Procedure to Prepare Village Water Balance Charts

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This document illustrates the procedure to prepare village level water balance charts using plugin water balance data and village specific agricultural data available from MLP app. The agricultural data for village water balance is fed into the MLP app by microplanning team during the microplanning process, conducted in PoCRA villages. The generated water balance provides the seasonal details of supply and demand in the village along with runoff available for impounding. This serves as a guidance in preparation of village intervention plan, as a conclusion to the microplanning process.

The app provides water balance report in pdf format for three scenarios consisting as below –

1. Current state scenario: current year cropping pattern and existing structures in village
2. Proposed state: current year cropping pattern with proposed structures in village
3. New Proposed state: proposed cropping pattern with proposed structures in the village.

To enable knowledge creation for participatory intervention and crop planning a simplified visual representation of village water balance, to be displayed and discussed in the village during finalization of the village intervention plan is designed. This is the first version of visual representation finalized in consultation with PoCRA PMU.

The visual representation consists of various graphs showing agricultural water supply and demand components in the village. Annexure I contain the sample visual representation for a village.

Overview for Automation

The idea is to automate the generation of village charts in Microplanning (MLP) app. The village charts must be generated for current rainfall year (now 2018). Facility to choose rainfall year for village charts may be provided later based on requirement from PMU. In order to prepare charts following inputs are required at village level.

Table 1 Input data required for village chart

Sr. no	Input	Data source	Generated
1	Zonal water balance excel outputs named 'kharif_model_zonewise_budget_year' (for last 6 years 2013 – 2018) for all villages in cluster	QGIS plugin output	Before microplanning
2	Current zone wise cropping pattern data	Water Budget data - MLP app	After water budget submission in MLP app during microplanning.
3	Current zone wise soil and water conservation structures data	Water Budget data - MLP app	
4	Proposed zone wise soil and water conservation structures data	Water Budget data - MLP app	

5	Population data	Water Budget data - MLP app	
6	Village zone map in pdf/jpeg format at 300 dpi resolution	PoCRA PMU	Before microplanning

Database:

This input dataset will reside on cloud server at PoCRA premises. The data will reside in following format –

1. Plugin folder - soil, LULC, slope, drainage, zone shapefiles, last 5 year rainfall excel, average year rainfall excel and 'kharif_model_zonewise_budget_year' excel outputs in UTF 8 encoding, '.csv' format for last 6 years (2013-2018).
2. Village zone map folder - in pdf or jpeg format at 300dpi resolution
3. MLP Water balance data in Postgress
4. Output files – Village charts Table and Zone level water balance table in postgress
5. Village charts output folder – village charts files in 'pdf' format named 'village_unicode_year'

The data which resides in folders will have following structure –

1. District folder
    a. Cluster folder
        i. Data (Plugin inputs / outputs/village zone maps/MLP data etc)

Plugin output, MLP data and Village zone map folder will be an input to village chart generation code. The output of this query will be a 'master_ouput_attributes_chart' table in postgress with village-wise and year-wise chart attributes for years 2013 to 2018.

Key steps in generation of village charts

The combination of plugin output-point level water balance and MLP app spatial data is together used to prepare village charts.

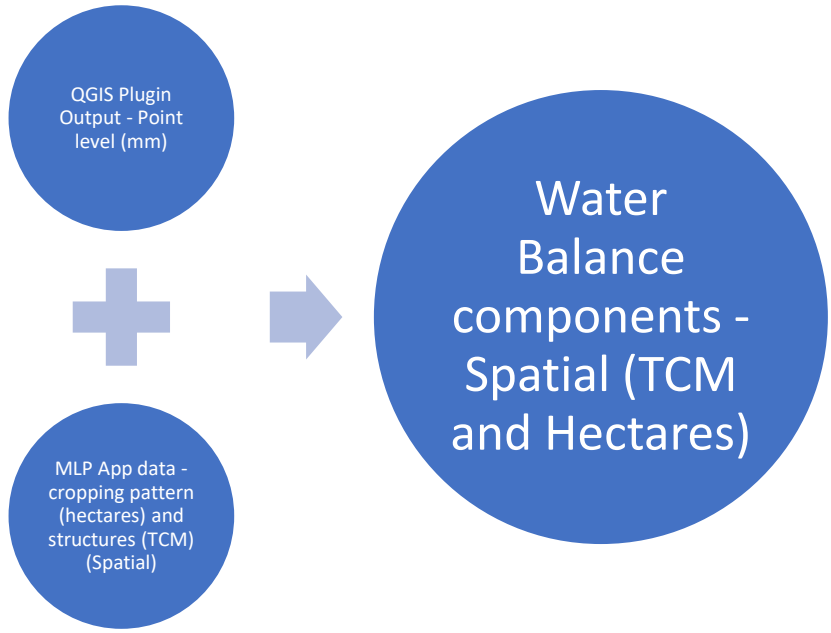


Figure 1 Input from plugin and MLP app

The key steps for this are –

1. Run Plugin: QGIS plugin is run for each cluster for years 2013-2018. This data is uploaded in year-wise sheet in Postgress named as kharif_model_zonewise_budget_2013.

2. Get MLP data: Data required from MLP app is uploaded into postgress database. (currently this data for all villages - actual and proposed cropping pattern, current structures, proposed structures and population downloaded from sales force server is available in compiled excel sheets)

3. Generate output table: Get chart and zone level water balance table. By running designed query in Postgress.

4. Zone maps: Ensure that village maps are available in village zone map folder within respective cluster folder on the cloud.

5. Prepare Village Chart pdf: Put up village map from village zone map folder. Generate graphs and populate summary table dynamically from the charts table in postgress named master_ouput_attributes_chart. Arrange these in 2 page poster, in a high resolution (300 dpi) scalable predesigned poster format. Store this as pdf file in village charts output folder in respective cluster folder. The poster format for charts is given in Appendix 2. (The details of how this is to be automated is to be discussed and worked out by trail and error before finalization)

6. Send village chart to app: make the generated village charts available in MLP app once the user submits the water balance and requests for village chart. A *village chart request option* must get activated in MLP app, after the user has submitted his water balance.

Note that currently entire automation is done as a one time process in postgress on local machine and considering issues in current database the query and automation would need to be newly built or suitably modified to be transferred to cloud later in consultation with PMU IT team.

Village Chart

This section describes the assumptions, graphs, summary table and format in which chart is to be generated.

Technical Assumptions

1. Monsoon is assumed to end by 10th October here while estimating seasonal water balance. This date defines the monsoon and post monsoon water balance. This monsoon end data is modifiable by user on plugin side as needed.

2.The water available from rainfall over village area is shown as the water available in village.

3. The crops have been classified into various ‘crop seasons and landuse’ types such as Kharif_Main, Long_Kharif, Rabi, Annual, Landuse based on their sowing time and crop duration.

4.Village Area is computed a sum of Agricultural and Non-Agricultural Area based on cropping pattern feeded by field staff in MLP app.

5. Agricultural area has been computed as sum of kharif, long kharif and annual area feeded by field staff into MLP app, leaving out Rabi area as it is sown after kharif season mostly on same patch of kharif land (also to reduce ambiguity). Non-agricultural area is taken into app as separate input to consider ‘current fallow’, ‘built-up or wasteland’, ’scrub forest’, ‘dense forest’ and ‘permanent fallow’ landuse types.

6. The aggregated soil moisture after kharif crops is shown as available to rabi crops in post monsoon water balance. This assumption again depends on the observations from field.

7.The runoff impounded in existing structures is assumed to be available half of storage capacity during monsoon and remaining half of storage capacity during post monsoon.

8. The storage capacity of structures is computed assuming 2 fillings during monsoon in default manner unless modified by the MLP app user.

9. The total ground water recharge is also assumed to be available one-third during monsoon and two-third during post monsoon.

Village Chart Components

Five village graphs (displayed in Sample Graphs section) are to be prepared in each village chart as given below –

1. Graph 1: Rainfall-Runoff graph for last 6 years - based on current year cropping pattern fed into the MLP app by microplanning team.
2. Graph 2: Village Cropping Pattern – Area in hectare for different crop types namely Kharif (Kharif_Main and Kharif_Vegetables as naming convention used in plugin output excel), Long Kharif, Annual and Rabi crops in village.
3. Graph 3: Village water demand and supply graph – Rainfall, Agricultural PET (Total crop water requirement) and Drinking water demand.
4. Graph 4: Agricultural crop water demand and supply in monsoon – PET, AET, Deficit
5. Graph 5: Agricultural crop water demand and supply in post monsoon – PET, AET, Deficit

The items in legend in each graph have been mentioned here and the formulas to compute the terms in legend have been illustrated further in this section. Along with the graphs there are two more items to be generated in chart.

6. Table: Final summary water balance table showing water balance in current and proposed state.
7. Text Box: A text box beside graph no. 2 mentioning Total Agricultural area, Non-Agricultural area and Village area in hectare.
8. Advisory: 2 statements to be automated as follows –
    1. scope to arrest ___ crore litres of runoff through soil and water conservation structures. (The number in blank must be filled from row 9 in summary table)
    2. Area under drip irrigation to be increased and cropping pattern to be modified to go for small duration and less water intensive crops. (this statement is constant)

    Both of these statements are to be written in Marathi as given in Sample village chart in Appendix I of this document.

Table 2 provides details of component wise input data required for chart.

Table 2 Input data used for different components in chart

Sr. no.	Chart	Inputs
1	Rainfall-Runoff graph for last 6 years (2013-2018)	1. plugin output for last 6 years 2. current cropping pattern from MLP
2	Village Cropping Pattern	1. current cropping pattern from MLP
3	Village water demand and supply graph	1. plugin output for current year 2. current cropping pattern from MLP

		3.Village population data from MLP
4	Agricultural crop water demand and supply in monsoon	1. plugin output for current year 2. current cropping pattern from MLP
5	Agricultural crop water demand and supply in post monsoon	1. plugin output for current year 2. current cropping pattern from MLP
6	Final summary water balance table showing water balance in current and proposed state.	1. plugin output for current year 2. current cropping pattern from MLP 3. current structures from MLP 4. proposed structures from MLP
7	Text box 1: Poster page 1 Title -Village water budget: year ___. Year to be automated	1. plugin output for current year
8	Text box 2: Poster Page 1 subtitle -Village name, cluster no. , taluka name, district name to be automated	1. Master Village file
9	Text box 3: Village area, agricultural area, non-agricultural area text box	1. current cropping pattern from MLP
10	Text box 4: Poster page 2 before summary table: Year in Title for summary table to be automated	1. plugin output for current year
11	Advisory statement 1	1. Summary table row 9

Sample Graphs:

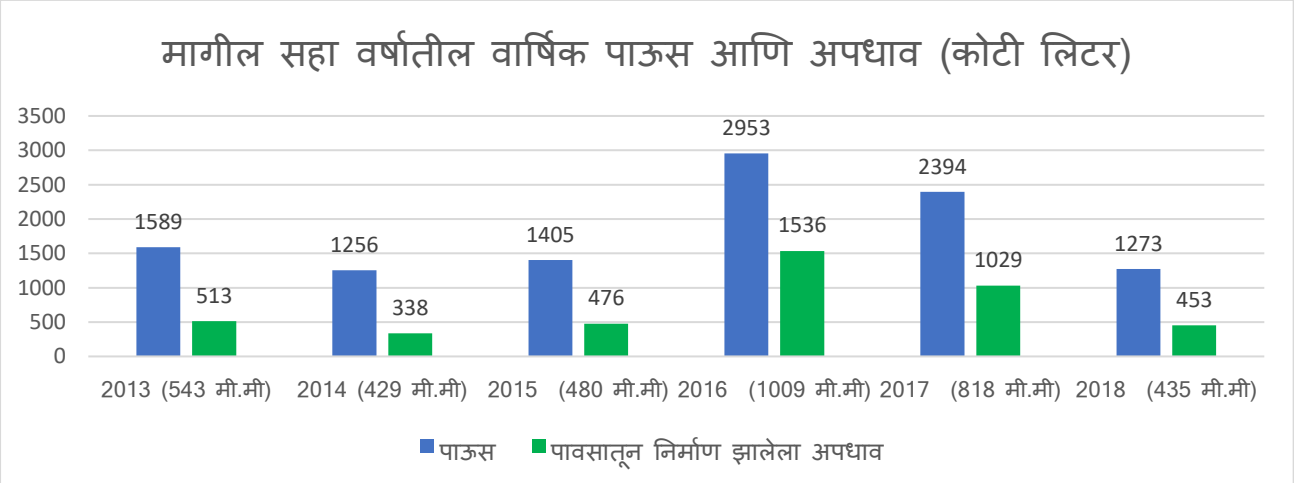
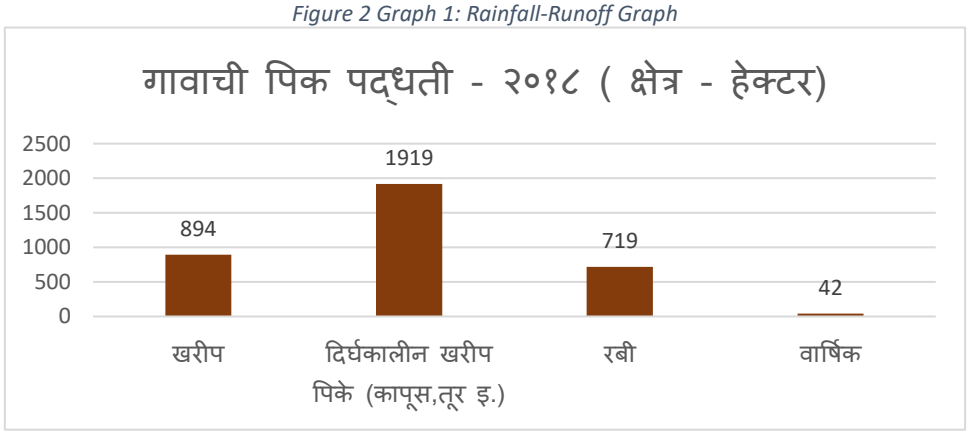


Figure 2 Graph 1: Rainfall-Runoff Graph



शेतीखालील क्षेत्र - २८५५ हे.

बिगरशेती क्षेत्र - ७२ हे.

एकूण क्षेत्र २९२७ हे.

Figure 3 Graph 2: Village cropping pattern

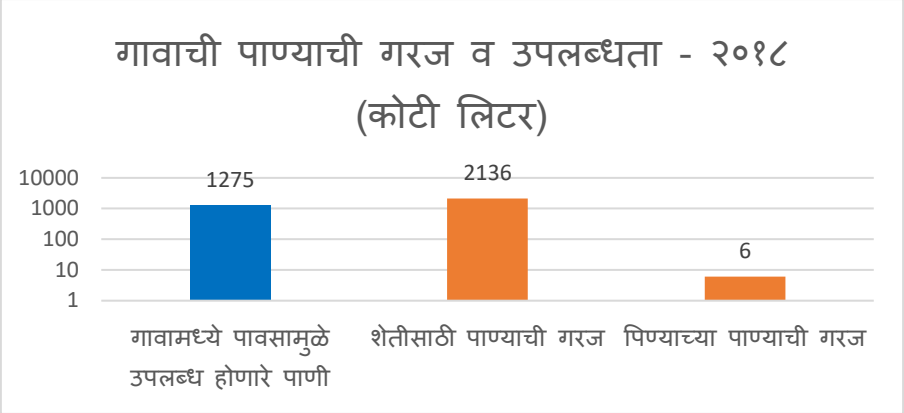


Figure 4 Graph 3: Village water demand and supply graph

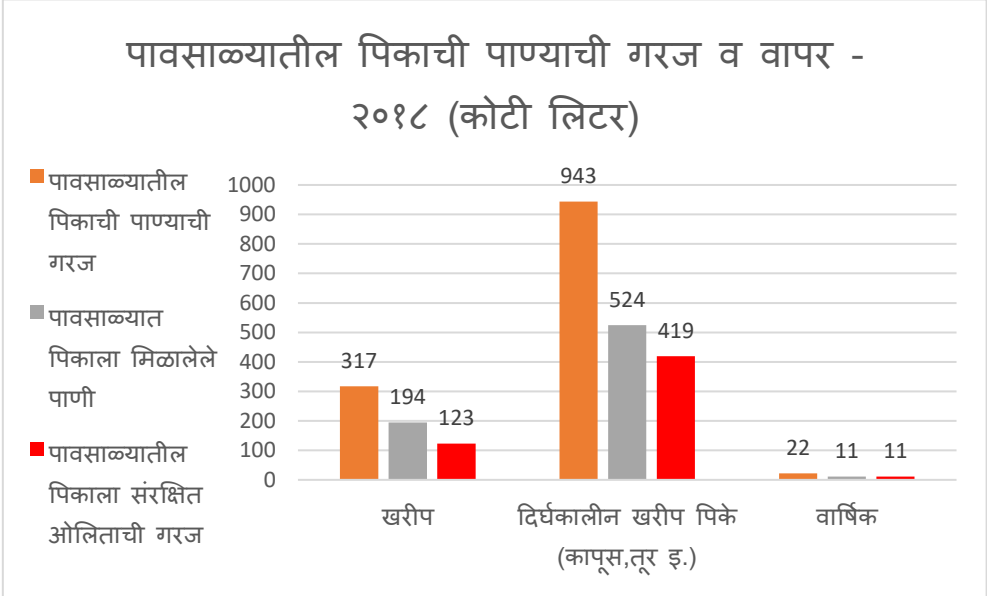


Figure 5 Graph 4: Agricultural crop water demand and supply in monsoon

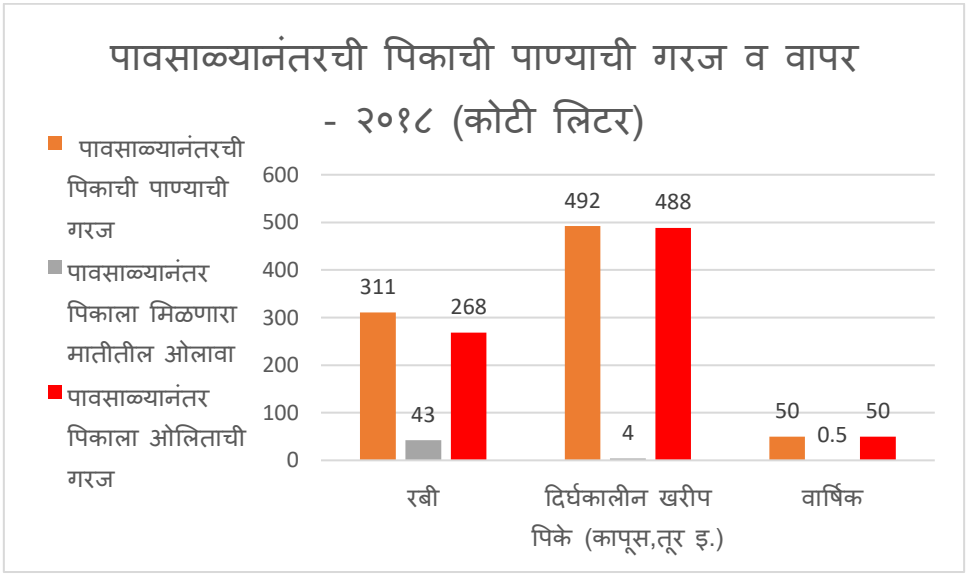


Figure 6 Graph 5 Agricultural crop water demand and supply in post monsoon

Table 3 Final summary water balance table showing water balance in current and proposed state.

पावसाच्या पाण्याचे गणित			
१	गावाचे एकूण क्षेत्र (हेक्टर)	२९२४	
२	पावसाचे पाणी (कोटी लिटर)	१२७३	
३	पावसाळ्यात पिकाने घेतलेले पाणी (कोटी लिटर)	७४०	
४	भूजल पुनर्भरण (कोटी लिटर)	१२	
५	मातीतील ओलावा (कोटी लिटर)	६७	
६	गाव शिवारातून निर्माण झालेला अपधाव (कोटी लिटर)	४५६	
७	गाव शिवारात अडविण्यासाठी उपलब्ध अपधाव (कोटी लिटर)	२२८	
८	गाव शिवारात आतापर्यंत अडवलेला अपधाव (कोटी लिटर)	८५	
९	अडविण्यासाठी शिल्लक अपधाव (कोटी लिटर)	१४३	
१०	प्रस्तावित कामांनंतर अडणारा एकूण अपधाव (कोटी लिटर)	१२४	
	पिकाची पाण्याची गरज आणि उपलब्धता	पावसाळ्यातील	पावसाळ्यानंतर
११	पिकाची पाण्याची गरज (कोटी लिटर)	१२८३	८५३
१२	पिकाला मिळालेले पाणी (कोटी लिटर)	७२९	४७
१३	पिकाला ओलितासाठी गरज (कोटी लिटर)	५५३	८०६
१४	अडवलेला अपधाव (कोटी लिटर)	४३	४३
१५	उपलब्ध भूजल (कोटी लिटर)	४.०	८.०
१६	सध्यास्थितीत पाण्याचा ताळेबंद	-५०६	-७५५
१७	एकूण तूट (कोटी लिटर)	-१२६२	
प्रस्तावित कामांनंतर पाण्याचा ताळेबंद			
१८	सध्याच्या पिकपद्धतीनुसार प्रस्तावित कामे केल्यानंतरची तूट (कोटी लिटर)	-१२२३	

The format to be followed for these charts is as per Annexure I. Same colours and naming convention are to be automated for the graphs.

Display Features to be automated:

1. Graph format: Vertical Bar graph
2. Unit of display: 'crore litres' for volume of water and 'hectares' for land.
3. Legend in all graphs: In Marathi as displayed in sample graphs

4. Graph titles: As given in sample chart in Marathi, note that each title must have 'graph year' and 'unit' mentioned. The year must be picked up from chart table generated in Postgress.
5. Colors for legend terms in graphs:
    a. Rainfall: blue
    b. Runoff: Green
    c. Cropping pattern area: Brown
    d. Crop PET: Orange
    e. Crop AET: Gray
    f. Crop Deficit: Red
    g. Summary table: All text to be displayed in Marathi as per Table 3
        i. Row 3 to Row 6: highlighted in light blue
        ii. Row 9: highlighted in Green
        iii. Row 13: text color: Red
        iv. Row14 and Row 15: text color: Green
        v. Row 17 and Row 18: Highlighted in Yellow, 'surplus' or 'deficit' (तुट / जादा) text display to be automated in these rows.
6. Text box 1: Village water budget: year _____. The year in this should be automated
7. Text box 2: Village: Name, Cluster no.: Number, Taluka: Taluka_Name, District: District_Name (This can be taken from shapefile / Master file).
8. Text Box 3: Agricultural area: Area in hectare, Non- Agricultural Area: Area in hectare, Total Village Area: Area in hectare.
9. Text box 4: water budget summary (Year) to be automated
10. Overall Poster: All graphs and table to be compiled in two posters pages of 6x4 foot flex printable quality. This must contain the poster headline: project name, logos, other titles, footer statement as per format (font style, colors, language) in sample 6x4 poster chart given in Appendix I. The placement of chart components should also be as per this sample poster.

Formulas for Automation:

The basic formula used for obtaining spatial water components from point level water balance is as below.

$$Volume\ (crore\ litres) = \frac{Area\ under\ crop\ (hectare) * water\ balance\ component\ (mm)}{1000}$$

Table below lists equations for each graph in detail –

Table 4: Formulas for legend item in each graph

Sr. no.	Chart name and parameter	Equation	Data source	Checks in this table
1	Rainfall - runoff for last 6 years (crore litres)			
a	Rainfall (Blue colour) – last 6 years	Rainfall (crore litres) = [Rainfall (mm) * Village Area (hectare)]/1000	Plugin Output	
b	Runoff (Green colour)- last 6 years	Runoff (crore litres) =	Runoff - Plugin output	

		∑ (i)(j) [Runoff in Monsoon (mm) (i)(j) * Crop Area (hectare) (i)(j)] / 1000 i-Zone no. j-Crop	Actual Crop Area – MLP database	
2	Village Cropping Pattern – Area in hectare			
a	Crop Season wise Area (Brown colour) – 1. Kharif (Kharif_Main and Kharif_Vegetables) 2. Long Kharif – (Cotton, Tur etc) 3. Rabi 4. Annual	Crop season wise area (hectare) = ∑(i)(j) [Crop Season and Landuse Area (hectare) (i)(j)] i-Zone j- Crop Season and Landuse for 4 types	Actual Crop Area – MLP database	
b	Village scenario – Text box 3 - beside graph 2a	Village area (hectare) = ∑(i) [Zone Area (i)] Agricultural Area (hectare) = ∑(i)(j) [Crop Season and Landuse Area (hectare) (i)(j)] for 'kharif', 'long kharif', 'annual' Non Agricultural Area (hectare) = ∑(i)(j) [Crop Season and Landuse Area (hectare) (i)(j)] for 'Landuse' i-Zone j- Crop Season and Landuse	Actual Crop Area – MLP database	Check: Village area = Agricultural Area + Non – Agricultural Area
3	Village water demand and supply graph			
a	Rainfall (Blue colour) – for current year	Rainfall (crore litres) = [Rainfall(mm) *∑(i) [Zone Area (hectare) (i)]]/1000 i-Zone	Plugin output	Match item 1a In this table with this item 3a
b	Agricultural Demand – PET (Orange colour)	PET (crore litres) = ∑ (i)(j) [(PET Monsoon end (mm) (i)(j) + Post Monsoon PET (mm) (i)(j)) * Crop Area (hectare) (i)(j))] / 1000 i-Zone no. j-Crop *(leaving out Non ag 'Landuse' PET from crop season and landuse)*	PET - Plugin output Actual Crop Area – MLP database	Check : 3b = 4a+5a

c	Drinking Water (Orange colour) (crore litres)	Directly Available in water budget output and MLP data for village Demand (crore litres) = count*LPCD*365*10^-7 1. Human – 55 LPCD 2.Animals –35 LPCD 3. Sheep – 5 LPCD 4. Poultry – 2 LPCD	Population data – human, animal, sheeps, poultry count	
4	Monsoon water balance (crore litres) – upto monsoon end To be computed only for crop seasons - 1. Kharif (Kharif_Main) 2. Long Kharif – (Cotton, Tur etc) 3. Annual			
a	Monsoon Crop water requirement (PET) (Orange colour) For crop seasons - 1. Kharif (Kharif_Main) 2. Long Kharif and Kharif Vegetables – (Cotton, Tur etc) 3. Annual	PET (crore litres) = $\sum_{(i)(j)}$ [PET Monsoon end (mm) $_{(i)(j)}$ * Crop Area (hectare) $_{(i)(j)}$)] / 1000 i-Zone no. j-Crop seasons and Landuse	PET - Plugin output Crop Area – MLP database	Check: 4a = 4b+4c
b	Monsoon Crop AET (Grey colour) crop seasons - 1. Kharif (Kharif_Main) 2. Long Kharif and Kharif Vegetables – (Cotton, Tur etc) 3. Annual	AET (crore litres) = $\sum_{(i)(j)}$ [AET Monsoon end (mm) $_{(i)(j)}$ * Crop Area (hectare) $_{(i)(j)}$)] / 1000 i-Zone no. j-Crop seasons and Landuse	AET - Plugin output Crop Area – MLP database	
c	Monsoon Deficit (Red colour) crop seasons - 1. Kharif (Kharif_Main)	Monsoon Deficit (crore litres) = $\sum_{(i)(j)}$ [Monsoon Deficit (PET-AET) (mm) $_{(i)(j)}$ * Crop Area (hectare) $_{(i)(j)}$)] / 1000 i-Zone no. j-Crop seasons and Landuse	Deficit - Plugin output Actual Crop Area – MLP database	

	2. Long Kharif and Kharif Vegetables – (Cotton, Tur etc) Annual			
5	Post Monsoon water balance (crore litres) To be computed only for crop seasons - 4. Rabi 5. Long Kharif & Kharif_Vegetables – (Cotton, Tur etc) 6. Annual			
a	Post Monsoon Crop water requirement (PET) (Orange colour) For crop seasons - 1. Rabi 2. Long Kharif & Kharif_Vegetables – (Cotton, Tur etc) 3. Annual	PET (crore litres) = $\sum_{(i)(j)}$ [Post Monsoon PET (mm) $_{(i)(j)}$ * Crop Area (hectare) $_{(i)(j)}$] / 1000 i-Zone no. j-Crop seasons and Landuse	PET - Plugin output Actual Crop Area – MLP database	Check: 5a = 5b+5c
b	Post Monsoon Crop AET (Grey colour) For crop seasons - 1. Rabi 2. Long Kharif (Kharif_Vegetables and Cotton, Tur etc) 3. Annual	AET (crore litres) = $\sum_{(i)(j)}$ [(Post monsoon PET (mm) $_{(i)(j)}$ – Crop Duration deficit (mm) $_{(i)(j)}$ + Monsoon Deficit (mm) $_{(i)(j)}$) * Crop Area (hectare) $_{(i)(j)}$] / 1000 i-Zone no. j-Crop seasons and Landuse ***note: (use this formula only for long kharif, kharif vegetables and annual crops)*** Water available for Rabi = Soil moisture available for Rabi Computation formula for soil moisture is given after the table. [5b-rabi]	AET - Plugin output Actual Crop Area – MLP database	
c	Post Monsoon Deficit (Red colour) For crop seasons - 1. Rabi 2. Long Kharif (Kharif_Vegetables	Post Monsoon Deficit (crore litres) = $\sum_{(i)(j)}$ [(Crop Duration Deficit - Monsoon Deficit (mm) $_{(i)(j)}$)* Crop Area (hectare) $_{(i)(j)}$] / 1000 i-Zone no.	Deficit - Plugin output Actual Crop Area – MLP database	

	and Cotton, Tur etc) 3. Annual	j-Crop seasons and Landuse		

The parameters used in equation in 'mm' are taken from the water balance plugin output whereas the parameters in 'hectares' are taken from MLP app database for the village. The plugin parameters mentioned in above table follow the same naming convention as given in plugin output excel.

Formula for Rabi AET (Soil Moisture available for Rabi) (5b-rabi)

The computation method for soil moisture available for Rabi is as follows -

Average Soil moisture after kharif (μ) (mm)

$$= \sum_{(i)(k)} \frac{\text{Monsoon end SM} * \text{Crop Area for Kharif\_Main crops}}{\sum_{(i)(k)} \text{Total Crop Area for Kharif\_Main crops in village}}$$

5b-rabi: Soil moisture available for Rabi (crore litres)

$$= \frac{\mu * \text{Total Rabi area (hectare)}}{1000}$$ (here i -zone, k – kharif crops)

Summary Table

The formulas for final summary table shown in Table 3 are as below –

Table 5 Summary Table formulas

Components of Rainfall		**Entries from Table 4 or Formula**	**Checks in this table**
1	Village Area	2b. from Table 4	
2	Rainfall (crore litres)	1a. from Table 4	
3	Monsoon AET (crore litres)	AET in Monsoon (crore litres) = $\sum_{(i)(j)}$ [AET in Monsoon (mm) $_{(i)(j)}$ * Crop Area (hectare) $_{(i)(j)}$] / 1000 i-Zone no. j-Crop seasons and Landuse *(all agricultural and non agricultural)*	Row 2 = row 3 + row 4 +row 5+ row 6
4	Ground water recharge (crore litres)	GW Recharge in Monsoon (crore litres) =	

		∑ (i)(j) [GW Recharge in Monsoon (mm) (i)(j) * Crop Area (hectare) (i)(j))] / 1000 i-Zone no. j-Crop seasons and Landuse *(all agricultural and non agricultural)*		
5	Soil Moisture (crore litres)	SM = ∑ (i)(j) [Monsoon end soil moisture (mm) (i)(j) * Crop Area (hectare) (i)(j))] / 1000 i-Zone no. j-Crop seasons and Landuse *(all agricultural and non agricultural)*		
6	Runoff (crore litres)	1b from Table 4		
7	Available Runoff (crore litres)	1b from Table 4 * 0.5		
8	Currently Impounded runoff (crore litres)	Current storage capacity from MLP app water budget. Current capacity in crore litres = Current capacity in TCM from MLP app/10 *(this can be detailed after report formats and data inventory for MLP app is fixed)*		.
9	Runoff available for impounding (crore litres)	(1b from Table 4 * 0.5) – (current storage capacity from MLP app water budget/10)		This should be shown '0' when negative
10	Runoff impounded after proposed structures (crore litres)	(Table5-row 8) + (Proposed storage capacity in TCM from MLP app water budget / 10)		Row 10 > = row 8 and < row 7
	Crop water requirement and availability	**Monsoon**	**Post Monsoon**	
11	PET (crore litres)	∑j 4a from Table 4	∑j 5a from Table 4	Row 11 = row 12 + row 13 j-Crop seasons and Landuse in all formulas here
12	AET (crore litres)	∑j 4b from Table 4	∑j 5b from Table 4	
13	Deficit (crore litres)	∑j 4c from Table 4	∑j 5c from Table 4	
14	Impounded runoff (crore litres)	Table 5 row 8* 0.5	Table 5 row 8 * 0.5	
15	Available ground water (crore litres)	Table 5 row 4 *(1/3)	Table 5 row 4 *(2/3)	

16	Water balance in current state (crore litres)	Table 5 (row 14 + row 15) – row 13	Table 5 (row 14 + row 15) – row 13	Include sign here
17	Total deficit or extra (crore litres)	Table 5 ∑ row 16		The word 'deficit' or 'surplus' should be chosen automatically based on sign (+/-) and sign should be included.
Water balance in proposed state				
18	Water balance in current cropping pattern and proposed structures (crore litres)	Table 5 ∑ row 13 – row 4 -row 10		Row 18 <= row 16 The word 'deficit' or 'surplus' should be chosen automatically based on sign (+/-) and sign should be included.

This document may be used for manual chart preparation in excel as well as reference for automation of chart generation.

Appendix I: Sample Village Chart

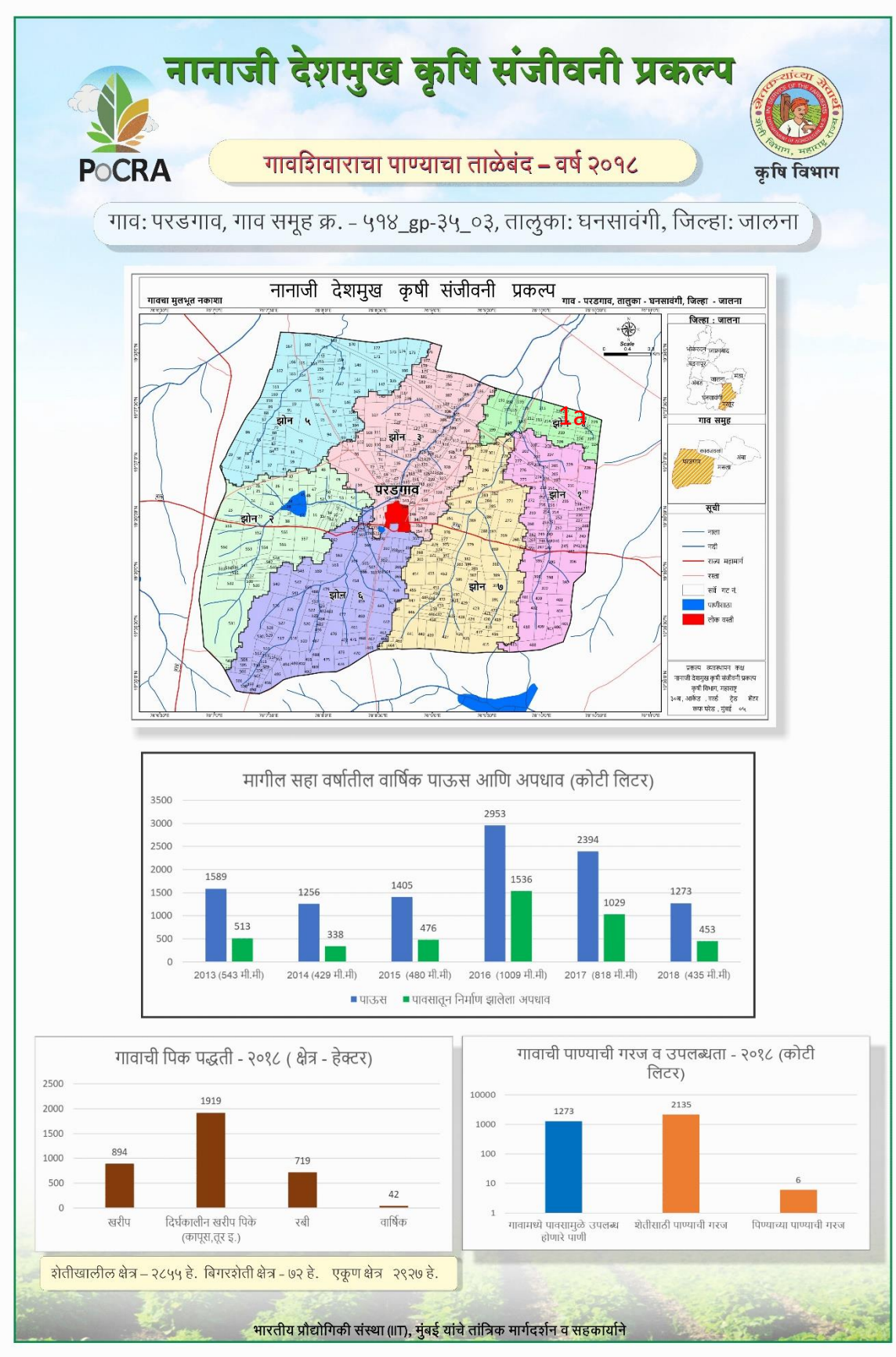
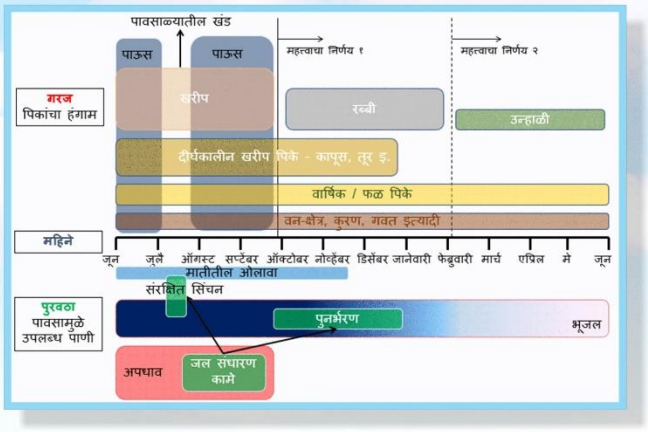
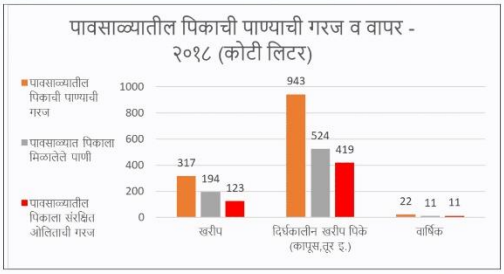
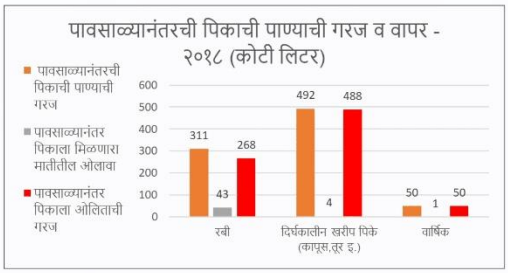


Figure 7 Poster Page 1: printable as 6x4 foot flex

गावाच्या शेतीच्या पाण्याचे गणित







पाण्याचा ताळेबंद: सारांश (वर्ष - २०१८)

पावसाच्या पाण्याचे गणित			
१	गावाचे एकूण क्षेत्र (हेक्टर)	२९२७	
२	पावसाचे पाणी (कोटी लिटर)	१२७३	
३	पावसाळ्यात पिकाने घेतलेले पाणी (कोटी लिटर)	७४०	
४	भूजल पुनर्भरण (कोटी लिटर)	१२	
५	मातीतील ओलावा (कोटी लिटर)	६७	
६	गाव शिवारातून निर्माण झालेला अपधाव (कोटी लिटर)	४५६	
७	गाव शिवारात अडविण्यासाठी उपलब्ध अपधाव (कोटी लिटर)	२२८	
८	गाव शिवारात आतापर्यंत अडवलेला अपधाव (कोटी लिटर)	८५	
९	अडविण्यासाठी शिल्लक अपधाव (कोटी लिटर)	१४३	
१०	प्रस्तावित कामांनंतर अडणारा एकूण अपधाव (कोटी लिटर)	१२४	
	पिकाची पाण्याची गरज आणि उपलब्धता	पावसाळ्यातील	पावसाळ्यानंतर
	पिकाची पाण्याची गरज (कोटी लिटर)	१२८३	८५३
१२	पिकाला मिळालेले पाणी (कोटी लिटर)	७२९	४७
१३	पिकाला ओलितावी गरज (कोटी लिटर)	५५३	८०६
१४	अडवलेला अपधाव (कोटी लिटर)	४३	४३
१५	उपलब्ध भूजल (कोटी लिटर)	४.०	८.०
१६	सध्यस्थितीत पाण्याचा ताळेबंद	-५०६	-७५१
१७	एकूण तुट (कोटी लिटर)	१२६२	
प्रस्तावित कामांनंतर पाण्याचा ताळेबंद			
१८	सध्याच्या पिकपद्धतीनुसार प्रस्तावित कामे केल्यानंतरची तुट (कोटी लिटर)	१२२३	

१.शिल्लक अपधाव १४३ कोटी लिटर अडवण्यासाठी नवीन मृद व जल संधारण कामे घेण्यास वाव आहे.

२.शिल्लक अपधाव अडवल्यावर देखील पाण्याची तुट असल्याने पिक पद्धतीत बदल करणे आवश्यक आहे. २०१८ मध्ये पर्जन्यमान कमी झाल्याने खरीप पिकांच्या उत्पादकतेवर व रबी पिकांच्या पेरणीवर परिणाम झाला आहे.

३.सूक्ष्म सिंचनाचा वापर वाढवणे, कमी पाणी लागणारी आणि कमी कालावधीची पिके घेणे आवश्यक आहे.

भारतीय प्रौद्योगिकी संस्था (IIT), मुंबई यांचे तांत्रिक मार्गदर्शन व सहकार्याने

Figure 8 Poster page 2 printable as 6x4 foot flex