on the funding commitments. More public support and investments should be dedicated to the key government agencies, private entities, and public, private, and academic research institutions that are currently conducting research and development to develop water technologies.[176] As discussed below, the government should explore various funding options within internal and external sources.

Undeniably, improvement of the NWRD largely rests with the frequent application of new technologies such as remote sensing and Geographic Information System. Remote sensing technologies can effectively map, monitor, and assess water use.[177] These technologies have the potential to enrich the NWRD by using and collecting intensive water data. In particular, the enhanced use of tubewell and mechanical pump allows for more precise and efficient application of these new technologies.[178] Additionally, borehole drilling and well construction records make a significant contribution in enriching the national water database.[179] Therefore, the WARPO should take initiatives to collect drilling and well construction records, and strict enforcement of licensing requirements would certainly help achieve this data collection target. As recommended above (Part IIB), a water metering requirement as part of licensing conditions needs to be introduced across the country that has the potential to offer significant opportunities in collecting groundwater data. Further, Bangladesh should enter into bilateral and multilateral international cooperation agreements especially with neighbouring countries which could significantly boost groundwater monitoring activities. The Indian Hydrology Project and the EU Water Framework Directory exemplify the immense benefit of this international cooperation.[180]

E *Addressing Resource Constraints*

Undoubtedly, sustained resources — both human and financial — could improve the functioning of water institutions like the WARPO. Interview data revealed that the WARPO suffered significant resource constraints — both human and financial. The current staffing is

[175] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[176] Ed Barbier, *The Water Paradox: Overcoming the Global Crisis in Water Management* (Yale University Press, 2019) 196.
[177] Ibid 191.
[178] Ibid 192.
[179] Saleem Romani, 'Central Groundwater Authority — Past Experience and Future Strategies for Regulating the Development and Utilization of Groundwater in India' in Bharat R Sharma, Karen G Villholth, Kapil D Sharma (eds), *Groundwater Research and Management: Integrating Science into Management Decisions* (International Water Management Institute, 2006) 92.
[180] Gun (n 162).

quite insufficient vis-à-vis the responsibilities entrusted to this responsible water institution. The current staff of the WARPO is 77 with 10 vacancies.[181] Hence, effective steps should be taken to upgrade human resources. Additionally, appropriate training both national and international should be provided to the WARPO personnel, ranging from the highest grade to the lowest grade. This training will make the staff more capable, competent, and dynamic to solve groundwater-related problems more effectively, efficiently, and promptly.[182]

Moreover, as is the case with all developing countries, financial requirements pose a significant challenge in establishing effective groundwater regulation in Bangladesh.[183] Interview findings suggested that the Ministry of Water Resources was rather one of the weakest ministries in Bangladesh, and its budget allocation was meagre compared to other ministries. Hence, to overcome such financial hardships, the government would require enhancing the budget allocation of this ministry. Perhaps, an effective water tariff system could be introduced across the country that could substantially bolster the funding needed for smooth water administration.[184] Appropriate imposition and rigorous collection of water charges have assisted the Barind Multipurpose Development Authority to transform into a self-sustained agency,[185] and other water institutions should follow suit. In particular, interview data highlighted the need for ensuring that water tariffs were rational and reasonable having regard to the specific context of Bangladesh, and that they were properly collected and utilised to administer the system, to get better water data, and address resource constraints.

Furthermore, in addition to the internal mobilisation of funds Bangladesh may seek financial aid from its donor agencies, notably the World Bank and the Asian Development Bank. Additionally, bilateral development agencies notably the Dutch, Danish, Japanese, British, Canadian, Australian, and American could offer substantial help in this regard.[186] Over the years these agencies have been active in investing money in water development projects with technical assistance and capacity building. Further, UNDP and other United Nations Agencies notably UNICEF could offer promising aid in tackling water problems.[187]

Notwithstanding, Bangladesh should pay more attention to increasing government funding, thereby lessening the high level of dependency of the groundwater management-reform

[181] Water Resources Planning Organisation, *Annual Report 2018-2019* (Report, 2019) 4.
[182] Interviews with GO 2, S 6 (Mohammad, Dhaka, Janury-March 2018).
[183] For a broader discussion on funding models for water institutions see, eg, Cornelius Ruiters and Maselaganye Petrus Matji, 'Water Institutions and Governance Models for the Funding, Financing and Management of Water Infrastructure in South Africa' (2015) 41(5) *Water SA* 660; C Ruiters, 'Funding Models for Financing Water Infrastructure in South Africa: Framework and Critical Analysis of Alternatives' (2013) 39(2) *Water SA* 313.
[184] See, eg, Jasper Dalhuisen and Peter Nijkamp, 'Critical Factors for Achieving Multiple Goals with Water Tariff Systems: Combining Limited Data Sources and Expert Testimony' (2002) 38(7) *Water Resources Research* 7-1; Xunzhou Ma, Dan Wu and Shiqiu Zhang, 'Multiple Goals Dilemma of Residential Water Pricing Policy Reform: Increasing Block Tariffs or a Uniform Tariff with Rebate?' (2018) 10(10) *Sustainability* 3526.
[185] See chapter 4(IVC).
[186] *National Water Management Plan 2001* (Approved in 2004) (Bangladesh) vol 2, 22 *('Water Plan')*.
[187] Ibid.

process on external support in the form of loans and grants. The user pays principles incorporated in the *Water Policy* that are also crucial for sustainability, if properly enforced, could significantly improve the current state of the resource.[188] Sustained political will and commitment are needed to address these resource constraints, thereby achieving the ultimate goals of groundwater sustainability. This sustainability issue needs to be embedded in the country's own development strategy.[189] Indeed, national goals of economic development, poverty alleviation, food security, public health and safety, and the protection of the natural environment are all dependent on a sustainable water policy. That said, however, to overcome resource constraints what is needed for the government is to explore other sources of funding. There is no one-size-fits-all prescription to address this resourcing issue.

To sum up, in order to rein in the groundwater overexploitation water institutions of Bangladesh notably the WARPO requires significant reforms. Centralised functioning fails to consider the threats posed to groundwater sustainability. Meaningful coordinated action that is much-needed to ensure sustainable groundwater withdrawal, requires decentralised water institutions — a factor that is currently missing in Bangladesh. Furthermore, to establish effective coordination among responsible water institutions and to better perform with limited resources there is no alternative to downsizing the existing water institutions. Downsized water institutions are most likely to implement groundwater laws in a targeted and strategic way.

IV INVOKING LIMITED JUDICIAL ACTION

The judiciary of Bangladesh continues to play a key role in protecting the country's environment in general[190] and water resources in particular.[191] Court action has made a significant contribution in shaping public policy, and in particular, it stimulated the government in reforming water governance to tackle contemporary challenges. Moreover, the Court liberalised the rule of *locus standi* enabling environmentally-conscious and public-spirited individuals or groups to resort to the Court and seek judge-fashioned remedies.[192]

In the context of groundwater sustainability, judicial action could directly trigger the implementation of some of the recommendations enumerated above. Notably, legal reforms pertaining to the installation of water metering and the introduction of capping in the industrial sector could be accelerated through targeted judicial action. In recent years, the higher judiciary has been very proactive in addressing issues requiring urgent attention. Water metering and capping on industrial groundwater use are such urgent issues requiring

[188] *Water Policy* (n 5) s 4.14.
[189] *Water Plan* (n 186) 181.
[190] See chapter 5(IIC).
[191] See chapter 5(III).
[192] See chapter 5(IID).

immediate intervention from the Court. Additionally, the recent *Bangladesh Rivers Case*[193] rekindles hope that judicial action has the potential to drive the immediate implementation of institutional reforms in relation to the reduction of the existing water institutions, thereby facilitating the transformation of the WARPO into a dedicated institution.[194] The Court directed the government to enhance the powers of the National River Protection Commission to transform it into an effective institution for the protection of Bangladeshi rivers.[195] The Court specifically ruled that the clearance of the National Protection Commission is a must before taking up any project related to rivers and water bodies,[196] and it directed all river-related agencies to actively assist the River Protection Commission in preventing all forms of river encroachment and pollution.[197] The Court could pass similar rulings to strengthen the WARPO.

However, the Court in no way should overstep its judicial remit, thereby undermining the doctrine of separation of powers. Therefore, targeted judicial action could be invoked to facilitate the sustainable abstraction of groundwater resources of Bangladesh. Building on interview data following recommendations are put forward to facilitate judicial action in a bid to promote groundwater sustainability.

A *Establishing a Specialist High Court Bench*

Scientific and technical issues are associated with water in general and groundwater in particular. Currently, no dedicated High Court Bench exists to deal with lawsuits around the environment including water. Generalist judges usually lack the needed experience around complex environmental laws and principles, and they are ill-equipped to handle highly expert testimony, and the necessity of balancing anticipated environmental harm and economic benefits.[198] More generally, environmental law encompasses technical/scientific issues; overlapping remedies and interests; international environmental treaties; precautionary approach; third-party access to environmental justice; and principles concerning sustainable development.[199] These factors necessitate the establishment of a specialist environment court.

In response to the call for special adjudicatory mechanisms, Bangladesh has established the Environment Court and the Environment Appellate Court.[200] However, interviews suggested

[193] *Human Rights and Peace for Bangladesh v Government of Bangladesh and Others* [2016] HCD (Writ Petition No 13989 of 2016) judgement declared on 3 February 2019 *('Bangladesh Rivers Case').*
[194] See chapter 5(III).
[195] Ibid.
[196] *Bangladesh Rivers Case* (n 193) 279 (Directive No 5).
[197] Ibid 178-9 (Directive No 3).
[198] Bharat H Desai and Balraj Sidhu, 'On the Quest for Green Courts in India Survey of Environmental Tribunals and Regulatory Schemes' (2010) 3(1) *Journal of Court Innovation* 79, 88.
[199] Maurice Sunkin, 'Modernising Environmental Justice: Regulation and the Role of an Environmental Tribunal' (2004) 16(2) *Journal of Environmental Law* 307, 308.
[200] The Environment Court and the Environment Appellate Court were firs established through the *Environment Court Act 2000* which was subsequently replaced by the *Environment Court Act 2010* (Bangladesh); see ss 4, 5, 6, 7, 9, 14, 20.

that the Environment Court had largely failed to address water issues which gave rise to the invocation of the writ jurisdiction of the High Court Division. This thesis does not intend to assess the success and failure of the Environment Court. Hence, it refrains from making further discussion on this issue. What the thesis focuses on here is the justification for the establishment of a specialist High Court Bench to deal with highly complex issues around the environment in general and groundwater in particular. Examples of the constitution of this higher level court include the Land and Environment Court of New South Wales, the Environment Court of New Zealand, and the National Green Tribunal of India.[201]

Interview data also suggested the constitution of a Specialist Bench within the Supreme Court of Bangladesh to deal with issues around the environment including water. Judges' lack of scientific knowledge significantly limits the Court's action in relation to suits and cases involving groundwater.[202] One respondent suggested that this Bench was to be named the 'Green Bench'.[203] Referring to the success of the specialist courts such as the National Green Tribunal of India and the Land and Environment Court of NSW, Australia, some interviewed judges suggested their replication, with *mutatis mutandis*, in Bangladesh.[204]

The introduction of this Specialist Bench will allow the Chief Justice to nominate technically sound judges for this Bench. In particular, judges having degrees and training on environmental issues should be targeted for this 'Green Bench' and in case of a fresh appointment, priority should be given to the candidates having degrees in environmental law and science. In order to make the judges of this specialist Bench more skilled, capable, and efficient, sufficient specialist training should be imparted to them. The significance of this type of training in undertaking and adjudicating lawsuits around groundwater resources can hardly be overemphasised.[205] One of the core functions of judicial training is to help the judges keep pace with contemporary scientific and technological developments such that they can effectively adjudicate disputes involving scientific issues.[206] These targeted training programs can potentially enhance the ability of judges to deal with a highly complex subject like groundwater resources. Currently, however, there is no dedicated judicial training institute in Bangladesh that can impart the required training among the judges of the Bangladesh Supreme Court. That is why as pointed out by the interview data, judges are usually reluctant to attend training organised by other institutes. Perhaps, a national judicial academy similar to that of India[207] may be established in Bangladesh to train the judges of the Supreme Court. Alternatively, the existing Judicial Administration Training Institute that

[201] Desai and Sidhu (n 198) 90.
[202] See chapter 5(VA).
[203] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[204] Interview with J 1, Justice (Mohammad, Dhaka, 28 February 2018).
[205] See chapter 5(VA).
[206] Geeta Oberoi, 'Role of Judicial Education in India' (2009) 35(3) *Commonwealth Law Bulletin* 497, 504-6.
[207] National Judicial Academy India <http://www nja nic.in/>.

provides legal training to the judges of the subordinate judiciary[208] may be tailored to the specific training needs of the judges of the higher judiciary.

Additionally, as suggested by interview findings, judges of this Bench should be assisted by some technical and scientific people to arrive at the right decision and also to dispose of the matter effectively, efficiently, and promptly.[209] Groundwater related cases particularly involve assessment and evolution of scientific and technical data, and as such, the presence of technical experts is required for proper adjudication of these types of cases. Specific qualifications of a technical expert need to be determined by the government. For instance, a person in order to act as a technical expert should possess a degree in environmental sciences coupled with a certain period of experience as an environmental scientist or engineer. Further, to expedite the disposal of suits and cases, this specialist Bench should not be bound to follow the traditional procedural as well as evidence laws. These laws have largely proven inaccessible, tardy, complex, non-participatory, and expensive.[210] Given the protracted elements of evidence laws, the three specialist courts as mentioned are not required to follow the rules of evidence.[211]

The notion of the inclusion of technical people in the composition of the Court is not new. In fact, this idea was first derived from the Land and Environment Court of Australia followed by the Environment Court of New Zealand and the National Green Tribunal of India.[212]

In short, calls for the establishment of a Specialist High Court Bench to tackle environmental issues in general and groundwater in particular have reached a crescendo in Bangladesh. The interviewed judges, as well as scholars, highly supported the idea of the constitution of this type of Bench. The Land and Environment Court of Australia and the National Green Tribunal of India speak volumes about the necessity of the proposed 'Green Bench' in Bangladesh.[213]

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[208] Judicial Administration Training Institute, Bangladesh <http://jati.judiciary.org.bd/>.
[209] Interview with J 2, Justice (Mohammad, Dhaka, 1 March 2018).
[210] Md Ahsan Habib, 'Reflections on Environmental Adjudication Regime' (Bangladesh Law Digest, 12 June 2015) <http://bdlawdigest.org/reflections-on-environmental-adjudication-regime.html>.
[211] See the *National Green Tribunal Act 2010* (India) ('*NGTA*'); it provides that the Tribunal shall not be bound by the procedure laid down by the Code of Civil Procedure, 1908 but shall be guided by the principles of natural justice; it also prescribes that subject to the provisions of this Act, the Tribunal shall have power to regulate its own procedure and the Tribunal shall also not be bound by the rules of evidence contained in the Indian Evidence Act, 1872; see the *NGTA* s 19(1)(2)(3).
[212] Desai and Sidhu (n 198) 88-90.
[213] See, eg, Armin Rosencranz and Geetanjoy Sahu, 'Assessing the National Green Tribunal after Four Years' (2014) 5(2) *Journal of Indian Law and Society* 191; Brian J Preston, 'Operating an Environment Court: The Experience of the Land and Environment Court of New South Wales' (2008) 25(6) *Environmental and Planning Law Journal* 385.

B *Suo Motu (self-initiated) Jurisdiction/Proceedings: Cautious Application Warranted*

Suo motu proceedings may facilitate the sustainable abstraction of groundwater resources at least in three ways. First, it is most likely to encourage individual lawyers and environmental groups to be concerned with groundwater issues and to bring the issues around groundwater before the Court for judicial intervention.[214] Thus, more accessibility to the Court is likely to be ensured, paving the way for obtaining more judicial remedies. Second, such a self-initiated judicial proceeding can potentially make the government more proactive in relation to groundwater issues.[215] Finally, it will create awareness among the people at large through media reports.[216]

Interview findings also suggested that the Court should sparingly and only in proper and appropriate cases invoke this unique tool in relation to groundwater issues. As identified by the interviewed judges, an excessive caseload dampens the Court to initiate *suo motu* proceedings, the constitution of the 'Green Bench' will certainly enhance the capacity of the Court, paving the way for taking resort to this tool in fit cases. Additionally, as put forward by some interviewed judges, improved groundwater data will greatly help the Court in applying this tool. Further, many interviewees highlighted that lawyers would need to be willing and active in making *suo motu* jurisdiction effective, and functional. Ultimately, the Court depends on the positive action of lawyers in effectuating a *suo motu* judicial intervention.[217] A lawyer, therefore, needs to be moved and inspired by goals and values such as broader community obligations, a sense of pro bono service, and a responsibility to protect nature and natural resources.[218] Hence, motivated lawyers are badly needed for the proper application of this tool.

However, the implementation of the Court's order emanating from *suo motu* proceedings remains a grave concern. To maximise the benefit of *suo motu* proceedings, the Court needs to follow up its order. One of the ways of enforcing the Court's order is the formation of a local committee to monitor whether the Court's directives are implemented. An alternative

[214] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[215] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[216] Kent E Portney and Jeffrey M Berry, 'The Impact of Local Environmental Advocacy Groups on City Sustainability Policies and Programs' (2016) 44(2) *Policy Studies Journal* 196, 199-201, 207-2011 (showing what role environmental advocacy can play in the policymaking process and eventually, in the sustainability); Alex Wang, 'The Role of Law in Environmental Protection in China: Recent Developments' (2006) 8(2) *Vermont Journal of Environmental Law* 195, 204-212 (showing how legal and public advocacy contributes to the protection of environment).
[217] Interview with J 3, Justice (Mohammad, Dhaka, 26 February 2018).
[218] Kennon M Sheldon and Lawrence S Krieger, 'Does Legal Education Have Undermining Effects on Law Students? Evaluating Changes in Motivation, Values, and Well-being' (2004) 22(2) *Behavioral Sciences and the Law* 261, 263-5; Robert Granfield, 'The Meaning of Pro Bono: Institutional Variations in Professional Obligations among Lawyers A Serendipitous Symposium: Two Issues Confronting the Legal Profession' (2007) 41(1) *Law and Society Review* 113, 113-15.

option would be to ask the concerned government agency to make rolling reports of progress or perform specific positive obligations within a fixed time.[219]

C The Need for Active NGOs

Public interest litigation is one of the most reliable mechanisms to invoke judicial action.[220] However, public interest litigation-based lawsuits are largely dependent on the willingness and capacity of the NGOs.[221] Resource constraints and a lack of data dampen the NGOs to file cases pertaining to groundwater depletion.[222] Rich and political influentials are generally involved in activities that trigger groundwater depletion.[223] Ultimately, they pose a significant threat to groundwater laws and regulations. Individually, therefore, it always remains highly challenging to initiate and continue a lawsuit against them in the Court. Additionally, experiences show that by inflicting significant damage upon the environment the government has often, instead of being a protector, been a perpetrator.[224] Moreover, pervasive poverty is a real barrier to the poor representing themselves before the Court with respect to issues around groundwater impacting them in one way or another.[225] These cases underscore the need for the active presence of NGOs before the Court through public interest litigation. Indeed, through litigation NGOs could launch a social movement towards the protection of groundwater resources.[226]

To play a meaningful role in the protection of groundwater resources, NGOs need to conduct in-depth research on groundwater resources for a better legal and scientific understanding of depletion issues.[227] Drafting a cause of action properly is impossible without the aid of scientific experts,[228] and here lies the importance of interaction and intersection of multidisciplinary people in this complex area of law and science. Interview data suggested that NGOs should have either their own scientific research team or they should collectively

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[219] See *Human Rights and Peace for Bangladesh v Bangladesh* (2009) 14 BLC (HCD) 759 (affirmed in *City Sugar Industries v HRPB* (2010) 62 DLR (AD) 428); see also Ridwanul Hoque, 'Constitutionalism and the Judiciary in Bangladesh' in Sunil Khilnani, Vikram Raghavan and Arun K Thiruvengadam (eds), *Comparative Constitutionalism in South Asia* (Oxford University Press, 2013) 326.
[220] See chapter 5(IID).
[221] Preston (n 213) 389.
[222] See chapter 5(VBC).
[223] See chapter 5(VD).
[224] 'River Grabbing: Protector Became Perpetrator', *The Daily Star* (online, 29 September 2020) <https://www.thedailystar.net/frontpage/news/river-grabbing-protector-became-perpetrator-1969065>; 'Sundarbans under Threat', *The Daily Star* (online, 25 July 2015) <https://www.thedailystar net/in-focus/sundarbans-under-threat-116224>; Sheikh Mohammad Towhidul Karim, 'Role of NGOs in Developing Public Interest Litigation: An Analytical Study' (2019) 49(2/3) *Environmental Policy and Law* 145, 148.
[225] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[226] Md Saiful Karim, Okechukwu Benjamin Vincents and Mia Mahmudur Rahim, 'Legal Activism for Ensuring Environmental Justice' (2012) 7(1) *Asian Journal of Comparative Law* 1, 7-14.
[227] Jona Razzaque, *Public interest environmental litigation in India, Pakistan, and Bangladesh*, (Kluwer Law International, 2004) 39-40.
[228] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).

form a research team of this kind. Alternatively/or additionally, they should have a strong collaboration with water-related scientific institutions such as the Department of Water Resources Engineering under the Bangladesh University of Engineering and Technology; and the Institute of Water Modelling.[229]

Furthermore, to maximise the impact of the groundwater resources campaign, NGOs should create a practice of information sharing and collaboration among themselves.[230] This networking among NGOs will allow them to substantially overcome their resource crisis by using their collective resources, and eventually, they are more likely to succeed in rights-oriented actions.[231] In addition, they should have a strong collaboration with water-related international organisations for getting an extended understanding of water issues in general and groundwater in particular.

Another way of improving the understanding of legal and scientific issues around groundwater depletion for NGOs as suggested by many interviews is to collaborate with public and private agencies of neighboring countries. In this case, Indian institutions, both public and private, could be of great help for NGOs in Bangladesh. Additionally, government agencies should provide the NGOs with required data, and offer needed support to advance groundwater-related research.[232] Finally, in bringing groundwater-related cases NGOs should be motivated by the broader public interest instead of self-interest like attracting media attention, or for political purposes.[233]

D *Technical-Expert Lawyers Needed*

Environmental problems, and more specifically groundwater problems are polycentric and multidisciplinary.[234] In order to invoke judicial action on the depletion of groundwater resources, a lawyer requires to have sufficient technical knowledge on groundwater. A lawyer taking a motion before the Court with this type of issue is required to explain to the Court — what is the current state of groundwater hydrogeology? What is the current storage of an aquifer in the issue? What type of aquifer is it — confined, unconfined, semi-confined? What threatens the aquifer? What are the current recharge, discharge, and withdrawal rates of an aquifer? What is the sustainable level of groundwater withdrawal, and what factors need to be considered for the determination of sustainability? Albeit the Court can always call for expert opinions on these stated issues,[235] a lawyer is, nevertheless, expected to have

[229] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[230] Karim (n 224).
[231] Karim, Vincents and Rahim (n 226) 25.
[232] Interview with S 7, Environmental Activist (Mohammad, Dhaka, 6 February 2018).
[233] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[234] Barry Commoner, *The Closing Circle: Confronting the Environmental Crisis* (Cape, 1972) 3; Preston (n 213) 385.
[235] *The Evidence Act 1872* (Bangladesh) s 45.

sound scientific and technical knowledge around groundwater resources such that s/he can convincingly answer all these questions.

Interview data revealed that due to a lack of scientific and technical knowledge lawyers were usually reluctant to bring this kind of case before the court. One way of enhancing the technical expertise of lawyers is to arrange specialised training for environmental lawyers. Bangladesh Bar Council[236] could arrange this targeted training from time to time. NGOs dealing with the environment like the Bangladesh Environmental Lawyers Association, Bangladesh Poribesh Andolon, Poribesh Banchao Andolon, etc could also arrange this type of training. Additionally, as suggested by many interviewees, science and engineering graduates should be encouraged to enter the law profession to make it a truly multidisciplinary platform for better understanding, explicating, and interpreting law and science around groundwater depletion.

More importantly, lawyers should comprehend the value and importance of groundwater resources with their hearts. Interview data disclosed that lawyers were rather ignorant of, and apathetic to, this precious resource leading to its invisibility in the Court. A committed group of willing and able lawyers is clearly absent now.

Beyond these recommendations outlined above, the media and civil society could also play a vital role in facilitating groundwater sustainability in diverse ways that include seeking the Court's attention through their targeted activities. However, an in-depth examination of the role of media and civil society in relation to the protection of groundwater resources is beyond the remit of this thesis. Instead, this thesis would like to precisely highlight that in Bangladesh over the years, the media has been active in provoking the judiciary to apply its targeted action to protect surface water resources.[237] Likewise, civil society in Bangladesh launched a social movement to protect the river Buriganga that played a significant role in mobilising public and media support in this regard.[238] On different occasions, the Court also underscored the role of media and civil society in preserving the country's natural resources.[239] Therefore, the time is ripe for these actors to direct their attention to the issues

[236] The Bangladesh Bar Council is a statutory autonomous body constituted under the *Bangladesh Legal Practitioners and Bar Council Order 1972* (Bangladesh). It is a licensing and regulatory body for all Advocates of Bangladesh, see Bangladesh Bar Council <http://www.barcouncil.gov.bd/>.

[237] For instance, media reports led a legal NGO to bring a watershed case that prompted the Court to recognise rivers in Bangladesh as living entities with legal rights, see Tawfique Ali, 'Time to Declare Turag Dead', *The Daily Star* (online, 6 November 2016) <https://www.thedailystar net/frontpage/time-declare-turag-dead-1310182>; see the *Bangladesh Rivers Case* (n 193); media report generated a Court ruling resulting in the demolition of a high-rise building that was constructed on the natural water bodies, see, 'No Plan to Demolish Unauthorised BGMEA Building', *New Age* (Dhaka, 2 October 2010); *President, Bangladesh Garment Manufacturers and Exporters Association (BGMEA) v Government of Bangladesh and Others* [2013] AD (Civil Petition for Leave Appeal No 1162 of 2013).

[238] Farjana Nasrin, 'Environmental Movement in Bangladesh: A New Dimension of Environment' (2016) 8(1) *Journal of Alternative Perspectives in the Social Sciences* 134, 137.

[239] In the *Bangladesh Rivers Case* the High Court Division asked the state-run Bangladesh Television to air every Friday an hour-long documentary on river, nature, and environment; and all private television channels

around groundwater resources. As suggested by many interviewees, perhaps, the media, both print and electronic, could publish special features, issues, and documentaries at regular intervals. In particular, given the popularity of Television Talk Shows in Bangladesh[240] groundwater issues may be placed in a roundtable discussion with eminent water jurists, scientists, and engineers that would draw broader attention of, and create awareness among, the community, government, and the Court. In the same vein, civil society could profitably create awareness across the country by holding seminars, symposiums, and press conferences; and publishing books and newsletters on issues around groundwater resources.[241]

To sum up, a balanced judicial action could substantially facilitate groundwater sustainability in Bangladesh. However, a higher level specialist Court is badly needed for meaningful judicial action in the area of groundwater resources. Environmental NGOs and lawyers have a major role to play in advancing proper judicial action in this overlooked field of the environment. Notwithstanding these three-angled reforms (groundwater laws, water institutions, and Court's action) particular attention should also be paid to develop some viable management strategies to mitigate increasingly mounting pressure on Bangladeshi groundwater resources. Hence, the next part attempts to develop some context-specific groundwater management strategies to arrest the declining water table of Bangladesh.

V INTRODUCING MANAGEMENT STRATEGIES

Beyond the improvement of legal and institutional frameworks, some management strategies could well advance groundwater sustainability in Bangladesh. Interview respondents also laid emphasis on adopting some management strategies alongside regulation. These included the conjunctive use of surface and groundwater; rainwater harvesting; alternate wetting and drying; and changing crop patterns. A full evaluation of these management issues, however, it is to be acknowledged, lies outside the scope of this thesis to consider in detail, they are, nonetheless, briefly included for completeness.

Respondents largely agreed that the conjunctive use of surface and groundwater could significantly contribute to groundwater sustainability. Given that Bangladesh is a riverine

were also asked to televise an hour-long similar documentary at least once in a week; this directive was endorsed by the Appellate Division on appeal; see *Bangladesh Rivers Case* (n 193) 281 (Directive No 17); *Nishat Jute Mills Limited vs Human Rights and Peace for Bangladesh (HRPB) and Others* [2019] AD (Civil Petition No 3039 of 2019) 38.

[240] Zahedur Rahman Arman and Rezaul Karim, 'Television Talk Shows in Bangladesh: Public Sphere Challenges' [2017] *JMSD* 46, 46.

[241] See generally Farjana Nasrin, 'Environmental Movement in Bangladesh: A New Dimension of Environment' (2016) 8(1) *Journal of Alternative Perspectives in the Social Sciences* 134 (discussing that NGOs can bring about a positive change through, among other things, doing research and publication, mobilising people, and applying various strategies).

country with more than 230 rivers crisscrossing the terrain, potential opportunities remain for the widespread application of the conjunctive water use that would in turn, significantly mitigate pressure on groundwater. The importance of conjunctive water use has already been reflected in the *Water Policy*.[242] The latest *Integrated Minor Irrigation Policy 2017* has also articulated the need for conjunctive water use to meet agricultural water demands, and in particular, more importance has been placed on the best use of surface water.[243] In the groundwater research literature, conjunctive use of surface and groundwater has also been identified as one of the best ways to promote groundwater sustainability.[244]

In addition, given the high annual rainfall,[245] interviews also suggested that rainwater harvesting could significantly solve many problems around groundwater. To facilitate rainwater harvesting, many interviewees suggested digging more irrigation canals, erecting rubber dams, creating dug-wells, and using rooftops. Rainwater harvesting technique has been used for a quite long time across the globe to overcome water scarcity[246] and it has emerged as a recognised water supply technology especially in many developing countries.[247]

Another management strategy suggested by the empirical findings, relates to the change of crop pattern. Instead of cultivating water-intensive crops like rice, less water demanding crops such as wheat, maize, legumes, etc could be introduced.[248] Further management strategies concern alternate wetting and drying (AWD) which is largely recognised as an effective water-saving tool.[249] Through this technique, instead of keeping rice fields continuously submerged, they are kept dry intermittently during the rice-growing stage. Research shows that if properly applied, the AWD could save 38% of irrigation water with no crop reduction.[250] Research further demonstrates that for Bangladesh the AWD technique is economically beneficial, and farmers' average profit is most likely to go up to 38%.[251]

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[242] See chapter 3(IVB).
[243] *Integrated Minor Irrigation Policy 2017* (Bangladesh) s 5.
[244] See, eg, Xin Wu et al, 'Optimizing Conjunctive Use of Surface Water and Groundwater for Irrigation to Address Human-Nature Water Conflicts: A Surrogate Modeling Approach' (2016) 163 *Agricultural Water Management* 380, 380-1, 389-91; Ajay Singh, 'Conjunctive Use of Water Resources for Sustainable Irrigated Agriculture' (2014) 519 *Journal of Hydrology* 1688, 1688-9, 1693.
[245] See chapter 2(VII).
[246] See, eg, Maharam Dakua et al, 'Potential of Rainwater Harvesting in Buildings to Reduce over Extraction of Groundwater in Urban Areas of Bangladesh' (2014) 9(10) *European Scientific Journal* 68; Sarah Ward, 'Rainwater Harvesting in the UK–Current Practice and Future Trends' (Centre for Water Systems, University of Exeter, 2007).
[247] Md Rezaul Karim, Anwara Begum Shelly and Michel Biswas, 'People Perception and Acceptance of Rainwater Harvesting in a Coastal Area in Bangladesh' (Conference Paper, International Rainwater Catchment Systems Conference, November 2005) 1.
[248] Qureshi, Asad Sarwar Qureshi, Zia Uddin Ahmed and Timothy J Krupnik, *Groundwater Management in Bangladesh: An Analysis of Problems and Opportunities* (CSISA-MI Project, Research Report No 2, Dhaka, 2014) 32.
[249] Fengxian Yao et al, 'Agronomic Performance of High-Yielding Rice Variety Grown under Alternate Wetting and Drying Irrigation' (2012) 126 *Field Crops Research* 16, 16.
[250] Rubenito M Lampayan et al, 'Adoption and Economics of Alternate Wetting and Drying Water Management for Irrigated Lowland Rice' (2015) 170 *Field Crops Research* 95 95, 106.
[251] Ibid 105, 107.

However, as highlighted below communication and education are crucial for the successful application of this method.

Apart from this, attention needs to be paid to the reduction of the excessive irrigation equipment; all of which are not required for conducting irrigation. Shallow tubewells swarm the country, and eventually, groundwater is over-extracted causing a significant depletion of the water table. Further, to prevent water wastage buried pipes could be installed in all deep tubewells which are also widely applied in other countries.[252]

Beyond these strategies, no less important are communication and education. The blatant ignorance of groundwater laws among groundwater users illustrates the need for communication and education in the context of Bangladesh. The message and information disseminated by the State have the potential to influence the behavior of the water users, and as such, the responsible departments and agencies need to consider their communication and education activities within a broader policy context.[253] In particular, a basic understanding of laws, policies, and plans must be imparted to the users. A lack of focused and coordinated communication and education efforts could render any well-designed groundwater laws and policies ineffective.[254] Interview findings suggested holding training and workshops at the doorsteps of water users so as to make them aware of the consequences of unsustainable groundwater withdrawal and the benefits of compliance with the law. Additionally, local members and chairmen of the Union Council and NGOs can make a significant contribution to promoting this noble effort for communication and education. This is more plausible given that local government networks spread across the country, and they have specific activities that include devising ways of locating safe water sources.[255]

VI IMPLEMENTING RECOMMENDATIONS

It is worth noting that each of these recommendations outlined above would have its own pathway and things that would need to change for its implementation. It would, however, be useful to exemplify the implementation of one of these enumerated recommendations to demonstrate what it would involve. Here an example of the most important one is illustrated — water metering in the agricultural sector, a reform that appears readily to be implemented. The agricultural sector of the Barind Tract could be a starting point for introducing water metering that would be used for imposing and realising charges as well as collecting

[252] Md Mosiur Rahman et al, 'Study on the Irrigation Water Distribution System Developed by Barind Multipurpose Development Authority' (2011) 1(2) *Journal of the Bangladesh Association of Young Researchers* 63, 70.
[253] Holley and Sinclair (n 28) 127; Romy Greiner et al, 'Reasons Why Some Irrigation Water Users Fail to Comply with Water Use Regulations: A Case Study from Queensland, Australia' (2016) 51 *Land Use Policy* 26, 38.
[254] Holley and Sinclair (n 28) 128.
[255] *Union Parishad Act* (n 152) ss 6, 45.

groundwater information. The Bangladesh Multipurpose Development Authority has already introduced water metering in the Tract, but it covers only 20% of the agricultural land.[256] This water metering could be expanded to cover the entire Barind Tract to promote sustainable groundwater irrigation. This region is especially important to immediately implement this recommendation given that 97% of its agricultural land is irrigated through groundwater.[257] Moreover, the average rainfall of this area is recorded at around 1,971 mm which is quite a meagre vis-à-vis the national average rainfall of 2,320 mm.[258]

In implementing this water metering, certain reforms need to be undertaken (see 6(II) and 6(III)). The *Groundwater Act* (or the *Water Act* if the two are integrated as recommended in chapter 6(IIA)) should contain provisions requiring water metering in the agricultural sector of the country. In addition, some institutional reforms need to be carried out. The Barind Multipurpose Development Authority (BMDA) which is currently monitoring and implementing metering in the Barind Tract needs to expand its zonal office to bring the entire region under the metering regime. The Bangladesh Agricultural Development Corporation under the Ministry of Agriculture is also working there to promote and facilitate small-scale irrigation in the region. Moreover, a regional WARPO office in the Barind Tract could also take part in the implementation of water metering efforts. What is needed to implement water metering in this region is to establish strong coordination among these organisations. Further, additional funds would be required to implement this recommendation. In addition to an external source of funding, more focus should be employed on exploring internal funding.[259] Following the Barind Tract water metering in the agricultural sector would be introduced in the north-central region of the country. For this region, it is important to see the immediate introduction of metering given that 84% of the agricultural land of the area is irrigated through groundwater.[260] Moreover, the water table of the region is depleting quickly due to the continuous groundwater pumping by various actors.[261] Since this region falls outside the jurisdiction of the BMDA, an authority like the BMDA could be established to implement and monitor the proper functioning of water metering. Alternatively, the Bangladesh Agricultural Development Corporation and the potential WARPO's regional office could work in collaboration to implement water metering across the region that would, as noted in Part II(B) of this chapter, be a useful legislative response to ward off the falling water table.

[256] See chapter 4(IV).
[257] CSIRO, WARPO, BWDB, IWM, BIDS and CEGIS, *Bangladesh Integrated Water Resources Assessment* (Final Report, May 2014) 24 ('CSIRO Report').
[258] See chapter 4(IVA).
[259] See this chapter ie chapter 6(IIIE).
[260] CSIRO Report (n 257).
[261] Helemul Alam, 'Natural Reservoir Runs Dry' *The Daily Star* (online, 22 March 2020) <https://www.thedailystar.net/backpage/news/natural-reservoir-runs-dry-1883983>.

VII CONCLUSION

This chapter has demonstrated that there is considerable scope to improve the existing legal and institutional frameworks to overcome the increasingly daunting challenges posed by the declining groundwater resources of Bangladesh. These challenges, however, are not static, rather rolling and evolving with time. Hence, laws and institutions pertaining to groundwater need to be constantly tested, explored, and refined to make them dynamic, innovative, and more responsive.

While the adoption of groundwater laws is a welcome initiative to address issues around groundwater sustainability, these laws, however, require significant improvement in order to effectively tackle the ever-increasing groundwater depletion. Certainly, a legislative requirement to obtain a permit for the installation of any well from the competent authorities is a timely initiative. Nevertheless, the introduction of a permit system that does not require a permit holder to install a water meter as part of a licence condition is incomplete. Water metering is certainly an area that deserves rigorous legislative attention. To impose a sustainable groundwater abstraction limit in the industrial sector, a quota system or broadly capping should be actively considered. Another area requiring particular attention is the integration of the *Groundwater Act* into the *Water Act* to remove clashes and overlaps among the existing water laws. Finally, to be more enduring and sustainable, water laws require multidisciplinary experts including stakeholders to be involved in their drafting process.

Of course, compliance and enforcement of these improved water laws are impossible without capable and dedicated water institutions that warrant substantial reforms. A vexing issue requiring immediate action is to truncate the water institutions such that appropriate responsibilities in relation to groundwater sustainability could be assigned among selected institutions. Moreover, a lesser number of water institutions will allow establishing better integration and coordination among water institutions, thereby facilitating the achievement of common goals around groundwater sustainability. Perhaps, promising solutions lie in making the WARPO more dynamic, capable, and functional. In order for that to happen, issues around the resource, both human and financial, need to be addressed. What is needed to overcome resource constraints is to explore both internal and external funding options. Promoting local groundwater users' associations is another option to facilitate the sustainable abstraction of groundwater resources that deserves serious consideration from the government.

Yet, another potential short-term solution lies in the targeted judicial action. However, this judicial action largely depends on the capacity and willingness of judges, lawyers, and environmental NGOs. Cautiously applied judicial action can alert and revitalise the slumbering institutions as well as bring about changes in policy and rules. Indeed, a judicial

intervention can trigger improved governance and increased public accountability.[262] More generally, an honestly activist judiciary can hold the executive accountable through the application of public interest litigation for its act of commission and omission in relation to the protection of groundwater resources. The current failure of the government in taking appropriate measures to prevent groundwater depletion is, by and large, attributable to the lack of public accountability.

Beyond these three-part improvements, some management options need to be explored and applied to promote groundwater sustainability. Some options explored in this thesis are the conjunctive use of surface and groundwater; rainwater harvesting; alternate wetting and drying; and changing crop patterns that have a direct influence on groundwater sustainability. Successful application of these management options is, however, conditioned on effective communication and education. Therefore, targeted programs need to be undertaken to advance this noble theme concerning communication and education. Given the series of recommendations that have been put forward across this chapter, it is worth considering how to prioritise suggested recommendations. Accordingly, this issue of the priority of various recommendations is addressed in chapter 7(III).

In short, ensuring sustainable extraction of groundwater in Bangladesh heavily hinges on the sophisticated legal and institutional frameworks. The current frameworks are, however, far from the sophistication and as such, ill-equipped to tackle the mounting challenges stemming from falling groundwater tables. Therefore, this chapter has prescribed ways how to improve the current legal and institutional frameworks such that they could better ensure groundwater sustainability, thereby has answered the central thesis question. This chapter, notwithstanding, acknowledges that there is no silver bullet to ameliorate the present regulatory framework overnight. What is rather needed is to continually experiment, devise, and redesign the framework so as to live up to the contemporary groundwater depletion challenges.

[262] Lavanya Rajamani, 'Public Interest Environmental Litigation in India: Exploring Issues of Access, Participation, Equity, Effectiveness and Sustainability' (2007) 19(3) *Journal of Environmental Law* 293, 319.

CHAPTER 7
CONCLUSION

I INTRODUCTION

Cities and industries, rivers and lakes, and biodiversity and terrestrial ecosystems are all heavily dependent on groundwater.[1] However, ever-increasing local and global pressures trigger the depletion of this precious resource at an alarming rate threatening the human environment, food security, and economy.[2] While different countries ranging from developed to developing to least developing have adopted varying legal approaches and strategies to tackle the groundwater depletion crisis, Bangladesh's legal response, which is the focus of this study, to this increasingly tenacious crisis has been both sluggish and ineffective. As shown in this thesis, the country preferred groundwater development to management and governance. Bangladesh has achieved near self-sufficiency in food through irrigated agriculture and has turned out to be the world's second garments exporter at a huge cost to groundwater resources.[3] Further, urban water supplies heavily rely on groundwater, putting additional stress on this resource. The combined effects of these unprecedented pressures on groundwater trigger the depletion of the water table to an extent that it cannot be naturally replenished.

Against this backdrop, this thesis investigated to what extent current legal and institutional frameworks of Bangladesh succeed or fail in ensuring sustainable groundwater abstraction across the country, and how they could be better improved to tackle the crises arising out of this depleting resource. Accordingly, the central research question framed for this thesis was: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources?

Initially, by virtue of the *Easements Act 1882* which was grounded in the common law deriving from the UK, landowners in Bangladesh continued to enjoy unbridled rights over groundwater beneath their lands. These extraction and use rights accruing to landowners caused significant damage to this precious resource. Indeed, groundwater extraction across the country virtually remained unregulated until 1985 when, for the first time, the

[1] Rebecca Nelson, Dissertation 'Groundwater Wells Versus Surface Water and Ecosystems: An Empirical Approach to Law and Policy Challenges and Solutions' (JSD Dissertation, Stanford University, 2014) 1.
[2] JS Famiglietti, 'The Global Groundwater Crisis' (2014) 4 *Nature Climate Change* 945, 945; Karen G Villholth and Kirstin I Conti, 'Groundwater Governance: Rationale, Definition, Current State and Heuristic Framework' in V Karen G Villholth et al (eds), *Advances in Groundwater Governance* (CRC Press, 2018) 4; Cameron Holley and Darren Sinclair, 'Replenishing Australia's Water Future: From Stagnation to Innovation' in Cameron Holley and Darren Sinclair (eds), *Reforming Water Law and Governance: From Stagnation to Innovation in Australia* (Springer, 2018) 2.
[3] See chapter 3(I).

Groundwater Management Ordinance[4] was adopted to regulate groundwater irrigation.[5] However, this legislative tool failed to make a difference partly due to its failure to address the core issues around unsustainable groundwater irrigation, and partly due to its poor implementation. As a result, the country saw uncontrolled groundwater irrigation.[6] Thenceforth, after nearly three decades of inaction, the government enacted the *Bangladesh Water Act*[7] for integrated development and management of water resources of the country. The *Water Act* has, however, more flaws than strengths in addressing groundwater issues, notably the overexploitation of the resource.[8] The *Water Act*, as a matter of fact, has placed emphasis on surface water and core issues around groundwater such as water metering, capping, etc remain largely unaddressed.[9] Finally, without making any substantial changes the *Groundwater Ordinance* was replaced by the *Groundwater Irrigation Management Act*[10] in 2018. Like its predecessor the *Groundwater Act* has failed to draw a clear map as to how to control unsustainable groundwater irrigation, not least it has failed to require water metering.[11]

In the result, the current legal framework has rather been ineffective and inefficient in ensuring sustainable abstraction of groundwater resources. Additionally, the existing water institutions are ill-equipped to prevent groundwater overexploitation. In particular, conflicting, overlapping, vague, and fragmented responsibilities significantly limit the capacity of the Bangladeshi water institutions in tackling ever-increasing depletion issues.[12] Resource shortage, a lack of coordination, limited research, a dearth of data, weak monitoring systems, a leadership crisis, and centralised functioning, significantly limit the effectiveness of the existing water institutions.[13] The overall institutional framework is riddled with segmentation and fragmentation where gaps and overlaps muddy the entire regime. The central argument of the thesis, therefore, has been that the existing legal and institutional frameworks fail to rein in the unsustainable extraction of groundwater resources since the laws are themselves defective and deficient, and responsible water institutions are patchy and fragmented leading to very weak compliance and enforcement. For instance, albeit a licence is required under the *Groundwater Ordinance* (now the *Groundwater Act*) for the installation of an irrigation well, interview data revealed that due to the lack of a capable institution this legislative prescription was hardly implemented on the ground. Indeed, none of the

[4] *Groundwater Management Ordinance 1985* (Bangladesh) *('Groundwater Ordinance').*
[5] See chapter 3(III).
[6] See chapter 2(VIII).
[7] *Bangladesh Water Act 2013* (Bangladesh) ('*Water Act'*)
[8] See chapter 3(IVE)(V).
[9] Ibid.
[10] *Groundwater Irrigation Management Act 2018* (Bangladesh) ('*Groundwater Act'*).
[11] See chapter 3(IVCD).
[12] See chapter 4(IIC).
[13] See chapter 4(III).

interviewed groundwater users (farmers) took a licence for the construction of his/her irrigation well.

To answer the central thesis question and establish the central argument, in addition to using the existing scholarly literature and analysing the law, the thesis has predominantly relied on empirical data. Precisely speaking, three diagnostic chapters — 3, 4 and 5 along with chapter 6 — that answered the central thesis question and established the central argument were significantly built on 43 in-depth interviews. These interviews were conducted with four broad categories of people — government officials, judges, scholars, and groundwater users.[14] This interview data has added immense value to this thesis. In particular, the views and observations of these interviewees have offered nuanced insights in understanding and evaluating the underpinnings of the existing groundwater laws and institutions. These empirical insights have enabled us to deeply look at how water institutions interact with groundwater laws, why laws do not get implemented or at least, are poorly implemented, and how these implementation barriers could be dispelled.

More broadly, the views, perceptions, and experiences of interviewees in relation to groundwater use, management, and regulations have helped us flag the broader issues around groundwater sustainability and eventually, propose several policy implications that engage a broader range of parties and facilitate better management of groundwater extraction. This could ultimately lead to more effective and efficient groundwater regulation in Bangladesh and potentially other regions of the world facing similar groundwater challenges.

This concluding chapter proceeds in five parts. Part II discusses research questions and key findings of the thesis. It shows how these findings are original and add knowledge to the literature. Part III then moves to prioritise recommendations made in chapter 6 given that some of them require immediate attention while others may be progressively realised depending on the availability of resources. Thereafter, Part IV identifies and highlights areas of future research for developing a holistic understanding of the role of legal and institutional frameworks in ensuring groundwater sustainability. Finally, Part V summarises the overall findings of the thesis.

II THESIS QUESTIONS AND KEY FINDINGS

This thesis has examined the legal and institutional frameworks of Bangladesh in relation to groundwater resources to answer this question: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? In doing so, this thesis has answered the following sub-questions:

[14] See chapter 2(IIBC).

a) To what extent do the current legal and institutional frameworks ensure the sustainable abstraction of groundwater resources?

b) What deficiencies presently exist in the legal and institutional settings?

c) Can judicial action promote the sustainable abstraction of this resource?

d) What specific changes in the current legal and institutional frameworks are needed to make them more effective and operational?

The answers and key findings are briefly discussed below.

Chapter 2 discussed the methodology of the thesis, and in doing so, it justified the need for empirical investigation for this study. The rationale behind the interviews was, the chapter noted, to provide more nuanced insights in relation to groundwater sustainability in Bangladesh not available through the published literature that in turn, has made a significant contribution to scholarship. In particular, this chapter showed that in the face of chronic literature scarcity, relevant to groundwater law and regulation in Bangladesh, the interviews that were conducted in Bangla and later translated into English, provide access to an understanding of the situation with regard to groundwater for those scholars unfamiliar with Bangla language.[15] The chapter further found that 'groundwater sustainability' was an evolving issue, and it was hard to lay down precisely what constituted sustainability and what not. More worryingly, the chapter found that Bangladeshi legislation governing groundwater extraction did not define the basic term groundwater 'sustainability'. Notwithstanding, for the purpose of this study, the chapter in a fairly straightforward terms defined sustainability to be 'when groundwater natural discharge including human extraction does not exceed groundwater recharge'. The chapter, however, suggested taking preemptive measures with diverse options to tackle the issues around sustainability.[16]

Thereafter, the chapter explored the connection between the environment and groundwater, and it showed that groundwater sustainability that has emerged as one of the core objectives of broader water law is an underpinning of environmental protection that needs to be achieved. The chapter took the discussion further by generally exploring the role of legal and institutional frameworks in preventing groundwater depletion. It showed that effective groundwater regulation was significantly dependent on the soundness and robustness of a legal framework. Ideal groundwater legislation provides an appropriate mechanism to protect an aquifer against depletion and presents suitable monitoring and planning tools.[17] It further showed that the implementation of groundwater laws would hinge on the capacity of water institutions.[18] Eventually, robust legal and institutional frameworks are crucial in achieving groundwater sustainability as the former, among other things, lays down abstraction rules

[15] Ibid.
[16] See chapter 2(IIIC).
[17] See chapter 2(VA).
[18] See chapter 2(VB).

and the latter ensures compliance and enforcement. Finally, the chapter showed that agricultural, industrial, and to a lesser extent domestic sectors continued to cause groundwater overexploitation in Bangladesh that turned into a serious legal and policy issue, and ultimately, a robust legal response was needed to curb this groundwater over-extraction.[19] The chapter, however, noted that in the context of Bangladesh, the Court was increasingly being recognised as an influential actor in shaping and improving the legal response to the water crisis of the country, thereby making a significant contribution to the water governance reform.

Chapter 3 argued that the existing legal framework of Bangladesh was insufficient, inefficient, and ineffective in tackling the groundwater depletion problem, thereby failing to ensure the sustainable abstraction of this resource. Before addressing the substantive research questions, the chapter demonstrated how unrestricted rights over groundwater derived from common law were altered and qualified in Bangladesh with the enactment of the modern water law. The chapter, however, warned that land-based groundwater rights that still existed in Bangladesh continued to undermine the realisation of the human right to water. Thereafter, responding to sub-questions (a) and (b) involving legal framework it showed that while enactment of groundwater laws was a commendable initiative toward the protection of groundwater resources, they suffered significant weaknesses warranting substantial reforms. The chapter found that the permit requirement for the installation of a well, especially an irrigation well was a significant step forward[20] since around 76% of the total cultivable land was irrigated through groundwater making agriculture the major groundwater consumer of the country. Moreover, currently, 37,175 deep tubewells and 1.4 million shallow tubewells are in use to pump groundwater across the country to meet irrigation demands.[21] A significant legal deficiency identified in the chapter was the absence of a legislative imperative of water metering in trying to control the unbridled groundwater extraction; notably in the fast-growing industrial and countrywide agricultural sectors.[22] The mere introduction of a permit system that does not require water metering as part of licensing conditions, is destined to fail in achieving groundwater sustainability.

More specifically, in addition to imposing appropriate water tariffs water metering assists in generating credible and reliable water extraction data that plays a significant role in undertaking a sustainable groundwater management plan and enhancing compliance and enforcement.[23] In the result, a permit without metering is ineffective in tackling unsustainable groundwater pumping. This finding was strongly supported by interview data where all interviewed judges, 86% of interviewed policymakers, 83% of interviewed scholars, and 62% of respondents from farmers registered their support for attaching water metering

[19] See chapter 2(VIII).
[20] See chapter 3(IVCDE).
[21] See chapter 2(VIII).
[22] See chapter 3(VB).
[23] See chapter 6(IIB).

requirements as an integral part of a permit system. As one of the respondents pointed out, 'You see licensing and metering system works well in some parts of the world, but we are lagging behind, I would certainly recommend water metering to regulate groundwater used by the industrial and agriculture sectors of the country.'[24] The chapter also showed that despite a promising solution lying in a quota system or more generally, in a capping tool in controlling the unaccounted groundwater pumping in the industrial sector, this system remained outside the purview of law and policy.[25] There was a compelling response from the interviewees in support of this capping for the industrial sector. One respondent from policymakers, for instance, termed the industrial groundwater withdrawal as 'indiscriminate' and suggested immediate 'capping'.[26] Another respondent warned that industries being in very close proximity, severe groundwater crisis would emerge soon if effective regulation was not placed to rein in unbridled industrial groundwater withdrawal.[27]

Additionally, an investigation over the legal framework carried out in chapter 3 revealed the telling weakness in the water lawmaking process itself. Drawing on interview data the chapter found that stakeholders and multidisciplinary experts were hardly consulted in enacting a highly technical law relating to groundwater, making the legislation practically dysfunctional and inoperative. Clearly, issues around groundwater sustainability travel across law, science, hydrology, hydrogeology, and engineering disciplines requiring the combination of multidisciplinary experts in crafting a sustainable groundwater law. Indeed, meaningful public participation in the lawmaking process facilitates compliance bringing forth a more targeted outcome of law.[28]

Another major finding of this chapter related to the undelineated responsibilities of water institutions that stood in the way of effective groundwater regulation ultimately leading to the unsustainable extraction of groundwater resources.[29] Bangladeshi water institutions are often confronted with uncertainty in relation to their respective responsibilities with regard to groundwater sustainability. For instance, both the Ministry of Agriculture and the Ministry of Water Resources set conflicting criteria for the registration of irrigation wells.[30] Another instance of uncertainty explored in chapter 4(IIC) concerned the overlapping responsibility of the Bangladesh Water Development Board and the Water Resources Planning Organisation (WARPO) in relation to the control and monitor of the flow of aquifers. As a result, agencies do conflicting things obstructing the achievement of groundwater sustainability. The *Water Act* being the principal legislation has not addressed these nagging issues. Interview data suggested that groundwater sustainability would not be achieved unless

[24] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[25] See chapter 3(VC) — the *Water Act* (n 7) has hopelessly failed to address this capping issue. Not a single provision is found in the *Act* which at least acknowledges the enormity of the problem.
[26] Interview with GO 4, Government Official (Mohammad, Dhaka, 12 February 2018).
[27] Interview with S 3, Academic (Mohammad, Dhaka, 7 February 2018).
[28] See chapter 6(IID).
[29] See chapter 3(VD).
[30] See chapter 3(VE).

the responsibilities of the water institutions were made clear in the water legislation. As a respondent commented, 'How do you expect groundwater sustainability when institutions are in a quandary with respect to their exact responsibilities and continue to fumble with them?'[31] Finally, the chapter explored some conflicting provisions among water laws that created obstruction in ensuring sustainable abstraction of groundwater resources. Notably, parallel administration is in place to deal with licensing around irrigation wells creating more problems and uncertainty in relation to groundwater governance regimes and significantly limiting the effectiveness of groundwater regulation.[32]

Beyond these recorded weaknesses of groundwater laws themselves, building and reflecting on interview data chapter 3(VI) identified some barriers to the implementation of these laws. Major findings in relation to this implementation issue concerned the poor processes for adopting groundwater law; a lack of knowledge of this law among the regulators and regulatees; an absence of active monitoring; a lack of effective coordination among responsible water institutions; and a historic lack of groundwater regulation. Interview data suggested that unless these implementation barriers were removed achieving groundwater sustainability would remain elusive in Bangladesh. Given these findings discussed above, amplifying the central argument of the thesis, the chapter concluded that the legal framework had significantly failed to ensure the sustainable abstraction of groundwater resources, thereby opening the floodgate of uninterrupted groundwater pumping leaving a deep-rooted scar on groundwater sustainability.

Chapter 4 answered sub-questions (a) and (b) pertaining to the institutional framework for groundwater governance in Bangladesh. It argued that the institutional design with respect to groundwater resources was faulty, shortsighted, and ultimately ineffective in arresting unsustainable groundwater withdrawal. It found that the existence of a huge number of water institutions created significant uncertainty in undertaking a sustained response to prevent the declining water table.[33] Pointing a finger to this institutional uncertainty, the interview data revealed that groundwater continued to be mismanaged in Bangladesh as different agencies undertook different responsibilities in an isolated way. For instance, licensing and enforcement of groundwater abstraction are concurrently dealt with by the Bangladesh Water Development Board, different water resources management committees constituted under the *Water Act*, and the Upazila Parishad.[34] Further, the National Water Resources Council (NWRC), the Executive Committee of the NWRC and the WARPO are engaged in formulating water law and policy, and other agencies such as the Department of Environment, the Ministry of Land, the Ministry of Industries, and the Ministry of Agriculture are also empowered to develop rules, regulations, guidelines, and legislation.[35]

[31] Interview with S 6, Water Specialist (Mohammad, Dhaka, 1 March 2018).
[32] See chapter 3(VE).
[33] See chapter 4(II).
[34] See chapter 4(IIC).
[35] Ibid.

But it remains unclear which agencies should do what, when, how, and to what extent. The existing laws and policies are nebulous in relation to these issues leaving a window of uncertainty as to how, when, in what manner, and under which circumstances issues around groundwater sustainability would be addressed in collaboration and in a targeted way.

Additionally, the long list of water institutions (35 public organisations and agencies are involved in the water sector of Bangladesh) poses a substantial challenge in establishing robust coordination among water-related institutions.[36] The majority of interviewees considered this complex web of institutional arrangements as a significant blow to the achievement of groundwater sustainability. As one respondent noted, '…..the groundwater anarchy that we are witnessing now is the outcome of a lack of dedicated water institution….if you mean the WARPO as the central water institution, focus on it, devise ways how it could be made functional……set your feet on one boat rather than multiples….'.[37] Another telling weakness of the institutions revealed by the interview data and discussed in that chapter (4(IIIA)) concerned the resource constraints, both human and financial. The scarcity of human resources, for example, prevents water institutions, notably the WARPO and the Bangladesh Agricultural Development Corporation from establishing an effective monitoring network across the country leading to fragile compliance and enforcement.[38] Eventually, the chapter argued that the lack of resources significantly limited the capacity of Bangladeshi water institutions in realising their stated goals.

Further significant shortcomings flagged in this chapter concerned the data shortage. Reflecting on the literature and interview data the chapter charted the value and importance of groundwater data in designing appropriate governance to overcome issues around groundwater depletion.[39] Due to the lack of appropriate data, as revealed by the interviewees, the WARPO has failed to identify the water stressed areas across the country, and in the result, it has yet to come up with appropriate groundwater management strategies. The inevitable result of groundwater data scarcity has been that water managers are mostly in the dark as to where over-extraction occurs, how much groundwater is stored in the country, and what should be the sustainable limit of extraction. As one respondent bluntly said, '……over the years we have been trying to identify the water hotspots areas, but data are so insufficient we are still struggling….'.[40] Additionally, having underscored the need for decentralised functioning of water institutions, the chapter showed the centralised functioning of Bangladeshi water institutions notably the WARPO. It demonstrated that centralised functioning had been documented as ineffective in preventing groundwater depletion.[41] The final set of institutional weaknesses revealed in this chapter was concerned with the

[36] See chapter 4(II)(IIIB).
[37] Interview with S 5, Academic (Mohammad, Dhaka, 27 February 2018).
[38] See chapter 4(IIIA).
[39] See chapter 4(IIIC).
[40] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).
[41] See chapter 4(IIIE).

insufficient research conducted by the responsible water institutions. Groundwater sustainability issues warrant a significant amount of research to develop priorities and define management options.[42]

In the face of these institutional limitations, the chapter presented the Barind Multipurpose Development Authority (BMDA) as a promising institution towards sustainable groundwater irrigation. The Prepaid Smart Metering System (PSMS) introduced by the BMDA plays a significant role in water use efficiency in this region.[43] Farmers need to pay irrigation charges upfront, and as such, they value every drop of water. Additionally, groundwater data could be easily collected through the PSMS.[44] Echoing the central thesis argument the chapter concluded that the institutional arrangements in Bangladesh with respect to groundwater resources were poorly designed to cope with the increasingly daunting challenges exerted by the declining groundwater resources. In order to overcome these challenges, Bangladeshi water institutions need to undergo significant reforms as outlined in chapter 6(III).

Chapter 5 then moved to answer thesis sub-question (c) that asks: Can judicial action promote the sustainable abstraction of this resource? Having recorded the constitutional mandate of the Supreme Court of Bangladesh, the chapter argued that due to the failure of representative institutions to effectively legislate for the protection of the environment in general and water resources in particular, the Court had increasingly been active in the development of the environment, and more narrowly the water resources of the country. It showed that in appropriate cases the Court could declare laws to fill legal gaps. The chapter found, *inter alia*, that the National River Protection Commission was the product of the proactive judiciary, and more recently, judicial action led to the recognition of legal entity, living entity, and legal personality for Bangladeshi rivers.[45] The chapter demonstrated the commendable role of the Court in restraining unlawful executive and legislative actions and also in shaping public policy. In particular, it considered the laudable contribution of the Court to the development of environmental jurisprudence. The chapter, however, noted that despite ample opportunity to make a wider contribution to facilitate the sustainable abstraction of groundwater resources, judicial action remained stinted in this area.

Drawing on in-depth interview data the chapter explored factors inhibiting the judicial action in this ripe area. Judges' lack of scientific knowledge; the inertia of legal NGOs; the non-availability of necessary groundwater data; and potential powerful defendants were identified as factors holding back the Court to contribute to this overlooked area. Interview data, however, suggested that despite growing barriers and challenges the judiciary had been playing a commendable role in the protection of the environment of Bangladesh. As one respondent commented, '….with its limited capacity, you see, the judiciary has been playing

[42] See chapter 4(IIID).
[43] See chapter 4(IVC).
[44] Ibid.
[45] See chapter 5(III).

a crucial role in protecting rivers, canals, lakes, air, and water quality….we can hardly deny that due to the intervention of the Court Dhaka's environment is still relatively good…'.[46] Answering the sub-question (c) in the affirmative the chapter concluded that there was considerable scope for the Court to improve the legal and institutional frameworks by compelling the executive to take appropriate action, thereby promoting groundwater sustainability.

Building on chapters 3, 4, and 5 and drawing on in-depth interview data, chapter 6 answered sub-question 4 by formulating recommendations to improve the legal and institutional frameworks as well as to show the pathways how the judiciary could play a more meaningful role such that groundwater sustainability issues were better addressed in a concerted way. Drawing on chapter 3 this chapter (6(II)) identified five areas for reforms to transform the existing regressive groundwater laws into innovative, dynamic, and responsive ones.[47] It showed that rigorous legislative attention was required to establish a competent groundwater licensing authority and sustainable irrigation well spacing settings, thereby dispelling conflicting provisions among water laws.[48] The chapter also charted that to control unsustainable groundwater withdrawal, as part of their licensing conditions water metering was needed to be mandatorily introduced in the agricultural and industrial sectors and to a limited scale in the urban areas.[49] In particular, to control indiscriminate industrial groundwater extraction, the chapter proposed capping (setting the extraction limit) for this sector.[50] The chapter further suggested that to undertake targeted management towards groundwater sustainability, appropriate and specific responsibilities were needed to be assigned among the water institutions such that they could clearly know what institution should do what, when, how, and at what level.[51] The chapter also recommended the inclusive participation of stakeholders and multidisciplinary experts in the lawmaking process such that water laws could be adopted taking into consideration the ground realities, potential challenges, and their possible way out.

In the same vein, for effective implementation of groundwater laws, the chapter (6(III)) identified five areas in relation to water institutions where significant improvements were needed. The chapter stressed the need for regional and local offices of water institutions particularly the WARPO; reduction of water institutions; promotion of groundwater users' associations; improvement of the National Water Resources Database; and enrichment of resources.[52]

[46] Interview with S 9, Advocate (Mohammad, Dhaka, 10 February 2018).
[47] See chapter 6(II).
[48] See chapter 6(IIA).
[49] See chapter 6(IIB).
[50] See chapter 6(IIC).
[51] See chapter 6(IIE).
[52] See chapter 6(III).

Given the potential of the Court in the context of Bangladesh, the chapter (6(IV)) also presented certain recommendations for effective judicial action in relation to groundwater sustainability. These recommendations concerned the establishment of a specialist High Court Bench; careful application of *suo motu* jurisdiction; the enhanced role of NGOs; and the need for technical expert lawyers. Beyond these three-angled reforms, the chapter (6(V)) also drew attention to some groundwater management strategies. Conjunctive use of surface water and groundwater; rainwater harvesting; alternate wetting and drying; and crop pattern change were put forward as the best management strategies toward the realisation of groundwater sustainability.

To sum up, alongside the advancement of the central argument chapters 3, 4, and 5 together with chapter 6 answered the central research question: In what ways could the legal and institutional frameworks of Bangladesh better ensure the sustainable abstraction of groundwater resources? In doing so, chapters 3, 4, and 5 categorically answered sub-questions (a), (b), and (c) while chapter 6 by formulating recommendations answered sub-question (d), thereby answering the central thesis question. The thesis demonstrated that while the existing legal and institutional frameworks significantly failed to prevent groundwater overexploitation, there was, notwithstanding, considerable scope to improve them to tackle the increasingly complex and daunting challenges triggered by the depleting groundwater resources.

The way this thesis has developed the argument and answered the thesis questions pertaining to the groundwater laws and institutions is unique in that it was never done before in Bangladesh. In particular, by presenting policymakers', judges', scholars', and groundwater users' views in relation to the potential challenges and opportunities associated with groundwater sustainability, the thesis has substantially deepened our knowledge and provided insights not available through the published literature. Additionally, drawing on in-depth interviews the investigation conducted, and the exploration of the water institutions are quite novel as this approach has been applied for the first time in Bangladesh. More importantly, by translating the elements of interviews and the key groundwater legislation[53] from Bangla to English this thesis has made the legal analysis in relation to groundwater regulations available to a wider audience, thereby strengthening the two-way learning between the global North and South. Consequently, the discussions, interpretations, and analyses involving groundwater laws and institutions that were advanced, with the arguments grounded significantly on the empirical data derived from interviews, make an original contribution to the scholarly literature on groundwater laws.

Having said that, it needs to be acknowledged that given the small sample size of the interview data empirical findings may not necessarily represent the entire country. Additionally, it is worth acknowledging that, this research, albeit taking Bangladesh as an

[53] Only the *Water Act* (n 7) was in English.

example, has dealt with a broader problem in environmental law more generally. It is not, however, intended, and does not claim, to present findings that can be applied in different jurisdictions facing a similar problem without further investigation. These findings, nonetheless, could assist other countries such as Iran, Iraq, Pakistan, Yemen, Somalia, Sudan, and Egypt in undertaking context-specific research to find solutions to issues around groundwater sustainability in their respective jurisdictions.

III PRIORITISING RECOMMENDATIONS MADE IN CHAPTER 6

Drawing heavily on interview data chapter 6 put forward some ways to strengthen the existing legal and institutional frameworks so as to promote and facilitate groundwater sustainability in Bangladesh. While some suggested reforms have a direct bearing on groundwater sustainability that require the immediate attention of the policymakers, other reforms impact it steadily allowing their delayed implementation. Moreover, interviewees talked more about some of the suggested reforms, placing heavy emphasis on them while speaking less about the others raising the question of priority. Therefore, mainly based on interview data some suggested reforms need to be prioritised over the others. Figure 1 below summarises the prioritised areas of recommendations. Conflicting and overlapping provisions among water laws impede groundwater sustainability.[54] Hence, these anomalous water law provisions need to be removed on a priority basis. The best way to overcome this problem as suggested is to integrate the *Groundwater Act* into the *Water Act*. It does not require any extra funds to bring about this reform; what is rather needed is the honest intention of the legislatures. A significant portion of professional respondents (80%) also highlighted this issue and suggested that contrasting provisions of water law should be struck down sooner rather than later. As one respondent noted, '….the government needs to review the existing water laws and should remove the obvious and noticeable clashes across water laws…..I would suggest that an immediate reform be undertaken to cure this malaise of law'.[55]

Another area to be prioritised under this theme is the legislative requirement of water metering that includes water pricing. Given the escalating pressures on groundwater resources exerted by the industrial and agricultural sectors, this reform should be undertaken immediately. Around 90% of irrigation water comes from a groundwater source, and about 76% of cultivable land is irrigated through the utilisation of groundwater; hence, legislation should focus on controlling groundwater irrigation. Likewise, the industrial sector notably leather and textiles exert mounting stress on groundwater resources resulting in fast depletion of the water table.[56] The introduction of water metering is a viable legislative response

[54] See chapter 6(IIA).
[55] Interview with S 1, Academic (Mohammad, Dhaka, 28 March 2018).
[56] See chapter 2(VIII).

towards groundwater sustainability.[57] Despite the need for significant investment in implementing this legislative reform of water metering, it should be carried out urgently given the enormity of damage these two sectors continue to inflict on groundwater resources. There was an overwhelming response from the interviewees in relation to this proposed metering reform. Of the professional respondents, for instance, 88% and 96% registered their strong support for this reform to be undertaken in the agricultural and industrial sectors of the country, respectively. Multiple options, however, need to be explored to overcome financial hardships, including mobilising internal funds.[58] Finally, a recommendation to be prioritised under the theme of the legal framework relates to introducing capping in the industrial sector. As Bangladeshi industries notably leather and textiles are tremendously straining groundwater supplies and systems,[59] a capping instrument should be actively and urgently considered. Capping seems feasible that can be introduced in the industrial sector of Bangladesh.[60] Perhaps, industrial zones in and around Dhaka where 70% of industries are located[61] could be a starting point for this capping tool to be applied first and thereafter could be expanded progressively across the country. There was compelling support from the interviewees (96% of professional respondents) for this reform to be undertaken immediately. As one respondent termed this legislative vacuum as 'outrageous and intolerable'.[62]

Area of Recommendations	Need Immediate Attention	Need Progressive Attention
Reforming Groundwater Laws	Removing Conflicts and Overlaps among Water Laws	Delineating the Responsibilities of the Water Institutions
	Introducing Water Metering Requirement- 1. Mandatory Water Metering for Industrial groundwater Use 2. Mandatory Water Metering for Agricultural Groundwater Use	Water Metering for Urban Domestic Use
	Introducing Capping in the Industrial Sector	
Reforming Water Institutions	The Need for Regional and Local Offices of the Water Institutions	
	Reducing Water Institutions	Promoting Groundwater Users' Associations

[57] See chapter 6(IIB).
[58] See chapter 6(IIIE).
[59] See chapter 2(VIII).
[60] See chapter 6(IIC).
[61] Ibid.
[62] Interview with GO 3, Government Official (Mohammad, Dhaka, 30 January 2018).

		Strengthening the National Water Resources Database
		Addressing Resource Constraints
Invoking Limited Judicial Action	Establishing a Specialist High Court Bench	Technical-Expert Lawyers Needed
	Suo Motu (self-initiated) Jurisdiction/Proceedings: Cautious Application Warranted	Active NGOs Needed
Introducing Management Strategies		Changing Crop Pattern
	Conjunctive Use of Surface Water and Groundwater	Rainwater Harvesting
		Alternate Wetting and Drying

Table 1 shows priority areas for reforms.

Similarly, in relation to reforms of the water institutions suggested in chapter 6III, some need to be prioritised given that all may not be carried out immediately. Reducing the number of water institutions is certainly an area that deserves urgent action. Redundant water institutions render the distribution of appropriate responsibilities among them difficult creating more problems and confusion in tackling groundwater depletion.[63] Moreover, a reduction in water institutions will save significant resources of the government which can be reallocated among the targeted and dedicated water institutions. In the result, to some extent, problems around funding could be resolved. There was considerable support from the interviewees (54%) to undertake this reform immediately to transform the dysfunctional water institutions notably the WARPO into functional ones. As one respondent commented, '….to end this institutional hotchpotch there should be a dedicated water institution…..let the WARPO take the lead and other agencies assist it…..'.[64] Additionally, the smaller number of water institutions would allow establishing effective and meaningful coordination among water institutions which is at the heart of groundwater sustainability since groundwater is a cross-cutting issue,[65] and a considerable number of water institutions are involved in the water sector of Bangladesh.[66] A significant portion of interviewees (68%) also stressed the need to establish robust coordination among water institutions immediately for effective and efficient groundwater management. One respondent from the policymakers, for instance, put it mildly, '……unfortunately, the current coordination is not up to the mark……..I can tell you that significant initiatives are needed to upgrade this botched coordination….'.[67] Recommendations in relation to the need for decentralised offices of water institutions should

[63] See chapter 6(IIIB).
[64] Interview with GO 8, Government Official (Mohammad, Dhaka, 29 February 2018).
[65] See chapter 4(IIC).
[66] See chapter 4(IIAB).
[67] Interview with GO 6, Government Official (Mohammad, Dhaka, 6 February 2018).

also be prioritised given that decentralised offices significantly assist, facilitate, and promote the collection of local groundwater data; the implementation of groundwater laws, policies, and strategies; and stakeholder participation.[68] Moreover, a decentralised office could educate groundwater users by holding workshops, training, and awareness programs.[69] Mindful of the benefit of the decentralised offices of the water institutions the vast majority of respondents (72%) also underscored the immediate implementation of this reform.

Additionally, some recommendations with respect to judicial action should also be prioritised given that many recommendations require progressive implementation. The recommendation concerning the establishment of a specialist High Court Bench merits the urgent attention of the government. Complex scientific and technical issues around groundwater[70] make it imperative that only a dedicated specialist court should deal with groundwater depletion issues to come up with prompt and appropriate judicial intervention. This prioritised reform received impressive support from the interviewees (71%) warranting immediate action from the government. Another reform to receive priority emerging under this theme concerns the cautious and sparing application of *suo motu* jurisdiction. This type of proceedings is most likely to encourage the environmental lawyers, NGOs, government, and public at large to take appropriate steps at their respective disposal to prevent groundwater depletion.[71] In particular, this *suo motu* proceedings would greatly invigorate the public interest litigation lawyers and NGOs to pay more attention to legal issues around groundwater resources.[72]

Beyond the reforms of the legal, institutional, and judicial frameworks chapter 6(V) also formulated some recommendations in relation to groundwater management strategies. This thesis, however, acknowledges that these management strategies have not been explored in-depth and further research needs to be undertaken for their full exploration. With this limitation in mind, this chapter, however, given its significance and importance, does prioritise the conjunctive use of surface and groundwater over other management strategies. The preponderance of rivers across Bangladesh offers ample opportunity for the conjunctive use of surface and groundwater.[73] Moreover, realising the potential of this management technique the government has recognised its utility in the policy documents such as the *Nation Water Policy 1999* and the *Integrated Minor Irrigation Policy 2017*.[74] In addition, an overwhelming majority of the respondents (87%) strongly espoused that this management technique would be applied alongside the regulation. As one respondent pointed out, '…..in

[68] See chapter 6(IIIA).
[69] Ibid.
[70] See chapters 3(VIA), 6(IID)(IVA).
[71] See chapters 5(IIE), 6(IVB).
[72] See generally Janice Gray, 'Pathways to Improved Water Law and Governance: Public Interest Litigation and Protest' in Laura Westra, Janice Gray and Franz-Theo Gottwald (eds), *The Role of Integrity in the Governance of the Commons* (Springer, 2017) 69-87 (arguing that public interest litigation could play a vital role in the protection of water resources).
[73] See chapters 2(VII), 6(V).
[74] See chapters 3(IVB), 6(V).

order to reserve groundwater, there should be a widespread practice of conjunctive use…'.[75] Having said that, it needs to be noted that this prioritised management strategy requires additional funds that need to be mobilised from both external and internal sources. Additionally, communication and education are at the heart of the successful implementation of groundwater laws and management strategies.[76]

IV AREAS FOR FUTURE RESEARCH

The thesis indicates that certain legal aspects of Bangladeshi groundwater resources need to be explored further. First, the thesis proposed that capping — setting a maximum groundwater withdrawal limit — should be introduced in the industrial sector. But connected with this term is the cap-and-trade that this thesis has not considered in any depth. As seen, a cap is the maximum ceiling of water that can be withdrawn within a region per year.[77] Cap-and-trade, an economic instrument, was devised to tackle common pool resource problems.[78] Capping, allocation, and trading constitute the cap-and-trade mechanism.[79] Indeed, this mechanism aims at achieving sustainability and economic efficiency where a cap focuses on sustainability and trade operates to ensure economic efficiency.[80] While this market-based instrument has been used in Australia for nearly three decades with commendable success,[81] other countries like the United States, Chile, Spain, and South Africa also followed suit.[82] More recently, the scholarly focus has shifted to experimentation with the operation of this tool in China intending to ensure water efficiency.[83] Hence, further research is needed to explore, evaluate, and experiment whether, when, and how this cap-and-trade tool could be introduced in the industrial sector of Bangladesh. Additionally, given that agriculture is the major user of groundwater resources in Bangladesh an intensive and thorough research requires to be undertaken to examine the feasibility and to explore what legal, social, and

[75] Interview with S 8, Advocate (Mohammad, Dhaka, 10 February 2018).
[76] See chapter 6(V).
[77] See chapter 3(VC).
[78] B Timothy Heinmiller, 'The Politics of Cap and Trade Policies' (2007) 47(2) *Natural Resources Journal* 445, 445.
[79] See chapter 2(VA2).
[80] Ibid.
[81] Cameron Holley and Darren Sinclair, 'Governing Water Markets: Achievements, Limitations and the Need for Regulatory Reform' (2016) 33(4) *Environmental and Planning Law Journal* 301; Andrew Ross, 'Groundwater Governance in Australia, the European Union and the Western USA' in Anthony J Jakeman et al (eds), *Integrated Groundwater Management* (Springer, 2016) 145-168.
[82] Doreen Burdack, Anne Biewald and Hermann Lotze-Campen, 'Cap-and-Trade of Water Rights: A Sustainable Way Out of Australia's Rural Water Problems?' (2014) 23(4) *GAIA Ecological Perspectives for Science and Society* 318, 325; Dustin Garrick, Stuart Whitten and Anthea Coggan, 'Understanding the Evolution and Performance of Water Markets and Allocation Policy: A Transaction Costs Analysis Framework' (2013) 88 *Ecological Economics* 195.
[83] David Lewis and Hang Zheng, 'How Could Water Markets like Australia's Work in China?' (2019) 35(4) *International Journal of Water Resources Development* 638, 642-3.

infrastructural changes are needed to apply this cap-and-trade tool in the agricultural sector of Bangladesh.

Second, it is briefly mentioned in chapter 3(IVE) that the Bangladesh legal framework does not address the issue of aquifer recharging. This issue is so pervasive, complex, and scientific that it warrants its own comprehensive study. Hence, further research and policy discussions are needed to explore the legal implications of managed aquifer recharge (MAR). In recent years, attention is increasingly being paid to artificial aquifer recharge across the globe as a way of restoring groundwater balance and securing the groundwater ecosystem.[84] In addition to the protection of aquifers against natural and man-made risks, this tool significantly contributes to the conservation, recycling, and reuse of different types of water such as surface water, treated wastewater or greywater, and rainwater.[85] Until now Bangladesh has paid little or no attention to this promising water management tool. Studies need to be conducted to understand and explore the challenges and opportunities associated with it in the context of Bangladesh. Deeper and nuanced knowledge is needed to understand what role law and policy can play in advancing the MAR tool; how law and science interact and interface in making this groundwater management tool operational. Perhaps, a comparative study with countries[86] where this tool operates successfully would better demonstrate the prospects and problems of its application in Bangladesh.

Third, this research is concerned with groundwater quantity. Groundwater quality, however, is also a huge problem in Bangladesh. Untreated effluent from the industrial sector continues to cause significant damage to the groundwater quality of Bangladesh.[87] In particular, the textile sector, notably the ready-made garment sector, despite its notable economic contributions,[88] poses a significant environmental threat in terms of overexploitation and

[84] See, eg, Robert G Maliva, *Anthropogenic Aquifer Recharge: WSP Methods in Water Resources Evaluation Series No 5* (Springer, 2020) 437-64; David Walker et al, 'Insights From a Multi-Method Recharge Estimation Comparison Study' (2019) 57(2) *Groundwater* 245, 245-6, 255-6; Adriana Palma Nava, Fernando J González Villarreal and Angélica Mendoza Mata, 'The Development of a Managed Aquifer Recharge Project with Recycled Water for Chihuahua, Mexico' (2018) 4(2) *Sustainable Water Resources Management* 371, 371-2, 380-2; Y Jadeja et al, 'Managing Aquifer Recharge and Sustaining Groundwater Use: Developing a Capacity Building Program for Creating Local Groundwater Champions' (2018) 4(2) *Sustainable Water Resources Management* 317, 317-19, 326-8.

[85] D Damigos et al, 'Revealing the Economic Value of Managed Aquifer Recharge: Evidence from a Contingent Valuation Study in Italy: Revealing the Economic Value of Mar' (2017) 53(8) *Water Resources Research* 6597, 6598.

[86] For instance, India could provide a better insight on the AAR/MAR; see, eg, Jadeja et al (n 84).

[87] Thomas Sagris and Justin Abbott, 'An Analysis of Industrial Water Use in Bangladesh with a Focus on the Textile and Leather Industries' (2030 Water Resources Group, May 2015) vi, 12.

[88] Currently, Bangladesh earns $28 billion foreign currency per annum from this sector which is expected to rise to $50 by 2021. In other words, 80% of export earnings comes from this sector contributing more than 12% of the national gross domestic product; see Laila Hossain, Sumit Kanti Sarker and Mohidus Samad Khan, 'Evaluation of Present and Future Wastewater Impacts of Textile Dyeing Industries in Bangladesh' (2018) 26 *Environmental Development* 23, 23-4; Rakibul Haque and ENRAC Team, *Use and Effectiveness of Effluent Treatment Plants (ETPs) in the Garments Industry of Bangladesh: A Water Sector Integrity Perspective* (Transparency International Bangladesh, May 2017) viii.

pollution of water resources.[89] Additionally, the indiscriminate development of leather industries poses a real impending threat to the groundwater quality of Bangladesh.[90] Moreover, arsenic wreaks havoc on the groundwater resources of Bangladesh. An estimated 35 to 77 million people of 59 districts (out of 64) are at grave risk of drinking arsenic-contaminated water.[91] Further, arsenic presents a looming threat to the food grains of Bangladesh.[92] Against this backdrop, research should be undertaken to investigate the underlying causes of groundwater pollution; why the existing legal and institutional frameworks fail to control this endemic problem; what should be the appropriate legal and institutional designs to tackle this fast-growing crisis; and what role Bangladeshi courts can play in overcoming the mounting challenges around groundwater quality. That said, there is, however, a strong connection between groundwater quality and quantity, and groundwater quality degradation heavily impacts the quantity and vice versa.[93] This future research, therefore, should also adopt a holistic approach as to how these quality and quantity issues could be better addressed in a single water law.

Fourth, chapter 4(IIIA) identified resource constraints of the Bangladeshi water institutions as a significant barrier to the implementation of groundwater laws, and accordingly, chapter 6(IIIE) offered some recommendations to address resourcing issues including the exploration of external aid and the mobilisation of internal funds. However, an in-depth research is needed to explore more funding options. In particular, this future research should be directed to unravel various funding models to test and experiment with their effectiveness in addressing the resource shortage of Bangladeshi water institutions. To be precise, new investment strategies and initiatives should be explored to encourage investment in the water sector of Bangladesh. Additionally, it needs to be examined whether, when, and how the 'user pays' principle applies, works, and makes a difference in tackling the resource crisis of Bangladeshi water institutions. Therefore, future research should be dedicated to devising and improvising sustainable long-term financial planning to overcome this funding issue. Mobilising internal funding, however, should be the ultimate goal of this future research.

Finally, given the small sample size of interviewees, further empirical research could be undertaken to examine whether observations made by the interviewees of this project are

[89] Hossain, Sarker and Khan (n 88) 24.
[90] Sagris and Abbott (n 87) 12-14; Md Shahin Alam et al, 'Assessment of Soil and Groundwater Contamination at a Former Tannery District in Dhaka, Bangladesh' [2019] *Environmental Geochemistry and Health* 1.
[91] Md Iqbal Mahmud Choudhury et al, 'Cutaneous Malignancy Due to Arsenicosis in Bangladesh: 12-Year Study in Tertiary Level Hospital' [2018] *BioMed Research International* 1, 1-3.
[92] PK Sahoo and A Mukherjee, 'Arsenic Fate and Transport in the Groundwater-Soil-Plant System: An Understanding of Suitable Rice Paddy Cultivation in Arsenic Enriched Areas' in Debashish Sengupta (ed), *Recent Trends in Modelling of Environmental Contaminants* (Springer, 2014) 21.
[93] RN Gejl et al, 'Understanding the Impacts of Groundwater Abstraction through Long-Term Trends in Water Quality' (2019) 156 *Water Research* 241, 241-3, 246, 249-50; Marc FP Bierkens and Yoshihide Wada, 'Non-Renewable Groundwater Use and Groundwater Depletion: A Review' (2019) 14(6) *Environmental Research Letters* 063002, 063022-5; Larry W Mays, 'Groundwater Resources Sustainability: Past, Present, and Future' (2013) 27(13) *Water Resources Management* 4409, 4410.

representative of the entire country. To be precise, the researcher interviewed only eight policymakers, six judges, 11 scholars, and 18 groundwater users. In particular, the number of groundwater users was very small vis-à-vis the regional variations; only five users represented the northwest region, seven represented the southwest region, four represented the southeast region, and two represented the eastern hill area of the country. Due to time and resource constraints, the researcher could not interview any groundwater users from the north-central, northeast, and south-central areas. Moreover, despite repeated attempts, the researcher could not interview any industrial groundwater users as none of these identified respondents agreed to be interviewed. Therefore, future empirical research should be conducted on a broader scale to understand the views and observations of groundwater users including industrial ones with respect to the sustainable use of groundwater.

V CONCLUSION

This thesis has demonstrated that while the legal and institutional response of Bangladesh is far from ensuring sustainable abstraction of groundwater resources, there are, nevertheless, ample opportunities to make these legal mechanisms more sophisticated, dynamic, and responsive. Challenges around groundwater sustainability as explored across the chapters, however, are not stationary, rather growing and spiraling with time. The legal response, therefore, requires constant surveillance from policymakers and groundwater managers.

The thesis showed in chapter 3 that despite some positive improvements such as a permit requirement for the installation of a well, the existing legal framework suffered significant legal infirmities not least water metering and limited capping options remained outside the hook of law. More conspicuously, the implementation of groundwater laws remains a far cry threatening the entire edifice of the legal regime. Thereafter, in chapter 4 the thesis showed that the current water institutions were poorly designed, and in the result, they were riddled with tenacious limitations leading to the failure in overcoming the notorious challenges posed by the declining groundwater resources of Bangladesh. Some of these exasperating limitations manifested in that chapter concerned the preponderance of water institutions and resource as well as data shortages. These institutional defects significantly limit the effectiveness of water institutions. The thesis then in chapter 5 showed that targeted judicial action could offer some promising solutions, albeit short-term.

In a bid to improve the current legal and institutional frameworks to better respond to the depleting groundwater resources, chapter 6 formulated a series of recommendations. This concluding chapter, however, given that all recommendations may not be implemented initially, has prioritised some of them. To control the unsustainable extraction of groundwater resources, industrial, agricultural, and urban domestic groundwater uses must be metered, and the installation of water metering must be made a mandatory part of licensing conditions for these groundwater users. Bangladeshi policymakers are well-advised to direct their

attention to make the WARPO a truly capable water institution such that it could tackle mounting challenges stemming from groundwater depletion more effectively and efficiently. A specialist High Court Bench, which is yet to be established, is well-placed to address groundwater depletion issues from judicial perspectives. These are some areas that merit immediate action from the executive government. Indeed, groundwater sustainability is needed to ensure the human right to water and other groundwater uses including irrigation that provides livelihoods to the millions of farmers across the country. More broadly, groundwater — an important environmental component — warrants sustainability for the broader protection of the environment.

To conclude, the legal and institutional frameworks of Bangladesh need to undergo significant reform processes to take up the daunting challenges exerted by the declining groundwater resources. The thesis, however, acknowledges that there is no silver bullet to arrest the falling groundwater tables of Bangladesh; but certainly, there is a silver lining in incessantly experimenting, improvising, and redesigning the legal and institutional apparatuses so as to tackle the contemporary groundwater depletion challenges more effectively, efficiently, and vigorously.

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APPENDICES

A *Table of Acronyms*

ACT	Australian Capital Territory
AD	Appellate Division
AWD	Alternate Wetting and Drying
BADC	Bangladesh Agricultural Development Corporation
BBS	Bangladesh Bureau of Statistics
BDP	Bangladesh Delta Plan
BELA	Bangladesh Environmental Lawyers Association
BLAST	Bangladesh Legal Aid and Services Trust
BMDA	Barind Multipurpose Development Authority
CGWA	Central Groundwater Authority
DPHE	Department of Public Health Engineering
DG	Director General
ECNWRC	Executive Committee of the National Water Resources Council
ETP	Effluent Treatment Plant
FAO	Food and Agriculture Organisation
GO	Government Official
GU	Groundwater User
GUA	Groundwater Users' Association
GWP	Global Water Partnership
HCD	High Court Division
IGRAC	International Groundwater Resources Assessment Centre
ILC	International Law Commission

IWM	Institute of Water Modelling
MAR	Managed Aquifer Recharge
NRPC	National River Protection Commission
NWMP	National Water Management Plan
NWRC	National Water Resources Council
NWRD	National Water Resources Database
PaCT	Partnership for Cleaner Textile
PSMS	Prepaid Smart Metering System
SDG	Sustainable Development Goals
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
WARPO	Water Resources Planning Organisation
WASA	Water Supply and Sewerage Authority
WHO	World Health Organisation
WWF	World Wide Fund for Nature

B *Tables*

1 *Summary Functions, Interactions and Overlaps of Major Water Institutions*

Name of the Institutions/Bodies	Functions	Interaction with other water institutions	Overlaps
National Water Resources Council (NWRC)	making policies, giving instructions for integrated development, proper use, safe abstraction, proper distribution, protection, and conservation of water resources	Executive Committee of the National Water Resources Council	Formulating water policies, rules, regulations, and guidelines simultaneously fall within the jurisdictions of the NWRC, the ECNWRC, the WARPO
Executive Committee of the National Water Resources Council (ECNWRC)	publicising, monitoring, and evaluating the National Water Policy and the National Water Resources Plan; taking initiatives with regard to any planning, management of, and inter-sector coordination on, water resources; keeping the Council periodically informed on issues around water resource management, and giving advice thereto; coordinating among the appropriate authorities; formulating policies regarding inter-sector and resolving thereof	WARPO is the Secretariat to the ECNWRC	
Water Resources Planning Organisation	coordinating all activities in the water sector; advising the ECNWRC on policy, planning, and regulatory matters; preparing, updating, and monitoring the implementation of the National Water Resources Plan and; implementing and applying water policies and strategies		
Ministry of Water Resources	leads on policy formulation and monitoring and implementation thereof through its five supporting organisations		
Bangladesh Water Development Board	developing and managing water resources projects; collecting water resources data; analysing the hydrological, hydrogeological, and morphological data; developing and disseminating appropriate technologies for conjunctive use of rainwater, groundwater, and surface water	The Bangladesh Water Development Board interacts with the Bangladesh Agricultural Development Corporation and the Department of Agricultural Extension in relation to minor irrigation; with respect to water quality it interacts with the Department of Environment;	Responsibilities in relation to monitoring, assessing, and evaluating the groundwater resources overlap between the Bangladesh Water Development Board and the WARPO

Department of Environment	setting standards, rules, and guidelines for all water projects		Responsibilities overlap with the WARPO with regard to standard settings, compliance and enforcement, data acquisition and storage
Bangladesh Agricultural Development Corporation	providing irrigation facilities; conducting survey on water resources to improve minor irrigation; ensuring water use efficiency through the best use of surface water		
Barind Multipurpose Development Authority	increasing irrigation facilities by using groundwater through the installation of deep tubewells; augmenting surface water resources and their use; ensuring water use efficiency through the metering system		
Institute of Water Modeling	enhancing the hydraulic and hydrologic knowledge base of the country for developing better planning and designing studies of the country's water management investments		
Water Supply and Sewerage Authority	providing water supply and sewerage services in the designated cities		
Department of Public Health Engineering	providing the provision of drinking water supply and waste management in all cities and municipalities where WASAs do not operate		

2 *Summary Functions, Overlaps, and Conflicts of Bodies and Committees Formed under Water Legislation*

Name of the Bodies/Committees	Authority/Law	Functions	Overlaps	Conflicts
National Water Resources Council	*Water Act*	making policies, giving instructions for safe abstraction, protection, and conservation of water resources (s 5(a))	Formulating policies, rules, regulations, and guidelines falls simultaneously within the jurisdictions of both the NWRC and the ECNWRC	
Executive Committee of the National Water Resources Council	*Water Act*	publicising the National Water Policy and the National Water Resources Plan; coordinating among the appropriate authorities; formulating policies regarding inter-sector disputes and resolution thereof (s 10)		
Upazila (Sub-district) Irrigation Committee	*Groundwater Act*	submitting a report to the Upazila Parishad for its consideration in		Under the *Groundwater Act*, a licence is required for

		relation to a licence application (s 5(4))		the installation of an irrigation well while the *Water Act* accords an exemption to 0.5 cusec capacity shallow tubewell to have 'no objection' from the competent authorities (*Groundwater Act* s 5; *Water Rules* r 29(1)(a))
Upazila Parishad (Sub-district Council)	Ditto	disposing of an application seeking a licence for the installation of an irrigation well (S 5(1)(2))	Granting a licence for an irrigation well lies concurrently upon the Upazila Parishad and different Committees formed under the *Water Act* or the WARPO	While the *Groundwater Act* sets the 7-meter vertical distance between the centrifugal pump and the pumped water level as a distinguishing mark for deep tubewell and shallow tubewell, the *Water Act* has not recognised such a number as a determining factor for these two types of wells (*Groundwater Act* s 2(a)(d); *Water Rules* r 19(a)(b)]
District Integrated Water Resources Management Committee	*Water Act* and *Water Rules*	identifying challenges and opportunities for sustainable management of district water resources; developing a water resources database; and ensuring the integrated development of water resources (*Water Rules* r 14(5))		
Upazila (sub-district) Integrated Water Resources Management Committee	Ditto	identifying challenges and opportunities for sustainable management of Upazila water resources; developing a water resources database; maintaining communication with the Distract Committee and the WARPO; and ensuring the integrated development of water resources (*Water Rules* r 15(5))		
Union Integrated Water Resources Management Committee	Ditto	identifying challenges and opportunities for sustainable management of union water resources; developing a water		

		resources database; maintaining communication with Upazila and District Committees and the WARPO; and ensuring the integrated development of water resources (*Water Rules* r 16(3))		
Technical Committees	Ditto	preparing technical reports in relation to water resources development projects upon the assessment of, among other things, their potential impact on flowing rivers or canals or water bodies (*Water Rules* r 22)		

C *Groundwater Glossary*

Abstraction

The term 'abstraction' is synonymous with extraction, withdrawal, and pumping. Abstraction refers to (a) the process of taking water from a source, either temporarily or permanently; (b) the volume of water taken during this process per unit of time.

Borehole

Hole made in the soil or the earth's upper crust by drilling. Its diameter is usually small, and its purpose is commonly either geological exploration or the construction of a well for abstracting or injecting liquids (eg water).

Confined Aquifer

Fully saturated aquifer (ie pressure everywhere greater than atmospheric pressure) directly overlain by an impermeable or almost impermeable formation (geological confining bed). The confining bed prevents the aquifer from interacting directly with the atmosphere and with surface water bodies (except for surface water bodies that intersect the aquifer).

Consumptive Use

Part of the water used that is not returned to aquifers, streams or seas, but is either incorporated in products or organisms, or discharged in the form of vapour into the atmosphere.

Depletion

Reduction of the stored volume of groundwater in an aquifer.

Domestic Water Use

Use of water for drinking water and other household purposes, in offices and for public water services outside the agricultural and industrial spheres. The water may be supplied either by municipal or public water supply systems or withdrawn by the users themselves (self-supply).

Drawdown

Lowering of the groundwater level or piezometric surface caused by abstraction of groundwater (including not only by pumping, but also outflow from an artesian well or discharge from a spring).

Ecosystem

A dynamic complex of plant, animal and micro-organism communities and their nonliving environment interacting as a functional unit.

Freshwater

Water of relatively low content of dissolved solids (usually less than 1 000 mg per litre).

Groundwater Development/Groundwater Exploitation

Human activity consisting of abstracting groundwater and making it available for beneficial use.

Groundwater Discharge

Outflow of water from a groundwater system.

Groundwater Level

Elevation to which groundwater will or does rise in a piezometer connected to a point in the groundwater domain. It is a time-dependent variable, varies from point to point within the groundwater domain, and indicates the potential energy of groundwater in any point considered (in metres of water column relative to a selected topographic reference level).

Groundwater Mining

Abstracting groundwater that will not be renewed anymore (fossil or non-renewable groundwater).

Groundwater Recharge/Groundwater Renewal/Groundwater Replenishment

1. Process of inflow of water into a groundwater system or aquifer.

2. Flux related to this inflow process.

Groundwater Table

Surface defined by the phreatic levels in an aquifer (ie surface of atmospheric pressure within an unconfined aquifer).

Hydrology

The science of the terrestrial part of the water cycle.

Hydrological Cycle

The circulatory flow of water at or near the Earth's surface (in which water is moving between the atmosphere, surface water, unsaturated zone, groundwater and oceans). **Synonyms**: Hydrologic cycle, water cycle, H2O cycle.

Groundwater Over-extraction/Overexploitation

Abstraction from a renewable groundwater resource that is excessive with respect to the hydrological budget of the corresponding aquifer. The abstraction intensity is too high to allow a new dynamic equilibrium to be established in the intermediate or long term.

Intensive exploitation considered to be excessive. Among groundwater specialists there is no generally shared interpretation of groundwater overexploitation, and it is often not explicitly specified

with respect to what criterion the exploitation is considered excessive. Here, overexploitation is interpreted as intensive exploitation characterized by a less favourable balance between benefits and negative side effects than would have been the case at a lower rate of exploitation.

Irrigation

Artificial application of surface water or groundwater to the land or soil, usually with the objective of promoting crop growth.

Land Subsidence

Sinking elevation of the ground surface, which may result from compression of sediments due to reduced water pressures, which may occur when water is drained or abstracted from subsurface strata, eg from an aquifer.

Non-renewable Groundwater

A groundwater body or unit that, under current climatic conditions, receives no or negligible quantities of recharge. **Synonym**: fossil groundwater.

Precipitation

1. Rain, hail, snow, dew and other liquid or solid condensation products of water vapour falling from clouds or deposited from the air on the ground.

2. Amount of water produced by rain, hail, snow, etc falling on a unit of horizontal surface per unit of time.

Recharge area

Area where most or all of the recharge of an aquifer occurs.

Renewable Groundwater

Body of groundwater that is replenished under current climate and geological conditions.

Runoff

The part of precipitation that appears as stream flow. Often three components are distinguished: (a) surface runoff, resulting from overland flow during and after a storm or precipitation event, and caused by that event; (b) interflow, which is a delayed flow passing at least partly through the upper soil layers; and (c) groundwater runoff, which is the outflow of groundwater to streams (forming the essential part of baseflow).

Safe yield

Flux of groundwater that can be withdrawn from an aquifer without causing undesirable side effects (used in a limited number of jurisdictions).

Saline Water

Water containing dissolved solids in concentrations of more than 10 000 milligram per litre.

Salinity

Concentration of dissolved salts in water.

Saltwater Intrusion/Seawater Intrusion

Invasion of seawater (usually seawater) into a body of freshwater (either a surface water or a groundwater body).

Saturated Zone

Part of the subsurface water-bearing formation in which all interstices (voids), large and small, are filled with water.

Semi-confined Aquifer

Confined aquifer, where either the confining bed on top of the aquifer or the poorly permeable basal formation underneath the aquifer have sufficient permeability (aquitards) to allow the exchange of water between the aquifer and the domains above or below it.

Spring

Location of concentrated natural groundwater outflow.

Storage/Stored Volume/Stock

Volume of water present in a component of the local hydrological system (eg aquifer, stream, lake, soil).

Stream

Body of water flowing in a natural surface channel. Generic term that includes rivers, rivulets, brooks and other natural water courses.

Surface Water

Water located on the surface of the Earth, such as in streams, rivers and lakes.

Sustainable Yield

Flux of groundwater that can be withdrawn from an aquifer without causing undesirable side effects, in particular without causing a permanent state of non-equilibrium of the hydrological budget of an aquifer.

Unconfined Aquifer

Aquifer in which the upper boundary of the groundwater mass forms a surface (water table) that is in direct contact with the atmosphere. This condition favours the aquifer being actively involved in the water cycle. **Synonyms**: water-table aquifer, phreatic aquifer, free aquifer.

Unsaturated Zone

Zone below ground surface where the interstices (voids) are partly filled with water and partly with air. This zone is located above the water table or above the top of a confined aquifer. The water pressure in the unsaturated zone is lower than atmospheric pressure.

Well

A man-made construction – usually of vertical cylindrical form – used to get access to groundwater and abstract it by lifting it to the surface.

D *Interviewees*

All interviewees of Category 1, 2 and 3, including their organisation, position, place and date of interview, and interview code, are listed below:

Category 1: Government Officials

Organisation	***Position***	***Place and Date Interview Conducted***	***Code***
Law Commission, Bangladesh, Dhaka	High Official	Dhaka, 14 February 2018	GO 1
Water Resources Planning Organisation, Dhaka	High Official	Dhaka, 30 January 2018	GO 2
Water Resources Planning Organisation, Dhaka	Mid-level Officer	Dhaka, 30 January 2018	GO 3
Ministry of Industries, Dhaka	High Official	Dhaka, 12 February 2018	GO 4
Legislative and Parliamentary Affairs Division, Dhaka	High Official	Dhaka, 26 February 2018	GO 5
Ministry of Water Resources, Dhaka	High Official	Dhaka, 6 February 2018	GO 6
Bangladesh Agricultural Development Corporation, Dhaka	High Official	Dhaka, 14 February 2018	GO 7
Ministry of Water Resources, Dhaka	High Official	Dhaka, 29 February 2018	GO 8

Category 2: Scholars

Organisation	***Position/Profession***	***Place and Date Interview Conducted***	***Code***
Faculty of Law, University of Dhaka	Academic	Dhaka, 28 March 2018	S 1
Faculty of Law, University of Dhaka	Academic	Dhaka, 4 February 2018	S 2
BRAC University, Dhaka	Academic	Dhaka, 7 February 2018	S 3
Department of Water Resources Engineering, Bangladesh University of Engineering and Technology, Dhaka	Academic	Dhaka, 5 February 2018	S 4
Department of Water Resources Engineering, Bangladesh University of Engineering and Technology, Dhaka	Academic	Dhaka, 27 February 2018	S 5
Institute of Water Modelling, Dhaka	Water Specialist	Dhaka, 1 March 2018	S 6

Environmental NGO, Dhaka	Environmental Activist	Dhaka, 6 February 2018	S 7
----------	Advocate, Dhaka	Dhaka, 10 February 2018	S 8
----------	Advocate, Dhaka	Dhaka, 10 February 2018	S 9
----------	Advocate, Dhaka	Dhaka, 19 February 2018	S 10
----------	Advocate, Chattogram	Chattogram, 7 March 2018	S 11

Category 3: Judges

Organisation	***Position***	***Place and Date Interview Conducted***	***Code***
Supreme Court of Bangladesh, Dhaka	Justice	Dhaka, 28 February 2018	J 1
Supreme Court of Bangladesh, Dhaka	Justice	Dhaka, 1 March 2018	J 2
Supreme Court of Bangladesh, Dhaka	Justice	Dhaka, 26 February 2018	J 3
Environment Appellate Court, Dhaka	Judge (District Judge)	Dhaka, 19 February 2018	J 4
Environment Court, Dhaka	Judge (Joint District Judge)	Dhaka, 27 February 2018	J 5
Environment Court, Chattogram	Judge (Joint District Judge)	Chattogram, 7 March 2018	J 6

All interviewees of Category 4 including their profession, location and date of interview conducted, and interview code, are listed below:

Category 4: Groundwater Users

Profession	***Location***	***Place and Date Interview Conducted***	***Code***
Irrigator and Domestic Groundwater User	Noakhali (Southeast)	Noakhali, 8 March 2018	GU 1
Irrigator and Domestic Groundwater User	Chattogram (Eastern Hill)	Chattogram, 13 March 2018	GU 2
Irrigator and Domestic Groundwater User	Chattogram (Eastern Hill)	Chattogram, 12 March 2018	GU 3
Irrigator and Domestic Groundwater User	Rajshahi (Northwest)	Rajshahi, 19 March 2018	GU 4
Irrigator and Domestic Groundwater User	Rajshahi (Northwest)	Rajshahi, 20 March 2018	GU 5
Irrigator and Domestic Groundwater User	Rajshahi (Northwest)	Rajshahi, 21 March 2018	GU 6
Irrigator and Domestic Groundwater User	Rajshahi (Northwest)	Rajshahi, 22 March 2018	GU 7

Irrigator and Domestic Groundwater User	Rajshahi (Northwest)	Rajshahi, 23 March 2018	GU 8
Irrigator and Domestic Groundwater User	Khulna (Southwest)	Khulna, 1 April 2018	GU 9
Irrigator and Domestic Groundwater User	Khulna (Southwest)	Khulna, 2 April 2018	GU 10
Irrigator and Domestic Groundwater User	Khulna (Southwest)	Khulna, 3 April 2018	GU 11
Irrigator and Domestic Groundwater User	Khulna (Southwest)	Khulna, 4 April 2018	GU 12
Irrigator and Domestic Groundwater User	Bagerhat (Southwest)	Bagerhat, 5 April 2018	GU 13
Domestic Groundwater User	Noakhali (Southeast)	Noakhali, 2 March 2018	GU 14
Domestic Groundwater User	Noakhali (Southeast)	Noakhali, 3 March 2018	GU 15
Domestic Groundwater User	Noakhali (Southeast)	Noakhali, 3 March 2018	GU 16
Domestic Groundwater User	Khulna (Southwest)	Khulna, 6 April 2018	GU 17
Domestic Groundwater User	Khulna (Southwest)	Khulna, 7 April 2018	GU 18

E *Interview Documents*

The following is a copy of the text of the three documents provided to the interviewees:

1) A schedule of the interview questions;

2) A plain language statement about the project; and

3) A consent form (which was signed and returned to the researcher).

1 *Schedule of Interview Questions*

(a) For Category 1 and 2 (Government Officials and Scholars)

Introductory Protocol

At the commencement of the interview, the interviewer will:

- thank the interviewee for his/her interest in participating the project;
- explain the purpose of the research and why the interviewee has been selected to participate (according to the plain language statement);
- explain the provisions of the plain language statement and consent form;
- explain why audio-recording of the interview is needed; explain what will occur if interviewee does not want recording;
- provide time for the interviewee to read the forms and sign the consent.

Interviewee Background:

How long have you been working at ……..?

What is your current position at this organisation? How long have you been in the current role?

Legal Framework

1. Are you familiar with the National Water Policy (NWP) 1999?
2. What mechanism has been proposed in the NWP to protect the groundwater quantity eg over-extraction for irrigation other purposes eg industrial effluents, agro-chemicals, human wastes?
3. How is water stress area determined under the Bangladesh Water Act 2013 and what is the purpose of it?
4. The Act has not set up any baseline for groundwater quality standard. How do you evaluate this ie do you favour it or do you suggest for drawing baseline?
5. What does the Act prescribe about the effluent treatment plant for industries? Are industries mandatorily required to have effluent treatment plant? How do you monitor that?
6. Has the Act fixed the maximum amount of groundwater that can be withdrawn by any individual or organisation?
7. Will you suggest any specific amendments to the Water Act to better protect the quality and quantity of the groundwater resources?
8. Will you suggest any specific amendments to the NWP to better protect the quality and quantity of the groundwater resources?
9. In your opinion, what factors drive people to comply or not to comply with the water laws?
10. What are the barriers to the on-the-ground implementation of the water laws?
11. Are stakeholders consulted and involved in the lawmaking process?
12. In the stakeholder consultations are groups such as women directly consulted? In your view, how best could women contribute to the protection of groundwater quality and quantity?
13. Do the existing legal frameworks clearly delineate the responsibilities of the relevant agencies in relation to the protection of the groundwater resources?
14. What is your overall assessment of the current legal framework of Bangladesh in relation to the protection of the groundwater resources ie how effective it is; gaps and recommendations?
15. Are there any other issues relating to the legal framework that you would like to talk about?

Institutional Framework

16. Over 40 different agencies and organisations are involved in the water sector, of which 35 organisations relate to the government under 13 different ministries and they are directly or indirectly involved for the implementation of the water policy. What is your view about the institutional framework in relation to the water resources?
17. What characteristics should an ideal institution/organisation possess for the protection of groundwater resources?
18. Do these characteristics exist in the current framework?
19. How could the institutional frameworks be better improved to protect the groundwater resources?
20. Are there any other issues relating to the institutional framework that you would like to speak about?

(b) For Category 3 (Judges of the Supreme Court, Environment Court and Environment Appellate Court)

Introductory Protocol

At the commencement of the interview, the interviewer will:

- thank the interviewee for his/her interest in participating the project;
- explain the purpose of the research and why the interviewee has been selected to participate (according to the plain language statement);
- explain the provisions of the plain language statement and consent form;
- explain why audio-recording of the interview is needed; (what if interviewee does not want recording?)
- provide time for the interviewee to read the forms and sign the consent.

Interviewee Background

How long have you been working at ……..?

What is your current position at this organisation? How long have you been in the current role?

As to Suits/Cases

To the Judges of the Supreme Court

1 Approximately, how many cases have you dealt with in relation to the protection of groundwater quality and quantity? Could you tell me the general contention of those cases?
2 Who brought those cases before the court ie individuals, Group of People, Class Action Suit, NGOs and against whom?
3 Are there any barriers/limitations in bringing suits/cases before the court in relation to the protection of groundwater resources? If so, how do you believe these barriers could be removed?
4 Do you get any applications (Misc Case) for the violation of the court's order in relation to the protection of groundwater resources? What are the perceived reasons for the violation of court's order?
5 Do you find any constraints for the court to intervene in the action or inaction of the government, organisation or individuals concerned so far it relates to the protection of the groundwater water resources?

To the Judges of the Environment Court, and Environment Appellate Court

6 Approximately, how many cases have you dealt with in relation to the protection of groundwater quality and quantity? Could you tell me the general contention of those cases?
7 Who brought those cases before the court ie individuals, Group of People, Class Action Suit, NGOs and against whom?
8 Are there any barriers/limitations in bringing suits/cases before the court in relation to the protection of groundwater resources? If so, how do you believe these barriers could be removed?

9 Do you get any applications (Misc Case) for the violation of the court's order in relation to the protection of groundwater resources? What are the perceived reasons for the violation of court's order?
10 In your view what are the scope and limitations of the existing Environment Court in entertaining the suits and cases in relation to the protection of groundwater resources?
11 Should the role of a specialist Environment Court be extended with respect to the protection of Groundwater or are there specific reforms that are needed to the Court's jurisdiction?
12 Are there other factors about the role of the Environment Court in relation to the protection of groundwater resources that you would like to talk about?

Legal Framework (To the Judges of all selected Courts)

13 What mechanism has been proposed in the National Water Policy (NWP) 1999 to protect the groundwater quantity eg over-extraction for irrigation other purposes, and quality eg industrial effluents, agro-chemicals, human wastes?
14 What specific amendments would you suggest to the NWP to better protect the quality and quantity of groundwater resources?
15 What are the barriers to the on-the-ground implementation of the water laws?
16 Do the existing legal frameworks clearly delineate the responsibilities of the relevant agencies in relation to the protection of the groundwater resources?
17 What is your evaluation of the effectiveness of the Bangladesh Water Act 2013 in relation to the protection of the groundwater resources?
18 What specific changes, if any, should be brought in the Water Act to make it more effective and efficient to protect the groundwater resources?
19 In your opinion, what factors drive people to comply or not to comply with the water laws?

Institutional framework (To the Judges of all selected Courts)

20 35 government organisations under 13 different ministries are directly or indirectly involved for the implementation of the water laws and policy. What is your view about the institutional framework in relation to the water resources?
21 What characteristics should an ideal institution/organisation possess for the protection of groundwater resources?
22 Do these characteristics exist in the current framework?
23 How could the institutional framework be better improved to protect the groundwater resources?
24 Would you like to talk about other factors with regard to institutional framework in relation to the protection of groundwater resources?

3 For Category 4 (Groundwater Users)

Introductory Protocol

At the commencement of the interview, the interviewer will:

- thank the interviewee for his/her interest in participating the project
- explain the purpose of the research and why the interviewee has been selected to participate (according to the plain language statement);
- explain the provisions of the plain language statement and consent form;

- explain why audio-recording of the interview is needed; explain also that it is not necessary to have the interview audio-recorded;
- provide time for the interviewee to read the forms and sign the consent.

General Questions

1 What is your perception about the groundwater resources you use ie is it finite or infinite? Can you use it at your will without having any intervention?
2 In your opinion, who owns the groundwater resource ie does it belong to the government or belong to individuals like yourself?

Usage and management of groundwater

3 What type of water (surface or groundwater or both) do you use to meet the domestic and agricultural needs?
4 Do you retain (harvest) rainwater to use it later?
5 Do you feel that over-extraction of groundwater causes depletion of groundwater table and causes harm to you and your neighbours?
6 What do you do if you see your neighbours over-extracting groundwater, using agro-chemicals indiscriminately, dumping domestic wastes which affect the resources?
7 In your opinion, how could the domestic use of groundwater be minimised?
8 In your opinion, how could the groundwater quality (free from pollution) be protected?
9 Who should manage the groundwater resources, government or local users?

Laws and Policies

10 Have you ever been consulted before water laws and policies are made?
11 Are you interested to participate in the law and policymaking process if called upon by the government?
12 If the government were to consider the introduction of licencing system for groundwater use what would be your view? (If necessary the interviewer will explain that licencing means prior permission/approval of the competent authorities to use groundwater).
13 If the government were to consider the introduction of metering system (like electricity metering) for groundwater use what would be your view? (If necessary the interviewer will explain that metering means measuring the taking of water by licensed water users for billing purposes)
14 Under the Groundwater Management Ordinance 1985, a licence is required for the installation of tubewells for irrigation purpose. Do people of your locality typically seek a licence for the installation of a tubewell for irrigation purpose?
15 What kind of laws and policies would you like to see adopted for groundwater regulation?

Court orders and enforcement

16 Are you familiar with the powers of the court to make an order in relation to groundwater resources? (Here court refers to the Supreme Court, the Environment Court, and the Special Magistrate Court)
17 How do people of your locality respond to the court's order in relation to the protection of groundwater quantity eg restricted withdrawal of groundwater?

18 How do people of your locality respond to court's order in relation to the protection of groundwater quality eg restricted use of agro-chemicals, prohibition of dumping domestic wastes indiscriminately?
19 Would you like to talk about your own experiences in relation to any court's order?
20 Do people of your locality feel that if they violate the court's order they run the risks of fine and/or imprisonment? Would you like to share any experiences of yourself in this regard?
21 Do you go to the court to seek remedies if your neighbours over-extract groundwater or dump domestic wastes impacting your groundwater?
22 In the above case, what sort of remedies do you expect from the court?
23 What other factors would you like to talk about the protection of groundwater quantity and quality in your locality?

Note: All interviews were conducted in such a way as to allow for a natural conversation flow. As a result, some interview responses were not directly related to the central thesis question, and ultimately, they were not incorporated into the thesis.

2 *Plain Language Statement for Interviews (sample text)*

(a) For professional participants (Category 1, 2 and 3)

Plain Language Statement

Melbourne Law School

Project Title:

CRAFTING LEGAL AND INSTITUTIONAL FRAMEWORKS FOR GROUNDWATER RESOURCES OF BANGLADESH: FROM OVEREXPLOITATION TO SUSTAINABLE ABSTRACTION

Primary Researcher: Mohammad Sohidul Islam (PhD Candidate, Melbourne Law School, The University of Melbourne, mohammadi2@student.unimelb.edu.au, +61420873725)

Project Supervisors: Professor Lee Godden [Director of the Centre for Resources, Energy and Environmental Law (CREEL), Melbourne Law School, The University of Melbourne] and Dr Rebecca Nelson (Melbourne Law School, The University of Melbourne)

Introduction

Thank you for your interest in participating in this research project. The following few pages will provide you with further information about the project, so that you can decide if you would like to take part in this research. Please take the time to read this information carefully. You may ask questions about anything you don't understand or want to know more about. Your participation is voluntary. If you don't wish to take part, you don't have to. If you begin participating, you can also stop at any time.

What is this research about?

Groundwater depletion is an acknowledged problem in Bangladesh. After decades of inaction, Bangladesh has only recently developed laws and institutions to regulate uncontrolled groundwater withdrawal. This project aims to examine the viability of the existing legal and institutional frameworks in tackling the mounting challenges stemming from groundwater overexploitation, and formulate recommendations to control unsustainable groundwater withdrawal. Your contributions to this project are of specific interest based on your engagement, knowledge, and practical expertise about the groundwater management of Bangladesh. This project is fully funded by the University of Melbourne through the Melbourne Research Scholarship (MRS), and the Government of the People's Republic of Bangladesh does not have any financial involvement in it.

What will I be asked to do?

Should you agree to participate, you will be invited to contribute by attending a brief interview with me, as the researcher, about your knowledge, views and experience relevant to this project. If you agree, the interview may be audio-recorded so that I can ensure to have an accurate record of your comments. I will provide you with a copy of the recording on request and, if transcribed, the transcript, so that you can verify that the information is correct and/or request deletions. The interview will be conducted in your preferred language, Bangla or English. Interviews are likely to take between 40-60 minutes. It is also possible that a follow-up interview may be requested.

How will my identity be protected?

I intend to protect your anonymity to the fullest possible extent. Your name and contact details will be kept in a password-protected computer file, separate from any data that you supply. Any audio recording, transcript, correspondence or notes of the interview will be available only to me for the purpose of this project. Any identifying information on such material will be removed and replaced with a code for use by me so that only I, as the researcher, will be able to identify you. In any publications arising from the research, while your responses may be incorporated, unless you expressly consent you will not be referred to by name, position or employer. However, as the number of people I seek to interview is small (no more than 45), it is possible that someone may still be able to identify you. The record of the interview will be retained by the primary researcher as long as they are of value.

What are the possible benefits?

A key aim of this project is to provide proposals for reforming the existing legal and institutional frameworks of Bangladesh to make them more effective and efficient in arresting declining groundwater resources. The information gained from these interviews will form the basis of analysis for this research project, which will later be published as a book. The findings of this project are expected to immensely assist the policymakers of Bangladesh to make more informed decisions that consider empirical and theoretical elements in making and structuring more enduring legal and institutional frameworks for the sustainable and equitable use of the groundwater resources which will contribute to the overall development of the country. Furthermore, the findings of this thesis are most likely to benefit other jurisdictions encountering similar challenges like Bangladesh centring their groundwater resources.

What are the possible risks?

There are no risks foreseen related to your participation in this research.

Do I have to take part?

No. Participation is completely voluntary. If you do not wish to take part, you do not have to. If you start participating, you can also stop at any time without explanation or prejudice, and withdraw any data you have provided. If you agree to participate, please indicate that you have read and understood this information by signing the accompanying consent form.

Will I hear about the results of this project?

If you would like to hear about the results of this project, a summary of the research in your preferred language (Bangla or English) can be forwarded to you. To request a copy, provide your email address at the bottom of the consent form. The findings of this project may also be included in academic publications once the dissertation has been completed, for example in journals, conference proceedings.

What will happen to information about me?

The data from this research will be retained by the primary researcher as long as they are of value. Any private and confidential information will be safeguarded subject to any legal requirements and the data will be kept in password-protected desktop or laptop and will be accessible only by the named researcher and project supervisors.

Where can I get further information?

If you would like more information about the project, please contact the primary researcher on mohammadi2@srudent.unimelb.edu.au or +61420873725; or one of the project supervisors: Professor Lee Godden (l.godden@unimelb.edu.au) or Dr Rebecca Nelson (rebecca nelson@unimelb.edu.au)

Who can I contact if I have any concerns about the project?

This research project has been approved by the Human Research Ethics Committee of the University of Melbourne. If you have any concerns or complaints about the conduct of this research project, which you do not wish to discuss with the research team, you should contact the Manager, Human Research Ethics, Research Ethics and Integrity, University of Melbourne, VIC 3010. Tel: +61 3 8344 2073 or Email: HumanEthics-complaints@unimelb.edu.au. All complaints will be treated confidentially. In any correspondence please provide the name of the research team or the name or ethics ID number of the research project.

(b) For groundwater users (Category 4)

Plain Language Statement

Melbourne Law School

THE UNIVERSITY OF MELBOURNE

Project Title:

CRAFTING LEGAL AND INSTITUTIONAL FRAMEWORKS FOR GROUNDWATEF BANGLADESH: FROM OVEREXPLOITATION TO SUSTAINABLE ABSTRACTION

Primary Researcher: Mohammad Sohidul Islam (PhD Candidate, Melbourne Law School, The University of Melbourne, mohammadi2@student.unimelb.edu.au, +61420873725)

Project Supervisors: Professor Lee Godden [Director of the Centre for Resources, Energy and Environmental Law (CREEL), Melbourne Law School, The University of Melbourne] and Dr Rebecca Nelson (Melbourne Law School, The University of Melbourne)

Introduction

Thank you for your interest in participating in this research project. The following few pages will provide you with further information about the project, so that you can decide if you would like to take part in this research. Please take the time to read this information carefully. You may ask questions about anything you don't understand or want to know more about. Your participation is voluntary. If you don't wish to take part, you don't have to. If you begin participating, you can also stop at any time.

What is this research about?

This project examines the strengths and weaknesses of the existing legal and institutional frameworks of Bangladesh in tackling challenges around groundwater overexploitation. Your contributions to this project are of specific interest based on your practical experience and knowledge about the extraction and use of groundwater resources. This project is fully funded by the University of Melbourne through the Melbourne Research Scholarship (MRS), and the Government of the People's Republic of Bangladesh does not have any financial involvement in it.

What will I be asked to do?

If you agree to participate, you will be invited to contribute by attending a brief interview with me, as the researcher, about your knowledge, views and experience relevant to this project. If you consent, the interview may be audio-recorded so that I can ensure to have an accurate record of your comments. I will provide you with a copy of the recording on request and, if transcribed, the transcript, so that you can verify that the information is correct and/or request deletions. The interview will be conducted in Bangla, if you are more comfortable then in your dialect. Interviews are likely to take between 30-60 minutes. It is also possible that a follow-up interview may be requested.

How will my identity be protected?

I will protect your anonymity to the fullest possible extent. Your name and contact details will be kept in a password-protected computer file, separate from any data that you supply. Any audio recording, transcript, correspondence or notes of the interview will be available only to me for the purpose of this project. Any identifying information on such material will be removed and replaced with a code for use by me so that only I, as the researcher, will be able to identify you. In any publications arising from the research, while your responses may be incorporated, unless you expressly consent you will not be referred to by name, position or employer. However, as the number of people I seek to interview is small (no more than 45), it is possible that someone may still be able to identify you. The record of the interview will be retained by the primary researcher as long as they are of value.

What are the possible benefits?

In rural areas of Bangladesh, groundwater scarcity is increasing, and its quality is deteriorating day by day. This precious resource needs to be protected. The findings of this project are expected to immensely assist the policymakers of Bangladesh in making and structuring timely legal and institutional frameworks to prevent groundwater depletion.

What are the possible risks?

There are no risks foreseen related to your participation in this research.

Do I have to take part?

No. Participation is completely voluntary. If you do not wish to take part, you do not have to. If you start participating, you can also stop at any time without explanation or prejudice, and withdraw any data you have provided. If you agree to participate, please indicate that you have read and understood this information by signing the accompanying consent form.

Will I hear about the results of this project?

If you would like to hear about the results of this project, a summary of the research in Bangla can be forwarded to you. To request a copy, provide your email or other suitable address at the bottom of the consent form.

What will happen to information about me?

The data from this research will be retained by the primary researcher as long as they are of value. Any private and confidential information will be safeguarded subject to any legal requirements and the data will be kept in password-protected desktop or laptop and will be accessible only by the named researcher and project supervisors.

Where can I get further information?

If you would like more information about the project, please contact the primary researcher on mohammadi2@srudent.unimelb.edu.au or +61420873725; or one of the project supervisors: Professor Lee Godden (l.godden@unimelb.edu.au) or Dr Rebecca Nelson (rebecca nelson@unimelb.edu.au)

Who can I contact if I have any concerns about the project?

This research project has been approved by the Human Research Ethics Committee of The University of Melbourne. If you have any concerns or complaints about the conduct of this research project, which you do not wish to discuss with the research team, you should contact the Manager, Human Research Ethics, Research Ethics and Integrity, University of Melbourne, VIC 3010. Tel: +61 3 8344 2073 or Email: HumanEthics-complaints@unimelb.edu.au. All complaints will be treated confidentially. In any correspondence please provide the name of the research team or the name or ethics ID number of the research project.

3 Consent Form for Interviews (sample text)

Consent Form

Melbourne Law School

THE UNIVERSITY OF MELBOURNE

Project Title:

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Primary Researcher: Mohammad Sohidul Islam (PhD Candidate, Melbourne Law School, The University of Melbourne, mohammadi2@student.unimelb.edu.au, +61420873725)

Project Supervisors: Professor Lee Godden [Director of the Centre for Resources, Energy and Environmental Law (CREEL), Melbourne Law School, The University of Melbourne] and Dr Rebecca Nelson (Melbourne Law School, The University of Melbourne)

Name of Participant: _____

1. I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written plain language statement to keep.

2. I understand that the purpose of this research is to investigate the strengths and weaknesses of the existing legal and institutional frameworks of Bangladesh in controlling unsustainable groundwater extraction in Bangladesh.

3. I understand that my participation in this project is for research purposes only.

4. I acknowledge that the possible effects of participating in this research project have been explained to my satisfaction.

5. In this project I will be required to participate in an **interview,** and I agree that the researchers may use the results as described in the written plain language statement.

6. I understand that with my consent my interview may be **audio-recorded**.

7. I understand that my participation is voluntary and that I am free to withdraw from this project anytime without explanation or prejudice and to withdraw any unprocessed data that I have provided.

8. I understand that the data from this research will be retained by the primary researcher as long as they are of value.

9. I have been informed that any confidential information I provide will be safeguarded subject to any legal requirements; my data will be password protected and accessible only by the named researchers. I will be anonymous in any publications arising from the research (unless I specify otherwise below).

10. I understand that if I prefer to remain unidentified in any publication, it is nevertheless possible that, due to the small number of people being interviewed, someone may still be able to identify me as the source of the information provided to the researchers.

11. I understand that after I sign and return this consent form, it will be retained by the researcher.

Anonymity is the default position. If you choose not to be anonymous, please indicate below (tick one box)

- ☐ **I choose to be identified as an interviewee, but I request that my name is not directly linked to the answers I provide**
- ☐ **I choose to be identified and I consent to being directly quoted for statements made by me during the interview**
- ☐ **I choose to be identified by generic reference to my position (eg 'judge'; 'government official'; 'academic')**

I consent to this interview being audio-recorded:	**Yes**	**No**
I wish to receive a summary of the research:	**Yes**	**No**
I wish to receive a copy of the summary project report in	**Bangla**	**English**

Participant's email address: _____

Participant's Signature: _____ **Date:** _____

F *Ethics Approval*

22 December 2017

Professor L Godden
Melbourne Law School
The University of Melbourne

Dear Professor Godden

I am pleased to advise that the Law Human Ethics Advisory Group has approved the following Minimal Risk Project.

Project title:	**Legal and Institutional Frameworks of Bangladesh Designed for the Protection of Groundwater Resources: Looming Challenges and Promising Opportunities**
Researchers:	**Professor L Godden, Dr R L Nelson, M Islam**
Ethics ID:	**1750624**

The Project has been approved for the period: **22-Dec-2017 to 31-Dec-2018.**

It is your responsibility to ensure that all people associated with the Project are made aware of what has actually been approved.

Research projects are normally approved to 31 December of the year of approval. Projects may be renewed yearly for up to a total of five years upon receipt of a satisfactory annual report. If a project is to continue beyond five years a new application will normally need to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

(a) **Limit of Approval:** Approval is limited strictly to the research as submitted in your Project application.

(b) **Amendments to Project:** Any subsequent variations or modifications you might wish to make to the Project must be notified formally to the Human Ethics Advisory Group for further consideration and approval before the revised Project can commence. If the Human Ethics Advisory Group considers that the proposed amendments are significant, you may be required to submit a new application for approval of the revised Project.

(c) **Incidents or adverse effects:** Researchers must report immediately to the Advisory Group and the relevant Sub-Committee anything which might affect the ethical acceptance of the protocol including adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the Project. Failure to do so may result in suspension or cancellation of approval.

(d) **Monitoring:** All projects are subject to monitoring at any time by the Human Research Ethics Committee.

(e) **Annual Report:** Please be aware that the Human Research Ethics Committee requires that researchers submit an annual report on each of their projects at the end of the year, or at the conclusion of a project if it continues for less than this time. Failure to submit an annual report will mean that ethics approval will lapse.

(f) **Auditing:** All projects may be subject to audit by members of the Sub-Committee.

Please quote the ethics registration number and the name of the Project in any future correspondence.

On behalf of the Ethics Committee I wish you well in your research.

Yours sincerely

A/Prof Amanda Whiting - Chair
Law Human Ethics Advisory Group

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