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Study of groundwater levels in Chevella sub basin, Rangareddy District, Telangana State, India

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Abstract

Average ground water levels in the study area varied from 9.98mbgl to 16.63mbgl in pre monsoon where as in post monsoon it varied from 4.72mbgl to 10.91mbgl. Three years of water levels such as 2008, 2009 and 2013 in pre monsoon; and five years of post monsoon water levels of 2008, 2009, 2010, 2011, and 2012 is observed increasing trend and 2013 and 2014 showing decreasing trend. There is no change in water levels during study period in pre monsoon of 2010; And post monsoon of 2013 and 2014. 2011, 2012 and 2014 of post monsoon season shows the decreasing trends. During the study years average lowest water levels recorded as 16.63mbgl in pre monsoon of 2012; and average highest water levels found as 3.96mbgl in post monsoon of 2013. Positive relation is observed between ground water levels and rainfall.

Keywords: Chevella sub basin, Contours, Ground water levels, Post monsoon, Pre monsoon.

Introduction

Monitoring of ground water levels reveals the state of water resource in a particular area. Water table measurements are useful to identify aquifer system, to analyse flow systems and water resources. These can be utilised in the delineation of recharge and discharge area[1]. In the present area water levels were monitored in fourteen well to assess the impact of the watershed activities as well as understanding the trend and aquifer response to rainfall.

Study area: Geographically Chevella basin forms part of survey of India toposheet no. 56K/3 of 1:50,000 scale lying between East longitude $78^0$04'10" and $78^0$13'58" and North latitude $17^0$26'50" and $17^0$17' 52" [2]. It is covering 23 villages of Chevella, and Sankarpalli mandals. It is located at central part of the district about 42 km from Hyderabad, lying on Hyderabad to Tanduru state highway number 4.

Materials and methods

Ground water levels from fourteen observation wells have been collected from 2008 to 2014 covering Chevella and Sankarpalli mandals. Data measured in May represent pre monsoon as well as November considered as post monsoon. Contour maps of water levels are generated using surfer 8.0 as well as graphs are prepared in MS Excel. The data are generalised and the trend of water table is observed.

Results and discussions

Table-1 shows that the ground water levels in pre and post monsoon in the study area.

Pre monsoon average water levels varied from 9.98 mbgl (meters below ground level) (2009) to 16.63mbgl (2012). In post monsoon it varied from 4.72mbgl (2010) to 10.91mbgl (2014). Average increase in the water levels is 2.23mbgl in 2008, 4.53mbgl in 2009, 6.97mbgl in 2010, 4.13mbgl in 2011, 7.79mbgl in 2012, 10.33mbgl in 2013 and 1.32mbgl in 2014[3].

In 2008 pre monsoon water level varies from 9mbgl in Masaniguda village to 12.5mbgl in Devuniyerravalli village where as in post monsoon water levels varies from 8.10mbgl in Malkapur village to 10.25mbgl in Nyalata. Average water level over the Chevella basin in pre monsoon is 11.46mbgl and in post monsoon it is 9.23mbgl Figure-1 indicates increasing in groundwater level in both the seasons i.e. pre and post monsoon. Water levels varies in 2009 Pre monsoon from 9.13mbgl in poddutur village to 10.70mbgl in Devuniyerravalli village where as in post monsoon water levels varies from 3.64mbgl in Chandipa village to 6.80mbgl in Mlkapur village. Average water level over the Chevella basin in pre monsoon is 9.98mbgl and in post monsoon it is 5.45mbgl. In 2010 pre monsoon water level varies from 10.17mbgl in poddutur village 12.98mbgl in Urella village where as in post monsoon water levels varies from 1.77 mbgl in Masaniguda village to 6.97mbgl in Malkapur village. Average water level over the Chevella basin in pre monsoon is 11.69mbgl and in post monsoon it is 4.72mbgl. In 2011 pre monsoon water level varies from 10.15mbgl in Mumudyal village 10.89mbgl in Yenkepalli village where as in post monsoon water levels varies from 5.79 mbgl in Tangator village to 6.92mbgl in Kottapalli village. Average water level over the Chevella basin in pre monsoon is 10.53mbgl and in post monsoon it is 6.40mbgl. In 2012 pre monsoon water level varies from 15.23mbgl in Proddutur village 17.43mbgl in Kothapalli village where as in post monsoon water levels varies

from 6.34mbgl in Yelwarthy village to 11.21mbgl in Malkapur village. Average water level over the Chevella basin in pre monsoon is 16.63mbgl and in post monsoon it is 8.84mbgl. In 2013 pre monsoon water level varies from 11.71mbgl in Chandipa village 15.9mbgl in Mumidyal village where as in post monsoon water levels varies from 3.50mbgl in Nyalata village to 5.10mbgl in Yelwarthy village. Average water level over the Chevella basin in pre monsoon is 14.29mbgl and in post monsoon it is 3.96mbgl. In 2014 pre monsoon water level varies from 10.87mbgl in Kammeta village 12.57mbgl in Malkapur village where as in post monsoon water levels varies from 9.09mbgl in Kammeta village to 11.86mbgl in Devuniyerravalli village. Average water level over the Chevella basin in pre monsoon is 12.23mbgl and in post monsoon it is 10.91mbgl.

Trend of water levels: Figure-1 to 7 depicts in pre and post monsoon ground water levels during seven years via, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 respectively. From the figures increasing trend is observed years in pre monsoon of 2008, 2009 and 2013 where as in 2011, 2012 and 2014 recorded decreasing trend. In post monsoon 2008, 2009, 2010, 2011, 2012 has increasing trend and remaining years 2013 and 2014 have decreasing trend[4]. No trend is observed in pre monsoon of 2010.

Table-1: Ground water levels in observation wells.

Mandal	Year	2008		2009		2010		2011		2012		2013		2014	
	Month/Village	May	Nov	May	Nov	May	Nov	May	May	Nov	May	Nov	May	Nov	May
Chevella mandal	Devuniyeravalli	12.50	9.50	10.70	6.19	11.50	5.90	10.76	6.52	16.56	9.65	14.98	3.60	12.57	11.86
	Gollapalli	12.20	9.14	10.23	5.86	10.90	5.30	10.34	5.90	17.01	10.61	15.13	4.30	12.12	11.05
	Kammeta	11.00	9.10	10.10	6.10	12.40	5.90	10.77	6.41	17.16	10.10	15.22	3.80	10.87	9.09
	Mumidyal	9.00	8.10	10.43	5.90	11.50	6.70	10.15	6.83	15.89	10.58	15.90	4.30	12.51	11.80
	Yenkepalli	11.00	9.90	10.00	6.76	10.90	6.11	10.89	6.31	16.99	10.39	15.29	3.55	12.32	11.61
	Urella	12.00	10.25	10.24	5.99	12.98	5.96	10.18	6.55	17.23	10.84	15.54	3.87	12.49	11.12
	Nyalata	12.40	9.76	9.90	5.65	11.00	6.23	10.64	6.29	16.67	10.00	15.69	3.50	12.21	11.73
	Malkapur	12.00	9.78	10.12	6.80	12.17	6.97	10.22	6.48	15.86	11.21	15.88	3.65	12.57	11.52
Sankarpalli mandal	Chandipa	12.03	9.10	9.40	3.64	12.29	2.10	10.23	6.31	15.89	6.86	11.71	4.20	12.34	10.20
	Kottapalli	12.32	8.24	9.57	4.61	11.00	2.20	10.38	6.92	17.43	6.83	12.32	3.98	11.90	10.34
	Masaniguda	10.00	8.43	9.98	5.10	12.54	1.77	10.73	6.67	17.17	6.38	13.10	3.70	12.41	10.11
	Poddutur	11.45	9.10	9.13	3.98	10.17	2.10	10.56	6.71	15.23	7.20	14.80	3.60	12.28	10.54
	Tangotore	12.10	9.80	9.86	4.08	12.18	3.67	10.71	5.79	16.84	6.81	11.80	4.25	12.47	10.21
	Yelwarthy	10.45	8.95	10.11	5.68	12.18	5.12	10.85	5.94	16.95	6.34	12.73	5.10	12.11	11.60
Average		11.46	9.23	9.98	5.45	11.69	4.72	10.53	6.40	16.63	8.84	14.29	3.96	12.23	10.91
Maximum		12.50	10.25	10.70	6.80	12.98	6.97	10.89	6.92	17.43	11.21	15.90	5.10	12.57	11.86
Minimum		9.00	8.10	9.13	3.64	10.17	1.77	10.15	5.79	15.23	6.34	11.71	3.50	10.87	9.09

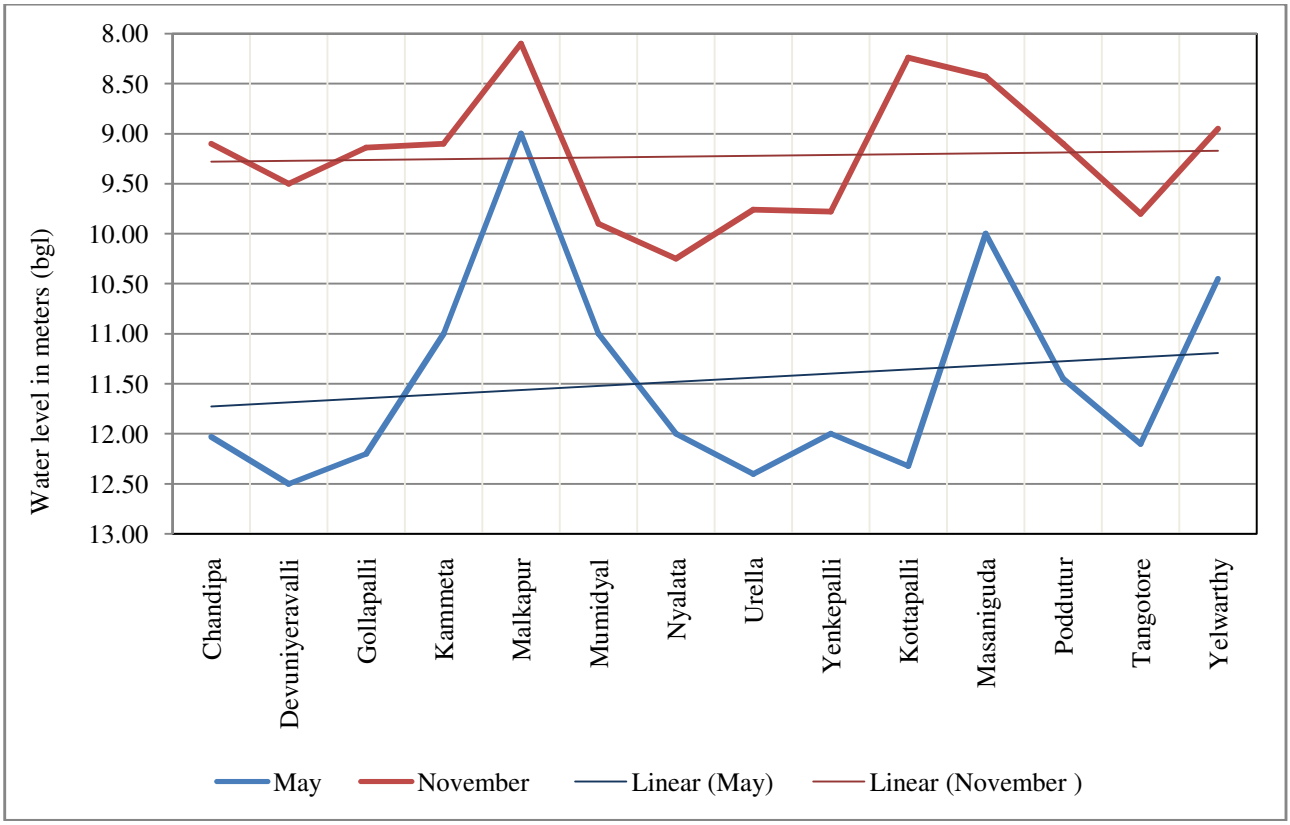

Figure-1: Groundwater levels in Pre and Post monsoon of 2008.

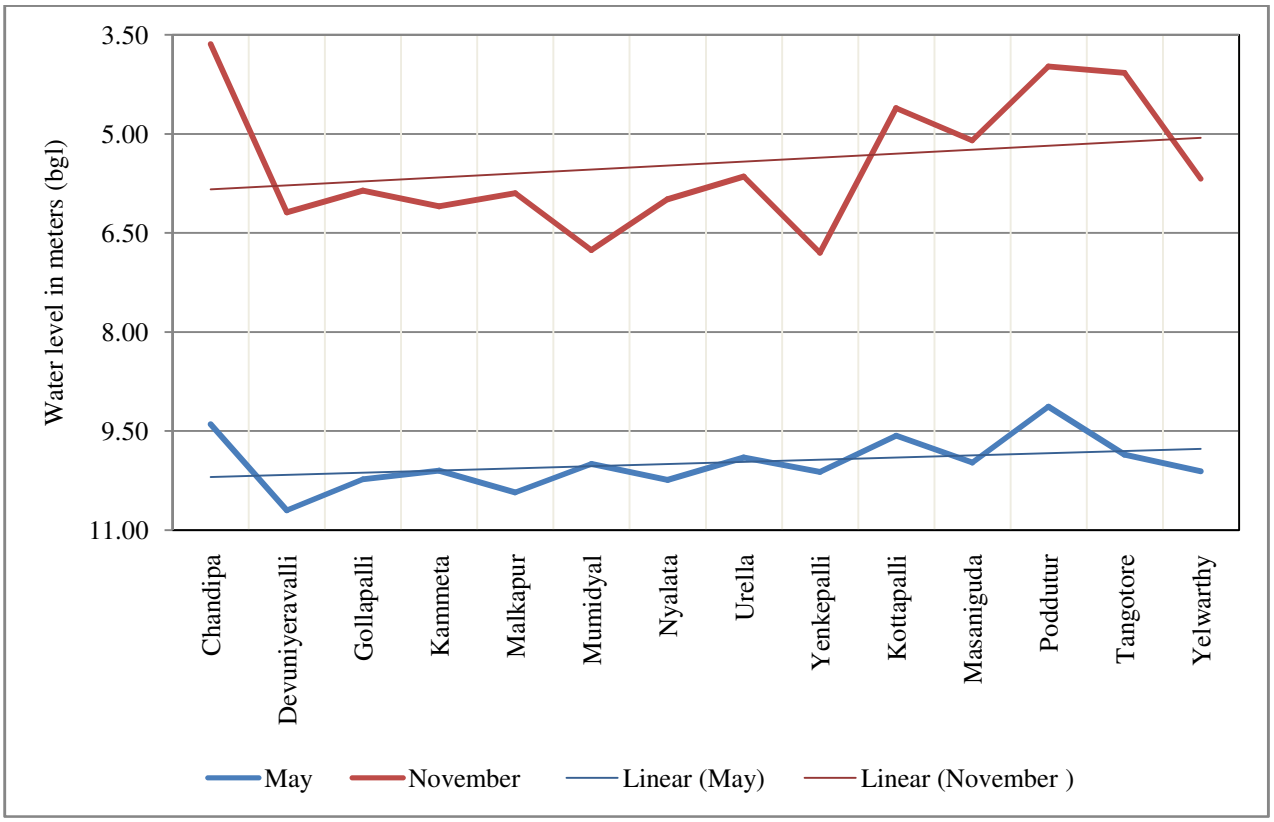

Figure-2: Groundwater levels in Pre and Post monsoon of 2009.

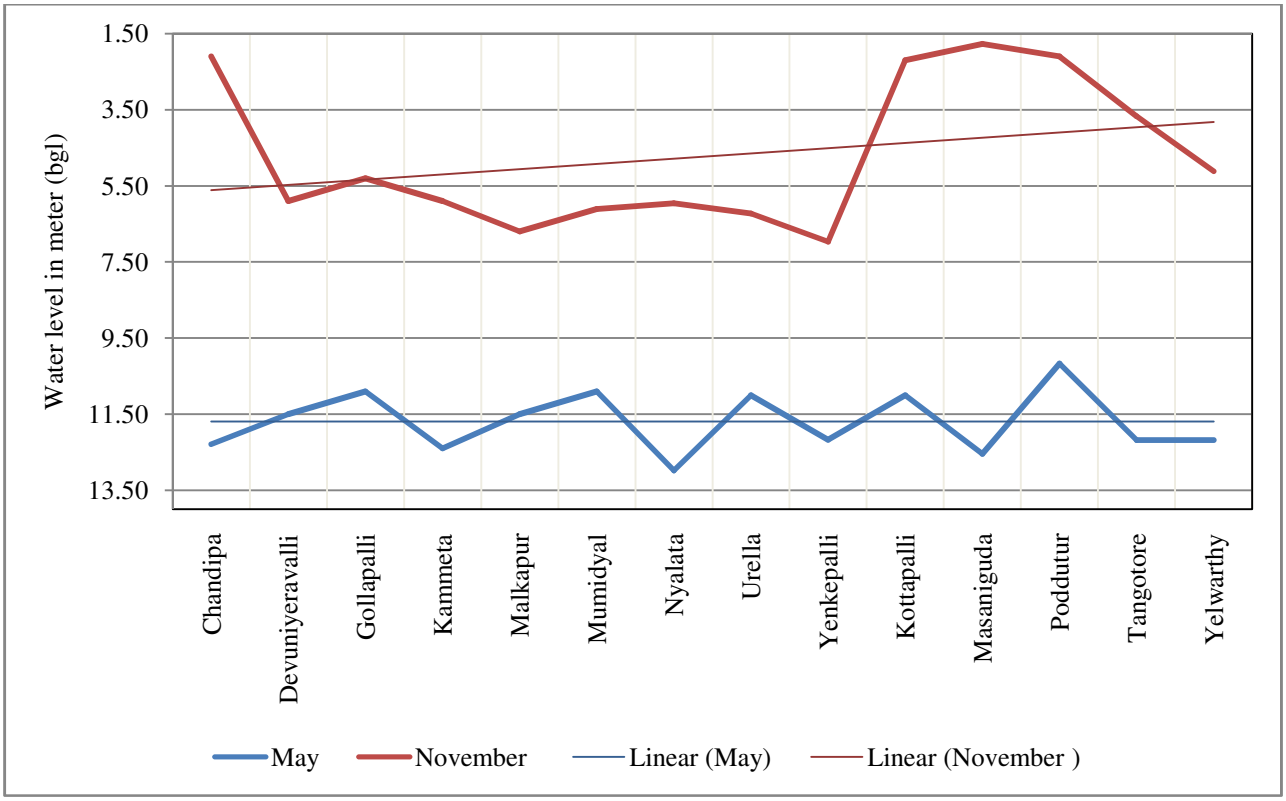

Figure-3: Groundwater levels in Pre and Post monsoon of 2010.

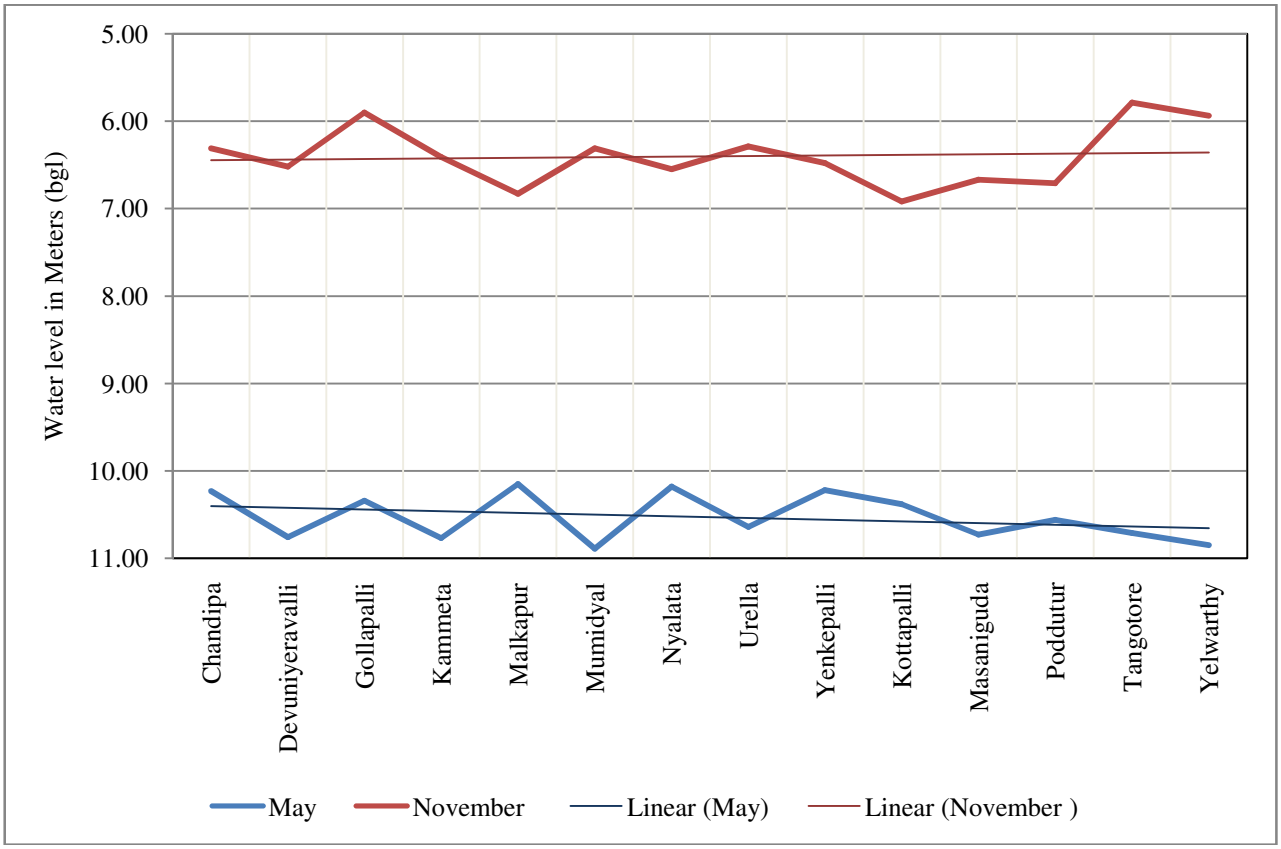

Figure-4: Groundwater levels in Pre and Post monsoon of 2011.

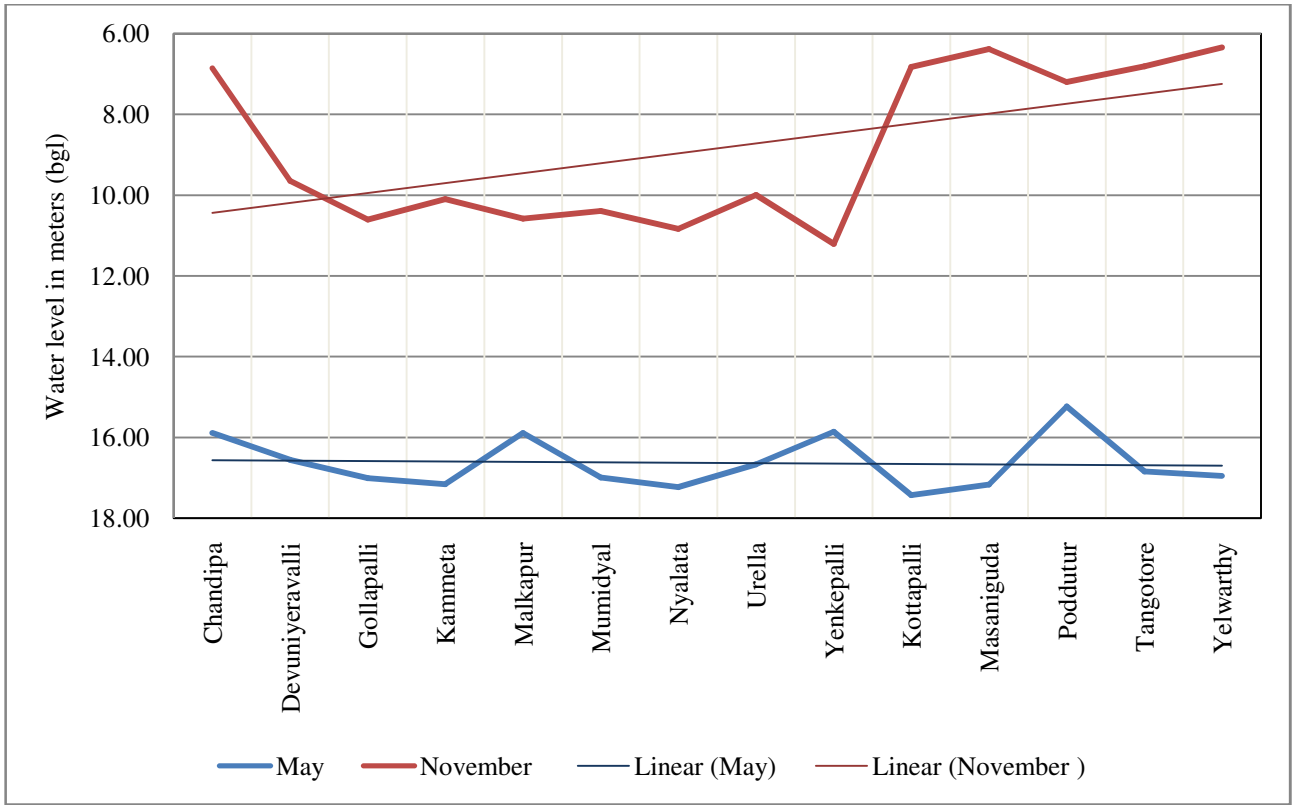

Figure-5: Groundwater levels in Pre and Post monsoon of 2012.

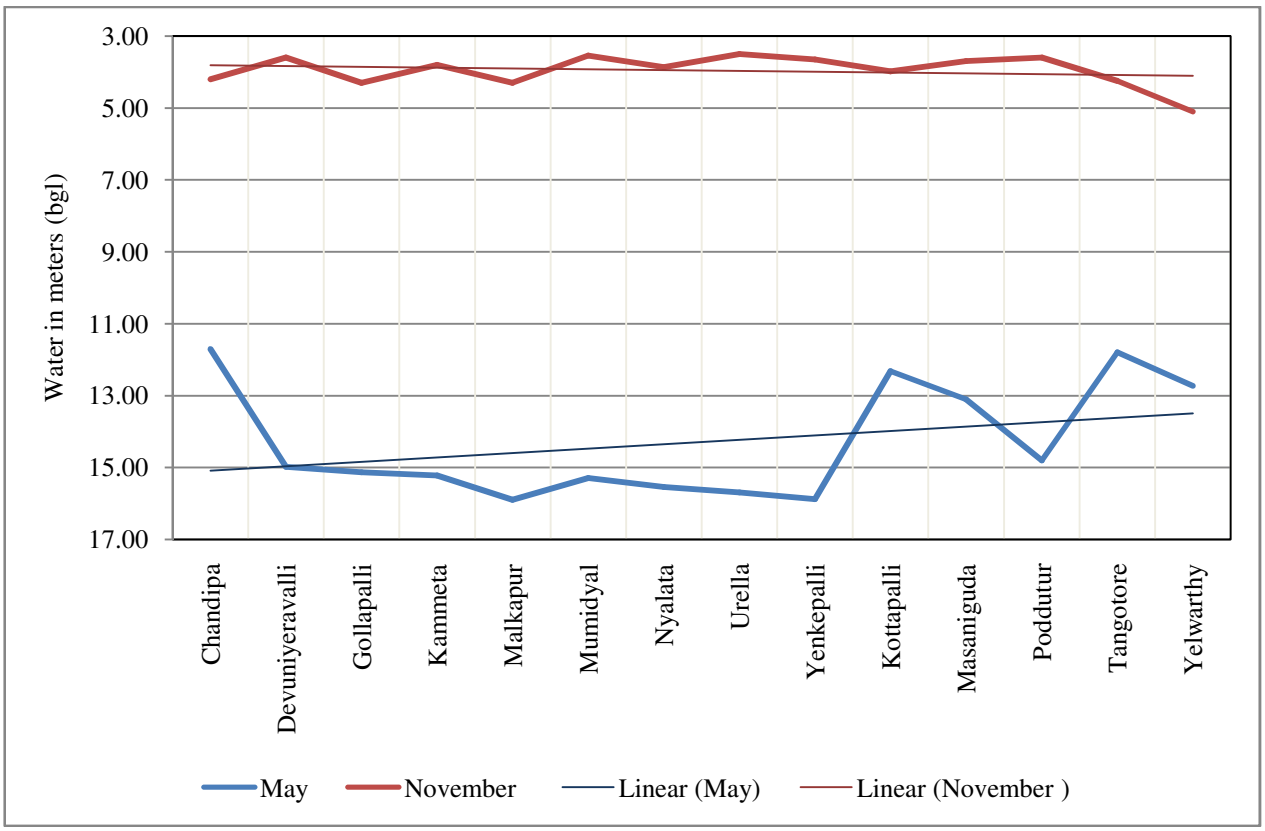

Figure-6: Groundwater levels in Pre and Post monsoon of 2013.

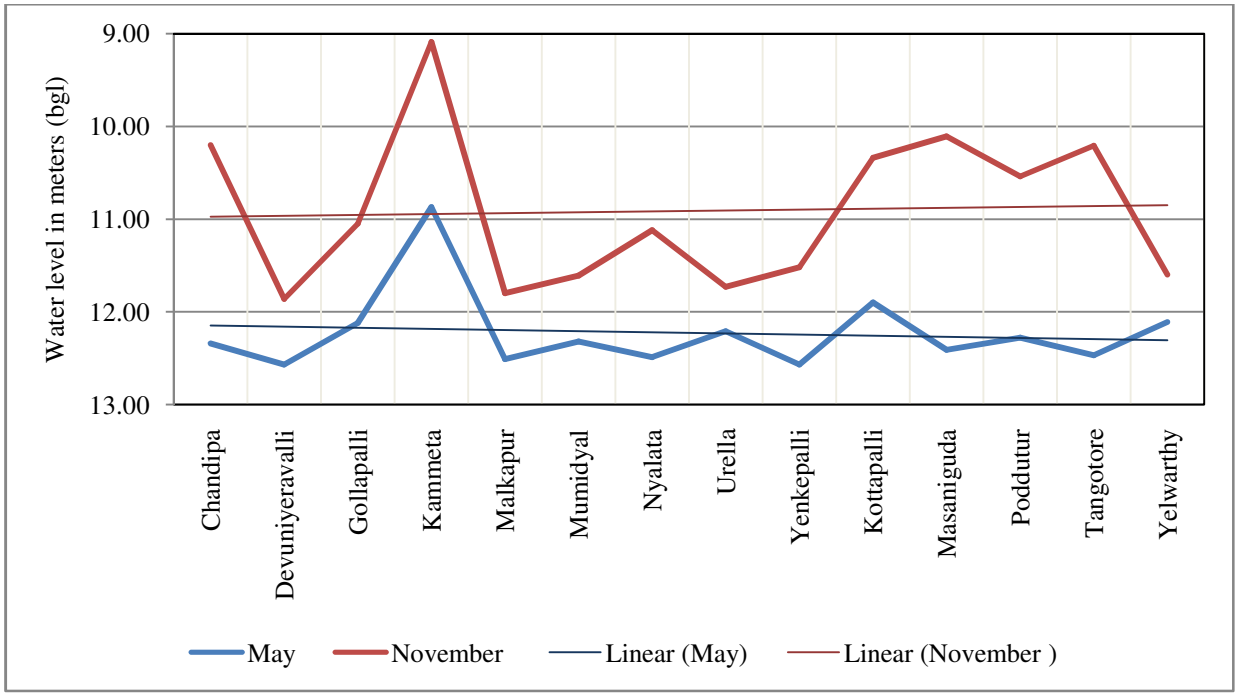

Figure-7: Groundwater levels in Pre and Post monsoon of 2014.

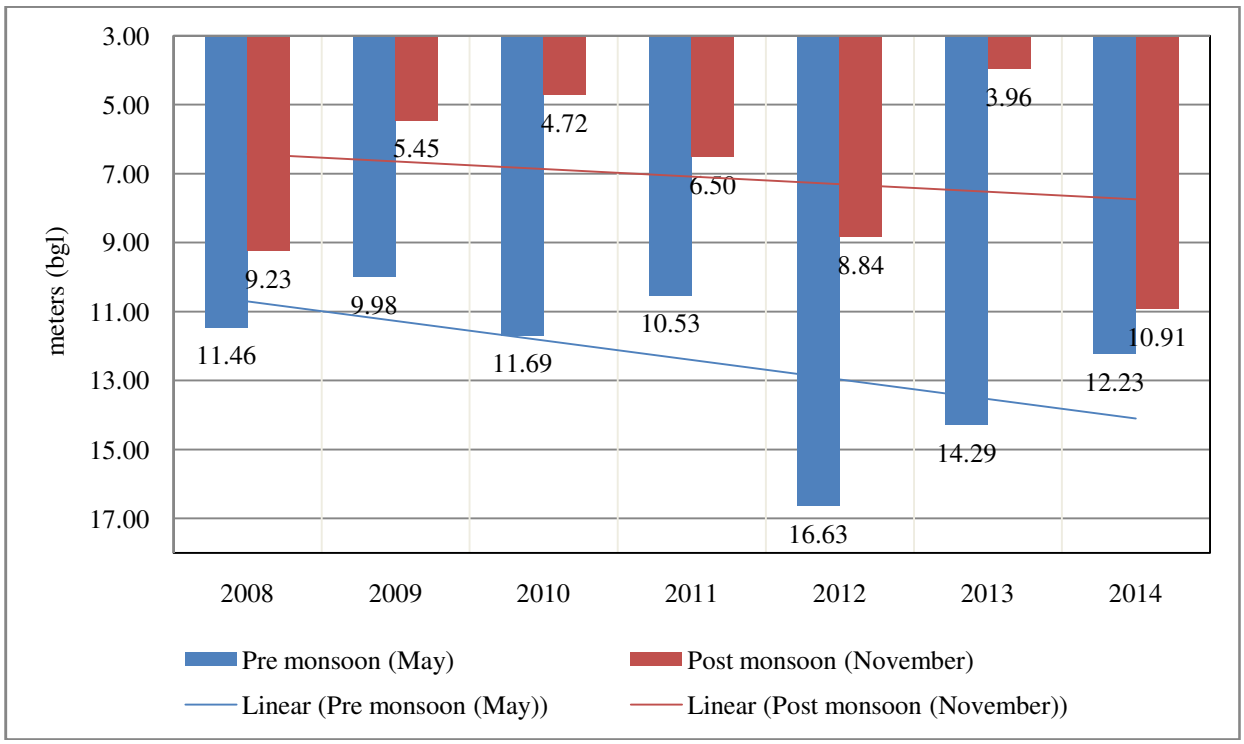

Figure-8: Average groundwater levels in both pre and post monsoon (2008 -2014).

Figure-8, shows that over the seven years period; pre monsoon of 2012 experienced lowest water level (16.63mbgl), followed by 2013 (14.29mbgl), 2014 (12.23mbgl), 2010 (11.69mbgl) and 2008 (11.46mbgl). Highest water levels 9.98mbgl is observed in 2009. As a hole it is observed ground water levels are fallen in Chevella basin in pre monsoon. In post monsoon highest water levels 3.96mbgl has been found in 2013, followed by 4.72mbgl in 2010, 5.45mbgl in 2009, 6.50mbgl in 2011, 8.84mbgl in 2012, 9.23mbgl in 2008 and 10.91mbgl in 2014. It is also reveals that trend of ground water levels are decreasing in both pre and post monsoon.

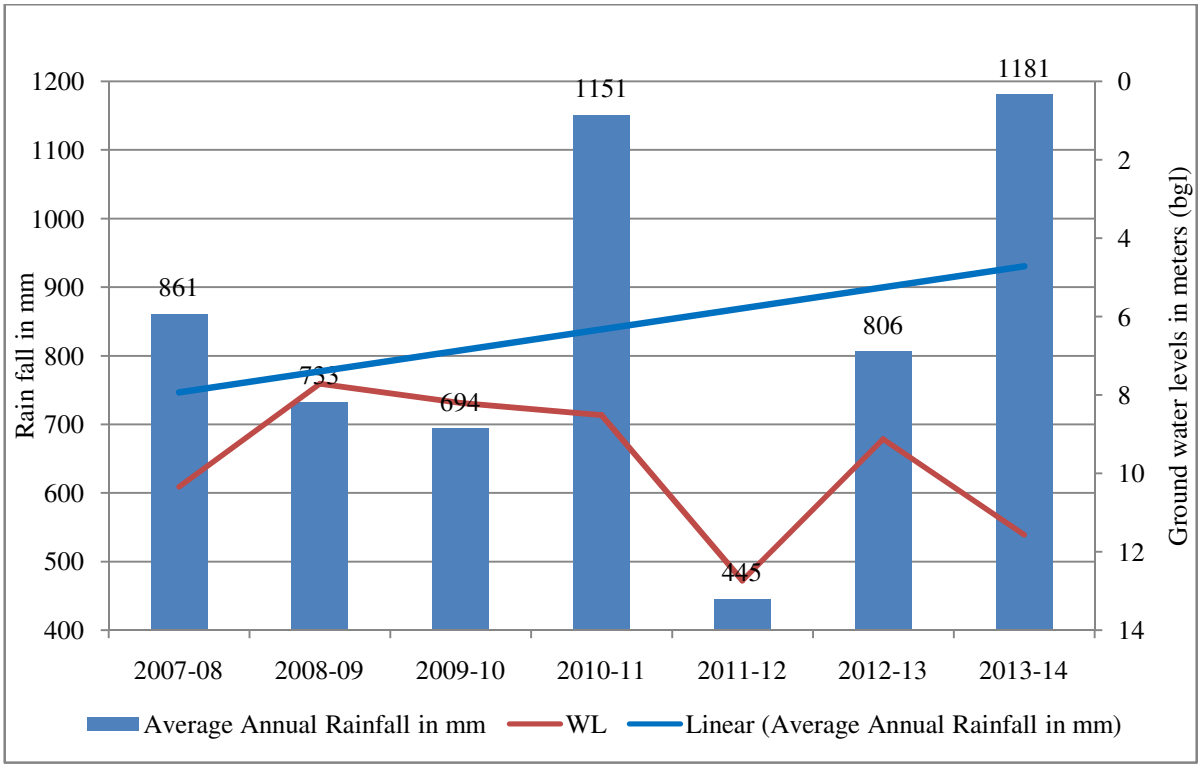

Figure-9: Average annual rain fall and water levels (2007- 2014).

Figure-9, show that the relation between rainfall and water levels. Lowest water levels (12.74) recorded in 2011-12 when highest rainfall (445mm) is recorded, followed by 11.57mbgl effect of 1181 mm of rain fall in 2013-14, 10.35mbgl in 2007-08 (861mm), 9.13mbgl in 2012-13 (806mm), 8.52mbgl in 2010-11 and 8.21mbgl in 2009-10 (733mm). Highest water levels 7.72mbgl is recorded in 2008-09. From the data positive relation is observed between rainfall and ground water levels.

Water level contours: Water level contours are prepared to understand the groundwater flow as well as areal distribution of water levels. Figure-10 to 25 depicts the contour maps of Chevella sub basin from 2008 to 2014 in both the seasons' i.e. pre and post monsoon seasons. Pre monsoon of 2008 (Figure 10) lowest water levels observed at south-west called as discharge area where as highest recorded recharge area at south of the Chevella sub basin. Groundwater flow is observed in two direction one towards south and another towards west from discharge area. In post monsoon of 2008 (Figure-11) lowest water levels (discharge area) found at south east and south west whereas highest levels (recharge area) is set up east and south. Groundwater is flowing towards east[5].

In pre monsoon of 2009 (Figure-12) lowest water levels observed at south could be called as discharge area where as highest recorded at north and east of the Chevella sub basin. Groundwater flow is observed in two directions; one towards north and another towards east from discharge area. In post monsoon of 2009 (Figure-13) lowest water levels (discharge area) found at south and central part where as highest levels (recharge area) is extended all other directions. Groundwater is flowing from centre of the study area. In pre monsoon of 2010 lowest water levels observed at central north east and west; could be called as discharge area where as highest recorded at central and east of the Chevella sub basin. Groundwater is flowing from west to south east and then takes it towards east direction.

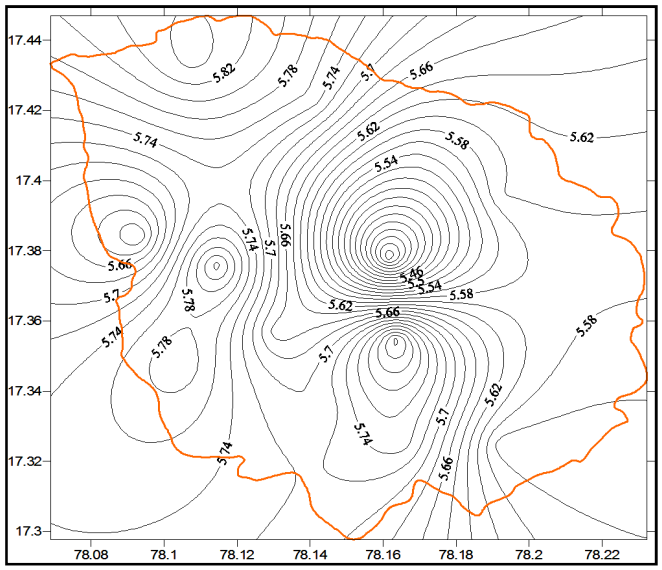

Figure-10: Groundwater level contour map of pre monsoon (May) 2008.

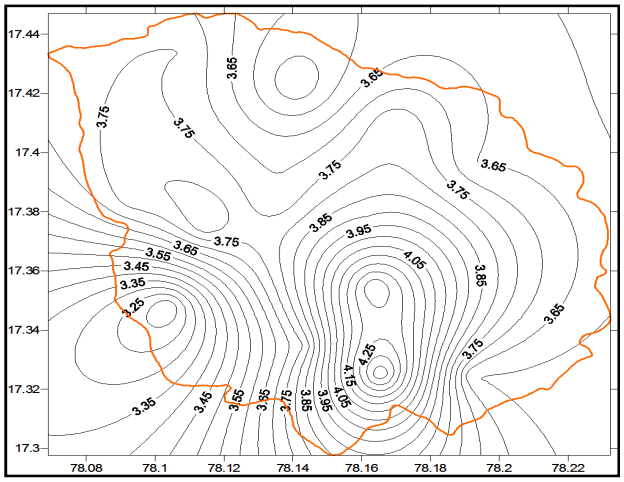

Figure-11: Groundwater level contour map of post monsoon (November) 2008.

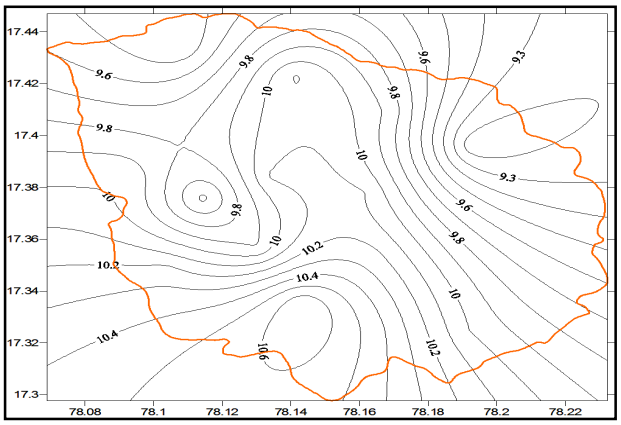

Figure-12: Groundwater level contour map of pre monsoon (May) 2009.

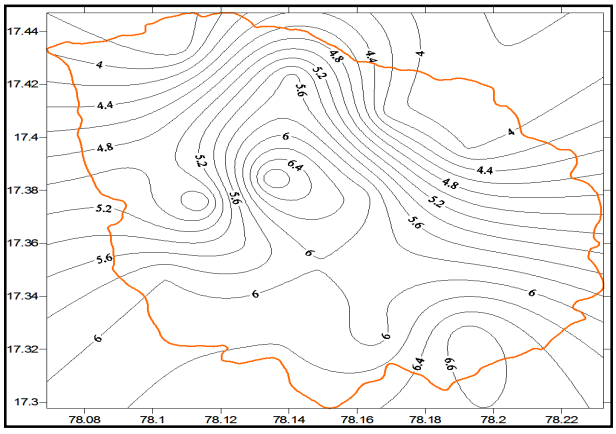

Figure-13: Groundwater level contour map of post monsoon (November) 2009.

Groundwater is flowing from central to east and north east in pre monsoon (Figure-14). In post monsoon of 2010 (Figure-15) lowest water levels are found at central portion of the Chevella sub basin whereas highest levels are set up at east and North West.

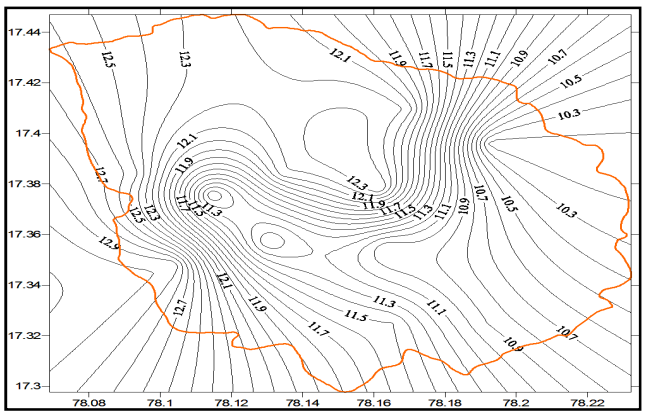

Figure-14: Groundwater level contour map of pre monsoon (May) 2010.

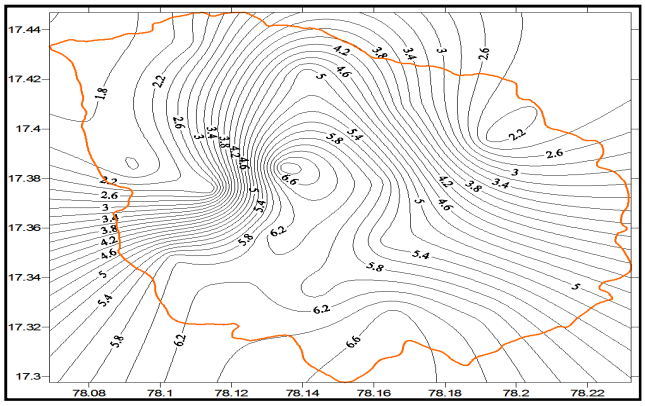

Figure-15: Groundwater level contour map of post monsoon (November) 2010.

In pre monsoon of 2011 (Figure-16) lowest water levels observed at north; could be called as discharge area where as highest recorded at south of the Chevella sub basin. Groundwater is flowing from north to south. In post monsoon of 2011 (Figure-17) lowest water levels are found at east and south portion of the Chevella sub basin whereas highest levels are set up at north east. Groundwater is flowing from discharge area to north east.

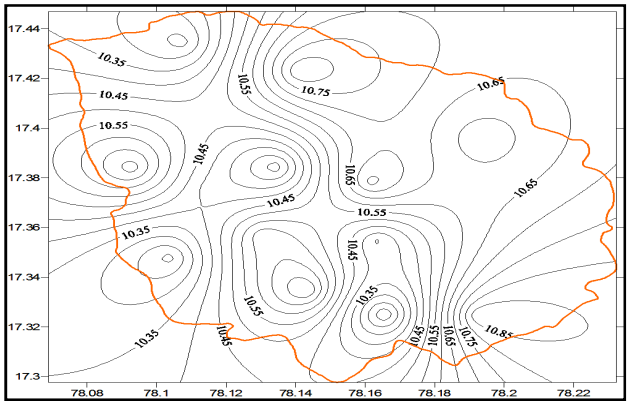

Figure-16: Groundwater level contour map of pre monsoon (May) 2011.

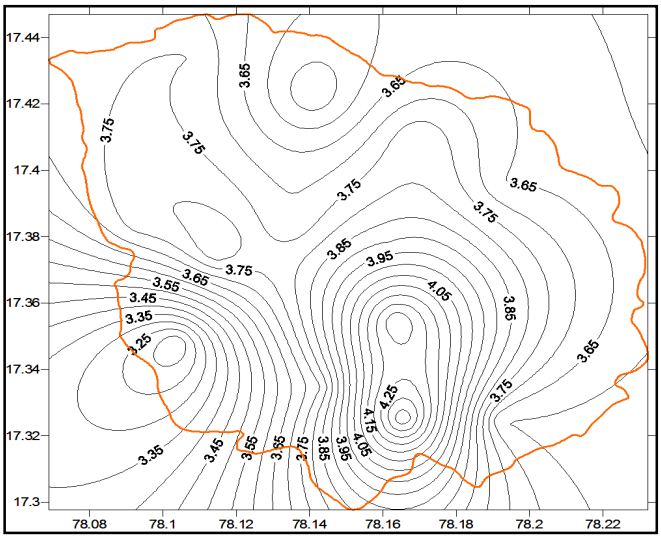

Figure-17: Groundwater level contour map of pre monsoon (November) 2011.

In pre monsoon of 2012 (Figure-18) lowest water levels observed at west part could be called as discharge area where as highest recorded at east of the Chevella sub basin. Groundwater flow is observed in two direction one towards north and another towards east from discharge area. In post monsoon of 2012 (Figure 19) lowest water levels found at central and south west whereas highest levels is set up north. Groundwater is flowing towards north in the Chevella sub basin.

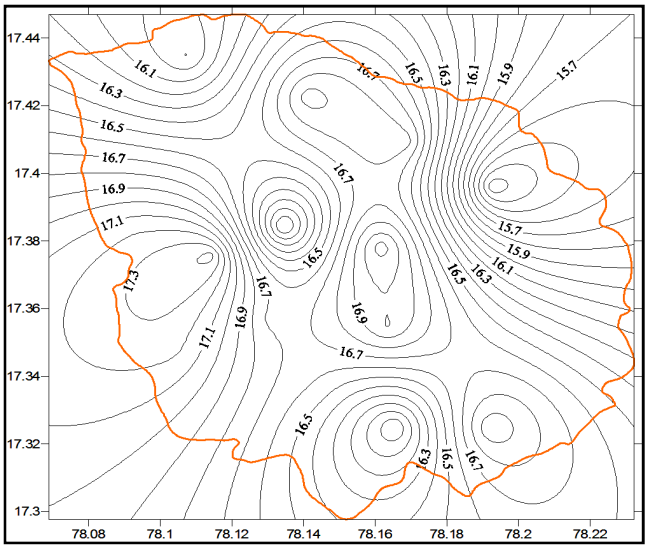

Figure-18: Groundwater level contour map of pre monsoon (May) 2012.

In pre monsoon of 2013 (Figure-20) lowest water levels observed at south could be called as discharge area where as highest recorded at north of the Chevella sub basin. Groundwater is flowing from south to north. In post monsoon of 2013 (Figure-21) lowest water levels are found at north and whereas highest levels is set up south. Groundwater is flowing towards south from north in the Chevella sub basin.

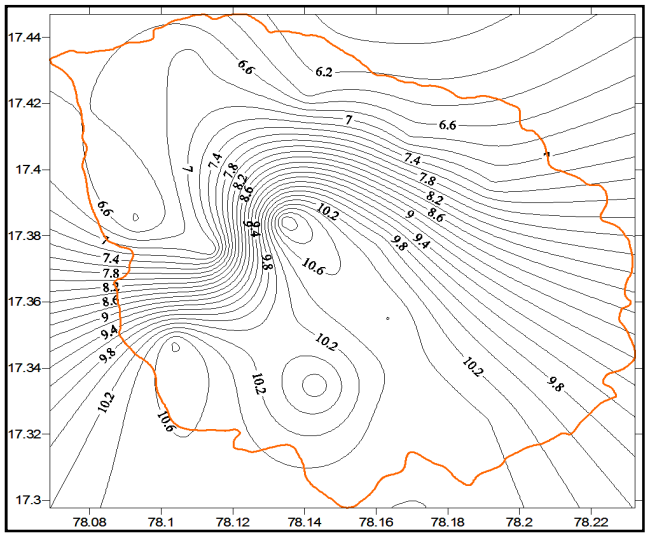

Figure-19: Groundwater level contour map of pre monsoon (November) 2012

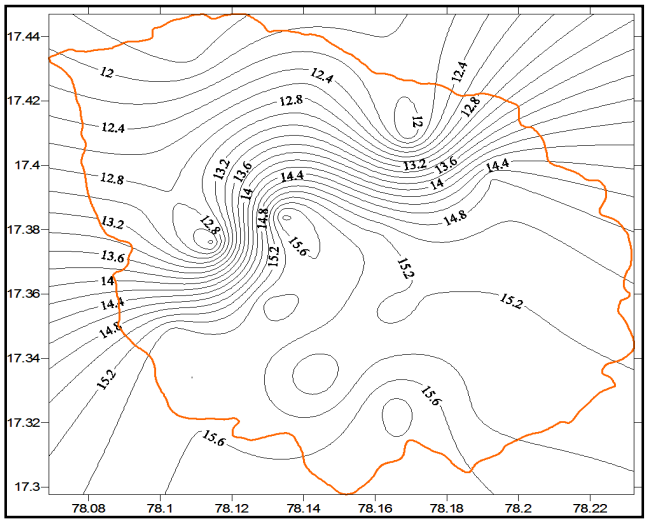

Figure-20: Groundwater level contour map of pre monsoon (May) 2013.

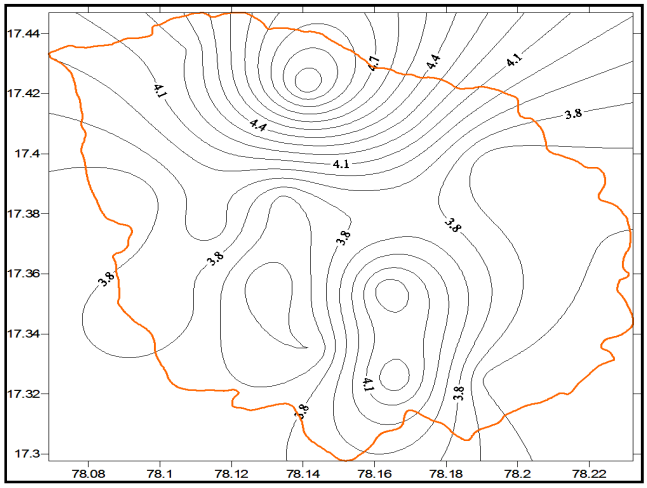

Figure-21: Groundwater level contour map of pre monsoon (November) 2013.

In pre monsoon of 2014 (Figure-22) highest water levels observed at central portion of the Chevella sub basin from all direction groundwater is flowing to the central portion. In post monsoon of 2014 (Figure-23) lowest water levels were found at south whereas highest levels at east and south. So it can be concluded that ground water is flowing towards north, south to the central east in the Chevella sub basin.

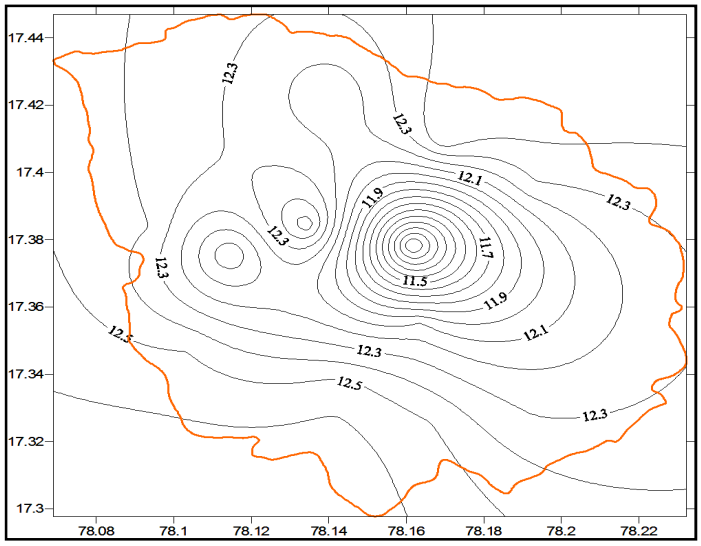

Figure-22: Groundwater level contour map of pre monsoon (May) 2014.

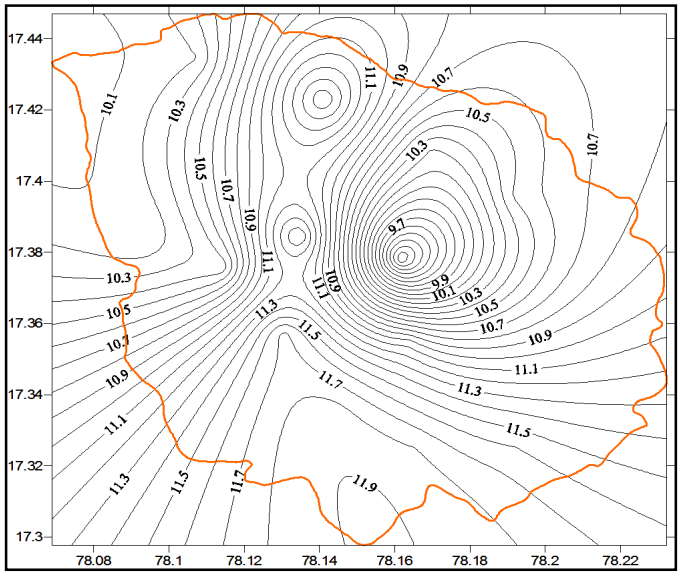

Figure-23: Groundwater level contour map of pre monsoon (November) 2014.

In pre monsoon (Figure-24) average lowest water levels observed at south whereas highest observed at east of the Chevella basin. Groundwater is flowing towards east in the study area. In post monsoon (Figure-25) average lowest water levels observed at south whereas highest observed at east and west of the Chevella sub basin. Groundwater is flowing towards east and west in the study area.

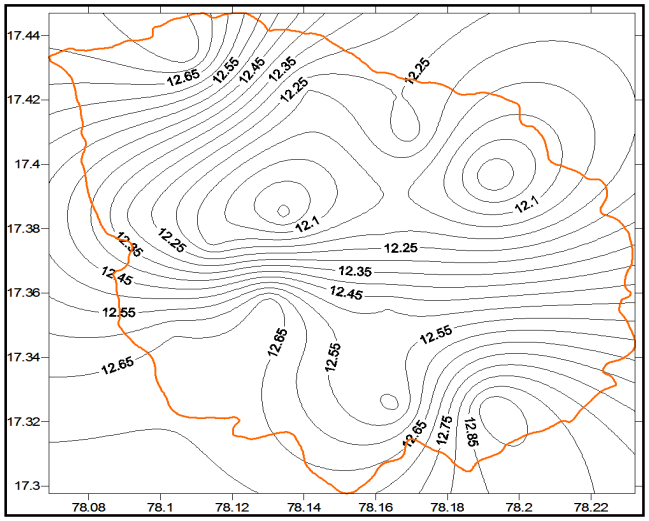

Figure-24: Average groundwater level contour map of pre monsoon (May) 2009-14

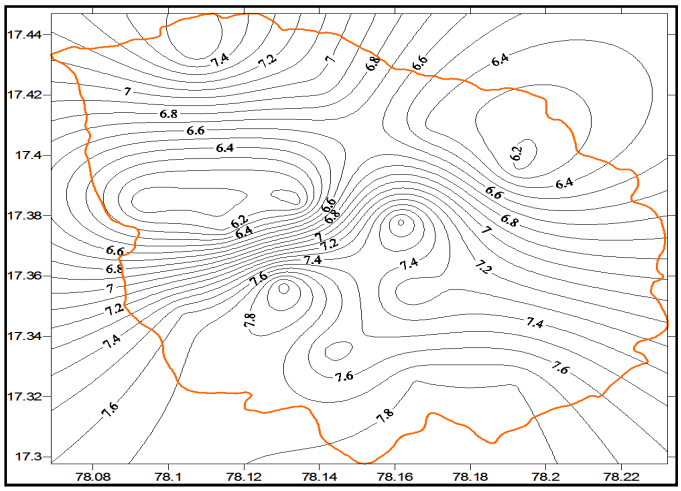

Figure-25: Average groundwater level contour map of pre monsoon (November) 2009-14.

Conclusion

There is clear evidence that watershed activities in study area have posses' high impact in respect to increasing Groundwater levels as well as water resources. It is also proved that increasing urbanisation since last decade in the study area is also a key component in developing water resource.

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