Development and application of Water Security Assessment Framework

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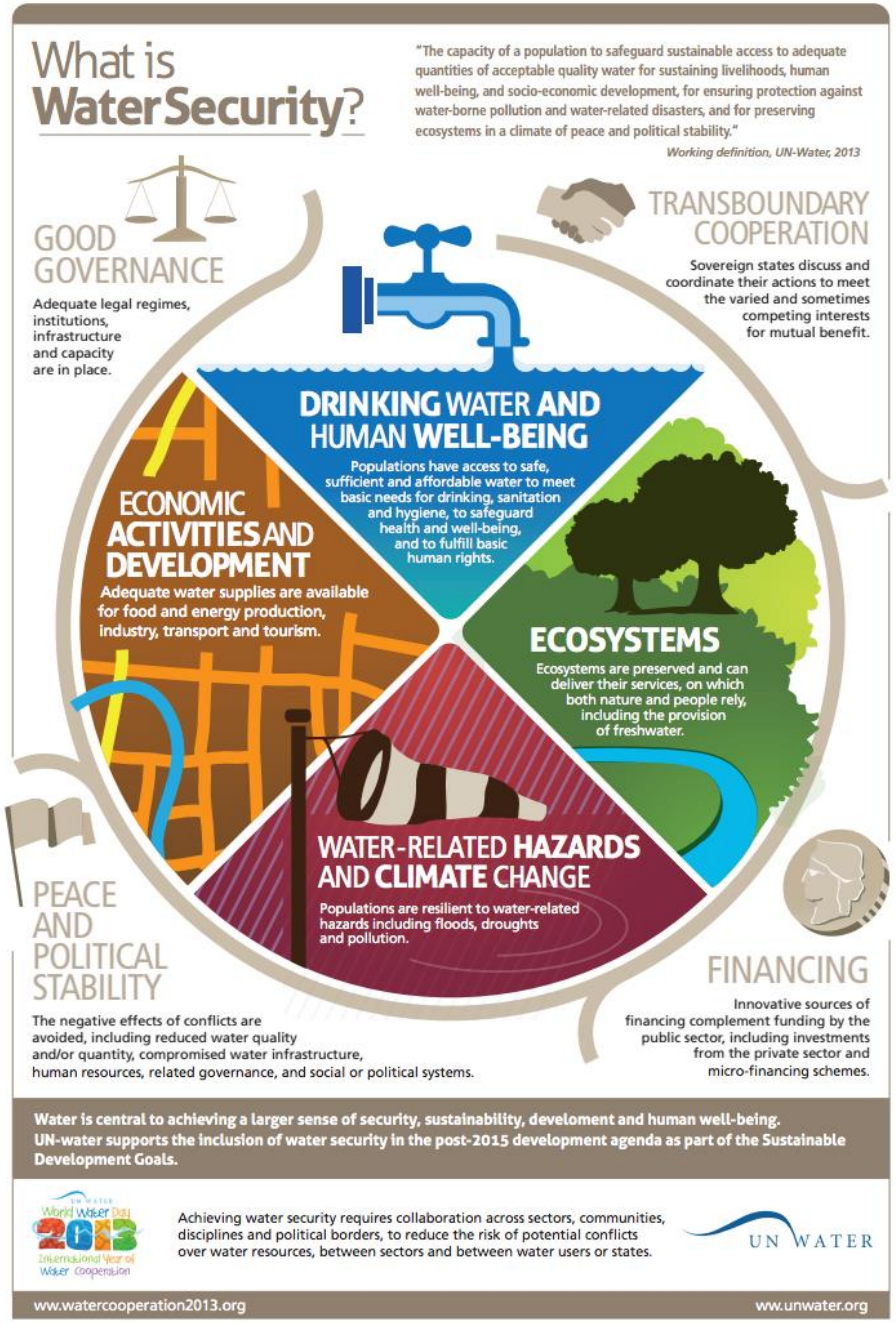
What is Water Security?

UN definition:

- *The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water*
  - *for sustaining livelihoods, human well-being, and socio-economic development,*
  - *for ensuring protection against water-borne pollution and water-related disasters, and*
  - *for preserving ecosystems in a climate of peace and political stability.*
- Water security is about learning to live with an acceptable level of water risk (OECD, 2013)

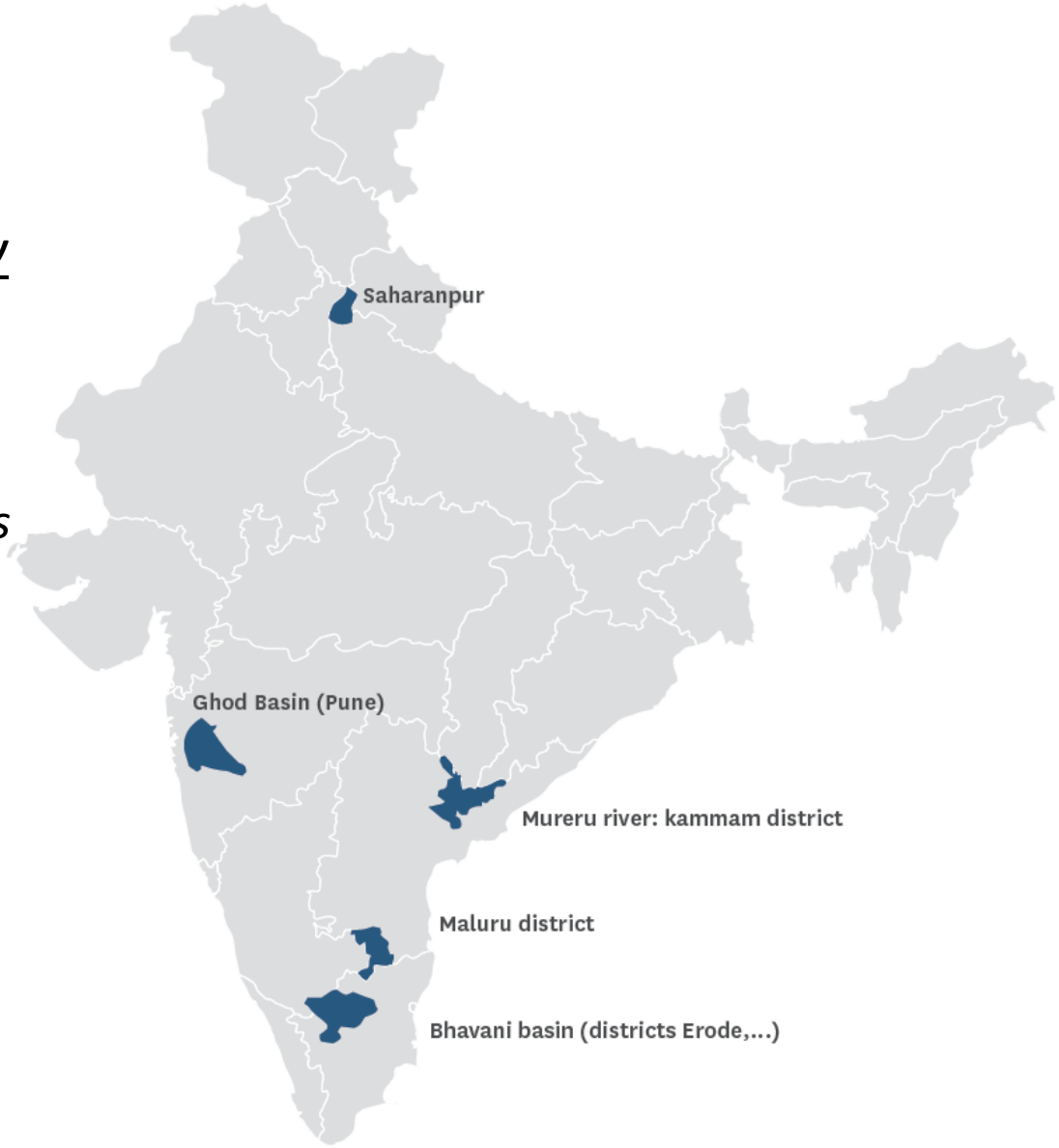


Water Security Framework

Water security

- *Availability of acceptable* quantity *and quality of water with acceptable water related risks:*
  - *for sustainable operation of factories, and*
  - *for all the "local" co-dependents of water resources used at selected factory catchments*

- **Water Security Framework:**
  - *Understand how different components of WS affect factory locations and co-dependents*



Water Security Framework

- Water security framework indicates how to
  - Delineate factory catchment area
  - Identify co-dependants of the water in the catchment
  - Find the current status in water scarcity, risks and security
  - Assess requirements for all changing climate and socio-economic environments
  - Captures the dynamic nature of water scarcity, risks, and water security on a scale of 0 to 1
  - Suggest interventions to improve water security

- *Water security has two aspects*
  - *Scarcity (supply and demand gap)*
  - *Risk (probability) of meeting demand*
  - *Scarcity & Risks are indexed on a scale of 0 to 1*

Assessing Scarcity & Risk

- Water scarcity has two components
  - Physical water scarcity (PWS): deals with the sufficiency of acceptable quantity and quality of available water for different uses
  - Economic water scarcity (EWS): deals with the adequacy of infrastructure-storage and diversions structures to meet the required demand.

- The Risk Assessments in terms of rainfall or water supply variability on the prospects for sustainable development.

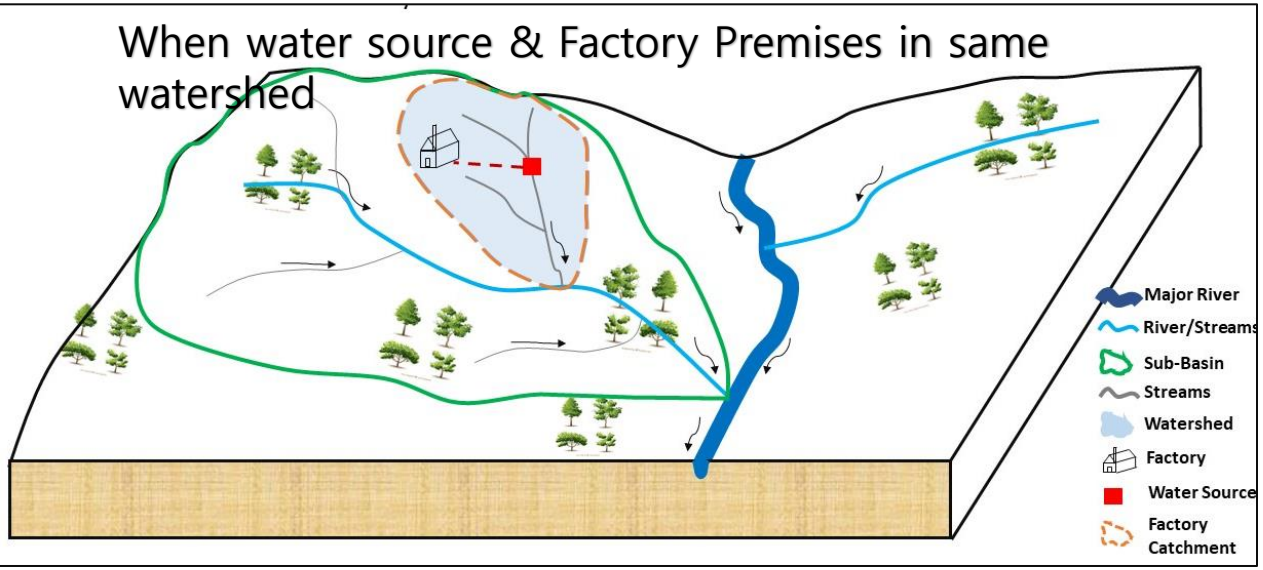
SOP's for Framework

1. Delineation of Study Area
2. Identify codependents of study area
3. Assess Rainfall & Environmental Needs (E-Flows)
4. Assess utilizable Water Supply
5. Assess Utilizable storage (Soil Moisture, Surface & Groundwater)
6. Assess Consumptive Water Use (Water Footprints) at present & future
7. Assess Water Scarcities & Risk (0 to 1)
8. Assess Water Security

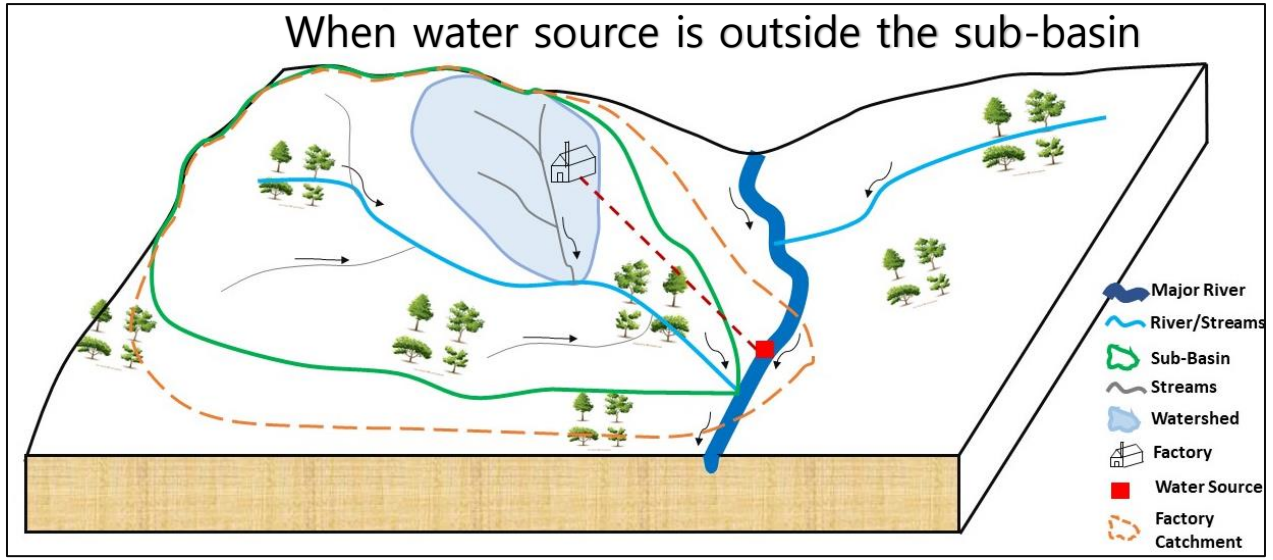
Delineation of Study Area

Surface Water as source

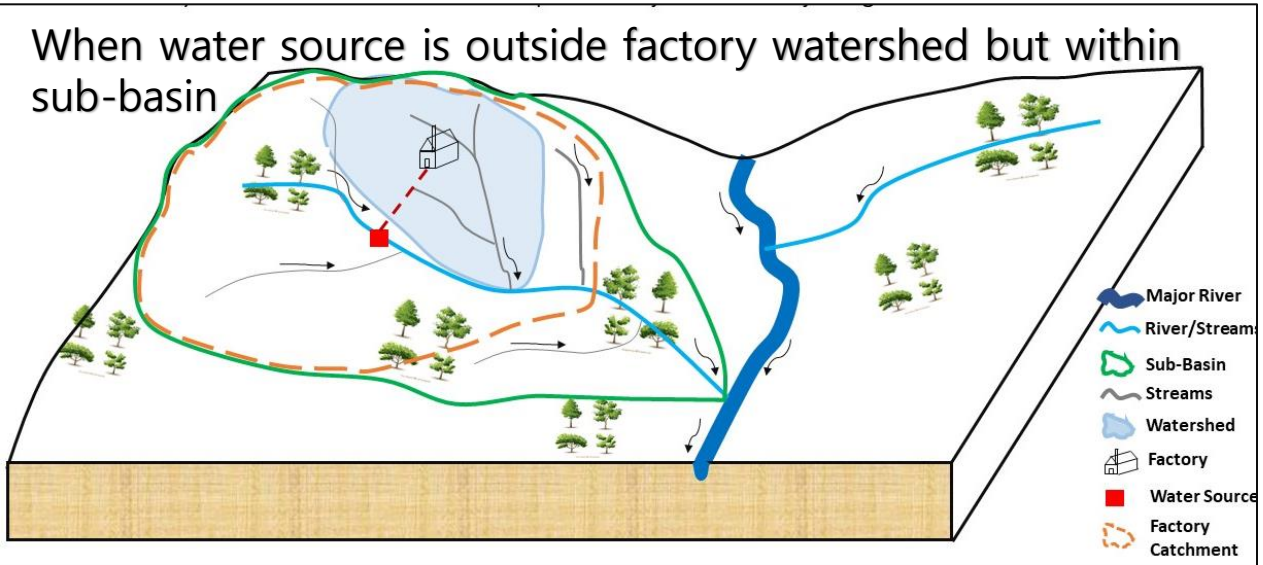
When water source & Factory Premises in same watershed



When water source is outside the sub-basin



When water source is outside factory watershed but within sub-basin



Delineation of Study Area

Groundwater as source

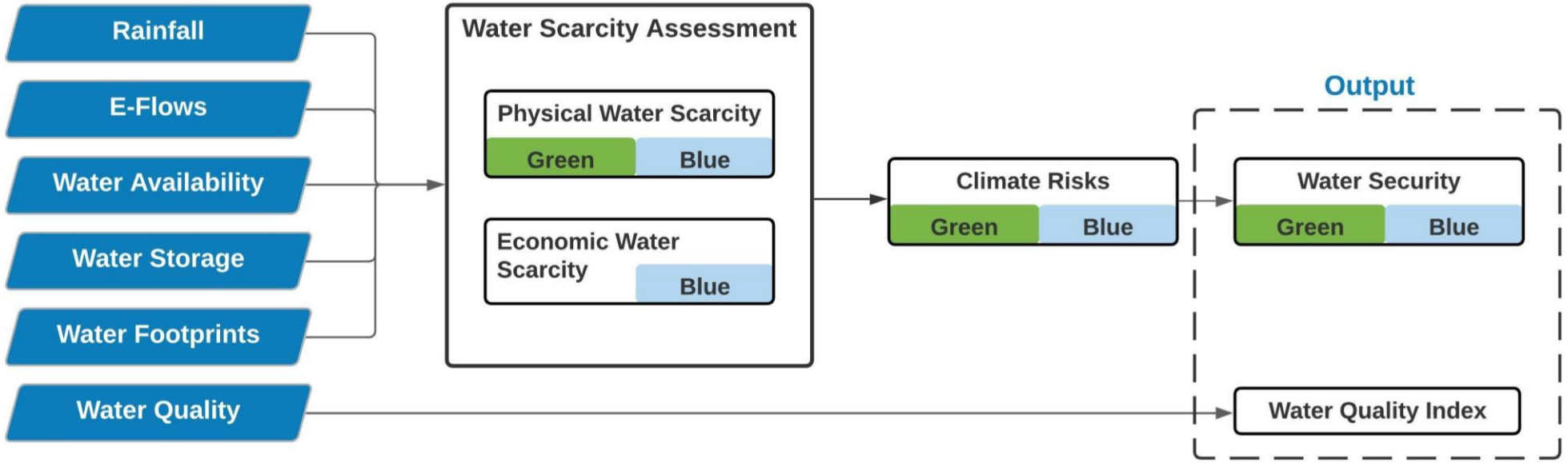
S.no	Groundwater Extraction	Stage of development of the Block where the industry is located (industry block)	
		Safe / semi-critical, Critical blocks	Over-exploited blocks
1	<500 m^3/day	Entire Block	Entire block
2	500 to 5000 m^3/day	Entire Block	Entire Block + adjoining block/blocks if the co-dependent area >30% area of that Block
3	>5000 m^3/day	Entire Block	Entire Block + adjoining block/blocks if the co-dependent area >20% area of that block

Both Surface and Groundwater as source

- Factory catchment and sub-basin delineation is dependent on the extent of groundwater monitoring block
  - If size of GW Monitoring block > Surface water catchment, then GW Monitoring block
  - If size of GW Monitoring block < Surface water catchment, then Surface water catchment area

Water Security Assessment

- The framework assesses 5 different dimensions to identify scarcity & Risks
  - Rainfall
  - E-Flows
  - Water Availability (Green, Blue & Grey Water)
  - Water Storage (Green, Blue & Grey Water)
  - Water Footprints (Green, Blue & Grey Water)
- Water Quality is assessed as separate parameter (Water Quality Index)
- Parameters assessed for different geographical units (ex: Factory premises, Factory catchment & Sub-basin)

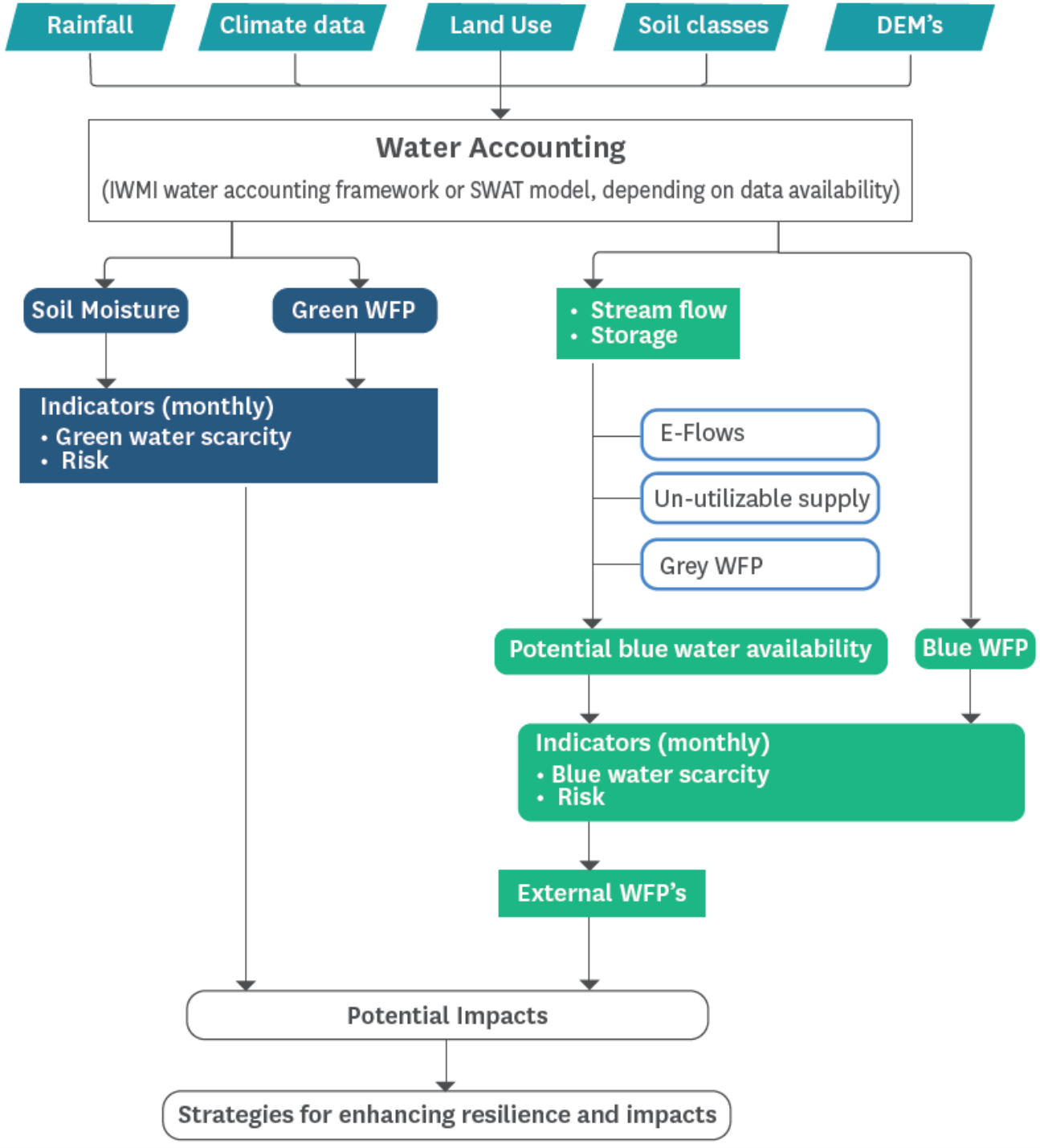


Dimensions of Water Security Framework

S.No	Dimension	Assessment / Description
1.	**Rainfall Analysis**	Rainfall tends, drought assessment, probability & frequency analysis
2	**Flows & E – Flows**	Seasonal & yearly flow pattern assessment, Flow duration curve to understand variability, Seasonal and yearly E – Flow assessment, selecting EMC classes, probability assessment
3	**Utilizable Water Supply**	Assessment of green water & blue water availability from surface runoff, soil mo isture, groundwater and reservoirs and tanks.
4	**Utilizable Storage**	Assess utilizable storage from runoff, soil moisture, groundwater and reservoirs and tanks.
5	**Water Footprints or CWU**	Water footprint assessment for domestic, industrial and agricultural sector and in turn
6	**Assess Scarcities & Risk**	Assess physical & economic water scarcity, assess risk of insufficient water supply and risk of inadequate infrastructure
7	**Assess Water Security**	Apply scarcity & risk results in the matrix

Analytical framework

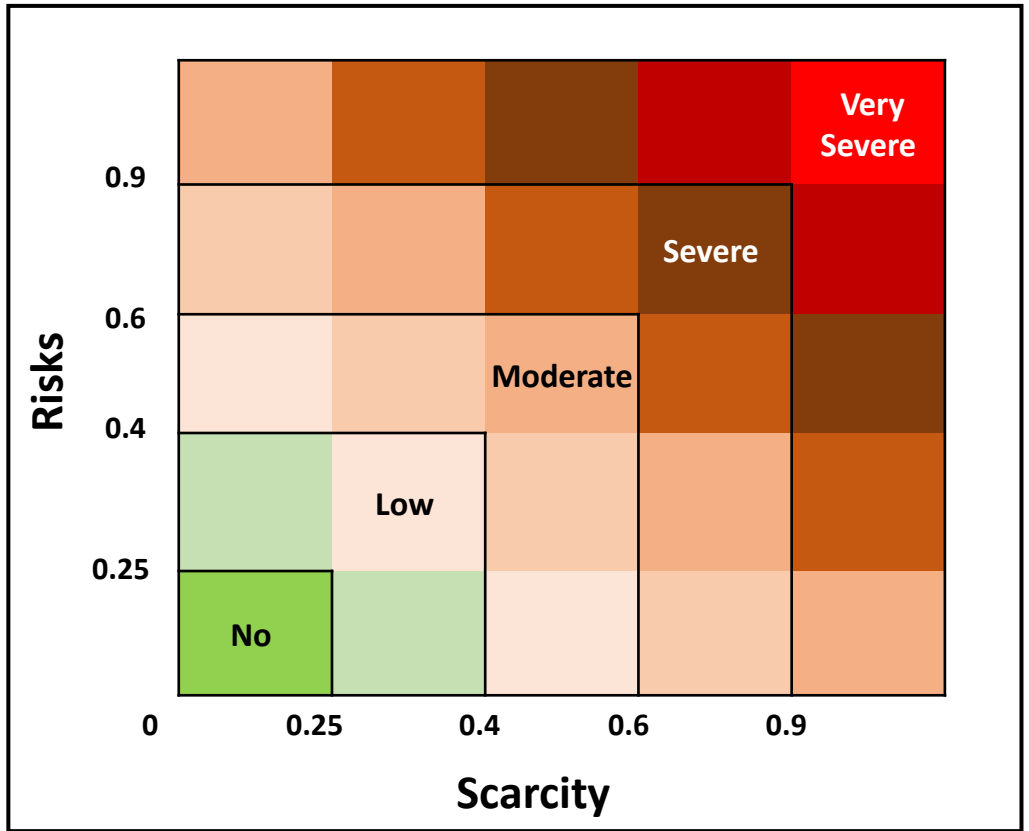
- The framework employs a systems approach to water security assessment.
- Assesses the total water availability and total water footprints
- The WS estimation essentially has three dimensions:
  - Physical water scarcity
  - Economic water scarcity
  - Risk of meeting the demand



Water Security Matrix

- Scarcity (0 to 1) & Risk (0 to 1) results are applied in the matrix to identify the level of water insecurity

Very Severe	Severe	Moderate	Low	No
Risk > 0.9 Scarcity > 0.9	Risk 0.6 to 0.9 Scarcity 0.6 to 0.9	Risk 0.4 to 0.6 Scarcity 0.4 to 0.6	Risk 0.25 to 0.4 Scarcity 0.25 to 0.4	Risk <0.25 Scarcity <0.25



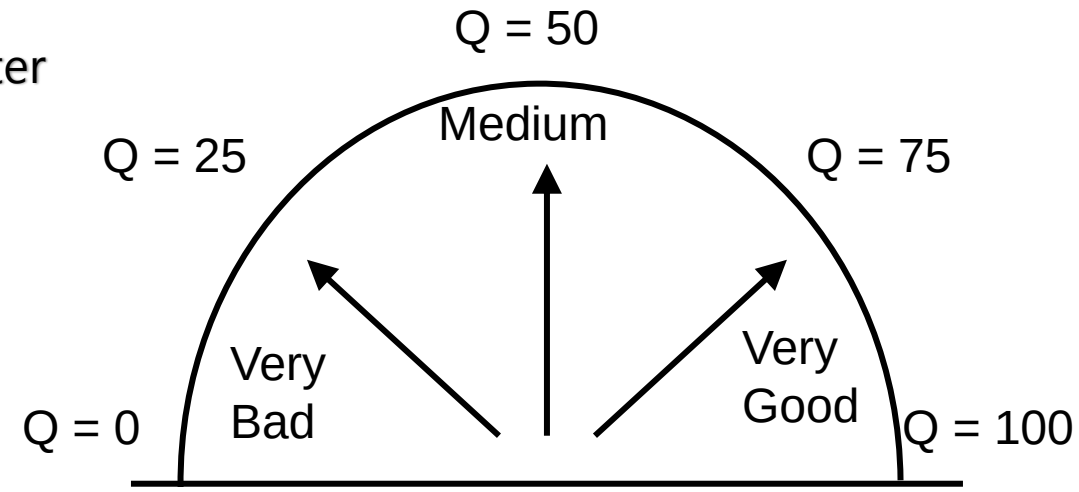
Water Quality Index - WQI

- WQI numerically summarizes the information from multiple water quality parameters into a single value
- It can be used to look at trends over time on the focus area

Key Components of WQI

Q-Value - indication of water quality relative to 100 of one parameter
Weighting Factor - sets the relative importance of the parameter to overall water quality

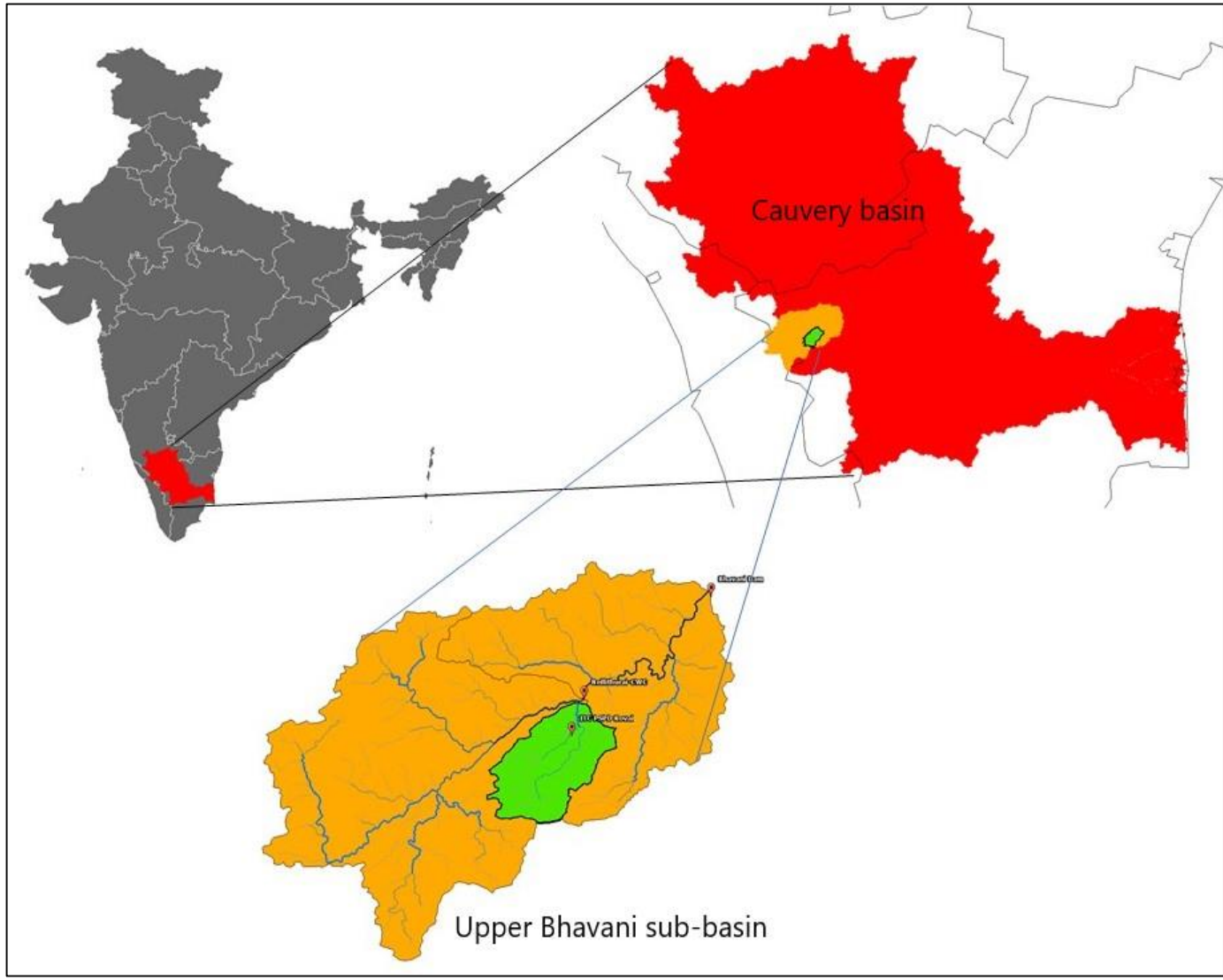
- The Q-Value is an indication of how good (or bad) the water quality is relative to one parameter.
- 100 = Very Good
- 1 = Very Bad



Application of WS Framework

Framework Applied for ITC's PSPD factory in Tamil Nadu

- ITC factory premises and its water source fall within the same catchment. i.e. Periyapallam catchment (PC).
- The factory catchment (FC) is the PC that contains factory premises and a water source.
- PC falls in the larger Upper Bhavani sub-basin (UBSB). Therefore, the WS assessment in this study is at three geographical scales.
  - Factory Premises (FP): ITC – PSPD factory.
  - Factory Catchment (FC): Periyapallam Catchment
  - Sub-basin (SB): Upper Bhavani sub-basin (UBSB)



ITC Limited

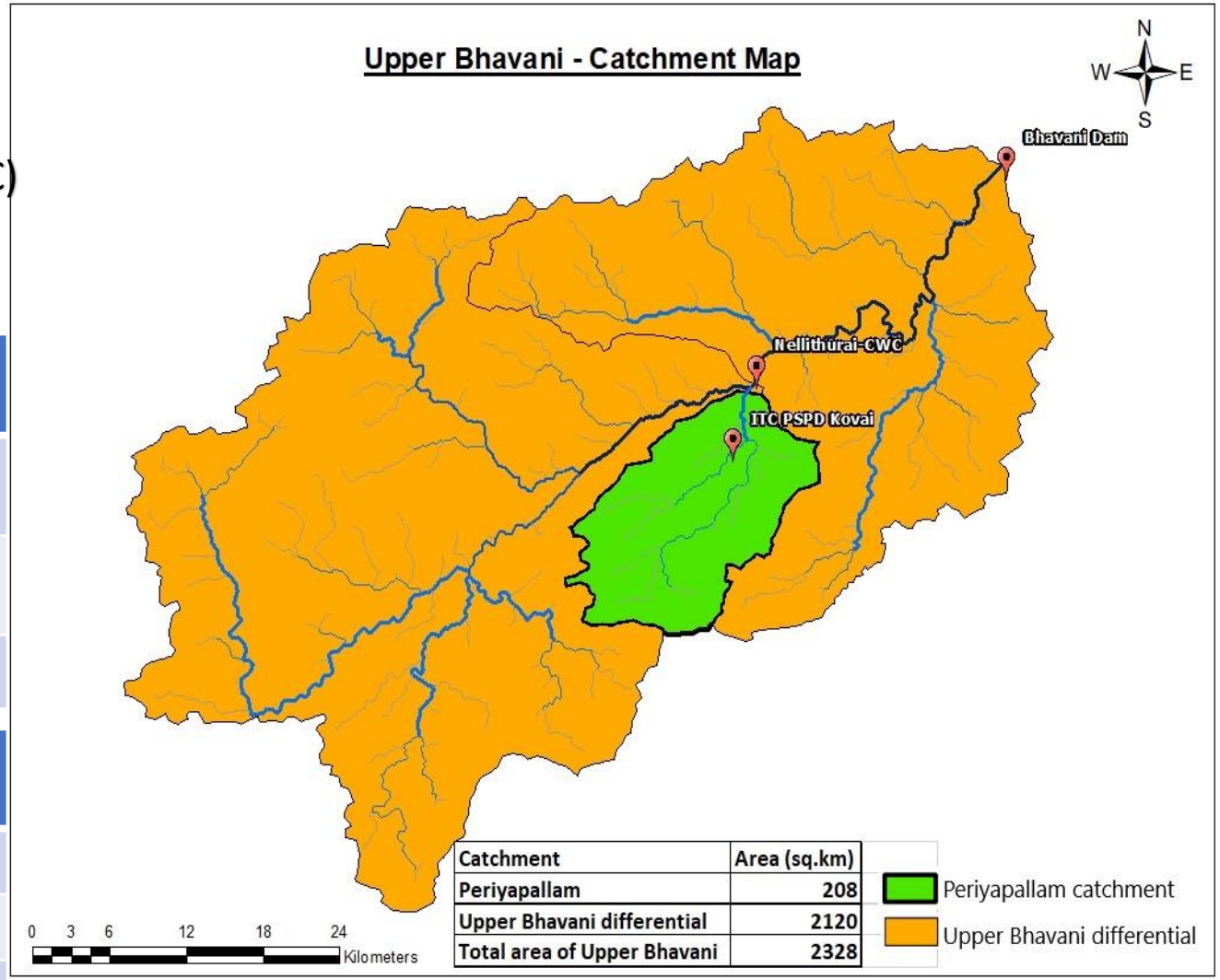
Water Security Assessment – Upper Bhavani

WS assessment in carried out at three geographical scales.

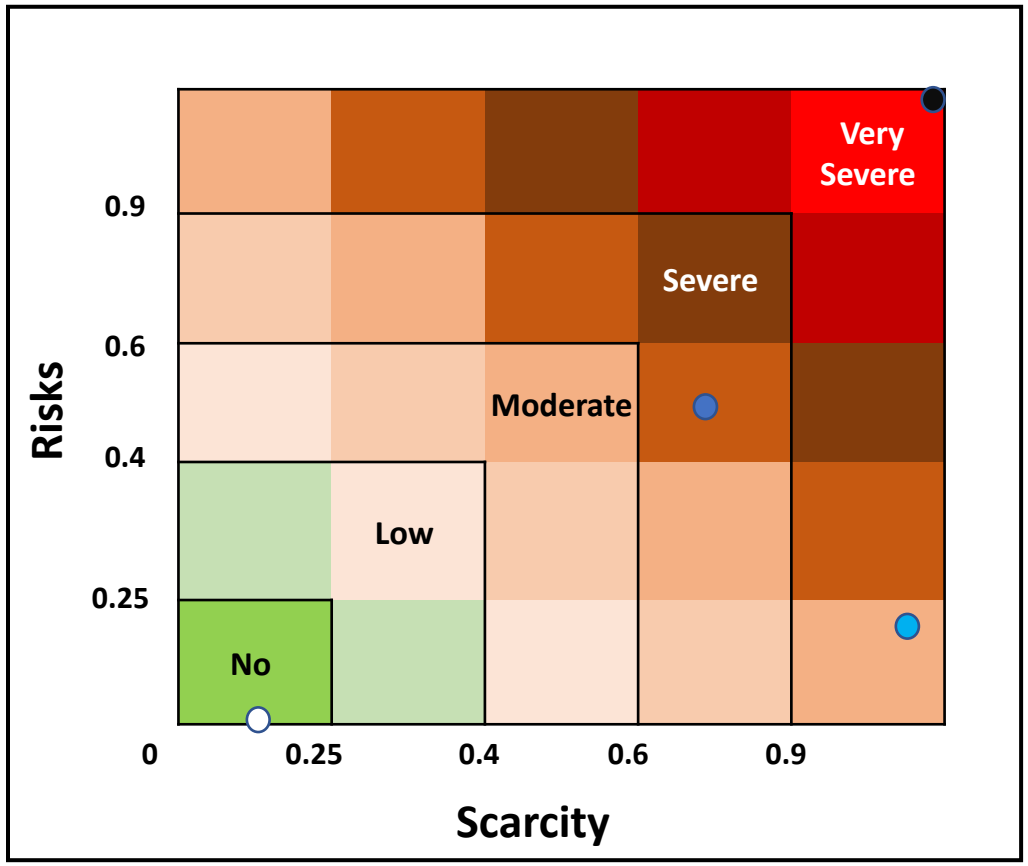
1. Factory Premises (FP): ITC – PSPD factory.
2. Factory Catchment (FC): Periyapallam Catchment (PC)
3. Sub-basin (SB): Upper Bhavani sub-basin (UBSB)

Scarcity	Factory premises	Factory catchment	Sub-basin
Physical Water Scarcity - Green water	0	2.39	0.97
Physical Water Scarcity - Blue water	0.33	0.76	0.13
Economic Water Scarcity - Green water	0.33	4.28	1.46

Risk	Factory premises	Factory catchment	Sub-basin
Risk - Green water	0.00	1.00	0.20
Risk - Blue water	0.00	0.45	0.00
Risk - Infrastructure	0	1.00	1.00



Water Security Assessment – Upper Bhavani



Green Water at sub-basin

Risk	0.20
Scarcity	0.97

Blue Water at sub-basin

Risk	0
Scarcity	0.13

Blue Water at FC

Risk	0.45
Scarcity	0.76

Infrastructure at sub-basin

Risk	**1**
Scarcity	**1**

Water Security Assessment – Upper Bhavani

- Scarcity (0 to 1) & Risk (0 to 1) is applied in the matrix to identify the level of water insecurity

Very Severe	Severe	Moderate	Low	No
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Unit	Water or infrastructure s carcity	Scarcity	Risk	Water Security
Factory premises	Green water	NA	NA	NA
	Blue water	Low	No	Low
	Infrastructure	No	No	No
Factory Catchment	Green water	Very severe	Very severe	Very severe
	Blue water	Severe	Moderate	Severe
	Infrastructure	Very severe	Very severe	Very severe
Sub-Basin	Green water	Very severe	No	Very severe
	Blue water	No	No	No
	Infrastructure	Very severe	Very severe	Very severe

Thank You

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