

# Part B

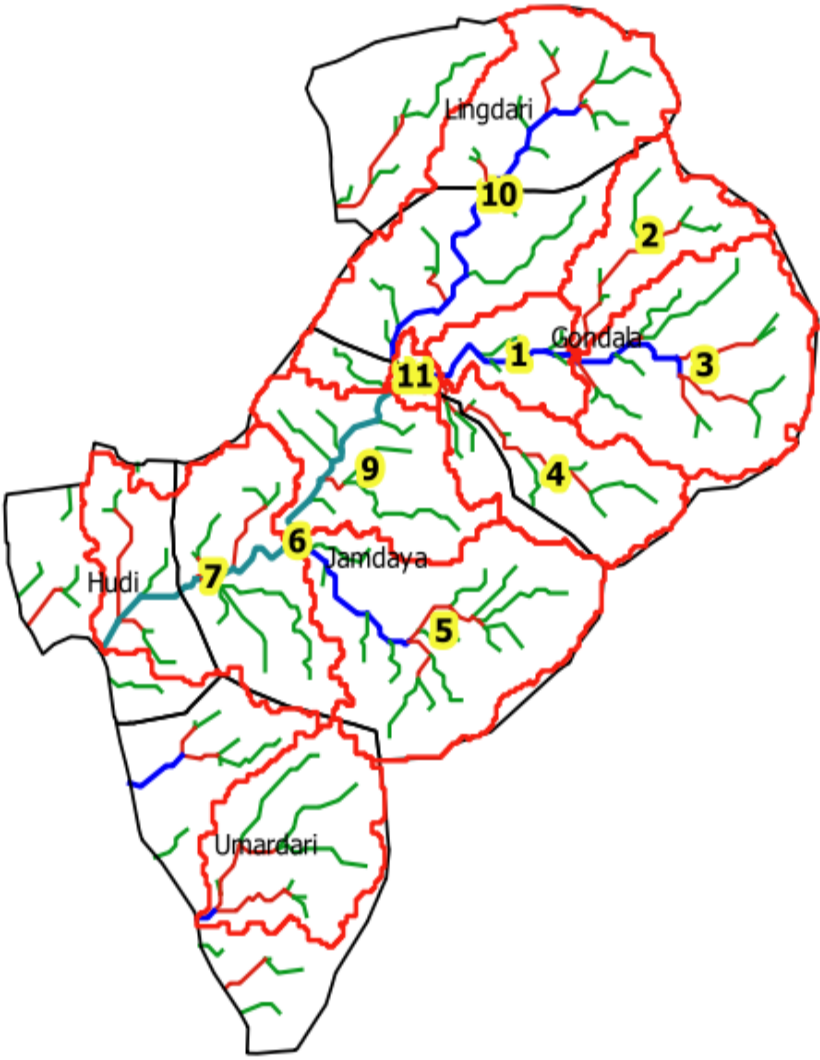
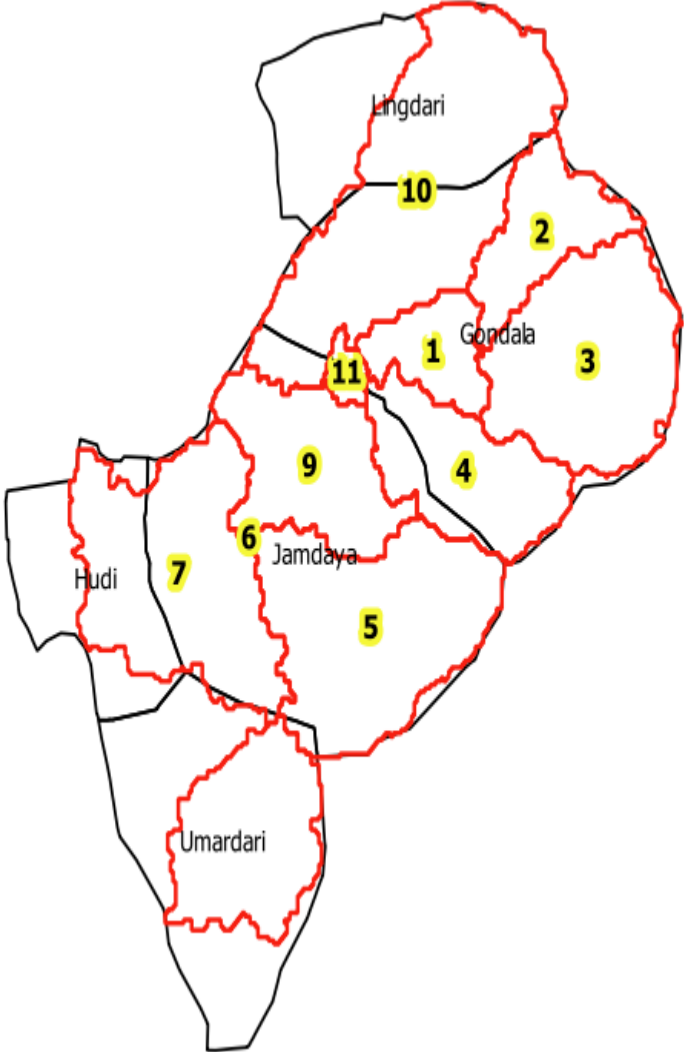
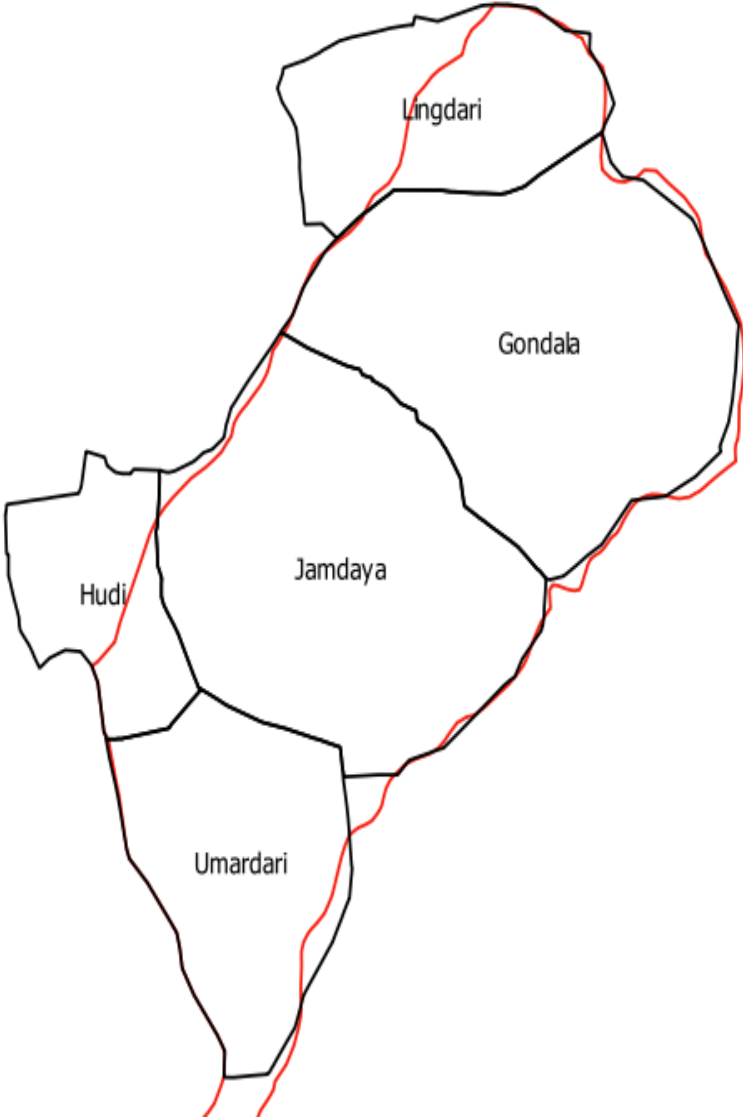
# Issue: Accounting Runoff from outside the zone

- Village Boundary not matching with watershed
  - Selection of villages while forming a cluster should be done on the basis of the micro or Mili-watershed boundaries.
  - E.g in the case of Gondala cluster.
- Most zones respect mini-watershed boundaries with drain points. In this case, inter-zone runoff can be computed by a suitable plugin.

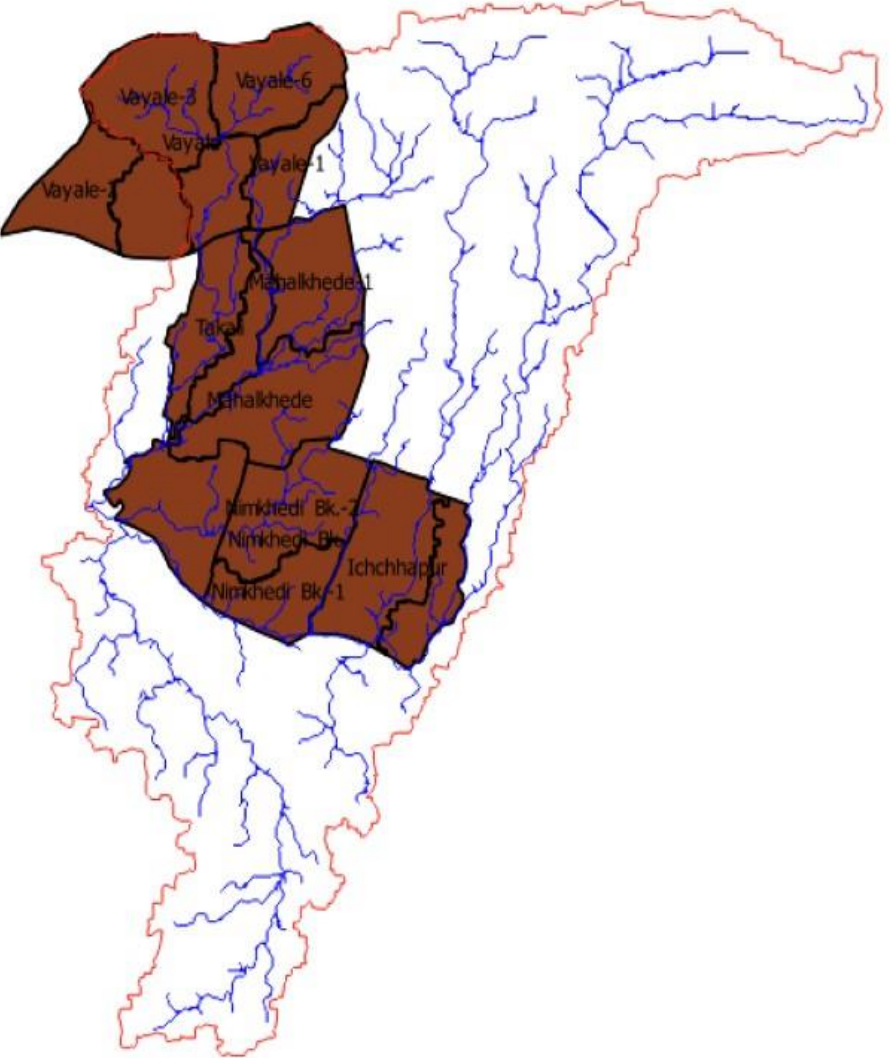
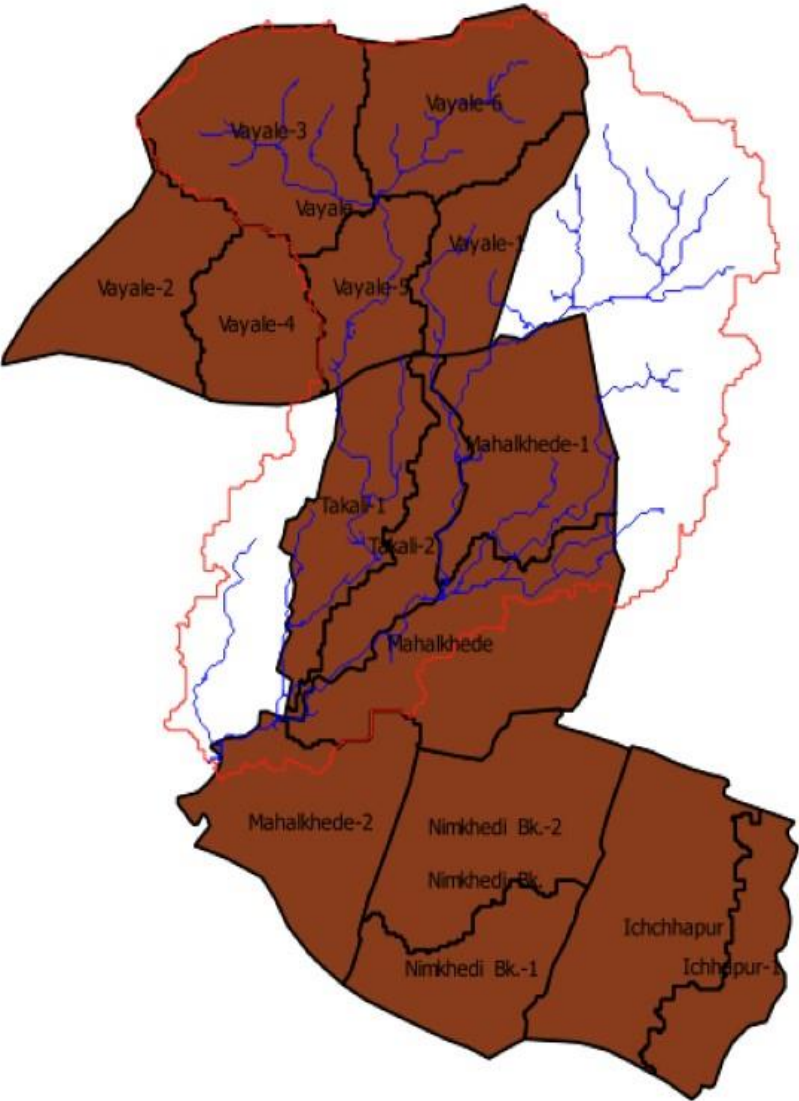
However, not clear is this is the right solution.

- For zones which are not watershed boundaries, this will be inaccurate.
- Most upstream zones would be utilizing run-off or will plan on utilizing run-off
- How is this to be incorporated in planning process?

# Gondala Cluster with Micro Watershed Boundary and Mini Watersheds within Micro Watersheds

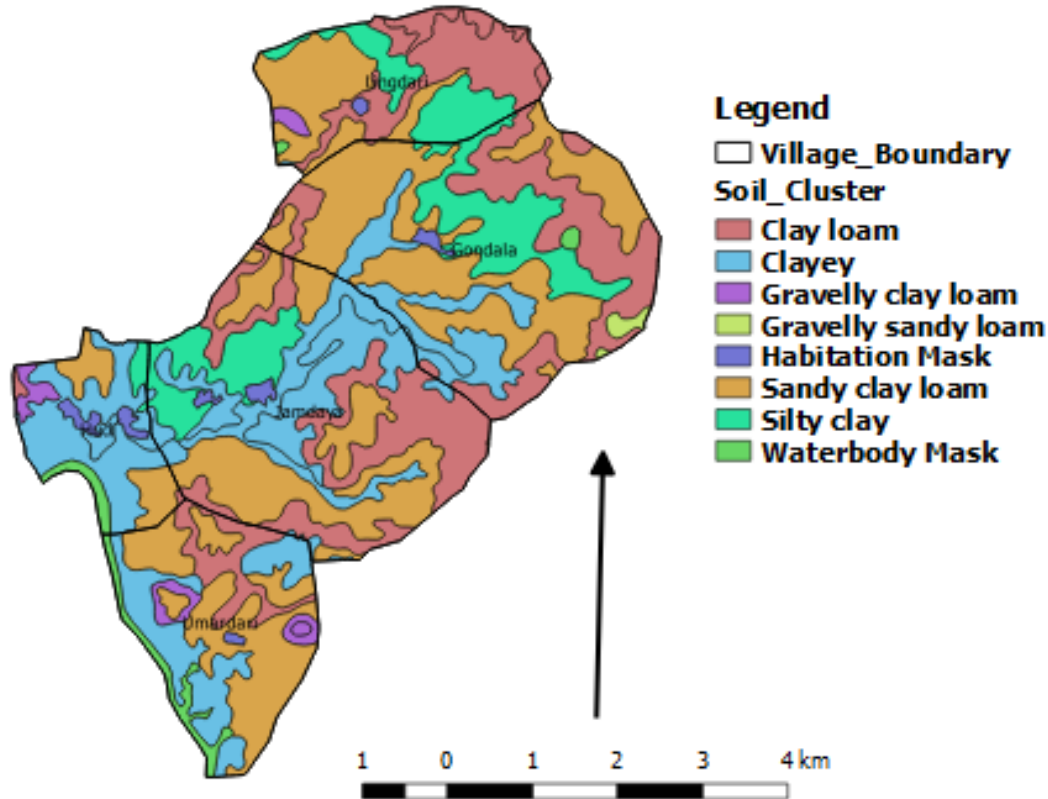


# Mis Match of Micro Watershed or Milli Watershed with cluster boundary



# Technical Description or Manual for MRSAC soil Layer

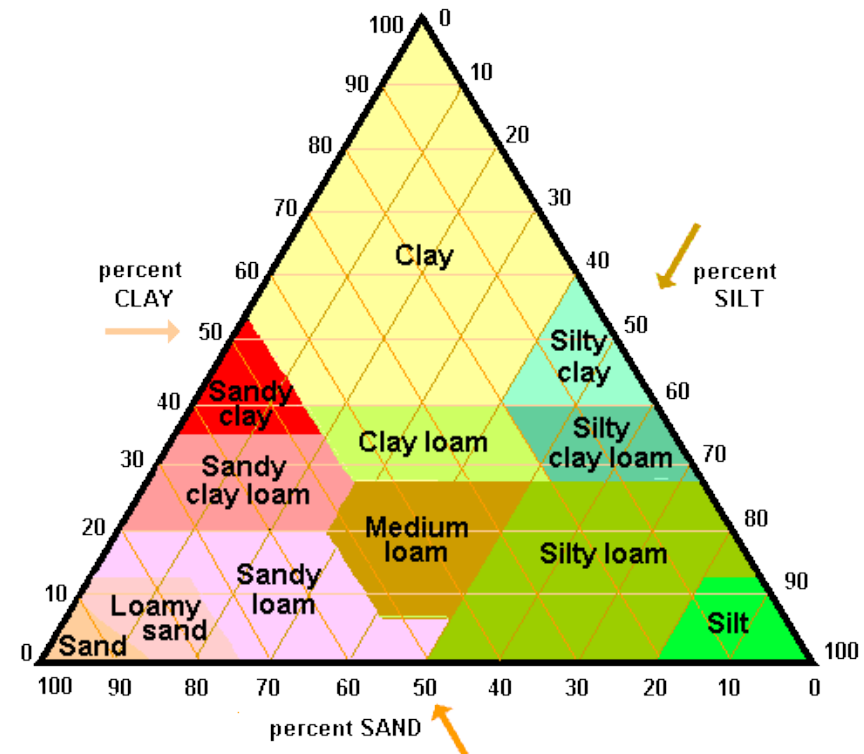
**Soil Map\_Gondala\_Cluster**



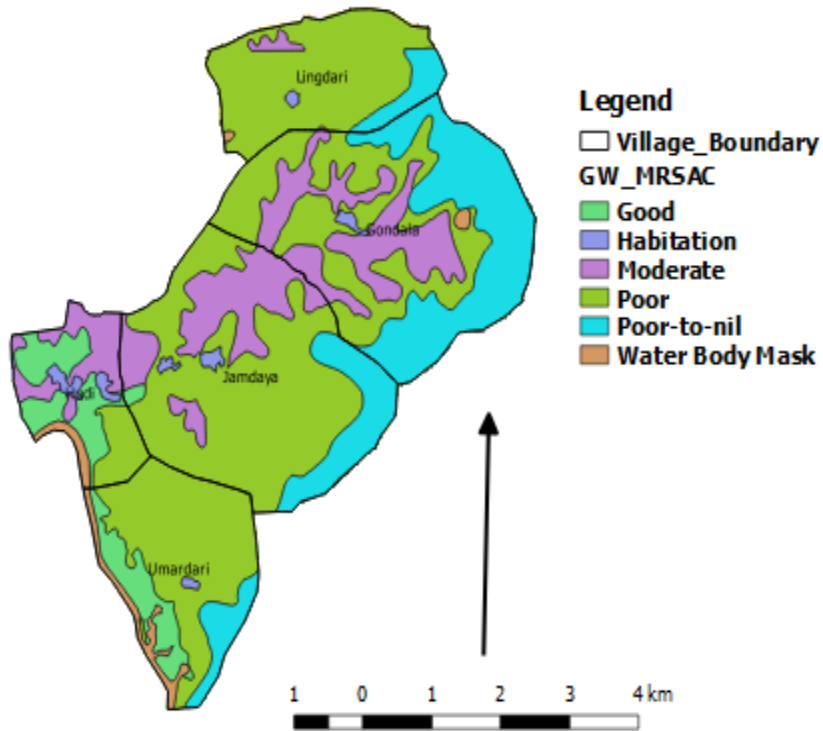
14 types of soil are available in the Layer provided by the MRSAC.

Range or composition used for Categorizing the different soil textures.

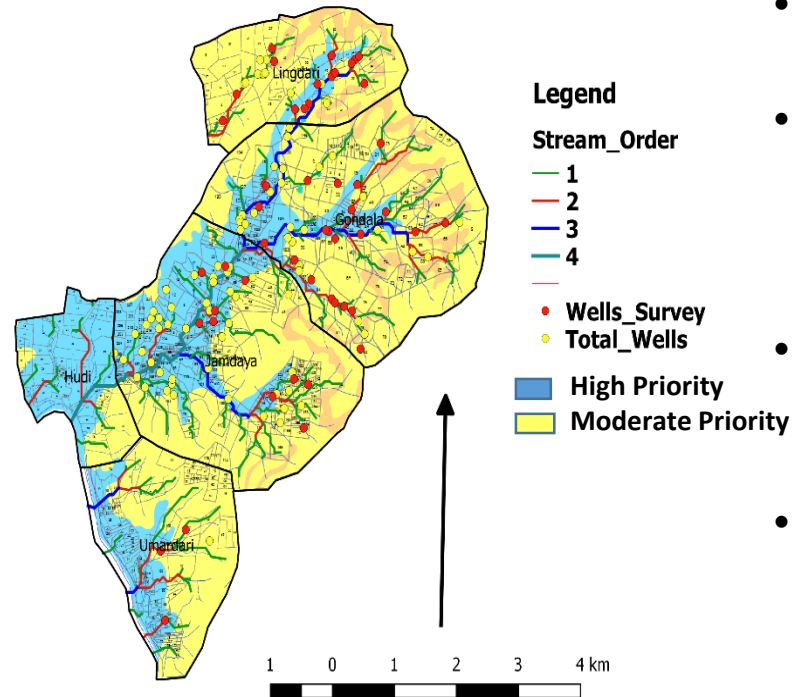
Technical manual for the generation of such layers. Validation process.



# Technical Description or Manual for yellow blue zones



MRSAC Groundwater Prospect Map  
(Shapefile Available)

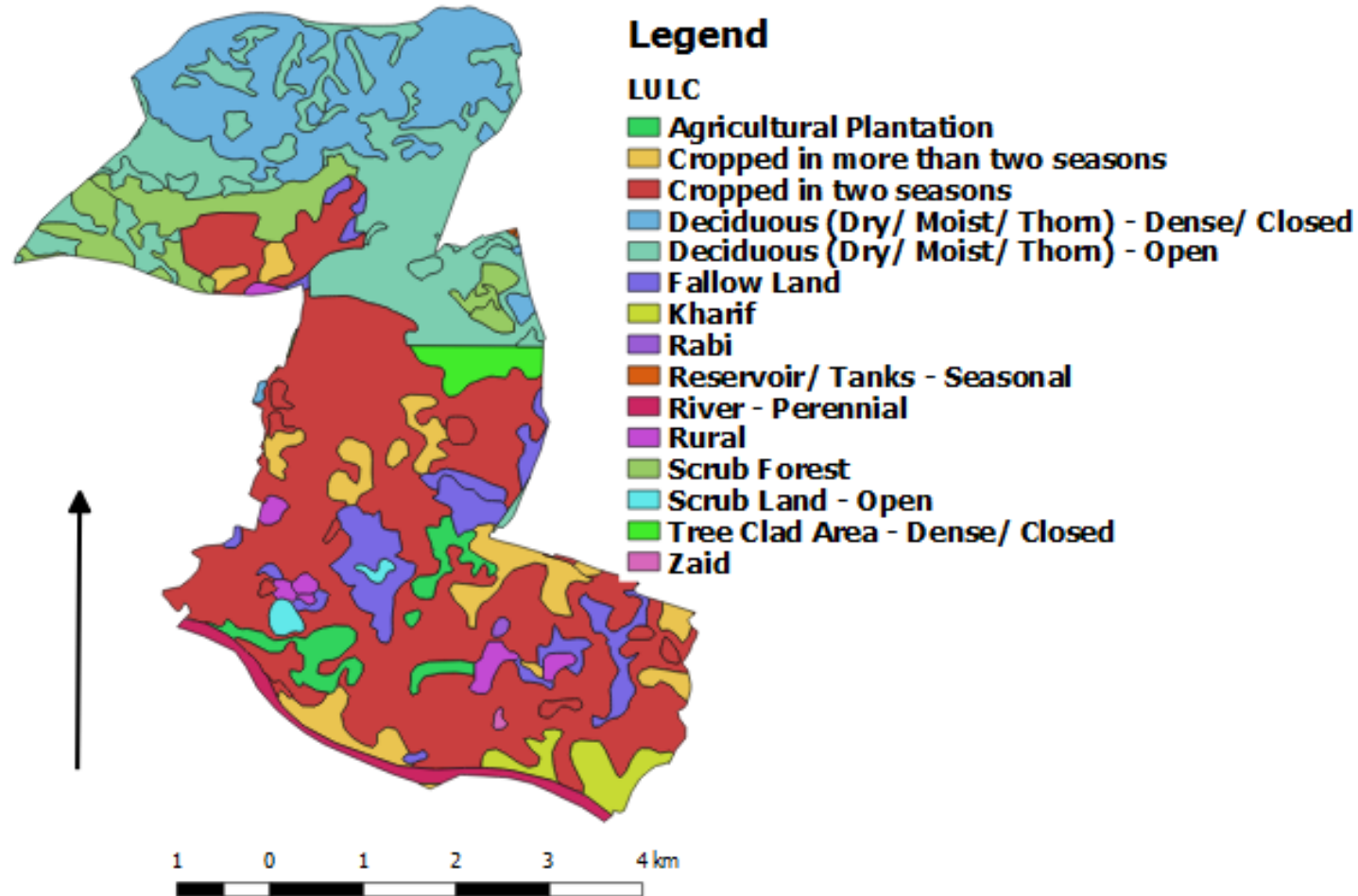


GSDA groundwater Recharge Priority Map  
(Shapefile not Available)

- Technical description or manual used for generation of such maps.
- Different Maps or layers used and their weightage for the generation of groundwater recharge priority maps.
- Methodology / formulae used / process used to generate blue / yellow / red zones
- Number of wells used or survey done for generation or validation of Maps.



# Technical Description or Manual for MRSAC LULC Layer



- Description of various types of land use classes.
- Process of classification in to various classes
- Validation Process
- E.g difference between Cropped in more than two seasons and Rabi
- Tree Clad area

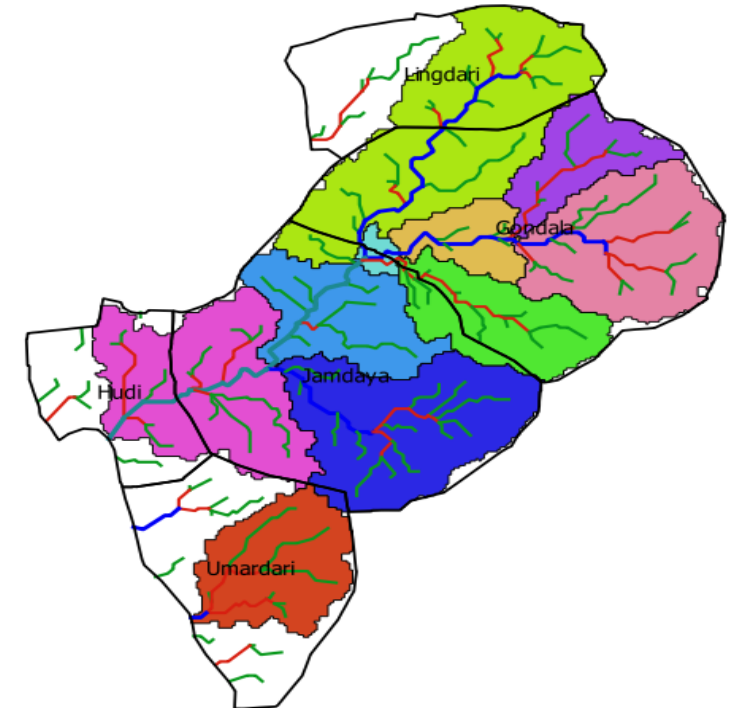
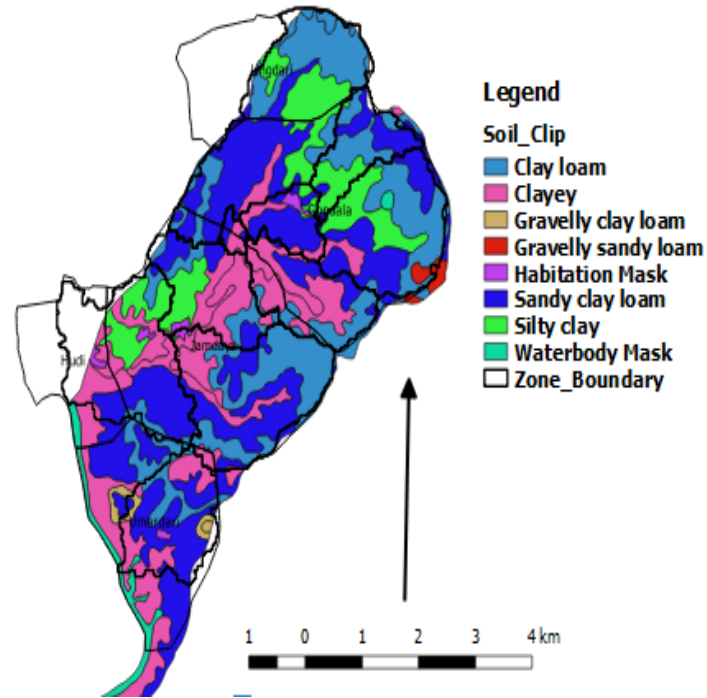
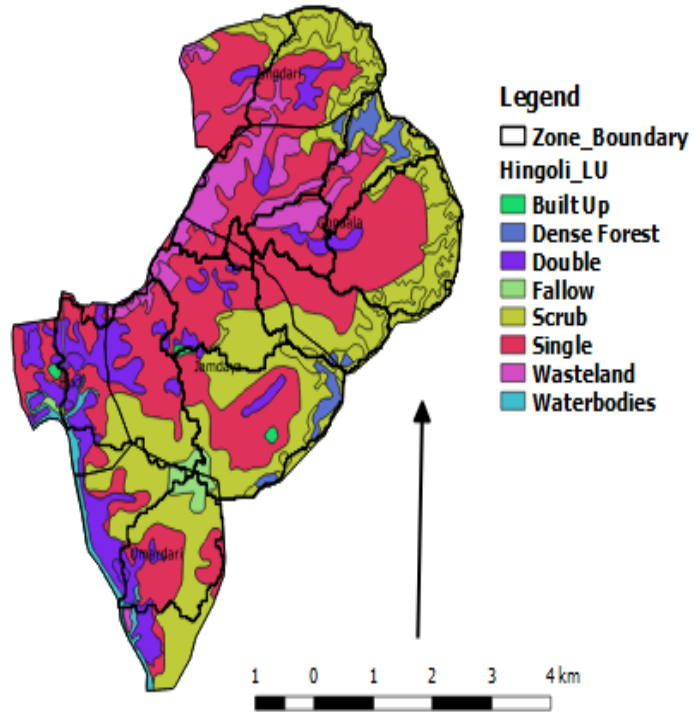
# Discussion with Agriculture Universities

- Region or district wise Crop varieties used with their duration and sowing date
- Potential Evapotranspiration Values.
- Stage wise crop coefficients or Kc values.
- Crop root zone and crop depletion factors.
- Runoff and soil moisture studies conducted in different region.
- Studies done on various crops for yield watering curves.
- Evapotranspiration from Non Agriculture land use types like dense forest, wasteland and scrub forests.
- Permission for GIS layers for VSTF.
- **Commissioning of new Studies.**

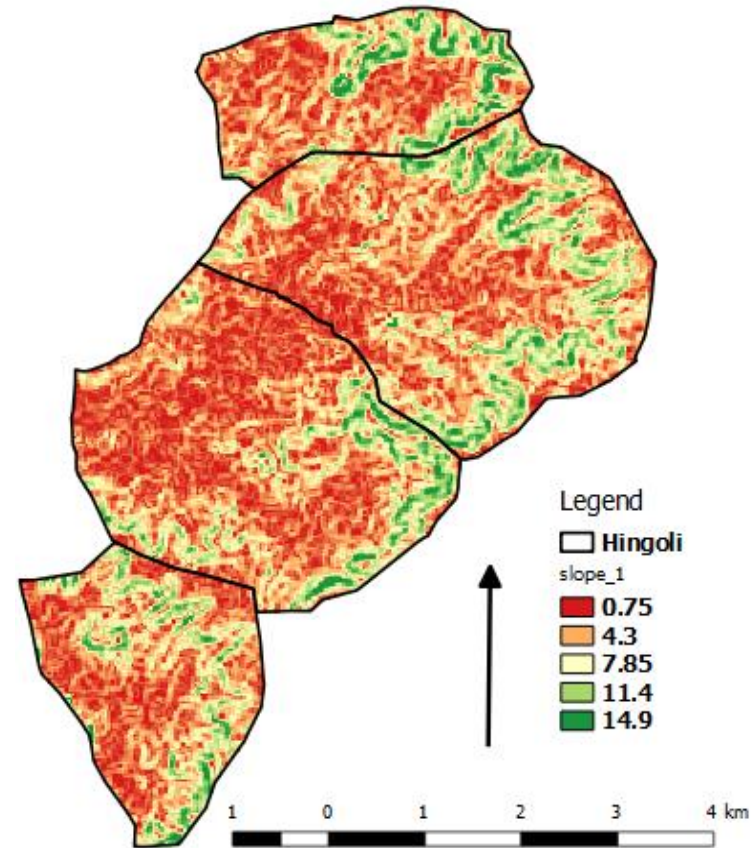


Thank You

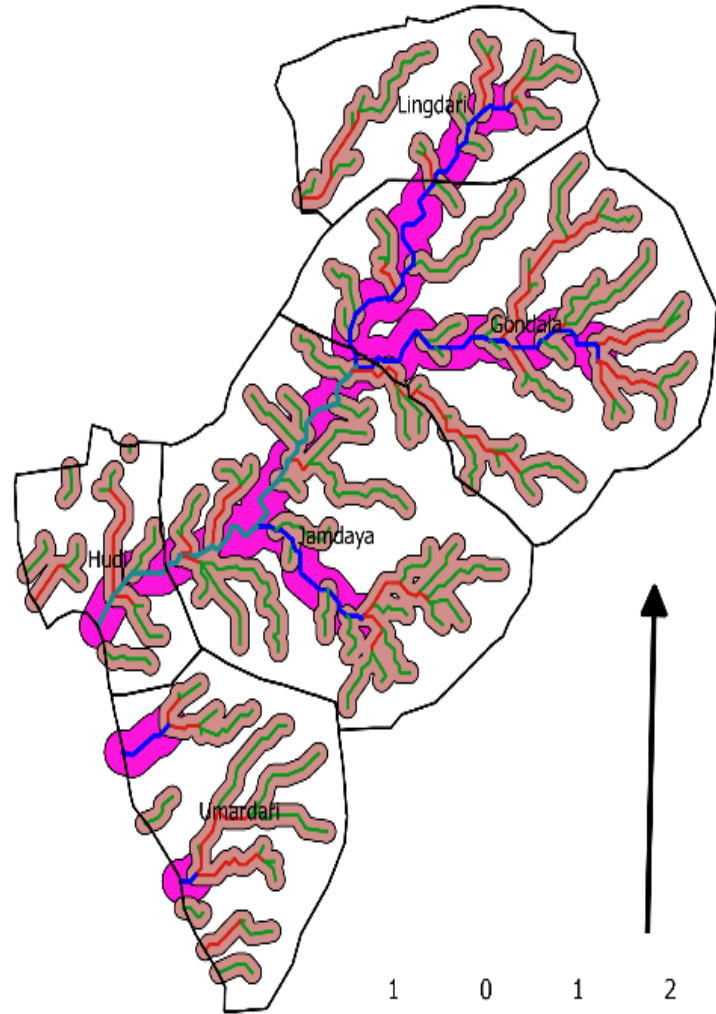
# Inputs - LULC, Soil and Zone shapefile



# Inputs - Cadastral shapefile and Slope raster



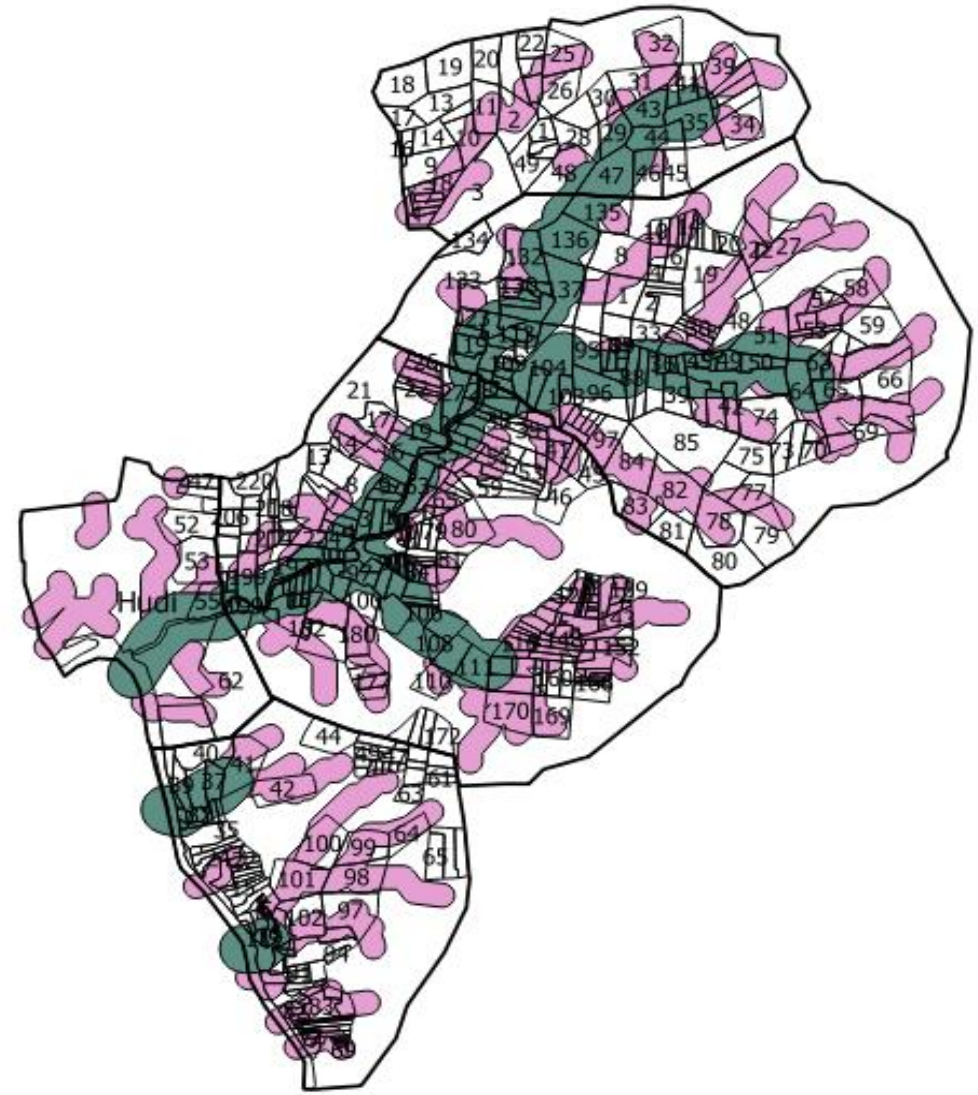
# Stream Order



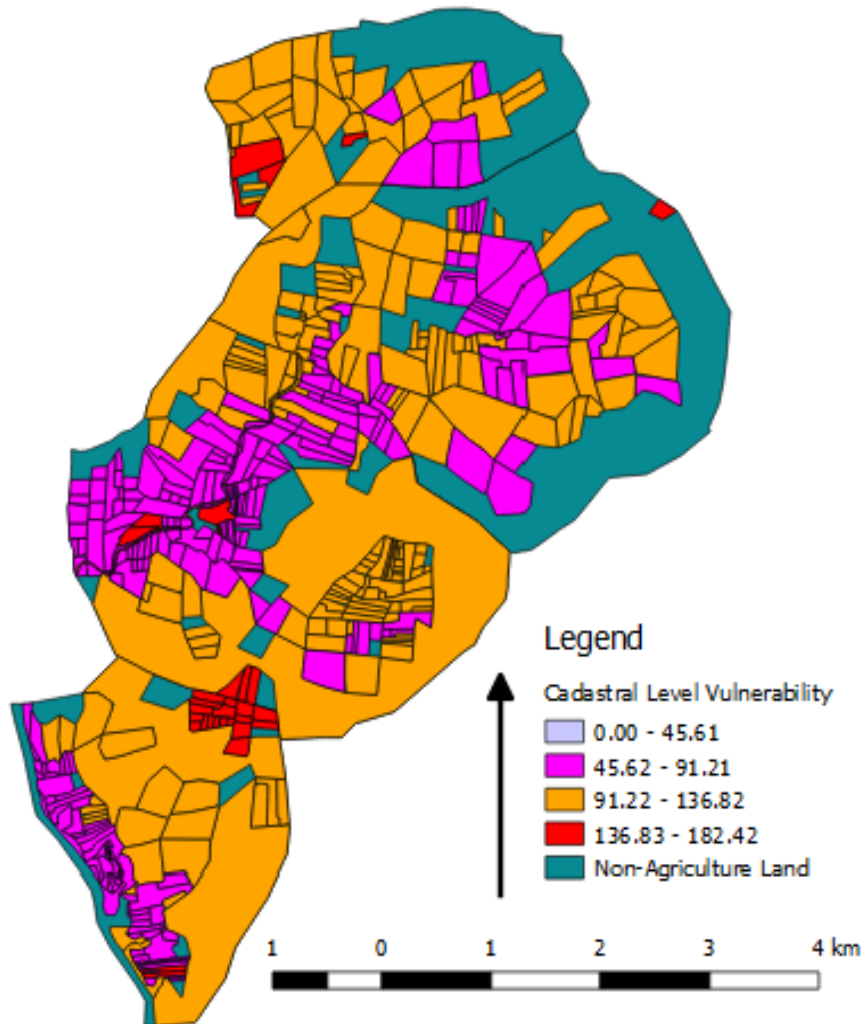
## Legend

□ Zone\_Boundary  
stream\_order

- 1
- 2
- 3
- 4
- Buffer\_100
- Buffer\_200



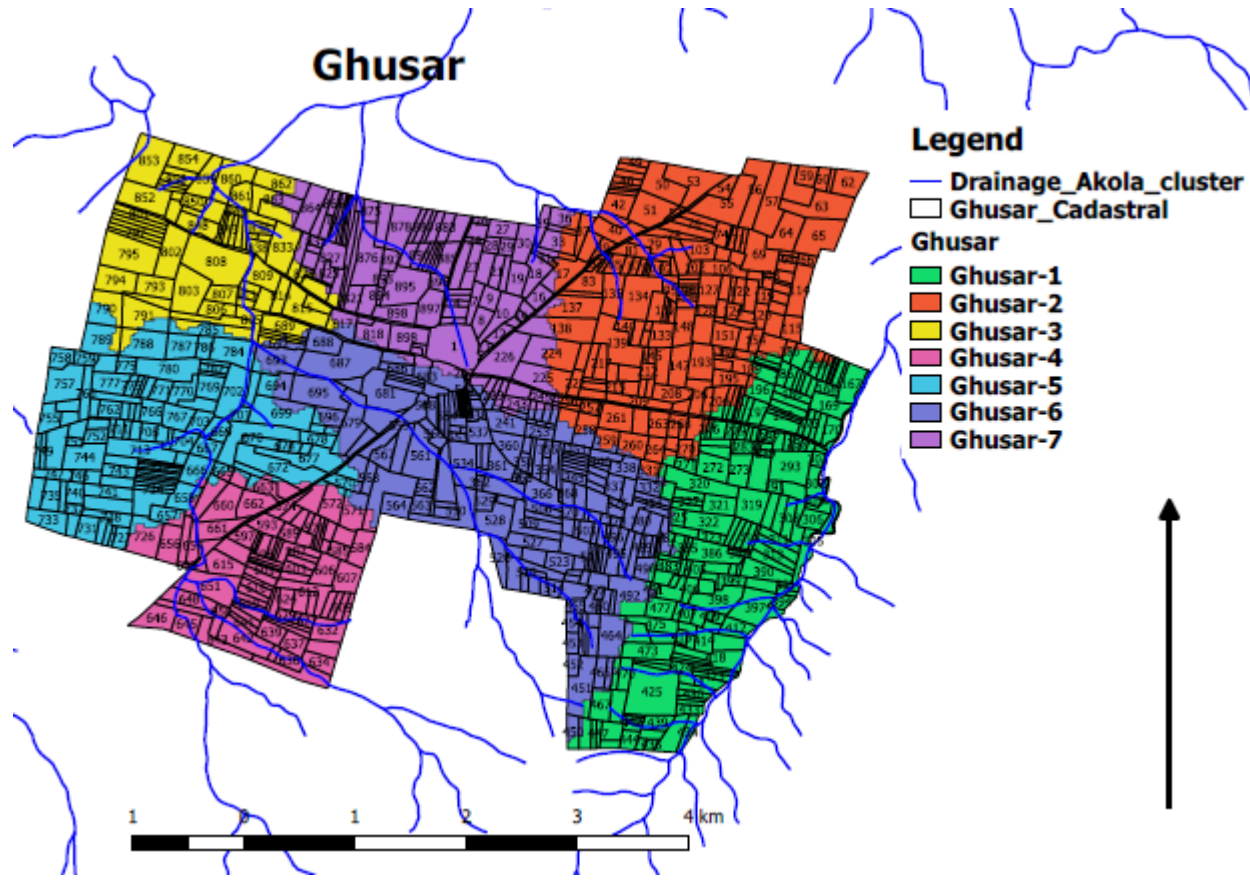
# Output - Cadastral Vulnerability Soyabean



| Plot ID | Crop end Vulnerability | Crop end Deficit Waterings | Monsoon end Vulnerability | Crop end Deficit Waterings |
|---------|------------------------|----------------------------|---------------------------|----------------------------|
| 24      | 182.42                 | 4                          | 182.42                    | 4                          |
| 571     | 182.42                 | 4                          | 182.42                    | 4                          |
| 573     | 182.42                 | 4                          | 182.42                    | 4                          |
| 15      | 179.88                 | 4                          | 179.88                    | 4                          |
| 251     | 177.3                  | 4                          | 177.3                     | 4                          |
| 260     | 177.3                  | 4                          | 177.3                     | 4                          |
| 262     | 177.3                  | 4                          | 177.3                     | 4                          |
| 317     | 177.3                  | 4                          | 177.3                     | 4                          |
| 325     | 177.3                  | 4                          | 177.3                     | 4                          |
| 327     | 177.3                  | 4                          | 177.3                     | 4                          |
| 17      | 176.11                 | 4                          | 176.11                    | 4                          |
| 22      | 176.11                 | 4                          | 176.11                    | 4                          |
| 423     | 161.78                 | 3                          | 161.78                    | 3                          |
| 438     | 161.46                 | 3                          | 161.46                    | 3                          |
| 422     | 161.45                 | 3                          | 161.45                    | 3                          |
| 424     | 161.45                 | 3                          | 161.45                    | 3                          |
| 284     | 124.61                 | 2                          | 124.61                    | 2                          |
| 66      | 123.59                 | 2                          | 123.59                    | 2                          |
| 51      | 123.44                 | 2                          | 123.44                    | 2                          |
| 388     | 123.35                 | 2                          | 123.35                    | 2                          |
| 471     | 122.27                 | 2                          | 122.27                    | 2                          |
| 279     | 121.87                 | 2                          | 121.87                    | 2                          |
| 2       | 121.79                 | 2                          | 121.79                    | 2                          |
| 8       | 121.61                 | 2                          | 121.61                    | 2                          |







| Crop       | Ghusar 1 | Ghusar 2 | Ghusar 3 | Ghusar 4 | Ghusar 5 | Ghusar 6 | Ghusar 7 | Total  |
|------------|----------|----------|----------|----------|----------|----------|----------|--------|
| Soybean    | 20.0     | 21.3     | 0.0      | 0.0      | 0.0      | 15.6     | 10.1     | 67.0   |
| Jowar      | 14.0     | 6.0      | 8.0      | 7.0      | 4.0      | 20.0     | 13.0     | 72.0   |
| Cotton     | 314.9    | 375.0    | 70.0     | 67.9     | 149.0    | 349.0    | 257.0    | 1582.8 |
| Moong      | 52.0     | 90.0     | 182.0    | 177.0    | 220.0    | 70.0     | 26.0     | 817.0  |
| Udid       | 5.0      | 4.0      | 5.0      | 5.0      | 7.0      | 12.0     | 6.0      | 44.0   |
| Tur        | 55.0     | 65.0     | 35.0     | 30.0     | 27.0     | 60.0     | 20.0     | 292.0  |
| Total      | 460.9    | 561.3    | 300.0    | 286.9    | 407.0    | 526.6    | 332.1    | 2874.8 |
| Farm ponds | 33       | 30       | 34       | 19       | 21       | 36       | 39       | 212.0  |



# Bad Year

| Zonal Water Budget Monsoon |   | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 |
|----------------------------|---|--------|--------|--------|--------|--------|--------|--------|
| Demand                     | Total Water Requirement(K+A+LK)             | 2051.3 | 2363.0 | 864.7  | 835.0  | 1187.4 | 2225.1 | 1644.9 |
|                            |   | 287.8  | 323.9  | 148.4  | 145.3  | 187.6  | 308.0  | 242.8  |
|                            | Rabi Total Water Requirement                | 1341.5 | 1574.6 | 433.8  | 416.1  | 695.9  | 1472.2 | 1062.7 |
|                            | Rabi Additional water Requirement (deficit) | 1026.0 | 1213.1 | 290.0  | 277.6  | 508.0  | 1131.2 | 811.3  |
| Supply                     | Water Available from Runoff (80%)           | 349.9  | 392.2  | 190.8  | 186.3  | 232.5  | 373.4  | 292.2  |
|                            | Water Available from Soil Moisture          | 315.5  | 361.5  | 143.7  | 138.6  | 187.9  | 341.0  | 251.3  |
|                            | Water Available from GW                     | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| Existing Storage           | Total Runoff Storage Capacity               | 72.5   | 65.9   | 74.7   | 41.7   | 46.1   | 79.1   | 85.6   |
| Additional Storage         |   | 277.4  | 326.3  | 116.1  | 144.6  | 186.4  | 294.4  | 206.6  |
| Drinking Water             | Drinking Water Need                         |        |        |        |        |        | 110.0  |        |

|  |         |         |        |        |        |         |        |
|--|---------|---------|--------|--------|--------|---------|--------|
| Water Available for New Structures- Monsoon protective irrigation req. (deficit)           | 62.1    | 68.3    | 42.4   | 41.0   | 44.9   | 65.4    | 49.4   |
| Water Available from GW+ Water Available from Soil Moisture - Rabi Total Water Requirement | -1026.0 | -1213.1 | -290.0 | -277.6 | -508.0 | -1131.2 | -811.3 |
| Monsoon Protective Irrigation Index  | 0.3     | 0.2     | 0.5    | 0.3    | 0.2    | 0.3     | 0.4    |
| Post Monsson Protective Irrigation Index   | 0.3     | 0.3     | 0.5    | 0.4    | 0.3    | 0.3     | 0.3    |
| Water Application Index  | 0.7     | 0.7     | 0.8    | 0.7    | 0.7    | 0.7     | 0.7    |

# Good Year

| Zonal Water Budget Monsoon |   | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 |
|----------------------------|---|--------|--------|--------|--------|--------|--------|--------|
| Demand                     | Total Water Requirement(K+A+LK)             | 2051.3 | 2363.0 | 864.7  | 835.0  | 1187.4 | 2220.6 | 1644.9 |
|                            |   | 343.9  | 392.6  | 160.5  | 155.4  | 208.9  | 370.3  | 277.9  |
|                            | Rabi Total Water Requirement                | 1341.5 | 1574.6 | 433.8  | 416.1  | 695.9  | 1468.7 | 1062.7 |
|                            | Rabi Additional water Requirement (deficit) | 867.6  | 1031.7 | 217.5  | 207.6  | 413.4  | 957.4  | 684.9  |
| Supply                     | Water Available from Runoff (80%)           | 1522.8 | 1739.3 | 706.2  | 683.9  | 922.7  | 1640.3 | 1231.5 |
|                            | Water Available from Soil Moisture          | 444.9  | 513.9  | 187.3  | 179.6  | 253.6  | 482.3  | 348.8  |
|                            | Water Available from GW                     | 29.0   | 29.0   | 29.0   | 29.0   | 29.0   | 29.0   | 29.0   |
| Existing Storage           | Total Runoff Storage Capacity               | 72.5   | 65.9   | 74.7   | 41.7   | 46.1   | 79.1   | 79.1   |
| Additional Storage         | Water Available for New Structures          | 1450.3 | 1673.4 | 631.5  | 642.2  | 876.6  | 1561.2 | 1152.5 |
| Drinking Water             | Drinking Water Need                         |        |        |        |        |        | 110.0  |        |

|  |        |         |        |        |        |        |        |
|--|--------|---------|--------|--------|--------|--------|--------|
| Water Available for New Structures- Monsoon protective irrigation req. (deficit)           | 1178.9 | 1346.7  | 545.7  | 528.5  | 713.9  | 1270.0 | 953.6  |
| Water Available from GW+ Water Available from Soil Moisture - Rabi Total Water Requirement | -867.6 | -1031.7 | -217.5 | -207.6 | -413.4 | -957.4 | -684.9 |
| Monsoon Protective Irrigation Index  | 0.21   | 0.19    | 0.47   | 0.27   | 0.22   | 0.21   | 0.28   |
| Post Monsson Protective Irrigation Index   | 0.41   | 0.39    | 0.67   | 0.60   | 0.47   | 0.40   | 0.43   |
| Water Application Index  | 0.77   | 0.77    | 0.88   | 0.84   | 0.79   | 0.77   | 0.78   |

# Computation data

| Village, Taluka | Year | Crop/LU        | Rainfall (mm) | Runoff in Monsoon (mm) | Soil Moisture Crop end (mm) | GW Recharge in Monsoon (mm) | AET Crop End (mm) | PET Crop End (mm) | Crop duration Deficit(PET-AET) (mm) |
|-----------------|------|----------------|---------------|------------------------|-----------------------------|-----------------------------|-------------------|-------------------|-------------------------------------|
| Wadhvi, Karanja | 2015 | soyabean       | 552           | 237                    | 26                          | 12                          | 277               | 460               | 183                                 |
|                 |      | scrub open     | 552           | 244                    | 1                           | 12                          | 295               | 541               |                                     |
|                 |      | scrub forest   | 552           | 156                    | 1                           | 62                          | 332               | 667               |                                     |
|                 |      | deciduous open | 552           | 153                    | 1                           | 30                          | 339               | 667               |                                     |
|                 |      | overall        | 552           | 234                    | 24                          | 13                          | 280               | 460               |                                     |
| Wadhvi, Karanja | 2016 | soyabean       | 929           | 459                    | 59                          | 41                          | 358               | 463               | 105                                 |
|                 |      | scrub open     | 929           | 506                    | 1                           | 37                          | 385               | 544               |                                     |
|                 |      | scrub forest   | 929           | 412                    | 1                           | 100                         | 415               | 670               |                                     |
|                 |      | deciduous open | 929           | 464                    | 1                           | 46                          | 418               | 670               |                                     |
|                 |      | overall        | 929           | 459                    | 54                          | 43                          | 361               | 463               |                                     |
| Wadhvi, Karanja | 2017 | soyabean       | 473           | 130                    | 55                          | 11                          | 277               | 452               | 176                                 |
|                 |      | scrub open     | 473           | 130                    | 1                           | 10                          | 332               | 529               |                                     |
|                 |      | scrub forest   | 473           | 85                     | 1                           | 40                          | 347               | 655               |                                     |
|                 |      | deciduous open | 473           | 100                    | 1                           | 21                          | 351               | 655               |                                     |
|                 |      | overall        | 473           | 128                    | 51                          | 12                          | 282               | 452               |                                     |
| Wadhvi, Karanja | 2015 | Tur            | 552           | 247                    | 2                           | 13                          | 291               | 644               | 354                                 |
|                 |      | scrub open     | 552           | 244                    | 1                           | 12                          | 295               | 541               |                                     |
|                 |      | scrub forest   | 552           | 156                    | 1                           | 62                          | 332               | 667               |                                     |
|                 |      | deciduous open | 552           | 153                    | 1                           | 30                          | 339               | 667               |                                     |
|                 |      | overall        | 552           | 242                    | 2                           | 15                          | 293               | 644               |                                     |
| Wadhvi, Karanja | 2016 | Tur            | 929           | 476                    | 3                           | 26                          | 425               | 645               | 220                                 |
|                 |      | scrub open     | 929           | 506                    | 1                           | 37                          | 385               | 544               |                                     |
|                 |      | scrub forest   | 929           | 412                    | 1                           | 100                         | 415               | 670               |                                     |
|                 |      | deciduous open | 929           | 464                    | 1                           | 46                          | 418               | 670               |                                     |
|                 |      | overall        | 929           | 475                    | 2                           | 28                          | 423               | 645               |                                     |
| Wadhvi, Karanja | 2017 | Tur            | 473           | 144                    | 2                           | 9                           | 319               | 639               | 321                                 |
|                 |      | scrub open     | 473           | 130                    | 1                           | 10                          | 332               | 529               |                                     |
|                 |      | scrub forest   | 473           | 85                     | 1                           | 40                          | 347               | 655               |                                     |
|                 |      | deciduous open | 473           | 100                    | 1                           | 21                          | 351               | 655               |                                     |
|                 |      | overall        | 473           | 141                    | 2                           | 10                          | 321               | 639               |                                     |