Water: A regional view

TEQIP Workshop
12th Sept 2014
Pooja Prasad
Agenda

• The regional perspective
  – Urban water
  – Rural water
• Regional water planning
  – Supply side, demand side
  – Planning activity
• Sample studies in surface water and ground water
The regional perspective

• TEQIP mandate: Colleges to be regionally relevant
  – Identify problems → academic projects → deliver to regional stakeholders

• The regional approach
  – The appropriate scale to observe trade-offs, interconnectedness of issues, stakeholders, policy
  – Requires interdisciplinary skills: makes an ideal case for the role of universities
Regional view

LOCATE:
Farmland
Villages
Road/highways
River/stream
Dam
Reservoir
Canal Network
Hills/Valleys
Urban/ peri-urban view

LOCATE:
- Villages
- Peri-urban area
- Farmland
- Roads
- Stream
- Small dam (KT bandhara)
- Waste water nallahs
Urban water cycle
Rural Water

Note:
Ground vs. surface water
Rain-fed vs. Irrigated farms
Drinking water
Public/ Private sources
Reservoirs/ Dams
Piped water assets
Waste water?
Agenda

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Regional Water Planning – The Challenges and Need

• Competing demand from different sectors
• Overcoming seasonality problems in water availability and use
• Managing water quality
• Addressing normative concerns: efficiency, equity, sustainability
Regional Planning- Key Attributes

• The supply
  – Groundwater, Surface water, rain water
• The demand
  – Domestic use, agriculture, industry
  – Cities, towns, large GPs, villages
• Policy and Institutions
  – Current regulations and norms (e.g. reservation priorities, sewerage requirements, waste water regulations..)
  – Institutions and stakeholders (supply side, demand side, implementing agents)
• Planning process (quantity and quality)
  – Matching water supply with demand/ allocation, tariff
  – long term asset planning
  – Scarcity assessment and management
  – Long term issues of water balance, equity and sustainability
Agents

• End-users – provide service requirements
• User bodies (WUA, VWSSCs, ULBs): Representative bodies that implement, own and manage schemes
• Government departments (MJP, RWS, MI, GSDA): Technical design inputs
• Administrative bodies (Block/ district/ municipal level): approvals and channelling funds
• Elected representatives: people’s voice
• Regional planning and monitoring?
  – we have a role here!
Estimating demand – Domestic use

• Rural norm
  – 55 lpcd of water available on a sustained basis within 100m of all households (NRDWP 2013)

• Urban Norm
  – Much higher
  – Norm ranges from 70 lpcd to 150 lpcd
  – Mumbai, Pune: 200+ lpcd
  – Sewerage requirements based on design lpcd

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Quantity (lpcd)</th>
</tr>
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<tbody>
<tr>
<td>Drinking</td>
<td>3</td>
</tr>
<tr>
<td>Cooking</td>
<td>5</td>
</tr>
<tr>
<td>Bathing</td>
<td>15</td>
</tr>
<tr>
<td>Washing utensils and house</td>
<td>10</td>
</tr>
<tr>
<td>Ablution/Toilets</td>
<td>10</td>
</tr>
<tr>
<td>Washing of Clothes and other uses</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
</tr>
</tbody>
</table>
Estimating Demand: non-domestic

• Agriculture demand
  – Kharif crop typically rain fed
  – Rabi and Hot Weather crops irrigated

• Others:
  – Industries/ Non-farm enterprises
  – Public school, offices

We need to work with projected future demand!
Water Supply

• Surface Water – lake, rivers, reservoirs, canals, dams, farm ponds

• Groundwater – dug wells, borewells, springs, sub surface bunds, trenches, contour bunds etc.

• Rainwater Rain water harvesting structures
Planning – Putting it all together

• Design and logistics
  – Design and optimization of the distribution network (pipes, canals)
  – Design of water treatment plant
  – Logistics: cost of energy, capital and O&M
  – Simulation of the operation schedule

• Tariff, Subsidy and Ability to Pay:
  – metering, tariff structure
  – Industry/ commercial establishments subsidize domestic use
  – Irrigation: generally subsidized by state
  – Poor households generally subsidized within community

• Institutions, monitoring and feedback mechanism
Agenda

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  – Rural water

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  – Supply side, demand side
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• Sample studies in surface water and ground water
Example: Tanker fed villages in Thane district

Ongoing Projects

- Regional analysis of tanker-fed habitations – Mokhada, Shahpur
- GIS as a representation tool
Surface sources

Tokarkhand reservoir

Thangaon, Nashik

Jambhe reservoir
Musai Reservoir

Water Level (m)

Live storage (Mm3)
# Small/ Medium Dams: Salient Features

<table>
<thead>
<tr>
<th></th>
<th>Name of Project</th>
<th>Musai M.I.Scheme</th>
<th>Dolkhamb M.I.Scheme.</th>
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<tbody>
<tr>
<td>2</td>
<td>Source</td>
<td>Local Nalla</td>
<td>Local Nalla</td>
</tr>
<tr>
<td></td>
<td>Location: State</td>
<td>Maharashtra</td>
<td>Maharashtra</td>
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<tr>
<td></td>
<td>District</td>
<td>Thane</td>
<td>Thane</td>
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<td></td>
<td>Taluka</td>
<td>Shahapur</td>
<td>Shahapur</td>
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<tr>
<td>3</td>
<td>Village</td>
<td>Musai</td>
<td>Dolkhamb</td>
</tr>
<tr>
<td>4</td>
<td>Catchment Area</td>
<td>1.76 Sq.mile</td>
<td>3.68 Sq.miles</td>
</tr>
<tr>
<td>5</td>
<td>Average Annual Rainfall</td>
<td>107.7&quot;</td>
<td>107.46&quot;</td>
</tr>
<tr>
<td>6</td>
<td>75% dependable yield</td>
<td>244 Mcft.</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Gross Storage</td>
<td>134.26 Mcft.</td>
<td>166.08 Mcft.</td>
</tr>
<tr>
<td>8</td>
<td>Dead Storage</td>
<td>5.75 Mcft.</td>
<td>9.32 Mcft.</td>
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<tr>
<td>9</td>
<td>Live Storage</td>
<td>128.51 Mcft.</td>
<td>156.76 Mcft.</td>
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<tr>
<td>10</td>
<td>Reservation for U/s</td>
<td>-</td>
<td>-</td>
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<tr>
<td>11</td>
<td>Annual Gross Utilisation</td>
<td>134.26 Mcft.</td>
<td>166.08 Mcft.</td>
</tr>
<tr>
<td>12</td>
<td>Top of Dam Level</td>
<td>103.00 m.</td>
<td>134.00 m.</td>
</tr>
<tr>
<td>13</td>
<td>H.F.L.</td>
<td>101.50 m.</td>
<td>132.50 m.</td>
</tr>
<tr>
<td>14</td>
<td>F.R.L.</td>
<td>100.00 m.</td>
<td>131.00 m.</td>
</tr>
<tr>
<td>15</td>
<td>M.D.D.L.</td>
<td>89.00 m.</td>
<td>120.00 m.</td>
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<tr>
<td>16</td>
<td>Max. Height of Dam</td>
<td>89.00 m.</td>
<td>19.76 m.</td>
</tr>
<tr>
<td>17</td>
<td>Type of Dam</td>
<td>Earthen Dam.</td>
<td>Earthen Dam.</td>
</tr>
<tr>
<td>18</td>
<td>Length of Earthen Dam</td>
<td>213 m.</td>
<td></td>
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<tr>
<td>19</td>
<td>Length of Waste Weir</td>
<td>44 m.</td>
<td>60 m.</td>
</tr>
<tr>
<td>20</td>
<td>Max.Flood discharge</td>
<td>35.52 Cusecs</td>
<td>9284 Cusecs</td>
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<tr>
<td>21</td>
<td>Location of Waste Weir</td>
<td>Left side</td>
<td>Right flank</td>
</tr>
<tr>
<td>22</td>
<td>Submergence area</td>
<td>65.59 Hect.</td>
<td></td>
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<tbody>
<tr>
<td>22</td>
<td>Canal length</td>
<td>3.00 Km.</td>
<td>7.17 Km.</td>
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<tr>
<td>23</td>
<td>Canal Capacity</td>
<td>12.72 Cusecs</td>
<td>10.21 Cusecs, 4.875 Cusecs</td>
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<tr>
<td>24</td>
<td>Area under command</td>
<td>600 Acres</td>
<td>196 Hect.</td>
</tr>
<tr>
<td>25</td>
<td>(Irrigable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) Gross Command</td>
<td>1300 Acres</td>
<td>980 Acres</td>
</tr>
<tr>
<td></td>
<td>ii)Cultural Command</td>
<td>1200 Acres</td>
<td>780 Acres</td>
</tr>
<tr>
<td></td>
<td>iii) Irrigable Command</td>
<td>600 Acres</td>
<td>496 Acres</td>
</tr>
<tr>
<td>26</td>
<td>Village benefitted</td>
<td>1) Musai, 2) Khaire.</td>
<td>1) Dolkhamb 2) Hedwali</td>
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<tr>
<td>27</td>
<td>Village (Taluka wise)</td>
<td>-</td>
<td>3) Bandanpada 4) Sakurli</td>
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<tr>
<td>28</td>
<td>Total Cost of the Project</td>
<td>Rs.11,110.00</td>
<td>Rs.17,03,275/-</td>
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<td>29</td>
<td>B.C.Ratio</td>
<td>2.31</td>
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<td>Name of Division: TMID Khalwa Thane</td>
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<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
<th>31</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Scheme</td>
<td>Adivali MI Thane Shahapur</td>
<td>Dolkham MI Shahapur</td>
<td>Jambhe MI Shahapur</td>
<td>Kharade MI Shahapur</td>
<td>Musai MI Shahapur</td>
<td>Velholi MI Shahapur</td>
<td>Hattipada MI Vasai</td>
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<tr>
<td>Type viz. LMI, MI, LIS, ST etc.</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
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<td>District</td>
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<tr>
<td>Taluka</td>
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<tr>
<td>Sub-basin No.</td>
<td>21</td>
<td>21</td>
<td>21</td>
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<td>21</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

1. Designed Storage in Mcum
   a. Gross
   b. Live
   c. Maximum live storage observed in the year
   d. Total (3a+3b+3c+3d)
2. Projected water use in Mcum for
   a. Kharif
   b. Rabi
   c. Hot weather
   d. Non irrigation
   e. Total (4a+4b+4c)
3. Water drawn at canal head for irrigation
   a. Kharif
   b. Rabi
   c. Hot weather
   d. Total (4a+4b+4c)
4. Lifts From Tank
   a. Kharif
   b. Rabi
   c. Hot weather
   d. Total (4a+4b+4c)
5. Evaporation Losses
   0.179
   0.609
6. Leakages through dam
   0.068
   1.887
7. Total (4d+5+6+7)
   1.752
   2.496
8. Actual Area Irrigated by Canals
   a. Kharif
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
   b. Rabi
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
   c. Hot weather
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
9. Actual Area Irrigated by Tank lifts
   a. Kharif
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
   b. Rabi
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
   c. Hot weather
   i. Area
   ii. Irrigation System Performance (ha/Mcum)
10. Non irrigation use
   0.150
   0.550
   0.250
   0.360
   0.140
   0.182
   0.000
11. Live Storage on 30th June
   0.088
   1.393
   2.885
   0.521
   1.070
   0.575
   0.112
12. Replenishment in the month June
   0.0
   0.0
13. Area Irrigated on wells/rivers/drainage in
   0.0
   0.0
Musai Reservoir and tanker fed villages
Musai reservoir- Proposed network
Ground water

• Primary source for drinking water and irrigation
• Increasing exploitation of groundwater a growing concern
• Planning questions – Scarcity assessment and management, interventions for increasing groundwater recharge, creating alternatives to GW use
Regional groundwater modeling—Observation well data

Pre-monsoon GEC-significant long-term trends (in m/year)

3 quantiles of the range of trends
-6.1634 - 0.2969
-0.2969 - 0.2041
-0.2041 - 4.0794

Post-monsoon GEC-significant long-term trends (in m/year)

3 quantiles of the range of trends
-1.3900 - 0.2548
-0.2548 - 0.2489
0.2489 - 4.6692
Sample studies: Groundwater analysis

• Large scale watershed activities for GW recharge
  – Analysis of watershed interventions and programs

• Small-scale watershed modeling for designing interventions to strengthen drinking water wells
## Key Engineering Activities

### Urban
- Design of WS schemes
- Design of sanitation systems
- Energy and water efficiency
- Simulation of schedules
  - Tariff structure

### Rural
- Single and multi-village schemes, bulk water grid
- Ensuring source quality and quantity
- Regional GW enhancement through watershed activity

### Planning
- Water balance computations – basin and district
  - Scarcity and mitigation
- GIS and planning processes, annual action plans

### Consultancy and Research
- Regional assessment expertise
  - Failure analysis and alternatives
- Supporting programs like MSNA, NRDWP, IWMP
- Long-term drinking water security
Case studies

• Next up- 4 examples of CTARA’s academic output
  – Groundwater and watershed analysis
  – Rural water supply planning and design
  – Urban water supply scheme analysis
  – Water quality/ sanitation
Thank you