10 CONCLUSIONS

10.1 Conclusions from Rainfall and Morphometric Analysis

1. Drought analysis shows that Jhalod Taluka suffered by mild to severe drought for 21 years (8 years mild, 7 years normal and 6 years severe) in total 27 years analysed. The Dahod Taluka suffered mild to severe drought for 17 years (7 years mild, 3 years normal and 7 years severe) in total 23 years analysed. Jhalod taluka had no drought condition for only 22 % years and Dahod taluka had no drought condition for only 26 % years.

2. Morphometric analysis suggests that the study area represents undulating topography with Total Relief, which is maximum vertical distance between highest and lowest points of a basin, 160 m.

3. The basin consist various streams of order first to six. Longest first order stream, longest second order stream and longest 4^{th} order streams are located in zone 11. Longest third order stream is located in zone 1 and longest 5^{th} order stream in zone 6. Thus zone 11 can be considered as having highest potential for harnessing water.

10.2 Conclusions from Ground Water Level and Area Irrigated Analysis

1. During post-monsoon 1980 when no check dam was constructed on river Machhan more than 99 % area had water table at 5 m or more depth from the ground. From pre-monsoon 1982-1991 the average depth of water levels ranged between 5.81 to 7.23 m below the ground whereas the recent period observation shows that in low lying areas along river banks, in central and North Eastern parts of the study area, the water table is between 2 to 5 m. B.G.L. In South-Western parts of the study area i.e. in beginning of the Machhan River the water table depth is 6.5 m B.G.L. or more. This shows as we move from upstream to towards downstream the water table is raised which clearly shows the positive impact of number of check dams constructed in succession.

2. Pre-monsoon RWLs at Dungri Falia, Kharsana, Anwarpura and Dhadhela suggests that the Pre-monsoon RWLs after the check dams are higher than Pre-monsoon RWLs before check dam. Post-pre difference of Dungri Falia indicate that after construction of check dams rise in water table is more in response of even less rainfall. This clearly indicates that check dam has caused rise in ground water level significantly even in less rainfall period.

3. Years 2000-2002 were years of consecutive severe droughts and 2003 was a less rainfall year still water table raised during post-monsoon 2003 (Refer Graphs 7.4, 7.12, 7.16, 7.20, 7.22, 7.26, etc.) It further raised during pre-monsoon 2004 compared to pre-monsoon 2003. (Refer Graphs 7.2, 7.8, 7.10, 7.14, 7.18, 7.24 etc.)

4. Irrigation is practiced from the storage of check dams by Lift Irrigation Schemes. Area irrigated mainly depends upon amount of storage which in turn depends on rainfall. It is worth noticing that even during Years 2000 to 2002, years of consecutive severe drought some amount of irrigation has been noticed (Refer Graph 7.36 Area Irrigated by Kachumber check dam, Graph 7.37 Area Irrigated by Wankol Check Dam, Graph 7.41 Area Irrigated by Mahudi check dam).

10.3 Conclusions from Tank Model Analysis

1. The Tank Model is quite versatile with wide range of applicability. The Model is best suited to catchments with limited data availability.

2. The model is calibrated with the basic data of year 1994; the model is tested then for the period of 1993 to 2003. (except drought years 2000 and 2002)

3. Area division has great influence on the behaviour of the Tank Model. Amongst various area division tried it is observed that division of area of different zone in proportion 43 %, 26 %, 16% and 15 % gives maximum base flow whereas 15 %, 20 %, 25 %, 40 % gives minimum of base flow. It is found that division of area from inner to outer zone in proportion 38%, 28%, 22% and 12% gives best output with 98 % accuracy.

4. Study of single check dam in different zones and number of check dams increasing one by one indicate that constructing check dam in outermost zone will cause more effect in reduction of runoff.

5. On increase in number of check dams total runoff decreases. There is also significant increase in base flow with drastic change in base flow pattern. This clearly indicates that construction of number of check dams in series on a river reduces runoff greatly with significant rise in base flow causing more recharging.

6. The model simulates high flows better than the low flows. It gives wonderfully good results in years of good rainfall. In years of poor rainfall or during drought years it underestimates the simulated value. The accuracy found to vary fro 99.9 % to 87.8 %. Root Mean Square Error (RMSE) found to range between 1.76 to 20.8 %

7. The model is sensitive to Tc, area ratio (proportion) and storages of primary and secondary soil moistures XP and XS.

8. Increase in base flow from 1 to 3 check dam condition is found higher for years of good rainfall e.g. in 1994 rainfall was very high, 1376 mm and base flow increase found to be 2.13 to 39 %. Similarly in 1998 rainfall was 1050 mm and base flow increase found to be 4.67 to 44.67 %.

9. Increasing trends noticed in the base flow in spite of decrease in rainfall in later years e.g. in 1995 rainfall of Jhalod was 641 mm and base flow increase from 1 to 3 check dam found to be 1.29 to 10.97 % whereas for similar range of rainfall in 1999 (rainfall 660 mm) base flow increase is found to be 6.36 to 32.96 % which clearly indicates effect of more recharging with passage of time.