Meet the Press
March 21, 2015

Water and Sustainable Development

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Value of Water

• Water is at the core of sustainable development.

• Water resources, and the range of services they provide, underpin poverty reduction, economic growth and environmental sustainability.

• From food and energy security to human and environmental health, water contributes to improvements in social well-being and inclusive growth, affecting the livelihoods of billions.

• Therefore, each drop of water is powerful and is in demand.

‘Sustainable Development’ means the integrated management of water resources to assure the efficient use and equitable access for the benefit of current and future generations, optimizing the use of nonrenewable resources, and averting the deterioration of renewable resources.
Water Cycle

- Hydrologic cycle – circulation of water in the environment

**World Distribution of Water (%)**

<table>
<thead>
<tr>
<th>Source</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean (Saline)</td>
<td>97.2</td>
</tr>
<tr>
<td>Glaciers and Other Ice</td>
<td>2.15</td>
</tr>
<tr>
<td>Ground Water</td>
<td>0.61</td>
</tr>
<tr>
<td>Lakes (Fresh)</td>
<td>0.009</td>
</tr>
<tr>
<td>Lakes (Saline)</td>
<td>0.008</td>
</tr>
<tr>
<td>Soil Moisture</td>
<td>0.005</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>0.001</td>
</tr>
<tr>
<td>Rivers</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
Content of Presentation

- Scale of water use in Bangladesh and constraints to sustainable development.
- Policy and planning of the Government of Bangladesh for water sector.
- Way forward to the wise use of water resources for sustainable development.
Thematic Issues of the WWD, 2015

Water is health
Water is nature
Water is urbanization
Water is industry
Water is energy
Water is food
Water is equality

Order of Water Use Priority based on Bangladesh Water Act 2013

(a) Use of Water as Potable
(b) Use of Water in Household
(c) Use of Water in Agriculture
(d) Use of Water in Aquaculture
(e) Use of Water for Eco-system
(f) Use of Water for Wild Life
(g) Use of Water for Natural River Flow
(h) Use of Water in Industry
(i) Use of Water for Salinity Control
(j) Use of Water for Power Generation
(k) Use of Water for Amusement
(l) Use of Water for Other Purposes
UN Water: A Post-2015 global Goal for Water

Synthesis of Key Findings and Recommendations from UN-Water
Suggestions for a Global Goal for Water

• Water’s fundamental importance for human development, the environment and the economy needs to feature and design prominently in the new post-2015 development agenda for ‘Securing sustainable water for all’.

• The proposal aims to support the protection of water resources from over exploitation and pollution while meeting safe drinking water and sanitation needs, energy, agriculture, industrial and other uses as well as ensure rights to all users. It further aims to protect communities from water-related disasters.

• All depend on the effective management, protection and provision of water and the delivery of safe water supply and sanitation services.

• The global goal for water seeks to be universally applicable while responding to specific national circumstances to eradicate extreme poverty by 2030.

• Meeting the goal will call for improved water governance and actions in the areas of policy-making, legislation, planning, coordination, and administration.

• Tools for project preparation, monitoring, and management will also need to be developed to enable effective implementation to take place.

• All this will require enhanced institutions and human capacities at all levels.
Key Issues for a Global Goal for Water

Healthy people

Increased prosperity

Equitable societies

Protected ecosystems

Resilient communities

through

- Universal access to safe drinking water, sanitation and hygiene, improving water quality and raising service standards
- The sustainable use and development of water resources, increasing and sharing the available benefits
- Robust and effective water governance with more effective institutions and administrative systems
- Improved water quality and wastewater management taking account of environmental limits
- Reduced risk of water-related disasters to protect vulnerable groups and minimize economic losses
Major Problems and Practices in Bangladesh

- Water is central to the way of life in Bangladesh and most important resource for the well-being of its population. Availability of water, including rainwater, surface water, and groundwater calls for its sustainable development.

- Water resources management in Bangladesh faces immense challenge for resolving many diverse problems and issues. The most critical of these are alternating flood and water scarcity during the wet and the dry seasons.

- To protect the population from water-borne diseases, millions of HTWs (<100m depth) have been installed in the shallow aquifers that is mostly affected by arsenic contamination.

- Over exploitation is usually the result of irrigation abstraction in rural areas and huge domestic and industrial usage in cities.

- High rates of pumping from the shallow aquifers may result in widespread saltwater intrusion in coastal areas, and the degradation of water resources.

- Since the early 1990’s, DTWs have been installed (100- 250m depth) in an attempt to find safe groundwater for drinking water supplies. However, the wells often contain high concentrations of iron, manganese and chloride.
The Ganges-Brahmaputra-Meghna (GBM) River System

93% of the catchment area is outside Bangladesh

Flow
- The Ganges-Padma: 1,000 ~ 120,000 cumec
- The Brahmaputra: 2,400 ~ 102,000 cumec
- The Meghna: 500 ~ 30,000 cumec

- Ganges Basin: 1,087,000 sq.km
- Brahmaputra Basin: 552,000 sq.km
- Meghna Basin: 82,000 sq.km
Abundance of Water during Monsoon Causing Flood and Inundation of Huge Agricultural Lands for 3-4 Months

Shortage of Water in Dry Season to Meet the Requirement
Water is essential to human health. The human body can last weeks without food, but only days without water.

As for the human body, in average it is made of 50-65% water. Newborn babies have 78% water.

Every day, every person needs access to water for drinking, cooking and personal hygiene. Water is essential for sanitation facilities that do not compromise health or dignity.

The WHO recommends 7.5 liters per capita per day to meet the requirements of most people under most conditions. A higher quantity of about 20 liters per capita per day will take care of basic hygiene needs and basic food hygiene.

Despite impressive gains made over the last decade, 748 million people do not have access to an improved source of drinking water and 2.5 billion do not use an improved sanitation facility.

To cover every person worldwide with safe water and sanitation is estimated to cost US$ 107 billion a year over a five-year period.
Water Supply in Bangladesh and Health Issues

• The development of groundwater resources for potable use has increased substantially over the decades as surface water supplies are generally polluted.

• Rural domestic water supplies are obtained mainly from tubewells fitted with hand pumps and dug wells.

• By early 1990's, Bangladesh achieved almost universal (i.e. about 97%) drinking water supply coverage until the success was overshadowed by the presence of excessive arsenic in the shallow groundwater and saline water encroachment in coastal aquifers.

• These water supply and sanitation problems have obvious implications for public health. About 20 million people (13% of the total) in Bangladesh are at risk of Arsenic contamination. Every year about 50000 children die due to diarrheal disease.

• Government is spending about 5000 million taka additionally to mitigate waterborne diseases every year.

• Currently the national water coverage is about 86%. Further progress in ensuring better water supply in rural areas, particularly in hard to reach areas still remain a big challenge.
Groundwater Development Zones in Bangladesh

- Unit 1: Upper Boundary
- Shallow Hand Tubewell Zone
- Shallow Irrigation Tubewell Zone
- Deep Irrigation Tubewell Zone / Shallow Urban Tubewell Zone
- Deep Hand Tubewell Zone / Deep Urban Tubewell Zone
- Deep Aquifer

- Shallow, Upper or First Aquifer
- Intermediate, Main or Second Aquifer
- Deep or Third Aquifer
Groundwater Quality: Iron and Arsenic Contamination
Groundwater Salinity in Coastal Aquifers

Monsoon/Wet Season

Pre-monsoon/Dry Season
Trend of Groundwater Table below Ground Surface
Aquifer Mapping in Bengal Delta
(350mx100m)
Depth-wise Groundwater Table Contour Maps

Monsoon/Wet Season

Pre-monsoon/Dry Season
Availability of Groundwater: Usable Recharge and Suitable Pumping Methods
Different Water Supply Options in HtR Areas
• Where a significant aquitard i.e. impermeable clay layer exist in the surface (3-10 m thick), the very shallow groundwater will be less vulnerable to surface contamination.

• To augment the fresh water storage within or above the brackish and above the arsenic prone shallow groundwater using precipitation and uncontaminated pond water simple recharge technology like small diameter recharge basin/pile digging the clay and filling by well sorted coarse sand can be constructed.

• This can be a low cost household level solution to provide fresh to slightly brackish water in hand tubewells by reducing the salt content in shallow groundwater in the coastal belt and more fresh and safe recent recharged water in the arsenic prone areas above the arsenic contaminated groundwater.
Groundwater Information of Nachole Upazila: Can Support to Prepare Upazila/Union Level Water Budget
Water is Food

• Irrigation takes up to 90% of water withdrawn in some developing countries.

• Globally, agriculture is the largest user of water, accounting for 70% of total withdrawal. By 2050, agriculture will need to produce 60% more food globally, and 100% more in developing countries.

• Economic growth and individual wealth are shifting diets from predominantly starch-based to meat and dairy, which require more water. Producing 1 kilo rice requires about 3,500 liters of water, while 1 kilo of beef some 15,000 liters. This shift in diet is the greatest to impact on water consumption over the past 30 years.

• The current growth rates of agricultural demands on the freshwater resources are unsustainable. Inefficient use of water for crop production depletes aquifers, reduces river flows, and has caused salinization of 20% of the irrigated land area.

• To increase efficiency in the use of water, agriculture can reduce water losses and, most importantly, increase crop productivity with respect to water.

• With increased agriculture, water pollution may worsen. A combination of incentives, including more stringent regulation, enforcement and well-targeted subsidies, can help reduce water pollution.
Development of Irrigation for Food Security in Bangladesh

• From about 700 rivers and tributaries, 98,000 ha of inland water bodies and more than 24,000 km streams, many have now dried out or filled up by human activities.

• The country has gained a significant success in the development of groundwater for its irrigated agriculture, industrial and domestic water supply.

• Along with surface water irrigation, DTW and STW irrigation was extended rapidly during the late 1970’s and 1980’s. As a result the target for self sufficiency in food has almost been achieved.

• Currently, about 98% of drinking water and 80% of dry season irrigation water supply has been provided by groundwater. Renewable freshwater resources of Bangladesh is over 1210 billion cubic meter where groundwater is only 21 billion cubic meter.

• This has already created a huge stress on groundwater resource where minimize the overuse of water (30-60%) in paddy fields can reduce this pressure.
Surface Water Irrigation Projects
Groundwater Irrigation in the Vicinity of Mighty Rivers

Branch of the Ganges

Branch of the Ganges

Failure of LLP Attempted

LLP was Replaced by STW
Low Cost Methods for TW Installation Causing Unwise Expansion of Groundwater Abstraction for Irrigation

<table>
<thead>
<tr>
<th>Year</th>
<th>Nos. of STW</th>
<th>Nos. of DTW</th>
<th>Year</th>
<th>Nos. of STW</th>
<th>Nos. of DTW</th>
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<tbody>
<tr>
<td>1985</td>
<td>133,844</td>
<td>15,322</td>
<td>1998</td>
<td>664,671</td>
<td>25,354</td>
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<tr>
<td>1988</td>
<td>186,431</td>
<td>23,482</td>
<td>2001</td>
<td>707,574</td>
<td>23,536</td>
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<tr>
<td>1989</td>
<td>217,879</td>
<td>23,352</td>
<td>2004</td>
<td>925,152</td>
<td>24,718</td>
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<tr>
<td>1991</td>
<td>270,309</td>
<td>21,519</td>
<td>2006</td>
<td>1,182,525</td>
<td>28,289</td>
</tr>
<tr>
<td>1993</td>
<td>348,875</td>
<td>25,714</td>
<td>2007</td>
<td>1,202,728</td>
<td>29,177</td>
</tr>
<tr>
<td>1996</td>
<td>556,383</td>
<td>27,169</td>
<td>2013</td>
<td>1,523,609</td>
<td>35,322</td>
</tr>
</tbody>
</table>

![Hand Percussion Method for STW (Upto 100m)](image1)

![Rotary Drilling Method for DTW (Upto 350m)](image2)

![STW (Million) vs Year](image3)
UNCONTROLLED WITHDRAWAL OF GROUNDWATER: MINIMUM WELL SPACING IS IGNORED
Mean Recharge and Irrigation Technology

Mean Recharge (mm) (Point estimates)
- 10 - 50
- 51 - 100
- 101 - 300
- 301 - 400
- 401 - 600

Mean Recharge (mm) (Interpolated estimates)
- 10 - 50
- 50 - 100
- 100 - 125
- 125 - 150
- 150 - 175
- 175 - 200
- 200 - 250
- 250 - 300
- 300 - 350
- 350 - 600

Irrigation by technology
- Deep Tubewell
- Shallow Tubewell
- Low-lift Pump

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Seasonal Fluctuations of Groundwater Level at Different Locations and Depths

Hydrographs for wells (2nd Aquifer) in Northern Kachua

- KH-28
- KH-40
- KH-44
- KH-46
- KH-63

Madaripur, Kachua, Chandpur
Groundwater Model to Determine the Depth of Safe Water Supply for Arsenic Mitigation

Aquifer | Travel Time (Years) 2004 stress | Anisotropic | Anisotropic (Discont.) | Low Anisotropic |
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</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
<td>Ave</td>
<td>Max</td>
</tr>
<tr>
<td>Unit 3</td>
<td>121</td>
<td>8</td>
<td>37</td>
<td>293</td>
</tr>
<tr>
<td>Unit 4</td>
<td>2557</td>
<td>21</td>
<td>133</td>
<td>2517</td>
</tr>
<tr>
<td>Unit 6</td>
<td>5881</td>
<td>122</td>
<td>2485</td>
<td>8099</td>
</tr>
<tr>
<td>Unit 7</td>
<td>4853</td>
<td>1288</td>
<td>2454</td>
<td>8363</td>
</tr>
<tr>
<td>Unit 9</td>
<td>3896</td>
<td>1150</td>
<td>2297</td>
<td>8392</td>
</tr>
</tbody>
</table>

- **A**: 2004 development stresses (anisotropic)
- **B**: 2004 development stresses (anisotropic, discontinuous aquitards)
- **C**: 2004 development stresses (low anisotropic)
- **D**: 2014 development stresses (anisotropic)
- **E**: 2014 development stresses (low anisotropic)
- **F**: 2014: new Shallow Irrigation Wells in unit 6 (anisotropic)
- **G**: 2014: new Shallow Irrigation Wells in unit 6 (low anisotropic)
- **H**: 2014: Hand Tube Wells in main aquifer upper (anisotropic)
- **I**: 2014: Hand Tube Wells in main aquifer upper (low anisotropic)
POTENTIAL AQUIFER UNITS FOR DRINKING WATER SUPPLY

• Under current development stress (anisotropic condition) water in the lower part of shallow aquifer may start to contaminate after 20 years. For main and deep aquifers minimum travel times are 125-1250 and 1200 years i.e. these aquifers remain safe at least for these time periods.

• If the aquitards are discontinuous, time will be reduced.

• Where aquitards are weakly anisotropic, all aquifer units would be start to contaminate by 150 years, that is less than 10 and 25 years for lower part of shallow and main aquifers.

• Maintaining current trend of irrigation abstraction, if only domestic wells are shifted to main aquifer from shallow aquifer, main aquifer will remain safe for longer period.

• Where weakly anisotropic condition exists in the alluvial aquifers, groundwater from the arsenic contaminated layer will take very little time to reach in different aquifers.
Depth to groundwater table on April and December in the years 2006 (current scenario), 2030 and 2050

Groundwater Model for Salinity Encroachment

Salinity zoning maps of base condition in 2012 and impact of climate change in 2050
Impact of Climate Change on Salinity Distribution

• The climate change scenario illustrate that there is significant impact on groundwater level and less impact on salinity distribution for south central coast. The groundwater level increases within range of 0.6 to 0.8m.

• The long term simulation for climate change options indicates that the salinity movement from river to aquifer is not significant which may depend on the high velocity of river water, the groundwater flow direction, significant SW-GW interactions and the seasonal variation of salinity concentration of rivers.

• The salinity level of Andharmanik river is 17000 mg/l for 2050 which dispersed into the aquifer upto the distance of 2.5 km from the river bank and the salinity concentration in the aquifer is found to be 1000 mg/l.

• The vertical movement of salinity is not noticeable and it reaches the aquitard-1 during this time if the assumption behind the model development is valid.

• Due to the tidal effect of major rivers for the tidal delta there is a considerable interaction between SW and GW. For the Chittagong coastal plain there is less interaction between the aquifer and Karnafuli river.

• The water budget study reveals that river plays an important role to balance inflow and outflow which means there is an interconnection between the river and aquifer.
Livelihood of about 75% are More or Less Dependent on Agriculture-Irrigation.
Water is Nature

• Ecosystems – including, forests, wetlands and grassland – lie at the heart of the global water cycle and understanding the water cycle is essential to achieving sustainable water management.

• Yet most economic models do not value the essential services provided by freshwater ecosystems. This leads to unsustainable use of water resources and ecosystem degradation.

• Pollution from untreated residential and industrial wastewater and agricultural run-off also weakens the capacity of ecosystem to provide water-related services.

• There is a need to shift towards environmentally sustainable economic policies that take account of the interconnection between ecological systems.

• Ecosystem valuation demonstrates that benefits far exceed costs of water-related investments in ecosystem conservation.

• Adoption of ‘ecosystem-based management’ is key to ensuring water long-term sustainability.
Impact of Uncontrolled Water Withdrawal

Natural conditions:
- Precipitation
- Evaporation
- Recharge
- Water table
- Riparian zone
- Stream
- Ground-water flow
- Confining unit

Ground-water withdrawals:
- Pumping well
- Lower water levels
- Reduce streamflow

Excessive ground-water withdrawals can affect the environment.

Withdrawal rates at well are adjusted to reduce adverse effects.
**Water for the Environment**

- Given that most of the country's environmental resources are linked to water resources, it is vital that the continued development and management of the nation's water resources should include the protection, restoration, and preservation of the environment and its bio-diversity including wetlands, haors, mangrove and other national forests, endangered species, and the water quality.

- Water quantity and water quality issues are uniquely linked. The economic loss due to environmental degradation of the country would be about 44633 crore TK. which is about 7364 crore TK for Dhaka water pollution.

- Contamination of surface water bodies and groundwater aquifers by agricultural pollutants, industrial discharge, domestic pollution, and non-point source urban runoff exacerbate water quality problems and endanger both natural ecosystem integrity and public health.

- Minimum stream-flows in designated rivers and streams should be maintained for navigation after diversion of water for drinking and municipal purposes.

- During summer the saline water enters 100 km inland which is 150 km in winter, causing increased encroachment of saline-water in groundwater.
River Water - Groundwater Interaction
Hydraulic Connectivity Between Aquifer Formations

Almost No Response in Upper Aquifers

Drawdown in Deep Aquifer

Water Level Elevations at Srirampur

Response in Shallow Aquifer

Long-term Monitoring of Water Level

Drawdown in Main Aquifer

Lowering of GW Table in Deep Aquifer
Water is Urbanization

• Every week, one million people move into cities. Today, one in two people on the planet live in a city.

• 93% of the urbanization occurs in poor or developing countries, and nearly 40% of the world's urban expansion is growing slums.

• Projections show that another 2.5 billion people will move to urban centers by 2050.

• Managing urban areas has become one of the most important development challenges of the 21st century. Success or failure in building sustainable cities will be a major factor in the success of the post-2015 UN development agenda.

• Thousands of kilometers of pipes make up each city’s water supply infrastructure. Many antiquated systems waste more freshwater than they deliver.

• In many fast-growing cities (small and medium-sized cities with populations of less than 500,000), wastewater infrastructure is non-existent, inadequate or outdated.
INCREASING TREND OF GROUNDWATER ABSTRACTION AND NUMBER OF TUBEWELLS IN DHAKA CITY

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</thead>
<tbody>
<tr>
<td>Nos. of Tubewell</td>
<td>49</td>
<td>75</td>
<td>130</td>
<td>197</td>
<td>300</td>
<td>423</td>
<td>500</td>
<td>690</td>
</tr>
<tr>
<td>Withdrawal (Mm³/day)</td>
<td>0.18</td>
<td>0.217</td>
<td>0.516</td>
<td>0.767</td>
<td>1.2</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
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<tr>
<td>Water Table (m)</td>
<td>0.5-10.5</td>
<td>0.5-9</td>
<td>6-22.5</td>
<td>12.5-32</td>
<td>19-41.5</td>
<td>19-54</td>
<td>19-67</td>
<td>24-71</td>
</tr>
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</table>
Declining Trend of Groundwater Table (meter) in Dhaka City and Surrounding Non-Urban Areas
<table>
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<tr>
<th>Service</th>
<th>Area</th>
<th>Coverage (sq.km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td>DCC area</td>
<td>360 sq.km</td>
</tr>
<tr>
<td></td>
<td>Outside DCC area</td>
<td>90 sq.km</td>
</tr>
<tr>
<td></td>
<td>Narayanganj</td>
<td>20 sq.km</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>470 sq.km</td>
</tr>
<tr>
<td>Sewerage</td>
<td>DCC area</td>
<td>110 sq.km</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(30% of DCC)</td>
</tr>
<tr>
<td>Drainage</td>
<td>DCC area</td>
<td>140 sq.km</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(38% of DCC)</td>
</tr>
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</table>
PROBLEMS DUE TO OVER EXPLOITATION

• If the present rate of abstraction and silting of river beds continues, inflow of groundwater will be reduced and groundwater mining will be aggravated.

• The annual mining of groundwater from the storage is calculated as 60 Mm$^3$, where, area of Dhaka city is considered as 260km$^2$ and the annual average declination of water table as 2.36m.

• Lowering of groundwater table leads to an increased cost of development, the early replacement and deepening of wells and need to enlarge energy facilities.

• Groundwater flow gradient towards the central part of the city allows surface and river water pollutants finds its way to the aquifer.

• The ground surface may be subsided and caused compaction and porosity loss in soil and can permanently ruin good aquifers.

• Changing groundwater head potential in and along wells or boreholes, or discharge areas may also change water quality progressively.
Water is Industry

• Industrialization can drive development by increasing productivity, jobs and income. However, industry’s priority is to maximize production rather than water efficiency and conservation.

• Every manufactured product requires water. 10 liters of water are used to make one sheet of paper. 91 liters are used to make 500 grams of plastic. Industry accounts for 20% of water demand.

• Global water demand for manufacturing is expected to increase by 400% from 2000 to 2050, which is much larger than other sectors. The main increases will be in emerging economies and developing countries.

• Many large corporations have made considerable progress in evaluating and reducing their water use.

• Technology and smart planning reduce the use of water, and can improve the quality of wastewater. Some progressive textile manufacturers have introduced technology that ensures the water coming out of the mill is as clean or cleaner than the water coming in from the town's drinking water.

• Large beverage companies are also improving their water use efficiency and have over the past 10 year substantially reduced the water used in their plants.
Industrial Water Need in Bangladesh

- Though Bangladesh is not an industrial country, however the growth rate of industries in the country is significant.

- Excessive water salinity in the southwest region is a major deterrent to industrial growth.

- Pollution of both surface and groundwater around various industrial centers of the country by untreated effluent discharge into water bodies is a critical water management issue.

- Buriganga, Sitalakhya and Bangshi rivers getting 56000, 43000 and 31000 kgs BOD every day from domestic and industrial wastes respectively.

- Zoning regulations must be established for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities.

- Effluent disposal should be monitored by relevant Government agencies to prevent water pollution.
Threats to Water Quality
### GENERAL OUTLINE OF LEATHER PROCESSING AT HAZARIBAGH

<table>
<thead>
<tr>
<th>Processes</th>
<th>Stages of processing</th>
<th>Chemical use</th>
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<tbody>
<tr>
<td>Beamhouse operations</td>
<td>Curing, washing, wetting and soaking</td>
<td>Sodium chloride/sulfide, antiseptics, proteolytic/limptolytic enzymes</td>
</tr>
<tr>
<td></td>
<td>Liming, hair burning/unhairing</td>
<td>Calcium oxide/hydroxide, sodium sulfide</td>
</tr>
<tr>
<td></td>
<td>Deliming, batting</td>
<td>Sulfuric/formic/lactic acid, ammonium sulfate/chloride, sodium carbonate/bi-sulfide, soda ash</td>
</tr>
<tr>
<td></td>
<td>Degreasing</td>
<td>Emulsifier, organic solvents, aldehyde, co-polymer</td>
</tr>
<tr>
<td></td>
<td>Pickling</td>
<td>Hydrochloric/sulfuric/organic acid, sodium chloride</td>
</tr>
<tr>
<td>Tanyard operations</td>
<td>Chrome tanning/ vegetable tanning</td>
<td>Sodium chloride, chromium salts, vegetable tans, brine</td>
</tr>
<tr>
<td>Dressing operations</td>
<td>Dressing, coloring</td>
<td>Neutralizing agents, retaining agents, dyes (sulfur, acid dye, metal complex), fat liquoring oils</td>
</tr>
<tr>
<td>Finishing operations</td>
<td>Drying, buffing and finishing</td>
<td>Liquor, resin, pigment, acrylic or polyurethane polymers, waxes, formalin</td>
</tr>
</tbody>
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### TRACE ELEMENT CONCENTRATIONS OF WASTEWATER AND SUSPENDED MATERIALS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SW-2 (canal water)</th>
<th>SW-1 (effluent)</th>
<th>Parameter</th>
<th>SW-2 (canal water)</th>
<th>SW-1 (effluent)</th>
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<tbody>
<tr>
<td></td>
<td>Water (mg/l)</td>
<td>Suspended solids (mg/kg)</td>
<td>Water (mg/l)</td>
<td>Suspended solids (mg/kg)</td>
<td>Water (mg/l)</td>
</tr>
<tr>
<td>As</td>
<td>0.0069</td>
<td>&lt; 1.45</td>
<td>0.025</td>
<td>&lt; 1.45</td>
<td>0.014</td>
</tr>
<tr>
<td>Cd</td>
<td>&lt; 0.001</td>
<td>0.14</td>
<td>&lt; 0.002</td>
<td>0.14</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Co</td>
<td>&lt; 0.001</td>
<td>1.45</td>
<td>&lt; 0.002</td>
<td>0.46</td>
<td>0.022</td>
</tr>
<tr>
<td>Cr</td>
<td>0.443</td>
<td>20,229.96</td>
<td>4.06</td>
<td>28,844.40</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td>Cu</td>
<td>0.048</td>
<td>21.07</td>
<td>0.237</td>
<td>8.16</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Ni</td>
<td>0.067</td>
<td>7.02</td>
<td>0.69</td>
<td>10.61</td>
<td>0.318</td>
</tr>
</tbody>
</table>
Declining Trend of Groundwater Table/Level
Water is Energy

• Water and energy are natural partners. Water is required to generate energy. Energy is required to deliver water. 90% of all power production is water intensive. Therefore, saving energy is saving water and vice-versa.

• Today over 80% of power generation is by thermal electricity. Water is heated to create steam to drive electrical generators. Billions of gallons of water are also needed for cooling.

• Coal, nuclear power and natural gas based electricity production require 17000, 15000 and 6000-6500 gallons/mega watt hour of water respectively. Wind and solar based electricity production requires less water.

• Worldwide hydropower accounts for 16% of global electricity production - an expected 3700 major dams may more than double the total electricity capacity of hydropower within the next two decades.

• Global energy consumption will increase by 49% from 2007 to 2035.

• New energy production should use widely adopting dry-cooling or highly efficient closed-loop cooling technologies. Using alternative water sources, such as sea or wastewater, offers a great potential for reducing the pressures on freshwater resources.
Water for Hydropower and Recreation

• Bangladesh has limited potential for hydropower due to its flat terrain and the absence of suitable reservoir area. However, it may be possible to build mini hydropower plants at small dam and barrage sites.

• A major environmental concern of hydropower development is the impediment to a river's natural flow imposed by structures built on it. A hydropower facility may be restrictive for fish movement also.

• Use of water for recreational purposes is useful for developing tourism facilities. Introducing these facilities at the sites of reservoirs, lakes, dighis (big ponds), sea resorts, etc. would help the tourism industry of the country.

The policy of the Government is therefore that:

• Mini-hydropower development schemes may be undertaken provided they are economically viable and environmentally safe.

• Recreational activities at or around water bodies will be allowed provided it is not damaging to the environment.
Water is Equality

• In developing nations the responsibility for collecting water every day falls disproportionately on women and girls. On average women in these regions spend 25% of their day collecting water for their families. This is time not spent working at an income-generating job, caring for family or attending school.

• Climate change negatively impacts fresh water sources. Current projections show that freshwater-related risks rise significantly with increasing greenhouse gas emissions, exacerbating competition for water among all uses and users, affecting regional water, energy and food securities. Combined with increased demands for water, this will create huge challenges for water resources management.

• Natural hazards are inevitable but much can be done to reduce the high number of death and destruction tolls. These water threats have been increasing with climate change and human activities.

• But, with preparedness and planning, fatalities and destruction can be decreased. The global community has committed itself to the principles of coherent disaster prevention and response. The need is now for concrete and significant changes to make this happen.
Water Rights and Allocation in Bangladesh

• In Bangladesh the ownership of water does not vest in an individual but in the state. The Government reserves the right to allocate water to ensure equitable distribution, efficient development and use, and to address poverty.

• The Government can redirect its use during periods of droughts, floods, cyclones, and other natural and man-made disasters, such as contamination of groundwater aquifers that threaten public health and the ecological integrity.

• Urban water supply coverage is >85% with piped service of 31%. For rural population this is about 82% and only 1% respectively. In HtR areas, the water supply coverage is only 24%.

• Allocation for non-consumptive use (e.g. navigation) would imply ensuring minimum levels in water bodies used for that purpose.
Women Empowerment and Involvement in Water Supply

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WATER POLICIES AND PLANS IN BANGLADESH

• The NWM Plan was prepared to provide guidance to future investment for WRM in the light of NWP.

• The plan has focused on the institutional development and enabling environment, along with urgent programs such as metropolitan flood protection, urban and rural water supply and sanitation, preparation of national pollution control plan and various other studies to fill the knowledge gaps.

• The goal of the PRS of the Government is to setup a vision for poverty reduction based on the understanding of key issues of the present state of the economy.

• Reviewing and considering NWP and NWMP objectives and actions, PRS recognized the need for promoting rational management and optimal use of water resources, improving the quality of life by ensuring equitable, safe and reliable access to water, availability of clean water in sufficient quantities and reservation of the aquatic and water dependent eco-systems.
Policies and Plans for Livelihood Improvement in Bangladesh

- Irrigation Act (1876), Irrigation Water Rate Ordinance (1983)
- Water Supply and Sewerage Authority Act (1996)
- Environment Conservation Policy (1997)
- Bangladesh Country Investment Plan (2010)
- National Strategy for water and sanitation in the Hard to Reach Areas of Bangladesh (2011)
- Sector Development Plan (FY 2011-25)
- Water Act (2013)
Weakness of Policies and Plans

• The main weakness of these tools is inadequate implementation and application.

• Existing laws and regulations do not cover sufficiently in areas such as the rights, powers, and duties of individual users and the government.

• Lack of research-based education and advocacy campaigns. Scientific and institutional approach analyzing research outputs is yet far behind.

• Most of these policies and plans were never reviewed though many years have passed after implementation.
**Recommendation**

- Adoption of appropriate and sustainable strategy to ensure food security, healthy society and safe water supply and combat climate change impacts.
- Reaching a common understanding between experts, planners, politicians and the general people about the changing environment and the optimal ways and means of achieving the national water management goals.
- Expansion and improvement the water supply services to satisfy the basic needs of the people that is greater for under privileged groups and regions.
- Estimation of the availability of water and water budget for different uses down to Upazila/Union Level.
- Preservation of natural depressions and water bodies in major urban areas for recharge of underground aquifers and rainwater management.
- Improvement of efficiency of resource utilization through conjunctive use of all forms of surface water and groundwater for irrigation and urban water supply.
- Strengthening crop diversification programs for efficient water utilization.
- Strengthening appropriate monitoring organizations for tracking groundwater recharge, surface and groundwater use, and changes in water quality.
Recommendation

• Due to arsenic contamination in shallow groundwater and salinity at different depth levels, deep fresh water aquifers may serve as sustainable options for safe drinking water. Irrigation use of deep groundwater should not be encouraged.

• Climate change is one of many factors that would influence future water stress in most regions. The direct impacts of sea-level rise on coastal inundation and extent of storm surges is of greater concern for groundwater conditions. Sea-level rise may shorten the lifetime of the fresh water resource in the coast.

• Understanding hydro-geochemistry as well as sediment and water interaction of the exploitable aquifers with increased development stresses and anticipated impact of climate change is very important.

• Coastal embankments and hydraulic structures are very important for coastal water resources management in Bangladesh to control coastal flooding, prevent saline water intrusion etc. The damage of these infrastructures has a severe impact on the agricultural production hence on the food security of the country.
Recommendation

• The process of planning and managing water resources require a comprehensive and integrated analysis of relevant hydrological, topographical, social, political, economic, environmental and institutional factors across all related water-using sectors.

• Stakeholder involvement should be an integral part of water resources management, at all stages of the project cycle.

• Informing policy makers of the choice of appropriate technology to meet policy goals and make them aware of their significance and impact is an essential requirement of a dynamic water management policy.

• Properly functioning institutions are essential for effective implementation and administration of the country’s water and related environmental resource management policies and directives.

• The extent of these impacts will depend, in a large part, on the ability of inhabitants to respond and adapt to future climate conditions.