Strengthening Institutional Framework for Flood Management in Bihar

Developing a Framework of Action
## Purpose of study

Flood management is central to narrative of Bihar

## Structure, Methodology & Approach

- Multi-disciplinary Team, Deep Engagement, Extensive Surveys, Open Consultations, Structured Analysis
- Understanding the Water Resources Department inside out to sketch the institutional setup

## Phase I – Framework for Action

### Conducting Phase I

Scoping studies to develop structure, leadership, field-staff, community and support system surveys

### Findings of Phase I

Alert engineer-driven institution lacking capacity to adopt technologies and institutionalize best practices

## Phase II – Roadmap for Reform

### Conducting of Phase II

Co-developing specific set of ideas based on findings of Phase I and outlining a roadmap for reform

### Ideas for Roadmap & Next Steps

- Prioritize key areas for action, build joint teams to formulate ideas, and conduct extensive consultations
- Technology organizational and institutional aspects training & skill development, community engagement

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**Developing a Framework of Institutional Strengthening**
Purpose of Study

- People of Bihar face recurring disaster of floods
- Flood management is a continuous cycle in Bihar
- Flood management practices need to improve every year
- Institutional strength of Water Resources Department is central to continuous improvement
- No previous study focused on analysis and strengthening of the institutional capabilities of WRD with respect to flood management
- Research on institutional aspects will enable policymakers to chart a roadmap of excellence
Developing a Framework of Institutional Strengthening
## Structure, Methodology and Approach

### Multidisciplinary Team
- Ranu Sinha: Extensive Water Sector Experience at WB
- Martin Burton: Engineering Expert in Water Resources
- Ghanshyam Tiwari: Organizational Consulting Experience

### Phase I – Framework for Action
- Deep Engagement at all levels of Water Resources Department (WRD)
- Scoping visits to flood divisions and supporting institutions and focus group discussions at WRD to outline the approach
- Survey of leadership, field staff, community, supporting institutions
- Parallel study of projects and case-studies matching WRD institution
- Structuring the findings and developing framework for action

### Phase II – Roadmap for Reform
- Building support in WRD to co-own the development of roadmap
- Prioritizing areas for reform
- Conceptualizing ideas and co-developing with WRD
- Engaging with experts/institutions that showcase ideas in action
- Outlining a set of specific ideas in prioritized areas and engaging WRD for a plan for implementation

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**ICG International Growth Centre**

Developing a Framework of Institutional Strengthening
Phase I – Developing a Framework for Action

1. Analysis and Diagnosis: Overall Institutional Framework

2. Analysis and Diagnosis: The Organization in its Institutional Context
Developing a Framework of Institutional Strengthening

Conducting Phase I – Outlining Steps

- Representative survey of key stakeholders including WRD senior leadership and field officers, community members, PRI, FGDs at village level
- Survey of officers at supporting organizations FMIS and WALMI
- Discussions at WRD and FMIS and existing research used for survey design
- Preliminary visits to Ghandak basin helped in validating the design
- Analysis of Irrigation Act, annual reports, research papers and other published materials helped in contextualizing the information
- Interaction with other agencies (DMD and SDMA) sharpened the focus
- Analysis of data and other information conducted through new as well as established frameworks for organizations
## Conducting Phase I: Design of Surveys

<table>
<thead>
<tr>
<th>WRD Field Survey</th>
<th>Community Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of knowledge held about flood risk</td>
<td>Understand the impact on flood affected households, businesses and industries in flood</td>
</tr>
<tr>
<td>Quality of interactions within the WRD on flooding issues;</td>
<td>Identify level of knowledge held about flood risk</td>
</tr>
<tr>
<td>Extent and timeliness of flood warnings</td>
<td>Level and quality of interactions with the WRD on flooding issues</td>
</tr>
<tr>
<td>Quality of embankment maintenance and management</td>
<td>Extent and timeliness of flood warnings</td>
</tr>
<tr>
<td>Quality of staff skills, training, and technical knowledge</td>
<td>Knowledge held about embankment maintenance and management</td>
</tr>
<tr>
<td>Map processes and quality of decision making</td>
<td></td>
</tr>
<tr>
<td>Identify types of technology, hardware and software for flood management</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WRD Leadership Survey</th>
<th>Supporting Organizations Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiences, professional growth, organizational practices, priorities, and institutional strengths and weaknesses</td>
<td><strong>WALMI survey:</strong> Infrastructure, training, processes, engagement and knowledge</td>
</tr>
<tr>
<td></td>
<td><strong>FMIS survey:</strong> Technology, engagement, resources, staffing and knowledge</td>
</tr>
</tbody>
</table>
## Basin Wise flood prone and protected areas

<table>
<thead>
<tr>
<th>Name of the Basin</th>
<th>Catchment Area (Sq. Km)</th>
<th>Length of River in Bihar (Km)</th>
<th>Embankment Constructed (Km)</th>
<th>Flood Prone Area (Sq.Km)</th>
<th>Protected Area (Sq. Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ganga</td>
<td>19322</td>
<td>445</td>
<td>596.92</td>
<td>12920</td>
<td>4300</td>
</tr>
<tr>
<td>Kosi</td>
<td>11410</td>
<td>260</td>
<td>387.51</td>
<td>10150</td>
<td>9300</td>
</tr>
<tr>
<td>Burhi Gandak</td>
<td>9601</td>
<td>320</td>
<td>704.26</td>
<td>8210</td>
<td>4010</td>
</tr>
<tr>
<td>Kiul Harohar</td>
<td>17225</td>
<td></td>
<td>14.00</td>
<td>6340</td>
<td>NIL</td>
</tr>
<tr>
<td>Punpun</td>
<td>9026</td>
<td>235</td>
<td>37.62</td>
<td>6130</td>
<td>260</td>
</tr>
<tr>
<td>Mahananda</td>
<td>6150</td>
<td>376</td>
<td>225.33</td>
<td>5150</td>
<td>1210</td>
</tr>
<tr>
<td>Sone</td>
<td>15820</td>
<td>202</td>
<td>59.54</td>
<td>3700</td>
<td>210</td>
</tr>
<tr>
<td>Bagmati</td>
<td>6500</td>
<td>394</td>
<td>400.79</td>
<td>4440</td>
<td>3170</td>
</tr>
<tr>
<td>Kamla Balan</td>
<td>4488</td>
<td>120</td>
<td>184.90</td>
<td>3700</td>
<td>2810</td>
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<tr>
<td>Gandak</td>
<td>4188</td>
<td>260</td>
<td>511.66</td>
<td>3350</td>
<td>3350</td>
</tr>
<tr>
<td>Ghaghra</td>
<td>2995</td>
<td>83</td>
<td>132.90</td>
<td>2530</td>
<td>790</td>
</tr>
<tr>
<td>Chandan</td>
<td>4093</td>
<td>118</td>
<td>83.18</td>
<td>1130</td>
<td>80</td>
</tr>
<tr>
<td>Badua</td>
<td>2215</td>
<td>130</td>
<td>NIL</td>
<td>1050</td>
<td>NIL</td>
</tr>
<tr>
<td>Lalbakeya</td>
<td></td>
<td></td>
<td></td>
<td>54.35</td>
<td></td>
</tr>
<tr>
<td>Adhwara</td>
<td></td>
<td></td>
<td></td>
<td>181.50</td>
<td></td>
</tr>
<tr>
<td>Bhuthi</td>
<td></td>
<td></td>
<td></td>
<td>54.70</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>68800</strong></td>
<td><strong>29490</strong></td>
</tr>
</tbody>
</table>

**IGC International Growth Centre**
**Institutional Strengthening**
Conducting Phase I Surveys

- Three key river basins (Bagamati, Kosi, Mahananda) were selected

- Selections for field survey and community survey:
  - Divisions (2) and sub-divisions (4) were selected based on flooding history and inputs from the WRD officers in Patna
  - Field officers (EE, AE, JE) were interviewed depending on availability (22)
  - Villages (4 per basin) included outside, on and inside embankments (12)
  - Respondents in villages were mixed: caste, gender, profession etc. (145)
  - PRI members were also part of the respondents in each village
  - Focused group discussions were held in every village (12)
  - Leadership survey was sent online as well as on paper (9)

- WRD Field and Leadership survey was conducted by the study team
- Community survey was conducted by professional survey team
Developing a Framework of Institutional Strengthening
### Conducting Phase I: List of Villages and Associated Households

<table>
<thead>
<tr>
<th>Village</th>
<th>River Basin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bagmati</td>
<td>Mahananda</td>
</tr>
<tr>
<td>Kuin</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Rampur Kanth</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Benipur</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Janardh</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Lalganj</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Kath Ghar Durgapur</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Lakh Tola</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Bhola Marhi</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Kalyanpur</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Kodhli</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Lokha</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Mansi Piprahi</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>49</td>
</tr>
</tbody>
</table>
## Findings of Phase I: Defining Institutional Gaps

<table>
<thead>
<tr>
<th>Institutional Gaps</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People Gap</strong></td>
<td>Disconnects in the mission and function of organization that arise when key positions remain unoccupied or employed by staff with mismatching capabilities</td>
</tr>
<tr>
<td><strong>Process Gap</strong></td>
<td>Inefficiencies in functioning and decision-making of organization arising from the way staff engage with hierarchy largely in a top-down manner, at peer level, and with stakeholders</td>
</tr>
<tr>
<td><strong>Technology Gap</strong></td>
<td>Existing processes, practices, methods, and tools do not integrate technological systems and tools</td>
</tr>
<tr>
<td><strong>Resources Gap</strong></td>
<td>Funding shortages reduce performance of institution</td>
</tr>
<tr>
<td><strong>Support System Gap</strong></td>
<td>Inadequate setup to help the department in supplementary (non-core) functions, long-term strategic projects and capacity building</td>
</tr>
<tr>
<td><strong>Ecosystem Gap</strong></td>
<td>Lack of vision and lack of ownership of overall goals of organization by staff and stakeholders</td>
</tr>
<tr>
<td><strong>Coordination Gap</strong></td>
<td>Methods to engage with partner organizations are weak or missing</td>
</tr>
</tbody>
</table>
Findings of Phase I: Model of Analysis

<table>
<thead>
<tr>
<th>Structure:</th>
<th>Comprises the organisation chart, job descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems:</td>
<td>The processes and procedures for getting the work done</td>
</tr>
<tr>
<td>Style:</td>
<td>The way that management behaves, including showing what is important to the organisation</td>
</tr>
<tr>
<td>Staff:</td>
<td>The people in the organisation - their capabilities, needs, strengths and weaknesses</td>
</tr>
<tr>
<td>Shared values:</td>
<td>The culture of the organisation</td>
</tr>
<tr>
<td>Skills:</td>
<td>The capabilities possessed by the organisation as a whole</td>
</tr>
<tr>
<td>Strategy:</td>
<td>A coherent set of actions to further the aims and objectives of the organisation</td>
</tr>
<tr>
<td>Indicators</td>
<td>Survey Findings</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Field offices are understaffed; vacancies in all basins | • Leaders concur that there is a shortage of field staff  
• Department has poor dynamic and flexible staff management and little to no planning for staff shortages post-retirement  
• Inadequate number of staff to monitor all flood risk areas |
| Uniform level of technical skills             | • Very few respondents understand remote sensing and GIS techniques  
• Evidence of high competency in river basin planning and preparation of Detailed Project Reports for water resources projects  
• Relatively equal technical expertise of senior level staff (EE, SE, CE) at Division level with junior level staff (JE, AE).  
• Few have received specialized formal training (barring seminars and introductory trainings) on flood management and associated aspects such as environment, ecology, remote sensing, flood forecasting, etc.  
• Little provision for training of newly transferred staff (Irrigation Division to Flood Division)  
• Overall desire to increase frequency & quality of flood management trainings |
| Need for more frequent technical training for all staff | • 8 out of 9 senior survey respondents think the promotion policy needs to be revised and reformulated  
• Promotions have weak linkage to performance & merit  
• Need for new time bound merit based promotion system |
People & skills gaps cause suboptimal decision-making, increased costs.

Inadequately skilled and motivated staff

- Inadequate training (in flood management techniques, inspections, river erosion, etc.)
- Staff promoted without commensurate training
- Inadequate capability and knowledge in community engagement

Lack of knowledge in:
- Flood management
- Role and effectiveness of flood infrastructure
- Flood protection works
- River morphology
- Flood fighting
- Infrastructure inspection
- Use of computers
- Community engagement

Effect
Problem
Cause
Staff vacancies & dysfunctional promotion system affect spirit

**Problem**
- Insufficient staffing
  - Junior level (JE) staff vacancies not being filled
  - Positions not being filled once staff retire
  - Positions not being filled once staff retire
  - Positions not being filled once staff retire
  - Positions not being filled once staff retire

- Performance and remuneration
  - Remuneration not linked to performance
  - Remuneration not linked to performance
  - Remuneration not linked to performance
  - Remuneration not linked to performance

- Significant dissatisfaction with promotion system
  - Dissatisfied, demotivated staff
    - Talented staff not promoted
    - Promotion not seen as merit based

**Cause**
- Staff promoted through reservation system. Not seen as fair or rewarding ability
- Promotion from junior positions can take years. Some JEs in post for 20-30 years

**Effect**
- Capable people don't perform to their optimum
- Young graduates not willing to join the service

**Dissatisfied, demotivated staff**

**Insufficient staffing**

**Performance and remuneration**
### Systems & Process Gap I

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Survey Findings</th>
</tr>
</thead>
</table>
| Mismatch in priorities between various levels in hierarchy | - All survey respondents claimed that primary proposals originate at the JE/AE level. However, role of JE/AE is insignificant in the technical review and decision-making process  
- Maintenance decisions sometimes disconnected from ground realities, little room for inputs from junior officers  
- Proposals rejected without adequate assessment of field situation |
| Top-down decision-making                            | - Most senior survey respondents feel JE/AE shouldn’t have decision-making powers in critical maintenance, anti-erosion works  
- Field officers feel more of their inputs should be taken into consideration |
| Lack of clarity in decision-making                  | - Each decision involves JE/AE (making the proposal), EE, SE, CE and experts in Patna conducting the review  
- Experts not traveling to field to inspect sites before decisions are made on projects  
- Decision-making processes need to be simplified |
| Delays in approvals due to time spent chasing proposals through multiple nodes | - All leaders agree that even the small proposals take up to two months to be approved and sanctioned  
- Anti-erosion works sometimes not completed in time  
- Results in increased risk to flood protection infrastructure |
| Weak inspection & maintenance systems               | - Insufficient number of inspections conducted (e.g. sometimes once a year)  
- Inadequate communication & transport systems for inspections |
# Systems & Process Gap II

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Survey Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate communication &amp; flood</td>
<td>• Inadequate lead time to provide information on flood risk and warnings</td>
</tr>
<tr>
<td>warning systems</td>
<td>• More data to be sent to divisions and sub-divisions on flood risk, rainfall</td>
</tr>
<tr>
<td></td>
<td>• Need for better patrolling and improved communication systems for flood warnings</td>
</tr>
<tr>
<td></td>
<td>• Need to engage community</td>
</tr>
<tr>
<td>Lack of adequate resources</td>
<td>• Poor facilities and equipment for field staff (e.g. vehicles, motor boats, offices)</td>
</tr>
<tr>
<td></td>
<td>• Higher quality materials required to carry out repair works</td>
</tr>
<tr>
<td>Training system is inadequate</td>
<td>• All leaders desire basic to advanced training in multiple subjects ranging from IT to Flood Management Systems</td>
</tr>
<tr>
<td></td>
<td>• No respondents mentioned any advanced trainings taken at local institutes</td>
</tr>
<tr>
<td></td>
<td>• National Institute of Hydrology (NIH) is only support system for advanced training, very few officers have training in this</td>
</tr>
<tr>
<td></td>
<td>• On specific subjects related to flood management, officers demanded advanced training</td>
</tr>
</tbody>
</table>
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Poor systems increase risks

Inadequate flood warning

- Risk to lives and property increased
- Inadequate lead in time to provide information on flood risk and warnings
- Need improved communication systems for flood warnings
- Need for more information for Division/Sub-Division on flood risk, rainfall, etc.

Inadequate preparation for floods

- Risk to lives and property increased
- Service roads and roads on embankments need repairing
- Flood fighting materials need to be located near vulnerable sites
- Proposed erosion protection works not approved
- Lack of sufficient funds
- Lack of time to carry out anti-erosion works
- Coding of spurs should take place – not done at present

Inadequate maintenance system

- Flood protection works not properly maintained
- Lack of delegation of decision-making on maintenance
- Budget allocations cut without understanding actual situation and needs
- Higher quality materials required for embankment repairs
- Requests for higher quality materials for embankment repairs cut by TSC
- Bad experience with geocbags – not learning from experience
- Some contractors are ineffective, resulting in poor-quality works

Effect

Problem

Cause
Inadequate and many-hop processes cause delay and risk WRD assets

- **Cause**
  - Insufficient/inadequate vehicles for inspections
  - Insufficient/inadequate communication and transport systems for inspections
  - Insufficient number of inspections - hardly done once per year
  - Experts from Patna visit during non-flood period when river conditions are very different and make recommendations
  - Anti-erosion works not completed in time
  - TSC needs to visit vulnerable sites before making decisions
  - Decision making processes need to be simplified

- **Problem**
  - Inadequate inspection
  - Inadequate checking and authorisation system

- **Effect**
  - Embankments at risk
  - Embankments and flood protection works at risk
  - Risk areas not assessed, likelihood of breach increased
  - Increased risk to embankments

- **Support systems**
  - Increased risk to embankments
  - Not able to assess flood risk sites
  - Damage to embankments

- **Inspection system**
  - Insufficient/inadequate vehicles for inspections
  - Insufficient/inadequate communication and transport systems for inspections
  - Insufficient number of inspections - hardly done once per year
  - Experts from Patna visit during non-flood period when river conditions are very different and make recommendations

- **Checking and authorization system**
  - Proposals for work to be done need to be done in time
  - Need timely inspections of works by TSC
  - Decision making processes need to be simplified

- **Flood fighting system**
  - 24/7 patrolling of embankments is essential during flood season. Not adequate at present
  - Cannot access at-risk areas due to damaged roads

- **Support systems**
  - Lack of support from police in preventing theft of porcupines
  - Encroachment on the embankment should be prevented

Proposals sent by the AE or EE to Patna are rejected by TAC without checking situation in the field
## Coordination & Collaboration Gap

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Survey Findings</th>
</tr>
</thead>
</table>
| Lack of collaboration within WRD                                          | • Decision-making too centralized on issues of inspection, maintenance, anti-erosion  
• More collaboration needed between JE/AE responsible for embankment and experts in Patna who have final say  
• Lack of collaboration among division level staff                          |
| Little to no coordination with partner agencies (e.g. WRD and DMD); Narrow focus on building and protecting flood management infrastructure | • Several senior leaders noted flood management is an integrated exercise and the coordination is lacking  
• Lack of clarity in roles and responsibilities within staff in the WRD and DMD – before, during, after a flood event  
• Better coordination required among GoB departments at district and state level |
| Lack of community centered approach; community stakeholders not integrated into WRD processes; WRD stakeholders are embankments NOT communities at risk | • Need for greater coordination with community during flood events, embankment patrolling & inspection  
• Lack of integration of community into WRD processes  
• Potential to engage in information sharing & flood warnings |
Coordination gap, lack of empowerment of JE/AE affect accountability

**Problem**

- Poor communication and awareness of flood risks and opportunities for mitigation
  - Lack of collaboration with DMD
  - Lack of collaboration with other GoB departments at District level
  - Lack of coordination between field staff and senior officers
  - Sometimes EE or SE commence some work which is then over-ridden by the CE.

**Cause**

- Staff disempowered
  - JE has no decision-making powers on work required, but held responsible if embankment breaches
  - Decisions made in Patna, not at the local District level
  - Too much decision-making by Patna

**Effect**

- Coordination gap
- Costs increased

- Coordination gap, lack of empowerment of JE/AE affect accountability
Coordination gaps also create inefficiencies and risks

- Inefficient use of resources
- Increased flood risk

Lack of coordination of effort and activities by key stakeholders

Lack of an integrated approach to flood management

Effect
- Problem
- Cause

Developing a Framework of Institutional Strengthening
## Resources & Funding Gap

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Survey Findings</th>
</tr>
</thead>
</table>
| Funding shortages reduce performance and quality of institution | - Discussions with senior leaders reveal a project-to-project mindset on funds  
- Funds are limited for upgrading office setup, facilities to field officers and field equipment |
| Insufficient funds for maintenance works                    | - Division officers felt funding insufficient to carry out maintenance works on the embankments and roads to embankments  
- Original budgets and cost estimates reduced; only low cost options approved  
- Resulting in poor maintenance works on roads and flood infrastructure  
- Need to maintain or remain within 80% of original budget requests  
- May lead to future increase of embankment failures |
| Inadequate equipment and technological resources            | - Lack of quality transport equipment, poor quality offices, need to increase communication devices or night vision equipment  
- Poor technical software and IT for communication and data collection at division levels  
- Poses constraints for officers to conduct inspections and reach flood sites |
Resource and funding gaps create poorly operational infrastructure.
Findings of Phase I - Community Survey

Community Survey:

- 3 level of insights: aggregate level of information, interaction and engagement on floods, variations at basin level and variations based on type of village (inside / on / outside embankment)

- Common feelings amongst community:
  - Water logging & siltation has increased
  - Maintenance of embankments slow; low levels of satisfaction
  - Lack of warning systems
  - Lack of coordinated community engagement
### Total Community Survey

- n=145

![Circle chart showing distribution of respondents across Bagmati, Mahananda, and Kosi](image)

#### Focus Group Discussions (12)

- Similar experiences across basins
- Inside embankments, flood caused by sudden release of water
- Outside, watelogging remained the chief grievance and is increasing. Dalits most affected.
- Warnings not issued regarding release of water in river
- Embankments increased flooding in Mahananda and Kosi
- Dissatisfaction with maintenance
- Complaints /suggestions ignored
- Rudimentary forecasting methods
- Collaboration within is low

### Flood cannot be prevented but can be managed better

<table>
<thead>
<tr>
<th>Response</th>
<th>River Basins</th>
<th>Location</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bagmati</td>
<td>Mahananda</td>
<td>Kosi</td>
</tr>
<tr>
<td>Do you think floods can be prevented No.,(%)</td>
<td>19 (40.4)</td>
<td>16 (32.7)</td>
<td>16</td>
</tr>
<tr>
<td>yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood protection can be better `No.,(yes)</td>
<td>25 (53.2)</td>
<td>18 (36.7)</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Majority unaware of the WRD and its functioning

<table>
<thead>
<tr>
<th>Which department is responsible for Flood protection No.,(% correct)</th>
<th>Bagmati</th>
<th>Mahananda</th>
<th>Kosi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 (53.2)</td>
<td>22 (44.9)</td>
<td>16 (32.7)</td>
<td>31 (41.9)</td>
<td>63 (43.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you know any WRD staff No.,(yes)</th>
<th>Bagmati</th>
<th>Mahananda</th>
<th>Kosi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (6.4)</td>
<td>9 (19.4)</td>
<td>10 (20.4)</td>
<td>10 (13.5)</td>
<td>22 (15.2)</td>
</tr>
</tbody>
</table>

### Community participation in rebuilding is low

<table>
<thead>
<tr>
<th>Does community collaborate during flood No.,(% yes)</th>
<th>Bagmati</th>
<th>Mahananda</th>
<th>Kosi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 (53.2)</td>
<td>19 (38.8)</td>
<td>14 (28.6)</td>
<td>33 (44.6)</td>
<td>58 (40.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does community help in rebuilding No.,(% yes)</th>
<th>Bagmati</th>
<th>Mahananda</th>
<th>Kosi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (17.0)</td>
<td>5 (10.2)</td>
<td>9 (18.4)</td>
<td>11 (14.9)</td>
<td>22 (15.2)</td>
</tr>
</tbody>
</table>
Findings of Phase I: WALMI Survey

- WALMI’s role in flood management is both strategic and operational
  - At strategic level, WALMI is responsible for developing institutional linkages for research and disseminating information within the WRD
  - At operational level, WALMI is responsible for offering training to AE and JE level staff on aspects of flood management
- Today nearly a 50% shortage of staff in WALMI at all levels
- 50% shortage in the number of training staff, which has a more significant impact of the quality and quantity of trainings that WALMI can provide to WRD staff
- Training apparatus is subject to ad hoc mechanisms and frequent transfers of staff
- Does not offer any training to officers above the rank of AE
- No evidence of institutional linkages created or strengthened by WALMI
- Focus on flood management is limited to three trainings
Findings of Phase I: FMIS Survey

• Aim of FMIS to generate and disseminate timely and customized information in order to support flood control and management in the flood prone areas of Bihar
• FMIS can generate satellite imagery of rivers in northern Bihar showing the movement and pathway of a flood
• Does not have the resources or capability to do real-time modeling
• No database of flood events, other than the reports provided in the annual report
• Essential for FMIS to generate database so that decision-making in Patna and in the field can be facilitated to cover high-risk areas of embankments and chart future trajectory of river movement
• Not all field offices of the WRD can take advantage of the satellite maps and data provided by the FMISC as they are not connected to the Internet; no computers.
• Need for WRD to join together the field offices with the excellent work of the FMISC in Patna so that a streamlined and integrated flood data gathering and sharing system can be put in place
### Summary of Phase I Findings

<table>
<thead>
<tr>
<th>Institutional Gaps</th>
<th>Findings</th>
</tr>
</thead>
</table>
| **Skills**        | • Technical know-how of staff needs to be improved  
                    • Need for research & development unit within the WRD that focuses on training and dissemination of latest flood management techniques to WRD staff  
                    • Need to make professional human resources development and management a core objective of the WRD |
| **Style of Leadership** | • Extensive emphasis on top-down decision-making  
                         • Need for leadership to transition from construction agency to management agency; evolve to “predict and prevent”.  
                         • Need to set mandate for a more professional agency  
                         • Provide strategic leadership to transform Department |
| **Staff**         | • Address staff shortages and weak promotion processes  
                    • Need a specialist HRM cell, staffed with experienced HRM people  
                    • Need to identify each individual’s skills and staff to match skills  
                    • Need to identify younger, capable staff and fast track promotion |
| **Systems**       | • WRD systems appear to be weak; communications systems are poor  
                    • Liaison/communication with communities poor  
                    • Mobile technology and modern communication systems can offer WRD significant opportunity to address systems gaps and leap frog |
| **Strategy**      | • Need to define a vision for flood management for the future; shift focus away from construction to management  
                    • Engage communities directly, integrate latest technology, improve training |
WRD today focuses mainly on engineering aspects

- Process Overheads and Paper-work (Proposals, Expert field visits, Paying contractors and laborers, TAC, SRCC)
- Intelligence (FMIS, Technology Use, Innovation, Modelling etc)
- Knowledge (Research, WALMI, Database, Partnerships, Training etc)
- Construction (New Projects, Maintaining Structures)
- Monitoring (Flood Monitoring Cell, Field Inspections of Projects)

Mismatch of activities and forces

- river course change
- sedimentation
- human settlements
- climate change
- unpredictability

Continuous improvements
- latest technologies
- resources
- leadership
- good fortune

Developing a Framework of Institutional Strengthening
Next Steps: Future WRD Scenario

- Process Overheads and Paper-work (Proposals, expert field visits, Paying contractors and laborers, TAC, SRCC)
- Monitoring (Flood Monitoring Cell, Field Inspections of Projects)
- Construction (New Projects, Maintaining Structures)
- Intelligence (FMIS, Technology Use, Innovation, Modelling etc)
- Knowledge (Research, WALMI, Database, Partnerships, Training etc)

Developing a Framework of Institutional Strengthening
Phase II : Developing Roadmap for Reform

Phase II Represents the “Design” stage

- Focus on five key challenges:
  - Skills
  - Style of Leadership
  - Staffing
  - Systems
  - Strategy

- Interaction & dialogue with WRD
- National & International consultations, best practices

Inclusive, Implementable and Sustainable Criteria for reform
Developing a Framework of Institutional Strengthening

Conducting Phase II: Prioritizing areas for reform

Institutional Gaps

- People Gap
- Process Gap
- Technology Gap
- Resources Gap
- Support Systems Gap
- Ecosystem Gap
- Coordination Gap

Ideas for Roadmap

- Technology
- Organizational and Institutional Aspects
- Skill and Training
- Community Engagement

Areas for Reform

- Skills
- Style of Leadership
- Systems
- Staffing

Developing a Framework of Institutional Strengthening
<table>
<thead>
<tr>
<th>Name of Organization</th>
<th>Key areas of engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh Water Development Board</td>
<td>Functions, operations of the Flood Forecasting and Warning Centre</td>
</tr>
<tr>
<td>Center for Environmental &amp; GIS</td>
<td>Understand research &amp; knowledge development arm for flood and water resources management in Bangladesh</td>
</tr>
<tr>
<td>Institute of Water Modeling</td>
<td>Explore potential for development of center of excellence in the field of water modeling, computational hydraulics, and allied sciences</td>
</tr>
</tbody>
</table>
| Indian Institute of Technology Delhi and Roorkee; Preliminary National Institute of Technology Patna | • Potential of research and training engagement in flood management  
• Organizational improvement required for managing floods, technology upgrades in flood management                                               |
| Water Resources Planning Organization, Bangladesh        | Understanding national policy framework for water management in Bangladesh                                                                                                                                     |
## Phase II Findings: Technological Roadmap

<table>
<thead>
<tr>
<th>Ideas</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| **Online database of basin-level flood risk** | • Database of basin-specific flood risks: past flood events, their impact, occurrence, quantity and extent of damage, types of flood protection infrastructure  
  • Risk-rating system, such as risk based color coding  
  • Develop practice of real-time and decentralized informed decision making  |
| **Transport equipment & communication tools** | • Modern, well maintained all-terrain vehicles, motor boats that can be utilized by field officers to conduct inspections  
  • Communication equipment such as radio technology, satellite phones, night-vision equipment, internet connectivity  |
| **Flood Risk Mapping & Flood Forecasting Model** | • Models for each of river basins  
  • Coupled with detailed flood risk mapping, this becomes useful decision making tool fro WRD and Disaster Management  
  • Scope of FMISC must be enhanced to enable this  |
| **Flood Early Warning & Dissemination Systems** | • System to provide lead time of at least three days advance notice  
  • Example of the Bangladesh Flood Forecasting and Warning Centre (FFWC) in the Bangladesh Water Development Board is an excellent case study  
  • Set up a dedicated flood forecasting and early warning cell within the WRD  |
| **Embankment Asset Management System** | • Robust electronic system to document and maintain status and history of the 2500 Km long embankment system  |
## Phase II Findings: Organizational & Institutional Roadmap

<table>
<thead>
<tr>
<th>Ideas</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Enhancing scope of Planning & Research Division | • Disseminating best practices of flood management, structural repairs and embankment maintenance across divisions  
  • Establish benchmark of excellence and publish annual score  
  • In-house Knowledge and Quality Center with a vision to assess progress and technological advancement of each of the divisional units of the WRD |
| Reconstructing Human Resource Apparatus of Organization | • Autonomous institutions for professionals specialized/multidisciplinary skilled such as hydrology, geomorphology, embankment maintenance, flood control measures, flood forecasting data collection and analysis and knowledge on state of the art technologies in flood management  
  • For example, CEGIS and IWM in Bangladesh enjoy high levels of autonomy to recruit experts and retain |
| Strategic Specialization in Emerging Areas of Flood Management | • Urgent need to recruit people with multi-disciplinary education  
  • Encourage full-time postgraduate education; well-established practice in Bangladesh where almost all senior level officers hold postgraduate degrees  
  • Focus on specialization in flood forecasting and building of modern flood structures, among other technical specializations in flood management |
| Dynamic Planning Structure of WRD Staff | • Linkages with external organizations; make IIT and NIT Patna national level centers for research on flood management, remote sensing and GIS  
  • In Bangladesh, CEGIS and IWM play an instrumental role in developing intelligence and planning for flood management; institutions can reach out to universities and researchers to work on projects in Bangladesh  
  • IIT Roorkee has linkages with several WRDs |
<table>
<thead>
<tr>
<th>Ideas</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Developing a Culture of Skill Development | • Integrate training and skill certification requirements into promotion  
• Mandatory training on flood and disaster management techniques  
• Develop a structured policy of job rotation                                                                                                                                                                         |
| Linkages with Education and Research Institutes | • Enable training, lecture and projects at different institutes and research centers                                                                                                                                                                    |
| Restructuring WALMI                        | • Strengthen training apparatus at WALMI such that AEs and JEs placed in flood-prone river basins of Bihar are adequately skilled and trained  
• WALMI driven assessment for annual training needs of WRD where each employee is surveyed to assess his/her training needs  
• Need to develop right staffing framework for WALMI; hire core multidisciplinary team coordinating the training calendar and pool of researchers and trainers  
• WALMI to play leading role in integrating and disseminating international and national research and best practices on flood management                                                                                           |
| Skill Development & Training Plan         | • Conduct statewide training needs assessment of WRD staff from CE to JE to establish requirements of training  
• Module design and curriculum development  
• Flood training schedule for each cadre of staff  
• Assess and monitor impact of training on staff                                                                                                                                                                     |
<table>
<thead>
<tr>
<th>Ideas</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raising Public Awareness</td>
<td>• Awareness of Risks, embankment safety and community responsibility</td>
</tr>
</tbody>
</table>
| Basin-wise Community Flood Planning| • Basin-specific plans for flood fighting should directly engage the community  
• Adopt, build upon and strengthen local knowledge of communities  
• Relationships-capital of JE-Villagers should be tapped institutionally |
| Community Flood Mgmt Committees   | • CFMCs flood-affected areas as an effective institutional platform for directly incorporating participation of communities  
• Committees can be organized to serve as community representatives, focal points or community partners for basin-level flood planning and can be activated during flood events  
• Participatory planning via CFMC for emergency situations can help build trust and confidence among stakeholders, enhance cooperation, facilitate information sharing and encourage regular communication  
• Committees can play vital role in disseminating early warning information received from WRD officials directly to other members of the community  
• CFMCs can run local training programs to train communities on flood protection measures |
| Community Flood Early Warning Systems | • WRD flood early warning systems needs to be linked with localized community flood early warning system; can disseminate crucial rainfall, inundation, river level, etc. directly to communities and villagers  
• Warnings can also be transmitted directly to communities via SMS technology or as in Bangladesh - via devices such as colored flags that warn villagers of risk levels; via CFMCs |
Way Forward

- Phase I provided qualitative understanding of some of the key challenges on the ground in some districts of Bihar
- Phase II analysis identified four key priority areas where reforms are necessary in the short and medium-term in order to reduce vulnerability from future floods
- Not all reforms will be feasible at once; WRD to prioritize reforms
- However, it is clear that WRD has the need and opportunity to take the road for institutional vision with ideas outlined here are more.
- Reform implementation plan should incorporate the elements of change vision, change strategy, commitment, capacity and leadership, and culture

Thank You