Zonal Planning Framework

PoCRA Cell
IIT Bombay
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Objectives:

1. To enable planning for soil and water conservation structures to meet zonal agricultural water requirements so as to ensure coverage of entire village.

Outcomes:

1. Zone wise target to meet kharip protective irrigation (KPI) requirement
2. Zonewise plan for runoff management to meet KPI
3. Zonewise area treatment plan to ensure improved soil moisture condition and Ground Water Recharge for Rabi
4. Identification of vulnerable zones for ground water

Process:

The zonal planning framework has been introduced considering the variations within the village such as soil type, soil depth, slope and nearness to streams. These factors influence the water balance and, this is visible through the differences in water balance for same crop in different zones. So each zone has different vulnerability, runoff, soil moisture and ground water recharge compared to the other zone. In order to take these factors into account it becomes important that planning is done at zone level to meet varying zonal requirements and thus ensure coverage of village area and maximum farmers.

The basic dataset required for zonal planning consists of –

1. Cropping pattern data of 30% farmers in the zone which can be interpolated to cover zonal area
2. Well survey data of 5-10 wells in each zone – covering wells near the streams, away from the streams, upstream and down stream using the well survey format by Yashada
3. Existing soil and water conservation structures storage capacity data for each zone

The recommended process is as follows

1. Show the village map to villagers during first village meeting and mark all the existing water conservation structures on village map before going for transect walk. Note their storage capacity on the map. This would ensure that all structures are visited during the transect walk. Mark the GPS location of these structures and validate their storage capacity noted on map through survey.
2. Call for zonal meeting of farmers in each zone, note down gat no. wise kharip, rabi, annual and summer cropping pattern along with used water sources of atleast 30% farmers in the zone using following format.

Year-wise crop data (for last 3 years)	Crop	Type of Crop	Area under Crop	Total Yield	Was watering required? If Yes mention -No. of Waterings given? In which month	Irrigation type	Watering source
Year	Crop Name	Rabi/Kharif/Summer/Annual/Perennial/Long Kharif	in Acre	quintal	- Yes/No., Number, Month	Drip/Sprinkle/Flood	Well/Borewell/Farmpond/Stream/Nala/Tanker/Others - Mention

Note down gat no. wise individual interventions demands and water availability for same. Such as demand for fruit trees and water source identified for same by the farmer or provision for new water source in the plan. So that list of gat no. wise individual demands with matched water sources is ready and selection of individual beneficiaries can be done based on this.

3. Conduct well survey to gather well level data for August, October, Jan, May months and current well level as this would be the input for any estimation on ground water.

Current process:

Following were the activities included in current process and observations on same–

1. Survey of existing water conservation structures during transect walk - This does not seem to have happened properly in terms of coverage of all structures in the zone. This zonewise data is not available for villages in Karanja cluster whereas in Malkapur cluster there seems to be estimation of storage capacities of structures in the zone instead of those obtained through primary survey.
2. Data collection for cropping pattern through transect walk – the transect walk format from Yashada recommends cropping pattern data collection for the zone, which has not happened in any cluster. This is evident through the data filled in POCRA App. The cropping pattern data is critical for water budget computation and hence should be representative of actual cropping pattern in the zone. In Malkapur cluster this data was estimated from overall village cropping pattern data. Such estimation may lead to inaccurate water budget and thus planning for less or more demand accordingly.
3. Inorder to be able to give estimates on number of wells that can be taken up in any zone we would need some critical primary data from field such as well level around the year for various locations in the zone, data on extraction of GW and time taken for recharge etc. This also was to be gathered through Yashada's well survey format. However there are gaps in the data collected and the process does not seem to have penetrated to ground team.

Hence the recommended process to ensure that the above data is gathered zonewise so that it becomes useful for planning.

Following is a zonal budget for Makner village in Malkapur cluster which will further illustrate the zonal differences and need for zonal planning.

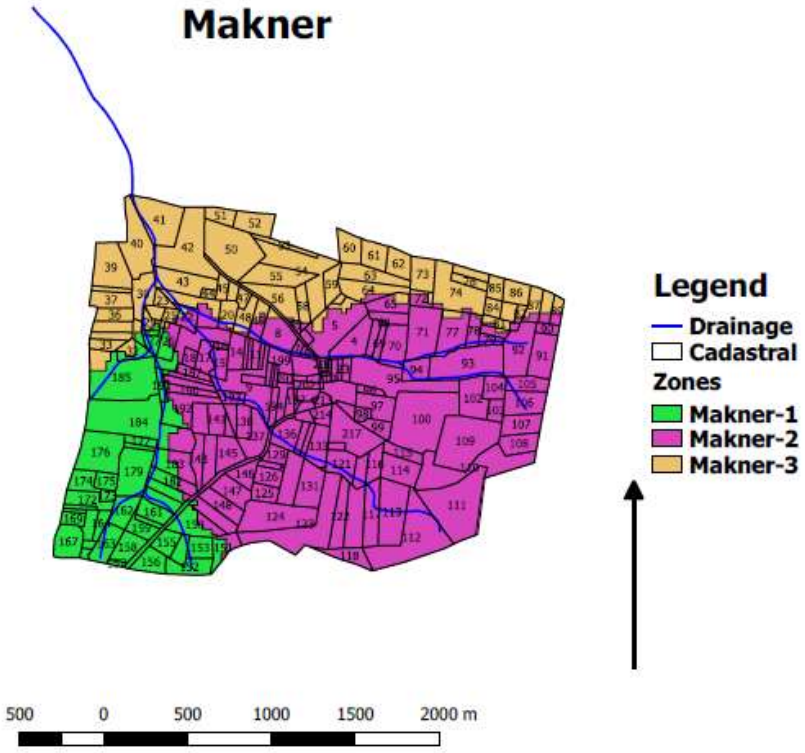

Figure-1 Zonal Map

Part of Makner village comes in command area and gets rotation water twice once in December and once in January, however as per interaction with villagers this water is not assured and they are not allowed to lift water from canal and store. Following table shows the water balance for kharif crops in three zones of Makner.

Table 1Water Balance for kharif crops

Village Zones	Crop	Rainfall (mm)	Runoff (mm)	Ground Water (mm)	Soil Moisture (mm)	PET (mm)	AET (mm)	Deficit (mm)
Makner -1	Soya bean	823	393	28	107	453	293	160
Makner -2		823	361	39	113	453	308	145
Makner -3		823	385	26	113	453	297	157
Makner -1	Bajra	823	507	17	138	292	162	130
Makner -2		823	482	12	162	292	166	127
Makner -3		823	425	11	230	292	157	134
Makner -1	Tur	823	401	6	18	626	398	228

Makner -2		823	372	12	28	626	411	215
Makner -3		823	392	7	18	626	407	219

From the Land Use map in figure 2 and water balance table it can be seen that zone 1 has considerable current fallow land and zone 3 has considerable waste land. The impact of these factors can be seen in runoff of zone 1 and zone 3 which is comparatively higher with respect to zone 2 having negligible wasteland or fallow land. This impact can also be seen by comparing soil moisture and ground water in zone 1 and zone 3 with respect to zone 2. These values are lower for zone 1 and zone 3 due to the presence of fallow and waste land which leads to higher runoff and lower infiltration.

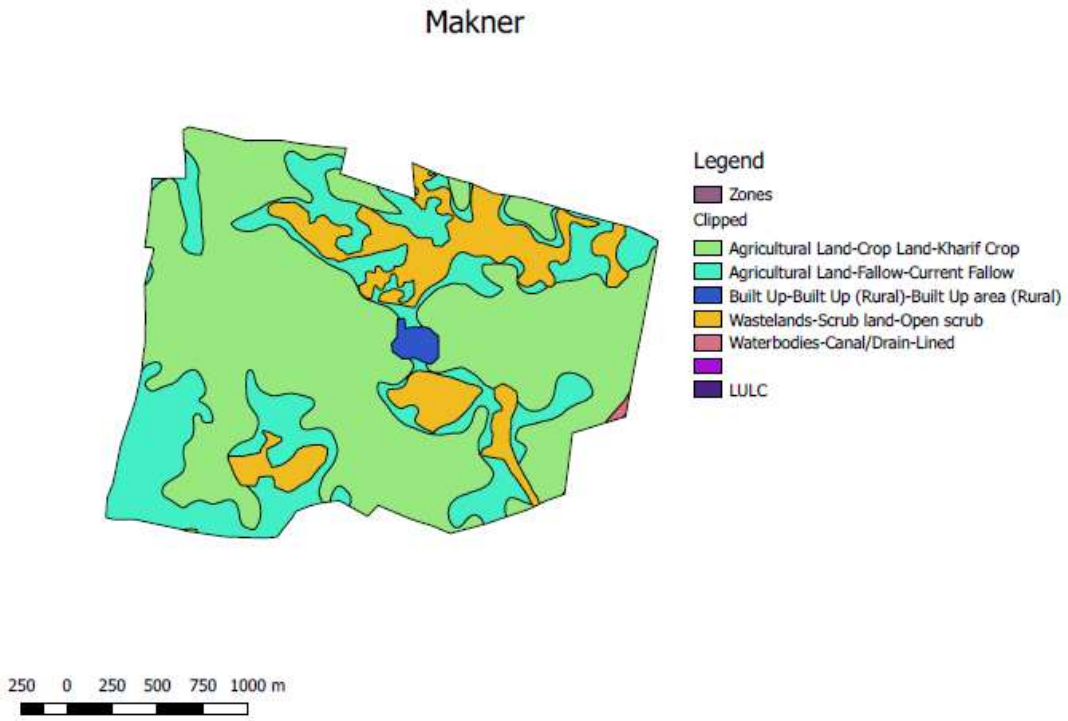

Figure-2 Land Use Land Cover

The differences in runoff, ground water and soil moisture between the zones is based on land use in the zone along with other geophysical factors and this is evident from the LU map, Zonal Map and table 1. Hence water balance table 1 validates the need for zonal planning and calls for a planning process (land management, area treatment, drain line treatment) considering land use in the zone.

Table 2 Cropping pattern

Cropping Pattern	Makner 1	Makner 2	Makner 3
Kharif	**Area in Hectare**	**Area in Hectare**	**Area in Hectare**
Soyabean	28	110	15
Jowar		45	60
Total Kharif Area (ha)	**28**	**155**	**75**
Long Kharif			
Tur	15	20	15
Cotton	12	65	10
Total long kharif area (ha)	**27**	**85**	**25**
Rabi			
Gram	14	16	0
Wheat	3	7	0
Maize		12	15
Total Rabi Area(ha)	**17**	**35**	**15**
Total Zonal Area (ha)	**88**	**295**	**129**
Kharip cropped %	**62%**	**81%**	**77%**
Rabi cropped %	**19%**	**12%**	**11.6%**

Table 3 Storage capacity

Storage structure	**Makner 1**		**Makner 2**		**Makner 3**	
Storage Capacity	no. or hectare	TCM	no. or hectare	TCM	no. or hectare	TCM
Compartment Bunding	72	32	280	127	158	71.9
CNB	1	8.3	6	49.5	0	0
Total Storage Capacity		40.3		176.5		71.9

As evident from cropping pattern in table 2 rabi area is negligible in all zones despite of the village lying in command area and receiving rotation water in December and January. The Land Use Land Cover Map in figure 2 also shows the same with majority of area lying under kharif and no area under rabi.

The Land use shows considerable current fallow land in zone 1 and wasteland in zone 3. The wasteland in zone 3 seems to have not been accounted properly in cropping pattern due to approximation

Zone 2 has good amount of storage capacity through 6 CNB's and its influence can be seen in long kharif cropping pattern of zone 2 which has 65 hectares under cotton and 20 hectares under Tur. Zone 2 has highest area under kharif 81%, compared to other zones.

The difference in storage capacity of each zone and its relation to cropping pattern highlights the need for zone wise planning while taking into account the availability of surface water sources in the zone, land use in the zone and through identification of appropriate interventions.

Planning:

This section illustrates the use of water budget for planning of interventions. Table 4 gives zonewise and overall water budget for Makner village.

Table 4 Zonal Water Budget

Zonal Water Budget		Makner 1 -TCM	Makner 2 -TCM	Makner 3 -TCM	Village - TCM
Demand	Total Water Requirement(K+A+LK)	317.4	1339.1	510.6	2295.7
	Kharif protective irrigation req. (deficit)	121.4	474.3	182.7	834.0
	Rabi + Summer Total Water Requirement	48.5	119.5	60.0	228.0
	Rabi + Summer Additional water Requirement (deficit)	21.2	13.6	16.7	51.1
Supply	Water Available from Runoff (80%)	171.8	688.3	308.4	1215.0
	Water Available from Soil Moisture	18.3	51.2	24.6	94.1
	Water Available from GW	9.1	54.7	18.7	82.8
Existing Storage	Total Runoff Storage Capacity	41.0	176.9	71.9	289.8
Additional Storage	Water Available for New Structures	130.8	511.4	236.5	925.2

**runoff considered here is 80% of available runoff*

As per overall village budget in last column, following are the specifics for planning

Target 1: Kharif Protective Irrigation Demand: 834 TCM

Target 2: Rabi + Summer Deficit: 51.1 TCM

Water available for new structures: 952.2 TCM

The water and soil conservation structures must be planned to meet target1 and target 2 water demand.

Table 5 List of soil and water conservation structures demands for Makner Village

Structure	No./Ha
Fruit Trees	4
MNB	1
CNB	5
Community FP	4
Wells	30
Well Recharge	5

*estimation for no. of wells will require primary data as mentioned in point 3 of process section

Table 5 gives the list of Water and soil conservation demands for the village obtained from current microplanning process. As the plan document is limited to mentioning demand in numbers without the actual location and storage capacity. The storage capacity of new structures is computed considering the storage capacity of existing structures as given by TAO or the planned capacity, if mentioned in plan document.

Since the planning has happened at village level and zonal planning was not conducted, so village level planning using water balance is illustrated here.

Table 6 Storage Capacity for new structures

Structure	No./Ha	Storage Capacity/unit	Total Storage Capacity (TCM)
MNB	1	5	5
CNB	5	8.3	41.5
Community FP	4	30	120
Total capacity		43.3	166.5

Storage Capacity through new structures: 166.5 TCM

Water Requirement for Fruit Trees: 4 ha *1600 mm/100 = 64 TCM

Plan Check

Target 1+Target 2+ Water requirement for Fruit trees – Storage Capacity through new structures

= 834 +51.1+ 64 – 166.5

= 782.6 : Deficit

The plan check formula shows that the planned storage capacity through new structures is insufficient to meet Target 1 - KPI and Target 2 - Rabi+Summer deficit, along with water requirement for newly planned fruit trees.

Water available for new structures: 952.2 TCM

When compared with runoff water available for new structures, the planning has happened for arresting only 17.4 % of water available.

Considering the deficit of 782 TCM to meet target 1 and target 2, and remaining water available for new structures 785.7 TCM (82.6%), planning for additional storage capacity through drain line or area treatment must be done to meet the target demands.

Thus, it is important to utilize the water budget in planning to meet demands, which is again recommended at zonal level for zonal water security.

Recommendation for planning:

1. This process of plan check must happen during microplanning process. So that villagers can review the water budget and plan accordingly to meet KPI and rabi+summer deficit demand.
2. To do this a water and soil conservation structures planning section will be added to water budget part in the app. After water budget computation, user will be directed to feed in the plan. Which will show if the planning is sufficient to meet the targets and if additional structures can be planned based on available runoff. Through this review villagers will be able to modify the plan accordingly to meet the target demands.
3. Accurate target demand computation thus becomes very critical here

Based on this case study we recommend improvement in existing microplanning data collection process on ground, zonal water balance computation and its use in zonal planning.