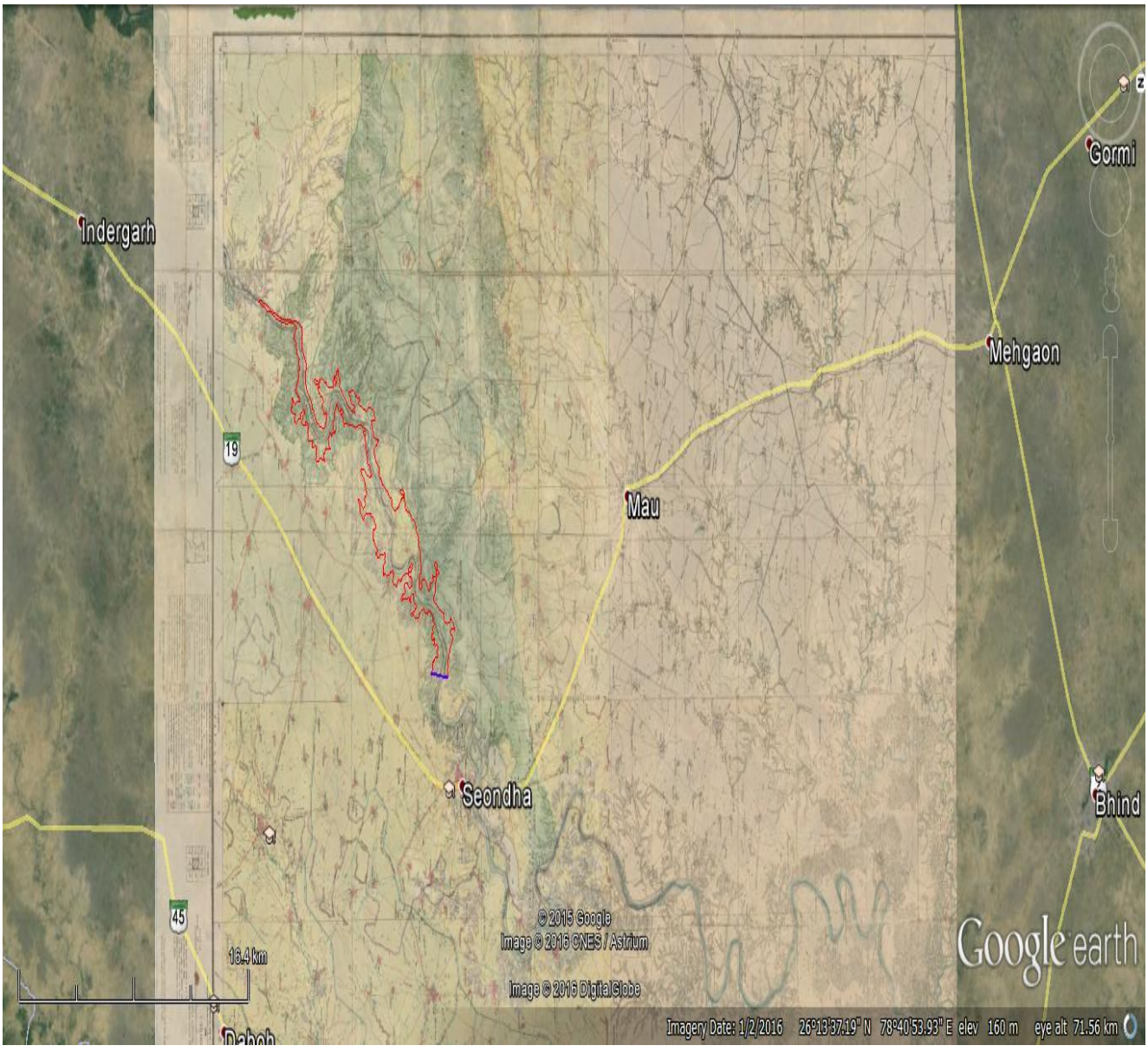
Prefeasibility report (PFR)

Sindh (Seondha) Barrage Project

Chief Engineer ,Rajghat Project,Datia

Index Map


Indergarh
Gormi
Mehgaon
Mau
Seondha
Bhind
19
45
16.4 km
© 2015 Google
Image © 2016 CNES / Astrium
Image © 2016 DigitalGlobe
Google earth
Imagery Date: 1/2/2016 26°13'37.19" N 78°40'53.93" E elev 160 m eye alt 71.56 km

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Executive Summary

On the basis of water availability, demand and other socio-economic factors , Sind (Seondha) Barrage project is designed to sustain all the possible uses for next decades . A 22m high barrage is proposed to be constructed across sind river near seonda town of datia District. The estimated Gross storage of barrage is 148 MCM. The estimated regeneration on the basis of observed flow and actual measurement of flow on 3/2/2016 by director hydro metrology wing of BODHI is 410 MCM for non monsoon months (oct-may).The net availability is 560 MCM .In initial phase,it is proposed to irrigate 43275 hectares of land by efficient pressurized piped network to facilitate farmers with assured water and head for adopting micro irrigation techniques. The project ensures the use of micro-irrigation techniques (drip/ sprinkler) by the users. The location of project creates a hydo power potential of 10 MW with PLF more than 50%.Three units of 3 MW is proposed to produce 9 MW of Power. The estimated number of power units (Kwhr) produced is more than the units required to irrigate 43275 hectares of land with annual irrigation 165 %.

The total submergence at full reservoir level is 2250 hectares, out of which 525 hectares is forest land and 300 hectares is private land. one small village Dongarpur (80 families) and hamlets of other two villages khamroli and Birampura villages are coming under submergence. Expected numbers of families needs to be rehabilitated are around 220.

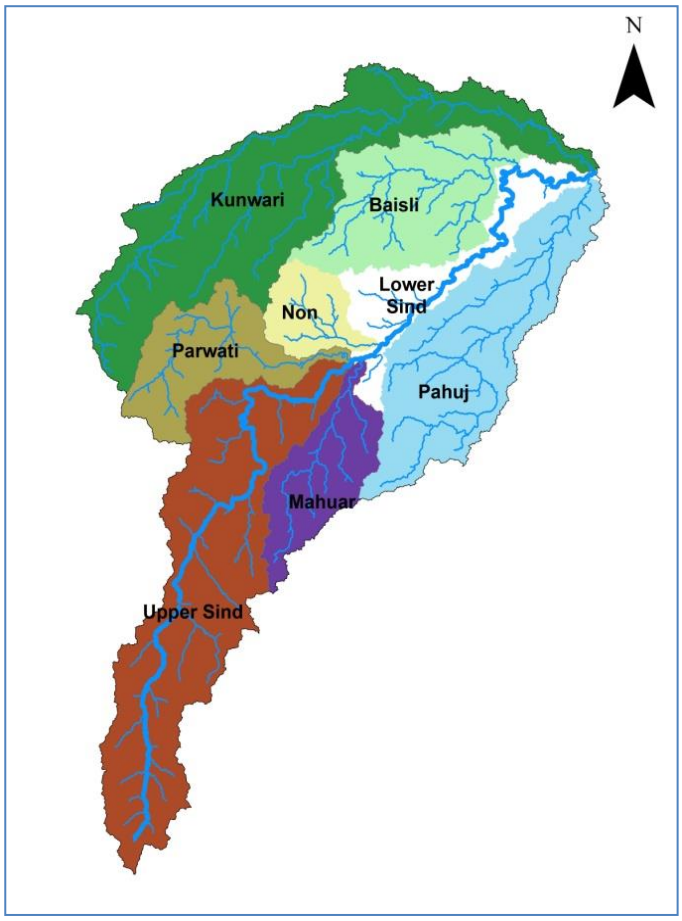
The project is designed on the principles of integrated water resource management to maximize the water productivity. The project ensures multiple use of water like Irrigation, Power production, Drought mitigation, Subsistence (Drinking & domestic),Land reclamation, fisheries and tourism.The background study of soil,agro-climatic zone and ground water conditions helps a lot in selecting a suitable site for accumate and use huge regeneration.

The estimated cost of Project is 1104 crores with Benefit-cost ratio of 2.6 and ERR of 28 %.The Project is vulnerable from environmental and ecological aspect. Insurance of e flow round the year and assured water for animals in summers to rehabilitate nearby reserve forest (Ratva and devgarh).

1.Background

Sind (Seondha) Barrage project lies in sind sub basin of Madhya Pradesh. The first and foremost requirement for any sizable water resources project to be implemented is the river basin Planning. River Basin plan of Sind is prepared by in house trained water resources professionals with the support of eminent water management institute, Unesco-IHE, Delft, the Netherlands. The basin plan study reveals that the basin is unharnessed to 65% of its gross yield of 6.1 BCM. The spatial and temporal variation throughout the basin is closely analyzed on the corners of

integrated water resources management principles in Plan. The basin is subdivided into 8 major sub basin namely Upper Sind, Parwati, Mahuar, Non, Lower sind, Pahuj, Baiseli and kunwari. The map demarcating sub-basins and a table featuring there catchment areas as below:



SNo	Sub catchment name	Drainage area in MP (km^2)
1	Mahuar	1,818
2	Parwati	2,181
3	Pahuj	2,466
4	Kunwari	6,770
5	Non	1,019
6	Baisili	3,145
7	Upper Sind	6,688
8	Lower Sind	1,995
	Total	26,082

Upper sind basin is almost harnessed by Atal sagar (manikheda major project),Harsi major project lies in Parwati sub basin.The lower sind project recieves yield of upper sind, parwati,mahuar,non and lower sind sub basins comprising of 12900 sq km catchment at proposed site.

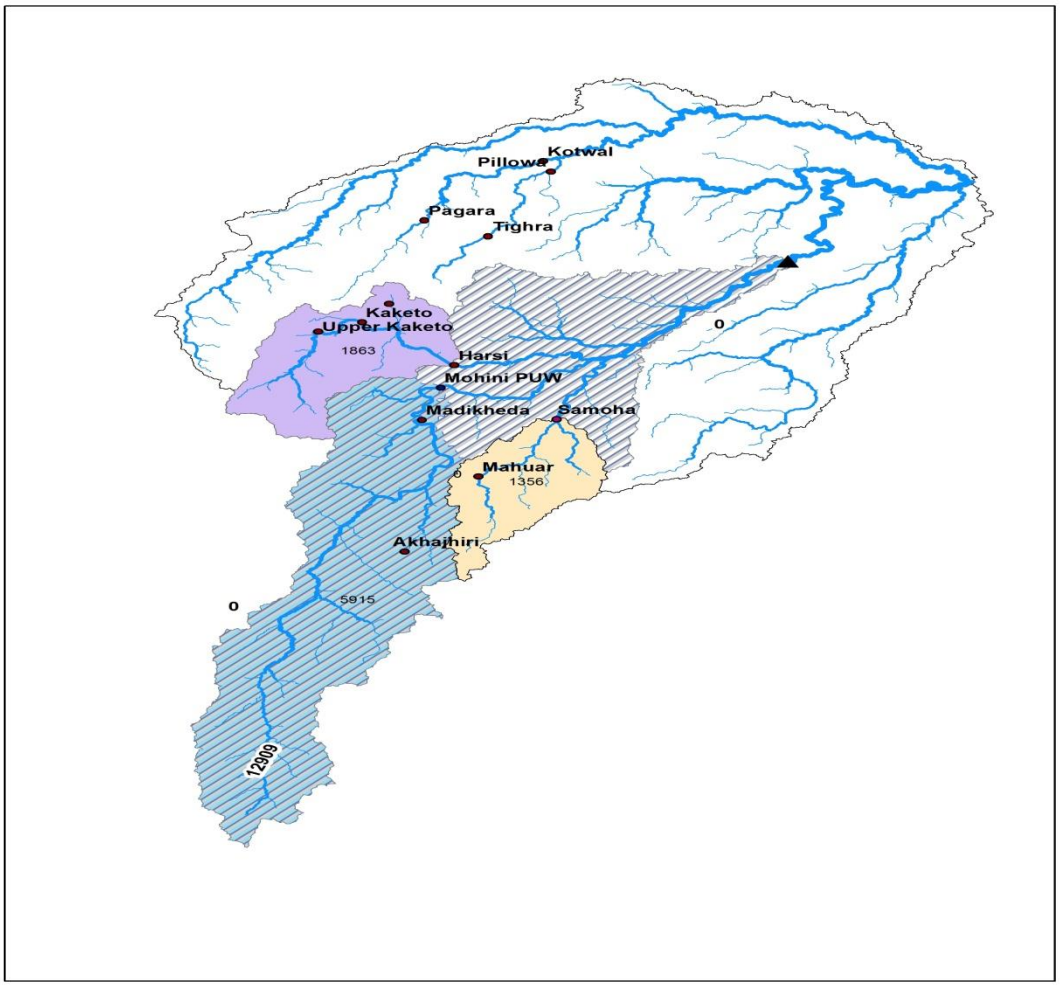
2.0 Project

2.1 Location

The Proposed barrage site is located near the village Dangdiroli which are nearly 10 km from Seodha tehsil District Datia Madhya Pradesh. The proposed site for barrage can be approachable from seodha-Bercha road. The Latitude and Longitude of the proposed site are $26^0$08'29'' and $78^0$44'20''respectivily.

2.2 Water availability

The total catchment area up to proposed site is 12900 sq km. Catchment up to last barrage in upstream (Mohini pick up weir) is 5915 sq km. The independent catchment upto dam site is 6985 sq.km. Yield from established R-R relationship of kunwari sind basin is 0.19 mcm/sqkm. Hence the independent yield of 6985@0.19mcm/sqkm is 1327 MCM.



An analysis on the basis of yield, upstream storages and uses at broader scale is tabulated below:-

SNo	Sub catchment name	Drainage area in MP (km^2)	Yield(MCM)	Use	Recieveing at LSP	Remark
1	Mahuar	1,818	345.42	80	265.42	One medium project
2	Parwati	2,181	414.39	225	189.39	Harsi major project
3	Non	1,019	193.61	40	153.61	Forested
4	Upper Sind	6,688	1270.72	950	320.72	Atal sagar+others
5	Lower Sind(upto dam)	1,194	226.86	26	1130	unharnessed
Total		12,900	2451	1345	1106	

As per data analysis and validated done in basin plan and uses as tabulated above, it is evident to claim that at LSP, the net available yield is approximately 1100 MCM. The average rainfall in basin (catchment area of barrage) is 875 mm. The proposed storage is 148 MCM against available net yield is 1100 MCM. Hence the project is constructed on high dependability more than 500%.

This project is located in drought prone and socio-economical backward Bundelkhand region. Creation of such assured storage with high dependable yield is a boon to the region and can mitigate severe droughts.

2.3 Subsistence Use

Subsistence use comprises of drinking and all other domestic use.The dam with high dependable storage and non monsoon month base flow yield suffice the irrigation and other demands.The reserve of more than 100 Mcm in the month of summers (April-June) in even severly drought year makes this Project as a boon to this region. The project after utilizing all the uses can cater as a Subsistence solution for one million population. Water can domestic purpose can be supplied to Gwalior and Bhind town,Nearby small towns Seonda,mehgaon,lahar and villages can be feeded by this abundant availability.

2.4 Irrigation use and area

There are two areas idetified to be irrigated in Bhind,Datia and Gwalior District.

Area	GCA	CCA	Benefited Villages
Area I (Ratva-Amayen)	38575	25075	110 villages of Bhind ,Datia and Gwalior District
Area II(Billoa-devgarh)	28000	18200	
	66575	**43275**	

Details of lifting and power is tabulated below for the Area -I (Ratva-Amayen)

	Design of Sindh Barrage Project II					
	Sr. No.	**Particulars**	**RM + Manifold/DC @ 247m**			
	1	CCA	25100	ha		
	2	Duty	0.35	lit./sec/hr		
	3	Discharge	8.78	Cumecs		
	4	Velocity in Rising main	1.8	m/s		
	5	Length of Rising Main	3000	m		
	6	Diameter of Rising main	2.5	m		
	7	Level to be pumped	230	m		
	8	MDDL	152	m		
	9	Static Head	78	m		
	10	Frictional loss	2.5	m		
	11	Total losses	80.48	m		
	12	Average level of command area	160.0	m		
	13	Available head	70.0	m		
	14	Friction Loss in GM of command area including bend and valve losses	28.00	m		
	15	Command area loss	8.40	m		
	16	Provision for exit gradient and filter losses	25	m		
	17	Total head required for pressurised irrigation	61.40	Less than 87.00 hence safe		
	18	Design Head	80.48	m		
	19	Power Requirement	8257	KW		
	20	**Total Power Requirement**	**8257**	**KW**		
			8.26	**MW**		

Details of lifting and power is tabulated below for the Area-II (Billowa-Devgarh)

	LSP (Area II)				
	Sr. No.	**Particulars**	**RM + Manifold/DC @ 270m**		
	1	CCA	18200	ha	
	2	Duty	0.35	lit./sec/hr	
	3	Discharge	6.37	Cumecs	
	4	Velocity in Rising main	1.8	m/s	
	5	Length of Rising Main	4500	m	
	6	Diameter of Rising main	2.1	m	
	7	Level to be pumped	230	m	
	8	MDDL	152	m	
	9	Static Head	78	m	
	10	Frictional loss	4.4	m	
	11	Total losses	82.37	m	
	12	Average level of command area	200.0	m	
	13	Available head	30.0	m	
	14	Friction Loss in GM of command area including bend and valve losses	21.00	m	
	15	Command area loss	6.30	m	
	16	Provision for exit gradient and filter losses	25	m	
	17	Total head required for pressurised irrigation	52.30	Less than 70.00 hence safe	
	18	Design Head	82.37	m	
	19	Power Requirement	6128	KW	
	20	**Total Power Requirement**	**6128**	**KW**	
			6.13	**MW**	

2.5 Agriculture:

Madhya Pradesh has about 72% rural population, which largely depends on agriculture. Approximately 66% of total geographical area is under cultivation. Out of the total cropped area in the state, the share of cereals is 40%, pulses 24%, oilseed 33% and the remaining area is covered by other crops like vegetables, fruits, fodder etc (Figure 1).

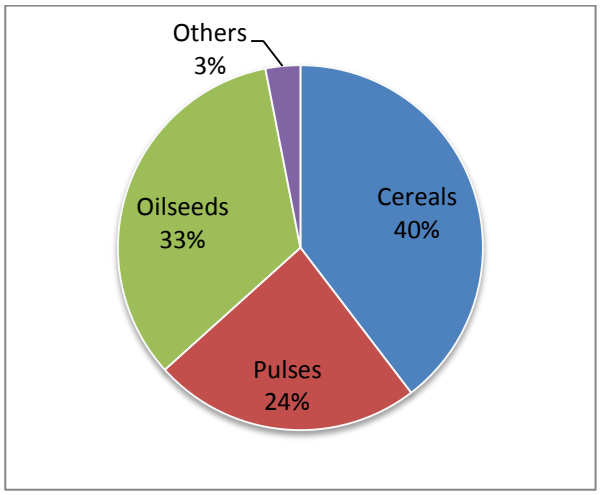


Figure 1: Area under different Crops in Madhya Pradesh

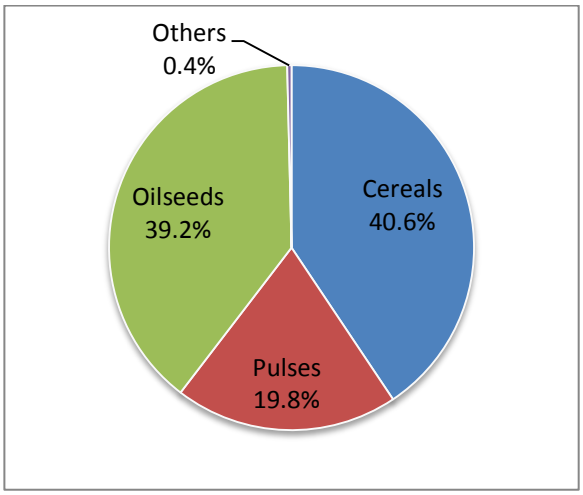


Figure 2: Area under different Crops in Sind sub-basin

In the Sind sub-basin, approximately 52% of the total geographical area is under cultivation. Out of the total cropped area in the sub-basin, cereals cover 40.5%, pulses 20% and oilseed 39% and the remaining are under other crops like vegetables, fruits, fodder etc (Figure 2).

Figure 3: Mustard crop in the sub-basin (Morena district)

Rabi crop (winter crop), which is sown in November and harvested in March, is the main crop in Sind sub-basin. Kharif crop, which is a rainfed crop, is sown in July and harvested in October. Major crops grown in Kharif season in the sub-basin are Paddy, Soyabean and in Rabi season are Pulses, wheat, mustard, and gram.

2.6 Tourism

A perenial storage in the heart and foothills of Devgarh and seonda forest creates a potential for eco-torism in the area.Around one million people visit twice in a year to Ratngarh Temple in thevicinity of Dam site.The elongated strch banks of river 10 km both sides (non forest area can be developed as recreation parks,water sports and tourist resorts.

Figure 4: Madhav National Park, Shivpuri

Water assurance all round the year gives the potential to convert Devgarh(ratngarh) and Ratva reserve forest into Tiger santury as they have a history of having lots of tigers and lions in the Forests.Presntly one tiger has made a teritory for last two years in this forest.

2.6 Green Power

The statregic selection of dam site and height of dam creats a hydel power potential of approx 10 Mw with Power load factor more than 45 %. Three units of 3 MW is proposed at barrage site.

2.7 Enviroment and Forest

The project ensures the e flow all round the year.The abundnt storage and project is so deisgned that the power generation and sub-surface flow accumalated the sufficient natural flow ,which is more than the requiste e flow.The abundant and elongated all round the year stiorage in the foothills of forest is a gross valuable reserve for forest ahbutants /animals.

2.8 Fisheries

An elongated all season storage with ensured e-flow is the highly potential water body for fish breeding. The Spread area of 2250 at full reservior level and approximately all season spread area of 1400 hectares is available for fisheries all over the year.

Alternates of Dam site

After carrying out the topographical survey of the proposed basin three dam alignment have been marked and studied with merits demerits of each.

Alignment No.1 Alternate alignment No.1 is located at 21 km upstream of the proposed site along the river.In this proposal major town Seondha of historical importance,Seondha Fort and pligrim (holy) place Sankuwa comes under submergence.

Alignment No.2 Alternate alignment No.2 is located at 3.5 km. upstream of proposed site along the river. In this proposal the available flank height impounds 110 mcm water which is less than the proposed site,further primafacie the river bed does not have rocky foundation.

Alignment No. 3 Alignment No.3 is located across deep gorge and river bed & left flank have visible exposed rock strata suitable for foundation. The available flank impounds 148 mcm of water. But comparatively slightly larger forest area comes under submergence as compare to alignment no 02 .

A comparative of broad features of each alignment are shown in the table for comparison and making a suitable choice.

Proposal	Lat/Long	Net catchment area in (sq.km.)	yield (MCM) as per sindh R-R relation	Total sub. Area	Forest Area
Alignment No.1(jara)	$26^0$13'03'' & $78^0$48'2''	7330	1393	3842	614
Alignment No.2 (shikarpura)	$26^0$08'00'' & $78^0$42'43''	6915	1313	1912	315
Alignment No.3 (Proposed)	$26^0$08'29'' & $78^0$44'20''	6985	1327	2250	525

Three alternates have been studied for Barrage alignment near Jara, Shikarpura,and Dangdiroli vilage. The proposed barrage alignment near Dangdiroli village is found feasible from the storage point of view and command area served.

3.0 Conclusion/ *Recommendation*

There are many reasons which makes this project the most feasible .the five important reasons to conclude with thios report are enumerated below:-

1. Site selection- Smart site selection makes the project most feasible as by submerging less and utilizing more yield by efficient water use planning.
2. Higher Returns- With the Lower barrage, the annual proposed irrigation is 165 %, which ultimately maximize the economic returns.
3. All season storage- The project is so engineered that the regeneration is utilized all along the Use perios by saving the buffer (148 Mcm) for summers.This special features makes the higly feasible in terms of drinking water source in summers
4. Drought mitigation- The project is designed on highly dependable yield more than 500 %.The vearge rainfall in basin is 875 Mcm. due to the high dependable yield at barrage site,in a severly drought year of rainfall less than 250 mm ,the storage is Full reservioe level in the project.It can mitigate Drought to the thirst of more than one million population of Lower Sindh Basin major towns Gwalior, Bhind and Datia District.
5. Green Project:-The project is environment friendly and hardly changes land use of Forest as the submergence is along the banks.It ensures the e flow to the downstream ravines areas of Bhind district and Uttar Pradesh. It again produces Green (Hydel power) of 10 Mw.

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Annexure-I

SALIENT FEATURE
SINDH BARRAGE MAJOR PROJECT

1 Name of project	**Sindh Barrage Major Project**
2 Estimated cost	**1104.00 Crores (Approximate)**
3 Location	
a) State	Madhya Pradesh
b) District	Datia
c) Tehsil/Block	Seondha/Seondha
d) Village	Dangdiroli
e) Longitude	78^0 44'20"
f) Latitude	$26^0$08'29"
4 Hydrology	
a) Catchment area	12900 Sq.km.
b) Average annual rainfall	792.60 mm (Datia)
c) Annual yield	
i) As per sindh Master Plan	2451 Mcum
ii) Yield available at site (deducting U/S use)	1251 Mcum
5 Reservoir Data	
A) Capacity	
a) Gross Capacity	148 Mcum
b) Dead Storage	11 Mcum
c) Live Capacity	137 Mcum
B) Principal Level	
a) Nalla bed level (N.B.L.)	138.00 m
b) Lowest sill level (L.S.L.)	148.00 m
c) Max.Draw down level (MDDL)	152.00 m
d) Full tank level (F.T.L.)	158.00 m
e) Max. water level (M.W.L.)	158.00 m
e) Top bund level (T.B.L.)	160.00 m
C) Water spread area	
a) Water spread area at L.S.L.	471 ha.
b) Water spread area at F.T.L.	2250 ha.
6 Irrigation	
a) Gross command area (GCA)	66575 ha
b) Culturable command area (CCA)	43275 ha
c) Annual irrigation (CCA X 1.65)	71400 ha
d) Cropp pattern proposed	Double Crop (Rabi & Kharif)
e) No. of benefitted villages	110 Nos.

Annexure -II

S.No	Subhead	Unit I	Unit-II	Amount (In Rs. Lakh)
		Amount (In Rs. Lakh)	Amount (In Rs. Lakh)	
1	A-Preliminary	80	128.93	208.93
2	B- Land	12000	210.00	12210.00
3	C-Works	18000	0.00	18000.00
4	D-Regulator		0.00	0.00
5	E-Fall		0.00	0.00
6	F-CD Works		0.00	0.00
7	G-Bridges		0.00	0.00
8	K-Building	200	20.00	220.00
9	L-Earth Work			0.00
	L1-Transmission Line		500.00	500.00
	L2- Pump House		3750.00	3750.00
	L3- Rising Main		18500.00	18500.00
	L-4- Rising Main Excavation, Backfilling & CD works +surge protection+valves @ 25 % of cost of RM		4325.00	4325.00
10	M-Plantation		0.00	0.00
11	O-Miscellaneous		0.00	0.00
12	P-Maintenance		321.62	321.62
13	Q- Special T & P		0.00	0.00
14	R-Communication		90.00	90.00
15	S-Power plant		9000.00	9000.00
16	T-Water Supply		0.00	0.00
17	U- Distributory & Minors		43300.00	43300.00
18	V-Water Courses		0.00	0.00
19	'X'-Environment		0.00	0.00
	Total 'I' Works	**30280**	**80146**	**110425.55**
	G Total :-			**110425.55**

Cost Per Hectare **2.55** lakk per hectare.

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