Safe WATER NETWORK

WATER BUDGETING TOOL FOR A WATERSHED

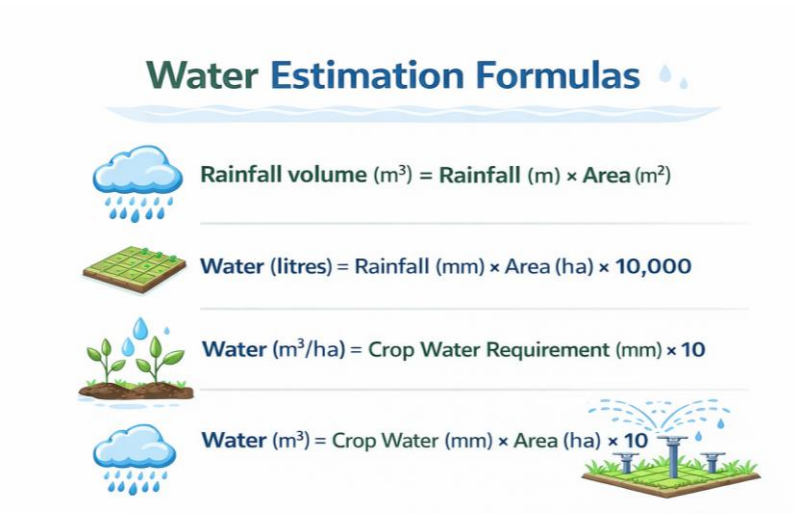
USER GUIDE

LIST OF ABBREVIATIONS

BCM	Billion Cubic Metres
CGWB	Central Ground Water Board
CPHEEO	Central Public Health and Environmental Engineering Organization
Cr	Crore
CWB	Crop Water Budgeting
CWR	Crop Water Requirement
Et_c	Crop Evapotranspiration
Et_o	Reference Evapotranspiration
FAO	Food and Agriculture Organization
GRES	Groundwater Resource Estimation System
Ha	Hectare
ICAR	Indian Council of Agricultural Research
K_C	Crop Coefficient (Growth Factor)
L	Litre
LPCD	Litre Per Capita per Day
Mm	Millimetre
M	Metre
m^2	Square Metre
m^3	Cubic Metre
mL	Million Litres
Mcm	Million Cubic Metres
MI Census	Minor Irrigation Census
NITI	National Institution for Transforming India
SWB	Surface Water Bodies
WASCA	Water Security and Climate Adaptation in Rural India
WRD	Water Resources Department

UNIT CONVERSION REFERENCE

Category	Unit	Value	Equivalent
Rainfall	1 m	1	100 cm
	1 m^3	1	1000000 cm^3
	1 mm over 1 hect	1	10 m^3
	1 m over 1 hect	1	10000 m^3
	1 m^3	1	1000 Litres
	10,000 m^3	1	10000000 Litres
	1 Inch	1	25.4 mm
			0.0254 m
			254 m^3 (1 hect)
			254000 Litres
Hectares	1 Hectare	1	10000 m^2
			2.47 acres
Acres	1 Acre	1	0.405 Ha
			4047 m^2
			0.00405 km^2
	1 Liter	1	1000 ml
	1 m	1	1000 mm
	1 CUm	1	1000 Litres
	1 BCm	1	1000000000000 Litres
	1 BCm	1	1000000000 m^3



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Flooding of the Sina River, Maharashtra

OVERVIEW OF THE WATER BUDGETING TOOL

ABOUT THE TOOL

SWNI implemented **Crop Water Budgeting (CWB)** across six villages in the Karmala block of Solapur district, Maharashtra. The tool was developed following a detailed watershed assessment to understand water availability for rabi crops, accounting for both water demand and supply dynamics.

The CWB tool is farmer-centric, enabling communities to align water demand with available resources. It ensures that water use remains within the limits of natural recharge from rainfall, streams, and surface storage. By facilitating informed decision-making, the tool supports efficient use of both surface and groundwater resources while preventing further depletion. It also helps farmers and village institutions assess the water balance for rabi crops and plan usage accordingly.

In addition to improving water availability, the tool emphasizes demand-side management by building awareness around water scarcity, the concept of water as a shared resource, water-saving practices, and relevant government programmes. Through participatory CWB exercises, farmers collectively evaluate crop water requirements, conservation strategies, and recharge measures, fostering coordinated action for responsible water use.

By placing farming communities at the center, the tool strengthens local ownership, promotes efficient irrigation practices, and contributes to sustainable agricultural livelihoods.

WATER BUDGETING

Water budgeting is the process of estimating water availability and planned water use within a watershed to ensure adequate supply for domestic needs, livestock, and agriculture. It supports communities in using water efficiently and sustainably for their livelihoods. As a key water management tool, it helps assess the gap between water availability and water requirements.

Water Budgeting means:

- Understanding how much water is available
- Understanding how much water is being used
- Planning crops in a way that prevents water depletion

Water Budgeting Exercise, Bitargaon

Need for Water Budgeting for Rabi Crops

Water Budgeting Helps Us Grow Rabi Crops Without Running Out Of Water!

WATER SUPPLY AND DEMAND

Water Supply – Availability

1. **Rainfall and Surface Water Sources:** Based on average rainfall and the storage capacity of surface water bodies/ structures (as per the First Census of Water Bodies).
   - *Water storage in water bodies*
   - *Watershed inputs for irrigation come from canals, tanks, lakes, rivers, etc.*
   - *Water availability from treatment and conservation structures like Farm Ponds, Bunds, Contour Trenches, Doha models, Gabions, check dams, etc.*
   - Annual extractable groundwater supply

   Annual rainfall (mm) ÷ 1000 = Annual rainfall (m)

2. **Surface Runoff:** Estimated at the village/block level based on catchment characteristics and land use patterns (forest areas, non-agricultural land, barren land, pastures, tree crops, cultivable wasteland, fallows, and irrigated land). **(Typically, ~35% runoff)**
   Runoff (m^3) = Rainfall (m) × Area (ha) × Runoff (%) ÷ 100

3. **Groundwater Availability**: Groundwater estimates are derived from the India Groundwater Resource Estimation System (IN-GRES) and the Central Ground Water Board (CGWB) (On average, **~20% of rainfall contributes to groundwater recharge)**

Water Demand – Usage

1. **Drinking and Domestic Use:** As per CPHEEPO guidelines, rural domestic water demand is 55 liters per capita per day (LPCD)
   Annual water requirement:
   Total Population x LPCD x 365 days

2. **Livestock and dairy:** Livestock population can be taken from the latest available census data (e.g., 2019 Livestock Census by the Department of Animal Husbandry and Dairying).
   Annual livestock water requirement:
   Population × Water requirement per livestock unit (LPCD) × 365 ÷ 10,000,000 (in ha. m)

3. **Agriculture (crop-wise water requirement):** Cropping Water Requirement (CWR) for irrigation is estimated at 0.5 meters per hectare of gross irrigated area. It is calculated using the village X's gross irrigated area, growth factor, and the irrigated water requirement coefficient (0.5m per/ha).
   Agricultural Water Demand:
   Gross Irrigated Area x Growth Factor × 0.5 m
   The Growth Factor reflects the expected increase in irrigated area or crop water demand over time.

4. **Industrial and Other Uses:** District officials input the industrial use of water at the village level.

The above four components determine the volume of water required in a village, which is essential for reducing wastage and improving crop yield.

WHAT IS WATER BALANCE

ESTIMATING THE WATER BALANCE

Water Balance = Total Water Supply – Total Water Demand

This enables informed crop planning and collective decision-making.

Water Balance	**= Credit (Water availability)**	**- Debit (Water utilization)**

Where

Water Available
(–) Evaporation Loss
(–) Runoff
(+) Soil Moisture
(+) Natural Groundwater Recharge
(+) Harvested / Artificial Recharge
(+) Imported Water (Canal/Dam/etc.)

Water Usage
Crop Water Requirement
Drinking (Human + Livestock + Industry)

Terms Used in Calculations

ha. m:	Hectare meters (equivalent to 10 million litres)
CUM:	Cubic Meters
Cr Litres:	Crore Litres
Hd:	Human Water Demand
Ld:	Livestock Water Demand
Id:	Irrigation Water Demand

VARUNI WATER BUDGETING APP BY NITI AAYOG

Varuni, a web-based Water Budgeting Application developed by **NITI Aayog** in collaboration with GIZ under the WASCA project, automatically extracts and processes data to assess both water demand and supply. The application streamlines water budgeting by integrating relevant datasets for efficient analysis and planning.

🔗 Access the application: https://wasca.in/ijalagam/

NATIONAL REPOSITORY FOR DATA SOURCES

Features	Data Description	Portals	Concerned Ministry / Departments
	Rainfall Data	India Meteorological Department (IMD)	https://mausam.imd.gov.in
Supply Side	Surface Water Sources	IndiaWRIS	https://indiawris.gov.in/wris/#/jaldharohar
	Groundwater Availability	Central Ground Water Board (CGWB)	https://ingres.iith.ac.in/home; https://cgwb.gov.in
	Water Transfer (Inwards & Outwards)	-	District & Block administration
Demand Side	Population	Census 2011	https://censusindia.gov.in/nada/index.php
	Livestock data	Livestock Census 2019	https://dahd.gov.in/schemes/programmes/animal-husbandry-statistics
	Crop Information	PMKSY	https://pmksy.gov.in/mis/rptDIPDocConsolidate.aspx
	Agricultural & Socio-Economic Data	Ministry of Statistics and Programme Implementation (MoSPI)	https://mospi.gov.in
Water Budgeting	Available Surface Run-off	Land Use Census 2011	https://censusindia.gov.in/nada/index.php
Water Budgeting	Rainfall data	IndiaWRIS	https://indiawris.gov.in/wris/#/jaldharohar

WATER BUDGETING METHODOLOGY

Features	Calculations	Formulae
Demand Side	**Human Water Requirement**	**Annual human water requirement (ha. m)** = (Population + decadal growth) * (LPCD + loses@20%) *(annual days) / (1,00,00,000) We explain the conversion as: 1 hectare-metre (ha-m) = 10,000 cubic metres (m^3) 1 cubic metre = 1,000 litres 1 ha-m = 10,000 × 1,000 = 10,000,000 litres (10 million litres)
	Livestock Water Requirement	**Annual livestock water requirement (ha. m)** = Population * Water requirement per livestock unit in LPCD * annual days/1,00,00,000
	Irrigation Water Requirement	**Irrigation Water Requirement** = Gross Irrigated Area (Ha)* Growth Factor (17% for the period of 2011-12 to 2022-23) * Irrigation Requirements (0.50 meters)
	Industrial Water Requirement	No. of industrial units * Annual water demand for the industry (ha.m)
Supply Side	**Surface Water Sources**	No. of structures* storage Capacity
	Groundwater Availability	**INDIA-Groundwater Resource Estimation System (IN-GRES)**
	Source from outside geography (If applicable)	Direct inputs from primary sources Net water transfer = Inward - Outward
Surface runoff from rainfall	**Available Surface Run-off**	Annual Rainfall in mm (x) / 1000 = Annual Rainfall in metre (y) Actual runoff (z) = y * area (hectare) * % age of run-off
	Rainfall Data	Direct inputs from web service add links
Water Budgeting	**Water Deficit/Surplus**	Water Balance

WATER BUDGETING – DEMAND SIDE

Features	Calculations	Formulae
Demand Side	**Human Water Requirement**	**Hd = Σ (x × Dw × Df × 365) / 10,000,000 (Hectare metres or 10 million litres)** Hd = Human Water Demand x = Human population (Census 2011) Dw = Daily water requirement Df = Decadal factor We explain the conversion as: 1 hectare-metre (ha-m) = 10,000 cubic metres (m^3) 1 cubic metre = 1,000 litres 1 ha-m = 10,000 × 1,000 = 10,000,000 litres (10 million litres)
	Livestock Water Requirement	**Ld = Σ (x × Dw × 365) / 10,000,000 (Hectare metres)** Ld = Livestock water demand x = Livestock population (Census 2019)Dw = Daily water requirement of each livestock type
	Irrigation Water Requirement	**Id = Ig × (1 + Gf) × Ir (Hectare meters)** Ig = Gross irrigated area Gf = Growth factor (17% for 2011–2023) Ir = Irrigation water requirement (0.50 m) **Irrigation Water Requirement = Gross Irrigated Area (Ha)*Growth Factor (17% for the period of 2011-12 to 2022-23 * irrigation requirements (.50 meters)** **Growth factor** *representing 17% increase in irrigated area between 2011–12 and 2022–23).*
	Industrial Water Requirement	Direct calculation from input (generally absent)

The crop water requirement is calculated based on the gross irrigated area of the Block, using the appropriate growth factor and an irrigated water requirement coefficient of 0.5 m per hectare.

WATER BUDGETING – SUPPLY SIDE

Features	Calculations	Fo (F zero) – Initial Capacity
Supply Side	**Surface Water Sources**	India-WRIS – https://indiawris.gov.in; Central Water Commission Reservoir Storage Monitoring – https://cwc.gov.in; Bhuvan NRSC Water Resources Portal – https://bhuvan.nrsc.gov.in
	Groundwater Availability	Central Ground Water Board – https://cgwb.gov.in; India-WRIS Groundwater Information System – https://indiawris.gov.in; Jal Shakti Ministry Groundwater Dashboard – https://jalshakti-dowr.gov.in
	Source from outside geography	Central Water Commission Inter-basin transfer / canal data – https://cwc.gov.in; Ministry of Jal Shakti National Hydrology Project – https://nhp.mowr.gov.in; India Meteorological Department rainfall & basin inflow – https://mausam.imd.gov.in

Features	Calculations	Formula
Surface runoff from rainfall	**Available Surface Run-off (Good / Average / Poor Catchment)**	**Rg = Σ (Ag × Sg × r) / 100,000 (Hectare metres)** **Ag = Catchment area (ha)** – area from which rainfall drains into a water body or watershed. Data can be obtained from: • National Remote Sensing Centre Bhuvan Watershed Atlas – https://bhuvan.nrsc.gov.in • India-WRIS basin and catchment data – https://indiawris.gov.in **Sg = Runoff coefficient (%)** – percentage of rainfall that becomes surface runoff depending on soil, slope, and vegetation. Reference guidelines available: • Central Water Commission hydrology manuals – https://cwc.gov.in • Central Ground Water Board watershed planning manuals – https://cgwb.gov.in
	Rainfall Data	Direct inputs from web service India Meteorological Department district rainfall statistics – https://mausam.imd.gov.in

GROWTH FACTOR OF RABI CROPS

The Growth Factor is used to estimate irrigation water requirements for crops.

The Growth Factor is a multiplier that represents the expected increase in water demand or irrigated area compared to the current baseline. It helps project future water needs for effective planning.

Growth Factor = Expected future increase in demand relative to the current baseline

The table below presents the Growth Factor (Crop Coefficient – Kc) and Seasonal Water Requirement for major Rabi crops in Maharashtra. These values are based on irrigation planning references from the Water Resources Department, Maharashtra (WRD-MH), and/or FAO guidelines, and are suitable for regional cultivation conditions.

Cereals

Crop	Growth Factor (2011-12 to 2022-23)	Growth Factor Value
Wheat	15%	**1.15**
Chickpea (Harbara)	18%	**1.18**
Rabi Jowar (Sorghum)	10%	**1.10**
Onion	20%	**1.20**
Maize	17%	**1.17**

CROPWISE ESTIMATION: WATER USAGE FOR RABI CROPS

Data to be recorded for each farmer on cropwise estimation of water usage for rabi crops

Name of crops	Number of farmers	Area under crop (Ha.)	No. of irrigation needed during the Rabi season	Pumping hours per irrigation	Total volume
Total					

Key Information is to be collected:

- **Crops:** List of crops planned for the Rabi season
- **Farmers:** Number of farmers for each crop
- **Area (ha):** Area to be cultivated under each crop
- **Irrigations:** Total number of irrigations required per crop during the Rabi season
- **Pumping Hours per Irrigation:** Average pumping duration per irrigation *(calculated as total pumping hours ÷ number of irrigations)*
- **Pump Discharge (L/hour):** Volume of water discharged per hour by the irrigation pump *(based on pump rating, secondary data sources, or field measurements)*

DATA COLLECTION FORM AND WATER BUDGET CALCULATION

DATA COLLECTION FORM

WATER BUDGETING EXERCISE IN A WATERSHED

VILLAGE DETAILS

A. Demographics

- Taluka
- District
- State
- Population
- Households
- Village code
- Pin code

B. Land

- Total Land Area (in ha)
- Arable Land Area (in ha

C. Water Source/Structure Details

- **Name of Structure:** Official or local known name of the water body (if any)
- **Maximum water depth (m):** Maximum water level in the structure (measured at the centre for ponds/tanks and near the dam wall for check dams)
- **Water Spread Area (ha):** Area covered by water *(pond/tank surface water or backwater storage area in case of check dams)*
- **Number of Fillings:** Number of times the structure fills and overflows during the season (continuous overflow is counted as one filling; a new overflow after water recedes is counted separately)

D. Rainfall Recharge

- Recharge from Direct Rainfall (mm)
- Village area, untreated

Recharge rate%

- Treated area of village (ha)
- Recharge Rate (will be higher due to newly built recharge structures)
- Coordinates

E. Irrigation Details

- Irrigations: Total number of irrigations required per crop during the Rabi season
- Pumping hours/irrigation: Average pumping hours per irrigation (total pumping hours ÷ number of irrigations)
- Pump discharge (L/hour): Water discharged per hour by the irrigation pump (based on pump rating, secondary sources, or field measurement

WATER AVAILABILITY

Rainfall Data

1 mm rainfall over 1 hectare = 0.01 crore Litres	Input data
Average annual rainfall (mm)	
Total Rainfall available in the village(Litres)	

WATER AVAILABILITY

Source	Volume (Crore Litres)
Natural Groundwater Recharge	
Groundwater Recharge (Rainfall)	
Surface Water Recharge (Artificial Storage)	
Surface Water Recharge (River / Canal Supply)	
Total Water Incoming in the village (A)	

Surplus / Deficit (A - B) xx Crore Litres

Water Availability

1. NATURAL GROUNDWATER RECHARGE

Total Only 30-40% is usable for crops

2. GROUNDWATER RECHARGE (RAINFALL)

Water cycle	Retained in soil (% of total rainfall water available)	Total Water Requirement (Cr Litres)
Soil Moisture	20%	
Water lost due to Evaporation	20%	
Naturally available as Groundwater	10%	
Water flowing out of the village	50%	

3. SURFACE WATER RECHARGE (ARTIFICIAL)

Treatment Structure	Number	Total water storage capacity (m^3)	How many times the structures are filled by rain	Total artificially available groundwater (Crore Litres) = Total water storage capacity*No. of times structures are filled by rain /1,000
Percolation Ponds				
Cement Check Dams				
Earthen Nala Bund				
Soil Nala Bunds (ha)				
Farm Ponds/Storage Ponds				
Continuous Contour Trenches (Ha.)				
Gross				
Net (Recharge efficiency)				

Typical Recharge Efficiency for sandy soil is 50%

4. SURFACE WATER RECHARGE (River/canal supply)

Source	Total Number of Pumps	Water thrown out per hour (Litres)	Days/hours pump runs per year	Days pump runs per year	Total water import (Crore Litres)
Canal					
Water lift by individual farmers from River					
Lakes					
River / Lift irrigation scheme					
Total					0

Total water import = Total no. of pumps*water thrown out per hour*Days/hours pump runs per year*days pump runs per year

WATER DEMAND

No of days in a year	365
Geographical area covered (Hectares)	669

WATER DEMAND				
Sector	**Volume (Crore Litres)**			
Agriculture (All Crops) - W				
Domestic + Livestock - X				
Industry / Others - Y				
System Loss / Wastage - Z				
Total Water outgoing in the village (B)	**W+X+Y+Z**			
Water Demand				
1. AGRICULTURAL CROPS				
Kharif Crops (Monsoon Crops)				
Crops	**Water Requirement (m^3/Ha)**	**Total Area (Hectares)**	**Total Water Requirement (Cr Litres)**	**Reference/Data Source**
Urad (Black Gram)	3500		-	FAO / MH Agri Dept/ICAR–IIPR
Maize	5000		-	FAO/ICAR
Pigeon pea (Arhar)	2000		-	FAO / ICAR
Moong bean	3000		-	State Agri Dept
Pulses	0		-	
Vegetables (Mixed)	3000		-	FAO
Gross total			-	
Net Total	**Cultivable area**	30%	**-**	
		30% irrigation		
Rabi Crops (Winter season)				
Crops	**Water Requirement (m^3/Ha)**	**Total Area (Hectares)**	**Total Water Requirement (Litres)**	**Reference/Data Source**
Jowar (Sorghum)	2100		-	FAO
Wheat	4000		-	ICAR, 4–5 irrigations assumed
Chickpea / Harbara / Green Gram	3500		-	
Onion	4000		-	
Maize	4500		-	FAO
Gross total			-	
Net Total	**Cultivable area**	75%	**-**	
		75% Irrigation		
Summer Season				
Crops	**Per Hectare water requirement**	**Total Area (Hectares)**	**Total Water Requirement (Litres)**	**Reference/Data Source**
Fodder Crops - Napier	10000		-	FAO fodder crop water requirement guidelines
Sugarcane	22500		-	ICAR–SBI
Gross total			-	
Net Total	**Cultivable area**	90%	**-**	
2. DOMESTIC + LIVESTOCK				
Total Water Usage	**Total Number**	**Water required per day (Litres)**	**Crore Litres per annum**	**Reference/Data Source**
A. Humans		55	-	CPHEEO norms (55 Lpcd – rural Maharashtra)
B. Hybrid cows and buffaloes		70	-	BAIF / NDDB livestock water norms
C. Indigenous cows and buffaloes		35	-	BAIF livestock norms
D. Goats/Sheep's Population		10		
E. Pigs		22	-	ICAR small ruminant norms
F. Poultry Farm-Birds		2	-	Poultry water requirement – ICAR
Net Total			**-**	
3. INDUSTRY / OTHERS				
Net Total	1	1350	**0.05**	DPR / CSR planning norm for villages
4. SYSTEMLOSS/WASTAGE				
			-	

WATER BALANCE

WATER AVAILABILITY	
Source	**Volume (Crore Litres)**
Natural Groundwater Recharge	
Groundwater Recharge (Rainfall)	
Surface Water Recharge (Artificial Storage)	
Surface Water Recharge (River / Canal Supply)	
Total Water Incoming in the village (A)	

WATER DEMAND	
Sector	**Volume (Crore Litres)**
Agriculture (All Crops) - W	
Domestic + Livestock - X	
Industry / Others - Y	
System Loss / Wastage - Z	
Total Water outgoing in the village (B)	**W+X+Y+Z**

Water Balance Statement	
Item	**Value in Crore Litres**
Total Availability (A)	
Total Demand (B)	
Surplus / Deficit (A-B)	

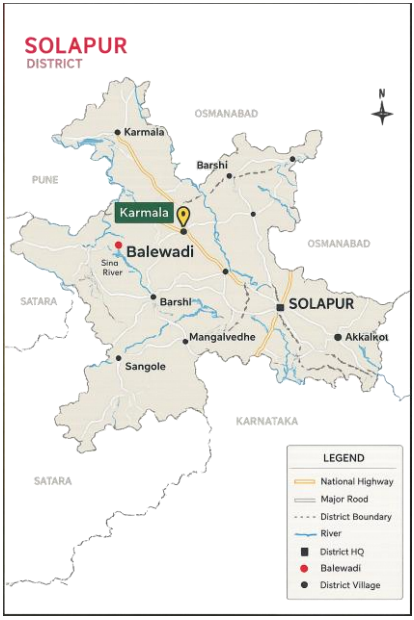
CASE STUDY

VILLAGE BALEWADI, MAHARASHTRA

Taluka: Karmala **District:** Solapur **State:** Maharashtra

Population: 1,139 **Households**: 214

Agricultural Area: 669 Ha **Rainfall Nature:** Scanty & Uncertain



Balewadi is a rural village in Karmala taluka, Solapur district, Maharashtra, located about 12 km from Karmala town. Governed under the Panchayati Raj system, it lies near the Sina River, a tributary of the Bhima. The region has fertile black cotton soils but is prone to cracking and seasonal droughts. Water scarcity is a major challenge due to erratic rainfall and low groundwater recharge.

Land and Natural Resources

- Total area of Balewadi is **669 Ha**
- Total sown/agricultural area is **639.29 ha**
- **133.75 ha** is an unirrigated area
- **505.54 ha** is the irrigated area.
- **103.75 ha** is irrigated by wells/tube wells
- About **30 ha** is irrigated by waterfalls

Topography

- **Eastern Zone** (Dry Zone)
  - Soil is Medium to deep black
  - **Main Crop**: Jawar, Bajra & Pulses
- **Central Zone**
  Moderate and poor soil with uncertain rainfall
- **Western Zone**
  - Soil is deep black and of rich quality
  - **Groundnut, bajra & rabbi** are grown here

Rainfall Estimates

- The average annual rainfall in Karmala ranges between **500 mm and 600 mm**.
- The region is classified as a drought-prone area, characterized by uncertain and scanty rainfall.
- High dependence on groundwater

Estimated rainfall month-wise

June: 90 mm
July: 130 mm
August: 110 mm
September: 70 mm
October: 30 mm

WATER RESOURCE STATUS

Parameter	Condition / Value	Implication for Balewadi
Groundwater Level (Post-Monsoon)	<5 to 10 m below ground level (regional)	Moderately shallow, can support shallow wells
Groundwater Level (Pre-Monsoon)	Often deeper (10–18+ m)	Stress increases in summer
Recharge Potential	Limited since the area is primarily composed of Deccan Trap basalts	Slow natural recharge
Groundwater Quality	Potential salinity / fluoride issues in region	Some water may need treatment
Surface Water (Sina River)	Seasonal flows with monsoon peak	Supports recharge & limited irrigation
Small Ponds & Tanks	Scant and rain-dependent	Often dry outside rainy months
Rainfall Pattern	Erratic, low outside monsoon	Limits recharge & surface storage
Overall Water Balance	Deficit (Demand > Availability)	High stress agriculture area

LAND USE & IRRIGATION AREA

Category	Area (Ha)
Total Agricultural Area	639
Total Irrigated Area	505
Irrigation by Wells/Tube wells	103
Irrigation by Canals/Waterfalls	30
Rainfed Area (Approx.)	134

Limited canal/waterfall irrigation
No major storage structures
Deccan Trap Basalt – Low natural recharge capacity

WATER DEMAND

DOMESTIC WATER DEMAND

Category	Demand	
Population	1,139	
Per Capita Supply	55	L/day
Annual Demand	**2.29**	Crore Litres per annum

LIVESTOCK WATER DEMAND

Livestock Type	Commonality in Karmala Area	Number	Daily Use (L/day)*	Crore Litres per annum
Hybrid cows and buffaloes	High – principal bovine livestock	197	100	0.72
Indigenous cows and buffaloes	Moderate – milk/buffalo rearing	598	35	0.76
Goats/Sheep's	High – suited to dry, low-fodder conditions	654	10	0.24
Poultry Farm-Birds	Usually backyard birds; common in villages	1,054	2	0.08
Gross Total			**1.80**	Crore Litres per annum

INDUSTRY WATER DEMAND

INDUSTRY / OTHERS	Total Number	Water required per day (Litres)	Crore Litres per annum
Small Rural enterprise (Flour mill, dairy, etc.)**	1	1,350	0.05
Total		**0.05**	Crore Litres per annum

* CPHEEO norms (55 Lpcd – rural Maharashtra), BAIF / NDDB livestock water norms, ICAR small ruminant norms & Poultry water requirement – ICAR

** DPR / CSR planning norm for villages

WATER DEMAND

AGRICULTURAL CROP WATER DEMAND

Kharif Crops (Monsoon Crops)

Crops	Water Requirement (m^3/Ha)*	Total Area (Ha)	Total Water Requirement (Cr Litres)
Urad (Black Gram)	3,500	100	35.00
Maize	5,000	40	20.00
Pigeon pea (Arhar)	2,000	120	24.00
Moong bean	3,000	50	15.00
Pulses	0	0	0
Vegetables (Mixed)	3,000	20	6.00
Gross total		330	100.00
Net Total	Cultivable area	30%	30.00

Rabi Crops (Winter season)

Crops	Water Requirement (m^3/Ha)*	Total Area (Ha)	Total Water Requirement (Cr Litres)
Jowar (Sorghum)	2,100	20	21.00
Wheat	4,000	150	80.00
Chickpea / Harbara / Green Gram	3,500	50	18.00
Onion	4,000	20	60.00
Maize	4,500	35	45.00
Gross total		275	105.45
Net Total	Cultivable area	75%	**79.09**

Summer Season

Crops	Per Hectare water requirement	Total Area (Ha)	Total Water Requirement (Cr Litres)
Fodder Crops - Napier	10,000	60	60.00
Sugarcane	22,500	250	562.50
Gross total			622.50
Net Total	Cultivable area	90%	**560.25**

*FAO / MH Agri Dept/ICAR–IIPR

Irrigation is used by summer crops as a Standard DPR practice

WATER AVAILABILITY SOURCES

RAINFALL ANALYSIS

Rainfall (mm)	430
Area (Ha)	669
DERIVED	
Area in M^2	66,90,000
Volume in M^3	28,76,700
Volume in Liters	2,87,67,00,000

The village receives approx.

287.67 Cr Litres of rainwater per year

- Annual Rainfall: **430 mm (Low – Moderate)**
- **Rainfall is unevenly distributed (July to September)**
- **High groundwater dependency**
- Assumption**: 10% harvestable rainfall**

GROUND WATER RECHARGE

GROUND WATER RECHARGE (RAINFALL)

Water cycle	Percentage	Total Water Requirement (Cr Litres)
Soil Moisture	20%*	57.53
Water lost due to Evaporation	20%	57.53
Naturally available as Groundwater	10%	**28.77**
Water flowing out of the village	50%	143.84

NATURAL GROUNDWATER RECHARGE	35%	57.53
Total	**Only 30-40% is usable for crops**	**20.14**

* Stays in the Soil. During Monsoon: Soil moisture will be higher (potentially reaching 10-20% or more depending on soil depth and rain intensity), but not a permanent high percentage.

WATER SUPPLY SOURCES

SURFACE WATER RECHARGE

SURFACE WATER RECHARGE (ARTIFICIAL)

Treatment Structure (Artificial)	Number	Total water storage capacity (m^3)	How many times the structures are filled by rain	Total artificially available groundwater (Crore Litres)
Percolation Ponds	1	2,500	1.50	3.75
Cement Check Dams	0	0	2.00	0
Earthen Nala Bund	35	5,000	2.00	10.00
Soil Nala Bunds (ha)	0	0	1.00	0
Farm Ponds/Storage Ponds	5	1,800	2.00	3.60
Continuous Contour Trenches (Ha.)	0	600	1.00	0.60
Gross				**17.95**
Net (Recharge efficiency)*				**8.98**

SURFACE WATER RECHARGE (River/canal supply)

Source	Total Number of Pumps	Water thrown out per hour (Litres)	Days/hours pump runs per year	Days pump runs per year	Total water import (Crore Litres)
Canal	0	45,000	180	8	0
Water lift by individual farmers from River	25	60,000	200	6	180
Lakes	0	30,000	150	6	0
River / Lift irrigation scheme	0	40,000	120	5	0
Total					**180**

* Net Recharge efficiency is assumed to be 0.5

WATER BALANCE BALEWADI WATERSHED

WATER AVAILABILITY

Source	Volume (Crore Litres)
Natural Groundwater Recharge	20.14
Groundwater Recharge (Rainfall)	28.77
Surface Water Recharge (Artificial Storage)	8.98
Surface Water Recharge (River / Canal Supply)	180
Total Water Incoming in the village (A)	**237.88**

WATER DEMAND

Sector	Volume (Crore Litres)
Agriculture (All Crops)	669.34
Domestic + Livestock	4.09
Industry / Others	0.05
System Loss / Wastage	0
Total Water outgoing in the village (B)	**673.47**

Water Balance Statement	
Item	**Crore Litres**
Total Availability (A)	**237.88**
Total Demand (B)	**673.47**
Surplus / Deficit (A-B)	**-435.59**

All calculations and unit conversions can be found in the attached sheet

KEY TAKEWAYS

Key Water Challenges	Recommended Interventions
Only 34% of water demand is met by existing resources	Enhance groundwater recharge through farm ponds, recharge trenches, soak pits
Structural water deficit (not temporary)	Promote rainwater harvesting at rooftop and community levels
Demand exceeds supply even in good monsoon years	Develop and maintain check dams, nala bunds, and small retention structures
Over-extraction of groundwater increasing drought risk	Encourage micro-irrigation (drip and sprinkler systems)
High agricultural demand	Promote crop diversification to less water-intensive crops
Weak storage and recharge systems	Strengthen water conservation infrastructure
Groundwater stress and climate risks	Conduct training and awareness on sustainable water management

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