Towards Rural Drinking Water Security: A Perspective of Regional Planning

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Under the guidance of

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Contents

Background

Approach towards rural drinking water security

Started with Accelerated Rural Water Supply Programme in 1972-73 – supply driven

Sector reform project by World bank introduced demand driven approach in the sector (2002)

National Rural Drinking Water Programme adopted demand driven approach in 2009

Regional planning

Demand driven v/s supply driven approaches both had some common lacunae

Supply driven represents centrally driven, top to bottom approach

Demand driven represents decentralized, bottom up approach

It was felt that the decision making place should be neither at the top, nor at the bottom, so that a good balance can be created

Regional Planning

Moving from Top to Down

To assure planning suitable for region in context

Devolution of power to local communities and PRI institues for quicker administrative response

Neither Top nor Bottom

Moving from Bottom to Up

To move decentralized, village level, single scheme centred design and resource planning at higher level for availing technical expertize

Past work in CTARA

Field work done in CTARA through various studies show that Thane district has geography that is characteristic to Western Ghats:

- Undulating terrain
- High rains
- High runoff

Which heavily contribute to create challenges specific to this region.

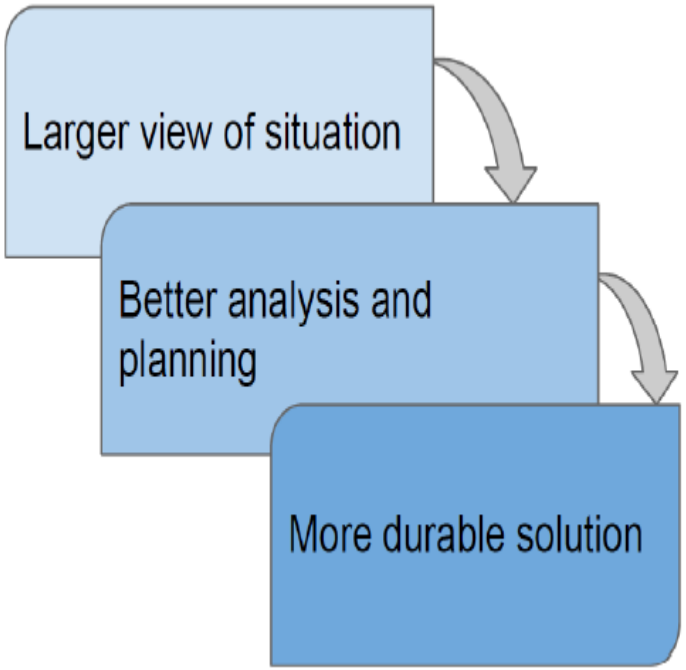
Hence, it would be good to have a regional perspective for ensuring drinking water security, taking into account the geography

Past work in CTARA…

This regional perspective can bring:

- geographical characteristics into picture while planning

- technically more efficient and sustainable solutions due to larger view of the area



Planning

Needs to know about

Past – failures and best practices

Present (current situation)

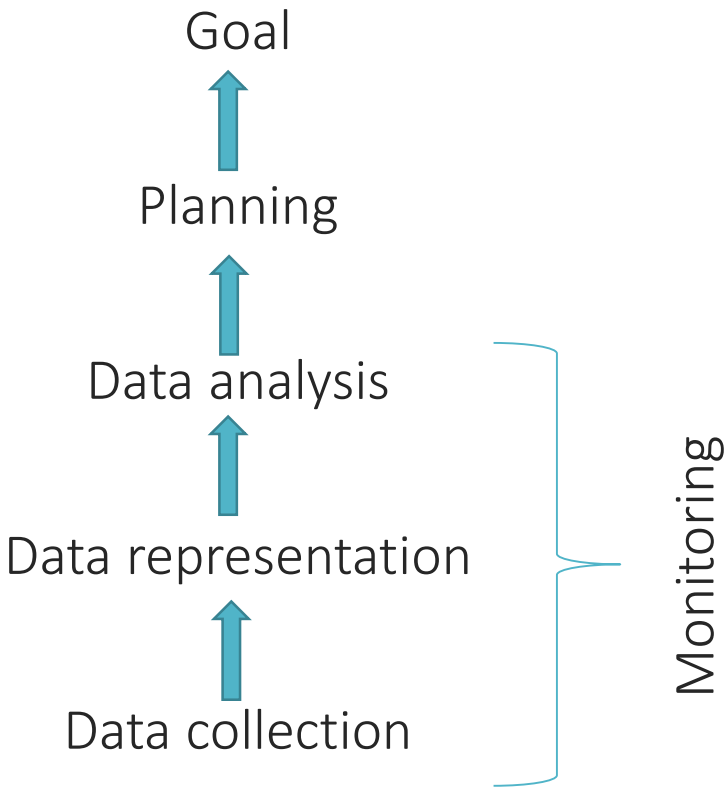
To address-

- urgent needs (such as drought mitigation)

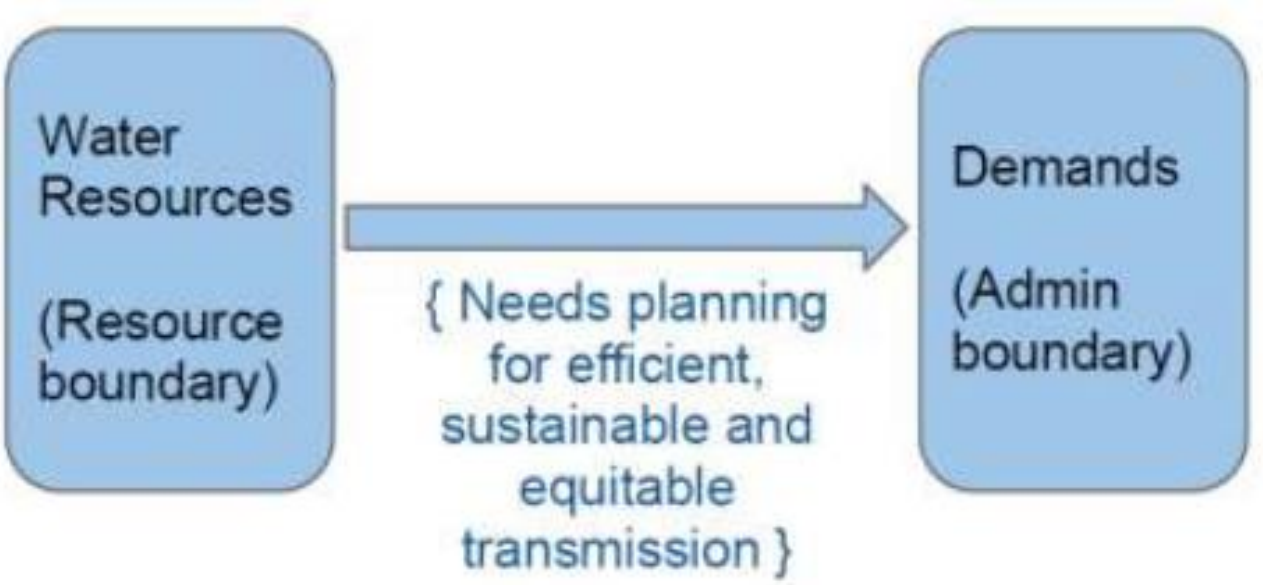
- intermediate goals (such as meeting goals set for next 5 years)

- long term goals (such as improving current policies for long term impact)

Place of Planning



Place of Planning



Place of Planning

Demand side elements

- Assets
  - *Pipe water supply scheme, dugwells, borewells, MI structures etc*
- Beneficiaries
  - *Block, village, habitation*

Supply side elements

- Water resources
  - *Surface water, groundwater, rainfall*

Planning & Implementing

- Players
  - *VWSC, GP, WSSD, GSDA, MI, MJP*

- Datasets
  - *Annual Action Plans*
  - *96 columns database*
  - *NRDWP database*

Place of Planning

Questions to be addressed-

- Finances such as energy costs
- Source strengthening
- Distances
- Ownership

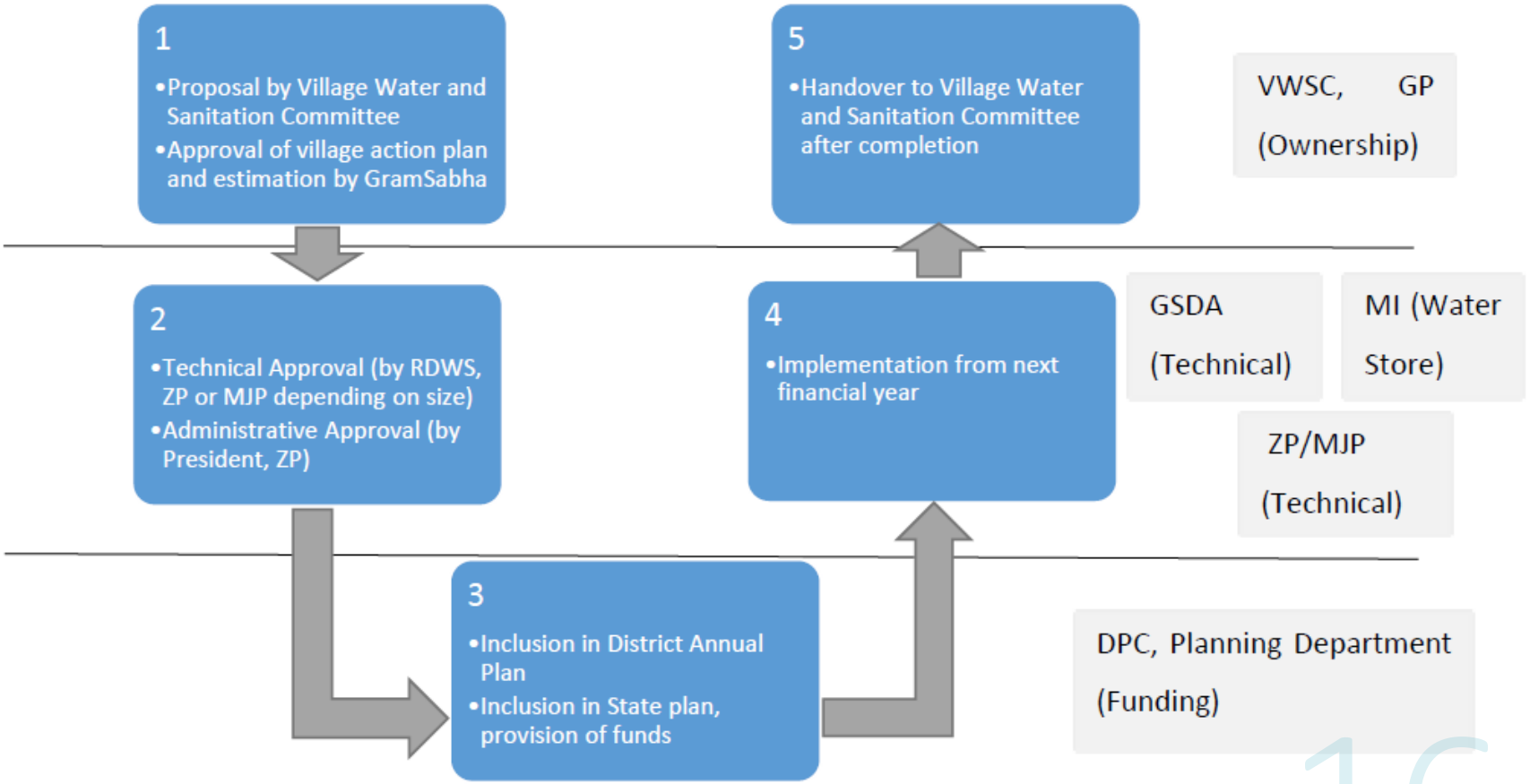
Study of Existing Processes

Study of Existing Processes

Creating a new asset

Monitoring existing assets

1. Creating a new asset



PWSS

MI dam Nampada

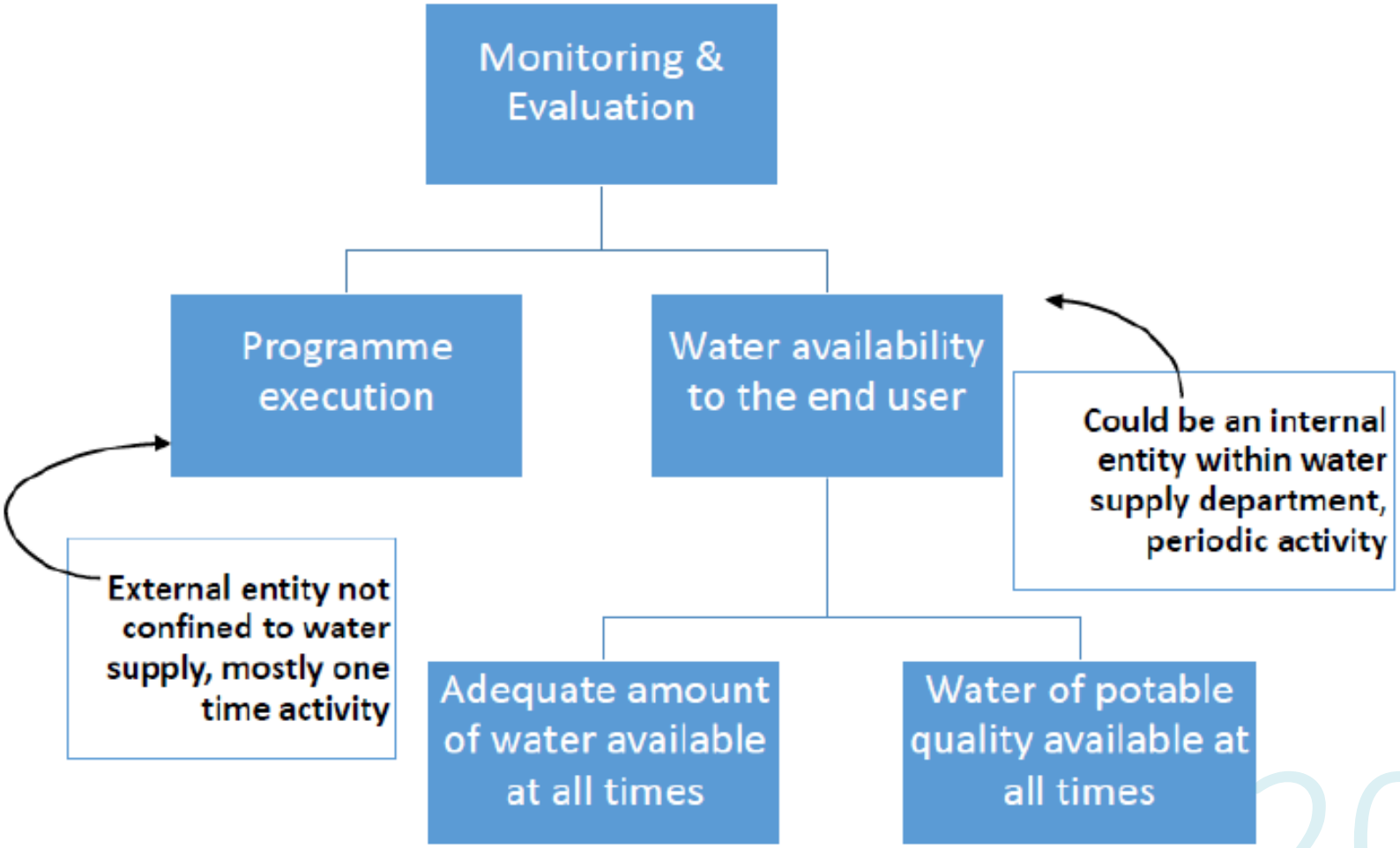
1. Conclusion:

Focus on consolidation of financial plans for individual schemes

Lack of effective horizontal communication between various agencies

(from interviews in offices of MI, GSDA, WSSD and meeting of DPC carried out in September – November 2013)

2. Monitoring existing assets



Monitoring

BRC responsible for monitoring water availability in habitations

Did not know their exact role

The ground reality is much different from what datasets show

Ambekhor visit

2. Conclusion

1. Staff not trained, nor instructed
   (Interviews with BRC at Shahapur, general meeting at Shahapur)

2. Reported data fails to capture seasonality and drudgery
   (analysis of AAP, 96 columns)

Thus, wrong picture of achievements gets created

Understanding essential parameters for planning tool

Possible Measure

Institutional strengthening

- *Technical capacity of the staff*
- *Reducing per head burden*
- *Cross-department communication*

Strengthening people's representation

Knowledge tools

- *Assisting planners and implementers in planning*
- *Common platform between people, implementers and planners*
- *Capturing demand-supply scenario in a region effectively*

Possible Measure

Use GIS interface as one such knowledge tool

geographical aspects are captured in GIS
larger area can be viewed and planned for
seasonality and drudgery can be captured

-through effective data management

Data gathering
Data representation
Data analysis

Procedure

- Deciding on the parameters to capture

- Suggesting processes to capture those parameters

- Demonstrating prototype of sample GIS portal

- Demonstrating use of the portal for deciding local intervention

- Demonstrating use of the portal for regional level overview and regional planning

Parameters to capture

Goal: Rural drinking water security to all

Sub-goals

i. Coverage: each person should get minimum amount of water

ii. Quality: water quality should be good

iii. Equity: every one should get water irrespective of socio-economic status

iv. Accessibility: no drudgery

v. Sustainability: at all times

Addressing each sub-goal

To ensure that the sub goals are addressed, we need to answer questions specific to each sub-goal. This section lists:

-Questions for sub-goal

-Mind Map exploring capability of current monitoring system to address this sub-goal (w.r.t. NRDWP, 96 columns, AAP)

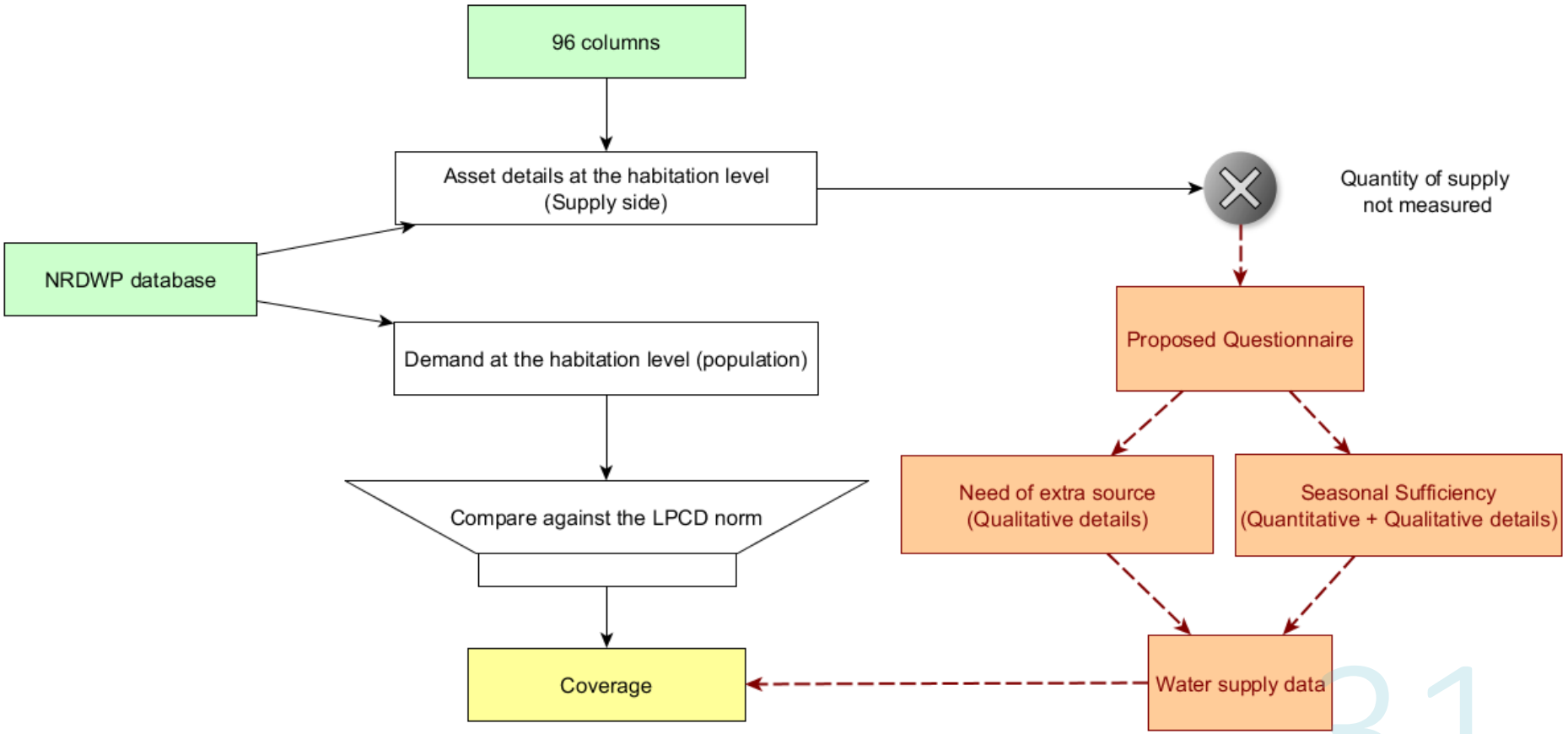
- Lacunae

-Proposal

Coverage

1. Do people get enough water for domestic use?
2. Who is responsible for the water assets?
3. Who is responsible for the O&M?

Coverage – Mind map



Coverage - Lacunae

Demand: population x current LPCD norm

Supply: quantity of water?

Coverage - Proposal

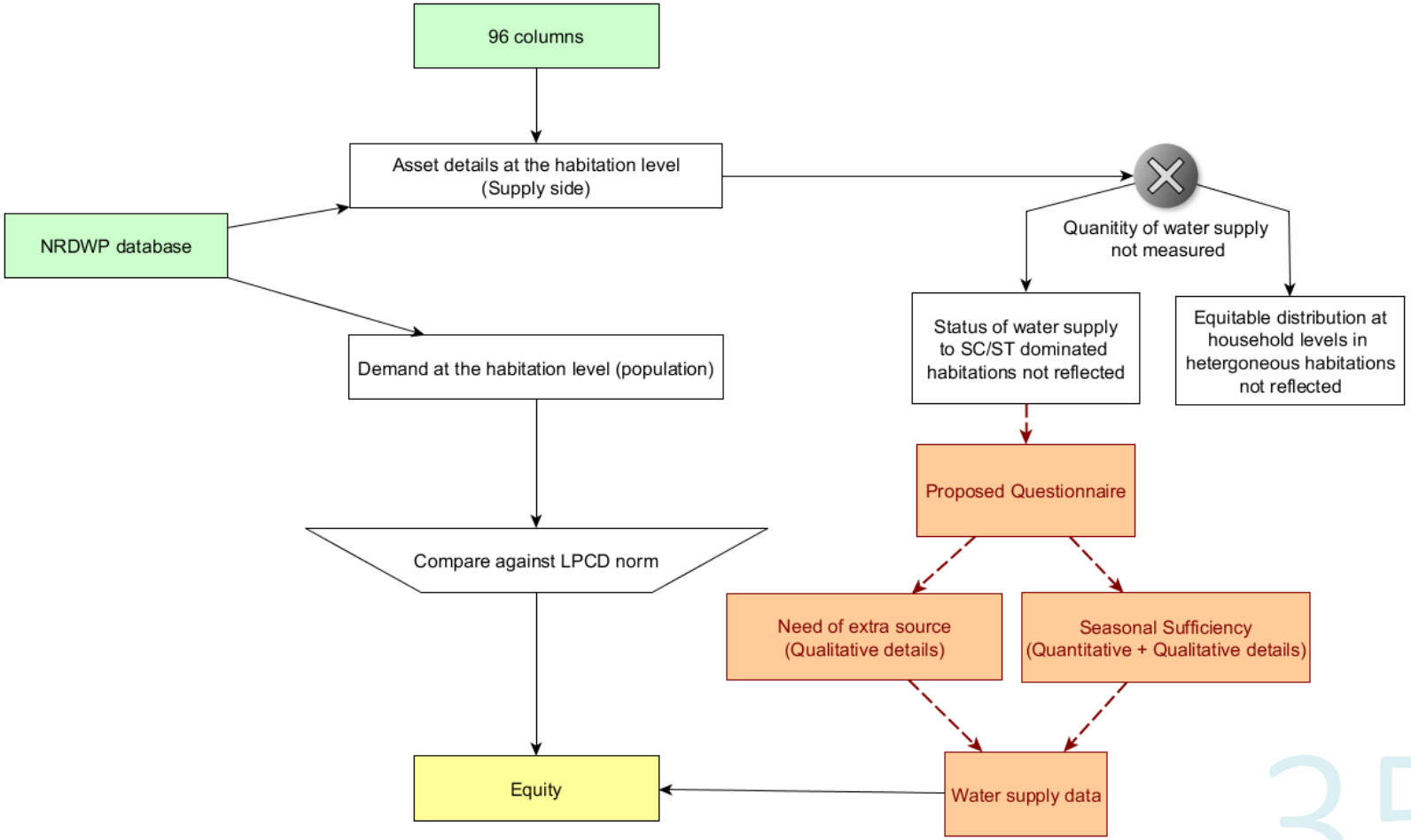
Do people need to use additional source for water? (e.g. tanker or an asset at a farther distance)

This would imply that the current source is not sufficient to meet the demand

Equity

Does every household get water irrespective of socio-economic status?

Equity – Mind map



Equity - Lacunae

While SC/ST habitations are given special attention for taking up new schemes

Coverage not guaranteed

Equity - Proposal

Regular monitoring for following-

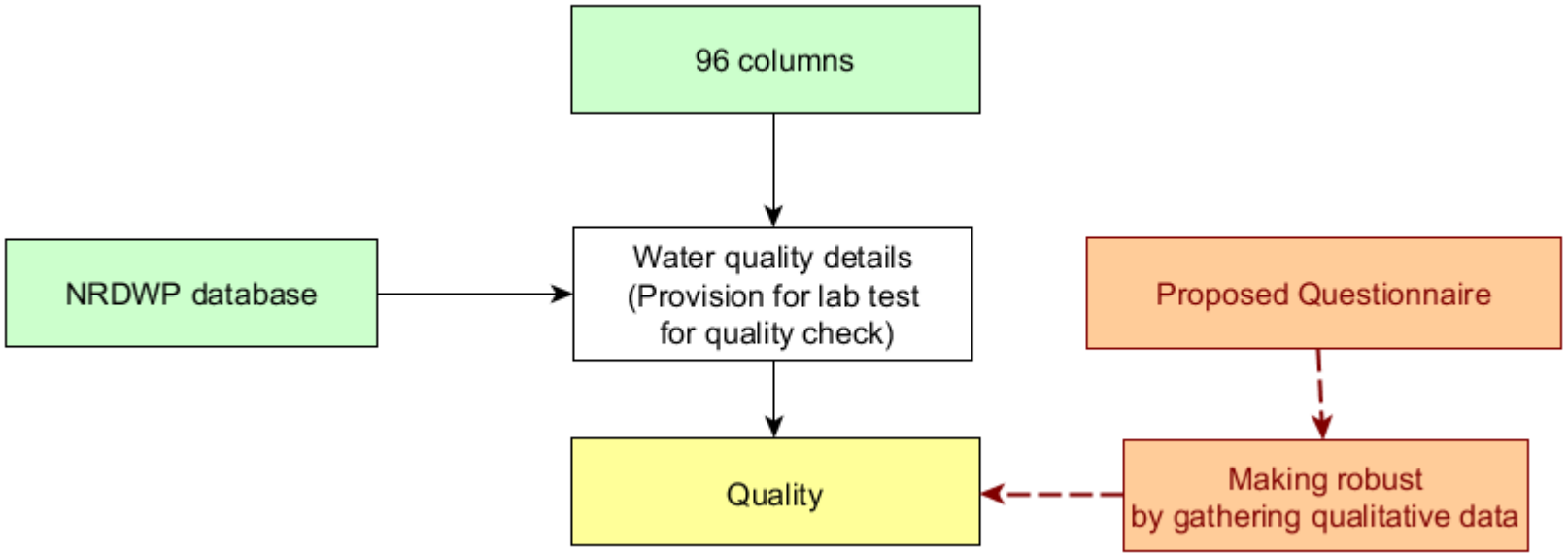
1. Do they need additional source of water?

2. Do they get water throughout the year?

Quality

1. Are the villagers satisfied with the quality of water?
2. Is quality testing done
3. Is water safe for consumption as per lab tests?
4. Are there provisions for water treatment?
5. Is the water treatment done according to the need and provision?

Quality – Mind map



Quality – Lacunae

Provision to report lab test results. But lab test results not updated

Quality - Proposal

1. Regular monitoring and data updation

2. Capturing qualitative aspects – people's perspective about
   - *Taste*
   - *Smell*
   - *Color*

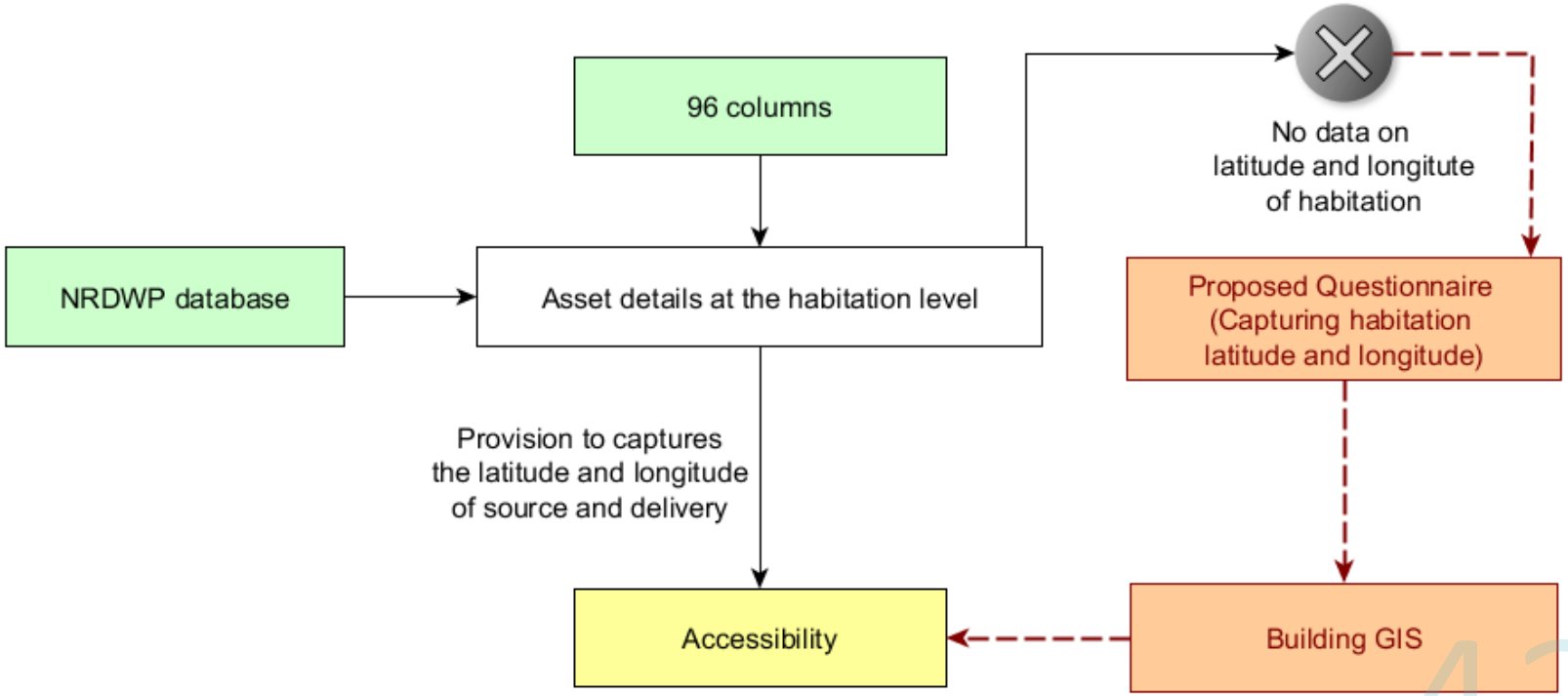
Accessibility

1. How far is the delivery point from habitation?

2. What is the elevation difference between delivery point and habitation?

3. What is the longest distance people need to walk throughout the year, and for what duration?

Accessibility – Mind map



Accessibility - Lacunae

Location of assets and delivery point, but not of habitation!

Location is raw data that needs to be processed to find out the distance

Accessibility - Proposal

Capturing the location of habitations as well as delivery points and assets

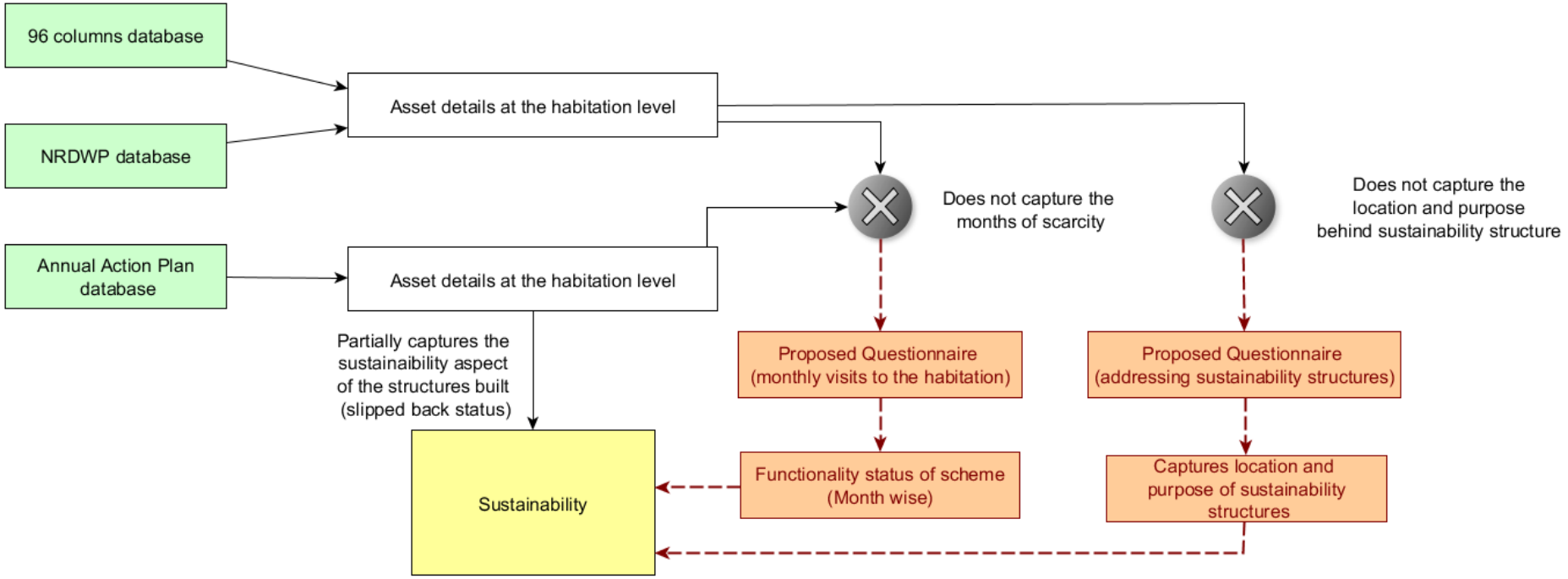
Capturing elevation differences

Using GIS for analysis of distance

Sustainability (of source)

1. Do people get water throughout the year?
2. Are sustainability structures created in village?
3. Are they specific for a water supply asset or are they general?
4. Do the structures directly provide water for usage?
5. Do the structures recharge groundwater?
6. Do they provide water in post monsoon / pre monsoon period?
7. Can animals access water in these structures?
8. Who is responsible for the structures? (implementing agency)

Sustainability – Mind map



Sustainability - Lacunae

No capturing of seasonal water stress

Functionality and purpose of different structures are not captured

Location is not captured

Sustainability - Proposal

Regular monitoring

Collection of data for functions and utility of structures

Capturing location

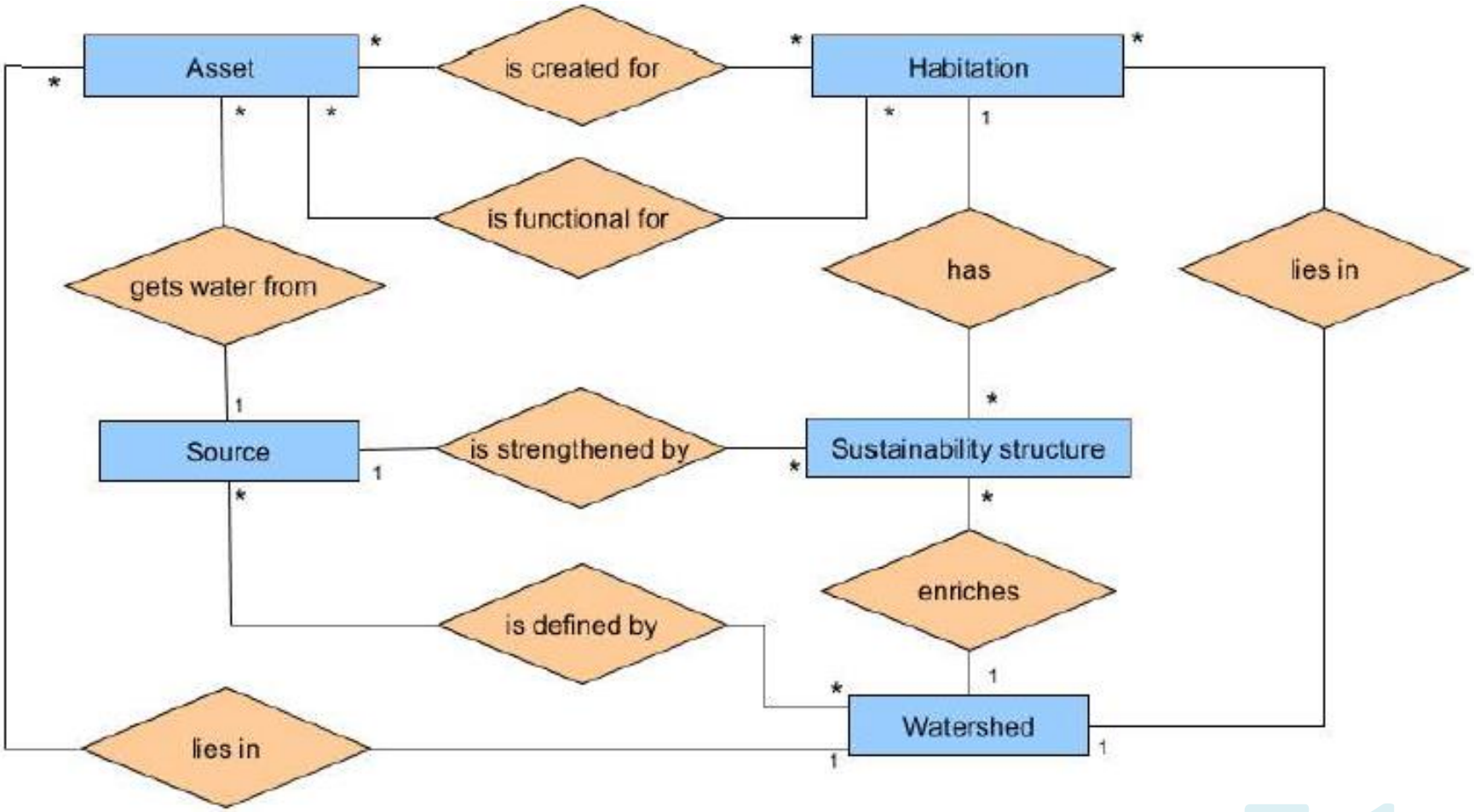
Overview of sub-goals

Sr. No.	Sub Goal	Addressed in Monitoring Process?
1	Coverage	Partially Addressed
2	Equity	Partially Addressed
3	Quality	Addressed
4	Accessibility	Not Addressed
5	Sustainability	Partially Addressed

The 3 datasets not helping in monitoring essential parameters for planning purpose

Thus, for strategic planning, exploring possibility of concise database

ERD


Asset
is created for
Habitation
is functional for
gets water from
has
lies in
Source
is strengthened by
Sustainability structure
is defined by
enriches
Watershed
lies in

Habitation

Habitation	Source of data
Name	GP office
Latitude	Primary data
Longitude	Primary data
Population	GP office
SC population	GP office
ST population	GP office
Households	GP office
village	GP office
GP	GP office
Block	GP office

Asset

Asset*	Source of data	Description
Source Type	AAP column 20	Groundwater or surfacewater
Source Name / Identifier	Field	Name of water body or source identifier if any
Delivery Mechanism	NRDWP, Format B22, Column: SchemeType	Piped / Hand Pump / Borewell / Dugwell / Tanker / Storage tank / river / lake
Water Treatment	Field	Provision for conventional water treatment plant / filter
Ownership of delivery point	Field	public / private / both
No of public delivery points under asset	Field / office of implementing agency	how many public delivery points are created, if applicable
No of private delivery points under asset	Field / office of implementing agency	how many private delivery points are created, if applicable
Scheme Type	AAP column 15	For water coverage or to tackle water quality issue
Funtionality agenda	96 columns 14B, 14C	perennial / seasonal
no of habitations touched	NRDWP, Format B22, Column: HabCovered	how many habitations benefit from this asset
implementing agency	NRDWP, Format B22, Column: ImplementingAgency	
Completion date	NRDWP, Format B22, Column: DateofCompletion	Date of completion of asset, if applicable
Commissioned date	NRDWP, Format B22, Column: DateofCommissioning	Date of commissioning of asset, if applicable
O&M agency	GP	Agency responsible for handling O&M of the asset, if applicable
O&M handover date	GP / office of implementing agency	The proposed date of handover of the asset by O&M agency, if applicable
Active Status	Field	Alive or permanently failed

* An asset is defined as a vessel that provides water for extraction and use

Source

Source	Source of information	Description
Type	Field	river / lake / dam
Name	Field	
Water availability	Field / GP office	perennial / seasonal
Quality Affected?	Field / GP office	contaminated / potable / seasonal variation
Quality problem	Field / GP office	Arsenic / Fl / NO3 / Chlorine / hardness / TDS / Fe / Sulphates / Coliform Organism / Faecal Ecoli
Source failed?	Field	yes / no

Sustainability Structures

sustainability structure	Source of information	Description
structure type	field	pits and trenches / check dams / percolation tanks / point source recharging / dugwells / injection / skimming wells / traditional water body / rooftop
structure id / name	field	
water storage capacity	field	small / medium / large : based on area (eg < 10sqm, 10-25sqm, >25sqm)
no of such structures	field	
latitude	field	
longitude	field	
completion date	field	
is operation required?	field	eg for solar power based systems
is maintenance required?	field	eg annual desilting
recharge for source?	field	does an existing asset directly benefit from recharge by this structure?
independent sustainability structure?	field	does it recharge GW in general, irrespecitve of an existing asset?
season of accumulating water	field	monsoon / post-monsoon / pre-monsoon
season of retaining water	field	monsoon / post-monsoon / pre-monsoon / never
season of recharging groundwater	field	monsoon / post-monsoon / pre-monsoon / never
accumulated water available for domestic use	field	yes / no
season of using accumulated water	field	monsoon / post-monsoon / pre-monsoon / never
accessible to animals?	field	yes / no

Watershed

Watershed	Source of Information	Description
micro-watershed	WRIS	identifier
mini-watershed	WRIS	identifier
sub-watershed	WRIS	identifier
watershed	WRIS	identifier
sub-catchment	WRIS	identifier
catchment	WRIS	identifier
basin	WRIS	identifier
water resource region	WRIS	identifier
average annual rainfall	WRIS	
slope gradient	computation	slope gradient can give the speed of runoff
permeability	GSDA	permeability value (k) for the strata of watershed
boundary	computation	GIS polygon feature, from DEM
area	computation	GIS attribute, from DEM

Asset is created for Habitation

provision *	Source of information
habitation	field
asset	field
distance of delivery point from habitation	field
elevation difference	field
provision for LPCD during functional period	field / GP office
provision for treatment during functional period	field / GP office
treatment needed at delivery point?	field / GP office

Asset if functional for Habitation

functioning*	Source of information	Description
Functional	field only	(yes / with problems / defunct / out of season)
functional for how many days of month	field only	
LPCD delivered	field only	the day of visit can be taken as a representative
no of households served	field only	this data needs to be gathered by a local in-charge person or by a small FGD
did the households depend on any other asset?	field only	yes / no. Data needs to be gathered by a small FGD
was water treatment done?	field only	only when any treatment mechanism is provided and recommended
how was the quality of water served	field only	irrespective of whether the treatment was done, was the quality good?
was there a water sample taken for lab testing?	field only	is the water tested?

* This table serves as regular monitoring tool. Ideally monthly entries should be made for each habitation as seasonality plays a big role in water supply.

Questionnaires for data collection

1. Asset details
   - *Once in a while, yearly or when some event occurs, such as a new scheme / augmentation / re-structuring*
   - *February / March (when water stress can start building up)*
2. Sustainability structures
   - *Once in a while, yearly or when some event occurs, such as a new scheme / augmentation / re-structuring*
   - *January (gives time to take immediate measures before summer)*
3. Monitoring
   - *Ideally monthly, at least once each quarter (July, October, January, April)*

A Sample GIS Interface

Knowledge Tool for Analysing Collected Data: Expectations

Assist planners at Taluka and District level with

- *Immediate*
- *Intermediate*
- *long term planning*

Common platform between people, planners and implementers

Holistic understanding of demand-supply scenario

Knowledge Tool for Analysing Collected Data : Features

Availability and access to water depend on geography and assets creation

GIS can capture spatial relationship between

- Water demand
- Water supply assets
- Water sources

Natural and Administrative boundaries

Components of this part

1. Prototype of GIS interface

2. Demonstration of regional view (mini-watershed)

3. Demonstration of local view (village having 5 habitations)

Data and Tools

Sr. No	Map	Agency
1	DEM	Bhuvan
2	Taluka polygon map	MRSAC
3	Village polygon map	MRSAC
4	Watershed polygon map	MRSAC
5	Drainage	MRSAC

QGIS: Free and open source GIS

Grass plugin for QGIS: Grass is Free and open source GIS

Google Earth

Region for study – Kalu mini-watershed

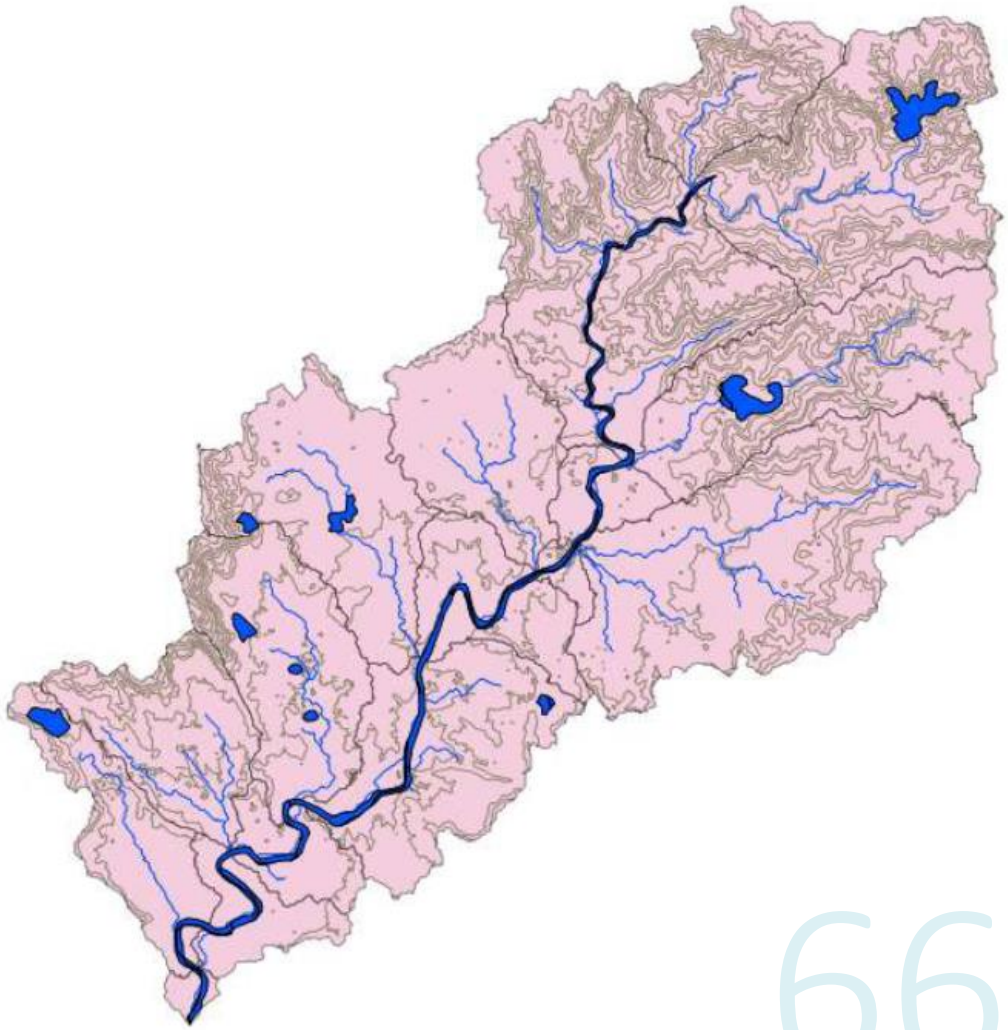
Prototype GIS interface

Geographical elements captured:

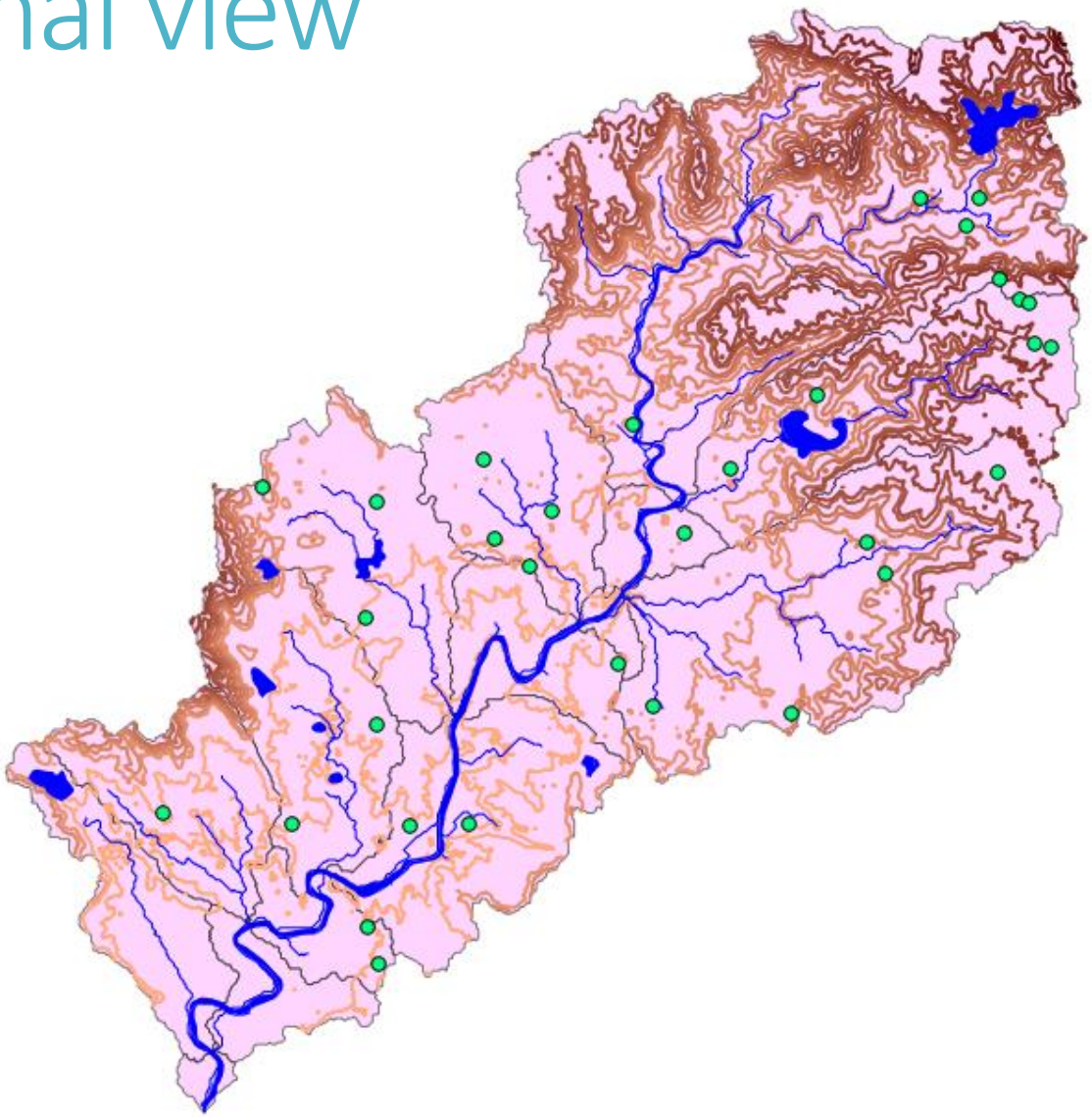
- Watershed
- Contours
- Water bodies

Kalu mini-watershed

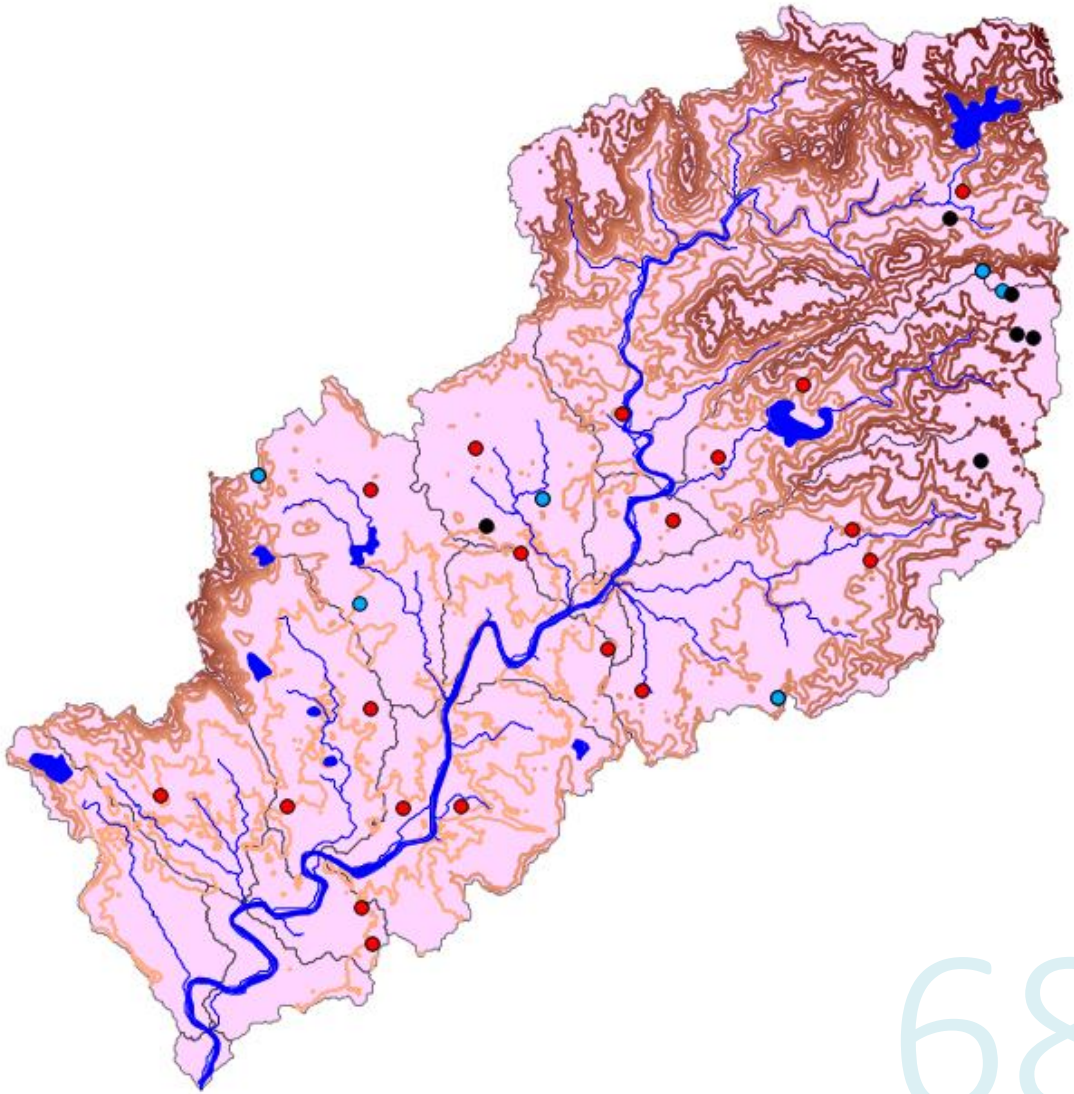
- Area 126 sq km
- Main drain 23km
- Relative contours (0m to 180m)
- Adivali dam 2.03 MCM
- Kharade dam 2.054 MCM
- Population: ~ 25000



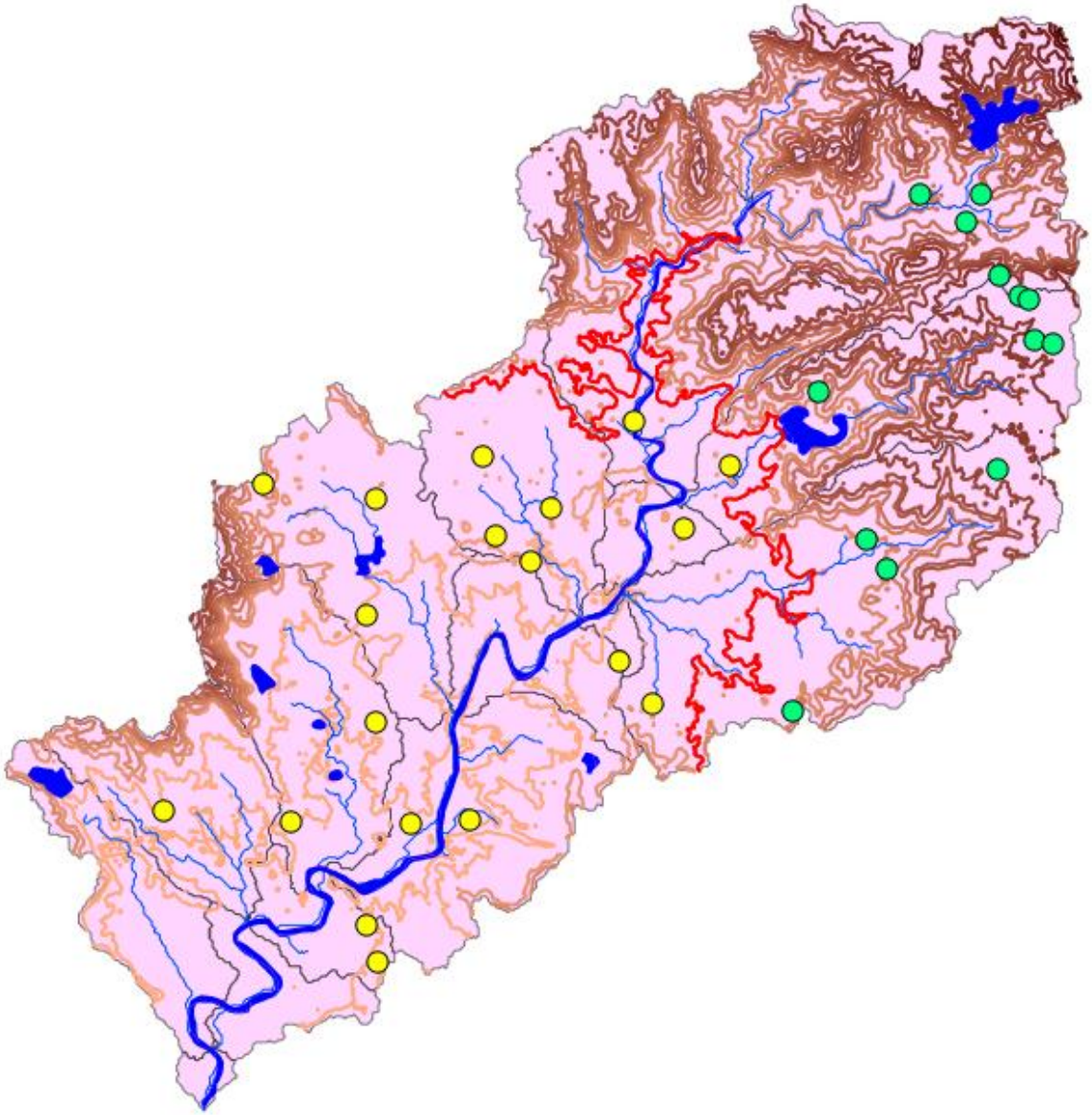
Regional view



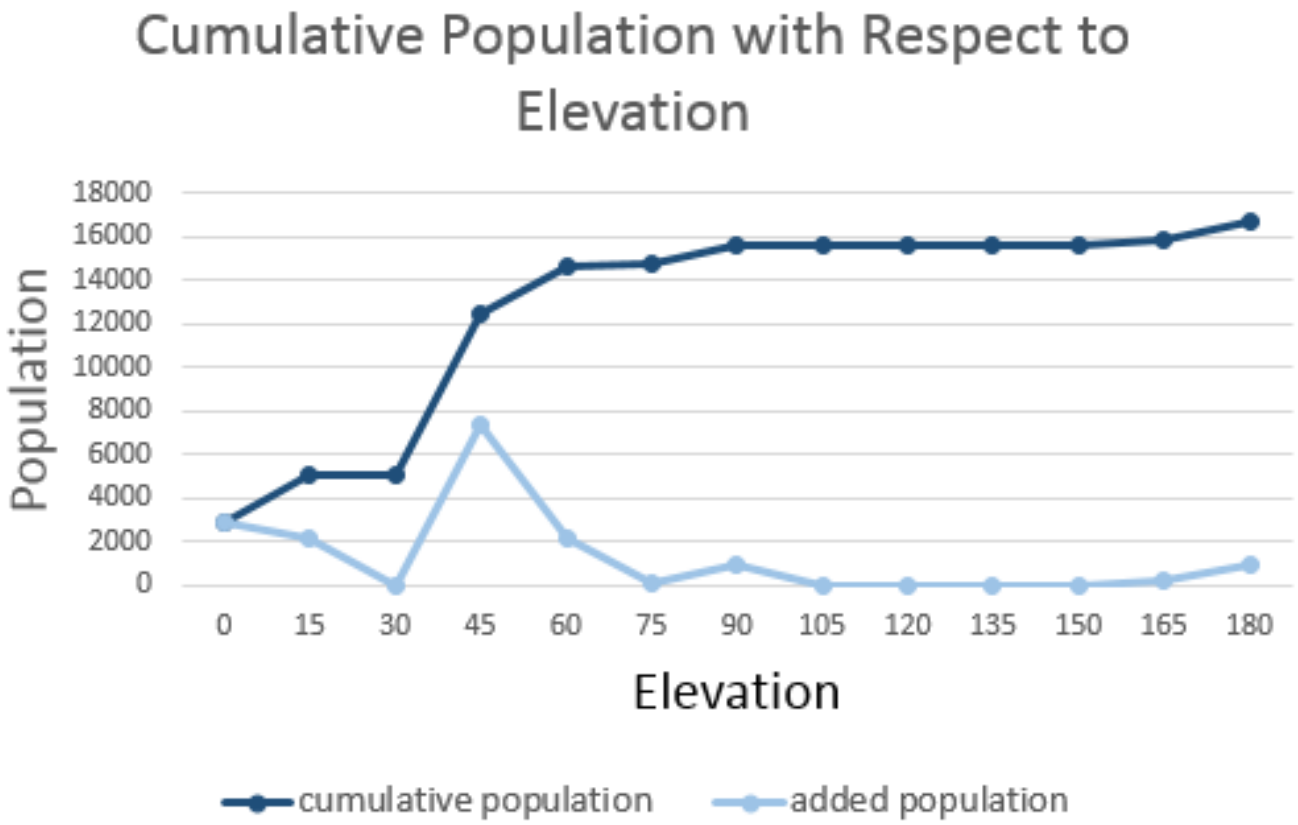
Regional view: Dominated by GW schemes



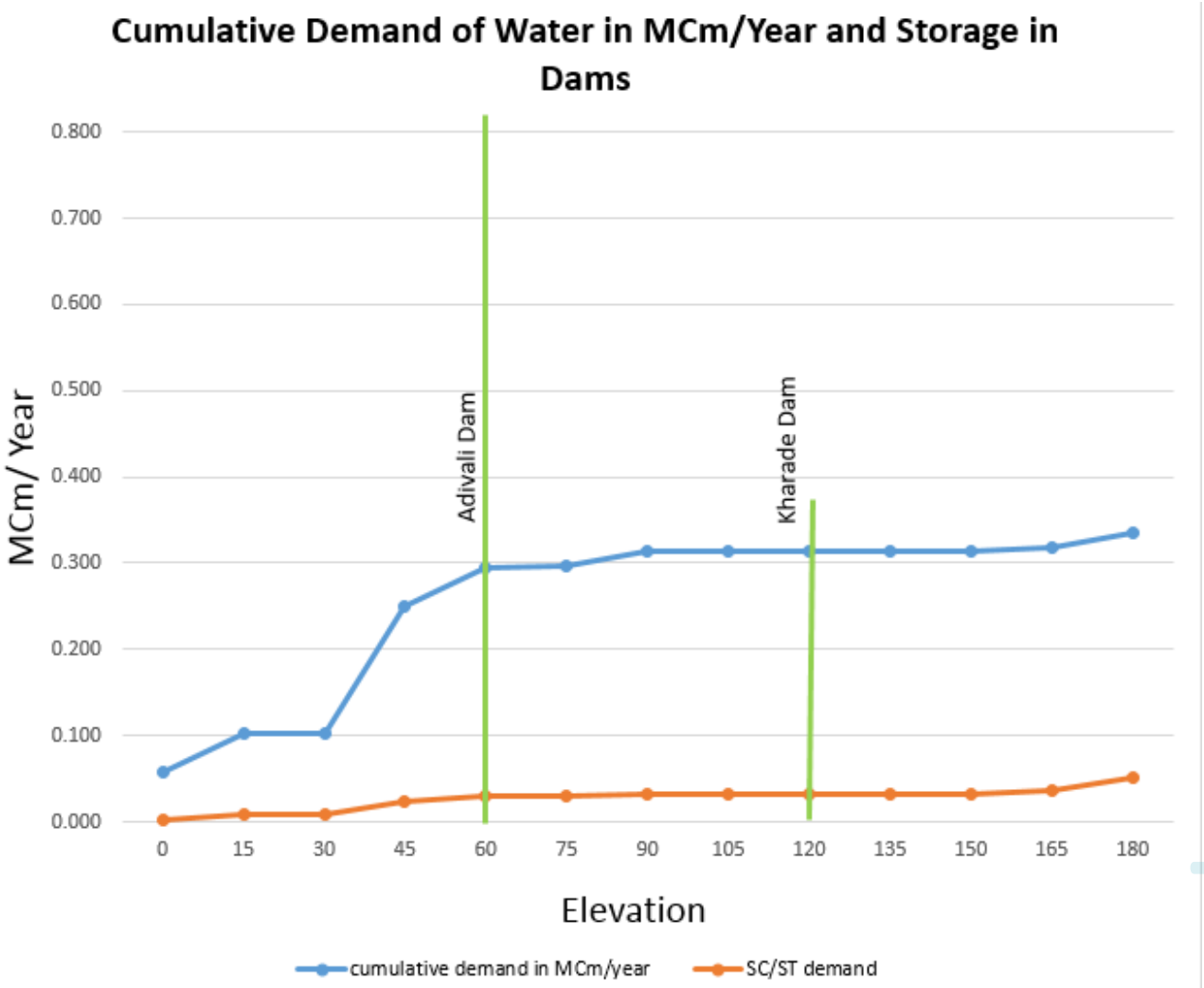
Regional View – Elevations



Regional View



Regional View



Inferences

1. Kalu watershed is groundwater dominated

2. The surface water reservoirs can provide surface water to many habitations with minimum energy cost

3. Using surface water would balance GW-SW usage

4. Habitations in highest elevations do not have schemes, they might need special attention

Future utility of regional view

Exploring option of water grid

Useful in analysing groundwater balance

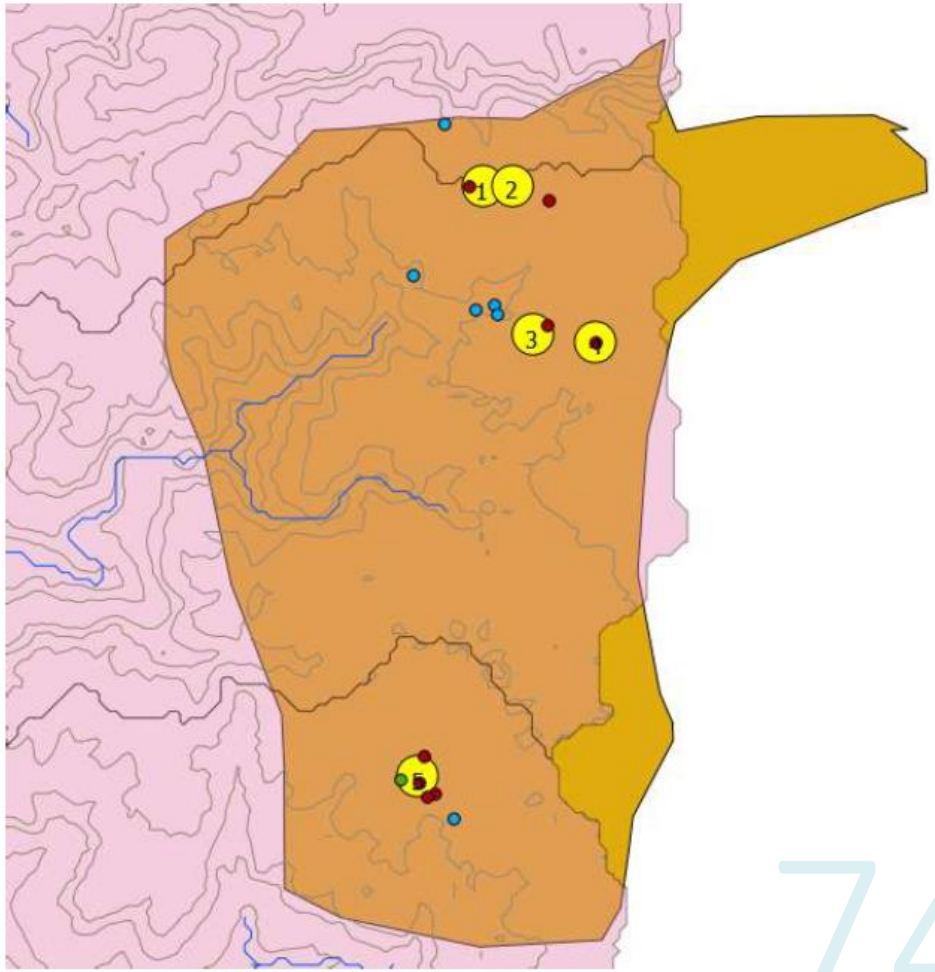
Balancing between surface water and ground water

Analysis of demand and supply at a region

Local View

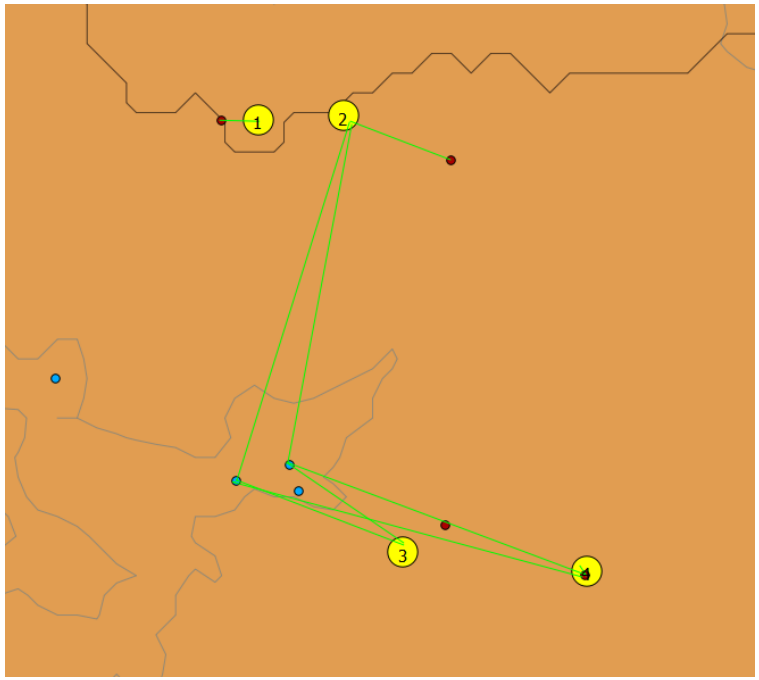
Administrative details captured:

- Village boundary (demand)
- Habitations (demand)
- Assets (provision for supply)

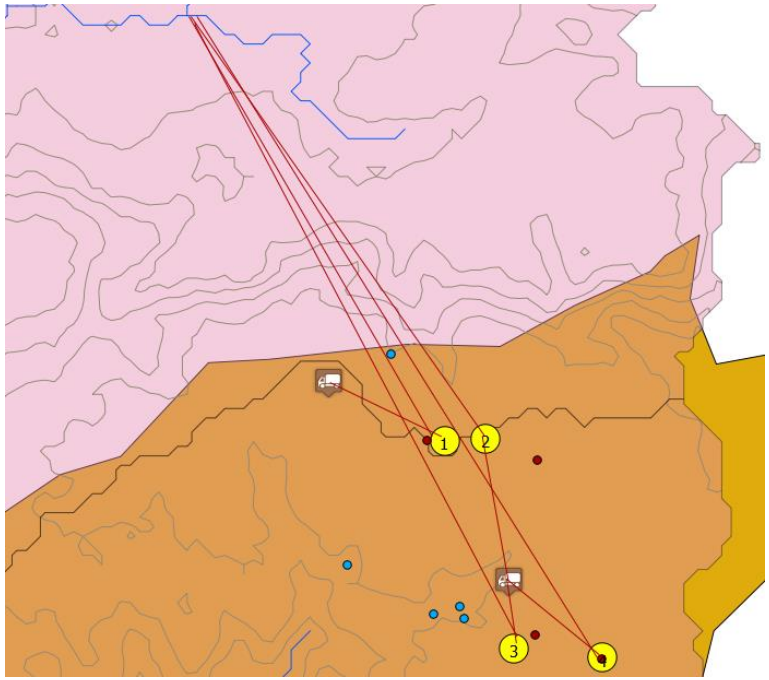


Seasonality and Drudgery

JULY

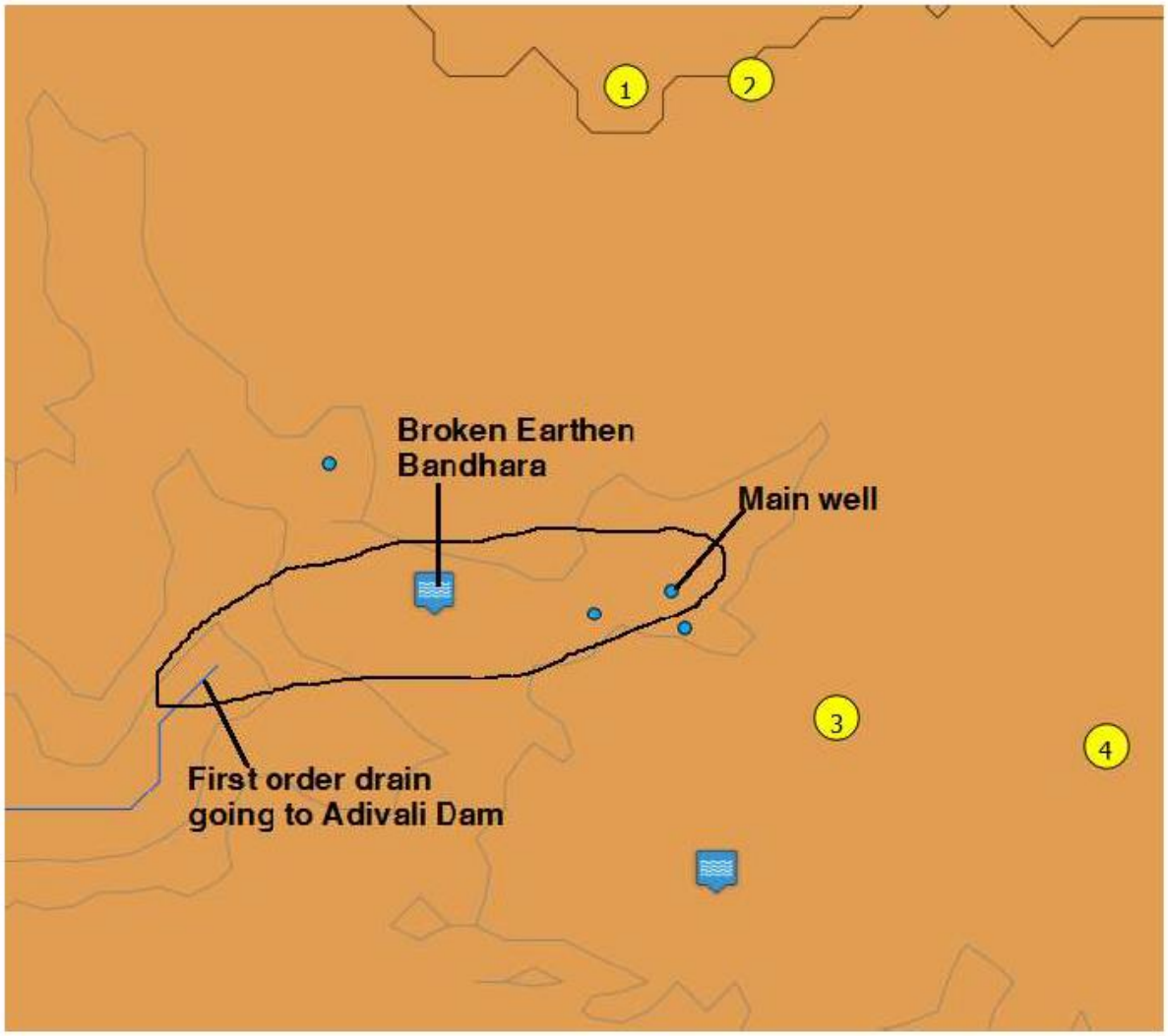


MAY



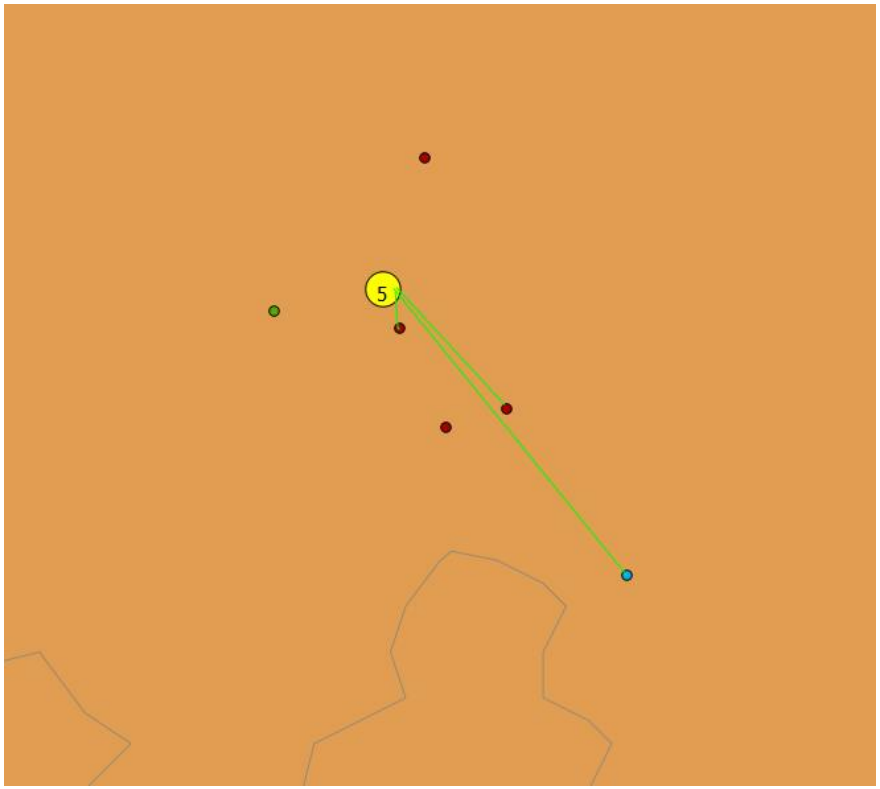
To be obtained from regular monitoring surveys

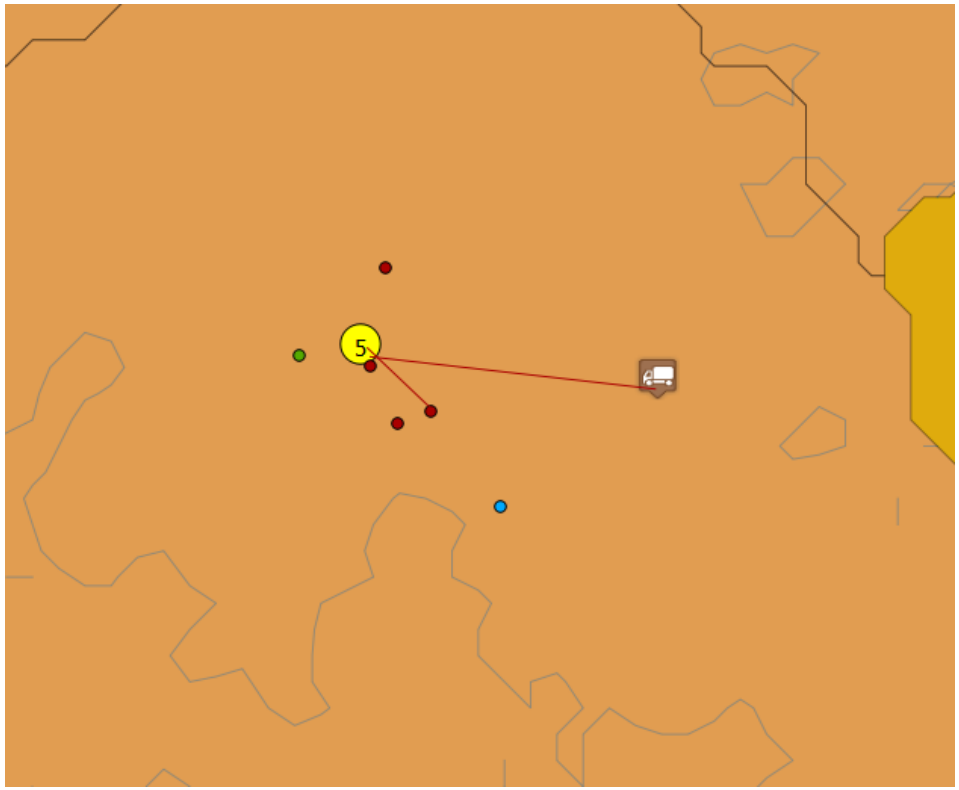
Possible local intervention



Possible local intervention

Local view – surface water scheme





Local view – ESR!

PWS from Adivali Dam

Villagers say water never reached

Only civil structure of ESR can be seen

Inferences

Seasonality and drudgery can be captured

Possible interventions can be identified

Position of habitation can be analysed w.r.t. larger regional view

Utility of GIS interface

EXPECTED

Assist planners at Taluka and District level with

- Immediate
- Intermediate
- long term planning

ACHIEVABLE?

Achievable

Immediate:

- Would Ambekhor need tankers this summer?
- Can the broken bandhara be repaired?

Intermediate:

- Scheme from SW sources

Long term planning:

- Enhancing water balance
- Special plans for high elevation habitations

Utility of GIS interface

EXPECTED

Common platform between people, planners and implementers

ACHIEVABLE?

Achievable

Easy to understand graphical interface

Utility of GIS interface

EXPECTED

Holistic understanding of demand-supply scenario

ACHIEVABLE?

ACHIEVABLE

Demand, supply and resources can be studied w.r.t space (proximity) and time (seasonality)

Conclusion

- Monitoring is weak, planning is only financial
- Water as a resource is not planned
- Seasonality, drudgery not captured
- Data handling is important, and can aid in strategic planning towards goal
- Regular monitoring mechanisms must
- For planning water as a resource,

  demand

  supply

  provision

can be studied together in GIS

Conclusion

- GIS can aid in regional planning
- potential to reveal information regarding drudgery, seasonality and equity
- locating effective and technically sound solutions for region
- useful input for immediate, intermediate and long term plans
- Studies such as

  Feasibility of water grid
  Groundwater balance
  Energy cost estimation

  can be carried out using a single platform

Conclusion

- useful in local analysis for identifying possible interventions
- as a common platform for local representatives, implementers and planners
- thus more accountable system

Recommendation

- Planning for water as a resource at regional level (Taluka / District)
- Such knowledge tools should be incorporated in existing system
- GIS can serve as a strong knowledge tool, thus, such an GIS interface should be studied further and implemented
- Instead of current format of data representation, use of thematic data views should be explored (such as the ERD presented)

Future work

- More pilot studies with current GIS interface
- Bringing together various departments using GIS as a common platform for data handling and planning
- Inclusion of analysis for forestry, agriculture, industrial water demand etc in GIS interface
- Exploring more knowledge tools for data collection and management for strengthening monitoring mechanism

Field Work – by self

Under construction MI dam – Nampada dam in Savaroli GP

Ambekhor village & five habitations in Manekhind GP

Under construction pipe water supply scheme in Dhar city & Maheshwar city, MP (technical visit to understand elements of piped water supply scheme)

Various office visits and meetings in MI local, GSDA, WSSD, DPC for Shahapur from August 2013 to November 2013

Interview of retired MJP engineer

Field work by others

MI state office in Thane (Vishal and Aditya)

Visit to Adivali, Adivali pada, Manekhind, Ashte (hired help for testing questionnaire)