

Sustainable Development in Krishna River Basin by Flood Control and Water Transfer through Micro Irrigation Methods

H. T. Dhumal, C. A. Birajdar, V. S. Ghogare, and V. A. Shahane

Abstract—The Sahyadri hill ranges running in north south direction parallel to Arabian sea in western Maharashtra, divides the region in two parts, ‘Konkan’ on western side and ‘Deccan plateau’ on Eastern side. The altitude of the hill ranges is 1000 to 1500 m. This hill range divides the region meteorologically in heavy rainfall and scarce rainfall zones. The Konkan is a coastal strip is about 25 to 40 km in east west direction between Sahyadri Hill toes and Arabian sea having heavy annual rainfall to the tune of 4000 mm, while plateau is scarce rainfall zone having rainfall 1000 mm to 400 mm. Konkan is having steep slopes, no sites for dams and no command area hence water goes directly to sea. The plateau is gentle slopes, so many dam sites, thirsty for water but no water available. Yield available in Konkan is 37129 cum per ha and 3496 Cum per capita, while in plateau it is 512 Cum per ha and 240 Cum per capita. There are topographical limitations on diverting water from abundant basin to scarce basins by conventional methods (dams, lifts etc. itself will be about 850 m). In the present study it is shown how the abundant water is diverted by gravity using micro methods without any wastage of energy.

These micro methods are small diverting weirs at high altitudes, catch water drains and small tunnels. It is just puncturing Sahyadri at various locations to serve the purpose.

Index Terms—Micro irrigation method, scarcity, water diversion.

I. INTRODUCTION

As stated earlier the Sahyadri range hills divides the region in heavy rainfall zone and rain shadow zone. The Isohytal map shows the rainfall distribution. In Konkan, the annual rainfall varies from 3000 mm to 4000 mm while in plateau it is between 400 mm to 1000 mm.

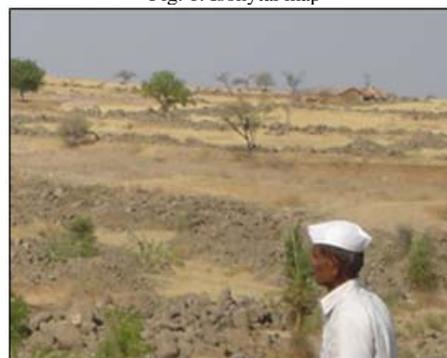
Average water available per hector in Konkan is 73 times that of plateau, per capita water availability in Konkan is 15 times that of plateau. Also annual rainy days in Konkan are 111, while in plateau are only 34. Every year in June and July the Konkan faces flood problems and the plateau faces scarcity. The Government has to work on flood relief and scarcity relief work simultaneously.

Average water available per hector in Konkan is 73 times that of plateau, per capita water availability in Konkan is 15 times that of plateau. Also annual rainy days in Konkan are 111, while in plateau are only 34. Every year in June and July

the Konkan faces flood problems and the plateau faces scarcity. The Government has to work on flood relief and scarcity relief work simultaneously.



Fig. 1. Isohytal map



A – dry



B – flood

Fig. 2. Diversity within 100 km.

Manuscript received August 9, 2012; revised September 22, 2012
The authors are with the Water Resources Department Govt. of Maharashtra (e-mail: dhumalht@gmail.com)

The Sahyadri has a peculiar topography in east and west directions. It has maximum altitude of 1000 to 1500 m at ridge. In western side it has sudden drop to altitude of 50 m (within 1 to 5 km), at some places cliffs and overhanging cliffs. While on eastern side it has steep slope up to 500 to

600 m altitude and then gentle slope up to Bay of Bengal (700 km from Sahyadri). The length of rivers in Konkan is not more than 50 km. Hence there are no major rivers. Individual sub-rivers directly meets the Arabian sea.

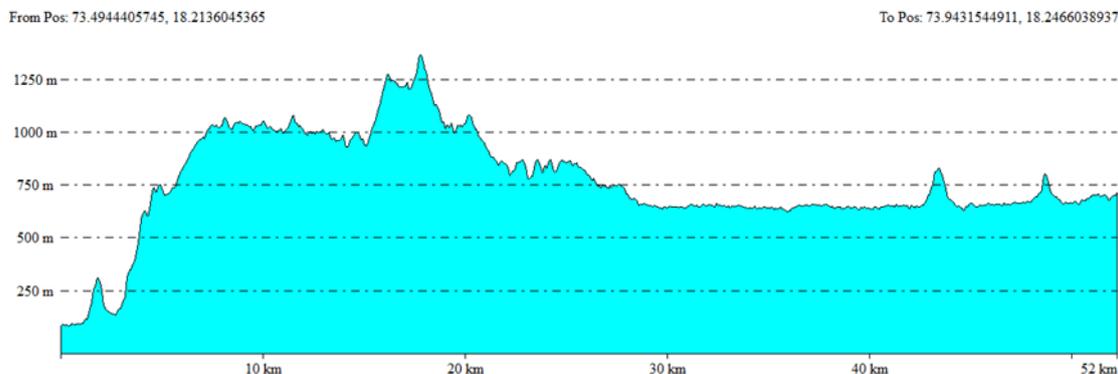


Fig. 3. Typical cross section of Sahyadri.

In Konkan area, there are very few or no sites for reservoirs, no command area available. The rain water just goes to Arabian Sea, within 2-3 hours after precipitation. The plateau is hungry of water but no water.

Most of the flat region in the Plateau is above 500 m altitude and in Konkan flat area is @ 50 m altitude. Hence large dam sites in Konkan are at 50 m altitude. Earlier studies to divert water from the Konkan to the Plateau were to construct dams at this 50 m altitude and lift water to the Plateau. The proposals are not feasible in present energy scenario of Maharashtra and India.

Hence there was no alternative to go for gravity methods to divert surplus water from Konkan by micro irrigation methods. These are catch water drains on steep slopes, high altitude micro diversion weirs and micro tunnels.

The most important job in this study is finding out individual site for catch water drain, tunnel and diversion reservoir.

II. NECESSITY

Large numbers of irrigation projects on eastern slopes of Sahyadri are constructed in Kukadi, Nira, Bhima and Krishna and Koyna basins. Many are under construction and proposed also. Even after completion of all these projects, the available water resources would not be sufficient to coup up with the requirement of region. Alternatives as like diversion of surplus yields of the one valley to the needy other valley have also been taken up in the region to overcome the short fall to some extent but this also insufficient to meet the demands. In this context as stated above the study of diverting the part of excess water of the west flowing rivers towards east of Sahyadri hills i.e. towards catchment of Kukadi, Nira, Bhima and Krishna and Koyna basins by gravity.

III. STUDY AREA.

The study area consists of strip of ridge of the Sahyadri hills

about 30 km in width. Sites between, Malashej Ghats in Junnar taluka to 'Lanja in Amba Ghats' have been considered for this study. The main river, valleys on west side are minor tributaries, on east are Kukadi, Indrayani, Bhima, Nira and Mula – Mutha from Bhima Basin & Koyna, Krishna and Pachganga from Krishna Basin.

A. Data Used.

- The topographical maps of 1:2,50,000 scale
- The Land sat TM digital satellite False Colour Composite (FCC) February, 1999.
- The land use and soil map of the area with scale 1: 250,000.
- Hydrological and Hydraulic data.
- Top sheet no. 47 E/11,12,15, 47F/5,6,7,11,12 are used.

IV. METHODOLOGY

In the present study it is shown how the abundant water is diverted by gravity using micro methods without any wastage of energy. These micro methods are small diverting weirs at high altitudes, catch water drains and small tunnels.

The methodology consists of following. For simplicity and identification weirs are named as sub- basin alphabet and D1, D2 etc. Similarly catch water drains and tunnels are named i.e. Indrayani sub basin weirs are named as ID1, ID2 etc. Catch water drains are named as IC1, IC2 etc. and tunnels are named are IT1, IT2 etc.



Fig. 4. Typical micro diversion weir on western

A. Diversion Weir

Possible diversion weir site is identified on western slope of the Sahyadri at altitude such that from such site water can be easily diverted by gravity by tunnel to eastern side. A typical high altitude weir is shown in figure 5. This weir is constructed for drinking water supply for Matheran hill station near Mumbai (India). On western side (d/s) of weir there is direct fall of 450 m.



Fig. 5. Typical catch water drain on steep western slope.

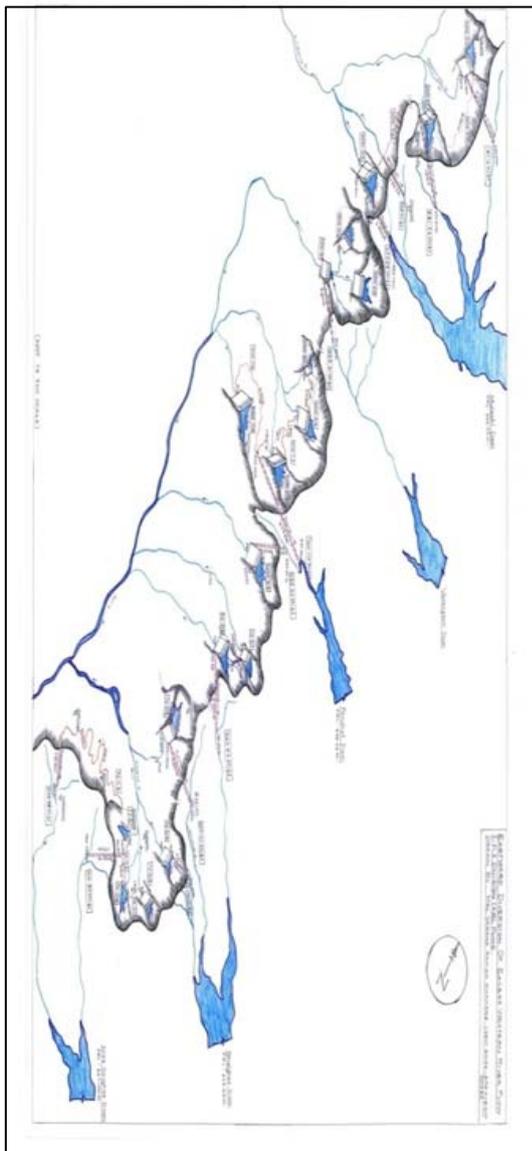


Fig. 6. Schematic diagram of the proposal slope at higher altitude.

B. Catch Water Drain.

At every location or small nalla it is not possible to construct a diversion structure, hence to collect additional water from hillocks, the catch water drains are proposed. These will collect additional water into diversion weir. A typical catch water drain is shown in figure 6 below. This is constructed for protection of roadway from heavy rains in Tamhini Ghats (hill road). A rain water drain like this are proposed to collect rain water on hill slope. These drains will collect water into diversion weirs, thus increasing diversion capacity of the weirs.

C. Diversion Tunnel.

At suitable location on probably on d/s of weir a tunnels site is selected to connect western slope to eastern reservoir or rivers. The inlet of tunnel is kept at such an altitude that the flow is free and by gravity. The size is so fixed that it should run online continuously and accommodate all flood water collected by weir, catch water drain.

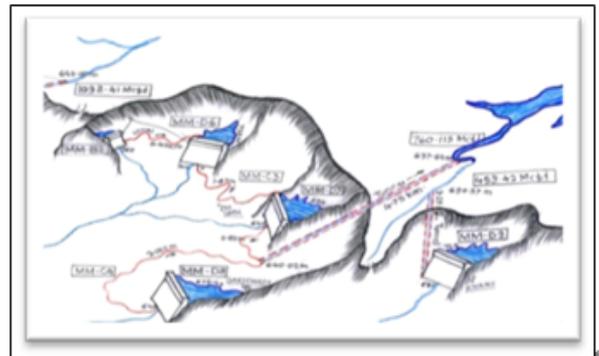


Fig. 7. Schematic diagram of panshet sub basin



Fig. 8. Satellite image of western part of panshet.

V. THE PROPOSAL

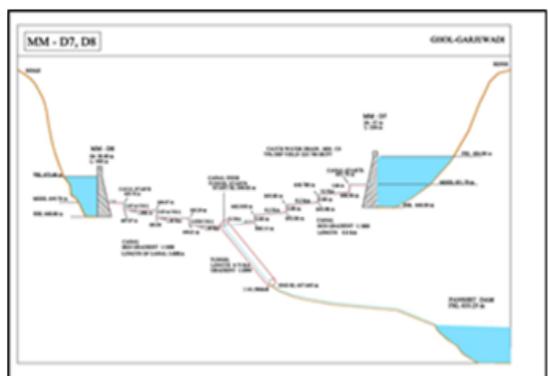
With help of data as mentioned in 3 above and methodology mentioned 4 above all possible site from Malshej to Lanja are studied. Total water can be diverted in Indrayani, Kukadi, Bhima, Mula-Mutha, Nira Krishna, Koyna, Warna, Panchganaga (sub basins of Krishna) is 496 Mm³

This can generate additional irrigation potential by 84,000 Ha in drought prone area. It will also save cost of drinking water supply by water tank in June July. The schematic view of proposal is shown in figure 6 below.

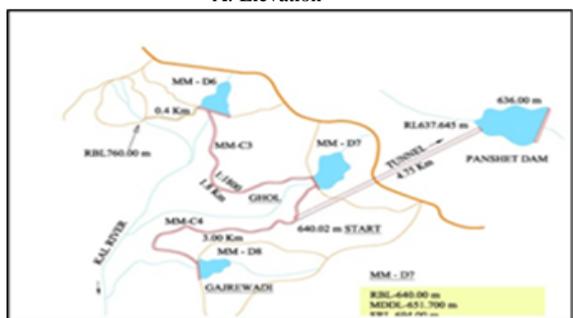
Example

A typical example how water can be diverted from west to

east in Panshet dam sub basin is explained below. In Panshet dam water 21.52 Mm³ can be diverted through two tunnels which connects five weirs and four catch water drains.



A. Elevation



B. Plan

Fig. 9a. Plan and elevation of panshet proposal

Sub Basin Name.	Project Designation.	Location Village.	Eastern Dam Name -Beneficiary	Quantum of Water diverted in cum.
Kukadi	KuC1	Khireswar	Pimpalgao Joga	10.77
	KUC2	Shelakewadi	Pimpalgao Joga	3.60
Indrayani	IC1	Mormarewadi	Andra	10.95
	IC2	Valvan	Valvan	5.26
	IC3	Kurwande	Shirota	6.21
	ID1	Lonawala	Lonwala lake	4.14
Mula Mutha	MM-C	Ghosekhamb	Mulshi lake	11.36
	MM-Co	Pan dongar	Mulshi lake	9.56
	MM-D1	Tailbaila	Mulshi	6.61
	MM-C1	Tailbaila	Mulshi	7.77
	MM-D2	Bhambarde	Mulshi	16.30
	MM-C2	Nive	Mulshi	4.52
	MM-D3	Nive	Mulshi	9.80
	MM-D4	Ambekhind	Varasgaon	7.64
	MM-D5	Ambekhind	Varasgaon	26.31
Nira	MM-B1	Balancing Tank	Varasgaon	4.84
	MM-B2	Balancing Tank	Panshet	1.31
	MM-D6	Ghol	Panshet	2.96
	MM-C3	Ghol	Panshet	3.83
	MM-D7	Ghol	Panshet	5.38
	MM-C4	Ghol	Panshet	7.97
	MM-D8	Garjewadi	Panshet	5.38
	MM-D9	Khanu	Panshet	16.01
	Nira	N-D1	Chandar	Bhatghar
N-D2		Chandar	Bhatghar	7.67
N-D3		Dhangarwadi	Bhatghar	18.27
N-D4		Saigungan	Bhatghar	2.55

	N-D5	Saigungan	Bhatghar	2.63
	N-C1	Saigungan	Bhatghar	1.82
	N-D6	Saigungan	Bhatghar	6.50
	N-C2	Saigungan	Nira Devghar	4.02
	N-D7	Saigungan	Nira Devghar	5.84
	N-C3	Ashimpi	Nira Devghar	22.91
Koyana,	K-C1	Kumbhrosi	Koyna	39.54
Panchgana	K-D1	Nagarmachiwadi	Koyna	17.01
	K-C2	Kudpan	Koyna	34.52
	K-C3	Jhadni	Koyna	58.77
	K-C4	Chakdev	Koyna	17.41
	K-C5	Tiwde	Koyna	33.94
	K-D2	Kumbarli	Koyna	13.30
	P-D1	Machal	Kasari	15.97
			Total	496.30

VI. FINDINGS

With above study, it can be concluded that 496 Mm³ t can be diverted in drought prone area without any energy. The sub basin wise quantum of water diverted is listed in following table.

VII. CONCLUSION

In present day scenario with limited water resources and ever growing demand of water for various uses, one has to consider alternative methodologies to fulfill the demand. The gravity water diversion studied in this paper will definitely provide the solution for such demands in drought prone areas. Rain water flow towards west side of the study area should be utilized for strengthening the water demand of east side area. The diversion of 496 Mm³ water will reduce the diversity in water availability in rain shadow and Konkan regions. Diversion of water from west to east does not require any electrical energy for lifting the water, as the water will flow by gravity there would be no recurring cost. Moreover, huge amount spent by Government of Maharashtra on scarcity relief works could be saved and this rain water diversion will also reduce the flood disaster up to certain extent in Konkan region.

REFERENCES

- [1] Government of Maharashtra, *Maharashtra Water and Irrigation Commission Report*.
- [2] Government of Maharashtra, *Maharashtra floods*.
- [3] V. T. Chow, "Open channel Hydraulics," McGraw Hill Book company pp. 274-206.
- [4] V. T. Chow, *Hand Book of Applied Hydraulics*.



Dhumal Hanumant Tukaram was born in Shrigonda, India. He is working as an Executive Engineer, water resources department, Government of Maharashtra. He has wide experience in planning, design and execution of minor, medium and major irrigation and power project. He has completed Nira Deoghar Project (Major irrigation project having storage capacity 335 Mm³) in Pune district of India. He has worked on hydrology. The dam break analysis of

Sina Kolegao and Goshi Khurd projects are appreciated by Government of Maharashtra. Mr. Dhumal is a member of Institute of Engineers, India